***EXHIBIT 13.19** Butterfly Valve with Built-In Supervisory Switch (Not Wired).*

Paragraphs 13.3.2.1 through 13.3.2.1.2 take users of NFPA 25 through a progression of valve supervision (or nonsupervision) arrangements. While this standard does not require valve supervision, it does permit extending inspection frequencies in this case, based on the presence of supervision. These paragraphs illustrate the value of supervision in that valve inspection frequencies range from weekly for unlocked and unsupervised valves to quarterly for those that are electronically supervised.

13.3.2.1.3 Control valve supervisory alarm devices shall be inspected quarterly to verify that they are free of physical damage.

13.3.2.1.4 After any alterations or repairs, an inspection shall be made by the property owner or designated representative to ensure that the system is in service and all valves are in the normal position and properly sealed, locked, or electrically supervised.

13.3.2.2* The valve inspection shall verify that the valves are in the following condition:

(1) In the normal open or closed position
(2)* Sealed, locked, or supervised

A.13.3.2.2(2) The purpose of the valve sealing program is as follows:

(1) The presence of a seal on a control valve is a deterrent to closing a valve indiscriminately without obtaining the proper authority.
(2) A broken or missing seal on a valve is cause for the plant inspector to verify that protection is not impaired and to notify superiors of the fact that a valve could have been closed without following procedures.

ITM Deficiency, Impairment, or Hazard Evaluation?

ANSWER: Impairment

While performing the inspection required by 13.3.2.1.1, this normally open water control valve was found in the closed position. When the indicating flag is parallel to the piping, the valve is open, and when perpendicular, the valve is closed. The flag position will also indicate when a valve is only partially open. The water gauge is showing no water pressure below the seat of this dry pipe valve, which is another indicator of a closed water control valve.

This system will not function at all during a fire event and should be considered impaired. The impairment procedures in Chapter 15 should be implemented immediately.

(Courtesy of John Johnson, Tyco Fire Protection Products)

ITM Deficiency, Impairment, or Hazard Evaluation?

ANSWER: ITM Deficiency or Impairment

At first glance, this post indicator valve (PIV) and post appear to be just fine, with the wrench attached and locked and no physical damage. However, upon closer examination, the target that indicates whether the valve is open or shut is not visible in the window. In 13.3.2.2(1), the inspector is required to verify whether the water control valve is "in the normal open or closed position." Without the visible target as the indicator, the position of the valve cannot be determined, and the assembly is either broken or the target is off track.

As defined in 3.3.24, an inspection is "a visual examination of a system or portion thereof to verify that it appears to be in operating condition and is free of physical damage." In this case, the PIV is obviously not in good operating condition, and as long as the valve can be confirmed to be in its normal open or closed position, this finding should be classified as a deficiency. If a further investigation reveals that the valve is not in its normal open position, then the system should be considered impaired and the impairment procedures in Chapter 15 should be implemented immediately.

(Courtesy of Byron Blake and SimplexGrinnell)

(3) Accessible
(4) Post indicator valves (PIVs) are provided with correct wrenches
(5) Free from external leaks
(6) Provided with applicable identification

Exhibit 13.20 shows a WPIV that has been rendered inoperable by the growth of a nearby tree branch.

EXHIBIT 13.20 *Inoperable WPIV. (Courtesy of John Jensen)*

A.13.3.2.2 Valves should be kept free of snow, ice, storage, or other obstructions so that access is ensured.

Confirmation that a control valve can operate through its full range of motion is important for several reasons. First, it is imperative that the valve can be opened 100 percent so that the full flow of water that is needed can get through the device. It is also important to confirm that a valve can close so that routine testing and maintenance can be done on schedule. When valves do not operate from fully closed to fully open, it typically signifies an obstruction or other impairment. For more information and a procedure for conducting the control valve for several different types of control valves, see the testing procedure at the end of this chapter.

