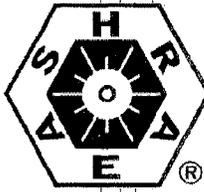


# **EXHIBIT 25**

**ANSI/ASHRAE/IESNA Standard 90.1-2004**

**(Includes ANSI/ASHRAE/IESNA Addenda listed in Appendix F)**



# ASHRAE STANDARD

## Energy Standard for Buildings Except Low-Rise Residential Buildings

**I-P Edition**

See Appendix F for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, the IESNA Board of Directors, and the American National Standards Institute.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site, <http://www.ashrae.org>, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: [orders@ashrae.org](mailto:orders@ashrae.org). Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada).

© Copyright 2004 ASHRAE, Inc.

ISSN 1041-2336

Jointly sponsored by



The  
LIGHTING  
AUTHORITY  
Illuminating Engineering Society of North America  
[www.iesna.org](http://www.iesna.org)



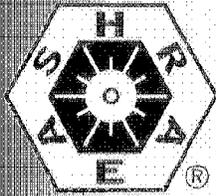
[www.ansi.org](http://www.ansi.org)

**American Society of Heating, Refrigerating  
and Air-Conditioning Engineers, Inc.**

1791 Tullie Circle NE, Atlanta, GA 30329

[www.ashrae.org](http://www.ashrae.org)

ANSI/ASHRAE/IESNA Standard 90.1-2004 ENERGY STANDARD FOR BUILDINGS EXCEPT LOW-RISE RESIDENTIAL



**ANSI/ASHRAE Standard 90.1-2007**  
(Supersedes ANSI/ASHRAE/IESNA Standard 90.1-2004)  
Includes ANSI/ASHRAE/IESNA Addenda listed in Appendix F

# ASHRAE STANDARD

## Energy Standard for Buildings Except Low-Rise Residential Buildings

### SI Edition

See Appendix F for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, the IESNA Board of Directors, and the American National Standards Institute.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site, <http://www.ashrae.org>, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: [orders@ashrae.org](mailto:orders@ashrae.org). Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada).

©Copyright 2007 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

ISSN 1041-2336

Jointly sponsored by



The  
LIGHTING  
AUTHORITY  
Illuminating Engineering Society of North America  
[www.iesna.org](http://www.iesna.org)



[www.ansi.org](http://www.ansi.org)

**American Society of Heating, Refrigerating  
and Air-Conditioning Engineers, Inc.**

1791 Tullie Circle NE, Atlanta, GA 30329  
[www.ashrae.org](http://www.ashrae.org)

# STANDARD

**ANSI/ASHRAE/IES Standard 90.1-2010**  
(Supersedes ANSI/ASHRAE/IESNA Standard 90.1-2007)  
Includes ANSI/ASHRAE/IES Addenda listed in Appendix F

# Energy Standard for Buildings Except Low-Rise Residential Buildings

**I-P Edition**

See Appendix F for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, the IES Board of Directors, and the American National Standards Institute.

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site ([www.ashrae.org](http://www.ashrae.org)) or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE Web site ([www.ashrae.org](http://www.ashrae.org)) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: [orders@ashrae.org](mailto:orders@ashrae.org). Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to [www.ashrae.org/permissions](http://www.ashrae.org/permissions).

© 2012 ASHRAE

ISSN 1041-2336



**Illuminating**  
ENGINEERING SOCIETY



# **EXHIBIT 26**

## NOTICE OF INCORPORATION

### *United States Legal Document*

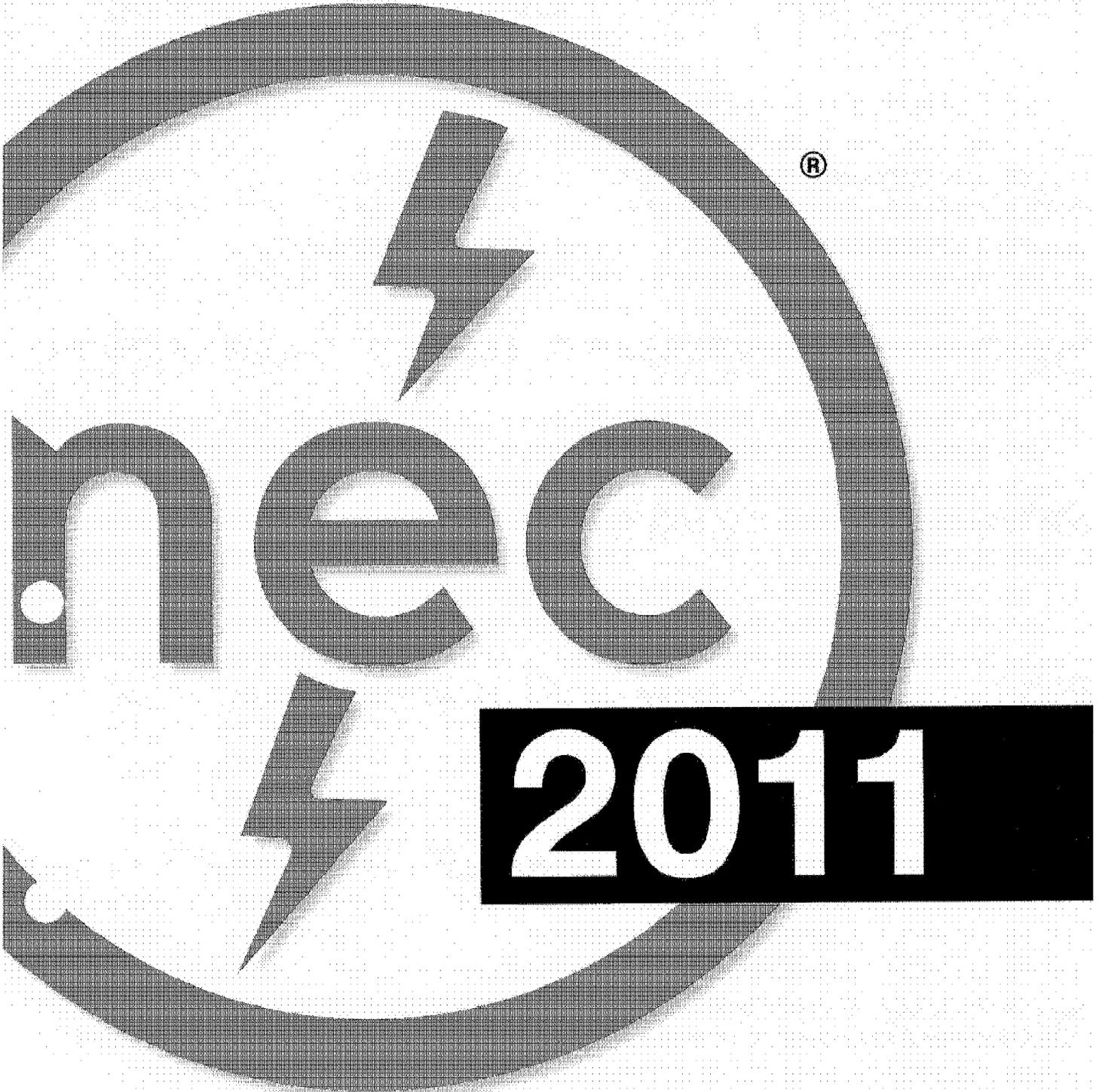
 All citizens and residents are hereby advised that this is a legally binding document duly incorporated by reference and that failure to comply with such requirements as hereby detailed within may subject you to criminal or civil penalties under the law. Ignorance of the law shall not excuse noncompliance and it is the responsibility of the citizens to inform themselves as to the laws that are enacted in the United States of America and in the states and cities contained therein. 

\* \*  
\*

NFPA NEC (2011), the National Electrical Code, as incorporated and mandated by the States and Municipalities of Alabama, Georgia, Iowa, Massachusetts, Minnesota, New Jersey, New Mexico, North Dakota, Ohio, Oklahoma, Rhode Island, Dallas (Texas), Houston (Texas), Vermont, Wyoming, et. alia.



# NFPA 70®



**National Electrical Code®**  
International Electrical Code® Series

# **EXHIBIT 27**

EXHIBIT  
Ashley See

38

Public Safety Standards of the United States

Date

2/20/15

Witness

Table of Codes ↑

MALAMUD

## Public Safety Standards United States (Federal Government)

In order to promote public education and public safety, equal justice for all, a better informed citizenry, the rule of law, world trade and world peace, this legal document is hereby made available on a noncommercial basis, as it is the right of all humans to know and speak the laws that govern them. (See also State and Local codes.)

STANDARD	YEAR	ORGANIZATION	TITLE	CFR AUTHORITY
3M 0222	1995	3M Corporation	Organochlorine Pesticides and PCBs in Wastewater Using Empore Disk	40 CFR 136.3(a) Table ID
AA CONSTRUCT	1971	Aluminum Association	Aluminum Construction Manual	24 CFR 200, Subpart S
AA	1967	Aluminum Association	Aluminum Construction Manual	24 CFR 200, Subpart S
AA DATA	1982	Aluminum Association	Aluminum Standards and Data, Seventh Edition	49 CFR 178.65(b)(2)
AAMA 101-IS2	1997	American Architectural Manufacturers Association	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors	10 CFR 434.402.2.2.4
AAMA 605	1998	American Architectural Manufacturers Association	Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels	40 CFR 59.401
AAMA 1002.10	1993	American Architectural Manufacturers Association	Aluminum Insulating Products for Windows and Sliding Glass Doors	24 CFR 200.938
AAMA 1102.7	1989	American Architectural Manufacturers Association	Voluntary Specifications for Aluminum Storm Doors	10 CFR 440 Appendix A
AAMA 1503.1	1988	American Architectural Manufacturers Association	Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections	24 CFR 3280.508(e)
AAMA 1702.2	1995	American Architectural	Swinging Exterior	24 CFR 3280.405(e)(2)

## Public Safety Standards of the United States

		Manufacturers Association	Passage Doors Voluntary Standard for Utilization in Manufactured-Housing	
AAMA 1704	1985	American Architectural Manufacturers Association	Voluntary Standard Egress Window Systems for Utilization in Manufactured-Housing	24 CFR 3280.404(b)
AAMD	1973	American Association on Mental Deficiency	Classification in Mental Retardation	42 CFR 483.102(b)(3)(i)
AAMVA CDLIS.2.0	1998	American Association of Motor Vehicle Administrators	Commercial Driver License Information System (CDLIS) State Procedures	49 CFR 384.231(d)
AASHTO	1973	American Association of State Highway and Transportation Officials	Standard Specifications for Highway Bridges	24 CFR 200, Subpart S
AASHTO	2001	American Association of State Highway and Transportation Officials	A Policy on Geometric Design of Highways and Streets	23 CFR 625.4
AASHTO	2005	American Association of State Highway and Transportation Officials	A Guide for Accommodating Utilities Within Highway Right-of-Way	23 CFR 645.211
AATCC 118	1997	American Association of Textile Chemists and Colorists	Oil Repellency: Hydrocarbon Resistance Test	10 CFR 430 Subpart B, App. J1, 2.6.4.5.1
AATCC 124	1996	American Association of Textile Chemists and Colorists	Appearance of Durable Press Fabrics After Repeated Home Laundering	16 CFR 1615.32(a)(1)
ABYC A-01	1993	American Boat and Yacht Council	Marine Liquified Petroleum Gas Systems	46 CFR 184.240(a)
ABYC A-07	1973	American Boat and Yacht Council	Boat Heating Systems	46 CFR 184.200
ABYC A-16	1997	American Boat and Yacht Council	Electric Navigation Lights	46 CFR 25.10-3(a)(2)
ABYC A-22	1993	American Boat and Yacht Council	Marine Compressed Natural Gas Systems	46 CFR 184.240(b)
ABYC E-01	1973	American Boat and Yacht Council	Bonding of Direct Current Systems	46 CFR 28.345(b)
ABYC E-09	1990	American Boat and Yacht Council	Direct Current (DC) Electrical Systems on Boats	46 CFR 183.340(b)(4)
ABYC H-02	1989	American Boat and Yacht Council	Ventilation of Boats Using Gasoline	46 CFR 28.340(c)
ABYC H-22	1986	American Boat and	DC Electric Bilge	46 CFR 182.500(b)

## Public Safety Standards of the United States

		Yacht Council	Pumps Operating Under 50 Volts	
ABYC H-24	1993	American Boat and Yacht Council	Gasoline Fuel Systems	46 CFR 182.455(c)
ABYC H-25	1994	American Boat and Yacht Council	Portable Gasoline Fuel Systems for Flammable Liquids	46 CFR 182.130
ABYC H-32	1987	American Boat and Yacht Council	Ventilation of Boats Using Diesel Fuel	46 CFR 182.470(c)
ABYC H-33	1989	American Boat and Yacht Council	Diesel Fuel Systems	46 CFR 182.130
ABYC P-01	1993	American Boat and Yacht Council	Safe Installation of Exhaust Systems for Propulsion and Auxiliary Engines	46 CFR 182.130
ABYC P-04	1989	American Boat and Yacht Council	Marine Inboard Engines	46 CFR 182.420(b)
ACGIH	1987	American Conference of Governmental Industrial Hygienists	Guidelines for the Selection of Chemical Protective Clothing, Third Edition	46 CFR 153.933(a)
ACGIH	1998	American Conference of Governmental Industrial Hygienists	Industrial Ventilation Manual	40 CFR 63.2984(e)
ACI 318	1995	American Concrete Institute	Building Code Requirements for Reinforced Concrete	30 CFR 250.901(d)(1)
ACI	1980	American Concrete Institute	Manual of Concrete Practice, Part 1	24 CFR 200, Subpart S
ACRI 210-240	2003	Air Conditioning and Refrigeration Institute	Unitary Air-Conditioning and Air-Source Heat Pump Equipment	10 CFR 431.96
ACRI 310/380	2004	Air-Conditioning, Heating and Refrigeration Institute	Packaged Terminal Air-Conditioners and Heat Pumps	10 CFR 431.96, Table 1
ACRI 320	1998	Air-Conditioning, Heating, and Refrigeration Institute	Water Source Heat Pumps	10 CFR 434.403
ACRI 325	1998	Air-Conditioning, Heating, and Refrigeration Institute	Ground Water-Source Heat Pumps	10 CFR 434.403
ACRI 330	1998	Air-Conditioning, Heating, and Refrigeration Institute	Ground-Source Closed-Loop Heat Pumps	10 CFR 434.403
ACRI 340-360	2004	Air Conditioning and Refrigeration Institute	Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment	10 CFR 434.403

## Public Safety Standards of the United States

ACRI 365	1994	Air Conditioning and Refrigeration Institute	Commercial and Industrial Unitary Air-Conditioning Condensing Units	10 CFR 434.403
ACRI 1200	2006	Air Conditioning and Refrigeration Institute	Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets	10 CFR 431.66(a)(3)
AERA	1999	American Educational Research Association	Standard for Educational and Psychological Testing	34 CFR 668.148(a)(2)(iv)
AFFPA	2001	American Forest and Paper Association	National Design Specification for Wood Construction With Supplemental Design Values for Wood Construction	24 CFR 3280.304(b)(1)
AGA 3.1	1990	American Gas Association	Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids: Part 1	40 CFR 75, Appendix D
AGA	2001	American Gas Association	Purging Principles and Practices	49 CFR 193.2615
AHA A135.4	1995	American Hardboard Association	Basic Hardboard	24 CFR 3280.304(b)(1)
AHA A135.5	1995	American Hardboard Association	Prefinished Hardboard Paneling	24 CFR 3280.304(b)(1)
AHA A135.6	1998	American Hardboard Association	Hardboard Siding	24 CFR 3280.304(b)(1)
AHAM DW-1	1992	Association of Home Appliance Manufacturers	Household Electric Dishwashers	10 CFR 430 Subpart B
AHAM HLD-1	1974	Association of Home Appliance Manufacturers	Performance Evaluation Procedure for Household Tumble Type Clothes Dryers	10 CFR 430 Subpart B
AHAM HRF-1	1979	Association of Home Appliance Manufacturers	Household Refrigerators, Combination Refrigerator-Freezers, and Household Freezers	10 CFR 430 Subpart B
AHPA	1992	American Herbal Products Association	Herbs of Commerce	21 CFR 101.4(h)
AI MSI-1	1970	Asphalt Institute	Thickness Design--Full Depth Asphalt Pavement Structures for Highways and Streets	24 CFR 200, Subpart S

## Public Safety Standards of the United States

AIHA	1994	American Industrial Hygiene Association	Laboratory Ventilation Workbook	42 CFR 52b.12(c)(10)
AIMM MS41	1996	Association for Information and Image Management	Dimensions of Unitized Microfilm Carriers and Apertures (Aperture, Camera, Copy and Image Cards)	36 CFR 1238.10(a)(1)
AIMM IT2.18	1996	Association for Information and Image Management	Photography—Density Measurements—Part 3: Spectral Conditions	36 CFR 1238.14(d)(2)
AIMM/PIMA IT9.2	1998	Association for Information and Image Management	Photographic Processed Films, Plates, and Papers—Filing Enclosures and Storage Containers	36 CFR 1238.10(a)(1)
AIMM/PIMA IT9.11	1998	Association for Information and Image Management	Imaging Materials—Processed Safety Photographic Film—Storage	36 CFR 1234.14(b)(1)
AIMM IT9.23	1996	Association for Information and Image Management	Imaging Materials—Polyester Based Magnetic Tape—Storage	36 CFR 1234.14(b)(2)
AIMM/PIMA IT9.25	1998	Association for Information and Image Management	Imaging Materials—Optical Disc Media—Storage	36 CFR 1234.14(b)(3)
AIMM MS1	1996	Association for Information and Image Management	Recommended Practice for Alphanumeric Computer-Output Microforms—Operational Practices for Inspection and Quality Control	36 CFR 1238.14(c)
AIMM MS5	1992	Association for Information and Image Management	Microfiche	36 CFR 1238.10(b)
AIMM MS14	1996	Association for Information and Image Management	Specifications for 16mm and 35mm Roll Microfilm	36 CFR 1238.10(a)(1)
AIMM MS19	1993	Association for Information and Image Management	Standard Recommended Practice—Identification of Microforms	36 CFR 1238.12(c)
AIMM MS23	1998	Association for Information and Image Management	Standard Recommended Practice—Production, Inspection, and Quality Assurance of First-Generation, Silver Microforms of Documents	36 CFR 1238.14(d)(2)

## Public Safety Standards of the United States

AIMM MS32	1996	Association for Information and Image Management	Microrecording of Engineering Source Documents on 35 mm Microfilm	36 CFR 1238.10(a)(1)
AIMM MS43	1998	Association for Information and Image Management	Standard Recommended Practice—Operational Procedures—Inspection and Quality Control of Microfilms and Documents	36 CFR 1238.14(d)(1)(i)
AIMM MS45	1990	Association for Information and Image Management	Recommended Practice for Inspection of Stored Silver-Gelatin Microforms for Evidence of Deterioration	36 CFR 1238.22(d)(1)
AIMM TR34	1996	Association for Information and Image Management	Sampling Procedures for Inspection by Attributes of Images in Electronic Image Management and Micrographic Systems	36 CFR 1237.28(d)(2)
ALCIDE 980342EA	1995	Alcide Corporation	Determination of Sodium Chlorite: 50 ppm to 1500 ppm concentration	21 CFR 173.325(g)
AMCA 210	1999	Air Movement and Control Association	Laboratory Methods of Testing Fans for Ratings	10 CFR 430 Subpart B, App. M
J-STD-102	2011	Alliance for Telecommunications Industry Solutions	Joint ATIS/TIA CMAS Federal Alert Gateway to CMSP Gateway Interface Text Specification	Warning, Alert and Response Network (WARN) Act of 2006
TELCO FAQ	1891	American Telephone and Telegraph	Practical Information for Telephonists	
ANSI A10.3	1970	American National Standards Institute	Safety Requirements for Powder Actuated Fastening Systems	29 CFR 1926
ANSI A10.4 (pdf) ANSI A10.4 (html)	1963	American National Standards Institute	Safety Requirements for Workmens Hoists	29 CFR 1926
ANSI A10.5 (pdf) ANSI A10.5 (html)	1969	American National Standards Institute	Safety Requirements for Material Joists	29 CFR 1926
ANSI A14.1 (pdf) ANSI A14.1 (html) ANSI A14.1 (svg)	1990	American National Standards Institute	Ladders—Wood—Safety Requirements	29 CFR 1917

## Public Safety Standards of the United States

ANSI A14.2 (pdf) ANSI A14.2 (html) ANSI A14.2 (svg)	1990	American National Standards Institute	Ladders—Portable Metal—Safety	29 CFR 1917
ANSI A92.2 (pdf) ANSI A92.2 (html)	1969	American National Standards Institute	Vehicle Mounted Elevating and Rotating Work Platforms	29 CFR 453
ANSI B7.1 (pdf) ANSI B7.1 (html)	1970	American National Standards Institute	Safety Code for the Use, Care, and Protection of Abrasive Wheels	29 CFR 1926
ANSI B20.1 (pdf) ANSI B20.1 (html) ANSI B20.1 (svg)	1957	American National Standards Institute	Safety Code for Conveyors, Cableways, and Related Equipment	29 CFR 1926
ANSI B30.6 (pdf) ANSI B30.6 (html) ANSI B30.6 (svg)	1969	American National Standards Institute	Safety Code for Derricks	29 CFR 1926
ANSI B36.19	1979	American National Standards Institute	Welded and Seamless Wrought Steel Pipe	24 CFR 3280.705(b)(1)
ANSI B56.1 (pdf) ANSI B56.1 (html) ANSI B56.1 (svg)	1969	American National Standards Institute	Safety Standard for Powered Industrial Trucks	29 CFR 1926
ANSI N14.1	2001	American National Standards Institute	Packaging of Uranium Hexafluoride for Transport	49 CFR 173.420(a)(1)
ANSI O1.1 (pdf) ANSI O1.1 (html)	1961	American National Standards Institute	Safety Code for Woodworking Machinery	29 CFR 1926
ANSI S1.4	1983	American National Standards Institute	Specifications for Sound Level Meters	7 CFR 1755.522(s)(3)(v)
ANSI S1.11	2004	American National Standards Institute	Specification for Octave, Half-Octave, and Third Octave Band Filter Sets	49 CFR 227
ANSI S1.25	1991	American National Standards Institute	Specification for Personal Noise Dosimeters	49 CFR 227.103(c)(2)(iii)
ANSI S1.40	1984	American National Standards Institute	Specification for Acoustical Calibrators	49 CFR 229, Appendix I
ANSI S1.43	1997	American National Standards Institute	Specifications for Integrating-Averaging Sound Level Meters	49 CFR 227.103(c)(2)(ii)
ANSI S3.22 (pdf) ANSI S3.22 (html)	2003	American National Standards Institute	Specification of Hearing Aid Characteristics	21 CFR 801
ANSI Z35.1 (pdf)	1968	American National	Specifications for	29 CFR 1926

## Public Safety Standards of the United States

ANSI Z35.1 (html) ANSI Z35.1 (svg)		Standards Institute	Accident Prevention Signs	
ANSI Z35.2 (pdf) ANSI Z35.2 (html) ANSI Z35.2 (svg)	1968	American National Standards Institute	Specifications for Accident Prevention Tags	29 CFR 1926
ANSI Z49.1 (pdf) ANSI Z49.1 (html)	1967	American National Standards Institute	Safety in Welding and Cutting	29 CFR 1926
ANSI Z87.1 (pdf) ANSI Z87.1 (html) ANSI Z87.1 (svg)	2003	American National Standards Institute	Practice for Occupational and Educational Eye and Face Protection	29 CFR 1910
ANSI Z88.2 (pdf) ANSI Z88.2 (html) ANSI Z88.2 (svg)	1992	American National Standards Institute	American National Standard for Respiratory Protection	30 CFR 250
ANSI Z89.1 (pdf) ANSI Z89.1 (html)	1969	American National Standards Institute	Safety Requirements for Industrial Head Protection	29 CFR 1926
ANSI Z89.2 (pdf) ANSI Z89.2 (html)	1971	American National Standards Institute	Industrial Protective Helmets for Electrical Workers	29 CFR 1926
ANSI Z90.4 (pdf) ANSI Z90.4 (html)	1984	American National Standards Institute	Protective Headgear for Bicyclists	16 CFR 1203
ANSI Z245.1 (pdf) ANSI Z245.1 (html) ANSI Z245.1 (svg)	1992	American National Standards Institute	Mobile Refuse Collection and Compaction--Safety Requirements	40 CFR 243
ANSI Z245.2 (pdf) ANSI Z245.2 (html)	1997	American National Standards Institute	Stationary Compactors--Safety Requirements	40 CFR 243
AOAC	1990	AOAC International	Official Methods of Analysis (Volume 1)	9 CFR 318.19(b)
AOAC	1980	AOAC International	Official Methods of Analysis, 1980	21 CFR 131.150(c)
APA 87-1	2001	American Pyrotechnics Association	Standard for Construction and Approval for Transportation of Fireworks and Novelties	49 CFR 173.56(j)(1)
APHA Method 2120 (pdf) APHA Method 2120 (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 141.121
APHA Method 2130 (pdf) APHA Method 2130 (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 141.121
APHA Method	1992	American Public Health	Standard Methods for	40 CFR 136.3(a)

## Public Safety Standards of the United States

2320 (pdf) APHA Method 2320 (html)		Association	the Examination of Water and Wastewater	
APHA Method 2510 (pdf) APHA Method 2510 (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 141.121
APHA Method 2550 (pdf) APHA Method 2550 (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 141.121
APHA Method 2580	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 141.121
APHA Method 3111 (pdf) APHA Method 3111 (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 444.12
APHA Method 3112 (pdf) APHA Method 3112 (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 444.12
APHA Method 3113 (pdf) APHA Method 3113 (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 444.12
APHA Method 3114	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 444.12
APHA Method 3120	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 444.12
APHA Method 3500-AS	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 444.12
APHA Method 3500-CA (pdf) APHA Method 3500-CA (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 3500-CD (pdf) APHA Method 3500-CD (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 444.12
APHA Method 3500-CR	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 63.404(a)
APHA Method 3500-CU	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 444.12
APHA Method	1992	American Public Health	Standard Methods for	40 CFR 136.3(a)

## Public Safety Standards of the United States

3500-MG (pdf) APHA Method 3500-MG (html)		Association	the Examination of Water and Wastewater	
APHA Method 3500-PB (pdf) APHA Method 3500-PB (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 444.12
APHA Method 3500-ZN (pdf) APHA Method 3500-ZN (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 4110 (pdf) APHA Method 4110 (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 4500-CIO2 (pdf) APHA Method 4500-CIO2 (html)	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	21 CFR 165.110(b)(4)(iii) (I)(7)(ii)
APHA Method 4500-CL	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	21 CFR 165.110(b)(4)
APHA Method 4500-CN	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 4500-F	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 4500-H	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 444.12
APHA Method 4500-NO2	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 4500-NO3	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 4500-O3	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 4500-P	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 4500-S2	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 4500-SI	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 141.121

## Public Safety Standards of the United States

APHA Method 4500-SO42	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 5540	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 141.121
APHA Method 6651	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 141.121
APHA Method 9215	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 141.121
APHA Method 9221	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 9222	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
APHA Method 9223	1992	American Public Health Association	Standard Methods for the Examination of Water and Wastewater	40 CFR 136.3(a)
API 2INT-MET	2007	American Petroleum Institute	Interim Guidance on Hurricane Conditions in the Gulf of Mexico	30 CFR 250.901(a)(6)
API 5L	2004	American Petroleum Institute	Specification for Line Pipe	49 CFR 192.113
API 5L1	2002	American Petroleum Institute	Recommended Practice for Railroad Transportation of Line Pipe	49 CFR 192.65(a)
API 6A	2004	American Petroleum Institute	Specification for Wellhead and Christmas Tree Equipment	30 CFR 250.806(a)(3)
API 6D	2008	American Petroleum Institute	Specification for Pipeline Valves	49 CFR 195.116(d)
API 12F	1994	American Petroleum Institute	Specification for Shop Welded Tanks for Storage of Production Liquids	49 CFR 195.264(b)(1)
API RP 14C	2001	American Petroleum Institute	Recommended Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms	30 CFR 250.1628(c)
API RP 14F	2008	American Petroleum Institute	Recommended Practice for Design and Installation of Electrical	30 CFR 250.114(c)

## Public Safety Standards of the United States

			Systems for Offshore Production Platforms	
API 17J	2008	American Petroleum Institute	Specification for Unbonded Flexible Pipe	30 CFR 250.1002(b)(4)
API 80	2000	American Petroleum Institute	Guidelines for the Definition of Onshore Gas Gathering Lines	49 CFR 192.8(a)
API 510	2006	American Petroleum Institute	Pressure Vessel Inspection Code	30 CFR 250.803(b)(1)
API 620	2002	American Petroleum Institute	Design and Construction of Large Welded Low Pressure Storage Tanks	49 CFR 195.264(e)(3)
API 650	2007	American Petroleum Institute	Welded Steel Tanks for Oil Storage	195.132(b)(3)
API 651	1997	American Petroleum Institute	Cathodic Protection of Aboveground Petroleum Storage Tanks	49 CFR 195.565
API 652	1997	American Petroleum Institute	Lining of Aboveground Petroleum Storage Tank Bottoms	49 CFR 195.579(d)
API 653	2003	American Petroleum Institute	Tank Inspection, Repair, Alteration, and Reconstruction	49 CFR 195.432(b)
API 1104	1999	American Petroleum Institute	Standard for Welding Pipelines and Related Facilities	49 CFR 195.214(a)
API 1130	2002	American Petroleum Institute	Computational Pipeline Monitoring	49 CFR 195.444
API 1162	2003	American Petroleum Institute	Public Awareness Programs for Pipeline Operators	49 CFR 192.616(a)
API 2000	1998	American Petroleum Institute	Venting Atmospheric and Low-Pressure Storage Tanks	49 CFR 195.264(e)(2)
API 2003	1998	American Petroleum Institute	Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents	49 CFR 195.405(a)
API 2350	2005	American Petroleum Institute	Overfill Protection for Storage Tanks in Petroleum Facilities	49 CFR 195.428(c)
API 2510	2001	American Petroleum Institute	Design and Construction of LPG Installations	49 CFR 195.205(b)(3)
API RP 14G	2007	American Petroleum	Recommended	30 CFR 250.803(b)(9)(v)

## Public Safety Standards of the United States

		Institute	Practice for Fire Prevention and Control on Open Type Offshore Production Platforms	
APLIC	1996	Avian Power Line Interaction Committee	Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996	7 CFR 1724.52(a)(1)(i)
APSP 16	2011	Association of Pool and Spa Professionals	Standard Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, and Hot Tubs	16 CFR 1450.3
ARMA	1984	Asphalt Roofing Manufacturers Association	Residential Asphalt Roofing Manual	24 CFR 200, Subpart S
ASHRAE 15	1994	American Society of Heating, Refrigerating and Air Conditioning Engineers	Safety Code for Mechanical Refrigeration	49 CFR 173.306(e)(1)(i)
ASHRAE	1993	American Society of Heating, Refrigerating and Air Conditioning Engineers	Fundamentals	10 CFR 434.402.2.2.5(a)
ASME B16.9	2003	American Society of Mechanical Engineers	Factory Made Wrought Steel Butt Welding Fittings	49 CFR 195.118(a)
ASME B30.2 (pdf) ASME B30.2 (html) ASME B30.2 (svg)	2005	American Society of Mechanical Engineers	Safety Requirements for Overhead and Gantry Cranes	29 CFR 1926
ASME B30.5 (pdf) ASME B30.5 (html)	2004	American Society of Mechanical Engineers	Safety Requirements for Mobile and Locomotive Cranes	29 CFR 1926
ASME B30.7 (pdf) ASME B30.7 (html)	2001	American Society of Mechanical Engineers	Safety Requirements for Base-Mounted Drum Hoists	29 CFR 1926
ASME B30.14 (pdf) ASME B30.14 (html) ASME B30.14 (svg)	2004	American Society of Mechanical Engineers	Safety Requirements for Side Boom Tractors	29 CFR 1926
ASME B31.4	2002	American Society of Mechanical Engineers	Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids	49 CFR 195.110(a)

## Public Safety Standards of the United States

ASME B31.8	2003	American Society of Mechanical Engineers	Gas Transmission and Distribution Piping Systems	49 CFR 192.619(a)(1)(i)
ASME B318S	2004	American Society of Mechanical Engineers	Managing System Integrity of Gas Pipelines	49 CFR 192.903(c)
ASME B31G	1991	American Society of Mechanical Engineers	Manual for Determining the Remaining Strength of Corroded Pipelines	49 CFR 192.485(c)
ASME UPV	1943	American Society of Mechanical Engineers	Code for Unfired Pressure Vessels	49 CFR 173.32(c)(4)
ASQC Q9001	1994	American Society for Quality Control	Quality Assurance in Design, Development, Production, Installation, and Servicing	33 CFR 96.430(a)(2)(ii)
ASQC Q9002	1994	American Society for Quality Control	Quality Systems – Model for Quality Assurance in Production, Installation, and Servicing	24 CFR 200.935(d)(4)(ii)(A)(3)
ASQC Q9003	1994	American Society for Quality Control	Quality Systems - Model for Quality Assurance in Final Inspection and Test	24 CFR 200.935(d)(4)(ii)(A)(4)
ASQC Q9004-1	1994	American Society for Quality Control	Quality Management and Quality Systems Elements-Guidelines	24 CFR 200.935(d)(4)(ii)(A)(5)
ASSE 1001	1990	American Society of Sanitary Engineering	Performance Requirements for Pipe Applied Atmospheric Type Vacuum Breakers	24 CFR 3280.604(b)(2)
ASSE 1006 (pdf) ASSE 1006 (html)	1986	American Society of Sanitary Engineering	Plumbing Requirements for Residential Use (Household) Dishwashers	24 CFR 3280.604(b)(2)
ASSE 1007 (pdf) ASSE 1007 (html)	1986	American Society of Sanitary Engineering	Performance Requirements for Home Laundry Equipment	24 CFR 3280.604(b)(2)
ASSE 1008 (pdf) ASSE 1008 (html)	1986	American Society of Sanitary Engineering	Performance Requirements for Household Food Waste Disposer Units	24 CFR 3280.604(b)(2)
ASSE 1016	1988	American Society of Sanitary Engineering	Performance Requirements for Individual Thermostatic	24 CFR 3280.604(b)(2)

## Public Safety Standards of the United States

			Pressure Balancing and Combination Control for Bathing Facilities	
ASSE 1023 (pdf) ASSE 1023 (html)	1979	American Society of Sanitary Engineering	Hot Water Dispensers, Household Storage Type, Electrical	24 CFR 3280.604(b)(2)
ASSE 1025	1978	American Society of Sanitary Engineering	Diverter for Plumbing Faucets with Hose Spray, Anti-Siphon Type, Residential Applications	24 CFR 3280.604(b)(2)
ASSE 1037 (pdf) ASSE 1037 (html)	1990	American Society of Sanitary Engineering	Performance Requirements for Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures	24 CFR 3280.604(b)(2)
ASCE 7	2002	American Society of Civil Engineers	Minimum Design Loads for Buildings and Other Structures	49 CFR 193.2013
ASTM A36	1977	American Society for Testing and Materials	Standard Specification for Carbon Structural Steel	24 CFR Part 200
ASTM A36	1997	American Society for Testing and Materials	Standard Specification for Carbon Structural Steel	46 CFR 160.035-3(b)(2)
ASTM A47	1968	American Society for Testing and Materials	Standard Specification for Malleable Iron Castings	29 CFR 1910.111(b)(7)(vi)
ASTM A82	1979	American Society for Testing and Materials	Cold-Drawn Steel Wire for Concrete Reinforcement	24 CFR 200, Subpart S
ASTM A100	1969	American Society for Testing and Materials	Standard Specification for Ferrosilicon	40 CFR 60.261(s)
ASTM A106	2004	American Society for Testing and Materials	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service	49 CFR 192.113
ASTM A134	1996	American Society for Testing and Materials	Standard Specification for Pipe, Steel, Electric Fusion (Arc)-Welded (Sizes NPS 16 and Over)	46 CFR 56.60-1(b)
ASTM A179	1990	American Society for Testing and Materials	Standard Specification for Seamless Cold-Drawn Low-Carbon Steel Heat-Exchanger and Condenser Tubes	46 CFR 56.60-1(b)
ASTM A184	1979	American Society for	Standard Specification	24 CFR 200, Subpart S

## Public Safety Standards of the United States

		Testing and Materials	for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement	
ASTM A185	1979	American Society for Testing and Materials	Steel Wire Fabric for Concrete Reinforcement	24 CFR 200, Subpart S
ASTM A203	1997	American Society for Testing and Materials	Standard Specification for Pressure Vessel Plates, Alloy Steel, Nickel	46 CFR 54.05-20(b)
ASTM A214	1996	American Society for Testing and Materials	Standard Specification for Electric-Resistance-Welded Carbon Steel Heat-Exchanger and Condenser Tubes	46 CFR 56.60-1(b)
ASTM A242	1979	American Society for Testing and Materials	Standard Specification for High-Strength Low-Alloy Structural Steel	24 CFR 200, Subpart S
ASTM A285	1978	American Society for Testing and Materials	Standard Specification for Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength	49 CFR 179.300-7(a)
ASTM A307	1978	American Society for Testing and Materials	Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength	46 CFR 56.25-20(b)
ASTM A325	1979	American Society for Testing and Materials	High-Strength Bolts for Structural Steel Joists	24 CFR 200, Subpart S
ASTM A333	1994	American Society for Testing and Materials	Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service	46 CFR 56.50-105
ASTM A369	1992	American Society for Testing and Materials	Standard Specification for Carbon and Ferritic Alloy Steel Forged and Bored Pipe for High-Temperature Service	46 CFR 56.60-1(b)
ASTM A370	1977	American Society for Testing and Materials	Standard Test Method and Definitions for Mechanical Testing of Steel Products	49 CFR 179.102-1(a)(1)
ASTM A381	1996	American Society for Testing and Materials	Standard Specification for Metal-Arc-Welded Steel Pipe for Use with High-Pressure Transmission Systems	49 CFR 192.113
ASTM A391	1965	American Society for Testing and Materials	Standard Specification for Alloy Steel Chain	29 CFR 1910.184(e)(4)
ASTM A416	1974	American Society for	Uncoated Seven-Wire	24 CFR 200, Subpart S

## Public Safety Standards of the United States

		Testing and Materials	Stress-Relieved Strand for Prestressed Concrete	
ASTM A441	1979	American Society for Testing and Materials	High-Strength Low-Alloy Structural Manganese Vanadium Steel	24 CFR 200, Subpart S
ASTM A449	1978	American Society for Testing and Materials	Quenched and Tempered Steel Bolts and Studs	24 CFR 200, Subpart S
ASTM A475	1978	American Society for Testing and Materials	Standard Specification for Zinc-Coated Steel Wire Strand	7 CFR 1755.370(b)
ASTM A483	1964	American Society for Testing and Materials	Standard Specification for Silicomanganese	40 CFR 60.261(o)
ASTM A490	1979	American Society for Testing and Materials	Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints	24 CFR 200, Subpart S
ASTM A496	1978	American Society for Testing and Materials	Deformed Steel Wire for Concrete Reinforcement	24 CFR 200, Subpart S
ASTM A497	1979	American Society for Testing and Materials	Welded Deformed Steel Wire, Fabric for Concrete Reinforcement	24 CFR 200, Subpart S
ASTM A500	1978	American Society for Testing and Materials	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes	24 CFR 200, Subpart S
ASTM A501	1976	American Society for Testing and Materials	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing	24 CFR 200, Subpart S
ASTM A502	1976	American Society for Testing and Materials	Steel Structural Rivets	24 CFR 200, Subpart S
ASTM A514	1977	American Society for Testing and Materials	High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding	24 CFR 200, Subpart S
ASTM A516	1990	American Society for Testing and Materials	Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate and Lower-Temperature Service	49 CFR 178.337-2(b)(2)(i)
ASTM A522	1995	American Society for Testing and Materials	Forged or Rolled 8 and 9% Nickel Alloy Steel Flanges, Fittings, Valves, and Parts for Low-Temperature	46 CFR 56.50-105

## Public Safety Standards of the United States

			Service	
ASTM A529	1972	American Society for Testing and Materials	Structural Steel with 42,000PSI (290 Mpa) Minimum Yield Point (1/2 in (12.7 mm) Maximum Thickness	24 CFR 200, Subpart S
ASTM A529	1975	American Society for Testing and Materials	Structural Steel with 42,000PSI (290 Mpa) Minimum Yield Point (1/2 in (12.7 mm) Maximum Thickness	24 CFR 200, Subpart S
ASTM A539	1990	American Society for Testing and Materials	Standard Specification for Electric-Resistance-Welded Coiled Steel Tubing for Gas and Fuel Oil Lines	24 CFR 3280.705(b)(4)
ASTM A570	1979	American Society for Testing and Materials	Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality	24 CFR 200, Subpart S
ASTM A572	1979	American Society for Testing and Materials	High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality	24 CFR 200, Subpart S
ASTM A588	1979	American Society for Testing and Materials	High-Strength Low-Alloy Structural Steel with 50 ksi Minimum Yield Point to 4 inches Thick	24 CFR 200, Subpart S
ASTM A611	1972	American Society for Testing and Materials	Steel, Cold-rolled Sheet, Carbon, Structural	24 CFR 200, Subpart S
ASTM A615	1979	American Society for Testing and Materials	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement	24 CFR 200, Subpart S
ASTM A616	1979	American Society for Testing and Materials	Rail-Steel Deformed and Plain Bars for Concrete Reinforcement	24 CFR 200, Subpart S
ASTM A617	1979	American Society for Testing and Materials	Axle-Steel Deformed and Plain Bars for Concrete Reinforcement	24 CFR 200, Subpart S
ASTM A618	1974	American Society for Testing and Materials	Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing	24 CFR 200, Subpart S
ASTM A633	1979	American Society for Testing and Materials	Standard Specification for Normalized High-Strength Low Alloy Structural Steel	49 CFR 178.338-2(a)

## Public Safety Standards of the United States

ASTM A671	2004	American Society for Testing and Materials	Standard Specification for Electric-Fusion-Welded Steel Pipe for Atmospheric and Lower Temperatures	49 CFR 192.113
ASTM A672	1996	American Society for Testing and Materials	Standard Specification for Electric-Fusion-Welded Steel Pipe for High-Pressure Service at Moderate Temperatures	49 CFR 192.113
ASTM A691	1998	American Society for Testing and Materials	Standard Specification for Carbon and Alloy Steel Pipe, Electric-Fusion-Welded for High-Pressure Service at High Temperature	49 CFR 192.113
ASTM B16	1985	American Society for Testing and Materials	Standard Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines	46 CFR 56.60-2
ASTM B16	1992	American Society for Testing and Materials	Standard Specification for Free-Cutting Brass Rod, Bar, and Shapes for Use in Screw Machines	46 CFR 56.60-2
ASTM B21	1983	American Society for Testing and Materials	Standard Specification for Naval Brass Rod, Bar, and Shapes	46 CFR 56.60-2
ASTM B21	1996	American Society for Testing and Materials	Standard Specification for Naval Brass Rod, Bar, and Shapes	46 CFR 56.60-2
ASTM B42	1996	American Society for Testing and Materials	Standard Specification for Seamless Copper Pipe, Standard Sizes	46 CFR 56.60-1(b)
ASTM B68	1995	American Society for Testing and Materials	Standard Specification for Seamless Copper Tube, Bright Annealed	46 CFR 56.60-1(b)
ASTM B75	1997	American Society for Testing and Materials	Standard Specification for Seamless Copper Tube	46 CFR 56.60-1(b)
ASTM B85	1984	American Society for Testing and Materials	Standard Specification for Aluminum-Alloy Die Castings	46 CFR 56.60-2
ASTM B88	1996	American Society for Testing and Materials	Standard Specification for Seamless Copper Water Tube	46 CFR 56.60-1(b)
ASTM B96	1993	American Society for Testing and Materials	Standard Specification for Copper-Silicon Alloy	46 CFR 119.440

