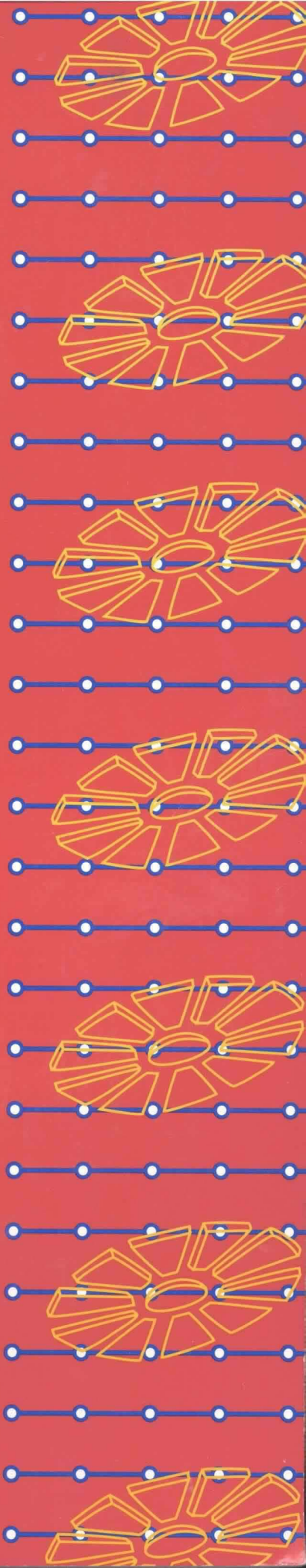
SPRINKLER SYSTEMS

in Residential Occupancies Up to and Including Four Stories in Height

NFPA

13R

1994 Edition



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Policy Adopted by NFPA Board of Directors on December 3, 1982

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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NFPA 13R

Standard for the

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

1994 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 Automatic Sprinklers and acted on by the National Fire Protection Association, Inc. at its Fall Meeting held November 15-18, 1993, in Phoenix, AZ. It was issued by the Standards Council on January 14, 1994, with an effective date of February 11, 1994, and supersedes all previous editions.

The 1994 edition of this document has been approved by the American National Standards Institute.

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 13R

The first edition of NFPA 13R 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 has also considered 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, it is felt that systems for certain residential occupancies can be efficiently and effectively installed in accordance with this standard.

The second edition of this document contained numerous changes including a slight modification of the title.

This edition contains expanded information on nonmetallic pipe materials, minor changes to clarify the established design criteria, as well as a new recommendation on underground pipe materials.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred

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: This Committee shall have primary responsibility for documents on the design, installation, inspection, and maintenance of automatic and of open sprinkler systems, including the character and adequacy of water supplies, and the selection of sprinklers, piping, valves, and all materials and accessories; but not including 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, and supervisory service, nor the supervision and care of valves controlling water supplies, nor the design of fire department hose connections, nor the installation of private fire service mains and their appurtenances.

Contents

NFPA 13R

Standard for the

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

1994 Edition

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 3 and Appendix B.

Preface

It is intended that this standard provide a method for those individuals wishing to install a sprinkler system for 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 72, *National Fire Alarm Code*.

Chapter 1 General Information

1-1* Scope. This standard deals with 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 alternate arrangements, provided that 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, 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 that is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. 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, 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.

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. Rate of water discharged by an automatic sprinkler, expressed in gallons per minute (L/min).

Dry System. A system employing automatic sprinklers that are 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, 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 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 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.

Multipurpose Piping Systems. Piping systems within residential occupancies intended to serve both domestic and fire protection needs.

Preaction System. A sprinkler system employing automatic sprinklers attached to a piping system containing air that may or may 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 permits water to flow into the sprinkler piping system and to be discharged from any sprinklers that may be open.

Residential Occupancies. Residential occupancies as included in the scope of this standard include the following, as defined in NFPA *101®, Life Safety Code®*:

(a) Apartment buildings.

(b) Lodging and rooming houses.

(c) Board and care facilities (slow evacuation type with 16 or fewer occupants and prompt evacuation type).

(d) Hotels, motels, and dormitories.

Residential Sprinkler. An automatic sprinkler that 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 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 will 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 that contains 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.

Thermal Barrier. A material that will limit the average temperature rise of the unexposed surface to not more than 250°F (121°C) after 15 min of fire exposure, complying with the standard time-temperature curve of NFPA 251, *Standard Methods of Fire Tests 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 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 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, with conversion factors, in Table 1-4.

1-4.1 If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated shall be regarded as the requirement. A given equivalent value may be approximate.

1-4.2 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.

Table 1-4

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 Use of the International System of Units (SI) (the Modernized Metric System)*.

1-5 Piping.

1-5.1* Pipe or tube used in sprinkler systems shall be of the materials 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 listed 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 bars).

