



8.1 Wet Pipe Systems.

8.1.1 Pressure Gauges.

8.1.1.1

An approved pressure gauge conforming to Section 16.13 shall be installed in each system riser.

8.1.1.2 *

Pressure gauges shall be installed above and below each alarm check valve or system riser check valve where such devices are present.

8.1.1.2.1

A single pressure gauge shall be permitted to be installed on a manifold below multiple riser check valves or alarm check valves.

8.1.1.2.2

Pressure gauges below check valves required by 16.9.10 and 16.15.2.2(1) shall not be required.

8.1.2 Relief Valves.

8.1.2.1 *

Unless the requirements of 8.1.2.2 are met, a wet pipe system shall be provided with a listed relief valve not less than $\frac{1}{2}$ in. (15 mm) in size and set to operate at 175 psi (12 bar) or 10 psi (0.7 bar) in excess of the maximum system pressure, whichever is greater.

8.1.2.2

Where auxiliary air reservoirs are installed to absorb pressure increases, a relief valve shall not be required.

8.1.2.3

A relief valve per 8.1.2.1 shall be required downstream of check valves required by 16.15.2.2(1).

8.1.3 Auxiliary Systems.

A wet pipe system shall be permitted to supply an auxiliary dry pipe, preaction, or deluge system, provided the water supply is adequate.

8.1.4

Heat tracing shall not be used in lieu of heated valve enclosures to protect the valve and supply pipe from freezing.

8.1.5 Air Venting.

A single air vent with a connection conforming to Section 16.7 shall be provided on each wet pipe system utilizing metallic pipe. (See A.16.7.)

8.1.5.1

Venting from multiple points on each system shall not be required.

8.2 * Dry Systems.

8.2.1 Gridded Dry Pipe Systems.

Gridded dry pipe systems shall not be installed.

8.2.2 Components.

8.2.2.1 Sprinklers.

8.2.2.1.1

The following orientations and arrangements shall be permitted for dry pipe systems:

- (1) Upright sprinklers
- (2)* Listed dry sprinklers
- (3) Pendent sprinklers and sidewall sprinklers installed on return bends, where the sprinklers, return bend, and branch line piping are in an area maintained above freezing
- (4) Horizontal sidewall sprinklers installed so that water is not trapped
- (5) Pendent sprinklers and sidewall sprinklers where the sprinklers and branch line piping are in an area maintained above freezing, the water supply is potable, and the piping for the dry system is copper or CPVC specifically listed for dry pipe applications

8.2.2.1.2

Residential sprinklers installed on dry pipe systems shall be listed for dry pipe applications.

8.2.2.2 Pressure Gauges.

Approved pressure gauges in accordance with Section 16.13 shall be provided as follows:

- (1) On the water side and pneumatic side of the dry pipe valve
- (2) At the air compressor supplying the system, where one is provided
- (3) At the air receiver, where one is provided
- (4) In each independent pipe from the pneumatic source to the dry pipe system
- (5) At mechanical quick-opening devices

8.2.3 * Location and Protection of Dry Pipe Valve.

8.2.3.1 * General.

The dry pipe valve and supply pipe shall be protected against freezing and mechanical injury.

8.2.3.2 Valve Rooms.

8.2.3.2.1

Valve rooms shall be lighted and heated.

8.2.3.2.2

The source of heat shall be of a permanently installed type.

8.2.3.2.3

Heat tape shall not be used in lieu of heated valve enclosures to protect the dry pipe valve and supply pipe against freezing.

8.2.3.3 Enclosure Protection.

The valve enclosure shall be protected with a sprinkler or sprinklers supplied from the dry system or from a wet pipe system that protects the area where the enclosure is located.

8.2.3.4 High Water Level Prevention.

Protection against accumulation of water above the clapper shall be provided for dry pipe valves in accordance with 8.2.3.4.1.

8.2.3.4.1

An automatic high water level signaling device, an automatic drain, or a means to manually drain shall be permitted.

8.2.4 * Dry Pipe System Water Delivery.

Dry pipe systems shall be sized such that water will be discharged from the system test connection within the time required by 8.2.4.1 for dwelling units and 8.2.4.2, 8.2.4.3, 8.2.4.4, or 8.2.4.5 for all other occupancies.

8.2.4.1 Dwelling Units.

For dry pipe systems protecting dwelling unit portions of any occupancy, initial water shall be discharged from the system test connection in not more than 15 seconds, starting at the normal air pressure on the system at the time of fully opened inspection test connection.

8.2.4.2 Single Orifice Test Connection.

System size shall be such that initial water is discharged from the system test connection in not more than 60 seconds, starting at the normal air pressure on the system at the time of fully opened inspection test connection.

8.2.4.2.1 *

A system size of not more than 500 gal (1900 L) shall be permitted without a quick-opening device and shall not be required to meet any specific water delivery requirement to the inspection test connection.

8.2.4.2.2

A system size of not more than 750 gal (2850 L) shall be permitted with a quick-opening device and shall not be required to meet any specific water delivery requirement to the inspection test connection.

8.2.4.3 Water Delivery Calculations.

8.2.4.3.1

Initial water shall be discharged from the system test connection based on calculations using a program listed by a nationally recognized testing laboratory.

8.2.4.3.2

Water delivery calculation for each dry pipe system shall be based on the hazard shown in Table 8.2.4.3.2.

Table 8.2.4.3.2 Dry Pipe System Water Delivery

Hazard	Number of Most Remote Sprinklers Initially Open	Maximum Time of Water Delivery (seconds)
Dwelling unit	1	15
Light	1	60
Ordinary (Group 1)	2	50
Ordinary (Group 2)	2	50
Extra (Group 1)	4	45
Extra (Group 2)	4	45
High-piled	4	40

8.2.4.3.3

Water delivery calculation shall be based on the time interval between the calculated point in time when the selected most remote sprinkler(s) open and the calculated point in time when the minimum design pressure at the most remote sprinkler is reached or surpassed and maintained.

8.2.4.4 * Manifold Test Connection.

8.2.4.4.1

System size shall be such that initial water discharge from the system manifold test connection is not more than the maximum time of water delivery specified in Table 8.2.4.3.2, starting at the normal air pressure on the system at the time of fully opened inspection test connection.

8.2.4.4.2

When flow is from four sprinklers, the test manifold shall be arranged to simulate two sprinklers on the most remote sprinkler branch line and two sprinklers on the next adjacent branch line.

8.2.4.4.3

When flow is from two sprinklers, the test manifold shall be arranged to simulate two sprinklers on the most remote sprinkler branch line.

8.2.4.5

Dry pipe systems with water delivery times other than given in 8.2.4 shall be acceptable where listed by a nationally recognized testing laboratory.

8.2.4.6 Dry Pipe System Subdivision.

8.2.4.6.1

Subdividing of dry pipe systems using check valves to facilitate water delivery shall be permitted when all the conditions in 8.2.4.6.2 through 8.2.4.6.5 are met.

8.2.4.6.2

Check valves shall be located in a heated enclosure.

8.2.4.6.3

A $\frac{1}{8}$ in. (3 mm) diameter hole shall be drilled in the clapper of each check valve to permit equalization of air or nitrogen pressure among various parts of the system.

8.2.4.6.4

Auxiliary drains shall be provided for each subdivided section of the system.

8.2.4.6.5

Where auxiliary drains are not provided for each subdivided section, a bypass around each check valve incorporating an approved and supervised normally closed indicating control valve shall be provided as a means to drain the subdivided section.

8.2.5 Quick-Opening Devices.

8.2.5.1

A listed quick-opening device shall be permitted to help meet the requirements of 8.2.4.

8.2.5.2

The quick-opening device shall be located as close as practical to the dry pipe valve.

8.2.5.3

Where a valve is installed in the connection between a dry pipe valve and the inlet of a quick-opening device, it shall be a supervised normally open indicating type valve.

8.2.5.4

To protect the quick-opening device against submergence, the connection to the riser shall be above the point at which water is expected when the device is set, unless the design features of the quick-opening device or dry pipe valve make this requirement unnecessary.

8.2.5.5

To protect the quick-opening device against submergence upon operation, a check valve shall be installed between the quick-opening device and the intermediate chamber of the dry pipe valve, unless the design features of the quick-opening device make this requirement unnecessary.

8.2.5.6

If the quick-opening device requires pressure feedback from the intermediate chamber, a supervised normally open indicating type valve shall be permitted in place of the check valve in 8.2.5.5.

8.2.5.7

Unless the quick-opening device has a built-in antiflooding device or is listed or approved for use without an antiflooding device, a listed anti-flooding device shall be installed in the connection between the dry pipe valve and the quick-opening device.

8.2.6 System Pneumatic Pressure.

8.2.6.1

System pneumatic pressure shall be maintained in accordance with the instruction sheet furnished with the dry pipe valve, or in the absence of manufactures data system pneumatic pressure shall be 20 psi (1.4 bar) in excess of the calculated trip pressure of the dry pipe valve, based on the highest normal water pressure of the system supply.

8.2.6.2

The permitted rate of pressure leakage shall be as specified in 29.2.2.

8.2.6.3

Each dry pipe valve shall have a low/high supervisory pressure switch that provides a supervisory signal when the pneumatic pressure within the system is out of the ranges specified in 8.2.6.4 and 8.2.6.5.