Testing Procedure Alert

ITM
NFPA 25

13.3.3 Testing.

13.3.3.1 Each control valve shall be operated annually through its full range and returned to its normal position.

When testing a nonindicating gate valve such as an underground sectional valve as required by 13.3.3.1, the number of turns needed to fully close and open the valve should be noted and compared to the number of turns needed to open and close as noted in the manufacturer's literature. This number should be recorded on the inspection form and retained for future reference.

Valves typically require lubrication annually per manufacturer's specifications. Valves that are difficult to turn might require maintenance. Forcing sticking valves to turn could result in breaking the valve shaft and creating an unplanned system impairment until repairs can be made. Valves should be able to turn smoothly and with minimal effort. If valves require the use of a person's full weight or a cheater bar to turn, the valve should be repaired or replaced. In the case of an emergency, this could lead to breaking the shaft limiting or eliminating the functionality of the valve.

FAQ How often do PIVs need to be cycled?

All control valves are required to be operated annually through their full range of motion per 13.3.3.1. Often, PIVs are not exercised, since they are not considered a control valve because they sit outside of the building envelope.

13.3.3.2* Post indicator valves shall be opened until spring or torsion is felt in the rod, indicating that the rod has not become detached from the valve.

A.13.3.3.2 A proper wrench needs to be used for this test. Using an improper wrench such as a pipe wrench has resulted in damage to the operating nut. The use of break over bars and extensions on the wrench can damage the valve and/or the post. If the valve cannot be closed and reopened using the proper wrench with reasonable force, then some maintenance and/or repairs are necessary so the valve can be operated when needed in a fire event. These "spring tests" are made to verify that a post indicator valve is fully open. If an operator feels the valve is fully open, he or she should push in the "open" direction. The handle usually moves a short distance (approximately a one-quarter turn) and "springs" back toward the operator in a subtle move when released. This spring occurs when the valve gate pulls up tight against the top of its casting and the valve shaft (being fairly long) twists slightly. The spring indicates that the valve is fully opened and that the gate is attached to the handle. If the gate is jammed due to a foreign particle, the handle is not likely to spring back. If the gate is loose from the handle, the handle continues to turn in the "open" direction with little resistance.

13.3.3.2.1 This test shall be conducted every time the valve is closed.

13.3.3.3 Post indicator and outside screw and yoke valves shall be backed a one-quarter turn from the fully open position to prevent jamming.

13.3.3.4 A valve status test shall be conducted any time the control valve is closed and reopened at system riser.

This requirement is intended to verify that the control valve has not been left fully closed. It is not meant to test that a valve has been returned to the fully open position. A main drain test might not reveal a partially closed (or partially open) valve in a large-diameter supply pipe. In most typical systems, a gate valve closure up to approximately 70 percent to 80 percent would not be detected with a main drain test. This is because the area that is still open under the gate has a combined area at least equal to that of the drain pipe and valve.

Testing Procedure Alert

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The valve status test was introduced in the 2014 edition of NFPA 25, and its importance cannot be overstated. The most common cause for system ineffectiveness in water-based fire protection systems is a closed valve. A rather simple test allows the owner or inspector to confirm that not only do the valves appear to be open but that water is in fact flowing through the control valve that had been recently closed. A process for conducting this test is provided at the end of this chapter.

• **13.3.3.5* Valve Supervisory Switches.**

A.13.3.3.5 For further information, see *NFPA 72*.

13.3.3.5.1 Valve supervisory switches shall be tested semiannually.

13.3.3.5.2 A distinctive signal shall indicate movement from the valve's normal position during either the first two revolutions of a handwheel or when the stem of the valve has moved one-fifth of the distance from its normal position.

This requirement is not meant to imply each valve tamper device must have its own distinctive signal at an annunciator panel. While highly advisable on larger systems with more than one valve, all tamper devices can annunciate as a single signal. Chapter 17 of *NFPA 72* requires valve tamper switches initiate a supervisory signal.

