INSPECTION, TESTING AND MAINTENANCE OF WATER-BASED FIRE PROTECTION SYSTEMS

INTRODUCTION

National Fire Protection Association (NFPA) documents describe a level of fire protection agreed on by persons representing a variety of interests. The guidance in these documents does not reflect unique conditions or special considerations, such as system performance under adverse conditions. Nor does NFPA guidance reflect the increased system reliability that AXA XL Risk Consulting recommends for high valued properties.

This PRC Guideline takes a position on the provisions of NFPA 25 that AXA XL Risk Consulting believes require clarification or changes. To understand the position, this PRC Guideline must be read with a copy of NFPA 25. The provisions of the NFPA document are not repeated.

POSITION

Water based extinguishing systems have been proven over a long history to be among the most effective ways to protecting property against fire loss. Like all mechanical equipment, fire protection equipment and systems are exposed to environmental and other external conditions that can consequently affect performance. These include, but are certainly not limited to; corrosion from environmental and chemical exposure, accidental and intentional damage, and normal wear which deteriorates the equipment over time. And, since fire protection equipment and systems are typically infrequently used for their intended purpose, routine inspections, testing and maintenance are critical to ensure operational readiness to an emergency.

NFPA 25 addresses the care and maintenance of water based extinguishing systems including sprinkler systems, standpipes, private fire service mains, fire pumps, water mist systems, water tanks, water spray systems and foam-water sprinkler and foam-water spray systems.

Scope

The scope clearly states NFPA 25 establishes minimum requirements only and is not intended to prevent increased frequencies where deemed necessary to improve system readiness to perform as designed and installed. This standard also assumes that the design and installation of the fire protection systems are in accordance with the applicable NFPA standards in effect at the time of the installation. If an evaluation concludes a system is improperly installed or if the design or installation deficiency results in inadequate protection, upgrade of the system is warranted. System upgrade may also be warranted if the hazard being protected changes or is found to be more severe than originally that of which the system was originally designed.

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General

The responsibility for fire system inspection, testing, and maintenance lies with the building owner or a designated representative. Depending on the specific circumstances, these responsibilities may be partially by the owner, the tenant, and/or contracted management. When all or portions of a facility are leased or have contracted management, a written agreement stating the responsibilities and performance expectations of each party is critical. Note that even when inspection, testing and/or maintenance are contracted to a vendor, oversight of the process and compliance documents should remain with the building owner (or assigned delegate) to insure the requirements of NFPA standards are met. And, in all cases, both the owner and all tenants should be notified before any fire protection system is shut down for maintenance through a properly implemented Impairment Handling Program such as AXA XL Risk Consulting's RSVP* (see *OVERVIEW* (PRC.1.1.0)).

Inspect buildings annually before cold weather starts to insure there are no open wall sections or doors/roof openings that could result in water-filled pipe being exposed to sustained temperatures below 40°F (4.4°C). Tank heaters should also be verified to be operational before sustained cold weather. Routine cold weather tank inspections should be implemented. Refer to *OVERVIEW,* Section 12, Appendix E, PRC.15.5, and PRC.15.5.1, for more information on protecting fire protection equipment from freezing conditions.

Qualified Inspector

If employees are responsible for inspecting, testing, and maintaining fire protection systems, adequate training is required. The assigned employee must be knowledgeable of the installation requirements of NFPA 13 as well as understand the interrelationships between the various components of the fire protection system. Training resources should be available to these employees in addition to the NFPA standards utilized at the time of installation. Alternate trained personnel should be available for times when the primary assigned person is not available. Employees assigned to maintain fire protection systems should have the responsibility to report any issues and pursue corrective action.

Several states such as Florida and North Carolina also require certifications for all employees involved in any sprinkler system testing or maintenance. Information on requirements can be acquired by contacting the associated state professional licensing office.

Records

The building owner or a designee that is not associated with the testing and maintenance contractor should always review each report for omissions or deficiencies and, to track the complete correction of all noted deficiencies. All new contracts with test and maintenance contractors should always include verbiage a record of each test will be provided to the building owner indicating every device tested in adherence to NFPA 25. AXA XL Risk Consulting recommends inspection, test and maintenance records be maintained for review for at least 5 years to allow proper investigation or trending after a system issue or failure. By maintaining only 1 year of records per NFPA 25, this may only represent two past tests in some cases. Additionally, records of major equipment overhauls or rebuilds and associated performance tests should be maintained for the life of the system, as is recommended for new systems. Refer to O*VERVIEW*, Section 12 for further guidance.

Sprinkler Head Replacement vs. Cleaning

Damaged and paint-coated sprinklers must be replaced. Under no circumstances are coated sprinklers allowed to be cleaned. Such sprinklers could have paint that dries under the orifice caps, preventing proper operation during a fire. Sprinklers with eutectic metal links that have been subjected to a fire (adjacent to those that actuated) but did not operate should be replaced due to the possibility of cold flow. This section states damage or coated sprinkler heads must be replaced.

For the same reason, heads that may not have activated but have been subjected to heat from a fire or environmental conditions where temperatures exceeded over 100°F (38°C) around the head should also be replaced. Exposure to heat may not cause the head to operate but metallurgical damage at the molecular level could cause these to operate at some point in the future for "no apparent reason." After a fire as a minimum all heads adjacent to those that operated should be replaced (in all directions). Depending on the size of a fire, this may be extended to the replacement of 2-3 sprinklers beyond those that activated.

Fine paint spray that settles under sprinkler head orifice caps effectively cannot be cleaned and may forever reduce the reaction time of that sprinkler head forever. Additionally, when installed heads are torqued on to a certain pressure as required if removed (or "torqued off") microscopic metallurgical damage could occur to a heads frame arm loosening the orifice cap and causing the head to operate "for no apparent reason" at future time.

Piping, Fittings, Hangers, And Seismic Braces

Visually inspect all piping and each hanger or seismic brace from floor level. In addition, spot check the condition of piping, hangers and seismic braces monthly during each fire protection equipment inspection, as outlined in *OVERVIEW,* Section 12, and after any seismic event. Make this inspection from floor level. Look for corroded piping or hangers, broken hangers, improper pipe alignment or other adverse conditions. Normally, this inspection is part of the sprinkler inspection recommended in section 5.2.1. The intent is to look for signs of damage or leakage. This may require accessing areas above drop ceilings. In many cases, the effectiveness of floor inspections is significantly increased with the use of a spot light and binoculars.

Automatic Sprinkler Replacement And Testing Program

The sample selected for testing should consist of at least two sprinklers per floor, 1% of the number of sprinklers installed in the system, or four sprinklers, whichever is greater.

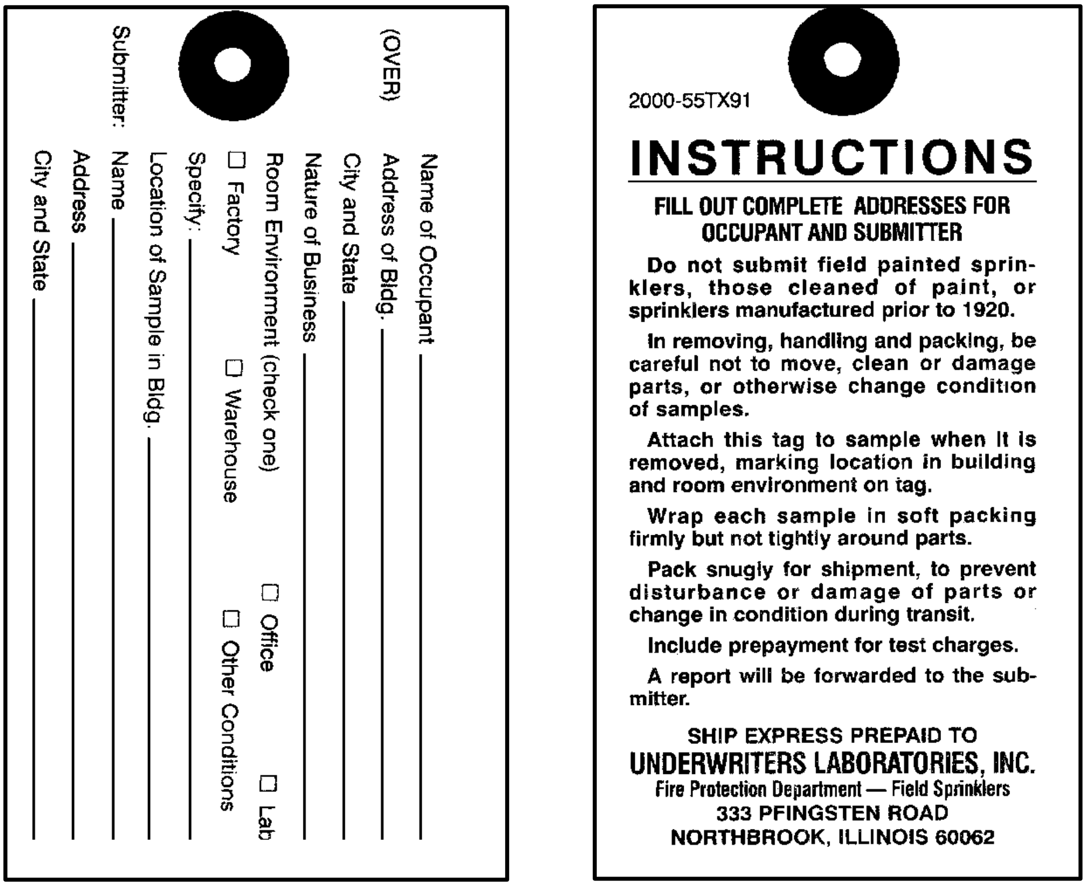
Properly tag sprinklers (see Figure 1) and ship them directly to:

