2.6 Precautions Against Freezing

2.6.1 General

Cold weather brings the danger of impaired fire protection through water freezing in sprinkler piping, underground mains, gravity or fire-pump suction tanks. This not only leaves a plant vulnerable to fire but also may involve expensive repairs for broken piping, and water escaping from piping may cause serious damage. To forestall or minimize such damage due to freezing weather, an active cold weather readiness program should be established. Such a program should include:

1. A schedule for preparing the plant facilities (building utilities and production equipment) prior to cold weather season.
2. An established weather watch with written procedures for alerting management and maintenance personnel. Procedures should be as ‘‘automatic’’ as possible, thereby authorizing certain actions at specific actual or forecasted temperatures.
3. Arrangements for watch service and maintenance personnel to be available during expected cold snaps.
4. Procedures for repairing or replacing damaged equipment and restoring fire protection, as safely and promptly as possible. Individuals such as fire brigade members, watch service personnel, valve inspectors, maintenance personnel and boiler operators should be familiar with these procedures. As cold weather approaches, carefully check the fire protection system. The following suggestions, all based on experience, will help to avoid the worry, trouble and damage that result from freeze-ups.

2.6.2 Wet-Pipe Sprinkler Systems

Freeze-ups in wet sprinkler systems occur most frequently in exposed and out-of-the-way places and during weekends or other shutdown periods when a sudden cold snap catches a plant unprepared. Most freeze-ups result from failure to provide adequate heat. Others are caused by doors, windows or ventilators carelessly left open or by broken windows, cracks, loose siding or similar defects in building maintenance.

2.6.2.1 Provide adequate heating capacity to prevent freezing during the severest protracted cold that might reasonably be expected. Responsible personnel should consult the American Society of Heating, Refrigerating and Air-Conditioning Engineering (ASHRAE) Standards for guidance if inadequate heating capacity is suspected. Pay particular attention to attics, underfloor spaces, entries, stair towers, shipping rooms and penthouses. Where false ceilings are installed below sprinklers or below piping with pendent heads, be sure that the concealed space receives sufficient heat. Temperature should be kept above 40°F (5°C) at all times. Keep emergency spare heaters on hand for trouble areas.

2.6.2.2 Search for isolated drafts or cold air leaks into infrequently visited areas or spaces where sprinkler pipes are installed. Keep in mind the possibility of high winds during periods of low temperatures. Provide necessary insulation. Repair windows and doors where necessary, and instruct watch service to keep them tightly closed.

2.6.2.3 Enclose pipes exposed to the outdoors in heated weathertight, insulated boxing.

2.6.2.4 Low temperature alarms may be beneficial in infrequently occupied areas.

2.6.2.5 Convert to a dry system, a nonfreeze system or install dry pendent heads where applicable.

2.6.2.6 See Data Sheet 9-18/17-18, *Prevention of Freeze-ups*, for protection against the freezing of industrial equipment and processes.

2.6.3 Dry-Pipe Sprinkler Systems
Observe the precautions outlined in the Section 2.9, Dry-pipe Sprinkler System Maintenance.

2.6.4 Fire Pumps

2.6.4.1 Keep pump rooms heated above 40°F (5°C) paying particular attention to detached buildings. Where internal combustion engines are installed, temperatures should be maintained as recommended by the engine manufacturer. This minimum is generally 70°F (21°C) for diesel engines.

2.6.4.2 Protect all pump piping and equipment from freezing. If pump suction is taken from open water, make sure that the pipe and intake are located so that they will at all times be completely below frost level underground and deep enough in the water to prevent their being obstructed by ice. Intake screens shouldbe kept clear of ice obstruction.

2.6.4.3 Fire pump suction reservoirs may develop a foot or more of ice covering during the winter. If a potential for vacuum conditions exists during water draw-down, maintain a hole in the ice by steam injection, water bubbling or other reliable means.

2.6.5 Mains, Hydrants and Fire Department Pumper Connections
See Data Sheet 3-10, *Installation and Maintenance of Private Fire Service Mains and Their Appurtenances*.