## Public Safety Standards of the United States

ASTM B111	1995	American Society for Testing and Materials	Plate, Sheet, Strip, and Bolled Bar for General Purposes and Pressure Vessels	46 CFR 56.60-1(b)
ASTM B117	1973	American Society for Testing and Materials	Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock	49 CFR 571.209 S5.2(a)
ASTM B122	1995	American Society for Testing and Materials	Standard Practice for Operating Salt Spray (Fog) Apparatus	46 CFR 119.440
ASTM B124	1996	American Society for Testing and Materials	Standard Specification for Copper-Nickel-Tin Alloy, Copper-Nickel-Zinc Alloy (Nickel Silver), and Copper-Nickel Alloy Plate, Sheet, Strip and Rolled Bar	46 CFR 56.60-2
ASTM B152	1997	American Society for Testing and Materials	Standard Specification for Copper and Copper-Alloy Forging Rod, Bar, and Shapes	46 CFR 58.50-5(a)(4)
ASTM B193	1987	American Society for Testing and Materials	Standard Specification for Copper, Sheet, Strip, Plate, and Rolled Bar	7 CFR 1755.390(i)(5)(v)(A)
ASTM B209	1996	American Society for Testing and Materials	Standard Test Method for Resistivity of Electrical Conductor Materials	46 CFR 58.50-5, Table 58.50-5(a)
ASTM B224	1980	American Society for Testing and Materials	Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate	7 CFR 1755.890(i)(5)(vi)
ASTM B227	1970	American Society for Testing and Materials	Standard Classification of Coppers	24 CFR 200, Subpart S
ASTM B280	1997	American Society for Testing and Materials	Hard-Drawn Copper-Clad Steel Wire	46 CFR 56.60-1(b)
ASTM B283	1996	American Society for Testing and Materials	Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	46 CFR 56.60-2
ASTM B315	1993	American Society for Testing and Materials	Standard Specification for Copper and Copper-Alloy Die Forgings (Hot-Pressed)	46 CFR 56.60-1(b)
ASTM B557	1984	American Society for Testing and Materials	Seamless Copper Alloy Pipe Tube	49 CFR 178.46(i)(3)(i)
			Tension Testing Wrought and Cast	

## Public Safety Standards of the United States

ASTM B580	1979	American Society for Testing and Materials	Aluminum and Magnesium-Alloy Products Standard Specification for Anodized Oxide Coatings on Aluminum	49 CFR 171.7
ASTM B694	1986	American Society for Testing and Materials	Standard Specification for Copper, Copper Alloy, and Copper-Clad Stainless Steel Sheet and Strip for Electrical Cable Shielding	7 CFR 1755.390(i)(5)(v)
ASTM B858	1995	American Society for Testing and Materials	Standard Test Method for Determination of Susceptibility to Stress Corrosion Cracking in Copper Alloys Using Ammonia Vapor Test	46 CFR 56.60-2
ASTM C4	1962	American Society for Testing and Materials	Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile	24 CFR 200, Subpart S
ASTM C5	1979	American Society for Testing and Materials	Standard Specification for Quicklime for Structural Purposes	24 CFR 200, Subpart S
ASTM C32	1973	American Society for Testing and Materials	Standard Specification for Sewer and Manhole Brick	24 CFR 200, Subpart S
ASTM C34	1962	American Society for Testing and Materials	Standard Specification for Structural Clay Load-Bearing Wall Tile	24 CFR 200, Subpart S
ASTM C52	1954	American Society for Testing and Materials	Specification for Gypsum Partition Tile or Block	24 CFR 200, Subpart S
ASTM C56	1971	American Society for Testing and Materials	Standard Specification for Structural Clay Nonloadbearing Tile	24 CFR 200, Subpart S
ASTM C64	1972	American Society for Testing and Materials	Specification for Fireclay Brick Refractories for Heavy Duty Stationary Boiler Service	24 CFR 200, Subpart S
ASTM C90	1970	American Society for Testing and Materials	Standard Specification for Hollow Load-Bearing Concrete Masonry Units	49 CFR 223 Appendix A (b)(10)(ii)
ASTM C126	1971	American Society for Testing and Materials	Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units	24 CFR 200, Subpart S

## Public Safety Standards of the United States

ASTM C139	1973	American Society for Testing and Materials	Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes	24 CFR 200, Subpart S
ASTM C150	1917	American Society for Testing and Materials	Standard Specification for Portland Cement	49 CFR 571.108
ASTM C150	1999	American Society for Testing and Materials	Standard Specification for Portland Cement	30 CFR 250.198
ASTM C150	2007	American Society for Testing and Materials	Standard Specification for Portland Cement	30 CFR 250.901(d)(9)
ASTM C177	1997	American Society for Testing and Materials	Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot-Plate Apparatus	10 CFR 431.102
ASTM C177 (pdf) ASTM C177 (html)	2004	American Society for Testing and Materials	Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot-Plate Apparatus	16 CFR 460.5(a)
ASTM C236	1989	American Society for Testing and Materials	Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box	10 CFR 434.402.1.2.1(a)
ASTM C330	1999	American Society for Testing and Materials	Standard Specification for Lightweight Aggregates for Structural Concrete	30 CFR 250.901(a)(18)
ASTM C476	1971	American Society for Testing and Materials	Standard Specification for Grout for Masonry	24 CFR 200, Subpart S
ASTM C509	1984	American Society for Testing and Materials	Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material	24 CFR 200, Subpart S
ASTM C516	1980	American Society for Testing and Materials	Standard Specification for Vermiculite Loose Fill Thermal Insulation	24 CFR 200, Subpart S
ASTM C518	1991	American Society for Testing and Materials	Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission	46 CFR 160.174-17(f)

## Public Safety Standards of the United States

ASTM C518	2004	American Society for Testing and Materials	Properties by Means of the Heat Flow Meter Apparatus Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus	16 CFR 460.5(a)
ASTM C549	1981	American Society for Testing and Materials	Standard Specification for Perlite Loose Fill Insulation	10 CFR 440 Appendix A
ASTM C564	1970	American Society for Testing and Materials	Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings	24 CFR 3280.611(d)(5)(iv)
ASTM C720	1989	American Society for Testing and Materials	Spray Applied Fibrous Insulation for Elevated Temperature	10 CFR 440 Appendix A
ASTM C1045	2001	American Society for Testing and Materials	Standard Practice for Calculating Thermal Transmission Properties from Steady-State Heat Flux Measurements	16 CFR 460.5(a)
ASTM C1114	2000	American Society for Testing and Materials	Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus	16 CFR 460.5(a)
ASTM C1149	2002	American Society for Testing and Materials	Standard Specification for Self-Supported Spray Applied Cellulosic Thermal Insulation	16 CFR 460.5(a)(4)
ASTM C1224	2003	American Society for Testing and Materials	Standard Specification for Reflective Insulation for Building Applications	16 CFR 460.5(c)
ASTM C1371	2004	American Society for Testing and Materials	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emisometers	16 CFR 460.5(b)
ASTM C1374	2003	American Society for Testing and Materials	Standard Test Method for Determination of	16 CFR 460.5(a)(5)

## Public Safety Standards of the United States

			Installed Thickness of Pneumatically Applied Loose-Fill Building Insulation	
ASTM D56	1970	American Society for Testing and Materials	Standard Test Method for Flash Point by Tag Closed Cup Tester	29 CFR 1910.106(a)(14)(i)
ASTM D86	2001	American Society for Testing and Materials	Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure	40 CFR 94.108(a)(1) Table B-5
ASTM D86	2004	American Society for Testing and Materials	Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure	40 CFR 1065.710
ASTM D86 (pdf) ASTM D86 (html)	2007	American Society for Testing and Materials	Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure	40 CFR 1065.710
ASTM D88	1956	American Society for Testing and Materials	Standard Test Method for Saybolt Viscosity	29 CFR 1910.106(a)(37)
ASTM D93	2002	American Society for Testing and Materials	Standard Test Method for Flash Point by Pensky-Martens Closed Cup Tester	40 CFR 94.108(a)(1) Table B-5
ASTM D129	1964	American Society for Testing and Materials	Standard Test Method for Sulfur in Petroleum Products (General Bomb Method)	40 CFR 60.106(j)(2)
ASTM D129	1995	American Society for Testing and Materials	Standard Test Method for Sulfur in Petroleum Products (General Bomb Method)	40 CFR 60.106(j)(2)
ASTM D129 (pdf) ASTM D129 (html)	2000	American Society for Testing and Materials	Standard Test Method for Sulfur in Petroleum Products (General Bomb Method)	40 CFR 60.335(b)(10)(i)
ASTM D257	1991	American Society for Testing and Materials	Standard Test Method for DC Resistance of Conductance of Insulating Materials	7 CFR 1755.860(e)(5)
ASTM D287	1992	American Society for Testing and Materials	Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)	40 CFR 94.108(a)(1) Table B-5
ASTM D323	1958	American Society for Testing and Materials	Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method)	29 CFR 1910.106(a)(30)

## Public Safety Standards of the United States

ASTM D388	1998	American Society for Testing and Materials	Standard Classification of Coals by Rank	40 CFR 60.251(b)
ASTM D396	1998	American Society for Testing and Materials	Standard Specification for Fuel Oils	40 CFR 60.41b
ASTM D396 (pdf) ASTM D396 (html)	2002	American Society for Testing and Materials	Standard Specification for Fuel Oils	40 CFR 63.7575
ASTM D412	1968	American Society for Testing and Materials	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension	21 CFR 801.410(d)(2)
ASTM D413	1982	American Society for Testing and Materials	Standard Test Method for Rubber Property—Adhesion to Flexible Substrate	46 CFR 160.055-3 Table 160-055-3(j)
ASTM D445	1965	American Society for Testing and Materials	Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids	29 CFR 1910.106(a)(37)
ASTM D445	1972	American Society for Testing and Materials	Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids	21 CFR 177.1430(c)(2)
ASTM D512	1989	American Society for Testing and Materials	Standard Test Methods for Chloride Ion In Water	40 CFR 136.3(a)
ASTM D611	1982	American Society for Testing and Materials	Standard Test Method for Aniline Point and Mixed Aniline Point of Petroleum Products and Hydrocarbon Solvents	21 CFR 177.1520(b)
ASTM D660	1944	American Society for Testing and Materials	Evaluating Degree of Resistant to Checking of Exterior Paints	24 CFR 200, Subpart S
ASTM D665	1998	American Society for Testing and Materials	Standard Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water	46 CFR 61.20-17(a)
ASTM D750	1968	American Society for Testing and Materials	Recommended Practice for Rubber Deterioration in Carbon-Arc or Weathering Apparatus	24 CFR 200, Subpart S
ASTM D756	1956	American Society for Testing and Materials	Standard Practice for Determination of Weight and Shape Changes of Plastics Under Accelerated Service Conditions	49 CFR 571.209 S5.2(b)

## Public Safety Standards of the United States

ASTM D781	1968	American Society for Testing and Materials	Standard Test Methods for Puncture and Stiffness of Paperboard and Corrugated and Solid Fiberboard	24 CFR 3280.304(b)(1)
ASTM D785	1965	American Society for Testing and Materials	Standard Method of Test for Rockwell Hardness of Plastics and Electrical Insulating Materials	16 CFR 1201.4
ASTM D814	1995	American Society for Testing and Materials	Standard Test Method for Rubber Property—Vapor Transmission of Volatile Liquids	40 CFR 1051.245(e)(1)
ASTM D975	1998	American Society for Testing and Materials	Standard Specification for Diesel Fuel Oils	46 CFR 160.176-13(r)
ASTM D975 (pdf) ASTM D975 (html)	2007	American Society for Testing and Materials	Standard Specification for Diesel Fuel Oils	40 CFR 1065.701
ASTM D976	1991	American Society for Testing and Materials	Standard Test Method for Calculated Cetane Index of Distillate Fuels	40 CFR 92.113
ASTM D1056	1973	American Society for Testing and Materials	Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber	49 CFR 571.213
ASTM D1060	1965	American Society for Testing and Materials	Standard Method of Core Sampling of Raw Wool Packages for Determination of Percentage of Clean Wool Fiber Present	7 CFR 31.204
ASTM D1067	2002	American Society for Testing and Materials	Standard Test Method for Acidity or Alkalinity of Water	40 CFR 141.21
ASTM D1068	2003	American Society for Testing and Materials	Standard Test Methods for Iron in Water	40 CFR 136.3(a)
ASTM D1072	1990	American Society for Testing and Materials	Standard Test Method for Total Sulfur in Fuel Gases	40 CFR 60.335(b)(10)(ii)
ASTM D1081	1960	American Society for Testing and Materials	Test for Evaluating Rubber Property—Sealing Pressure	24 CFR 200, Subpart S
ASTM D1126 (pdf) ASTM D1126 (html) ASTM D1126 (svg)	2002	American Society for Testing and Materials	Standard Test Method for Hardness in Water	40 CFR 136

## Public Safety Standards of the United States

ASTM D1193	1977	American Society for Testing and Materials	Standard Specification for Reagent Water	40 CFR 60, Appendix A-3
ASTM D1200	1970	American Society for Testing and Materials	Viscosity of Paints, Varnishes and Lacquers by Ford Viscosity Cup	49 CFR 171.8
ASTM D1217	1993	American Society for Testing and Materials	Standard Test Method for Density and Relative Density (Specific Gravity) of Liquids by Bingham Pycnometer	40 CFR 75, Appendix D
ASTM D1246	1995	American Society for Testing and Materials	Bromide - Titrimetric	40 CFR 136.3(a) Table IB
ASTM D1253	1986	American Society for Testing and Materials	Standard Test Method for Residual Chlorine in Water	21 CFR 165.110(b)(4)(iii)(1)(5)(i)
ASTM D1253 (pdf) ASTM D1253 (html)	2003	American Society for Testing and Materials	Standard Test Method for Residual Chlorine in Water	40 CFR 136.3(a) Table IB
ASTM D1266	1998	American Society for Testing and Materials	Standard Test Method for Sulfur in Petroleum Products (Lamp Method)	40 CFR 60.106(j)(2)
ASTM D1298	1999	American Society for Testing and Materials	Standard Practice for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products	40 CFR 75, Appendix D, Section 2.2.6
ASTM D1303	1955	American Society for Testing and Materials	Standard Method of Test for Total Chlorine in Vinyl Chloride Polymers and Copolymers	21 CFR 177.1610(a)
ASTM D1319 (pdf) ASTM D1319 (html)	2003	American Society for Testing and Materials	Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption	40 CFR 80.2(z)
ASTM D1331	1989	American Society for Testing and Materials	Standard Test Methods for Surface and Interfacial Tension of Solutions of Surface Active Agents	40 CFR 63, Appendix A
ASTM D1335	1967	American Society for Testing and Materials	Standard Test Method for Tuft Bind of Pile Floor Coverings	24 CFR 200.945(a)(1)(ii)

## Public Safety Standards of the United States

ASTM D1412	1993	American Society for Testing and Materials	Standard Test Method for Equilibrium Moisture of Coal at 96 to 97 Percent Relative Humidity and 30 Degrees Celsius	30 CFR 870.19
ASTM D1415	1968	American Society for Testing and Materials	Tentative Method of Test for International Hardness of Vulcanized Natural and Synthetic Rubbers	49 CFR 571.116 S7.4.1(b)
ASTM D1415	1988	American Society for Testing and Materials	Standard Practice for Rubber and Rubber Latices—Nomenclature	21 CFR 177.2600(c)(4)(i)
ASTM D1475	1960	American Society for Testing and Materials	Standard Test Method for Density of Paint, Varnish, Lacquer, and Related Products	40 CFR 60, Appendix A-7
ASTM D1480	1993	American Society for Testing and Materials	Standard Test Method for Density and Relative Density (Specific Gravity) of Viscous Materials by Bingham Pycnometer	40 CFR 75, Appendix D
ASTM D1481	1993	American Society for Testing and Materials	Standard Test Method for Density and Relative Density (Specific Gravity) of Viscous Materials by Lipkin Bicapillary Pycnometer	40 CFR 136.3(a) Table IC
ASTM D1505	1968	American Society for Testing and Materials	Standard Test Method for Density of Plastics by the Density-Gradient Technique	21 CFR 177.2480
ASTM D1518	1985	American Society for Testing and Materials	Standard Test Method for Thermal Transmittance of Textile Materials	46 CFR 160.174-17(f)
ASTM D1535	1968	American Society for Testing and Materials	Specifying Color by the Munsell System	16 CFR 1402
ASTM D1535	1968	American Society for Testing and Materials	Specifying Color by the Munsell System	16 CFR 1402.4(a)(1)(i)(E)(2)
ASTM D1535	1989	American Society for Testing and Materials	Specifying Color by the Munsell System	7 CFR 1755.860(c)(3)
ASTM D1552	1995	American Society for Testing and Materials	Standard Test Method for Sulfur in Petroleum Products (High-Temperature Method)	40 CFR 60, Appendix A-7
ASTM D1564	1971	American Society for	Standard Method of	40 CFR 136.3(a)

## Public Safety Standards of the United States

		Testing and Materials	Testing Flexible Cellular Materials--Slab Urethane Foam	
ASTM D1687	1992	American Society for Testing and Materials	Standard Test Methods for Chromium in Water	40 CFR 444.12(b)(1)
ASTM D1688	1995	American Society for Testing and Materials	Standard Test Method for Copper in Water	40 CFR 141.23(k)(1)
ASTM D1692	1968	American Society for Testing and Materials	Test for Flammability of Plastic Sheeting and Cellular Plastics	29 CFR 1910.103(c)(1)(v)(D)
ASTM D1785	1986	American Society for Testing and Materials	Standard Specification for Poly (Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120	46 CFR 56.01-2
ASTM D1835	1997	American Society for Testing and Materials	Standard Specification for Liquefied Petroleum (LP) Gases	49 CFR 180.209(e)
ASTM D1890	1996	American Society for Testing and Materials	Standard Test Method for Beta Particle Radioactivity of Water	40 CFR 136.3(a)
ASTM D1943	1996	American Society for Testing and Materials	Standard Test Method for Alpha Particle Radioactivity of Water	40 CFR 136.3(a)
ASTM D1945	1996	American Society for Testing and Materials	Standard Test Method for Analysis of Natural Gas By Gas Chromatography	40 CFR 60.45(f)(5)(i)
ASTM D1946	1990	American Society for Testing and Materials	Standard Method for Analysis of Reformed Gas by Gas Chromatography	40 CFR 60.614(e)(4)
ASTM D1962	1967	American Society for Testing and Materials	Standard Test Method for Saponification Value of Drying Oils, Fatty Acids, and Polymerized Fatty Acids	21 CFR 178.2010(b)
ASTM D2013	1986	American Society for Testing and Materials	Standard Method of Preparing Coal Samples for Analysis	40 CFR 60, Appendix A-7
ASTM D2015	1996	American Society for Testing and Materials	Standard Test Method for Gross Calorific Value of Solid Fuel by the Adiabatic Bomb Calorimeter	40 CFR 60.45(f)(5)(ii)
ASTM D2036	1998	American Society for Testing and Materials	Standard Test Method for Cyanides in Water	40 CFR 136.3(a) Table IB
ASTM D2099	2000	American Society for Testing and Materials	Standard Test Method for Dynamic Water	40 CFR 63.5350(b)

## Public Safety Standards of the United States

ASTM D2156	1965	American Society for Testing and Materials	Resistance of Shoe Upper Maeser Water Penetration Tester Method of Tests for Smoke Density in Flue Gases from Distillate Fuels	10 CFR 430 Subpart B
ASTM D2161	1966	American Society for Testing and Materials	Standard Method of Conversion of Kinematic Viscosity to Saybolt Universal Viscosity or to Saybolt Furol Viscosity	29 CFR 1910.106(a)(37)
ASTM D2163	1991	American Society for Testing and Materials	Standard Test Method for Analysis of Liquefied Petroleum (LP) Gases and Propane Concentrates by Gas Chromatography	40 CFR 86.1313-94(f)(3)
ASTM D2216	1998	American Society for Testing and Materials	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass	40 CFR 258.41(a)(4)(iii) (A)
ASTM D2234	1998	American Society for Testing and Materials	Standard Practice for Collection of a Gross Sample of Coal	40 CFR 60, Appendix A-7
ASTM D2236	1970	American Society for Testing and Materials	Standard Method of Test for Dynamic Mechanical Properties of Plastics by Means of a Torsional Pendulum	21 CFR 177.1810(c)(2)(i)
ASTM D2247	1968	American Society for Testing and Materials	Standard Practice for Testing Water Resistance of Coatings in 100 Percent Relative Humidity	24 CFR 200, Subpart S
ASTM D2267	1968	American Society for Testing and Materials	Standard Test Method for Aromatics in Light Naphthas and Aviation Gasoline by Gas Chromatography	40 CFR 61.67(h)(1)
ASTM D2460	1997	American Society for Testing and Materials	Standard Test Method for Alpha-Particle-Emitting Isotopes of Radium in Water	40 CFR 136.3(a) Table IE
ASTM D2502	1992	American Society for Testing and Materials	Standard Test Method for Estimation of Molecular Weight	40 CFR 75, Appendix G

## Public Safety Standards of the United States

ASTM D2503	1992	American Society for Testing and Materials	(Relative Molecular Mass) of Petroleum Oils from Viscosity Measurements Standard Method of Test for Molecular Weight of Hydrocarbons by Thermoelectric Measurement of Vapor Pressure	40 CFR 98.254
ASTM D2505	1988	American Society for Testing and Materials	Standard Test Method for Ethylene, Other Hydrocarbons, and Carbon Dioxide in High-Purity Ethylene by Gas Chromatography	40 CFR 98.7
ASTM D2515	1966	American Society for Testing and Materials	Standard Specification for Kinematic Glass Viscosity	49 CFR 571.116 S6.3.2(a)
ASTM D2565	1970	American Society for Testing and Materials	Standard Practice for Operating Xenon Arc-Type Light-Exposure Apparatus With or Without Water for Exposure of Plastics	16 CFR 1201.4(b)(3)(ii)
ASTM D2597	1994	American Society for Testing and Materials	Standard Test Method for Analysis of Demethanized Hydrocarbon Liquid Mixtures Containing Nitrogen and Carbon Dioxide by Gas Chromatography	40 CFR 60.335(b)(9)(i)
ASTM D2622	1998	American Society for Testing and Materials	Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry	40 CFR 80.46(a)(1)
ASTM D2724	1987	American Society for Testing and Materials	Standard Test Method for Bonded, Fused, and Laminated Apparel Fabrics	49 CFR 238 Appendix B(a)(1)(ii)
ASTM D2777	1998	American Society for Testing and Materials	Standard Practice for Determination of Precision and Bias of Applicable Test Methods of Committee D-19 on Water	46 CFR 162.050-15(f)(1)
ASTM D2857	1970	American Society for	Standard Method of	21 CFR 177.2210(b)(3)

## Public Safety Standards of the United States

		Testing and Materials	Test for Dilute Solution Viscosity of Polymers	
ASTM D2879	1997	American Society for Testing and Materials	Standard Test Method for Vapor Pressure-Temperature Relationship and Initial Decomposition Temperature of Liquids by Isoteniscope	40 CFR 60.116b(e)(3)(ii)
ASTM D2908	1974	American Society for Testing and Materials	Standard Practice for Measuring Volatile Organic Matter in Water by Aqueous-Injection Gas Chromatography	40 CFR 60.564(j)(1)
ASTM D2908	1991	American Society for Testing and Materials	Standard Practice for Measuring Volatile Organic Matter in Water by Aqueous-Injection Gas Chromatography	40 CFR 60.564(j)(1)
ASTM D2986	1995	American Society for Testing and Materials	Standard Method for Evaluation of Air, Assay Media by the Monodisperse DOP (Diethyl Phthalate) Smoke Test	40 CFR 86.1310-2007(b)(7)(i)(A)
ASTM D3120	1996	American Society for Testing and Materials	Standard Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry	40 CFR 80.46(a)(3)(iii)
ASTM D3168	1973	American Society for Testing and Materials	Standard Recommended Practices for Qualitative Identification of Polymers in Emulsion Paints	21 CFR 200.946
ASTM D3173	1987	American Society for Testing and Materials	Standard Test Method for Moisture in the Analysis Sample of Coal and Coke	40 CFR 60, Appendix A-7
ASTM D3176	1989	American Society for Testing and Materials	Standard Practice for Ultimate Analysis of Coal and Coke	40 CFR 76.15(a)(1)
ASTM D3177	1989	American Society for Testing and Materials	Standard Test Method for Total Sulfur in the Analysis Sample of Coal and Coke	40 CFR 60, Appendix A-7

## Public Safety Standards of the United States

ASTM D3178	1989	American Society for Testing and Materials	Standard Test Method for Carbon and Hydrogen in the Analysis Sample of Coal and Coke	40 CFR 60.45(f)(5)(i)
ASTM D3236	1988	American Society for Testing and Materials	Standard Test Method for Apparent Viscosity of Hot Metal Adhesives and Coating Materials	21 CFR 177.1520(b)
ASTM D3246	1996	American Society for Testing and Materials	Standard Test Method for Sulfur in Petroleum Gas by Oxidative Microcoulometry	40 CFR 60.335(b)(10)(ii)
ASTM D3286	1996	American Society for Testing and Materials	Standard Test Method for Gross Calorific Value of Coal and Coke by the Isoperibol Bomb Calorimeter	40 CFR 60.17
ASTM D3371	1995	American Society for Testing and Materials	Standard Test Method for Nitriles in Aqueous Solution by Gas-Liquid Chromatography	40 CFR 136.3(a) Table IF
ASTM D3454	1997	American Society for Testing and Materials	Standard Test Method for Radium-226 in Water	40 CFR 136.3(a) Table IE
ASTM D3559 (pdf) ASTM D3559 (html)	2003	American Society for Testing and Materials	Standard Test Methods for Lead in Water	40 CFR 136
ASTM D3588	1998	American Society for Testing and Materials	Standard Practice for Calculating Heat Value, Compressibility Factor, and Relative Density (Specific Gravity) of Gaseous Fuels	40 CFR 75, Appendix F
ASTM D3695	1995	American Society for Testing and Materials	Standard Test Method for Volatile Alcohols in Water by Direct Aqueous-Injection Gas Chromatography	40 CFR 136.3(a) Table IF
ASTM D3697	1992	American Society for Testing and Materials	Standard Test Method for Antimony in Water	21 CFR 165.110(b)(4)(iii)(E)(1)(iv)
ASTM D4057	1995	American Society for Testing and Materials	Standard Practice for Manual Sampling of Petroleum and Petroleum Products	40 CFR 80.8(a)
ASTM D4084	1994	American Society for Testing and Materials	Standard Test Method for Analysis of Hydrogen Sulfide in Gaseous Fuels (Lead	40 CFR 60.334(h)(1)

## Public Safety Standards of the United States

ASTM D4177	1995	American Society for Testing and Materials	Acetate Reaction Rate Method) Standard Practice for Automatic Sampling of Petroleum and Petroleum Products	40 CFR 80.330(b)(2)
ASTM D4239	1997	American Society for Testing and Materials	Standard Test Methods for Sulfur in the Analysis Sample of Coal and Coke Using High Temperature Tube Furnace Combustion Methods	40 CFR 60, Appendix A-7
ASTM D4268	1993	American Society for Testing and Materials	Standard Test Method for Testing Fiber Ropes	33 CFR 164.74(a)(3)(i)
ASTM D4294	1998	American Society for Testing and Materials	Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy-Dispersive X-Ray Fluorescence Spectrometry	40 CFR 75, Appendix A, Section 2.1.1.1(c)
ASTM D4329	1999	American Society for Testing and Materials	Standard Practice for Fluorescent UV Exposure of Plastics	49 CFR 571.106
ASTM D4420	1994	American Society for Testing and Materials	Standard Test Method for Determination of Aromatics in Finished Gasoline by Gas Chromatography	40 CFR 61.67(h)(1)
ASTM D4442	1992	American Society for Testing and Materials	Standard Test Method for Direct Moisture Content Measurement of Wood and Wood-Based Materials	40 CFR 60, Appendix A-8
ASTM D4444	1992	American Society for Testing and Materials	Standard Test Method for Use and Calibration of Hand-Held Moisture Meters	40 CFR 60, Appendix A-8
ASTM D4763	1988	American Society for Testing and Materials	Standard Practice for Identification of Chemicals in Water by Fluorescence Spectroscopy	40 CFR 136.3(a) Table IF
ASTM D4809	1995	American Society for Testing and Materials	Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method)	40 CFR 61.245(e)(3)

## Public Safety Standards of the United States

ASTM D4891 (pdf) ASTM D4891 (html)	1989	American Society for Testing and Materials	Standard Test Method for Heating Value of Gases in Natural Gas Range by Stolchiometric Combustion	40 CFR 75, Appendix F, Section 5.5.2
ASTM D4986	1998	American Society for Testing and Materials	Standard Test Method for Horizontal Buming Characteristics of Cellular Polymeric Materials	46 CFR 32.57-10(d)(7-a)
ASTM D5257	1997	American Society for Testing and Materials	Standard Test Method for Dissolved Hexavalent Chromium in Water by Ion Chromatography	40 CFR 136.3(a)
ASTM D5373	1993	American Society for Testing and Materials	Standard Methods for Instrumental Determination of Carbon, Hydrogen, and Nitrogen in Laboratory Samples of Coal and Coke	40 CFR 75, Appendix G
ASTM D5392	1993	American Society for Testing and Materials	Standard Test Method for Isolation and Enumeration of Escherichia Coli in Water by the Two-Step Membrane Filter Procedure	40 CFR 136.3(a) Table IH
ASTM D5489	1996	American Society for Testing and Materials	Standard Guide for Care Symbols for Care Instructions on Textile Products	16 CFR 423.8(g)
ASTM D5673	1996	American Society for Testing and Materials	Standard Test Method for Elements in Water by Inductively Coupled Plasma	40 CFR 444.12(b)(1)
ASTM D5865	1998	American Society for Testing and Materials	Standard Test Method for Gross Calorific Value of Coal and Coke	40 CFR 60.45(f)(5)(ii)
ASTM D6216	1998	American Society for Testing and Materials	Standard Practice for Opacity Monitor Manufacturers to Certify Conformance with Design and Performance Specifications	40 CFR 60, Appendix B
ASTM D6228	1998	American Society for Testing and Materials	Standard Test Method for Determination of Sulfur Compounds in	40 CFR 60.334(h)(1)

## Public Safety Standards of the United States

			Natural Gas and Gaseous Fuels by Gas Chromatography and Flame Photometric Detection	
ASTM D6420	1999	American Society for Testing and Materials	Standard Test Method for Determination of Gaseous Organic Compounds by Direct Interface Gas Chromatography-Mass Spectrometry	40 CFR 63.5850(e)(4)
ASTM D6503	1999	American Society for Testing and Materials	Standard Test Method for Enterococci in Water Using Enterolert	40 CFR 136.3(a) Table IH
ASTM D6522	2000	American Society for Testing and Materials	Standard Test Method for Determination of Nitrogen Oxides, Carbon Monoxide, and Oxygen Concentrations in Emissions from Natural Gas-Fired Reciprocating Engines, Combustion Turbines, Boilers, and Process Heaters Using Portable Analyzers	40 CFR 60.335(a)(2)
ASTM E11	1970	American Society for Testing and Materials	Standard Specification for Wire Cloth and Sieves for Testing Purposes	33 CFR 159.4
ASTM E11	1995	American Society for Testing and Materials	Standard Specification for Wire Cloth and Sieves for Testing Purposes	33 CFR 159.125
ASTM E23	1982	American Society for Testing and Materials	Standard Test Methods for Notched Bar Impact Testing of Metallic Materials	46 CFR 56.50-105(a)(1)(ii)
ASTM E23	1993	American Society for Testing and Materials	Standard Test Method for Notched Bar Impact Testing of Metallic Materials	46 CFR 56.50-105(a)(1)(ii)
ASTM E29	1967	American Society for Testing and Materials	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications	40 CFR 86.609-98
ASTM E29	1990	American Society for Testing and Materials	Standard Practice for Using Significant Digits	40 CFR 86.000-28(a)(4)(iii)

## Public Safety Standards of the United States

			in Test Data to Determine Conformance with Specifications	
ASTM E29 (pdf) ASTM E29 (html)	2002	American Society for Testing and Materials	Standard Specification for Diesel Fuel Oils	40 CFR 1065.701 Table 1
ASTM E72	1980	American Society for Testing and Materials	Standard Test Methods of Conducting Strength Tests of Panels for Building Construction	30 CFR 75.333(e)(1)(i)
ASTM E84 (pdf) ASTM E84 (html)	2001	American Society for Testing and Materials	Standard Test Method for Surface Burning Characteristics of Building Materials	24 CFR 3280.203(a)
ASTM E96	1995	American Society for Testing and Materials	Standard Test Methods for Water Vapor Transmission of Materials	24 CFR 3280.504(a)
ASTM E119 (pdf) ASTM E119 (html)	2000	American Society for Testing and Materials	Standard Test Methods for Fire Tests of Building Construction and Materials	49 CFR 238 Appendix B(a)(1)(v)
ASTM E145	1994	American Society for Testing and Materials	Standard Specification for Gravity-Convection and Forced-Ventilation Ovens	40 CFR 63.14
ASTM E145	1994	American Society for Testing and Materials	Standard Specification for Gravity-Convection and Forced-Ventilation Ovens	40 CFR 63.4581
ASTM E154	1968	American Society for Testing and Materials	Materials for Use as Vapor Barriers Under Concrete Slabs and as Ground Cover in Crawl Spaces	24 CFR 200, Subpart S
ASTM E163	1963	American Society for Testing and Materials	Methods for Fire Tests of Window Assemblies	24 CFR 200, Subpart S
ASTM E168	1967	American Society for Testing and Materials	Standard Practices for General Techniques of Infrared Quantitative Analysis	40 CFR 60.485(d)(1)
ASTM E168	1988	American Society for Testing and Materials	Standard Practices for General Techniques of Infrared Quantitative Analysis	40 CFR 264.1063(d)(1)
ASTM E169	1987	American Society for Testing and Materials	Standard Practices for General Techniques of Ultraviolet-Visible Quantitative Analysis	40 CFR 264.1063(d)(1)

## Public Safety Standards of the United States

ASTM E185	1982	American Society for Testing and Materials	Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels	10 CFR 50 App. H, I
ASTM E258	1967	American Society for Testing and Materials	Standard Test Method for Total Nitrogen Inorganic Material by Modified Kjeldahl Method	40 CFR 761.71(b)(2)(vi)
ASTM E260	1996	American Society for Testing and Materials	Standard Practice for Packed Column Gas Chromatography	40 CFR 60.485(d)(1)
ASTM E283	1991	American Society for Testing and Materials	Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors	10 CFR 434.402.2
ASTM E298	1968	American Society for Testing and Materials	Standard Methods for Assay of Organic Peroxides	49 CFR 571.116 S6.11.3(a)
ASTM E408	1971	American Society for Testing and Materials	Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques	16 CFR 460.5(b)
ASTM E424	1971	American Society for Testing and Materials	Test for Solar Energy Transmittance and Reflectance (Terrestrial) of Sheet Materials	24 CFR 200, Subpart S
ASTM E606	1980	American Society for Testing and Materials	Standard Recommended Practice for Constant-Amplitude Low-Cycle Fatigue Testing	24 CFR 200.946
ASTM E681	1985	American Society for Testing and Materials	Standard Test Method for Concentration Limits of Flammability of Chemicals	49 CFR 173.115(a)(2)
ASTM E695	1979	American Society for Testing and Materials	Standard Method of Measuring Relative Resistance of Wall, Floor and Roof Construction to Impact Loading	24 CFR 200.946(a)(1) (vii)
ASTM E711	1987	American Society for Testing and Materials	Standard Test Method for Gross Calorific Value of Refuse-Derived Fuel by the	40 CFR 63, Subpart DDDDD, Table 6

## Public Safety Standards of the United States

ASTM E773	1997	American Society for Testing and Materials	Bomb Calorimeter Standard Test Method for Seal Durability of Sealed Insulating Glass Units	4 CFR 3280.403(d)(2)
ASTM E774	1997	American Society for Testing and Materials	Standard Specifications for Sealed Insulating Glass Units	24 CFR 3280.403(d)(2)
ASTM E775	1987	American Society for Testing and Materials	Standard Test Methods for Total Sulfur in the Analysis Sample of Refuse-Derived Fuel	40 CFR 49.123(e)
ASTM E776	1987	American Society for Testing and Materials	Standard Test Method for Forms of Chlorine in Refuse-Derived Fuel	40 CFR 63, Subpart DDDDD, Table 6
ASTM E885	1988	American Society for Testing and Materials	Standard Test Method for Analyses of Metals in Refuse-Derived Fuel by Atomic Absorption Spectroscopy	40 CFR 63, Subpart DDDDD, Table 6
ASTM E1333	1996	American Society for Testing and Materials	Standard Test Method for Determining Formaldehyde Levels from Wood Products Under Defined Test Conditions Using a Large Chamber	24 CFR 3280.406(b)
ASTM E1337	1990	American Society for Testing and Materials	Standard Test Method for Determining Longitudinal Peak Braking Coefficient of Paved Surfaces Using Standard Reference Test Tire	49 CFR 571.105 S6.9.2(a)
ASTM E1590 (pdf) ASTM E1590 (html)	2001	American Society for Testing and Materials	Standard Test Method for Fire Testing of Mattresses	49 CFR 238 Appendix B(a)(1)(xi)
ASTM E1625	1994	American Society for Testing and Materials	Standard Test Method for Determining Biodegradability of Organic Chemicals in Semi-Continuous Activated Sludge	40 CFR 799.5085
ASTM E1719	1997	American Society for Testing and Materials	Standard Test Method for Vapor Pressure of Liquids by Ebulliometry	40 CFR 799.5085
ASTM F462	1979	American Society for Testing and Materials	Slip-Resistant Bathing Facilities	24 CFR 200, Subpart S

## Public Safety Standards of the United States

ASTM F476	1984	American Society for Testing and Materials	Standard Test Method for Security of Swinging Door Assemblies	24 CFR 200.949(a)(1)(ix)
ASTM F478	1992	American Society for Testing and Materials	Standard Specification for In-Service Care of Insulating Line Hose and Covers	29 CFR 1910.137(b)(2)(ix)
ASTM F631	1980	American Society for Testing and Materials	Standard Guide for Collecting Skimmer Performance Data in Controlled Environments	33 CFR 156.40
ASTM F631	1993	American Society for Testing and Materials	Standard Guide for Collecting Skimmer Performance Data in Controlled Environments	33 CFR 154 Appendix C
ASTM F682	1982	American Society for Testing and Materials	Standard Specification for Wrought Carbon Steel Sleeve-Type Pipe Couplings	46 CFR 56.01-2
ASTM F715	1981	American Society for Testing and Materials	Standard Test Methods for Coated Fabrics Used for Oil Spill Control and Storage	33 CFR 154.106
ASTM F715	1995	American Society for Testing and Materials	Standard Test Methods for Coated Fabrics Used for Oil Spill Control and Storage	33 CFR 155, Appendix B, 2.4
ASTM F722	1982	American Society for Testing and Materials	Standard Specification for Welded Joints for Shipboard Piping Systems	33 CFR 155.140
ASTM F808	1983	American Society for Testing and Materials	Guide for Collecting Skimmer Performance Data in Uncontrolled Environments	33 CFR 154, Appendix C
ASTM F808	1983	American Society for Testing and Materials	Guide for Collecting Skimmer Performance Data in Uncontrolled Environments	33 CFR 154, Appendix C, 6.3.1
ASTM F1003	1986	American Society for Testing and Materials	Standard Specification for Searchlights on Motor Lifeboats	46 CFR 199.175(a)(28)(i)
ASTM F1006	1986	American Society for Testing and Materials	Standard Specification for Entrainment Separators for Use in Marine Piping Applications	46 CFR 56.60-1(b)

## Public Safety Standards of the United States

ASTM F1007	1986	American Society for Testing and Materials	Standard Specification for Pipe-Line Expansion Joints of the Packed Slip Type for Marine Application	46 CFR 56.60-1(b)
ASTM F1014	1992	American Society for Testing and Materials	Standard Specification for Flashlights on Vessels	46 CFR 35.30-20(c)(3)
ASTM F1020	1986	American Society for Testing and Materials	Standard Specification for Line-Blind Valves for Marine Applications	46 CFR 56.60-1(b)
ASTM F1120	1987	American Society for Testing and Materials	Standard Specification for Circular Metallic Bellows Type Expansion Joints for Piping Applications	46 CFR 56.60-1(b)
ASTM F1121	1987	American Society for Testing and Materials	Standard Specification for International Shore Connections for Marine Fire Applications	33 CFR 126.15(a)(5)
ASTM F1122	1987	American Society for Testing and Materials	Standard Specification for Quick Disconnect Couplings	33 CFR 154.500(d)(3)
ASTM F1123	1987	American Society for Testing and Materials	Standard Specification for Non-Metallic Expansion Joints	46 CFR 56.60-1(b)
ASTM F1139	1988	American Society for Testing and Materials	Standard Specification for Steam Traps and Drains	46 CFR 56.60-1(b)
ASTM F1155	1998	American Society for Testing and Materials	Standard Practice for Selection and Application of Piping System Materials	33 CFR 154
ASTM F1172	1988	American Society for Testing and Materials	Fuel Oil Meters of the Volumetric Positive Displacement Type	46 CFR 56.60-1(b)
ASTM F1173	1995	American Society for Testing and Materials	Standard Specification for Thermosetting Resin Fiberglass Pipe and Fittings to be Used for Marine Applications	46 CFR 56.60-1(b)
ASTM F1196	1994	American Society for Testing and Materials	Standard Specification for Sliding Watertight Door Assemblies	46 CFR 170.270(c)(1)
ASTM F1197	1989	American Society for Testing and Materials	Standard Specification for Sliding Watertight Door Control Systems	46 CFR 174.100(e)(2)
ASTM F1199	1988	American Society for Testing and Materials	Cast (All Temperatures and Pressures) and Welded Pipe Line Strainers (150 psig and	46 CFR 56.60-1(b)

