

Cartridge/Insertion Heaters

Cartridge/Insertion Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in ²	W/cm ²	
FIREROD®	Incoloy®	1400	760	400	62.0	9
	Stainless steel	1000	538	400	62.0	
High-Temperature FIREROD	Incoloy®	1800	982	100	15.5	31
Metric FIREROD	Incoloy®	1400	760	330	50.0	46
MULTICELL™	Alloy	2050	1120	30	4.6	56

Cartridge/Insertion Heaters





Cartridge/Insertion Heaters

FIREROD® Cartridge Heaters

Watlow® FIREROD® cartridge heaters revolutionized the heating element industry in 1954 when it was patented as the first swaged cartridge heater. The mechanical procedure of swaging reduces the diameter of the heater by compacting the unit; this directly improves the heat transfer and efficiency of the heater.

FIREROD cartridge heaters are built using only the finest materials and construction methods and are backed with extensive quality assurance programs. With premium materials and tight manufacturing controls, the FIREROD heater provides superior heat transfer, uniform temperatures, resistance to oxidation and corrosion and a long life even at high temperatures.

FIREROD offers many delivery programs to meet your needs.

Performance Capabilities

- Part temperatures up to 1400°F (760°C) on Incoloy® sheath
- Watt densities up to 400 W/in² (62 W/cm²)
- Maximum voltage up to 480V

Features and Benefits

Nickel-chromium resistance wire

- Assures even and efficient distribution of heat to the sheath

Conductor pins

- Provides a metallurgical bond to the resistance wire
- Ensures a trouble-free electrical connection

Magnesium oxide insulation of specific grain and purity

- 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

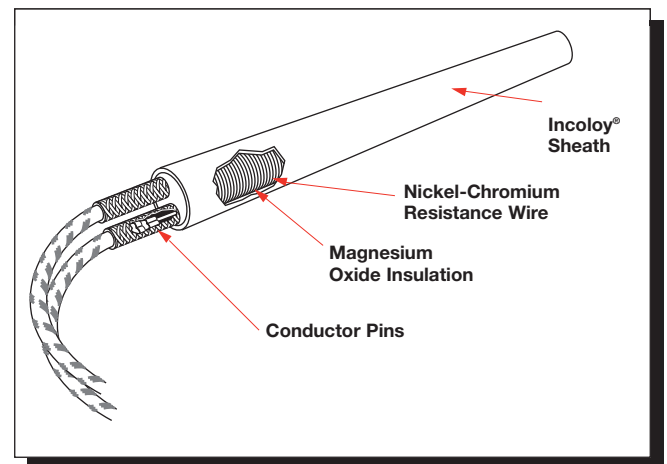
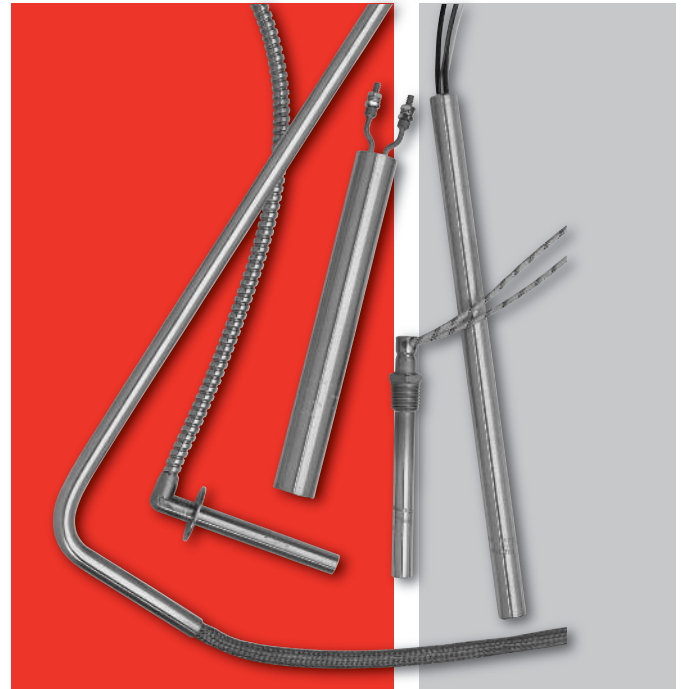
- Results in lower internal temperature
- Accommodates a design with fewer or smaller heaters operating at higher watt densities

UL® and CSA approved flexible stranded wires

- Lead insulation rated to temperatures of 480°F (250°C)

Patented lead adapter (LA) method

- Allows same day shipment on more than 150,000 configurations of stock FIREROD heaters and lead combinations



Typical Applications

- Semiconductor chamber heating
- Semiconductor wafer lead connection
- Semiconductor wire and die bonding
- Freeze protection and deicing of equipment in cold climates or applications
- Humidity control
- Patient comfort heating used in medical devices
- Mold die and platen heating
- Seal bars used in packaging equipment
- Test sample heating in gas chromatography equipment

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Applications and Technical Data

Tolerances

Diameter

- 1 in. (25 mm) units: ± 0.003 in. (± 0.08 mm)
- All other units: ± 0.002 in. (± 0.05 mm)

Length

- All units to $4\frac{1}{2}$ in. (114 mm) long: $\pm \frac{3}{32}$ in. (± 2.4 mm)
- $\frac{1}{8}$ in. diameter units over $4\frac{1}{2}$ in. (114 mm) long: $\pm 3\%$
- All other units over $4\frac{1}{2}$ in. (114 mm) long: $\pm 2\%$

Wattage

- $\frac{1}{8}$ in. units: +10%, -15%
- All other units: +5%, -10%

Resistance

- $\frac{1}{8}$ in. units: +15%, -10%
- All other units: +10%, -5%

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

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

Note: Resistance and wattage values are approximate depending on application conditions.

Camber

Units to 12 in. (305 mm) long: 0.005 in. (0.1 mm) per 6 in. (152 mm) length. Standard camber tolerance varies as the square of the length, in feet, is multiplied by 0.020 in. (0.5 mm). For example, a 36 in. (914 mm) FIREROD has a camber tolerance of $0.020 \text{ in.} \times (3)^2 = 0.180 \text{ in.}$ 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 480VAC
- CSA component rated to 240VAC
- VDE component rated to 480VAC
- CE component rated

Note: Not all options or combination of options are covered. UL®, CSA, VDE and CE marking is available upon request.

Dimensional Data

This table gives minimum/maximum lengths for available FIREROD diameters.

FIREROD Diameter		Length			
Nominal	Actual	Min.		Max.	
in.	in. (mm)	in.	(mm)	in.	(mm)
$\frac{1}{8}$	0.122 (3.1)	$1\frac{1}{4}$	(32.0)	12	(305)
$\frac{1}{4}$	0.246 (6.3)	$\frac{7}{8}$	(22.2)	36	(915)
$\frac{3}{8}$	0.371 (9.4)	$\frac{7}{8}$	(22.2)	48	(1220)
$\frac{1}{2}$	0.496 (12.6)	$\frac{7}{8}$	(22.2)	60	(1520)
$\frac{5}{8}$	0.621 (15.8)	1	(25.0)	72	(1830)
$\frac{3}{4}$	0.746 (18.9)	1	(25.0)	72	(1830)
1	0.996 (25.3)	$1\frac{1}{4}$	(32.0)	72	(1830)

Indicates **recommended** maximum length; however longer lengths may be available.

Cartridge/Insertion Heaters

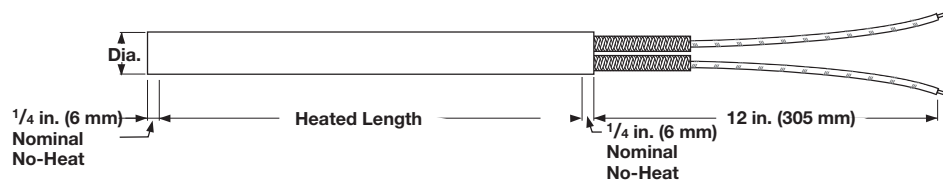
FIREROD Cartridge Heaters

Applications and Technical Data (Continued)

Electrical Data

The table below 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 representative.



FIREROD Diameter in.	Volts Max.	Ampere Max. ①	Min. Watts @ 120V ③			Max. Watts				
			Heater Length			120V 1-phase	240V 1-phase	480V 1-phase	240V 3-phase	480V 3-phase
			1 in. (25 mm)	1½ in. (38 mm)	2 in. (50 mm)					
⅛	240	3.1	—	8	5	360	720	—	—	—
¼	240	4.4②	100	55	40	525	1050	—	—	—
⅜	240	6.7	65	35	25	800	1600	—	⑤	—
½	240	9.7	40	25	20	1160	2320	—	⑤	—
⅝	480	23.0	35	20	15	2760	5520	11,000	⑤	—
¾	480	23.0	30	15	10	2760④	5520	11,000	9550	19,100
1	480	23.0	—	15	10	2760④	5520	11,000	9550④	19,100④

Number Of Circuits ⑥		
Diameter in.	1-phase	3-phase
¾	3	1
1	5	2

- ① Determined by the current carrying capacity of internal parts and lead wire. Alternate material may be available.
- ② For ¼ in. (6 mm) units with thermocouple maximum amperage is 3.1A.
- ③ Determined by the limitation of space for resistance winding. For minimum wattage of 240VAC multiply value by four.
- ④ Higher wattages are available using more than one set of power leads. Multiply the wattage from the table by the applicable factor.
- ⑤ Contact your Watlow representative for data.
- ⑥ On ¾ in. (19 mm) diameter units, either three single-phase circuits or one three-phase delta or wye circuit is available. On 1 in. (25 mm) diameter units, either five single-phase or two three-phase delta circuits are available.

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Maximum Allowable Watt Density

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

Correction Factors

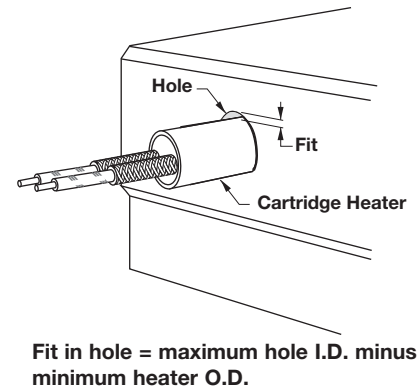
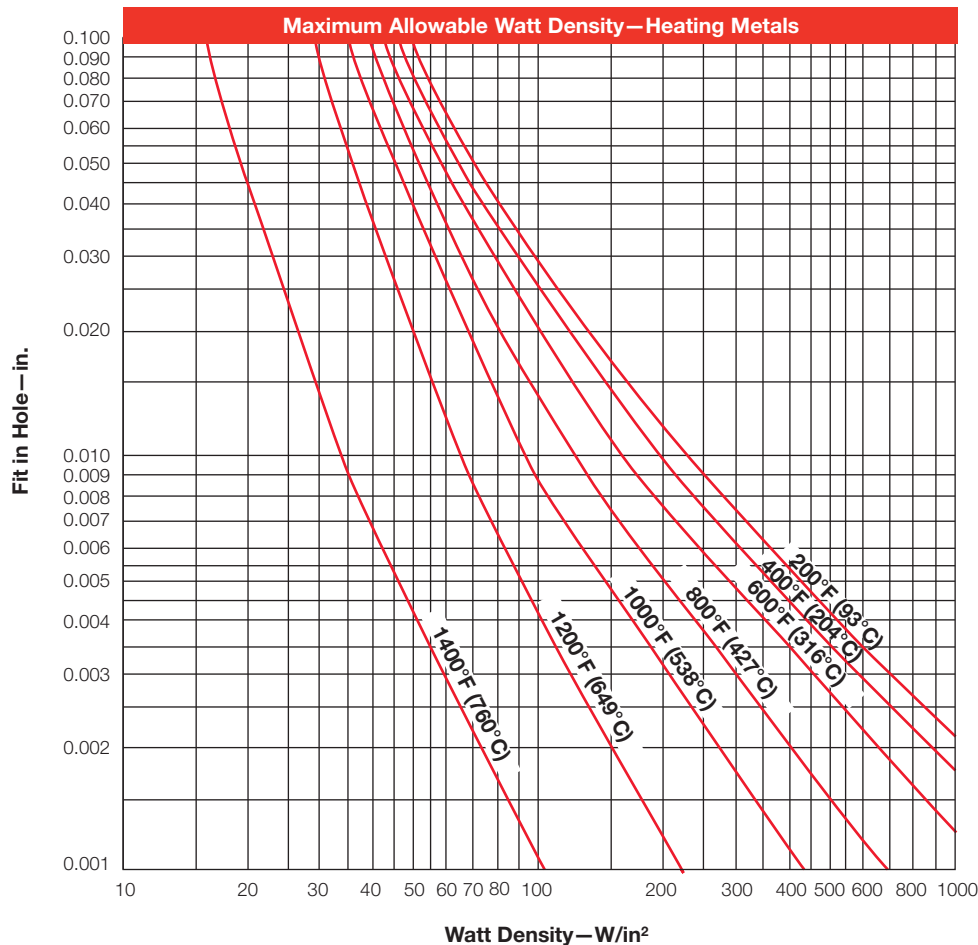
Also note, these graphs depict FIRERODs used in steel parts. Therefore, for either stainless steel, aluminum or brass, refer to applicable correction factors:

1. For stainless steel, enter the graph with a fit 0.0015 in. (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 show 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 (13 mm) minus a heater diameter of 0.496 in. (12.6 mm) ±0.002 in. (0.05 mm). The hole fit would be 0.006 in. (0.15 mm). For FIREROD heaters in square holes or grooves, contact your Watlow representative for the fit in hole dimension.



Cartridge/Insertion Heaters

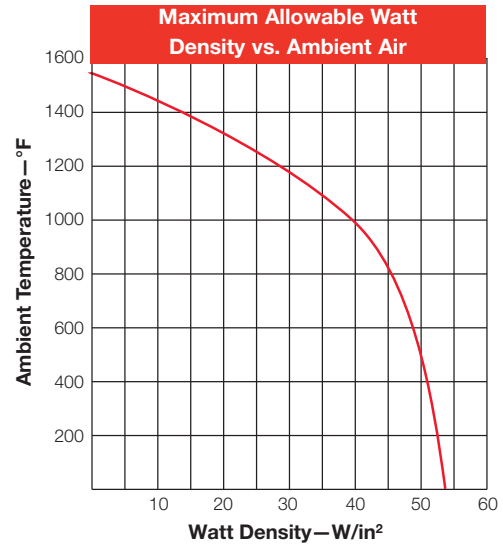
FIREROD Cartridge Heaters

Maximum Allowable Watt Density (Continued)

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.

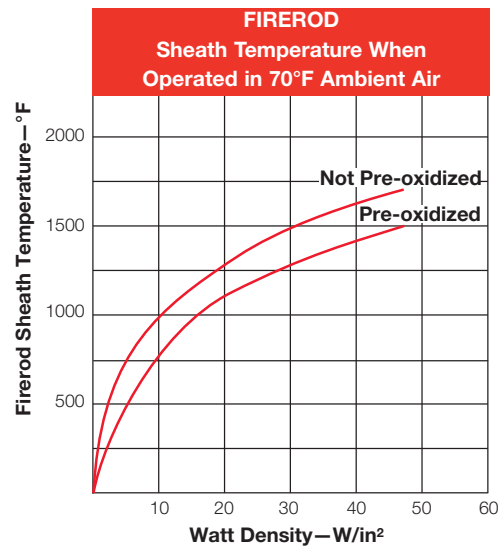
For FIRERODs grouped in a single row, with no less than one diameter between elements, multiply value from graph by 0.95. When a reflector is placed behind the heaters, multiply the maximum allowable watt density value from the graph by 0.85.



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 (21°C) ambient air.

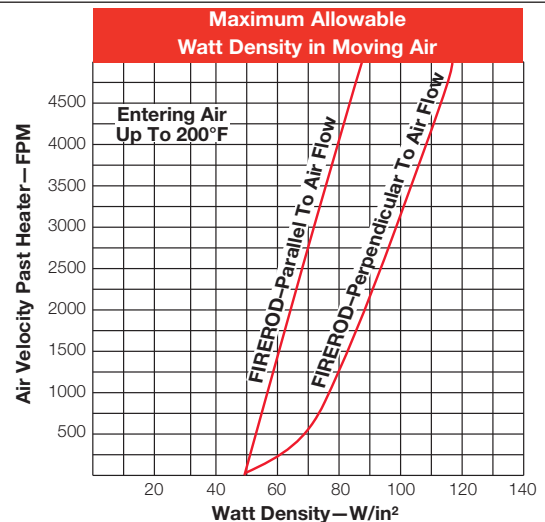
At 44 W/in² (6.8 W/cm²), the sheath temperature would be 1450°F (784°C). At this temperature, one year life would be expected, provided that cycling is not too frequent. Higher temperatures would result in reduced heater life.



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.



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Lead and Diameter Information

Standard Lead Specifications

Heater Diameter in.	Gauge	Max. Voltage	Max. Temperature Fiberglass	Max. Temperature Teflon®	Size Tolerance Fiberglass	Size Tolerance Teflon®	SS Hose I.D.	SS Braid I.D.
1/8	24	300	482°F (250°C) ①	392°F (200°C)	0.044 - 0.058	0.036 - 0.044	1/8	1/8
1/4	24	300	842°F (450°C)	392°F (200°C)	0.066 - 0.078	0.050 - 0.058	5/32	1/8
3/8	22	300	842°F (450°C)	392°F (200°C)	0.076 - 0.088	0.056 - 0.064	7/32	3/16
1/2	18	300	842°F (450°C)	392°F (200°C)	0.089 - 0.101	0.074 - 0.084	9/32	1/4
5/8	18 fiberglass ② 14 Teflon®	600	842°F (450°C)	392°F (200°C)	0.108 - 0.124	0.097 - 0.113	7/16	3/8
3/4	18 fiberglass ② 14 Teflon®	600	842°F (450°C)	392°F (200°C)	0.108 - 0.124	0.097 - 0.113	7/16	3/8
1	18	600	482°F (250°C) ①	392°F (200°C)	0.095 - 0.109	0.087 - 0.101	NA	NA

Lead length tolerances:

1 to 36 in. (25 to 914 mm) = -1/2 in. (13 mm), +1 1/2 in. (38 mm)
 > 36 to 72 in. (914 to 1829 mm) = -1, +3 in. (-25 + 76 mm)
 > 72 in. (1829 mm) = ±4 in. (102 mm)

SS hose and braid tolerances: same as lead wire.

Units constructed with 480V require MGT or Teflon® leads. If connecting heaters in series above 300V, MGT leads are also required.

Ratings: GGS, 300V, 482°F (250°C)
 MGT, 600V, 842°F (450°C)
 Teflon®, 600V, 392°F (200°C)
 Silicone rubber, 600V, 302°F (150°C)

① 842°F (450°C) MGT fiberglass lead wire available.

② 14 gauge GGS fiberglass leads available for 5/8 and 3/4 in. diameters (0.155 to 0.163 O.D.)

