

Dry Pipe Sprinkler Systems

Inspection, Testing & Maintenance

Inspection, testing and maintenance of dry pipe valves and dry pipe systems are critical to maintaining effective fire protection. Dry pipe valves are used in areas subject to freezing temperatures.

This is part of a series of articles on the inspection, testing and maintenance of water-based fire protection systems. This article provides a review of what should be included in a typical self-inspection program as it relates to dry pipe valves. Your program should be customized to meet your specific needs.

The primary standard in use in most companies and municipalities is NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems. NFPA 25 establishes minimum requirements for the periodic inspection, testing and maintenance of water-based fire protection systems. It is not an optimum standard, rather, it is the minimum level of action NFPA 25 requires to maintain water-based fire sprinkler systems. It is the base from which you should start and improve upon to meet your facility's needs.

Many facilities the author visits do not have an adequately documented inspection, maintenance and testing program in accordance with NFPA 25. Some do not keep written records of inspections, while others conduct limited or no testing. A facility without a documented program does not meet NFPA 25's intent. The program must include documentation. If it is not documented, most authorities having jurisdiction (AHJs) will be skeptical that the activities have been completed.

A program that meets the minimums stated in NFPA 25 is an ongoing program, which typically requires weekly and daily interaction with the systems. It should not be a program that is solely carried out by a sprinkler contractor. You are ultimately responsible for your systems. You must familiarize staff with your facility's systems, and they should know what actions to take in the event of an emergency. It is unlikely that the sprin-

klers contractor will be on site at the time of a fire or other emergency that involves the fire protection systems.

The inspection, testing and maintenance of dry pipe sprinkler valves and systems may require that fire



Photo 1: Three dry pipe valves on a common header.

protection systems be taken out of service, resulting in an impairment to the fire protection systems. Proper impairment handling procedures should be followed during any impairment to the fire protection system.

The information and techniques described in this article are provided for illustration and general information and may not be appropriate for your specific equipment. Installations vary based on the valve type, its age, arrangement and manufacturer design. Prior to performing testing and maintenance, refer to information and instructions provided by your fire protection contractors, consultants and the manufacturer of your specific systems and equipment.

SYSTEMS INCLUDED IN NFPA 25

NFPA 25 addresses sprinkler, standpipe and hose, fixed water spray and foam water protection systems. It covers the components of these systems, such as private fire service mains and appurtenances, fire pumps and water storage tanks and valves that control system flow. It does not cover residential installations for one- and two-family dwellings and manufactured homes.

NFPA 25 uses NFPA 13, Standard for the Installation of Sprinkler Systems, as the basis for its inspection, testing and maintenance standards. Not all items listed in NFPA 25 are included in this article, and NFPA should always be referenced for the complete standard.

A comprehensive program includes the following elements:

- Inspection.** A visual examination of a system to verify that it appears to be in operating condition and is free of physical damage.

This article focuses on Chapter 13, Valves, Valve Components and Trim, and assumes that all items discussed in previous articles regarding valve inspection and testing, records plans and calculations and impairments to the fire system have been completed. This article discusses items that apply specifically to dry pipe valves.

•**Testing.** A physical trying or operation of a system or part of a system to ensure or prove that it functions properly, as intended, or to an acceptable standard of operation.

•**Maintenance.** The work performed to repair and/or maintain equipment in operable condition.

Trained in-house staff or a qualified contractor may perform the service. As with any inspection, maintenance and testing program, good recordkeeping is important. Written logs should be maintained, and relevant results should be retained for future reference or for AHJ review. Ultimately, it is the property owner's responsibility to ensure that the systems are properly serviced. Tenants may also want to ensure that the work is completed satisfactorily. Management should review completed reports and correct deficiencies. An inspection and testing program is of limited value if identified system deficiencies are never corrected.

DRY PIPE VALVES

Wet pipe sprinklers must be maintained at or above 40 °F (4 °C). Systems that cannot be reliably maintained at or above 40 °F require nonfreeze-type systems. In small areas subject to freezing conditions, other arrangements may be installed, such as dry sprinkler heads or antifreeze systems. In locations requiring the protection of larger areas, one of the most commonly installed sprinkler systems is the dry pipe sprinkler system. Dry pipe sprinkler systems may be used where there is a danger of the entire system, or portions of the system, freezing. While dry pipe sprinkler systems have the advantage of not freezing, they are more complicated than wet pipe systems and require more care, inspection, maintenance and testing.

There are many dry pipe valve manufacturers, and each may produce many different dry pipe valve models. Over the years, there have been many designs of dry pipe valves. Some dry pipe valves use differential pressure of a clapper. Other valves may use a latch assembly to seek the clapper or a rod chamber and rod to hold the clapper in the closed position. Because so many different valves exist, the manufacturer's material data sheets and instruction manuals should be referenced for the specific valves in your facility. This article discusses some of the more common styles of dry pipe valves.

A dry pipe sprinkler valve is a special valve that prevents the pressurized water in the fire mains from entering the sprinkler system piping. Normally, this is accomplished by filling the system with air. Most valves use a differential method of keeping the valve shut, and generally, the differential is 5:1 or 6:1. This means that 5 or 6 psi of water pressure is held back by 1 psi of air pressure. In the event of a fire in which a sprinkler head actuates, the air pressure in the system decreases until the valve trips. The trip pressure in a 5:1 dry pipe valve at 60 psi of water pressure is

12 psi. As the air pressure dips below 12 psi, the valve will trip, allowing water to enter the sprinkler piping and eventually exit through the open sprinkler head. A safety factor, usually about 20 to 25 psi, is maintained above the trip pressure to help prevent false trips. An air compressor, or other means of maintaining pressure in the system, is arranged to automatically maintain adequate air pressure.

Dry pipe sprinkler systems have a higher likelihood of internal corrosion in the piping due to moisture-laden air. Sometimes air drying systems are installed in the air line between the air compressor and the system piping. Other systems use an alternate gas, such as nitrogen, to slow down the corrosion process and to extend the life of the piping.

Another disadvantage of dry pipe sprinkler systems is the time delay between the operation of the sprinkler head and the water actually discharging from the sprinkler head. NFPA 13, Standard for the Installation of Sprinkler Systems, identifies water delivery times based on the occupancy hazard. Light Hazard occupancies must deliver water within 60 seconds with one head open; Ordinary Hazard (I and II), 50 seconds with two heads open; Extra Hazard (I and II), 45 seconds with 4 heads open; and High-Piled Storage Occupancies, 40 seconds with 4 heads open. Typically, older systems were designed to provide water to the inspectors test connection within 60 seconds. Accelerators or exhausters may be installed if the system's water delivery time is excessive. These devices should be in service if they were originally installed in the system design.

