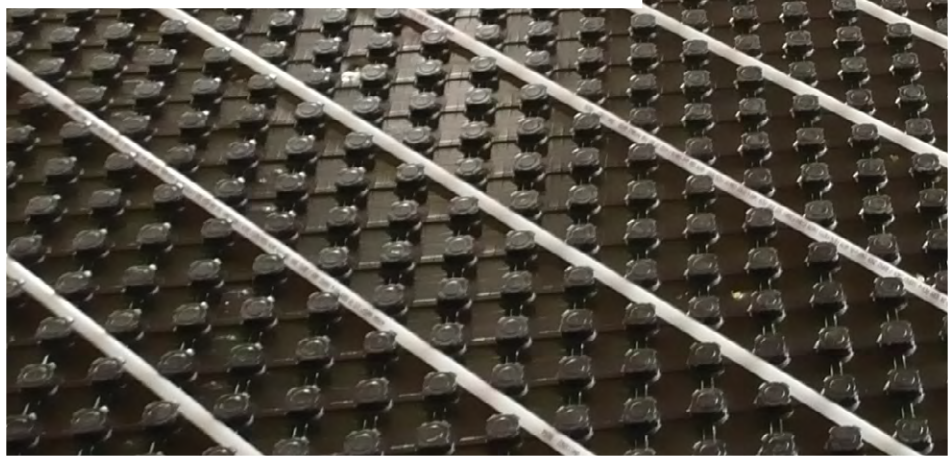
Consumer Guide to Smart and Comfortable Radiant Heating and Cooling

Air temperature is only half the story.

We rely on air temperature and radiant transfer to be comfortable. Unfortunately, most heating and cooling systems only deal with air temperature and leave us at the mercy of unchecked cold surfaces which drain away body heat like a sponge.

What is a "Radiant Panel?"

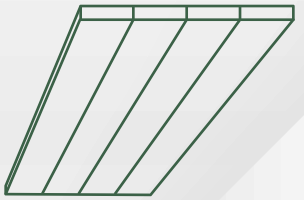
According to Webster's dictionary, the term "panel heating" was coined in 1928 to define, "space heating by means of wall, floor, baseboard, or ceiling panels with embedded electric conductors or hot-air or hot-water pipes." Today, to be a true heating or cooling panel, the surface temperature of the panel must be controllable and not exceed 300°F (Most panels operate under 150°F; floors generally less than 85°F.) It is only a "radiant" panel if 50% or more of the heat transfer is by radiant energy. You may be more familiar with terms like "radiant floor" or "radiant ceiling," or "radiators." These are not to be confused with hot water or electric baseboard heaters, which actually produce only a small percent of radiant energy and primarily heat air.



What exactly is radiant energy?

Hold your hand over a hot cup of coffee and feel the heat. The logical conclusion is that heat rises. Logical maybe, but incorrect! "Hot air" rises, but "heat" can travel in any direction. That is why you can feel the heat of the cup when you place your hand to the side of it. Radiant energy transfer is caused by a warm surface giving up its heat to a cooler surface. Whenever there is a temperature difference between two surfaces, both surfaces will attempt to equalize. Radiant energy travels through space without heating the space itself. It only turns into heat when it contacts a cooler surface. Our human comfort relies just as much on radiant heat transfer as it does on air temperature, yet the majority of heating and air-conditioning professionals think only in terms of air temperature. As a result, Americans are missing out on a truly comfortable living environment in their own homes or places of business. By controlling both the air temperature and the radiant transfer, radiant panel systems deliver a comfort that is unsurpassed.

