Plumbing & Mechanical, The Glitch and The Fix — June 2008
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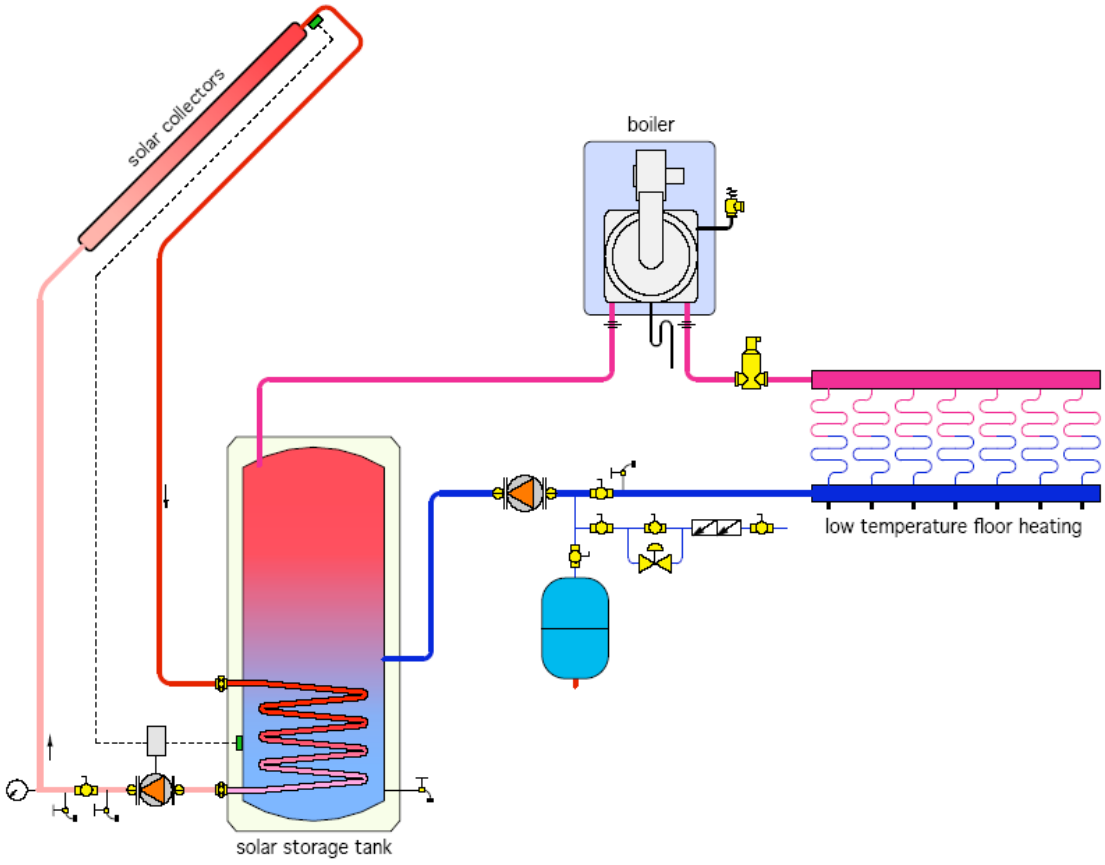
Solar By The Seat Of Your Pants

The Glitch

Overview: Much of the hardware used in solar thermal systems is similar if not identical to that used in “classic” hydronic heating. With additional training, many hydronic heating pros can extend their skill set to include design and installation of solar thermal systems.

However, some choose to jump into designing or installing solar thermal systems with no additional training. This is not unlike what happened while the radiant panel market expanded rapidly over the last couple of decades.

