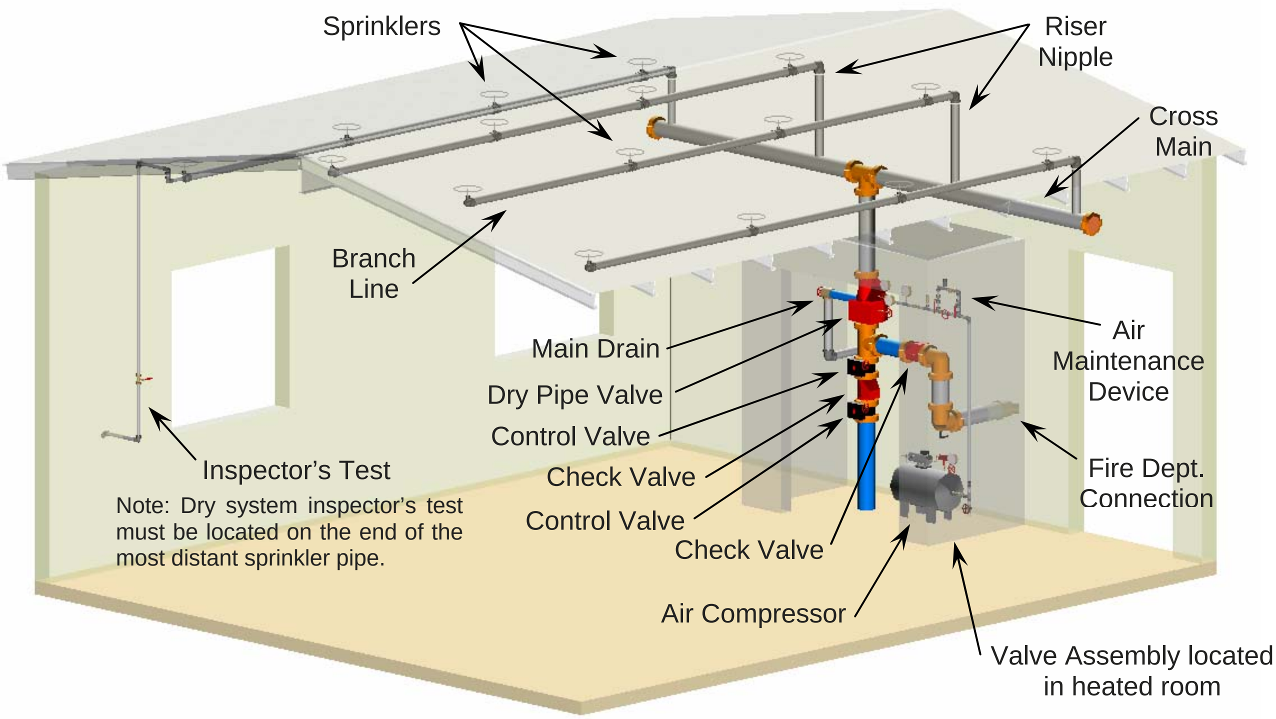
QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

March 2006



This particular system, known as a **dry sprinkler system**, has been designed for situations in which there is a potential for freezing conditions. This means that instead of being filled with water, the system is filled with air under pressure. Air pressure is maintained in the system by means of an air compressor. The dry pipe valve is designed to mechanically hold back the force of water by air pressure. The only location where water is present is at the control valves which require continuous heating to prevent freezing.

In the event of a fire, the heat-activated sprinkler(s) will open and the air will begin to exhaust, reducing the air pressure in the system. The air can not be replenished fast enough which allows the water pressure to force the dry pipe valve to open and water to flow into the piping system. After the valve operates, the entire sprinkler system operates just like a regular wet system. Water flows to the activated sprinkler or sprinklers and flow over the fire thereby controlling and cooling. Again, only those sprinklers near the fire origin operate. In addition, sensing switches operate an alarm which is wired to the electronic alarm system sending a signal indicating sprinkler activation. The water will flow until the system is manually shut- off.

Because dry systems are usually installed in areas subject to freezing, proper drainage is critical. Branch lines are to be pitched at least ½ inch per 10 feet and mains pitched at least ¼ inch per 10 feet.

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QUICK RESPONSE

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April 2006

Valves, a basic component of all fire sprinkler systems, play a multifaceted role. There are numerous types of valves that serve specific functions. This month control, check and specialty valves are discussed.

Control valve - A control valve's function is to shut down the water supply to the sprinkler system. Control valves normally remain in the open position and are occasionally closed to allow for periodic system repairs, maintenance and modification. Control valves must be listed for use in fire protection systems and must have an external means to readily indicate that the valve is open or closed. Shown below are samples of numerous styles of valves which are available. NFPA 13 only requires that control valves be listed and indicating. Valves such as P.I.V. or wall post indicating are acceptable but not required. To prevent water hammer control valves shall not close in less than 5 seconds when operated at maximum possible speed from the fully open position.

OS&Y

Butterfly

Butterball

Post-Indicator Valve (P.I.V.)

Wall Post Indicator

Check valve – A check valve is a one-way directional valve that permits flow in one direction. The two most common locations of check valves are on the system riser, to prevent the backflow of sprinkler system water into the potable water supply, and on the fire department connection (FDC) piping to prevent the backflow of water out through the FDC. As with control valves, numerous styles of check valves are available. NFPA 13 requires that check valves be listed for use in fire protection systems. Although acceptable, detector check valves or double backflow prevention are not required by NFPA 13. Double backflow prevention is only required by the MN State Plumbing Code when there is a risk of cross-contamination with a non-potable source (i.e. lake, pond, etc.).

Flanged

Grooved

Wafer

Detector

Double Backflow

Specialty valves - Dry-pipe, preaction and deluge sprinkler systems require complex, special valves that are designed to hold water from the system piping until needed. These valves also include air pressure maintenance equipment and emergency operation/release systems. As with control valves and check valves NFPA 13 requires that specialty valves are listed for use in fire protection systems.

Deluge

Preaction

Dry

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EST. 1905

QUICK RESPONSE

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May 2006

Frequently asked questions about Minnesota Fire Sprinkler licensing

1. Does the state of Minnesota require licensing for fire protection related work? Yes, licensure is required for the following:

- **Fire Protection Contractor:** a person who contracts to sell, design, install, modify, alter or inspect a fire protection system or its parts or related equipment.
- **Designer Contractor:** a person who contracts to design a fire protection system or its parts or related equipment.
- **Limited Contractor:** A person who may, without insurance or bond, perform fire protection-related work on premises or that part of premises actually occupied by the contractor and owned by the contractor or leased by the contractor for a period of at least one year.

2. Does the state of Minnesota require certification of employees? Yes, certification is required for the following:

- **Fire Protection Managing Employee:** a person who is employed by a contractor who supervises the performance of all fire protection-related work by the contractor.
- **Journeyman Sprinkler Fitter:** a person who is licensed as competent to engage in installing, connecting, altering, repairing or adding to a fire protection system for and under the supervision of a fire protection contractor.
- **Limited Journeyman Sprinkler Fitter:** Journeyman sprinkler fitters with limited certificates are limited to working on premises or that part of the premises actually occupied by the journeyman's employer and owned by the employer or leased by the employer for a period of at least one year. A journeyman with a limited certificate is limited to working in areas of competence, as certified and documented by the journeyman's employer. A journeyman with a limited certificate may not perform fire protection-related work unless the journeyman is under the supervision of the employer's managing employee.

3. What qualifies as fire protection related work? Fire protection related work, when applied to a licensed fire protection contractor, means the sale, design, installation, modification, or inspection of a fire protection system, its parts, or related equipment, or the offer to do so. Fire protection related work, when applied to a journeyman sprinkler fitter or an apprentice sprinkler fitter, means the installation, connection, alteration, repair, or addition to a fire protection system.

4. How many Certified Journeyman Sprinkler Fitters are required to be on a job site?
At least one Certified Journeyman Sprinkler Fitter is required on site when installing sprinkler components such as sprinkler heads, valves, pipe, or hangers. When a Certified Journeyman Sprinkler Fitter is not on site, personnel may perform duties preparing system components for installation (material handling, cutting and threading of pipe, patching holes and openings, etc.) but are not allowed to place components, pipe, or hangers into their final resting place.

5. Is there any fire protection related work that does not require a license? Yes, the following work does not require a license:

- Selling fire protection system parts or related equipment to a licensed contractor.
- Installing or servicing a special agent fire suppression system that is not connected to a potable water source.
- Acting in an official capacity as a building official, fire official or insurance inspector.
- Performing activities authorized by the alarm and communication contractor license or electrical contractor license.
- Performing scheduled activities to keep a fire suppression system operable or to make emergency repairs to correct an impairment of a fire protection system until such time as a licensed fire protection contractor can do permanent repairs.
- Residential installations by the owner-occupant of a one- or two-family dwelling.

6. Are the fire protection licensing statutes and rules available on the internet? Yes, links to fire protection licensing statutes and rules can be found at www.fire.state.mn.us/firesprink.html.

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MINNESOTA PUBLIC SAFETY STATE FIRE MARSHAL EST. 1905

QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

August 2006

Fire Department Connections

The **Fire Department Connection (FDC)**, also know as the **Siamese Connection**, is an important component found on most sprinkler and standpipe systems. When a sprinkler system activates, the fire department connects hose lines from a pumper truck to the fire department connection. This connection allows the fire department to supplement the fire protection system in the event of a fire. In a recent Comment on Proposal, the NFPA 13 technical committee stated, *"The purpose of the Fire Department Connection is to supplement the water supply, but not necessarily provide the entire sprinkler system demand. Fire Department Connections are not intended to deliver a specific volume of water."*

The fire department connection can be thought of as only consisting of the inlet body, however, the FDC is actually made up of the inlet, check valve, and piping connecting to the sprinkler system riser or main. **13(99) Figure 13:5-15.2.1** illustrates an FDC from the inlet to a system header. **13(99) 5-15.2.3.1** says that the FDC shall be on the system side of the water supply check valve. This provision refers to the inlet, piping, check valve, etc. as being one unit. The sizing of all these components from the connection to the sprinkler system to the inlet shall be determined by **13(99) 5-15.2.2**. It is important to note that **13(99) 10-2.2.3** states that the piping between the exterior FDC and the check valve be hydrostatically tested in the same manner as the balance of the system. The test is to confirm that the piping is properly installed and will not leak or come apart.

The required number of inlet connections varies depending on the type and demand of the system being served. For fire sprinkler systems, **NFPA 13(99) 5-15.2.2** requires a 4" pipe size for fire engine connections. **Exception #2** allows a single-outlet FDC where piped to a 3" or smaller riser. These criteria indicate that unless the riser of the sprinkler system is 3" or smaller, the FDC must have a minimum of two connections. There is no other criterion in NFPA 13 requiring more than two connections. For standpipe systems, **NFPA 14(00) 2-8.2** requires each FDC to have at least two 2-1/2" internal threaded swivel fittings. Further **14(00) 5-7** requires standpipe systems to be designed so that the system demand can be supplied by both the attached water supply, where required, and fire department connections. There is no explicit requirement for an FDC to have a 4-way connection. However, if the standpipe demand is such that it cannot be adequately supplied through a 2-way FDC, **14(00) 5-7** provides a basis for requiring additional connections.

Siamese connections are most commonly located on the side of buildings, but may also be located remote from the building. These are know as "freestanding" or "sidewalk" FDCs. NFPA 13 requires the fire department connection to be located on the street side of buildings and the Minnesota State Fire Marshal policy FP-03 further clarifies the location as the address side of buildings. There are situations where locating the FDC in these locations is impractical (i.e. large shopping malls). It is important that the fire department connection be provided at a location approved by the local fire official.

