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Designers' Guide

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Design Considerations for Domestic Hot Water Return Systems with Mixing Valves

When laying out a hot water return system, there are a number of things you need to be aware of if the system has a mixing valve. Three basic designs will be covered here, although there are other types.

Master mixing valve located at the water heater (Figure 1): One of the most common mistakes made by designers is connecting the domestic hot water return to the water heater in a system with a mixing valve. If the hot water return line is connected directly to the water heater, the mixing valve would open to temper the water and, because there is no flow through the system, cold water would not be able to enter the mixing valve to blend with the hot water. Manufacturers refer to this as "the valve hunting for the right temperature". This condition causes fluctuations in temperature and pressure. To correct this problem, most mixing valve manufacturers are now recommending the piping diagram shown in Figure 1; the hot water return is split and routed to two locations.

By placing an additional hot water return line with appropriate valving to the cold water side of the mixing valve, as shown, there can be flow from both sides of the mixing valve, thus solving the problem. Most mixing valve manufacturers require a minimum temperature differential between the hot and cold sides of the mixing valve in order for the valve to func-

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Figure 1 — Master Mixing Valve

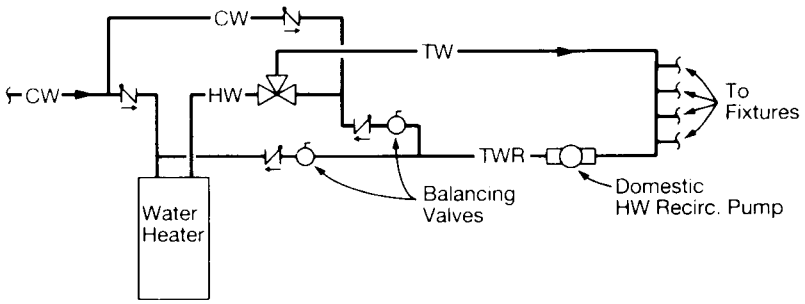


Figure 2 — Local Mixing Valve

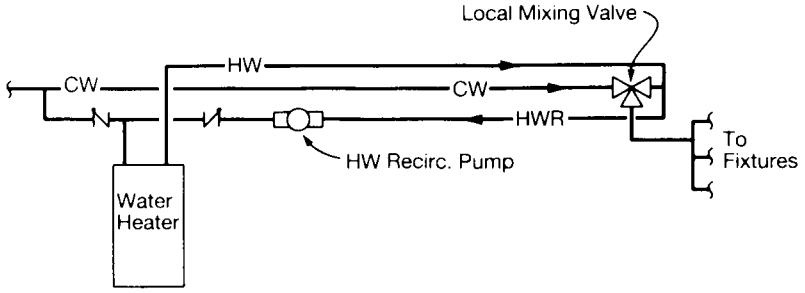
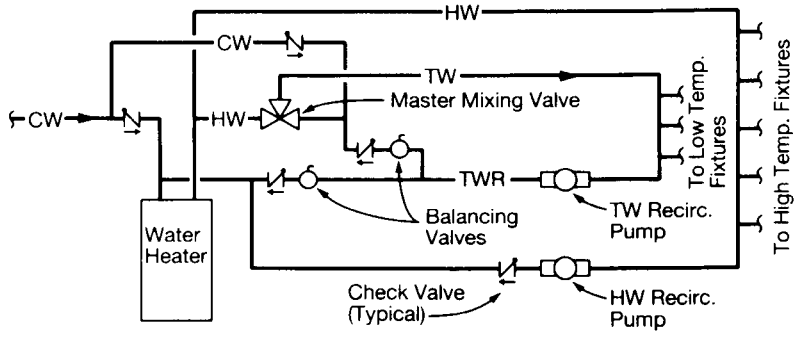


Figure 3 — Dual Temperature System with Master Mixing Valve



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tion properly. A 20-degree differential from the mixing valve setting to the hot water return temperature should be acceptable, but check with the manufacturer for your application. If you follow the hot water return pump sizing as outlined in the ASPE Data Book, it should be fine because it is based on a 20-degree temperature differential.

Local mixing valve (Figure 2): This piping diagram is the easiest to pipe and maintain. Designers should try to keep their systems as simple and easy to maintain as possible. I have found this system to be cost effective because you can pipe only one hot water temperature out and mix down to various usage temperatures near the fixtures.

Dual temperature systems (Figure 3): Dual temperature systems offer more of a challenge to the plumbing designer. They typically have a master mixing valve and two hot water return temperatures. Notice that there are two hot heater return circulating pumps. These pumps need to be independent of each other to prevent the hot water return temperature at the cold water side of the mixing valve from exceeding the set point of the valve. For example, if the mixing valve is set at 110 F and the water heater set to 180 F, the hot water return from the 180 F line would be about 160 F. It would mix with the tempered water return and the temperature would exceed the mixing valve setting of 110 F. This is why these lines should be kept separated until after the pumps and check valves. Notice how the tempered water return line splits, as shown in Figure 1, above, and connects to the water heater and cold water side of the mixing valve. Always check with the valve manufacturer for recommended piping arrangements. Remember to include any pressure drop through the mixing valve in the head requirement for the circulating pump. I hope these suggestions will keep you out of hot water. □□