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13R

Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies

2022

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Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies

2022 Edition

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NFPA® 13R

Standard for the

Installation of Sprinkler Systems in Low-Rise Residential Occupancies

2022 Edition

This edition of NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies*, was prepared by the Technical Committee on Residential Sprinkler Systems and released by the Correlating Committee on Automatic Sprinkler Systems. It was issued by the Standards Council on March 18, 2021, with an effective date of April 8, 2021, and supersedes all previous editions.

This edition of NFPA 13R was approved as an American National Standard on April 8, 2021.

Origin and Development of NFPA 13R

The first edition of NFPA 13R, published in 1989, represented a milestone in the development of sprinkler installation design standards. The first edition resulted in a standard for the protection of low-rise residential facilities.

This standard is intended to provide a high degree of life safety and property protection to the inhabitants of low-rise multifamily dwellings. Promulgated as a document that provides for increased levels of protection to building occupants, the document also considers the economic aspects of a sprinklered facility as compared to an unsprinklered facility.

As the number of states and cities that implements sprinkler ordinances continues to grow, and as the threshold levels for sprinkler requirements in residential occupancies in the building codes extend to certain low-rise structures, it is believed that systems for certain residential occupancies can be installed efficiently and effectively in accordance with this standard.

The 1994 edition provided expanded information on nonmetallic pipe materials, made minor changes to clarify the established design criteria, and added a new recommendation on underground pipe materials.

The 1996 edition included several changes that paralleled amendments in the 1996 edition of NFPA 13, *Standard for the Installation of Sprinkler Systems*. Other changes included a number of clarifications concerning the selection of sprinklers as well as the proper use of sprinklers.

The 1999 edition clarified criteria for nonmetallic pipe and fittings and established a minimum operating pressure for sprinklers. Guidance on providing freeze protection using insulation in attics and antifreeze systems was provided, as was information on the application of solvent cement for nonmetallic piping. Exceptions were added for omitting sprinkler coverage in closets, on balconies, and underneath garage doors.

The 2002 edition incorporated revisions to update the standard to comply with the 2000 edition of the *Manual of Style for NFPA Technical Committee Documents*. These revisions included rewording exceptions as requirements. The 2002 edition also included changes that further clarified the scope of the standard, established a minimum design discharge density, and added protection requirements specifically for garages. The section addressing spaces where sprinklers are permitted to be omitted was changed so that the area of full-height tub/shower enclosures would be included in the area determination for bathrooms, sprinklers would be provided in concealed spaces with fuel-fired equipment, and the omission of sprinklers in elevator machine rooms would not be dependent on the room's location.

The 2007 edition included spacing and obstruction rules addressing sloped ceilings, ceiling pockets, ceiling fans, and kitchen cabinets. Also, the requirements for using quick-response sprinklers within NFPA 13R regulations were clarified, and new requirements addressing architectural features in dwelling units were added. Additionally, the requirements covering closets, including obstructions within closets and protection of mechanical closets, were clarified. Finally,

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new NFPA 13 requirements were added that apply to NFPA 13R to ensure proper administration of those requirements where relevant.

The 2010 edition was reorganized, dividing material on installation, discharge, plans and calculation, water supplies, acceptance testing, and care and maintenance into separate chapters. Clarification was provided in the Annex A material of Chapter 1 for assistance in determining when NFPA 13R applies and establishing that the building code defines the structure. NFPA 13R is used after such determination has been made. Further clarification was added stating that sprinklers are not required on balconies or balcony closets.

The 2013 edition revised the title to address low-rise residential occupancies instead of addressing the number of stories outlined in the document scope. Several sections were added to address the concept of shadow areas in different configurations within NFPA 13R protected structures. The requirements for locations of sprinklers were updated to provide specific direction on protection of porte cocheres, closets, and areas outside the dwelling unit. New language addressing the number of heads to be calculated for certain sloped and beamed ceiling configurations was added based on a Fire Protection Research Foundation report.

Several significant revisions were made during the development of the 2016 edition. The definition of sprinkler system was revised to correlate with NFPA 13 and NFPA 25. The Annex A text for the scope statement of the document was significantly revised to address mixed-use buildings and the applicability of NFPA 13R systems. Clarification was added that once a sprinkler is removed from a fitting or welded outlet it should not be reinstalled if torque was applied to the sprinkler itself. Nonmetallic piping compatibility language was updated for consistency with NFPA 13. The section addressing sprinkler protection outside dwelling units was reorganized and restructured to make it easier for the user to follow. Language was added to address sprinkler protection where the device is intended to protect a glazing assembly. One of the largest changes to the 2016 edition of NFPA 13R was the review of all metric conversions. Historically the document had used an “exact” conversion process, but in the 2016 edition an approximate conversion process was used. The intent of this change was to make the document more usable outside the United States.

The 2019 edition added a new definition for carport, as well as several new requirements that address where pipe and tube, listed for light hazard, can be used in an ordinary hazard application; beam rules for sprinklers installed under and adjacent to beams (along with new figures); waste and linen systems; installation of fuel-fired equipment; and obstructions in hallways.

Chapter 9, Water Supplies, was reorganized, and the domestic demand tables were moved from the annex to the body of the standard, and values were updated. In addition, new images clarifying sprinkler location and clearances needed around fireplaces were added.

