The Glitch and The Fix — December 2008

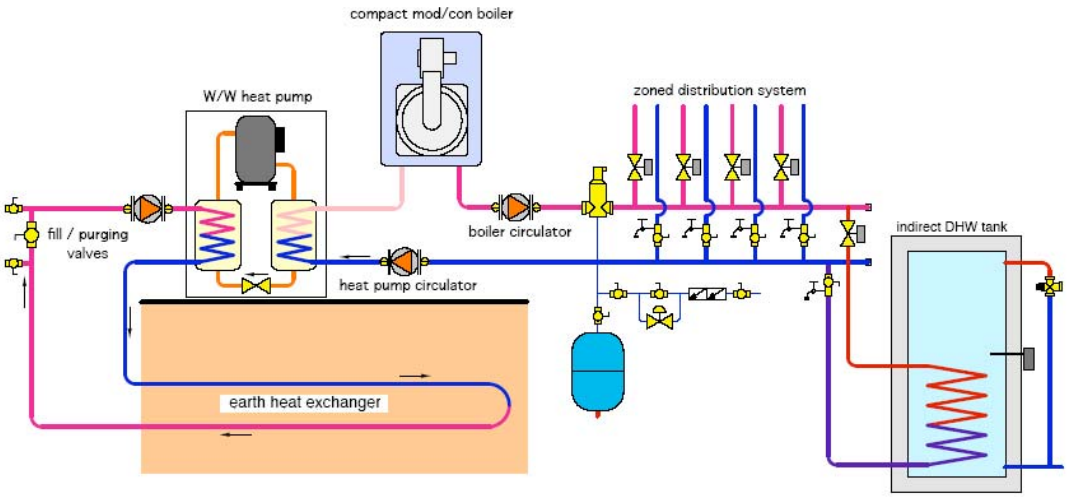
Trouble Waiting To Happen

The Glitch

Overview: An installer was asked by a client to use both a ground source heat pump and a boiler as alternative heat sources in a zoned, low-temperature hydronic distribution system. Realizing the compact mod/con boiler and heat pump both have high flow resistances, he installs a circulator for each, and decides that both of them operating simultaneously will provide sufficient flow.

He also incorporates an indirect water heater into the system. When there's a demand for domestic water heating, the mod/con boiler goes to a high-temperature setting and the heat pump remains off.

Problem: Can you spot at least five details that will surely lead to trouble with this system?



The Fix

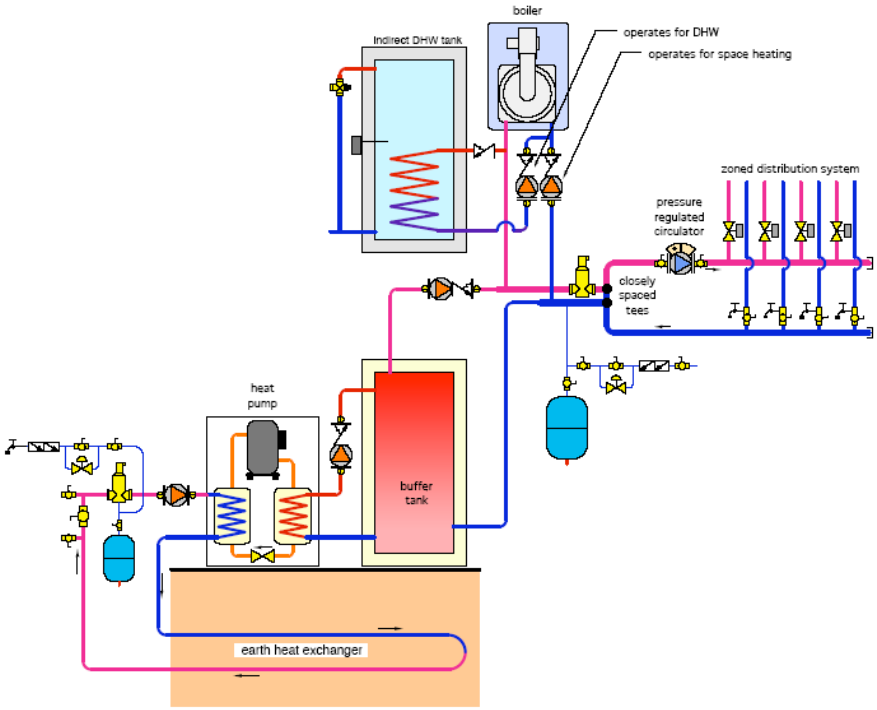
It's almost never a good idea to pipe heat sources in series. Doing so creates additive flow resistance, and creates the potential for incompatibilities in operating temperature. It also allows the inactive heat source to act as a heat dissipater.

The two circulators operating simultaneously needlessly add to electrical operating cost. When only one zone is operating, there may still be a chance the heat pump would be operating with insufficient flow, and trip out under a high head pressure condition.

Beyond these aberrations is a valved distribution system without differential pressure regulation. The expansion tank is incorrectly located near the discharge side of a circulator. The earth loop lacks an expansion tank and air-separating device. The indirect water heater at the far end of the headers also creates more heat loss than necessary from the headers. Hot water produced by the boiler will also have flow through the heat pump's condenser during the water heating mode.

The corrected schematic places the boiler and heat pump so each can serve as the system's heat source without affecting the other. The heat pump delivers heat to a buffer tank, which in turn delivers heat to the zoned distribution system. This prevents the heat pump from short cycling under low load conditions. A pressure-regulated variable speed circulator controls differential pressure in the distribution system. An air separator, expansion tank and valving for adding fluid have been added to the earth loop.

Although some earth loops operate without this trim, having it in place limits pressure variations and helps the earth loop clear itself of air for the quietest possible operation. Domestic water is treated as a priority load, and is only served by the boiler.


boiler
Indirect DHW tank
operates for DHW
operates for space heating
zoned distribution system
pressure
regulated
circulator
closely
spaced
tees
heat
pump
buffer
tank
earth heat exchanger