Radiant Panels Come in Many Shapes and Sizes



1. Attached to the Ceiling
2. Manufactured Wall Panels
3. Attached to the Underside of Subfloor
4. Embedded in Gypsum underlayment, Concrete Slab or Modular Panels

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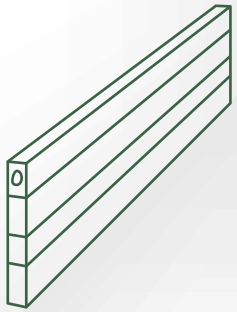

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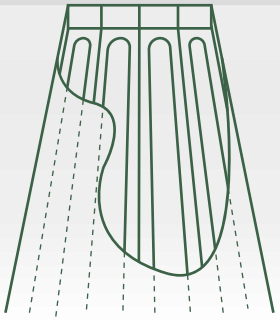

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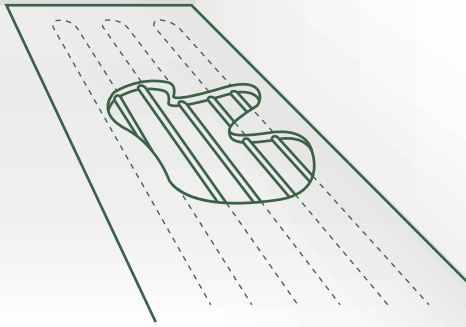

Natural Waves of Warmth
Warmth is carried to living spaces on invisible waves of radiant energy naturally.

Comfort-Comfort-Comfort
No other heating system can come close to the high degree of comfort provided by radiant heating.

More for Less = Smart
The efficient delivery of radiant heat is more comfortable while using less energy.

Clean Breathable Air
No air passes through dusty ducts or dirty fans before reaching the room.

Even Heating
Radiant systems gently warm the air, leaving no hot air to rise and be wasted at ceilings. Objects are warmed, while cold windows and walls are neutralized by the heated surfaces.

Silent Running
The quietest way to deliver heat to your home or business.

Radiant Heating Methods
There are dozens of radiant heating methods using floors, walls and ceilings as the surface.

What Utilities?
Natural gas, propane, oil, wood, electricity, solar, ground source and air source heat pumps. You name it and there is a radiant heating system that can run on it.

WALLS, CELINGS, OR FLOORS

A radiant panel can be effectively mounted on any flat surface. The only requirement is the surface be sufficiently large enough. The larger the surface, the lower the actual surface temperature required. A wall radiator may have a surface temperature of 180°F while an 81°F floor will do the same job.

Radiant energy will heat the surfaces of all objects which are in direct line of sight from the panel; that means all walls, floors, ceilings, chairs, tables, or people which can be "seen" by the radiant panel. Therefore, a heated ceiling will raise the surface temperature of floors and walls, while heated floors will raise the temperature of ceilings and walls. Air coming in contact with these surfaces is also gently heated.

TEMPERATURE & RADIANT ENERGY

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HOW PANELS ARE HEATED

Whether your choice is floor, wall or ceiling panels, they are heated in one of three ways, electrical circuits, water pipes or air ducts embedded in the panel. Of these three, air is seldom used, leaving electric circuits and water pipes (or channels) as the most prevalent. Electric panels have electricity as their sole utility, are quite simple in construction and generally have a lower 'up-front' cost. Water, on the other hand, can be heated by almost any utility be it natural gas, propane, oil, wood, solar, or electricity, and is quite versatile. Your choice will probably hinge on the energy costs of the available utility and the size of the project.

CONTROLLING COMFORT

A simple wall thermostat is generally all that is required. Working in the background may be an "outdoor reset control," which adjusts the panel temperature based on the outdoor temperature for increased comfort and economy. A big advantage is the option of a thermostat in every room. This provides additional comfort as well as energy savings because you can turn down those rooms that are not in use or that you prefer to have cooler. Keep in mind additional features like these also increase the cost just like adding DVD players & navigation systems to the sticker price of an automobile. But unlike automobile options, these comfort features will pay back in energy savings.