Table 1-5.1

Materials and Dimensions	Standard
Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use	ASTM A795
Specification for Welded and Seamless Steel Pipe	ASTM A53
Wrought-Steel Pipe	ANSI B36.10M
Specification for Electric-Resistance Welded Steel Pipe	ASTM A135
Copper Tube (Drawn, Seamless) Specification for Seamless Copper Tube	ASTM B88
Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube	ASTM B251
Fluxes for Soldering Applications of Copper and Copper Alloy Tube	ASTM B813
Brazing Filler Metal (Classification BCuP-3 or BCuP-4)	AWS A5.8
Specification for Solder Metal, 95-5 (Tin-Antimony-Grade 95TA)	ASTM B32

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

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

1-5.4 Pipe joined with mechanical grooved fittings shall be joined by a listed combination of fittings, gaskets, and

Table 1-5.2 Specially Listed Pipe or Tube Materials and Dimensions

Materials and Dimensions	Standard
Nonmetallic Piping	
Specification for Special Listed Chlorinated Polyvinyl Chloride (CPVC) Pipe	ASTM F442
Specification for Special Listed Polybutylene (PB) Pipe	ASTM D3309

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 Schedule 30 [in sizes 8 in. (203 mm) and larger] or Schedule 40 [in 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 listed 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 the working pressures involved, but not less than 175 psi (12.1 bars) cold water pressure.

Table 1-5.5

Materials and Dimensions	Standard
Cast Iron	
Cast Iron and 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 Threaded Fittings Class 150 and 300	ANSI B16.9
Buttwelding Ends for Pipe, Valves, Flanges, and Fittings	ANSI B16.25
Specification 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

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 those listed for this service. Listed fittings, including but not limited to chlorinated polyvinyl chloride (CPVC), polybutylene, and steel differing from that provided in Table 1-5.5, shall be installed in accordance with their listing and the manufacturer's installation instructions. Nonmetallic pipe and tube 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 1-5.7 Specially Listed Fittings and Dimensions

Materials and Dimensions	Standard
Chlorinated Polyvinyl Chloride (CPVC)	
Specification for Schedule 80 CPVC Threaded Fittings	ASTM F437
Specification for Schedule 40 CPVC Socket-type Fittings	ASTM F438
Specification for Schedule 80 CPVC Socket-type Fittings	ASTM F439

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* Provision shall be made to protect piping from freezing in unheated areas by use of one of the following acceptable methods:

(a) Antifreeze system.

(b) Dry pipe system.

(c) Preaction system.

(d) Listed standard dry pendent, dry upright, or dry sidewall sprinklers extended from heated areas.

1-6.2.1 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 require permission of the authority having jurisdiction.

2-1.1.2 Working plans shall be drawn to an indicated scale, on sheets of uniform size, with a plan of each floor, made so that they can be easily duplicated, and shall show the following data:

(a) Name of owner and occupant.

(b) Location, including street address.

(c) Point of compass.

(d) Ceiling construction.

(e) Full height cross section.

(f) Location of fire walls.

(g) Location of partitions.

(h) Occupancy of each area or room.

(i) Location and size of concealed spaces, attics, closets, and bathrooms.

(j) Any small enclosures in which no sprinklers are to be installed.

(k) Size of city main in street, pressure, and whether dead-end or circulating and, if dead-end, direction and distance to nearest circulating main, and city main test results including elevation of test hydrant.

(l) Make, manufacturer, type, heat-response element, temperature rating, and nominal orifice size of sprinkler.

(m) Temperature rating and location of high-temperature sprinklers.

(n) Number of sprinklers on each riser, per floor.

(o) Kind and location of alarm bells.

(p) Type of pipe and fittings.

(q) Type of protection for nonmetallic pipe.

(r) Nominal pipe size with lengths shown to scale.

NOTE: Where typical branch lines prevail, it will be necessary to size only one line.

(s) Location and size of riser nipples.

(t) Type of fittings and joints and location of all welds and bends.

(u) Types and locations of hangers, sleeves, braces, and methods of securing sprinklers, where applicable.

(v) All control valves, check valves, drain pipes, and test connections.

(w) Underground pipe size, length, location, weight, material, point of connection to city main; the type of valves, meters, and valve pits; and the depth at which the top of the pipe is laid below grade.

(x) For hydraulically designed systems, the material to be included on the hydraulic data nameplate.

(y) Name and address of 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 desires to be present during the conducting of acceptance tests, the installer shall give 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 foreign materials that may 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 shall be provided in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*.

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

2-2 Design and Installation.

2-2.1 Devices and Materials.

2-2.1.1 Only new sprinklers shall be employed in the installation of sprinkler systems. At least 3 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.

2-2.1.2 Only listed or approved devices and materials as indicated in this standard shall be used in sprinkler systems.

2-2.1.3 Sprinkler systems shall be designed for a maximum working pressure of 175 psi (12.1 bars).

Exception: Higher design pressures may be used where all system components are rated for pressures higher than 175 psi (12.1 bars).

2-2.1.4* Waterflow test connections shall be provided at locations that will permit 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 are acceptable:

(a) A connection to a reliable water works system with or without a booster pump, as required.

(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, installed in accordance with NFPA 20, *Standard for the Installation of Centrifugal Fire Pumps*.

2-3.3 Multipurpose Piping System.

2-3.3.1* A common supply main to the building, serving both sprinklers and domestic uses, shall be acceptable where the domestic design demand is added to the sprinkler system demand.

Exception: Domestic design demand need not be added if 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*.

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	MIN.	SEC.

DRY PIPE OPERATING TEST

DRY VALVE			Q. O. D.		
MAKE	MODEL	SERIAL NO.	MAKE	MODEL	SERIAL NO.

