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APPROVED

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WASHINGTON, D.C.

NINTH EDITION

ISSUED EVERY THREE YEARS

The BOCA® National Plumbing Code/1993

BUILDING OFFICIALS & CODE ADMINISTRATORS
INTERNATIONAL, INC.

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The BOCA® National Plumbing Code/ 1993

Model building regulations for the protection of public health, safety and welfare.

NINTH EDITION

As recommended and maintained by the voting membership of

BUILDING OFFICIALS & CODE ADMINISTRATORS INTERNATIONAL, INC.

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PREFACE

The need for a modern, up-to-date performance code covering the design and installation of plumbing systems has long been recognized by code officials. The *BOCA National Plumbing Code*, now in its ninth edition, has been designed to meet this need through the establishment of model regulations to safeguard the public health in large metropolitan areas and small communities alike.

The *BOCA National Plumbing Code* establishes minimum plumbing regulations in terms of performance objectives, implemented by specific requirements, rather than in rigid specifications. This makes possible the acceptance of new materials which can be evaluated under nationally recognized standards, without the necessity of adopting cumbersome amendments for each variable condition. In addition, by presenting the purposes to be accomplished rather than the method to be followed, the designer is allowed the widest possible freedom, and the development of new and innovative plumbing systems is not hindered.

The code adopts nationally recognized standards as the criteria for evaluation of minimum safe practice, or for determining the performance of materials or systems of construction. The application of these standards is stated in the text of the code requirements, and the standards are listed and identified in Chapter 19, making it practical and convenient to update any standard as it is revised or reissued by the sponsoring agency.

In seeking to provide communities with a complete set of provisions to cover plumbing and plumbing systems, articles on hospital plumbing and individual water supply have been included. These specialty articles, in addition to the more general articles such as vents and venting, drainage systems, plumbing fixtures, etc., serve to make the *BOCA National Plumbing Code* the most complete and up-to-date model plumbing code available.

This ninth edition presents the *BOCA National Plumbing Code* as originally issued with changes through 1992 and with certain editorial changes made to maintain the sequence of the code and to update the references to standards.

This code, as are the other codes published by Building Officials and Code Administrators International, is kept up to date through the review of changes proposed by code enforcement officials, industry and design professionals, and other interested persons and organizations. Proposed changes are discussed in a public hearing, carefully reviewed by committees, and acted upon by code enforcement officials in an open meeting of the organization. A new edition such as this is then prepared every three years, and contains all approved changes since the previous edition.

Changes as described above do not just happen. The *BOCA National Plumbing Code* is dedicated to the thousands of code enforcement officials from throughout the United States and Canada; to the engineers, architects, technicians, builders, contractors, material producers, trade associations and others who voluntarily collaborated in its preparation; and to the members of the code changes committees and their constituent committees, who participated in the important work of keeping the code abreast of new developments in construction technology. These individuals have given unstintingly of their time and their talents to produce and maintain this performance-type code, which has been widely recognized, highly respected, and adopted by countless communities.

Use of the *BOCA National Plumbing Code* or any of the other *BOCA National Codes* within a government jurisdiction is intended to be accomplished only through *adoption by reference* in a proceeding of the jurisdiction's board, council, or other authoritative governing body. At the time of adoption, jurisdictions should insert the appropriate information in those passages of a code requiring specific local information, such as the date of adoption, name of adopting jurisdiction, dollar amount of fines and permit costs, etc. These passages are shown in bracketed small capital letters in the codes, and are also listed in the sample adoption ordinance page of each code for which the local adoption information is required. Additionally, jurisdictions may amend or modify *BOCA National Code* provisions to accomplish desired local requirements, although use of the codes in substantially original and standardized form is encouraged by the BOCA organization. A sample draft of an adopting ordinance for the *BOCA National Plumbing Code* is provided on page *vii*.

This document has been developed under the published procedures of Building Officials and Code Administrators International, Inc. These procedures are designed to obtain the views and comments of those in the construction industry willing to participate. While these procedures assure the highest degree of care, neither BOCA, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

BOCA has no power or authority to police or enforce compliance with the contents of this code. It is only the governmental body that enacts the code into law that does so.

NOTE TO BOCA® NATIONAL CODE USERS

The 1993 editions of the *BOCA National Codes* contain, for the benefit and convenience of code users, vertical lines in the outside margins of some pages.

As in previous editions, vertical lines in the margin indicate approved changes to the text of code requirements. Editorial changes are not so marked. For example, lines shown in the margins of the *1993 BOCA National Codes* indicate technical content changes since the 1990 editions. Asterisks in the margin indicate locations from which 1990 code text has been deleted. Unlike the 1990 editions, these asterisks are no longer used to indicate text that has moved to a different location in the code. These features are designed to streamline the review process for jurisdictions wishing to adopt current, up-to-date provisions.

Several additional features are reflected in the 1993 editions of the *BOCA National Codes.*

Definitions of terms have been rearranged in order to locate them within the chapter or section that represents the predominant subject matter associated with each term. Definitions related predominantly to Chapter 1 and those that have broad applicability throughout the code remain in full in Chapter 2. All defined terms are listed alphabetically in Chapter 2 followed by either the text of the definition or a reference to the section number that contains the text of the definition. Selected defined terms are italicized where they appear in the code in the same manner as in previous editions.

Additionally, an indenting feature is used in tandem with the codes' decimal-based section numbering system to indicate the hierarchy of each subsection.

The values stated in the U.S. customary units of measurement are to be regarded as code requirements. The metric equivalents of U.S. customary units may be approximate. Metric equivalents are not indicated for materials identified by nominal sizes. For actual dimensions refer to the appropriate material standard listed in Chapter 19. The nominal sizes included in the *BOCA National Codes* indicate the common designation of materials by that industry.

A GUIDE TO USE OF THE BOCA® NATIONAL PLUMBING CODE

The format and provisions of the *BOCA National Plumbing Code* are designed to provide units of government with effective minimum requirements for safe plumbing systems.

The following step-by-step approach is recommended for use in determining the code's application to particular building plumbing systems within a government's jurisdiction.

1. **Plumbing fixtures:** Determine minimum number of fixtures required in Section P-1204.0 and Table P-1204.1. Determine compliance with fixture requirements (Chapter 12).
2. **Piping material:** Determine compliance with piping material requirements (Chapter 4) and proper joints and connections (Chapter 5). Determine compliance with pipe support requirements and hanger spacing (Chapter 13).
3. **Drainage, waste and vent:** Determine compliance with drainage piping requirements and size (Chapters 6, 7 and 18). Determine compliance with vent system requirements and size (Chapters 9 and 18). Determine compliance with cleanout location and installation requirements (Chapter 11).
4. **Special waste:** Determine if separators, interceptors or neutralizing devices are required as specified in Sections P-305.0, P-704.0 and P-1004.0, and comply with requirements.
5. **Water supply:** Determine compliance with water supply requirements (Chapters 15 and 16). Determine compliance with protection of potable water against backflow (Section P-1507.0).
6. **Storm drainage:** Determine rainfall rate of area (Appendix A). Determine compliance with drainage system requirements (Chapter 8).
7. **Health care facilities:** Determine compliance with special requirements for health care facilities (Chapter 14).

ADOPTION INFORMATION

The *BOCA National Codes* are designed and promulgated to be adopted by reference by ordinance. Jurisdictions wishing to adopt the *BOCA National Plumbing Code/1993* as enforceable minimum plumbing safety requirements should insure that certain factual information is included in the adopting ordinance at the time adoption is being considered by the appropriate governmental body. The following sample adoption ordinance addresses several key elements of a code adoption ordinance, including the information required for insertion into the code text.

SAMPLE ORDINANCE FOR ADOPTION OF THE 1993 BOCA NATIONAL PLUMBING CODE

Bill Number _____ Ordinance Number _____

AN ORDINANCE ESTABLISHING THE MINIMUM REGULATIONS GOVERNING THE DESIGN, INSTALLATION AND CONSTRUCTION OF PLUMBING SYSTEMS, BY PROVIDING REASONABLE SAFEGUARDS FOR SANITATION TO PROTECT THE PUBLIC HEALTH AGAINST THE HAZARDS OF INADEQUATE, DEFECTIVE OR INSANITARY PLUMBING INSTALLATIONS; KNOWN AS THE PLUMBING CODE; AND REPEALING EXISTING ORDINANCE NUMBER (*Present Ordinance if any*) OF THE (*Type of Jurisdiction*) OF (*Name of Jurisdiction*), STATE OF (*State Name*).

Be it ordained by the (*Governing Body*) of the (*Name of Jurisdiction*) as follows:

SECTION 1. ADOPTION OF PLUMBING CODE.

That a certain document, three (3) copies of which are on file in the office of the (*Jurisdiction's Keeper of Records*) of the (*Type of Jurisdiction*) of (*Name of Jurisdiction*), being marked and designated as "The BOCA National Plumbing Code, Ninth Edition, 1993", as published by The Building Officials and Code Administrators International, Inc., be and is hereby adopted as the Plumbing Code of the (*Type of Jurisdiction*) of (*Name of Jurisdiction*) in the State of (*State Name*); for the control of buildings and structures as herein provided; and each and all of the regulations, provisions, penalties, conditions and terms of said *BOCA National Plumbing Code* are hereby referred to, adopted and made a part hereof, as if fully set out in this Ordinance, with the additions, insertions and changes, if any, prescribed in Section 3 of this Ordinance.

SECTION 2. INCONSISTENT ORDINANCES REPEALED.

That Ordinance Number (*Present Ordinance Number*) of the (*Type of Jurisdiction*) of (*Name of Jurisdiction*) entitled (*Full Title of Present Ordinance*) and all other ordinances or parts of ordinances in conflict herewith are hereby repealed.

SECTION 3. ADDITIONS, INSERTIONS AND CHANGES.

That the following sections are hereby revised as follows:

Section P-101.1 (page 1, second line). Insert: (*Name of Jurisdiction*).

Section P-113.2 (page 4, third line). Insert: (*Dollar Amount for Fees*).

Section P-116.4 (page 5, seventh, eighth and ninth lines). Insert: (*Offense, Dollar Amount and Time*).

Section P-117.2 (page 5, fifth and sixth lines). Insert: (*Dollar Amount in Two Locations*).

Section P-304.3 (page 13, third line). Insert: (*Distance in Feet*).

Section P-309.4 (page 14, second and third lines). Insert: (*Depth in Feet, Depth in Inches*).

Section P-309.5 (page 14, second and fourth lines). Insert: (*Number in Inches in Two Locations*).

SECTION 4. SAVING CLAUSE.

That nothing in this Ordinance or in the Plumbing Code hereby adopted shall be construed to affect any suit or proceeding impending in any court, or any rights acquired, or liability incurred, or any cause or causes of action acquired or existing, under any act or ordinance hereby repealed as cited in Section 2 of this Ordinance; nor shall any just or legal right or remedy of any character be lost, impaired or affected by this Ordinance.

SECTION 5. DATE OF EFFECT.

That the (*Jurisdiction's Keeper of Records*) shall certify to the adoption of this Ordinance and cause the same to be published as required by law; and this Ordinance shall take full force and effect (*Time Period*) after this date of final passage and approval.

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EDITORIAL CHANGES — SECOND PRINTING

pg. 68, Section P-1507.9.7: Entire Section P-1507.9.7 has been renumbered and relocated as new *Section P-1507.13.6.*

pg. 68, Section P-1507.9.8: Section has been renumbered as *Section P-1507.9.7.*

CHAPTER 1

ADMINISTRATION

SECTION P-101.0 GENERAL

P-101.1 Title: These regulations shall be known as the Plumbing Code of [NAME OF JURISDICTION] hereinafter referred to as "this code."

P-101.2 Scope: The design, installation, maintenance, alteration and inspection of plumbing systems, including sanitary and storm drainage, sanitary facilities, water supplies, storm water and sewage disposal in buildings, shall comply with the requirements of this code.

The design and installation of gas piping, chilled water piping in connection with refrigeration processes and comfort cooling, and hot water piping in connection with building heating shall conform to the requirements of the mechanical code listed in Chapter 19. The design and installation of piping for fire sprinklers and standpipes shall conform to the requirements of the building code listed in Chapter 19. Water supply and drainage connections to such installations shall be made in accordance with the requirements of this code.

P-101.3 Intent: This code shall be construed to secure its expressed intent, which is to insure public health, safety and welfare insofar as they are affected by the installation and maintenance of plumbing systems.

SECTION P-102.0 APPLICABILITY

P-102.1 General: The provisions of this code shall apply to all matters affecting or relating to structures, as set forth in Section P-101.0.

P-102.2 Existing structures: The legal occupancy of any structure existing on the date of adoption of this code, or for which it has been heretofore approved, shall be permitted to continue without change except as is specifically covered in this code or the property maintenance code listed in Chapter 19 or as is deemed necessary by the code official for the general health, safety and welfare of the occupants and the public.

P-102.3 Change in occupancy: It shall be unlawful to make any change in the occupancy of any structure which will subject the structure to any special provision of this code without approval of the code official. The code official shall certify that such structure meets the intent of the provisions of law governing building construction for the proposed new occupancy and that such change of occupancy does not result in any hazard to the public health, safety or welfare.

P-102.4 Alterations, additions or repairs: Alterations, additions and repairs to any plumbing system shall conform to that required for a new plumbing system without requiring the existing plumbing to comply with all of the requirements of this code. Alterations, additions and repairs shall not cause an existing plumbing system to become unsafe or adversely affect the performance of the plumbing. Where additions or alterations subject parts of existing systems to loads exceeding those permitted herein, such parts shall be made to comply with this code.

P-102.5 Referenced standards: The standards referenced in this code and listed in Chapter 19 shall be considered part of the requirements of this code to the prescribed extent of each such reference. Where differences occur between provisions of this code and the referenced standards, the provisions of this code shall apply.

SECTION P-103.0 REPAIRS AND MAINTENANCE

P-103.1 Repairs: Minor repairs or replacement of any existing system shall be permitted in the same manner and arrangement as in the existing system, provided that such repairs or replacement are not hazardous and are approved.

P-103.2 Maintenance: All plumbing systems, both existing and new, shall be maintained in a safe and sanitary condition. All service equipment, devices and safeguards which are required by this code, or which were required by a previous statute or code for the structure, shall be maintained in working order.

P-103.3 Owner responsibility: The owner or the owner's designated agent shall be responsible for the safe and sanitary maintenance of the plumbing system.

SECTION P-104.0 VALIDITY

P-104.1 Partial invalidity: In the event any part or provision of this code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions thereof, which are determined to be legal; and it shall be presumed that this code would have been passed without such illegal or invalid parts or provisions.

P-104.2 Segregation of invalid provisions: Any invalid part of this code shall be segregated from the remainder of this code by the court holding such part invalid, and the remainder shall remain effective.

P-104.3 Existing structures: The invalidity of any provision in any section of this code as applied to existing buildings and

structures shall not be held to affect the validity of such section in its application to buildings and structures hereafter erected.

SECTION P-105.0 DEPARTMENT OF PLUMBING INSPECTION

P-105.1 Code official: The department of plumbing inspection is hereby created and the executive official in charge thereof shall be known as the code official.

P-105.2 Appointment: The code official shall be appointed by the chief appointing authority of the jurisdiction; and the code official shall not be removed from office except for cause and after full opportunity to be heard on specific and relevant charges by and before the appointing authority.

P-105.3 Relief from personal responsibility: The code official, officer or employee charged with the enforcement of this code, while acting for the jurisdiction, shall not thereby be rendered liable personally, and is hereby relieved from all personal liability for any damage accruing to persons or property as a result of any act required or permitted in the discharge of official duties.

Any suit instituted against any officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by the legal representative of the jurisdiction until the final termination of the proceedings. The code official or any subordinate shall not be liable for costs in any action, suit or proceeding that is instituted in pursuance of the provisions of this code; and any officer of the department of plumbing inspection, acting in good faith and without malice, shall be free from liability for acts performed under any of its provisions or by reason of any act or omission in the performance of official duties in connection therewith.

P-105.4 Restriction of employees: An official or employee connected with the department of plumbing inspection, except one whose only connection is that of a member of the board of appeals established under the provisions of Section P-121.0, shall not be engaged in or directly or indirectly connected with the furnishing of labor, materials or appliances for the construction, alteration or maintenance of a building, or the preparation of *construction documents* thereof, unless that person is the owner of the building; nor shall such officer or employee engage in any work that conflicts with official duties or with the interests of the department.

SECTION P-106.0 DUTIES AND POWERS OF THE CODE OFFICIAL

P-106.1 General: The code official shall enforce all of the provisions of this code and shall act on any question relative to the installation, alteration, repair, maintenance or operation of all plumbing systems, devices and equipment, except as otherwise specifically provided for by statutory requirements or as provided for in Sections P-106.2 through P-106.8.

P-106.2 Applications and permits: The code official shall receive applications and issue permits for the installation and alteration of plumbing, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.

P-106.3 Notices and orders: The code official shall issue all necessary notices or orders to ensure compliance with this code.

P-106.4 Inspections: The code official shall make all of the required inspections, or shall accept reports of inspection by approved agencies or individuals. All reports of such inspections shall be in writing and be certified by a responsible officer of such approved agency or by the responsible individual. The code official is authorized to engage such expert opinion as deemed necessary to report upon unusual technical issues that arise, subject to the approval of the appointing authority.

P-106.5 Identification: The code official shall carry proper identification when inspecting structures or premises in the performance of duties under this code.

P-106.6 Rule-making authority: The code official shall have authority as necessary in the interest of public health, safety and general welfare, to adopt and promulgate rules and regulations to interpret and implement the provisions of this code to secure the intent thereof and to designate requirements applicable because of local climatic or other conditions. Such rules shall not have the effect of waiving structural or fire performance requirements specifically provided for in this code, or of violating accepted engineering practice involving public safety.

P-106.7 Department records: The code official shall keep official records of applications received, permits and certificates issued, fees collected, reports of inspections, and notices and orders issued. Such records shall be retained in the official records as long as the building or structure to which such records relate remains in existence unless otherwise provided for by other regulations.

P-106.8 Annual report: At least annually, the code official shall submit to the chief authority of the jurisdiction a written statement of operations in the form and content as shall be prescribed by such authority.

SECTION P-107.0 APPROVAL

P-107.1 Approved materials and equipment: All materials, equipment and devices approved by the code official shall be constructed and installed in accordance with such approval.

P-107.2 Modifications: Where there are practical difficulties involved in carrying out the provisions of this code, the code official shall have the right to vary or modify such provisions upon application by the owner or the owner's representative, provided that the spirit and intent of the law is observed and that the public health, safety and welfare is assured.

P-107.2.1 Records: The application for modification and the final decision of the code official shall be in writing and shall be officially recorded with the application for the permit in the permanent records of the department of plumbing inspection.

P-107.3 Material and equipment reuse: Materials, equipment and devices shall not be reused unless such elements have been reconditioned, tested and placed in good and proper working condition and approved.

P-107.4 Alternative materials and equipment: The provisions of this code are not intended to prevent the installation of any material or to prohibit any method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material or method of con-

struction shall be approved where the code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fireresistance, durability and safety.

P-107.4.1 Research and investigations: Sufficient technical data shall be submitted by the applicant to substantiate the proposed installation of any material, assembly or manufacturer-engineered plumbing components, equipment or systems. If it is determined that the evidence submitted is satisfactory proof of performance for the proposed installation, the code official shall approve such alternative subject to the requirements of this code. The costs of all tests, reports and investigations required under these provisions shall be paid for by the applicant.

SECTION P-108.0 APPLICATION FOR PERMIT

P-108.1 Permit required: Plumbing work shall not be commenced until a permit for such work has been issued by the code official. A permit is not required for repairs that involve only the working parts of a faucet or valve, the clearance of stoppages, or the repairing or replacement of defective faucets or valves, provided that alterations are not made in the existing piping or fixtures.

P-108.2 Form: The application for a permit for plumbing work shall be made in such written form as the code official prescribes and shall be accompanied by the required fee as prescribed in Section P-113.0 and a description of the proposed plumbing work.

P-108.3 By whom application is made: The application for a permit shall be made by the owner or lessee of a structure, or the agent of either, or by the *registered design professional* employed in connection with the proposed work or the contractor employed to perform the work. The applicant shall meet all qualifications established by rules promulgated with this code or by ordinance, resolution or statute. The full names and addresses of the owner, lessee, applicant and the responsible officers, if the owner or lessee is a corporate body, shall be stated in the application.

P-108.4 Description of work: The applicant shall list the number of fixtures of each type to be installed, the location of the work, and the occupancy of the building in which the work is to be performed.

P-108.5 Construction documents: The application for a permit shall be accompanied by not less than two sets of *construction documents*. The code official is permitted to waive the requirements for filing *construction documents* where the work involved is of a minor nature. When the quality of the materials is essential for conformity to this code, specific information shall be given to establish such quality, and this code shall not be cited, or the term "legal" or its equivalent used as a substitute for specific information.

P-108.5.1 Details: *Construction documents* shall include floor plans and a plumbing riser diagram. The *construction documents* shall indicate the direction of flow, pipe size, slope of *horizontal piping*, elevations, drainage *fixture unit* loads of both stacks and drains in the drain, waste and *vent systems*, and the supply *fixture unit* load for the water system and any *branch* supplies which serve more than one plumbing fixture, appliance or hose outlet.

P-108.6 Site plan: There shall also be filed a site plan showing the location of water service and sewer connections with respect to any building in which a plumbing system is to be installed. Vent stack terminations shall be shown with respect to building ventilation openings that could allow introduction of sewer gases into the building or any adjacent building.

P-108.6.1 Private sewage disposal system: The site plan shall indicate the location of a private sewage disposal system where a *public sewer* is not available. All technical data and soil data required by the private sewage disposal code listed in Chapter 19 shall be submitted with the site plan.

P-108.7 Amendments to application: Subject to the limitations of Section P-108.8, amendments to the *construction documents*, application or other records accompanying the same shall be filed at any time before completion of the work for which the permit is sought or issued. Such amendments shall be deemed part of the original application and shall be filed therewith.

P-108.8 Time limitation of application: An application for a permit for any proposed work shall be deemed to have been abandoned six months after the date of filing, unless such application has been diligently prosecuted or a permit shall have been issued; except that the code official shall grant one or more extensions of time for additional periods not exceeding 90 days each, if there is reasonable cause.

SECTION P-109.0 PERMITS

P-109.1 Action on application: The code official shall examine or cause to be examined all applications for permits, and amendments thereto within a reasonable time after filing. If the application or the *construction documents* do not conform to the requirements of all pertinent laws, the code official shall reject such application in writing, stating the reasons therefor. If the code official is satisfied that the proposed work conforms to the requirements of this code and all laws and ordinances applicable thereto, the code official shall issue a permit therefor as soon as practicable. A plumbing permit shall not be transferable.

P-109.2 Suspension of permit: Any permit issued shall become invalid if the authorized work is not commenced within six months after issuance of the permit, or if the authorized work is suspended or abandoned for a period of six months after the time of commencing the work.

P-109.3 Previous approvals: This code shall not require changes in the *construction documents* or plumbing system of a building for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the installation of which shall have been actively prosecuted within 90 days after the effective date of this code and is completed with dispatch.

P-109.4 Signature to permit: The code official's signature shall be attached to every permit; or the code official shall authorize a subordinate to affix such signature thereto.

P-109.5 Approved construction documents: The code official shall stamp or endorse in writing both sets of *construction*

documents "Approved," and one set of the approved *construction documents* shall be retained by the code official and the other set shall be kept at the building site, open to inspection of the code official at all reasonable times.

P-109.6 Revocation of permit: The code official shall revoke a permit or approval issued under the provisions of this code in case of any false statement or misrepresentation of fact in the application or on the *construction documents* upon which the permit or approval was based.

P-109.7 Approval in part: The code official is authorized to issue a permit for the installation of part of a plumbing system before the *construction documents* for the whole system have been submitted, provided that adequate information and detailed statements have been filed complying with all of the pertinent requirements of this code. The holder of such permit shall proceed at the holder's own risk with the work and without assurance that a permit for the entire system will be granted.

P-109.8 Posting of permit: A true copy of the permit shall be kept on the site of operations, open to public inspection during the entire time of prosecution of the work and until the completion of the same.

P-109.9 Notice of start: At least 24-hour notice of start of work under a permit shall be given to the code official.

SECTION P-110.0 DEMOLITION OF STRUCTURES

P-110.1 Service connections: Before a structure is demolished or removed, the owner or agent shall notify all utilities having service connections within the structure such as water, electric, gas, *sewer* and other connections. A permit to demolish or remove a structure shall not be issued until a release is obtained from the utilities, stating that their respective service connections and appurtenant equipment, such as meters and regulators, have been removed or sealed and plugged in an approved manner.

SECTION P-111.0 MOVED STRUCTURES

P-111.1 General: Before any structure that has been moved in the jurisdiction is occupied, the plumbing system shall be inspected and tested for safe operation and compliance with the requirements of this code.

SECTION P-112.0 CONDITIONS OF PERMIT

P-112.1 Payment of fees: A permit shall not be issued until the fees prescribed in Section P-113.0 have been paid.

P-112.2 Compliance with code: The permit shall be a license to proceed with the work and shall not be construed as authority to violate, cancel or set aside any of the provisions of this code, except as specifically stipulated by modification or legally granted variation as described in the application.

P-112.3 Compliance with permit: All work shall conform to the approved application and the approved *construction documents* for which the permit has been issued and any approved amendments to the approved application or the approved *construction documents.*

SECTION P-113.0 FEES

P-113.1 General: A permit to begin work for new construction or alteration shall not be issued until the prescribed fees shall have been paid nor shall an amendment to a permit necessitating an additional fee because of the additional work involved be approved until the additional fee has been paid.

P-113.2 Fee schedule: The fees for all plumbing work shall be as indicated in the following schedule.

[JURISDICTION TO INSERT APPROPRIATE SCHEDULE]

SECTION P-114.0 INSPECTION

P-114.1 Required inspections: After issuing a permit, the code official shall conduct inspections from time to time during and upon completion of the work for which a permit has been issued. A record of all such examinations and inspections and of all violations of this code shall be maintained by the code official.

P-114.1.1 Approved inspection agencies: The code official shall accept reports of approved inspection agencies provided such agencies satisfy the requirements as to qualifications and reliability.

P-114.1.2 Evaluation and follow-up inspection services: Prior to the approval of a closed, prefabricated plumbing system and the issuance of a plumbing permit, the code official shall require the submittal of an evaluation report on each prefabricated plumbing system, indicating the complete details of the plumbing system, including a description of the system and its components, the basis upon which the plumbing system is being evaluated, test results and similar information, and other data as necessary for the code official to determine conformance to this code.

P-114.1.2.1 Evaluation service: The code official shall designate the evaluation service of an approved agency as the evaluation agency, and review such agency's evaluation report for adequacy and conformance to this code.

P-114.1.2.2 Follow-up inspection: Except where *ready access* is provided to all plumbing systems, service equipment and accessories for complete inspection at the site without disassembly or dismantling, the code official shall conduct the frequency of in-plant inspections necessary to assure conformance to the approved evaluation report or shall designate an independent, approved inspection agency to conduct such inspections. The inspection agency shall furnish the code official with the follow-up inspection manual and a report of inspections upon request, and the plumbing system shall have an identifying label permanently affixed to the system indicating that factory inspections have been performed.

P-114.1.2.3 Test and inspection records: All required test and inspection records shall be available to the code official at all times during the fabrication of the plumbing system and the erection of the building; or such records as the code official designates shall be filed.

P-114.2 Final inspections: Upon completion of the plumbing work and before final approval is given, a final inspection shall be made. All violations of the approved *construction documents*

and permit shall be noted, and the holder of the permit shall be notified of the discrepancies.

P-114.3 Right of entry: The code official shall have the authority to enter at any reasonable time any structure or premises for which a permit has been issued and for which a notice of approval has not been issued in accordance with Section P-118.0.

For all other structures or premises, when the code official has reasonable cause to believe that a code violation exists, the code official is authorized to enter the structure or premises at reasonable times to inspect. Prior to entering into a space not otherwise open to the general public, the code official shall make a reasonable effort to locate the owner or other person having charge or control of the structure or premises, present proper identification and request entry. If requested entry is refused or not obtained, the code official shall pursue recourse as provided by law.

P-114.4 Coordination of inspections: Whenever in the enforcement of this code or another code or ordinance, the responsibility of more than one code official of the jurisdiction is involved, it shall be the duty of the code officials involved to coordinate their inspections and administrative orders as fully as practicable so that the owners and occupants of the structure shall not be subjected to visits by numerous inspectors or multiple or conflicting orders. Whenever an inspector from any agency or department observes an apparent or actual violation of some provision of some law, ordinance or code not within the inspector's authority to enforce, the inspector shall report the findings to the code official having jurisdiction.

SECTION P-115.0 WORKMANSHIP

P-115.1 General: All work shall be conducted, installed and completed in a workmanlike and approved manner so as to secure the results intended by this code.

SECTION P-116.0 VIOLATIONS

P-116.1 Unlawful acts: It shall be unlawful for any person, firm or corporation to erect, construct, alter, repair, remove, demolish or utilize any plumbing system, or cause same to be done, in conflict with or in violation of any of the provisions of this code.

P-116.2 Notice of violation: The code official shall serve a notice of violation or order to the person responsible for the erection, installation, alteration, extension, repair, removal or demolition of plumbing work in violation of the provisions of this code, or in violation of a detail statement or the approved *construction documents* thereunder, or in violation of a permit or certificate issued under the provisions of this code. Such order shall direct the discontinuance of the illegal action or condition and the abatement of the violation.

P-116.3 Prosecution of violation: If the notice of violation is not complied with promptly, the code official shall request the legal counsel of the jurisdiction to institute the appropriate proceeding at law or in equity to restrain, correct or abate such violation, or to require the removal or termination of the unlawful occupancy of the structure in violation of the provisions of this code or of the order or direction made pursuant thereto.

P-116.4 Violation penalties: Any person who shall violate a provision of this code or shall fail to comply with any of the requirements thereof or who shall erect, install, alter or repair plumbing work in violation of the approved *construction documents* or directive of the code official, or of a permit or certificate issued under the provisions of this code, shall be guilty of a [SPECIFY OFFENSE], punishable by a fine of not more than [AMOUNT] dollars or by imprisonment not exceeding [NUMBER OF DAYS], or both such fine and imprisonment. Each day that a violation continues after due notice has been served shall be deemed a separate offense.

P-116.5 Abatement of violation: The imposition of the penalties herein prescribed shall not preclude the legal officer of the jurisdiction from instituting appropriate action to prevent unlawful construction or to restrain, correct or abate a violation, or to prevent illegal occupancy of a building, structure or premises, or to stop an illegal act, conduct, business or utilization of the plumbing on or about any premises.

SECTION P-117.0 STOP WORK ORDER

P-117.1 Notice: Upon notice from the code official that work on any structure is being prosecuted contrary to the provisions of this code or in an unsafe and dangerous manner, such work shall be immediately stopped. The stop work order shall be in writing and shall be given to the owner of the property involved, or to the owner's agent, or to the person doing the work. The stop work order shall state the conditions under which work will be permitted to resume.

P-117.2 Unlawful continuance: Any person who shall continue any work in or about the structure after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be liable to a fine of not less than [AMOUNT] dollars or more than [AMOUNT] dollars.

SECTION P-118.0 NOTICE OF APPROVAL

P-118.1 Approval: After the prescribed tests and inspections indicate that the work complies in all respects with this code, a notice of approval shall be issued by the code official.

P-118.2 Temporary occupancy: Upon the request of the holder of a permit, the code official shall issue a temporary authorization before the entire work covered by the permit is completed, provided that such portion or portions will be put into service safely prior to full completion of the structure without endangering public health or welfare.

SECTION P-119.0 UNSAFE CONDITIONS

P-119.1 General: All plumbing installations, regardless of type, which are unsanitary or which constitute a hazard to health, safety or welfare are hereby declared illegal and shall be abated by repair and rehabilitation or removal.

P-119.2 Record: The code official shall cause a report to be filed on an unsafe condition. The report shall state the occupancy of the structure and the nature of the unsafe condition.

P-119.3 Notice: If an unsafe condition is found, the code official shall serve on the owner, agent or person in control of the

structure, a written notice that describes the condition deemed unsafe and specifies the required repairs or improvements to be made to abate the unsafe condition, or that requires the unsafe plumbing to be removed within a stipulated time. Such notice shall require the person thus notified to declare immediately to the code official acceptance or rejection of the terms of the order.

P-119.4 Method of service: Such notice shall be deemed properly served if a copy thereof is (a) delivered to the owner personally; or (b) sent by certified or registered mail addressed to the owner at the last known address with the return receipt requested. If the certified or registered letter is returned showing that the letter was not delivered, a copy thereof shall be posted in a conspicuous place in or about the structure affected by such notice. Service of such notice in the foregoing manner upon the owner's agent or upon the person responsible for the structure shall constitute service of notice upon the owner.

P-119.5 Restoration: The plumbing that is determined to be unsafe by the code official is permitted to be restored to a safe condition. To the extent that repairs, alterations or additions are made during the restoration of the structure, such repairs, alterations and additions shall comply with the requirements of Section P-102.4 and P-103.0.

P-119.6 Disregard of notice: Upon refusal or neglect of the person served with an unsafe notice to comply with the requirements of the order to abate the unsafe condition, the legal counsel of the jurisdiction shall be advised of all the facts in order to pursue recourse provided by law.

SECTION P-120.0 EMERGENCY MEASURES

P-120.1 Imminent danger: When, in the opinion of the code official, there is imminent danger of contamination or a sanitation hazard which would endanger life, the code official hereby is authorized and empowered to order and require the occupants to vacate a structure forthwith. The code official shall cause to be posted at each entrance to such structure a notice reading as follows: "This Structure is Unsafe and its Occupancy has been Prohibited by the Code Official." It shall be unlawful for any person to enter such structure except for the purpose of making the required repairs or demolition.

SECTION P-121.0 MEANS OF APPEAL

P-121.1 Application for appeal: Any person shall have the right to appeal a decision of the code official to the board of appeals. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply, or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

P-121.2 Membership of board: The board of appeals shall consist of five members appointed by the chief appointing authority as follows: one for five years, one for four years, one for three years, one for two years, and one for one year. Thereafter, each new member shall serve for five years or until a successor has been appointed.

P-121.2.1 Qualifications: The board of appeals shall consist of five individuals, one from each of the following professions or disciplines.

1. *Registered design professional* that is a registered architect; or a builder or superintendent of building construction with at least ten-years experience, five of which shall have been in responsible charge of work.
2. *Registered design professional* with structural engineering or architectural experience.
3. *Registered design professional* with mechanical and plumbing engineering experience; or a mechanical and plumbing contractor with at least ten-years experience, five of which shall have been in responsible charge of work.
4. *Registered design professional* with electrical engineering experience; or an electrical contractor with at least ten-years experience, five of which shall have been in responsible charge of work.
5. *Registered design professional* with fire protection engineering experience; or a fire protection contractor with at least ten-years experience, five of which shall have been in responsible charge of work.

P-121.2.2 Alternate members: The chief appointing authority shall appoint two alternate members who shall be called by the board chairman to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for five years or until a successor has been appointed.

P-121.2.3 Chairman: The board shall annually select one of its members to serve as chairman.

P-121.2.4 Disqualification of member: A member shall not hear an appeal in which that member has any personal, professional or financial interest.

P-121.2.5 Secretary: The chief administrative officer shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings in the office of the chief administrative officer.

P-121.2.6 Compensation of members: Compensation of members shall be determined by law.

P-121.3 Notice of meeting: The board shall meet upon notice from the chairman, within ten days of the filing of an appeal, or at stated periodic meetings.

P-121.4 Open hearing: All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

P-121.4.1 Procedure: The board shall adopt and make available to the public through the secretary procedures under which a hearing will be conducted. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be received.

P-121.5 Postponed hearing: When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

P-121.6 Board decision: The board shall modify or reverse the decision of the code official by a concurring vote of three members.

P-121.6.1 Resolution: The decision of the board shall be by resolution. Certified copies shall be furnished to the appellant and to the code official.

P-121.6.2 Administration: The code official shall take immediate action in accordance with the decision of the board.

P-121.7 Court review: Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

CHAPTER 2

DEFINITIONS

SECTION P-201.0 GENERAL

P-201.1 Scope: Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings shown in this chapter.

P-201.2 Interchangeability: Words stated in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural the singular.

P-201.3 Terms defined in other codes: Where terms are not defined in this code and are defined in the building or mechanical codes listed in Chapter 19, such terms shall have the meanings ascribed to them as in those codes.

P-201.4 Terms not defined: Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

SECTION P-202.0 GENERAL DEFINITIONS

Accepted engineering practice: That which conforms to accepted principles, tests or standards of nationally recognized technical or scientific authorities.

Access (to): That which enables a fixture, appliance or equipment to be reached by *ready access* or by a means that first requires the removal or movement of a panel, door or similar obstruction (see "*Ready access*").

Adapter fitting: See Section P-502.0.

Administrative authority: The individual official, board, department, or agency established and authorized by a state, county, city or other political subdivision created by law to administer and enforce the provisions of the plumbing code.

Air admittance valve: See Section P-1808.2.

Air break (drainage system): See Section P-702.0.

Air gap (drainage system): See Section P-702.0.

Air gap (water distribution system): See Section P-1502.0.

Alternative engineered design: See Section P-1802.0.

Anchors: See "Supports."

Antisiphon: See Section P-1222.2.

Approved: Approved by the code official or other authority having jurisdiction.

Area drain: See Section P-802.0.

Aspirator: See Section P-1402.0.

Backflow
Drainage: See Section P-1005.2.
Water supply system: See Section P-1507.2.

Backflow connection: See Section P-1507.2.

Backflow preventer: See Section P-1507.2.

Backwater valve: See Section P-1005.2.

Ball cock: See Section P-1222.2.

Bathroom group: See Section P-602.0.

Bedpan steamer or boiler: See Section P-1402.0.

Bedpan washer and sterilizer: See Section P-1402.0.

Bedpan washer hose: See Section P-1402.0.

Branch: See Section P-602.0.

Branch interval: See Section P-602.0.

Branch vent: See Section P-902.0.

Building: Any structure occupied or intended for supporting or sheltering any occupancy.

Building drain: See Section P-602.0.
Combined: See Section P-802.0.
Sanitary: See Section P-602.0.
Storm: See Section P-802.0.

Building sewer: See Section P-602.0.
Combined: See Section P-802.0.
Sanitary: See Section P-602.0.
Storm: See Section P-802.0.

Building subdrain: See Section P-602.0.

Building trap: See Section P-1002.0.

Circuit vent: See Section P-902.0.

Cistern: See Section P-1602.0.

Cleanout: See Section P-1102.0.

Code: These regulations, subsequent amendments thereto, or any emergency rule or regulation which the administrative authority having jurisdiction has lawfully adopted.

Code official: The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

Combination fixture: See Section P-1002.0.

Combined building drain: See "Building drain, combined."

Combined building sewer: See "Building sewer, combined."

Conductor: See Section P-802.0.

Construction documents: All of the written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of the project necessary for obtaining a building permit. The construction drawings shall be drawn to an appropriate scale.

Contamination: See Section P-1507.2.

Critical level (C-L): See Section P-1507.2.

Cross connection: See Section P-1507.2.

Dead end: See Section P-602.0.

Developed length: See Section P-902.0.

Drain: See Section P-602.0.

Drainage fittings: See Section P-602.0.

Drainage system: See Section P-602.0.
Building gravity: See Section P-602.0.
Sanitary: See Section P-602.0.
Storm: See Section P-802.0.

Effective opening: See Section P-1507.2.

Emergency floor drain: See Section P-602.0.

Essentially nontoxic transfer fluids: See Section P-1507.2.

Essentially toxic transfer fluids: See Section P-1507.2.

Existing work: Any plumbing system regulated by this code which was legally installed prior to the effective date of this code, or for which a permit to install has been issued.

Faucet: See Section P-1225.2.

Fixture: See "Plumbing fixture."

Fixture branch: See Section P-902.0.

Fixture drain: See Section P-902.0.

Fixture fitting: See Section P-1225.2.

Fixture supply: See Section P-1502.0.

Fixture unit
Drainage (dfu): See Section P-602.0.

Flood level rim: See Section P-1507.2.

Flow pressure: See Section P-1502.0.

Flushometer tank: See Section P-1222.2.

Flushometer valve: See Section P-1222.2.

Full-open valve: See Section P-1502.0.

Hangers: See "Supports."

Horizontal branch drain: See Section P-902.0.

Horizontal pipe: Any pipe or fitting which makes an angle of less than 45 degrees (0.79 rad) with the horizontal.

Hot water: See Section P-1508.2.

House trap: See "Building trap."

Indirect waste pipe: See Section P-702.0.

Individual sewage disposal system: See Section P-304.2.

Individual vent: See Section P-902.0.

Individual water supply: See Section P-1602.0.

Interceptor: See Section P-1002.0.

Joint
Expansion: See Section P-502.0.
Flexible: See Section P-502.0.
Mechanical: See "*Mechanical joint.*"
Slip: See Section P-502.0.

Leader: See Section P-802.0.

Local vent stack: See Section P-1402.0.

Main: The principal pipe artery to which *branches* are connected.

Main vent: See Section P-902.0.

Manifold: See "Plumbing appurtenance."

Mechanical joint: See Section P-502.0.

Nonpotable water: See Section P-1502.0.

Nuisance: Public nuisance as known as common law or in equity jurisprudence; whatever is dangerous to human life or detrimental to health; whatever structure or premises is not sufficiently ventilated, sewered, drained, cleaned or lighted, with respect to its intended occupancy; and whatever renders the air or human food or drink or water supply unwholesome.

Occupancy: The purpose for which a building or portion thereof is utilized or occupied.

Offset: See Section P-602.0.

Open air: Outside the structure.

Plumbing: The practice, materials and fixtures utilized in the installation, maintenance, extension and alteration of all piping, fixtures, plumbing appliances and plumbing appurtenances, within or adjacent to any structure, in connection with sanitary drainage or storm drainage facilities; venting systems; and public or private water supply systems.

Not included in this definition are installations of gas piping; chilled water piping in connection with refrigeration, process and comfort cooling; hot water piping in connection with building heating; and piping for fire protection systems.

Plumbing appliance: See Section P-1202.0.

Plumbing appurtenance: See Section P-1202.0.

Plumbing fixture: See Section P-1202.0.

Plumbing system: Includes the water supply and distribution pipes; plumbing fixtures and traps; soil, waste and vent pipes; and sanitary and storm sewers and *building drains*; in addition to their respective connections, devices and appurtenances within a structure or premises.

Potable water: See Section P-1502.0.

Pressure gradient monitor: See Section P-1507.2.

Private: See Section P-1202.0.

Public or public utilization: See Section P-1202.0.

Public water main: See Section P-304.2.

Quick-closing valve: See Section P-1502.0.

Ready access: That which enables a fixture, appliance or equipment to be directly reached without requiring the removal or movement of any panel, door or similar obstruction.

Reduced pressure principle backflow preventer: See Section P-1507.2.

