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NFPA 14 Installation of Standpipe and Hose Systems 1993 Edition

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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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NFPA 14

Standard for the

Installation of Standpipe and Hose Systems

1993 Edition

This edition of NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, was prepared by the Technical Committee on Standpipes, released by the Correlating Committee on Water Extinguishing Systems, and acted on by the National Fire Protection Association, Inc. at its Fall Meeting held November 16-18, 1992, in Dallas, TX. It was issued by the Standards Council on January 15, 1993, with an effective date of February 12, 1993, and supersedes all previous editions.

The 1993 edition of this document has been approved by the American National Standards Institute.

Origin and Development of NFPA 14

This standard dates from 1912 when an initial report was made by the Committee on Standpipe and Hose Systems. The report was amended in 1914 and adopted by the Association in 1915. Revisions were adopted in 1917. Next revisions were presented by the Committee on Field Practice and adopted in 1926, 1927, 1931, 1938 (included action by Board of Directors), 1941, and 1945. The Committee on Standpipes recommended revisions adopted in 1949, 1952, 1963, 1968, 1969, 1970, 1971, 1973, 1974, 1976, 1978, 1980, 1982, 1985, and 1990.

The 1993 edition of NFPA 14 represents a complete reorganization of the document. As with other NFPA standards, the "user friendliness" of NFPA 14 was evaluated, and numerous changes followed. The standard is now arranged to provide for a logical system design approach when designing and installing a standpipe system.

Substantive changes to this edition resulted from recent experience with standpipe systems under fire conditions. Flow rates, pressures, and the specific location of the hose connections were studied to determine optimum combinations for each factor.

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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 dealing with the installation of standpipe and hose systems in buildings and structures.

Contents

NFPA 14

Standard for the

Installation of Standpipe and Hose Systems

1993 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 10 and Appendix B.

Chapter 1 General Information

1-1 Scope. This standard covers the minimum requirements for the installation of standpipe and hose systems for buildings and structures.

1-2 Purpose. The purpose of this standard is to provide a reasonable degree of protection for life and property from fire through installation requirements for standpipe systems based on sound engineering principles, test data, and field experience. 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 Retroactivity. The provisions of this document are considered necessary to provide a reasonable level of protection from loss of life and property from fire. They reflect situations and the state of the art at the time the standard was issued.

Unless otherwise noted, it is not intended that the provisions of this document be applied to facilities, equipment, structures, or installations that were existing or approved for construction or installation prior to the effective date of the document.

Exception: In those cases where it is determined by the authority having jurisdiction that the existing situation involves a distinct hazard to life or property, this standard shall apply.

1-4 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."

Automatic Standpipe System. A standpipe system that is attached to a water supply capable of supplying the system demand at all times and that requires no action other than opening a hose valve to provide water at hose connections. (*See Chapter 3.*)

Branch Line. A piping system, generally in a horizontal plane, connecting one or more hose connections with a standpipe.

Combined System. A standpipe system having piping that supplies both hose connections and automatic sprinklers.

Control Valve. A valve used to control the water supply system of a standpipe system.

Dry Standpipe. A standpipe system designed to have piping contain water only when the system is being utilized. (*See Chapter 3.*)

Feed Main. That portion of a standpipe system that supplies water to one or more standpipes.

Fire Department Connection. A connection through which the fire department can pump water into the standpipe system.

High-Rise Building. A building more than 75 ft (23 m) in height. Building height shall be measured from the lowest level of fire department vehicle access to the floor of the highest occupiable story.

Hose Connection. A combination of equipment provided for connection of a hose to the standpipe system that includes a hose valve with a threaded outlet.

Hose Station. A combination of a hose rack, hose nozzle, hose, and hose connection.

Hose Valve. The valve to an individual hose connection.

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.

Manual Standpipe System. A standpipe system that relies exclusively on the fire department connection to supply the system demand. (*See Chapter 3.*)

Pressure, Nozzle. Pressure required at the inlet of a nozzle to produce the desired water discharge characteristics.

Pressure, Residual. Pressure acting on a point in the system with a flow being delivered by the system.

Pressure, Static. Pressure acting on a point in the system with no flow from the system.

Pressure Control Valve. A pilot-operated valve designed for the purpose of reducing the downstream water pressure to a specific value under both flowing (residual) and nonflowing (static) conditions.

Pressure Reducing Valve. A valve designed for the purpose of reducing the downstream water pressure under both flowing (residual) and nonflowing (static) conditions.

Pressure Regulating Device. A device designed for the purpose of reducing, regulating, controlling, or restricting water pressure. Examples include pressure reducing valves, pressure control valves, and pressure restricting devices.

Pressure Restricting Device. A valve or device designed for the purpose of reducing the downstream water pressure under flowing (residual) conditions only.

Semiautomatic Standpipe System. A standpipe system that is attached to a water supply capable of supplying the system demand at all times and that requires activation of a control device to provide water at hose connections. See Chapter 3.

Shall.* Indicates a mandatory requirement.

Standpipe. The riser portion of the system piping that delivers the water supply for hose connections, and sprinklers on combined systems, vertically from floor to floor.

Standpipe System. An arrangement of piping, valves, hose connections, and allied equipment installed in a building or structure with the hose connections located in such a manner that water can be discharged in streams or spray patterns through attached hose and nozzles, for the purpose of extinguishing a fire and so protecting a building or structure and its contents in addition to protecting the occupants. This is accomplished by connections to water supply systems or by pumps, tanks, and other equipment necessary to provide an adequate supply of water to the hose connections.

System Demand. The flow rate and residual pressure required from a water supply, measured at the point of connection of a water supply to a standpipe system, to deliver:

(a) The total water flow rate required for a standpipe system established in Section 5-9, and

(b) The minimum residual pressures established by Section 5-7 at the hydraulically most remote hose connection, and

(c) The minimum water flow rate for sprinkler connections, on combined systems.

Type (of System). (*See Chapter 3.*)

Wet Standpipe. A standpipe system having piping containing water at all times. (*See Chapter 3.*)

1-5 Units.

1-5.1 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 1-5 with conversion factors.

Table 1-5

Name of Unit	Unit Symbol	Conversion Factor
meter	m	1 ft = 0.3048 m
millimeter	mm	1 in. = 25.4 mm
liter	L	1 gal = 3.785 L
cubic decimeter	dm^3	1 gal = 3.785 dm^3
Pascal	Pa	1 psi = 6894.757 Pa
bar	bar	1 psi = 0.0689 bar
bar	bar	1 bar = 10^5 Pa

For additional conversion and information, see ASTM E380.

1-5.2 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 could be approximate.

Chapter 2 System Components and Hardware

2-1* General. Standpipe system components and hardware shall be in accordance with this chapter. All devices and materials used in standpipe systems shall be of an approved type. System components shall be rated for working pressures not less than the maximum pressure to be developed at that point in the system under any condition including the pressure when a permanently installed fire pump is operating at shutoff pressure.

2-2 Pipe and Tube.

2-2.1 Pipe or tube used in standpipe systems shall meet or exceed one of the standards in Table 2-2.1 or be in accordance with 2-2.2 through 2-2.5.

Table 2-2.1 Pipe or Tube Materials and Dimensions

Material and Dimensions (Specifications)	Standard
Ferrous Piping	
Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids	AWWA C151
Electric-Resistance Welded Steel Pipe Spec. for Black and Hot-Dipped Zinc-Coated (Galvanized)	ASTM A135
Welded and Seamless Steel Pipe for Fire Protection Use	ASTM A795
Welded and Seamless Steel Pipe	ASTM A53
Wrought-Steel and Wrought-Iron Pipe	ANSI B36.10
Copper Tube (Drawn, Seamless)	
Seamless Copper Tube	ASTM B75
Seamless Copper Water Tube	ASTM B88
General Requirements for Wrought Seamless Copper and Copper-Alloy Tube	ASTM B251
Brazing Filler Metal (Classifications BCuP-3 or BCuP-4)	AWS A5.8

2-2.2 Where steel pipe listed in Table 2-2.1 is used and joined by welding as referenced in 2-4.2 or by roll-grooved pipe and fittings as referenced in 2-4.3, the minimum nominal wall thickness for pressures up to 300 psi (20.7 bars) shall be in accordance with Schedule 10 for sizes up to 5 in. (127 mm); 0.134 in. (3.40 mm) for 6 in. (152 mm); and 0.188 in. (4.78 mm) for 8- and 10-in. (203- and 254-mm) pipe.

Exception: Pressure limitations and wall thickness for steel pipe listed in accordance with 2-2.5 shall be in accordance with the listing requirements.

2-2.3 Where steel pipe listed in Table 2-2.1 is joined by threaded fittings referenced in 2-4.1 or by fittings used with pipe having cut grooves, the minimum wall thickness shall be in accordance with Schedule 30 [in sizes 8 in. (203 mm) and larger] or Schedule 40 [in sizes less than 8 in. (203 mm)] pipe for pressures up to 300 psi (20.7 bars).

Exception: Pressure limitations and wall thickness for steel pipe specially listed in accordance with 2-2.5 shall be in accordance with the listing requirements.

2-2.4 Copper tube as specified in the standards listed in Table 2-2.1 shall have a wall thickness of Type K, L, or M where used in standpipe systems.

2-2.5 Other types of pipe or tube investigated for suitability in standpipe installations and listed for this service, including but not limited to steel differing from that provided in Table 2-2.1, shall be permitted where installed in accordance with their listing limitations, including installation instructions. Pipe or tube shall not be listed for portions of an occupancy classification.

2-2.6 Pipe Bending. Bending of Schedule 40 steel pipe and Types K and L copper tube shall be permitted where bends are made with no kinks, ripples, distortions, reductions in diameter, or any noticeable deviations from round. The minimum radius of a bend shall be 6 pipe diameters for pipe sizes 2 in. (51 mm) and smaller, and 5 pipe diameters for pipe sizes 2½ in. (64 mm) and larger.

2-3 Fittings.

2-3.1 Fittings used in sprinkler systems shall meet or exceed the standards in Table 2-3.1 or be in accordance with 2-3.2.

Table 2-3.1 Fittings Materials and Dimensions

Material and Dimensions	Standard
Cast Iron	
Cast-Iron Threaded Fittings, Class 125 and 250	ANSI B16.4
Cast-Iron Pipe Flanges and Flanged Fittings, Class 125 and 250	ANSI B16.1
Malleable Iron	
Malleable Iron Threaded Fittings, Class 150 and 300	ANSI B16.3
Ductile Iron	
Gray-Iron and Ductile-Iron Fittings, 3 in. through 48 in. for Water and Other Liquids	AWWA C110
Steel	
Factory-Made Wrought Steel Buttweld Fittings	ANSI B16.9
Buttwelding Endings 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
Steel Pipe Flanges and Flanged Fittings	ANSI B16.5
Forged Steel Fittings, Socketed, Welded and Threaded	ANSI B16.11
Copper	
Wrought Copper and Bronze Solder-Joint Pressure Fittings	ANSI B16.22
Cast Bronze Solder Joint Pressure Fittings	ANSI B16.18

2-3.2 Other types of fittings investigated for suitability in standpipe installations and listed for this service, including but not limited to steel differing from that provided in Table 2-3.1, shall be permitted where installed in accordance with their listing limitations, including installation instructions.

2-3.3 Fittings shall be extra-heavy pattern where pressures exceed 175 psi (12.1 bars).

Exception No. 1: Standard weight pattern cast-iron fittings 2 in. (51 mm) in size and smaller shall be permitted where pressures do not exceed 300 psi (20.7 bars).

Exception No. 2: Standard weight pattern malleable iron fittings 6 in. (152 mm) in size and smaller shall be permitted where pressures do not exceed 300 psi (20.7 bars).

Exception No. 3: Fittings shall be permitted for system pressures up to the limits specified in their listings.

2-3.4 Couplings and Unions. Screwed unions shall not be used on pipe larger than 2 in. (51 mm). Couplings and unions of other than screwed-type shall be of types listed specifically for use in sprinkler systems.

2-3.5 Reducers and Bushings. A one-piece reducing fitting shall be used wherever a change is made in the size of the pipe.

Exception: Hexagonal or face bushings shall be permitted in reducing the size of openings of fittings where standard fittings of the required size are not available.

2-4 Joining of Pipe and Fittings.

2-4.1 Threaded Pipe and Fittings.

2-4.1.1 All threaded pipe and fittings shall have threads cut to ANSI/ASME B1.20.1.

2-4.1.2 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 threaded fittings.

Exception: A threaded assembly investigated for suitability in standpipe installations and listed for this service shall be permitted.

2-4.1.3 Joint compound or tape shall be applied only to male threads.

2-4.2 Welded Pipe and Fittings.

2-4.2.1 Welding methods that comply with all of the requirements of AWS D10.9, *Standard Specification for Qualification of Welding Procedures and Welders for Piping and Tubing*, Level AR-3, are acceptable means of joining fire protection piping.

