BY REX CAULDWELL

ANTISCALD PROTECTION FOR SHOWERS

Although the solution is just a plumbing service call away, scalding in the tub or shower is still a severe problem throughout the U.S. — especially for the very young and the elderly. It's easy for a two-year-old standing in the bathtub to reach up and turn the water on to full hot — possibly to get blasted with dangerously hot water. Elderly bathers may also be at risk because their reaction time is slower and their sensitivity to heat may be lower than normal. Or they may panic and turn the wrong handle or turn the handle in the wrong direction. Either way, by the time help comes, it may be too late.

Scalding can also occur if the cold water pressure drops suddenly while someone is showering. This typically happens in houses with undersized or otherwise poorly designed water supply lines (see "When the Pressure's Off," *K&B*, 3/94). Someone flushes the toilet while another person is showering, and the person in the shower is hit by an untempered spray of hot water. The problem is exacerbated by low-flow shower heads: There is already such a small volume of cold water being delivered that any further decrease has even greater effect.

CAROLYN BATES

PRESSURE-BALANCING VALVES GIVE RELIABLE AND AFFORDABLE PROTECTION AGAINST SCALDING IN THE SHOWER

Water Heater Settings

There are several ways of attacking the scalding problem. The simplest first step is to reduce the temperature setting on the hot water heater. In most cases, the temperature setting can be lowered without greatly affecting the hot water supply. In the past, water heaters were commonly set at higher temperatures to produce the hot water needed for dishwashers. Today, however, the trend is toward dishwashers that heat their own water. Clothes washers and bathroom vanities need only warm water, so with the possible exception of soaking dishes, extremely hot water isn't really required.

Still, I often find water heaters adjusted as high as 160°F! Water at this temperature will give a second-degree burn in a second or less. Even a medium setting of 130°F can cause first- and second-degree burns in 30 seconds — even faster on the sensitive, thinner skin of small children. *I recommend setting the water heater no higher than 120°F.*

Water heater manufacturers have responded to the problem and are now presetting the electric thermostats at 120°F. Gas water heaters, which are sent from the factory in the "off" position, have explicit instructions explaining the risks of temperature settings higher than 120°F.

Even with these measures, however, it is still possible for a gas water heater to deliver scalding water, because of a phenomenon called the *stacking effect*: After a series of short draws from the water heater, the water at the top of the tank can become much hotter than the setting on the thermostat, which is located near the bottom of a gas water heater. Manufacturers are required to keep the temperature at the top to within 30°F of the thermostat setting, but with a 120°F setting this would still permit 150°F water to exit the tank at the top — plenty hot to cause scalding.

Pressure-Balancing Valves

Lowering the water heater temperature is a good first step in scald prevention, but this alone cannot guarantee protection. In many cases, customers will still choose to have the water heater at a higher setting — either because the tank is not large enough to supply all the hot water they want, or because they are accustomed to having very hot water in the kitchen.

The best way to protect your clients against scalding in the shower is to install a pressure-balancing shower control. If installed correctly, these valves have a physical stop, set by the installer, that limits the maximum mixed-water temperature to 120°F (see Figure 1, next page). They also keep the water temperature within 3°F plus or minus of where the user sets it, regardless of pressure fluctuations in the house.

Pressure-balancing valves come in two main types — those using a piston,

or spool, mechanism and those that use a flexible rubber diaphragm (Figure 2).

Sliding piston type. The pressure-balancing valve I am most familiar with is the Moentrol, manufactured by Moen, which uses a sliding stainless-steel piston mechanism to regulate the incoming water. When you are showering under normal water pressure, both cold and hot water flow equally through the spool, and up to the shower head. When someone turns on the cold water elsewhere in the house and the pressure on the cold water side drops, the piston instantaneously moves to reduce the flow of incoming hot water, preventing scalding. The hot water flow matches the reduced cold water volume, so the mixed-water temperature remains the same. Likewise, if a sudden pressure drop occurs in the hot water supply, the pressure-balancing piston moves instantly to decrease the flow of cold water into the valve body.

Diaphragm types. The second type of pressure-balancing mechanism uses a rubber diaphragm to respond to pressure differences. One example is the Danfoss pressure-balancing cartridge, which is used in valves made by Briggs, Central Brass, Gerber, Grohe, and other manufacturers.

CAROLYN BATES

Figure 1. *A plumber sets the adjustable stop that limits mixed-water temperature of this Moentrol pressure-balancing valve to 120°F.*

Another is the Kohler Rite-Temp pressure-balancing unit.

As the rubber diaphragm moves in response to pressure differences, it restricts the flow of the side with the greater pressure, working in a manner similar to the piston-type mechanism.

Thermostatic Valves

The vast majority of residential antiscald valves are pressure-balancing units of one of the types described above. Another category of antiscald valve is the thermostatic control valve. These come in two types — those that respond only to temperature changes, and so-called combination valves, which have both a thermostatic device and a pressure-balancing mechanism.

Thermostatic valves are widely used in Europe but are not common in the U.S. They typically cost two to four times what a pressure-balancing valve costs, so they are mainly installed in high-end jobs.