A less common type of FDC that is utilized is known as a "Storz" type fire department connection. These are typically used for large diameter hose connections. This connection features two to three lugs for "quick" connection of the fitting, depending on hose diameter. Storz connections are currently not listed for use in fire protection systems. It is important that the hose lines between the pumper truck and the Storz connection are properly rated for the higher pressures produced by the pumper truck.

Siamese connections are to be equipped with plugs or caps. This is to prevent dirt and other foreign objects from entering the piping, which would inhibit water flow or prevent the connection from being used during an emergency. It is important to replace broken or missing caps to maintain the connections in working order.

To prevent water from collecting in the piping between the check valve and the inlet body, an automatic drip is to be installed at the lowest point of the FDC piping. Without the automatic drip any collected water could freeze and prevent use of the fire department connection under fire conditions.

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QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

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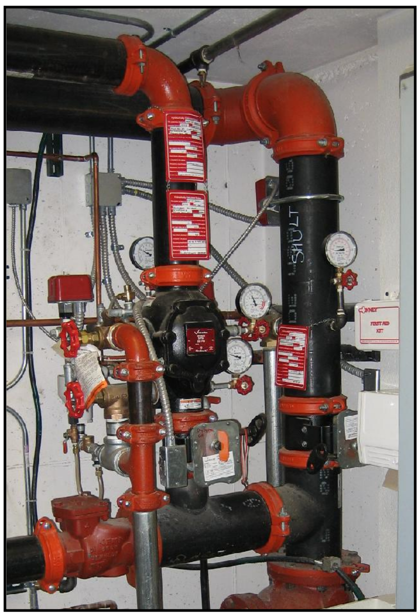
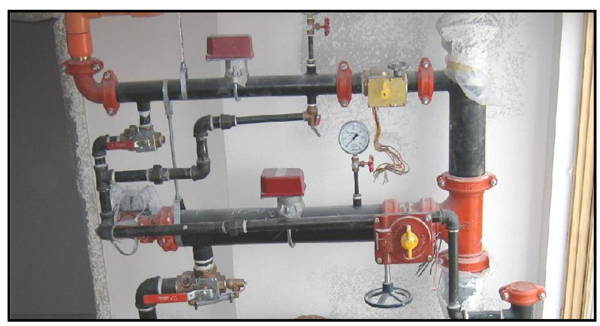
Supervising, Locking and Securing Valves

The **Minnesota State Fire Code (MSFC)** has separate requirements in regard to supervising (monitoring) and securing valves. **Section 903.4** requires supervising (monitoring) of valves. It states: *All valves controlling the water supply for automatic sprinkler systems and water-flow switches on all sprinkler systems shall be electrically supervised.* **Section 903.4.4**, which requires securing of valves, states: *All valves controlling water supplies for automatic sprinklers shall be locked or secured in the open position. Exception: Valves located in a room where access is limited to essential personnel only.*



It is important to note that in addition to electrically supervising (monitoring) control valves, all valves controlling water supplies for automatic sprinklers, which are not located in a room or area where access is limited to essential personnel only, shall be locked or secured in the open position. This applies not only to the valves located on the system riser(s) but also to any auxiliary/sectional zone valves controlling more than 20 sprinklers. Auxiliary valves serving less than 20 sprinklers do not need to be supervised, but these valves need to be locked or secured in the open position. Also jockey pump control valves, trim valves to pressure switches in dry, preaction and deluge systems that are sealed or lock in the open position do not need to be supervised. See **MSFC Section 903.4** for valves that are exempt from supervision.



It is important to note, when valves are located in a room where access is limited to essential personnel, proper signage is required. **MSFC Section 510.1** states: *Rooms containing controls for air conditioning systems, sprinkler risers and valves, or other fire detection, suppression or control elements shall be identified for fire department use.*

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Minnesota State Fire Marshal – Fire Protection Section

www.fire.state.mn.us

MINNESOTA PUBLIC SAFETY STATE FIRE MARSHAL EST. 1905

QUICK RESPONSE

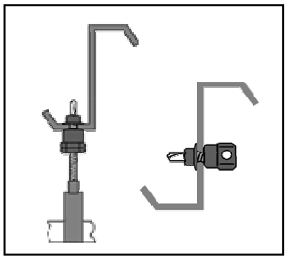
Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

January 2007

Hanger Attachment Points

There are two separate issues to consider when attaching hangers to structural members. One is the adequacy of the hanger assembly and the other is the adequacy of the structural member to support the sprinkler piping per **NFPA** requirements. Although a hanger assembly is listed for fire sprinkler use, the structural component (e.g. bar joist, purlin or metal roof deck) that sprinkler system piping hanger is attached to, must be capable of supporting the required loads.

> ***NFPA 13(99) 6-2.1.3*** *Sprinkler piping shall be substantially supported from the building structure, which must support the added load of the water-filled pipe plus a minimum of 250 lb (114 kg) applied at the point of hanging.*



Today's purlins present limited hanger installation locations. The flanges have a minimal load carrying capacity. Most manufacturers' engineering data specifies that their purlin flanges are not capable of supporting fire sprinkler piping. When hanging from the flange of a purlin, substantiation demonstrating the ability of the hanger assembly and the purlin is required.

Beam clamps may be used on the bottom chord of bar joists if listed for this point of attachment and if the point of attachment can support the weight of water filled pipe plus 250 pounds. Typically, bar joists are designed to be top loaded with the top chord in compression and the bottom chord in tension. Torque forces are greater when the piping is attached to the bottom chord. With heavier joists, the difference in load carrying capacity of the top chord versus the bottom chord is minimal. However, with lighter (more common) joists, the difference is significant. Again, substantiation demonstrating the ability of the hanger assembly and the structural member is required.

Metal decking may be used as a point of attachment for sprinkler system hangers provided the two criteria, adequacy of the hanger assembly and the adequacy of the point of attachment using the metal decking, are substantiated. One may infer by **NFPA 13(99) 6-2.1.3 *Exception*** that a metal deck cannot be used to support system piping unless it complies with this exception. However, this is not the intent. Hanging from a non-conventional point of support or other elements may also be utilized and **NFPA 13** does not prohibit their use provided a registered professional engineer certifies that it will be adequately supported (**NFPA 13(99) 6-1.1 *Exception No. 1***).

QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

February 2007

Skylights and Ceiling Pockets

Two recurring issues that seem to derail a successful sprinkler plan review are: (a) the placement of sprinklers in skylights and, (b) the placement of sprinklers in stepped ceilings.

MN State Fire Marshal Division Policy #FP-9 sets the tone for sprinklers in skylights, especially as far as the historic "sidewall in the side-wall" is concerned. It reads in part:

> *"The use of horizontal sidewall sprinklers installed in the vertical sidewall of the skylight is not acceptable. Horizontal sidewall sprinklers are listed to be installed four to six inches (some cases twelve inches) below a smooth, flat ceiling. Skylights do not provide this smooth, flat surface for heat collection. Therefore, this type of installation is not acceptable."*

The entire policy may be found at www.fire.mn.us. Click on ***Fire Protection Systems Policies***.

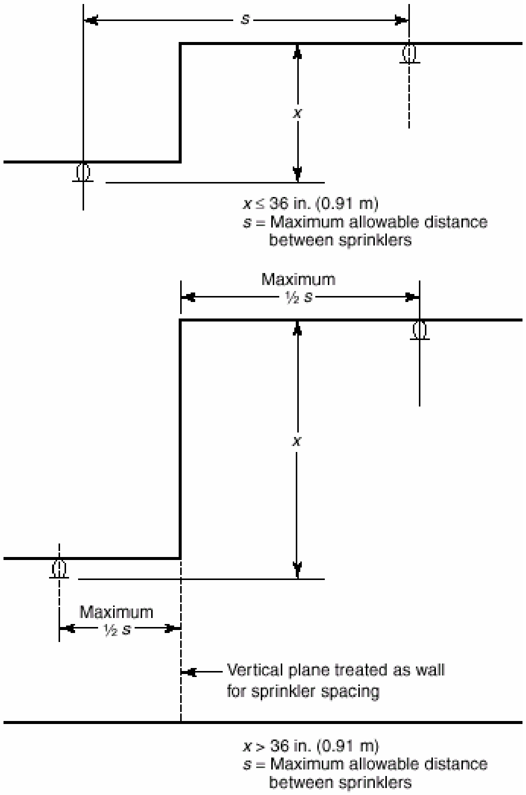


FIGURE 8.6.4.1.1.3 Vertical Changes in Ceiling Elevations.

The other issue of sprinklers in ceiling pockets is addressed in **NFPA 13(02) section 8.6.4.1.1.3**. It is important to note that this section applies only to light and ordinary hazard occupancies with non-combustible or limited combustible ceiling construction.

Section 8.6.4.1.1.3 states, *"The requirements of **8.6.4.1.1.1** shall not apply for light and ordinary hazard occupancies with ceilings of noncombustible or limited combustible construction. Where there is a vertical change in ceiling elevation within the area of coverage of the sprinkler creating a distance of more than 36 in. between the upper ceiling and the sprinkler deflector, a vertical plane extending down from the ceiling at the change in elevation shall be considered a wall for the purpose of sprinkler spacing. Where the distance between the upper ceiling and the sprinkler deflector is less than or equal to 36 in., the sprinklers shall be permitted to be spaced as though the ceiling was flat provided the obstruction rules and ceiling pocket rules are observed. (See **Figure 8.6.4.1.1.3**.)"*

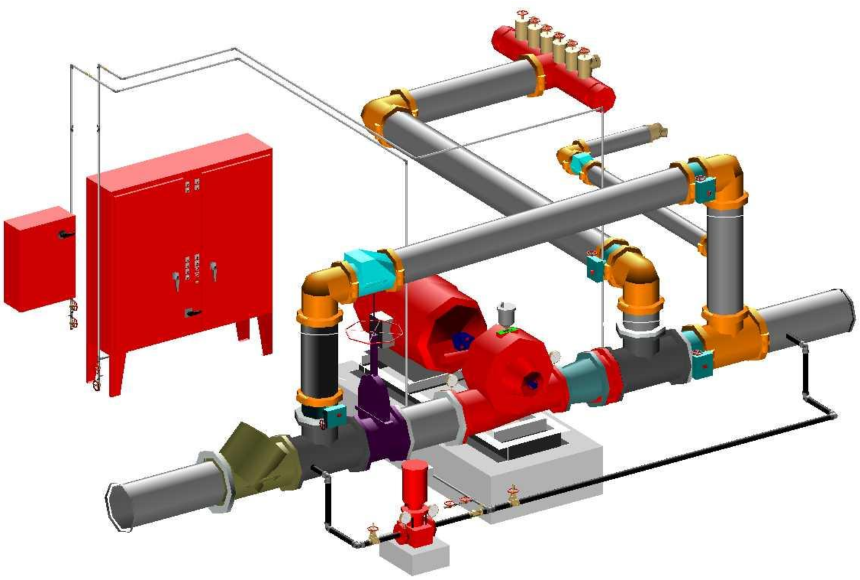
QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

February 2008

FIRE PUMPS

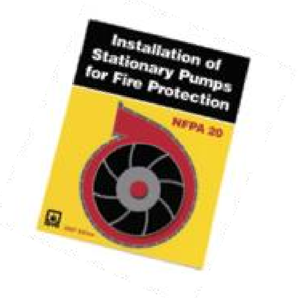
A **fire pump** is a device that increases the pressure of an available water supply. It can be considered part of the water supply for a fire protection system. It may either boost available pressure or generate all pressure for a given water supply. It is important to recognize that a **fire pump** cannot create water and increase the water supply's overall quantity (volume). As alluded to earlier, what a **fire pump** does is increase the pressure of water at a specific flow.