8.2.6.4

The low pressure signal shall be set at a minimum of 5 psi (0.3 bar) above the trip pressure of the dry pipe valve or per the manufacturer's instructions.

8.2.6.5

The high pressure signal shall be set at a minimum of 5 psi (0.3 bar) above the system pneumatic pressure specified in 8.2.6.1 or per the manufacturer's instructions.

8.2.6.6

When a low or high pneumatic pressure condition is detected, notification shall be by either of the following:

- (1) An audible signal at a location that will be heard by building maintenance staff
- (2) Through the fire alarm control unit as a supervisory condition

8.2.7 * Air Supply.**8.2.7.1**

Air under pressure, as permitted in Section 4.7, shall be maintained on dry pipe systems throughout the year.

8.2.7.2 *

The air shall be supplied from a permanent source available at all times.

8.2.7.3 *

The air supply shall be capable of restoring normal pressure in the system within 30 minutes.

8.2.7.4

The requirement of 8.2.7.3 shall not apply in refrigerated spaces maintained below 5°F (-15°C), where the air supply is capable of restoring normal pressure in the system within 60 minutes.

8.2.7.5 Compressed Air.**8.2.7.5.1**

Air supply shall be from a dependable plant compressed air system or a dedicated air compressor with an air receiver.

8.2.7.5.2 *

Where an air compressor is dedicated for the sprinkler system, the air compressor shall be listed for fire protection.

8.2.7.5.3

Where the air compressor supplying a single dry pipe system has a capacity of less than 5.5 ft³/min (160 L/min) at 10 psi (0.7 bar), the air receiver shall not be required.

8.2.7.5.4

Where an air compressor is the dedicated air supply, it shall be installed in accordance with *NFPA 70*, Article 430.

8.2.7.5.5

The disconnecting means for an automatic air compressor shall not be a general use switch or a cord-and-plug connection.

8.2.7.6 Compressed Nitrogen.**8.2.7.6.1**

Nitrogen supply shall be from a dependable nitrogen generator or from one or more industrial cylinders or containers.

8.2.7.6.2

Where a nitrogen generator is the dedicated nitrogen supply, it shall be installed in accordance with *NFPA 70*, Article 430.

8.2.7.6.3

The disconnecting means for a nitrogen generator shall not be a general use switch or a cord-and-plug connection.

8.2.7.6.4

Where nitrogen or other approved gas stored in high-pressure industrial cylinders is used, the gas shall be introduced through an approved regulator on the supply side of the pressure maintenance device(s).

8.2.7.6.5

A low pressure alarm shall be provided between the regulator in 8.2.7.6.3 and the air maintenance device(s) to notify the need for refilling cylinder(s).

8.2.7.6.6

Combinations of approved sources of air supplies shall be permitted.

8.2.8 Air Maintenance Devices.**8.2.8.1 ***

Unless the requirements of 8.2.7.5.2 are met, each dry pipe system shall have a dedicated and listed air maintenance device capable of controlling the required pressure on the system and the maximum flow of air into the system.

8.2.8.2

Where the air compressor supplying a single dry pipe system has a capacity of less than 5.5 ft³/min (160 L/min) at 10 psi (0.7 bar), an air maintenance device shall not be required.

8.2.9 Connections.**8.2.9.1 ***

The connection from the air source shall not be less than 1/2 in. (15 mm) in diameter and shall enter the system above the priming water level of the dry pipe valve, or as otherwise specified by the manufacturer.

8.2.9.2

A check valve shall be installed in the pneumatic supply connection.

8.2.9.3

A listed or approved shutoff valve of either the renewable disc or ball valve type shall be installed on the supply side of the check valve in 8.2.9.2.

8.2.9.4

An approved relief valve shall be provided between the pneumatic supply and shutoff valve required in 8.2.9.3 and shall be set to relieve pressure no less than 10 psi (0.7 bar) in excess of the system pneumatic air pressure provided in 8.8.2.6.1.

8.2.10 * Nitrogen Supply for Increased C Value.

Where nitrogen is used to allow for increased *C* value in hydraulic calculations in accordance with Table 28.2.4.8.1, the nitrogen supply shall be in accordance with 8.2.10.1 through 8.2.10.5.

8.2.10.1

Nitrogen shall be from a listed nitrogen generator permanently installed.

8.2.10.2

The generator shall be capable of supplying and maintaining at least 98 percent nitrogen concentration throughout the system at a minimum leakage rate of 1.5 psi (0.1 bar) per hour.

8.2.10.3

A means of verifying nitrogen concentration shall be provided for each system where increased *C* value is used.

8.2.10.4

The nitrogen generator shall be installed per the manufacturer's instructions.

8.2.10.5

The nitrogen generator shall be maintained in accordance with Chapter 32.

8.2.11 Vapor Corrosion Inhibitor.

8.2.11.1

The vapor corrosion inhibitor shall be from a listed assembly permanently installed in accordance with the manufacturer's instructions.

8.2.11.2

The vapor corrosion inhibitor equipment shall be maintained in accordance with Chapter 32 and manufacturer's instructions.

8.2.11.3

A means of verifying vapor concentration shall be provided for each system.

8.3 Preaction Systems and Deluge Systems.

8.3.1 * General.

8.3.1.1 * Components.

All components of pneumatic, hydraulic, or electrical systems shall be compatible.

8.3.1.2 Detection.

Automatic systems shall be controlled by the operation of fire detection devices in accordance with Section 8.10.

8.3.1.3 Actuator Supervision.

Removal or disabling of an electric actuator from the preaction or deluge valve that it controls shall result in an audible and visual indication of system impairment at the system releasing control panel.

8.3.1.4 Automatic Water Control Valve.

The automatic water control valve shall be provided with hydraulic, pneumatic, or mechanical manual means for operation that is independent of detection devices and of the sprinklers.

8.3.1.5 Pressure Gauges.

8.3.1.5.1

Approved pressure gauges conforming with Section 16.13 shall be installed as follows:

- (1) Above and below water control valve on preaction systems
- (2) Below water control valve on deluge systems
- (3) On air supply to preaction systems

8.3.1.5.2

For deluge systems only, a pressure gauge connection shall be installed near the most remote open sprinkler or nozzle.

8.3.1.6 * Additional Indicating Control Valve.

A separate additional indicating control valve, supervised in accordance with 16.9.3.3, shall be permitted to be installed in the riser assembly above the water control valve on preaction and deluge systems to permit full function trip testing as required by NFPA 25, without flooding the system.

8.3.1.7 Location and Protection of System Water Control Valves.

8.3.1.7.1

System water control valves and supply pipes shall be protected against freezing and mechanical injury.

8.3.1.7.2 Valve Rooms.

8.3.1.7.2.1

Valve rooms shall be lighted and heated.

8.3.1.7.2.2

The source of heat shall be of a permanently installed type.

8.3.1.7.2.3

Heat tracing shall not be used in lieu of heated valve enclosure rooms to protect preaction and deluge valves and supply pipe against freezing.

8.3.2 Praction Systems.**8.3.2.1**

Praction systems shall be one of the following types:

- (1) A single interlock system, which admits water to sprinkler piping upon operation of detection devices
- (2) A noninterlock system, which admits water to sprinkler piping upon operation of detection devices or automatic sprinklers
- (3) A double interlock system, which admits water to sprinkler piping upon operation of both detection devices and automatic sprinklers

8.3.2.2 Size of Systems — Single and Non-Interlock Praction Systems.

Not more than 1000 automatic sprinklers shall be controlled by any one preaction valve.

8.3.2.3 Size of Systems — Double Interlock Praction Systems.**8.3.2.3.1**

The system size controlled by a double interlock preaction valve shall be determined by either 8.3.2.3.1.1, 8.3.2.3.1.2, 8.3.2.3.1.3, or 8.3.2.3.1.4.

8.3.2.3.1.1

A system size for double interlock preaction systems of not more than 500 gal (1900 L) shall be permitted and shall not be required to meet any specific water delivery requirement to the trip test connection.

8.3.2.3.1.2

The system size for double interlock preaction systems shall be designed to deliver water to the system test connection in no more than 60 seconds, starting at the normal air pressure on the system, with the detection system activated and the inspection test connection fully opened simultaneously.

8.3.2.3.1.3

The system size for double interlock preaction systems shall be based on calculating water delivery in accordance with 8.2.4.3, anticipating that the detection system activation and sprinkler operation will be simultaneous.

8.3.2.3.1.4 *

The system size for double interlock preaction systems shall be designed to deliver water to the system trip test connection or manifold outlets in not more than the maximum time of water delivery specified in Table 8.2.4.3.2, starting at the normal air pressure on the system, with the detection system activated and the inspection trip test connection or manifold opened simultaneously.

8.3.2.3.2

A listed quick-opening device shall be permitted to be used to help meet the requirements of 8.3.2.3.1.2, 8.3.2.3.1.3, and 8.3.2.3.1.4.

8.3.2.4 * Supervision.

Sprinkler piping and fire detection devices shall be automatically supervised where more than 20 sprinklers are on the system.

8.3.2.5 Air Pressure

Except as provided by 8.3.2.5.1 through 8.3.2.5.3, supervisory air pressure for preaction systems shall be installed in conformance with the dry pipe system air pressure and supply rules of 8.2.6.

8.3.2.5.1

The relief valves required by 8.2.6 shall be permitted to be omitted for the type of preaction system described in 8.3.2.1(1) when the air pressure is supplied from a source that is not capable of developing pressures in excess of 15 psi (1.0 bar).

