COMBATING CORROSION

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QUESTION: What are some ways to identify fire suppression system failures, and how can costly water-damage claims from these failures be prevented?

A: Fire suppression systems are required by code in many buildings to protect the life and safety of occupants, and the National Fire Protection Association (NFPA) standards are typically referenced by local building codes for the installation and maintenance of fire protection systems.

In colder climates, where the sprinkler piping needs to be installed in an area that is susceptible to freezing, a "dry-pipe system" is typically selected. In a dry-pipe system, the piping is charged with pressurized air. A device known as a "dry valve" is located between the source of fire-fighting water and the pressurized air portion of the system, with the air pressure keeping the dry valve in the closed position. When the sprinkler head is activated, the pressurized air escapes through the activated head, triggering the dry valve to open.

Dry-pipe systems are often constructed of steel or galvanized steel piping. Steel piping is economical, readily available, and strong, but is also susceptible to corrosion.

There are a number of ways water and oxygen may be introduced into the piping system, which can result in internal corrosion of the piping.

First, NFPA 13, which covers design and installation standards for fire-suppression systems, requires that the system be hydrostatically tested for it to be accepted, which introduces water into the system. While gravity draining removes most of the water from the system, it does not remove it all. Piping is commonly connected with threaded fittings or rolled-and-grooved joints, where water can remain trapped.

After acceptance testing is completed, the system is typically filled with compressed ambient air, which contains moisture and oxygen, creating an environment for corrosion to begin. Maintenance and testing requirements over the life of the system (as outlined in NFPA 25) mean water and compressed air will continually be introduced.

Eventually corrosion manifests itself as small perforations of the piping near joints, which causes the compressed air to leak out. The dry-pipe system is fitted with an air compressor designed to replace any lost air and maintain pressure, but eventually the leaks exceed the air compressor's ability to maintain system pressure and the dry valve trips. Water is then discharged through the perforations in the piping.

Pipes with higher schedule numbers have thicker walls. Schedule 40 is a common pipe wall thickness, but the NFPA 13 specifies a minimum wall thickness for piping at schedule 10. Many residential facilities, such as retirement homes and hotels, have schedule 10 piping installed in attic dry-pipe systems. When the facilities follow the testing and maintenance outlined in NFPA 25, it has been our experience that schedule 10 steel piping begins exhibiting corrosion-related perforations in approximately 10 to 20 years.

NPFA 25 requires that a sample section of piping be inspected internally for obstructions every five years. while this inspection is designed to look for debris that may clog sprinklers, it will likely reveal corrosion-related issues as well. But NPFA 25 also states that "pipe and fittings installed in concealed spaces such as above suspended ceilings shall not require inspection."

We have found some common scenarios that can result in water damage claims from corrosion-related dry-pipe-system failures:

- The maintenance contractor considers the attic a "concealed space" and does not include an inspection in its scope, unless requested.
- Significant corrosion and perforation occur between five-year inspection intervals.
- The section of pipe inspected does not reveal corrosion.
- An air leak is discovered, and the leaking section of piping is replaced, but no further evaluation of the system is performed.

The use of thicker wall pipe and galvanized pipe can extend the life of the system, but does not alleviate the corrosion issue. Some effective engineering solutions—which come with increased installation or operational costs—include selecting alternative materials for construction, using a desiccant system to dry the compressed air, and using nitrogen gas to fill the piping system.

If a case or claim arises from a fire-suppression system failure, consulting a qualified engineer can help mitigate damages and ascertain potential parties at fault. ■