A **fire pump** is most often utilized in conjunction with a municipal water supply. Where a public main is not available a stored water supply (i.e. tank) can be combined with a **fire pump** to supply the fire protection system. Other sources of water supplies may be ponds, lakes, rivers or wells.

A **fire pump** may powered by an electric motor or diesel engine. On very rare occasions a **fire pump** is powered by a steam turbine.

Types of **fire pumps** include: horizontal split case, vertical split case, vertical inline, vertical turbine, and end suction.



The National Fire Protection Association's (NFPA) standard that governs **fire pump** installations is *NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection*.

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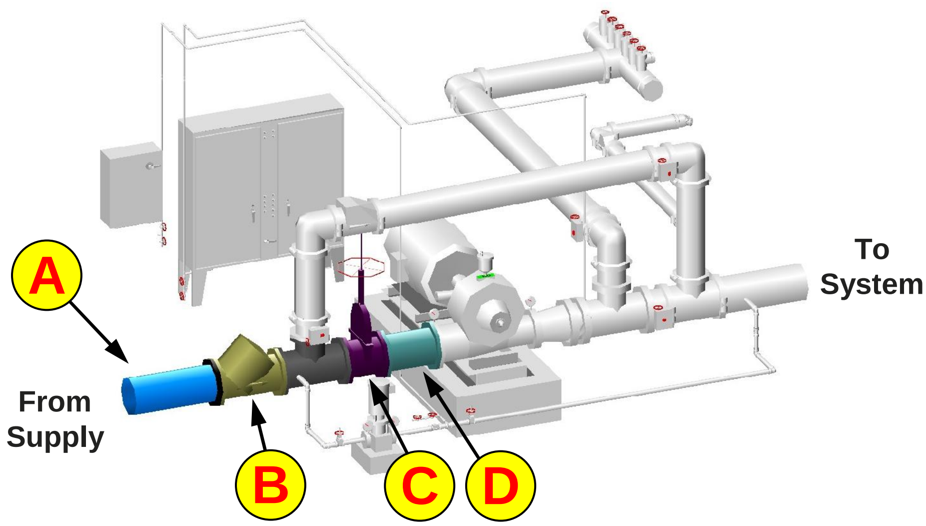
MINNESOTA PUBLIC SAFETY STATE FIRE MARSHAL EST. 1905

QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

May 2008

FIRE PUMPS – SUCTION COMPONENTS

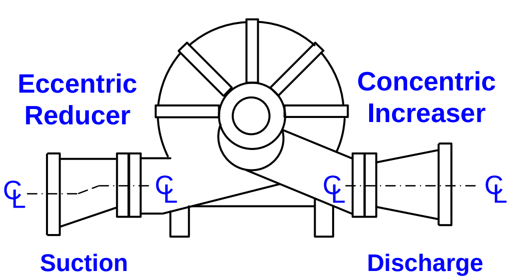


A = **Suction Pipe –** NFPA 20, Section 5.14.3.4, *"The size of that portion of the suction pipe located within 10 pipe diameters upstream of the pump suction flange shall be not less than that specified in Section 5.25."*

B = **Check Valve (when required) –** NFPA 20, Section 5.26.3, "*Where located in the suction pipe of the pump, check valves and backflow prevention devices or assemblies shall be located a minimum of 10 pipe diameters from the pump suction flange."* The 10 times the pipe diameter requirement is to minimize the turbulence created by the check valve.

C = **Control Valve (always required) –** NFPA 20, Section 5.14.5.1, *"A listed outside screw and yoke (OS&Y) gate valve shall be installed in the suction pipe."* This valve must be an OS&Y because these types of valves do not create turbulence when in the fully open position.

D = **Eccentric Reducer (when required) –** NFPA 20, Section 5.14.6.4, "*Where the suction pipe and pump suction flange are not of the same size, they shall be connected with an eccentric tapered reducer or increaser installed in such a way as to avoid air pockets."* When the size of the suction piping is different than the suction flange of the pump an eccentric reducer needs to be installed. An eccentric reducer differs from a concentric reducer in that the centerlines of the openings on each end of the fitting do not line up. To avoid air being trapped, the eccentric reducer is to be installed with the flat side up.



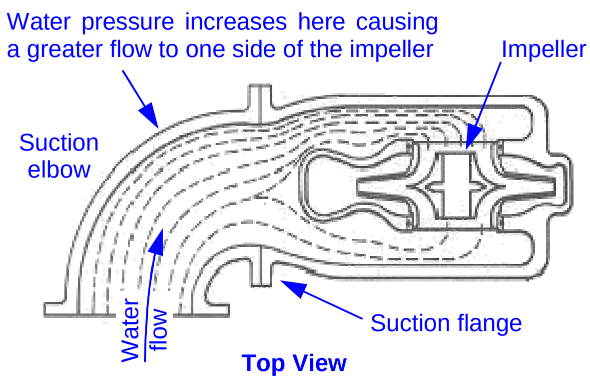
QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

June 2008

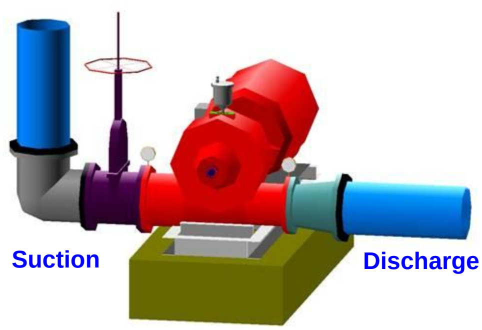
FIRE PUMPS – SUCTION PIPING ARRANGMENT

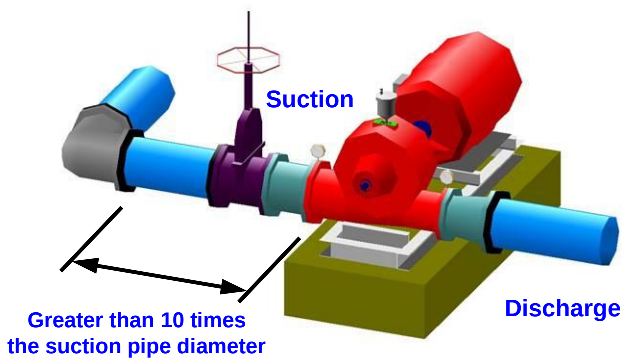
Horizontal turns into a horizontal fire pump are problematic. It is important that the water entering a horizontal fire pump load the fire pump impeller evenly. As water goes around a turn, momentum pushes the water to one side. If the water entering the suction flange does not even out, more water will push to one side of the impeller. The extra load of that water will cause the impeller to spin out of balance and damage the pump. The figure to the left is a plan view section showing the unbalanced loading of a double suction impeller due to uneven flow through an elbow adjacent to the pump. It is extremely important that turbulence and changes in water flow direction are carefully controlled close to the pump suction flange.



The ideal arrangement is when the water flows directly into the pump suction flange. This direct entry minimizes the turbulence of the water and allows the impeller to load evenly. Unfortunately, it is not uncommon that the water supply does not line up directly with the pump suction flange. This requires alternative piping arrangements.

Vertical changes in direction do create some turbulence. However the region of instability is in the vertical plane thus having no effect on the loading of the fire pump impeller. As the water goes into the impeller it crosses evenly across the horizontal axis of the impeller. **NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection**, allows vertical direction changes directly on the suction flange of a horizontial fire pump.





As stated eailer, horizontal turns into a horizontal fire pump are problematic. To allow the water flow to straighten out, **NFPA 20 section 5.14.6.3.2** requires a straight run of pipe prior to the suction flange. The length of this straight run shall be greater than 10 times the diameter of the suction pipe. This is measured from the end of the fitting to the fire pump suction flange. The suction control valve and eccentric reducer, if installed, are allowed to be included as part of the straight run measurement.

QUICK RESPONSE

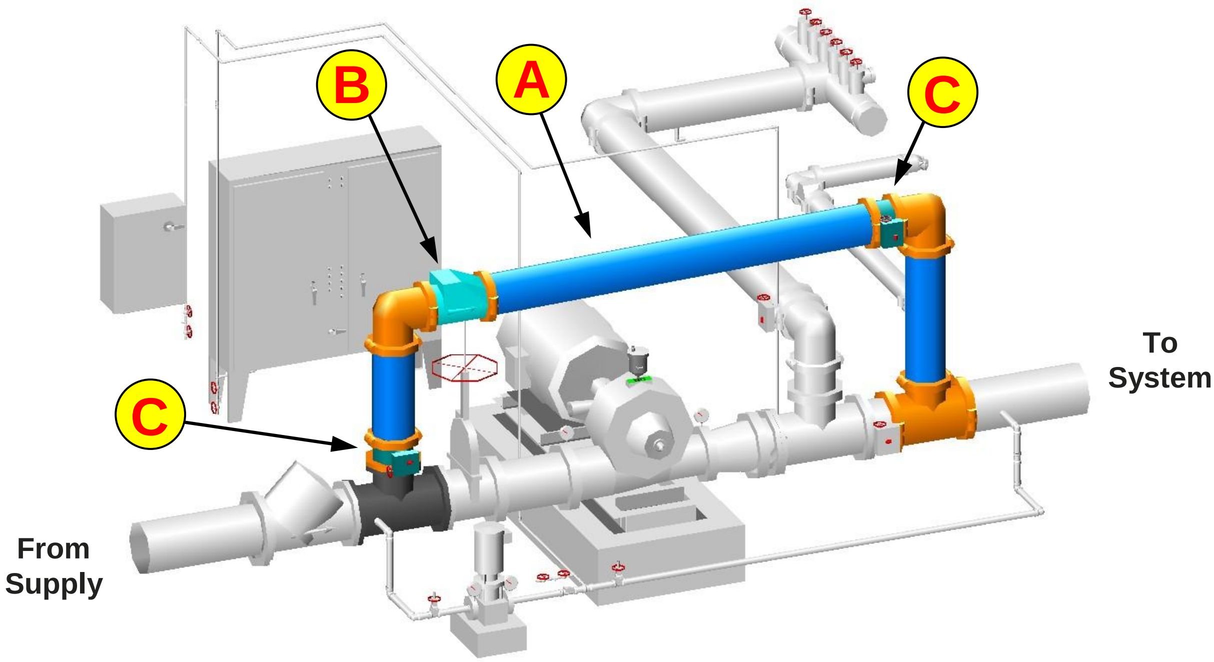
Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

July 2008

FIRE PUMPS – BYPASS

The function of the fire pump bypass is to supply water to the fire protection system if the pump is taken out of service, does not start or something gets lodged in the pump. The bypass needs to be arranged in a manner that allows water to flow through the bypass while the fire pump suction and discharge control valves are closed.

The bypass line is to be installed when the water supply pressure is considered to have material value to the fire protection system without the pump (**NFPA 20 (2003 edition), Section 5.14.4.1**). The water available does not need to supply the entire demand of the system without the pump. This requirement is obviously subjective. As a general rule, a bypass is usually installed when the supply is a public or private main. When supplied by storage tanks or reservoirs, the bypass may have a reduced material value.



A = **Bypass Pipe – NFPA 20, Section 5.14.4.2**, *"The size of the bypass shall be at least as large as the pipe size required for discharge pipe as specified in Section 5.25."*

B = **Check Valve –** This check valve is installed to prevent the discharge water from the fire pump from recirculating back to the pump suction.

C = **Control Valve –** Since a check valve is installed, control valves need to be installed on either side of the check valve. This allows the check valve to be isolated for maintenance purposes. These valves may be OS&Y or butterfly type.

