Flexible Heater Wattage Recommendations

Step 1 Determine the Required Wattage

Every process has a unique wattage requirement to heat that particular load up to temperature or to maintain a particular temperature.

If the required heater wattage is not known, estimate the required wattage using the thermodynamic formulas listed in chapter 16, Engineering. A safety factor of 25% additional wattage is recommended to compensate for unknown variables.

Example

To raise the temperature of an aluminum plate 6" × 12" × 0.5" (3.53 lb.) 200°F (from 70° to 270°F) in 0.5 hours:

$$\text{Watts} = \frac{3.53 \text{ lbs.} \times (0.24 \text{ Btu/lb.°F}) \times 200°\text{F}}{3.412 \text{ btu/watt hr.} \times 0.5 \text{ hrs.}} = 99 \text{ watts}$$

Add safety margin: 99 W + 25% = 124 watts

Step 2 Determine the Heater Size and Watt Density

A flexible heater should use the maximum space available for mounting and heating the process. Factors that affect heater size include the mounting method and watt density.

$$\text{Watt Density} = \frac{\text{Heater Wattage}}{\text{Area of the Heater}}$$

As a general rule, the following can be applied for silicone rubber heaters:

Low Heat-Up: 2.5 w/in²

Average Heat-Up: 5 w/in²

High Heat-Up: 7.5 w/in² and greater

Continuing the aluminum plate example, determine what size the heater should be:

Silicone Rubber Heater: 5" × 10" = 50 in²

Watt Density = 135 watts ÷ 50 in² = 2.7 watts/in²

Since the watt density falls between 2.5 and 5 w/in², the silicone rubber heater selected should work satisfactorily.

Referring to the chart below for a wire wound silicone rubber heater, pressure sensitive adhesive mounting should work well for this application at the required temperature.

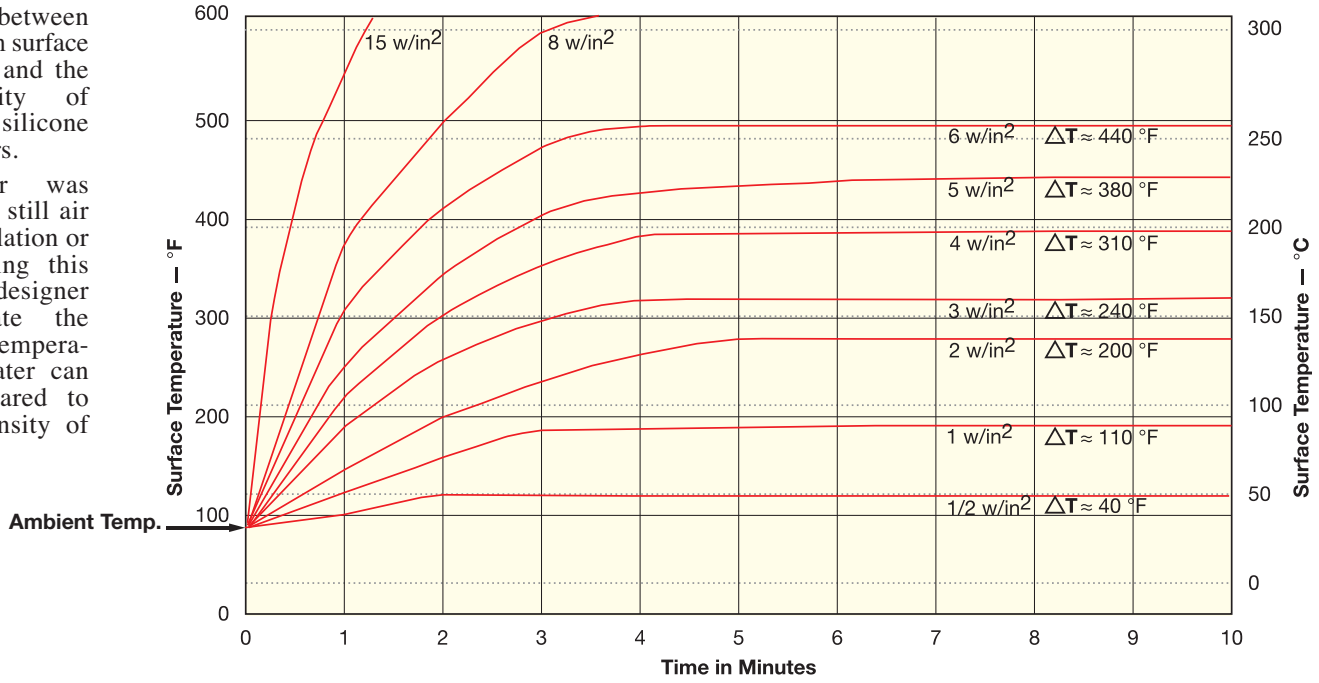
If the calculated watt density is too high, a larger heater will lower the required watt density and still produce the same wattage.

Silicone Rubber Heater Surface Temperature vs. Watt Density

Graph shows the relationship between the maximum surface temperature and the watt density of standard silicone rubber heaters.

The heater was energized in still air without insulation or a load. Using this graph the designer can estimate the maximum temperature the heater can reach compared to the watt density of the heater.

Surface Temperature vs. Time for Various Watt Densities



△T = Temperature Rise From Ambient at Specified Watt Densities

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