8.3.2.5.2

A preaction system type described in 8.3.2.1(2) and 8.3.2.1(3) shall maintain a minimum supervisory air pressure of 7 psi (0.5 bar).

8.3.2.5.3

The air pressure values for the type of preaction system described in 8.3.2.1(1) shall be set in accordance with the manufacturer's installation instructions.

8.3.2.6 Sprinklers.

The following sprinkler orientations and arrangements shall be permitted for preaction systems:

- (1) Upright sprinklers
- (2)* Listed dry sprinklers
- (3) Pendent sprinklers and sidewall sprinklers installed on return bends, where the sprinklers, return bend, and branch line piping are in an area maintained above freezing
- (4) Horizontal sidewall sprinklers, installed so that water is not trapped
- (5) Pendent sprinklers and sidewall sprinklers, where the sprinklers and branch line piping are in an area maintained above freezing, the water supply is potable, and the piping for the preaction system is copper or CPVC specifically listed for dry pipe applications

8.3.2.7 System Configuration.

8.3.2.7.1

Double interlock preaction systems shall not be gridded.

8.3.2.7.2

Single and non-interlock preaction systems protecting high-piled storage occupancies shall not be gridded.

8.3.3 * Deluge Systems.

8.3.3.1

The detection devices or systems shall be automatically supervised.

8.3.3.2

Deluge systems shall be hydraulically calculated.

8.3.3.3 *

A sign to identify its function shall be provided at the deluge system manual releasing mechanism.

8.4 Combined Dry Pipe and Preaction Systems for Piers, Terminals, and Wharves.

8.4.1

In addition to the requirements of Section 8.4, design and installation requirements for piers, terminals, and wharves shall be in accordance with Section 27.27.

8.4.2 * General.

8.4.2.1 *

Combined automatic dry pipe and preaction systems shall be so constructed that failure of the detection system shall not prevent the system from functioning as a conventional automatic dry pipe system.

8.4.2.2

Combined automatic dry pipe and preaction systems shall be so constructed that failure of the dry pipe system of automatic sprinklers shall not prevent the detection system from properly functioning as an automatic fire alarm system.

8.4.2.3

Provisions shall be made for the manual operation of the detection system at locations requiring not more than 200 ft (61 m) of travel.

8.4.2.4 Sprinklers.

The following types of sprinklers and arrangements shall be permitted for combined dry pipe and preaction systems:

- (1) Upright sprinklers
- (2)* Listed dry sprinklers
- (3) Pendent sprinklers and sidewall sprinklers installed on return bends, where both the sprinklers and the return bends are located in a heated area

- (4) Horizontal sidewall sprinklers, installed so that water is not trapped

8.4.3 Dry Pipe Valves in Combined Systems.

8.4.3.1

Where the system consists of more than 600 sprinklers or has more than 275 sprinklers in any fire area, the entire system shall be controlled through two 6 in. (150 mm) dry pipe valves connected in parallel and shall feed into a common feed main.

8.4.3.2 *

Where parallel dry pipe valves are required by 8.4.3.1, these valves shall be checked against each other.

8.4.3.3

Each dry pipe valve shall be provided with a listed tripping device actuated by the detection system.

8.4.3.4

Dry pipe valves shall be cross-connected through a 1 in. (25 mm) pipe connection to permit simultaneous tripping of both dry pipe valves.

8.4.3.5

The 1 in. (25 mm) cross-connection pipe shall be equipped with an indicating valve so that either dry pipe valve can be shut off and worked on while the other remains in service.

8.4.3.6

The check valves between the dry pipe valves and the common feed main shall be equipped with $\frac{1}{2}$ in. (15 mm) bypasses so that a loss of air from leakage in the trimmings of a dry pipe valve will not cause the valve to trip until the pressure in the feed main is reduced to the tripping point.

8.4.3.7

An indicating valve shall be installed in each of these bypasses so that either dry pipe valve can be completely isolated from the main riser or feed main and from the other dry pipe valve.

8.4.3.8

Each combined dry pipe and preaction system shall be provided with listed quick-opening devices at the dry pipe valves.

8.4.4 Subdivision of System Using Check Valves.

8.4.4.1

Where more than 275 sprinklers are required in a single fire area, the system shall be divided into sections of 275 sprinklers or fewer by means of check valves.

8.4.4.2

Where the system is installed in more than one fire area or story, not more than 600 sprinklers shall be supplied through any one check valve.

8.4.4.3

Each section shall have a $1\frac{1}{4}$ in. (32 mm) drain on the system side of each check valve supplemented by a dry pipe system auxiliary drain.

8.4.4.4

Section drain lines and dry pipe system auxiliary drains shall be located in heated areas or inside heated cabinets to enclose drain valves and auxiliary drains for each section.

8.4.5 Time Limitation.

8.4.5.1

The sprinkler system shall be so constructed and the number of sprinklers controlled shall be so limited that water shall reach the farthest sprinkler within a period of time not exceeding 1 minute for each 400 ft (120 m) of common feed main from the time the heat-responsive system operates.

8.4.5.2

The maximum time permitted shall not exceed 3 minutes.

8.4.6 System Test Connection.

The end section shall have a system test connection as required for dry pipe systems.

8.5 Multicycle Systems.

8.5.1

All multicycle systems shall be specifically tested and listed as systems.

8.5.2

All multicycle systems shall be installed in compliance with the manufacturer's installation instructions.

8.6 * Antifreeze Systems.

8.6.1 * General.

8.6.1.1

The use of antifreeze solutions shall be in conformity with state and local health regulations.

8.6.1.2

Antifreeze shall not be used in ESFR systems unless the ESFR sprinkler is listed for use with the antifreeze solution.

8.6.1.3 *

Where pendent sprinklers are utilized, the water shall be drained from the entire system after hydrostatic testing with water.

8.6.1.3.1

The requirements of 8.6.1.3 shall not apply where the system is hydrostatically tested with a listed antifreeze solution.

8.6.1.4

Where antifreeze systems are remote from the system riser, a placard shall be mounted on the system riser that indicates the number and location of all remote antifreeze systems supplied by that riser.

8.6.1.5

A placard shall be placed on the antifreeze system main valve that indicates the manufacture type and brand of the antifreeze solution, the minimum use temperature of the antifreeze solution used, and the volume of the antifreeze solution used in the system.

8.6.2 * Antifreeze Solutions.

8.6.2.1 *

Except as permitted in 8.6.2.2, antifreeze solutions shall be listed for use in sprinkler systems.

8.6.2.2

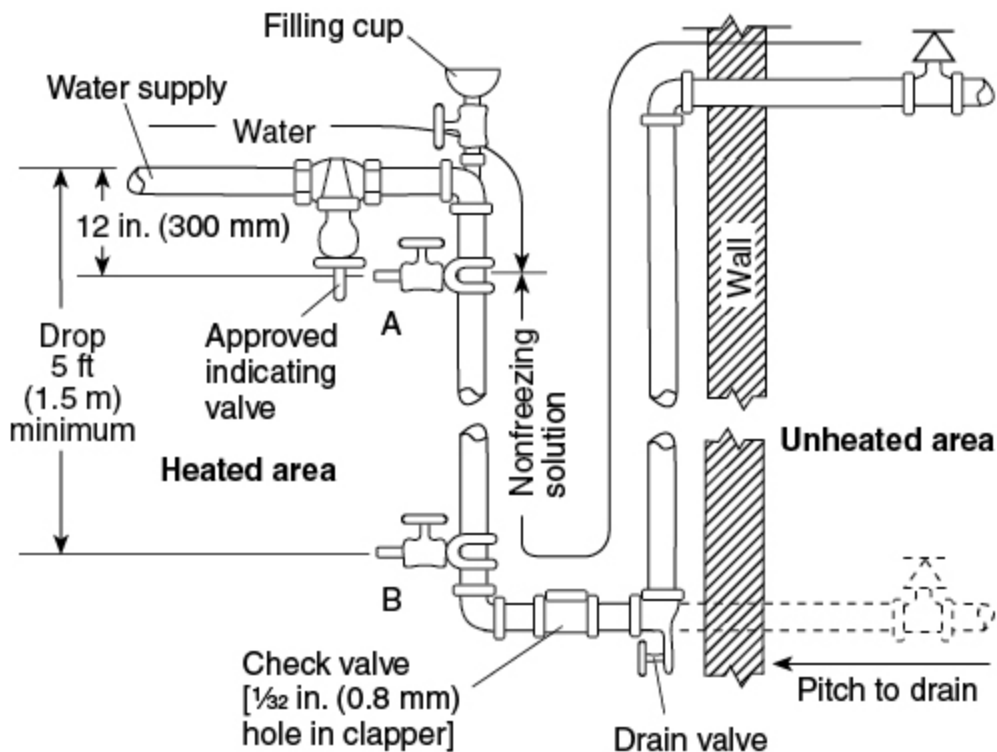
Premixed antifreeze solutions of propylene glycol shall be permitted to be used with ESFR sprinklers where the ESFR sprinklers are listed for such use in a specific application.

8.6.3 Arrangement of Supply Piping and Valves.

8.6.3.1

Where the connection between the antifreeze system and the supply piping does not incorporate a backflow prevention device, and the conditions of 8.6.3.5 are not met, piping and valves shall be installed as illustrated in Figure 8.6.3.1.

