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The Importance of Hot Water Recirculation

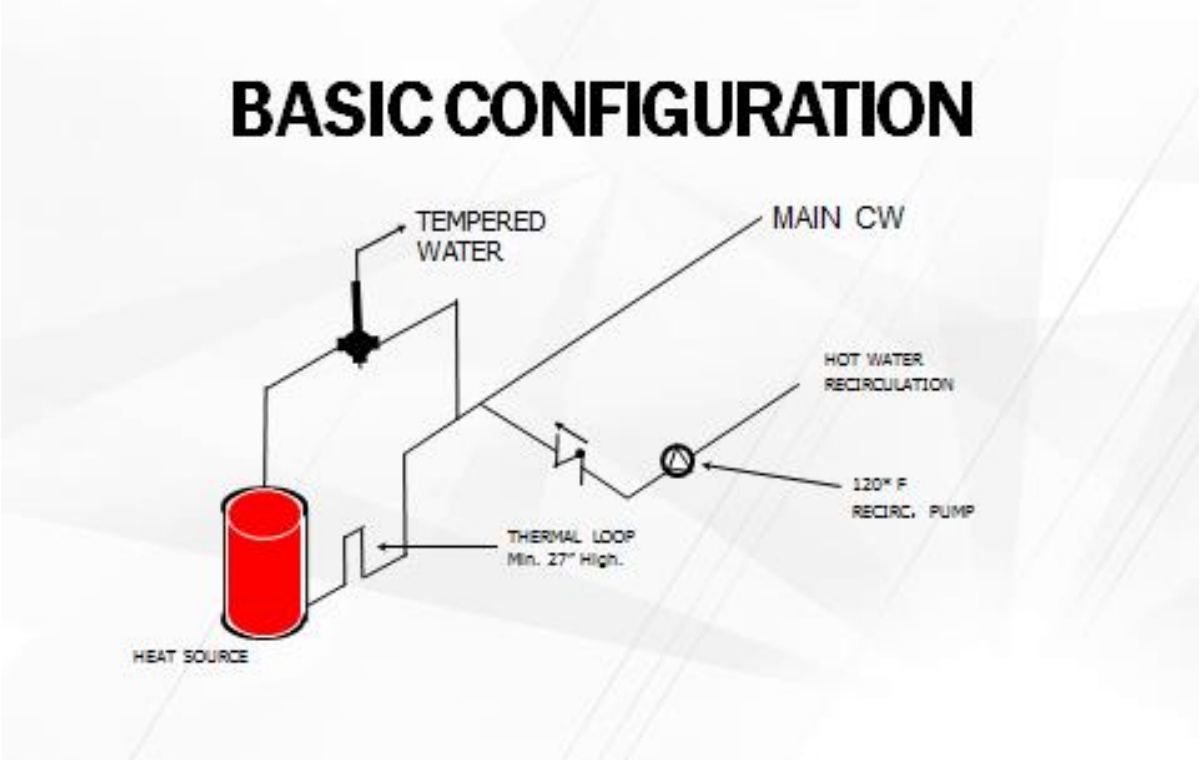
The tempering valve will continuously sense the outlet water temperature and make adjustments to the primary hot water flow and the cold water flow to maintain the proper mixed water temperature. The challenge is to maintain the mixed water temperature during periods of no demand. If there is no demand, and no recirculation flow, the entire tempering valve assembly would heat up and approach the primary hot water temperature. This is due to the primary hot water, typically at 140 deg or above connected to the hot inlet of the tempering valve. The hot water recirculation pump is the only way to provide flow through the valve when there is no system demand. Therefore, the recirculation pump must be piped so that the recirculation flow can reach both the Cold connection of the tempering valve as well as the Cold connection of the heat source.

Based on the temperature of the recirculating flow as it leaves the valve, the valve's internal thermostat will continuously adjust the piston position to allow more or less recirculation flow to enter the Cold Port of the valve. As the valve assembly begins to increase in temperature the internal thermostat will adjust the piston position to open the cold port and close the hot port thus allowing the hot water recirculation to flow through the valve body from the cold connection to the valve outlet. As the recirculation passes through the valve body it carries some of the heat away from the body and out into the piping system thus preventing "thermal creep". Likewise, as the hot water recirculation flows through the system, the recirculating temperature will begin to drop during the "no demand" period, the valve sense the change and the thermostat will move the piston to open more of the Hot Port and close more of the Cold Port to increase the leaving water temperature.

Systems that are installed without a hot water recirculation pump, a malfunctioning recirculation pump or an improperly piped recirculation pump will cause the tempering valve to overheat every time there is no demand in the building. This overheating of the valve assembly may go unnoticed for several months. However, continuously overheating the internal components of the tempering valve may cause the thermostat to fail prematurely. This premature failure could take place in a few months' time or perhaps during the second year of operation. The demand patterns in buildings vary greatly and there is no way to estimate how long a thermostat might function before the continuous overheating causes it to fail.

Another common concern is with hot water systems that have a "direct" hot water line (140 deg or higher) feeding a kitchen or laundry area. In this case, if the high temperature system has a hot water recirculation pump, it must be piped such that the high temperature recirculation cannot reach the cold connection of the tempering valve.

The following diagram shows a basic hot water system configuration. Isolation valves and safety devices are not shown.



The following section describes the piping of each line in the diagram.

1. **Cold-Water Line** - As the cold-water line approaches the tempering valve and the hot water heater, the first connection to the cold-water line should be the discharge from the hot water recirculating pump. The next connection should be the tee which feeds the cold connection of the tempering valve. The cold-water line continues through the tee feeding the tempering valve to the heat source with a 27" Thermal Loop in the cold line at the heat source. The 27" Thermal loop will prevent hot water from rising up into the cold-water line during periods of no demand.

2. **Hot-Water Recirculation Line** – The recirculation line is critical to maintain the circulating temperature during periods of no demand. Assume a system with 140 deg. F. in the storage tank or hot water heater. When there is no demand, the 140-degree hot water connection to the valve will cause the valve body to approach the 140-degree hot water temperature. As the valve's internal thermostat senses the increase in temperature, the piston moves to open more of the cold port. Recirculation water flows into the cold connection through the valve and carries some heat away from the valve body preventing the body from overheating and the circulating temperature from creeping up. If the recirculation loop is too short, the heat transferred from the valve body to the recirculation flow may not have a chance to dissipate before the recirculating flow returns to the valve body.
3. **Hot Water Recirculation Pump** – The recirculation pump must operate continuously for the same reasons described in item #2 above. A check valve is required in the discharge line. If there is a high temperature zone such as a kitchen or a laundry, any recirculation pump from these higher temperature zones must be piped such that the flow cannot reach the lower temperature tempering valve.