**Chapter 10 Discharge and Hydraulic Calculations**

10.1 Design Discharge

10.1.1\* Sprinklers That Are Listed With Specific Discharge Criteria

The system shall provide at least the flow required to produce a minimum discharge density of 0.05 gpm/ft2 (2.0 mm/min) or the sprinkler listing, whichever is greater, to the design sprinklers.

10.1.2 Water Supply

Where the water supply is a public or private water main 4 in. (100 mm) (nominal) in size or larger, the static pressure shall be permitted to be used for comparison to the sprinkler system demand regardless of the method used to determine the adequacy of the piping.

10.2\* Number of Design Sprinklers

10.2.1

For each of the following situations, the number of sprinklers in the design area shall be all of the sprinklers within a compartment, up to a maximum of two sprinklers, that require the greatest hydraulic demand:

A flat, smooth, horizontal ceiling with no beams up to a maximum of 24 ft (7.3 m) above the floor.

A flat, horizontal beamed ceiling, with a maximum ceiling height of 24 ft (7.3 m), with beams up to 14 in. (350 mm) deep with pendent sprinklers under the beams. The compartment containing the beamed ceiling shall be a maximum of 600 ft2 (56 m2) in area. The highest sprinkler in the compartment shall be above all openings from the compartment into any communicating spaces.

A smooth, flat, sloped ceiling with no beams up to a maximum slope of 8 in 12. The highest portion of the ceiling shall not be more than 24 ft (7.3 m) above the floor. The highest sprinkler in the sloped portion of the ceiling shall be above all openings from the compartment containing the sloped ceiling into any communicating spaces.

A sloped ceiling with beams up to 14 in. (350 mm) deep with pendent sprinklers under the beams. The compartment containing the sloped, beamed ceiling shall be a maximum of 600 ft2 (56 m2) in area. The slope of the ceiling shall be between 2 in 12 and 8 in 12. The highest portion of the ceiling shall not be more than 24 ft (7.3 m) above the floor. The highest sprinkler in the sloped portion of the ceiling shall be above all openings from the compartment containing the sloped ceiling into any communicating spaces.

A sloped ceiling with beams of any depth with sidewall or pendent sprinklers in each pocket formed by the beams. The compartment containing the sloped, beamed ceiling shall be a maximum of 600 ft2 (56 m2) in area. The slope of the ceiling shall be between 2 in 12 and 8 in 12. The highest portion of the ceiling shall not be more than 24 ft (7.3 m) above the floor.

10.2.2

Listed flows associated with testing under a smooth, flat, horizontal 8 ft (2.4 m) high ceiling shall be permitted to be used for the ceiling configurations referenced in 10.2.1.

10.2.3

For situations not meeting one of the conditions in 10.2.1, residential sprinklers listed for use in specific ceiling configurations shall be permitted to be used in accordance with their listing.

10.2.4\*

For situations not meeting one of the conditions in 10.2.1 and 10.2.3, the number of sprinklers in the design area shall be determined in consultation with the authority having jurisdiction as appropriate for the conditions.

10.3 Piping Configurations

10.3.1

The piping configuration shall be permitted to be looped.

10.3.2

The piping configuration shall be permitted to be gridded except where gridded systems are prohibited by Chapter 9.

10.3.3

The piping configuration shall be permitted to be straight run.

10.3.4

The piping configuration shall be permitted to be a combination of the configurations permitted in 10.3.1 through 10.3.3.

10.4 Pipe Sizing

10.4.1

For specially listed piping products, friction loss for pipe and fittings shall be permitted to be calculated based on the manufacturer's data.

10.4.2 Minimum Pipe Size

10.4.2.1

The minimum size of steel pipe shall be 1 in. (25 mm).

10.4.2.2

The minimum size of pipe other than steel pipe shall be 3/4 in. (20 mm) unless smaller sizes are permitted by 10.4.2.3.

10.4.2.3\*

Along with listed special fittings, 1/2 in. (15 mm) nonmetallic pipe and 1/2 in. (15 mm) copper pipe shall be permitted to be used only in network systems under the following conditions:

\* Each sprinkler shall be supplied through a minimum of three separate paths from the supply manifold.

Calculations shall clearly indicate the pipes that create the paths to each sprinkler.

A water distribution pipe that supplies a sprinkler shall not terminate in a dead end.

Hydraulic calculations shall be prepared for each sprinkler flowing individually within the system and for each pair of sprinklers within the same compartment.

The location of the most demanding single sprinkler and pair of sprinklers, including their pressure and flow requirements, shall be indicated on the plan review documents.

The system shall be hydraulically calculated in accordance with the provisions of NFPA 13, except that the friction loss straight through a fitting shall be included.

The method of joining the pipe to fittings or to other pipe shall be in accordance with the applicable plumbing code.

A maximum of one insert tee shall be permitted in each pipe section between sprinklers to serve only domestic fixtures.

When insert fittings are installed, each sprinkler shall have four separate paths from the water supply.

The piping supplying only plumbing fixtures shall be in accordance with the applicable plumbing code.

10.4.3

The pipes shall be sized using one of the following techniques:

The simplified calculation method of 10.4.4, which can only be used for connections to a city water main of at least 4 in. (100 mm) in diameter

The prescriptive pipe sizing method of 10.4.9

The hydraulic calculation procedure for NFPA 13

The manufacturer's listed installation instructions

10.4.4\* General Pipe Sizing Method

The following is the general pipe sizing method for straight-run systems connected to a city water main of at least 4 in. (100 mm) in diameter in accordance with 10.4.3(1):

The system flow rate shall be established in accordance with Sections 10.1 and 10.2, and it shall be determined that the flow allowed by the water meter meets or exceeds the system demand and that the total demand flow does not exceed the maximum flow allowed by the piping system components.

The water pressure in the street shall be determined.

Pipe sizes shall be selected.

\* Pressure loss for a water meter, if any, shall be determined and deducted using one of the following:

Table 10.4.4(a) shall be permitted to be used, even where the sprinkler demand flow exceeds the meter's rated continuous flow.

