REFRIGERATED STORAGE AND WAREHOUSING

INTRODUCTION

Refrigerated storage and warehousing is used in the food industry to prevent spoilage, in the pharmaceutical industry to store antibiotics, and in general industry to store chemicals that are unstable at higher temperatures. Depending upon the product, storage is in a cooler or a freezer. Coolers operate between 60°F and 32°F (16°C and 0°C); freezers operate between 32°F and minus 40°F (0°C and minus 40°C). Coolers and freezers, which can be small walk-in units or large warehouses, can be found in hospitals, laboratories, pharmaceutical manufacturers, department stores and food industries such as juice processing, grocery stores, dairies and meat processing and packaging. The storage can be in racks, in piles or on shelves. The products can be stored in steel drums, glass bottles, cardboard boxes, wood crates or plastic containers.

The belief that fires do not occur in a refrigerated warehouse is incorrect. Not only do they occur, but suppressing them is more difficult than in a standard warehouse. Usually, access into the building is limited, the water from the sprinklers and hoses can overload the rack due to freezing, and the building is often insulated with a foam plastic.

This section deals with the protection of stock from fire. Protection of plastic insulation is covered in PRC.2.0.2.

POSITION

Provide automatic sprinkler protection for walk-in units and warehouses in accordance with NFPA 13 and PRC.12.1.1.0, as modified by this guideline, for the appropriate commodity class and storage configuration.

Install alarms in accordance with NFPA 72 and PRC.11.1.1.0.

Provide a high temperature alarm that would sound an alarm at a constantly attended location when the temperature in the refrigerated space rises above the high temperature limit of the product being stored.

Walk-in Units

Protect walk-in coolers operating above 40°F (4.4°C) with a wet pipe system. Protect small walk-in coolers operating below 40°F (4.4°C) and freezers operating above 0°F (-17°C), with either dry pendent sprinklers with the piping on the outside of the units or with an antifreeze system.

Warehouses

Protect coolers operating above 40°F (4.4°C) with a wet pipe system. Protect coolers operating below 40°F (4.4°C) and freezers operating above 0°F (-17°C), with a dry pipe system. Protect freezers operating below 0°F (-17°C), with a double interlock preaction system. In addition, follow the requirements of NFPA 13 for Refrigerated Spaces for units that operate below 40°F (4.4°C). Install the shutoff valves and alarm-, dry-, or preaction- valves in a heated section of the facility. Arrange the sprinkler system so the piping can be inspected easily and the system disassembled to remove ice plugs.

In a freezer, limit the area covered by a sprinkler riser to 20,000 ft² (1860 m²). When the storage is in racks and in-rack sprinklers are provided, provide separate risers and shutoff valves for the ceiling and in-rack sprinklers. NFPA 13 allows a maximum 40,000 ft² (3720 m²) area per sprinkler riser, but if a sprinkler system trips in a freezer, the extent of the impairment in terms of time and area could be extensive.

Air supply for the dry-pipe and preaction systems must be free of moisture; therefore, pass the air through an air dryer. Dry nitrogen can be used in lieu of air.

Use one of the following types of detection systems for a preaction system:

- Linear heat detection
- Dry pilot system
- Heat detectors

Whichever detection system is used, the response time index (RTI) of the detector must be the same as the sprinkler. The installation must be in accordance with the listing and with the manufacturer's recommendations. Certain detectors can not be used in extreme cold conditions. If in-rack sprinklers are installed, the detectors must be installed in the racks at the same location as the sprinkler. If linear heat detection is installed in the racks, do not fasten it to the in-rack sprinkler piping. Support it directly from the rack structure. This will prevent it from being damaged should the sprinkler piping be hit.

A protection system for refrigerated warehouses has been developed that utilizes early suppression fast response sprinkler technology and a proprietary antifreeze solution. The system requires special hydraulic calculations, pressure maintenance and solution makeup equipment, and has critical design, installation and maintenance requirements. While approved by a nationally recognized testing laboratory, there is limited field experience with these systems since they were introduced in 2001.

Maintenance

Test alarms in accordance with NFPA 72 and PRC.11.1.1.0.

Inspect, test and maintain sprinkler systems in accordance with NFPA 25 and PRC.12.0.2. Special attention must be paid to dry sprinklers due to the harsh environments in which they are installed as in the protection of refrigerated storage. Temperature, humidity and corrosive conditions contribute to shortened life expectancy. Because of this, NFPA 25 requires a 10 year interval for the testing or replacement of dry sprinklers.

DISCUSSION

There are a number of problems associated with fires in refrigerated warehouses. One problem is foam plastic insulation in the refrigerated building or room. Foam plastic insulation, when ignited, will spread a fire rapidly throughout the area. Another problem is the result of manual firefighting in a refrigerated area. Firefighters spray water on the fire; however, when water collects on the racks and the rest of the stock, it freezes and could cause the racks or building to collapse. A third problem is the belief that fires cannot start in the cold warehouses, thus pre-emergency planning is lacking.

Two losses reflect different concerns with the storage of products in refrigerated warehouses. A fire destroyed a five-building, 224,000 ft² (20,830 m²) complex storing a variety of perishable goods in

racks and piles to a maximum height of 55 ft (16.8 m). Three of the five buildings were protected with an automatic sprinkler system. The 55 ft (16.8 m) high building was protected with a ceiling only sprinkler system. The complex contained a total of 27.1 million pounds (12.3 million kg) of butter, cheese, meat, poultry and vegetables. The fire started in a battery-operated forklift truck. The fire caused an estimated $87.5 million (2014 dollars) loss. Almost 21 million gal (80 million L) of water and 48 hours were needed to get the fire under control. Another eight days were required for cleanup operations.

Another fire destroyed a 260,000 ft² (24,000 m²), fully sprinklered warehouse storing 20 million pounds (9 million kg) of food. The sprinkler system was properly designed using double interlocked, pre-action systems installed at the ceiling and in the racks. However, the alarm system to actuate the double interlock system had been out of service for approximately three weeks because of insulation work being done in the freezer. The fire was discovered by a passer-by who notified the fire department. This fire caused an estimated $71.2 million (2014 dollars) loss to the building and contents.