	TIME TO TRIP THROUGH TEST CONNECTION*		WATER PRESSURE	AIR PRESSURE	TRIP POINT AIR PRESSURE	TIME WATER REACHED TEST OUTLET*		ALARM OPERATED PROPERLY	
	MIN.	SEC.	PSI	PSI	PSI	MIN.	SEC.	YES	NO
Without Q.O.D.									
With Q.O.D.									

IF NO, EXPLAIN

*MEASURED FROM TIME INSPECTOR'S TEST CONNECTION IS OPENED.

Figure 2-1.2.1 Contractor's material and test certificate for aboveground piping. **(Continued on next page.)**

DELUGE & PREACTION VALVES

OPERATION ☐ PNEUMATIC ☐ ELECTRIC ☐ HYDRAULIC

PIPING SUPERVISED ☐ YES ☐ NO | DETECTING MEDIA SUPERVISED ☐ YES ☐ NO

DOES VALVE OPERATE FROM THE MANUAL TRIP AND/OR REMOTE 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	MIN.	SEC

PRESSURE REDUCING VALVE TEST

LOCATION & FLOOR	MAKE & 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 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.2 bars) for two hours. Differential dry-pipe valve clappers shall be left open during test to prevent damage. All aboveground piping leakage shall be stopped.

PNEUMATIC: Establish 40 psi (2.7 bars) air pressure and measure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours. Test pressure tanks at normal water level and air pressure and measure air pressure drop, which shall not exceed 1-1/2 psi (0.1 bars) in 24 hours.

TESTS

ALL PIPING HYDROSTATICALLY TESTED AT ____ PSI FOR ____ HRS. | 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 GAGE LOCATED NEAR WATER SUPPLY TEST CONNECTION: _____ PSI | RESIDUAL PRESSURE WITH VALVE IN TEST CONNECTION OPEN WIDE _____ PSI

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 UNDER-GROUND SPRINKLER PIPING ☐ YES ☐ NO

IF POWDER DRIVEN FASTENERS ARE USED IN CONCRETE, HAS REPRESENTATIVE SAMPLE TESTING BEEN SATISFACTORILY COMPLETED? ☐ YES ☐ NO | IF NO, EXPLAIN

BLANK TESTING GASKETS

NUMBER USED	LOCATIONS	NUMBER REMOVED

WELDING

WELDED PIPING ☐ YES ☐ NO

IF YES. . .

DO YOU CERTIFY AS THE SPRINKLER CONTRACTOR THAT WELDING PROCEDURES COMPLY WITH THE REQUIREMENTS OF AT LEAST AWS D10 9, LEVEL AR-3? ☐ YES ☐ NO

DO YOU CERTIFY THAT THE WELDING WAS PERFORMED BY WELDERS QUALIFIED IN COMPLIANCE WITH THE REQUIREMENTS OF AT LEAST AWS D10.9, LEVEL AR-3? ☐ YES ☐ NO

DO YOU,CERTIFY THAT WELDING WAS CARRIED OUT IN COMPLIANCE WITH A DOCUMENTED QUALITY CONTROL PROCEDURE TO INSURE 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) Contractor's material and test certificate for aboveground piping.

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 EXPLANATION AND NOTES		

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

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 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 that will cause the sounding of an audible signal at a constantly attended point, or

(c) Locking the valves open.

2-4.1.2 Each sprinkler system shall have a 1-in. (25.4-mm) or larger drain and test connection with 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.

2-4.2 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 sq ft (186 m^2) 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 inside dwelling units. The basis of such a listing shall consist of 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 systems unless specifically listed for that purpose.

Exception No. 2: Other types of listed sprinklers may be installed in accordance with their listing in dwelling units meeting the definition of a compartment (as defined in 2-5.1.2.2) provided no more than 4 sprinklers are located in the dwelling unit and at least 1 smoke detector is provided in each sleeping room.

2-4.5.2 Ordinary-temperature-rated sprinklers [135 to 170°F (57 to 77°C)] shall be installed where maximum ambient ceiling temperatures do not exceed 100°F (38°C).

2-4.5.3 Intermediate-temperature-rated residential sprinklers [175 to 225°F (79 to 107°C)] shall be installed where maximum ambient ceiling temperatures are between 101 and 150°F (38 and 66°C).

2-4.5.4 The following practices shall be observed when installing residential sprinklers, unless maximum expected ambient temperatures are otherwise determined.

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

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

2-4.5.5 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 are permitted where required by 2-4.5.4.

2-4.5.6 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).

2-4.5.7 Operated or damaged sprinklers shall be replaced with sprinklers having the same performance characteristics as the original equipment.

2-4.5.8 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.

2-4.5.9 Painting and Ornamental Finishes.

2-4.5.9.1 Sprinkler frames are permitted to be factory painted or enameled as ornamental finish in accordance with 2-4.5.9.2; otherwise, sprinklers shall not be painted and any sprinklers that have been painted, except those with factory-applied coatings, shall be replaced with new listed sprinklers.

2-4.5.9.2* 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.

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 not less than the listing of the sprinkler(s).

Exception: Design discharge for sprinklers installed in accordance with Exception No. 2 of 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 to a maximum of 4 sprinklers under a flat, smooth, horizontal ceiling. For compartments containing 2 or more sprinklers, calculations shall be provided to verify the single operating sprinkler criteria and the multiple (2, 3, or 4) operating sprinkler criteria.

2-5.1.2.2 The definition of compartment for use in 2-5.1.2.1 to determine the number of design sprinklers is a space that is completely enclosed by walls and a ceiling. The compartment enclosure is permitted to have openings to an adjoining space if 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 of 2-5.1.1 by the number of design sprinklers of 2-5.1.2.