13.3.3.5.3 The signal shall not be restored at any valve position except the normal position.

Some approved valve tamper devices are easy to reset. These devices allow the alarm panel to indicate that all valves are open, when in actuality, the valves are closed. When circuit lacing devices are used, special care must be taken in restoration. Exhibit 13.21 shows a valve monitored by lacing a wire around the valve handle.

EXHIBIT 13.21 *Valve Monitored by Wire Laced Through Handle.*

13.3.4 Maintenance.

13.3.4.1 The operating stems of outside screw and yoke valves shall be lubricated annually.

13.3.4.2 The valve then shall be completely closed and reopened to test its operation and distribute the lubricant.

13.4 System Valves.

13.4.1 Inspection of Alarm Valves. Alarm valves shall be inspected as described in 13.4.1.1 and 13.4.1.2.

13.4.1.1* Alarm valves and system riser check valves shall be externally inspected quarterly and shall verify the following:

(1) The gauges indicate normal supply water pressure is being maintained.
(2) The valves and trim are free of physical damage.
(3) All valves are in the appropriate open or closed position.
(4) The retarding chamber or alarm drains are not leaking.

A.13.4.1.1 A higher pressure reading on the system gauge is normal in variable pressure water supplies. Pressure over 175 psi (12.1 bar) can be caused by fire pump tests or thermal expansion and should be investigated and corrected.

13.4.1.2* Alarm valves and their associated strainers, filters, and restriction orifices shall be inspected internally every 5 years unless tests indicate a greater frequency is necessary.

A.13.4.1.2 The system should be drained for internal inspection of valve components as follows:

(1) Close the control valve
(2) Open the main drain valve
(3) Open the inspector's test valve
(4) Wait for the sound of draining water to cease and for all gauges to indicate 0 psi (0 bar) before removing the handhole cover or dismantling any component

FAQ Is the requirement for the 5-year internal inspection of an alarm check valve valid if the valve no longer has an active retard chamber?

The internal inspection of an alarm valve is not contingent upon retard chambers or any other trim. The purpose of the internal inspection is to verify the operation of the clapper and the condition of the valve seats, as well as to look for evidence of corrosion or obstructing material (inorganic and organic). This can also meet the requirement of an internal obstruction investigation if required per 14.3.2.2(2). Exhibit 13.22 illustrates the internal components of an alarm check valve that would be seen upon an internal inspection. Exhibit 13.23 shows the interior corrosion of an alarm valve during an internal inspection.

FAQ What test results would indicate that more frequent internal inspections of alarm valves are needed?

Test results that might indicate more frequent inspections are needed include the following:

- Internal biological growth
- Significant corrosion on internal metal parts, such as the check valve plate
- Previously found obstructions that, due to water supply sources or other reasons, could be expected to occur again

If the presence of foreign material is enough to warrant increasing the frequency of internal inspections of the valve, consideration must also be given to the requirements of Chapter 14. That chapter contains triggers for conducting obstruction investigations. See 14.3.1 for more information.

13.4.1.3 Maintenance.

13.4.1.3.1 Internal components shall be cleaned/repaired as necessary in accordance with the manufacturer's instructions.

13.4.1.3.2 The system shall be returned to service in accordance with the manufacturer's instructions.

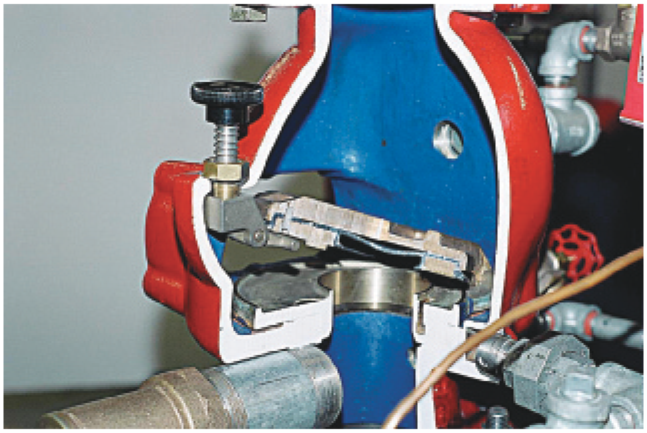

EXHIBIT 13.22 Alarm Valve Internal Inspection.

