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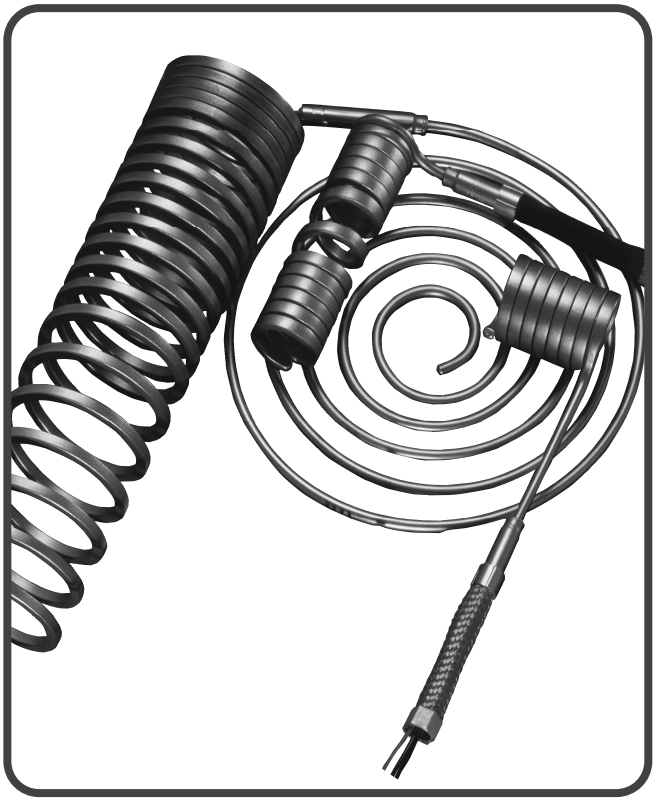
Coil/Cable Heaters

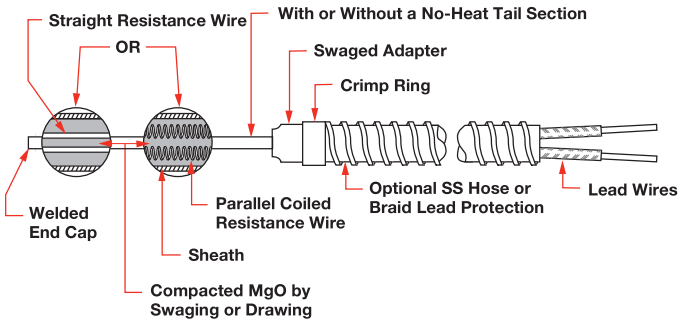
The versatile Watlow coil/cable heater can be formed into a variety of shapes. Small diameter, high performing cable heaters are fully annealed and readily bent to a multitude of configurations.

The heater can be formed into a compact, coiled nozzle heater supplying a full 360 degrees of heat with optional distributed wattage. A straight cable heater can snake through an equipment application. Flat, spiral configurations can be used in high-tech manufacturing while a star wound cable can be used for air and gas heating.

Different applications require different construction methods, including one, two or four resistance wires; parallel coil or straight wire; drawn or swaged sheaths; with or without internal thermocouples; leads exiting from one or both ends, and round, rectangular or square cable cross sectionals.

Whatever the application requirement, a Watlow coil/cable heater can be shaped to fit.





Performance Capabilities

- Continuous operating temperatures up to 1200°F (650°C) with intermittent operating periods achieving up to 1500°F (815°C) dependent on the type of element wire used
- Sheath watt densities on the cable up to 30 W/in^2 (4.65 W/cm^2), and as high as 75 W/in^2 (11.62 W/cm^2) subject to factory approval
- Maximum voltage up to 240V

Features and Benefits

High ductility

- Allows the heater to be cold-formed into almost any shape

Low mass

- Allows quick response in both heating and cooling

Constructed with no open seams

- Enables operation in unusual environments, including cryogenic and sub-freezing temperatures, high vacuum, gaseous and liquid immersion heaters
- Decreases opportunity for corrosion

