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NFPA 13D

Sprinkler Systems— One- and Two- Family Dwellings 1984



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The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

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**Standard for the
Installation of Sprinkler Systems in
One- and Two-Family Dwellings
and Mobile Homes**

NFPA 13D-1984

1984 Edition of NFPA 13D

This edition of NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes*, was prepared by the Technical Committee on Automatic Sprinklers, released by the Correlating Committee on Water Extinguishing Systems, and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 21-24, 1984 in New Orleans, Louisiana. It was issued by the Standards Council on June 14, 1984, with an effective date of July 5, 1984, and supersedes all previous editions.

The 1984 edition of this standard has been approved by the American National Standards Institute as an American National Standard.

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.

Origin and Development of NFPA 13D

Recognizing the need to reduce the annual life loss from fire in residential occupancies (about 50 percent of total loss of life by fire), the Committee on Automatic Sprinklers appointed a subcommittee in May 1973 to prepare a Standard on the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes. The Subcommittee was composed of members of the Committee on Automatic Sprinklers and other technically competent experts. The standard was submitted and adopted at the Annual Meeting in Chicago, IL on May 12-16, 1975.

The 1980 edition was a complete rewrite of the 1975 edition including SI units where appropriate. The 1980 edition incorporated the results of the residential sprinkler test program administered by the National Fire Protection Association, and funded by a research grant from the United States Fire Administration. Factory Mutual Research Corporation and the Los Angeles City Fire Department conducted the dwelling tests. Factory Mutual Research Corporation, McNeary Insurance Consulting Services and the Charlotte, North Carolina Fire Department conducted the mobile home tests. Further amendments were made in 1984.

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Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes

NFPA 13D-1984

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

Information on referenced publications can be found in Chapter 5.

Preface

It is intended that this standard provide a method for those individuals wishing to install a sprinkler system for additional life safety and property protection. It is not the purpose of this standard to require the installation of an automatic sprinkler system. This standard assumes that one or more smoke detectors will be installed in accordance with NFPA 74, *Standard for the Installation, Maintenance, and Use of Household Fire Warning Equipment*.

Chapter 1 General Information

1-1* Scope. This standard deals with the design and installation of automatic sprinkler systems for one- and two-family dwellings and mobile homes.

1-2* Purpose. The purpose of this standard is to provide a sprinkler system that will aid in the detection and control of residential fires and thus provide improved protection against injury, life loss, and property damage. A sprinkler system installed in accordance with this standard is expected to prevent flashover (total involvement) in the room of fire origin, when sprinklered, and to improve the chance for occupants to escape or be evacuated.

Guidelines are established for the design and installation of sprinkler systems for one- and two-family dwellings and mobile homes. Nothing in this standard is intended to restrict new technologies or alternate arrangements providing the level of safety prescribed by the standard is not lowered.

1-3* Definitions.

Approved. Acceptable to the "authority having jurisdiction."

NOTE: 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 or 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 concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: 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, 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 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."

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

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

Design Discharge. Rate of water discharged by an automatic sprinkler expressed in gallons-per-minute.

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. Any building which contains not more than one or two "dwelling units" intended to be used, rented, leased, let or hired out to be occupied, or which are occupied for habitation purposes.

Dwelling Unit. One or more rooms arranged for the use of one or more individuals living together as in a single housekeeping unit, normally having 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 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 or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of

listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which 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.

Mobile Home. A factory-assembled structure equipped with service connections and made so as to be readily movable as a unit on its running gear and designed to be used as a dwelling unit with or without a foundation.

Multipurpose Piping Systems. Piping systems within dwellings and mobile homes intended to serve both domestic and fire protection needs.

Preengineered System. A packaged sprinkler system including all components connected to the water supply designed to be installed according to pretested limitations.

Pump. A mechanical device that transfers and/or raises the pressure of a fluid (water).

Residential Sprinkler. An automatic sprinkler which has been specifically listed for use in residential occupancies.

Shall. Indicates a mandatory requirement.

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

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

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

Standard. A document containing only mandatory provisions using the word "shall" to indicate requirements. Explanatory material may be included only in the form of "fine print" notes, in footnotes, or in an Appendix.

Supply Pressure. Pressure within the supply (i.e., city or private supply water source).

System Pressure. A pressure within the system (i.e., above the control valve).

Water Flow Alarm. A sounding device activated by a water flow detector or alarm check valve and arranged to sound an alarm which will be audible in all living areas over background noise levels with all intervening doors closed.

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

Wet System. A 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 a fire.

1-4* Maintenance. The owner is responsible for the condition of a sprinkler system and shall keep the system in normal operating condition.

1-5 Design and Installation.

1-5.1 Devices and Materials.

1-5.1.1* Only new residential sprinklers shall be employed in the installation of sprinkler systems.

1-5.1.2 Only listed and approved devices and approved materials shall be used in sprinkler systems.

Exception: Listing may be waived for tanks, pumps, hangers, water flow detection devices, and water flow valves.

1-5.1.3 Preengineered systems shall be installed within the limitations which have been established by the testing laboratories where listed.

1-5.1.4* All systems shall be tested for leakage at normal system operating water pressure.