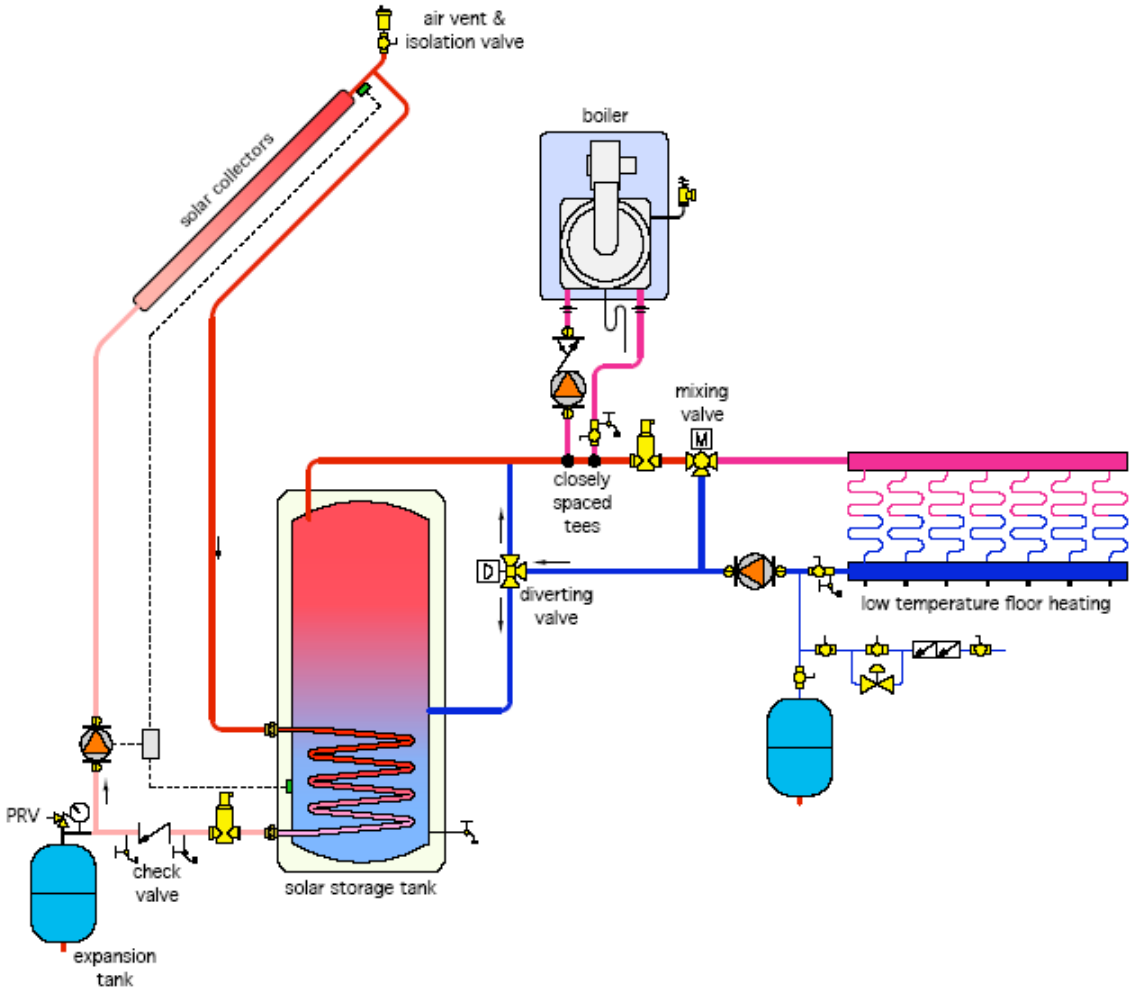
Exercise: The schematic below comes from this “seat-of-the-pants” school of solar system design. See if you can find and correct at least six piping design errors.



The Fix

The following components are missing in the collector circuit:

a. Check valve to prevent reverse thermosyphoning when collectors are cooler than tank
b. Expansion tank (because it's a closed pressurized circuit)
c. Pressure relieve valve (because it's a closed pressurized circuit)
d. Isolation valve for air vent at top of collector array (to prevent damage to vent during stagnation conditions)
e. Air separator (because the collector circuit will contain dissolved air when filled)



On the distribution side, this system forces flow through the solar storage tank and the boiler whenever space heating is required. This will warm the storage tank whenever the boiler is operating.

Maintaining the solar storage tank at an elevated temperature delays the start-up of the solar collection process when the sun reappears. The fix is to install a

motorized diverting valve to prevent water from passing through the storage tank when the boiler is serving as the heat source.

When the storage tank is warm enough to supply the low temperature floor circuits, water is still forced to flow through the boiler. This uses the boiler jacket and flue as heat dissipaters. The fix is to set up the boiler on its own secondary circuit, and only route flow through it when it's operating.

Next, imagine the sun has been bright for a couple of days and the space heating load is low. The storage tank has warmed to 170 ºF. The original piping design would allow water form the storage tank to flow directly to the floor circuits. Can you say "cracked slab"?

The fix is to install a 3-way mixing valve to reduce the water temperature to the radiant floor circuits when necessary. If a condensing boiler is used, the mixing valve could motor to its fully open position and pass through flow from the boiler, which now provides the water temperature required based on outdoor reset control.

The fix drawing shows these details in place.