

# Radiant Floors Create More Comfort, Use Less Energy

Sales of radiant heating equipment jumped by nearly 40 percent from 1991 to 1994, according to the Radiant Panel Association (a trade group of radiant heating manufacturers). This should come as no surprise. Radiant floors have a reputation for being clean, quiet, comfortable and efficient.

The most common radiant technology is the Hydronic Radiant Floor, or HRF. It works like any hydronic heating system, but instead of distributing heat through a convective baseboard or wall-mounted radiator, a pump circulates hot water through tubing in the floor. Tubing can be made of polybutylene, cross-linked polyethylene, or rubber.

HRFs use lower water temperatures than hydronic baseboards. Beneath a tile floor, the water temperature can be as low as 90°F to 105° F, while a baseboard heater requires 160° F to 200° F water. This makes an HRF a good match with a low-temperature heat source like an air- or ground-source heat pump, or even an active solar system.

HRFs can run on such low temperatures because they don't warm up the air mass like a convective system. Instead, they radiate heat directly to the objects and people in a room. Just how much energy this saves depends on how the building is sealed and insulated. In buildings with lower heat loss, the efficiency gains of radiant floors will be lower. HRFs also eliminate duct leakage—a key source of heat loss in many homes. Operating costs for HRFs can be 20 percent to 40 percent lower than forced air systems.

Studies conducted by the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) indicate that radiant heat lets people feel comfortable at air temperatures several degrees lower than those required for convective systems.

Another HRF advantage is versatility. Zoning is fairly easy with hydronic systems, so you can have separate thermostats in each room. Special mixing valves also let you use a single boiler to supply different devices: warm tile floors in the bathroom, and less expensive, finned-tube baseboards in the rest of the house. You can even add a towel warmer to the master bath or a glove drying rack to the entry hall.

The same water that's used for space heating can also be pressed into service for heating domestic hot water by sending it to an indirect water heater tank.

## Variables

As with any product, HRFs come with a list of requirements and cautions. If you've never installed an HRF before, here are some things to consider.

**Underlayment:** Tubing is usually embedded in a concrete slab or a thin layer of gypsum poured over a wood subfloor. Gypsum underlayments must be applied by authorized installers, who may be hard to find in some areas. If so, or if floor heights are a problem, you can also install the tubing beneath the subfloor between the floor joists. In this case, heat is transferred to the floor by aluminum fins.

**Water temperature:** The proper water temperature depends on the way tubing is installed and on the type of floor covering. Tubing under a tile floor will get by with 90°F to 105°F water. Adding a carpet and pad will raise the minimum temperature to 130°F. An underfloor installation with carpet will require up to 160°F. Higher temperature means lower system efficiency.

**Tubing Type:** Nearly every manufacturer now offers a tubing with an oxygen diffusion barrier that prevents oxygen from penetrating the tubing and getting into the water. (Oxygen can be in water but you can't see it.) While this might add 30 percent to the tubing cost, it protects metal parts such as boilers and valves from rust.

## Getting Technical Help

The key to success is getting a qualified heating designer. The heat-loss analysis is different for a radiant floor system than a forced-air system, because you have to calculate temperature cycling in the floor material. If you don't have experience with radiant technology, look for a manufacturer who provides generous technical support. Most manufacturers offer design assistance, and some will even plan the circuit layout for you. They should also be able to give you a list of qualified designers.

## Operative Temperature: A Better Measure of Comfort

Ever feel chilled next to a cold window, even though the air temperature was 70 degrees F? The problem is that air temperature is only half of what makes you comfortable; the other half is the temperature of nearby surfaces.

"Operative temperature" is the average of the air temperature and the temperature of the surrounding surfaces. Warm surfaces nearby can keep you comfortable even when air temperature is lower. That's why a radiant floor can operate at a lower temperature than a forced air system. And, it makes operative temperature a better measure of comfort than air temperature