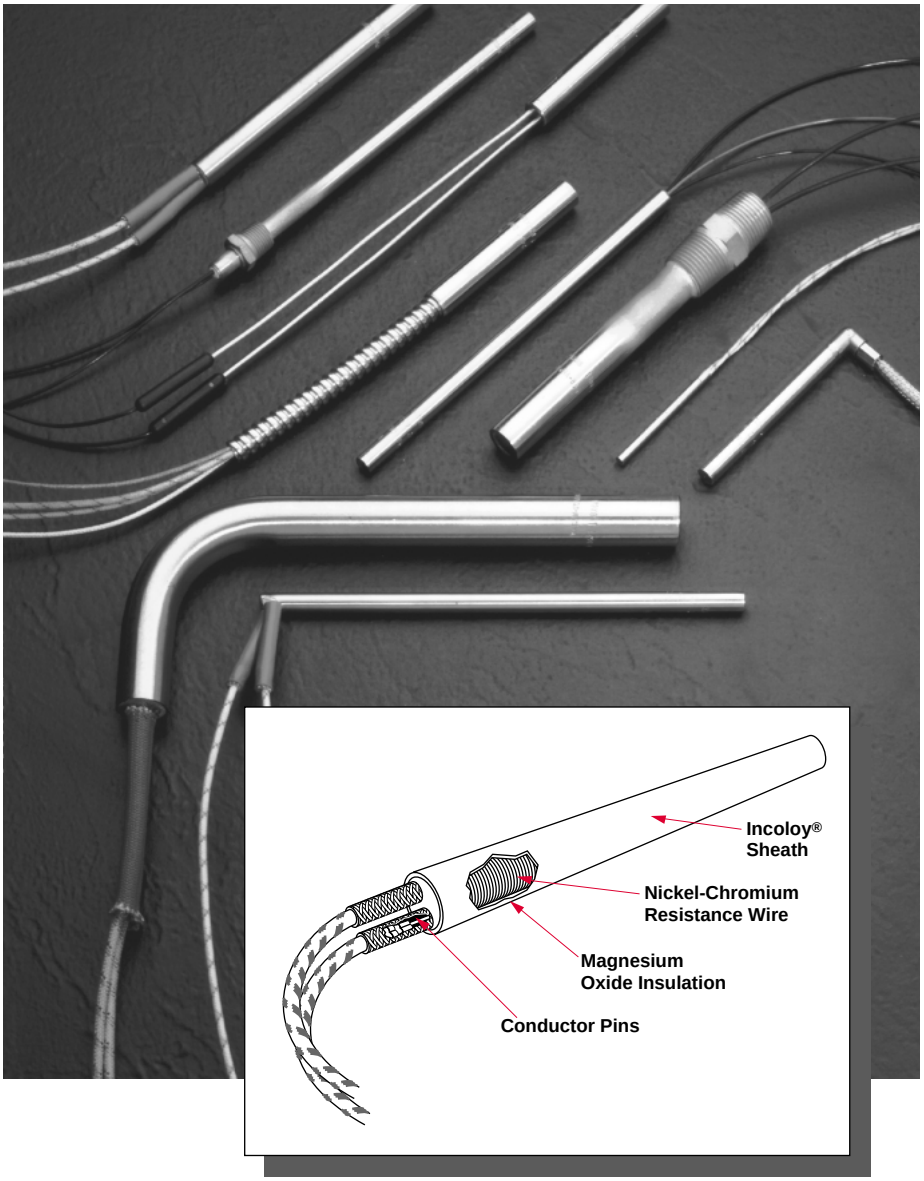
Cartridge Heaters

FIREROD®

The Watlow FIREROD® revolutionized the heating element industry in 1954 when it was patented as the first swaged cartridge heater. With premium materials and tight manufacturing controls, the FIREROD heater continues to provide superior heat transfer, uniform temperatures and resistance to oxidation and corrosion even at high temperatures.

FIREROD offers many delivery programs to meet your needs: same day shipment, Ship-to-Stock or Just-in-Time. And our experience in customized engineering is reflected in over 250,000 FIREROD cartridge heater designs. Stock or made-to-order, the Watlow FIREROD delivers heat in a hurry.



Performance Capabilities

- Part temperatures to 1400°F (760°C) on Incoloy® sheath
- Part temperatures to 1000°F (540°C) on optional stainless steel sheath
- Watt densities to 400 W/in^2 (62 W/cm^2)

Features and Benefits

- **Nickel-chromium resistance wire,** precisely wound and centered in the unit, assures even, efficient distribution of heat to the sheath.
- **Conductor pins** metallurgically bonded to the resistance wire ensure trouble-free electrical continuity.
- **Magnesium oxide insulation of specific grain and purity,** swaged to the proper density, results in high dielectric strength and contributes to faster heat-up.
- **Incoloy® sheath** resists oxidation and corrosion from many chemicals, heat and atmospheres.
- **Minimal spacing between the element wire and sheath** results in lower internal temperature, giving you the ability to design with fewer or smaller heaters that operate at higher watt densities.
- **UL® and CSA approved flexible stranded wires,** with silicone-fiberglass oversleeve, insulate the wires to temperatures of 480°F (250°C).
- **Patented Lead Adaptor (LA) method** allows same day shipment on more than 150,000 configurations of stock FIREROD heaters and lead combinations.

Applications

- Molds
- Dies
- Platens
- Hot plates
- Sealings
- Fluid heating
- Life sciences
- Aerospace
- Semiconductor
- Foodservice equipment

FIREROD

Applications and Technical Data

Tolerances

Diameter:

1 inch units: ±0.003 inches (±0.076 mm)

All other units: ±0.002 inches (±0.0508 mm)

Length:

All units to 4½ inches (115 mm) long: ±3/32 inch (±2.4 mm)

⅛ inch diameter units over 4½ inches (75 mm) long: ±3 percent

All other units over 4½ inches (115 mm) long: ±2 percent

Wattage:

⅛ inch units: +10 percent, -15 percent

All other units: +5 percent, -10 percent

Resistance:

⅛ inch units: +15 percent, -10 percent

All other units: +10 percent, -5 percent

Resistance changes with temperature. There are three circumstances under which resistance can be measured:

1. Room temperature (before use): nominal ohms are 90 percent of ohm's law calculation.
2. Room temperature (after use): nominal ohms are 95 percent of ohm's law calculation.
3. At temperature (during use): depending on application nominal ohms are approximately 100 percent of ohm's law.

Camber:

Units to 12 inches long: 0.005 inch per six inch length. Standard camber tolerance varies as the square of the length, in feet, is multiplied by 0.020 inches. For example, a 36 inch FIREROD has a camber tolerance of 0.020 inches X $(3)^2$ = 0.180 inches. Normally, slight camber does not present a problem since the heater will flex enough to fit into a straight, close fit hole.

Component Recognition File Numbers

UL® component rated to 240V~(ac) (file number E52951)

CSA component rated to 240V~(ac) (file number LR7392)

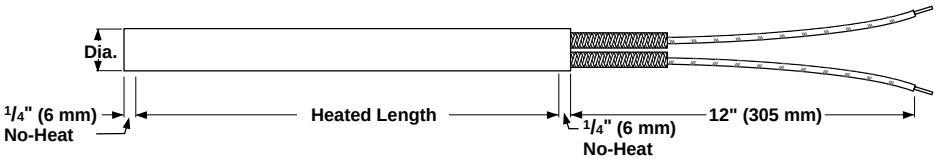
VDE component rated to 240V~(ac) (file number 10062-4911-0006)

Note: Not all options are covered.

Electrical Data

The *Electrical Data* table will assist you in selecting the correct FIREROD heater for your application, according to available voltage, amperage and wattage.

Please note, some combinations of minimum and maximum wattages are not available on the same heater diameter. Also, if you need to exceed limitations shown, contact your Watlow sales engineer or authorized distributor.



Number Of Circuits ⑤		
Diameter inches	1-phase	3-phase
¾	3	1
1	5	2

FIREROD Diameter inches	Volts Max.	Amp Max. ①	Minimum Watts@120V② Heater Length			Maximum Watts				
			1 in (25 mm)	1 ½ in (38 mm)	2 in (50 mm)	120V 1-phase	240V 1-phase	480V 1-phase	240V 3-phase	480V 3-phase
⅛	240	3.1	—	8	5	360	720	—	—	—
¼	240	4.4⑥	100	55	40	525	1050	—	—	—
⅜	240	6.7	65	35	25	800	1600	—	④	—
½	240	9.7	40	25	20	1,160	2,320	—	④	—
⅝	480	23.0	35	20	15	2,760	5,520	11,000	④	—
¾	480	23.0	30	15	10	2,760③	5,520	11,000	9,550	19,100
1	480	23.0	—	15	10	2,760③	5,520	11,000	9,550③	19,100③

① Determined by the current carrying capacity of internal parts and standard lead wire.

② Determined by the limitation of space for resistance winding. For minimum wattage of 240V~(ac) multiply value by four.

③ Higher wattages are available using more than one set of power leads. Multiply the wattage from the table by the applicable factor.

④ Consult the Watlow factory in St. Louis, Missouri, for data.

⑤ On ¾ inch diameter units, either three single- phase circuits or one three-phase Delta or Wye circuit is available. On one inch diameter units, either five single-phase or two three-phase Delta circuits are available.

⑥ For ¼ inch units with thermocouple maximum amperage is 3.1.

Cartridge Heaters

FIREROD

Maximum Allowable Watt Density

For metric watt density conversion see Metric FIREROD Cartridge, pages 119 and 120.

The following four charts detail maximum allowable watt densities for applications involving metal heating or steam, air and gas heating. Please review these respective charts and applicable data to determine the correct watt density for your application.

Correction Factors:

Also note, these graphs depict FIRERODs used in steel parts. Therefore, for either stainless steel or aluminum and brass, refer to applicable correction factors:

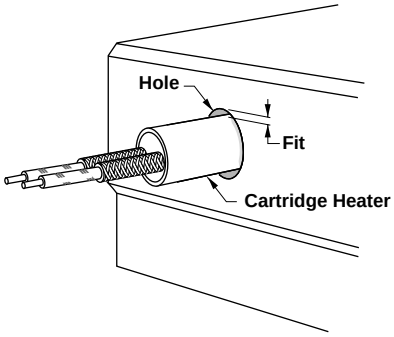
① For stainless steel, enter the graph with a fit 0.0015 inch (0.04 mm) larger than actual.

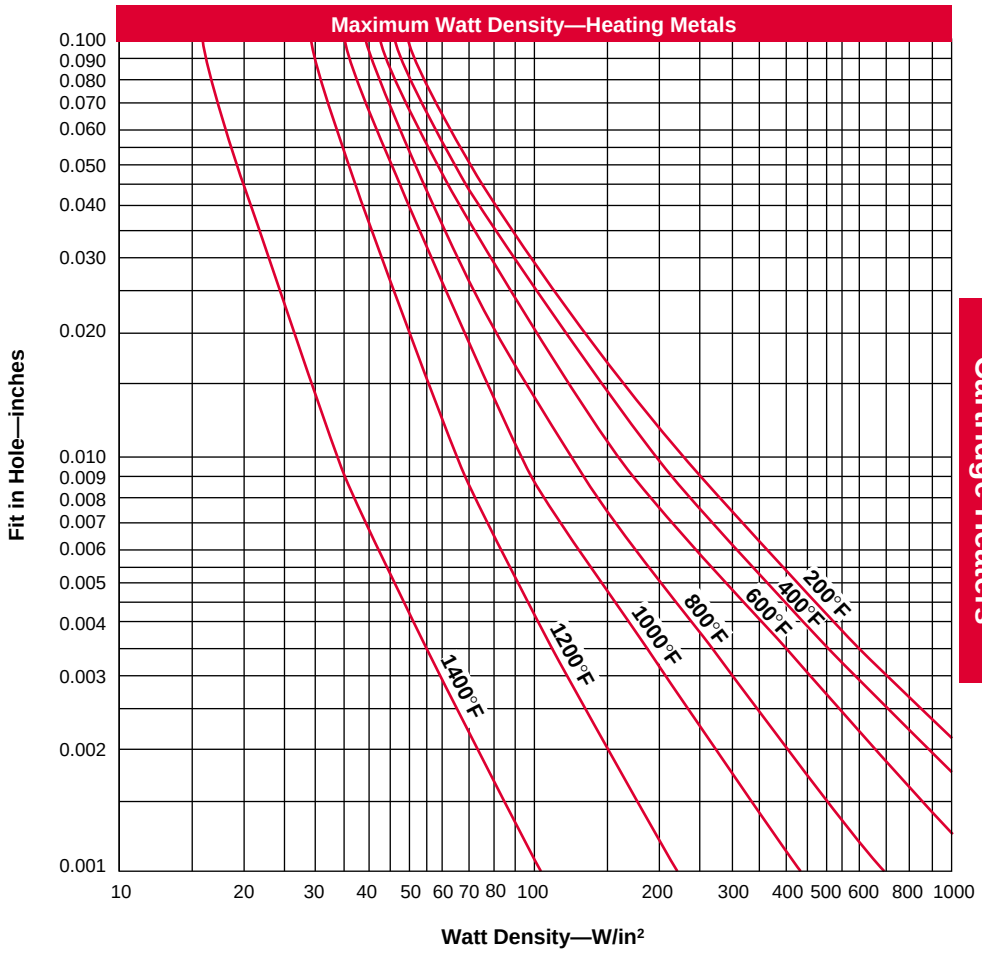
② For aluminum and brass, enter the graph with a temperature 100°F (38°C) above actual temperature.

Heating Metals

The *Maximum Watt Density—Heating Metals* chart will tell you either the maximum hole fit or recommended watt density of the heater. Enter the chart with either known variable, part fit in hole dimension or W/in². Then find the application temperature by reading up or over on the chart.

If the fit of the heater in the hole dimension is not known, it is easily determined. Subtract the minimum diameter of the FIREROD (nominal diameter minus tolerance) from the maximum hole diameter. For example, take a hole diameter of 0.500 minus a heater diameter of 0.496 ±0.002 inch. The hole fit would be 0.006 inch. For FIREROD heaters in square holes or grooves, contact your Watlow sales engineer or authorized distributor for the fit in hole dimension.



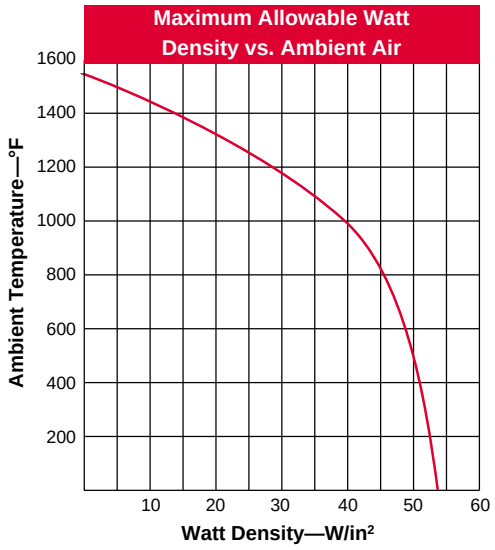


Cartridge Heaters

FIREROD

Maximum Allowable Watt Density
Continued

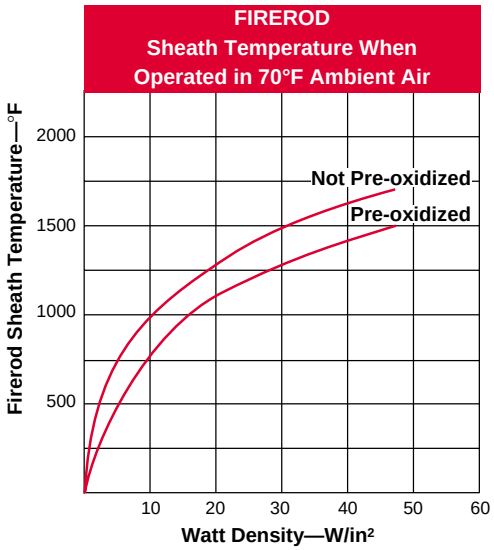
Heating Steam, Air and Gases



Watt Density vs Ambient Air Temperature

The *Watt Density vs Ambient Air Temperature* graph shows the maximum allowable watt density when one FIREROD is operated in air or similar gas.

For FIRERODs grouped in a single row, with no less than one diameter between elements, multiply value from graph by 0.95. When a reflector is placed behind the heaters, multiply the maximum allowable watt density value from the graph by 0.85.

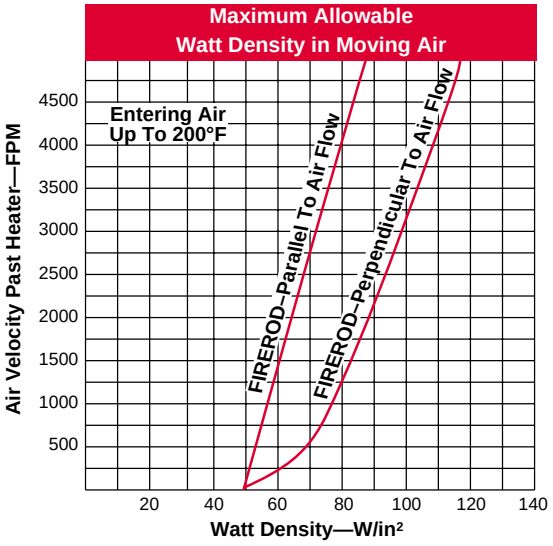


Sheath Temperature in Ambient Air

The *Sheath Temperature in Ambient Air* graph indicates the watt density required to bring a pre-oxidized FIREROD to a given sheath temperature when operated in 70°F (20°C) ambient air.

At 44 W/in² (6.8 W/cm²), the sheath temperature would be 1450°F (790°C). At this temperature, one year life would be expected, provided that cycling is not too frequent.

Higher temperatures would result in reduced heater life.



Watt Density in Moving Air

The *Watt Density in Moving Air* graph gives the maximum allowable watt density of a FIREROD in moving air.

The air movement is expressed in feet per minute (FPM). If the air flow is known in cubic feet per minute (CFM), divide the CFM by the net free area around the heater (ft²). The net free area is the total area of the enclosure minus the area occupied by the heater.

Cartridge Heaters

FIREROD

Lead and Diameter Information

Lead Specifications

Heater Diameter inches	Standard Lead Gauge Fiberglass	Lead Wire Size Tolerance Fiberglass	Standard Lead Gauge Teflon®	Lead Wire Size Tolerance Teflon®	Standard Stainless Steel Hose I.D.	Standard Stainless Steel Braid I.D.
⅛	24	0.044 - 0.058	24 solid	0.036 - 0.044	⅛	⅛
¼	22	0.079 - 0.093	22	0.046 - 0.054	⅛	⅛
⅜	22	0.079 - 0.093	20	0.054 - 0.062	7/32	¼
½	18	0.095 - 0.109	20	0.054 - 0.062	9/32	¼
⅝	18	0.095 - 0.109	18	0.064 - 0.074	⅜	¼
¾	18	0.095 - 0.109	14	0.087 - 0.101	½	⅜
1	18	0.095 - 0.109	14	0.087 - 0.101	N/A	N/A

Lead length tolerances: 1 inch to 36 inches = -½ inch, +1½ inches; > 36 inches to 72 inches = -1, +3 inches; > 72 inches = ±4 inches.

Stainless steel hose and braid tolerances: same as lead wire.

Units constructed with 480 volts require MGT leads. If connecting heaters in series above 300 volts, MGT leads are also required.

Ratings: GGS, 300V, 480°F (250°C)
MGT, 600V, 840°F (450°C)
Teflon®, 600V, 400°F (205°C)
Silicone Rubber, 600V, 300°F (150°C)

Lead Gauge	Nickel Ampacity	N.C.C. Ampacity	SPC/NPC
26	2.5	4.2	6.0
24 stranded	3.1	5.2	7.5
24 solid	3.1	5.2	7.5
22	4.4	7.2	10.5
20	N/A	N/A	14.0
18	7.6	12.6	18.0
16	9.7	16.1	23.0
14	12.5	21.0	30.0
12	16.8	28.0	40.0
10	23.0	38.5	55.0

Dimensional Data

The *Dimensional Data* table gives minimum/maximum lengths for available FIREROD diameters.

FIREROD Diameter			Length			
Nominal	Actual		Minimum		Maximum	
inches	inches	(mm)	inches	(mm)	inches	(mm)
⅛	0.122	(3.10)	1 ¼	(32)	12	(305)
¼	0.246	(6.25)	⅞	(22)	36	(915)
⅜	0.371	(9.42)	⅞	(22)	48	(1,220)
½	0.496	(12.60)	⅞	(22)	60	(1,520)
⅝	0.621	(15.77)	1	(25)	72	(1,830)
¾	0.746	(18.95)	1	(25)	72	(1,830)
1	0.996	(25.30)	1 ¼	(32)	72	(1,830)

Indicates **recommended** maximum length; however longer lengths are available.

Cartridge Heaters

FIREROD

Non LA Stock

Modification Coding

Watlow offers heaters in various diameters, lengths and volt-wattage combinations that are ready for shipping. Stock heaters are listed on pages 97-107. Any stock heaters can have basic modifications made and shipped the same day. These modifications include flanges, threaded fittings, locating rings, elbows, couplers, ceramic beads and leads. The following is a list of all available non LA modifications and their code numbers.

Mounting Option Codes

BA	Small flange FS (available on ¼", ⅜", ½")
BB	Medium flange FM (available on ¼", ⅜", ½", ⅝", ¾")
BC	Large flange FL (available on ⅝", ¾")
BD	Locating rIng (available on ¼", ⅜", ½", ⅝", ¾")
BE	Single brass fitting
BF	Double brass fitting
BG	Single stainless steel fitting
BH	Double stainless steel fitting
BY	Stainless steel reversed
BZ	Brass reversed

Lead Protection Option Codes

CC	Straight coupler	—	BX			
CD	Right angle elbow	—	BX			
CE	Straight coupler	—	stainless steel hose			
CF	Right angle elbow	—	stainless steel hose			
CJ	Straight coupler	—	BX	—	solder coupler to heater	
CK	Straight coupler	—	BX	—	solder coupler to BX	
CL	Straight coupler	—	BX	—	solder coupler to BX and heater	
CM	Right angle elbow	—	BX	—	solder elbow to heater	
CN	Right angle elbow	—	BX	—	solder elbow to BX	
CP	Right angle elbow	—	BX	—	solder elbow to BX and heater	
CR	Straight coupler	—	stainless steel hose	—	solder coupler to heater	
CS	Straight coupler	—	stainless steel hose	—	solder coupler to hose	
CT	Straight coupler	—	stainless steel hose	—	solder coupler to hose and heater	
CU	Right angle elbow	—	stainless steel hose	—	solder elbow to heater	
CV	Right angle elbow	—	stainless steel hose	—	solder elbow to hose	
CW	Right angle elbow	—	stainless steel hose	—	solder elbow to hose and heater	
CX	Straight coupler	—	stainless steel braid	—	⅛" diameter only	
CY	Straight coupler	—	stainless steel hose	—	⅛" diameter only	

Example:

J10A52- CT 12 L 72

Option Code — CT
Lead protection length — 12
Must be used to call out Leads — L
Lead length — 72

Pin Option Codes

AA	Short pins 5/16"
AB	Medium pins ⅝"
AC	Long pins 1¾
AD	Stagger pins
AE	Ceramic beads ½"
AF	Ceramic beads ¾"
AG	Ceramic beads 1"
AH	Ceramic beads 1¼"
AJ	Ceramic beads 1½"

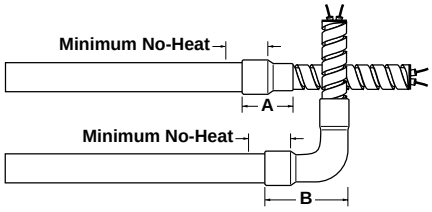
Note: Mounting options are located on the last ¼ inch of all non-LA stock units

FIREROD

Non LA Stock

Termination Options

Modified Stock Straight and Right Angle Galvanized BX Conduit



Galvanized BX conduit equals stainless steel hose in its abrasion protection. The conduit is attached with either a crimped-on straight or 90 degree elbow copper coupling which overlaps the heater sheath.

The ¼-inch diameter FIRERODs use stainless steel hose instead of conduit. On one-inch (25 mm) diameter FIRERODs, only flexible galvanized hose is used.

Modified Stock units may be ordered either with copper coupler/elbow and BX conduit or stainless steel hose. To order, specify **BX conduit** or **stainless steel hose** as well as straight or right angle coupler, conduit/hose length and lead lengths.

Unless specified, 12-inch (305 mm) hose or conduit is supplied. Leads are two inches (51 mm) longer than hose.

BX Conduit

Coupler utilizes BX conduit or SS hose.

Heater Diameter inches	Straight A Dimension inches	(mm)	Right Angle B Dimension inches	(mm)	BX O.D. inches	(mm)	Hose O.D. inches	(mm)
¼	⅞	(22)	1 1/16	(27)	— ①	—	⅜	(10)
⅜	1	(25)	1 ⅜	(35)	½	(13)	⅜	(10)
½	1 3/16	(30)	1 ⅝	(41)	9/16	(14)	½	(13)
⅝	1 ¼	(32)	2 1/16	(52)	9/16	(14)	⅝	(16)
¾	1 ½	(38)	2 ⅛	(54)	9/16	(14)	⅝	(16)

① ¼ inch diameter unit uses SS hose only.

Galvanized BX conduit is available on Modified Stock units. It is also available on Stock/Standard FIRERODs in combination with LA swaged-in flexible leads, as well as LA Teflon® and silicone rubber seals and leads.

On Modified Stock, insert length = overall length of heater - ¼ inch.

Note: If the heater diameter you need is not shown on the chart, Watlow will manufacture to your specifications.

Cartridge Heaters

FIREROD

LA Stock

Termination Options

Patented LA—or Lead Adaptor—Modification Method

1000°F maximum on LA cap

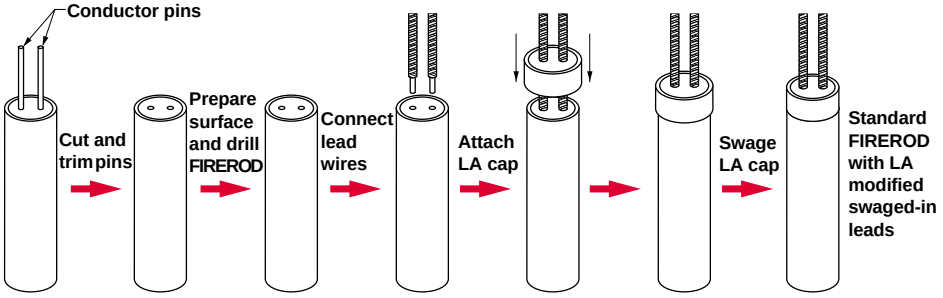
Watlow has developed a patented Lead Adaptor (LA) program for customers in need of heaters quickly. The LA program takes a stock heater adds leads and lead protection, if requested. The LA adder has a standard 12 inches (305 mm) of protection and 14 inches (356 mm) of leads, but additional length can be added. The leads and protection can also be attached in a right angle configuration for applications with restricted space.

LA configurations are permanently attached to the heater. Most configurations can be ordered with no-heat extensions. These can also have mounting options including flanges, threaded fittings or locating rings.

LA adders can be used on either stock heaters or made-to-order heaters. The LA adders usually take one to three days to ship.

To configure a FIREROD with swaged-in leads, Watlow:

- Cuts the pins off flush with the end piece and prepares the surface for drilling.
- Drills the heater.
- Connects the lead wires, and then places an LA cap over the lead end of the heater.
- Swages the heater to produce a rugged unit with swaged-in leads.



LA options available on ⅜ inch to ¾ inch diameters.

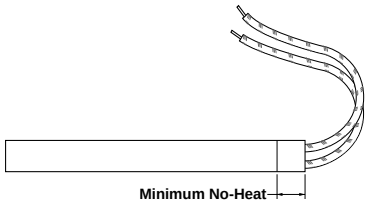
Note: Limited LA options available on ¼ inch diameter.

Maximum temperature of LA cap is 1000°F (538°C) except for MI leads option.

FIREROD

LA Stock

Termination Options

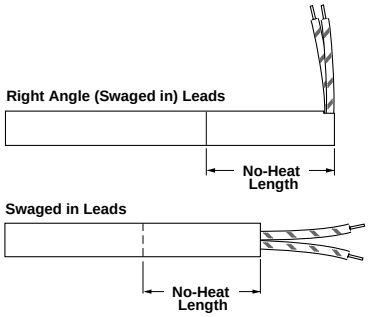


LA Swaged-in Flexible Leads

LA swaged-in flexible leads are used in applications where a high degree of flexing exists or the leads must be bent sharply adjacent to the heater without exposing or breaking the conductor. The stranded wire leads are connected internally and exit through the lead end. The overall length of the heater is extended by 3⁄16 inch (5 mm).

To order, specify **length adder code D** bringing the total disk end no-heat to 7⁄16 inch.

