PRESSURE REDUCING VALVES FOR FIRE PROTECTION SERVICE

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1.0 SCOPE

This data sheet provides guidelines for the sizing, selection, installation, and testing of pressure reducing valves in fire protection service.

1.1 Changes

April 2015. Interim revision. Figure 8, Form 2702, was updated and editorial changes were made.

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 Protection

2.1.1 Design water supply and fire protection systems to avoid or minimize the need for pressure reducing valves (PRVs). Designs of fire protection systems using a ''zoned system'' approach, as shown in Data Sheet 4-4N, *Standpipe and Hose Systems*, and proper selection of fire pumps can often eliminate excessively high pressures. In many cases, the need for pressure reducing valves can be eliminated, or the total number of valves needed can be reduced.

2.1.2 When the use of PRVs is unavoidable, use properly sized PRVs for the intended application. Sizing of PRVs is discussed in Section 3.

2.1.3 Do not use pressure reducing valves on sprinkler systems and hose connections where the static inlet pressure is 175 psi (12.1 bar) (1210 kPa) or less.

Table 1 gives the maximum allowed static and residual pressures at the outlet of hose connections in standpipe systems. When the static inlet pressure at 1-½ in. (38 mm) hose connections is 175 psi (12.1 bar) or less, use FM Approved (see Appendix A for definition) hose valves if it is necessary to limit the residual pressure at the outlet to the values given on Table 1.

Table 1. Maximum Static and Residual Pressures Allowed in Standpipe Systems in the U.S.A.[1]

Standpipe Class and Hose Size per Data Sheet 4-4N		*Max Press. Allowed at Outlet of Hose Connection*	
Standpipe Class	*Hose Size*	*Max Static Pressure psi (bar)*	*Residual Pressure[2,3] psi (bar)*
Class I	2½ in. (64 mm) Fire Dept. Use	175 (12.1)	Maximum: 175 (12.1) Minimum: 100 (6.9)
Class II	1½ in. (38 mm) Build. Occ. Use	175 (12.1)	Maximum: 100 (6.9) Minimum: 65 (4.5)
Class III	1½ in. (38 mm) Build. Occ. Use	175 (12.1)	Maximum: 100 (6.9) Minimum: 65 (4.5)
	2½ in. (64 mm) Fire Dept. Use	175 (12.1)	Maximum: 175 (12.1) Minimum: 100 (6.9)

Note 1: Other countries or jurisdictions may have different maximum static and residual pressure limits in standpipe systems.

Note 2: Minimum residual pressures should be available at the hydraulically most remote hose connection.

Note 3: Minimum residual pressures of 65 psi (4.5 bar) are allowed for 2-½ in. (64 mm) hose connections in locations where, based on suppression tactics, the local fire service allows minimum outlet pressures for 2-½ in. (64 mm) hose connections lower than 100 psi (6.9 bar). (See discussion on hose nozzles in Section 3.1.)

2.1.4 Operation charts for all models of pressure reducing valves used should be available on site for reference.

2.1.5 Provide each pressure reducing valve with a permanently attached placard that indicates valve setting pressure. For direct acting pressure reducing valves, the placard also should indicate the flow and inlet pressure used in setting the outlet pressure. For valves supplying automatic sprinkler systems, the sprinkler system design flow and pressure requirements at the valve outlet also should be indicated on the placard.

2.1.6 Use pilot-operated pressure reducing valves when it is necessary to take full advantage of the water supply available at the valve setting, such as in underground piping and when supplying multiple floors in a high-rise building. **Do not use pilot-operated valves in dry-pipe or preaction type sprinkler systems, since these valves generally require the upper chamber (cover chamber) of the valve to be full of water for proper operation of the valve.**

2.1.7 Direct-acting pressure reducing valves are acceptable for single hose connection applications or for the supply of individual sprinkler systems only. For system reliability purposes, do not use one direct acting PRV to supply multiple hose outlets or sprinkler systems on several floors.

2.1.8 Brass or bronze valves are preferred to minimize long term corrosion attack and mineral deposit buildup on the valve. Epoxy coating of iron valves is an alternative to the brass or bronze valves; however, the protective coating may be subject to damage by rocks or other debris in the pipeline.

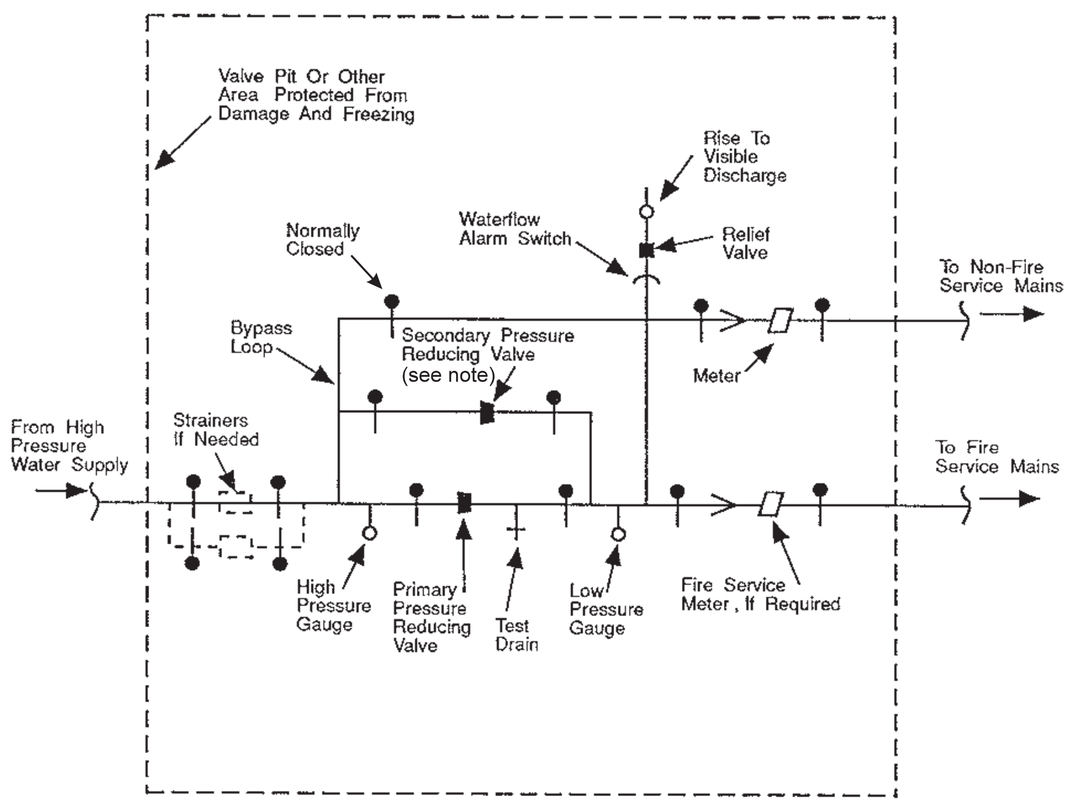
2.1.9 Carefully review and follow the manufacturers' instructions and recommendations for sizing, selection, installation and maintenance of the valves.

