By Lance MacNevin

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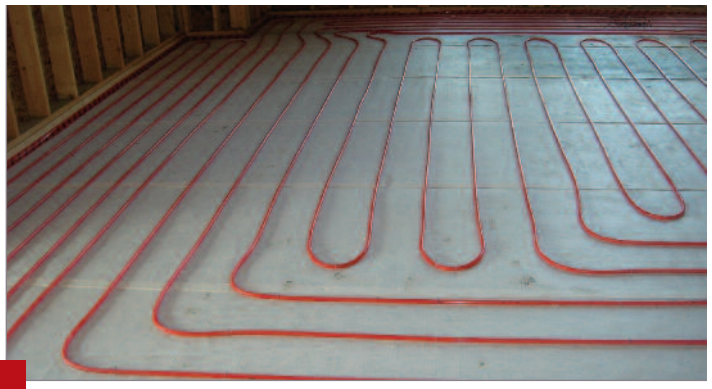
Start at the **beginning**

Radiant designers are often asked to make calculations without prior receipt of the most fundamental information for a job. To ensure a proper design, it is important for designers to be proactive in acquiring information, before calculations are done.



Stay Tuned…

While important to the overall radiant design process, the heat loss, and the other values derived from it, don't allow for much creativity. The real fun actually begins with picking the best piping layout for the job. This is where the impact of such factors as pipe size, pipe spacing and pipe circuit lengths comes into play. Be sure to pick up the March/April 2011 edition of Mechanical Business as Lance discusses these critical elements.

What's being heated?

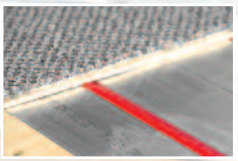
While radiant floors are usually the most efficient and comfortable panel choice for installation of a radiant system, this is not always a viable construction option. Therefore, it is vital to first confirm whether it's the floor, walls, ceilings – or even a combination of these areas – into which the radiant system will be installed.

What installation technique will be used?

Many radiant installation techniques are used today, oftentimes in relation to building requirements and installer capabilities. Perhaps the PEX pipes will be encased in a poured thermal mass. How thick will that thermal mass be? Or, perhaps the pipes will be used with a dry panel system utilizing a highly thermally conductive material such as aluminum. How will that affect the design?

What floor coverings have been specified?

To accommodate the effects of heat on, for example, carpet versus hardwood floors, radiant designers must know what floor coverings have been chosen prior to providing any calculations.



The Math: A.K.A. "The Easy Part"

Like all heating system designs, radiant heating design must always start with calculated heat loss of the space, on a room-by-room basis, according to established procedures. From the overall heat loss of the space, calculate the radiant panel heating requirement – how many BTUHs or Watts of energy are required per unit area of heated panel. Don't forget to watch for obvious but sometimes overlooked obstructions that impede the panel area from contributing heat to the space – for example an island in the middle of a kitchen.

$$\text{Radiant panel heating requirement} = \frac{\text{Total Heat Loss}}{\text{Available Area}}$$

Take, for example, a 100,000 sq. ft. commercial building with a heat loss of 2,000,000 BTUH and 90,000 sq. ft. of floor available for installing radiant pipes. The radiant panel heating requirement is 2,000,000 BTUH divided by 90,000 sq. ft. of floor, or 22.2 BTUH per sq. ft. This is the average required output for the entire heated floor area at design conditions.

The next step is to determine how warm the panel will need to be in order to sufficiently heat the space.

$$\text{Radiant Panel Operating Temperature} = \left(\frac{\text{Radiant Panel Heating Requirement}}{\text{Radiant HTC*}}\right) + \text{Indoor Air Temperture**}$$

Our commercial building had a radiant panel heating requirement of 22.2 BTUH per sq. ft., and the customer wants an indoor air temperature of 68°F (20°C).
To find the radiant panel operating temperature, we take the 22.2 BTUH per sq. ft. and divide by our 2.0 HTC. Adding 68°F for the desired temperature gives us an operating temperature of 79.1°F (26.2°C). This represents the average floor temperature required to heat this building at design conditions.

**Radiant HTC is the heat transfer coefficient, a value for predicting the combined radiant and convective output of a heated panel. For radiant floors, in most situations that value is 2.0.*

***Indoor Air Temperature is the desired air temperature for the space. Most radiant designs use 68°F (20°C) for this value, but this is based on customer needs.*