2-5.1.4 Sprinkler Coverage.

2-5.1.4.1 Residential sprinklers shall be so spaced that the maximum area protected by a single sprinkler does not exceed 144 sq ft (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 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 may be used with special sprinklers that have been listed for such specific residential installation conditions.

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 to 4 in. (25.4 to 102 mm) of 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 to 6 in. (102 to 152 mm) of the ceiling.

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

2-5.1.7.3* Sprinklers shall be so positioned that the response time and discharge are not unduly affected by obstructions such as ceiling slope, beams, or light fixtures.

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 sq ft (46 m^2) or less by 30-min fire-rated construction, and the area is protected by standard or quick-response sprinklers not exceeding 130 sq ft (12 m^2) per sprinkler, the system demand may be limited to the number of sprinklers in the compartment area, but not less

than a total of 4 sprinklers. Openings from the compartments need not be protected provided such openings are provided with a lintel at least 8 in. (203 mm) in depth and the total area of such openings does not exceed 50 sq ft (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, in other than hotels and motels, foyers, corridors, and halls outside the dwelling unit, with flat, smooth ceilings and not exceeding 10 ft (3.0 m) in height may be protected with residential sprinklers, with a maximum system demand of 4 sprinklers.

2-5.3 Pipe Sizing. Piping shall be sized in accordance with hydraulic calculation procedures to comply 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 are not required in bathrooms where the area does not exceed 55 sq ft (5.1 m^2) and the walls and ceilings, including behind fixtures, are of noncombustible or limited combustible materials providing a 15-min thermal barrier.

Exception No. 2: Sprinklers are not required in clothes closets, linen closets, and pantries within the dwelling units where the area of the space does not exceed 24 sq ft (2.2 m^2) and 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 are not required in any porches, balconies, corridors, and stairs that are open and attached.

Exception No. 4: Sprinklers are not 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.

2-7* Maintenance. The owner is 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 and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

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*, 1994 edition.

NFPA 20, *Standard for the Installation of Centrifugal Fire Pumps*, 1993 edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection*, 1993 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 1992 edition.

NFPA 72, *National Fire Alarm Code*, 1993 edition.

NFPA *101*, *Life Safety Code*, 1994 edition.

NFPA 220, *Standard on Types of Building Construction*, 1992 edition.

NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials*, 1990 edition.

3-1.2 Other Publications.

3-1.2.1 ANSI Publications. American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

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

ANSI B16.3-1992, *Malleable Iron Threaded Fittings.*

ANSI B16.4-1992, *Gray Iron Threaded Fittings.*

ANSI B16.5-1988, *Pipe Flanges and Flanged Fittings.*

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

ANSI B16.11-1991, *Forged Steel Fittings, Socket-Welding and Threaded.*

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

ANSI B16.22-1989, *Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.*

ANSI B16.25-1992, *Buttwelding Ends.*

ANSI B36.10M-1985, *Welded and Seamless Wrought Steel Pipe.*

3-1.2.2 ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM A53-1992, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless Steel.*

ASTM A135-1992, *Standard Specification for Electric-Resistance-Welded Steel Pipe.*

ASTM A234-1992, *Standard Specification for Piping Fittings of Wrought-Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.*

ASTM A795-1992, *Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.*

ASTM B32-1993, *Standard Specification for Solder Metal.*

ASTM B88-1993, *Standard Specification for Seamless Copper Water Tube.*

ASTM B251-1993, *Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.*

ASTM B813-1991, *Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper-Alloy Tube.*

ASTM D3309-1992, *Standard Specification for Polybutylene (PB) Plastic Hot and Cold Water Distribution Systems.*

ASTM E380-1991, *Standard for Use of the International System of Units (SI) (the Modernized Metric System).*

ASTM F437-1989, *Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 (SDR-PR).*

ASTM F438-1990, *Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.*

ASTM F439-1990, *Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.*

ASTM F442-1989, *Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).*

3-1.2.3 AWS Publication. American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33135.

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

Appendix A Explanatory Material

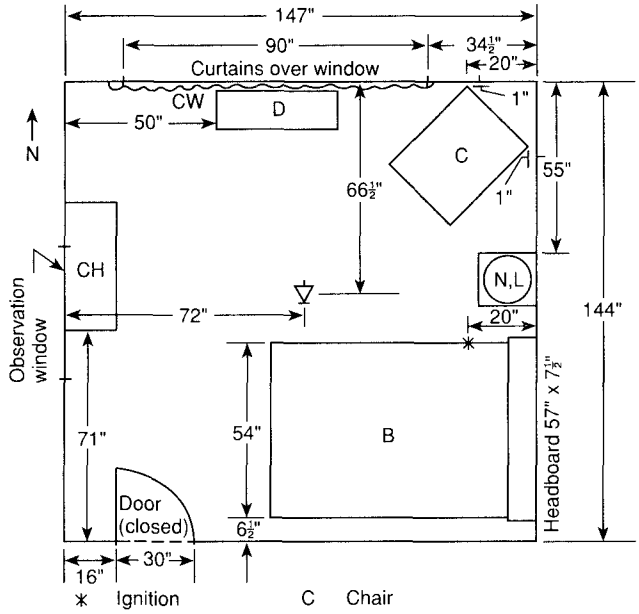
This Appendix is not a part of the requirements of the NFPA document, but is included for informational purposes only.