2.6.6 Gravity and Fire Pump Suction Tanks
See Data Sheet 3-2, *Water Tanks for Fire Protection*.

2.6.7 Extreme Cold Spells
Extra precautionary measures during unusually cold weather may include the following:

1. Maintain extra heat during periods of extreme cold, especially during idle periods, to keep the sprinkler piping from freezing. Check the heating system to make sure that it is delivering heat to all areas. Use its full capacity if necessary, and keep more heat on at night than usual.
2. Look particularly for places where cold winds can blow in; close up even small openings and keep all doors, especially large shipping doors, tightly closed at all times except when they must be opened.
3. Check room temperatures frequently, especially if they fall close to freezing. Use temporary heaters in those areas where temperatures drop below 40°F (5°C).
4. After a prolonged period of abnormally cold weather, make drain tests of sprinkler risers wherever practicable to determine if underground mains are frozen. Open the drain wide, let it run 30 seconds or more, and then shut it off. If the pressure fails to return promptly to normal, clear the mains of ice as soon as possible.
5. If needed, install FM Approved (See Appendix A for definition) heat tracing systems during unusually cold weather on piping susceptible to freezing. (Do not use heat tracing systems as a substitute for heated dry-pipe valve rooms or enclosures).
6. Provide sufficient watch service to ensure that all plant areas can be visited each hour.

2.7 Restoring Protection After Freeze-ups
Sprinkler system freeze-ups demand immediate attention. The thawing method selected will depend on the facilities available and the severity of the freeze-up. The methods described in the following paragraphs have been used successfully. Though they may not be applicable to all situations, they will at least suggest a possible procedure. Unless qualified personnel are available, it is best to hire a sprinkler contracting company for dependable and prompt restoration work.

1. Investigate carefully to determine the extent of freezing. Watch for broken bits of pipe fittings on the floor, sprinkler fusible links that have been forced open, and cracks in piping. If the inspector's test connection does not flow water, piping may be obstructed by ice. If the pressure on the alarm check valve is much higher above the valve than below it, the pressure increase may have been caused by expansion of water as it froze.
2. If some or all of the sprinkler system is found to be frozen, safety procedures outlined in Section 2.5, Fire Protection Impairment Precautions, should be followed. Sufficient watch service should be provided to look not only for fires but for leakage through damaged piping not previously discovered.
3. If only part of a sprinkler system is affected, disconnect the frozen section and restore protection to other areas before any attempt is made to remove the ice. Often the quickest way of thawing frozen piping in a partial freeze-up is to take the piping down and remove it to a heated location. It is not necessary to leave the piping in a warm place until ice is completely melted; a short exposure to heat will loosen the ice sufficiently so that it can be removed from the pipe.
4. If a sprinkler is completely frozen and a heating system is available, restore heat to the building. If the building cannot be heated conveniently, removing the piping to a warm place may be the only practical method.
5. Portable fuel-oil, gasoline or LPG-fired heaters or salamanders may be used to heat noncombustible buildings. Heaters that are listed or labeled by a nationally recognized testing

agency such as UL or AGA are preferred. If possible, remove combustible storage from the building. If this is impractical, these heaters may be used if all the following conditions exist.

a) Combustibles are removed 15 to 20 ft (4.6 to 6.1 m) from the heaters.
b) Constant watch is provided.
c) Portable extinguishers are readily available.
d) Hose lines are laid out.

Thawing can be speeded by using blowers in areas where heating by convection would be too slow. Do not use open flames or torches for thawing frozen pipes in a combustible building or near any combustible materials.

Electrical thawing usually is not practical. Caution: Do not use welding machines to thaw frozen sprinkler piping.

6. After the piping has been freed of ice, examine it carefully for cracked fittings, split pipe, and opened or weakened sprinklers. Examine all sprinklers in the affected areas, and replace any showing evidence of reduction in link tension.
7. After repairs, hydrostatically test as outlined in Data Sheet 2-8N, *Installation of Sprinkler Systems*.
8. Be sure the control valve is locked in the wide open position and a full-flow drain test is conducted, as outlined in Section 2.5, Fire Protection Impairment Precautions, after all work is completed.