A dry pipe sprinkler valve is a special valve that prevents the pressurized water in the fire mains from entering the sprinkler system piping.

MECHANICAL DRY PIPE VALVES

Early dry pipe valves were of a mechanical tripping design. Some of these valves could be recognized by large kidney-shaped swinging doors, which concealed a heavy weight. As the air pressure decreased, the weight would drop, the doors would fly open, there might have been a gush of water and the valve was mechanically opened. These valves were used in the 1800s and in the first decade of the 1900s. By 1920, they were no longer manufactured. They remained in service until the mid-1900s, and the last valve the author encountered was in the late 1970s.

DIFFERENTIAL DRY PIPE VALVES

Differential dry pipe valves use the principal of a lower air pressure on the top of the clapper holding back a higher water pressure below the valve. The way this is accomplished in many valves is to build the valve with a large clapper that covers two seats. The inner ring is the water seat in the middle of the valve;



Photo 2: 1922 Rockwood Model A dry pipe valve, which is still in service. Originally developed in 1908 and improved in 1909, the large bulge in the rear of the valve is for a counterweight arm that helps raise the clapper when the valve trips. The clapper is situated on the plane of the lower housing bolt ring, and the priming water comes to between the lower and middle bolts of the hinged faceplate. This valve required gallons of priming water compared to the few quarts required in most newer dry pipe valves. An automatic intermediate chamber drip drain is built into the valve body at the bottom rear of the clapper seat.

the outer seat is for the intermediate chamber that surrounds the water inlet. The surface area that the air compresses may be five times the area of the water inlet. In this way, 1 psi of air pressure will counteract 5 psi of water pressure. This is typically referred to as the differential. Then, additional air pressure, usually 20 psi, is placed in the dry pipe valve.

In such a valve, if the water pressure is 60 psi, the air pressure needed to equalize this force is 12 psi. Adding 20 psi of air pressure, 32 psi of air pressure is preventing the 60 psi of water pressure from tripping the valve. When a sprinkler head opens, the air pressure decreases. As the pressure decreases to below 12 psi, the force of the water pressure will overcome the air pressure, opening and latching the clapper in the open position, thereby tripping the valve.

TRIM COMPONENTS

A dry pipe valve has several pieces of trim hardware. Each device has a purpose in the operation, resetting or supervision of the system.

CONTROL VALVES

Control valves control the flow of water to water-based fire protection systems. These valves are used to shut off water to main systems. Control valves do not include hose valves, inspectors test valves, drain valves, trim valves for dry pipe, preaction and deluge valves, check valves or relief valves. The main control valve is located below the dry pipe valve. This is an indicating control valve and is typically an outside stem and yoke (OS&Y) valve. OS&Y valves are advantageous because there is nothing in the waterway to slow the water.

GAUGES

There are typically at least two gauges on the valve trim and possibly more on the compressor side of the air supply regulating valve. The water pressure gauge indicates the water pressure below the valve seat. The air gauge indicates the air pressure in the sprinkler piping. If provided, the system air gauge usually indicates the shop air pressure upstream of the pressure regulator. A gauge may also be provided on an air receiver tank. When accelerators are installed, a gauge will be installed on the top of the accelerator.

VELOCITY DRIP VALVE

The velocity drip (also known as a ball drip valve) normally has a brass ball sitting loosely inside a housing. The housing has a small hole through which water can flow. Under normal conditions, the ball sits at the bottom of the housing, and any water seepage from the valve will slowly drain through the device. However, when the valve trips, a large flow of water will enter the device, sweeping the ball up against the hole and preventing additional water flow. A plunger protruding from the end of the valve may be used as a push rod to push the ball back into the housing, allowing water to drain through the device. The plunger should be pushed on a periodic basis to ensure that the ball is free. If the plunger is pushed and more than a few drips come out, it may indicate that the water seat is leaking. Eventually, the leak may become great enough to fill the intermediate chamber, break the differential ration and trip the valve. Some velocity drips do not have the plunger assembly, however, it is provided on most.

PRIMING WATER FILL CUP

The priming water fill cup assembly allows water to be introduced into the body of the dry pipe valve. It typically consists of a funnel cup and valve, which is piped into the body of the dry pipe valve. When the dry pipe valve is reset, water is needed to create a



Photo 3

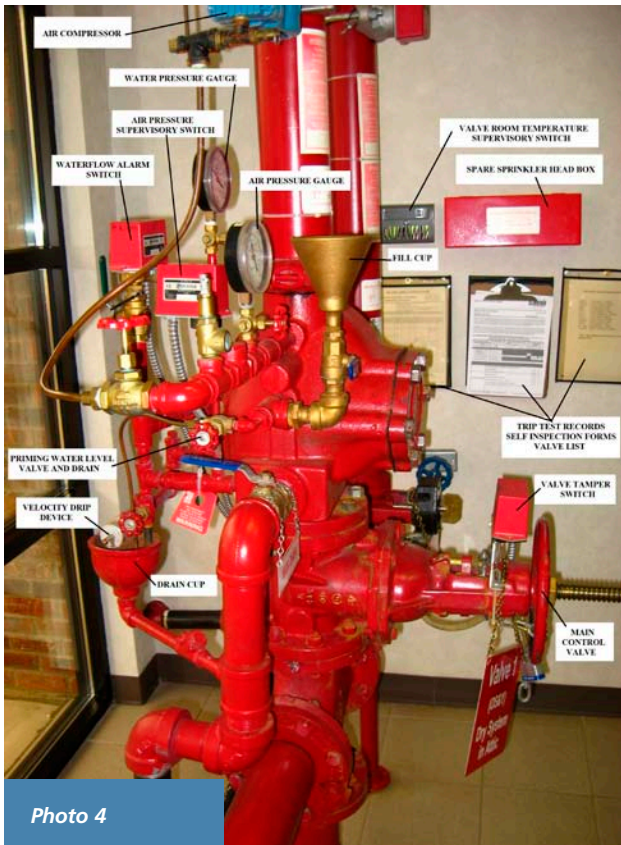


Photo 4



Photo 5: Velocity Drip Drain. The plunger extends out of the housing and is spring-loaded. Corrosion can accumulate inside this device and prevent it from properly draining. This is the plunger that may be depressed when testing the waterflow alarm. In the event the check valve does not seat fully, water will enter into the intermediate chamber trim piping. If the velocity drip drain is also plugged with corrosion, the valve may trip.

water seat on top of the clapper. Various arrangements are found, and some older installations may also be provided with a priming water chamber between two valves. An advantage of this arrangement is that water may be added to raise the priming water level while the valve is set and under pressure.

