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## What type of heater do you need?

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# Heater Selection Matrix



## Heating Solids

Heater Type	Application Description	Sheath Materials	Typical Max. Watt Densities		Max. Operating Temperatures		Catalog Page
			W/in <sup>2</sup>	W/cm <sup>2</sup>	°F	°C	
<b>Cartridge/ Insertion Heaters</b>	These heaters are inserted into a close fit hole (i.e. platens, dies and molds).	Alloy 800	up to 400	62.0	1400	760	9
		Stainless steel	up to 400	62.0	1000	540	
<b>Tubular Heaters</b>	These heaters are clamped to the object to be heated, usually exterior surfaces of tanks or other process vessels or fitted into milled grooves in a platen.	Flat: Alloy 800	40	6.2	1400	760	84
		Stainless steel	40	6.2	1200	650	84
		Round: Alloy 800	40	6.2	1600	870	57
		Stainless steel	40	6.2	1200	650	57
<b>Flexible Heaters</b>	These heaters are bonded or otherwise fastened to the part. Commonly used to heat irregular surfaces and shapes, or applications requiring distributed wattage or limited space.	Polyimide	20	3.1	390	200	111
		Silicone rubber	10	1.6	500	260	109
<b>High-Temperature Heaters</b>	MULTICELL™ heaters are loosely inserted into the platen hole for radiant heating. Can also be used in any static or dynamic non-contact application as a radiant heat source. Commonly used for extreme high temperature applications. Ceramic fiber heaters can be formed into an oversized chamber to surround the object being heated. Using radiant and convection heat transfer, ceramic fiber heaters are used in ovens and furnaces. HT FIREROD® cartridge heaters are especially designed for high-temperature platen applications up to 1600°F (871°C). The HT FIREROD is inserted directly into the platen hole for conduction heating.	Alloy 600	60	9.3	2100	1150	411
		Alloy 800	60	9.3	2100	1150	
		Molded ceramic fiber	30	4.6	2200	1205	419
<b>Specialty Heaters</b>	ULTRAMIC® advanced ceramic heaters are bonded or clamped to the object being heated. Thick film conduction heaters are clamped to the part being heated. Coil/cable heaters can be formed to heat flat or curved surfaces, or wound around the object being heated. Typical applications include platen heating and plastic injection molding nozzles.	Aluminum nitride	1000	155	1112	600	449
		Dielectric glass on 430 stainless steel substrate	75	11.6	1022	550	453
		Stainless steel or alloy 600	30	4.6	1200	650	457
<b>Strip/ Clamp-On Heaters</b>	These heaters are bolted or clamped to a surface (i.e. dies, molds, ovens). Often used for freeze and moisture protection.	Aluminized steel with refractory insulation	100	15.5	1100	595	471
		Stainless steel with mineral insulation	140	21.7	1400	760	467
<b>Band/ Barrel Heaters</b>	These heaters are clamped to cylindrical surfaces (i.e. extrusion barrels and nozzles).	Stainless steel with mineral insulation	100	15.5	1400	760	483
<b>Radiant Heaters</b>	These heaters are used in any static or dynamic, non-contact application where conduction or convection heating is not practical. Commonly used in laminating processes, thermoforming and paint drying.	Molded ceramic fiber	20	3	2000	1095	502

# Heater Selection Matrix



## Heating Liquids/Surface Heating and Immersion

Heater Type	Application Description	Sheath Materials	Typical Max. Watt Densities		Max. Operating Temperatures		Catalog Page
			W/in <sup>2</sup>	W/cm <sup>2</sup>	°F	°C	
<b>Cartridge/ Insertion Heaters</b>	These are used as an immersion heater placed either directly in the liquid, or in a protective well (recommended for immersion in water or 90 plus percent water soluble solutions).	Alloy 800	Up to 300 in water	46.5	212 in water	100	9
<b>Tubular Heaters</b>	These heaters are immersed directly in the liquid being heated. Most commonly used when high kilowatts are required. Multiple style mounting adaptors, such as flanges and NPT fittings, provide excellent pressure boundaries.	Flat: Alloy 800	60	9.3	1400	760	84
		Stainless steel	60	9.3	1200	650	84
		Round: Alloy 800	60	9.3	350	180	57
		Stainless steel	60	9.3	1600	870	57
		Steel	60	9.3	1200	650	57
		Steel	60	9.3	750	400	57
<b>Flexible Heaters</b>	These heaters are applied to the surface of a pipe vessel containing a liquid (well suited for curved surfaces and irregular shaped objects; frequently used for freeze protection).	Polyimide	20	3.1	390	200	111
		Silicone rubber	10	1.6	500	260	109
<b>Immersion Heaters</b>	FIREBAR® heaters have multiple elements mounted in a screw plug fitting. They are immersed directly in a fluid.	Alloy 800 Stainless steel	Up to 100	15.5	212 in water	100	145
	WATROD™ heaters have multiple elements mounted in a flange or screw plug fitting. These are immersed directly in a fluid or in a protective well.	Alloy 800 316 stainless steel Steel	Up to 100	15.5	212 in water 1400 in air	100	145
<b>Circulation Heaters</b>	Tubular heaters have multiple elements mounted in a screw plug or ANSI flange fitting and placed in a vessel through which fluid is passed.	Alloy 800	60	9.3	1600	870	305
		Stainless steel	60	9.3	350	180	
		Steel	60	9.3	1200	650	
		Steel	60	9.3	750	400	
	FLUENT® heaters are high-performance in-line heaters that provide on-demand heating of fluids which flow directly through the heater.	444 Stainless steel (substrate tube), 316L stainless steel (baffle and fittings)	450	70	212 (in water)	100	445
<b>Fluid Delivery Heaters</b>	FREEFLEX® heaters have polymeric heated tubing, used to maintain temperature in medical applications where heated flexible tubing is required.	Polyimide	72 W/ft	22 W/m	212	100	369
	Syringe heaters are formed to fit a cylindrical part. They are often used in medical applications for heating contrast media and often incorporate a sensor and on-board system.	Lexan® Silicone rubber	2 3	0.31 0.47	185 428	85 220	372
	FLUENT heaters are high-performance in-line heaters that provide on-demand heating of fluids which flow directly through the heater.	444 Stainless steel (substrate tube), 316L stainless steel (baffle and fittings)	450	70	212 (in water)	100	445
<b>High-Temperature Heaters</b>	Ceramic fiber assembled heaters can be used in a chamber surrounding the tank, vessel, crucible or bath. Radiant and convection heat transfer heat the load.	Molded ceramic fiber	30	4.6	2200	1205	419
<b>Specialty Heaters</b>	Coil/cable heaters that are wrapped or wound around pipe or vessel containing a liquid can be used, or used directly as an immersion heater. They are often used in applications with space limitations (i.e. photo processing equipment, scientific instruments and heat tracing).	Stainless steel or Alloy 600	30	4.6	1200	650	457
	FLUENT heaters are high-performance in-line heaters that provide on-demand heating of fluids which flow directly through the heater.	444 Stainless steel (substrate tube), 316L stainless steel (baffle and fittings)	450	70	212 (in water)	100	445
<b>Strip/ Clamp-On Heaters</b>	These heaters are bolted or clamped to the wall of a tank or vessel. They are used in food warming and other applications offering a flat mounting surface.	Aluminized steel with refractory insulation	100	15.5	1100	595	471
		Stainless steel with mineral insulation	140	21.7	1400	760	467
<b>Band/ Barrel Heaters</b>	These heaters are clamped to cylindrical surfaces and are most commonly used to heat liquids flowing through pipes as freeze protection.	Stainless steel with mineral insulation	100	15.5	1400	760	483

# Heater Selection Matrix



## Heating Gases

Heater Type	Application Description	Sheath Materials	Typical Max. Watt Densities		Max. Operating Temperatures		Catalog Page
			W/in <sup>2</sup>	W/cm <sup>2</sup>	°F	°C	
<b>Cartridge/Insertion Heaters</b>	These heaters are mounted in pipes or vessels through which gases pass. They can be placed in protection tubes, making access and wiring easier.	Alloy 800 or stainless steel	100	15.5	Contact Watlow		9
<b>Tubular Heaters</b>	These heaters have multiple elements mounted in an array and placed in a duct or vessel through which gases pass. Flat tubular elements can be modified with the addition of fins to increase surface area.	Flat: Alloy 800 Stainless steel Round: Alloy 800 Alloy 600	30 30 30 30	4.6 4.6 4.6 4.6	1400 1200 1600 1800	760 650 870 980	220
<b>Flexible Heaters</b>	These heaters are applied to the surface of a pipe or vessel containing gases. They are well suited for curved surfaces and irregular shaped objects. Excellent for use in enclosures.	Polyimide Silicone rubber Coated fiberglass cloth	5 5 3.22	0.8 0.8 0.5	390 500 482	200 260 250	111 109 124,131 133
<b>Circulation Heaters</b>	Tubular heaters have multiple elements mounted in a screw plug or ANSI flange fitting and placed in a vessel through which fluid is passed. FLUENT <sup>®</sup> heaters are high-performance in-line heaters that provide on-demand heating of fluids which flow directly through the heater.	Round: Alloy 800 Alloy 600 444 Stainless steel (substrate tube), 316L stainless steel (baffle and fittings)	30 30 150	4.6 4.6 23	1600 1800 482 (internal)	870 980 250	305 445
<b>Air Heaters</b>	Duct heaters have multiple elements placed in a duct through which gases pass. Enclosure heaters prevent freezing and condensation in electrical and mechanical housings. Finned FIREBAR heaters have aluminized steel fins attached to a FIREBAR element. They are used for forced air heating and radiant heating in drivers, ovens and duct work. Finned strip have aluminized steel fins attached to a 375 heater. They are used for air heating, freeze protection and load bank resistors.	Alloy 800 Stainless steel Aluminum Stainless steel Alloy 800 Aluminized steel	20 to 30 15 5 Up to 50 30	3 to 4.6 2.3 0.8 7.7 4.7	1400 1200 150 1200 1100	760 650 66 650 595	377 403 405 103 395
<b>High-Temperature Heaters</b>	MULTICELL heaters have multiple elements placed in a duct or vessel through which gases pass. Designs are also available to heat a pass tube externally to isolate gas from the element. Excellent for use in high temperature/high pressure applications. Ceramic fiber heaters are used to construct chambers and furnaces through which gases are passed. Heaters function as high-temperature radiant heaters surrounding transfer pipes or other special vessels.	Alloy 600 Alloy 800 Molded ceramic fiber	60 60 30	9.3 9.3 4.6	2100 2100 2200	1150 1150 1205	411 419
<b>Specialty Heaters</b>	Coil/cable heaters are sinuated or wound into coils, which can be inserted into a pipe or vessel to heat flowing air or gases. Cable heaters readily lend themselves to applications where space is restricted. FLUENT heaters are high-performance in-line heaters that provide on-demand heating of fluids which flow directly through the heater.	Stainless steel or Alloy 600 444 Stainless steel (substrate tube), 316L stainless steel (baffle and fittings)	30 150	4.6 23	1200 482 (internal)	650 250	457 445

# Heater Selection Matrix



## Heating Within a Vacuum

Heater Type	Application Description	Sheath Materials	Typical Max. Watt Densities		Max. Operating Temperatures		Catalog Page
			W/in <sup>2</sup>	W/cm <sup>2</sup>	°F	°C	
<b>Cartridge/ Insertion Heaters</b>	These heaters are mounted in a vacuum vessel for radiant energy transfer.	Alloy 800	up to 35	5.4	1400	760	9
		Stainless steel	up to 35	5.4	1000	538	
<b>Tubular Heaters</b>	These heaters are mounted in a vacuum vessel for radiant energy transfer.	Alloy 800	30	4.6	1600	870	57
		Alloy 600	30	4.6	1800	980	57
<b>Flexible Heaters</b>	These heaters are applied to the exterior surface of a pipe or vessel. They are well suited for curved surfaces and irregular shaped objects. Note: Polyimide is the only flexible heater type recommended for use in the vacuum.	Polyimide	7	1.1	390	200	111
<b>High-Temperature Heaters</b>	MULTICELL heaters are mounted in a vacuum vessel for radiant energy transfer.	Alloy 600	60	9.3	2250	1230	411
	Ceramic fiber heaters surround the exterior surface of a vacuum vessel, using radiant energy for heat transfer.	Alloy 800	60	9.3	2250	1230	419
<b>Specialty Heaters</b>	ULTRAMIC advanced ceramic heaters are bonded or clamped to the object being heated.	Molded ceramic fiber	30	4.6	2200	1205	
	Coil/cable heaters are wound into a coil or sinuated pattern and mounted in a vacuum vessel for radiant energy transfer.	Aluminum nitride	1000	155	1112	600	449
<b>Band/Barrel Heaters</b>	These heaters are applied to exterior surface of a pipe or vessel.	Alloy 600 or Stainless steel	20	3.1	1200	650	457
		Stainless steel with mineral insulation	100	15.5	1400	760	483

# Cartridge/Insertion Heaters



Cartridge/Insertion Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
<b>FIREROD®</b>	Alloy 800	1400	760	400	62.0	<b>9</b>
	Stainless steel	1000	538	400	62.0	
<b>High-Temperature FIREROD</b>	Alloy 800	1600	982	100	15.5	<b>33</b>
<b>Metric FIREROD</b>	Alloy 800	1400	760	330	50.0	<b>45</b>
<b>MULTICELL™</b>	Alloy 800	2050	1120	30	4.6	<b>54</b>

Cartridge/Insertion Heaters







# Cartridge/Insertion Heaters



## FIREROD® Cartridge Heaters

The Watlow® FIREROD® cartridge heater incorporates engineering excellence and is supported by over 60 years of solid industry performance across a broad range of simple and complex applications. As the premier choice in swaged cartridge heating, thousands of industrial manufacturers continue to choose Watlow as their trusted thermal partner and certified cartridge heater supplier.

Built using 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. Every system component that leaves our manufacturing facilities meets our strict quality assurance specifications, in addition to those set forth by leading standards and regulating industries.

To meet our customer's individual needs, there are many delivery options available for FIREROD heaters.

### Performance Capabilities

- Part temperatures up to 1400°F (760°C) on alloy 800 sheath
- Watt densities up to 400 W/in<sup>2</sup> (62 W/cm<sup>2</sup>)
- Maximum voltage up to 480V

### Features and Benefits

#### Nickel-chromium resistance wire

- Ensures even and efficient distribution of heat to the sheath

#### 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

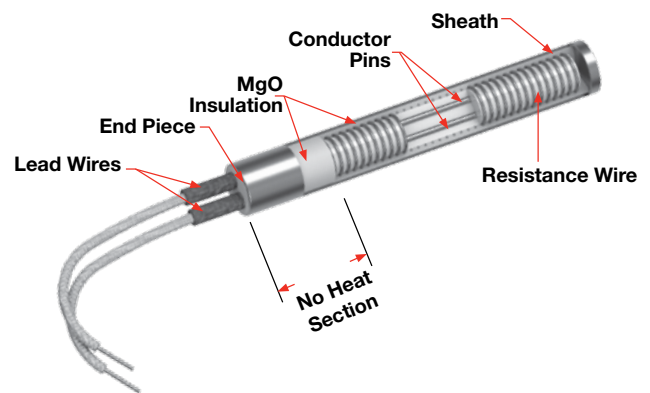
- Resists oxidation and corrosion from heat, many chemicals and atmospheres

#### 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

#### International Organization for Standardization (ISO) 9001 certified

- Provides confidence that quality and reliability expectations are met



### UL® and CSA approved flexible stranded wires

- Lead insulation rated to temperatures up to 840°F (450°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 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
- High temperature glass forming equipment

# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Applications and Technical Data

#### Tolerances

##### Diameter

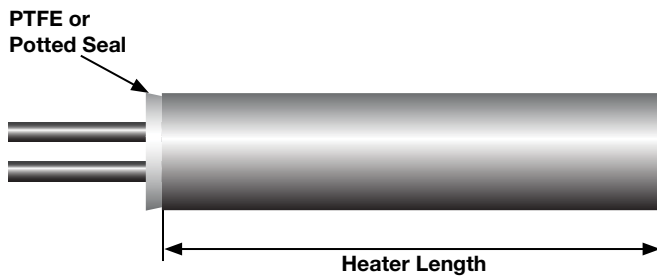
- 1 in. (25 mm) units:  $\pm 0.003$  in. ( $\pm 0.08$  mm)
- All other units:  $\pm 0.002$  in. ( $\pm 0.05$  mm)

##### Sheath Length

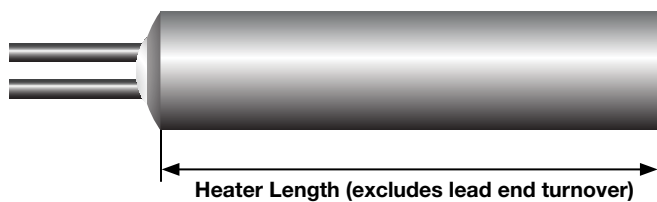
- All units up to 4<sup>1</sup>/<sub>2</sub> in. (114 mm) long:  $\pm 3$ /<sub>32</sub> in. ( $\pm 2.4$  mm)
- 1/8 in. diameter units over 4<sup>1</sup>/<sub>2</sub> in. (114 mm) long:  $\pm 3\%$
- All other units over 4<sup>1</sup>/<sub>2</sub> in. (114 mm) long:  $\pm 2\%$

##### Length Measurements

###### Pin Style and Potted FIRERODs



###### PTFE - Swaged-in Leads FIRERODs



##### Wattage

- 1/8 in. units: +10%, -15%
- All other units: +5%, -10%

##### Resistance

- 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.

##### Component Recognition File Numbers

- UL<sup>®</sup> component rated to 240VAC (file number E52951)
- CSA component rated to 240VAC (file number LR7392)
- VDE component rated to 240VAC (file number 1164800-4911-0009) (file number 1164800-4911-0004)

**Note:** Not all options or combinations of options are covered. UL<sup>®</sup>, CSA, VDE and CE marking is available upon request.

# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Applications and Technical Data

#### Dimensional Data

This table shows minimum/maximum sheath lengths for available FIREROD diameters.

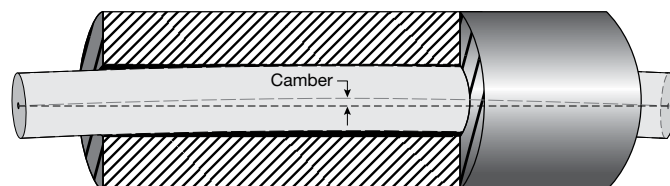
FIREROD Diameter			Length			
Nominal in.	Actual in.	(mm)	Min. in.	(mm)	Max. in.	(mm)
1/8	0.122	(3.1)	7/8	(22.2)	12	(305)
1/4	0.246	(6.3)	7/8	(22.2)	36	(915)
3/8	0.371	(9.4)	7/8	(22.2)	48	(1220)
1/2	0.496	(12.6)	7/8	(22.2)	60	(1520)
5/8	0.621	(15.8)	1	(25.0)	72	(1830)
3/4	0.746	(18.9)	1	(25.0)	72	(1830)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

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

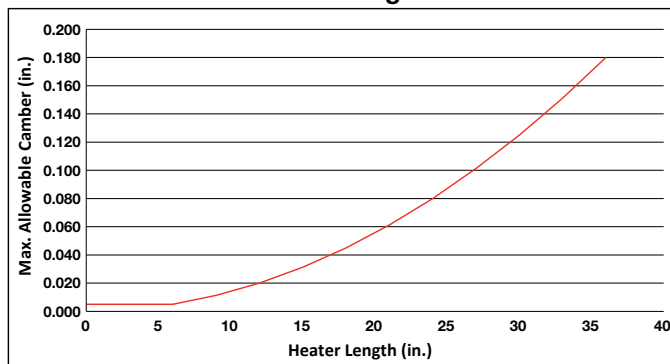
#### Camber

Camber is defined as the maximum deviation of the heater's center line from straight. FIREROD camber within allowable tolerances is verified via passage through a cylindrical gauge of specified length and diameter. Normally, slight camber does not present a problem since the heater will flex enough to fit into a straight, close-fit hole.

#### Camber Measurement



#### Allowable Camber Versus Length



Max. camber = 0.020 in. x (length in feet)<sup>2</sup> or 0.005 in., whichever is greater.

# Cartridge/Insertion Heaters



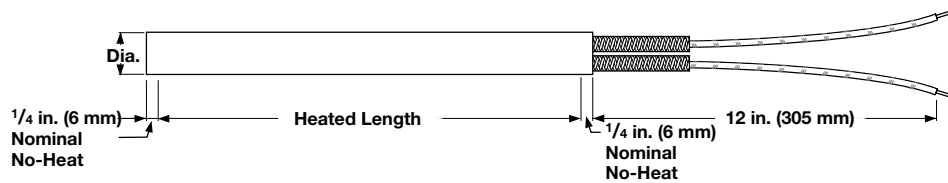
## FIREROD Cartridge Heaters

### 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. If your application exceeds the limitations shown, contact your Watlow representative.



Crimped on Lead Termination Shown

FIREROD Diameter in.	Volts Max.	Ampere Max. <sup>①</sup>	Min. Watts @ 120V <sup>③</sup> Heater Length			Max. Watts				
			1 in. (25 mm)	1 1/2 in. (38 mm)	2 in. (50 mm)	120V 1-phase	240V 1-phase	480V 1-phase	240V 3-phase	480V 3-phase
1/8	240	3.1	—	8	5	360	720	—	—	—
1/4	240	4.4 <sup>②</sup>	100	55	40	525	1050	—	—	—
3/8	240	6.7	65	35	25	800	1600	—	—	—
1/2	240	9.7	40	25	20	1160	2320	—	—	—
5/8	480	23.0	35	20	15	2760	5520	11,000	⑤	⑤
3/4	480	23.0	30	15	10	2760 <sup>④</sup>	5520	11,000	9550	19,100
1 <sup>⑦</sup>	480	23.0	—	15	10	2760 <sup>④</sup>	5520	11,000	9550 <sup>④</sup>	19,100 <sup>④</sup>

Number Of Circuits <sup>⑥</sup>		
Diameter in.	1-phase	3-phase
3/4	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 1/4 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 3/4 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.
- ⑦ A minimum charge per line item applies.

# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Maximum Allowable Watt Density

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

### Correction Factors

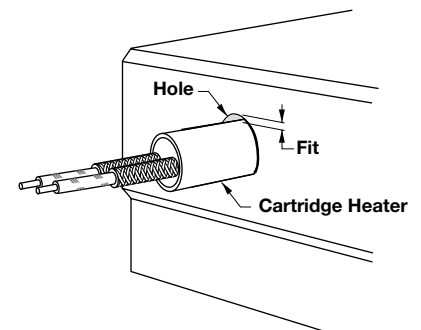
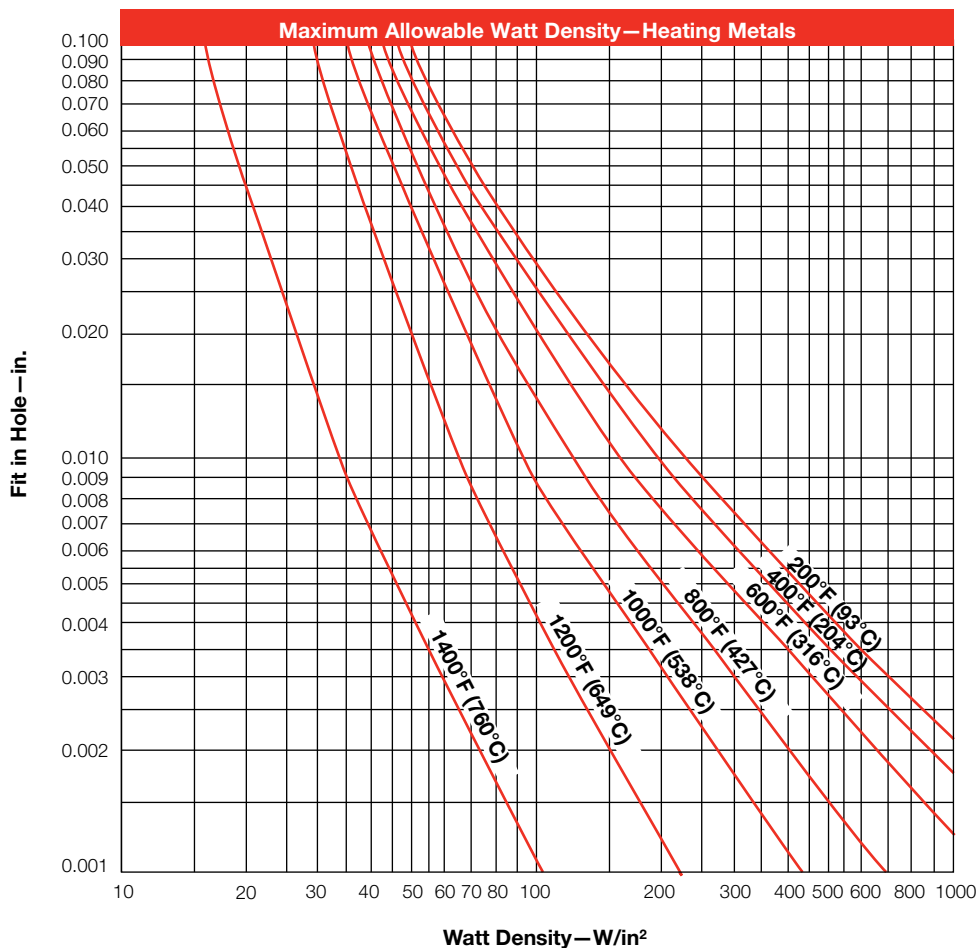
These graphs depict FIRERODs used in steel parts, therefore, for stainless steel, aluminum or brass, refer to applicable correction factors:

1. For stainless steel, enter the graph with a fit 0.0015 in. (0.04 mm) larger than actual fit.
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 display 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/in<sup>2</sup>. 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 can be easily determined. Subtract the minimum diameter of the FIREROD (nominal diameter minus tolerance) from the maximum hole diameter. For example, the hole fit is 0.006 in. (0.15 mm) for a hole diameter of 0.500 in. (13 mm) minus a heater diameter of 0.496 in. (12.6 mm) ±0.002 in. (0.05 mm). For FIREROD heaters in square holes or grooves, contact your Watlow representative for the fit in hole dimension.