Registered design professional: An architect or engineer, registered or licensed to practice professional architecture or engineering, as defined by the statutory requirements of the professional registration laws of the state in which the project is to be constructed.

Relief valve
Pressure relief valve: See Section P-1502.0.
Temperature and pressure relief (T&P) valve: See Section P-1502.0.
Temperature relief valve: See Section P-1502.0.

Relief vent: See Section P-902.0.

Rim: See Section P-1507.2.

Riser: See "Water pipe, riser."

Roof drain: See Section P-802.0.

Rough-in: Parts of the plumbing system that are installed prior to the installation of fixtures. This includes drainage, water supply, vent piping and the necessary fixture supports.

Separator: See "Interceptor."

Sewage: Any liquid waste containing animal or vegetable matter in suspension or solution, including liquids containing chemicals in solution.

Sewage ejectors: See Section P-602.0.

Sewer
Building sewer: See Section P-602.0.
Public sewer: See Section P-602.0.
Sanitary sewer: See Section P-802.0.
Storm sewer: See Section P-802.0.

Slope: The fall (pitch) of a line of pipe in reference to a horizontal plane. In drainage, the slope is expressed as the fall in a fraction of an inch per foot length of pipe.

Soil pipe: A pipe that conveys sewage containing fecal matter to the *building drain* or *building sewer*.

Stack: A general term for any vertical line of soil, waste, vent or inside conductor piping, except vertical vent branches that do not extend through the roof and which pass through less than two stories before being reconnected to a vent stack or stack vent.

Stack vent: See Section P-902.0.

Sterilizer
Boiling type: See Section P-1402.0.
Instrument: See Section P-1402.0.
Pressure (autoclave): See Section P-1402.0.
Pressure instrument washer sterilizer: See Section P-1402.0.
Utensil: See Section P-1402.0.
Water: See Section P-1402.0.

Sterilizer vent: See Section P-1402.0.

Storm drain: See "Drainage system, storm."

Structure: That which is built or constructed or a portion thereof.

Subsoil drain: See Section P-802.0.

Sump: See Section P-602.0.

Sump pump: See Section P-802.0.

Sump vent: See Section P-902.0.

Supports: Devices for supporting and securing pipe, fixtures and equipment.

Swimming pool: See Section P-702.0.

Tempered water: See Section P-1508.2.

Trap: See Section P-1002.0.

Trap seal: See Section P-1002.0.

Vacuum: Any pressure less than that exerted by the atmosphere.

Vacuum breaker: See Section P-1507.2.

Vent pipe: See Section P-902.0.

Vent stack: See Section P-902.0.

Vent system: See Section P-902.0.

Vertical pipe: Any pipe or fitting which makes an angle of 45 degrees (0.79 rad) or more with the horizontal.

Wall-hung water closet: See Section P-1202.0.

Waste: The discharge from any fixture, appliance, area or appurtenance, which does not contain fecal matter.

Waste pipe: A pipe that conveys only waste.

Water-hammer arrestor: See Section P-1502.0.

Water heater: See Section P-1508.2.

Water main: See Section P-304.2.

Water outlet: See Section P-1502.0.

Water pipe
Riser: See Section P-1502.0.
Water distribution pipe: See Section P-1502.0.
Water service pipe: See Section P-1502.0.

Water supply system: See Section P-1502.0.

Well
Bored: See Section P-1602.0.
Drilled: See Section P-1602.0.
Driven: See Section P-1602.0.
Dug: See Section P-1602.0.

Whirlpool bathtub: See Section P-1202.0.

Yoke vent: See Section P-902.0.

CHAPTER 3

GENERAL REGULATIONS

SECTION P-301.0 GENERAL

P-301.1 Scope: This chapter contains general regulations regarding the installation of plumbing, including: provisions for health and safety; the connection to public systems where available; the exclusion of certain wastes detrimental to the sewage system; and the matters of corrosion, freezing, trenching, bedding, tunneling and backfilling.

SECTION P-302.0 HEALTH AND SAFETY

P-302.1 General: Where a health or safety hazard exists on a premises by reason of an existing plumbing installation, or lack thereof, the owner or the owner's agent shall install additional plumbing or make such corrections as are necessary to abate such nuisance and bring the plumbing installation within the provisions of this code.

P-302.2 Safety: Any part of a structure or premises which is changed, altered or required to be replaced as a result of the installation, alteration, renovation or replacement of a plumbing system, or any part thereof, shall be left in a safe, nonhazardous condition.

P-302.3 Cutting or notching: A structural member shall not be cut, notched or pierced in excess of the limitations specified in the building code listed in Chapter 19, unless proven safe by a structural analysis prepared by the *registered design professional* of record.

P-302.4 Protection of footings: Trenching installed parallel to footings shall not extend below the line of a 45-degree (0.79 rad) angle to the loadbearing plane of the footing.

SECTION P-303.0 CONNECTIONS TO PLUMBING SYSTEMS REQUIRED

P-303.1 General: Every plumbing fixture, drain, appliance or appurtenance thereto which is to receive water or waste, or discharge any liquid wastes or sewage, shall discharge to the sanitary *drainage system* of the structure in accordance with the requirements of this code.

SECTION P-304.0 CONNECTION TO PUBLIC WATER AND SEWER SYSTEM

P-304.1 General: The water distribution and *drainage system* of any structure in which plumbing fixtures are installed shall be connected to a public water main and *sewer*, respectively, where available. Where a public water main is not available, an individual water supply shall be provided. Where a public sewer is not available, a private sewage disposal system that conforms to the private sewage disposal code listed in Chapter 19 shall be provided.

P-304.2 Definitions: The following words and terms shall, for the purposes of this section and as stated elsewhere in this code, have the meanings shown herein.

Individual sewage disposal system: A system for disposal of domestic sewage by means of a septic tank, cesspool or mechanical treatment, designed for utilization apart from a public sewer to serve a single establishment or building.

Public water main: A water supply pipe for public utilization controlled by public authority.

Water main: A water supply pipe for public utilization.

P-304.3 Public systems available: A public water main or public sewer system shall be considered available to a structure where the structure is located within [NUMBER] feet of the public water main or *sewer*.

SECTION P-305.0 EXCLUSION OF MATERIALS DETRIMENTAL TO THE SEWER SYSTEM

P-305.1 Detrimental or dangerous materials: Ashes, cinders or rags; flammable, poisonous or explosive liquids or gases; oil, grease or any other insoluble material which is capable of obstructing, damaging or overloading the building *drainage* or *sewer* system, or which is capable of interfering with the normal operation of the sewage treatment processes, shall not be deposited, by any means, into such systems.

P-305.2 Industrial wastes: Waste products from manufacturing or industrial operations shall not be introduced into the public sewer until it has been determined by the code official or other authority having jurisdiction that the introduction thereof will not damage the public sewer system or interfere with the functioning of the sewage treatment plant.

SECTION P-306.0 PIPING MEASUREMENTS

P-306.1 General: Except where otherwise specified in this code, all measurements shall be made to the centerlines of pipes.

P-306.2 Pipe and tube sizes: Unless otherwise specified, the pipe and tube sizes specified in this code are expressed in nominal or standard sizes as designated in the referenced material standards.

SECTION P-307.0 WASHROOM AND TOILET ROOM REQUIREMENTS

P-307.1 Light and ventilation: Washrooms and toilet rooms shall be illuminated in accordance with the building code listed in Chapter 19, and shall be ventilated in accordance with the mechanical code listed in Chapter 19.

P-307.2 Location of fixtures and piping: Piping, fixtures or equipment shall not be located in such a manner as to interfere with the normal operation of windows, doors or other means of egress openings.

P-307.3 Toilet rooms: Interior finish surfaces of toilet rooms shall comply with the building code listed in Chapter 19.

P-307.4 Water closet compartment: Each water closet utilized by the public or employees shall occupy a separate compartment with a door and walls or partitions between fixtures to assure privacy.

Exception: Water closet compartments shall not be required in a single-occupant toilet room with a lockable door.

SECTION P-308.0 STRAINS AND STRESSES IN PIPE

P-308.1 General: Piping in a plumbing system shall be installed so as to prevent strains and stresses which exceed the structural strength of the pipe. Where necessary, provisions shall be made to protect piping from damage resulting from expansion, contraction and structural settlement.

P-308.2 Underground piping: Piping installed in underground plumbing systems shall be protected from structural damage by an approved method of installation which accounts for the conditions of the installation and application and the type of piping material.

SECTION P-309.0 PROTECTION OF PIPES

P-309.1 Breakage: Pipes passing under or through walls shall be protected from breakage. Any plumbing pipe passing under a footing or through a foundation wall shall be provided with a relieving arch or sleeve two pipe sizes greater than the pipe passing through the wall.

P-309.2 Protection against physical damage: In concealed locations, where piping, other than cast-iron or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1¼ inches (32 mm) from the nearest edge of the member, the pipe shall be protected by shield plates. Protective shield plates shall be a minimum of 1/16-inch-thick (2 mm) steel, shall cover the area of the pipe where the member is notched or bored and shall extend a minimum of 2 inches (51 mm) above sole plates and below top plates.

P-309.3 Corrosion: Pipe subject to corrosion by passing through or under corrosive fill including, but not limited to, cinders, concrete or other corrosive material, shall be protected against external corrosion by a protective coating, wrapping or other means that will resist such corrosion.

P-309.4 Freezing: Water service piping shall be installed below recorded frost penetration but not less than [NUMBER] feet [NUMBER] inches below grade. In climates with freezing temperatures, plumbing piping in exterior building walls or areas subjected to freezing temperatures shall be protected against freezing by insulation or heat or both.

P-309.5 Sewer depth: *Building sewers* that connect to private sewage disposal systems shall be a minimum of [NUMBER] inches below finished grade at the point of septic tank connection. *Building sewers* shall be a minimum of [NUMBER] inches below grade.

P-309.6 Trenching and bedding: Where trenches are excavated to grade such that the bottom of the trench forms the bed for the pipe, solid and continuous loadbearing support shall be provided between joints, and bell holes shall be provided at points where the pipe is joined. Such pipe shall not be supported on blocks to grade.

P-309.6.1 Backfill: Where trenches are excavated below grade such that the bottom of the trench does not form the bed for the pipe, the trench shall be backfilled to grade with sand or fine gravel placed in layers of 6 inches (152 mm) maximum depth and such backfill shall be compacted after each placement.

P-309.6.2 Rock removal: Where rock is encountered in trenching, the rock shall be removed to a minimum of 3 inches (76 mm) below the grade line of the trench, and the trench shall be backfilled to grade with sand tamped in place so as to provide uniform loadbearing support for the pipe between joints. The pipe shall not rest on rock at any point including the joints.

P-309.6.3 Soft loadbearing material: If soft materials of poor loadbearing qualities are found at the bottom of the trench, stabilization shall be achieved by overexcavating a minimum of two pipe diameters and backfilling to grade with fine gravel, crushed stone or a concrete foundation. The concrete foundation shall be bedded with sand tamped in place so as to provide uniform loadbearing support for the pipe between joints.

P-309.7 Flood hazard: All piping systems and equipment located in a flood-hazard zone (A Zone) or a high-hazard zone (V Zone) shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the base flood elevation.

P-309.8 Tunneling: The pipe shall be protected from damage during tunneling installation and from uneven loading. Where earth tunnels are utilized, supporting structures shall be provided to prevent future settling or caving.

P-309.9 Backfilling: Loose earth, free from rocks, broken concrete, frozen chunks and other rubble, shall be placed in the trench in 6-inch (152 mm) layers and tamped in place. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that the pipe remains aligned.

SECTION P-310.0 SLEEVES

P-310.1 Exterior walls: In exterior walls, the annular space between sleeves and pipes shall be filled with an approved caulking material.

SECTION P-311.0 RATPROOFING

P-311.1 Strainer plates: All strainer plates on drain inlets shall be designed and installed so that all openings are not greater than ½ inch (13 mm) in least dimension.

P-311.2 Meter boxes: Meter boxes shall be constructed in such a manner that rats are prevented from entering a structure by way of the water service pipes connecting the meter box and the structure.

P-311.3 Openings for water service pipes: In or on structures where openings have been made in walls, floors or ceilings for the passage of pipes, such openings shall be closed and protected by the installation of approved metal collars that are securely fastened to the adjoining structure.

SECTION P-312.0 TOILET FACILITIES FOR WORKERS

P-312.1 General: Toilet facilities shall be provided for construction workers and such facilities shall be maintained in a sanitary condition. Construction worker toilet facilities of the nonsewer type shall conform to ANSI Z4.3 listed in Chapter 19.

SECTION P-313.0 ELEVATOR SHAFTS AND EQUIPMENT ROOMS

P-313.1 General: Plumbing systems shall not be located in an elevator shaft or in an elevator equipment room.

Exception: Floor drains, sumps and sump pumps shall be permitted at the base of the shaft.

CHAPTER 4

MATERIALS

SECTION P-401.0 GENERAL

P-401.1 General: This chapter shall govern the quality of all materials, fixtures and equipment utilized in the alteration, repair or installation of plumbing systems.

SECTION P-402.0 IDENTIFICATION AND LABELING OF MATERIALS

P-402.1 Identification: The manufacturer's mark or name and the quality of the product or identification shall be cast, embossed, stamped or indelibly marked on each length of pipe and each pipe fitting, trap, fixture, material and device utilized in a plumbing system in accordance with the applicable approved standard.

P-402.2 Plastic pipe, fittings and components: All plastic pipe, fittings and components shall bear the label of an approved agency as conforming to NSF 14 listed in Chapter 19.

P-402.3 Labeling: Materials and piping required to be labeled shall be labeled in accordance with the procedures set forth in Sections P-402.3.1 through P-402.3.2.3.

P-402.3.1 Testing: An approved agency shall test a representative sample of the material or piping being labeled to the relevant standard or standards. The approved agency shall maintain a record of all of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

P-402.3.2 Inspection and identification: The approved agency shall periodically perform an inspection, which shall be in-plant if necessary, of the material or piping that is to be labeled. The inspection shall verify that the labeled material or piping is representative of the material or piping tested.

P-402.3.2.1 Independent: The agency to be approved shall be objective and competent. The agency shall also disclose all possible conflicts of interest so that objectivity can be confirmed.

P-402.3.2.2 Equipment: An approved agency shall have adequate equipment to perform all required tests. The equipment shall be periodically calibrated.

P-402.3.2.3 Personnel: An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests.

SECTION P-403.0 WATER SUPPLY PIPING SYSTEM MATERIALS

P-403.1 Water quality: Water service pipe and water distribution pipe shall be resistant to corrosive action and degrading action from the potable water supplied by the water purveyor or individual water supply system.

P-403.2 Soil and ground water: The installation of a water service pipe shall be prohibited in soil and ground water which are contaminated with solvents, fuels, organic compounds or other detrimental materials causing permeation, corrosion, degradation or structural failure of the piping material. Where detrimental conditions are suspected, a chemical analysis of the soil and ground water conditions shall be required to ascertain the acceptability of the water service material for the specific installation. Where detrimental conditions exist, approved alternative materials or routing shall be required.

P-403.3 Lead-free water supply pipe and fittings: Pipe and pipe fittings, including valves and faucets, utilized in the water supply system shall have a maximum of 8-percent lead.

P-403.4 Water service pipe: Water service pipe shall conform to NSF 61 listed in Chapter 19 and shall conform to one of the standards listed in Table P-403.4. All water service pipe or tubing, installed underground and outside of the structure, shall have a minimum working pressure of 160 pounds per square inch (psi) (1100 kPa) at 73.4 degrees F. (23 degrees C.). Where the water pressure exceeds 160 psi (1100 kPa), piping material shall have a minimum rated working pressure equal to the highest available pressure. Plastic water service piping shall terminate within 5 feet (1524 mm) inside the point of entry into a building.

P-403.5 Water distribution pipe: Water distribution pipe shall conform to NSF 61 listed in Chapter 19 and shall conform to one of the standards listed in Table P-403.5. All hot water distribution pipe and tubing shall have a minimum pressure rating of 80 psi (550 kPa) at 180 degrees F. (82 degrees C.).

Table P-403.4
WATER SERVICE PIPE

Material	Standard (see Chapter 19)
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D1527; ASTM D2282
Asbestos-cement pipe	ASTM C296
Brass pipe	ASTM B43
Copper or copper-alloy pipe	ASTM B42; ASTM B302
Copper or copper-alloy tubing (Type K, WK, L, WL, M or WM)	ASTM B75; ASTM B88; ASTM B251; ASTM B447
Chlorinated polyvinyl chloride (CPVC) plastic pipe	ASTM D2846; ASTM F441; ASTM F442; CSA B137.6
Ductile iron water pipe	AWWA C151
Galvanized steel pipe	ASTM A53
Polybutylene (PB) plastic pipe and tubing	ASTM D2662; ASTM D2666; ASTM D3309; CSA CAN3-B137.8
Polyethylene (PE) plastic pipe	ASTM D2239; CSA CAN/CSA-B137.1
Polyethylene (PE) plastic tubing	ASTM D2737; CSA CAN/CSA-B137.1
Polyvinyl chloride (PVC) plastic pipe	ASTM D1785; ASTM D2241; ASTM D2672; CSA CAN/CSA-B137.3

Table P-403.5
WATER DISTRIBUTION PIPE

Material	Standard (see Chapter 19)
Brass pipe	ASTM B43
Chlorinated polyvinyl chloride (CPVC) plastic pipe and tubing	ASTM D2846; ASTM F441; ASTM F442; CSA B137.6
Copper or copper-alloy pipe	ASTM B42; ASTM B302
Copper or copper-alloy tubing (Type K, WK, L, WL, M or WM)	ASTM B75; ASTM B88; ASTM B251; ASTM B447
Cross-linked polyethylene (PEX) plastic tubing	ASTM F877; CSA CAN/CSA-B137.5
Cross-linked polyethylene/ aluminum/cross-linked polyethylene (PEX-AL-PEX) pipe	CSA CAN/CSA-B137.10
Galvanized steel pipe	ASTM A53
Polybutylene (PB) plastic pipe and tubing	ASTM D3309; CSA CAN3-B137.8
Polyethylene/aluminum/ polyethylene (PE-AL-PE) pipe	CSA CAN/CSA-B137.9

SECTION P-404.0 SANITARY DRAINAGE AND VENT PIPING SYSTEM MATERIALS

P-404.1 Above-ground sanitary drainage and vent pipe: Above-ground soil, waste and vent pipe shall conform to one of the standards listed in Table P-404.1.

Table P-404.1
ABOVE-GROUND DRAINAGE AND VENT PIPE

Material	Standard (see Chapter 19)
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D2661; ASTM F628; CSA CAN/CSA-B181.1
Brass pipe	ASTM B43
Cast-iron pipe	ASTM A74; CISPI 301
Copper or copper-alloy pipe	ASTM B42; ASTM B302
Copper or copper-alloy tubing (Type K, L, M or DWV)	ASTM B75; ASTM B88; ASTM B251; ASTM B306
Galvanized steel pipe	ASTM A53
Lead pipe	FS WW-P-325B
Polyolefin pipe	CSA CAN/CSA-B181.3
Polyvinyl chloride (PVC) plastic pipe (Type DWV)	ASTM D2665; ASTM D2949; ASTM F891; CSA CAN/CSA-B181.2

P-404.2 Underground building sanitary drainage and vent pipe: Underground building sanitary drainage and vent pipe shall conform to one of the standards listed in Table P-404.2.

Table P-404.2
UNDERGROUND BUILDING DRAINAGE AND VENT PIPE

Material	Standard (see Chapter 19)
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D2661; ASTM F628
Asbestos-cement pipe	ASTM C428
Cast-iron pipe	ASTM A74; CISPI 301
Concrete pipe	ASTM C14; ASTM C76
Copper or copper-alloy tubing (Type K or L)	ASTM B75; ASTM B88; ASTM B251
Polyolefin pipe	CSA CAN/CSA-B181.3
Polyvinyl chloride (PVC) plastic pipe (Type DWV)	ASTM D2665; ASTM D2949; ASTM F891; CSA CAN/CSA-B181.2

P-404.3 Building sewer pipe: *Building sewer* pipe shall conform to one of the standards listed in Table P-404.3.

Table P-404.3
BUILDING SEWER PIPE

Material	Standard (see Chapter 19)
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D2661; ASTM D2751; ASTM F628
Asbestos-cement pipe	ASTM C428
Bituminized fiber pipe	ASTM D1861; ASTM D1862
Cast-iron pipe	ASTM A74; CISPI 301
Concrete pipe	ASTM C14; ASTM C76; CSA A257.1; CSA A257.2
Copper or copper-alloy tubing (Type K or L)	ASTM B75; ASTM B88; ASTM B251
Polyvinyl chloride (PVC) plastic pipe (Type DWV, SDR26, SDR35, SDR41, PS50 or PS100)	ASTM D2665; ASTM D2949 ASTM D3034; ASTM F891; CSA CAN/CSA-B182.2; CSA CAN/CSA-B182.4
Vitrified clay pipe	ASTM C4; ASTM C700

P-404.3.1 Building sewer pipe in trench with water service: Where the *building sewer* is installed in the same trench as the water service, as provided for in Section P-1504.2, the *building sewer* pipe shall conform to one of the standards for ABS plastic pipe, cast-iron pipe, copper or copper-alloy tubing, or PVC plastic pipe listed in Table P-404.3.

P-404.3.2 Drainage pipe in filled ground: Where a *building sewer* or *building drain* is installed on filled or unstable ground, the drainage pipe shall conform to one of the standards for ABS plastic pipe, cast-iron pipe, copper or copper-alloy tubing, or PVC plastic pipe listed in Table P-404.3.

P-404.4 Existing building sewers and drains: Existing *building sewers* and drains shall connect with new *building sewer* and *drainage systems* only where found by examination and test to conform to the new system in quality of material.

P-404.5 Chemical waste and vent pipe: Separate *drainage systems* for chemical wastes and vent pipes shall be of an approved material that is resistant to corrosion and degradation for the concentrations of chemicals involved. Polyolefin drainage pipe installed in chemical waste or vent piping systems shall conform to CSA CAN/CSA-B181.3 listed in Chapter 19.

SECTION P-405.0 STORM DRAINAGE PIPING SYSTEM MATERIAL

P-405.1 Inside storm drainage conductors: Inside storm drainage conductors installed above ground shall conform to one of the standards listed in Table P-404.1.

P-405.2 Underground building storm drain pipe: Underground building storm drain pipe shall conform to one of the standards listed in Table P-404.2.

P-405.3 Building storm sewer pipe: Building storm sewer pipe shall conform to one of the standards listed in Table P-405.3.

Table P-405.3
BUILDING STORM SEWER PIPE

Material	Standard (see Chapter 19)
Acrylonitrile butadiene styrene (ABS) plastic pipe	ASTM D2661; ASTM D2751; ASTM F628
Asbestos-cement pipe	ASTM C428
Bituminized fiber pipe	ASTM D1861; ASTM D1862
Cast-iron pipe	ASTM A74; CISPI 301
Concrete pipe	ASTM C14; ASTM C76; CSA A257.1; CSA A257.2
Copper or copper-alloy tubing (Type K, L, M or DWV)	ASTM B75; ASTM B88; ASTM B251; ASTM B306
Polyvinyl chloride (PVC) plastic pipe (Type DWV, SDR26, SDR35, SDR41, PS50 or PS100)	ASTM D2665; ASTM D3034; ASTM F891; CSA CAN/CSA-B182.2; CSA CAN/CSA-B182.4
Vitrified clay pipe	ASTM C4; ASTM C700

P-405.4 Subsoil drain pipe: Subsoil drains shall be open-jointed, horizontally split or perforated pipe conforming to one of the standards listed in Table P-405.4.

Table P-405.4
SUBSOIL DRAIN PIPE

Material	Standard (see Chapter 19)
Asbestos-cement pipe	ASTM C508
Bituminized fiber pipe	ASTM D2311
Cast-iron pipe	ASTM A74; CISPI 301
Polyethylene (PE) plastic pipe	ASTM F405
Polyvinyl chloride (PVC) plastic pipe (Type Sewer Pipe, PS25, PS50 or PS100)	ASTM D2729; ASTM F891; CSA CAN/CSA-B182.2; CSA CAN/CSA-B182.4
Vitrified clay pipe	ASTM C4; ASTM C700

P-405.5 Roof drains: Roof drains shall conform to ASME A112.21.2 listed in Chapter 19.

SECTION P-406.0 PIPE FITTINGS, VALVES AND NIPPLES

P-406.1 Fittings: Pipe fittings shall be approved for installation with the piping material installed, and shall conform to the respective pipe standards or one of the standards listed in Table P-406.1. The fittings shall not have ledges, shoulders or reductions which are capable of retarding or obstructing flow in the piping. Threaded drainage pipe fittings shall be of the recessed drainage type.

P-406.1.1 Water supply system pipe fittings: All pipe fittings utilized in water supply systems shall conform to NSF 61 listed in Chapter 19.

P-406.2 Valves: All valves shall be of the approved type, and compatible with the type of piping material installed in the system.

Table P-406.1
PIPE FITTINGS

Material	Standard (see Chapter 19)
Cast iron	ASME B16.4; ASME B16.12
Copper or copper alloy	ASME B16.15; ASME B16.18; ASME B16.22; ASME B16.23; ASME B16.26; ASME B16.29; ASME B16.32
Gray iron and ductile iron	AWWA C110
Malleable iron	ASME B16.3
Plastic	ASTM D2464; ASTM D2466; ASTM D2467; ASTM D2468; ASTM D2609; ASTM F409; ASTM F437; ASTM F438; ASTM F439; CSA CAN/CSA-B137.2
Steel	ASME B16.9; ASME B16.11; ASME B16.28

P-406.3 Manufactured pipe nipples: Manufactured pipe nipples shall conform to one of the standards listed in Table P-406.3.

Table P-406.3
MANUFACTURED PIPE NIPPLES

Material	Standard (see Chapter 19)
Steel	ASTM A733
Brass-, copper-, chromium-plated	ASTM B687

SECTION P-407.0 SPECIAL MATERIALS

P-407.1 Sheet lead: Sheet lead for the applications shall conform to FS QQ-L-201f-2 listed in Chapter 19, and shall weigh not less than indicated in the following:

1. General application, 4 pounds per square foot (20 kg/m^2).
2. Flashings for vent pipes, 3 pounds per square foot (15 kg/m^2).
3. Prefabricated flashings for vent pipes, 2½ pounds per square foot (12 kg/m^2).

P-407.2 Lead bends and traps: The walls of lead bends and traps shall be at least ⅛ inch (3 mm) thick, and shall conform to FS WW-P-325B listed in Chapter 19.

P-407.3 Copper or tubular brass traps and tailpiece fittings: All copper or tubular brass traps and tailpiece fittings shall be not less than 0.054 inch (No. 17 gage) in material thickness, and shall conform to the requirements of ASME A112.18.1 listed in Chapter 19.

P-407.4 Sheet copper: Sheet copper for the following applications shall conform to ASTM B152 listed in Chapter 19, and shall weigh not less than the following:

1. General application, 12 ounces per square foot (3.7 kg/m^2).
2. Flashing for vent pipes, 8 ounces per square foot (2.5 kg/m^2).
3. Flush tank linings, 10 ounces per square foot (3 kg/m^2).

P-407.5 Caulking ferrules: Ferrules shall be of red brass and shall be in accordance with Table P-407.5.

P-407.6 Soldering bushings: Soldering bushings shall be of red brass and shall be in accordance with Table P-407.6.

P-506.2 Brazed joints: All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8 listed in Chapter 19.

P-506.3 Mechanical joints: *Mechanical joints* shall be installed in accordance with the manufacturer's instructions.

P-506.4 Threaded joints: Threads shall conform to ASME B1.20.1 listed in Chapter 19. Pipe-joint compound or tape shall be applied on the male threads only.

P-506.5 Welded joints: All joint surfaces shall be cleaned. The joint shall be welded with an approved filler metal.

SECTION P-507.0 CAST-IRON PIPE AND FITTINGS

P-507.1 General: Joints between cast-iron pipe or fittings shall comply with Sections P-507.2 through P-507.5.

P-507.2 Caulked joints (drain): Joints for hub and spigot pipe shall be firmly packed with oakum or hemp. Molten lead shall be poured in one operation to a depth of not less than 1 inch (25 mm). The lead shall not recede more than ⅛ inch (3 mm) below the rim of the hub and shall be caulked tight. Paint, varnish or other coatings shall not be permitted on the joining material until after the joint has been tested and approved.

P-507.3 Caulked joints (water): Joints for bell and spigot pipe shall be firmly packed with clean, sound asbestos rope or treated paper rope. Molten lead shall be poured in one operation to a depth indicated in Table P-507.3. The lead shall be caulked tight.

Table P-507.3
LEAD DEPTH FOR CAULKED CAST-IRON PIPE

Pipe size (inches)	Depth of lead (inches)[a]
Up to 20	2¼
24, 30, 36	2½
Larger than 36	3

Note a. 1 inch = 25.4 mm.

P-507.4 Mechanical compression joints: Compression gaskets shall conform to ASTM C564 listed in Chapter 19. Gaskets shall be compressed when the pipe is fully inserted.

P-507.5 Mechanical joint coupling: *Mechanical joint* couplings shall have an elastomeric sealing sleeve that conforms to ASTM C564 or CSA CAN/CSA-B602 listed in Chapter 19 and is provided with a center stop. *Mechanical joint* couplings shall be installed in accordance with the manufacturer's installation instructions.

SECTION P-508.0 CONCRETE PIPE AND FITTINGS

P-508.1 Mechanical joints: Joints between concrete pipe or fittings shall be made with an elastomeric seal conforming to ASTM C443 or CSA A257.3 listed in Chapter 19.

SECTION P-509.0 COPPER OR COPPER-ALLOY PIPE AND FITTINGS

P-509.1 General: Joints between copper or copper-alloy pipe or fittings shall comply with Sections P-509.2 through P-509.6.

P-509.2 Brazed joints: All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8 listed in Chapter 19.

P-509.3 Mechanical joints: *Mechanical joints* shall be installed in accordance with the manufacturer's instructions.

P-509.4 Soldered joints: All joint surfaces shall be cleaned. A flux conforming to ASTM B813 listed in Chapter 19 shall be applied. The joint shall be soldered with a solder conforming to ASTM B32 listed in Chapter 19. The joining of water supply piping shall be made with lead-free solder and fluxes. "Lead free" shall mean a chemical composition equal to or less than 0.2-percent lead.

P-509.5 Threaded joints: Threads shall conform to ASME B1.20.1 listed in Chapter 19. Pipe-joint compound or tape shall be applied on the male threads only.

P-509.6 Welded joints: All joint surfaces shall be cleaned. The joint shall be welded with an approved filler metal.

SECTION P-510.0 COPPER OR COPPER-ALLOY TUBING AND FITTINGS

P-510.1 General: Joints between copper or copper-alloy tubing or fittings shall comply with Sections P-510.2 through P-510.5.

P-510.2 Brazed joints: All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8 listed in Chapter 19.

P-510.3 Flared joints: Flared joints for water pipe shall be made by a tool designed for that operation.

P-510.4 Mechanical joints: *Mechanical joints* shall be installed in accordance with the manufacturer's instructions.

P-510.5 Soldered joints: All joint surfaces shall be cleaned. A flux conforming to ASTM B813 listed in Chapter 19 shall be applied. The joint shall be soldered with a solder conforming to ASTM B32 listed in Chapter 19. The joining of water supply piping shall be made with lead-free solders and fluxes. "Lead free" shall mean a chemical composition equal to or less than 0.2-percent lead.

SECTION P-511.0 CPVC PLASTIC PIPE AND FITTINGS

P-511.1 General: Joints between CPVC plastic pipe or fittings shall comply with Sections P-511.2 through P-511.4.

P-511.2 Mechanical joints: *Mechanical joints* shall be installed in accordance with the manufacturer's instructions.

P-511.3 Solvent cementing: Joint surfaces shall be clean and free from moisture, and an approved primer shall be applied. Solvent cement, orange in color and conforming to ASTM F493 listed in Chapter 19, shall be applied to all joint surfaces. The joint shall be made while the cement is wet, and in accordance with ASTM D2846 or F493 listed in Chapter 19. Solvent-cement joints shall be permitted above or below ground.

P-511.4 Threaded joints: Threads shall conform to ASME B1.20.1 listed in Chapter 19. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

SECTION P-512.0 GALVANIZED STEEL PIPE AND FITTINGS

P-512.1 General: Joints between galvanized steel pipe or fittings shall comply with Sections P-512.2 and P-512.3.

P-512.2 Threaded joints: Threads shall conform to ASME B1.20.1 listed in Chapter 19. Pipe-joint compound or tape shall be applied on the male threads only.

P-512.3 Mechanical joints: Joints shall be made with an approved elastomeric seal. *Mechanical joints* shall be installed in accordance with the manufacturer's instructions.

SECTION P-513.0 LEAD PIPE AND FITTINGS

P-513.1 General: Joints between lead pipe or fittings shall comply with Sections P-513.2 and P-513.3.

P-513.2 Burned: Burned joints shall be uniformly fused together into one continuous piece. The thickness of the joint shall be at least as thick as the lead being joined. The filler metal shall be of the same material as the pipe.

P-513.3 Wiped: Joints shall be fully wiped, with an exposed surface on each side of the joint not less than ¾ inches (19 mm). The joint shall be at least ⅜ inch (10 mm) thick at the thickest point.

SECTION P-514.0 POLYBUTYLENE PLASTIC PIPE, TUBING AND FITTINGS

P-514.1 General: Joints between polybutylene plastic pipe and tubing or fittings shall comply with Sections P-514.2 through P-514.4.

P-514.2 Flared joints: Flared pipe ends shall be made by a tool designed for that operation.

P-514.3 Heat-fusion joints: Joints shall be of the socket-fusion or butt-fusion type. Joint surfaces shall be clean and free from moisture. All joint surfaces shall be heated to melt temperature and joined. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM D2657, ASTM D3309 or CSA CAN3-B137.8 listed in Chapter 19.

P-514.4 Mechanical joints: *Mechanical joints* shall be installed in accordance with the manufacturer's instructions. Metallic lock rings employed with insert fittings as described in ASTM D3309 or CSA CAN3-B137.8 listed in Chapter 19 shall be installed in accordance with the manufacturer's instructions.

SECTION P-515.0 POLYETHYLENE PLASTIC PIPE, TUBING AND FITTINGS

P-515.1 General: Joints between polyethylene plastic pipe and tubing or fittings shall comply with Sections P-515.2 through P-515.5.

P-515.2 Flared joints: Flared joints shall be permitted where so indicated by the pipe manufacturer. Flared joints shall be made by a tool designed for that operation.

P-515.3 Heat-fusion joints: Joint surfaces shall be clean and free from moisture. All joint surfaces shall be heated to melt temperature and joined. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM D2657 listed in Chapter 19.

P-515.4 Mechanical joints: *Mechanical joints* shall be installed in accordance with the manufacturer's instructions.

P-515.5 Installation: Polyethylene pipe shall be cut square, with a cutter designed for plastic pipe. Except where joined by heat fusion, pipe ends shall be chamfered to remove sharp edges. Kinked pipe shall not be installed. The minimum pipe bending radius shall not be less than 30 pipe diameters, or the minimum coil radius, whichever is greater. Piping shall not be bent beyond straightening of the curvature of the coil. Bends shall not be permitted within ten pipe diameters of any fitting or valve. Stiffener inserts installed with compression-type couplings and fittings shall not extend beyond the clamp or nut of the coupling or fitting.

SECTION P-516.0 PVC PLASTIC PIPE AND FITTINGS

P-516.1 General: Joints between PVC plastic pipe or fittings shall comply with Sections P-516.2 through P-516.4.

P-516.2 Mechanical joints: *Mechanical joints* on water pipe shall be made with an elastomeric seal conforming to ASTM D3139 listed in Chapter 19. *Mechanical joints* on drainage pipe shall be made with an elastomeric seal conforming to ASTM D3212 listed in Chapter 19. *Mechanical joints* shall not be installed in above-ground systems, unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.

P-516.3 Solvent cementing: Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F656 listed in Chapter 19 shall be applied. Solvent cement not purple in color and conforming to ASTM D2564, CSA CAN/CSA-B137.3, CSA CAN/CSA-B181.2 or CSA CAN/CSA-B182.1 listed in Chapter 19 shall be applied to all joint surfaces. The joint shall be made while the cement is wet, and shall be in accordance with ASTM D2855 listed in Chapter 19. Solvent-cement joints shall be permitted above or below ground.

P-516.4 Threaded joints: Threads shall conform to ASME B1.20.1 listed in Chapter 19. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

SECTION P-517.0 VITRIFIED CLAY PIPE AND FITTINGS

P-517.1 Mechanical joint: Joints between vitrified clay pipe or fittings shall be made with an elastomeric seal conforming to ASTM C425 listed in Chapter 19.

SECTION P-518.0 JOINTS BETWEEN PIPE AND FITTINGS OF DIFFERENT MATERIAL

P-518.1 General: Joints between different piping materials shall be made with a *mechanical joint* of the compression or mechanical-sealing type, or as permitted in Sections P-518.2 through P-518.6. Connectors or adapters shall have an elastomeric seal conforming to ASTM C425, ASTM C443, ASTM C564, ASTM D1869, ASTM F477 or CSA A257.3 listed in Chapter 19. Joints shall be installed in accordance with the manufacturer's instructions.

P-518.2 Copper or copper-alloy tubing to cast-iron hub pipe: Joints between copper or copper-alloy tubing and cast-iron hub

pipe shall be made with a brass ferrule or compression joint. The copper or copper-alloy tubing shall be soldered to the ferrule in an approved manner, and the ferrule shall be joined to the cast-iron hub by a caulked joint or a *mechanical* compression joint.

P-518.3 Copper or copper-alloy tubing to galvanized steel pipe: Joints between copper or copper-alloy tubing and galvanized steel pipe shall be made with a brass converter fitting or dielectric fitting. The copper tubing shall be soldered to the fitting in an approved manner, and the fitting shall be screwed to the threaded pipe.

P-518.4 Cast-iron pipe to galvanized steel or brass pipe: Joints between cast-iron and galvanized steel or brass pipe shall be made by either caulked or threaded joints or with an approved adapter fitting.

P-518.5 Plastic pipe or tubing to other piping material: Joints between different grades of plastic pipe or between plastic pipe and other piping material shall be made with an approved adapter fitting. Joints between plastic pipe and cast-iron hub pipe shall be made by a caulked joint or a *mechanical* compression joint.

P-518.6 Lead pipe to other piping material: Joints between lead pipe and other piping material shall be made by a wiped joint to a caulking ferrule, soldering nipple, bushing or shall be made with an approved adapter fitting.

SECTION P-519.0 PROHIBITED JOINTS AND CONNECTIONS

P-519.1 General: The following types of joints and connections shall be prohibited:

1. Cement or concrete joints.
2. Mastic or hot-pour bituminous joints.
3. Joints made with fittings not approved for the specific installation.
4. Joints between different diameter pipes made with elastomeric rolling O-rings.
5. Solvent-cement joints between different types of plastic pipe.

SECTION P-520.0 CONNECTIONS BETWEEN FIXTURES

P-520.1 Floor and wall drainage connections: Connections between the drain and floor outlet plumbing fixtures shall be made with a floor flange. The flange shall be attached to the drain and anchored to the structure. Connections between the drain and wall-hung water closets shall be made with an approved extension nipple or horn adapter. The water closet shall be bolted to the hanger with corrosion-resistant bolts or screws. Joints shall be sealed with an approved elastomeric gasket or setting compound conforming to FS TT-P-1536a listed in Chapter 19.

P-520.2 Drainage slip joints: Slip joints shall be made with an approved elastomeric gasket and shall only be installed on the trap outlet, trap inlet or within the *trap seal.*

SECTION P-521.0 EXPANSION JOINTS

P-521.1 General: Expansion joint fittings shall be of an approved type for the piping material being joined.

SECTION P-522.0 PENETRATIONS

P-522.1 Penetrations of floor/ceiling assemblies and fireresistance rated assemblies: Penetrations of floor/ceiling assemblies and assemblies required to have a fireresistance rating shall be protected in accordance with the building code listed in Chapter 19.

P-522.2 Exterior openings: Openings through the roof shall be made water tight by an approved flashing. Openings through exterior walls shall be made water tight.

CHAPTER 6

SANITARY DRAINAGE SYSTEMS

SECTION P-601.0 GENERAL

P-601.1 Scope: The provisions of this chapter shall set forth the requirements for the design and installation of sanitary *drainage systems*.

P-601.2 Engineered systems: Engineered sanitary *drainage systems* shall conform to the provisions of Chapter 18.

P-601.3 Chemical waste system: A chemical waste system shall be completely separated from the sanitary *drainage system*. The chemical waste shall be treated in accordance with Section P-704.0 before discharging to the sanitary drainage system.

SECTION P-602.0 DEFINITIONS

P-602.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Bathroom group: A water closet, bidet, lavatory and bathtub or shower located together on the same floor level.

Branch: Any part of the piping system except a riser, main or stack.

Branch interval: A distance along a soil or waste stack corresponding in general to a story height, but not less than 8 feet (2438 mm), within which the horizontal branches from one floor or story of a structure are connected to the stack.

Building drain: That part of the lowest piping of a *drainage system* which receives the discharge from soil, waste and other drainage pipes inside the walls of the building and conveys the drainage to the *building sewer*.
Sanitary: A *building drain* that conveys sewage only.

Building sewer: That part of the *drainage system* which extends from the end of the *building drain* and conveys the discharge to a public sewer, private sewer, individual sewage disposal system, or other point of disposal.
Sanitary: A *building sewer* that conveys sewage only.

Building subdrain: That portion of a *drainage system* which does not drain by gravity into the *building sewer*.

Dead end: A *branch* leading from a soil, waste or vent pipe, a *building drain*, or a *building sewer*, and terminating at a *developed length* of 2 feet (610 mm) or more by means of a plug, cap or other closed fitting.

Drain: Any pipe that carries waste water or water-borne wastes in a building *drainage system*.

Drainage fittings: A special type of fitting or fittings utilized in the *drainage system*. Drainage fittings are similar to cast-iron fittings, except that instead of having a bell and spigot, drainage fittings are recessed and tapped to eliminate ridges on the inside of the installed pipe.

Drainage system: All of the piping within a public or private premises which conveys sewage, rainwater or other liquid wastes to a point of disposal. A drainage system does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.
Building gravity: A *drainage system* that drains by gravity into the *building sewer*.
Sanitary: A *drainage system* that carries sewage and excludes storm, surface and ground water.

Emergency floor drain: A floor drain that does not receive the discharge of any drain or *indirect waste pipe*. A floor drain that protects against damage from accidental spills, fixture overflows and leakage.

Fixture unit
Drainage (dfu): A measure of the probable discharge into the *drainage system* by various types of plumbing fixtures.

Offset: A combination of approved bends which makes two changes in direction bringing one section of the pipe out of line but into a line parallel with the other section.

Sewage ejectors: A device for lifting sewage by entraining the sewage in a high-velocity jet of steam, air or water.