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MINNESOTA PUBLIC SAFETY STATE FIRE MARSHAL EST. 1905

QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

January 2009

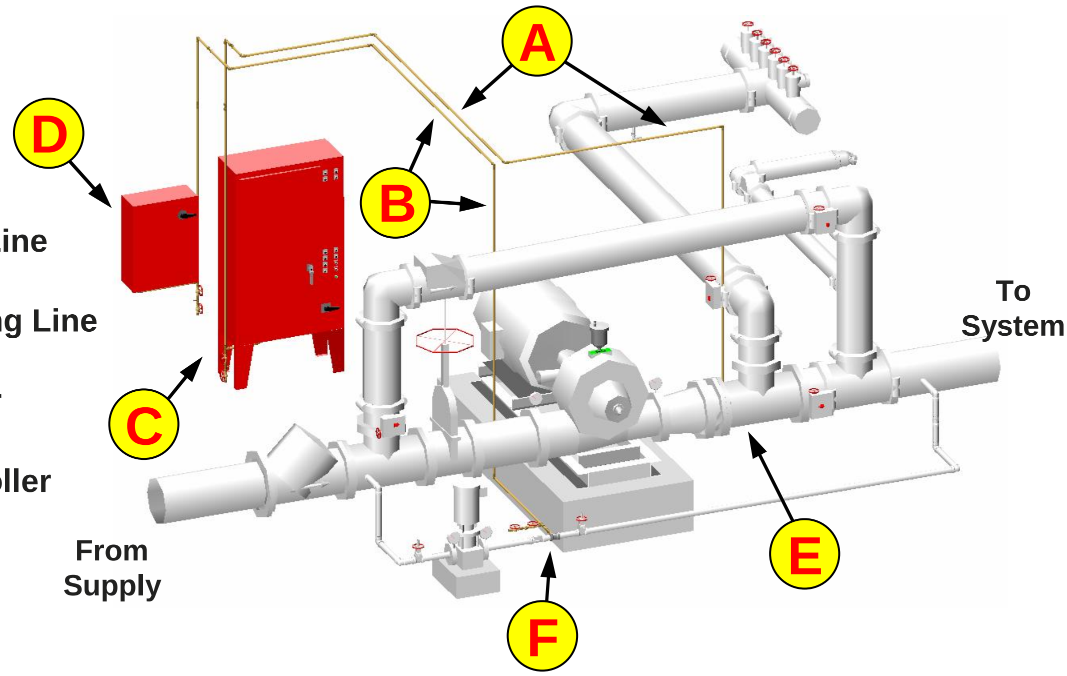
FIRE PUMPS – SENSING LINES

A = **Fire Pump Sensing Line**

B = **Jockey Pump Sensing Line**

C = **Fire Pump Controller**

D = **Jockey Pump Controller**



Most commonly the pump controller is connected to the fire protection system by means of piping know as a **sensing or pilot line**. Each pump, including the jockey pump, shall have its own individual controller and each controller shall have its own individual **sensing line**. The **sensing line** is connected to the fire protection system between its respective pump discharge check valve and the discharge control valve (**E** and **F**).

The size of the **sensing lines** shall be a minimum of ½-inch and must be of non-corrosive metallic pipe or tube (brass, copper, stainless steel). Galvanized pipe is not corrosion resistant enough to be suitable for **sensing line** use. Plastic pipe is corrosion resistant, however, due to it being easily damaged, it too is not suitable for **sensing line** use.

To absorb pressure surges and protect the controller pressure switch from damage, two check valves shall be installed in each **sensing line**. These check valves shall be at least five feet apart. To aid in dampening, a small 3/32" hole shall be drilled into the clapper of each check valve. Where the water is clean, ground-face unions with noncorrosive diaphragms drilled with a nominal 3/32" orifice shall be permitted in place of the check valves.

Lastly, control valves are not allowed to be installed in the **sensing line**.

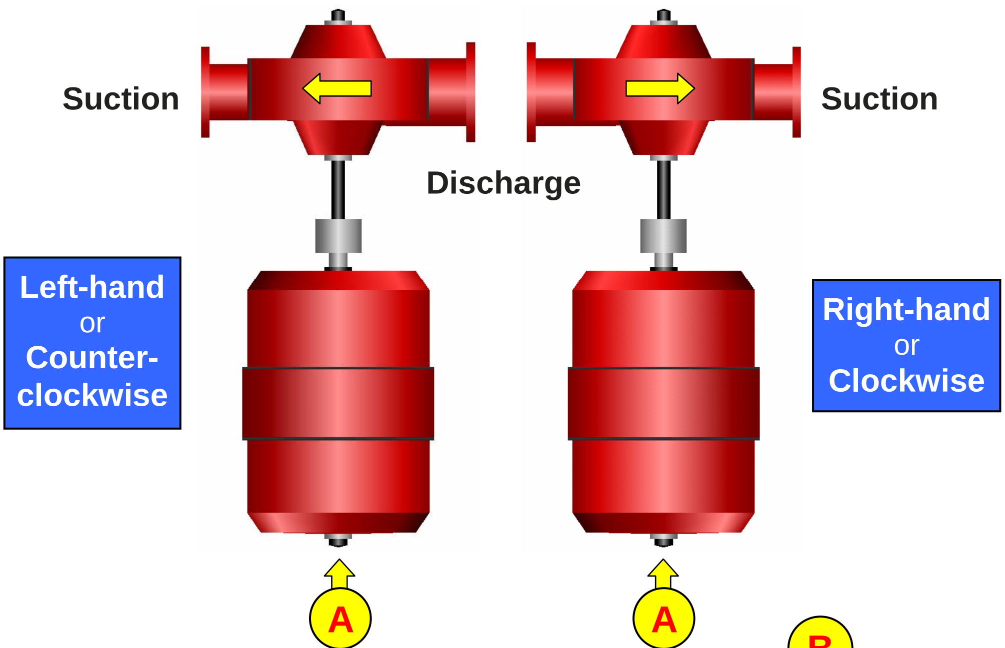
QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

February 2009

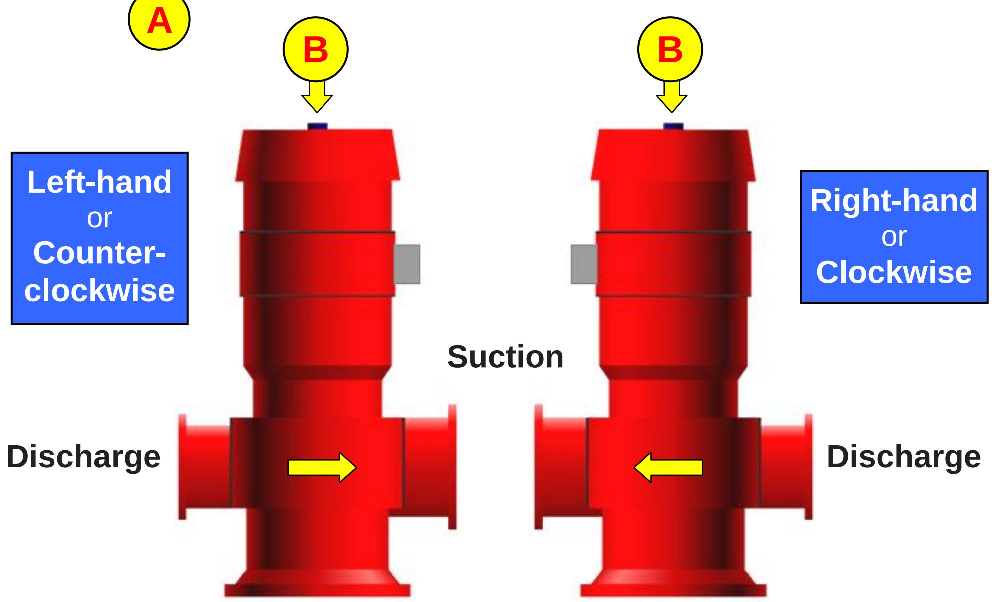
FIRE PUMPS – ROTATION

Fire pump **rotation** refers to the direction that the fire pump shaft revolves. Pumps are designated as having right-hand (clockwise) **rotation**, or left-hand (counter-clockwise) **rotation**.



To determine the rotation of a horizontal pump, stand at the driver end and face the pump (**A**). If the suction is on your left the **rotation** is a left-hand or counter-clockwise. If the suction is on your right the rotation is a right-hand or clockwise **rotation**.

To determine the rotation of a vertical pump, view from the driver end and look down upon the top of the pump (**B**). If the suction is on your left the **rotation** is a left-hand or counter-clockwise. If the suction is on your right the rotation is a right-hand or clockwise **rotation**.



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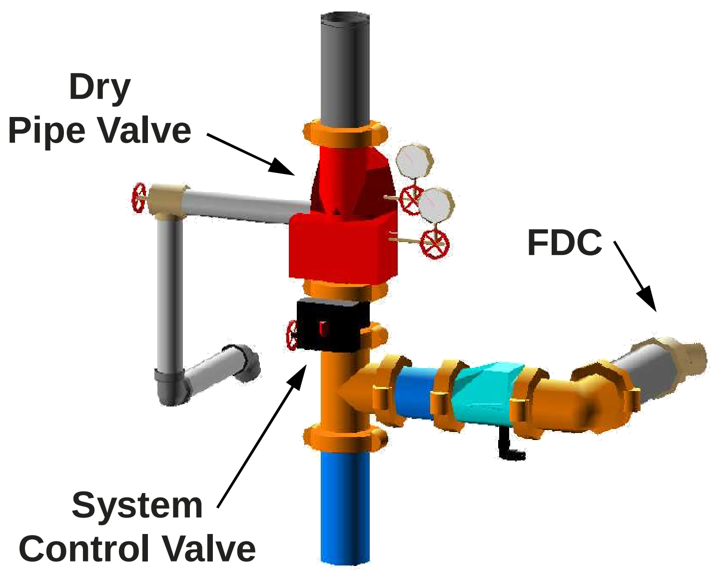
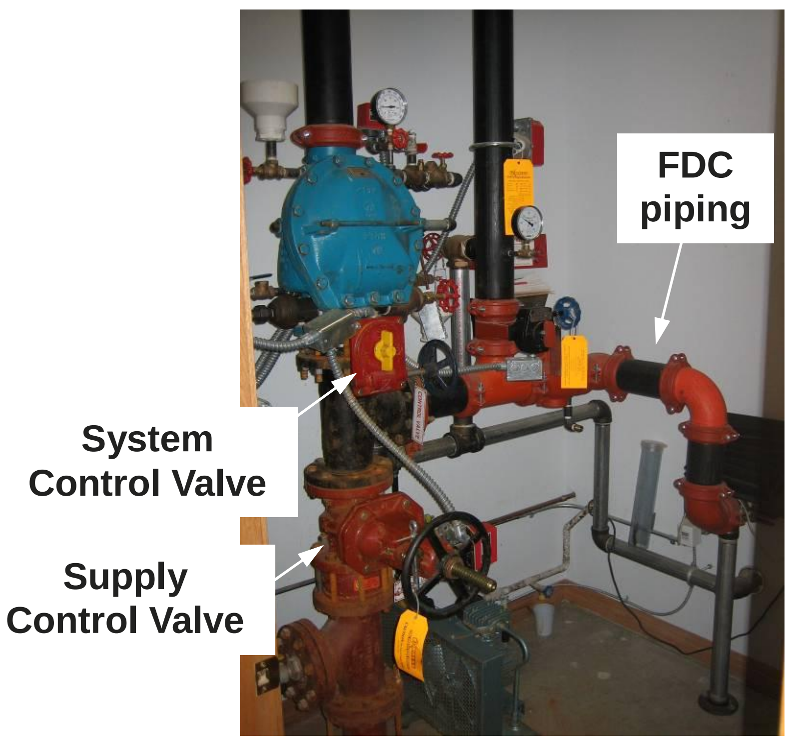
February 2010

DRY PIPE VALVE – CONTROL VALVE LOCATION



Section 8016.2.4.2(2) of the **2002 edition** of **NFPA 13** requires the fire department connection (FDC) piping to be installed between the system control valve and the dry pipe valve. Also, **Section 8.16.2.5.2** does not permit a **control valve** in the FDC piping. A **control valve** in the FDC piping serves no useful purpose and only provides a point of potential system failure. The picture to the left illustrates the **control valve** improperly located between the dry pipe valve and the FDC piping. The proper location of the **control valve** would be below the FDC piping.

