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Big radiation is 'hot' but not hot, at least not in Europe

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BIG RADIATION IS hot in Europe. That is, heat emission surfaces. Radiant floor heat is about as big a distribution system as one can get, but even radiators are larger over there.

We've discussed continuous circulation hydronic systems with outdoor reset on these pages (July 1992, p. 36; Jan. 1993, p. 19). Now that we can get boiler and loop temperatures to match the load exactly, we need better distribution system than small-surface fin tube, which relies more on convection than radiation.

The larger the heat emission surfaces, the lower the heating medium temperature. This produces a high percentage radiant heat output and less convection – and less air movement. So, the lower the radiation surface temperature, the greater the heating comfort.

A floor-heated space allows a reduction of 3°F-4°F in ambient temperature without any loss of heating comfort. In addition, floor heating eliminates heat stratification near the ceiling, thus reducing heat loss through the roof. Floor heat provides an almost ideal vertical heat distribution curve.

By actually heating the objects in the room, a number of heat sinks are created in the space, and they, too, gently radiate warmth.

Large surface panel-type radiators with water at 80°F-160°F emit approximately 60% convection and 40% radiant heat, depending on load conditions.

(In Europe there are floor heating systems for special applications where water temperature nearly approaches room temperature under design conditions; they're too costly for conventional use.)

'Temperatures at the ceiling are actually lower than those at head level'

A low water temperature heating system controlled by constant circulation and a weather responsive outdoor reset control is not only more comfortable but more efficient.

It's generally accepted that for every degree Fahrenheit a building's temperature setpoint is lowered, a 3% fuel savings can be expected. For every 3°F reduction of a building's seasonal mean supply water temperature, a 1% fuel savings can be expected. This is an empirically derived figure that's been confirmed in actual use.

One reason is that constant circulation tends to smooth out any temperature fluctuations in water temperatures, eliminating overshooting of the desired setpoint and maintaining an almost straight line temperature curve.

Furthermore, in-transit losses between the boiler and the radiation hardware are greatly reduced, eliminating overheating of spaces housing supply and return lines.

Note, too, that radiant distribution results in less stratification than does convective distribution. Less heat loss, too since the DT between the heated space and the outdoor is reduced.

This is dramatically evident in large volume, high-ceilinged modern homes (cathedral ceilings), factories and warehouses. Temperatures measured at ceiling level are actually lower than at head level. Enormous reductions in fuel consumption can be realized.

Continuous circulation and low water temperature systems also allow the boiler to be downsized. A continuous and steady Btuh draw on the boiler eliminates the need for reserves since on-off cycles of the circulator, which intermittently "temperature drain" the boiler, do not occur.

In floor heating systems the high-mass floor becomes an extended Btu storage sink to the boiler and the boiler becomes a miniaturized Btu-injection device to the floor. Boilers can be downsized 30% or more.

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