Sewer
Building sewer: See "*Building sewer.*"
Public sewer: A common *sewer* directly controlled by public authority.

Sump: A tank or pit which receives sewage or liquid waste and is located below the normal grade of the gravity system. The tank or pit is emptied by mechanical means.

SECTION P-603.0 DRAINAGE SYSTEM SIZING

P-603.1 Drainage load: The drainage *fixture unit* load shall be determined for each sanitary drainage pipe in accordance with Table P-603.1(1), Table P-603.1(2) and Section P-603.1.1. Fixtures not listed in Table P-603.1(1) shall have a drainage *fixture*

unit load based on the outlet size of the fixture in accordance with Table P-603.1(2). The minimum trap size for unlisted fixtures shall be the size of the drainage outlet but not less than 1¼ inches.

Table P-603.1(1)
DRAINAGE FIXTURE UNIT VALUES FOR VARIOUS PLUMBING FIXTURES

Type of fixture or group of fixtures	Drainage fixture unit value	Trap size (inches)
Automatic clothes washer standpipe — commercial	3	2
Automatic clothes washer standpipe — domestic	2	1½
Bathroom group	6	—
Bathtub	2	1½
Bidet	1	1¼
Combination sink and tray	2	1½
Dental unit	1	1¼
Dishwasher	2	1½
Drinking fountain	½	1¼
Emergency floor drains	0	2
Floor drains	2	2
Kitchen sink	2	1½
Laundry tray	2	1½
Lavatory	1	1¼
Mop basin	2	2
Service sink	2	1½
Shower (each head)	2	1½
Sink	2	1½
Urinal	4	2
Water closet, private	4	—
Water closet, public	6	—
Water closet, pneumatic assist, private or public installation	4[a]	—

Note a. For the purpose of computing loads on building drains and sewers, water closets shall not be rated at a lower drainage fixture unit unless the lower values are confirmed by testing.

Table P-603.1(2)
DRAINAGE FIXTURE UNIT VALUES FOR FIXTURE DRAINS OR TRAPS

Size (inches)	Drainage fixture unit value
1¼ or less	1
1½	2
2	3
2½	4
3	5
4	6

P-603.1.1 Values for continuous flow: Drainage *fixture unit* values for continuous or semicontinuous flow into a *drainage system*, such as from a pump, sump ejector, air conditioning equipment or similar device, shall be computed on the basis that one *fixture unit* is equivalent to 7½ gallons per minute (28 l/m).

P-603.2 Pipe sizing: Sanitary drainage pipes shall be sized in accordance with Tables P-603.2(1) and P-603.2(2) based on the drainage *fixture unit* load. Future fixtures that are *roughed-in* shall be included in the drainage *fixture unit* load.

P-603.3 Sizing of horizontal offsets: Horizontal offsets of sanitary drainage stacks shall be sized in accordance with Table P-603.2(1). For purposes of sizing the stack, the horizontal offset shall be classified as part of the stack.

Table P-603.2(1)
BUILDING DRAINS AND SEWERS

Diameter of pipe (inches)	Maximum number of fixture units connected to any portion of the building drain or the building sewer, including branches of the building drain			
	Slope per foot[a]			
	1/16 inch	1/8 inch	1/4 inch	1/2 inch
1¼			1	1
1½			3	3
2			21	26
2½			24	31
3		36	42	50
4		180	216	250
5		390	480	575
6		700	840	1,000
8	1,400	1,600	1,920	2,300
10	2,500	2,900	3,500	4,200
12	2,900	4,600	5,600	6,700
15	7,000	8,300	10,000	12,000

Note a. 1 inch per foot = 83.3 mm/m.

Table P-603.2(2)
HORIZONTAL FIXTURE BRANCHES AND STACKS[a]

Diameter of pipe (inches)	Maximum number of fixture units			
	Total for a horizontal branch	Stacks[b]		
		Total discharge into one branch interval	Total for stack of three branch intervals or less	Total for stack greater than three branch intervals
1½	3	2	4	8
2	6	6	10	24
2½	12	9	20	42
3	20	20	48	72
4	160	90	240	500
5	360	200	540	1,100
6	620	350	960	1,900
8	1,400	600	2,200	3,600
10	2,500	1,000	3,800	5,600
12	3,900	1,500	6,000	8,400
15	7,000	Note c	Note c	Note c

Note a. Does not include branches of the building drain. Refer to Table P-603.2(1).

Note b. Stacks shall be sized based on the total accumulated connected load at each story or branch interval. As the total accumulated connected load decreases, stacks are permitted to be reduced in size. Stack diameters shall not be reduced to less than one-half of the diameter of the largest stack size required.

Note c. Sizing load based on design criteria.

SECTION P-604.0 DRAINAGE PIPING INSTALLATION

P-604.1 Slope of horizontal drainage piping: Horizontal drainage piping shall be installed in uniform alignment at uniform slopes. The minimum slope of a horizontal drainage pipe shall be in accordance with Table P-604.1.

Table P-604.1
SLOPE OF HORIZONTAL DRAINAGE PIPE

Size (inches)	Minimum slope (inch per foot)[a]
2½ or less	1/4
3 to 6	1/8
8 or larger	1/16

Note a. 1 inch per foot = 83.3 mm/m.

P-604.2 Continuous flow: The size of the drainage piping shall not be reduced in size in the direction of the flow. A 4-inch by 3-inch water closet connection shall not be considered as a reduction in size.

P-604.3 Connections to offsets and bases of stacks: Horizontal *branches* shall connect to horizontal stack offsets and to the bases of stacks at a point located not less than ten pipe diameters downstream from the stack.

P-604.4 Future fixtures: Drainage piping for future fixtures shall terminate with an approved cap or plug.

P-604.5 Dead ends: In the installation or removal of any part of a *drainage system, dead ends* shall be prohibited. *Cleanout* extensions and approved future fixture drainage piping shall not be considered as *dead ends.*

P-604.6 Flood hazard: All drainage piping located in a flood-hazard zone (A Zone) or a high-hazard zone (V Zone) shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the base flood elevation.

SECTION P-605.0 FITTINGS AND CONNECTIONS

P-605.1 Approval: All connections and changes in direction of the sanitary *drainage system* shall be made with approved drainage fittings. The fittings shall not obstruct or retard flow in the system.

P-605.2 Installation of fittings: Fittings shall be installed to guide sewage and waste in the direction of flow. Change in direction shall be made by fittings installed in accordance with Table P-605.2. Change in direction by combination fittings, side inlets, increasers or reducers shall be installed in accordance with Table P-605.2 based on the pattern of flow created by the fitting. Double sanitary tee patterns shall not receive the discharge of blowout fixtures and fixtures or appliances with pumping action discharge.

Table P-605.2
FITTINGS FOR CHANGE IN DIRECTION

Type of fitting pattern	Change in direction		
	Horizontal to vertical	Vertical to horizontal	Horizontal to horizontal
Sixteenth bend	X	X	X
Eighth bend	X	X	X
Sixth bend	X	X	X
Quarter bend	X	X[c]	X[c]
Short sweep	X	X[a, c]	X[c]
Long sweep	X	X	X
Sanitary tee	X[b]		
Wye	X	X	X
Combination wye and eighth bend	X	X	X

Note a. 3 inches and larger.
Note b. For a limitation on double sanitary tees, see Section P-605.2.
Note c. The fittings shall only be permitted for a 2-inch or smaller fixture drain.

SECTION P-606.0 SEWAGE PUMPS AND EJECTORS

P-606.1 Sumps: *Building subdrains* shall discharge into an approved sump. The sump shall have a gas-tight cover and be vented in accordance with Section P-904.2. The capacity of the sump or the setting of controls shall be such that the storage period does not exceed 12 hours. Minimum sump dimensions shall be 18 inches (457 mm) in diameter and 24 inches (610 mm) deep, or as required to ensure at least 15 seconds per pump running cycle.

P-606.2 Sewage pumps and sewage ejectors: A sewage pump or sewage ejector shall automatically discharge the contents of the sump to the building *drainage system.*

P-606.2.1 Capacity: A sewage pump or sewage ejector shall have the capacity and head for the application requirements. Pumps or ejectors which receive the discharge of water closets shall be capable of handling spherical solids with a diameter of up to and including 2 inches (51 mm). Other pumps or ejectors shall be capable of handling spherical solids with a diameter of up to and including 1 inch (13 mm). The minimum capacity of a pump or ejector based on the diameter of the discharge pipe shall be in accordance with Table P-606.2.1.

Exception: Grinder pumps or grinder ejectors that receive the discharge of water closets shall have a minimum discharge opening of 1¼ inches.

Table P-606.2.1
MINIMUM CAPACITY OF SEWAGE PUMP OR SEWAGE EJECTOR

Diameter of the discharge pipe (inches)	Capacity of pump or ejector (gallons per minute)[a]
2	21
2½	30
3	46

Note a. 1 gallon per minute = 3.78 l/m.

P-606.2.2 Check valve: The discharge pipe shall have an approved check valve installed between the pump or ejector and the point of discharge.

CHAPTER 7

INDIRECT WASTE PIPING AND SPECIAL WASTE

SECTION P-701.0 GENERAL

P-701.1 Scope: This chapter shall govern matters concerning indirect waste piping and special wastes. This chapter shall further control matters concerning food-handling establishments, sterilizers, clear-water wastes, *swimming pools*, methods of providing *air breaks* or *air gaps*, and neutralizing devices for corrosive wastes.

SECTION P-702.0 DEFINITIONS

P-702.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Air break (drainage system): A piping arrangement in which a drain from a fixture, appliance or device discharges indirectly into another fixture, receptacle or interceptor at a point below the flood level rim.

Air gap (drainage system): The unobstructed vertical distance through the free atmosphere between the outlet of the waste pipe and the flood level rim of the receptacle into which the waste pipe is discharging.

Indirect waste pipe: A waste pipe that does not connect directly with the *drainage system*, but that discharges into the *drainage system* through an *air break* or *air gap* into a trap, fixture, receptor or interceptor.

Swimming pool: Any structure, basin, chamber, or tank containing an artificial body of water for swimming, diving or recreational bathing, and having a depth of 2 feet (610 mm) or more at any point.

SECTION P-703.0 INDIRECT WASTES

P-703.1 Where required: Food-handling equipment and clear-water waste shall discharge through an *indirect waste pipe* as specified in Sections P-703.1.1 through P-703.1.3.

P-703.1.1 Food handling: Equipment and fixtures utilized for the storage, preparation and handling of food shall discharge through an *indirect waste pipe* by means of an *air gap*.

Exception: This requirement shall not apply to dishwashing machines and dishwashing sinks.

P-703.1.2 Potable clear-water waste: Where devices and equipment, such as sterilizers, lawn sprinkler systems, *swimming pools* and relief valves, discharge potable water to the building *drainage system*, the discharge shall be through an *indirect waste pipe* by means of an *air gap*.

P-703.1.3 Nonpotable clear-water waste: Where devices and equipment, such as process tanks, filters, drips and boilers, discharge nonpotable water to the building *drainage system*, the discharge shall be through an *indirect waste pipe* by means of an *air break*.

P-703.2 Installation: All *indirect waste piping* shall discharge through an *air gap* or *air break* into a waste receptor or standpipe. Waste receptors and standpipes shall be trapped and vented and shall connect to the building *drainage system*. All *indirect waste piping* that exceeds 2 feet (610 mm) in *developed length* measured horizontally, or 4 feet (1219 mm) in total *developed length*, shall be trapped.

P-703.2.1 Air gap: The *air gap* between the *indirect waste pipe* and the flood level rim of the waste receptor shall be a minimum of twice the effective opening of the *indirect waste pipe*.

P-703.2.2 Air break: An *air break* shall be provided between the *indirect waste pipe* and the *trap seal* of the waste receptor or standpipe.

P-703.3 Waste receptor: Every waste receptor shall be of an approved type. A removable strainer or basket shall cover the waste outlet of waste receptors. Waste receptors shall be installed in ventilated spaces. Waste receptors shall not be installed in bathrooms or toilet rooms. *Ready access* shall be provided to waste receptors.

P-703.3.1 Size of receptor: A waste receptor shall be sized for the maximum discharge of all *indirect waste pipes* served by the receptor. Receptors shall be installed to prevent splashing.

P-703.3.2 Clear-water waste receptors: Waste receptors receiving only clear-water wastes shall be permitted in the form of a hub or pipe extending not less than 2 inches (51 mm) above a water-impervious floor, and are not required to have a strainer.

P-703.4 Standpipes: Standpipes shall be individually trapped. Standpipes shall extend a minimum of 18 inches (457 mm) and a maximum of 42 inches (1066 mm) above the trap. Standpipes having a 1½-inch diameter which serve domestic automatic clothes washers, shall extend a minimum of 30 inches (762 mm)

above the trap. *Access* shall be provided to all standpipe traps and drains for rodding.

P-703.5 Waste-water temperature: Steam pipes shall not connect to any part of a drainage or plumbing system, nor shall any water above 140 degrees F. (60 degrees C.) be discharged into any part of a *drainage system*. Such pipes shall discharge into an indirect waste receptor connected to the *drainage system*.

SECTION P-704.0 SPECIAL WASTES

P-704.1 Neutralizing device required for corrosive wastes: Corrosive liquids, spent acids, or other harmful chemicals which destroy or injure a drain, *sewer*, soil or waste pipe, or create noxious or toxic fumes, or interfere with sewage treatment processes, shall not be discharged into the plumbing system without being thoroughly diluted, neutralized or treated by passing through an approved dilution or neutralizing device. Such devices shall be automatically provided with a sufficient supply of diluting water or neutralizing medium so as to make the contents noninjurious before discharge into the *drainage system*. The nature of the corrosive or harmful waste and the method of its treatment or dilution shall be approved prior to installation.

P-704.2 System design: A chemical drainage and *vent system* shall be designed and installed in accordance with this code. Chemical drainage and *vent systems* shall be completely separated from the sanitary systems. Chemical waste shall not discharge to a sanitary *drainage system* until such waste has been treated in accordance with Section P-704.1.

CHAPTER 8

STORM DRAINAGE SYSTEMS

SECTION P-801.0 GENERAL

P-801.1 Scope: This chapter shall govern methods of installation of storm drains, maximum projected roof area for drains of various slopes, size of roof gutters and vertical leaders, size of combined *building drains* and *sewers*, *building subdrains*, methods of installation, roof drains and general utilization.

SECTION P-802.0 DEFINITIONS

P-802.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Area drain: A receptacle designed to collect surface or storm water from an open area.

Building drain

Combined: A *building drain* that conveys both sewage and storm water or other drainage.

Storm: A *building drain* that conveys storm water or other drainage, but not sewage.

Building sewer

Combined: A *building sewer* that conveys both sewage and storm water or other drainage.

Storm: A *building sewer* that conveys storm water or other drainage, but not sewage.

Conductor: A pipe inside the building which conveys storm water from the roof to a storm or combined *building drain.*

Drainage system

Storm: A *drainage system* that carries rainwater, surface water, condensate, cooling water or similar liquid wastes.

Leader: An exterior drainage pipe for conveying storm water from roof or gutter drains.

Roof drain: A drain installed to receive water collecting on the surface of a roof and to discharge such water into a leader or a conductor.

Sewer

Sanitary sewer: A *sewer* that carries sewage and excludes storm, surface and ground water.

Storm sewer: A *sewer* that conveys rainwater, surface water, condensate, cooling water, or similar liquid wastes.

Subsoil drain: A drain that collects subsurface water and conveys such water to a place of disposal.

Sump pump: An automatic water pump powered by an electric motor for the removal of drainage, except raw sewage, from a sump, pit or low point.

SECTION P-803.0 WHERE REQUIRED

P-803.1 General: All roofs, paved areas, yards, courts and courtyards shall drain into a separate storm *sewer* system, or a combined *sewer* system, or to an approved place of disposal. For one- and two-family dwellings, and where approved, storm water is permitted to discharge onto flat areas, such as streets or lawns, provided that the storm water flows away from the building.

P-803.2 Cleanouts required: *Cleanouts* shall be installed in the storm *drainage system* and shall comply with the provisions of this code for drainage pipe *cleanouts.*

SECTION P-804.0 STORM WATER DRAINAGE SYSTEM INSTALLATION

P-804.1 General: Storm water shall not be drained into sanitary *sewers.*

P-804.2 Slope of horizontal drainage piping: Horizontal drainage piping, excluding gutters, shall be installed with a minimum slope of ⅛ inch per foot unless otherwise approved.

P-804.3 Continuous flow: The size of a drainage pipe shall not be reduced in the direction of flow.

P-804.4 Flood hazard: All drainage piping located in a flood-hazard zone (A Zone) or a high-hazard zone (V Zone) shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the base flood elevation.

P-804.5 Fittings and connections: All connections and changes in direction of the storm *drainage system* shall be made with approved drainage-type fittings in accordance with Table P-605.2. The fittings shall not obstruct or retard flow in the system.

SECTION P-805.0 SIZE OF BUILDING STORM DRAINS, BUILDING STORM SEWERS AND LEADERS

P-805.1 Size of horizontal drains and sewers: The size of the *building storm drains*, *building storm sewers* and any *horizontal branches* of such drains or *sewers* shall be based upon the maximum projected roof or paved area to be drained. The size shall be determined in accordance with Table P-805.1, and adjusted to local rainfall rates listed in Appendix A.

Table P-805.1
SIZE OF HORIZONTAL BUILDING STORM DRAINS AND BUILDING STORM SEWERS[a]

Diameter of drain (inches)	Maximum projected area, in square feet, and flow, in gallons per minute, for various slopes[b]					
	1/8 inch per foot slope		1/4 inch per foot slope		1/2 inch per foot slope	
	Square feet[a]	Gallons per minute	Square feet[a]	Gallons per minute	Square feet[a]	Gallons per minute
3	3,288	34	4,640	48	6,576	68
4	7,520	78	10,600	110	15,040	156
5	13,360	139	18,880	196	26,720	278
6	21,400	222	30,200	314	42,800	445
8	46,000	478	65,200	677	92,000	956
10	82,800	860	116,800	1,214	165,600	1,721
12	133,200	1,384	188,000	1,953	266,400	2,768
15	238,000	2,473	336,000	3,491	476,000	4,946

Note a. Table P-805.1 is based upon a maximum rate of rainfall of 1 inch per hour for a 1-hour duration and a 100-year return period. The figure for drainage area shall be adjusted to local conditions by dividing by the local rate in inches per hour. See Appendix A.
Note b. 1 inch per foot = 83.3 mm/m; 1 square foot = 0.093 m^2; 1 gallon per minute = 3.78 l/m; 1 inch = 25.4 mm.

P-805.2 Size of vertical conductors and leaders: The size of vertical leaders shall be based on the maximum projected roof area in accordance with Table P-805.2, and adjusted to local rainfall rates listed in Appendix A.

Table P-805.2
SIZE OF VERTICAL CONDUCTORS AND LEADERS[a]

Size of leader or conductor[b] (inches)	Maximum projected roof area	
	Square feet[a,c]	Gallons per minute[c]
2	2,176	23
2 1/2	3,948	41
3	6,440	67
4	13,840	144
5	25,120	261
6	40,800	424
8	88,000	913

Note a. Table P-805.2 is based upon a maximum rate of rainfall of 1 inch per hour for a 1-hour duration and a 100-year return period. The figure for drainage area shall be adjusted to local conditions by dividing by the local rate in inches per hour. See Appendix A.
Note b. The area of rectangular leaders shall be equivalent to the circular leader or conductor required. The width-to-depth ratio of rectangular leaders shall not exceed 3:1.
Note c. 1 inch per foot = 83.3 mm/m; 1 square foot = 0.093 m^2; 1 gallon per minute = 3.78 l/m; 1 inch = 25.4 mm.

P-805.3 Size of roof gutters: The size of semicircular gutters shall be based on the maximum projected roof area in accordance with Table P-805.3, and adjusted to local rainfall rates listed in Appendix A.

P-805.4 Size of combined drains and sewers: The size of a combination sanitary and storm drain or *sewer* shall be computed in accordance with the method in Section P-805.1. The *fixture units* shall be converted into an equivalent projected roof or paved area. Where the total fixture load on the combined drain is less than 256 *fixture units*, the equivalent drainage area in horizontal projection shall be taken as 4,000 square feet (372 m^2). Where the total fixture load exceeds 256 units, each additional *fixture unit* shall be considered the equivalent of 15.6 square feet (1.5 m^2) of drainage area.

P-805.5 Values for continuous flow: Where there is a continuous or semicontinuous discharge into the *building storm drain* or *building storm sewer*, such as from a pump, ejector, air conditioning plant or similar device, each gallon per minute of such discharge shall be computed as being equivalent to 96 square feet (9 m^2) of roof area, based upon a 1-inch (25 mm) rainfall.

Table P-805.3
SIZE OF SEMICIRCULAR ROOF GUTTERS[a]

Diameter of gutter[b] (inches)	Maximum projected roof area for gutters of various slopes[c]							
	1/16 inch per foot slope		1/8 inch per foot slope		1/4 inch per foot slope		1/2 inch per foot slope	
	Square feet[a]	Gallons per minute	Square feet[a]	Gallons per minute	Square feet[a]	Gallons per minute	Square feet[a]	Gallons per minute
3	680	7	960	10	1,360	14	1,920	20
4	1,440	15	2,040	21	2,880	30	4,080	42
5	2,500	26	3,520	37	5,000	52	7,080	74
6	3,840	40	5,440	57	7,680	80	11,080	115
7	5,520	57	7,800	81	11,040	115	15,600	162
8	7,960	83	11,200	116	14,400	165	22,400	233
10	14,400	150	20,400	212	28,800	299	40,000	416

Note a. Table P-805.3 is based upon a maximum rate of rainfall of 1 inch per hour for a 1-hour duration and a 100-year return period. The figure for drainage area shall be adjusted to local conditions by dividing by the local rate in inches per hour. See Appendix A.
Note b. Gutters, other than semicircular, shall have an equivalent cross-sectional area.
Note c. 1 inch per foot = 83.3 mm/m; 1 square foot = 0.093 m^2; 1 gallon per minute = 3.78 l/m; 1 inch = 25.4 mm.

SECTION P-806.0 BUILDING SUBDRAINS

P-806.1 Sump: *Building subdrains* located below the public *sewer* level shall discharge into a sump or receiving tank, the contents of which shall be automatically lifted and discharged into the *drainage system* as required for building sumps, or into another type of approved disposal system. The subsoil sump shall not be required to have either a gas-tight cover or a vent.

P-806.2 Sump pump systems: A sump pump system shall include the sump pump, pit, discharge piping, and an individual branch electrical circuit. The system shall include a pump with a capacity and head appropriate for the anticipated application requirements.

P-806.3 Sump pit: The size of the sump pit shall be as specified by the sump pump manufacturer. The pit shall be topped by a removable cover adequate to support anticipated loads in the area of installation. The pit floor shall provide permanent support for the sump pump. The pit shall be constructed of tile, concrete, steel, plastic or other approved material.

P-806.4 Discharge piping: Where discharging into a storm or sanitary *sewer* system, a suitable antisiphon device or free-flow check valve shall be installed. Where discharge to separate sanitary and storm *sewers* is required, two independent sump pump systems shall be required. Discharge pipe size and fittings shall be the same size as, or larger than, the sump pump discharge tapping.

SECTION P-807.0 SUBSOIL DRAINS

P-807.1 General: Where the subsoil drain for a structure is subject to *backflow*, such subsoil drain shall be protected by a backwater valve. *Access* shall be provided to the backwater valve. Subsoil drains shall discharge to a trapped area drain, sump, dry well or approved location above grade.

SECTION P-808.0 TRAPS ON STORM DRAINS AND LEADERS

P-808.1 Where required: Leaders, conductors and storm drains, where connected to a combined *sewer*, shall be trapped.

P-808.2 Trap size: Traps for individual conductors shall be the same size as the horizontal drain to which the traps are connected.

P-808.3 Method of installation: Individual storm water traps shall be installed on the storm drain *branch* serving each storm water inlet, or a single trap shall be installed in the main storm drain before connection of the main storm drain with the combined *building sewer* or public *sewer*. Such traps shall be provided with a *cleanout*. *Access* shall be provided to the *cleanout*.

SECTION P-809.0 CONDUCTORS AND CONNECTIONS

P-809.1 Improper utilization prohibited: Conductors shall not be utilized as soil, waste or vent pipes, nor shall drainage or vent pipes be utilized as conductors.

P-809.2 Protection of leaders: Leaders installed along alleyways, driveways or other locations exposed to damage shall be recessed into the wall or otherwise protected by metal guards.

P-809.3 Separate storm and sanitary drainage: The sanitary and storm *drainage systems* of a structure shall be entirely separate.

> **Exception:** Where a combined *sewer* is utilized, the *building storm drain* shall be connected in the same horizontal plane through a single-wye fitting to the combined *sewer* at least 10 feet (3048 mm) downstream from any soil stack.

P-809.4 Double connections of storm drains: Where the sanitary and storm drains are connected on both sides of the combined *sewer*, single wyes shall be utilized and the requirements of Section P-809.3 shall apply to the location of connections.

SECTION P-810.0 ROOF DRAINS

P-810.1 General: All roof areas, except those draining to hanging gutters, shall be equipped with roof drains with strainers extending not less than 4 inches (102 mm) above the surface of the roof, and shall have an available inlet area not less than two times the area of the conductor or leader to which the drain is connected.

P-810.2 Roof design: Roofs shall be designed for the maximum possible depth of water that will pond thereon as determined by the relative levels of roof deck and overflow weirs, scuppers, edges or serviceable drains in combination with the deflected structural elements. In determining the maximum possible depth of water, all primary roof drainage means shall be assumed to be blocked.

P-810.3 Flat decks: Roof drain strainers for utilization on sun decks, parking decks and similar areas normally serviced and maintained, are permitted to be of a flat-surface type and level with the deck, and shall have an available inlet area not less than two times the area of the conductor or leader to which the drain is connected.

P-810.4 Roof drain flashings required: The connection between roofs and roof drains passing through the roof and into the interior of the structure shall be made water tight by an approved flashing material.

SECTION P-811.0 CONTROLLED FLOW ROOF DRAIN SYSTEMS

P-811.1 General: The roof of a structure shall be designed for the storage of water where the storm *drainage system* is engineered for controlled flow. The controlled flow system shall be designed based on the local rainfall rate listed in Appendix A.

P-811.2 Control devices: The control devices shall be installed so that the rate of discharge of water per minute shall not exceed the rates indicated in Tables P-805.1 and P-805.2 and utilizing values for continuous flow as indicated in Section P-805.5.

P-811.3 Installation: Runoff control shall be by control devices. Control devices shall be protected by strainers.

P-811.4 Sizing: Not less than two roof drains shall be installed in roof areas 10,000 square feet (930 m^2) or less and not less than four roof drains shall be installed in roofs over 10,000 square feet (930 m^2) in area.

CHAPTER 9

VENTS AND VENTING

SECTION P-901.0 GENERAL

P-901.1 Scope: This chapter shall govern the selection and installation of piping, tubing and fittings for *vent systems*. This chapter shall control the minimum diameter of vent pipe, *individual vents* and relief vents, and the size and length of vents and various aspects of vent stacks and stack vents. Additionally, this chapter regulates vent grades and connections, height above fixtures, hydraulic gradient and relief vents for stacks and fixture traps and the venting of sumps and *sewers*.

P-901.2 Chemical vent system: The *vent system* for a chemical waste system shall be independent of the sanitary *vent system* and shall terminate separately through the roof to the open air.

SECTION P-902.0 DEFINITIONS

P-902.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Branch vent: A vent connecting one or more *individual vents* with a vent stack or stack vent.

Circuit vent: A vent that connects to a horizontal drainage branch and vents two traps to a maximum of eight traps or trapped fixtures connected in a battery.

Developed length: The length of a pipeline measured along the centerline of the pipe and fittings.

Fixture branch: A drain serving one or more fixtures and which discharges to another drain or to a stack.

Fixture drain: The drain from the trap of a fixture to a junction with any other drain pipe.

Horizontal branch drain: A drainage branch pipe extending laterally from a soil or waste stack or *building drain*, with or without vertical sections or *branches*, which receives the discharge from one or more *fixture drains* and conducts the discharge to the soil or waste stack or to the *building drain*.

Individual vent: A pipe installed to vent a *fixture drain*. An individual vent connects with the *vent system* above the fixture served or terminates outside the structure into the open air.

Main vent: The principal artery of the venting system to which vent *branches* are connected.

Relief vent: An auxiliary vent that permits additional circulation of air in or between drainage and *vent systems*.

Stack vent: The extension of a soil or waste stack above the highest horizontal drain connected to the stack.

Sump vent: A vent from pneumatic sewage ejectors or similar equipment which terminates separately to the open air.

Vent pipe: Part of the *vent system*.

Vent stack: A vertical vent pipe installed to provide circulation of air to and from the *drainage system*.

Vent system: A pipe or pipes installed to provide a flow of air to or from a *drainage system*, or to provide a circulation of air within such system to protect *trap seals* from siphonage and back pressure.

Yoke vent: A pipe connecting upward from a soil or waste stack to a vent stack for the purpose of preventing pressure changes in the stack.

SECTION P-903.0 WHERE REQUIRED

P-903.1 Individual vent: Every trap and trapped fixture shall be provided with an *individual vent*, except as otherwise provided for in Chapters 9 and 18. The *individual vent* shall connect to the *fixture drain* of the trap or trapped fixture being vented.

P-903.2 Trap seal: The *vent system* shall be designed and installed so that the *trap seal* shall be subject to a maximum pneumatic pressure differential equal to 1-inch (25 mm) water column.

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SECTION P-904.0 VENT PIPE SIZING

P-904.1 General: The diameter of *individual vents*, branch vents, circuit vents, relief vents, vent stacks and stack vents shall be at least one-half the required diameter of the drain served. The required size of the drain shall be determined in accordance with Chapter 6. Vent pipes shall not be less than 1 1/4 inch in diameter. Vents exceeding 40 feet (12192 mm) in *developed length* shall be increased by one nominal pipe size.

*

P-904.1.1 Developed length: The *developed length* of *individual*, branch, circuit and relief vents shall be measured from the farthest point of vent connection to the *drainage system*, to the point of connection to the vent stack, stack vent or termination outside of the building.

P-904.1.2 Multiple branch vents: Where multiple branch vents are connected to a common branch vent, the common branch vent shall be sized in accordance with this section, based on the size of the common horizontal drainage branch that is or would be required to serve the total drainage *fixture unit* (dfu) load being vented.

P-904.2 Sump vents: Sump vent sizes shall be determined in accordance with Sections P-904.2.1 and P-904.2.2.

P-904.2.1 Sewage pumps and sewage ejectors other than pneumatic: Drainage piping below *sewer* level shall be vented in a similar manner to that of a gravity system. Building sump vent sizes for sumps with sewage pumps or sewage ejectors, other than pneumatic, shall be determined in accordance with Table P-904.2.1.

P-904.2.2 Pneumatic sewage ejectors: The air pressure relief pipe from a pneumatic sewage ejector shall be connected to an independent vent stack terminating as required for vent extensions through the roof. The relief pipe shall be sized to relieve air pressure inside the ejector to atmospheric pressure, but shall not be less than 1¼ inches in size.

SECTION P-905.0 VENT STACKS AND STACK VENTS

P-905.1 Main vent required: Every sanitary *drainage system* receiving the discharge of a water closet shall have a main vent that is either a vent stack or a stack vent.

P-905.2 Vent stack required: A vent stack shall be required for every drainage stack that is five *branch intervals* or more.

P-905.3 Vent termination: Every vent stack or stack vent shall extend outdoors and terminate to the open air.

P-905.4 Vent connection at base: Every vent stack shall connect to the base of the drainage stack. The vent stack shall connect at or below the lowest horizontal *branch*. Where the vent stack connects to the *building drain*, the connection shall be located within ten pipe diameters downstream of the drainage stack. The size of the vent stack connection to the drainage stack shall not be less than the size required for the vent stack.

P-905.5 Vent for horizontal offset of drainage stack: Horizontal offsets of drainage stacks shall be vented where five or more *branch intervals* are located above the offset. The offset shall be vented by venting the upper section of the drainage stack and the lower section of the drainage stack.

P-905.5.1 Upper section: The upper section of the drainage stack shall be vented as a separate stack with a vent stack connection installed in accordance with Section P-905.4. The offset shall be considered the base of the stack.

P-905.5.2 Lower section: The lower section of the drainage stack shall be vented by a yoke vent connecting between the offset and the next lower horizontal *branch*. The yoke vent connection shall be permitted to be a vertical extension of the drainage stack. The size of the yoke vent and connection shall be a minimum of the size required for the vent stack of the drainage stack.

P-905.6 Vent headers: Stack vents and vent stacks connected into a common vent header at the top of the stacks and extending to the open air at one point shall be sized in accordance with the requirements of Section P-904.1. The number of *fixture units* shall be the sum of all *fixture units* on all stacks connected thereto, and the *developed length* shall be the longest vent length from the intersection at the base of the most distant stack to the vent terminal in the open air, as a direct extension of one stack. A reduction in the vent size to 75 percent of the combined areas of the vents so connected is permitted where approved.

SECTION P-906.0 VENT TERMINALS

P-906.1 Extension above roofs: Extension of vent pipes through a roof shall be terminated a minimum of 12 inches (305 mm) above the roof. Where a roof is to be utilized for any purpose

Table P-904.2.1
SIZE AND LENGTH OF SUMP VENTS

Discharge capacity of pump (gallons per minute)[d]	Maximum developed length of vent (feet)[a,d]					
	Diameter of vent (inches)					
	1¼	1½	2	2½	3	4
10	No limit[b]	No limit	No limit	No limit	No limit	No limit
20	270	No limit	No limit	No limit	No limit	No limit
40	72	160	No limit	No limit	No limit	No limit
60	31	75	270	No limit	No limit	No limit
80	16	41	150	380	No limit	No limit
100	10[c]	25	97	250	No limit	No limit
150	Not permitted[d]	10[c]	44	110	370	No limit
200	Not permitted	Not permitted	20	60	210	No limit
250	Not permitted	Not permitted	10	36	132	No limit
300	Not permitted	Not permitted	10[c]	22	88	380
400	Not permitted	Not permitted	Not permitted	10[c]	44	210
500	Not permitted	Not permitted	Not permitted	Not permitted	24	130

Note a. Developed length plus an appropriate allowance for entrance losses and friction due to fittings, changes in direction and diameter. Suggested allowances shall be obtained from NBS Monograph 31 or other approved sources. An allowance of 50 percent of the developed length shall be assumed if a more precise value is not available.
Note b. Actual values greater than 500 feet.
Note c. Less than 10 feet.
Note d. 1 foot = 304.8 mm; 1 gallon per minute = 3.78 l/m.

other than weather protection, the vent extensions shall extend a minimum of 7 feet (2134 mm) above the roof.

P-906.2 Location of vent terminal: Vent terminals shall not be located directly beneath any door, window or other ventilating opening of the structure or of an adjacent structure, nor shall any such vent terminal be within 10 feet (3048 mm) horizontally of such an opening unless such vent terminal is at least 2 feet (610 mm) above the top of such opening.

P-906.3 Extension through the wall: Vent terminals extending through the wall shall terminate a minimum of 10 feet (3048 mm) from the lot line and 10 feet (3048 mm) above average ground level. Vent terminals shall not terminate under the overhang of a structure with soffit vents. Side wall vent terminals shall be protected to prevent birds or rodents from entering or blocking the vent opening.

P-906.4 Extension outside a structure: In climates with freezing temperatures, vent pipes installed on the exterior of the structure shall be protected against freezing by insulation, heat or both.

SECTION P-907.0 VENT GRADES AND CONNECTIONS

P-907.1 Connection: All *individual*, branch and circuit vents shall connect to a vent stack, stack vent or extend to the open air.

Exception: *Individual*, branch and circuit vents shall be permitted to terminate at an air admittance valve in accordance with Section P-1808.0.

P-907.2 Vent grade: All vent pipes and branch vents shall be graded and connected so as to drain back to the soil or waste pipe by gravity.

P-907.3 Vent connection to drainage system: Every dry vent connecting to a horizontal drain shall connect above the centerline of the horizontal drain pipe.

P-907.4 Vertical rise of vent: Every dry vent shall rise vertically to a minimum of 6 inches (152 mm) above the flood level rim of the highest trap or trapped fixture being vented.

P-907.5 Height above fixtures: A connection between a vent pipe and a vent stack or stack vent shall be made a minimum of 6 inches (152 mm) above the flood level rim of the highest fixture vented by the vent pipe. Horizontal vent pipes forming branch vents, relief vents and circuit vents shall be a minimum of 6 inches (152 mm) above the flood level rim of the highest fixture being vented.

P-907.6 Vent for future fixtures: Where the drainage piping has been *roughed-in* for future fixtures, a *rough-in* connection for a vent shall be installed a minimum of one-half the diameter of the drain. The vent *rough-in* shall connect to the *vent system*. The connection shall be identified to indicate that the connection is a vent.

SECTION P-908.0 WET VENTING

P-908.1 Wet vent permitted: Any combination of fixtures within two *bathroom groups* located on the same floor level are permitted to be vented by a wet vent. The wet vent shall be considered the vent for the fixtures and shall extend from the connection of the dry vent along the direction of the flow in the drain pipe, to the most downstream *fixture drain* connection to the *horizontal branch drain*. Only the fixtures being wet vented shall connect to the wet-vented *horizontal branch drain*. Any additional fixtures shall discharge downstream of the wet vent.

P-908.2 Vent connection: The dry vent connection to the wet vent shall be an *individual vent* or common vent to the lavatory, bidet, shower or bathtub.

P-908.3 Size: The wet vent shall be of a minimum size as specified in Table P-908.3, based on the *fixture unit* discharge to the wet vent.

Table P-908.3
WET VENT SIZE

Wet vent pipe size (inches)	Fixture unit load (dfu)
1½	1
2	4
2½	6
3	12

SECTION P-909.0 COMMON VENTS

P-909.1 Individual vent as common vent: An *individual vent* is permitted to vent two traps or trapped fixtures as a common vent. The traps or trapped fixtures being common vented shall be located on the same floor level.

Exception: Three lavatories are permitted to be common vented by an *individual vent*.

P-909.2 Connection at the same level: Where the *fixture drains* being common vented connect at the same level, the vent connection shall be at the interconnection of the *fixture drains* or downstream of the interconnection.

P-909.3 Connection at different levels: Where the *fixture drains* connect at different levels, the vent shall connect as a vertical extension of the vertical drain. The vertical drain pipe connecting the two *fixture drains* shall be considered the vent for the lower *fixture drain*, and shall be sized in accordance with Table P-909.3.

Table P-909.3
COMMON VENT SIZES

Pipe size (inches)	Maximum discharge from upper fixture drain (dfu)
1½	1
2	4
2½ to 3	6

SECTION P-910.0 CIRCUIT VENTING

P-910.1 Circuit vent permitted: A maximum of eight fixtures connected to a *horizontal branch drain* shall be permitted to be circuit vented. Each *fixture drain* shall connect horizontally to the horizontal *branch* being circuit vented. The *horizontal branch drain* shall be classified as a vent from the most downstream *fixture drain* connection to the most upstream *fixture drain* connection to the horizontal *branch*.

P-910.1.1 Multiple circuit-vented branches: Circuit-vented *horizontal branch drains* are permitted to be connected together. Each group of a maximum of eight fixtures

shall be considered a separate circuit vent and shall conform to the requirements of this section.

P-910.2 Vent connection: The circuit vent connection shall be located between the two most upstream *fixture drains*. The vent shall connect to the horizontal *branch* and be installed in accordance with Section P-907.0. The circuit vent pipe shall not receive the discharge of any soil or waste.

P-910.3 Slope and size of horizontal branch: The maximum slope of the vent section of the *horizontal branch drain* shall be 1 inch per foot (83 mm/m). The entire length of the vent section of the *horizontal branch drain* shall be sized for the total drainage discharge to the *branch*.

P-910.3.1 Size of multiple circuit vent: Each separate circuit-vented horizontal *branch* that is interconnected shall be sized independently in accordance with Section P-910.3. The downstream circuit-vented horizontal *branch* shall be sized for the total discharge into the *branch*, including the upstream *branches* and the fixtures within the *branch*.

P-910.4 Relief vent: A relief vent shall be provided for circuit-vented horizontal *branches* receiving the discharge of four or more water closets and connecting to a drainage stack that receives the discharge of soil or waste from upper horizontal *branches*.

P-910.4.1 Connection and installation: The relief vent shall connect to the *horizontal branch drain* between the stack and the most downstream *fixture drain* of the circuit vent. The relief vent shall be installed in accordance with Section P-907.0.

P-910.4.2 Fixture drain or branch: The relief vent is permitted to be a *fixture drain* or *fixture branch* for fixtures located within the same *branch interval* as the circuit-vented horizontal *branch*. The maximum discharge to a relief vent shall be four *fixture units*.

P-910.5 Additional fixtures: Fixtures, other than the circuit-vented fixtures, are permitted to discharge to the *horizontal branch drain*. Such fixtures shall be located on the same floor as the circuit-vented fixtures and shall be either individually or common vented.

SECTION P-911.0 FIXTURE VENTS

P-911.1 Distance of trap from vent: Each fixture trap shall have a protecting vent so located that the *developed length* of the *fixture drain* from the trap weir to the vent fitting is within the requirements set forth in Table P-911.1.

Table P-911.1
MAXIMUM DISTANCE OF FIXTURE TRAP FROM VENT[a]

Size of trap (inches)	Size of fixture drain (inches)	Slope (inch per foot)[a]	Distance from trap (feet)[a]
1¼	1¼	¼	3½
1¼	1½	¼	5
1½	1½	¼	5
1½	2	¼	8
2	2	¼	6
3	3	⅛	10
4	4	⅛	12

Note a. 1 inch per foot = 83.3 mm/m; 1 foot = 304.8 mm.

P-911.2 Venting of fixture drains: The vent for a *fixture drain*, except where serving a fixture with integral traps, such as water closets, shall connect above the weir of the fixture trap being vented.

P-911.3 Crown venting limitation: Vents shall not be installed within two pipe diameters of the trap weir.

SECTION P-912.0 RELIEF VENTS FOR STACKS OF MORE THAN TEN BRANCH INTERVALS

P-912.1 Relief vent required: Relief vents shall be provided for every drainage stack greater than ten *branch intervals*. A relief vent shall be installed every tenth *branch interval* measured downward from the highest horizontal *branch* connecting to the stack. Every relief vent shall connect to the vent stack.

SECTION P-913.0 COMBINATION DRAIN AND VENT SYSTEM

P-913.1 Type of fixtures: A combination drain and *vent system* shall not serve fixtures other than floor drains, standpipes, sinks and lavatories.

P-913.2 Installation: The only vertical pipe of a combination drain and *vent system* shall be the connection between the *fixture branch* of a sink, lavatory or standpipe, and the horizontal combination drain and vent pipe. The maximum vertical distance shall be 8 feet (2438 mm).