Figure 8.6.3.1 Arrangement of Supply Piping and Valves.



Notes:

1. Check valves are permitted to be omitted where sprinklers are below the level of valve A.
2. The 1/32 in. (0.8 mm) hole in the check valve clapper is needed to allow for expansion of the solution during a temperature rise, thus preventing damage to sprinklers.

8.6.3.2 *

Where the connection between the antifreeze system and the supply piping incorporates a backflow prevention device, and the conditions of 8.6.3.5 are not met, piping and valves shall be installed as illustrated in Figure 8.6.3.3 or Figure 8.6.3.4.

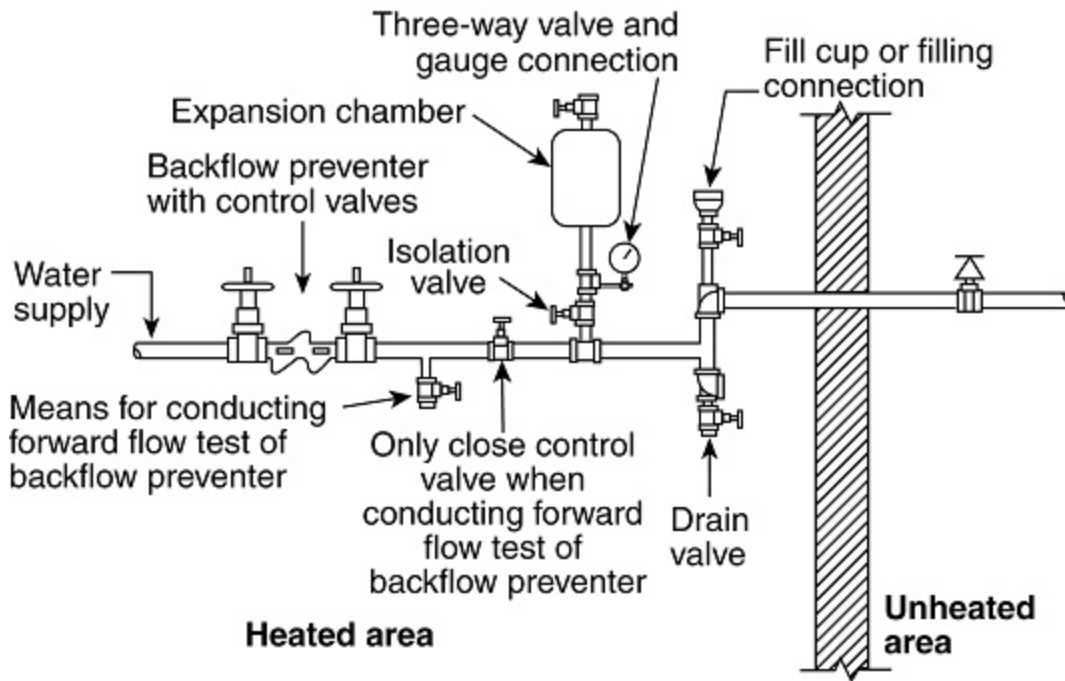
8.6.3.2.1

A means shall be provided to perform a full forward flow test in accordance with 16.14.5.

8.6.3.3 *

Where the connection between the antifreeze system and supply pipe incorporates a backflow prevention device, and the conditions of 8.6.3.5 are not met, a listed expansion chamber shall be provided to compensate for thermal expansion of the antifreeze solution as illustrated in Figure 8.6.3.3.

Figure 8.6.3.3 Arrangement of Supply Piping with Backflow Device.



8.6.3.3.1

When determining the size of the expansion chamber, the precharge air temperature and precharge air pressure shall be included.

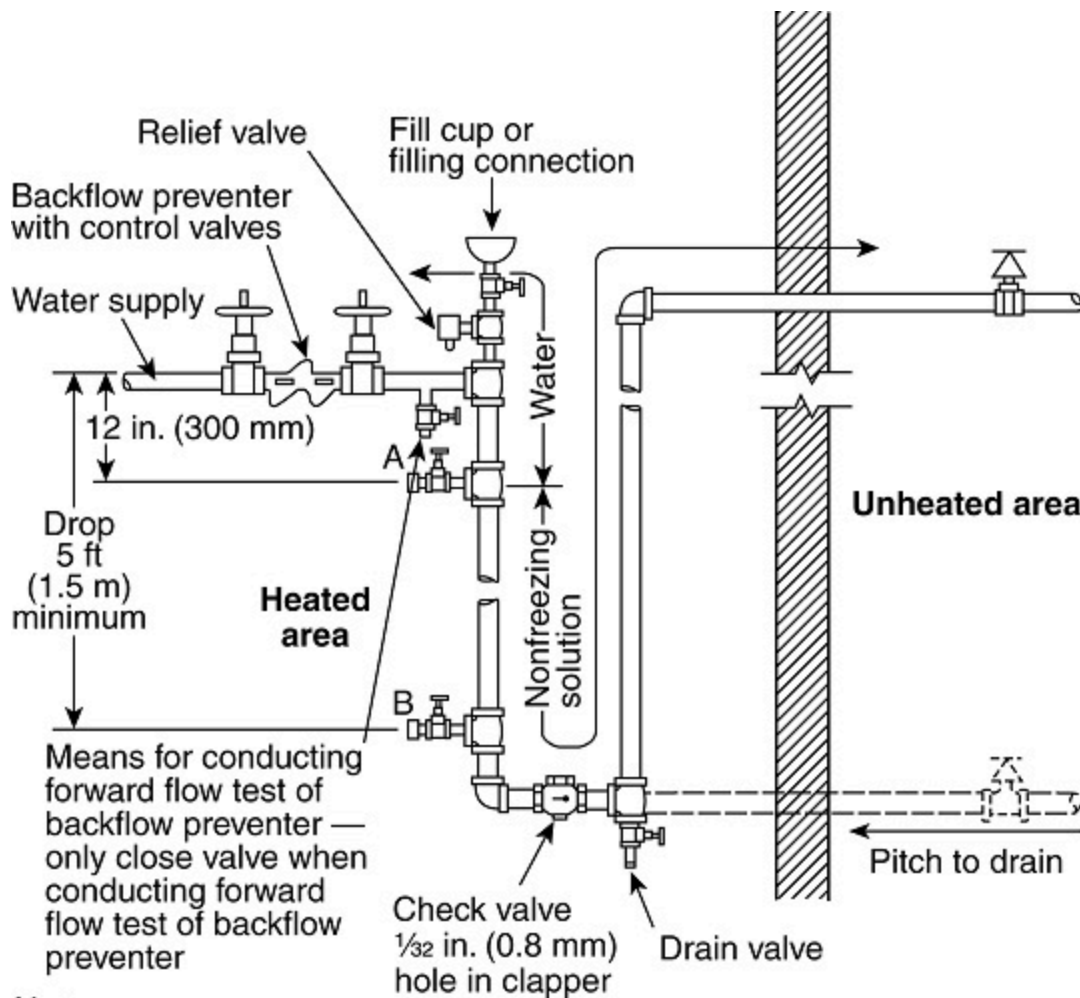
8.6.3.3.2

The size of the expansion chamber shall be such that the maximum system pressure does not exceed the rated pressure for any components of the antifreeze system.

8.6.3.4

A listed $\frac{1}{2}$ in. (15 mm) relief valve shall be permitted in lieu of the expansion chamber required in 8.6.3.3, and as illustrated in Figure 8.6.3.4, provided the antifreeze system volume does not exceed 40 gal (150 L).

Figure 8.6.3.4 Arrangement of Supply Piping with Relief Valve and Backflow Device.



Notes:

1. Check valve can be omitted where sprinklers are below the level of valve A.
2. The 1/32 in. (0.8 mm) hole in the check valve clapper is needed to allow for expansion of the solution during a temperature rise, thus preventing damage to sprinklers.

8.6.3.5

The requirements of 8.6.3.1, 8.6.3.2, and 8.6.3.3 shall not apply where the following three conditions are met:

- (1) The antifreeze system is provided with an automatic pressure pump or other device or apparatus to automatically maintain a higher pressure on the system side than on the supply side of the water supply check valve separating the antifreeze system from the water supply.
- (2) Provision is made to automatically release solution to prevent overpressurization due to thermal expansion of the solution.
- (3) Provision is made to automatically supply premixed solution as needed to restore system pressure due to thermal contraction.

8.6.3.6 *

A drain/test connection shall be installed at the most remote portion of the system.

8.6.3.7

For systems with a capacity larger than 150 gal (570 L), an additional test connection shall be provided for every additional 150 gal (570 L).

8.7 Outside Sprinklers for Protection Against Exposure Fires (Exposure Protection Sprinkler Systems).

8.7.1 Applications.

8.7.1.1

Exposure protection sprinkler systems shall be permitted on buildings and structures regardless of whether the building's interior is protected by a sprinkler system.

8.7.1.2

Where exposure protection systems are required, they shall be installed to provide protection of windows and other openings within masonry walls, complete protection of walls, protection of roofs, or any combination thereof.

8.7.2 Water Supply and Control.**8.7.2.1**

Unless the requirements of 8.7.2.2 are met, sprinklers installed for protection against exposure fires shall be supplied from a standard water supply as outlined in Chapter 5.

8.7.2.2

Where approved, other supplies, such as manual valves or pumps or fire department connections, shall be permitted to supply water to sprinklers for exposure protection.

