
Subject: *Water Boiler Installations with Three-Way Valves*

Primary/Secondary pumping is the preferred method for system temperature modulation in commercial hydronic heating installations. Three-way valves are also used on many installations for this purpose. Without proper system design and control, three-way valves can cause cold system water to be returned to a hot boiler. This condition could lead to boiler thermal shock, creating a potential for section failure. With minimal equipment investment, thermal shock conditions can be reduced on three-way valve installations. Weil-McLain makes the following design recommendations.

Piping Selection:

1. Use by-pass piping arrangement – See Figure 1 or 2.
2. Follow basic boiler piping instructions in the boiler manual.

Three-Way Valve Selection:

1. Use valves with minimum timing of four minutes from one extreme position to the other.
2. Size to circuit design requirements. Follow manufacturer's recommendations. Normally valve will be one or two pipe sizes smaller than recommended boiler piping size.
3. Avoid oversizing to prevent poor control of mixed water.
4. Pressure drop across the valve should be high enough to provide accurate control without "hunting".

Circulator Selection:

1. Size system circulator to circuit flow characteristics. Specify gpm and head requirements.
2. Size each by-pass circulator as follows:

$$[1/4 \text{ to } 1/3 \text{ flow (gpm) of system circulator}] \times \frac{1}{\# \text{ of boilers used}}$$

3. All circulators must run at the same time.

EXAMPLE: Specify equipment to by-pass one 1,000,000 btuh Weil-McLain boiler.

Piping: (1) tee, (1) ell, (1) 45° tee (By-pass size and length will vary on each installation.)

Circulator:

$$\text{System flow rate with } 20^\circ \Delta T \text{ through boiler} = \frac{1,000,000 \text{ btuh}}{10,000 \text{ btuh}} = 100 \text{ gpm}$$

$$\text{By-pass flow rate} = 1/4 \times 100 \text{ gpm} \times \frac{1}{1 \text{ boiler}} = 25 \text{ gpm}$$

In most cases a standard booster pump can provide the necessary flow at by-pass gpm and head requirements.

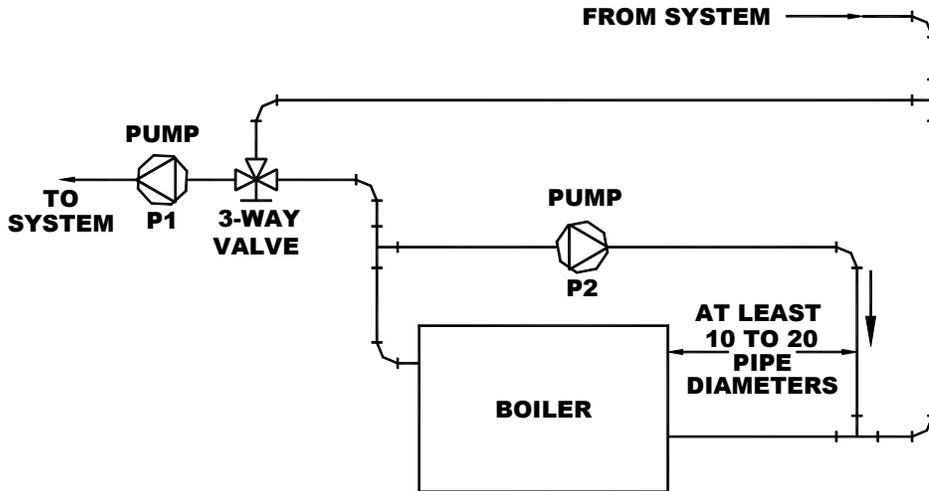


Figure 1
By-Pass Piping Using Three-Way Valve – Single Boiler

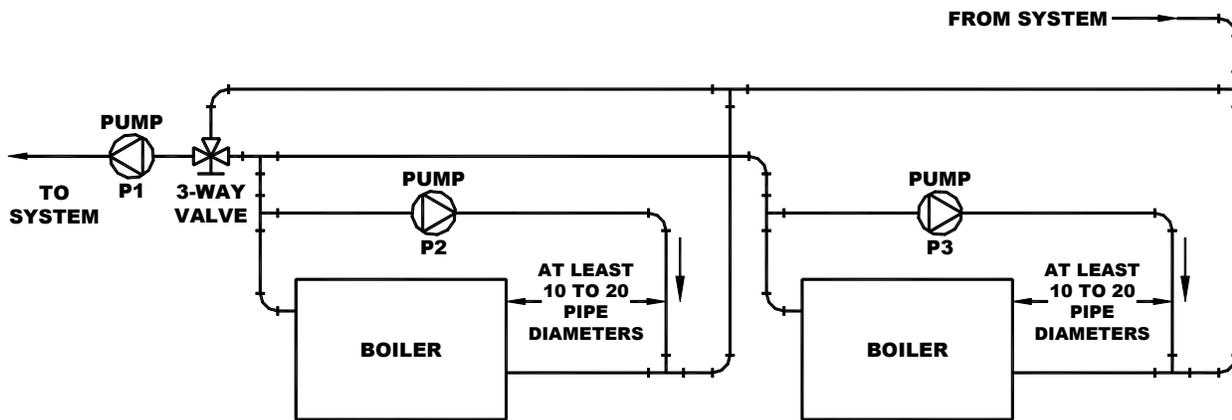


Figure 2
By-Pass Piping Using Three-Way Valve – Multiple Boilers