Constructed of standard 304 stainless steel, optional 316 stainless steel or Alloy 600

- Provides high temperature corrosion and oxidation resistance along with ideal expansion properties

Heater sheath can be brazed

- Allows the permanent attachment of mounted fittings to the heater, contact your Watlow representative

Sizes range from 0.040 in. (1.02 mm) to 0.188 in. (4.8 mm) diameter

- Delivers a high volume of heat into a tiny space

Internal construction options

- Allows for internal thermocouples and no-heat sections (not available in all sizes)

Coil/Cable Heaters

Typical Applications

- Plastic injection molding nozzles
- Semiconductor manufacturing and wafer processing
- Semiconductor pedestal heating and showerhead
- Hot metal forming dies and punches
- Sealing and cutting bars
- Medical, analytical and scientific instruments
- Restaurant and food processing equipment
- Cast-in heaters
- Laminating and printing presses
- Air heating
- Textile manufacturing
- Heating in a vacuum environment

Electrical Data and Coiling Limits

Sheath Diameter in.	Sheath Diameter (mm)	Max. Voltage	Surface Area Per Linear Foot in.	Surface Area Per Linear Foot (cm)	Min. Bend Radius in.	Min. Bend Radius (mm)	Min. Coiled Inside Diameter in.	Min. Coiled Inside Diameter (mm)
0.040 ± 0.002	(1.016 ± 0.051)	48	1.51	(9.740)	1/16	(1.6)	1/8	(3.2)
0.062 ± 0.002	(1.575 ± 0.051)	120	2.34	(15.098)	1/8	(3.2)	1/4	(6.0)
0.094 + 0.002 - 0.003	(2.388 + 0.051 - 0.076)	240	3.54	(22.840)	3/16	(4.8)	3/8	(9.5)
0.102 square ± 0.003	(2.591 ± 0.076)	240	4.90	(31.615)	1/4	(6.0)	1/2	(13.0)
0.102 ± 0.003 x 0.156 ± 0.005 rectangular	(2.591 ± 0.076) x (3.962 ± 0.127)	240	6.19	(39.938)	1/4	(6.0)	1/2	(13.0)
0.125 ± 0.003	(3.175 ± 0.076)	240	4.71	(30.389)	1/4	(6.0)	1/2	(13.0)
0.157 ± 0.004	(3.988 ± 0.102)	240	5.92	(38.196)	5/16	(7.9)	5/8	(15.9)
0.188 + 0.003 - 0.006	(4.775 + 0.076 - 0.152)	240	7.09	(45.745)	3/8	(9.5)	3/4	(19.0)
0.128 square ± 0.003	(3.251 ± 0.076)	240	6.31	(40.712)	1/4	(6.0)	1/2	(13.0)

In most cases 30 W/in^2 (4.65 W/cm^2) is the safe allowable limit for cable watt density. Please contact your Watlow representative prior to ordering >30 W/in^2 cables.
Resistance/Wattage Tolerance ±10%.
Cable heaters can run on both ac and dc. Contact your Watlow representative for amperage limitations.