8.7.2.3

Where fire department connections are used for water supply, they shall be so located that they will not be affected by the exposing fire.

8.7.3 Control.**8.7.3.1**

Each system of outside sprinklers shall have an independent control valve.

8.7.3.2

Manually controlled open sprinklers shall be used only where constant supervision is present.

8.7.3.3

Sprinklers shall be of the open or automatic type.

8.7.3.4

Automatic sprinklers in areas subject to freezing shall be on dry pipe systems conforming to Section 8.2 or antifreeze systems conforming to Section 8.6, or be dry sprinklers of an adequate length connected to wet pipe systems located in heated areas.

8.7.3.5

Automatic systems of open sprinklers shall be controlled by the operation of fire detection devices designed for the specific application.

8.7.4 System Components.**8.7.4.1 Drain Valves.**

Each system of outside sprinklers shall have a separate drain valve installed on the system side of each control valve, except where an open sprinkler, top-fed system is arranged to facilitate drainage.

8.7.4.2 Check Valves.**8.7.4.2.1 ***

Where sprinklers are installed on two adjacent sides of a building, protecting against two separate and distinct exposures, with separate control valves for each side, the end lines shall be connected with check valves located so that one sprinkler around the corner will operate.

8.7.4.2.2

The intermediate pipe between the two check valves shall be arranged to drain.

8.7.4.2.3 *

As an alternate solution, an additional sprinkler shall be installed on each system located around the corner from the system involved.

8.7.4.3 System Arrangement.

Where one exposure affects two sides of the protected structure, the system shall not be subdivided between the two sides but rather shall be arranged to operate as a single system.

8.7.5 Pipe and Fittings.

Pipe and fittings installed on the exterior of the building or structure shall be corrosion resistant.

8.7.6 Strainers.

A listed strainer shall be provided in the riser or feed main that supplies sprinklers having nominal K-factors smaller than K-2.8 (40).

8.7.7 Gauge Connections.

A pressure gauge conforming to Section 16.13 shall be installed immediately below the control valve of each system.

8.7.8 Sprinklers.**8.7.8.1**

A single line of sprinklers is permitted to protect a maximum of two stories of wall area or two levels of vertically aligned windows where architectural features are sufficiently flush to allow rundown.

8.7.8.2

Where window sills or similar features result in recesses or projections exceeding 1 in. (25 mm) in depth, separate sprinklers shall be provided for each window on each level, regardless of whether protection is being provided for windows or complete walls.

8.7.8.3

For wall protection systems, sprinklers shall be located 6 in. to 12 in. (150 mm to 300 mm) from the wall surface and within 6 in. (150 mm) of the top of the wall, with maximum spacing of 8 ft (2.4 m) or as indicated in the sprinkler listing for exposure protection use.

8.7.8.4

For protection of window and similar openings, listed window sprinklers shall be positioned within 2 in. (50 mm) of the top of the window sash in accordance with Table 8.7.8.4.

Table 8.7.8.4 Position of Window Sprinklers

Width of Window (ft)	Nominal K-Factor		Nominal Distance from Window	
	US	Metric	in.	mm
Up to 3	2.8	40	7	175
>3 to 4	2.8	40	8	200
>4 to 5	2.8	40	9	225
	5.6	80	12	300
>5 to 7	11.2	160	12	300
	Two 2.8	40	7	175
>7 to 9.5	14.0	200	12	300
	Two 2.8	40	9	225
>9.5 to 12	Two 5.6	80	12	300

For SI units, 1 ft = 0.3048 m.

8.7.8.5

Where exposure protection sprinkler systems are installed, listed cornice sprinklers shall be used to protect combustible cornices exceeding 12 in. (300 mm) in depth.

8.7.8.5.1

Cornice sprinklers shall be installed in each bay formed by cornice features and shall be spaced up to a maximum distance of 10 ft (3.0 m) apart, with deflectors 8 in. (200 mm) below the underside of the roof sheathing.

8.7.8.6

Open spray sprinklers (upright, pendent, or sidewall) shall be permitted for application in roof protection when installed in accordance with ordinary hazard Group 1 protection areas and discharge criteria, with deflectors aligned parallel to the slope and positioned a minimum 18 in. (450 mm) above the roof surface.

8.7.8.6.1

Upright sprinklers positioned as ridge pole sprinklers shall be permitted with their deflectors horizontal and minimum 6 in. (150 mm) above the ridge, with their maximum spacing and protection areas determined in the plan view rather than along the slope.

8.7.9 * Exposure Protection Sprinkler Systems.

8.7.9.1

Exposure protection sprinkler systems shall be hydraulically calculated using Table 8.7.9.1 based on severity of exposure as indicated by a relative classification of guide number or other approved source.

Table 8.7.9.1 Exposure Protection

Section A — Wall and Window Sprinklers						
Exposure Severity	Guide Number	Level of Wall or Window Sprinklers	Minimum Nominal K-Factor	Discharge Coefficient (K-Factor)	Minimum Average Application Rate Over Protected Surface	
					gpm/ft ²	mm/min
Light	1.50 or less	Top 2 levels	2.8 (40)	2.8 (40)	0.20	8.1
		Next lower 2 levels	1.9 (27)	1.9 (27)	0.15	6.1
		Next lower 2 levels	1.4 (20)	1.4 (20)	0.10	4.1
Moderate	1.5–2.20	Top 2 levels	5.6 (80)	5.6 (80)	0.30	12.2
		Next lower 2 levels	4.2 (60)	4.2 (60)	0.25	10.2
		Next lower 2 levels	2.8 (40)	2.8 (40)	0.20	8.2
Severe	>2.20	Top 2 levels	11.2 (161)	11.2 (161)	0.40	16.3
		Next lower 2 levels	8.0 (115)	8.0 (115)	0.35	14.3
		Next lower 2 levels	5.6 (80)	5.6 (80)	0.30	12.2
Section B — Cornice Sprinklers						
Guide Number	Cornice Sprinkler Minimal Nominal K-Factor		Application Rate per Lineal Foot (gpm)		Application Rate per Lineal Meter (L/min)	
1.50 or less	2.8 (40)		0.75		9.3	
>1.51–2.20	5.6 (80)		1.50		18.6	
>2.20	11.2 (161)		3.00		37.3	

8.7.9.2

In no case shall compliance with Table 8.7.9.1 result in a sprinkler discharge pressure below 7 psi (0.5 bar).

8.7.9.3

Only half of the flow from upright, pendent, and other nondirectional sprinklers shall be used in determining the minimum average application rate over the protected surface.

8.7.9.4

The water supply shall be capable of simultaneously supplying the total demand of sprinklers along an exposure to a maximum length of 300 ft (91 m). Where systems of open sprinklers are used, the water supply shall be capable of simultaneously flowing all sprinklers that would flow as part of all systems that could be actuated within any 300 ft (91 m) length.

8.7.9.5

The water supply duration for an exposure protection sprinkler system shall be a minimum of 60 minutes.

8.7.9.6

A level of window sprinklers as described in Table 8.7.9.1 shall be defined as a floor level of the building being protected.

8.7.9.7

Window sprinklers shall be permitted to cover more than 25 ft² (2.3 m²) of window area per level.

8.7.9.7.1

The starting pressure shall be calculated based on the application rate over 25 ft² (2.3 m²) of window area as indicated in Table 8.7.9.1.

8.7.9.7.2

The maximum spacing between window sprinklers shall not exceed 8 ft (2.4 m) unless listed for a greater distance.

8.8 * Refrigerated Spaces.**8.8.1 Spaces Maintained at Temperatures Above 32°F (0°C).**

Where temperatures are maintained above 32°F (0°C) in refrigerated spaces, the requirements in this section shall not apply.

8.8.2 * Spaces Maintained at Temperatures Below 32°F (0°C).**8.8.2.1 General.****8.8.2.1.1 ***

Where sprinkler pipe passes through a wall or floor into the refrigerated space, a section of pipe arranged for removal shall be provided immediately inside the space.

8.8.2.1.2

The removable length of pipe required in 8.8.2.1.1 shall be a minimum of 30 in. (750 mm).

8.8.2.2 Low Air Pressure Alarm.**8.8.2.2.1**

Unless the requirements of 8.8.2.2.2 are met, a low air pressure alarm to a constantly attended location shall be installed.

8.8.2.2.2

Systems equipped with local low pressure alarms and an automatic air maintenance device shall not be required to alarm to a constantly attended location.

8.8.2.3 Piping Pitch.

Piping in refrigerated spaces shall be installed with pitch as outlined in 16.10.3.2.

8.8.2.4 * Air Supply.

Air supply for systems shall be one of the following:

- (1) Air from the room of lowest temperature to reduce the moisture content
- (2) Air compressor/dryer package listed for the application utilizing ambient air
- (3) Compressed nitrogen gas from cylinders used in lieu of compressed air

8.8.2.5 * Control Valve.

An indicating-type control valve for operational testing of the system shall be provided on each sprinkler riser outside of the refrigerated space.

8.8.2.6 * Check Valve.**8.8.2.6.1**

Unless the requirements of 8.8.2.6.2 are met, a check valve with a $\frac{3}{32}$ in. (2 mm) diameter hole in the clapper shall be installed in the system riser below the test valve required in 8.8.2.5.