Exception: When a fire department pumper connection is provided, hydrostatic pressure tests shall be provided in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.

1-6 Units. Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI). Two units (liter and bar), outside of but recognized by SI, are commonly used in international fire protection. These units are listed in Table 1-6 with conversion factors.

Table 1-6

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

For additional conversions and information see ASTM E380, *Standard for Metric Practice*.

1-6.1 If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated is to be regarded as the requirement. A given equivalent value may be approximate.

1-6.2 The conversion procedure for the SI units has been to multiply the quantity by the conversion factor and then round the result to the appropriate number of significant digits.

Chapter 2 Water Supply

2-1 General Provisions. Every automatic sprinkler system shall have at least one automatic water supply. When stored water is used as the sole source of supply, the minimum quantity shall equal the water demand rate times 10 minutes. (See 4-1.3.)

2-2* Water Supply Sources. The following water supply sources are acceptable:

- (a) A connection to a reliable water works system.
- (b) An elevated tank.
- (c) 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*.
- (d) A stored water source with an automatically operated pump.

2-3* Multipurpose Piping System. A piping system serving both sprinkler and domestic needs shall be acceptable when:

- (a)* In common water supply connections serving more than one dwelling unit, 5 gallons per minute (19 L/min) is added to the sprinkler system demand to determine the size of common piping and the size of the total water supply requirements.
- (b) Smoke detectors are provided in accordance with NFPA 74, *Standard for the Installation, Maintenance, and Use of Household Fire Warning Equipment*.
- (c) All piping in the system conforms to the piping specifications of this standard.
- (d) Permitted by the local plumbing or health authority.

2-4 Mobile Home Water Supply. A water supply for a sprinklered dwelling manufactured off-site shall not be less than that specified on the manufacturer's nameplate [see 4-4.3 (k) *Exception*].

Chapter 3 System Components

3-1 Valves and Drains.

3-1.1 Each system shall have a single control valve arranged to shut off both the domestic and sprinkler systems, and a separate shutoff valve for the domestic system only.

Exception No. 1: The sprinkler system piping may 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 which will cause the sounding of an audible signal at a constantly attended point, or
- (c) Locking the valves open.

Exception No. 2: A separate shutoff valve is not required for the domestic water supply in multipurpose piping systems.

3-1.2 Each sprinkler system shall have a ½ in. or larger drain and test connection with valve on the system side of the control valve.

3-1.3 Additional drains shall be installed for each trapped portion of a dry system which is subject to freezing temperatures.

3-2 Pressure Gages.

3-2.1 A pressure gage shall be installed to indicate air pressure on dry systems and on water supply pressure tanks.

3-3 Piping.

3-3.1 Pipe or tube used in sprinkler systems shall be of the materials in Table 3-3.1 or in accordance with 3-3.2 through 3-3.5. The chemical properties, physical properties and dimensions of the materials listed in Table 3-3.1 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 bars).

Table 3-3.1

Materials and Dimensions	Standard
Ferrous Piping (Welded and Seamless), Welded and Seamless Steel Pipe for Ordinary Uses, Specification for Black and Hot-Dipped Zinc Coated (Galvanized)	ASTM A120
Specification for Welded and Seamless Steel Pipe	ASTM A53
Wrought-Steel Pipe	ANSI B36.10
Specifications for Electric-Resistance Welded Steel Pipe	ASTM A135
Copper Tube (Drawn, Seamless) Specification for Seamless Copper Tube	ASTM B75
Specification for Seamless Copper Water Tube	ASTM B88
Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube	ASTM B251
Brazing Filler Metal (Classification BCuP-3 or BCuP-4)	AWS A5.8
Specification for Solder Metal, 95-5 (Tin-Antimony-Grade 95TA)	ASTM B32
Specification for Solder Metal, 50-50	ASTM B32

3-3.2 Other types of pipe or tube may be used, but only those investigated and listed for this service by a testing and inspection agency laboratory.

3-3.3 Whenever the word pipe is used in this standard, it shall be understood to also mean tube.

3-3.4 Schedule 10 steel pipe may be joined with mechanical groove couplings approved for service with grooves rolled on the pipe by an approved groove rolling machine.

3-3.5 Fittings used in sprinkler systems shall be of the materials listed in Table 3-3.5 or in accordance with 3-3.7. The chemical properties, physical properties and dimensions of the materials listed in Table 3-3.5 shall be at least equivalent to the standards cited in the table. Fittings used in sprinkler systems shall be designed to withstand the working pressures involved, but not less than 175 psi (12.1 bars) cold water pressure.

Table 3-3.5

Material and Dimensions	Standard
Cast Iron	
Cast Iron Threaded Fittings, Class 125 and 250	ANSI B16.4
Cast Iron Pipe Flanges and Flanged Fittings	ANSI B16.1
Malleable Iron	
Malleable Iron Threaded Fittings, Class 150 and 300	ANSI B16.3
Steel	
Factory-made Wrought Steel Buttweld Fittings	ANSI B16.9
Buttwelding Ends for Pipe, Valves, Flanges and Fittings	ANSI B16.25
Spec. for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures	ASTM A234
Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys	ANSI B16.5
Forged Steel Fittings, Socket Welded and Threaded	ANSI B16.11
Copper	
Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings	ANSI B16.22
Cast Copper Alloy Solder-Joint Pressure Fittings	ANSI B16.18

3-3.6 Joints for the connection of copper tube shall be brazed.

