Healthcare

Sprinkler System Freeze Prevention Guide for Healthcare Facilities

Frozen fire sprinkler piping and other water-based fire protection system components can lead to system impairments that leave your facilities vulnerable to damage from fire as well as significant water damage from fractured piping and components.

The National Fire Protection Association (NFPA), The Joint Commission™ and other healthcare regulatory agencies require continuity of fire protection systems and preparedness measures in cold-weather conditions. Use this guide to help quantify your facilities' freeze risk and implement preventative measures to keep your key fire protection systems operating as intended during the cold weather months.

Freeze Prevention in Healthcare Occupancies: Risk Assessment

Frozen sprinkler piping can lead to the displacement of patients and residents, procedure cancellations, loss of fire protection and damage to key diagnostic equipment. Its timing can also be disruptive for healthcare environments because cold weather is typically correlated with the onset of flu season and increased hospitalizations.

In healthcare facilities, sprinkler system piping is commonly installed above fire-rated ceiling assemblies and near exterior walls and windows where cold air intrusion can lead to frozen piping. When assessing freeze potential, focus on concealed spaces such as attics, under floors, entries, stair towers, the underside of roof decks, supply rooms, interior loading dock areas, near glass exterior curtain walls and penthouses.

In residential healthcare settings, particularly buildings with Type V (ISO 1) construction, sprinkler branch piping that protects dwelling unit spaces may run through unheated attics directly above the finished ceiling of an occupied space. In these cases, improper installation of insulating materials can lead to freezing of sprinkler piping.

This often occurs when insulation (particularly loose fill) is incorrectly installed between branch piping and the ceiling space, which does not allow conductive heat from the occupied areas to reach branch piping. Improper layering of batt insulation and sealing of pipe penetrations in joists, as well as a lack of "tenting," can also lead to freezing of sprinkler piping in these areas.

Use the practical tips on next page to help evaluate and mitigate the risk of freezing in your facility's sprinkler systems and associated equipment.

Wet Pipe Sprinkler Systems

Water is continuously present in these systems, so failure to maintain proper temperatures is a leading cause of frozen pipes. Temperatures higher than 40 degrees Fahrenheit must be maintained at a minimum wherever wet pipe systems are installed.

- In areas vulnerable to freezing, ensure there are adequate heating registers and airflow, that insulation has not been disturbed or compressed and air leaks are properly sealed.
- Verify that concealed space receives sufficient heat when branch piping is installed above rated ceilings, within plenums or below sprinklers (utilizing "melt away" ceiling tile). In some cases, temperatures in these areas can be significantly colder than what is shown on in-room thermostats or building automation system readouts, particularly if roof decks are poorly insulated or piping is in direct contact with the colder underside of the deck. Rooftop penetrations, if not properly sealed, can also allow cold air to infiltrate these spaces. Temperature sensors, or even infrared thermography, can be useful in assessing these conditions.
- Entryway vestibules can be problematic due to the continuous operation of automatic doors from individuals entering or leaving the building. Windy conditions will exacerbate this problem, particularly for west-facing openings. Consider using sidewall dry sprinklers (commonly known as dry pendants) to protect these areas, since this can eliminate the need for branch piping within the vestibule.
- Closely inspect and monitor business occupancy areas, spaces without continuous occupancy, areas under construction/ renovation and temporarily vacant areas as part of daily rounds during cold weather. Frozen sprinkler piping in these areas can be particularly damaging since discovery and response time may be delayed.
- Ensure heaters in outdoor weather-tight boxes are operational and supplied by the life safety branch of the emergency power system.
- Implement preventative maintenance procedures to check operation of heaters protecting sprinkler systems.
- Ensure that ball drip valves on fire department connection piping are drained prior to cold weather to remove any water or condensation build-up in the FDC.

Dry Pipe Sprinkler Systems

These systems are designed to protect unheated spaces, but are still subject to freezing. This can occur when water accumulates in improperly pitched piping or low point drains, valve areas are inadequately heated, or return bends are not included when pendant sprinklers are installed.

- Install air driers on air intakes to reduce the accumulation of condensation in branch piping from air compressors, which can introduce moist air into dry pipe systems. As an alternative, use dry nitrogen gas in lieu of air.
- Drain low point valves at least monthly to ensure pipes remain free of water.
- Repair, replace or refasten broken, missing or loose sprinkler pipe hangers to ensure sprinkler piping is properly pitched for good drainage.
- Repair all air leaks in the system to prevent valve from tripping should the compressor lose power.
- Perform inspection, testing and maintenance procedures prior to the onset of cold weather. If a dry pipe valve fails, this allows the system to remain in service (in a temporary "wet pipe" configuration with the valve clapper secured in the open position) until repairs can be made. It also eliminates the need for impairment procedures.
- Ensure dry pipe valve enclosures have permanently installed heating equipment and temperatures are always maintained above 40° F. Connect a low temperature alarm to a constantly attended location to help monitor conditions when valves are in closets or areas that are not frequently visited by personnel.