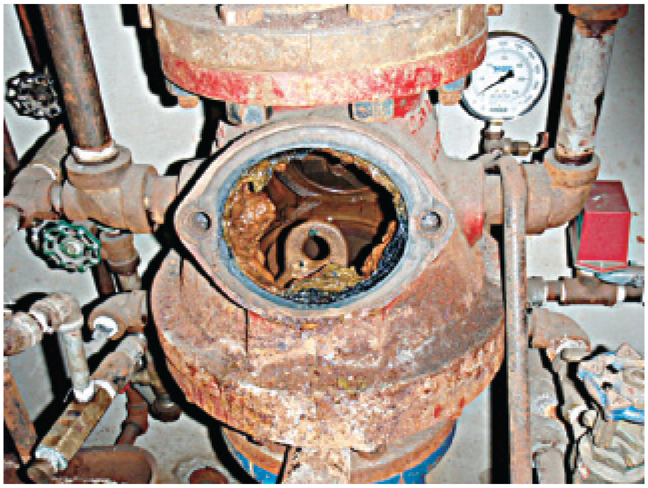

EXHIBIT 13.23 Interior Valve Corrosion. (Courtesy of Wayne Automatic Fire Sprinklers, Inc.)

13.4.2 Check Valves.

13.4.2.1 Inspection.
Valves shall be inspected internally every 5 years to verify that all of the valve's components operate correctly.

13.4.2.2 Maintenance.
Internal components shall be cleaned, repaired, or replaced as necessary in accordance with the manufacturer's instructions.

13.4.3 Preaction Valves.

FAQ What is the difference between a preaction valve and a deluge valve?

Preaction and deluge valves have identical main valves but with different trim, which is arranged based on the type of operation. For example, a deluge valve activates and discharges water into a piping system of open nozzles or sprinklers, whereas a preaction system trips and floods a piping system of closed sprinklers and will not discharge water until a sprinkler activates. Therefore, a preaction system has a check valve installed immediately above the preaction valve to isolate it from the system air pressure. Except for this difference, the two valve bodies (preaction and deluge) are basically the same. See Exhibit 13.24 for a typical preaction valve arrangement and a typical deluge valve arrangement.

13.4.3.1 Inspection.

13.4.3.1.1 The preaction valve shall be externally inspected monthly to verify the following:

(1) The valve is free from physical damage.
(2) All trim valves are in the appropriate open or closed position.
(3) The valve seat is not leaking.
(4) Electrical components are in service.

The external inspection of the preaction valve required by 13.4.3.1.1 should also include inspection of pneumatic components.