2-4.2.2 Standpipe piping shall be shop welded.

Exception: Welding of standpipe piping in place inside new buildings under construction shall be permitted only where the construction is noncombustible and no combustible contents are present, and when the welding process is performed in accordance with NFPA 51B, Standard for Fire Prevention in Use of Cutting and Welding Processes.

2-4.2.3 Fittings used to join pipe shall be listed fabricated fittings or manufactured in accordance with Table 2-3.1. Such fittings joined in conformance with a qualified welding procedure as set forth in this section are an acceptable product under this standard, provided that materials and wall thickness are compatible with other sections of this standard.

Exception: Fittings are not required where pipe ends are buttwelded.

2-4.2.4 No welding shall be performed if there is impingement of rain, snow, sleet, or high wind on the weld area of the pipe product.

2-4.2.5 When welding is performed:

(a) Holes in piping for outlets shall be cut to the full inside diameter of fittings prior to welding in place of the fittings.

(b) Discs shall be retrieved.

(c) Openings cut into piping shall be smooth bore, and all internal slag and welding residue shall be removed.

(d) Fittings shall not penetrate the internal diameter of the piping.

(e) Steel plates shall not be welded to the ends of piping or fittings.

(f) Fittings shall not be modified.

(g) Nuts, clips, eye rods, angle brackets, or other fasteners shall not be welded to pipe or fittings.

Exception: Only tabs welded to pipe for longitudinal earthquake braces shall be permitted. (See NFPA 13.)

2-4.2.6 When reducing the pipe size in a run of piping, a reducing fitting designed for that purpose shall be used.

2-4.2.7 Torch cutting and welding shall not be permitted as a means of modifying or repairing standpipe systems.

2-4.2.8 Qualifications.

2-4.2.8.1 A welding procedure shall be prepared and qualified by the contractor or fabricator before any welding is done. Qualification of the welding procedure to be used and the performance of all welders and welding operators is required and shall meet or exceed the requirements of American Welding Society Standard AWS D10.9, Level AR-3.

2-4.2.8.2 Contractors or fabricators shall be responsible for all welding they produce. Each contractor or fabricator shall have an established written quality assurance procedure ensuring compliance with the requirements of 2-4.2.5 available to the authority having jurisdiction.

2-4.2.9 Records.

2-4.2.9.1 Welders or welding machine operators shall, upon completion of each weld, stamp an imprint of their identification into the side of the pipe adjacent to the weld.

2-4.2.9.2 Contractors or fabricators shall maintain certified records, which are available to the authority having jurisdiction, of the procedures used and the welders or welding machine operators employed by them along with their welding identification imprints. Records shall show the date and the results of procedure and performance qualifications.

2-4.3 Groove Joining Methods.

2-4.3.1 Pipe joined with grooved fittings shall be joined by a listed combination of fittings, gaskets, and grooves. Grooves cut or rolled on pipe shall be dimensionally compatible with the fittings.

2-4.3.2 Grooved fittings including gaskets used on dry pipe systems shall be listed for dry pipe service.

2-4.4 Brazed and Soldered Joints.

2-4.4.1 Joints for the connection of copper tube shall be brazed.

Exception No. 1: Solder joints shall be permitted for exposed wet standpipe systems in Light Hazard Occupancies.

Exception No. 2: Solder joints shall be permitted for wet standpipe systems in Light Hazard and Ordinary Hazard (Group 1) Occupancies where the piping is concealed.

2-4.4.2 Highly corrosive fluxes shall not be used.

2-4.5 Other Types. Other joining methods investigated for suitability in standpipe systems and listed for this service shall be permitted where installed in accordance with their listing limitations, including installation instructions.

2-4.6 End Treatment. After cutting, pipe ends shall have burrs and fins removed.

2-4.6.1 Pipe used with listed fittings and its end treatment shall be in accordance with the fitting manufacturer's installation instructions and the fitting's listing.

2-5 Hangers.

2-5.1* General. Types of hangers shall be in accordance with the requirements of this section.

Exception: Hangers certified by a registered professional engineer to include all of the following shall be acceptable:

(a) Hangers are designed to support 5 times the weight of the water-filled pipe plus 250 lb (114 kg) at each point of piping support.

(b) These points of support are adequate to support the standpipe system.

(c) Hanger components shall be ferrous.

Detailed calculations shall be submitted, where required by the reviewing authority, showing stresses developed both in hangers and piping and safety factors allowed.

2-5.1.1 The components of hanger assemblies that directly attach to the pipe or to the building structure shall be listed.

Exception: Mild steel hangers formed from rods need not be listed.

2-5.1.2 Hangers and their components shall be ferrous.

Exception: Nonferrous components that have been proven by fire tests to be adequate for the hazard application, that are listed for this purpose, and that are in compliance with the other requirements of this section shall be acceptable.

2-5.1.3 Standpipe piping shall be substantially supported from the building structure, which must support the added load of the water-filled pipe plus a minimum of 250 lb (114 kg) applied at the point of hanging.

2-5.1.4 Where standpipe piping is installed below ductwork, piping shall be supported from the building structure or from the ductwork supports, provided such supports are capable of handling both the load of the ductwork and the load specified in 2-5.1.3.

2-5.1.5 For trapeze hangers, the minimum size of steel angle or pipe span between purlins or joists shall be such that the available section modulus of the trapeze member from Table 2-5.1.5(b) equals or exceeds the section modulus required in Table 2-5.1.5(a).

Table 2-5.1.5(a) Section Modulus Required for Trapeze Member (in^3)

Span of Trapeze	1 in.	1¼ in.	1½ in.	2 in.	2½ in.	3 in.	3½ in.	4 in.	5 in.	6 in.	8 in.	10 in.
1 ft 6 in.	.08	.09	.09	.09	.10	.11	.12	.13	.15	.18	.24	.32
	.08	.09	.09	.10	.11	.12	.13	.15	.18	.22	.30	.41
2 ft 0 in.	.11	.12	.12	.13	.13	.15	.16	.17	.20	.24	.32	.43
	.11	.12	.12	.13	.15	.16	.18	.20	.24	.29	.40	.55
2 ft 6 in.	.14	.14	.15	.16	.17	.18	.20	.21	.25	.30	.40	.54
	.14	.15	.15	.16	.18	.21	.22	.25	.30	.36	.50	.68
3 ft 0 in.	.17	.17	.18	.19	.20	.22	.24	.26	.31	.36	.48	.65
	.17	.18	.18	.20	.22	.25	.27	.30	.36	.43	.60	.82
4 ft 0 in.	.22	.23	.24	.25	.27	.29	.32	.34	.41	.48	.64	.87
	.22	.24	.24	.26	.29	.33	.36	.40	.48	.58	.80	1.09
5 ft 0 in.	.28	.29	.30	.31	.34	.37	.40	.43	.51	.59	.80	1.08
	.28	.29	.30	.33	.37	.41	.45	.49	.60	.72	1.00	1.37
6 ft 0 in.	.33	.35	.36	.38	.41	.44	.48	.51	.61	.71	.97	1.30
	.34	.35	.36	.39	.44	.49	.54	.59	.72	.87	1.20	1.64
7 ft 0 in.	.39	.40	.41	.44	.47	.52	.55	.60	.71	.83	1.13	1.52
	.39	.41	.43	.46	.51	.58	.63	.69	.84	1.01	1.41	1.92
8 ft 0 in.	.44	.46	.47	.50	.54	.59	.63	.68	.81	.95	1.29	1.73
	.45	.47	.49	.52	.59	.66	.72	.79	.96	1.16	1.61	2.19
9 ft 0 in.	.50	.52	.53	.56	.61	.66	.71	.77	.92	1.07	1.45	1.95
	.50	.53	.55	.59	.66	.74	.81	.89	1.08	1.30	1.81	2.46
10 ft 0 in.	.56	.58	.59	.63	.68	.74	.79	.85	1.02	1.19	1.61	2.17
	.56	.59	.61	.65	.74	.82	.90	.99	1.20	1.44	2.01	2.74

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

Top values are for Schedule 10 pipe; bottom values are for Schedule 40 pipe.

NOTE: The table is based on a maximum allowable bending stress of 15 KSI and a midspan concentrated load from 15 ft of water-filled pipe, plus 250 lb.

Any other sizes or shapes giving equal or greater section modulus shall be acceptable. All angles shall be used with the longer leg vertical. The trapeze member shall be secured to prevent slippage. Where a pipe is suspended from a pipe trapeze of a diameter less than the diameter of the pipe being supported, ring, strap, or clevis hangers of the size corresponding to the suspended pipe shall be used on both ends.

Table 2-5.1.5(b) Available Section Moduli of Common Trapeze Hangers

Pipe	Modulus	Angles					Modulus
Schedule 10							
1 in.	.12	1½	×	1½	×	3/16	.10
1¼ in.	.19	2	×	2	×	⅛	.13
1½ in.	.26	2	×	1½	×	3/16	.18
2 in.	.42	2	×	2	×	3/16	.19
2½ in.	.69	2	×	2	×	¼	.25
3 in.	1.04	2½	×	1½	×	3/16	.28
3½ in.	1.38	2½	×	2	×	3/16	.29
4 in.	1.76	2	×	2	×	5/16	.30
5 in.	3.03	2½	×	2½	×	3/16	.30
6 in.	4.35	2	×	2	×	⅜	.35
		2½	×	2½	×	¼	.39
		3	×	2	×	3/16	.41
Schedule 40		3	×	2½	×	3/16	.43
1 in.	.13	3	×	3	×	3/16	.44
1¼ in.	.23	2½	×	2½	×	5/16	.48
1½ in.	.33	3	×	2	×	¼	.54
2 in.	.56	2½	×	2	×	⅜	.55
2½ in.	1.06	2½	×	2½	×	⅜	.57
3 in.	1.72	3	×	3	×	¼	.58
3½ in.	2.39	3	×	3	×	5/16	.71
4 in.	3.21	2½	×	2½	×	½	.72
5 in.	5.45	3½	×	2½	×	¼	.75
6 in.	8.50	3	×	2½	×	⅜	.81
		3	×	3	×	⅜	.83
		3½	×	2½	×	5/16	.93
		3	×	3	×	7/16	.95
		4	×	4	×	¼	1.05
		3	×	3	×	½	1.07
		4	×	3	×	5/16	1.23
		4	×	4	×	5/16	1.29
		4	×	3	×	⅜	1.46
		4	×	4	×	⅜	1.52
		5	×	3½	×	5/16	1.94
		4	×	4	×	½	1.97
		4	×	4	×	⅝	2.40
		4	×	4	×	¾	2.81
		6	×	4	×	⅜	3.32
		6	×	4	×	½	4.33
		6	×	4	×	¾	6.25
		6	×	6	×	1	8.57

For SI Units: 1 in. = 25.4 mm; 1 ft = 0.30458 m.

2-5.1.6 The size of hanger rods and fasteners required to support the steel angle iron or pipe indicated in Table 2-5.1.5(a) shall comply with 2-5.4.

2-5.1.7 Standpipe piping or hangers shall not be used to support nonsystem components.

2-5.2 Hangers in Concrete.

2-5.2.1 The use of listed inserts set in concrete to support hangers shall be permitted.

2-5.2.2 Listed expansion shields for supporting pipes under concrete construction shall be permitted to be used in a horizontal position in the sides of beams. In concrete having gravel or crushed stone aggregate, expansion shields shall be permitted to be used in the vertical position to support pipes 4 in. (102 mm) or less in diameter.

2-5.2.3 For the support of pipes 5 in. (127 mm) and larger, expansion shields, if used in the vertical position, shall alternate with hangers connected directly to the structural members, such as trusses and girders, or to the sides of concrete beams. In the absence of convenient structural members, pipes 5 in. (127 mm) and larger shall be permitted to be supported entirely by expansion shields in the vertical position, but spaced not more than 10 ft (3 m) apart.

2-5.2.4 Expansion shields shall not be used in ceilings of gypsum or similar soft material. In cinder concrete, expansion shields shall not be used except on branch lines where they shall alternate with through bolts or hangers attached to beams.

2-5.2.5 Where expansion shields are used in the vertical position, the holes shall be drilled to provide uniform contact with the shield over its entire circumference. Depth of the hole shall not be less than specified for the type of shield used.

2-5.2.6 Holes for expansion shields in the side of concrete beams shall be above the center line of the beam or above the bottom reinforcement steel rods.

2-5.3 Powder-Driven Studs and Welding Studs.

2-5.3.1 Powder-driven studs, welding studs, and the tools used for installing these devices shall be listed. Pipe size, installation position, and construction material into which they are installed shall be in accordance with individual listings.

2-5.3.2 Representative samples of concrete into which studs are to be driven shall be tested to determine that the studs will hold a minimum load of 750 lb (341 kg) for 2-in. (51-mm) or smaller pipe, 1000 lb (454 kg) for 2½-, 3-, or 3½-in. (64-, 76-, or 89-mm) pipe, and 1200 lb (545 kg) for 4- or 5-in. (102- or 127-mm) pipe.