## Public Safety Standards of the United States

ASTM F1200	1988	American Society for Testing and Materials	150 Degrees F Maximum) Standard Specification for Fabricated (Welded) Pipe Line Strainers (Above 150 psig and 150°F)	46 CFR 56.60-1(b)
ASTM F1201	1988	American Society for Testing and Materials	Standard Specification for Fluid Conditioner Fittings in Piping Applications Above Zero Degrees F	46 CFR 56.60-1(b)
ASTM F1271	1990	American Society for Testing and Materials	Standard Specification for Spill Valves for Use in Marine Tank Liquid Overpressure Protection Applications	46 CFR 39.20-9(c)(1)
ASTM F1273	1991	American Society for Testing and Materials	Standard Specification for Tank Vent Flame Arresters	46 CFR 32.20-10
ASTM F1292	2004	American Society for Testing and Materials	Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment	36 CFR 1191, App B, 105.2.3
ASTM F1321	1992	American Society for Testing and Materials	Standard Guide for Conducting a Stability Test (Lightweight Survey and Inclining Experiment) to Determine Light Ship Displacement and Centers of Gravity of a Vessel	46 CFR 28.535(d)
ASTM F1323	1998	American Society for Testing and Materials	Standard Specification for Shipboard Incinerators	46 CFR 63.25-9
ASTM F1471	1993	American Society for Testing and Materials	Standard Test Method for Air Cleaning Performance of a High-Efficiency Particulate Air-Filter System	40 CFR 86.1310-2007(b)(1)(iv)(B)
ASTM F1546	1996	American Society for Testing and Materials	Standard Specification for Firehose Nozzles	46 CFR 162.027-3(a)
ASTM F1548	1994	American Society for Testing and Materials	Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications	46 CFR 56.30-35(a)
ASTM F1951	1999	American Society for	Standard Specification	36 CFR 1191, App B,

## Public Safety Standards of the United States

		Testing and Materials	for Determination of Accessibility of Surface Systems Under and Around Playground Equipment	1008.2.6.1
ASTM F2412 (pdf)	2005	American Society for Testing and Materials	Standard Test Methods for Foot Protection	29 CFR 1910
ASTM F2412 (html)				
ASTM F2412 (svg)				
ASTM F2413 (pdf)	2005	American Society for Testing and Materials	Performance Requirements for Protective Footwear	29 CFR 1910
ASTM F2413 (html)				
ASTM G21	1990	American Society for Testing and Materials	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi	7 CFR 1755.910(d)(5)(iv)
ASTM G23	1969	American Society for Testing and Materials	Standard Practice for Operating Light Exposure Apparatus (Carbon Arc Type) With and Without Water for Exposure of Nonmetallic Materials	49 CFR 571.209 S5.1(e)
ASTM G26	1970	American Society for Testing and Materials	Standard Recommended Practice for Light- and Water-Exposure Apparatus (Xenon-Arc Type) for Exposure of Non-metallic Materials	16 CFR 1201.4(b)(3)(ii)
ASTM G151	1997	American Society for Testing and Materials	Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources	49 CFR 571.106 S12.7(b)
ASTM G154	2000	American Society for Testing and Materials	Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials	49 CFR 571.106 S12.7(b)
ATAA 300	1996	Air Transport Association of America	Packaging of Airline Supplies, Revision 19	49 CFR 171.7
AWPA A1	1991	American Wood Preservers Association	Standard Methods for Analysis of Creosote and Oil-Type Preservatives	7 CFR 1728.201(i)(1)(i)

## Public Safety Standards of the United States

AWPA A2	1991	American Wood Preservers Association	Standard Methods for Analysis of Waterborne Preservatives and Fire-Retardant Formulations	7 CFR 1728.201(i)(1)(iii) (A)
AWPA A3	1991	American Wood Preservers Association	Standard Methods for Determining Penetration of Preservatives and Fire Retardants	7 CFR 1728.201(k)(3)
AWPA A5	1991	American Wood Preservers Association	Standard Methods for Analysis of Oil-Borne Preservatives	7 CFR 1728.202(g)(1)(v) (B)
AWPA A6	1989	American Wood Preservers Association	Method for the Determination of Oil-Type Preservatives and Water in Wood	7 CFR 1728.202(g)(1)(v) (A)
AWPA A7	1975	American Wood Preservers Association	Standard Wet Ashing Procedure for Preparing Wood for Chemical Analysis	7 CFR 1728.202(g)(1)(v) (D)
AWPA A9	1990	American Wood Preservers Association	Standard Method for Analysis of Treated Wood and Treating Solutions by X-ray Spectroscopy	7 CFR 1728.202(g)(1)(v) (C)
AWPA A11	1983	American Wood Preservers Association	Standard Method for Analysis of Treated Wood and Treating Solutions by Atomic Absorption Spectroscopy	7 CFR 1728.201(i)(1)(iii) (B)
AWPA M3	1981	American Wood Preservers Association	Standard Quality Control Procedures for Wood Preserving Plants	7 CFR 1728.202(f)(1)
AWPA P1	1991	American Wood Preservers Association	Standard for Coal Tar Creosote for Land and Fresh Water and Marine (Coastal) Water Use	7 CFR 1728.201(i)(1)(i)
AWPA P5	1991	American Wood Preservers Association	Standard for Waterborne Preservative	7 CFR 1728.201(i)(1)(iii) (A)
AWPA P8	1991	American Wood Preservers Association	Standard for Oil-Borne Preservatives	7 CFR 1728.201(i)(1)(iv)
AWPA P9	1991	American Wood Preservers Association	Standard for Solvents and Formulations for Organic Preservative Systems	7 CFR 1728.201(i)(1)(iv)
AWS B3.0	1977	American Welding	Standard Qualification	49 CFR 178.356-2(e)

## Public Safety Standards of the United States

		Society	Procedure	
AWS D1.1	2000	American Welding Society	Structural Welding Code—Steel	30 CFR 250.901(a)(20)
BHMA A156.10	1999	Builders Hardware Manufacturers Association	Power Operated Pedestrian Doors	36 CFR 1191, App B, 105.2.1
BHMA A156.19	2002	Builders Hardware Manufacturers Association	Power Assist and Low Energy Power Operated Doors	36 CFR 1191, App B, 408.3.2.1
BOCA	1993	Building Officials and Code Administrators International	Mechanical Code	24 CFR 200.925c(a)(1)(i)
BOCA	1993	Building Officials and Code Administrators International	Plumbing Code	24 CFR 200.925c(a)(1)(i)
BSI EN-13000 (pdf) BSI EN-13000 (html)	2004	British Standards Institute	Cranes—Safety—Mobile Cranes	29 CFR 1926
BSI EN-14439 (pdf) BSI EN-14439 (html)	2006	British Standards Institute	Cranes—Safety—Tower Cranes	29 CFR 1926
CEC Test Method	2004	California Energy Commission	Calculating the Energy Efficiency of Single-Voltage External Ac-Dc and Ac-Ac Power Supplies	10 CFR 430 Subpart B
CABO	1992	Council of American Building Officials	One and Two Family Dwelling Code	24 CFR 200.926b(c)
CABO	1993	Council of American Building Officials	One and Two Family Dwelling Code with Errata Package and 1993 Amendments	24 CFR 200.926(d)(1)(ii) ((B)(2)(ii))
CFTA	1977	Cosmetic, Toiletry, and Fragrance Association	Cosmetic Ingredient Dictionary	21 CFR 701.3(c)(2)(i)
CGA C-5	1991	Compressed Gas Association	Cylinder Service Life—Seamless Steel High Pressure Cylinders	49 CFR 173.302a(b)(3)(i) (A)
CGA C-8	1985	Compressed Gas Association	Standard for Requalification of DOT-3HT Cylinders	49 CFR 180.205(f)(1)
CGA C-11	2001	Compressed Gas Association	Recommended Practice for Inspection of Compressed Gas Cylinders at Time of Manufacture	49 CFR 178.35(g)
CGA C-12	1994	Compressed Gas Association	Qualification Procedure for Acetylene Cylinder	49 CFR 173.303(a)

## Public Safety Standards of the United States

			Design	
CGA C-13	2000	Compressed Gas Association	Guidelines for Periodic Visual Inspection and Requalification of Acetylene Cylinders	49 CFR 173.303(e)
CGA G-1	2009	Compressed Gas Association	Acetylene	29 CFR 1910.102(a)
CGA G-2.2	1985	Compressed Gas Association	Guideline Method for Determining Minimum of 0.2% Water in Anhydrous Ammonia	49 CFR 173.315(l)(5)
CGA G-4.1	1985	Compressed Gas Association	Cleaning Equipment for Oxygen Service	49 CFR 178.338-15
CGA P-1	1965	Compressed Gas Association	Safe Handling of Compressed Gases	29 CFR 1910.101(b)
CGA P-20	2003	Compressed Gas Association	Standard for the Classification of Toxic Gas Mixtures	49 CFR 173.115
CGA S-1.1	2005	Compressed Gas Association	Pressure Relief Device Standards	49 CFR 173.301(c)
CGA S-1.2	1980	Compressed Gas Association	Safety Release Device Standard--Cargo and Portable Tanks for Compressed Gases	49 CFR 178.277(e)(4)(iv)
CGA S-7 (pdf) CGA S-7 (html)	2005	Compressed Gas Association	Method for Selecting Pressure Relief Devices for Compressed Gas Mixtures in Cylinders	49 CFR 173.301(c)
CGA TB-2	1980	Compressed Gas Association	Guidelines for Inspection and Repair of MC-330 and MC-331 Cargo Tanks	49 CFR 180.407(g)(3)
CGA TB-25	2008	Compressed Gas Association	Design Considerations for Tube Trailers	49 CFR 173.301
CGSB 43.147	2005	Canadian General Standards Board	Construction, Modification, Qualification, Maintenance, and Selection and Use of Means of Containment for the Handling, Offering for Transport, or Transportation of Dangerous Goods by Rail	49 CFR 171.12
CGSB 43.147	2005	Office des Normes Generales du Canada	Construction, Modification, Qualification, Entretien, Selection Et Utilisation	49 CFR 171.12

## Public Safety Standards of the United States

			Des Contenants Pour La Manutention, La Demande De Transport Ou La Transport Des Marchandises Dangereuses Par Chemin De Fer	
CI 57	2009	Chlorine Institute	Emergency Shut-Off Systems for Bulk Transfer of Chlorine	49 CFR 177.840(u)
CI 101-7	1993	Chlorine Institute	Excess Flow Valve with Removable Seat	49 CFR 178.276(c)(7)(i)
CI 104-9	2002	Chlorine Institute	Standard Chlorine Angle Valve Assembly	49 CFR 178.337-9(b)(8)
CI 106-6	1993	Chlorine Institute	Excess Flow Valve with Removable Baskets	49 CFR 178.276(c)(7)(ii)
CI 166	2002	Chlorine Institute	Angle Valve Guidelines for Chlorine Bulk Transportation	49 CFR 178.337-9(b)(8)
CI H50155	1996	Chlorine Institute	Pressure Relief Device for Chlorine Service	49 CFR 173.315(i)(13)
CI H51970	1996	Chlorine Institute	Safety Valve for Chlorine Service	49 CFR 173.315(i)(13)
CI	2009	Chlorine Institute	Chlorine Institute Emergency Kit A for 100-lb. and 150-lb. Chlorine Cylinders	49 CFR 173.3(e)(1)
CI	2009	Chlorine Institute	Chlorine Institute Emergency Kit B for Chlorine Ton Containers	49 CFR 173.3(e)(1)
CIE 15	2004	International Commission on Illumination	Technical Report: Colorimetry, 3rd edition	10 CFR 430 Subpart B, App. R, 4.1.1
CIE 15A (xls)	2004	International Commission on Illumination	Supplementary Spectra	10 CFR 430 Subpart B, App. R, 4.1.1
CIE 15B (xls)	2004	International Commission on Illumination	Supplementary Tables	10 CFR 430 Subpart B, App. R, 4.1.1
CRA A-20	1986	Com Refiners Association	Analysis for Starch in Corn	7 CFR 801.7(a)(2)
CSA C390	1993	Canadian Standards Association	Energy Efficiency Test Methods for Three-Phase Induction Motors	10 CFR 431.19(b)(4)
CTIOA R8-103-62	1969	Ceramic Tile Institute of America	Standard Specifications for the	24 CFR 200, Subpart S

## Public Safety Standards of the United States

			Installation of Tile Lined Shower Receptors	
CSVA	2004	Commercial Vehicle Safety Alliance	North American Standard Out-of-Service Criteria and Level VI Inspection Procedures and Out-of-Service Criteria for Commercial Highway Vehicles	49 CFR 385.415(b)(1)
EI IP-501	2005	Energy Institute	Determination of aluminum, silicon, vanadium, nickel, iron, sodium, calcium, zinc and phosphorus in residual fuel oil	40 CFR 1065.705 Table 1
FGMA	1990	Flat Glass Marketing Association	Glazing Manual	24 CFR 200, Subpart S
GLI METHOD 2	2009	Great Lakes Instruments	Turbidity	40 CFR 141.74(a)(1)
GPA 2261	2000	Gas Producers Association	Analysis of Natural Gas and Similar Gaseous Mixtures by Gas Chromatography	40 CFR 75, Appendix F, Section 5.5.2
GPA 2261	2000	Gas Processors Association	Analysis of Natural Gas and Similar Gaseous Mixtures by Gas Chromatography	40 CFR 75, Appendix F
GPA 2377	1986	Gas Processors Association	Test for Hydrogen Sulfide and Carbon Dioxide in Natural Gas Using Length of Stain Tubes	40 CFR 60.334(h)(1)
GRI 02-0057	2002	Gas Research Institute	Internal Corrosion Direct Assessment of Gas Transmission Pipelines Methodology	49 CFR 192.927(c)(2)
HACH 8000	2007	Hach Chemical Company	Oxygen Demand, Chemical Using Reactor Digestion Method	40 CFR 136.3(a)
HACH 8008	2007	Hach Chemical Company	1, 10--Phenanthroline Method Using FerroVer Iron Reagent for Water	40 CFR 136.3(a)
HACH 8009	2007	Hach Chemical Company	Zincon Method for Zinc, Hatch Handbook of Water Analysis	40 CFR 444.12(b)(1)
HACH 8034	2007	Hach Chemical Company	Periodate Oxidation Method for Manganese	40 CFR 136.3(a)
HACH 8507	2007	Hach Chemical	Nitrogen Nitrite--Low	40 CFR 136.3(a)

## Public Safety Standards of the United States

		Company	Range, Diazotization Method for Water and Wastewater	
HI BTS-2000	2007	Hydronics Institute	Method to Determine Efficiency of Commercial Space Heating Boilers	10 CFR 431.86
HPMA HP-SG-96	1996	Hardwood Plywood Manufacturers Association	Structural Design Guide for Hardwood Plywood Wall Panels	24 CFR 3280.304(b)(1)
IAPMO PS-2	1989	International Association of Plumbing and Mechanical Officials	Material and Property Standard for Cast Brass and Tubing P-Traps	24 CFR 3280.604(b)(2)
IAPMO PS-5	1984	International Association of Plumbing and Mechanical Officials	Material and Property Standard for Special Cast Iron Fittings	24 CFR 3280.604(b)(2)
IAPMO PS-9	1984	International Association of Plumbing and Mechanical Officials	Material and Property Standard for Diversion Tees and Twin Waste Elbow	24 CFR 3280.604(b)(2)
IAPMO PS-14	1989	International Association of Plumbing and Mechanical Officials	Material and Property Standard for Flexible Metallic Water Connectors	24 CFR 3280.604(b)(2)
IAPMO PS-23	1989	International Association of Plumbing and Mechanical Officials	Material and Property Standard for Dishwasher Drain Airgaps	24 CFR 3280.604(b)(2)
IAPMO PS-31	1977	International Association of Plumbing and Mechanical Officials	Material and Property Standard for Backflow Prevention Devices	24 CFR 3280.604(b)(2)
ICAO 9284	2011	International Civil Aviation Organization	Technical Instructions for the Safe Transport of Dangerous Goods by Air	49 CFR 171.7
ICAO Annex 2	1990	International Civil Aviation Organization	Convention on International Civil Aviation, Rules of the Air	14 CFR 135.3(a)(2)
ICAO Annex 16	2008	International Civil Aviation Organization	Environmental Protection, Volume II – Aircraft Engine Emissions	40 CFR 87.89
ICBO	1991	International Conference of Building Officials	Uniform Building Code (1991)	24 CFR 200.925c(a)(1)(iii)
ICBO	1991	International	Uniform Mechanical	24 CFR 200.925c(c)(3)

## Public Safety Standards of the United States

		Conference of Building Officials	Code (1991)	
ICEA S-87-640	2006	Insulated Cable Engineers Association	Standard for Optical Fiber Outside Plant Communications Cable	7 CFR 901(c)
ICEA S-110-717	2003	Insulated Cable Engineers Association	Standard for Optical Drop Cable	7 CFR 901(c)
ICS	1973	International Chamber of Shipping	Clean Seas Guide for Oil Tankers	33 CFR 157.23(b)
IEEE 45	2002	Institute of Electrical and Electronics Engineers	Recommended Practice for Electrical Installations on Shipboard	46 CFR 110.10-1
IEEE 112	2004	Institute of Electrical and Electronics Engineers	Test Procedure for Polyphase Induction Motors and Generators	10 CFR 431.15
IEEE 114	2010	Institute of Electrical and Electronics Engineers	IEEE Standard Test Procedure for Single-Phase Induction Motors	10 CFR 431
IEEE 1202 (pdf) IEEE 1202 (html)	1991	Institute of Electrical and Electronics Engineers	Standard for Flame Testing of Cables	46 CFR 111
IEEE C2	1997	Institute of Electrical and Electronics Engineers	National Electrical Safety Code	7 CFR 1755.503(d)(1)
IEEE C2	2007	Institute of Electrical and Electronics Engineers	National Electrical Safety Code (2007)	7 CFR 1755.901(b)
IEEE C37.14	2002	Institute of Electrical and Electronics Engineers	Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures	46 CFR 110.10-1
IEEE P730.1	1989	Institute of Electrical and Electronics Engineers	Standard for Software Quality Assurance Plans	7 CFR 1755.522(n)(2)
IESNA LM-45	2000	Illuminating Engineering Society of North America	Method for Electrical and Photometric Measurements of General Service Incandescent Filament Lamps	10 CFR 430 Subpart B
IME 22	2011	Institute of Makers of Explosives	Recommendations for the Safe Transportation of Detonators in a Vehicle with Certain Other Explosive Materials	30 CFR 57.6133(b)
IME	1940	Institute of Makers of	Safety in the Handling	29 CFR 1910.261(a)(4)

## Public Safety Standards of the United States

		Explosives	and Use of Explosives	(iii)
IMO IMDG.1	2006	International Maritime Organization	International Maritime Dangerous Goods Code (Volume 1)	49 CFR 172.519(f)
IMO IMDG.2	2006	International Maritime Organization	International Maritime Dangerous Goods Code (Volume 2)	49 CFR 172.519(f)
IMO ISPS	2003	International Maritime Organization	International Ship and Port Facility Security Code	33 CFR 101.410(a)
AG ENG	1965	Interstate Printers and Publishers, Inc.	Agriculture Engineering	29 CFR 570.71(b)
ISO 535	1991	International Organization for Standardization	Paper and Board—Determination of Water Absorptiveness--Cobb Method	49 CFR 178.516(b)(1)
ISO 1496-1	1990	International Organization for Standardization	Series 1 Freight Containers—Specification and Testing—Part 1, General Cargo Containers	49 CFR 173.411(b)(6)(iii)
ISO 1496-3	1995	International Organization for Standardization	Series 1 Freight Containers—Specification and Testing—Part 3, Tank containers for Liquids, Gases and Pressurized Dry Bulk	49 CFR 178.74(c)(5)(ii)
ISO 3807-2	2000	International Organization for Standardization	Cylinders for acetylene—Basic requirements—Part 2: Cylinders with fusible plugs	49 CFR 173.303(f)(1)
ISO 6406 (pdf) ISO 6406 (html)	2005	International Organization for Standardization	Seamless Steel Gas Cylinders—Inspection and Testing	49 CFR 180
ISO 7225	2005	International Organization for Standardization	Gas Cylinders—Precautionary Labels	49 CFR 178.71(r)(2)
ISO 7366	1999	International Organization for Standardization	Gas Cylinders—Refillable Seamless Aluminum Alloy Gas Cylinders--Design, Construction and Testing	49 CFR 178.71(h)
ISO 8115	1986	International Organization for Standardization	Cotton bales—Dimensions and density	49 CFR 171.7
ISO 9809-1	1999	International	Gas Cylinders--	49 CFR 178.71(g)(1)

## Public Safety Standards of the United States

		Organization for Standardization	Refillable Seamless Steel Gas Cylinders--Design, Construction and Testing--Part 1: Quenched and Tempered Steel Cylinders with Tensile Strength less than 1 100 MPa	
ISO 9809-2	2000	International Organization for Standardization	Gas Cylinders--Refillable Seamless Steel Gas Cylinders--Design, Construction and Testing--Part 2: Quenched and Tempered Steel Cylinders with Tensile Strength Greater than or Equal to 1 100 MPa	49 CFR 178.71(g)(2)
ISO 9809-3	2000	International Organization for Standardization	Gas Cylinders--Refillable Seamless Steel Gas Cylinders--Design, Construction and Testing--Part 3: Normalized Steel Cylinders	49 CFR 178.71(g)(3)
ISO 9978	1992	International Organization for Standardization	Sealed Radioactive Sources--Leak Test Methods	49 CFR 173.469(a)(4)(ii)
ISO 10297	1999	International Organization for Standardization	Gas cylinders--Refillable gas cylinder valves--Specification and type testing	49 CFR 173.301b(c)(1)
ISO 10461 (pdf) ISO 10461 (html)	2005	International Organization for Standardization	Seamless Aluminum Alloy Gas Cylinders--Inspection and Testing	49 CFR 180
ISO 10462 (pdf) ISO 10462 (html)	2005	International Organization for Standardization	Transportable Cylinders for Dissolved Acetylene	49 CFR 180
ISO 11114-1	1997	International Organization for Standardization	Transportable gas cylinders--Compatibility of cylinder and valve materials with gas contents--Part 1: Metallic materials	49 CFR 173.301b(a)(2)
ISO 11114-2	2000	International Organization for Standardization	Transportable gas cylinders--Compatibility of cylinder and valve materials with gas contents--Part 2: Non-metallic materials	49 CFR 173.301b(a)(2)

## Public Safety Standards of the United States

ISO 11117	1998	International Organization for Standardization	Gas cylinders--Valve protection caps and valve guards for industrial and medical gas cylinders--Design, construction and tests	49 CFR 173.301b(c)(2)(ii)
ISO 11118	1999	International Organization for Standardization	Gas cylinders--Non-refillable metallic gas cylinders--Specification and test methods	49 CFR 178.71(i)
ISO 11119-1	2002	International Organization for Standardization	Gas cylinders--Gas cylinders of composite construction--Specification and test methods--Part 1: Hoop-wrapped composite gas cylinders	49 CFR 171.7
ISO 11119-2	2002	International Organization for Standardization	Gas cylinders--Gas cylinders of composite construction--Specification and test methods--Part 2: Fully wrapped fibre reinforced composite gas cylinders with load-sharing metal liners	49 CFR 171.7
ISO 11119-3	2002	International Organization for Standardization	Gas cylinders of composite construction--Specification and test methods--Part 3: Fully wrapped fibre reinforced composite gas cylinders with non-load-sharing metallic or non-metallic liners	49 CFR 171.7
ISO 11120	1999	International Organization for Standardization	Gas cylinders--Refillable seamless steel tubes of water capacity between 150 L and 3000 L--Design, construction and testing	49 CFR 178.71(j)
ISO 11621	1997	International Organization for Standardization	Gas cylinders--Procedures for change of gas service	49 CFR 173.301b(a)(2)
ISO 11623 (pdf) ISO 11623 (html)	2002	International Organization for Standardization	Periodic Inspection and Testing of Composite Gas Cylinders	49 CFR 180
ISO 11660-1 (pdf) ISO 11660-1	2008	International Organization for	Cranes: Access, Guards and Restraints:	29 CFR 1926

## Public Safety Standards of the United States

		Standardization	General	
(html)				
ISO 11660-2 (pdf)	1994	International Organization for Standardization	Cranes: Access, Guards and Restraints: Mobile Cranes	29 CFR 1926
ISO 11660-2 (html)				
ISO 11660-3 (pdf)	2008	International Organization for Standardization	Cranes: Access, Guards and Restraints: Tower Cranes	29 CFR 1926
ISO 11660-3 (html)				
ISO 14230-4	2000	International Organization for Standardization	Road Vehicles—Diagnostic Systems	40 CFR 1048.110(g)(2)
ISO 18902 (pdf)	2001	International Organization for Standardization	Photographic Processed Films, Plates, and Papers	36 CFR 1237
ISO 18902 (html)				
ISO 18906 (pdf)	2000	International Organization for Standardization	Photographic Films—Specifications for Safety Film	36 CFR 1237
ISO 18906 (html)				
ITU-R M-493-11	2004	International Telecommunication Union	Digital Selective-calling System for Use in the Maritime Mobile Service, with Annexes 1 and 2	47 CFR 80.1101(c)(2)(ii)
ITU-R M-541-8	1997	International Telecommunication Union	Operational Procedures for the Use of Digital Selective-Calling Equipment in the Maritime Mobile Service	47 CFR 80.1101(c)(4)(iii)
ITU-R M-541-9	2004	International Telecommunication Union	Operational Procedures for the Use of Digital Selective-Calling Equipment in the Maritime Mobile Service	47 CFR 80.1101(c)(2)(iii)
ITU-R M-628-3	1994	International Telecommunication Union	Technical Characteristics for Search and Rescue Radar Transponders	47 CFR 80.1101(c)(6)(ii)
ITU-R M-632-3	1997	International Telecommunication Union	Transmission Characteristics of a Satellite Emergency Position Indicating Radio Beacon	47 CFR 80.1101(c)(11)(iii)
ITU-R M-633-3	2004	International Telecommunication Union	Transmission characteristics of a satellite emergency position-indicating radiobeacon system operating through a low polar-orbiting satellite system	47 CFR 80.1101(c)(5)(iii)
ITU-R M-1371-1	2001	International	Technical	47 CFR 80.1101(c)(12)(i)

## Public Safety Standards of the United States

		Telecommunication Union	Characteristics for a Universal Shipborne Automatic Identification System Using Time Division Multiple Access	
ITU-T E.161	2001	International Telecommunication Union	Arrangement of Digits, Letters and Symbols on Telephones and Other Devices that Can Be Used for Gaining Access to a Telephone Network	47 CFR 80.1101(b)(2)
ITU-T E.164.1	2008	International Telecommunication Union	Numbering Plan of the International Telephone Service	47 CFR 80.1101(b)(3)
LACHAT 10-204	2008	Lachat Instruments	Digestion and Distillation of Total Cyanide in Drinking and Wastewaters	40 CFR 136.3(a) Table IB
STEAM	1917	Commonwealth of Massachusetts	District Police Steam Boiler Rules	
MSS SP-44	1996	Manufacturers Standardization Society	Steel Pipe Line Flanges	46 CFR 56.01-2
MSS SP-75	2004	Manufacturers Standardization Society	Specification for High-Test Wrought Butt Welding Fittings	49 CFR 118(a)
NACE RP-0502	2002	National Association of Corrosion Engineers	Pipeline External Corrosion Direct Assessment Methodology	49 CFR 192.925(b)(3)
NACM	2003	National Association of Chain Manufacturers	Welded Steel Chain Specifications	49 CFR 393.104(e)(2)
NAS	1972	National Academy of Sciences	Food Chemicals Codex (1972)	21 CFR 701.3(c)(2)(iv)
NAS	1996	National Academy of Sciences	Food Chemicals Codex (1996)	21 CFR 184
NAS	2011	National Academy of Sciences	Prudent Practices in the Laboratory: Handling and Disposal of Chemicals	42 CFR 52b.12(c)(6)
NCASI 98-01	1998	National Council of the Paper Industry for Air and Stream Improvements	Chilled Impinger Method For Use At Wood Products Mills to Measure Formaldehyde, Methanol, and Phenol	40 CFR 63, Subpart DDDD
NCASII 94-03	2002	National Council of the Paper Industry for Air	Methanol in Process Liquids by Gas	40 CFR 63.457(c)(3)(ii)

## Public Safety Standards of the United States

		and Stream Improvements	Chromatography/Flame Ionization Detection	
NCASI A105	2001	National Council of the Paper Industry for Air and Stream Improvements	Impinger Source Sampling Method for Selected Aldehydes, Ketones, and Polar Compounds	40 CFR 63, Subpart DDDD
NCASI 99-02	2002	National Council of the Paper Industry for Air and Stream Improvements	Impinger/Canister Source Sampling Method For Selected HAPs and Other Compounds at Wood Products Facilities	40 CFR 63, Subpart DDDD
NCCA	2011	National Cotton Council of America	Specifications for Cotton Bale Packaging Material	7 CFR 1427.5(b)(10)
UCC	2002	National Conference of Commissioners on Uniform State Laws	2002 Official Text and Comments, Sections 8-102 and 8-103	17 CFR 270.17f-4(c)(1)
UCC	2002	National Conference of Commissioners on Uniform State Laws	2002 Official Text and Comments, Sections 8-501 through 8-511	17 CFR 270.17f-4(c)(1)
NCUTLO	1969	National Committee on Uniform Traffic Laws and Ordinances	Uniform Vehicle Code and Model Ordinance	41 CFR 50-204.75
NFPA 10 (pdf) NFPA 10 (html) NFPA 10 (svg)	2002	National Fire Protection Association	Standard for Portable Fire Extinguishers	29 CFR 1915
NFPA 11 (pdf) NFPA 11 (html)	2005	National Fire Protection Association	Standard for Foam	29 CFR 1915
NFPA 12 (pdf) NFPA 12 (html)	2005	National Fire Protection Association	Standard for Carbon Dioxide Extinguishing Systems	29 CFR 1915
NFPA 13	2002	National Fire Protection Association	Standard for the Installation of Sprinkler Systems	36 CFR 1234.12(i)
NFPA 25 (pdf) NFPA 25 (html)	2002	National Fire Protection Association	Standard for Water-Based Fire Protection Systems	29 CFR 1915
NFPA 30 (pdf) NFPA 30 (html)	2003	National Fire Protection Association	Flammable and Combustible Liquids Code	49 CFR 192
NFPA 54 (pdf) NFPA 54 (html) NFPA 54 (svg)	2002	National Fire Protection Association	National Fuel and Gas Code	24 CFR 3280
NFPA 58 (pdf) NFPA 58 (html)	2001	National Fire Protection Association	Standard for Liquefied Petroleum Gases	49 CFR 173
NFPA 58	2004	National Fire Protection	Standard for the	49 CFR 192.11(b)

## Public Safety Standards of the United States

		Association	Storage and Handling of Liquefied Petroleum Gases	
NFPA 59	2004	National Fire Protection Association	Standard for the Storage and Handling of Liquefied Petroleum Gases at Utility Gas Plants	49 CFR 192.11(b)
NFPA 72 (pdf) NFPA 72 (html) NFPA 72 (svg)	2002	National Fire Protection Association	National Fire Alarm Code	29 CFR 1915
NFPA 99	2005	National Fire Protection Association	Standard for Health Care Facilities	38 CFR 51.200(b)(4)
NFPA 101 (pdf) NFPA 101 (html)	2000	National Fire Protection Association	Life Safety Code	59 CFR 130
NFPA 704	2007	National Fire Protection Association	Standard System for the Identification of the Hazards of Materials for Emergency Response	6 CFR 27.204(a)(2)
NFPA DUST	1957	National Fire Protection Association	Report of Important Dust Explosions	
NFPA HOST	1953	National Fire Protection Association	Handling Hose and Ladders	
NFPA 70	2005	National Fire Protection Association	National Electrical Code	49 CFR 192.189(c)
NACHA	2005	National Automated Clearing House Association	A Complete Guide to the Rules Governing the ACH Network	45 CFR 162.920
ISS-MCB	2011	International Space Station Multilateral Coordination Board	International Docking Standard	1 Code of Intergalactic Regulations 32
NCRP 33	1968	National Council on Radiation Protection and Measurement	Medical X-ray and Gamma-Ray Protection for Energies Up to 10 MeV—Equipment Design and Use	42 CFR 37.43
NCRP 48	1976	National Council on Radiation Protection and Measurement	Medical Radiation Protection for Medical and Allied Health Personnel	42 CFR 37.43
NCRP 49	1976	National Council on Radiation Protection and Measurement	Structural Shielding Design and Evaluation for Medical Use of X-Rays and Gamma-Rays up to 10 MeV	42 CFR 37.43
NEMA MG-1	2009	National Electrical Manufacturers Association	Motors and Generators	10 CFR 431

## Public Safety Standards of the United States

NSF 61 (pdf) NSF 61 (html)	2001	National Sanitation Foundation	Drinking Water System Components—Health Effects	24 CFR 3280
OECD 404	2002	Organization for Economic Cooperation and Development	Guideline for Testing of Chemicals, Acute Dermal Irritation/Corrosion	49 CFR 173.137
OECD C93	1974	Organization for Economic Cooperation and Development	Green List of Wastes	40 CFR 262.89(e)
OR REG	1975	State of Oregon	Oregon Grade Standards Hazelnuts in Shell	7 CFR 982.45(a)
ORION	1970	ORION Research Incorporated	Residual Chlorine Electrode Model 97-70	40 CFR 136.3(a) Table IB
PCI MNL-121	1977	Precast/Prestressed Concrete Institute	Manual for Structural Design of Architectural Precast Concrete	24 CFR 200, Subpart S
PCI MNL-117-77	1977	Precast/Prestressed Concrete Institute	Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products	24 CFR 200, Subpart S
PCSA 1	1968	Power Crane and Shovel Association	Mobile Crane and Excavator Standards	29 CFR 1926.602(b)(3)
PCSA 2	1968	Power Crane and Shovel Association	Mobile Hydraulic Crane Standards	29 CFR 1926.602(b)(3)
PCSA 3	1969	Power Crane and Shovel Association	Mobile Hydraulic Excavator Standards	29 CFR 1926.602(b)(3)
PPI TR-3	2004	Plastics Pipe Institute	Policies and Procedures for Developing Hydrostatic Design Bases (HDB), Pressure Design Bases (PDB), and Minimum Required Thermoplastic Piping Materials	49 CFR 192.121
RTCM C071	1995	Radio Technical Commission for Maritime Services	Recommended Standards for Marine Radar Equipment Installed on Ships of Less Than 300 Tons Gross Tonnage	33 CFR 164.72(a)(1)(i) (B)
RTCM C191	1993	Radio Technical Commission for Maritime Services	Recommended Standards for Marine Radar Equipment Installed on Ships of 300 Tons Gross Tonnage and Upwards	33 CFR 164.72(a)(1)(iii) (B)

## Public Safety Standards of the United States

SAE Paper 770141	1977	Society of Automotive Engineers	Optimization of a Flame Ionization Detector for Determination of Hydrocarbon in Diluted Automotive Exhausts	40 CFR 1065.360(c)
SAE J4C	1965	Society of Automotive Engineers	Motor Vehicle Seat Belt Assembly	29 CFR 1928.51(b)(2)(ii)
SAE J30	1998	Society of Automotive Engineers	Fuel and Oil Hoses	40 CFR 1051.501(c)(2)
SAE J166	1971	Society for Automotive Engineering	Minimum Performance Criteria for Brake Systems for Off-Highway Trucks and Wagons	29 CFR 1926.602(a)(4)
SAE J166	1971	Society of Automotive Engineers	Minimum Performance Criteria for Brake Systems for Off-Highway Trucks and Wagons	29 CFR 1926.602(a)(4)
SAE J167	1970	Society for Automotive Engineering	Protective Frame with Overhead Protection	29 CFR 1926.1003(g)
SAE J167	1974	Society of Automotive Engineers	Protective Frame with Overhead Protection	30 CFR 77.403-1(d)(1)(v)
SAE J168	1970	Society for Automotive Engineering	Protective Enclosures—Test Procedures and Performance Requirements	29 CFR 1926.1002(a)(5)(i)
SAE J185	1988	Society of Automotive Engineers	Recommended Practice for Access Systems for Off-Road Machines	29 CFR 1910.266(f)(5)(i)
SAE J186A	1977	Society of Automotive Engineers	Supplemental High Mounted Stop and Rear Turn Signal Lamps	49 CFR 571.108
SAE J211-1 (pdf) SAE J211-1 (html)	1995	Society of Automotive Engineers	Instrumentation for Impact Test	49 CFR 571
SAE J211	1971	Society of Automotive Engineers	Instrumentation for Impact Tests	49 CFR 571.222 S6.6.2
SAE J222	1970	Society of Automotive Engineers	Parking Lamps (Position Lamps)	49 CFR 571.108 S5.1.1.6
SAE J231	1971	Society for Automotive Engineering	Minimum Performance Criteria for Falling Object Protective Structures (FOPS)	30 CFR 77.403(a)
SAE J231	1971	Society of Automotive Engineers	Minimum Performance Criteria for Falling Object Protective	30 CFR 77.403(a)

## Public Safety Standards of the United States

SAE J231	1981	Society of Automotive Engineers	Structures (FOPS) Minimum Performance Criteria for Falling Object Protective Structures (FOPS)	29 CFR 1910.266(f)(3)(iii)
SAE J236	1971	Society for Automotive Engineering	Minimum Performance Criteria for Brake Systems for Rubber Tire Self-Propelled Graders	29 CFR 1926.602(a)(4)
SAE J237	1971	Society for Automotive Engineering	Minimum Performance Criteria for Brake Systems for Off-Highway Rubber-Tired Front End Loaders and Dozers	29 CFR 1926.602(a)(4)
SAE J244	1983	Society for Automotive Engineering	Recommend Practice for Measurement of Intake Air or Exhaust Gas Flow of Diesel Engines	40 CFR 92.108(a)(3)
SAE J319	1971	Society of Automotive Engineers	Minimum Performance Criteria for Brake Systems for Off-Highway Rubber-Tired Self-Propelled Scrapers	29 CFR 1926.602(a)(4)
SAE J320	1972	Society for Automotive Engineering	Minimum Performance Criteria for Roll-Over Protective Structures for Rubber-Tired Self-Propelled Scrapers	29 CFR 1926.1001(h)
SAE J320A	1969	Society of Automotive Engineers	Minimum Performance Criteria for Roll-Over Protective Structures for Rubber-Tired Self-Propelled Scrapers	30 CFR 77.403-1(d)(1)(i)
SAE J321	1970	Society of Automotive Engineers	Fenders for Pneumatic-Tired Earthmoving Haulage Equipment	29 CFR 1926.602(a)(5)
SAE J333	1970	Society for Automotive Engineering	Operation Protection for Wheel-Type Agricultural and Industry Tractors	29 CFR 1926.602(a)(2)
SAE J334	1968	Society of Automotive Engineers	Protective Frame Test Procedures and Performance Requirements	30 CFR 77.403-1(d)(1)(vi)
SAE J334	1970	Society for Automotive Engineering	Protective Frame Test Procedures and Performance	30 CFR 77.403-1(d)(1)(vi)

## Public Safety Standards of the United States

			Requirements	
SAE J386	1969	Society of Automotive Engineers	Operator Restraint Systems for Off-Road Work Machines	29 CFR 1926.602(a)(2)
SAE J386	1985	Society for Automotive Engineering	Operator Restraint Systems for Off-Road Work Machines	30 CFR 56.14130(h)
SAE J386	1993	Society of Automotive Engineers	Operator Restraint Systems for Off-Road Work Machines	30 CFR 56.14130(h)
SAE J386	1997	Society of Automotive Engineers	Operator Restraint Systems for Off-Road Work Machines	30 CFR 57.14131(c)
SAE J387 (pdf) SAE J387 (html)	1987	Society of Automotive Engineers	Terminology: Motor Vehicle Lighting	49 CFR 571
SAE J394	1969	Society of Automotive Engineers	Minimum Performance Criteria for Roll-Over Protective Structures for Rubber-Tired Front End Loaders and Rubber-Tired Dozers	30 CFR 77.403-1(d)(1)(ii)
SAE J394	1972	Society of Automotive Engineers	Minimum Performance Criteria for Rollover Protective Structures for Wheeled Front-End Loaders and Wheeled Dozers	30 CFR 77.403-1(d)(1)(ii)
SAE J395	1969	Society of Automotive Engineers	Minimum Performance Criteria for Roll-Over Protective Structures for Crawler Tractors and Crawler-Type Loaders	30 CFR 77.403-1(d)(1)(iii)
SAE J396	1972	Society for Automotive Engineering	Minimum Performance Criteria for Roll-Over Protective Structures for Motor Graders	30 CFR 77.403-1(d)(1)(iv)
SAE J397	1969	Society of Automotive Engineers	Deflection Limiting Volume-Protective Structures Laboratory Evaluation	29 CFR 1926.1001(f)(1)(ii)
SAE J397	1988	Society of Automotive Engineers	Deflection Limiting Volume-Protective Structures Laboratory Evaluation	29 CFR 1910.266(f)(3)(iv)
SAE J429	1971	Society for Automotive Engineering	Mechanical and Quality Requirements for Externally Threaded Fasteners	30 CFR 77.403-1(d)(2)(iii)(B)
SAE J429	1983	Society of Automotive	Mechanical and	46 CFR 58.30-15(c)

## Public Safety Standards of the United States

		Engineers	Quality Requirements for Externally Threaded Fasteners	
SAE J429D	1967	Society of Automotive Engineers	Mechanical and Quality Requirements for Externally Threaded Fasteners	30 CFR 77.403-1(d)(2)(iii)(B)
SAE J449a	1963	Society of Automotive Engineers	Surface Texture Control	49 CFR 581.6(b)(1)
SAE J476a	1961	Society of Automotive Engineers	Dryseal Pipe Threads	49 CFR 393.67(c)(3)
SAE J527	1967	Society of Automotive Engineers	Brazed Double Wall Low Carbon Steel Tubing	49 CFR 571.116 S6.13.3(b)
SAE J533	1972	Society of Automotive Engineers	Flares for Tubing	24 CFR 3280.703
SAE J557	1968	Society of Automotive Engineers	High Tension Ignition Cable	33 CFR 183.440(a)
SAE J565	1969	Society of Automotive Engineers	Semi-Automatic Headlamp Beam Switching Devices	49 CFR 571.108 S5.5.1
SAE J566	1960	Society of Automotive Engineers	Headlamp Mountings	49 CFR 571.108
SAE J571	1976	Society of Automotive Engineers	Dimensional Specification for Sealed Beam Headlamp Units	49 CFR 571.108
SAE J573d (pdf) SAE J573d (html)	1968	Society of Automotive Engineers	Requirements for Lamp Bulbs and Sealed Units	49 CFR 571
SAE J575	1970	Society of Automotive Engineers	Test for Motor Vehicle Lighting Devices and Components	49 CFR 571.108 S6.1
SAE J575	1983	Society for Automotive Engineering	Test for Motor Vehicle Lighting Devices and Components	49 CFR 571.131 S6.2.3
SAE J575	1988	Society of Automotive Engineers	Test for Motor Vehicle Lighting Devices and Components	49 CFR 571.108 S7.5.8.3(e)
SAE J576	1970	Society of Automotive Engineers	Plastic Materials for Use in Optical Parts, such as Lenses and Reflectors, of Motor Vehicle Lighting Devices	49 CFR 571.108 S6.2
SAE J576 (pdf) SAE J576 (html)	1991	Society of Automotive Engineers	Plastic Materials for Use in Optical Parts	49 CFR 571
SAE J576B	1966	Society of Automotive Engineers	Plastic Materials for Use in Optical Parts,	49 CFR 571.108 S6.2

