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Electrolux

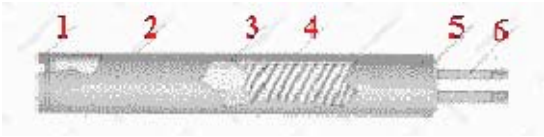
Cartridge Heaters: Superwatt High Watt Density

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 dissipated to the outside sheath. With low and moderate watt density elements, such as Electrolux Macedonia '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 below). 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.

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.

Diameter: 1/8" (.124/.120)

Maximum Amperage: 3.5 Not UL/CSA

Sheath Length	Cat.No.	Min. Watts	Max. Volts
1"	HS12-1	20	120
1 1/2"	HS12-1.5	30	120
2"	HS12-2	40	120
2 1/2"	HS12-2.5	50	120
3"	HS12-3	60	120
3 1/2"	HS12-3.5	70	120
4"	HS12-4	80	120

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Diameter:	1/4" (.249/.245)			3/8" (.374/370)			1/2" (.499/495)		
Maximum Amperage:	4			6			10		
Sheath Length	Cat.No.	Min. Watts	Max. Volts	Cat.No.	Min. Watts	Max. Volts	Cat.No.	Min. Watts	Max. Volts
1"	HS25-1	70	120	HS37-1	70	120			
1 1/2"	HS25-1.5	70	120	HS37-1.5	80	120	HS50-1.5	110	240
2"	HS25-2	100	120	HS37-2	120	240	HS50-2	160	240
2 1/2"	HS25-2.5	130	120	HS37-2.5	160	240	HS50-2.5	210	240
3"	HS25-3	150	240	HS37-3	200	240	HS50-3	270	240
3 1/2"	HS25-3.5	180	240	HS37-3.5	240	240	HS50-3.5	330	240
4"	HS25-4	210	240	HS37-4	280	240	HS50-4	380	240
4 1/2"	HS25-4.5	240	240	HS37-4.5	320	240	HS50-4.5	430	240
5"	HS25-5	260	240	HS37-5	360	240	HS50-5	490	240
5 1/2"	HS25-5.5	290	240	HS37-5.5	400	240	HS50-5.5	550	240
6"	HS25-6	320	240	HS37-6	440	240	HS50-6	600	240
6 1/2"	HS25-6.5	350	240	HS37-6.5	480	240	HS50-605	650	240
7"	HS25-7	380	240	HS37-7	520	240	HS50-7	700	240
7 1/2"	HS25-7.5	410	240	HS37-7.5	560	240	HS50-7.5	750	240
8"	HS25-8	440	240	HS37-8	600	240	HS50-8	800	240
8 1/2"	HS25-8.5	470	240	HS37-8.5	640	240	HS50-8.5	850	240
9"	HS25-9	500	240	HS37-9	680	240	HS50-9	900	240
9 1/2"	HS25-9.5	530	240	HS37-9.5	720	240	HS50-9.5	950	240
10"	HS25-10	560	240	HS37-10	760	240	HS50-10	1000	240
10 1/2"	HS25-10.5	590	240	HS37-10.5	800	240	HS50-10.5	1050	240
11"	HS25-11	620	240	HS37-11	840	240	HS50-11	1100	240
11 1/2"	HS25-11.5	650	240	HS37-11.5	880	240	HS50-11.5	1150	240
12"	HS25-12	680	240	HS37-12	920	240	HS50-12	1200	240

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Diameter:	5/8" (.624/.620)			3/4" (.749/.745)			1" (999/.993)		
Maximum Amperage:	20			28			30		
Sheath Length	Cat.No.	Min. Watts	Max. Volts	Cat.No.	Min. Watts	Max. Volts	Cat.No.	Min. Watts	Max. Volts
1 1/2"	HS62-1.5	130	240						
2"	HS62-2	200	240						
2 1/2"	HS62-2.5	270	240	HS75-2.5	330	240			
3"	HS62-3	340	240	HS75-3	410	240	HS1.0-3	475	240
3 1/2"	HS62-3.5	410	240	HS75-3.5	495	240	HS1.0-3.5	570	240
4"	HS62-4	480	240	HS75-4	575	240	HS1.0-4	665	240
4 1/2"	HS62-4.5	550	240	HS75-4.5	660	240	HS1.0-4.5	760	240
5"	HS62-5	620	240	HS75-5	740	240	HS1.0-5	855	240
5 1/2"	HS62-5.5	690	240	HS75-5.5	825	240	HS1.0-5.5	950	240
6"	HS62-6	760	240	HS75-6	910	240	HS1.0-6	1045	240
6 1/2"	HS62-6.5	830	240	HS75-6.5	980	240	HS1.0-6.5	1140	240
7"	HS62-7	900	240	HS75-7	1075	240	HS1.0-7	1235	240
7 1/2"	HS62-7.5	970	240	HS75-7.5	1150	240	HS1.0-7.5	1330	240
8"	HS62-8	1040	240	HS75-8	1240	240	HS1.0-8	1425	240
8 1/2"	HS62-8.5	1110	240	HS75-8.5	1325	240	HS1.0-8.5	1520	240
9"	HS62-9	1180	240	HS75-9	1400	240	HS1.0-9	1615	240
9 1/2"	HS62-9.5	1250	240	HS75-9.5	1475	240	HS1.0-9.5	1710	240
10"	HS62-10	1320	240	HS75-10	1560	240	HS1.0-10	1805	240
10 1/2"	HS62-10.5	1390	240	HS75-10.5	1645	240	HS1.0-10.5	1900	240
11"	HS62-11	1460	240	HS75-11	1730	240	HS1.0-11	1995	240
11 1/2"	HS62-11.5	1530	240	HS75-11.5	1820	240	HS1.0-11.5	2090	240
12"	HS62-12	1600	240	HS75-12	1890	240	HS1.0-12	2185	240
14"	HS62-14	1740	240	HS75-14	2050	240	HS1.0-14	2545	240
16"	HS62-16	1880	240	HS75-16	2210	240	HS1.0-16	2920	240
18"	HS62-18	2020	240	HS75-18	2370	240	HS1.0-18	3300	240
20"	HS62-20	2090	240	HS75-20	2450	240	HS1.0-20	3675	240

