

**P2902.6 Location of backflow preventers.** Access shall be provided to backflow preventers as specified by the manufacturer's installation instructions.

**P2902.6.1 Outdoor enclosures for backflow prevention devices.** Outdoor enclosures for backflow prevention devices shall comply with ASSE 1060.

**P2902.6.2 Protection of backflow preventers.** Backflow preventers shall not be located in areas subject to freezing except where they can be removed by means of unions, or are protected by heat, insulation or both.

**P2902.6.3 Relief port piping.** The termination of the piping from the relief port or air gap fitting of the backflow preventer shall discharge to an *approved* indirect waste receptor or to the outdoors where it will not cause damage or create a nuisance.

## SECTION P2903 WATER SUPPLY SYSTEM

**P2903.1 Water supply system design criteria.** The water service and water distribution systems shall be designed and pipe sizes shall be selected such that under conditions of peak

demand, the capacities at the point of outlet discharge shall be not less than shown in Table P2903.1.

**P2903.2 Maximum flow and water consumption.** The maximum water consumption flow rates and quantities for plumbing fixtures and fixture fittings shall be in accordance with Table P2903.2.

**P2903.3 Minimum pressure.** Where the water pressure supplied by the public water main or an individual water supply system is insufficient to provide for the minimum pressures and quantities for the plumbing fixtures in the building, the pressure shall be increased by means of an elevated water tank, a hydropneumatic pressure booster system or a water pressure booster pump.

**P2903.3.1 Maximum pressure.** The static water pressure shall be not greater than 80 psi (551 kPa). Where the main pressure exceeds 80 psi (551 kPa), an *approved* pressure-reducing valve conforming to ASSE 1003 or CSA B356 shall be installed on the domestic water branch main or riser at the connection to the water service pipe.

**P2903.4 Thermal expansion control.** A means for controlling increased pressure caused by thermal expansion shall be installed where required in accordance with Sections P2903.4.1 and P2903.4.2.

**TABLE P2903.1  
REQUIRED CAPACITIES AT POINT OF OUTLET DISCHARGE**

FIXTURE SUPPLY OUTLET SERVING	FLOW RATE (gpm)	FLOW PRESSURE (psi)
Bathtub, balanced-pressure, thermostatic or combination balanced-pressure/thermostatic mixing valve	4	20
Bidet, thermostatic mixing valve	2	20
Dishwasher	2.75	8
Laundry tray	4	8
Lavatory	0.8	8
Shower, balanced-pressure, thermostatic or combination balanced-pressure/thermostatic mixing valve	2.5 <sup>a</sup>	20
Sillcock, hose bibb	5	8
Sink	1.75	8
Water closet, flushometer tank	1.6	20
Water closet, tank, close coupled	3	20
Water closet, tank, one-piece	6	20

For SI: 1 pound per square inch = 6.895 kPa, 1 gallon per minute = 3.785 L/m.

a. Where the shower mixing valve manufacturer indicates a lower flow rating for the mixing valve, the lower value shall be applied.

**TABLE P2903.2  
MAXIMUM FLOW RATES AND CONSUMPTION FOR PLUMBING FIXTURES AND FIXTURE FITTINGS<sup>b</sup>**

PLUMBING FIXTURE OR FIXTURE FITTING	MAXIMUM FLOW RATE OR QUANTITY
Lavatory faucet	2.2 gpm at 60 psi
Shower head <sup>a</sup>	2.5 gpm at 80 psi
Sink faucet	2.2 gpm at 60 psi
Water closet	1.6 gallons per flushing cycle

For SI: 1 gallon per minute = 3.785 L/m,

1 pound per square inch = 6.895 kPa.

a. A handheld shower spray shall be considered to be a shower head.

b. Consumption tolerances shall be determined from referenced standards.

**P2903.4.1 Pressure-reducing valve.** For water service system sizes up to and including 2 inches (51 mm), a device for controlling pressure shall be installed where, because of thermal expansion, the pressure on the downstream side of a pressure-reducing valve exceeds the pressure-reducing valve setting.

**P2903.4.2 Backflow prevention device or check valve.** Where a backflow prevention device, check valve or other device is installed on a water supply system using storage water heating equipment such that thermal expansion causes an increase in pressure, a device for controlling pressure shall be installed.

**P2903.5 Water hammer.** The flow velocity of the water distribution system shall be controlled to reduce the possibility of water hammer. A water-hammer arrestor shall be installed where quick-closing valves are utilized. Water-hammer arrestors shall be installed in accordance with the manufacturer's instructions. Water-hammer arrestors shall conform to ASSE 1010.

**P2903.6 Determining water supply fixture units.** Supply loads in the building water distribution system shall be determined by total load on the pipe being sized, in terms of water supply fixture units (w.s.f.u.), as shown in Table P2903.6, and gallon per minute (gpm) flow rates [see Table P2903.6(1)]. For fixtures not listed, choose a w.s.f.u. value of a fixture with similar flow characteristics.

**P2903.7 Size of water-service mains, branch mains and risers.** The size of the water service pipe shall be not less than  $\frac{3}{4}$  inch (19 mm) diameter. The size of water service mains, branch mains and risers shall be determined from the water supply demand [gpm (L/m)], available water pressure [psi (kPa)] and friction loss caused by the water meter and *developed length* of pipe [feet (m)], including *equivalent length* of fittings. The size of each water distribution system shall be determined according to design methods conforming to acceptable engineering practice, such as those methods in Appendix P and shall be *approved* by the *building official*.

