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Cartridge Heater Specifications & Tolerances

Heater Wattage Determination

The procedures used to establish cartridge wattage are outlined below. Please note that the required equations, as well as typical application examples, are detailed in the catalog section "Application Data".

1 Establish an acceptable heat up time and desired operating temperature.

2 Calculate the total wattage required to meet the application requirements.

3 Determine the cartridge diameter and length most suitable to the dimensions of your application.

4 Establish the quantity of heaters required to maintain temperature uniformity.

5 Calculate heater wattage by dividing total wattage required by heater quantity.

6 Calculate cartridge heater watt density. (See column "Watt Density Calculations".)

7 Select the graph or table appropriate to your application and insure that the calculated watt density of the cartridge does not exceed the recommended maximum watt density. Additional graphs are contained in the catalog section titled "Application Data".

8 If the calculated watt density is found to be excessive, implement a correction method from the list below and repeat the calculation process.

* Increase either the cartridge heater diameter or length, or both.
* Increase the quantity of cartridge heaters used in the application.
* Increase the heat up time allowed to lower the total wattage required.

Watt Density Calculations

The calculation of heater watt density consists of a simple, three step procedure.

1 Determine actual heated length by subtracting all cold lengths from the cartridge overall length. Minimum cold lengths include 1/4" at both disc and lead end with additional cold length required for certain lead and construction options.

2 Calculate heated area.

Cartridge Heated Area = Cartridge Heated Length x Actual Cartridge Diameter x 3.14

3 Calculate Watt Density

Cartridge Watt Density = Total Cartridge Watts ÷ Cartridge Heated Area

Watt Density Recommendations For Heating Solids

Using The Graph To Establish Appropriate Watt Density Based On Cartridge Fit.

Heater to hole fit is critical. Subtract minimum diameter of the heater (actual diameter minus tolerance) from maximum hole diameter to determine fit.

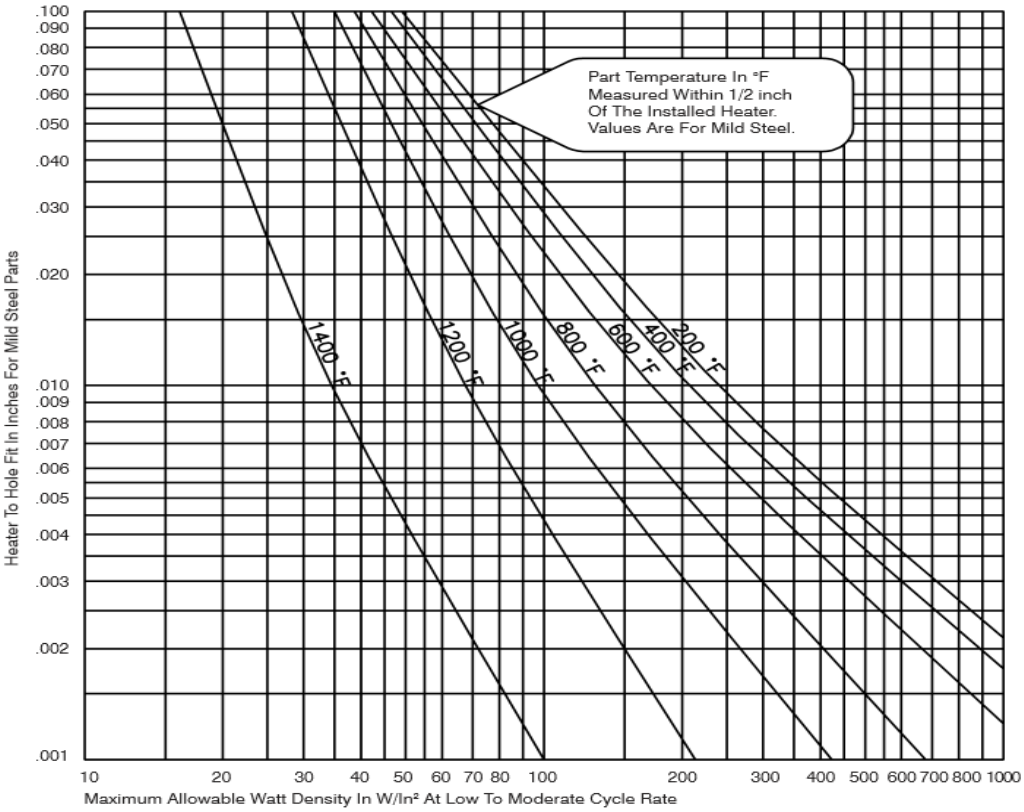
To determine maximum watt density when operating temperature and fit are known:

* Locate the intersection point of operating temperature curve and planned scale fit value. Read recommended watt density on scale directly below this point.

To determine maximum fit value when part temperature and watt density are known:

* Locate the intersection point of operating temperature curve and known watt density scale value. Read maximum fit value on scale directly across from this point.

Adjustment Factors:
* For stainless steel parts enter graph with a .002 greater than actual fit value.
* For brass and aluminum enter graph with 100 °F greater part temperature.
* For on-off cycles more frequent than once an hour multiply maximum recommended watt density by .8.
* For on-off cycles more frequent than once a minute multiply maximum recommended watt density by .7.



ITP, a long-term partner collaborating on lasting solutions!

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Electrical Tolerances

Standard electrical tolerances are shown in the right hand column. High precision tolerances can be held if required. Cartridge heater electrical limits for a standard, two lead construction are listed in the tables shown below. Special units with multiple leads are available in single phase and three phase wiring systems, permitting the use of higher ratings than those shown.

Power (Watts) - 1/8" & 3/16" diameter units +10%, -15%
- All other units +5%, -10%

Resistance (Ohms) - 1/8" & 3/16" diameter units +15%, -10%
- All other units +10%, -5%
- Resistance increases with temperature. All cartridges are designed to a resistance value 5% lower than the calculated resistance.

Dimensional Tolerances

Standard dimensional tolerances are shown in the right hand column. High precision tolerances can be maintained if required. All standard imperial and metric diameters and their related length limits are outlined in the tables shown below. Diameters and lengths not shown can be produced as a specialty item if required.

Diameter - See diameter tolerances in the tables below.

Length - All units < 4 1/2" long +/- 3/32"
- 1/8" & 3/16" dia. units > 4 1/2" long +/- 3% of length
- All other units > 4 1/2" long +/- 2% of length

Camber - .015 inches per foot. Slight camber does not normally present a problem since the heater will flex sufficiently to enter a straight, clean hole.

Imperial Diameter Specifications		
Nominal Dia. (Inches)	Actual Dia. (Inches)	Actual Diameter (Millimeters)
1/8	.122 +/-.002	3.11
3/16	.184 +/-.002	4.67
1/4	.246 +/-.002	6.25
5/16	.308 +/-.002	7.82
3/8	.371 +/-.002	9.42
7/16	.433 +/-.002	11.00
1/2	.496 +/-.002	12.60
9/16	.558 +/-.002	14.15
5/8	.621 +/-.002	15.77
3/4	.746 +/-.002	18.95
7/8	.871 +/-.003	22.12
1	.996 +/-.003	25.30

Metric Diameter Specifications		
Nominal Dia. (Millimeters)	Actual Dia. (Millimeters)	Actual Diameter (Inches)
6	5.90 +/-.05	.232
6.5	6.40 +/-.05	.252
8	7.90 +/-.05	.311
10	9.90 +/-.05	.390
12	11.90 +/-.05	.469
12.5	12.40 +/-.05	.488
15	14.90 +/-.05	.587
16	15.90 +/-.05	.626
20	19.90 +/-.05	.783