The importance of maintaining the priming water at the appropriate level cannot be stressed enough. Allowing too much water to accumulate inside of the valve can form a water column, which can prevent system operation. It can cause a hidden impairment of the entire sprinkler system. After the sprinkler system has tripped and been reset, water will continue to drain from the system piping to the low point. On most dry systems, the low point is the valve riser. As the water continues to trickle down into the riser, it will accumulate and fill the riser pipe above the dry pipe valve. The water trapped in the riser has weight and will exert downward pressure onto the clapper. For each foot of water in elevation, the water will exert 0.434 psi. Assume the riser is 25 ft high and the water column reaches 22 ft in height. An additional 9.5 psi is exerted upon the clapper. Assume the sprinkler system is supplied by a water system with a static pressure of 50 psi and the dry pipe differential is 6:1. The trip pressure of the dry pipe valve is $50 \text{ psi} / 6 = 8.3 \text{ psi}$. Even after all of the air is expelled through the open sprinkler heads, the valve will not trip because the pressure from the water column is too great to allow the valve to trip. The total volume of water required to fill a schedule 40 pipe

to a height of 22 ft is approximately 14.5 gallons of water. Commercially available UL-listed devices can automatically maintain the priming water level at the appropriate level; however, most systems rely upon manually testing for a water column.

DRAIN CUP

The drain cup is a funnel for water from the intermediate chamber velocity drip valve, priming water level and waterflow alarm test line wastewater. It is usually located lower than the priming water fill cup and is typically below the level of the clapper. Ideally, the drain pipe from this cup should be piped directly to the outdoors. Many times, the drain cup is piped into the main drain piping. When the drain is tied into the main drain, a check valve must be provided. The check valve is another item that requires regular maintenance. If the check valve is not adequately maintained, the clapper may become stuck. If stuck in the closed position, water will overflow the cup and run onto the floor. If stuck in the open position, water under pressure will shoot out of the cup when the main drain valve is opened.



Photo 6: An older priming water fill cup assembly. Normally, both valves are closed. The top valve is opened and water is poured into the water chamber. Then, the top valve is closed and the bottom valve is opened. The water will drain into the dry pipe valve body to add priming water while the valve is set.

SUPERVISORY & ALARM SWITCHES

Waterflow alarm switches and low air pressure

Photo 7: This is a globe dry pipe valve with full dry pipe trim package and a vane type waterflow alarm switch. This system was installed as a dry system then later converted to a wet pipe system. The original trim remains and is out of service. Vane-type waterflow alarm switches are prohibited on dry pipe sprinkler systems.

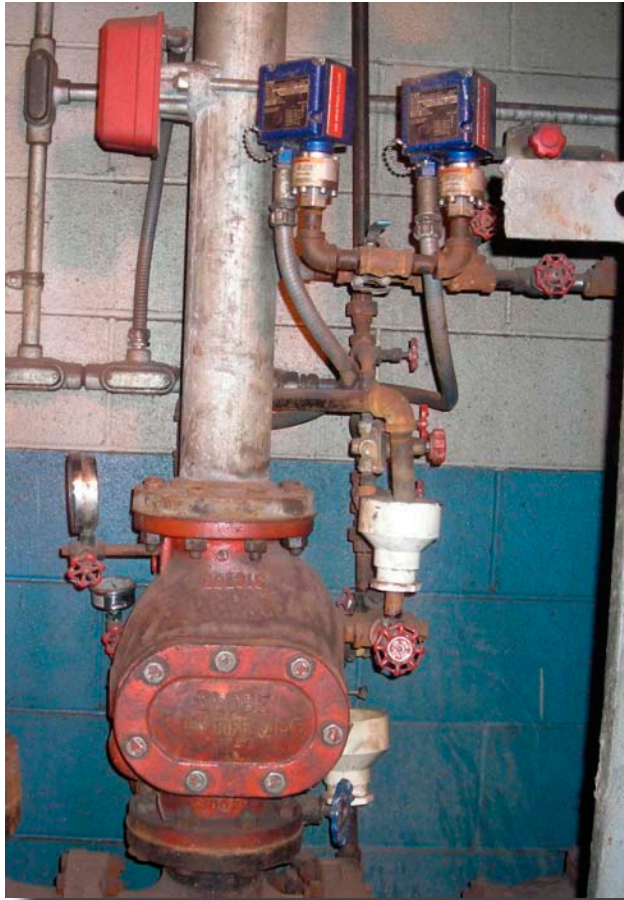


Photo 8: This is a typical accelerator installed on a dry pipe valve. The piping from the left has air pressure from the sprinkler system piping. The pipe on the right side of the photo is connected into the intermediate chamber. When the device trips, it introduces air from the system piping directly into the intermediate chamber to quickly break the differential and to trip the valve more quickly.

supervisory switches should be provided on the dry pipe valve. Low temperature supervisory devices should be installed in each dry pipe valve room. Each alarm should be tied into the facility alarm system. It is important to note that vane-type waterflow devices are prohibited in dry pipe valves. When a dry pipe valve trips, the force of the water may tear the vane from the switch and force it into the piping.

QUICK OPENING DEVICES

Dry pipe valves have a delay between the actuation of the sprinkler head and the water discharge onto the fire. Some systems have a delay, which is greater than permitted by NFPA 13. To help speed water delivery, manufacturers have designed quick-opening devices that trip the valve more quickly than it would otherwise trip. The common types are accelerators and exhausters. Accelerators trip the dry pipe valve more quickly by sensing the pressure drop and introducing pressure into the intermediate chamber. This additional pressure breaks the differential and trips the valve immediately. An exhauster works by exhausting air from the system piping to atmosphere through a large-diameter pipe. On some large volume systems, multiple exhausters may be installed to quickly expel air, reducing the system air pressure quickly.