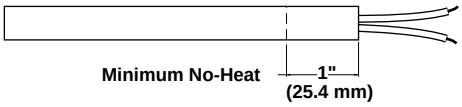
This LA option is not available on ⅛ inch (3 mm) diameter. On ⅛ inch (3 mm) diameter FIRERODs, leads are connected externally using a solid conductor lead wire. If stranded wire is desired on ⅛ inch (3 mm) diameter units, consult factory.



No-Heat Extensions

No-heat extensions are recommended in applications where leads may be exposed to excessive heat, thus requiring a cooler lead end. Also used when heat is not required along the entire length of the FIREROD.

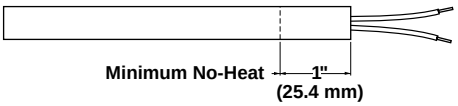
No-heat extensions are available for most LA stock options in diameters of ⅜, ½, ⅝ and ¾ inch (9, 13, 16 and 19 mm). These extensions are designed to provide a total no-heat length of 1, 1½, 2 or 2½ inches (25, 38, 51 or 65 mm) at the lead end of stock FIRERODs only. Consult factory for available LA options.



LA Teflon® Seal and Leads

LA Teflon® seal and leads protect the heater against moisture/contamination from lubricating oil, cleaning solvents, plastic material or fumes and organic tapes. This seal is effective to 400°F (205°C) under continuous operation.

Please note when ordering this option, that a minimum no-heat section is required to allow for construction. Additional no-heat may be required to keep the seal below effective temperatures. The minimum lead end no-heat is one inch. The LA cap adds ¾ inch (19 mm) to the overall length of the heater. To order, specify **option code T**.



LA Silicone Rubber Seal and Leads

LA silicone rubber seal and leads protect the heater against moisture/contamination from lubricating oil, cleaning solvents, plastic material or fumes and organic tapes. This seal is effective to 450°F (230°C) under continuous operation.

Please note when ordering this option, that a minimum no-heat section is required to allow for construction. Additional no-heat may be required to keep the seal below effective temperatures. The minimum lead end no-heat is one inch. The LA cap adds ¾ inch (19 mm) to the overall length. To order, specify **option code P**.

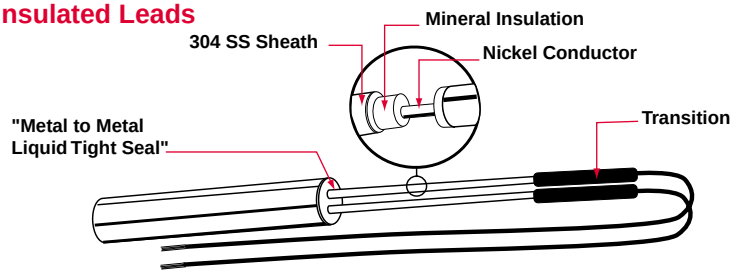
Cartridge Heaters

FIREROD

LA Stock

Termination Options
Continued

Mineral Insulated Leads



MI leads handle both high temperatures and contamination, and resist other problems like abrasion and excessive vibration. The metal seal and swaged-in, formable MI cable leads are capable of handling temperatures up to 1500°F (815°C). In addition, the lead end seal resists moisture and other forms of contamination, including gases, oils, plastic drool, solvents and water.

Features and Benefits

- **Increased heater life**.
- **Less down time**.
- **No need for a soft start** due to moisture penetration.
- **Ability to use a cartridge heater where not possible before**.
- **Abrasion and vibration resistant**.
- **Able to be formed or bent** to fit the contours of wiring raceways.
- **No additional insulation of lead wires is needed** to protect against high temperatures.
- **Lead cables and seal will not out-gas** in vacuum environments.

The Watlow FIREROD with the patented MI lead and seal option is covered by a two-year limited warranty. This extended warranty for this product only applies to manufacturing defects or failures due to over-temperature or product failure due to contamination.

This LA option is also available as a manufactured item. Specify MI leads and seal, as well as volts, watts, cable length, lead length and type. Six inches of MI cable and 12 inches (305 mm) of Teflon® leads will be supplied unless otherwise specified. To order, specify **option code J.**

Applications

- Vacuum forming
- Plastic molding
- Medical instrument manufacturing
- Food handling equipment
- Zinc die-casting

Heater Diameter inches	Maximum Current amps	Conductor Diameter inches	Cable Diameter inches	Transition Diameter inches	Cable Length min inches	Cable Length max inches	Minimum Bend Radius	Maximum Voltage inches	Length Adder
⅜	7.0	0.044	0.108	0.230	6	72	0.225	240	G(3/8)
½	7.0	0.044	0.108	0.230	6	72	0.225	240	K(9/16)
⅝	9.7	0.062	0.138	0.250	6	72	0.280	240	L(5/8)
¾	9.7	0.062	0.138	0.250	6	72	0.280	240	L(5/8)

The above information pertains to standard FIREROD heaters. However, variations in these parameters may be accommodated to suit specific customer needs.

Technical Data

Max. temp. of cable: 1500°F

Max. temp. of cable to lead transition: 300°F
(where flexible leads attach to cable)

Cable sheath material: 304 SS

Conductor material: Nickel

Maximum voltage: 240V

Lead Types

Teflon® (400°F/205°C) – T

Silicone Rubber (300°F/150°C) – S

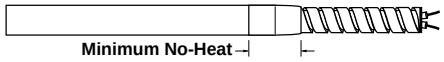
GGS (480°F/250°C) – No code

MGT (840°F/450°C) – H

FIREROD

LA Stock

Straight Protection Options

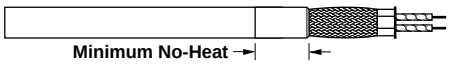


LA Straight Stainless Steel Hose

LA straight stainless steel hose provides the best protection against abrasion from sharp edges. It also offers ease of handling and wiring in abrasive environments. Unless specified a 12-inch (305 mm) hose is supplied. Leads are two inches (51 mm) longer than hose.

Minimum lead end no-heat required is ⅝ inch (16 mm). Option adds ⅜ inch (9 mm) to overall length on stock units.

To order, specify **option code H**.



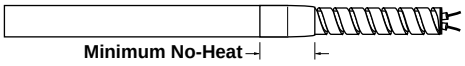
LA Straight Stainless Steel Braid

LA straight stainless steel braid is designed to protect leads from abrasion against sharp edges. It is the most flexible of Watlow's protective lead arrangements.

Unless specified a 12-inch (305 mm) braid is supplied. Leads are two inches (51 mm) longer than braid.

Minimum lead end no-heat required is ⅝ inch (16 mm). Option adds ⅜ inch (9 mm) to overall length on stock units.

To order, specify **option code C**.



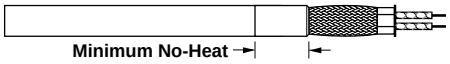
LA Straight Stainless Steel Hose with Teflon® Leads and Seal

LA straight stainless steel hose with Teflon® leads and seal provides the ultimate combination of abrasion protection and a moisture resistant seal. Unless specified a standard 12-inch (305 mm) hose is supplied.

Leads are two inches (51 mm) longer than hose.

Minimum lead end no-heat required is ¾ inch (19 mm). Option adds ½ inch (13 mm) to overall length on stock units.

To order, specify **option code G**.



LA Straight Stainless Steel Braid with Teflon® Leads and Seal

LA straight stainless steel braid with Teflon® leads and seal provides Waltow's most flexible lead protection with a moisture resistant seal. Unless specified a 12-inch (305 mm) braid is supplied. Leads are two inches (51 mm) longer than the braid.

Minimum lead end no-heat required is ¾ inch (19 mm). Option adds ½ inch (13 mm) to overall length on stock units.

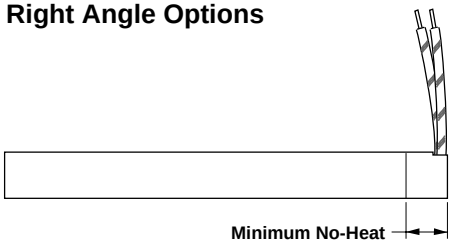
To order, specify **option code F**.

Cartridge Heaters

FIREROD

LA Stock

Right Angle Options



LA Right Angle Leads

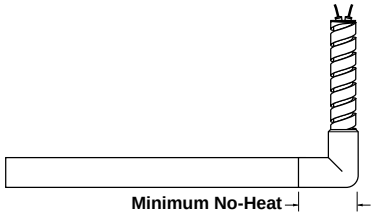
LA right angle leads are used in applications with a high degree of flexing and when space limitations are critical. Stranded lead wires are connected internally (swaged-in) and exit at a 90 degree angle at the end of the heater.

To order, specify **option code R**.

To order right angle leads with Teflon® leads and seals, specify **option code B**.

Minimum No-Heat Required inches					
Dia.	¼	⅜	½	⅝	¾
Inches	11/16	⅝	11/16	11/16	11/16

Note: Option is not available on ¼ inch (6 mm) diameter.



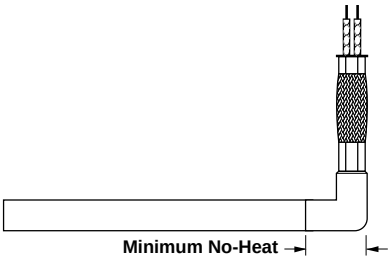
LA Right Angle Stainless Steel Hose

LA right angle stainless steel hose is provided for wiring convenience. Like the LA straight stainless steel hose, it protects leads from abrasion against sharp edges. Unless specified, 12-inch (305 mm) hose is supplied. Leads are two inches (51 mm) longer than hose.

To order, specify **option code W**.

Minimum No-Heat Required inches					
Dia.	¼	⅜	½	⅝	¾
Inches	N/A	¾	13/16	13/16	1

Note: Option is not available on ¼ inch (6 mm) diameter.



LA Right Angle Stainless Steel Braid

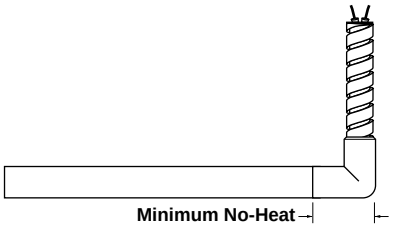
LA right angle stainless steel braid is provided for wiring convenience. Like the LA straight braid, it protects leads from abrasion against sharp edges.

Unless specified, 12-inch (305 mm) braid is supplied. Leads are two inches (51 mm) longer than braid.

To order, specify **option code Y**.

Minimum No-Heat Required inches					
Dia.	¼	⅜	½	⅝	¾
Inches	N/A	¾	13/16	13/16	1

Note: Option is not available on ¼ inch (6 mm) diameter.



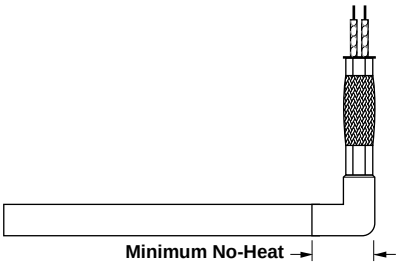
LA Right Angle Stainless Steel Hose with Teflon® Leads and Seal

LA right angle stainless steel hose with Teflon® leads and seal provides the ultimate combination of abrasion protection and a moisture resistant seal with wiring convenience. Unless specified, a 12-inch (305 mm) hose is supplied. Leads are two inches (51 mm) longer than hose.

Minimum lead end no-heat required is 1½ inch (38 mm). Option adds 1¼ inch (32 mm) to overall length on stock units.

To order, specify **option code M**.

Note: Option is not available on ¼ inch (6 mm) diameter.



LA Right Angle Stainless Steel Braid with Teflon® Leads and Seal

LA right angle stainless steel braid with Teflon® leads and seal provides Waltow's most flexible lead protection and moisture resistant Teflon® seal with wiring convenience. Unless specified a 12-inch (305 mm) braid is supplied. Leads are two inches (51 mm) longer than the braid.

Minimum lead end no-heat required is 1½ inch (38 mm). Option adds 1¼ inch (32 mm) to overall length on stock units.

To order, specify **option code A**.

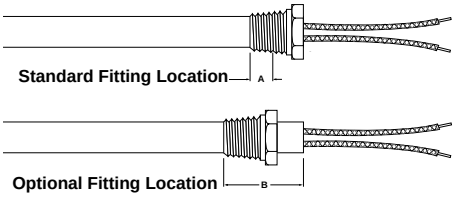
Note: Option is not available on ¼ inch (6 mm) diameter.

Cartridge Heaters

FIREROD

LA Stock

Mounting Options



Fitting overlaps the unheated section and is soldered to the sheath.

LA Stock Threaded Fittings

Threaded fittings allow for fast, water-tight installation of the heater into a threaded hole. These fittings can be ordered in either brass or 304 stainless steel. Other stainless steel alloys are available upon request. Double threaded fittings are also available.

To order, specify either **brass** or **stainless steel threaded fittings**.

On LA stock give location of fittings, if no-heat extension option is requested. Specify location from disc end to bottom of threads.

Lead Arrangement	STD Fitting ① Location Dimension A inches	(mm)
Crimped Leads	¼	(6)
Swaged in Leads	5⁄16 ②④	(8)
STR SS Hose	½ ③	(13)
STR SS Braid	½	(13)
Teflon® Seal & LDS	⅞	(22)
Silicone Seal & LDS	⅞	(22)

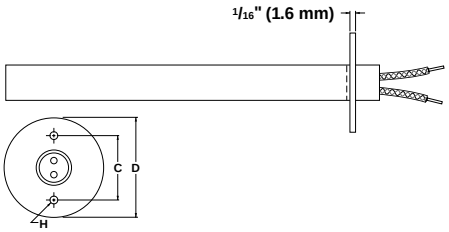
① The location of the threaded fitting from thread end of fitting to the lead end of heater.

All optional fitting locations are available only with LA Stock no-heat extensions. Consult the Watlow factory in St. Louis, Missouri, for details.

② On ¼ inch diameter FIREROD only "A" dimension is 7⁄16 inch (11 mm).

③ On ¼ inch diameter FIREROD only "A" dimension is ⅝ inch (16 mm).

④ On ⅝ inch and ¾ inch the fitting is located at ⅞ inch from lead end using a ¾ no-heat extension. In order to locate at 5⁄16 inch the fitting must be epoxied.



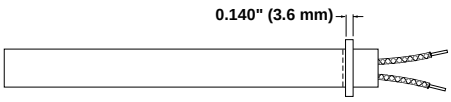
Flanges

Stainless steel flanges are a convenient mounting method as well as a way to position a heater within an application. The standard flange is staked on and located ¼ (6 mm) inch from the LE. The flange can be located up to 2¼ inches (57 mm) from the LE as long as it is over a no-heat section. Use this option in combination with most LA configurations.

To order, specifiy **flange**, size and locations.

Flange Specifications

FIREROD Diameter inches	Flange Size	inches D	C	H
¼, ⅜, ½	FS	1	¾	0.144
¼, ⅜, ½ ⅝, ¾	FM	1 ½	1 ⅛	0.156
⅝, ¾, 1	FL	2	1 ½	0.201



Locating Ring

A stainless steel locating ring can be used as a retaining collar to position a FIREROD if mounting requirements are not critical.

On LA Stock, give location if the no-heat extension option is requested. On in-stock FIRERODs without an LA option, location will be on the last ¼ inch (6 mm). To order, specify **locating ring**.

Locating Ring Specifications

Minimum No-Heat Required inches				
Diameter	⅜	½	⅝	¾
Ring O.D.	⅝	¾	⅞	1

Cartridge Heaters

FIREROD

LA Stock

LA Build-a-Code Number

___-___ ___ ___

Stock Code Number
See List

Length Adder Code
See Below

Option Code
See Below

Lead Length ①

Example:

J12A89 - K W 74

Code Number

Length Adder Code

Option Code

Lead Length

① Lead length will be two inches (51 mm) longer than braid or hose unless otherwise specified on the order.

Option	Minimum Length Adders Per Diameter Per Option inches					Option Code
Heater Diameter	¼	⅜	½	⅝	¾	
Swaged-in Leads	D (3/16)	D (3/16)	D (3/16)	D (3/16)	D (3/16)	None
Right Angle Leads	H (7/16)	G (⅜)	H (7/16)	H (7/16)	H (7/16)	R
Teflon® Seal and Leads	— —	N (¾)	N (¾)	N (¾)	N (¾)	T
Right Angle Teflon® Seal and Leads	— —	1E (1¼)	1E (1¼)	1E (1¼)	1E (1¼)	B
Silicone Seal and Leads	— —	N (¾)	N (¾)	N (¾)	N (¾)	P
Straight Hose	G (⅜)	G (⅜)	G (⅜)	G (⅜)	G (⅜)	H
Right Angle Hose	— —	J (½)	K (9/16)	K 9/16)	N (¾)	W
Straight Hose with Teflon® Seal and Leads	— —	J (½)	J (½)	J (½)	J (½)	G
Straight Braid	G (⅜)	G (⅜)	G (⅜)	G (⅜)	G (⅜)	C
Right Angle Braid	— —	J (½)	K (9/16)	K (9/16)	N (⅜)	Y
Right Angle Braid with Teflon® Seal and Leads	— —	M (11/16)	N (¾)	P (13/16)	R (⅞)	A
SJO Cord	— —	— —	N (¾)	N (¾)	— —	S

LA options are available on all stock FIREROD s, except ⅛ inch diameter. To order any of these options, please build the order number by specifying Watlow code number, length adder code, option code and lead length.

Ordering Example: The order number **J12A89-K72W74** indicates you have ordered a 12 inch (305 mm) FIREROD with 72 inch (1830 mm) right angle stainless steel hose and 74 inch (1880 mm) leads. The overall heater length equals 12 9/16 inches (320 mm).

Note: No-heat extensions are available for most LA options in diameters of ⅜, ½, ⅝ and ¾ inch. Consult factory for available LA options. No-heat length extensions are available in the following dimensions.

No-Heat Length Adder Codes

No-Heat Option inches	(mm)	Length Adder Code
¾	(10)	N
1 ¼	(32)	1E
1 ¾	(44)	1N
2 ¼	(56)	2E

To order any of these dimensions, please specify the applicable length adder code shown. No-heat extensions on all termination options are shipped within two to three days.

How to Order

To order Stock FIREROD cartridge heaters, specify:

- Watlow code number
- Quantity
- Options
- Lead length: If not specified, 12-inch (305 mm) crimped on leads will be shipped.

For **made-to-order** FIREROD s, please specify:

- Diameter
- Overall length
- Volts
- Watts
- Lead option and length or terminal configuration
- Lead end no-heat if different from standard
- Optional accessories, finishing, internal construction, sensors/ controls and mounting

Availability

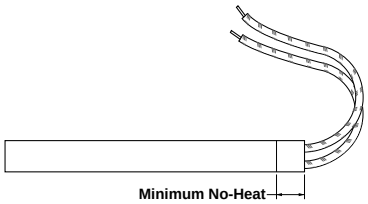
Stock: Same day shipment on many FIREROD stock options

Made-to-Order: Consult factory

FIREROD

Made-to-Order

Straight Options

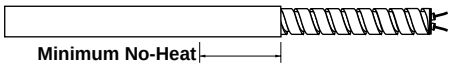


Swaged-in Flexible Leads

Swaged-in flexible leads are used in applications where a high degree of flexing exists or the leads must be bent sharply adjacent to the heater without exposing or breaking the conductor. The stranded wire leads are connected internally and exit through the lead end.

Minimum lead end no-heat required is 1 inches (24.5 mm). For heaters over 10 inches (250 mm) the minimum no-heat is 12 percent of overall length plus ¼ inch (6 mm).

To order please contact the factory.

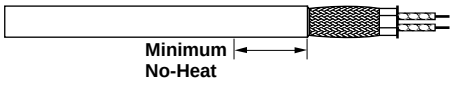


Made-to-Order Straight Stainless Steel Hose

Straight stainless steel hose provides the best protection against abrasion from sharp edges. It also offers ease of handling and wiring in abrasive environments. Unless specified a 12-inch (305 mm) hose is supplied. Leads are two inches (51 mm) longer than hose.

Minimum lead end no-heat required is 1½ inches (38 mm). For heaters over 10 inches (250 mm) the minimum no-heat is 12 percent of overall length plus ¼ inch (6 mm).

To order, specify **straight hose units 10 inches (250 mm) and under**.



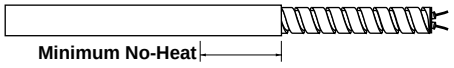
Made-to-Order Straight Stainless Steel Braid

Stainless steel braid is designed to protect leads from abrasion against sharp edges. It is the most flexible of Watlow's protective lead arrangements.

Unless specified a 12-inch (305 mm) braid is supplied. Leads are two inches (51 mm) longer than braid.

Minimum lead end no-heat required is 1½ inches (38 mm). For heaters over 10 inches (250 mm) the minimum no-heat is 12 percent of overall length plus ¼ inch (6 mm).

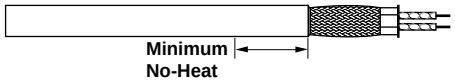
To order, specify **straight stainless steel braid**.



Made-to-Order Straight Stainless Steel Hose with Teflon® Leads and Seal

Straight stainless steel hose with Teflon® leads and seal for FIREROD s greater than 10 inches (250 mm) long with straight hose will have a minimum lead end no-heat required is 1½ inch (35 mm).

To order, specify **straight stainless steel hose**.



Made-to-Order Straight Stainless Steel Braid with Teflon® Leads and Seal

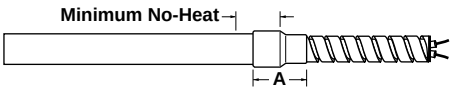
Straight stainless steel braid with Teflon® leads and seal for FIREROD s greater than 10 inches (250 mm) long with straight braid will have a minimum lead end no-heat required is 1½ inch (35 mm).

To order, specify **straight stainless steel braid with Teflon® leads and seal**.

Home Print

Made-to-Order

Straight Options
Continued



Made-to-Order Straight Galvanized BX Conduit

Galvanized BX conduit equals stainless steel hose in its abrasion protection. The conduit is attached with a crimped-on straight copper coupling which overlaps the heater sheath.

The ¼-inch (6 mm) diameter FIREROD s use stainless steel hose instead of conduit. On one-inch (25 mm) diameter FIREROD s, one inch O.D. flexible galvanized hose is used.

To order, specify **straight galvanized BX conduit**.

Dia. inches	No-Heat	Dim. inches	BX O.D.
¼	½	⅞	—
⅜	⅝	1	½
½	⅝	1 3/16	9/16
⅝	¾	1¼	9/16
¾	⅞	1½	9/16
1	1	1⅞	—

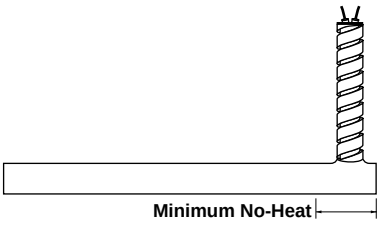
Right Angle Options

Made-to-Order Right Angle Leads

Made-to-order right angle leads are used when space is limited or a high degree of flexing occurs. However, these leads are externally connected (crimped) and insulated with fiberglass sleeving.

To order, specify **right angle leads** and **lead length**.

Dia. inches	Lead End Minimum No-Heat inches	(mm)
¼	7/16	(11)
⅜	½	(13)
½	⅝	(16)
⅝	¾	(19)
¾	⅞	(22)



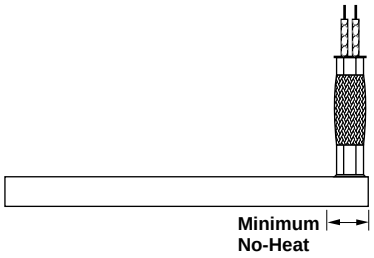
Made-to-Order Right Angle Stainless Steel Hose

Made-to-order right angle stainless steel hose, connected at a 90 degree angle, is provided for wiring convenience. Like the LA straight stainless steel hose, it protects leads from abrasion against sharp edges.

Unless specified, 12-inch (305 mm) hose is supplied. Leads are two inches (51 mm) longer than hose.

Option is also available with Teflon® leads and seal. To order, specify **right angle stainless steel hose**.

Dia. inches	Lead End Minimum No-Heat inches	(mm)
⅜	⅝	(16)
½	3/16	(21)
⅝	⅞	(22)
¾	1⅛	(29)



Made-to-Order Right Angle Stainless Steel Braid

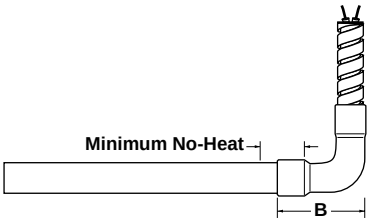
Made-to-order right angle stainless steel braid, connected at a 90 degree angle, is provided for wiring convenience. Like the LA straight stainless steel braid, it protects leads from abrasion against sharp edges.

Unless specified, 12-inch (305 mm) braid is supplied. Leads are two inches (51 mm) longer than braid. Option is also available with Teflon® leads and seal. To order, specify **right angle stainless steel braid**.

Dia. inches	Lead End Minimum No-Heat inches	(mm)
⅜	⅝	(16)
½	3/16	(17)
⅝	⅞	(22)
¾	1⅛	(29)

Made-to-Order

Right Angle Options
Continued



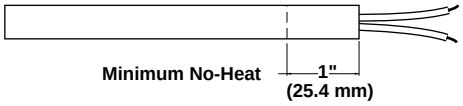
Made-to-Order Right Angle Galvanized BX Conduit

Galvanized BX conduit equals stainless steel hose in its abrasion protection. The conduit is attached with a crimped-on 90 degree elbow copper coupling which overlaps the heater sheath.

The ¼-inch diameter FIREROD s use stainless steel hose instead of conduit. On one-inch (25 mm) diameter FIREROD s, one inch O.D. flexible galvanized hose is used.

Dia. inches	No-Heat	Dim. inches	BX O.D.
¼	½	1 1/16	—
⅜	⅝	1⅜	½
½	⅝	1⅝	9/16
⅝	¾	2 1/16	9/16
¾	⅞	2⅛	9/16
1	1	2⅛	—

Moisture Resistant Seals

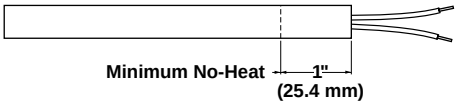


Teflon® Seal and Leads

Made-to-order Teflon® seal and leads protect the heater against moisture/ contamination from lubricating oil, cleaning solvents, plastic material or fumes and organic tapes. This seal is effective to 400°F (205°C) under continuous operation.

Teflon® seal and leads for made-to-order FIREROD s greater than 10 inches (250 mm) long will have a minimum unheated section of approximately 12 percent of the overall length. Longer no-heat sections are available if required.

Additional no-heat may be required to keep the seal below its maximum operating temperature.



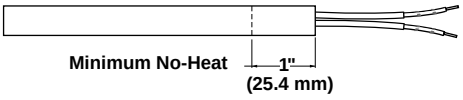
Silicone Rubber Seal and Leads

Made-to-order silicone rubber seal and leads protect the heater against moisture/ contamination from lubricating oil, cleaning solvents, plastic material or fumes and organic tapes. This seal is effective to 450°F (230°C) under continuous operation.

Silicone rubber seal and leads for made-to-order units greater than 10 inches (250 mm) long will have a minimum unheated section of approximately 12 percent of the overall length. Longer no-heat sections are available if required.

Made-to-Order

Termination Options

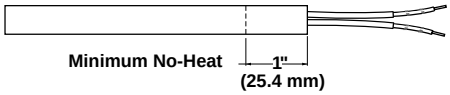


Epoxy Seal

Epoxy seals help protect the heater against moisture/contamination from lubricating oil, cleaning solvents, plastic material or fumes and organic tapes. These seals are effective to 500°F (260°C) under continuous operation.

Epoxy seals can be ordered only on units greater than ⅛ inch (3 mm) diameter with crimped on leads. Minimum unheated section at the lead end is one inch (25 mm). Longer unheated sections are available upon request.

To order, specify **epoxy seal**.

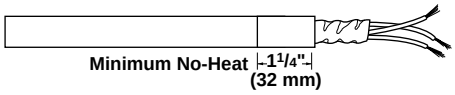


Hermetic Seal

Hermetic seals protect the heater against moisture/contamination from lubricating oil, cleaning solvents, plastic material or fumes and organic tapes. These seals are effective to 650°F (345°C) under continuous operation. Hermetic seals are supplied in units of ¼, ⅜ and ½ inch (6, 9 and 13 mm) diameter with 12 inch (305 mm) crimped on leads. The overall heater length is limited to nine inches (230 mm).

Minimum unheated section at lead end is one inch (25 mm). Longer unheated sections are available upon request.

To order, specify **hermetic seal**.



SJO Cord

SJO cord is used in low temperature applications where lead wires require protection against moisture or when UL® listed plugs are needed. This cord is limited to 140°F (60°C) under continuous operation.

FIRERODs greater than 10 inches (250 mm) long will have a minimum no-heat section of approximately 12 percent + ¼ inch (6 mm) of the overall length.

To order, specify either **two conductor or three conductor** as well as **overall length**.