P-913.2.1 Slope: The horizontal combination drain and vent pipe shall have a maximum slope of ½ inch per foot (42 mm/m). The minimum slope shall be in accordance with Table P-604.1.

P-913.2.2 Connection: The combination drain and vent pipe shall connect to a horizontal drain that is vented or a vent shall connect to the combination drain and vent. The vent connecting to the combination drain and vent pipe shall extend vertically a minimum of 6 inches (152 mm) above the flood level rim of the highest fixture being vented before offsetting horizontally.

P-913.2.3 Vent size: The vent shall be sized for the total *fixture unit* load in accordance with Section P-904.1.

P-913.2.4 Fixture branch or drain: The *fixture branch* or *fixture drain* shall connect to the combination drain and vent within a distance specified in Table P-911.1. The combination drain and vent pipe shall be considered the vent for the fixture.

P-913.3 Size: The minimum size of a combination drain and vent pipe shall be in accordance with Table P-913.3.

Table P-913.3
SIZE OF COMBINATION DRAIN AND VENT PIPE

Diameter pipe (inches)	Maximum number of fixture units (dfu)	
	Connecting to a horizontal branch or stack	Connecting to a building drain or building subdrain
2	3	4
2½	6	26
3	12	31
4	20	50
5	160	250
6	360	575

SECTION P-914.0 ISLAND FIXTURE VENTING

P-914.1 Limitation: Island fixture venting shall not be permitted for fixtures other than sinks and lavatories. Residential kitchen sinks with a dishwasher waste connection, a food waste grinder, or both, in combination with the kitchen sink waste, shall be permitted to be vented in accordance with this section.

P-914.2 Vent connection: The island fixture vent shall connect to the *fixture drain* as required for an *individual* or common *vent*. The vent shall rise vertically to above the drainage outlet of the fixture being vented before offsetting horizontally or vertically downward. The vent or branch vent for multiple island fixture vents shall extend to a minimum of 6 inches (152 mm) above the highest island fixture being vented before connecting to the outside vent terminal.

P-914.3 Vent installation below the fixture flood level rim: The vent located below the flood level rim of the fixture being vented shall be installed as required for drainage piping in accordance with Chapter 6, except for sizing. The vent shall be sized in accordance with Section P-904.0. The lowest point of the island fixture vent shall connect full size to the *drainage system*. The connection shall be to a vertical drain pipe or to the top half of a horizontal drain pipe. *Cleanouts* shall be provided in the island fixture vent to permit rodding of all vent piping located below the flood level rim of the fixtures. Rodding in both directions shall be permitted through a *cleanout*.

SECTION P-915.0 WASTE STACK VENT

P-915.1 Waste stack vent permitted: A waste stack shall be considered a vent for all of the fixtures discharging to the stack where installed in accordance with the requirements of this section.

P-915.2 Stack installation: The waste stack shall be vertical, and both horizontal and vertical offsets shall be prohibited. Every *fixture drain* shall connect separately to the waste stack. The stack shall not receive the discharge of water closets or urinals.

P-915.3 Stack vent: A stack vent shall be provided for the waste stack. The size of the stack vent shall be equal to the size of the waste stack.

P-915.4 Waste stack size: The waste stack shall be sized based on the total discharge to the stack and the discharge within a *branch interval* in accordance with Table P-915.4. The waste stack shall be the same size throughout the length of the waste stack.

Table P-915.4
WASTE STACK VENT SIZE

Stack size (inches)	Maximum number of fixture units (dfu)	
	Total discharge into one branch interval	Total discharge for stack
1½	1	2
2	2	4
2½	No limit	8
3	No limit	24
4	No limit	50
5	No limit	75
6	No limit	100

SECTION P-916.0 FROST CLOSURE

P-916.1 General: Where the 97½-percent value for outside design temperature as determined from Appendix A of the mechanical code listed in Chapter 19 or other approved source is less than 0 degrees F. (-18 degrees C.), every vent extension through a roof or wall shall be a minimum of 3 inches in diameter. Any increase in the size of the vent shall be made inside the structure a minimum of 1 foot (305 mm) below the roof or inside the wall.

SECTION P-917.0 OTHER UTILIZATION PROHIBITED

P-917.1 General: The plumbing *vent system* shall not be utilized for purposes other than the venting of the plumbing system.

CHAPTER 10

TRAPS, INTERCEPTORS, SEPARATORS AND BACKWATER VALVES

SECTION P-1001.0 GENERAL

P-1001.1 Scope: This chapter shall govern the installation of traps, interceptors, separators and backwater valves.

SECTION P-1002.0 DEFINITIONS

P-1002.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Building trap: A device, fitting or assembly of fittings installed in the *building drain* to prevent circulation of air between the *drainage system* of the building and the *building sewer*.

Combination fixture: A fixture combining one sink and laundry tray or a two- or three-compartment sink or laundry tray in one unit.

Interceptor: A device designed and installed so as to separate and retain for removal by automatic or manual means, deleterious, hazardous or undesirable matter from normal wastes, while permitting normal sewage or wastes to discharge into the *drainage system* by gravity.

Trap: A fitting or device which provides a liquid seal to prevent the emission of sewer gases without materially affecting the flow of sewage or waste water through the trap.

Trap seal: The vertical distance between the crown weir and the top of the dip of the trap.

SECTION P-1003.0 FIXTURE TRAPS

P-1003.1 Separate traps for each fixture: Each plumbing fixture shall be separately trapped by a water-seal trap, except as otherwise permitted by this code. The trap shall be placed as close as possible to the fixture outlet. The vertical distance from the fixture outlet to the trap weir shall not exceed 24 inches (610 mm). A fixture shall not be double trapped. A clothes washer or laundry tub shall not discharge to a trap serving a kitchen sink.

Exceptions

1. This section shall not apply to fixtures with integral traps.
2. A combination plumbing fixture is permitted to be installed on one trap, provided that one compartment is not more than 6 inches (152 mm) deeper than the other compartment and the waste outlets are not more than 30 inches (762 mm) apart.
3. One trap is permitted to be installed for a set of not more than three single-compartment sinks, laundry trays or lavatories, which are adjacent to each other and in the same room. The trap shall be centrally located where three such fixtures are installed.
4. A grease interceptor intended to serve as a fixture trap in accordance with the manufacturer's installation instructions, shall be permitted to serve as the trap for a single fixture or a combination sink of not more than three compartments where the vertical distance from the fixture outlet to the inlet of the interceptor does not exceed 30 inches (762 mm), and the *developed length* of the waste pipe from the most upstream fixture outlet to the inlet of the interceptor does not exceed 60 inches (1524 mm).

P-1003.2 Size of fixture traps: Fixture trap size shall be sufficient to drain the fixture rapidly and not less than the size indicated in Table P-603.1(1). A trap shall not be larger than the drainage pipe into which the trap discharges.

P-1003.3 Prohibited traps: The following types of traps are prohibited:

1. Traps that depend upon moving parts to maintain the seal.
2. Bell traps.
3. Crown-vented traps.
4. Separate fixture traps that depend on interior partitions for the seal.
5. "S" traps.
6. Drum traps, except where approved.

P-1003.4 Design of traps: Fixture traps shall be self-scouring and shall not have interior partitions, except where such traps are integral with the fixture. Slip joints shall be permitted on the trap inlet, trap outlet or within the trap seal.

P-1003.5 Trap seals: Each fixture trap shall have a liquid seal of not less than 2 inches (51 mm) and not more than 4 inches (102 mm). Where a trap seal is subject to loss by evaporation, a deep-seal trap consisting of a 4-inch (102 mm) seal or a trap seal primer valve shall be installed. A trap seal primer valve shall conform to ASSE 1018 or 1044 listed in Chapter 19.

P-1003.6 Trap setting and protection: Traps shall be set level with respect to the trap seal and, where necessary, shall be protected from freezing.

P-1003.7 Building traps: Building (house) traps shall not be installed, except where required by the code official. Where installed, each building trap shall be provided with a *cleanout* and a relief vent or fresh air intake on the inlet side of the trap. The size of the relief vent or fresh air intake shall not be less than one-half the diameter of the drain to which the relief vent or air intake connects. Such relief vent or fresh air intake shall be carried above grade and shall be terminated in a screened outlet located outside the building.

P-1003.8 Acid-resisting traps: Where a vitrified clay or other brittleware, acid-resisting trap is installed underground, such trap shall be embedded in concrete extending 6 inches (152 mm) beyond the bottom and sides of the trap.

P-1003.9 Recess for trap connection: A recess provided for connection of the underground trap, such as one serving a bathtub in slab-type construction, shall have sides and a bottom of corrosion-resistant, insect and vermin-proof construction.

SECTION P-1004.0 INTERCEPTORS AND SEPARATORS

P-1004.1 Interceptors required: Interceptors for oil, grease, sand and other substances harmful or hazardous to the building *drainage system*, the public *sewer* or sewage treatment plant or processes shall be provided as required in this chapter.

P-1004.1.1 Interceptor not required: A grease interceptor shall not be required for individual dwelling units or any private living quarters.

P-1004.2 Separators required: At repair garages, gasoline stations with grease racks, grease pits or work racks, and at factories where oily and flammable liquid wastes are produced, separators shall be installed into which all oil-bearing, grease-bearing or flammable wastes shall be discharged before emptying in the building *drainage system* or other point of disposal.

P-1004.3 Size, type and location to be approved: The size, type and location of each interceptor and of each separator, shall be approved, and wastes that do not require treatment or separation shall not be discharged into any interceptor or separator.

P-1004.4 Grease interceptors: Grease interceptors shall conform to PDI G101 listed in Chapter 19.

P-1004.5 Efficiency of interceptors: Interceptors shall be rated for efficiency.

P-1004.6 Grease interceptors required: A grease interceptor shall be required to receive the drainage from fixtures and equipment with grease-laden waste located in food preparation areas, such as in restaurants, hotel kitchens, bars, factory cafeterias or restaurants and clubs. Food waste grinders shall not discharge to the building *drainage system* through a grease interceptor.

P-1004.6.1 Interceptor capacity: Grease interceptors shall have the grease retention capacity indicated in Table P-1004.6.1 for the flow-through rates indicated.

P-1004.6.2 Rate of flow controls: Grease interceptors shall be equipped with devices to control the rate of water flow so that the water flow does not exceed the rated flow.

Table P-1004.6.1
CAPACITY OF GREASE INTERCEPTORS

Total flow-through rating (gallons per minute)[a]	Grease retention capacity (pounds)[a]
4	8
6	12
7	14
9	18
10	20
12	24
14	28
15	30
18	36
20	40
25	50
35	70
50	100

Note a. 1 gallon per minute = 3.785 l/m; 1 pound = 0.454 kg.

P-1004.7 Separation of liquids: A mixture of treated or untreated light and heavy liquids with various specific gravities shall be separated in an approved receptacle. Separators shall be designed in accordance with Sections P-1004.7.1 and P-1004.7.2.

P-1004.7.1 General design requirements: Oil separators shall have a depth of not less than 2 feet (610 mm) below the invert of the discharge drain. The outlet opening of the separator shall have not less than an 18-inch (457 mm) water seal.

P-1004.7.2 Garages and service stations: Where automobiles are serviced, greased, repaired, washed or where gasoline is dispensed, separators shall have a minimum capacity of 6 cubic feet (0.168 m^3) for the first 100 square feet (9.3 m^2) of area to be drained, plus 1 cubic foot (0.028 m^3) for each additional 100 square feet (9.3 m^3) of area to be drained into the separator. Parking garages in which servicing, repairing or washing is not conducted, and in which gasoline is not dispensed, shall not require a separator. Areas of commercial garages utilized only for storage of automobiles are not required to be drained through a separator.

P-1004.8 Sand interceptors, commercial establishments: Sand and similar interceptors for heavy solids shall be designed and located so as to be provided with *ready access* for cleaning, and shall have a water seal of not less than 6 inches (152 mm).

P-1004.9 Laundries: Commercial laundries shall be equipped with an interceptor with a wire basket or similar device, removable for cleaning, which prevents passage into the *drainage system* of solids ½ inch (13 mm) or larger in size, string, rags, buttons or other materials detrimental to the public sewerage system.

P-1004.10 Bottling establishments: Bottling plants shall discharge process wastes into an interceptor that will provide for the separation of broken glass or other solids before discharging waste into the *drainage system*.

P-1004.11 Slaughterhouses: Slaughtering room and dressing room drains shall be equipped with approved separators. The separator shall prevent the discharge into the *drainage system* of feathers, entrails and other materials that cause clogging.

P-1004.12 Venting of interceptors and separators: Interceptors and separators shall be designed so as not to become air bound where tight covers are utilized. Each interceptor or separator shall be vented where subject to a loss of trap seal.

P-1004.13 Access and maintenance of interceptors and separators: *Ready access* shall be provided to each interceptor and separator for service and maintenance. Interceptors and separators shall be maintained by periodic removal of accumulated grease, scum, oil or other floating substances and solids deposited in the interceptor or separator.

SECTION P-1005.0 BACKWATER VALVES

P-1005.1 Approval: Metallic backwater valves shall conform to ASME A112.14.1 listed in Chapter 19. Nonmetallic backwater valves shall conform to CSA CAN3-B181.1 or CAN/CSA B181.2 listed in Chapter 19.

P-1005.2 Definitions: The following words and terms shall, for the purposes of this section and as stated elsewhere in this code, have the meanings shown herein.

Backflow

Drainage: A reversal of flow in the *drainage system.*

Backwater valve: A device or valve which is installed in the house drain or *sewer* pipe where a *sewer* is subject to *backflow*, and which prevents drainage or waste from backing into a low level or fixtures and causing a flooding condition.

P-1005.3 Fixtures subject to backflow: A backwater valve shall be installed where plumbing fixtures are subject to *backflow* from the public *sewer.*

P-1005.4 Location of backwater valves: Backwater valves shall be installed so that *access* is provided to the working parts for service and repair.

CHAPTER 11

DRAINAGE PIPE CLEANOUTS

SECTION P-1101.0 GENERAL

P-1101.1 Scope: This chapter shall govern the size, location, installation and maintenance of drainage pipe *cleanouts*.

SECTION P-1102.0 DEFINITIONS

P-1102.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Cleanout: An *access* opening in the *drainage system* utilized for the removal of obstructions. Types of cleanouts include a removable plug or cap, a removable fixture trap and a water closet.

SECTION P-1103.0 WHERE REQUIRED

P-1103.1 Horizontal drains within buildings: All horizontal drains 4 inches in diameter or less shall have *cleanouts* located not more than 50 feet (15240 mm) apart. All horizontal drains larger than 4 inches in diameter shall have *cleanouts* located not more than 100 feet (30480 mm) apart.

P-1103.2 Building sewers: All *building sewers* shall have *cleanouts* located not more than 100 feet (30480 mm) apart.

P-1103.3 Changes of direction: *Cleanouts* shall be installed at each change of direction of the *building drain* or of horizontal waste or soil lines, which is greater than 45 degrees (0.79 rad). Where more than one change of direction occurs in a run of piping, only one *cleanout* shall be required for each 40 feet (12192 mm) of *developed length* of the drainage piping. *Access* shall be provided to all *cleanouts*.

P-1103.4 Base of stack: A *cleanout* shall be provided at the base of each waste or soil stack.

P-1103.5 Building drain and building sewer junction: There shall be a *cleanout* at the junction of the *building drain* and the *building sewer*. The *cleanout* shall be either inside or outside the building wall and shall be brought up to the finished ground level or to the basement floor level. The *cleanout* at the junction of the *building drain* and *building sewer* shall not be required if the *cleanout* on a 3-inch or larger diameter vertical soil stack is located within 10 feet (3048 mm) of the *building drain* and *building sewer* connection.

SECTION P-1104.0 UNDERGROUND DRAINAGE

P-1104.1 General: *Cleanouts* for an underground drain or *sewer* shall extend to the ground or floor level.

SECTION P-1105.0 CONCEALED PIPING

P-1105.1 General: *Cleanouts* on concealed piping shall extend through and terminate flush with the finished wall or floor. Pits or chases, sized to permit removal of the *cleanout* plug and cleaning of the system, shall be incorporated in the wall or floor.

SECTION P-1106.0 DIRECTION OF FLOW

P-1106.1 General: Every *cleanout* shall be installed to open in the direction of the flow of the drainage pipe or at right angles thereto.

SECTION P-1107.0 CLEANOUT SIZE

P-1107.1 General: *Cleanouts* shall be of the same size as the pipes served, up to 4 inches. *Cleanouts* for pipes larger than 4 inches shall be sized in accordance with Table P-1107.1.

Table P-1107.1
CLEANOUT SIZES

Nominal pipe size (inches)	Nominal size cleanout (inches)
5	4
6	4
8	6
10 and above	8

SECTION P-1108.0 MANHOLES

P-1108.1 Building sewers: *Building sewers* 10 inches in diameter or larger shall have approved manholes for *cleanouts*. Manholes shall be located at every change of direction, elevation, grade and size of the *building sewer* and at intervals not more than 400 feet (122 m).

P-1108.2 Building drains: Underground *building drains* 10 inches in diameter or larger shall have *cleanouts* in accordance with Section P-1107.1 or manholes in accordance with Section P-1108.1. The manhole shall have secured gas-tight covers.

P-1108.3 Flood hazard: All manhole covers located in a flood-hazard zone (A zone) or a high-hazard zone (V Zone) shall either be elevated to or above the base flood elevation or shall be sealed to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the base flood elevation.

SECTION P-1109.0 CLEANOUT CLEARANCES

P-1109.1 Clearances: *Cleanouts* on 6-inch and smaller pipes shall have a clearance of not less than 18 inches (457 mm) for rodding. *Cleanouts* on 8-inch and larger pipes shall have a clearance of not less than 36 inches (914 mm) for rodding.

SECTION P-1110.0 ACCESS TO CLEANOUTS

P-1110.1 Permanent covers prohibited: *Cleanout* plugs shall not be covered with cement, plaster or any other permanent finish material. Where necessary to conceal a *cleanout* plug, a cover plate or *access* door shall provide *access* to the plug.

P-1110.2 Prohibited installation: *Cleanout* openings shall not be utilized for the installation of new fixtures or floor drains, except where approved and where another *cleanout* of equal *access* and capacity is provided.

CHAPTER 12

PLUMBING FIXTURES

SECTION P-1201.0 GENERAL

P-1201.1 Scope: This chapter shall govern the installation of plumbing fixtures in accordance with the type of occupancy, and shall provide for the minimum number of fixtures for various types of occupancies.

SECTION P-1202.0 DEFINITIONS

P-1202.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Plumbing appliance: Any one of a special class of plumbing fixtures which is intended to perform a special function. Included are fixtures having the operation or control dependent upon one or more energized components, such as motors, controls, heating elements, or pressure or temperature sensing elements.

Such fixtures are manually adjusted or controlled by the owner or operator, or are operated automatically through one or more of the following actions: a time cycle, a temperature range, a pressure range, a measured volume or weight.

Plumbing appurtenance: A manufactured device or prefabricated assembly of component parts which is an adjunct to the basic piping system and plumbing fixtures. An appurtenance does not demand additional water supply, nor add any discharge load to a fixture or to the *drainage system.*

Plumbing fixture: A receptacle or device which is either permanently or temporarily connected to the water distribution system of the premises, and demands a supply of water therefrom; or discharges waste water, liquid-borne waste materials, or sewage either directly or indirectly to the *drainage system* of the premises; or requires both a water supply connection and a discharge to the *drainage system* of the premises.

Private: In the classification of plumbing fixtures, "private" applies to fixtures in residences and apartments, and to fixtures in nonpublic toilet rooms of hotels and motels and similar installations in buildings where the plumbing fixtures are intended for utilization by a family or an individual.

Public or public utilization: In the classification of plumbing fixtures, "public" applies to fixtures in general toilet rooms of schools, gymnasiums, hotels, railroad stations, public buildings, bars, public comfort stations and other installations where a number of fixtures are installed so that their utilization is similarly unrestricted.

Wall-hung water closet: A wall-mounted water closet installed in such a way that the fixture does not touch the floor.

Whirlpool bathtub: A bathtub fixture that is equipped and fitted with a circulation piping system, pump and similar appurtenances, and is so designed to accept, circulate and discharge bathtub water.

SECTION P-1203.0 CONNECTIONS TO PLUMBING SYSTEM REQUIRED

P-1203.1 General: All plumbing fixtures and drains that receive or discharge wastes or sewage shall be connected to the sanitary *drainage system* of the structure or premises. Clear-water waste shall be permitted to discharge to the storm *drainage system* where approved.

SECTION P-1204.0 MINIMUM PLUMBING FACILITIES

P-1204.1 Minimum number of fixtures: Plumbing fixtures shall be provided for the type of occupancy and in the minimum number shown in Table P-1204.1. Types of occupancies not shown in Table P-1204.1 shall be considered individually by the code official. The number of occupants shall be determined by the building code listed in Chapter 19.

P-1204.2 Separate facilities: Where plumbing fixtures are required, separate facilities shall be provided for each sex.

Exceptions

1. Separate facilities shall not be required in residential occupancies.
2. Separate employee facilities shall not be required in occupancies in which 15 or less people are employed.
3. Separate facilities shall not be required in structures or tenant spaces with a total occupant load, including both employees and customers, of 15 or less in which food or beverage is served for consumption within the structure or tenant space.

P-1204.3 Number of occupants of each sex: The required water closets, lavatories and showers or bathtubs shall be distributed equally between the sexes based on the percentage of each sex anticipated in the occupant load. The occupant load shall be composed of 50 percent of each sex, unless statistical data approved by the code official indicates a different distribution of the sexes.

Table P-1204.1
MINIMUM NUMBER OF PLUMBING FACILITIES[a]
Fixtures (Number of fixtures per number of occupants)
(see Sections P-1204.2 and P-1204.3)

	Building use group	Water closets (Urinals see Section P-1220.2)		Lavatories	Bathtubs/ showers	Drinking fountains (see Section P-1211.1)	Others
		Male	Female				
A-1	Assembly, theaters	1 per 125	1 per 65	1 per 200		1 per 1,000	1 service sink
A-2	Assembly, nightclubs	1 per 40	1 per 40	1 per 75		1 per 500	1 service sink
A-3	Assembly, restaurants	1 per 75	1 per 75	1 per 200		1 per 500	1 service sink
	Halls, museums, etc.	1 per 125	1 per 65	1 per 200		1 per 1,000	1 service sink
	Coliseums, arenas	1 per 75	1 per 40	1 per 150		1 per 1,000	1 service sink
A-4	Assembly, churches[b]	1 per 150	1 per 75	1 per 200		1 per 1,000	1 service sink
A-5	Assembly, stadiums, pools, etc.	1 per 100	1 per 50	1 per 150		1 per 1,000	1 service sink
B	Business (see Sections P-1204.2 and P-1204.4)	1 per 25		1 per 40		1 per 100	1 service sink
E	Educational	1 per 50		1 per 50		1 per 100	1 service sink
F	Factory and industrial	1 per 100		1 per 100	(see Section P-1212.0)	1 per 400	1 service sink
H	High hazard (see Sections P-1204.2 and P-1204.4)	1 per 100		1 per 100	(see Section P-1212.0)	1 per 1,000	1 service sink
I-1	Institutional, residential care	1 per 10		1 per 10	1 per 8	1 per 100	1 service sink
I-2	Institutional, hospitals, ambulatory nursing home patients[c]	1 per room[e]		1 per room[e]	1 per 15	1 per 100	1 service sink per floor
	Day nurseries, sanitariums, nonambulatory nursing home patients, etc.[c]	1 per 15		1 per 15	1 per 15[f]	1 per 100	1 service sink
	Employees[c]	1 per 25		1 per 35		1 per 100	
	Visitors	1 per 75		1 per 100		1 per 500	
I-3	Institutional, prisons[c]	1 per cell		1 per cell	1 per 15	1 per 100	1 service sink
	Asylums, reformatories, etc.[c]	1 per 15		1 per 15	1 per 15	1 per 100	1 service sink
	Employees[c]	1 per 25		1 per 35		1 per 100	
	Visitors	1 per 75		1 per 100		1 per 500	
M	Mercantile (see Sections P-1204.2, P-1204.4 and P-1204.5)	1 per 500		1 per 750		1 per 1,000	1 service sink
R-1	Residential, hotels, motels	1 per guestroom		1 per guestroom	1 per guestroom		1 service sink
	Lodges	1 per 10		1 per 10	1 per 8	1 per 100	1 service sink
R-2	Residential, multiple family	1 per dwelling unit		1 per dwelling unit	1 per dwelling unit		1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per 20 dwelling units
	Dormitories	1 per 10		1 per 10	1 per 8	1 per 100	1 service sink
R-3	Residential, one- and two-family dwelling	1 per dwelling unit		1 per dwelling unit	1 per dwelling unit		1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per dwelling unit[d]
S	Storage (see Sections P-1204.2 and P-1204.4)	1 per 100		1 per 100	(see Section P-1212.0)	1 per 1,000	1 service sink

Note a. The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by the building code listed in Chapter 19.

Note b. Fixtures located in adjacent buildings under the ownership or control of the church shall be made available during periods the church is occupied.

Note c. Toilet facilities for employees shall be separate from facilities for inmates or patients.

Note d. For attached one- and two-family dwellings, one automatic clothes washer connection shall be required per 20 dwelling units.

Note e. A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient rooms shall be permitted where such room is provided with direct access from each patient room and with provisions for privacy.

Note f. For day nurseries, a maximum of one bathtub shall be required.

P-1204.4 Location of employee toilet facilities in occupancies other than Use Group A or M: *Access* to toilet facilities in occupancies other than Use Group A or M shall be from within the employees' regular working area. The required toilet facilities shall be located not more than one story above or below the employees' regular working area and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m). Employee facilities shall be either separate facilities or *public* customer facilities.

Exception: Facilities that are required for employees in storage structures or kiosks, and which are located in adjacent structures under the same ownership, lease or control, shall be a maximum travel distance of 500 feet (152 m) from the employees' regular working area.

P-1204.4.1 Location of employee toilet facilities in buildings of Use Groups A and M: Employees shall be provided with toilet facilities in buildings and tenant spaces utilized as restaurants, nightclubs, places of public assembly and mercantile occupancies. The employee facilities shall be either separate facilities or *public* customer facilities.

Exception: Employee toilet facilities shall not be required in tenant spaces of 900 square feet (84 m^2) or less where the travel distance from the main entrance of the tenant space to a central toilet area does not exceed 500 feet (152 m) and such central toilet facilities are located not more than one story above or below the tenant space.

P-1204.5 Customer facilities: Customers, patrons and visitors shall be provided with *public* toilet facilities in structures and tenant spaces utilized as restaurants, nightclubs, places of assembly and mercantile occupancies. Customer toilet facilities shall be located not more than one story above or below the space required to be provided with customer toilet facilities and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m). In covered mall buildings, required facilities shall be based on total square footage, and facilities shall be installed in each individual store or in a central toilet area located in accordance with this section. The maximum travel distance to the central toilet facilities in covered mall buildings shall be measured from the main entrance of any store or tenant space.

Exception: Customer facilities are not required in structures or tenant spaces with a customer occupant load of less than 150 and which do not serve food or beverages to be consumed within the structure or tenant space.

SECTION P-1205.0 ACCESSIBLE PLUMBING FACILITIES

P-1205.1 Where required: Toilet rooms and bathing facilities containing fixtures for occupants of a structure that is required to be accessible to a physically disabled person by the building code listed in Chapter 19, shall have at least one fixture of each type accessible to and usable by a physically disabled person. Where water closet compartments are provided in a toilet room or bathing facility, a wheelchair-accessible compartment shall be provided in accordance with Section P-1205.2. Where six or more water closet compartments are provided in a toilet room or bathing facility, at least one ambulatory-accessible compartment shall be provided in accordance with Section P-1205.2 in addition to the wheelchair-accessible compartment. Fixtures in dwelling units of multiple-family dwellings required to be adaptable by the building code listed in Chapter 19 shall comply with CABO A117.1 listed in Chapter 19. Accessible routes to plumbing fixtures shall be provided in accordance with the requirements of the building code listed in Chapter 19.

Where drinking fountains or water coolers are provided on each floor, 50 percent but not less than one drinking fountain or water cooler per floor shall be accessible to and usable by physically disabled persons.

Exceptions

1. A private toilet room or bathing facility intended for utilization by a single occupant shall be permitted to be adaptable.
2. Dwelling units, guestrooms and patient toilet rooms that are not required by the building code listed in Chapter 19 to be accessible or adaptable.

P-1205.1.1 Use Groups A and E: Where showers are provided in gymnasium facilities in conjunction with sports activities, a minimum of one shower shall be accessible to and usable by physically disabled persons.

P-1205.2 Water closet compartment: The minimum net clear opening to the water closet compartment shall be 32 inches (813 mm). The door shall swing out and away from the water closet compartment. The minimum clear width in front of the door to the water closet compartment shall be 48 inches (1219 mm). The size and configuration of the water closet compartment or room shall conform to Section P-1205.2.1 or P-1205.2.2. The grab bars shall be mounted parallel to the floor a minimum of 33 inches (838 mm) and a maximum of 36 inches (914 mm) above the finished floor.

P-1205.2.1 Wheelchair-accessible compartment: The minimum width of a wheelchair-accessible water closet compartment shall be 60 inches (1524 mm). The minimum length of the compartment shall be 56 inches (1422 mm) for wall-mounted water closets and 59 inches (1499 mm) for floor-mounted water closets. The water closet shall be mounted 18 inches (457 mm) from the side wall of the compartment to the centerline of the water closet.

P-1205.2.1.1 Grab bars: The compartment shall have a side grab bar a minimum of 42 inches (1067 mm) in length and a rear grab bar a minimum of 36 inches (914 mm) in length. The side grab bar shall be mounted on the side wall closest to the water closet a maximum of 12 inches (305 mm) from the rear wall and shall extend a minimum of 52 inches (1321 mm) from the rear wall. The rear grab bar shall be mounted behind the water closet a maximum of 6 inches (152 mm) from the closest side wall and shall extend a minimum of 24 inches (610 mm) beyond the centerline of the water closet away from the closest side wall.

P-1205.2.1.2 Lavatory in compartment: Where a lavatory is installed within the compartment, the lavatory shall be located against the back wall adjacent to the water closet. The edge of the lavatory shall be a minimum of 18 inches (457 mm) from the centerline of the water closet. *

P-1205.2.2 Ambulatory-accessible compartment: The maximum width of an ambulatory-accessible water closet compartment shall be 36 inches (914 mm). The minimum length of the compartment shall be 60 inches (1524 mm). The water closet shall be mounted 18 inches (457 mm) from the side wall of the compartment to the centerline of the water closet.

P-1205.2.2.1 Grab bars: Compartments shall have grab bars a minimum of 42 inches (1067 mm) in length mounted on both sides of the compartment. The grab bars shall be mounted to a maximum of 12 inches (305 mm) from the rear wall and shall extend a minimum of 54 inches (1372 mm) from the rear wall.

P-1205.2.3 Single-occupant rooms: Single-occupant toilet rooms or bathrooms shall have the water closet mounted 18 inches (457 mm) from a side wall to the centerline of the water closet. The clear space around the water closet and the grab bars shall conform to the compartment size and grab bar requirements of Section P-1205.2.1. The door to the room shall not swing into the water closet clear space.

P-1205.3 Water closet: The seat of the water closet shall be a minimum of 16 inches (406 mm) and a maximum of 20 inches (508 mm) above the finished floor. The water closet bowl shall be of the blowout, siphon-jet, reverse-trap, siphon-vortex or siphon-wash design.

P-1205.4 Lavatory and kitchen sink: The minimum clear space in front of the lavatory shall be 30 inches (762 mm) by 30 inches (762 mm) measured from the front face of the lavatory, kitchen sink, counter or vanity. The top of the lavatory shall be located a maximum of 35 inches (889 mm) above the finished floor. The top of the kitchen sink shall be located a maximum of 34 inches (864 mm) above the finished floor.

P-1205.4.1 Clearance: An unobstructed knee clearance a minimum of 29 inches (737 mm) high by 8 inches (203 mm) deep shall be provided from the face of the lavatory or kitchen sink. An unobstructed toe clearance a minimum of 9 inches (229 mm) high by 9 inches (229 mm) deep shall be provided from the lavatory wall.

P-1205.4.2 Piping: All exposed hot water piping under the lavatory or kitchen sink shall be insulated.

P-1205.5 Faucet: The controls to operate a faucet shall be located a maximum of 25 inches (635 mm) from the front face of a lavatory, kitchen sink, counter or vanity. The faucet shall open and close with a maximum force of 5 pounds (22 N).

P-1205.6 Drinking fountain: The height of the drinking fountain or water cooler spout shall be a maximum of 36 inches (914 mm) above the finished floor. The spout shall be located in front of the unit. The flow of water from the spout shall rise a minimum of 4 inches (102 mm) above the basin. Hand controls to operate the fountain or cooler shall be located on the front or the side at the front edge of the unit.

P-1205.6.1 Clear space: The minimum clear space in front of the drinking fountain or water cooler shall be 30 inches (762 mm) measured away from the front edge of the unit by 48 inches (1219 mm) wide. Units protruding from the wall shall be permitted to have the clear space reduced to 30 inches (762 mm) wide where the clear space underneath the unit conforms to the requirements of Section P-1205.4.

P-1205.7 Bathtub and shower: Prefabricated shower or bathtub enclosures shall conform to CABO A117.1 listed in Chapter 19. The minimum clear space in front of the bathtub or shower shall be 30 inches (762 mm) from the edge of the enclosure away from the unit and 48 inches (1219 mm) wide. Where the bathtub or shower is not accessible from the side, the clear space in front of the unit shall be increased to a minimum of 48 inches (1219 mm) by 48 inches (1219 mm) wide. Built-in-place shower or bathtub enclosures shall conform to Section P-1205.7.1, P-1205.7.2 or P-1205.7.3.

P-1205.7.1 Bathtub enclosure: The bathtub shall have either a built-in seat, a seat at the end of the tub or a detachable seat. Two grab bars a minimum of 24 inches (610 mm) in length shall be mounted against the back wall in line with each other and parallel to the floor. The top grab bar shall be mounted a minimum of 33 inches (838 mm) and a maximum of 36 inches (914 mm) above the finished floor. The lower grab bar shall be mounted 9 inches (229 mm) above the flood level rim of the bathtub. A grab bar shall be mounted at each end of the bathtub at the same height as the top grab bar on the back wall. The grab bar at the end of the bathtub with the faucet shall be a minimum length of 24 inches (610 mm). The grab bar at the other end of the bathtub shall be a minimum length of 12 inches (305 mm). Where the seat is located at the end of the bathtub, the grab bars shall not be installed at that end. The bathtub and shower faucet shall be located below the grab bars.

P-1205.7.2 Wide shower enclosure: The minimum width of the shower enclosure shall be 60 inches (1524 mm) and the minimum depth shall be 30 inches (762 mm). There shall not be a threshold on the shower floor. The shower shall be designed to permit the wheelchair to enter the enclosure. The shower valve shall be mounted on the back wall a minimum of 38 inches (965 mm) and a maximum of 48 inches (1219 mm) above the shower floor. A grab bar shall be mounted along the entire length of the three walls a minimum of 33 inches (838 mm) and a maximum of 36 inches (914 mm) above and parallel to the shower floor.

P-1205.7.3 Square shower enclosure: The shower enclosure shall be 36 inches (914 mm) square. A seat a maximum of 16 inches (406 mm) wide shall be mounted against the side wall for the entire depth of the enclosure. The seat shall be a minimum of 17 inches (432 mm) and a maximum of 19 inches (483 mm) above the finished floor. A grab bar shall be mounted parallel to the floor extending from the edge of the seat around the side wall opposite the seat. The grab bars shall be a minimum of 33 inches (838 mm) and a maximum of 36 inches (914 mm) above the finished floor. The shower valve shall be mounted on the side wall opposite the seat, a minimum of 38 inches (965 mm) and a maximum of 48 inches (1219 mm) above the finished floor.

P-1205.7.4 Faucet: Showers and bathtubs shall have a hand-held shower with a hose a minimum of 60 inches (1524 mm) in length. The faucet shall open and close with a maximum

force of 5 pounds (22 N). The shower and bathtub valve shall comply with Section P-1225.6.

P-1205.8 Grab bars: The diameter or width of a grab bar shall be a minimum of 1¼ inches (32 mm) and a maximum of 1½ inches (38 mm). Grab bars shall be spaced 1½ inches (38 mm) from the wall. Grab bars shall not rotate. Grab bars shall be designed and constructed for the load requirements specified in the building code listed in Chapter 19.

SECTION P-1206.0 INSTALLATION OF FIXTURES

P-1206.1 Access for cleaning: Plumbing fixtures shall be installed so as to afford easy *access* for cleaning both the fixture and the area around the fixture. Where practical, all pipes from fixtures shall be routed to the nearest wall.

P-1206.2 Convenience and function: Fixtures shall be set level and in proper alignment with reference to adjacent walls.

P-1206.2.1 Water closets, lavatories and bidets: A water closet, lavatory or bidet shall not be set closer than 15 inches (381 mm) from its center to any side wall, partition, vanity or other obstruction, nor closer than 30 inches (762 mm) center-to-center between toilets or adjacent fixtures. There shall be at least 18 inches (457 mm) clearance in front of the water closet or bidet to any wall, fixture or door. Water closet compartments shall not be less than 30 inches (762 mm) wide and 60 inches (1524 mm) deep. There shall be at least 18 inches (457 mm) clearance in front of a lavatory to any wall, fixture or door (see Figure P-1206.2.1).

P-1206.2.2 Urinals: A urinal shall not be set closer than 15 inches (381 mm) from the center of the urinal to any side wall, partition, vanity or other obstruction, nor closer than 30 inches (762 mm) center-to-center between urinals (see Figure P-1206.2.1).

P-1206.3 Securing floor outlet fixtures: Floor outlet fixtures shall be secured to the floor or floor flanges by screws or bolts of corrosion-resistant material.

P-1206.4 Water-tight joints: Joints formed where fixtures come in contact with walls or floors shall be sealed.

P-1206.5 Securing wall-hung water closet bowls: Wall-hung water closet bowls shall be supported by a concealed hanger attached to the building structural members so that strain is not transmitted to the closet connector or any other part of the plumbing system. The hanger shall conform to ASME A112.6.1 listed in Chapter 19.

P-1206.6 Water supply protection: The supply lines or fittings for every plumbing fixture shall be installed so as to prevent *backflow*.

P-1206.7 Design of overflows: Where any fixture is provided with an overflow, the waste shall be designed and installed so that standing water in the fixture will not rise in the overflow when the stopper is closed, nor shall any water remain in the overflow when the fixture is empty.

P-1206.7.1 Connection of overflows: The overflow from any fixture shall discharge into the *drainage system* on the inlet or fixture side of the trap.

Exception: The overflow from a flush tank serving a water closet or urinal shall discharge into the fixture served.

P-1206.8 Access to concealed connections: Fixtures with concealed slip-joint connections shall be provided with an *access* panel or utility space or other approved arrangement so as to provide *access* to the slip connections for inspection and repair. Where such *access* cannot be provided, *access* doors are not required provided that all joints are soldered, solvent cemented or screwed so as to form a solid connection.

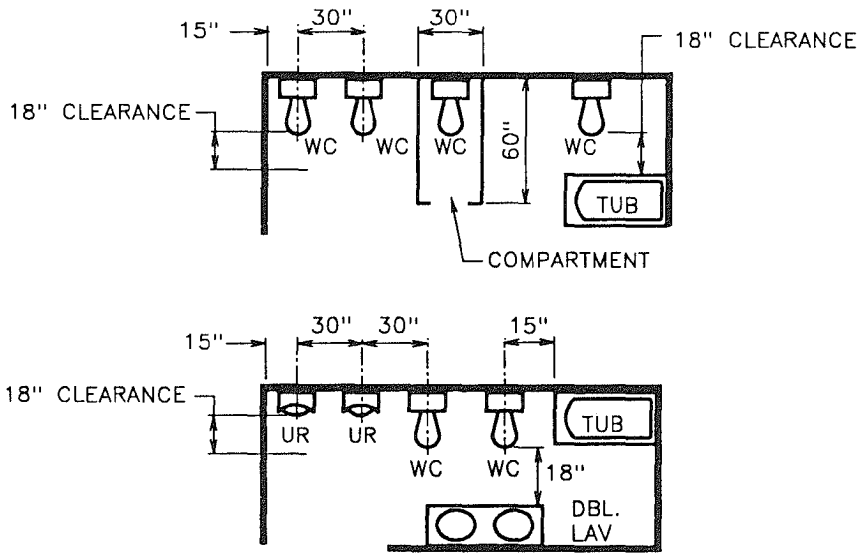

Figure P-1206.2.1
FIXTURE CLEARANCES[a]

Note a. 1 inch = 25.4 mm.

SECTION P-1221.0 WATER CLOSETS

P-1221.1 Approval: Water closets shall conform to the water consumption requirements of Section P-1505.9 and shall conform to ANSI Z124.4 or ASME A112.19.2 listed in Chapter 19. Water closets shall conform to the hydraulic performance requirements of ASME A112.19.6 listed in Chapter 19. Water closet tanks shall conform to ANSI Z124.4, ASME A112.19.2 or ASME A112.19.9 listed in Chapter 19.

P-1221.2 Water closets for public or employee toilet facilities: Water closet bowls for *public* or employee toilet facilities shall be of the elongated type with a minimum water surface area of 8 inches by 7 inches (203 mm by 178 mm).

P-1221.3 Water closet seats: Water closets shall be equipped with seats of smooth, nonabsorbent material. All seats of water closets provided for *public* or employee toilet facilities shall be of the hinged open-front type. Integral water closet seats shall be of the same material as the fixture. Water closet seats shall be sized for the water closet bowl type.

P-1221.4 Water closet connections: A 4-inch by 3-inch closet bend shall be acceptable. Where a 3-inch bend is utilized on water closets, a 4-inch by 3-inch flange shall be installed to receive the fixture horn.

SECTION P-1222.0 FLUSHING DEVICES FOR WATER CLOSETS AND URINALS

P-1222.1 Flushing devices required: Each water closet, urinal, clinical sink or other plumbing fixture that depends on trap siphonage to discharge the fixture contents to the *drainage system* shall be provided with a flushometer valve, flushometer tank or a flush tank designed and installed so as to supply water in quantity and rate of flow to flush the contents of the fixture, cleanse the fixture and refill the fixture trap.

P-1222.1.1 Separate for each fixture: A flushing device shall not serve more than one fixture.

P-1222.2 Definitions: The following words and terms shall, for the purposes of this section and as stated elsewhere in this code, have the meanings shown herein.

Antisiphon: A term applied to valves or mechanical devices which eliminate siphonage.

Ball cock: A water supply valve, opened or closed by means of a float or similar device, utilized to supply water to a tank. An antisiphon ball cock contains an antisiphon device in the form of an approved *air gap* or vacuum breaker which is an integral part of the ball cock unit and which is positioned on the discharge side of the water supply control valve.

Flushometer tank: A device integrated within an air accumulator vessel which is designed to discharge a predetermined quantity of water to fixtures for flushing purposes.

