NFPA 13R

Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height

2002 Edition

NFPA, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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This edition of NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, was prepared by the Technical Committee on Residential Sprinkler Systems, released by the Technical Correlating Committee on Automatic Sprinkler Systems, and acted on by NFPA at its May Association Technical Meeting held May 19–23, 2002, in Minneapolis, MN. It was issued by the Standards Council on July 19, 2002, with an effective date of August 8, 2002, and supersedes all previous editions.

This edition of 13R was approved as an American National Standard on July 19, 2002.

Origin and Development of NFPA 13R

The first edition of 13R, which was 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 higher 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 implement 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 efficiently and effectively installed in accordance with this standard.

The 1994 edition provided expanded information on nonmetallic pipe materials, minor changes to clarify the established design criteria, and 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 for omitting sprinkler coverage in closets on balconies and underneath garage doors were added.

The 2002 edition incorporates revisions that update the standard to comply with the 2000 edition of the NFPA *Manual of Style*. These revisions include editorially rewording any exceptions as requirements. The 2002 edition also includes changes that further clarify the scope of the standard, establish a minimum design discharge density, and add 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 must be included in the area determination for bathrooms, sprinklers must be provided in concealed spaces with fuel-fired equipment, and the omission of sprinklers in elevator machine rooms is not dependent on the room's location.

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Committee Scope: This Committee shall have overall responsibility for documents that pertain to the criteria for the design and installation of automatic, open and foam-water sprinkler systems including the character and adequacy of water supplies, and the selection of sprinklers, piping, valves, and all materials and accessories. This Committee does not cover the installation of tanks and towers, nor the installation, maintenance, and use of central station, proprietary, auxiliary, and local signaling systems for watchmen, fire alarm, supervisory service, nor the design of fire department hose connections.

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Committee Scope: This Committee shall have primary responsibility for documents on the design and installation of automatic sprinkler systems in dwellings and residential occupancies up to and including four stories in height, including the character and adequacy of water supplies, and the selection of sprinklers, piping, valves, and all materials and accessories.

These lists represent the membership at the time the Committees were balloted on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

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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.

Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet between the paragraphs that remain.

Information on referenced 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.

1.2* Purpose. The purpose of this standard shall be to provide design and installation requirements for a sprinkler system to aid in the detection and control of fires in residential occupancies and thus provide improved protection against injury, life loss, and property damage. A sprinkler system designed and installed in accordance with this standard shall be expected 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.

1.3 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. 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. 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. 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 restrict new technologies or alternative arrangements, provided that the level of safety prescribed by the standard is not reduced.

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

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.

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, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2002 edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection,* 1999 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection,* 1998 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems,* 1998 edition.

NFPA *101®, Life Safety Code®,* 2000 edition.

NFPA 220, *Standard on Types of Building Construction,* 1999 edition.

NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials,* 1999 edition.

2.3 Other Publications.

2.3.1 ANSI Publication. American National Standards Institute, Inc., 11 West 42nd Street, 13th floor, New York, NY 10036.

ANSI B36.10M, *Welded and Seamless Wrought Steel Pipe*, 1996.

2.3.2 ASME Publications. American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

ASME B16.1, *Cast Iron Pipe Flanges and Flanged Fittings*, 1989.

ASME B16.3, *Malleable Iron Threaded Fittings,* 1992.

ASME B16.4, *Gray Iron Threaded Fittings*, 1992.

ASME B16.5, *Pipe Flanges and Flanged Fittings,* 1996.

ASME B16.9, *Factory-Made Wrought Steel Buttwelding Fittings*, 1993.

ASME B16.11, *Forged Fittings, Socket-Welding and Threaded*, 1996.

ASME B16.18, *Cast Copper Alloy Solder Joint Pressure Fittings*, 1984.

ASME B16.22, *Wrought Copper and Copper Alloy Solder Joint Pressure Fittings*, 1995.

ASME B16.25, *Buttwelding Ends*, 1997.

2.3.3 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM A 53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*, 1998.

ASTM A 135, *Standard Specification for Electric-Resistance-Welded Steel Pipe*, 1997.

ASTM A 234, *Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures*, 1997.

ASTM A 795, *Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use*, 1997.

ASTM B 32, *Standard Specification for Solder Metal*, 1996.

ASTM B 88, *Standard Specification for Seamless Copper Water Tube*, 1996.

ASTM B 251, *Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube*, 1997.

ASTM B 813, *Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper-Alloy Tube*, 1993.

ASTM D 3309, *Standard Specification for Polybutylene (PB) Plastic Hot- and Cold-Water Distribution Systems*, 1996.

ASTM F 437, *Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80*, 1996.

ASTM F 438, *Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40*, 1997.

ASTM F 439, *Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80*, 1997.

ASTM F 442, *Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)*, 1997.

2.3.4 AWS Publication. American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126.

AWS A5.8, *Specification for Filler Metals for Brazing and Braze Welding*, 1992.

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 included, common usage of the terms shall apply.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). The organization, office, or individual responsible 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 Should. Indicates a recommendation or that which is advised but not required.

3.2.7 Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

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 Compartment. See Section 4.1.

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

3.3.4 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.

3.3.5 Multipurpose Piping System. A piping system within a residential occupancy intended to serve both domestic and fire protection needs.

3.3.6 Residential Occupancies. Occupancies, as specified in the scope of this standard, that include the following, as defined in NFPA *101®*, *Life Safety Code®*: (1) Apartment buildings, (2) Lodging and rooming houses, (3) Board and care facilities (prompt and slow evacuation type), and (4) Hotels, motels, and dormitories.

3.3.7 Sprinkler.

3.3.7.1 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.

3.3.7.2 Residential Sprinkler. A type of fast-response sprinkler that meets the criteria of NFPA 13, *Standard for the Installation of Sprinkler Systems,* that has been specifically investigated for its ability to enhance survivability in the room of fire origin and is listed for use in the protection of dwelling units.

3.3.8 Sprinkler System. For fire protection purposes, an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The installation includes one or more automatic water supplies. The portion of the sprinkler system aboveground is a network of specially sized or hydraulically designed piping installed in a building, structure, or area, generally overhead, and to which sprinklers are attached in a systematic pattern. The valve controlling each system riser is located in the system riser or its supply piping. Each sprinkler system riser includes a device for actuating an alarm when the system is in operation. The system is usually activated by heat from a fire and discharges water over the fire area.

3.3.8.1 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.

3.3.8.2 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.

3.3.8.3 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.

3.3.9 System Working Pressure. The maximum anticipated static (nonflowing) or flowing pressure applied to sprinkler system components exclusive of surge pressures.

3.3.10 Thermal Barrier. A material that limits the average temperature rise of an unexposed surface to not more than 250°F (121°C) for a specified fire exposure complying with the standard time–temperature curve of NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials.*

3.3.11 Valve.

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

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

3.3.12 Waterflow Alarm. A sounding device activated by a waterflow detector or alarm check valve.

3.3.13 Waterflow Detector. An electric signaling indicator or alarm check valve actuated by waterflow in one direction only.

Chapter 4 General Requirements

4.1 Compartments.

4.1.1 A compartment, for the purposes of this standard, shall be a space that is completely enclosed by walls and a ceiling.

4.1.2 A compartment enclosure shall be permitted to have openings in walls, provided the openings have a minimum lintel depth of 8 in. (203 mm) from the ceiling.

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

Chapter 5 System Components

5.1 General.

5.1.1 Only new sprinklers shall be installed in sprinkler systems.

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

5.1.3 Sprinkler system components shall be rated for a working pressure of not less than 175 psi (12.1 bar).

5.2 Piping.

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.

