

# Basic Design Considerations For Perimeter Radiant Panel Systems

## PANEL FUNDAMENTALS

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Radiant panel perimeter heating systems are very compatible to the modern building design. The performance capacity and width of the radiant panel is directly related to the construction of the perimeter wall where the panel will be located. All Sun-el performance ratings are based on a 70° Fahrenheit room air temperature and a 70° Fahrenheit AUST (Average Unheated Surface Temperature). Wall conditions that would lower the (AUST) will actually increase the panel performance. Therefore Sun-el performance ratings are established at a level that are safe to use in nearly all types of perimeter heating applications.

## BASIC DESIGN CONSIDERATIONS

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The design of an extruded radiant panel system should follow with all the usual design considerations for a closed water system. The following criteria are needed to proceed:

1. Establish the indoor design temperature.
2. Estimate the heat loss for the exposure zone or room.
3. Establish the heating water design entering and leaving temperature.
4. Determine the capacity of the radiant panel from the catalog by using the mean water temperature.
5. Calculate the area, width and length of the panel.
6. Calculate the flow rate of the panel.

All the design criteria can be based on the following standard formulas:

### 1. Heat Loss

$$\frac{\text{Total BTU/HR}}{\text{Lineal Foot of Panel}} = \text{BTU/HR Required Per Lineal Foot}$$

### 2. Panel Width

$$\frac{\text{Req. BTU/HR Per Lineal Foot}}{\text{Panel Performance BTU/HR (from catalog)}} = \text{Panel Width in Feet}$$

### 3. Flow Rate in Gallons Per Minute

$$\text{GPM} = \frac{\text{Total BTU/HR}}{500 \times \text{Water Temperature Drop. F}} \times \text{Constant}$$



# RADIANT HEATING (cont.)

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The following design criteria will apply to this building example.  
The building is multi-floor and, this example is based on an intermediate floor.

## Building Criteria

- 80 Foot X 80 Foot Building Dimensions
- 12'0" – Floor to Floor
- Wall U = 0.15 BTU/HR Per SF – Per Degree Fahrenheit
- Glass U = 0.6 BTU/HR Per SF – Per Degree Fahrenheit
- Glass Height 5 Foot Continuous
- Average U = 0.33 BTU/HR SF – Per Degree Fahrenheit
- Outside Design = 0 degrees F Dry Bulb
- Inside Design = 72 Degrees F Dry Bulb

Calculated Heat Loss Per Floor  
320 LF x 12'0" x 0.33 BTU/HR Per SF – Per Degree  
Fahrenheit x 72 degrees F = 91,238  
BTU/HR Total  
Per Floor

## DESIGN EXAMPLE

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Indoor Design temperature = 72 Degrees Fahrenheit  
Supply Water Temperature = 200 Degrees Fahrenheit  
Water Temperature Drop (WTD) = 20 Degrees Fahrenheit  
Mean Water Temperature (MWT) = 190 Degrees Fahrenheit  
Heat Loss Per Floor = 91,238 BTU/HR

### 1. Calculate the Heat Loss Per Lineal Foot of Perimeter Wall

$$\frac{91,238 \text{ BTU/HR Total}}{320 \text{ LF of Wall}} = 285 \text{ BTU/HR Per Lin. Ft. of Wall}$$

### 2. Determine Length of Extruded Panels.

Standard panel lengths are available in 10 foot to 16 foot lengths : Select lengths most compatible to room dimensions or column spacing. (For example : A 20 Ft. center line to center line of column dimension will use two 10 Ft. panels between columns.)

### 3. Calculate the Width of Panel Required.

Sun-el Extruded Panels are available in various surface configurations. Fluted face (ELF), V-Groove(ELV), or Smooth(ELS) face patterns will have the same performance ratings. Select the face pattern desired by the architect or building owner.

The performance curve for Extruded linear series will produce 290 BTU/HR per sq. ft. with a 190 degree MWT.

Therefore, the panel width will be as follows :

$$\frac{285 \text{ BTU/HR Per Lineal Foot Required}}{290 \text{ BTU/HR Per Square Foot Panel Capacity}} = .98 \text{ Foot Wide}$$

Therefore, a 12" wide (2-6" Wide Extrusions) panel will meet requirements for this design.