Flushometer valve: A device that discharges a predetermined quantity of water to fixtures for flushing purposes and is closed by direct water pressure or other mechanical means.

P-1222.3 Flushometer valves: Flushometer valves shall comply with ASSE 1037 listed in Chapter 19. Vacuum breakers on flushometer valves shall conform to the performance requirements of ASSE 1001 listed in Chapter 19. *Access* shall be provided to vacuum breakers. Flushometer valves shall be of the water-conservation type and shall not be utilized where the water pressure is lower than the minimum required for normal operation. When operated, the valve shall automatically complete the cycle of operation, opening fully and closing positively under the water supply pressure. Each flushometer valve shall be provided with a means for regulating the flow through the valve.

P-1222.4 Flush tanks: Flush tanks equipped for manual flushing shall be controlled by a device designed to refill the tank after each discharge and to shut off completely the water flow to the tank when the tank is filled to operational capacity. The *trap seal* to the fixture shall be automatically refilled after each flushing. The water supply to flush tanks equipped for automatic flushing shall be controlled with a timing device.

P-1222.4.1 Ball cocks: All flush tanks shall be equipped with an antisiphon ball cock conforming to ASSE 1002 or CSA CAN/CSA-B125 listed in Chapter 19. The ball cock backflow preventer shall be located at least 1 inch (25 mm) above the full opening of the overflow pipe. A sheathed ball cock shall be installed in all gravity flush tanks in which the flush valve seat is located less than 1 inch (25 mm) above the flood level rim of the bowl.

P-1222.4.2 Overflows in flush tanks: Flush tanks shall be provided with overflows discharging to the water closet or urinal connected thereto and shall be sized to prevent flooding the tank at the maximum rate at which the tanks are supplied with water. The opening of the overflow pipe shall be located above the flood level rim of the water closet or urinal or above a secondary overflow in the flush tank.

P-1222.5 Flushometer tanks: Flushometer tanks shall comply with ASSE 1037 listed in Chapter 19.

SECTION P-1223.0 WHIRLPOOL BATHTUBS

P-1223.1 Approval: Whirlpool bathtubs shall comply with ASME A112.19.7 listed in Chapter 19.

P-1223.2 Installation: Whirlpool bathtubs shall be installed and tested in accordance with the manufacturer's installation instructions. The pump shall be located above the weir of the fixture trap. *Access* shall be provided to the pump.

P-1223.3 Drain: The pump drain shall be sloped to drain the water in the volute when the whirlpool bathtub is empty.

P-1223.4 Suction fittings: Suction fittings for whirlpool bathtubs shall comply with ASME A112.19.8 listed in Chapter 19.

SECTION P-1224.0 SPECIAL PLUMBING FIXTURES

P-1224.1 Water connections: Baptisteries, ornamental and lily pools, aquariums, ornamental fountain basins, *swimming pools* and similar constructions, where provided with water supplies, shall be protected against *backflow* in accordance with Section P-1507.0.

P-1224.2 Approval: Specialties requiring water and waste connections shall be submitted for approval.

SECTION P-1225.0 FAUCETS AND FIXTURE FITTINGS

P-1225.1 Approval: Faucets and fixture fittings shall conform to ASME A112.18.1 or CSA CAN/CSA-B125 listed in Chapter 19 and shall conform to the water consumption requirements of Section P-1505.9.

P-1225.2 Definitions: The following words and terms shall, for the purposes of this section and as stated elsewhere in this code, have the meanings shown herein.

Faucet: A valve end of a water pipe by means of which water can be drawn from or held within the pipe.

Fixture fitting: Any device to control or guide the flow of water into, or convey water from, fixtures.

P-1225.3 Hose spray: Sink faucets with a flexible hose and spray assembly shall conform to ASSE 1025 or CSA CAN/CSA-B125 listed in Chapter 19.

P-1225.4 Hand showers: Hand-held showers shall conform to ASSE 1014 or CSA CAN/CSA-B125 listed in Chapter 19.

P-1225.5 Installation: Faucets and diverters shall be installed so that the flow of hot water from the fitting corresponds to the left-hand side of the fixture fitting.

P-1225.6 Shower valves: Shower valves for all showers shall be balanced pressure-mixing valves or thermostatic-mixing valves which conform to the requirements of ASSE 1016 listed in Chapter 19. Such valves shall be equipped with high-limit stops adjusted to a maximum hot water setting of 120 degrees F. (49 degrees C).

Exception: Balanced pressure-mixing valves or thermostatic-mixing valves shall not be required for showers where the hot water supply for such showers is controlled by an approved master thermostatic-mixing valve set to limit the hot water temperature to a maximum of 120 degrees F. (49 degrees C).

CHAPTER 13

HANGERS AND SUPPORTS

SECTION P-1301.0 GENERAL

P-1301.1 Scope: This chapter shall govern the types, materials and installation of anchors, hangers and supports for plumbing piping.

P-1301.2 Piping seismic supports: Where earthquake loads are applicable in accordance with Sections 1612.1 and 1612.6 of the building code listed in Chapter 19, plumbing piping supports shall be designed and installed for the seismic forces in accordance with the building code listed in Chapter 19.

SECTION P-1302.0 MATERIAL

P-1302.1 General: Hangers, anchors and supports shall support the piping and the contents of the piping. Hangers and strapping material shall be of approved material that will not promote galvanic action.

SECTION P-1303.0 ATTACHMENT TO BUILDING

P-1303.1 General: Hangers and anchors shall be attached to the building construction in an approved manner.

SECTION P-1304.0 INTERVAL OF SUPPORT

P-1304.1 General: Pipe shall be supported in accordance with Table P-1304.1 or MSS SP-69 listed in Chapter 19.

SECTION P-1305.0 BASE OF STACKS

P-1305.1 General: Bases of cast-iron stacks shall be supported on concrete, brick laid in cement mortar or metal brackets attached to the building construction.

SECTION P-1306.0 ANCHORAGE

P-1306.1 General: Anchorage shall be provided to restrain drainage piping joined with friction couplings, hubless and others from axial movement.

P-1306.2 Location: Restraints shall be provided for drain pipes connected with *mechanical joints* at all changes in direction and diameter greater than two pipe sizes for pipe sizes greater than 4 inches. Braces, blocks, rodding and other suitable methods as specified by the coupling manufacturer shall be utilized.

SECTION P-1307.0 SWAY BRACING

P-1307.1 General: Rigid support sway bracing shall be provided at changes in direction greater than 45 degrees (0.79 rad) for pipe sizes 4 inches and larger.

SECTION P-1308.0 PARALLEL WATER DISTRIBUTION SYSTEMS

P-1308.1 Support: Piping bundles for manifold systems shall be supported in accordance with Table P-1304.1. Support at changes in direction shall be in accordance with the manufacturer's installation instructions. Hot and cold water piping shall not be grouped in the same bundle.

Table P-1304.1
HANGER SPACING

Piping material	Maximum horizontal spacing (feet)[c]	Maximum vertical spacing (feet)[c]
ABS pipe	4	4
Aluminum tubing	10	15
Brass pipe	10	10
Cast-iron pipe[a]	5	15
Copper or copper-alloy pipe	12	10
Copper or copper-alloy tubing, 1¼-inch diameter and smaller	6	10
Copper or copper-alloy tubing, 1½-inch diameter and larger	10	10
CPVC pipe or tubing, 1 inch or smaller	3	5[b]
CPVC pipe or tubing, 1¼ inch or larger	4	6[b]
Galvanized steel pipe	12	15
Lead pipe	Continuous	4
PB pipe or tubing	2⅔ (32 inches)	4
PVC pipe	4	4

Note a. The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.
Note b. Mid-story guide.
Note c. 1 foot = 304.8 mm.

CHAPTER 14

HEALTH CARE PLUMBING

SECTION P-1401.0 GENERAL

P-1401.1 Scope: This chapter shall govern those aspects of health care plumbing systems which differ from plumbing systems in other structures. Health care plumbing systems shall conform to the requirements of this chapter and to the other requirements of this code.

P-1401.1.1 Occupancies: The provisions of this chapter shall apply to the special devices and equipment installed and maintained in the following occupancies: nursing homes, homes for the aged, orphanages, infirmaries, first aid stations, psychiatric facilities, clinics, professional offices of dentists and doctors, mortuaries, educational facilities, surgery, dentistry, research and testing laboratories and establishments manufacturing pharmaceutical drugs and medicines and other structures with similar apparatus and equipment classified as plumbing.

SECTION P-1402.0 DEFINITIONS

P-1402.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Aspirator: A fitting or device supplied with water or other fluid under positive pressure which passes through an integral orifice or constriction, causing a vacuum. Aspirators are also referred to as suction apparatus, and are similar in operation to an ejector.

Bedpan steamer or boiler: A fixture utilized for scalding bedpans or urinals by direct application of steam or boiling water.

Bedpan washer and sterilizer: A fixture designed to wash bedpans and to flush the contents into the sanitary *drainage system*. Included are fixtures of this type that provide for disinfecting utensils by scalding with steam or hot water.

Bedpan washer hose: A device supplied with hot and cold water and located adjacent to a water closet or clinical sink to be utilized for cleansing bedpans.

Local vent stack: A vertical pipe to which connections are made from the fixture side of traps and through which vapor or foul air is removed from the fixture or device utilized on bedpan washers.

Sterilizer

Boiling type: A boiling-type sterilizer is a fixture of a nonpressure type, utilized for boiling instruments, utensils or other equipment for disinfection. These devices are portable or are connected to the plumbing system.

Instrument: A device for the sterilization of various instruments.

Pressure (autoclave): A pressure vessel fixture designed to utilize steam under pressure for sterilizing.

Pressure instrument washer sterilizer: A pressure instrument washer sterilizer is a pressure vessel fixture designed to both wash and sterilize instruments during the operating cycle of the fixture.

Utensil: A device for the sterilization of utensils as utilized in health care services.

Water: A water sterilizer is a device for sterilizing water and storing sterile water.

Sterilizer vent: A separate pipe or stack, indirectly connected to the building *drainage system* at the lower terminal, which receives the vapors from nonpressure sterilizers, or the exhaust vapors from pressure sterilizers, and conducts the vapors directly to the open air. Also called vapor, steam, atmospheric or exhaust vent.

SECTION P-1403.0 SPECIAL FIXTURES

P-1403.1 Approval: All special plumbing fixtures, equipment, devices and apparatus shall be of an approved type.

P-1403.2 Materials: Fixtures designed for therapy, special cleansing or disposal of waste materials, combinations of such purposes or any other special purpose, shall be of smooth, impervious, corrosion-resistant materials and where subjected to temperatures in excess of 180 degrees F. (82 degrees C.), shall be capable of withstanding, without damage, higher temperatures.

P-1403.3 Protection: All devices, appurtenances, appliances and apparatus intended to serve some special function, such as sterilization, distillation, processing, cooling, storage of ice or foods, and which connect to either the water supply or *drainage system*, shall be provided with protection against *backflow*, flooding, fouling, contamination of the water supply system and stoppage of the drain.

P-1403.4 Access: *Access* shall be provided to concealed piping in connection with special fixtures, where such piping contains steam traps, valves, relief valves, check valves, vacuum breakers, or other similar items that require periodic inspection, servicing, maintenance or repair. *Access* shall be provided to

concealed piping that requires periodic inspection, maintenance or repair.

P-1403.5 Clinical sink: A clinical sink shall have an integral trap in which the upper portion of a visible trap *seal* provides a water surface. The fixture shall be designed so as to permit complete removal of the contents by siphonic or blowout action and to reseal the trap. A flushing rim shall provide water to cleanse the interior surface. The fixture shall have the flushing and cleansing characteristics of a water closet.

P-1403.6 Prohibited usage of clinical sinks and service sinks: A clinical sink serving a soiled utility room shall not be considered as a substitute for, nor be utilized as, a service sink. A service sink shall not be utilized for the disposal of urine, fecal matter or other human waste.

P-1403.7 Ice prohibited in soiled utility room: Machines for manufacturing ice, or any device for the handling or storage of ice, shall not be located in a soiled utility room.

P-1403.8 Sterilizer equipment requirements: The approval and installation of all sterilizers shall conform to the requirements of the mechanical code listed in Chapter 19.

P-1403.8.1 Sterilizer piping: *Access* for the purposes of inspection and maintenance shall be provided to all sterilizer piping and devices necessary for the operation of sterilizers.

P-1403.8.2 Steam supply: Steam supplies to sterilizers, including those connected by pipes from overhead mains or *branches*, shall be drained to prevent any moisture from reaching the sterilizer. The condensate drainage from the steam supply shall be discharged by gravity.

P-1403.8.3 Steam condensate return: Steam condensate returns from sterilizers shall be a gravity return system.

P-1403.8.4 Condensers: Pressure sterilizers shall be equipped with a means of condensing and cooling the exhaust steam vapors. Nonpressure sterilizers shall be equipped with a device that will automatically control the vapor, confining the vapors within the vessel.

P-1403.9 Special elevations: Control valves, vacuum outlets and devices protruding from a wall of an operating, emergency, recovery, examining or delivery room, or in a corridor or other location where patients are transported on a wheeled stretcher, shall be located at an elevation which prevents bumping the patient or stretcher against the device.

P-1403.10 Plumbing in mental health centers: In mental health centers, pipes or traps shall not be exposed, and fixtures shall be bolted through walls.

SECTION P-1404.0 DRAINAGE AND VENTING

P-1404.1 Bedpan washers and clinical sinks: Bedpan washers and clinical sinks shall connect to the *drainage* and *vent system* in accordance with the requirements for a water closet. Bedpan washers shall also connect to a local vent.

P-1404.2 Indirect waste: All sterilizers, steamers and condensers shall discharge to the drainage through an *indirect waste pipe* by means of an *air gap*. Where a battery of not more than three sterilizers discharges to an individual receptor, the distance between the receptor and a sterilizer shall not exceed 8 feet (2438 mm). The *indirect waste pipe* on a bedpan steamer shall be trapped.

P-1404.3 Vacuum system station: *Ready access* shall be provided to vacuum system station receptacles. Such receptacles shall be built into cabinets or recesses and shall be visible.

P-1404.4 Bottle system: Vacuum (fluid suction) systems intended for collecting, removing and disposing of blood, pus or other fluids by the bottle system shall be provided with receptacles equipped with an overflow prevention device at each vacuum outlet station.

P-1404.5 Central disposal system equipment: All central vacuum (fluid suction) systems shall provide continuous service. Systems equipped with collecting or control tanks shall provide for draining and cleaning of the tanks while the system is in operation. In hospitals, the system shall be connected to the emergency power system. The exhausts from a vacuum pump serving a vacuum (fluid suction) system shall discharge separately to open air above the roof.

P-1404.6 Central vacuum or disposal systems: Where the waste from a central vacuum (fluid suction) system of the barometric-lag, collection-tank or bottle-disposal type is connected to the *drainage system*, the waste shall be directly connected to the sanitary *drainage system* through a trapped waste.

P-1404.6.1 Piping: The piping of a central vacuum (fluid suction) system shall be of corrosion-resistant material with a smooth interior surface. A *branch* shall not be less than ½-inch nominal pipe size for one outlet and shall be sized in accordance with the number of vacuum outlets. A main shall not be less than 1-inch nominal pipe size. The pipe sizing shall be increased in accordance with the manufacturer's instructions as stations are increased. For the purposes of inspection, maintenance and replacement, all piping shall have *cleanout* facilities on mains and *branches*. *Access* shall be provided to such *cleanout* facilities.

P-1404.6.2 Velocity: The velocity of airflow in a central vacuum (fluid suction) system shall be less than 5,000 feet per minute (25 m/s).

P-1404.7 Vent connections prohibited: Connections between local vents serving bedpan washers or sterilizer vents serving sterilizing apparatus, and normal sanitary plumbing systems are prohibited. Only one type of apparatus shall be served by a local vent.

P-1404.8 Local vents and stacks for bedpan washers: Bedpan washers shall be vented to open air above the roof by means of one or more local vents. The local vent for a bedpan washer shall not be less than a 2-inch diameter pipe. A local vent serving a single bedpan washer is permitted to drain to the fixture served.

P-1404.8.1 Multiple installations: Where bedpan washers are located above each other on more than one floor, a local vent stack is permitted to be installed to receive the local vent on the various floors. Not more than three bedpan washers shall be connected to a 2-inch local vent stack, not more than six to a 3-inch local vent stack and not more than 12 to a 4-inch local vent stack. In multiple installations, the connections between a bedpan washer local vent and a local vent stack

shall be made with tee or tee-wye sanitary pattern drainage fittings installed in an upright position.

P-1404.8.2 Trap required: The bottom of the local vent stack, except where serving only one bedpan washer, shall be drained by means of a trapped and vented waste connection to the sanitary *drainage system*. The trap and waste shall be the same size as the local vent stack.

P-1404.8.3 Trap seal maintenance: A water supply pipe not less than ¼ inch in diameter shall be taken from the flush supply of each bedpan washer on the discharge or fixture side of the vacuum breaker, shall be trapped to form not less than a 3-inch (76 mm) water seal and shall be connected to the local vent stack on each floor. The water supply shall be installed so as to provide a supply of water to the local vent stack for cleansing and drain trap seal maintenance each time a bedpan washer is flushed.

P-1404.9 Sterilizer vents and stacks: Multiple installations of pressure and nonpressure sterilizers shall have the vent connections to the sterilizer vent stack made by means of inverted wye fittings. *Access* shall be provided to vent connections for the purpose of inspection and maintenance.

P-1404.9.1 Drainage: The connection between sterilizer vent or exhaust openings and the sterilizer vent stack shall be designed and installed to drain to the funnel or basket-type waste fitting. In multiple installations, the sterilizer vent stack shall be drained separately to the lowest sterilizer funnel or basket-type waste fitting or receptor.

P-1404.10 Sterilizer vent stack sizes: Sterilizer vent stack sizes shall comply with Sections P-1404.10.1 through P-1404.10.4.

P-1404.10.1 Bedpan steamers: The minimum size of a sterilizer vent serving a bedpan steamer shall be 1½ inches in diameter. Multiple installations shall be sized in accordance with Table P-1404.10.1.

Table P-1404.10.1
STACK SIZES FOR BEDPAN STEAMERS AND BOILING-TYPE STERILIZERS (NUMBER OF CONNECTIONS OF VARIOUS SIZES PERMITTED TO VARIOUS-SIZED STERILIZER VENT STACKS)

Stack size (inches)	Connection size		
	1½″		2″
1½[a]	1	or	0
2[a]	2	or	1
2[b]	1	and	1
3[a]	4	or	2
3[b]	2	and	2
4[a]	8	or	4
4[b]	4	and	4

Note a. Total of each size.
Note b. Combination of sizes.

P-1404.10.2 Boiling-type sterilizers: The minimum size of a sterilizer vent stack shall be 2 inches in diameter where serving a utensil sterilizer, and 1½ inches in diameter where serving an instrument sterilizer. Combinations of boiling-type sterilizer vent connections shall be sized in accordance with Table P-1404.10.1.

P-1404.10.3 Pressure sterilizers: Pressure sterilizer vent stacks shall be 2½ inches minimum. Those serving combinations of pressure sterilizer exhaust connections shall be sized in accordance with Table P-1404.10.3.

Table P-1404.10.3
STACK SIZES FOR PRESSURE STERILIZERS (NUMBER OF CONNECTIONS OF VARIOUS SIZES PERMITTED TO VARIOUS-SIZED VENT STACKS)

Stack size (inches)	Connection size							
	¾″		1″		1¼″		1½″	
1½[a]	3	or	2	or	1			
1½[b]	2	and	1					
2[a]	6	or	3	or	2	or	1	
2[b]	3	and	2					
2[b]	2	and	1	and	1			
2[b]	1	and	1	and			1	
3[a]	15	or	7	or	5	or	3	
3[b]			1	and	2	and	2	
	1	and	5	and			1	

Note a. Total of each size.
Note b. Combination of sizes.

P-1404.10.4 Pressure instrument washer sterilizer sizes: The minimum diameter of a sterilizer vent stack serving an instrument washer sterilizer shall be 2 inches. Not more than two sterilizers shall be installed on a 2-inch stack, and not more than four sterilizers shall be installed on a 3-inch stack.

SECTION P-1405.0 WATER SUPPLY

P-1405.1 Water service: All hospitals shall have two water service pipes installed in such a manner so as to provide an uninterrupted supply of water in the event of a water main or water service pipe failure.

P-1405.2 Hot water: Hot water shall be provided to supply all of the hospital fixture, kitchen and laundry requirements. Special fixtures and equipment shall have hot water supplied at a temperature specified by the manufacturer. The hot water system shall be installed in accordance with Section P-1508.0.

P-1405.3 Vacuum breaker installation: Vacuum breakers shall be installed a minimum of 6 inches (152 mm) above the flood level rim of the fixture or device in accordance with Section P-1507.0. The flood level rim of hose connections shall be the maximum height at which any hose is utilized.

P-1405.4 Prohibited water closet and clinical sink supply: Jet- or water-supplied orifices, except those supplied by the flush connections, shall not be located in or connected with a water closet bowl or clinical sink. This section shall not prohibit an approved bidet installation.

P-1405.5 Special equipment, water supply protection: The water supply for hospital fixtures shall be protected against *backflow* in accordance with Table P-1405.5.

P-1405.6 Clinical, hydrotherapeutic and radiological equipment: All clinical, hydrotherapeutic, radiological or any equipment which is supplied with water or which discharges to the waste system, shall conform to the requirements of this section and Section P-1507.0.

P-1405.7 Condensate drain trap seal: A water supply shall be provided for cleaning, flushing and resealing the condensate trap, and the trap shall discharge through an *air gap* in accordance with Section P-1507.0.

P-1405.8 Valve leakage diverter: Each water sterilizer filled with water through directly connected piping shall be equipped with an approved leakage diverter or bleed line on the water supply control valve to indicate and conduct any leakage of unsterile water away from the sterile zone.

Table P-1405.5
BACKFLOW PROTECTION FOR FIXTURES

Fixtures	Type of protection[a]	Remarks
Aspirators:		
Laboratory	Vacuum breaker	
Portable	Vacuum breaker	
Vacuum system	Vacuum breaker	
Bedpan:		
Washers	Vacuum breaker	
Washer hose	Vacuum breaker	Locate 5 feet above floor[b]
Boiling-type sterilizer	Air gap	Not less than twice the effective opening of the water supply
Exhaust condenser	Vacuum breaker	
Flush floor drain	Vacuum breaker	
Hose connection in health care and laboratory areas	Vacuum breaker	Locate in accordance with Section P-1405.3 and not less than 6 feet above finish floor
Pressure instrument washer sterilizer	Vacuum breaker	
Pressure sterilizer	Vacuum breaker	
Vacuum systems:		
Cleaning	Air gap or vacuum breaker	
Fluid suction	Air gap or vacuum breaker	

Note a. Where utilized, atmospheric vacuum breakers shall be installed after the last control valve.
Note b. 1 foot = 304.8 mm.

CHAPTER 15

WATER SUPPLY AND DISTRIBUTION

SECTION P-1501.0 GENERAL

P-1501.1 Scope: This chapter shall govern the design and installation of water supply systems, both hot and cold, for utilization in connection with human occupancy and habitation.

SECTION P-1502.0 DEFINITIONS

P-1502.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Air gap (water distribution system): The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, plumbing fixture or other device and the flood level rim of the receptacle.

Fixture supply: The water supply pipe connecting a fixture to a *branch* water supply pipe or directly to a main water supply pipe.

Flow pressure: The pressure in the water supply pipe near the faucet or water outlet while the faucet or water outlet is wide open and flowing.

Full-open valve: A shutoff valve that, in the full position, has a straight-through flow passageway with a diameter not less than one nominal pipe size smaller than the nominal pipe size of the connecting pipe.

Nonpotable water: Water not safe for drinking, personal or culinary utilization.

Potable water: Water free from impurities present in amounts sufficient to cause disease or harmful physiological effects and conforming in bacteriological and chemical quality to the requirements of the Public Health Service Drinking Water Standards or the regulations of the public health authority having jurisdiction.

Quick-closing valve: A valve or faucet which closes automatically when released manually, or which is controlled by a mechanical means for fast-action closing.

Relief valve

Pressure relief valve: A pressure-actuated valve held closed by a spring or other means and designed to relieve pressure automatically at the pressure at which such valve is set.

Temperature and pressure relief (T&P) valve: A combination relief valve designed to function as both a temperature relief and pressure relief valve.

Temperature relief valve: A temperature-actuated valve designed to discharge automatically at the temperature at which such valve is set.

Water-hammer arrestor: A device utilized to absorb the pressure surge (water hammer) that occurs when water flow is suddenly stopped in a water supply system.

Water outlet: A discharge opening through which water is supplied to a fixture, into the atmosphere (except into an open tank that is part of the water supply system), to a boiler or heating system, or to any devices or equipment requiring water to operate but which are not part of the plumbing system.

Water pipe

Riser: A water supply pipe that extends one full story or more to convey water to *branches* or to a group of fixtures.

Water distribution pipe: A pipe within the structure or on the premises which conveys water from the water service pipe or meter to the points of utilization.

Water service pipe: The pipe from the water main or other source of potable water supply to the water distribution system of the building served.

Water supply system: The water service pipe, water distribution pipes, and the necessary connecting pipes, fittings, control valves and all appurtenances in or adjacent to the structure or premises.

SECTION P-1503.0 WATER REQUIRED

P-1503.1 Structures: Every structure equipped with plumbing fixtures and utilized for human occupancy or habitation shall be provided with a potable supply of cold water in the amounts and at the pressures specified in this chapter. For permanent residences or structures in which people are employed, hot water shall also be provided.

P-1503.2 Nonpotable water prohibited: Only potable water shall be supplied to plumbing fixtures that provide water for drinking, bathing or culinary purposes, or for the processing of food, medical or pharmaceutical products.

SECTION P-1504.0 WATER SERVICE

P-1504.1 Size of water service pipe: The water service pipe shall be sized to supply water to the structure in the quantities and at the pressures required in this code. The minimum diameter of water service pipe shall be ¾ inch.

P-1504.2 Separation of water service and building sewer/drain: Water service pipe and the *building sewer* shall be separated by undisturbed or compacted earth.

The water service pipe shall not be placed in the same trench with the *building drain* and *building sewer* unless the installation conforms to the following requirements:

1. The bottom of the water service pipe at all points shall be a minimum of 12 inches (305 mm) above the top of the highest point of the *sewer*.
2. The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.

P-1504.2.1 Water service near sources of pollution: Potable water service pipes shall not be located in, under or above cesspools, septic tanks, septic tank drainage fields or seepage pits (see Section P-403.2 for soil and groundwater conditions). Where the water service pipe crosses the *sewer*, the bottom of the water service within 10 feet (3048 mm) of the point of crossing shall be at least 12 inches (305 mm) above the top of the *sewer*.

P-1504.3 Flood hazard: All water service pipes located in a flood-hazard zone (A Zone) or a high-hazard zone (V Zone) shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the base flood elevation in order to minimize or eliminate infiltration of floodwaters into the water supply system.

SECTION P-1505.0 DESIGN OF BUILDING WATER DISTRIBUTION SYSTEM

P-1505.1 General: The design of the building's hot and cold water distribution system shall conform to approved engineering practice. Methods utilized to determine pipe sizes shall be approved. At the points of interconnection between the hot and cold water supply piping systems and the individual fixtures, appliances or devices, provisions shall be made to prevent flow between such piping systems.

P-1505.2 Size of fixture supply: The minimum size of a fixture supply pipe shall be as shown in Table P-1505.2. The fixture supply pipe shall not terminate more than 30 inches (762 mm) from the point of connection to the fixture. A reduced-size flexible connector installed between the supply pipe and the fixture shall be of an approved type. The supply pipe shall extend to the floor or wall adjacent to the fixture.

P-1505.3 Excessive pressures: Where street main pressure exceeds 80 pounds per square inch (psi) (550 kPa), an approved pressure-reducing valve shall be installed in the water service pipe near the entrance of the water service pipe into the structure. Such valve shall reduce the water pressure to 80 psi (550 kPa) or less. Water pressure-reducing valves shall conform to ASSE 1003 listed in Chapter 19.

Exception: Where the water service pipe supplies water directly to a water pressure booster system, an elevated water gravity tank or to pumps provided in connection with a hydropneumatic or elevated gravity water supply tank system, the pressure at any fixture shall be limited to not more than 80 psi (550 kPa) under no-flow conditions.

Table P-1505.2
MINIMUM SIZES OF FIXTURE WATER SUPPLY PIPES (INCHES)

Fixture	Minimum pipe size (inches)
Bathtubs	1/2
Bidet	3/8
Combination sink and tray	1/2
Dishwasher, domestic	1/2
Drinking fountain	3/8
Hose bibbs	1/2
Kitchen sink	1/2
Laundry, 1, 2 or 3 compartments	1/2
Lavatory	3/8
Shower, single head	1/2
Sinks, flushing rim	3/4
Sinks, service	1/2
Urinal, flush tank	1/2
Urinal, flush valve	3/4
Wall hydrant	1/2
Water closet, flushometer tank	3/8
Water closet, flush tank	3/8
Water closet, flush valve	1
Water closet, one piece	1/2

P-1505.4 Water hammer: The flow velocity of the water distribution system shall be controlled to reduce the possibility of water hammer. A water-hammer arrestor shall be installed where quick-closing valves are utilized, unless otherwise approved. The arrestor shall be located within an effective range of the quick-closing valve. Water-hammer arrestors shall conform to ASME A112.26.1 or ASSE 1010 listed in Chapter 19. *Access* shall be provided to water-hammer arrestors.

P-1505.5 Inadequate water pressure: Wherever water pressure from the street main or other source of supply is insufficient to provide flow pressures at fixture outlets as required under Section P-1505.7, a booster pump and pressure tank, or other approved means, shall be installed on the building water supply system.

P-1505.6 Variable street pressures: Where street water main pressures fluctuate, the building water distribution system shall be designed for the minimum pressure available.

P-1505.7 Water distribution system design criteria: The water distribution system shall be designed, and pipe sizes shall be selected such that under conditions of peak demand, the capacities at the fixture supply pipe outlets shall not be less than shown in Table P-1505.7.

P-1505.8 Parallel water distribution system manifolds: Hot water and cold water manifolds installed with parallel connected individual distribution lines to each fixture or fixture fitting shall be designed in accordance with Sections P-1505.8.1 through P-1505.8.3.

P-1505.8.1 Manifold sizing: Hot water and cold water manifolds shall be sized in accordance with Table P-1505.8.1. The total gallons per minute is the demand of all outlets supplied.

P-1505.8.2 Valves: Individual fixture shutoff valves installed at the manifold shall be identified as to the fixture being supplied.

P-1505.8.3 Access: *Access* shall be provided to manifolds.

Table P-1505.7
WATER DISTRIBUTION SYSTEM DESIGN CRITERIA
REQUIRED CAPACITIES AT FIXTURE SUPPLY PIPE OUTLETS

Fixture supply outlet serving	Flow rate[a,b] (gpm)	Flow pressure[b] (psi)
Bathtub	4	8
Bidet	2	4
Combination fixture	4	8
Dishwasher, residential	2.75	8
Drinking fountain	0.75	8
Laundry tray	4	8
Lavatory	2	8
Shower	3	8
Shower, temperature controlled	3	20
Sillcock, hose bibb	5	8
Sink, residential	2.5	8
Sink, service	3	8
Urinal, valve	15	15
Water closet, blow out, flushometer valve	35	25
Water closet, flushometer tank	1.6	8
Water closet, tank, close coupled	3	8
Water closet, tank, one piece	6	20
Water closet, siphonic, flushometer valve	25	15

Note a. For additional requirements for flow rates and quantities, see Section P-1505.9.
Note b. 1 pound per square inch = 6.894 kPa; 1 gallon per minute = 3.785 l/m.

Table P-1505.8.1
MANIFOLD SIZING

Nominal size internal diameter (inches)	Maximum gallons per minute demand[a]	
	Velocity at 4 feet per second[a]	Velocity at 8 feet per second[a]
½	2	5
¾	6	11
1	10	20
1¼	15	31
1½	22	44

Note a. 1 gallon per minute = 3.785 l/m; 1 foot per second = 0.305 m/s.

P-1505.9 Maximum flow and water consumption: The maximum water consumption flow rates and quantities for all plumbing fixtures and fixture fittings shall be in accordance with Table P-1505.9. Water consumption for water closets listed in the following exceptions shall not be greater than 4.0 gallons (15 l) per flushing cycle. Water consumption for urinals listed in the following exceptions shall not be greater than 1.5 gallons (5.7 l) per flushing cycle.

Exceptions

1. Blowout design fixtures.
2. Penalware.
3. Clinical sinks.
4. Service sinks.
5. Emergency showers.
6. Water closets provided for the *public* in occupancies in Use Groups A-1, A-2, A-3 and A-5.
7. Water closets provided for patients and residents in occupancies in Use Group I-2.
8. Water closets provided for inmates and residents in occupancies in Use Group I-3.

Table P-1505.9
MAXIMUM FLOW RATES AND CONSUMPTION FOR PLUMBING FIXTURES AND FIXTURE FITTINGS

Plumbing fixture or fixture fitting	Maximum flow rate or quantity[a]
Water closet	1.6 gallons per flushing cycle
Urinal	1.0 gallon per flushing cycle
Shower head	2.5 gallons per minute at 80 pounds per square inch
Lavatory, private	2.2 gallons per minute at 60 pounds per square inch
Lavatory, public	0.5 gallon per minute at 80 pounds per square inch
Lavatory, public, metering or self-closing	0.25 gallons per metering cycle
Sink faucet	2.2 gallons per minute at 60 pounds per square inch

Note a. 1 gallon = 3.785 l; 1 gallon per minute = 3.785 l/m; 1 pound per square inch = 6.895 kPa.

SECTION P-1506.0 INSTALLATION OF THE BUILDING WATER DISTRIBUTION SYSTEM

P-1506.1 Location of full-open valves: *Full-open valves* shall be installed in the following locations:

1. On the building water service pipe from the *public* water supply near the curb.
2. On the water distribution supply pipe at the entrance into the structure.
3. On the discharge side of every water meter.
4. On the base of every water riser pipe in occupancies other than Use Group R-2 which are two stories or less in height and in occupancies in Use Group R-3.
5. On the top of every water down-feed pipe in occupancies other than Use Group R-3.
6. On the entrance to every water supply pipe to a dwelling unit, except where supplying a single fixture equipped with individual stops.
7. On the water supply pipe to a gravity or pressurized water tank.
8. On the water supply pipe to every water heater.

P-1506.2 Location of shutoff valves: Shutoff valves shall be installed in the following locations:

1. On the fixture supply to each plumbing fixture in all occupancies other than Use Groups R-2 and R-3, and other than in individual guestrooms that are provided with unit shutoff valves in occupancies in Use Group R-1.
2. On the water supply pipe to each sillcock.
3. On the water supply pipe to each appliance or mechanical equipment.

P-1506.3 Access to valves: *Access* shall be provided to all required *full-open valves* and shutoff valves.

P-1506.3.1 Identification: Service and hose bibb valves shall be identified. All other valves installed in locations that are not adjacent to the fixture or appliance shall be identified, indicating the fixture or appliance served.

P-1506.4 Water pressure booster systems: Water pressure booster systems shall be provided as required by Sections P-1506.4.1 through P-1506.4.11.

P-1506.4.1 Water pressure booster systems required: Where the water pressure in the public water main or individual water supply system is insufficient to supply the minimum pressures and quantities specified in this code, the supply shall be supplemented by an elevated water tank, a hydropneumatic pressure booster system or a water pressure booster pump installed in accordance with Section P-1506.4.5.

P-1506.4.2 Support: All water supply tanks shall be supported in accordance with the building code listed in Chapter 19.

P-1506.4.3 Covers: All water supply tanks shall be covered to keep out unauthorized persons, dirt and vermin. The covers of gravity tanks shall be vented with a return bend vent pipe with an area not less than the area of the down-feed riser pipe, and the vent shall be screened with a corrosion-resistant screen of not less than 16 × 20 mesh per inch (630 × 787 mesh per m).

P-1506.4.4 Overflows for water supply tanks: Each gravity or suction water supply tank shall be provided with an overflow with a diameter not less than that shown in Table P-1506.4.4. The overflow outlet shall discharge above and within not less than 6 inches (152 mm) of a roof or roof drain, floor or floor drain or over an open water-supplied fixture. The overflow outlet shall be covered with a corrosion-resistant screen of not less than 16 × 20 mesh per inch (630 × 787 mesh per m) and by ¼-inch (6 mm) hardware cloth or shall terminate in a horizontal angle seat check valve. Drainage from overflow pipes shall be directed so as not to freeze on roof walks.

Table P-1506.4.4
SIZES FOR OVERFLOW PIPES FOR WATER SUPPLY TANKS

Maximum capacity of water supply line to tank (gallons per minute)[a]	Diameter of overflow pipe (inches)
0 - 50	2
50 - 150	2½
150 - 200	3
200 - 400	4
400 - 700	5
700 - 1,000	6
Over 1,000	8

Note a. 1 gallon per minute = 3.785 l/m.

P-1506.4.5 Low-pressure cutoff required on booster pumps: A low-pressure cutoff shall be installed on all booster pumps in a water pressure booster system to prevent creation of a vacuum or negative pressure on the suction side of the pump when a positive pressure of 10 psi (68.94 kPa) or less occurs on the suction side of the pump.

P-1506.4.6 Potable water inlet control and location: Potable water inlets to gravity tanks shall be controlled by a ball cock or other automatic supply valve installed so as to prevent the tank from overflowing. The inlet shall be terminated so as to provide an *air gap* not less than 4 inches (102 mm) above the overflow.

P-1506.4.7 Tank drain pipes: A valved pipe shall be provided at the lowest point of each tank to permit emptying of the tank. The tank drain pipe shall discharge as required for overflow pipes and shall not be smaller in size than specified in Table P-1506.4.7.

Table P-1506.4.7
SIZE OF DRAIN PIPES FOR WATER TANKS

Tank capacity (gallons)[a]	Drain pipe (inches)
Up to 750	1
751 to 1,500	1½
1,501 to 3,000	2
3,001 to 5,000	2½
5,001 to 7,500	3
Over 7,500	4

Note a. 1 gallon = 3.785 l.

P-1506.4.8 Prohibited location of potable supply tanks: Potable water gravity tanks or manholes of potable water pressure tanks shall not be located directly under any soil or waste piping or any source of contamination.

P-1506.4.9 Pressure tanks, vacuum relief: All water pressure tanks shall be provided with a vacuum relief valve at the top of the tank which will operate up to a maximum water pressure of 200 psi (1380 kPa) and up to a maximum temperature of 200 degrees F. (93 degrees C.). The minimum size of such vacuum relief valve shall be ½ inch.

P-1506.4.10 Pressure relief for tanks: Every pressure tank in a hydropneumatic pressure booster system shall be protected with a pressure relief valve. The pressure relief valve shall be set at a maximum pressure equal to the rating of the tank. The relief valve shall be installed on the supply pipe to the tank or on the tank. The relief valve shall discharge by gravity to a safe place of disposal.

P-1506.4.11 Pumps and other appliances: Water pumps, filters, softeners, tanks and all other appliances and devices which handle or treat potable water shall be protected against contamination.

SECTION P-1507.0 PROTECTION OF POTABLE WATER SUPPLY

P-1507.1 General: A potable water supply system shall be designed, installed and maintained in such a manner so as to prevent contamination from nonpotable liquids, solids or gases being introduced into the potable water supply through cross connections or any other piping connections to the system.

P-1507.1.1 Stop-and-waste valves prohibited: Combination stop-and-waste valves or cocks shall not be installed underground.

P-1507.2 Definitions: The following words and terms shall, for the purposes of this section and as stated elsewhere in this code, have the meanings shown herein.

Backflow

Water supply system: The flow of water or other liquids, mixtures or substances into the distribution pipes of a potable water supply from any source except the intended source.

Backflow connection: Any arrangement whereby *backflow* is possible.

Backflow preventer: A device or means to prevent *backflow*.

Contamination: A general term meaning the introduction into the potable water supply of chemicals, wastes or sewage which renders the water unfit for the intended purpose.

Critical level (C-L): An elevation (height) reference point that determines the height at which a vacuum breaker is installed above the flood level rim of the fixture or receptor served by the device. The critical level is the elevation level below which there is a potential for *backflow* to occur.

Cross connection: Any physical connection or arrangement between two otherwise separate piping systems, one of which contains potable water and the other either water of unknown or questionable safety or steam, gas or chemical, whereby there exists the possibility for flow from one system to the other, with the direction of flow depending on the pressure differential between the two systems (see "*Backflow*").

Effective opening: The minimum cross-sectional area at the point of water supply discharge, measured or expressed in terms of the diameter of a circle or, if the opening is not circular, the diameter of a circle of equivalent cross-sectional area. For faucets and similar fittings, the effective opening shall be measured at the smallest orifice in the fitting body or in the supply piping to the fitting.

Essentially nontoxic transfer fluids: Fluids having a Gosselin rating of 1, including: propylene glycol; mineral oil; polydimethyoil oxane; hydrochlorofluorocarbon, chlorofluorocarbon and hydrofluorocarbon refrigerants; and FDA-approved boiler water additives for steam boilers.

Essentially toxic transfer fluids: Soil, waste or gray water and fluids having a Gosselin rating of 2 or more including ethylene glycol, hydrocarbon oils, ammonia refrigerants and hydrazine.

Flood level rim: The edge of the receptacle from which water overflows.

Pressure gradient monitor: A device utilized to protect the quality of water, fail safe by design, which secures the potable water system by isolating the heat exchanger when the positive pressure gradient is less than 10 pounds per square inch (psi) (70 kPa) of the nonpotable side.

Reduced pressure principle backflow preventer: A device consisting of two independently acting check valves, spring loaded to a closed position and separated by an intermediate chamber in which there is an automatic relief vented to atmosphere, spring loaded to the open position.

Rim: An unobstructed open edge of a fixture.

Vacuum breaker: A type of backflow preventer installed on openings subject to normal atmospheric pressure.

P-1507.3 Identification of potable and nonpotable water: In all buildings where two or more water distribution systems, one potable water and the other nonpotable water, are installed, each system shall be identified either by color marking or metal tags as required in ASME A13.1 listed in Chapter 19.

P-1507.4 Cross-connection control: Cross connections are prohibited, except where approved protective devices are installed.

P-1507.4.1 Private water supplies: Cross connections between a private water supply and a potable public supply shall be prohibited.

P-1507.5 Chemicals and other substances: Chemicals and other substances that produce either toxic conditions, taste, odor or discoloration in a potable water system, shall not be introduced into, or utilized in, such systems.

P-1507.6 Painting of water tanks: The interior surface of a potable water tank shall not be lined, painted or repaired with any material that changes the taste, odor, color or potability of the water supply when the tank is placed in, or returned to, service. The application of a coating to the interior of a steel tank shall conform to AWWA D102 listed in Chapter 19.

P-1507.7 Reuse of piping: Piping that has been utilized for any purpose other than conveying potable water shall not be utilized for conveying potable water.

