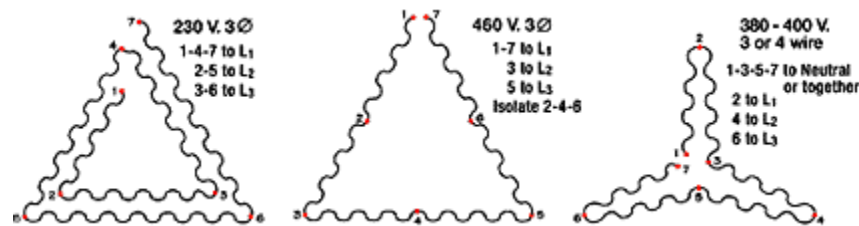


Because Solar Products is a custom manufacturer of heaters, we can design our heater models for all commercially or industrially supplied voltages including 120, 208, 220, 230, 240, 277, 380, 415, 460, 480, 575, and 600. In many cases, our heaters are provided with dual voltage to help reduce heater stocking requirements. Dual voltage heaters accept a derivative of two voltages, usually 120/240 or 240/480. Three voltages can be provided for heaters with a minimum of six heating elements and seven terminals. This wiring arrangement can be configured for three voltages and dual phase.



Phase

Solar Products can manufacture our heaters for single, three, or, in some instances, dual phase.

Frequency

Because fixed resistance heaters operate using any particular frequency without requiring design changes, frequency is not a significant issue.

Fixed Resistance

Our heaters are all fixed resistance. This means that the wattage attained is a direct result of the voltage applied ($W = V^2/R$). In other words, if the voltage varies the heater wattage will vary by a squared relationship of the voltage unless the heater is properly controlled. Proper control makes use of a temperature controller or a power controller that can maintain a constant power output. Solar Products' heaters are designed for hot resistance in order to ensure true power output.

Zoning

The heaters can be separated into multiple zones in one given panel. An example is the use of three 12" x 24" (305 mm x 610 mm) zones in a 12" x 72" (305 mm x 1829 mm) heater or two 6" x 48" (152.4 mm x 1219 mm) zones in a 12" x 48" (309 mm x 1219 mm) heater. This particular heater is divided up in this fashion to accommodate different widths in a web application. Sometimes a heater is divided up into an outer zone and an inner zone. A last option is to apply multiple oddly-shaped zones to match a specific heating profile.

Edge Compensation

Another option that is applied to our infrared heaters is the use of edge compensation. This approach places a slightly higher watt density along one long edge of a heater (ex. a 24" x 36" 610mm x 915mm heater). To help compensate for heat loss along that open edge, a higher watt density is constructed into the heater's design to reduce edge heat loss.

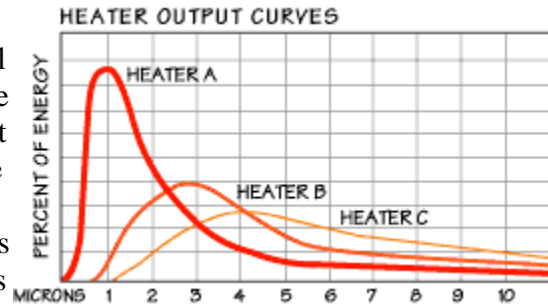
Depth

There is no standard thickness for Solar Products' heaters. The most common depth is 3" (76

mm). Our heaters can be manufactured as thin as 1.250" (32 mm) and as thick as 6" (152 mm). The heater depth is most often determined by available space and/or a required back temperature.

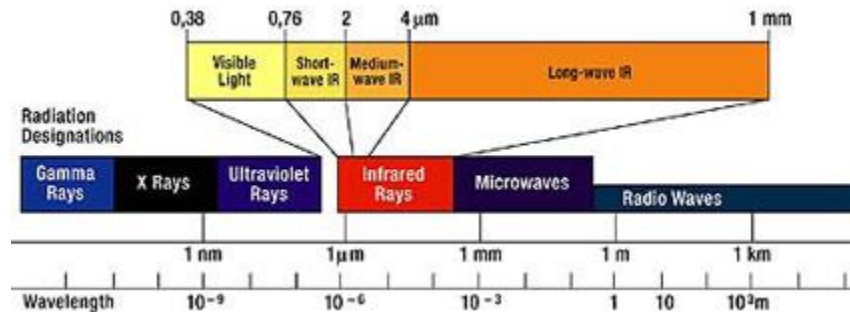
Wavelength

The wavelength output from our heaters ranges from 2.3 microns to 6 microns and is inversely proportional to heater temperature; that is to say, as the temperature increases the wavelength decreases. All heaters output energy over a range of wavelengths as depicted in the heater output curves appearing below. Heater 'A' displays a typical shortwave heater, Heater 'B' displays a typical medium-wave heater, and Heater 'C' displays a typical long-wave heater. All of the curves have one common characteristic. If a line were drawn vertically through the peak of the curve, then the area left of the line represents 25% of the total energy output shorter than the peak wavelength, and the area to the right of the curve represents 75% of the energy at a longer wavelength than the peak.



If a line were drawn vertically through the peak of the curve, then the area left of the line represents 25% of the total energy output shorter than the peak wavelength, and the area to the right of the curve represents 75% of the energy at a longer wavelength than the peak.

Solar Products' panel heaters output the majority of their energy in the medium wavelengths when operating at high watt densities and temperatures. When the temperature is reduced below 900°F (482°C), the majority of the energy falls into the longer wavelengths. The medium wavelength ranges from 2-4 microns, and the long wavelength ranges from 4-1000 microns. The effective process heating range for long wavelength infrared is from 4-6 microns. Six microns relates to a temperature of 500°F (260°C). An infrared heater with a surface temperature below 500°F (260°C) has little use in industrial process heating applications.



Complete Heater Layout

The heater below displays examples of the options that can be customized for our heaters and the typical positioning of heater components. All options, however, will not be used simultaneously on a production heater.



A Snap-in Mounting Nut
B 4"x 4" Electrical Box
C Information Tag
D Compression Nut
E Heater end

F Back Mount Thermowell and Thermocouple
G Bayonet Style Thermowell
H Pyrometer Hole
I Mounting Studs