2.1.10 Size the relief valve and associated piping to prevent pressures above the pressure rating of components. Size the discharge drain for the flow rate required by the relief valve or the maximum flow rate to be handled by the PRV, whichever is greater. The minimum drain size is 1-½ in. (38 mm).

2.1.11 Installation of PRVs in underground piping systems

2.1.10.1 When a pressure reducing valve is needed to reduce only ''non-fire'' service water pressures, provide a separate fire service water connection without a pressure reducing valve.

2.1.11.2 When a pressure reducing valve is needed for non-fire service in addition to fire service water, arrange the second pressure reducing valve and non-fire service water connection as shown in Figure 1. This will allow isolation of the non-fire service water connection without affecting fire service water. This also allows regular exercising of the pressure reducing valve through normal draft



Note: A secondary PRV may be needed to handle low flow rates that may otherwise activate the larger primary PRV.

Fig. 1. Arrangement of pressure reducing valve for fire service and non-fire service

2.1.11.3 Provide a bypass loop around the pressure reducing valves, with a normally closed indicating control valve, to allow water for fire protection to be available in the event the pressure reducing valves are out of service. The bypass line should be of the same size as the main line.

2.1.11.4 Large pressure reducing valves may not provide accurate pressure regulation or may cavitate at low water flow rates. Thus, it is necessary to provide a smaller pressure reducing valve in parallel with the primary pressure reducing valve, as indicated in Figure 1. The smaller pressure reducing valve should be capable of regulating the pressure in the range of flows from ‘‘no flow’’ up to about 20% of the maximum flow rate capacity of the main valve. The main (larger) pressure reducing valve should be capable of regulating the pressure in the range of the upper limit of the smaller pressure reducing valve up to the maximum water demand. Each installation should be carefully engineered, taking into consideration the water supply, the water demand and the characteristics of the particular pressure reducing valves. If necessary, consult with the valve manufacturer to ensure correct valve settings and installations.

2.1.11.5 Provide FM Approved indicating control valves as shown in Figure 1 to allow:

a) Isolation of each pressure reducing valve for maintenance.

b) Isolation of the bypass loop around the pressure reducing valves. The indicating control valve is normally closed and can be opened in an emergency. This valve should be exercised regularly to ensure operation during an emergency.

c) Isolation of non-fire service mains from fire service mains.

2.1.11.6 Provide check valves and pressure gauges as shown in Figure 1.

2.1.11.7 Locate any water flow meters on the outlet side of pressure reducing valves.

2.1.11.8 Locate all pressure reducing valves in dry, accessible areas, arranged for convenient maintenance and testing.

2.1.11.9 Provide a 1-½ in. (38 mm) or larger test drain on the downstream side of the pressure reducing valve. The test valve and piping should be at least one-half the nominal size of the largest pressure reducing valve. If an extension pipe longer than 15 ft (4.6 m) or hose fitting is needed to discharge water from the test drain, use at least the next larger size test valve and drain piping to compensate for the added friction loss.

2.1.11.10 Provide a pressure relief valve, water flow alarm switch, and check valve on a separate tee off the underground piping system as shown in Figure 1. Size the pressure relief valve and associated piping according to Section 3.1. Discharge should be visible and directed to a safe location. Set the pressure relief valve at the pressure rating of the piping system, or at 10 psi (69 kPa) (0.69 bar) above the maximum available system pressure, whichever is less. This will enable a leaking pressure reducing valve to be detected by the water flow alarm and repaired.

2.1.12 Installation of PRVs in individual sprinkler systems:

2.1.12.1 Arrange the valve installation as shown in Figure 2. This is the typical arrangement for pressure reducing valves used on individual sprinkler systems, such as would be typical at each of the floors of a high-rise building that are exposed to excessively high water pressures.

2.1.12.2 Provide an indicating control valve upstream from the pressure reducing valve to allow isolation of the pressure reducing valve for maintenance. This valve also provides control for the individual sprinkler system at each floor.

2.1.12.3 Provide a check valve, water flow alarm switch and pressure gauges as shown in Figure 2. A check valve is not needed for PRVs that have a check valve function incorporated in their design.

2.1.12.4 Provide a pressure relief valve and associated piping, a test valve and associated piping, a drain valve and associated piping, and a sight glass with flow indicator as shown in Figure 2. Or alternatively use an FM Approved ‘‘sprinkler system alarm tester.’’

2.1.12.5 Size the pressure relief valve and associated piping according to Section 3.1. Set the pressure relief valve 10 psi (0.69 bar) below the pressure rating of the sprinkler system or maximum allowable system pressure. This will enable a leaking pressure reducing valve to be detected and repaired.

The test valve and associated piping, should be 1 in. (25 mm) in size, with a ½ in. (13 mm) restricted orifice downstream. This will allow testing of the water flow alarm by simulating the flow through one sprinkler.