Fit in hole = maximum hole I.D. minus minimum heater O.D.



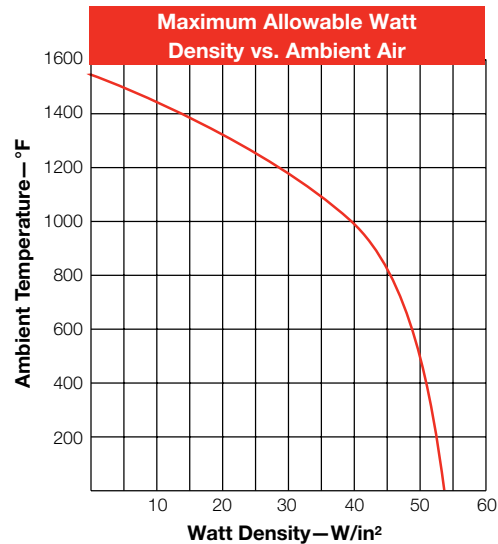
## FIREROD Cartridge Heaters

### 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 the 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.

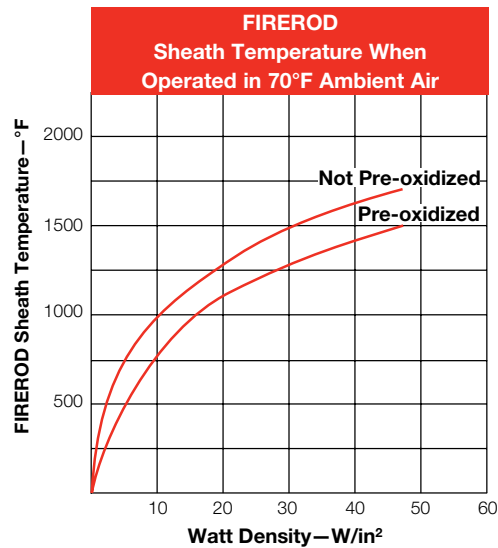


#### Sheath Temperature in Ambient Air

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/in<sup>2</sup> (6.8 W/cm<sup>2</sup>), the sheath temperature is 1450°F (784°C). At this temperature, a one-year life is expected if cycling is not too frequent.

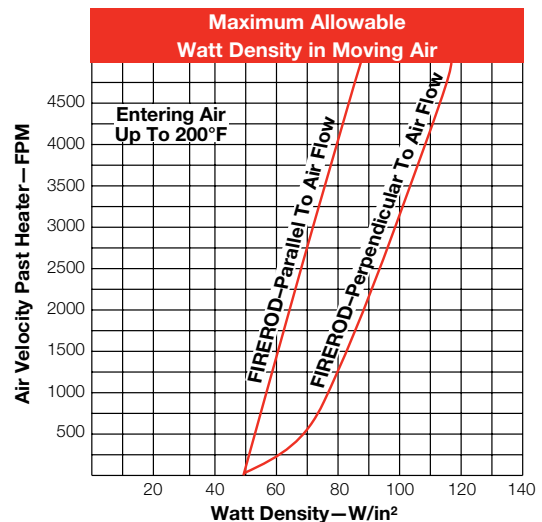
Higher temperatures result in reduced heater life.



#### Watt Density in Moving Air

The *Watt Density in Moving Air* graph shows 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 (ft<sup>2</sup>). The net-free area is the total area of the enclosure minus the area occupied by the heater.



# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Lead and Diameter Information

#### Standard Lead Specifications

Heater Diameter in. (mm)	Max. Voltage	Typical Lead Gauge Fiberglass	Size Tolerance Fiberglass	Typical Lead Gauge PTFE	Size Tolerance PTFE	Stainless Steel Hose I.D.	Stainless Steel Braid I.D.
1/8 (3)	300	24	0.044 - 0.058	24 solid	0.036 - 0.044	1/8	1/8
1/4 (6)	300	22	0.066 - 0.078	22	0.050 - 0.058	5/32	1/8
3/8 (10)	300	22	0.076 - 0.088	20	0.056 - 0.064	7/32	3/16
1/2 (13)	300	18	0.089 - 0.101	18	0.074 - 0.084	9/32	1/4
5/8 (16)	600	18	0.108 - 0.124	18	0.097 - 0.113	7/16	3/8
3/4 (19)	600	18	0.108 - 0.124	14	0.097 - 0.113	7/16	3/8
1 (25)	600	18	0.095 - 0.109	14	0.087 - 0.101	N/A	N/A

Lead length tolerances:

1 to 36 in. (25 to 914 mm) = -1/2 in. (13 mm), +1 1/2 in. (38 mm)  
 > 36 to 76 in. (914 to 1930 mm) = -1, +3 in. (-25 + 76 mm)  
 > 76 in. (1930 mm) = ±4 in. (102 mm)

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

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

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

#### 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



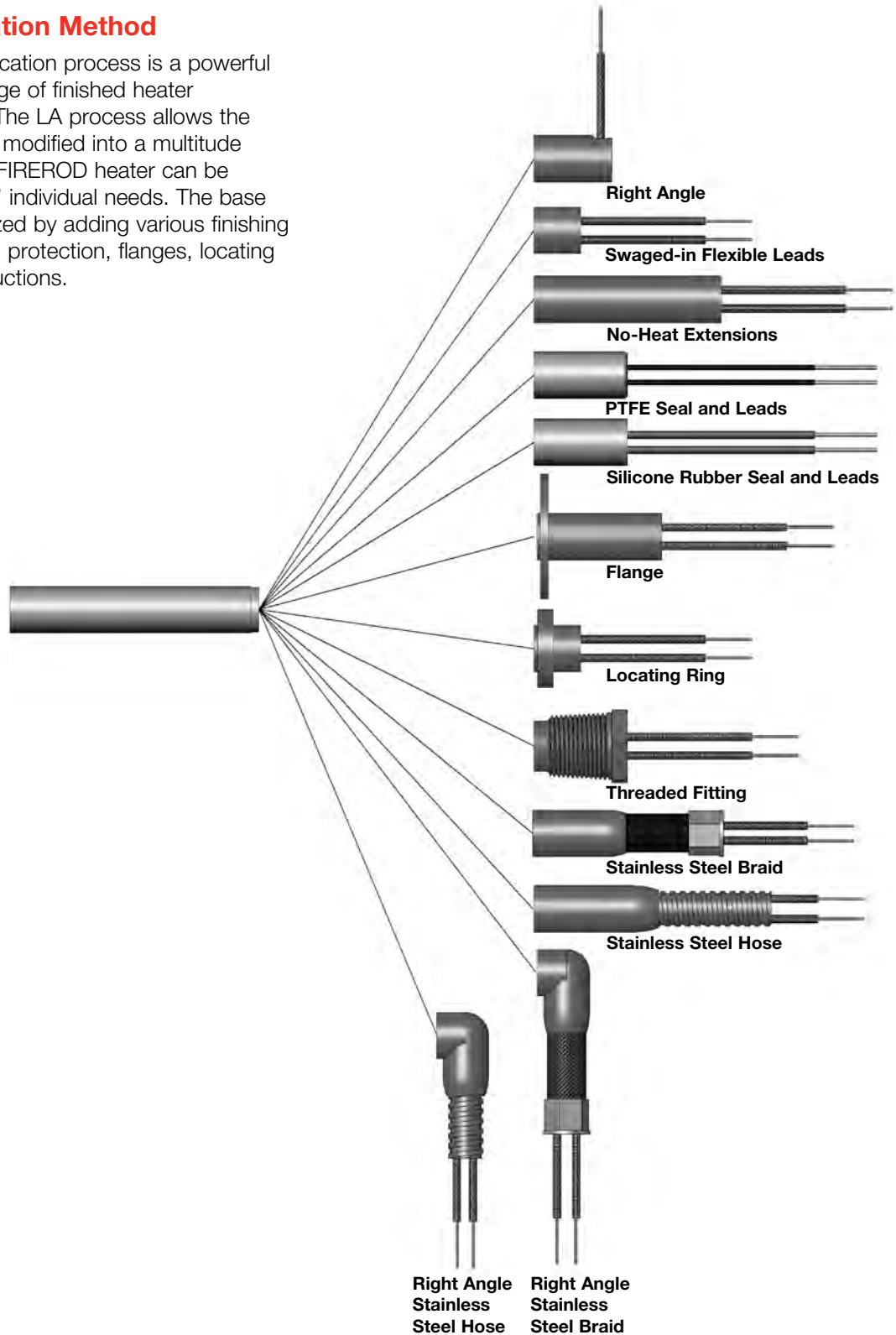
## FIREROD Cartridge Heaters

### 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 customers' 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

#### Options (Continued)

#### Modifying Basic FIRERODs Using the LA Process for Swaged-in Leads

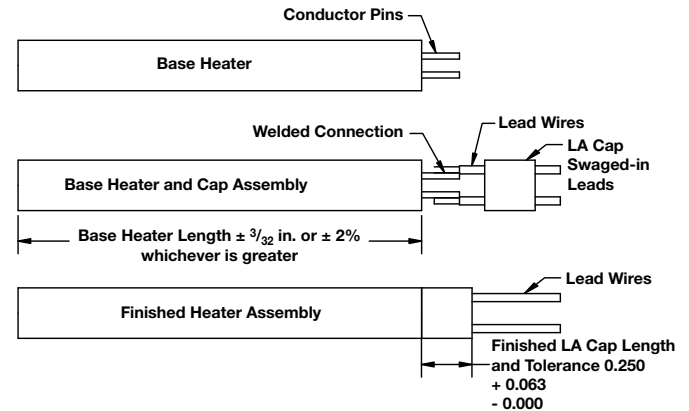
Watlow:

- Shortens conductor pins
- Welds lead wires to pins
- Places an LA cap over the lead end of the heater
- Reduces the diameter of the LA cap over the lead end of the base unit to produce a rugged integrated heater assembly

#### Notes:

- Other LA construction options use a similar modification process
- Maximum temperature of LA cap is 1000°F (538°C)

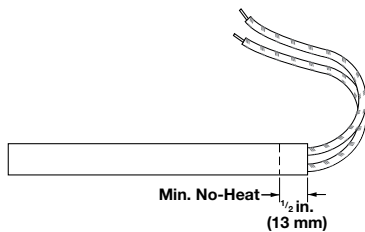
#### Length Tolerance for Stock Heaters With LA Options



Note: Base heater tolerance + LA cap tolerance = total tolerance for assembly

## Termination Options

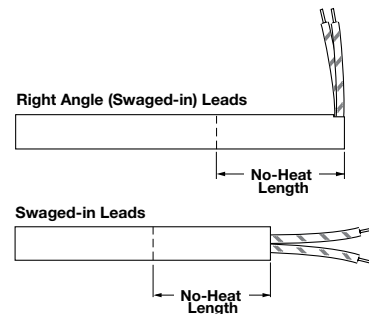
### LA Swaged-in Flexible Leads



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

This LA option is not available on 1/8 in. (3 mm) diameter FIRERODs. On 1/8 in. (3 mm) diameter FIRERODs, leads are connected externally using a solid conductor lead wire. If stranded wire is desired on 1/8 in. (3 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 and require a cooler lead end. They are 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 3/8, 1/2, 5/8 and 3/4 in. (10, 13, 16 and 19 mm). These extensions are designed to provide a total no-heat length of 1, 1 1/2, 2 or 2 1/2 in. (25, 38, 51 or 65 mm) at the lead end of FIRERODs only. Contact your Watlow representative for available LA options.

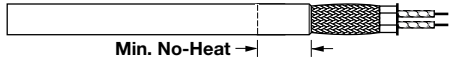


## FIREROD Cartridge Heaters

### LA

#### Termination Options (Continued)

#### LA Straight Stainless Steel Braid

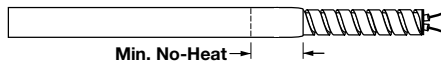


The LA straight stainless steel braid is designed to protect leads from abrasion against sharp edges. It is the most flexible Watlow protective lead arrangement.

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

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

#### LA Straight Stainless Steel Hose



An LA straight stainless steel hose provides the best protection against abrasion from sharp edges. It also offers ease of handling and wiring in abrasive environments. Unless specified a 12 in. (305 mm) hose is supplied. Leads are 2 in. (51 mm) longer than the hose but, longer leads are available.

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

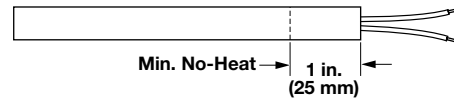
#### LA Straight Stainless Steel Hose with PTFE Leads and Seal



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

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

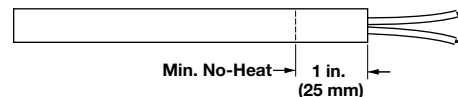
#### LA Silicone Rubber Seal and Leads



The LA silicone rubber seal and leads protect the heater against moisture and contamination from lubricating oil, cleaning solvents, plastic material, fumes and organic tapes. This seal is effective to 302°F (150°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 required is 1 in. (25 mm). The LA cap adds  $\frac{3}{4}$  in. (19 mm) to the overall length. To order, specify **option code P**.

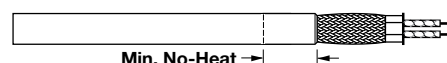
#### LA PTFE Seal and Leads



The LA PTFE 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 required is 1 in. (25 mm). The LA cap adds  $\frac{3}{4}$  in. (19 mm) to the overall length of the heater. To order, specify **option code T**.

#### LA Straight Stainless Steel Braid with PTFE Leads and Seal



The LA straight stainless steel braid with PTFE leads and seal is Watlow's most flexible lead protection with a moisture resistant seal. Unless specified, a 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 up to 392°F (200°C) under continuous operation.

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

# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### LA

#### Right Angle Options

#### LA Right Angle Leads



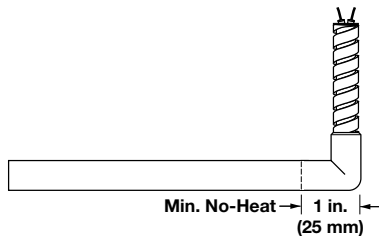
LA right angle leads are used in applications with a high degree of flexing and when space limitations are critical. Stranded lead wires are connected internally (swaged-in) and exit at a 90 degree angle at the end of the heater.

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

Minimum No-Heat Required in. (mm)					
Dia.	1/4	3/8	1/2	5/8	3/4
In. (mm)	13/16 (21)	3/4 (19)	13/16 (21)	13/16 (21)	13/16 (21)

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

#### LA Right Angle Stainless Steel Hose



**The diameter of the right angle extension is equal to the nominal diameter of the heater.**

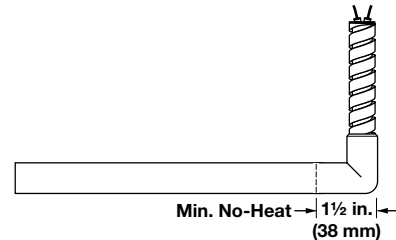
An LA right angle stainless steel hose is provided for wiring convenience. Like the LA straight stainless steel hose, it protects leads from abrasion against sharp edges. Unless specified, a 12 in. (305 mm) hose is supplied. Leads are 2 in. (51 mm) longer than the hose, but longer leads are available.

Diameter	3/8	1/2	5/8	3/4
Adder length in. (mm)	3/4 (19)	3/4 (19)	3/4 (19)	7/8 (22)
Min. no-heat in. (mm)	1 (25)	1 (25)	1 (25)	1 1/8 (29)

To order specify **option code W**.

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

#### LA Right Angle Stainless Steel Hose with PTFE Leads and Seal



**The diameter of the right angle extension is equal to the nominal diameter of the heater.**

An LA right angle stainless steel hose with PTFE leads and a seal is the ultimate combination for providing abrasion protection and a moisture resistant seal with wiring convenience. Unless specified, a 12 in. (305 mm) hose is supplied. Leads are 2 in. (51 mm) longer than the hose but longer leads are available. This seal is effective to 392°F (200°C) under continuous operation.

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

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

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

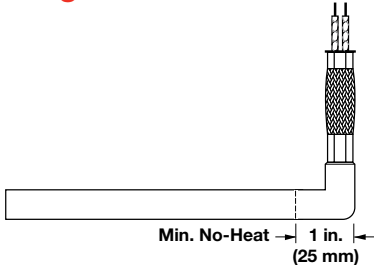


## FIREROD Cartridge Heaters

### LA

#### Right Angle Options *(Continued)*

#### LA Right Angle Stainless Steel Braid



The diameter of the right angle extension is equal to the nominal diameter of the heater.

An LA right angle stainless steel braid is provided for wiring convenience. It protects leads from abrasion against sharp edges.

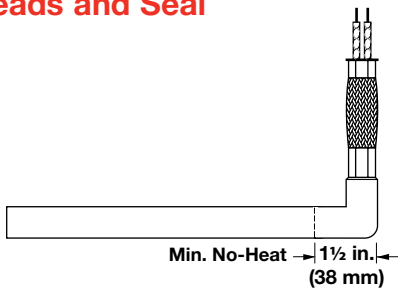
Unless specified, a 12 in. (305 mm) braid is supplied. Leads are 2 in. (51 mm) longer than the braid, but longer leads are available.

Diameter	3/8	1/2	5/8	3/4
Adder length in. (mm)	3/4 (19)	3/4 (19)	3/4 (19)	7/8 (22)
Min. no-heat in. (mm)	1 (25)	1 (25)	1 (25)	1 1/8 (29)

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

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

#### LA Right Angle Stainless Steel Braid with PTFE Leads and Seal



The diameter of the right angle extension is equal to the nominal diameter of the heater.

The LA right angle stainless steel braid with PTFE leads and seal is Watlow's most flexible lead protection with a moisture resistant PTFE seal and wiring convenience. Unless specified, a 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 up to 392°F (200°C) under continuous operation.

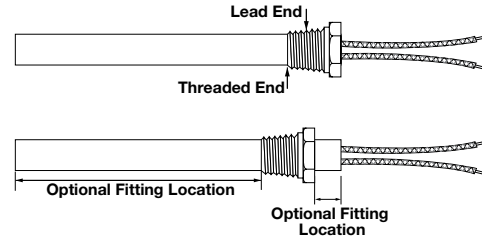
The minimum lead end no-heat required is 1 1/2 in. (38 mm). This option adds 1 1/4 in. (32 mm) to the overall length on stock units.

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

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

#### Mounting Options

#### LA Stainless Steel Threaded Fittings



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

Threaded fittings allow fast, water-tight installation of the heater into a threaded hole. These fittings are 304 stainless steel, other stainless steel alloys are available upon request. Double threaded fittings are also available. Please see page 27 for threaded fitting specifications. Provide the location of the fittings if no-heat extension option is requested.

Lead Arrangement	Minimum Distance <sup>①</sup> Between Threaded End and Lead End	
	in.	(mm)
Crimped Leads	1/4	(6)
Swaged-in Leads	5/16 <sup>②④</sup>	(8)
STR SS Hose	1/2 <sup>③</sup>	(13)
STR SS Braid	1/2	(13)
PTFE Seal & Leads	7/8	(22)
Silicone Seal & Leads	7/8	(22)

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

All optional fitting locations are available only with LA no-heat extensions. Contact your Watlow representative for details.

② On 1/4 in. diameter FIREROD only "A" dimension is 7/16 in. (11.1 mm).

③ On 1/4 in. diameter FIREROD only "A" dimension is 5/8 in. (15.9 mm).

④ On 5/8 in. and 3/4 in. the fitting is located at 7/8 in. from the lead end using a 3/4 in. no-heat extension. In order to locate at 5/16 in., the fitting must be epoxied.

**Note:** Minimum distance between threaded end and heated section is 1/4 in.

# Cartridge/Insertion Heaters

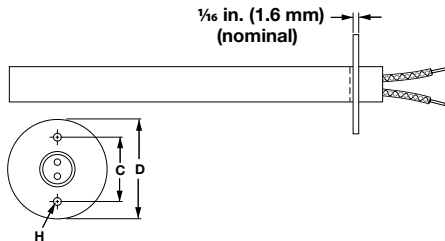


## FIREROD Cartridge Heaters

### LA

#### Mounting Options *(Continued)*

#### Flanges



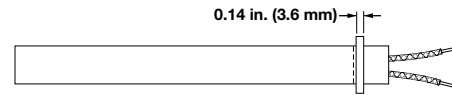
Stainless steel flanges are a convenient mounting method to position a heater within an application. The flange is staked on and located 1/4 in. (6 mm) from the lead end. The flange can be located up to 2 1/4 in. (57 mm) from the lead end if it is over a no-heat section. Use this option in combination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

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

#### Flange Specifications

FIREROD Diameter in.	Flange Size	in. (mm)		
		D	C	H
1/4, 3/8, 1/2	FS	1 (25)	3/4 (19)	0.144 (4)
1/4, 3/8, 1/2 5/8, 3/4	FM	1 1/2 (38)	1 1/8 (29)	0.156 (4)
5/8, 3/4	FL	2 (51)	1 1/2 (38)	0.201 (5)

#### 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)

# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### LA

### LA Options

Option	Minimum Length Adders Per Diameter Per Option in. (mm)					Option Code
	1/4 (6)	3/8 (9.5)	1/2 (13)	5/8 (15.9)	3/4 (19)	
Heater Diameter						
Swaged-in leads	E 1/4 (6)	E 1/4 (6)	E 1/4 (6)	E 1/4 (6)	E 1/4 (6)	<b>None</b>
Right angle leads	K 9/16 (14)	J 1/2 (13)	K 9/16 (14)	K 9/16 (14)	K 9/16 (14)	<b>R</b>
PTFE seal and leads	— —	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	<b>T</b>
Right angle PTFE seal and leads	— —	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	<b>B</b>
Silicone seal and leads	— —	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	<b>P</b>
Straight hose	J 1/2 (13)	J 1/2 (13)	J 1/2 (13)	J 1/2 (13)	J 1/2 (13)	<b>H</b>
Right angle hose	— —	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	R 7/8 (22.2)	<b>W</b>
Straight hose with PTFE seal and leads	— —	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	<b>G</b>
Straight braid	J 1/2 (13)	J 1/2 (13)	J 1/2 (13)	J 1/2 (13)	J 1/2 (13)	<b>C</b>
Right angle braid	— —	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	R 7/8 (22)	<b>Y</b>
Right angle braid with PTFE seal and leads	— —	1E 1 1/4 (32)	1E 1 1/4 (32)	1E 1 1/4 (32)	1E 1 1/4 (32)	<b>A</b>
Straight braid with PTFE seal and leads	— —	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	N 3/4 (19)	<b>F</b>
Right angle hose with PTFE seal and leads	— —	1E 1 1/4 (32)	1E 1 1/4 (32)	1E 1 1/4 (32)	1E 1 1/4 (32)	<b>M</b>

LA options are available as shown in the table above. To order any of these options, please build the order number by specifying the Watlow part number, length adder code, option code and lead length.

### Lead Type Codes

Type	Maximum Temperature	Option Code
GGS	482°F (250°C)	<b>None</b>
MGT	842°F (450°C)	<b>H</b>
PTFE	392°F (200°C)	<b>T</b>

**Note:** Available for LA fiberglass leads.

### No-Heat Length Adder Codes

No-Heat Option in. (mm)	Length Adder Code
3/4 (19)	<b>N</b>
1 1/4 (32)	<b>1E</b>
1 3/4 (44)	<b>1N</b>
2 1/4 (56)	<b>2E</b>

# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Non-LA

#### Modification Coding

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

#### Mounting Option Codes

- BA - Small flange FS (available on 1/4, 3/8 and 1/2 in.)
- BB - Medium flange FM (available on 1/4, 3/8, 1/2, 5/8 and 3/4 in.)
- BC - Large flange FL (available on 5/8 and 3/4 in.)
- BD - Locating ring (available on 1/4, 3/8, 1/2, 5/8 and 3/4 in.)
- BG - Single stainless steel fitting
- BH - Double stainless steel fitting
- BY - Stainless steel reversed

#### Pin Option Codes

- AA - Short pins 3/8 in. (10 mm)
- AB - Medium pins 5/8 in. (16 mm)
- AC - Long pins 1 3/4 in. (45 mm)
- AD - Stagger pins
- AE - Ceramic beads 1/2 in. (13 mm)
- AF - Ceramic beads 3/4 in. (19 mm)
- AG - Ceramic beads 1 in. (25 mm)
- AH - Ceramic beads 1 1/4 in. (32 mm)
- AJ - Ceramic beads 1 1/2 in. (38 mm)



Crimped-on Leads



Ceramic Beads



Locating Ring



Threaded Fitting

# Cartridge/Insertion Heaters

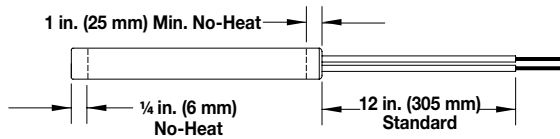


## FIREROD Cartridge Heaters

### Made-to-Order

### Straight Options

#### Swaged-in Flexible Leads

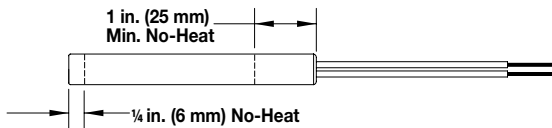


Swaged-in flexible leads are used in applications where a high degree of flexing exists or leads must be bent sharply adjacent to the heater without exposing or breaking the conductor. Stranded wire leads are connected internally and exit through the lead end.

