RiskTopics

Management practices – Cold weather freeze-ups

Cold weather regions where temperatures can fall below freezing present a threat to any building housing water-filled systems.

Introduction

While this document will focus on water-based fire protection systems, the guidance offered will benefit other water-based systems such as domestic plumbing, steam condensate returns, chilled water lines, and other similar systems.

To help reduce the chance of freeze-ups, a primary objective is maintaining adequate building heat in all areas where water-filled systems are present. This objective can be pursued through:

- Pre-season preparations
- Periodic cold weather inspections
- Special action plans when severe cold weather (or Arctic blasts) are predicted
- Special precautions for extended idle periods
- Response plan for low building temperature conditions

Discussion

When water-filled systems freeze, the formation of ice can develop into significant obstructions that can leave the systems impaired. For domestic systems, a freeze-up may be identified by a loss of water pressure or flow. For fire protection systems, the freeze-up may represent a hidden impairment that is not immediately apparent.

Water is unusual in that it expands when it freezes. Water that freezes within piping systems can impose significant loads that can eventually break pipes, valves and fittings. This secondary impact can lead to further system impairments. Not only must the ice thaw, but repairs will be needed.

If temperatures moderate and ice plugs thaw before broken pipes are detected, a tertiary impact can develop as water escapes from the systems and damages the building and contents. At this stage, not only can the freeze-up impair and damage a water-filled system, but it can potentially magnify into widespread property damage, business interruption, and irate tenants and customers.

The impacts of a fire sprinkler system freeze-up

- Impairment – When the system freezes, ice plugs obstruct the flow of water to sprinklers
- Pipe damage – Freezing water expands and damages system pipe, valves and fittings
- Water damage – When the cold subsides and the ice thaws, damaged pipe will release water

Adequate heat

A primary objective to help reduce freeze-ups is maintaining adequate building heat. A likely question will be what is adequate building heat?

As ice forms at 0°C (32°F), building temperature will certainly not be adequate if it is at or below this freezing threshold. So, what temperature is considered sufficient?

Standards (such as the LPC Rules including BS EN 12845, NFPA 13, VdS 2373, and VdS CEA 4001) use 4°C (40°F) as the threshold for an adequate building temperature with higher temperatures typically needed for diesel engine-driven fire pump rooms (consult with the diesel engine manufacturer for specific guidance). At this point, actions should be initiated to identify and correct the cause of the low building temperature condition.

Monitoring heat loss

Monitoring a building for a low temperature is a challenging effort. Three methods are typically used. They include:

- Normal building occupancy
- Security patrols
- Electronic low building temperature supervision

Normal building occupancy is a simple and reliable approach to monitor a building during normal business hours. Of course, there may be some normally unoccupied areas that would require a special effort to maintain periodic human presence.

Outside of normal business hours, security patrols can maintain periodic human presence throughout an unoccupied building. Hourly patrols in accordance with standards such as NFPA 601 would be one approach.

With electronic supervision, room temperature supervisory devices may be provided as part of the building fire alarm system. Room temperature supervisory devices initiate a supervisory signal when the temperature falls below 4°C (40°F). These devices are typically installed only at automatic sprinkler system risers, so, the extent of coverage provided may be limited.

Overall, there is no substitute for human presence, and few businesses provide human presence at all times. As a result, continuous monitoring of building temperature can be difficult. No doubt this explains a continuing experience with freeze-ups, and the importance of taking appropriate actions to prepare for cold weather, periodically conduct cold weather inspections, and have a special action plan when extreme cold weather is expected.

The challenge of monitoring buildings for low temperature

- Normal building occupancy – Few businesses operate around the clock
- Security patrols – Few businesses maintain a security tour service
- Electronic supervision – The number of room temperature supervisory devices is usually limited

Guidance

The following guidance applies to buildings exposed to cold temperatures at any point during the year. Implement a plan to maintain adequate heat throughout the cold weather season.