Table 5.2.1 Pipe or Tube Materials and Dimensions

Materials and Dimensions	Standard
Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use	ASTM A 795
Specification for Welded and Seamless Pipe	ASTM A 53
Wrought Steel Pipe	ANSI B36.10M
Specification for Electric-Resistance-Welded Steel Pipe	ASTM A 135
Specification for Seamless Copper Water Tube [Copper Tube (Drawn, Seamless)]	ASTM B 88
Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube	ASTM B 251
Fluxes for Soldering Applications of Copper and Copper-Alloy Tube	ASTM B 813
Specification for Filler Metals for Brazing and Braze Welding (Classification BCuP-3 or BCuP-4)	AWS A5.8
Specification for Solder Metal [95-5 (Tin-Antimony-Grade 95TA)]	ASTM B 32

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 (12.1 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).

5.2.2 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 manufacturers' installation instructions.

5.2.2.2* Chlorinated polyvinyl chloride (CPVC) and polybutylene (PB) pipe shall comply with the portions of the American Society for Testing and Materials (ASTM) standards specified in Table 5.2.2.2 that apply to fire protection service.

Table 5.2.2.2 Specially Listed Pipe or Tube Materials and Dimensions

Materials and Dimensions	Standard
Nonmetallic Piping	
Specification for Chlorinated Polyvinyl Chloride (CPVC) Pipe	ASTM F 442
Specification for Polybutylene (PB) Pipe	ASTM D 3309

5.2.3 Pipe having 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. (203 mm) nominal or larger in size.

5.2.4 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. (203 mm) nominal in size.

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

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

5.2.7 Fittings used in sprinkler systems shall be of the materials listed in Table 5.2.7 or in accordance with 5.2.10.

5.2.7.1 The chemical properties, physical properties, and dimensions of fitting materials shall be at least equivalent to the standards cited in Table 5.2.7.

Table 5.2.7 Fitting Materials and Dimensions

Materials and Dimensions	Standard
Cast Iron	
Cast Iron and Threaded Fittings (Class 125 and 250)	ASME B16.4
Cast Iron Pipe Flanges and Flanged Fittings	ASME B16.1
Malleable Iron	
Malleable Iron Threaded Fittings	ASME B16.3
Steel	
Factory-Made Wrought Steel Buttwelding Fittings	ASME B16.9
Buttwelding Ends	ASME B16.25
Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures	ASTM A 234
Pipe Flanges and Flanged Fittings (Nickel Alloy and Other Special Alloys)	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

5.2.7.2 Fittings used in sprinkler systems shall be designed to withstand a working pressure of not less than 175 psi (12.1 bar).

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

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

5.2.9 Joints for the connection of copper pipe for wet systems shall use solder joints with 95-5 solder metal or be brazed.

5.2.10 Types of fittings other than those specified in Table 5.2.7 shall be permitted to be used where listed for sprinkler system use.

5.2.10.1 Fittings differing from those specified in Table 5.2.7 shall be installed in accordance with their listings and the manufacturers' installation instructions.

5.2.10.2* Chlorinated polyvinyl chloride (CPVC) and polybutylene (PB) fittings shall comply with the portions of the American Society for Testing and Materials (ASTM) standards specified in Table 5.2.10.2 that apply to fire protection service.

Table 5.2.10.2 Specially Listed Fittings and Dimensions

Materials and Dimensions	Standard
Specification for Schedule 80 CPVC Threaded Fittings	ASTM F 437
Specification for Schedule 40 CPVC Socket-Type Fittings	ASTM F 438
Specification for Schedule 80 CPVC Socket-Type Fittings	ASTM F 439

5.3 System Types.

5.3.1 A wet pipe system shall be used where piping is installed in areas that can be maintained reliably above 40°F (4°C).

5.3.2* Piping in areas that cannot be maintained reliably above 40°F (4°C) shall be protected by use of one of the following methods:

(1) *Antifreeze system
(2) Dry pipe system
(3) Preaction system
(4) Listed standard dry-pendent, dry-upright, or dry-sidewall sprinklers extended from pipe in heated areas

5.3.3 Where antifreeze systems, dry pipe systems, and preaction systems are installed, they shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

Chapter 6 Working Plans, Design, Installation, Acceptance Tests, and Maintenance

6.1 Working Plans.

6.1.1 Working plans shall be submitted for approval to the authority having jurisdiction before any equipment is installed or remodeled.

6.1.2 Deviations from approved plans shall require permission of the authority having jurisdiction.

6.1.3 Working plans shall be drawn to a specified scale.

6.1.4 Sprinkler plans shall be drawn on sheets of uniform size.

6.1.5 Sprinkler plans shall provide a plan of each floor.

6.1.6 Sprinkler plans shall be capable of being easily duplicated.

6.1.7 Sprinkler plans shall indicate the following:

(1) Name of owner and occupant
(2) Location, including street address
(3) Point of compass
(4) Ceiling construction
(5) Full height cross section
(6) Location of fire walls
(7) Location of partitions
(8) Occupancy of each area or room
(9) Location and size of concealed spaces, attics, closets, and bathrooms
(10) Any small enclosures in which no sprinklers are to be installed
(11) Size of the city main in the street, pressure, whether dead-end or circulating and, if dead-end, the direction and distance to the nearest circulating main, and the city main test results including elevation of the test hydrant
(12) Make, manufacturer, type, heat-response element, temperature rating, and nominal orifice size of the sprinkler
(13) Temperature rating and location of high-temperature sprinklers
(14) Number of sprinklers on each riser, per floor
(15) Kind and location of alarm bells
(16) Type of pipe and fittings
(17) Type of protection for nonmetallic pipe
(18) *Nominal pipe size with lengths shown to scale
(19) Location and size of riser nipples
(20) Types of fittings and joints and the locations of all welds and bends
(21) Types and locations of hangers, sleeves, and braces, and methods of securing sprinklers, where applicable
(22) All control valves, check valves, drain pipes, and test connections
(23) Underground pipe size, length, location, weight, material, and point of connection to the city main; type of valves, meters, and valve pits; and depth at which the top of the pipe is laid below grade
(24) In the case of hydraulically designed systems, the material to be included on the hydraulic data nameplate
(25) Name and address of the contractor

6.2 Approval of Sprinkler Systems.

6.2.1 The installer shall perform all required acceptance tests *(see Section 6.3)* prior to asking for approval of the installation.

6.2.2 The installer shall complete the contractor's material and test certificate(s) *(see Figure 6.2.2)* prior to asking for approval of the installation.

6.2.3 The installer shall forward the certificate(s) to the authority having jurisdiction prior to asking for approval of the installation.

6.2.4 Where the authority having jurisdiction requires to be present during the conducting of acceptance tests, the installer shall provide advance notification of the time and date the testing will be performed.

6.3 Acceptance Tests.

6.3.1* Flushing of Underground Connections.

6.3.1.1 Underground mains and lead-in connections to system risers shall be flushed before a connection is made to sprinkler piping.

6.3.1.2 The flushing operation shall be continued until the water issuing from the main is clear.

6.3.1.3 The flushing operation shall be performed at the hydraulically calculated water demand rate of the system.

6.3.1.4 The flushing operation shall be performed such that the disposal of water issuing from the test outlets does not damage the property.

6.3.2* Hydrostatic Pressure Tests.