**P2903.8 Gridded and parallel water distribution systems.** Hot water and cold water manifolds installed with parallel-connected individual distribution lines and cold water manifolds installed with gridded distribution lines to each fixture or fixture fitting shall be designed in accordance with Sections P2903.8.1 through P2903.8.5. Gridded systems for hot water distribution systems shall be prohibited.

**P2903.8.1 Sizing of manifolds.** Manifolds shall be sized in accordance with Table P2903.8.1. Total gallons per minute is the demand for all outlets.

**TABLE P2903.8.1  
MANIFOLD SIZING<sup>a</sup>**

PLASTIC		METALLIC	
Nominal Size ID (inches)	Maximum <sup>b</sup> gpm	Nominal Size ID (inches)	Maximum <sup>b</sup> gpm
$\frac{3}{4}$	17	$\frac{3}{4}$	11
1	29	1	20
$1\frac{1}{4}$	46	$1\frac{1}{4}$	31
$1\frac{1}{2}$	66	$1\frac{1}{2}$	44

For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/m,  
1 foot per second = 0.3048 m/s.

a. See Table P2903.6 for w.s.f.u and Table P2903.6(1) for gallon-per-minute (gpm) flow rates.

b. Based on velocity limitation: plastic-12 fps; metal-8 fps.

**P2903.8.2 Minimum size.** Where the *developed length* of the distribution line is 60 feet (18 288 mm) or less, and the available pressure at the meter is not less than 40 pounds per square inch (276 kPa), the size of individual distribution lines shall be not less than  $\frac{3}{8}$  inch (10 mm) diameter. Certain fixtures such as one-piece water closets and whirlpool bathtubs shall require a larger size where specified by the manufacturer. Where a water heater is fed from the end of a cold water manifold, the manifold shall be one size larger than the water heater feed.

**P2903.8.3 Support and protection.** Plastic piping bundles shall be secured in accordance with the manufacturer's instructions and supported in accordance with Section P2605. Bundles that have a change in direction equal to or greater than 45 degrees (0.79 rad) shall be protected from chafing at the point of contact with framing members by sleeving or wrapping.

**P2903.8.4 Valving.** Fixture valves, when installed, shall be located either at the fixture or at the manifold. Valves installed at the manifold shall be labeled indicating the fixture served.

**P2903.8.5 Hose bibb bleed.** A *readily accessible* air bleed shall be installed in hose bibb supplies at the manifold or at the hose bibb exit point.

**P2903.9 Valves.** Valves shall be installed in accordance with Sections P2903.9.1 through P2903.9.5.

**P2903.9.1 Service valve.** Each *dwelling unit* shall be provided with an accessible main shutoff valve near the entrance of the water service. The valve shall be of a full-open type having nominal restriction to flow, with provision for drainage such as a bleed orifice or installation of a separate drain valve. Additionally, the water service shall be valved at the curb or lot line in accordance with local requirements.

**TABLE P2903.6**  
**WATER-SUPPLY FIXTURE-UNIT VALUES FOR VARIOUS PLUMBING FIXTURES AND FIXTURE GROUPS**

TYPE OF FIXTURES OR GROUP OF FIXTURES	WATER-SUPPLY FIXTURE-UNIT VALUE (w.s.f.u.)		
	Hot	Cold	Combined
Bathtub (with/without overhead shower head)	1.0	1.0	1.4
Clothes washer	1.0	1.0	1.4
Dishwasher	1.4	—	1.4
Full-bath group with bathtub (with/without shower head) or shower stall	1.5	2.7	3.6
Half-bath group (water closet and lavatory)	0.5	2.5	2.6
Hose bibb (sillcock) <sup>a</sup>	—	2.5	2.5
Kitchen group (dishwasher and sink with or without food-waste disposer)	1.9	1.0	2.5
Kitchen sink	1.0	1.0	1.4
Laundry group (clothes washer standpipe and laundry tub)	1.8	1.8	2.5
Laundry tub	1.0	1.0	1.4
Lavatory	0.5	0.5	0.7
Shower stall	1.0	1.0	1.4
Water closet (tank type)	—	2.2	2.2

For SI: 1 gallon per minute = 3.785 L/m.

- a. The fixture unit value 2.5 assumes a flow demand of 2.5 gpm, such as for an individual lawn sprinkler device. If a hose bibb or sill cock will be required to furnish a greater flow, the equivalent fixture-unit value may be obtained from this table or Table P2903.6(1).