Higher pressure losses specified by the manufacturer shall be used in place of those specified in Table 10.4.4(a).

Lower pressure losses shall be permitted to be used where supporting data are provided by the meter manufacturer.

Pressure loss for elevation shall be deducted as follows:

Building height above street (ft) × 0.433 = pressure loss (psi)

Building height above street (m) × 0.098 = pressure loss (bar)

\* Pressure losses from the city main to the inside control valve shall be deducted by multiplying the pressure loss associated with the pipe material by the total length (s) of pipe in feet (meters).

Pressure loss for piping within the building shall be deducted by multiplying the pressure loss associated with the pipe material by the total length (s) of pipe in feet (meters).

Pressure loss for valves and fittings shall be deducted as follows:

The valves and fittings from the control valve to the farthest sprinkler shall be counted.

The equivalent length for each valve and fitting as shown in Table 10.4.4(b), Table 10.4.4(c), Table 10.4.4(d), Table 10.4.4(e), or as specified by the manufacturer shall be determined and the values added to obtain the total equivalent length for each pipe size.

The equivalent length for each size shall be multiplied by the pressure loss associated with the pipe material and the values totaled.

In multilevel buildings, the steps in 10.4.4(1) through 10.4.4(8) shall be repeated to size piping for each floor.

If the remaining pressure is less than the operating pressure established by the testing laboratory for the sprinkler being used, the sprinkler system shall be redesigned.

If the remaining pressure is higher than required, smaller piping shall be permitted to be used where justified by calculations.

The remaining piping shall be sized the same as the piping up to and including the farthest sprinkler unless smaller pipe sizes are justified by calculations.

Table 10.4.4(a) Pressure Losses in psi in Water Meters

Meter Size (in.) Flow (gpm) (L/min)

18 or less (68) 23 (87) 26 (98) 31 (117) 39 (148) 52 (197)

5/8 (15 mm) 9 (0.67 bar) 14 (0.97 bar) 18 (1.2 bar) 26 (1.8 bar) 38 (2.6 bar) \*

3/4 (20 mm) 7 (0.48 bar) 11 (0.76 bar) 14 (1.5 bar) 22 (1.5 bar) 35 (2.4 bar) \*

2 (0.14 bar) 3 (0.21 bar) 3 (0.21 bar) 4 (0.28 bar) 6 (0.41 bar) 10 (0.69 bar)

11/2 (40 mm) 1 (0.07 bar) 1 (0.07 bar) 2 (0.14 bar) 2 (0.14 bar) 4 (0.28 bar) 7 (0.48 bar)

2 (50 mm) 1 (0.07 bar) 1 (0.07 bar) 1 (0.07 bar) 1 (0.07 bar) 2 (0.14 bar) 3 (0.21 bar)

For SI units, 1 gpm = 3.785 L/min; 1 in. = 25 mm; 1 psi = 0.07 bar.

\*Above maximum rated flow of commonly available meters.

Table 10.4.4(b) Equivalent Length in Feet of Fittings and Valves for Schedule 40 Steel Pipe

Diameter (in.) 45 Degree Elbow 90 Degree Elbow Long-Radius Elbow Tee or Cross (flow turned 90 degrees) Tee or Cross (flow straight through) Gate Valve Angle Valve Globe Valve Globe "Y" Pattern Valve Cock Valve Check Valve

1 (25 mm) 1 (0.3 m) 2 (0.6 m) 2 (0.6 m) 5 (1.5 m) 2 (0.6 m) 0 12 (3.7 m) 28 (8.5 m) 15 (4.6 m) 4 (1.2 m) 5 (1.5 m)

11/4 (32 mm) 1 (0.3 m) 3 (0.9 m) 2 (0.6 m) 6 (1.8 m) 2 (0.6 m) 0 15 (4.6 m) 35 (10.7 m) 18 (5.5 m) 5 (1.5 m) 7 (2.1 m)

11/2 (40 mm 2 (0.6 m) 4 (1.2 m) 2 (0.6 m) 8 (2.4 m) 3 (0.9 m) 0 18 (5.5 m) 43 (13.1 m) 22 (6.7 m) 6 (1.8 m) 9 (2.7 m)

2 (50 mm) 2 (0.6 m) 5 (1.5 m) 3 (0.9 m) 10 (3 m) 3 (0.9 m) 1 (0.3 m) 24 (7.3 m) 57 (17.4 m) 28 (8.5 m) 7 (2.1 m) 11 (3.3 m)

For SI units, 1 in. = 25 mm; 1 ft = 0.3 m.

Table 10.4.4(c) Equivalent Length in Feet of Fittings and Valves for Type K Copper Tube

Diameter (in.) 45 Degree Elbow 90 Degree Elbow Long-Radius Elbow Tee or Cross (flow turned 90 degrees) Tee or Cross (flow straight through) Gate Valve Angle Valve Globe Valve Globe "Y" Pattern Valve Cock Valve Check Valve

3/4 (20 mm) 0 1 (0.3 m) 0 3 (0.9 m) 1 (0.3 m) 0 7 (2.1 m) 14 (4.3 m) 7 (2.1 m) 2 (0.6 m) 0

1 (25 mm) 1 (0.3 m) 2 (0.6 m) 2 (0.6 m) 6 (1.8 m) 2 (0.6 m) 0 14 (4.3 m) 33 (10 m) 18 (5.5 m) 5 (1.5 m) 6 (1.8 m)

11/4 (32 mm) 1 (0.3 m) 3 (0.9 m) 2 (0.6 m) 5 (1.5 m) 2 (0.6 m) 0 14 (4.3 m) 32 (9.8 m) 16 (4.9 m) 5 (1.5 m) 6 (1.8 m)

11/2 (40 mm) 2 (0.6 m) 4 (1.2 m) 2 (0.6 m) 8 (2.4 m) 3 (0.9 m) 0 18 (5.5 m) 43 (13.1 m) 22 (6.7 m) 6 (1.8 m) 9 (2.7 m)

2 (50 mm) 2 (0.6 m) 6 (1.8 m) 3 (0.9 m) 12 (3.7 m) 4 (1.2 m) 1 (0.3 m) 28 (8.5 m) 66 (20.1 m) 33 (10 m) 8 (2.4 m) 13 (4 m)

For SI units, 1 in. = 25 mm; 1 ft = 0.3 m.