6.3.2.1 Systems having more than 20 sprinklers or having a fire department connection shall pass a hydrostatic pressure test performed for the aboveground piping system in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

6.3.2.2 Systems having both fewer than 20 sprinklers and no fire department connection shall pass a hydrostatic pressure test performed for the aboveground piping system at 50 psi higher than the maximum system pressure using the hydrostatic test procedure specified in NFPA 13, *Standard for the Installation of Sprinkler Systems*.

6.4 Design and Installation.

6.4.1 At least three spare sprinklers of each type, temperature rating, and orifice size used in the system shall be installed on the premises.

6.4.2 Where solvent cement is used as the pipe and fittings bonding agent, sprinklers shall not be installed in the fittings prior to the fittings being cemented in place.

6.4.3 A test connection shall be installed that permits the testing of the alarm mechanisms.

6.5 Water Supply.

6.5.1 Every sprinkler system shall have at least one automatic water supply.

6.5.2 The water supply shall be capable of supplying the system demand for at least 30 minutes. *(See 6.7.1.2.)*

6.5.3* The water supply source shall be one of the following:

(1) A connection to a reliable waterworks system with or without a pump, as required
(2) An elevated tank
(3) A pressure tank installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, and NFPA 22, *Standard for Water Tanks for Private Fire Protection*
(4) A stored water source with an automatically operated pump

6.5.4 Where a fire pump is installed, the fire pump shall be installed in accordance with NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*.

6.5.5* Domestic demand shall be included as part of the overall system demand for systems with common domestic/fire mains where no provisions are made to prevent the domestic water flow upon sprinkler system activation.

Contractor's Material and Test Certificate for Aboveground Piping

PROCEDURE

Upon completion of work, inspection and tests shall be made by the contractor's representative and witnessed by an owner's representative. All defects shall be corrected and system left in service before contractor's personnel finally leave the job.

A certificate shall be filled out and signed by both representatives. Copies shall be prepared for approving authorities, owners, and contractor. It is understood the owner's representative's signature in no way prejudices any claim against contractor for faulty material, poor workmanship, or failure to comply with approving authority's requirements or local ordinances.

Property name	Date
Property address	

Plans

Accepted by approving authorities (names)

Address

Installation conforms to accepted plans	☐ Yes	☐ No
Equipment used is approved	☐ Yes	☐ No
If no, explain deviations		

Instructions

Has person in charge of fire equipment been instructed as to location of control valves and care and maintenance of this new equipment?	☐ Yes	☐ No
If no, explain		
Have copies of the following been left on the premises?	☐ Yes	☐ No
1. System components instructions	☐ Yes	☐ No
2. Care and maintenance instructions	☐ Yes	☐ No
3. NFPA 25	☐ Yes	☐ No

Location of system

Supplies buildings

Sprinklers

Make	Model	Year of manufacture	Orifice size	Quantity	Temperature rating

Pipe and fittings

Type of pipe _____

Type of fittings _____

Alarm valve or flow indicator

Alarm device			Maximum time to operate through test connection	
Type	Make	Model	Minutes	Seconds

Dry pipe operating test

Dry valve			Q. O. D.		
Make	Model	Serial no.	Make	Model	Serial no.

	Time to trip through test connection†		Water pressure	Air pressure	Trip point air pressure	Time water reached test outlet†		Alarm operated properly	
	Minutes	Seconds	psi	psi	psi	Minutes	Seconds	Yes	No
Without Q.O.D.									
With Q.O.D.									

If no, explain

† Measured from the time inspector's test connection is opened

FIGURE 6.2.2 Contractor's Material and Test Certificate for Aboveground Piping.

Deluge and preaction valves

Operation ☐ Pneumatic ☐ Electric ☐ Hydraulic

Piping supervised ☐ Yes ☐ No | Detecting media supervised ☐ Yes ☐ No

Does valve operate from the manual trip, remote, or both control stations? ☐ Yes ☐ No

Is there an accessible facility in each circuit for testing? ☐ Yes ☐ No | If no, explain

Make	Model	Does each circuit operate supervision loss alarm?		Does each circuit operate valve release?		Maximum time to operate release	
		Yes	No	Yes	No	Minutes	Seconds

Pressure reducing valve test

Location and floor	Make and model	Setting	Static pressure		Residual pressure (flowing)		Flow rate
			Inlet (psi)	Outlet (psi)	Inlet (psi)	Outlet (psi)	Flow (gpm)

Test description

Hydrostatic: Hydrostatic tests shall be made at not less than 200 psi (13.6 bar) for 2 hours or 50 psi (3.4 bar) above static pressure in excess of 150 psi (10.2 bar) for 2 hours. Differential dry-pipe valve clappers shall be left open during the test to prevent damage. All aboveground piping leakage shall be stopped.

Pneumatic: Establish 40 psi (2.7 bar) air pressure and measure drop, which shall not exceed 1½ psi (0.1 bar) in 24 hours. Test pressure tanks at normal water level and air pressure and measure air pressure drop, which shall not exceed 1½ psi (0.1 bar) in 24 hours.

Tests

All piping hydrostatically tested at _____ psi (___ bar) for ____ hours ☐ Yes ☐ No
Dry piping pneumatically tested ☐ Yes ☐ No
Equipment operates properly | If no, state reason

Do you certify as the sprinkler contractor that additives and corrosive chemicals, sodium silicate or derivatives of sodium silicate, brine, or other corrosive chemicals were not used for testing systems or stopping leaks? ☐ Yes ☐ No

Drain test | Reading of gauge located near water supply test connection: _____ psi (___ bar) | Residual pressure with valve in test connection open wide: _____ psi (___ bar)

Underground mains and lead-in connections to system risers flushed before connection made to sprinkler piping verified by a copy of the "Contractor's Material and Test Certificate for Underground Piping." ☐ Yes ☐ No | Other Explain

Flushed by installer of underground sprinkler piping ☐ Yes ☐ No

If powder-driven fasteners are used in concrete, has representative sample testing been satisfactorily completed? ☐ Yes ☐ No | If no, explain

Blank testing gaskets

Number used	Locations	Number removed

Welding

Welding piping ☐ Yes ☐ No

If yes . . .

Do you certify as the sprinkler contractor that welding procedures comply with the requirements of at least AWS B2.1? ☐ Yes ☐ No

Do you certify that the welding was performed by welders qualified in compliance with the requirements of at least AWS B2.1? ☐ Yes ☐ No

Do you certify that the welding was carried out in compliance with a documented quality control procedure to ensure that all discs are retrieved, that openings in piping are smooth, that slag and other welding residue are removed, and that the internal diameters of piping are not penetrated? ☐ Yes ☐ No

Cutouts (discs)

Do you certify that you have a control feature to ensure that all cutouts (discs) are retrieved? ☐ Yes ☐ No

FIGURE 6.2.2 ***Continued***

Hydraulic data nameplate	Nameplate provided ☐ Yes ☐ No	If no, explain
Remarks	Date left in service with all control valves open	
Signatures	Name of sprinkler contractor	
	Tests witnessed by	
	For property owner (signed)	Title Date
	For sprinkler contractor (signed)	Title Date
Additional explanations and notes		

FIGURE 6.2.2 *Continued*

6.5.6 Sprinkler systems with non-fire protection connections shall comply with Section 7.6 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

6.6 Installation of System Components.

6.6.1 Valves.

6.6.1.1 A single control valve arranged to shut off both the domestic system and the sprinkler system shall be installed for systems with common sprinkler/domestic mains unless a separate shutoff valve for the sprinkler system is installed in accordance with 6.6.1.2.