2-5.3.3 Increaser couplings shall be attached directly to the powder-driven studs or welding studs.

2-5.3.4 Welding studs or other hanger parts shall not be attached by welding to steel less than U.S. Standard, 12 gauge.

2-5.4 Rods and U-Hooks.

2-5.4.1 Hanger rod size shall be the same as that approved for use with the hanger assembly, and the size of rods shall not be less than that given in Table 2-5.4.1.

Exception: Rods of smaller diameter shall be permitted where the hanger assembly has been tested and listed by a testing laboratory and installed within the limits of pipe sizes expressed in individual listings. For rolled threads, the rod size shall be not less than the root diameter of the thread.

Table 2-5.4.1 Hanger Rod Sizes

Pipe Size	Dia. of Rod in.	mm
Up to and including 4 in.	3/8	9.5
5, 6, and 8 in.	1/2	12.7
10 and 12 in.	5/8	15.9

For SI Units: 1 in. = 25.4 mm.

2-5.4.2 U-Hooks. The size of the rod material of U-hooks shall not be less than that given in Table 2-5.4.2. Drive screws shall be used only in a horizontal position as in the side of a beam in conjunction with U-hangers only.

Table 2-5.4.2 U-Hook Rod Sizes

Pipe Size	Hook Material Diameter in.	mm
Up to 2 in.	5/16	7.9
2 1/2 in. to 6 in.	3/8	9.5
8 in.	1/2	12.7

For SI Units: 1 in. = 25.4 mm.

2-5.4.3 Eye Rods. The size of the rod material for eye rods shall not be less than that specified in Table 2-5.4.3. Where eye rods are fastened to wood structural members, the eye rod shall be backed with a large flat washer bearing directly against the structural member, in addition to the lock washer.

Table 2-5.4.3 Eye Rod Sizes

	Diameter of Rod			
	With Bent Eye		With Welded Eye	
Pipe Size	in.	mm	in.	mm
Up to 4 in.	3/8	9.5	3/8	9.5
5 to 6 in.	1/2	12.7	1/2	12.7
8 in.	3/4	19.1	1/2	12.7

For SI Units: 1 in. = 25.4 mm.

2-5.4.3.1 Eye rods shall be secured with lock washers to prevent lateral motion.

2-5.4.4 Threaded sections of rods shall not be formed or bent.

2-5.4.5 Screws. For ceiling flanges and U-hooks, screw dimensions shall not be less than those given in Table 2-5.4.5.

Exception: Where the thickness of planking and thickness of flange do not permit the use of screws 2 in. (51 mm) long, screws 1 3/4 in. (44 mm) long shall be permitted with hangers spaced not more than 10 ft (3 m) apart. Where the thickness of beams or joists does not permit the use of screws 2 1/2 in. (64 mm) long, screws 2 in. (51 mm) long shall be permitted with hangers spaced not more than 10 ft (3 m) apart.

Table 2-5.4.5 Screw Dimensions for Ceiling Flanges and U-Hooks

Pipe Size	2 Screw Flanges
Up to 2 in.	Wood Screw No. 18 x 1 1/2 in.
Pipe Size	**3 Screw Flanges**
Up to 2 in.	Wood Screw No. 18 x 1 1/2 in.
2 1/2 in., 3 in., 3 1/2 in.	Lag Screw 3/8 in. x 2 in.
4 in., 5 in., 6 in.	Lag Screw 1/2 in. x 2 in.
8 in.	Lag Screw 5/8 in. x 2 in.
Pipe Size	**4 Screw Flanges**
Up to 2 in.	Wood Screw No. 18 x 1 1/2 in.
2 1/2 in., 3 in., 3 1/2 in.	Lag Screw 3/8 in. x 1 1/2 in.
4 in., 5 in., 6 in.	Lag Screw 1/2 in. x 2 in.
8 in.	Lag Screw 5/8 in. x 2 in.
Pipe Size	**U-Hooks**
Up to 2 in.	Drive Screw No. 16 x 2 in.
2 1/2 in., 3 in., 3 1/2 in.	Lag Screw 3/8 in. x 2 1/2 in.
4 in., 5 in., 6 in.	Lag Screw 1/2 in. x 3 in.
8 in.	Lag Screw 5/8 in. x 3 in.

For SI Units: 1 in. = 25.4 mm.

2-5.4.6 The size bolt or lag (coach) screw used with an eye rod or flange on the side of the beam shall not be less than specified in Table 2-5.4.6.

Table 2-5.4.6 Minimum Bolt or Lag Screw Sizes

Size of Pipe	Size of Bolt or Lag Screw in.	mm	Length of Lag Screw Used with Wood Beams in.	mm
Up to and including 2 in.	3/8	9.5	2 1/2	64
2 1/2 to 6 in. (inclusive)	1/2	12.7	3	76
8 in.	5/8	15.9	3	76

For SI Units: 1 in. = 25.4 mm.

Exception: Where the thickness of beams or joists does not permit the use of screws 2 1/2 in. (64 mm) long, screws 2 in. (51 mm) long shall be permitted with hangers spaced not more than 10 ft (3 m) apart.

2-5.4.7 Wood screws shall be installed with a screwdriver. Nails are not acceptable for fastening hangers.

2-5.4.8 Screws in the side of a timber or joist shall be not less than 2 1/2 in. (64 mm) from the lower edge where supporting branch lines and not less than 3 in. (76 mm) where supporting main lines.

Exception: This requirement shall not apply to 2-in. (51-mm) or thicker nailing strips resting on top of steel beams.

2-5.4.9 The minimum plank thickness and the minimum width of the lower face of beams or joists in which lag screw rods are used shall be as given in Table 2-5.4.9.

Table 2-5.4.9 Minimum Plank Thicknesses and Beam or Joist Widths

Pipe Size	Nominal Plank Thickness in.	Nominal Plank Thickness mm	Nominal Width of Beam or Joist Face in.	Nominal Width of Beam or Joist Face mm
Up to 2 in.	3	76	2	51
2½ in. to 3½ in.	4	102	2	51
4 in. and 5 in.	4	102	3	76
6 in.	4	102	4	102

For SI Units: 1 in. = 25.4 mm.

2-5.4.10 Lag screw rods shall not be used for support of pipes larger than 6 in. (152 mm). All holes for lag screw rods shall be predrilled ⅛ in. (3.2 mm) less in diameter than the maximum root diameter of the lag screw thread.

2-6 Valves. All valves controlling connections to water supplies and standpipes shall be listed indicating valves.

Such valves shall not close in less than 5 sec when operated at maximum possible speed from the fully open position.

Exception No. 1: A listed underground gate valve equipped with a listed indicator post shall be permitted.

Exception No. 2: A listed water control valve assembly with a reliable position indication connected to a remote supervisory station shall be permitted.

Exception No. 3: A nonindicating valve, such as an underground gate valve with approved roadway box complete with T-wrench, accepted by the authority having jurisdiction, shall be permitted.

2-7 Hose Stations.

2-7.1 Closets and Cabinets.

2-7.1.1 Closets and cabinets used to contain fire hose shall be of sufficient size to permit the installation of the necessary equipment at hose stations and so designed as not to interfere with the prompt use of the hose connection, the hose, and other equipment at the time of fire. Within the cabinet, the hose connections shall be located so that there is at least 1 in. (25 mm) between any part of the cabinet and the handle of the valve when the valve is in any position from fully open to fully closed. The cabinet shall be used for fire equipment only, and each cabinet shall be conspicuously identified.

2-7.1.2 Where a "break glass" type protective cover for a latching device is provided, the device provided to break the glass panel shall be securely attached in the immediate area of the "break glass" panel and shall be so arranged that the device cannot be used to break other glass panels in the cabinet door.

2-7.1.3 Where a fire resistive assembly is penetrated by a cabinet, the fire resistance of the assembly shall be maintained as required by the local building code.

2-7.2* Hose. Each hose connection provided for use by building occupants (Class II and Class III systems) shall be equipped with not more than 100 ft (30.5 m) of listed 1½-in. (38.1-mm) lined, collapsible or noncollapsible fire hose attached and ready for use.

Exception: Where hose less than 1½ in. (38.1 mm) is used for 1½-in. (38.1-mm) hose stations in accordance with 3-3.2 and 3-3.3, listed noncollapsible hose shall be used.

2-7.3 Hose Racks. Each 1½-in. (38.1-mm) hose station provided with 1½-in. (38.1-mm) hose shall be equipped with a listed rack or other approved storage facility.

Each 1½ in. (38.1-mm) hose station provided with hose less than 1½ in. (38.1 mm) in accordance with 3-3.2 and 3-3.3 shall be equipped with a listed continuous flow reel.

2-7.4 Nozzles. Nozzles provided for Class II service shall be listed.

2-7.5 Label. Each rack or storage facility for 1½-in. (38.1-mm) or smaller hose shall be provided with a label that includes "Fire Hose for Use by Occupants" and operating instructions.

2-8 Hose Connections. Hose connections shall have external NH standard threads, for the valve size specified, as specified in NFPA 1963, *Standard for Screw Threads and Gaskets for Fire Hose Connections*. Hose connections shall be equipped with caps to protect hose threads.

Exception: Where local fire department hose threads do not conform to NFPA 1963, the authority having jurisdiction shall designate the hose threads to be used.

2-9* Fire Department Connections.

2-9.1 Fire department connections shall be listed for a working pressure equal to or greater than the pressure requirement of the system demand.

2-9.2* Each fire department connection shall have at least two 2½-in. (63.5-mm) internal threaded swivel fittings having NH standard threads, as specified in NFPA 1963, *Standard for Screw Threads and Gaskets for Fire Hose Connections*. Fire department connections shall be equipped with caps to protect against entry of debris into the system.

Exception: Where the local fire department uses fittings different than those specified, fittings compatible with local fire department equipment shall be used and the minimum size shall be 2½ in. (62 mm).

2-10 Signs. Signs shall be permanently marked and shall be constructed of weather-resistant metal or rigid plastic materials.

Chapter 3 System Requirements

3-1 General.

3-1.1 The number and arrangement of standpipe equipment necessary for proper protection is governed by the local conditions such as occupancy, character, and construction of building and accessibility. The authority having jurisdiction shall be consulted as to the required type of system, class of system, and special requirements.

3-1.2 Spacing and location of standpipes and hose connections shall be in accordance with Chapter 5.

3-1.3 Standpipe and hose systems not required by the authority having jurisdiction and not meeting the requirements of this standard shall be marked with a sign stating "FOR FIRE BRIGADE USE ONLY."

3-2 Types of Standpipe Systems.

3-2.1 Automatic-Dry. An automatic-dry standpipe system shall be a dry standpipe system, normally filled with pressurized air, that is arranged through the use of devices, such as a dry pipe valve, to automatically admit water into system piping upon opening of a hose valve. The water supply for an automatic-dry standpipe system shall be capable of supplying the system demand.

3-2.2 Automatic-Wet. An automatic-wet standpipe system shall be a wet standpipe system that has a water supply that is capable of supplying the system demand automatically.

3-2.3 Semiautomatic-Dry. A semiautomatic-dry standpipe system shall be a dry standpipe system that is arranged through the use of devices, such as a deluge valve, to admit water into system piping upon activation of a remote control device located at a hose connection. A remote control activation device shall be provided at each hose connection. The water supply for a semiautomatic-dry standpipe system shall be capable of supplying the system demand.

3-2.4 Manual-Dry. A manual-dry standpipe system shall be a dry standpipe system that does not have a permanent water supply attached to the system. Manual-dry standpipe systems require water from a fire department pumper (or the like) to be pumped into the system through the fire department connection to supply the system demand.

3-2.5 Manual-Wet. A manual-wet standpipe system shall be a wet standpipe system connected to a small water supply for the purpose of maintaining water within the system, but that does not have a water supply capable of delivering the system demand attached to the system. Manual-wet standpipe systems require water from a fire department pumper (or the like) to be pumped into the system to supply the system demand.

3-3 Classes of Standpipe Systems.

3-3.1 Class I Systems. A Class I standpipe system shall provide 2½-in. (63.5-mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.

3-3.2 Class II Systems. A Class II standpipe system shall provide 1½-in. (38.1-mm) hose stations to supply water for use primarily by the building occupants or by the fire department during initial response.

Exception: A minimum 1-in. (25.4-mm) hose shall be permitted to be used for hose stations in Light Hazard Occupancies where investigated and listed for this service and where approved by the authority having jurisdiction.

3-3.3 Class III Systems. A Class III standpipe system shall provide 1½-in. (38.1-mm) hose stations to supply water for use by building occupants and 2½-in. (63.5-mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.

Exception No. 1: A minimum 1-in. (25.4-mm) hose shall be permitted to be used for hose stations in Light Hazard Occupancies where investigated and listed for this service and where approved by the authority having jurisdiction.