Table 10.4.4(d) Equivalent Length in Feet of Fittings and Valves for Type L Copper Tube

Diameter (in.) 45 Degree Elbow 90 Degree Elbow Long-Radius Elbow Tee or Cross (flow turned 90 degrees) Tee or Cross (flow straight through) Gate Valve Angle Valve Globe Valve Globe "Y" Pattern Valve Cock Valve Check Valve

3/4 (20 mm) 0 2 (0.6 m) 0 4 (1.2 m) 1 (0.3 m) 0 8 (2.4 m) 18 (5.5 m) 10 (3 m) 3 (0.9 m) 0

1 (25 mm) 1 (0.3 m) 3 (0.9 m) 3 (0.9 m) 7 (2.1 m) 2 (0.6 m) 0 16 (4.9 m) 38 (11.6 m) 20 (6.1 m) 5 (2.1 m) 7 (2.1 m)

11/4 (32 mm) 1 (0.3 m) 3 (0.9 m) 2 (0.6 m) 6 (1.8 m) 2 (0.6 m) 0 15 (4.6 m) 35 (10.7 m) 18 (5.5 m) 5 (1.5 m) 7 (2.1 m)

11/2 (40 mm) 2 (0.6 m) 4 (1.2 m) 2 (0.6 m) 9 (2.7 m) 3 (0.9 m) 0 20 (6.1 m) 47 (14.3 m) 24 (7.3 m) 7 (2.1 m) 10 (3 m)

2 (50 mm) 2 (0.6 m) 6 (1.8 m) 4 (1.2 m) 12 (3.7 m) 4 (1.2 m) 1 (0.3 m) 30 (9.1 m) 71 (21.6 m) 35 (10.7 m) 9 (2.7 m) 14 (4.3 m)

For SI units, 1 in. = 25 mm; 1 ft = 0.3 m.

Table 10.4.4(e) Equivalent Length in Feet of Fittings and Valves for Type M Copper Tube

Diameter (in.) 45 Degree Elbow 90 Degree Elbow Long-Radius Elbow Tee or Cross (flow turned 90 degrees) Tee or Cross (flow straight through) Gate Valve Angle Valve Globe Valve Globe "Y" Pattern Valve Cock Valve Check Valve

3/4 (20 mm) 0 2 (0.6 m) 0 4 (1.2 m) 1 (0.3 m 0 10 (3 m) 21 (6.4 m) 11 (3.3 m) 3 (0.9 m) 0

1 (25 mm) 2 (0.6 m) 3 (0.9 m) 3 (0.9 m) 8 (2.4 m) 3 (0.9 m) 0 19 (5.8 m) 43 (13.1 m) 23 (7 m) 6 (1.8 m) 8 (2.1 m)

l1/4 (32 mm) 1 (0.3 m) 3 (0.9 m) 2 (0.6 m) 7 (2.1 m) 2 (0.6 m) 0 16 (4.9 m) 38 (11.5 m) 20 (6.1 m) 5 (1.5 m) 8 (2.4 m)

11/2 (40 mm) 2 (0.6 m) 5 (1.5 m) 2 (0.6 m) 9 (2.7 m) 3 (0.9 m) 0 21 (6.4 m) 50 (15.2 m) 26 (7.9 m) 7 (2.1 m) 11 (3.3 m)

2 (50 mm) 3 (0.9 m) 7 (2.1 m) 4 (1.2 m) 13 (4 m) 5 (1.5 m) 1 (0.3 m) 32 (9.8 m) 75 (22.9 m) 37 (11.3 m) 9 (2.7 m) 14 (4.3 m)

For SI units, 1 in. = 25 mm; 1 ft = 0.3048 m.

10.4.5

To size piping for systems with an elevated tank, pump, or pump-tank combination, the pressure at the water supply outlet shall be determined and the steps in 10.4.4(3), 10.4.4(4), 10.4.4(7), 10.4.4(8), 10.4.4(9), 10.4.4(10), and 10.4.4(11) shall be followed.

10.4.6

Hydraulic calculation procedures in accordance with NFPA 13 shall be used for grid-type systems.

10.4.6.1

Where the water supply is a public or private water main 4 in. (100 mm) nominal in size or larger, only the static pressure measured at the main shall be required for performing hydraulic calculations.

10.4.7

Hydraulic calculation procedures in accordance with NFPA 13 shall be used for looped-type systems.

10.4.7.1

Where the water supply is a public or private water main 4 in. (100 mm) nominal in size or larger, only the static pressure measured at the main shall be required for performing hydraulic calculations.

10.4.8

Hydraulic calculation procedures in accordance with NFPA 13 shall be used for systems connected to city water mains of less than 4 in. (100 mm) in diameter.

10.4.9 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 10.4.9.1 and the procedure in 10.4.9.2.

10.4.9.1 Available Pressure Equation

The pressure available to offset friction loss in the interior piping system (Pt) shall be determined in accordance with the following formula:

[10.4.9.1]

Pt = Psup - PLsvc - PLm - PLd - PLe - Psp

where:

Pt = pressure used in applying Table 10.4.9.2(a) through Table 10.4.9.2(h)

Psup = pressure available from the water supply source

PLsvc = pressure loss in the water service pipe

PLm = pressure loss in the water meter

PLd = pressure loss from devices other than the water meter

PLe = pressure loss associated with changes in elevation

Psp = maximum pressure required by a sprinkler

10.4.9.2 Calculation Procedure

Determination of the required size for water distribution piping shall be in accordance with the following procedure:

Step 1 — Determine Psup. Obtain the static supply pressure that will be available from the water main from the water purveyor or from a private source, such as a tank system, a private well system, or a combination of these. For a private source, the available water supply pressure shall be based on the minimum pressure control setting for the pump.