**TABLE P2903.6(1)**  
**CONVERSIONS FROM WATER SUPPLY FIXTURE UNIT TO GALLON PER MINUTE FLOW RATES**

SUPPLY SYSTEMS PREDOMINANTLY FOR FLUSH TANKS			SUPPLY SYSTEMS PREDOMINANTLY FOR FLUSHOMETER VALVES		
Load	Demand		Load	Demand	
(Water supply fixture units)	(Gallons per minute)	(Cubic feet per minute)	(Water supply fixture units)	(Gallons per minute)	(Cubic feet per minute)
1	3.0	0.04104	—	—	—
2	5.0	0.0684	—	—	—
3	6.5	0.86892	—	—	—
4	8.0	1.06944	—	—	—
5	9.4	1.256592	5	15.0	2.0052
6	10.7	1.430376	6	17.4	2.326032
7	11.8	1.577424	7	19.8	2.646364
8	12.8	1.711104	8	22.2	2.967696
9	13.7	1.831416	9	24.6	3.288528
10	14.6	1.951728	10	27.0	3.60936
11	15.4	2.058672	11	27.8	3.716304
12	16.0	2.13888	12	28.6	3.823248
13	16.5	2.20572	13	29.4	3.930192
14	17.0	2.27256	14	30.2	4.037136
15	17.5	2.3394	15	31.0	4.14408
16	18.0	2.90624	16	31.8	4.241024
17	18.4	2.459712	17	32.6	4.357968
18	18.8	2.513184	18	33.4	4.464912
19	19.2	2.566656	19	34.2	4.571856
20	19.6	2.620128	20	35.0	4.6788

*(continued)*

TABLE P2903.6(1)—continued  
CONVERSIONS FROM WATER SUPPLY FIXTURE UNIT TO GALLON PER MINUTE FLOW RATES

SUPPLY SYSTEMS PREDOMINANTLY FOR FLUSH TANKS			SUPPLY SYSTEMS PREDOMINANTLY FOR FLUSHOMETER VALVES		
Load	Demand		Load	Demand	
(Water supply fixture units)	(Gallons per minute)	(Cubic feet per minute)	(Water supply fixture units)	(Gallons per minute)	(Cubic feet per minute)
25	21.5	2.87412	25	38.0	5.07984
30	23.3	3.114744	30	42.0	5.61356
35	24.9	3.328632	35	44.0	5.88192
40	26.3	3.515784	40	46.0	6.14928
45	27.7	3.702936	45	48.0	6.41664
50	29.1	3.890088	50	50.0	6.684

For SI: 1 gallon per minute = 3.785 L/m, 1 cubic foot per minute = 0.4719 L/s.

**P2903.9.2 Water heater valve.** A *readily accessible* full-open valve shall be installed in the cold-water supply pipe to each water heater at or near the water heater.

**P2903.9.3 Fixture valves and access.** Shutoff valves shall be required on each fixture supply pipe to each plumbing appliance and to each plumbing fixture other than bathtubs and showers. Valves serving individual plumbing fixtures, *plumbing appliances*, risers and branches shall be accessible.

**P2903.9.4 Valve requirements.** Valves shall be compatible with the type of piping material installed in the system. Valves shall conform to one of the standards indicated in Table P2903.9.4 or shall be *approved*. Valves intended to supply drinking water shall meet the requirements of NSF 61.

**P2903.9.5 Valves and outlets prohibited below grade.** Potable water outlets and combination stop-and-waste valves shall not be installed underground or below grade. Freezeproof yard hydrants that drain the riser into the ground are considered to be stop-and-waste valves.

**Exception:** Installation of freezeproof yard hydrants that drain the riser into the ground shall be permitted if the potable water supply to such hydrants is protected upstream of the hydrants in accordance with Section P2902 and the hydrants are permanently identified as nonpotable outlets by *approved* signage that reads as follows: "CAUTION, NONPOTABLE WATER. DO NOT DRINK."

**P2903.10 Hose bibb.** Hose bibbs subject to freezing, including the "frostproof" type, shall be equipped with an accessible stop-and-waste-type valve inside the building so that they can be controlled and drained during cold periods.

**Exception:** Frostproof hose bibbs installed such that the stem extends through the building insulation into an open heated or *semiconditioned space* need not be separately valved (see Figure P2903.10).

**P2903.11 Drain water heat recovery units.** Drain water heat recovery units shall be in accordance with Section N1103.5.4.

## SECTION P2904 DWELLING UNIT FIRE SPRINKLER SYSTEMS

**P2904.1 General.** The design and installation of residential fire sprinkler systems shall be in accordance with NFPA 13D or Section P2904, which shall be considered to be equivalent to NFPA 13D. Partial residential sprinkler systems shall be permitted to be installed only in buildings not required to be equipped with a residential sprinkler system. Section P2904 shall apply to stand-alone and multipurpose wet-pipe sprinkler systems that do not include the use of antifreeze. A multipurpose fire sprinkler system shall provide domestic water to both fire sprinklers and plumbing fixtures. A stand-alone sprinkler system shall be separate and independent from the water distribution system. A backflow preventer shall not be required to separate a sprinkler system from the water distribution system, provided that the sprinkler system complies with all of the following:

1. The system complies with NFPA 13D or Section P2904.
2. The piping material complies with Section P2906.
3. The system does not contain antifreeze.
4. The system does not have a fire department connection.

**P2904.1.1 Required sprinkler locations.** Sprinklers shall be installed to protect all areas of a *dwelling unit*.

### Exceptions:

1. Attics, crawl spaces and normally unoccupied concealed spaces that do not contain fuel-fired appliances do not require sprinklers. In *attics*, crawl spaces and normally unoccupied concealed spaces that contain fuel-fired equipment, a sprinkler shall be installed above the equipment; however, sprinklers shall not be required in the remainder of the space.
2. Clothes closets, linen closets and pantries not exceeding 24 square feet (2.2 m<sup>2</sup>) in area, with the smallest dimension not greater than 3 feet (915 mm) and having wall and ceiling surfaces of gypsum board.