Accelerators are typically mechanical devices that use a small pressure volume to quickly sense a drop

in pressure. The drop in pressure allows a flexible membrane between two sensing chambers to move and open a valve, which releases air into the intermediate chamber of the dry pipe valve. The resulting rush of pressure into the intermediate chamber of the dry pipe valve breaks the differential and quickly trips the valve. These devices require regular maintenance. When accelerators are not adequately maintained, false trips of the dry pipe valve may occur. However, some building owners will simply shut off the accelerator. This is an extremely dangerous practice because the water delivery time may be extended beyond allowable times, and a fire may grow to the point of overtaxing the sprinkler system. If the gauge pressure on top of the accelerator is zero, or is definitely lower than the air pressure in the system, the accelerator may be disabled. For this reason, the 2010 edition of NFPA 13 requires that when a valve is installed between a dry pipe sprinkler riser and a quick-opening device, it must be an indicating-type valve that is sealed, locked or electrically supervised in the open position.

AIR SUPPLY

Dry pipe valves must be provided with a reliable air supply that is available at all times. The air supply must have sufficient capacity to restore normal air pressure in the system within 30 minutes. The air supply may be a dedicated compressor and receiver arrangement or may be supplied from shop air. If shop air is used, a regulator must be installed to restrict the airflow into the dry pipe valve. A bypass arrangement may be installed around the regulator to fill the system quickly after a valve is reset. The bypass valve must be maintained in the closed position under normal circumstances. Air dryers are permitted to be used in the air

supply to a dry pipe valve. Some of these systems use a desiccant material.

Frozen condensate is a major problem in dry pipe systems, especially in freezer storage warehouses. If you have a freezer, whether it has a dry pipe system, a preaction system or a combined dry pipe and preaction system, the air supply must be dry to help prevent ice plugs from forming in the sprinkler feed main. When moist air is piped directly into the sprinkler riser within the heated enclosure of the dry pipe valve, the water may condense and freeze as it enters the refrigerated space. The frozen condensate will eventually plug the sprinkler feed main. If the sprinkler feed main pipe is totally blocked by ice and a fire occurs in the freezer, the sprinklers will activate. The air within the freezer will escape, but the ice plug prevents the air pressure from dropping at the dry pipe valve, and the valve will not trip. If the pipe is partially plugged, the valve may trip, but the ice will prevent a full flow of water through the sprinkler feed main, and the discharge density may be insufficient to control the fire.

To prevent ice plugs, a dual piping arrangement may be installed in the air supply system. NFPA 13, Figure A.7.9.2.4, "Refrigerator Area Sprinkler Systems Used to Minimize the Chances of Developing Ice Plugs," provides a piping arrangement that helps reduce moisture in the air supply. The air supply is taken directly from the freezer space to obtain air that is relatively free of moisture. The air is then dried with an air dryer and reintroduced into the freezer space using a dual piping arrangement. The air supply piping is split into two separate legs, with only one leg used at a time. The piping enters back into the freezer space and any residual air moisture immediately condensates

and freezes against the wall of the pipe. The moisture-free air is then piped back into the warm area of the dry pipe valve to be introduced into the sprinkler piping. When one leg becomes plugged, its valves are shut and the valves on the alternate leg are opened to allow air through the clear pipe.

The ice-clogged pipe is then dismantled at union fittings, removed from the system and allowed to thaw. After the pipes are thawed, cleared of ice and dried, they are reinstalled into the system to be used when the adjacent piping requires thawing.

The author has seen some variations on this arrangement. Some systems direct the dual supply air piping into the freezer, and the piping does not exit the freezer compartment. The dual lines are brought together within the freezer space and are connected to the sprinkler supply main while still located in the freezer space. If the pressure gauge reading at the compressor does not match the pressure in the sprinkler system piping, the condition should be immediately investigated because an ice plug may have formed. Facility maintenance department workers learn the typical time intervals between ice buildups in the air supply piping and schedule maintenance in a timely fashion.

AUXILIARY DRAINS

Dry pipe systems have some special requirements in their installation, such as the branch lines and feed mains pitched to drain. Every portion of the system must be provided with provisions to drain the system.

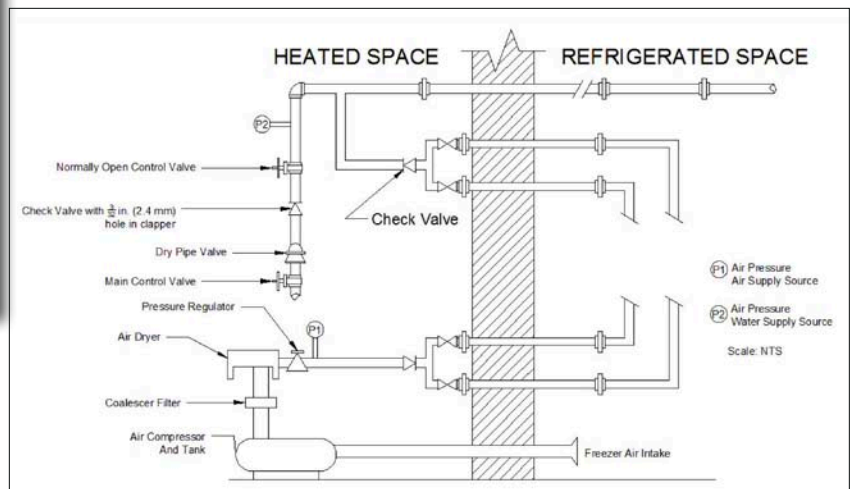
Figure 1

This is the General Arrangement Similar to NFPA 13, Figure A.7.9.2.4, "Refrigerator Area Sprinkler Systems Used to Minimize the Chances of Developing Ice Plugs."

PHOTO COURTESY OF SONITECH NDT



Photo 9: Ice plugs are a major problem in dry pipe systems, especially in freezer systems. Ice restricts the flow of water, can plug pipes and can prevent the sprinkler system from operating properly. NFPA 25 requires freezers to be inspected annually for ice plugs, and some companies perform this inspection at more frequent intervals. This ice plug was discovered using ultrasonic scanning. Used with permission.



DRAWING BY JEFF BEATTIE

While many systems drain back to the riser, other systems use auxiliary drains. The auxiliary drains, also called low point drains, typically consist of a piping arrangement, which has two 1-in. valves, a bell fitting and a 12-in. or longer section of 2-in. pipe between them.