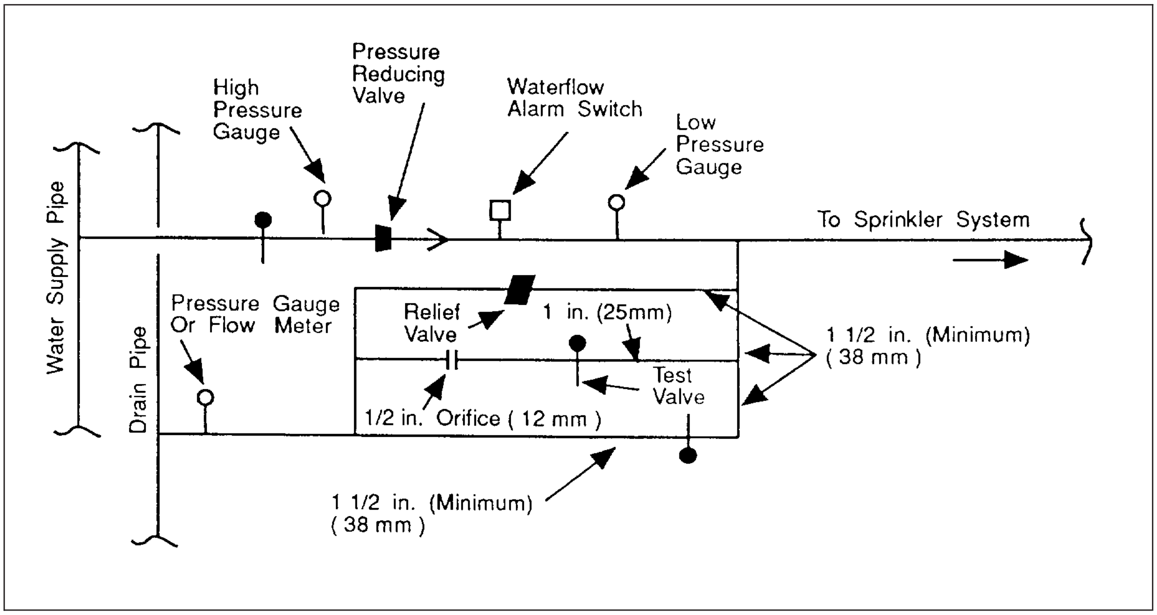


Fig. 2. Pressure reducing valve installation for individual sprinkler system

The drain valve and associated piping should be sized according to Section 3.1. The minimum size of the drain line is 1-½ in. (38 mm) or at least one-half the size of the pressure reducing valve.

2.1.12.6 For testing purposes, install a pressure gauge or flow meter downstream of the inspector's test valve so that the flow rate past the valve during testing can be determined. This gauge or flow meter should be installed as close as possible to the point where the floor drain meets the riser drain.

2.1.12.7 Locate all pressure reducing valves in dry, accessible areas, arranged for convenient maintenance and testing.

2.1.12.8 In combined standpipe sprinkler systems, connect all test and drain lines to the 3 in. (76 mm) minimum test drain riser discussed in Section 2.1.13.3.

2.1.13 Installation of PRVs in hose outlets in standpipe systems:

2.1.13.1 Install PRVs on the hose outlet as shown in Figure 3.

2.1.13.2 Provide a valved outlet for a pressure gauge on the upstream side of the hose connection, leaving ample space for a test gauge to be installed at the connection (Fig. 3). This gauge outlet is needed for testing the PRV installed at the hose connection.

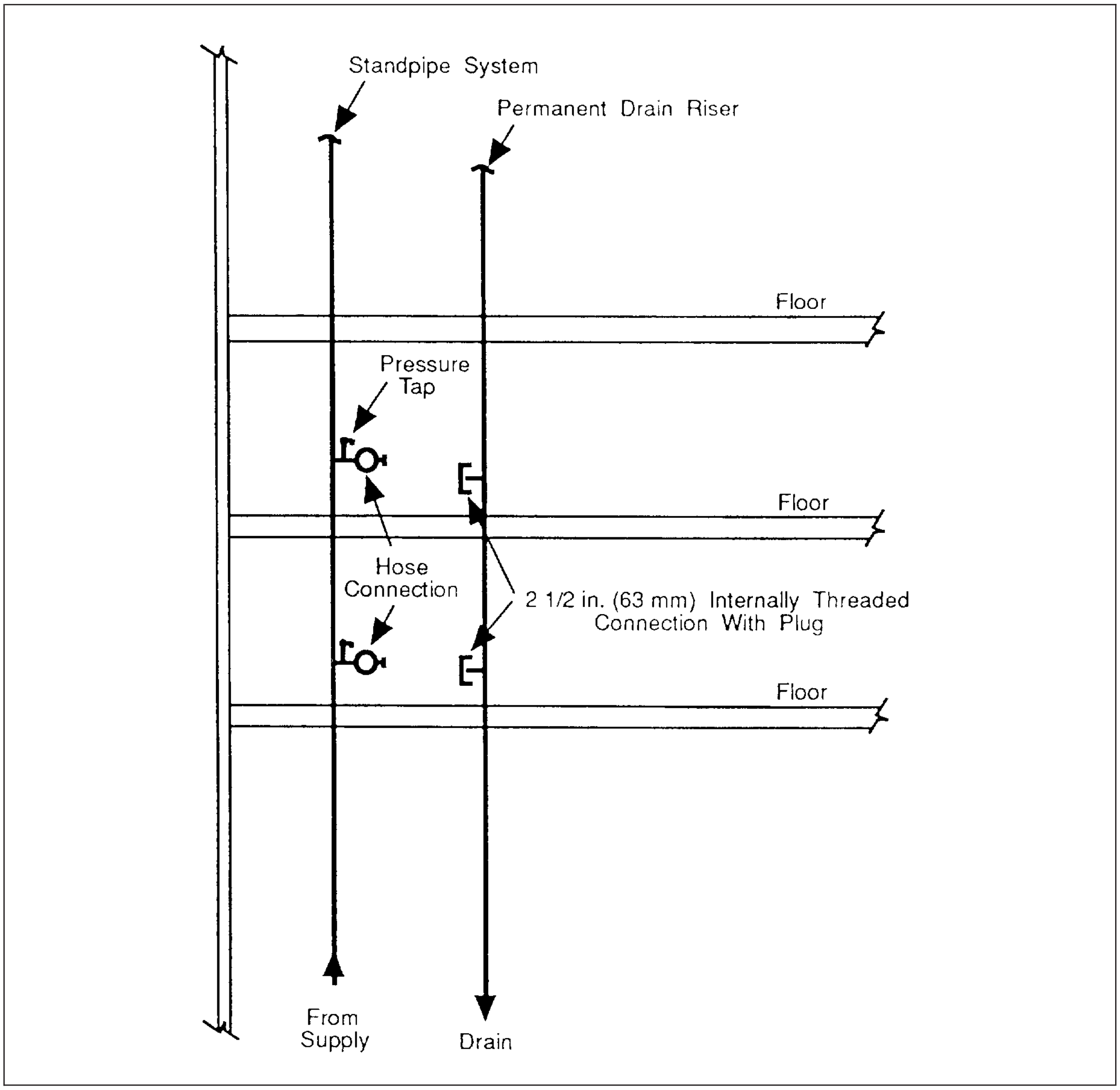


Fig. 3. Pressure reducing valve installation on hose outlets in a standpipe system

2.1.13.3 Install a 3 in. (76 mm) permanent drain riser adjacent to each standpipe equipped with pressure reducing valves, or provide a means for full flow testing of pressure reducing devices installed in the hose connection. The installation of a drain riser will facilitate testing of the hose connection as well as the sprinkler system valves. The riser should be equipped with a 3 in. (76 mm) × 2-½ in. (64 mm) tee with internal threads, with plug, located at every floor; this will allow for connection between the drain riser and the test apparatus needed for conducting full flow tests on the PRVs used in hose connections (Fig. 4).