Passivation

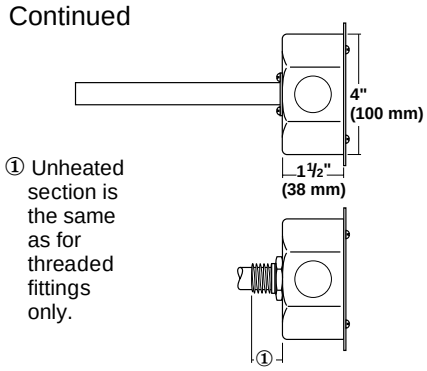
During the manufacturing and handling of stainless steel, particles of iron or tool steel may be embedded in the sheath. If not removed, these particles may corrode and produce rust spots. In critical sheath contact applications, like the medical industry, passivation will remove free iron from the sheath. To order, specify **316L stainless steel sheath** and **passivation**.

Cartridge Heaters

FIREROD

Made-to-Order

Termination Options
Continued

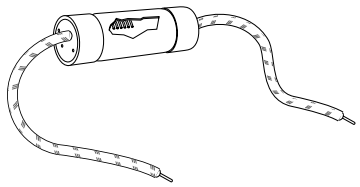


① Unheated section is the same as for threaded fittings only.

Terminal Box

A four inch (100 mm) NEMA 1 octagonal terminal box is mounted on a flange or a threaded fitting. Boxes have ½ inch (13 mm) conduit knockouts for electrical connection.

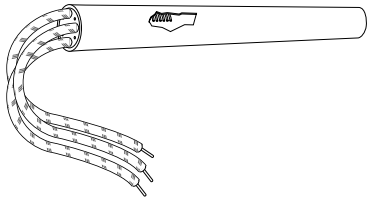
Hazardous location (NEMA 4 and NEMA 7) terminal boxes are also available. Consult your Watlow sales engineer or authorized distributor for details. Terminal boxes are available on ½ inch (13 mm) through one inch (25 mm) diameter FIRERODs. To order, specify **terminal box** and **NEMA type**.



Lead Out Each End

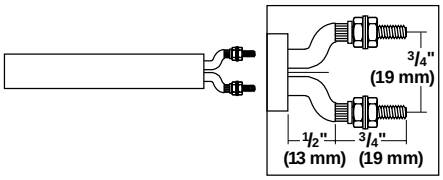
One power lead exiting out each end is used in applications with special wiring requirements.

This configuration is not available on all options. Consult the Watlow factory in St. Louis, Missouri, for additional information.



Ground Lead

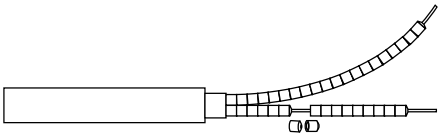
Ground leads are a safety feature to protect both workers and equipment. This configuration is not available on all options. Consult the Watlow factory in St. Louis, Missouri, for additional information. To order, specify **ground lead**.



Post Terminals

Post terminals provide a quick, secure connection with ring or fork connectors, or bus bars. Threaded 6-32 studs are soldered to the solid power pins. Nuts and washers are provided.

Post terminals are available on FIRERODs of ½, ⅝, ¾ and one inch (13, 16, 19 and 25 mm) diameter. On one inch (25 mm) diameters, pins are straight. To order, specify **post terminals**.

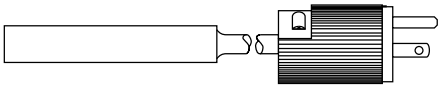


Ceramic Bead Insulation

Ceramic bead insulation protects the leads from high ambient temperatures above 840°F (450°C).

The beads fit over solid conductors that are extended long enough to reach a cooler area where flexible wires can be attached.

This option is not available on ⅛ inch (3 mm) diameter. The maximum available length on stock FIRERODs is 1½ inches (38 mm). To order, specify **ceramic beads** and length, and additional lead length.



UL® Listed Plugs

UL® listed plugs are a safe, convenient method of installation, especially when frequent connection or disconnection is required. These plugs have a nylon dead front, a molded-in cord grip and either straight or Twist-Lock® blades with or without ground.

Use UL® listed plugs with stainless steel hose, conduit, braid or lead wires with sleeving. To order, specify **UL® listed plugs**.

Twist-Lock® is a registered trademark of Hubbell Incorporated.

Home Print

Made-to-Order

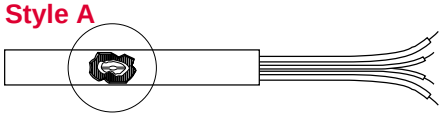
Options

Thermocouple Types

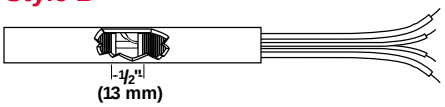
ASTM Code	Conductor Characteristics		Temperature Range °F (°C)
	Positive	Negative	
J	Iron (Magnetic) (White)	Constantan (Non-Magnetic) (Red)	0 to 1400 (-20 to 760)
K	Chromel® (Non-Magnetic) (Yellow)	Alumel® (Magnetic) (Red)	0 to 2300 (-20 to 1260)

For other ISA types, contact the Watlow factory in St. Louis, Missouri.

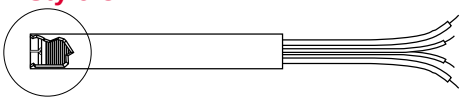
Style A



Style B



Style C



Internal Thermocouple

A Style A internal thermocouple can be used to evaluate heat transfer efficiency of an application … a measure that enables you to cut energy costs and increase heater life. This junction is located in the heater core to monitor the internal temperature of the heater.

The Style B internal thermocouple gives a good approximation of part temperature and can be located anywhere along the length of the heater. This style may be grounded or ungrounded.

This junction is located adjacent to the inside heater sheath in the center of the heated section unless other wise specified. A ½ inch (13 mm) unheated section is required.

A Style C internal thermocouple is useful in applications where material flows past the end of the heater, as in plastic molding. This junction is embedded in a special end disc. Unless requested, the disc end is not mechanically sealed.

To order, specify **internal thermo-couple**, **Style A, B** or **C** and **thermocouple ASTM Type J** or **K**.

If not specified, 12 inch (305 mm) power and thermocouple leads are supplied.

Availability

All styles are available on all diameters with the exception of ⅛ inch (3 mm) diameter, which is available only with Style C.

Low Electrical Leakage

This construction technique minimizes current leakage of the heating element. It is especially useful in critical applications, like the medical field where low set point ground fault interrupts are used.

Low electrical leakage is available on ⅜, ½, ⅝ and ¾ inch (9, 13, 16 and 19 mm) diameter FIRERODs. To order, specify **low electrical leakage**.

Cartridge Heaters

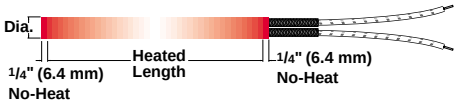
FIREROD

Made-to-Order

Options

Continued

Internal Construction



Distributed Wattage

Distributed wattage varies the watt density along the length of the heater. This construction technique is used to compensate for heat losses along the edges of heated parts. This is ideal for seal bar applications.

To order, specify **distributed wattage** and give the length and wattage for each section.

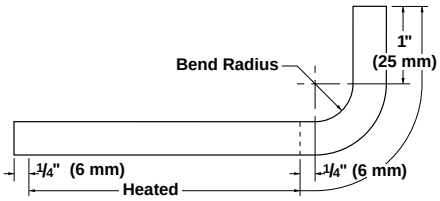
Individually Controlled Heat Zones

Individually controlled heat zones give the flexibility of controlling temperature by zones, along the length of the FIREROD. This is an advantage for heating requirements of certain applications, like sealing bars. This internal construction can be ordered on ⅝, ¾ and one inch (16, 19 and 25 mm) diameter FIRERODs. To order, specify **individually controlled heat zones** as well as wattage and length per zone.

Dual Voltage

When the FIREROD requires the flexibility of operating on two voltages, use this internal construction. Dual voltage is not compatible for all lead options. Consult the Watlow factory in St. Louis, Missouri, for availability. To order, specify **dual voltage** and voltage requirements.

Bent FIREROD



FIREROD Diameter in	Minimum Required No-Heat Length in (mm)	Bend Radius in (mm)
¼	2 ¼ (56)	½ (13)
⅜	2 ⅜ (60)	½ (13)
½	2 ⅞ (72)	¾ (19)
⅝	3 5/16 (83)	1 (25)
¾	3 13/16 (98)	1 ¼ (32)

In applications where the leads must exit at an angle, a bend can be made in the unheated section only. Heated sections may be on either side of the bend. It is recommended that the heater be bent at the Watlow factory.

A 304 stainless steel sheath is used on bent FIRERODs. If the sheath temperature exceeds 1000°F (540°C), consult your Watlow sales engineer or authorized distributor.

See dimensions noted on the chart, or contact the Watlow factory in St. Louis, Missouri, if you need to exceed limitations shown.

Centerless Grinding

FIREROD Diameter inches	Actual Precision Diameter inches
¼	0.241 ± 0.0005
⅜	0.363 ± 0.0005
½	0.488 ± 0.0005
⅝	0.613 ± 0.0005
¾	0.738 ± 0.0005
1	0.984 ± 0.0005

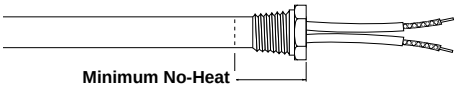
Centerless grinding can be used to furnish precision diameters, thus permitting closer heater-to-part fit. Therefore, higher watt densities can be used.

For centerless ground heaters, the heater must either have Teflon® leads and seal (maximum 12 inch lead length) or have crimped on leads. Longer lead lengths are available, but require external connection. The length of a FIREROD available for centerless grinding is dependent on the construction, please consult factory for assistance. To order, specify **centerless grinding**.

Home Print

Made-to-Order

Mounting Options



Mounted at lead end, unless otherwise specified and welded or silver soldered, depending upon construction.

Threaded Fittings

Threaded fittings allow for fast, water-tight installation of the heater into a threaded hole. These fittings can be ordered in either brass or 304 stainless steel. Other stainless steel alloys are available upon request. Double threaded fittings are also available.

To order, specify either brass or stainless steel **threaded fittings**.

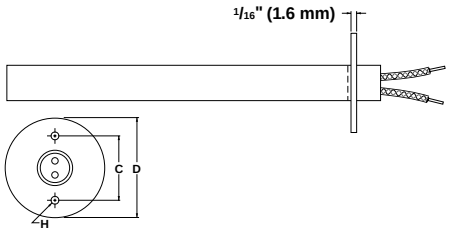
Made-to-order, specify location from disc end to bottom of threads.

Made-to-Order Availability

FIREROD Diameter inches	Minimum No-Heat inches	(mm)
¼	¾	(19)
⅜	1	(25)
½	1	(25)
⅝	1	(25)
¾	1 ¼	(32)
1	1 ¼	(32)

Threaded Fittings Specifications

FIREROD Diameter inches	Pipe Thread Size NPTF	Fitting Length inches	(mm)
¼	⅛	½	(13)
⅜	¼	11/16	(17)
½	⅜	¾	(19)
⅝	½	⅞	(22)
¾	¾	1	(23)
1	1	1	(25)



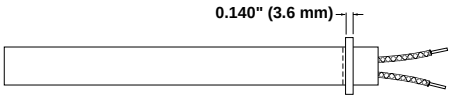
Flanges

Stainless steel flanges are a convenient mounting method as well as a way to position a heater within an application. Standard location is ¼ inch (6 mm) from lead end, however a specific location may be requested any place on the unheated section. Flanges can be staked, soldered or welded.

To order, specify **flange**, size and location.

Flange Specifications

FIREROD Diameter inches	Flange Size	inches D	C	H
¼, ⅜, ½	FS	1	¾	0.144
¼, ⅜, ½ ⅝, ¾	FM	1 ½	1 ⅛	0.156
⅝, ¾, 1	FL	2	1 ½	0.201



Locating Ring

A stainless steel locating ring can be used as a retaining collar to position a FIREROD if mounting requirements are not critical.

To order, specify **locating ring** and location.

Diameter inches:	⅜	½	⅝	¾
Ring O.D. inches:	5/8	3/4	7/8	1

Cartridge Heaters

F.O.B.: St. Louis, Missouri

FIREROD

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
⅛	1 ¼	(31.8)	120	25	87	(13)	0.02	(0.009)	Stock	**C1E14**
	1 ¼	(31.8)	120	50	174	(18)	0.02	(0.009)	Stock	**C1E13**
	1 ¼	(31.8)	240	35	113	(27)	0.02	(0.009)	Stock	**C1E42**
	1 ½	(38.1)	120	30	78	(12)	0.02	(0.009)	Stock	**C1J5**
	1 ½	(38.1)	120	60	156	(24)	0.02	(0.009)	Stock	**C1J6**
	2	(50.8)	120	50	87	(13)	0.02	(0.009)	Stock	**C2A4**
	2	(50.8)	120	100	174	(27)	0.02	(0.009)	Stock	**C2A5**
¼	1	(25.4)	120	80	208	(32)	0.02	(0.009)	Stock	**E1A51**
	1	(25.4)	120	100	260	(40)	0.02	(0.009)	Stock	**E1A52**
	1	(25.4)	120	150	390	(60)	0.02	(0.009)	Stock	**E1A53**
	1	(25.4)	240	100	250	(39)	0.02	(0.009)	Stock	**E1A66**
	1 ¼	(31.8)	120	75	130	(20)	0.02	(0.009)	Stock	**E1E41**
	1 ¼	(31.8)	120	100	173	(27)	0.02	(0.009)	Stock	**E1E42**
	1 ¼	(31.8)	120	150	260	(40)	0.02	(0.009)	Stock	**E1E43**
	1 ¼	(31.8)	240	225	390	(60)	0.02	(0.009)	Stock	**E1E61**
	1 ½	(38.1)	120	50	65	(10)	0.02	(0.009)	Stock	**E1J39**
	1 ½	(38.1)	120	100	130	(20)	0.02	(0.009)	Stock	**E1J40**
	1 ½	(38.1)	120	150	195	(30)	0.02	(0.009)	Stock	**E1J41**
	1 ½	(38.1)	240	175	228	(35)	0.02	(0.009)	Stock	**E1J49**
	1 ½	(38.1)	120	200	260	(40)	0.02	(0.009)	Stock	**E1J42**
	1 ½	(38.1)	240	200	260	(40)	0.02	(0.009)	Stock	**E1J52**
	1 ½	(38.1)	240	250	325	(50)	0.02	(0.009)	Stock	**E1J35**
	2	(50.8)	120	80	68	(11)	0.03	(0.014)	Stock	**E2A136**
	2	(50.8)	120	100	87	(13)	0.03	(0.014)	Stock	**E2A55**
	2	(50.8)	240	125	108	(17)	0.03	(0.014)	Stock	**E2A82**
	2	(50.8)	120	150	130	(20)	0.03	(0.014)	Stock	**E2A56**
	2	(50.8)	240	150	130	(20)	0.03	(0.014)	Stock	**E2A77**
	2	(50.8)	120	200	173	(27)	0.03	(0.014)	Stock	**E2A57**
	2	(50.8)	240	200	173	(27)	0.03	(0.014)	Stock	**E2A50**
	2	(50.8)	120	250	217	(33)	0.03	(0.014)	Stock	**E2A72**
	2	(50.8)	240	250	215	(33)	0.03	(0.014)	Stock	**E2A76**
	2	(50.8)	240	300	260	(40)	0.03	(0.014)	Stock	**E2A83**
	2 ½	(63.5)	120	250	159	(25)	0.03	(0.014)	Stock	**E2J80**
	2 ½	(63.5)	240	250	159	(25)	0.03	(0.014)	Stock	**E2J49**
	3	(76.2)	120	100	52	(8)	0.04	(0.018)	Stock	**E3A48**
	3	(76.2)	120	200	104	(16)	0.04	(0.018)	Stock	**E3A49**
	3	(76.2)	240	200	104	(16)	0.04	(0.018)	Stock	**E3A60**
	3	(76.2)	240	250	128	(20)	0.04	(0.018)	Stock	**E3A124**
	3	(76.2)	120	300	156	(24)	0.04	(0.018)	Stock	**E3A50**
	3	(76.2)	240	300	156	(24)	0.04	(0.018)	Stock	**E3A51**
	4	(101.6)	120	100	37	(6)	0.04	(0.018)	Stock	**E4A28**
	4	(101.6)	120	200	74	(11)	0.04	(0.018)	Stock	**E4A29**
	4	(101.6)	240	200	74	(11)	0.04	(0.018)	Stock	**E4A32**
	4	(101.6)	120	300	111	(17)	0.04	(0.018)	Stock	**E4A30**
	4	(101.6)	240	300	111	(17)	0.04	(0.018)	Stock	**E4A6**
	4 ½	(114.3)	120	200	64	(10)	0.05	(0.023)	Stock	**E4J30**
	5	(127)	240	350	101	(16)	0.05	(0.023)	Stock	**E5A45**
	5	(127)	120	400	113	(18)	0.05	(0.023)	Stock	**E5A57**
	5	(127)	240	400	113	(18)	0.05	(0.023)	Stock	**E5A34**
	6	(152.4)	240	400	94	(14)	0.06	(0.027)	Stock	**E6A46**
	8	(203.2)	240	800	136	(21)	0.08	(0.036)	Stock	**E8A76**

CONTINUED

Cartridge Heaters

FIREROD

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
⅜	1	(25.4)	120	55	95	(15)	0.03	(0.014)	Stock	**G1A71**
	1	(25.4)	120	100	172	(26)	0.03	(0.014)	Stock	**G1A29** ①
	1	(25.4)	120	150	259	(40)	0.03	(0.014)	Stock	**G1A38** ①
	1	(25.4)	240	200	344	(53)	0.03	(0.014)	Stock	**G1A83**
	1 ¼	(31.8)	120	100	115	(18)	0.03	(0.014)	Stock	**G1E91**
	1 ¼	(31.8)	120	125	144	(22)	0.03	(0.014)	Stock	**G1E74**
	1 ¼	(31.8)	120	150	172	(27)	0.03	(0.014)	Stock	**G1E92** ①
	1 ¼	(31.8)	240	150	172	(27)	0.03	(0.014)	Stock	**G1E93**
	1 ¼	(31.8)	120	200	230	(35)	0.03	(0.014)	Stock	**G1E94**
	1 ¼	(31.8)	240	200	230	(36)	0.03	(0.014)	Stock	**G1E95**
	1 ¼	(31.8)	120	400	426	(66)	0.03	(0.014)	Stock	**G1E99**
	1 5/16	(33.3)	120	100	104	(16)	0.03	(0.014)	Stock	**G1F13**
	1 5/16	(33.3)	240	100	104	(16)	0.03	(0.014)	Stock	**G1F15**
	1 5/16	(33.3)	120	150	160	(25)	0.03	(0.014)	Stock	**G1F17**
	1 ⅜	(34.9)	240	160	151	(23)	0.03	(0.014)	Stock	**G1G23**
	1 17/16	(36.5)	120	100	94	(15)	0.03	(0.014)	Stock	**G1H6**
	1 ½	(38.1)	120	50	43	(7)	0.04	(0.018)	Stock	**G1J25**
	1 ½	(38.1)	120	75	65	(10)	0.04	(0.018)	Stock	**G1J70**
	1 ½	(38.1)	120	80	68	(11)	0.04	(0.018)	Stock	**G1J66**
	1 ½	(38.1)	120	100	86	(13)	0.04	(0.018)	Stock	**G1J59**
	1 ½	(38.1)	240	100	86	(13)	0.04	(0.018)	Stock	**G1J110**
	1 ½	(38.1)	240	125	106	(16)	0.04	(0.018)	Stock	**G1J182**
	1 ½	(38.1)	120	150	129	(20)	0.04	(0.018)	Stock	**G1J31**
	1 ½	(38.1)	240	150	129	(20)	0.04	(0.018)	Stock	**G1J39** ①
	1 ½	(38.1)	120	200	173	(27)	0.04	(0.018)	Stock	**G1J85**
	1 ½	(38.1)	240	200	173	(27)	0.04	(0.018)	Stock	**G1J73**
	1 ½	(38.1)	120	250	216	(33)	0.04	(0.018)	Stock	**G1J86**
	1 ½	(38.1)	240	250	216	(33)	0.04	(0.018)	Stock	**G1J54**
	1 ¾	(44.5)	120	125	86	(13)	0.05	(0.023)	Stock	**G1N45**
	1 ¾	(44.5)	120	175	122	(19)	0.05	(0.023)	Stock	**G1N46**
	1 ¾	(44.5)	120	250	172	(27)	0.05	(0.023)	Stock	**G1N43**
	1 ¾	(44.5)	240	250	172	(27)	0.05	(0.023)	Stock	**G1N32**
	1 13/16	(46)	240	150	98	(15)	0.05	(0.023)	Stock	**G1P14**
	1 13/16	(46)	120	200	129	(20)	0.05	(0.023)	Stock	**G1P15**
	1 13/16	(46)	240	250	161	(25)	0.05	(0.023)	Stock	**G1P11**
	1 ⅞	(47.6)	120	250	152	(24)	0.05	(0.023)	Stock	**G1R14**
	2	(50.8)	120	50	29	(5)	0.06	(0.027)	Stock	**G2A53**
	2	(50.8)	120	75	42	(7)	0.06	(0.027)	Stock	**G2A192**
	2	(50.8)	120	100	57	(9)	0.06	(0.027)	Stock	**G2A84**
	2	(50.8)	240	100	57	(9)	0.06	(0.027)	Stock	**G2A76**
	2	(50.8)	120	150	86	(13)	0.06	(0.027)	Stock	**G2A56** ①
	2	(50.8)	240	150	86	(13)	0.06	(0.027)	Stock	**G2A81** ①
	2	(50.8)	120	200	115	(18)	0.06	(0.027)	Stock	**G2A127** ①
	2	(50.8)	240	200	115	(18)	0.06	(0.027)	Stock	**G2A37** ①
	2	(50.8)	120	250	144	(22)	0.06	(0.027)	Stock	**G2A47**
	2	(50.8)	240	250	144	(22)	0.06	(0.027)	Stock	**G2A73**
	2	(50.8)	120	300	172	(27)	0.06	(0.027)	Stock	**G2A139**
	2	(50.8)	240	300	172	(27)	0.06	(0.027)	Stock	**G2A98** ①
	2	(50.8)	120	400	230	(36)	0.06	(0.027)	Stock	**G2A153**
	2	(50.8)	240	400	230	(36)	0.06	(0.027)	Stock	**G2A146**
	2	(50.8)	120	500	282	(44)	0.06	(0.027)	Stock	**G2A95**

CONTINUED

① MI leads available from stock. Add "Z" after Code No. to order. ex: GIJ39Z

Cartridge Heaters

FIREROD

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
⅜	2	(50.8)	240	500	282	(44)	0.06	(0.027)	Stock	**G2A97**
	2 ⅛	(54)	240	200	106	(16)	0.06	(0.027)	Stock	**G2C13**
	2 ¼	(57.2)	120	75	37	(6)	0.07	(0.032)	Stock	**G2E88**
	2 ¼	(57.2)	120	125	62	(10)	0.07	(0.032)	Stock	**G2E89**
	2 ¼	(57.2)	240	125	62	(10)	0.07	(0.032)	Stock	**G2E138**
	2 ¼	(57.2)	240	150	73	(11)	0.07	(0.032)	Stock	**G2E68**
	2 ¼	(57.2)	120	175	86	(13)	0.07	(0.032)	Stock	**G2E90**
	2 ¼	(57.2)	120	250	123	(19)	0.07	(0.032)	Stock	**G2E2**
	2 ¼	(57.2)	240	250	123	(19)	0.07	(0.032)	Stock	**G2E78**
	2 ¼	(57.2)	120	300	148	(23)	0.07	(0.032)	Stock	**G2E108**
	2 ¼	(57.2)	240	300	148	(23)	0.07	(0.032)	Stock	**G2E12**
	2 ¼	(57.2)	120	350	173	(27)	0.07	(0.032)	Stock	**G2E91**
	2 ¼	(57.2)	240	350	173	(27)	0.07	(0.032)	Stock	**G2E75**
	2 ½	(63.5)	120	200	87	(13)	0.07	(0.032)	Stock	**G2J110**
	2 ½	(63.5)	240	200	87	(13)	0.07	(0.032)	Stock	**G2J81**
	2 ½	(63.5)	120	250	108	(17)	0.07	(0.032)	Stock	**G2J46**
	2 ½	(63.5)	240	250	108	(17)	0.07	(0.032)	Stock	**G2J80**
	2 ½	(63.5)	120	300	130	(20)	0.07	(0.032)	Stock	**G2J118**
	2 ½	(63.5)	240	300	130	(20)	0.07	(0.032)	Stock	**G2J119**
	2 ½	(63.5)	120	400	174	(27)	0.07	(0.032)	Stock	**G2J26**
	2 ½	(63.5)	240	400	174	(27)	0.07	(0.032)	Stock	**G2J146**
	2 ½	(63.5)	120	500	216	(33)	0.07	(0.032)	Stock	**G2J109**
	2 ½	(63.5)	240	500	216	(33)	0.07	(0.032)	Stock	**G2J52**
	2 13/16	(71.4)	120	60	22	(3)	0.08	(0.036)	Stock	**G2P9**
	2 13/16	(71.4)	120	250	92	(14)	0.08	(0.036)	Stock	**G2P3**
	2 13/16	(71.4)	240	300	110	(17)	0.08	(0.036)	Stock	**G2P5**
	3	(76.2)	120	100	34	(5)	0.08	(0.036)	Stock	**G3A55**
	3	(76.2)	240	100	34	(5)	0.08	(0.036)	Stock	**G3A137**
	3	(76.2)	120	150	52	(8)	0.08	(0.036)	Stock	**G3A121**
	3	(76.2)	120	200	69	(11)	0.08	(0.036)	Stock	**G3A61**
	3	(76.2)	240	200	69	(11)	0.08	(0.036)	Stock	**G3A39** ①
	3	(76.2)	120	250	86	(13)	0.08	(0.036)	Stock	**G3A52**
	3	(76.2)	240	250	86	(13)	0.08	(0.036)	Stock	**G3A54**
	3	(76.2)	120	300	104	(16)	0.08	(0.036)	Stock	**G3A73** ①
	3	(76.2)	240	300	104	(16)	0.08	(0.036)	Stock	**G3A92**
	3	(76.2)	120	400	138	(21)	0.08	(0.036)	Stock	**G3A44**
	3	(76.2)	240	400	138	(21)	0.08	(0.036)	Stock	**G3A65**
	3	(76.2)	120	500	173	(27)	0.08	(0.036)	Stock	**G3A119** ①
	3	(76.2)	240	500	173	(27)	0.08	(0.036)	Stock	**G3A120**
	3	(76.2)	240	600	208	(32)	0.08	(0.036)	Stock	**G3A133**
	3 5/16	(84.2)	120	500	152	(24)	0.08	(0.036)	Stock	**G3F24**
	3 ½	(88.9)	120	250	72	(11)	0.09	(0.041)	Stock	**G3J77**
	3 ½	(88.9)	240	250	72	(11)	0.09	(0.041)	Stock	**G3J65**
	3 ½	(88.9)	120	300	87	(13)	0.09	(0.041)	Stock	**G3J87**
	3 ½	(88.9)	240	300	87	(13)	0.09	(0.041)	Stock	**G3J68**
	3 ½	(88.9)	120	500	144	(22)	0.09	(0.041)	Stock	**G3J22**
	3 ½	(88.9)	240	500	144	(22)	0.09	(0.041)	Stock	**G3J63**
	3 13/16	(96.8)	120	150	38	(6)	0.09	(0.041)	Stock	**G3P8**
	3 13/16	(96.8)	240	500	128	(20)	0.09	(0.041)	Stock	**G3P3**
	4	(101.6)	120	125	31	(5)	0.09	(0.041)	Stock	**G4A54**
	4	(101.6)	240	125	31	(5)	0.09	(0.041)	Stock	**G4A163**

CONTINUED

① MI leads available from stock. Add "Z" after Code No. to order.