Additional Lead Specifications

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

Cartridge/Insertion Heaters

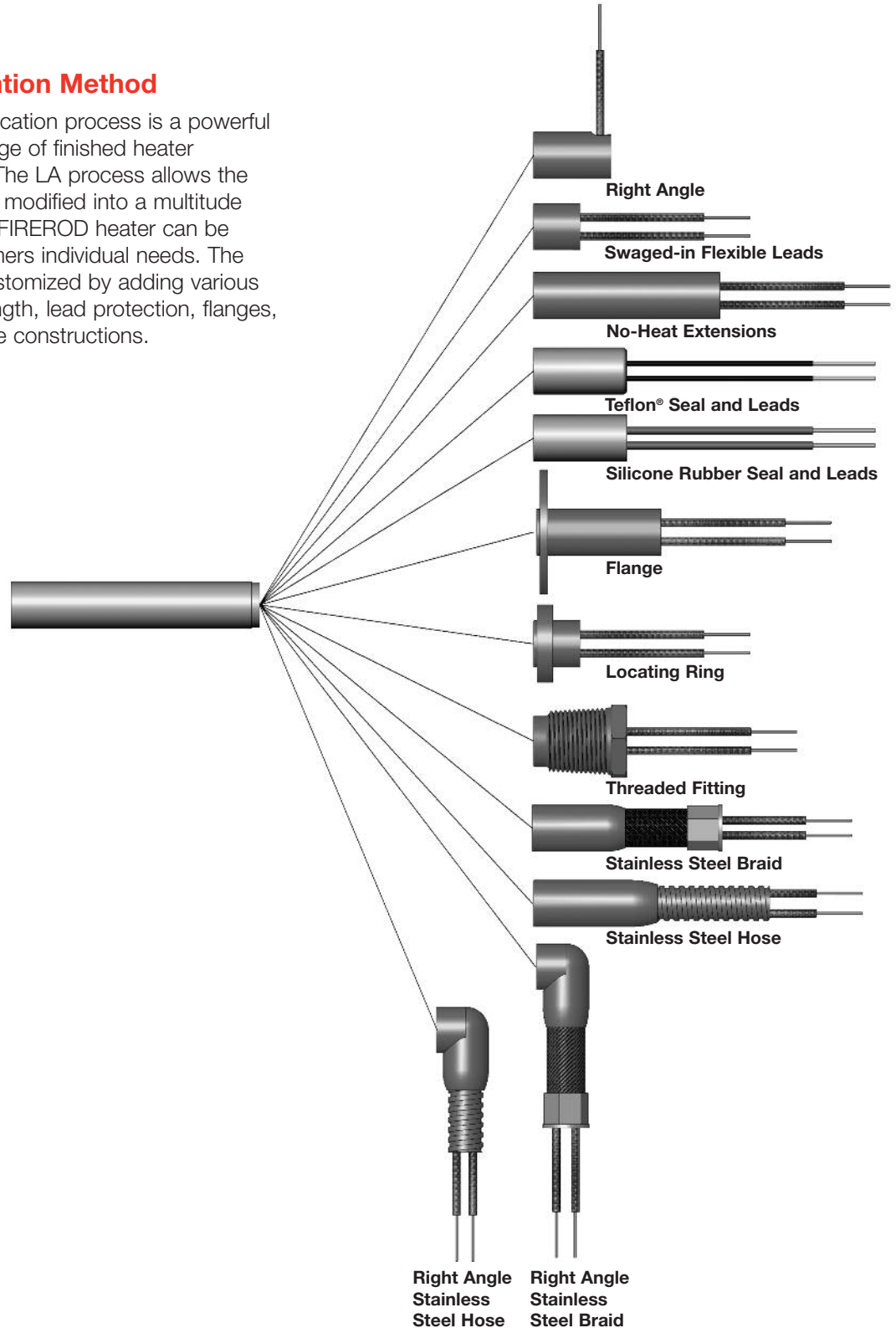
FIREROD Cartridge Heaters

Lead Adapter (LA)

Options

Patented LA Modification Method

The lead adapter (LA) modification process is a powerful tool for providing a wide range of finished heater configurations very quickly. The LA process allows the base FIREROD heater to be modified into a multitude of configurations. The base FIREROD heater can be selected to meet the customer's individual needs. The base heater can then be customized by adding various finishing options like lead length, lead protection, flanges, locating rings and right angle constructions.



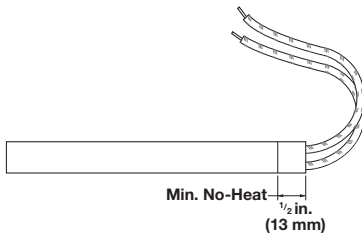
Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

LA

Termination Options

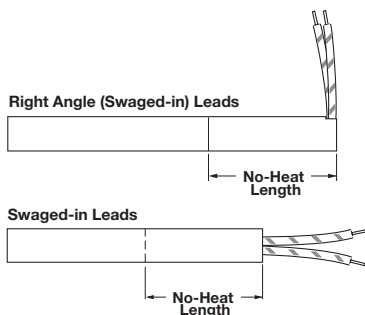
LA Swaged-in Flexible Leads



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 $\frac{1}{4}$ in. (6 mm). To order, specify **length adder code E** bringing the total lead end no-heat to $\frac{1}{2}$ in. (13 mm).

This LA option is not available on $\frac{1}{8}$ in. (3.2 mm) diameter. On $\frac{1}{8}$ in. (3.2 mm) diameter FIRERODs, leads are connected externally using a solid conductor lead wire. If stranded wire is desired on $\frac{1}{8}$ in. (3.2 mm) diameter units, contact your Watlow representative.

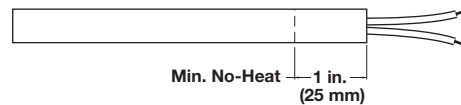
No-Heat Extensions



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 options in diameters of $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ in. (9.5, 13, 15.9 and 19 mm). These extensions are designed to provide a total no-heat length of 1, $1\frac{1}{2}$, 2 or $2\frac{1}{2}$ in. (25, 38, 51 or 65 mm) at the lead end of FIRERODs only. Contact your Watlow representative 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 392°F (200°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 1 in. (25 mm). The LA cap adds $\frac{3}{8}$ in. (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 400°F (204°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 $\frac{3}{8}$ in. (19 mm) to the overall length. To order, specify **option code P**.

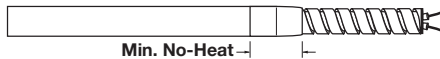
Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

LA

Termination Options *(Continued)*

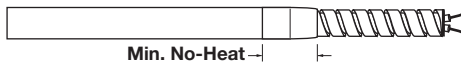
LA Straight Stainless Steel Hose



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, 12 in. (305 mm) hose is supplied. Leads are 2 in. (51 mm) longer than hose but, longer leads are available.

Minimum lead end no-heat required is $\frac{3}{4}$ in. (19 mm). This option adds $\frac{1}{2}$ in. (13 mm) to overall length. To order, specify **option code H**.

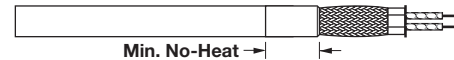
LA Straight Stainless Steel Hose with Teflon® Leads and Seal



LA straight stainless steel hose with Teflon® leads and seal provides the ultimate combination of abrasion protection and a moisture resistant seal. Unless specified, standard 12 in. (305 mm) hose is supplied. Leads are 2 in. (51 mm) longer than hose but, longer leads are available. This seal is effective to 392°F (200°C) under continuous operation.

Minimum lead end no-heat required is 1 in. (25 mm). This option adds $\frac{3}{4}$ in. (19 mm) to overall length. To order, specify **option code G**.

LA Straight Stainless Steel Braid

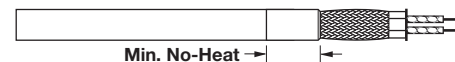


LA straight stainless steel braid is designed to protect leads from abrasion against sharp edges. It is the most flexible of Watlow's protective lead arrangements.

Unless specified, 12 in. (305 mm) braid is supplied. Leads are 2 in. (51 mm) longer than braid, but longer leads are available.

Minimum lead end no-heat required is $\frac{3}{4}$ in. (19 mm). This option adds $\frac{1}{2}$ in. (13 mm) to overall length. To order, specify **option code C**.

LA Straight Stainless Steel Braid with Teflon® Leads and Seal



LA straight stainless steel braid with Teflon® leads and seal provides Watlow's most flexible lead protection with a moisture resistant seal. Unless specified, 12 in. (305 mm) braid is supplied. Leads are 2 in. (51 mm) longer than the braid but, longer leads are available. This seal is effective to 392°F (200°C) under continuous operation.

Minimum lead end no-heat required is 1 in. (25 mm). This option adds $\frac{3}{4}$ in. (19 mm) to overall length. To order, specify **option code F**.

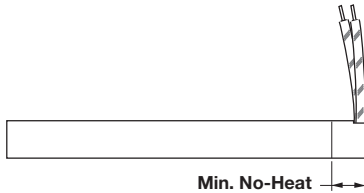
Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

LA

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**.

Minimum No-Heat Required in. (mm)					
Dia.	1/4	3/8	1/2	5/8	3/4
In.	13/16 (20.6)	3/4 (19.0)	13/16 (20.6)	13/16 (20.6)	13/16 (20.6)

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

LA Right Angle Stainless Steel Hose

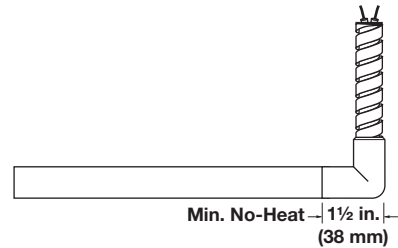


LA right angle stainless steel hose is provided for wiring convenience. Like the LA straight stainless steel hose, it protects leads from abrasion against sharp edges. Unless specified, 12 in. (305 mm) hose is supplied. Leads are 2 in. (51 mm) longer than hose, but longer leads are available.

To order, specify **option code W**. Option adds 3/4 in. (19 mm) to overall length for 3/8, 1/2 and 5/8 in. (9.5, 13 and 15.9 mm) diameter heaters and 7/8 in. (22.2 mm) for 3/4 in. (19 mm) diameter heaters. Minimum lead end no-heat is 1 in (25 mm) for 3/8, 1/2 and 5/8 in. (9.5, 13 and 15.9 mm) diameter heaters and 1 1/8 in. (28.6 mm) for 3/4 in. (19 mm) diameter.

Note: Option is not available on 1/4 in. (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, 12 in. (305 mm) hose is supplied. Leads are 2 in. (51 mm) longer than hose but longer leads are available. This seal is effective to 392°F (200°C) under continuous operation.

Minimum lead end no-heat required is 1 1/2 in. (38 mm). This option adds 1/4 in. (32 mm) to overall length on stock units.

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

Note: Option is not available on 1/4 in. (6 mm) diameter.

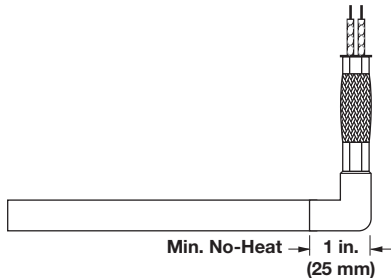
Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

LA

Right Angle Options *(Continued)*

LA Right Angle Stainless Steel Braid



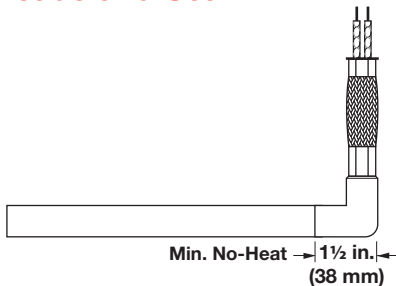
LA right angle stainless steel braid is provided for wiring convenience. Like the LA straight braid, it protects leads from abrasion against sharp edges.

Unless specified, 12 in. (305 mm) braid is supplied. Leads are 2 in. (51 mm) longer than braid, but longer leads are available.

To order, specify **option code Y**. Option adds $\frac{3}{8}$ in. (19 mm) to overall length for $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{3}{4}$ in. (9.5, 13 and 15.9 mm) diameter heaters and $\frac{7}{8}$ in. (22.2 mm) for $\frac{3}{4}$ in. (19 mm) diameter heaters. Minimum lead end no-heat is 1 in. (25 mm) for $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{3}{4}$ in. (9.5, 13 and 15.9 mm) diameter heaters and $1\frac{1}{2}$ in. (28.6 mm) for $\frac{7}{8}$ in. (19 mm) diameter.

Note: Option is not available on $\frac{1}{4}$ in. (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 Watlow's most flexible lead protection and moisture resistant Teflon® seal with wiring convenience. Unless specified, 12 in. (305 mm) braid is supplied. Leads are 2 in. (51 mm) longer than the braid, but longer leads are available. This seal is effective to 392°F (200°C) under continuous operation.

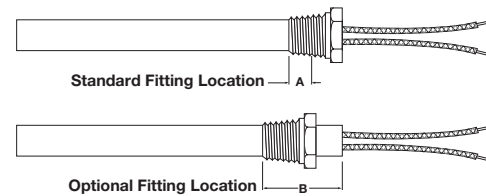
Minimum lead end no-heat required is $1\frac{1}{2}$ in. (38 mm). This option adds $1\frac{1}{4}$ in. (32 mm) to overall length on stock units.

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

Note: Option is not available on $\frac{1}{4}$ in. (6 mm) diameter.

Mounting Options

LA Threaded Fittings



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

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 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 in. (mm)
Crimped Leads	$\frac{1}{4}$ (6)
Swaged in Leads	$\frac{5}{16}$ ^{②④} (8)
STR SS Hose	$\frac{1}{2}$ ^③ (13)
STR SS Braid	$\frac{1}{2}$ (13)
Teflon® Seal & Leads	$\frac{7}{8}$ (22)
Silicone Seal & Leads	$\frac{7}{8}$ (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 no-heat extensions. Contact your Watlow representative for details.

- ② On $\frac{1}{4}$ in. diameter FIREROD only "A" dimension is $\frac{7}{16}$ in. (11.1 mm).
- ③ On $\frac{1}{4}$ in. diameter FIREROD only "A" dimension is $\frac{5}{8}$ in. (15.9 mm).
- ④ On $\frac{1}{2}$ in. and $\frac{3}{4}$ in. the fitting is located at $\frac{7}{8}$ in. from lead end using a $\frac{3}{4}$ no-heat extension. In order to locate at $\frac{5}{8}$ in. the fitting must be epoxied.

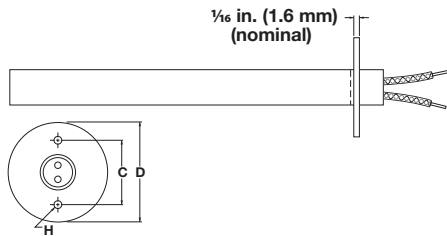
Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

LA

Mounting Options

Flanges



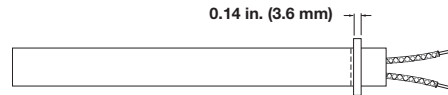
Stainless steel flanges are a convenient mounting method as well as a way to position a heater within an application. The flange is staked on and located $\frac{1}{4}$ in. (6 mm) from the lead end. The flange can be located up to $2\frac{1}{4}$ in. (57 mm) from the lead end as long as it is over a no-heat section. Use this option in combination with most LA configurations.

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

Flange Specifications

FIREROD Diameter in.	Flange Size	in. (mm)		
		D	C	H
$\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$	FS	1 (25.0)	$\frac{3}{4}$ (19.0)	0.144 (3.7)
$\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$ $\frac{5}{8}$, $\frac{3}{4}$	FM	$1\frac{1}{2}$ (38.0)	$1\frac{1}{8}$ (28.5)	0.156 (4.0)
$\frac{3}{4}$, $\frac{3}{4}$, 1	FL	2 (51.0)	$1\frac{1}{2}$ (38.0)	0.201 (5.1)

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, specify location if the no-heat extension option is requested. On FIRERODs with crimped on leads without the LA option, locating ring will be on the last $\frac{1}{4}$ in. (6 mm).

To order, specify **locating ring**.

Locating Ring Specifications

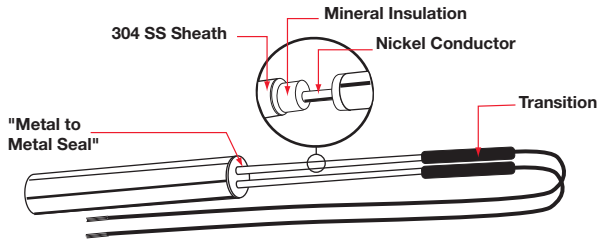
Diameter	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$
Ring O.D. in. (mm)	$\frac{1}{2}$ (13.0)	$\frac{5}{8}$ (15.9)	$\frac{3}{4}$ (19.0)	$\frac{7}{8}$ (22.2)	1 (25.0)

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

LA

Mineral Insulated (MI) 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.

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 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. Unless specified a 6 in. (152 mm) of MI cable and 12 in. (305 mm) of Teflon® leads will be supplied. To order, specify **option code J**.

Product Benefits

- Increases 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

Applications

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

Technical Data

Max. temp. of cable: 1500°F (815°C)

Max. temp. of cable to lead transition: 300°F (149°C)
(where flexible leads attach to cable)

Cable sheath material: 304 SS

Conductor material: nickel

Max. voltage: 240V

Lead Types

Teflon® 392°F (200°C) – T

Silicone rubber 302°F (150°C) – S

GGs 482°F (250°C) – No code

MGT 842°F (450°C) – H

Heater Diameter in.	Max. Current Amperes	Conductor Diameter in.	Cable Diameter in.	Transition Diameter in.	Cable Length in.		Min. Bend Radius	Max. Voltage in.	Length Adder
					Min.	Max.			
3/8	7.0	0.044	0.108	0.230	6	72	0.225	240	G (3/8)
1/2	7.0	0.044	0.108	0.230	6	72	0.225	240	K (9/16)
5/8	9.7	0.062	0.138	0.250	6	72	0.280	240	L (5/8)
3/4	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.

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

LA Options

Option	Minimum Length Adders Per Diameter Per Option in. (mm)					Option Code
	¼ (6 mm)	⅜ (9.5 mm)	½ (13 mm)	⅝ (15.9 mm)	¾ (19 mm)	
Heater Diameter	¼ (6 mm)	⅜ (9.5 mm)	½ (13 mm)	⅝ (15.9 mm)	¾ (19 mm)	
Swaged-in leads	E ¼ (6 mm)	E ¼ (6 mm)	E ¼ (6 mm)	E ¼ (6 mm)	E ¼ (6 mm)	None
Right angle leads	K ⅝ (14.3 mm)	J ½ (13 mm)	K ⅝ (14.3 mm)	K ⅝ (14.3 mm)	K ⅝ (14.3 mm)	R
Teflon® seal and leads	— —	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	T
Right angle Teflon® seal and leads	— —	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	B
Silicone seal and leads	— —	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	P
Straight hose	J ½ (13 mm)	J ½ (13 mm)	J ½ (13 mm)	J ½ (13 mm)	J ½ (13 mm)	H
Right angle hose	— —	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	R ⅞ (22.2 mm)	W
Straight hose with Teflon® seal and leads	— —	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	G
Straight braid	J ½ (13 mm)	J ½ (13 mm)	J ½ (13 mm)	J ½ (13 mm)	J ½ (13 mm)	C
Right angle braid	— —	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	R ⅞ (22.2 mm)	Y
Right angle braid with Teflon® seal and leads	— —	1E 1¼ (32 mm)	1E 1¼ (32 mm)	1E 1¼ (32 mm)	1E 1¼ (32 mm)	A
Straight braid with Teflon® seal and leads	— —	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	N ¾ (19 mm)	F
Right angle hose with Teflon® seal and leads	— —	1E 1¼ (32 mm)	1E 1¼ (32 mm)	1E 1¼ (32 mm)	1E 1¼ (32 mm)	M

LA options are available on all FIRERODs, except ¼ in. 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-N72W74** indicates you have ordered a 12 in. (305 mm) FIREROD with 72 in. (1830 mm) right angle stainless steel hose and 74 in. (1880 mm) leads. The overall heater length equals 12¾ in. (324 mm).