Exception: Soldered joints (50-50 or 95-5 solder metal) may be used for wet-pipe copper tube systems.

3-3.7 Other types of fittings may be used, but only those investigated and listed for this service by a testing and inspection agency laboratory.

3-4 Piping Support.

3-4.1 Piping shall be supported from structural members. This standard contemplates support methods comparable to those used in local plumbing codes. Piping layed on open joist or rafter shall be secured to minimize lateral movement.

3-4.2 Piping laid on open joists or rafters shall be secured to prevent lateral movement.

3-5 Sprinklers.

3-5.1 Listed residential sprinklers shall be used. The basis of such a listing shall be 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: Residential sprinklers shall not be used in dry systems unless specifically listed for that purpose.

3-5.2 The sprinklers shall have fusing temperatures not less than 35°F (19°C) above maximum expected ambient temperature.

3-5.3 Operated or damaged sprinklers shall be replaced with sprinklers having the same performance characteristics as original equipment.

3-5.4 Painting and Ornamental Finishes.

3-5.4.1* Sprinkler frames may be factory painted or enameled as ornamental finish in accordance with 3-5.4.2, otherwise sprinklers shall not be painted and any sprinklers which have been painted, except for factory applied coatings, shall be replaced with new listed sprinklers.

3-5.4.2 Ornamental finishes shall not be applied to sprinklers by anyone other than the sprinkler manufacturer, and only sprinklers listed with such finishes shall be used.

3-6* Alarms. Local water flow alarms shall be provided on all sprinkler systems.

Exception: Dwellings or mobile homes having smoke detectors in accordance with NFPA 74, Standard for the Installation, Maintenance, and Use of Household Fire Warning Equipment.

Chapter 4 System Design

4-1 Design Criteria.

4-1.1 Design Discharge. The system shall provide a discharge of not less than 18 gallons per minute (68 L/min) to any single operating sprinkler and not less than 13 gallons per minute (49 L/min) per sprinkler to the number of design sprinklers.

4-1.2* Number of Design Sprinklers. The number of design sprinklers shall include all sprinklers within a compartment to a maximum of 2 sprinklers.

4-1.2.1 The definition of compartment for use in 4-1.2 to determine the number of design sprinklers is a space which is completely enclosed by walls and a ceiling. The compartment enclosure may have openings to an adjoining space if the openings have a minimum lintel depth of 8 in. (203 mm) from the ceiling.

4-1.3 Water Demand. The water demand for the system shall be determined by multiplying the design discharge of 4-1.1 by the number of design sprinklers of 4-1.2.

4-1.4 Sprinkler Coverage.

4-1.4.1 Residential sprinklers shall be spaced so that the maximum area protected by a single sprinkler does not exceed 144 sq ft (13.4 m²).

4-1.4.2 The maximum distance between sprinklers shall not exceed 12 ft (3.7 m) on or between pipelines and the maximum distance to a wall or partition shall not exceed 6 ft (1.8 m). The minimum distance between sprinklers within a compartment shall be 8 ft (2.4 m).

4-1.5 The minimum operating pressure of any sprinkler shall be in accordance with the listing information of the sprinkler and provide the minimum flow rates specified in 4-1.1.

4-1.6 Application rates, design areas, areas of coverage, and minimum design pressures other than those specified in 4-1.1, 4-1.2, 4-1.4, and 4-1.5 may be used with special sprinklers which have been listed for such specific residential installation conditions.

4-2 Position of Sprinklers.

4-2.1 Pendent and upright sprinklers shall be positioned so that the deflectors are within 1 to 4 in. (25.4 to 102 mm) from the ceiling.

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

4-2.2 Sidewall sprinklers shall be positioned so that the deflectors are within 4 to 6 in. from the ceiling.

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

4-2.3* 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.

4-3 System Types.

4-3.1 Wet-Pipe Systems. A wet-pipe system shall be used when all piping is installed in areas not subject to freezing.

4-3.2 Dry-Pipe Systems. Where system piping is located in unheated areas subject to freezing, a dry-pipe system shall be used.

4-4 Pipe Sizing.

4-4.1 Piping shall be sized in accordance with 4-4.3 and 4-4.4. If more than one design discharge is required (see 4-1.1), the pipe sizing procedure shall be repeated for each design discharge.

Exception: When piping is sized hydraulically, calculations shall be made in accordance with the methods described in NFPA 13, Standard for the Installation of Sprinkler Systems.

4-4.2 Minimum pipe size shall be $\frac{3}{4}$ in. for copper; 1 in. for steel.

4-4.3* To size piping for systems connected to a city water supply, the following approximate method is acceptable.

(a) Establish system flow rate in accordance with Section 4-1.

(b) Determine water pressure in the street.

(c) Select pipe sizes.

(d) Deduct meter pressure losses if any. [See Table 4-4.3(d).]

(e) Deduct pressure loss for elevation. (Building height above street in ft $\times 0.434$ = psi.) (Building height above street in meters $\times 0.098$ = bars.)