Step 2 — Determine PLsvc. Use Table 10.4.9.2(a) to determine the pressure loss in the water service pipe based on the selected size of the water service.

Step 3 — Determine PLm. Use Table 10.4.4(a) to determine the pressure loss from the water meter based on the selected water meter size. Where the actual water meter pressure loss is known, PLm shall be the actual loss.

Step 4 — Determine PLd. Determine the pressure loss from devices, other than the water meter, installed in the piping system supplying sprinklers, such as pressure-reducing valves, backflow preventers, water softeners, or water filters, taking into account the following:

Device pressure losses shall be based on the device manufacturer's specifications.

The flow rate used to determine pressure loss shall be the rate from Section 10.1, except that 5 gpm (20 L/min) shall be added where the device is installed in a water service pipe that supplies more than one dwelling.

As an alternative to deducting pressure loss for a device, an automatic bypass valve shall be installed to divert flow around the device when a sprinkler activates.

Step 5 — Determine PLe. Use Table 10.4.9.2(b) to determine the pressure loss associated with changes in elevation. The elevation used in applying the table shall be the difference between the elevation where the water source pressure was measured and the elevation of the highest sprinkler.

Step 6 — Determine PLsp. Determine the maximum pressure required by any individual sprinkler based on the following:

The area of coverage

The ceiling configuration

The temperature rating

\* Any additional conditions specified by the sprinkler manufacturer

Step 7 — Calculate PLt. Using the equation in 10.4.9.1, calculate the pressure available to offset friction loss in water distribution piping between the service valve and the sprinklers.

Step 8 — Determine the maximum allowable pipe length. Use Table 10.4.9.2(c) through Table 10.4.9.2(h) to select a material and size for water distribution piping. The piping material and size shall be acceptable if the developed length of pipe between the service valve and the most remote sprinkler does not exceed the maximum allowable length specified by the applicable table. Interpolation of Pt between the tabular values shall be permitted.

Table 10.4.9.2(a) Water Service Pressure Loss (PLsvc)

Flow Rate\* (gpm) 3/4 in. Water Service Pressure Loss (psi) 1 in. Water Service Pressure Loss (psi) 11/4 in. Water Service Pressure Loss (psi)

40 ft or less 41 ft to 75 ft 76 ft to 100 ft 101 ft to 150 ft 40 ft or less 41 ft to 75 ft 76 ft to 100 ft 101 ft to 150 ft 40 ft or less 41 ft to 75 ft 76 ft to 100 ft 101 ft to 150 ft

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

Rate\* (lpm) 20 mm pipe 25 mm Pipe 32 mm Pipe

12 m or less 13 m to 23 m 23 m to 30 m 31 m to 49 m 12 m or less 13 m to 23 m 23 m to 30 m 31 m to 49 m 12 m or less 13 m to 23 m 23 m to 30 m 31 m to 49 m

30 0.4 0.6 0.8 1.2 0.1 0.2 0.2 0.4 0.0 0.1 0.1 0.1

38 0.5 0.9 1.2 1.8 0.2 0.3 0.4 0.5 0.1 0.1 0.1 0.2

45 0.7 1.3 1.7 NP 0.2 0.4 0.5 0.7 0.1 0.1 0.2 0.3

53 1.0 1.7 NP NP 0.3 0.5 0.7 1.0 0.1 0.2 0.2 0.4

61 1.3 NP NP NP 0.4 0.6 0.9 1.3 0.1 0.2 0.3 0.5

68 1.6 NP NP NP 0.5 0.8 1.1 1.6 0.2 0.3 0.4 0.6

76 1.9 NP NP NP 0.6 1.0 1.3 1.9 0.2 0.4 0.5 0.7

83 NP NP NP NP 0.7 1.1 1.5 NP 0.3 0.4 0.6 0.9

91 NP NP NP NP 0.8 1.3 1.8 NP 0.3 0.5 0.7 1.0

98 NP NP NP NP 0.9 1.5 NP NP 0.3 0.6 0.8 1.2

106 NP NP NP NP 1.0 1.8 NP NP 0.4 0.7 0.9 1.3

114 NP NP NP NP 1.2 NP NP NP 0.4 0.8 1.0 1.5

121 NP NP NP NP 1.3 NP NP NP 0.5 0.9 1.2 1.7

129 NP NP NP NP 1.5 NP NP NP 0.6 1.0 1.3 NP

136 NP NP NP NP 1.7 NP NP NP 0.6 1.1 1.4 NP

NP: Not permitted. Pressure loss exceeds reasonable limits.

Notes:

Values are applicable for underground piping materials permitted by the local plumbing code and are based on an SDR of 11 and a Hazen-Williams C factor of 150.

Values include the following length allowances for fittings: 25 percent length increase for actual lengths up to 100 ft (30.5 m) and 15 percent length increase for actual lengths over 100 ft (30.5 m).

\*Flow rate from Sections 10.1 and 10.2. Add 5 gpm (18.9 1pm) to the flow rate required by 10.4.9.2, Step 4, where the water service pipe supplies more than one dwelling.