Note: No-heat extensions are available for most LA options in diameters of ⅜, ½, ⅝ and ¾ in. Contact your Watlow representative for available LA options.

To order any of these dimensions, please specify the applicable length adder code shown.

No-Heat Length Adder Codes

No-Heat Option in. (mm)	Length Adder Code
¾ (19)	N
1¼ (32)	1E
1¾ (44)	1N
2¼ (56)	2E

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Non-Lead Adapter (LA)

Modification Coding

Watlow offers heaters in various diameters, lengths and volt-wattage combinations that are ready for shipping. These heaters can have basic modifications made and shipped the same day. These modifications include flanges, threaded fittings, locating rings, ceramic beads and crimped on leads. The following is a list of all available non-LA mounting and pin option codes.

Mounting Option Codes

- BA - Small flange FS (available on $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ in.)
- BB - Medium flange FM (available on $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ in.)
- BC - Large flange FL (available on $\frac{3}{8}$ and $\frac{1}{2}$ in.)
- BD - Locating ring (available on $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ in.)
- 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

Pin Option Codes

- AA - Short pins $\frac{5}{16}$ in. (7.9 mm)
- AB - Medium pins $\frac{5}{8}$ in. (15.9 mm)
- AC - Long pins $1\frac{3}{4}$ (45 mm)
- AD - Stagger pins
- AE - Ceramic beads $\frac{1}{2}$ in. (13 mm)
- AF - Ceramic beads $\frac{3}{4}$ in. (19 mm)
- AG - Ceramic beads 1 in. (25 mm)
- AH - Ceramic beads $1\frac{1}{4}$ in. (32 mm)
- AJ - Ceramic beads $1\frac{1}{2}$ in. (38 mm)



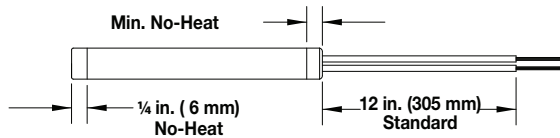
Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Made-to-Order

Straight Options

Swaged-in Flexible Leads



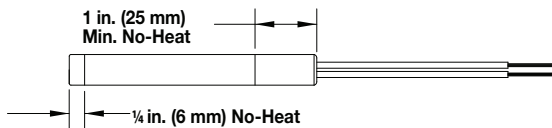
Swaged-in flexible leads are used in applications where a high degree of flexing exists or the leads must be bent sharply adjacent to the heater without exposing or breaking the conductor. The stranded wire leads are connected internally and exit through the lead end.

Lead wire type is high temperature fiberglass. The maximum temperature of the standard fiberglass end piece is 842°F (450°C). Unless specified, 12 in. (305 mm) leads are supplied.

Minimum lead end no-heat is 1/4 in. (6 mm). High amperage designs require longer lead end no-heat. Additional no-heat may be required to keep the end piece and leads below maximum operating temperatures.

Heater Diameter	Standard Lead Gauge	Max. Amperes	Min. No-Heat (in.)	Max. Amperes	Min. No-Heat (in.)
1/4	24	3.1	1/4	>3.1	7/16
3/8	22	4.4	1/4	>4.4	7/16
1/2	18	7.6	1/4	>7.6	7/16
5/8	18	12.6	1/4	>12.6	1/2
3/4	18	12.6	7/16	>12.6	1/2

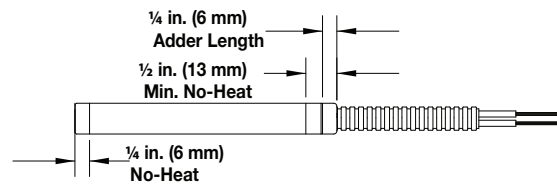
Teflon® Seal and Leads



Teflon® seal and leads protect the heater against moisture and contamination from cleaning solvents, plastic material or fumes and organic tapes. This seal is effective to 392°F (200°C) under continuous operation.

Teflon® seal and leads will have a minimum lead end unheated section of 1 in. (25 mm). Additional no-heat may be required to keep the seal below its maximum operating temperature.

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.

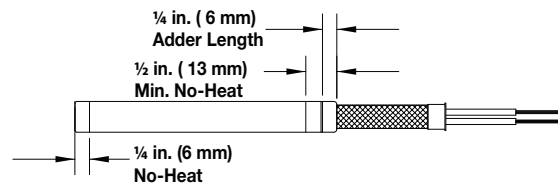
Unless specified, 12 in. (305 mm) hose is supplied.

Leads are 2 in. (51 mm) longer than hose.

Option adds 1/4 in. (6 mm) to overall length of heater.

Note: This option is available with Teflon® leads and seal. Minimum no-heats are longer, contact your Watlow representative details.

Straight Stainless Steel Braid



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

Unless specified, 12 in. (305 mm) braid is supplied.

Leads are 2 in. (51 mm) longer than braid.

Option adds 1/4 in. (6 mm) to overall length of heater.

Note: This option is available with Teflon® leads and seal. Minimum no-heats are longer, contact your Watlow representative for details.

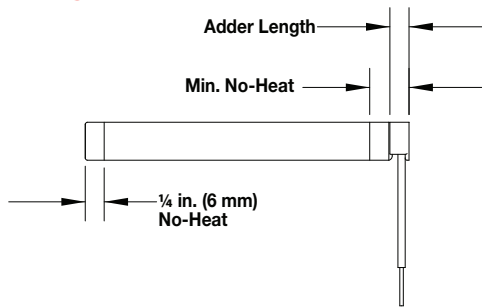
Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Made-to-Order

Right Angle Options

Right Angle Leads

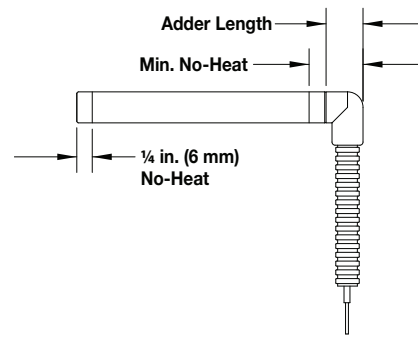


Right angle leads are used in applications with a high degree of flexing and when space limitations are critical. Standard lead wires are connected internally (swaged-in) and exit at a 90° angle at the end of the heater.

Diameter	1/4	3/8	1/2	5/8	3/4
Adder length (in.)	1/4	1/4	5/16	7/16	7/16
Min. No-Heat (in.)	1/2	1/2	9/16	11/16	7/8

Note: This option is available with Teflon® leads and seal. Minimum no-heats are longer, contact your Watlow representative for details.

Right Angle Stainless Steel Hose



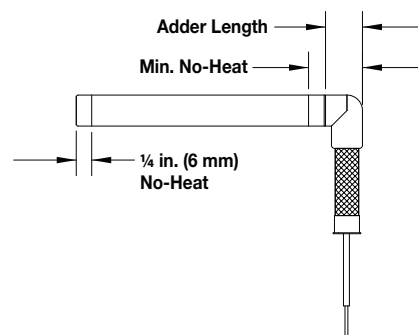
Right angle stainless steel hose is provided for wiring convenience. Like straight stainless steel hose, it protects leads from abrasion against sharp edges.

Unless specified, 12 in. (305 mm) hose is supplied. Leads are 2 in. (51 mm) longer than hose.

Diameter	1/4	3/8	1/2	5/8	3/4
Adder length (in.)	5/16	3/8	9/16	11/16	13/16
Min. No-Heat (in.)	9/16	5/8	13/16	15/16	1 1/16

Note: This option is available with Teflon® leads and seal. Minimum no-heats are longer, contact your Watlow representative for details.

Right Angle Stainless Steel Braid



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

Unless specified, 12 in. (305 mm) hose is supplied. Leads are 2 in. (51 mm) longer than hose.

Diameter	1/4	3/8	1/2	5/8	3/4
Adder length (in.)	5/16	3/8	9/16	11/16	13/16
Min. No-Heat (in.)	9/16	5/8	13/16	15/16	1 1/16

Note: This option is available with Teflon® leads and seal. Minimum no-heats are longer, contact your Watlow representative for details.

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Made-to-Order

Termination Options

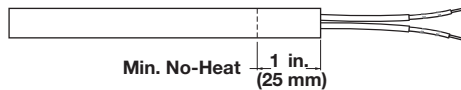
Silicone Rubber Seal and Leads



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 400°F (204°C) under continuous operation.

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

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 250°F (121°C) under continuous operation.

Epoxy seals can be ordered only on units greater than 1/8 in. (3.2 mm) diameter with crimped on leads. Minimum no-heat section at the lead end is 1 in. (25 mm). Longer no-heat sections are available upon request.

To order, specify **epoxy seal**.

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**.

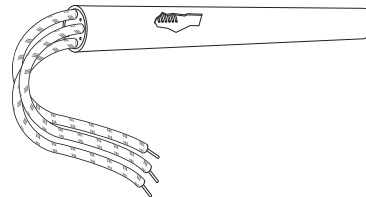
UL® Listed Plugs



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**.

Ground Lead



Ground leads are a safety feature to protect both workers and equipment. This configuration is not available on all options. Contact your Watlow representative for additional information. To order, specify **ground lead**.

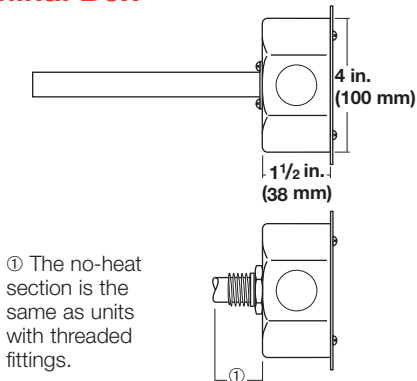
Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Made-to-Order

Termination Options (Continued)

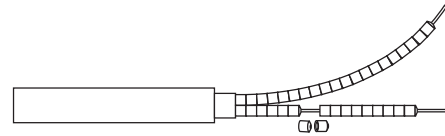
Terminal Box



A 4 in. (100 mm) NEMA 1 octagonal terminal box is mounted on a flange or a threaded fitting. Boxes have 1/2 in. (13 mm) conduit knockouts for electrical connection.

Hazardous location (NEMA 4 and NEMA 7) terminal boxes are also available. Contact your Watlow representative for details. Terminal boxes are available on 1/2 in. (13 mm) through 1 in. (25 mm) diameter FIRERODs. To order, specify **terminal box** and **NEMA type**.

Ceramic Bead Insulation

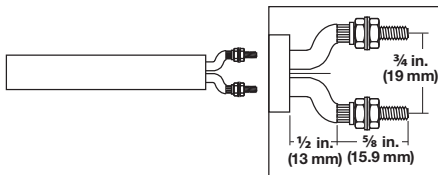


Ceramic bead insulation protects the leads from high ambient temperatures above 842°F (450°C).

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 1/8 in. (3.2 mm) diameter. The maximum available length on FIRERODs is 12 in. (305 mm). To order, specify **ceramic beads** and length, and additional lead length.

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 1/2, 5/8, 3/4 and 1 in. (13, 15.9, 19 and 25 mm) diameter. On 1 in. (25 mm) diameters, pins are straight. To order, specify **post terminals**.

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Made-to-Order

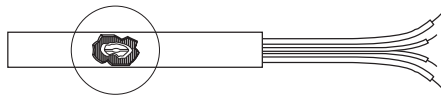
Options

Thermocouple Types

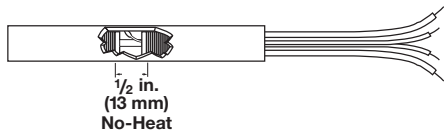
ASTM Code	Conductor Characteristics		Temperature Range °F (°C)
	Positive	Negative	
J	Iron (Magnetic) (White)	Constantan (Non-Magnetic) (Red)	0 to 1400 (-20 to 760)
K	Chromel® (Non-Magnetic) (Yellow)	Alumel® (Magnetic) (Red)	0 to 2300 (-20 to 1260)

For other ISA types, contact your Watlow representative.

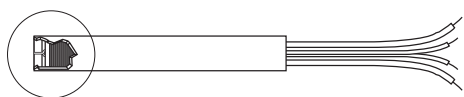
Style A



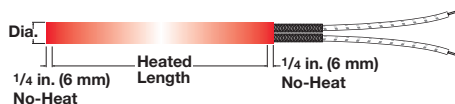
Style B



Style C



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.

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. Contact your Watlow representative for availability. To order, specify **dual voltage** and voltage requirements.

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 ungrounded 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. Due to variations in production, 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 otherwise specified. A 1/2 in. (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 grounded junction is embedded in a special end disc. Unless requested, the disc end is not mechanically sealed.

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

If not specified, 12 in. (305 mm) thermocouple leads are supplied.

Availability

All styles are available on all diameters with the exception of 1/8 in. (3.2 mm) diameter, which is available only with Style C and 1 in. (25 mm) which is available only with Style A and B.

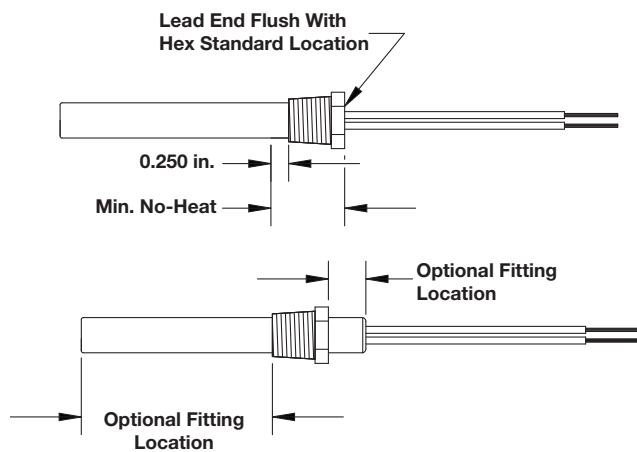
Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Made-to-Order

Mounting Options

Threaded Fittings



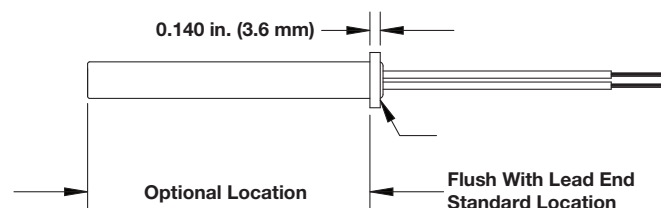
Threaded fittings allow for fast, water-tight installation of the heater into a threaded hole. Standard fittings are 304 stainless steel and welded to the heater sheath. Other materials are available upon request. Double threaded fittings are also available.

Unless specified, the fitting hex will be located flush with the lead end.

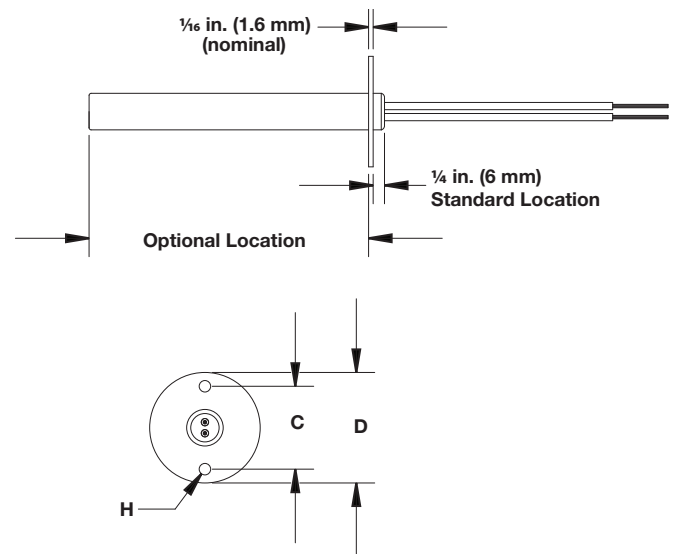
Threaded Fittings Specifications

Heater Diameter in.	Pipe Thread Size (NPTF) in. (mm)	Single Thread Fitting Length in. (mm)	Double Thread Fitting Length in. (mm)
¼	⅛ (3.2)	½ (13.0)	⅞ (22.2)
⅜	¼ (6.0)	⅝ (15.9)	1⅞ (49.2)
½	⅜ (9.5)	¾ (19.0)	1⅜ (34.9)
⅝	½ (13.0)	⅞ (22.2)	1⅞ (46.0)
¾	¾ (19.0)	1 (25.0)	1⅞ (46.0)
1	1 (25.0)	1 (25.0)	1½ (38.0)

Locating Rings



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 in. (6 mm) from lead end; however, a specific location may be requested any place on the no-heat section. Unless specified, flanges will be staked to the sheath.

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

Flange Specifications

FIREROD Diameter in.	Flange Size	D in. (mm)	C in. (mm)	H in. (mm)
¼, ⅜, ½	FS	1 (25.0)	¾ (19.0)	0.144
⅝, ¾, 1	FM	1½ (38.0)	1 (28.6)	0.156
¾, 1	FL	2 (51.0)	1½ (38.0)	0.201

A stainless steel locating ring can be used as a retaining collar to position a FIREROD if mounting requirements are not critical. Standard locating rings are staked to the heater sheath.

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

Locating Ring Specifications

Diameter - in.	¼	⅜	½	¾	1
Ring O.D. in. (mm)	½ (13.0)	¾ (15.9)	¾ (19.0)	¾ (22.2)	1 (25.0)

Cartridge/Insertion Heaters

**EXTENDED
CAPABILITY**

Extended Capabilities For FIREROD Cartridge Heaters

Made-to-Order

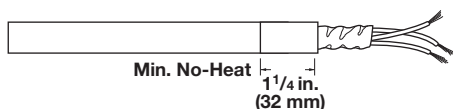
Termination Options

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 $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ in. (9.5, 13, 15.9 and 19 mm) diameter FIRERODs. To order, specify **low electrical leakage**.

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 in. (250 mm) long will have a minimum no-heat section of approximately 12 percent + $\frac{1}{4}$ in. (6 mm) of the overall length.

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

Centerless Grinding

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 in. (305 mm) 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 contact your Watlow representative for assistance. To order, specify **centerless grinding**.