(f) Deduct pressure losses from city main to control valve by multiplying the factor from Table 4-4.3(a) or (b) by the total length(s) of pipe in ft (m).

(g) Deduct pressure losses for piping within building by multiplying factor from Table 4-4.3(a) or (b) by the total length in ft (m) of each size of pipe between the control valve and the farthest sprinkler.

(h) Deduct valve and fitting pressure losses. Count the valves and fittings from the control valve to the farthest sprinkler. Determine the equivalent length for each valve and fitting as shown in Table 4-4.3(c) and add these values to obtain the total equivalent length for each pipe size. Multiply the equivalent length for each size by the factor from Table 4-4.3(a) or (b) and total these values.

(i) In multilevel buildings, steps (a) through (g) shall be repeated to size piping for each floor.

(j) If the remaining pressure is less than the operating pressure established by the testing laboratory for the sprinkler being used, a redesign is necessary. If this pressure is higher than required, smaller piping may be used when justified by calculations.

(k) The remaining piping shall be sized the same as the piping to the farthest sprinkler unless smaller sizes are justified by calculations.

Exception: For sprinklered dwellings manufactured off-site, the minimum pressure needed to satisfy the system design criteria on the system side of the meter shall be specified on a data plate by the manufacturer. (See Section 2-3.)

Table 4-4.3 (a) Pressure Losses (psi/ft) Schedule 40 Steel Pipe, C = 120

Pipe Size in.	Flow Rate -- GPM											
	10	12	14	16	18	20	25	30	35	40	45	50
1	0.04	0.05	0.07	0.09	0.11	0.13	0.20	0.28	0.37	0.47	0.58	0.71
1 $\frac{1}{4}$	0.01	0.01	0.02	0.02	0.03	0.03	0.05	0.07	0.10	0.12	0.15	0.19
1 $\frac{1}{2}$	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.07	0.09
2	—	—	—	—	—	0.01	0.01	0.01	0.01	0.02	0.02	0.03

For SI Units: 1 gal = 3.785 L; 1 psi = 0.0689 bar; 1 ft = 0.3048 m.

Table 4-4.3 (b) Pressure Losses (psi/ft) Copper Tubing — Types K, L & M. C = 150

		Flow Rate -- GPM											
Tubing Size in.	Type	10	12	14	16	18	20	25	30	35	40	45	50
¾	M	0.08	0.12	0.16	0.20	0.25	0.30	0.46	0.64	0.85	—	—	—
	L	0.10	0.14	0.18	0.23	0.29	0.35	0.53	0.75	1.00	—	—	—
	K	0.13	0.18	0.24	0.30	0.38	0.46	0.69	0.97	1.28	—	—	—
1	M	0.02	0.03	0.04	0.06	0.07	0.08	0.13	0.18	0.24	0.30	0.38	0.46
	L	0.03	0.04	0.05	0.06	0.08	0.10	0.15	0.20	0.27	0.35	0.43	0.53
	K	0.03	0.04	0.06	0.07	0.09	0.11	0.17	0.24	0.31	0.40	0.50	0.61
1¼	M	0.01	0.01	0.02	0.02	0.03	0.03	0.05	0.07	0.09	0.11	0.14	0.17
	L	0.01	0.01	0.02	0.02	0.03	0.03	0.05	0.07	0.10	0.12	0.16	0.19
	K	0.01	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.11	0.13	0.17	0.20
1½	M	—	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08
	L	—	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.04	0.05	0.07	0.08
	K	—	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.05	0.06	0.07	0.09
2	M	—	—	—	—	—	—	0.01	0.01	0.01	0.01	0.02	0.02
	L	—	—	—	—	—	—	0.01	0.01	0.01	0.01	0.02	0.02
	K	—	—	—	—	—	—	0.01	0.01	0.01	0.01	0.02	0.02

For SI Units: 1 gal. = 3.785 L; 1 psi = 0.0689 bar; 1 ft = 0.3048 m.

Table 4-4.3 (c) Equivalent Length of Pipe in Feet for Steel and Copper Fittings and Valves

Fitting/Valve Diameter In.	Tees					Gate	Angle	Globe	Valves		
	45 Degrees	Elbows 90 Degrees	Long Radius	Flow Thru Branch	Flow Thru Run				Globe "Y"	Pattern	Cock
¾	1	2	1	4	1	1	10	21	11	3	3
1	1	3	2	5	2	1	12	28	15	4	4
1¼	2	3	2	6	2	2	15	35	18	5	5
1½	2	4	3	8	3	2	18	43	22	6	6
2	3	5	3	10	3	2	24	57	28	7	8

Based on Crane Technical Paper No. 410.

For SI Units: 1 ft = 0.3048 m.

Table 4-4.3 (d)
Pressure Losses in Water Meters

Meter (Inches)	Pressure Loss (psi) Flow (gpm)					
	18	23	26	31	39	52
5/8	9	14	18	26	*	*
3/4	4	8	9	13	*	*
1	2	3	3	4	6	10
1-1/2	**	1	2	2	4	7
2	**	**	**	1	2	3

NOTE: Lower pressure losses may be used when supporting data is provided by the meter manufacturer.

