Cartridge Heaters/ Pencil Heaters

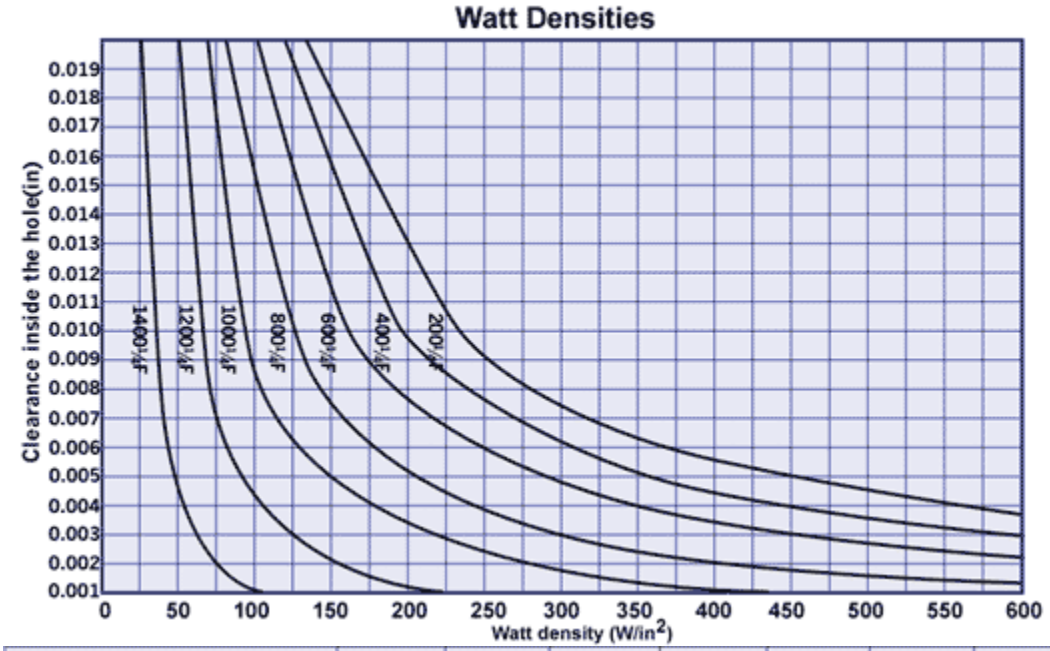
Cartridge Heaters Metric – Description

Metric & Imperial high density cartridge heaters are round tubular heaters with electrical terminations on one side. These dependable heaters are made to withstand tough industrial usage. With a tolerance of +/-0.002" on its outside diameter to secure a tight fit inside receptacle holes, and rock hard compaction of MgO insulation through swaging, these heaters can attain 1500ºF sheath temperature. High density cartridge heaters are available with various termination styles and mounting attachments. In high-density cartridge heaters the resistance wire loops are positioned as close as possible to the outside shell. Because the MgO powder insulation around these loops is compacted by

swaging and transformed into a very hard medium, heat transmission is very efficient. Metric and Imperial cartridges can have up to 200 w/in watt densities.
Cartridge Heaters are usually supplied with lead wires. The attachment of the leads to the central pins is done internally, in a 3/8” cold section. In excessively hot applications the length of this cold section could be increased. To facilitate installation and avoid excessive air pockets, cartridge heaters are made 0.004” less than the nominal size of the receptacle hole with a tolerance of +/- 0.002”. Metric and Imperial cartridges can be dual-voltage, three-phase, and/or be supplied with a ground terminal. With ten different termination styles, mounting attachments and various optional features, Our high density cartridge heaters are widely used in numerous high temperature applications.

