

RADIANT HEAT

Heat does not rise. Heat goes to cold. Hot air rises.

Heat is transmitted / transferred from one point to another by:

- **Conduction:** The transfer of heat between two parts of a stationary system caused by a temperature difference between the parts.
- **Convection:** The transfer of heat by circulation or movement of the heated parts of liquid or gas.
- **Radiant:** The process in which energy is emitted, as particles or waves, by one body and transmitted through an intervening medium or space, then absorbed by another body.

A convection system, like forced-air, relies on blowing warm air into the house. Since air does not maintain heat, the room temperature fluctuates as the system goes on and off.

The concept of radiant heating is to heat cold objects within the room. Objects maintain heat, thereafter warming the air and giving an even and comfortable environment.

A large area of mild surface temperatures, such as a warm floor, is capable of transferring as much heat as a small surface area, such as a radiator, at high surface temperatures.

The even distribution of heat eliminates drafts and gives a pleasant comfort at a lower temperature, making the system more cost-effective.

RADIANT FLOOR SYSTEMS

Commonly used radiant floor heating systems are: **hot water radiant floors** (hydronic systems) and **electric radiant floors** (heating cables, flexible heating films and self-regulating heating elements).

- **Hydronic systems** pump heated water from a boiler through tubing laid in a pattern underneath the floor. The water supplied to the system generally ranges from 85°F (29°C) to 140°F (60°C) and is controlled by thermostats to moderate the floor temperature. A cementitious material or an air gap is required to distribute evenly the heat.
- **Electric cables and flexible heating films** convert electrical power into heat and require a thermal mass or an air gap to spread out the heat. Since the power generated is fixed, temperatures are controlled by on/off thermostats and floor sensors, creating differential temperature changes in the floor.
- **Self-regulating elements** are made of a semi-conductive material, which acts as a sensor; the heat output increases as the temperature decreases and conversely, the heat output decreases as the temperature increases. The self-regulating element comes as a mat and can be placed directly under the floor covering because it cannot overheat.

Refer to the Radiant Panel Association Standard Guidelines for the design and installation of residential radiant panel heating systems and to the ANSI/UL-1693 Standard for Electric Radiant Heating Panels and Heating Panel Sets. Also, follow manufacturer's specifications.

In a "wet" installation, the **hydronic and electric cable systems** are installed in concrete or poured masonry. The cementitious material helps to radiate the heat produced by the heating product by spreading the warmth horizontally, thereby reducing hot and cold spots in the floor. Follow radiant heating standards and manufacturer's instructions for tubing and cable minimum depth specifications (nominal minimum depth is 2 inches (50 mm) below the surface).

Before installing the floor covering, the subfloor must be completely dry. Turn the radiant heating on to a low heat, then raise the supply temperature progressively until it reaches the maximum operating temperature and maintain it until the ambient relative humidity is stabilized.

The **self-regulating elements** can be installed on the slab surface after the concrete is poured and cured.

A "dry" installation involves installing the **hydronic and electric cable systems** under the subfloor between the joists or over the subfloor between two layers of plywood. A 2-inch (50-mm) minimum air gap is required. Reflective insulation should be installed under the heating product to direct the heat upward.

Self-regulating elements can be sandwiched between the insulation and the floor covering. Definitely avoid air gaps. Do not place the heating elements in direct contact with any conductive material, e.g. wire mesh, reflective foil, etc.

APPLICATION EXAMPLES WITH STEP WARMFLOOR