* Above maximum rated flow of commonly available meters.

** Less than 1 psi.

For SI Units: 1 gpm = 3.785 L/min; 1 in. = 25.4 mm

4-4.4 To size piping for systems with an elevated tank pump or pump-tank combination, determine the pressure at the water supply outlet and proceed through steps (c), (e), (g), (h), (i), (j) and (k) of 4-4.3.

4-5 Piping Configurations. Piping configurations may be looped, gridded, straight run, or combinations thereof.

4-6 Location of Sprinklers. Sprinklers shall be installed in all areas.

Exception No. 1: Sprinklers may be omitted from bathrooms not exceeding 55 sq ft (5.1 m²) with noncombustible plumbing fixtures.

Exception No. 2: Sprinklers may be omitted from small closets where the least dimension does not exceed 3 ft (0.9 m) and the area does not exceed 24 sq ft (2.2 m²) and the walls and ceiling are surfaced with noncombustible materials.

Exception No. 3: Sprinklers may be omitted from open attached porches, garages, carports and similar structures.

Exception No. 4: Sprinklers may be omitted from attics and crawl spaces which are not used or intended for living purposes or storage.

Exception No. 5: Sprinklers may be omitted from entrance foyers which are not the only means of egress.

Chapter 5 Mandatory Referenced Publications

5-1 This chapter lists publications referenced within this document which, in whole or in part, are part of the requirements of this document.

5-1.1 NFPA Publications. The following publications are available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 13-1983, *Standard for the Installation of Sprinkler Systems*

NFPA 13A-1981, *Recommended Practice for the Inspection, Testing and Maintenance of Sprinkler Systems*

NFPA 20-1983, *Standard for the Installation of Centrifugal Fire Pumps*

NFPA 22-1984, *Standard for Water Tanks for Private Fire Protection*

NFPA 74-1984, *Standard for the Installation, Maintenance, and Use of Household Fire Warning Equipment*

NFPA 101-1981, *Code for Safety to Life from Fire in Buildings and Structures*

NFPA 220-1979, *Standard on Types of Building Construction*

5-1.2 Other Codes and Standards. This publication makes reference to the following codes and standards and the year dates shown indicate the latest editions available.

Publications designated ANSI are available from the American National Standard Institute, Inc., 1450 Broadway, New York, NY 10018; those designated ASTM are available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19105; those designated AWS are available from the American Welding Society, 550 NW Le Jeune Road, Miami, FL 33135.

ANSI B16.1-1975, *Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800*

ANSI B16.11-1980, *Forged Steel Fittings, Socket Welding and Threaded*

ANSI B16.18-1978, *Cast Copper Alloy Solder Joint Pressure Fittings*

ANSI B16.22-1980, *Wrought Copper and Copper Alloy Solder Joint Pressure Fittings*

ANSI B16.25-1979, *Butt-welding Ends*

ANSI B16.3-1977, *Malleable Iron Threaded Fittings, Class 150 and 300*

ANSI B16.4-1977, *Cast Iron Threaded Fittings, Class 125 and 250*

ANSI B16.5-1981, *Pipe Flanges and Flanged Fittings*

ANSI B16.9-1978, *Factory-Made Wrought Steel Butt-welding Fittings*

ANSI B36.10-1979, *Welded and Seamless Wrought Steel Pipe*

ASTM B32-1976, *Specifications for Solder Metal*

ASTM A53-83, *Specifications for Pipe, Steel Black, and Hot-Dipped, Zinc-Coated Welded and Seamless Steel Pipe*

ASTM B75-81, *Specifications for Seamless Copper Tube*

ASTM B88-83, *Specifications for Seamless Copper Water Tube*

ASTM A120-83, *Specification for Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless Steel Pipe for Ordinary Uses*

ASTM A135-83, *Specifications for Electric Resistance Welded Steel Pipe*

ASTM A234-82, *Specifications for Piping Fittings of Wrought Carbon Steel and Alloy for Moderate and Elevated Temperatures*

ASTM E380-82, *Standard for Metric Practice*

ASTM B251-81, *Specifications for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube*

ASTM A795-83, *Specification for Black and Hot-Dipped Zinc-Coated Welded and Seamless Steel Pipe for Fire Protection Use*

AWS A5.8-81, *Specification for Brazing Filler Metal*

Appendix A

This Appendix is not a part of the requirements of this NFPA document but is included for information purposes only.

A-1-1 NFPA 13D is appropriate for use only in one- and two-family dwellings and mobile homes. Residential portions of any other building may be protected with residential sprinklers in accordance with 3-16.2.9 of NFPA 13-1983, *Standard for the Installation of Sprinkler Systems*. Other portions of such sections 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-mm) 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 if sprinklers are installed in the compartment. A sprinkler system designed and installed according to this standard cannot, however, be completely expected to control a fire involving unusually higher average fuel loads than typical for dwelling units [10 lbs/ft² (49 kg/m²)] and where the interior finish has an unusually high flame spread rating (greater than 225).