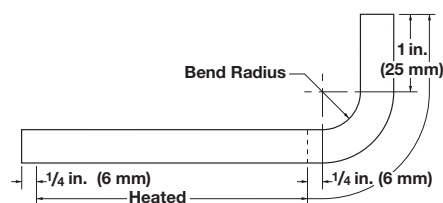
FIREROD Diameter in.	Actual Precision Diameter in.
$\frac{1}{4}$	0.241 ± 0.0005
$\frac{3}{8}$	0.363 ± 0.0005
$\frac{1}{2}$	0.488 ± 0.0005
$\frac{5}{8}$	0.613 ± 0.0005
$\frac{3}{4}$	0.738 ± 0.0005
1	0.984 ± 0.0005

Options

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 seal bars. This internal construction can be ordered on $\frac{3}{8}$, $\frac{1}{4}$ and 1 in. (16, 19 and 25 mm) diameter FIRERODs. To order, specify **individually controlled heat zones** as well as wattage and length per zone.

Bent FIREROD



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), contact your Watlow representative.

See dimensions noted on the chart, or contact your Watlow representative, if you need to exceed limitations shown.

FIREROD Diameter in.	Min. Required No-Heat Length in. (mm)	Bend Radius in. (mm)
$\frac{1}{4}$	2 $\frac{1}{4}$ (56)	$\frac{1}{2}$ (13)
$\frac{3}{8}$	2 $\frac{3}{8}$ (60)	$\frac{1}{2}$ (13)
$\frac{1}{2}$	2 $\frac{7}{8}$ (72)	$\frac{3}{4}$ (19)
$\frac{5}{8}$	3 $\frac{1}{6}$ (83)	1 (25)
$\frac{3}{4}$	3 $\frac{1}{2}$ (98)	1 $\frac{1}{4}$ (32)

Cartridge/Insertion Heaters

**EXTENDED
CAPABILITY**

Extended Capabilities For High-Temperature (HT) FIREROD® Heaters

The Watlow HT FIREROD heater is especially designed for high temperature platen applications up to 1800°F (980°C). The HT FIREROD utilizes the same industry leading design principals used on all of Watlow's FIREROD products. Taking the cartridge heater one step further enables the HT FIREROD to withstand application temperatures up to 400°F (204°C) higher than standard cartridge heaters.

There are certain differences in the HT FIREROD design which are important in high temperature applications:

- HT FIRERODS are specially constructed with an end seal that is virtually airtight to reduce the effects of resistance wire oxidation
- The high temperature sheath is treated to improve its emissivity for better heat transfer

Performance Capabilities

- Platen temperatures to 1800°F (980°C)
- Maximum watt density to 100 W/in² (15.5 W/cm²)
- Maximum voltage 277VAC to ground
- Length tolerance: +0, -4 percent standard diameters; +0, -8 percent for special diameter

Made-to-Order Availability

Nominal Diameter in.	Actual Diameter in.	Max. Amperes
1/2	0.496 ± 0.004	10
5/8	0.580 ± 0.004	23
	0.621 ± 0.004	23
3/4	0.710 ± 0.004	46
	0.746 ± 0.004	46
1	0.960 ± 0.004	46
	0.996 ± 0.006	46

Contact your Watlow representative, for special diameter requests.

Features and Benefits

High temperature seal

- Reduces exposure to the atmosphere which minimizes oxidation of the winding wires, resulting in longer life of the element

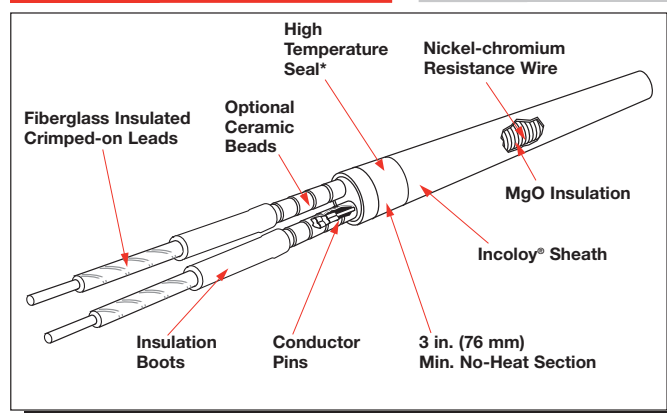
Note: First 2 in. (51 mm) must be outside the platen in free air and less than 1000°F (538°C).

Incoloy® sheath

- Transfers heat more efficiently

High emissivity sheath

- Provides better heat transfer and longer life



* First 2 in. (51 mm) at lead end must be kept below 1000°F (538°C)

Typical Applications

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

Cartridge/Insertion Heaters

EXTENDED
CAPABILITY

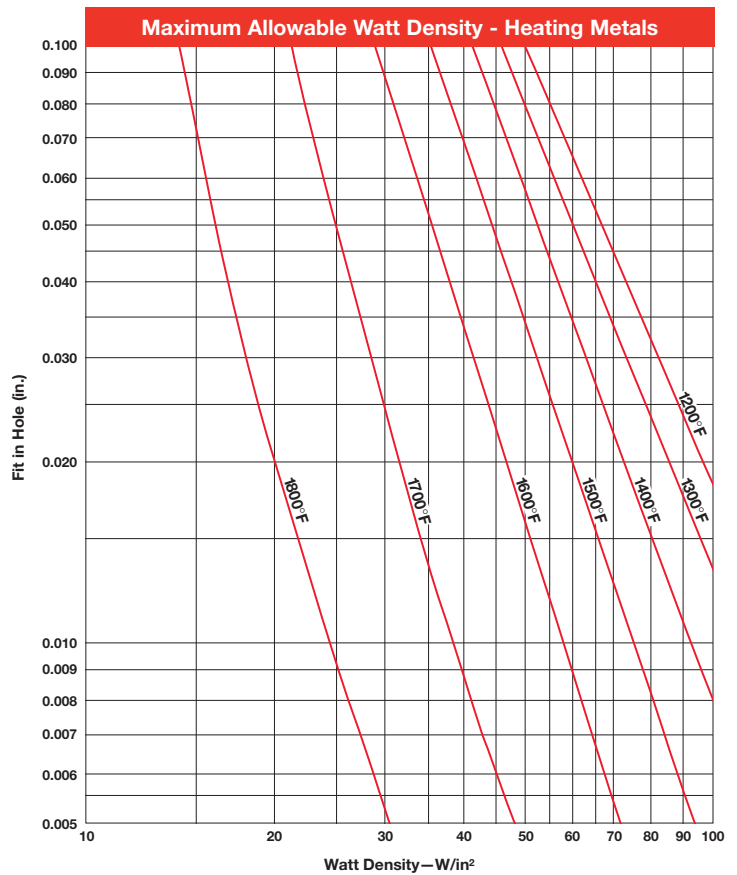
Extended Capabilities For High-Temperature (HT) FIREROD® Heaters

Applications and Technical Data

Options

- Thermocouples
- Independently controllable heat zones
- Distributed wattage
- Flanges
- Post terminals
- Conduit NEMA boxes
- Bent FIREROD

For consideration of the HT FIREROD for your application, use the recommended *Maximum Watt Density graph* to the right for these units.



Cartridge/Insertion Heaters

**EXTENDED
CAPABILITY**

Extended Capabilities For Custom Cartridge Heaters

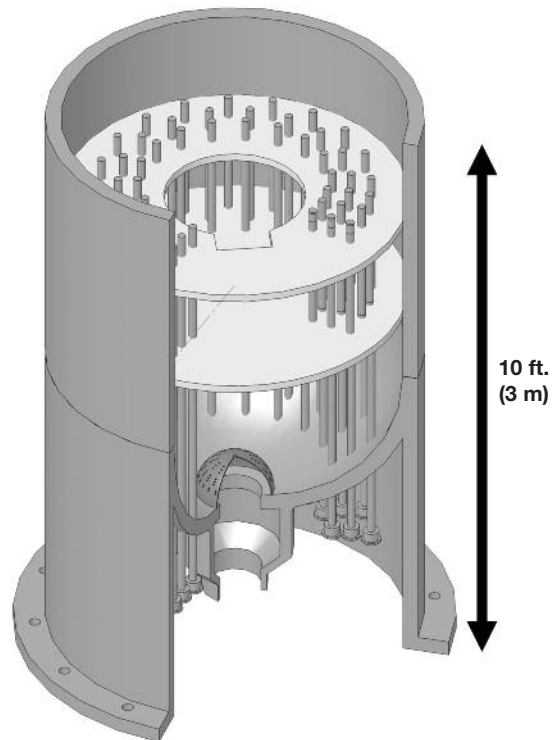
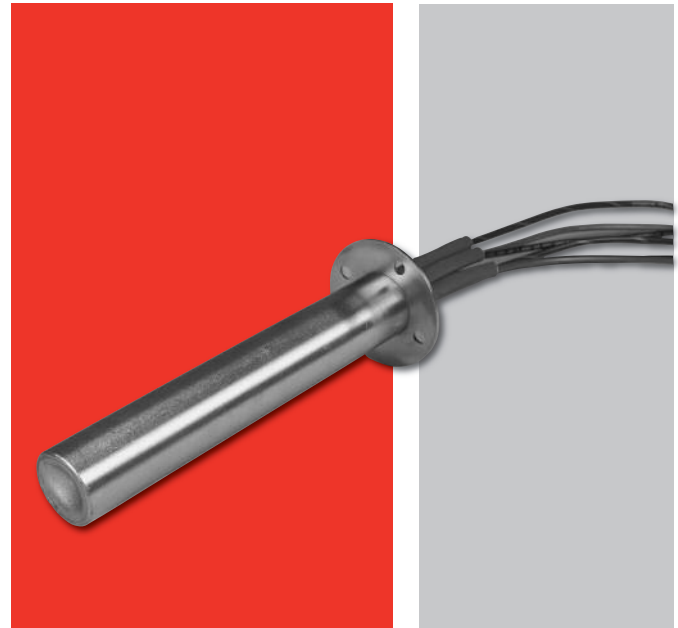
Special cartridge heaters can be engineered and designed to meet the most difficult applications and the highest quality standards. From nuclear power plants to open heart surgeries, Watlow cartridge heaters with extended capabilities are exceeding customer expectations. For over 80 years, Watlow's emphasis on sound engineering and quality control has established us as a preferred supplier for many high-performance heating requirements. For large opportunities, Watlow can engineer a solution for you. Watlow has the extensive experience in:

- Custom diameters
- High watt density applications
- Heater lengths greater than 36 in. (914 mm)
- Low current leakage constructions
- Special testing and inspection
- Non-destructive testing: x-ray, helium leak tests and start up verification
- Integrated thermostats
- Value added integration of the Watlow heater into a sub-assembly
- Complete documentation packages: approval drawings, material traceability, inspection traceability and other documents required for compliance to customer requirements



High Performance Cartridge Heaters

Watlow has developed a wide range of heaters and assemblies for the most demanding applications. Watlow can engineer and manufacture heaters with low leakage constructions, integrated temperature controls or limits and customer unique hardware and connectors.



Nuclear Pressurizer Heaters

Watlow has been providing specialized heaters to the nuclear industry for over 40 years. Watlow pressurizer heaters are engineered to be highly reliable and manufactured to the exacting standards of the nuclear industry.

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heater Code Numbers

Diameter in.	Sheath Length in. (mm)	Volts	Watts	Watt Density W/in ² (W/cm ²)		Approx. Net Wt. lbs (kg)		Delivery	Code Number
1/8	1/4 (32.0)	120	25	87	(13)	0.02	(0.009)	Stock	C1E14
	1/4 (32.0)	120	50	174	(18)	0.02	(0.009)	Stock	C1E13
	1/4 (32.0)	240	35	113	(27)	0.02	(0.009)	Stock	C1E42
	1/2 (38.0)	120	30	78	(12)	0.02	(0.009)	Stock	C1J5
	1/2 (38.0)	120	60	156	(24)	0.02	(0.009)	Stock	C1J6
	2 (51.0)	120	50	87	(13)	0.02	(0.009)	Stock	C2A4
2 (51.0)	120	100	174	(27)	0.02	(0.009)	Stock	C2A5	
1/4	1 (25.0)	120	80	208	(32)	0.02	(0.009)	Stock	E1A51
	1 (25.0)	120	100	260	(40)	0.02	(0.009)	Stock	E1A52
	1 (25.0)	120	150	390	(60)	0.02	(0.009)	Stock	E1A53
	1 (25.0)	240	100	250	(39)	0.02	(0.009)	Stock	E1A66
	1/4 (32.0)	120	75	130	(20)	0.02	(0.009)	Stock	E1E41
	1/4 (32.0)	120	100	173	(27)	0.02	(0.009)	Stock	E1E42
	1/4 (32.0)	120	150	260	(40)	0.02	(0.009)	Stock	E1E43
	1/4 (32.0)	240	225	390	(60)	0.02	(0.009)	Stock	E1E61
	1/2 (38.0)	120	50	65	(10)	0.02	(0.009)	Stock	E1J39
	1/2 (38.0)	120	100	130	(20)	0.02	(0.009)	Stock	E1J40
	1/2 (38.0)	120	150	195	(30)	0.02	(0.009)	Stock	E1J41
	1/2 (38.0)	240	175	228	(35)	0.02	(0.009)	Stock	E1J49
	1/2 (38.0)	120	200	260	(40)	0.02	(0.009)	Stock	E1J42
	1/2 (38.0)	240	200	260	(40)	0.02	(0.009)	Stock	E1J52
	1/2 (38.0)	240	250	325	(50)	0.02	(0.009)	Stock	E1J35
	2 (51.0)	120	80	68	(11)	0.03	(0.014)	Stock	E2A136
	2 (51.0)	120	100	87	(13)	0.03	(0.014)	Stock	E2A55
	2 (51.0)	240	125	108	(17)	0.03	(0.014)	Stock	E2A82
	2 (51.0)	120	150	130	(20)	0.03	(0.014)	Stock	E2A56
	2 (51.0)	240	150	130	(20)	0.03	(0.014)	Stock	E2A77
	2 (51.0)	120	200	173	(27)	0.03	(0.014)	Stock	E2A57
	2 (51.0)	240	200	173	(27)	0.03	(0.014)	Stock	E2A50
	2 (51.0)	120	250	217	(33)	0.03	(0.014)	Stock	E2A72
	2 (51.0)	240	250	215	(33)	0.03	(0.014)	Stock	E2A76
	2 (51.0)	240	300	260	(40)	0.03	(0.014)	Stock	E2A83
	2 1/2 (64.0)	120	250	159	(25)	0.03	(0.014)	Stock	E2J80
	2 1/2 (64.0)	240	250	159	(25)	0.03	(0.014)	Stock	E2J49
	3 (76.0)	120	100	52	(8)	0.04	(0.018)	Stock	E3A48
	3 (76.0)	120	200	104	(16)	0.04	(0.018)	Stock	E3A49
	3 (76.0)	240	200	104	(16)	0.04	(0.018)	Stock	E3A60
	3 (76.0)	240	250	128	(20)	0.04	(0.018)	Stock	E3A124
	3 (76.0)	120	300	156	(24)	0.04	(0.018)	Stock	E3A50
	3 (76.0)	240	300	156	(24)	0.04	(0.018)	Stock	E3A51
	4 (102.0)	120	100	37	(6)	0.04	(0.018)	Stock	E4A28
	4 (102.0)	120	200	74	(11)	0.04	(0.018)	Stock	E4A29
	4 (102.0)	240	200	74	(11)	0.04	(0.018)	Stock	E4A32
4 (102.0)	120	300	111	(17)	0.04	(0.018)	Stock	E4A30	
4 (102.0)	240	300	111	(17)	0.04	(0.018)	Stock	E4A6	
4 1/2 (114.0)	120	200	64	(10)	0.05	(0.023)	Stock	E4J30	
5 (127.0)	240	350	101	(16)	0.05	(0.023)	Stock	E5A45	
5 (127.0)	120	400	113	(18)	0.05	(0.023)	Stock	E5A57	
5 (127.0)	240	400	113	(18)	0.05	(0.023)	Stock	E5A34	
6 (152.0)	240	400	94	(14)	0.06	(0.027)	Stock	E6A46	
8 (203.0)	240	800	136	(21)	0.08	(0.036)	Stock	E8A76	

CONTINUED

12 inch crimped on GGS leads supplied unless otherwise specified.

• Stock delivery, same day

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heater Code Numbers (Continued)

Diameter in.	Sheath Length in. (mm)	Volts	Watts	Watt Density W/in ² (W/cm ²)		Approx. Net Wt. lbs (kg)		Delivery	Code Number
3/8	1 (25.0)	120	55	95	(15)	0.03	(0.014)	Stock	G1A71
	1 (25.0)	120	100	172	(26)	0.03	(0.014)	Stock	G1A29
	1 (25.0)	120	150	259	(40)	0.03	(0.014)	Stock	G1A38
	1 (25.0)	240	200	344	(53)	0.03	(0.014)	Stock	G1A83
1/4	1 1/4 (32.0)	120	100	115	(18)	0.03	(0.014)	Stock	G1E91
	1 1/4 (32.0)	120	125	144	(22)	0.03	(0.014)	Stock	G1E74
	1 1/4 (32.0)	120	150	172	(27)	0.03	(0.014)	Stock	G1E92
	1 1/4 (32.0)	240	150	172	(27)	0.03	(0.014)	Stock	G1E93
1/4	1 1/4 (32.0)	120	200	230	(35)	0.03	(0.014)	Stock	G1E94
	1 1/4 (32.0)	240	200	230	(36)	0.03	(0.014)	Stock	G1E95
	1 1/4 (32.0)	120	400	426	(66)	0.03	(0.014)	Stock	G1E99
1 5/16	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 3/8	(34.9)	240	160	151	(23)	0.03	(0.014)	Stock	G1G23
1 7/16	(36.5)	120	100	94	(15)	0.03	(0.014)	Stock	G1H6
1/2	1 1/2 (38.0)	120	50	43	(7)	0.04	(0.018)	Stock	G1J25
	1 1/2 (38.0)	120	75	65	(10)	0.04	(0.018)	Stock	G1J70
	1 1/2 (38.0)	120	80	68	(11)	0.04	(0.018)	Stock	G1J66
	1 1/2 (38.0)	120	100	86	(13)	0.04	(0.018)	Stock	G1J59
	1 1/2 (38.0)	240	100	86	(13)	0.04	(0.018)	Stock	G1J110
	1 1/2 (38.0)	240	125	106	(16)	0.04	(0.018)	Stock	G1J182
	1 1/2 (38.0)	120	150	129	(20)	0.04	(0.018)	Stock	G1J31
	1 1/2 (38.0)	240	150	129	(20)	0.04	(0.018)	Stock	G1J39
	1 1/2 (38.0)	120	200	173	(27)	0.04	(0.018)	Stock	G1J85
	1 1/2 (38.0)	240	200	173	(27)	0.04	(0.018)	Stock	G1J73
1 1/2	1 1/2 (38.0)	120	250	216	(33)	0.04	(0.018)	Stock	G1J86
	1 1/2 (38.0)	240	250	216	(33)	0.04	(0.018)	Stock	G1J54
3/4	1 3/4 (45.0)	120	125	86	(13)	0.05	(0.023)	Stock	G1N45
	1 3/4 (45.0)	120	175	122	(19)	0.05	(0.023)	Stock	G1N46
	1 3/4 (45.0)	120	250	172	(27)	0.05	(0.023)	Stock	G1N43
	1 3/4 (45.0)	240	250	172	(27)	0.05	(0.023)	Stock	G1N32
1 13/16	1 13/16 (46.0)	240	150	98	(15)	0.05	(0.023)	Stock	G1P14
	1 13/16 (46.0)	120	200	129	(20)	0.05	(0.023)	Stock	G1P15
	1 13/16 (46.0)	240	250	161	(25)	0.05	(0.023)	Stock	G1P11
1 1/8	(47.6)	120	250	152	(24)	0.05	(0.023)	Stock	G1R14
2	2 (51.0)	120	50	29	(5)	0.06	(0.027)	Stock	G2A53
	2 (51.0)	120	75	42	(7)	0.06	(0.027)	Stock	G2A192
	2 (51.0)	120	100	57	(9)	0.06	(0.027)	Stock	G2A84
	2 (51.0)	240	100	57	(9)	0.06	(0.027)	Stock	G2A76
	2 (51.0)	120	150	86	(13)	0.06	(0.027)	Stock	G2A56
2	2 (51.0)	240	150	86	(13)	0.06	(0.027)	Stock	G2A81
	2 (51.0)	120	200	115	(18)	0.06	(0.027)	Stock	G2A127
	2 (51.0)	240	200	115	(18)	0.06	(0.027)	Stock	G2A37
	2 (51.0)	120	250	144	(22)	0.06	(0.027)	Stock	G2A47
	2 (51.0)	240	250	144	(22)	0.06	(0.027)	Stock	G2A73
	2 (51.0)	120	300	172	(27)	0.06	(0.027)	Stock	G2A139
	2 (51.0)	240	300	172	(27)	0.06	(0.027)	Stock	G2A98
	2 (51.0)	120	400	230	(36)	0.06	(0.027)	Stock	G2A153
2	2 (51.0)	240	400	230	(36)	0.06	(0.027)	Stock	G2A146
	2 (51.0)	120	500	282	(44)	0.06	(0.027)	Stock	G2A95

CONTINUED

12 inch crimped on GGS leads supplied unless otherwise specified.