## Public Safety Standards of the United States

			such as Lenses and Reflectors, of Motor Vehicle Lighting Devices	
SAE J578 (pdf) SAE J578 (html)	1995	Society of Automotive Engineers	Color Specifications for Electric Signal Lighting Devices	49 CFR 571.403
SAE J584	1964	Society of Automotive Engineers	Motorcycle and Motor Driven Cycle Headlamps	49 CFR 571.108 S7.9.1(a)
SAE J584 (pdf) SAE J584 (html)	1993	Society of Automotive Engineers	Requirements for Motorcycle Headlamps	49 CFR 571
SAE J585	1970	Society for Automotive Engineering	Tail Lamps (Rear Position Lamps) for Use on Motor Vehicles Less Than 2032 mm in Overall Width	49 CFR 571.108 S5.8.8
SAE J585	1977	Society for Automotive Engineering	Tail Lamps (Rear Position Lamps) for Use on Motor Vehicles Less Than 2032 mm in Overall Width	49 CFR 571.108 S5.1.1.6
SAE J585	2000	Society of Automotive Engineers	Tail Lamps (Rear Position Light)	49 CFR 571.108 S6.1
SAE J586	1970	Society of Automotive Engineers	Stop Lamps for Use on Motor Vehicles Less than 2032 mm in Overall Width	49 CFR 571.108 S5.8.3(b)
SAE J586	1984	Society for Automotive Engineering	Stop Lamps for Use on Motor Vehicles Less Than 2032 mm in Overall Width	49 CFR 571.108 S6.1
SAE J586	2000	Society of Automotive Engineers	Stop Lamps for Use on Motor Vehicles Less than 2032 mm in Overall Width	49 CFR 571.108 S6.1
SAE J586B	1966	Society of Automotive Engineers	Stop Lamps for Use on Motor Vehicles Less than 2032 mm in Overall Width	49 CFR 571.108 S5.8.3(a)
SAE J587 (pdf) SAE J587 (html)	1981	Society of Automotive Engineers	License Plate Lamps (Rear Registration Lamps)	49 CFR 571
SAE J588	1970	Society for Automotive Engineering	Turn Signal Lamps for Use on Motor Vehicles Less Than 2032 mm in Overall Width	49 CFR 571.108 S5.1.1.1
SAE J588	1970	Society of Automotive Engineers	Turn Signal Lamps for Use on Motor Vehicles	49 CFR 571.108 S5.8.4(b)

## Public Safety Standards of the United States

			Less Than 2032 mm in Overall Width	
SAE J588 (pdf) SAE J588 (html)	1984	Society of Automotive Engineers	Requirements for Turn Signal Lamps	49 CFR 571
SAE J588	2000	Society of Automotive Engineers	Turn Signal Lamps for Use on Motor Vehicles Less Than 2032 mm in Overall Width	49 CFR 393.25(c)
SAE J588D	1966	Society of Automotive Engineers	Turn Signal Lamps for Use on Motor Vehicles Less Than 2032 mm in Overall Width	49 CFR 571.108 S5.8.4(a)
SAE J592	1972	Society of Automotive Engineers	Clearance, Side Marker and Identification Lamps	49 CFR 571.108 Table III
SAE J592 (pdf) SAE J592 (html)	1992	Society of Automotive Engineers	Clearance, Side Marker, and Identification Lamps	49 CFR 571
SAE J593C	1968	Society of Automotive Engineers	Back-up Lamps	49 CFR 571.108
SAE J594f (pdf) SAE J594f (html)	1977	Society of Automotive Engineers	Requirements for Reflex Reflectors	49 CFR 571
SAE J599	1997	Society of Automotive Engineers	Lighting Inspection Code	49 CFR 581.5(c)(1)
SAE J602 (pdf) SAE J602 (html)	1980	Society of Automotive Engineers	Mechanically Aimable Sealed Beam Headlamps	49 CFR 571
SAE J743A	1964	Society of Automotive Engineers	Tractor Mounted Side Boom	29 CFR 1926.550(a)(18)
SAE J759 (pdf) SAE J759 (html)	1995	Society of Automotive Engineers	Lighting Identification Code	49 CFR 571
SAE J800C	1973	Society of Automotive Engineers	Recommended Practice, Motor Vehicle Seat Belt Installations	49 CFR 571.209
SAE J826	1962	Society of Automotive Engineers	Devices for Use in Defining and Measuring Vehicle Seating Accommodations	49 CFR 571.3(b)
SAE J826	1980	Society for Automotive Engineering	Devices for Use in Defining and Measuring Vehicle Seating Accommodations	49 CFR 571.214 S12.1.3(b)(1)
SAE J826 (pdf) SAE J826 (html)	1995	Society of Automotive Engineers	Defining and Measuring Vehicle Seating Accommodation	49 CFR 571
SAE J839	1991	Society of Automotive Engineers	Passenger Car Side Door Latch System	49 CFR 571.206

## Public Safety Standards of the United States

SAE J839B	1965	Society of Automotive Engineers	Passenger Car Side Door Latch System	49 CFR 571.201
SAE J845	1997	Society of Automotive Engineers	Optical Warning Devices for Authorized Emergency, Maintenance and Service Vehicles	49 CFR 393.25(e)
SAE J887	1964	Society of Automotive Engineers	School Bus Red Signal Lamps	49 CFR 571.108
SAE J902A	1967	Society of Automotive Engineers	Passenger Car Windshield Defrosting Systems	49 CFR 571.103
SAE J934	1965	Society of Automotive Engineers	Recommended Practice for Vehicle Passenger Door Hinge Systems	49 CFR 571.206
SAE J942	1965	Society of Automotive Engineers	Passenger Car Windshield Washer System	49 CFR 571.104
SAE J944	1980	Society for Automotive Engineering	Steering Control System-Passenger Car-Laboratory Test Procedure	49 CFR 571.203 S5.1(a)
SAE J945	1966	Society of Automotive Engineers	Vehicular Hazard Warning Signal Flashers	49 CFR 571.108 Table I
SAE J959	1966	Society of Automotive Engineers	Lifting Crane Wire-Rope Strength Factors	29 CFR 1926.550(a)(7)(vi)
SAE J964	1984	Society for Automotive Engineering	Test Procedure for Determining Reflectivity of Rear View Mirrors	49 CFR 571.111
SAE J972	1966	Society of Automotive Engineers	Moving Barrier Collision Test	49 CFR 571.105
SAE J995	1967	Society of Automotive Engineers	Mechanical and Quality Requirements for Steel Nuts	30 CFR 77.403-1(d)(2)(iii)(B)
SAE J995	1971	Society of Automotive Engineers	Mechanical and Quality Requirements for Steel Nuts	30 CFR 77.403-1(d)(2)(iii)(B)
SAE J1040	1994	Society of Automotive Engineers	Performance Criteria for Rollover Protective Structures (ROPS) for Construction, Earthmoving, Forestry and Mining Machines	30 CFR 56.14130(b)(1)
SAE J1063	1993	Society of Automotive Engineers	Cantilevered Boom Crane Structures--Method of Test	29 CFR 1926.1433(c)
SAE J1100	1984	Society for Automotive	Motor Vehicle	49 CFR 571.3(b)

## Public Safety Standards of the United States

		Engineering	Dimensions	
SAE J1100 (pdf) SAE J1100 (html)	2001	Society of Automotive Engineers	Motor Vehicle Dimensions	49 CFR 571
SAE J1127	1980	Society for Automotive Engineering	Battery Cable	33 CFR 183.430(a)(2)(ii)
SAE J1128	1975	Society of Automotive Engineers	Low Tension Primary Cable	33 CFR 183.430(a)(2)(ii)
SAE J1133	1984	Society for Automotive Engineering	School Bus Stop Arm	49 CFR 571.131 S6.2.3
SAE J1151	1991	Society of Automotive Engineers	Methane Measurement Using Gas Chromatography	40 CFR 86.111-94(b)(3)(vi)
SAE J1194	1983	Society for Automotive Engineering	Roll-Over Protective Structures for Wheeled Agricultural Tractors	30 CFR 56.14130(h)
SAE J1194	1994	Society of Automotive Engineers	Roll-Over Protective Structures for Wheeled Agricultural Tractors	30 CFR 56.14130(h)
SAE J1194	1999	Society of Automotive Engineers	Roll-Over Protective Structures for Wheeled Agricultural Tractors	30 CFR 57.14130(h)
SAE J1228	1991	Society of Automotive Engineers	Small Craft-Marine Propulsion Engine and Systems-Power Measurements and Declarations	40 CFR 91.115(a)
SAE J1292	1981	Society of Automotive Engineers	Automobile, Truck, Truck-Tractor, Trailer, and Motor Coach Wiring	49 CFR 393.28
SAE J1318	1986	Society of Automotive Engineers	Gaseous Discharge Warning Lamp for Authorized Emergency, Maintenance, and Service Vehicles	49 CFR 393.25(e)
SAE J1383 (pdf) SAE J1383 (html)	1985	Society of Automotive Engineers	Performance Requirements for Motor Vehicle Headlamps	49 CFR 571
SAE J1395 (pdf) SAE J1395 (html)	1985	Society of Automotive Engineers	Turn Signal Lamps for Use on Motor Vehicles	49 CFR 571
SAE J1398 (pdf) SAE J1398 (html)	1985	Society of Automotive Engineers	Stop Lamps for Use on Motor Vehicles	49 CFR 571
SAE J1475	1984	Society for Automotive Engineering	Hydraulic Hose Fittings for Marine Applications	46 CFR 27.211(e)(2)(v)(B)
SAE J1527	1993	Society of Automotive Engineers	Marine Fuel Hoses	33 CFR 183.540(a)
SAE J1703	1983	Society for Automotive	Motor Vehicle Brake	49 CFR 571.116

## Public Safety Standards of the United States

		Engineering	Fluid	S6.5.4.1
SAE J1703 (pdf) SAE J1703 (html)	1995	Society of Automotive Engineers	Motor Vehicle Brake Fluids	49 CFR 571
SAE J1733 (pdf) SAE J1733 (html)	1994	Society of Automotive Engineers	Sign Convention for Vehicle Crash Testing	49 CFR 572
SAE J1817	2001	Society of Automotive Engineers	Long Stroke Air Brake Actuator Marking	49 CFR 393.47(e)
SAE J1850	1995	Society of Automotive Engineers	Class B Data Communication Network Interface	40 CFR 86.099-17(h)(1)(i)
SAE J1850	2001	Society of Automotive Engineers	Class B Data Communication Network Interface	40 CFR 86.1806-05(h)(1)(i)
SAE J1877	1994	Society of Automotive Engineers	Recommended Practice for Bar-Coded Vehicle Identification Number Label	40 CFR 86.095-35(h)(2)(i)
SAE J1892	1993	Society of Automotive Engineers	Recommended Practice for Bar-Coded Vehicle Emission Configuration Label	40 CFR 86.095-35(h)(2)(i)
SAE J1930	1993	Society of Automotive Engineers	Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms	40 CFR 1039.135(c)(8)
SAE J1930	2002	Society of Automotive Engineers	Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms	40 CFR 86.1806-05(h)(1)(v)
SAE J1937	1989	Society of Automotive Engineers	Recommended Practice for Engine Testing with Low Temperature Charge Air Cooler Systems in a Dynamometer Test Cell	40 CFR 86.1330-90(b)(5)
SAE J1962	1995	Society of Automotive Engineers	Diagnostic Connector Equivalent to ISO/DIS	40 CFR 86.094-17(h)(4)
SAE J1962	2002	Society of Automotive Engineers	Diagnostic Connector Equivalent to ISO/DIS 15031	40 CFR 86.1806-05(h)(1)(iv)
SAE J1978	2002	Society of Automotive Engineers	OBD II Scan Tool Equivalent to ISO/DIS 15031-4	40 CFR 86.1806-05(h)(1)(vi)
SAE J1979	2002	Society of Automotive Engineers	E/E Diagnostic Test Modes	40 CFR 86.1806-05(h)(1)(ii)
SAE J2009 (pdf)	1993	Society of Automotive	Discharge Forward	49 CFR 571

## Public Safety Standards of the United States

SAE J2009 (html)		Engineers	Lighting Systems	
SAE J2012	2002	Society of Automotive Engineers	Diagnostic Trouble Code Definitions	40 CFR 86.1806-04(h)(1)(iii)
SAE J2040	2002	Society of Automotive Engineers	Tail Lamps (Rear Position Lamps) for Use on Vehicles 2032 mm or More in Overall Width	9 CFR 393.25(c)
SAE J2260	1996	Society of Automotive Engineers	Non-metallic Fuel System Tubing with One or More Layers	40 CFR 1048.105(a)(2)
SAE J2261	2002	Society of Automotive Engineers	Stop Lamps and Front- and Rear-Turn Signal Lamps for Use on Motor Vehicles 2032 mm or More in Overall Width	49 CFR 393.25(c)
SAE J2534	2002	Society of Automotive Engineers	Recommended Practice for Pass-Thru Vehicle Programming	40 CFR 86.096-38(g)(17)(iv)
SCTE 26	2010	Society of Cable Telecommunications Engineers	Home Digital Network Interface Specification with Copy Protection	47 CFR 76.640(b)(4)(iii)
SCTE 28	2007	Society of Cable Telecommunications Engineers	Host-POD Interface Standard	47 CFR 15.123(b)(4)
SCTE 40	2004	Society of Cable Telecommunications Engineers	Digital Cable Network Interface Standard (2004)	47 CFR 15.123(b)(2)
SCTE 40	2011	Society of Cable Telecommunications Engineers	Digital Cable Network Interface Standard (2011)	47 CFR 15.123(b)(2)
SCTE 41	2011	Society of Cable Telecommunications Engineers	POD Copy Protection System	47 CFR 76.640(b)(2)(ii)
SCTE 54	2009	Society of Cable Telecommunications Engineers	Digital Video Service Multiplex and Transport System Standard for Cable Television	47 CFR 15.123(b)(3)
SCTE 65	2008	Society of Cable Telecommunications Engineers	Service Information Delivered Out-of-Band for Digital Cable Television	47 CFR 76.640(b)(1)(ii)
SEAC	1996	Structural Engineers Association of California	Recommended Lateral Force Requirements and Commentary including Errata	42 CFR 52b.12(c)(5)
SJI	1994	Steel Joist Institute	Standard Specification Load Tables and	24 CFR 3280.304(b)(1)

## Public Safety Standards of the United States

SMACCNA HVAC (pdf) SMACCNA HVAC (html) SMACCNA HVAC (svg)	1985	Sheet Metal and Air Conditioning Contractors National Association	Weight Tables for Steel Joists and Joist Girders SMACNA: HVAC Air Duct Leakage Test Manual	10 CFR 434.403.2.9.3
SMACCNA DUCT (pdf) SMACCNA DUCT (html) SMACCNA DUCT (svg)	1995	Sheet Metal and Air Conditioning Contractors National Association	SMACCNA: HVAC Duct Construction Standards – Metal and Flexible (RS-34)	10 CFR 434.403.2.9.3
SMACCNA GLASS (pdf)	1992	Sheet Metal and Air Conditioning Contractors National Association	SMACCNA: Fibrous Glass Duct Construction Standards (RS-36)	10 CFR 434.403.2.9.3
SMACCNA AIR (pdf)	1978	Sheet Metal and Air Conditioning Contractors National Association	SMACCNA: Energy Recovery Equipment and Systems, Air-to-Air	10 CFR 440 Appendix A
NIST Handbook H-28	1942	Department of Commerce	Handbook of Screw-Thread Standards for Federal Service	49 CFR 178.45(f)(5)(ii)
DOD AFTO 11A-1-47	1988	Department of Defense	Explosive Hazard Classification Procedures	49 CFR 173.56(b)(2)(i)
FedSpec RR-C-901D	2003	Department of Transportation	Cylinders, Compressed Gas: High Pressure, Steel DOT 3AA, and Aluminum Applications	49 CFR 173.302(b)(3)
RTCA 23-63	1963	Radio Technical Commission for Aeronautics	Standard Adjustment Criteria for Airborne Localizer and Glide Slope Receivers	14 CFR 91 App. A, 3(a)(1)
SNELL B-90	1998	Snell Memorial Foundation	Standard for Protective Headgear for Use in Bicycling	16 CFR 1203.53(a)(4)
SNELL B-95	1998	Snell Memorial Foundation	Standard for Protective Headgear for Use in Bicycling	16 CFR 1203.53(a)(7)
SRCC OG-300	2008	Solar Rating and Certification Corporation	Operating Guidelines and Minimum Standards for Certifying Solar Water Heating Systems	24 CFR 200.950(a)(1)
TPI	1985	Truss Plate Institute	Design Specifications for Metal Plate Connected Wood	24 CFR 3280.304(b)(1)

## Public Safety Standards of the United States

			Trusses	
TTMA RP-61	1998	Truck Trailer Manufacturers Association	Performance of Manhole and/or Fill Opening Assemblies	49 CFR 180.405(g)(2)(i)
TTMA RP-81	1997	Truck Trailer Manufacturers Association	Performance of Spring Loaded Pressure Relief Valves	49 CFR 178.345-10(b)(3)(i)
TTMA RP-107	1998	Truck Trailer Manufacturers Association	Procedure for Testing In-Service Unmarked and/or Uncertified MC 306 and Non-ASME MC 312 Type Cargo Tank Manhole	49 CFR 180.405(g)(2)(i)
UL 17	1988	Underwriters Laboratories	Vent or Chimney Connector Dampers for Oil-Fired Appliances	10 CFR 440 Appendix A
UL 38	1993	Underwriters Laboratories	Standard for Manually Actuated Signaling Boxes for Use with Fire-Protective Signaling Systems	46 CFR 161.002-4(b)(1)
UL 44	2002	Underwriters Laboratories	Standard for Thermoset-Insulated Wire and Cable	46 CFR 110.10-1
UL 50	1995	Underwriters Laboratories	Standard for Enclosures for Electrical Equipment	46 CFR 111.81-1(d)
UL 62	1997	Underwriters Laboratories	Standard for Flexible Cord and Fixture Wire	46 CFR 110.10-1
UL 127	1996	Underwriters Laboratories	Factory-Built Fireplaces	24 CFR 3280
UL 142 (pdf) UL 142 (html)	1968	Underwriters Laboratories	Steel Above Ground Tanks for Flammable and Combustible Liquids	49 CFR 1910
UL 174	1989	Underwriters Laboratories	Household Electric Storage Tank Water Heaters	46 CFR 63.25-3(a)
UL 217	1993	Underwriters Laboratories	Single and Multiple Station Smoke Detectors	46 CFR 181.450(a)(1)
UL 486A	1990	Underwriters Laboratories	Wire Connections and Soldering Lugs for Use With Copper Conductors	46 CFR 175.600
UL 521	1993	Underwriters Laboratories	Heat Detectors for Fire Protective Signaling Systems	46 CFR 161.002-4(b)(1)
UL 727	1994	Underwriters	Oil-Fired Central	10 CFR 431.76(c)(1)

## Public Safety Standards of the United States

UL 746C	1995	Laboratories Underwriters Laboratories	Furnaces Polymeric Material– Use in Electrical Equipment Evaluations	16 CFR 1211.10(e)(2)
UL 913	1988	Underwriters Laboratories	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III Division 1, Hazardous (Classified) Locations	46 CFR 111.105-11(a)
UL 991	1995	Underwriters Laboratories	Tests for Safety- Related Controls Employing Solid-State Devices	16 CFR 1211.4(c)
UL 1042	1995	Underwriters Laboratories	Electric Baseboard Heating Equipment	24 CFR 3280.703
UL 1072	1995	Underwriters Laboratories	Standard for Medium- Voltage Power Cables	46 CFR 111.60-1(e)
UL 1096	1986	Underwriters Laboratories	Electrical Central Air Heating Equipment	24 CFR 3280.703
UL 1104	1983	Underwriters Laboratories	Standard for Marine Navigation Lights	46 CFR 120.420
UL 1426	1986	Underwriters Laboratories	Cables for Boats	33 CFR 183.435(a)(4)
UL 1570	1995	Underwriters Laboratories	Fluorescent Lighting Fixtures	46 CFR 183.410(d)
UL 1571	1995	Underwriters Laboratories	Incandescent Lighting Fixtures	46 CFR 111.75-20(e)
UL 1572	1995	Underwriters Laboratories	High Intensity Discharge Lighting Fixtures	46 CFR 120.410(d)
UL 1574	1995	Underwriters Laboratories	Track Lighting Systems	46 CFR 111.75-20(e)
UL 1995	1995	Underwriters Laboratories	Heating and Cooling Equipment, Second Edition, with 1999 revisions	24 CFR 3280.4
UN ECE	1996	United Nations Economic Commission of Europe	Uniform Provisions Concerning the Approval of Vehicles with Regard to the Installation of Lighting and Light-Signaling Devices	49 CFR 571.108
UN ESC	2009	United Nations Economic and Social Council	Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria	49 CFR 173.128(c)(3)

## Public Safety Standards of the United States

UN ESC	2005	United Nations Economic and Social Council	Recommendations on the Transport of Dangerous Goods	49 CFR 173.40(d)(2)
FAO 4	1995	UN Food and Agriculture Organization	Requirements for the Establishment of Pest-free Areas	7 CFR 319.56
IAEA Circular 225	1999	International Atomic Energy Agency	Physical Protection of Nuclear Material and Nuclear Facilities	10 CFR 110.44(b)(1)
IAEA TS-R-1	2009	International Atomic Energy Agency	Regulations for the Safe Transport of Radioactive Material	49 CFR 171.23
IMO Resolution A.264	1960	International Maritime Organization	Amendment to Chapter VI of the International Convention for the Safety of Life at Sea	46 CFR 172.015(a)(2)
IMO Resolution A.265	1973	International Maritime Organization	Carriage of Grain	46 CFR 170.135(a)
IMO Resolution A.342	1975	International Maritime Organization	Recommendations on Performance Standards for Automatic Pilots	33 CFR 164.13(d)(1)
IMO Resolution A.414	1979	International Maritime Organization	Code for Construction and Equipment of Mobile Offshore Drilling Units	33 CFR 143.207(c)
IMO Resolution A.520	1983	International Maritime Organization	Code of Practice for the Evaluation, Testing and Acceptance of Prototype Novel Life-Saving Appliances and Arrangements	46 CFR 108.105(c)(1)
IMO Resolution A.525	1983	International Maritime Organization	Performance Standards for Narrow-band Direct Printing Telegraph Equipment for the Reception of Navigational and Meteorological Warnings	47 CFR 80.1101(c)(1)(i)
IMO Resolution A.601	1987	International Maritime Organization	Provision and Display of Manoeuvring Information on Board Ships	33 CFR 157.450
IMO Resolution A.649	1991	International Maritime Organization	Code for the Construction and Equipment of Mobile Offshore Drilling Units (MODU Code)	46 CFR 108.503
IMO Resolution	1989	International Maritime	Graphical Symbols for	46 CFR 109.563(a)(6)

## Public Safety Standards of the United States

A.654		Organization	Fire Control Plans	
IMO Resolution A.657	1989	International Maritime Organization	Instructions for Action in Survival Craft	46 CFR 160.151-21(v)(3)
IMO Resolution A.658	1989	International Maritime Organization	Use and Fitting of Retro-Reflective Materials on Life-Saving Appliances	46 CFR 108.645(a)(4)
IMO Resolution A.662	1989	International Maritime Organization	Performance Standards for Float-Free Release and Activation Arrangements for Emergency Radio Equipment	47 CFR 80.1101(c)(11)(ii)
IMO Resolution A.664	1989	International Maritime Organization	Performance Standards for Enhanced Group Call Equipment	47 CFR 80.1101(c)(10)
IMO Resolution A.688	1991	International Maritime Organization	Fire Test Procedures for Ignitability of Bedding Components	46 CFR 116.405(j)(2)
IMO Resolution A.689	1996	International Maritime Organization	Recommendation on Testing Life-Saving Appliances	46 CFR 160.151-21(f)
IMO Resolution A.694	1991	International Maritime Organization	General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System and for Electronic Navigational Aids	47 CFR 80.1101(b)(1)
IMO Resolution A.700	1991	International Maritime Organization	Performance Standards for Narrow-band Direct-printing Telegraph Equipment for the Reception of Navigational and Meteorological Warnings and Urgent Information to Ships	47 CFR 80.1101(c)(4)(iv)
IMO Resolution A.739	1993	International Maritime Organization	Guidelines for the Authorization of Organizations Acting on Behalf of the Administration	33 CFR 96.440(a)(12)
IMO Resolution A.741	1993	International Maritime Organization	International Management Code for the Safe Operation of Ships and for Pollution Prevention	33 CFR 96.220(b)

## Public Safety Standards of the United States

IMO Resolution A.744	1993	International Maritime Organization	Guidelines on the Enhanced Program of Inspections During Surveys of Bulk Carriers and Oil Tankers	33 CFR 157.430(a)
IMO Resolution A.751	1994	International Maritime Organization	Interim Standards for Ship Manoeuvrability	33 CFR 157.445(a)
IMO Resolution A.753	1993	International Maritime Organization	Guidelines for the Application of Plastic Pipe on Ships	46 CFR 56.60-25(a)
IMO Resolution A.760	1993	International Maritime Organization	Symbols Related to Life-Saving Appliances and Arrangements	46 CFR 108.646(a)
IMO Resolution A.788	1995	International Maritime Organization	Guidelines on Implementation of the International Safety Management (ISM) Code by Administrations	33 CFR 96.320(c)(2)
IMO Resolution A.802	1995	International Maritime Organization	Performance Standards for Survival Craft Radar Transponders for Use in Search and Rescue Operations	47 CFR 80.1101(c)(6)(i)
IMO Resolution A.803	1995	International Maritime Organization	Performance Standards for Shipborne VHF Radio Installations Capable of Voice Communication and Digital Selective Calling	47 CFR 80.1101(c)(2)(i)
IMO Resolution A.804	1995	International Maritime Organization	Performance Standards for Shipborne MF Radio Installations Capable of Voice Communication and Digital Selective Calling	47 CFR 80.1101(c)(3)(i)
IMO Resolution A.806	1995	International Maritime Organization	Performance Standards for Shipborne MF/HF Radio Installations Capable of Voice Communication, Narrow-Band Direct Printing and Digital Selective Calling	47 CFR 80.1101(c)(4)(i)
IMO Resolution A.807	1995	International Maritime Organization	Performance Standards for INMARSAT Standard-C	47 CFR 80.1101(c)(9)

## Public Safety Standards of the United States

			Ship Earth Stations Capable of Transmitting and Receiving Direct-Printing Communications	
IMO Resolution A.808	1995	International Maritime Organization	Performance Standards for Ship Earth Stations Capable of Two-Way Communications	47 CFR 80.1101(c)(8)
IMO Resolution A.809	1995	International Maritime Organization	Performance Standards for Survival Craft Two-Way VHF Radiotelephone Apparatus	47 CFR 80.1101(c)(7)(i)
IMO Resolution A.810	1995	International Maritime Organization	Performance Standards for Float-free Satellite Emergency Position-Indicating Radio Beacons (EPIRBs) Operating on 406 MHz	47 CFR 80.1101(c)(5)(i)
IMO Resolution A.812	1995	International Maritime Organization	Performance Standards for Float-Free Satellite EPIRBs Operating Through the Geostationary INMARSAT Satellite System on 1.6 GHz	47 CFR 80.1101(c)(11)(i)
USEC 651	1995	United States Enrichment Corporation	Good Handling Practices for Uranium Hexafluoride	49 CFR 173.417(a)(3)(i)
USPHS 934	1962	U.S. Public Health Service	Food Service Sanitation Ordinance and Code	29 CFR 1910.142(i)(1)
USPHS 956	1962	U.S. Public Health Service	Drinking Water Standards	46 CFR 160.026-4(a)
USPHS 934	1962	U.S. Public Health Service	Food Service Sanitation Ordinance and Code	29 CFR 1910.142(i)(1)
USPHS 9	2003	U.S. Public Health Service	The Ships Medicine Chest and Medical Aid at Sea	33 CFR 143.405(a)(15)
WCLIB R17	2004	West Coast Lumber Inspection Bureau	Grading Rules for West Coast Lumber	7 CFR 1728.201(f)(1)(i)
WHO	1973	World Health Organization	Laboratory Techniques in Rabies	9 CFR 113.209(d)(3)
WIPO ST.25	2001	World Intellectual Property Organization	Handbook on Industrial Property Information	37 CFR 1.821(a)(1)

Public Safety Standards of the United States

WQA S-100	1985	Water Quality Association	and Documentation Water Softeners	24 CFR 200, Subpart S
WQA S-200	1988	Water Quality Association	Water Filters	24 CFR 200, Subpart S
WQA S-300	1984	Water Quality Association	Point-of-Use, Low Pressure Reverse Osmosis Drinking Water Systems	24 CFR 200, Subpart S
WQA S-400	1986	Water Quality Association	Point-of-Use Distillation Drinking Water Systems	24 CFR 200, Subpart S
WSTDA T-1	2005	Web Sling and Tiedown Association	Recommended Standard Specification for Synthetic Web Tiedowns	49 CFR 393.104(e)(3)

Last Updated: December 31, 2012

↑  
Published by Public.Resource.Org

# **EXHIBIT 28**

Public Safety Codes of the United States

40  
 'o 12019  
 2/26/15  
 Witness: MALAMMO

# Public Safety Codes Incorporated By Law

**ATTENTION!** Always Check With Your Authority For Additions, Deletions, and Etc!

This page is dedicated to Peter Veeck in recognition of his pioneering work in public safety.

You may also browse bulk data.

Please send updates and corrections to [Public.Resource.Org](http://Public.Resource.Org).

Building	Fire	Mechanical	Plumbing	Fuel/Gas	Electrical	Accessibility	Energy
<b>ALABAMA</b>							
Authority: Building Commission							
IBC2009   IBC2009 Storm: ICC500- 2008	IFC2009   IBC2009	IMC2009   IBC2009	IPC2009   IPC2009	IFGC2009	NEC2011   NEC2011		ASHRAE 90.1-2007
<b>ALASKA</b>							
Authority: Fire Authority: Energy							
IBC2009   IBC2009	IFC2009   IBC2009	IMC2009   IBC2009	UPC2003	IFGC2006	NEC2005 IEE C2- 2002		
<b>ARIZONA</b>							
Authority: SOS Authority: Fire							
	IFC2006						IECC2006
<b>Phoenix</b>							
Authority: Building							
IBC2012 IRC2012 IEBC2012 IPMC2012	IFC2012	IMC2012	UPC2012	IFGC2012	NEC2011   NEC2011	A117.1-2009	IECC2012
<b>ARKANSAS</b>							
Authority: Fire Authority: Building							
IBC2006	IFC2006	IMC2006	IPC2006	IFGC2006			
<b>CALIFORNIA</b>							
Authority: BSC							
2013 Building	2013 FIRE	2013 MECH	2013 PLUM		2013 ELEC		ENERGY GREEN
<b>COLORADO</b>							
Authority: Architect							
IBC2012	IFC2006	IMC2012	IPC2009   IPC2009	IFGC2009	NEC2011 	A117.1-2003	IECC2012

Public Safety Codes of the United States

							NEC2011
<b>Denver</b>							Authority: Building
IBC2009   IBC2009 IRC2009	IFC2009   IBC2009	IMC2009   IBC2009	IPC2009   IPC2009	IFGC2009	NEC2008	IECC2009   IECC2009	
<b>CONNECTICUT</b>							Authority: Construction
IBC2003 IRC2009		IMC2003	IPC2003		NEC2005	A117.1-2003 IECC2009   IECC2009	
<b>DELAWARE</b>							
			IPC2009   IPC2009		NEC2011   NEC2011	A117.1-1992 IECC2009   IECC2009	
<b>Sussex County</b>							Authority: Building
IBC2012 IRC2012							
<b>DISTRICT OF COLUMBIA</b>							Authority: Building
IBC2006 IRC2006	IFC2006	IMC2006	IPC2006	IFGC2006	NEC2005	IECC2006	
<b>FLORIDA</b>							Authority: Building
IBC2009   IBC2009 IRC2009   IRC2009 IEBC2009 ICC HURRICANE		IMC2009   IMC2009		IFGC2009			
<b>GEORGIA</b>							Authority: Building
IBC2012 IRC2012 IEBC2012 IPMC2012	IFC2012	IMC2012	IPC2012	IFGC2012	NEC2011   NEC2011	IECC2009   IECC2009	
<b>HAWAII</b>							Authority: Building
IBC2006	NFPA1-2006		UPC2006		NEC2008	IECC2006	
<b>IDAHO</b>							Authority: Rules, Fire, Building
IBC2012 IEBC2012 IRC2009   IRC2009	IFC2012	IMC2012	UPC2009	IFGC2012	NEC2008	A117.1-2009	
<b>ILLINOIS</b>							Authority: Codes
IBC2009   IBC2009	IFC2009   IFC2009	IMC2009   IMC2009	Illinois	IFGC2009		Verbiage Images	

Public Safety Codes of the United States

<b>Chicago</b>		Authority: Building					
Code (Official) Code (Bulk)							
<b>INDIANA</b>		Authority: Housing					
IBC2006	IFC2006	IMC2006	UPC1997	IFGC2006	NEC2008	A117.1-2003	ASHRAE 90.1-2007
<b>IOWA</b>		Authority: Building					
IBC2009   IBC2009 IRC2009   IRC2009 IEBC2009		IMC2009   IMC2009	UPC2012		NEC2011   NEC2011		IECC2009   IECC2009
<b>KANSAS</b>		Authority: Building					
<b>Wichita</b>		Authority: Building					
IBC2006 IRC2006 IEBC2006	IFC2006	IMC2006	UPC2000		NEC2005		
<b>KENTUCKY</b>		Authority: Building Authority: Plumbing					
IBC2012 IRC2012	IFC2012 NFPA101-2012	IMC2012			NEC2008	A117.1-2009	IECC2009   IECC2009
<b>LOUISIANA</b>		Authority: Safety					
IBC2012		IMC2009   IMC2009		IFGC2009	NEC2008	Accessibility	ASHRAE 90.1-2007
<b>MAINE</b>		Authority: Building Authority: Fire					
IBC2009   IBC2009 IRC2009   IRC2009 IEBC2009	NFPA1-2006		UPC2006		NEC2011   NEC2011		IECC2009   IECC2009 ASHRAE 90.1-2007
<b>MARYLAND</b>		Authority: Housing					
IBC2012 IRC2012	IFC2012 NFPA101-2012	IMC2006	PHCC-NSPC-2006	IFGC2006	NEC2011   NEC2011		IECC2012
<b>MASSACHUSETTS</b>		Authority: Building					
IBC2009   IBC2009 IEBC2009	IFC2009   IFC2009	IMC2009   IMC2009			NEC2014		IECC2009   IECC2009 ASHRAE 90.1-2007
<b>MICHIGAN</b>		Authority: Labor					

Public Safety Codes of the United States

IBC2009   IBC2009 IRC2009   IRC2009		IMC2009   IMC2009	IPC2009   IPC2009	IFGC2009	NEC2008		IECC2009   IECC2009
<b>MINNESOTA</b>		Authority: DLI					
IBC2006 IRC2006		IMC2006		IFGC2006	NEC2011   NEC2011		ASHRAE 90.1-2004
<b>MISSISSIPPI</b>							
<b>Jackson</b>		Authority: Building					
IBC2003	IFC2003		IPC2003	IFGC2003	NEC2005		
<b>MISSOURI</b>							
<b>St. Louis</b>		Authority: Building					
IBC2009   IBC2009 IRC2009   IRC2009 IEBC2009	IFC2009   IFC2009	IMC2009   IMC2009	UPC2009	IFGC2009	NEC2011   NEC2011		IECC2009   IECC2009
<b>MONTANA</b>		Authority: Building					
IBC2009   IBC2009 IRC2009   IRC2009 IEBC2009		IMC2009   IMC2009	UPC2009	IFGC2009	NEC2011   NEC2011		IECC2009   IECC2009
<b>NEBRASKA</b>		Authority: Fire Authority: Energy					
	NFPA101- 2003						ASHRAE 90.1-2007
<b>Lincoln</b>		Authority: Building					
IBC2009   IBC2009 IRC2009   IRC2009	IFC2009   IFC2009	IMC2009   IMC2009		IFGC2009	NEC2011   NEC2011		
<b>NEVADA</b>		Authority: Fire					
IBC2006	IFC2006	UMC2006	UPC2006				
<b>Las Vegas</b>		Authority: Building Authority: Amusement					
IBC2009   IBC2009 IRC2009   IRC2009		UMC2009	UPC2009	Fuel/Gas	NEC2008		IECC2009   IECC2009
<b>NEW HAMPSHIRE</b>		Authority: Building					
IBC2009							

Public Safety Codes of the United States

IBC2009 IRC2009   IRC2009		IMC2009   IMC2009	IPC2009   IPC2009		NEC2011   NEC2011		IECC2009   IECC2009
<b>NEW JERSEY</b> Authority: Building							
IBC2009   IBC2009 IRC2009   IRC2009		IMC2009   IMC2009	NSPC2009	IFGC2009	NEC2011   NEC2011	A117.1-2003	IECC2009   IECC2009
<b>NEW MEXICO</b> Authority: Building Authority: Fire							
IBC2009   IBC2009 IRC2009   IRC2009 IEBC2009	IFC2003	UMC2009	UPC2009 USPSHTC2009		NEC2011   NEC2011		IECC2009   IECC2009 USEC2009
<b>NEW YORK</b> Authority: Building							
IBC2006 IRC2006 IEBC2006	IFC2006	IMC2006	IPC2006	IFGC2006			IECC2006
<b>New York City</b> Authority: Building (Get the Updates!)							
Building Zoning	Fire	Mechanical	Plumbing	Fuel/Gas	Electrical		
<b>NORTH CAROLINA</b> Authority: Building							
IBC2009   IBC2009 IRC2009   IRC2009	IFC2009   IFC2009	IMC2009   IMC2009	IPC2009   IPC2009	IFGC2009	NEC2011   NEC2011		IECC2009   IECC2009
<b>NORTH DAKOTA</b> Authority: Building Authority: Electric Authority: Plumbing							
IBC2012 IRC2012		IMC2012	UPC2009	IFGC2012	NEC2011   NEC2011		
<b>OHIO</b> Authority: Building							
IBC2009   IBC2009	IFC2009   IFC2009	IMC2009   IMC2009	IPC2009   IPC2009	IFGC2009	NEC2011   NEC2011	A117.1-2009   A117.1- 2009	ASHRAE 90.1-2009   IECC2009   IECC2009
<b>OKLAHOMA</b> Authority: Building							
IBC2009   IBC2009 IRC2009   IRC2009 IEBC2009	IFC2009   IFC2009	IMC2009   IMC2009	IPC2009   IPC2009	IFGC2009	NEC2011   NEC2011		

Public Safety Codes of the United States

<b>OREGON</b>								Authority: Building
Structural Residential	Fire	Mechanical					Energy	
<b>PENNSYLVANIA</b>								Authority: Building
IBC2009   IBC2009 IRC2009   IRC2009 IEBC2009	IFC2009   IFC2009	IMC2009   IMC2009	IPC2009   IPC2009	IFGC2009	NEC2008		IECC2009   IECC2009	
<b>RHODE ISLAND</b>								Authority: Building
IBC2012 IRC2012	NFPA1-2003	IMC2012	IPC2012	IFGC2012	NEC2011   NEC2011		IECC2012	
<b>SOUTH CAROLINA</b>								Authority: Building
IBC2006 IRC2006	IFC2006		IPC2006	IFGC2006	NEC2008			
<b>SOUTH DAKOTA</b>								Authority: Plumbing Authority: Electrical
			UPC2003		NEC2008			
<b>Sioux City</b>								Authority: Building Authority: Reed
IBC2012 IRC2012 IEBC2012		IMC2012	UPC2009	IFGC2012	NEC2011   NEC2011			
<b>TENNESSEE</b>								Authority: SOS
IBC2006 IRC2009   IRC2009	IFC2006 NFPA 101- 2006	IMC2006					IECC2006 ASHRAE 90.1-2007	
<b>TEXAS</b>								Authority: Reed
IBC2003					NEC2008			
<b>Dallas</b>								Authority: Building
IBC2012 IRC2012	IFC2006	IMC2012	IPC2012	IFGC2012	NEC2011   NEC2011		IECC2012   IECC2009	
<b>Houston</b>								Authority: Building
IBC2006 IRC2006	IFC2006	UMC2006	UPC2006		NEC2011   NEC2011		ASHRAE 90.1-2007 IECC2009   IECC2009	
<b>UTAH</b>								Authority: Building

Public Safety Codes of the United States

IBC2009   IBC2009 IRC2009   IRC2009 IEBC2009 UCADB 1997	IFC2012 NFPA101- 2012	IMC2009   IMC2009	IPC2009   IPC2009	IFGC2009	NEC2008		IECC2009   IECC2009
<b>VERMONT</b> Authority: Fire							
IBC2012	IFC2012 NFPA101- 2012		IPC2012		NEC2011   NEC2011		
<b>VIRGINIA</b> Authority: Building							
IRC2009   IRC2009 IEBC2009	IFC2009   IFC2009	IMC2009   IMC2009		IFGC2009	NEC2008		IECC2009   IECC2009
<b>WASHINGTON</b> Authority: Building							
IBC2012 IRC2012 IEBC2012	IFC2012	IMC2012	UPC2012		NEC2005	A117.1-2003	
<b>WEST VIRGINIA</b> Authority: Fire							
IBC2009   IBC2009 IRC2009   IRC2009 IEBC2009	NFPA101- 2012	IMC2009   IMC2009	IPC2009   IPC2009	IFGC2009	NEC2008	A117.1-2003	IECC2003
<b>WISCONSIN</b> Authority: Public Safety							
IBC2009   IBC2009 IEBC2009		IMC2009   IMC2009		IFGC2009		A117.1-2003	IECC2009   IECC2009
<b>WYOMING</b> Authority: Fire							
IBC2006 IEBC2006	IFC2006	IMC2006		IFGC2006	NEC2011   NEC2011		
<b>BOILER CODES</b> Authority: National Board Synopsis							
API 510 (2006): Pressure Vessel Inspection Code: In-Service Inspection, Rating, Repair, and Alteration							
ASME B31.1 (2007): Code for Pressure Piping, Power Piping							
ASME B31.1 (2007): 2008 Addendum to the 2007 Edition							
ASME B31.1 (2007): 2009 Addendum to the 2007 Edition							
ASME B31.5 (2001): Code for Pressure Piping, Refrigeration Piping and Heat Transfer Components							
ASME B31.5 (2001): 2004 Addendum to the 2001 Edition							
ASME B31.9 (2008): Building Services Piping							
ASME BPVCI (2010): Boiler and Pressure Vessel Code, Part I, Rules for the Construction of Power Boilers							

