CONTRACTOR®
THE NEWSMAGAZINE OF MECHANICAL CONTRACTING
Reprint from April 1995

Constant circulation boosts system's comfort, efficiency

BY JOE FIEDRICH
Hydronic heating authority

WHEN HOT WATER heating systems finally became a proven success after the sizzling steam era, the ideal form of heating was finally proclaimed. Thousands of gravity circulation systems were installed and steam heating gradually became history.

Everyone loved this new form of heating because it afforded a dramatic improvement in comfort and system performance especially since boilers were coal-fired and a constant Btuh draw on the boiler was important to prevent boiler overheating and pressure blow offs. A coal boiler could not be turned on and off like modern oil and gas fired units.

The next improvement in the hydronic heating evolution was the invention of circulators and power oil and gas burners, which eliminated the need for massive heat distribution piping diameters and constant boiler draw. Many of these old gravity piping systems are still in operation today. Most have been converted to forced circulation over the years by simply adding circulators. A lot of problems, however, arose with these forced circulation conversions.

Typically, the customer would call in a heating consultant to discuss the conversion of his old gravity system, which has an old high mass oil/gas converted coal boiler sitting in the basement with a single round thermostat upstairs firing the burner intermittently upon demand.

The customer likes the performance of his system, especially the evenness of heating and associated comfortable feeling - the radiators are always gently warm, giving him radiant comfort. He would, however, like to get better zone control and set back capabilities. He wants to "update" his system to forced circulation and to install a low water content boiler to improve controllability and efficiency.

The heating contractor moves in, guts the boiler room and looks at that big - 2" to 6", depending on the structure - supply and return steel piping. He now uses all his modern hydronic know how and basic rules to attach a high tech appliance to an outdated heat distribution system.

The two huge pipe openings are bushed down to modern, small diameter copper tubing and piped into a low water content boiler with a circulator in between. For zoneability he might use non-electric zone valves at the radiators or separate some risers in the basement and add additional circulators or zone valves. The boiler room now meets the standards of modern hydronics.

After going through the first heating season, however, problems seem to surface.

The customer's first reaction is that the heat used to be a lot more even and efficient. On the mechanical side, the boiler is having problems; condensation and thermal shock are threatening its life and performance.

What happened?

As far as the comfort issue is concerned, it's explained simply. We took away his old, natural constant circulation systems and gave him an on/off intermittent system. We traded highway cruise control for stop-and-go city driving.

We're dealing with a high mass system with huge amounts of steel piping and large water content, which generates a tremendous flywheel effect similar to a high mass radiant floor system. The result is huge room temperature swings when the system is controlled with intermittent circulation.

The boiler condensation is caused by on/off circulation of large amounts of cool radiation water, temperature-draining the low mass boiler, which constantly is trying to catch up, repeating this cycle thousands of times per heating season. The end result is flue gas condensation, boiler corrosion, and caking and sooting of flue passages.

What are the remedies?

The first rule is to maintain constant circulation: Use a four-way mixing valve between the boiler or boilers and the heat distribution system. This tempers both the flow and return water temperatures, creating a slow, steady draw on the boiler while protecting the boiler from thermal shock of cold return water.

Install an outdoor reset control to operate the mixing valve and circulator. The pump must run from the first day to the last day of the heating season. Use a boiler with a decent water content of at least four to five gallons in a residential system. Use a buffer tank with an instantaneous type boiler or else the mixing valve won't work. When the volume of water is too low, the mixing valve will hunt and never stabilize.

Constant circulation will give your customer his comfort and efficiency back. The four-way valve will protect your boiler from thermal shock and condensation. Other methods of primary/secondary pumping and boiler by-pass piping achieve similar results. The four-way valve method, however, gives us the most precise control over system supply and boiler return temperatures, providing the proper reset control strategy is used, simply because it's a modulating and not an on/off control.

As you can see, these old gravity systems can be updated from the boiler room. Use the large water content distribution system to your advantage. When confronted with such a conversion, remember that the system was designed for constant circulation. By installing an outdoor reset control and a four-way mixing valve properly, constant circulation can be maintained, and a comfortable, reliable and efficient system radiant heating system can be achieved.

The author is president of Stadler Corp. (tel. 781/275-3122), a Bedford, Mass.-based supplier of hydronic heating equipment