3. Bathrooms not more than 55 square feet (5.1 m<sup>2</sup>) in area.
4. Garages; carports; exterior porches; unheated entry areas, such as mud rooms, that are adjacent to an exterior door; and similar areas.

**P2904.2 Sprinklers.** Sprinklers shall be new listed residential sprinklers and shall be installed in accordance with the sprinkler manufacturer's instructions.

**P2904.2.1 Temperature rating and separation from heat sources.** Except as provided for in Section P2904.2.2, sprinklers shall have a temperature rating of not less than 135°F (57°C) and not more than 170°F (77°C). Sprinklers

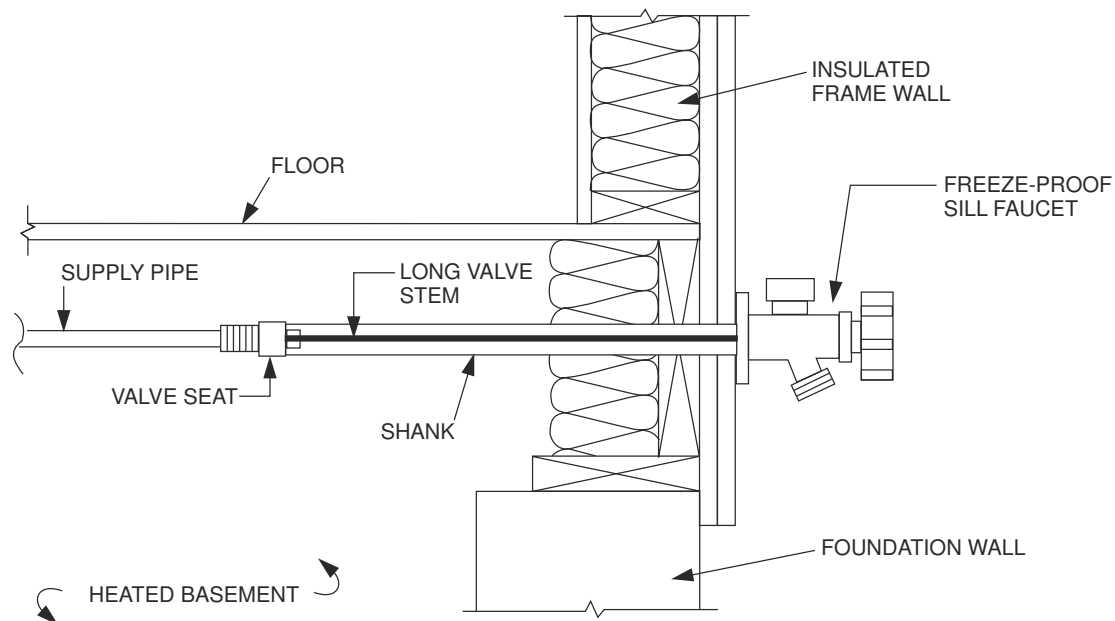
shall be separated from heat sources as required by the sprinkler manufacturer's installation instructions.

**P2904.2.2 Intermediate temperature sprinklers.** Sprinklers shall have an intermediate temperature rating not less than 175°F (79°C) and not more than 225°F (107°C) where installed in the following locations:

1. Directly under skylights, where the sprinkler is exposed to direct sunlight.
2. In attics.
3. In concealed spaces located directly beneath a roof.
4. Within the distance to a heat source as specified in Table P2904.2.2.

**TABLE P2903.9.4  
VALVES**

MATERIAL	STANDARD
Chlorinated polyvinyl chloride (CPVC) plastic	ASME A112.4.14, ASME A112.18.1/CSA B125.1, ASTM F1970, CSA B125.3, MSS SP-122
Copper or copper alloy	ASME A112.4.14, ASME A112.18.1/CSA B125.1, ASME B16.34, CSA B125.3, MSS SP-67, MSS SP-80, MSS SP-110, MSS SP-139
Gray and ductile iron	ASTM A126, AWWA C500, AWWA C504, AWWA C507, MSS SP-42, MSS SP-67, MSS SP-70, MSS SP-71, MSS SP-72, MSS SP-78
Cross-linked polyethylene (PEX) plastic	ASME A112.4.14, ASME A112.18.1/CSA B125.1, CSA B125.3, NSF 359
Polypropylene (PP) plastic	ASME A112.4.14, ASTM F2389
Polyvinyl chloride (PVC) plastic	ASME A112.4.14, ASTM F1970, MSS SP-122



**FIGURE P2903.10  
TYPICAL FROSTPROOF HOSE BIBB INSTALLATION NOT REQUIRING SEPARATE VALVE**

**TABLE P2904.2.2**  
**LOCATIONS WHERE INTERMEDIATE TEMPERATURE SPRINKLERS ARE REQUIRED**

HEAT SOURCE	RANGE OF DISTANCE FROM HEAT SOURCE WITHIN WHICH INTERMEDIATE TEMPERATURE SPRINKLERS ARE REQUIRED <sup>a, b</sup> (inches)
Fireplace, side of open or recessed fireplace	12 to 36
Fireplace, front of recessed fireplace	36 to 60
Coal and wood burning stove	12 to 42
Kitchen range top	9 to 18
Oven	9 to 18
Vent connector or chimney connector	9 to 18
Heating duct, not insulated	9 to 18
Hot water pipe, not insulated	6 to 12
Side of ceiling or wall warm air register	12 to 24
Front of wall mounted warm air register	18 to 36
Water heater, furnace or boiler	3 to 6
Luminaire up to 250 watts	3 to 6
Luminaire 250 watts up to 499 watts	6 to 12

For SI: 1 inch = 25.4 mm.

a. Sprinklers shall not be located at distances less than the minimum table distance unless the sprinkler listing allows a lesser distance.

b. Distances shall be measured in a straight line from the nearest edge of the heat source to the nearest edge of the sprinkler.

