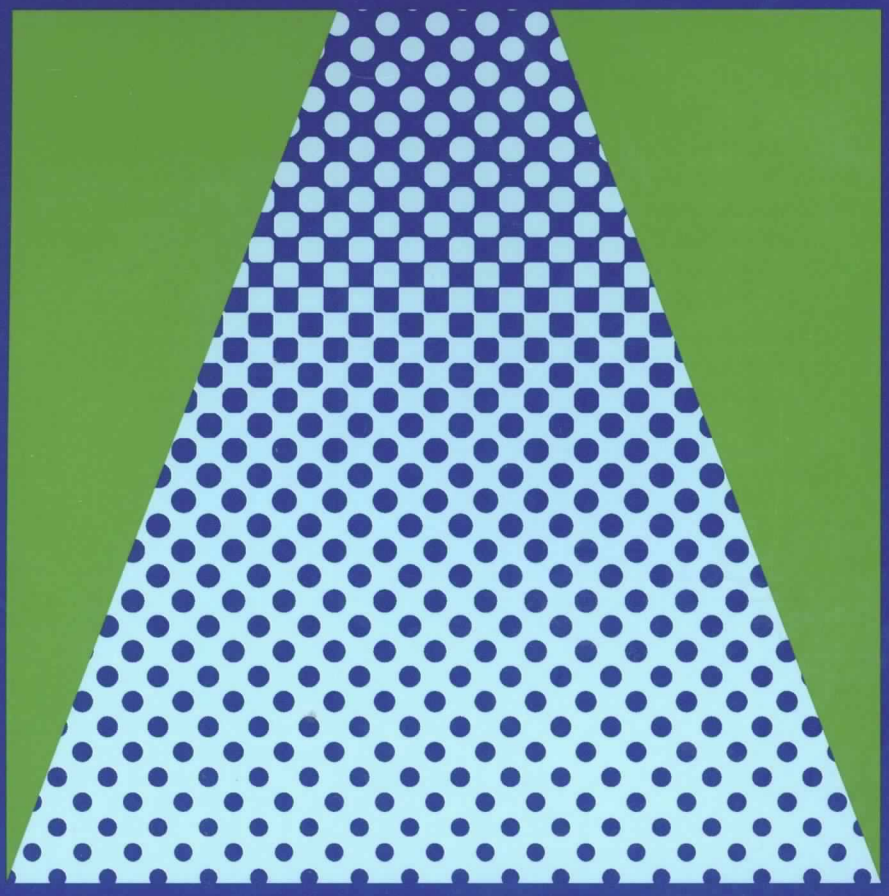
Installation of Sprinkler Systems

Residential Occupancies up to and Including Four Stories in Height



NFPA 13R
1999 Edition

National Fire Protection Association
An International Codes and Standards Organization

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NFPA 13R

Standard for the

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

1999 Edition

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 the National Fire Protection Association, Inc., at its May Meeting held May 17–20, 1999, in Baltimore, MD. It was issued by the Standards Council on July 22, 1999, with an effective date of August 13, 1999, and supersedes all previous editions.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

This edition of NFPA 13R was approved as an American National Standard on August 13, 1999.

Origin and Development of NFPA 13R

The first edition of NFPA 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. Other changes included a number of clarifications concerning the selection of sprinklers as well as the proper use of sprinklers.

The 1999 edition clarifies criteria for nonmetallic pipe and fittings and establishes 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.

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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.

Committee Scope: The 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 fire pumps, nor the construction and installation of gravity and pressure 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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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.

Committee Scope: The 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.

Contents

NFPA 13R

Standard for the

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

1999 Edition

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

Information on referenced publications can be found in Chapter 3 and Appendix B.

Chapter 1 General Information

1-1* **Scope.** This standard covers 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 is 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 is 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.

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.

1-3 Definitions.

Approved.* Acceptable to the authority having jurisdiction.

Authority Having Jurisdiction.* The organization, office, or individual responsible for approving equipment, materials, an installation, or a procedure.

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

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

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

Dry System. A system employing automatic sprinklers attached to a piping system containing air under atmospheric or higher pressures. Loss of pressure from the opening of a sprinkler or detection of a fire condition causes the release of water into the piping system and out the opened sprinkler.

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.

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.

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.

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

Preaction 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. Actuation of the detection system opens a valve that allows water to flow into the sprinkler piping system and to be discharged from any sprinklers that are open.

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 (slow evacuation type with 16 or fewer occupants and prompt evacuation type), and (4) Hotels, motels, and dormitories.

Residential Sprinkler. A type of sprinkler that meets the definition of fast response as defined by 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 that is listed for use in the protection of dwelling units.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Sprinkler, Automatic. 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.

Sprinkler System. An integrated system of piping, connected to a water supply, with listed sprinklers that automatically initiate water discharge over a fire area. Where required, the sprinkler system also includes a control valve and a device for actuating an alarm when the system operates.

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, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

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

Thermal Barrier. A material that limits the average temperature rise of the unexposed surface to not more than 250°F (121°C) after 15 minutes of fire exposure and that complies with the standard time-temperature curve of

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

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

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

Wet System. A system employing automatic sprinklers that are attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by a fire.

1-4* Units. Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI). The liter and bar units are outside of but recognized by SI and are commonly used in international fire protection. These units are provided in Table 1-4 with their conversion factors.

Table 1-4 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 = 105 Pa

Table 1-5.1 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

1-4.1 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. A given equivalent value is considered to be approximate.

1-4.2 SI units have been converted by multiplying the quantity by the conversion factor and then rounding the result to the appropriate number of significant digits.

1-5 Piping.

1-5.1* Pipe or tube used in sprinkler systems shall be of the materials specified in Table 1-5.1 or in accordance with 1-5.2 through 1-5.5. The chemical properties, physical properties, and dimensions of the materials in Table 1-5.1 shall be at least equivalent to the standards cited in the table and designed to withstand a working pressure of not less than 175 psi (12.1 bar). When nonmetallic piping is used, it shall be rated at not less than 175 psi (12.1 bar) working pressure at not less than 120°F (49°C).

1-5.2* Other types of pipe or tube shall be permitted to be used where listed for sprinkler systems. Listed piping materials including but not limited to chlorinated polyvinyl chloride (CPVC), polybutylene (PB), and steel differing from those provided in Table 1-5.1 shall be installed in accordance with their listings and the manufacturers' installation instructions. CPVC and PB pipe shall comply with the portions of the American Society for Testing and Materials (ASTM) standards specified in Table 1-5.2 that apply to fire protection service in addition to the provisions of this paragraph.