I have not had wide experience with thermostatic valves. Most of my customers are more comfortable with the cost of a pressure-balancing valve. However, I have installed one model — a combination type — in my own home. Yet with this valve, expensive as it was, I cannot adjust the water temperature while I'm showering unless I turn the faucet off first and then turn it back on at the new temperature. This particular model has a bimetallic thermostatic element. The technology has improved, and most makers are now using wax thermostatic cartridges, which are reportedly more reliable. If a client insists on having a thermostatically controlled valve, look for a wax element.

ANTISCALD CODE UPDATE

In a drive to prevent scalding injuries, many state and local plumbing codes now require antiscald valves in residential showers. That's because all four of the national plumbing codes — the *National Standard Plumbing Code* (1993), the *National Plumbing Code* (1993), the *Standard Plumbing Code* (1994), and the *Uniform Plumbing Code* (1994) — have adopted the rule. The codes call for all showers, including bath/shower combinations, to be equipped with pressure-balancing or thermostatic controls that comply with ASSE standard 1016 (American Society of Sanitary Engineers, Bay Village, Ohio). The valve must be installed according to the manufacturer's instructions and adjusted to deliver a maximum mixed-water temperature of 120°F.

So what does compliance with ASSE 1016 mean? Among other things, that the valve can maintain a set water temperature within 3°F plus or minus when either the hot or cold water pressure drops by 50%. Also, if the cold water fails altogether, the valve must be able to reduce the hot water to a trickle within 5 seconds while not allowing the temperature to exceed 120°F. Manufacturers must have their products tested by independent laboratories for compliance with these and other standards.

There are a couple of exceptions in the codes: Instead of a pressure-balancing or thermostatic control in the shower, the *National Standard Plumbing Code* allows the supply piping serving the shower to be designed to slow the water velocity down to 4 gpm, making it unlikely that pressure imbalances would occur. But because this requires using larger pipe, it would probably cost more than simply installing a pressure-balancing shower control. Likewise, under the *National Plumbing Code*, you can use a master thermostatic mixing valve in the supply lines, set at 120°F, instead of an antiscald control in the shower.

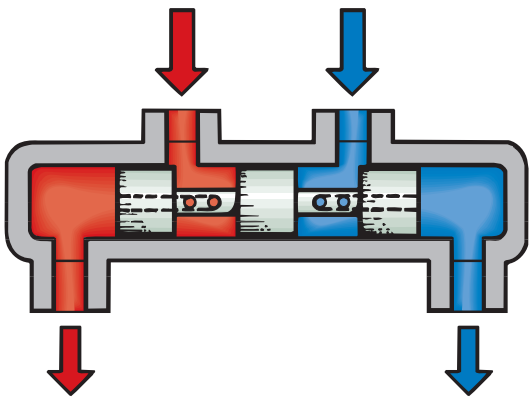
Check with your plumbing inspector for local regulations on pressure-balancing valves. As in all code matters, it's up to the local jurisdiction to decide which rules to adopt and how to enforce them. For example, some inspectors may require upgrading to pressure-balancing controls for any remodels that affect the bathroom; others may require the valves in new installations only.

— The Editors

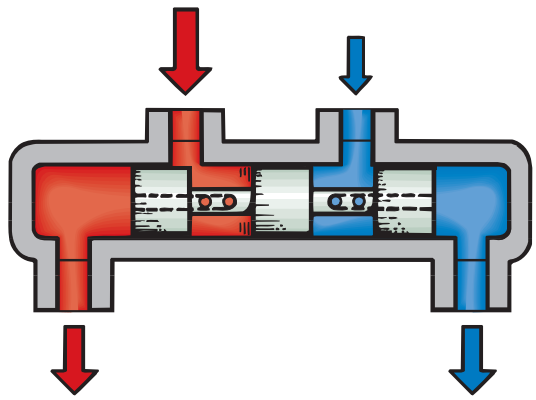
How Pressure-Balancing Valves Work

Piston Type

Equal Pressure: Under normal water pressure, equal volumes of hot and cold water pass through the pressure-balancing cartridge.

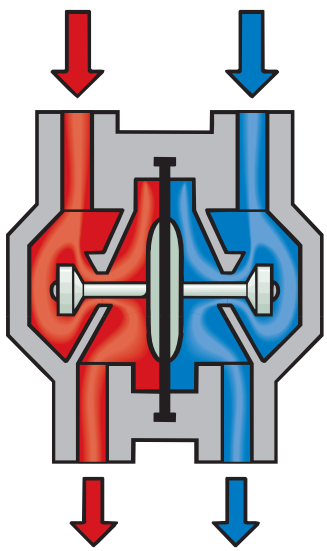


Balanced Pressure: With a drop in cold water pressure, the balancing spool is pushed over by the greater hot water pressure, instantly reducing the volume of hot water coming through the cartridge.



Diaphragm Type

Equal Pressure: Under normal water pressure, the rubber diaphragm remains in the center of the cartridge, allowing equal volumes of hot and cold water to pass through.



Balanced Pressure: With a drop in cold water pressure, the diaphragm is forced over by the greater hot water pressure, simultaneously reducing the volume of hot water.