**P2904.2.3 Freezing areas.** Piping shall be protected from freezing as required by Section P2603.5. Where sprinklers are required in areas that are subject to freezing, dry-side-wall or dry-pendent sprinklers extending from a nonfreezing area into a freezing area shall be installed.

**P2904.2.4 Sprinkler coverage.** Sprinkler coverage requirements and sprinkler obstruction requirements shall be in accordance with Sections P2904.2.4.1 and P2904.2.4.2.

**P2904.2.4.1 Coverage area limit.** The area of coverage of a single sprinkler shall not exceed 400 square feet (37 m<sup>2</sup>) and shall be based on the sprinkler *listing* and the sprinkler manufacturer's installation instructions.

**P2904.2.4.2 Obstructions to coverage.** Sprinkler discharge shall not be blocked by obstructions unless additional sprinklers are installed to protect the obstructed area. Additional sprinklers shall not be required where the sprinkler separation from obstructions complies with either the minimum distance indicated in Figure P2904.2.4.2 or the minimum distances specified in the sprinkler manufacturer's instructions where the manufacturer's instructions permit a lesser distance.

**P2904.2.4.2.1 Additional requirements for pendent sprinklers.** Pendent sprinklers within 3 feet (915 mm) of the center of a ceiling fan, surface-mounted ceiling luminaire or similar object shall be considered to be obstructed, and additional sprinklers shall be installed.

**P2904.2.4.2.2 Additional requirements for side-wall sprinklers.** Sidewall sprinklers within 5 feet (1524 mm) of the center of a ceiling fan, surface-mounted ceiling luminaire or similar object shall be considered to be obstructed, and additional sprinklers shall be installed.

**P2904.2.5 Sprinkler installation on systems assembled with solvent cement.** The solvent cementing of threaded adapter fittings shall be completed and threaded adapters for sprinklers shall be verified as being clear of excess cement prior to the installation of sprinklers on systems assembled with solvent cement.

**P2904.2.6 Sprinkler modifications prohibited.** Painting, caulking or modifying of sprinklers shall be prohibited. Sprinklers that have been painted, caulked, modified or damaged shall be replaced with new sprinklers.

**P2904.3 Sprinkler piping system.** Sprinkler piping shall be supported in accordance with requirements for cold water distribution piping. Sprinkler piping shall comply with the requirements for cold water distribution piping. For multipurpose piping systems, the sprinkler piping shall connect to and be a part of the cold water distribution piping system.

**Exception:** For plastic piping, it shall be permissible to follow the manufacturer's installation instructions.

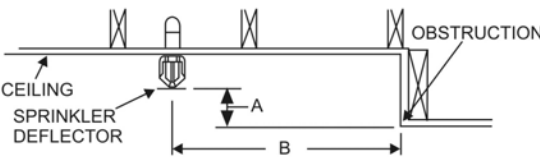
**P2904.3.1 Nonmetallic pipe and tubing.** Nonmetallic pipe and tubing, such as CPVC, PEX, and PE-RT shall be *listed* for use in residential fire sprinkler systems.

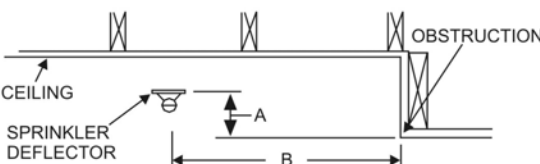
**P2904.3.1.1 Nonmetallic pipe protection.** Nonmetallic pipe and tubing systems shall be protected from exposure to the living space by a layer of not less than  $\frac{3}{8}$ -inch-thick (9.5 mm) gypsum wallboard,  $\frac{1}{2}$ -inch-thick (13 mm) plywood, or other material having a 15-minute fire rating.

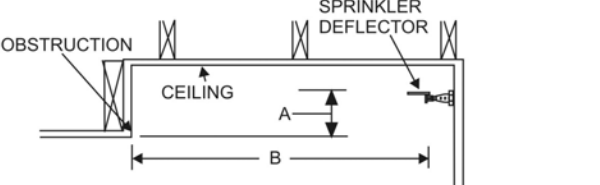
**Exceptions:**

1. Pipe protection shall not be required in areas that do not require protection with sprinklers as specified in Section P2904.1.1.
2. Pipe protection shall not be required where exposed piping is permitted by the pipe *listing*.



