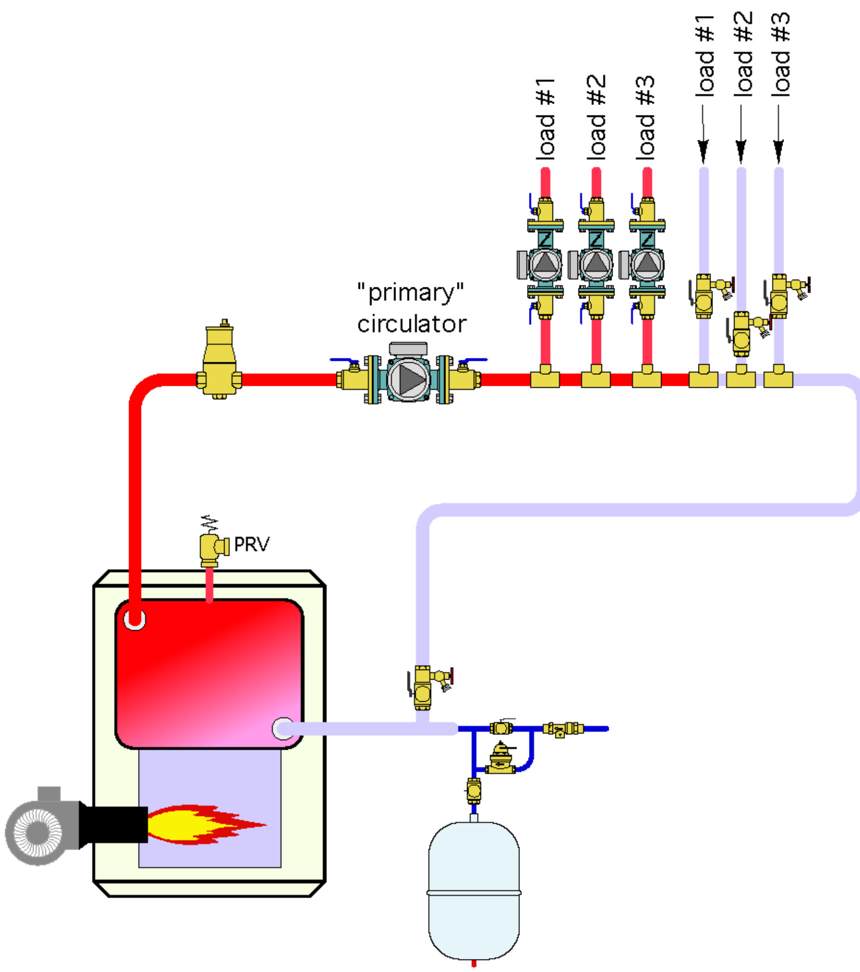
The Glitch & The Fix, March 2016

‘Modified’ primary/secondary hydronic piping system

The Glitch

An installer wants to achieve hydraulic separation between three zone circulators. He also wants to have the same supply water temperature to each zone. He pipes up what he calls a “modified primary/secondary system,” as shown in the Glitch drawing below. His rationale is that since all the zone returns are downstream of the zone supplies, each supply will have the same supply water temperature.

Can you think of a situation where this will work? How about where it will *not* work?

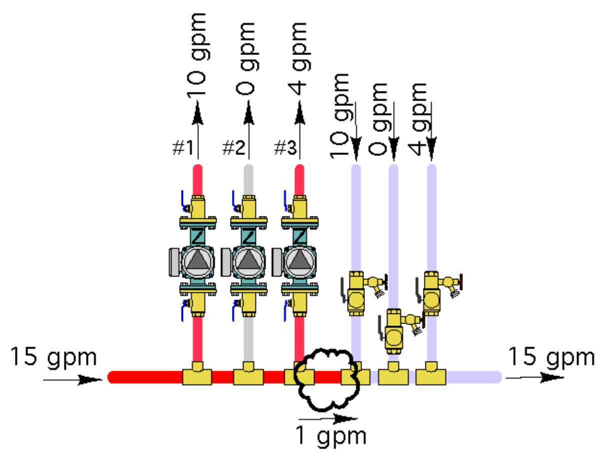


The Fix

Each zone will get the same supply water temperature *if and only if* the flow rate created by the primary circulator is greater than the total of all the active zone flow rates.