Underwriters Laboratories, Inc.
Field Sprinklers Coordinator
2500 W. Dundee Road
Northbrook, IL 60062

The current charge for UL's Field Sample Sprinkler Testing service is $40.00 per sprinkler, with a minimum charge of $160.00. Payment for this service is required when submitting sprinklers to UL for testing. Underwriters Laboratories provides tags, including shipping instructions, without charge. To receive these tags, call a UL representative at 847.664.2488.

More details can be found at https://www.ul.com/news/ul-field-sample-testing-automatic-sprinklers

After testing, a report identifying the sprinkler by the tag information will be sent to the submitter and the regional Insurance Services Office. The client should send a copy of the report to their local AXA XL Risk Consulting Office.



(OVER)

Name of Occupant ______

Address of Bldg. ______

City and State ______

Nature of Business ______

Room Environment (check one)

☐ Office ☐ Lab

☐ Factory ☐ Warehouse ☐ Other Conditions

Specify: ______

Location of Sample in Bldg. ______

Submitter:

Name ______

Address ______

City and State ______

2000-55TX91

INSTRUCTIONS

FILL OUT COMPLETE ADDRESSES FOR OCCUPANT AND SUBMITTER

Do not submit field painted sprinklers, those cleaned of paint, or sprinklers manufactured prior to 1920.

In removing, handling and packing, be careful not to move, clean or damage parts, or otherwise change condition of samples.

Attach this tag to sample when it is removed, marking location in building and room environment on tag.

Wrap each sample in soft packing firmly but not tightly around parts.

Pack snugly for shipment, to prevent disturbance or damage of parts or change in condition during transit.

Include prepayment for test charges.

A report will be forwarded to the submitter.

SHIP EXPRESS PREPAID TO
UNDERWRITERS LABORATORIES, INC.
Fire Protection Department — Field Sprinklers
333 PFINGSTEN ROAD
NORTHBROOK, ILLINOIS 60062

Figure 1. Sample UL Tag 2000-55TX91

Testing Of Dry Pipe Sprinklers

Dry sprinklers should be replaced after 10 years of service or tested to demonstrate that they will perform satisfactorily. In harsh environments, replacement or testing is required every 5 years due to the increased possibility of failure. The potential for failure is greater for sprinklers that have been in service for over 10 years. Problems include but are not limited to inlet seat leakage, which can result in ice build-up inside the sprinkler barrel, as well as the condensation of moisture as air circulates through the internal components of the dry sprinkler. Moisture can also cause corrosion of the internal parts and the barrel of the dry sprinklers. Tests conducted by UL have also indicated a very high percentage of dry sprinklers have required an inlet pressure over 40 psi (2.72 bar) to operate, exceeding NFPA 25 minimum performance requirements and creating a potential impairment in which these sprinklers in low pressure systems do not operation in a fire. While many models of dry sprinklers have noted problems, only two manufacturers have issued recalls - Star Sprinkler (Mealane Corp. of Philadelphia, PA) and Tyco Fire Products (marketed under the Central and Star brand names).

Gauges

When a 5 year calibration test is done with a calibrated gauge to verify accuracy, drain testing should also be done with both gauges to insure the gauges are accurate through the complete pressure range (and one is not frozen at a given reading). It is not necessary to place a calibrated test gauge on each riser for comparison if the readings on the gauges located on adjacent risers are at the same elevation as the test gauge.

Fire Pump Operation During Fire System Testing

During regular system testing fire pumps should remain in full service. Fire pumps are sometimes impaired during testing due to fears of pressure surges and water hammer damaging water mains. Water testing without fire pumps in service will not adequately test the integrity of the water mains. It is better to detect a problem while testing under normal conditions so the issue can be resolved, rather than experiencing a failure during a fire. Furthermore, this prevents a major impairment to the system should a fire occur during testing. AXA XL Risk Consulting recommends testing be completed with all systems including fire pumps in the normal operating position.

NFPA 25 recommends an annual visual inspection of sprinklers from the floor level but does not require this for those located in concealed spaces such as drop ceilings. AXA XL Risk Consulting recommends, as a minimum, sprinklers located in concealed spaces be inspected every 5 years and whenever the ceiling tiles have been removed for maintenance or other reasons.

The effectiveness of floor inspections can be significantly increased with the use of a high powered spot light and binoculars. As an example, this can help locate taped or coated heads in high bay structures. A camera with a high powered zoom in conjunction with a spot light can also be a very good tool for finding sprinkler heads with damage during floor inspections. Sprinklers should also be spot-checked monthly during each fire protection equipment inspection as outlined in *OVERVIEW* Section 12.

Antifreeze Systems

When sprinklers are supplied from potable water systems, use glycerin (chemically pure or U.S.P. grade) or propylene glycol as a replacement antifreeze solution unless proper backflow prevention has been provided. For additional information on backflow prevention, refer to PRC.14.5.0.2.

Significant debate occurred around the proper mixing of antifreeze solution in 2010. Concern was raised about system effectiveness due to cases of improperly mixed antifreeze solution in these systems. In August 2010, the NFPA Standards Council issued amendments to NFPA 13 effectively banning the use of antifreeze in new dwelling units. Other types of occupancies and use in existing systems were not directly addressed. An updated Fire Safety Alert was issued in an attempt to clarify this, recommending that existing systems be limited to factory premixed solutions. The maximum concentration of 50% glycerin or 40% propylene glycol by volume should be used. The NFPA 25 Committee recently proposed their own standard amendment which is expected to be issued by April 2012. Under this proposal as currently drafted, it will include a similar definition as NFPA 13 for “premixed antifreeze solution” and require newly introduced solutions to be limited to premixed solutions of glycerin at a maximum concentration of 48% by volume, or propylene glycol at a maximum concentration of 38% by volume.

Replacement Of Sprinklers

Replacement sprinklers must have the same characteristics as those being replaced. Consider the style, thread size, orifice size, temperature rating, response characteristics, coating and deflector type (upright, pendant, sidewall, extended coverage or residential) when choosing a replacement. Many “special sprinklers” with unique response or distribution characteristics have restrictions placed on their use. Use caution, especially with special sprinklers, because a casual glance may not reveal the sprinkler type. In some cases, examination of the model numbers on both the frame and deflector to determine the characteristics of the sprinkler. Previously used sprinklers shall not be reinstalled.

Spare Sprinklers

Include sufficient sprinklers of each type installed, e.g., ESFR, large drop, extended coverage, intermediate (rack storage), and dry sprinklers, in the stock of spare sprinklers to allow complete replacement of the hydraulically designed area, e.g., 3000 ft^2 (280 m^2). Storage of smaller quantities is acceptable in areas where contractors can respond quickly with replacements in an emergency. In other areas, maintain sufficient stocks on-site to avoid prolonged impairments. Where deluge systems depend on specific sensing sprinklers or other fusible elements, these spares should also be maintained on-site.

Sprinklers Subject To Overspray

Sprinklers protecting spray finishing areas are subject to overspray residue. Keep these sprinklers clean and protect them against overspray. Annual sprinkler replacement is not an acceptable alternative to protection and regular inspections as the overspray buildup may reach unacceptable levels long before a year elapses. Affected sprinklers can never be cleaned and reinstalled.

Standpipe Systems

AXA XL Risk Consulting recommends visual monthly inspections of standpipe and hose system components, not annual inspections.

Hydrants And Monitor Nozzles

AXA XL Risk Consulting recommends maintaining hydrants semi-annually, not annually, in areas subject to freezing. Semi-annual “cold weather maintenance” should be performed before the change to cold weather occurs. This should include inspecting each hydrant and monitor nozzle for proper drainage and pumping out excess water and making repairs as necessary. Mark dry barrel hydrants that are not self-draining and pump them out after each use.