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.

The minimum lead end for no-heat is 1 in. (25 mm) min. or 12 percent of overall heater length. Additional no-heat may be required to keep the end piece and leads below the maximum operating temperatures.

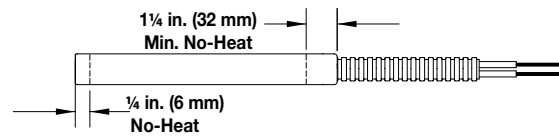
#### PTFE Seal and Leads



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

The PTFE seal and leads 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

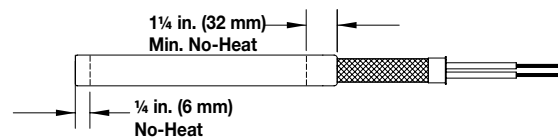


A straight stainless steel hose provides the best protection against abrasion from sharp edges. It also offers ease of handling and wiring in abrasive environments.

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

**Note:** This option is available with PTFE leads and seal. Minimum no-heats are longer. Contact your Watlow representative for details.

#### Straight Stainless Steel Braid



A straight stainless braid is designed to protect leads from abrasion against sharp edges and is Watlow's most flexible protective lead arrangement.

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

**Note:** This option is available with PTFE leads and seal. Minimum no-heats are longer. Contact your Watlow representative for details.

**Note:** If your application requires smaller no heat, contact your Watlow representative for details.



# Cartridge/Insertion Heaters

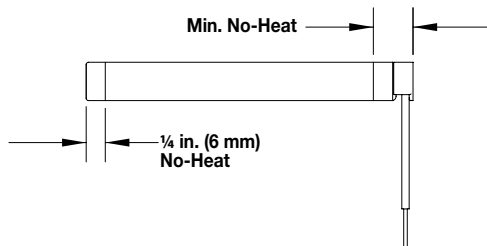


## FIREROD Cartridge Heaters

### Made-to-Order

### Right Angle Options

#### Right Angle Leads

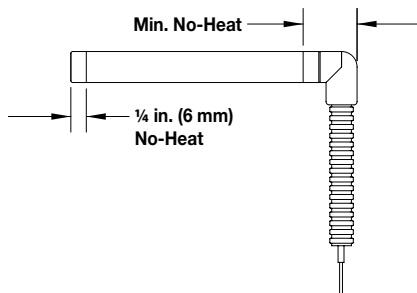


Right angle leads are used in applications with a high degree of flexing and when space limitations are critical. Standard lead wires are connected internally (swaged-in) and exit at a 90° angle at the end of the heater.

Diameter	1/4	3/8	1/2	5/8	3/4
Min. no-heat in. (mm)	1 1/4 (32)	1 1/4 (32)	1 5/16 (33)	1 7/16 (37)	1 7/16 (37)

**Note:** This option is available with PTFE leads and seal. Minimum no-heats are longer. Contact your Watlow representative for details.

#### Right Angle Stainless Steel Hose



**The diameter of the right angle extension is equal to the nominal diameter of the heater.**

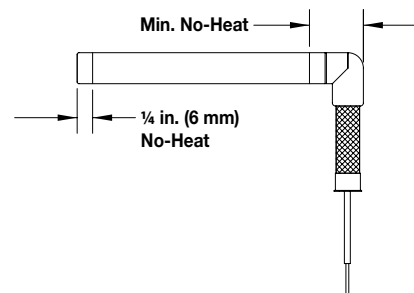
A right angle stainless steel hose is provided for wiring convenience. It protects leads from abrasion against sharp edges.

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

Diameter	1/4	3/8	1/2	5/8	3/4
Min. no-heat in. (mm)	1 5/16 (33)	1 3/8 (35)	1 9/16 (40)	1 11/16 (43)	1 13/16 (46)

**Note:** This option is available with PTFE leads and seal. Minimum no-heats are longer. Contact your Watlow representative for details.

#### Right Angle Stainless Steel Braid



**The diameter of the right angle extension is equal to the nominal diameter of the heater.**

A right angle stainless steel braid is provided for wiring convenience. It protects leads from abrasion against sharp edges.

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

Diameter	1/4	3/8	1/2	5/8	3/4
Min. no-heat in. (mm)	1 5/16 (33)	1 3/8 (35)	1 9/16 (40)	1 11/16 (43)	1 13/16 (46)

**Note:** This option is available with PTFE leads and seal. Minimum no-heats are longer. Contact your Watlow representative for details.

# Cartridge/Insertion Heaters

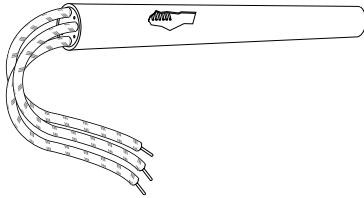


## FIREROD Cartridge Heaters

*Made-to-Order*

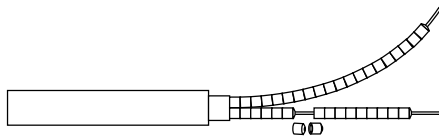
### Termination Options

#### 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**.

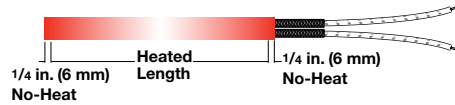
#### Ceramic Bead Insulation



Ceramic bead insulation protects the leads from high ambient temperatures above 842°F (450°C). The beads fit over solid conductors that extend to reach a cooler area where flexible wires can be attached. This option is not available on 1/8 in. (3 mm) diameter leads. The maximum available length on FIRERODs is 6 in. (152 mm). To order, specify **ceramic beads** and length, and additional lead length.

### Options

#### Distributed Wattage



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

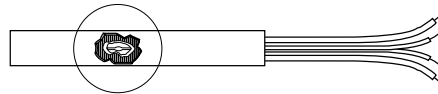
To order, specify **distributed wattage** and give the length and wattage for each section.

### Thermocouple Types

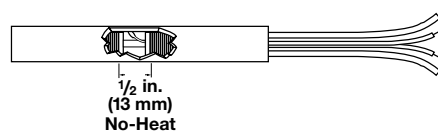
ASTM Code	Conductor Characteristics		Temperature Range °F (°C)
	Positive	Negative	
J	Iron (Magnetic) (White)	Constantan (Non-Magnetic) (Red)	0 to 1400 (-20 to 760)
K	Chromel® (Non Magnetic) (Yellow)	Alumel® (Magnetic) (Red)	0 to 2300 (-20 to 1260)

For other ISA types, contact your Watlow representative.

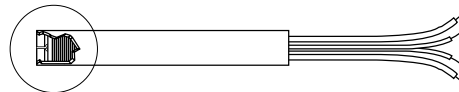
#### Style A



#### Style B



#### Style C



# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Made-to-Order

### Options

#### Internal Thermocouple

Style A internal thermocouples can be used to evaluate heat transfer efficiency of an application. This measurement can help to cut energy costs and increase heater life. The ungrounded junction is located in the heater core to monitor the internal temperature of the heater.

The Style B internal thermocouple provides a good approximation of part temperature and is 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**.

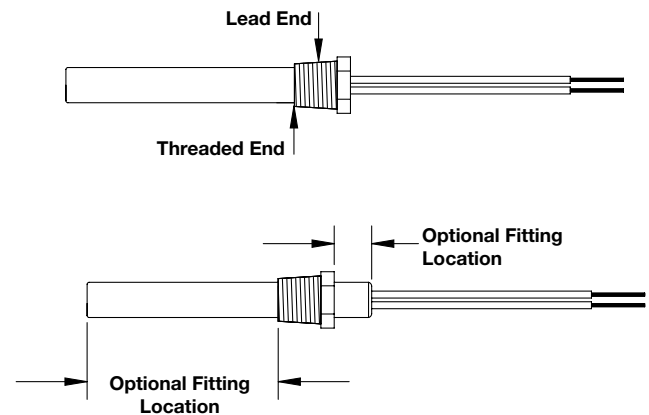
If not specified, 12 in. (305 mm) thermocouple leads are supplied.

#### 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.

### Mounting Options

#### Threaded Fittings



Threaded fittings allow fast, water-tight heater installation into a threaded hole. Standard fittings are 304 stainless steel and welded to the heater sheath. Other materials, including brass are available as an extended option. Double threaded fittings are also available.

Unless specified, the fitting hex is 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)
1/4	1/8 (3)	1/2 (13)	7/8 (22)
3/8	1/4 (6)	5/8 (16)	1 <sup>5</sup> / <sub>16</sub> (33)
1/2	3/8 (10)	3/4 (19)	1 <sup>3</sup> / <sub>8</sub> (35)
5/8	1/2 (13)	7/8 (22)	1 <sup>13</sup> / <sub>16</sub> (46)
3/4	3/4 (19)	1 (25)	1 <sup>13</sup> / <sub>16</sub> (46)
1	1 (25)	1 (25)	1 <sup>1</sup> / <sub>2</sub> (38)

# Cartridge/Insertion Heaters

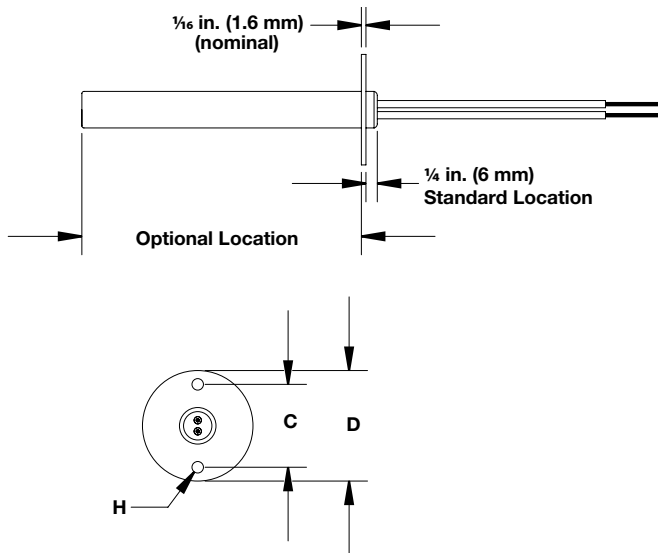


## FIREROD Cartridge Heaters

Made-to-Order

Mounting Options (Continued)

### Flanges



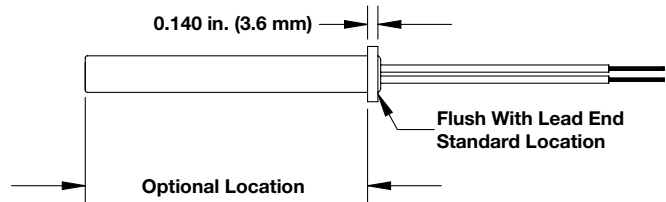
Stainless steel flanges are a convenient mounting method and can be used to position a heater within an application. The standard location is 1/4 in. (6 mm) from the lead end. However, a specific location may be requested in any location along the no-heat section. Unless specified, flanges are staked 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.
1/8, 1/4, 3/8, 1/2	FS	1 (25)	3/4 (19)	0.144
1/4, 3/8, 1/2, 5/8, 3/4	FM	1 1/2 (38)	1 1/8 (28)	0.156
5/8, 3/4, 1	FL	2 (51)	1 1/2 (38)	0.201

### Locating Rings



A stainless steel locating ring can be used as a retaining collar to position a FIREROD heater 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	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)

# Cartridge/Insertion Heaters

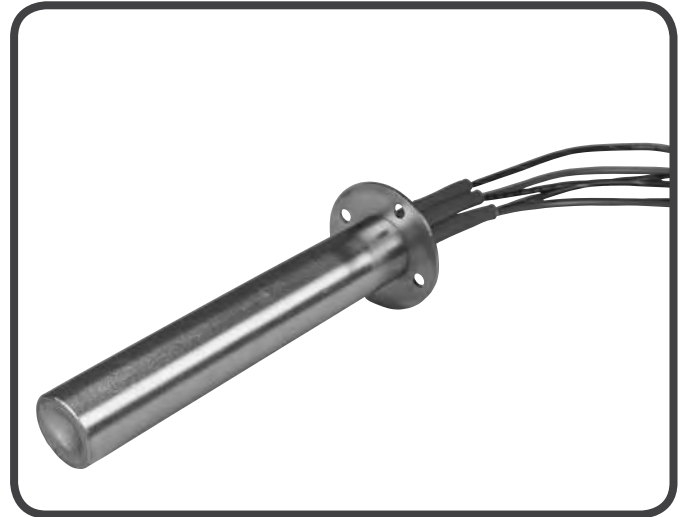
**EXTENDED  
CAPABILITY**



## 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 more than 90 years, emphasis on sound engineering and quality control has established Watlow as a preferred supplier for many high-performance heating requirements. For large opportunities, a solution for you can be engineered to accommodate:

- Custom diameters
- High watt density applications
- Long heater lengths
- 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 compliance documents



### High Performance Cartridge Heaters

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

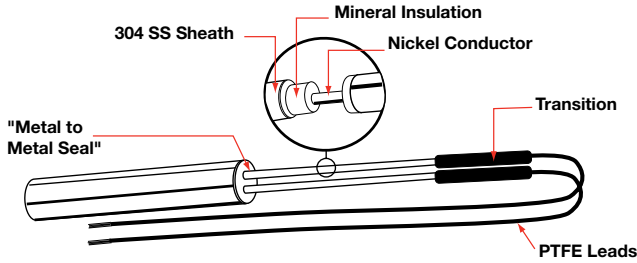
# Cartridge/Insertion Heaters

**EXTENDED  
CAPABILITY**



## Extended Capabilities for Custom Cartridge Heaters

### Mineral Insulated (MI Leads)



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

**Note:** MI leads do not provide a hermetic seal on the heater.

### Benefits

- Increases heater life
- Minimizes down time
- Resists moisture contamination
- Allows a cartridge heater to be used where it was not previously possible
- Resists abrasion and vibration
- Forms and bends to fit the contours of wiring raceways
- Protects against high temperatures without additional insulation

### Typical Applications

- 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

Transition length: 1<sup>1</sup>/<sub>8</sub> in. (28.6 mm)

### Lead Types

PTFE 392°F (200°C) – T

Heater Diameter in.	Max. Current Amperes	Conductor Diameter in.	Cable Diameter in.	Transition Diameter in.	Cable Length Min. in.	Max. in.	Min. Bend Radius	Max. Voltage in.	Length Adder
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)

This information pertains to standard FIREROD heaters.

**Note:** Extended capabilities are subject to a business case review.

# Cartridge/Insertion Heaters

**EXTENDED  
CAPABILITY**



## Extended Capabilities for Custom Cartridge Heaters

### Termination Options

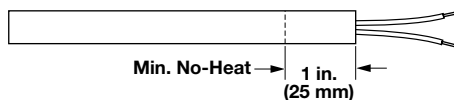
#### Low Electrical Leakage

This construction technique minimizes current leakage of the heating element. It is especially useful in critical medical applications 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. (10, 13, 16 and 19 mm) diameter FIREROD heaters.

To order, specify **low electrical leakage**.

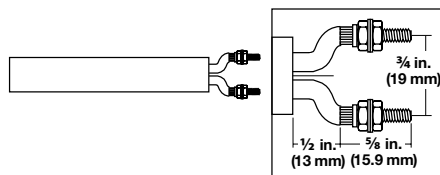
#### Silicone Rubber Seal and Leads



Made-to-order silicone rubber seal and leads protect the heater against moisture and contamination from lubricating oil, cleaning solvents, plastic material, fumes and organic tapes. This seal is effective up to 302°F (150°C) under continuous operation.

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

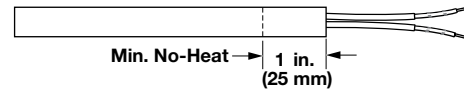
#### Post Terminals



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 FIREROD heaters of  $\frac{5}{8}$ ,  $\frac{3}{4}$  and 1 in. (16, 19 and 25 mm) diameter. On 1 in. (25 mm) diameters, pins are straight. To order, specify **post terminals**.

#### Epoxy Seal



Epoxy seals help protect the heater against moisture and contamination from lubricating oil, cleaning solvents, plastic material, fumes and organic tapes. These seals are effective up to 250°F (121°C) under continuous operation.

Epoxy seals can be ordered only on units greater than  $\frac{1}{8}$  in. (3 mm) in diameter with crimped on leads. The 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**.

### Options

#### Individually Controlled Heat Zones

Individually controlled heat zones offer the flexibility to control temperature by zones, along the length of the FIREROD heater. This is an advantage for heating requirements of certain applications, such as seal bars. This internal construction can be ordered on  $\frac{5}{8}$ ,  $\frac{3}{4}$  and 1 in. (16, 19 and 25 mm) diameter FIREROD heaters. To order, specify **individually controlled heat zones** and wattage and length per zone.

#### Passivation

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

**Note:** Extended capabilities are subject to a business case review.

# Cartridge/Insertion Heaters

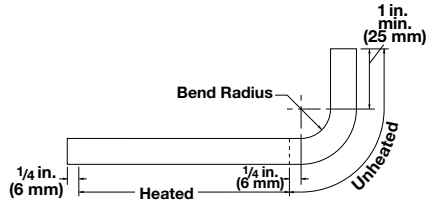
**EXTENDED  
CAPABILITY**



## Extended Capabilities for Custom Cartridge Heaters

*Options (Continued)*

### Bent FIREROD



In applications where 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 FIREROD heaters. 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 application needs exceed limitations shown.

FIREROD Diameter in.	Min. Required No-Heat Length in. (mm)	Bend Radius in. (mm)
1/4	2 1/4 (56)	1/2 (13)
3/8	2 3/8 (60)	1/2 (13)
1/2	2 7/8 (72)	3/4 (19)
5/8	3 5/16 (83)	1 (25)
1/2	3 13/16 (98)	1 1/4 (32)

### Centerless Grinding

Centerless grinding can be used to furnish precision diameters to permit closer heater-to-part fit allowing higher watt densities to be used.

For centerless ground heaters, the heater must have PTFE seal and leads (maximum 12 in. (305 mm) lead length) or crimped on leads. Longer lead lengths are available, but require an external connection. The length of a FIREROD available for centerless grinding depends on the construction. Please contact your Watlow representative for assistance. To order, specify **centerless grinding**.

FIREROD Diameter in.	Actual Precision Diameter in.
1/4	0.241 ± 0.0005
3/8	0.363 ± 0.0005
1/2	0.488 ± 0.0005
5/8	0.613 ± 0.0005
3/4	0.738 ± 0.0005
1	0.984 ± 0.0005

**Note:** Extended capabilities are subject to a business case review.



# 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 1600°F (871°C). The HT FIREROD heater utilizes the same industry leading design principles used on all Watlow FIREROD products. Advancing the FIREROD heater enables it to withstand application temperatures up to 400°F (204°C) higher than standard cartridge heaters. HT FIREROD design features, which are important in high temperature applications, include:

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

### Performance Capabilities

- Platen temperatures up to 1600°F (871°C)
- Maximum watt density up to 100 W/in<sup>2</sup> (15.5 W/cm<sup>2</sup>)
- Maximum voltage up to 277VAC ground
- Length tolerance of +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 0.621 ± 0.004	23
3/4	0.710 ± 0.004 0.746 ± 0.004	46
1	0.960 ± 0.006 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 element life

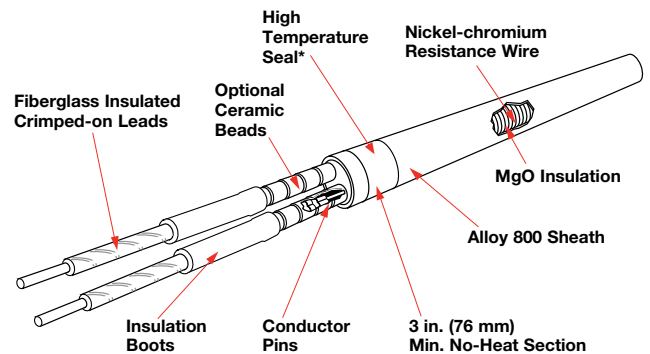
**Note:** The first 2 in. (51 mm) must be outside of the platen in free air and less than 1000°F (538°C).

#### Alloy 800 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
- High temperature glass forming

**Note:** Extended capabilities are subject to a business case review.

# Cartridge/Insertion Heaters

**EXTENDED  
CAPABILITY**

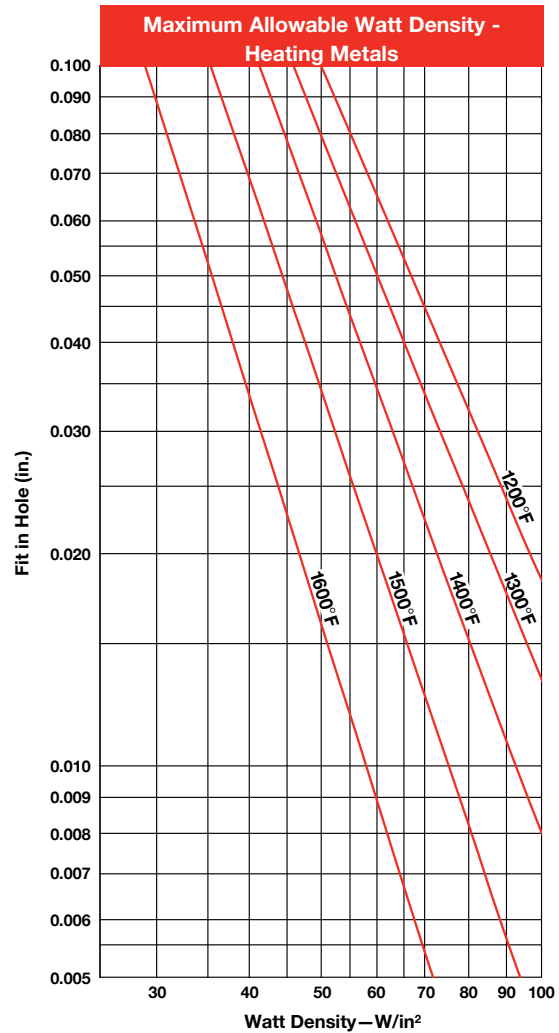


## Extended Capabilities for High-Temperature (HT) FIREROD® Heaters

### Options

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

To consider the HT FIREROD for your application, use the recommended *Maximum Watt Density graph* shown.



**Note:** Extended capabilities are subject to a business case review.



## FIREROD Cartridge Heaters

The following tables contain lists of standard base FIREROD constructions. The Watlow SELECT™ program offers millions of potential FIREROD configurations to meet your thermal needs, many of those configurations available in one or five days. Please contact your local Watlow distributor or sales office to configure your FIREROD.