A-1-1 NFPA 13R is appropriate for use only in residential occupancies, as an option to NFPA 13, *Standard for the Installation of Sprinkler Systems*, as defined in this standard, up to and including four stories in height. Residential portions of any other building may be protected with residential sprinklers in accordance with 4-3.6 of NFPA 13, *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), (b), and (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 if sprinklers are installed in the compartment. A sprinkler system designed and installed according to this standard may not, however, be expected to control a fire involving unusually higher average fuel loads than typical for dwelling units [10 lb/sq ft (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).

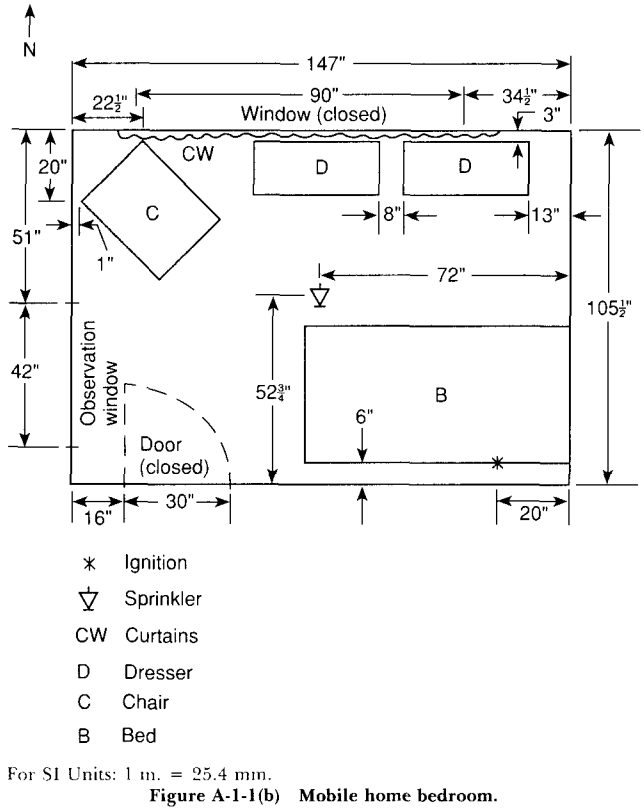
To be effective, sprinkler systems installed in accordance with this standard must have the sprinklers closest to the fire open before the fire exceeds the ability of the sprinkler discharge to extinguish or control that fire. Conditions that allow the fire to grow beyond that point before sprinkler 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 Levels of Protection. Various levels of sprinkler protection are available to provide life safety and property protection. This standard is designed to provide a high,



For SI Units: 1 in. = 25.4 mm.

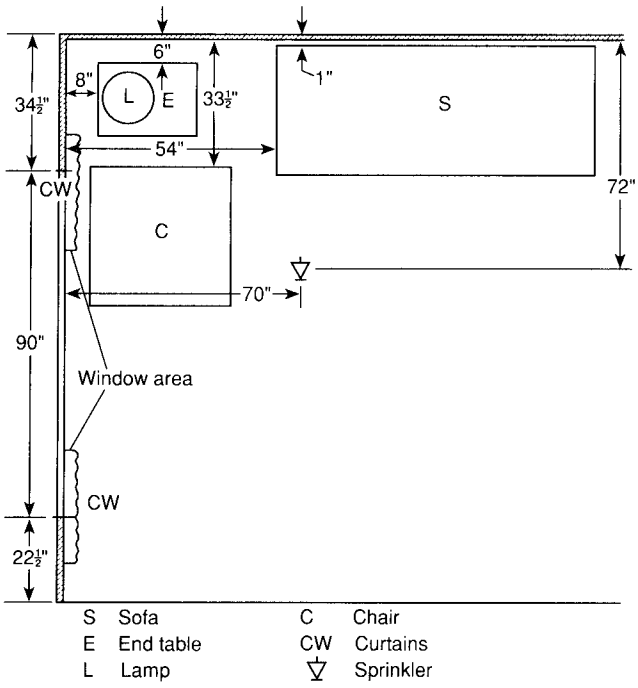
Figure A-1-1(a) Bedroom.



For SI Units: 1 in. = 25.4 mm.

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

but not absolute, level of life safety and a lesser level of property protection. Greater protection to both life and



For SI Units: 1 in. = 25.4 mm.

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

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 are those shown by NFPA statistics to be ones where the incidence of life loss from fires in residential occupancies is low. Such an approach provides a reasonable degree of fire safety to life. (*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 may be delayed, additional sprinkler protection and other fire protection features, such as detection and compartmentation, may be necessary.

A-1-5.1 This standard anticipates the water supply for the system to be in compliance with the governing plumbing code for the jurisdiction. It is intended that any pipe material or diameter acceptable for multiple family dwellings in the plumbing code and that will satisfy the hydraulic criteria of NFPA 13R are considered to be acceptable.

A-1-5.2 Not all pipe or tube made to ASTM F442 and D3309 as described in Section 3-1.2.2 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 F437, F438, and F439 as described in Section 3-1.2.2 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 with glycerine only. The use of diethylene, ethylene, or propylene glycols are 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-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 furthest sprinklers before the test pressure is applied. Compressed air or compressed gas should never be used for pressure testing CPVC piping. Testing with air pressure is acceptable for polybutylene piping when conducted in accordance with the testing procedures of 8-2.3 of NFPA 13.