6.6.1.2 The sprinkler system piping shall not have a separate control valve installed unless supervised by one of the following methods:

(1) Central station, proprietary, or remote station alarm service
(2) Local alarm service that causes the sounding of an audible signal at a constantly attended location
(3) Valves that are locked open

6.6.1.3 A separate shutoff valve shall be installed for the domestic water supply in installations having a common sprinkler/domestic main.

6.6.2* Drains.

6.6.2.1 Each sprinkler system shall have a drain on the system side of the control valve.

6.6.2.2 The drain pipe shall be at least 1 in. (25 mm) nominal diameter.

6.6.2.3 A valve shall be installed in the drain piping.

6.6.2.4 A ½-in. (13-mm) drain shall be installed for each trapped portion of a dry system that is subject to freezing temperatures.

6.6.3* Test Connection.

6.6.3.1 Each sprinkler system shall have a test connection.

6.6.3.2 The test connection pipe shall be at least 1 in. (25 mm) nominal diameter.

6.6.3.3 A valve shall be installed in the test connection piping.

6.6.3.4 When the drain required in 6.6.2.1 is arranged as a test connection, a separate test connection shall not be required.

6.6.4 Fire Department Connection.

6.6.4.1 At least one fire department connection shall be provided for buildings accessible by a fire department that exceed 2000 ft^2 (186 m^2) or are more than a single story.

6.6.4.2 Fire department connections shall be at least 1½ in. (38 mm).

6.6.5 Pressure Gauges.

6.6.5.1 A pressure gauge shall be provided to indicate pressure of the supply.

6.6.5.2 A pressure gauge shall be provided to indicate pressure of the system.

6.6.6* Piping Support. Piping hanging and bracing methods shall comply with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

6.6.7 Sprinklers.

6.6.7.1 Inside the Dwelling Units.

6.6.7.1.1 Listed residential sprinklers shall be used unless another type is permitted by 6.6.7.1.3 or 6.6.7.1.4.

6.6.7.1.2 Residential sprinklers shall not be used on systems other than wet pipe systems unless specifically listed for use on that particular type of system.

6.6.7.1.3 Listed quick-response sprinklers shall be permitted to be installed in dwelling units meeting the definition of a compartment, as defined in Section 4.1, where no more than four sprinklers are located in the dwelling unit.

6.6.7.1.4 Quick-response sprinklers shall be permitted to be used in mechanical closets.

6.6.7.1.5 Temperature Ratings.

6.6.7.1.5.1* Sprinklers installed where maximum ambient ceiling temperatures do not exceed 100°F (38°C) shall be ordinary temperature–rated sprinklers unless modified by 6.6.7.1.5.3.

6.6.7.1.5.2* Sprinklers installed where maximum ambient ceiling temperatures are between 101°F and 150°F (39°C and 66°C) shall be intermediate temperature–rated sprinklers unless modified by 6.6.7.1.5.3.

6.6.7.1.5.3 The following practices shall be observed when installing residential sprinklers unless higher expected ambient temperatures require a higher temperature rating.

(A) Sprinklers under glass or plastic skylights exposed to direct rays of the sun shall be of intermediate temperature classification.

Table 6.6.7.1.5.3 Minimum Distances for Ordinary and Intermediate Temperature Residential Sprinklers

	From Edge of Source to Ordinary Temperature Sprinkler		From Edge of Source to Intermediate Temperature Sprinkler	
Heat Source	**in.**	**mm**	**in.**	**mm**
Side of open or recessed fireplace	36	914	12	305
Front of recessed fireplace	60	1524	36	914
Coal- or wood-burning stove	42	1067	12	305
Kitchen range	18	457	9	229
Wall oven	18	457	9	229
Hot air flues	18	457	9	229
Uninsulated heat ducts	18	457	9	229
Uninsulated hot water pipes	12	305	6	152
Side of ceiling- or wall-mounted hot air diffusers	24	607	12	305
Front of wall-mounted hot air diffusers	36	914	18	457
Hot water heater or furnace	6	152	3	76
Light fixture:				
0 W – 250 W	6	152	3	76
250 W – 499 W	12	305	6	152

(B) Sprinklers in an unventilated concealed space under uninsulated roof or in an unventilated attic shall be of intermediate temperature classification.

(C) Sprinklers installed near specific heat sources that are identified in Table 6.6.7.1.5.3 shall be of the temperature rating indicated in Table 6.6.7.1.5.3 unless sprinklers are listed for positioning closer to the heat source.

6.6.7.1.5.4 All sprinklers within a compartment shall have the same temperature classification except where required by 6.6.7.1.5.3 for a specific location.

6.6.7.1.6 Where nonmetallic ceiling plates (escutcheons) are used, they shall be listed. Escutcheon plates used to create a recessed or flush-type sprinkler shall be part of a listed sprinkler assembly.

6.6.7.1.7* Painting and Ornamental Finishes. Sprinkler frames shall not be painted or enameled unless applied by the manufacturer and the sprinkler has been listed with such finishes.

6.6.7.2 Outside the Dwelling Unit.

6.6.7.2.1 Sprinklers outside of the dwelling units shall be quick response and selection shall be based on the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*, except where permitted by 6.6.7.2.2.

6.6.7.2.2 Residential sprinklers shall be permitted to be used in corridors leading to dwelling units and in areas covered by 6.7.2.2, 6.7.2.3 and 6.7.3.3.

6.6.8 Alarms.

6.6.8.1 A local waterflow alarm shall be provided on all sprinkler systems.

6.6.8.2 Where a building fire alarm system is provided, the local waterflow alarms shall be connected to the building fire alarm system.

6.7 System Design.

6.7.1 Design Criteria — Inside Dwelling Unit.

6.7.1.1 Design Discharge.

6.7.1.1.1 Sprinklers That Have Not Been Listed with Specific Discharge Criteria.

6.7.1.1.1.1 The system shall provide a discharge of not less than 13 gpm (49 L/min) per sprinkler simultaneously to all of the design sprinklers.

6.7.1.1.1.2 The system shall provide a discharge of not less than 18 gpm (68 L/min) to any sprinkler in the system.

6.7.1.1.2* Sprinklers That Have Been Listed with Specific Discharge Criteria.

6.7.1.1.2.1 The system shall provide at least the flow required for the multiple and single sprinkler operating criteria specified by the sprinkler listing.

6.7.1.1.2.2* The system shall provide at least the flow required to produce a minimum discharge density of 0.05 gpm/ft^2 (2.04 mm/min) to the design sprinklers.

6.7.1.2* Number of Design Sprinklers. The number of design sprinklers under flat, smooth, horizontal ceilings shall include all sprinklers within a compartment, up to a maximum of four sprinklers, that requires the greatest hydraulic demand.

6.7.1.3 Sprinkler Coverage.

6.7.1.3.1 Residential Sprinklers That Have Not Been Listed with Specific Coverage Criteria.

6.7.1.3.1.1 Sprinklers shall be spaced so that the maximum area protected by a single sprinkler does not exceed 144 ft^2 (13.4 m^2).

6.7.1.3.1.2 The maximum distance between sprinklers shall not exceed 12 ft (3.7 m).

6.7.1.3.1.3 The maximum distance from the sprinkler to a wall or partition shall not exceed 6 ft (1.8 m).

6.7.1.3.1.4 The minimum distance between sprinklers within a compartment shall be 8 ft (2.4 m).

6.7.1.3.2 Residential Sprinklers That Have Been Listed with Specific Coverage Criteria. Sprinklers shall be installed in accordance with the coverage criteria specified by the listing.