Table 1-5.2 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

Note: In addition to satisfying these minimum standards, specially listed pipe shall be required to comply with the provisions of 1-5.2.

1-5.3 Wherever the word *pipe* is used in this standard, it shall be understood also to mean *tube.*

1-5.4 Pipe joined with mechanical grooved fittings shall be joined by a listed combination of fittings, gaskets, and grooves. Where grooves are cut or rolled on the pipe, they shall be dimensionally compatible with the fittings.

Exception: Steel pipe with wall thicknesses less than those of Schedule 30 [sizes 8 in. (203 mm) and larger] or Schedule 40 [sizes less than 8 in. (203 mm)] shall not be joined by fittings used with pipe having cut grooves.

1-5.5 Fittings used in sprinkler systems shall be of the materials listed in Table 1-5.5 or in accordance with 1-5.7. The chemical properties, physical properties, and dimensions of the materials specified in Table 1-5.5 shall be at least equivalent to the standards cited in the table. Fittings used in sprinkler systems shall be designed to withstand a working pressure of not less than 175 psi (12.1 bar). When nonmetallic fittings are used, they shall be rated at not less than 175 psi (12.1 bar) working pressure at not less than 120°F (49°C).

1-5.6 Joints for the connection of copper shall be brazed.

Exception: Soldered joints (95-5 solder metal) shall be permitted for wet pipe copper tube systems.

1-5.7* Other types of fittings shall be permitted to be used, but only where listed for sprinkler systems. Listed fittings including but not limited to CPVC, PB, and steel differing from those provided in Table 1-5.5 shall be installed in accordance with their listings and the manufacturers' installation instructions. CPVC and PB pipe fittings shall comply with the portions of the ASTM standards specified in Table 1-5.7 that apply to fire protection service in addition to the provisions of this paragraph.

Table 1-5.5 Fitting Materials and Dimensions

Materials and Dimensions	Standard
Cast Iron:	
Gray 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

Table 1-5.7 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

Note: In addition to satisfying these minimum standards, specially listed pipe fittings are required to comply with the provisions of 1-5.7.

1-6 System Types.

1-6.1 Wet Pipe Systems. A wet pipe system shall be used where all piping is installed in areas not subject to freezing.

1-6.2* Protection of Piping.

1-6.2.1* Provision shall be made to protect piping from freezing in unheated areas 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 heated areas

1-6.2.2* Antifreeze systems, dry pipe systems, and preaction systems shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

Chapter 2 Working Plans, Design, Installation, Acceptance Tests, and Maintenance

2-1 Working Plans and Acceptance Tests.

2-1.1 Working Plans.

2-1.1.1 Working plans shall be submitted for approval to the authority having jurisdiction before any equipment is installed or remodeled. Deviations from approved plans shall require permission of the authority having jurisdiction.

2-1.1.2 Working plans shall be drawn to a specified scale on sheets of uniform size, shall provide a plan of each floor, shall be capable of being easily duplicated, and shall indicate the following:

(1) The name of owner and occupant
(2) The location, including street address
(3) The point of compass
(4) The ceiling construction
(5) The full height cross section
(6) The location of fire walls
(7) The location of partitions
(8) The occupancy of each area or room
(9) The location and size of concealed spaces, attics, closets, and bathrooms
(10) Any small enclosures in which no sprinklers are to be installed
(11) The 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) The make, manufacturer, type, heat-response element, temperature rating, and nominal orifice size of the sprinkler
(13) The temperature rating and location of high-temperature sprinklers
(14) The number of sprinklers on each riser, per floor
(15) The kind and location of alarm bells
(16) The type of pipe and fittings
(17) The type of protection for nonmetallic pipe
(18) * The nominal pipe size with lengths shown to scale
(19) The location and size of riser nipples
(20) The types of fittings and joints and the locations of all welds and bends
(21) The 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) The 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) The name and address of the contractor

2-1.2 Approval of Sprinkler Systems.

2-1.2.1 The installer shall perform all required acceptance tests *(see 2-1.3)*, complete the contractor's material and test certificate(s) *(see Figure 2-1.2.1)*, and forward the certificate(s) to the authority having jurisdiction prior to asking for approval of the installation.

2-1.2.2 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.

2-1.3 Acceptance Tests.

2-1.3.1 Flushing of Underground Connections.

2-1.3.1.1 Underground mains and lead-in connections to system risers shall 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. For all systems, the flushing operation shall be continued until the water is clear.

2-1.3.1.2 Underground mains and lead-in connections shall be flushed at the hydraulically calculated water demand rate of the system.

2-1.3.1.3 To avoid property damage, provision shall be made for the disposal of water issuing from test outlets.

2-1.3.2* Hydrostatic Pressure Tests. Hydrostatic pressure tests shall be provided in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

Exception: Testing for leakage at a water pressure of 50 psi (3.4 bar) above the maximum system pressure shall be permitted for systems having fewer than 20 sprinklers and no fire department connection.

2-2 Design and Installation Devices and Materials.

2-2.1 Only new sprinklers shall be employed in the installation of sprinkler systems. At least three spare sprinklers of each type, temperature rating, and orifice size used in the system shall be kept on the premises. Replacement sprinklers shall have the same operating characteristics as the sprinklers being replaced.

2-2.1.1 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.

2-2.2 Only listed or approved devices and materials as specified in this standard shall be used in sprinkler systems.

2-2.3 Sprinkler systems shall be designed for a maximum working pressure of 175 psi (12.1 bar).

Exception: Higher design pressures shall be permitted to be used where all system components are rated for pressures higher than 175 psi (12.1 bar).

2-2.4* Waterflow test connections shall be provided at locations that allow flow testing of water supplies, connections, and alarm mechanisms.

2-3 Water Supply.

2-3.1 General Provisions. Every automatic sprinkler system shall have at least one automatic water supply. Where stored water is used as the sole source of supply, the minimum quantity shall equal the water demand rate times 30 minutes. *(See 2-5.1.3.)*

2-3.2* Water Supply Sources. The following water supply sources shall be acceptable.

(1) A connection to a reliable waterworks system with or without a pump, as required. Fire pumps shall be installed in accordance with NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection.*
(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, installed in accordance with NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection.*

2-3.3 Multipurpose Piping System.

