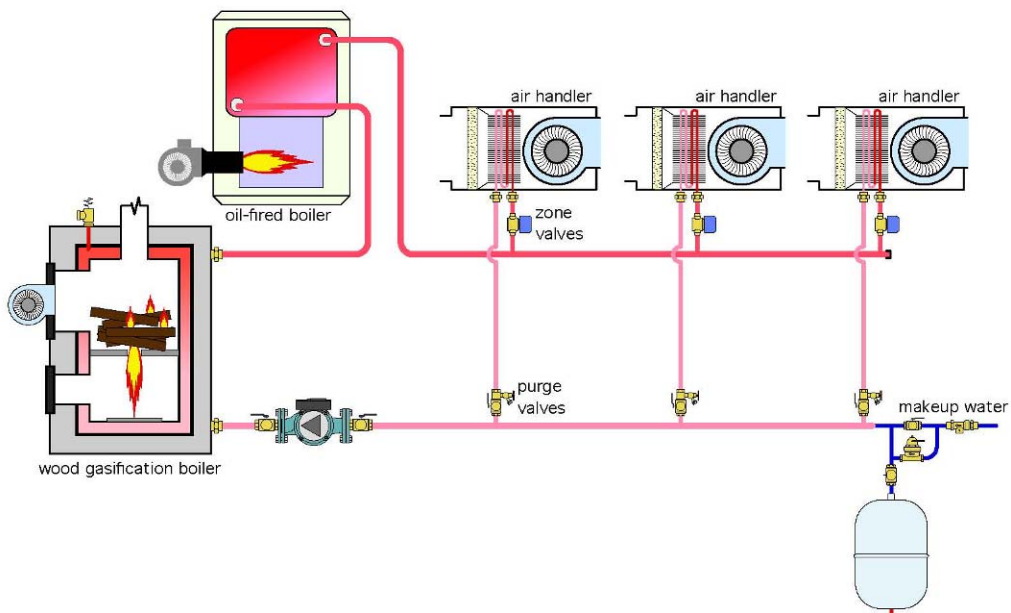


Born to burn

The Glitch

Due to the high price of fuel oil, a contractor is hired by a building owner to install a wood-gasification boiler to supplement the oil boiler. The building's distribution system consists of a three-zoned air handler with hot water coils. The owner tells the contractor that even the existing system doesn't evenly heat all the zones. The contractor installs the boiler as shown, but doesn't make any changes in the distribution system.

Can you spot several details the spell trouble ahead or that should be changed to provide better heat distribution?