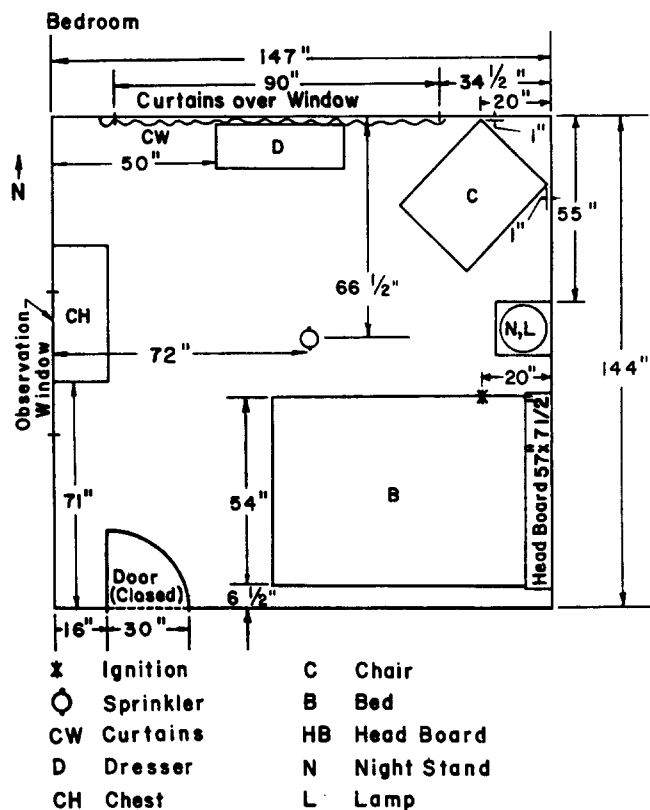


Figure A-1-1(a)

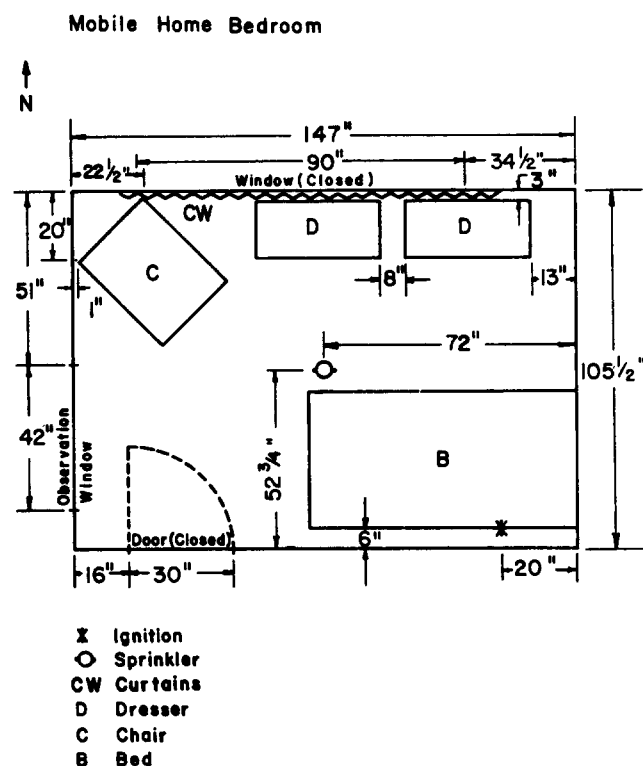


Figure A-1-1(b)

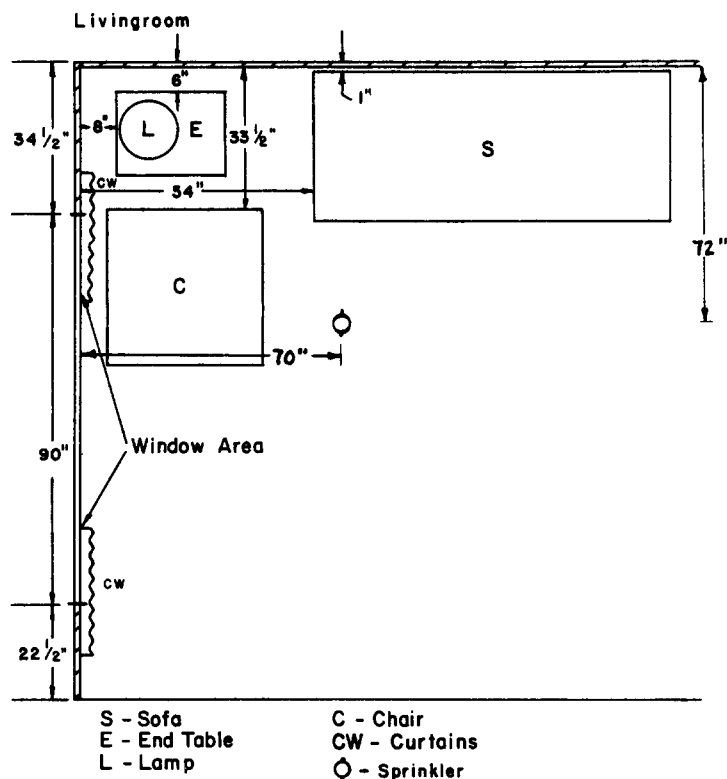


Figure A-1-1(c)

A-1-2 Levels of Protection. Various levels of firesafety are available to dwelling occupants to provide life safety and property protection.