• Stock delivery, same day

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heater Code Numbers (Continued)

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Delivery	Code Number
	in.	(mm)			W/in ²	(W/cm ²)	lbs	(kg)		
3/8	2	(51.0)	240	500	282	(44)	0.06	(0.027)	Stock	G2A97
	2 1/8	(54.0)	240	200	106	(16)	0.06	(0.027)	Stock	G2C13
1/4	2 1/4	(57.0)	120	75	37	(6)	0.07	(0.032)	Stock	G2E88
	2 1/4	(57.0)	120	125	62	(10)	0.07	(0.032)	Stock	G2E89
1/4	2 1/4	(57.0)	240	125	62	(10)	0.07	(0.032)	Stock	G2E138
	2 1/4	(57.0)	240	150	73	(11)	0.07	(0.032)	Stock	G2E68
1/4	2 1/4	(57.0)	120	175	86	(13)	0.07	(0.032)	Stock	G2E90
	2 1/4	(57.0)	120	250	123	(19)	0.07	(0.032)	Stock	G2E2
1/4	2 1/4	(57.0)	240	250	123	(19)	0.07	(0.032)	Stock	G2E78
	2 1/4	(57.0)	120	300	148	(23)	0.07	(0.032)	Stock	G2E108
1/4	2 1/4	(57.0)	240	300	148	(23)	0.07	(0.032)	Stock	G2E12
	2 1/4	(57.0)	120	350	173	(27)	0.07	(0.032)	Stock	G2E91
1/4	2 1/4	(57.0)	240	350	173	(27)	0.07	(0.032)	Stock	G2E75
	2 1/2	(64.0)	120	200	87	(13)	0.07	(0.032)	Stock	G2J110
1/2	2 1/2	(64.0)	240	200	87	(13)	0.07	(0.032)	Stock	G2J81
	2 1/2	(64.0)	120	250	108	(17)	0.07	(0.032)	Stock	G2J46
1/2	2 1/2	(64.0)	240	250	108	(17)	0.07	(0.032)	Stock	G2J80
	2 1/2	(64.0)	120	300	130	(20)	0.07	(0.032)	Stock	G2J118
1/2	2 1/2	(64.0)	240	300	130	(20)	0.07	(0.032)	Stock	G2J119
	2 1/2	(64.0)	120	400	174	(27)	0.07	(0.032)	Stock	G2J26
1/2	2 1/2	(64.0)	240	400	174	(27)	0.07	(0.032)	Stock	G2J146
	2 1/2	(64.0)	120	500	216	(33)	0.07	(0.032)	Stock	G2J109
1/2	2 1/2	(64.0)	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
3/8	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
3/8	3	(76.0)	120	100	34	(5)	0.08	(0.036)	Stock	G3A55
	3	(76.0)	240	100	34	(5)	0.08	(0.036)	Stock	G3A137
3/8	3	(76.0)	120	150	52	(8)	0.08	(0.036)	Stock	G3A121
	3	(76.0)	120	200	69	(11)	0.08	(0.036)	Stock	G3A61
3/8	3	(76.0)	240	200	69	(11)	0.08	(0.036)	Stock	G3A39
	3	(76.0)	120	250	86	(13)	0.08	(0.036)	Stock	G3A52
3/8	3	(76.0)	240	250	86	(13)	0.08	(0.036)	Stock	G3A54
	3	(76.0)	120	300	104	(16)	0.08	(0.036)	Stock	G3A73
3/8	3	(76.0)	240	300	104	(16)	0.08	(0.036)	Stock	G3A92
	3	(76.0)	120	400	138	(21)	0.08	(0.036)	Stock	G3A44
3/8	3	(76.0)	240	400	138	(21)	0.08	(0.036)	Stock	G3A65
	3	(76.0)	120	500	173	(27)	0.08	(0.036)	Stock	G3A119
3/8	3	(76.0)	240	500	173	(27)	0.08	(0.036)	Stock	G3A120
	3	(76.0)	240	600	208	(32)	0.08	(0.036)	Stock	G3A133
3/8	3 5/16	(84.2)	120	500	152	(24)	0.08	(0.036)	Stock	G3F24
	3 1/2	(89.0)	120	250	72	(11)	0.09	(0.041)	Stock	G3J77
3/4	3 1/2	(89.0)	240	250	72	(11)	0.09	(0.041)	Stock	G3J65
	3 1/2	(89.0)	120	300	87	(13)	0.09	(0.041)	Stock	G3J87
3/4	3 1/2	(89.0)	240	300	87	(13)	0.09	(0.041)	Stock	G3J68
	3 1/2	(89.0)	120	500	144	(22)	0.09	(0.041)	Stock	G3J22
3/4	3 1/2	(89.0)	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
3/4	3 13/16	(96.8)	240	500	128	(20)	0.09	(0.041)	Stock	G3P3

CONTINUED

12 inch crimped on GGS leads supplied unless otherwise specified.

• Stock delivery, same day

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heater Code Numbers (Continued)

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Delivery	Code Number
	in.	(mm)			W/in ²	(W/cm ²)	lbs	(kg)		
3/8	4	(102.0)	120	125	31	(5)	0.09	(0.041)	Stock	G4A54
	4	(102.0)	240	125	31	(5)	0.09	(0.041)	Stock	G4A163
	4	(102.0)	120	150	37	(6)	0.09	(0.041)	Stock	G4A78
	4	(102.0)	120	175	43	(7)	0.09	(0.041)	Stock	G4A191
	4	(102.0)	120	250	62	(10)	0.09	(0.041)	Stock	G4A40
	4	(102.0)	240	250	62	(10)	0.09	(0.041)	Stock	G4A87
	4	(102.0)	120	300	74	(11)	0.09	(0.041)	Stock	G4A94
	4	(102.0)	240	300	74	(11)	0.09	(0.041)	Stock	G4A95
	4	(102.0)	120	400	99	(15)	0.09	(0.041)	Stock	G4A48
	4	(102.0)	240	400	99	(15)	0.09	(0.041)	Stock	G4A44
	4	(102.0)	240	450	109	(17)	0.09	(0.041)	Stock	G4A64
	4	(102.0)	120	500	123	(19)	0.09	(0.041)	Stock	G4A96
	4	(102.0)	240	500	123	(19)	0.09	(0.041)	Stock	G4A92
	4	(102.0)	120	550	134	(21)	0.09	(0.041)	Stock	G4A200
	4 1/4	(108.0)	240	300	67	(10)	0.09	(0.041)	Stock	G4E25
	4 1/4	(108.0)	240	750	167	(26)	0.09	(0.041)	Stock	G4E15
	4 1/2	(114.0)	120	300	65	(10)	0.10	(0.045)	Stock	G4J54
	4 1/2	(114.0)	240	300	65	(10)	0.10	(0.045)	Stock	G4J33
	4 1/2	(114.0)	120	500	108	(17)	0.10	(0.045)	Stock	G4J55
	4 1/2	(114.0)	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	(127.0)	120	150	29	(4)	0.11	(0.050)	Stock	G5A68	
5	(127.0)	240	150	29	(4)	0.11	(0.050)	Stock	G5A56	
5	(127.0)	120	300	58	(9)	0.11	(0.050)	Stock	G5A69	
5	(127.0)	240	300	58	(9)	0.11	(0.050)	Stock	G5A70	
5	(127.0)	120	500	96	(15)	0.11	(0.050)	Stock	G5A38	
5	(127.0)	240	500	96	(15)	0.11	(0.050)	Stock	G5A71	
5	(127.0)	240	750	144	(22)	0.11	(0.050)	Stock	G5A67	
5	(127.0)	240	1000	192	(30)	0.11	(0.050)	Stock	G5A115	
5 1/4	(133.0)	240	200	45	(7)	0.12	(0.054)	Stock	G5E16	
5 1/2	(140.0)	240	600	104	(16)	0.12	(0.054)	Stock	G5J36	
5 1/2	(140.0)	240	1000	173	(27)	0.12	(0.054)	Stock	G5J45	
6	(152.0)	120	200	31	(5)	0.13	(0.059)	Stock	G6A80	
6	(152.0)	120	250	39	(6)	0.13	(0.059)	Stock	G6A40	
6	(152.0)	240	250	39	(6)	0.13	(0.059)	Stock	G6A92	
6	(152.0)	120	400	63	(10)	0.13	(0.059)	Stock	G6A81	
6	(152.0)	240	400	63	(10)	0.13	(0.059)	Stock	G6A82	
6	(152.0)	120	500	79	(12)	0.13	(0.059)	Stock	G6A125	
6	(152.0)	240	500	79	(12)	0.13	(0.059)	Stock	G6A59	
6	(152.0)	120	600	94	(15)	0.13	(0.059)	Stock	G6A56	
6	(152.0)	240	600	94	(15)	0.13	(0.059)	Stock	G6A51	
6	(152.0)	240	750	117	(18)	0.13	(0.059)	Stock	G6A46	
6	(152.0)	240	1000	157	(24)	0.13	(0.059)	Stock	G6A83	
6 1/2	(165.0)	240	600	86	(13)	0.14	(0.064)	Stock	G6J23	
6 1/2	(165.0)	240	1000	144	(22)	0.14	(0.064)	Stock	G6J33	
7	(178.0)	120	250	33	(5)	0.14	(0.064)	Stock	G7A40	
7	(178.0)	240	250	33	(5)	0.14	(0.064)	Stock	G7A32	
7	(178.0)	240	500	65	(10)	0.14	(0.064)	Stock	G7A30	
7	(178.0)	120	600	80	(12)	0.14	(0.064)	Stock	G7A41	

CONTINUED

12 inch crimped on GGS leads supplied unless otherwise specified.

• Stock delivery, same day

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heater Code Numbers (Continued)

Diameter in.	Sheath Length in. (mm)	Volts	Watts	Watt Density W/in ² (W/cm ²)		Approx. Net Wt. lbs (kg)		Delivery	Code Number
3/8	7 (178.0)	240	600	80	(12)	0.14	(0.064)	Stock	G7A42
	7 (178.0)	240	1000	133	(21)	0.14	(0.064)	Stock	G7A43
	7 1/2 (191.0)	240	600	74	(11)	0.15	(0.068)	Stock	G7J27
	7 1/2 (191.0)	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 (203.0)	120	300	34	(5)	0.16	(0.073)	Stock	G8A54
	8 (203.0)	240	300	34	(5)	0.16	(0.073)	Stock	G8A47
	8 (203.0)	120	400	45	(7)	0.16	(0.073)	Stock	G8A109
	8 (203.0)	120	500	58	(9)	0.16	(0.073)	Stock	G8A81
	8 (203.0)	240	500	58	(9)	0.16	(0.073)	Stock	G8A32
	8 (203.0)	120	600	69	(11)	0.16	(0.073)	Stock	G8A53
	8 (203.0)	240	600	69	(11)	0.16	(0.073)	Stock	G8A37
	8 (203.0)	240	700	79	(12)	0.16	(0.073)	Stock	G8A98
	8 (203.0)	240	1000	115	(18)	0.16	(0.073)	Stock	G8A45
	8 5/8 (219.0)	240	500	52	(8)	0.17	(0.077)	Stock	G8L3
	9 (229.0)	240	1000	100	(16)	0.18	(0.082)	Stock	G9A37
	9 1/2 (241.0)	240	600	57	(9)	0.19	(0.086)	Stock	G9J20
	9 1/2 (241.0)	240	1000	96	(15)	0.19	(0.086)	Stock	G9J12
	10 (254.0)	120	400	36	(6)	0.19	(0.086)	Stock	G10A48
	10 (254.0)	120	600	54	(8)	0.19	(0.086)	Stock	G10A35
	10 (254.0)	240	600	54	(8)	0.19	(0.086)	Stock	G10A31
	10 (254.0)	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 (305.0)	120	400	30	(5)	0.22	(0.100)	Stock	G12A45
	12 (305.0)	120	600	45	(7)	0.22	(0.100)	Stock	G12A29
	12 (305.0)	240	600	45	(7)	0.22	(0.100)	Stock	G12A46
	12 (305.0)	240	1000	75	(12)	0.22	(0.100)	Stock	G12A47
	12 13/16 (325.5)	240	1000	69	(11)	0.23	(0.104)	Stock	G12P3
1/2	1 (25.0)	120	50	65	(10)	0.06	(0.027)	Stock	J1A30
	1 (25.0)	120	150	193	(30)	0.06	(0.027)	Stock	J1A31
	1 1/4 (32.0)	120	50	43	(7)	0.07	(0.032)	Stock	J1E50
	1 1/4 (32.0)	120	125	107	(17)	0.07	(0.032)	Stock	J1E51
	1 1/4 (32.0)	240	125	107	(17)	0.07	(0.032)	Stock	J1E58
	1 1/4 (32.0)	240	200	172	(27)	0.07	(0.032)	Stock	J1E52
	1 1/4 (32.0)	240	250	212	(33)	0.07	(0.032)	Stock	J1E88
	1 1/2 (38.0)	120	50	32	(3)	0.08	(0.036)	Stock	J1J47
	1 1/2 (38.0)	120	150	97	(15)	0.08	(0.036)	Stock	J1J48
	1 1/2 (38.0)	240	150	97	(15)	0.08	(0.036)	Stock	J1J96
	1 1/2 (38.0)	120	200	128	(20)	0.08	(0.036)	Stock	J1J59
	1 1/2 (38.0)	240	200	128	(20)	0.08	(0.036)	Stock	J1J38
	2 (51.0)	120	75	32	(5)	0.09	(0.041)	Stock	J2A80
	2 (51.0)	120	200	86	(13)	0.09	(0.041)	Stock	J2A49
	2 (51.0)	240	200	86	(13)	0.09	(0.041)	Stock	J2A75
	2 (51.0)	120	250	108	(17)	0.09	(0.041)	Stock	J2A85
	2 (51.0)	240	250	108	(17)	0.09	(0.041)	Stock	J2A71
	2 (51.0)	120	300	128	(20)	0.09	(0.041)	Stock	J2A95
	2 (51.0)	240	300	128	(20)	0.09	(0.041)	Stock	J2A96
	2 (51.0)	120	400	171	(27)	0.09	(0.041)	Stock	J2A81
	2 (51.0)	240	400	171	(27)	0.09	(0.041)	Stock	J2A82

CONTINUED

12 inch crimped on GGS leads supplied unless otherwise specified.

• Stock delivery, same day

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heater Code Numbers (Continued)

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Delivery	Code Number
	in.	(mm)			W/in ²	(W/cm ²)	lbs	(kg)		
½	2¼	(57.0)	120	75	28	(4)	0.10	(0.045)	Stock	J2E86
	2¼	(57.0)	120	125	46	(7)	0.10	(0.045)	Stock	J2E87
	2¼	(57.0)	120	250	92	(14)	0.10	(0.045)	Stock	J2E56
	2¼	(57.0)	240	250	92	(14)	0.10	(0.045)	Stock	J2E69
	2¼	(57.0)	120	400	147	(22)	0.10	(0.045)	Stock	J2E114
	2¼	(57.0)	240	400	147	(22)	0.10	(0.045)	Stock	J2E115
	2¼	(57.0)	120	500	184	(29)	0.10	(0.045)	Stock	J2E64
	2¼	(57.0)	240	500	184	(29)	0.10	(0.045)	Stock	J2E88
	2⅝	(60.3)	120	100	34	(5)	0.10	(0.045)	Stock	J2G35
	2⅝	(60.3)	240	100	34	(5)	0.10	(0.045)	Stock	J2G28
	2⅝	(60.3)	120	250	86	(13)	0.10	(0.045)	Stock	J2G34
	2⅝	(60.3)	240	250	86	(13)	0.10	(0.045)	Stock	J2G37
	2⅝	(60.3)	120	500	172	(27)	0.10	(0.045)	Stock	J2G36
	2⅝	(60.3)	240	500	172	(27)	0.10	(0.045)	Stock	J2G38
	2½	(64.0)	120	100	32	(5)	0.11	(0.050)	Stock	J2J67
	2½	(64.0)	240	100	32	(5)	0.11	(0.050)	Stock	J2J57
	2½	(64.0)	120	250	81	(13)	0.11	(0.050)	Stock	J2J68
	2½	(64.0)	240	250	81	(13)	0.11	(0.050)	Stock	J2J69
	2½	(64.0)	120	300	96	(15)	0.11	(0.050)	Stock	J2J109
	2½	(64.0)	240	300	96	(15)	0.11	(0.050)	Stock	J2J110
2½	(64.0)	120	400	128	(20)	0.11	(0.050)	Stock	J2J81	
2½	(64.0)	240	400	128	(20)	0.11	(0.050)	Stock	J2J82	
2½	(64.0)	120	500	161	(24)	0.11	(0.050)	Stock	J2J66	
2½	(64.0)	240	500	161	(24)	0.11	(0.050)	Stock	J2J70	
2⅞	(65.1)	120	350	108	(17)	0.11	(0.050)	Stock	J2K6	
2⅞	(65.1)	240	300	93	(14)	0.11	(0.050)	Stock	J2K3	
2¾	(70.0)	240	400	115	(18)	0.11	(0.050)	Stock	J2N43	
2¾	(70.0)	120	400	115	(18)	0.11	(0.050)	Stock	J2N45	
3	(76.0)	120	125	32	(5)	0.12	(0.054)	Stock	J3A108	
3	(76.0)	240	125	32	(5)	0.12	(0.054)	Stock	J3A109	
3	(76.0)	120	250	64	(10)	0.12	(0.054)	Stock	J3A107	
3	(76.0)	240	250	64	(10)	0.12	(0.054)	Stock	J3A89	
3	(76.0)	120	300	78	(12)	0.12	(0.054)	Stock	J3A65	
3	(76.0)	120	350	89	(14)	0.12	(0.054)	Stock	J3A173	
3	(76.0)	240	300	78	(12)	0.12	(0.054)	Stock	J3A73	
3	(76.0)	120	400	104	(16)	0.12	(0.054)	Stock	J3A132	
3	(76.0)	240	400	104	(16)	0.12	(0.054)	Stock	J3A29	
3	(76.0)	120	500	129	(20)	0.12	(0.054)	Stock	J3A110	
3	(76.0)	240	500	129	(20)	0.12	(0.054)	Stock	J3A111	
3	(76.0)	120	600	154	(24)	0.12	(0.054)	Stock	J3A51	
3	(76.0)	240	600	154	(24)	0.12	(0.054)	Stock	J3A127	
3	(76.0)	120	750	193	(30)	0.12	(0.054)	Stock	J3A137	
3	(76.0)	240	750	193	(30)	0.12	(0.054)	Stock	J3A112	
3	(76.0)	120	1000	254	(39)	0.12	(0.054)	Stock	J3A79	

CONTINUED

12 inch crimped on GGS leads supplied unless otherwise specified.