However, for multiple systems, **Section 8.16.2.4.3** requires the fire department connection piping to be installed between the ***supply* control valve** and the ***system* control valves**. The picture to the right illustrates the dry system **control valve** properly located between the dry pipe valve and the FDC piping.



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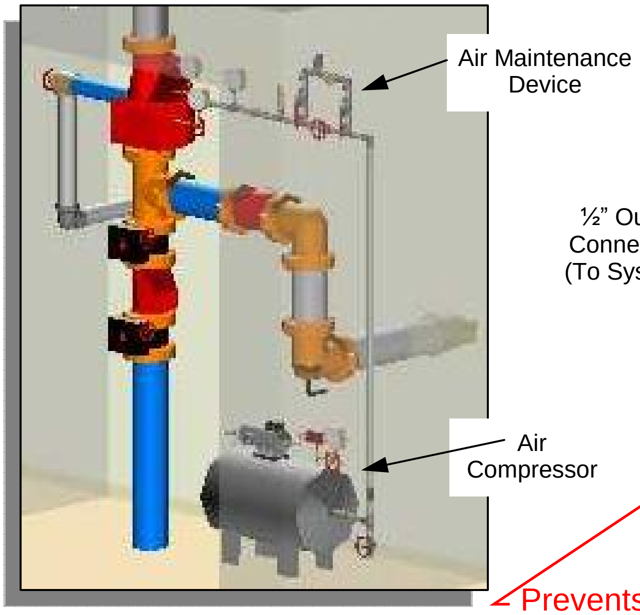
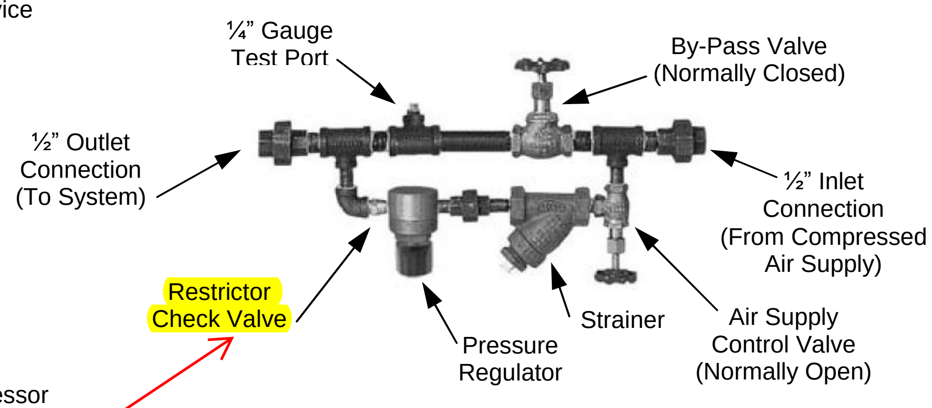
DRY PIPE VALVE – AIR SUPPLY

A reliable **air supply** is necessary to allow the dry pipe system to remain in service and maintain the necessary pressure differential between the air and water sides of the dry pipe valve clapper. The proper air pressure should be maintained in the system at all times. Low air pressures could result in accidental operation of the dry pipe valve. High air pressures result in slower dry pipe valve operation because additional air must be exhausted before water can be delivered to open sprinklers.

Generally, air is supplied from an air compressor. The source of compressed **air supply** shall be available at all times and be capable of restoring normal air pressure in the system within 30 minutes.

The connection pipe from the air compressor shall not be less than ½ inch diameter and shall enter the system above the priming water level of the dry pipe valve. Pumping air directly from an air compressor through a fully open supply pipe into the sprinkler system is not permitted. This unrestricted flow of air can add air too quickly thus preventing or slowing operation of the dry pipe valve. A listed air maintenance device provides both restriction of air flow and regulation of the air pressure.





Air Maintenance Device

Prevents air supply from keeping up with an operating sprinkler head

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August 2010

DRY PIPE VALVE – TESTING

Dry system piping must undergo the same 2 hour, 200 psi hydrostatic test that all other systems are subject to. (This test should NOT be done against the dry valve clapper.) Additionally, **NFPA 13 (2002 edition)** requires that the dry system piping be air tested at 40 psi for 24 hours without losing more than 1½ psi of air pressure in that time period. Finally, **NFPA 13** requires that the dry pipe valve be "trip tested" alone without a quick-opening device, and then with the quick-opening device, if installed. The purpose of the last test is to measure the time it takes to "trip" (open) the dry pipe valve and the time for water to reach the most remote part of the system.

The focus here is on the "trip test" and the normal air pressure. The "trip test" must be conducted starting with the normal amount of air pressure that will be carried in the system. The common "differential-type" dry valve will require about ¼ air pressure to static water pressure to hold the dry pipe valve clapper shut. Newer "hydraulic assist-type" dry valves may require as little as 13 psi of air to operate properly. Always follow the manufacturer's recommendations for the air-to-water pressure ratio and be sure the "trip test" is performed starting at the recommended "normal" system air pressure. Allowing anything less than normal air pressure during the performance test might result in a successful 60-second delivery time to the test connection, but it would not be an accurate representation of how the system will perform when the normal, permanent air pressure is applied to the system.

Standard Differential-type Dry Valve

Low-differential, hydraulic assist type

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October 2010

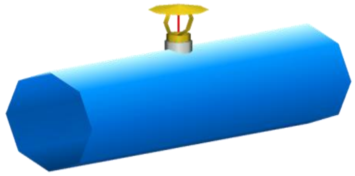
UPRIGHT SPRINKLER INSTALLATION

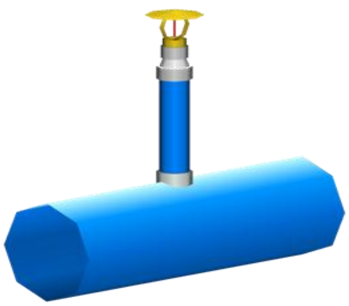
An **upright sprinkler's** frame arm and the piping below the sprinkler both the represent potential obstructions to the water distribution pattern and can prevent a uniform spray pattern.

NFPA 13 requires that **upright sprinklers** shall be installed with the frame arms parallel to the branch line, unless specifically listed for other orientation. The purpose of this requirement is to minimize the obstruction of the discharge pattern. Even though the frame arm is designed to minimize obstruction, the potential for obstruction cannot be completely eliminated. Installation of an **upright sprinkler** with its frame arm parallel to the branch line minimizes the likelihood of the water distribution pattern being obstructed. Figure 1 illustrates an **upright sprinkler** installed with its frame arm installed in the proper orientation.

Figure 1

As stated earlier, an **upright sprinkler** may be listed allowing installation of the frame arms not parallel to the branch line. An example is some specific application sprinklers for combustible interstitial (concealed) spaces. Their listing permits the sprinkler frame arms to be positioned parallel to the truss or joist.





The pipe on which an **upright sprinkler** is located is not considered a major obstruction unless the piping is 3-inch or larger. **Upright sprinklers** on pipe 3-inch or larger must be placed on sprigs or offset from the pipe to eliminate the obstruction that is created directly below the sprinkler. Problems can occur when a fire is located directly below the sprinkler. The obstruction from the large pipe can prevent the sprinkler discharge from reaching the fire. The large pipe may also create dead-spots that might delay sprinkler activation.

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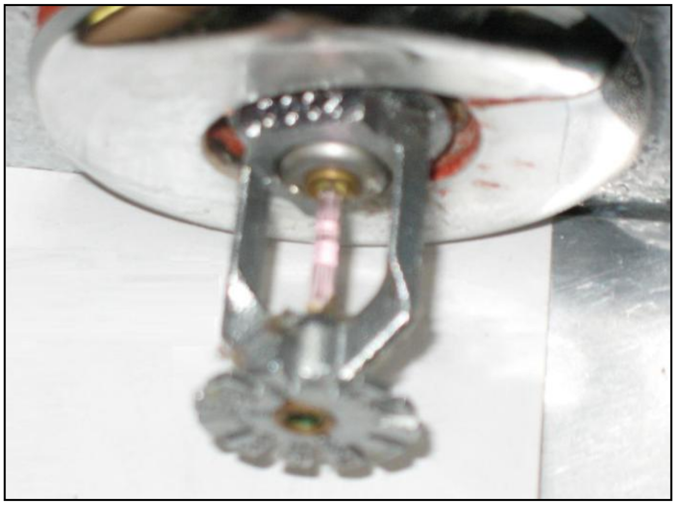
January 2011

GLASS BULB – FLUID COLOR

Sprinklers are color coded to provide a ready means of identifying the temperature classification of their operating element. The operating temperature of glass bulb sprinklers is indicated by the color of the fluid encased within the bulb. Color on the frames of glass bulb sprinklers is purely for aesthetic purposes and is not an indication of the sprinklers operating temperature. For example, in the picture above, the third sprinkler from the left has a white frame arm finish and a green fluid filled bulb. The green colored fluid is used to determine the temperature classification of the sprinkler.

As illustrated below, glass bulb sprinklers may lose their coloration. Although the loss of coloration does not affect the proper operation of the sprinkler, since the proper operating temperature cannot be readily identified, sprinklers that have lost their coloration shall be replaced.



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QUICK RESPONSE

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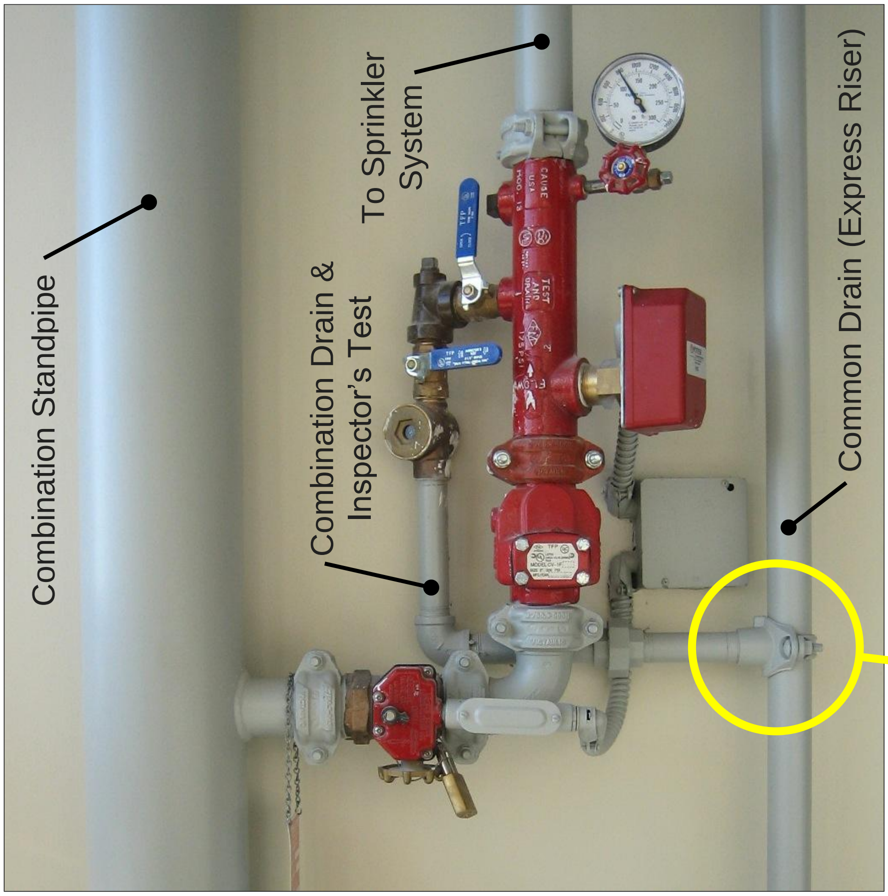
February 2011

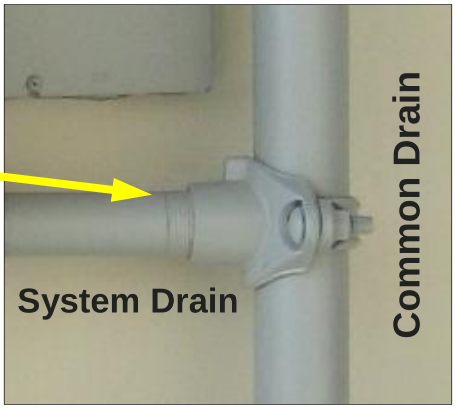
COMMON DRAIN RISER

Piping controlled by sectional valves represents a significant segment of a fire sprinkler system. The arrangement of main, sectional, and auxiliary drains expedites the manner in which a system can be taken out of service for maintenance or repairs. In addition, sectional or floor control valves serve the same function for that portion of the sprinkler system as the main drain does for the entire system.

