AVOID FROZEN ASSETS

by Heather Koehn

You've been called to a jobsite that requires a new emergency safety plumbing system because the product installed last summer froze. Needless to say, despite having a damaged emergency drench shower and eyewash—and several hundreds of gallons of water lost—the greater potential tragedy is that which looms while the fixture is out of service. Thus, when selecting a drench shower and eyewash for use in frigid conditions, a designer must be sure to understand all of the available alternatives to select the most appropriate system for the application.

OSHA's 29 Code of Federal Regulations 1910.151(c) states: "Where the eyes or body of any person may be exposed to injurious or corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use." ANSI Z358.1 (2009): *Emergency Eyewash and Shower Equipment* outlines requirements for manufacturers, installers, facility managers, and others performing weekly and annual inspections or product testing. Prior to the installation of an emergency drench shower and eyewash in an outdoor or an indoor location, ANSI requirements stress the importance of understanding how the system will interact with its environment. Most important is to identify if freezing temperatures are likely, how often they may occur, and for what time duration.

A range of products exists to address various environmental conditions to ensure that the appropriate emergency specialty fixture is installed for the specific environment. Keep in mind that although very cold temperatures present a considerable risk, warm temperatures also can be harmful. Prior to discussing each method and type of fixture that prevents freezing or scalding, it is important to understand that regardless of the chosen delivery method, each system must supply tepid water. Tepid water traditionally is defined as ranging from 60–100°F (16–38°C). If workers are aware that the emergency system is not regularly tested, maintained, and/or plumbed with tepid water, they may be hesitant to use an emergency shower or eyewash. Therefore, when an injured person uses a combination unit in an extreme environment, water temperature should be of the utmost concern.

Selecting the appropriate freeze-protected fixture for given site requirements can prove to be a confusing task. Several freeze- and scald-protected systems are available, including:

- Standard systems retrofitted with freeze- and scald-protection valves
- Frost-proof units
- Heat-traced fixtures
- Enclosed safety showers

This article is intended to answer many of your application questions and provide additional information about these systems, which will help you ask detailed, product-specific questions of your chosen manufacturer.

Figure 1 Frost-proof emergency unit

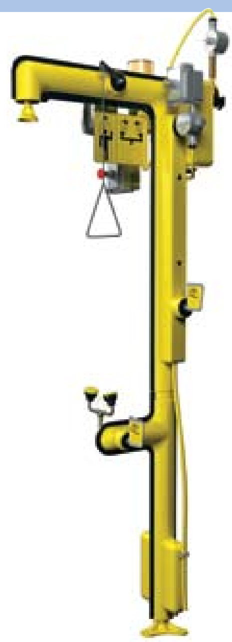

Figure 2 Heat-traced combination drench shower and eyewash

RETROFITTED STANDARD SYSTEMS

Virtually any emergency fixture product may be retrofitted with an integral freeze- or scald-protection valve. Systems with these valves typically are installed in temperate or warm climates that rarely see freezing during even the coldest months. Traditionally, a scald-protection valve begins to bleed off hot water at approximately 85°F (29°C). The freeze-protection valve serves the inverse function and begins to bleed off cold water at approximately 45°F (7°C). As the water temperature inside the pipeline hovers above freezing, the freeze-protection valve automatically moves to the fully open position and bleeds off the water inside the pipe, allowing fresh, ideally warmer water to enter the fixture. It will continue to bleed off cold water until it is purged completely from the system. Take caution during design, however, to prevent water from pooling around the fixture because it is not appropriately bled off via a hose to another location.

FROST-PROOF UNITS

In many instances, a freeze-protection valve is not the appropriate product due to geographical location. This may be an opportunity to consider a frost-proof unit (see Figure 1). Two product configurations are available. The first features a ball valve that may be buried 18 inches to 6 feet beneath the ground. When the eyewash or drench shower is activated, water flows from beneath the earth's surface and is supplied immediately to the eyewash and showerhead. These systems typically require a buried water line.

The second is a through-wall frost-proof unit, which is available for wall depths ranging up to 18 inches. These systems locate the valve inside the building, which prevents the flow of water to the outside frigid temperatures until the system is activated. A through-wall system helps facilitate the supply of tepid water. Since it is installed adjacent to a facility wall, it can be hooked up to a tempering system to provide tepid water. However, this can be a challenging task for frost-proof fixtures that are located in remote areas.