P-1507.8 Return water: Water utilized for the cooling of equipment or other processes shall not be returned to the potable water system. Such water shall be discharged into a *drainage system* through an *air gap* or shall be utilized for nonpotable purposes.

P-1507.9 Backflow protection: Means of protection against *backflow* shall be provided in accordance with Sections P-1507.9.1 through P-1507.9.8.

P-1507.9.1 Air gap: The minimum required *air gap* shall be measured vertically from the lowest end of a potable water outlet to the flood level rim of the fixture or receptacle into which such potable water outlet discharges.

P-1507.9.2 Backflow preventer with intermediate atmospheric vent: Backflow preventers with intermediate atmospheric vents shall conform to ASSE 1012 or CSA CAN/CSA-B64.3 listed in Chapter 19. These devices shall be permitted to be installed where subject to continuous pressure conditions. The relief opening shall discharge by *air gap* and shall be prevented from being submerged.

P-1507.9.3 Reduced pressure principle backflow preventers: Reduced pressure principle backflow preventers shall conform to ASSE 1013, AWWA C511 or CSA CAN/CSA-B64.4 listed in Chapter 19. These devices shall be permitted to be installed where subject to continuous pressure conditions. The relief opening shall discharge by *air gap* and shall be prevented from being submerged.

P-1507.9.4 Atmospheric-type vacuum breakers: Pipe-applied atmospheric-type vacuum breakers shall conform to ASSE 1001 or CSA CAN/CSA-B64.1.1 listed in Chapter 19. Hose-connection vacuum breakers shall conform to ASSE 1011, CSA CAN/CSA-B64.2, ASSE 1019, CSA CAN/CSA-B64.2.2, ASSE 1035 or CSA CAN/CSA-B64.7 listed in Chapter 19. These devices shall operate under normal atmospheric pressure when the critical level is installed at the required height.

P-1507.9.5 Barometric loop: Barometric loops shall precede the point of connection and shall extend vertically to a height

of 35 feet (10668 mm). A barometric loop shall only be utilized as an atmospheric-type or pressure-type vacuum breaker.

P-1507.9.6 Pressure-type vacuum breakers: Pressure-type vacuum breakers shall conform to ASSE 1020 listed in Chapter 19. These devices are designed for installation under continuous-pressure conditions when the critical level is installed at the required height.

P-1507.9.7 Double check-valve assemblies: Double check-valve assemblies shall conform to ASSE 1015 or AWWA C510 listed in Chapter 19. Double-detector check-valve assemblies shall conform to ASSE 1048 listed in Chapter 19. These devices shall be capable of operating under continuous pressure conditions.

P-1507.10 Location of backflow preventers: *Access* shall be provided to backflow preventers.

P-1507.11 Inspection of devices: Periodic inspections shall be made of all backflow preventers to determine whether they are operable. Reduced pressure principle backflow preventers, double check-valve assemblies and double-detector check-valve assemblies shall be periodically tested. The periodic testing shall be performed in accordance with one of the following standards listed in Chapter 19:

ASSE 5010-1013-1, Sections 1 and 2
ASSE 5010-1015-1, Sections 1 and 2
ASSE 5010-1015-2
ASSE 5010-1015-3, Sections 1 and 2
ASSE 5010-1015-4, Sections 1 and 2
ASSE 5010-1020-1, Sections 1 and 2
ASSE 5010-1047-1, Sections 1, 2, 3 and 4
ASSE 5010-1048-1, Sections 1, 2, 3 and 4
ASSE 5010-1048-2
ASSE 5010-1048-3, Sections 1, 2, 3 and 4
ASSE 5010-1048-4, Sections 1, 2, 3 and 4

P-1507.12 Protection of potable water outlets: All potable water openings and outlets shall be protected against *backflow*, in accordance with one of the following Sections P-1507.12.1 through P-1507.12.4.

P-1507.12.1 Protection by air gap: Openings and outlets shall be protected by an *air gap* between the opening and the fixture flood level rim as specified in Table P-1507.12.1. Openings and outlets equipped for hose connection shall be protected by means other than an *air gap*.

P-1507.12.2 Protection by a backflow preventer with intermediate atmospheric vent: Openings and outlets shall be protected by a backflow preventer with an intermediate atmospheric vent.

P-1507.12.3 Protection by a vacuum breaker: Openings and outlets shall be protected by atmospheric-type or pressure-type vacuum breakers. The critical level of the vacuum breaker shall be set a minimum of 6 inches (152 mm) above the flood level rim of the fixture or device. Ball cocks shall be set in accordance with Section P-1222.4.1. Vacuum breakers shall not be installed under exhaust hoods or similar locations which will contain toxic fumes or vapors. Pipe-applied vacuum breakers shall be installed not less than 6 inches (152 mm) above the flood level rim of the fixture, receptor or device served.

P-1507.12.3.1 Hose connections: Sillcocks, hose bibbs, wall hydrants and other openings with a hose connection shall be protected by an atmospheric-type or pressure-type vacuum breaker or a permanently attached hose connection vacuum breaker.

P-1507.12.3.2 Deck-mounted vacuum breakers: Approved deck-mounted vacuum breakers shall be installed in accordance with the manufacturer's instructions with the critical level not less than 1 inch (25 mm) above the flood level rim.

Table P-1507.12.1
MINIMUM AIR GAPS FOR PLUMBING FIXTURES

Fixture	Minimum air gap	
	Away from a wall[a] (inches)[b]	Close to a wall (inches)[b]
Lavatories and other fixtures with effective opening not greater than ½ inch in diameter	1	1½
Sink, laundry trays, gooseneck back faucets and other fixtures with effective openings not greater than ¾ inch in diameter	1½	2½
Over-rim bath fillers and other fixtures with effective openings not greater than 1 inch in diameter	2	3
Drinking water fountains, single orifice not greater than 7/16 inch in diameter or multiple orifices with a total area of 0.150 square inches (area of circle 7/16 inch in diameter)	1	1½
Effective openings greater than 1 inch	Two times the diameter of the effective opening	Three times the diameter of the effective opening

Note a. Applicable where walls or obstructions are spaced from the nearest inside edge of the spout opening a distance greater than three times the diameter of the effective opening for a single wall, or a distance greater than four times the diameter of the effective opening for two intersecting walls.
Note b. 1 inch = 25.4 mm.

P-1507.12.4 Protection by a reduced pressure principle backflow preventer: Openings and outlets shall be protected by a reduced pressure principle backflow preventer.

P-1507.13 Connections to the potable water system: Connections to the potable water system shall conform to Sections P-1507.13.1 through P-1507.13.5.

P-1507.13.1 Connections to boilers: The potable supply to the boiler shall be equipped with a backflow preventer with an intermediate atmospheric vent. Where conditioning chemicals are introduced into the system, the potable water connection shall be protected by an *air gap* or a reduced pressure principle backflow preventer.

P-1507.13.2 Heat exchangers: Heat exchangers utilizing an essentially toxic transfer fluid shall be separated from the potable water by double-wall construction. An *air gap* open to the atmosphere shall be provided between the two walls. Heat exchangers utilizing an essentially nontoxic transfer fluid are permitted to be of single-wall construction.

Exception: Heat exchangers utilizing an essentially toxic transfer fluid with a pressure on the transfer fluid side a minimum of 10 psi lower than the pressure on the potable water side protected with a pressure gradient monitor are permitted to be of single-wall construction.

P-1507.13.3 Connections to automatic fire sprinkler systems and standpipe systems: The potable water supply to automatic fire sprinkler and standpipe systems shall be protected against *backflow* by a double check-valve assembly or a reduced pressure principle backflow preventer.

Exception: Where systems are installed as a portion of the water distribution system in accordance with the requirements of this code and are not provided with a fire department connection, isolation of the water supply system shall not be required.

P-1507.13.3.1 Additives or nonpotable source: Where systems contain chemical additives or antifreeze, or where systems are connected to a nonpotable secondary water supply, the potable water supply shall be protected against *backflow* by a reduced pressure principle backflow preventer. Where chemical additives or antifreeze are added to only a portion of an automatic fire sprinkler or standpipe system, the reduced pressure principle backflow preventer shall be permitted to be located so as to isolate that portion of the system.

P-1507.13.4 Connections subject to back pressure: Where a potable water connection is made to a nonpotable line, fixture, tank, vat, pump or other equipment subject to back pressure, the potable water connection shall be protected by a reduced pressure principle backflow preventer.

P-1507.13.5 Connections to lawn irrigation systems: The potable water supply to lawn irrigation systems shall be protected against *backflow* by an atmospheric-type vacuum breaker, a pressure-type vacuum breaker or a reduced pressure principle backflow preventer. A valve shall not be installed downstream from an atmospheric vacuum breaker. Where chemicals are introduced into the system, the potable water supply shall be protected against *backflow* by a reduced pressure principle backflow preventer.

P-1507.13.6 Beverage dispensers: The water supply connection to carbonated beverage dispensers shall be protected against *backflow* by a double check valve with an intermediate atmospheric vent conforming to ASSE 1012 listed in Chapter 19. The double check valve with an intermediate atmospheric vent device and the piping downstream therefrom shall not be affected by carbon dioxide gas. Secondary protection in the form of a dual check valve conforming to ASSE 1032 listed in Chapter 19 shall be installed on the beverage-dispensing equipment.

SECTION P-1508.0 HOT WATER SUPPLY SYSTEM

P-1508.1 Where required: In occupied structures, hot water shall be supplied to all plumbing fixtures and equipment utilized for bathing, washing, culinary purposes, cleansing, laundry or building maintenance.

Exception: In nonresidential occupancies, hot water or tempered water shall be supplied for bathing and washing purposes where approved.

P-1508.2 Definitions: The following words and terms shall, for the purposes of this section and as stated elsewhere in this code, have the meanings shown herein.

Hot water: Water at a temperature greater than or equal to 110 degrees F. (43 degrees C.).

Tempered water: Water ranging in temperature from 85 degrees F. (29 degrees C.) to 110 degrees F. (43 degrees C.).

Water heater: Any heating appliance or equipment which heats potable water and supplies such water to the potable hot water distribution system.

P-1508.3 Hot water supply piping: Where the *developed length* of hot water piping from the source of hot water supply to the farthest fixture exceeds 100 feet (30480 mm), the hot water supply system shall be provided with a method of maintaining the temperature of hot water to within 100 feet (30480 mm) of the fixtures. The methods of maintaining the temperatures shall not expend more energy than required by a recirculation system.

P-1508.3.1 Piping insulation: Piping in required return circulation systems shall be insulated to provide a thermal resistance (R), excluding film resistances, of

$$R = \frac{t_i - t_o}{25} \text{ (hr.) (ft.}^2\text{) (degrees F.)/Btu}$$

where $t_i - t_o$ is the design temperature differential between the water in the pipe and the surrounding air in degrees Fahrenheit.

Exception: Pipe insulation is not required where $t_i - t_o$ is 25 degrees F. (14 degrees C.) or less.

P-1508.3.2 Pump operation: Where a circulating pump is installed on a return circulation hot water system, the pump shall be arranged to shut off automatically or to allow manual shut off when the hot water system is not in operation.

P-1508.4 Water heaters: The approval and installation of all water heaters shall conform to the requirements of the mechanical code listed in Chapter 19.

P-1508.4.1 Minimum size: Water heating systems shall be sized to provide hot water to supply both daily requirements and hourly peak loads of the occupants of a structure. Storage-type water heaters serving individual dwelling units shall be sized in accordance with Table P-1508.4.1.

P-1508.4.2 Pressure rating: Water heaters utilized for pressures above atmospheric shall be rated for a minimum working pressure of 125 psi (860 kPa). The maximum allowable working pressure shall be permanently marked on the water heater in a location to which *access* is provided.

P-1508.4.3 Drain valves: Drain valves for emptying shall be installed at the lowest point of each tank-type water heater and hot water storage tank. Drain valves shall conform to ASSE 1005 listed in Chapter 19.

P-1508.4.4 Hot water from tankless heaters: The temperature of water from tankless water heaters shall be tempered to 140 degrees F. (60 degrees C.) where intended for domestic utilization. This provision shall not supersede the requirement for protective valves in accordance with Section P-1225.6.

P-1508.4.5 Insulation: Unfired hot water storage tanks shall be insulated so that heat loss is limited to a maximum of 15 British thermal units per hour (Btuh) per square foot (47 W/m^2) of external tank surface area. For purposes of determining this heat loss, the design ambient temperature shall not be higher than 65 degrees F. (18 degrees C.).

P-1508.5 Safety devices: All water heaters shall be protected with a temperature relief valve and a pressure relief valve or a combination temperature and pressure relief valve. The relief valve shall conform to ANSI Z21.22 listed in Chapter 19. All relief valves shall have a minimum rated capacity for the equipment served. Temperature relief valves shall be set at a maximum of 210 degrees F. (99 degrees C.). Pressure relief valves shall be set at a maximum of the pressure rating of the water heater and shall not exceed 150 psi (1034 kPa).

P-1508.5.1 Installation: Safety devices shall be installed in the relief valve opening of the water heater, where such opening is provided. For tank-type water heaters, the sensing element of the temperature relief valve or combination temperature and pressure relief valve shall extend into the tank and monitor the temperature in the top 6 inches (152 mm) of the tank. Valves shall not be installed between a safety device and the water heater.

P-1508.5.2 Relief valve discharge: Relief valves shall discharge so as not to be a hazard, a potential cause of damage or otherwise a nuisance.

P-1508.5.2.1 Material: Relief valve discharge pipe shall be rigid pipe approved for water distribution or other pipe that is rated as suitable for conveying water that is 210 degrees F. (99 degrees C.) to an atmospheric discharge.

P-1508.5.2.2 Size: The discharge piping shall be the same diameter as the relief valve outlet and shall be installed so as to drain by gravity flow.

P-1508.5.2.3 Valves: Valves shall not be installed in the relief valve discharge pipe.

P-1508.5.2.4 Installation: The discharge pipe from a relief valve shall terminate atmospherically not more than 4 inches (102 mm) above the floor. The end of the discharge pipe shall not be threaded. The discharge pipe from a relief valve shall be protected in accordance with Section P-309.4. Where a relief valve discharges to a *drainage*

Table P-1508.4.1
MINIMUM WATER HEATER CAPACITIES[a,b]

Fuel		Gas	Elec.	Oil	Gas	Elec.	Oil	Gas	Elec.	Oil	Gas	Elec.	Oil
Number of bedrooms			1			2			3			—	
1 to 1½ Baths	Storage (gallons)	20	20	30	30	30	30	30	40	30	—	—	—
	Input in Btuh (kW)[c]	27K	(2.5)	70K	36K	(3.5)	70K	36K	(4.5)	70K	—	—	—
	Draw (gph)	43	30	89	60	44	89	60	58	89	—	—	—
	Recovery (gph)	23	10	59	30	14	59	30	18	59	—	—	—
Number of bedrooms			2			3			4			5	
2 to 2½ Baths	Storage (gallons)	30	40	30	40	50	30	40	50	30	50	66	30
	Input in Btuh (kW)[c]	36K	(4.5)	70K	36K	(5.5)	70K	38K	(5.5)	70K	47K	(5.5)	70K
	Draw (gph)	60	58	89	70	72	89	72	72	89	90	88	89
	Recovery (gph)	30	18	59	30	22	59	32	22	59	40	22	59
Number of bedrooms			3			4			5			6	
3 to 3½ Baths	Storage (gallons)	40	50	30	50	66	30	50	66	30	50	80	40
	Input in Btuh (kW)[c]	38K	(5.5)	70K	38K	(5.5)	70K	47K	(5.5)	70K	50K	(5.5)	70K
	Draw (gph)	72	72	89	82	88	89	90	88	89	92	102	99
	Recovery (gph)	32	22	59	32	22	59	40	22	59	42	22	59

Note a. Storage capacity, input and the recovery requirements indicated in the table are typical and vary with each individual manufacturer. Any combination of these requirements that produce the 1-hour draw stated is permitted. Recovery is based on 100 degree F. water-temperature rise.

Note b. British thermal units per hour (Btuh); gallons per hour (gph); kilowatts (kW); 1 Btuh = 0.293 W; 1 gallon = 3.785 l; 1 gph = 3.785 l/hr.

Note c. The symbol K in the table indicates Btuh in thousands. Quantities in parenthesis are in kW.

system, the relief valve discharge shall be by indirect connection in accordance with Section P-703.1.2.

P-1508.5.3 Replacement: When water heaters are replaced, the temperature relief valve and the pressure relief valve or the combination temperature and pressure relief valve shall also be replaced. Such safety devices shall not be reinstalled.

P-1508.6 Temperature controls: All hot water supply systems shall be equipped with automatic temperature controls capable of adjustments from the lowest to the highest acceptable temperature settings for the intended temperature operating range.

P-1508.6.1 Shutdown: A separate switch shall be provided to terminate the energy supplied to electric hot water supply systems. A separate valve shall be provided to turn off the energy supplied to the main burner of all other types of hot water supply systems.

P-1508.7 Thermal expansion control: Where a backflow prevention device or a check valve is installed in the potable water supply of the building, a device for controlling thermal expansion shall be installed if the building supply pressure is capable of exceeding the temperature and pressure relief valve pressure settings.

Exception: This section shall not apply to potable water supply systems served by instantaneous water heaters.

SECTION P-1509.0 DISINFECTION OF POTABLE WATER SYSTEM

P-1509.1 General: New or repaired potable water systems shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be that prescribed by the health authority having jurisdiction or, in the absence of a prescribed method, the procedure described in either AWWA C651 or AWWA C652 listed in Chapter 19, or as described in this section. This requirement shall apply to "on-site" or "in-plant" fabrication of a system or to a modular portion of a system.

1. The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.
2. The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million (50 mg/l) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million (200 mg/l) of chlorine and allowed to stand for 3 hours.
3. Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.
4. The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

CHAPTER 16

INDIVIDUAL WATER SUPPLY

SECTION P-1601.0 GENERAL

P-1601.1 Scope: This chapter shall govern the installation of individual water supply systems.

SECTION P-1602.0 DEFINITIONS

P-1602.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Cistern: A small covered tank for storing water for a home or farm. Generally, this tank stores rainwater to be utilized for purposes other than in the potable water supply, and such tank is placed underground in most cases.

Individual water supply: A water supply except an approved public water supply that serves one or more families.

Well

Bored: A well constructed by boring a hole in the ground with an auger, and installing a casing.

Drilled: A well constructed by making a hole in the ground with a drilling machine of any type, and installing casing and screen.

Driven: A well constructed by driving a pipe in the ground. The drive pipe is usually fitted with a well point and screen.

Dug: A well constructed by excavating a large diameter shaft and installing a casing.

SECTION P-1603.0 WHERE REQUIRED

P-1603.1 General: Where a potable public water supply is not available, individual sources of potable water supply shall be utilized.

SECTION P-1604.0 TYPES OF INDIVIDUAL WATER SUPPLY

P-1604.1 General: Dependent upon geological and soil conditions and the amount of rainfall, individual water supplies are of the following types: drilled well, driven well, dug well, bored well, spring, stream or cistern. Surface bodies of water and land cisterns shall not be sources of individual water supply, unless properly treated by approved means to prevent contamination.

SECTION P-1605.0 QUANTITY AND QUALITY OF WATER

P-1605.1 Minimum quantity: The combined capacity of the source and storage on the system shall supply the fixtures with water at rates and pressures as required by Chapter 15.

P-1605.2 Water quality: Water from an individual water supply shall be certified as potable by the authority having jurisdiction prior to connection to the plumbing system.

P-1605.3 Disinfection of system: After construction or major repair, the private potable water supply system shall be purged of deleterious matter and disinfected in accordance with Section P-1509.0.

SECTION P-1606.0 PROTECTION OF SUPPLY

P-1606.1 General: An individual water supply shall be located and constructed so as to be safeguarded against contamination.

P-1606.2 Well locations: A potable ground water source or pump suction line shall not be located closer to potential sources of contamination than the distances shown in Table P-1606.2. In the event the underlying rock structure is limestone or fragmented shale, the local or state health department shall be consulted on well site location. The distances in Table P-1606.2 constitute minimum separation and shall be increased in areas of creviced rock or limestone, or where the direction of movement of the ground water is from sources of contamination toward the well.

Table P-1606.2
DISTANCE FROM SOURCES OF CONTAMINATION TO PRIVATE WATER SUPPLIES AND PUMP SUCTION LINES

Source of contamination	Distance (feet)[a]
Sewer	10
Septic tank	25
Subsurface pits	50
Pasture	100
Subsurface disposal fields	50
Seepage pits	50
Barnyard	100
Farm silo	25
Pumphouse floor drain of cast iron draining to ground surface	2

Note a. 1 foot = 304.8 mm.

P-1606.3 Elevation: Well sites shall be positively drained and shall be at higher elevations than potential sources of contamination.

P-1606.4 Depth: Private potable well supplies shall not be developed from a water table less than 10 feet (3048 mm) below the ground surface.

P-1606.5 Water-tight casings: Each well shall be provided with a water-tight casing to a minimum distance of 10 feet (3048 mm)

below the ground surface. All casings shall extend at least 6 inches (152 mm) above the well platform. The casing shall be large enough to permit installation of a separate drop pipe. Casings shall be sealed at the bottom in an impermeable stratum or extend several feet into the water-bearing stratum.

P-1606.6 Drilled or driven well casings: Drilled or driven well casings shall be of steel or other approved material. Where drilled wells extend into a rock formation, the well casing shall extend to and set firmly in the formation. The annular space between the earth and the outside of the casing shall be filled with cement grout to a minimum distance of 10 feet (3048 mm) below the ground surface. In an instance of casing to rock installation, the grout shall extend to the rock surface.

P-1606.7 Dug or bored well casings: Dug or bored well casings shall be of water-tight concrete, tile, or galvanized or corrugated metal pipe to a minimum distance of 10 feet (3048 mm) below the ground surface. Where the water table is more than 10 feet (3048 mm) below the ground surface, the water-tight casing shall extend below the table surface. Well casings for dug wells or bored wells constructed with sections of concrete, tile, or galvanized or corrugated metal pipe shall be surrounded by 6 inches (152 mm) of grout poured into the hole between the outside of the casing and the ground to a minimum depth of 10 feet (3048 mm).

P-1606.8 Cover: Every potable water well shall be equipped with an overlapping water-tight cover at the top of the casing well or pipe sleeve such that contaminated water or other substances are prevented from entering the well through the annular opening at the top of the well casing, wall or pipe sleeve. Covers shall extend downward at least 2 inches (51 mm) over the outside of the well casing or wall. A dug well cover shall be provided with a pipe sleeve permitting the withdrawal of the pump suction pipe, cylinder or jet body without disturbing the cover. Where pump sections or discharge pipes enter or leave a well through the side of the casing, the circle of contact shall be water tight.

P-1606.9 Flood hazard: Wells located in a flood-hazard zone (A Zone) or a high-hazard zone (V Zone) shall have the top of the casing well or pipe sleeve elevated to at least 1 foot (305 mm) above the base flood elevation, or shall have sealed covers capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the base flood elevation.

P-1606.10 Drainage: All potable water wells and springs shall be constructed such that surface drainage will be diverted away from the well or spring.

SECTION P-1607.0 PUMPING EQUIPMENT

P-1607.1 Pump: Pumps shall be constructed and installed so as to prevent contamination from entering a potable water supply through the pump units. Pumps shall be sealed to the well casing or covered with a water-tight seal. Pumps shall be designed to maintain a prime and installed such that *ready access* is provided to the pump parts of the entire assembly for repairs.

P-1607.2 Flood hazard: Pumps located in a flood-hazard zone (A Zone) or a high-hazard zone (V Zone), and which are below the base flood elevation, shall have seals capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the base flood elevation.

P-1607.3 Pump enclosure: The pump room or enclosure around a well pump shall be drained and protected from freezing by heating or other approved means. Where pumps are installed in basements, such pumps shall be mounted on a block or shelf not less than 18 inches (457 mm) above the basement floor. Well pits shall be prohibited.

CHAPTER 17

INSPECTION, TESTS AND MAINTENANCE

SECTION P-1701.0 GENERAL

P-1701.1 Scope: This chapter shall govern the inspections, methods of testing and maintenance of plumbing installations.

SECTION P-1702.0 INSPECTIONS

P-1702.1 Required: A plumbing system or part thereof shall not be enclosed, covered or put into operation until such system has been inspected and approved. During the progress of the plumbing work, inspection shall be made by the code official as required, and the holder of the permit shall be responsible for the scheduling of such inspections with the code official at least 24 hours before such inspection is to be made.

P-1702.2 Defective plumbing: An installation of plumbing work, whether new or existing, which is found to be defective or unsafe shall not be allowed to continue in service. The code official shall revoke all permits and certificates in effect, and the utilization of such a defective or unsafe plumbing system shall be discontinued until such time that the system is brought into compliance with this code.

P-1702.3 Rough-in inspection: Plumbing work shall not be closed in, concealed or covered until the work has been inspected and approved and permission is granted to close in, conceal or cover the work. *Rough-in* inspection shall be performed after the plumbing system is *roughed in* and before fixtures are set. Tests shall be performed in accordance with Section P-1703.0.

P-1702.4 Final inspection: Upon completion of the plumbing work and before final approval is given, the code official shall inspect the work and observe the final test to ensure compliance with this code.

P-1702.5 Reinspections: Where any work or installation does not pass any initial test or inspection, the necessary corrections shall be made to comply with this code. The work or installation shall then be resubmitted to the code official for inspection.

SECTION P-1703.0 TESTING OF PLUMBING SYSTEMS

P-1703.1 New, altered, extended or repaired systems: Tests herein required shall be made by the permit holder and observed by the code official. New plumbing systems and parts of existing systems, which have been altered, extended or repaired, shall be tested as prescribed herein to disclose leaks and defects, except that testing is not required in the following cases:

1. In any case which does not include addition to, replacement, alteration or relocation of any water supply, drainage or vent piping.
2. In any case where plumbing equipment is set up temporarily for exhibition purposes.

P-1703.2 Defective plumbing: Where there is reason to believe that the plumbing system of any structure is defective, the system shall be subjected to tests or inspection and all defects shall be corrected.

P-1703.3 Exposure of work: All new, altered, extended or replaced plumbing shall be left uncovered and unconcealed until such plumbing has been tested and approved. Plumbing work that has been covered or concealed before testing and approval shall be uncovered for testing.

P-1703.4 Equipment, material and labor for tests: All equipment, material and labor required for testing a plumbing system or part thereof shall be furnished by the plumbing contractor responsible for installing the work.

P-1703.5 Drainage and vent systems test: *Drainage* and *vent system* test methods shall conform to the requirements of Sections P-1703.5.1 and P-1703.5.2.

P-1703.5.1 Rough plumbing: Except for outside leaders and perforated or open-jointed drain tile, the piping of plumbing drainage and venting systems shall be tested upon completion of the rough piping installation by water or air and proved water tight. Where required by the code official, the *cleanout* plugs shall be removed to determine if the pressure has reached all parts of the system. Tests shall be performed by either of the following methods:

1. Water test: The water test shall be applied to the *drainage system* either in its entirety or in sections after rough piping has been installed.
   1.1. Where applied to the entire system, all openings in the piping shall be closed, except the highest opening, and the system shall be filled with water to the point of overflow.
   1.2. Where the system is tested in sections, each opening shall be plugged, except the highest opening of the section under test, and each section shall be filled with water. A section shall not be tested with less than a 10-foot (3048 mm) head of water.
   1.3. In testing successive sections, at least the upper 10 feet (3048 mm) of the next preceding section shall be tested such that a joint or pipe in the building,

except the uppermost 10 feet (3048 mm) of the system, shall not have been subjected to a test of less than a 10-foot (3048 mm) head of water.

1.4. The water shall be kept in the system or in the portion under test for a minimum of 15 minutes before inspection starts. The system shall then be tight at all points.

2. Air test: The air test shall be made by attaching an air compressor testing apparatus to an opening and, after closing all other inlets and outlets to the system, forcing air into the system until there is a gauge pressure of 5 pounds per square inch (34 kPa) or a pressure not less than a 10-inch (254 mm) column of mercury. This pressure shall be held without introduction of additional air for a minimum period of 15 minutes.

P-1703.5.2 Finished plumbing: Where required by the code official, after the plumbing fixtures have been set and the plumbing fixture traps filled with water, the plumbing fixture connections shall be tested and proved gas and water tight by one of the following test methods:

1. Final test for gas and water tightness: The final test for gas and watertightness of the completed *drainage* and *vent system* shall be made by a smoke test or other approved method. The test shall be made by filling all traps with water and then introducing into the system smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1-inch (249 P) water column shall be introduced and maintained for the period of the inspection.
2. After the plumbing fixtures have been set and the traps filled with water, the fixture connections shall be tested and proven gas and water tight. The vent terminals and the *building drain* where the drain leaves the building shall be plugged and air shall be introduced into the system equal to the pressure of a 1-inch (249 P) water column. This shall be accomplished by inserting a "U" tube or manometer into the trap of a water closet. Such pressure shall remain constant for the period of inspection without the introduction of additional air.

P-1703.6 Building sewer test: The *building sewer* shall be tested by insertion of a test plug at the point of connection with the public sewer or individual sewage disposal system. The *building sewer* shall then be filled with water under a head of not less than 10 feet (3048 mm). The water level at the top of the test head of water shall not drop for at least 15 minutes.

P-1703.7 Water supply system test: Upon completion of a section of or the entire water supply system, the system, or portion completed, shall be tested and proved tight under a water pressure not less than the working pressure of the system. The water utilized for tests shall be obtained from a potable source of supply.

SECTION P-1704.0 MAINTENANCE

P-1704.1 General: All plumbing and *drainage systems*, both existing and new and all parts thereof, shall be maintained in a safe and sanitary condition. All devices and safeguards required by this code shall be maintained in working order. The owner, or designated agent, shall be responsible for the maintenance of plumbing systems.

CHAPTER 18

ALTERNATIVE ENGINEERED DESIGN

SECTION P-1801.0 GENERAL

P-1801.1 Scope: This chapter shall govern the design, installation, inspection and supervision of an *alternative engineered design* plumbing system, including the requirement that *construction documents* be submitted and approved.

SECTION P-1802.0 DEFINITIONS

P-1802.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Alternative engineered design: A plumbing system that performs in accordance with the intent of Chapters 3 through 16 and provides an equivalent level of performance for the protection of public health, safety and welfare. The system design is not specifically regulated by Chapters 3 through 16.

SECTION P-1803.0 DESIGN CRITERIA

P-1803.1 General: An *alternative engineered design* shall conform to the intent of the provisions of this code and shall provide an equivalent level of quality, strength, effectiveness, fireresistance, durability and safety. Material, equipment or components shall be designed and installed in accordance with the manufacturer's installation instructions.

P-1803.2 Technical data: The *registered design professional* shall submit sufficient technical data to substantiate the proposed *alternative engineered design* and to prove that the performance meets the intent of this code.

SECTION P-1804.0 SUBMITTAL

P-1804.1 Application: The *registered design professional* shall indicate on the permit application that the plumbing system is an *alternative engineered design* that conforms to Chapter 18. The permit and permanent permit records shall indicate that an *alternative engineered design* was part of the approved installation.

P-1804.2 Construction documents: The *registered design professional* shall submit to the code official two complete sets of signed and sealed *construction documents* for the *alternative engineered design*. The *construction documents* shall include floor plans and a riser diagram of the work. Where appropriate, the *construction documents* shall indicate the direction of flow, all pipe sizes, grade of horizontal piping, loading and location of fixtures and appliances.

SECTION P-1805.0 DESIGN APPROVAL

P-1805.1 General: Where the code official determines that the *alternative engineered design* conforms to the intent of this code, the plumbing system shall be approved. If the *alternative engineered design* is not approved, the code official shall notify the *registered design professional* in writing, stating the reasons therefor.

P-1805.2 Inspection and test: The *alternative engineered design* shall be tested and inspected in accordance with the requirements of Chapter 17.

SECTION P-1806.0 SPECIAL INSPECTION

P-1806.1 Periodic inspection: The *registered design professional* or designated inspector shall periodically inspect and observe the *alternative engineered design* to determine that the installation is in accordance with the approved plans. All discrepancies shall be brought to the immediate attention of the plumbing contractor for correction. Records shall be kept of all inspections.

P-1806.2 Written report: The *registered design professional* shall submit a final report in writing to the code official upon completion of the installation, certifying that the *alternative engineered design* conforms to the approved *construction documents*. A notice of approval for the plumbing system shall not be issued until a written certification has been submitted.

SECTION P-1807.0 ENGINEERED VENT SYSTEM

P-1807.1 Individual branch fixture and individual fixture header vents: The maximum *developed length* of individual fixture vents to vent *branches* and vent headers shall be determined in accordance with Table P-1807.1 for the minimum pipe diameters at the indicated vent airflow rates.

The *individual vent* airflow rate shall be determined in accordance with the following:

$$Q_{h,b} = N_{n,b}Q_v$$

where:

$Q_{h,b}$ = Vent *branch* or vent header airflow rate (cubic feet per minute).

Q_v = Total vent stack airflow rate (cubic feet per minute).

$N_{h,b}$ = Number of fixtures per header (or vent *branch*), total number of fixtures connected to vent stack.

$$Q_v \text{ (gpm)} = 27.8 r_s^{2/3} (1-r_s) D^{8/3}$$
$$Q_v \text{ (cfm)} = 0.134\, Q_v \text{ (gpm)}$$

where:

D = Drainage stack diameter (inches).

r_s = Waste water flow area to total area.

$$= \frac{Q_w}{27.8\ D^{8/3}}$$

Q_w = Design discharge load (gallons per minute).

Individual vent airflow rates are obtained by equally distributing $Q_{h,b}$ into one-half the total number of fixtures on the *branch* or header for more than two fixtures; for an odd number of total fixtures, decrease by one; for one fixture, apply the full value of $Q_{h,b}$.

Individual vent developed length shall be increased by 20 percent of the distance from the vent stack to the fixture vent connection on the vent *branch* or header.

SECTION P-1808.0 AIR ADMITTANCE VALVES

P-1808.1 Approval: Individual- and branch-type air admittance valves shall conform to ASSE 1051 listed in Chapter 19. The valves shall be installed in accordance with the requirements of this section and the manufacturer's installation instructions.

P-1808.2 Definitions: The following words and terms shall, for the purposes of this section and as stated elsewhere in this code, have the meanings shown herein.

Air admittance valve: A one-way valve designed to allow air to enter the plumbing *drainage system* when negative pressures develop in the piping system. The device shall close by gravity and seal the vent terminal when the internal pressure is equal to or greater than atmospheric pressure. An air admittance valve is designed to act as a substitute for vent piping extending to the open air.

P-1808.3 Where permitted: *Individual*, *branch* and circuit vents shall be permitted to terminate with a connection to an air admittance valve. The air admittance valve shall only vent fixtures that are on the same floor level and connect to a *horizontal branch drain*. The *horizontal branch drain* shall conform to Section P-1808.3.1 or P-1808.3.2.

P-1808.3.1 Location of branch: The *horizontal branch drain* shall connect to the drainage stack or *building drain* a maximum of four *branch intervals* from the top of the stack.

P-1808.3.2 Relief vent: The horizontal *branch* shall be provided with a relief vent which shall connect to a vent stack, or stack vent, or extend outdoors to the open air. The relief vent shall connect to the *horizontal branch drain* between the stack or *building drain* and the most downstream *fixture drain* connected to the *horizontal branch drain*. The relief vent shall be sized and installed in accordance with Sections P-904.1 and P-907.0.

P-1808.4 Location: The air admittance valve shall be located a minimum of 4 inches (102 mm) above the *horizontal branch drain* or *fixture drain* being vented. The air admittance valve shall be located within the maximum *developed length* permitted for the vent. The air admittance valve shall be installed a minimum of 6 inches (152 mm) above insulation materials.

P-1808.5 Access and ventilation: *Access* shall be provided to all air admittance valves. The valve shall be located within a ventilated space that allows air to enter the valve.

P-1808.6 Size: The air admittance valve shall be rated for the size of the vent to which the valve is connected.

P-1808.7 Vent required: Within each plumbing system, a minimum of one stack vent or vent stack shall extend outdoors to the open air.

P-1808.8 Prohibited installations: Air admittance valves shall not be installed in nonneutralized special waste systems as described in Chapter 7. Valves shall not be located in spaces utilized as supply or return air plenums.

SECTION P-1809.0 COMPUTERIZED DRAINAGE DESIGN

P-1809.1 Design of drainage system: The sizing requirements for plumbing *drainage systems* shall be determined by approved computer program design methods.

P-1809.2 Load on drainage system: The load shall be computed from the simultaneous or sequential discharge conditions from fixtures, appurtenances and appliances or the peak usage design condition.

P-1809.2.1 Fixture discharge profiles: The discharge profiles for flow rates versus time from fixtures and appli-

Table P-1807.1
MINIMUM DIAMETER AND MAXIMUM LENGTH OF INDIVIDUAL BRANCH FIXTURE VENTS AND INDIVIDUAL FIXTURE HEADER VENTS FOR SMOOTH PIPES

Diameter of vent pipe (inches)	Individual vent airflow rate (cubic feet per minute)[a]																			
	Maximum developed length of vent (feet)[a]																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1/2	95	25	13	8	5	4	3	2	1	1	1	1	1	1	1	1	1	1	1	1
3/4	100	88	47	30	20	15	10	9	7	6	5	4	3	3	3	2	2	2	2	1
1			100	94	65	48	37	29	24	20	17	14	12	11	9	8	7	7	6	6
1 1/4								100	87	73	62	53	46	40	36	32	29	26	23	21
1 1/2												100	96	84	75	67	60	54	49	45
2																				100

Note a. 1 cubic foot per minute = 0.0004719 m^3/s; 1 foot = 304.8 mm.

ances shall be in accordance with the manufacturer's specifications.

P-1809.3 Selections of drainage pipe sizes: Pipe shall be sized to prevent full-bore flow.

P-1809.3.1 Selecting pipe wall roughness: Pipe size calculations shall be conducted with the pipe wall roughness factor (k_s), in accordance with the manufacturer's specifications and as modified for aging roughness factors related to pipe wall deposits and corrosion.

P-1809.3.2 Slope of horizontal drainage piping: Horizontal drainage piping shall be designed and installed at slopes in accordance with Table P-604.1.

CHAPTER 19

REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section P-102.5.

ANSI

American National Standards Institute
11 West 42nd Street
New York, NY 10036

Standard reference number	Title	Referenced in code Section number
Z4.3 – 87	Minimum Requirements for Nonsewered Waste-Disposal Systems	P-312.1
Z21.22 – 86	Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems	P-1508.5
Z124.1 – 87	Plastic Bathtub Units	P-1208.1
Z124.2 – 87	Plastic Shower Receptors and Shower Stalls	P-1218.1
Z124.3 – 86	Plastic Lavatories	P-1217.2
Z124.4 – 86	Plastic Water Closet Bowls and Tanks	P-1221.1
Z124.6 –90	Plastic Sinks	P-1219.1

ARI

Air-Conditioning & Refrigeration Institute
1501 Wilson Blvd.
Arlington, VA 22209

Standard reference number	Title	Referenced in code Section number
1010 – 84	Drinking Fountains and Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers	P-1211.1

ASME

American Society of Mechanical Engineers
345 East 47th Street
New York, NY 10017

Standard reference number	Title	Referenced in code Section number
A13.1 – 81	Scheme for the Identification of Piping Systems — with 1985 Revision	P-1507.3
A112.6.1 – 88	Supports for Off-the-Floor Plumbing Fixtures for Public Use	P-1206.5
A112.14.1 – 75	Backwater Valves	P-1005.1
A112.18.1 – 89	Finished and Rough Brass Plumbing Fixture Fittings	P-407.3 P-1225.1
A112.19.1 – 87	Enameled Cast Iron Plumbing Fixtures	P-1208.1 P-1211.1, P-1216.1, P-1217.1, P-1219.1

ASME (cont'd.)

A112.19.2 – 90	Vitreous China Plumbing Fixtures	P-1209.1 P-1211.1, P-1217.1, P-1219.1, P-1220.1, P-1221.1
A112.19.3 – 87	Stainless Steel Plumbing Fixtures (Designed for Residential Use)	P-1216.1 P-1217.1, P-1219.1
A112.19.4 – 84	Porcelain Enameled Formed Steel Plumbing Fixtures	P-1208.1 P-1217.1, P-1219.1
A112.19.5 – 79	Trim for Water-Closet Bowls, Tanks, and Urinals	P-407.9
A112.19.6 – 90	Hydraulic Requirements for Water Closets and Urinals	P-1220.1 P-1221.1
A112.19.7 – 87	Whirlpool Bathtub Appliances	P-1223.1
A112.19.8 – 87	Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Whirlpool Bathtub Appliances	P-1223.4
A112.19.9 – 91	Non-Vitreous Ceramic Plumbing Fixtures	P-1208.1 P-1209.1, P-1211.1, P-1216.1, P-1217.1, P-1218.1, P-1219.1, P-1221.1
A112.21.1 – 91	Floor Drains	P-1213.1
A112.21.2 – 91	Roof Drains	P-405.5
A112.26.1 – 84	Water Hammer Arrestors	P-1505.4
B1.20.1 – 83	Pipe Threads, General Purpose (inch)	P-503.4 P-506.4, P-509.5, P-511.4, P-512.2, P-516.4
B16.3 – 85	Malleable Iron Threaded Fittings	Table P-406.1
B16.4 – 85	Cast Iron Threaded Fittings	Table P-406.1
B16.9 – 86	Factory-Made Wrought Steel Buttwelding Fittings	Table P-406.1
B16.11 – 91	Forged Steel Fittings, Socket-Welding and Threaded	Table P-406.1
B16.12 – 91	Cast-Iron Threaded Drainage Fittings	Table P-406.1
B16.15 – 85	Cast Bronze Threaded Fittings	Table P-406.1
B16.18 – 84	Cast Copper Alloy Solder Joint Pressure Fittings	Table P-406.1
B16.22 – 89	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings	Table P-406.1
B16.23 – 84	Cast Copper Alloy Solder Joint Drainage Fittings (DWV)	Table P-406.1
B16.26 – 88	Cast Copper Alloy Fittings for Flared Copper Tubes	Table P-406.1
B16.28 – 86	Wrought Steel Buttwelding Short Radius Elbows and Returns	Table P-406.1
B16.29 – 86	Wrought Copper and Wrought Copper Alloy Solder Joint Fittings for Sovent Drainage Systems	Table P-406.1
B16.32 – 84	Cast Copper Alloy Solder Joint Fittings for Sovent Drainage Systems	Table P-406.1

ASSE

American Society of Sanitary Engineering
P.O. Box 40362
Bay Village, OH 44140

Standard reference number	Title	Referenced in code Section number
1001 – 82	Performance Requirements for Pipe Applied Atmospheric Type Vacuum Breakers — with 1988 Revision	P-1222.3, P-1507.9.4
1002 – 86	Performance Requirements for Water Closet Flush Tank Ball Cocks — with 1986 Revision	P-1222.4.1
1003 – 82	Performance Requirements for Water Pressure Reducing Valves	P-1505.3
1004 – 67	Performance Requirements for Commercial Dishwashing Machines	P-1210.1
1005 – 86	Performance Requirements for Water Heater Drain Valves — with 1986 Revision	P-1508.4.3
1006 – 86	Performance Requirements for Residential Use (Household) Dishwashers	P-1210.1
1007 – 86	Performance Requirements for Home Laundry Equipment — with 1986 Revision	P-1207.1
1008 – 86	Performance Requirements for Household Food Waste Disposer Units — with 1986 Revision	P-1214.1
1009 – 70	Performance Requirements for Commercial Food Waste Disposer Units	P-1214.1
1010 – 82	Performance Requirements for Water Hammer Arresters — with 1982 Revision	P-1505.4
1011 – 82	Performance Requirements for Hose Connection Vacuum Breakers	P-1507.9.4
1012 – 78	Performance Requirements for Backflow Preventers with Intermediate Atmospheric Vent	P-1507.9.2, P-1507.9.7
1013 – 71	Performance Requirements for Reduced Pressure Principle Backflow Preventers — with 1988 Revision	P-1507.9.3
1014 – 79	Performance Requirements for Hand-Held Showers — with 1989 Revision	P-1225.4
1015 – 88	Performance Requirements for Double Check Backflow Prevention Assembly	P-1507.9.8
1016 – 79	Performance Requirements for Individual Thermostatic, Pressure Balancing and Combination Control Valves for Bathing Facilities — with 1988 Revision	P-1225.6
1018 – 86	Performance Requirements for Trap Seal Primer Valves; Water Supply Fed — with 1986 Revision	P-1003.5
1019 – 78	Performance Requirements for Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Types	P-1507.9.4
1020 – 82	Performance Requirements for Pressure Vacuum Breaker Assembly (Recommended for Outdoor Usage) — with 1989 Revision	P-1507.9.6
1025 – 78	Performance Requirements for Diverters for Plumbing Faucets with Hose Spray, Anti-Siphon Type, Residential Applications	P-1225.3
1032 – 80	Performance Requirements for Dual Check Valve Type Backflow Preventers; For Carbonated Beverage Dispensers — Post Mix-Types	P-1507.9.7
1035 – 84	Performance Requirements for Laboratory Faucet Vacuum Breakers	P-1507.9.4
1037 – 86	Performance Requirements for Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures	P-1222.3, P-1222.5
1044 – 86	Performance Requirements for Trap Seal Primer Valves; Drainage Type	P-1003.5
1048 – 89	Performance Requirements for Double Check Detector Assembly Backflow Preventer	P-1507.9.8
1051 – 90	Performance Requirements for Air Admittance Valves for Plumbing Drainage Systems, Fixture and Branch Devices — with September 1992 Revisions	P-1808.1

ASSE (cont'd.)