Coiling Tolerances

Cable Diameters	Coiled Width Tolerances: Coiled Width in.	Coiled Width Tolerances: Coiled Width (mm)	Coiled Width Tolerances: Tolerances in.	Coiled Width Tolerances: Tolerances (mm)	Coiled I.D. Tolerances: Coil I.D. Range in.	Coiled I.D. Tolerances: Coil I.D. Range (mm)	Coiled I.D. Tolerances: Tolerances in.	Coiled I.D. Tolerances: Tolerances (mm)
All Diameters	Below 6	(152)	+ 1/8 -1/8	(+3.18 - 3.18)	Below 0.625	(Below 15.88)	+0.000 - 0.015	(+0 - 0.38)
	6 to 10	(152 to 254)	+ 1/8 - 3/8	(+3.18 - 9.53)	0.625 to 0.999	(15.88 to 25.38)	+0.000 - 0.030	(+0 - 0.76)
	Over 10	(Over 254)	+ 1/4 -1/4	(+6.35 - 6.35)	1.000 to 1.999	(25 to 50.78)	+0.000 - 0.062	(+0 - 1.58)
					2.000 to 2.999	(51 to 76.18)	+0.000 - 0.125	(+0 - 3.18)
					3.000 to 3.999	(76 to 101.58)	+0.000 - 0.250	(+0 - 6.35)
					4.000 to 4.999	(102 to 126.98)	+0.000 - 0.375	(+0 - 9.53)
					5.000 and Over	(127 and Over)	+0.000 - 0.500	(+0 - 13.00)

When the O.D. of the coil is required as the critical dimension, it must be specified at the time of ordering so that proper coiling procedures can be determined. I.D. and O.D. dimensions cannot be held on the same unit. Please contact your Watlow representative prior to ordering coiled cable heaters requiring other than standard tolerances.

Cable Straight Length Tolerances

Length	≤ 24 in.	>24 in. ≤ 60 in.	>60 in. ≤ 100 in.	>100 in.
Tolerance	±3/8 in.	±1/2 in.	±1 in.	±1%

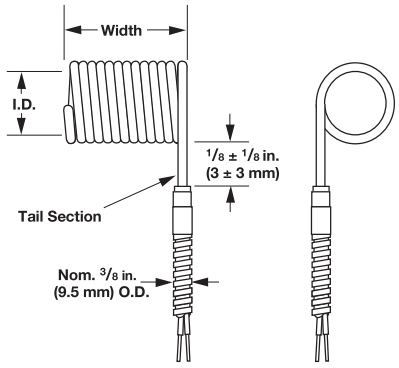
Coil/Cable Heaters

Formation Options

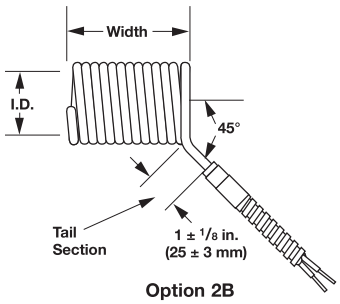
Coil Heaters

The coil heater can be tight wound or open pitch.

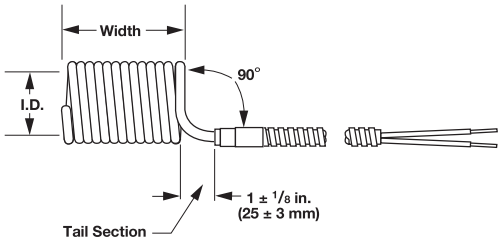
Lead Orientation Options for Coiled Cable Heaters



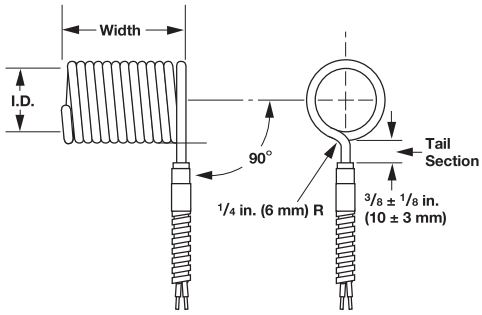
Option 2A



Option 2B



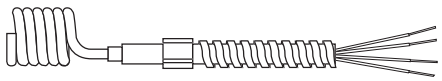
Option 2C



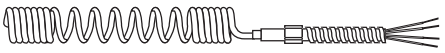
Option 2F

Note: Coiling or complex forming of stock heaters will generally result in increased resistance and reduction in wattage below 10 percent tolerance. Please contact factory before specifying power and resistance tolerance for formed cables.