Exception No. 2: Where the building is protected throughout by an approved automatic sprinkler system, hose stations for use by the building occupants are not required, subject to the approval of the authority having jurisdiction, provided that each hose connection is 2½ in. (63.5 mm) and is equipped with a 2½-in. by 1½-in. (63.5-mm by 38.2-mm) reducer and a cap attached with a chain.

3-4 Requirements for Manual Standpipe Systems.

3-4.1 Manual standpipe systems shall not be used in high-rise buildings.

3-4.2 Each hose connection for manual standpipes shall be provided with a conspicuous sign stating "MANUAL STANDPIPE FOR FIRE DEPARTMENT USE ONLY."

3-4.3 Manual standpipes shall not be used for Class II or Class III systems.

3-5 Requirements for Dry Standpipe Systems.

3-5.1 Dry standpipes shall only be used where piping is subject to freezing.

3-5.2 Dry standpipes shall not be used for Class II or Class III systems.

3-6* Gauges.

3-6.1 A listed 3½-in. (87-mm) dial spring pressure gauge shall be connected to each discharge pipe from the fire pump and public water works, at the pressure tank, at the air pump supplying the pressure tank, and at the top of each standpipe. Gauges shall be located in a suitable place so water will not freeze. Each gauge shall be controlled by a valve having an arrangement for draining.

Exception: Where several standpipes are interconnected at the top, a single gauge, properly located, shall be permitted to be substituted for a gauge at the top of each standpipe.

3-6.2 A valved outlet for a pressure gauge shall be installed on the upstream side of every pressure regulating device.

3-7* Water Flow Alarms.

3-7.1 Where required by the authority having jurisdiction for automatic or semiautomatic systems, listed water flow alarms shall be provided.

3-7.2 Water flow alarms shall utilize a sensing mechanism appropriate to the type of standpipe.

Chapter 4 Installation Requirements

4-1* Location and Protection of Piping.

4-1.1 Location of Dry Standpipes. Dry standpipes shall not be concealed in building walls or built into pilasters.

4-1.2 Protection of Piping.

4-1.2.1* Standpipe system piping shall not pass through hazardous areas and shall be located so that they are protected from mechanical and fire damage.

4-1.2.2 Standpipes and lateral piping supplied by standpipes shall be located in enclosed exit stairways or shall be protected by a degree of fire resistance equal to that required for enclosed exit stairways in the building in which they are located.

Exception No. 1: In buildings equipped with an approved automatic sprinkler system, lateral piping to 2½-in. (63.5-mm) hose connections shall not be required to be protected.

Exception No. 2: Piping connecting standpipes to 1½-in. (38.1-mm) hose connections.

4-1.2.3 Where a standpipe or lateral pipe that is normally filled with water passes through an area subject to freezing temperatures, it shall be protected by a reliable means to maintain the temperature of the water in the piping between 40°F (4.4°C) and 120°F (48.9°C).

Antifreeze solutions shall not be used to protect standpipe system piping from freezing.

4-1.2.4 Where corrosive conditions exist, or piping is exposed to the weather, corrosion-resistant types of pipe, tube, fittings, and hangers or protective corrosion-resistive coatings shall be used. If steel pipe is to be buried underground, it shall be protected against corrosion before being buried.

4-1.2.5 To minimize or prevent pipe breakage where subject to earthquakes, standpipe systems shall be protected in accordance with the rules contained in NFPA 13, *Standard for the Installation of Sprinkler Systems*.

4-2 Gate Valves and Check Valves.

4-2.1 Connections to each water supply, except the fire department connections, shall be provided with an approved indicating-type valve and check valve located close to the supply, such as at tanks, pumps, and connections from waterworks systems.

Where a backflow prevention device of the reduced pressure type is required by the authority having jurisdiction, the check valve and shutoff shall not be omitted and shall be installed on the discharge side of the reduced pressure backflow device.

4-2.2 Valves shall be provided to permit isolating a standpipe without interrupting the supply to other standpipes from the same source of supply.

4-2.3 Listed indicating type valves shall be provided at the standpipe for controlling branch lines for remote hose stations.

4-2.4 Where wafer-type valve discs are used, they shall be installed in such a manner that they do not interfere with the operation of other system components.

4-2.5 Valves on Combined Systems.

4-2.5.1 Each connection from a standpipe that is part of a combined system to a sprinkler system shall have an individual control valve of the same size as the connection.

4-2.5.2* Each connection from a standpipe that is part of a combined system to a sprinkler system and interconnected with other standpipes shall have an individual control valve and check valve of the same size at the connection.

4-2.6 Connections to public water systems shall be controlled by indicator post valves of an approved type located at least 40 ft (12.2 m) from the building protected. All valves shall be plainly marked to indicate the service that they control.

Exception No. 1: Where the valve cannot be located at least 40 ft (12.2 m) from the building, it shall be placed in an approved location and where it will be readily accessible in case of fire and not subject to damage.

Exception No. 2: Where post indicator valves cannot be used, underground valves shall be permitted. The valve locations, directions to open, and services that they control shall be plainly marked on the buildings served.

4-2.7* Where the standpipes are supplied from a yard main or header in another building, the connection shall be provided with a listed indicating-type valve located outside at a safe distance from the building or at the header.

4-2.8 System water supply valves, isolation control valves, and other valves in feed mains shall be supervised in an approved manner in the open position by one of the following methods:

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

(b) Local signaling service that will cause the sounding of an audible signal at a constantly attended point

(c) Locking valves open

(d) Sealing of valves and an approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

Exception: Underground gate valves with roadway boxes need not be supervised.

4-2.9 Signs and Room Identification for Valves.

4-2.9.1 All main and sectional system control valves, including water supply control valves, shall have a sign indicating the portion of the system controlled by the valve.

4-2.9.2 All control, drain, and test connection valves shall be provided with signs indicating their purpose.

4-2.9.3 Where sprinkler system piping supplied by a combined system is supplied by more than one standpipe ("loop" or "dual feed" type design), a sign shall be located

at each dual or multiple feed connection to the combination system standpipe to identify that to isolate the sprinkler system served by the control valve, an additional control valve or valves at other standpipes must be shut off. The sign shall also identify the location of the additional control valves.

4-2.9.4 Where a main or sectional system control valve is located in a closed room or concealed space, the location of the valve shall be indicated by a sign in an approved location on the outside of the door or near the opening to the concealed space.

4-3* Fire Department Connections.

4-3.1 There shall be no shutoff valve between the fire department connection and the system.

4-3.2 A listed check valve shall be installed in each fire department connection, located as near as practicable to the point where it joins the system.

4-3.3 The fire department connection shall be installed as follows:

(a) Automatic-wet and manual-wet standpipe systems: On the system side of the system control and check valve.

(b) Automatic-dry standpipe systems: On the system side of the control valve and check valve and the supply side of the dry pipe valve.

(c) Semiautomatic-dry standpipe systems: On the system side of the deluge valve.

(d) Manual-dry standpipe systems: Directly connected to system piping.

4-3.4 In areas subject to freezing, a listed automatic drip valve shall be installed in the piping between the check valve and the fire department connection that is arranged to allow drainage without causing water damage.

4-3.5 Location and Identification.

4-3.5.1 Fire department connections shall be on the street side of buildings and shall be located and arranged so that hose lines can be attached to the inlets without interference from nearby objects including buildings, fences, posts, or other fire department connections.

4-3.5.2 Each fire department connection shall be designated by a sign having raised letters, at least 1 in. (25 mm) in size cast on the plate or fitting, reading "STANDPIPE." If automatic sprinklers are also supplied by the fire department connection, the sign or combination of signs shall indicate both designated services, e.g., "STANDPIPE AND AUTOSPKR," or "AUTOSPKR AND STANDPIPE."

A sign shall also indicate the pressure required at the inlets to deliver the system demand.

4-3.5.3 Where a fire department connection services only a portion of a building, a sign shall be attached indicating the portions of the building served.

4-3.5.4* A fire department connection for each standpipe system shall be located not more than 100 ft (30.5 m) from the nearest fire hydrant connected to an approved water supply.

4-3.6 Fire department connections shall be located not less than 18 in. (45.7 cm) nor more than 48 in. (121.9 cm) above the level of the adjoining ground, sidewalk, or grade surface.

4-3.7 Fire department connection piping shall be supported in accordance with Section 4-4.

4-4 Support of Piping.

4-4.1 Support of Standpipes.

4-4.1.1 Standpipes shall be supported by attachments connected directly to the standpipe.

4-4.1.2 Standpipe supports shall be provided at the lowest level, at each alternate level above, and at the top of the standpipe. Supports above the lowest level shall restrain the pipe to prevent movement by an upward thrust where flexible fittings are used.

4-4.1.3 Clamps supporting pipe by means of set screws shall not be used.

4-4.2 Support of Horizontal Piping.

4-4.2.1 Horizontal piping from the standpipe to hose connections that are more than 18 in. (457 mm) in length shall be provided with hangers.

4-4.2.2 Horizontal piping hangers shall be spaced at a maximum separation distance of 15 ft (4.6 m). The piping shall be restrained to prevent movement by horizontal thrust where flexible fittings are used.

4-5 Installation of Signs. Signs shall be secured to a device or the building wall with substantial and corrosion-resistant chains or fasteners.

4-6 Signs for Water Supply Pumps. Where a fire pump is provided, a sign shall be located in the vicinity of the pump indicating the minimum pressure and flow required at the pump discharge flange to meet the system demand.

4-7* Hydraulic Design Information Sign. The installing contractor shall provide a sign identifying the design basis of a system as hydraulic calculations or pipe schedule. The sign shall be located at the water supply control valve for automatic or semiautomatic standpipe systems and at an approved location for manual systems.

The sign shall indicate the following:

(a) The location of the 2 hydraulically most remote hose connections

(b) The design flow rate for the connections identified in (a)

(c) The design residual inlet and outlet pressures for the connections identified in (a)

(d) The design static pressure and the design system demand (flow and residual pressure) at the system control valve, or at the pump discharge flange where a pump is installed, and at each fire department connection.

Chapter 5 Design

5-1* General. Design of the standpipe system is governed by building height, area per floor occupancy classification, egress system design, required flow rate and residual pressure, and the distance of the hose connection from the source(s) of water supply. See Chapter 3 for general system requirements.

5-2* Pressure Limitation. The maximum pressure at any point in the system at any time shall not exceed 350 psi.

5-3 Locations of Hose Connections.

5-3.1* General. Hose connections and hose stations shall be unobstructed and shall be located not less than 3 ft (0.9 m) or more than 5 ft (1.5 m) above the floor.

5-3.2* Class I Systems. Class I systems shall be provided with 2½-in. (63.5-mm) hose connections in the following locations:

(a) At each intermediate landing between floor levels in every required exit stairway

Exception: Hose connections shall be permitted to be located at main floor landings in exit stairways when approved by the authority having jurisdiction.

(b) On each side of the wall adjacent to exit openings of horizontal exits

(c) In each exit passageway at the entrance from building areas into the passageway

(d) In covered mall buildings, at the entrance to each exit passageway or exit corridor, and at exterior public entrances to the mall

(e) At the highest landing of stairways with stairway access to a roof, and on the roof where stairways do not access the roof

(f)* Where the most remote portion of a nonsprinklered floor or story exceeds 150 ft (45.7 m) of travel distance from a required exit or the most remote portion of a sprinklered floor or story exceeds 200 ft (61 m) of travel distance from a required exit, additional hose connections shall be provided, in approved locations, where required by the local fire department.

5-3.3* Class II Systems. Class II systems shall be provided with 1½-in. (38.1-mm) hose stations so that all portions of each floor level of the building are within 130 ft (39.7 m) of a hose connection provided with 1½-in. (38.1-mm) hose or within 120 ft (36.6 m) of a hose connection provided with less than 1½-in. (38.1-mm) hose. Distances shall be measured along a path of travel originating at the hose connection.

5-3.4 Class III Systems. Class III systems shall be provided with hose connections as required for both Class I and Class II systems.

5-4 Number of Standpipes. Separate standpipes shall be provided in each required exit stairway.

5-5 Interconnection of Standpipes. Where 2 or more standpipes are installed in the same building or section of building, they shall be interconnected at the bottom. Where standpipes are supplied by tanks located at the top of the building or zone, they shall also be interconnected at the top; in such cases, check valves shall be installed at the base of each standpipe to prevent circulation.

5-6 Minimum Sizes for Standpipes.

5-6.1 Class I and Class III standpipes shall be at least 4 in. (102 mm) in size.

5-6.2 Standpipes that are part of a combined system shall be at least 6 in. (152 mm) in size.

Exception: In fully sprinklered buildings having a combined standpipe system that is hydraulically calculated, the minimum standpipe size is 4 in (102 mm).