PENDANT SPRINKLER TO SIDE OBSTRUCTION	
	
WHERE "A" IS LESS THAN OR EQUAL TO: (INCHES)	"B" MUST BE NOT LESS THAN: (FEET)
1	1½
3	3
5	4
7	4½
9	1½
11	6½
14	7

SIDEWALL SPRINKLER TO SIDE OBSTRUCTION	
	
WHERE "A" IS LESS THAN OR EQUAL TO: (INCHES)	"B" MUST BE NOT LESS THAN: (FEET)
1	1½
3	3
5	4
7	4½
9	6
11	6½
14	7

SIDEWALL SPRINKLER TO FORWARD OBSTRUCTION	
	
WHERE "A" IS LESS THAN OR EQUAL TO: (INCHES)	"B" MUST BE NOT LESS THAN: (FEET)
1	8
2	10
3	11
4	12
6	13
7	14
9	15
11	16
14	17

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**FIGURE P2904.2.4.2**  
**MINIMUM ALLOWABLE DISTANCE BETWEEN**  
**SPRINKLER AND OBSTRUCTION**

**P2904.3.2 Shutoff valves prohibited.** With the exception of shutoff valves for the entire water distribution system, valves shall not be installed in any location where the valve would isolate piping serving one or more sprinklers.

**P2904.3.3 Single dwelling limit.** Piping beyond the service valve located at the beginning of the water distribution system shall not serve more than one *dwelling*.

**P2904.3.4 Drain.** A means to drain the sprinkler system shall be provided on the system side of the water distribution shutoff valve.

**P2904.4 Determining system design flow.** The flow for sizing the sprinkler piping system shall be based on the flow rating of each sprinkler in accordance with Section P2904.4.1 and the calculation in accordance with Section P2904.4.2.

**P2904.4.1 Determining required flow rate for each sprinkler.** The minimum required flow for each sprinkler shall be determined using the sprinkler manufacturer's published data for the specific sprinkler model based on all of the following:

1. The area of coverage.
2. The ceiling configuration.
3. The temperature rating.
4. Any additional conditions specified by the sprinkler manufacturer.

**P2904.4.2 System design flow rate.** The design flow rate for the system shall be based on the following:

1. The design flow rate for a room having only one sprinkler shall be the flow rate required for that sprinkler, as determined by Section P2904.4.1.
2. The design flow rate for a room having two or more sprinklers shall be determined by identifying the sprinkler in that room with the highest required flow rate, based on Section P2904.4.1, and multiplying that flow rate by 2.
3. Where the sprinkler manufacturer specifies different criteria for ceiling configurations that are not smooth, flat and horizontal, the required flow rate for that room shall comply with the sprinkler manufacturer's instructions.
4. The design flow rate for the sprinkler system shall be the flow required by the room with the largest flow rate, based on Items 1, 2 and 3.
5. For the purpose of this section, it shall be permissible to reduce the design flow rate for a room by subdividing the space into two or more rooms, where each room is evaluated separately with respect to the required design flow rate. Each room shall be bounded by walls and a ceiling. Openings in walls shall have a lintel not less than 8 inches (203 mm) in depth and each lintel shall form a solid barrier between the ceiling and the top of the opening.

**P2904.5 Water supply.** The water supply shall provide not less than the required design flow rate for sprinklers in accordance with Section P2904.4.2 at a pressure not less than that used to comply with Section P2904.6.

**P2904.5.1 Water supply from individual sources.**

Where a *dwelling unit* water supply is from a tank system, a private well system or a combination of these, the available water supply shall be based on the minimum pressure control setting for the pump.

**P2904.5.2 Required capacity.** The water supply shall have the capacity to provide the required design flow rate for sprinklers for a period of time as follows:

1. Seven minutes for *dwelling units* one story in height and less than 2,000 square feet (186 m<sup>2</sup>) in area.
2. Ten minutes for *dwelling units* two or more stories in height or equal to or greater than 2,000 square feet (186 m<sup>2</sup>) in area.

Where a well system, a water supply tank system or a combination thereof is used, any combination of well capacity and tank storage shall be permitted to meet the capacity requirement.

**P2904.6 Pipe sizing.** The piping to sprinklers shall be sized for the flow required by Section P2904.4.2. The flow required to supply the plumbing fixtures shall not be required to be added to the sprinkler design flow.

**P2904.6.1 Method of sizing pipe.** Piping supplying sprinklers shall be sized using the prescriptive method in Section P2904.6.2 or by hydraulic calculation in accordance with NFPA 13D. The minimum pipe size from the water supply source to any sprinkler shall be <sup>3</sup>/<sub>4</sub> inch (19 mm) nominal. Threaded adapter fittings at the point where

sprinklers are attached to the piping shall be not less than <sup>1</sup>/<sub>2</sub> inch (13 mm) nominal.

**P2904.6.2 Prescriptive pipe sizing method.** Pipe shall be sized by determining the available pressure to offset friction loss in piping and identifying a piping material, diameter and length using the equation in Section P2904.6.2.1 and the procedure in Section P2904.6.2.2.

**P2904.6.2.1 Available pressure equation.** The pressure available to offset friction loss in the interior piping system ( $P_t$ ) shall be determined in accordance with the Equation 29-1.

$$P_t = P_{sup} - PL_{svc} - PL_m - PL_d - PL_e - P_{sp} \quad \text{(Equation 29-1)}$$

where:

$P_t$  = Pressure used in applying Tables P2904.6.2(4) through P2904.6.2(9).