In addition to the semi-annual maintenance, hydrants, hose houses and monitor nozzles should be inspected after large snow falls or ice storms to ensure continued accessibility and operability.

Hose/Hydrant Houses

NFPA 25 requires maintaining hose houses and equipment if installed. NFPA 24 does not specifically require they be provided, but does require hose and accessories be made available when hydrants are provided for use by industrial plant personnel. Refer to PRC.14.5.0.1 for additional information on hose/hydrant houses.

Flow Testing

AXA XL Risk Consulting recommends flow testing of fire service mains (or loop testing) every 3 years. This will give an indication of the internal condition of the pipes, insure that sectional control valves are open and back flow preventers are operational, etc. Fire main loop testing can also detect possible obstructions and should be completed after initial installation, after major changes, or following sprinkler system work where valves may have been required to be closed. Furthermore, hydrant flow testing should be done after work has been completed on municipal water mains due to the possibility that valves on water mains were left closed or improperly flushed causing an impairment. Refer to PRC.14.1.2.1 and PRC.14.1.2.3 and PRC.14.1.2.4 sections for additional guidance on testing fire protection distribution systems.

Hydrant Testing

Hydrants should be fully opened when tested. Throttling the hydrant shaft valve to control waterflow on dry barrel hydrants will not completely plug the drain at the base of the hydrant. Water discharge from the drain during testing could erode the soil around the hydrant undermining the hydrant and piping.

During testing, care should be taken to close the hydrant slowly to prevent water hammer and resulting damage to the underground piping. Excessive pressures can be trapped above check valves on sprinkler systems. Closing the valve slowly minimizes water hammer and the potential for damage.

Fire Pumps

Fire pumps should not be used for general site processes such as cleaning equipment or yards. Fire pumps should only be operated during a fire or during routine testing and maintenance. The likelihood of impairment is increased when more personnel have access to use fire pumps for uses other than emergency response.

A qualified (i.e. well-trained) person should be assigned on all site shifts to immediately report to the fire pump or pumps and supervise operation each time a pump is started and running. This person is critical to insure pump operation and detect potential alarms or other issues before a catastrophic failure to the controller, driver or pump occurs.

Water Supply To Pump Suction

AXA XL Risk Consulting believes the water supplies for existing fire pumps should meet or exceed the pump volume and pressure demands at 150% of the rated capacity of the pump. For new pump installations, PRC.14.2.1.1 recommends the supply be capable of providing at least 200% of rated capacity at 20 psi (1.4 bar). Additionally, supply deterioration that exceeds normal fluctuations should be investigated immediately.

Fire Pump Inspection

Where practical the fuel storage tank level should be maintained as full. Top off the tank on a regular basis and schedule deliveries to prevent the fuel level in the tank from falling below ⅔ full. This can help avoid moisture condensation and resulting algae contaminating the fuel.

Fire Pump Test Frequency

Although NFPA 25 allows the test frequency to be established by an approved risk analysis, one item that needs to be taken into consideration in the analysis is the damage that can be caused by not running the pump. For example; if the pump is not run for a period of time the packing can dry out and cause the pump to leak. A diesel engine can develop moisture inside the crank case which can lead to issues. There have been battery explosions when the diesel engine is started, by conducting weekly pump runs this problem is identified before the pump is started in an emergency.

The regular maintenance or “churn testing” of electric driven fire pumps can be conducted monthly as long as other weekly, monthly, quarterly, and annual requirements are met. Diesel drive fire pumps should be tested on a weekly basis. The other visual checks of a diesel drive fire pump in NFPA 25 must also be done weekly in conjunction with flow testing.

And in addition to the monthly churn test of electric fire pumps, this should also be conducted after major storms where site power could be affected to insure pump driver power and transfer switches, etc. have not been damaged. And, as the NFPA 25 annex comments, consideration to increasing the monthly test frequency should be considered for electric driven pumps in areas of high lightning activity due to similar concerns (which may be undetected and result in a hidden fire pump system impairment unless churn tested.)

During churn testing, automatic pump starts should be tested by dropping the system pressure. For diesel driven fire pumps, the automatic start should be conducted on each set of batteries. Pumps should not be isolated from the fire protection underground by closing valves. This is sometimes done due to concerns testing will “over-pressurize” underground water mains and increase the likelihood if leaks (as in older mains) due to these higher pressures. In reality, although water main leaks result in unplanned capital expense to fix, it is better to find such leaks in a test situation before a real fire. Thus, part of regular churn testing is to insure the entire fire protection system, including underground water mains, can maintain integrity with churn pressures and start-stop pressure fluctuations.

Operators should take precautions when starting diesel driven fire pumps, such as taking a physical position with maximum shielding from the cranking batteries. Cases have been documented where batteries exploded at start up, spraying acid across the pump room. Several cases have been documented where fire pump batteries exploded at start up- spraying acid across the pump room. For this reason, AXA XL Risk Consulting also recommends batteries be shielded in a manner to contain such an explosion but vented so as not to trap hydrogen from the batteries. This is typically done with an open sides shield that covers battery tops.

Automatic Timer Starts

Using an automatic test timer to start a fire pump during churn testing is an option on all controllers and alternative starting procedure. However, this does not negate the requirement to have qualified personnel present every time a fire pump is operated. Maintenance or other personnel should be present whenever the pump is operating to continuously watch for poor performance and trouble conditions.

Annual Fire Pump Testing

The annual fire pump test confirms that the pump and associated equipment operate as well as they did during the acceptance test. In general, annual testing is less intensive than the acceptance test described in PRC.14.2.1.1. NFPA 25 outlines three methods for testing fire pumps. AXA XL Risk Consulting recommends using the hose stream testing since it is the most comprehensive and accurate. Avoid the closed-loop test method as it does not evaluate the suction supply.

This testing should include the following:

- A minimum of three flow points close to shut-off (also called “churn” or “no load”), 100% flow (rated) and 150% flow of rated capacity.
- A duration long enough to demonstrate the pump is in good condition for prolonged operation and suction and power supplies are sufficient to sustain continuous operation at full capacity. Combustion engine-driven pumps should also be run long enough, especially at 150% capacity, to demonstrate the engine will not overheat under peak load.
- Starts made from each power supply using a drop in pressure including testing transfer switches, if provided.
- Checks of pressure settings to ensure the pump operates promptly with minimized water hammering.
- At least one manually start on each battery set.

Most communities have a minimum 20 psi (1.37 bar) limitation on pump suction pressures. AXA XL Risk Consulting strongly supports this pressure limitation. On rare occasions fire pumps need to be tested using dry barrel hydrants. In these cases, the main hydrant valve should be completely opened and not be used for throttling the volume. Partially opening the valve stem does not allow drain holes at the base of the hydrant to fully close which allow the drains to release water under pressure. This could cause underground soil erosion around the hydrant below the thrust blocks and piping, eventually damaging the pipe, thrust blocks and hydrant.

Annual tests should include an extensive visual inspection of the parallel and angular alignment of the pump and driver. Flexible couplings are installed to allow for very minor misalignments of the pump and driver. At the annual test a visual inspection should detect wear on the coupling if there has been a pronounced problem. Minor problems can be detected by use of a straight edge, taper gauge and feeler gauges. If issues are detected, corrections should be made immediately.

Controller Alarms

This section is meant to ensure controller alarms (low oil, high coolant temperature, failure of engine to start, engine overspeed, etc.) are tested and work as installed at each annual fire pump test. While it is not the intent of NFPA 25 to require these test signals beyond the controller , AXA XL Risk Consulting recommends these alarms be activated at the driver when possible and, signals be verified at the main facility controller and/or central station to insure signals are received and annunciate with the proper verbiage on text displays.

Other Tests

Fire pump controllers are equipped with numerous features that should be tested on a periodic basis to ensure fire pump reliability. When installed, AXA XL Risk Consulting recommends the testing schedule shown in Table 1 performed by qualified personnel. Several features noted are only normally present on pumps with electric drivers or diesel drivers but, not both.

