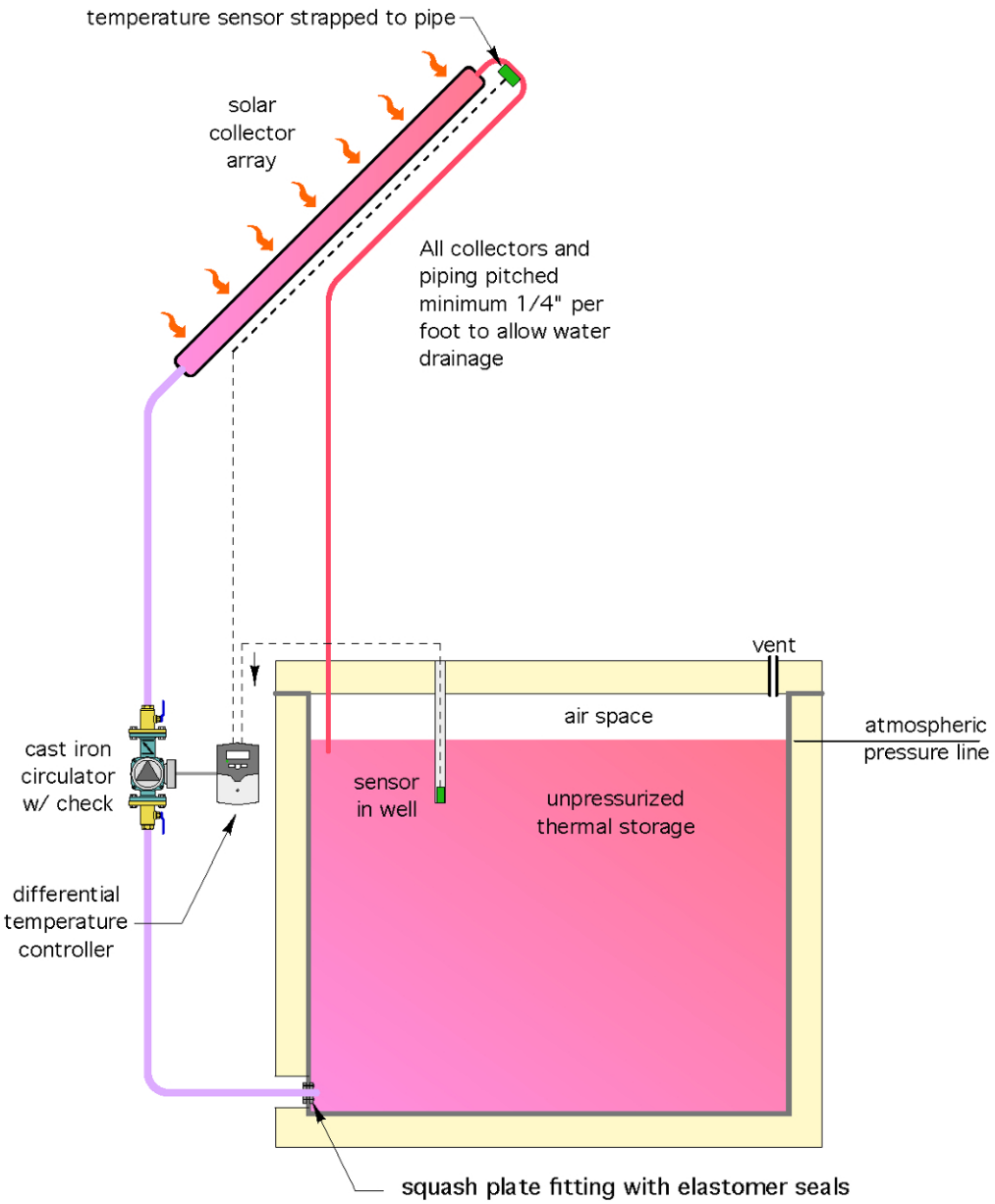
Dubious drainback

The Glitch

Having heard the virtues of drainback freeze protection, an installer creates the system shown below. He uses an unpressurized thermal storage tank, and carefully slopes all the collectors and collector array piping for 1/4 in. per ft. drop to ensure efficient drainage.

Can you spot several other details that will immediately (or eventually) lead to problems with this system?



The Fix

Do you remember what check valves are for? They stop reverse flow. The check valve that now comes installed in many hydronic circulators is going to prevent water from draining back down the collector supply pipe. The first hard freeze will likely rupture the absorber plates in the collectors.

The solution: Be absolutely sure there are no check valves in any piping that must carry flow in both directions.

It's also not a good idea to use a cast-iron circulator in a piping assembly that directly connects to an unpressurized thermal storage tank. The dissolved oxygen level in the water will remain higher than in a closed-loop system and will quickly corrode the circulator.

Also notice that the circulator is barely below the water level in the tank. As such, it will have very little static pressure at its inlet and is likely to cavitate under most operating conditions.

The solution: Move the circulator as low as possible in the system to increase the static head at the circulator's inlet port.