6.7.1.3.3 Non-Residential Sprinklers. Sprinklers other than residential sprinklers shall be installed in accordance with the coverage criteria specified by NFPA 13, *Standard for the Installation of Sprinkler Systems*.

6.7.1.4 Operating Pressure. The minimum operating pressure of any sprinkler shall be the higher of the minimum operating pressure specified by the listing or 7 psi (0.5 bar).

6.7.1.5 Position of Residential Sprinklers.

6.7.1.5.1 Pendent and Upright Sprinklers.

6.7.1.5.1.1 Pendent and upright sprinklers that have not been listed with specific positioning criteria shall be positioned so that the deflectors are within 1 in. to 4 in. (25.4 mm to 102 mm) from the ceiling.

6.7.1.5.1.2 Pendent and upright sprinklers that have been listed with specific positioning criteria shall be positioned in accordance with the listing.

6.7.1.5.2 Sidewall Sprinklers.

6.7.1.5.2.1 Sidewall sprinklers that have not been listed with specific positioning criteria shall be positioned so that the deflectors are within 4 in. to 6 in. (102 mm to 152 mm) from the ceiling.

6.7.1.5.2.2 Sidewall sprinklers that have been listed with specific positioning criteria shall be positioned in accordance with the listing.

6.7.1.5.3* Sprinklers shall be positioned so that the response time and discharge are not unduly affected by obstructions such as ceiling slope, beams, or light fixtures.

6.7.1.5.4 In closets and storage areas with both a volume no larger than 300 ft^3 (8.93 m^3) and a ceiling height less than 5 ft (1.5 m) at the lowest ceiling, a single sprinkler located at the highest ceiling shall be permitted to protect that space.

6.7.2* Design Criteria — Outside Dwelling Unit.

6.7.2.1 For areas outside the dwelling unit, the following criteria shall comply with specifications in NFPA 13, *Standard for the Installation of Sprinkler Systems*, unless permitted by 6.7.2.2 and 6.7.2.3:

(1) Design discharge
(2) Number of design sprinklers
(3) Sprinkler coverage
(4) Position of sprinklers

6.7.2.2 The system demand of areas outside the dwelling unit shall be permitted to be limited to the number of sprinklers in the compartmented area but shall not be greater than the demand for a total of four sprinklers where all of the following conditions are met:

(1) The area is compartmented into areas of 500 ft^2 (46 m^2) or less by 30-minute fire-rated construction.
(2) The area is protected by quick-response or residential sprinklers not exceeding 130 ft^2 (12 m^2) per sprinkler for ordinary hazard, 225 ft^2 (20.9 m^2) for light hazard, or the allowable coverage of the sprinkler listing.
(3) Openings have a lintel at least 8 in. (203 mm) in depth.
(4) The total area of openings does not exceed 50 ft^2 (4.6 m^2) for each compartment.
(5) Discharge densities are in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

6.7.2.3 The following types of spaces are permitted to be protected by residential sprinklers where they have flat, smooth ceilings not exceeding 10 ft (3.0 m) in height and are protected in accordance with the requirements for residential sprinklers:

(1) Lobbies not in hotels and motels
(2) Foyers
(3) Corridors
(4) Halls
(5) Lounges
(6) Other areas with fire loads similar to residential

6.7.3 Design Criteria — Garages.

6.7.3.1 Garages that are completely separated from the residential portion of the building by fire resistive construction sufficient to have them considered separate buildings under the local code shall be protected in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

6.7.3.2 Garages that are accessible by people from more than one dwelling unit, and are not covered by 6.7.3.1, shall be considered part of the building and shall be protected in accordance with 6.7.2. Garage doors shall not be considered obstructions and shall be permitted to be ignored for placement and calculation of sprinklers.

6.7.3.3* Garages that are only accessible from a single dwelling unit shall be considered as part of that dwelling unit. Such garages shall be sprinklered with residential sprinklers in accordance with 6.7.1 or quick-response sprinklers designed to provide a density of 0.05 gpm/ft^2 (2.04 mm/min) over the area of the garage, but not to exceed four sprinklers. Garage doors shall not be considered obstructions and shall be permitted to be ignored for placement and calculation of sprinklers.

6.7.4 Pipe Sizing. Piping shall be sized using hydraulic calculation procedures in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

6.8 Location of Sprinklers.

6.8.1 Sprinklers shall be installed in all areas except where omission is permitted by 6.8.2 through 6.8.6.

6.8.2* Sprinklers shall not be required in bathrooms where both of the following conditions are met:

(1) The bathroom area does not exceed 55 ft^2 (5.1 m^2).
(2) The walls and ceilings, including walls and ceilings behind fixtures, are of noncombustible or limited-combustible materials providing a 15-minute thermal barrier.

6.8.3 Sprinklers shall not be required in clothes closets, linen closets, and pantries within the dwelling units that meet all of the following conditions:

(1) The area of the space does not exceed 24 ft^2 (2.2 m^2).
(2) The least dimension does not exceed 3 ft (0.91 m).
(3) The walls and ceilings are surfaced with noncombustible or limited-combustible materials as defined by NFPA 220, *Standard on Types of Building Construction.*

6.8.4 Sprinklers shall not be required in any porches, balconies, corridors, and stairs that are open and attached.

6.8.5 Sprinklers shall not be required in attics, penthouse equipment rooms, elevator machine rooms, concealed spaces dedicated exclusively to and containing only dwelling unit ventilation equipment, crawl spaces, floor/ceiling spaces, elevator shafts, and other concealed spaces that are not used or intended for living purposes or storage and do not contain fuel-fired equipment.

6.8.6 Sprinklers shall not be required in closets on exterior balconies, regardless of size, as long as there are no doors or unprotected penetrations from the closet directly into the dwelling unit.

6.9* Maintenance.

6.9.1 The owner shall be responsible for the condition of a sprinkler system and shall keep the system in normal operating condition.

6.9.2 Sprinkler systems shall be inspected, tested, and maintained in accordance with NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.*

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1 NFPA 13R is appropriate for use as an option to NFPA 13, *Standard for the Installation of Sprinkler Systems,* only in those residential occupancies, as defined in this standard, up to and including four stories in height. It is the intent of this standard that if NFPA 13R is appropriate for use, that it be used throughout the entire building. It is recognized that an occupancy incidental to the operations of the residential occupancy might exist within that residential occupancy. Such incidental occupancy would be considered part of the predominant (residential) occupancy and subject to the provisions of the predominant (residential) occupancy by 6.1.14.2 of NFPA *101,*®*,Life Safety Code*®, and similar provisions in many local building and fire codes. Use of NFPA 13R throughout the entire building in this case is allowed.

Where buildings are greater than four stories in height, or where buildings are of mixed use where residential is not the predominant occupancy, residential portions of such buildings should be protected with residential or quick-response sprinklers in accordance with 8.4.5 of NFPA 13. Other portions of such buildings should be protected in accordance with NFPA 13. Where buildings of mixed use can be totally separated so that the residential portion is considered a separate building under the local code, NFPA 13R can be used in the residential portion, while NFPA 13 is used in the rest of the building.