5010-1013-1 – 91	Field Test Procedure for a Reduced Pressure Principle Assembly Using a Differential Pressure Gauge — with August 1992 Revisions	P-1507.11
5010-1015-1 – 91	Field Test Procedure for a Double Check Valve Assembly Using a Duplex Gauge — with August 1992 Revisions	P-1507.11
5010-1015-2 – 91	Field Test Procedure for a Double Check Valve Assembly Using a Differential Pressure Gauge — High- and Low-Pressure Hose Method — with August 1992 Revisions	P-1507.11
5010-1015-3 – 91	Field Test Procedure for a Double Check Valve Assembly Using a Differential Pressure Gauge — High Pressure Hose Method — with August 1992 Revisions	P-1507.11
5010-1015-4 – 91	Field Test Procedure for a Double Check Valve Assembly Using a Sight Tube — with August 1992 Revisions	P-1507.11
5010-1020-1 – 91	Field Test Procedure for a Pressure Vacuum Breaker Assembly	P-1507.11
5010-1047-1 – 91	Field Test Procedure for a Reduced Pressure Detector Assembly Using a Differential Pressure Gauge — with August 1992 Revisions	P-1507.11
5010-1048-1 – 91	Field Test Procedure for a Double Check Detector Assembly Using a Duplex Gauge — with August 1992 Revisions	P-1507.11
5010-1048-2 – 91	Field Test Procedure for a Double Check Detector Assembly Using a Differential Pressure Gauge — High- and Low-Pressure Hose Method — with August 1992 Revisions	P-1507.11
5010-1048-3 – 91	Field Test Procedure for a Double Check Detector Assembly Using a Differential Pressure Gauge — High-Pressure Hose Method — with August 1992 Revisions	P-1507.11
5010-1048-4 – 91	Field Test Procedure for a Double Check Detector Assembly Using a Sight Tube — with August 1992 Revisions	P-1507.11

ASTM

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103-1187

Standard reference number	Title	Referenced in code Section number
A53 – 90b	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless	Table P-403.4, Table P-403.5, Table P-404.1
A74 – 92	Specification for Cast Iron Soil Pipe and Fittings	Table P-404.1, Table P-404.2, Table P-404.3, Table P-405.3, Table P-405.4, P-407.8
A733 – 89	Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples	Table P-406.3
B32 – 91	Specification for Solder, Metal	P-509.4, P-510.5
B42 – 92	Specification for Seamless Copper Pipe, Standard Sizes	Table P-403.4, Table P-403.5, Table P-404.1
B43 – 91	Specification for Seamless Red Brass Pipe, Standard Sizes	Table P-403.4, Table P-403.5, Table P-404.1
B75 – 92a	Specification for Seamless Copper Tube	Table P-403.4, Table P-403.5, Table P-404.1, Table P-404.2, Table P-404.3, Table P-405.3
B88 – 92	Specification for Seamless Copper Water Tube	Table P-403.4, Table P-403.5, Table P-404.1, Table P-404.2, Table P-404.3, Table P-405.3

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B152 – 92 Specification for Copper Sheet, Strip Plate and Rolled Bar P-407.4
B251 – 88 Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube ..... Table P-403.4 Table P-403.5, Table P-404.1, Table P-404.2, Table P-404.3, Table P-405.3
B302 – 88 Specification for Threadless Copper Pipe ..... Table P-403.4 Table P-403.5, Table P-404.1
B306 – 92 Specification for Copper Drainage Tube (DWV) ..... Table P-404.1 Table P-405.3
B447 – 92a Specification for Welded Copper Tube ..... Table P-403.4 Table P-403.5
B687 – 88 Specification for Brass, Copper, and Chromium-Plated Pipe Nipples ..... Table P-406.3
B813 – 91 Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube P-509.4 P-510.5
C4 – 62 Specification for Clay Drain Tile ..... Table P-404.3 Table P-405.3, Table P-405.4
C14 – 92 Specification for Concrete Sewer, Storm Drain, and Culvert Pipe ..... Table P-404.2 Table P-404.3, Table P-405.3
C76 – 90 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe ..... Table P-404.2 Table P-404.3, Table P-405.3
C296 – 91 Specification for Asbestos-Cement Pressure Pipe ..... Table P-403.4
C425 – 91 Specification for Compression Joints for Vitrified Clay Pipe and Fittings P-517.1 P-518.1
C428 – 92 Specification for Asbestos-Cement Nonpressure Sewer Pipe ..... Table P-404.2 Table P-404.3, Table P-405.3
C443 – 85a Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets P-508.1 P-518.1
C508 – 90 Specification for Asbestos-Cement Underdrain Pipe ..... Table P-405.4
C564 – 88 Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings P-507.4 P-507.5, P-518.1
C700 – 91 Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated ..... Table P-404.3 Table P-405.3, Table P-405.4
D1527 – 89 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80 ..... Table P-403.4
D1785 – 91 Specification for Poly (Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80 and 120 ..... Table P-403.4
D1861 – 88 Specification for Homogeneous Bituminized Fiber Drain and Sewer Pipe ..... Table P-404.3 Table P-405.3
D1862 – 88 Specification for Laminated-Wall Bituminized Fiber Drain and Sewer Pipe ..... Table P-404.3 Table P-405.3
D1869 – 78 Specification for Rubber Rings for Asbestos-Cement Pipe P-504.1 P-518.1
D2235 – 89 Specification for Solvent Cement for Acrylonitrile-Butadiene- Styrene (ABS) Plastic Pipe and Fittings P-503.3
D2239 – 89 Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter ..... Table P-403.4
D2241 – 89 Specification for Poly (Vinyl Chloride)(PVC) Plastic Pipe (SDR-Series) ..... Table P-403.4
D2282 – 89 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR) ..... Table P-403.4
D2311 – 88 Specification for Perforated, Homogeneous Bituminized Fiber Pipe for General Drainage ..... Table P-405.4
D2464 – 91 Specification for Threaded Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 80 ..... Table P-406.1

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D2466 – 90a Specification for Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40 ..... Table P-406.1
D2467 – 92 Specification for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 ..... Table P-406.1
D2468 – 90 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40 ..... Table P-406.1
D2564 – 91a Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings P-516.3
D2609 – 90a Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe ..... Table P-406.1
D2657 – 90 Standard Practice for Heat-Joining Polyolefin Pipe and Fittings P-514.3 P-515.3
D2661 – 91 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings ..... Table P-404.1 Table P-404.2, Table P-404.3, Table P-405.3, P-503.3
D2662 – 89 Specification for Polybutylene (PB) Plastic Pipe (SDR-PR) Based on Controlled Inside Diameter ..... Table P-403.4
D2665 – 91b Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings ..... Table P-404.1 Table P-404.2, Table P-404.3, Table P-405.3
D2666 – 89 Specification for Polybutylene (PB) Plastic Tubing ..... Table P-403.4
D2672 – 89 Specification for Joints for IPS PVC Pipe Using Solvent Cement ..... Table P-403.4
D2729 – 89 Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings ..... Table P-405.4
D2737 – 89 Specification for Polyethylene (PE) Plastic Tubing ..... Table P-403.4
D2751 – 91 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings ..... Table P-404.3 Table P-405.3
D2846 – 92 Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot and Cold Water Distribution Systems ..... Table P-403.4 Table P-403.5, P-511.3
D2855 – 90 Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings .. P-516.3
D2949 – 89 Specification for 3.25-In Outside Diameter Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings ..... Table P-404.1 Table P-404.2, Table P-404.3
D3034 – 89 Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings ..... Table P-404.3 Table P-405.3
D3139 – 89 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals P-503.2 P-516.2
D3212 – 92 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals P-503.2 P-516.2
D3309 – 92 Specification for Polybutylene (PB) Plastic Hot Water Distribution Systems ..... Table P-403.4 Table P-403.5, P-514.3, P-514.4
F405 – 89 Specification for Corrugated Polyethylene (PE) Tubing and Fittings ..... Table P-405.4
F409 – 91a Specification for Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings .. Table P-406.1
F437 – 89b Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 ..... Table P-406.1
F438 – 90 Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40 ..... Table P-406.1
F439 – 90 Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 ..... Table P-406.1
F441 – 89 Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80 ..... Table P-403.4 Table P-403.5

PDI

Plumbing and Drainage Institute
1106 W. 77th Street, South Drive
Indianapolis, IN 46260-3318

Standard reference number	Title	Referenced in code Section number
G101 – 85	Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data	P-1004.4

APPENDIX A

RATES OF RAINFALL FOR VARIOUS CITIES

Rainfall rates, in inches per hour, are based on a storm of 1-hour duration and a 100-year return period.

Alabama:
- Birmingham 3.8
- Huntsville 3.6
- Mobile 4.6
- Montgomery 4.2

Alaska:
- Fairbanks 1.0
- Juneau 0.6

Arizona:
- Flagstaff 2.4
- Nogales 3.1
- Phoenix 2.5
- Yuma 1.6

Arkansas:
- Fort Smith 3.6
- Little Rock 3.7
- Texarkana 3.8

California:
- Barstow 1.4
- Crescent City 1.5
- Fresno 1.1
- Los Angeles 2.1
- Needles 1.6
- Placerville 1.5
- San Fernando 2.3
- San Francisco 1.5
- Yreka 1.4

Colorado:
- Craig 1.5
- Denver 2.4
- Durango 1.8
- Grand Junction 1.7
- Lamar 3.0
- Pueblo 2.5

Connecticut:
- Hartford 2.7
- New Haven 2.8
- Putnam 2.6

Delaware:
- Georgetown 3.0
- Wilmington 3.1

District of Columbia:
- Washington 3.2

Florida:
- Jacksonville 4.3
- Key West 4.3
- Miami 4.7
- Pensacola 4.6
- Tampa 4.5

Georgia:
- Atlanta 3.7
- Dalton 3.4
- Macon 3.9
- Savannah 4.3
- Thomasville 4.3

Hawaii:
- Hilo 6.2
- Honolulu 3.0
- Wailuku 3.0

Idaho:
- Boise 0.9
- Lewiston 1.1
- Pocatello 1.2

Illinois:
- Cairo 3.3
- Chicago 3.0
- Peoria 3.3
- Rockford 3.2
- Springfield 3.3

Indiana:
- Evansville 3.2
- Fort Wayne 2.9
- Indianapolis 3.1

Iowa:
- Davenport 3.3
- Des Moines 3.4
- Dubuque 3.3
- Sioux City 3.6

Kansas:
- Atwood 3.3
- Dodge City 3.3
- Topeka 3.7
- Wichita 3.7

Kentucky:
- Ashland 3.0
- Lexington 3.1
- Louisville 3.2
- Middlesboro 3.2
- Paducah 3.3

Louisiana:
- Alexandria 4.2
- Lake Providence 4.0
- New Orleans 4.8
- Shreveport 3.9

Maine:
- Bangor 2.2
- Houlton 2.1
- Portland 2.4

Maryland:
- Baltimore 3.2
- Hagerstown 2.8
- Oakland 2.7
- Salisbury 3.1

Massachusetts:
- Boston 2.5
- Pittsfield 2.8
- Worcester 2.7

Michigan:
- Alpena 2.5
- Detroit 2.7
- Lansing 2.8
- Grand Rapids 2.6
- Marquette 2.4
- Sault Ste. Marie 2.2

Minnesota:
- Duluth 2.8
- Grand Marais 2.3
- Minneapolis 3.1
- Moorhead 3.2
- Worthington 3.5

Mississippi:
- Biloxi 4.7
- Columbus 3.9
- Corinth 3.6
- Natchez 4.4
- Vicksburg 4.1

Missouri:
- Columbia 3.2
- Kansas City 3.6
- Springfield 3.4
- St. Louis 3.2

Montana:
- Ekalaka 2.5
- Havre 1.6
- Helena 1.5
- Kalispell 1.2
- Missoula 1.3

Nebraska:
- North Platte 3.3
- Omaha 3.8
- Scottsbluff 3.1
- Valentine 3.2

Nevada:
- Elko 1.0
- Ely 1.1
- Las Vegas 1.4
- Reno 1.1

New Hampshire:
- Berlin 2.5
- Concord 2.5
- Keene 2.4

New Jersey:
- Atlantic City 2.9
- Newark 3.1
- Trenton 3.1

New Mexico:
- Albuquerque 2.0
- Hobbs 3.0
- Raton 2.5
- Roswell 2.6
- Silver City 1.9

New York:
- Albany 2.5
- Binghamton 2.3
- Buffalo 2.3
- Kingston 2.7
- New York 3.0
- Rochester 2.2

North Carolina:
- Asheville 4.1
- Charlotte 3.7
- Greensboro 3.4
- Wilmington 4.2

North Dakota:
- Bismarck 2.8
- Devils Lake 2.9
- Fargo 3.1
- Williston 2.6

Ohio:
- Cincinnati 2.9
- Cleveland 2.6
- Columbus 2.8
- Toledo 2.8

Oklahoma:
- Altus 3.7
- Boise City 3.3
- Durant 3.8
- Oklahoma City 3.8

Oregon:
- Baker 0.9
- Coos Bay 1.5
- Eugene 1.3
- Portland 1.2

Pennsylvania:
- Erie 2.6
- Harrisburg 2.8
- Philadelphia 3.1
- Pittsburgh 2.6
- Scranton 2.7

Rhode Island:
- Providence 2.6

South Carolina:
- Charleston 4.3
- Columbia 4.0
- Greenville 4.1

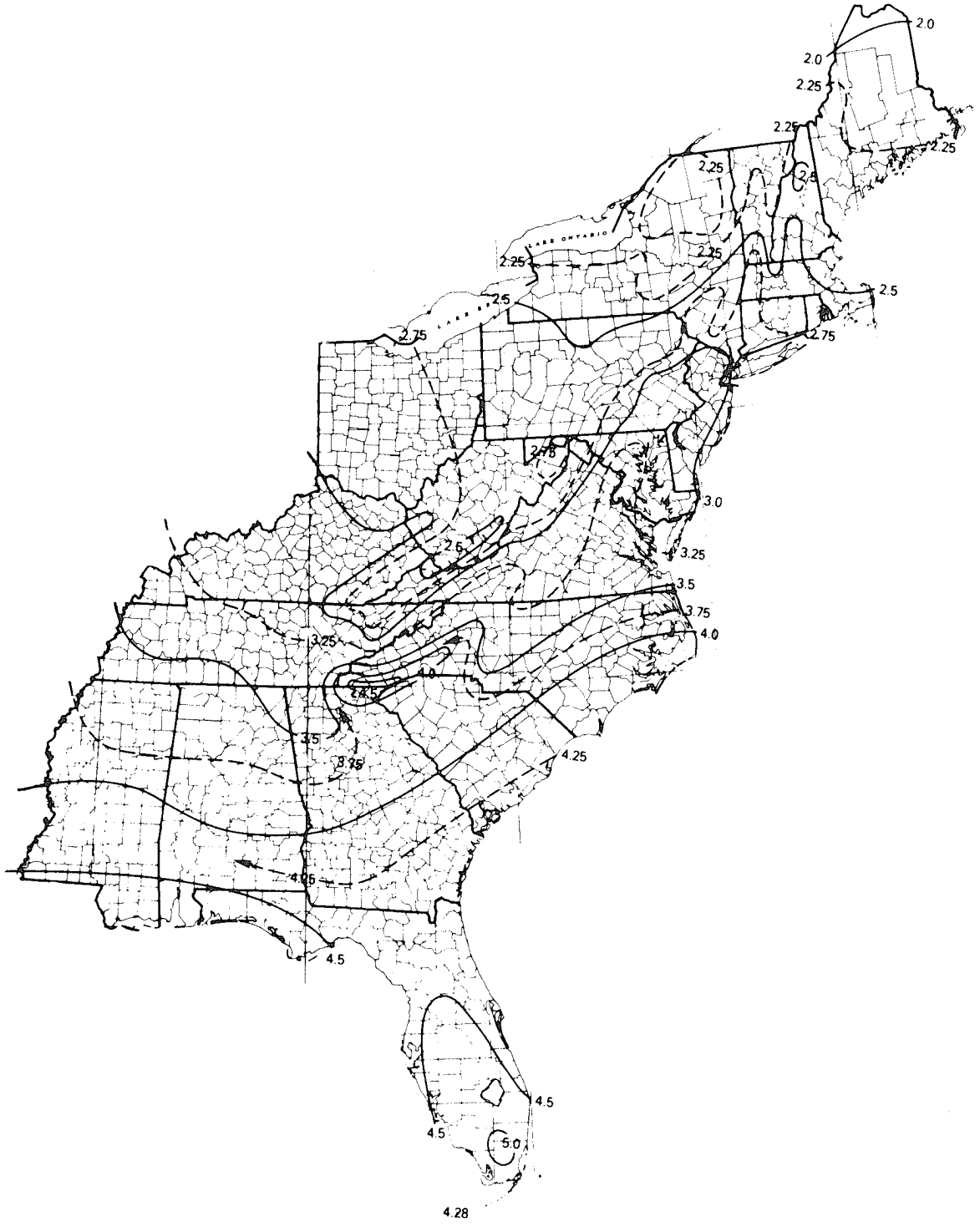
South Dakota:
- Buffalo 2.8
- Huron 3.3
- Pierre 3.1
- Rapid City 2.9
- Yankton 3.6

Tennessee:
- Chattanooga 3.5
- Knoxville 3.2
- Memphis 3.7
- Nashville 3.3

Texas:
- Abilene 3.6

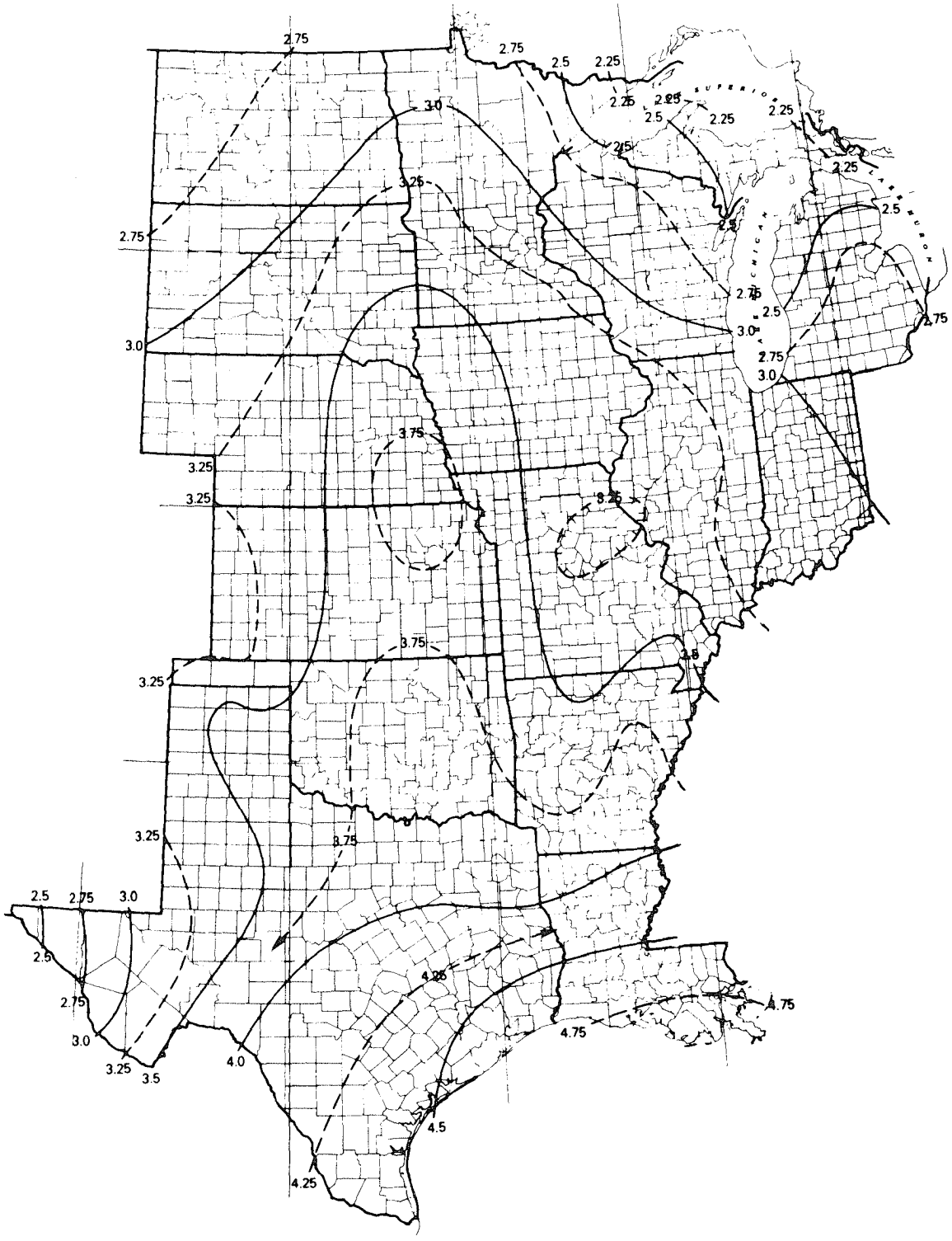
Amarillo	3.5
Brownsville	4.5
Dallas	4.0
Del Rio	4.0
El Paso	2.3
Houston	4.6
Lubbock	3.3
Odessa	3.2
Pecos	3.0
San Antonio	4.2
Utah:	
Brigham City	1.2
Roosevelt	1.3
Salt Lake City	1.3
St. George	1.7
Vermont:	
Barre	2.3
Bratteboro	2.7
Burlington	2.1
Rutland	2.5
Virginia:	
Bristol	2.7
Charlottesville	2.8
Lynchburg	3.2
Norfolk	3.4
Richmond	3.3
Washington:	
Omak	1.1
Port Angeles	1.1
Seattle	1.4
Spokane	1.0
Yakima	1.1
West Virginia:	
Charleston	2.8
Morgantown	2.7
Wisconsin:	
Ashland	2.5
Eau Claire	2.9
Green Bay	2.6
La Crosse	3.1
Madison	3.0
Milwaukee	3.0
Wyoming:	
Cheyenne	2.2
Fort Bridger	1.3
Lander	1.5
New Castle	2.5
Sheridan	1.7
Yellowstone Park	1.4

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, D.C.



100-YEAR, 1-HOUR RAINFALL (INCHES)
EASTERN UNITED STATES

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, D.C.

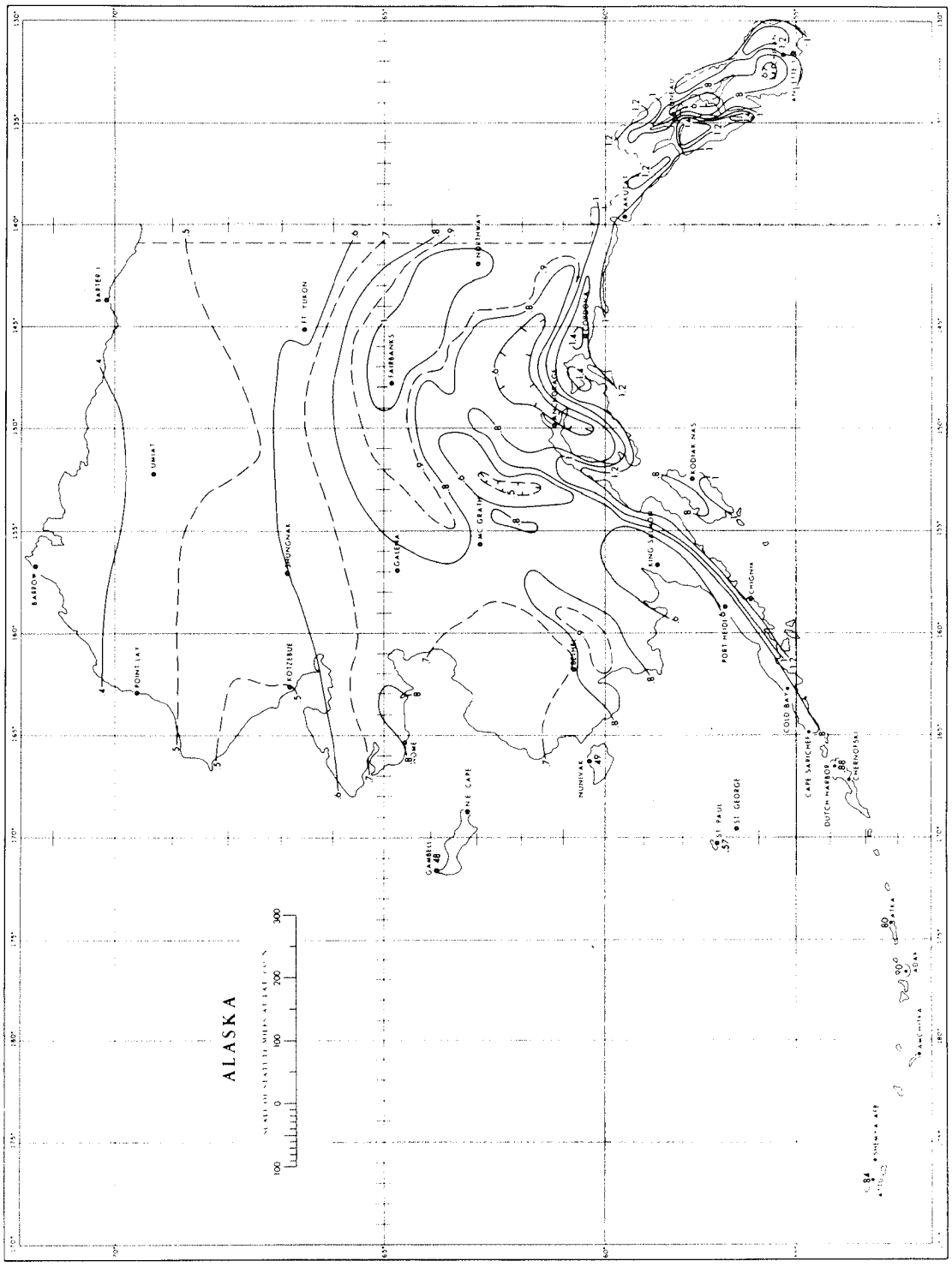


100-YEAR, 1-HOUR RAINFALL (INCHES)
CENTRAL UNITED STATES

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, D.C.

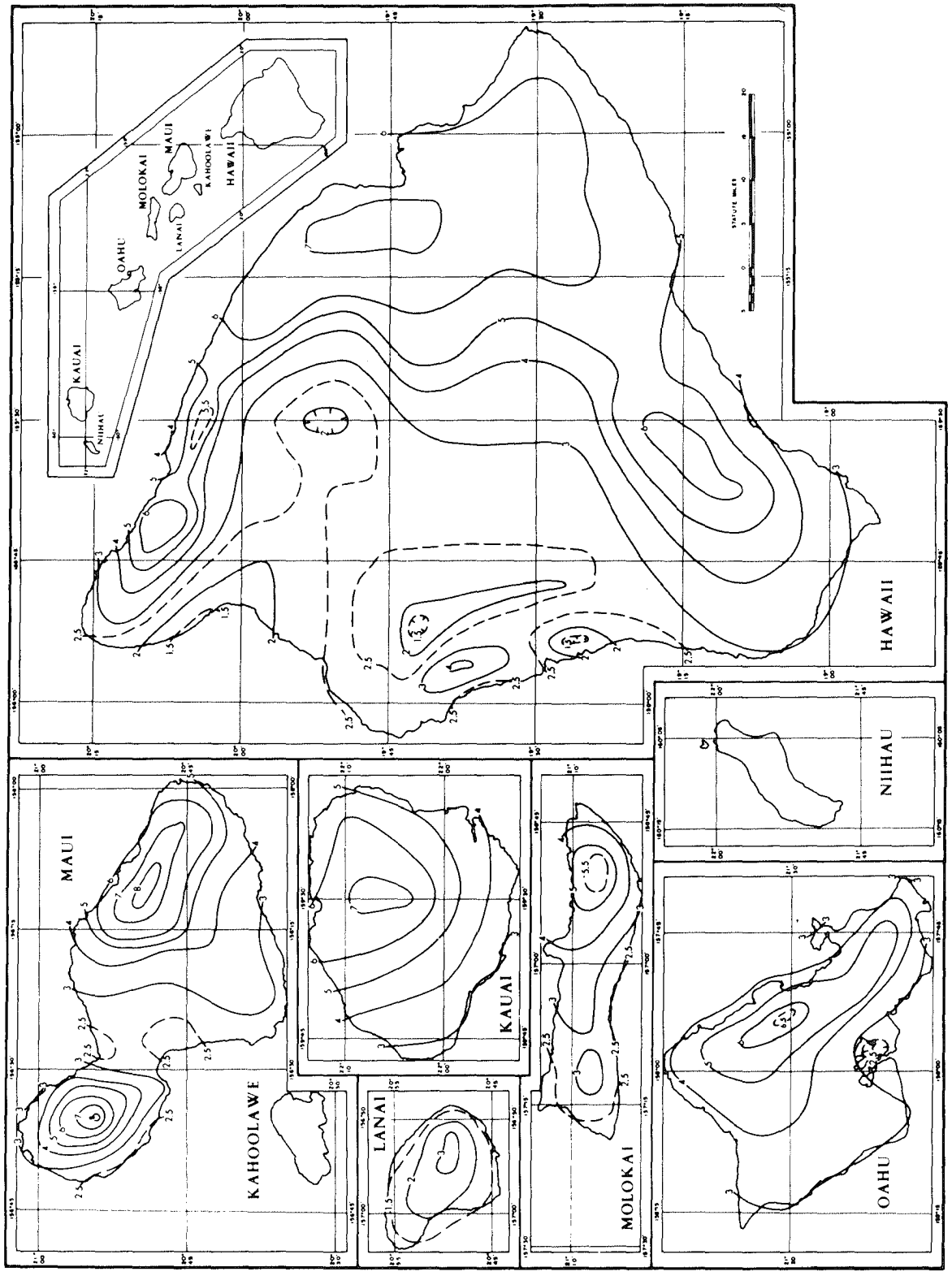
100-YEAR, 1-HOUR RAINFALL (INCHES)
WESTERN UNITED STATES

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, D.C.



100-YEAR, 1-HOUR RAINFALL (INCHES)
ALASKA

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, D.C.



100-YEAR, 1-HOUR RAINFALL (INCHES)
HAWAII

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, D.C.

APPENDIX B

GAS PIPING SYSTEMS

This appendix contains Chapter 8 of the BOCA National Mechanical Code/1993 *and is not considered a part of the plumbing code. Appendix B is provided for informational purposes only since gas piping is often installed by a plumbing contractor and inspected by a plumbing inspector. For further information, references should be made to the* BOCA National Mechanical Code/1993.

SECTION M-801.0 GENERAL

M-801.1 Scope: This chapter shall govern the installation, repair and maintenance of fuel-gas piping systems. Coverage of piping systems extends from the point of delivery to the connections with each utilization device and includes the design, materials, components, fabrication, assembly, installation, testing, inspection, operation and maintenance of such piping systems.

M-801.1.1 Point of delivery: Except for undiluted liquefied petroleum gas systems, the point of delivery is the outlet of the service meter assembly, or the outlet of the service regulator or service shutoff valve where a meter is not provided. For undiluted liquefied petroleum gas systems, the point of delivery is the outlet of the first stage pressure regulator.

M-801.2 Liquefied petroleum gas storage: The storage system for liquefied petroleum gas shall be designed and installed in accordance with NFiPA 58 listed in Chapter 21.

M-801.3 Modifications to existing systems: In modifying or adding to existing piping systems, sizes shall be maintained in accordance with this chapter.

M-801.4 Interconnections: Where two or more meters are installed on the same premises but supply separate consumers, the piping systems shall not be interconnected on the outlet side of the meters.

M-801.5 Interconnections for standby fuels: Where a supplemental gas supply for standby utilization is connected downstream from a meter, an approved device to prevent backflow shall be installed.

SECTION M-802.0 DEFINITIONS

M-802.1 General: The following words and terms shall, for the purposes of this chapter and as stated elsewhere in this code, have the meanings shown herein.

Dry gas: A gas having a moisture and hydrocarbon dew point below any normal temperature to which the gas piping is exposed.

Gas outlet: A connection in a gas piping system to which gas equipment is intended to be attached.

Heating value: The heat released by combustion of a unit quantity of waste or fuel, measured in British thermal units (Btu).

Liquefied petroleum gas (LP-gas): A gas containing certain specific hydrocarbons which are gaseous under normal atmospheric conditions, but are capable of being liquefied under moderate pressure at normal temperatures.

Manual gas shutoff valve: A manually operated valve in the gas line for the purpose of completely turning on or shutting off the gas supply downstream of the valve.

Manufactured gas: A gas obtained by destructive distillation of coal, or by the thermal decomposition of oil, or by the reaction of steam passing through a bed of heated coal or coke or catalyst beds. Examples are coal gases, coke oven gases, producer gas, blast furnace gas, blue (water) gas, and carbureted water gas. British thermal unit (Btu) content varies widely.

Natural gas: A naturally occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geologic formations beneath the earth's surface, often in association with petroleum. The principal constituent is methane.

Purge: To clear of air, water or other foreign substances.

Regulator, line gas pressure: A device placed in a gas line between the service pressure regulator and the gas equipment for controlling, maintaining or reducing the pressure in that portion of the piping system downstream of the device.

Regulator, LP-gas, first stage: On undiluted LP-gas systems, the first pressure regulator reduces the storage container pressure.

Regulator, LP-gas, second stage: A line gas pressure regulator for service on undiluted LP-gas systems, reducing an intermediate high pressure to utilization pressure.

Regulator, service pressure: A device installed by the serving gas supplier to reduce and limit the service line gas pressure to delivery pressure.

Riser, gas: A fuel gas supply pipe that extends vertically one full story or more.

SECTION M-803.0 PIPING MATERIAL

M-803.1 General: Piping material shall conform to the standards cited in this section for the installation, alteration or repair of fuel-gas piping systems.

M-803.2 Piping standards: Fuel gas pipe shall conform to one of the standards listed in Table M-803.2.

Table M-803.2
FUEL GAS PIPE

Material	Standard (see Chapter 21)
Aluminum-alloy pipe and tubing	ASTM B210; ASTM B241
Brass pipe	ASTM B43
Copper or copper-alloy pipe	ASTM B42; ASTM B302
Copper or copper-alloy tubing (Type K or L)	ASTM B75; ASTM B88; ASTM B280
Ductile iron pipe	ANSI A21.52
Plastic pipe and tubing	ASTM D2513; ASTM D2517
Stainless steel pipe and tubing	ASTM A240
Steel pipe	ASTM A53; ASTM A106
Steel tubing	ASTM A539; ASTM A254

M-803.3 Metallic pipe and tubing: Metallic pipe and tubing shall be utilized for systems which supply fuel gas that is not corrosive to the pipe or tubing material.

M-803.4 Aluminum-alloy pipe or tubing: Aluminum-alloy pipe or tubing shall not be installed underground or outside of the structure. The pipe or tubing shall not be subject to moisture or come in contact with masonry, plaster or insulation.

M-803.5 Plastic pipe and tubing: Plastic pipe and tubing shall not be installed above ground or inside of the structure.

M-803.6 Ductile iron pipe: Ductile iron pipe shall not be installed above ground or inside of the structure.

M-803.7 Corrosion protection: Metallic pipe or tubing exposed to corrosive action, such as soil conditions or moisture, shall be protected in an approved manner.

M-803.8 Fittings: Fittings shall be approved for gas piping systems. The fittings shall be compatible with or shall be of the same material as the pipe or tubing. Bushings shall not be utilized.

M-803.8.1 Flanges: Flange fittings shall conform to ASME B16.1 or ASME B16.5 listed in Chapter 21. Gasket material for flanged fittings shall be approved for the quality of the fuel gas.

M-803.9 Bending of piping: Pipe shall be approved for bending. Pipe bends shall be made with approved equipment. The bend shall not exceed the structural limitations of the pipe.

M-803.10 Flexible connectors: Flexible connectors shall bear the *label* of an approved agency. The connectors shall be a maximum of 6 feet (1829 mm) in length.

M-803.11 Interior gas piping systems utilizing corrugated stainless steel tubing (conduit): Interior gas piping systems constructed of corrugated stainless steel tubing (conduit) shall be tested and *labeled* by an approved testing agency for such installation and shall be installed in accordance with the manufacturer's instructions.

M-803.12 Identification: Fuel gas piping shall be identified as fuel gas piping. Identification shall be in the form of a tag, stencil or other permanent marking, spaced at intervals of not more than 25 feet (7620 mm) in concealed locations, not more than 50 feet (5240 mm) in exposed locations, and not less than once in any room or space.

SECTION M-804.0 JOINTS AND CONNECTIONS

M-804.1 Approval: All joints and connections shall be of an approved type for gas piping systems. Joints and connections shall be gas tight for the pressure required by test.

M-804.1.1 Joints between different piping materials: Joints between different piping materials shall be made with approved adapter fittings. Joints between different metallic piping materials at the point of delivery, and at other locations where necessary, shall be made with approved dielectric fittings to isolate electrically above-ground piping from underground piping or to isolate electrically different metallic piping materials joined underground.

M-804.2 Preparation of pipe ends: All pipe shall be cut square, reamed and chamfered and be free from all burrs and obstructions. Pipe ends shall have full-bore openings and shall not be undercut.

M-804.3 Joint preparation and installation: Where required by Sections M-804.4 through M-804.11, the preparation and installation of brazed, flared, *mechanical,* threaded and welded joints shall comply with Sections M-804.3.1 through M-804.3.5.

M-804.3.1 Brazed joints: All joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8 listed in Chapter 21.

M-804.3.2 Flared joints: Flared joints shall be made by a tool designed for that operation.

M-804.3.3 Mechanical joints: *Mechanical joints* shall be installed in accordance with the manufacturer's instructions.

M-804.3.4 Threaded joints: Threads shall conform to ASME B1.20.1 listed in Chapter 21. Pipe-joint compound or tape shall be applied on the male threads only.

M-804.3.5 Welded joints: All joint surfaces shall be cleaned by approved procedure. The joint shall be welded with an approved filler metal.

M-804.4 Aluminum-alloy pipe and tubing: Joints between aluminum-alloy pipe and tubing or fittings shall be flared or *mechanical joints* conforming to Section M-804.3.

M-804.5 Brass pipe: Joints between brass pipe or fittings shall be brazed, *mechanical,* threaded or welded joints conforming to Section M-804.3.

M-804.6 Copper or copper-alloy pipe: Joints between copper or copper-alloy pipe or fittings shall be brazed, *mechanical,* threaded or welded joints conforming to Section M-804.3.

M-804.7 Copper or copper-alloy tubing: Joints between copper or copper-alloy tubing or fittings shall be brazed, flared or *mechanical joints* conforming to Section M-804.3.

M-804.8 Ductile iron pipe: Joints between ductile iron pipe and fittings shall be flanged. Joints shall be installed in accordance with the manufacturer's instructions.

M-804.9 Plastic pipe and tubing: Joints between plastic pipe and tubing or fittings shall be in accordance with Sections M-804.9.1 through M-804.9.3.

M-804.9.1 Heat-fusion joints: Only polyolefin (PE and PB) piping shall be heat fused. Joint surfaces shall be clean and free from moisture. All joint surfaces shall be heated to melt temperature and joined. The joint shall be undisturbed until cool in accordance with the manufacturer's instructions.

M-804.9.2 Mechanical compression joints: *Mechanical compression joints* shall be made with an elastomeric seal. Joints shall be installed in accordance with the manufacturer's instructions.

M-804.9.3 Solvent cementing: Joint surfaces shall be clean and free from moisture. An approved primer shall be applied to PVC pipe, tubing or fittings. An approved solvent cement shall be applied to all joint surfaces. The joint shall be made while the cement is wet. Joints shall be made in accordance with the manufacturer's instructions. Polyolefin plastic pipe, tubing or fittings (PE and PB) shall not be solvent cemented.

M-804.10 Steel pipe: Joints between steel pipe or fittings shall be threaded or welded joints conforming to Section M-804.3 or *mechanical joints* conforming to Section M-804.10.1.

M-804.10.1 Mechanical joints: Joints shall be made with an approved elastomeric seal. *Mechanical joints* shall be installed in accordance with the manufacturer's instructions. *Mechanical joints* shall be installed outside, underground, unless otherwise approved.

M-804.11 Steel tubing: Joints between steel tubing or fittings shall be *mechanical* or welded joints conforming to Section M-804.3.