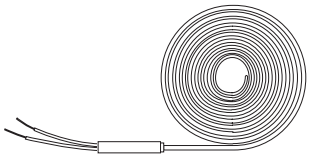
Closed Coil without Distributed Wattage



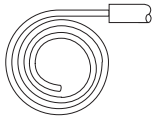
Closed Coil with Distributed Wattage



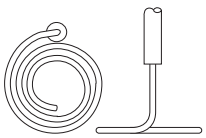
Flat Spiral



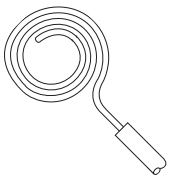
Flat, spiral formations are used to heat flat circular surfaces. This formation is often used in semiconductor and medical applications.



Flat Spiral with 2A Type Lead Orientation



Flat Spiral with 2C Type Lead Orientation



Flat Spiral with 2F Type Lead Orientation

Flat Spiral Inside Diameter Standards							
			Cable Diameter—in.				
			1/16 (0.062)	3/32 (0.094)	1/8 (0.125)	5/32 (0.156)	3/16 (0.188)
Spiral Inside Diameter—in.	5/8	(0.625)	✓	✓	✓		
	3/4	(0.75)		✓	✓	✓	✓
	7/8	(0.875)			✓	✓	
	1	(1.0)			✓	✓	✓
	1 3/16	(1.187)			✓		
	1 1/4	(1.25)			✓		
	1 1/2	(1.5)			✓	✓	✓
	2	(2.0)			✓		
	2 1/2	(2.5)			✓		
	3	(3.0)			✓	✓	✓

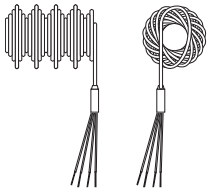
Note: Maximum outside diameter is 6 inches.

Coil/Cable Heaters

Formation Options *(Continued)*

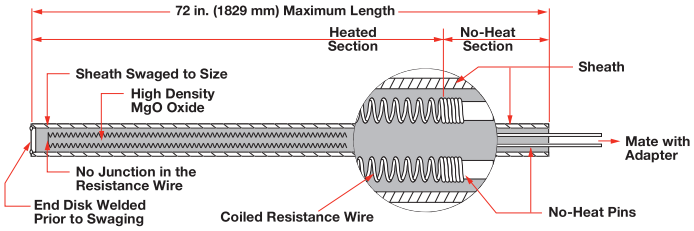
Star Wound

Star wound formations are usually inserted into pipes or ducts and used to heat moving air or liquids. The offset coils increase and induce turbulent flow. This allows the flowing material to have better contact with the heater surface to provide efficient heat transfer.



Internal Construction

Sheath with Coiled Internal Resistance Wire



Resistance wire wound into a small coil is loaded into insulating cores, then into metal tubing and swaged to final size. This construction method is called **coil wire or parallel coil.**

The coil method allows for a no-heat section in the sheath. The length of either the heated section or the no-heat section is variable as long as the combined length does not exceed 72 in. (1829 mm). Other features of this construction method include:

- Variable ohms/foot within a minimum and maximum range
- Variable location of the thermocouple junction
- Grounded or ungrounded thermocouple junction
- No-heat sections
- 304 stainless steel
- A variety of diameters and shapes:

  0.094 in. (2.4 mm) round

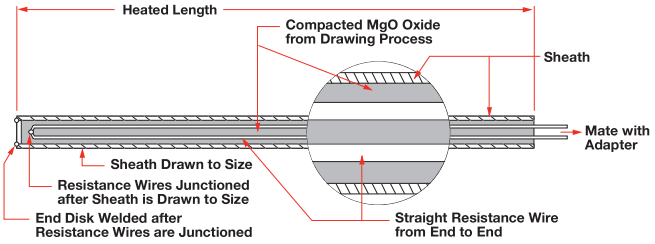
  0.125 in. (3.2 mm) round (minimum diameter with internal thermocouple)