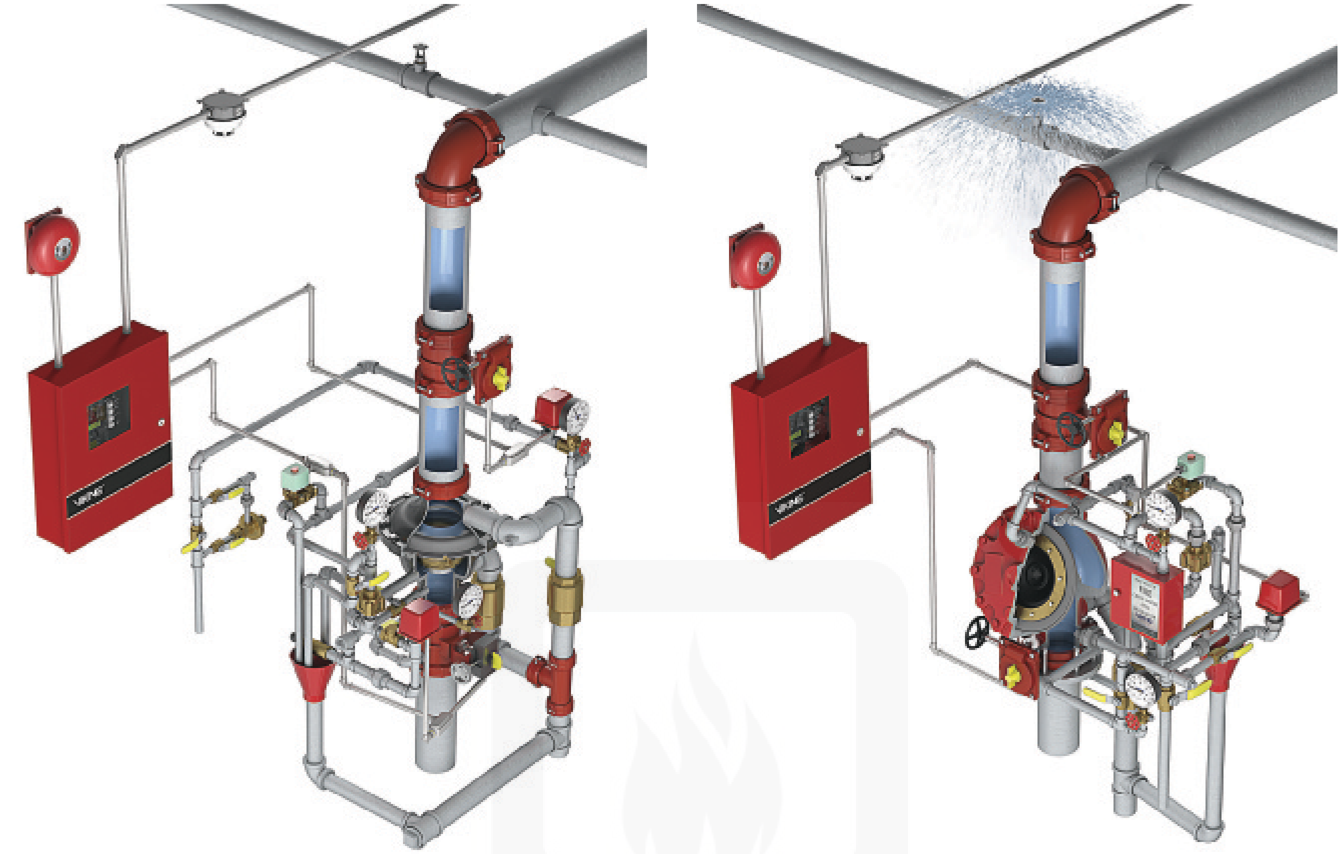

EXHIBIT 13.24 *Preaction Valve with Trim Piping and Accessories (left) and Deluge Valve with Trim Piping and Accessories (right). (Courtesy of Jesse Cappon and Viking®)*

13.4.3.1.2 The interior of the preaction valve and the condition of detection devices shall be inspected annually when the trip test is conducted.

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The purpose of completing a trip test (partial or full) for a preaction valve is to ensure the system operates in a manner consistent with the original design application. A comparative assessment of the water delivery time during the full trip test of a double interlock preaction and combined dry pipe/preaction system can reveal significant delays in system operation. For more information on conducting this test, see the testing procedure at the end of this chapter.

13.4.3.1.2.1 Internal inspection of valves that can be reset without removal of a faceplate shall be permitted to be conducted every 5 years.

13.4.3.1.3 Strainers, filters, restricted orifices, and diaphragm chambers shall be inspected internally every 5 years unless tests indicate a greater frequency is necessary.

A situation in which a more frequent inspection is required per 13.4.3.1.3 would be a reservoir, where water supply conditions can lead to obstructing material or rapid corrosion.

13.4.3.1.4 Preaction systems with auxiliary drains shall require a sign at the valve indicating the number of auxiliary drains and the location of each individual drain.