The 2022 edition includes a revised method for determining when system components are subject to freezing and needing protection, which will require the use of current temperature data. Criteria for the protection of pipes or tubes from mechanical damage has been added to Chapter 5. Ceiling pocket protection criteria for quick-response sprinklers has been added to Chapter 6, and the obstruction tables have been modified for ease of use. A new section on system operational tests and main drain valves has been added to Chapter 10 for system acceptance. The Contractor’s Material and Test Certificate for Aboveground Piping has been relocated to Annex A. In addition, the fire data tables of A.1.2 have been updated with the most current information.

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Correlating Committee on Automatic Sprinkler Systems

William E. Koffel, *Chair*
Koffel Associates, Inc, MD [SE]

Roland A. Asp, National Fire Sprinkler Association, Inc., MD [M]
Rep. National Fire Sprinkler Association

Jose R. Baz, JRB Associates Group Inc., FL [M]
Rep. NFPA Latin American Section

Kerry M. Bell, UL LLC, IL [RT]

Tracey D. Bellamy, Telgian Corporation, GA [U]
Rep. The Home Depot

Chase A. Browning, Medford Fire Department, OR [E]

Steven W. Dellasanta, Jensen Hughes Associates, Inc., RI [SE]

John August Denhardt, American Fire Sprinkler Association (AFSA), TX [IM]
Rep. American Fire Sprinkler Association

Michael J. Friedman, Friedman Consulting, Inc, MD [SE]

Alex Hoffman, Viking Fire Protection Inc., Canada [IM]
Rep. Canadian Automatic Sprinkler Association

Sultan M. Javeri, SC Engineering, France [IM]

Charles W. Ketner, National Automatic Sprinkler Fitters LU 669, MD [L]
Rep. United Assn. of Journeymen & Apprentices of the Plumbing & Pipe Fitting Industry

James D. Lake, Viking Corporation, MI [M]

John A. LeBlanc, FM Global, MA [I]

Kenneth W. Linder, Swiss Re, CT [I]

David O. Lowrey, City of Boulder Fire Rescue, CO [E]

Bryan Edwin Matthews, Liberty Mutual Group, NY [I]

Garner A. Palenske, Wiss Janney Elstner Associates, Inc., CA [SE]

Lawrence Richard Phillips, US Department of the Navy, VA [E]

Adam Seghi, Coda Risk Analysis, TX [I]

Joseph Su, National Research Council of Canada, Canada [RT]

J. Michael Thompson, GHD/The Protection Engineering Group, PC, VA [SE]

Alternates

Ralph E. Bless, Jr., Telgian Corporation, GA [U]
(Alt. to Tracey D. Bellamy)

Bruce H. Clarke, American International Group, Inc. (AIG), SC [I]
(Alt. to Adam Seghi)

Russell P. Fleming, Northeast Fire Suppression Associates, LLC, NH [SE]
(Alt. to Michael J. Friedman)

Scott T. Franson, The Viking Corporation, MI [M]
(Alt. to James D. Lake)

David B. Fuller, FM Approvals, RI [I]
(Alt. to John A. LeBlanc)

Jeffrey E. Harper, JENSEN HUGHES, IL [SE]
(Alt. to Steven W. Dellasanta)

Jeff Hebenstreit, UL LLC, IL [RT]
(Alt. to Kerry M. Bell)

Jeffrey M. Hugo, National Fire Sprinkler Association, Inc., MI [M]
(Alt. to Roland A. Asp)

Jack A. Medovich, Fire & Life Safety America, MD [IM]
(Alt. to John August Denhardt)

Donato A. Pirro, Electro Sistemas De Panama, S.A., Panama [M]
(Alt. to Jose R. Baz)

Jason W. Ryckman, Canadian Automatic Sprinkler Association, Canada [IM]
(Alt. to Alex Hoffman)

Douglas Paul Stultz, US Department of the Navy, VA [E]
(Alt. to Lawrence Richard Phillips)

Jeffrey J. Van Rhyn, Jr., Local 669 JATC, NV [L]
(Alt. to Charles W. Ketner)

Nonvoting

James B. Biggins, TUV SUD America Inc./Global Risk Consultants Corporation, IL [SE]
Rep. TC on Hanging & Bracing of Water-Based Systems

Christopher I. Deneff, FM Global, RI [I]
Rep. TC on Hanging & Bracing of Water-Based Systems

Raymond A. Grill, Arup, DC [SE]
Rep. TC on Sprinkler System Installation Criteria

Kenneth E. Isman, University of Maryland, MD [SE]
Rep. TC on Residential Sprinkler Systems

Russell B. Leavitt, Telgian Corporation, AZ [U]
Rep. TC on Sprinkler System Discharge Criteria

John J. Walsh, UA Joint Apprenticeship Committee Local 669, MD [SE]
Rep. United Assn. of Journeymen & Apprentices of the Plumbing & Pipe Fitting Industry
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Kenneth E. Isman, *Chair*
University of Maryland, MD [SE]

Roland A. Asp, National Fire Sprinkler Association, Inc., MD [M]

Kerry M. Bell, UL LLC, IL [RT]

Fred Benn, Advanced Automatic Sprinkler, Inc., CA [IM]

Jonathan C. Bittenbender, REHAU Incorporated, VA [M]

Chase A. Browning, Medford Fire Department, OR [E]

Bradford T. Cronin, Newport Fire Department, RI [E]

John August Denhardt, American Fire Sprinkler Association (AFSA), TX [IM]
Rep. American Fire Sprinkler Association

Jeffrey Feid, State Farm Insurance Company, IL [I]

Cesar Lujan, National Association of Home Builders (NAHB), DC [U]
Rep. National Association of Home Builders