$P_{sup}$  = Pressure available from the water supply source.

$PL_{svc}$  = Pressure loss in the water service pipe. (Table P2904.6.2(1))

$PL_m$  = Pressure loss in the water meter. (Table P2904.6.2(2))

$PL_d$  = Pressure loss from devices other than the water meter.

$PL_e$  = Pressure loss associated with changes in elevation. (Table P2904.6.2(3))

$P_{sp}$  = Maximum pressure required by a sprinkler.

**TABLE P2904.6.2(1)  
WATER SERVICE PRESSURE LOSS ( $PL_{svc}$ )<sup>a, b</sup>**

FLOW RATE <sup>c</sup> (gpm)	<sup>3</sup> / <sub>4</sub> -INCH WATER SERVICE PRESSURE LOSS (psi)				1-INCH WATER SERVICE PRESSURE LOSS (psi)				1 <sup>1</sup> / <sub>4</sub> -INCH WATER SERVICE PRESSURE LOSS (psi)			
	Length of water service pipe (feet)				Length of water service pipe (feet)				Length of water service pipe (feet)			
	40 or less	41 to 75	76 to 100	101 to 150	40 or less	41 to 75	76 to 100	101 to 150	40 or less	41 to 75	76 to 100	101 to 150
8	5.1	8.7	11.8	17.4	1.5	2.5	3.4	5.1	0.6	1.0	1.3	1.9
10	7.7	13.1	17.8	26.3	2.3	3.8	5.2	7.7	0.8	1.4	2.0	2.9
12	10.8	18.4	24.9	NP	3.2	5.4	7.3	10.7	1.2	2.0	2.7	4.0
14	14.4	24.5	NP	NP	4.2	7.1	9.6	14.3	1.6	2.7	3.6	5.4
16	18.4	NP	NP	NP	5.4	9.1	12.4	18.3	2.0	3.4	4.7	6.9
18	22.9	NP	NP	NP	6.7	11.4	15.4	22.7	2.5	4.3	5.8	8.6
20	27.8	NP	NP	NP	8.1	13.8	18.7	27.6	3.1	5.2	7.0	10.4
22	NP	NP	NP	NP	9.7	16.5	22.3	NP	3.7	6.2	8.4	12.4
24	NP	NP	NP	NP	11.4	19.3	26.2	NP	4.3	7.3	9.9	14.6
26	NP	NP	NP	NP	13.2	22.4	NP	NP	5.0	8.5	11.4	16.9
28	NP	NP	NP	NP	15.1	25.7	NP	NP	5.7	9.7	13.1	19.4
30	NP	NP	NP	NP	17.2	NP	NP	NP	6.5	11.0	14.9	22.0
32	NP	NP	NP	NP	19.4	NP	NP	NP	7.3	12.4	16.8	24.8
34	NP	NP	NP	NP	21.7	NP	NP	NP	8.2	13.9	18.8	NP
36	NP	NP	NP	NP	24.1	NP	NP	NP	9.1	15.4	20.9	NP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 gallon per minute = 0.063 L/s, 1 pound per square inch = 6.895 kPa.

NP = Not Permitted. Pressure loss exceeds reasonable limits.

a. Values are applicable for underground piping materials listed in Table P2905.4 and are based on an SDR of 11 and a Hazen Williams C Factor of 150.

b. Values include the following length allowances for fittings: 25% length increase for actual lengths up to 100 feet and 15% length increase for actual lengths over 100 feet.

c. Flow rate from Section P2904.4.2. Add 5 gpm to the flow rate required by Section P2904.4.2 where the water service pipe supplies more than one dwelling.



**TABLE P2904.6.2(2)**  
**MINIMUM WATER METER PRESSURE LOSS ( $PL_m$ )<sup>a</sup>**

FLOW RATE (gallons per minute, gpm) <sup>b</sup>	<sup>5</sup> / <sub>8</sub> -INCH METER PRESSURE LOSS (pounds per square inch, psi)	<sup>3</sup> / <sub>4</sub> -INCH METER PRESSURE LOSS (pounds per square inch, psi)	1-INCH METER PRESSURE LOSS (pounds per square inch, psi)
8	2	1	1
10	3	1	1
12	4	1	1
14	5	2	1
16	7	3	1
18	9	4	1
20	11	4	2
22	NP	5	2
24	NP	5	2
26	NP	6	2
28	NP	6	2
30	NP	7	2
32	NP	7	3
34	NP	8	3
36	NP	8	3

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 gallon per minute = 0.063 L/s.

NP = Not permitted unless the actual water meter pressure loss is known.

a. Table P2904.6.2(2) establishes conservative values for water meter pressure loss or installations where the water meter loss is unknown. Where the actual water meter pressure loss is known,  $P_m$  shall be the actual loss.

b. Flow rate from Section P2904.4.2. Add 5 gpm to the flow rate required by Section P2904.4.2 where the water service pipe supplies more than one dwelling.

**TABLE P2904.6.2(3)**  
**ELEVATION LOSS ( $PL_e$ )**

ELEVATION (feet)	PRESSURE LOSS (psi)
5	2.2
10	4.4
15	6.5
20	8.7
25	10.9
30	13
35	15.2
40	17.4

For SI: 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa.