## Public Safety Codes of the United States

ASME BPVCI (2010): 2011 Addendum to the 2010 Edition

ASME BPVC IV (2007): Boiler and Pressure Vessel Code, Part IV, Rules for Construction of Heating Boilers

ASME BPVC IV (2007): 2008 Addendum to the 2007 Edition

ASME BPVC V (2010): Boiler and Pressure Vessel Code, Part V, Nondestructive Examination

ASME BPVC VI (2007): Boiler and Pressure Vessel Code, Part VI, Recommended Rules for the Care and Operation of Heating Boilers

ASME BPVC VI (2007): 2008 Addendum to the 2007 Edition

ASME BPVC VI (2010): Boiler and Pressure Vessel Code, Part VI, Recommended Rules for the Care and Operation of Heating Boilers

ASME BPVC VII (2010): Boiler and Pressure Vessel Code, Part VII, Recommended Guidelines for the Care of Power Boilers

ASME BPVC IX (2010): Boiler and Pressure Vessel Code, Part IX, Welding and Brazing Qualifications

ASME BPVC IX (2010): 2011 Addendum to the 2010 Edition

ASME CSD-1 (2009): Controls and Safety Devices for Automatically Fired Boilers

ASME PHVO-1 (2007): Safety Standard for Pressure Vessels for Human Occupancy

NB NBIC 1 (2007): National Board Inspection Code, Part 1, Installation

NB NBIC 1 (2007): 2008 Addendum to Part 1

NB NBIC 1 (2007): 2009 Addendum to Part 1

NB NBIC 2 (2007): National Board Inspection Code, Part 2, Inspection

NB NBIC 2 (2007): 2008 Addendum to Part 2

NB NBIC 2 (2007): 2009 Addendum to Part 2

NB NBIC 3 (2007): National Board Inspection Code, Part 3, Repair and Alteration

NB NBIC 3 (2007): 2008 Addendum to Part 3

NB NBIC 3 (2007): 2009 Addendum to Part 3

## **ELEVATOR CODES**

ANSI A10.4 (2007): Safety Requirements for Personnel Hoists on Construction and Demolition Sites

ANSI A10.5 (2006): Safety Requirements for Material Hoists - American National Standard for Construction and Demolition Operations

ASCE 21.1 (2005): Automated People Mover Standards, Part 1

ASCE 21.2 (2008): Automated People Mover Standards, Part 2

ASCE 21.3 (2008): Automated People Mover Standards, Part 3

ASCE 21.4 (2008): Automated People Mover Standards, Part 4

ASME A17.1 (1971): Safety Code for Elevators and Escalators

ASME A17.1 (2004): Safety Code for Elevators and Escalators

ASME A17.1 (2004): Addenda to the 2004 Edition

ASME A17.1 (2004): Addenda to the 2004 Edition

ASME A17.1 (2007): Safety Code for Elevators and Escalators

ASME A17.1 (2007): Addenda to the 2007 Edition

ASME A17.1 (2007): Addenda to the 2007 Edition

## Public Safety Codes of the United States

ASME A17.2 (2007): Guide for Inspection of Elevators, Escalators, and Moving Walks  
 ASME A17.2 (2010): Guide for Inspection of Elevators, Escalators, and Moving Walks  
 ASME A17.3 (2002): Safety Code for Existing Elevators and Escalators (Includes Requirements for Electric and Hydraulic Elevators and Escalators)  
 ASME A17.3 (2008): Safety Code for Existing Elevators and Escalators (Includes Requirements for Electric and Hydraulic Elevators and Escalators)  
 ASME A17.4 (1999): Guide for Emergency Personnel  
 ASME A17.5 (2004): Elevator and Escalator Electrical Equipment  
 ASME A17.6 (2010): Standard for Elevator Suspension, Compensation, and Governor Systems  
 ASME A17.7 (2007): Performance-Based Safety Code for Elevators and Escalators  
 ASME A18.1 (2005): Safety Standard for Platform Lifts and Stairway Chairlifts  
 ASME A18.1 (2008): Safety Standard for Platform Lifts and Stairway Chairlifts  
 ASME A90.1 (2003): Safety Standard for Belt Manlifts  
 ASME QEI-1 (2007): Standard for the Qualification of Elevator Inspectors

### **AMUSEMENT CODES**

ASTM F698 (1994): Standard Specification for Physical Information to be Provided for Amusement Rides and Devices  
 ASTM F747 (1997): Standard Terminology Relating to Amusement Rides and Devices  
 ASTM F747 (2006): Standard Terminology Relating to Amusement Rides and Devices  
 ASTM F770 (1993): Standard Practice for Ownership and Operation of Amusement Rides and Devices  
 ASTM F770 (2006): Standard Practice for Ownership and Operation of Amusement Rides and Devices  
 ASTM F846 (1992): Standard Guide for Testing Performance of Amusement Rides and Devices  
 ASTM F853 (2004): Standard Practice for Maintenance Procedures for Amusement Rides and Devices  
 ASTM F853 (2005): Standard Practice for Maintenance Procedures for Amusement Rides and Devices  
 ASTM F893 (2005): Standard Guide for Inspection of Amusement Rides and Devices  
 ASTM F1159 (2003): Standard Practice for Design and Manufacture of Patron Directed, Artificial Climbing Walls, Dry Slide, and Purposeful Water Immersion Amusement  
 ASTM F1193 (2004): Standard Practice for Quality, Manufacture, and Construction of Amusement Rides and Devices  
 ASTM F1193 (2006): Standard Practice for Quality, Manufacture, and Construction of Amusement Rides and Devices  
 ASTM F1305 (1994): Standard Guide for Classification of Amusement Ride and Device Related Injuries and Illnesses  
 ASTM F1950 (1999): Standard Specification for Physical Information to be Transferred With Used Amusement Rides and Devices  
 ASTM F1957 (1999): Standard Test Method for Composite Foam Hardness Durometer Hardness  
 ASTM F2007 (2000): Standard Practice for Design, Manufacture, and Operation of Concession Go Karts and Facilities  
 ASTM F2007 (2006): Standard Practice for Design, Manufacture, and Operation of Concession

Public Safety Codes of the United States

Go Karts and Facilities

ASTM F2137 (2001): Standard Practice for Measuring the Dynamic Characteristics of Amusement Rides and Devices

ASTM F2291 (2004): Standard Practice for Design of Amusement Rides and Devices

ASTM F2291 (2006): Standard Practice for Design of Amusement Rides and Devices

ASTM F2374 (2000): Standard Practice for Design, Manufacture, Operation, and Maintenance of Inflatable Amusement Devices

ASTM F2376 (2006): Standard Practice for Classification, Design, Manufacture, Construction, and Operation of Water Slide Systems

Last Updated: March 12, 2014



# **EXHIBIT 29**

PREAMBLE (NOT PART OF THE STANDARD)

In order to promote public education and public safety, equal justice for all, a better informed citizenry, the rule of law, world trade and world peace, this legal document is hereby made available on a noncommercial basis, as it is the right of all humans to know and speak the laws that govern them.

END OF PREAMBLE (NOT PART OF THE STANDARD)

An American National Standard



Designation: D 86 - 07

## Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure<sup>1</sup>

This standard is issued under the fixed designation D 86; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

### 1. Scope\*

1.1 This test method covers the atmospheric distillation of petroleum products using a laboratory batch distillation unit to determine quantitatively the boiling range characteristics of such products as light and middle distillates, automotive spark-ignition engine fuels, aviation gasolines, aviation turbine fuels, 1-D and 2-D regular and low sulfur diesel fuels, special petroleum spirits, naphthas, white spirits, kerosines, and Grades 1 and 2 burner fuels.

1.2 The test method is designed for the analysis of distillate fuels; it is not applicable to products containing appreciable quantities of residual material.

1.3 This test method covers both manual and automated instruments.

1.4 Unless otherwise noted, the values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

2.1 All standards are subject to revision, and parties to agreement on this test method are to apply the most recent edition of the standards indicated below, unless otherwise specified, such as in contractual agreements or regulatory rules where earlier versions of the method(s) identified may be required.

#### 2.2 ASTM Standards:<sup>2</sup>

- D 97 Test Method for Pour Point of Petroleum Products
- D 323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)
- D 2892 Test Method for Distillation of Crude Petroleum (15-Theoretical Plate Column)
- D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products
- D 4177 Practice for Automatic Sampling of Petroleum and Petroleum Products
- D 4953 Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)
- D 5190 Test Method for Vapor Pressure of Petroleum Products (Automatic Method)
- D 5191 Test Method for Vapor Pressure of Petroleum Products (Mini Method)
- D 5842 Practice for Sampling and Handling of Fuels for Volatility Measurement
- D 5949 Test Method for Pour Point of Petroleum Products (Automatic Pressure Pulsing Method)
- D 5950 Test Method for Pour Point of Petroleum Products (Automatic Tilt Method)
- D 5985 Test Method for Pour Point of Petroleum Products (Rotational Method)
- E 1 Specification for ASTM Liquid-in-Glass Thermometers
- E 77 Test Method for Inspection and Verification of Thermometers
- E 1272 Specification for Laboratory Glass Graduated Cylinders
- E 1405 Specification for Laboratory Glass Distillation Flasks

EXHIBIT 64  
Ashley Soevyn, CSR No. 12019

Date 2/27/15

Witness: MALAMUD

2.3 Energy Institute Standards:<sup>3</sup>

IP 69 Determination of Vapour Pressure—Reid Method

IP 123 Petroleum Products—Determination of Distillation Characteristics

IP 394 Determination of Air Saturated Vapour Pressure

IP Standard Methods for Analysis and Testing of Petroleum and Related Products 1996—Appendix A

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.08.0A on Distillation.

In the IP, the equivalent test method is published under the designation IP 123. It is under the jurisdiction of the Standardization Committee.

Current edition approved Jan. 15, 2007. Published February 2007. Originally approved in 1921. Last previous edition approved in 2005 as D 86–05.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from Energy Institute, 61 New Cavendish St., London, WIG 7AR, U.K., http://www.energyinst.org.uk.

\*A Summary of Changes section appears at the end of this standard.

TABLE 1 Preparation of Apparatus

	Group 1	Group 2	Group 3	Group 4
Flask, mL	125	125	125	125
ASTM distillation thermometer	7C (7F)	7C (7F)	7C (7F)	8C (8F)
IP distillation thermometer range	low	low	low	high
Flask support board	B	B	C	C
diameter of hole, mm	38	38	50	50
Temperature at start of test				
Flask C	13–18	13–18	13–18	not above
	°F 55–65	55–65	55–65	ambient
Flask support and shield	not above ambient	not above ambient	not above ambient	
Receiving cylinder and 100 mL charge				
	°C 13–18	13–18	13–18 <sup>A</sup>	13-ambient <sup>A</sup>
	°F 55–65	55–65	55–65 <sup>A</sup>	55-ambient <sup>A</sup>

<sup>A</sup>See 10.3.1.1 for exceptions.

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *charge volume, n*—the volume of the specimen, 100 mL, charged to the distillation flask at the temperature specified in Table 1.

3.1.2 *decomposition, n—of a hydrocarbon*, the pyrolysis or cracking of a molecule yielding smaller molecules with lower boiling points than the original molecule.

3.1.2.1 *Discussion*—Characteristic indications of thermal decomposition are evolution of fumes and erratic temperature readings that usually decrease after any attempt is made to adjust the heat.

3.1.3 *decomposition point, n*—the corrected thermometer reading that coincides with the first indications of thermal decomposition of the liquid in the flask.

3.1.3.1 *Discussion*—The decomposition point, as determined under the conditions of this test method, does not necessarily correspond to the decomposition temperature in other applications.

3.1.4 *dry point, n*—the corrected thermometer reading that is observed at the instant the last drop of liquid (exclusive of any drops or film of liquid on the side of the flask or on the temperature sensor), evaporates from the lowest point in the distillation flask.

3.1.4.1 *Discussion*—The end point (final boiling point), rather than the dry point, is intended for general use. The dry point can be reported in connection with special purpose naphthas, such as those used in the paint industry. Also, it is substituted for the end point (final boiling point) whenever the sample is of such a nature that the precision of the end point (final boiling point) cannot consistently meet the requirements given in the precision section.

3.1.5 *dynamic holdup, n*—the amount of material present in the neck of the flask, in the sidearm of the flask, and in the condenser tube during the distillation.

3.1.6 *emergent stem effect, n*—the offset in temperature reading caused by the use of total immersion mercury-in-glass thermometers in the partial immersion mode.

3.1.6.1 *Discussion*—In the partial immersion mode, a portion of the mercury thread, that is, the emergent portion, is at a lower temperature than the immersed portion, resulting in a shrinkage of the mercury thread and a lower temperature reading.

3.1.7 *end point (EP) or final boiling point (FBP), n*—the maximum corrected thermometer reading obtained during the test.

3.1.7.1 *Discussion*—This usually occurs after the evaporation of all liquid from the bottom of the flask. The term maximum temperature is a frequently used synonym.

3.1.8 *front end loss, n*—loss due to evaporation during transfer from receiving cylinder to distillation flask, vapor loss during the distillation, and uncondensed vapor in the flask at the end of the distillation.

3.1.9 *initial boiling point (IBP), n*—the corrected thermometer reading that is observed at the instant the first drop of condensate falls from the lower end of the condenser tube.

3.1.10 *percent evaporated, n*—the sum of the percent recovered and the percent loss.

3.1.11 *percent loss (or observed loss), n*—one hundred minus the percent total recovery.

3.1.11.1 *corrected loss, n*—percent loss corrected for barometric pressure.

3.1.12 *percent recovered, n*—the volume of condensate observed in the receiving cylinder, expressed as a percentage of the charge volume, associated with a simultaneous temperature reading.

3.1.13 *percent recovery, n*—the maximum percent recovered, as observed in accordance with 10.18.

3.1.13.1 *corrected percent recovery, n*—the percent recovery, adjusted for the difference between the observed loss and the corrected loss, as described in Eq 8.

3.1.13.2 *percent total recovery, n*—the combined percent recovery and residue in the flask, as determined in accordance with 11.1.

3.1.14 *percent residue, n*—the volume of residue in the flask, measured in accordance with 10.19, and expressed as a percentage of the charge volume.

3.1.15 *rate of change (or slope), n*—the change in temperature reading per percent evaporated or recovered, as described in 13.2.

3.1.16 *temperature lag, n*—the offset between the temperature reading obtained by a temperature sensing device and the true temperature at that time.

3.1.17 *temperature measurement device, n*—a thermometer, as described in 6.3.1, or a temperature sensor, as described in 6.3.2.

3.1.18 *temperature reading, n*—the temperature obtained by a temperature measuring device or system that is equal to the thermometer reading described in 3.1.19.

3.1.18.1 *corrected temperature reading, n*—the temperature reading, as described in 3.1.18, corrected for barometric pressure.

3.1.19 *thermometer reading (or thermometer result), n*—the temperature of the saturated vapor measured in the neck of the flask below the vapor tube, as determined by the prescribed thermometer under the conditions of the test.

3.1.19.1 *corrected thermometer reading, n*—the thermometer reading, as described in 3.1.19, corrected for barometric pressure.

## 4. Summary of Test Method

4.1 Based on its composition, vapor pressure, expected B3P or expected EP, or combination thereof, the sample is placed in one of four groups. Apparatus arrangement, condenser temperature, and other operational variables are defined by the group in which the sample falls.

4.2 A 100-mL specimen of the sample is distilled under prescribed conditions for the group in which the sample falls. The distillation is performed in a laboratory batch distillation unit at ambient pressure under conditions that are designed to provide approximately one theoretical plate fractionation. Systematic observations of temperature readings and volumes of condensate are made, depending on the needs of the user of the data. The volume of the residue and the losses are also recorded.

4.3 At the conclusion of the distillation, the observed vapor temperatures can be corrected for barometric pressure and the data are examined for conformance to procedural requirements, such as distillation rates. The test is repeated if any specified condition has not been met.

4.4 Test results are commonly expressed as percent evaporated or percent recovered versus corresponding temperature, either in a table or graphically, as a plot of the distillation curve.

## 5. Significance and Use

5.1 The basic test method of determining the boiling range of a petroleum product by performing a simple batch distillation has been in use as long as the petroleum industry has existed. It is one of the oldest test methods under the jurisdiction of ASTM Committee D02, dating from the time when it was still referred to as the Engler distillation. Since the test method has been in use for such an extended period, a tremendous number of historical data bases exist for estimating end-use sensitivity on products and processes.

5.2 The distillation (volatility) characteristics of hydrocarbons have an important effect on their safety and performance, especially in the case of fuels and solvents. The boiling range gives information on the composition, the properties, and the behavior of the fuel during storage and use. Volatility is the major determinant of the tendency of a hydrocarbon mixture to produce potentially explosive vapors.

5.3 The distillation characteristics are critically important for both automotive and aviation gasolines, affecting starting, warm-up, and tendency to vapor lock at high operating

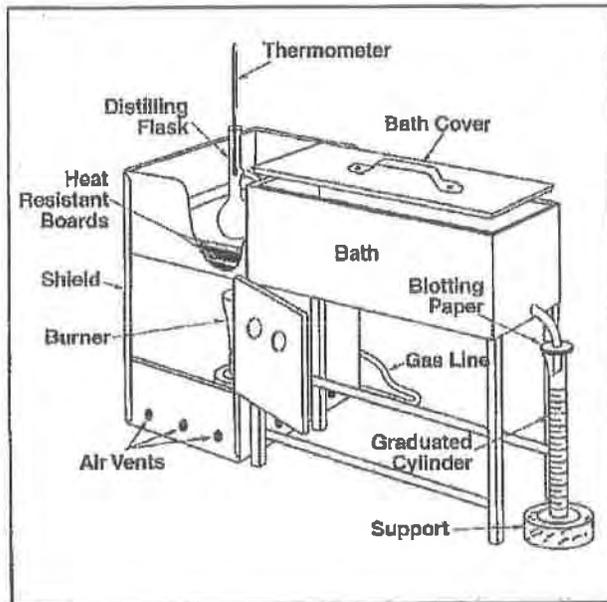


FIG. 1 Apparatus Assembly Using Gas Burner

temperature or at high altitude, or both. The presence of high boiling point components in these and other fuels can significantly affect the degree of formation of solid combustion deposits.

5.4 Volatility, as it affects rate of evaporation, is an important factor in the application of many solvents, particularly those used in paints.

5.5 Distillation limits are often included in petroleum product specifications, in commercial contract agreements, process refinery/control applications, and for compliance to regulatory rules.

## 6. Apparatus

### 6.1 Basic Components of the Apparatus:

6.1.1 The basic components of the distillation unit are the distillation flask, the condenser and associated cooling bath, a metal shield or enclosure for the distillation flask, the heat source, the flask support, the temperature measuring device, and the receiving cylinder to collect the distillate.

6.1.2 Figs. 1 and 2 are examples of manual distillation units.

6.1.3 In addition to the basic components described in 6.1.1, automated units also are equipped with a system to measure and automatically record the temperature and the associated recovered volume in the receiving cylinder.

6.2 A detailed description of the apparatus is given in Annex A2.

### 6.3 Temperature Measuring Device:

6.3.1 Mercury-in-glass thermometers, if used, shall be filled with an inert gas, graduated on the stem and enamel backed. They shall conform to Specification E1 or IP Standard Methods for Analysis and Testing of Petroleum and Related Products 1996—Appendix A, or both, for thermometers ASTM

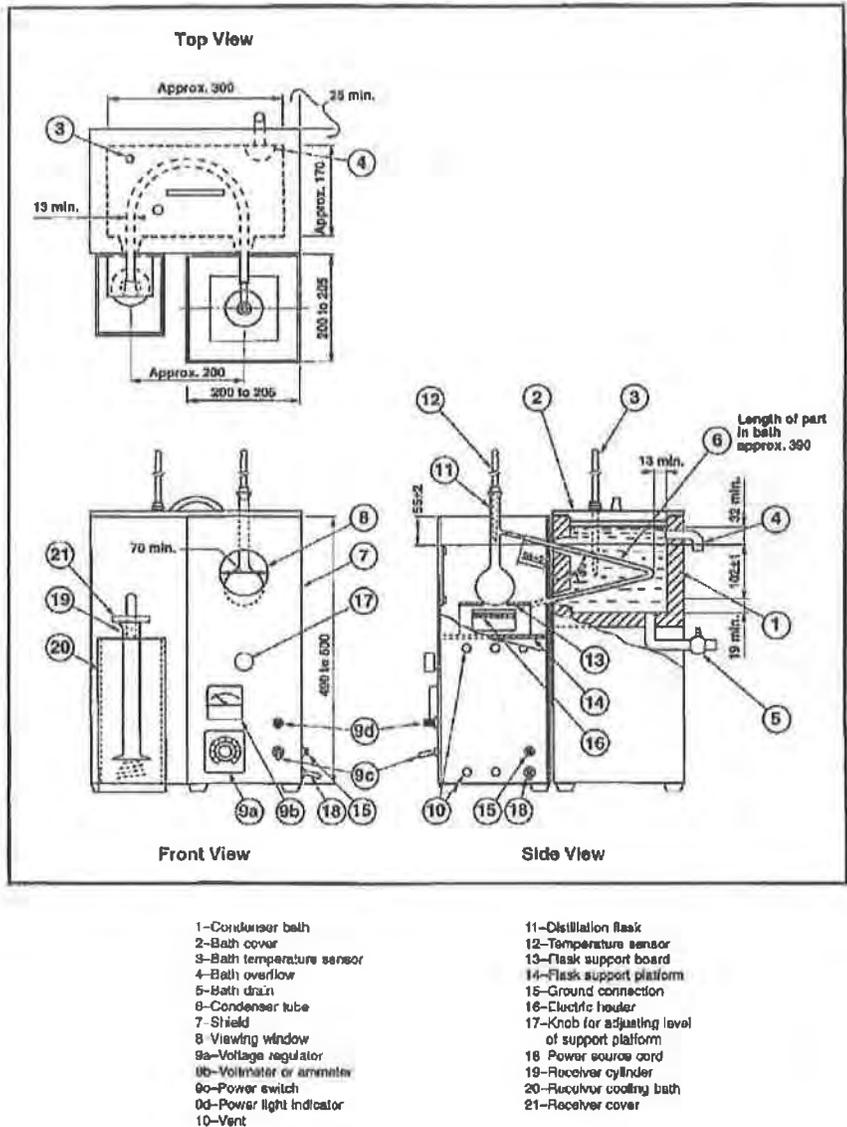


FIG. 2 Apparatus Assembly Using Electric Heater

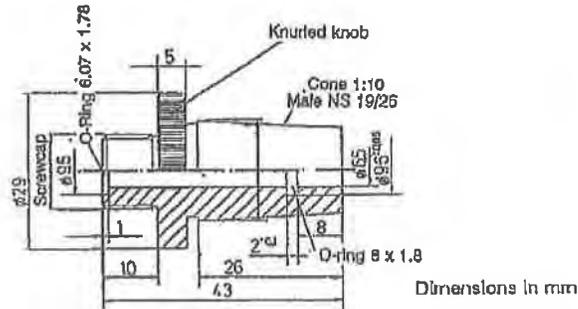


FIG. 3 PTFE Centering Device for Ground Glass Joint

7C/IP 5C and ASTM 7F for the low range thermometers, and ASTM 8C/IP 6C and ASTM 8F for the high range thermometers.

6.3.1.1 Thermometers that have been exposed for an extended period above an observed temperature of 370°C shall not be reused without a verification of the ice point or checked as prescribed in Specification E 1 and Test Method E 77.

NOTE 1—At an observed thermometer reading of 370°C, the temperature of the bulb is approaching a critical range in the glass and the thermometer may lose its calibration.

6.3.2 Temperature measurement systems other than those described in 6.3.1 are satisfactory for this test method, provided that they exhibit the same temperature lag, emergent stem effect, and accuracy as the equivalent mercury-in-glass thermometer.

6.3.2.1 The electronic circuitry or the algorithms, or both, used shall include the capability to simulate the temperature lag of a mercury-in-glass thermometer.

6.3.2.2 Alternatively, the sensor can also be placed in a casing with the tip of the sensor covered so that the assembly, because of its adjusted thermal mass and conductivity, has a temperature lag time similar to that of a mercury-in-glass thermometer.

NOTE 2—In a region where the temperature is changing rapidly during the distillation, the temperature lag of a thermometer can be as much as 3 seconds.

6.3.3 In case of dispute, the referee test method shall be carried out with the specified mercury-in-glass thermometer.

6.4 Temperature Sensor Centering Device:

6.4.1 The temperature sensor shall be mounted through a snug-fitting device designed for mechanically centering the sensor in the neck of the flask without vapor leakage. Examples of acceptable centering devices are shown in Figs. 3 and 4. (Warning—The use of a plain stopper with a hole drilled through the center is not acceptable for the purpose described in 6.4.1.)

NOTE 3—Other centering devices are also acceptable, as long as they position and hold the temperature sensing device in the proper position in the neck of the distillation column, as shown in Fig. 5 and described in 10.5.

NOTE 4—When running the test by the manual method, products with

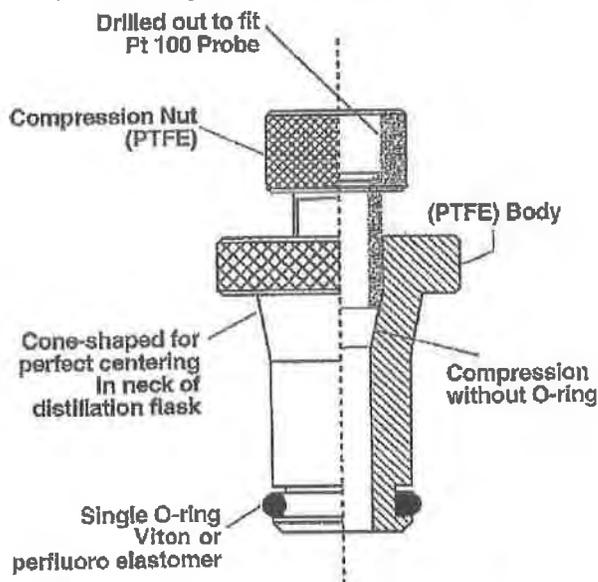


FIG. 4 Example of Centering Device Designs for Straight-Bore Neck Flasks

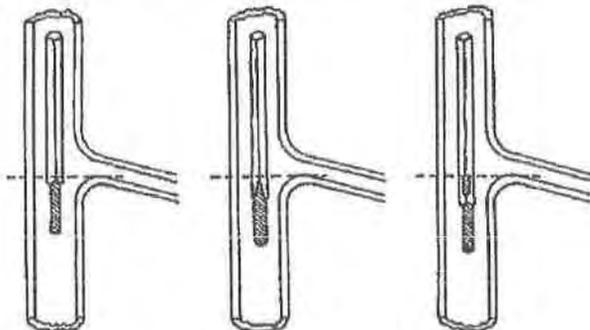


FIG. 5 Position of Thermometer in Distillation Flask

a low IBP may have one or more readings obscured by the centering device. See also 10.14.3.1.

6.5 Automated equipment manufactured in 1999 and later shall be equipped with a device to automatically shut down power to the unit and to spray an inert gas or vapor in the chamber where the distillation flask is mounted in the event of fire.

NOTE 5—Some causes of fires are breakage of the distillation flask, electrical shorts, and foaming and spilling of liquid sample through the top opening of the flask.

6.6 Barometer—A pressure measuring device capable of measuring local station pressure with an accuracy of 0.1 kPa (1 mm Hg) or better, at the same elevation relative to sea level as the apparatus in the laboratory. (Warning—Do not take readings from ordinary aneroid barometers, such as those used

TABLE 2 Group Characteristics

	Group 1	Group 2	Group 3	Group 4
Sample characteristics Distillate type Vapor pressure at				
37.8°C, kPa	≥65.5	<65.5	<65.5	<65.5
100°F, psi	≥9.5	<9.5	<9.5	<9.5

	Group 1	Group 2	Group 3	Group 4
(Test Methods D 323, D 4953, D 5190, D 5191, D 5482, IP 69 or IP 394)				
Distillation, IBP °C			≤100	>100
°F			≤212	>212
EP °C	≤250	≤250	>250	>250
°F	≤482	≤482	>482	>482

at weather stations and airports, since these are precorrected to give sea level readings.)

## 7. Sampling, Storage, and Sample Conditioning

7.1 Determine the Group characteristics that correspond to the sample to be tested (see Table 2). Where the procedure is dependent upon the group, the section headings will be so marked.

### 7.2 Sampling:

7.2.1 Sampling shall be done in accordance with Practice D 4057 or D 4177 and as described in Table 3.

7.2.1.1 *Group 1*—Condition the sample container to below 10°C, preferably by filling the bottle with the cold liquid sample and discarding the first sample. If this is not possible because, for instance, the product to be sampled is at ambient temperature, the sample shall be drawn into a bottle prechilled to below 10°C, in such a manner that agitation is kept at a minimum. Close the bottle immediately with a tight-fitting closure. (**Warning**—Do not completely fill and tightly seal a cold bottle of sample because of the likelihood of breakage on warming.)

7.2.1.2 *Groups 2, 3, and 4*—Collect the sample at ambient temperature. After sampling, close the sample bottle immediately with a tight-fitting closure.

7.2.1.3 If the sample received by the testing laboratory has been sampled by others and it is not known whether sampling has been performed as described in 7.2, the sample shall be assumed to have been so sampled.

### 7.3 Sample Storage:

7.3.1 If testing is not to start immediately after collection, store the samples as indicated in 7.3.2, 7.3.3, and Table 3. All samples shall be stored away from direct sunlight or sources of direct heat.

7.3.2 *Group 1*—Store the sample at a temperature below 10°C.

NOTE 6—If there are no, or inadequate, facilities for storage below 10°C, the sample may also be stored at a temperature below 20°C, provided the operator ensures that the sample container is tightly closed and leak-free.

7.3.3 *Group 2*—Store the sample at a temperature below 10°C.

NOTE 7—If there are no, or inadequate, facilities for storage below 10°C, the sample may also be stored at a temperature below 20°C, provided the operator ensures that the sample container is tightly closed and leak-free.

7.3.4 *Groups 3 and 4*—Store the sample at ambient or lower temperature.

### 7.4 Sample Conditioning Prior to Analysis:

7.4.1 Samples shall be conditioned to the temperature shown in Table 3 before opening the sample container.

7.4.1.1 *Groups 1 and 2*—Samples shall be conditioned to a temperature of less than 10°C (50°F) before opening the sample container.

7.4.1.2 *Groups 3 and 4*—If the sample is not fluid at ambient temperature, it is to be heated to a temperature of 9 to 21°C above its pour point (Test Method D 97, D 5949, or D 5985) prior to analysis. If the sample has partially or completely solidified during storage, it shall be vigorously shaken after melting prior to opening the sample container to ensure homogeneity.

7.4.1.3 If the sample is not fluid at room temperature, the temperature ranges shown in Table 3 for the flask and for the sample do not apply.

### 7.5 Wet Samples:

7.5.1 Samples of materials that visibly contain water are not suitable for testing. If the sample is not dry, obtain another sample that is free from suspended water.

7.5.2 *Groups 1 and 2*—If such a sample cannot be obtained, the suspended water can be removed by maintaining the sample at 0 to 10°C, adding approximately 10 g of anhydrous sodium sulfate per 100 mL of sample, shaking the mixture for approximately 2 min, and then allowing the mixture to settle for approximately 15 min. Once the sample shows no visible signs of water, use a decanted portion of the sample, maintained between 1 and 10°C, for the analysis. Note in the report that the sample has been dried by the addition of a desiccant.

NOTE 8—Suspended water in hazy samples in Groups 1 and 2 can be removed by the addition of anhydrous sodium sulfate and separating the liquid sample from the drying agent by decanting without statistically affecting the results of the test.<sup>4</sup>

7.5.3 *Groups 3 and 4*—In cases in which a water-free sample is not practical, the suspended water can be removed by shaking the sample with anhydrous sodium sulfate or other suitable drying agent and separating it from the drying agent by decanting. Note in the report that the sample has been dried by the addition of a desiccant.

## 8. Preparation of Apparatus

8.1 Refer to Table 1 and prepare the apparatus by choosing the appropriate distillation flask, temperature measuring device, and flask support board, as directed for the indicated group. Bring the temperature of the receiving cylinder, the flask, and the condenser bath to the indicated temperature.

8.2 Make any necessary provisions so that the temperature of the condenser bath and the receiving cylinder will be maintained at the required temperatures. The receiving cylinder shall be in a bath such that either the liquid level is at least

<sup>4</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D02-1455.

6

**TABLE 3 Sampling, Storage, and Sample Conditioning**

		Group 1	Group 2	Group 3	Group 4
Temperature of sample bottle	°C	<10			
	°F	<50			
Temperature of stored sample	°C	<10 <sup>A</sup>	<10	ambient	ambient
	°F	<50 <sup>A</sup>	<50	ambient	ambient
Temperature of sample after conditioning prior to analysis	°C	<10	<10	Ambient or	Ambient or
	°F	<50	<50	9 to 21°C above pour point <sup>B</sup>	Ambient or
				48 to 70°F above pour point <sup>B</sup>	
If sample is wet		resample	resample	dry in accordance with 7.5.3	
If resample is still wet <sup>C</sup>		dry in accordance with 7.5.2			

<sup>A</sup> Under certain circumstances, samples can also be stored at temperatures below 20°C (68°F). See also 7.3.2 and 7.3.3.  
<sup>B</sup> If sample is (semi)-solid at ambient temperature, see also 10.3.1.1.  
<sup>C</sup> If sample is known to be wet, resampling may be omitted. Dry sample in accordance with 7.5.2 and 7.5.3.

as high as the 100-mL mark or the entire receiving cylinder is surrounded by an air circulation chamber.

8.2.1 *Groups 1, 2, and 3*—Suitable media for low temperature baths include, but are not limited to, chopped ice and water, refrigerated brine, and refrigerated ethylene glycol.

8.2.2 *Group 4*—Suitable media for ambient and higher bath temperatures include, but are not limited to, cold water, hot water, and heated ethylene glycol.

8.3 Remove any residual liquid in the condenser tube by swabbing with a piece of soft, lint-free cloth attached to a cord or wire.

## 9. Calibration and Standardization

9.1 *Temperature Measurement System*—Temperature measurement systems using other than the specified mercury-in-glass thermometers shall exhibit the same temperature lag, emergent stem effect, and accuracy as the equivalent mercury-in-glass thermometer. Confirmation of the calibration of these temperature measuring systems shall be made at intervals of not more than six months, and after the system has been replaced or repaired.

9.1.1 The accuracy and the calibration of the electronic circuitry or computer algorithms, or both, shall be verified by the use of a standard precision resistance bench. When performing this verification, no algorithms shall be used to correct the temperature for lag and the emergent stem effect (see manufacturer's instructions).

9.1.2 Verification of the calibration of temperature measuring devices shall be conducted by distilling toluene in accordance with Group 1 of this test method and comparing the 50 % recovered temperature with that shown in Table 4.<sup>5</sup>

9.1.2.1 If the temperature reading is not within the values shown in Table 4 for the respective apparatus being used (see Note 10 and Table 4), the temperature measurement system shall be considered defective and shall not be used for the test.

NOTE 9—Toluene is used as a verification fluid for calibration; it will yield almost no information on how well an electronic measurement system simulates the temperature lag of a liquid-in-glass thermometer.

9.1.2.2 Reagent grade toluene and hexadecane (cetane), conforming to the specifications of the Committee on Analytical Reagents of the American Chemical Society,<sup>6</sup> shall be used. However, other grades may also be used, provided it is first ascertained that the reagent is of sufficient purity to permit its use without lessening the accuracy of the determination.

NOTE 10—At 101.3 kPa, toluene is shown in reference manuals as boiling at 110.6°C when measured using a partial immersion thermometer. Because this test method uses thermometers calibrated for total immersion, the results typically will be lower and, depending on the thermometer and the situation, may be different for each thermometer. At 101.3 kPa, hexadecane is shown in reference manuals as boiling at 287.0°C when measured using a partial immersion thermometer. Because this test method uses thermometers calibrated for total immersion, the results typically will be lower, and, depending on the thermometer and the situation, may be different for each thermometer.

9.1.3 A procedure to determine the magnitude of the temperature lag is described in Annex A3.

9.1.4 A procedure to emulate the emergent stem effect is described in Appendix X4.

9.1.5 To verify the calibration of the temperature measurement system at elevated temperatures, use hexadecane. The temperature measurement system shall indicate, at 50% recovered, a temperature comparable to that shown in Table 4 for the respective apparatus under Group 4 distillation conditions.

NOTE 11—Because of the high melting point of hexadecane, Group 4 verification distillations will have to be carried out with condenser temperatures >20°C.

9.2 Automated Method:

9.2.1 Level Follower—For an automated distillation apparatus, the level follower/recording mechanism of the apparatus shall have a resolution of 0.1 mL or better with a maximum error of 0.3 mL between the 5 and 100 mL points. The calibration of the assembly shall be verified in accordance with manufacturer's instructions at intervals of not more than three months and after the system has been replaced or repaired.

NOTE 12—The typical calibration procedure involves verifying the output with the receiver containing 5 and 100 mL of material respectively.

9.2.2 Barometric Pressure—At intervals of not more than six months, and after the system has been replaced or repaired,

<sup>5</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: Do2-1580.

<sup>6</sup> Reagent Chemicals, American Chemical Society Specifications, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

7

TABLE 4 True and Min and Max D 86 50 % Recovered Boiling Points (°C)<sup>A</sup>

		Manual		Automated	
		Distillation conditions min D 86 50 % boiling point	Distillation conditions max D 86 50 % boiling point	Distillation conditions min D 86 50 % boiling point	Distillation conditions max D 86 50 % boiling point
Toluene	ASTM/IP true boiling point	Group 1, 2, and 3			
	110.6	105.9	111.8	108.5	109.7
Hexadecane	ASTM/IP true boiling point	Group 4	Group 4	Group 4	Group 4
	287.0	272.2	283.1	277.0	280.0

<sup>A</sup> The manual and automated temperatures show in this table are the values for the 95 % tolerance interval for the 99 % population coverage. The proposed tolerance is approximately 3 × sigma. Information on the values in this table can be found in RR:Do2-1580.

the barometric reading of the instrument shall be verified against a barometer, as described in 6.6.

10. Procedure

10.1 Record the prevailing barometric pressure.

10.2 Groups 1 and 2—Fit a low range thermometer provided with a snug-fitting cork or stopper of silicone rubber, or equivalent polymeric material, rightly into the neck of the sample container and bring the temperature of the sample to the temperature indicated in Table 3.

10.3 Groups 1, 2, 3, and 4—Check that the temperature of the sample is as shown in Table 3. Pour the specimen precisely to the 100-mL mark of the receiving cylinder, and transfer the contents of the receiving cylinder as completely as practical into the distillation flask, ensuring that none of the liquid flows into the vapor tube.

NOTE 13—It is important that the difference between the temperature of the specimen and the temperature of the bath around the receiving cylinder is as small as practically possible. A difference of 5°C can make a difference of 0.7 mL.

10.3.1 Groups 3 and 4—If the sample is not fluid at ambient temperature, it is to be heated to a temperature between 9 and 21°C above its pour point (Test Methods D97, D 5949, D 5950, or D 5985) prior to analysis. If the sample has partially or completely solidified in the intervening period, it shall be vigorously shaken after melting, and prior to sampling, to ensure homogeneity.

10.3.1.1 If the sample is not fluid at ambient temperatures, disregard the temperature range shown in Table 1 for the receiving cylinder and sample. Prior to analysis, heat the receiving cylinder to approximately the same temperature as the sample. Pour the heated specimen precisely to the 100-mL mark of the receiving cylinder, and transfer the contents of the receiving cylinder as completely as practical into the distillation flask, ensuring that none of the liquid flows into the vapor tube.

NOTE 14—Any material that evaporates during the transfer will contribute to the loss; any material that remains in the receiving cylinder will contribute to the observed recovery volume at the time of the IBP.

10.4 If the sample can be expected to demonstrate irregular boiling behavior, that is, bumping, add a few boiling chips to the specimen. The addition of a few boiling chips is acceptable for any distillation.

10.5 Fit the temperature sensor through a snug-fitting device, as described in 6.4, to mechanically center the sensor in the neck of the flask. In the case of a thermometer, the bulb is centered in the neck and the lower end of the capillary is level with the highest point on the bottom of the inner wall of the vapor tube (see Fig. 5). In the case of a thermocouple or resistance thermometer, follow the manufacturer's instructions as to placement (see Fig. 6).

NOTE 15—If vacuum grease is used on the mating surface of the centering device, use the minimum amount of grease that is practical.

10.6 Fit the flask vapor tube, provided with a snug-fitting cork or rubber stopper of silicone, or equivalent polymeric material, tightly into the condenser tube. Adjust the flask in a vertical position so that the vapor tube extends into the condenser tube for a distance from 25 to 50 mm. Raise and adjust the flask support board to fit it snugly against the bottom of the flask.

10.7 Place the receiving cylinder that was used to measure the specimen, without drying the inside of the cylinder, into its temperature-controlled bath under the lower end of the condenser tube. The end of the condenser tube shall be centered in the receiving cylinder and shall extend therein for a distance of at least 25 mm, but not below the 100-mL mark.

### 10.8 Initial Boiling Point:

10.8.1 *Manual Method*—To reduce evaporation loss of the distillate, cover the receiving cylinder with a piece of blotting paper, or similar material, that has been cut to fit the condenser tube snugly. If a receiver deflector is being used, start the distillation with the tip of the deflector just touching the wall of the receiving cylinder. If a receiver deflector is not used, keep the drip tip of the condenser away from the wall of the receiving cylinder. Note the start time. Observe and record the IBP to the nearest 0.5°C (1.0°F). If a receiver deflector is not being used, immediately move the receiving cylinder so that the tip of the condenser touches its inner wall.

10.8.2 *Automated Method*—To reduce evaporation loss of the distillate, use the device provided by the instrument manufacturer for this purpose. Apply heat to the distillation flask and contents with the tip of the receiver deflector just touching the wall of the receiving cylinder. Note the start time. Record the IBP to the nearest 0.1°C (0.2°F).

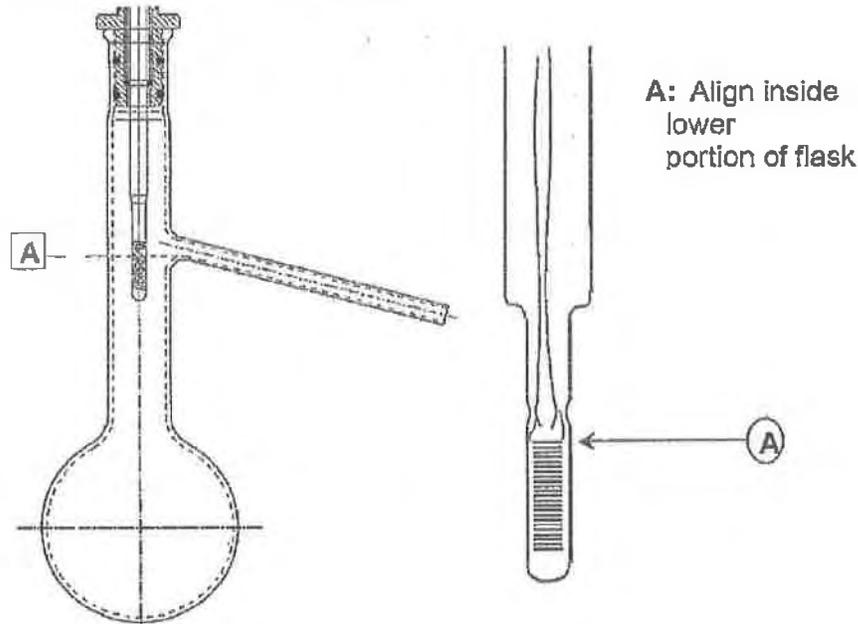


FIG. 6 Example of Recommended Placement of Pt-100 Probe Relative to Distillation Flask Sidearm for Automated D 86 Distillation Instrument

10.9 Regulate the heating so that the time interval between the first application of heat and the IBP is as specified in Table 5.

