Bell & Gossett CounterPoint™

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Gravity Hot Water - Conversion to Forced Flow

Life may have been simpler before the invention of the circulator, but those old gravity hot water systems of yesteryear sure weren't! Gravity systems had slow response time, no control, plus poor circulation in radiation. The addition of the booster pump increased circulation and provided rapid response and more complete control. But there are still many things you need to consider besides using a booster pump to increase circulation.

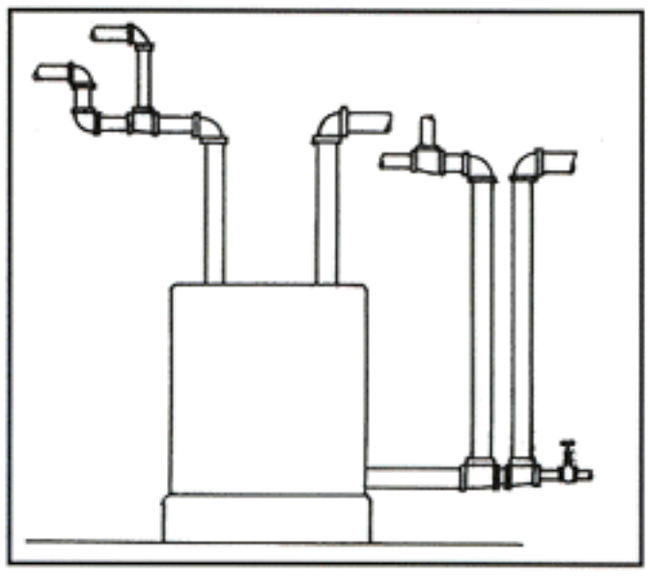
Supply and return - The old gravity system boilers had multiple tappings that were used for multiple circuits direct off the boiler to increase circulation. When you convert to forced flow you want only one supply and one return, so boilers should be cross connected for full use of the boiler and better efficiency, and the piping around the boiler should be reduced to the flow required according to the radiation BTU load. Measurement of the longest circuit will determine the pressure drop of the system - most buildings are either rectangles or squares, so measure the length and width and multiply by 2 to get the approximate length of the longest circuit. The pressure drop and flow will then determine pump size. Note that this method applies to 1- or 2-story residential only.

Orifice plates - In many of the old systems, orifice plates were used to balance the flow between the first and second floor. Because hot water rises and takes the path of least resistance (which would occur in upper floor radiation), a small hole was drilled into these plates to increase the pressure drop of the second floor radiation and create flow in the first floor radiation. In converting to forced flow it may be advisable to reverse the location of the orifice plates from the second floor radiation to the first floor to increase the resistance so flow will occur equally in each piece of radiation.

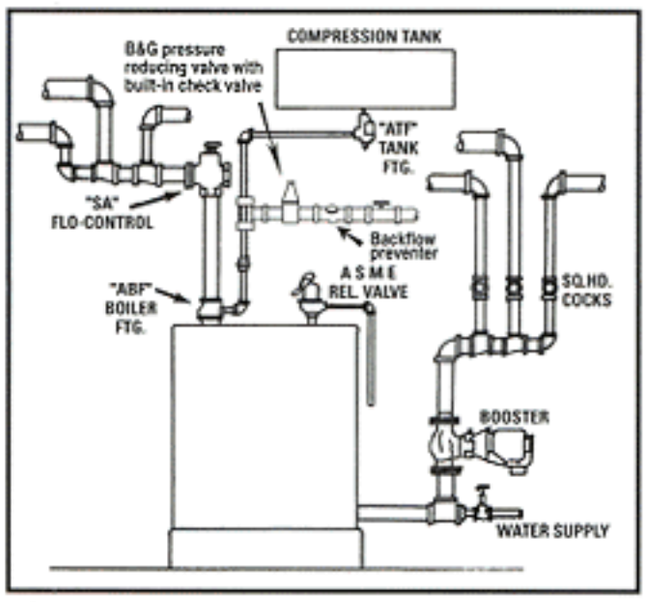
Radiator valves - In old systems with radiator valves, the valves do not have to be changed. These globe type valves can be used to balance each individual radiator, and in multiple circuit systems each circuit should be balanced. It is easy to get short circuiting in older systems because of the larger diameter pipes, and low resistance in some circuits will cause a tremendous flow unbalance causing less heat in some circuits and more than needed in others.

Distribution piping - The existing distribution piping can be used when changes are made at the boiler; however, if the existing boiler is to be used, remember that it holds a great deal of water compared to newer boilers. If a new boiler is to be installed, the piping water volume will be much greater than boiler water volume. To prevent possible water hammer, thermal shock and flue gas condensation in the boiler, it is recommended you install a bypass line that mixes hot supply water with colder water from the system and modulates return water from the system to the boiler.

Pressurization - Older gravity systems are open to the atmosphere and cannot be pressurized, so an open expansion tank was used to take up the expansion of water as it was heated in the system (maximum operating temperature was 180 degrees). If the old system is changed to a closed system, you must put in a compression tank (a closed tank) to take up the expansion and pressure of the water as it is heated.



Typical old gravity system.



Converted gravity to forced system.

Air control - In a forced flow installation, an air control system would have to be installed to control the air in the system once it is closed. An air separator and a standard or pressurized tank could be used.

Relief valves - Gravity systems did not have a relief valve on the boiler. Don't forget that closing the system requires a safety relief valve rated at the maximum boiler operating pressure and gross BTU output load of the boiler.

Flow control - Valves are needed to prevent gravity flow and if they are not used, you will get flow in the system whether or not the pump is on. Old systems operated on gravity flow, and without flow control, will be subject to overheating or loss of control.

Thermostats - In older systems, the boiler maintained a set temperature all the time with an aquastat controlling the burner. In new systems, a two-stage thermostat can activate the boiler and pump to control the system. For greater energy savings, the boiler doesn't have to be kept at a constant temperature, but it should only be called into operation when needed.

Some final reminders - Before raising water temperature, know that the boiler is rated at a certain capacity per hour, and that raising the water temperature does not increase the output of the boiler (it will increase the output of the radiation if the boiler has the capability).

If you're changing the type of radiation in any part of the building, put it on a separate zone. Convector baseboard and free-standing radiation have different characteristics of heat transfer and capacity: convector baseboard heats up fast and cools down rapidly, while old radiation with more water and a greater metal mass heats up slowly and holds heat longer.

There are many factors which must be considered in conversion jobs, and common sense should be applied with good judgment in designing a conversion from gravity to forced flow. When you have questions about gravity hot water, or any hydronic system (old or new!) you'll find the answers at your Bell & Gossett representative's. They're there to help, so give them a call!