8.8.2.6.2

Check valves shall not be required where dry pipe or preaction valves are used and designed to completely drain all water above the seat and that are listed for installation without priming water remaining and where priming water is not used in the system riser.

8.8.2.7 Air or Nitrogen Supply Piping.

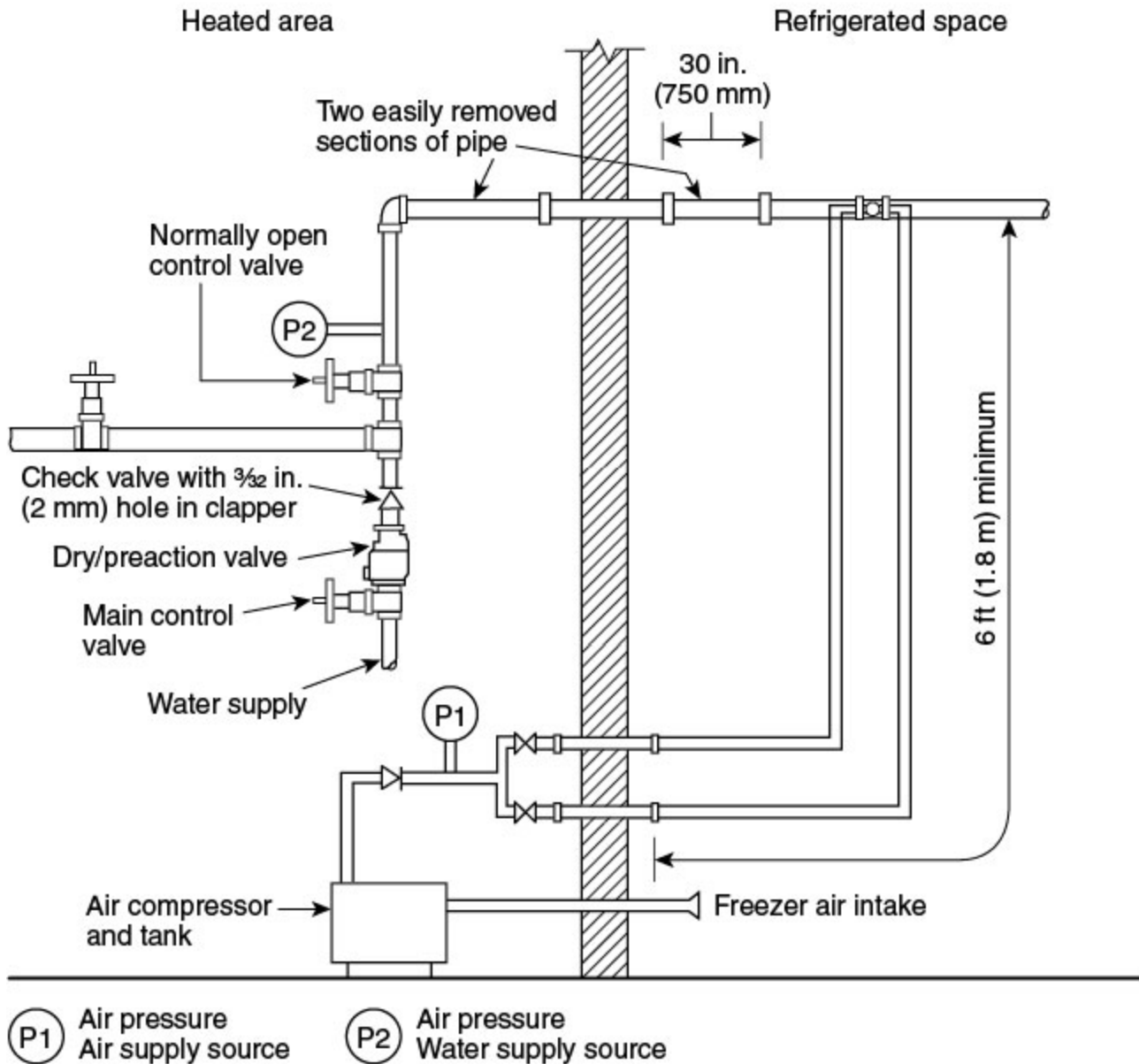
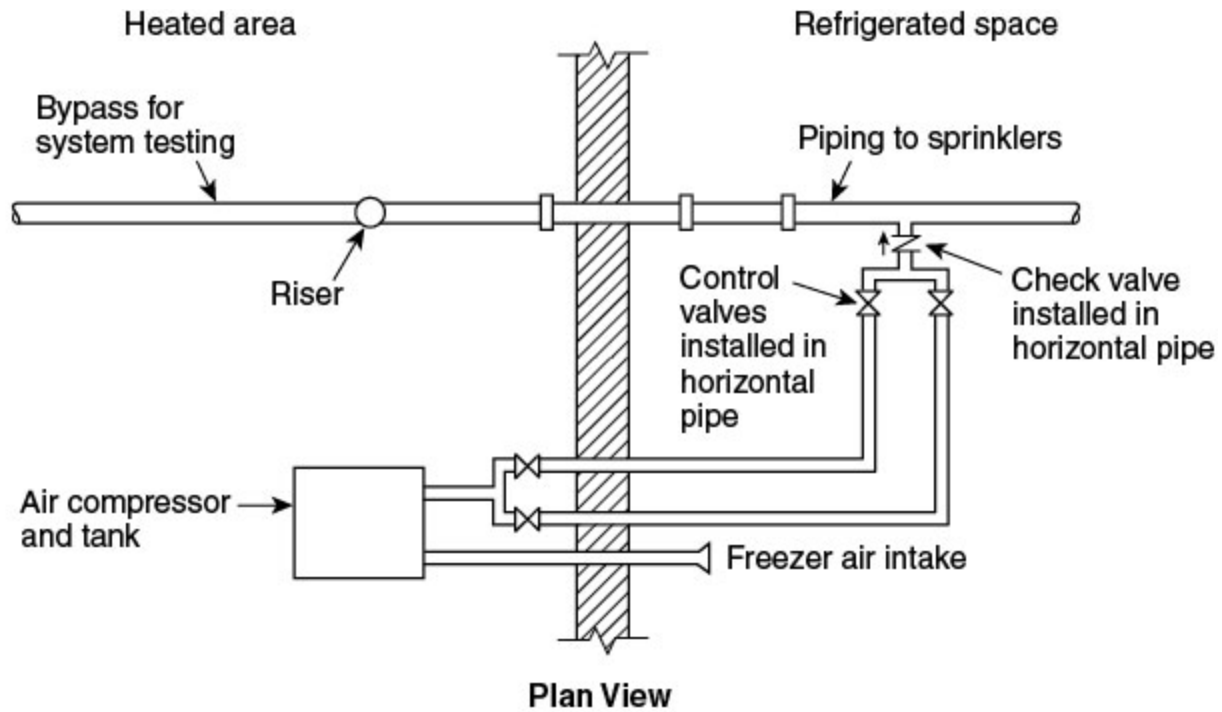
8.8.2.7.1 *

The air supply piping entering the freezer area shall be as stated in 8.8.2.7.1.1 and 8.8.2.7.1.2.

8.8.2.7.1.1 Air Supply.

The supply piping shall be equipped with two easily removable supply lines at least 6 ft (1.8 m) long and at least 1 in. (25 mm) in diameter as shown in Figure 8.8.2.7.1.1(a) or Figure 8.8.2.7.1.1(b).

Figure 8.8.2.7.1.1(a) Refrigerator Area Sprinkler System Used to Minimize the Chances of Developing Ice Plugs.