  0.102 in. (2.6 mm) square

  0.128 in. (3.3 mm) square

  0.102 in. X 0.156 in. (2.6 mm X 4 mm) rectangular

Sheath with Straight (Uncoiled) Resistance Wire



Straight resistance wires are positioned inside a large diameter metal tube. The tube assembly is repeatedly pulled through draw dies until the desired diameter is achieved. Though limited to fixed incremental ohms/foot and without no-heat sections, this **straight wire or drawn cable** construction method allows:

- Essentially no limit on cable length
- Thermocouple junction only at the disk end of the sheath
- Grounded or ungrounded thermocouple junction
- Full length of the sheath is heated
- 304 stainless steel
- A variety of diameters and shapes:

  0.040 in. (1.0 mm) round

  0.062 in. (1.6 mm) round

  0.094 in. (2.4 mm) round

  0.125 in. (3.2 mm) round (minimum diameter with internal thermocouple)

  0.157 in. (4.0 mm) round

  0.188 in. (4.8 mm) round

  0.128 in. (3.3 mm) square*

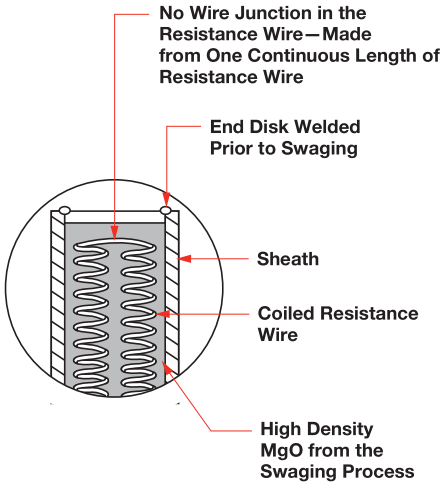
  0.102 in. X 0.156 in.* (2.6 mm X 4 mm) rectangular

* Maximum length is 140 in. (3556 mm)

Coil/Cable Heaters

Internal Construction *(Continued)*

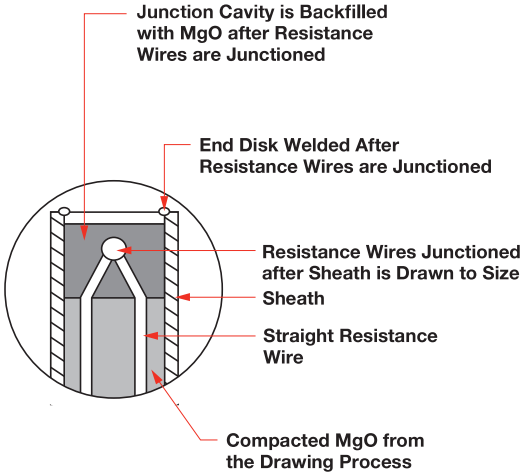
Disk End of Sheath



Coiled Internal Resistance Wire

The end of the heater sheath opposite from the lead exit end is called the disk end.

With coil construction methods, the internal resistance wires form a 180° bend inside the sheath and do not require a junction. After the end cap has been welded in place, the entire area at the end of the sheath is swaged to provide maximum density of the magnesium oxide (MgO).



Straight (Uncoiled) Resistance Wire

With straight construction, the internal wires—whether resistance or thermocouple—must be junctioned before the heater sheath can be finished. MgO is removed from the tip of the sheath to expose the wires, which are junctioned by welding. MgO powder is backfilled into the cavity surrounding the junctioned wires and lightly compacted. The end cap is inserted and welded into place.

Thermocouples

Internal thermocouples are available in ASTM Type J or K calibration with both the coil or straight construction methods.