TABLE 1
Fire Pump Controller Features

	INSPECT WEEKLY	TEST ANNUALLY
1. Start By Dropping Water Pressure***	YES	YES
2. Start By Remote Manual Actuation	NO	YES
3. Start By Remote Equipment Control	NO	YES
4. Running Alarm***	YES	YES
5. Running Timer	YES	YES
6. Cooling-Water Solenoid*,***	YES	YES
7. Lubrication Solenoid (Vertical Turbine)*,***	YES	YES
8. Low-Lubricating Oil Pressure Alarm*,***	YES	YES
9. Low-Lubricating Oil Pressure Switch*,**	YES	YES
10. Ratchet-Relays*	YES	YES
11. Start By Power Failure*	NO	YES
12. High-Engine Temperature Alarm,*,***	YES	YES
13. High-Engine Temperature Switch*,**	YES	YES
14. Overspeed Shutdown (Diesel)*	YES	YES
15. Overspeed Position Alarm*,***	YES	YES
16. Failure-To-Start Alarm*,***	NO	YES
17. Battery-Failure Alarm*	NO	YES
18. Battery-Failure Lockout Circuit*	NO	YES
20. Start By Manual Actuation*	YES	YES
21. Start Engine With Loss Of Controller*	NO	YES

* Does not apply to all engines
** Bench test
*** Tested on first start during weekly operation

Pumps, drivers and controllers operation and wiring arrangements vary widely, especially with newer equipment. With minor variations, the following procedures can be used to perform the numbered tests outlined in Table 1 on most installed systems:

1. Starting on a drop in water pressure is tested weekly as part of the weekly inspection, if the controller is arranged to automatically drop the pressure in the sensing line at a prescribed time. Verify by observing its operation.

   Test this function manually on an annual basis. Check the water pressure. Test the auto starting feature by manually reducing the water system pressure.

2. If provided, test the remote manual actuation device to ensure the circuit is functioning properly.
3. If provided, test automatic remote starting equipment by operating the water flow alarm, dry pipe valve or deluge valve.
4. Check local and remote running alarms.
5. If a running period timer is used, verify its settings.
6. Check the rate of discharge from the engine cooling system and observe the operation of the solenoid valve. Clean strainers as required.
7. On vertical turbine pumps having oil lubricated shaft bearings, check for oil in the sight glass to confirm operation of the solenoid valve.
8. The circuit may be tested by jumping the terminals on the pressure switch while the engine is running.
9. On some controllers the trouble lamp lights momentarily each time the engine is started. This provides an automatic test of the pressure switch, observed during weekly starting. If this feature is not provided, verify the position of the normally closed pressure switch contacts annually, while the engine is not running. Use an ohmmeter or a test light that does not exceed battery voltage.

10. Start the engine twice under automatic control and observe the operation of the ratchet relay plungers, observing the dimming of the appropriate battery lights, or listen for the reaction of the contactor solenoid armature.
11. When provided, test power failure starting of the engine by opening the ac circuit to the controller.
12. Test the high engine temperature alarm circuit by jumpering the terminals on the temperature switch.
13. Test the high temperature switch according to the engine manufacturer’s recommendations.
14. The method of overspeed shutdown is engine specific. It may be accomplished either by shutdown of the air damper for Detroit Diesels manufactured prior to 1980 or by shutdown of the fuel solenoid for all other engines. Test overspeed with the pump discharge valve shut. The engine should shut down at approximately 20% overspeed and should operate the alarm. If the relief valve has to be adjusted for this test, reset it to the correct pressure at the completion of the test. Some engines may have a verify switch on the instrument panel which will verify the operation of the overspeed switch. Some engines require that terminals on the back of the instrument panel be jumpered to activate the switch. Be sure and use the reset switch to place the engine back in operation.

    If a solenoid-operated air damper is used as the overspeed shutdown device, place a jumper across the normally open contact terminals of the overspeed switch which actuates the air damper solenoid. This should energize the solenoid and close the air damper. If a mechanically operated air damper is used, the air damper may be operated by hand to check its mechanical features.

    Newer engines use fuel solenoids with contacts that can be jumpered to simulate an overspeed condition. Where this cannot be done, a speed adapter is installed in place of the normal tachometer drive adapter during the test. This device simulates an overspeed condition by sending a doubling of the speed to the governor. In all cases follow procedures established by the manufacturer.
15. If an air damper position supervisory switch has been provided, it should continue to operate until the air damper is reset.
16. Test the failure-to-start alarm by disconnecting the starter cable (be sure and secure it so that it doesn’t touch anything) at the engine.
17. If provided, test the battery failure alarm by opening the dc circuit breakers in the controller one at a time. This should de-energize a time delay relay to reverse the “on” or “off” condition of the corresponding battery lamp and operate the alarm. Press the controller-reset push-button to reset the relay. This alarm is also tested with item 18.
18. Disconnect the battery cable as follows to avoid the possibility of a charging-current spark igniting hydrogen vents:
    - Turn controller switch to “Off.”
    - Open the ac circuit to the battery charger.
    - Disconnect cable from one battery.
    - Restore ac circuit to battery charger.
    - Turn controller switch to “Automatic.”
    - Operate reset push-button for disconnected battery.

    Start the engine twice on the in service battery to prove that the ratchet-relay locks in on each connected battery set. The failure alarm for the disconnected battery should sound on the first attempt to start. Reconnect the battery cable and repeat the procedure for the other battery.
19. Start the engine with each battery by the manual push-button.

20. Start/stop engine with loss of controller using the instructions found on the required placard supplied by the engine manufacturer on all new installations. For older models, obtain instructions from the manufacturer and post them at the engine.

Test Results And Evaluations

AXA XL Risk Consulting supports additional verbiage in NFPA 25 requiring the pump test results to be further analyzed. In addition to evaluating fire pump performance relative to the original performance curve, evaluation should also be made relative to the fire systems that the fire pumps supplies. This is not meant to imply this is necessarily the contractor's responsibility. A pump test would not be considered complete until an evaluation is made by a qualified person that the pump is performing as intended and will produce an adequate water supply (flow and pressure) to all fixed fire protection systems.

Water Storage Tank Inspection

While NFPA 25 recommends a quarterly external tank inspection, AXA XL Risk Consulting recommends this weekly to better detect and correct adverse conditions that can occur quickly such as vegetation growth. Water level, exterior tank condition (missing bolts, cracking, exposed foam insulation, etc.) and other items covered in various sections should be included. The areas directly around gravity tank tower supports should be free from weeds, debris, dirt and all combustible materials. Debris and dirt around tower legs can trap moisture and cause corrosion. Paving the area around the legs and beneath the tank is an effective solution. A fire involving combustible materials near gravity tanks may cause steel tank supports to fail. Severe exposures, such as yard storage of lumber, waste paper, flammable liquids and other materials, can expose tower supports. Where an exposure cannot be avoided, fireproof the tank supports. There should not be any signs of subsidence or steel fatigue. And, both internal and external tank surfaces should be inspected for corrosion.

NFPA 25 lists minimum internal inspection frequencies which are tied to a tanks construction and cathodic protection installed. However the exact best inspection frequency for tanks will depend on many factors including water quality, weather exposure, and, the nature of corrosion protection provided (cathodic protection, tank coating, etc.). NFPA 25 also list specific items to be conducted to help identify potential failure points, weaken structural areas and components, and obstructions but now how best complete these tasks. And while using certified commercial divers and remotely operated video equipment are now routinely used for compliance, the series of inspection tasks listed is primarily for a drained tank. And some items cannot be conducted in water-filled tanks or by remote vehicles. Thus, as a minimum, tanks should be drained once every 10 years for a thorough internal examination of dry surfaces.

When tanks are drained for inspection, this can also create a major site fire protection impairment that must be fully managed. Inspection contractors should be hired that will work continuously to minimize the duration of such an impairment. Certified repair companies should be contacted for potential availability before a tank is drained for inspection in the event work is required. In one case, a tank was drained for inspection. It was determined the interior of the tank required resurfacing. However, as this was specialized in the area the tank was required; the result was a site fire protection impairment extending over a month awaiting response from the contractor approved by the AHJ to complete this work.

The requirements are only intended for water storage tanks dedicated to fire protection use. This was specified as these requirements have been applied to tanks used for both domestic and fire protection water. While water tanks used for domestic, potable water use is outside of the scope of this standard, these tanks internal condition must be maintained as well when used for fire protection. A source for inspection of such tanks that could be reverenced is: AWWA *Manual of Water Supply Practices- M42 Steel Water-Storage Tanks* and Annex C. NFPA 25 also does not address inspection requirements for several types of non-steel tanks such as rubber bladder tanks and dike-supported rubber inflatable tanks. For these specialized tanks, most are not constructed of steel thus do not have the same rust issues. But, these could have the same obstruction issues from foreign material and debris. Consult the manufacturer for best inspection practices for such “special” water storage tanks.

Pressure Tanks

AXA XL Risk Consulting recommends inspecting all water supplies weekly. This includes the air pressure and water level in pressure tanks. This could vary by design or jurisdiction. It is somewhat common for a tank to be maintained at ⅔-¾ full of water and pressurized at 75 psi (5.17 bar) to 100 psi (6.89 bar).