10.10 Regulate the heating so that the time from IBP to 5 or 10 % recovered is as indicated in Table 5.

10.11 Continue to regulate the heating so that the uniform average rate of condensation from 5 or 10 % recovered to 5 mL residue in the flask is 4 to 5 mL per min. (**Warning**—Due to the configuration of the boiling flask and the conditions of the test, the vapor and liquid around the temperature sensor are not in thermodynamic equilibrium. The distillation rate will consequently have an effect on the measured vapor temperature. The distillation rate shall, therefore, be kept as constant as possible throughout the test.)

NOTE 16—When testing gasoline samples, it is not uncommon to see the condensate suddenly form non-miscible liquid phases and bead up on the temperature measuring device and in the neck of the boiling flask at a vapor temperature of around 160°C. This may be accompanied by a sharp (about 3°C) dip in the vapor temperature and a drop in the recovery rate. The phenomenon, which may be due to the presence of trace water in the sample, may last for 10 to 30 s before the temperature recovers and the condensate starts flowing smoothly again. This point is sometimes colloquially referred to as the Hesitation Point.

10.12 Repeat any distillation that did not meet the requirements described in 10.9, 10.10, and 10.11.

10.13 If a decomposition point, as described in 3.1.3, is observed, discontinue the heating and proceed as directed in 10.17.

10.14 In the interval between the IBP and the end of the distillation, observe and record data necessary for the calculation and reporting of the results of the test as required by the specification involved, or as previously established for the sample under test. These observed data can include temperature readings at prescribed percentages recovered or percentages recovered at prescribed temperature readings, or both.

10.14.1 *Manual Method*—Record all volumes in the graduated cylinder to the nearest 0.5 mL, and all temperature readings to the nearest 0.5°C (1.0°F).

10.14.2 *Automated Method*—Record all volumes in the receiving cylinder to the nearest 0.1 mL, and all temperature readings to the nearest 0.1°C (0.2°F).

10.14.3 *Group 1, 2, 3, and 4*—In cases in which no specific data requirements have been indicated, record the IBP and the EP (FBP) or the dry point, or both, and temperature readings at 5, 15, 85, and 95 % recovered, and at each 10 % multiple of volume recovered from 10 to 90, inclusive.

10.14.3.1 *Group 4*—When a high range thermometer is used in testing aviation turbine fuels and similar products, pertinent thermometer readings can be obscured by the centering device. If these readings are required, perform a second distillation in accordance with Group 3. In such cases, reading from a low range thermometer can be reported in place of the obscured high range thermometer readings, and the test report shall so indicate. If, by agreement, the obscured readings are waived, the test report shall so indicate.

10.14.4 When it is required to report the temperature reading at a prescribed percent evaporated or recovered for a sample that has a rapidly changing slope of the distillation curve in the region of the prescribed percent evaporated or recovered reading, record temperature readings at every 1 % recovered. The slope is considered rapidly changing if the

9

TABLE 5 Conditions During Test Procedure

		Group 1	Group 2	Group 3	Group 4
Temperature of cooling bath <sup>4</sup>	°C	0-1	0-5	0-5	0-60
	°F	32-34	32-40	32-40	32-140
Temperature of bath around receiving cylinder	°C	13-18	13-18	13-18	±3
	°F	55-65	55-65	55-65	±5
					of charge temperature
Time from first application of heat to initial boiling point, min		5-10	5-10	5-10	5-15
Time from initial boiling point to 5 % recovered, s to 10 % recovered, min		60-100	60-100		
Uniform average rate of condensation from 5 % recovered to 5 mL in flask, mL/min		4-5	4-5	4-5	4-5
Time recorded from 5 mL residue to end point, min		5 max	5 max	5 max	5 max

<sup>4</sup> the proper condenser bath temperature will depend upon the wax content of the sample and of its distillation fractions. The test is generally performed using one single condenser temperature. Wax formation in the condenser can be deduced from (a) the presence of wax particles in the distillate coming off the drip tip, (b) a higher distillation loss than what would be expected based on the initial boiling point of the specimen, (c) an erratic recovery rate and (d) the presence of wax particles during the removal of residual liquid by swabbing with a lint-free cloth (see: 8.3). The minimum temperature that permits satisfactory operation shall be used. In general, a bath temperature in the 0 to 4°C range is suitable for kerosine, Grade No. 1 fuel oil and Grade No. 1-D diesel fuel oil. In some cases involving Grade No. 2 fuel oil, Grade No. 2-D diesel fuel oil, gas oils and similar distillates, it may be necessary to hold the condenser bath temperature in the 38 to 60°C range.

change in slope (C) of the data points described in 10.14.2 in that particular area is greater than 0.6 (change of slope (F) is greater than 1.0) as calculated by Eq 1 (Eq 2).

$$\text{Change of Slope (C)} = (C_2 - C_1)/(V_2 - V_1) - (C_3 - C_2)/(V_3 - V_2) \quad (1)$$

$$\text{Change of Slope (F)} = (F_2 - F_1)/(V_2 - V_1) - (F_3 - F_2)/(V_3 - V_2) \quad (2)$$

where:

C<sub>1</sub> = temperature at the volume % recorded one reading prior to the volume % in question, °C,

C<sub>2</sub> = temperature at the volume % recorded in question, °C,

C<sub>3</sub> = temperature at the volume % recorded following the volume % in question, °C,

F<sub>1</sub> = temperature at the volume % recorded one reading prior to the volume % in question, °F,

F<sub>2</sub> = temperature at the volume % recorded in question, °F,

F<sub>3</sub> = temperature at the volume % recorded following the volume % in question, °F,

V<sub>1</sub> = volume % recorded one reading prior to the volume % in question,

V<sub>2</sub> = volume % recorded at the volume % in question, and

V<sub>3</sub> = volume % recorded following the volume % in question.

10.15 When the residual liquid in the flask is approximately 5 mL, make a final adjustment of the heat. The time from the 5 mL of liquid residue in the flask to the EP (FBP) shall be within the limits prescribed in Table 5. If this condition is not satisfied, repeat the test with appropriate modification of the final heat adjustment.

NOTE 17—Since it is difficult to determine when there is 5 mL of boiling liquid left in the flask, this time is determined by observing the amount of liquid recovered in the receiving cylinder. The dynamic holdup has been determined to be approximately 1.5 mL at this point. If there are no front end losses, the amount of 5 mL in the flask can be assumed to correspond with an amount of 93.5 mL in the receiving cylinder. This amount has to be adjusted for the estimated amount of front end loss.

10.15.1 If the actual front end loss differs more than 2 mL from the estimated value, the test shall be rerun.

10.16 Observe and record the EP (FBP) or the dry point, or both, as required, and discontinue the heating.

10.17 Allow the distillate to drain into the receiving cylinder, after heating has been discontinued.

10.17.1 *Manual Method*—While the condenser tube continues to drain into the graduated cylinder, observe and note the volume of condensate to the nearest 0.5 mL at 2 min intervals until two successive observations agree. Measure the volume in the receiving cylinder accurately, and record it to the nearest 0.5 mL.

10.17.2 *Automated Method*—The apparatus shall continually monitor the recovered volume until this volume changes by no more than 0.1 mL in 2 min. Record the volume in the receiving cylinder accurately to the nearest 0.1 mL.

10.18 Record the volume in the receiving cylinder as percent recovery. If the distillation was previously discontinued under the conditions of a decomposition point, deduct the percent recovered from 100, report this difference as the sum of percent residue and percent loss, and omit the procedure given in 10.19.

10.19 After the flask has cooled and no more vapor is observed, disconnect the flask from the condenser, pour its contents into a 5-mL graduated cylinder, and with the flask suspended over the cylinder, allow the flask to drain until no appreciable increase in the volume of liquid in the cylinder is observed. Measure the volume in the graduated cylinder to the nearest 0.1 mL, and record as percent residue.

10.19.1 If the 5-mL graduated cylinder does not have graduations below 1 mL and the volume of liquid is less than 1 mL, prefill the cylinder with 1 mL of a heavy oil to allow a better estimate of the volume of the material recovered.

10.19.1.1 If a residue greater than expected is obtained, and the distillation was not purposely terminated before the EP, check whether adequate heat was applied towards the end of the distillation and whether conditions during the test conformed to those specified in Table 5. If not, repeat test.

NOTE 18—The distillation residues of this test method for gasoline, kerosine, and distillate diesel are typically 0.9-1.3, 0.9-1.3, and 1.0-1.4 volume %, respectively.

NOTE 19—The test method is not designed for the analysis of distillate fuels containing appreciable quantities of residual material (see 1.2).

10.19.2 Groups 1, 2, 3, and 4—Record the volume in the 5-mL graduated cylinder, to the nearest 0.1 mL, as percent residue.

10.20 If the intent of the distillation is to determine the percent evaporated or percent recovered at a predetermined corrected temperature reading, modify the procedure to conform to the instructions described in Annex A4.

10.21 Examine the condenser tube and the side arm of the flask for waxy or solid deposits. If found, repeat the test after making adjustments described in Footnote A of Table 5.

### 11. Calculations

11.1 The percent total recovery is the sum of the percent recovery (see 10.18) and the percent residue (see 10.19). Deduct the percent total recovery from 100 to obtain the percent loss.

11.2 Do not correct the barometric pressure for meniscus depression, and do not adjust the pressure to what it would be at sea level.

NOTE 20—The observed barometric reading does not have to be corrected to a standard temperature and to standard gravity. Even without performing these corrections, the corrected temperature readings for the same sample between laboratories at two different locations in the world will, in general, differ less than 0.1°C at 100°C. Almost all data obtained earlier have been reported at barometric pressures that have not been corrected to standard temperature and to standard gravity.

11.3 Correct temperature readings to 101.3 kPa (760 mm Hg) pressure. Obtain the correction to be applied to each temperature reading by means of the Sydney Young equation as given in Eq 3, Eq 4, or Eq 5, as appropriate, or by the use of Table 6. For Celsius temperatures:

$$C_c = 0.0009 (101.3 - P_k) (273 + t_c) \quad (3)$$

$$C_c = 0.00012 (760 - P) (273 + t_c) \quad (4)$$

For Fahrenheit temperatures:

$$C_f = 0.00012 (760 - P) (460 + t_f) \quad (5)$$

where:

$t_c$  = the observed temperature reading in °C,

$t_f$  = the observed temperature reading in °F,

$C_c$  and  $C_f$  = corrections to be added algebraically to the observed temperature readings,

$P_k$  = barometric pressure, prevailing at the time and location of the test, kPa, and

$P$  = barometric pressure, prevailing at the time and location of the test, mm Hg.

After applying the corrections and rounding each result to the nearest 0.5°C (1.0°F) or 0.1°C (0.2°F), as appropriate to the

TABLE 6 Approximate Thermometer Reading Correction

Temperature Range		Correction <sup>A</sup> per 1.3 kPa (10 mm Hg) Difference in Pressure	
°C	°F	°C	°F
10-30	50-86	0.35	0.63
30-50	86-122	0.38	0.68
50-70	122-158	0.40	0.72
70-90	158-194	0.42	0.76
90-110	194-230	0.45	0.81
110-130	230-266	0.47	0.85
130-150	266-302	0.50	0.89
150-170	302-338	0.52	0.94
170-190	338-374	0.54	0.98

<sup>A</sup>Values to be added when barometric pressure is below 101.3 kPa (760 mm Hg) and to be subtracted when barometric pressure is above 101.3 kPa.

Temperature Range		Correction <sup>a</sup> per 1.3 kPa (10 mm Hg) Difference in Pressure	
°C	°F	°C	°F
190-210	374-410	0.57	1.02
210-230	410-446	0.59	1.07
230-250	446-482	0.62	1.11
250-270	482-518	0.64	1.15
270-290	518-554	0.66	1.20
290-310	554-590	0.69	1.24
310-330	590-626	0.71	1.28
330-350	626-662	0.74	1.33
350-370	662-698	0.76	1.37
370-390	698-734	0.78	1.41
390-410	734-770	0.81	1.46

<sup>a</sup>Values to be added when barometric pressure is below 101.3 kPa (760 mm Hg) and to be subtracted when barometric pressure is above 101.3 kPa.

apparatus being used, use the corrected temperature readings in all further calculations and reporting.

NOTE 21—Temperature readings are not corrected to 101.3 kPa (760 mm Hg) when product definitions, specifications, or agreements between the parties involved indicate, specifically, that such correction is not required or that correction shall be made to some other base pressure.

11.4 Correct the actual loss to 101.3 kPa (760 mm Hg) pressure when temperature readings are corrected to 101.3 kPa pressure. The corrected loss,  $L_c$ , is calculated from Eq 6 or Eq 7, as appropriate, or can be read from the tables presented as Fig. X3.1 or Fig. X3.2.

$$L_c = 0.5 + (L - 0.5) / \{1 + (101.3 - P_k) / 8.00\} \quad (6)$$

$$L_c = 0.5 + (L - 0.5) / \{1 + (760 - P) / 60.0\} \quad (7)$$

where:

$L$  = observed loss,

$L_c$  = corrected loss,

$P_k$  = pressure, kPa, and

$P$  = pressure, mm Hg.

NOTE 22—Eq 6 and 7 above have been derived from the data in Table 7 and Eqs 5 and 6 in Test Method D 86 - 95 and earlier versions. It is probable that Eq 6 and 7 shown were the original empirical equations from which the table and equations in the Test Method D 86 - 95 and earlier versions were derived.

11.4.1 Calculate the corresponding corrected percent recovery in accordance with the following equation:

$$R_c = R + (L - L_c) \quad (8)$$

where:

$L$  = percent loss or observed loss,

$L_c$  = corrected loss,

$R$  = percent recovery, and

$R_c$  = corrected percent recovery.

TABLE 7 Data Points for Determining Slope,  $S_C$  or  $S_F$

Slope at %	IBP	5	10	20	30	40	60	80	70	80	90	95	EP
$T_L$ at %	0	0	0	10	20	30	40	50	60	70	80	90	95
$T_U$ at %	5	10	20	30	40	50	60	70	80	90	90	95	$V_{EP}$
$V_U - V_L$	5	10	20	20	20	20	20	20	20	20	10	5	$V_{EP} - 95$

11.5 To obtain the percent evaporated at a prescribed temperature reading, add the percent loss to each of the observed percent recovered at the prescribed temperature readings, and report these results as the respective percent evaporated, that is:

$$P_e = P_r + L \quad (9)$$

where:

$L$  = observed loss,

$P_e$  = percent evaporated, and

$P_r$  = percent recovered.

11.6 To obtain temperature readings at prescribed percent evaporated, and if no recorded temperature data is available within 0.1 volume % of the prescribed percent evaporated, use either of the two following procedures, and indicate on the report whether the arithmetical procedure or the graphical procedure has been used.

11.6.1 *Arithmetical Procedure*—Deduct the observed loss from each prescribed percent evaporated to obtain the corresponding percent recovered. Calculate each required temperature reading as follows:

$$T = T_L + (T_H - T_L)(R - R_L)/(R_H - R_L) \quad (10)$$

where:

$R$  = percent recovered corresponding to the prescribed percent evaporated,

$R_H$  = percent recovered adjacent to, and higher than  $R$ ,

$R_L$  = percent recovered adjacent to, and lower than  $R$ ,

$T$  = temperature reading at the prescribed percent evaporated,

$T_H$  = temperature reading recorded at  $R_H$ , and

$T_L$  = temperature reading recorded at  $R_L$ .

Values obtained by the arithmetical procedure are affected by the extent to which the distillation graphs are nonlinear. Intervals between successive data points can, at any stage of the test, be no wider than the intervals indicated in 10.18. In no case shall a calculation be made that involves extrapolation.

11.6.2 *Graphical Procedure*—Using graph paper with uniform subdivisions, plot each temperature reading corrected for barometric pressure, if required (see 11.3), against its corresponding percent recovered. Plot the IBP at 0 % recovered. Draw a smooth curve connecting the points. For each prescribed percent evaporated, deduct the distillation loss to obtain the corresponding percent recovered and take from the graph the temperature reading that this percent recovered indicates. Values obtained by graphical interpolation procedures are affected by the care with which the plot is made.

NOTE 23—See Appendix XI for numerical examples illustrating the arithmetical procedure.

11.6.3 In most automated instruments, temperature-volume data are collected at 0.1 volume % intervals or less and stored in memory. To report a temperature reading at a prescribed percent evaporated, neither of the procedures described in 11.6.1 and 11.6.2 have to be used. Obtain the desired temperature directly from the database as the temperature closest to and within 0.1 volume % of the prescribed percent evaporated.

## 12. Report

12.1 Report the following information (see Appendix X5 for examples of reports):

12.2 Report the barometric pressure to the nearest 0.1 kPa (1 mm Hg).

12.3 Report all volumetric readings in percentages.

12.3.1 *Manual Method*—Report volumetric readings to the nearest 0.5, and all temperature readings to the nearest 0.5°C (1.0°F).

12.3.2 *Automated Method*—Report volumetric readings to the nearest 0.1, and all temperature readings to the nearest 0.1 °C (0.2°F) or less.

12.4 After barometric corrections of the temperature readings have been made, the following data require no further calculation prior to reporting: IBP, dry point, EP (FBP), decomposition point, and all pairs of corresponding values involving percent recovered and temperature readings.

12.4.1 The report shall state if the temperature readings have not been corrected for barometric pressure.

12.5 When the temperature readings have not been corrected to 101.3 kPa (760 mm Hg) pressure, report the percent residue and percent loss as *observed* in accordance with 10.19 and 11.1, respectively.

12.6 Do not use the corrected loss in the calculation of percent evaporated.

12.7 It is advisable to base the report on relationships between temperature readings and percent evaporated when the sample is a gasoline, or any other product classified under Group 1, or in which the percent loss is greater than 2.0. Otherwise, the report can be based on relationships between temperature readings and percent evaporated or percent recovered. Every report must indicate clearly which basis has been used.

12.7.1 In the manual method, if results are given in percent evaporated versus temperature readings, report if the arithmetical or the graphical procedure was used (see 11.6).

12.8 Report if a drying agent, as described in 7.5.2 or 7.5.3, was used.

12.9 Fig. X1.1 is an example of a tabular report. It shows the percent recovered versus the corresponding temperature reading and versus the corrected temperature reading. It also shows the percent loss, the corrected loss, and the percent evaporated versus the corrected temperature reading.

Evaporated Point, %	Manual Repeatability <sup>A</sup>		Manual Reproducibility <sup>A</sup>		Automated Repeatability <sup>A</sup>		Automated Reproducibility <sup>A</sup>	
	°C	°F	°C	°F	°C	°F	°C	°F
IBP	3.3	6	5.6	10	3.9	7	7.2	13
5	1.9+0.86S <sub>C</sub>	3.4+0.86S <sub>F</sub>	3.1+1.74S <sub>C</sub>	5.6+1.74S <sub>F</sub>	2.1+0.67S <sub>C</sub>	3.8+0.67S <sub>F</sub>	4.4+2.0S <sub>C</sub>	7.9+2.0S <sub>F</sub>
10	1.2+0.86S <sub>C</sub>	2.2+0.86S <sub>F</sub>	2.0+1.74S <sub>C</sub>	3.6+1.74S <sub>F</sub>	1.7+0.67S <sub>C</sub>	3.0+0.67S <sub>F</sub>	3.3+2.0S <sub>C</sub>	6.0+2.0S <sub>F</sub>
20	1.2+0.86S <sub>C</sub>	2.2+0.86S <sub>F</sub>	2.0+1.74S <sub>C</sub>	3.6+1.74S <sub>F</sub>	1.1+0.67S <sub>C</sub>	2.0+0.67S <sub>F</sub>	3.3+2.0S <sub>C</sub>	6.0+2.0S <sub>F</sub>
30-70	1.2+0.86S <sub>C</sub>	2.2+0.86S <sub>F</sub>	2.0+1.74S <sub>C</sub>	3.6+1.74S <sub>F</sub>	1.1+0.67S <sub>C</sub>	2.0+0.67S <sub>F</sub>	2.6+2.0S <sub>C</sub>	4.7+2.0S <sub>F</sub>
80	1.2+0.86S <sub>C</sub>	2.2+0.86S <sub>F</sub>	2.0+1.74S <sub>C</sub>	3.6+1.74S <sub>F</sub>	1.1+0.67S <sub>C</sub>	2.0+0.67S <sub>F</sub>	1.7+2.0S <sub>C</sub>	3.0+2.0S <sub>F</sub>
90	1.2+0.86S <sub>C</sub>	2.2+0.86S <sub>F</sub>	0.8+1.74S <sub>C</sub>	1.4+1.74S <sub>F</sub>	1.1+0.67S <sub>C</sub>	2.0+0.67S <sub>F</sub>	0.7+2.0S <sub>C</sub>	1.2+2.0S <sub>F</sub>
95	1.2+0.86S <sub>C</sub>	2.2+0.86S <sub>F</sub>	1.1+1.74S <sub>C</sub>	1.9+1.74S <sub>F</sub>	2.5+0.67S <sub>C</sub>	4.5+0.67S <sub>F</sub>	2.6+2.0S <sub>C</sub>	4.7+2.0S <sub>F</sub>
FBP	3.9	7	7.2	13	4.4	8	8.9	16

<sup>A</sup> S<sub>C</sub> or S<sub>F</sub> is the average slope (or rate of change) calculated in accordance with 13.2.

**13. Precision and Bias**

**13.1 Precision:**

13.1.1 The precision of this test method has been determined by the statistical examination of interlaboratory test results obtained by 26 laboratories on 14 gasolines, by 4 laboratories on 8 samples of kerosine by the manual procedure, 3 laboratories on 6 samples of kerosine by the automated procedure, and 5 laboratories on 10 samples of diesel fuel by both the manual and automated procedures. Table A1.1 lists which tables and figures are to be used for the different fuel groups, distillation methods, and temperature scales.

13.1.2 The following terms are used in this section: (1) *r* = repeatability and (2) *R* = reproducibility. The value of any of these terms will depend upon whether the calculations were carried out in °C or °F.

**13.2 Slope or Rate of Change of Temperature:**

13.2.1 To determine the precision of a result, it is generally necessary to determine the slope or rate of change of the temperature at that particular point. This variable, denoted as S<sub>C</sub> or S<sub>F</sub>, is equal to the change in temperature, either in °C or in °F, respectively, per percent recovered or evaporated.

13.2.2 For Group 1 in the manual method and for all groups in the automated method, the precision of the IBP and EP does not require any slope calculation.

13.2.3 With the exception stated in 13.2.2 and in 13.2.4, the slope at any point during the distillation is calculated from the following equations, using the values shown in Table 7:

$$S_C \text{ (or } S_F) = (T_U - T_L) / (V_U - V_L) \quad (11)$$

where:

S<sub>C</sub> = is the slope, °C/volume %,

S<sub>F</sub> = is the slope, °F/volume %,

T<sub>U</sub> = is the upper temperature, °C (or °F),

T<sub>L</sub> = is the lower temperature, °C (or °F),

V<sub>U</sub> = is the volume % recovered or evaporated corresponding to T<sub>U</sub>,

V<sub>L</sub> = is the volume % recovered or evaporated corresponding to T<sub>L</sub> and

V<sub>EP</sub> = is the volume % recovered or evaporated corresponding to the end point.

13.2.4 In the event that the distillation end point occurs prior to the 95 % point, the slope at the end point is calculated as follows:

$$S_C \text{ (or } S_F) = (T_{EP} - T_{HR}) / (V_{EP} - V_{HR}) \quad (12)$$

where:

T<sub>EP</sub> or T<sub>HR</sub> is the temperature, in °C or °F at the percent volume recovered indicated by the subscript,

V<sub>EP</sub> or V<sub>HR</sub> is the volume % recovered.

13.2.4.1 The subscripts in Eq 12 refer to:

EP = end point

HR = highest reading, either 80% of 90%, prior to the end point.

13.2.5 For points between 10 to 85 % recovered which are not shown in Table 7, the slope is calculated as follows:

$$S_C \text{ (or } S_F) = 0.05 (T_{(V+10)} - T_{(V-10)}) \quad (13)$$

13.2.6 For samples in Group 1, the precision data reported are based on slope values calculated from percent evaporated data.

13.2.7 For samples in Group 2, 3, and 4, the precision data reported (Table 8) are based on slope values calculated from percent recovered data.

13.2.8 When results are reported as volume % recovered, slope values for the calculation of precision are to be determined from percent recovered data; when results are reported as volume % evaporated slope values are to be determined from % evaporated data.

13.3 *Manual Method:*

13.3.1 *Repeatability:*

13.3.1.1 *GROUP 1*—The difference between successive results obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of this test method, exceed the values calculated from Table 9 in only one case in twenty.

13.3.1.2 *GROUPS 2, 3, and 4*—The difference between successive results obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of this test method, exceed the values calculated from the values in Table 9 in only one case in twenty.

13.3.2 *Reproducibility:*

**TABLE 9 Repeatability and Reproducibility for Groups 2, 3 and 4 (Manual Method)**

	Repeatability <sup>A</sup>		Reproducibility <sup>A</sup>	
	°C	°F	°C	°F
IBP	1.0+0.35S <sub>C</sub>	1.9+0.35S <sub>F</sub>	2.8+0.93S <sub>C</sub>	5.0+0.93S <sub>F</sub>
5–95%	1.0+0.41S <sub>C</sub>	1.8+0.41S <sub>F</sub>	1.8+1.33S <sub>C</sub>	3.3+1.33S <sub>F</sub>
FBP	0.7+0.36S <sub>C</sub>	1.3+0.36S <sub>F</sub>	3.1+0.42S <sub>C</sub>	5.7+C.42S <sub>F</sub>
% volume at temperature reading	0.7+0.92/S <sub>C</sub>	0.7+1.66/S <sub>F</sub>	1.5+1.78/S <sub>C</sub>	1.53+3.20/S <sub>F</sub>

<sup>A</sup> Calculate S<sub>C</sub> or S<sub>F</sub> from 13.2.

13.3.2.1 *GROUP 1*—The difference between two single and independent results obtained by different operators working in different laboratories on identical Test material would, in the normal and correct operation of this method, exceed the values calculated from Table 9 in only one case in twenty.<sup>7</sup>

13.3.2.2 *GROUPS 2, 3, and 4*—The difference between two single and independent results obtained by different operators working in different laboratories on identical test material would, in the normal and correct operation of this test method, exceed the values calculated from the data in Table 9 in only one case in twenty.<sup>8</sup>

13.4 *Automated Method:*

13.4.1 *Repeatability:*

13.4.1.1 *GROUP 1*—The difference between successive results obtained by the same operator with die same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of this test method, exceed the values calculated from Table 8 in only one case in twenty.

13.4.1.2 *GROUPS 2, 3, and 4*—The difference between successive results obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of this test method, exceed the values calculated from Table 10 in only one case in twenty.

13.4.2 *Reproducibility;*

13.4.2.1 *GROUP 1*—The difference between two single and independent results obtained by different operators working in different laboratories on identical test material would, in the normal and correct operation of this test method, exceed the values calculated from Table 8 in only one case in twenty.<sup>7</sup>

13.4.2.2 *GROUPS 2, 3, and 4*—The difference between two single and independent results obtained by different operators working in different laboratories on identical test material would, in the normal and correct operation of this test method, exceed the values calculated from Table 10 in only one case in twenty.

13.5 *Bias:*

13.5.1 *Bias*—Due to the use of total immersion thermometers, or temperature sensing systems designed to emulate them, the distillation temperatures in this test method are somewhat lower than the true temperatures. The amount of bias depends on the product being distilled and the thermometer used.

13.5.2 *Relative Bias*—There exists a bias between the empirical results of distillation properties obtained by this test method and the true boiling point distillation curve obtained by Test Method D 2892. The magnitude of this bias, and how it relates to test precision, has not been rigorously studied.

13.5.3 *Relative Bias*—An interlaboratory study<sup>5</sup> conducted in 2003 using manual and automated apparatus has concluded that there is no statistical evidence to suggest that there is a bias between manual and automated results.

**14. Keywords**

14.1 batch distillation; distillates; distillation; laboratory distillation; petroleum products

<sup>7</sup> Precision data obtained from RR study on bath manual and automated D 86 units by North American and IP Laboratories.

<sup>8</sup> Table 9 has been derived from the nomographs in Figs. 6 and 7 in ASTM D 86-97.

14

**TABLE 10 Repeatability and Reproducibility for Groups 2, 3 and 4 (Automated)**

Collected, %	Repeatability <sup>A</sup>		Reproducibility <sup>A</sup>	
	°C	°F	°C	°F
IBP	3.5	6.3	8.5	15.3
2%	3.5	6.3	2.6 + 1.92S <sub>C</sub>	4.7 + 1.92S <sub>F</sub>
5%	1.1 + 1.08S <sub>C</sub>	2.0 + 1.08S <sub>F</sub>	2.0 + 2.53S <sub>C</sub>	3.6 + 2.53S <sub>F</sub>
10%	1.2 + 1.42S <sub>C</sub>	2.2 + 1.42S <sub>F</sub>	3.0 + 2.64S <sub>C</sub>	5.4 + 2.64S <sub>F</sub>
20-70 %	1.2 + 1.42S <sub>C</sub>	2.2 + 1.42S <sub>F</sub>	2.9 + 3.97S <sub>C</sub>	5.2 + 3.97S <sub>F</sub>
80%	1.2 + 1.42S <sub>C</sub>	2.2 + 1.42S <sub>F</sub>	3.0 + 2.64S <sub>C</sub>	5.4 + 2.64S <sub>F</sub>
90-95%	1.1 + 1.08S <sub>C</sub>	2.0 + 1.08S <sub>F</sub>	2.0 + 2.53S <sub>C</sub>	3.6 + 2.53S <sub>F</sub>
FBP	3.5	6.3	10.5	18.9

<sup>A</sup> S<sub>C</sub> or S<sub>F</sub> is the average slope (or rate of change) calculated in accordance with 13.5.

**ANNEXES  
(Mandatory Information)**

**A1. REPEATABILITY AND REPRODUCIBILITY DEFINITION AIDS**

A1.1 Table A1.1 is an aid for determining which repeatability and reproducibility table or section, is to be used.

**TABLE A1.1 Summary of Aids for Definition of Repeatability and Reproducibility**

Group	Method	Temperature Scale	Table or Section to Use	
			Reproducibility	Repeatability
1	Manual	°C	Table 8	Table 8
		°F	Table 8	Table 8
1	Automated	°C	Table 8	Table 8
		°F	Table 8	Table 8
2,3,4	Manual	°C	Table 9	Table 9
		°F	Table 9	Table 9
2,3,4	Automated	°C	Table 10	Table 10
		°F	Table 10	Table 10

**A2. DETAILED DESCRIPTION OF APPARATUS**

A2.1 *Distillation Flasks*—Flasks shall be of heat resistant glass, constructed to the dimensions and tolerances shown in Fig. A2.1 and shall otherwise comply with the requirements of Specification E 1405. Flask A (100 mL) may also be constructed with a ground glass joint, in which case the diameter of the neck shall be the same as the 125-mL flask.

NOTE A2.1—For tests specifying dry point, specially selected flasks with bottoms and walls of uniform thickness are desirable.

A2.2 *Condenser and Condenser Bath*—Typical types of condenser and condenser baths are illustrated in Figs. 1 and 2.

A2.2.1 The condenser shall be made of seamless noncorrosive metal tubing, 560 ± 5 mm in length, with an outside diameter of 14 mm and a wall thickness of 0.8 to 0.9 mm.

NOTE A2.2—Brass or stainless steel has been found to be a suitable material for this purpose.

A2.2.2 The condenser shall be set so that 393 ± 3 mm of the tube is in contact with the cooling medium, with 50 ± 3 mm outside the cooling bath at the upper end, and with 114 ± 3 mm outside at the lower end. The portion of the tube projecting at the upper end shall be set at an angle of 75 ± 3° with the vertical. The portion of the tube inside the condenser bath shall be either straight or bent in any suitable continuous smooth curve. The average gradient shall be 15 ± 1° with respect to the horizontal, with no 10-cm section having a gradient outside of the 15 ± 3° range. The projecting lower portion of the condenser tube shall be curved downward for a length of 76 mm and the lower end shall be cut off at an acute angle. Provisions shall be made to enable the flow of the distillate to run down the side of the receiving cylinder. This can be accomplished by using a drip-deflector, which is attached to the outlet of the tube. Alternatively, the lower portion of the condenser tube can be curved slightly backward to ensure

15

contact with the wall of the receiving cylinder at a point 25 to 32 mm below the top of the receiving cylinder. Fig. A2.3 is a drawing of an acceptable configuration of the lower end of the condenser tube.

A2.2.3 The volume and the design of the bath will depend on the cooling medium employed. The cooling capacity of the bath shall be adequate to maintain the required temperature for the desired condenser performance. A single condenser bath may be used for several condenser tubes.

**A2.3 Metal Shield or Enclosure for Flask.** (Manual units only).

**A2.3.1 Shield for Gas Burner** (see Fig. 1)—The purpose of this shield is to provide protection for the operator and yet allow easy access to the burner and to the distillation flask during operation. A typical shield would be 480-mm high, 280-mm long and 200-mm wide, made of sheet metal of 0.8-mm thickness (22 gauge). The shield shall be provided with at least one window to observe the dry point at the end of the distillation.

**A2.3.2 Shield for Electric Heater** (see Fig. 2)—A typical shield would be 440-mm high, 200-mm long, and 200-mm wide, made of sheet metal of approximately 0.8-mm thickness (22 gauge) and with a window in the front side. The shield shall be provided with at least one window to observe the dry point at the end of the distillation.

**A2.4 Heat Source:**

**A2.4.1 Gas Burner** (see Fig. 1), capable of bringing over the first drop from a cold start within the time specified and of continuing the distillation at the specified rate. A sensitive manual control valve and gas pressure regulator to give complete control of heating shall be provided.

**A2.4.2 Electric Heater** (see Fig. 2), of low heat retention.

**NOTE A2.3**—Heaters, adjustable from 0 to 1000 W, have been found to be suitable for this purpose.

**A2.5 Flask Support:**

**A2.5.1 Type 1**—Use a Type 1 flask support with a gas burner (see Fig. 1). This support consists of either a ring support of the ordinary laboratory type, 100 mm or larger in diameter, supported on a stand inside the shield, or a platform adjustable from the outside of the shield. On this ring or platform is mounted a hard board made of ceramic or other heat-resistant material, 3 to 6 mm in thickness, with a central opening 76 to 100 mm in diameter, and outside line dimensions slightly smaller than the inside boundaries of the shield.

**A2.5.2 Type 2**—Use a Type 2 flask support assembly with electric heating (see Fig. 2 as one example). The assembly consists of an adjustable system onto which the electric heater is mounted with provision for placement of a flask support board (see A2.6) above the electric heater. The whole assembly is adjustable from the outside of the shield.

**A2.6 Flask Support Board**—The flask support board shall be constructed of ceramic or other heat-resistant material, 3 to 6 mm in thickness. Flask support boards are classified as A, B, or C, based on the size of the centrally located opening, the dimension of which is shown in Table 1. The flask support board shall be of sufficient dimension to ensure that thermal heat to the flask only comes from the central opening and that extraneous heat to the flask other than through the central opening is minimized. (**Warning**—Asbestos-containing materials shall not be used in the construction of the flask support board.)

**A2.7** The flask support board can be moved slightly in different directions on the horizontal plane to position the distillation flask so that direct heat is applied to the flask only through the opening in this board. Usually, the position of the flask is set by adjusting the length of the side-arm inserted into the condenser.

**A2.8** Provision shall be made for moving the flask support assembly vertically so that the flask support board is in direct contact with the bottom of the distillation flask during the distillation. The assembly is moved down to allow for easy mounting and removal of the distillation flask from the unit.

**A2.9 Receiving Cylinders**—The receiving cylinder shall have a capacity to measure and collect 100 mL. The shape of the base shall be such that the receiver does not topple when placed empty on a surface inclined at an angle of 13° from the horizontal.

**A2.9.1 Manual Method**—The cylinder shall be graduated at intervals of 1 mL and have a graduation at the 100-mL mark. Construction details and tolerances for the graduated cylinder are shown in Fig. A2.4.

**A2.9.2 Automated Method**—The cylinder shall conform to the physical specifications described in Fig. A2.4, except that graduations below the 100-mL mark are permitted, as long as they do not interfere with the operation of the level follower. Receiving cylinders for use in automated units may also have a metal base.

**A2.9.3** If required, the receiving cylinder shall be immersed during the distillation to above the 100-mL graduation line in a cooling liquid contained in a cooling bath, such as a tall-form beaker of clear glass or transparent plastic. Alternatively, the receiving cylinder may be placed in a thermostated bath air circulation chamber.

**A2.10 Residue Cylinder**—The graduated cylinder shall have a capacity of 5 or 10 mL, with graduations into 0.1 mL subdivisions, beginning at 0.1 mL. The top of the cylinder may be flared, the other properties shall conform to Specification E 1272.

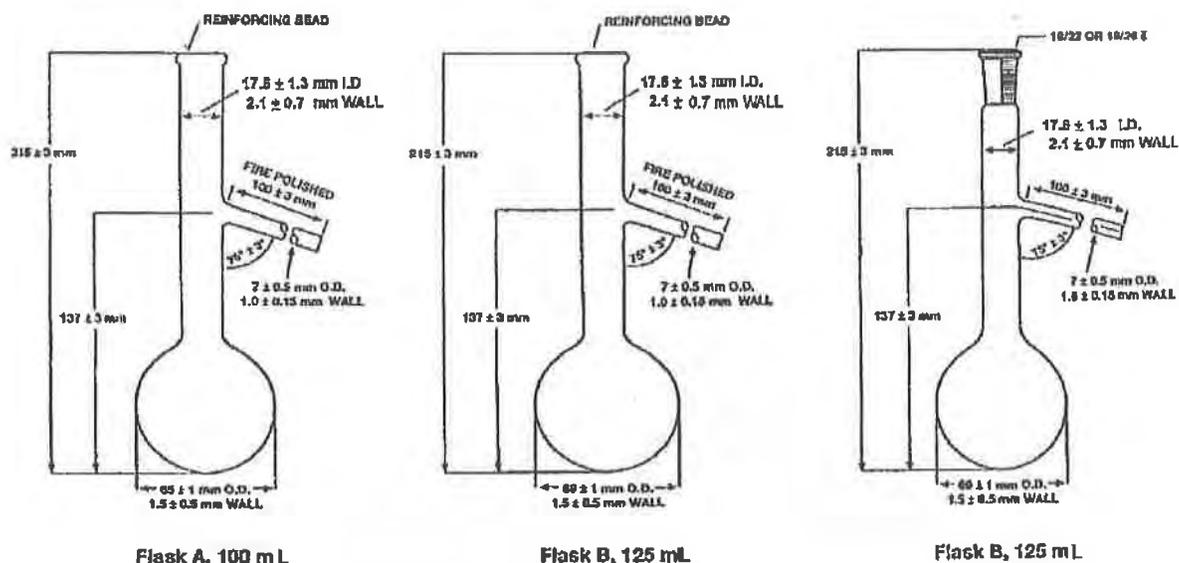


FIG. A2.1 Flask A, 100 mL, Flask B, 125 mL, and Flask B with Ground Glass Joint, 125 mL

17

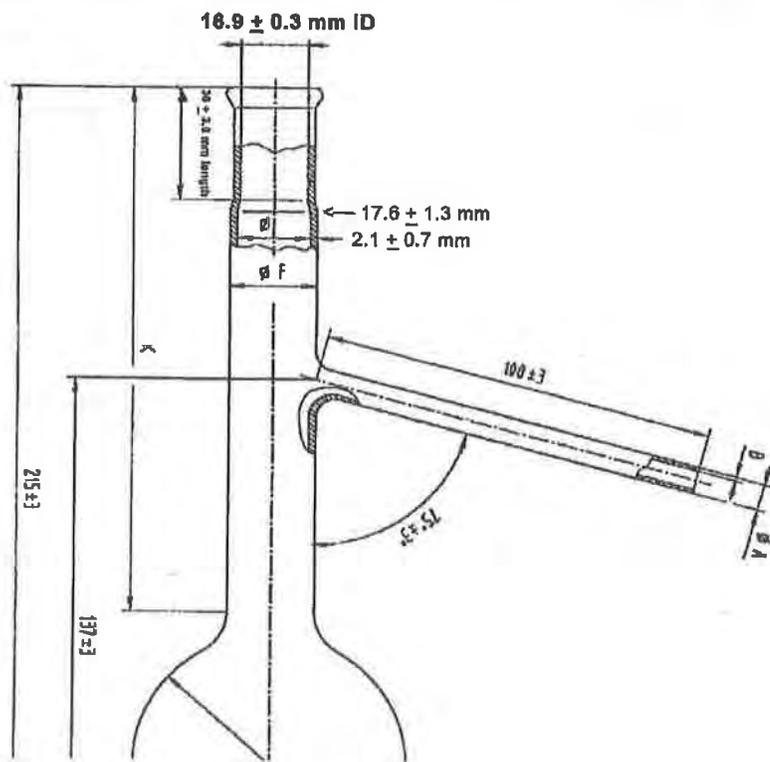


FIG. A2.2 Detail of Upper Neck Section

18

X2.2.3 From the calculated value of R, determine the value of volume, as described in A4.8.4.

$$\begin{aligned}
 R \text{ volume } \% &= R/(S_c) \quad (X2.3) \\
 &= 5.5/1.1 \\
 &= 5.0 \\
 R \text{ volume } \% &= R/(S_F) \\
 &= 9.8/1.9 \\
 &= 5.1
 \end{aligned}$$

TABLE X2.1 Distillation Data from a Group 1 Sample Automated Distillation

Distillation Point Recovered, mL	Temperature °C	Temperature °F	Volume (mL) Recovered at 93.3°C (200°F)
			18.0
10	84	183	
20	94	202	
30	103	217	
40	112	233	
Distillation Point Evaporated, mL	Temperature °C	Temperature °F	Volume (mL) Evaporated at 93.3°C (200°F)
			18.4
10	83	182	
20	94	201	
30	103	217	
40	111	232	

X3. TABLES OF CORRECTED LOSS FROM MEASURED LOSS AND BAROMETRIC PRESSURE

X3.1 The table presented as Fig. X3.1 can be used to determine the corrected loss from the measured loss and the barometric pressure in kPa.