# RADIANT HEATING (cont.)

## 4. Determine Flow Rate Required

$$\text{GPM} = \frac{\text{Total BTU/HR}}{500 \times \text{WTD}}$$

$$\frac{91,238}{500 \times 20 \text{ degrees F (WTD)}} = \text{Total GPM per floor (9.12 GPM)}$$

Conversion for Exposure.

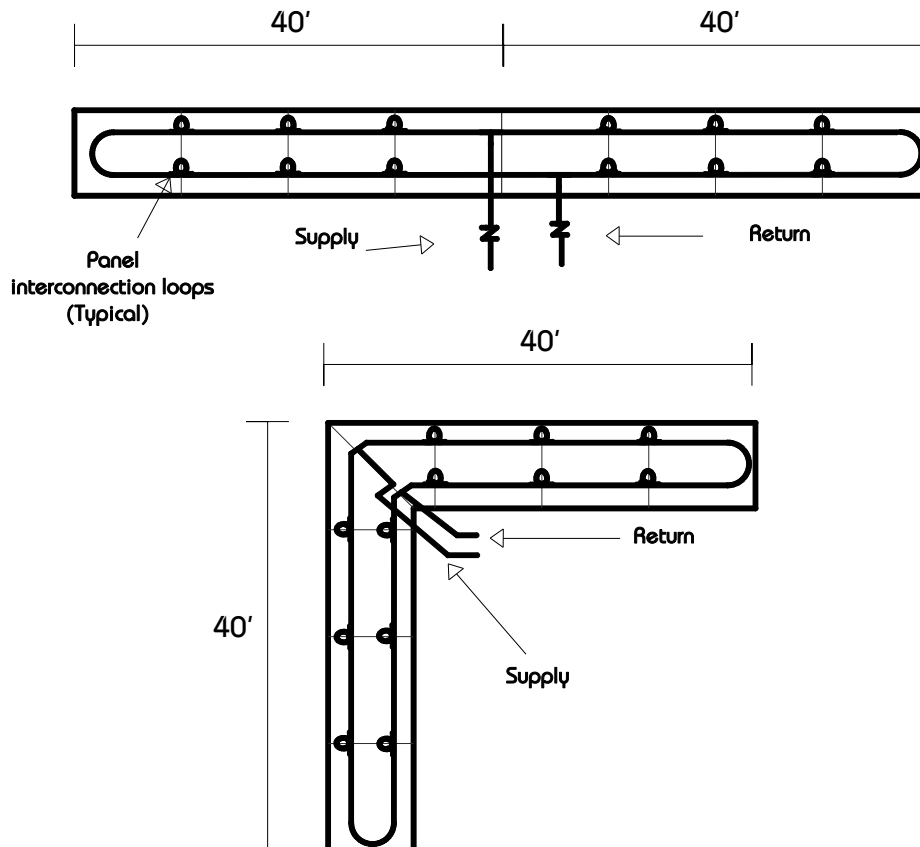
$$\frac{22,810 \text{ BTU/HR Per Zone}}{500 \times 20 \text{ degrees F (WTD)}} = 2.28 \text{ GPM Per Zone}$$

## 5. Establish Piping Design and Water Pressure Drop Per Circuit.

Below we will illustrate two scheme of panel circuit design.

For this example, split an 80 LF exposure using four 10 foot panels in each circuit. Each circuit will have 80 foot of copper tubing with 1.14 GPM per circuit.

Referring to the Sun-el pressure drop curve each circuit will produce a headloss of 1.9 foot.



# RADIANT HEATING (cont.)

Supply Water Temperature = 190 Degrees Fahrenheit  
 Water Temperature Drop (WTD) = 50 Degree Fahrenheit  
 Mean Water Temperature (MWT) = 165 Degrees Fahrenheit  
 Heat Loss Per Floor = 91,238 BTU/HR

At 50 degrees F WTD panel performance = 190 degrees F  $\Delta$ WT; 50 degrees F WTD; 165 degrees F MWT; 200 BTU/HR per square foot.

### Calculate Width Requirement

$\frac{285 \text{ BTU/HR Require Per Lineal Foot}}{200 \text{ BTU/HR Panel Capacity}} = 1.43 \text{ Foot Wide}$

Therefore, an 18" wide panel (3-6" Wide Extrusions) will be nearest width to wall loss requirements.

### Calculate GPM

$\frac{91,238 \text{ Total BTU/HR Per Floor}}{500 \times 50 \text{ degrees F WTD}} = 3.65 \text{ GPM Per Floor}$

.91 GPM Per Zone = 3.6 Foot Head

