

Cartridge Heater Built to Meet the Specifications of the Global Market

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 Alloy 800 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

Metalurgically-bonded conductor pins

- 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

Alloy 800 sheath

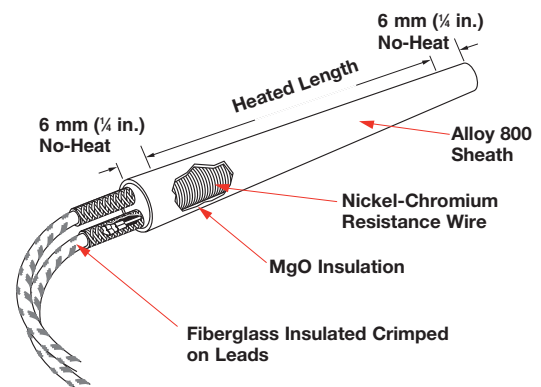
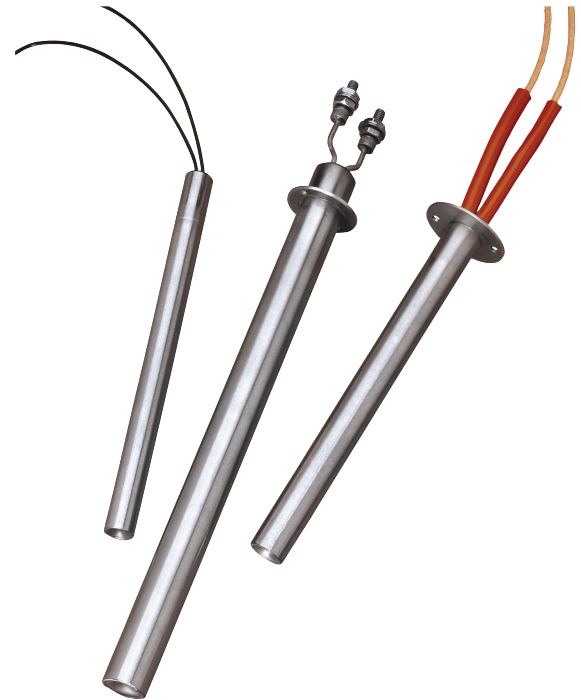
- Resists oxidation and corrosion from many chemicals, heat or atmospheres

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

- Lead insulation rated to temperatures up to 450°C (840°F)



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

Applications and Technical Data

Tolerances

Diameter: -0.02 mm, -0.12 mm (-0.0008 in., -0.0047 in.)

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

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

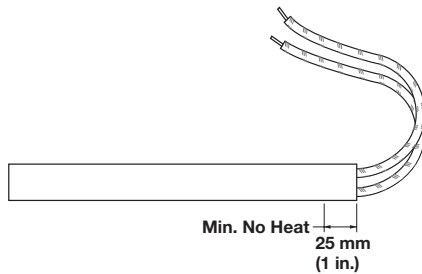
Resistance: +10%, -5%, resistance is measured at room temperature following first heater operation.

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

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

Termination Options

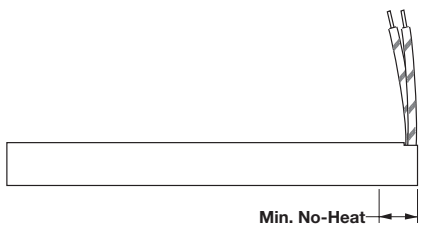
Swaged-in Flexible Leads



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 ($1/4$ 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**.

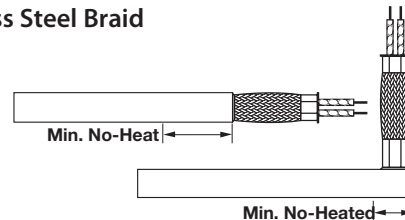
Right Angle Leads



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. Right angle tube may be necessary on certain constructions. 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 ($2/3$)
12.5	18 ($11/16$)
16.0	20 ($3/4$)
20.0	21 ($13/16$)

Stainless Steel Braid



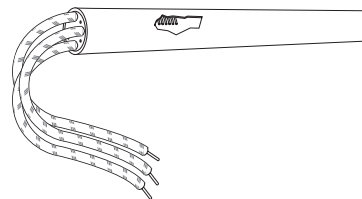
A stainless steel braid is designed to protect leads from abrasion against sharp edges. It is the most flexible of Watlow's protective lead arrangements.

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 250 mm (10 in.) and the braid is 200 mm (8 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 ($2/3$)
12.5	30 ($1 1/8$)	18 ($11/16$)
16.0	30 ($1 1/8$)	20 ($3/4$)
20.0	30 ($1 1/8$)	21 ($13/16$)

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**.

Your Authorized Supplier is:



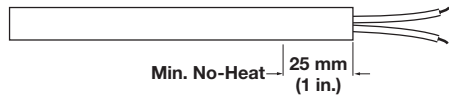
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Termination Options *(Continued)*

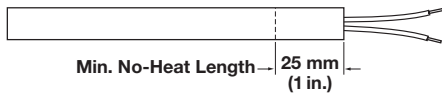
PTFE Seal and Leads



PTFE 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 **PTFE seal and leads** and lead length.

