BY REBECCA GEISSLER & RYAN PFUND

SPECIFYING THE RIGHT VALVE

Drench showers and eyewash units are essential to the safety of workers in hazardous locations, but are business owners doing enough by simply providing the fixtures? It is quite possible they are not. Consider this scenario: An employee splashed with a hazardous chemical runs to the nearest emergency shower, stands underneath the showerhead and activates the unit. Water rushes out of the shower drenching the worker, but it is a frigid 4C. At this temperature, the worker quickly goes into shock and is unable to fully flush the chemical from her skin.

This situation could easily occur during winter months if an eyewash or drench shower is fed directly from an incoming cold water line. Well-water temperatures in North America range from 4C to more than 15C, and surface water temperatures can range from 0C to almost 30C. While some of the piping to the unit may be indoors, the vast amount of water required by emergency fixtures means most of the water supplied to the drench shower will soon be coming in from plumbing exposed to the cold outdoor temperatures.

Just as cold temperatures can be harmful, water that is too warm can also be dangerous. With many chemicals, warmer water can actually accelerate the chemical reaction and cause further tissue damage. Moreover, at higher temperatures the user could be scalded and will be unable to remain under the shower for an extended period of time.

Whenever a worker is unable to flush affected areas in a drench shower or eyewash for the full 15 minutes required by the ANSI Z358.1-2004 standard, or the water temperature supplied causes further harm to the worker, the emergency system and plan have failed to protect employees.

A cross-section of a thermostatic mixing valve shows where the hot and cold water are blended to produce tempered water.

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TEPID WATER REQUIREMENTS

The ANSI Z358.1-2004 standard requires a tepid water supply for emergency drench showers and eyewashes. Tepid is defined by ANSI as "moderately warm; lukewarm." The appendix to the standard further explains that the lower temperature limit should be about 15.6C, and that water over 38C could enhance interaction of the chemical with the skin and be harmful to the eyes.

Within this range, the ANSI standard indicates that a facility's safety/health advisor be consulted to determine the optimum water temperature for a particular application. In addition, the manufacturer of chemicals used on the job site should be consulted for specific information on drenching temperatures in situations where there is a risk of accelerating a chemical reaction.

Unfortunately, many existing emergency fixtures do not meet the tepid water requirement. Because of the potential risks to workers and the responsibility of owners to protect them, it is important that all new and existing systems have a tepid flow of water. The best solution is to install a thermostatic mixing valve (TMV) designed for this application, which will accurately control the incoming water temperature to emergency fixtures.

BLENDED WATER

TMVs "mix" water together to provide the desired outlet temperature within a preset temperature range. (Note that these temperatures should be set and adjusted by the installer according to the site conditions.) Both hot and cold water are fed into the valve and are mixed together to the appropriate temperature. The blended water is then fed to the emergency drench shower or eyewash.

To maintain a constant temperature, incoming water is routed over an internal thermal element called a thermostat. The thermostat continually measures the temperature of the mixed water flowing through the TMV. If the temperature differs from the valve's set temperature, the thermostat will react and move a mechanism which modulates one or

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Photo Bradley Corp.

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both of the inlet ports until the valve returns to the set temperature, thus ensuring that each emergency fixture is provided with tepid water.

It is important to understand the difference between standard thermostatic valves and thermostatic mixing valves designed for emergency fixtures. Standard thermostatic mixing valves are designed to shut off the flow of water should there be a loss to either the hot or cold water supply. This is fine for typical domestic situations where a supply of only hot or only cold water would shock someone taking a shower.

An emergency application is different. It is unlikely that a worker exposed to a hazardous material can withstand scalding temperatures for any amount of time; however, it has also been determined that it is better for that worker to rinse in cold water than to not rinse at all.

For this reason, emergency valves are designed with a cold-water bypass. Should the thermostat fail or the valve lose its hot water source for any reason, the cold water would still be allowed to flow through the valve to the emergency fixture. If the cold supply is lost, the valve will shut off and prevent the hot water from flowing through the valve to the emergency fixture. This protects the user from the potential dangers of a hot flushing fluid being supplied to the eyewash or shower.