Operational Test Performance (Water Spray)

Whenever possible water spray systems, foam-water systems, and deluge sprinkler systems tests should be done to fully simulate actual emergency events. Water should flow from the systems long enough to test water supply adequacy and allow a visual check. A visual check should include verifying proper discharge patterns from all nozzles or sprinklers to help insure they are not plugged and that drainage systems are operating properly to handle the system discharge. Full flow testing also helps verify that protected surfaces of special hazards (such as transformers) are properly covered by the spray discharge.

Pressure Readings

Take pressure readings at the most remote portion of the system and at the system riser to determine that the system will continue to meet the original design criteria. Compare the pressures with the results of previous tests and the original acceptance test results if available. If the base of riser pressure reading is different from previous results, take pressure readings at the most remote discharge outlet to ensure the design criteria can still be met. Decreases in the pressure available at the base of the riser usually indicate problems such as a change in the water supply or a partly closed valve. The pressure may increase if the water supply has been improved. Small pressure increases at the riser may also result from a partial blockage of the system piping, which can normally be detected by changed discharge patterns.

Multiple Systems

When multiple systems are expected to operate simultaneously, NFPA 25 recommends testing them simultaneously. When multiple systems are tested, water should be flowed from all systems long enough to verify proper drainage and water supply operation as, simultaneous testing may discharge large quantities of water.

Although both NFPA 25 and AXA XL Risk Consulting recommend discharging water from the systems during the annual tests, NFPA 25 allows the systems to be “dry tripped” without flowing water if plant conditions do not permit the water to safely discharge. This exception applies to deluge valves and deluge water spray systems. This can also be done on dry trip systems in areas experiencing severe drought. However, when possible, wet trip testing is recommended at minimum 3 year intervals.

Bladder Tank Proportioner

Check for the presence of foam in the water surrounding the bladder. The presence of concentrate surrounding the bladder can indicate abnormal conditions such as rupture in the bladder or some other degradation creating a foam water migration. This could also be the result of an improper procedure for filling the bladder or a problem with the check valve.

Operation Test Performance (Foam Water Systems)

NFPA 25 recommends annual discharge testing, but this may not be possible because of environmental regulations. Foam may be considered environmentally hazardous even though it is used in small concentrations. Foam solution can kill the microorganisms used in some wastewater treatment facilities. When foam cannot be discharged into the protected area, make alternate arrangements to discharge and collect the foam in order to test the pumping and proportioning equipment (such as discharging directly into tanker trucks).

Main Drain Tests

Conduct main drain tests whenever a sprinkler control valve has been exercised/closed and following a spring testing of the valve whenever the seal on the system control valve is missing or broken (indicating there may have been unauthorized access). The primary function of the main drain on a sprinkler system is to allow the system to be drained quickly. The main drain test is used to detect a serious obstruction such as a detached gate from a valve stem or a fully shut valve. But this test alone generally will not detect a partially closed valve. For example, an 8 in. (150 mm) gate valve could be more than ¾ shut and only increase the friction loss by 3 psi – 5 psi (0.2 bar – 0.3 bar) thus not showing appreciable change to warrant an investigation on a system sprinkler riser pressure gage. Testing should also be conducted with all water supplies in service (i.e. all fire pumps left on) so an adequate water supply is available should a fire occur during testing as well as to increase friction loss and the potential to detect issues. During testing where pumps are in service, as always it is important to insure qualified personnel directly monitor pump operation from the pump room while running.

Quarterly drain testing is still required for systems with feed mains that pass through backflow apparatus and/or pressure reducing devices valves to provide more regular exercising of the internal mechanical parts of these systems and insure debris has not prevented proper operation.

Test Procedures

Prior to conducting any tests, take precautions since the act of testing will require that alarms be impaired. Notify appropriate personnel that testing is being conducted, and coordinate the testing with security or other personnel to insure that should an emergency develop, the fire department and other emergency personnel will be notified. The procedures outlined in *OVERVIEW* and PRC.1.1.0 must be followed.

To perform a drain test, use the following procedure:

1. Record the static pressure. To obtain a true static pressure, it may be necessary to crack open the main drain to relieve trapped pressure above an alarm check valve.
2. Open the 2 in. (50 mm) drain fully and allow the water to flow until the pressure has stabilized, and record the residual pressure.
3. Close the 2 in. (50 mm) drain valve and observe the pressure to be sure it returns promptly to the static pressure recorded in Step 1.
4. Compare the friction loss with that recorded in previous tests. If the loss increases more than a minimal amount, determine the reason and take any necessary action. Conduct drain tests with all of the water supplies in service.

Alarm Devices

Test waterflow alarms on wet pipe systems by flowing water from the inspector’s test connection or the alarm bypass on dry, pre-action or deluge systems. AXA XL Risk Consulting recommends that the alarm sound (either locally or transmitted to the receiving facility) within 90 s as measured from the time the test valve is fully opened and should continue to sound until flow is stopped. Some wet pipe systems equipped with alarm check valves and local water motor gongs may not operate continuously or within 90 s if the system contains significant amounts of trapped air. Eliminate the trapped air or modify the system so that the alarm sounds promptly and continuously. AXA XL Risk Consulting recommends semiannual testing for all waterflow devices.

Although NFPA 25 does not specify that alarm signal receipt be confirmed at a monitoring company (i.e. central station), AXA XL Risk Consulting recommends that each test include this confirmation such that the time of receipt and signal received are confirmed by the alarm company operator.

And, while vane and pressure type water flow detection devices are required to be tested semi-annual, the requirements for monthly and quarterly inspections and testing of other fire sprinkler devices have not changed. This includes the quarterly testing of mechanical water flow detection devices such as water motor gongs.

Valve Security

A review of major losses revealed that losses involving shut valves fall into three main categories:

- A sprinkler valve closed during a fire prematurely by the fire department with the result that many more sprinkler heads fused overtaxing existing water supplies.
- A sprinkler valve was shut during repairs or alterations and not opened before fire occurred.
- A sprinkler valve was shut as a result of a sprinkler leakage incident prior to a fire occurring and it was forgotten (thus not reopened).

A program of valve sealing and inspection is critical to helping preventing impairments of fire protection systems. All unsupervised fire protection control valves should be sealed in the open position. And, whenever a seal is found missing or broken, a spring test should be conducted with a main drain test to ensure the valve is open. In addition, whenever a valve is found improperly closed, the reason for the valve closure or tampering should be determined. The preferred arrangement for sealing valves is shown in Figure 2. Other less desirable but acceptable arrangements are shown in Figure 3.

NFPA 25 recommends either seals or locks for unsupervised valves. AXA XL Risk Consulting recommends that valves be sealed rather than locked and that valves be sealed with non-reusable straps even if locked. After analysis, it has been concluded that valve locks alone would not have prevented or mitigated many losses where an impaired sprinkler system was a contributing factor. And, serious complications and consequence can be anticipated through widespread use of locks such as a delayed response in shutting down systems with accidental discharge due to time spent locating keys on off/weekend shifts. Even when good quality locks are employed, corrosive atmospheres, extreme cold, ice or freezing rain can render locks difficult or impossible to open. Malicious hands can quickly render a lock inoperable by the introduction of foreign materials, (such as glue, toothpicks or matches) into the key slot. And, locks cannot make a valve inviolate. Where malicious intent is premeditated and action has been carefully planned (as opposed to spontaneous reaction during a riot), locks and their accessories can usually be severed by bolt cutters, saws or other devices. In a majority of cases, therefore, where there is concern over exposed and critical valves, better security is achieved by placing them under central station or proprietary supervision. By this means, valve tampering can be immediately identified.

And, where a program of locked valves is followed, NFPA 25 allows the extension of weekly inspections to a monthly basis. Locks would not prevent an honest but careless employee from securing a valve in the closed position during repairs and alterations, and then forgetting it. And, this could mean that an impairment condition could go undiscovered for a month instead of a week under the extended inspection frequency.

Restrict the use of locks to locations where:

- A full-time security and fire protection department is available and prompt response to emergencies at all times is thus ensured. As an additional precaution, carry a device, such as a bolt cutter or saw, capable of severing the lock, on the fire truck or emergency vehicle.
- Exposed valves exist outside the security fence in areas of potential social unrest. AXA XL Risk Consulting recommends supervisory devices for these valves, but locks are also justified to deter valve closures during riots or civil commotion.
- Supervision consists only of sprinkler water flow and the water flow supervision is not the drop-in-pressure type.