This standard recommends, but does not require, sprinklering of all areas in a dwelling; it permits sprinklers to be omitted in certain areas. These areas are the ones shown by NFPA statistics (*see Table A-1-2*) to be the ones where the incidence of life loss from fires in dwellings is low. Such an approach produces a reasonable degree of fire safety. Greater protection to both life and property will be achieved by sprinklering all areas.

Guidance for installation of smoke detectors and fire detection systems may be found in NFPA 74, *Standard for the Installation, Maintenance and Use of Household Fire Warning Equipment*.

Table A-1-2
Causal Factors in
One- and Two-Family Dwelling
Fires Which Caused One or More Deaths

Area of Origin		
Living Room	41%	
Bedroom	27%	
Kitchen	15%	
Storage Area	4%	Based on 6066 incidents where area of origin was reported
Heating Equipment Room	3%	
Structural Area	2%	
Other Areas	8%	
Form of Material		
Furniture	27%	
Bedding	18%	
Combustible Liquid or Gas	13%	
Interior Finish	9%	Based on 5080 incidents where form of material ignited was reported
Structural Member	9%	
Waste, Rubbish	4%	
Clothing, on a Person	3%	
Cooking Materials	3%	
Electrical Insulation	2%	
Curtains, Drapery	2%	
Other	10%	
Form of Heat of Ignition		
Smoking Materials	36%	
Heat from Fuel — Fire or Powered Object	25%	
Heat from Miscellaneous Open Flame (Including Match)	15%	Based on 5016 incidents where form of heat of ignition was reported
Heat from Electrical Equipment Arcing or Overload	14%	
Hot Objects Including Properly Operating Electrical Equipment	7%	
Other	3%	
		Total number of incidents reported
		10,194

Source: FIDO Data Base 1973 to 1982, NFPA Fire Analysis Department.

A-1-3 System control valves should be of the indicating type, such as plug valves, ball valves, butterfly valves, or OS & Y gate valves.

A-1-4 The responsibility for properly maintaining a sprinkler system is the obligation of the owner or manager who should understand the sprinkler system operation. A minimum monthly maintenance program should include the following:

(a) Visually inspect all sprinklers to ensure against obstruction of spray.

(b) Inspect all valves to assure that they are open,

(c) Test all water flow devices.

(d) The alarm system, if installed, should be tested.

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

(e) Pumps, where employed, should be operated. See NFPA 20, *Standard for the Installation of Centrifugal Fire Pumps*.

(f) The pressure of air used with dry systems should be checked.

(g) Water level in tanks should be checked.

(h) Care should be taken to see that sprinklers are not painted either at the time of installation or during subsequent redecoration. When painting sprinkler piping or painting in areas next to sprinklers, the sprinklers may be protected by covering with a bag which should be removed immediately after painting has been finished.

(i) For further information see NFPA 13A, *Recommended Practice for the Inspection, Testing and Maintenance of Sprinkler Systems*.

A-1-5.1.1 At least 3 spare sprinklers of each type, temperature rating and orifice size used in the system should be kept on the premises. When fused sprinklers are replaced by the owner, fire department or others, care should be taken to assure that the replacement sprinkler has the same operating characteristics.

A-1-5.1.4 Testing of a system can be accomplished by filling the system with water and checking visually for leakage at each joint or coupling.

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

Dry systems should also be tested by placing the system under air pressure. Any leak which results in a drop in system pressure greater than 2 lb/sq in. (0.14 bars) in 24 hours should be corrected. Check for leaks using soapy water brushed on each joint or coupling. Leaks will be shown by the presence of bubbles. This test should be made prior to concealing of piping.

A-2-2 Connection for fire protection to city mains is often subject to local regulation concerning metering and backflow prevention requirements. Preferred and acceptable water supply arrangements are shown in Figures A-2-2 (a), (b) and (c). When a meter must be used between the city water main and the sprinkler system supply, an acceptable arrangement is shown in Figure A-2-2(c). Under these circumstances, the flow characteristics of the meter must be included in the hydraulic calculation of the system. [See Table 4-4.3(d).] When a tank is used for both domestic and fire protection purposes, a low water alarm actuated when the water level falls below 110 percent of the minimum quantity specified in Section 2-1 should be provided.