Michael O'Brian, Brighton Area Fire Authority, MI [E]
Rep. International Association of Fire Chiefs

Wade Palazini, JENSEN HUGHES, RI [SE]

Darren Palmieri, The Viking Corporation, MI [M]

Maurice M. Pilette, Mechanical Designs Ltd., MA [SE]

Milosh T. Puchovsky, Worcester Polytechnic Institute, MA [SE]

Jason W. Ryckman, Canadian Automatic Sprinkler Association, Canada [IM]
Rep. Canadian Automatic Sprinkler Association

Peter T. Schwab, Wayne Automatic Fire Sprinklers, Inc., FL [IM]

Eric J. Skare, Uponor, Inc., MN [M]

George W. Stanley, Wiginton Fire Protection Engineering, Inc., FL [IM]

Donald R. Townley, Lubrizol, OH [M]

Martin C. W. Trim, Barrett Engineered Pumps, CA [SE]
Rep. American Society of Plumbing Engineers

Jeffrey J. Van Rhyn, Jr., Local 669 JATC, NV [L]
Rep. United Assn. of Journeymen & Apprentices of the Plumbing & Pipe Fitting Industry

Ed Van Walraven, Basalt And Rural Fire Protection District, CO [E]

Terry L. Victor, Johnson Controls, MD [M]

John F. Viola, JFV Engineering, LLC, MA [IM]
Rep. American Fire Sprinkler Association

Ronald N. Webb, S.A. Comunale Company, Inc., OH [IM]
Rep. National Fire Sprinkler Association

Steven D. Wolin, Reliable Automatic Sprinkler Company, Inc., SC [M]
Rep. National Fire Sprinkler Association

Hong-Zeng Yu, FM Global, MA [I]

Alternates

Jon R. Ackley, Dalmatian Fire, IN [IM]
(Alt. to Ronald N. Webb)

Robert S. Blach, Menlo Park Fire Protection District, CA [E]
(Alt. to Michael O'Brian)

Katherine M. Clay, Jackson Hole Fire/EMS, WY [E]
(Alt. to Ed Van Walraven)

Samuel S. Dannaway, Coffman Engineers, HI [SE]
(Alt. to Martin C. W. Trim)

John Desrosier, Globe Fire Sprinkler Corporation, MI [M]
(Alt. to Steven D. Wolin)

Robert L. Dufault, Newport Fire Department, RI [E]
(Alt. to Bradford T. Cronin)

Gary Ehrlich, National Association of Home Builders (NAHB), DC [U]
(Alt. to Cesar Lujan)

Mark E. Fessenden, Johnson Controls, WI [M]
(Alt. to Terry L. Victor)

Yogish Gopala, FM Global, MA [I]
(Alt. to Hong-Zeng Yu)

Forest Hampton, Lubrizol Advanced Materials, Inc., OH [M]
(Alt. to Donald R. Townley)

Jeff Hebenstreit, UL LLC, IL [RT]
(Alt. to Kerry M. Bell)

Brent Kotula, Uponor, MN [M]
(Alt. to Eric J. Skare)

David O. Lowrey, City of Boulder Fire Rescue, CO [E]
(Alt. to Chase A. Browning)

James R. Lugar, JENSEN HUGHES, MD [SE]
(Alt. to Wade Palazini)

Daniel J. Mathias, Absolute Fire Protection, Inc., MD [IM]
(Alt. to John August Denhardt)

Dan Mendoza, Advanced Automatic Sprinkler, CA [IM]
(Alt. to Fred Benn)

Matthew Osburn, Canadian Automatic Sprinkler Association, Canada [IM]
(Alt. to Jason W. Ryckman)

Ryan Lee Peterson, Wayne Auto Fire Sprinklers, FL [IM]
(Alt. to Peter T. Schwab)

William Scott Roberts, Quick Response Fire Protection, NJ [M]
(Alt. to Roland A. Asp)

Ernesto Rodriguez, Jr., Wiginton Fire Protection Engineering, Inc., FL [IM]
(Alt. to George W. Stanley)

Ralph D Young, Sprinkler Fitters Local 669, NY [L]
(Alt. to Jeffrey J. Van Rhyn, Jr.)

Brent Zimiga, Rapid Fire Protection Inc., SD [IM]
(Alt. to John Viola)

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Rohit "Rik" Khanna, US Consumer Product Safety Commission (CPSC), MD [C]
Rep. US Consumer Product Safety Commission (CPSC)

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex B.

Chapter 1 Administration

1.1* Scope. This standard shall cover the design and installation of automatic sprinkler systems for protection against fire hazards in residential occupancies up to and including four stories in height that are located in buildings not exceeding 60 ft (18 m) in height above grade plane.

1.1.1 This standard shall be based on the concept that the sprinkler system is designed to protect against a fire originating from a single ignition location.

1.1.2 This standard shall not provide requirements for the design or installation of water mist fire protection systems, which are not considered fire sprinkler systems and are addressed by NFPA 750.

1.2* Purpose.

1.2.1 The purpose of this standard shall be to provide a sprinkler system that aids in the detection and control of residential fires and thus provides improved protection against injury, life loss, and property damage.

1.2.2 A sprinkler system shall be designed and installed in accordance with this standard to prevent flashover (total involvement) in the room of fire origin, where sprinklered, and to improve the chance for occupants to escape or be evacuated.

1.2.3 The layout, calculation, and installation of sprinkler systems installed in accordance with this standard shall only be performed by people knowledgeable and trained in such systems.