• Stock delivery, same day

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heater Code Numbers (Continued)

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Delivery	Code Number
	in.	(mm)			W/in ²	(W/cm ²)	lbs	(kg)		
½	3½	(89.0)	120	250	54	(8)	0.14	(0.064)	Stock	J3J44
	3½	(89.0)	240	250	54	(8)	0.14	(0.064)	Stock	J3J64
	3½	(89.0)	240	350	75	(12)	0.14	(0.064)	Stock	J3J65
	3½	(89.0)	120	500	107	(17)	0.14	(0.064)	Stock	J3J45
	3½	(89.0)	240	500	107	(17)	0.14	(0.064)	Stock	J3J46
	3½	(89.0)	240	750	162	(25)	0.14	(0.064)	Stock	J3J63
3 ¹³ / ₁₆	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	4	(102.0)	120	150	28	(4)	0.15	(0.068)	Stock	J4A117
	4	(102.0)	240	150	28	(4)	0.15	(0.068)	Stock	J4A122
	4	(102.0)	120	250	46	(7)	0.15	(0.068)	Stock	J4A118
	4	(102.0)	240	250	46	(7)	0.15	(0.068)	Stock	J4A90
	4	(102.0)	120	300	56	(9)	0.15	(0.068)	Stock	J4A63
	4	(102.0)	240	300	56	(9)	0.15	(0.068)	Stock	J4A26
	4	(102.0)	120	350	65	(10)	0.15	(0.068)	Stock	J4A1
	4	(102.0)	240	350	65	(10)	0.15	(0.068)	Stock	J4A103
	4	(102.0)	120	400	74	(11)	0.15	(0.068)	Stock	J4A139
	4	(102.0)	240	400	74	(11)	0.15	(0.068)	Stock	J4A68
4	4	(102.0)	120	500	92	(14)	0.15	(0.068)	Stock	J4A16
	4	(102.0)	120	550	100	(16)	0.15	(0.068)	Stock	J4A242
	4	(102.0)	240	500	92	(14)	0.15	(0.068)	Stock	J4A92
	4	(102.0)	120	750	138	(21)	0.15	(0.068)	Stock	J4A198
	4	(102.0)	240	750	138	(21)	0.15	(0.068)	Stock	J4A119
	4	(102.0)	240	1000	184	(28)	0.15	(0.068)	Stock	J4A73
	4½	(114.0)	120	500	80	(12)	0.17	(0.077)	Stock	J4J69
	4½	(114.0)	240	500	80	(12)	0.17	(0.077)	Stock	J4J57
4½	4½	(114.0)	120	750	120	(19)	0.17	(0.077)	Stock	J4J70
	4½	(114.0)	240	750	120	(19)	0.17	(0.077)	Stock	J4J32
4 ¹³ / ₁₆	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	5	(127.0)	120	200	29	(4)	0.19	(0.086)	Stock	J5A85
	5	(127.0)	240	200	29	(4)	0.19	(0.086)	Stock	J5A74
	5	(127.0)	120	350	50	(8)	0.19	(0.086)	Stock	J5A86
	5	(127.0)	240	350	50	(8)	0.19	(0.086)	Stock	J5A63
	5	(127.0)	120	400	58	(9)	0.19	(0.086)	Stock	J5A98
	5	(127.0)	240	400	58	(9)	0.19	(0.086)	Stock	J5A46
	5	(127.0)	120	500	72	(11)	0.19	(0.086)	Stock	J5A52
	5	(127.0)	240	500	72	(11)	0.19	(0.086)	Stock	J5A45
	5	(127.0)	120	750	108	(17)	0.19	(0.086)	Stock	J5A121
	5	(127.0)	240	750	108	(17)	0.19	(0.086)	Stock	J5A72
5	(127.0)	240	1000	143	(22)	0.19	(0.086)	Stock	J5A87	
5½	5½	(140.0)	240	200	25	(4)	0.20	(0.091)	Stock	J5J38
	5½	(140.0)	120	500	64	(10)	0.20	(0.091)	Stock	J5J43
	5½	(140.0)	240	500	64	(10)	0.20	(0.091)	Stock	J5J33
	5½	(140.0)	240	650	83	(13)	0.20	(0.091)	Stock	J5J69
	5½	(140.0)	120	750	97	(15)	0.20	(0.091)	Stock	J5J44
	5½	(140.0)	240	750	97	(15)	0.20	(0.091)	Stock	J5J45
5¾	5¾	(146.0)	120	700	86	(13)	0.20	(0.091)	Stock	J5N6
	5¾	(146.0)	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

CONTINUED

12 inch crimped on GGS leads supplied unless otherwise specified.

• Stock delivery, same day

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heater Code Numbers (Continued)

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Delivery	Code Number
	in.	(mm)			W/in ²	(W/cm ²)	lbs	(kg)		
½	6	(152.0)	120	250	29	(4)	0.21	(0.095)	Stock	J6A114
	6	(152.0)	240	250	29	(4)	0.21	(0.095)	Stock	J6A171
	6	(152.0)	240	300	35	(6)	0.21	(0.095)	Stock	J6A66
	6	(152.0)	240	350	41	(7)	0.21	(0.095)	Stock	J6A119
	6	(152.0)	120	500	59	(9)	0.21	(0.095)	Stock	J6A115
	6	(152.0)	240	500	59	(9)	0.21	(0.095)	Stock	J6A94
	6	(152.0)	120	750	88	(14)	0.21	(0.095)	Stock	J6A99
	6	(152.0)	240	750	88	(14)	0.21	(0.095)	Stock	J6A90
	6	(152.0)	120	1000	117	(18)	0.21	(0.095)	Stock	J6A53
	6	(152.0)	240	1000	117	(18)	0.21	(0.095)	Stock	J6A36
	6½	(165.0)	240	500	54	(8)	0.23	(0.104)	Stock	J6J45
	6½	(165.0)	240	1000	108	(17)	0.23	(0.104)	Stock	J6J27
	7	(178.0)	120	250	25	(4)	0.24	(0.109)	Stock	J7A79
	7	(178.0)	120	500	50	(8)	0.24	(0.109)	Stock	J7A80
	7	(178.0)	240	500	50	(8)	0.24	(0.109)	Stock	J7A57
7	(178.0)	120	600	60	(9)	0.24	(0.109)	Stock	J7A50	
7	(178.0)	240	600	60	(9)	0.24	(0.109)	Stock	J7A95	
7	(178.0)	240	1000	99	(15)	0.24	(0.109)	Stock	J7A81	
7½	(191.0)	240	500	46	(7)	0.26	(0.118)	Stock	J7J25	
7½	(191.0)	240	1000	92	(14)	0.26	(0.118)	Stock	J7J26	
8	(203.0)	120	300	26	(4)	0.28	(0.127)	Stock	J8A71	
8	(203.0)	240	300	26	(4)	0.28	(0.127)	Stock	J8A111	
8	(203.0)	120	500	43	(7)	0.28	(0.127)	Stock	J8A64	
8	(203.0)	240	500	43	(7)	0.28	(0.127)	Stock	J8A66	
8	(203.0)	120	1000	86	(13)	0.28	(0.127)	Stock	J8A84	
8	(203.0)	240	1000	86	(13)	0.28	(0.127)	Stock	J8A60	
8	(203.0)	240	1500	129	(20)	0.28	(0.127)	Stock	J8A100	
8	(203.0)	240	2000	172	(27)	0.28	(0.127)	Stock	J8A101	
8½	(216.0)	240	300	24	(4)	0.29	(0.132)	Stock	J8J39	
8½	(216.0)	240	500	40	(6)	0.29	(0.132)	Stock	J8J30	
8½	(216.0)	240	1000	80	(12)	0.29	(0.132)	Stock	J8J28	
9	(229.0)	240	500	38	(6)	0.30	(0.136)	Stock	J9A35	
9	(229.0)	240	1000	76	(12)	0.30	(0.136)	Stock	J9A58	
9½	(241.0)	240	500	36	(6)	0.32	(0.145)	Stock	J9J14	
9½	(241.0)	240	1000	72	(11)	0.32	(0.145)	Stock	J9J12	
10	(254.0)	120	500	34	(5)	0.33	(0.150)	Stock	J10A61	
10	(254.0)	240	500	34	(5)	0.33	(0.150)	Stock	J10A62	
10	(254.0)	120	1000	68	(11)	0.33	(0.150)	Stock	J10A63	
10	(254.0)	240	1000	68	(11)	0.33	(0.150)	Stock	J10A42	
10	(254.0)	240	1500	102	(16)	0.33	(0.150)	Stock	J10A33	
10	(254.0)	240	2000	136	(21)	0.33	(0.150)	Stock	J10A64	
11	(279.0)	240	1000	61	(9)	0.36	(0.163)	Stock	J11A60	
12	(305.0)	120	500	28	(4)	0.40	(0.181)	Stock	J12A63	
12	(305.0)	240	500	28	(4)	0.40	(0.181)	Stock	J12A76	
12	(305.0)	120	1000	56	(9)	0.40	(0.181)	Stock	J12A40	
12	(305.0)	240	1000	56	(9)	0.40	(0.181)	Stock	J12A49	

CONTINUED

12 inch crimped on GGS leads supplied unless otherwise specified.

• Stock delivery, same day

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heater Code Numbers (Continued)

Diameter in.	Sheath Length in. (mm)	Volts	Watts	Watt Density W/in ² (W/cm ²)	Approx. Net Wt. lbs (kg)	Delivery	Code Number
½	12 (305.0)	240	1500	84 (13)	0.40 (0.181)	Stock	J12A37
	12 (305.0)	240	2000	112 (17)	0.40 (0.181)	Stock	J12A89
	14 (356.0)	240	1000	48 (7)	0.48 (0.218)	Stock	J14A41
	14 (356.0)	240	2300	110 (17)	0.48 (0.218)	Stock	J14A39
	15 (381.0)	240	1500	66 (10)	0.50 (0.227)	Stock	J15A19
	16 (406.0)	240	1000	41 (7)	0.52 (0.236)	Stock	J16A12
	18 (457.0)	240	1500	55 (9)	0.57 (0.259)	Stock	J18A19
	18 (457.0)	240	1700	62 (9)	0.57 (0.259)	Stock	J18A23
¾	1¼ (32.0)	120	50	34 (5)	0.10 (0.045)	Stock	L1E26
	1¼ (32.0)	120	200	137 (21)	0.10 (0.045)	Stock	L1E24
	1¼ (32.0)	120	250	171 (27)	0.10 (0.045)	Stock	L1E27
	1½ (38.0)	120	250	128 (20)	0.11 (0.050)	Stock	L1J23
	1½ (38.0)	240	250	128 (20)	0.11 (0.050)	Stock	L1J24
	2 (51.0)	120	100	34 (5)	0.13 (0.059)	Stock	L2A48
	2 (51.0)	120	200	68 (11)	0.13 (0.059)	Stock	L2A49
	2 (51.0)	240	500	170 (26)	0.13 (0.059)	Stock	L2A54
	2¼ (57.0)	120	100	29 (4)	0.14 (0.064)	Stock	L2E49
	2¼ (57.0)	120	250	73 (11)	0.14 (0.064)	Stock	L2E50
	2¼ (57.0)	240	250	73 (11)	0.14 (0.064)	Stock	L2E12
	2¼ (57.0)	120	350	103 (16)	0.14 (0.064)	Stock	L2E40
	2¼ (57.0)	240	350	103 (16)	0.14 (0.064)	Stock	L2E51
	2⅝ (60.3)	120	280	77 (12)	0.16 (0.073)	Stock	L2G18
	2⅝ (60.3)	240	280	77 (12)	0.16 (0.073)	Stock	L2G19
	3 (76.0)	120	150	31 (5)	0.20 (0.091)	Stock	L3A81
	3 (76.0)	120	250	51 (8)	0.20 (0.091)	Stock	L3A82
	3 (76.0)	240	250	51 (8)	0.20 (0.091)	Stock	L3A9
	3 (76.0)	120	400	81 (13)	0.20 (0.091)	Stock	L3A94
	3 (76.0)	120	500	102 (16)	0.20 (0.091)	Stock	L3A113
	3 (76.0)	240	500	103 (16)	0.20 (0.091)	Stock	L3A33
	3 (76.0)	240	750	154 (24)	0.20 (0.091)	Stock	L3A71
	3¾ (95.0)	120	525	82 (13)	0.24 (0.109)	Stock	L3N12
	3¾ (95.0)	240	525	82 (13)	0.24 (0.109)	Stock	L3N1
	4 (102.0)	120	250	37 (6)	0.26 (0.118)	Stock	L4A99
	4 (102.0)	240	250	37 (6)	0.26 (0.118)	Stock	L4A104
	4 (102.0)	240	400	58 (9)	0.26 (0.118)	Stock	L4A47
	4 (102.0)	240	500	73 (11)	0.26 (0.118)	Stock	L4A53
	4 (102.0)	240	600	88 (14)	0.26 (0.118)	Stock	L4A44
	4 (102.0)	240	750	110 (17)	0.26 (0.118)	Stock	L4A100
	4 (102.0)	240	1000	146 (23)	0.26 (0.118)	Stock	L4A71
	5 (127.0)	120	250	28 (4)	0.29 (0.132)	Stock	L5A76
	5 (127.0)	240	250	28 (4)	0.29 (0.132)	Stock	L5A107
	5 (127.0)	240	500	57 (9)	0.29 (0.132)	Stock	L5A24
	5 (127.0)	240	750	86 (13)	0.29 (0.132)	Stock	L5A31
	5 (127.0)	240	1000	114 (18)	0.29 (0.132)	Stock	L5A77
5⅝ (85.7)	120	800	84 (13)	0.30 (0.136)	Stock	L5G3	
5⅝ (85.7)	240	800	84 (13)	0.30 (0.136)	Stock	L5G1	
6 (152.0)	120	300	28 (4)	0.34 (0.154)	Stock	L6A28	
6 (152.0)	240	300	28 (4)	0.34 (0.154)	Stock	L6A64	
6 (152.0)	240	500	47 (7)	0.34 (0.154)	Stock	L6A73	
6 (152.0)	240	750	70 (11)	0.34 (0.154)	Stock	L6A70	
6 (152.0)	240	1000	93 (14)	0.34 (0.154)	Stock	L6A71	

CONTINUED

12 inch crimped on GGS leads supplied unless otherwise specified.

• Stock delivery, same day

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heater Code Numbers (Continued)

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Delivery	Code Number
	in.	(mm)			W/in ²	(W/cm ²)	lbs	(kg)		
5/8	6	(152.0)	120	1500	139	(22)	0.34	(0.154)	Stock	L6A163
	6	(152.0)	240	1500	140	(22)	0.34	(0.154)	Stock	L6A94
	6½	(165.0)	120	500	43	(7)	0.38	(0.172)	Stock	L6J43
	6½	(165.0)	240	500	43	(7)	0.38	(0.172)	Stock	L6J55
	7	(178.0)	120	500	39	(6)	0.40	(0.181)	Stock	L7A42
	7	(178.0)	240	500	39	(6)	0.40	(0.181)	Stock	L7A15
	7	(178.0)	240	1000	79	(12)	0.40	(0.181)	Stock	L7A37
	7	(178.0)	240	1500	118	(18)	0.40	(0.181)	Stock	L7A12
	8	(203.0)	120	500	34	(5)	0.47	(0.213)	Stock	L8A96
	8	(203.0)	240	500	34	(5)	0.47	(0.213)	Stock	L8A46
	8	(203.0)	240	850	58	(9)	0.47	(0.213)	Stock	L8A115
	8	(203.0)	240	1000	68	(10)	0.47	(0.213)	Stock	L8A10
	8	(203.0)	240	1500	102	(16)	0.47	(0.213)	Stock	L8A37
	8	(203.0)	240	2000	137	(21)	0.47	(0.213)	Stock	L8A80
	10	(254.0)	120	500	27	(4)	0.53	(0.240)	Stock	L10A51
	10	(254.0)	240	500	27	(4)	0.53	(0.240)	Stock	L10A40
	10	(254.0)	240	750	40	(6)	0.53	(0.240)	Stock	L10A69
	10	(254.0)	240	1000	54	(8)	0.53	(0.240)	Stock	L10A52
	10	(254.0)	480	1000	54	(8)	0.53	(0.240)	Stock	L10A193
	10	(254.0)	240	1500	81	(13)	0.53	(0.240)	Stock	L10A8
	10	(254.0)	240	2000	108	(17)	0.53	(0.240)	Stock	L10A50
	12	(305.0)	120	500	22	(3)	0.66	(0.300)	Stock	L12A81
	12	(305.0)	240	500	22	(3)	0.66	(0.300)	Stock	L12A80
	12	(305.0)	240	900	40	(6)	0.66	(0.300)	Stock	L12A102
	12	(305.0)	120	1000	45	(7)	0.66	(0.300)	Stock	L12A82
	12	(305.0)	240	1000	45	(7)	0.66	(0.300)	Stock	L12A34
	12	(305.0)	120	1500	66	(10)	0.66	(0.300)	Stock	L12A147
	12	(305.0)	240	1500	67	(10)	0.66	(0.300)	Stock	L12A39
	12	(305.0)	240	2000	89	(14)	0.66	(0.300)	Stock	L12A63
	14	(356.0)	240	3700	140	(22)	0.79	(0.358)	Stock	L14A21
	15	(381.0)	240	750	27	(4)	0.84	(0.381)	Stock	L15A35
	15	(381.0)	240	2400	84	(13)	0.84	(0.381)	Stock	L15A20
	15	(381.0)	480	2500	88	(14)	0.84	(0.381)	Stock	L15A88
	15	(381.0)	240	4000	141	(22)	0.84	(0.381)	Stock	L15A41
	16	(406.0)	240	2500	82	(13)	0.91	(0.412)	Stock	L16A33
	16	(406.0)	240	4500	148	(23)	0.91	(0.412)	Stock	L16A40
18	(457.0)	240	1500	44	(7)	1.03	(0.467)	Stock	L18A32	
18	(457.0)	240	3000	87	(13)	1.03	(0.467)	Stock	L18A34	
18	(457.0)	240	4700	137	(21)	1.03	(0.467)	Stock	L18A36	
20	(508.0)	240	1500	40	(6)	1.25	(0.567)	Stock	L20A19	
20	(508.0)	240	3500	92	(14)	1.25	(0.567)	Stock	L20A13	
20	(508.0)	480	3500	92	(14)	1.25	(0.567)	Stock	L20A96	
20	(508.0)	240	4700	123	(19)	1.25	(0.567)	Stock	L20A14	
24	(610.0)	240	2000	44	(7)	1.47	(0.667)	Stock	L24A19	
24	(610.0)	240	4700	102	(15)	1.47	(0.667)	Stock	L24A14	
36	(914.0)	240	3000	43	(7)	2.30	(1.04)	Stock	L36A8	
¾	2¼	(57.0)	120	200	49	(8)	0.19	(0.086)	Stock	N2E8
	3	(76.0)	120	250	43	(7)	0.24	(0.109)	Stock	N3A11
	3	(76.0)	240	500	85	(13)	0.24	(0.109)	Stock	N3A12

CONTINUED

12 inch crimped on GGS leads supplied unless otherwise specified.