Fire department connections are not required for all 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 that results in a drop in system pressure greater than 2 psi (0.14 bar) 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-2-2.1.4 These connections should be installed so that the valve may be opened fully and for a sufficient time period to assure a proper test without causing water damage. The test connection should be designed and sized to verify sufficiency of the water supply and alarm mechanisms.

A-2-3.2 The connection for fire protection to city mains is often subject to local regulations concerning metering and backflow prevention requirements. Preferred and acceptable water supply arrangements are shown in Figures A-2-3.2(a), (b), and (c). Where a meter must be used between the city water main and the sprinkler system supply, an acceptable arrangement is shown in Figure A-2-3.2(c). Under these circumstances, the flow characteristics of the meter must 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 actuated when the water level falls below 110 percent of the minimum quantity specified in 2-3.1 should be provided.

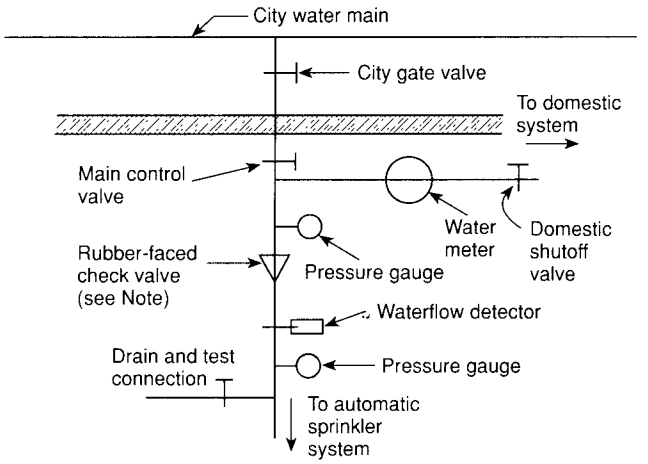
A-2-3.3.1 Tables A-2-3.3.1(a) and (b) can be used to determine a domestic design demand. Using Table A-2-3.3.1(a), determine the total number of water supply fixture units downstream of any point in the piping serving both sprinkler and domestic needs. Using Table A-2-3.3.1(b), determine the appropriate total flow allowance and add this flow to the sprinkler demand at the total pressure required for the sprinkler system at that point.

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

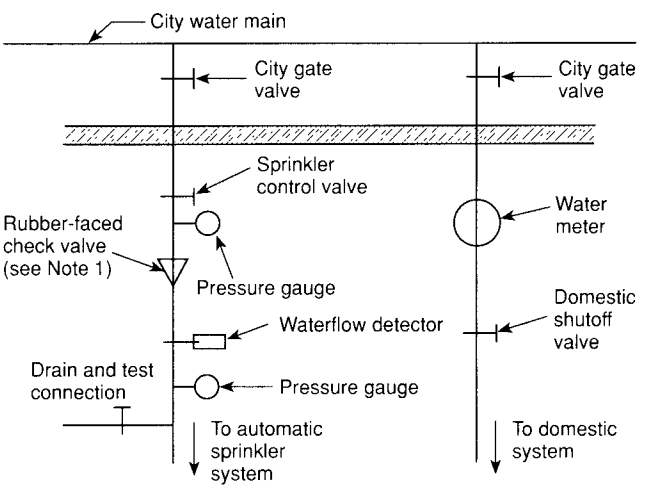
Table A-1-2 Fires and Associated Deaths and Injuries in Apartments, by Area of Origin — Annual Average of 1986-90 Structure Fires Reported to U.S. Fire Departments

Area of Origin	Civilian Deaths	Civilian Pct	Fires	Pct	Injuries	Pct
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%

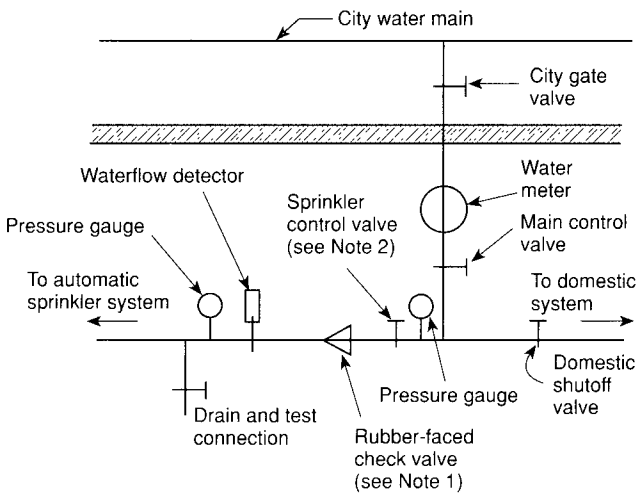
*Does not include dwelling garages coded as a separate property.
NOTE: Fires are estimated to the nearest ten; civilian deaths and injuries to the nearest one.
SOURCE: 1986-1990 NFIRS and NFPA Survey.



NOTE: Rubber-faced check valves optional.
Figure A-2-3.2(a) Preferable arrangement.