HEAT-TRACED FIXTURES

When faced with a frigid environment, a common, versatile, and cost-effective solution is the heat trace, a freeze-resistant combination drench shower and eyewash (see Figure 2). Most heat-traced systems prevent freeze-ups down to -50°F (-46°C). They are among the most complex emergency fixtures on the market, surpassed only by those products in the enclosed safety shower category.

The heat-trace fixture does not create tepid water. Its intent is simply to prevent the piping and fittings from freezing. It serves as a conduit to the water and provides various layers of freeze protection as an integral feature of the unit.

To clearly understand this product, you first must understand its most basic structure: the piping. In its most simplistic form, a heat trace typically is manufactured with galvanized, coated, or stainless steel piping that is wrapped with a sheathed heat-trace cable secured to the piping. A thick layer of foam insulation is positioned over the top of the piping to provide an extra layer of insulation. Finally, a custom PVC shell is fitted over the entire fixture. Typically, the only parts external to the PVC shell are the stainless steel pull rod (that activates the shower) and the eyewash yoke, which may or may not be coated with a protective enamel or powder. The protective coating increases the unit's corrosion resistance.

Most heat-trace fixtures include a freeze-protection valve integral to the drench shower and eyewash. It's important to note that when ordering a heat trace, you often will have the option to either top or bottom supply the fixture. The freeze-protection valve is positioned opposite of the supply to ensure that the entire line is bled of cold water. Customers frequently mistakenly order a heat-trace fixture that has the supply in the wrong location, given the setup of their site. In this instance, it is advised to contact the manufacturer of the product rather than modify the system in the field, which may unintentionally void warranties, alter how the unit functions, or damage the fixture.

Two versions of heat-trace fixtures exist in the market. The first is a system that depends on a thermostat to regulate the temperature at a constant rate regardless of the ambient temperature, which can waste a significant amount of energy. The second type of heat-trace unit conserves energy via a self-regulating cable that uses only as much power as it needs. As ambient temperatures change, the cable adjusts accordingly, minimizing costs.

Heat-traced systems are assembled to order due to various site-specific product options, which can be selected and tailored to site conditions to accommodate challenges in the field. Traditionally, site assessments define the most basic system requirements, including the electrical classification for the heat trace. You should assess the electrical hazards of the system's environment: Class 1 Division 2 (gas or vapor, abnormal) or Class 1 Division 1 (gas or vapor, normal) as defined by NFPA 70: *National Electrical Code*.

Defer to the facility's safety supervisor as to which electrical rating is required for given hazards and material handling. Following is a basic structure to help you evaluate which system's electrical rating is compliant with the site conditions. The simplified synopsis is:

- A CID2 rating is required if hazardous material that has the potential to explode enters and leaves the area in which the heat trace will be installed.
- A CID1 rating is required for intrinsically safe locations in which potentially explosive, dangerous materials or particulates are present on a constant basis. Intrinsically safe systems are constructed with multiple seals between various conduit connections. The heat trace cable is a higher grade of material, and the enclosures are fabricated from the highest industrial grade of its kind.

Among other options, heat-trace systems allow the customer to choose their voltage, which is typically either 120V or 220V. However, different voltages are available upon request. Additionally, customers may choose a stainless steel showerhead to enhance the look of their system or choose the classic ABS (acrylonitrile butadiene styrene) version, which may or may not feature a shroud.

You also must ensure that the drench shower system ships with an integral flow control or that existing systems are retrofitted with a flow-control device (inexpensive retrofit systems are available). ANSI Z358.1 requires a minimum 20-gallon-per-minute (gpm) flow rate, but some systems are capable of releasing up to 65 gpm unrestrained at the higher end of the pressure range. Water consumption aside, without a flow control, it's a challenge to meet the tepid water requirements with an unregulated system.

Figure 3
Enclosed safety shower

To fairly assess the value provided by additional options, such as alarm systems and indicator lights, it's important to understand how they function. Various alarm system configurations are available, such as single pole, single throw (SPST), which, as implied, has a single set of contacts that activates the audible and visual signal. Other systems provide double pole, double throw (DPDT) contacts as their standard. DPDT systems also activate the audible and visual signal via a single set of contacts; however, an auxiliary set is provided that may be wired at the installer's discretion to a remote monitoring station, which receives a signal when the fixture is activated.