Drain connections for floor (sectional) control valves are often tied into a **common drain or express riser**. To facilitate the need to drain a portion of a system in an effective manner, NFPA 13 requires the **common drain riser** be one pipe size larger than the largest size drain connection tying into it.



NOTE: Common drain riser properly sized larger than system drain.



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QUICK RESPONSE

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March 2011

BONDING AND GROUNDING

Bonding and **grounding** are frequently confused and often the terms are mistakenly used interchangeably. However, **bonding** and **grounding** are two different things, with different purposes. In regard to fire sprinkler systems, while **bonding** of the sprinkler system piping is acceptable, using the sprinkler system piping as a **grounding** electrode is prohibited per **NFPA 13** and **NFPA 24**.

Bonding is the connection of two or more conductive objects to one another by means of a conductor such as a wire or a wire and a pipe. **Bonding** ensures that these two things will be at the same electrical potential. That means you would not get electricity building up in one and not in the other.

Grounding is a special form of **bonding**. It is the act of connecting something to the ground (earth), so it has zero electrical potential. Everything that is grounded is connected to the ground and can have no electrical energy stored in it.

An explanation of **bonding** is that it is done to prevent you from being shocked/electrocuted when your left hand touches one metal component, and your right hand touches another metal component. By running a wire (**bonding** wire) from one metal component to another, stray electricity, for example from a short, will equalize through the **bonding** wire and one metal component will not have a greater voltage in it than another metal component. **Grounding** on the other hand is to give the stray electrical current a place to go (other than you).

A metal pipe fire sprinkler system is usually **bonded** automatically through its metallic components. Most fittings are metal-to-metal and are **bonding** devices. Also, the metal hangers that attach metal sprinkler pipes to metal structural members **bond** the sprinkler system and the building structure.

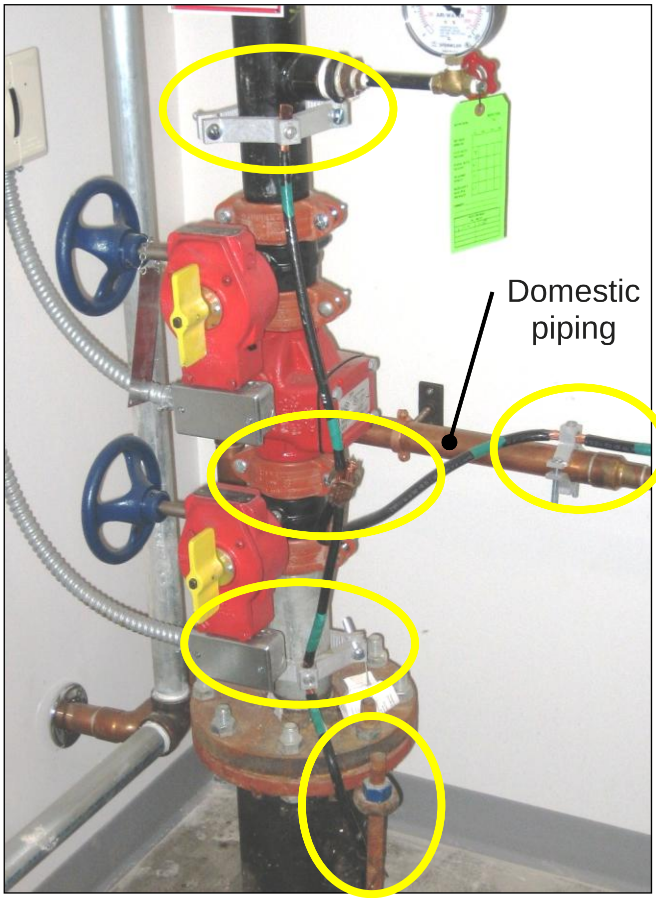

Exhibit 1: Fire sprinkler system improperly utilized for **grounding**.

As stated earlier, utilizing a fire sprinkler system for **grounding** is prohibited. This is to protect and prevent the fire sprinkler system from the increased potential for stray electrical currents and increased galvanic corrosion (electrolysis).

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QUICK RESPONSE

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May 2011

Riser Gauge Arrangement

Accurately characterizing the flow and pressure of the available water supply is paramount not only during the initial design and installation of a sprinkler system, but also for the continued protection of the building. Degradation of the water supply or impairment to a sprinkler system can have catastrophic consequences.

Conducting a main drain test on a fire sprinkler system is an essential component of maintaining system performance. This test allows you to evaluate the water supply coming into the fire sprinkler system. It is conducted at each sprinkler system riser to determine whether there has been a change in the condition of the water supply, supply piping and control valves. A decrease in pressure may indicate a deteriorated water supply, obstruction, closed valve or other system impairment. The data obtained from sprinkler system testing is only as valid as the instruments used for measurement. The **riser gauge** shall be properly located to provide true and accurate readings.

Exhibit 1 shows examples of unacceptable **riser gauge** locations. A true residual (water flowing) pressure reading will not be given because it will indicate an excessive pressure drop. **Exhibit 2** are examples of acceptable **riser gauge** locations.

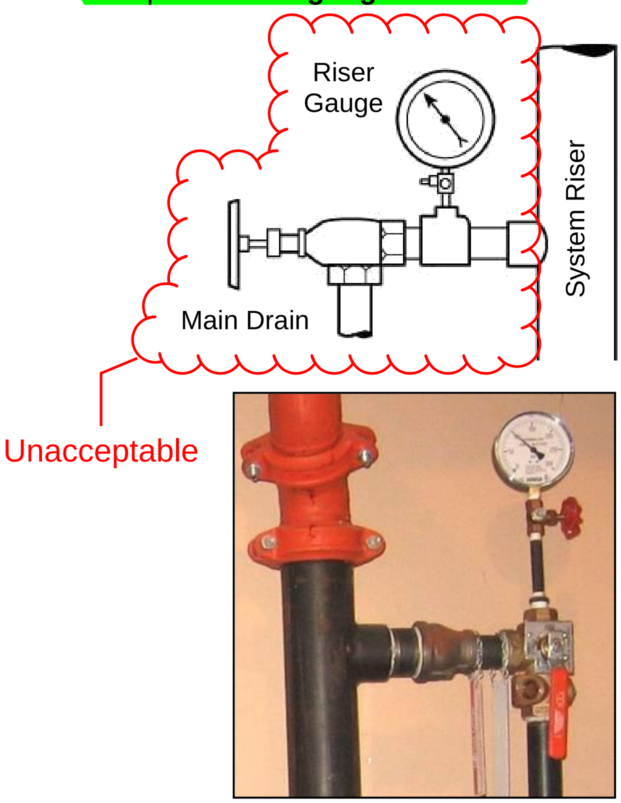

Exhibit 1: Unacceptable gauge locations.

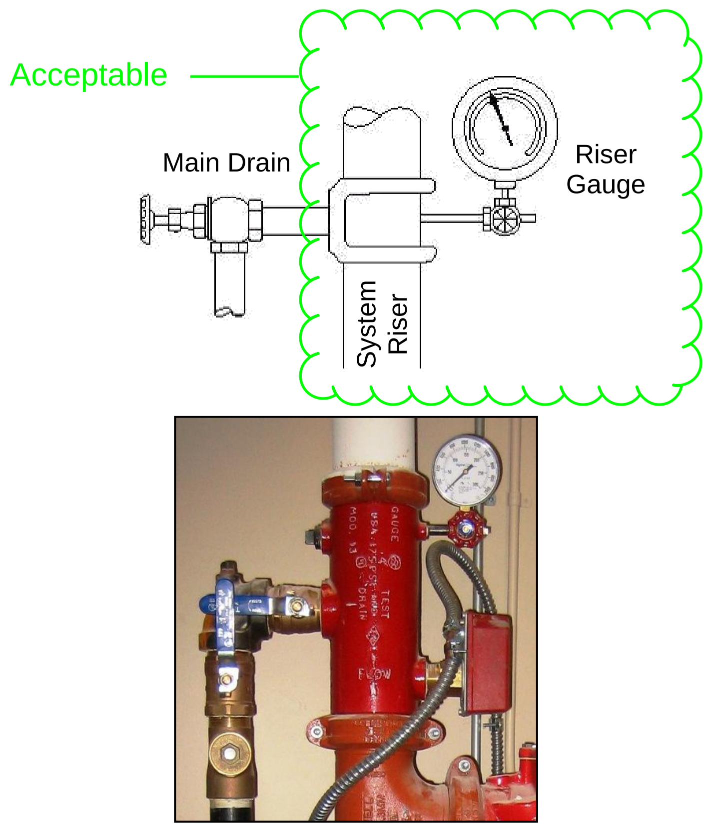

Exhibit 2: Acceptable gauge locations.

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July 2011

Protective Coverings

When sprinklers are installed in environments that present unique challenges to maintain sprinkler functionality, additional measures to protect fire sprinklers may be appropriate. For example, fire sprinklers located in spray paint booths may be subject to paint over-spray residue. This can result in deposits on the sprinkler head which could adversely impact sprinkler performance.

NFPA 13 requires that sprinklers protecting spray areas and mixing rooms shall be protected against overspray residue so that they will operate in the event of fire. This protection may be provided by simply placing a bag over the sprinkler head. Cellophane bags having a thickness of 0.003 inch or less (**Exhibit 1**) or thin paper bags (**Exhibit 2**) shall be used. It is important to note that cellophane, not plastic, bags shall be used. Most common sandwich bags (**Exhibit 3**) are not cellophane bags and shall not be used.

Exhibit 1: Cellophane bag

Exhibit 2: Thin paper bag

Exhibit 3: Plastic sandwich bag

Exhibit 4

Protective coverings shall be replaced frequently so that heavy deposits of residue do not accumulate. Sprinklers that have been painted or coated by overspray or residues shall be replaced with new listed sprinklers of the same characteristics, including orifice size, thermal response, and water distribution.

Exhibit 4 shows a sprinkler that was properly protected from overspray by a thin paper bag. A fire in the spray booth burned away the paper bag allowing the fire sprinkler to properly operate and control the fire.

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QUICK RESPONSE

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August 2011

Auxiliary Drain – Wet System

Wet system **auxiliary drains** shall be provided where a change in piping direction prevents drainage of system piping (trapped piping) through the main drain valve. The type of a wet system **auxiliary drain**, its size, and its arrangement depend on the capacity (volume) of trapped piping.