The criteria in this standard are based on full-scale fire tests of rooms containing typical furnishings found in residential living rooms, kitchens, and bedrooms. The furnishings were arranged as typically found in dwelling units in a manner similar to that shown in Figure A.1.1(a), Figure A.1.1(b), and Figure A.1.1(c). Sixty full-scale fire tests were conducted in a two-story dwelling in Los Angeles, California, and 16 tests were conducted in a 14 ft (4.3 m) wide mobile home in Charlotte, North Carolina. Sprinkler systems designed and installed according to this standard are expected to prevent flashover within the compartment of origin where sprinklers are installed in the compartment. A sprinkler system designed and installed according to this standard cannot, however, be expected to completely control a fire involving fuel loads that are significantly higher than average for dwelling units [10 lb/ft^2 (49 kg/m^2)], configurations of fuels other than those with typical residential occupancies, or conditions where the interior finish has an unusually high flame spread rating (greater than 225).

To be effective, sprinkler systems installed in accordance with this standard need to open the sprinklers closest to the fire before the fire exceeds the ability of the sprinkler discharge to extinguish or control the fire. Conditions that allow the fire to grow beyond that point before sprinkler activation or that interfere with the quality of water distribution can produce conditions beyond the capabilities of the sprinkler system described in this standard. Unusually high ceilings or ceiling configurations that tend to divert the rising hot gases from sprinkler locations or change the sprinkler discharge pattern from its standard pattern can produce fire conditions that cannot be extinguished or controlled by the systems described in this standard.

A.1.2 Various levels of sprinkler protection are available to provide life safety and property protection. This standard is designed to provide a high, but not absolute, level of life safety and a lesser level of property protection. Greater protection to both life and property could be achieved by sprinklering all areas in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems,* which permits the use of residential sprinklers in residential areas.

This standard recommends, but does not require, sprinklering of all areas in the building; it permits sprinklers to be omitted in certain areas. These areas have been proved by NFPA statistics to be those where the incidence of life loss from fires in residential occupancies is low. Such an approach provides a reasonable degree of fire safety. (*See Table A.1.2 for deaths and injuries in multifamily residential buildings.*)

It should be recognized that the omission of sprinklers from certain areas could result in the development of untenable conditions in adjacent spaces. Where evacuation times could be delayed, additional sprinkler protection and other fire protection features, such as detection and compartmentation, could be necessary.

A.1.5.1 For additional conversions and information, see ASTM SI 10, *Standard for Use of the International System of Units (SI): the Modern Metric System.*

A.1.5.4 A given equivalent value is considered to be approximate.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, proce-

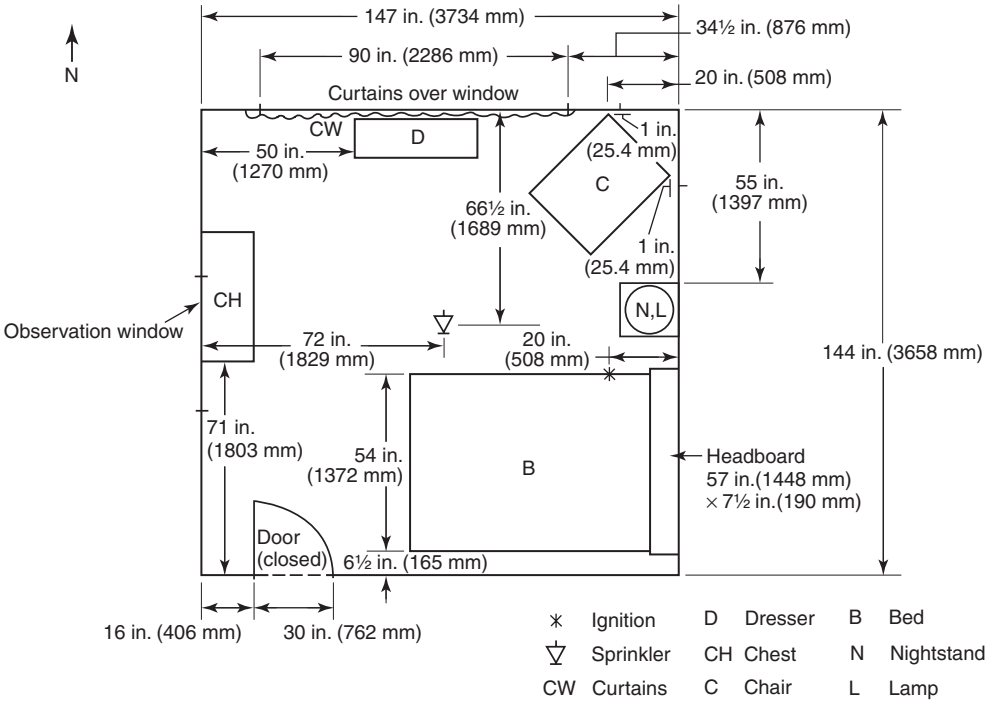


FIGURE A.1.1(a) Bedroom.

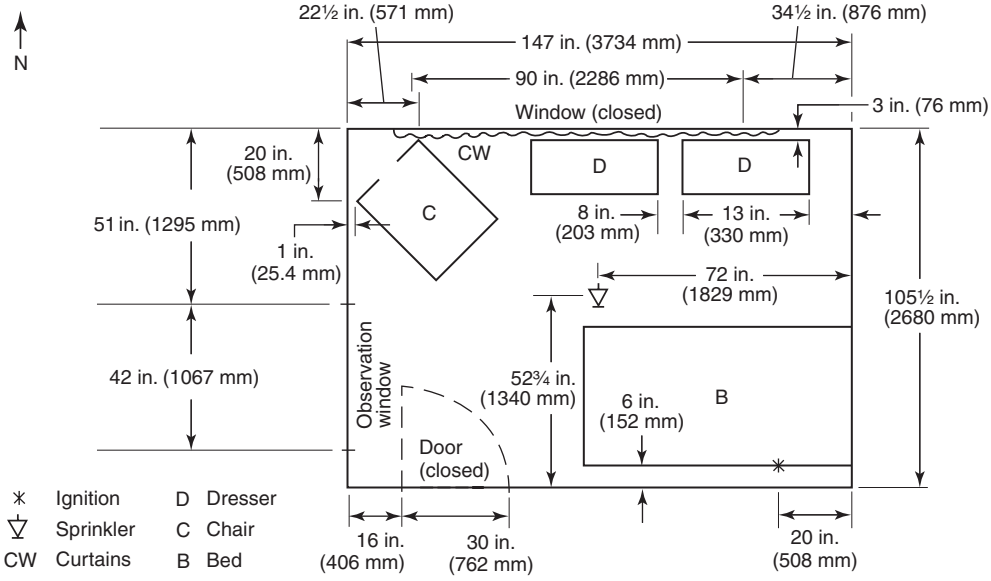


FIGURE A.1.1(b) Mobile Home Bedroom.

dures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or indi-

Table A.1.2 Fires and Associated Deaths and Injuries in Apartments by Area of Origin; Annual Average of 1986–1990 Structure Fires Reported to U.S. Fire Departments