NOTE 1: Rubber-faced check valves optional.
NOTE 2: Option: reference 2-4.1.1 Exception.
Figure A-2-3.2(b) Acceptable arrangement with valve supervision. (*See 2-4.1.1 Exception.*)



NOTE 1: Rubber-faced check valves optional
NOTE 2: Option: reference 2-4.1.1 Exception.
Figure A-2-3.2(c) Acceptable arrangement with valve supervision. (*See 2-4.1.1 Exception.*)

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	
Bathtub	4
Drinking fountain	0
Kitchen sink	4
Lavatory	2
Service sink	3
Shower head	4
Urinal with 1-in. flush valve	10
Urinal with 3/4-in. flush valve	5
Urinal with flush tank	3
Washing machine (8 lb)	3
Washing machine (16 lb)	4
Water closet with flush valve	10
Water closet with flush tank	5

CPVC pipe and listed polybutylene pipe have specific requirements for piping support to include additional pipe bracing at sprinklers.

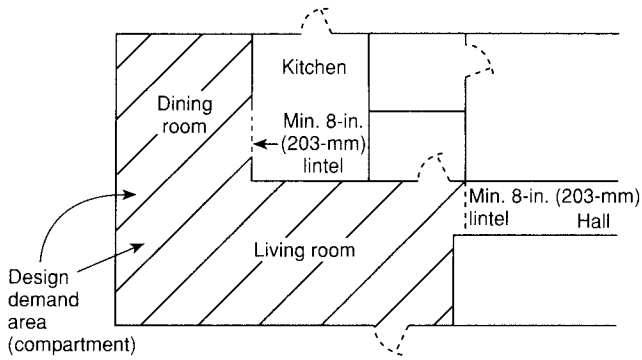
A-2-4.5.9.2 Decorative painting of a residential sprinkler is not to be confused with the temperature identification colors as referenced in 2-2.3 of NFPA 13, *Standard for the Installation of Sprinkler Systems*.

A-2-5.1.2 It is intended that the design area is to include up to four adjacent sprinklers producing the greatest water demand within the compartment.

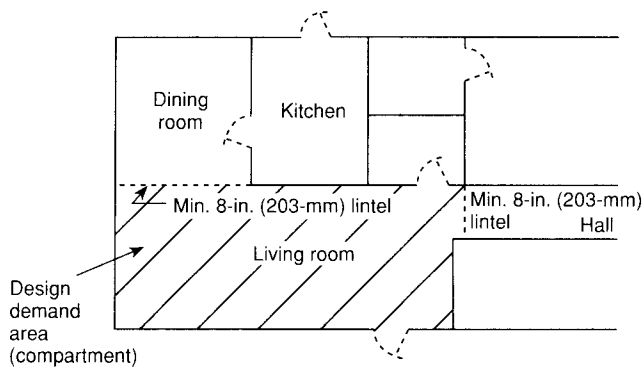
Table A-2-3.3.1(b) Total Estimated Domestic Demand

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
1	3 gpm	
2	5	
5	10	15 gpm
10	15	25
20	20	35
35	25	45
50	30	50
70	35	60
100	45	70
150	55	80
200	65	90
250	75	100
350	100	125
500	125	150
750	175	175
1000	200	200
1500	275	275
2000	325	325
3500	500	500

For SI Units: 1 gal/min = 3 785 L/min.



NOTE: For design demand area, see 2-5.1.2.1.
Figure A-2-5.1.2(a) Sprinkler design areas for typical residential occupancy.



NOTE: For design demand area, see 2-5 1.2.1.
Figure A-2-5.1.2(b) Sprinkler design areas for typical residential occupancy.

A-2-5.1.2.1 Residential sprinklers are currently listed for use under flat, smooth, horizontal ceilings only. Sloped, beamed, and pitched ceilings may require special design

approaches such as larger flows or design for 5 or more sprinklers to operate in the compartment.

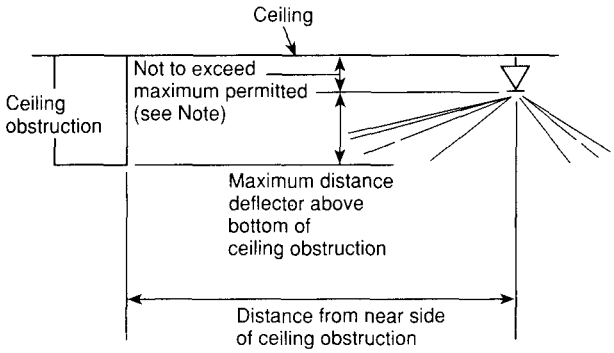
A-2-5.1.7.3 Fire testing has indicated the need to wet walls in the area protected by residential sprinklers at a level closer to the ceiling than that accomplished by standard sprinkler distribution. Where beams, light fixtures, sloped ceilings, and other obstructions occur, additional residential sprinklers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

Table A-2-5.1.7.3 and Figure A-2-5.1.7.3 provide guidance for location of sprinklers near ceiling obstructions.

Table A-2-5.1.7.3 Maximum Distance from Sprinkler Deflector to Bottom of Ceiling Obstruction

Distance from Sprinkler to Side of Ceiling Obstruction	Maximum Distance from Sprinkler Deflector to Bottom of Ceiling Obstruction
Less than 6 in.	Not permitted
6 in. to less than 1 ft	0 in.
1 ft to less than 2 ft	1 in.
2 ft to less than 2 ft 6 in.	2 in.
2 ft 6 in. to less than 3 ft	3 in.
3 ft to less than 3 ft 6 in.	4 in.
3 ft 6 in. to less than 4 ft	6 in.
4 ft to less than 4 ft 6 in.	7 in.
4 ft 6 in. to less than 5 ft	9 in.
5 ft to less than 5 ft 6 in.	11 in.
5 ft 6 in. to less than 6 ft	14 in.