Normally, both valves are maintained in the closed position. To remove water from an auxiliary drain, verify that the bottom valve is fully closed, then open the top valve. Allow the water to drain into the 2-in. collection pipe. Fully close the top valve, then open the bottom valve to allow water to drain into a bucket. When the water has drained out, fully close the bottom valve, open the top valve and repeat the process until all water is drained from the system.

CLAPPER LATCH

Inside the dry pipe valve is a latch. The latch engages the clapper when the valve trips to prevent it from fully closing back over the water opening. When the valve is opened to reset, the clapper latch must be verified as holding the clapper in the open position. Some dry valves have the latch on the cover so when the cover is removed, the latching position must be confirmed. This is important because if the clapper fully closes over the waterway, a water column can be formed, which will close the valve and prevent water from reaching the sprinkler heads.

DAILY & WEEKLY INSPECTIONS & TESTS

NFPA 25 recommends weekly checks of all sprin-

kler control valves. The inspection should verify that the valves are in the normal open or closed position. They should be properly sealed, locked or supervised to prevent tampering. All sprinkler valves should be readily accessible. Risers and riser rooms should not be blocked with pallets of stock, equipment or other goods, and outside valves should be accessible and not blocked by yard storage or snow banks. If the valve needs a wrench, one should be available. No leaks or corrosion should be visible, and the valve should be identified with a label or other suitable identification. If a facility has multiple risers, especially when on a common manifold, labeling is indispensable when the fire department needs to shut the proper valve. A graphic diagram with color-coded areas of protection is useful. Also, a list of all low point drains should be posted at the dry valve. A missed drain may result in frozen piping and unnecessary system trips, which may result in significant loss from water damage and repairs to the system.

Dry pipe sprinkler systems require a heated valve enclosure to prevent freezing. Valve enclosure heating equipment should be inspected daily during cold weather for its ability to maintain a minimum temperature of at least 40 °F (4 °C). The inspection frequency of valve enclosures equipped with low temperature alarms may be extended to weekly.

All gauges should be inspected weekly. The gauge on the supply side of the dry pipe valve should indicate that the normal supply water pressure is maintained.

The gauge on the system side of the dry pipe valve should indicate that the proper ratio of air or nitrogen pressure to water supply pressure is being maintained in accordance with the manufacturer's instructions. Using a marker pen to indicate safe pressure ranges on the face cover of the gauge is a common practice.

If a quick-opening device is provided, it should have the same pressure reading as the gauge on the system side of the dry pipe valve. If the gauge reads zero, the device may be shut off and inoperative. If a discrepancy exists between readings, it

Figure 2 This Is an Alternative Air Supply Piping Arrangement to Help Prevent Ice Plugs in the Sprinkler Piping

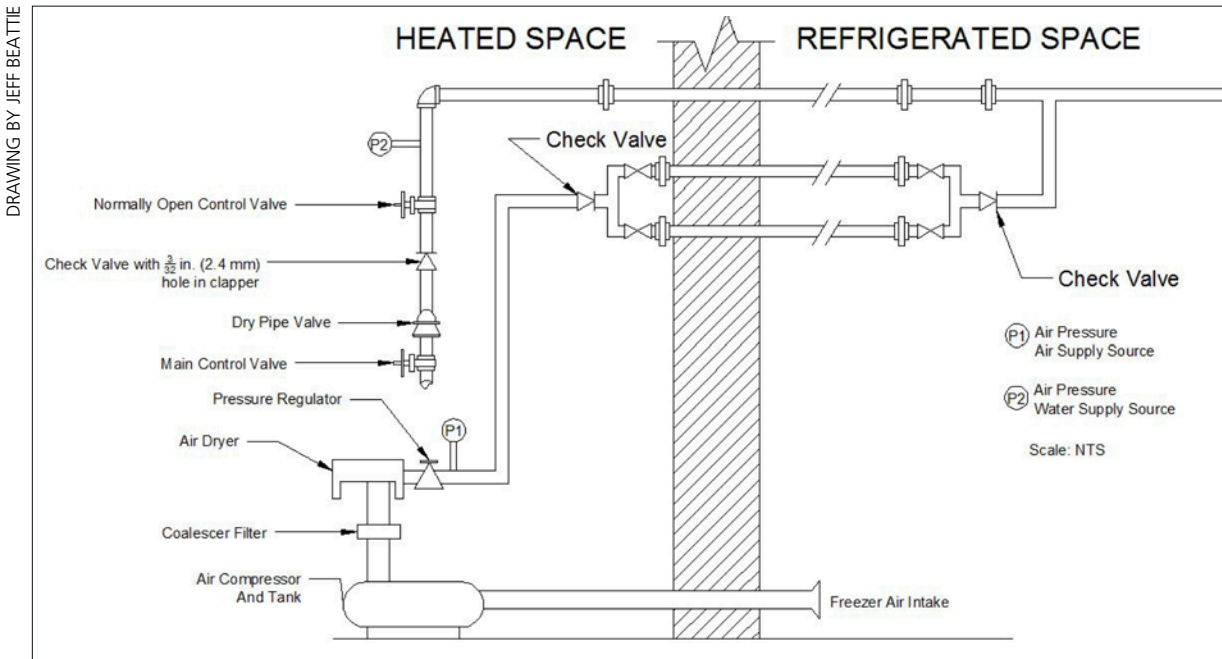




Photo 10: The sprinkler feed main on this dry pipe system was routed below structural members. This low point was provided with an auxiliary drain.

water level, open the small priming water level test valve. If water flows in a steady stream, it should be drained until air begins to discharge. Sometimes there will be an air and water mix or sputtering of air and water. Close the valve, as this indicates the water level is appropriate. If only air escapes, close the valve immediately; the water level may be too low. The priming cup may be used to add water in accordance with the manufacturer's instructions.

Low air pressure alarms, if provided, should be tested quarterly. The manufacturer's instructions are to be followed. A bleeder test valve is typically provided in line with the low pressure supervisory switch to bleed off the air pressure or testing.

The quick-opening device, if provided, should be tested quarterly. Usually, the device can be isolated for the test so it can be tested without tripping the dry pipe valve.

Mechanical waterflow devices, such as water motor gongs, need to be tested quarterly. Pressure switch-type waterflow devices need to be tested semiannually. It is important to note that vane-type waterflow devices are prohibited in dry pipe valves. The force of the water when a dry pipe valve trips may tear the vane from the switch and force it into the piping.

could also indicate an obstructed orifice or possibly a leak in the isolated chamber of the device. Either condition could make the device inoperable, delaying tripping of the dry pipe valve.