2-3.3.1* A common supply main to the building, serving both the sprinklers and domestic use, shall be permitted where the domestic design demand is added to the sprinkler system demand and the total demand flow does not exceed the maximum allowable flow of the piping system components.

Exception: Domestic design demand shall not be required to be added where provision is made to prevent flow on the domestic water system upon operation of sprinklers.

2-3.3.2 Sprinkler systems with nonfire protection connections shall comply with Section 3-6 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

2-4 System Components.

2-4.1 Valve and Drains.

2-4.1.1 Where a common supply main is used to supply both domestic and sprinkler systems, a single, listed control valve shall be provided to shut off both the domestic and sprinkler systems, and a separate shutoff valve shall be provided for the domestic system only. *[See Figure A-2-3.2(a).]*

Exception: The sprinkler system piping shall be permitted to have a separate control valve where supervised by one of the following methods:

(a) Central station, proprietary, or remote station alarm service

(b) Local alarm service that causes the sounding of an audible signal at a constantly attended location

(c) Valves that are locked open

2-4.1.2 Each sprinkler system shall have a 1-in. (25.4-mm) or larger drain and test connection with a valve on the system side of the control valve.

2-4.1.3 Additional $^1/_2$-in. (13-mm) drains shall be installed for each trapped portion of a dry system that is subject to freezing temperatures.

Figure 2-1.2.1 Contractor's material and test certificate for aboveground piping.

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[1]		Water pressure	Air pressure	Trip point air pressure	Time water reached test outlet[1]		Alarm operated properly	
	Minutes	Seconds	psi	psi	psi	Minutes	Seconds	Yes	No
Without Q.O.D.									
With Q.O.D.									

If no, explain

[1] Measured from time inspector's test connection is opened

Figure 2-1.2.1 *(Continued)*

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 | If no, state reason

Dry piping pneumatically tested ☐ Yes ☐ No

Equipment operates properly ☐ Yes ☐ No

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 copy of the U Form No. 85B ☐ 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 be 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 2-1.2.1 *(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			

2-4.2 Fire Department Connection. At least one $1^1/_2$-in. (38-mm) or $2^1/_2$-in. (64-mm) fire department connection shall be provided.

Exception No. 1: Buildings located in remote areas that are inaccessible for fire department support.

Exception No. 2: Single-story buildings not exceeding 2000 ft² (186 m²) in area.

2-4.3 Pressure Gauges. Pressure gauges shall be provided to indicate pressures on the supply and system sides of main check valves and dry pipe valves and to indicate pressure on water supply pressure tanks.

2-4.4* Piping Support. Piping hanging and bracing methods shall comply with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

2-4.5 Sprinklers.

2-4.5.1 Listed residential sprinklers shall be used. Listing shall be based on tests to establish the ability of the sprinklers to control residential fires under standardized fire test conditions. The standardized room fires shall be based on a residential array of furnishings and finishes.

Exception No. 1: Residential sprinklers shall not be used in dry pipe systems unless specifically listed for that purpose.

Exception No. 2: Listed quick-response sprinklers shall be permitted to be installed in dwelling units meeting the definition of a compartment as defined in 2-5.1.2.2, provided no more than four sprinklers are located in the dwelling unit.

2-4.5.2 Temperature Ratings. The requirements of 2-4.5.2.1 through 2-4.5.2.3 shall be used for the selection of sprinkler temperature ratings.

2-4.5.2.1 Ordinary temperature–rated residential sprinklers [135°F to 170°F (57°C to 77°C)] shall be installed where maximum ambient ceiling temperatures do not exceed 100°F (38°C).

2-4.5.2.2 Intermediate temperature–rated residential sprinklers [175°F to 225°F (79°C to 107°C)] shall be installed where maximum ambient ceiling temperatures are between 101°F and 150°F (39°C and 66°C).

2-4.5.2.3 The following practices shall be observed when installing residential sprinklers.

Exception: Where higher expected ambient temperatures are otherwise determined.

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

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

(3) Sprinklers installed near specific heat sources that are identified in Table 2-4.5.2.3 shall be of ordinary- or intermediate-temperature rating, as indicated.

Exception: Where sprinklers are listed for positioning closer to a heat source than the minimum distance shown in Table 2-4.5.2.3, the closer minimum distances shall be permitted to be used.

2-4.5.3 Operated or damaged sprinklers shall be replaced with sprinklers having the same performance characteristics as the original equipment.

2-4.5.4 Where residential sprinklers are installed within a compartment, as defined in 2-5.1.2.2, all sprinklers shall have the same temperature classification.

Exception: Different temperature classifications shall be permitted where required by 2-4.5.2.3.

2-4.5.5 Standard or quick-response spray sprinklers shall be used in areas outside the dwelling unit.

Exception: Residential sprinklers shall be permitted to be used in adjoining corridors or lobbies with flat, smooth ceilings and a height not exceeding 10 ft (3.0 m).

2-4.5.6 Operated or damaged sprinklers shall be replaced with sprinklers having the same performance characteristics as the original equipment.

Table 2-4.5.2.3 Minimum Distances for Ordinary- and Intermediate-Temperature Residential Sprinklers

	Minimum Distance from Edge of Source to Ordinary-Temperature Sprinkler		Minimum Distance 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: 0W–250W	6	152	3	76
250W–499W	12	305	6	152

2-4.5.7 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.

2-4.5.8 Painting and Ornamental Finishes.

2-4.5.8.1 Sprinkler frames shall be permitted to be factory painted or enameled as ornamental finish in accordance with 2-4.5.8.2; otherwise, sprinklers shall not be painted, and any sprinklers that have been painted shall be replaced with new, listed sprinklers.

Exception: Sprinklers painted with factory-applied coatings shall not be required to be replaced.

2-4.5.8.2* Ornamental finishes shall not be applied to sprinklers by an individual other than the sprinkler manufacturer, and only sprinklers listed with such finishes shall be used.

2-4.6 Alarms. Local waterflow alarms shall be provided on all sprinkler systems and shall be connected to the building fire alarm system, where provided.

2-5 System Design.

2-5.1 Design Criteria — Inside Dwelling Unit.

2-5.1.1 Design Discharge. The system shall provide a discharge of not less than 18 gpm (68 L/min) to any single operating sprinkler and not less than 13 gpm (49 L/min) per sprinkler to the number of design sprinklers, but the discharge shall not be less than the listing of the sprinkler.