Obtaining maximum heat transfer and long life.

Fit

High watt density heaters require careful fit to insure optimum performance and long life. Electrolux Macedonia recommends that installation holes not be drilled and reamed over .002 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 heattransfer 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 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 1/2" 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:

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

Table 1: Maximum allowable Ohms per inch by diameter,

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

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.

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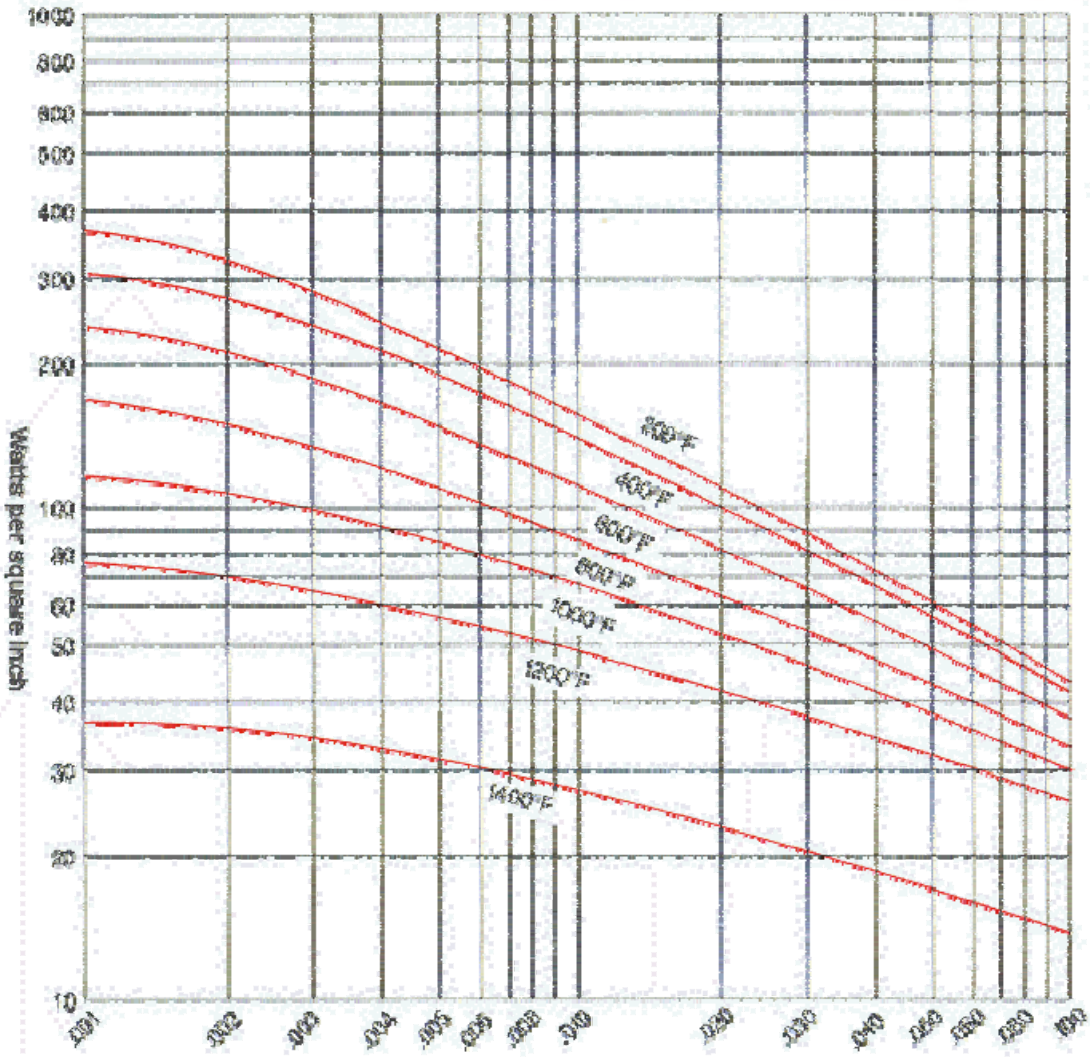

Hole size over nominal fractional size

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:

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

Heated Length is 1/2" less than sheath length.

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 into a straight, close fit hole.