Coil:

- 0.125 in. (3.2 mm) round
- 0.128 x 0.128 in. (3.3 x 3.3 mm) square
- 0.102 x 0.156 in. (2.6 x 4.0 mm) rectangular

Straight:

- 0.125 in. (3.2 mm) round
- 0.157 in. (4.0 mm) round
- 0.188 in. (4.8 mm) round
- 0.128 x 0.128 in. (3.3 x 3.3 mm) square
- 0.102 x 0.156 in. (2.6 x 4.0 mm) rectangular

Coil/Cable Heaters

Options—Internal Construction

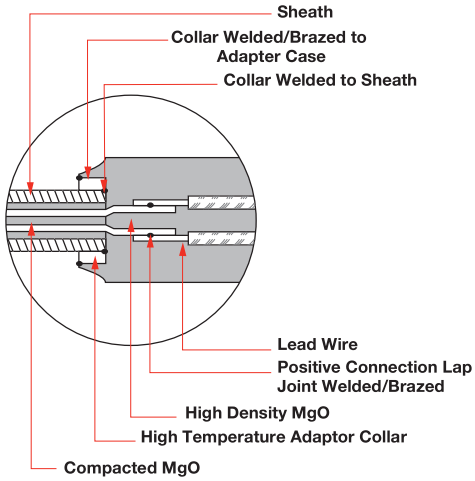
Adapters

Adapters are transition sections where lead wires are attached and connected with the internal wires from the heater sheath.

The **positive connection** lap joint brazes or welds the wire lap joint before the adapter is compacted. Positive connection is used in all standard applications and adds protection in high temperature environments.

An extended length adapter collar, or **high temperature** collar, is used as a heat sink enabling the heater to operate in high temperature, demanding applications.

The positive connection and collar are used in conjunction with both power leads and thermocouple leads.



External Construction

Lead Wire

100 percent nickel, copper, nickel plated copper or silver plated copper

Insulation

PTFE, fiberglass or a high temperature variety such as MGT or MGE

Lead Protection

Stainless steel hose, stainless steel braid or fiberglass braid

Contact your Watlow representative for details.

Coil/Cable Heaters

Cable Heater Units (Internal thermocouple is not available)

Straight Cable Length in. (mm)	Volts	Watts	Watt Density W/in² (W/cm²)	No-Heat Length in. (mm)	Lead Wire	Part Number
0.062 in. (1.6 mm) Diameter Round (with ±10% wattage tolerance) 0.250 in. x 1.125 in. adapter						
24 (610)	120	240	51 (7.9)	0 (0)	36 in. (914) mm swaged-in fiberglass	**62H24A6X-1138**
36 (914)	120	400	57 (8.8)	0 (0)		**62H36A5X-1015**
56 (1422)	120	330	30 (4.7)	0 (0)		**62H56A4X-942**
65 (1651)	120	500	39 (6.0)	0 (0)		**62H65A3X-1111**
0.094 in. (2.4 mm) Diameter Round (with ±5% wattage tolerance) 0.132 in. x 1.250 in. adapter— **Lead protection not available**						
30 (762)	230	125	17 (2.6)	5 (127)	48 in. (1219) mm swaged-in PTFE leads only	**94PC30A1X**
30 (762)	230	250	34 (5.3)	5 (127)		**94PC30A2X**
0.125 in. (3.2 mm) Diameter Round (with ±10% wattage tolerance) 0.250 in. x 1.125 in. adapter, *0.375 in. x 2.000 in. adapter						
18 (457)	240	250	35 (5.4)	1.5 (38)	36 in. (914) mm swaged-in fiberglass	**125CH18A4X-1066**
19 (483)	120	165	21 (3.3)	1.5 (38)		**125CH19A1X-879**
24 (610)	120	275	29 (4.5)	1.5 (38)		**125CH24A1X-1049**
24 (610)	240	275	29 (4.5)	1.5 (38)		**125CH24A14X-806**
38 (965)	240	325	21 (3.3)	1.5 (38)		**125CH38A1X-631**
38 (965)	120	175	12 (1.9)	1.5 (38)		**125CH38A2X-246**
47 (1194)	240	260	14 (2.2)	1.5 (38)		**125CH47A1X-108**
47 (1194)	120	235	12 (1.9)	1.5 (38)		**125CH47A2X-182**
47 (1194)	120	375	20 (3.1)	1.5 (38)		**125CH47A3X-986**
47 (1194)	240	345	19 (2.9)	1.5 (38)		**125CH47A4X-1081**
65 (1651)	240	420	16 (2.5)	1.5 (38)		**125CH65A1X-940**
65 (1651)	240	675	27 (4.2)	1.5 (38)		**125CH65A2X-1115**
95 (2413)	240	1000	28 (4.3)	0 (0)		**125CH93A1X-1154**
126 (3200)	240	1500	30 (4.7)	0 (0)	48 in. (1219) mm swaged-in fiberglass	**125H126A4A-969**
150 (3810)	240	2000	34 (5.3)	0 (0)		**125H150A3A-1168***
223 (5664)	240	3000	34 (5.3)	0 (0)		**125H223A1A-1057***
0.128 in. (3.3 mm) Square Cross-Section (with ±10% wattage tolerance) 0.250 in. x 1.125 in. adapter						
12 (305)	120	200	36 (5.6)	1.5 (38)	36 in. (914) mm swaged-in fiberglass	**125PS12A24A-647**
12 (305)	240	200	36 (5.6)	1.5 (38)		**125PS12A23A-155**
20 (508)	120	300	31 (4.8)	1.5 (38)		**125PS20A37A-537**
20 (508)	240	300	31 (4.8)	1.5 (38)		**125PS20A38A-142**
30 (762)	120	450	30 (4.7)	1.5 (38)		**125PS30A47A-159**
30 (762)	240	450	30 (4.7)	1.5 (38)		**125PS30A48A1019**
38 (965)	240	600	31 (4.8)	1.5 (38)		**125PS38A23A-562**