### Heater Part Numbers

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number	
	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)		
1/8	1	(25.0)	24	20	104	(16)	0.02	(0.009)	<b>C1A-9600<sup>①</sup></b>	
	1	(25.0)	24	25	130	(20)	0.02	(0.009)	<b>C1A-9601<sup>①</sup></b>	
	1	(25.0)	24	30	157	(24)	0.02	(0.009)	<b>C1A-9602<sup>①</sup></b>	
	1	(25.0)	48	20	104	(16)	0.02	(0.009)	<b>C1A-9603<sup>①</sup></b>	
	1	(25.0)	48	40	208	(32)	0.02	(0.009)	<b>C1A-9604<sup>①</sup></b>	
	1	(25.0)	50	50	260	(40)	0.02	(0.009)	<b>C1A-9605<sup>①</sup></b>	
	1 1/4	(32.0)	120	25	87	(13)	0.02	(0.009)	<b>C1E14</b>	
	1 1/4	(32.0)	120	50	174	(18)	0.02	(0.009)	<b>C1E13</b>	
	1 1/4	(32.0)	240	35	113	(27)	0.02	(0.009)	<b>C1E42</b>	
	1 1/2	(38.0)	120	30	78	(12)	0.02	(0.009)	<b>C1J5</b>	
	1 1/2	(38.0)	120	60	156	(24)	0.02	(0.009)	<b>C1J6</b>	
	2	(51.0)	120	50	87	(13)	0.02	(0.009)	<b>C2A4</b>	
	2	(51.0)	120	100	174	(27)	0.02	(0.009)	<b>C2A5</b>	
	1/4	1	(25.0)	120	80	208	(32)	0.02	(0.009)	<b>E1A51</b>
		1	(25.0)	120	100	260	(40)	0.02	(0.009)	<b>E1A52</b>
		1	(25.0)	120	150	390	(60)	0.02	(0.009)	<b>E1A53</b>
1		(25.0)	240	100	250	(39)	0.02	(0.009)	<b>E1A66</b>	
1 1/4		(32.0)	120	75	130	(20)	0.02	(0.009)	<b>E1E41</b>	
1 1/4		(32.0)	120	100	173	(27)	0.02	(0.009)	<b>E1E42</b>	
1 1/4		(32.0)	120	150	260	(40)	0.02	(0.009)	<b>E1E43</b>	
1 1/4		(32.0)	240	225	390	(60)	0.02	(0.009)	<b>E1E61</b>	
1 1/2		(38.0)	120	50	65	(10)	0.02	(0.009)	<b>E1J39</b>	
1 1/2		(38.0)	120	100	130	(20)	0.02	(0.009)	<b>E1J40</b>	
1 1/2		(38.0)	120	150	195	(30)	0.02	(0.009)	<b>E1J41</b>	
1 1/2		(38.0)	240	175	228	(35)	0.02	(0.009)	<b>E1J49</b>	
1 1/2		(38.0)	120	200	260	(40)	0.02	(0.009)	<b>E1J42</b>	
1 1/2		(38.0)	240	200	260	(40)	0.02	(0.009)	<b>E1J52</b>	
1 1/2		(38.0)	240	250	325	(50)	0.02	(0.009)	<b>E1J35</b>	
2		(51.0)	120	80	68	(11)	0.03	(0.014)	<b>E2A136</b>	
2		(51.0)	120	100	87	(13)	0.03	(0.014)	<b>E2A55</b>	
2		(51.0)	240	125	108	(17)	0.03	(0.014)	<b>E2A82</b>	
2		(51.0)	120	150	130	(20)	0.03	(0.014)	<b>E2A56</b>	
2		(51.0)	240	150	130	(20)	0.03	(0.014)	<b>E2A77</b>	
2		(51.0)	120	200	173	(27)	0.03	(0.014)	<b>E2A57</b>	
2		(51.0)	240	200	173	(27)	0.03	(0.014)	<b>E2A50</b>	
2		(51.0)	120	250	217	(33)	0.03	(0.014)	<b>E2A72</b>	
2		(51.0)	240	250	215	(33)	0.03	(0.014)	<b>E2A76</b>	
2		(51.0)	240	300	260	(40)	0.03	(0.014)	<b>E2A83</b>	
2 1/2		(64.0)	120	250	159	(25)	0.03	(0.014)	<b>E2J80</b>	
2 1/2		(64.0)	240	250	159	(25)	0.03	(0.014)	<b>E2J49</b>	
3		(76.0)	120	100	52	(8)	0.04	(0.018)	<b>E3A48</b>	
3		(76.0)	120	200	104	(16)	0.04	(0.018)	<b>E3A49</b>	
3		(76.0)	240	200	104	(16)	0.04	(0.018)	<b>E3A60</b>	
3		(76.0)	240	250	128	(20)	0.04	(0.018)	<b>E3A124</b>	
3		(76.0)	120	300	156	(24)	0.04	(0.018)	<b>E3A50</b>	
3		(76.0)	240	300	156	(24)	0.04	(0.018)	<b>E3A51</b>	
4		(102.0)	120	100	37	(6)	0.04	(0.018)	<b>E4A28</b>	
4		(102.0)	120	200	74	(11)	0.04	(0.018)	<b>E4A29</b>	
4		(102.0)	240	200	74	(11)	0.04	(0.018)	<b>E4A32</b>	
4	(102.0)	120	300	111	(17)	0.04	(0.018)	<b>E4A30</b>		
4	(102.0)	240	300	111	(17)	0.04	(0.018)	<b>E4A6</b>		

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Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.

<sup>①</sup>12 inch GGS swaged-in leads, no additional options available.



## FIREROD Cartridge Heaters

### Heater Part Numbers

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
1/4	4 1/2	(114.0)	120	200	64	(10)	0.05	(0.023)	<b>E4J30</b>
	5	(127.0)	240	350	101	(16)	0.05	(0.023)	<b>E5A45</b>
	5	(127.0)	120	400	113	(18)	0.05	(0.023)	<b>E5A57</b>
	5	(127.0)	240	400	113	(18)	0.05	(0.023)	<b>E5A34</b>
	6	(152.0)	240	400	94	(14)	0.06	(0.027)	<b>E6A46</b>
	8	(203.0)	240	800	136	(21)	0.08	(0.036)	<b>E8A76</b>
3/8	1	(25.0)	120	55	95	(15)	0.03	(0.014)	<b>G1A71</b>
	1	(25.0)	120	100	172	(26)	0.03	(0.014)	<b>G1A29</b>
	1	(25.0)	120	150	259	(40)	0.03	(0.014)	<b>G1A38</b>
	1	(25.0)	240	200	344	(53)	0.03	(0.014)	<b>G1A83</b>
	1 1/4	(32.0)	120	100	115	(18)	0.03	(0.014)	<b>G1E91</b>
	1 1/4	(32.0)	120	125	144	(22)	0.03	(0.014)	<b>G1E74</b>
	1 1/4	(32.0)	120	150	172	(27)	0.03	(0.014)	<b>G1E92</b>
	1 1/4	(32.0)	240	150	172	(27)	0.03	(0.014)	<b>G1E93</b>
	1 1/4	(32.0)	120	200	230	(35)	0.03	(0.014)	<b>G1E94</b>
	1 1/4	(32.0)	240	200	230	(35)	0.03	(0.014)	<b>G1E95</b>
	1 1/4	(32.0)	120	400	426	(66)	0.03	(0.014)	<b>G1E99</b>
	1 1/2	(38.0)	120	50	43	(7)	0.04	(0.018)	<b>G1J25</b>
	1 1/2	(38.0)	120	75	65	(10)	0.04	(0.018)	<b>G1J70</b>
	1 1/2	(38.0)	120	80	68	(11)	0.04	(0.018)	<b>G1J66</b>
	1 1/2	(38.0)	120	100	86	(13)	0.04	(0.018)	<b>G1J59</b>
	1 1/2	(38.0)	240	100	86	(13)	0.04	(0.018)	<b>G1J110</b>
	1 1/2	(38.0)	240	125	106	(16)	0.04	(0.018)	<b>G1J182</b>
	1 1/2	(38.0)	120	150	129	(20)	0.04	(0.018)	<b>G1J31</b>
	1 1/2	(38.0)	240	150	129	(20)	0.04	(0.018)	<b>G1J39</b>
	1 1/2	(38.0)	120	200	173	(27)	0.04	(0.018)	<b>G1J85</b>
	1 1/2	(38.0)	240	200	173	(27)	0.04	(0.018)	<b>G1J73</b>
	1 1/2	(38.0)	120	250	216	(33)	0.04	(0.018)	<b>G1J86</b>
	1 1/2	(38.0)	240	250	216	(33)	0.04	(0.018)	<b>G1J54</b>
	1 3/4	(45.0)	120	125	86	(13)	0.05	(0.023)	<b>G1N45</b>
	1 3/4	(45.0)	120	175	122	(19)	0.05	(0.023)	<b>G1N46</b>
	1 3/4	(45.0)	120	250	172	(27)	0.05	(0.023)	<b>G1N43</b>
	1 3/4	(45.0)	240	250	172	(27)	0.05	(0.023)	<b>G1N32</b>
	2	(51.0)	120	50	29	(5)	0.06	(0.027)	<b>G2A53</b>
	2	(51.0)	120	75	42	(7)	0.06	(0.027)	<b>G2A192</b>
	2	(51.0)	120	100	57	(9)	0.06	(0.027)	<b>G2A84</b>
	2	(51.0)	240	100	57	(9)	0.06	(0.027)	<b>G2A76</b>
	2	(51.0)	120	150	86	(13)	0.06	(0.027)	<b>G2A56</b>
	2	(51.0)	240	150	86	(13)	0.06	(0.027)	<b>G2A81</b>
	2	(51.0)	120	200	115	(18)	0.06	(0.027)	<b>G2A127</b>
	2	(51.0)	240	200	115	(18)	0.06	(0.027)	<b>G2A37</b>
	2	(51.0)	120	250	144	(22)	0.06	(0.027)	<b>G2A47</b>
2	(51.0)	240	250	144	(22)	0.06	(0.027)	<b>G2A73</b>	
2	(51.0)	120	300	172	(27)	0.06	(0.027)	<b>G2A139</b>	
2	(51.0)	240	300	172	(27)	0.06	(0.027)	<b>G2A98</b>	
2	(51.0)	120	400	230	(36)	0.06	(0.027)	<b>G2A153</b>	
2	(51.0)	240	400	230	(36)	0.06	(0.027)	<b>G2A146</b>	
2	(51.0)	120	500	282	(44)	0.06	(0.027)	<b>G2A95</b>	
2	(51.0)	240	500	282	(44)	0.06	(0.027)	<b>G2A97</b>	
2 1/4	(57.0)	120	75	37	(6)	0.07	(0.032)	<b>G2E88</b>	
2 1/4	(57.0)	120	125	62	(10)	0.07	(0.032)	<b>G2E89</b>	

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Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.

# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Heater Part Numbers

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
3/8	2 1/4	(57.0)	240	125	62	(10)	0.07	(0.032)	<b>G2E138</b>
	2 1/4	(57.0)	240	150	73	(11)	0.07	(0.032)	<b>G2E68</b>
	2 1/4	(57.0)	120	175	86	(13)	0.07	(0.032)	<b>G2E90</b>
	2 1/4	(57.0)	120	250	123	(19)	0.07	(0.032)	<b>G2E2</b>
	2 1/4	(57.0)	240	250	123	(19)	0.07	(0.032)	<b>G2E78</b>
	2 1/4	(57.0)	120	300	148	(23)	0.07	(0.032)	<b>G2E108</b>
	2 1/4	(57.0)	240	300	148	(23)	0.07	(0.032)	<b>G2E12</b>
	2 1/4	(57.0)	120	350	173	(27)	0.07	(0.032)	<b>G2E91</b>
	2 1/4	(57.0)	240	350	173	(27)	0.07	(0.032)	<b>G2E75</b>
	2 1/2	(64.0)	120	200	87	(13)	0.07	(0.032)	<b>G2J110</b>
	2 1/2	(64.0)	240	200	87	(13)	0.07	(0.032)	<b>G2J81</b>
	2 1/2	(64.0)	120	250	108	(17)	0.07	(0.032)	<b>G2J46</b>
	2 1/2	(64.0)	240	250	108	(17)	0.07	(0.032)	<b>G2J80</b>
	2 1/2	(64.0)	120	300	130	(20)	0.07	(0.032)	<b>G2J118</b>
	2 1/2	(64.0)	240	300	130	(20)	0.07	(0.032)	<b>G2J119</b>
	2 1/2	(64.0)	120	400	174	(27)	0.07	(0.032)	<b>G2J26</b>
	2 1/2	(64.0)	240	400	174	(27)	0.07	(0.032)	<b>G2J146</b>
	2 1/2	(64.0)	120	500	216	(33)	0.07	(0.032)	<b>G2J109</b>
	2 1/2	(64.0)	240	500	216	(33)	0.07	(0.032)	<b>G2J52</b>
	3	(76.0)	120	100	34	(5)	0.08	(0.036)	<b>G3A55</b>
	3	(76.0)	240	100	34	(5)	0.08	(0.036)	<b>G3A137</b>
	3	(76.0)	120	150	52	(8)	0.08	(0.036)	<b>G3A121</b>
	3	(76.0)	120	200	69	(11)	0.08	(0.036)	<b>G3A61</b>
	3	(76.0)	240	200	69	(11)	0.08	(0.036)	<b>G3A39</b>
	3	(76.0)	120	250	86	(13)	0.08	(0.036)	<b>G3A52</b>
	3	(76.0)	240	250	86	(13)	0.08	(0.036)	<b>G3A54</b>
	3	(76.0)	120	300	104	(16)	0.08	(0.036)	<b>G3A73</b>
	3	(76.0)	240	300	104	(16)	0.08	(0.036)	<b>G3A92</b>
	3	(76.0)	120	400	138	(21)	0.08	(0.036)	<b>G3A44</b>
	3	(76.0)	240	400	138	(21)	0.08	(0.036)	<b>G3A65</b>
	3	(76.0)	120	500	173	(27)	0.08	(0.036)	<b>G3A119</b>
	3	(76.0)	240	500	173	(27)	0.08	(0.036)	<b>G3A120</b>
	3	(76.0)	240	600	208	(32)	0.08	(0.036)	<b>G3A133</b>
3 1/2	(89.0)	120	250	72	(11)	0.09	(0.041)	<b>G3J77</b>	
3 1/2	(89.0)	240	250	72	(11)	0.09	(0.041)	<b>G3J65</b>	
3 1/2	(89.0)	120	300	87	(13)	0.09	(0.041)	<b>G3J87</b>	
3 1/2	(89.0)	240	300	87	(13)	0.09	(0.041)	<b>G3J68</b>	
3 1/2	(89.0)	120	500	144	(22)	0.09	(0.041)	<b>G3J22</b>	
3 1/2	(89.0)	240	500	144	(22)	0.09	(0.041)	<b>G3J63</b>	
4	(102.0)	120	125	31	(5)	0.09	(0.041)	<b>G4A54</b>	
4	(102.0)	240	125	31	(5)	0.09	(0.041)	<b>G4A163</b>	
4	(102.0)	120	150	37	(6)	0.09	(0.041)	<b>G4A78</b>	
4	(102.0)	120	175	43	(7)	0.09	(0.041)	<b>G4A191</b>	
4	(102.0)	120	250	62	(10)	0.09	(0.041)	<b>G4A40</b>	
4	(102.0)	240	250	62	(10)	0.09	(0.041)	<b>G4A87</b>	
4	(102.0)	120	300	74	(11)	0.09	(0.041)	<b>G4A94</b>	
4	(102.0)	240	300	74	(11)	0.09	(0.041)	<b>G4A95</b>	
4	(102.0)	120	400	99	(15)	0.09	(0.041)	<b>G4A48</b>	
4	(102.0)	240	400	99	(15)	0.09	(0.041)	<b>G4A44</b>	
4	(102.0)	240	450	109	(17)	0.09	(0.041)	<b>G4A64</b>	
4	(102.0)	120	500	123	(19)	0.09	(0.041)	<b>G4A96</b>	
4	(102.0)	240	500	123	(19)	0.09	(0.041)	<b>G4A92</b>	

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Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.

# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Heater Part Numbers

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
3/8	4	(102.0)	120	550	134	(21)	0.09	(0.041)	<b>G4A200</b>
	4 1/4	(108.0)	240	300	67	(10)	0.09	(0.041)	<b>G4E25</b>
	4 1/4	(108.0)	240	750	167	(26)	0.09	(0.041)	<b>G4E15</b>
	4 1/2	(114.0)	120	300	65	(10)	0.10	(0.045)	<b>G4J54</b>
	4 1/2	(114.0)	240	300	65	(10)	0.10	(0.045)	<b>G4J33</b>
	4 1/2	(114.0)	120	500	108	(17)	0.10	(0.045)	<b>G4J55</b>
	4 1/2	(114.0)	240	500	108	(17)	0.10	(0.045)	<b>G4J37</b>
	5	(127.0)	120	150	29	(4)	0.11	(0.050)	<b>G5A68</b>
	5	(127.0)	240	150	29	(4)	0.11	(0.050)	<b>G5A56</b>
	5	(127.0)	120	300	58	(9)	0.11	(0.050)	<b>G5A69</b>
	5	(127.0)	240	300	58	(9)	0.11	(0.050)	<b>G5A70</b>
	5	(127.0)	120	500	96	(15)	0.11	(0.050)	<b>G5A38</b>
	5	(127.0)	240	500	96	(15)	0.11	(0.050)	<b>G5A71</b>
	5	(127.0)	240	750	144	(22)	0.11	(0.050)	<b>G5A67</b>
	5	(127.0)	240	1000	192	(30)	0.11	(0.050)	<b>G5A115</b>
	5 1/4	(133.0)	240	200	45	(7)	0.12	(0.054)	<b>G5E16</b>
	5 1/2	(140.0)	240	600	104	(16)	0.12	(0.054)	<b>G5J36</b>
	5 1/2	(140.0)	240	1000	173	(27)	0.12	(0.054)	<b>G5J45</b>
	6	(152.0)	120	200	31	(5)	0.13	(0.059)	<b>G6A80</b>
	6	(152.0)	120	250	39	(6)	0.13	(0.059)	<b>G6A40</b>
	6	(152.0)	240	250	39	(6)	0.13	(0.059)	<b>G6A92</b>
	6	(152.0)	120	400	63	(10)	0.13	(0.059)	<b>G6A81</b>
	6	(152.0)	240	400	63	(10)	0.13	(0.059)	<b>G6A82</b>
	6	(152.0)	120	500	79	(12)	0.13	(0.059)	<b>G6A125</b>
	6	(152.0)	240	500	79	(12)	0.13	(0.059)	<b>G6A59</b>
	6	(152.0)	120	600	94	(15)	0.13	(0.059)	<b>G6A56</b>
	6	(152.0)	240	600	94	(15)	0.13	(0.059)	<b>G6A51</b>
	6	(152.0)	240	750	117	(18)	0.13	(0.059)	<b>G6A46</b>
	6	(152.0)	240	1000	157	(24)	0.13	(0.059)	<b>G6A83</b>
	6 1/2	(165.0)	240	600	86	(13)	0.14	(0.064)	<b>G6J23</b>
	6 1/2	(165.0)	240	1000	144	(22)	0.14	(0.064)	<b>G6J33</b>
	7	(178.0)	120	250	33	(5)	0.14	(0.064)	<b>G7A40</b>
	7	(178.0)	240	250	33	(5)	0.14	(0.064)	<b>G7A32</b>
	7	(178.0)	240	500	65	(10)	0.14	(0.064)	<b>G7A30</b>
	7	(178.0)	120	600	80	(12)	0.14	(0.064)	<b>G7A41</b>
	7	(178.0)	240	600	80	(12)	0.14	(0.064)	<b>G7A42</b>
7	(178.0)	240	1000	133	(21)	0.14	(0.064)	<b>G7A43</b>	
7 1/2	(191.0)	240	600	74	(11)	0.15	(0.068)	<b>G7J27</b>	
7 1/2	(191.0)	240	1000	124	(19)	0.15	(0.068)	<b>G7J28</b>	
8	(203.0)	120	300	34	(5)	0.16	(0.073)	<b>G8A54</b>	
8	(203.0)	240	300	34	(5)	0.16	(0.073)	<b>G8A47</b>	
8	(203.0)	120	400	45	(7)	0.16	(0.073)	<b>G8A109</b>	
8	(203.0)	120	500	58	(9)	0.16	(0.073)	<b>G8A81</b>	
8	(203.0)	240	500	58	(9)	0.16	(0.073)	<b>G8A32</b>	
8	(203.0)	120	600	69	(11)	0.16	(0.073)	<b>G8A53</b>	
8	(203.0)	240	600	69	(11)	0.16	(0.073)	<b>G8A37</b>	
8	(203.0)	240	700	79	(12)	0.16	(0.073)	<b>G8A98</b>	
8	(203.0)	240	1000	115	(18)	0.16	(0.073)	<b>G8A45</b>	
9	(229.0)	240	1000	100	(16)	0.18	(0.082)	<b>G9A37</b>	
9 1/2	(241.0)	240	600	57	(9)	0.19	(0.086)	<b>G9J20</b>	
9 1/2	(241.0)	240	1000	96	(15)	0.19	(0.086)	<b>G9J12</b>	
10	(254.0)	120	400	36	(6)	0.19	(0.086)	<b>G10A48</b>	

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Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.

# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Heater Part Numbers

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
3/8	10	(254.0)	120	600	54	(8)	0.19	(0.086)	<b>G10A35</b>
	10	(254.0)	240	600	54	(8)	0.19	(0.086)	<b>G10A31</b>
	10	(254.0)	240	1000	91	(14)	0.19	(0.086)	<b>G10A32</b>
	12	(305.0)	120	400	30	(5)	0.22	(0.100)	<b>G12A45</b>
	12	(305.0)	120	600	45	(7)	0.22	(0.100)	<b>G12A29</b>
	12	(305.0)	240	600	45	(7)	0.22	(0.100)	<b>G12A46</b>
	12	(305.0)	240	1000	75	(12)	0.22	(0.100)	<b>G12A47</b>
1/2	1	(25.0)	120	50	65	(10)	0.06	(0.027)	<b>J1A30</b>
	1	(25.0)	120	150	193	(30)	0.06	(0.027)	<b>J1A31</b>
	1 1/4	(32.0)	120	50	43	(7)	0.07	(0.032)	<b>J1E50</b>
	1 1/4	(32.0)	120	125	107	(17)	0.07	(0.032)	<b>J1E51</b>
	1 1/4	(32.0)	240	125	107	(17)	0.07	(0.032)	<b>J1E58</b>
	1 1/4	(32.0)	240	200	172	(27)	0.07	(0.032)	<b>J1E52</b>
	1 1/4	(32.0)	240	250	212	(33)	0.07	(0.032)	<b>J1E88</b>
	1 1/2	(38.0)	120	50	32	(3)	0.08	(0.036)	<b>J1J47</b>
	1 1/2	(38.0)	120	150	97	(15)	0.08	(0.036)	<b>J1J48</b>
	1 1/2	(38.0)	240	150	97	(15)	0.08	(0.036)	<b>J1J96</b>
	1 1/2	(38.0)	120	200	128	(20)	0.08	(0.036)	<b>J1J59</b>
	1 1/2	(38.0)	240	200	128	(20)	0.08	(0.036)	<b>J1J38</b>
	2	(51.0)	120	75	32	(5)	0.09	(0.041)	<b>J2A80</b>
	2	(51.0)	120	200	86	(13)	0.09	(0.041)	<b>J2A49</b>
	2	(51.0)	240	200	86	(13)	0.09	(0.041)	<b>J2A75</b>
	2	(51.0)	120	250	108	(17)	0.09	(0.041)	<b>J2A85</b>
	2	(51.0)	240	250	108	(17)	0.09	(0.041)	<b>J2A71</b>
	2	(51.0)	120	300	128	(20)	0.09	(0.041)	<b>J2A95</b>
	2	(51.0)	240	300	128	(20)	0.09	(0.041)	<b>J2A96</b>
	2	(51.0)	120	400	171	(27)	0.09	(0.041)	<b>J2A81</b>
	2	(51.0)	240	400	171	(27)	0.09	(0.041)	<b>J2A82</b>
	2 1/4	(57.0)	120	75	28	(4)	0.10	(0.045)	<b>J2E86</b>
	2 1/4	(57.0)	120	125	46	(7)	0.10	(0.045)	<b>J2E87</b>
	2 1/4	(57.0)	120	250	92	(14)	0.10	(0.045)	<b>J2E56</b>
	2 1/4	(57.0)	240	250	92	(14)	0.10	(0.045)	<b>J2E69</b>
	2 1/4	(57.0)	120	400	147	(22)	0.10	(0.045)	<b>J2E114</b>
	2 1/4	(57.0)	240	400	147	(22)	0.10	(0.045)	<b>J2E115</b>
	2 1/4	(57.0)	120	500	184	(29)	0.10	(0.045)	<b>J2E64</b>
	2 1/4	(57.0)	240	500	184	(29)	0.10	(0.045)	<b>J2E88</b>
	2 1/2	(64.0)	120	100	32	(5)	0.11	(0.050)	<b>J2J67</b>
	2 1/2	(64.0)	240	100	32	(5)	0.11	(0.050)	<b>J2J57</b>
	2 1/2	(64.0)	120	250	81	(13)	0.11	(0.050)	<b>J2J68</b>
	2 1/2	(64.0)	240	250	81	(13)	0.11	(0.050)	<b>J2J69</b>
	2 1/2	(64.0)	120	300	96	(15)	0.11	(0.050)	<b>J2J109</b>
	2 1/2	(64.0)	240	300	96	(15)	0.11	(0.050)	<b>J2J110</b>
	2 1/2	(64.0)	120	400	128	(20)	0.11	(0.050)	<b>J2J81</b>
	2 1/2	(64.0)	240	400	128	(20)	0.11	(0.050)	<b>J2J82</b>
	2 1/2	(64.0)	120	500	161	(24)	0.11	(0.050)	<b>J2J66</b>
	2 1/2	(64.0)	240	500	161	(24)	0.11	(0.050)	<b>J2J70</b>
	2 3/4	(70.0)	240	400	115	(18)	0.11	(0.050)	<b>J2N43</b>
	2 3/4	(70.0)	120	400	115	(18)	0.11	(0.050)	<b>J2N45</b>
	3	(76.0)	120	125	32	(5)	0.12	(0.054)	<b>J3A108</b>
3	(76.0)	240	125	32	(5)	0.12	(0.054)	<b>J3A109</b>	
3	(76.0)	120	250	64	(10)	0.12	(0.054)	<b>J3A107</b>	
3	(76.0)	240	250	64	(10)	0.12	(0.054)	<b>J3A89</b>	
3	(76.0)	120	300	78	(12)	0.12	(0.054)	<b>J3A65</b>	

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Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.

# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Heater Part Numbers

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
1/2	3	(76.0)	120	350	89	(14)	0.12	(0.054)	<b>J3A173</b>
	3	(76.0)	240	300	78	(12)	0.12	(0.054)	<b>J3A73</b>
	3	(76.0)	120	400	104	(16)	0.12	(0.054)	<b>J3A132</b>
	3	(76.0)	240	400	104	(16)	0.12	(0.054)	<b>J3A29</b>
	3	(76.0)	120	500	129	(20)	0.12	(0.054)	<b>J3A110</b>
	3	(76.0)	240	500	129	(20)	0.12	(0.054)	<b>J3A111</b>
	3	(76.0)	120	600	154	(24)	0.12	(0.054)	<b>J3A51</b>
	3	(76.0)	240	600	154	(24)	0.12	(0.054)	<b>J3A127</b>
	3	(76.0)	120	750	193	(30)	0.12	(0.054)	<b>J3A137</b>
	3	(76.0)	240	750	193	(30)	0.12	(0.054)	<b>J3A112</b>
	3	(76.0)	120	1000	254	(39)	0.12	(0.054)	<b>J3A79</b>
	3 1/2	(89.0)	120	250	54	(8)	0.14	(0.064)	<b>J3J44</b>
	3 1/2	(89.0)	240	250	54	(8)	0.14	(0.064)	<b>J3J64</b>
	3 1/2	(89.0)	240	350	75	(12)	0.14	(0.064)	<b>J3J65</b>
	3 1/2	(89.0)	120	500	107	(17)	0.14	(0.064)	<b>J3J45</b>
	3 1/2	(89.0)	240	500	107	(17)	0.14	(0.064)	<b>J3J46</b>
	3 1/2	(89.0)	240	750	162	(25)	0.14	(0.064)	<b>J3J63</b>
	4	(102.0)	120	150	28	(4)	0.15	(0.068)	<b>J4A117</b>
	4	(102.0)	240	150	28	(4)	0.15	(0.068)	<b>J4A122</b>
	4	(102.0)	120	250	46	(7)	0.15	(0.068)	<b>J4A118</b>
4	(102.0)	240	250	46	(7)	0.15	(0.068)	<b>J4A90</b>	
4	(102.0)	120	300	56	(9)	0.15	(0.068)	<b>J4A63</b>	
4	(102.0)	240	300	56	(9)	0.15	(0.068)	<b>J4A26</b>	
4	(102.0)	120	350	65	(10)	0.15	(0.068)	<b>J4A1</b>	
4	(102.0)	240	350	65	(10)	0.15	(0.068)	<b>J4A103</b>	
4	(102.0)	120	400	74	(11)	0.15	(0.068)	<b>J4A139</b>	
4	(102.0)	240	400	74	(11)	0.15	(0.068)	<b>J4A68</b>	
4	(102.0)	120	500	92	(14)	0.15	(0.068)	<b>J4A16</b>	
4	(102.0)	120	550	100	(16)	0.15	(0.068)	<b>J4A242</b>	
4	(102.0)	240	500	92	(14)	0.15	(0.068)	<b>J4A92</b>	
4	(102.0)	120	750	138	(21)	0.15	(0.068)	<b>J4A198</b>	
4	(102.0)	240	750	138	(21)	0.15	(0.068)	<b>J4A119</b>	
4	(102.0)	240	1000	184	(28)	0.15	(0.068)	<b>J4A73</b>	
4 1/2	(114.0)	120	500	80	(12)	0.17	(0.077)	<b>J4J69</b>	
4 1/2	(114.0)	240	500	80	(12)	0.17	(0.077)	<b>J4J57</b>	
4 1/2	(114.0)	120	750	120	(19)	0.17	(0.077)	<b>J4J70</b>	
4 1/2	(114.0)	240	750	120	(19)	0.17	(0.077)	<b>J4J32</b>	
5	(127.0)	120	200	29	(4)	0.19	(0.086)	<b>J5A85</b>	
5	(127.0)	240	200	29	(4)	0.19	(0.086)	<b>J5A74</b>	
5	(127.0)	120	350	50	(8)	0.19	(0.086)	<b>J5A86</b>	
5	(127.0)	240	350	50	(8)	0.19	(0.086)	<b>J5A63</b>	
5	(127.0)	120	400	58	(9)	0.19	(0.086)	<b>J5A98</b>	
5	(127.0)	240	400	58	(9)	0.19	(0.086)	<b>J5A46</b>	
5	(127.0)	120	500	72	(11)	0.19	(0.086)	<b>J5A52</b>	
5	(127.0)	240	500	72	(11)	0.19	(0.086)	<b>J5A45</b>	
5	(127.0)	120	750	108	(17)	0.19	(0.086)	<b>J5A121</b>	
5	(127.0)	240	750	108	(17)	0.19	(0.086)	<b>J5A72</b>	
5	(127.0)	240	1000	143	(22)	0.19	(0.086)	<b>J5A87</b>	
5 1/2	(140.0)	240	200	25	(4)	0.20	(0.091)	<b>J5J38</b>	
5 1/2	(140.0)	120	500	64	(10)	0.20	(0.091)	<b>J5J43</b>	
5 1/2	(140.0)	240	500	64	(10)	0.20	(0.091)	<b>J5J33</b>	
5 1/2	(140.0)	240	650	83	(13)	0.20	(0.091)	<b>J5J69</b>	

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Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.



# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Heater Part Numbers

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
1/2	5 1/2	(140.0)	120	750	97	(15)	0.20	(0.091)	J5J44
	5 1/2	(140.0)	240	750	97	(15)	0.20	(0.091)	J5J45
	5 3/4	(146.0)	120	700	86	(13)	0.20	(0.091)	J5N6
	5 3/4	(146.0)	240	700	86	(13)	0.20	(0.091)	J5N8
	6	(152.0)	120	250	29	(4)	0.21	(0.095)	J6A114
	6	(152.0)	240	250	29	(4)	0.21	(0.095)	J6A171
	6	(152.0)	240	300	35	(6)	0.21	(0.095)	J6A66
	6	(152.0)	240	350	41	(7)	0.21	(0.095)	J6A119
	6	(152.0)	120	500	59	(9)	0.21	(0.095)	J6A115
	6	(152.0)	240	500	59	(9)	0.21	(0.095)	J6A94
	6	(152.0)	120	750	88	(14)	0.21	(0.095)	J6A99
	6	(152.0)	240	750	88	(14)	0.21	(0.095)	J6A90
	6	(152.0)	120	1000	117	(18)	0.21	(0.095)	J6A53
	6	(152.0)	240	1000	117	(18)	0.21	(0.095)	J6A36
	6 1/2	(165.0)	240	500	54	(8)	0.23	(0.104)	J6J45
	6 1/2	(165.0)	240	1000	108	(17)	0.23	(0.104)	J6J27
	7	(178.0)	120	250	25	(4)	0.24	(0.109)	J7A79
	7	(178.0)	120	500	50	(8)	0.24	(0.109)	J7A80
	7	(178.0)	240	500	50	(8)	0.24	(0.109)	J7A57
	7	(178.0)	120	600	60	(9)	0.24	(0.109)	J7A50
	7	(178.0)	240	600	60	(9)	0.24	(0.109)	J7A95
	7	(178.0)	240	1000	99	(15)	0.24	(0.109)	J7A81
	7 1/2	(191.0)	240	500	46	(7)	0.26	(0.118)	J7J25
	7 1/2	(191.0)	240	1000	92	(14)	0.26	(0.118)	J7J26
	8	(203.0)	120	300	26	(4)	0.28	(0.127)	J8A71
	8	(203.0)	240	300	26	(4)	0.28	(0.127)	J8A111
	8	(203.0)	120	500	43	(7)	0.28	(0.127)	J8A64
	8	(203.0)	240	500	43	(7)	0.28	(0.127)	J8A66
	8	(203.0)	120	1000	86	(13)	0.28	(0.127)	J8A84
	8	(203.0)	240	1000	86	(13)	0.28	(0.127)	J8A60
	8	(203.0)	240	1500	129	(20)	0.28	(0.127)	J8A100
	8	(203.0)	240	2000	172	(27)	0.28	(0.127)	J8A101
	8 1/2	(216.0)	240	300	24	(4)	0.29	(0.132)	J8J39
	8 1/2	(216.0)	240	500	40	(6)	0.29	(0.132)	J8J30
	8 1/2	(216.0)	240	1000	80	(12)	0.29	(0.132)	J8J28
	9	(229.0)	240	500	38	(6)	0.30	(0.136)	J9A35
	9	(229.0)	240	1000	76	(12)	0.30	(0.136)	J9A58
	9 1/2	(241.0)	240	500	36	(6)	0.32	(0.145)	J9J14
	9 1/2	(241.0)	240	1000	72	(11)	0.32	(0.145)	J9J12
	10	(254.0)	120	500	34	(5)	0.33	(0.150)	J10A61
	10	(254.0)	240	500	34	(5)	0.33	(0.150)	J10A62
	10	(254.0)	120	1000	68	(11)	0.33	(0.150)	J10A63
10	(254.0)	240	1000	68	(11)	0.33	(0.150)	J10A42	
10	(254.0)	240	1500	102	(16)	0.33	(0.150)	J10A33	
10	(254.0)	240	2000	136	(21)	0.33	(0.150)	J10A64	
11	(279.0)	240	1000	61	(9)	0.36	(0.163)	J11A60	
12	(305.0)	120	500	28	(4)	0.40	(0.181)	J12A63	
12	(305.0)	240	500	28	(4)	0.40	(0.181)	J12A76	
12	(305.0)	120	1000	56	(9)	0.40	(0.181)	J12A40	
12	(305.0)	240	1000	56	(9)	0.40	(0.181)	J12A49	
12	(305.0)	240	1500	84	(13)	0.40	(0.181)	J12A37	
12	(305.0)	240	2000	112	(17)	0.40	(0.181)	J12A89	
14	(356.0)	240	1000	48	(7)	0.48	(0.218)	J14A41	

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# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Heater Part Numbers

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
1/2	14	(356.0)	240	2300	110	(17)	0.48	(0.218)	<b>J14A39</b>
	15	(381.0)	240	1500	66	(10)	0.50	(0.227)	<b>J15A19</b>
	16	(406.0)	240	1000	41	(7)	0.52	(0.236)	<b>J16A12</b>
	18	(457.0)	240	1500	55	(9)	0.57	(0.259)	<b>J18A19</b>
	18	(457.0)	240	1700	62	(9)	0.57	(0.259)	<b>J18A23</b>
5/8	1 1/4	(32.0)	120	50	34	(5)	0.10	(0.045)	<b>L1E26</b>
	1 1/4	(32.0)	120	200	137	(21)	0.10	(0.045)	<b>L1E24</b>
	1 1/4	(32.0)	120	250	171	(27)	0.10	(0.045)	<b>L1E27</b>
	1 1/2	(38.0)	120	250	128	(20)	0.11	(0.050)	<b>L1J23</b>
	1 1/2	(38.0)	240	250	128	(20)	0.11	(0.050)	<b>L1J24</b>
	2	(51.0)	120	100	34	(5)	0.13	(0.059)	<b>L2A48</b>
	2	(51.0)	120	200	68	(11)	0.13	(0.059)	<b>L2A49</b>
	2	(51.0)	240	500	170	(26)	0.13	(0.059)	<b>L2A54</b>
	2 1/4	(57.0)	120	100	29	(4)	0.14	(0.064)	<b>L2E49</b>
	2 1/4	(57.0)	120	250	73	(11)	0.14	(0.064)	<b>L2E50</b>
	2 1/4	(57.0)	240	250	73	(11)	0.14	(0.064)	<b>L2E12</b>
	2 1/4	(57.0)	120	350	103	(16)	0.14	(0.064)	<b>L2E40</b>
	2 1/4	(57.0)	240	350	103	(16)	0.14	(0.064)	<b>L2E51</b>
	3	(76.0)	120	150	31	(5)	0.20	(0.091)	<b>L3A81</b>
	3	(76.0)	120	250	51	(8)	0.20	(0.091)	<b>L3A82</b>
	3	(76.0)	240	250	51	(8)	0.20	(0.091)	<b>L3A9</b>
	3	(76.0)	120	400	81	(13)	0.20	(0.091)	<b>L3A94</b>
	3	(76.0)	120	500	102	(16)	0.20	(0.091)	<b>L3A113</b>
	3	(76.0)	240	500	103	(16)	0.20	(0.091)	<b>L3A33</b>
	3	(76.0)	240	750	154	(24)	0.20	(0.091)	<b>L3A71</b>
	3 3/4	(95.0)	120	525	82	(13)	0.24	(0.109)	<b>L3N12</b>
	3 3/4	(95.0)	240	525	82	(13)	0.24	(0.109)	<b>L3N1</b>
	4	(102.0)	120	250	37	(6)	0.26	(0.118)	<b>L4A99</b>
	4	(102.0)	240	250	37	(6)	0.26	(0.118)	<b>L4A104</b>
	4	(102.0)	240	400	58	(9)	0.26	(0.118)	<b>L4A47</b>
	4	(102.0)	240	500	73	(11)	0.26	(0.118)	<b>L4A53</b>
	4	(102.0)	240	600	88	(14)	0.26	(0.118)	<b>L4A44</b>
	4	(102.0)	240	750	110	(17)	0.26	(0.118)	<b>L4A100</b>
	4	(102.0)	240	1000	146	(23)	0.26	(0.118)	<b>L4A71</b>
	5	(127.0)	120	250	28	(4)	0.29	(0.132)	<b>L5A76</b>
	5	(127.0)	240	250	28	(4)	0.29	(0.132)	<b>L5A107</b>
	5	(127.0)	240	500	57	(9)	0.29	(0.132)	<b>L5A24</b>
	5	(127.0)	240	750	86	(13)	0.29	(0.132)	<b>L5A31</b>
	5	(127.0)	240	1000	114	(18)	0.29	(0.132)	<b>L5A77</b>
6	(152.0)	120	300	28	(4)	0.34	(0.154)	<b>L6A28</b>	
6	(152.0)	240	300	28	(4)	0.34	(0.154)	<b>L6A64</b>	
6	(152.0)	240	500	47	(7)	0.34	(0.154)	<b>L6A73</b>	
6	(152.0)	240	750	70	(11)	0.34	(0.154)	<b>L6A70</b>	
6	(152.0)	240	1000	93	(14)	0.34	(0.154)	<b>L6A71</b>	
6	(152.0)	120	1500	139	(22)	0.34	(0.154)	<b>L6A163</b>	
6	(152.0)	240	1500	140	(22)	0.34	(0.154)	<b>L6A94</b>	
6 1/2	(165.0)	120	500	43	(7)	0.38	(0.172)	<b>L6J43</b>	
6 1/2	(165.0)	240	500	43	(7)	0.38	(0.172)	<b>L6J55</b>	
7	(178.0)	120	500	39	(6)	0.40	(0.181)	<b>L7A42</b>	
7	(178.0)	240	500	39	(6)	0.40	(0.181)	<b>L7A15</b>	
7	(178.0)	240	1000	79	(12)	0.40	(0.181)	<b>L7A37</b>	
7	(178.0)	240	1500	118	(18)	0.40	(0.181)	<b>L7A12</b>	

**CONTINUED**

Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.

# Cartridge/Insertion Heaters



## FIREROD Cartridge Heaters

### Heater Part Numbers

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
5/8	8	(203.0)	120	500	34	(5)	0.47	(0.213)	L8A96
	8	(203.0)	240	500	34	(5)	0.47	(0.213)	L8A46
	8	(203.0)	240	850	58	(9)	0.47	(0.213)	L8A115
	8	(203.0)	240	1000	68	(10)	0.47	(0.213)	L8A10
	8	(203.0)	240	1500	102	(16)	0.47	(0.213)	L8A37
	8	(203.0)	240	2000	137	(21)	0.47	(0.213)	L8A80
	10	(254.0)	120	500	27	(4)	0.53	(0.240)	L10A51
	10	(254.0)	240	500	27	(4)	0.53	(0.240)	L10A40
	10	(254.0)	240	750	40	(6)	0.53	(0.240)	L10A69
	10	(254.0)	240	1000	54	(8)	0.53	(0.240)	L10A52
	10	(254.0)	480	1000	54	(8)	0.53	(0.240)	L10A193
	10	(254.0)	240	1500	81	(13)	0.53	(0.240)	L10A8
	10	(254.0)	240	2000	108	(17)	0.53	(0.240)	L10A50
	12	(305.0)	120	500	22	(3)	0.66	(0.300)	L12A81
	12	(305.0)	240	500	22	(3)	0.66	(0.300)	L12A80
	12	(305.0)	240	900	40	(6)	0.66	(0.300)	L12A102
	12	(305.0)	120	1000	45	(7)	0.66	(0.300)	L12A82
	12	(305.0)	240	1000	45	(7)	0.66	(0.300)	L12A34
	12	(305.0)	120	1500	66	(10)	0.66	(0.300)	L12A147
	12	(305.0)	240	1500	67	(10)	0.66	(0.300)	L12A39
	12	(305.0)	240	2000	89	(14)	0.66	(0.300)	L12A63
	14	(356.0)	240	3700	140	(22)	0.79	(0.358)	L14A21
	15	(381.0)	240	750	27	(4)	0.84	(0.381)	L15A35
	15	(381.0)	240	2400	84	(13)	0.84	(0.381)	L15A20
	15	(381.0)	480	2500	88	(14)	0.84	(0.381)	L15A88
	15	(381.0)	240	4000	141	(22)	0.84	(0.381)	L15A41
	16	(406.0)	240	2500	82	(13)	0.91	(0.412)	L16A33
	16	(406.0)	240	4500	148	(23)	0.91	(0.412)	L16A40
	18	(457.0)	240	1500	44	(7)	1.03	(0.467)	L18A32
	18	(457.0)	240	3000	87	(13)	1.03	(0.467)	L18A34
	18	(457.0)	240	4700	137	(21)	1.03	(0.467)	L18A36
	20	(508.0)	240	1500	40	(6)	1.25	(0.567)	L20A19
	20	(508.0)	240	3500	92	(14)	1.25	(0.567)	L20A13
20	(508.0)	480	3500	92	(14)	1.25	(0.567)	L20A96	
20	(508.0)	240	4700	123	(19)	1.25	(0.567)	L20A14	
24	(610.0)	240	2000	44	(7)	1.47	(0.667)	L24A19	
24	(610.0)	240	4700	102	(15)	1.47	(0.667)	L24A14	
36	(914.0)	240	3000	43	(7)	2.30	(1.04)	L36A8	
3/4	2 1/4	(57.0)	120	200	49	(8)	0.19	(0.086)	N2E8
	3	(76.0)	120	250	43	(7)	0.24	(0.109)	N3A11
	3	(76.0)	240	500	85	(13)	0.24	(0.109)	N3A12
	4	(102.0)	120	250	31	(5)	0.31	(0.141)	N4A16
	4	(102.0)	240	500	61	(9)	0.31	(0.141)	N4A17
	4	(102.0)	240	1000	122	(19)	0.31	(0.141)	N4A15
	5	(127.0)	120	300	28	(4)	0.38	(0.172)	N5A19
	5	(127.0)	240	500	47	(7)	0.38	(0.172)	N5A12
	5	(127.0)	240	1000	95	(15)	0.38	(0.172)	N5A20
	6	(152.0)	120	500	39	(6)	0.44	(0.200)	N6A19
	6	(152.0)	240	500	39	(6)	0.44	(0.200)	N6A20
	6	(152.0)	240	1000	78	(12)	0.44	(0.200)	N6A21
	6	(152.0)	480	1000	78	(12)	0.44	(0.200)	N6A225

CONTINUED

Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.



## FIREROD Cartridge Heaters

### Heater Part Numbers

Diameter in.	Sheath Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
3/4	6	(152.0)	240	1500	116	(18)	0.44	(0.200)	<b>N6A82</b>
	6	(152.0)	240	2000	155	(24)	0.44	(0.200)	<b>N6A22</b>
	7	(178.0)	120	500	33	(5)	0.51	(0.231)	<b>N7A15</b>
	7	(178.0)	240	500	33	(5)	0.51	(0.231)	<b>N7A1</b>
	7	(178.0)	240	1000	66	(10)	0.51	(0.231)	<b>N7A16</b>
	8	(203.0)	120	500	28	(4)	0.58	(0.263)	<b>N8A19</b>
	8	(203.0)	240	500	28	(4)	0.58	(0.263)	<b>N8A20</b>
	8	(203.0)	240	1000	57	(9)	0.58	(0.263)	<b>N8A21</b>
	8	(203.0)	240	2000	114	(17)	0.58	(0.263)	<b>N8A22</b>
	10	(254.0)	240	1000	45	(7)	0.72	(0.327)	<b>N10A15</b>
	10	(254.0)	240	2000	90	(14)	0.72	(0.327)	<b>N10A14</b>
	12	(305.0)	240	1000	37	(6)	0.84	(0.381)	<b>N12A15</b>
	12	(305.0)	240	2000	74	(11)	0.84	(0.381)	<b>N12A24</b>
	12	(305.0)	480	2000	74	(11)	0.84	(0.381)	<b>N12A198</b>
	12	(305.0)	240	4000	148	(23)	0.84	(0.381)	<b>N12A25</b>
	13	(330.0)	240	1000	34	(5)	0.93	(0.422)	<b>N13A26</b>
	14	(356.0)	240	1250	40	(6)	1.03	(0.467)	<b>N14A22</b>
	14	(356.0)	240	2500	79	(12)	1.03	(0.467)	<b>N14A20</b>
	14	(356.0)	240	4500	142	(22)	1.03	(0.467)	<b>N14A21</b>
	15	(381.0)	240	1500	44	(7)	1.09	(0.494)	<b>N15A26</b>
	16	(406.0)	240	1800	49	(8)	1.14	(0.517)	<b>N16A26</b>
	16	(406.0)	240	4700	129	(20)	1.14	(0.517)	<b>N16A18</b>
	18	(457.0)	240	2000	49	(8)	1.25	(0.567)	<b>N18A13</b>
	18	(457.0)	240	5000	122	(19)	1.25	(0.567)	<b>N18A15</b>
	20	(508.0)	240	1150	25	(4)	1.40	(0.635)	<b>N20A21</b>
	20	(508.0)	240	2250	49	(8)	1.40	(0.635)	<b>N20A22</b>
	20	(508.0)	240	5250	115	(18)	1.40	(0.635)	<b>N20A10</b>
	24	(610.0)	240	1375	25	(4)	1.80	(0.816)	<b>N24A24</b>
	24	(610.0)	240	2750	50	(8)	1.80	(0.816)	<b>N24A23</b>
	24	(610.0)	480	2750	50	(8)	1.80	(0.816)	<b>N24A78</b>
24	(610.0)	240	5500	100	(16)	1.80	(0.816)	<b>N24A13</b>	
36	(914.0)	240	2500	30	(6)	2.50	(1.13)	<b>N36A4</b>	

Heaters are manufactured to standard specifications. 12 inch crimped on GGS leads supplied unless otherwise specified.

# 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 alloy 800 sheath
- Watt densities up to 50 W/cm<sup>2</sup> (330 W/in<sup>2</sup>)

### 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

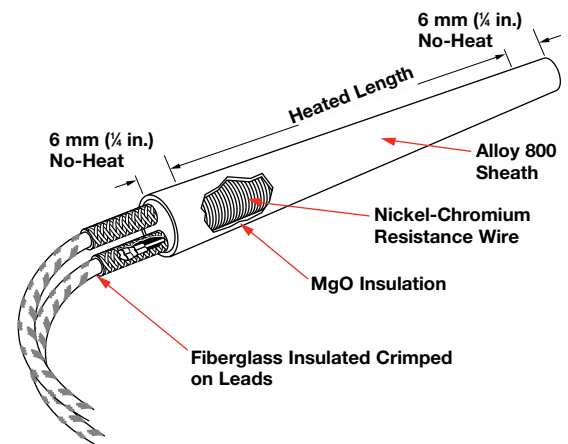
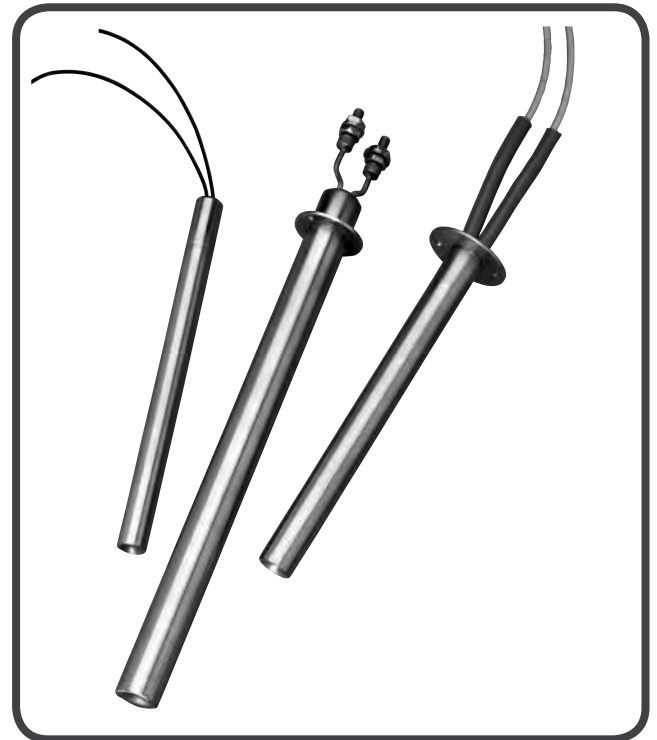
- Resists oxidation and corrosion from many chemicals, heat or atmospheres

#### 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 840°F (450°C)



### 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



## 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
<b>Crimped on Leads</b>						
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
<b>Swaged-in Leads</b>						
Max. Amperes	5.2/7.2 <sup>①</sup>	5.2/7.2 <sup>①</sup>	12.6	12.6	12.6/21 <sup>①</sup>	21
Max. Wattage @ 230V	1190/1650	1190/1650	2890	2890	2890/4830	4830
Max. Wattage @ 400V	—	—	—	5040	5040/8400	8400

<sup>①</sup>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, -0.12 mm (-0.0008 in., -0.0047 in.)

**Length:** ±2% with ±2.4 mm (±<sup>3</sup>/<sub>32</sub> 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 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.

