CONTRACTOR
THE NEWSMAGAZINE OF MECHANICAL CONTRACTING
Reprint from June 1996

Constant circulation improves hydronic systems' efficiency

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OVER THE YEARS I've been involved in many hydronic heating system projects which have been greatly improved by converting them to constant circulation. In all cases, by installing a three- or four-way mixing valve and the proper controls, heating comfort levels have been improved with the added benefit of, on average, a 25% reduction in fuel consumption.

Constant circulation was used as a basis for the first hydronic heating systems in the United States: gravity fed hydronic systems. Gravity systems used large diameter piping and gradually circulated low temperature water to achieve a stable room temperature. The results were comfortable and constant room temperatures with minimal temperature fluctuations.

Frequently these homes were upgraded with new boilers, circulators and thermostats controlling intermittent circulation. The results of many of these upgrades left the homeowners feeling that their systems were not as comfortable as they had been. The on-again, off-again temperature fluctuation inherent in an intermittent system removed the even heating effect of the gravity system. Constant circulation may be a solution to many such problems and complaints you are encountering in the field.

Over the years, our company, in conjunction with many mechanical contractors, has converted hundreds of residential and commercial systems to constant circulation. Everything from nursing homes, apartment buildings, single family homes and office buildings. Besides a 100% improvement in comfort, we have experienced 15% to 35% fuel reductions.

Air elimination becomes a non-issue, because there is a gradual change in system water volume. The water body does not go through thousands of temperature fluctuation cycles, which cause excessive water expansion and contraction, which, in turn, causes small system vacuum conditions, especially if the expansion tank is not properly maintained (who maintains expansion tanks, anyway?). Air is steadily sucked in and accumulates, becoming a chronic problem. In one case an apartment building owner had to employ a full time maintenance person to bleed the radiators all day long. This problem was eliminated after the system was converted to constant circulation.

In another project, a newly constructed condominium had a heating system made of copper tubing which, during the heating season, had such horrific expansion and contraction noises that the tenants were threatened to move out. By installing a mixing valve coupled with an electronic outdoor reset control, constant circulation was achieved and the problem was solved.

The magnificent state-owned Rose Cliff Mansion in Newport, R.I., has a 3,000 sq.ft. ballroom which is only occasionally used for functions, mainly wedding receptions. A T87 thermostat was installed in the ballroom which turned a huge circulator on and off intermittently. Even the 5,000 pound chandelier didn't like the temperature fluctuations and fell off the ceiling once, luckily without killing anyone.

The system, built at the turn of the century, holds 1,200 gallons of water with boiler return lines resembling 6-inch cast iron sewer piping. It was converted to forced circulation fed by a huge coal boiler that had been converted to oil. This beast was replaced with three modern modular boilers which disappeared in a wonderfully large boiler room. The only system control was the T87 Round located in the ballroom that controlled one circulator.

After the first heating season the boilers were completely corroded. The system was never able to maintain temperature. The boilers were continuously temperature-drained every time the pump came on, dumping 1,200 gallons of ice cold water back to a boiler bank that continuously tried to play catch up. The boilers' heat exchangers gradually

plugged up due to internal boiler condensation.

Constant circulation once again solved the problem. A four-way mixing valve was cut into the supply and return lines and controlled via an outdoor reset control that monitors outdoor, ballroom, supply water, return water, and boiler temperature. A heating optimization feature in the control logic even allows marginal temperature set-back during non-occupied periods, taking outdoor conditions and boiler output capacities into consideration.

The boilers never get into trouble or have to catch up. The 4-way valve with a boiler return sensor gives 100% boiler condensation protection. Comfort within the building is superb within +/-0.5°F. The high mass system's flywheel effect was eliminated and the fuel efficiency went through the roof - all by simply cutting in a mixing valve and installing an outdoor reset control.

Are there any disadvantages to constant circulation? The only one that I have encountered in 20 years is potential heat recovery problems after set back.

A constant circulation system only offers the Btus needed to the building at any given moment during the heating season by modulating the water temperature to the Nth degree. If you put the building into a night or weekend set back and the system goes into instantaneous heat loss operation, it has a hard time recovering 6°F or 8°F because the control is designed to offer just enough Btuh to the building to maintain temperature but not recover.

A good electronic reset control can compensate for this shortfall by putting the system into a short boost cycle period. It can ignore outdoor and water temperature temporarily until the building temperature approaches set point, at which time the control goes back into outdoor modulation.

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