2.2 Operation and Maintenance

This section gives minimum inspection and testing frequencies for PRVs. Regular testing and maintenance of pressure reducing valves are necessary to maintain the valves in good operating condition.

Any malfunction of the valves should be promptly investigated and corrected. A gradual increase in the outlet pressure may indicate a serious problem with the valve, which needs to be promptly investigated and corrected to prevent water leakage losses caused by breakage of pipe and fittings downstream of the PRV due to excessively high pressures.

2.2.1 Direct Acting Valves Supplying Sprinkler Systems

2.2.1.1 The recommended maintenance and test schedule of valves controlling the supply of water to sprinkler systems should be in accordance to Table 2.

2.2.1.2 Valves should be visually examined every week in accordance with Section 2.2.4.

2.2.1.3 Valves should be physically inspected every month in accordance with Section 2.2.5. After installation of the valve, and monthly thereafter, test the PRVs during the water flow alarm test of the system through use of the inspector's test valve. Record the static and residual inlet and outlet pressures of the valve. Compare monthly test results with bench mark data collected during installation of the valve. Investigate any changes in test results.

2.2.1.4 Immediately after installation or repair, and once a year after that, a full flow test should be conducted on the valves. The Annual Performance Test Record of Pressure Reducing Valves form (Form 2707) should be used for all full flow tests (Fig. 8 in Appendix C). Local water supply conditions may indicate the need for more frequent testing, such as when the water is ''hard'' or is considered corrosive to the valve.

Table 2. Test Frequency for PRVs Installed in Fire Protection Systems

	Equipment		
Activity	*Sprinkler System Floor Control Valves*	*Hose Connection Hose Rack Valves*	*Underground Main & Pilot Operated Valves*
Visual Inspection	Weekly	Weekly	Weekly
Physical Inspection	Monthly	DNA[1]	DNA[2]
Operational Test	Monthly	DNA	DNA
Full Flow Test	Yearly	Yearly	Yearly

Note 1: Physical inspections, although desirable, generally cannot be conducted on hose valves without flowing water; hence physical and operational tests of PRVs installed in hose connections and hose racks do not apply.

Note 2: Valves used in underground mains and pressure zones are generally of the pilot-operated type. These valves have no handwheel that can be opened and closed for the physical test; hence, physical testing of these valves does not apply.

2.2.2 Direct Acting Valves in Hose Connections

2.2.2.1 Maintenance and test schedule of valves used in hose connections should be in accordance with Table 2.

2.2.2.2 Valves should be visually examined every week.

2.2.2.3 Immediately after installation or repair, and once a year thereafter, conduct a full flow test on the valves. The Annual Performance Test Record of Pressure Reducing Valves form (Form 2707) should be used for all full flow tests. Local water supply conditions may indicate the need for more frequent testing, such as when the water is ''hard'' or is considered corrosive to the valve.

2.2.2.4 To prevent water damage during testing, do not test the system by running charged fire hoses through floors or up and down stairways. All testing should be done in place to reduce costs and chances for human error in reinstallaling the devices. Use the test drain connection for flow testing the system.

2.2.2.5 Install a test gauge on the gauge outlet provided upstream of the hose connection. Connect the PRV outlet to the test drain connection using a test line provided with a gauge for measuring the PRV outlet pressure; a flowmeter; and a gate valve for controlling the flow (Fig. 4).

2.2.3 Pilot Operated Valves in Underground Mains and Other Applications

2.2.3.1 Maintenance and test schedule of valves used in underground fire main and pump houses should be in accordance with Table 2.

2.2.3.2 Valves should be visually examined every week.

2.2.3.3 Every time the system is drained, eliminate air pockets from the valve cover by bleeding the cover chamber following the manufacturer's instructions. For proper operation of pilot operated valves, it is necessary that the chamber be filled with water; therefore, when pilot operated PRVs are provided in installations with vertical fire pumps, the valves should always be located downstream of the check valve.