5-7* Minimum Pressure for System Design and Sizing of Pipe. Standpipe systems shall be designed so that the system demand can be supplied by both the attached water supply, where required, and fire department connections. For the water supply available from a fire department pumper, the authority having jurisdiction shall be consulted. Also see NFPA 1901, *Standard for Pumper Fire Apparatus*. Standpipe systems shall be either:

(a) Hydraulically designed to provide the required water flow rate at a minimum residual pressure of 100 psi (10.3 bars) at the outlet of the hydraulically most remote 2½-in. (63.5-mm) hose connection and 65 psi (4.5 bars) at the outlet of the hydraulically most remote 1½-in. (38.1-mm) hose station.

Exception: Where the authority having jurisdiction permits pressures lower than 100 psi for 2½-in. (63.5-mm) hose connections, based on suppression tactics, the pressure shall be permitted to be reduced but not to less than 65 psi (4.5 bars).

(b) Sized in accordance with the pipe schedule of Table 5-7 to provide the required water flow rate at a minimum residual pressure of 100 psi (10.3 bars) at the topmost 2½-in. (63.5-mm) hose connection and 65 psi (4.5 bars) at the topmost 1½-in. (38.1-mm) hose station. Pipe schedule designs shall be limited to wet standpipes and for buildings that are not defined as high-rise.

Table 5-7 Pipe Schedule – Standpipes and Supply Piping Minimum Nominal Pipe Sizes in Inches

Total Accumulated Flow (gpm)	Total Distance of Piping from Furthest Outlet		
	<50 ft	50–100 ft	>100 ft
100	2	2½	3
101–500	4	4	6
501–750	5	5	6
751–1250	6	6	6
1251 and over	8	8	8

For SI Units: 1 gal = 3.785 L/min; 1 ft = 0.3048 m.

5-8* Maximum Pressure for Hose Connections.

5-8.1 Where the residual pressure at a 1½-in. (38.1-mm) outlet on a hose connection available for occupant use exceeds 100 psi (6.9 bars), an approved pressure regulating device shall be provided to limit the residual pressure at the flow required by Section 5-9 to 100 psi (69 bars).

5-8.2 Where the static pressure at a hose connection exceeds 175 psi (12.1 bars), an approved pressure regulating device shall be provided to limit static and residual pressures at the outlet of the hose connection to 100 psi (6.9 bars) for 1½-in. (38.1-mm) hose connections available for occupant use and 175 psi (12.1 bars) for other hose connections. The pressure on the inlet side of the pressure regulating device shall not exceed the device's rated working pressure.

5-9 Minimum Flow Rates for Hydraulically Designed Systems.

5.9.1 Class I and Class III Systems.

5-9.1.1* Minimum Flow Rate. For Class I and Class III systems, the minimum flow rate for the hydraulically most remote standpipe shall be 500 gpm (1893 L/min). The minimum flow rate for additional standpipes shall be 250 gpm (946 L/min) per standpipe, the total not to exceed 1250 gpm (4731 L/min).

For combined systems, see 5-9.1.3.

Exception: When the floor area exceeds 80,000 sq ft (7432 m²), the second most remote standpipe shall be designed to accommodate 500 gpm (1893 L/min).

5-9.1.2* Hydraulic Calculation Procedure. Hydraulic calculations and pipe sizes for each standpipe shall be based on providing 250 gpm (946 L/min) at the hydraulically most remote two hose connections on the standpipe and at the top most outlet of each of the other standpipes at the minimum residual pressure required by Section 5-7. Common supply piping shall be calculated and sized to provide the required flow rate for all standpipes connected to such supply piping, the total not to exceed 1250 gpm (4731 L/min).

5-9.1.3 Combined Systems.

5-9.1.3.1* For a building protected throughout by an approved automatic sprinkler system, the system demand established by Section 5-7 and 5-9.1 is also permitted to serve the sprinkler system. Sprinkler demand need not be added.

Exception: Where the sprinkler system water supply requirement, including hose stream allowance as determined in NFPA 13, Standard for the Installation of Sprinkler Systems, exceeds the system demand established by Section 5-7 and 5-9.1, the larger of the two values shall be provided. The flow rate required for the standpipe demand of a combined system in a building protected throughout by an automatic sprinkler system need not exceed 1000 gpm (3785 L/min) unless more supply is required by the authority having jurisdiction.

5-9.1.3.2 For a combined system in a building equipped with partial automatic sprinkler protection, the flow rate required by 5-9.1 shall be increased by an amount equal to the lesser of the hydraulically calculated sprinkler demand or 150 gpm (568 L/min) for Light Hazard Occupancies, or by 500 gpm (1893 L/min) for Ordinary Hazard Occupancies.

5-9.1.3.3 Where an existing standpipe system having standpipes with a minimum diameter of 4 in. (102 mm) is to be utilized to supply a new retrofit sprinkler system, the water supply required by 5-9.1 need not be provided by automatic or semiautomatic means if approved by the authority having jurisdiction, so long as the water supply is adequate to supply the hydraulic demand of the sprinkler system.

5-9.2 Class II Systems.

5-9.2.1 Minimum Flow Rate. For Class II systems, the minimum flow rate for the hydraulically most remote standpipe shall be 100 gpm (379 L/min). Additional flow need not be added when more than 1 standpipe is provided.

5-9.2.2 Hydraulic Calculation Procedure. Hydraulic calculations and pipe sizes for each standpipe shall be based on providing 100 gpm (379 L/min) at the hydraulically most remote hose connection on the standpipe at the minimum residual pressure required by Section 5-7. Common supply piping serving multiple standpipes shall be calculated and sized to provide 100 gpm (379 L/min).

5-10 Equivalent Pipe Lengths of Valves and Fittings for Hydraulically Designed Systems.

5-10.1 General. Table 5-10.1 shall be used to determine the equivalent length of pipe for fittings and devices unless manufacturer's test data indicate that other factors are appropriate. For saddle-type fittings having friction loss greater than that shown in Table 5-10.1, the increased friction loss shall be included in hydraulic calculations.

Table 5-10.1 Equivalent Pipe Length Chart

Fittings and Valves	Fittings and Valves Expressed in Equivalent Feet of Pipe													
	¾ in.	1 in.	1¼ in.	1½ in.	2 in.	2½ in.	3 in.	3½ in.	4 in.	5 in.	6 in.	8 in.	10 in.	12 in.
45° Elbow	1	1	1	2	2	3	3	3	4	5	7	9	11	13
90° Standard Elbow	2	2	3	4	5	6	7	8	10	12	14	18	22	27
90° Long Turn Elbow	1	2	2	2	3	4	5	5	6	8	9	13	16	18
Tee or Cross (Flow Turned 90°)	3	5	6	8	10	12	15	17	20	25	30	35	50	60
Butterfly Valve	-	-	-	-	6	7	10	-	12	9	10	12	19	21
Gate Valve	-	-	-	-	1	1	1	1	2	2	3	4	5	6
Swing Check*	-	5	7	9	11	14	16	19	22	27	32	45	55	65
Globe Valve	-	-	-	46	-	70	-	-	-	-	-	-	-	-
Angle Valve	-	-	-	20	-	31	-	-	-	-	-	-	-	-

For SI Units: 1 ft = 0.3048 m.

*Due to the variations in design of swing check valves, the pipe equivalents indicated in the above chart are considered average.

5-10.2 Adjustments. Table 5-10.1 shall be used with Hazen-Williams C = 120 only. For other values of C, the values in Table 5-10.1 shall be multiplied by the factors indicated in Table 5-10.2.

Table 5-10.2 Adjustments Chart

Value of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

5-11* Drains and Test Riser.

5-11.1 A permanently installed 3-in. (75-mm) drain riser shall be provided adjacent to each standpipe equipped with pressure regulating devices to facilitate tests of each device. The riser shall be equipped with a 3-in. (76.2-mm) × 2½-in. (63.5-mm) tee with internal threaded swivel fitting having NH standard threads, as specified in NFPA 1963, *Standard for Screw Threads and Gaskets for Fire Hose Connections*, with plug, located on at least every other floor.

Exception: Where local fire department hose threads do not conform to NFPA 1963, the authority having jurisdiction shall designate the hose threads to be used.

5-11.2 Each standpipe shall be provided with a means of draining. A drain valve and piping, located at the lowest point of the standpipe piping downstream of the isolation valve, shall be arranged to discharge water at an approved location. Sizing shall be as follows:

Standpipe Size	Size of Drain Connection
Up to 2 in.	¾ in. or larger
2½ in., 3 in., or 3½ in.	1¼ in. or larger
4 in. or larger	2 in. only

5-12* Fire Department Connections.

5-12.1 One or more fire department connections shall be provided for each Class I or Class III standpipe system.

5-12.2 High-rise buildings shall have at least 2 remotely located fire department connections.

Exception: A single connection shall be permitted where acceptable to the fire department.

Chapter 6 Plans and Calculations

6-1* Plans and Specifications. Plans accurately showing the details and arrangement of the standpipe system shall be furnished to the authority having jurisdiction prior to the installation of the system. Such plans shall be clear, readable, and drawn to scale. The drawings shall show the location, arrangement, water supply, equipment, and all other details necessary to show compliance with this standard.

The plans shall include specifications covering the character of materials used and shall describe all system components. Plans shall include an elevation diagram.

6-2 Hydraulic Calculations. Where standpipe system piping is sized by hydraulic calculations, a complete set of calculations shall be submitted with the plans.

Chapter 7 Water Supplies

7-1* Required Water Supply. Automatic and semiautomatic standpipe systems shall be attached to an approved water supply capable of supplying the system demand. Manual standpipe systems shall have an approved water supply accessible to a fire department pumper.

A single automatic or semiautomatic water supply shall be acceptable where it is capable of supplying the system demand for the required duration.

Exception: Where a secondary water supply is required by 7-4.3.

7-1.1* Acceptable water supplies shall be from:

(a) Public waterworks system where pressure and flow rate are adequate

(b) Automatic fire pumps connected to an approved water source

(c) Manually controlled fire pumps in combination with pressure tanks

(d) Pressure tanks installed in accordance with NFPA 22, *Standard for Water Tanks for Private Fire Protection*

(e) Manually controlled fire pumps operated by remote control devices at each hose station

(f) Gravity tanks installed in accordance with NFPA 22, *Standard for Water Tanks for Private Fire Protection.*

7-2 Minimum Supply for Class I and Class III Systems. The water supply shall be sufficient to provide the system demand established by Section 5-7 and 5-9.1 for a period of at least 30 min.

7-3 Minimum Supply for Class II Systems. The minimum supply for Class II systems shall be sufficient to provide the system demand established by Section 5-7 and 5-9.2 for a period of at least 30 min.

7-4 Standpipe System Zones. Each zone requiring pumps shall be provided with a separate pump. This shall not preclude the use of pumps arranged in series.

7-4.1 Where pumps supplying 2 or more zones are located at the same level, each zone shall have separate and direct supply piping of a size not smaller than the standpipe that it serves. Zones with 2 or more standpipes shall have at least 2 direct supply pipes of a size not smaller than the largest standpipe that they serve.

7-4.2 Where supply for each zone is pumped from the next lower zone, and the standpipe or standpipes in the lower zone are used to supply the higher zone, such standpipes shall comply with the provisions for supply lines in 7-4.1. At least 2 lines shall be provided between zones; 1 of these lines shall be arranged so that supply can be automatically delivered from the lower to the higher zone.

7-4.3 For systems with 2 or more zones in which portions of the second and higher zones cannot be supplied with the residual pressure required by Section 5-7 by fire department pumpers through a fire department connection, another auxiliary means of supply shall be provided. This shall be in the form of high-level water storage with additional pumping equipment or other means acceptable to the authority having jurisdiction.

Chapter 8 System Acceptance

8-1* General.

8-1.1 All new systems shall be tested prior to building occupancy. Existing standpipe systems that are to be utilized as standpipes for a combination system in the retrofit of a new sprinkler system shall be tested in accordance with Section 8-4.

8-1.2 The installing contractor shall complete and sign the appropriate Contractors Material and Test Certificate(s). [*See Figures 8-1(a) and 8-1(b).*]

8-2 Flushing of Piping.

8-2.1 Underground piping supplying the system shall be flushed in accordance with NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances.*

8-2.2 Piping between the fire department connection and the check valve in the inlet pipe shall be flushed with a sufficient volume of water so as to remove any construction debris and trash accumulated in this pipe prior to the completion of the system and prior to the installation of the fire department connection.

8-3 Hose Threads. All hose connection and fire department connection threads shall be tested to verify compatibility with threads used by the local fire department. The test shall consist of threading coupling samples, caps, or plugs onto the installed devices.

8-4 Hydrostatic Tests.