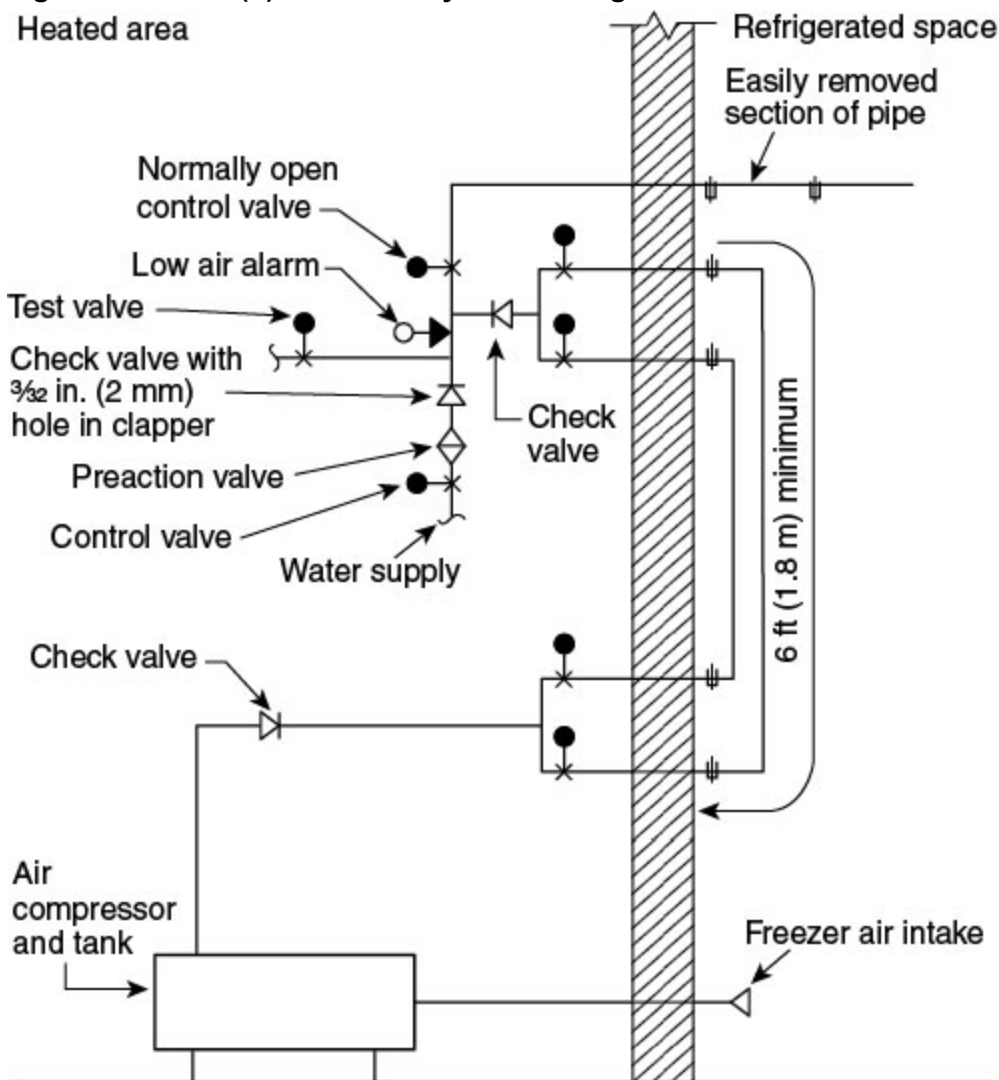


Elevation View

Notes:

1. Check valve with $\frac{3}{32}$ in. (2 mm) hole in clapper not required if prime water not used.
2. Supply air to be connected to top or side of system pipe.
3. Each removable air line to be a minimum of 1 in. (25 mm) diameter and a minimum of 6 ft (1.8 m) long.

Figure 8.8.2.7.1.1(b) Preaction System Arrangement.



Notes:

1. Check valve with $\frac{3}{32}$ in. (2 mm) hole in clapper not required if prime water not used.
2. Each removable air line is to be installed a minimum of 1 in. (25 mm) in diameter and a minimum of 6 ft (1.8 m) long.

8.8.2.7.1.2 Nitrogen Supply.

The supply piping shall be equipped with a single easily removable supply line at least 6 ft (1.8 m) long and at least 1 in. (25 mm) in diameter.

8.8.2.7.2

Each supply line shall be equipped with control valves located in the warm area.

8.8.2.7.3

Only one air supply line shall be open to supply the system air at any one time.

8.8.2.8 Fire Detection for Preaction Release.

Systems shall be automatically controlled by the operation of fire detection devices in accordance with 8.10.5.

8.9 Commercial-Type Cooking Equipment and Ventilation.

8.9.1 General.

In cooking areas protected by automatic sprinklers, additional sprinklers or automatic spray nozzles shall be provided to protect commercial-type cooking equipment and ventilation systems that are designed to carry away grease-laden vapors unless otherwise protected.

8.9.2 * Sprinklers and Automatic Spray Nozzles.

8.9.2.1

Standard spray sprinklers or automatic spray nozzles shall be so located as to provide for the protection of exhaust ducts, hood exhaust duct collars, and hood exhaust plenum chambers.

8.9.2.2

Unless the requirements of 8.9.2.4 are met, standard spray sprinklers or automatic spray nozzles shall be so located as to provide for the protection of cooking equipment and cooking surfaces.

8.9.2.3

Hoods containing automatic fire-extinguishing systems are protected areas; therefore, these hoods are not considered obstructions to overhead sprinkler systems and shall not require floor coverage underneath.

8.9.2.4

Cooking equipment below hoods that contain automatic fire-extinguishing equipment is protected and shall not require protection from the overhead sprinkler system.

8.9.3 Sprinkler and Automatic Spray Nozzle Location — Ducts.

8.9.3.1

Unless the requirements of 8.9.3.2 or 8.9.3.4 are met, exhaust ducts shall have one sprinkler or automatic spray nozzle located at the top of each vertical riser and at the midpoint of each offset.

8.9.3.2

Sprinklers or automatic spray nozzles shall not be required in a vertical riser located outside of a building, provided the riser does not expose combustible material or provided the interior of the building and the horizontal distance between the hood outlet and the vertical riser is at least 25 ft (7.6 m).

8.9.3.3

Unless the requirements of 8.9.3.4 are met, horizontal exhaust ducts shall have sprinklers or automatic spray nozzle devices located on 10 ft (3.0 m) centers beginning no more than 5 ft (1.5 m) from the duct entrance.

8.9.3.4

Sprinklers or automatic spray nozzles shall be required in ducts.

8.9.3.4.1

Where ducts do not exceed 75 ft (23 m) in length and the entire exhaust duct is protected in accordance with NFPA 96, sprinkler(s) or automatic spray nozzle(s) shall not be required.

8.9.3.5

A sprinkler(s) or an automatic spray nozzle(s) in exhaust ducts subject to freezing shall be properly protected against freezing by approved means. (See 16.4.1.)

8.9.4 Sprinkler and Automatic Spray Nozzle Location — Duct Collar.

8.9.4.1

Each hood exhaust duct collar shall have one sprinkler or automatic spray nozzle located 1 in. minimum to 12 in. maximum (25 mm minimum to 300 mm maximum) above the point of duct collar connection in the hood plenum.

8.9.4.2

Hoods that have listed fire dampers located in the duct collar shall be protected with a sprinkler or automatic spray nozzle located on the discharge side of the damper and shall be so positioned as not to interfere with damper operation.

8.9.5 Sprinkler and Automatic Spray Nozzle Location — Exhaust Plenum Chambers.**8.9.5.1**

Hood exhaust plenum chambers shall have one sprinkler or automatic spray nozzle centered in each chamber not exceeding 10 ft (3.0 m) in length.

8.9.5.2

Plenum chambers greater than 10 ft (3.0 m) in length shall have two sprinklers or automatic spray nozzles evenly spaced, with the maximum distance between the two sprinklers not to exceed 10 ft (3.0 m).

8.9.6 Sprinkler and Automatic Spray Nozzle Temperature Ratings and K-Factors.**8.9.6.1**

Where the exposed temperature is expected to be 300°F (149°C) or less, sprinklers or automatic spray nozzles being used in duct, duct collar, and plenum areas shall be of the extra high-temperature classification [325°F to 375°F (163°C to 191°C)].

8.9.6.2

When use of a temperature-measuring device indicates temperatures above 300°F (149°C), a sprinkler or automatic spray nozzle of higher classification shall be used.

8.9.6.3

Sprinklers or automatic spray nozzles being used in duct, duct collar, and plenum areas shall have orifices with K-factors not less than K-1.4 (20) and not more than K-5.6 (80).

8.9.7 Sprinkler and Automatic Spray Nozzle.

Access shall be provided to all sprinklers or automatic spray nozzles for examination and replacement.

8.9.8 Cooking Equipment.**8.9.8.1 General.**

Cooking equipment (such as deep fat fryers, ranges, griddles, and broilers) that is considered to be a source of ignition shall be protected in accordance with the provisions of 8.9.1.

8.9.8.2 Deep Fat Fryers.**8.9.8.2.1**

A sprinkler or automatic spray nozzle used for protection of deep fat fryers shall be listed for that application.

8.9.8.2.2

The position, arrangement, location, and water supply for each sprinkler or automatic spray nozzle shall be in accordance with its listing.

8.9.8.3 Fuel and Heat Shutoff.**8.9.8.3.1**

The operation of any cooking equipment sprinkler or automatic spray nozzle shall automatically shut off all sources of fuel and heat to all equipment requiring protection.

8.9.8.3.2

Any gas appliance not requiring protection but located under ventilating equipment shall also be shut off.

8.9.8.3.3

All shutdown devices shall be of the type that requires manual resetting prior to fuel or power being restored.

8.9.9 Indicating Valves.

A listed indicating valve shall be installed in the water supply line to the sprinklers and spray nozzles protecting the cooking and ventilating system.

8.9.10 Strainers.

A listed line strainer shall be installed in the main water supply preceding sprinklers or automatic spray nozzles having nominal K-factors smaller than K-2.8 (40).

8.9.11 Test Connection.

A system test connection shall be provided to verify proper operation of equipment specified in 8.9.8.3.

8.10 Detection and Release System for Preaction and Deluge Systems.

8.10.1 General.

8.10.1.1

The type of detection shall be appropriate for the hazard protected and shall be approved by the authority having jurisdiction.

8.10.1.2

All components of pneumatic, hydraulic, or electrical systems shall be compatible.

8.10.1.3

The detection system shall serve all areas that the preaction or deluge system protects.

8.10.1.4 *

The detection system for preaction systems shall be designed to activate prior to sprinkler operation.

8.10.1.5

Where thermal activation is utilized for preaction systems, the activation temperature of the release system shall be lower than the activation temperature of the sprinklers.

8.10.1.6

The temperature rating of thermal detection devices shall be selected in accordance with 9.4.2.

8.10.1.7

A supply of spare fusible elements for heat-responsive devices, not less than two of each temperature rating, shall be maintained on the premises for replacement purposes.