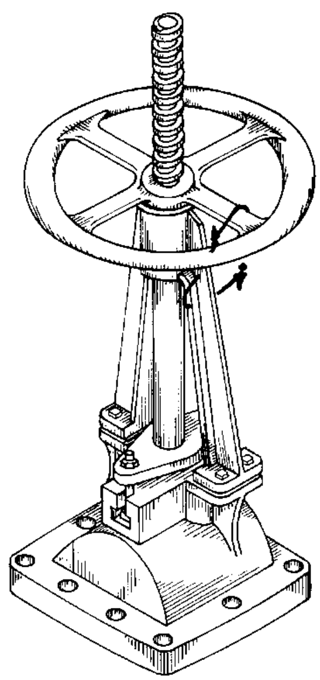
INSTRUCTIONS FOR USE OF PLASTIC FASTENER FOR SEALING VALVES

INSERT

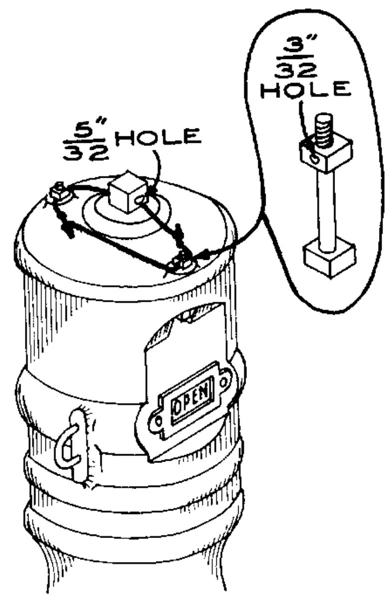
1. Simply Pass The Pointed End Through The Loopholes Of The Items You Want To Join.

LOCK

2. Insert Arrowhead Firmly Into Socket. You Can Feel It Snap Into Place.



Secure Two Seals Around Valve Yoke And Wheel



Secure Two Seals Through Operating Stem Nut And Two Bolts. Drill Required Holes

Other Types Of Valves Require Similar Sealing Arrangement. Keep In Mind The Objective Is To Seal The Valve In A Reliable Manner So That The Valve Can Not Be Operated Without Breaking The Seal.

Figure 2. Preferred Arrangement For Sealing Valves.

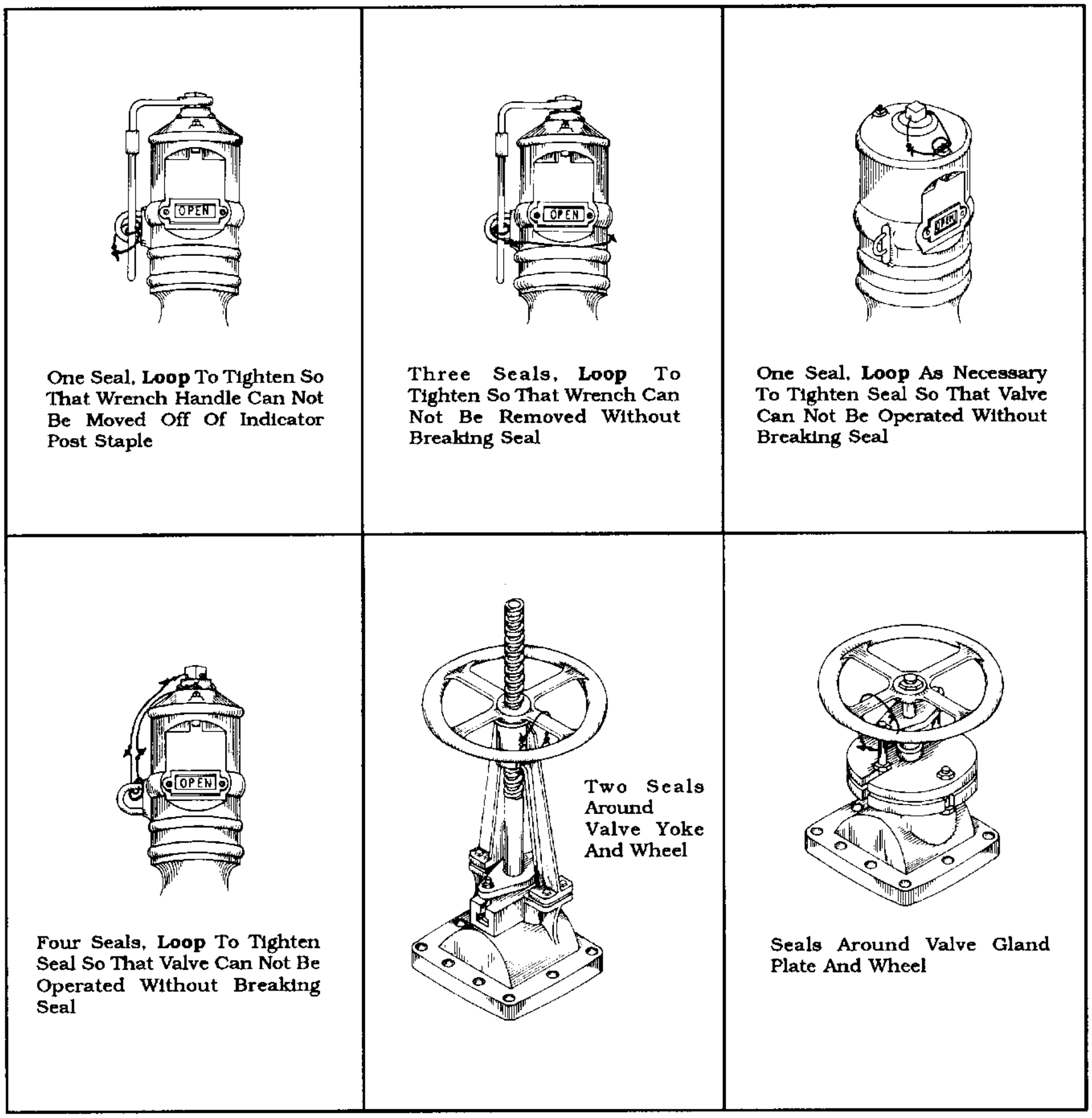


Figure 3. Alternative Arrangements For Sealing Valves.

In conclusion, the AXA XL Risk Consulting recommends owner/occupants seal all valves and conduct weekly visual valve inspections along with valve spring testing and 2 in. (50 mm) drain testing whenever a seal is missing or broken. In addition, implement a thorough program for impairment handling with top management review for closed valve incidents to insure an effective overall program for valve security.

Carelessness on the part of employees must be of equal, if not greater, concern in relation to the incidence of shut valves as the potential for malicious tampering. Where an increased concern for tampering exists, provide complete alarm and supervisory service. Locked valves have merit in special cases, but the indiscriminant use is not justified or acceptable.

NFPA 25 has changed the frequency of inspecting electrically supervised valves from monthly to quarterly. AXA XL Risk Consulting believe that the high values associated with our clients property still warrants monthly inspections and the time needed to do this is minor compared to the assurance that the valves are open. Shut sprinkler valves remain the number one cause of sprinkler failure. On a case by case basis the Loss Prevention Center of Excellence will review probabilistic based data to determine if a greater frequency if inspection still results in an a mutually acceptable risk.

In looking at the reason for the change, the committee statement states:

> "If there is no data to support keeping these inspections at a monthly frequency, they should be made quarterly for consistency with other inspections and tests. The frequencies in the standard are minimum and can certainly be exceeded when specific circumstances warrant. This change will aid in the improved application and compliance with the standard."

One of the major reasons for fires to grow in a sprinklered building is that the sprinkler system was impaired prior to the fire. The visual inspection of all the electronically supervised valves on a monthly basis is to verify the valves are open. While the valve is supervised, depending on the type of supervision, the wiring to the valve and the switch are not supervised and could themselves be impaired. Since the supervision is a not an alarm circuit, any impairment of the circuit would not be detected.

AXA XL Risk Consulting recommends all locked and supervised valves be inspected on the monthly schedule.

Valve Tests and Maintenance

Conduct a spring test, reseal the valve, and conduct a drain test on control valves whenever the seal is missing or broken, the valve is found improperly closed, or inspection otherwise indicates that the valve may not be fully open. AXA XL Risk Consulting does not recommend the routine spring testing of sealed valves, unless a visual inspection of the valve and its seal indicates a potential problem. Test supervisory switches on all valves quarterly and at the same time, conduct a spring test, reseal the valve and conduct a drain test.

Annually, lubricate all control valves and maintain valves in accordance with the manufacturers' instructions as part of an acceptable preventive maintenance program. Conduct a main drain test after any system control valve maintenance and loop testing after any sectional control valve maintenance.

Deluge And Preaction System Testing

Test the detection system for deluge and preaction systems as recommended in NFPA 72. Treat heat actuated devices (HADs) as restorable heat detectors and not pneumatic line type detectors. Regardless of the detection method used and NFPA 25 testing requirements, alarms system components/devices should be tested at NFPA 72 recommended intervals.