Cartridge Heaters

FIREROD

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
⅜	4	(101.6)	120	150	37	(6)	0.09	(0.041)	Stock	**G4A78**
	4	(101.6)	120	175	43	(7)	0.09	(0.041)	Stock	**G4A191**
	4	(101.6)	120	250	62	(10)	0.09	(0.041)	Stock	**G4A40**
	4	(101.6)	240	250	62	(10)	0.09	(0.041)	Stock	**G4A87**
	4	(101.6)	120	300	74	(11)	0.09	(0.041)	Stock	**G4A94**
	4	(101.6)	240	300	74	(11)	0.09	(0.041)	Stock	**G4A95**
	4	(101.6)	120	400	99	(15)	0.09	(0.041)	Stock	**G4A48**
	4	(101.6)	240	400	99	(15)	0.09	(0.041)	Stock	**G4A44**
	4	(101.6)	240	450	109	(17)	0.09	(0.041)	Stock	**G4A64**
	4	(101.6)	120	500	123	(19)	0.09	(0.041)	Stock	**G4A96**
	4	(101.6)	240	500	123	(19)	0.09	(0.041)	Stock	**G4A92** ①
	4	(101.6)	120	550	134	(21)	0.09	(0.041)	Stock	**G4A200**
	4 ¼	(108)	240	300	67	(10)	0.09	(0.041)	Stock	**G4E25**
	4 ¼	(108)	240	750	167	(26)	0.09	(0.041)	Stock	**G4E15**
	4 ½	(114.3)	120	300	65	(10)	0.10	(0.045)	Stock	**G4J54**
	4 ½	(114.3)	240	300	65	(10)	0.10	(0.045)	Stock	**G4J33**
	4 ½	(114.3)	120	500	108	(17)	0.10	(0.045)	Stock	**G4J55**
	4 ½	(114.3)	240	500	108	(17)	0.10	(0.045)	Stock	**G4J37**
	4 13/16	(122.2)	240	300	59	(9)	0.11	(0.050)	Stock	**G4P11**
	4 13/16	(122.2)	240	500	98	(15)	0.11	(0.050)	Stock	**G4P3**
	5	(127)	120	150	29	(4)	0.11	(0.050)	Stock	**G5A68**
	5	(127)	240	150	29	(4)	0.11	(0.050)	Stock	**G5A56**
	5	(127)	120	300	58	(9)	0.11	(0.050)	Stock	**G5A69**
	5	(127)	240	300	58	(9)	0.11	(0.050)	Stock	**G5A70** ①
	5	(127)	120	500	96	(15)	0.11	(0.050)	Stock	**G5A38**
	5	(127)	240	500	96	(15)	0.11	(0.050)	Stock	**G5A71** ①
	5	(127)	240	750	144	(22)	0.11	(0.050)	Stock	**G5A67**
	5	(127)	240	1000	192	(30)	0.11	(0.050)	Stock	**G5A115**
	5 ¼	(133.4)	240	200	45	(7)	0.12	(0.054)	Stock	**G5E16**
	5 ½	(139.7)	240	600	104	(16)	0.12	(0.054)	Stock	**G5J36**
	5 ½	(139.7)	240	1000	173	(27)	0.12	(0.054)	Stock	**G5J45**
	6	(152.4)	120	200	31	(5)	0.13	(0.059)	Stock	**G6A80**
	6	(152.4)	120	250	39	(6)	0.13	(0.059)	Stock	**G6A40** ①
	6	(152.4)	240	250	39	(6)	0.13	(0.059)	Stock	**G6A92**
	6	(152.4)	120	400	63	(10)	0.13	(0.059)	Stock	**G6A81**
	6	(152.4)	240	400	63	(10)	0.13	(0.059)	Stock	**G6A82**
	6	(152.4)	120	500	79	(12)	0.13	(0.059)	Stock	**G6A125**
	6	(152.4)	240	500	79	(12)	0.13	(0.059)	Stock	**G6A59**
	6	(152.4)	120	600	94	(15)	0.13	(0.059)	Stock	**G6A56**
	6	(152.4)	240	600	94	(15)	0.13	(0.059)	Stock	**G6A51**
	6	(152.4)	240	750	117	(18)	0.13	(0.059)	Stock	**G6A46**
	6	(152.4)	240	1000	157	(24)	0.13	(0.059)	Stock	**G6A83**
	6 ½	(165.1)	240	600	86	(13)	0.14	(0.064)	Stock	**G6J23**
	6 ½	(165.1)	240	1000	144	(22)	0.14	(0.064)	Stock	**G6J33**
	7	(177.8)	120	250	33	(5)	0.14	(0.064)	Stock	**G7A40**
	7	(177.8)	240	250	33	(5)	0.14	(0.064)	Stock	**G7A32**
	7	(177.8)	240	500	65	(10)	0.14	(0.064)	Stock	**G7A30**
	7	(177.8)	120	600	80	(12)	0.14	(0.064)	Stock	**G7A41**
	7	(177.8)	240	600	80	(12)	0.14	(0.064)	Stock	**G7A42** ①
	7	(177.8)	240	1000	133	(21)	0.14	(0.064)	Stock	**G7A43** ①
	7 ½	(190.5)	240	600	74	(11)	0.15	(0.068)	Stock	**G7J27** ①

CONTINUED

① MI leads available from stock. Add "Z" after Code No. to order.

Cartridge Heaters

FIREROD

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
⅜	7 ½	(190.5)	240	1000	124	(19)	0.15	(0.068)	Stock	**G7J28**
	7 13/16	(198.5)	240	750	87	(13)	0.15	(0.068)	Stock	**G7P5**
	8	(203.2)	120	300	34	(5)	0.16	(0.073)	Stock	**G8A54**
	8	(203.2)	240	300	34	(5)	0.16	(0.073)	Stock	**G8A47**
	8	(203.2)	120	400	45	(7)	0.16	(0.073)	Stock	**G8A109**
	8	(203.2)	120	500	58	(9)	0.16	(0.073)	Stock	**G8A81**
	8	(203.2)	240	500	58	(9)	0.16	(0.073)	Stock	**G8A32**
	8	(203.2)	120	600	69	(11)	0.16	(0.073)	Stock	**G8A53**
	8	(203.2)	240	600	69	(11)	0.16	(0.073)	Stock	**G8A37**
	8	(203.2)	240	700	79	(12)	0.16	(0.073)	Stock	**G8A98**
	8	(203.2)	240	1000	115	(18)	0.16	(0.073)	Stock	**G8A45** ①
	8 ⅝	(219)	240	500	52	(8)	0.17	(0.077)	Stock	**G8L3**
	9	(228.6)	240	1000	100	(16)	0.18	(0.082)	Stock	**G9A37**
	9 ½	(241.3)	240	600	57	(9)	0.19	(0.086)	Stock	**G9J20**
	9 ½	(241.3)	240	1000	96	(15)	0.19	(0.086)	Stock	**G9J12**
	10	(254)	120	400	36	(6)	0.19	(0.086)	Stock	**G10A48**
	10	(254)	120	600	54	(8)	0.19	(0.086)	Stock	**G10A35**
	10	(254)	240	600	54	(8)	0.19	(0.086)	Stock	**G10A31** ①
	10	(254)	240	1000	91	(14)	0.19	(0.086)	Stock	**G10A32**
	10 13/16	(274.7)	240	375	31	(5)	0.20	(0.091)	Stock	**G10P5**
	12	(304.8)	120	400	30	(5)	0.22	(0.100)	Stock	**G12A45**
	12	(304.8)	120	600	45	(7)	0.22	(0.100)	Stock	**G12A29**
	12	(304.8)	240	600	45	(7)	0.22	(0.100)	Stock	**G12A46**
	12	(304.8)	240	1000	75	(12)	0.22	(0.100)	Stock	**G12A47** ①
	12 13/16	(325.5)	240	1000	69	(11)	0.23	(0.104)	Stock	**G12P3**
½	1	(25.4)	120	50	65	(10)	0.06	(0.027)	Stock	**J1A30**
	1	(25.4)	120	150	193	(30)	0.06	(0.027)	Stock	**J1A31**
	1 ¼	(31.8)	120	50	43	(7)	0.07	(0.032)	Stock	**J1E50**
	1 ¼	(31.8)	120	125	107	(17)	0.07	(0.032)	Stock	**J1E51**
	1 ¼	(31.8)	240	125	107	(17)	0.07	(0.032)	Stock	**J1E58**
	1 ¼	(31.8)	240	200	172	(27)	0.07	(0.032)	Stock	**J1E52**
	1 ¼	(31.8)	240	250	212	(33)	0.07	(0.032)	Stock	**J1E88**
	1 ½	(38.1)	120	50	32	(3)	0.08	(0.036)	Stock	**J1J47**
	1 ½	(38.1)	120	150	97	(15)	0.08	(0.036)	Stock	**J1J48**
	1 ½	(38.1)	240	150	97	(15)	0.08	(0.036)	Stock	**J1J96**
	1 ½	(38.1)	120	200	128	(20)	0.08	(0.036)	Stock	**J1J59**
	1 ½	(38.1)	240	200	128	(20)	0.08	(0.036)	Stock	**J1J38**
	2	(50.8)	120	75	32	(5)	0.09	(0.041)	Stock	**J2A80**
	2	(50.8)	120	200	86	(13)	0.09	(0.041)	Stock	**J2A49**
	2	(50.8)	240	200	86	(13)	0.09	(0.041)	Stock	**J2A75**
	2	(50.8)	120	250	108	(17)	0.09	(0.041)	Stock	**J2A85**
	2	(50.8)	240	250	108	(17)	0.09	(0.041)	Stock	**J2A71** ①
	2	(50.8)	120	300	128	(20)	0.09	(0.041)	Stock	**J2A95**
	2	(50.8)	240	300	128	(20)	0.09	(0.041)	Stock	**J2A96**
	2	(50.8)	120	400	171	(27)	0.09	(0.041)	Stock	**J2A81**
	2	(50.8)	240	400	171	(27)	0.09	(0.041)	Stock	**J2A82**
	2 ¼	(57.2)	120	75	28	(4)	0.10	(0.045)	Stock	**J2E86**
	2 ¼	(57.2)	120	125	46	(7)	0.10	(0.045)	Stock	**J2E87**
	2 ¼	(57.2)	120	250	92	(14)	0.10	(0.045)	Stock	**J2E56**
	2 ¼	(57.2)	240	250	92	(14)	0.10	(0.045)	Stock	**J2E69**
	2 ¼	(57.2)	120	400	147	(22)	0.10	(0.045)	Stock	**J2E114**

CONTINUED

① MI leads available from stock. Add "Z" after Code No. to order.

Cartridge Heaters

FIREROD

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
½	2 ¼	(57.2)	240	400	147	(22)	0.10	(0.045)	Stock	**J2E115**
	2 ¼	(57.2)	120	500	184	(29)	0.10	(0.045)	Stock	**J2E64**
	2 ¼	(57.2)	240	500	184	(29)	0.10	(0.045)	Stock	**J2E88**
	2 ⅜	(60.3)	120	100	34	(5)	0.10	(0.045)	Stock	**J2G35**
	2 ⅜	(60.3)	240	100	34	(5)	0.10	(0.045)	Stock	**J2G28**
	2 ⅜	(60.3)	120	250	86	(13)	0.10	(0.045)	Stock	**J2G34**
	2 ⅜	(60.3)	240	250	86	(13)	0.10	(0.045)	Stock	**J2G37**
	2 ⅜	(60.3)	120	500	172	(27)	0.10	(0.045)	Stock	**J2G36**
	2 ⅜	(60.3)	240	500	172	(27)	0.10	(0.045)	Stock	**J2G38**
	2 ½	(63.5)	120	100	32	(5)	0.11	(0.050)	Stock	**J2J67**
	2 ½	(63.5)	240	100	32	(5)	0.11	(0.050)	Stock	**J2J57**
	2 ½	(63.5)	120	250	81	(13)	0.11	(0.050)	Stock	**J2J68**
	2 ½	(63.5)	240	250	81	(13)	0.11	(0.050)	Stock	**J2J69**
	2 ½	(63.5)	120	300	96	(15)	0.11	(0.050)	Stock	**J2J109**
	2 ½	(63.5)	240	300	96	(15)	0.11	(0.050)	Stock	**J2J110**
	2 ½	(63.5)	120	400	128	(20)	0.11	(0.050)	Stock	**J2J81**
	2 ½	(63.5)	240	400	128	(20)	0.11	(0.050)	Stock	**J2J82**
	2 ½	(63.5)	120	500	161	(24)	0.11	(0.050)	Stock	**J2J66**
	2 ½	(63.5)	240	500	161	(24)	0.11	(0.050)	Stock	**J2J70**
	2 9/16	(65.1)	120	350	108	(17)	0.11	(0.050)	Stock	**J2K6**
	2 9/16	(65.1)	240	300	93	(14)	0.11	(0.050)	Stock	**J2K3**
	2 ¾	(69.9)	240	400	115	(18)	0.11	(0.050)	Stock	**J2N43**
	2 ¾	(69.9)	120	400	115	(18)	0.11	(0.050)	Stock	**J2N45**
	3	(76.2)	120	125	32	(5)	0.12	(0.054)	Stock	**J3A108**
	3	(76.2)	240	125	32	(5)	0.12	(0.054)	Stock	**J3A109**
	3	(76.2)	120	250	64	(10)	0.12	(0.054)	Stock	**J3A107**
	3	(76.2)	240	250	64	(10)	0.12	(0.054)	Stock	**J3A89**
	3	(76.2)	120	300	78	(12)	0.12	(0.054)	Stock	**J3A65**
	3	(76.2)	120	350	89	(14)	0.12	(0.054)	Stock	**J3A173**
	3	(76.2)	240	300	78	(12)	0.12	(0.054)	Stock	**J3A73**
	3	(76.2)	120	400	104	(16)	0.12	(0.054)	Stock	**J3A132**
	3	(76.2)	240	400	104	(16)	0.12	(0.054)	Stock	**J3A29**
	3	(76.2)	120	500	129	(20)	0.12	(0.054)	Stock	**J3A110**
	3	(76.2)	240	500	129	(20)	0.12	(0.054)	Stock	**J3A111**
	3	(76.2)	120	600	154	(24)	0.12	(0.054)	Stock	**J3A51**
	3	(76.2)	240	600	154	(24)	0.12	(0.054)	Stock	**J3A127**
	3	(76.2)	120	750	193	(30)	0.12	(0.054)	Stock	**J3A137**
	3	(76.2)	240	750	193	(30)	0.12	(0.054)	Stock	**J3A112**
	3	(76.2)	120	1000	254	(39)	0.12	(0.054)	Stock	**J3A79**
	3 ½	(88.9)	120	250	54	(8)	0.14	(0.064)	Stock	**J3J44**
	3 ½	(88.9)	240	250	54	(8)	0.14	(0.064)	Stock	**J3J64**
	3 ½	(88.9)	240	350	75	(12)	0.14	(0.064)	Stock	**J3J65**
	3 ½	(88.9)	120	500	107	(17)	0.14	(0.064)	Stock	**J3J45**
	3 ½	(88.9)	240	500	107	(17)	0.14	(0.064)	Stock	**J3J46**
	3 ½	(88.9)	240	750	162	(25)	0.14	(0.064)	Stock	**J3J63**
	3 13/16	(96.8)	120	500	96	(15)	0.15	(0.068)	Stock	**J3P9**
	3 13/16	(96.8)	240	250	48	(7)	0.15	(0.068)	Stock	**J3P2**
	4	(101.6)	120	150	28	(4)	0.15	(0.068)	Stock	**J4A117**
	4	(101.6)	240	150	28	(4)	0.15	(0.068)	Stock	**J4A122**
	4	(101.6)	120	250	46	(7)	0.15	(0.068)	Stock	**J4A118**
	4	(101.6)	240	250	46	(7)	0.15	(0.068)	Stock	**J4A90** ①

CONTINUED

Cartridge Heaters

FIREROD

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
½	4	(101.6)	120	300	56	(9)	0.15	(0.068)	Stock	**J4A63**
	4	(101.6)	240	300	56	(9)	0.15	(0.068)	Stock	**J4A26**
	4	(101.6)	120	350	65	(10)	0.15	(0.068)	Stock	**J4A1**
	4	(101.6)	240	350	65	(10)	0.15	(0.068)	Stock	**J4A103**
	4	(101.6)	120	400	74	(11)	0.15	(0.068)	Stock	**J4A139**
	4	(101.6)	240	400	74	(11)	0.15	(0.068)	Stock	**J4A68**
	4	(101.6)	120	500	92	(14)	0.15	(0.068)	Stock	**J4A16**
	4	(101.6)	120	550	100	(16)	0.15	(0.068)	Stock	**J4A242**
	4	(101.6)	240	500	92	(14)	0.15	(0.068)	Stock	**J4A92**
	4	(101.6)	120	750	138	(21)	0.15	(0.068)	Stock	**J4A198**
	4	(101.6)	240	750	138	(21)	0.15	(0.068)	Stock	**J4A119**
	4	(101.6)	240	1000	184	(28)	0.15	(0.068)	Stock	**J4A73**
	4 ½	(114.3)	120	500	80	(12)	0.17	(0.077)	Stock	**J4J69**
	4 ½	(114.3)	240	500	80	(12)	0.17	(0.077)	Stock	**J4J57**
	4 ½	(114.3)	120	750	120	(19)	0.17	(0.077)	Stock	**J4J70**
	4 ½	(114.3)	240	750	120	(19)	0.17	(0.077)	Stock	**J4J32**
	4 13/16	(122.2)	240	300	44	(7)	0.19	(0.086)	Stock	**J4P3**
	4 13/16	(122.2)	240	1000	148	(23)	0.19	(0.086)	Stock	**J4P6**
	5	(127)	120	200	29	(4)	0.19	(0.086)	Stock	**J5A85**
	5	(127)	240	200	29	(4)	0.19	(0.086)	Stock	**J5A74**
	5	(127)	120	350	50	(8)	0.19	(0.086)	Stock	**J5A86**
	5	(127)	240	350	50	(8)	0.19	(0.086)	Stock	**J5A63**
	5	(127)	120	400	58	(9)	0.19	(0.086)	Stock	**J5A98**
	5	(127)	240	400	58	(9)	0.19	(0.086)	Stock	**J5A46**
	5	(127)	120	500	72	(11)	0.19	(0.086)	Stock	**J5A52**
	5	(127)	240	500	72	(11)	0.19	(0.086)	Stock	**J5A45** ①
	5	(127)	120	750	108	(17)	0.19	(0.086)	Stock	**J5A121**
	5	(127)	240	750	108	(17)	0.19	(0.086)	Stock	**J5A72**
	5	(127)	240	1000	143	(22)	0.19	(0.086)	Stock	**J5A87**
	5 ½	(139.7)	240	200	25	(4)	0.20	(0.091)	Stock	**J5J3**
	5 ½	(139.7)	120	500	64	(10)	0.20	(0.091)	Stock	**J5J43**
	5 ½	(139.7)	240	500	64	(10)	0.20	(0.091)	Stock	**J5J33**
	5 ½	(139.7)	240	650	83	(13)	0.20	(0.091)	Stock	**J5J69**
	5 ½	(139.7)	120	750	97	(15)	0.20	(0.091)	Stock	**J5J44**
	5 ½	(139.7)	240	750	97	(15)	0.20	(0.091)	Stock	**J5J45**
	5 ¾	(146)	120	700	86	(13)	0.20	(0.091)	Stock	**J5N6**
	5 ¾	(146)	240	700	86	(13)	0.20	(0.091)	Stock	**J5N8**
	5 13/16	(147.6)	240	300	36	(6)	0.21	(0.095)	Stock	**J5P10**
	6	(152.4)	120	250	29	(4)	0.21	(0.095)	Stock	**J6A114**
	6	(152.4)	240	250	29	(4)	0.21	(0.095)	Stock	**J6A171**
	6	(152.4)	240	300	35	(6)	0.21	(0.095)	Stock	**J6A66**
	6	(152.4)	240	350	41	(7)	0.21	(0.095)	Stock	**J6A119**
	6	(152.4)	120	500	59	(9)	0.21	(0.095)	Stock	**J6A115**
	6	(152.4)	240	500	59	(9)	0.21	(0.095)	Stock	**J6A94** ①
	6	(152.4)	480	500	59	(9)	0.21	(0.095)	Stock	**J6A301**②
	6	(152.4)	120	750	88	(14)	0.21	(0.095)	Stock	**J6A99**
	6	(152.4)	240	750	88	(14)	0.21	(0.095)	Stock	**J6A90**
	6	(152.4)	120	1000	117	(18)	0.21	(0.095)	Stock	**J6A53**
	6	(152.4)	240	1000	117	(18)	0.21	(0.095)	Stock	**J6A36** ①
	6 ½	(165.1)	240	500	54	(8)	0.23	(0.104)	Stock	**J6J45**
	6 ½	(165.1)	240	1000	108	(17)	0.23	(0.104)	Stock	**J6J27** ①

CONTINUED

① MI leads available from stock. Add "Z" after Code No. to order.
② Units with 480 volts cannot be supplied with LA lead terminations.

Cartridge Heaters

FIREROD

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
½	7	(177.8)	120	250	25	(4)	0.24	(0.109)	Stock	**J7A79**
	7	(177.8)	120	500	50	(8)	0.24	(0.109)	Stock	**J7A80**
	7	(177.8)	240	500	50	(8)	0.24	(0.109)	Stock	**J7A57**
	7	(177.8)	120	600	60	(9)	0.24	(0.109)	Stock	**J7A50**
	7	(177.8)	240	600	60	(9)	0.24	(0.109)	Stock	**J7A95**
	7	(177.8)	240	1000	99	(15)	0.24	(0.109)	Stock	**J7A81**
	7 ½	(190.5)	240	500	46	(7)	0.26	(0.118)	Stock	**J7J25**
	7 ½	(190.5)	240	1000	92	(14)	0.26	(0.118)	Stock	**J7J26**
	8	(203.2)	120	300	26	(4)	0.28	(0.127)	Stock	**J8A71**
	8	(203.2)	240	300	26	(4)	0.28	(0.127)	Stock	**J8A111**
	8	(203.2)	120	500	43	(7)	0.28	(0.127)	Stock	**J8A64**
	8	(203.2)	240	500	43	(7)	0.28	(0.127)	Stock	**J8A66**
	8	(203.2)	120	1000	86	(13)	0.28	(0.127)	Stock	**J8A84**
	8	(203.2)	240	1000	86	(13)	0.28	(0.127)	Stock	**J8A60**
	8	(203.2)	480	1000	86	(13)	0.28	(0.127)	Stock	**J8A35** ②
	8	(203.2)	240	1500	129	(20)	0.28	(0.127)	Stock	**J8A100**
	8	(203.2)	240	2000	172	(27)	0.28	(0.127)	Stock	**J8A101** ①
	8 ½	(215.9)	240	300	24	(4)	0.29	(0.132)	Stock	**J8J39**
	8 ½	(215.9)	240	500	40	(6)	0.29	(0.132)	Stock	**J8J30**
	8 ½	(215.9)	240	1000	80	(12)	0.29	(0.132)	Stock	**J8J28**
	9	(228.6)	240	500	38	(6)	0.30	(0.136)	Stock	**J9A35**
	9	(228.6)	240	1000	76	(12)	0.30	(0.136)	Stock	**J9A58**
	9 ½	(241.3)	240	500	36	(6)	0.32	(0.145)	Stock	**J9J14**
	9 ½	(241.3)	240	1000	72	(11)	0.32	(0.145)	Stock	**J9J12** ①
	10	(254)	120	500	34	(5)	0.33	(0.150)	Stock	**J10A61**
	10	(254)	240	500	34	(5)	0.33	(0.150)	Stock	**J10A62**
	10	(254)	120	1000	68	(11)	0.33	(0.150)	Stock	**J10A63**
	10	(254)	240	1000	68	(11)	0.33	(0.150)	Stock	**J10A42**
	10	(254)	240	1500	102	(16)	0.33	(0.150)	Stock	**J10A33**
	10	(254)	240	2000	136	(21)	0.33	(0.150)	Stock	**J10A64** ①
	11	(279.4)	240	1000	61	(9)	0.36	(0.163)	Stock	**J11A60**
	12	(304.8)	120	500	28	(4)	0.40	(0.181)	Stock	**J12A63**
	12	(304.8)	240	500	28	(4)	0.40	(0.181)	Stock	**J12A76**
	12	(304.8)	120	1000	56	(9)	0.40	(0.181)	Stock	**J12A40**
	12	(304.8)	240	1000	56	(9)	0.40	(0.181)	Stock	**J12A49**
	12	(304.8)	480	1200	66	(10)	0.40	(0.181)	Stock	**J12A215** ②
	12	(304.8)	240	1500	84	(13)	0.40	(0.181)	Stock	**J12A37**
	12	(304.8)	240	2000	112	(17)	0.40	(0.181)	Stock	**J12A89**
	14	(355.6)	240	1000	48	(7)	0.48	(0.218)	Stock	**J14A41**
	14	(355.6)	240	2300	110	(17)	0.48	(0.218)	Stock	**J14A39**
	15	(381)	240	1500	66	(10)	0.50	(0.227)	Stock	**J15A19**
	16	(406.4)	240	1000	41	(7)	0.52	(0.236)	Stock	**J16A12**
	18	(457.2)	240	1500	55	(9)	0.57	(0.259)	Stock	**J18A19**
	18	(457.2)	240	1700	62	(9)	0.57	(0.259)	Stock	**J18A23**
⅝	1 ¼	(31.8)	120	50	34	(5)	0.10	(0.045)	Stock	**L1E26**
	1 ¼	(31.8)	120	200	137	(21)	0.10	(0.045)	Stock	**L1E24**
	1 ¼	(31.8)	120	250	171	(27)	0.10	(0.045)	Stock	**L1E27**
	1 ½	(38.1)	120	250	128	(20)	0.11	(0.050)	Stock	**L1J23**
	1 ½	(38.1)	240	250	128	(20)	0.11	(0.050)	Stock	**L1J24**
	2	(50.8)	120	100	34	(5)	0.13	(0.059)	Stock	**L2A48**

CONTINUED

① MI leads available from stock. Add "Z" after Code No. to order.
② Units with 480 volts cannot be supplied with LA lead terminations.

Cartridge Heaters

FIREROD

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
⅝	2	(50.8)	120	200	68	(11)	0.13	(0.059)	Stock	**L2A49**
	2	(50.8)	240	500	170	(26)	0.13	(0.059)	Stock	**L2A54**
	2 ¼	(57.2)	120	100	29	(4)	0.14	(0.064)	Stock	**L2E49**
	2 ¼	(57.2)	120	250	73	(11)	0.14	(0.064)	Stock	**L2E50**
	2 ¼	(57.2)	240	250	73	(11)	0.14	(0.064)	Stock	**L2E12**
	2 ¼	(57.2)	120	350	103	(16)	0.14	(0.064)	Stock	**L2E40**
	2 ¼	(57.2)	240	350	103	(16)	0.14	(0.064)	Stock	**L2E51**
	2 ⅜	(60.3)	120	280	77	(12)	0.16	(0.073)	Stock	**L2G18**
	2 ⅜	(60.3)	240	280	77	(12)	0.16	(0.073)	Stock	**L2G19**
	3	(76.2)	120	150	31	(5)	0.20	(0.091)	Stock	**L3A81**
	3	(76.2)	120	250	51	(8)	0.20	(0.091)	Stock	**L3A82**
	3	(76.2)	240	250	51	(8)	0.20	(0.091)	Stock	**L3A9**
	3	(76.2)	120	400	81	(13)	0.20	(0.091)	Stock	**L3A94**
	3	(76.2)	120	500	102	(16)	0.20	(0.091)	Stock	**L3A113**
	3	(76.2)	240	500	103	(16)	0.20	(0.091)	Stock	**L3A33**
	3	(76.2)	240	750	154	(24)	0.20	(0.091)	Stock	**L3A71**
	3 ¾	(95.3)	120	525	82	(13)	0.24	(0.109)	Stock	**L3N12**
	3 ¾	(95.3)	240	525	82	(13)	0.24	(0.109)	Stock	**L3N1**
	4	(101.6)	120	250	37	(6)	0.26	(0.118)	Stock	**L4A99**
	4	(101.6)	240	250	37	(6)	0.26	(0.118)	Stock	**L4A104**
	4	(101.6)	240	400	58	(9)	0.26	(0.118)	Stock	**L4A47**
	4	(101.6)	240	500	73	(11)	0.26	(0.118)	Stock	**L4A53**
	4	(101.6)	240	600	88	(14)	0.26	(0.118)	Stock	**L4A44**
	4	(101.6)	240	750	110	(17)	0.26	(0.118)	Stock	**L4A100**
	4	(101.6)	240	1000	146	(23)	0.26	(0.118)	Stock	**L4A71**
	5	(127)	120	250	28	(4)	0.29	(0.132)	Stock	**L5A76**
	5	(127)	240	250	28	(4)	0.29	(0.132)	Stock	**L5A107**
	5	(127)	240	500	57	(9)	0.29	(0.132)	Stock	**L5A24**
	5	(127)	240	750	86	(13)	0.29	(0.132)	Stock	**L5A31**
	5	(127)	240	1000	114	(18)	0.29	(0.132)	Stock	**L5A77**
	5 ⅜	(85.7)	120	800	84	(13)	0.30	(0.136)	Stock	**L5G3**
	5 ⅜	(85.7)	240	800	84	(13)	0.30	(0.136)	Stock	**L5G1**
	6	(152.4)	120	300	28	(4)	0.34	(0.154)	Stock	**L6A28**
	6	(152.4)	240	300	28	(4)	0.34	(0.154)	Stock	**L6A64**
	6	(152.4)	240	500	47	(7)	0.34	(0.154)	Stock	**L6A73** ①
	6	(152.4)	240	750	70	(11)	0.34	(0.154)	Stock	**L6A70**
	6	(152.4)	240	1000	93	(14)	0.34	(0.154)	Stock	**L6A71** ①
	6	(152.4)	120	1500	139	(22)	0.34	(0.154)	Stock	**L6A163**
	6	(152.4)	240	1500	140	(22)	0.34	(0.154)	Stock	**L6A94** ①
	6 ½	(165.1)	120	500	43	(7)	0.38	(0.172)	Stock	**L6J43**
	6 ½	(165.1)	240	500	43	(7)	0.38	(0.172)	Stock	**L6J55**
	7	(177.8)	120	500	39	(6)	0.40	(0.181)	Stock	**L7A42**
	7	(177.8)	240	500	39	(6)	0.40	(0.181)	Stock	**L7A15** ①
	7	(177.8)	240	1000	79	(12)	0.40	(0.181)	Stock	**L7A37** ①
	7	(177.8)	240	1500	118	(18)	0.40	(0.181)	Stock	**L7A12** ①
	8	(203.2)	120	500	34	(5)	0.47	(0.213)	Stock	**L8A96** ①
	8	(203.2)	240	500	34	(5)	0.47	(0.213)	Stock	**L8A46** ①
	8	(203.2)	240	850	58	(9)	0.47	(0.213)	Stock	**L8A115** ①
	8	(203.2)	240	1000	68	(10)	0.47	(0.213)	Stock	**L8A10** ①
	8	(203.2)	240	1500	102	(16)	0.47	(0.213)	Stock	**L8A37** ①
	8	(203.2)	240	2000	137	(21)	0.47	(0.213)	Stock	**L8A80** ①

CONTINUED

① MI leads available from stock. Add "Z" after Code No. to order.

