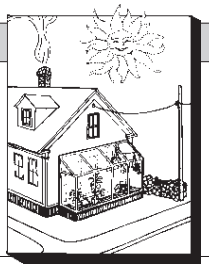
FOCUS ON ENERGY

Radiant Floor Heating Update



by Alex Wilson

Interest in radiant floor heating is rapidly growing. Everywhere I turn, the topic comes up. Companies specializing in this type of heating are seeing dramatic growth. One example is Earth Star Energy Systems, Inc. of Waldoboro, Me., which became a Wirsbo systems distributor 2½ years ago. Earth Star's vice-president Lori Bailey estimates that they've put in over half of their 100-plus systems in the last six months. "We're installing three or four a week now," she said.

Radiant floor heating is attractive for several reasons. First, it is the most comfortable form of heat available. The entire floor surface serves as the radiator, therefore its temperature can be quite low-just above room temperature. Most of the heat delivery will be by radiation, very little by convection. You won't get drafts or temperature stratification and your feet stay warm!

Radiant floor heating can also save energy. Because there is no temperature stratification, you are comfortable at a lower air temperature. The thermostat setting can be kept lower and save energy.

Radiant floor heating offers many design advantages. There are no hot air registers, ducts, radiators or exposed pipes. Furniture placement is not restricted in any way. The heating system is also quiet and clean.

As homeowners learn about these advantages, they're asking for radiant floor heating, a trend which will only continue. This article takes a look at hydronic (warm water) radiant floor heating systems.

The Basics

There are four options with hydronic radiant floor heating, depending on how the tubing is integrated into the floor system: Tubes can be embedded in a standard concrete slab; they can be embedded into a thin Gyp-Crete slab; they can be installed under a subfloor between the joists; or they can be installed on top of the subfloor with sleepers and a finish floor installed above.

Concrete-slab radiant heating systems are the least expensive, assuming the slab is to be poured anyway. Plastic tubing is attached to the reinforcing mesh in the prescribed pattern (to provide even heat to the slab), and the concrete slab poured over it. The various controls and regulating equipment are kept outside the slab, providing easy access for the plumber or heating contractor.

Though high-mass flooring materials like tile are better from a heat-transfer standpoint, they are not required. The slab can be finished in any way, with tile, vinyl, slate, wood flooring or carpeting. Installing wood over a radiant slab is becoming increasingly common. The National Oak Flooring Manufacturer's Association (P.O. Box 3009, Memphis, TN 38173) offers special guidelines for oak flooring installations over radiant slabs.

When a concrete slab is not planned, the best option is to embed tubing in lightweight concrete such as Gyp-Crete. Gyp-Crete can be installed directly over a subfloor, though it adds 15 pounds per square foot dead load, so additional reinforcement or heavier joists may be necessary. The company recommends a good sturdy base such as ¾-inch T&G plywood or OSB.

Polybutylene tubing is the most widely used. However, because it is somewhat permeable to oxygen, some boiler manufacturers will not provide standard warranty coverage if their product is used with a polybutylene radiant floor.

Radiant floor heating systems can also be installed without a poured slab. The most common technique is to attach the tubing to the underside of the subfloor, between joists and then insulate under the joists, though some installers insulate the joist cavity with fiberglass. William Johansen, President of Solartechnic Contractors, Inc., of East Corinth, Maine recommends installing foil-faced rigid insulation to the underside of the joists, providing an air-space next to the tubing.

With the Infloor system sold by Solartechnic Contractors, tubing is stapled to the underside of the subflooring. Wirsbo, a Swedish system, provides special aluminum fins to increase heat transfer from the tubing to the wood.

An alternative recommended by some companies, is to install the tubing on top of the subfloor, then lay down sleepers to which the finish flooring is attached. Wirsbo shows several variations of this technique, but, in general it seems to be losing favor. According to Johansen, it is too labor-intensive. With some floor systems, such as an existing concrete slab, this will be the only feasible option.

Which Type of Tubing?