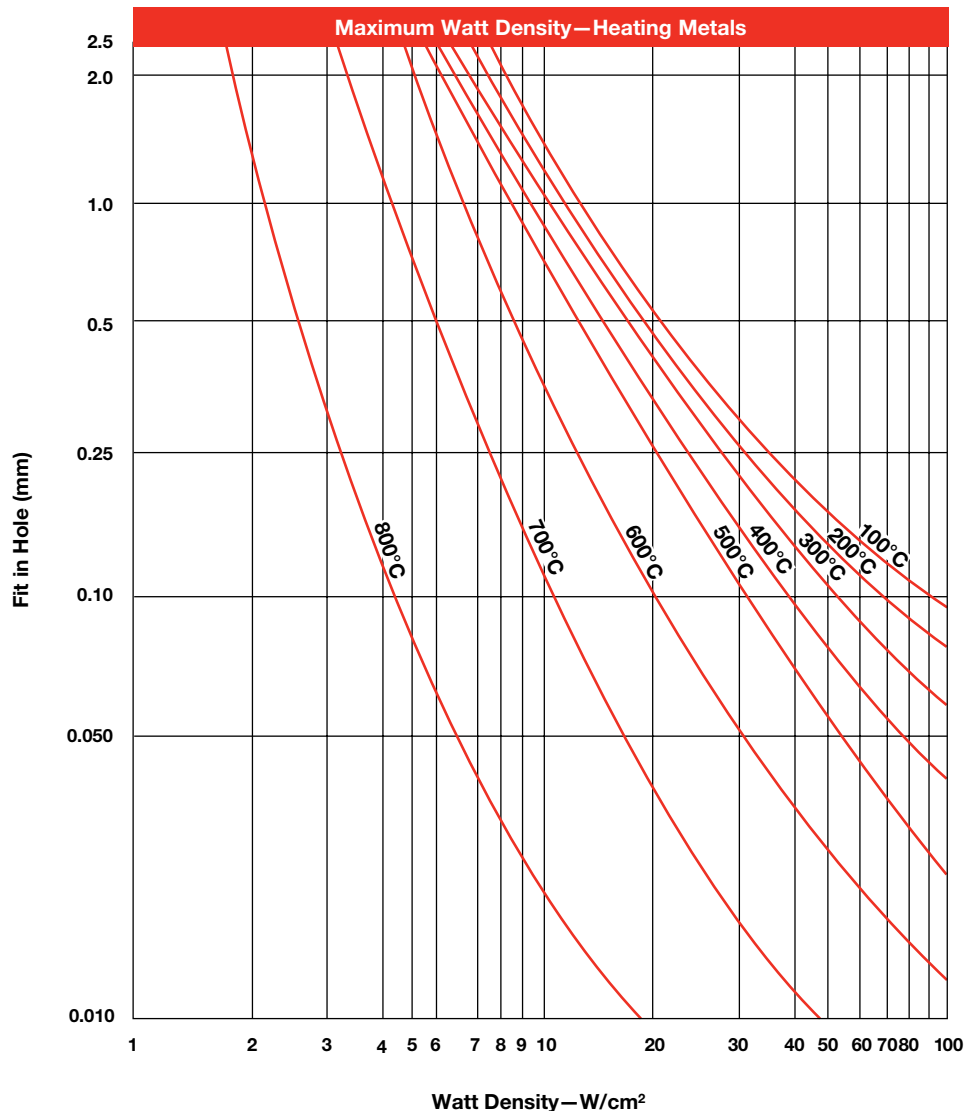
### Heating Metals

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 - 0.12 mm. The hole fit would be 0.22 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 <sup>①</sup> and <sup>②</sup>.



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

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

# Cartridge/Insertion Heaters

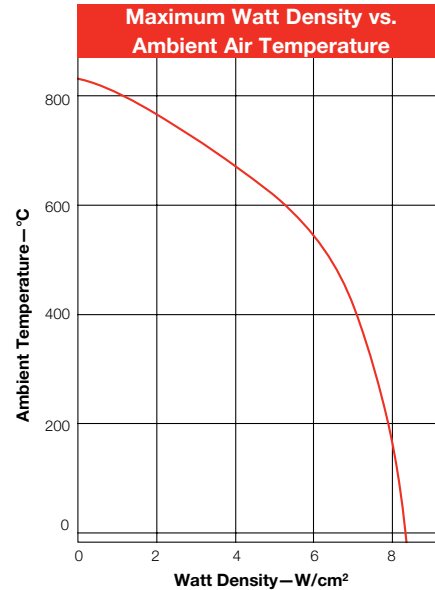


## Metric FIREROD Cartridge Heaters

### Maximum Allowable Watt Density (Continued)

#### Watt Density vs. Ambient Air

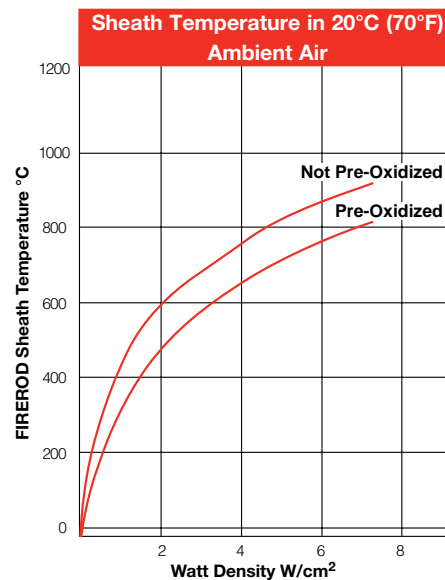
The *Watt Density vs. Ambient Air Temperature* graph shows the maximum allowable watt density when one metric FIREROD heater is operated in air or similar gas. For metric FIRERODs grouped in a single row, with no less than one diameter between elements, multiply value from graph by 0.95. When a reflector 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.

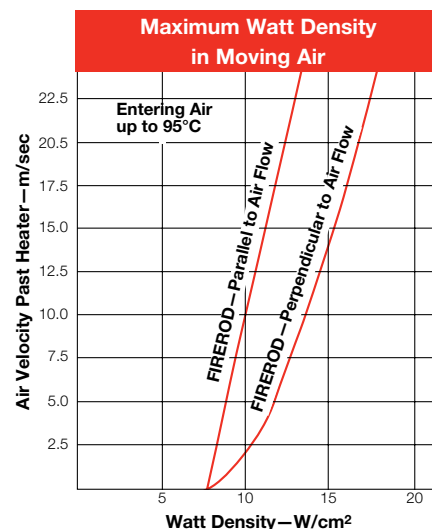
At 7 W/cm<sup>2</sup> (44 W/in<sup>2</sup>), the sheath temperature will be 790°C (1450°F). At this temperature, one year of heater life would be expected, provided cycling is not too frequent. Higher temperatures would result in reduced heater life.



#### 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 m<sup>3</sup>/s (or CFM), divide this value by the net free area in m<sup>2</sup> (or ft<sup>2</sup>) 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.





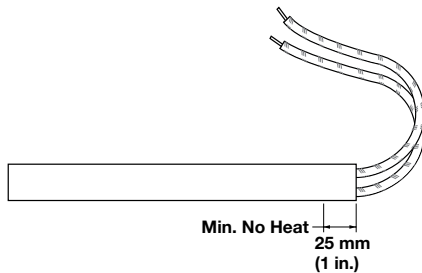
# Cartridge/Insertion Heaters



## 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 (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**.

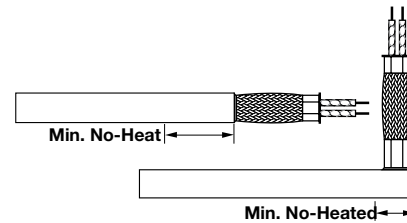
#### Right Angle Leads



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



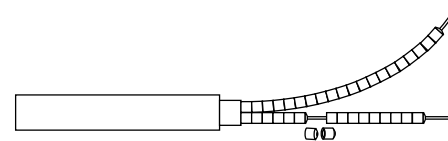
A stainless steel braid is designed to protect leads from abrasion against sharp edges. It is the most flexible of Watlow's protective lead arrangements.

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 (1 1/16)
16.0	30 (1 1/8)	20 (3/4)
20.0	30 (1 1/8)	21 (1 3/16)

#### 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.

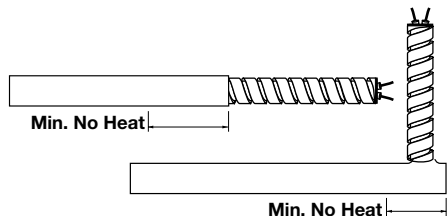
# Cartridge/Insertion Heaters



## Metric FIREROD Cartridge Heaters

### Termination Options (Continued)

#### Stainless Steel Hose

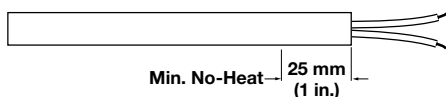


Stainless steel hose provides the best protection against abrasion from sharp edges or abrasive equipment. It also offers ease of handling and wiring in abrasive environments.

When the leads exit at a right angle to the heater, the hose is silver soldered to the sheath. Unless otherwise specified, leads are 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 <sup>1</sup> / <sub>8</sub> )	N/A	4.7 (3 <sup>1</sup> / <sub>16</sub> )
8.0	30 (1 <sup>1</sup> / <sub>8</sub> )	15 (9 <sup>9</sup> / <sub>16</sub> )	5.7 (7 <sup>7</sup> / <sub>32</sub> )
10.0	30 (1 <sup>1</sup> / <sub>8</sub> )	17 (2 <sup>2</sup> / <sub>3</sub> )	7.6 (3 <sup>3</sup> / <sub>10</sub> )
12.5	30 (1 <sup>1</sup> / <sub>8</sub> )	18 (1 <sup>11</sup> / <sub>16</sub> )	9.5 (3 <sup>3</sup> / <sub>8</sub> )
16.0	30 (1 <sup>1</sup> / <sub>8</sub> )	20 (3 <sup>3</sup> / <sub>4</sub> )	12.7 (1 <sup>1</sup> / <sub>2</sub> )
20.0	30 (1 <sup>1</sup> / <sub>8</sub> )	21 (1 <sup>13</sup> / <sub>16</sub> )	15.8 (5 <sup>5</sup> / <sub>8</sub> )

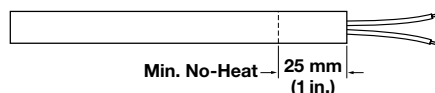
#### PTFE Seal and Leads



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.

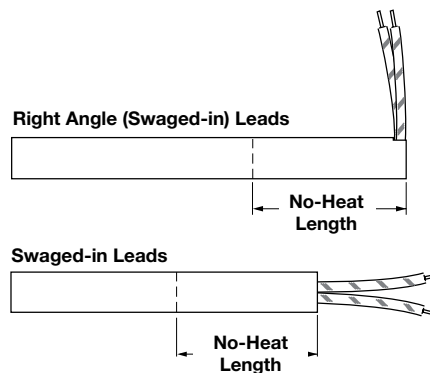
#### Silicone Rubber Seal and Leads



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.

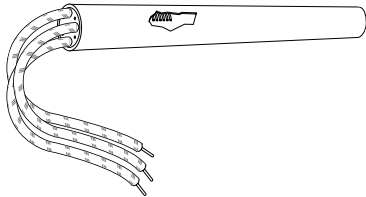
# Cartridge/Insertion Heaters



## Metric FIREROD Cartridge Heaters

### Termination Options (Continued)

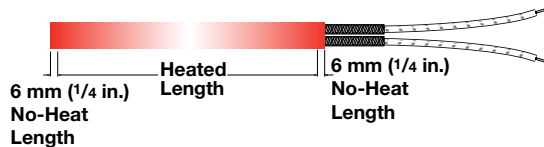
#### Ground Lead



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**.

### Options

#### Distributed Wattage

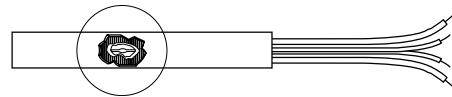


Distributed wattage varies the watt density along the length of the heater. This construction technique is used to compensate for heat losses along the edges of heated parts. To order, specify **distributed wattage** and give the length and wattage for each section.

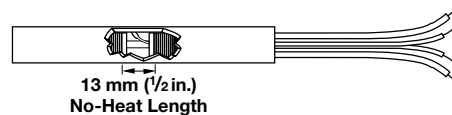
### Options (Continued)

#### Internal Thermocouple Sensors

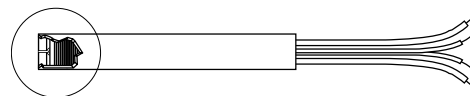
##### Style A



##### 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.

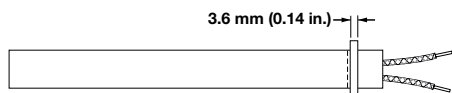
# Cartridge/Insertion Heaters



## Metric FIREROD Cartridge Heaters

### Mounting Options

#### Locating Ring



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

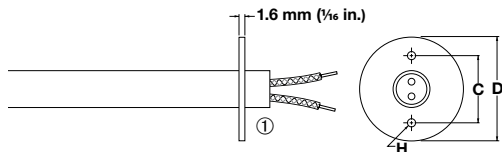
For LA, specify the location if the no-heat extension option is requested. On FIRERODs with crimped on leads without the LA option, the locating ring will be located on the last 1/4 in. (6 mm).

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)

#### 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.

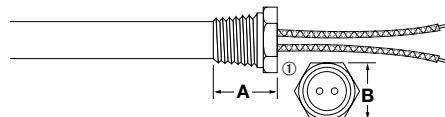
Metric FIREROD Diameter mm	Flange Size	D mm (in.)	C mm (in.)	H mm (in.)
6.5, 8, 10, 12.5, 16 <sup>②</sup>	FS	25.4 (1)	19.1 (3/4)	3.7 (9/64)
6.5, 8, 10, 12.5, 16, 20	FM	38.1 (1 1/2)	28.6 (1 1/8)	4.3 (3/16)
16, 20	FL	51.0 (2)	38.1 (1 1/2)	5.3 (13/64)

<sup>①</sup> Swaged-in unit pictured.

<sup>②</sup> FS flange for 16 mm diameter is without holes.

#### 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 (7/16)	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 (1 1/16)	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 (3/5)	24 (15/16)	9.0 (3/8)
20.0	22 (7/8)	M26 X 1.5	16.0 (5/8)	30 (1 3/8)	10.0 (3/8)

<sup>①</sup> 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. 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 (1 1/20)	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 (1 1/16)	14.0 (1 1/20)
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

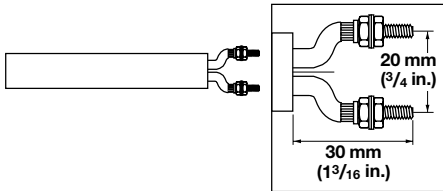
**EXTENDED  
CAPABILITY**



## Extended Capabilities for Metric FIREROD Cartridge Heaters

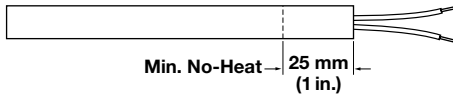
### Termination Options

#### 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**.

#### Epoxy Seal and Leads



Made-to-order epoxy seal and leads protect the heater against moisture and contamination from lubricating oil, cleaning solvents, plastic material, fumes and organic tapes. This seal is effective up to 302°F (150°C) under continuous operation.

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

### Options

#### 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.

**Note:** Extended Capabilities are subject to a business case review.

# Cartridge/Insertion Heaters

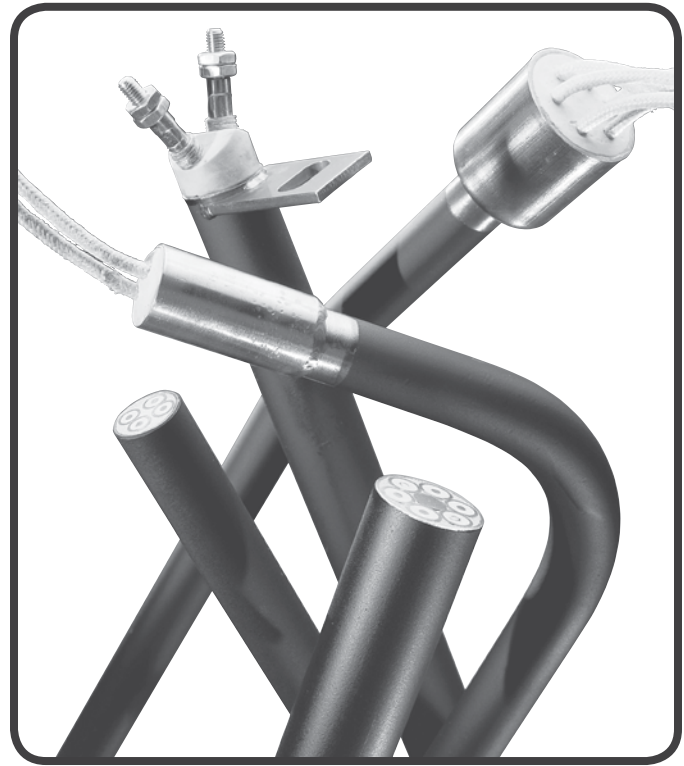
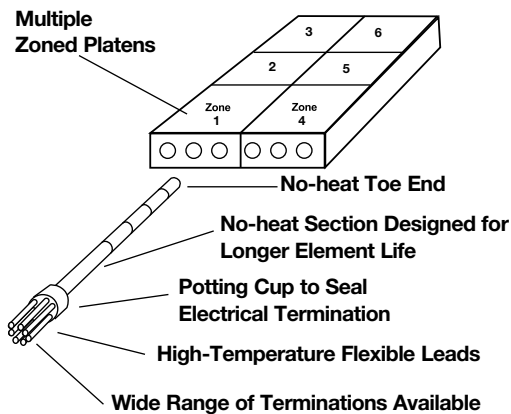


## MULTICELL™ Heaters

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.

### Performance Capabilities

- Engineered to achieve sheath temperatures up to 2050°F (1120°C)
- Up to six independently controllable zones



### 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

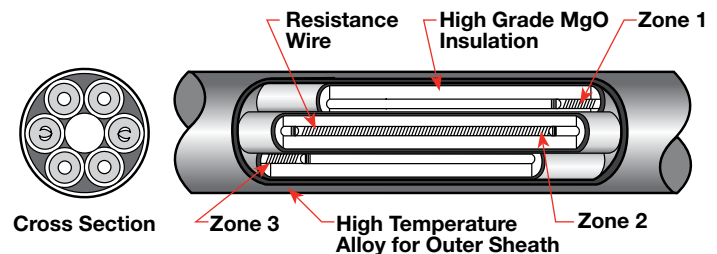
#### Oxidized sheath

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

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

- Provides maximum protection against element burnout through the outer sheath

#### Independently Controllable Heated Zones



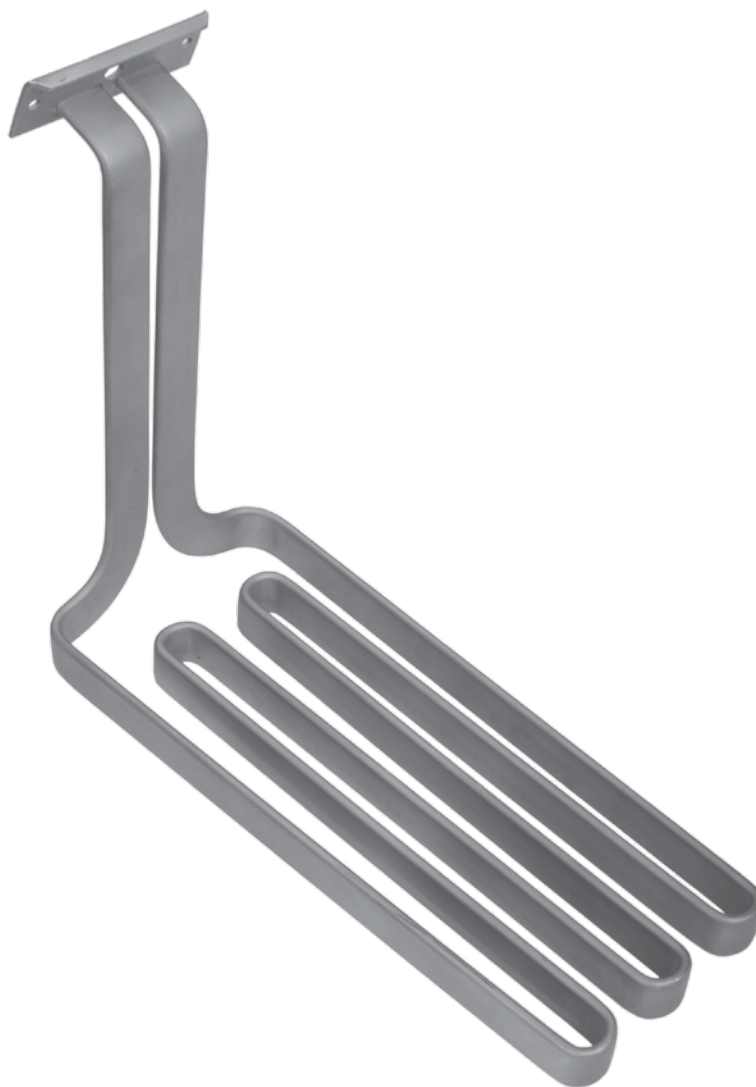
For detailed product and technical data,  
see the full MULTICELL product  
section located on pages 411 through 416.

# Tubular Heaters



Tubular Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
<b>WATROD™</b> Single-Ended Double-Ended	Alloy 800/840	1600	870	45	6.9	<b>57</b>
	Stainless steel	1200	650	60	9.3	
	Steel	750	400	45	6.9	
	Alloy 600	1800	982	45	6.9	
<b>High-Temperature</b>	Alloy 600	1800	982	45	6.9	<b>80</b>
<b>MULTICOIL™</b>	Alloy 800	1400	760	45	6.9	<b>82</b>
	304 stainless steel	1200	650	45	6.9	
	316 stainless steel	1200	650	45	6.9	
<b>FIREBAR®</b> Single-Ended Double-Ended	Alloy 800/840	1400	760	60	9.3	<b>84</b>
	304 stainless steel	1200	650	60	9.3	
<b>FINBAR™</b> Single-Ended	304 stainless steel	1200	650	50	7.7	<b>103</b>

Tubular Heaters







# Tubular Heaters



## WATROD™ Single/Double-Ended Heaters

Available in single- or double-ended termination styles, the versatile and economical WATROD™ tubular heating element from Watlow® lends itself to virtually the entire range of immersion and air heating applications.

The single-ended WATROD tubular design has both terminals at one end. The opposite end is sealed. Flexible lead wires are 12 in. (305 mm) crimp connected to the terminal pin and have silicone-impregnated fiberglass oversleeves.

The double-ended WATROD, with its round cross-sectional geometry, is highly adaptable for bending—especially when bending is performed in the field. Watlow's double-ended MULTICOIL™ tubular elements offer various combinations of resistor coils and thermocouples inside one sheath. They have the ability to sense the heater's internal temperature accurately every time, or offer three-phase capability in one element.

Both single- and double-ended WATRODs share many construction features delivering long life—the resistance wire is centered in the heater sheath and electrically insulated with compacted, high-grade magnesium oxide for superior heating performance.

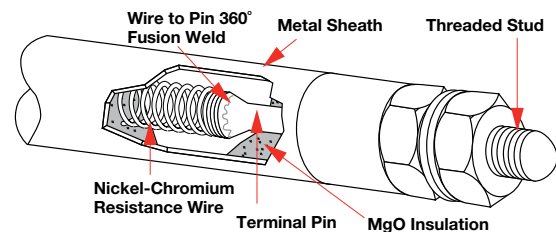
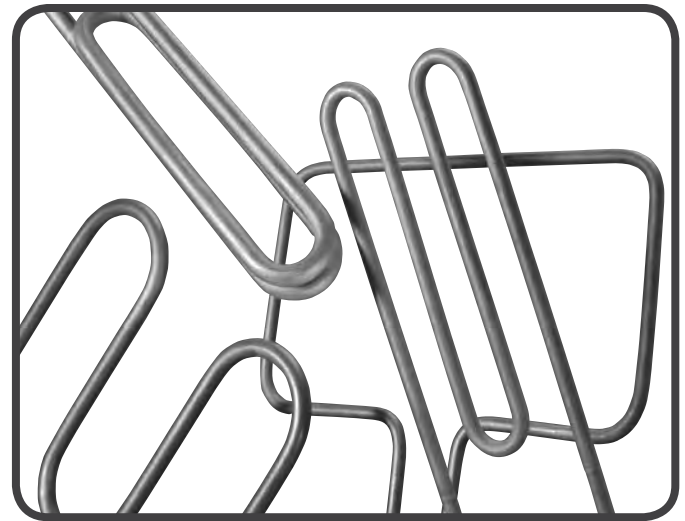
WATROD heating elements have a variety of mounting and termination options making them highly popular among industrial customers.