Area of Origin	Civilian Deaths	Civilian Percent	Fires	Percent	Injuries	Percent
Bedroom	309	33.9	17,960	15.8	1,714	27.2
Living room, family room, or den	308	33.8	10,500	9.3	1,272	20.2
Kitchen	114	12.5	46,900	41.4	1,973	31.2
Interior stairway	29	3.2	1,040	0.9	91	1.4
Hallway or corridor	23	2.6	3,130	2.8	165	2.6
Exterior balcony or open porch	17	1.8	1,880	1.7	69	1.1
Dining room	10	1.1	800	0.7	69	1.1
Closet	9	1.0	2,120	1.9	116	1.8
Multiple areas	9	1.0	780	0.7	38	0.6
Tool room or other supply storage room or area	8	0.9	1,250	1.1	53	0.8
Unclassified area	8	0.9	480	0.4	29	0.5
Exterior stairway	8	0.8	870	0.8	22	0.4
Bathroom	7	0.7	2,510	2.2	101	1.6
Heating equipment room or area	6	0.6	2,510	2.2	75	1.2
Exterior wall surface	5	0.5	2,150	1.9	26	0.4
Laundry room or area	4	0.4	3,380	3.0	89	1.4
Crawl space or substructure space	4	0.4	1,490	1.3	62	1.0
Wall assembly or concealed space	3	0.4	1,020	0.9	21	0.3
Attic or ceiling/roof assembly or concealed space	3	0.3	1,100	1.0	18	0.3
Ceiling/floor assembly or concealed space	3	0.3	560	0.5	18	0.3
Garage or carport*	3	0.3	1,290	1.1	36	0.6
Lobby or entrance way	3	0.3	670	0.6	31	0.5
Unclassified structural area	3	0.3	520	0.5	32	0.5
Unclassified storage area	3	0.3	430	0.4	22	0.3
Unclassified function area	3	0.3	250	0.2	13	0.2
Laboratory	2	0.3	80	0.1	3	0.0
Elevator or dumbwaiter	1	0.2	220	0.2	4	0.1
Sales or showroom area	1	0.2	110	0.1	3	0.1
Exterior roof surface	1	0.1	1,040	0.9	15	0.2
Unclassified means of egress	1	0.1	180	0.2	6	0.1
Office	1	0.1	120	0.1	4	0.1
Chimney	1	0.1	980	0.9	2	0.0
Personal service area	1	0.1	40	0.0	4	0.1
Library	1	0.1	10	0.0	0	0.0
Other known area	2	0.2	5,000	4.4	115	1.8
Total	912	100.0	113,390	100.0	6,313	100.0

Note: Fires are estimated to the nearest 10; civilian deaths and injuries are estimated to the nearest 1.
* Does not include dwelling garages coded as a separate property.
(Source: 1986-1990 NFIRS and NFPA survey.)

vidual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.1 Bathroom. A room is still considered a bathroom if it contains just a toilet. Additionally, two bathrooms can be adjacent to each other and are considered separate rooms provided they are enclosed with the required level of construction.

A.5.2.1 This standard anticipates that the water supply for the system is in compliance with the governing plumbing code for the jurisdiction. It is intended that any pipe material or diameter permitted for multiple family dwellings in the plumbing code and satisfying the hydraulic criteria of NFPA 13R is considered to be in compliance.

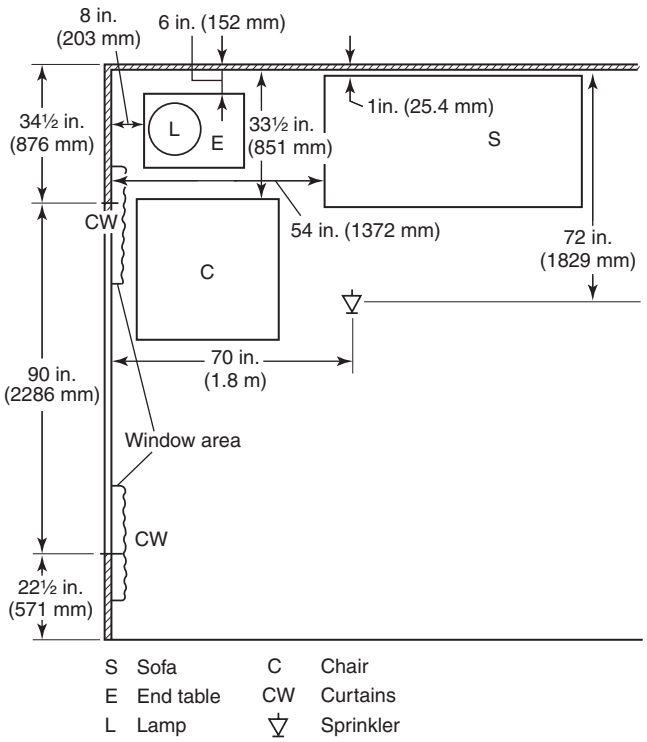


FIGURE A.1.1(c) Living Room.

A.5.2.2.2 Not all pipe or tube made to ASTM D 3309, *Standard Specification for Polybutylene (PB) Plastic Hot- and Cold-Water Distribution Systems*, and ASTM F 442, *Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)*, as described in 5.2.2.2 is listed for fire sprinkler service. Listed pipe is identified by the logo of the listing agency.

A.5.2.10.2 Not all fittings made to ASTM F 437, *Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80*; ASTM F 438, *Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40*; and ASTM F 439 *Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80*, as described in 5.2.10.2 are listed for fire sprinkler service. Listed fittings are identified by the logo of the listing agency.

A.5.3.2 Piping covered by insulation, as shown in Figure A.5.3.2(a) through Figure A.5.3.2(e), is considered part of the area below the ceiling and not part of the unheated attic area.

A.5.3.2(1) Antifreeze solutions can be used for maintaining automatic sprinkler protection in small, unheated areas. Because of the cost of refilling the system or replenishing small leaks, antifreeze solutions are recommended only for systems not exceeding 40 gal (151 L).

Listed CPVC sprinkler pipe and fittings should be protected from freezing only with glycerine. The use of diethylene, ethylene, or propylene glycols is specifically prohibited. Laboratory testing shows that glycol-based antifreeze solutions present a chemical environment detrimental to CPVC. Listed polybutylene sprinkler pipe and fittings can be protected with glycerine, diethylene glycol, ethylene glycol, or propylene glycol.

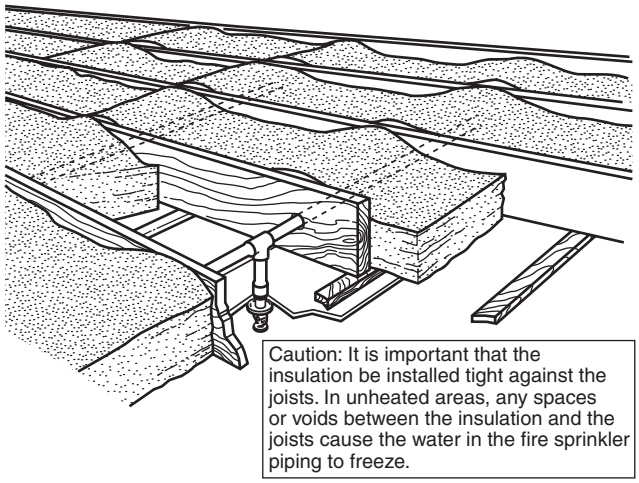


FIGURE A.5.3.2(a) Insulation Recommendations — Arrangement 1.

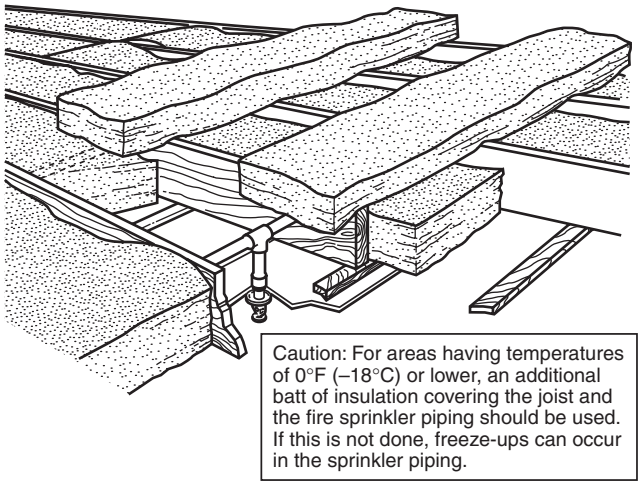


FIGURE A.5.3.2(b) Insulation Recommendations — Arrangement 2.