PANEL CONSTRUCTION

Panels come factory assembled or constructed on site. They can be surface mounted on floors, walls or ceilings or embedded. Floor panels are usually part of the floor construction. They consist of electric cable or warm water tubes embedded in or attached to the floor. The cable or tubes may be buried in a concrete slab, covered with concrete or gypsum on a wood subfloor, sandwiched between layers of a wood floor or attached beneath the subfloor. Often metal plates which act as fins to disperse the heat within the floor are used in wood floor applications. Radiant panels can be used effectively in combination with other forms of heat distribution including baseboard convectors and forced-air. For example, a home may have a heated concrete floor on the lower level and forced air on the upper level.

THERMAL MASS

You may encounter the terms "high-mass" and "low-mass" when referring to radiant floor systems (not to be confused with high-mass or low-mass boilers). Thermal "mass" refers to the ability of a material to retain heat. For instance, a heated stone will remain warm much longer than a block of wood. This is because the stone is denser, thereby containing more mass.

Radiant systems containing a lot of mass, such as concrete slab heated floors, are called high-mass systems and tend to respond slowly to temperature change. They consist of electric cable or warm water tubes embedded in or

attached to the floor. High-mass systems can be used to store energy and produce a very even heat. Because of the dense material in high-mass systems, they have a capacity to hold and release heat as well as spread heat easily across the surface.

Low-mass systems rely less on the heat storage capacity of the floor materials and more on controlling delivery temperatures. They may use light weight metal plates or metal skins to transfer the heat rapidly across the surface. A thin cement may also be used in some cases. Some under floor systems simply rely on air currents within the joist space and the wood subfloor to spread the heat. Because of the lack of substantial mass, low-mass systems generally respond much faster than high-mass systems, but they lack the ability to store much heat in the mass of the floor itself and must rely on a constant delivery of energy to maintain an even surface temperature. This can be an advantage in installations where quick response is required, just as high-mass can have an advantage where response time is less of an issue and construction requires massive floors, like slab-on-grade homes, shops and commercial buildings.

The key to any radiant panel system is to provide a consistent and even surface temperature. This is done with a blend of thermal mass and controls. Your contractor or system designer will be able to determine which combination of controls and mass is best for your application.

RESPONSE TIME

As a rule, wall and ceiling panels have far less mass than floor panels and therefore respond quickly to changes in the room environment. This is particularly true when recovering from setting back a thermostat at night or when returning from vacation. Floor systems are very stable and maintain a uniform climate because the floor surface remains at a constant temperature.

ENERGY SAVINGS

Increasing your comfort and, at the same time, saving money on your utility bill is a winning combination. Multiple zoning to allow unused rooms to be turned down, and use of thermal mass for off-peak storage can reduce energy bills. Another energy saving feature is lower thermostat settings. When both air temperature and radiant transfer are compensated for, you feel comfortable at room air temperatures which are lower. You no longer have to force yourself to turn down the thermostat to save; you will do it automatically to be comfortable.

Heat loss from any building is driven by the temperature difference between the inside of the structure and the outside. Conventional systems locate registers along outside walls, under windows and in front of sliding glass doors to compensate for all those cold surfaces. That hot air goes up those cold outside walls, across the ceiling and down to the cold air return. In other words, every place

where heat loss occurs. This is a great setup for wasting energy. Radiant panels direct the heat to the interior of the space and reduce or eliminate the excessive temperatures on outside walls and ceilings. This can result in energy savings of 10% to 30% in most residences and up to 60% or more in shops, hangars and warehouses.

COOLING AND AIR-CONDITIONING

Some radiant panel systems are capable of cooling by circulating cool water through the panel. All the principles of radiant transfer still apply. By providing a cool surface, all other surfaces, including our bodies, will give up heat to the panel. Just as in heating, this is extremely pleasant. Radiant panel cooling is most often done with ceiling panels although it can be accomplished using walls or floors. Floors become enjoyably cool, not cold. It is only when humidity is a factor that steps must be taken to avoid condensation on the panel. In this case, an auxiliary air-conditioning system is used to dry the air.