For SI Units: 1 in. = 25.4 mm; 1 ft = 0.3048 m.



NOTE: See 2-5.1.7.1 and 2-5.1.7.2.
For SI Units: 1 in. = 25.4 mm; 1 ft = 0.3048 m.
Figure A-2-5.1.7.3 Position of deflector, upright or pendent, when located above bottom of ceiling obstruction.

A-2-7 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) Visual inspection of all sprinklers to ensure against obstruction of spray.

(b) Inspection of all valves to assure that they are open.

(c) Testing of all waterflow devices.

(d) Testing of the alarm system, if installed.

NOTE: Where 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) Operation of pumps, where employed. See NFPA 20, *Standard for the Installation of Centrifugal Fire Pumps.*

(f) Checking of the pressure of air used with dry systems.

(g) Checking of water level in tanks.

(h) Care should be taken to see 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 may be protected by being covered 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

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

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

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*, 1994 edition.

NFPA 20, *Standard for the Installation of Centrifugal Fire Pumps*, 1993 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 1992 edition.

B-1.2 Other Publications.

B-1.2.1 ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D3309-1992, *Standard Specification for Polybutylene (PB) Plastic Hot and Cold Water Distribution Systems.*

ASTM F437-1989, *Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 (SDR-PR).*

ASTM F438-1990, *Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.*

ASTM F439-1990, *Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.*

ASTM F442-1989, *Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).*

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The NFPA Codes and Standards Development Process

Since 1896, one of the primary purposes of the NFPA has been to develop and update the standards covering all areas of fire safety.

Calls for Proposals
The code adoption process takes place twice each year and begins with a call for proposals from the public to amend existing codes and standards or to develop the content of new fire safety documents.

Report on Proposals
Upon receipt of public proposals, the technical committee members meet to review, consider, and act on the proposals. The public proposals – together with the committee action on each proposal and committee-generated proposals – are published in the NFPA's Report on Proposals (ROP). The ROP is then subject to public review and comment.

Report on Comments
These public comments are considered and acted upon by the appropriate technical committees. All public comments – together with the committee action on each comment – are published as the Committee's supplementary report in the NFPA's Report on Comments (ROC).

The committee's report and supplementary report are then presented for adoption and open debate at either of NFPA's semi-annual meetings held throughout the United States and Canada.

Association Action
The Association meeting may, subject to review and issuance by the NFPA Standards Council, (a) adopt a report as published, (b) adopt a report as amended, contingent upon subsequent approval by the committee, (c) return a report to committee for further study, and (d) return a portion of a report to committee.

Standards Council Action
The Standards Council will make a judgement on whether or not to issue an NFPA document based upon the entire record before the Council, including the vote taken at the Association meeting on the technical committee's report.

Voting Procedures
Voting at an NFPA Annual or Fall Meeting is restricted to members of record for 180 days prior to the opening of the first general session of the meeting, except that individuals who join the Association at an Annual or Fall Meeting are entitled to vote at the next Fall or Annual Meeting.

"Members" are defined by Article 3.2 of the Bylaws as individuals, firms, corporations, trade or professional associations, institutes, fire departments, fire brigades, and other public or private agencies desiring to advance the purposes of the Association. Each member shall have one vote in the affairs of the Association. Under Article 4.5 of the Bylaws, the vote of such a member shall be cast by that member individually or by an employee designated in writing by the member of record who has registered for the meeting. Such a designated person shall not be eligible to represent more than one voting privilege on each issue, nor cast more than one vote on each issue.

Any member who wishes to designate an employee to cast that member's vote at an Association meeting in place of that member must provide that employee with written authorization to represent the member at the meeting. The authorization must be on company letterhead signed by the member of record, with the membership number indicated, and the authorization must be recorded with the President of NFPA or his designee before the start of the opening general session of the Meeting. That employee, irrespective of his or her own personal membership status, shall be privileged to cast only one vote on each issue before the Association.

Sequence of Events Leading to Publication of an NFPA Committee Document

Call for proposals to amend existing document or for recommendations on new document.

▼

Committee meets to act on proposals, to develop its own proposals, and to prepare its report.

▼

Committee votes on proposals by letter ballot. If two-thirds approve, report goes forward. Lacking two-thirds approval, report returns to committee.

▼

Report is published for public review and comment. (Report on Proposals - ROP)

▼

Committee meets to act on each public comment received.

▼

Committee votes on comments by letter ballot. If two-thirds approve, supplementary report goes forward. Lacking two-thirds approval, supplementary report returns to committee.

▼

Supplementary report is published for public review. (Report on Comments - ROC).

▼

NFPA membership meets (Annual or Fall Meeting) and acts on committee report (ROP and ROC).

▼

Committee votes on any amendments to report approved at NFPA Annual or Fall Meeting.

▼

Complaints to Standards Council on Association action must be filed within 20 days of the NFPA Annual or Fall Meeting.

▼

Standards Council decides, based on all evidence, whether or not to issue standard or to take other action, including hearing any complaints.

▼

Appeals to Board of Directors on Standards Council action must be filed within 20 days of Council action.