Cartridge Heaters -Specifications and Watt Density

Cartridge Heater Specifications



DIAMETRE (NAME)	1/4	5/16	3/8	1 /2	5/8	3/4	1
DIAMETRE (ACTUAL)	0.246	0.310	0.371	0.496	0.621	0.746	0.996
LONGUEUR MAX	36"	36"	72"	96"	96"	96"	96"
VOLTAGE MAX (CSA)	240V	240V	480V	480V	480V	480V	480V
VOLTAGE MAX	250V	250V	600V	600V	600V	600V	600V
WATTAGE MAX AT 240V	1200W	1300W	2000W	3000W	5300W	5300W	5300W
TOLERANCE WATTAGE	+5%						
TOLERANCE DIAMETER	- 10%						
TOLERANCE LENGTH	+/- 0.002"						
TOLERANCE BOMBAGE	+/- 2% OF LENGTH						
	0.010" PER FT UP 12in						

Cartridge Heaters - Termination Styles

A1 Style
High temperature (840 deg F) fiberglass insulated wire is connected externally to the two solid pins exiting from the cartridge. A silicone impregnated fiberglass jacket insulates the connection.

A2 Style
To provide flexibility at the lead end, high temperature (840 deg F) leads are connected to the solid pins inside the cartridge.

A3 Style
A bracket having the same diameter as the cartridge provides a 90 degree exit to the fiberglass insulated high temperature wire. The bracket is potted with high temperature cement (480 deg F).

PT Style
For high temperature applications, screw terminals (#10-32 is standard, other sizes are available) are silver-brazed to the 1” extended solid pins of a cartridge. This type of terminals are not recommended for cartridges having less than ½" diamerter.

TF Style
Internally connected Teflon leads (480 deg F) with Teflon plugs, protect the cartridge from contamination. High temperature black epoxy or silicone RTV seals are available too. A minimum cold section of 1” at the leads end is necessary to protect the Teflon leads from high temperature.

Cartridge Heaters - Optional Features

1) Built-in thermocouples: One optional feature on cartridges is built-in thermocouples. These could be type “J” or “K”, grounded or ungrounded, and attached either at the disc end or middle of the cartridge.

2) Graphite coating: To facilitate their installation and removal, cartridges could be coated with a graphite-like substance. This solid lubricant doesn't increase the outside diameter, and is suitable for temperatures up to 750 degrees F.

3) Moisture and contamination proofing: To protect cartridge heaters against moisture and contamination, Teflon lead wires are used and the lead end is sealed using Epoxy, RTV silicone or Teflon. The temperature limitation is 480 degrees F.

4) Distributed wattage: In applications such as sealing bars or rubber molds, the two ends of a cartridge heater are usually colder than the middle. To overcome this inconsistency and have a uniformly distributed heat source, cartridges could be made to have higher wattages at the ends. 35/30/35 is a common wattage distribution.

5) Center-less grinding: In applications where superior heat transfer is required, the tolerance on the outside diameter could be improved to +/- 0.001" by center-less grinding.

6) Zones and cold sections: We can also manufacture cartridges with cold sections and separate zones that can be controlled independently.

Cartridge Heaters

Operating Temperature vs Actual Temperature of a Cartridge Heater

Cartridge heaters are designed to withstand a sheath temperature of up to 1500ºF. The recommended maximum operating temperatures for different applications are much less than that. There are many factors that have a direct effect on the lag between the actual sheath temperature of a cartridge heater and the monitored temperature of a material during the heat-up cycle. In some cases, this temperature lag is so significant that the cartridge will reach its elevated critical temperature even when the surrounding material is monitored to have a relatively lower temperature level. The most common factors that contribute to the degree of temperature difference are the following:

- **Thermal conductivity of the material being heated**
- **The cartridge sheath watt density**
- **The tightness of the cartridge inside the hole**
- **The location of the monitoring sensor**
- **The allow of the cartridge sheath material**
- **Contamination around the cartridge heater**

These factors should be taken into consideration while selecting a cartridge for a specific application. One common practice is to use stainless steel cartridge sheathes for

temperatures up to 1000ºF and incoloy sheathes for temperatures up to 1400ºF.

Another design consideration related to the operating temperature is the electrical termination of a cartridge. Teflon and TGGT leads have 480ºF rating while MGT wires can withstand up to 840ºF. When cartridges are used at relatively high temperatures, the terminals selected should be either different than the common high temperature lead wires or the design should be done such that the temperature around the lead wires (whether the leads are connected internally or externally to the cartridge) is maintained at a temperature level lower than the critical temperature limit of the lead wire.

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