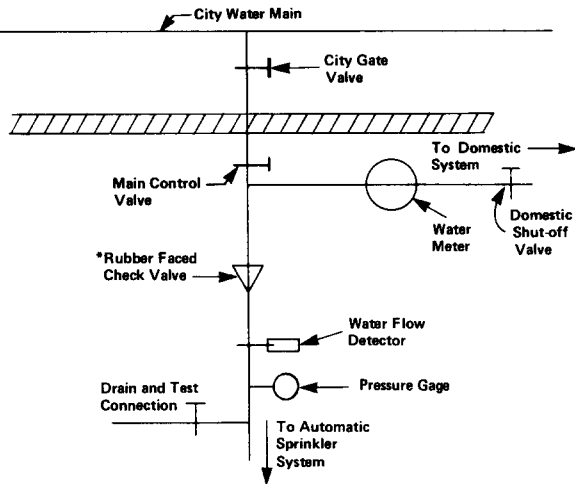


Figure A-2-2(a) Preferable Arrangement

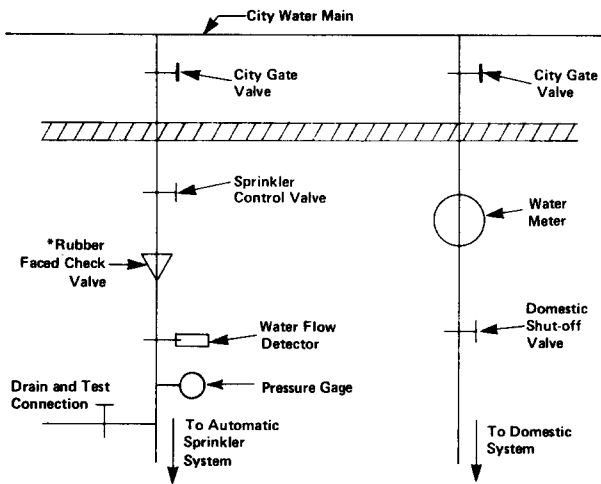
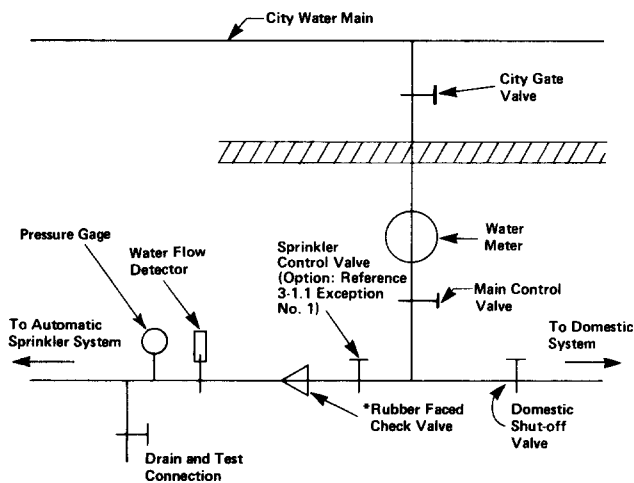


Figure A-2-2(b) Acceptable Arrangement



*Rubber faced check valves optional.

Figure A-2-2(c) Acceptable Arrangement

A-2-3(a) In dwellings where long term use of lawn sprinklers is common, provision should be made for such usage.

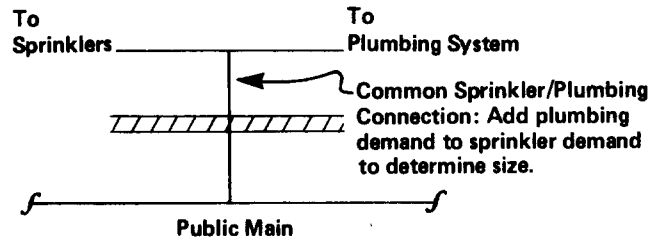


Figure A-2-3(a)

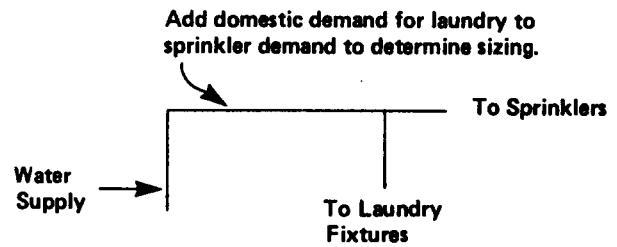


Figure A-2-3(b)

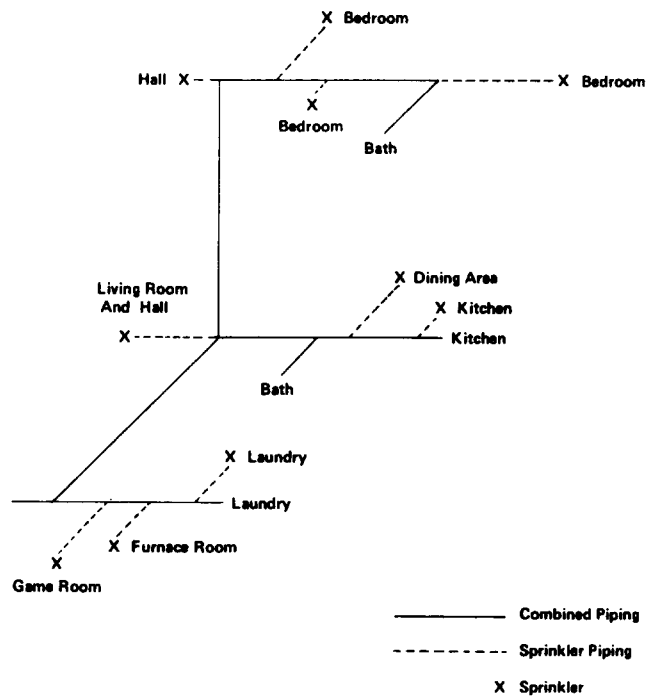


Figure A-2-3(c)