Pre-season preparations

Before the cold weather season begins, have qualified persons conduct inspection and maintenance actions including:

- Heating systems – Provide annual service.
- Air-handling units – Verify dampers work and fans are controlled by thermostat for automatic shutdown in the event of freezing temperatures.
- Non-freeze fire protection systems – Check dry pipe system air sources, air pressure levels, low point drains; and check antifreeze system solution in accordance with standards (such as the LPC Rules including BS EN 12845, NFPA 13, and VdS CEA 4001).
- Insulating systems protecting water-filled pipe – Verify coverings are intact.
- Heat trace systems protecting water-filled pipe – Verify system performance and supervision.
- Building envelope – Verify windows and doors are functional, weather-tight, and in good repair.
- Fire alarm systems – Check building low temperature and sprinkler system air pressure supervisory devices in accordance with standards (such as BS EN 54, NFPA 72, VdS 2373, and VdS 2095).

Correct any noted deficiencies before cold weather arrives. Some building spaces seem to have a greater exposure to freezing. They include:

- Stairwells
- Lobby vestibules
- Elevator penthouses

- Above-ceiling spaces
- Fire pump rooms and houses
- Dry pipe valve closets

In preparation for cold weather, review these spaces. Consider actions such as:

- Installing thermometers to simplify periodic inspections. For above-ceiling spaces, provide remote reading thermometers that allow temperature checks from floor level.
- Replacing wet-pipe sprinklers with non-freeze type systems in areas that are difficult to heat.

Periodic cold weather inspections

Once cold weather arrives, begin periodic inspections. Ideally, conduct periodic inspections on a daily basis. Prepare and use a form to record each inspection. Develop the form to capture data including the following:

- Building windows, doors, and walls are closed and weather-tight.
- Building temperature is maintained in each area including those with a greater exposure to freezing.
- Heaters are working.
- Air pressure in each dry-pipe or pre-action sprinkler systems is normal.

  Note: The normal air pressure in dry-pipe and pre-action systems will vary. Consider consulting your sprinkler contractor for guidance on what is normal for each system.
- Dry-pipe system low point drains have been drained to remove accumulated water.
- Water-filled pipe insulations are intact.
- Water-filled pipe heat tracing systems are working.

Special action plans when severe cold weather (or Arctic blasts) are predicted

When extreme cold temperatures are forecast, recognize that unusually frigid conditions could overwhelm normally effective combinations of building heat and building insulation. Take time to implement a special action plan before the severe cold weather arrives. Actions should include:

- Conducting a periodic cold weather inspection.
- Safely increasing building heat to all areas.
- Overriding energy saving set-back thermostats or building management programs that may automatically reduce building temperatures during the cold wave.

Special precautions for extended idle periods

When extended idle periods are planned during cold weather, recognize that the interruption of normal human presence during a long weekend or holiday period increases the potential that a freeze-up may occur. Implement special precautions to maintain:

- Periodic cold weather inspections
- An awareness of weather forecasts, specifically predictions of severe cold weather
- An availability of knowledgeable personnel to promptly respond to abnormal conditions

Response plan for low building temperature conditions

Develop and implement a written procedure to respond to abnormal conditions identified during a periodic cold weather inspection. Whether it is a broken window, a heater failure, or other factors causing low building temperature conditions, be prepared to provide prompt action.

For each condition listed on the cold weather inspection form, identify potential actions that may be appropriate. This may include a contractor contact list to expedite requests for heater repairs, glazing repairs, or sprinkler system service.

Conclusion

Reducing the chance of freeze-ups depends upon maintaining adequate building heat in all areas where water-filled systems are present. While this goal is easily stated, ongoing freeze-ups demonstrate just how difficult it is to achieve.

Exposures to freeze-ups can be reduced by implementing a plan that addresses pre-season preparations, periodic cold weather inspections, and actions to promptly mitigate any identified freeze-up threat.

For further support to implement a cold weather plan, contact your Zurich account team.

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