The Authoritative Source for Plumbing, Hydronics, Fire Protection and PVF

Plumbing Engineer

A TMB Publication

October 2010

WINNER 2010 APEX® AWARDS FOR PUBLICATION EXCELLENCE

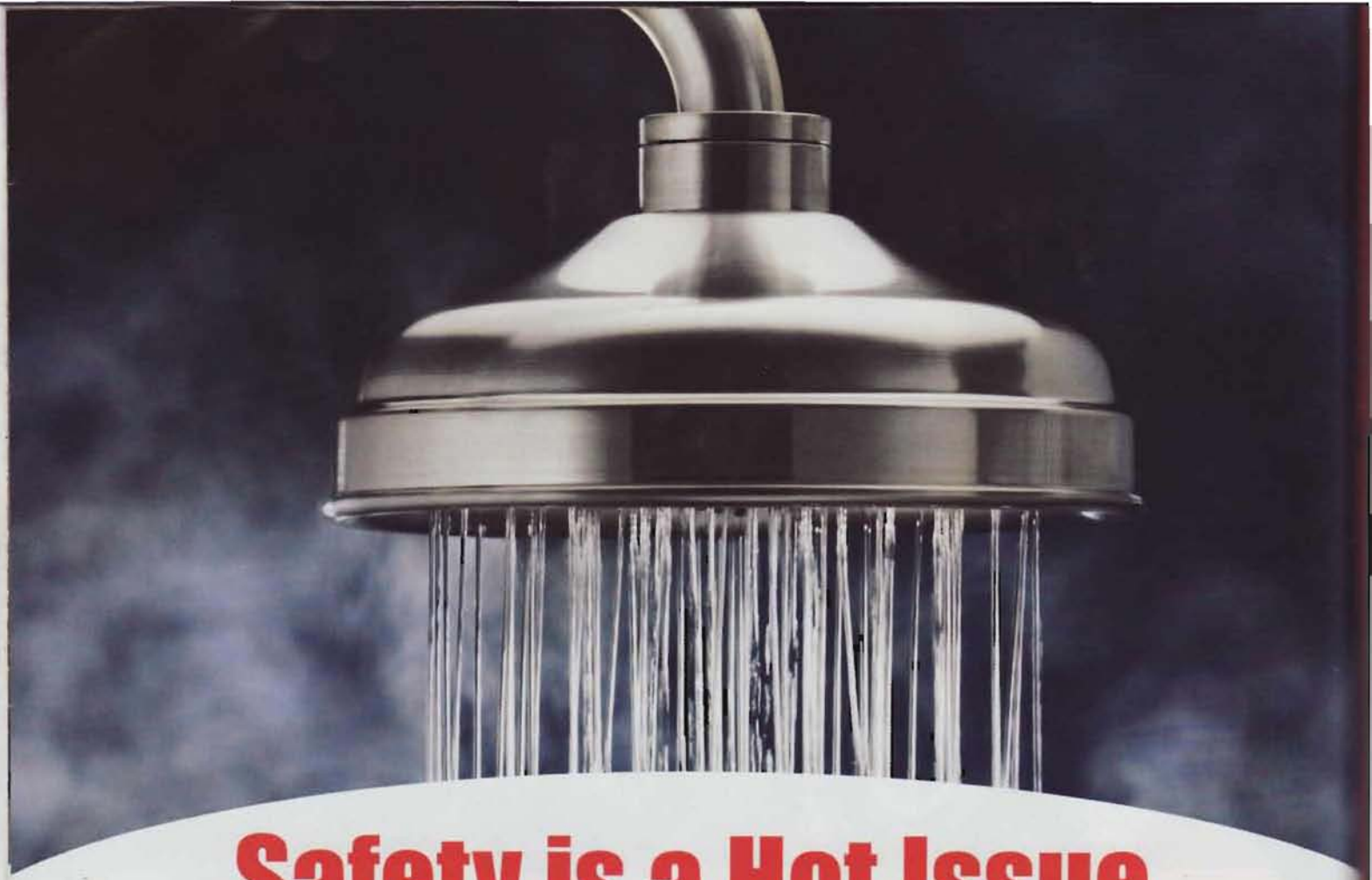
Follow us on twitter for updates and news
twitter.com/plumbingeng

Scald Protection

The Hot Issue

Inside this issue

- Eliminating Air & Dirt in Modern Hydronic Systems
- The Importance of End-user Experience in Water-efficient showerheads
- Sloan Valve: A Clear Mission



Safety is a Hot Issue

T/P Shower Valves Offer Protection Against Scalding, Thermal Shock, and Lawsuits

Scalding is a second degree or third degree burn caused by a hot liquid or vapor. It is a serious injury that can be fatal. It is the second most common form of burn injury. Many of these scalds are caused by tap water. Young children, the elderly, and the infirm are the most vulnerable, both in terms of how quickly hot water can cause them injury, and their likelihood to be exposed to it.