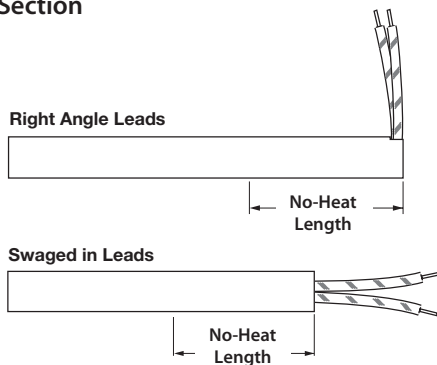
Silicone Rubber Seal and Leads



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.

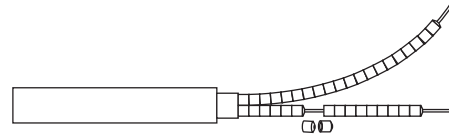
Please note, when ordering this option, a 25 mm (1 in.) minimum no-heat section is required to allow for construction. Additional no-heat may be required to keep the seal below effective temperatures. To order, specify **silicone rubber seal and leads** and lead length.

No-Heat Section



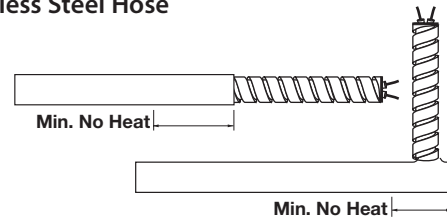
No-heat sections are recommended in applications where leads may be exposed to excessive heat, thus requiring a cooler lead end. Also use when heat is not required along the entire length of the metric FIREROD. No-heat extensions are available on all diameters with both pin style and swaged-in leads.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

Stainless Steel Hose



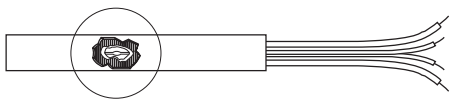
Stainless steel hose provides the best protection against abrasion from sharp edges or abrasive equipment. It also offers ease of handling and wiring in abrasive environments. When the leads exit at a right angle to the heater, the hose is silver soldered to the sheath. Unless otherwise specified, leads are 250 mm (10 in.) long and the hose is 200 mm (8 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 ¹ / ₁₆)
8.0	30 (1 ¹ / ₈)	15 (9 ¹ / ₁₆)	5.7 (7 ¹ / ₃₂)
10.0	30 (1 ¹ / ₈)	17 (2 ¹ / ₃)	7.6 (3 ¹ / ₁₀)
12.5	30 (1 ¹ / ₈)	18 (1 ¹ / ₁₆)	9.5 (3 ⁷ / ₈)
16.0	30 (1 ¹ / ₈)	20 (3 ¹ / ₄)	12.7 (1 ¹ / ₂)
20.0	30 (1 ¹ / ₈)	21 (1 ³ / ₁₆)	15.8 (5 ¹ / ₈)

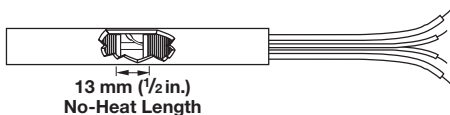
Options

Internal Thermocouple Sensors

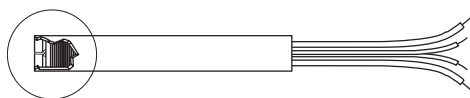
Style A



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. The thermocouple junction is 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.

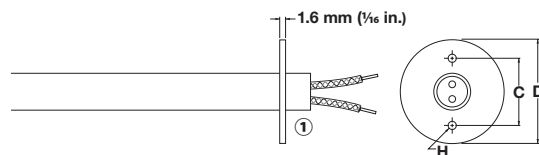
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Mounting Options

Flanges



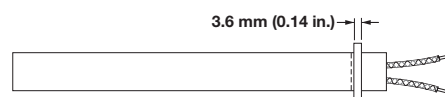
Stainless steel flanges are a convenient mounting method as well as a way to position a heater within an application. These flanges can be located in any no-heat section of the heater sheath. To order, specify **flange**, flange size and location.

Metric FIREROD Diameter mm	Flange Size	D mm (in.)	C mm (in.)	H mm (in.)
6.5, 8, 10, 12.5, 16 ^②	FS	25.4 (1)	19.1 (3/4)	3.7 (9/64)
6.5, 8, 10, 12.5, 16, 20	FM	38.1 (1 1/2)	28.6 (1 1/8)	4.3 (3/16)
16, 20	FL	51.0 (2)	38.1 (1 1/2)	5.3 (13/64)

① Swaged-in unit pictured.

② FS flange for 16 mm diameter is without holes.

Locating Ring



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

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

To order, specify **locating ring**.

Locating Ring Specifications

Diameter	1/4	3/8	1/2	5/8	3/4
Ring O.D. in., (mm)	1/2 (13)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)

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