MONTHLY INSPECTIONS

The dry pipe valve, enclosure, trim and other related components should be externally inspected on a monthly basis. There should be no physical damage, and all trim valves should be in the appropriate open or closed position. The intermediate chamber should not drip or leak.

Valves locked in the open position or supervised with an alarm service may be inspected monthly. While NFPA 25 permits the frequency to be expanded to monthly, depending on your circumstances, you may decide to continue weekly valve checks. Many corporate policies require each facility to maintain a weekly visual check as good practice. If your facility has public access or is in an area noted for vandalism, weekly checks may also be warranted.

Gauges should be checked monthly and repaired or replaced as needed. Damaged gauges and those not accurate to within 3% of the full scale should be recalibrated or replaced. Otherwise, gauges require 5-year replacement or testing.

QUARTERLY TESTS

During the quarterly inspections, all items of the weekly and monthly checks should be made. Additional tests and checks should also be made. The priming water level should be checked to ensure that the water level is appropriate. To test the priming

PERIODIC LOW POINT DRAIN TESTING

After a dry pipe valve trip, auxiliary low point drains should be drained on a daily basis to ensure all condensate is fully drained. After several days with no water drained, the frequency of low point drain testing may be reduced to weekly or as needed. Also, in autumn, colder temperatures may form condensate, which will accumulate in the low point piping. Weekly draining of low point drains should be performed prior to freezing temperatures and as needed thereafter.

SEMIANNUAL WATERFLOW

Pressure switch-type waterflow devices need to be tested at least semiannually. Unlike waterflow alarm testing of a wet pipe sprinkler system, the inspectors test connection is not opened. If the inspectors test valve is opened, the dry pipe valve will trip. Waterflow alarm testing on a dry pipe valve may be performed by opening the alarm test line valve. It is important to realize that the waterflow test line is normally tied into the same line, which drains from the intermediate chamber to the velocity drip. A check valve prevents the test water from entering the intermediate chamber and tripping the valve.

The author recommends to his clients that prior to opening the alarm test valve, the velocity drip valve be exercised by pushing the plunger a few times to ensure the operation is smooth and unobstructed by corrosion and to ensure that the ball is not stuck in front of the drain hole. Then, while continuously depressing the

Photo 11: The inspectors test connection is on the left. The dry pipe valve inspectors test connection and auxiliary drain is on the right. The inspectors test is fitted with a sprinkler head (not shown in photo) to simulate one sprinkler head flowing.



check valve is unable to fully close to prevent water from flowing into the intermediate chamber, it is likely that the dry pipe valve will trip, flood the piping and require resetting.

ANNUAL TESTING & INSPECTION

Each dry pipe valve should be trip-tested annually. To prevent freezing, they should be tested during warm weather. Annual trip testing may be performed without flooding the sprinkler system. When testing the system, the control valve should be partially open. This allows the clapper to pop up and latch. If the clapper does not latch in the open position, the test is a failure and should be retested after repairs are performed. The condition of the inside of the valve is inspected and cleaned. Any worn or broken parts are to be replaced or repaired as necessary.

Systems protecting freezers should be tested in a manner that prevents the introduction of water or moisture into the freezer. In the event water is introduced into the sprinkler pipes within the freezer, it may freeze almost immediately. It is usually not practical to bring the freezer back up to a thawing temperature to thaw the sprinkler system, and other concerns about insulation and building systems may also become an issue. To thaw the system, workers may need to dismantle the pipes, take the components out of the freezer, allow them to thaw, then reassemble them inside of the freezer. This is a time-consuming process, which disrupts storage operations and is expensive. Ice plug investigations should be conducted at least annually. Most freezer systems have an arrangement that facilitates ice plug investigations and maintenance, but older systems may not.

In areas, such as valve enclosures, where low temperature alarms are installed, annual inspections should be performed at the beginning of the heating season to ensure that they are operable and in reasonable calibration.

Automatic air pressure maintenance devices are to be tested annually in conjunction with the annual trip test. The manufacturer's instructions should be followed, and any maintenance identified should be performed.

A main drain test is to be performed at least annually. The main drain test should also be performed after each valve closure, such as after each trip test. Many insurance carriers and risk managers look for the main drain test on a more frequent basis, at least quarterly and sometimes monthly.

TRIANNUAL TESTING

Each third year and whenever the system is altered, the dry pipe valve is to be trip-tested with the control valve fully open. Any quick-opening device, if provided, is to be in service.

An air leakage test should also be conducted every 3 years. Two methods are permitted:

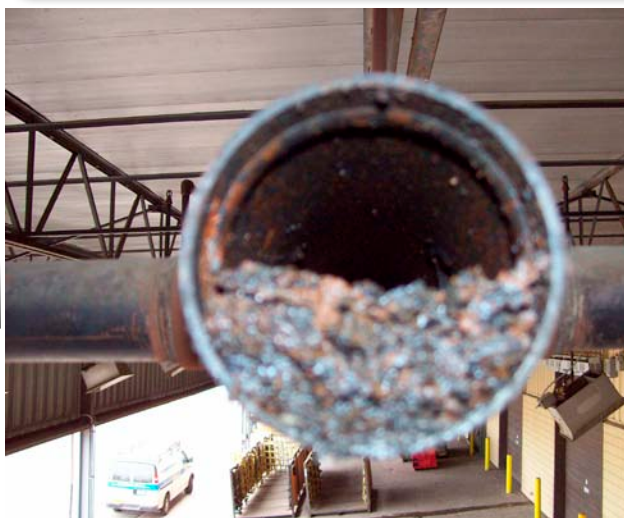


PHOTO COURTESY OF SONITECH NDT. USED WITH PERMISSION.

Photo 12: This corrosion was discovered in a dry pipe sprinkler system using ultrasonic scanning methods. Such methods allow for total system scans without dismantling the system piping.

plunger, slowly open the alarm test valve. If no water discharges from the velocity drip, continue opening the valve and performing the waterflow test. When the alarm activates, close the valve. If you open the alarm test valve and water begins to flow from the velocity drip valve, close the alarm test valve. This indicates that the check valve between the alarm line and the intermediate chamber is not preventing water from flowing back into the intermediate chamber. If the velocity drip valve is clogged and at the same time the



Area in RED is where 0.034 wall was found. Area in blue is a larger nodule behind it

Photo 13: Corrosion in dry pipe sprinkler systems may be severe. This type of corrosion may be found in older sprinkler systems. Pipe integrity problems include scale as well as corrosion of the pipe, causing thin areas that may begin leaking. This condition was discovered using ultrasonic scanning.