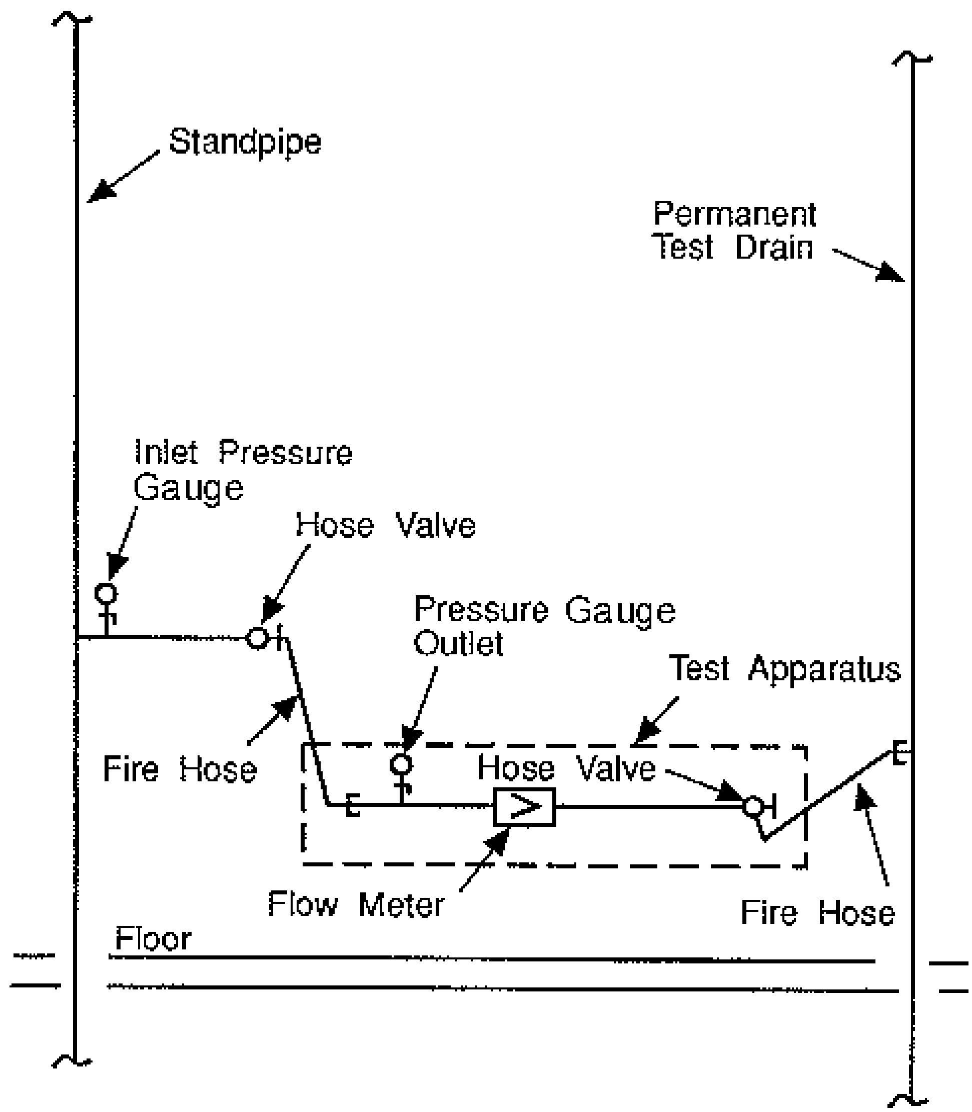


Fig. 4. Arrangement of annual full flow test on valves used in hose connections

2.2.3.4 Pilot operated valves should not be used in dry-pipe systems.

2.2.3.5 Immediately after installation or repair, and once a year after that, conduct a full flow test on the valves. The Annual Performance Test Record of Pressure Reducing Valves form (Form 2707) should be used for all full flow tests. Local water supply conditions may indicate the need for more frequent testing, such as when the water is ‘‘hard’’ or is considered corrosive to the valve.

2.2.3.6 Test indicating gate valves installed on the bypass line to the PRV by opening and closing them. This test is important for the reliability of the system. Indicating gate valves on bypass piping should preferably be tested on the same frequency as other indicating control valves installed in the system, but not less then once a year during testing of the PRV.

2.2.4 Visual Inspections

2.2.4.1 Visually inspect all pressure reducing valves weekly. For valves that have open/close indicators, ensure that they are open and locked. In high-rise buildings, make sure valves are installed on the correct floor. Check pressure gauges to make sure the system is pressurized and that the inlet and outlet pressures at the PRV have not changed significantly. Check both the PRV and its relief valve for signs of leakage; in case of leakage, examine the packing glands or stuffing boxes of the valve, but do not tighten them since this will cause sluggish operation of the valve.

2.2.5 Physical Inspections

2.2.5.1 Physically inspect the valves by opening and closing the gate valve located in the drain line downstream of the PRV, and allowing for sufficient time for flow to become established in the drain line. This operation forces the PRV to automatically open and close.

In high-rise buildings, this test may be combined with the monthly test of the flow switches in the fire alarm system, which requires flowing of water through the inspector’s test valve at each floor of the sprinkler system.

3.0 SUPPORT FOR RECOMMENDATIONS

3.1 Use of Pressure Reducing Valves in Fire Protection Service

In fire protection service, pressure reducing valves can be found on standpipes and sprinkler systems in high-rise buildings, in underground piping, in pump houses, and on public and private gravity water systems. Other uses may exist if warranted by specific local conditions.

A common application of pressure reducing valves is in the connection for hose and sprinkler systems in combined standpipe/sprinkler system risers in high-rise buildings. In these combined systems, PRVs are used to keep maximum pressures at the hose connections within the limits given in Data Sheet 4-4N, *Standpipe and Hose Systems*, and the maximum static pressure in sprinkler system components within the limits given in Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*.

3.1.1 Sizing and Selection of Pressure Reducing Valves

Correct sizing of a PRV is an important step in system design. Under static condition a PRV needs to be able to prevent outlet static pressures from exceeding the rated pressure of system components, or the maximum allowed system pressures given by Data Sheet 2-0 and Data Sheet 4-4N. Under flowing conditions, the valve needs to be able to use the available inlet supply pressures to deliver the flow rates and outlet pressures required by the fire protection system(s) being supplied through the valve.

Consider the following when sizing PRVs:

- The maximum available inlet static pressure.
- The maximum allowable outlet static pressure.
- The minimum available inlet residual pressure.
- The minimum required outlet residual pressure.
- The range of required flow rates through the valve.
- The different water supplies available for the system.

The maximum available inlet static pressure at the valve is a function of the maximum static pressure of the water supply and the elevation of the valve.

The maximum allowable outlet static pressure is a function of the pressure rating of system components or code regulations.

The minimum available inlet residual pressure at the valve is a function of the minimum static pressure of the water supply, the elevation of the valve, and the friction loss calculated for the maximum flows expected in the operation of the piping system supplying the pressure reducing valve, e.g., the standpipe system in high-rise buildings.

The required residual outlet pressure at the valve is a function of the water demand and hydraulics of the system being supplied through the PRV.

1. a) *Inlet Supply.* Based on the hydraulic characteristics of the inlet supply piping, determine the maximum inlet static pressure and the minimum inlet residual pressures anticipated to be available at the valve.

   In high rise buildings, for the purpose of sizing direct acting PRVs in sprinkler systems and hose connections, determine the minimum available inlet residual pressures at the valve, for each design floor, based on the expected flows in the standpipe system given on Table 3.

Table 3. Standpipe Flows for Determining Minimum Available Inlet Pressures at PRVs in High-Rise Buildings

Type of Standpipe System	*Sprinkler Protection*	*Standpipe Flow Rate for Determining Available Inlet Pressures at PRV*
		Maximum Flow gpm (l/min)
Class I	None	500 (1900)
Class II	None	100 (380)
Class III	None	500 (1900)
Combined	Fully Sprinklered Building	500 (1900)
Combined	Partially Protected Building	Sprinkler Demand plus 500 gpm (1900 l/min)

   b) *Required Flow Rates Through the Valve.* Based on the characteristics of the fire protection system being supplied by the valve, determine the flow rates that the valve is required to handle. This is the required flow rate downstream of the valve.

   In high-rise buildings, determine the required flow rates for the purpose of sizing direct-acting PRVs in sprinkler systems and hose connections based on Table 4. For sprinkler systems, the flow rate varies with the system demand. For hose connections, the design flow rates are dependent only on the class of the standpipe system (Class I, II, or III).