Table 10.4.9.2(b) Elevation Loss (PLe)

Elevation (ft) (m) Pressure Loss (psi) (bar)

5 (1.5) 2.2 (0.15)

10 (3) 4.4 (0.30)

15 (4.6) 6.5(0.45)

20 (6.1) 8.7 (0.6)

25 (7.6) 10.9 (0.75)

30 (9.1) 13.0 (0.89)

35 (11) 15.2 (1.0)

40 (12) 17.4 (1.2)

Table 10.4.9.2(c) Allowable Pipe Length for 3/4 in. Type M Copper Water Tubing

Sprinkler Flow Rate\* (gpm) Water Distribution Size (in.) Available Pressure, Pt (psi)

15 20 25 30 35 40 45 50 55 60

Allowable Length of Pipe from Service Valve to Farthest Sprinkler (ft)

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

Sprinkler Flow Rate (lpm) Available Pressure Pt (bar)

1.0 1.4 1.7 2.1 2.4 2.8 2.9 3.4 3.8 4.1

Allowable Length of pipe from Service Valve to Farthest Sprinkler (m)

30 66 88 110 132 154 176 198 220 242 264

34 53 71 89 106 124 142 159 177 195 212

38 44 58 73 87 102 117 131 146 160 175

42 37 49 61 73 86 98 110 122 134 147

45 31 42 52 62 73 83 94 104 114 125

49 27 36 45 54 63 72 81 90 99 108

53 23 31 39 47 55 62 70 78 86 94

57 21 27 34 41 48 55 62 69 76 83

61 18 24 30 37 43 49 55 61 67 73

64 16 22 27 33 38 44 49 55 60 66

68 15 20 25 30 34 39 44 49 54 59

72 13 18 22 27 31 36 40 45 49 53

76 12 16 20 24 28 32 36 41 45 48

79 11 15 19 22 26 30 33 37 41 44

83 10 13 17 20 24 27 30 34 37 41

87 9.4 12 16 19 22 25 28 31 34 37

91 8.5 12 14 17 20 23 26 29 32 35

95 7.9 11 13 16 19 21 24 27 30 32

98 7.3 10 12 15 17 20 22 25 27 30

102 7.0 9.1 12 14 16 19 21 23 26 28

106 6.4 8.5 11 13 15 17 20 22 24 26

110 6.1 8.2 10 12 14 16 18 20 22 24

114 5.8 7.6 9.4 12 13 15 17 19 21 23

117 5.5 7.3 8.8 11 12 14 16 18 20 22

121 5.2 6.7 8.5 10 12 13 15 17 19 20

125 4.9 6.4 7.9 9.8 11 13 14 16 18 19

129 NP 6.1 7.6 9.1 11 12 14 15 17 18

132 NP 5.8 7.3 8.5 10 12 13 14 16 17

136 NP 5.5 6.7 8.2 9.4 11 12 14 15 16

140 NP 5.2 6.4 7.9 9.1 10 12 13 14 16

144 NP 4.9 6.1 7.3 8.5 9.8 11 12 14 15

148 NP 4.6 5.8 7.0 8.2 9.4 11 12 13 14

151 NP NP 5.5 6.7 7.9 8.8 10 11 12 13

NP: Not permitted.

\*Flow rate from Sections 10.1 and 10.2.

Table 10.4.9.2(d) Allowable Pipe Length for 1 in. Type M Copper Water Tubing

Sprinkler Flow Rate\* (gpm) Water Distribution Size (in.) Available Pressure, Pt (psi)

15 20 25 30 35 40 45 50 55 60

Allowable Length of Pipe from Service Valve to Farthest Sprinkler (ft)

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 1 447 596 745 894 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

Sprinkler Flow Rate (lpm) Available Pressure Pt (bar)

1.0 1.4 1.7 2.1 2.4 2.8 2.9 3.4 3.8 4.1

Allowable Length of pipe from Service Valve to Farthest Sprinkler (m)

30 246 328 409 491 573 655 737 819 901 983

34 198 263 329 395 461 527 593 659 725 790

38 162 217 271 325 379 433 488 542 596 650

42 136 182 227 272 318 363 409 454 500 545

45 116 155 193 232 271 309 348 387 426 464

49 100 134 167 200 233 267 300 333 367 400

53 87 116 145 174 204 233 262 291 320 349

57 77 102 128 154 179 205 230 256 282 307

61 68 91 114 136 159 182 205 227 250 272

64 61 81 101 122 142 162 183 203 223 244

68 55 73 91 110 128 146 164 183 201 219

72 50 66 83 99 116 132 149 165 182 198

76 45 60 75 90 105 120 135 150 166 180

79 41 55 69 82 96 110 124 137 151 165

83 38 50 63 76 88 101 113 126 139 151

87 35 46 58 69 81 93 105 116 128 139

91 32 43 54 64 75 86 97 107 118 129

95 30 40 50 60 69 80 90 99 109 119

98 28 37 46 55 65 74 83 93 102 111

102 26 34 43 52 60 69 78 86 95 104

106 24 32 40 48 56 65 73 81 89 97

110 23 30 38 45 53 60 68 76 83 91

114 21 28 35 43 50 57 64 71 78 85

117 20 27 34 40 47 53 60 67 73 80

121 19 25 31 38 44 50 57 63 69 76

125 18 24 30 36 42 48 54 59 66 71

129 17 23 28 34 39 45 51 56 62 68

132 16 21 27 32 37 43 48 53 59 64

136 15 20 25 30 35 41 46 51 56 61

140 14 19 24 29 34 38 43 48 53 58

144 14 18 23 27 32 37 41 46 50 55

148 13 17 22 26 30 35 39 44 48 52

151 12 17 21 25 29 33 37 42 46 50

\*Flow rate from Sections 10.1 and 10.2.

Table 10.4.9.2(e) Allowable Pipe Length for 3/4 in. CPVC (IPS) Pipe

Sprinkler Flow Rate\* (gpm) Water Distribution Size (in.) Available Pressure, Pt (psi)

15 20 25 30 35 40 45 50 55 60

Allowable Length of Pipe from Service Valve to Farthest Sprinkler (ft)