Exception: Design discharge for sprinklers installed in accordance with Exception No. 2 to 2-4.5.1 shall be in accordance with sprinkler listing criteria.

2-5.1.2* Number of Design Sprinklers.

2-5.1.2.1* The number of design sprinklers shall include all sprinklers within a compartment up to a maximum of four sprinklers under a flat, smooth, horizontal ceiling. For compartments containing two or more sprinklers, calculations shall be provided to verify the single operating sprinkler criteria and the multiple (two, three, or four) operating sprinkler criteria.

2-5.1.2.2 The definition of *compartment* as used in 2-5.1.2.1 for determining the number of design sprinklers shall be a space that is completely enclosed by walls and a ceiling. The compartment enclosure shall be permitted to have openings to an adjoining space, provided the openings have a minimum lintel depth of 8 in. (203 mm) from the ceiling.

2-5.1.3 Water Demand. The water demand for the system shall be determined by multiplying the design discharge specified in 2-5.1.1 by the number of design sprinklers specified in 2-5.1.2.

2-5.1.4 Sprinkler Coverage.

2-5.1.4.1 Residential sprinklers shall be spaced so that the maximum area protected by a single sprinkler does not exceed 144 ft^2 (13.4 m^2).

2-5.1.4.2 The maximum distance between sprinklers shall not exceed 12 ft (3.7 m), and the maximum distance to a wall or partition shall not exceed 6 ft (1.8 m).

2-5.1.4.3 The minimum distance between sprinklers within a compartment shall be 8 ft (2.4 m).

2-5.1.5 Operating Pressure. The minimum operating pressure of any sprinkler shall be in accordance with the listing information of the sprinkler and shall provide the minimum flow rates specified in 2-5.1.1.

2-5.1.6 Application rates, design areas, areas of coverage, and minimum design pressures other than those specified in 2-5.1.1, 2-5.1.2, 2-5.1.4, and 2-5.1.5 shall be permitted to be used with special sprinklers that have been listed for such specific residential installation conditions. The minimum operating pressure of any residential sprinkler shall be 7 psi (0.5 bar).

2-5.1.7 Position of Residential Sprinklers.

2-5.1.7.1 Pendent and upright sprinklers shall be positioned so that the deflectors are within 1 in. to 4 in. (25.4 mm to 102 mm) from the ceiling.

Exception: Special residential sprinklers shall be installed in accordance with the listing limitations.

2-5.1.7.2 Sidewall sprinklers shall be positioned so that the deflectors are within 4 in. to 6 in. (102 mm to 152 mm) from the ceiling.

Exception: Special residential sprinklers shall be installed in accordance with the listing limitations.

2-5.1.7.3* 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.

2-5.1.8 Sprinklers in Closets and Storage Areas. In closets and storage areas that are required to be protected in accordance with Section 2-6 and are less than 5 ft (1.5 m) in height at the lowest ceiling, a single sprinkler located at the highest ceiling shall be permitted to protect a volume not larger than 300 ft^3 (8.93 m^3).

2-5.2 Design Criteria — Outside Dwelling Unit. The design discharge, number of design sprinklers, water demand of the system, sprinkler coverage, and position of sprinklers for areas to be sprinklered outside the dwelling unit shall comply with specifications in NFPA 13, *Standard for the Installation of Sprinkler Systems.*

Exception No. 1: Where compartmented into areas of 500 ft^2 (46 m^2) or less by 30-minute fire-rated construction and the area is protected by standard or quick-response sprinklers not exceeding 130 ft^2 (12 m^2) per sprinkler, the system demand shall be permitted to be limited to the number of sprinklers in the compartment area but shall not be less than the demand for a total of four sprinklers. Openings from the compartments shall not be required to be protected, provided such openings have a lintel at least 8 in. (203 mm) in depth and the total area of such openings does not exceed 50 ft^2 (4.6 m^2) for each compartment. Discharge density shall be appropriate for the hazard classification as determined by NFPA 13.

Exception No. 2: Lobbies, other than in hotels and motels, foyers, corridors, and halls outside the dwelling unit, with flat, smooth ceilings not exceeding 10 ft (3.0 m) in height, shall be permitted to be protected with residential sprinklers, with a maximum system demand of four sprinklers.

Exception No. 3: Garage doors shall not be considered obstructions and shall be permitted to be ignored for placement and calculation of sprinklers.

2-5.3 Pipe Sizing. Piping shall be sized using hydraulic calculation procedures in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems.*

2-6 Location of Sprinklers. Sprinklers shall be installed in all areas.

Exception No. 1: Sprinklers shall not be required in bathrooms where the area does not exceed 55 ft^2 (5.1 m^2) and the walls and ceilings, including walls and ceilings behind fixtures, are of noncombustible or limited-combustible materials providing a 15-minute thermal barrier. The area occupied by a noncombustible, full height, shower/bathtub enclosure shall not be required to be added to the floor area when determining the area of the bathroom.

Exception No. 2: Sprinklers shall not be required in clothes closets, linen closets, and pantries within the dwelling units where the area of the space does not exceed 24 ft^2 (2.2 m^2), the least dimension does not exceed 3 ft (0.91 m), and the walls and ceilings are surfaced with noncombustible or limited-combustible materials as defined by NFPA 220, Standard on Types of Building Construction.

Exception No. 3: Sprinklers shall not be required in any porches, balconies, corridors, and stairs that are open and attached.

Exception No. 4: Sprinklers shall not be required in attics, penthouse equipment rooms, crawl spaces, floor/ceiling spaces, elevator shafts, and other concealed spaces that are not used or intended for living purposes or storage.

Exception No. 5: 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.

2-7* Maintenance. The owner shall be responsible for the condition of a sprinkler system and shall keep the system in normal operating condition. 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.*

Chapter 3 Referenced Publications

3-1 The following documents or portions thereof are referenced within this standard as mandatory requirements and shall be considered part of the requirements of this standard. The edition indicated for each referenced mandatory document is the current edition as of the date of the NFPA issuance of this standard. Some of these mandatory documents might also be referenced in this standard for specific informational purposes and, therefore, are also listed in Appendix B.

3-1.1 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,* 1999 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®,* 1997 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.

3-1.2 Other Publications.

3-1.2.1 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.

3-1.2.2 ASME Publications. American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.

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.

3-1.2.3 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.

3-1.2.4 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.