• Stock delivery, same day

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heater Code Numbers (Continued)

Diameter in.	Sheath Length in. (mm)	Volts	Watts	Watt Density W/in ² (W/cm ²)		Approx. Net Wt. lbs (kg)		Delivery	Code Number
¾	4 (102.0)	120	250	31	(5)	0.31	(0.141)	Stock	N4A16
	4 (102.0)	240	500	61	(9)	0.31	(0.141)	Stock	N4A17
	4 (102.0)	240	1000	122	(19)	0.31	(0.141)	Stock	N4A15
	5 (127.0)	120	300	28	(4)	0.38	(0.172)	Stock	N5A19
	5 (127.0)	240	500	47	(7)	0.38	(0.172)	Stock	N5A12
	5 (127.0)	240	1000	95	(15)	0.38	(0.172)	Stock	N5A20
	6 (152.0)	120	500	39	(6)	0.44	(0.200)	Stock	N6A19
	6 (152.0)	240	500	39	(6)	0.44	(0.200)	Stock	N6A20
	6 (152.0)	240	1000	78	(12)	0.44	(0.200)	Stock	N6A21
	6 (152.0)	480	1000	78	(12)	0.44	(0.200)	Stock	N6A225
	6 (152.0)	240	1500	116	(18)	0.44	(0.200)	Stock	N6A82
	6 (152.0)	240	2000	155	(24)	0.44	(0.200)	Stock	N6A22
	7 (178.0)	120	500	33	(5)	0.51	(0.231)	Stock	N7A15
	7 (178.0)	240	500	33	(5)	0.51	(0.231)	Stock	N7A1
	7 (178.0)	240	1000	66	(10)	0.51	(0.231)	Stock	N7A16
	8 (203.0)	120	500	28	(4)	0.58	(0.263)	Stock	N8A19
	8 (203.0)	240	500	28	(4)	0.58	(0.263)	Stock	N8A20
	8 (203.0)	240	1000	57	(9)	0.58	(0.263)	Stock	N8A21
	8 (203.0)	240	2000	114	(17)	0.58	(0.263)	Stock	N8A22
	10 (254.0)	240	1000	45	(7)	0.72	(0.327)	Stock	N10A15
	10 (254.0)	240	2000	90	(14)	0.72	(0.327)	Stock	N10A14
	12 (305.0)	240	1000	37	(6)	0.84	(0.381)	Stock	N12A15
	12 (305.0)	240	2000	74	(11)	0.84	(0.381)	Stock	N12A24
	12 (305.0)	480	2000	74	(11)	0.84	(0.381)	Stock	N12A198
	12 (305.0)	240	4000	148	(23)	0.84	(0.381)	Stock	N12A25
	13 (330.0)	240	1000	34	(5)	0.93	(0.422)	Stock	N13A26
	14 (356.0)	240	1250	40	(6)	1.03	(0.467)	Stock	N14A22
	14 (356.0)	240	2500	79	(12)	1.03	(0.467)	Stock	N14A20
	14 (356.0)	240	4500	142	(22)	1.03	(0.467)	Stock	N14A21
	15 (381.0)	240	1500	44	(22)	1.09	(0.494)	Stock	N15A26
	16 (406.0)	240	1800	49	(8)	1.14	(0.517)	Stock	N16A26
	16 (406.0)	240	4700	129	(20)	1.14	(0.517)	Stock	N16A18
	18 (457.0)	240	2000	49	(8)	1.25	(0.567)	Stock	N18A13
18 (457.0)	240	5000	122	(19)	1.25	(0.567)	Stock	N18A15	
20 (508.0)	240	1150	25	(4)	1.40	(0.635)	Stock	N20A21	
20 (508.0)	240	2250	49	(8)	1.40	(0.635)	Stock	N20A22	
20 (508.0)	240	5250	115	(18)	1.40	(0.635)	Stock	N20A10	
24 (610.0)	240	1375	25	(4)	1.80	(0.816)	Stock	N24A24	
24 (610.0)	240	2750	50	(8)	1.80	(0.816)	Stock	N24A23	
24 (610.0)	480	2750	50	(8)	1.80	(0.816)	Stock	N24A78	
24 (610.0)	240	5500	100	(16)	1.80	(0.816)	Stock	N24A13	
36 (914.0)	240	2500	30	(6)	2.50	(1.13)	Stock	N36A4	

12 inch crimped on GGS leads supplied unless otherwise specified.

• Stock delivery, same day

Cartridge/Insertion Heaters

FIREROD Cartridge Heaters

Heaters for Hot Runner Systems

Diameter in.	Sheath Length in. (mm)	Volts	Watts	Watt Density W/in ² (W/cm ²)	Approx. Net Wt. lbs (kg)	Delivery	Code Number	Reference Part No.
¼	1½ (38.0)	240	200	260 (40)	0.03 (0.014)	Stock	E1JX442A	—
	2 (51.0)	240	200	172 (27)	0.04 (0.018)	Stock	E2AX619A	—
	2½ (64.0)	120	200	129 (20)	0.04 (0.018)	Stock	E2JX287A	—
	2½ (64.0)	240	200	129 (20)	0.04 (0.018)	Stock	E2JX288A	—
	3 (76.0)	240	200	103 (16)	0.05 (0.023)	Stock	E3AX575A	—
	3½ (89.0)	240	250	108 (17)	0.05 (0.023)	Standard	E3JX155A	—
	4 (102.0)	240	250	93 (14)	0.05 (0.023)	Stock	E4AX509A	—
	5 (127.0)	240	250	71 (11)	0.06 (0.027)	Stock	E5AX299A	—
⅜	1¾ (45.0)	240	200	142 (22)	0.09 (0.041)	Stock	G1NX39E	TJ38017
	2 (51.0)	240	250	152 (24)	0.09 (0.041)	Stock	G2AX163B	TJ38020
	2½ (64.0)	240	250	112 (17)	0.10 (0.045)	Stock	G2JX131D	TJ38025
	3 (76.0)	240	260	92 (14)	0.10 (0.045)	Stock	G3AX238K	TJ38030
	3½ (89.0)	240	320	91 (14)	0.12 (0.054)	Stock	G3JX114K	TJ38035
	4 (102.0)	240	370	92 (14)	0.12 (0.054)	Stock	G4AX255D	TJ38040
	4½ (114.0)	240	420	90 (14)	0.13 (0.059)	Standard	G4JX84E	TJ38045
	5 (127.0)	240	470	108 (17)	0.14 (0.064)	Stock	G5AX183E	TJ38050
	5½ (140.0)	240	525	91 (14)	0.15 (0.068)	Standard	G5JX64C	TJ38055
	6 (152.0)	240	575	90 (14)	0.15 (0.068)	Standard	G6AX222D	TJ38060
	6½ (165.0)	240	625	93 (15)	0.16 (0.073)	Standard	G6JX34C	TJ38065
½	7 (178.0)	240	675	92 (14)	0.17 (0.077)	Standard	G7AX105C	TJ38070
	7½ (191.0)	240	725	101 (16)	0.18 (0.082)	Standard	G7JX36D	TJ38075
	8 (203.0)	240	775	91 (14)	0.19 (0.086)	Stock	G8AX202C	TJ38080
	3½ (89.0)	240	420	92 (14)	0.17 (0.077)	Stock	J3JX103C	TJ12035
	4 (102.0)	240	490	90 (14)	0.19 (0.086)	Stock	J4AX372A	TJ12040
	4½ (114.0)	240	550	80 (12)	0.20 (0.091)	Standard	J4JX62C	TJ12045
	5 (127.0)	240	625	89 (14)	0.22 (0.100)	Standard	J5AX178B	TJ12050
	5½ (140.0)	240	700	91 (14)	0.23 (0.104)	Standard	J5JX54B	TJ12055
	6 (152.0)	240	775	104 (16)	0.25 (0.113)	Standard	J6AX412A	TJ12060
	6½ (165.0)	240	850	104 (16)	0.26 (0.118)	Standard	J6JX45C	TJ12065
7½ (191.0)	240	975	100 (16)	0.29 (0.132)	Stock	J7JX88A	TJ12075	

Note: ¼ inch diameter heaters have Type J thermocouple, Style B (location at the end disk) with 36 inch swaged-in GGS leads.

⅜ and ½ inch heaters have Type J thermocouple, Style C (location in the end disk) with 36 inch swaged in GGS leads.

- Stock delivery, same day
- Standard delivery, 10 working days

Cartridge/Insertion Heaters

Metric FIREROD Cartridge Heaters

The Watlow FIREROD not only sets the industry standard for cartridge heaters, but continues to make improvements in construction and design. Among those improvements is the metric FIREROD, a variation of the FIREROD cartridge heater built to meet the exact specifications of the global market.

Like its counterpart, the metric FIREROD consistently outperforms other cartridge heaters with its design solutions such as its exclusive resistance wire winding and swaging process. These processes bring the resistance wire closer to the sheath and compacts the MgO insulation to maximize heat transfer. The end result is longer service life and better efficiency.

Performance Capabilities

- Part temperatures up to 760°C (1400°F) on Incoloy® sheath
- Watt densities up to 50 W/cm² (330 W/in²)

Features and Benefits

Nickel-chromium resistance wire

- Assures even and efficient distribution of heat to the sheath because the wire is precisely wound and centered in the heater

Conductor pins

- Ensures a trouble-free electrical connection because of the metallurgical bond between the conductor pins and resistance wire

Magnesium oxide insulation of specific grain and purity

- Results in high dielectric strength and contributes to faster heat-up

Incoloy® sheath

- Resists oxidation and corrosion from many chemicals, heat or atmospheres

Minimal spacing between the element wire and sheath

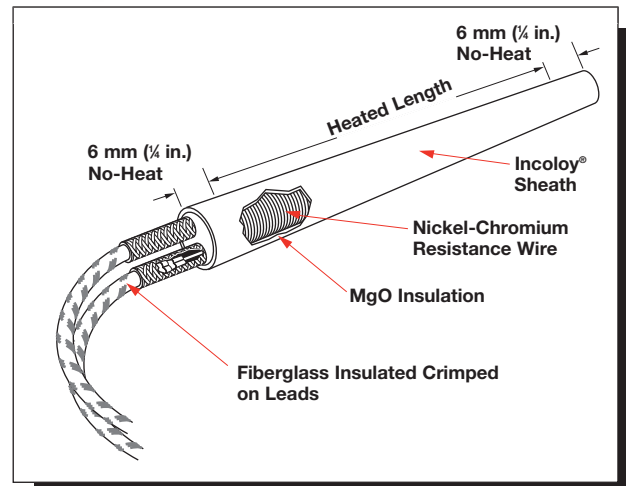
- Results in lower internal temperature
- Accommodates a design with fewer or smaller heaters operating at higher watt densities

UL® and CSA approved flexible stranded wires

- Insulates the wires to temperatures of 250°C (480°F)

Patented lead adapter (LA) method

- Allows same day shipment on more than 150,000 configurations of stock FIREROD heaters and lead combinations



Typical Applications

- Semiconductor chamber heating
- Semiconductor water lead connection
- Semiconductor wire and die bonding
- Freeze protection and deicing of equipment in cold climates or applications
- Humidity control
- Patient comfort heating used in medical devices
- Mold heating in injection molding equipment
- Seal bars used in packaging equipment

Cartridge/Insertion Heaters

Metric FIREROD Cartridge Heaters

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
Max. Voltage	250	250	250	400	480	480
Crimped on Leads						
Max. Amperes	7.2	7.2	16.1	16.1	21	21
Max. Wattage @ 230V	1650	1650	3700	3700	4830	4830
Max. Wattage @ 400V				6440	8400	8400
Swaged-in Leads						
Max. Amperes	5.2/7.2 ^①	5.2/7.2 ^①	12.6	12.6	12.6/21 ^①	21
Max. Wattage @ 230V	1190/1650	1190/1650	2880	2890	2890/4830	4830
Max. Wattage @ 400V	—	—	—	5040	5040/8400	8400

① On certain lead constructions, maximum amperes are 5.2 or 12.6. In these instances, amperes are determined by internal construction and current carrying capacity of internal parts to the lead wire. For more information about these amperes restrictions or higher current requirements, please contact your Watlow representative.

Tolerances

Diameter: -0.02 mm, -0.08 mm (-0.0008 in., -0.0031 in.)

Length: ±2% with ±2.4 mm (±³/₃₂ in.) min.

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

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

Camber: 0.25 mm (0.01 in.) max. on any length to 300 mm (12 in.). For lengths over 300 mm:

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

Cartridge/Insertion Heaters

Metric FIREROD Cartridge Heaters

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 the application.

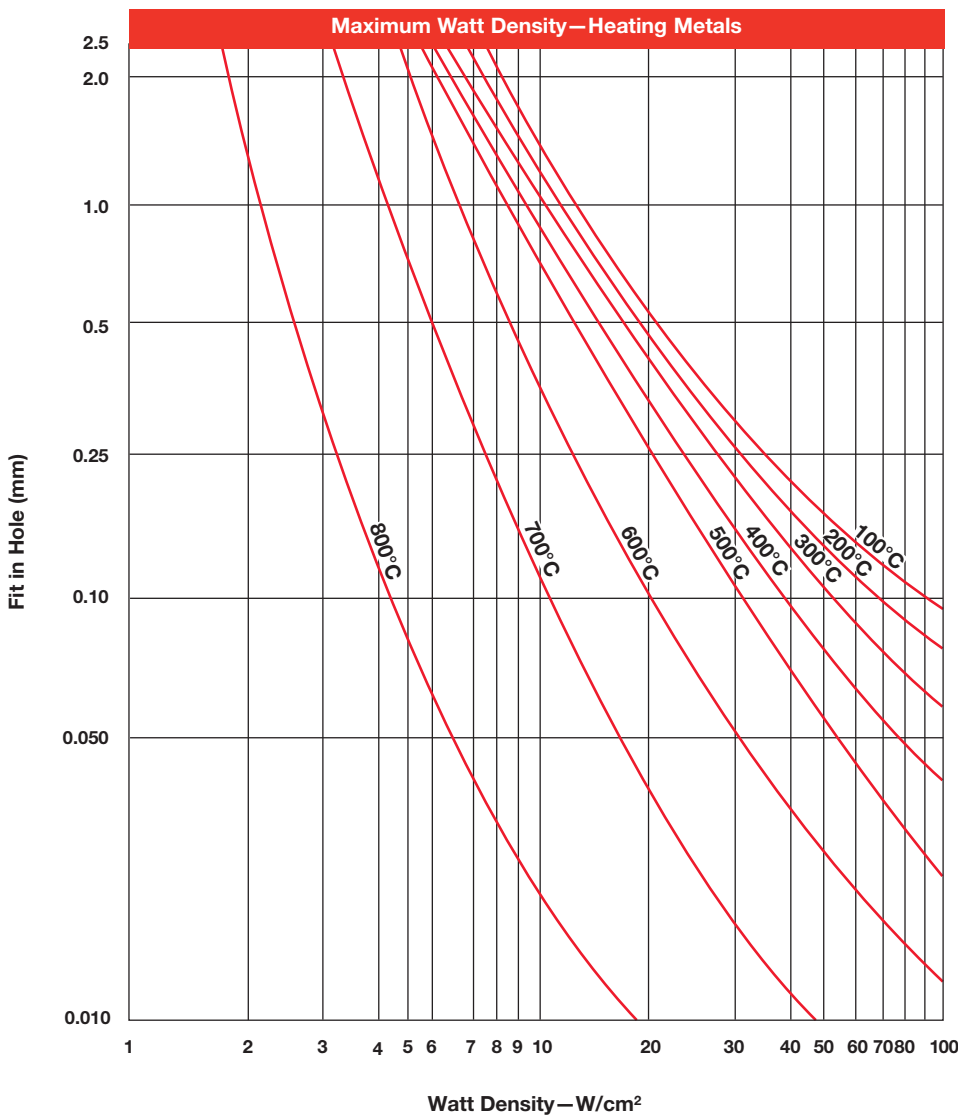
Heating Metals

The *Maximum Watt Density—Heating Metals* graph will show 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 representative 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, aluminum or brass, refer to applicable correction factors ① and ②.



① For SS, enter the graph with a fit 0.04 mm (0.0015 in.) larger than actual.

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

Cartridge/Insertion Heaters

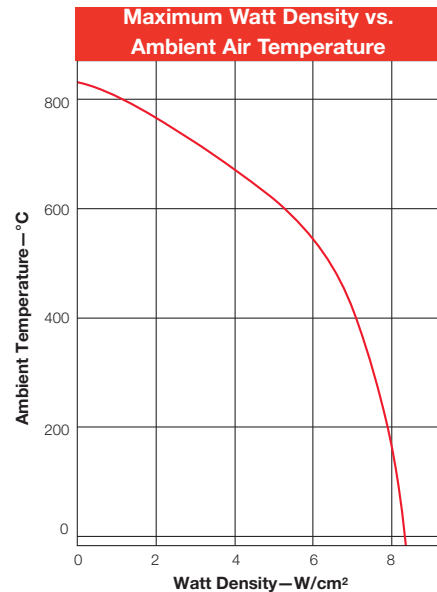
Metric FIREROD Cartridge Heaters

Maximum Allowable Watt Density (Continued)

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.