### Single-Ended WATROD Performance Capabilities

- Watt densities up to 45 W/in<sup>2</sup> (6.9 W/cm<sup>2</sup>)
- UL® and CSA component recognition up to 240VAC
- Alloy 800/840 and stainless steel sheath temperatures up to 1200°F (650°C)

### Double-Ended WATROD Performance Capabilities

- Watt densities up to 120 W/in<sup>2</sup> (18.6 W/cm<sup>2</sup>)
- UL® and CSA component recognition up to 600VAC
- Alloy 800/840 sheath temperatures up to 1600°F (870°C)
- Stainless steel sheath temperatures up to 1200°F (650°C)
- Steel sheath temperatures up to 750°F (400°C)
- Alloy 800 sheath temperatures up to 1800°F (982°C)



### Features and Benefits

#### Precision wound nickel-chromium resistance wire

- Distributes heat evenly to the sheath for optimum heater performance

#### Silicone resin seals

- Protects against moisture contamination and is rated to 221°F (105°C)

#### MgO insulation filled sheath

- Maximizes dielectric strength, heat transfer and life

#### Standard sheath materials

- Steel, 304 and 316 stainless steel, alloy 800/840 and alloy 600

#### 53 standard bend formations

- Allows forming the heating element to the application. Spirals, compound bends and multi-axis and multi-plane configurations

#### Stainless steel studs

- Fusion welded to terminal pins for mechanical strength

**Popular termination, mounting and moisture seal options available**

# Tubular Heaters



## WATROD Single/Double-Ended Heaters

### Specifications

#### Double-Ended

#### Single-Ended



<b>Applications</b>	Direct immersion Hot runner mold (manifold) Forced air Ovens Radiant Clamp-on	Vacuums Semiconductor	Platens Forced air Deicing antennas Plastic wrap cutting Seal bars
<b>Watt Density</b> W/in <sup>2</sup> (W/cm <sup>2</sup> )	Catalog P/N: Standard:	up to 60 (9.3) up to 120 (18.6)	Catalog P/N: Standard:
			up to 20 (3.1) up to 45 (6.9)
<b>Element Diameters</b> in. (mm) <b>and Surface Area per Linear</b> in <sup>2</sup> (cm <sup>2</sup> ) Diameter Tolerance ± 0.005 in. (0.13 mm)	<b>Dia.</b> 0.210 0.260 0.315 0.375 0.430 0.475	<b>in<sup>2</sup></b> 0.660 0.817 0.990 1.178 1.351 1.492	<b>Dia. (mm)</b> (5.33) (6.60) (8.00) (9.53) (10.92) (12.07)
			<b>cm<sup>2</sup></b> (4.26) (5.27) (6.38) (7.60) (8.72) (9.63)
<b>Sheath Materials</b> <b>Max. Operating</b> <b>Temperature</b>	Standard: Alloy 800/840 316 SS Steel 304 SS Alloy 600	1600°F (870°C) 1200°F (650°C) 750°F (400°C) 1200°F (650°C) 1800°F (980°C)	Standard: Alloy 800/840 316 SS 304 SS 1200°F (650°C) 1200°F (650°C) 1200°F (650°C)
<b>Sheath Length By Diameter</b> in. (mm)	<b>Dia.</b> Standard: 0.210 0.260 0.315 0.375 0.430 0.475	<b>Sheath Length (in.)</b> 9 to 130 9 to 270 9 to 270 11 to 360 11 to 360 11 to 275	<b>Sheath Length (mm)</b> (5.33) (230 to 3300) (6.60) (230 to 6858) (8.00) (230 to 6858) (9.53) (280 to 9144) (10.92) (280 to 9144) (12.07) (280 to 6985)
			<b>Dia.</b> Standard: 0.375 0.430 0.475
			<b>Sheath Length (in.)</b> 11 to 125 11 to 106 11 to 125
			<b>Dia. (mm)</b> (9.53) (10.92) (12.07)
			<b>Sheath Length (mm)</b> (280 to 3175) (280 to 2690) (280 to 3175)
<b>Min. No-Heat Length</b> in. (mm)	<b>Sheath Length</b> 11 to 20 21 to 50 51 to 80 81 to 110 111 to 140 141 to 170 171 to 200 201 & up	<b>No-Heat Length</b> 1 1 <sup>1</sup> / <sub>4</sub> 1 <sup>1</sup> / <sub>2</sub> 1 <sup>5</sup> / <sub>8</sub> 1 <sup>3</sup> / <sub>4</sub> 2 2 <sup>1</sup> / <sub>4</sub> 2 <sup>1</sup> / <sub>2</sub>	<b>Sheath Length</b> (280 to 510) (535 to 1270) (1295 to 2030) (2055 to 2795) (2820 to 3555) (3580 to 4320) (4345 to 5080) (5105 & up)
			<b>No-Heat Length</b> (25) (32) (38) (42) (44) (51) (57) (64)
			<b>Sheath Length</b> 11 to 20 21 to 50 51 to 80 81 to 110 111 to 125
			<b>No-Heat Length</b> 1 <sup>1</sup> / <sub>2</sub> 1 <sup>3</sup> / <sub>4</sub> 2 <sup>1</sup> / <sub>8</sub> 2 <sup>3</sup> / <sub>8</sub> 2 <sup>5</sup> / <sub>8</sub>
			<b>Sheath Length</b> (280 to 5100) (533 to 1270) (1295 to 2030) (2055 to 2795) (2820 to 3175)
			<b>No-Heat Length</b> (38) (44) (54) (60) (67)
			<b>½ in. (13 mm) No-heat length on all blunt ends</b>
<b>Max. Voltage/Amperage</b> <b>By Dia.</b> in. (mm)	<b>Dia.</b> 0.260 (6.6) 0.315 (8.0) 0.375 (9.53) 0.430 (10.92) 0.475 (12.07)	<b>Volts</b> 250VAC 480VAC 480VAC 600VAC 600VAC	<b>Amperes</b> 15 30 30 40 40
			<b>Dia.</b> 0.375 (9.53) 0.430 (10.92) 0.475 (12.07)
			<b>Volts</b> 480VAC 480VAC 480VAC
			<b>Ampere</b> 30 30 30

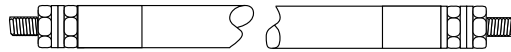
# Tubular Heaters



## WATROD Single/Double-Ended Heaters

Specifications (Continued)

### Double-Ended



### Single-Ended



Ohms Per Heated Inch By Dia. in.	Double-Ended			Single-Ended		
	Dia.	Min.	Max.	Dia.	Min.	Max.
0.210	0.130Ω	14Ω		0.375	0.150Ω	25Ω
0.260	0.080Ω	16Ω		0.430	0.150Ω	24Ω
0.315	0.050Ω	25Ω		0.475	0.150Ω	22Ω
0.375	0.030Ω	20Ω				
0.430	0.030Ω	25Ω				
0.475	0.035Ω	25Ω				
<b>Terminations</b>	Standard:	Threaded stud Screw lug (plate) Quick connect (spade) Flexible lead wires		Standard:	Flexible lead wires	
<b>Seals</b>	Standard:	Silicone resin 221°F (105°C) Ceramic base 2800°F (1535°C) Ceramic-to-metal 482°F (250°C) Silicone rubber (RTV) 392°F (200°C) Silicone resin 392°F (200°C) Epoxy resin 194/356°F (90/180°C)		Standard:	Silicone resin 221°F (105°C) Silicone rubber (RTV) 500°F (260°C) Epoxy resin 194/356°F (90/180°C)	
<b>Mounting Options</b>		Threaded bulkheads Mounting brackets Locator washers			Threaded bulkhead Locator washers Single leg bracket	
<b>Surface Finish Options</b>		Oxide anneal Bright anneal Passivation			Oxide anneal Bright anneal Passivation	
<b>Agency Recognition</b>		UL® component to 480VAC (File # E52951/E56488) CSA component to 600VAC (File # 31388)			UL® component to 240VAC (File # E52951) CSA component to 240VAC (File # 31388) ①	

① Not applicable to 0.375 inch diameter single-ended WATROD.

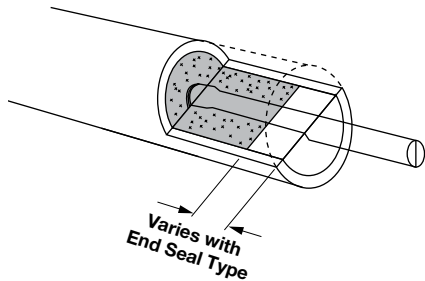
# Tubular Heaters



## WATROD Single/Double-Ended Heaters

### Options

#### Moisture Resistant Seals



WATROD's MgO insulating material is hygroscopic. To control the rate of moisture entering the heater, an appropriate moisture seal must be used. Choosing the correct seal is important to the life and performance of the heater. All materials have varying rates of gas vapor transmission. Be sure the maximum continuous use temperature is not exceeded at the seal location. Most end seals are applied with a small cavity in the end of the heater. The seal will also help prevent arcing at the terminal ends.

#### Zoned Heaters

Single zone heaters are only available.

#### End-Seal Options

End-Seal	Color	UL® Recognition	Max. Cont. Use Temperature	Typical or General Usage/Application
Standard Epoxy	Cream	Yes	194°F (90°C)	Long term stable insulation resistance
Intermediate Epoxy	Gray	Yes	356°F (180°C)	Long term stable insulation resistance
High-Temp. Epoxy	Amber	No	450°F (232°C)	Long term stable insulation resistance
Silicone Resin	Clear	Yes	221°F (105°C)	General usage on tubular products - porous
Silicone Fluid	Clear	Yes	392°F (200°C)	Moisture resistance of the MgO, or high temperature ceramic seal (storage only) - porous
Lavacone	Dark Brown	Yes	221°F (105°C)	Porous seal for the FIREBAR
Silicone Rubber RTV	Red-Orange	Yes	392°F (200°C)	General usage on FIREBAR applications - porous
High-Temperature Ceramic	White	Yes	2800°F (1538°C)	Very high-temperature applications - for extremely low vapor transmission rate

#### External Finishes

##### Bright Annealing

Bright annealing is a process that produces a smooth, metallic finish. It is a special annealed finish created in a non-oxidizing atmosphere. This finish is popular in the pharmaceutical and food and beverage markets.

To order, specify **bright annealing**.

##### Passivation

During the manufacturing process, particles of iron or tool steel may become embedded in the stainless steel or alloy sheath. If not removed, these particles may corrode, produce rust spots and/or contaminate the process. For critical sheath applications, passivation will remove free iron from the sheath.

To order, specify **passivation**.

# Tubular Heaters



## WATROD Single/Double-Ended Heaters

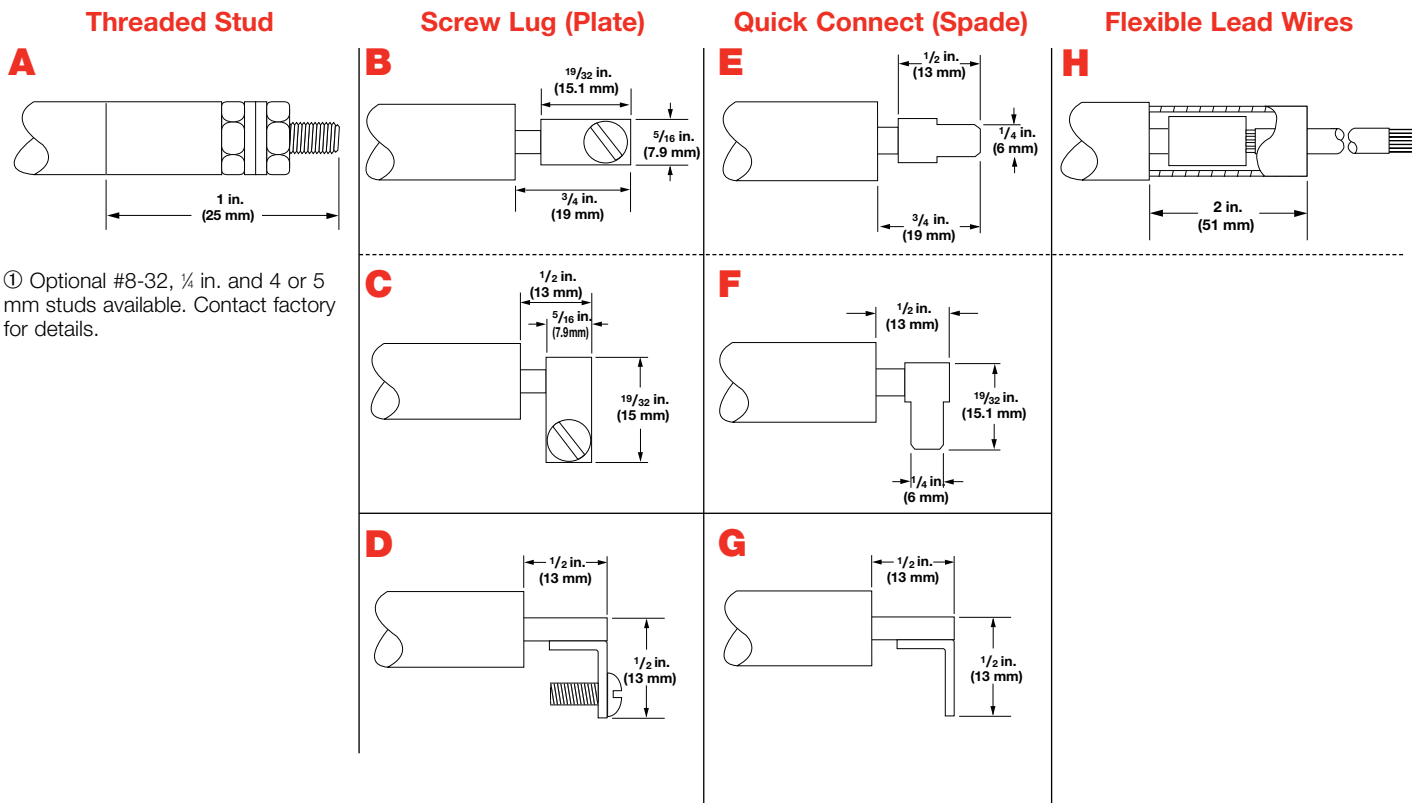
### Terminations

Double-ended WATROD elements are available with a variety of terminations. Single-ended WATROD elements are available with only flexible lead wires.

The following table and illustrations detail the terminations available with double- or single-ended WATRODs—for each available sheath diameter.

Flexible lead wires are 12 in. (305 mm), Sil-A-Blend® 390°F (200°C) unless otherwise specified. Insulation options include TGGT 480°F (250°C) plus other temperature ratings. Contact your Watlow representative.

WATROD Element	Sheath Diameter		Threaded Stud ①	Screw Lug (Plate)				Quick Connect (Spade)			Flexible Lead Wires
	in.	(mm)	A	B	C	D	E	F	G	H	
Double-Ended	0.260	(6.6)	#6-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	0.315	(8.0)	#10-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	0.375	(9.5)	#10-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	0.430	(10.9)	#10-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	0.475	(12.1)	#10-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Single-Ended	0.375	(9.53)	No	No	No	No	No	No	No	No	Yes
	0.430	(10.9)	No	No	No	No	No	No	No	No	Yes
	0.475	(12.1)	No	No	No	No	No </td <td>No</td> <td>No</td> <td>No</td> <td>Yes</td>	No	No	No	Yes





## WATROD Single/Double-Ended Heaters

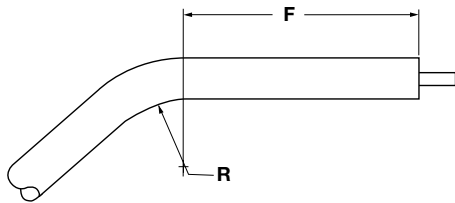
### Bend Formations

#### Double-Ended WATROD Bend Formations

Double-ended WATROD heating elements can be formed into spirals, compounds, multi-axis and multi-planes from 36 common bend configurations. Custom bending with tighter tolerances can be made to meet specific application needs.

Formation is limited by the minimum bend radius (R) and the straight length (F) required beyond the bend. In order to locate the end of a heated length within a bend, the radius must be 3 in. (76 mm) or larger. Additionally, overall length tolerance (T) must be included in one or more of the straight lengths.

Minimum radius for various sheath diameters and lengths are shown in the *Bend Formations* chart below. Illustrated on pages 62 to 71 are the 56 common bend configurations available on both standard and made-to-order WATROD heating elements.



#### Single-Ended WATROD Bend Formations

Watlow does not recommend field bending single-ended WATROD elements. Formation is limited by the minimum radius of a bend (R) and the straight length (F) beyond the bend. The radius must be 3 in. (75 mm) or more for the heated length's end to be inside a bend.

Additionally, the overall length tolerance (T) must be provided for in one or more of the specified lengths.

The four common bend configurations available for standard and made-to-order single-ended WATROD elements are Figures 1, 6, 22 and 28.

To order a common bend formation, specify the **bend figure number**, dimensions and critical tolerances.

WATROD Minimum Radius				
Sheath Diameter in. (mm)	Field Bend R <sup>①</sup> in. (mm)	Factory R <sup>①</sup> in. (mm)	F <sup>②</sup> Dimension in. (mm)	
0.260 (6.6)	3/4 (19.0)	3/8 (9.5)	1/2 (13.0)	
0.315 (8.0)	3/4 (19.0)	1/2 (13.0)	1/2 (13.0)	
0.375 (9.52)	1 (25.0)	1/2 (13.0)	1/2 (13.0)	
0.430 (10.92)	1 (25.0)	1/2 (13.0)	3/4 (19.0)	
0.475 (12.07)	1 (25.0)	5/8 (15.9)	1 (25.0)	

① R is the inside radius of a bend.

② F is the distance from the sheath's end to the start of the first bend.

WATROD Length Tolerance (T)			
Sheath Length in. (mm)	Length Tolerance in. (mm)	Length Tolerance in. (mm)	Length Tolerance in. (mm)
11-50 (280-1270)	±1/8 (±3)	±1/8 (±3)	±1/8 (±3)
51-110 (1295-2795)	±3/16 (±5)	±3/16 (±5)	±3/16 (±5)
111-170 (2820-4320)	±1/4 (±6)	±1/4 (±6)	±1/4 (±6)
171-200 (4345-5080)	±3/8 (±10)	±3/8 (±10)	±3/8 (±10)
201 & up (5105 & up)	±1/2 (±13)	±1/2 (±13)	±1/2 (±13)

Figure 1

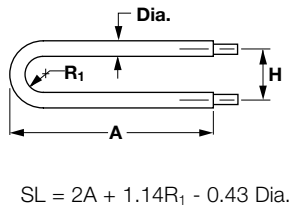
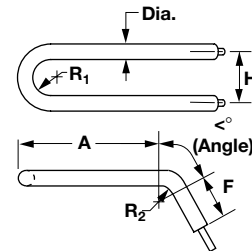


Figure 2



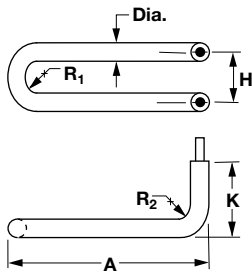
# Tubular Heaters



## WATROD Single/Double-Ended Heaters

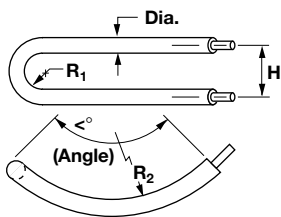
### Bend Formations (Continued)

Figure 3



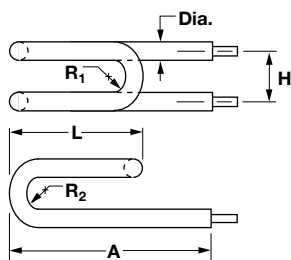
$$SL = 2K - 0.86R_2 - 2.86 \text{ Dia.} + 2A + 1.14R_1$$

Figure 5



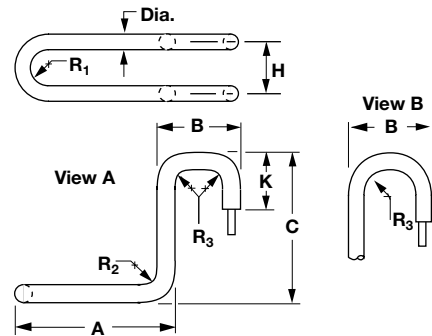
$$SL = 0.0175(\angle) (2R_2 + \text{Dia.}) + 1.14R_1 + 0.43 \text{ Dia.}$$

Figure 7



$$SL = 2A + 2.28R_2 - 1.29 \text{ Dia.} + 2L + 1.14R_1$$

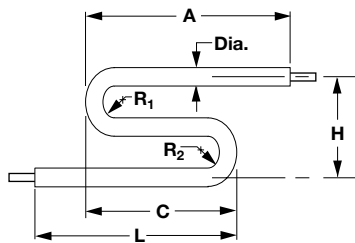
Figure 4



$$\text{View A: } SL = 2K - 1.72R_3 - 7.72 \text{ Dia.} + 2C - 0.86R_2 + 2A + 1.14R_1$$

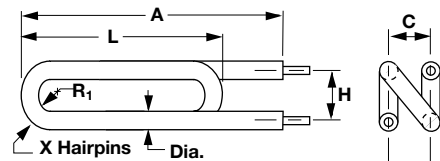
$$\text{View B: } SL = 2K - 2.28R_3 - 3.72 \text{ Dia.} + 2C - 0.86R_2 + 2A + 1.14R_1$$

Figure 6



$$SL = L + 1.14R_2 - 0.86 \text{ Dia.} + C + 1.14R_1 + A$$

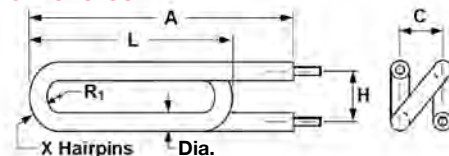
Figure 8



X = number of outside hairpins

$$SL = 2A + 3.42R_1 - 1.29 \text{ Dia.} + 2L$$

Figure 8 Reverse



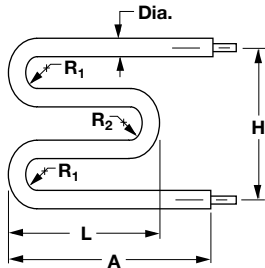
# Tubular Heaters



## WATROD Single/Double-Ended Heaters

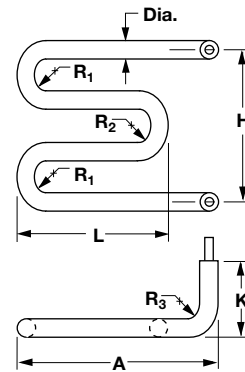
### Bend Formations (Continued)

Figure 9



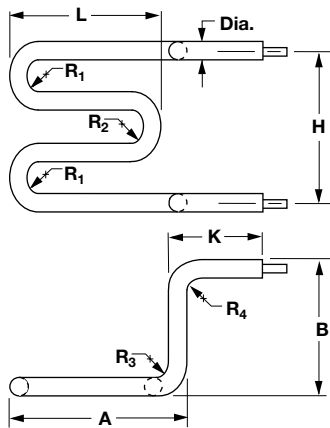
$$SL = 2A + 2.28R_1 - 1.29 \text{ Dia.} + 2L + 1.14R_2$$

Figure 10



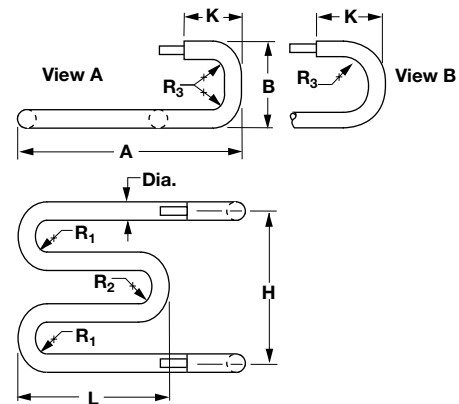
$$SL = 2K - 0.86R_3 - 3.72 \text{ Dia.} + 2A + 2L + 2.28R_1 + 1.14R_2$$

Figure 11



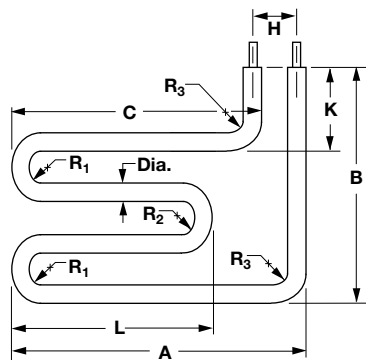
$$SL = 2K - 0.86R_3 - 0.86R_4 - 6.15 \text{ Dia.} + 2B + 2A + 2L + 2.28R_1 + 1.14R_2$$

Figure 12



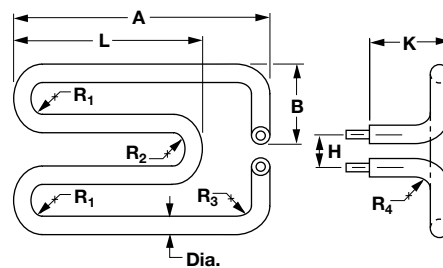
$$\begin{aligned} \text{View A: } SL &= 2K + 2B + 2A + 2L + 2.28R_1 + 1.14R_2 - 1.72R_3 - 6.15 \text{ Dia.} \\ \text{View B: } SL &= 2K + 2A + 2L + 2.28R_1 + 1.14R_2 - 2.28R_3 - 2.15 \text{ Dia.} \end{aligned}$$

Figure 13



$$SL = 2B + 2A + 2L - 6.717 \text{ Dia.} - 1.717R_1 - H - 0.858R_2 - 0.858R_3$$

Figure 14



$$SL + 2K + 2A + 2L + 2.28R_1 + 1.14R_2 + 2B - 6.15 \text{ Dia.} - 0.86R_3 + 0.86R_4$$



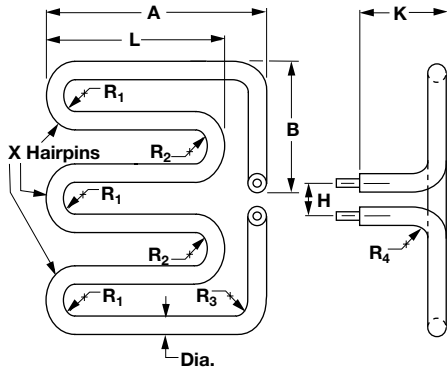
# Tubular Heaters



## WATROD Single/Double-Ended Heaters

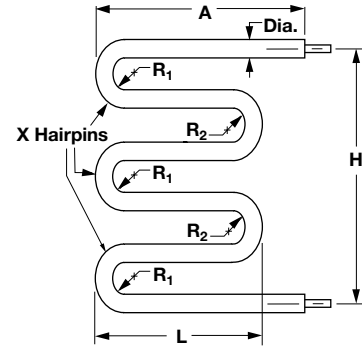
### Bend Formations (Continued)