Cartridge Heaters

FIREROD

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
⅝	10	(254)	120	500	27	(4)	0.53	(0.240)	Stock	**L10A51**
	10	(254)	240	500	27	(4)	0.53	(0.240)	Stock	**L10A40** ①
	10	(254)	240	750	40	(6)	0.53	(0.240)	Stock	**L10A69**
	10	(254)	240	1000	54	(8)	0.53	(0.240)	Stock	**L10A52** ①
	10	(254)	480	1000	54	(8)	0.53	(0.240)	Stock	**L10A193** ②
	10	(254)	240	1500	81	(13)	0.53	(0.240)	Stock	**L10A8** ①
	10	(254)	240	2000	108	(17)	0.53	(0.240)	Stock	**L10A50** ①
	12	(304.8)	120	500	22	(3)	0.66	(0.300)	Stock	**L12A81** ①
	12	(304.8)	240	500	22	(3)	0.66	(0.300)	Stock	**L12A80** ①
	12	(304.8)	240	900	40	(6)	0.66	(0.300)	Stock	**L12A102**
	12	(304.8)	120	1000	45	(7)	0.66	(0.300)	Stock	**L12A82** ①
	12	(304.8)	240	1000	45	(7)	0.66	(0.300)	Stock	**L12A34** ①
	12	(304.8)	120	1500	66	(10)	0.66	(0.300)	Stock	**L12A147**
	12	(304.8)	240	1500	67	(10)	0.66	(0.300)	Stock	**L12A39** ①
	12	(304.8)	240	2000	89	(14)	0.66	(0.300)	Stock	**L12A63** ①
	14	(355.6)	240	3700	140	(22)	0.79	(0.358)	Stock	**L14A21**
	15	(381)	240	750	27	(4)	0.84	(0.381)	Stock	**L15A35** ①
	15	(381)	240	2400	84	(13)	0.84	(0.381)	Stock	**L15A20**
	15	(381)	480	2500	88	(14)	0.84	(0.381)	Stock	**L15A88** ②
	15	(381)	240	4000	141	(22)	0.84	(0.381)	Stock	**L15A41**
	16	(406.4)	240	2500	82	(13)	0.91	(0.412)	Stock	**L16A33**
	16	(406.4)	240	4500	148	(23)	0.91	(0.412)	Stock	**L16A40**
	18	(457.2)	240	1500	44	(7)	1.03	(0.467)	Stock	**L18A32**
	18	(457.2)	240	3000	87	(13)	1.03	(0.467)	Stock	**L18A34**
	18	(457.2)	240	4700	137	(21)	1.03	(0.467)	Stock	**L18A36**
	20	(508)	240	1500	40	(6)	1.25	(0.567)	Stock	**L20A19** ①
	20	(508)	240	3500	92	(14)	1.25	(0.567)	Stock	**L20A13**
	20	(508)	480	3500	92	(14)	1.25	(0.567)	Stock	**L20A96** ②
	20	(508)	240	4700	123	(19)	1.25	(0.567)	Stock	**L20A14**
	24	(609.6)	240	2000	44	(7)	1.47	(0.667)	Stock	**L24A19** ①
	24	(609.6)	240	4700	102	(15)	1.47	(0.667)	Stock	**L24A14**
	36	(914.4)	240	3000	43	(7)	2.30	(1.04)	Stock	**L36A8**
¾	2 ¼	(57.2)	120	200	49	(8)	0.19	(0.086)	Stock	**N2E8**
	3	(76.2)	120	250	43	(7)	0.24	(0.109)	Stock	**N3A11**
	3	(76.2)	240	500	85	(13)	0.24	(0.109)	Stock	**N3A12** ①
	4	(101.6)	120	250	31	(5)	0.31	(0.141)	Stock	**N4A16** ①
	4	(101.6)	240	500	61	(9)	0.31	(0.141)	Stock	**N4A17** ①
	4	(101.6)	240	1000	122	(19)	0.31	(0.141)	Stock	**N4A15**
	5	(127)	120	300	28	(4)	0.38	(0.172)	Stock	**N5A19**
	5	(127)	240	500	47	(7)	0.38	(0.172)	Stock	**N5A12** ①
	5	(127)	240	1000	95	(15)	0.38	(0.172)	Stock	**N5A20** ①
	6	(152.4)	120	500	39	(6)	0.44	(0.200)	Stock	**N6A19**
	6	(152.4)	240	500	39	(6)	0.44	(0.200)	Stock	**N6A20** ①
	6	(152.4)	240	1000	78	(12)	0.44	(0.200)	Stock	**N6A21** ①
	6	(154.4)	480	1000	78	(12)	0.44	(0.200)	Stock	**N6A225** ②
	6	(152.4)	240	1500	116	(18)	0.44	(0.200)	Stock	**N6A82**
	6	(152.4)	240	2000	155	(24)	0.44	(0.200)	Stock	**N6A22** ①
	7	(177.8)	120	500	33	(5)	0.51	(0.231)	Stock	**N7A15**
	7	(177.8)	240	500	33	(5)	0.51	(0.231)	Stock	**N7A1** ①
	7	(177.8)	240	1000	66	(10)	0.51	(0.231)	Stock	**N7A16** ①
	8	(203.2)	120	500	28	(4)	0.58	(0.263)	Stock	**N8A19**

CONTINUED

① MI leads available from stock. Add "Z" after Code No. to order.
② Units with 480 volts cannot be supplied with LA lead terminations.

Cartridge Heaters

FIREROD

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
¾	8	(203.2)	240	500	28	(4)	0.58	(0.263)	Stock	**N8A20** ①
	8	(203.2)	240	1000	57	(9)	0.58	(0.263)	Stock	**N8A21** ①
	8	(203.2)	240	2000	114	(17)	0.58	(0.263)	Stock	**N8A22** ①
	10	(254)	240	1000	45	(7)	0.72	(0.327)	Stock	**N10A15** ①
	10	(254)	240	2000	90	(14)	0.72	(0.327)	Stock	**N10A14** ①
	12	(304.8)	240	1000	37	(6)	0.84	(0.381)	Stock	**N12A15** ①
	12	(304.8)	240	2000	74	(11)	0.84	(0.381)	Stock	**N12A24**
	12	(304.8)	480	2000	74	(11)	0.84	(0.381)	Stock	**N12A198** ②
	12	(304.8)	240	4000	148	(23)	0.84	(0.381)	Stock	**N12A25**
	13	(304.8)	240	1000	34	(5)	0.93	(0.422)	Stock	**N13A26** ①
	14	(355.6)	240	1250	40	(6)	1.03	(0.467)	Stock	**N14A22** ①
	14	(355.6)	240	2500	79	(12)	1.03	(0.467)	Stock	**N14A20**
	14	(355.6)	240	4500	142	(22)	1.03	(0.467)	Stock	**N14A21**
	15	(381)	240	1500	44	(22)	1.09	(0.494)	Stock	**N15A26** ①
	16	(406.4)	240	1800	49	(8)	1.14	(0.517)	Stock	**N16A26** ①
	16	(406.4)	240	4700	129	(20)	1.14	(0.517)	Stock	**N16A18**
	18	(457.2)	240	2000	49	(8)	1.25	(0.567)	Stock	**N18A13**
	18	(457.2)	240	5000	122	(19)	1.25	(0.567)	Stock	**N18A15**
	20	(508)	240	1150	25	(4)	1.40	(0.635)	Stock	**N20A21** ①
	20	(508)	240	2250	49	(8)	1.40	(0.635)	Stock	**N20A22** ①
	20	(508)	240	5250	115	(18)	1.40	(0.635)	Stock	**N20A10**
	24	(609.6)	240	1375	25	(4)	1.80	(0.816)	Stock	**N24A24**
	24	(609.6)	240	2750	50	(8)	1.80	(0.816)	Stock	**N24A23**
	24	(609.6)	480	2750	50	(8)	1.80	(0.816)	Stock	**N24A78** ②
	24	(609.6)	240	5500	100	(16)	1.80	(0.816)	Stock	**N24A13**
	36	(914.4)	240	2500	30	(6)	2.50	(1.13)	Stock	**N36A4**

① MI leads available from stock. Add "Z" after Code No. to order.
② Units with 480 volts cannot be supplied with LA lead terminations.

Cartridge Heaters

FIREROD

Heaters for Hot Runner Systems

Diameter inches	Sheath Length inches	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.	Incoe® Part No.
⅜	1 ¾	(44.5)	240	200	142	(22)	0.09	(0.041)	Stock	**G1NX39E**	TJ38017
	2	(50.8)	240	250	152	(24)	0.09	(0.041)	Stock	**G2AX163B**	TJ38020
	2 ½	(63.5)	240	250	112	(17)	0.10	(0.045)	Stock	**G2JX131D**	TJ38025
	3	(76.2)	240	260	92	(14)	0.10	(0.045)	Stock	**G3AX238K**	TJ38030
	3 ½	(88.9)	240	320	91	(14)	0.12	(0.054)	Stock	**G3JX114K**	TJ38035
	4	(101.6)	240	370	92	(14)	0.12	(0.054)	Stock	**G4AX255D**	TJ38040
	4 ½	(114.3)	240	420	90	(14)	0.13	(0.059)	Stock	**G4JX84E**	TJ38045
	5	(127)	240	470	108	(17)	0.14	(0.064)	Stock	**G5AX183E**	TJ38050
	5 ½	(139.7)	240	525	91	(14)	0.15	(0.068)	Stock	**G5JX64C**	TJ38055
	6	(152.4)	240	575	90	(14)	0.15	(0.068)	Stock	**G6AX222D**	TJ38060
	6 ½	(165.1)	240	625	93	(15)	0.16	(0.073)	Stock	**G6JX34C**	TJ38065
	7	(177.8)	240	675	92	(14)	0.17	(0.077)	Stock	**G7AX105C**	TJ38070
	7 ½	(190.5)	240	725	101	(16)	0.18	(0.082)	Stock	**G7JX36D**	TJ38075
	8	(203.2)	240	775	91	(14)	0.19	(0.086)	Stock	**G8AX202C**	TJ38080
	3 ½	(88.9)	240	420	92	(14)	0.17	(0.077)	Stock	**J3JX103C**	TJ12035
	4	(101.6)	240	490	90	(14)	0.19	(0.086)	Stock	**J4AX372A**	TJ12040
	4 ½	(114.3)	240	550	80	(12)	0.20	(0.091)	Stock	**J4JX62C**	TJ12045
½	5	(127)	240	625	89	(14)	0.22	(0.100)	Stock	**J5AX178B**	TJ12050
	5 ½	(139.7)	240	700	91	(14)	0.23	(0.104)	Stock	**J5JX54B**	TJ12055
	6	(152.4)	240	775	104	(16)	0.25	(0.113)	Stock	**J6AX412A**	TJ12060
	6 ½	(165.1)	240	850	104	(16)	0.26	(0.118)	Stock	**J6JX45C**	TJ12065
	7 ½	(190.5)	240	975	100	(16)	0.29	(0.132)	Stock	**J7JX88A**	TJ12075

Note: All heaters have Type J thermocouple in location C and 36 inch swaged-in leads.

Cartridge Heaters

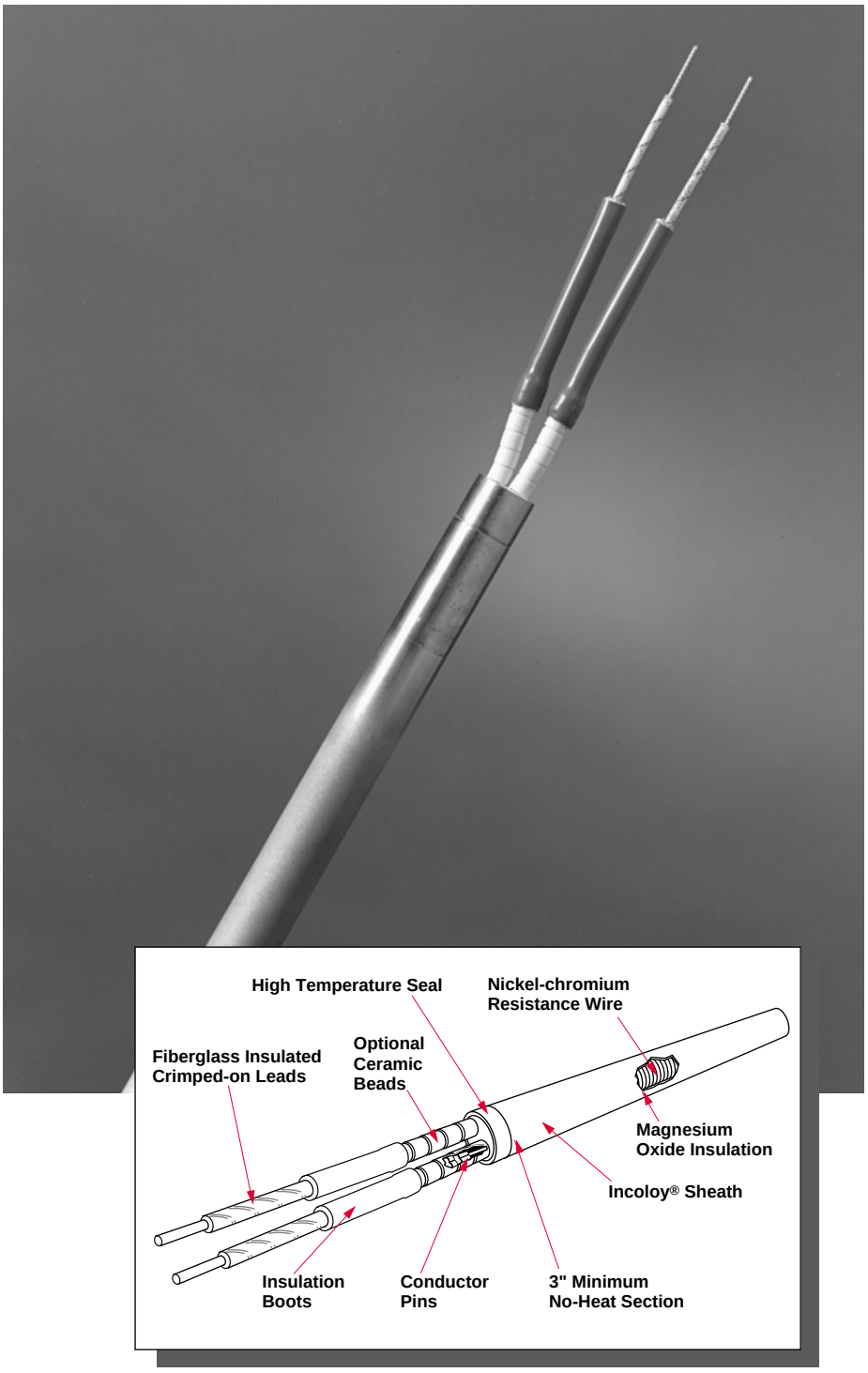
HT FIREROD®

Performance Capabilities

- Platen temperatures to 1800°F (980°C)
- Maximum watt density to 100 W/in^2 (15.5 W/cm^2)
- Maximum voltage 277V~(ac) to ground
- Length tolerance:
  +0, -4 percent standard diameters;
  +0, -8 percent for special diameters

Features and Benefits

- **High temperature seal** prevents exposure to the atmosphere which minimizes oxidation of the winding wires. The end result is longer life of the element.
- **Incoloy® sheath** is treated for better emissivity, which transfers heat more efficiently.



Made-to-Order Availability

Nominal Diameter inches	Actual Diameter inches	Max Amps
½	0.496 ± 0.004	10
⅝	0.580 ± 0.004	23
	0.621 ± 0.004	23
¾	0.710 ± 0.004	46
	0.746 ± 0.004	46
1	0.960 ± 0.004	46
	0.996 ± 0.006	46

Contact the Watlow factory in St. Louis, Missouri, for special diameter requests.

Applications

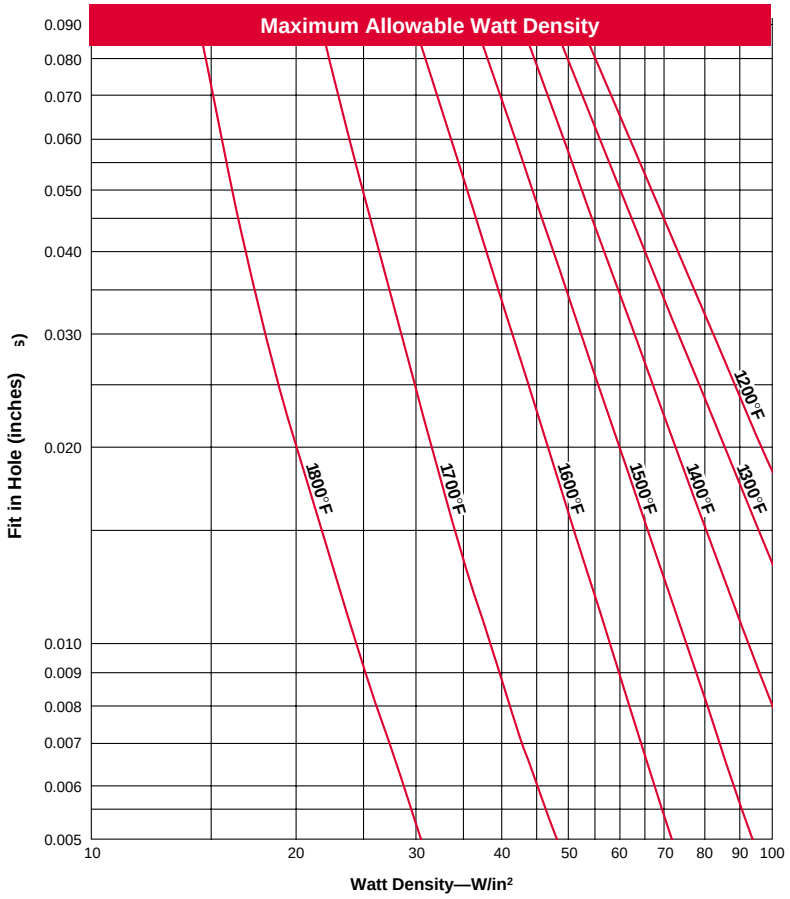
- Thermo plastic
- Superplastic forming of titanium aircraft parts
- Diffusion bonding to laminate and shape titanium

Incoloy® is a registered trademark of Special Metals Corporation.

HT FIREROD

Applications and Technical Data

Continued



Options

Options available on the HT FIREROD:

- Thermocouples
- Independently controllable heat zones
- Bending (chart to the right)
- Distributed wattage
- MI leads
- Flanges
- Threaded fittings
- Post terminals
- Conduit NEMA boxes

Dia. in	Minimum Required No-Heat Length in (mm)	Bend Radius in (mm)
0.496	1 ⅞ (47)	¾ (19)
0.580	2 ¼ (57)	1 (25)
0.621	2 5/16 (59)	1 (25)
0.710	2 ¾ (70)	1 ¼ (32)
0.746	2 13/16 (71)	1 ¼ (32)
0.996	3 ⅜ (86)	1 ½ (38)

F.O.B.: St. Louis, Missouri

How to Order

HT FIRERODs are available only as **made-to-order** units. To place an order, please specify:

- Diameter
- Overall length
- No-heat length, if greater than three inches (76 mm)
- Volts
- Watts
- Intended application and temperature
- Atmospheric information
- Lead type and length or terminal configuration
- Options including finishing, internal construction and mounting.

Quick Ship • *Same day shipment on all stock units.*

Cartridge Heaters

FIREROD® Immersion

FIREROD® immersion heaters package to 300 W/in² (46.5 W/cm²) in a compact unit, giving you greater versatility in designing your heating system. This design solution is ideal for replacing large screw-plug immersion heaters.

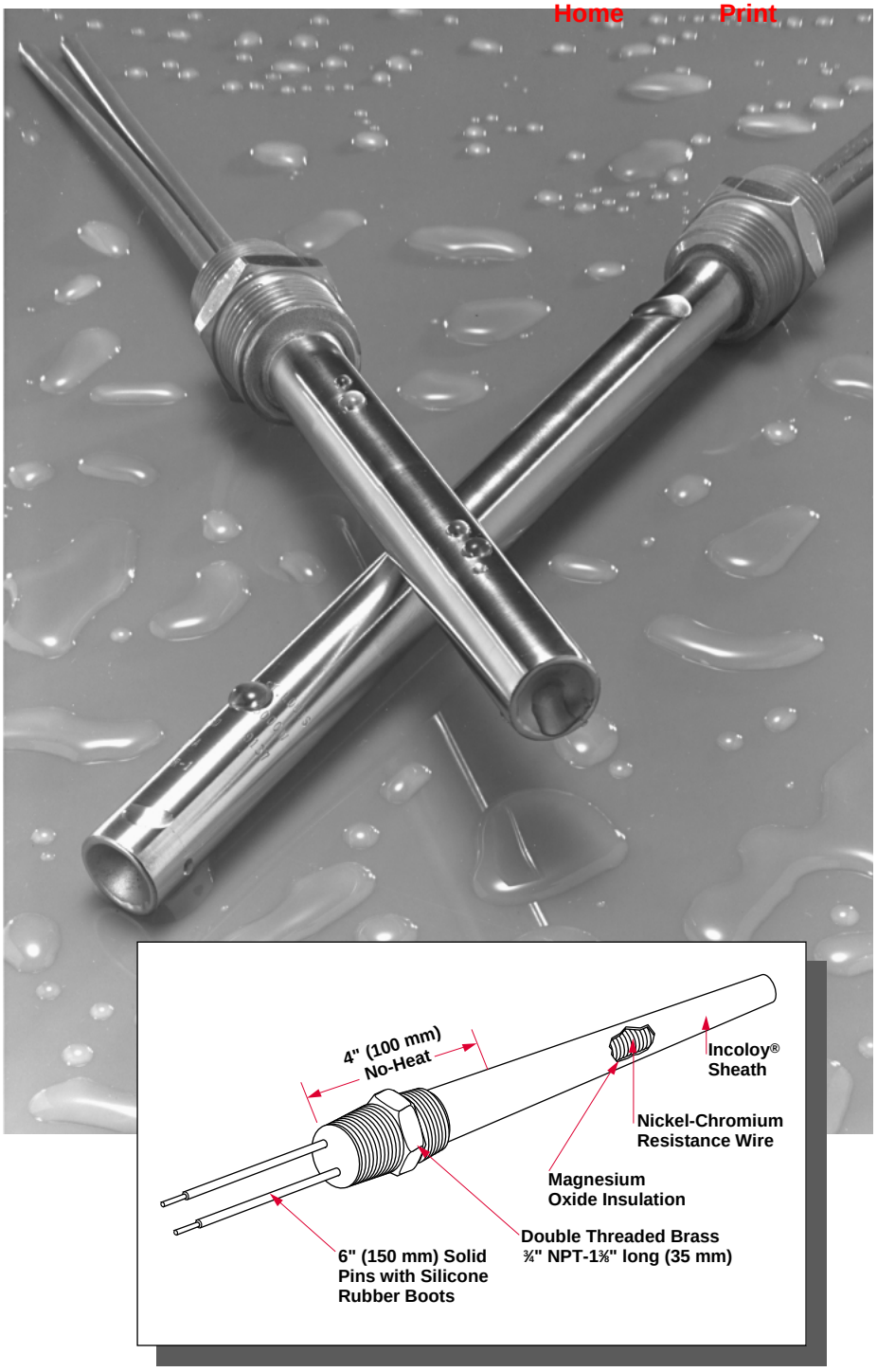
Aside from its versatile design, these heaters come complete with a brass ¾ inch NPT double threaded screw plug, which allows you to add conduit boxes. Also, FIREROD immersion heaters are sealed at the lead end with a silicone rubber seal. Solid copper leads, with silicone rubber sleeve, are provided for unconfined wiring. These units are recommended for immersion in water or 90+ percent water soluble solutions.

Performance Capabilities

- Maximum operating temperature in water to 212°F (100°C) at atmospheric pressure
- Maximum watt density to 300 W/in² (46.5 W/cm²)
- Maximum voltage to 480V~(ac)

Features and Benefits

- **Nickel-chromium resistance wire,** precisely centered in the unit, assures even, efficient distribution of heat to the sheath.
- **Magnesium oxide insulation,** compacted to the proper density, results in high dielectric strength and contributes to faster heat-up.
- **Incoloy® sheath** resists corrosion from water.
- **Metallurgically-bonded conductor pins** overlap the resistance wire inside the core, ensuring trouble-free electrical continuity.
- **Lead end with silicone rubber seal** protects the heater against moisture contamination.
- **Optional stainless steel fittings** are available for use in corrosive applications.



- **Horizontal through the wall tank mounting** makes set-up faster.
- **240 and 480V~(ac)** give flexibility in wiring the heater for use in your particular application.

Applications

- Plastic reclamation
- Food preparation
- Lab equipment

Incoloy® is a registered trademark of Special Metals Corporation.

Cartridge Heaters

FIREROD Immersion

Applications and Technical Data

The small size and big capacity of FIREROD cartridge heating units make them ideal immersion heaters in cramped quarters. When heating liquids of low viscosity, FIRERODs have the high watt density to pack more heat into tight spots. For water heating applications a rating of 150 to 300 W/in^2 is recommended. (Laboratory tests show that under certain conditions ratings as high as 700 W/in^2 are safe.) For longer life at high watt densities:

- The FIREROD unit should be in the main body of the liquid and not in a restricted space.
- The FIREROD heater should be covered with liquid at all times.
- The heater should not be allowed to cycle on and off too frequently.
- Scale should not form.

When heating viscous liquids, such as oils, watt densities must be kept low to prevent carbonization at the heater sheath. FIREROD cartridges offer advantages for heating viscous materials where long life and high quality outweigh the usual economic considerations. As in all immersion applications, scale build-up on the sheath and sludge on the bottom of the tank must be carefully controlled to assure long heater life.

Equipped with smaller threaded fittings than conventional immersion heaters, FIRERODs leave room for more units in the same space. Replacement of single FIREROD units in multiheater assemblies is fast and easy, and avoids discarding the complete assembly.

Moisture proof seals are available to give protection from damp atmospheres outside the tank.

Built for sustained operation at high temperatures, the FIREROD is especially valuable in heat-transfer applications with liquid metals. This factor alone has made the FIREROD heater a widely used component in the development of nuclear power systems.

Threaded fittings are furnished in either stainless steel or brass. FIRERODs with Incoloy® or 304 stainless steel sheaths are standard, but other sheath materials can be provided. Headers and sheath material should be suited to the material being heated.

Consult FIREROD section, pages 75 to 76 for more information.

Sheath Material Compositions

Sheath Material	Chemical Composition															
	Al	C	Co	Cr	Cu	Fe	Mn	Mo	Ni	P	S	Si	Ta	Ti	V	W
Stainless Steels																
304		0.08 ①		18/20		Bal	2 ①		8/12			1 ①				
316		0.08 ①		16/18		Bal	2 ①	2/3	10/14			1 ①				
Nickel Alloys																
Incoloy® 800	0.15/0.6	0.1		19/23	0.75	Bal	1.5		30/35		0.015	1.0		0.15/0.6		

① Maximum

See application guide for additional sheath material composition.

Cartridge Heaters

FIREROD Immersion

Applications and Technical Data

Continued

How to Order

To order stock FIREROD immersion heaters, specify Watlow code number and quantity.

For **made-to-order** units, please specify:

- Diameter
- Overall length
- Immersed length
- Heated length
- Watts
- Volts
- Threaded fitting material

Ordering Example: Specify FIREROD immersion heater ⅝ inch diameter, six inches overall length, immersed length of four inches, and two inches heated length. The heater is to be supplied with 1200 watts, 240 volts, ¾ inch NPT double threaded brass fitting, silicone seal and six inch pins, no leads.