8-4.1* General. All new systems, including yard piping and fire department connections, shall be tested hydrostatically at not less than 200 psi (13.8 bars) pressure for 2 hr, or at 50 psi (3.5 bars) in excess of the maximum pressure where the maximum pressure is in excess of 150 psi (10.3 bars). The hydrostatic test pressure shall be measured at the low elevation point of the individual system or zone being tested. The inside standpipe system piping shall show no leakage. Underground pipe shall be tested in accordance with NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances.*

Exception: Where cold weather will not permit testing with water, an interim air test can be conducted prior to the standard hydrostatic test. An air pressure leakage test at 40 psi (2.8 bars) shall be conducted for 24 hr. Any leakage that results in a loss of pressure in excess of 1½ psi (0.1 bars) during a continuous 24-hr period shall be corrected.

8-4.2 Fire Department Connection. Piping between the fire department connection and the check valve in the inlet pipe shall be tested hydrostatically in the same manner as the balance of the system.

8-4.3 Existing Systems. Where an existing standpipe system, including yard piping and fire department connection, is modified, the new piping shall be tested in accordance with 8-4.1.

8-4.4 Protection from Freezing. During testing, care shall be taken to ensure no portion of the piping is subject to freezing during cold weather.

8-4.5 Gauges. During the hydrostatic test, the pressure gauge at the top of each standpipe shall be observed and the pressure recorded.

8-4.6 Water Additives. Additives, corrosive chemicals such as sodium silicate, or derivatives of sodium silicate, brine, or other chemicals shall not be used while hydrostatically testing systems or for stopping leaks.

CONTRACTOR'S MATERIAL & TEST CERTIFICATE FOR ABOVEGROUND PIPING
Standpipe System NFPA 14

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 IF NO, EXPLAIN DEVIATIONS _____
EQUIPMENT USED IS APPROVED OR LISTED ☐ YES ☐ NO IF NO, EXPLAIN DEVIATIONS _____

TYPE OF SYSTEM

AUTOMATIC-DRY ☐ YES
AUTOMATIC-WET ☐ YES
SEMIAUTOMATIC-DRY ☐ YES
MANUAL-DRY ☐ YES
MANUAL-WET ☐ YES
COMBINATION STANDPIPE/SPRINKLER ☐ YES
OTHER ☐ YES EXPLAIN _____

WATER SUPPLY DATA USED FOR DESIGN AND AS SHOWN ON PLANS

FIRE PUMP DATA
MANUFACTURER _____ MODEL _____
TYPE: ☐ ELECTRIC ☐ DIESEL ☐ OTHER EXPLAIN _____
RATED GPM _____ RATED PSI _____ SHUT-OFF PSI _____

WATER SUPPLY SOURCE CAPACITY, GALLONS

PUBLIC WATER-WORKS SYSTEM ☐ STORAGE TANK ☐ GRAVITY TANK ☐ OPEN RESERVOIR ☐ OTHER ☐ EXPLAIN

IF PUBLIC WATER-WORKS SYSTEM:
STATIC PSI ☐ RESIDUAL PSI ☐ FLOW IN GPM ☐

HAVE COPIES OF THE FOLLOWING BEEN LEFT ON THE PREMISES?

☐ SYSTEM COMPONENTS INSTRUCTIONS ☐ CARE AND MAINTENANCE OF SYSTEM ☐ NFPA 25
☐ COPY OF ACCEPTED PLANS ☐ HYDRAULIC DATA/CALCULATIONS

SUPPLIES BUILDING(S)

MAIN WATER FLOW SHUT-OFF LOCATION _____
NUMBER OF STANDPIPE RISERS _____ DO ALL STANDPIPE RISERS HAVE BASE OF RISER SHUT-OFF VALVES? ☐ YES ☐ NO

VALVE SUPERVISION

LOCKED OPEN ☐ SEALED AND TAG ☐ TAMPER PROOF SWITCH ☐ OTHER ☐ IF OTHER, EXPLAIN

TYPE OF PIPE _____

TYPE OF FITTING _____

BACKFLOW PREVENTER

A) DOUBLE CHECK ASSEMBLY ☐ SIZE _____ MAKE AND MODEL _____
B) REDUCED PRESSURE DEVICE ☐

Figure 8-1(a).

CONTROL VALVE DEVICE

TYPE	SIZE	MAKE	MODEL

TIME TO TRIP THROUGH REMOTE HOSE VALVE _____ MIN ____ SEC WATER PRESSURE _____ AIR PRESSURE _____
TIME WATER REACHED REMOTE HOSE VALVE OUTLET _____ MIN _____ SEC TRIP POINT AIR PRESSURE _____ PSI
ALARM OPERATED PROPERLY ☐ YES ☐ NO IF NO, EXPLAIN _____

TIME WATER REACHED REMOTE HOSE VALVE OUTLET _____ MIN _____ SEC

HYDRAULIC ACTIVATION ☐ YES
ELECTRIC ACTIVATION ☐ YES
PNEUMATIC ACTIVATION ☐ YES
MAKE AND MODEL OF ACTIVATION DEVICE _____
EACH ACTIVATION DEVICE TESTED ☐ YES ☐ NO IF NO, EXPLAIN _____

EACH ACTIVATION DEVICE OPERATED PROPERLY ☐ YES ☐ NO IF NO, EXPLAIN _____

PRESSURE REGULATING DEVICE

LOCATION & FLOOR	MODEL	NON-FLOWING (PSI) INLET	NON-FLOWING (PSI) OUTLET	FLOWING (PSI) INLET	FLOWING (PSI) OUTLET	GPM

ALL HOSE VALVES ON SYSTEM OPERATED PROPERLY ☐ YES ☐ NO IF NO, EXPLAIN _____

Figure 8-1(a) (cont.).

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. DRY PIPING PNEUMATICALLY TESTED ☐ YES ☐ NO EQUIPMENT OPERATES PROPERLY ☐ YES ☐ NO	IF NO, STATE REASON	
	DO YOU CERTIFY AS THE STANDPIPE CONTRACTOR THAT ADDITIVES AND CORROSIVE CHEMICALS, SODIUM SILICATE OR DERIVATIVES OF SODIUM SILICATE, BRINE, OR OTHER CORROSIVE CHEMICALS WERE NOT USED FOR TESTING SYSTEMS OR STOPPING LEAKS? ☐ YES ☐ NO		
	DRAIN TEST	READING OF GAUGE LOCATED NEAR WATER SUPPLY TEST CONNECTION: _____ PSI	RESIDUAL PRESSURE WITH VALVE IN TEST CONNECTION OPEN WIDE _____ PSI
	UNDERGROUND MAINS AND LEAD IN CONNECTIONS TO SYSTEM RISERS FLUSHED BEFORE CONNECTION MADE TO STANDPIPE PIPING. VERIFIED BY COPY OF THE U FORM NO. 85B ☐ YES ☐ NO OTHER EXPLAIN FLUSHED BY INSTALLER OF UNDER-GROUND STANDPIPE PIPING ☐ YES ☐ NO		
BLANK TESTING	NUMBER USED	LOCATIONS	NUMBER REMOVED
WELDING	WELDED PIPING ☐ YES ☐ NO IF YES...		
	DO YOU CERTIFY AS THE STANDPIPE 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 THE THE INTERNAL DIAM-ETERS OF PIPING ARE NOT PENETRATED ☐ YES ☐ NO		
CUTOUTS (DISCS)	DO YOU CERTIFY THAT YOU HAVE A CONTROL FEATURE TO INSURE THAT ALL CUTOUTS (DISCS) ARE RETRIEVED? ☐ YES ☐ NO		
HYDRAULIC DATA NAMEPLATE	NAME PLATE PROVIDED ☐ YES ☐ NO	IF NO, EXPLAIN	
REMARKS	DATE LEFT IN SERVICE WITH ALL CONTROL VALVES OPEN:		

NAME OF SPRINKLER/STANDPIPE CONTRACTOR

NAME OF CONTRACTOR _____
ADDRESS _____
STATE LICENSE NUMBER (IF APPLICABLE) _____

SYSTEM OPERATING TEST WITNESSED BY

FOR PROPERTY OWNER _____ TITLE _____ DATE _____
FOR SPRINKLER/STANDPIPE CONTRACTOR _____ TITLE _____ DATE _____
FOR APPROVING AUTHORITIES _____ TITLE _____ DATE _____

ADDITIONAL EXPLANATION AND NOTES

Figure 8-1(a) (cont.).

CONTRACTOR'S MATERIAL & TEST CERTIFICATE FOR UNDERGROUND 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, STATE 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 APPROPRIATE INSTRUCTIONS AND CARE AND MAINTENANCE CHARTS BEEN LEFT ON PREMISES?	☐ YES	☐ NO
	IF NO, EXPLAIN		
LOCATION	SUPPLIES BUILDINGS		
UNDERGROUND PIPES AND JOINTS	PIPE TYPES AND CLASS / TYPE JOINT		
	PIPE CONFORMS TO _____ STANDARD	☐ YES	☐ NO
	FITTINGS CONFORM TO _____ STANDARD	☐ YES	☐ NO
	IF NO, EXPLAIN		
	JOINTS NEEDING ANCHORAGE CLAMPED, STRAPPED, OR BLOCKED IN	☐ YES	☐ NO
	ACCORDANCE WITH _____ STANDARD		
	IF NO, EXPLAIN		
TEST DESCRIPTION	FLUSHING. Flow the required rate until water is clear as indicated by no collection of foreign material in burlap bags at outlets such as hydrants and blow-offs. Flush at flows not less than 390 GPM (1476 L/min) for 4-inch pipe, 880 GPM (3331 L/min) for 6-inch pipe, 1560 GPM (5905 L/min) for 8-inch pipe, 2440 GPM (9235 L/min) for 10-inch pipe, and 3520 GPM (13323 L/min) for 12-inch pipe. When supply cannot produce stipulated flow rates, obtain maximum available. HYDROSTATIC. Hydrostatic tests shall be made at not less than 200 psi (13.8 bars) for two hours or 50 psi (3.4 bars) above static pressure in excess of 150 psi (10.3 bars) for two hours. LEAKAGE. New pipe laid with rubber gasketed joints shall, if the workmanship is satisfactory, have little or no leakage at the joints. The amount of leakage at the joints shall not exceed 2 qts. per hr. (1.89 L/h) per 100 joints irrespective of pipe diameter. The leakage shall be distributed over all joints. If such leakage occurs at a few joints the installation shall be considered unsatisfactory and necessary repairs made. The amount of allowable leakage specified above may be increased by 1 fl oz per in. valve diameter per hr. (30 mL/25 mm/h) for each metal seated valve isolating the test section. If dry barrel hydrants are tested with the main valve open, so the hydrants are under pressure, an additional 5 oz per minute (150 mL/min) leakage is permitted for each hydrant.		
FLUSHING TESTS	NEW UNDERGROUND PIPING FLUSHED ACCORDING TO _____ STANDARD	☐ YES	☐ NO
	BY (COMPANY)		
	IF NO, EXPLAIN		
	HOW FLUSHING FLOW WAS OBTAINED: ☐ PUBLIC WATER ☐ TANK OR RESERVOIR ☐ FIRE PUMP / THROUGH WHAT TYPE OPENING: ☐ HYDRANT BUTT. ☐ OPEN PIPE		
	LEAD-INS FLUSHED ACCORDING TO _____ STANDARD	☐ YES	☐ NO
	BY (COMPANY)		
	IF NO, EXPLAIN		
	HOW FLUSHING FLOW WAS OBTAINED: ☐ PUBLIC WATER ☐ TANK OR RESERVOIR ☐ FIRE PUMP / THROUGH WHAT TYPE OPENING: ☐ Y CONN. TO FLANGE & SPIGOT ☐ OPEN PIPE		

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Figure 8-1(b).

HYDROSTATIC TEST	ALL NEW UNDERGROUND PIPING HYDROSTATICALLY TESTED AT _____ PSI FOR _____ HOURS		JOINTS COVERED ☐ YES ☐ NO	
LEAKAGE TEST	TOTAL AMOUNT OF LEAKAGE MEASURED _____ GALS. _____ HOURS			
	ALLOWABLE LEAKAGE _____ GALS. _____ HOURS			
HYDRANTS	NUMBER INSTALLED	TYPE AND MAKE	ALL OPERATE SATISFACTORILY ☐ YES	☐ NO
CONTROL VALVES	WATER CONTROL VALVES LEFT WIDE OPEN IF NO, STATE REASON		☐ YES	☐ NO
	HOSE THREADS OF FIRE DEPARTMENT CONNECTIONS AND HYDRANTS INTERCHANGEABLE WITH THOSE OF FIRE DEPARTMENT ANSWERING ALARM		☐ YES	☐ NO
REMARKS	DATE LEFT IN SERVICE			
SIGNATURES	NAME OF INSTALLING CONTRACTOR			
	TESTS WITNESSED BY			
	FOR PROPERTY OWNER (SIGNED)	TITLE	DATE	
	FOR INSTALLING CONTRACTOR (SIGNED)	TITLE	DATE	

ADDITIONAL EXPLANATION AND NOTES

Figure 8-1(b) (cont.).

8-5 Flow Tests.