External Resetting Dry Pipe Valves

There are valves on the market that allow for resetting without removal of the faceplate. These valves should also be inspected interiorly where water supplies are corrosive (or corrosion has been a problem) or where non-potable water from lakes, rivers or other supplies may contain sediment. Dry valve interiors are subject to very corrosive conditions and annual inspections with internal maintenance can minimize performance issues. When clean water supplies are used interior inspections of these valves can be conducted at three-year intervals in conjunction with the triennial full flow trip test.

Dry Pipe Testing

Trip test dry pipe valves with the control valve fully open not partly open. Test in the fully open position to simulate the same conditions as those encountered during a fire. Tests conducted with the valve partly closed have limitations. These tests:

- May not prove the valve can or will open wide.
- May not prove the latches will hold parts in the proper order or position.
- Do not prove all parts of the valve will withstand the hydraulic shocks involved.

- Do not prove the system fittings and piping will withstand the shock of full operation.
- As a minimum, conduct a full flow test triennially.

A dry valve protecting an area such as a freezer that is constantly below freezing may present a challenge. The partial flow trip test outlined in NFPA 25 may not be sufficient to prevent water or moisture from entering the system piping and freezing. In these cases, AXA XL Risk Consulting recommends the following:

- Modify the piping supplying the dry pipe valve so it can be drained and filled with dry compressed gas (air or nitrogen). This allows the mechanical operation of the valve to be tested without the potential for water to enter the system. Figure 4 details two possible piping arrangements. Ask the valve manufacturer to determine the required volume, which usually will be about 2 ft3 (57 L). Placing a control valve above the dry valve to prevent water from entering the system piping is not acceptable, even when the valve is supervised.
- Do not use water as the priming fluid, because its vapor can rise into the piping, condense and freeze. The manufacturer of the valve should be consulted for an appropriate priming material (propylene glycol or other suitable liquid) that is acceptable to local health authorities and will prevent ice from forming and damaging the gaskets and valve parts.

Leave air maintenance devices in service during all dry pipe valve tests. This ensures that the setting on the air maintenance devices do not admit enough air to delay dry valve operation.

When the results of the trip test are being reviewed, evaluate the performance of the dry valve and the overall system. Consider the operation of the dry valve itself unsatisfactory if:

- The valve fails to operate.
- A differential dry pipe valve trips at more than 150% of the design pressure differential.
- A mechanical dry pipe valve trips at less than 50% of the normal trip pressure.
- A mechanical or operating failure of parts occurs.

Determine the reason for unsatisfactory tests and correct immediately.

The performance of the system is unsatisfactory if water does not reach the inspectors test connection within one minute, measured from the time the inspector's test valve is fully open. When the test results do not meet this objective, install a quick opening device (QOD) or add a supplemental chamber to an existing QOD.

Pipe Size	Feet Of Pipe For 2 cu ft Volume
4 in.	22.5
6 in.	10.5
8 in.	5.5
10 in.	3.5

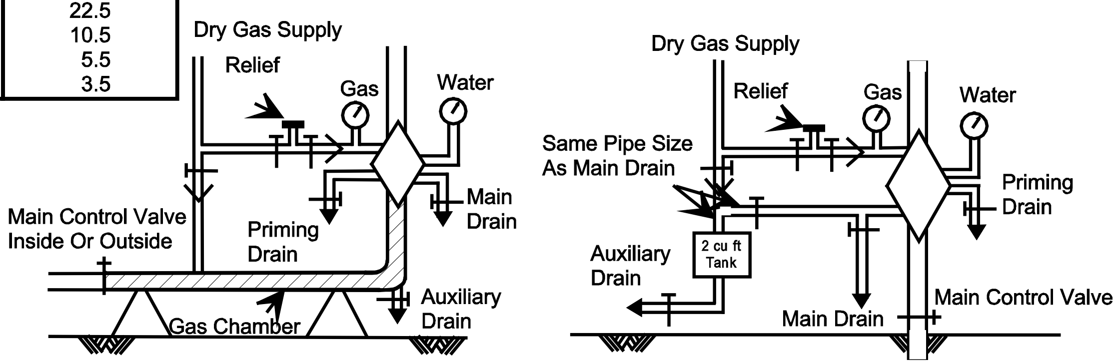


Figure 4. Piping For Dry Valves Protecting Areas Constantly Below Freezing.

Quick Opening Device Testing (Accelerator Or Exhauster)

Test dry pipe systems first in the "as found" condition with the QOD in service. If the QOD is an accelerator, trip the dry valve a second time without the QOD to ensure it operates properly. Have available spare QODs or, as a minimum, critical spare parts to minimize the length of the impairment when repairs are needed.

Air Leaks

Maintain the air pressure on a dry pipe system no higher than necessary to prevent the system from false tripping because of air leakage. Follow manufacturer's recommendations. Typically, maintain dry pipe valve air pressure at 15 psi – 20 psi (1.03 bar – 1.38 bar) above the dry valve trip pressure. Repair all significant air leaks. For systems in-service, investigate air leakages over 5 psi (0.25 bar) per week. Automatic air maintenance devices should not run frequently. Do not maintain excess air pressure on a dry pipe valve to make up for system leaks. While important for all dry systems, these recommendations are critical to prevent ice formation in freezers and other areas that are constantly below freezing.

Hose Rack Assembly Pressure Regulating Valve Flow Testing

Testing pressure-regulating valves in standpipe systems, as recommended in this section, can significantly impair the standpipe and sprinkler systems. Most standpipe systems cannot remove the water that must be flowed from the hose outlets. This can be a significant problem in many buildings, especially high rise buildings. The floor drains for the sprinkler system are usually too small to handle the flow required for testing the hose valves. Testing may involve one of several options:

- Install a drain riser and test the hose valves "in-place" with a flow meter. This is the preferred arrangement. Provide new standpipe systems with a drain riser large enough to handle the flow rates required for testing. This would typically be a 250 gpm – 500 gpm (950 L/min – 1900 L/min) flow and would require a 4 in. (100 mm) or larger drain riser.
- Avoid removing each hose valve for testing, either on-site or at a contractor's facility, if possible. However, when this option is used, cap the hose connections so the standpipe can be returned to service while the valves are tested. Test only 50% of the connections on any riser at one time and leave all of the connections on alternate floors in service. Impair only one standpipe at a time.
- Test each hose valve by temporarily using another standpipe as a drain. Disconnecting the pressure-regulating valve on a lower level and connecting hose lines arranged to discharge outside the building can accomplish this. This option is the least desirable, because it completely impairs a standpipe and sprinkler system on a combination sprinkler/standpipe riser.
- Test hose connections through lengths of hose discharging outside the building on the lower floors and upper floors if there is access to the building roof. Do not discharge water directly on the roof.

Regardless of the method chosen, test valves in accordance with the manufacturer's recommendations. Plan testing in advance to minimize the duration of impairments to the system. When valves are removed for bench testing, tag them to identify their specific locations, and return them to their proper locations. Valves on different floors or risers are not normally interchangeable.

Backflow Prevention Assemblies

See PRC.14.5.0.2 for AXA XL Risk Consulting's recommendations for installing and testing backflow prevention assemblies.

Locking Fire Department Connection Caps

In order to reduce the replacement of missing conventional break-a-way caps, some locations are replacing these caps with locking caps. This creates a problem when the local fire department is not provided with a key. The property owner cannot be expected to respond as quickly to an incident as the local fire department. Without access (or delayed access) to the fire department connection in the event of a fire, valuable firefighting time may be lost. Without access, responding fire departments could lose the ability to provide high-pressure water at the incipient stage of the fire which would enhances the performance of the sprinkler system and help allows for rapid fire control. Locking caps should only be used where there is a history of vandalism and access is provided during all times as part of site pre-emergency response.

Obstruction Investigation

This section applies to all four “primary” sprinkler system types- wet, dry, preaction, and deluge. It also is meant to be applied to foam systems.

Due to industry confusion, the NFPA 25 has clearly defined the requirements of internal obstruction inspections and internal obstruction investigations. NFPA 25 recommends routine internal obstruction inspections at 5-year intervals while obstruction investigations, which are more extensive, are only required if inspection results raise concern or conditions exist.