With regard to the indicator light, this option is perhaps the most misunderstood feature associated with heat-trace systems. When the indicator light is a selected option, customers should receive one that is green and another that is amber. The green light indicates that power is running to the unit. The amber light traditionally signals that the thermostat is turned on and the heating element is functioning. The indicator light serves as a visual reassurance that the system is functional and ready for use.

Finally, as a reminder, heat-traced systems do not temper water; therefore, an auxiliary system should be considered. If the tempering design involves the selection of an emergency thermostatic mixing valve, confirm that it is just that—an emergency thermostatic mixing valve—and not a standard valve. These systems allow for a continuous free flow of cold water if the hot water supply exceeds the preset temperature. Similarly, when selecting a tankless heating system, look for a system that has a low pressure drop (10–12 pounds per square inch) to ease supply demands with respect to line pressure. Systems with this capacity will minimize potential post-installation complications due to a steep pressure drop, resulting in minimal pressure at the fixture. The symptoms, of course, are reduced water pressure and performance, specifically out of the eyewash orifice. As a complement, look for systems that have low watt-density heating elements that protect internal components and provide longer element life, increasing operational reliability.

ENCLOSED SAFETY SHOWERS

The last freeze-resistant product category to be addressed is enclosed safety showers (see Figure 3). With respect to drench showers and eyewashes, this is a relatively new division within emergency fixtures. Enclosed showers are available for indoor or outdoor use and provide a comprehensive safety solution to industries as varied as consumer packaged goods, food processing, energy facilities, and, of course, mining and petrochemical.

Highly engineered systems such as this fixture lend themselves to complexity; however, following is a simplified explanation of how they function. The shelter of an enclosed system may be manufactured from a wooden structure, a wooden structure covered with chopped fiberglass, an entirely chopped fiberglass structure, or a single vacuum-formed enclosure. The corrosion resistance of each of these enclosures varies with its respective construction and typically is hallmarked by either a NEMA 4 or NEMA 4X enclosure rating.

When looking for a system that can accommodate extremely cold temperatures, review the grade of insulation (R value) inside of the wall structure. Similarly, when searching for a product that has virtually no heat sink properties for warm environments, it's important to consider fiberglass systems with the highest proportion of fiberglass versus filler. Certain facilities require the enclosed system to accommodate the stark opposites of seasons, as well as the system's insulation to be fire retardant and self-extinguishing, per local codes and ordinances.

Various products on the market feature hurricane wind-load-resistant ratings (when properly anchored) and are simultaneously seismic resistant. Outdoor enclosures may feature reinforced bumper pads to transport the enclosure from one area of a site to another, while others also include lifting lugs at each corner of the enclosure that span the height of the enclosure and are anchored into the base for added stability. Outdoor systems with higher wall insulation R values usually contain a standard combination drench shower, eyewash, and drench hose and are fully equipped with freeze- and scald-protection valves. Those that feature systems with a lower R value tend to include a heat-traced unit inside the enclosure. Most outdoor systems include an integral convection heater to ensure that the interior temperature of the enclosure remains comfortable for an injured person, specifically when it is cold. A higher R value in the walls can virtually eliminate heat loss from the building, providing added comfort to an injured party.

Outdoor systems are equipped with various other product accessories, such as internal lighting, an external area light, and often an additional strobe and horn with remote monitoring capability. These systems can vary from a basic enclosure that accepts tepid water to an enclosure that has a large footprint and is fully equipped with a tankless tempering system, a 119-gallon hot water tank and mixing valve, or a steam-driven design.

The key takeaway from this overview is that enclosed safety systems are portable solutions that provide maximum protection in terms of safety and environmental comfort, while minimizing shock to workers exposed to hazardous materials.

Indoor systems are preferable primarily because they are portable turnkey tepid water systems. As organizations implement lean initiatives and reorganize, they find value in portable systems. In addition, indoor enclosed showers may be retrofitted with freeze- or scald-protection valves to protect against unusual spikes in temperature inside a facility.

KNOW WHO TO ASK

In summary, without knowledge about how freeze-resistant systems work or the configurations available, it is difficult to know all the questions that should be asked about implementing such systems. In addition to working closely with your client, you should develop a trusted working relationship with your preferred distributor, sales representative, or manufacturer. Be sure to explain your site conditions and the challenges you've experienced as well as those that remain unresolved. Technical information is invaluable, but little compares to having a solid relationship with a knowledgeable expert who can provide product, design, and application advice. PSD

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