Appendix A Explanatory Material

Appendix A is not a part of the requirements of this NFPA document but is included for informational purposes only. This appendix 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. Residential portions of any other building should be protected with residential or quick-response sprinklers in accordance with 5-4.5 of NFPA 13. Other portions of such buildings should be protected in accordance with NFPA 13.

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 Figures A-1-1(a), A-1-1(b), and 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).

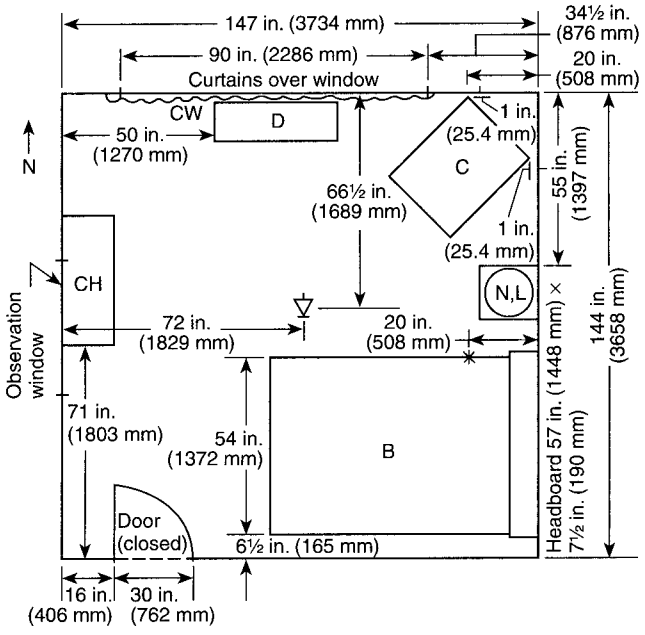
To be effective, sprinkler systems installed in accordance with this standard need to open the sprinklers closest to the fire before the fire exceeds the ability of the sprinkler discharge to extinguish or control the fire. Conditions that allow the fire to grow beyond that point before sprinkler activation 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.)*

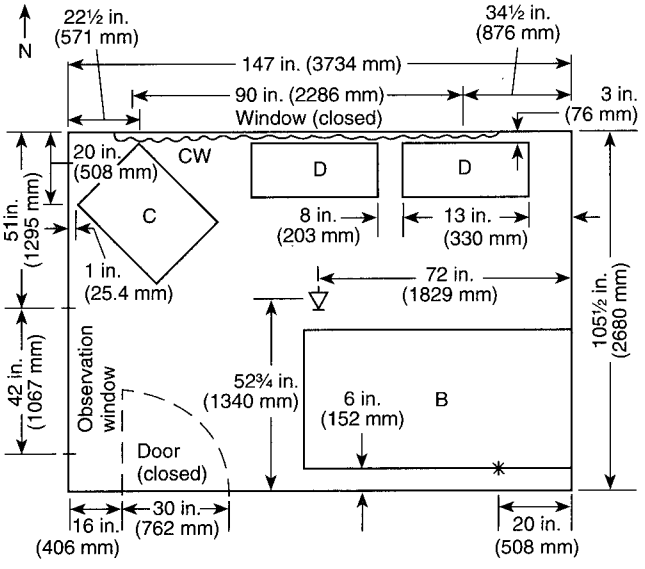
It should be recognized that the omission of sprinklers from certain areas could result in the development of untenable conditions in adjacent spaces. Where evacuation times could be delayed, additional sprinkler protection and other fire protection features, such as detection and compartmentation, could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

Figure A-1-1(a) Bedroom.



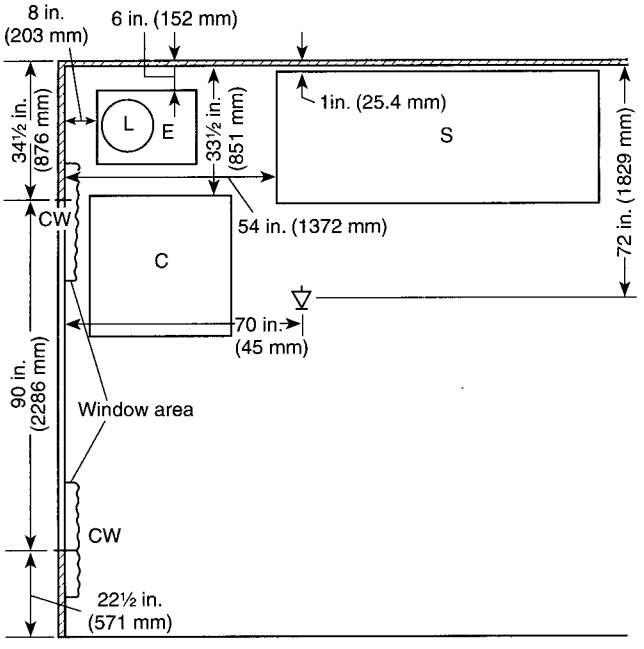
✳	Ignition	C	Chair
▽	Sprinkler	B	Bed
CW	Curtains	N	Nightstand
D	Dresser	L	Lamp
CH	Chest		

Figure A-1-1(b) Mobile home bedroom.



✳	Ignition	D	Dresser
▽	Sprinkler	C	Chair
CW	Curtains	B	Bed

Figure A-1-1(c) Living room.



S	Sofa	C	Chair
E	End table	CW	Curtains
L	Lamp	▽	Sprinkler

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.

A-1-3 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, 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-1-3 Authority Having Jurisdiction. The phrase "authority having jurisdiction" 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 individual 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-1-3 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-1-4 For additional conversions and information, see ASTM SI 10, *Standard for Use of the International System of Units (SI): the Modern Metric System.*

A-1-5.1 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.

A-1-5.2 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 1-5.1 and 1-5.2 is listed for fire sprinkler service. Listed pipe is identified by the logo of the listing agency.

A-1-5.7 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 1-5.5 and 1-5.7 are listed for fire sprinkler service. Listed fittings are identified by the logo of the listing agency.

A-1-6.2 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.

A-1-6.2.1 Piping covered by insulation, as shown in Figures A-1-6.2.1(a) through A-1-6.2.1(e), is considered part of the area below the ceiling and not part of the unheated attic area.

Figure A-1-6.2.1(a) Insulation recommendations — Arrangement.