8.10.1.8

Where two or more adjacent water spray systems in one fire area are controlled by separate detection systems, the detectors on each system shall be spaced independently as if the dividing line between the systems was a wall or draft curtain.

8.10.2 Electrical Detection.

Electrical detection and release systems shall comply with the requirements of *NFPA 72*.

8.10.3 Pilot Line Detection.

8.10.3.1

Piping for wet and dry pilot line detection shall be permitted to be any type of approved pipe or tube.

8.10.3.2

Piping for wet and dry pilot line detection shall be considered branch lines for purposes of installation and shall be installed in accordance with the applicable requirements of this standard, except as modified by 8.10.3.2 and 8.10.3.3.

8.10.3.3

Pipe supplying pilot line detectors shall be permitted to be supported from the same points of hanger attachment as the piping system it serves.

8.10.3.4

Pipe supplying pilot line detectors shall not be required to meet the requirements of Section 18.5.

8.10.3.5

Pilot line detectors, spray sprinklers utilized as pilot line detectors, and related components including pipe and fittings shall be corrosion resistant when installed in areas exposed to weather or corrosive conditions.

8.10.3.6

Where subject to mechanical or physical damage, pilot line detection piping and related detection system components shall be protected.

8.10.3.7

Where spray sprinklers are used as pilot line detectors, they shall be installed in accordance with the spacing and location rules of Section 10.2, except that the obstruction to water distribution rules shall not be required to be followed.

8.10.3.7.1

Pilot line detectors shall be permitted to be located more than 22 in. (550 mm) below a ceiling or deck where the maximum spacing between pilot line detectors is 10 ft (3.0 m) or less.

8.10.3.8

Wet pilot release systems shall be designed and installed in accordance with manufacturer's requirements and listing for height limitations above deluge valves or deluge valve actuators to prevent water column.

8.10.3.9

Pilot line detectors shall be installed in the upright position on dry pilot lines.

8.10.3.10

Dry pilot lines shall be pitched $\frac{1}{2}$ in. per 10 ft (4 mm/m) for drainage.

8.10.3.11

The air supply for dry pilot lines shall be arranged to enable maintenance of dry pilot line pressure independent from that of the preaction system.

8.10.3.12

A row of pilot line detectors shall be located along the open sides of open-sided buildings.

8.10.3.13

Where pilot line detectors are installed in water cooling tower applications, they shall be in accordance with Section 27.26.

8.10.4 Spacing of Detection Devices.**8.10.4.1**

Spacing of detection devices shall be in accordance with their listing and manufacturer's specifications.

8.10.4.2

Where spray sprinklers are used as pilot line detectors, spacing of detectors shall not exceed that of the sprinkler spacing in the area it serves.

8.10.4.3

The maximum horizontal distance between pilot line detectors installed indoors shall not exceed 12 ft (3.7 m).

8.10.4.3.1

Pilot line detectors located in open-sided buildings shall in accordance with 8.10.4.3.

8.10.4.4

The maximum horizontal distance between pilot line detectors installed outdoors shall not exceed 8 ft (2.4 m).

8.10.4.4.1

Pilot line detectors required by 8.10.3.11 shall be spaced in accordance with 8.10.4.4.

8.10.4.5

Where multiple levels of pilot line detectors are present, the horizontal distance between pilot line detectors installed outdoors on a given level shall be permitted to be increased to 10 ft (3.0 m) when all the following conditions are met:

- (1) The elevation of the first level does not exceed 15 ft (4.6 m).
- (2) The distance between additional levels does not exceed 12 ft (3.7 m).
- (3) The pilot line detectors are staggered vertically.

8.10.4.6

Pilot line detectors located outdoors, such as in open process structures, shall be spaced such that the vertical distance between levels of pilot line detectors does not exceed 17 ft (5.2 m).

8.10.4.7

Horizontal spacing of pilot line detectors differing from those required in 8.10.4.3 and 8.10.4.4 shall be permitted where installed in accordance with their listing.

8.10.5 Detection for Refrigerated Spaces.

8.10.5.1

Detection devices shall be electric or pneumatic fixed temperature type with temperature ratings less than that of the sprinklers in the protected space.

8.10.5.2

Detection devices shall not be rate-of-rise type.

8.10.5.3

Where the system is a double interlock preaction system or single interlock antifreeze system, detection devices shall be permitted to be any type specifically approved for use in a refrigerated area if installed in accordance with their listing requirements and *NFPA 72* or other approved fire alarm code.

8.10.5.4 Detector Location at Ceiling.

8.10.5.4.1

Under smooth ceilings, detectors shall be spaced not exceeding their listed spacing.

8.10.5.4.2

For other than smooth ceilings, detector spacing shall not exceed one-half of their listed spacing or full allowable sprinkler spacing in the protected area, whichever is greater.

8.10.5.5 Detector Location in Racks.

8.10.5.5.1

Unless the conditions in 8.10.5.6 are met, one level of detectors shall be installed for each level of sprinklers.

8.10.5.5.2

Detectors shall be installed vertically no further than one storage level away from the rack sprinklers and as follows:

- (1) Detectors shall be located in the transverse flue in single-row racks and in the longitudinal flue in double-row racks.
- (2) For multiple-row racks, detectors shall be located in either longitudinal or transverse flue space and shall be within 5 ft (1.5 m) horizontally of each sprinkler.
- (3) Separate detection systems shall be installed for ceiling sprinkler systems and in-rack sprinkler systems.
- (4) Where the system is double interlock preaction type, the ceiling detection system shall operate both the ceiling and in-rack preaction systems.

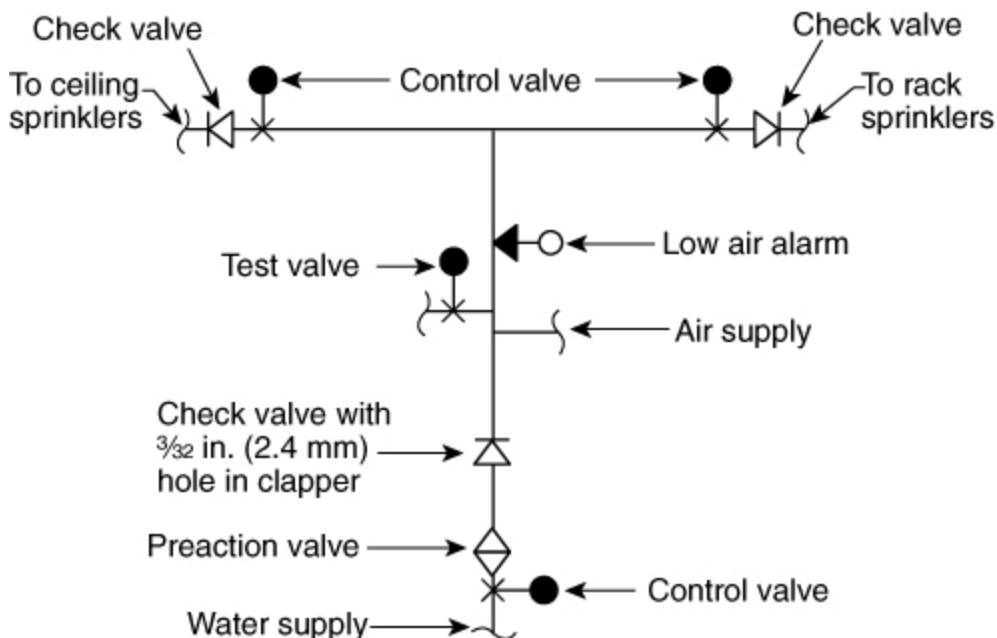
8.10.5.6

Ceiling detection only shall be permitted where all the following conditions are met:

- (1) Maximum storage height is 35 ft (11 m)
- (2) Maximum ceiling height is 40 ft (12 m)
- (3) Maximum hazard of storage class is Class III
- (4) No solid shelves are present

- (5) One preaction valve is used for both ceiling and in-rack sprinklers protecting the same area, with separate indicating control valves and check valves provided downstream, as shown in Figure 8.10.5.6

Figure 8.10.5.6 Valve Arrangement.



8.10.6 Devices for Test Purposes and Testing Apparatus.

8.10.6.1

Where detection devices are located where not accessible for testing, an additional detection device shall be provided on each detection zone for test purposes at an accessible location and shall be connected at a point that will ensure a proper test of each zone.

8.10.6.2

Any specialized testing apparatus needed to activate the detection devices shall be furnished to the owner of the property with each installation.

8.10.6.3

Where explosive vapors or material are present, hot water, steam, or other methods of testing not involving an ignition source shall be used.

8.11 Vacuum Systems.

8.11.1 General.

8.11.1.1

Vacuum system equipment shall be listed for fire sprinkler system use.

8.11.1.2

Vacuum systems shall be installed in accordance with the manufacturer's installation instructions.

8.11.1.3

Sprinklers shall be listed for use under vacuum conditions.

8.11.2 Vacuum Dry Pipe.

8.11.2.1

Unless modified by 8.11.2, vacuum dry pipe systems shall meet the requirements of Section 8.2.

8.11.2.2

The relief valve required by 8.2.9.4 shall be set in accordance with the manufacturer's instructions.

8.11.3 Vacuum Preaction.**8.11.3.1**

Unless modified by 8.11.3, vacuum preaction systems shall meet the requirements of Section 8.3.

8.11.3.2

The relief valve required by 8.2.9.4 shall be set in accordance with the manufacturer's instructions.