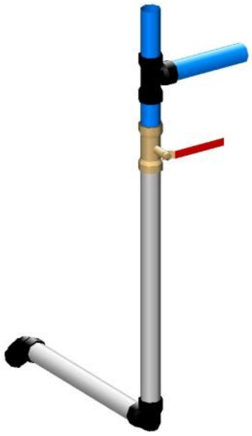

Exhibit 1

Wet system where the capacity of trapped section of pipe is ***50 gallons or more,*** the **auxiliary drain** shall consist of a valve not smaller than 1 in. piped to an accessible location (**Exhibit 1**).

Wet system where the capacity of trapped section of pipe is ***less than 50 gallons and more than 5 gallons***, the **auxiliary drain** shall consist of a valve ¾-inch or larger and a plug (**Exhibit 2**) or a nipple and cap (**Exhibit 3**).

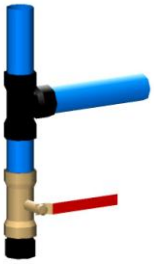

Exhibit 2

Exhibit 3

Wet system where the capacity of trapped sections of pipe is ***less than 5 gallons*** one of the following arrangements shall be provided:

(1) A nipple and cap or plug not less than ½-inch in size. (**Exhibit 4**)

(2) An **auxiliary drain** shall not be required for trapped sections ***less than 5 gallons*** where the system piping can be drained by removing a single pendent sprinkler. (**Exhibit 5**)

(3) Where flexible couplings or other easily separated connections are used, the nipple and cap or plug can be omitted. (**Exhibit 6**)

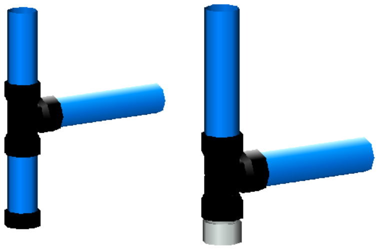

Exhibit 4

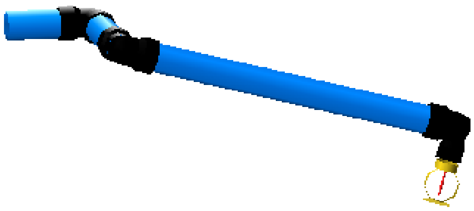

Exhibit 5

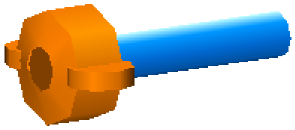

Exhibit 6

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October 2011

Paddle-Type Flow Switch

Paddle-type, also known as **vane-type**, **flow switches** are used in wet sprinkler systems to detect the flow of water and to send an alarm signal.

Exhibit 1

Exhibit 2

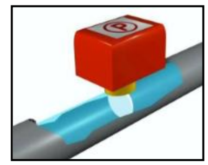

Exhibit 3

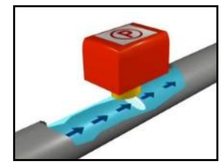

Exhibit 4

The **flow switch** is usually mounted on the main fire sprinkler riser (and in some case secondary as well). It has a plastic vane or paddle, which installs through an opening in the wall of the pipe **(Exhibits 1 and 2)**. When water flows through the pipe the **flow switch** paddle is deflected by the running water **(Exhibits 3 and 4)**. This movement triggers the switch to close and send an alarm signal. To minimize false alarms due to pressure surges or air trapped in the sprinkler system, a mechanical delay is often used to postpone switch activation. Most time delays are adjustable from 0 to 90 seconds.

For optimal performance **flow switches** should be mounted in an area where there is adequate clearance for installation, removal and inspection. It is important that the **flow switch** is installed in the proper flow direction, which is indicated by an arrow on the product.

Exhibit 5

Flow switches should be installed at an adequate height above the floor to prevent damage. When installing a **flow switch** on horizontal pipe, the switch should be placed on top of the pipe to avoid build up of rust or other particles from collecting and interfering with the actuation of the device. When installing a **flow switch** on vertical pipes, make sure the switch is installed in an area where there is an upward flow.

For the accurate detection of water flow, **flow switches** should be installed at the proper distance from fittings that change the direction of flow in the pipe, from a drain, or from a valve. The manufacturer of the device provides these proper distances.

Paddle-type flow switches are to be installed in wet systems only. The impact from the sudden high-velocity surge of water when a dry-pipe valve trips could damage the **flow switch**; in addition, it could totally disengage the paddle and carry it downstream until it lodges in the piping, causing an obstruction. **Exhibit 5** shows a **paddle-type flow switch** improperly installed on a dry system.

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EST. 1905

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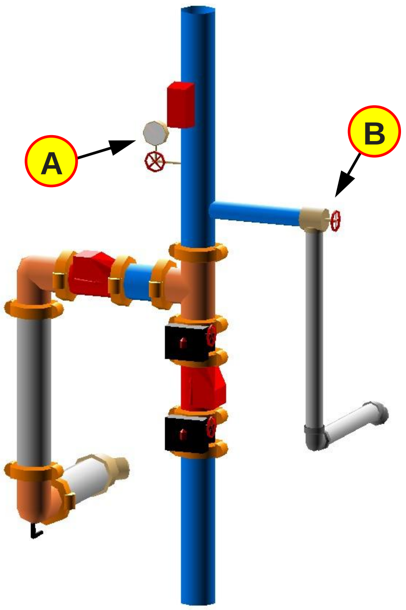
December 2011

Main Drain Test

The **main drain test** serves as a tool in evaluating the condition of the water supply to a fire sprinkler system. It is intended to reveal any deterioration of the water supply by comparing the test results to those of previous test results. Deterioration of the water supply could be caused by a major obstruction in the waterway, a control valve fully or partially closed, or the clapper of a check valve stuck to its valve seat. It is important to keep in mind that a **main drain test** is not intended to evaluate a water supply for hydraulic calculation purposes.

The **main drain test** is done when the system is commissioned (put into service), in order to establish the baseline of values. This initial test is commonly known as the “acceptance test.” The points of interest are the static pressure (no water flowing), and the residual pressure (with water flowing).

After the acceptance test a **main drain test** is required annually or any time the water supply control valve is closed, this includes any time a fire sprinkler system undergoes maintenance or repair. This test is essential to ensure that the water supply valve is fully open. Sprinkler systems perform exceptionally well, however, when they do fail the major cause of failure is because the water supply valve was closed, thus the verification of an open water supply valve cannot be over emphasized.



Typical Wet Pipe System Riser

The **main drain test** is conducted in the following manner:

1. Record the static pressure indicated on the supply gauge **(A)**.
2. Slowly open the main drain valve **(B)** to the fully open position and allow the water to flow until it runs clear and is stabilized.
3. Record the residual pressure indicated on the supply gauge.
4. Slowly close the main drain valve.
5. Record the time taken for the supply water pressure to return to the original static pressure.

Compare the results of the **main drain test** to those of previous tests, including the original acceptance test, to identify any deterioration of the water supply. When there is a 10% reduction in full flow pressure when compared to previously performed tests, the cause of the reduction shall be identified and corrected.

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STATE FIRE MARSHAL
EST. 1905

QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

January 2012

Fire Sprinklers – Service Period

Fire sprinklers have proven to be extremely reliable, long-lasting devices. If no fire incident occurs, fire sprinklers may sit idle for years. As a result of this idleness, the operation of the sprinkler itself cannot be verified without periodic testing. This testing is needed to identify potential problems that would otherwise go unnoticed.

After a specific **service period**, sprinklers shall be replaced or a representative sample of sprinklers shall be removed and sent to an approved testing laboratory for evaluation. The test frequency varies based on the type and use of the sprinklers.

Standard Response Heads

- Sprinklers in service for 50 years shall be replaced or a representative sample tested. Test procedures shall then be repeated at 10-year intervals.
- Sprinklers in service for 75 years shall be replaced or a representative sample tested. Test procedures shall then be repeated at 5-year intervals.
- Sprinklers with fast-response elements in service for 20 years shall be replaced or a representative sample tested. Test procedures shall then be repeated at 10-year intervals.

Fast Response (Quick response & residential)

- The failure rate of dry sprinklers in service for 10 years is approximately 50%. As such, dry sprinklers in service for 10 years shall be replaced or a representative sample tested. Test procedures shall then be repeated at 10-year intervals.
- Due to the phenomenon known as solder migration, solder-type sprinklers with an extra high temperature classification (325°F) or greater, exposed to high temperature conditions, shall be tested at 5-year intervals.
- Fire sprinklers subject to harsh environments shall be replaced or a representative sample tested at 5-year intervals. Some examples of these environments are, corrosive atmospheres, exposed to outside weather, cold storage areas (including walk-in refrigerators and freezers).
- Sprinklers manufactured prior to 1920 shall be replaced.

The representative sample of sprinklers shall be the greater of a minimum of 4 sprinklers or 1% of the number of sprinklers per individual sprinkler sample. For example, if a system contains 500 sprinklers (400 upright and 100 pendent), a total of 8 sprinklers shall be removed for testing.

- 400 uprights x 1% = 4
- 100 pendents x 1% = 1 (but not less than 4, therefore 4 pendents)
- 4 pendent + 4 upright = 8 total.

The term “individual sprinkler sample” pertains to the style of the sprinkler such as upright, pendent, etc.

Where one sprinkler within a representative sample fails to meet the test requirement, all sprinklers represented by that sample shall be replaced.

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EST. 1905

QUICK RESPONSE

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February 2012

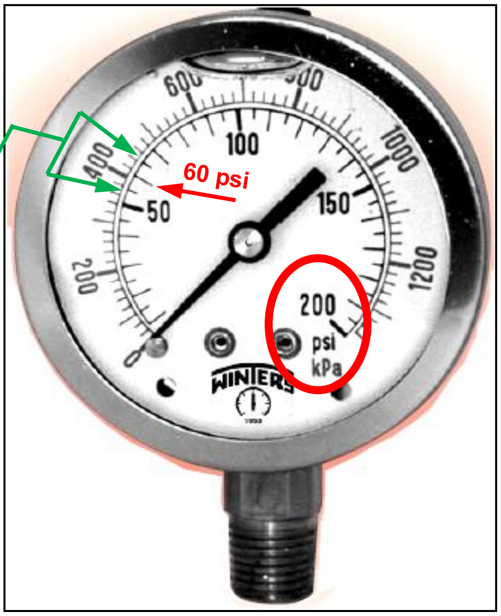
Pressure Gauges – Service Period

The life expectancy of a pressure gauge is generally 10 to 15 years. Since many of a fire sprinkler system tests and inspections rely on the accuracy of the system's pressure gauge(s), they shall be periodically tested or replaced.

According to **NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems***, gauges shall be replaced every 5 years or tested every 5 years by comparison with a calibrated gauge. Gauges not accurate to within ±3% of the maximum (full scale) gauge reading shall be recalibrated or replaced.

For example, the full scale of the pictured gauge is 200 psi and is installed on a sprinkler system with a normal pressure of 60 psi.

- 200 psi gauge ±3% = 200 x 0.03 = 6 psi
- Normal pressure = 60 psi + 6 psi = 66 psi
- Normal pressure = 60 psi - 6 psi = 54 psi
- The pictured gauge on a system with 60 psi normal pressure is permitted to read from 54 psi to 66 psi.



Each and every gauge on a system does not have to be tested for accuracy or calibrated. Comparing the reading of the tested or calibrated gauge to other gauges on the sprinkler system is permissible. For example, pressure gauges on systems that are installed in similar positions and elevations (e.g. on an adjacent riser) that show similar readings are acceptable.

QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

March 2012

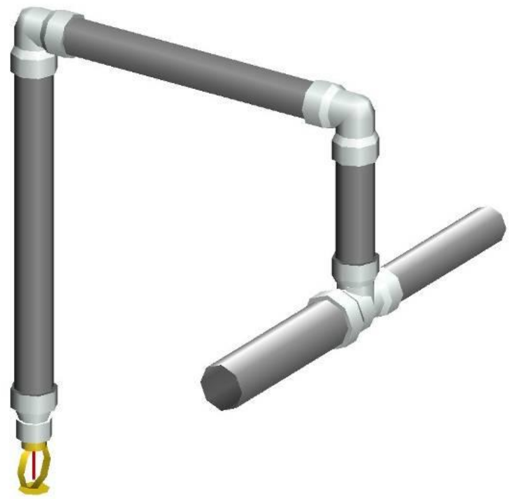
Return Bend

The purpose of a **return bend**, also known as gooseneck, is to prevent the accumulation of sediment, mineral deposits, and pipe scale in the pipe drop to a fire sprinkler. If these materials collect, the drop pipe or sprinkler orifice could be obstructed and impaired.

Return bends shall be utilized where pendent sprinklers are supplied from a raw water source, a mill pond, or open-top reservoir. These water sources have the potential of containing excessive sediment.

Pendent and sidewall sprinklers utilized in dry or preaction systems are permitted to be installed on **return bends** provided the sprinklers, **return bend**, and branch line piping are in an area maintained at or above 40°F.

Return bends are not required for deluge systems or where dry-pendent sprinklers are utilized. **Return bends** are also not necessary on wet systems that use a potable water supply.



Return Bend Arrangement

Since the objective of a **return bend** to avoid accumulation of sediment in the drop nipples, the **return bend** is required to be connected to the top of branch lines.

Another common use of a **return bend** is where exact positioning of a sprinkler head is desired, such as positioning of a sprinkler head in the center of a ceiling tile.

QUICK RESPONSE

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June 2012

Ball Drip

In areas subject to freezing, the piping between the fire department connection (FDC) and the FDC check valve is to be provided with an automatic means to drain water. This is most commonly done with the installation of an approved automatic **ball drip**. Without the **ball drip**, water would be trapped and during freezing weather that could cause an ice plug which would prevent the fire department from pumping into the system under fire conditions. Fire department connection components may also be damaged such as the cracked check valve indicated in *Exhibit 1*.

The **ball drip** is installed at the low point in the fire department connection piping of automatic sprinkler systems. Under fire conditions, water pressure from a fire department pumper pumping into the FDC automatically closes this valve. When the pressure ceases, the ball drip automatically re–opens, permitting this piping to drain and thereby preventing freezing.

It is important that the **ball drip** be installed in the proper orientation, horizontal or vertical, per the installation instructions.

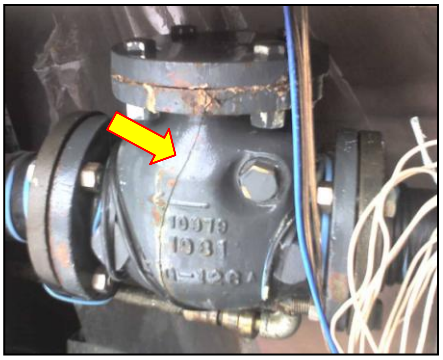

Exhibit 1

Exhibit 2 is a **ball drip** that is to be installed only horizontally. The internal ball **(A)** rests in the lower most area of the valve body allowing for proper drainage of moisture accumulation. Upon FDC pressurization, the internal ball is "pushed" into the small end of the ball drip body closing the opening. When pressure is removed, gravity returns the ball to its original position.

Exhibit 3 shows a **ball drip** that can be installed vertically. This type of **ball drip** utilizes a spring **(B)** loaded ball mechanism to maintain the valve open under normal conditions. As the inlet is pressurized, the ball is forced downward and the opening is closed. On decreasing pressure, the spring automatically reopens the valve.

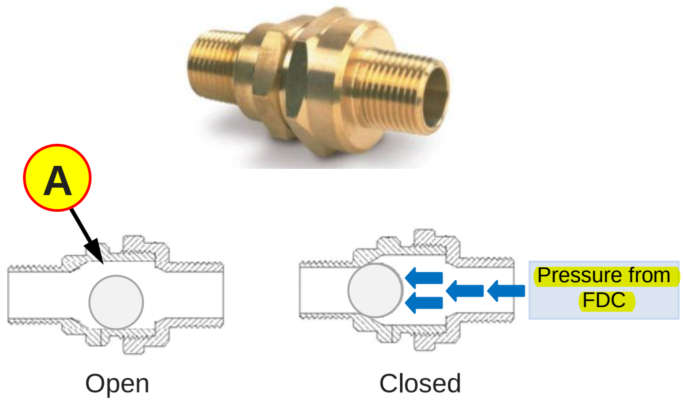

Exhibit 2 - Horizontal Ball Drip

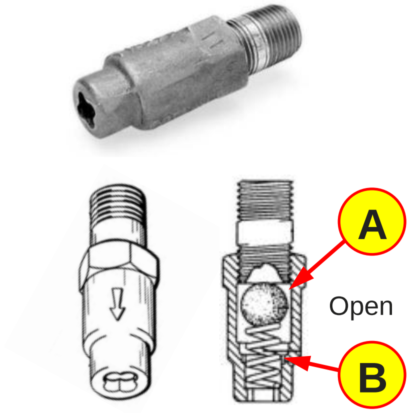

Exhibit 3 - Vertical Ball Drip

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QUICK RESPONSE

Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

November 2012

HORIZONTAL SIDEWALL SPRINKLER IN LINTELS AND SOFFITS

Horizontal sidewall sprinklers installed in a lintel or soffit shall be installed where the distance from the bottom of the lintel or soffit is within 4-inches (**Exhibit 1**).

When installed under a lintel or soffit, both the minimum distance from the bottom of the lintel or soffit to the sprinkler deflector **and** the maximum distance from the upper ceiling to the sprinkler deflector shall be maintained (**Exhibit 2**).

As pictured in **Exhibit 3**, where soffits used for the installation of **horizontal sidewall sprinklers** exceed 8-inches in depth or projection from the wall, additional sprinklers shall be installed below the soffit. Evaluation of a **horizontal sidewall sprinkler** includes its ability to project water to the back wall area of a soffit and wall. This ability decreases as the depth of the soffit increases. The 8-inch maximum soffit is viewed as the maximum practical depth.

When **horizontal sidewall sprinklers** are installed in a back-to-back configuration (**Exhibit 4**), additional sprinklers are not required below the soffit when the width of the soffit does not exceed 16-inches.

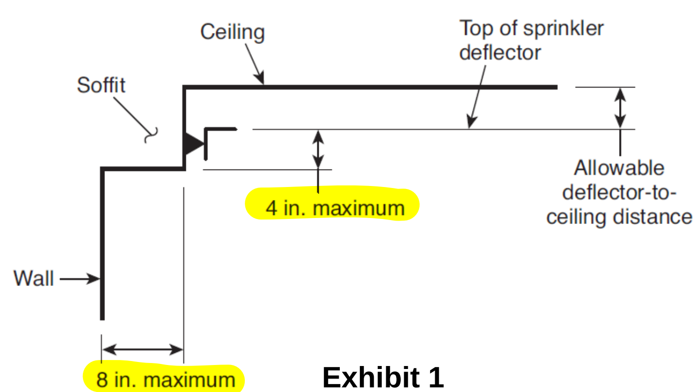


Exhibit 1

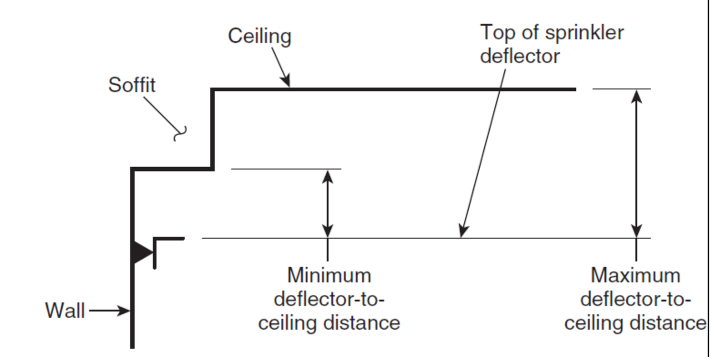


Exhibit 2

Exhibit 3

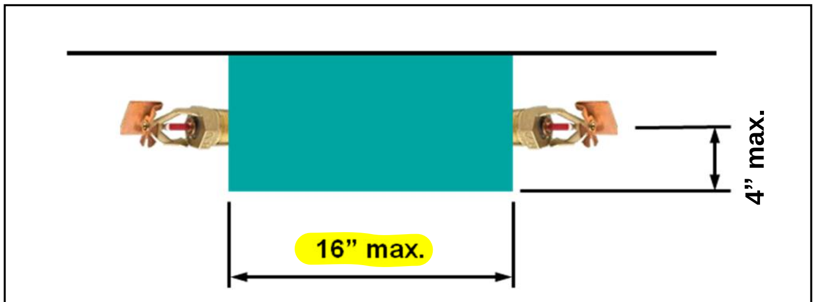


Exhibit 4

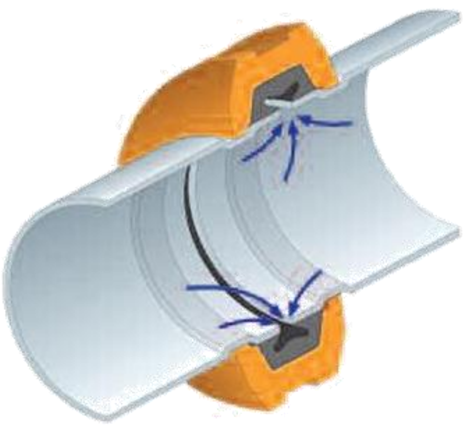
Saving life and property through effective licensing, plan review, and inspection of fire protection systems.

QUICK RESPONSE

December 2012

Coupling Gaskets for Dry Pipe Service

Grooved connections of fitting or valves need to be installed properly per their specific application. Not all couplings or gaskets are intended nor listed to be used for dry pipe service. As such, **NFPA 13** requires that grooved couplings, including gaskets used on dry pipe, preaction, and deluge systems, shall be listed for dry pipe service.



Coupling gaskets utilized for dry pipe service typically are exposed to extreme temperatures. The issue is not only freezing temperatures, but also the performance of the gasket when exposed to heat from a fire before it fills with water.

Coupling gaskets commonly referred to as Flush Seal or Tri-Seal Gaskets (**Exhibit 1**) differ from standard gaskets (**Exhibit 2**) by closing off the gap between the pipes or gasket cavity. This closure is accomplished by positioning the center "rib" of the gasket over the gap between the pipes. These gaskets have two tapered sealing edges, in addition to the center rib, for additional strength and sealing.

In addition to verifying that the coupling and gasket are correct for the application, it is important to verify the proper lubricant is used during installation. Standard lubricant is not recommended for dry pipe and freezer applications as it freezes and can cause leakage. For dry pipe and freezer applications, the use of a petroleum-free silicone lubricant may be required as part of the listing. Also petroleum based lubricants can deteriorate some grades of gaskets.

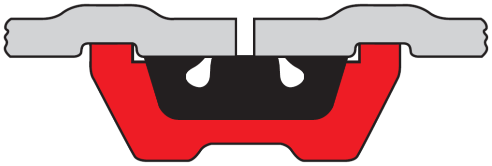


Exhibit 1 – Flush Type Coupling Gasket

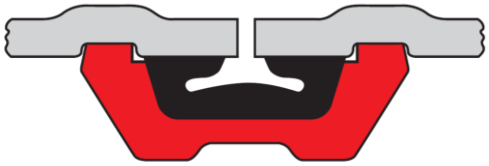


Exhibit 2 – Standard Coupling Gasket

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