The biggest controversy with radiant floor heating is the type of tubing to use: polybutylene or cross-linked polyethylene. (Copper tubing caused so many problems that the whole idea of radiant floor heating disappeared for a while!)

Polybutylene is the most widely used now, having been very successful for many years without significant problems. Vanguard, a leading manufacturer of polybutylene tubing, recently *increased* its limited warranty on the product to 25 years (when installed as part of the InFloor system).

However, polybutylene, like many plastics, is somewhat permeable to oxygen (see "The Oxygen-Diffusion Debate," by Paul Hanke, *NEB* 3/86). Oxygen diffuses through it, dissolves in the circulating fluid, and eventually corrodes the boiler system. Because of this, some boiler manufacturers will not provide standard warranty coverage if their product is used with a polybutylene radiant floor system.

The alternative is high-quality, cross-linked polyethylene tubing with oxygen diffusion barrier. This is produced by various European manufacturers, including Wirsbo of Sweden and Hewing of Germany. Earth Star Energy Systems, which distributes Wirsbo products in Vermont, New Hampshire and Maine, is extremely satisfied. They have encountered no problems in over 100 systems installed.

Matthew Friedlander, President of Thermal Options, Inc. of Brattleboro, Vt., agrees that cross-linked polyethylene with oxygen diffusion barriers are excellent products. But, he cautions, they are four times as expensive as polybutylene tubing, and can double the total system cost.

Friedlander, whose company is a leader in the industry offers either type of tubing. He also suggests several other ways to prevent corrosion problems at a much lower cost. Spirex manufactures a "micro bubble resorber," which effectively removes most of the oxygen and other gases from the system. Various circulating fluid additives can effectively limit the intrusion of oxygen into the circulating fluid. Good quality boiler antifreeze, which should be added to the circulating water, also helps reduce oxygen buildup.

Friedlander believes both types of tubing have their place: "We feel that decision is often best left to the builder or heating contractor. For some people, knowing they have the best tubing available is worth the extra cost; with other projects and budgets, polybutylene is perfectly appropriate."

System Options and Cost

The two biggest players in the radiant floor heating industry are Infloor Heating Systems and the Wirsbo Company. Both offer complete systems, including tubing, manifolds, controls and connections, along with system design services. InFloor Heating Systems is owned by the Gyp-Crete Corporation, of Hamel, Minnesota, so most InFloor dealers are Gyp-Crete installers as well.

Solartechnic Contractors, Inc., picked up the InFloor dealership a year ago and has put in fifty systems to date (90,000 sq. ft.). Owner William Johansen is very satisfied with the company's support (both technical and marketing), equipment quality and cost. While his company is a licensed Gyp-Crete installer, a quarter of their installations are under wood floors.

Wirsbo is a Swedish company, with distributors and dealers throughout the U.S. While more expensive than the InFloor system, many consider the components to be of higher quality—including the tubing, zone controls and manifolds with balancing valves. Lori Bailey of Earth Star Energy Systems, offered a rough cost estimate for a Wirsbo System of $1.50 per square foot in a concrete or Gyp-Crete slab (cost does not include boiler or cost of slab). The cost would be $2.50 to $3.00 per sq. ft. for a wood floor application, including the heat transfer fins. These costs, she stressed, are highly dependent on the size of the house. For small slabs, the square foot cost will be considerably more; for large commercial buildings, unit costs will probably be lower.

Thermal Options, offers either InFloor or custom radiant floor heating systems. This flexibility allows him to respond to a client's needs more precisely. But the customized system approach also requires a lot more in-house expertise in sizing and assembling the systems. Unless the company has been in the business for a while, you are better off sticking with a dealer using one of the major packaged systems.

Radiant floor heating has a lot of advantages, but you will pay for them. It is far more expensive than forced hot air and typically 50 to 60 percent more expensive than standard hot-water baseboard systems according to Friedlander. It is a premium system, and at least until the systems are more widespread, you can expect to pay a premium price. ■

Alex Wilson is a technical writer based in Brattleboro, Vermont who specializes in energy and building issues.