Table 4. Required Flow Rates for Sizing of PRVs in High-Rise Buildings

Type of System where PRV is Installed		*Required Flow Rates through PRV*
		Maximum Flow, gpm (l/min)
Automatic Sprinkler Systems		*System Demand*
Hose Connections	Class I Standpipe	250 (950)
	Class II Standpipe	100 (380)
	Class III Standpipe	250 (950)

   c) *Required Outlet Residual Pressure*. Based on the characteristics of the system being supplied by the PRV, determine the outlet residual pressures required at the valve to supply the flow rates determined in Item 1(b) above.

   The outlet pressure requirement for pressure reducing valves to be installed in hose connections is a function of the type of hose nozzle to be used on the fire hose and the friction loss through the hose. Hose nozzles require a certain amount of pressure at the nozzle so that proper spray or jet stream patterns can be achieved during fire fighting. ''Smooth bore'' fire hose nozzles require 50 psi (3.4 bar) at the nozzle to produce a useful jet stream, and ''combination'' type nozzles (also called fog nozzles), i.e., nozzles that produce both fog and jet (straight) stream patterns, require pressures of 100 psi (6.9 bar) at the nozzle. (Source: NFPA 14, *Installation of Standpipe and Hose Systems)*

   For Class I and III and combination standpipe systems, the local fire department should be consulted for information on the type of hose nozzles used and required nozzle pressures, and information about the fire department's fire suppression tactics for high-rise buildings.

d) *Style of Valve and Connections*. Determine the style of valve (globe or angle) and the style of the connections needed on the inlet and outlet of the valve, i.e., flanged, grooved or threaded.

Determine the best suited valve for the specific application and service intended through Recommendation Nos. 2.1.5 to 2.1.8.

3.1.1.1 Sizing Direct-Acting PRVs

The valve size and setting selected must be able to perform two functions:

a) limit the outlet static pressure to acceptable levels, and

b) handle the water demands of the system within the range of inlet pressures available at the valve.

Sizing of direct-acting PRVs is based on flow charts available from the manufacturer of the valve. It is customary for manufacturers of direct-acting valves to provide flow charts showing a plot of the outlet pressure versus the inlet pressure for a given flow rate through the valve (Fig. 5). In these graphs, each curve represents the performance of the valve at a given pressure setting.

Other manufacturers provide flow charts that show a plot of the outlet pressure versus the flow rate through the valve for a given inlet pressure range or condition (Fig. 6). This type of chart gives better indication of the valve performance than the previously described "inlet pressure vs. outlet pressure" charts.

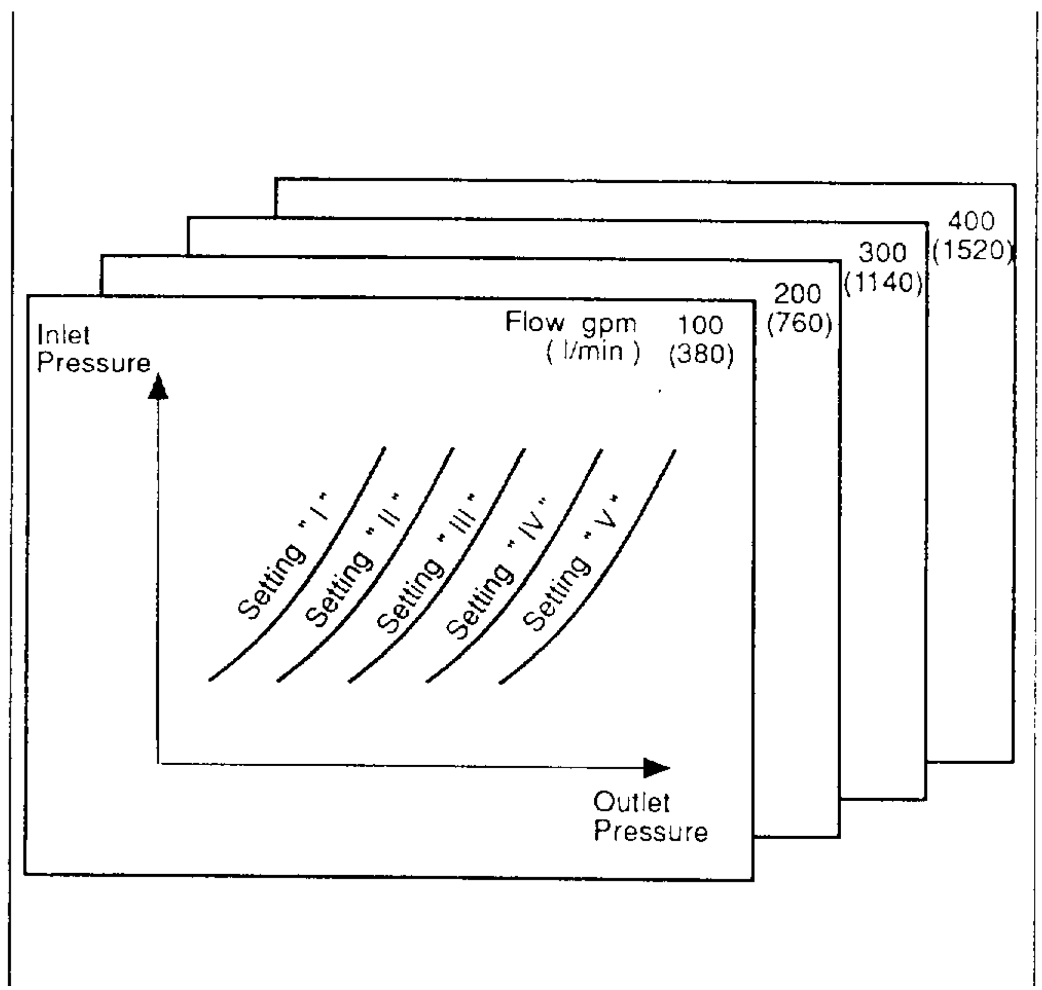


Fig. 5. Flow chart showing plot of outlet pressure versus inlet pressure for a given flow rate