Availability

Stock: Same day shipment

Made-to-Order: Consult Watlow

F.O.B.: St. Louis, Missouri

Diameter in	Overall length in	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx Fittings Type	Net Wt. lbs	(kg)	Availability	Code No.
⅝	6 ¼	(159)	120	500	127	(19.7)	Brass	0.58	(0.26)	Stock	**L6EX12A**
	6 ¼	(159)	120	500	127	(19.7)	SS	0.58	(0.26)	Stock	**L6EX12B**
	6 ¼	(159)	240	500	127	(19.7)	Brass	0.58	(0.26)	Stock	**L6EX13A**
	6 ¼	(159)	240	500	127	(19.7)	SS	0.58	(0.26)	Stock	**L6EX13B***
	6 ¼	(159)	120	750	191	(29.6)	Brass	0.58	(0.26)	Stock	**L6EX14A**
	6 ¼	(159)	120	750	191	(29.6)	SS	0.58	(0.26)	Stock	**L6EX14B**
	6 ¼	(159)	240	750	191	(29.6)	Brass	0.58	(0.26)	Stock	**L6EX15A**
	6 ¼	(159)	240	750	191	(29.6)	SS	0.58	(0.26)	Stock	**L6EX15B**
	6 ¼	(159)	120	1000	254	(39.4)	Brass	0.58	(0.26)	Stock	**L6EX16A**
	6 ¼	(159)	120	1000	254	(39.4)	SS	0.58	(0.26)	Stock	**L6EX16B**
	6 ¼	(159)	240	1000	254	(39.4)	Brass	0.58	(0.26)	Stock	**L6EX17A**
	6 ¼	(159)	240	1000	254	(39.4)	SS	0.58	(0.26)	Stock	**L6EX17B**
	6 ¾	(159)	240	1500	300	(46.5)	Brass	0.60	(0.27)	Stock	**L6NX7A**
	6 ¾	(171)	240	1500	300	(46.5)	SS	0.60	(0.27)	Stock	**L6NX7B**
	6 ¾	(171)	480	1500	300	(46.5)	Brass	0.60	(0.27)	Stock	**L6NX8A**
	6 ¾	(171)	480	1500	300	(46.5)	SS	0.60	(0.27)	Stock	**L6NX8B**
	7 ¾	(197)	240	2000	291	(45.1)	Brass	0.66	(0.30)	Stock	**L7NX5A**
	7 ¾	(197)	240	2000	291	(45.1)	SS	0.66	(0.30)	Stock	**L7NX5B**
	7 ¾	(197)	480	2000	291	(45.1)	Brass	0.66	(0.30)	Stock	**L7NX6A**
	7 ¾	(197)	480	2000	291	(45.1)	SS	0.66	(0.30)	Stock	**L7NX6B**
	8 ½	(216)	240	2500	300	(46.5)	Brass	0.68	(0.31)	Stock	**L8JX16A**
	8 ½	(216)	240	2500	300	(46.5)	SS	0.68	(0.31)	Stock	**L8JX16B**
	8 ½	(216)	480	2500	300	(46.5)	Brass	0.68	(0.31)	Stock	**L8JX17A**
	8 ½	(216)	480	2500	300	(46.5)	SS	0.68	(0.31)	Stock	**L8JX17B***
	9 ¼	(235)	240	3000	300	(46.5)	Brass	0.72	(0.33)	Stock	**L9EX11A**
	9 ¼	(235)	240	3000	300	(46.5)	SS	0.72	(0.33)	Stock	**L9EX11B**
	9 ¼	(235)	480	3000	300	(46.5)	Brass	0.72	(0.33)	Stock	**L9EX12A**
	9 ¼	(235)	480	3000	300	(46.5)	SS	0.72	(0.33)	Stock	**L9EX12B**
	11	(279)	240	4000	300	(46.5)	Brass	0.80	(0.36)	Stock	**L11AX59A**
	11	(279)	240	4000	300	(46.5)	SS	0.80	(0.36)	Stock	**L11AX59B**
	11	(279)	480	4000	300	(46.5)	Brass	0.80	(0.36)	Stock	**L11AX60A**
	11	(279)	480	4000	300	(46.5)	SS	0.80	(0.36)	Stock	**L11AX60B**

CONTINUED

* Limited quantities available, consult factory for delivery.

Cartridge Heaters

F.O.B.: St. Louis, Missouri

FIREROD Immersion

Diameter in	Overall length in	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx Fittings Type	Net Wt. lbs	(kg)	Availability	Code No.
⅝	12 ¾	(324)	240	5000	300	(46.5)	Brass	0.89	(0.41)	Stock	**L12NX4A**
	12 ¾	(324)	240	5000	300	(46.5)	SS	0.89	(0.41)	Stock	**L12NX4B**
	12 ¾	(324)	480	5000	300	(46.5)	Brass	0.89	(0.41)	Stock	**L12NX5A**
	12 ¾	(324)	480	5000	300	(46.5)	SS	0.89	(0.41)	Stock	**L12NX5B**
	14 ½	(368)	240	6000	300	(46.5)	Brass	0.95	(0.43)	Stock	**L14JX8A**
	14 ½	(368)	240	6000	300	(46.5)	SS	0.95	(0.43)	Stock	**L14JX8B**
	14 ½	(368)	480	6000	300	(46.5)	Brass	0.95	(0.43)	Stock	**L14JX9A**
	14 ½	(368)	480	6000	300	(46.5)	SS	0.95	(0.43)	Stock	**L14JX9B**
	18	(457)	240	8000	295	(45.7)	Brass	1.14	(0.52)	Stock	**L18AX43A**
	18	(457)	240	8000	295	(45.7)	SS	1.14	(0.52)	Stock	**L18AX43B**
	18	(457)	480	8000	295	(45.7)	Brass	1.14	(0.52)	Stock	**L18AX44A**
	18	(457)	480	8000	295	(45.7)	SS	1.14	(0.52)	Stock	**L18AX44B**
	21 ¼	(540)	240	10000	300	(46.5)	Brass	1.3	(0.59)	Stock	**L21EX1A**
	21 ¼	(540)	240	10000	300	(46.5)	SS	1.3	(0.59)	Stock	**L21EX1B**
	21 ¼	(540)	480	10000	300	(46.5)	Brass	1.3	(0.59)	Stock	**L21EX2A**
	21 ¼	(540)	480	10000	300	(46.5)	SS	1.3	(0.59)	Stock	**L21EX2B**
	24 ¾	(629)	480	12000	300	(46.5)	Brass	1.5	(0.68)	Stock	**L24NX1A**
	24 ¾	(629)	480	12000	300	(46.5)	SS	1.5	(0.68)	Stock	**L24NX1B***
	29 ¾	(756)	480	15000	300	(46.5)	Brass	1.8	(0.82)	Stock	**L29NX5A**
	29 ¾	(756)	480	15000	300	(46.5)	SS	1.8	(0.82)	Stock	**L29NX5B***
	35	(889)	480	18000	300	(46.5)	Brass	2.0	(0.91)	Stock	**L35AX5A**
	35	(889)	480	18000	300	(46.5)	SS	2.0	(0.91)	Stock	**L35AX5B**

* Limited quantities available, consult factory for delivery.

Quick Ship • *Same day shipment on all stock units.*

Cartridge Heaters

FIREROD® Bolt

The high performance FIREROD® that has served the heater industry for almost 30 years has been upgraded with a conduit box and wooden handle.

When inserted into a hollow bolt, this heater lengthens the bolt by heat expansion allowing the nut to be further wrench-tightened. The FIREROD bolt is then de-energized and removed. Upon cooling, the bolt contracts to a tight fit.

Performance Capabilities

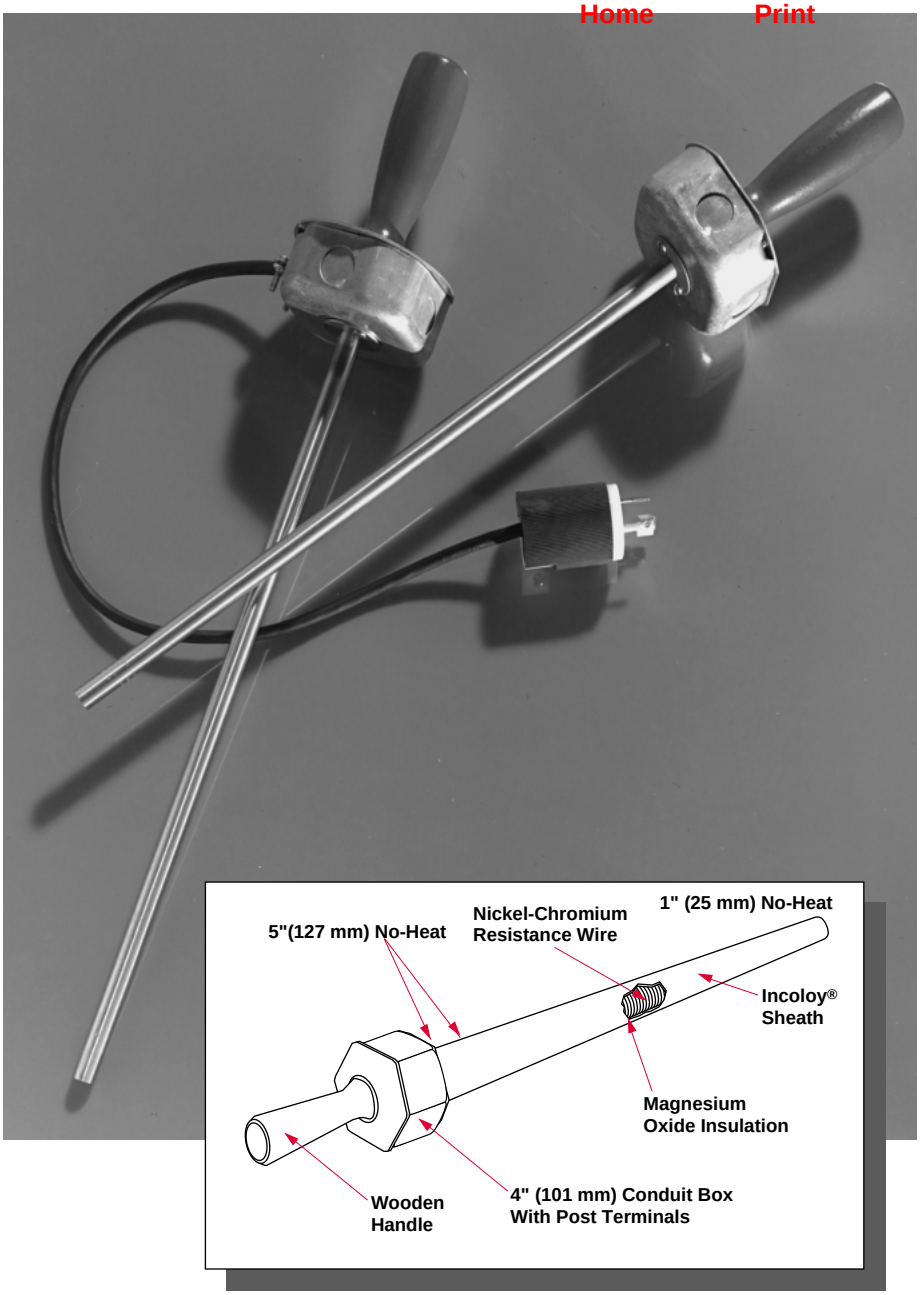
- Part temperatures to 1000°F (540°C)
- Maximum watt density to 100 W/in^2 (15.5 W/cm^2)

Features and Benefits

- **Conduit box** has been added for wiring convenience.
- **Wooden handle** is attached for ease of handling the heater.
- **Magnesium oxide insulation,** compacted to the proper density, results in high dielectric strength and contributes to faster heat-up.
- **Nickel-chromium resistance wire**, precisely wound through the heated length, assures even, efficient distribution of heat to the sheath.
- **Conductor pins metallurgically-bonded** to the resistance wires, ensure trouble-free electrical continuity.
- **UL® approved flexible stranded wires,** with silicone-fiberglass sleeve, insulate the wires to temperatures of 480°F (250°C).

Applications

- Power plants
- Shipyards
- Press & die manufacturers
- Construction contractors
- Boiler manufacturers



Applications and Technical Data

FIREROD Bolt Specifications											
Diameter ±0.005 in		0.460	0.496	0.553	0.580	0.621	0.688	0.710	0.746	0.813	0.996
Maximum Volts		240	240	240	480	480	480	480	480	480	480
Maximum Amps		9.7	9.7	14	23	23	23	46	46	46	46
Maximum Watts	**120**	1,160	1,160	1,680	2,760	2,760	2,760	5,520	5,520	5,520	5,520
	240	2,320	2,320	5,520	5,520	5,520	5,520	11,000	11,000	11,000	11,000
1 PH	**480**	—	—	11,000	11,000	11,000	11,000	22,000	22,000	22,000	22,000
3 PH	**Available**	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES

UL® is a registered trademark of Underwriter's Laboratories.

Incoloy® is a registered trademark of Special Metals Corporation.

Cartridge Heaters

FIREROD Bolt

How to Order

To order stock FIREROD bolt heaters, specify:

- Watlow code number
- Quantity
- Diameter
- Overall length
- Heated length
- Watts
- Volts
- Lead type or post terminals

Availability

Stock: Same day shipment

Standard: Shipment within four to six weeks

Made-to-Order: Shipment within four to six weeks

F.O.B.: St. Louis, Missouri

Diameter in	Overall Length in	(mm)	Heated Length in	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Availability	Code No.
0.460	18	(457.2)	12	(304.8)	240	1700	98	(15)	1.4	(0.64)	Standard	**H18AX7A**
	24	(609.6)	18	(457.2)	240	2300	88	(14)	1.6	(0.73)	Standard	**H24AX4A**
	30	(762.0)	24	(609.6)	240	2300	66	(10)	1.8	(0.82)	Standard	**H30AX2A**
	36	(914.4)	30	(762.0)	240	2300	53	(8)	2.1	(0.95)	Standard	**H36AX1A**
0.496	18	(457.2)	12	(304.8)	240	1900	100	(16)	1.5	(0.68)	Standard	**J18AX157A**
	24	(609.6)	18	(457.2)	240	2300	82	(13)	1.8	(0.82)	Standard	**J24AX86A**
	30	(762.0)	24	(609.6)	240	2300	62	(10)	2.0	(0.91)	Standard	**J30AX34A**
	36	(914.4)	30	(762.0)	240	2300	49	(8)	2.4	(1.08)	Standard	**J36AX15A**
0.553	18	(457.2)	12	(304.8)	240	1200	59	(9)	1.8	(0.82)	Stock	**K18AX9A**
	24	(609.6)	18	(457.2)	240	1700	55	(9)	2.0	(0.91)	Stock	**K24AX4A**
	30	(762.0)	24	(609.6)	240	2500	60	(9)	2.3	(1.04)	Stock	**K30AX7A**
	36	(914.4)	30	(762.0)	240	3200	62	(10)	2.7	(1.22)	Stock	**K36AX3A**
0.580	18	(457.2)	12	(304.8)	240	2200	100	(16)	1.9	(0.86)	Standard	**K18AX12A**
	24	(609.6)	18	(457.2)	240	3300	100	(16)	2.1	(0.95)	Standard	**K24AX5A**
	30	(762.0)	24	(609.6)	240	4350	100	(16)	2.4	(1.08)	Standard	**K30AX8A**
	36	(914.4)	30	(762.0)	240	5450	100	(16)	2.9	(1.32)	Standard	**K36AX4A**
0.621	18	(457.2)	12	(304.8)	240	2350	100	(16)	2.0	(0.91)	Standard	**L18AX176A**
	24	(609.6)	18	(457.2)	240	3500	100	(16)	2.3	(1.04)	Standard	**L24AX101A**
	30	(762.0)	24	(609.6)	240	4700	100	(16)	2.7	(1.22)	Standard	**L30AX63A**
	36	(914.4)	30	(762.0)	240	5500	94	(15)	3.1	(1.41)	Standard	**L36AX41A**
0.688	18	(457.2)	12	(304.8)	240	1500	59	(9)	2.3	(1.04)	Stock	**M18AX5A**
	24	(609.6)	18	(457.2)	240	2100	55	(9)	2.7	(1.22)	Stock	**M24AX5A**
	30	(762.0)	24	(609.6)	240	3000	58	(9)	3.1	(1.41)	Stock	**M30AX4A**
	36	(914.4)	30	(762.0)	240	4000	62	(10)	3.6	(1.63)	Stock	**M36AX5A**
0.710	18	(457.2)	12	(304.8)	240	2700	100	(16)	2.3	(1.04)	Standard	**M18AX6A**
	24	(609.6)	18	(457.2)	240	4000	100	(16)	2.8	(1.27)	Standard	**M24AX6A**
	30	(762.0)	24	(609.6)	240	5350	100	(16)	3.2	(1.45)	Standard	**M30AX5A**
	36	(914.4)	30	(762.0)	240	5500	83	(13)	3.6	(1.63)	Standard	**M36AX9A**
0.746	18	(457.2)	12	(304.8)	240	2800	100	(16)	2.5	(1.13)	Standard	**N18AX119A**
	24	(609.6)	18	(457.2)	240	4200	100	(16)	3.0	(1.36)	Standard	**N24AX91A**
	30	(762.0)	24	(609.6)	240	5500	98	(15)	3.4	(1.54)	Standard	**N30AX30A**
	36	(914.4)	30	(762.0)	240	5500	78	(12)	3.8	(1.72)	Standard	**N36AX25A**
0.813	18	(457.2)	12	(304.8)	240	1800	60	(9)	2.7	(1.22)	Stock	**P18AX1A**
	24	(609.6)	28	(711.2)	240	2500	55	(9)	3.2	(1.45)	Stock	**P24AX2A**
	30	(762.0)	24	(609.6)	240	3500	55	(9)	3.7	(1.68)	Stock	**P30AX1A**
	42	(1066.8)	36	(914.4)	240	6000	66	(10)	4.8	(2.18)	Stock	**P42AX2A**
0.996	18	(457.2)	12	(304.8)	240	3750	100	(16)	3.4	(1.54)	Standard	**T18AX36A**
	24	(609.6)	18	(457.2)	240	5500	98	(15)	4.0	(1.81)	Standard	**T24AX40A**
	30	(762.0)	24	(609.6)	240	5500	73	(11)	4.7	(2.13)	Standard	**T30AX20A**
	36	(914.4)	30	(762.0)	240	5500	59	(9)	5.3	(2.40)	Standard	**T36AX23A**

Cartridge Heaters

Metric FIREROD® Cartridge

The Watlow FIREROD® not only set the industry standard for cartridge heaters, it continues making improvements in construction and design. Among those improvements is the metric FIREROD, a variation of the FIREROD cartridge heater which was built to meet the exacting specifications of the global market.

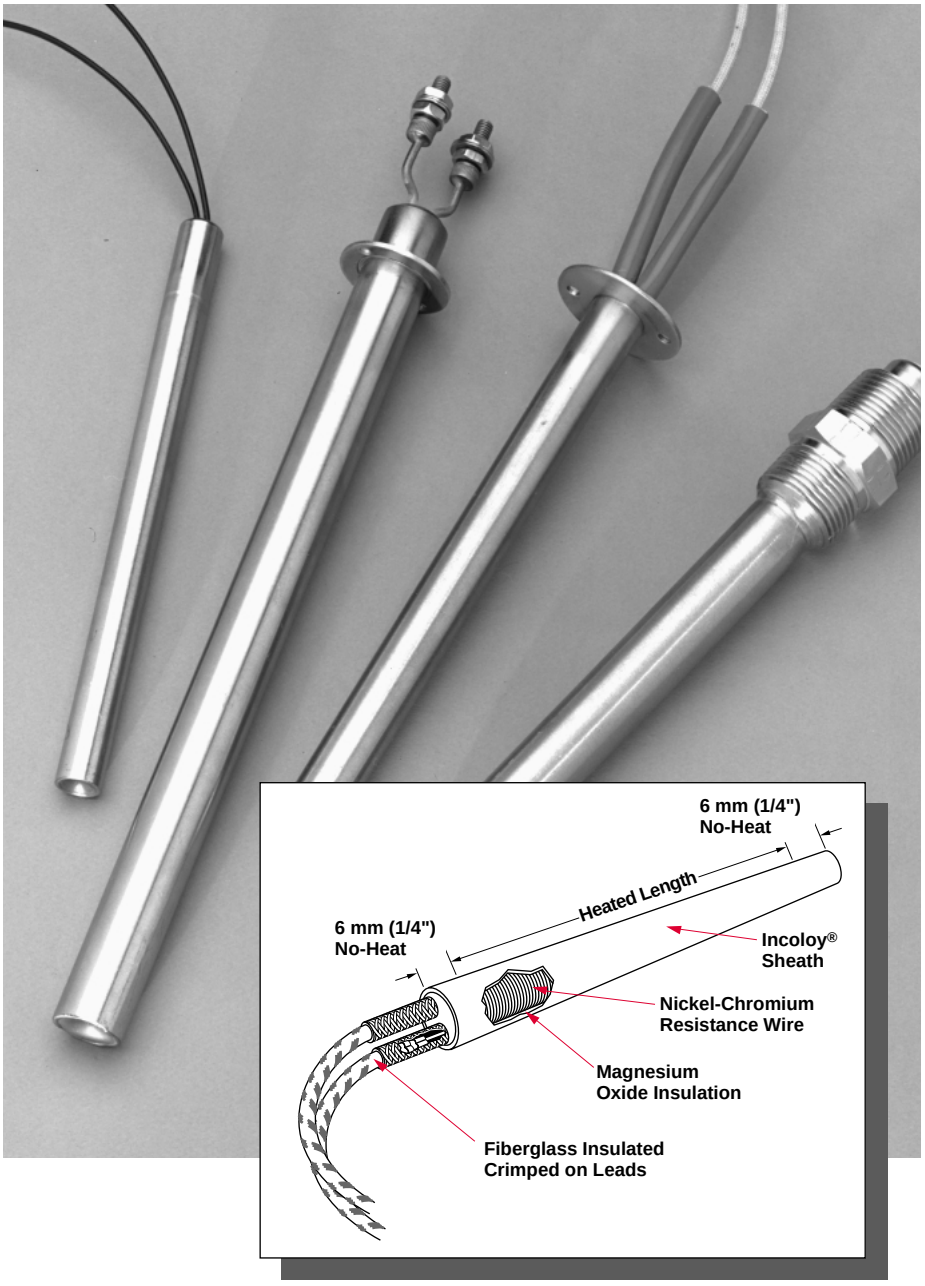
Like its counterpart, the metric FIREROD consistently outperforms other cartridge heaters because of design solutions like its exclusive resistance wire winding process. Plus details, like bringing the resistance wire closer to the sheath, and compacting the MgO insulation, maximize heat transfer. The end result is longer service life and better efficiency.

Performance Capabilities

- Part temperatures to 870°C (1600°F) on Incoloy® sheath
- Watt densities to 60 W/cm^2 (400 W/in^2)

Features and Benefits

- **Nickel-chromium resistance wire,** precisely wound and centered in the unit, assures even, efficient distribution of heat to the sheath.
- **Conductor pins** metallurgically bonded to the resistance wire ensure trouble-free electrical continuity.
- **Magnesium oxide insulation of specific grain and purity,** swaged to the proper density, results in high dielectric strength and contributes to faster heat-up.



- **Incoloy® sheath** resists oxidation and corrosion from chemicals, heat and atmospheres.
- **Minimal spacing between the element wire and sheath** results in lower internal temperature, giving you the ability to design with fewer or smaller heaters that operate at higher watt densities.

Applications

- Molds
- Dies
- Platens
- Hot plates
- Sealings
- Gas and liquid heating

Incoloy® is a registered trademark of Special Metals Corporation.

Cartridge Heaters

Metric FIREROD Cartridge

Applications and Technical Data

The *Electrical Data* table will assist you in selecting the correct metric FIREROD heater for your application, according to available voltage, amperage and wattage.

Electrical Data

Heater Diameter (mm)	6.5	8	10	12.5	16	20
Nominal Diameter (in)	0.256	0.315	0.394	0.492	0.630	0.787
Maximum Voltage	250	250	250	400	480	480
Crimped on Leads						
Maximum Amps	4.4	6.7	9.7	9.7	23	23
Maximum Wattage @ 230V	1010	1540	2230	2230	5290	5290
Maximum Wattage @ 400V				3880	9200	9200
Swaged-in Leads						
Maximum Amps	3.1/4.4 ①	4.4/7.2 ①	7.6/12.5	7.6/12.5 ①	7.6/12.5 ①	12.5/21
Maximum Wattage @ 230V	710/1010	1010/1560	1750/2875	1750/2875	1750/2875	2875/4830
Maximum Wattage @ 400V	—	—	—	3040/5000	3040/5000	5000/8400

① On certain lead constructions, maximum amperage is 3.1, 4.4, 7.6 or 12.5. In these instances, amperage is determined by internal construction and the current carrying capacity of internal parts to the lead wire. For more information about these amperage restrictions or higher current requirements, please contact your Watlow sales engineer or authorized distributor.

Tolerances

Diameter:

-0.02 mm, -0.08 mm
(-0.0008 inch, -0.0031 inch)

Length:

±2% with ±2.4 mm
(±3/32 inch) minimum

Wattage:

+10 percent, -5 percent. Wattage decreases approximately five percent with temperature. Wattage tolerances are for heaters at operating temperature.

Resistance:

+5 percent, -10 percent. Resistance is measured at room temperature following first heater operation.

Camber:

0.25 mm (0.01 inch) maximum on any length to 300 mm (12 inches). For lengths over 300 mm:

$$\frac{[\text{Heater Length (mm)}]^2}{182{,}900}$$

Cartridge Heaters

Metric FIREROD Cartridge

Maximum Allowable Watt Density

The following four graphs detail maximum allowable watt densities for applications involving metal heating or steam, air and gas heating. Please review these respective graphs and applicable data to determine the correct watt density for your application.

Heating Metals

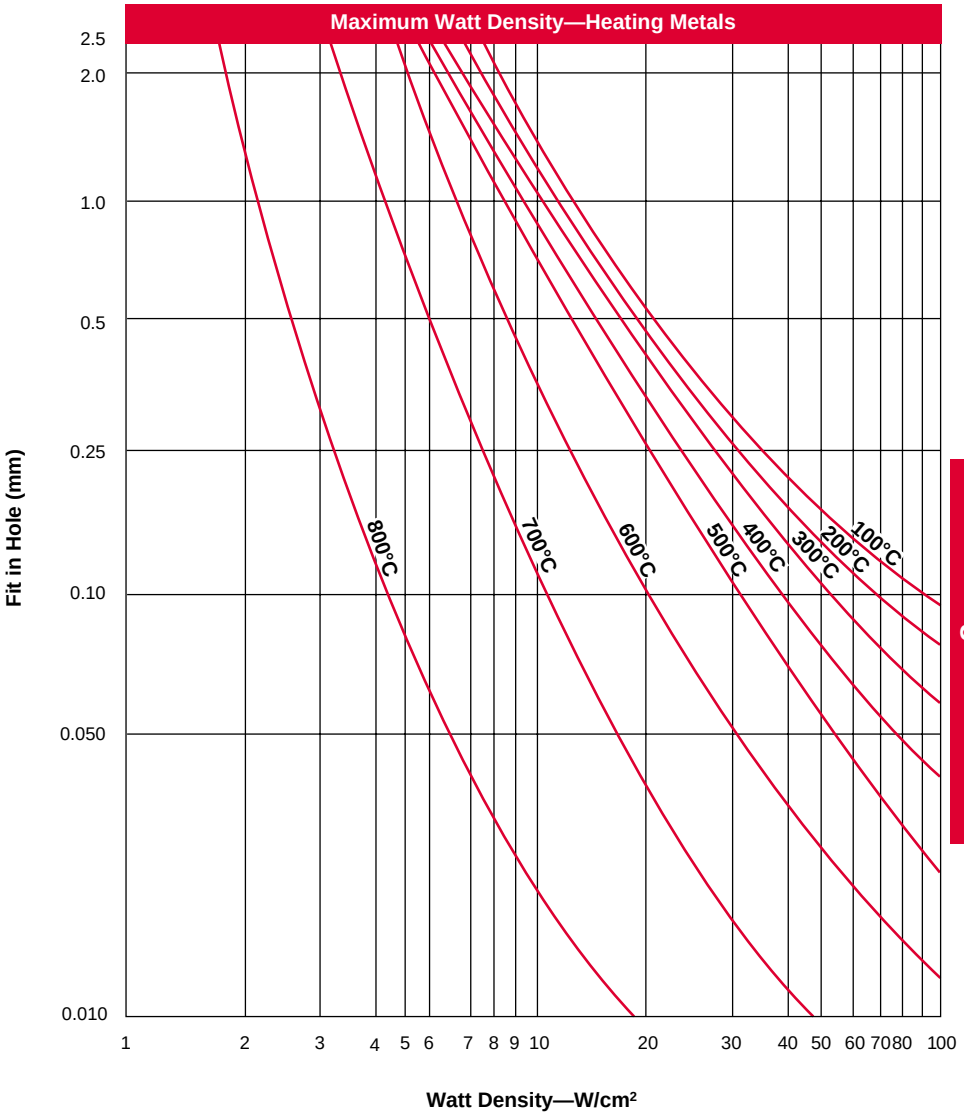
The *Maximum Watt Density—Heating Metals* graph will tell you either the maximum hole fit or recommended watt density of the heater. Enter the chart with either known variable, part fit in hole dimension or watt density. Then find the application temperature by reading up or over on the chart.

