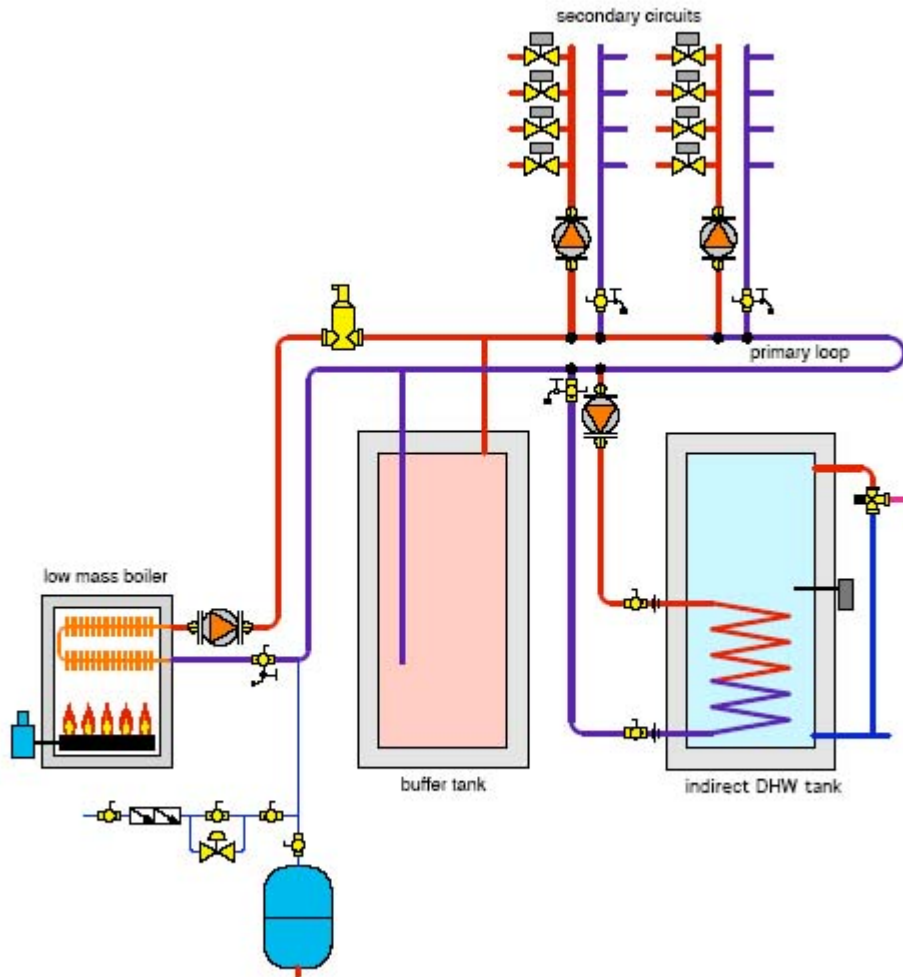


Preventing Short Cycling

The Glitch

Overview: An installer is advised to use a buffer tank to prevent short cycling of a low mass boiler serving several independently controlled space heating zones. The system also needs to provide domestic hot water. The design he comes up with is shown below.

Exercise: Find at least five errors in this layout.



The Fix

One rule of working with buffer tanks is to not operate the buffer tank as part of the domestic water heating mode. The indirect tank provides plenty of thermal mass to stabilize the boiler during this mode. Storing heat in buffer tank for domestic water heating only adds to standby heat loss. The fix is to operate the indirect tank as a separate circuit independent of the space heating loads. Notice that hot water from the boiler is drawn through the air separator in either space heating or DHW mode.

The series primary/secondary piping shown in the Glitch lowers the supply water temperature to the downstream secondary circuits. If the DHW tank were allowed to operate simultaneously with space heating, the heat exchanger in the indirect tank would get a relatively low supply temperature due to temperature drop across the space heating secondary circuits. Better to pipe these secondary circuits as parallel circuit to give them the same supply temperature.

The incorrect piping also allows an undetermined percentage of the boiler flow to pass through the buffer tank rather than pass through the primary loop. This could exasperate the problem of temperature drop along the primary loop due to low flow.

Finally, if the boiler is off and heat is being supplied from the buffer tank, there is no way to prevent hot water flow through the boiler heat exchanger. This situation will lead to excessive heat loss from the boiler jacket.

In the Fix drawing, the buffer tank is simply piped in as an alternative heat source. When its secondary circulator is operating, its thermal mass “participates” in the space heat operation. If there is any space heating mode where the buffer tank is not needed, it can be taken offline by turning off its circulator.

OPERATING MODES:

1. Buffer tank charging mode: Circulators P2 and P3 are operating and boiler is firing. If zone circulators are off then flow make “U-turn” between closely spaced tees A and B. If one or more zones are on entering flow “splits” at tee A (some to load, remainder to buffer tank through tee B).
2. Supplying zones from boiler only: P2 is on, P3 is off. Hot water from boiler is injected at tee A, and drawn through zones. Return water is pulled out at B and returned to boiler.
3. Supplying zones from buffer tank only: If buffer tank is hot enough, and there is a call for space heating. P2 is off, P3 is on. Hot water enters distribution system at tee A and returns to buffer tank from tee B.
4. Prioritized domestic water heating: Circulator P1 is on, P2 is off. P3 might be operating if space heating zones are active.