Antifreeze Systems

Antifreeze systems are used in small unheated areas of buildings or exterior spaces such as loading docks. They use a premixed antifreeze solution of water and glycerine or propylene glycol to reduce the risk of freezing. If properly maintained, the effective freeze and burst temperature is significantly lower than that of water alone. However, a lack of proper maintenance can still result in freezing in these systems.

- Have the antifreeze solution tested annually by a qualified contractor to assure proper solution to water mixture.
- Protect listed CPVC sprinkler piping and fittings from freezing with glycerin only, as propylene glycol is not compatible with CPVC piping.

Note: New antifreeze systems are not permitted in NFPA 13 unless a listed antifreeze is used. This is due to the potential risk of ignition during sprinkler discharge in systems with higher concentrations of antifreeze. Consult your local AHJ (authority having jurisdiction) for further guidance, particularly if these systems protect occupied spaces where exposed ignition sources are present.

Fire and Booster Pumps

- Keep pump rooms heated above 40° F at all times and inspect frequently during cold weather. Pay particular attention to housing pumps and enclosures around suction intake lines in detached buildings.
- For diesel engine drives, maintain the manufacturer's recommended room temperature. If the engine drive uses block heaters, make sure they are included on preventative maintenance testing schedules.

Gravity/Suction Tanks

Despite their volume, gravity and suction tanks are susceptible to freezing. The formation of ice in the tank or on any part of the tank structure could impact water availability for fire protection systems during a fire emergency.

- Service heating and circulation equipment well in advance of the heating season to permit adequate time for repairs or maintenance.
- During cold weather, check the heating system daily, if it is not equipped with a supervised low-temperature alarm connected to a constantly attended location.
- Test low water temperature alarms annually, prior to the heating season.

My Sprinkler System is Frozen: Now What?

If your sprinkler system is frozen, take immediate action to minimize water damage or an uncontrolled fire while the sprinkler system is impaired:

- First, close the control valve to the affected sprinkler system, or if possible, a sectional or floor control valve for the affected area, to limit the scope of the impairment.
- If the piping system is not compromised, slowly open the 2-inch drain or combination riser/standpipe drain and any low point drains on the system to allow water to drain. Use plastic tarps, absorbent socks or other suitable means in the area of any actual pipe breakage to limit water damage to patient areas, supplies and diagnostic equipment in accordance with water damage mitigation plans for your facility.

After water flow has been stopped, follow these steps:

1. Notify the public fire department and consult the Fire Protection Impairment Kit provided by CNA Risk Control. If sprinkler system impairment is anticipated to extend beyond 10 hours, notify CNA Risk Control, as outlined in the kit.
2. Do not attempt to thaw piping in the building by using a torch, open flame or any other method that would require a hot work permit. Prohibit cutting, welding or other high-risk operations in the area(s) where the sprinkler system is out of service.
3. If extensive repairs are required, direct efforts toward restoring as much protection as possible by plugging, blocking or isolating the damaged section. Be sure to keep records of all plugs or blind flanges used so you can check to ensure they have all been removed when repairs are completed.
4. Implement a 24-hour fire watch until repairs are completed and all system(s) have been restored. In the event of a fire, instruct the watchperson to first notify the public fire department and then reopen any closed valves.
5. If temporary heat is necessary, use only portable units that are UL-listed or FM-Approved. Do not operate temporary heating units without supervision. Keep combustibles at least 3 feet from the unit in all directions.
6. Do not directly attach electrical resistance heating to overhead piping unless it is specifically listed for use with fire sprinkler systems and sprinkler branch lines. Improper use of "heat trace" on branch lines can result in inadvertent sprinkler operation. If it is used to thaw underground piping, it should only be used by well-trained personnel.
7. Examine the system for cracked fittings, split pipes or leaking sprinklers prior to the sprinkler system being restored to service and piping filled.
8. Open all control valves and conduct a main drain test in accordance with NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems. Closely monitor the system to ensure that restoration of water pressure does not result in subsequent failures, or in the case of dry pipe systems, inadvertent tripping of the valve due to previously unidentified air leaks.
9. Notify the public fire department and CNA Risk Control that the system is back in service and fully restored.

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