Scald prevention valves automatically adjust to changes in inlet water pressure or temperature, keeping outlet temperature close to constant, avoiding serious burn injuries and thermal shock reactions that can cause slip/fall accidents. Photo Courtesy of Speakman Company.

Even more surprising, many of these injuries could easily be prevented with the use of automatic adjusting shower valves. Type P valves — pressure-balancing valves that adjust to sudden changes in the pressure of hot or cold water lines — have been available for decades. They are the norm in certain types of construction — health care and hospitality, for example. Type P valves are effective at preventing thermal shock, a sudden temperature change up or down that leads to a startle reaction, and may cause a slip/fall accident. Type T valves — automatic thermostatic adjusters — have been available for about 20 years, but have seen little acceptance because, until now, they have been significantly more expensive than P valves. Type T valves provide a higher level of temperature protection, regardless of inlet temperature fluctuation. However, T valves are not required to be as sensitive or as quickly response as P valves under standard test procedures, which may lead to thermal shock situations.

A third type, the Type T/P valve, uses both pressure-balancing and thermostatic sensing to control temperature. This double system can deal with both high temperature and thermal shock risks. In some T/P valves, the pressure and thermostatic functions are performed by two separate elements which provide extra protection if one element should fail. New design advances have

Continued on page 42

Scalding

Continued from page 40

brought down the cost of some T/P valves, comparable in price to common P valves, offering facilities excellent value and better protection against legal liability from scalding injuries. (It is significant that some of the most prominently available scald injury information on the Internet is on the websites of personal injury lawyers.)

When choosing a scald-protection device, however, care must be taken to match the device to actual site conditions and codes. Valve testing standards, written in 2005, have not kept up with the actual conditions in the rapidly changing sustainable construction trend. Shower flow rates have lowered dramatically. Many valves are not being tested at realistic flow rates, and do not perform properly at those lower flows.

Scalding

Hot liquids or vapors make human skin burn, sometimes very rapidly and deeply. The severity of the burn depends on how long the skin is exposed, and how high the temperature is. Age of the victim is also a factor. A second degree burn is defined as penetrating to a medium depth through the skin thickness. A third-degree burn is a full-depth burn, and can involve damage to nerve tissue, sweat glands, veins and arteries. Treatment of third degree burns requires skin grafts. According to recent figures published by the Minnesota Department of Community Health, an adult exposed to 120°F flowing water will get a 2nd degree burn in 8 minutes, a third degree burn in 10 minutes. At 140°F, it takes only three seconds for a 2nd-degree burn, 5.5 seconds for a third degree burn. At 160°F, a third degree burn occurs in less than one second.[1]

Water Temp (F)[2]	Approx. Time for 2nd Degree Burns (Adult)	Approx Time for 3rd Degree Burns (Adult)
120°F	5 min.	9 min.
130°F	18 secs.	30 secs.
140°F	3 secs.	5.5 secs.
150°F	.09 secs	2 secs
160°F	0.9 secs	0.4 secs

For young children and elderly adults, whose skin is thinner and more vulnerable, burns happen in roughly half the time.

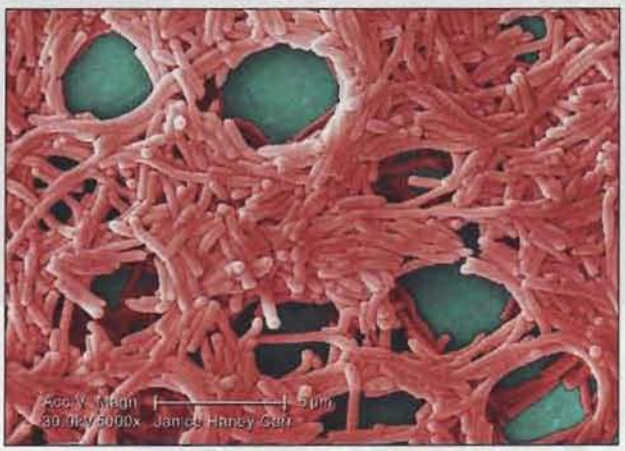
Moreover, the elderly are often less aware of heat on their skin, and their reaction times tend to be slower, increasing the likelihood of longer exposure in a sudden temperature change event. A person with impaired mobility — including many of the elderly — would also be less able to move out of a hot water stream quickly, an increased risk.