8 3/4 348 465 581 697 813 929 1045 1161 1278 1394

9 3/4 280 374 467 560 654 747 841 934 1027 1121

10 3/4 231 307 384 461 538 615 692 769 845 922

11 3/4 193 258 322 387 451 515 580 644 709 773

12 3/4 165 219 274 329 384 439 494 549 603 658

13 3/4 142 189 237 284 331 378 426 473 520 568

14 3/4 124 165 206 247 289 330 371 412 454 495

15 3/4 109 145 182 218 254 290 327 363 399 436

16 3/4 97 129 161 193 226 258 290 322 354 387

17 3/4 86 115 144 173 202 230 259 288 317 346

18 3/4 78 104 130 155 181 207 233 259 285 311

19 3/4 70 94 117 141 164 188 211 234 258 281

20 3/4 64 85 107 128 149 171 192 213 235 256

21 3/4 58 78 97 117 136 156 175 195 214 234

22 3/4 54 71 89 107 125 143 161 179 197 214

23 3/4 49 66 82 99 115 132 148 165 181 198

24 3/4 46 61 76 91 107 122 137 152 167 183

25 3/4 42 56 71 85 99 113 127 141 155 169

26 3/4 39 52 66 79 92 105 118 131 144 157

27 3/4 37 49 61 73 86 98 110 122 135 147

28 3/4 34 46 57 69 80 92 103 114 126 137

29 3/4 32 43 54 64 75 86 96 107 118 129

30 3/4 30 40 50 60 70 81 91 101 111 121

31 3/4 28 38 47 57 66 76 85 95 104 114

32 3/4 27 36 45 54 63 71 80 89 98 107

33 3/4 25 34 42 51 59 68 76 84 93 101

34 3/4 24 32 40 48 56 64 72 80 88 96

35 3/4 23 30 38 45 53 61 68 76 83 91

36 3/4 22 29 36 43 50 57 65 72 79 86

37 3/4 20 27 34 41 48 55 61 68 75 82

38 3/4 20 26 33 39 46 52 59 65 72 78

39 3/4 19 25 31 37 43 50 56 62 68 74

40 3/4 18 24 30 35 41 47 53 59 65 71

Sprinkler Flow Rate (lpm) Available Pressure Pt (bar)

1.0 1.4 1.7 2.1 2.4 2.8 2.9 3.4 3.8 4.1

Allowable Length of pipe from Service Valve to Farthest Sprinkler (m)

30 106 142 177 212 248 283 319 354 390 425

34 85 114 142 171 199 228 256 285 313 342

38 70 94 117 141 164 187 211 234 258 281

42 59 79 98 118 137 157 177 196 216 236

45 50 67 84 100 117 134 151 167 184 201

49 43 58 72 87 101 115 130 144 158 173

53 38 50 63 75 88 101 113 126 138 151

57 33 44 55 66 77 88 100 111 122 133

61 30 39 49 59 69 79 88 98 108 118

64 26 35 44 53 62 70 79 88 97 105

68 24 32 40 47 55 63 71 79 87 95

72 21 29 36 43 50 57 64 71 79 86

76 20 26 33 39 45 52 59 65 72 78

79 18 24 30 36 41 48 53 59 65 71

83 16 22 27 33 38 44 49 55 60 65

87 15 20 25 30 35 40 45 50 55 60

91 14 19 23 28 33 37 42 46 51 56

95 13 17 22 26 30 34 39 43 47 52

98 12 16 20 24 28 32 36 40 44 48

102 11 15 19 22 26 30 34 37 41 45

106 10 14 17 21 24 28 31 35 38 42

110 10 13 16 20 23 26 29 33 36 39

114 9.1 12 15 18 21 25 28 31 34 37

117 8.5 12 14 17 20 23 26 29 32 35

121 8.2 11 14 16 19 22 24 27 30 33

125 7.6 10 13 16 18 21 23 26 28 31

129 7.3 10 12 15 17 20 22 24 27 29

132 7.0 9.1 12 14 16 19 21 23 25 28

136 6.7 8.8 11 13 15 17 20 22 24 26

140 6.1 8.2 10 12 15 17 19 21 23 25

144 6.1 7.9 10 12 14 16 18 20 22 24

148 5.8 7.6 9.4 11 13 15 17 19 21 23

151 5.5 7.3 9.1 11 12 14 16 18 20 22

\*Flow rate from Sections 10.1 and 10.2.

Table 10.4.9.2(f) Allowable Pipe Length for 1 in. CPVC (IPS) Pipe

Sprinkler Flow Rate\* (gpm) Water Distribution Size (in.) Available Pressure, Pt (psi)

15 20 25 30 35 40 45 50 55 60

Allowable Length of Pipe from Service Valve to Farthest Sprinkler (ft)

8 1 1049 1398 1748 2098 2447 2797 3146 3496 3845 4195

9 1 843 1125 1406 1687 1968 2249 2530 2811 3093 3374

10 1 694 925 1157 1388 1619 1851 2082 2314 2545 2776

11 1 582 776 970 1164 1358 1552 1746 1940 2133 2327

12 1 495 660 826 991 1156 1321 1486 1651 1816 1981

13 1 427 570 712 854 997 1139 1281 1424 1566 1709

14 1 372 497 621 745 869 993 1117 1241 1366 1490

15 1 328 437 546 656 765 874 983 1093 1202 1311

16 1 291 388 485 582 679 776 873 970 1067 1164

17 1 260 347 433 520 607 693 780 867 954 1040

18 1 234 312 390 468 546 624 702 780 858 936

19 1 212 282 353 423 494 565 635 706 776 847

20 1 193 257 321 385 449 513 578 642 706 770

21 1 176 235 293 352 410 469 528 586 645 704

22 1 161 215 269 323 377 430 484 538 592 646

23 1 149 198 248 297 347 396 446 496 545 595

24 1 137 183 229 275 321 366 412 458 504 550

25 1 127 170 212 255 297 340 382 425 467 510

26 1 118 158 197 237 276 316 355 395 434 474

27 1 111 147 184 221 258 295 332 368 405 442

28 1 103 138 172 207 241 275 310 344 379 413

29 1 97 129 161 194 226 258 290 323 355 387

30 1 91 121 152 182 212 242 273 303 333 364

31 1 86 114 143 171 200 228 257 285 314 342

32 1 81 108 134 161 188 215 242 269 296 323

33 1 76 102 127 152 178 203 229 254 280 305

34 1 72 96 120 144 168 192 216 240 265 289

35 1 68 91 114 137 160 182 205 228 251 273

36 1 65 87 108 130 151 173 195 216 238 260

37 1 62 82 103 123 144 165 185 206 226 247

38 1 59 78 98 117 137 157 176 196 215 235

39 1 56 75 93 112 131 149 168 187 205 224

40 1 53 71 89 107 125 142 160 178 196 214

Sprinkler Flow Rate (lpm) Available Pressure Pt (bar)