Note: Lead protection is available upon request.

Coil/Cable Heaters

Cable Heater Units (Type J internal thermocouple)

Straight Cable Length in. (mm)	Volts	Watts	Watt Density W/in² (W/cm²)	No-Heat Length in. (mm)	Lead Wire	Part Number
0.125 in. (3.2 mm) Diameter Round (with ±10% wattage tolerance), thermocouple located in center of heated section, 0.250 in. x 1.125 in. adapter						
24 (610)	120	275	29 (4.5)	1.5 (38)	48 in. (1219) mm swaged-in fiberglass	**125CH24A13X**
38 (965)	120	175	12 (1.9)	1.5 (38)		**125CH38A18X**
47 (1194)	120	235	13 (2.0)	1.5 (38)		**125CH47A21X**
65 (1651)	240	675	26 (4.0)	1.5 (38)		**125CH65A26X**
0.157 in. (4 mm) Diameter Round (with ±10% wattage tolerance), thermocouple located at the disk end of the cable, 0.375 in. x 2.000 in. adapter						
124 (3150)	240	1500	25 (3.9)	0 (0)	48 in. (1219) mm swaged-in fiberglass	**157CH124AX**
150 (3810)	240	2000	27 (4.2)	0 (0)		**157CH150AX**
220 (5588)	240	3000	28 (4.3)	0 (0)		**157CH220AX**
0.128 in. (3.3 mm) Square Cross-Section (with ±10% wattage tolerance), thermocouple located in center of heated section, 0.250 in. x 1.125 in. adapter						
12 (305)	240	200	36 (5.6)	1.5 (38)	48 in. (1219) mm swaged-in fiberglass	**125PS12A22A**
20 (508)	120	300	31 (4.8)	1.5 (38)		**125PS20A35A**
20 (508)	240	300	31 (4.8)	1.5 (38)		**125PS20A36A**
30 (762)	240	450	30 (4.7)	1.5 (38)		**125PS30A46A**
38 (965)	240	600	31 (4.8)	1.5 (38)		**125PS38A24A**

Note: Lead protection is available upon request.

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