If the fit of the heater in the hole dimension is not known, it is easily determined. Subtract the minimum diameter of the metric FIREROD (nominal diameter minus tolerance) from the maximum hole diameter.

For example, take a hole diameter of 16.1 mm minus a heater diameter of 16 mm - 0.08 mm. The hole fit would be 0.18 mm. For metric FIREROD heaters in square holes or grooves, contact your Watlow sales engineer or authorized distributor for fit in hole dimension.

Correction Factors:

Also note, the *Maximum Watt Density—Heating Metals* graph depicts metric FIRERODs used in steel parts. Therefore, for either stainless steel or aluminum and brass, refer to applicable correction factors ① and ②.



① For stainless steel, enter the graph with a fit 0.04 mm (0.0015 inch) larger than actual.

② For aluminum and brass, enter the graph with a temperature 55°C (100°F) above actual temperature.

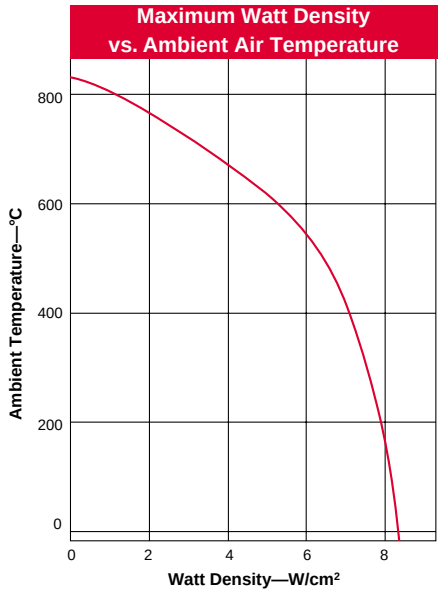
For English-base watt density graphs see FIREROD, page 77.

Metric FIREROD Cartridge

Maximum Allowable Watt Density

Continued

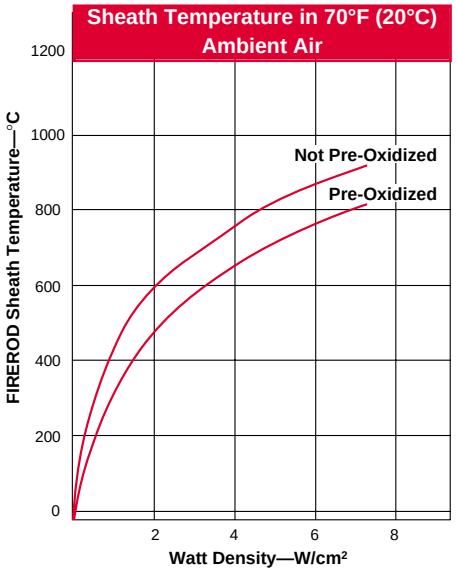
Heating Steam, Air and Gases



Watt Density vs. Ambient Air

The *Watt Density vs. Ambient Air Temperature* graph shows the maximum allowable watt density when one metric FIREROD heater is operated in air or similar gas.

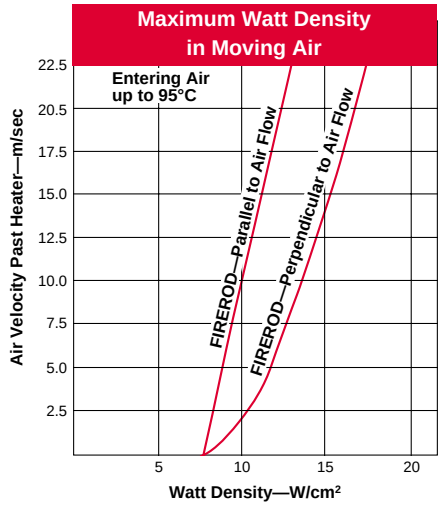
For metric FIREROD s grouped in a single row, with no less than one diameter between elements, multiply value from graph by 0.95. When a reflector is placed behind the heaters, multiply the maximum allowable watt density value from the graph by 0.85.



Sheath Temperature in Ambient Air

The *Sheath Temperature in Ambient Air* graph indicates the watt density required to bring a metric FIREROD heater to a given sheath temperature when operated in 20°C (70°F) ambient air.

At 7 W/cm² (44 W/in²), the sheath temperature would be 790°C (1450°F). At this temperature, one year life would be expected, provided that cycling is not too frequent. Higher temperatures would result in reduced heater life.



Watt Density in Moving Air

The *Watt Density in Moving Air* graph gives the maximum allowable watt density of a metric FIREROD heater in moving air.

If the volumetric flow rate of air is known in m³/s (or CFM), divide this value by the net free area in m² (or ft²) around the heater to determine air flow velocity. The net free area is the total area of the enclosure minus the area occupied by the heater.

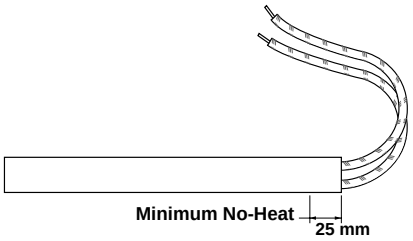
For English-base watt density graphs see FIREROD Cartridge, pages 77 and 78.

Cartridge Heaters

Metric FIREROD Cartridge

Termination Options

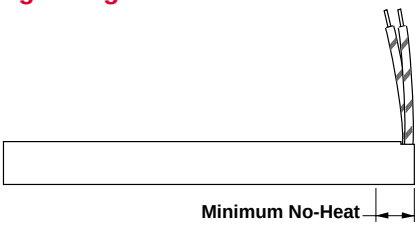
Swaged-in Flexible Leads



Swaged-in flexible leads, with a silicone-fiberglass insulation, are recommended for applications in which the leads must be bent at the exit point from the heater. Unless longer length is specified, 250 mm (10 inch) leads are supplied.

Heaters 150 mm (6 inches) or shorter generally have a six mm (¼ inch) no-heat section. Heaters to 250 mm (10 inches) require a 25 mm (one inch) no-heat section. Heaters greater than 250 mm may require more than a 25 mm no-heat section. To order, please specify **swaged-in flexible leads**.

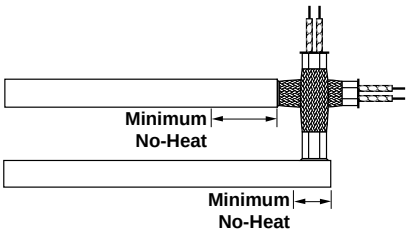
Right Angle Leads



Metric FIREROD Diameter mm	Minimum No-Heat Length mm (inches)
6.5	11 (7/16)
8	11 (7/16)
10	13 (½)
12.5	16 (⅝)
16	19 (¾)
20	22 (⅞)

Right angle leads are used in applications with a high degree of flexing and when space limitations are critical. Lead wires exit at a 90 degree angle through the side of the heater sheath. To order, specify **right angle leads** and lead length.

Stainless Steel Braid



Stainless steel braid is designed to protect leads from abrasion against sharp edges. It is the most flexible of Watlow's protective lead arrangements.

When the leads exit straight out, the braid is swaged into the no-heat section of the heater. When the leads exit at a right angle, a crimp connector is used to attach the braids.

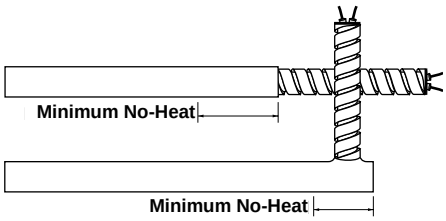
Unless otherwise specified, leads are 350 mm (14 inches) and the braid is 300 mm (12 inches) long. To order, specify either **straight or right angle stainless steel braid**, lead length and no-heat section.

Metric FIREROD Dia. mm	Min. No-Heat Length Straight mm (inches)	Min. No-Heat Length Right Angle mm (inches)
6.5	29 (1 ⅛)	14 (½)
8	29 (1 ⅛)	14 (½)
10	38 (1 ½)	16 (⅝)
12.5	38 (1 ½)	17 (⅔)
16	38 (1 ½)	22 (⅞)
20	38 (1 ½)	30 (1 3/16)

Cartridge Heaters

Metric FIREROD Cartridge

Termination Options
Continued



Stainless Steel Hose

Stainless steel hose provides the best protection against abrasion from sharp edges or abrasive equipment. It also offers ease of handling and wiring in abrasive environments.

When the leads exit at a right angle to the heater, the hose is silver-soldered to the sheath. Unless otherwise specified, leads are 350 mm (14 inches) long and the hose is 305 mm (12 inches) long. To order, specify **stainless steel hose**, lead length and no-heat section.

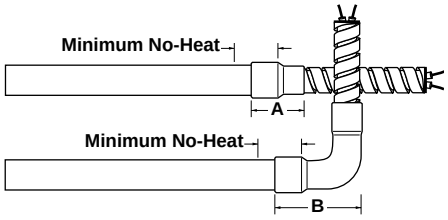
Metric FIREROD Diameter mm	Min. No-Heat Length		Stainless Steel Hose O.D. mm (inches)
	Straight mm (inches)	Right Angle mm (inches)	
6.5	29 (1 1/8)	14 (1/2)	5.6 (9/16)
8	29 (1 1/8)	14 (1/2)	6.5 (1/4)
10	38 (1 1/2)	16 (5/8)	7.2 (5/16)
12.5	38 (1 1/2)	17 (2/3)	9.5 (3/8)
16	38 (1 1/2)	22 (7/8)	12.7 (1/2)
20	38 (1 1/2)	30 (1 3/16)	15.9 (5/8)

Galvanized Conduit

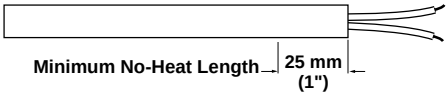
Galvanized conduit equals stainless steel hose in its abrasion protection.

The conduit is attached with 90 degree elbow copper coupler which overlaps the heater sheath.

Unless specified, 250 mm (10 inch) leads are supplied. To order, specify **galvanized conduit**, lead length and no-heat section.



Metric FIREROD Diameter mm	Minimum No-Heat Length mm (inches)	Dimension A mm (inches)	Dimension B mm (inches)	Galvanized Conduit O.D. mm (inches)
6.5	12 (7/16)	22 (7/8)	29 (1 1/8)	10 (3/8)
8	12 (7/16)	22 (7/8)	29 (1 1/8)	10 (3/8)
10	14 (1/2)	22 (7/8)	29 (1 1/8)	10 (3/8)
12.5	16 (5/8)	28 (1 1/8)	30 (1 3/16)	14 (1/2)
16	19 (3/4)	28 (1 1/8)	34 (1 5/16)	14 (1/2)
20	22 (7/8)	29 (1 1/8)	36 (1 7/16)	16 (5/8)



Teflon® Seal and Leads

Teflon® seal and leads protect the heater against moisture/ contamination from lubricating oil, cleaning solvents, plastic material or fumes and organic tapes. This seal is effective to 200°C (400°F) under continuous operation.

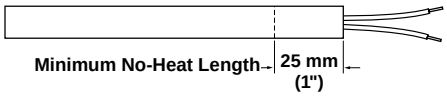
Please note, when ordering this option, that a 25 mm (one inch) minimum no-heat section is required to allow for construction. Additional no-heat may be required to keep the seal below effective temperatures. To order, specify **Teflon® seal and leads** and lead length.

Teflon® is a registered trademark of E.I. du Pont de Nemours & Company.

Metric FIREROD Cartridge

Termination Options

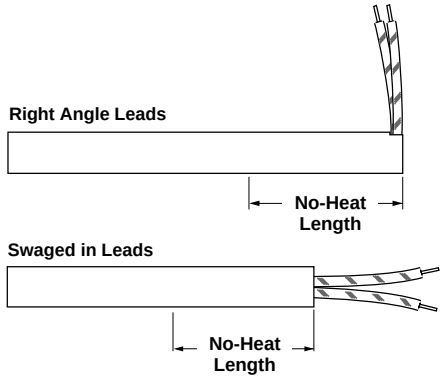
Continued



Silicone Rubber Seal and Leads

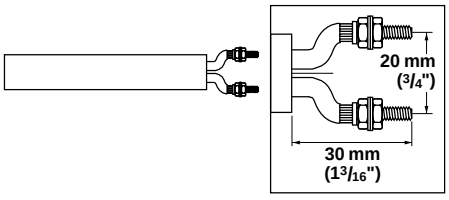
Silicone rubber seal and leads protect the heater against moisture/ contamination from lubricating oil, cleaning solvents, plastic material or fumes and organic tapes. This seal is effective to 230°C (450°F) under continuous operation. Epoxy potting for up to 260°C (500°F) for continuous operation is available upon request.

Please note, when ordering this option, that a 25 mm (one inch) minimum unheated section is required to allow for construction. Additional no-heat may be required to keep the seal below effective temperatures. To order, specify **silicone or epoxy seal and leads** and lead length.



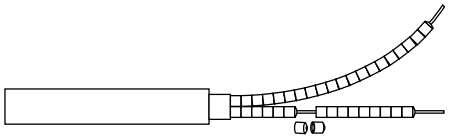
No-Heat Section

No-heat sections are recommended in applications where leads may be exposed to excessive heat, thus requiring a cooler lead end. Also use when heat is not required along the entire length of the metric FIREROD. Unheated extensions are available on all diameters with both pin style and swaged in leads. To order, specify **no-heat** section and length of no-heat.



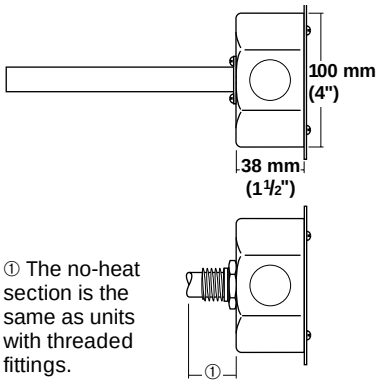
Post Terminals

Post terminals provide a quick, secure connection with ring or fork connectors or bus bars. Threaded M4 X 12 mm studs are soldered to the solid power pins. Nuts and washers are provided. This termination is available on 16 and 20 mm diameter units. To order, specify **post terminals.**



Ceramic Bead Insulation

Ceramic bead insulation protects the leads from high temperature ambients above 450°C (840°F). The beads fit over solid conductors that are extended long enough to reach a cooler area where flexible wires can be attached. To order, specify **ceramic bead insulation.**



① The no-heat section is the same as units with threaded fittings.

Terminal Box

NEMA 1, NEMA 4 (moisture-proof) and NEMA 7 (explosion-proof) octagonal terminal boxes can be mounted to a flange or threaded fitting on the 12.5, 16 and 20 mm diameter units. These 100 mm (four inch) terminal boxes have conduit knockouts to protect electrical connections.

Aluminum and macrolon plastic terminal boxes are also available in the following sizes:

- 50 X 50 X 30 mm nominal size for heaters to 10 mm in diameter;
- 80 X 80 X 55 mm nominal size for heaters 12.5 mm or larger in diameter.

To order, specify **terminal box**, NEMA type and/or material type.

Cartridge Heaters

Metric FIREROD Cartridge

Options

Accessories

Watlube

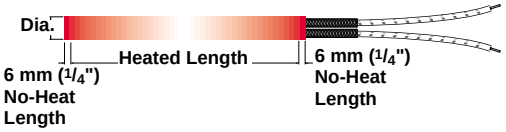
Watlube is an electrically non-conductive lubricant that acts as a barrier against high temperature oxidation, thus making heater removal easier. In addition, it aids in the transfer of heat from the metric FIREROD to the block. However, do not use it as a substitute for proper hole fit. Watlube is packaged in 118 ml (four ounce) bottles.

To order, specify **Watlube**.

External Finishing

Centerless Grinding

Centerless grinding can be used to finish precision diameters, thus permitting closer heater-to-part fit and higher watt densities. Centerless grinding of metric FIREROD heaters with swaged-in flexible leads is limited to 305 mm (12 inch) lead length. Longer lead lengths are available, but require external connection. To order, specify **centerless grinding**.



Distributed Wattage

Distributed wattage varies the watt density along the length of the heater. This construction technique is used to compensate for heat losses along the edges of heated parts. To order, specify **distributed wattage** and give the length and wattage for each section.

Individually Controlled Heat Zones

Individually controlled heat zones give the flexibility of controlling temperature by zones, along the length of the metric FIREROD. This is an advantage for heating requirements of certain applications, like sealing bars. This internal construction can be ordered on 12.5, 16 and 20 mm diameter units. If not specified, 250 mm (10 inch) crimped on leads will be supplied. To order, specify **individually controlled heat zones** as well as length and wattage per zone and length of crimped on leads.

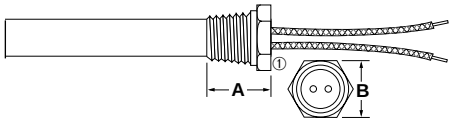
Dual Voltage

When the metric FIREROD requires the flexibility of operating on two voltages, use this internal construction. Dual voltage is available on 12.5, 16 and 20 mm diameter units. If not specified, 250 mm (10 inch) crimped on leads will be supplied. To order, specify **dual voltage**, voltage requirements and length of crimped on leads.

Metric FIREROD Cartridge

Options
Continued

Mounting Methods



Threaded Fittings

DIN Thread Size

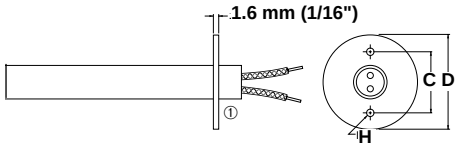
Metric FIREROD Diameter mm	Minimum No-Heat Length mm (in)	Thread Size DIN 13	A mm (in)	B mm (in)	Length of Threaded Section mm (in)
6.5	16 (5/8)	M10 X 1.0	10 (3/8)	12 (7/16)	6 (1/4)
8	16 (5/8)	M12 X 1.0	10 (3/8)	14 (1/2)	6.5 (1/4)
10	18 (11/16)	M14 X 1.5	11 (7/16)	17 (5/8)	6.5 (1/4)
12.5	19 (3/4)	M16 X 1.5	12 (7/16)	19 (3/4)	7.5 (5/16)
16	20 (3/4)	M20 X 1.5	14 (1/2)	24 (15/16)	9 (3/8)
20	22 (7/8)	M26 X 1.5	15 (9/16)	30 (1 3/16)	10 (3/8)

① Swaged in unit pictured.

NPT Thread Size

Metric FIREROD Diameter mm	Minimum No Heat Length mm (in)	Thread Size NPT (in)	A mm (in)	B mm (in)	Length of Threaded Section mm (in)
6.5	19 (3/4)	(1/8)	13 (1/2)	11 (7/16)	10 (3/8)
8	22 (7/8)	(1/4)	16 (5/8)	14 (1/2)	13 (1/2)
10	22 (7/8)	(1/4)	16 (5/8)	14 (1/2)	13 (1/2)
12.5	25 (1)	(3/8)	19 (3/4)	17.5 (11/16)	15 (9/16)
16	28 (1 1/8)	(1/2)	22 (7/8)	22 (7/8)	16 (5/8)
20	32 (1 1/4)	(3/4)	25 (1)	29 (1 1/8)	19 (3/4)

Threaded fittings allow for fast, water-tight installation of the heater into a threaded hole. These fittings can be ordered in either brass or stainless steel. Double threaded fittings are also available. See dimensions noted on the *DIN Size and NPT Size Threaded Fittings* charts or contact your Watlow sales engineer or authorized distributor if you need to exceed limitations shown. To order, specify either brass or stainless steel **threaded fittings**.



Flanges

Stainless steel flanges are a convenient mounting method as well as a way to position a heater within an application. These flanges can be located in any no-heat section of the heater sheath. To order, specify **flange**, flange size and location.

Metric FIREROD Diameter mm	Flange Size	D mm (inches)	C mm (inches)	H mm (inches)
6.5, 8, 10,12.5, 16 ②	FS	25 (1)	19 (3/4)	4.3 (3/16)
6.5, 8, 10, 12.5, 16, 20	FM	38 (1 1/2)	28.5 (1 1/8)	4.3 (3/16)
16, 20	FL	51 (2)	38 (1 1/2)	5.3 (3/16)

① Swaged in unit pictured.
② The FS flange for 16 mm diameter units have no “H” holes.

Cartridge Heaters

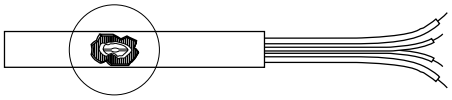
Metric FIREROD Cartridge

Options
Continued

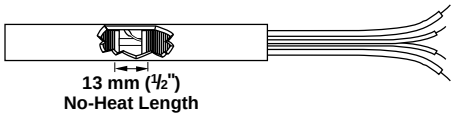
Sensors

Internal Thermocouple

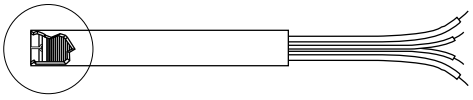
Style A



Style B



Style C



The **Style A** internal thermocouple can be used to evaluate heat transfer efficiency of an application a measure that enables you to cut energy costs and increase heater life.

The **Style B** internal thermocouple gives a good approximation of part temperature, and is available in all diameters. The thermocouple junction can be in contact with the inside of the heater sheath, located in the 13 mm (½ inch) no-heat section anywhere along the heater length.

A **Style C** internal thermocouple is useful in applications where material flows past the end of the heater, as in plastic molding. This junction is embedded in a special end disc. Style C is not available on 20 mm diameter units.

To order, specify **internal thermocouple Style A, B** or **C** and thermocouple **Type J, T, K** or **E**. If not specified, 250 mm (10 inch) thermocouple leads are supplied.

Thermocouple Types

ISA Code	Conductor Characteristics Positive	Negative	Temperature Range °C	(°F)
J	Iron (Magnetic)	Constantan (Non-magnetic)	-20 to 760	(0 to 1400)
K	Chromel® (Non-magnetic)	Alumel® (Magnetic)	-20 to 1260	(0 to 2300)

For other thermocouple types, contact your Watlow sales engineer or authorized distributor.

Alumel® and Chromel® are registered trademarks of Hoskins Manufacturing Co.

Made in Kronau, Germany

How to Order

Metric FIREROD cartridge heaters are available as **made-to-order** units only. To order, please specify:

- Diameter
- Overall length
- Volts
- Watts
- Lead type and length or terminal configuration
- Options

Availability

Made-to-Order: Shipment within three weeks.

Quick Ship • *Next day shipment on all stock units.*

Cartridge Heaters

Metric EB Cartridge

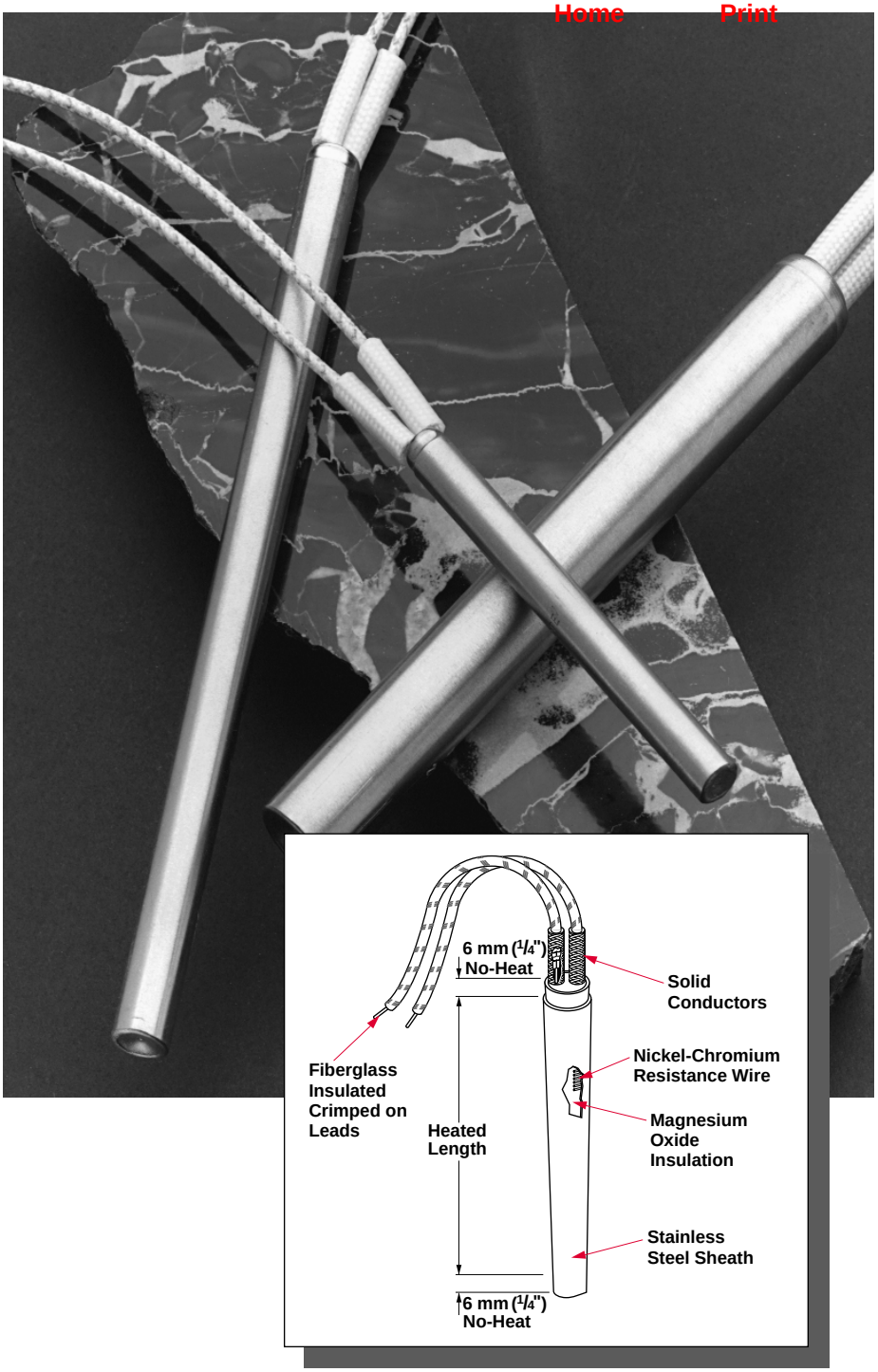
The Watlow EB cartridge heater is a proven performer like the metric FIREROD®. That's because the same quality materials go into its construction; MgO insulation, nickel-chromium resistance wire, silicone-fiberglass insulated lead wires. The only difference is that the EB cartridge is packaged in a more economical design. Instead of having the high watt density capabilities of a metric FIREROD, it's made for medium watt density applications.

Performance Capabilities

- Part temperatures to 600°C (1100°F)
- Maximum watt density to 30 W/cm² (190 W/in²)
- Maximum voltage to 480V~(ac)

Features and Benefits

- **Magnesium oxide insulation,** compacted to the proper density, results in high dielectric strength and contributes to faster heat-up.
- **Nickel-chromium resistance wire,** precisely wound through the heated length, assures even, efficient distribution of heat to the sheath.
- **Metallurgically-bonded conductor pins,** crimp-connected to the resistance wires, ensure trouble-free electrical continuity. This process provides lead flexibility just 8 mm (5/16 inch) from the end of the heater.
- **Flexible stranded wires,** with silicone-fiberglass sleeve, insulate the wires to temperatures of 250°C (480°F).
- **Optional lead end with silicone rubber seal** protects the leads against moisture and other contaminants.



- **VDE component recognition** to 230V~(ac) according to VDE 0721 part 1/3.78 and part 2/3.78 Section E in connection with VDE 0720 part 1/11.74.

Applications

- Plastic injection molds, dies and sealing jaws
- Hot melt systems, labeling
- Industrial and textile manufacturing equipment

Cartridge Heaters

Metric EB Cartridge

Applications and Technical Data

Maximum Allowable Watt Density

Both the *Maximum Allowable Watt Density* metric and inch-base charts will tell you either the hole fit or recommended watt density in relationship to part temperature. Enter the chart with either known variable, part fit in hole dimension or watt density. Then find the part temperature by reading up or over on the chart. The part temperature curves shown are measured 13 mm (½ inch) from the heater in a mild steel block. For stainless steel blocks, enter the graph with a fit of 0.04 mm (0.0015 inch) larger than actual. For aluminum and brass blocks, enter the graph with a temperature 55°C (100°F) above actual block temperature.

On-Off Cycling: On-off cycling shortens heater life. If the heater cycles more than once per hour, multiply the watt density, shown on the chart, by 0.8 to determine the maximum allowable watt density for the application. If the heater cycles more than once a minute, multiply by 0.7.