1.3 Retroactivity. The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

1.3.1 Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

1.3.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.3.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

1.4 Equivalency. Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.4.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

1.4.2 The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

1.5 Units.

1.5.1* Metric units of measurement in this standard shall be in accordance with the modernized metric system known as the International System of Units (SI).

1.5.2 The liter and bar units shall be permitted to be used in this standard.

1.5.3 The conversion factors for liter, pascal, and bar shall be in accordance with Table 1.5.3.

Table 1.5.3 Metric Conversions

Name of Unit	Unit Symbol	Conversion Factor
liter	L	1 gal = 3.785 L
pascal	Pa	1 psi = 6894.757 Pa
bar	bar	1 psi = 0.0689 bar
bar	bar	1 bar = 10^5 Pa

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1.5.4* Where a value for measurement as specified in this standard is followed by an equivalent value in other units, the first stated value shall be regarded as the requirement.

1.5.5 The equivalent value for a measurement in SI shall be converted by multiplying the value by the conversion factor and then rounding the result to the appropriate number of significant digits.

1.6 New Technology.

1.6.1 Nothing in this standard shall be intended to restrict new technologies or alternate arrangements, provided the level of safety prescribed by this standard is not lowered.

1.6.2 Materials or devices not specifically designated by this standard shall be utilized in complete accord with all conditions, requirements, and limitations of their listings.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2022 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection,* 2022 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection,* 2018 edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances,* 2022 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 2020 edition.

NFPA 82, *Standard on Incinerators and Waste and Linen Handling Systems and Equipment,* 2019 edition.

NFPA *101®, Life Safety Code®,* 2021 edition.

NFPA 220, *Standard on Types of Building Construction,* 2021 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems,* 2019 edition.

NFPA 5000®, Building Construction and Safety Code®, 2021 edition.

2.3 Other Publications.

Δ **2.3.1 ASME Publications.** American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME A17.1/CSA B44, *Safety Code for Elevators and Escalators,* 2019.

ASME B16.1, *Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250,* 2015.

ASME B16.3, *Malleable Iron Threaded Fittings: Classes 150 and 300,* 2016.

ASME B16.4, *Gray Iron Threaded Fittings: Classes 125 and 250,* 2016.

ASME B16.5, *Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard,* 2017.

ASME B16.9, *Factory-Made Wrought Buttwelding Fittings,* 2018.

ASME B16.11, *Forged Fittings, Socket-Welding and Threaded,* 2016.

ASME B16.15, *Cast Copper Alloy Threaded Fittings: Classes 125 and 250,* 2018.

ASME B16.18, *Cast Copper Alloy Solder Joint Pressure Fittings,* 2018.

ASME B16.22, *Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings,* 2018.

ASME B16.25, *Buttwelding Ends,* 2017.

ASME B36.10M, *Welded and Seamless Wrought Steel Pipe,* 2018.

Δ **2.3.2 ASTM Publications.** ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM A53/A53M, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless,* 2018.

ASTM A135/A135M, *Standard Specification for Electric-Resistance-Welded Steel Pipe,* 2019.

ASTM A234/A234M, *Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperatures,* 2019.

ASTM A795/A795M, *Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use,* 2013 (2020).

ASTM B32, *Standard Specification for Solder Metal,* 2008, reapproved 2014.

ASTM B43, *Standard Specification for Seamless Red Brass Pipe, Standard Sizes,* 2020.

ASTM B88, *Standard Specification for Seamless Copper Water Tube,* 2020.

ASTM B251/B251M, *Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube,* 2017.

ASTM B813, *Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper-Alloy Tube,* 2016.

ASTM F437, *Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80,* 2015.

ASTM F438, *Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40,* 2017.

ASTM F439, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80,* 2019.

ASTM F442/F442M, *Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR–PR),* 2019.

Δ **2.3.3 AWS Publications.** American Welding Society, 8669 NW 36 Street, #130, Miami, FL 33166-6672.

AWS A5.8/A5.8M, *Specification for Filler Metals for Brazing and Braze Welding,* 2011, Amendment 1, 2012.

2.3.4 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

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2.4 References for Extracts in Mandatory Sections.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2022 edition.

NFPA 5000®, Building Construction and Safety Code®, 2021 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

3.3.1* Bathroom. Within a dwelling unit, any room or compartment containing a lavatory dedicated to personal hygiene, or a water closet, or bathing capability such as a shower or tub, or any combination of facilities thereof.

3.3.2 Carport. A freestanding or attached covered structure open on at least two sides that provides shelter for motor vehicles.

3.3.3 Compartment. A space completely enclosed by walls and a ceiling. Each wall in the compartment is permitted to have openings to an adjoining space if the openings have a minimum lintel depth of 8 in. (200 mm) from the ceiling and the total width of the openings in a single wall does not exceed 8 ft (2.4 m) in width. A single opening of 36 in. (900 mm) or less in width without a lintel is permitted when there are no other openings to adjoining spaces.

3.3.4 Design Discharge. The rate of water discharged by an automatic sprinkler, expressed in gpm (mm/min).

3.3.5 Dwelling Unit. One or more rooms, arranged for the use of one or more individuals living together, as in a single housekeeping unit, that normally have cooking, living, sanitary, and sleeping facilities.

