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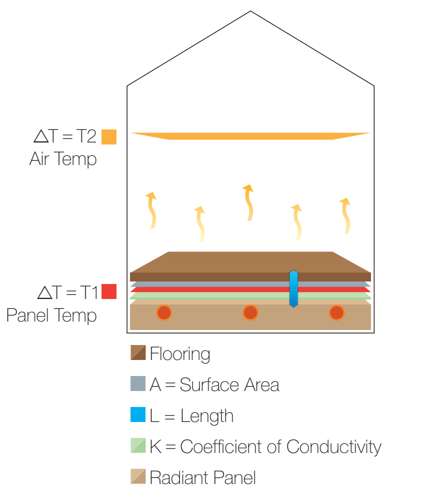
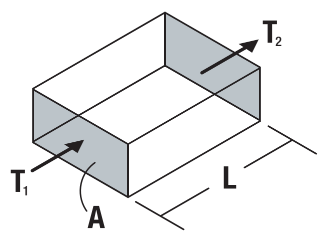
Low water temps save energy

Warmboard offers superior performance with lower energy use.

While we insulate our homes to prevent heat from escaping outside, even in the most well-insulated homes there is loss. The job of a radiant system is to generate heat and transfer it to the interior space. To maximize energy efficiency, walls should be low in conductivity (well insulated) and radiant panels should have a very high level of conductivity.



The rate at which heat flows through a panel is determined by the difference in temperature between the inside of the home and the water temperature in the radiant tubing (called the Delta T [△T]), the cross sectional area (A) or thickness of the conductive panel, the coefficient of conductivity (K) of the panel material, and the distance the heat must travel to reach the midpoint between two tubes (L). There is an equation that predicts heat flow through any material, whether it is a wall or a radiant panel.



Panel type	Material	Thickness	Conductivity (K)	Conductive efficiency
Staple-up	Plywood	0.75"	0.75"	0.105
Thin slab	Gypsum concrete	1.5"	1.5"	1.071
Warmboard	Aluminum	0.025"	0.025"	6.25

By doubling the difference in temperature (△T), between the water in the tubing and the air inside of your home, we can double the heat flow. We can also double the thickness (A) of a radiant panel or double the conductivity (K) of a panel material and we double the heat flow.

$$F = \frac{\Delta TKA}{L}$$

The graph above assumes that we hold tubing spacing (L) and water to air temperature difference (△T) constant. With these values held constant we multiply thickness (A) by the conductivity (K) to find the relative conductive efficiency of common panels used in framed floor construction.

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These bars show the huge difference in heat flow between these panel types. It becomes obvious why thick aluminum is so essential for high performance. Of course for a given home, all panel types need the same heat flow in order to overcome the same heat loss. So in order to ensure that the more efficient panels do not overheat the home, you can lower the water temperature until the heat flow is held constant for all three panels.

This brings us to the second graph. Here we took long accepted lab testing of various panels. We assumed that all panels had a floor covering with a resistance of R-2 (common for carpeting) and that we had a heat loss of 20 BTU h/sf (common for modern construction). The Warmboard and gypsum panels assumed 12" on center tubing but the staple-up assumed 8" because that was the only testing available. Interestingly enough, even with 50% more tubing, the staple was running at the maximum temperature 180°F (82°C) allowed for radiant tubing. Gypsum slabs run a lot lower at about 145°F (63°C) but still above the threshold for condensing boiler optimization. Warmboard runs at a modest 115°F (46°C), which maximizes the efficiency of condensing boilers or water heaters. These low water temperatures open up the possibility of using the most energy efficient new technologies such as geothermal, solar and fuel cell cogeneration.