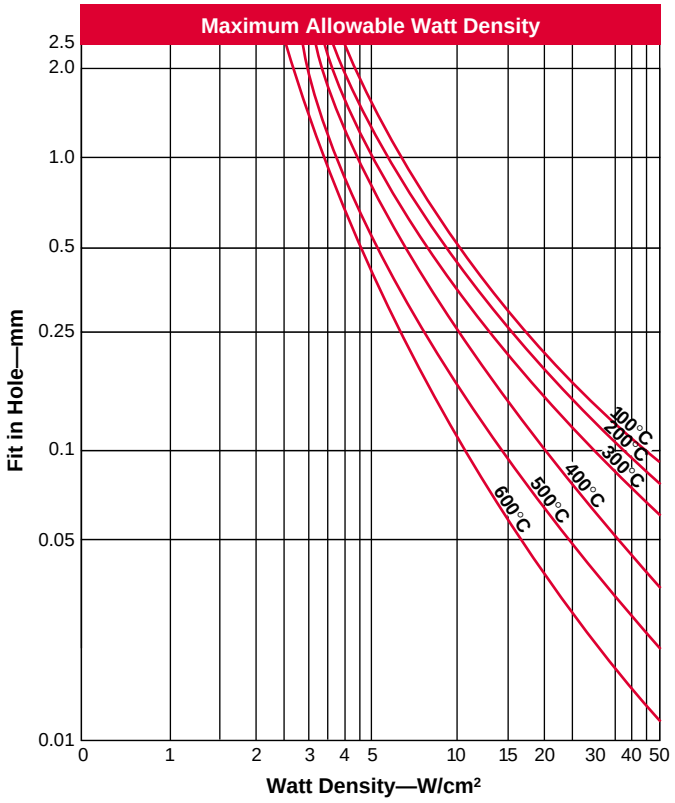
Tolerances

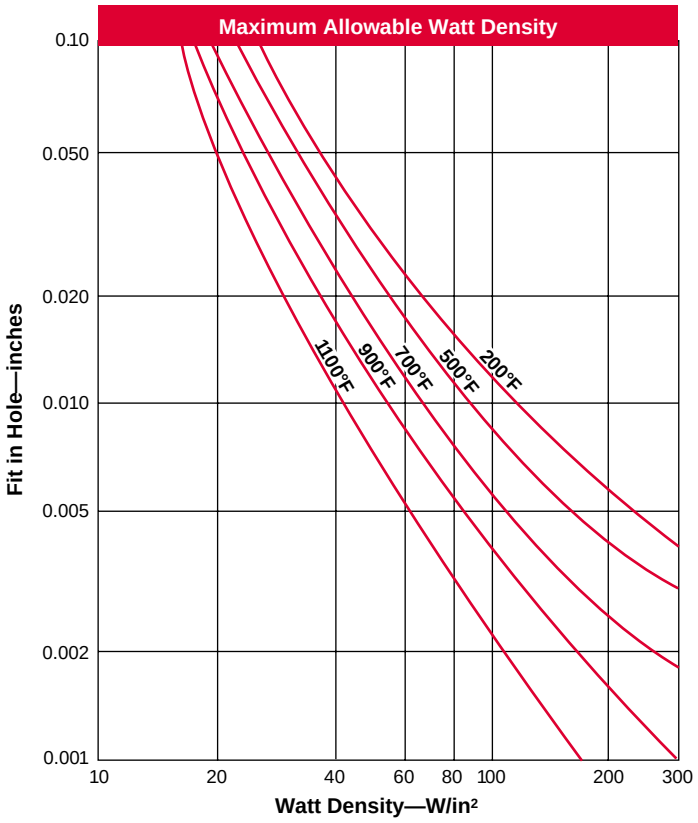
Diameter: -0.02 mm, -0.08 mm (-0.0008 inch, -0.0031 inch)

Length: ±3 percent with ±2.4 mm (±3/32 inch) minimum

Resistance: +5 percent, -10 percent. Resistance is measured at room temperature following first heater operation.

Wattage: +10 percent, -5 percent. Wattage decreases approximately 5 percent with temperature. Wattage tolerances are for heaters at operating temperature.





Cartridge Heaters

Metric EB Cartridge

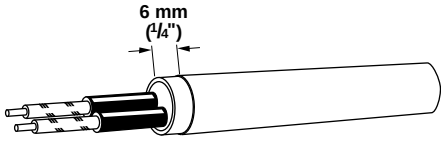
Applications and Technical Data
Continued

Dimensional & Electrical Data

Heater Diameter (mm)	6.5	8	10	12.5	16	20
Nominal Diameter (in)	0.256	0.315	0.394	0.492	0.630	0.787
Maximum Voltage	250	250	250	400	480	480
Crimped-on Leads						
Maximum Amps	4.4	4.4	6.7	9.7	23	23
Maximum Wattage @ 230V	1010	1010	1540	2230	5290	5290
Maximum Wattage @ 400V				3880	9200	9200
Swaged-in Leads						
Maximum Amps	3.1/4.4 ①	3.1/4.4 ①	4.4	7.6/12.5 ②	7.6/12.5	12.5
Maximum Wattage @ 230V	710/1010	710/1010	1010	1750/2875	1750/2875	2875
Maximum Wattage @ 400V	—	—	—	3040/5000	3040/5000	5000

① On certain lead construction, maximum amperage is 3.1. Please consult Watlow.
② On certain lead construction, maximum amperage is 7.6. Please consult Watlow.

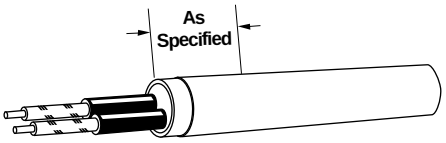
Termination Options



Crimped-on Lead

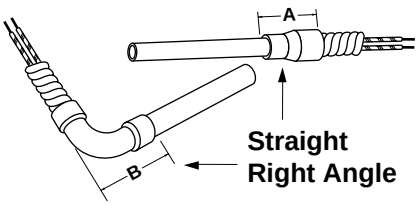
Crimped-on leads with a 6 mm (¼ inch) unheated section are recommended for applications where the lead wire temperature does not exceed 250°C (480°F).

Unless a longer length is specified, 250 mm (10 inch) leads will be supplied. To order, request **crimped-on leads** and desired lead length.



No-Heat Zone

An unheated section can be used to extend the leads safely into a cool zone in a high temperature application. Leads should be kept below 250°C (480°F) for maximum service life. To order, specify **no-heat zone** and length of unheated section.



Galvanized Conduit

Flexible galvanized conduit can be installed over the leads for abrasion protection. It is attached with either a straight or 90 degree elbow copper coupler. The copper coupler overlaps the heater sheath by 6 mm (¼ inch). A no-heat section is required. To order, specify **galvanized conduit, straight** or **right angle.**

Stainless Steel Hose

Stainless steel hose also protects leads against abrasion. It is attached with a straight or 90 degree elbow copper coupler. The copper coupler overlaps the heater sheath by 6 mm (¼ inch).

It can also be swaged-in straight or silver soldered to the heater sheath at a right angle. A no-heat section is required. To order, specify **stainless steel hose, straight** or **right angle with copper coupler, straight swaged-in** or **right angle silver soldered.**

Cartridge Heaters

Metric EB Cartridge

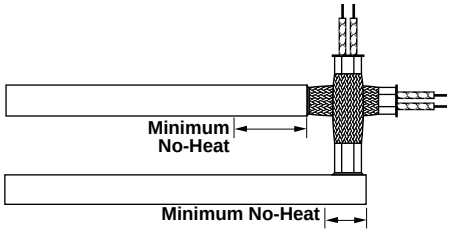
Termination Options

Continued

Galvanized Conduit and Stainless Steel Hose Dimensions

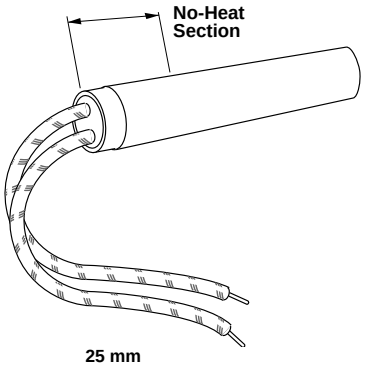
Heater Diameter mm	Minimum No-Heat Length mm (inches)	Dimension A mm (inches)	Dimension B mm (inches)	Galvanized Conduit O.D. mm (inches)	Stainless Steel Hose O.D. mm (inches)
6.5	12 (7/16)	22 (7/8)	29 (1 1/8)	10 (3/8)	5.6 (3/16)
8	12 (7/16)	22 (7/8)	29 (1 1/8)	10 (3/8)	6.5 (1/4)
10	14 (1/2)	22 (7/8)	29 (1 1/8)	10 (3/8)	7.2 (5/16)
12.5	16 (5/8)	28 (1 1/8)	30 (1 3/16)	14 (9/16)	9.5 (3/8)
16	19 (3/4)	28 (1 1/8)	34 (1 3/8)	14 (9/16)	12.7 (1/2)
20	22 (7/8)	29 (1 1/8)	36 (1 7/16)	16 (5/8)	15.9 (5/8)

Dimensions are shown for designs with copper coupler only.



Stainless Steel Braid

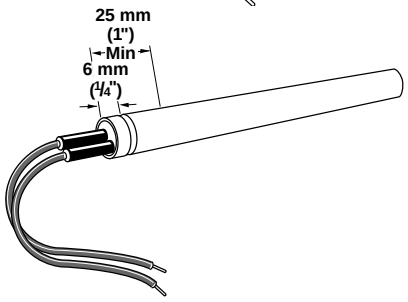
Like stainless steel hose, stainless steel braid also protects against abrasion. Stainless steel braid is swaged-in straight or crimped-on to the heater at a right angle. Metal braid is recommended when excellent flexibility with good physical protection is needed. A unheated section is required. To order, specify **stainless steel braid, straight** or **right angle.**



Swaged-in Flexible Lead

Swaged-in flexible leads, with a silicone-fiberglass insulation, are recommended for applications in which the leads must be bent at the exit point from the heater. Unless longer length is specified, 250 mm (10 inch) leads are supplied.

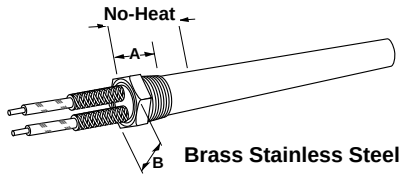
Heaters 140 mm (5 ½ inches) or shorter generally have a six mm (¼ inch) no-heat section. Heaters to 250 mm (10 inches) require a 25 mm (one inch) no-heat section. Heaters greater than 250 mm may require more than a 25 mm no-heat section. To order, please specify **swaged-in flexible leads.**



Moisture Resistant Seal

Silicone rubber moisture resistant seals can be provided at the lead end to virtually seal the heater. This seal is rated to 230°C (450°F) continuous operation.

A 25 mm (one inch) no-heat section is required at the lead end. Solid pin leads exit through the seal with crimped-on silicone rubber insulated lead wires and silicone rubber sleeves that extend into the seal. Swaged-in leads are also an option where flexibility at the lead exit is required. To order specify, **silicone rubber moisture resistant seal** and either **crimped-on** or **swaged-in leads**.



Threaded Fitting

Either brass or stainless steel threaded fittings for screw-in mounting can be added to units that have moisture resistant seals. Available dimensions are shown on the *Threaded Fittings* charts. To order, please request **brass** or **stainless steel threaded fittings** and location on the heater.

Note: For liquid immersion applications, please also specify heavy weld end disc.

Cartridge Heaters

Metric EB Cartridge

Termination Options
Continued

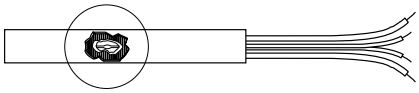
DIN Thread Size

Heater Diameter mm	Minimum No-Heat Length mm	(inches)	Thread Size DIN 13	Dimension A mm	(inches)	Dimension B mm	(inches)	Length of Threaded Section mm	(inches)
6.5	16	(5/8)	M 10 X 1	10	(3/8)	12	(7/16)	6	(1/4)
8	16	(5/8)	M 12 X 1	10	(3/8)	14	(1/2)	6.5	(1/4)
10	18	(11/16)	M 14 X 1.5	11	(7/16)	17	(5/8)	6.5	(1/4)
12.5	19	(3/4)	M 16 X 1.5	12	(7/16)	19	(3/4)	7.5	(9/16)
16	20	(3/4)	M 20 X 1.5	14	(9/16)	24	(15/16)	9	(3/8)
20	22	(7/8)	M 26 X 1.5	15	(9/16)	30	(1 3/16)	10	(3/8)

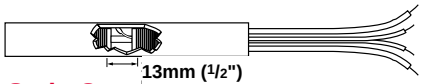
NPT Thread Size

Heater Diameter mm	Minimum No-Heat Length mm	(inches)	Thread Size NPT inches	Dimension A mm	(inches)	Dimension B mm	(inches)	Length of Threaded Section mm	(inches)
6.5	19	(3/4)	1/8	13	(1/2)	11	(7/16)	10	(3/8)
8	22	(7/8)	1/4	16	(5/8)	14	(1/2)	13	(1/2)
10	22	(7/8)	1/4	16	(5/8)	14	(1/2)	13	(1/2)
12.5	25	(1)	3/8	19	(3/4)	17.5	(11/16)	15	(9/16)
16	28	(1 1/8)	1/2	22	(7/8)	22	(7/8)	16	(5/8)
20	32	(1 1/4)	3/4	25	(1)	29	(1 1/8)	19	(3/4)

Style A



Style B



Style C

Internal Thermocouple

Style A is used to evaluate heat transfer efficiency of an application. The junction is located in the heater core to monitor the internal temperature of the heater.

Style B approximates part temperature, and is available in all diameters. The thermocouple junction can be in contact with the inside of the heater sheath, located in the 13 mm (½ inch) no-heat section anywhere along the heater length.

Style C is useful in applications where material flows past the end of the heater. This junction is embedded in a special end disc. Type C is available only on 6.5, 8, 10, 12.5 and 16 mm diameter units.

To order, specify **internal thermocouple**, **Style A, B** or **C** and **thermocouple ASTM Type J, T, K** or **E**. If not specified, 250 mm (10 inch) thermocouple leads are supplied.

Thermocouple Types

ASTM Code	Conductor Characteristics		Temperature Range	
	Positive	Negative	°C	(°F)
J	Copper	Constantan (Silver Color)	-60 to 370	(-75 to 700)
K	Chromel® (Non-Magnetic)	Alumel® (Magnetic)	-20 to 1260	(0 to 2300)

For other ASTM types, contact Watlow.

How to Order

To order stock AB cartridge heaters, please specify:

- Code number
- Termination options, and length of leads

For **made-to-order** units, please specify:

- Diameter
- Overall length
- Watts
- Termination options, and length of leads

Availability

Stock: Next day shipment

Made-to-Order: Shipment within three weeks

Cartridge Heaters

Made in Kronau, Germany

Metric EB Cartridge

Diameter mm	Sheath Length mm	(inches)	No-Heat Length mm	Watts	Watt Density W/cm²	(W/in²)	Availability	Code No.
6.5	40	(1 9/16)		50	9	(58)	Stock	**KEBE0040C001A**
	40	(1 9/16)		75	14	(90)	Stock	**KEBE0040C002A**
	40	(1 9/16)		100	19	(123)	Stock	**KEBE0040C003A**
	40	(1 9/16)		125	24	(155)	Stock	**KEBE0040C004A**
	40	(1 9/16)		150	28	(181)	Stock	**KEBE0040C005A**
	60	(2 3/8)		50	5	(32)	Stock	**KEBE0060C001A**
	60	(2 3/8)		100	11	(71)	Stock	**KEBE0060C002A**
	60	(2 3/8)		150	16	(103)	Stock	**KEBE0060C003A**
	60	(2 3/8)		200	21	(135)	Stock	**KEBE0060C004A**
	60	(2 3/8)		250	27	(174)	Stock	**KEBE0060C005A**
	80	(3 1/8)		100	7	(45)	Stock	**KEBE0080C001A**
	80	(3 1/8)		150	11	(71)	Stock	**KEBE0080C002A**
	80	(3 1/8)		200	15	(97)	Stock	**KEBE0080C003A**
	80	(3 1/8)		300	22	(142)	Stock	**KEBE0080C004A**
	80	(3 1/8)		450	33	(213)	Stock	**KEBE0080C005A**
	100	(3 15/16)		100	6	(39)	Stock	**KEBE0100C001A**
	100	(3 15/16)		200	11	(71)	Stock	**KEBE0100C002A**
	100	(3 15/16)		300	17	(110)	Stock	**KEBE0100C003A**
8.0	40	(1 9/16)		50	8	(52)	Stock	**KEBF0040C001A**
	40	(1 9/16)		75	11	(71)	Stock	**KEBF0040C002A**
	40	(1 9/16)		100	15	(97)	Stock	**KEBF0040C003A**
	40	(1 9/16)		150	23	(148)	Stock	**KEBF0040C004A**
	40	(1 9/16)		200	31	(200)	Stock	**KEBF0040C005A**
	60	(2 3/8)		75	6	(39)	Stock	**KEBF0060C001A**
	60	(2 3/8)		150	13	(84)	Stock	**KEBF0060C002A**
	60	(2 3/8)		200	17	(110)	Stock	**KEBF0060C003A**
	60	(2 3/8)		250	22	(142)	Stock	**KEBF0060C004A**
	60	(2 3/8)		300	26	(168)	Stock	**KEBF0060C005A**
	80	(3 1/8)		100	6	(39)	Stock	**KEBF0080C001A**
	80	(3 1/8)		200	12	(77)	Stock	**KEBF0080C002A**
	80	(3 1/8)		300	18	(116)	Stock	**KEBF0080C003A**
	80	(3 1/8)	25	400	33	(213)	Stock	**KEBF0080D001A**
	80	(3 1/8)	25	500	41	(265)	Stock	**KEBF0080D002A**
	100	(3 15/16)		100	5	(32)	Stock	**KEBF0100C001A**
	100	(3 15/16)		250	12	(77)	Stock	**KEBF0100C002A**
	100	(3 15/16)	25	400	23	(148)	Stock	**KEBF0100D001A**
	100	(3 15/16)	25	500	29	(187)	Stock	**KEBF0100D002A**
	100	(3 15/16)	25	600	35	(226)	Stock	**KEBF0100D003A**
	130	(5 1/8)	25	200	8	(52)	Stock	**KEBF0130D001A**
	130	(5 1/8)	25	350	14	(90)	Stock	**KEBF0130D002A**
	130	(5 1/8)	25	500	20	(129)	Stock	**KEBF0130D003A**
10.0	40	(1 9/16)		50	6	(39)	Stock	**KEBG0040C001A**
	40	(1 9/16)		100	12	(77)	Stock	**KEBG0040C002A**
	40	(1 9/16)		150	18	(116)	Stock	**KEBG0040C003A**
	40	(1 9/16)		200	24	(155)	Stock	**KEBG0040C004A**
	40	(1 9/16)		250	31	(200)	Stock	**KEBG0040C005A**
	60	(2 3/8)		100	7	(45)	Stock	**KEBG0060C001A**
	60	(2 3/8)		150	10	(65)	Stock	**KEBG0060C002A**
	60	(2 3/8)		200	14	(90)	Stock	**KEBG0060C003A**
	60	(2 3/8)		300	21	(135)	Stock	**KEBG0060C004A**
	60	(2 3/8)		400	28	(181)	Stock	**KEBG0060C005A**
	80	(3 1/8)		100	5	(32)	Stock	**KEBG0080C001A**
	80	(3 1/8)		200	10	(65)	Stock	**KEBG0080C002A**
	80	(3 1/8)		300	14	(90)	Stock	**KEBG0080C003A**
	80	(3 1/8)		400	19	(123)	Stock	**KEBG0080C004A**
	80	(3 1/8)		600	29	(187)	Stock	**KEBG0080C005A**
	100	(3 15/16)		200	7	(45)	Stock	**KEBG0100C001A**
	100	(3 15/16)		300	11	(71)	Stock	**KEBG0100C002A**
	100	(3 15/16)		400	15	(97)	Stock	**KEBG0100C003A**
	100	(3 15/16)		500	19	(123)	Stock	**KEBG0100C004A**
	100	(3 15/16)	25	700	33	(213)	Stock	**KEBG0100D001A**

CONTINUED

Note: All stock EB cartridge heaters 230V~(ac) and 1000 mm fiberglass insulated swaged-in leads.

Cartridge Heaters

Made in Kronau, Germany

Metric EB Cartridge

Diameter mm	Sheath Length mm	(inches)	No-Heat Length mm	Watts	Watt Density W/cm²	(W/in²)	Availability	Code No.
10.0	130	(5 1/8)		200	5	(32)	Stock	**KEBG0130C001A**
	130	(5 1/8)		400	11	(71)	Stock	**KEBG0130C002A**
	130	(5 1/8)	25	600	19	(123)	Stock	**KEBG0130D001A**
	130	(5 1/8)	25	800	26	(168)	Stock	**KEBG0130D002A**
	130	(5 1/8)	25	1000	32	(206)	Stock	**KEBG0130D003A**
	160	(6 5/16)	25	200	5	(32)	Stock	**KEBG0160D001A**
	160	(6 5/16)	25	500	12	(77)	Stock	**KEBG0160D002A**
	160	(6 5/16)	25	800	20	(129)	Stock	**KEBG0160D003A**
	160	(6 5/16)	25	1000	25	(161)	Stock	**KEBG0160D004A**
	160	(6 5/16)	25	1200	30	(194)	Stock	**KEBG0160D005A**
	200	(7 7/8)	25	300	6	(39)	Stock	**KEBG0200D001A**
	200	(7 7/8)	25	600	11	(71)	Stock	**KEBG0200D002A**
	200	(7 7/8)	25	1000	19	(123)	Stock	**KEBG0200D003A**
	200	(7 7/8)	25	1200	23	(148)	Stock	**KEBG0200D004A**
	200	(7 7/8)	25	1400	27	(174)	Stock	**KEBG0200D005A**
	250	(9 7/8)	25	400	6	(39)	Stock	**KEBG0250D001A**
	250	(9 7/8)	25	700	10	(65)	Stock	**KEBG0250D002A**
	250	(9 7/8)	25	1000	15	(97)	Stock	**KEBG0250D003A**
	250	(9 7/8)	25	1400	20	(129)	Stock	**KEBG0250D004A**
	300	(11 13/16)	30	500	6	(39)	Stock	**KEBG0300D004A**
	300	(11 13/16)	30	1000	12	(77)	Stock	**KEBG0300D002A**
	300	(11 13/16)	30	1500	18	(116)	Stock	**KEBG0300D003A**
12.5	80	(3 1/8)		150	6	(39)	Stock	**KEBJ0080C001A**
	80	(3 1/8)		300	12	(77)	Stock	**KEBJ0080C003A**
	80	(3 1/8)		400	15	(97)	Stock	**KEBJ0080C004A**
	80	(3 1/8)		500	19	(123)	Stock	**KEBJ0080C002A**
	80	(3 1/8)		700	27	(174)	Stock	**KEBJ0080C005A**
	100	(3 15/16)		200	6	(39)	Stock	**KEBJ0100C001A**
	100	(3 15/16)		400	12	(77)	Stock	**KEBJ0100C002A**
	100	(3 15/16)		600	18	(116)	Stock	**KEBJ0100D003A**
	100	(3 15/16)		800	24	(155)	Stock	**KEBJ0100D004A**
	100	(3 15/16)	25	1000	37	(239)	Stock	**KEBJ0100D001A**
	130	(5 1/8)		250	5	(32)	Stock	**KEBJ0130C001A**
	130	(5 1/8)		500	11	(71)	Stock	**KEBJ0130C002A**
	130	(5 1/8)	25	800	21	(135)	Stock	**KEBJ0130D001A**
	130	(5 1/8)	25	1000	26	(168)	Stock	**KEBJ0130D002A**
	130	(5 1/8)	25	1400	36	(232)	Stock	**KEBJ0130D003A**
	160	(6 5/16)	25	300	6	(39)	Stock	**KEBJ0160D001A**
	160	(6 5/16)	25	600	12	(77)	Stock	**KEBJ0160D002A**
	160	(6 5/16)	25	1000	20	(129)	Stock	**KEBJ0160D003A**
	160	(6 5/16)	25	1400	28	(181)	Stock	**KEBJ0160D004A**
	160	(6 5/16)	25	1700	34	(219)	Stock	**KEBJ0160D005A**
	200	(7 7/8)	25	400	6	(39)	Stock	**KEBJ0200D002A**
	200	(7 7/8)	25	700	11	(71)	Stock	**KEBJ0200D003A**
	200	(7 7/8)	25	1000	15	(97)	Stock	**KEBJ0200D004A**
	200	(7 7/8)	25	1500	23	(148)	Stock	**KEBJ0200D005A**
	200	(7 7/8)	25	2000	30	(194)	Stock	**KEBJ0200D006A**
	250	(9 7/8)	25	500	6	(39)	Stock	**KEBJ0250D001A**
	250	(9 7/8)	25	1000	12	(77)	Stock	**KEBJ0250D002A**
	250	(9 7/8)	25	1500	18	(116)	Stock	**KEBJ0250D003A**
	250	(9 7/8)	25	2000	23	(148)	Stock	**KEBJ0250D004A**
	300	(11 13/16)	30	600	6	(39)	Stock	**KEBJ0300D001A**
	300	(11 13/16)	30	1500	15	(97)	Stock	**KEBJ0300D002A**
16.0	80	(3 1/8)		200	6	(39)	Stock	**KEBL0080C001A**
	80	(3 1/8)		400	12	(77)	Stock	**KEBL0080C002A**
	80	(3 1/8)		600	18	(116)	Stock	**KEBL0080C003A**
	80	(3 1/8)		800	24	(155)	Stock	**KEBL0080C004A**
	100	(3 15/16)		300	7	(45)	Stock	**KEBL0100C001A**
	100	(3 15/16)		500	12	(77)	Stock	**KEBL0100C002A**
	100	(3 15/16)		700	16	(103)	Stock	**KEBL0100C003A**
	100	(3 15/16)	25	1000	29	(187)	Stock	**KEBL0100D001A**

CONTINUED

Note: All stock EB cartridge heaters 230V~(ac) and 1000 mm fiberglass insulated swaged-in leads.

Cartridge Heaters

Made in Kronau, Germany

Metric EB Cartridge

Diameter mm	Sheath Length mm	(inches)	No-Heat Length mm	Watts	Watt Density W/cm²	(W/in²)	Availability	Code No.
16.0	130	(5 1/8)	25	400	8	(52)	Stock	**KEBL0130D001A**
	130	(5 1/8)	25	600	12	(77)	Stock	**KEBL0130D002A**
	130	(5 1/8)	25	800	16	(103)	Stock	**KEBL0130D003A**
	130	(5 1/8)	25	1200	24	(155)	Stock	**KEBL0130D004A**
	160	(6 5/16)	25	500	8	(52)	Stock	**KEBL0160D001A**
	160	(6 5/16)	25	700	11	(71)	Stock	**KEBL0160D002A**
	160	(6 5/16)	25	1000	16	(103)	Stock	**KEBL0160D003A**
	160	(6 5/16)	25	1500	23	(148)	Stock	**KEBL0160D004A**
	160	(6 5/16)	25	2000	31	(200)	Stock	**KEBL0160D005A**
	200	(7 7/8)	25	600	7	(45)	Stock	**KEBL0200D001A**
	200	(7 7/8)	25	1000	12	(77)	Stock	**KEBL0200D002A**
	200	(7 7/8)	25	1500	18	(116)	Stock	**KEBL0200D003A**
	200	(7 7/8)	25	2000	24	(155)	Stock	**KEBL0200D004A**
	250	(9 7/8)	25	700	6	(39)	Stock	**KEBL0250D001A**
	250	(9 7/8)	25	1500	14	(90)	Stock	**KEBL0250D002A**
	250	(9 7/8)	25	2000	18	(116)	Stock	**KEBL0250D003A**
	300	(11 13/16)	30	1000	8	(52)	Stock	**KEBL0300D001A**
	300	(11 13/16)	30	1500	11	(71)	Stock	**KEBL0300D002A**
	300	(11 13/16)	30	2000	15	(97)	Stock	**KEBL0300D003A**
20.0	200	(7 7/8)	25	1000	9	(58)	Stock	**KEBN0200D001A**
	200	(7 7/8)	25	1500	14	(90)	Stock	**KEBN0200D002A**
	200	(7 7/8)	25	2000	19	(123)	Stock	**KEBN0200D003A**
	300	(11 13/16)	30	1000	6	(39)	Stock	**KEBN0300D001A**
	300	(11 13/16)	30	1500	9	(58)	Stock	**KEBN0300D002A**
	300	(11 13/16)	30	2500	15	(97)	Stock	**KEBN0300D003A**
	400	(15 3/4)	40	1000	5	(32)	Stock	**KEBN0400D001A**
	400	(15 3/4)	40	2500	11	(71)	Stock	**KEBN0400D002A**
	400	(15 3/4)	40	4000	18	(116)	Stock	**KEBN0400D003A**
	500	(19 11/16)	50	1000	4	(26)	Stock	**KEBN0500D001A**
	500	(19 11/16)	50	2500	9	(58)	Stock	**KEBN0500D002A**
	500	(19 11/16)	50	4000	14	(90)	Stock	**KEBN0500D003A**

Note: All stock EB cartridge heaters 230V~(ac) and 1000 mm fiberglass insulated swaged-in leads.