3.3.6 Fuel-Fired Heating Unit. An appliance that produces heat by burning fuel.

3.3.7 Grade Plane. A reference plane upon which vertical measurements of a building are based representing the average of the finished ground level adjoining the building at all exterior walls. *[See also 3.3.222, Finished Ground Level (Grade), of NFPA 5000.]* [**5000,** 2021]

3.3.8 Hazard Classifications.

3.3.8.1* ***Light-Hazard Occupancy.*** Occupancies or portions of other occupancies where the quantity and/or combustibility of contents is low and fires with relatively low rates of heat release are expected.

3.3.8.2* ***Ordinary Hazard (Group 1).*** Occupancies or portions of other occupancies where combustibility is low, quantity of combustibles is moderate, stockpiles of combustibles do not exceed 8 ft (2.4 m), and fires with moderate rates of heat release are expected.

3.3.8.3* ***Ordinary Hazard (Group 2).*** Occupancies or portions of other occupancies where the quantity and combustibility of contents are moderate to high, stockpiles of contents with moderate rates of heat release do not exceed 12 ft (3.7 m), and stockpiles of contents with high rates of heat release do not exceed 8 ft (2.4 m).

3.3.9* Raw Water Source. A water supply taken from the environment that has not been treated and could contain foreign material that could accumulate freely and enter the sprinkler system.

3.3.10* Residential Occupancies. Occupancies that include the following, as defined in NFPA *101*: (1) apartment buildings, (2) lodging and rooming houses, (3) board and care facilities, and (4) hotels, motels, and dormitories.

3.3.11* Shadow Area. The dry floor area within the protection area of a sprinkler created by the portion of sprinkler discharge that is blocked by a wall or partition.

3.3.12 Sprinkler.

3.3.12.1 ***Automatic Sprinkler.*** A fire suppression or control device that operates automatically when its heat-actuated element is heated to its thermal rating or above, allowing water to discharge over a specific area.

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3.3.12.2 ***Quick-Response (QR) Sprinkler.*** A type of spray sprinkler having a thermal element with an RTI of 50 (meters-second)$^{1/2}$ or less and is listed as a quick-response sprinkler for its intended use.

3.3.12.3 ***Residential Sprinkler.*** A type of fast-response sprinkler having a thermal element with an RTI of 50 (meters-second)$^{1/2}$ or less, that has been specifically investigated for its ability to enhance survivability in the room of fire origin, and that is listed for use in the protection of dwelling units.

Δ **3.3.13 Sprinkler System.** A system, commonly activated by heat from a fire and discharges water over the fire area, that consists of an integrated network of piping designed in accordance with fire protection engineering standards that includes a water supply source, a water control valve, a waterflow alarm, and a drain. The portion of the sprinkler system above ground is a network of specifically sized or hydraulically designed piping installed in a building, structure, or area, generally overhead, and to which sprinklers are attached in a systematic pattern. [**13,** 2022]

3.3.13.1 ***Dry Pipe Sprinkler System.*** A sprinkler system employing automatic sprinklers that are attached to a piping system that contains air or nitrogen under pressure, the release of which (as from the opening of a sprinkler) permits the water pressure to open a valve known as a dry pipe valve, and the water then flows into the piping system and out the opened sprinkler.

3.3.13.2 ***Preaction Sprinkler System.*** A sprinkler system employing automatic sprinklers that are attached to a piping system containing air that might or might not be under pressure, with a supplemental detection system installed in the same areas as the sprinklers.

3.3.13.3 ***Wet Pipe Sprinkler System.*** A sprinkler system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by heat from a fire.

3.3.14 System Working Pressure. The maximum anticipated static (i.e., nonflowing) or residual flowing pressure applied to sprinkler system components exclusive of surge pressures and of pressure from the fire department connection.

3.3.15 Valve.

3.3.15.1 ***Check Valve.*** A valve that allows flow in one direction only.

3.3.15.2 ***Control Valve.*** An indicating valve employed to control (shut) a supply of water to a sprinkler system.

3.3.16 Waterflow Alarm Device. An attachment to the sprinkler system that detects a predetermined water flow and is connected to a fire alarm system to initiate an alarm condition or is used to mechanically or electrically initiate a fire pump or local audible or visual alarm. [**13,** 2022]

3.3.17 Waterflow Detector. An electric signaling indicator or alarm check valve actuated by water flow in one direction only.

Chapter 4 General Requirements

4.1 Sprinklered Throughout. A building provided with a fire sprinkler system designed and installed in accordance with the requirements of this standard, including its allowable omissions, shall be considered fully sprinklered throughout.

4.2 Basic Requirements. The requirements for spacing, location, and position of sprinklers shall be based on the following principles:

(1) Sprinklers shall be installed throughout the premises.
(2) Sprinklers shall be located so as not to exceed maximum protection area per sprinkler.
(3) Sprinklers shall be positioned and located so as to provide satisfactory performance with respect to activation time and distribution.
(4) Sprinklers shall be permitted to be omitted from areas specifically allowed by this standard *(see Section 6.6)*.
(5) When sprinklers are specifically tested and test results demonstrate that deviations from clearance requirements to structural members do not impair the ability of the sprinkler to control or suppress a fire, their positioning and locating in accordance with the test results shall be permitted.
(6) Clearance between sprinklers and ceilings exceeding the maximums specified in this standard shall be permitted, provided that tests or calculations demonstrate comparable sensitivity and performance of the sprinklers to those installed in conformance with these sections.

4.3 Tube. Wherever the word *pipe* is used in this standard, it shall also mean *tube*.

4.4 Listed or Labeled. Listed or labeled devices and materials shall be installed and used in accordance with the listing limitations and the manufacturers' instructions unless permitted by other sections of this document.