X3.2 The table presented as Fig. X3.2 can be used to determine the corrected loss from the measured loss and the barometric pressure in mm Hg.

23

Barometric Pressure, kPa																									
from	76.1	80.9	84.5	87.9	89.6	91.5	93.1	94.1	95.5	96.4	97.2	97.9	98.4	98.9	99.5	100.0	100.4	100.8	101.2	101.5	102.0	102.4	102.8	103.2	
through	80.8	84.4	87.2	89.5	91.4	93.0	94.0	95.4	96.3	97.1	97.8	98.3	98.8	99.4	99.9	100.3	100.7	101.1	101.4	101.9	102.3	102.7	103.1	103.5	
Observed Loss	/--Corrected Loss----->																								
Units																									
0	0.37	0.35	0.33	0.31	0.29	0.27	0.25	0.23	0.20	0.18	0.16	0.14	0.13	0.11	0.09	0.06	0.04	0.02	-0.00	-0.02	-0.06	-0.09	-0.13	-0.17	
1	0.63	0.65	0.67	0.69	0.71	0.73	0.75	0.78	0.80	0.82	0.86	0.86	0.87	0.89	0.92	0.94	0.96	0.98	1.00	1.03	1.06	1.09	1.13	1.17	
2	0.89	0.95	1.01	1.08	1.14	1.20	1.26	1.33	1.40	1.46	1.52	1.67	1.62	1.68	1.75	1.81	1.87	1.94	2.00	2.08	2.17	2.27	2.38	2.51	
3	1.16	1.25	1.36	1.46	1.57	1.67	1.77	1.88	1.99	2.09	2.19	2.28	2.37	2.47	2.58	2.89	2.79	2.90	3.00	3.13	3.29	3.48	3.63	3.84	
4	1.41	1.66	1.70	1.84	1.99	2.14	2.28	2.43	2.59	2.73	2.87	3.00	3.12	3.26	3.41	3.56	3.70	3.85	4.00	4.18	4.40	4.63	4.89	5.18	
5	1.68	1.86	2.04	2.23	2.42	2.61	2.79	2.98	3.19	3.37	3.55	3.71	3.87	4.05	4.25	4.44	4.62	4.81	5.00	5.23	5.51	5.81	6.14	6.52	
6	1.94	2.16	2.39	2.61	2.84	3.08	3.30	3.53	3.78	4.01	4.23	4.42	4.62	4.84	5.08	5.31	5.53	5.77	6.00	6.28	6.63	6.99	7.40	7.86	
7	2.20	2.46	2.73	3.00	3.27	3.55	3.80	4.08	4.38	4.65	4.90	5.14	5.37	5.63	5.91	6.18	6.44	6.73	7.00	7.33	7.74	8.17	8.65	9.20	
8	2.49	2.76	3.07	3.38	3.70	4.02	4.31	4.63	4.98	5.28	5.58	5.85	6.12	6.41	6.74	7.06	7.36	7.69	8.00	8.38	8.86	9.35	9.90	10.53	
9	2.72	3.07	3.41	3.76	4.12	4.49	4.82	5.18	5.57	5.92	6.26	6.56	6.87	7.20	7.57	7.93	8.27	8.65	9.00	9.43	9.97	10.53	11.16	11.87	
10	2.98	3.37	3.76	4.15	4.55	4.96	5.33	5.73	6.17	6.56	6.94	7.28	7.52	7.99	8.41	8.81	9.19	9.60	10.00	10.48	11.08	11.71	12.41	13.21	
11	3.24	3.67	4.10	4.53	4.97	5.43	5.84	6.28	6.77	7.20	7.61	7.99	8.37	8.78	9.24	9.68	10.10	10.56	11.00	11.53	12.20	12.89	13.67	14.55	
12	3.50	3.97	4.44	4.92	5.40	5.90	6.35	6.83	7.36	7.84	8.29	8.71	9.12	9.57	10.07	10.56	11.02	11.52	12.00	12.59	13.31	14.07	14.92	15.89	
13	3.76	4.27	4.78	5.30	5.83	6.36	6.86	7.39	7.96	8.47	8.97	9.42	9.86	10.36	10.90	11.43	11.93	12.48	13.00	13.64	14.43	15.25	16.17	17.22	
14	4.03	4.58	5.13	5.69	6.25	6.83	7.38	7.94	8.56	9.11	9.64	10.13	10.61	11.15	11.74	12.31	12.85	13.44	14.00	14.69	15.54	16.43	17.43	18.56	
15	4.29	4.88	5.47	6.07	6.68	7.30	7.87	8.49	9.15	9.75	10.32	10.85	11.36	11.93	12.57	13.18	13.76	14.40	15.00	15.74	16.66	17.61	18.68	19.90	
16	4.55	5.18	5.81	6.45	7.10	7.77	8.38	9.04	9.75	10.39	11.00	11.58	12.11	12.72	13.40	14.06	14.68	15.36	16.00	16.79	17.77	18.79	19.94	21.24	
17	4.81	5.48	6.16	6.84	7.53	8.24	8.89	9.53	10.35	11.03	11.68	12.27	12.66	13.51	14.23	14.93	15.59	16.31	17.00	17.84	18.88	19.97	21.19	22.58	
18	5.07	5.78	6.50	7.22	7.96	8.71	9.40	10.14	10.94	11.65	12.35	12.99	13.61	14.30	15.07	15.80	16.50	17.27	18.00	18.89	20.00	21.15	22.44	23.91	
19	5.33	6.08	6.84	7.61	8.38	9.18	9.91	10.69	11.54	12.30	13.03	13.70	14.36	15.09	15.90	16.68	17.42	18.23	19.00	19.94	21.11	22.39	23.70	25.25	
20	5.59	6.39	7.18	7.99	8.81	9.65	10.41	11.24	12.14	12.94	13.71	14.41	15.11	15.88	16.73	17.55	18.33	19.19	20.00	20.99	22.23	23.51	24.95	26.59	
Tenths																									
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
0.1	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.13	0.13

0.2	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.12	0.13	0.14	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.27
0.3	0.08	0.09	0.10	0.12	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.38	0.40
0.4	0.10	0.12	0.14	0.15	0.17	0.19	0.20	0.22	0.24	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.37	0.38	0.40	0.42	0.45	0.47	0.50	0.54
0.5	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.28	0.30	0.32	0.34	0.36	0.37	0.39	0.42	0.44	0.46	0.48	0.50	0.53	0.56	0.59	0.63	0.67
0.6	0.16	0.18	0.21	0.23	0.26	0.28	0.31	0.33	0.36	0.38	0.41	0.43	0.45	0.47	0.50	0.52	0.55	0.58	0.60	0.63	0.67	0.71	0.75	0.80
0.7	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.39	0.42	0.45	0.47	0.50	0.52	0.55	0.58	0.61	0.64	0.67	0.70	0.74	0.78	0.83	0.88	0.94
0.8	0.21	0.24	0.27	0.31	0.34	0.38	0.41	0.44	0.48	0.51	0.54	0.57	0.60	0.63	0.67	0.70	0.73	0.77	0.80	0.84	0.89	0.94	1.00	1.07
0.9	0.24	0.27	0.31	0.35	0.38	0.42	0.46	0.50	0.54	0.57	0.61	0.64	0.67	0.71	0.75	0.79	0.82	0.86	0.90	0.95	1.00	1.06	1.13	1.20

FIG. X3.1 Corrected Loss from Observed Loss and Barometric Pressure kPa

Barometric Pressure, mmHg.		571	607	634	655	672	686	698	706	716	723	729	734	738	742	746	750	753	756	759	762	765	768	771	774	
from	through	806	633	654	671	685	697	706	715	722	728	733	737	741	745	749	752	755	758	761	764	767	770	773	776	
Observed Loss		/--Corrected Loss----->																								
Units																										
0	0.37	0.35	0.33	0.31	0.29	0.27	0.25	0.23	0.20	0.18	0.16	0.14	0.13	0.11	0.09	0.07	0.05	0.02	-0.00	-0.03	-0.06	-0.09	-0.13	-0.17		
1	0.63	0.65	0.67	0.69	0.71	0.73	0.75	0.77	0.80	0.82	0.84	0.86	0.87	0.89	0.91	0.93	0.95	0.98	1.00	1.03	1.06	1.09	1.13	1.17		
2	0.89	0.95	1.01	1.07	1.14	1.20	1.26	1.32	1.39	1.45	1.51	1.57	1.62	1.68	1.74	1.80	1.86	1.93	2.00	2.08	2.17	2.27	2.38	2.50		
3	1.15	1.25	1.36	1.48	1.56	1.67	1.77	1.87	1.99	2.09	2.19	2.28	2.36	2.46	2.57	2.67	2.77	2.88	3.00	3.13	3.28	3.44	3.63	3.83		
4	1.41	1.55	1.70	1.84	1.99	2.14	2.27	2.42	2.58	2.72	2.86	2.99	3.11	3.25	3.40	3.54	3.68	3.83	4.00	4.19	4.39	4.62	4.88	5.17		
5	1.67	1.86	2.04	2.22	2.41	2.61	2.78	2.97	3.17	3.36	3.54	3.70	3.86	4.03	4.23	4.41	4.59	4.79	5.00	5.24	5.50	5.80	6.13	6.50		
6	1.93	2.16	2.38	2.61	2.84	3.07	3.29	3.52	3.77	3.99	4.21	4.41	4.60	4.82	5.05	5.28	5.50	5.74	6.00	6.29	6.61	6.97	7.38	7.84		
7	2.19	2.46	2.72	2.99	3.26	3.54	3.79	4.07	4.36	4.63	4.86	5.12	5.35	5.60	5.88	6.15	6.41	6.69	7.00	7.34	7.72	8.15	8.63	9.17		
8	2.46	2.76	3.07	3.37	3.69	4.01	4.30	4.62	4.98	5.27	5.56	5.83	6.09	6.38	6.71	7.02	7.32	7.64	8.00	8.40	8.84	9.33	9.88	10.50		
9	2.72	3.06	3.41	3.76	4.11	4.48	4.81	5.17	5.55	5.90	6.23	6.54	6.84	7.17	7.54	7.89	8.23	8.60	9.00	9.46	9.95	10.50	11.13	11.84		
10	2.98	3.38	3.75	4.14	4.54	4.94	5.31	5.71	6.15	6.54	6.91	7.25	7.58	7.95	8.37	8.76	9.14	9.55	10.00	10.50	11.06	11.68	12.38	13.17		
11	3.24	3.68	4.09	4.52	4.96	5.41	5.82	6.26	6.74	7.17	7.58	7.96	8.33	8.74	9.19	9.63	10.05	10.50	11.00	11.56	12.17	12.86	13.63	14.51		
12	3.50	3.96	4.43	4.91	5.39	5.88	6.33	6.81	7.34	7.81	8.26	8.77	9.07	9.52	10.02	10.50	10.96	11.46	12.00	12.61	13.28	14.03	14.88	15.84		
13	3.76	4.27	4.78	5.29	5.81	6.35	6.83	7.36	7.93	8.44	8.93	9.38	9.82	10.31	10.85	11.37	11.87	12.41	13.00	13.66	14.39	15.21	16.13	17.17		
14	4.02	4.57	5.12	5.67	6.24	6.82	7.34	7.91	8.53	9.08	9.61	10.09	10.57	11.09	11.68	12.24	12.78	13.36	14.00	14.71	15.51	16.39	17.38	18.51		
15	4.28	4.87	5.46	6.06	6.66	7.28	7.85	8.46	9.12	9.71	10.28	10.80	11.31	11.88	12.51	13.11	13.68	14.31	15.00	15.77	16.62	17.57	18.63	19.84		
16	4.54	5.17	5.80	6.44	7.09	7.75	8.35	9.01	9.72	10.35	10.95	11.61	12.06	12.65	13.33	13.98	14.59	15.27	16.00	16.82	17.73	18.74	19.88	21.18		
17	4.80	5.47	6.14	6.82	7.51	8.22	8.86	9.56	10.31	10.98	11.63	12.22	12.80	13.45	14.16	14.85	15.50	16.22	17.00	17.87	18.84	19.92	21.13	22.51		
18	5.06	5.77	6.49	7.21	7.94	8.69	9.37	10.11	10.91	11.62	12.30	12.93	13.66	14.23	14.99	15.72	16.41	17.17	18.00	18.93	19.95	21.10	22.38	23.84		
19	5.32	6.07	6.83	7.59	8.36	9.15	9.88	10.66	11.50	12.25	12.98	13.84	14.29	15.02	15.82	16.59	17.32	18.12	19.01	19.98	21.06	22.27	23.64	25.18		
20	5.88	6.37	7.17	7.97	8.79	9.62	10.38	11.20	12.09	12.89	13.65	14.35	15.04	15.80	16.64	17.46	18.23	19.08	20.01	21.03	22.17	23.45	24.89	26.51		
Tenths																										
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
0.1	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.13	0.13		
0.2	0.05	0.06	0.07	0.08	0.08	0.09	0.10	0.11	0.12	0.13	0.13	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.27		
0.3	0.08	0.09	0.10	0.11	0.13	0.14	0.15	0.16	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.38	0.40		
0.4	0.10	0.12	0.14	0.15	0.17	0.19	0.20	0.22	0.24	0.25	0.27	0.28	0.30	0.31	0.33	0.35	0.36	0.38	0.40	0.42	0.44	0.47	0.50	0.53		
0.5	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.30	0.32	0.34	0.36	0.37	0.39	0.41	0.43	0.45	0.48	0.50	0.53	0.56	0.59	0.63	0.67		
0.6	0.16	0.18	0.21	0.23	0.25	0.28	0.30	0.33	0.36	0.38	0.40	0.43	0.45	0.47	0.50	0.52	0.55	0.57	0.60	0.63	0.67	0.71	0.75	0.80		
0.7	0.18	0.21	0.24	0.27	0.30	0.33	0.35	0.38	0.42	0.44	0.47	0.50	0.52	0.55	0.58	0.61	0.64	0.67	0.70	0.74	0.78	0.82	0.88	0.93		
0.8	0.21	0.24	0.27	0.31	0.34	0.37	0.41	0.44	0.48	0.51	0.54	0.57	0.60	0.63	0.66	0.70	0.73	0.76	0.80	0.84	0.88	0.94	1.00	1.07		
0.9	0.23	0.27	0.31	0.34	0.38	0.42	0.46	0.49	0.54	0.57	0.61	0.64	0.67	0.71	0.75	0.78	0.82	0.86	0.90	0.95	1.00	1.06	1.13	1.20		

FIG. X3.2 Corrected Loss from Observed Loss and Barometric Pressure mm Hg

**X4. PROCEDURE TO EMULATE THE EMERGENT STEM ERROR OF A MERCURY-IN-GLASS THERMOMETER**

X4.1 When an electronic or other sensor without an emergent stem error is used, the output of this sensor or the associated data system should emulate the output of a mercury-in-glass thermometer. Based on information supplied by four manufacturers of automated Test Method D 86 equipment, the averaged equations shown in X4.2 and X4.3 have been reported to be in use.

X4.1.1 The equations shown in X4.2 have limited applicability and are shown for information purposes only. In addition to the correction for the emergent stem, the electronic sensor and associated data system will also have to emulate the lag in response time observed for mercury-in-glass thermometers.

X4.2 When a low range thermometer would have been used, no stem correction is to be applied below 20°C. Above this temperature, the correction is calculated using the following formula:

$$ASTM\ 7C\ T_{elr} = T_t - 1.000162 \times (T_t - 20^\circ C)^2 \quad (X4.1)$$

X4.3 When a high range thermometer would have been used, no stem correction is to be applied below 35°C. Above this temperature the correction is calculated using the following formula:

$$ASTM\ 8C\ T_{elr} = T_t - 0.000131 \times (T_t - 35^\circ C)^2 \quad (X4.2)$$

where:

$T_{elr}$  = emulated temperature in °C for low range thermometers,

$T_{elr}$  = emulated temperature in °C for high range thermometers, and

$T_t$  = true temperature in °C.

**X5. EXPLANATORY REPORT FORMS**

X5.1 Fig. X5.1 and Fig. X5.2 show report forms.

**"Percent Recovered" Report Form**

Date:   
 Time:   
 Operator:

Ambient temperature (°C)   
 Atmospheric pressure (kPa)   
 Condenser temperature (°C)   
 Temperature of the bath around receiving cylinder (°C)

Percent Recovered	Corrected Temperature Reading (°C)	Time or mL / min
IEP		
5		
10		
15		
20		
25		
30		
35		
40		
45		
50		
55		
60		
65		
70		
75		
80		
85		
90		
5 ml residua		
FBP		

Percent Recovery   
 Percent Residua   
 Percent Total Recovery   
 Percent Loss   
 Corrected Percent Recovery       Corrected Loss   
 Corrected Total Recovery

- Ambient temperature at the start of the test
- Ambient barometric pressure at the start of the test
- Volume of condensate observed in the receiving cylinder at any point in the distillation, expressed as a percentage of the charge volume, in connection with simultaneous temperature reading
- Temperature measuring device readings which are corrected to 101.3 kPa barometric pressure
- Group 1, 2 & 3: 5 to 10 minutes  
Group 4: 5 to 15 minutes
- Group 1 & 2: 60 to 100 seconds
- 4 to 5 ml / min uniform average rate from 5% recovered to 5 ml in flask
- Volume of condensate observed in the receiving cylinder when the 5ml conditions are reached
- Volume of condensate observed in the receiving cylinder when the final boiling point is observed
- Maximum percent recovered
- Volume of residue in the flask expressed as a percentage of the charge volume
- Combined Percent Recovery and Percent Residue in the flask
- Time from 5 ml in flask to FBP = < 5 minutes
- 100 minus the Total Recovery
- Percent Recovery corrected for barometric pressure
- Percent Loss corrected for barometric pressure
- Combined Percent Recovery and Percent Residue in the flask corrected for barometric pressure

Comments:

FIG. X5.1 Percent Recovered Report Form

25

26

### "Percent Evaporated" Report Form

Laboratory: \_\_\_\_\_

Date: \_\_\_\_\_  
 Time: \_\_\_\_\_  
 Operator: \_\_\_\_\_

Ambient temperature (°C)	_____
Atmospheric pressure (kPa)	_____
Condenser temperature (°C)	_____
Temperature of the bath around receiving cylinder (°C)	_____

Percent Recovered	Corrected Temperature Reading (°C)	Time or mL / min	Percent Evaporated	Temperature Readings at prescribed percent evaporated (°C)
IBP			IBP	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
35			35	
40			40	
45			45	
50			50	
55			55	
60			60	
65			65	
70			70	
75			75	
80			80	
85			85	
90			90	
5 ml residue			95	
FBP			FBP	

Percent Recovery	_____	Corrected Loss	_____
Percent Residue	_____	Corrected Total Recovery	_____
Percent Total Recovery	_____		
Percent Loss	_____		
Corrected Percent Recovery	_____		

Comments: \_\_\_\_\_

- Ambient temperature at the start of the test
- Ambient barometric pressure at the start of the test
- Volume of condensate observed in the receiving cylinder at any point in the distillation, expressed as a percentage of the charge volume, in connection with simultaneous temperature reading
- Temperature measuring device readings which are corrected to 101,3 kPa barometric pressure
- Sum of the percent recovered and the percent loss
- Temperature measuring device readings at specified percentages evaporated calculated with arithmetical or graphical procedures
- Group 0: 2 to 5 minutes  
 Group 1, 2 & 3: 5 to 10 minutes  
 Group 4: 5 to 15 minutes
- Group 1 & 2: 60 to 100 seconds
- Group 0: time from first application of heat to 10% recovered = 3 to 4 minutes  
 Group 0, 1, 2, 3 & 4: 4 to 5 ml / min uniform average rate from 5% recovered to 5 ml in flask
- Volume of condensate observed in the receiving cylinder when the 5ml conditions are reached
- Volume of condensate observed in the receiving cylinder when the final boiling point is observed
- Maximum percent recovered
- Volume of residue in the flask expressed as a percentage of the charge volume
- Combined Percent Recovery and Percent Residue in the flask
- Time from 5 ml in flask to FBP = < 5 minutes
- 100 minus the Total Recovery
- Percent Recovery corrected for barometric pressure
- Percent Loss corrected for barometric pressure
- Combined Percent Recovery and Percent Residue in the flask corrected for barometric pressure

FIG. X5.2 Percent Evaporated Report Form

27

### SUMMARY OF CHANGES

Subcommittee D02.08 has identified the location of selected changes to this standard since the last issue (D 86-05) that may impact the use of this standard. (Approved Jan. 15, 2007.)

- (1) Deleted "natural gasolines" from 1.1.
- (2) Deleted "Group 0" from the entire standard.
- (3) Added Fig. 6.

Subcommittee D02.08 has identified the location of selected changes to this standard since the last issue, (D 86-04b), that may impact the use of this standard. (Approved July 1, 2005.)

- (1) Replaced Table 4 with new values.
- (2) Revised 9.1.2-9.1.2.2, 9.1.5, and Notes 9-11.

# **EXHIBIT 30**

58  
EXHIBIT  
Ashley [unclear] 2019  
Date 2/27/15  
Witness: MALAMUD

From: Kickstarter  
Sent: Fri 10/25/2013 12:16 PM (GMT -7)  
To: carl@media.org  
Cc:  
Bcc:  
Subject: Project Update #8: Public Safety Codes of the World: Stand Up For Safety! by Carl Malamud, Public.Resource.Org

## Project Update #8: A Prayer for Our Democracy

Posted by Carl Malamud, Public.Resource.Org ♥ Like

ASCII to ASCII, disk to disk, data thou art and data thou shalt return.

Today, I published 130 more ASTM standards that have been rekeyed into HTML. We have posted a total of 328 ASTM files as scans from PDF and 256 are now available as open HTML. They are available for open access without restriction from our servers. These are a few of these laws with which we have chosen to govern ourselves:

- ASTM D86 (2007): Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure, as required by the EPA in 40 CFR 1065.710.
- ASTM D129 (1964): Standard Test Method for Sulfur in Petroleum Products (General Bomb Method) as required by the EPA in 40 CFR 60.106(j)(2).
- ASTM D257 (1991): Standard Test Method for DC Resistance of Conductance of Insulating Materials as required by the Rural Utilities Service, Department of Agriculture at 7 CFR 1755.860(e)(5).
- ASTM D323 (1958): Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method) as required by OSHA in 29 CFR 1910.106(a)(30).
- ASTM D412 (1968): Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension as required by the Food and Drug Administration in 21 CFR 801.410(d).
- ASTM D413 (1982): Standard Test Method for Rubber Property-- Adhesion to Flexible Substrate as required by the Coast Guard in 46 CFR 160.055-3.
- ASTM D445 (1972): Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids as required by the FDA in 21 CFR 177.1430(c)(2).
- ASTM D756 (1956): Standard Practice for Determination of Weight and Shape Changes of Plastics Under Accelerated Service

21/5/15  
CONFIDENTIAL

- CFR 571.209 S5.2(b).
- ASTM D781 (1971): Standard Test Methods for Puncture and Stiffness of Paperboard and Corrugated and Solid Fiberboard as required by the Department of Housing and Urban Development in 24 CFR 3280.304(b)(1).
- ASTM D1056 (1973): Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber as required by the National Highway Safety Administration in 49 CFR 571.213.
- ASTM D2156 (1965): Method of Tests for Smoke Density in Flue Gases from Distillate Fuels as required by the Department of Energy in 10 CFR 430 Subpart B.
- ASTM D4268 (1993): Standard Test Method for Testing Fiber Ropes as required by the Coast Guard in 33 CFR 164.74(a)(3)(i).

The rule of law is the secular underpinning of our society. John Adams, in "A Dissertation on the Canon and the Feudal Law" said that for democracy to succeed, we must all know and speak the laws. He said:

*"Let the public disputations become researches into the grounds and nature and ends of government, and the means of preserving the good and demolishing the evil. Let the dialogues, and all the exercises, become the instruments of impressing on the tender mind, and of spreading and distributing far and wide, the ideas of right and the sensations of freedom.*

*In a word, let every sluice of knowledge be opened and set a-flowing."*

---

For our democracy to succeed, we must all be scanners. ASCII to ASCII, disk to disk. Data thou art and data thou shalt return.



When I started to publish federal law, I sent the ASTM and 9 other



I continue publishing the laws of our land. Let every sluice of knowledge be set a-flowing. Thanks for your support.

[Like](#) [Comment](#) on [Kickstarter](#)

© 2015 Kickstarter.com. All rights reserved. This is not an offer to sell securities. See the prospectus for more information.

Want to get these notifications straight to your iPhone?  
**Get the Kickstarter app for iPhone.**

# **EXHIBIT 31**

EXHIBIT

Ashley Soevyn, ... 12019

Date

Witness:

59

2/27/15

MALAMUD

From: Kickstarter  
Sent: Fri 10/18/2013 10:55 AM (GMT -7)  
To: carl@media.org  
Cc:  
Bcc:  
Subject: Project Update #6: Public Safety Codes of the World: Stand Up For Safety! by Carl Malamud, Public.Resource.Org

## Project Update #6: Meet the Code People

Posted by Carl Malamud, Public.Resource.Org ♥ Like

I post legally-mandated public safety codes, like the National Electrical Code, on our web site for anybody to read. The National Electrical Code is required by law by the Federal government and by all 50 states. But, not everybody thinks that's a good idea. In fact, 3 of the big Standards Development Organizations (SDOs) filed suit against me in U.S. federal court, alleging "massive copyright infringement." Ouch!

The maker of the National Electrical Code is a wonderful organization called the National Fire Protection Association. There's lots of code makers out there, but the NFPA is among the best. They do great work. Their president is Jim Shannon, whom I've had the pleasure of meeting. He's a dedicated public servant. The former Attorney General of Massachusetts, he has personally led the drives to require cigarettes to be fire-safe and to put in home sprinkler systems. His work has saved many, many lives.

I'm going to let Jim tell you in his own words why he thinks there should be only one web site that has the National Electrical Code. This video is from the NFPA free access site and I'm embedding it from YouTube. When he's done, I want to make 4 points about what this all means.

<http://www.youtube.com/watch?v=tBFGjvYOBIM>

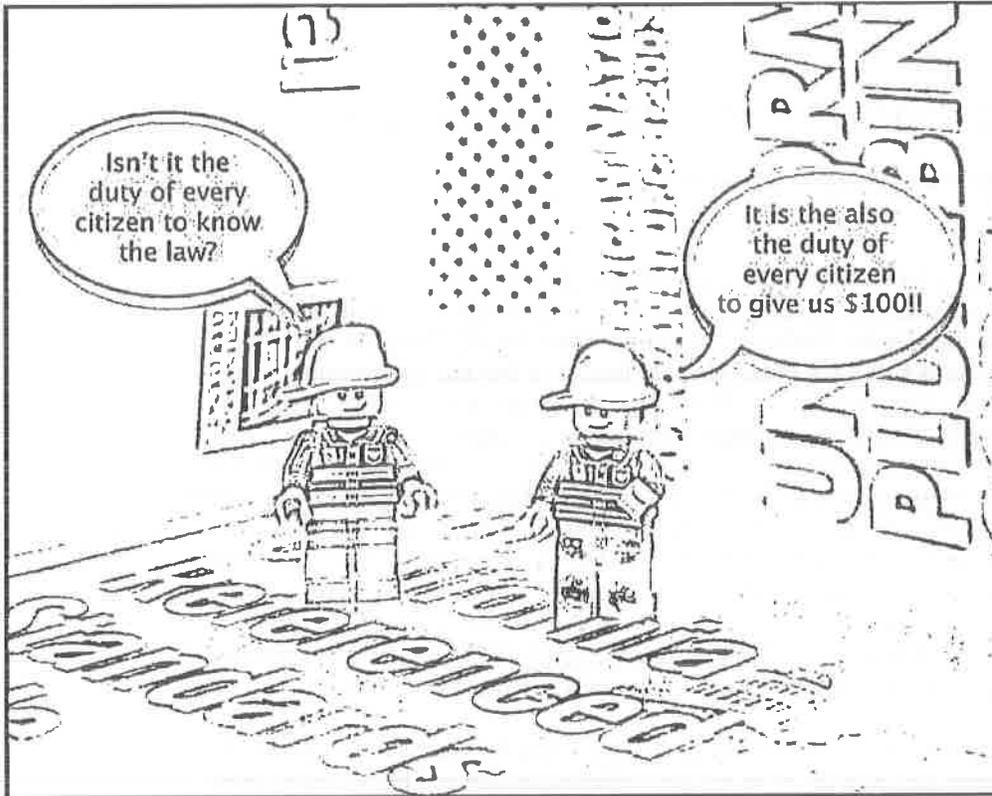
### Point 1: The Code People Want These Documents To Become the Law

The first thing to realize is that the NFPA really, really wants their documents to be the law. This isn't some casual appropriation by Big Government, the entire point of their enterprise is that their documents become law. And, when that happens, they used to issue a proud press release. Here's a few examples:

- [Michigan Adopts NFPA 1 Fire Code!](#)

2/1/15  
COMPLAINT

- West Virginia Adopts Updated Editions of NFPA 70 NFPA 1 and NFPA 101!
- States Move to Improve Fire and Life Safety With Statewide Code Adoptions!



**Point 2: These Are Big Money Operations**

My friend Jim says the NFPA needs the money. All of these code operations are nonprofits, so their tax returns are public. In fact, it's my organization that posts all 7,190,942 nonprofit tax returns on the Internet, so I have ready access to this information (just like you do!). Let's look at the money.

- The NFPA 2011 tax return shows revenue of \$80,721,664 and CEO compensation of \$1,044,035. They made \$10 million in membership dues, \$3 million from government grants, and \$9 million from training.
- The American Society for Testing and Materials 2011 tax return shows revenue of \$61,199,159 and CEO compensation of \$914,548. Their tax returns show millions of dollars in revenue in inspection

- The American National Standards Institute 2012 tax return shows revenue of \$36,516,523, including \$1,036,926 to Joe Bhatia, their CEO, who lists himself as working 35 hours a week so he has room in his schedule for work-life balance.



### **Point 3: The U.S.A. Gold Seal of Approval!**

The code people complain that if everybody can read the law willy-nilly, this is a big burden they will bear. It seems to me that when the government of the United States of America delegates to you law-making power and designates you as the OFFICIAL CREATOR of something like the National Electrical Code, that's a marketing dream come true.

So what if everybody can read, speak, and know the law? What a huge privilege to say "We Are The Official Creators Of An Important Public Safety Law!" Think of all the ancillary products!

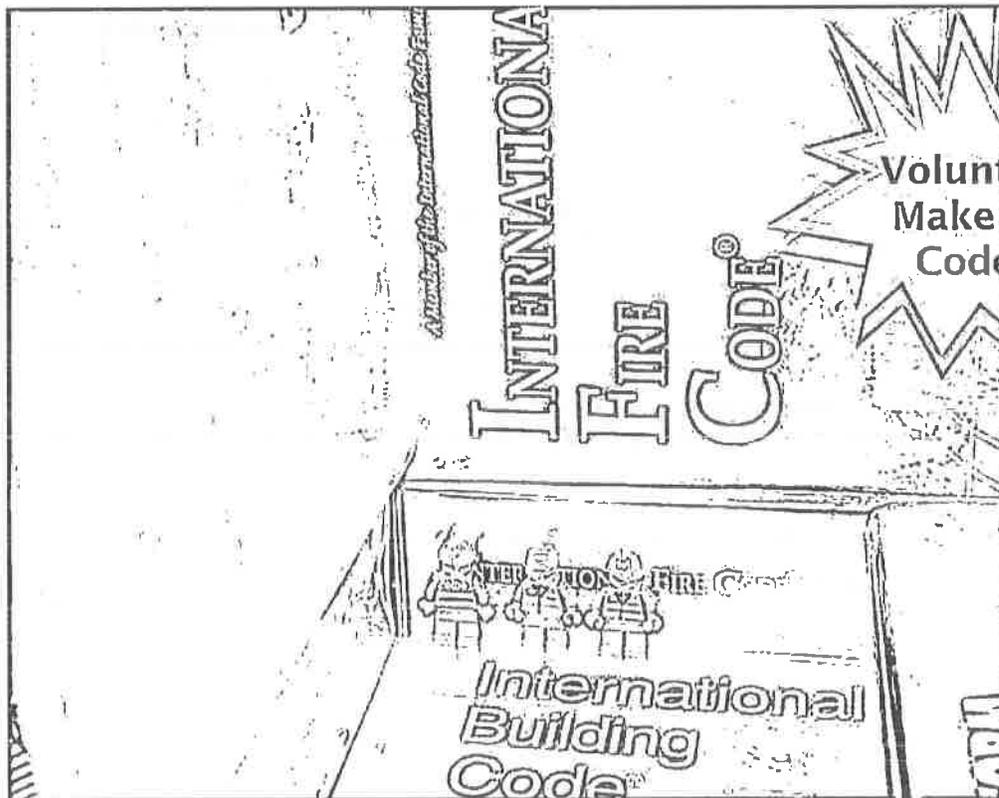
- The International Code Council brought in \$3.5 in certification

of a building code? (Think that's impressive? Underwriters Laboratories brought in \$834,579,721 in certification revenue!)

- Look at all the amazing value added products that NFPA up-sells on the National Electrical Code. You can buy redlines, handbooks, enhanced eBooks, certificates of educational achievement, special tabbed editions, and much more.

Let's be clear. The only thing that Public.Resource.Org wants to publish is the law. We don't care about standards that aren't the law. We don't care about value-added products. What we care about is that if an organization has law-making power, be they the Environmental Protection Agency or the National Fire Protection Association, we should all have the right to read, know, and speak the law!

(Let's also be clear on one more point. Standards are made by volunteers. They don't get paid, they do this because they believe in their profession. All that money is overhead. We need overhead, but let's not forget who makes the codes.)



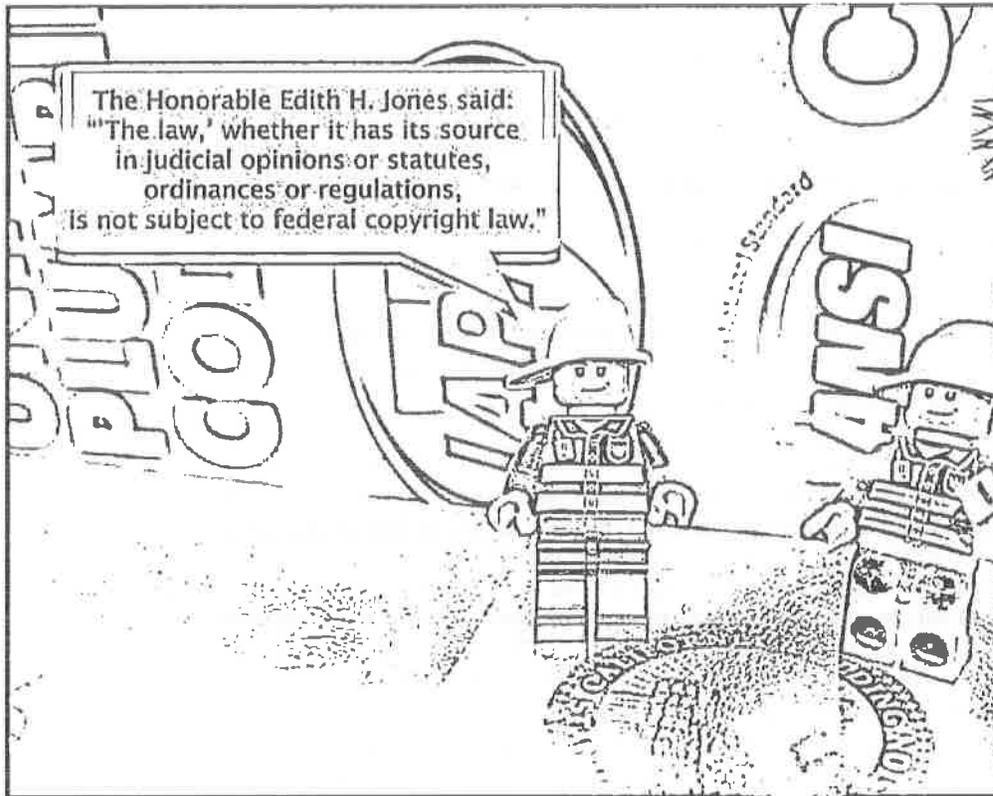
#### **Point 4: Is Read-Only Good Enough?**

When I got into the business of making the law available in 2007, there was no public access to public safety codes. You couldn't reading your building code without passing the cash register. You couldn't build a web site that compared OSHA-required safety standards. You couldn't read hazardous material safety specifications after the BP Oil Spill.

As a direct result of our efforts, the code people are grudgingly providing limited public access. NFPA, as always, is the best of the lot, but all the standards bodies have started to provide limited public access in order to make the case for their monopoly.

- In reaction to our efforts in 2012, the American National Standards Institute has created a "reading room" with many standards required by the federal government. They're really proud of this effort, but the dirty secret is that this site well not let you print, copy, or save the standard, you'll have to preregister and accept terms of use, and ANSI will be sending out reports to standards bodies about exactly what you read and when. (See page 5 of these IEC minutes if you don't believe me.) They even have Java software that purports to prevent you from making a screengrab.
- In addition to the ANSI effort, quite a few standards bodies have their one independent efforts. For example, the American Petroleum Institute, the NFPA, and the ASTM have all installed their own systems.

There's nothing wrong with ANSI or ASTM or NFPA putting together a web site. That's great. They should be applauded. But, just imagine if another law-making agency, such as OSHA, were to put a law on their web site and say nobody can make a copy of it without prior permission and you can't print the law the without paying money. Wouldn't you be totally outraged?

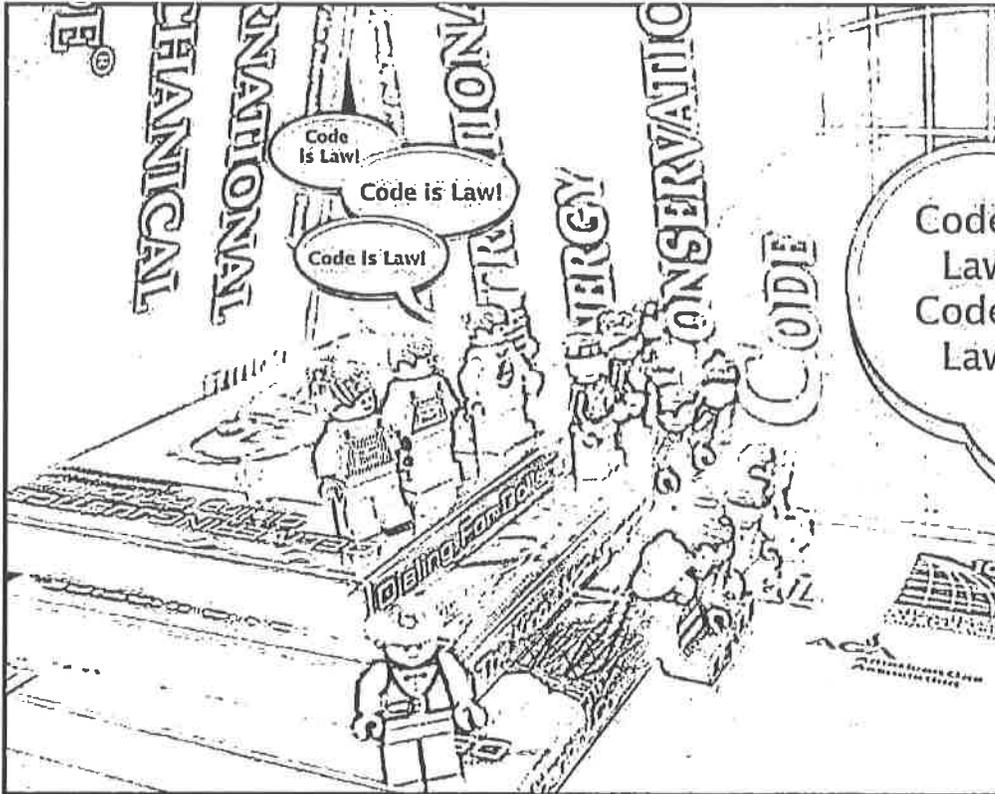


Making public safety codes isn't about money. The code people have lots of money. They're going to have to adjust their business models, but the Internet has forced all of us to do that.

Making public safety codes available is about the rule of law, it's about the freedom of speech. If the code people get their way and they're the only ones able to post the law on their read-only, no-print, no-save, no-copy web sites, we've made a mockery of constitutional principles of due process, equal protection, and the freedom of speech.

*If the code people get their way, our First Amendment would no longer be about the **Freedom of Speech**. If the code people get their way, our First Amendment becomes the **Freedom to Look But Don't Touch**.*

We can do better than that in our democracy. Please stand by me. Code is law!



These images were all prepared by me for my Ignite talk on "Welcome to Code City." Click to watch it.

[Like](#) [View update](#)



Facebook logo and text are trademarks of Facebook, Inc. All other marks are the property of their respective owners.

Want to get these notifications straight to your iPhone?  
Get the Kickstarter app for iPhone.

# **EXHIBIT 32**

## Twelve Tables of Codes

D I R E C T O R Y   O F   T A B L E S	
Table 01	Table of Codes
Table 02	Table of Authorities
Table 03	Table of Revenue and Remuneration
Table 04	Table of Pricing Variances
Table 05	Table of Procurement
Table 06	Table of Production
Table 07	Table of Reverse Lookup
Table 08	Table of Works Consulted
Table 09	Table of Tweets
Table 10	Table of Transformative Use
Table 11	Table of Official Proceedings
Table 12	Table of Requests for Comment

### *§ 1. The Right To Know*

The right to know the law, so as not to be ignorant, as ignorance of the law is no excuse.

The right to speak the law, so as to inform the citizenry.

The right to know and speak the law is the underpinning of government in ancient and modern times. The right to know and speak the law is the foundation of the doctrine of the Rule of Law, which provides:

- First, that the laws shall be public, that the arbitrary whims of individual men and women have no place in a society ruled by law. We declare ourselves to be nations of laws, not empires of men.
- Second, that the laws shall apply equally to all. There shall not be one minimum wage for people of color and another for white people. There shall not be one court for men and another for women. The vote shall not be reserved for the rich, disenfranchising the poor with poll taxes or other artificial barriers meant to come between a people and their government.
- Third, that there shall be due process under the law. Judgment shall only be applied after a fair and open proceeding; you shall know the

charges levied against you and shall be provided counsel, so that you may be heard.

When we fail to live up to the Rule of Law, we have failed as a society. Despots may make excuses about extraordinary times or states of emergency, but those reasons are given sheepishly and accepted grudgingly, as we all know that a government that fails to live by the Rule of Law is one that will eventually face the springtime of revolt.

## § 2. *The Rule of Law*

In the early days of the Roman Republic, the commoners rose against their aristocratic masters and demanded that the laws by which they would be judged should be made known. When the aristocrats resisted, preferring to impose the law arbitrarily, the people quit the city of Rome, leaving the city defenseless and without workers to keep it running.

The great secession led in 450 BCE to the promulgation of the Twelve Tables of Law, which were inscribed on bronze tablets and placed in the agoras for all to read. All citizens were expected to read and know the law, indeed when the Gauls burnt the city in 390 BCE and the tablets were destroyed, all the schoolchildren were able to recite them from memory and they were easily reconstructed.