**TABLE P2904.6.2(4)**  
**ALLOWABLE PIPE LENGTH FOR 3/4-INCH TYPE M COPPER WATER TUBING**

SPRINKLER FLOW RATE <sup>a</sup> (gpm)	WATER DISTRIBUTION SIZE (inch)	AVAILABLE PRESSURE— $P_t$ (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable length of pipe from service valve to farthest sprinkler (feet)									
8	3/4	217	289	361	434	506	578	650	723	795	867
9	3/4	174	232	291	349	407	465	523	581	639	697
10	3/4	143	191	239	287	335	383	430	478	526	574
11	3/4	120	160	200	241	281	321	361	401	441	481
12	3/4	102	137	171	205	239	273	307	341	375	410
13	3/4	88	118	147	177	206	235	265	294	324	353
14	3/4	77	103	128	154	180	205	231	257	282	308
15	3/4	68	90	113	136	158	181	203	226	248	271
16	3/4	60	80	100	120	140	160	180	200	220	241
17	3/4	54	72	90	108	125	143	161	179	197	215
18	3/4	48	64	81	97	113	129	145	161	177	193
19	3/4	44	58	73	88	102	117	131	146	160	175
20	3/4	40	53	66	80	93	106	119	133	146	159
21	3/4	36	48	61	73	85	97	109	121	133	145
22	3/4	33	44	56	67	78	89	100	111	122	133
23	3/4	31	41	51	61	72	82	92	102	113	123
24	3/4	28	38	47	57	66	76	85	95	104	114
25	3/4	26	35	44	53	61	70	79	88	97	105
26	3/4	24	33	41	49	57	65	73	82	90	98
27	3/4	23	30	38	46	53	61	69	76	84	91
28	3/4	21	28	36	43	50	57	64	71	78	85
29	3/4	20	27	33	40	47	53	60	67	73	80
30	3/4	19	25	31	38	44	50	56	63	69	75
31	3/4	18	24	29	35	41	47	53	59	65	71
32	3/4	17	22	28	33	39	44	50	56	61	67
33	3/4	16	21	26	32	37	42	47	53	58	63
34	3/4	NP	20	25	30	35	40	45	50	55	60
35	3/4	NP	19	24	28	33	38	42	47	52	57
36	3/4	NP	18	22	27	31	36	40	45	49	54
37	3/4	NP	17	21	26	30	34	38	43	47	51
38	3/4	NP	16	20	24	28	32	36	40	45	49
39	3/4	NP	15	19	23	27	31	35	39	42	46
40	3/4	NP	NP	18	22	26	29	33	37	40	44

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 gallon per minute = 0.963 L/s.

NP = Not Permitted.

a. Flow rate from Section P2904.4.2.

**TABLE P2904.6.2(5)**  
**ALLOWABLE PIPE LENGTH FOR 1-INCH TYPE M COPPER WATER TUBING**

SPRINKLER FLOW RATE <sup>a</sup> (gpm)	WATER DISTRIBUTION SIZE (inch)	AVAILABLE PRESSURE— $P_t$ (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable length of pipe from service valve to farthest sprinkler (feet)									
8	1	806	1075	1343	1612	1881	2149	2418	2687	2955	3224
9	1	648	864	1080	1296	1512	1728	1945	2161	2377	2593
10	1	533	711	889	1067	1245	1422	1600	1778	1956	2134
11	1	447	586	745	894	1043	1192	1341	1491	1640	1789
12	1	381	508	634	761	888	1015	1142	1269	1396	1523
13	1	328	438	547	657	766	875	985	1094	1204	1313
14	1	286	382	477	572	668	763	859	954	1049	1145
15	1	252	336	420	504	588	672	756	840	924	1008
16	1	224	298	373	447	522	596	671	745	820	894
17	1	200	266	333	400	466	533	600	666	733	799
18	1	180	240	300	360	420	479	539	599	659	719
19	1	163	217	271	325	380	434	488	542	597	651
20	1	148	197	247	296	345	395	444	493	543	592
21	1	135	180	225	270	315	360	406	451	496	541
22	1	124	165	207	248	289	331	372	413	455	496
23	1	114	152	190	228	267	305	343	381	419	457
24	1	106	141	176	211	246	282	317	352	387	422
25	1	98	131	163	196	228	261	294	326	359	392
26	1	91	121	152	182	212	243	273	304	334	364
27	1	85	113	142	170	198	226	255	283	311	340
28	1	79	106	132	159	185	212	238	265	291	318
29	1	74	99	124	149	174	198	223	248	273	298
30	1	70	93	116	140	163	186	210	233	256	280
31	1	66	88	110	132	153	175	197	219	241	263
32	1	62	83	103	124	145	165	186	207	227	248
33	1	59	78	98	117	137	156	176	195	215	234
34	1	55	74	92	111	129	148	166	185	203	222
35	1	53	70	88	105	123	140	158	175	193	210
36	1	50	66	83	100	116	133	150	166	183	199
37	1	47	63	79	95	111	126	142	158	174	190
38	1	45	60	75	90	105	120	135	150	165	181
39	1	43	57	72	86	100	115	129	143	158	172
40	1	41	55	68	82	96	109	123	137	150	164

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 gallon per minute = 0.963 L/s.

a. Flow rate from Section P2904.4.2.