The seriousness of scalds and other burn injuries also increases with age. A 40-year-old with second and third degree burns on half of his body would have an almost 80% chance of survival. For a 65-year-old with the same burns, the survival chance drops to 0%, almost certain death.[3]

Current Trends Increase Risks

Two current trends in water usage contribute to increased risk of scalding.

First, hot water in many hotels and health care facilities is hotter than it used to be. The Centers for Disease Control (CDC) and other authorities recommend that water heaters be set to a top temperature of 120°F to prevent scald injuries, since exposure at that temperature takes as long as eight minutes to produce a second degree burn. However, in order to prevent the spread of legionella bacteria (the germ that causes Legionnaire's Disease) and other water-borne pathogens, some facilities set their hot water temperatures significantly higher. Legionella grows rapidly in water between 90°-130°F. Water temperature needed to prevent it is considered 140°F or higher. This greatly increases scald risk. An unadjusted drop in cold water pressure can have dramatic and dangerous effects if the hot water line is at 140°-160°F.



Many hotels and healthcare facilities set their hot water temperatures higher than 140ºF to prevent the growth of legionella bacteria (above) and other water-borne pathogens. This raises the risk of scalding and increases the need for scald-prevention valves. Scanning electron microscope photo by the Centers for Disease Control.

Second, flow-rates for showerheads have been steadily lowering in recent years as the effort to conserve water gains ground. Federal law mandates 2.5 gallon per minute (gpm) max. showerheads. The U.S. Environmental Protection Agency's (EPA) WaterSense initiative requires a showerhead to demonstrate 2.0 gpm or less to receive the WaterSense certification label. Many facilities are adopting 2.0 gpm max for showerheads; some local codes are now mandating 1.5 gpm.

Testing standards have not kept up with the new lower flow rates, either. The standard test for scald-prevention valves, *ASSE 1016-2005 — Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Showers Combinations*, uses 2.5 gpm flow. Most manufacturers, therefore, do not test at flow-rates that reflect current real-world conditions, and in fact, many code-approved valves do not perform properly at the lower flow rates with which they will actually be used.

A position of the Plumbing Manufacturer's

Continued on page 44

Scalding

Continued from page 42

Association states:

"In new construction and renovated plumbing systems, the shower should be equipped with an automatic compensating valve that complies with ASSE 1016 or ASME A112.18.1/CSA B125.1, and specifically designed to provide thermal shock and scald protection at the flow rate of the showerhead being used. [author's italics] Ideally, the performance combination should be verified by the product manufacturer(s)." [4]

It further recommends that existing shower valves without protective features either be replaced, or at minimum the entire hot water delivery and use system be professionally evaluated for safety.

Belt and Suspenders

Type P (pressure-balancing) valves respond to inlet pressure. Sudden pressure drops, due to water usage elsewhere on the same plumbing system, are compensated by a balancing mechanism in the valve. The user sets the valve to a desired temperature mix and the valve adjusts to pressure changes to try to maintain the temperature. Most of the time, pressure-balancing provides adequate protection. However, P-valves do not respond to changes in the temperature of inlet water, and a sudden rise or drop in temperature would be passed unregulated.

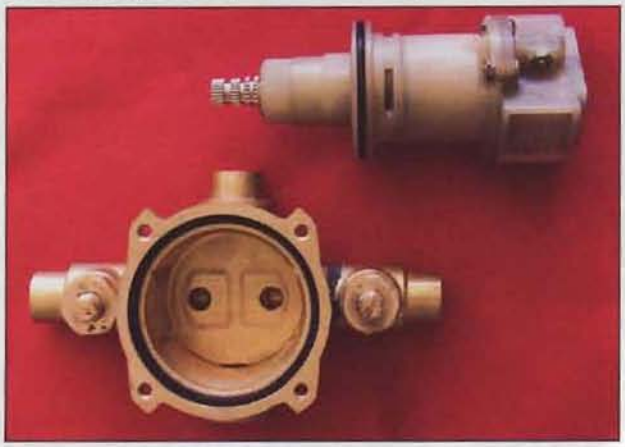
Type T (thermostatic) valves respond to inlet temperature and control the outlet temperature. If the hot temperature spikes, they throttle down the hot and bring up the cold. Type T valves provide good anti-scald maximum temperature protection, but are not as effective at controlling thermal shock from a sudden pressure drop.