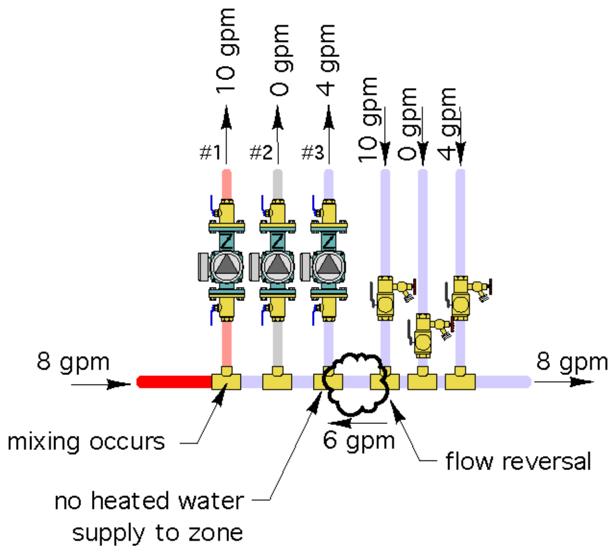
For example, assume the first zone circulator was operational at a flow rate of 10 gal. per min., the second zone circulator was off and the third zone circulator was operating at 4 gpm. Also assume that the flow rate created by the primary circulator was 15 gpm. This would produce the result shown in the Fix 1 drawing. All zones would be receiving water at the same temperature.

Fix 1



Now, keep all three zone flow rates the same, but reduce the primary flow rate from 15 gpm to 8 gpm. The result is shown in Fix 2 drawing (on the next page).

Fix 2



Notice that the flow between the third and fourth tee has reversed. This is the only possible scenario since the flow entering any portion of the system has to be the same as the flow leaving that portion of the system.

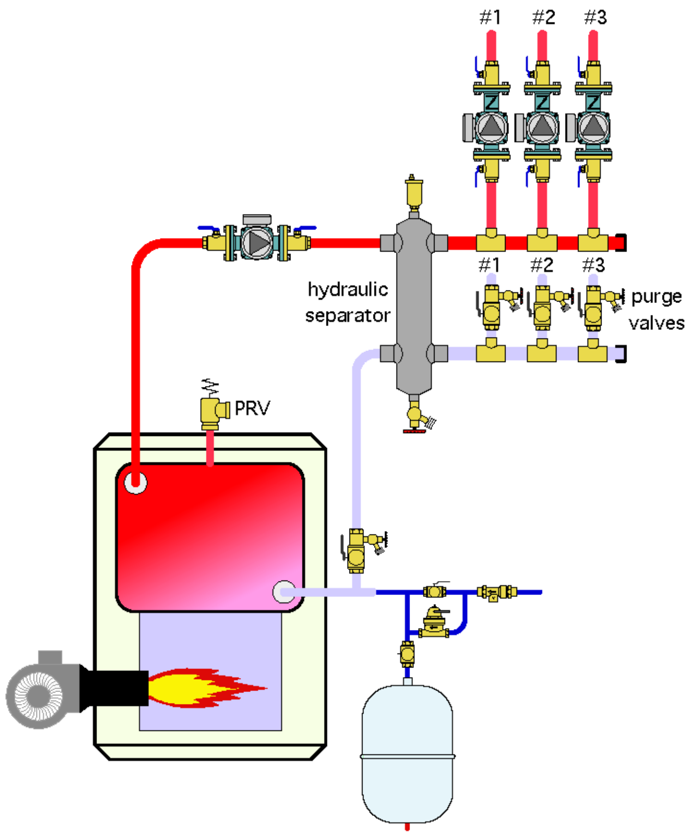
The water “doesn’t care” that it is flowing backwards, but you should. That’s because there will be no heated water entering zone No. 3, and the flow sent into zone No. 1 will be mixed (eight parts heated water with two parts return water). This will obviously have detrimental effects on the heat delivery of these zones.

There are many other possibilities for what might happen based on assumptions for the primary loop flow rate and the combined zone flow rates. The bottom line is that you can’t rely on this piping arrangement to produce acceptable results in all cases — unless you blast water around the primary loop at high flows (e.g., always keeping the primary flow rate greater than what the total zone flow rates might be).

The latter is possible but it’s also wasteful. It requires larger circulators and larger piping, and could result in hundreds of dollars’ worth of unnecessary pumping energy use over the life of the system.

There are several ways to correct this situation. One of the simplest is to install a hydraulic separator between the boiler and distribution circuits, as shown in the Fix 3 drawing.

Fix 3



This arrangement ensures equal supply water temperature to all zones under all circumstances. The hydraulic separator also replaces the high-performance air separator and provides dirt separation for the system.

Keep in mind that the boiler circuit flow rate does *not* have to equal or exceed the total zone flow rate. My suggestion is to select a boiler flow rate that's relatively wide — perhaps 30° F or more, provided that the boiler is compatible with that flow rate and the return water temperature to the boiler stays above the dew point of the flue gases. A boiler inlet temperature of 130° is generally sufficient for the latter.