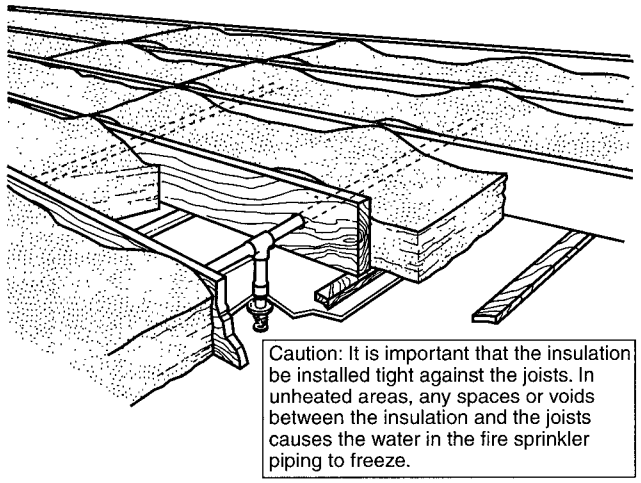


Figure A-1-6.2.1(b) Insulation recommendations — Arrangement 2.

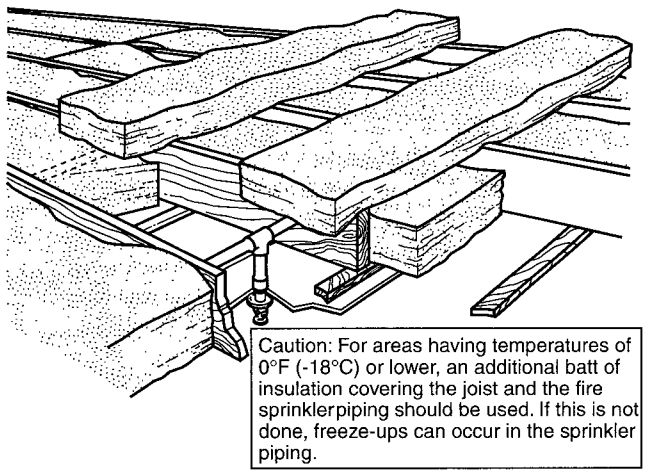


Figure A-1-6.2.1(c) Insulation recommendations — Arrangement 3.

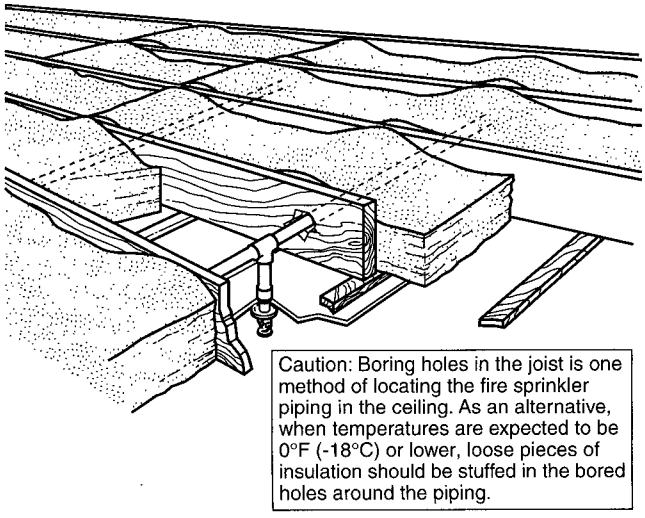
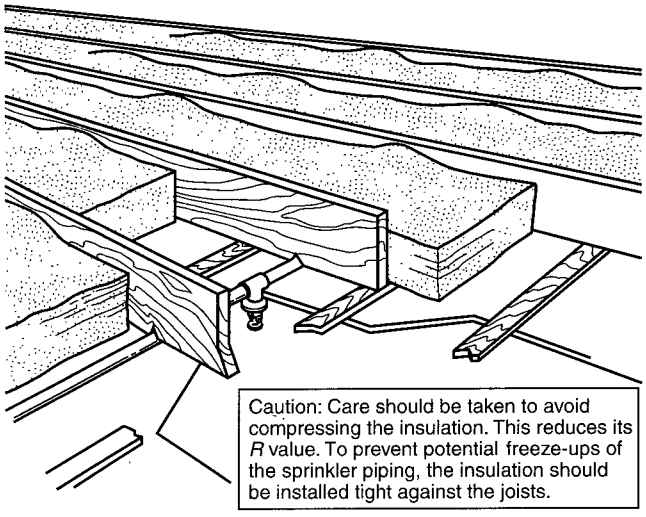


Figure A-1-6.2.1(d) Insulation recommendations — Arrangement 4.



A-1-6.2.2 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).

A-2-1.1.2(18) Where typical branch lines prevail, it will be necessary to size only one line.

A-2-1.3.2 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 10-2.3 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-2-2.4 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 connection should be designed and sized to verify the sufficiency of the water supply and alarm mechanisms.

A-2-3.2 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 Figures A-2-3.2(a), A-2-3.2(b), and A-2-3.2(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-2-3.2(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 2-3.1 should be provided.

Figure A-1-6.2.1(e) Insulation recommendations — Arrangement 5.

