The Continuous Circulation Concept In Hydronic Heating

- By J.R. Fiedrich, originally published 1981 -

Flow temperature modulation, a standard feature of European hydronic heating system for many years, smoothes out the highs and lows of the heating curve caused by on-off circulation, saving fuel and offering a high level of heating comfort.

Boiler temperature modulation in response to outside temperature change is a first step towards the continuous circulation concept; but a true continuous circulation system cannot be obtained without the use of a three way or four way mixing valve. Depending on the application. A three way or four way valve, with rotary or plug and seat design, sized from _ to 8 is available in threaded, flanged, weld neck or sweat adapter connections.

A typical four way mixing valve installed in an existing intermittently working system will divide the circulation loop into a radiation loop and a boiler loop. (See diagram) In the fully closed position, the valve will separate the two loops completely. In the fully open position, the valve will have no effect on the circulation loop at all. It is when the valve is in any intermediate position that the mixing action takes place. The valve will mix boiler flow and radiation return water, modulating the temperature of the water flowing through the radiation loop either up or down depending upon the heating demand and outside temperatures.

Mixing valves can be adjusted manually or automatically. Manual adjustment requires a walk into the boiler room every time Mother Nature decides to change the outside temperature. This can be annoying to the owner and full benefit of the valve can never be achieved by manual operation.

A weather responsive control system is recommended. Over the years, many types and variations of weather responsive controls have evolved. They determine the precise flow temperature for a given building along an adjusted heating curve which is the relationship between a certain outside temperature and the necessary corresponding flow temperature. The heating curve will vary, depending on the amount of radiation in the building. Therefore, an initial heating curve adjustment must be made on the control at the time of installation.

These proportional controllers modulate the mixing valve through a motor drive by sensing the outside temperature and the flow temperature of the radiation loop. Most controllers can be set for temperature setback periods, as well as burner and pump switching. More complex, commercial versions have built in functions, which take wind chill, solar gain and residual heat factors into consideration. An additional feature of the more sophisticated controller is heating optimization. This logic module calculates, by monitoring the outside temperatures and inside temperatures of the building the latest possible moment to bring the heating system s temperature back to the required level before the building is occupied. This keeps Delta-T at the smallest possible value during periods when the building is not occupied, saving additional fuel.

Elimination of boiler over-firing and draining of boiler temperature during circulator start up is eliminated. This allows higher combustion efficiencies. Can the mixing valve concept be integrated into an existing standard American forced hot water heating system? It s an ideal marriage.

All existing thermostats, operating zone valves or circulators will become high limit controls taking solar gain and foreign heat sources (body heat, fireplaces, stoves, appliance heat, etc.) into consideration, thus eliminating possible temperature override in certain sections of the building. Therefore, none of the existing controls should be removed. It is strictly a matter of adding a mixing valve, controller and sensors to the system.

These systems offer the ability to fine tune a hydronic system to within a fraction of a degree in room temperature, maintain boiler temperature for sufficient domestic hot water supply if desired. Other advantages:

Elimination of thermal shock caused by surges of cold return water to the boiler (with the use of a 4 way valve)The return water is pre-tempered by the mixing valve. This increases the life expectancy of the boiler.

Elimination of the uncomfortable dust-smoldering effect on the fin tube convectors and the radiators, due to lower flow temperatures.

Peak Performance of thermostatic radiator valves, installed in the system is obtained since the optimum flow temperature for any of these valves lies within the median range of 90 to 140 degrees Fahrenheit.

Elimination of circulator startups prolongs the life of the motor, while decreasing electricity consumption.

KEY QUESTION: Cost and Payback?

The necessary hardware for a residential application ranges from 800 to 1,000 dollars, including mixing valve, controller, mixing valve motor, flow and outside sensors, manual valve adjuster. Commercial applications have mixing valves that can tie into building automation systems. Most systems are available in either 120V or 24V.

A mixing valve system can realistically save 16 percent to 30 percent of the present fuel cost of a building, depending upon the existing system and the use of temperature setbacks.