Most often a separate air-conditioning system is installed. This could be a simplified central system or a split system with strategically placed units. The advantage is zoned cooling. Using zoned cooling and placing air registers in the ceiling (where they should be), will result in summer energy savings.

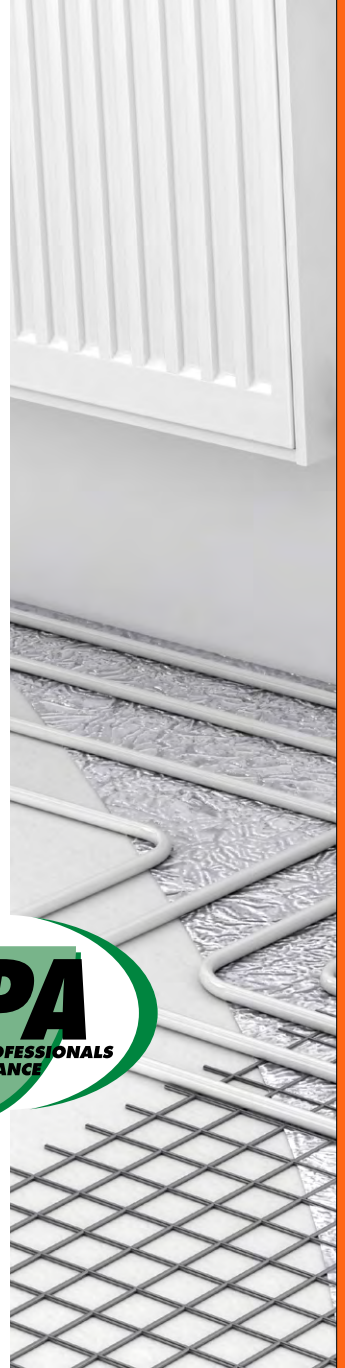
FINDING AN INSTALLER

The hardest part about using radiant heat in your next project may be finding a qualified installer. You may be fortunate enough to live in an area where radiant panel heating and cooling is well known. Visit www.radiantpros.org and check the Radiant Professionals Alliance (RPA) member directory to find someone in your area. Contact a few manufacturers. Have them send you their literature and the name(s) of installers or dealers in your area.

Choose an installer who either has experience or has the proper training. Avoid those who appear to be flying by the seat-of-their pants. The industry has been around long enough that "design as you go" is not acceptable. The installer should have a room-by-room heat loss analysis of your building done as well as a step-by-step system sizing process. Many companies have these on computers and can provide you with a printout, although work done by hand is perfectly acceptable. Guesses and estimates are OK for preliminary work, but nothing replaces good planning. Look for members of the RPA; they have access to current information and educational material. RPA-trained installers have been tested and have demonstrated a high degree of knowledge about radiant technology.

THE CHOICE IS YOURS

You will encounter objections. The construction trade does not like to do anything out of the ordinary. Anyone involved in the building or remodeling process who is not experienced with radiant panels is likely to balk. This is a normal, self-preservation reaction encountered in architects, engineers, builders, plumbers, electricians, mechanical contractors and anyone else who has input into your project that might be affected. By their objection they are really saying, "I don't know enough about radiant panels and therefore do not feel comfortable working with them." Your choices are either find someone else who does know radiant panels or educate the people you are working with. Working with professionals or trades people who are unfamiliar with the systems can result in inflated costs and a potentially poor installation. Have them contact the RPA for assistance.



RPA
RADIANT PROFESSIONALS ALLIANCE

Remember, you are the one that will live or work in the building, not the contractors. It all comes back to your desire for comfort and energy savings. Do your homework, ask a lot of questions, use a reputable installer and you will end up with a level of comfort you may not have thought possible. People who have experienced radiant panel heating, seldom, if ever, return to conventional heating and cooling systems. Make the decision for radiant panel heating and you will not be disappointed.

Radiant Professionals Alliance

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