• **13.4.3.2 Testing.**

13.4.3.2.1* The priming water level in supervised preaction systems shall be tested quarterly for compliance with the manufacturer's instructions.

• **A.13.4.3.2.1** High priming water levels can adversely affect the operation of supervisory air. Test the water level as follows:

(1) Open the priming level test valve.
(2) If water flows, drain it.
(3) Close the valve when water stops flowing and air discharges.
(4) If air discharges when the valve is opened, the priming water level could be too low. To add priming water, refer to the manufacturer's instructions.

13.4.3.2.2 Except for preaction systems covered by 13.4.3.2.5, every 3 years the preaction valve shall be trip tested with the control valve fully open.

13.4.3.2.3 During those years when full flow testing in accordance with 13.4.3.2.2 is not required, the preaction valve shall be trip tested with the control valve partially open.

N **13.4.3.2.4*** Preaction valve flow tests shall incorporate full functionality of the system as a unit, including automatic and manual activation.

• *N* **A.13.4.3.2.4** It is necessary that the full flow test incorporate the full functionality of the system, which would include any solenoid valves or other actuation devices. It was common practice in the past to test the detection system or manual pull station up to the solenoid valve or actuator and to separately test the preaction valve and system after the solenoid valve or actuator. The detectors on the system can be tested separately as long as the functional test includes activation of the actuator or solenoid when it receives an actual or simulated signal.

13.4.3.2.5 Preaction valves protecting freezers shall be trip tested in a manner that does not introduce moisture into the piping in the freezer.

13.4.3.2.6 Preaction systems shall be tested once every 3 years for air leakage, using one of the following test methods:

(1) Perform a pressure test at 40 psi (3.2 bar) for 2 hours. The system shall be permitted to lose up to 3 psi (0.2 bar) during the duration of the test. Air leaks shall be addressed if the system loses more than 3 psi (0.2 bar) during this test.
(2) With the system at normal system pressure, shut off the air source (compressor or shop air) for 4 hours. If the low air pressure alarm goes off within this period, the air leaks shall be addressed.

Paragraph 13.4.3.2.6 addresses the integrity of preaction systems that have supervisory air pressure. Single interlock preaction systems are not typically equipped with supervisory air pressure and, as a result, would not be subject to the test required in this paragraph.

13.4.3.2.7 Manual Operation. Manual actuation devices shall be operated annually.

13.4.3.2.8 Return to Service. After the annual trip test, the preaction system shall be returned to service in accordance with the manufacturer's instructions.

13.4.3.2.9 Grease or other sealing materials shall not be applied to the seating surfaces of preaction valves.

13.4.3.2.10* Records indicating the date the preaction valve was last tripped and the tripping time, as well as the individual and organization conducting the test, shall be maintained at a location or in a manner readily available for review by the authority having jurisdiction.

A.13.4.3.2.10 Methods of recording maintenance include tags attached at each riser, records retained at each building, and records retained at one building in a complex.

See Supplement 4 for sample report forms. Note that 13.4.3.2.10 does not preclude the use of electronic reporting systems or other methods for documenting the service history of valves and other equipment.

13.4.3.2.11 Low air pressure alarms, if provided, shall be tested quarterly in accordance with the manufacturer's instructions.

13.4.3.2.12 Low temperature alarms, if installed in valve enclosures, shall be tested annually at the beginning of the heating season.

13.4.3.2.13 Automatic air pressure maintenance devices, if provided, shall be tested yearly at the time of the annual preaction valve trip test, in accordance with the manufacturer's instructions.

13.4.3.3 Maintenance.

13.4.3.3.1 Leaks causing drops in supervisory pressure sufficient to sound warning alarms and electrical malfunctions causing alarms to sound shall be located and repaired.

13.4.3.3.2 During the annual trip test, the interior of the preaction valve shall be cleaned thoroughly and the parts replaced or repaired as necessary.