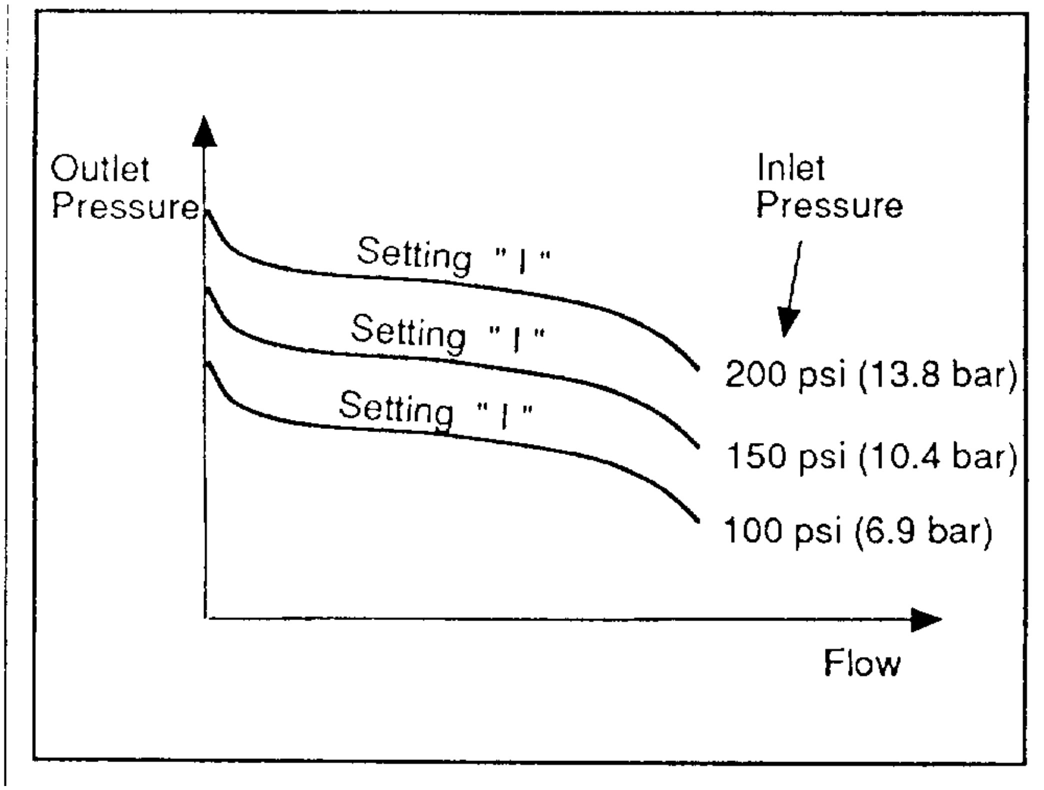


Fig. 6. Flow chart showing plot of outlet pressure versus flow rate through the valve for a given inlet pressure range

3.1.1.2 Sizing Pilot-Operated PRVs

Similar to direct-acting valves, pilot-operated valves should be sized and set to handle both the minimum and maximum water demands of the system, and to prevent excessive outlet static pressures. The valve should be sized to operate within 20% to 80% of its maximum flow rate capacity to avoid instability, system oscillation and damage to the seat and trim caused by localized high velocities, and to ensure adequate differential across the valve so that the valve can provide quick controlled response. Therefore, in a system where there is a wide flow range, *parallel* installation of two or more valves may be required. In a system where a large pressure drop is needed, installation of two or more valves *in series* may be necessary.

Sizing of the valves is done with the aid of ‘‘high’’ and ‘‘low’’ flow sizing graphs as shown in Figure 7. These charts show a plot of the maximum pressure drop across the valve as a function of the flow rate. Charts and sizing instructions can be obtained from the manufacturer of the valve.

3.1.1.3 Sizing Drains and Relief Valves

Sizing of the relief valve and drain to be installed downstream of the PRV is important to ensure that in the event of leakage or failure of the PRV, excess pressure in the piping system will be relieved. Flow through the pressure relief valves also will cause the water flow alarm on sprinkler systems to sound, alerting building occupants of the problem with the pressure reducing valve. Properly designed drains will accommodate the flows required during testing of the pressure reducing valves.

3.1.2 Installation

In general, good installation practice for PRVs should include a bypass to permit emergency use of the system or maintenance without shutting off the supply, a relief valve downstream of the PRV to relieve the system of excess pressure should the PRV malfunction, and pressure gauges both upstream and downstream of the valve for setting and checking the PRV.

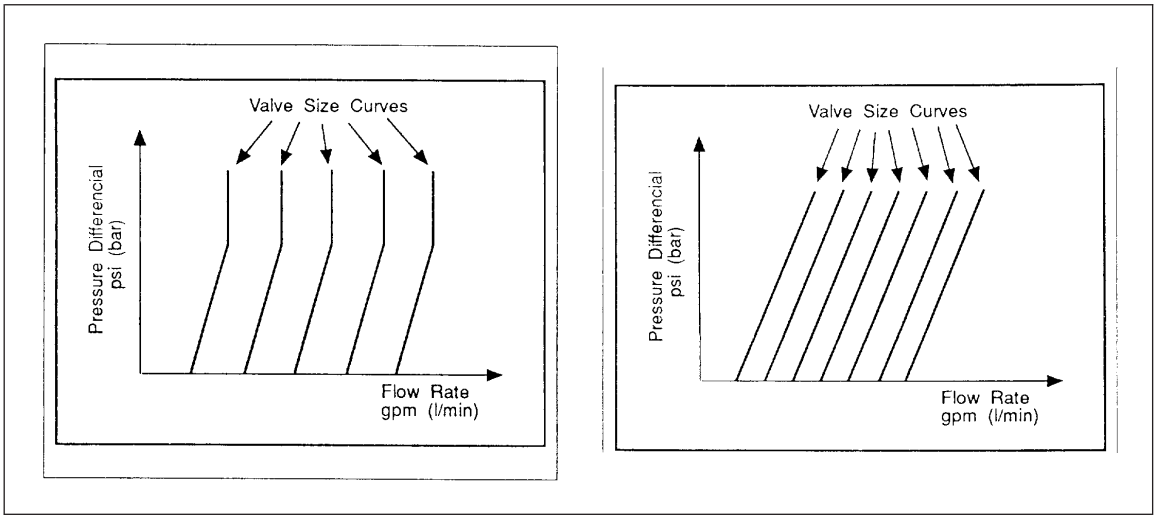


Fig. 7. Flow sizing graphs showing plot of maximum pressure drop across valve as a function of flow rate

Keep all pipe strains off the valves by providing pipe supports (hangers) on either side of the valves and independent support for large heavy valves. The valves should not carry the weight of the piping system.

