

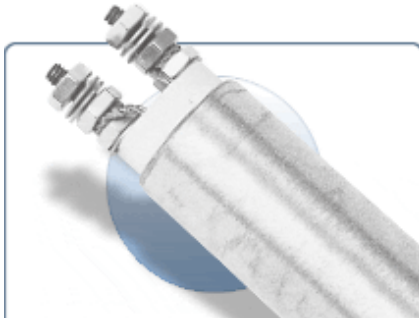
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**OMEGA Engineering Technical Reference**

[Cartridge Heater Home Page](#)

**cartridge heater: kahr-trij hee-ter**

Cartridge Heater: A cartridge heater is a device that is usually tubular and is inserted into drilled holes of metal blocks for heating.



## Heavy Duty Cartridge Heaters

### C-HD Series

- Reliable, Premium Quality
  - CSA Certified
  - For use in applications involving hot plates, molds, dies, platens & container heat
- [More Info »](#)

### Product Links:

#### A sampling of our cartridge heaters:

- 1/4" Diameter Cartridge Heaters
- 1/2" Diameter Cartridge Heaters
- 3/8" Diameter Cartridge Heaters
- 3/4" Diameter Cartridge Heaters
- Heavy Duty Cartridge Heaters
- High Watt Density Construction
- Electric Stud Heaters

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- Introduction To Cartridge Heaters
- Cartridge Options

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## Introduction to Cartridge Heaters

### What is a Cartridge Heater?

A cartridge heater is a device that is usually tubular and is inserted into drilled holes of metal blocks for heating.

### Cartridge Heater Selection

The key questions which need to be answered before selecting a cartridge heater are:

- How much wattage is required?
- What voltage will be used?
- What is the heated length required?
- How long do the heater leads need to be?
- What is the diameter required?
- What is maximum temperature?
- What is the time required to reach your temperature?
- What is the ambient temperature?

### Application Of Cartridge Heaters

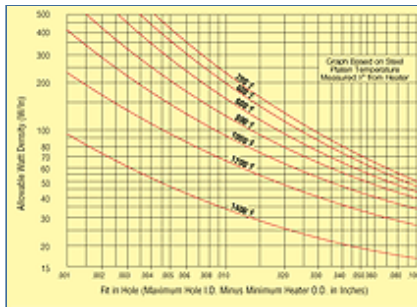
The majority of applications do not require maximum watt/in<sup>2</sup>. Use a watt density only as high as needed. Take advantage of the safety margin provided by using ratings less than the maximum allowed. Select space heaters for most even heat pattern rather than the highest possible wattage per heater.

At medium Watt densities, general purpose drills are usually adequate for drilling holes. Typically, these result in holes .003" to .008" over the nominal size of the drill, resulting in fits of .010" .015". Of course, the tightest fit is desirable from a heat transfer standpoint, but somewhat looser fits aid in installing and removing cartridge heaters, especially long ones. Holes drilled completely through the part are recommended to facilitate removal of the heater. After drilling, clean or degrease the part to remove cutting lubricants.

At high Watt densities holes should be drilled and reamed, rather than just drilled to final diameter with a general purpose drill. At high watt densities, a close fit is important. The



CIR Series Cartridge Heaters with Incoloy Sheath



**Allowable Watt density vs platen temperature for various fits using OMEGALUX® Type CIR cartridge elements.**

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fit is the difference between the minimum diameter of the heater and maximum diameter of the hole. For example, at 1/2" diameter an OMEGALUX cartridge heater is actually .498" plus .000" minus .005". If this heater is placed in a hole which has been drilled and reamed to a diameter of .503" - .493" = .010").

## Temperature Controllers and Sensors for Cartridge Heaters

The sensor for the temperature control is also an important factor and should be placed between the working surface of the part and the heaters. The temperature of the part approximately 1/2" away from the heaters is used in selecting maximum allowable Watt density from the graph.

Control of power is an important consideration in high Watt density applications. On-off control is frequently utilized, but it can cause wide excursions in the temperature of the heater and working parts. Thyristor power controls are valuable in extending the life of high Watt density heaters, since they effectively eliminate on-off cycling.

There are a variety of temperature controllers and sensors one can use depending on the application. One of the more popular sensor types for cartridge heater applications are the surface mount temperature sensors. Thermocouple, RTD or Thermistors are available with an adhesive backing or the ability to be cemented to the surface being heated. There also bolt on and magnetic surface mount type temperature sensors available. Digital temperature controllers come in many different sizes with many output and input choices. Thermocouple and RTD inputs are the most popular with a dc pulse output. DC pulse outputs allow the user to go to a larger relay to switch the heater load and use proportional control versus on/off control which can shorten the heater life.

## Important Formula To Know: Determining Watt Density

The term "Watt density" refers to the heat flow rate or surface loading. It is the number of Watts per square inch of heated surface area. For calculation purposes, stock cartridge heaters have a 1/4" unheated length at each end. Thus, for a 1/2" x 12" heater rated 1000 Watts, the Watt density calculation would be as follows:

$$\text{Watt Density} = W / (\pi \times D \times HL)$$

Where:

W= wattage = 1000 W

$\pi$  = pi (3.14)

D= diameter = 0.5 inch

HL = Heated Length = 11.5 inch

Watt Density =  $1000 / (3.14 \times .5 \times 11.5) = 55 \text{ W/in}$

## Cartridge Heaters



### 1/4" Diameter Cartridge Heaters

OMEGALUX® CIR series high watt density cartridge heaters are manufactured to the highest industry standards using only premium materials. They have been designed to last longer and outperform any other brand cartridge heater in both laboratory and industrial applications. Their heavy duty construction provides high dielectric strength as well as shock and vibration resistance.

### 1/2" Diameter Cartridge Heaters

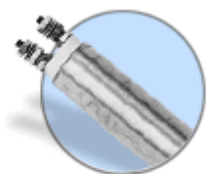
OMEGALUX® CIR series high watt density cartridge heaters are especially well suited for use in applications involving molds, dies, platens, hot plates, and sealing operations.

### 3/8" Diameter Cartridge Heaters

OMEGALUX® CIR series high watt density cartridge heaters are especially well suited for use in applications involving molds, dies, platens, hot plates, and sealing operations. They are available in lengths from 1 to 24".

### 3/4" Diameter Cartridge Heaters

OMEGALUX® CIR series high Watt density cartridge heaters are especially well suited for use in applications involving molds, dies, platens, hot plates, and sealing operations. They are available in lengths from 2 1/4" to 48".



**C-HD Series Heavy-Duty Cartridge Heaters**

### Heavy Duty Cartridge Heaters

OMEGALUX® C Series heavy duty cartridge heaters are especially suited for use in applications involving hot plates, molds, dies, platens and container heating.



**CBH Series Electric Stud Heaters**

### Electric Stud Heaters

CBH Series heaters are constructed of rugged metal sheathed tubular elements homogeneously combined with a metal sleeve that has been accurately dimensioned to provide a proper clearance and ease of inserting into standard drill hole sizes so large bolts or studs may be rapidly expanded and tightened with a wrench, providing "shrink fit tightness" when cool.

Useful in assembly of large compressors, presses, turbines, die blocks, cylinders, engine heads, pressure vessels, etc. Quick heat-up is important to avoid heat drain-away of surrounding metal. CBH heaters are generally used in sets to permit uniform tightening of mating parts.

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