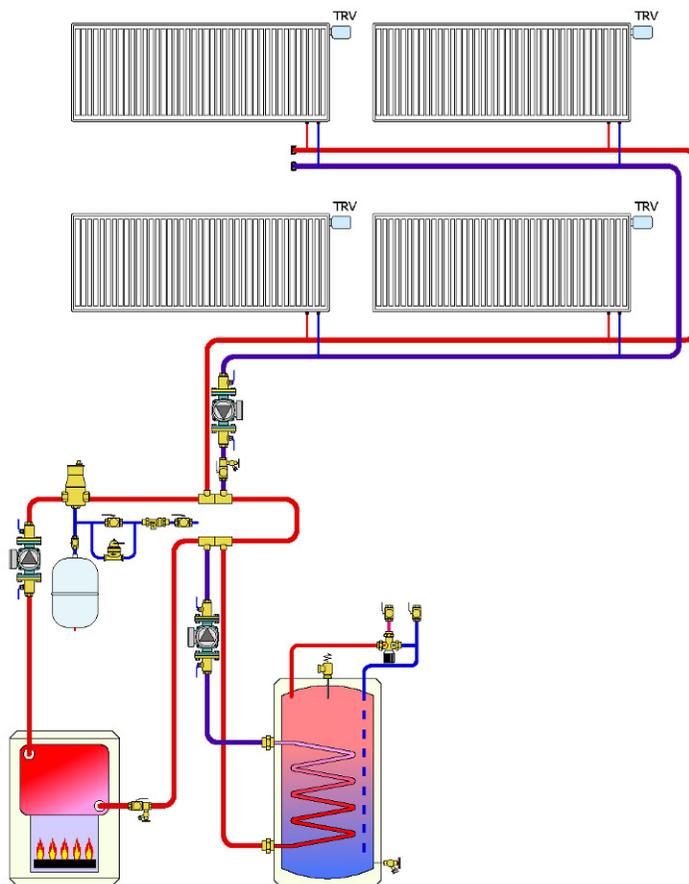


Simpler Is Better

The Glitch

A hydronic system is to be designed to supply four identical panel radiators and an indirect water heater from a gas-fired, sectional cast-iron boiler. The system is designed using primary/secondary piping as shown below. The primary circulator operates whenever the space-heating load or the indirect water heater call for heat.

- A. Can you spot at least five details that are incorrect?
- B. Is there a better way to pipe this system?



The Fix

Let's tally the errors on the primary/secondary approach before getting into a better piping layout:

1. The primary circulator is pumping toward, rather than away from, the point of no pressure change (e.g., where the expansion tank connects to the system).
2. The secondary circulators are both pumping toward, rather than away from, the primary loop. This is incorrect because each secondary circuit “sees” the primary loop connection as its point of no pressure change (because the expansion tank is in the primary loop). Thus, all secondary circulators should pump into their respective secondary circuits.
3. The heat exchanger coil within the indirect water heater is not piped for counterflow. The hot water should always enter the top connection of the coil.
4. There is no thermal trap installed on the thermostatic tempering valve of the indirect tank. This will lead to thermosiphoning and wasted energy.
5. Assuming primary/secondary piping is used, the indirect tank should be the first load connected to the primary loop, thus able to operate with the highest available water temperature.
6. The purging valve is missing on the return side of the secondary circuit serving the indirect water heater.
7. There is no means of differential pressure control within the zoned secondary circuit serving the panel radiators.
8. The lack of check valves in the secondary circulators will allow for heat migration. As shown, the indirect water heater will use its secondary circuit piping to continually dump heat to its surroundings.

Now, let's take a look at an improved design (next page):

First, the loads do not require this to be a primary/secondary system. The low-head-loss boiler and generously sized header piping provide sufficient hydraulic separation between the two load circuits, even when one of the loads operates with a variable-speed circulator. Just keep the headers relatively short and sized for a maximum flow velocity of 2 feet per second. This approach eliminates both the installation and operating cost of a primary circulator.

Another change is use of a pressure-regulated circulator within the circuit serving the zone panel radiators. This eliminates the need of a differential pressure bypass valve and significantly reduces operating cost compared to a fixed-speed circulator. A check valve is included to prevent reverse flow when the indirect water heater load is active.

The panel radiators are now supplied through a home-run distribution system. This is likely to install faster and at a lower cost relative to the hard-piped, two-pipe direct return system on the original drawing.

A thermal trap is shown on the piping leading to the thermostatic mixing valve on the indirect water heater.

Because of the very low hydraulic resistance of the boiler and headers, it is possible to locate the system's expansion tank on the inlet of the boiler where its temperature will remain a bit cooler.