1.0 1.4 1.7 2.1 2.4 2.8 2.9 3.4 3.8 4.1

Allowable Length of pipe from Service Valve to Farthest Sprinkler (m)

30 320 426 533 639 746 853 959 1066 1172 1279

34 257 343 429 514 600 685 771 857 943 1028

38 212 282 353 423 493 564 635 705 776 846

42 177 237 296 355 414 473 532 591 650 709

45 151 201 252 302 352 403 453 503 554 604

49 130 174 217 260 304 347 390 434 477 521

53 113 151 189 227 265 303 340 378 416 454

57 100 133 166 200 233 266 300 333 366 400

61 89 118 148 177 207 237 266 296 325 355

64 79 106 132 158 185 211 238 264 291 317

68 71 95 119 143 166 190 214 238 262 285

72 65 86 108 129 151 172 194 215 237 258

76 59 78 98 117 137 156 176 196 215 235

79 54 72 89 107 125 143 161 179 197 215

83 49 66 82 98 115 131 148 164 180 197

87 45 60 76 91 106 121 136 151 166 181

91 42 56 70 84 98 112 126 140 154 168

95 39 52 65 78 91 104 116 130 142 155

98 36 48 60 72 84 96 108 120 132 144

102 34 45 56 67 79 90 101 112 123 135

106 31 42 52 63 73 84 94 105 116 126

110 30 39 49 59 69 79 88 98 108 118

114 28 37 46 55 65 74 83 92 101 111

117 26 35 44 52 61 69 78 87 96 104

121 25 33 41 49 57 66 74 82 90 98

125 23 31 39 46 54 62 70 77 85 93

129 22 29 37 44 51 59 66 73 81 88

132 21 28 35 42 49 55 62 69 77 83

136 20 27 33 40 46 53 59 66 73 79

140 19 25 31 37 44 50 56 63 69 75

144 18 24 30 36 42 48 54 60 66 72

148 17 23 28 34 40 45 51 57 62 68

151 16 22 27 33 38 43 49 54 60 65

\*Flow rate from Sections 10.1 and 10.2.

Table 10.4.9.2(g) Allowable Pipe Length for 3/4 in. PEX Tubing

Sprinkler Flow Rate\* (gpm) Water Distribution Size (in.) Available Pressure, Pt (psi)

15 20 25 30 35 40 45 50 55 60

Allowable Length of Pipe from Service Valve to Farthest Sprinkler (ft)

8 3/4 93 123 154 185 216 247 278 309 339 370

9 3/4 74 99 124 149 174 199 223 248 273 298

10 3/4 61 82 102 123 143 163 184 204 225 245

11 3/4 51 68 86 103 120 137 154 171 188 205

12 3/4 44 58 73 87 102 117 131 146 160 175

13 3/4 38 50 63 75 88 101 113 126 138 151

14 3/4 33 44 55 66 77 88 99 110 121 132

15 3/4 29 39 48 58 68 77 87 96 106 116

16 3/4 26 34 43 51 60 68 77 86 94 103

17 3/4 23 31 38 46 54 61 69 77 84 92

18 3/4 21 28 34 41 48 55 62 69 76 83

19 3/4 19 25 31 37 44 50 56 62 69 75

20 3/4 17 23 28 34 40 45 51 57 62 68

21 3/4 16 21 26 31 36 41 47 52 57 62

22 3/4 NP 19 24 28 33 38 43 47 52 57

23 3/4 NP 17 22 26 31 35 39 44 48 52

24 3/4 NP 16 20 24 28 32 36 40 44 49

25 3/4 NP NP 19 22 26 30 34 37 41 45

26 3/4 NP NP 17 21 24 28 31 35 38 42

27 3/4 NP NP 16 20 23 26 29 33 36 39

28 3/4 NP NP 15 18 21 24 27 30 33 36

29 3/4 NP NP NP 17 20 23 26 28 31 34

30 3/4 NP NP NP 16 19 21 24 27 29 32

31 3/4 NP NP NP 15 18 20 23 25 28 30

32 3/4 NP NP NP NP 17 19 21 24 26 28

33 3/4 NP NP NP NP 16 18 20 22 25 27

34 3/4 NP NP NP NP NP 17 19 21 23 25

35 3/4 NP NP NP NP NP 16 18 20 22 24

36 3/4 NP NP NP NP NP 15 17 19 21 23

37 3/4 NP NP NP NP NP NP 16 18 20 22

38 3/4 NP NP NP NP NP NP 16 17 19 21

39 3/4 NP NP NP NP NP NP NP 16 18 20

40 3/4 NP NP NP NP NP NP NP 16 17 19

Sprinkler Flow Rate (lpm) Allowable Pipe Length for 20 mm PEX Tubing

1.0 1.4 1.7 2.1 2.4 2.8 2.9 3.4 3.8 4.1

Allowable Length of Pipe from Service Valve to Farthest Sprinkler (m)