SECTION M-805.0 SIZING OF GAS PIPING SYSTEMS

M-805.1 General: All pipe utilized for the installation, extension and alteration of any gas piping system shall be sized to supply the full number of outlets for the intended purpose. The gas piping system shall be sized in accordance with this section.

M-805.2 Appliance gas volume: The hourly gas volume for each gas-burning *appliance* shall be determined based on the input rating of the *appliance.* The hourly gas volume (demand quantity) shall equal the input rating of the *appliance* divided by the average heating value of the fuel gas.

M-805.3 Sizing criteria: The fuel gas piping shall be sized for the maximum length of pipe, measured from the point of delivery to the most remote outlet. Piping shall be sized for the total gas demand for each section of pipe.

M-805.3.1 Diversity factor for multiple-family dwelling units: The common gas supply line to multiple-family dwelling units is permitted to be sized for a percentage of the total gas demand. The total gas demand for each common section of pipe shall be sized in accordance with the multiplier indicated in Table M-805.3.1.

Where individual heating equipment is installed in each dwelling unit, the gas demand for such equipment shall be multiplied by 0.9 and added to the demand value of the common piping.

Table M-805.3.1
DEMAND VALUES FOR DETERMINING GAS PIPING SIZE IN MULTIPLE-FAMILY DWELLING UNITS

Number of units	Multiplier of total connected load based on similar appliances being installed in each unit	
	Ranges only	Ranges and water heaters
2	.85	.77
4	.65	.59
6	.54	.49
8	.46	.44
10	.42	.40
15	.36	.34
20	.31	.30
30	.25	.24
40	.23	.22
50	.21	.20
60	.19	.19
70	.18	.18
80	.17	.16
90	.16	.15
100	.15	.14
125	.14	.14
150	.13	.13
175	.13	.12
200	.12	.11

M-805.4 Pipe sizing: The size of gas piping shall be determined by computing the maximum demand quantity in accordance with the following equation:

High Pressure (1.5 psig and above):

$$Q = 181.6 \sqrt{\frac{D^5 \cdot (P_1^2 - P_2^2) \cdot Y}{Cr \cdot fba \cdot L}}$$

$$= 2237\, D^{2.623} \left[\frac{(P_1^2 - P_2^2) \cdot Y}{Cr \cdot L} \right]^{0.541}$$

Low pressure (less than 1.5 psig):

$$Q = 187.3 \sqrt{\frac{D^5 \cdot \Delta H}{Cr \cdot fba \cdot L}}$$

$$= 2313\, D^{2.623} \left[\frac{\Delta H}{Cr \cdot L} \right]^{0.541}$$

where:

Q = Rate, cubic feet per hour at 60 degrees F. and 30-inch mercury column.
D = Inside diameter of pipe (inches).
P_1 = Upstream pressure (psia).
P_2 = Downstream pressure (psia).
Y = Superexpansibility factor.
= 1/supercompressibility factor.
Cr = Factor for viscosity, density and temperature.

$$= 0.00354\, ST \left(\frac{Z}{S} \right)^{.152}$$

S = Specific gravity of gas at 60 degrees F. and 30-inch mercury column.
T = Absolute temperature (degrees Rankine).
= t (degrees Fahrenheit) + 460.
t = Temperature (degrees Fahrenheit).
Z = Viscosity of gas, centipoise (0.012 for natural gas, 0.008 for propane).
= 1488 μ.
μ = Viscosity (pounds per second feet).
fba = Base friction factor for air at 60 degrees F. ($CF = 1$).
L = Length of pipe (feet).
ΔH = Pressure drop, inch water column (27.7 inch water column = 1 psi).
CF = Factor $CF = \left(\frac{fb}{fba} \right)$; and
fb = Base friction factor for any fluid at a given temperature (degrees F.).

M-805.4.1 Sizing by tables: Gas piping systems are permitted to be sized for the maximum capacity of pipe in accordance with Tables M-805.4.1(1) through M-805.4.1(16).

M-805.4.1.1 Basis for table selection: The table selected for sizing the system shall be based on the fuel-gas system pressure, the pressure drop, and the specific gravity.

Table M-805.4.1(1)
MAXIMUM CAPACITY OF PIPE FOR GAS PRESSURE OF 0.5 PSIG OR LESS WITH PRESSURE DROP OF 0.5 INCH WATER COLUMN AND 0.60 SPECIFIC GRAVITY

Pipe size of Schedule 40 standard pipe (inches)	Internal diameter (inches)	Pipe capacity (cubic feet of gas per hour)													
		Length of pipe (feet)													
		10	20	30	40	50	60	70	80	90	100	125	150	175	200
¼	.364	43	29	24	20	18	16	15	14	13	12	11	10	9	8
⅜	.493	95	65	52	45	40	36	33	31	29	27	24	22	20	19
½	.622	175	120	97	82	73	66	61	57	53	50	44	40	37	35
¾	.824	360	250	200	170	151	138	125	118	110	103	93	84	77	72
1	1.049	680	465	375	320	285	260	240	220	205	195	175	160	145	135
1¼	1.380	1,400	950	770	660	580	530	490	460	430	400	360	325	300	280
1½	1.610	2,100	1,460	1,180	990	900	810	750	690	650	620	550	500	460	430
2	2.067	3,950	2,750	2,200	1,900	1,680	1,520	1,400	1,300	1,220	1,150	1,020	950	850	800
2½	2.469	6,300	4,350	3,520	3,000	2,650	2,400	2,250	2,050	1,950	1,850	1,650	1,500	1,370	1,280
3	3.068	11,000	7,700	6,250	5,300	4,750	4,300	3,900	3,700	3,450	3,250	2,950	2,650	2,450	2,280
4	4.026	23,000	15,800	12,800	10,900	9,700	8,800	8,100	7,500	7,200	6,700	6,000	5,500	5,000	4,600

Table M-805.4.1(2)
MAXIMUM CAPACITY OF PIPE FOR GAS PRESSURE OF 0.5 PSIG OR LESS WITH PRESSURE DROP OF 0.3 INCH WATER COLUMN AND 0.60 SPECIFIC GRAVITY

Pipe size of Schedule 40 standard pipe (inches)	Internal diameter (inches)	Pipe capacity (cubic feet of gas per hour)													
		Length of pipe (feet)													
		10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/4	.364	32	22	18	15	14	12	11	11	10	9	8	8	7	6
3/8	.493	72	49	40	34	30	27	25	23	22	21	18	17	15	14
1/2	.622	132	92	73	63	56	50	46	43	40	38	34	31	28	26
3/4	.824	278	190	152	130	115	105	96	90	84	79	72	64	59	55
1	1.049	520	350	285	245	215	195	180	170	160	150	130	120	110	100
1 1/4	1.380	1,050	730	590	500	440	400	370	350	320	305	275	250	225	210
1 1/2	1.610	1,600	1,100	890	760	670	610	560	530	490	460	410	380	350	320
2	2.067	3,050	2,100	1,650	1,450	1,270	1,150	1,050	990	930	870	780	710	650	610
2 1/2	2.469	4,800	3,300	2,700	2,300	2,000	1,850	1,700	1,600	1,500	1,400	1,250	1,130	1,050	980
3	3.068	8,500	5,900	4,700	4,100	3,600	3,250	3,000	2,800	2,600	2,500	2,200	2,000	1,850	1,700
4	4.026	17,500	12,000	9,700	8,300	7,400	6,800	6,200	5,800	5,400	5,100	4,500	4,100	3,800	3,500

Table M-805.4.1(3)
MAXIMUM CAPACITY OF SEMI-RIGID TUBING FOR GAS PRESSURE OF 0.5 PSIG OR LESS WITH PRESSURE DROP OF 0.3 INCH WATER COLUMN AND 0.60 SPECIFIC GRAVITY

Outside diameter (inch)	Tubing capacity (cubic feet of gas per hour)													
	Length of tubing (feet)													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
3/8	20	14	11	10	9	8	7	7	6	6	5	5	4	4
1/2	42	29	23	20	18	16	15	14	13	12	11	10	9	8
5/8	86	59	47	40	36	33	30	28	26	25	22	20	18	17
3/4	150	103	83	71	63	57	52	49	46	43	38	35	32	30
7/8	212	146	117	100	89	81	74	69	65	61	54	49	45	42

Table M-805.4.1(4)
MAXIMUM CAPACITY OF SEMI-RIGID TUBING FOR GAS PRESSURE OF 0.5 PSIG OR LESS WITH PRESSURE DROP OF 0.5 INCH WATER COLUMN AND 0.60 SPECIFIC GRAVITY

Outside diameter (inch)	Tubing capacity (cubic feet of gas per hour)													
	Length of tubing (feet)													
	10	20	30	40	50	60	70	80	90	100	125	150	175	200
3/8	27	18	15	13	11	10	9	9	8	8	7	6	6	5
1/2	56	38	31	26	23	21	19	18	17	16	14	13	12	11
5/8	113	78	62	53	47	43	39	37	34	33	29	26	24	22
3/4	197	136	109	93	83	75	69	64	60	57	50	46	42	39
7/8	280	193	155	132	117	106	98	91	85	81	71	65	60	55

Table M-805.4.1(5)
PIPE SIZING TABLE FOR PRESSURES UNDER 1 POUND APPROXIMATE CAPACITY OF PIPES WITH PRESSURE DROP OF 0.3 INCH WATER COLUMN AND 0.60 SPECIFIC GRAVITY

Pipe size of Schedule 40 standard pipe (inches)	Internal diameter (inches)	Pipe capacity (cubic feet of gas per hour)										
		Total equivalent length of pipe (feet)										
		50	100	150	200	250	300	400	500	1,000	1,500	2,000
1.00	1.049	215	148	119	102	90	82	70	62	43	34	29
1.25	1.380	442	304	244	209	185	168	143	127	87	70	60
1.50	1.610	662	455	366	313	277	251	215	191	131	105	90
2.00	2.067	1,275	877	704	602	534	484	414	367	252	203	173
2.50	2.469	2,033	1,397	1,122	960	851	771	660	585	402	323	276
3.00	3.068	3,594	2,470	1,983	1,698	1,505	1,363	1,167	1,034	711	571	488
3.50	3.548	5,262	3,616	2,904	2,485	2,203	1,996	1,708	1,514	1,041	836	715
4.00	4.026	7,330	5,038	4,046	3,462	3,069	2,780	2,380	2,109	1,450	1,164	996
5.00	5.047	13,261	9,114	7,319	6,264	5,552	5,030	4,305	3,816	2,623	2,106	1,802
6.00	6.065	21,472	14,758	11,851	10,143	8,990	8,145	6,971	6,178	4,246	3,410	2,919
8.00	7.981	44,118	30,322	24,350	20,840	18,470	16,735	14,323	12,694	8,725	7,006	5,997
10.00	10.020	80,130	55,073	44,225	37,851	33,547	30,396	26,015	23,056	15,847	12,725	10,891
12.00	11.938	126,855	87,187	70,014	59,923	53,109	48,120	41,185	36,501	25,087	20,146	17,242

Table M-805.4.1(6)
PIPE SIZING TABLE FOR PRESSURES UNDER 1 POUND APPROXIMATE CAPACITY OF PIPES WITH PRESSURE DROP OF 0.5 INCH WATER COLUMN AND 0.60 SPECIFIC GRAVITY

Pipe size of Schedule 40 standard pipe (inches)	Internal diameter (inches)	Pipe capacity (cubic feet of gas per hour)										
		Total equivalent length of pipe (feet)										
		50	100	150	200	250	300	400	500	1,000	1,500	2,000
1.00	1.049	284	195	157	134	119	108	92	82	56	45	39
1.25	1.380	583	400	322	275	244	221	189	168	115	93	79
1.50	1.610	873	600	482	412	366	331	283	251	173	139	119
2.00	2.067	1,681	1,156	928	794	704	638	546	484	333	267	229
2.50	2.469	2,680	1,842	1,479	1,266	1,122	1,017	870	771	530	426	364
3.00	3.068	4,738	3,256	2,615	2,238	1,983	1,797	1,538	1,363	937	752	644
3.50	3.548	6,937	4,767	3,828	3,277	2,904	2,631	2,252	1,996	1,372	1,102	943
4.00	4.026	9,663	6,641	5,333	4,565	4,046	3,666	3,137	2,780	1,911	1,535	1,313
5.00	5.047	17,482	12,015	9,649	8,258	7,319	6,632	5,676	5,030	3,457	2,776	2,376
6.00	6.065	28,308	19,456	15,624	13,372	11,851	10,738	9,190	8,145	5,598	4,496	3,848
8.00	7.981	58,161	39,974	32,100	27,474	24,350	22,062	18,883	16,735	11,502	9,237	7,905
10.00	10.020	105,636	72,603	58,303	49,900	44,225	40,071	34,296	30,396	20,891	16,776	14,358
12.00	11.938	167,236	114,940	92,301	78,998	70,014	63,438	54,295	48,120	33,073	26,559	22,731

Table M-805.4.1(7)
PIPE SIZING TABLE FOR PRESSURES UNDER 1 POUND PRESSURE CAPACITY OF PIPES FOR AN INITIAL PRESSURE OF 1.0 PSIG WITH A 10-PERCENT PRESSURE DROP AND A GAS OF 0.60 SPECIFIC GRAVITY

Pipe size of Schedule 40 standard pipe (inches)	Internal diameter (inches)	Pipe capacity (cubic feet of gas per hour)										
		Total equivalent length of pipe (feet)										
		50	100	150	200	250	300	400	500	1,000	1,500	2,000
1.00	1.049	717	493	396	338	300	272	233	206	142	114	97
1.25	1.380	1,471	1,011	812	695	616	558	478	423	291	234	200
1.50	1.610	2,204	1,515	1,217	1,041	923	836	716	634	436	350	300
2.00	2.067	4,245	2,918	2,343	2,005	1,777	1,610	1,378	1,222	840	674	577
2.50	2.469	6,766	4,651	3,735	3,196	2,833	2,567	2,197	1,947	1,338	1,075	920
3.00	3.068	11,962	8,221	6,602	5,650	5,008	4,538	3,884	3,442	2,366	1,900	1,626
3.50	3.548	17,514	12,037	9,666	8,273	7,332	6,644	5,686	5,039	3,464	2,781	2,381
4.00	4.026	24,398	16,769	13,466	11,525	10,214	9,255	7,921	7,020	4,825	3,875	3,316
5.00	5.047	44,140	30,337	24,362	20,851	18,479	16,744	14,330	12,701	8,729	7,010	6,000
6.00	6.065	71,473	49,123	39,447	33,762	29,923	27,112	23,204	20,566	14,135	11,351	9,715
8.00	7.981	146,849	100,929	81,049	69,368	61,479	55,705	47,676	42,254	29,041	23,321	19,960
10.00	10.020	266,718	183,314	147,207	125,990	111,663	101,175	86,592	76,745	52,747	42,357	36,252
12.00	11.938	422,248	290,209	233,048	199,459	176,777	160,172	137,087	121,498	83,505	67,057	57,392

Table M-805.4.1(8)
PIPE SIZING TABLE FOR 2 POUNDS PRESSURE CAPACITY OF PIPES FOR AN INITIAL PRESSURE OF 2.0 PSIG WITH A 10-PERCENT PRESSURE DROP AND A GAS OF 0.60 SPECIFIC GRAVITY

Pipe size of Schedule 40 standard pipe (inches)	Internal diameter (inches)	Pipe capacity (cubic feet of gas per hour)										
		Total equivalent length of pipe (feet)										
		50	100	150	200	250	300	400	500	1,000	1,500	2,000
1.00	1.049	1,112	764	614	525	466	422	361	320	220	177	151
1.25	1.380	2,283	1,569	1,260	1,079	956	866	741	657	452	363	310
1.50	1.610	3,421	2,351	1,888	1,616	1,432	1,298	1,111	984	677	543	465
2.00	2.067	6,589	4,528	3,636	3,112	2,758	2,499	2,139	1,896	1,303	1,046	896
2.50	2.469	10,501	7,217	5,796	4,961	4,396	3,983	3,409	3,022	2,077	1,668	1,427
3.00	3.068	18,564	12,759	10,246	8,769	7,772	7,042	6,027	5,342	3,671	2,948	2,523
3.50	3.548	27,181	18,681	15,002	12,840	11,379	10,311	8,825	7,821	5,375	4,317	3,694
4.00	4.026	37,865	26,025	20,899	17,887	15,853	14,364	12,293	10,895	7,488	6,013	5,147
5.00	5.047	68,504	47,082	37,809	32,359	28,680	25,986	22,240	19,711	13,547	10,879	9,311
6.00	6.065	110,924	76,237	61,221	52,397	46,439	42,077	36,012	31,917	21,936	17,616	15,077
8.00	7.981	227,906	156,638	125,786	107,657	95,414	86,452	73,992	65,578	45,071	36,194	30,977
10.00	10.020	413,937	284,497	228,461	195,533	173,297	157,020	134,389	119,106	81,861	65,737	56,263
12.00	11.938	655,315	450,394	361,682	309,553	274,351	248,582	212,754	188,560	129,596	104,070	89,071

Table M-805.4.1(9)
PIPE SIZING TABLE FOR 2 POUNDS PRESSURE CAPACITY OF PIPES OR TUBING FROM POINT OF DELIVERY TO 2 PSIG REGULATOR, BASED ON A PRESSURE DROP OF 1.5 PSI AND A GAS OF 0.65 SPECIFIC GRAVITY[a]

Tubing diameter inside (OD) (inches)	Pipe capacity (cubic feet of gas per hour)																	
	Length of tubing (feet)																	
	5	10	15	20	30	40	50	60	70	80	90	100	125	150	175	200	250	300
¼ (⅜)	540	360	285	240	192	163	143	130	118	110	102	96	85	76	69	64	58	51
⅜ (½)	1,260	850	670	570	450	380	335	300	275	255	240	225	198	178	164	146	140	120
½ (⅝)	2,400	1,630	1,280	1,080	860	730	645	580	530	490	460	430	380	340	315	290	255	230
⅝ (¾)	4,150	2,780	2,150	1,860	1,480	1,250	1,100	1,000	910	850	790	740	650	585	540	500	440	395
¾ (⅞)	6,500	4,350	3,450	2,950	2,300	2,000	1,750	1,560	1,430	1,330	1,230	1,160	1,025	920	845	780	690	620
1 (1⅛)	10,500	7,600	6,200	5,400	4,400	3,800	3,350	3,050	2,800	2,650	2,500	2,350	2,100	1,900	1,800	1,700	1,500	1,350
1¼ (1⅜)	21,000	15,000	12,000	10,500	8,600	7,500	6,700	6,100	5,600	5,200	4,900	4,700	4,150	3,800	3,550	3,300	2,950	2,700
1½ (1⅝)	31,000	22,000	18,000	15,000	13,000	11,000	9,800	9,000	8,200	7,700	7,200	6,800	6,100	5,600	5,200	4,900	4,300	4,000
2 (2⅛)	58,000	41,000	34,000	29,000	24,000	20,000	18,000	17,000	15,000	14,000	13,500	12,500	11,300	10,400	9,700	9,000	8,100	7,400
2½ (2⅝)	90,000	64,000	52,000	45,000	36,000	32,000	28,000	26,000	24,000	22,000	21,000	20,000	18,000	16,000	15,500	14,000	12,500	11,500
3 (3⅛)	150M	110M	90,000	79,000	63,000	55,000	49,000	45,000	41,000	38,000	36,000	34,500	31,000	28,000	26,000	24,000	22,000	19,000
4 (4⅛)	310M	220M	180M	150M	125M	110M	97,000	90,000	82,000	77,000	72,000	70,000	62,000	56,000	53,000	49,000	44,000	40,000

Note a. Use this table when metering or reduced pressure is 2 psig. Minimum inlet pressure to pounds-to-inches regulator will be ½ pound or 14 inches.

Table M-805.4.1(10)
PIPE SIZING TABLE FOR 2 POUNDS PRESSURE CAPACITY OF PIPES OR TUBING FROM 2 PSIG REGULATOR TO APPLIANCE, BASED ON A PRESSURE DROP OF 1 INCH WATER COLUMN AND A GAS OF 0.65 SPECIFIC GRAVITY[a]

Tubing diameter inside (OD) (inches)	Pipe capacity (cubic feet of gas per hour)																	
	Length of tubing (feet)																	
	5	10	15	20	30	40	50	60	70	80	90	100	125	150	175	200	250	300
¼ (⅜)	62	42	33	28	22	19	16	15	14	13	12	11	10	9	8	7	6	6
⅜ (½)	145	96	76	66	52	44	39	35	32	30	28	26	23	21	19	18	16	14
½ (⅝)	280	187	148	126	100	84	74	67	61	57	53	50	44	39	36	34	30	26
⅝ (¾)	475	320	252	215	170	145	129	115	105	97	91	86	76	68	62	58	51	45
¾ (⅞)	750	500	395	335	265	225	200	180	165	153	142	134	118	106	97	90	79	71
1 (1⅛)	1,080	760	620	520	440	380	345	315	290	270	255	240	215	195	180	170	150	140
1¼ (1⅜)	2,200	1,550	1,300	1,100	900	795	700	640	600	560	520	500	450	410	380	355	315	285
1½ (1⅝)	3,450	2,450	2,000	1,700	1,400	1,200	1,100	1,000	920	860	810	770	690	620	580	540	490	445
2 (2⅛)	7,000	4,950	4,000	3,450	2,850	2,500	2,200	2,000	1,850	1,750	1,650	1,580	1,400	1,290	1,190	1,100	980	900
2½ (2⅝)	11,200	8,000	6,500	5,600	4,600	4,000	3,550	3,250	3,000	2,800	2,650	2,500	2,250	2,050	1,900	1,780	1,600	1,460
3 (3⅛)	20,000	14,200	11,500	10,000	8,300	7,200	6,350	5,800	5,400	5,050	4,750	4,500	4,000	3,650	3,400	3,200	2,850	2,600
4 (4⅛)	42,000	29,500	24,000	21,000	17,000	14,500	13,000	12,000	11,000	10,400	9,700	9,300	8,400	7,600	7,000	6,600	5,900	5,400

Note a. Use this table when metering or reducing pressure is 6 inches water column.

Table M-805.4.1(11)
PIPE SIZING TABLE FOR 5 POUNDS PRESSURE CAPACITY OF PIPES FOR AN INITIAL PRESSURE OF 5.0 PSIG WITH A 10-PERCENT PRESSURE DROP AND A GAS OF 0.60 SPECIFIC GRAVITY

Pipe size of Schedule 40 standard pipe (inches)	Internal diameter (inches)	Pipe capacity (cubic feet of gas per hour)										
		Total equivalent length of pipe (feet)										
		50	100	150	200	250	300	400	500	1,000	1,500	2,000
1.00	1.049	1,989	1,367	1,098	940	833	755	646	572	393	316	270
1.25	1.380	4,084	2,807	2,254	1,929	1,710	1,549	1,326	1,175	808	649	555
1.50	1.610	6,120	4,206	3,378	2,891	2,562	2,321	1,987	1,761	1,210	972	832
2.00	2.067	11,786	8,101	6,505	5,567	4,934	4,471	3,827	3,391	2,331	1,872	1,602
2.50	2.469	18,785	12,911	10,368	8,874	7,865	7,126	6,099	5,405	3,715	2,983	2,553
3.00	3.068	33,209	22,824	18,329	15,687	13,903	12,597	10,782	9,556	6,568	5,274	4,514
3.50	3.548	48,623	33,418	26,836	22,968	20,356	18,444	15,786	13,991	9,616	7,722	6,609
4.00	4.026	67,736	46,555	37,385	31,997	28,358	25,694	21,991	19,490	13,396	10,757	9,207
5.00	5.047	122,544	84,224	67,635	57,887	51,304	46,485	39,785	35,261	24,235	19,461	16,656
6.00	6.065	198,427	136,378	109,516	93,732	83,073	75,270	64,421	57,095	39,241	31,512	26,970
8.00	7.981	407,692	280,204	225,014	192,583	170,683	154,651	132,361	117,309	80,626	64,745	55,414
10.00	10.020	740,477	508,926	408,686	349,782	310,005	280,887	240,403	213,065	146,438	117,595	100,646
12.00	11.938	1,172,269	805,694	647,001	553,749	490,777	444,680	380,588	337,309	231,830	186,168	159,336

Table M-805.4.1(12)
PIPE SIZING TABLE FOR 10 POUNDS PRESSURE CAPACITY OF PIPES FOR AN INITIAL PRESSURE OF 10.0 PSIG WITH A 10-PERCENT PRESSURE DROP AND A GAS OF 0.60 SPECIFIC GRAVITY

Pipe size of Schedule 40 standard pipe (inches)	Internal diameter (inches)	Pipe capacity (cubic feet of gas per hour)										
		Total equivalent length of pipe (feet)										
		50	100	150	200	250	300	400	500	1,000	1,500	2,000
1.00	1.049	3,259	2,240	1,798	1,539	1,364	1,236	1,058	938	644	517	443
1.25	1.380	6,690	4,598	3,692	3,160	2,801	2,538	2,172	1,925	1,323	1,062	909
1.50	1.610	10,024	6,889	5,532	4,735	4,197	3,802	3,254	2,884	1,982	1,592	1,362
2.00	2.067	19,305	13,268	10,655	9,119	8,082	7,323	6,268	5,555	3,818	3,066	2,624
2.50	2.469	30,769	21,148	16,982	14,535	12,882	11,672	9,990	8,854	6,085	4,886	4,182
3.00	3.068	54,395	37,385	30,022	25,695	22,773	20,634	17,660	15,652	10,757	8,638	7,393
3.50	3.548	79,642	54,737	43,956	37,621	33,343	30,211	25,857	22,916	15,750	12,648	10,825
4.00	4.026	110,948	76,254	61,235	52,409	46,449	42,086	36,020	31,924	21,941	17,620	15,080
5.00	5.047	200,720	137,954	110,782	94,815	84,033	76,140	65,166	57,755	39,695	1,875	27,282
6.00	6.065	325,013	223,379	179,382	153,527	136,068	123,288	105,518	93,519	64,275	51,615	44,176
8.00	7.981	667,777	458,959	368,561	315,440	279,569	253,310	216,800	192,146	132,061	106,050	90,765
10.00	10.020	1,212,861	833,593	669,404	572,924	507,772	460,078	393,767	348,988	239,858	192,614	164,853
12.00	11.938	1,920,112	1,319,682	1,059,751	907,010	803,866	728,361	623,383	552,493	379,725	304,933	260,980

Table M-805.4.1(13)
PIPE SIZING TABLE FOR 20 POUNDS PRESSURE CAPACITY OF PIPES FOR AN INITIAL PRESSURE OF 20.0 PSIG WITH A 10-PERCENT PRESSURE DROP AND A GAS OF 0.60 SPECIFIC GRAVITY

Pipe size of Schedule 40 standard pipe (inches)	Internal diameter (inches)	Pipe capacity (cubic feet of gas per hour)										
		Total equivalent length of pipe (feet)										
		50	100	150	200	250	300	400	500	1,000	1,500	2,000
1.00	1.049	5,674	3,900	3,132	2,680	2,375	2,152	1,842	1,633	1,122	901	771
1.25	1.380	11,649	8,006	6,429	5,503	4,877	4,419	3,782	3,352	2,304	1,850	1,583
1.50	1.610	17,454	11,996	9,633	8,245	7,307	6,621	5,667	5,022	3,452	2,772	2,372
2.00	2.067	33,615	23,103	18,553	15,879	14,073	12,751	10,913	9,672	6,648	5,338	4,569
2.50	2.469	53,577	36,823	29,570	25,308	22,430	20,323	17,394	15,416	10,595	8,509	7,282
3.00	3.068	94,714	65,097	52,275	44,741	39,653	35,928	30,750	27,253	18,731	15,042	12,874
3.50	3.548	138,676	95,311	76,538	65,507	58,058	52,604	45,023	39,903	27,425	22,023	18,849
4.00	4.026	193,187	132,777	106,624	91,257	80,879	73,282	62,720	55,538	38,205	30,680	26,258
5.00	5.047	349,503	240,211	192,898	165,096	146,322	132,578	113,470	100,566	69,118	55,505	47,505
6.00	6.065	565,926	388,958	312,347	267,329	236,928	214,674	183,733	162,840	111,919	89,875	76,921
8.00	7.981	1,162,762	799,160	641,754	549,258	486,797	441,074	377,502	334,573	229,950	184,658	158,048
10.00	10.020	2,111,887	1,451,488	1,165,596	997,600	884,154	801,108	685,645	607,674	417,651	335,388	287,049
12.00	11.938	3,343,383	2,297,888	1,845,285	1,579,326	1,399,727	1,268,254	1,085,462	962,025	661,194	530,962	454,435

Table M-805.4.1(14)
PIPE SIZING TABLE FOR 50 POUNDS PRESSURE CAPACITY OF PIPES FOR AN INITIAL PRESSURE OF 50.0 PSIG WITH A 10-PERCENT PRESSURE DROP AND A GAS OF 0.60 SPECIFIC GRAVITY

Pipe size of Schedule 40 standard pipe (inches)	Internal diameter (inches)	Pipe capacity (cubic feet of gas per hour)										
		Total equivalent length of pipe (feet)										
		50	100	150	200	250	300	400	500	1,000	1,500	2,000
1.00	1.049	12,993	8,930	7,171	6,138	5,440	4,929	4,218	3,739	2,570	2,063	1,766
1.25	1.380	26,676	18,335	14,723	12,601	11,168	10,119	8,661	7,676	5,276	4,236	3,626
1.50	1.610	39,970	27,471	22,060	18,881	16,733	15,162	12,976	11,501	7,904	6,348	5,433
2.00	2.067	76,977	52,906	42,485	36,362	32,227	29,200	24,991	22,149	15,223	12,225	10,463
2.50	2.469	122,690	84,324	67,715	57,955	51,365	46,540	39,832	35,303	24,263	19,484	16,676
3.00	3.068	216,893	149,070	119,708	102,455	90,804	82,275	70,417	62,409	42,893	34,445	29,480
3.50	3.548	317,564	218,260	175,271	150,009	132,950	120,463	103,100	91,376	62,802	50,432	43,164
4.00	4.026	442,393	304,054	244,166	208,975	185,211	167,814	143,627	127,294	87,489	70,256	60,130
5.00	5.047	800,352	550,077	441,732	378,065	335,072	303,600	259,842	230,293	158,279	127,104	108,784
6.00	6.065	1,295,955	890,703	715,266	612,175	542,559	491,598	420,744	372,898	256,291	205,810	176,147
8.00	7.981	2,662,693	1,830,054	1,469,598	1,257,785	1,114,752	1,010,046	864,469	766,163	526,579	422,862	361,915
10.00	10.020	4,836,161	3,323,866	2,669,182	2,284,474	2,024,687	1,834,514	1,570,106	1,391,556	956,409	768,030	657,334
12.00	11.938	7,656,252	5,262,099	4,225,651	3,616,611	3,205,335	2,904,266	2,485,676	2,203,009	1,514,115	1,215,888	1,040,843

Table M-805.4.1(15)
MAXIMUM CAPACITY OF PIPE FOR UNDILUTED LIQUEFIED PETROLEUM GASES AT 11 INCHES WATER COLUMN INLET PRESSURE BASED ON A PRESSURE DROP OF 0.5 INCH WATER COLUMN

Nominal iron pipe size (inches)	Pipe capacity (thousands of Btu per hour)											
	Length of pipe (feet)											
	10	20	30	40	50	60	70	80	90	100	125	150
½	275	189	152	129	114	103	96	89	83	78	69	63
¾	567	393	315	267	237	217	196	185	173	162	146	132
1	1,071	732	590	504	448	409	378	346	322	307	275	252
1¼	2,205	1,496	1,212	1,039	913	834	771	724	677	630	567	511
1½	3,307	2,299	1,858	1,559	1,417	1,275	1,181	1,086	1,023	976	866	787
2	6,221	4,331	3,465	2,992	2,646	2,394	2,205	2,047	1,921	1,811	1,606	1,496

Table M-805.4.1(16)
MAXIMUM CAPACITY OF SEMI-RIGID TUBING FOR UNDILUTED LIQUEFIED PETROLEUM GASES AT 11 INCHES WATER COLUMN INLET PRESSURE BASED ON A PRESSURE DROP OF 0.5 INCH WATER COLUMN

Outside diameter (inch)	Tubing capacity (thousands of Btu per hour)									
	Length of tubing (feet)									
	10	20	30	40	50	60	70	80	90	100
⅜	39	26	21	19	—	—	—	—	—	—
½	92	62	50	41	37	35	31	29	27	26
⅝	199	131	107	90	79	72	67	62	59	55
¾	329	216	181	145	131	121	112	104	95	90
⅞	501	346	277	233	198	187	164	155	146	138

M-805.4.1.2 Table application: The length utilized to compute the gas pipe size for a section of pipe shall equal the maximum length of pipe for the entire system. The tables take into consideration the normal installation of valves and fittings.

M-805.4.1.3 Specific gravity other than 0.60: Where the specific gravity of the gas is other than 0.60, the values in Tables M-805.4.1(1) through M-805.4.1(14) shall be multiplied by the applicable value from Table M-805.4.1.3.

Table M-805.4.1.3
MULTIPLIERS FOR SPECIFIC GRAVITY OF THE GAS OTHER THAN 0.60

Specific gravity	Multiplier	Specific gravity	Multiplier
.35	1.31	1.00	.78
.40	1.23	1.10	.74
.45	1.16	1.20	.71
.50	1.10	1.30	.68
.55	1.04	1.40	.66
.60	1.00	1.50	.63
.65	.96	1.60	.61
.70	.93	1.70	.59
.75	.90	1.80	.58
.80	.87	1.90	.56
.85	.84	2.00	.55
.90	.82	2.10	.54

M-805.5 Maximum design pressure: The maximum design operating pressure of a system inside the structure shall not exceed 5 psig (34 kPa) unless otherwise approved.

Exceptions

1. Industrial processing or heating structures.
2. Research structures.
3. Structures that exclusively contain *boilers* or mechanical equipment.
4. Where the piping system is welded steel pipe.
5. Where the piping is a temporary installation for structures under construction.

M-805.5.1 Liquefied petroleum gas systems: The maximum design operating pressure for undiluted LP-gas systems shall be 20 psig (138 kPa).

Exception: The maximum design operating pressure shall not apply to structures, or separate areas of structures, constructed in accordance with Chapter 7 of NFiPA 58 listed in Chapter 21, and which exclusively contain industrial processes, research and experimental laboratories, or equipment or processing having similar hazards.

SECTION M-806.0 GAS FLOW CONTROLS

M-806.1 Gas pressure regulators: A gas pressure regulator or gas equipment pressure regulator shall be installed where the gas *appliance* is designed to operate at a lower pressure than the fuel gas system. *Access* shall be provided to pressure regulators. Pressure regulators shall be protected from physical damage. Regulators installed on the exterior of the building shall be approved for outdoor installation.

M-806.1.1 Second stage LP-gas regulators: Second stage regulators for undiluted liquefied petroleum gas piping systems shall conform to UL 144 listed in Chapter 21.

M-806.2 Venting of regulators: Gas pressure regulators that require a vent shall have an independent vent to the outside of the building. The vent shall be designed to prevent the entry of water or foreign objects.

Exception: A vent to the outside of the building is not required for second stage regulators equipped with and *labeled* for utilization with approved vent-limiting devices.

SECTION M-807.0 UNDERGROUND GAS PIPING

M-807.1 Clearance: Underground gas piping shall be installed to allow proper maintenance and to protect against contact or damage resulting

from proximity to other structures. Underground plastic piping shall be installed with sufficient clearance from any source of heat.

M-807.2 Minimum depth: Underground piping systems shall be installed a minimum depth of 18 inches (457 mm) below grade except as provided for in Section M-807.2.1.

M-807.2.1 Individual outside appliances: Individual gas lines to outside lights, grills or other *appliances* shall be installed a minimum of 8 inches (203 mm) below grade provided that such installation is approved and is installed in locations not susceptible to physical damage.

M-807.2.2 Protection of footings: Trenching installed parallel to footings shall not extend below the line of a 45-degree (0.79 rad) angle downward from the loadbearing plane of the footing, and shall conform to the requirements of the building code listed in Chapter 21.

M-807.3 Protection against corrosion: Gas piping in contact with material that will corrode the piping shall be protected in an approved manner. Where dissimilar metals are joined underground, dielectric fittings or couplings shall be installed.

M-807.4 Connection of plastic piping: Connections between metallic and plastic piping shall only be made outside, underground, with approved fittings. Where plastic pipe is connected to rigidly held fittings, a protective sleeve complying with the manufacturer's instructions shall be installed.

M-807.5 Piping through foundation walls: Where installed below grade through the outer foundation or basement wall of a structure, underground piping shall be encased in an approved sleeve. The annular space between the gas piping and the sleeve shall be sealed at the foundation or basement wall to prevent entry of gas or water.

M-807.6 Flood hazard: All underground piping located in a flood-hazard zone (A Zone) or a high-hazard zone (V Zone) shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the base flood elevation.

M-807.7 Tracer for plastic piping: An insulated copper tracer wire or other approved conductor shall be installed adjacent to underground nonmetallic gas piping. *Access* shall be provided to the tracer wire or the tracer wire shall terminate above ground at each end of the nonmetallic gas piping. The tracer wire size shall not be less than 18 AWG and the insulation type shall be suitable for direct burial.

Exception: A tracer wire is not required for individual gas lines to outside lights and grills installed in accordance with Section M-807.2.1.

SECTION M-808.0 OUTSIDE ABOVE-GROUND PIPING

M-808.1 General: Piping installed outside above ground shall be securely supported and protected from physical damage. Pipe shall not be laid on the ground surface where subject to mechanical injury.

M-808.2 Flood hazard: All outside above-ground piping located in a flood-hazard zone (A Zone) or a high-hazard zone (V Zone) shall be anchored and reinforced so that the piping is capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, and loads resulting from water-borne debris during the occurrence of flooding to the base flood elevation.

SECTION M-809.0 INSIDE BUILDING GAS PIPING

M-809.1 Stresses and strains: Gas piping shall be installed so as to prevent strains and stresses which exceed the structural strength of the pipe. Provisions shall be made to protect the piping from damage resulting from expansion, contraction and structural settlement. Piping shall be installed so as not to create structural stresses or strains within building components.

M-809.2 Piping for other than dry gas: Piping for other than dry gas shall be sloped not less than ¼ inch in 15 feet (1:720). Horizontal lines shall slope upward to the risers and upward from the risers to the meter, the service regulator or the equipment. Drips shall be provided at such points to act as storage for condensate. *Access* shall be provided to drips. A drip shall not be located where the condensate will freeze.

M-809.2.1 Branch connections: All branch connections shall be made on the top or side of horizontal lines.

M-809.3 Prohibited locations: Gas piping shall not be run in or through supply air ducts, clothes chutes, chimneys, *vents*, dumbwaiters or elevator shafts.

M-809.3.1 Air plenums: Valves shall not be located in any air plenum.

M-809.4 Piping in concealed locations: Portions of a gas piping system installed in concealed locations shall not have unions, tubing fittings or running threads.

M-809.5 Protection against physical damage: In concealed locations, where gas piping other than black or galvanized steel is installed through holes or notches in wood studs, joists, rafters or similar members less than 1¼ inches (32 mm) from the nearest edge of the member, the pipe shall be protected by shield plates. Shield plates shall be a minimum of 1/16-inch-thick (2 mm) steel, shall cover the area of the pipe where the member is notched or bored, and shall extend a minimum of 4 inches (102 mm) above sole plates, below top plates and to each side of a stud, joist or rafter.

M-809.6 Concrete slabs: Gas piping embedded in concrete slabs shall be surrounded with a minimum of 1½ inches (38 mm) of concrete. The pipe shall not be in contact with any metal. The slab concrete shall not contain quickset additives or cinder aggregate.

M-809.7 Cutting or notching: A structural member shall not be cut, notched or pierced in excess of the limitations specified in the building code listed in Chapter 21, unless proven safe by a structural analysis.

SECTION M-810.0 HANGERS AND SUPPORTS

M-810.1 Hanger material: Hangers and supports shall be of material of sufficient strength to support the piping. Hangers and strapping material shall be of similar material as the piping to avoid galvanic action.

M-810.2 Interval of support: Gas piping shall be supported at intervals not exceeding the spacing specified in Table M-810.2.

Table M-810.2
HANGER SPACING

Material	Maximum spacing (feet)[a]
Rigid pipe, ¾-inch diameter and under	10
Rigid pipe, 1-inch diameter and over	12
Tubing, 1¼-inch diameter and under	6
Tubing, 1½-inch diameter and over	10

Note a. 1 foot = 304.8 mm.

SECTION M-811.0 SHUTOFF VALVES

M-811.1 Valve approval: Shutoff valves shall be of an approved type. Shutoff valves shall be constructed with materials compatible with the gas piping.

M-811.2 Exterior shutoff: An exterior shutoff valve shall be provided for each structure.

M-811.3 Meter valve: Every meter shall be equipped with a shutoff valve located on the supply side of the meter.

M-811.4 Appliance connection: Every gas outlet shall have an individual shutoff valve. The shutoff valve shall be adjacent to the *appliance*. *Access* shall be provided to the shutoff valve.

SECTION M-812.0 OUTLETS AND CONNECTIONS

M-812.1 Gas connections: Gas *appliances* and equipment shall be connected by rigid pipe, tubing or flexible connectors. A union shall be installed between the *appliance* and the *appliance* shutoff valve.

M-812.2 Capped outlets: Gas outlets that do not connect to *appliances* shall be capped gas tight.

SECTION M-813.0 GAS-DISPENSING SYSTEMS

M-813.1 Dispenser protection: The gas dispenser shall have an emergency switch to shut off the power to the dispenser. An approved backflow device that prevents the reverse flow of gas shall be installed on the gas supply pipe or in the gas dispenser.

M-813.2 Ventilation: Gas-dispensing systems installed inside the structure shall be *ventilated* by mechanical means in accordance with Section M-1604.0.

M-813.3 Compressed natural gas vehicular fuel systems: Compressed natural gas (CNG) fuel-dispensing systems for CNG vehicles shall be designed and installed in accordance with NFiPA 52 listed in Chapter 21.

SECTION M-814.0 SUPPLEMENTAL AND STANDBY GAS SUPPLY

M-814.1 Special supplementary gas: Where air, oxygen or other special supplementary gas is introduced into the gas piping system, an approved backflow preventer shall be installed. The backflow preventer shall be on the gas line to the equipment supplied by the special gas and located between the source of the special gas and the gas meter.

M-814.2 Standby gas: Where LP-gas or other standby gas is interconnected with regular gas piping systems, an approved three-way, two-port valve or other approved safeguard shall be installed to prevent backflow into either supply system.

SECTION M-815.0 TESTING

M-815.1 General: The gas piping shall be tested and inspected in accordance with NFiPA 54 listed in Chapter 21.

SECTION M-816.0 PURGING GAS PIPING

M-816.1 General: Gas piping systems shall be purged in accordance with NFiPA 54 listed in Chapter 21.

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