There was a time when squash plate fittings with elastomer gaskets were installed below the water level in unpressurized thermal storage tanks. In some cases they maintained a watertight seal for years. In other systems, no so much …

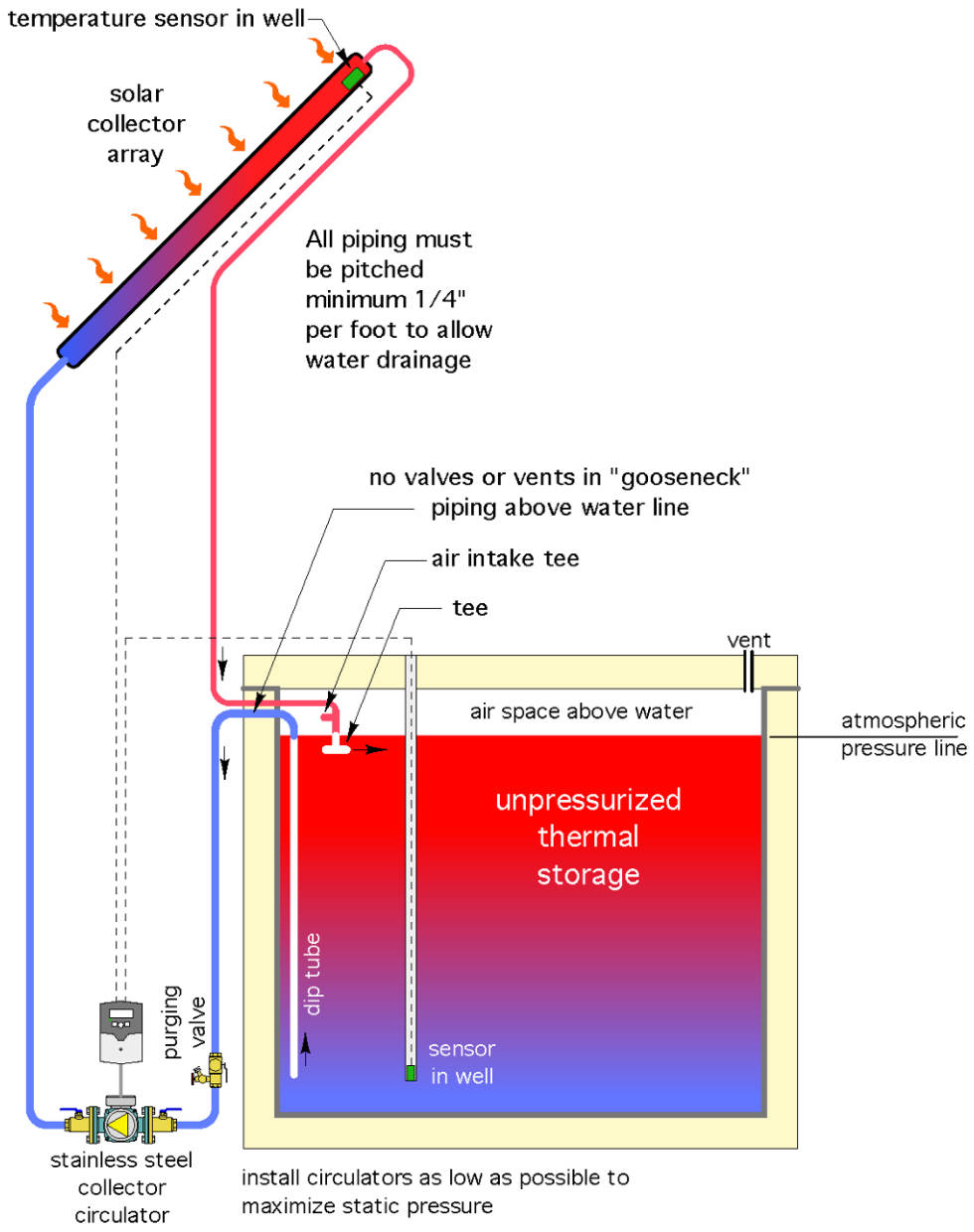
Can you afford to have 200+ gallons of water waiting to move through a seal that *might* last several years? Didn't think so.

The solution: Use "gooseneck" piping as shown in the Fix drawing on the next page.

All piping connects to the tank above the highest water level (accounting for thermal expansion of the water when heated). The squash plate fittings can still be used to minimize water vapor loss from the tank, but now they are not subject to static water pressure if their seals should eventually harden.

After passing through the upper side wall of the tank, the piping drops to collect water from the cooler, lower portion of the tank and route it to the collector array. Once this piping passes through the upper sidewall of the tank, it drops outside the tank to provide the maximum static head on the collector circulator.

Notice that a purging valve is installed to allow the air initially in the gooseneck piping to be flushed out using forced-water purging when the system is commissioned. Once this air is flushed, water will remain in the gooseneck piping.



Fix drawing

Other incorrect detailing includes:

1. The piping returning from the collectors to the tank drops vertically downward into the tank. This will create a vertical flow jet that disrupts temperature stratification in the tank. All inlet piping to thermal storage tanks should terminate in a horizontal direction to minimize this internal mixing.

2. There is no way for air to enter the collector return piping and allow drainback. No air entry = no drainback. This is corrected by installing a tee with its side port open to the air space in the tank, and above the highest water level. Air will enter this port to initiate drainback whenever the collector circulator turns off.

3. The temperature sensor in the thermal storage tank should be located in the lower portion of the tank. This increases the “solar harvest” because it allows the differential temperature controller to turn the collector circulator on at lower temperatures (e.g., perhaps 8° to 10° F above the temperature in the lower portion of the tank).

4. The temperature sensor strapped to the piping at the outlet of the collector array will delay onset of collector circulator operation because it can only “feel” the temperature resulting from heat conducting along the (empty) piping between the collector absorber plate and the sensor location.

Drainback systems should have the collector temperature sensor mounted into a well that is brazed to the absorber plate. If no such well exists, a sensor with a flat “tongue” should be bolted directly to the absorber plate.