4.5 System Arrangement. In townhouse-style buildings protected in accordance with this standard, each dwelling unit shall have its own dedicated sprinkler system or the control valve for the sprinkler system in the building shall be located outside the dwelling units or in a common area.

Chapter 5 System Components

5.1 General.

5.1.1 Sprinklers.

5.1.1.1* Sprinkler Removal. Only new listed sprinklers shall be installed in sprinkler systems.

5.1.1.1.1* Where a sprinkler is removed from a fitting or welded outlet, it shall not be reinstalled except as permitted by 5.1.1.1.1.1.

5.1.1.1.1.1 Dry sprinklers shall be permitted to be reinstalled when removed in accordance with the manufacturer's installation and maintenance instructions.

5.1.1.2* Sprinkler Replacement. Where replacing residential sprinklers manufactured prior to 2003 and that are no longer available from the manufacturer and are installed using a design density less than 0.05 gpm/ft^2 (2.04 mm/min), a residential sprinkler with an equivalent K-factor (± 5%) shall be permitted to be used provided the currently listed coverage area for the replacement sprinkler is not exceeded.

5.1.1.3* Sprinkler Identification. All sprinklers shall be permanently marked with a one- or two-character manufacturer symbol, followed by three or four numbers, so as to iden-

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tify a unique sprinkler identification for every change in orifice size or shape, deflector characteristic, pressure rating, and thermal sensitivity.

5.1.1.4 Sprinkler Discharge Characteristics.

5.1.1.4.1 General. Unless the requirements of 5.1.1.4.2 or 5.1.1.4.3 are met, the K-factor, relative discharge, and marking identification for sprinklers having different orifice sizes shall be in accordance with Table 5.1.1.4.1.

5.1.1.4.2 Pipe Threads. Listed sprinklers having pipe threads different from those shown in Table 5.1.1.4.1 shall be permitted.

5.1.1.4.3 Residential Sprinklers. Residential sprinklers with K-factors other than those specified in Table 5.1.1.4.1 shall be permitted.

5.1.1.5 Occupancy Limitations. Unless the requirements of 5.1.1.5.1 or 5.1.1.5.2 are met, sprinklers shall not be listed for protection of a portion of an occupancy classification.

5.1.1.5.1 Residential Sprinklers. Residential sprinklers shall be permitted to be listed for portions of residential occupancies.

5.1.1.5.2 Special Sprinklers. Special sprinklers shall be permitted to be listed for protection of a specific construction feature in a portion of an occupancy classification where such sprinklers meet 5.1.1.5.3 and have been evaluated and listed for performance under the following conditions:

(1) Fire tests related to the intended hazard
(2) Distribution of the spray pattern with respect to wetting of floors and walls
(3) Distribution of the spray pattern with respect to obstructions
(4) Evaluation of the thermal sensitivity of the sprinkler
(5) Performance under horizontal or sloped ceilings
(6) Area of design

5.1.1.5.3 Special sprinklers shall maintain the following characteristics:

(1) Orifice size shall be in accordance with 5.1.1.4.
(2) Temperature ratings shall be in accordance with Table 5.1.1.6.1.
(3) The protection area of coverage shall not exceed 400 ft^2 (37 m^2) for light-hazard and ordinary-hazard occupancies.

5.1.1.6* Temperature Characteristics.

5.1.1.6.1 Automatic sprinklers shall have their frame arms, deflector, coating material, or liquid bulb colored in accordance with the requirements of Table 5.1.1.6.1 or the requirements of 5.1.1.6.2, 5.1.1.6.3, 5.1.1.6.4, or 5.1.1.6.5.

5.1.1.6.2 A dot on the top of the deflector, the color of the coating material, or colored frame arms shall be permitted for color identification of corrosion-resistant sprinklers.

5.1.1.6.3 Color identification shall not be required for ornamental sprinklers such as factory-plated or factory-painted sprinklers or for recessed, flush, or concealed sprinklers.

5.1.1.6.4 The frame arms of bulb-type sprinklers shall not be required to be color coded.

5.1.1.6.5 The liquid in bulb-type sprinklers shall be color coded in accordance with Table 5.1.1.6.1.

5.1.1.7 Escutcheons and Cover Plates.

5.1.1.7.1 Nonmetallic escutcheons shall be listed.

5.1.1.7.2* Escutcheons used with recessed, flush-type, or concealed sprinklers shall be part of a listed sprinkler assembly.

5.1.1.7.3 Cover plates used with concealed sprinklers shall be part of the listed sprinkler assembly.

5.1.1.8 Painting and Finish. Sprinkler painting and finish material shall only be permitted in accordance with NFPA 13.

5.1.1.9 Protective Caps and Straps.

5.1.1.9.1* Protective caps and straps shall be removed using means that are in accordance with the manufacturer's instructions.

5.1.1.9.2* Protective caps and straps shall be removed from all sprinklers prior to the time when the sprinkler system is placed in service.