8-5.1* The water supply shall be tested to verify compliance with the design. This test shall be conducted by flowing water from the hydraulically most remote hose connections.

8-5.2 For a manual standpipe, a fire department pumper or portable pump of adequate capacity (required flow and pressure) shall be used, to verify the system design, by pumping into the fire department connection.

8-5.3 A flow test shall be conducted at each roof outlet to verify that the required pressure is available at the required flow.

8-5.4 The filling arrangement for suction tanks shall be verified by shutting down all supplies to the tank, draining the tank to below designated low water level, then opening the supply valve to ensure operation of its automatic features.

8-5.5 Pressure Regulating Devices. Each pressure regulating device shall be tested to verify that the installation is correct, that the device is operating properly, and that the inlet and outlet pressures at the device are in accordance with the design. Static and residual inlet pressure and static and residual outlet pressure and flow shall be recorded on the contractor's test certificate.

8-5.6 Main Drain Flow Test. The main drain valve shall be opened and remain open until the system pressure stabilizes. The static and residual pressure shall be recorded on the contractor's test certificate.

8-5.7 Testing of Automatic and Semiautomatic Dry Systems. Automatic and semiautomatic dry systems shall be tested by initiating a flow of water from the hydraulically most remote hose connection. The system shall deliver a minimum of 250 gpm (946 L/min) at the hose connection within 3 min of opening the hose valve. Each remote control device for operating a semiautomatic system shall be tested in accordance with the manufacturer's instructions.

8-5.8 Systems Having Pumps. Where pumps are part of the water supply for a standpipe system, testing shall be conducted with pumps operating.

8-6 Manual Valve Test. Each valve intended to be manually opened or closed shall be operated by turning the handwheel crank or wrench throughout its range and returned to its normal position. Hose valve caps shall be tightened sufficiently to avoid leaking during the test, then removed after the test to drain water and relieve pressure.

8-7 Alarm and Supervision Tests. Each alarm and supervisory device provided shall be tested in accordance with NFPA 72, *Standard for the Installation, Maintenance, and Use of Protective Signaling Systems*.

8-8 Instructions. The installing contractor shall provide the owner with the following:

(a) All literature and instructions provided by the manufacturer describing proper operation and maintenance of equipment and devices installed

(b) A copy of NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.*

8-9 Signs. The installation of signs required by this standard shall be verified.

Chapter 9 Buildings under Construction

9-1 General. Where required by the authority having jurisdiction, in buildings under construction a standpipe system, either temporary or permanent in nature, shall be provided in accordance with this chapter.

9-2 Fire Department Connections. The standpipes shall be provided with conspicuously marked and readily accessible fire department connections on the outside of the building at the street level.

9-3 Other System Features. Pipe sizes, hose connections, hose, water supply, and other details for new construction shall be in accordance with this standard.

9-4 Support of Piping. Standpipes shall be securely supported and restrained at each alternate floor.

9-5* Hose Connections. At each floor level, there shall be provided at least 1 hose connection. Hose valves shall be kept closed at all times and guarded against mechanical injury.

9-6* Extension of System Piping. Standpipes shall be extended up with each floor and securely capped at the top.

9-7 Temporary Installations. Temporary standpipes shall remain in service until the permanent standpipe is complete. Where temporary standpipes normally contain water, the piping shall be protected against freezing.

9-8 Timing of Water Supply Installation. Where construction reaches a height at which public waterworks system pressure is no longer adequate, temporary or permanent fire pumps shall be installed to provide protection to the uppermost level or to the height as required by the authority having jurisdiction.

Exception: Unless local fire department pumping apparatus is acceptable to the authority having jurisdiction as adequate for the standpipe pressure required.

9-9 Protection of Hose Connections and Fire Department Connections. Threaded caps and plugs shall be installed on fire department connections and hose connections. Fire department connections and hose connections shall be protected against physical damage.

Chapter 10 Referenced Publications

10-1 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.

10-1.1 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*, 1991 edition

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

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 1992 edition

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

NFPA 51B, *Standard for Fire Prevention in Use of Cutting and Welding Processes*, 1989 edition

NFPA 72, *Standard for the Installation, Maintenance, and Use of Protective Signaling Systems*, 1990 edition

NFPA 1901, *Standard for Pumper Fire Apparatus*, 1991 edition

NFPA 1963, *Standard for Screw Threads and Gaskets for Fire Hose Connections*, 1985 edition

10-1.2 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 B16.3-1985, *Malleable Iron Threaded Fittings*, Classes 150 and 300

ANSI B16.4-1985, *Cast-Iron Threaded Fittings*, Classes 125 and 250

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

ANSI B16.9-1986, *Factory-Made Wrought Steel Buttwelding Fittings*

ANSI B16.11-1991, *Forged 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 B16.25-1986, *Buttwelding Ends*

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

ANSI B1.20.1-1983, *Pipe Threads, General.Purpose (Inch)*

10-1.3 ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM A53-1990, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless Pipe*

ASTM A135-1989, *Standard Specification for Electric-Resistance-Welded Steel Pipe*

ASTM A234-1991, *Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures*

ASTM A795-1990, *Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use*

ASTM B75-1991, *Standard Specification for Seamless Copper Tube (Metric)*

ASTM B88-1989, *Standard Specification for Seamless Copper Water Tube (Metric)*

ASTM B251-1988, *Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube*

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

10-1.4 AWS Publications. American Welding Society, 550 N. LeJeune Road, P.O. Box 351040, Miami, FL 33135.

AWS A5.8-1989, *Specification for Filler Metals for Brazing*

AWS D10.9-1980, *Specification for Qualification of Welding Procedures and Welders for Piping and Tubing*

10-1.5 AWWA Publications. American Water Works Association, 6666 W. Quincy Avenue, Denver, CO 80235.

AWWA C110-87, *Ductile-Iron and Gray-Iron Fittings, 3 in. Through 48 in. for Water and Other Liquids*

AWWA C151-80, *Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids*

Appendix A

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

A-1-4 Should. Indicates a recommendation or that which is advised but not required.

A-2-1 The use of standard-weight valves and fittings should ordinarily be confined to the upper stories of very high buildings and to equipments where the highest available pressures are less than 175 psi (12.1 bars).

A-2-5.1 Many fire departments will lay a hose line from the pumper into the building and connect to an accessible valve outlet using a double female swivel when the building fire department connections are inaccessible or inoperable. To pressurize the standpipe, the hose valve is opened and the engine pumps into the system.

If the standpipe is equipped with pressure reducing hose valves, the valve will act as a check valve prohibiting pumping into the system when the valve is opened.

A supplementary single inlet fire department connection or hose valve with female threads at an accessible location on the standpipe will permit pumping into that system.

A-2-7.2 See NFPA 1961, *Standard for Fire Hose.*

The factors to be considered in selecting a rack or reel for storage of 1½-in. hose are the number of persons likely to be available to place the equipment into operation and the extent to which potential users are trained. With hose racks of the "semiautomatic" or "one-person" type, the hose valve should first be opened wide. The nozzle should then be grasped firmly and the hose lines drawn toward the fire. The water is automatically released as the last few feet of hose are pulled from the rack.

A-2-9 See Figure A-4-3.

A-2-9.2 See Sections 5-7 and 5-12 for design requirements.

A-3-6 Additional pressure gauges at the base of the standpipes may be desirable in some equipment, particularly in large plants and high buildings.

A-3-7 Audible alarms are normally located on the outside of the building. Approved electric gong bells, horns, or sirens inside the building or a combination inside and outside are sometimes advisable.

A-4-1 Connections from fire pumps and sources outside the building should be made at the base of the standpipes.

A-4-1.2.1 Standpipes should not be placed in unsprinklered areas of combustible construction.

A-4-2.5.2 Combined automatic sprinkler and standpipe risers should not be interconnected by sprinkler system piping.

A-4-2.7 See NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances.*

A-4-3 See Figure A-4-3.

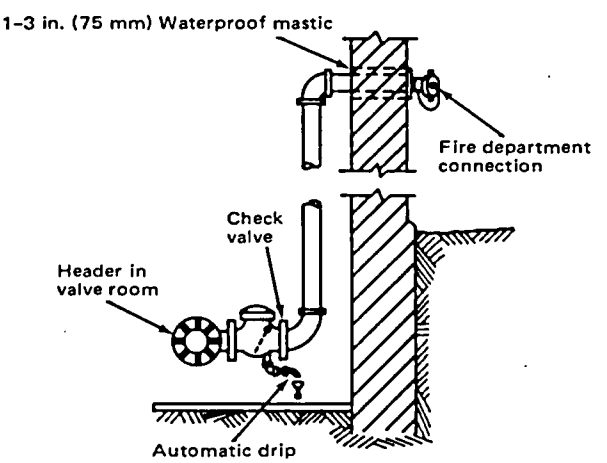


Figure A-4-3 Typical fire department connection for wet standpipes.

A-4-3.5.4 The system designer should contact the authority having jurisdiction prior to establishing the location of the fire department connection. The location should be based on the requirements of the fire department.

A-4-7 See Figure A-4-7.

Location of the 2 hydraulically most remote hose connections:_____
Design flow rate for the connections identified above: _____
Design residual inlet and outlet pressures for the connections identified above: _____
Design static pressure and the design system demand (flow and residual pressure) at the system control valve, or at the pump discharge flange when a pump is installed, and at each fire department connection: ____

Figure A-4-7 System hydraulic information.

A-5-1 The building height determines the number of vertical zones. The area of a floor or fire area and exit locations, as well as the occupancy, will determine the number and locations of hose connections. Local building codes influence types of systems, classes of systems, and locations of hose connections. Pipe sizing is dependent on the number of hose connections flowing, quantity of water flowed, the required residual pressure, and vertical and horizontal distance of those hose connections from the water supplies.

For typical elevation drawings, see Figures A-5-1(a), A-5-1(b), and A-5-1(c).

A-5-2 The system pressure units have been implemented to replace the prior height units. Since the issue addressed by the heights units has always been maximum pressure, pressure limitations are a more direct method of regulation and allow flexibility in height units when pumps are used because a pump curve with less excess pressure at churn yields lower maximum system pressures while achieving the required system demand.

The maximum system pressure will normally be at pump churn. The measurement should include both the pump boost and city static pressures. The 350 psi limit was selected because it is the maximum pressure at which most system components are available, and it recognizes the need for a reasonable pressure unit.

A-5-3.1 Hose may be located at one side of the standpipe and supplied by short lateral connections to the standpipe where necessary to avoid obstructions.

Hose connections for Class I systems should be located in a stairway enclosure, and for Class II systems in the corridor or space adjacent to the stairway enclosure and connected through the wall to the standpipe. For Class III systems, the connections for 2½-in. (63.5-mm) hose should be located in a stairway enclosure, and for Class II system hose, located in the corridor or space adjacent to the stairway enclosure. These arrangements make it possible to use Class II system hose streams promptly in case the stairway is filled with people escaping at the time of fire. In buildings having large areas, connections for Class I and Class III systems may be located at interior columns.

A-5-3.2 Hose connections are now specified to be located at intermediate landings between floors to prevent congestion at doorways. Where there are multiple intermediate floor landings between floors, hose connections should be located at the landing approximately midway between floors. It is recognized that fire departments often use the hose connection on the floor below the fire floor, and the location of hose connections at intermediate landings also reduces the hose lay distance in such cases as well.

The approach to locating hose connections with respect to exits is shown in Figure A-5-3.2.

For purposes of this standard, the following definitions will assist the user in locating the hose connections.

Exit Passageways. Hallways, corridors, passages, or tunnels used as exit components and separated from other parts of the building in accordance with the NFPA *101*,® *Life Safety Code*.®

Horizontal Exit. A way of passage from an area in one building to an area in another building on approximately the same level, or a way of passage through or around a fire barrier from one area to another on approximately the same level in the same building that affords safety from fire and smoke originating from the area of incidence and areas communicating therewith.

A-5-3.2(f) This paragraph is intended to provide authority to local fire departments to require additional hose connections outside of or away from a 2-hr fire-resistive separation. These additional hose connections may be needed to allow fire fighters to attack a fire in a reasonable time frame based on the lengths of hose available on fire department standpipe packs or in carry bags. While it is recognized that outlet spacing limitations provide controls to limit the maximum hose length needed to fight a fire, thereby minimizing the physical demands on fire fighters, it is also recognized that in some cases based on architectural layout, additional outlets may be indicated in open floor areas just to meet spacing requirements. In such cases, it is unlikely that such outlets could be utilized, since there would not be a staging area for fire fighters to use when accessing the hose connection. Therefore, additional hose connections, when provided to meet distance limitations, should be located in 1-hr fire-resistive exit corridors whenever possible to provide a degree of protection for fire fighters accessing the connection. It is also desirable to locate such connections as uniformly as possible from floor to floor for ease of locating connections during a fire.