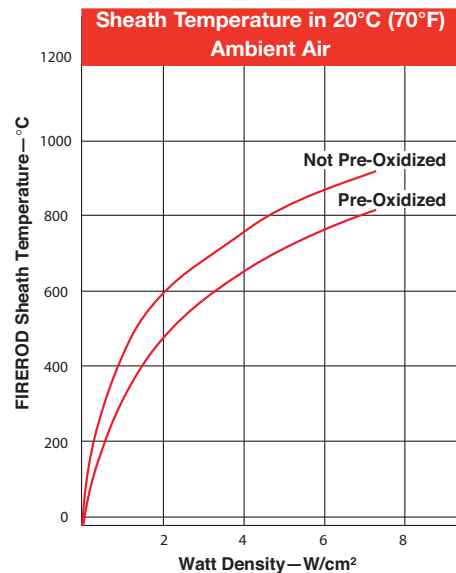
For metric FIRERODs grouped in a single row, with no less than one diameter between elements, multiply value from graph by 0.95. When a reflector is placed behind the heaters, multiply the maximum allowable watt density value from the graph by 0.85.



Sheath Temperature in Ambient Air

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

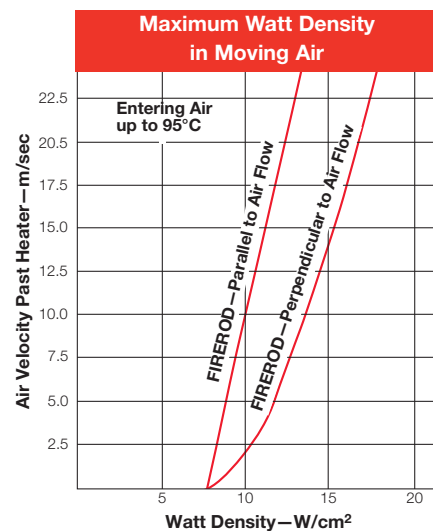
At 7 W/cm² (44 W/in²), the sheath temperature will be 790°C (1450°F). At this temperature, one year of heater life would be expected, provided cycling is not too frequent. Higher temperatures would result in reduced heater life.



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.

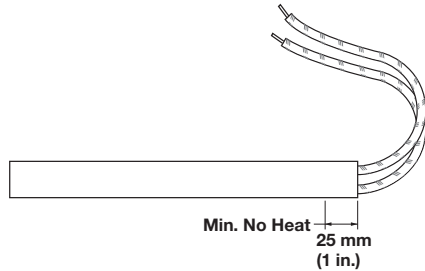


Cartridge/Insertion Heaters

Metric FIREROD Cartridge Heaters

Termination Options

Swaged-in Flexible Leads



Swaged-in flexible leads, with 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 in.) leads are supplied.

Heaters 150 mm (6 in.) or shorter generally have a 6 mm (¼ in.) no-heat section. Heaters up to 250 mm (10 in.) require a 25 mm (1 in.) 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**.

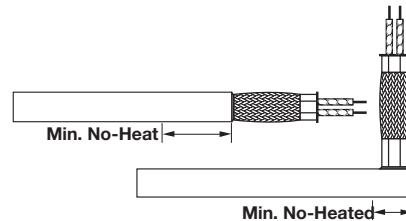
Right Angle Leads



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° angle through the side of the heater sheath. To order, specify **right angle leads** and lead length.

Metric FIREROD Diameter mm	Min No-Heat Length mm (in.)
6.5	15 (9/16)
8.0	15 (9/16)
10.0	17 (7/8)
12.5	18 (1 1/16)
16.0	20 (3/4)
20.0	21 (1 3/16)

Stainless Steel Braid



A 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 in.) and the braid is 300 mm (12 in.) long. To order, specify either **straight or right angle stainless steel braid**, lead length and no-heat section.

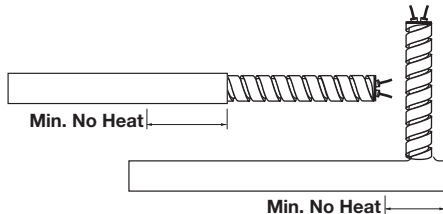
Metric FIREROD Diameter mm	Min. No-Heat Length	
	Straight mm (in.)	Right Angle mm (in.)
6.5	30 (1 1/8)	N/A
8.0	30 (1 1/8)	15 (9/16)
10.0	30 (1 1/8)	17 (7/8)
12.5	30 (1 1/8)	18 (1 1/16)
16.0	30 (1 1/8)	20 (3/4)
20.0	30 (1 1/8)	21 (1 3/16)

Cartridge/Insertion Heaters

Metric FIREROD Cartridge Heaters

Termination Options (Continued)

Stainless Steel Hose

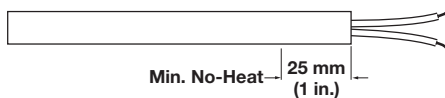


Stainless steel hose provides the best protection against abrasion from sharp edges or abrasive equipment. It also offers ease of handling and wiring in abrasive environments.

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 in.) long and the hose is 305 mm (12 in.) long. To order, specify **stainless steel hose**, lead length and no-heat section.

Metric FIREROD Diameter mm	Min. No-Heat Length		SS Hose O.D. mm (in.)
	Straight mm (in.)	Right Angle mm (in.)	
6.5	30 (1 1/8)	N/A	4.7 (3/16)
8.0	30 (1 1/8)	15 (5/8)	5.7 (7/32)
10.0	30 (1 1/8)	17 (2/3)	7.6 (3/10)
12.5	30 (1 1/8)	18 (1 1/16)	9.5 (3/8)
16.0	30 (1 1/8)	20 (3/4)	12.7 (1/2)
20.0	30 (1 1/8)	21 (1 3/16)	15.8 (5/8)

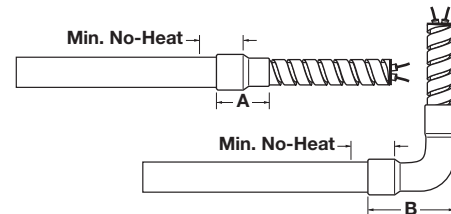
Teflon® Seal and Leads



Teflon® seal and leads protect the heater against moisture and 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 (1 in.) minimum no-heat section is required to allow construction. Additional no-heat area may be required to keep the seal below effective temperatures. To order, specify **Teflon® seal and leads** and lead length.

Galvanized Conduit



Galvanized conduit equals stainless steel hose in its abrasion protection.

The conduit is attached with a 90° elbow copper coupler, which overlaps the heater sheath. Unless specified, 250 mm (10 in.) leads are supplied. To order, specify **galvanized conduit**, lead length and no-heat section.

Metric FIREROD Diameter mm	Min. No-Heat Length mm (in.)	Dimension A mm (in.)	Dimension B mm (in.)	Galvanized Conduit O.D. mm (in.)
6.5	12 (1/2)	22 (7/8)	29 (1 1/8)	10 (3/8)
8.0	12 (1/2)	22 (7/8)	29 (1 1/8)	10 (3/8)
10.0	12 (1/2)	22 (7/8)	29 (1 1/8)	10 (3/8)
12.5	12 (1/2)	28 (1 1/8)	30 (1 3/16)	14 (1/2)
16.0	12 (1/2)	28 (1 1/8)	34 (1 5/16)	14 (1/2)
20.0	12 (1/2)	29 (1 1/8)	36 (1 7/16)	16 (5/8)

Silicone Rubber Seal and Leads



Silicone rubber seals and leads protect the heater against moisture and 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.

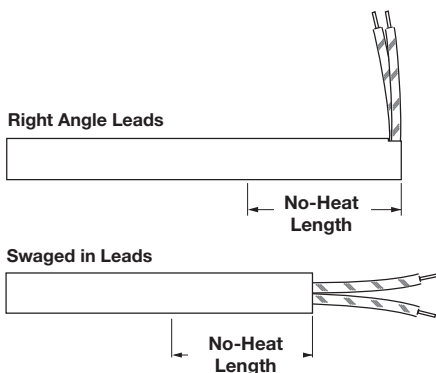
Please note, when ordering this option, a 25 mm (1 in.) minimum no-heat section is required to allow for construction. Additional no-heat may be required to keep the seal below effective temperatures. To order, specify **silicone or epoxy seal and leads** and lead length.

Cartridge/Insertion Heaters

Metric FIREROD Cartridge Heaters

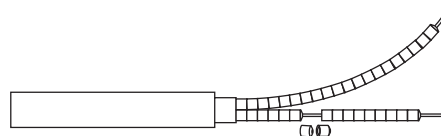
Termination Options (Continued)

No-Heat Section



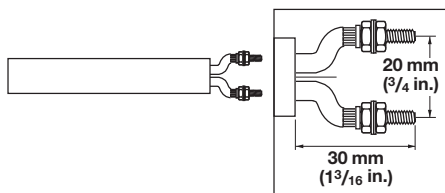
No-heat sections are recommended in applications where leads may be exposed to excessive heat, thus requiring a cooler lead end. Also use when heat is not required along the entire length of the metric FIREROD. No-heat extensions are available on all diameters with both pin style and swaged-in leads.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

Ceramic Bead Insulation



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

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 (0.63 and 0.79 in.) diameter units.

To order, specify **post terminals**.

Cartridge/Insertion Heaters

Metric FIREROD Cartridge Heaters

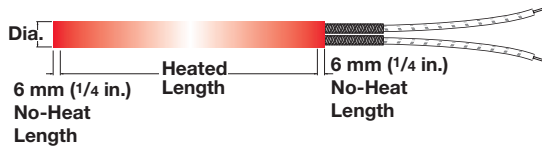
Options

Accessories

WATLUBE™

WATLUBE™ is an electrically non-conductive lubricant acting 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 (4 oz) bottles. To order, specify **WATLUBE**.

Distributed Wattage



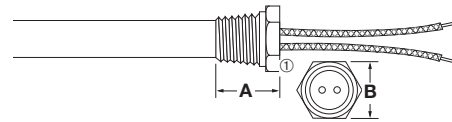
Distributed wattage varies the watt density along the length of the heater. This construction technique is used to compensate for heat losses along the edges of heated parts. To order, specify **distributed wattage** and give the length and wattage for each section.

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 (0.5, 0.6 and 0.8 in.) diameter units. If not specified, 250 mm (9.8 in.) crimped on leads will be supplied. To order, specify **dual voltage**, voltage requirements and length of crimped on leads.

Threaded Fittings

DIN Thread Size



Metric FIREROD Diameter mm	Min. No-Heat Length mm (in.)	Thread Size DIN 13	A mm (in.)	B mm (in.)	Length of Threaded Section
6.5	16 (5/8)	M10 X 1.0	10.0 (3/8)	12 (1/2)	6.0 (1/4)
8.0	16 (5/8)	M12 X 1.0	11.0 (7/16)	14 (1/2)	6.5 (1/4)
10.0	18 (11/16)	M14 X 1.5	11.5 (7/16)	17 (5/8)	6.5 (1/4)
12.5	19 (3/4)	M16 X 1.5	12.0 (7/16)	19 (3/4)	6.5 (1/4)
16.0	20 (3/4)	M20 X 1.5	15.0 (5/8)	24 (15/16)	9.0 (3/8)
20.0	22 (7/8)	M26 X 1.5	16.0 (5/8)	30 (1 1/8)	10.0 (3/8)

① Swaged-in unit pictured.

National Pipe Thread (NPT) Thread Size

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 Thread Size and NPT Thread Size* charts or contact your Watlow representative if application exceeds limitations shown.

To order, specify stainless steel **threaded fittings**.

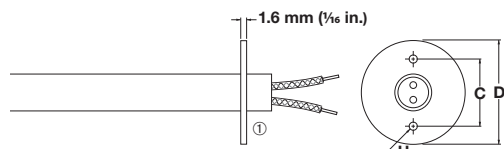
Metric FIREROD Diameter mm	Min. No-Heat Length mm (in.)	Thread Size NPT (in.)	A mm (in.)	B mm (in.)	Length of Threaded Section
6.5	19 (3/4)	(1/8)	13.5 (11/32)	11.0 (7/16)	9.5 (3/8)
8.0	22 (7/8)	(1/4)	17.0 (5/8)	14.0 (1/2)	13.0 (1/2)
10.0	22 (7/8)	(1/4)	17.0 (5/8)	14.0 (1/2)	13.0 (1/2)
12.5	25 (1)	(3/8)	20.0 (7/8)	17.5 (11/16)	14.0 (11/32)
16.0	28 (1 1/8)	(1/2)	23.0 (9/10)	22.0 (15/16)	16.0 (5/8)
20.0	32 (1 1/4)	(3/4)	26.0 (1)	29.0 (1 1/8)	19.0 (3/4)

Cartridge/Insertion Heaters

Metric FIREROD Cartridge Heaters

Options (Continued)

Flanges



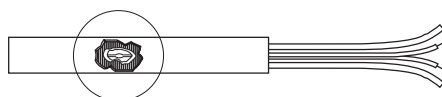
Stainless steel flanges are a convenient mounting method as well as a way to position a heater within an application. These flanges can be located in any no-heat section of the heater sheath. To order, specify **flange**, flange size and location.

Metric FIREROD Diameter mm	Flange Size	D mm (in.)	C mm (in.)	H mm (in.)
6.5, 8, 10, 12.5, 16	FS	25 (1)	19.0 (3/4)	4.3 (1/16)
6.5, 8, 10, 12.5, 16, 20	FM	38 (1 1/2)	28.5 (1 1/8)	4.3 (1/16)
16, 20	FL	51 (2)	38.0 (1 1/2)	5.3 (1/16)

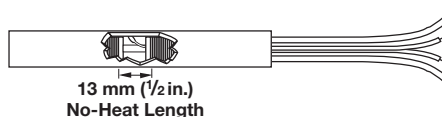
① Swaged-in unit pictured.

Internal Thermocouple Sensors

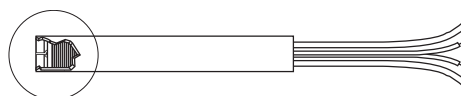
Style A



Style B



Style C



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

The **Style B** internal thermocouple gives a good approximation of part temperature and is only available for diameters 8 mm (0.3 in.) and above. The thermocouple junction can be in contact with the inside of the heater sheath, located in the 13 mm (1/2 in.) 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 (0.8 in.) diameter units. Unless requested, the disc end is not mechanically sealed.

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

Thermocouple Types

ISA Code	Conductor Characteristics		Temperature Range	
	Positive	Negative	°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 representative.

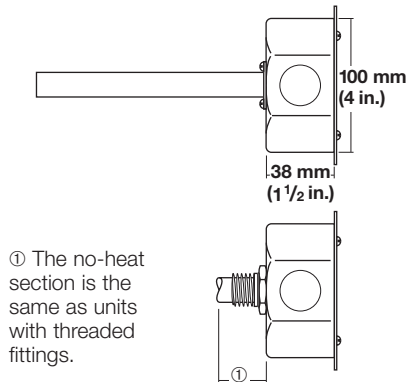
Cartridge/Insertion Heaters

EXTENDED
CAPABILITY

Extended Capabilities For Metric FIREROD Cartridge Heaters

Options

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 (0.5, 0.6 and 0.8 in.) diameter units. These 100 mm (4 in.) 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 (0.4 in.) in diameter;
- 80 x 80 x 55 mm nominal size for heaters 12.5 mm (0.5 in.) or larger in diameter.

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

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 seal bars.

This internal construction can be ordered on 12.5, 16 and 20 mm diameter units. If not specified, 250 mm 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.

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 are limited to 305 mm (12 in.) lead length. Longer lead lengths are available, but require external connection. To order, specify **centerless grinding**.

Cartridge/Insertion Heaters

MULTICELL™ Heaters

The advanced design of the MULTICELL™ insertion heater from Watlow offers three major advantages: extreme process temperature capability, independent zone control for precise temperature uniformity and loose fit design for easy insertion and removal.

Features and Benefits

Multiple, independently controllable zones

- Allows process temperature uniformity not possible with any other single sheathed heater

Radiant design of heater

- Allows for loose insertion in boiling holes and piping holes
- Permits easy removal and replacement with minimal down time since it will not bind or seize in the hole

Oxidized sheath

- Provides high emissivity and improves the heater's performance as oxidation increases

Individually metal-sheathed coils swaged into a larger, high temperature alloy outer sheath

- Provides maximum protection against element burnout through the outer sheath

Quick disconnect plug and jack

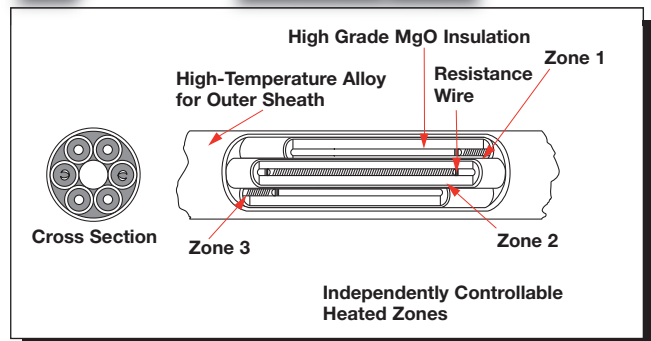
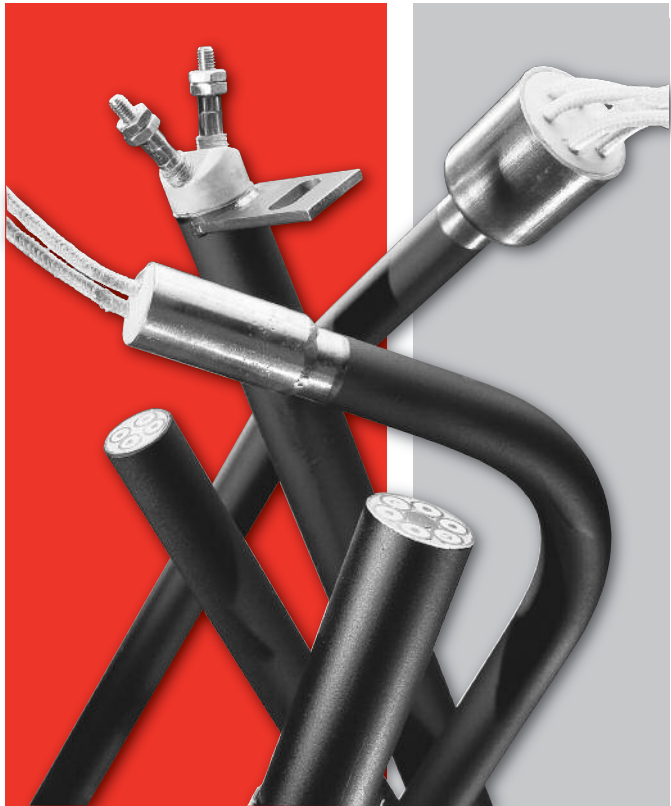
- Permits fast replacement of individual elements while the press stays at operating temperature

Special bending capabilities

- Solves unusual machinery needs and keeps leads away from heated zones

Flexible leads up to 842°F (450°C)

- Protects termination from high-temperature environment



For detailed product and ordering information, see the full MULTICELL product section located on pages 461 through 466.