Δ Table 5.1.1.4.1 Sprinkler Discharge Characteristics Identification

Nominal K-factor [gpm/(psi)$^{1/2}$]	K-factor Range [gpm/(psi)$^{1/2}$]	K-factor Range [dm^3/min/(kPa)$^{1/2}$]	Percent of Nominal K-5.6 Discharge	Thread Type (in. NPT)
1.4	1.3–1.5	1.9–2.2	25	½
1.9	1.8–2.0	2.6–2.9	33.3	½
2.8	2.6–2.9	3.8–4.2	50	½
4.2	4.0–4.4	5.9–6.4	75	½
5.6	5.3–5.8	7.6–8.4	100	½
8.0	7.4–8.2	10.7–11.8	140	¾ or ½
11.2	11.0–11.5	15.9–16.6	200	½ or ¾
14.0	13.5–14.5	19.5–20.9	250	¾
16.8	16.0–17.6	23.1–25.4	300	¾
19.6	18.6–20.6	27.2–30.1	350	1
22.4	21.3–23.5	31.1–34.3	400	1
25.2	23.9–26.5	34.9–38.7	450	1
28.0	26.6–29.4	38.9–43.0	500	1

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Table 5.1.1.6.1 Sprinkler Temperature Ratings, Classifications, and Color Codings

Maximum Ceiling Temperature		Temperature Rating		Temperature Classification	Color Code	Glass Bulb Colors
°F	°C	°F	°C			
100	38	135–170	57–77	Ordinary	Uncolored or black	Orange or red
150	66	175–225	79–107	Intermediate	White	Yellow or green
225	107	250–300	121–149	High	Blue	Blue
300	149	325–375	163–191	Extra high	Red	Purple
375	191	400–475	204–246	Very extra high	Green	Black
475	246	500–575	260–302	Ultra high	Orange	Black
625	329	650	343	Ultra high	Orange	Black

5.1.1.9.3 Protective caps and straps on all upright sprinklers or on any sprinklers installed more than 10 ft (3 m) above the floor shall be permitted to be removed from sprinklers immediately following their installation.

5.1.2 Listing. Only listed or approved devices and materials as specified in this standard shall be used in sprinkler systems.

5.1.2.1 Water meters and pressure-reducing valves that are installed in a combined domestic water and fire protection supply to the building shall not be required to be listed for fire protection.

5.1.2.2 Materials and components shall be installed in accordance with material compatibility information that is available as a part of a listing or manufacturer's published information.

5.1.3 Rated Pressure. System components shall be rated for the maximum system working pressure to which they are exposed but shall not be rated at less than 175 psi (12.1 bar) for components installed above ground and 150 psi (10 bar) for components installed underground between the water supply and the system riser.

5.1.4 Reconditioned Equipment.

5.1.4.1 The use of reconditioned valves and devices as replacement equipment in existing systems shall be permitted.

5.1.4.2 Reconditioned sprinklers shall not be permitted to be utilized on any new or existing system.

5.2 Aboveground Piping and Equipment.

5.2.1 Pipe or tube used in sprinkler systems shall be of the materials specified in Table 5.2.1 or in accordance with 5.2.2.

5.2.1.1 The chemical properties, physical properties, and dimensions of pipe materials shall be at least equivalent to the standards cited in Table 5.2.1.

5.2.1.2 Pipe shall be designed to withstand a working pressure of not less than 175 psi (12 bar).

5.2.1.3 When nonmetallic pipe is used, the pipe shall be designed to withstand a working pressure of not less than 175 psi (12.1 bar) at 120°F (49°C).

5.2.1.4 Nonmetallic pipe and fittings included in Table 5.2.1 and Table 5.2.9 shall be listed.

Δ **Table 5.2.1 Pipe or Tube Materials and Dimensions**

Materials and Dimensions	Standard
Black and hot-dipped zinc-coated (galvanized) welded and seamless steel pipe for fire protection use	ASTM A795/A795M
Pipe, steel, black and hot-dipped, zinc-coated, welded and seamless	ASTM A53/A53M
Welded and seamless wrought steel pipe	ASME B36.10M
Electric-resistance-welded steel pipe	ASTM A135/A135M
Seamless copper water tube [copper tube (drawn, seamless)]	ASTM B88
Wrought seamless copper and copper-alloy tube	ASTM B251/B251M
Liquid and paste fluxes for soldering applications of copper and copper-alloy tube	ASTM B813
Filler metals for brazing and braze welding (Classification BCuP-3 or BCuP-4)	AWS A5.8/A5.8M
Solder alloys containing less than 0.2 percent lead (Pb) as identified in Table 5 of Section 1 ASTM B32 and having a solidus temperature that exceeds 400°F (204°C)	ASTM B32
Cast copper alloy threaded fittings, Classes 125 and 250	ASME B16.15
Seamless red brass pipe, standard sizes	ASTM B43
Chlorinated poly(vinyl chloride) (CPVC) plastic pipe (SDR–PR)	ASTM F442/F442M

5.2.2 Types of pipe other than those specified in Table 5.2.1 shall be permitted to be used where listed for sprinkler system use.

5.2.2.1 Pipe differing from those specified in Table 5.2.1 shall be installed in accordance with their listings and the manufacturer's installation instructions.

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Δ **5.2.2.2** Pipe or tube listed for light-hazard occupancies shall be permitted to be installed in ordinary-hazard rooms of otherwise light-hazard occupancies under the following conditions:

(1) In rooms 800 ft^2 (74 m^2) or less, piping shall be permitted to be installed either exposed in accordance with its listing or concealed behind a minimum of one layer of ⅜ in. (10 mm) thick gypsum wallboard or ½ in. (13 mm) thick plywood.

(2) In rooms over 800 ft^2 (74 m^2), piping shall be permitted to be installed concealed behind a minimum of one layer

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of ⅜ in. (10 mm) thick gypsum wallboard or ½ in. (13 mm) thick plywood.