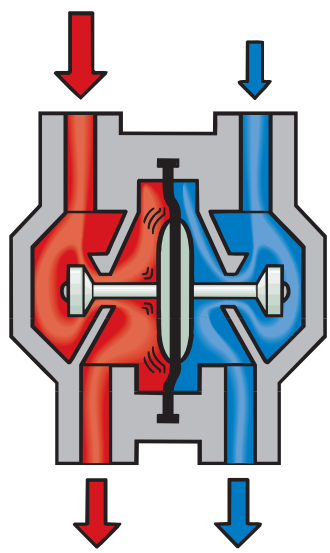


Figure 2. *Pressure-balancing valves come in two main types. With piston, or spool, mechanisms (top), increased water pressure on one side pushes the piston over, simultaneously closing the inlet on that side and balancing the pressure of the mixed water. With diaphragm types (bottom), a flexible rubber diaphragm responds to pressure fluctuations, closing the inlet on the side with greater pressure.*


MOENTROL


MOEN POSI-TEMP

Figure 3. *All pressure-balancing valves have single-handle controls. With one type, the handle rotates to adjust temperature and pulls out to adjust the volume (left). With cycling valves (right), there is no volume control; the lever turns the water on at full volume and rotates to adjust the mixed-water temperature.*

Shopping for Pressure-Balancing Valves

There are many pressure-balancing valves on the market. I personally like the Moentrol because it's reasonably priced and reliable. Plus, I've been installing them for years and have never had a callback.

Currently, only single-handle pressure-balancing valves are available. They come in two types. With one type — those like the Moentrol — the handle pulls out to adjust the volume and rotates to adjust temperature (Figure 3). With the other type, called a cycling valve, you rotate a lever to adjust the temperature but there is no volume adjustment — the valve operates only at full volume. Manufacturers claim that with the advent of low-flow shower heads, volume adjustment is less important, since most people will prefer to shower at full volume anyway. But I happen to prefer the units like the Moentrol because you can preset the temperature before you turn on the water.

Retrofit jobs. Although pressure-balancing valves must be plumbed for single-handle operation, some manufacturers make a cover plate that allows you to convert double- or triple-handle controls to single-handle operation — without having to retile over the holes left by the previous valves. Sometimes, the cutout for the plate is even large enough to allow room for the new connections — even when there is no rear access panel. However, most of the time you need rear access.

You get what you pay for. Never buy a bottom-of-the-line unit. Because the new codes (see "Antiscald Code Update," page 54) are boosting the sale of pressure-balancing valves, many manufacturers have introduced less-expensive, do-it-yourself models. I suggest sticking with the older proven designs — your plumbing sub will undoubtedly have a recommendation.

Installation Tips

These tips apply to all valve installations, though careful installation is even more important with pressure-balancing controls.

Read and follow instructions. This goes without saying. Even so, most instructions leave a lot to be desired — which is where your plumber's experience comes in.

Buy a unit with IPS (iron pipe size) connections. These valves have threads on the inside of the faucet body, as opposed to copper sweat connections. With sweated connections, it's possible that the heat from the torch can ruin heat-sensitive parts in the delicate pressure-balancing mechanism or the valve cartridge itself. Using IPS bodies solves that problem. However, if you must use copper sweat connections, either disassemble the entire faucet so that the heat cannot warp or destroy the plastic cartridge parts or use a heat sink (a wet rag wrapped around the faucet) to absorb the heat once it enters the main body. Either way, do not use any more heat than is necessary to sweat the joint.

Thoroughly wash out new plumbing pipes before installing the valve. Sediment is the bane of pressure-balancing valves. New water lines must be totally purged of sawdust, dirt, sand, wood and rock chips, solder globs, and pieces of teflon tape before connecting the fixture. Renovation jobs pose even more problems. With old galvanized water lines, bits of rust will invariably break loose during installation. A bit of debris lodged in the wrong place will prevent the balancing assembly from working.

Turn the water on and have it "fountain up" to get rid of as much loose sediment as possible. When you work on old water lines, treat the pipes gently to keep pieces of rust from breaking off inside.

When water pressure is released into the fixture, have the fixture valve on full, both hot and cold, with the shower head removed. Do not turn the fixture handle to the off position until enough water has been run through the fixture to purge the lines of any foreign material. If the handle is turned off when a sharp object, like a rock shard, comes through, the fixture could be ruined. If the client's water supply is notorious for incoming sediment, install an in-line filter.

Do not pressurize one side only. Slowly release both hot and cold water pressure to the fixture at the same time. I've had pressure-balancing valves jam when they were hit with 50 to 80 pounds of water pressure on one side only. When this happens, pressurizing the other side by itself usually unjams the piston. If not, you have to remove the pressure-balancing spool, open it up, and free up the piston.

Set the temperature limit stop carefully. By code, the installer must limit the maximum hot water temperature to 120°F. I have used a meat thermometer to check this, but typically I use my hand and adjust the hot water just below where it starts to feel really uncomfortable on my skin. If the installer sets the limit stop too high, scalding can still occur. ■

Rex Cauldwell is a master plumber and owner of Little Mountain Plumbing Co. in Copper Hill, Va.