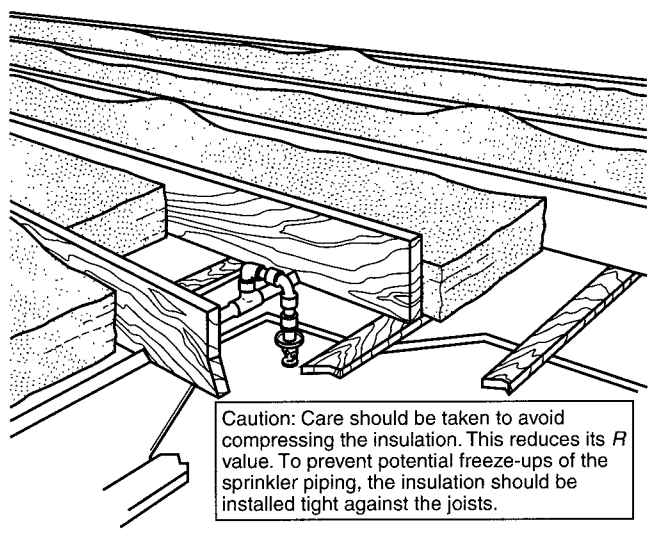
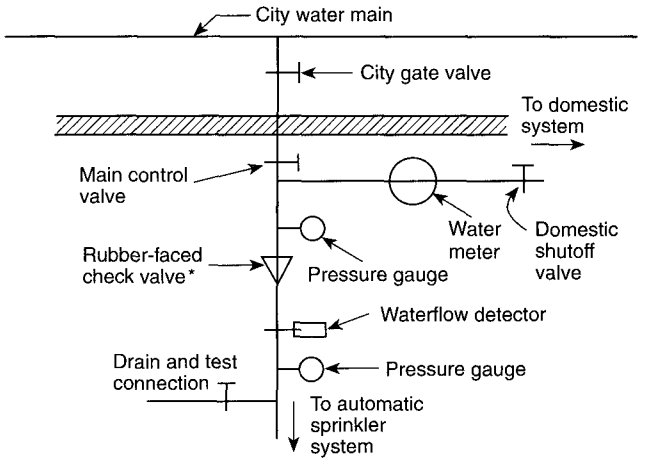
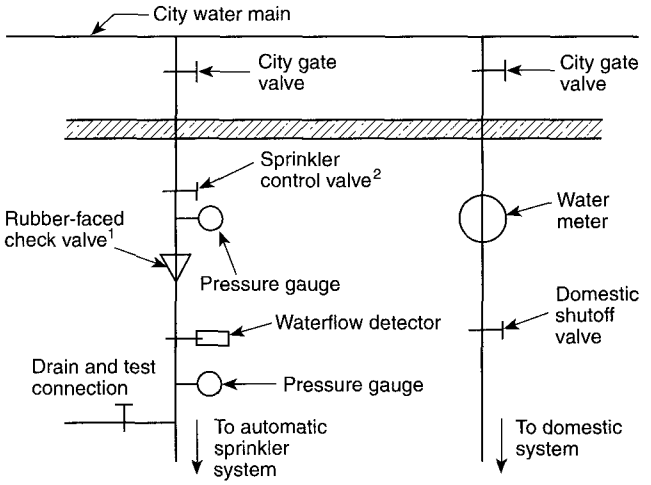


Figure A-2-3.2(a) Preferable arrangement.



* Rubber-faced check valves are optional.

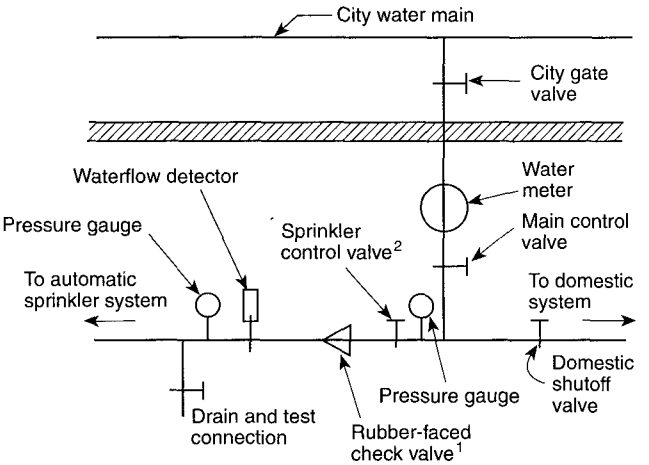
Figure A-2-3.2(b) Acceptable arrangement with valve supervision (see 2-4.1.1, Exception).



[1] Rubber-faced check valves are optional.
[2] Option: See 2-4.1.1, Exception.

A-2-3.3.1 Tables A-2-3.3.1(a) and A-2-3.3.1(b) can be used to determine a domestic design demand. Using Table A-2-3.3.1(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-2-3.3.1(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.

Figure A-2-3.2(c) Acceptable arrangement with valve supervision (see 2-4.1.1, Exception).



[1] Rubber-faced check valves are optional.
[2] Option: See 2-4.1.1, Exception.

Table A-2-3.3.1(a) Fixture Load Values

Private Facilities (within individual dwelling units)	Unit
Bathroom group with flush tank (including lavatory, water closet, and bathtub with shower)	6
Bathroom group with flush valve	8
Bathtub	2
Dishwasher	1
Kitchen sink	2
Laundry trays	3
Lavatory	1
Shower stall	2
Washing machine	2
Water closet with flush valve	6
Water closet with flush tank	3
Public Facilities	**Unit**
Bathtub	4
Drinking fountain	0
Kitchen sink	4
Lavatory	2
Service sink	3
Shower head	4
Urinal with 1-in. (25.4-mm) flush valve	10
Urinal with $^3/_4$-in. (19-mm) flush valve	5
Urinal with flush tank	3
Washing machine [8 lb (17.6 kg)]	3
Washing machine [16 lb (35.2 kg)]	4
Water closet with flush valve	10
Water closet with flush tank	5

Table A-2-3.3.1(b) Total Estimated Domestic Demand

Total Fixture Load Units [from Table A-2-3.3.1(a)]	Total Demand			
	For Systems with Predominately Flush Tanks		For Systems with Predominately Flush Valves	
	gpm	L/min	gpm	L/min
1	3	11.25	—	—
2	5	18.75	—	—
5	10	37.5	15	56
10	15	56	25	94
20	20	75	35	13
35	25	94	45	169
50	30	113	50	187
70	35	131	60	225
100	45	169	70	262
150	55	200	80	300
200	65	244	90	337
250	75	261	100	375
350	100	375	125	469
500	125	469	150	562
750	175	656	175	656
1000	200	750	200	750
1500	275	1031	275	1031
2000	325	1219	325	1219
3500	500	1875	500	1875

Figure A-2-5.1.2(a) Sprinkler design areas for typical residential occupancy — without lintel.

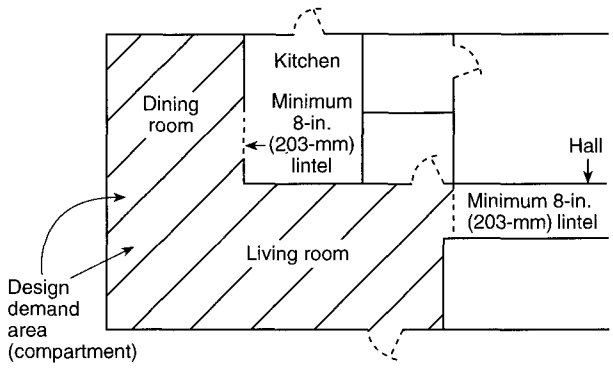
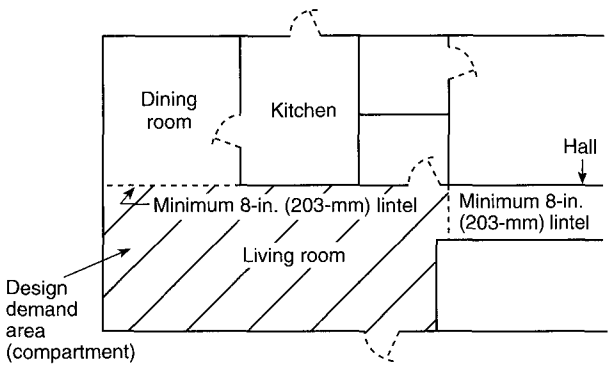


Figure A-2-5.1.2(b) Sprinkler design areas for typical residential occupancy — with lintel.