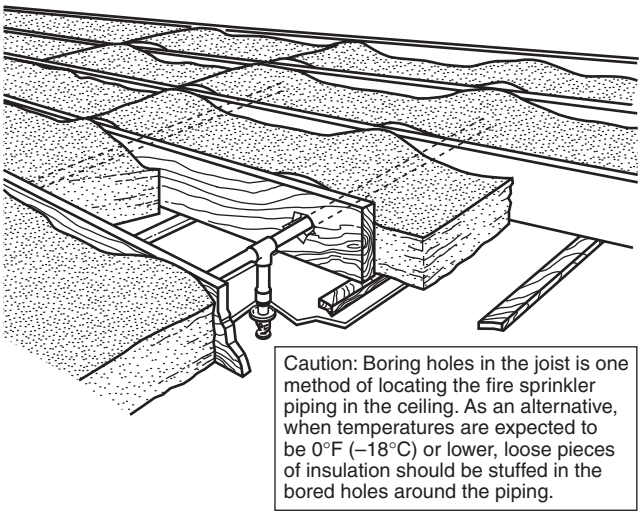


FIGURE A.5.3.2(c) Insulation Recommendations — Arrangement 3.

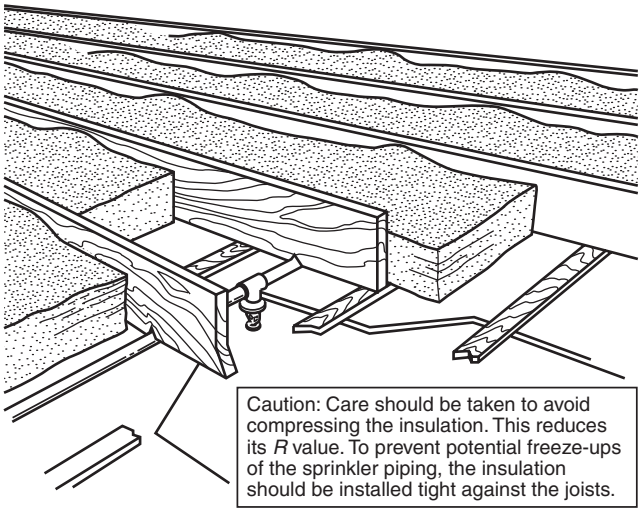


FIGURE A.5.3.2(d) Insulation Recommendations — Arrangement 4.

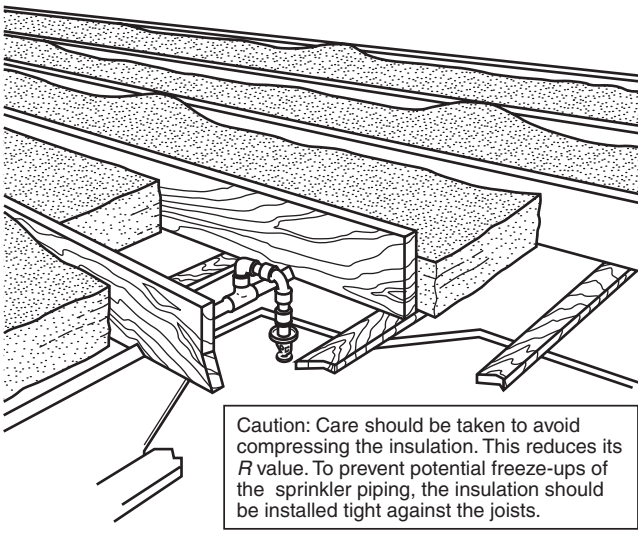


FIGURE A.5.3.2(e) Insulation Recommendations — Arrangement 5.

A.6.1.7(18) Where typical branch lines prevail, it will be necessary to size only one line.

A.6.3.1 Underground mains and lead-in connections to system risers are required to be flushed before a connection is made to sprinkler piping in order to remove any foreign materials that have entered the underground piping during the course of the installation.

A.6.3.2 Testing of a system can be accomplished by pressurizing the system with water and checking visually for leakage at each joint or coupling.

Where pressure testing systems have rigid thermoplastic piping, such as listed CPVC, or flexible piping, such as listed polybutylene, the sprinkler system should be filled with water. The air should be bled from the highest and farthest sprinklers before the test pressure is applied. Compressed air or compressed gas never should be used for pressure testing CPVC piping. Testing with air pressure is permitted for polybutylene piping where conducted in accordance with the testing procedures of 16.2.2.1 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

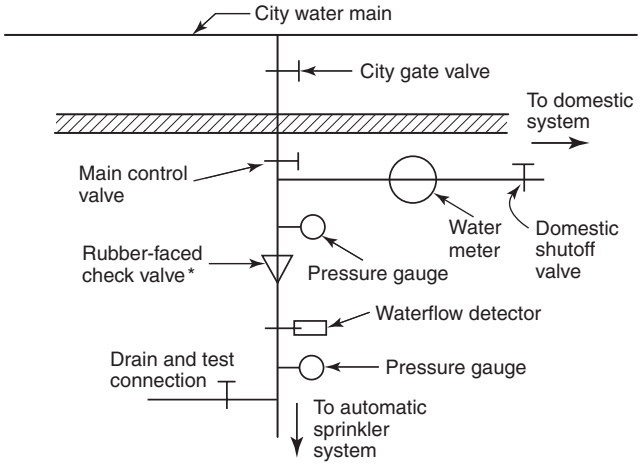
Fire department connections are not required for all systems covered by this standard but can be installed at the discretion of the owner. In these cases, hydrostatic tests in accordance with NFPA 13 are required.

Dry systems also should be tested by placing the system under air pressure. Any leak that results in a drop in system pressure greater than 2 psi (0.14 bar) in 24 hours should be corrected. Leaks should be identified using soapy water brushed on each joint or coupling. The presence of bubbles indicates a leak. This test should be made prior to concealing the piping.

A.6.5.3 The connection to city mains for fire protection is often subject to local regulation of metering and backflow prevention requirements. Preferred and acceptable water supply arrangements are shown in Figure A.6.5.3(a), Figure A.6.5.3(b), and Figure A.6.5.3(c). Where it is necessary to use a meter between the city water main and the sprinkler system supply, an acceptable arrangement as shown in Figure A.6.5.3(c) can be used. Under these circumstances, the flow characteristics of the meter are to be included in the hydraulic calculation of the system. Where a tank is used for both domestic and fire protection purposes, a low water alarm that actuates when the water level falls below 110 percent of the minimum quantity specified in 6.5.2 should be provided.

A.6.5.5 Table A.6.5.5(a) and Table A.6.5.5(b) can be used to determine a domestic design demand. Using Table A.6.5.5(a), the total number of water supply fixture units downstream of any point in the piping serving both sprinkler and domestic needs is determined. Using Table A.6.5.5(b), the appropriate total flow allowance is determined and added to the sprinkler demand at the total pressure required for the sprinkler system at that point.

A.6.6.2 These connections should be installed so that the valve can be opened fully and for a sufficient time period to ensure a proper test without causing water damage. The test



* Rubber-faced check valves are optional.

FIGURE A.6.5.3(a) Preferable Arrangement.