1) A pressure test at 40 psi for 2 hours. The system is pressurized, and the air supply is shut off. The system may lose up to 3 psi during the duration of the test. If the system loses more than 3 psi during the test, the air leaks must be addressed.

2) A pressure test at normal system pressure for 4 hours. The air source is shut off for 4 hours and if the low air pressure supervisory alarm activates within this period, the air leaks must be addressed.

5-YEAR MAINTENANCE

Every 5 years or as needed on a more frequent basis, each strainer, filter and restricted orifice is to be inspected internally.

The sprinkler piping should be inspected in accordance with Chapter 14, Obstruction Investigation. Many sprinkler systems are not properly internally inspected on a 5-year basis. The author has witnessed sprinkler flushing that was so plugged the water stopped flowing through the branch lines despite having a fully open end. The pipe was disassembled, and the plugs were physically removed. Alternative non-destructive examination is permitted in lieu of opening the sprinkler piping. This is an effective method of performing the 5-year internal inspection.

Microbiologically influenced corrosion (MIC) is a major problem in some areas. If MIC is suspected, tests should be performed to positively identify if it exists.

DOCUMENTATION

NFPA 25 requires documentation of testing. A

tag or card documenting testing is to be attached to the valve. Information on the card should include the test date and the name of the person and organization conducting the test. Separate records should be maintained, which record the initial air and water pressures, the air trip pressure, time for water discharge from the inspectors test connection during full trips and the valve's condition. Prior test results should be compared with the current test and if the results are deficient or deteriorating, appropriate actions should be taken.

PERFORMING A TRIP TEST ON A DRY PIPE VALVE

Tripping a dry pipe valve is a simple process, which will usually require at least two people using the following general steps that may vary depending upon your equipment and local conditions.

1) Your impairment program should be implemented prior to making a trip test. The area protected by the dry system will not have protection or alarms in service while the valve is reset. The alarm system will be impaired and may be in a silenced mode. Inform your alarm company, fire department and insurance carrier that you are working on the system and will advise them when the system is back in service. The alarm company may not call the fire department in the event of subsequent alarms, so a fire watch should be implemented and managers informed that the system and alarms are impaired.

2) Have all of your tools ready to reset the valve after the test.

Have at least one stopwatch or a watch with a second hand. Install calibrated test gauges on the water and air sides of the system. Two-way radios will be helpful to communicate between the inspectors test connection and the riser. Two key times are needed—the dry pipe valve trip time and the time for the water to reach the inspectors test connection.

3) Depending upon your water conditions, you may want to perform a main drain test. This will help clean the incoming lateral of scale and debris prior to the trip test.

4) Record both the water and air pressures before the test. One person will remain at the valve to carefully watch the gauges and to time the valve trip with the stopwatch.

5) The second person will open the inspectors test connection in quick fashion and will radio the person at the riser to start the timer. In the event radios are not available, the person at the riser may determine the start time by observing the needle on the air gauge. When the valve begins to move downward, that is the time the inspectors test connection is opened.

6) The person at the riser will continue to watch the air gauge and to record the time and pressure at

Tripping a dry pipe valve is a simple process, which will usually require at least two people.

the valve trip. Typically, the valve trip will be evident. The operator will hear the trip. The air gauge will jump from the trip pressure and will increase as the water rushes into the piping. Many times, the sprinkler piping will shake noticeably.

7) Allow the water to flow into the sprinkler system. Note the time when water starts to discharge from the inspectors test connection.

8) Allow the inspectors test valve to remain open and flowing until clean water continuously flows from the connection.

9) Terminate the test by closing the inspectors test valve and then the main water supply control valve.

10) Compare the data of trip pressure, trip time and water delivery time to the inspectors test connection with previous test records. If the data differ significantly, the cause should be investigated and any improper conditions corrected.

11) If repairs or corrections are required, the test should be repeated until the valve performs properly.

RESETTING A DIFFERENTIAL DRY PIPE VALVE

After the dry pipe valve has tripped, it must be manually reset. Prior to resetting the valve, refer to the manufacturer's material data sheet for your particular make and model of dry pipe valve. Most valves require that the valve be opened, but some newer valves do not require that the faceplate be removed. Other valves use a pin to hold the clapper closed and require a slightly different procedure. This is a general method to reset a typical dry pipe valve and is not specific to any dry pipe valve.

1) Your impairment program should be implemented after a trip. The area protected by the dry system will not have protection or alarms in service while the valve is reset. The alarm system will be impaired and

may be in a silenced mode. Inform your alarm company, fire department and insurance carrier that you are working on the system and will advise them when the system is back in service. The alarm company may not call the fire department in the event of subsequent alarms, so a fire watch should be implemented and managers informed that the system and alarms are impaired.

2) You will need at least one large wrench sized for the faceplate nuts, priming water, a 5-gallon bucket to drain inside drains and possibly a few other tools. It is best to have the materials available prior to shutting off the water.

3) Close the main control valve.

4) Close the air supply valve(s).

5) Open the system main drain, which is usually a 2-in. valve, the priming water level valve, condensate drain valve and the inspectors test connection.

6) Drain each system auxiliary drain using the 5-gallon bucket. Draining the system may take several minutes, and water will continue to drain to low points even after the valve is reset.

7) After the system has drained, close the auxiliary drain valves. Leave the inspectors test and main drain valves open.

8) After you are sure there is no pressure on the system and the system is drained, remove the faceplate nuts, cover and gasket. Never open the faceplate of a pressurized dry pipe valve.

9) Ensure the clapper latch system has engaged and the clapper has not fully closed onto the valve seat. Some models have the latch on the faceplate and must be verified as you remove the faceplate.



Photo 14: The faceplate has been removed from this dry pipe valve after it tripped. This particular valve requires the clapper to be placed over the seat, then a bar is inserted through the hole in the latching assembly and onto the top of the clapper. The bar is used to move the latch onto the edge of the clapper to hold it while the clapper is seated with air.



Photo 15: The Victaulic NXT Series 768 dry pipe valve has a latch and actuator design, which allows the valve to be reset without opening the valve. Two valves are installed in this enclosure. These valves are installed on an outdoor process, which is not near any other buildings. To help prevent freezing, an insulated enclosure was built. The enclosure is provided with a heater and a low temperature alarm. The dry pipe valves in the photo are ready to be set to undergo their initial acceptance testing prior to being placed in active service.