A-2-4.4 Sprinkler piping should be adequately secured to restrict the movement of piping upon sprinkler operation. The reaction forces caused by the flow of water through the sprinkler could result in displacement of the sprinkler, thereby adversely affecting sprinkler discharge. Listed CPVC pipe and listed PB pipe have specific requirements for piping support to include additional pipe bracing at sprinklers.

A-2-4.5.8.2 Decorative painting of a residential sprinkler is not to be confused with the temperature identification colors as referenced in 3-2.3 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

A-2-5.1.2 It is intended that the design area is to include up to four adjacent sprinklers that produce the greatest water demand within the compartment. *[See Figures A-2-5.1.2(a) and A-2-5.1.2(b).]*

A-2-5.1.2.1 Residential sprinklers are currently listed for use under flat, smooth, horizontal ceilings only. Sloped, beamed, and pitched ceilings could require special design features such as larger flows or a design for five or more sprinklers to operate in the compartment.

A-2-5.1.7.3 Fire testing has indicated the need to wet walls in the area protected by residential sprinklers at a level closer to the ceiling than that accomplished by standard sprinkler distribution. Where beams, light fixtures, sloped ceilings, and other obstructions occur, additional residential sprinklers could be necessary to achieve proper response and distribution, and a greater water supply could be necessary. Table A-2-5.1.7.3 and Figure A-2-5.1.7.3 provide guidance for the location of sprinklers near ceiling obstructions.

Small areas created by architectural features such as planter box windows, bay windows, and similar features can be evaluated as follows.

(a) Where no additional floor area is created by the architectural feature, no additional sprinkler protection is required.

(b) Where additional floor area is created by an architectural feature, no additional sprinkler protection is required, provided all of the following conditions are met.

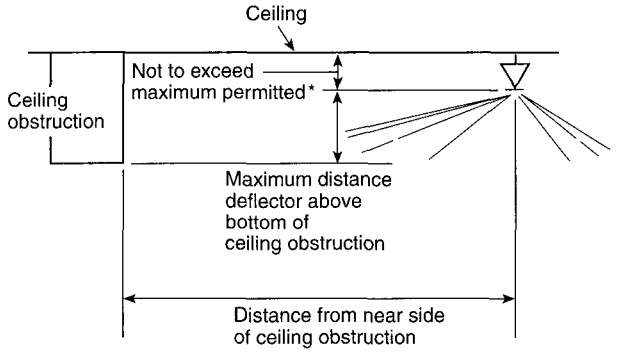
(1) The floor area does not exceed 18 ft^2 (1.7 m^2).
(2) The floor area is not greater than 2 ft (0.65 m) in depth at the deepest point of the architectural feature to the plane of the primary wall where measured along the finished floor.
(3) The floor is not greater than 9 ft (2.9 m) in length where measured along the plane of the primary wall.

Measurement from the deepest point of the architectural feature to the sprinkler should not exceed the maximum listed spacing of the sprinkler. The hydraulic design is not required to consider the area created by the architectural feature.

Table A-2-5.1.7.3 Positioning of Sprinklers to Avoid Obstructions to Discharge

Distance from Sprinkler to Side of Ceiling Obstruction		Maximum Distance from Sprinkler Deflector to Bottom of Ceiling Obstruction	
		in.	mm
<6 in.	<152 mm	Not permitted	
6 in. to <1 ft	152 mm to <305 mm	0	0
1 ft to <2 ft	0.32 m to <0.64 m	1	25.4
2 ft to <2 ft 6 in.	0.64 m to <0.80 m	2	51
2 ft 6 in. to <3 ft	0.80 m to <0.97 m	3	76
3 ft to <3 ft 6 in.	0.97 m to <1.13 m	4	102
3 ft 6 in. to <4 ft	1.13 m to <1.29 m	6	152
4 ft to <4 ft 6 in.	1.29 m to <1.45 m	7	178
4 ft 6 in. to <5 ft	1.45 m to <1.61 m	9	229
5 ft to <5 ft 6 in.	1.61 m to <1.77 m	11	279
5 ft 6 in. to <6 ft	1.77 m to <1.93 m	14	356

Figure A-2-5.1.7.3 Position of deflector, upright or pendent, where located above bottom of ceiling obstruction.



* See 2-5.1.7.1 and 2-5.1.2.

A-2-7 The responsibility for properly maintaining a sprinkler system is that of the owner or manager, who should understand the sprinkler system operation. A minimum monthly maintenance program should include the following.

(1) Visual inspection of all sprinklers to ensure against obstruction of spray.
(2) Inspection of all valves to ensure that they are open.
(3) Testing of all waterflow devices.
(4) Testing of the alarm system, where installed.

NOTE: Where it is likely that the test will result in a fire department response, notification to the fire department should be made prior to the test.

(5) Operation of pumps, where employed. *(See NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection.)*
(6) Checking of the pressure of air used with dry systems.
(7) Checking of the water level in tanks.
(8) Special attention to ensure that sprinklers are not painted either at the time of installation or during subsequent redecoration. When sprinkler piping or areas next to sprinklers are being painted, the sprinklers should be protected by covering them with a bag, which should be removed immediately after painting is finished.

(For further information, see NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.)

Appendix B Referenced Publications

B-1 The following documents or portions thereof are referenced within this standard for informational purposes only and are thus not considered part of the requirements of this standard unless also listed in Chapter 3. The edition indicated here for each reference is the current edition as of the date of the NFPA issuance of this standard.

B-1.1 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*, 1999 edition.

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

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

B-1.2 Other Publications.

B-1.2.1 ASTM Publications. American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 3309, *Standard Specification for Polybutylene (PB) Plastic Hot- and Cold-Water Distribution Systems*, 1995.

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.

ASTM SI 10, *Standard for Use of the International System of Units (SI): the Modern Metric System*, 1997.

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