That the laws shall be written down and promulgated for all to know was a universal value. In Greece, the laws of Solon were inscribed on wooden cylinders and placed in the markets. Aristotle stated in *Politics* that “the rule of law...is preferable to that of any individual...[H]e who bids the law rule may be deemed to bid God and Reason alone rule, but he who bids man rule adds an element of the beast; for desire is a wild beast, and passion perverts the minds of rulers, even when they are the best of men. The law is reason unaffected by desire.”

In India, Ashoka the Great ruled from 269 BCE to 231 BCE and inscribed the Code of the Dhamma on 50-foot pillars of stone throughout the land, declaring in Edict Number 4 “that there should be uniformity in law and uniformity in sentencing.” Ashoka appointed Dhamma Officers who went out into the provinces, reading the edicts aloud to the people and helping them to understand his laws.

That the law should be known to all was fundamental, but equally important was that the law should not be for sale. When the Barons of

England confronted King John in 1215 on the meadow of Runnymede, one of their chief complaints was that access to the courts had become matter of access to money and that judgments were for sale to those who chose to pay for them. This led to the most long-lasting provision of Magna Carta, one still in force in the United Kingdom and many other common law jurisdictions:

Article 40: “To no one will we sell—to no one will we deny or delay—access to right or justice.”

Likewise, in Japan, the 7th-century Prince Shokotu recognized that access to the law and justice should not be a matter of access to money. In the 17-Article Constitution, which is also still in effect, he instructed all Ministers and officials of state to observe the principles he set out:

Article 5: “Of complaints brought by the people there are a thousand in one day. If in one day there are so many, how many will there be in a series of years? If the man who is to decide suits at law makes gain his ordinary motive, and hears causes with a view to receiving bribes, then will the suits of the rich man be like a stone flung into water while the complaints of the poor will resemble water cast upon a stone. Under these circumstances the poor man will not know where to take their complaints.”

That all people should know their duties was expressed in China in the first printed book, *The Diamond Sutra*, which was dedicated to “universal free distribution.” In the Chinese Buddhist tradition, one gains merit by copying or printing. The writing of the laws began in China in 536 BCE, when Xing Shu inscribed the code of punishments on a bronze tripod for all to see. Then, 20 years later a neighboring state inscribed the laws on an iron tripod, then private citizens copied them onto bamboo. For the next millennium, the Chinese government balanced the Confucian precepts of rule-by-man with the codified principles of rule-by-law.

As new governments were formed to throw off colonial and dynastic yokes, equality under the law and government by Rule of Law became guiding principles. The U.S. Constitution enshrined equality and due process into the fabric of the newly United States. John Adams explained in his *Dissertation on the Canon and Feudal Law* that the key to making this experiment in democracy work would be the participation of an informed citizenry:

“Let us tenderly and kindly cherish, therefore, the means of knowledge. Let us dare to read, think, speak, and write. Let every order and degree among the people rouse their attention and animate their resolution. Let them all become attentive to the grounds and principles of government, ecclesiastical and civil. Let us study the law of nature; search into the spirit of the British constitution; read the histories of ancient ages; contemplate the great examples of Greece and Rome; set before us the conduct of our own British ancestors, who have defended for us the inherent rights of mankind against foreign and domestic tyrants and usurpers, against arbitrary kings and cruel priests, in short, against the gates of earth and hell.”

An informed citizenry requires the freedom to read and write the law. When the issue came before the U.S. Supreme Court, it ruled unanimously in *Wheaton v. Peters* (1834) that the law belonged to the people, not to the government and certainly not to private citizens, stating “no reporter has or can have any copyright in the written opinions delivered by this Court.”

The principle that the law belongs to the people was repeatedly affirmed. In *Banks v. Manchester* (1888), the Supreme Court rejected copyright claims over state court opinions. In *Veck v. Southern Bldg. Code Congress* (2002), the 5th Circuit of the Court of Appeals rejected copyright claims over model building codes that were incorporated into law in Texas, stating “[P]ublic ownership of the law means precisely that ‘the law’ is in the ‘public domain’ for whatever use the citizens choose to make of it.”

In the 20th Century, governments all over the world have repeatedly reaffirmed the importance of the Rule of Law and of fundamental human rights, which include the right to know what our governments require of us. This right has been particularly important in the formation of the European Union. Article 15 of the Treaty on the Functioning of the European Union emphasized the “right of access to documents of the Union's institutions,” the Charter of Fundamental Rights of the European Union guarantees a “right of access to documents,” and the Treaty of Amsterdam firmly reaffirmed the principle:

Article 1: “The Union is founded on the principles of liberty, democracy, respect for human rights and fundamental freedoms, and the rule of law, principles which are common to the Member States.”

The courts in Europe have repeatedly reaffirmed these principles. In the United Kingdom, for example, in *Blackpool v. Locker* (1948), the King's Bench refused to enforce regulations that were not available for the public to read. In *Fothergill v. Monarch Airlines* (1981), the House of Lords stated that “the need for legal certainty demands that the rules by which the citizen is bound should be ascertainable by him.” In *Sunday Times v. United Kingdom* (1979), the European Court of Human Rights stated that “[T]he law must be adequately accessible: the citizen must be able to have an indication that is adequate in the circumstances of the legal rules applicable to a given case.”

The Rule of Law is not a concept limited to western or northern countries, to developed countries, or any other lines drawn that divide our world into sectors. The Rule of Law unites our world around a basic truth, that all human beings have basic rights. The Universal Declaration of Human Rights (1948) states:

Article 19: “Everyone has the right to freedom of opinion and expression; this right includes ... to seek, receive and impart information and ideas through any media and regardless of frontiers.”

The rights of speech and expression are fundamental to any declaration of human rights. The right of access to justice is equally fundamental. There can be no human rights in any meaningful sense if we limit who is allowed to read the law and who is allowed to speak it. Human rights begin with all citizens knowing their duties and their rights under the law.

### § 3. *Code is Law*

Law has always been technical. Regulation of public safety and the promotion of standards for fair trade have always stood hand-in-hand with the regulation of the procedures of justice. When the Barons at Runnymede forced King John to agree to Magna Carta, the articles guaranteeing access to justice came right after the article proclaiming a system of uniform weights and measures:

Article 35: “Let there be throughout our kingdom a single measure for wine and a single measure for ale and a single measure for corn, namely ‘the London quarter,’ and a single width of cloth (whether dyed, russet or halberjet) namely two ells within the selvedges and let it be the same with weights and measures.”

England was not unique. In most of the ancient edicts of government, we see the regulation of technology for public safety and the promotion of trade sitting alongside the procedures of justice, the functioning of the divisions of government, and other constitutional issues. In Ashoka's Second Edict he made provisions for the availability of important medical roots and fruits; in other edicts he established systems of irrigation and safe roads. In early Irish law we see provisions of family law sit alongside standards for beekeeping and the proper functioning of watermills.

As our modern era began, the provision of the public safety became an increasingly important function of government. Railways helped open up the United States, but at a tremendous cost in lives from manual hand brakes and link-and-pin couplers for the cars. With the passage of the Railroad Safety Appliance in 1893, the number of accidents fell dramatically as air brakes and automatic couplers became required on all trains.

In American cities, children were dying because milk was being adulterated with fillers such as chalk and kept in grossly unsanitary conditions. With the passage of the Food Act of 1899, the Board of Agriculture was finally able to issue the 1901 Sale of Milk Regulations, establishing standards of purity and hygiene, followed soon after by the Federal Foods and Drugs Act of 1906 which established the Food and Drug Administration.

Perhaps the most significant of the public safety regulations at the turn of the century were the fire codes. The impetus was the horrific New York Triangle Shirtwaist Factory Fire of 1911, where the exit doors were locked shut and 146 garment workers died from fire and smoke, many of them leaping to their deaths from the 10th floor of the factory, a scene so horrific that an observer called it “the day it rained children.”

The fire led to the creation of a Committee on Public Safety led by Frances Perkins, and with the backing of Tammany Hall's Al Smith, to the promulgation of mandatory fire codes. Since then, groups such as the National Fire Protection Association have created the high quality building, fire, electrical, and other public safety codes required throughout the world. When those codes are ignored, we see tragedies such as the Bangladesh Tazreen Fashions fire of 2012, a fire that bore a striking and horrifying resemblance to the Triangle Shirtwaist fire 101 years earlier.

In our modern world, public safety regulations are a key function of government. Natural gas and oil, for example, power our modern cities, but those substances can cause grave harm. In the United States, we learned this repeatedly when the Texas City refinery explosion of 2005 killed 15 and injured 170, when the Deepwater Horizon oil spill of 2010 threw 4.9 billion gallons of oil into the Gulf, and when a 30-inch gas pipeline in San Bruno, California, exploded and sent a blast of fire 1,000 feet high.

Technical regulations encompass a huge swathe of our modern life, a natural outcome of our technical society. Building and other codes, food safety, hazardous materials, the environment, occupational safety in factories and farms, and the safety of products are all subject to these regulations. While some may argue there is too much regulation and others argue there is too little, before we can have that discussion the citizenry must be informed.

#### § 4. *Indefensible Thunderbolts*

*Ignorantia juris non excusat* is the well-established doctrine that ignorance of the law is no excuse. That citizens must be notified of the laws that affect them was the genesis of the Federal Register, an official gazette of the United States, established after the Supreme Court ruled in the *Hot Oil Case* (1935) that regulations that the government failed to publish were not valid. Notification of the citizenry of their rights and responsibilities is a requirement of lawmaking.

In most of the world, including the United States, there has arisen a system for technical laws known as incorporation by reference. The standards governing topics such as building codes or hazardous material transport are developed by ostensibly private bodies. The government then publishes a notice in an Official Gazette incorporating these standards into the law, but the text of the standards must often be purchased from a private body.

The private bodies that develop these standards have been delegated law-making authority from their governments. In most cases, these private bodies are created by their governments. The British Standards Institution, for example, was created by a Royal Charter in 1929 and represents the United Kingdom in numerous international forums, including the International Organization for Standardization (which it helped create) and the European Union's European Committee for

Standardization (CEN). As the duly delegated agent for this form of European Union regulation, the British Standards Institution is required to adopt and publish EU standards without change, making the law available to citizens. The official United Kingdom repository of statutes lists hundreds of statutory instruments that mention British Standards Institution documents.

While technical standards have the force of law, the governmental bodies that promulgate these standards and a series of nonprofit organizations that have sprung up besides them all too often maintain that the laws are their private property and can only be accessed after paying a fee. More insidiously, these organizations maintain that they continue to own the documents even after you have paid the fee, exercising controls such as restricting the ability to print the document, or copy it, or even to quote excerpts without their case-by-case prior written approval.

These restrictions on use are implemented through a number of techniques. Many standards are only available in a shrink-wrap license, an agreement that claims that by opening the packaging the reader agrees that they don't own the document but only "license" it and agree not to redistribute or quote without permission. For online distribution, many standards come with Digital Rights Management (DRM) software that ties the document to a specific computer and restricts the ability to copy text from the standard or print it.

These restrictions on use are proclaimed loudly and prominently, with watermarks being put on every page of some documents purchased, strident terms of use, and publicity campaigns reminiscent of the "FBI Warnings" stamped on the beginning of many movies. But, there is a world of difference between a privately created movie and a legal document carrying out the edicts of government. To proclaim ownership of edicts of government is a false proclamation, what is known in the law as the *Doctrine of Brutum Fulmen*, the use of an indefensible thunderbolt to make others give up their rights under the law.

The law belongs to the people, and cannot become the private property of some governmental or non-governmental organization, no matter how seemingly well-deserved are the rents one could extract from winning a monopoly concession on a parcel of the law. While standards bodies need money to carry out their valuable work, and while it is clear that these standards bodies create high-quality documents that are essential to our public safety, one cannot cordon off the public domain simply because of an institutional desire for funds.

An examination of the financial status of standards organizations reveals a wide variation in composition and revenue streams. In India, for example, less than 4% of revenue at the Bureau of Indian Standards (BIS) comes from the sales of documents. BIS, like the British Standards Institution, Underwriters Laboratories, Standards New Zealand, and many other organizations throughout the world, have a thriving business in certification and testing.

Some standards bodies, such as the National Fire Protection Association and the International Organization for Standardization, depend more heavily on the sale of standards documents. However, even in these cases there are many other revenue streams and there are opportunities to adjust the business models to more properly reflect the importance of their work throughout society. And, in many cases, there is room for a fresh look at expenses, such as million-dollar CEO salaries, some of the highest salaries in the non-profit world.

Not all standards bodies have become addicted to these copious revenues that accompany these indefensible thunderbolts. In some countries, such as Thailand, Indonesia, and Ecuador, standards are freely available to citizens as a matter of public policy. Many standards bodies thrive on an open standards model, including key areas such as all the standards that govern the operation of the Internet created by the Internet Engineering Task Force and the World Wide Web Consortium, and the food safety standards promulgated in the Codex Alimentarius by the World Health Organization and the Food and Agriculture Organization of the United Nations.

One of the most insidious aspects of the current system is the wide variance of the price of standards. A basket of 11 public safety standards published by the International Organization for Standardization and also required by the European Union was assembled and priced by Public.Resource.Org in the retail outlets of 42 national standards bodies. Even within the European Union the prices varied wildly, from \$175 in the Former Yugoslav Republic of Macedonia to in Lithuania to \$2628 for the same standards in the United Kingdom. Because access to the standards (and the national forwards to the standards) is vital for economic activity across national borders, the opportunistic pricing by money-hungry standards bodies becomes a tall barrier to trade.

While extracting a tax on each reader of a standards document is an impediment to the Rule of Law, the restriction on reuse of the documents is even more serious. The law is the raw material of democracy, and

being able to work with these documents to create better ways to inform the citizenry is crucial to the proper workings of justice, governance, and politics.

In many cases, the standards promulgated by standards bodies are only available electronically on a web site that only works on a certain of browser, or as a PDF file with a plugin that only runs on certain operating systems. In many cases, the documents are so restricted in use that they won't work with software used by the visually impaired, or the searching capabilities are so restricted that lawyers, paralegals, policy analysts, legislative aides, and government officials are unable to find the passages they need.

One of the most important reasons the law has no restrictions on use is so that innovation may flourish in the marketplace, creating better solutions for citizens, lawyers, government workers, and public safety professionals. Restrictions on reuse have frozen the format of standards documents inside dozens of old web sites and outmoded formats maintained by standards organizations, many of whom run Internet sites that are littered with technical errors and broken software.

Perhaps the most troubling indefensible thunderbolts are when the law is kept secret and may not be consulted. In Estonia, one of the most advanced and democratic societies and generally an exemplar of open government practices, Eesti Standardikeskuse (EVS) received an order with payment via PayPal from Public.Resource.Org for €3,208.68 for the purchase of 166 technical standards required under Estonian law. The next day, the order was cancelled, the money returned, and a notice dispatched indicating that the service was being refused. When we inquired as to why, the answer was a curt 1-line response:

“We would keep the circumstances to ourselves and we recommend to order the standards from another country.”

Even in the case of European Union regulations, which must be adopted by all European Union nations without change, there is a national foreword. Other standards are developed specifically for Estonia and are only available from EVS. Public.Resource.Org wrote to the Honorable Thomas Hendrik Ilves, the President of Estonia and a leader in open government and asked him for help. When he didn't answer, we wrote to the President's aide, and then to the President's son, neither of whom answered. In a society governed by the Rule of Law, should one have to know the President's son to be able to purchase the law? In a modern

democracy, should the government be able to pick and choose who shall know the rules?

§ 5. *This Law is Your Law*

The U.S. Copyright Office, in the *Compendium of Copyright Office Practices*, states:

“Edicts of government, such as judicial opinions, administrative rulings, legislative enactments, public ordinances, and similar official legal documents are not copyrightable for reasons of public policy.”

In order to promote public education and public safety, equal justice for all, a better informed citizenry, the rule of law, world trade and world peace, Public.Resource.Org has undertaken to make technical edicts of government available on a noncommercial basis, as it is the right of all humans to know and speak the laws that govern them.

The focus in this release is on mandatory public safety standards. In many nations, public safety standards are expressly mandatory. In other countries, elaborate dances are undertaken to protect an illusion that the standards are somehow voluntary, but in each of the documents published there is a compelling public interest and the documents have been promulgated under the direction of government and play a key role in society.

A number of the documents released come directly from the standard bodies, because they make the documents available in draft or in final form. In other cases, such as China, the documents were submitted to the World Trade Organization, which maintains a portal with thousands of standards. These standards are made available to the public as part of the WTO's mandate to promote world trade by requiring full disclosure of the rules and standards governing trade with a country.

Many of the documented released were purchased directly from standards organizations after careful research. Most of the standards were ordered in paper format. For PDF files, such as those that were obtained from the World Trade Organization, the documents were fixed by properly embedding fonts and fixing technical errors.

One of the most important reasons for making standards available is to allow for transformative uses, providing better access and utility for citizens. Of the standards being published, several hundred have so far been rekeyed and reset by Public.Resource.Org into valid HTML files. Many of the graphics have been redrawn into the open Scalable Vector Graphics (SVG) format so that the graphics can be resized and manipulated. Likewise, mathematical formulas are being reset into the Math Markup Language (MML), providing better access for the visually impaired and better functionality for those wishing to cut and paste formulas.

A number of other transformative uses become possible when the documents have been rekeyed into valid HTML. Proper metadata is added to the document headers, making them accessible and discoverable by search engines. Access protocols such as FTP and rsync allow bulk access and resynchronization to large collections of standards documents. Digital signatures allow users to verify that the documents have not been modified by comparing them to a known good version of the document.

All over the world, for centuries, nations have embraced the concept of the Rule of Law—the principle that prescribed law, rather than the whims and desires of any individual, should govern society. The Rule of Law is enshrined in ancient texts and in modern legislation, treaties, and judicial decisions. It is a central protection against tyranny and against a society where justice is arbitrary and some gain unfair advantage over others.

Only if the law is truly free and available can we expect people and enterprises to obey the law, to know their rights under the law, and to evaluate and participate in the work of improving the law. Only if the law is accessible to all, can we truly say that a society is governed by the Rule of Law.

By making technical standards governing building safety, transportation safety, energy safety, food and water safety, and other important areas readily available to all without restriction, we make society better. First responders and government officials can do more to protect citizens. Small enterprises can more easily and affordably comply with the law and build new businesses. Students, educators, scientists, engineers, policy advocates, journalists, and government workers can more easily read the standards and learn about technology, commerce, and government. They can work to improve the standards themselves, and they can improve upon the accessibility and usefulness of the standards by making searchable databases or better navigational tools.

Innovation and education will benefit by opening up this world, but at the root are basic issues of democracy and justice. We cannot tell citizens to obey laws that are only available for the rich to read. The current system acts as a poll tax on access to justice, a deliberate rationing and restriction of information critical to our public safety and economic progress.

The law must be easily available to all people, access to the legal system and the texts that make up the law should not be bought, or sold, or rationed. People must have the right—an unfettered right—to read the law.

People must also have the right to communicate the provisions of law to others—to speak the law. When Justice Stephen Breyer said, “if a law isn't public, it isn't a law,” he was expressing the long-standing doctrine of the Rule of Law, one that has become ever more important in our information age.

Nobody can deny you the right to read and know the law. Nobody can tell you that justice is for sale. Read the law and make it better. Make your society better and make it safer.

You own your government. The Rule of Law is the rule of the people.

The law is yours to read, yours to know, and yours to speak. This law is your law.

---

Published by [Public.Resource.Org](http://Public.Resource.Org)  
Last Modified January 7, 2013

# **EXHIBIT 33**

From: Carl Malamud  
Sent: Wed 8/24/2011 10:52 AM (GMT -7)  
To: Josh Greenberg  
Cc:  
Bcc:  
Subject: Re: Federal Register/Code of Federal Regulations  
Attachments: org.sloan.201108016\_to.pdf

Here you go ... I'm not in top form today (been sick, dentist this morning, etc, etc) so hopefully I didn't screw this up and it is semi-coherent.

My biggest worry on these things is over-promising ... I try stay conservative on what I'm promising to deliver and what that will mean to the world. Maybe not the best sales strategy, and certainly one not practiced by some of my nonprofit colleagues. :)

I also want to be very careful that this is framed as an activity meant to help the code producers and building officials make their work better. We're not out to disenfranchise them, this is their job not ours. I don't want to piss them off and have them see this as a threat and I definitely don't want this in court.

Carl

EXHIBIT 77  
Ashley Soevyn, CSR No. 12019  
Date 2/27/15  
Witness: MALAMUD



**PUBLIC.RESOURCE.ORG** ~ *A Nonprofit Corporation*

**Public Works for a Better Government**

**Recoding the Public Safety Codes of California**

Proposal to the Sloan Foundation

August 19, 2011

**1. Background**

This is a proposal to make Title 24 of the California Code of Regulations significantly more usable than it is today. Title 24 contains 5,562 pages of the public safety codes of California—building, electrical, mechanical, plumbing, energy, and fire—the laws that most closely touch our daily lives.

Across the United States, states and municipalities Incorporate by Reference model public safety codes created by groups such as the International Code Council and the National Fire Protection Association. While these model codes have copyright, once incorporated by reference and duly enacted as law by a jurisdiction, the material becomes public domain, a principle most recently articulated in the case of *Veck v. Southern Building Code Congress* (293 F.3d 791).

In 2008, when we began our work in this area, none of the public safety codes of the U.S. were on the Internet. Even state web sites such as the California Building Standards Commission directed citizens to sites for purchase of paper copies or electronic products with tight usage restrictions built into the terms of use. The cost for a paper copy of California's 2010 Triennial Edition of Title 24 is \$1,177.

In 2008, relying on the *Veck* decision, Public.Resource.Org systematically purchased model codes, scanned them, found the relevant regulations or statutes that

incorporated specific model codes, and published the results on-line. This collection—[bulk.resource.org/codes.gov](http://bulk.resource.org/codes.gov)—contains 278 public safety codes for 45 states.

Every one of those codes contained strong copyright assertions by the model code creators and in many cases by the state or municipality. Despite these strong copyright assertions, and despite extensive national publicity, not a single letter of protest or legal action was received by [Public.Resource.Org](http://Public.Resource.Org).

After about two years, we began to notice most of the code creation bodies in states and municipalities were now beginning to provide some form of public access to these laws, usually in a “crippleware” system with no printing, bookmarking, or saving.

Making public safety codes broadly available is more than just an abstract notion of transparency. These extremely detailed and technical rules are crucial to how we lead our lives:

- Apprentices wishing to become electricians, plumbers, or carpenters must be intimately familiar with the codes in their field and in related fields. Firefighters, including volunteer firefighters, should be able to easily read the provisions of the fire codes.
- Homeowners should be able to quickly check to see if their home is up to code or if a recent repair is up to code. The web sites provided by the code developers and the 5,000 page documents published by the state are aimed at high-end professionals, and there is a strong barrier (which we hope to reduce) to building new kinds of web sites that are aimed at other kinds of users.
- Building supervisors for commercial properties, architectural firms, engineering firms, and property developers need to incorporate the code into their plans and procedures and internal computing systems. With today’s complex

computer systems for CAD and engineering, this means having the codes in a format that is computable. That capability is available today in very high-end CAD systems, but developers wishing to incorporate such capability into web-based systems or open source software do not have the raw materials they need.

- Students of architecture and engineering are required to be familiar with the codes and (one would hope) professors of architecture and engineering would be some of the most astute critics of gaps in the codes or malformed specifications. Because of the high cost and inappropriate formatting of today's public safety codes, educational uses of the public safety codes do not exist and we are not seeing graduate students and professors tackling the codes to help improve them.
- Building officials, legislators, realtors, and developers all need to know how the code varies across jurisdictions. Today, there is no place to look in California to see how these codes vary. Variance across jurisdictions is just one of a class of applications not possible when distribution of the laws we must obey is sandwiched into a single government-endorsed web site and a \$1200 document.

Today, our public safety codes are locked, available only in specific formats and in specific places. Training materials are not widely available, the one-size-fits-all web sites are aimed at a specific class of existing users, new uses can not be implemented or even imagined because the raw materials of our public safety codes are hidden behind walls. By making these codes more widely available and in better formats, we hope to promote no less than increased awareness of the law, increased observance of the law, and better public safety in our daily lives.

## **2. California's Title 24**

In 2010, we began working more extensively with the 2010 Triennial edition of California's Title 24 to see if we could set a concrete example of how much better an open code based on open standards can be. The Triennial edition took effect January 1, 2011 and stays in effect for 3 years. To date, we have produced the following transformations:

- We began by "double-keying" the entire code base into XHTML, including all the tables. Double-keying is a process of converting scanned documents by typing them twice and then comparing the results to catch errors. Double-keying achieves accuracies of approximately 99.51%. The HTML markup we produced is quite extensive, including coding of lists, change markers from previous version and to the model code, tables of contents, indices, and other finding aids.
- This code base was then checked into Google Code, a source code maintenance system along with corollary materials such as documentation. This allows multiple developers to work in a distributed fashion and makes it a truly open source project.
- This summer, working with the Rural Design Collective, a mentoring program for students under our fiscal sponsorship, students have been begun recoding all the mathematical formulas into MathML (which will make the public safety codes accessible for the first time) and transformed further into SVG (which makes the mathematical markup work across a range of browsers, including those that don't support MathML).
- Also working with the Rural Design Collective, we have begun recoding all the graphics into vector graphic files and SVG. This includes providing editable vector art for icons, and other graphic elements used in the public safety codes.

### **3. Proposed 2012 Work**

This proposal, which covers 12 months of work in 2012, will bring Title 24 to a new level, making the public safety codes far more useful. Our aim is to make Title 24 so much more useful than the version provided by the state that California, model code creators, and jurisdictions across the United States all see very clearly the benefits of creating accessible laws on open standards with much better navigation and production values.

We'd like to make this code so good, it can't be ignored, so that politicians clearly see how much better it is, so citizens clammer to see this happen in their own jurisdictions. Our 2012 work is focused on 8 key tracks.

Track 1: Coding. The first track is on getting the underlying code truly converted. Our work with the Rural Design Collective student mentoring program will be expanded to finish all the coding into MathML, proper geographic coding (e.g., KML) for geographic maps, better icon sets, and much better overall graphics. We will also complete the process of making sure every section number has a unique marker and all tables of indices, cross-citations, and tables of contents point to the correct location.

- Deliverables for Q1: Indices and section numbering coding complete.
- Deliverables for Q2 and Q3: Delivery and incorporation into the main corpus of complete math, geographic, and graphic coding.
- Deliverable for Q4: Quality assurance and cross-browser audit of rendering.

Track 2: User Interface. The second track is on user interface elements and transformation into other formats. User interface elements such as better navigation in the HTML can be vastly improved. In addition, using a CSS-based transformation, we

are able to turn the HTML back into PDF, including keeping all pagination and change control markers. This PDF transformation is a technique we've already tested extensively with Title 24. In addition, we are investigating epub and other e-book formats, an area we've worked extensively on in the past.

- Deliverables for Q1: PDF transformation. Design work for UI complete.
- Deliverables for Q2: Better UI in alpha. Investigation of Epub and other formats complete.
- Deliverables for Q3: Better UI in beta.

Track 3: Table of Variances. The third track is to produce a state-wide table of variances. California's Title 24 is the governing law, but individual municipalities will provide local amendments. In addition, there is an ongoing process of notices and errata to the codes. This track will produce a systematic on-going survey of all municipal and county references to Title 24, allowing us to provide a variety of navigation and reference tables. For example, local building contractors will be able to access a table showing how the building code varies in different towns across a county.

- Deliverables for Q1: Tracking of errata and identification of municipal code sections complete.
- Deliverables for Q3: Table of variances published in alpha.

Track 4: Standards Incorporated by Reference. The fourth track addresses standards incorporated by reference into Title 24. The 5,562 pages of Title 24 are only the beginning of the laws that a citizen, contractors, building official, or firefighter must be aware of. Just as the State of California incorporates by reference a model code, the model codes incorporate by reference a large number of technical standards.

A few examples of such technical standards are already published on our Title 24 site and each part of Title 24 contains a listing of all standards incorporated by reference. Public.Resource.Org has already published a substantial number of these secondary standards, and will continue to expand that collection.

The Veeck decision is unclear if the holding is recursive. As such, we don't feel it would be wise to simply publish all secondary standards wholesale. Rather, our strategy is to assemble a group of well-qualified engineering professionals and ask them to read the public safety code and then read the standard that is incorporated by reference and render an opinion on how critical the secondary standard is to understanding the law.

Our hope is to have a well-considered body of technical opinion that identifies which are the most important secondary standards, the ones without which it is impossible to understand the law. A simple example is when certain types of fire sprinkler standards are mandated in a fire or electrical code, and the definition of those fire sprinkler standards is contained in a secondary document.

- Deliverables for Q1: Identify venue and participants for study. Identify which standards to make available to group.
- Deliverables for Q2 and Q3: Work with group to complete evaluation of standards.
- Deliverables for Q4: Present results in report, present the report to SDOs, state officials, county officials.

Track 5: Outreach to Users. Outreach is a two-way cycle: we help educate people who will use the codes, but also learn from them what would make the code more useful. We will convene two kinds of meetings in 2012. First, at least 4 workshops will

be delivered on "How to Use the Code," aimed at librarians, active homeowners, and other non-professionals. We will also convene at least 4 workshops with contractors, architects, and other professionals to walk them through what we have done with Title 24 and solicit their suggestions and feedback. Our commitment in Track is to "hit the street" and make sure that we've talked with (and listened to) code consumers throughout the state.

- Deliverables for Q2 and Q3: Conduct at least 8 workshops throughout the state.

Track 6: Outreach to Government and SDOs. A key audience for this effort are Standards Development Organizations (SDOs) such as the National Fire Protection Association and governmental bodies that adopt and implement code, such as county building inspectors and the state Building Standards Commission and Office of the Fire Marshall. There is also a national audience for this work with organization such as the Administrative Conference of the United States, which is studying the Incorporation by Reference issues as applied to the Code of Federal Regulations.

Our hope is to raise the bar on all organizations that incorporate by reference public safety codes, persuading them to invest in open interfaces and much better coding. As a member of the Administrative Conference, Carl Malamud has participated extensively in this national dialogue. At the state level and local level, and with the SDOs, we hope to demonstrate that making codes more accessible and more usable is not only good for their business, it is inevitable and they should join the effort instead of fighting it.

- Deliverables for Q2 and Q3: Secure invitations to address or meet with officials of at least 2 professional groups (SDOs or professional associations) and at least 5 governmental bodies (state officials, county or municipal public safety officials or administrators).

Track 7: Outreach to Developers. We will make our effort a vibrant open source effort using techniques such as a contest for application developers, appearing at appropriate forums such as the Open Source Convention (OSCON), and at gathering of legal/technical groups such as the ABA Tech show or the annual Center for Computer-Assisted Legal Instruction (CALI).

By turning the codes into well-formed XHTML with standardized markup of tables and standardized formatting of graphics, maps, and formulas, developers will be able to break the code into components and easily repurpose them. For example, a legal information site that serves the California Code of Regulations and the opinions of the California courts will find numerous references in those documents to public safety code provisions. Because the code will be easily parsable, developers could easily build a popup function that allows a user to see the text of a specific provision in the building code referenced in a regulation or court opinion.

In addition to linking into the broader corpus, there are a number of stand-alone applications that a "computable" version of the public safety codes enable. The table of variances will identify modifications to the state safety codes at the local level. However, those variances are typically in reference to the existing code ("Section A.2 of the Building Code is amended with the following provisions"). Developers should be able to integrate the local provisions into the underlying base code to provide a single version with all the provisions.

A third possible set of new applications consist of sub-setting the codes for specific uses, something hard to do with a monolithic PDF file or a hard-coded web site. The codes cover a broad set of uses, but specific provisions are particularly important for classes of use, such as certain types of industrial applications (e.g., a juice factory), for residential construction, or for schools. Being able to pull out the specific provisions

applicable to, e.g., juice factories, and then coupling the public safety with other relevant provisions (such as the FDA's HACCP requirements for food handling) is an application that is not possible today but would be with better public safety codes.

- Deliverables for Q1: Talk to O'Reilly Media, Google, CALL, ABA and secure their participation. Talk to Clay Johnson and others familiar with apps contests and determine if that is feasible.
- Deliverables for Q2 and Q3: Appear in at least 2 developer-rich venues with an in-depth introduction to the codes (e.g., long talks, a workshop, a tutorial) and find several other venues for reaching developers (e.g., a Google tech talk, an O'Reilly video, a series of Ignite talks).

Track 8: Scaling Up and Marketing. The process we've gone through with Title 24 is one that could be repeated in other jurisdictions. More importantly, the process can be quantified based on our experience with operations such as double-keying. As more of the codes get converted, there is also an opportunity for reuse of key elements. For example, turning the national icon sets into vector art only needs to be done once. Likewise, many jurisdictions incorporate with no changes or few changes the same model codes.

In track 8, we will pick at least 10 specific jurisdictions, including the cities of Chicago and New York, and quantify how much it would cost to turn those codes into the same kind of work we are doing on Title 24. By quantifying the cost for converting those codes, and then posting our analysis, we believe we will be in a position to attract other funders to the effort, particularly those with specific geographic focuses. The Knight Foundation, for example, has a particular focus on 26 "Knight Communities." Likewise, the Lilly Endowment is receptive to proposals that help Indianapolis.

- Deliverables for Q1 and Q2: Quantify the cost of doing at least 10 jurisdictions. Establish a partnership with Code for America so that the "package" includes not only digitization but implementation of the codes into the relevant jurisdictions.
- Deliverables for Q3 and Q4: Pitch those 10 jurisdictions to appropriate funding bodies, including foundations and governments.

#### **4. Metrics**

Making Title 24 better has two purposes. First, making a better code should lead to more usage and better uses. Second, making one code better should lead to making all codes better.

- The first metric is the number of users. Our version of Title 24 should have more users than those that purchase the books and DVDs or use the state or SDO-provided web site. We'd like to be number one in the marketplace by the end of the year.
- The second metric is repurposing of our code. We'd like to see Title 24 moved into corporate computing environments, such as universities or architectural firms. While high-end CAD environments already allow high-end professionals to do things like automatically verify compliance of the code in a building plan, such functionality is not available in schools, open source software, or for small contractors or building professionals. Likewise, we'd like to see the legal information vendors integrating the codes into their broader offerings, such as linking code sections into court opinions and the broader California Code of Regulations.
- The third metric is value-added uses: we'd like to see people conducting workshops for apprentices, students, homeowners, or officials using our version of Title 24. Today, training is all conducted on the official materials, and those

materials are limited and expensive. That means there are no training classes, e.g., for homeowners wishing to learn enough about building and fire codes to be able to evaluate the work done by their contractors. By making alternative versions of the codes available, we hope to see a flowering of workshops aimed at previously under-served classes of users and specialized software such as self-study tests for apprentices studying for licenses.

- The fourth metric is institutional change: we'd like to see the SDOs start copying what we did on Title 24 in their own on-line presences and see state and county officials start asking hard questions as to why their codes aren't more open. The true metric of change, one unlikely to happen in 2012, is for the state to require that any codes incorporated by reference be readily available to the public in an open format.

#### **4. Project Budget**

We are requesting a grant of \$200,000 for 2012 to conduct this project. The project budget is allocated as follows:

Track 1: Core coding, including mentoring program for 5 students over the summer and additional student work in the spring and fall.	30,000
Track 2: UI, styling, and transformations. This track continues for all 12 months of the year at \$3,000/month.	30,000
Track 3: Table of Variances. We aim to work with a student group such as at Berkeley's School of Information and with either a graduate student or a contractor to do core research.	35,000
Track 4: Standards Incorporated by Reference. Approximately \$10,000 of this track is for purchase of standards, the rest of the budget is based on estimate of a group of 20 participants with meeting expense, and either a graduate student or a contractor to help us run the group and draft the report.	40,000

The Sloan Foundation, Page 13

Track 5: Outreach to Users. We will work with a contractor for development of core materials. The primary expenses are for at least 10 workshops to be held throughout the state.	\$30,000
Track 6: Outreach to Government and SDOs.	\$10,000
Track 7: Outreach to Developers. The main cost is an apps contest cost of \$10,000 and \$5,000 for travel, meeting expense, and tchotchkes such as custom USB drives with copies of the code base installed.	\$15,000
Track 8: Scaling up and Marketing.	\$10,000
<b>Total</b>	<b>\$200,000</b>

#### **6. Governance and Program Management**

Public.Resource.Org is a 501(c)(3) corporation incorporated in 2007 in California. We strongly support best current practices of corporate governance including strong financial controls, conflict of interest policies, and standards of conduct. Information about the company, including board members and major donors, can be found on our about page and on Guidestar.

- IRS Determination
- Audited Financials: 2007, 2008, 2009, 2010
- Articles of Incorporation and Bylaws

Public.Resource.Org has been instrumental in making legal materials in the United States more readily available and we have worked with all 3 branches of the federal government. In 2011, our major projects have included working with Speaker John Boehner and Chairman Darrell Issa to make available an archive of approximately 5,000 congressional hearings and working with a number of partners to digitize and officially certify as federal electronic reference copies 3.3 million pages of briefs submitted to the 9th Circuit of the U.S. Court of Appeals.

Carl Malamud is the principal investigator on this proposal and the President of Public.Resource.Org. The author of 8 books, Malamud was previously founder of the Internet Multicasting Service and the Chief Technology Officer at the Center for American Progress. He is credited with creating the first radio station on the Internet and was responsible for placing the SEC EDGAR database online. He is the winner of the Berkman Award from Harvard "for his extraordinary contributions to the Internet's impact on society," the Pioneer Award from the EFF, and the Bill Farr Award from the First Amendment Coalition.

#### **7. Background Links**

- Noam Cohen, Who Owns the Law? Arguments May Ensnue, New York Times, September 28, 2008
- Nathan Halverson, He's giving you access, one document at a time, Santa Rosa Press Democrat, September 3, 2008.
- Carl Malamud, Welcome to Code City!, Ignite Sebastopol, Hopmonk Tavern, October 20, 2010
- Matthew B. Stannard, Sebastopol man puts code manuals online, San Francisco Chronicle, September 27, 2008

# **EXHIBIT 34**

EXHIBIT 65  
Ashley Sowyn, CSR No. 12019  
Date 2/27/15  
Witness: MALAMUD

From: Carl Malamud  
Sent: Fri 8/09/2013 4:58 PM (GMT -7)  
To: REDACTED  
Cc:  
Subject: Re: sult

In case you're interested about the documents at issue, here's a good look:

<https://www.google.com/search?q=nfpa+site%3Alaw.resource.org>  
<https://www.google.com/search?q=astm+site%3Alaw.resource.org>  
<https://www.google.com/search?q=ashrae+site%3Alaw.resource.org>

I screwed up some of the pdf's and some of the SEO stuff, but for the most part it came out pretty nicely. I've got 11,000 standards, plus the state and city codes and court opinions, and we're coming up pretty well in searches.

# **EXHIBIT 35**

From: Carl Malamud  
Sent: Thu 1/16/2014 3:46 PM (GMT -8)  
To: Rebecca Malamud  
Cc:  
Subject: funding

You're funded at the \$5k/month level for at least 6 months from p.r.o. as long as you can keep pumping out visible progress on the svg/mathml front (plus, of course, your design help, which I need, but what the funders are going to be looking at is our walking through the standards ... they're funding my legal fight, so that's the piece they care about.)

You're going into the astm, ashrae stuff next? you'll make sure I get monthly releases of stuff and I know what your queue looks like and approximately when I'm getting stuff?

There are no hard deadlines, I'm most interested in seeing you manage the releases and just plowing through the stuff and handing me no-hassle collections I can easily add to the archive and add value. While there are no hard deadlines, it is important that we systematically walk through the stuff and get it done.

Deal?

Carl

No.	27
Date	11-13-14
	Malamud
	CC Reporting

# **EXHIBIT 36**

EXHIBIT 73  
Ashley Soevyn, CSR No. 12019  
Date 2/27/15  
Witness: MALAMUD

From: Carl Malamud  
Sent: Fri 4/20/2012 7:59 PM (GMT -7)  
To: Maura Marx  
Cc:  
Bcc:  
Subject: Re: [sc-digitalpublic] dinner & Steering Commlltee meeting

Definitely enjoying myself. Amazingly important trove of information which will see the light of day for the first time. It isn't original authorship, but for millions of people it will effectively be that.

Hopefully won't have too large a reserve of humor as some folks consider it rude if you start laughing at inappropriate times.

Good night to you as well!

On Apr 20, 2012, at 7:26 PM, Maura Marx wrote:

> you're having a blast buying all those standards, I know you are. hope you had that beer, and a good night. we'll need reserves of humor patience and probably sleep too next week. if not stronger substances.

> buona notte

>

> On Fri, Apr 20, 2012 at 6:39 PM, Carl Malamud <carl@media.org> wrote:

> btw, this is why I'm going a little batty by this time on a Friday. I spent the entire week buying standards. Shopping is tough work in this case ... lots of double-checking to find the exact version. Took me the entire week and over \$10k, and this is what I have to show for it. What a way to make a living. Much harder than assembling the paper copies.

>

> Carl

>

> Partial list of Standards for week of 4/15:

>

> AIIM MS1

> AIIM MS5

> AIIM MS14

> AIIM MS19

> AIIM MS23

> AIIM MS32

> AIIM MS41

> AIIM MS43

> AIIM MS45

> AIIM TR34

> ANSI A10.3

> ANSI A14.3

> ANSI A156.10

> ANSI A156.19

> ANSI IT2.18

> ANSI IT9.2

> ANSI IT9.11

> ANSI IT9.23

> ANSI IT9.25

> ANSI N14.1

> ANSI Z9.2

> API 510

> API 1130

- > API BULL 2 (INT-MET)
- > API RP 14C
- > API RP 14E
- > API RP 14G
- > API SPEC 5L
- > API SPEC 6A
- > API SPEC 17J + REDLINE
- > API STD 620
- > API STD 653
- > API STD 1104
- > API STD 2510
- > ASHRAE STD 15
- > ASHRAE STD 16
- > ASHRAE STD 23
- > ASHRAE STD 41.1
- > ASHRAE STD 93
- > ASHRAE STD 103
- > ASME A112.19.6
- > ASME B31.1
- > ASME B31.2
- > ASME B31.4
- > ASME B31.5
- > ASME B31.8
- > ASME B31.8S
- > ASME B31G
- > ASME OM
- > ASQ Q9001
- > ASQ Q9002
- > ASQ Q9003
- > ASQ Q9004-1
- > ASSE 1001
- > ASSE 1006
- > ASSE 1007
- > ASSE 1008
- > ASSE 1014
- > ASSE 1016
- > ASSE 1023
- > ASSE 1025
- > ASSE 1037
- > BS IEC 60092-101
- > CIE 13.3
- > CIE 15
- > CISPI HSN
- > CSA C390
- > IEC 60034-1
- > IEC 60034-12
- > IEC 60331
- > IEC 60705
- > IEC 60705
- > IEC 61097-1
- > IEC 61097-13
- > IEC 61162-1

- IP 501
- ISO 9141-2
- NEMA MG 1
-