30 28 37 47 56 66 75 85 94 103 113

34 23 30 38 45 53 61 68 76 83 91

38 19 25 31 37 44 50 56 62 69 75

42 16 21 26 31 37 42 47 52 57 62

45 13 18 22 27 31 36 40 45 49 53

49 12 15 19 23 27 31 34 38 42 46

53 10 13 17 20 23 27 30 34 37 40

57 9 12 15 18 21 23 27 29 32 35

61 8 10 13 16 18 21 23 26 29 31

64 7 9 12 14 16 19 21 23 26 28

68 6 9 10 12 15 17 19 21 23 25

72 6 8 9 11 13 15 17 19 21 23

76 5 7 9 10 12 14 16 17 19 21

79 5 6 8 9 11 12 14 16 17 19

83 NP 6 7 9 10 12 13 14 16 17

87 NP 5 7 8 9 11 12 13 15 16

91 NP 5 6 7 9 10 11 12 13 15

95 NP NP 6 7 8 9 10 11 12 14

98 NP NP 5 6 7 9 9 11 12 13

102 NP NP 5 6 7 8 9 10 11 12

106 NP NP 5 5 6 7 8 9 10 11

110 NP NP NP 5 6 7 8 9 9 10

114 NP NP NP 5 6 6 7 8 9 10

117 NP NP NP 5 5 6 7 8 9 9

121 NP NP NP NP 5 6 6 7 8 9

125 NP NP NP NP 5 5 6 7 8 8

129 NP NP NP NP NP 5 6 6 7 8

132 NP NP NP NP NP 5 5 6 7 7

136 NP NP NP NP NP 5 5 6 6 7

140 NP NP NP NP NP NP 5 5 6 7

144 NP NP NP NP NP NP 5 5 6 6

148 NP NP NP NP NP NP NP 5 5 6

151 NP NP NP NP NP NP NP 5 5 6

NP: Not permitted.

\*Flow rate from Sections 10.1 and 10.2.

Table 10.4.9.2(h) Allowable Pipe Length for 1 in. PEX Tubing

Sprinkler Flow Rate\* (gpm) Water Distribution Size (in.) Available Pressure, Pt (psi)

15 20 25 30 35 40 45 50 55 60

Allowable Length of Pipe from Service Valve to Farthest Sprinkler (ft)

8 1 314 418 523 628 732 837 941 1046 1151 1255

9 1 252 336 421 505 589 673 757 841 925 1009

10 1 208 277 346 415 485 554 623 692 761 831

11 1 174 232 290 348 406 464 522 580 638 696

12 1 148 198 247 296 346 395 445 494 543 593

13 1 128 170 213 256 298 341 383 426 469 511

14 1 111 149 186 223 260 297 334 371 409 446

15 1 98 131 163 196 229 262 294 327 360 392

16 1 87 116 145 174 203 232 261 290 319 348

17 1 78 104 130 156 182 208 233 259 285 311

18 1 70 93 117 140 163 187 210 233 257 280

19 1 63 84 106 127 148 169 190 211 232 253

20 1 58 77 96 115 134 154 173 192 211 230

21 1 53 70 88 105 123 140 158 175 193 211

22 1 48 64 80 97 113 129 145 161 177 193

23 1 44 59 74 89 104 119 133 148 163 178

24 1 41 55 69 82 96 110 123 137 151 164

25 1 38 51 64 76 89 102 114 127 140 152

26 1 35 47 59 71 83 95 106 118 130 142

27 1 33 44 55 66 77 88 99 110 121 132

28 1 31 41 52 62 72 82 93 103 113 124

29 1 29 39 48 58 68 77 87 97 106 116

30 1 27 36 45 54 63 73 82 91 100 109

31 1 26 34 43 51 60 68 77 85 94 102

32 1 24 32 40 48 56 64 72 80 89 97

33 1 23 30 38 46 53 61 68 76 84 91

34 1 22 29 36 43 50 58 65 72 79 86

35 1 20 27 34 41 48 55 61 68 75 82

36 1 19 26 32 39 45 52 58 65 71 78

37 1 18 25 31 37 43 49 55 62 68 74

38 1 18 23 29 35 41 47 53 59 64 70

39 1 17 22 28 33 39 45 50 56 61 67

40 1 16 21 27 32 37 43 48 53 59 64

Sprinkler Flow Rate (lpm) Available Pressure Pt (bar)

1.0 1.4 1.7 2.1 2.4 2.8 2.9 3.4 3.8 4.1

Allowable Length of pipe from Service Valve to Farthest Sprinkler (m)

30 96 127 159 191 223 255 287 319 351 383

34 77 102 128 154 180 205 231 256 282 308

38 63 84 105 126 148 169 190 211 232 253

42 53 71 88 106 124 141 159 177 194 212

45 45 60 75 90 105 120 136 151 166 181

49 39 52 65 78 91 104 117 130 143 156

53 34 45 57 68 79 91 102 113 125 136

57 30 40 50 60 70 80 90 100 110 119

61 27 35 44 53 62 71 80 88 97 106

64 24 32 40 48 55 63 71 79 87 95

68 21 28 36 43 50 57 64 71 78 85

72 19 26 32 39 45 52 58 64 71 77

76 18 23 29 35 41 47 53 59 64 70

79 16 21 27 32 37 43 48 53 59 64

83 15 20 24 30 34 39 44 49 54 59

87 13 18 23 27 32 36 41 45 50 54

91 12 17 21 25 29 34 37 42 46 50

95 12 16 20 23 27 31 35 39 43 46

98 11 14 18 22 25 29 32 36 40 43

102 10 13 17 20 23 27 30 34 37 40

106 9.4 12 16 19 22 25 28 31 34 38

110 8.8 12 15 18 21 23 27 30 32 35

114 8.2 11 14 16 19 22 25 28 30 33

117 7.9 10 13 16 18 21 23 26 29 31

121 7.3 10 12 15 17 20 22 24 27 30

125 7.0 9.1 12 14 16 19 21 23 26 28

129 6.7 8.8 11 13 15 18 20 22 24 26

132 6.1 8.2 10 12 15 17 19 21 23 25

136 5.8 7.9 10 12 14 16 18 20 22 24

140 5.5 7.6 9.4 11 13 15 17 19 21 23

144 5.5 7.0 8.8 11 12 14 16 18 20 21

5.2 6.7 8.5 10 12 14 15 17 19 20

4.9 6.4 8.2 10 11 13 15 16 18 20

10.4.9.3

The maximum allowable length of piping in Table 10.4.9.2(c) through Table 10.4.9.2(h) incorporates an adjustment for pipe fittings, and no additional consideration of friction losses associated with pipe fittings shall be required.