T/P valves (thermostatic and pressure-balancing) protect against both high temperatures and thermal shock. They have been around for many years, but high cost and complexity limited their acceptance. Recently, low-cost T/P valves have made an appearance, offering a very practical choice. Some T/P valves — the Speakman Sentinel Pro TP (model #SM-5000), for example — actually accomplish the two functions with two separate elements, so that if one fails, the other is still providing protection.

A typical T/P valve has a single handle that turns water flow on and controls temperature. Models with separate temperature and flow volume controls are also available. Photo courtesy of Speakman Company.

Selecting Valve Performance

Under the ASSE 1016 standard, P valves are tested at higher pressure fluctuations (+/- 50%) than T valves (+/- 20%). Moreover, T valves are allowed wider temperature fluctuations and slightly longer response time in their initial adjustment period (five seconds), which may result in thermal shock. However, temperature testing for T valves includes an additional temperature test at higher inlet temperatures, a more stringent trial of temperature control. T/P valves are tested for both – the more stringent temperature conditions and the most stringent pressure fluctuations. In all cases, automatic adjusting valves must have a mechanism to limit maximum outlet temperature to 120°F (48.9°C). Bear in mind that standard tests are done at 2.5 gpm.



Some shower valves are configured as a valve body (lower left) with a replaceable cartridge element (upper right) that contains the actual valve mechanism. It may be possible to upgrade an existing valve body with a T/P Scald Prevention valve cartridge at substantially lower cost than replacing the entire valve. Photo courtesy of Speakman Company.

Some T/P valves have not performed up to standard time and temperature limits when used with low flows. When selecting a T/P valve, it is important to match the valve to the predictable flow-rates to be used during the life of the structure, a number that's trending lower all the time. If code requires 2.0 gpm max or lower, select a valve that has been tested at least down to that flow. Looking to the future, it may be wise to select a valve that has been tested and performs at flows as low as 1.5 gpm to anticipate even more stringent water conservation standards. As noted, a dual-element valve - one that has separate elements for pressure-balancing and thermostatic control - may provide better protection.

In the case of remodels and upgrades, replacement of an entire shower valve body can be a costly process

Continued on page 46

Scalding

Continued from page 44

because of labor. However, many manufacturers make valve bodies with replaceable cartridges. If the existing valve body accepts a replaceable cartridge, it may be possible to upgrade to a T/P cartridge at lower material cost and significantly less labor — minutes vs. hours.

Summary

The risk of scalding injuries is increased by recent trends in water usage such as low-flow showerheads and higher temperatures in hot water lines. Scald prevention shower valves are, therefore, more important than ever, and many healthcare, hotel, and dormitory facilities are incorporating them as a standard part of their risk-management policy. T/P valves offer the best available protection against both scalding and thermal shock, and they are now as affordable as P valves. When selecting any scald-prevention valve, it is important to make sure it has been tested at flows as low as those that will actually be used in the showerheads, which may be much lower than those prescribed in the standard performance test. ■

The risk of scalding injuries is increased by recent trends in water usage such as low-flow showerheads and higher temperatures in hot water lines.

1. State of Michigan Department of Community Health, *Scalding Injuries Caused By Excessive Hot Water, Food and Hot Beverage Temperatures*, Alert, rev. Aug. 5, 2008

2. Bynum, Dr. D. Jr., Petri, Vernon J, and Myers, John T., *Domestic Hot Water Scald Burn Lawsuits, The Who, What, When, where, Why and How*, a technical paper presented at the ASPE annual meeting, Oct 1998.

3. Ibid.

4. Showerhead Flow Rates-Safety and Performance Issues www.pmihome.org/positionstatements/showerheads.aspx

***Bill Walbrandt**, MBA, is the director of product strategy for Speakman Company and has over 25 years experience in plumbing design and product development.*

Steven H. Miller, CDT, is an award-winning writer and photographer specializing in issues of the construction industry. He works with Chusid Associates, North America's leading building products marketing and technical consulting firm. He can be reached via www.chusid.com

...THE LAW FIRM OF ROBBEM, CHEATEM, AND BLINDEM IS DOWN IN THE DUMPS... WHY?

THE NEW SPEAKMAN SENTINEL PRO™ TP SHOWER VALVE IS HERE

NO MORE EASY LEGAL SETTLEMENTS FOR HOSPITAL AND HOTEL SCALDING & FALLING PERSONAL INJURY LAWSUITS

DEFEND YOURSELF

Specify the new SENTINEL PRO™ TP SHOWER VALVE for maximum protection

SPEAKMAN®
Absolutely the best.

CERTIFIED TO 1.5 GALLONS PER MINUTE
Call 800-537-2107 to learn more or visit us at **www.SentinelProTPValve.com**

Circle 37 on Reader Reply Form on page 81