13.4.3.3.2.1 Interior cleaning and parts replacement or repair shall be permitted every 5 years for valves that can be reset without removal of a faceplate.

13.4.3.3.3* Auxiliary drains in preaction systems shall be operated after each system operation and before the onset of freezing conditions (and thereafter as needed).

A.13.4.3.3.3 Suitable facilities should be provided to dispose of drained water. Low points equipped with a single valve should be drained as follows:

(1) Open the low-point drain valve slowly.
(2) Close the drain valve as soon as water ceases to discharge, and allow time for additional accumulation above the valve.
(3) Repeat this procedure until water ceases to discharge.
(4) Replace plug or nipple and cap as necessary.

Low points equipped with dual valves should be drained as follows:

(1) Close the upper valve.
(2) Open the lower valve, and drain the accumulated water.
(3) Close the lower valve, open the upper valve, and allow time for additional water accumulation.
(4) Repeat this procedure until water ceases to discharge.
(5) Replace plug or nipple and cap in lower valve.

Removing water from a deluge system is an essential part of a good maintenance program. Failure to keep these systems free of water can result in damage and expensive repairs to both the system and the building. A program for monitoring the condition of the system and the operation of the auxiliary drains should be instituted. Auxiliary drains should be operated on a daily basis after a system operation until several days pass with no discharge of water from the drain valve. Thereafter, it might be possible to decrease the frequency to weekly or longer intervals, depending on the volume of water discharged. Likewise, when preparing for cold weather, the auxiliary drains should be operated daily, with the frequency of operation decreasing depending on the discharge of accumulated water. In many cases, the frequency of the operation can decrease significantly if a system is shown to be dry.

It is important that the piping be kept dry, particularly in areas subject to freezing. When a system is tripped during testing or as the result of a fire or other event, it is important to follow a plan to monitor the removal of any water as it accumulates in the system. Systems located in conditioned spaces that have supervised air pressure are particularly susceptible to moisture accumulating during the summer season as a result of warm moist air being introduced into the system.

13.4.3.3.4 Additional maintenance as required by the manufacturer's instructions shall be provided.

13.4.4 Deluge Valves.

13.4.4.1 Inspection.

13.4.4.1.1 The deluge valve shall be externally inspected monthly to verify the following:

(1) The valve is free from physical damage.
(2) All trim valves are in the appropriate open or closed position.
(3) The valve seat is not leaking.
(4) Electrical components are in service.

13.4.4.1.2 The interior of the deluge valve and the condition of detection devices shall be inspected annually when the trip test is conducted.

13.4.4.1.2.1 Internal inspection of valves that can be reset without removal of a faceplate shall be permitted to be conducted every 5 years.

The requirement in 13.4.4.1.2.1 acknowledges the fact that some listed deluge valves do not have to be opened to be reset. The arrangement of the deluge valve with accessories shown in Exhibit 13.24 illustrates an externally reset deluge valve.

13.4.4.1.3 Strainers, filters, restricted orifices, and diaphragm chambers shall be inspected internally every 5 years unless tests indicate a greater frequency is necessary.

• **13.4.4.2 Testing.**

13.4.4.2.1 Deluge valve flow tests shall incorporate full functionality of the system as a unit, including automatic and manual activation.

To ensure that the deluge valve will release and open when needed, testing must include all of the components. Paragraph 13.4.4.2.1 requires that activation systems be tested and that the valve opens as part of the same test.

13.4.4.2.2 Protection shall be provided for any devices or equipment subject to damage by system discharge during flow tests.

13.4.4.2.3* Except as provided by 13.4.4.2.3.1 and 13.4.4.2.3.2, each deluge valve shall be trip tested annually at full flow in warm weather and in accordance with the manufacturer's instructions.

• **A.13.4.4.2.3** Deluge valves in areas subject to freezing should be trip tested in the spring to allow time before the onset of cold weather for all water that has entered the system or condensation to drain to low points or back to the valve.