

Master Mixing Valve Sizing

By: Ron George, CIPE, CPD

I received a phone call from a manufacturers representative and he asked if I could help him with a problem he was having with a thermostatic mixing valve he had sold. It seems this valve was in a new motel and there was a problem with it maintaining its set temperature.

The motel was a design/build project. The motel operator had hired a contractor to design and build him a motel. The contractor did a very good job building the facility. In fact, the contractor went out of his way to provide good workmanship and materials that any contractor and owner would be proud of.

After the system was installed, and the facility began operation there were complaints about the water temperature fluctuating. The contractor was called to look at the system, the piping looked fine to him, but the discharge temperature on the mixing valve was fluctuating. He knew that, because he was a good contractor and he provided temperature gauges so he could see these things.

The contractor called the manufacturers representative and asked him to come take a look at his valve it was not working properly. The contractor was sure it must be a faulty mixing valve. The manufacturers rep looked at the installation and it was piped up just like the picture on the literature. The system had a circulating pump and the HWR line was split after the pump and piped to the cold water inlet to the water heater and it was also connected to the cold water side of the mixing valve with all of the appropriate unions, valves and reducers, just like the picture on his literature. He was a bit perplexed and not quite sure why it was not working properly. The manufacturers rep did not have any sizing information at his fingertips, he figured Ron had helped him before, so he called me to ask a few quick questions about sizing to make sure he selected the right valve. We discussed the layout of the building, the number of units, the number and types of fixtures, the flow rate of the showerheads and a few other things. A quick look at the sizing revealed a peak flow rate of about 100 gallons per minute that required about a three-inch hot water main to keep from exceeding 5 feet per second in the hot water pipe during peak flows.

He said with a bit of relief in his voice “Yes there’s a three-inch water main here, so the pipes were sized OK”. Then a he had a concerned tone in his voice as he asked “Did I undersize the valve? It is only a 1-1/2 inch mixing valve.” I asked what the published flow rates were for the valve? He said “according to the literature he had it should deliver about 100 gallons per minute at a 30 pound per square inch (psi) pressure drop and about 125 gallons per minute at a 45 psi drop.” He said “It’s right there in the literature, so I’m OK, right” I said “OK, that’s good for the maximum flow, but what is the minimum recommended flow for that valve”. He said “it looks like 50 gallons per minute. What does that mean?” I said “it probably means if there is only one shower in use at 2.5 Gallons per minute flowing, it will be hard for that valve to maintain the minimum temperature published in the literature, that is why the manufacturers publish

the minimum flow rates in their literature. In fact, it would take about 20 showers flowing at the same time for that valve to meet the minimum flow requirement of plus or minus three degrees per the American Society of Sanitary Engineering (ASSE) Standard # 1017". (ASSE 1017 is the standard for master temperature actuated mixing valves).

The phone was quiet for a few seconds and he asked, "So what do I need to do?" The next smaller valve on this chart won't meet the maximum flow requirement of 100 gallons per minute it will only give me a little over 80 gallons per minute at a 45 pounds per square inch pressure drop. And it has a minimum flow of 28 gallons per minute".

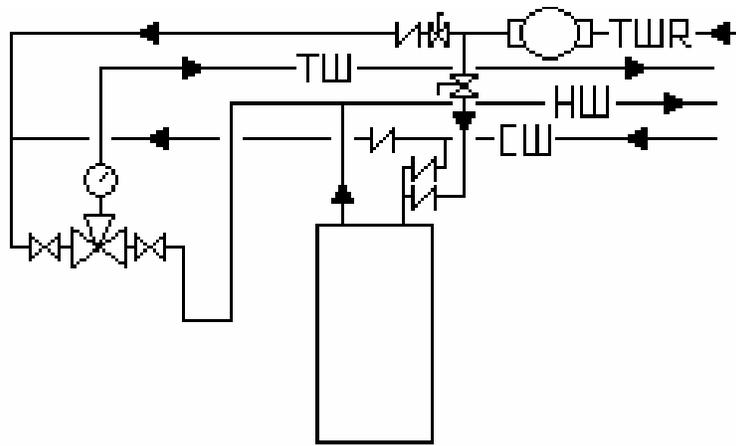
I suggested using a high low mixing valve assembly with a pressure-reducing valve that forces water through the smaller valve until there is a few pounds of pressure drop from flow through the small valve then the larger valve starts to open up.

Another less expensive option would be to choose one of the newer style mixing valves with a larger and more sensitive thermal element that covers a wide range of flows.

He made the appropriate changes and selected a valve that covers flows for a wide range. This avoided a situation that could scald someone and protected himself, the contractor and the owner from potential litigation resulting in a scald injury. It happens all the time. People are scalded because of oversized master mixing valves.

I heard of an installation where a contractor had a two-inch pipe and called the local distributor and ordered the least expensive two-inch mixing valve he's got. He did not specify any flows, so that was a recipe for scalding. In most cases master mixing valves when sized properly are smaller than the pipe size they are connected to. Remember mixing valves should be sized for each application based on flow rate and building type, not on the pipe size.

A convention hotel where everyone jumps into the shower at the same time in the morning is probably the extreme for peak flows. The other extreme is when only one shower is flowing during off periods of a large facility. It could be in a hotel, motel, nursing home or hospital. Make sure the minimum flow rate will not cause temperature fluctuations when you size the mixing valve on your next project. Sizing your mixing valves properly will keep you out of hot water.



Mixing Valve Piping Diagram