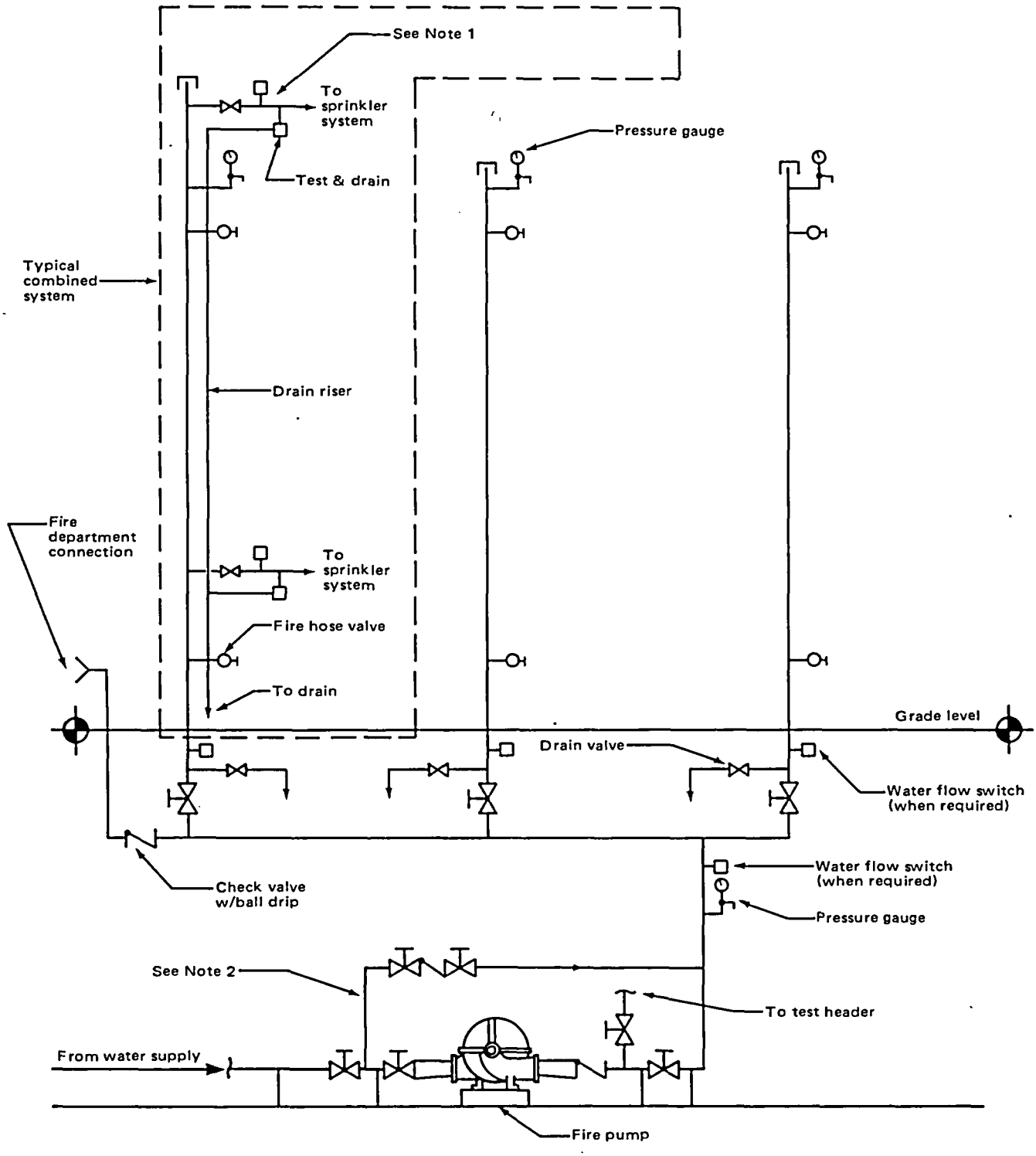
It is recognized that the 200-ft (61-m) distance allowed for sprinklered buildings may require additional hose lengths to be added to reach the most remote portion of a floor; however, automatic sprinklers should provide adequate control to allow time for fire fighters to extend hoses in those cases where a fire may be located in the most remote area.

A-5-3.3 Hose stations should be so arranged as to permit directing the discharge from the nozzle into all portions of important enclosures such as closets and like enclosures.

A-5-7 When determining the pressure at the outlet of the remote hose connection, the pressure loss in the hose valve should be considered.

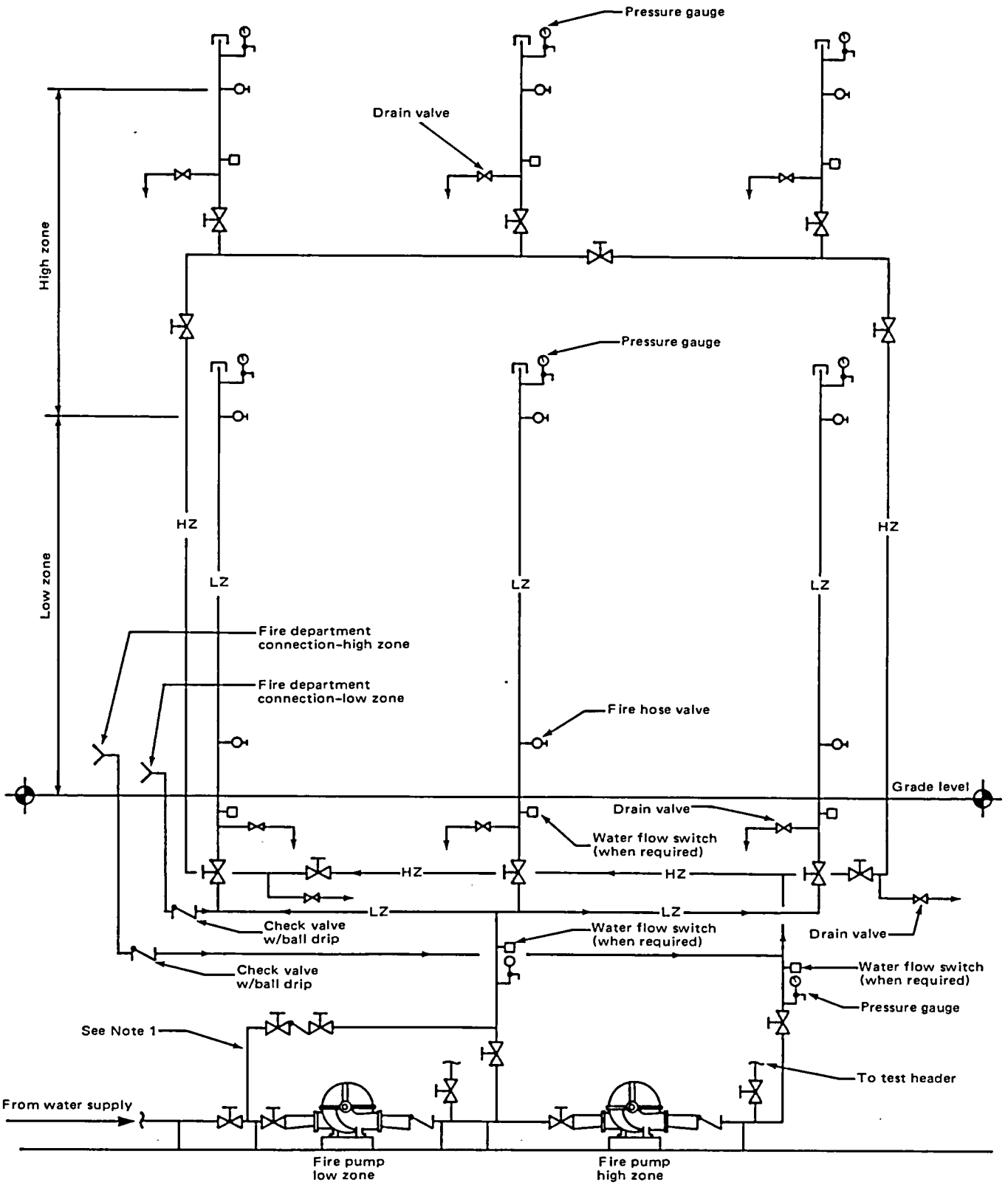
It is very important that fire departments choose an appropriate nozzle type for their standpipe fire fighting operations. Constant pressure (automatic) type spray nozzles (*See NFPA 1964*) should not be used for standpipe operations because many of this type require a minimum of 100 psi at the nozzle inlet to produce a reasonably effective fire stream. In standpipe operations, hose friction loss may prevent the delivery of 100 psi to the nozzle.

In high-rise standpipe systems with pressure reducing hose valves, the fire department has little or no control over hose valve outlet pressure.



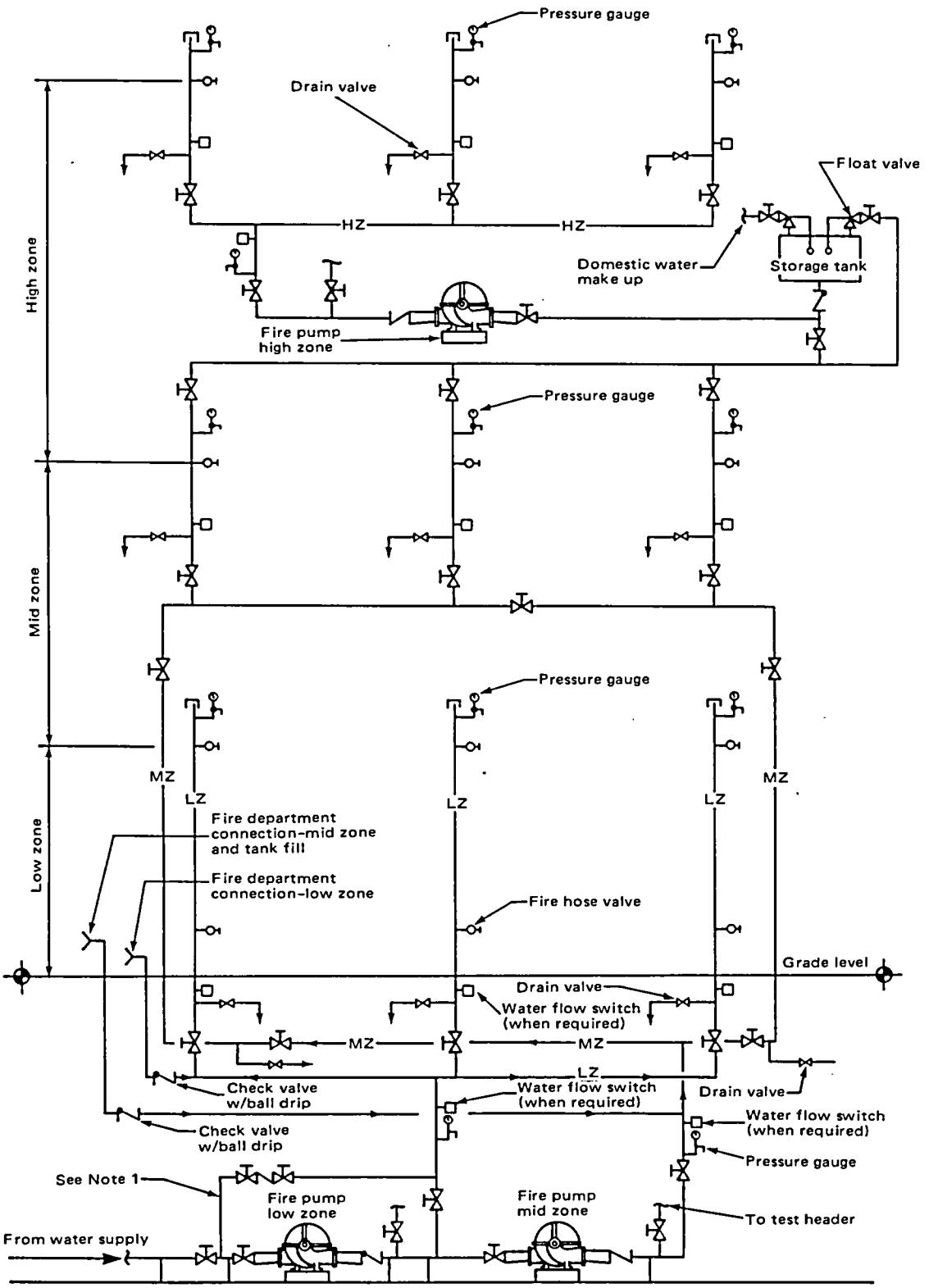
NOTE 1: Sprinkler floor assembly. NFPA 13.
NOTE 2: Bypass subject to NFPA 20.

Figure A-5-1(a) Typical single-zone system.



NOTE 1: Bypass subject to NFPA 20.
NOTE 2: High zone pump may be arranged to take suction directly from source of supply.

Figure A-5-1(b) Typical two-zone system.



NOTE 1: Bypass subject to NFPA 20.

Figure A-5-1(c) Typical multi-zone system.