Cartridge Heaters

Superwatt® High Watt Density

U.L. Recongnized - E56973
C.S.A. Certified - LR - 016386-0-000

Applications:

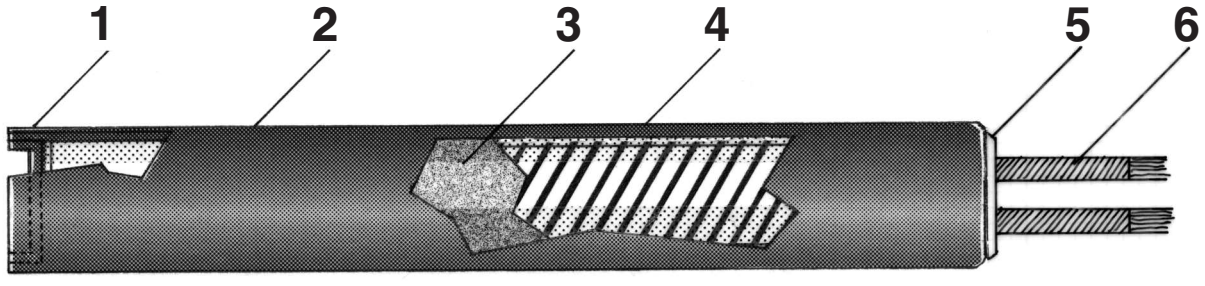
Dies, Heat Sealing, Hot Melt Adhesive, Plastic Molding, Platens, Shoe Machinery.

Features:

- **Elements are designed for maximum:** Watt density, temperature, heat transfer and heater life.
- The useful life of a Cartridge heating element is determined by how quickly the heat generated in the resistance wire can be disappated to the outside sheath. With low and moderate watt density elements, such as Hotwatt's standard line, the conventional method of inserting helical coils in formed ceramics is an entirely satisfactory method of construction because the wire temperature relative to sheath temperature, even though considerably higher, is still well within safe long-life operating temperatures.
- The Superwatt® cartridge heater accelerates the transfer of heat from the resistance wire to the sheath. This is accomplished by relocating the wire so that it is closer to the sheath; and swaging the outside diameter of the heater, thereby compressing the magnesium oxide filler so that it becomes an improved conductor of heat from the wire while maintaining its dielectric properties. (See diagram this page). By improving the heat transfer rate, it is possible to manufacture elements of higher densities because the differential between the wire temperature and the sheath temperature has been minimized.
- Long, trouble free service.
- Made in U.S.A.

Construction:

1. Heliarc welded end seal.
2. Series 300 stainless steel sheath of precision dimensions and tolerances for intimate, stable, non-oxidizing contact with cavities machined for them.
3. Pure magnesium oxide compressed to an optimum density for best heat transfer and electrical insulation at elevated temperatures.
4. Element wire situated in close proximity to outside surface for maximum heat transfer and minimum internal temperature while preserving good dielectric qualities.
5. Ceramic cap.
6. Fiberglass insulated leads.



BACKER HOTWATT

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Diameter: ¼"

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
1"	HS25-1	100	120	250	.02
1¼"	HS25-1.25	100	120	165	.02
1½"	HS25-1.5	70	120	85	.02
1½"	HS25-1.5	100	120	125	.02
1½"	HS25-1.5	120	120	150	.02
2"	HS25-2	100	120	85	.03
2"	HS25-2	150	120	125	.03
2½"	HS25-2.5	135	120	85	.03
2½"	HS25-2.5	185	120	115	.03

Diameter: ¼" (continued)

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
2½"	HS25-2.5	250	120	159	.03
3"	HS25-3	75	120	38	.04
3"	HS25-3	170	120	90	.04
3"	HS25-3	220	120	115	.04
3"	HS25-3	300	120	156	.04
3½"	HS25-3.5	50	120	21	.04
3½"	HS25-3.5	65	120	27	.04
3½"	HS25-3.5	200	120	85	.04