NFPA 25 indicates “every other system” must have internal inspections every 5 years on “buildings with multiple systems.” This comment was a point of detailed discussion on the committee when developing the current verbiage. The word “system” as defined is open to some interpretation when it comes to these inspections. And, there have been numerous incidents of contractors misinterpretation. As written, if the Annex is not referenced, requirements could be interpreted to indicate in high-rise type structures, every other floor must be drained and broken down for inspection every other year. For a city such as New York or Los Angeles with many high-rise structures, this could affect almost every building almost every year. This also has caused confusion in structures such as large warehouses that may have as many as 50 risers per building. NFPA 25 added a section to indicate that a representative sample may in fact be used to indicate the health of the remainder of the system in some cases (i.e. that, in a single structure with numerous risers, a test of a portion of the building can be used to indicate the health of the remainder of the building without requiring each riser to be drained and inspected). With the verbiage and implications considered and subject to local AHJ approval, there may be cases where these inspections could be extrapolated further from the testing one or several risers in a multi-riser building using a combination of performance –based design and predictive maintenance techniques. Contact your AXA XL Risk Consulting representative in these cases. And, in many cases this may make sense as, each time a system is impaired, oxygen which in increase corrosions is introduced and, a major impairment is created. It should be noted however there have been many cases where, in single buildings with multiple risers/systems, a portion of systems were damaged by MIC while adjacent systems were clean and unaffected. These cases have never been fully explained other than to assume poor materials, poor workmanship, or poor commissioning methods, or sporadic contamination. Impairments during such in sections must be properly managed.

NFPA 25 directs obstruction investigation, but does not provide guidance with actions to be taken with MIC or oxygen-cell corrosion. In these cases, the systems could be salvaged (i.e., cleaning the pitted or corroded pipe) or replaced. This cost/benefit decision requires expert consultation and study. There are not any documented best practices for these cases in the fire protection industry; however, it must be considered that pipe cleaning will not address pitting and the pipe’s “C-factor”, a measure of internal pipe wall condition, must be determined by an engineering analysis. This type of analysis is typically outside of the expertise of most sprinkler contractors and corrosion control consultants. For this reason, replacement of affected pipe is normally the best solution before chemical treatment, etc.

Alternative Nondestructive Examination Methods

Nondestructive alternatives are available such as ultrasound inspections from commercially available systems. However, based on poor results from analysis of several of these cases with subsequent visual inspections, this is not recommended by AXA XL Risk Consulting for either obstruction investigation or wall thickness measurements.

MIC Testing

Refer to PRC.12.0.3.A for guidance. Care should be used in selecting a testing service. One should only be utilized that has a proven record of fire protection systems and biological testing. Self-test kits available today should not be used as a conclusive test, whether done internally or by a contractor due to inherent inaccuracies.

Ice Obstruction

Recent studies have found significant ice build-up in dry pipe sprinkler systems protecting freezers. In some cases, ice has completely blocked the piping. NFPA 25 now requires annual inspection of the interior of piping protecting freezers.

There are several potential causes of ice buildup. These include:

- Improperly arranged air intakes;
- Malfunctioning or inadequately sized air dryers;
- Excessive air leaks;
- Use of water as a priming fluid;
- Improper testing procedures.

When ice buildup is found in sprinkler piping, determine the cause to prevent future ice buildup. In some cases, modifications to the dry pipe system air supply may be required. For additional information on the design and testing of dry systems in areas with temperatures constantly below freezing see Interpretation 13.4.4.2 and PRC.12.1.1.0.

Ultrasonic examination has also been successful in discovering ice plugs.

SUMMARY OF MINIMUM INSPECTION, TEST AND MAINTENANCE FREQUENCIES

The frequencies in the following table reflect the interpretations in PRC.12.0.2.

Parts	Activity	Frequency
Air Pressure Maintenance Device	Test	Annually
Air Pressure Alarms	Test	Quarterly
Alarm Valves	Inspection Inspection	Monthly 5 Years
Alarm Valves	Maintenance	Per Manufacturer's Instructions
Alarms – Sprinkler	Inspection	Quarterly
Alarms – Standpipe	Test	Quarterly
Alarms - Waterflow	Test	Quarterly
Antifreeze Solutions	Test	Annually
Backflow Preventer	Inspection	Weekly
Backflow Preventer	Test	Annually
Buildings	Inspection	Annually prior to cold weather
Check Valves	Inspection (Internal)	5 Years
Control Valves	Inspection	Weekly(sealed) Monthly(locked, supervised)
Control Valves	Test	Annual and When Seal Is Missing/Broken Or Valve Operated
Control Valves	Maintenance	Annual
Drainage (Areas Protected by Water Spray Systems)	Inspection	Quarterly
Dry Pipe System Air Compressors	Maintenance	Per Manufacturer's Instructions
Dry Pipe System Air Driers	Maintenance	Per Manufacturer's Instructions
Dry Pipe Valve	Inspection	Monthly
Dry Pipe Valve	Trip Test	Annually
Dry Pipe Valve	Maintenance	Annually
Dry Pipe Valve Enclosure	Inspection	Daily During Cold Weather

Parts	Activity	Frequency
Fire Department Connection	Inspection	Quarterly
Fire Pump	Inspection	Weekly
Fire Pump	Maintenance	Per Manufacturer's Instructions
Fire Pump - Operation	Test	Weekly
Fire Pump - Performance	Test	Annually
Fire Pump Controller	Test	Weekly and Annually
Fire Pump House	Inspection	Weekly
Flow Test - Distribution System	Test	Loop Test After Initial Installation/Major Changes/Every 3 Years, Flow Test Annually
Flow Test - Standpipe System	Test	5 Years
Foam Concentrate	Test	Annually
Foam Concentrate Pumps	Maintenance	Monthly
Foam Proportioning System	Maintenance	5 or 10 Years
Foam Proportioning Systems	Inspection	Monthly
Foam System - Performance	Test	Annually
Foam-Water Discharge Devices	Inspection	Monthly
Gauges	Inspection	Weekly - Dry Systems, Preaction and Deluge Monthly - All Others
Gauges	Test	5 Years
Hangers - Pipe	Inspection	Annual/Spot Check Monthly
Hose	Test	Per NFPA 1962
Hose Connection Pressure Regulating Valves	Flow Test	5 Years
Hose Connection Pressure Regulating Valves	Inspection	Quarterly
Hose Nozzles	Test	Annually
Hose/Hydrant Houses	Inspect	Quarterly
Hose/Hydrant Houses	Maintenance	Annually
Hydrants	Inspect	Annually/After Snow or Ice Storms/After Operation
Hydrants	Test	Annually
Hydrants	Maintenance	Annually
Hydraulic Nameplate	Inspection	Quarterly
Hydrostatic Testing - Dry Standpipes	Test	5 Years

Parts	Activity	Frequency
Low Air Pressure Alarms	Test	Quarterly
Low Point Drains	Maintenance	Annually Before Onset of Cold Weather
Main Drain	Test	Annually and Whenever Valve is Operated/Tested
Monitor Nozzles	Test	Annually
Monitor Nozzles	Maintenance	Annually
Pipe and Fittings	Inspection	Annually/Spot Check Monthly
Preaction/Deluge Valve	Inspection	Weekly/Daily During Cold Weather
Preaction/Deluge Valve	Maintenance	Annually
Preaction/Deluge Valve - Performance	Test	Annually
Pressure Regulating Valves	Flow Test	5 Years
Pressure Regulating/Relief Valves	Inspection	Quarterly
Pressure Tanks	Inspection	Weekly
Priming Water	Test	Quarterly
Quick Opening Devices	Test	Quarterly
Relief Valve - Fire Pump	Inspection	Weekly
Sprinkler Piping - Ice Obstructions	Maintenance	Annually
Sprinkler Piping - Obstruction Investigation	Maintenance	5 Years
Sprinklers	Inspection	Annually/Spot Check Monthly
Sprinklers	Test	At 50 Years every 10 Years thereafter At 75 Years every 5 Years thereafter
Sprinklers - Fast Response	Test	At 20 Years every 10 Years thereafter
Sprinklers - Dry	Test	At 10 Years, every 10 Years thereafter
Sprinklers - High Temperature	Test	5 Years
Standpipe Components	Inspection	Monthly
Standpipe Components	Maintenance	Annually
Storage Tank - Condition/Exposures	Inspection	Quarterly

Parts	Activity	Frequency
Storage Tank - Expansion Joints	Inspection	Annually
Storage Tank - Flush Sediment	Maintenance	3-5 Years
Storage Tank - Heating System	Inspection	Daily During Cold Weather
Storage Tank - Heating System	Test	Annually Before Onset of Cold Weather
Storage Tank - Level Indicators	Test	5 Years
Storage Tank - Low Water Temperature Alarms	Test	Monthly During Cold Weather
Storage Tank - Water Level alarms	Test	Semi-annually
Storage Tank - Interior	Inspection	5 Years
Storage Tank - Level	Inspection	Monthly
Strainers, Mainline	Maintenance	Annually & After Each Operation
Water Spray Nozzles	Inspection	Monthly
Water Spray Nozzles	Testing	Annually