Detailed Technical Description of Advantages of Radiant Heat

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Advantages of radiant heat by Richard D. Watson

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Studies conducted by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) indicate that with radiant heating systems **people can be comfortable at temperatures 6°F to 8°F lower** than with convective systems. Forced-air and baseboard (whether electric or hot-water) heating systems are convective systems because they use air as the primary heat-transfer medium.

Typically, heating outlets or baseboards are placed on outside walls, and the system is designed to fill the area with warm air until the preset temperature on the thermostat is reached. The warm air rises to the ceiling until it cools, falling to the floor for return to the furnace or to fill the convective vacuum created by a baseboard heater. Air stratification and heat loss to the ceiling are significant with convective heat.

Air is transparent to the transfer of radiant energy, which occurs directly from warmer to cooler objects. With radiant ceiling heat, the temperature varies only about 2°F to 4°F between the ceiling and the floor, with the floor being about 2°F warmer than the air. And radiant floor heating results in reverse stratification.

Humidification is unnecessary with a radiant system because radiant heat does not alter residential air moisture content, which is generally adequate if the air isn't dried out by combustion or by increased infiltration of cold, dry outside air.

Glass, particularly low-e glass, reflects long-wave radiance produced by residential radiant systems. This greenhouse effect serves to contain radiant energy within the heated building cavity, reducing heat loss.

Air-infiltration heat loss is reduced with radiant heat. Air infiltration and exfiltration increase as the difference between inside and outside temperature (ΔT) becomes larger. When superheated air from a furnace or baseboard heater flows against relatively cold exterior walls, the increased temperature differential results in a stack effect that draws cold air into the house through any cracks. With radiant systems, the air is only warmed to the temperature of the thermostat setting (which is usually lower to start with), so **the temperature differential at the outside wall is less, thereby reducing air infiltration**.

When applied to the sizing of a radiant system, **conventional heat-loss analysis often includes a reduction in design temperature from 70°F to 65°F and a 10% to 25% reduction in building air infiltration, exfiltration, stratification and glass heat loss**. The average 65°F radiant comfort temperature with 59°F day/night setback should reduce building heat load by 25% to 35% over convective systems.

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