Formulas for Calculating Hot Water Requirements

These formulas will provide a general idea of the amount of hot water required for a system. It is important to account for all emergency fixtures and devices that will be fed from this hot water source when making calculations.

$$\frac{\text{TMV Set Temperature} - \text{Cold Water}}{\text{Hot Water Temperature} - \text{Cold Water Temperature}} = \%\ \text{Hot Water Required}$$

(% Hot Water) x (Flow in Litres Per Minute) x (Time) = Total Hot Water

"If the hot water supply to drench showers and eyewashes is insufficient, the thermostatic mixing valve will not have the incoming hot water to achieve the desired temperature."

SIZING EMERGENCY VALVES

Sizing an emergency valve for each specific application is extremely important. Emergency showers use a high volume of water which the valve must be able to accommodate. Valves also have a minimum incoming flow rate required to maintain the appropriate set temperature. Therefore, a valve must be sized correctly to meet the water demands of one or more emergency fixtures.

Valves should be specified based on several different factors. The maximum flow demand on the valve is one consideration. If the valve will feed more than one fixture, it should be sized to provide the appropriate amount of water to all eyewashes and drench showers simultaneously. Check with the emergency fixture manufacturer to determine the flow rates of the products being installed. A flow control may need to be added to a drench shower if one is not provided.

Emergency valves are designed with a cold-water bypass.

According to ANSI, the minimum flow rate for a drench shower is 75.7 litres per minute at 0.207 megapascals. Eye/face wash units require a lower volume of water with a minimum of 11.4 litres per minute at 0.207 megapascals. Smaller emergency fixtures, such as eyewash units, require just 1.5 litres per minute at 0.207 megapascals. With a combination drench shower and eye/face wash, a valve capable of supplying tepid water at a rate as low as 11.4 litres per minute or as high as the combined flow rate of the drench shower and the eye/face wash (minimum of 87.1 litres per minute at 0.207 megapascals but may be more) would be required.

Beyond the minimum and maximum flow rates, the line pressure will also affect the size of the valve required. At higher pressures, a thermostatic mixing valve will typically be able to supply a larger volume of water.

Most valve manufactures offer TMVs in different sizes to meet the flow requirements of the various emergency fixtures. Flow rates of each valve under normal operation or cold-water bypass operation should be clearly provided.

OTHER CONSIDERATIONS

In addition to selecting a valve designed for emergency fixture applications, there are other important features to look for when selecting a thermostatic valve. For emergencies, an adjustable set point temperature is required to provide the proper temperature for rinsing specific chemicals. A TMV with an accurate temperature control is capable of holding temperatures within a few degrees and helps to maintain a more reliable outlet temperature. Be sure to choose a valve with an inlet strainer – these check stops prevent the cross flow of hot and cold water and keep dirt and debris from entering the valve.

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Photo Leonard Valve

emergency fixtures

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TMVs that allow for universal mounting ensure that the valve functions properly in any position. Finally, a valve with a thermometer will provide an accurate reading of the outlet temperature for the valve.

KEEPING HOT WATER FLOWING

A final consideration for controlling water temperatures for emergency equipment is the size of the hot water tanks. If the hot water supply to drench showers and eyewashes is insufficient, the thermostatic mixing valve will not have the incoming hot water to achieve the desired temperature. The amount of hot water needed is based on the total water flow required, the temperature of the incoming hot and cold water and the set temperature of the emergency valve. Calculations should be based on the worst case, which is the lowest incoming cold-water temperature that the facility expects to experience.

THE EMERGENCY MIX

Obviously, there are a number of rather technical decisions to make when it comes to specifying and installing thermostatic mixing valves for safety equipment. The process starts with sizing the appropriate valve for the application but does not stop there. To ensure that emergency fixtures have the optimal flow of incoming tempered water, check with equipment manufacturers and emergency safety consultants.

Also, remember to activate and test fixtures weekly. In an emergency, keeping the appropriate amount of tepid water flowing from emergency equipment is just as critical as supplying the fixture for workers to use. HPAC

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