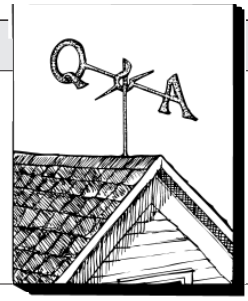
Combining Radiant and Baseboard Heat



Q. *I have a hot-water system feeding high-temperature baseboard heaters and a low-temperature radiant slab. How should the system be set up to accommodate these separate zones?*

A. *John Siegenthaler responds:* There are several ways of combining low-temperature radiant floor heating with higher-temperature distribuition systems, such as fin-tube baseboard convectors. Above all, the system must be designed 1) to prevent condensation within the boiler, and 2) with a specific type of control system.

Conventional boilers must have return water temperatures high enough to prevent sustained condensation on the fire-side of the boiler, or within the flue pipe. Water vapor is a byproduct of combustion, and if allowed to condense, it can cause severe corrosion. Flue pipes are especially vulnerable, and can fail in a matter of weeks when condensation is present. This could allow toxic gases to be released into the building.

Typically, the return water temperature for a gas- or oil-fired boiler should be 140°F or higher to prevent condensation. Since radiant systems operate with a return water temperature in the range of 80° to 100°F, their return water must be mixed with hotter water before it is sent back to the boiler. There are two simple ways to do this — with a four-way valve or with injection mixing.

The four-way mixing valve lowers the temperature of the water supplied to the radiant floor system by mixing return water into the radiant loop, as shown in Illustration A. To avoid condensation in the boiler, the four-way mixing valve maintains a relatively high return water temperature by mixing some hot supply water into its return flow.

To control the four-way valve, you'd ideally have a motor-operator regulated by an outdoor reset control. This measures outdoor temperatures and automatically adjusts the valve to maintain a suitable water temperature in the radiant floor to match the required heating load. A less expensive (and less exact) control system for the four-way valve is to control the circulator in the floor heating loop with a room thermostat. This way, the four-way valve is set at the design-load temperature of the floor heating system and left there. When heat is needed, the circulator comes on to deliver hot water to the area. The thermostat should have a low differential (one or two degrees), to minimize swings in room temperature.

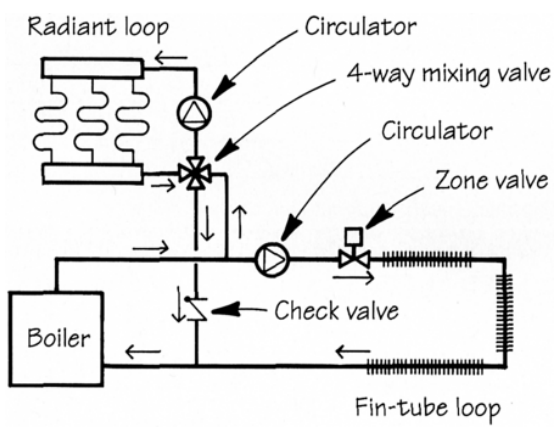
Another way to lower the water temperature of the radiant floor is through injection mixing (Illustration B). In this system, the high-temperature zones have individual circulators (C1) that are controlled by room thermostats, just as in a standard multi-zone system. Water circulates continuously (using circulator C2) through the radiant floor loop during the heating season, and a zone valve opens to allow hot water to flow into the loop when heat is needed. This zone valve can be controlled by a thermostat or for more precise control, a reset control.

The hot water from the zone valve is mixed with cool return water at the tee downstream from the valve. A balancing valve determines how much hot water flows into the radiant loop when the zone valve is open. To prevent condensation, the circulator in the main system loop (C3) must operate when the zone valve is open to shunt a significant portion of hot water back towards the boiler.

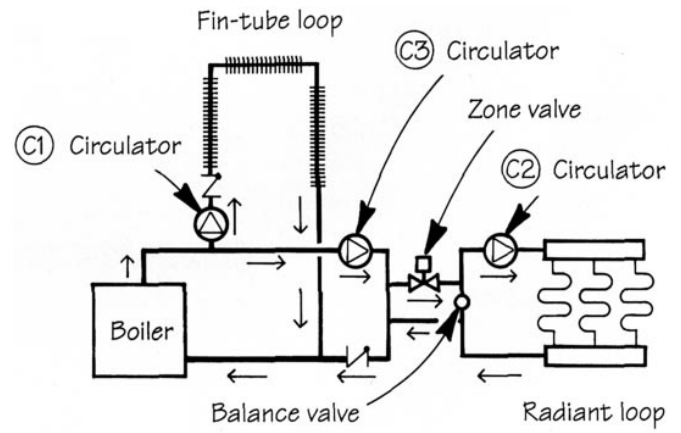
The injection mixing hardware (zone valve plus reset control) is significantly less expensive than the four-way valve system with a reset control (about $300 vs. $800). Detailed information about both approaches can be obtained from Tekmar Control, 4611 23rd St., Vernon, BC V1T 4K7, Canada; 604/545-7749.

John Siegenthaler, P.E., owns Appropriate Designs, a building systems engineering firm in Holland Patent, N.Y.

A. Four-Way Mixing Valve



B. Injection Mixing



When combining radiant and baseboard heat, you must prevent condensation in the boiler caused by the low temperature of the radiant heat's return water. One method uses a four-way mixing valve (left) to mix hot supply water into the radiant heat's return water. Another approach (right) uses a zone valve to deliver hot water to the radiant loop and a circulator (C3) to heat the return water.

Grounding Water Lines

Q. *In most of the houses we work in, the grounding cable for the electric panel is attached to the incoming water supply. Is this necessary or even a good idea? Can this damage an electronic water meter?*

A. *Rex Cauldwell responds:* In the past, using metal water lines as the building's sole grounding electrode was very common. But not anymore. It goes against the National Electric Code, and is very dangerous besides. If a piece of plastic plumbing is installed along the metal water line, the ground is lost. If the lines are all metal and a surge comes along, it can kill the person working on the lines or on the water meter. And yes, it can damage an electronic meter if it is not backed up with a legal ground rod.

To conform to code, a water line can only be used as a ground if it is in contact with the earth for at least 10 feet and the attachment is made within 5 feet of where the water line enters the house. And most important, it must be backed up with another electrode, such as a ground rod system.

A common legal ground rod is 5/8-inch-diameter, 8-foot long copper-clad or galvanized steel rod. Most houses have just one such rod, but to comply with code you technically should have at least two rods spaced at least 6 feet apart. Connect the rods to each other and to the main panel with a #6 or bigger copper wire (I typically use #4 wire).

While the water lines should not be the sole ground for the electrical system, they should, nevertheless, be grounded in case a hot wire ever comes in contact with them. I typically attach a #4 wire from the water line into the main panel, where it connects to the electrical ground rod system. In addition, I install a jumper (another #4 wire) that bypasses the water heater. If you have metal drain lines, it's good practice to ground them, too.

Rex Cauldwell is owner of Little Mountain Electric and Plumbing, in Copper Hill, Va.

Got a question about a building or renovation project? Send it to On the House, JLC, RR#2, Box 146, Richmond, VT 05477.