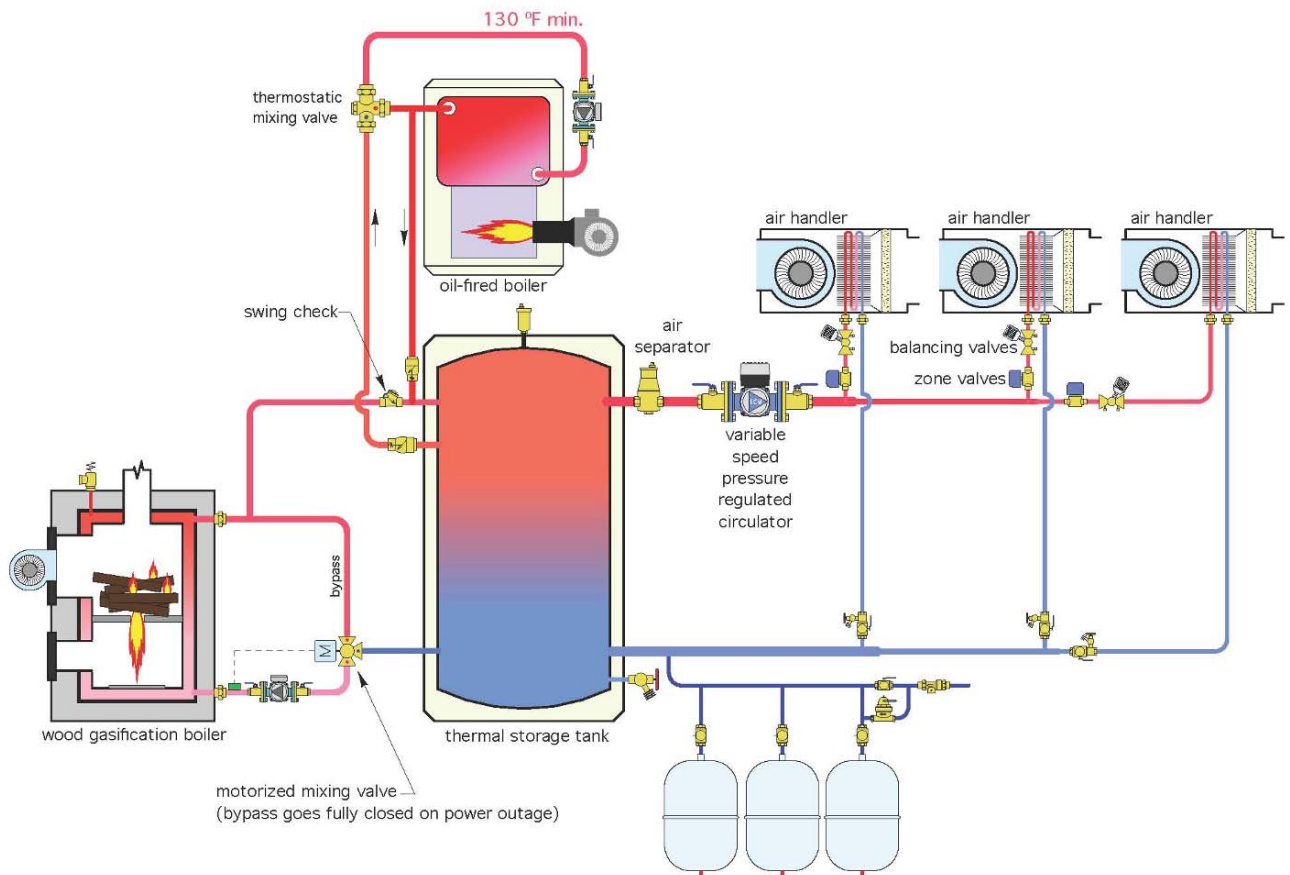


The Fix

Wood-gasification boilers are not like oil- and gas-fired boilers. You can't just turn them on and off several times an hour. Once started, they are designed to completely burn a firebox full of dry wood at the highest possible combustion rate. In most cases this means heat is being produced much faster than the building requires it.

The answer is thermal storage. Don't even think about using a wood-gasification boiler without adequate thermal storage.

The figure below shows one way to reconfigure this system.



The system now includes thermal storage, the size of which needs to be calculated based on the capacity of the boiler and the allowable temperature change in the tank. A typical residential-scale wood-gasification boiler will usually require 300 to 500 gal. of storage.

Other details in the Fix drawing include boiler inlet water temperature protection. This is necessary, even in systems with distribution systems that may operate at 140° F or higher

supply water temperature under design load conditions. The reason is the potential for cool water in the storage tank at times.

The large mass of this cool water could cause the wood-fired boiler, or the oil-fired boiler, to operate with sustained flue gas condensation. The wood-gasification boiler is protected by a three-way motorized mixing valve operated by a spring return actuator. Upon a power failure, the actuator fully closes the bypass port of the valve. This allows a piping pathway, driven by thermosiphoning, to carry residual heat from the boiler to the storage tank.

The oil-fired boiler also connects to the storage tank, but only to the top 20% to 25% of its volume. This provides some buffering mass between the oil-fired boiler and zoned distribution system, but without heating the entire volume of the tank. Temperature stratification will limit the “active” thermal mass of the tank when the oil-fired boiler is providing heat. The oil-fired boiler also has been configured with a three-way thermostatic mixing valve to ensure its inlet water temperature is high enough to prevent sustained flue gas condensation.

Other corrections/details include a variable-speed, pressure-regulated circulator to provide differential pressure control of the distribution system as various zones turn on and off.

Each air handler branch now has a balancing valve.

A microbubble air separator has been added to the distribution system at the point of highest temperature and lowest pressure.

The size of the expansion tank has been increased, in this case using three smaller tanks in parallel, to accommodate the much higher water volume in the system. This also could be handled using a single floor-mounted tank with sufficient volume. As an estimate, plan on an expansion tank volume that’s about 10% that of the storage tank volume.