5.2.2.2.1 Pipe or tube installed in accordance with 5.2.2.2 shall be permitted to be installed exposed, in accordance with their listing.

5.2.3* Chlorinated polyvinyl chloride (CPVC) pipe shall comply with the portions of the American Society for Testing and Materials (ASTM) standards specified in Table 5.2.1 that apply to fire protection service.

5.2.3.1 Nonmetallic pipe in accordance with Table 5.2.1 shall be investigated for suitability in automatic sprinkler installations and listed for this service.

5.2.3.1.1 Listed nonmetallic pipe shall be installed in accordance with its listing limitations, including installation instructions.

5.2.3.1.2 Manufacturer's installation instructions shall include its listing limitations.

5.2.3.2 When nonmetallic pipe is used in systems utilizing steel pipe internally coated with corrosion inhibitors, the steel pipe coating shall be listed for compatibility with the nonmetallic pipe materials.

5.2.3.3 When nonmetallic pipe is used in systems utilizing steel pipe that is not internally coated with corrosion inhibitors, no additional evaluations shall be required.

5.2.3.4* When nonmetallic pipe is used in systems utilizing steel pipe, cutting oils and lubricants used for fabrication of the steel piping shall be compatible with the nonmetallic pipe materials in accordance with 5.1.2.2.

5.2.3.5 Fire-stopping materials intended for use on nonmetallic piping penetrations shall be compatible with the nonmetallic pipe materials in accordance with 5.1.2.2.

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5.2.3.6 Nonmetallic pipe shall not be listed for portions of an occupancy classification.

N **5.2.3.7** Where pipe other than steel is run horizontally or vertically through wood or metal studs, the following provisions shall apply:

(1) Steel shield plates shall be provided where the face of the piping is less than 1.25 in. (32 mm) from the nearest edge of the member.
(2) Steel shield plates shall have a minimum thickness of 0.0575 in. (1.463 mm) (No. 16 gauge).
(3) Steel shield plates shall cover the area of the pipe where the member is notched or bored.

5.2.4 Brass pipe specified in Table 5.2.1 shall be permitted in the standard weight in sizes up to 6 in. (150 mm) for pressures up to 175 psi 12 bar) and in the extra strong weight in sizes up to 8 in (200 mm) for pressures up to 300 psi (21 bar).

5.2.5 Pipe with a wall thickness less than that of Schedule 30 pipe shall not be joined by fittings utilizing cut grooves where the pipe is 8 in. (200 mm) nominal or larger in size.

5.2.6 Pipe having a wall thickness less than that of Schedule 40 pipe shall not be joined by fittings utilizing cut grooves where the pipe is less than 8 in. (200 mm) nominal in size.

5.2.7 Pipe joined with mechanical fittings using cut or rolled grooves shall be joined by a listed combination of fittings, gaskets, and grooves.

5.2.8 Grooves cut or rolled on pipe shall be dimensionally compatible with the fittings.

5.2.9 Fittings used in sprinkler systems shall meet or exceed the standards in Table 5.2.9 or be in accordance with 5.2.12.

5.2.9.1 The chemical properties, physical properties, and dimensions of fitting materials shall be at least equivalent to the standards cited in Table 5.2.9.

5.2.9.2 Fittings used in sprinkler systems shall be designed to withstand a working pressure of not less than 175 psi (12 bar).

5.2.9.3 When nonmetallic fittings are used, the fittings shall be designed to withstand a working pressure of not less than 175 psi (12 bar) at 120°F (49°C).

5.2.10 Joints for the connection of copper pipe shall be brazed on dry pipe and preaction systems.

5.2.11 Joints for the connection of copper pipe for wet systems shall be solder joints or be brazed.

5.2.12 Types of fittings other than those specified in Table 5.2.9 shall be permitted to be used where listed for sprinkler system use.

5.2.12.1 Fittings differing from those specified in Table 5.2.9 shall be installed in accordance with their listings and the manufacturer's installation instructions.

5.2.12.2* Nonmetallic fittings shall comply with the portions of the ASTM standards specified in Table 5.2.9 that apply to fire protection service.

Δ **Table 5.2.9 Fittings Materials and Dimensions**

Materials and Dimensions	Standard
Cast Iron:	
Gray iron threaded fittings, Classes 125 and 250	ASME B16.4
Gray iron pipe flanges and flanged fittings, Classes 25, 125, and 250	ASME B16.1
Malleable Iron:	
Malleable iron threaded fittings, Classes 150 and 300	ASME B16.3
Steel:	
Factory-made wrought buttwelding fittings	ASME B16.9
Buttwelding ends	ASME B16.25
Piping fittings of wrought carbon steel and alloy steel for moderate and high temperatures	ASTM A234/A234M
Pipe flanges and flanged fittings, NPS 1/2 through NPS 24 metric/inch standard	ASME B16.5
Forged fittings, socket-welding and threaded	ASME B16.11
Copper:	
Wrought copper and copper alloy solder joint pressure fittings	ASME B16.22
Cast copper alloy solder joint pressure fittings	ASME B16.18
CPVC:	
Threaded chlorinated poly(vinyl chloride) (CPVC) plastic pipe fittings, Schedule 80	ASTM F437
Socket-type chlorinated poly(vinyl chloride) (CPVC) plastic pipe fittings, Schedule 40	ASTM F438
Socket-type chlorinated poly(vinyl chloride) (CPVC) plastic pipe fittings, Schedule 80	ASTM F439

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