Diameter: ¼" (continued)

Length	Cat.No.	Watts	Volts	Watt Density w/in.²	Approx. Wght. (lbs.)
3½"	HS25-3.5	260	120	110	.04
4"	HS25-4	60	120	21	.04
4"	HS25-4	75	120	27	.04
4"	HS25-4	100	120	27	.04
4"	HS25-4	235	120	85	.04
4"	HS25-4	300	120	110	.04
4"	HS25-4	400	120	150	.04
4½"	HS25-4.5	70	120	21	.05
4½"	HS25-4.5	90	120	27	.05
4½"	HS25-4.5	270	120	85	.05
4½"	HS25-4.5	350	120	110	.05
5"	HS25-5	75	120	21	.06
5"	HS25-5	100	120	28	.06
5"	HS25-5	305	120	85	.06
5"	HS25-5	400	120	115	.06
6"	HS25-6	100	120	23	.06
6"	HS25-6	400	120	94	.06
7"	HS25-7	90	120	18	.12
7"	HS25-7	300	120	69	.12

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Obtaining maximum heat transfer and long life.

Fit

High watt density heaters require careful fit to insure optimum performance and long life. Hotwatt recommends 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. These close fits insure rapid heat transfer from the heater and also help keep the unit as cool as possible, which contributes to long life. See chart A for allowable watt densities at different fit tolerances and operating temperatures.

Cycling

Rapid cycling of heaters from very low to very high temperatures shortens their life considerably. It is recommended therefore, 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 temperature operation (over 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.

Location of temperature control point

When thermostats are used, the sensing element ought not to be placed further than ½" away from the heater wherever possible. Location further away could conceivably cause the unit to run too hot and thereby shorten life.

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 Table 1:

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

Table 1: Maximum allowable Ohms per inch by diameter.

Superwatt Diameter	Maximum Ohms per Inch of Heated Length
⅛"	500
¼"	600
⅜"	800
½"	600
⅝"	500
¾"	400
1"	300

Voltage

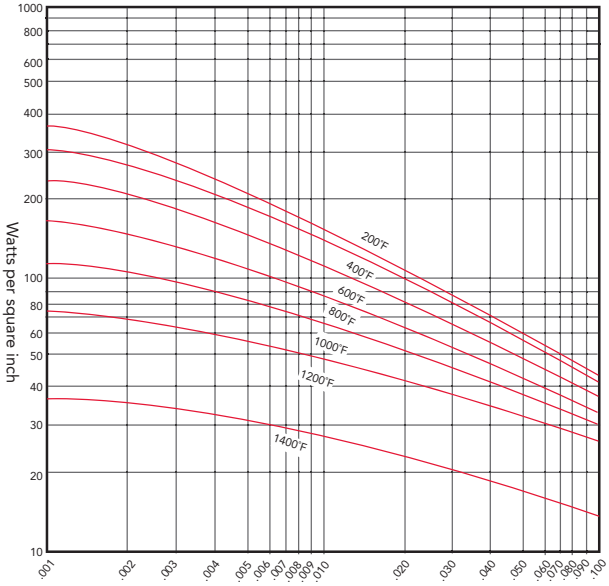
Standard Voltage is either 120V or 240V. Other voltages are available.

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 supplied with 12" leads.

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



Hole size over nominal fractional size

The watt densities are based on a unit installed in mild steel. Different materials affect the above values i.e. 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/square inch from Graph A.

Formula for determination of watts/sq.in:

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

Heated Length is ½" less than sheath length

Tolerances

Wattage tolerances is +5% -10% at rated voltage. Length tolerances are ±2% with a ±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. (i.e.—a 36" unit has a camber tolerance of .020" x $(3)^2$ = .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 heaters required.
Review Stock List for In-Stock Items.

Specify: catalog number, wattage, voltage, lead type, and special features if required.

Example: HS37-4.25/375W120V/SF1-18/SF26