



High Watt Density Cartridge Heaters

Obtaining Maximum Heat Transfer and Long Life

Fit

High Watt Density heaters require careful fit to ensure optimum performance and long life. We recommend that installation holes not be drilled and reamed over .002" or larger than the nominal hole size required. The heaters are sized so that they never exceed .005" less than the nominal diameter and always at least .001" under the nominal diameter for a slide fit. Close fits ensure rapid heat transfer from the heater and also help keep the unit as cool as possible., which contributes to long life.

Cycling

Rapid cycling of heaters from very low to very high temperatures shortens their life considerably. It is recommended that care be taken to compute the correct wattage for any given installation. Optimum wattage should result in a 50/50 off/on cycle. For very high temperatures operation (750°F), off/on control might well be replaced by input voltage regulation through variable transformers or silicon rectifiers so that great temperature fluctuations in the heater wire are minimized.

Wattage

Minimum wattage is based on 60 watts per square inch. Units with lower watt densities may be manufactured for special conditions such as high temperature or vibration. Minimum wattage available can be determined using the following formula and the values in the table below.

$$\text{Minimum Watts} = \frac{\text{Voltage Squared}}{\text{Ohms/inch} \times \text{Heated Length}}$$

Table 1: Maximum allowable Ohms per inch by diameter.

Superwatt Diameter	Maximum Ohms per Inch of Heated Length
1/8"	800
1/4"	600
3/8"	800
1/2"	600
5/8"	500
3/4"	600
1"	700

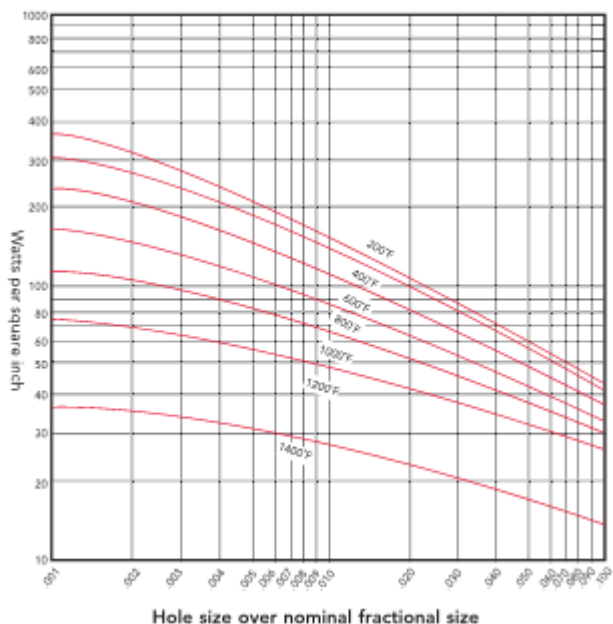
Graph A: The watt densities are based on a unit installed in mild steel. Different materials affect values in the graph. The lower the thermal conductivity of the material, the lower the maximum allowable watts per square inch.

Formula for determination of allowable element wattage:

Element Wattage: 3.142 x diameter x heated length x Maximum watts/ in² from Graph

Formula for determination of watts/ sq. inch:

Graph A: Maximum watts/sq. in. with various increasing temperatures and hole tolerances.



$$\text{Watts/sq. in.} = \frac{\text{Unit Wattage}}{3.142 \times \text{Diameter} \times \text{Heated Length}}$$

Heated Length is 1/2" less than sheath length

Voltage

Standard Voltage is either 120V or 240V. Other wattages available. **Consult OEM Heaters** for details.

Location of Temperature Control Point

When thermostats are used, the sensing element should not be placed further than 1/2" away from the heater wherever possible. Location further away could conceivably cause the unit to run too hot and thereby shorten life.

Termination

All units up to 1" diameter, within published amperage limits, are manufactured with 6" **(type SF1)** leads. 1" diameter units are manufactured with 6" **(type SF2)**. Longer length leads are available. Stock units are supplied with 12" leads.

Tolerances

Wattage tolerance is +5% -10% at rated voltage. Length tolerances are $\pm 2\%$ with a $\pm 1/16"$ minimum. Length tolerances apply to element sheath length.

Camber tolerances for units up to 12" long is .005" per six inch length. For units over 12" long, tolerance is .020" per foot of length. This value varies as the square of the length in feet. (ex: - a 36" unit has a camber tolerance of $.020" \times (3)^2 = 180"$). Normally camber does not present a problem since the unit will flex enough to fit a straight, close fit hole.

How to order

After determining the wattage required and the line voltage available: determine the physical space available for heaters and the number of heater required. You can use our **Cartridge Heater Configurator** for custom pieces, or you can search our **Stock Cartridge Heaters** by size to find the stock heater for your application. Always feel free to call with any questions. Our application engineers will answer your questions. **(866) 685-4443**.