To reduce the possibility of foreign material becoming lodged in the valves, pressure reducing valves should be installed in a horizontal orientation with the stem up. The installation site should be accessible. Provide sufficient clearance to allow proper operation and maintenance of the valves; this is particularly important with rising stem valves.

Some direct-acting pressure reducing valves are tagged with a ''set pressure'' and must be installed at the factory-designated floor; this tag should not be removed nor should the valve be installed in any other location without factory agreement.

Any special tools required to adjust the setting of field-adjustable direct-acting pressure reducing valves should be available on-site.

Installation guidelines that apply to most common applications of PRVs in fire protection service are found in Recommendation Nos. 2.1.10, 2.1.11 and 2.1.12.

4.0 REFERENCES

4.1 FM Global

Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*
Data Sheet 4-4N, *Standpipe and Hose Systems*

4.2 NFPA Standards

NFPA 14, *Installation of Standpipe and Hose Systems*, 1996.

NFPA 13, *Installation of Sprinkler Systems*, 1996.

APPENDIX A GLOSSARY OF TERMS

Angle Valve: a manually operated valve with its outlet opening oriented at right angles to its inlet opening; used for regulating flow of a fluid in a pipeline.

Direct-Acting Valve: a pressure reducing or relief valve in which the position of the valve (disk) is controlled directly by the reaction of a mechanism acting on the stem of the valve (typically a pre-loaded spring) to any changes in inlet and outlet pressures of the system.

FM Approved: products and services that have satisfied the criteria for FM Approval. Refer to the *Approval Guide* for a complete listing of products and services that are FM Approved.

Factory Set: pressure reducing valves that have their outlet pressure set by the manufacturer and do not allow any adjustment of the set pressure in the field. This term generally applies to direct acting PRVs only.

Field Set: pressure reducing valves that allow field adjustments of the manufacturer's set pressure, also called ''Field Adjustable.'' This term applies to direct acting and pilot operated PRVs.

Globe Valve: a device for regulating flow in a pipeline consisting of a movable disk-type element and a stationary ring seat in a generally spherical body. Globe valves are closing-down valves in which the closure disk-type member mentioned above is moved squarely on and off its seat. By this mode of disk travel, the seat opening varies in direct proportion to the travel of the disk, thus making the valve ideally suited for tasks where regulation of the flow rate is required.

Inlet Pressure: pressure acting on the inlet side of the valve, also referred to as upstream pressure.

Outlet Pressure: pressure acting on the outlet side of the valve, also referred to as reduced pressure or downstream pressure.

Pilot-Operated Valve: a pressure reducing or relief valve that is controlled by a pilot mechanism that senses the inlet and outlet pressures in the pipeline where the valve is installed, and pilots the main valve open or closed. Other terms used for pilot operated pressure reducing are *flow control* valves or *pressure control* valves.

Pressure Reducing Valve: a valve used to reduce high inlet fluid pressures (water in the case of valves used in the fire service) to a lower outlet pressure in both the static (no-flow) condition and the flowing (residual) condition.

Pressure Relief Valve: a valve used to relieve a system of excess pressure by opening when the pressure in the system exceeds a set limit. The valve re-closes when the abnormal pressure drops below the set limit.

Reduced Pressure Fall Off: the decrease in outlet pressure that occurs when the flow passing through the pressure reducing valve increases.

Residual Pressure: the pressure head acting at a given point of the system with flow being delivered by the system.

Set Pressure: the definition of set pressure varies according to the type of valve as follows:

- For pressure relief valves, it is the pressure at which the valve starts to open.
- For direct-acting pressure reducing valves, the setting of the valve may be given as a code or letter that specifies the performance of the valve for a given flow condition. When a specific value of pressure is given as the valve ''set pressure,'' this may refer to the maximum outlet static pressure of the valve.
- For pilot operated pressure reducing valves, it is the outlet residual pressure for which the pilot regulator of the valve has been adjusted and is expected to maintain, regardless of changing flow rate and varying inlet pressures.

Standpipe: in a multi-story building, it is the riser portion of the fire protection piping system that delivers the water supply for hose connections and sprinklers vertically from floor to floor. A standpipe that supplies both hose connections and sprinkler systems is called a *combination* standpipe.

Static Pressure: the pressure head acting at a given point of the piping system with no flow being delivered by the system.

APPENDIX B DOCUMENT REVISION HISTORY

April 2015. Interim revision. Figure 8, Form 2702, was updated and editorial changes were made.

September 2000. This revision of the data sheet has been reorganized to provide a consistent format.

February 1995. First Issue.

APPENDIX C FORMS

ANNUAL PERFORMANCE TEST RECORD FOR
PRESSURE REDUCING VALVES (PRV)

FM Global

Property Name	Index Number	Account Number
Property Address	Operations Center Location	

INSTRUCTIONS

1. Conduct a Full Flow Test on each PRV on site in accordance with FM Global Data Sheet 3-11.
2. Use a separate form for each valve.
3. Keep a copy of form on site for review of test record.

Valve Manufacturer's Name	**Model Number**	**Type of Valve** ☐ Pilot Operated ☐ Direct Acting	**Installation At:** ☐ Sprinkler System ☐ Hose Connection ☐ Fire Main ☐ Other
Year Installed			

Date & Initials	Location of Valve (e.g. Floor No. Standpipe No.)	Valve Setting Per Manufacturer Specs.	Static Pressure		Residual Pressure		Flow Rate (gpm)	Performance S=Satis. U=Unsatis.	Red Tag Permits Used		Comments/ Corrective Action Needed
			Inlet (psi)	Outlet (psi)	Inlet (psi)	Outlet (psi)			Yes	No	
									☐	☐	
									☐	☐	
									☐	☐	
									☐	☐	
									☐	☐	
									☐	☐	
									☐	☐	
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									☐	☐	
									☐	☐	
									☐	☐	
									☐	☐	
									☐	☐	

The FM Global *RED TAG PERMIT SYSTEM* is used to guard against shut valve fires, and should be used every time a sprinkler control valve or pressure-reducing valve is closed. When the valve is reopened, a downstream main drain or waterflow alarm test connection should be flowed to confirm the valve has been reopened. The valve should then be relocked in the full-open position.

Were any valves closed since the last inspection? ☐ Yes ☐ No	
If inspected by Contractor (Contractor's Name)	Signature:
Address	Date:
Reviewed By:	Date:

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Fig. 8. Form 2707, Annual Performance Test Record of Pressure Reducing Valves