Photo 16: The Tyco Model DPV-1 dry pipe valve may be reset without opening the valve. When the dry pipe valve is ready to be reset after the system is drained, the black plunger knob on the right side of the valve is depressed. A pivoting clapper latch will rotate and will allow the clapper assembly to return to the seated position. Air is then introduced into the system, and the valve may be reset. Proper maintenance dictates internal inspections of dry pipe valves despite being able to reset them without the need to remove the faceplate.



Photo 17: The inside of a dry pipe valve. The clapper in this valve is under spring tension. Notice the two seats upon which the clapper rests. The inner pipe is the water main. The outer ring seals the air pressure and priming water from the intermediate chamber. The intermediate chamber is in the space between the two seat rings. There is a normal amount of corrosion inside the valve body.

10) Lift the clapper assembly and inspect the gasket, water seat ring, air seat ring and valve interior. It is not unusual to find rust residue and stalactites inside the valve. Ensure the inner workings move freely and are not damaged. Wipe out the inside to remove large pieces of debris. Wipe the seats and gasket with a rag. Do not use tools that could scratch the seats. Never use coins or small disks to rub the seats clean. They will add unnecessary wear to the seats. If any small object is dropped into the pipe, it must be removed. That can be a difficult task, but any object dropped inside the valve must be removed because it could become an obstruction, which will plug pipes or sprinklers on future trips.

11) Release the valve latch and position the clapper into the fully closed position. Do not force the clapper. If it does not seat readily, it should be inspected for damage. Do not use any grease or other sealing material to seat the valve. These materials may harden or even seal the clapper to the seat preventing proper operation under fire conditions.

12) Reinstall the cover gasket and valve cover. Tighten the bolts gradually and carefully, alternating opposite bolts when tightening. Tightening bolts on only one side before tightening the opposite side could lead to a cracked faceplate.

13) Close the condensate and priming water drain valves. Open the valve from the priming water fill funnel. Prime the valve by slowly pouring water into the valve. When water stands in the fill cup, the water is up to the priming level.

14) Open the priming level drain to lower the priming water level to the proper level.

15) Inspect the intermediate chamber ball drip valve for leakage. There should be no leakage while the ball is free from the drain opening. You can verify that the ball is free by pushing on the spring rod. Leakage from the valve indicates that the clapper is not properly seated. Reopen the valve cover and verify the clapper position.

16) Close the inspectors test connection and reset the accelerator or exhauster according to the manufacturer's instructions and procedures.

17) Open the air supply valve and pressurize the system. As the system pressurizes, it is advisable to go to each low point drain and remove any additional water. Follow the manufacturer's instructions for setting the air pressure. Typically, using a rule of thumb, if the valve is a 5:1 ration valve, divide the highest anticipated water supply system pressure by the seat ratio and add 15 to 20 psi as a safety factor. If the system water pressure from the city is usually 100 psi, divide by 5 to approximate 20 psi as the trip pressure. This calculated trip pressure should be very close to the trip pressures noted from prior trip tests. Then add 15 to 20 psi as a safety factor to help prevent false valve trips. The air pressure should be maintained at approximately 35 to 40 psi.

18) Open the air to the accelerator or quick-opening device and reset the device. The accelerator must be reset before opening the main control valve.

19) Slowly open the main control valve until water begins to trickle from the main drain outlet. Then, slowly close the main drain valve. This will gradually raise the pressure and will help prevent unwanted tripping of the valve. When the main drain is fully closed, verify that no water is leaking from the intermediate ball drip.

20) Perform a main drain test and compare the readings with prior tests. If the pressure drops too much, investigate for blockage or a valve not fully open.

21) Reset the waterflow alarm and low air pressure alarm. It is a good practice to perform a test on each device, then reset the alarm panel.

22) Lock the control and alarm valves.

23) Conclude the impairment process by calling the alarm company, placing the alarms back into service and notifying others who were previously notified.

24) Auxiliary low point drains should be drained on a daily basis after a valve trip to ensure that all condensate is fully drained. After several days with no water drained, the frequency of low point drains may be reduced to weekly or as needed.

CONCLUSION

Dry pipe valves typically protect areas subject to freezing and are a vital portion of your overall fire protection system. They should be inspected, maintained and tested to ensure that an adequate water supply is available in the event of a fire. Following the procedures outlined in NFPA 25 will help ensure that your equipment will operate properly when you most need it. ☺

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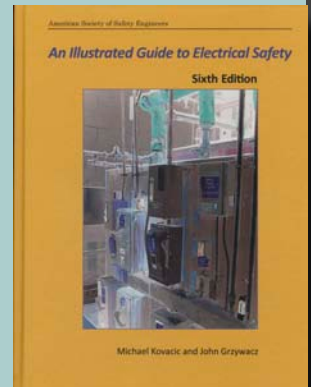
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Walter S. Beattie, CSP, CFPS, CSHM, joined the volunteer fire service in 1969 and has held various leadership roles in several departments. He has worked in the highly protected risk insurance field since 1979 in various capacities, including senior loss control specialist, HPR technical manager, underwriting special agent and account engineer. He is senior consulting engineer-insurance service with AXA MATRIX Risk Consultants in Miamisburg, OH. He is a 2011 recipient of ASSE's Charles V. Culbertson Outstanding Volunteer Service Award, was named 2007-08 Fire Protection Branch (now Practice Specialty) Safety Professional of the Year and is currently that group's Administrator.

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New Edition of Electrical Safety Guide

ASSE has published the sixth edition of *An Illustrated Guide to Electrical Safety*. The new edition, edited by Michael Kovacic and John Grzywacz, provides all text and changes to 29 CFR 1910 Subpart S implemented by OSHA in 2007, including an easy-to-use cross-reference to find new and renumbered sections.



These changes have been documented and commented on to synchronize the requirements of OSHA to the 2011 National Electrical Code, as well as to coordinate 29 CFR 1926 Subpart K requirements for construction. While OSHA did not revise the safety-related work practices section of Subpart S, the guide harmonizes the OSHA requirements with the latest NFPA 70E, Standard for Electrical Safety in the Workplace, 2012 Edition.

More than 130 illustrations are used to explain the revised OSHA requirements, and the updated analysis provides the reader with insight into how to implement OSHA requirements for a safer workplace, as well as explaining the history of some requirements. ☺

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