Figure 15



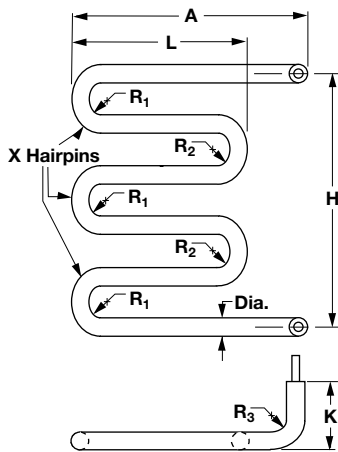
X = number of outside hairpins  
 $SL = 2K + 2A + 2K(X - 1) + 2B - 0.86R_3 - 0.86R_4 + 1.14R_1(X) + 1.14R_2(X - 1) - 4.86 \text{ Dia.} - (2X - 1) 0.43 \text{ Dia.}$

Figure 16



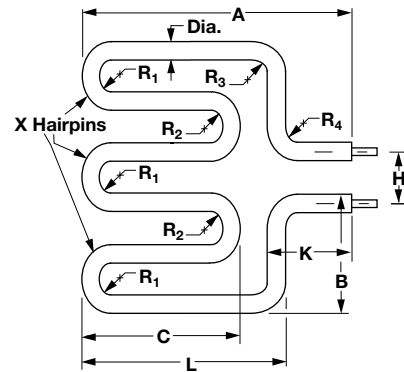
X = number of outside hairpins  
 $SL = 2A + 0.43 \text{ Dia.} (1 - 2X) + 2L(X - 1) + 1.14R_1 + 1.14R_2(X - 1)$

Figure 17



X = number of outside hairpins  
 $SL = 1.14R_2X - 0.88 \text{ Dia.} X - 1.14R_2 - 2 \text{ Dia.} + 1.14R_1 X - 0.86R_3 + 2L X - 2L + 2A + 2K$

Figure 18



X = number of outside hairpins  
 $SL = 2L + 2K + 2B + 2C(X - 1) - 0.86R_3 - 0.86R_4 - 4.86 \text{ Dia.} + 1.14R_1(X) + 1.14R_2(X - 1) - (2X - 1) 0.43 \text{ Dia.}$

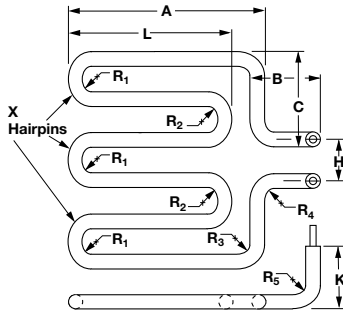
# Tubular Heaters



## WATROD Single/Double-Ended Heaters

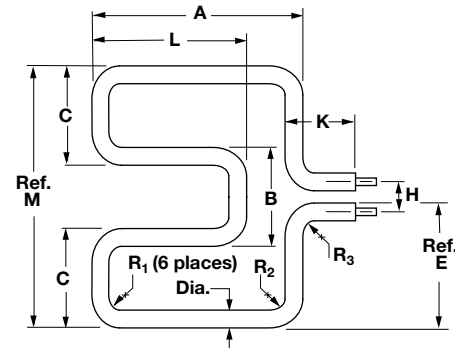
### Bend Formations (Continued)

Figure 19



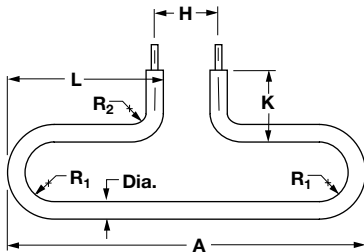
$$\begin{aligned}
 X &= \text{number of outside hairpins} \\
 SL &= 2K + 2A + 2B + 2C + 2L(X - 1) + 1.14R_1 \\
 &\quad (X) + 1.14R_2(X - 1) - 0.86R_3 - 0.86R_4 \\
 &\quad - 0.86R_5 - 7.29 \text{ Dia.} - (2X - 1) 0.43 \text{ Dia.}
 \end{aligned}$$

Figure 20



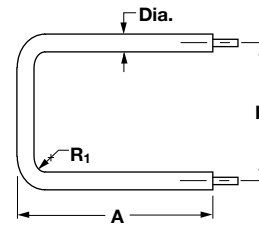
$$\begin{aligned}
 SL &= 2K + 2C + B + 2A + 2L - 2.58R_1 - 0.86R_2 - \\
 &\quad 0.86R_3 - 12.15 \text{ Dia.}
 \end{aligned}$$

Figure 21



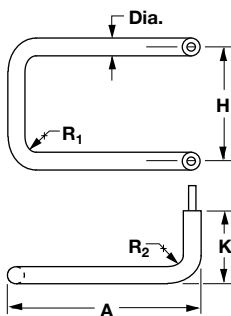
$$\begin{aligned}
 SL &= 2A + 2K - H - 2.28R_1 - 0.86R_2 \\
 &\quad - 3.29 \text{ Dia.}
 \end{aligned}$$

Figure 22



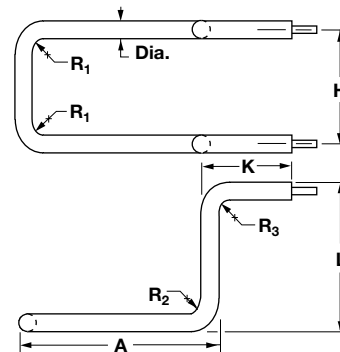
$$SL = 2A - 0.86R_1 - 1.43 \text{ Dia.} + H$$

Figure 23



$$SL = 2K - 0.86R_2 - 3.86 \text{ Dia.} + 2A - 0.86R_1 + H$$

Figure 24



$$\begin{aligned}
 SL &= 2K + 2L + H - 0.86R_1 - 0.86R_2 - 0.86R_3 \\
 &\quad - 7.29 \text{ Dia.}
 \end{aligned}$$

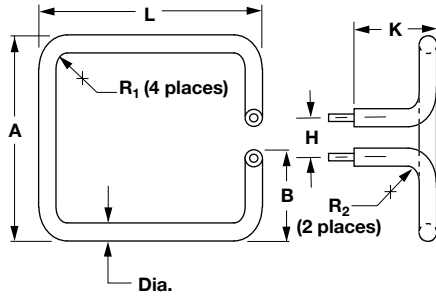
# Tubular Heaters



## WATROD Single/Double-Ended Heaters

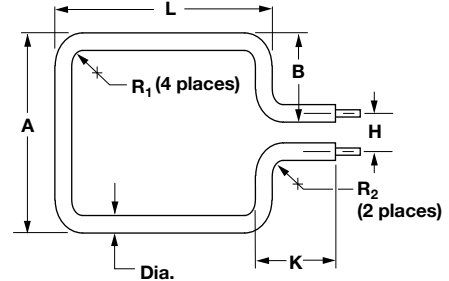
### Bend Formations (Continued)

Figure 25



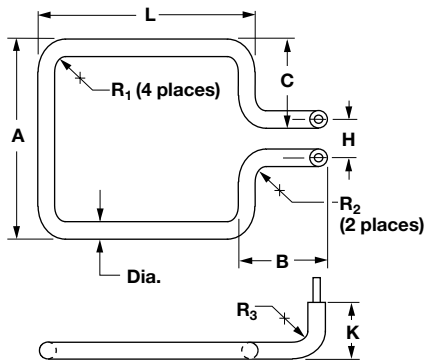
$$SL = 2K + 2A + 2L - H - 1.72R_1 - 0.86R_2 - 6.92 \text{ Dia.}$$

Figure 26



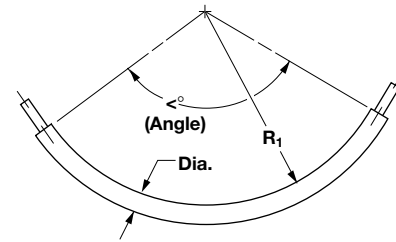
$$SL = 2K + 2A + 2L - H - 1.72R_1 - 0.86R_2 - 6.29 \text{ Dia.}$$

Figure 27



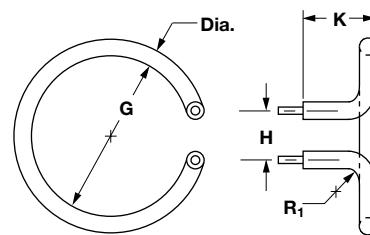
$$SL = 2K + 2A + 2L + 2B - H - 1.72R_1 - 1.72R_2 - 8.72 \text{ Dia.}$$

Figure 28



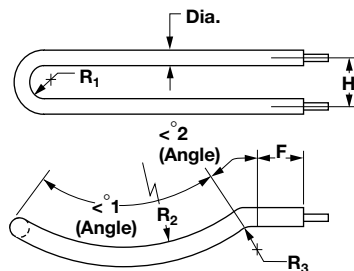
$$SL = 0.0175 \angle^\circ (R_1 + 0.5 \text{ Dia.})$$

Figure 30



$$SL = (G + \text{Dia.}) 3.14 + 1.14R_1 + 2K + 3.28 \text{ Dia.} - H$$

Figure 29



$$SL = 0.0175 \angle^{\circ 1} (2R_2 + \text{Dia.}) + 2F + 1.14R_1 + 0.0175 \angle^{\circ 2} (2R_3 + \text{Dia.}) - 0.43 \text{ Dia.}$$

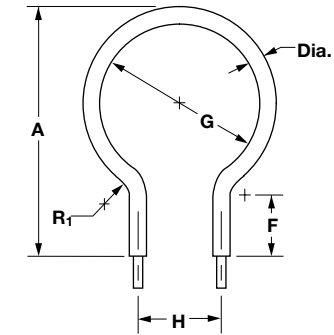
# Tubular Heaters



## WATROD Single/Double-Ended Heaters

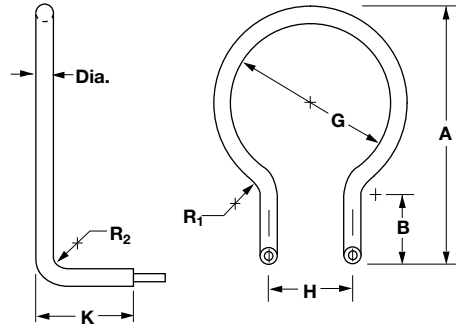
### Bend Formations (Continued)

Figure 31



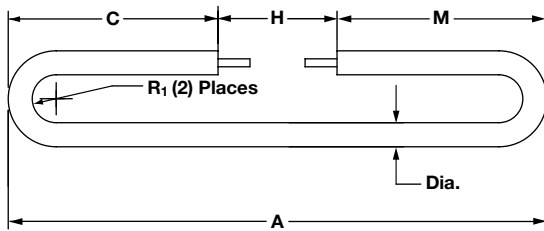
$$SL = (G + \text{Dia.}) 3.14 + 1.14R_1 + 2F + 3.71 \text{ Dia.} - H$$

Figure 32



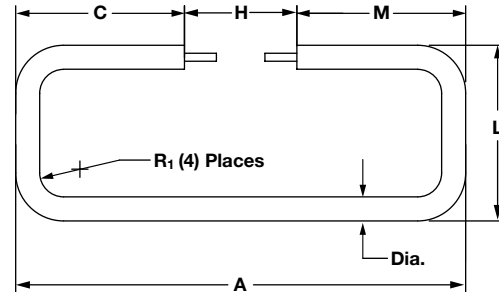
$$SL = (G + \text{Dia.}) 3.14 + 1.14R_1 + 2B + 1.14R_2 + 2K + 3.28 \text{ Dia.} - H$$

Figure 37



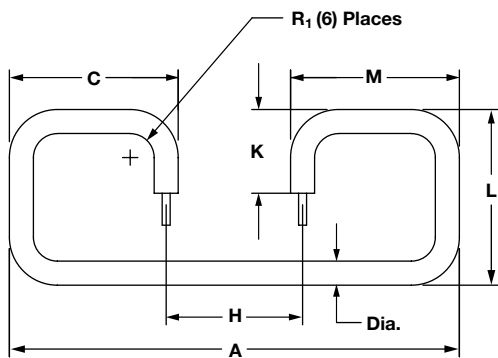
$$SL = (2A - H) + 2\pi R_1 - 2R_1$$

Figure 38



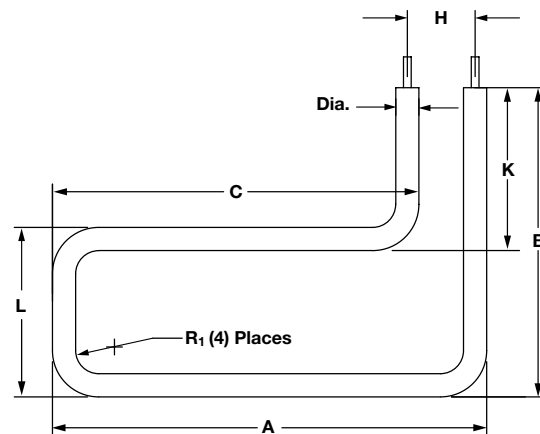
$$SL = (2A - H) + 2L + 2\pi R_1 - 4R_1$$

Figure 39



$$SL = (2A - H) + 2L + 2K + 3\pi R_1 - 6R_1$$

Figure 40



$$SL = (2A - H) + 2B + 2\pi R_1 - 4R_1$$

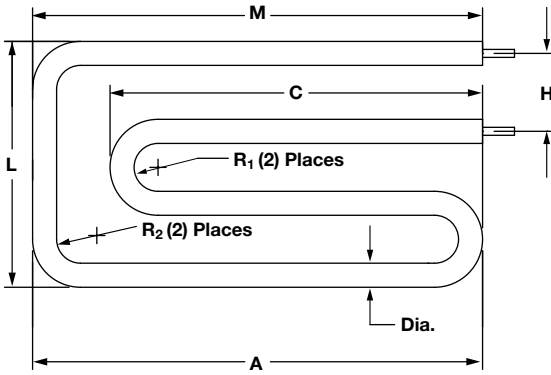
# Tubular Heaters



## WATROD Single/Double-Ended Heaters

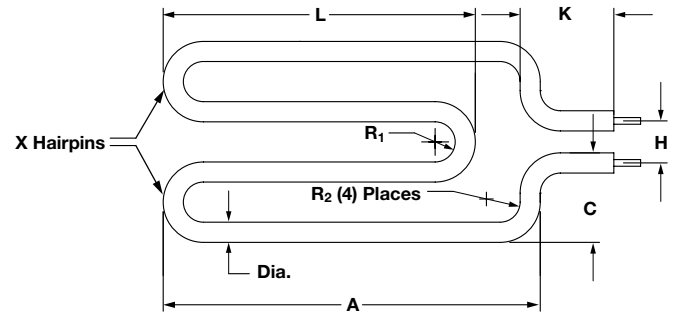
### Bend Formations (Continued)

Figure 41



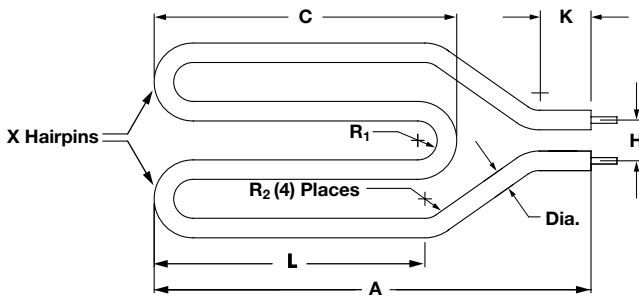
$$SL = 2A + 2C + L - H + 2\pi R_1 + \pi R_2 - 2R_1 \cdot 2R_2$$

Figure 42



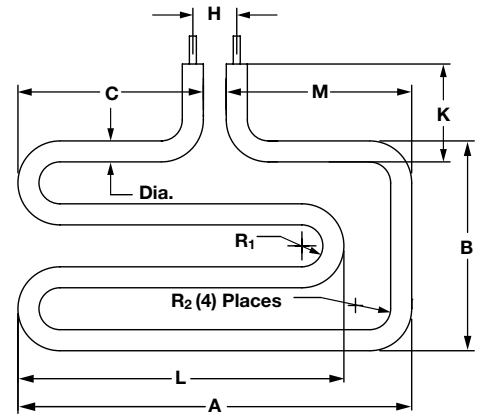
$$SL = 2A + (\#)L + 2K + 2C + 2\pi R_2 + (\# \text{ of } R_1) \pi R_1 - (\# \text{ of } R_1) R_1$$

Figure 43



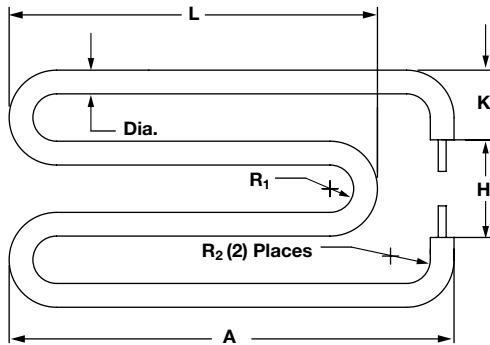
$$SL = 2A + (\#)C + (\# \text{ of } R_1) \pi + 2\pi R_2 - (\# \text{ of } R_1) R_1 - 4R_2$$

Figure 44



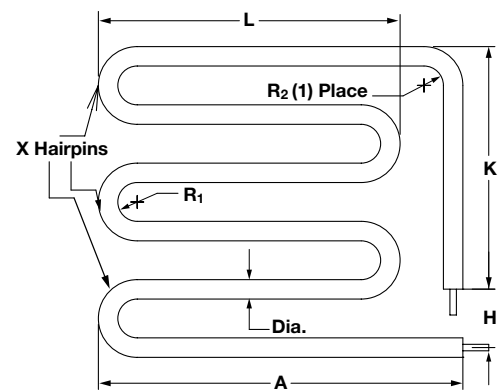
$$SL = 2A + 2L + B + 2K + 2\pi R_2 + 3\pi R_1 - 4R_2 - 3R_1$$

Figure 45



$$SL = 2A + 2L + 2K + 3\pi R_1 + \pi R_2 - 3R_1 - 2R_2$$

Figure 46



$$SL = 2A + (\#)L + K + (\# \text{ of } R_1) \pi + \pi R_2 - (\# \text{ of } R_1) R_1 - \frac{R_2}{2}$$

# Tubular Heaters



## WATROD Single/Double-Ended Heaters

### Bend Formations (Continued)

Figure 47

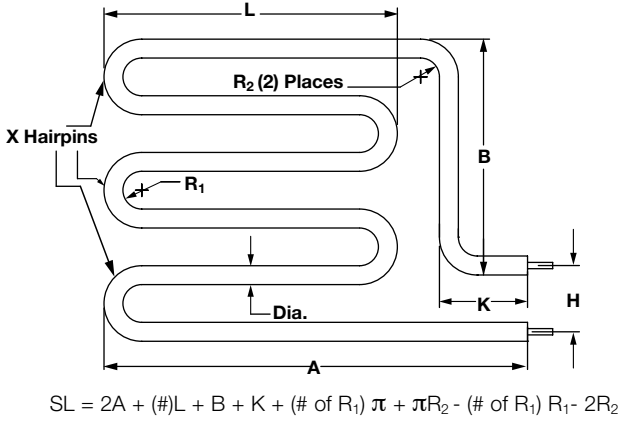


Figure 48

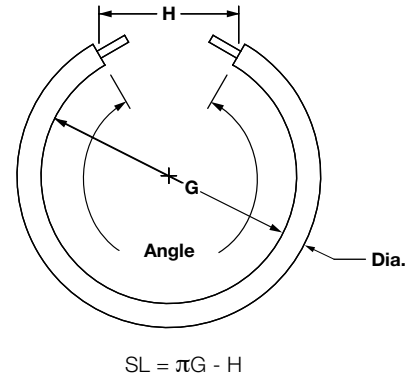


Figure 49

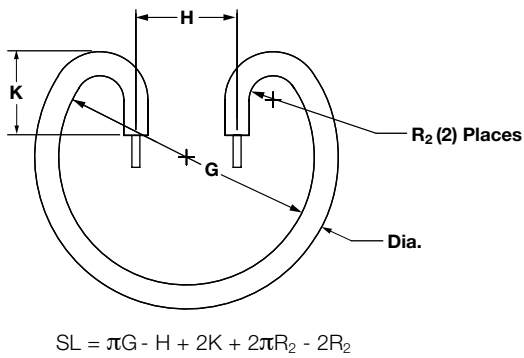


Figure 50

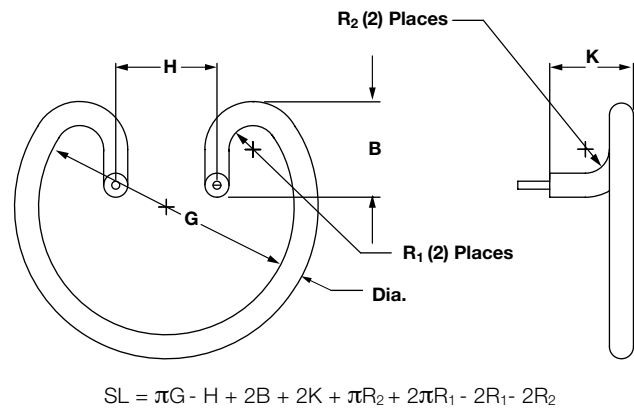


Figure 51

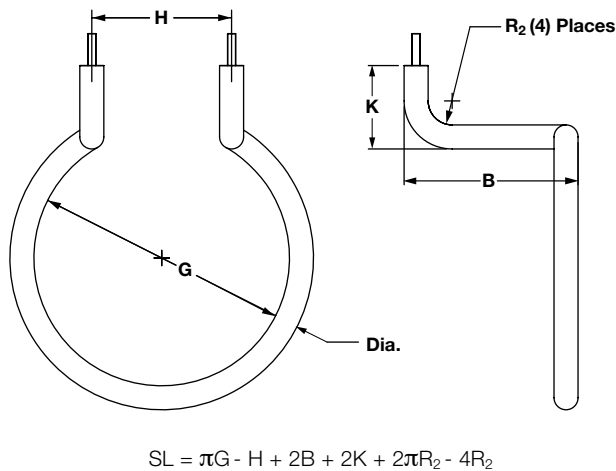
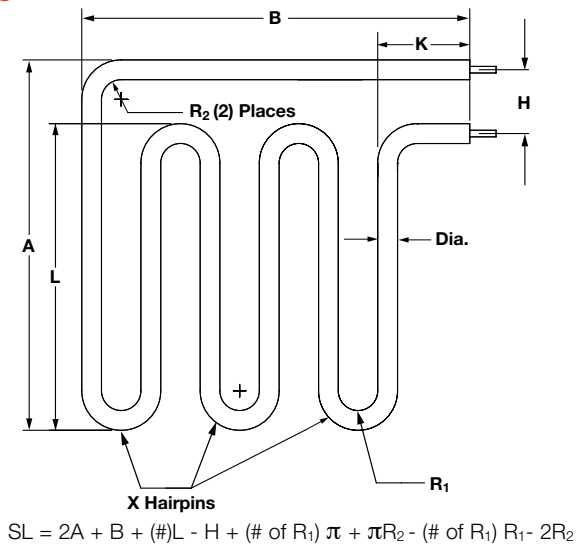


Figure 52



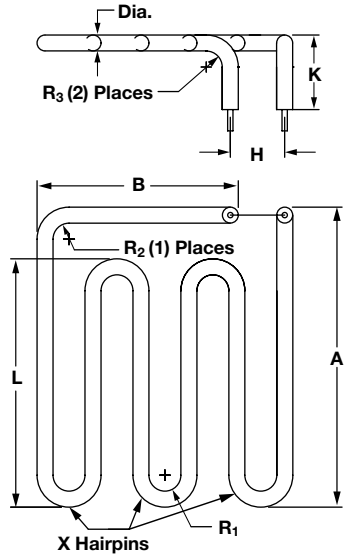
# Tubular Heaters



## WATROD Single/Double-Ended Heaters

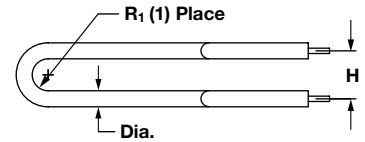
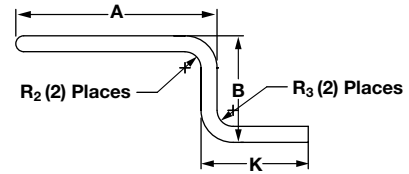
### Bend Formations (Continued)

Figure 53



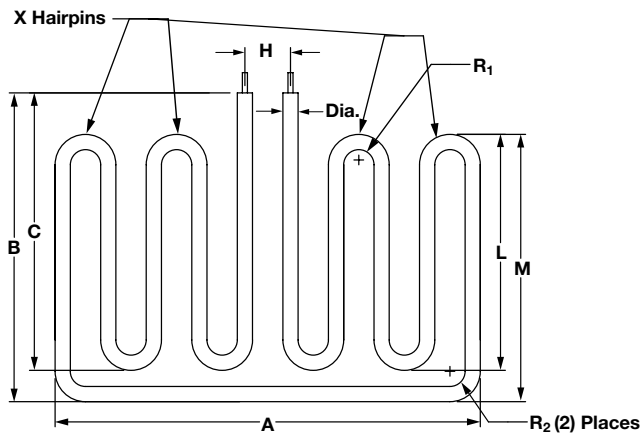
$$SL = 2A + (\#)L + B + 2K + (\# \text{ of } R_1)\pi + 2\left(\frac{\pi R_3}{2}\right) - (\# \text{ of } R_1)R_1 - 2R_3 - R_2$$

Figure 54



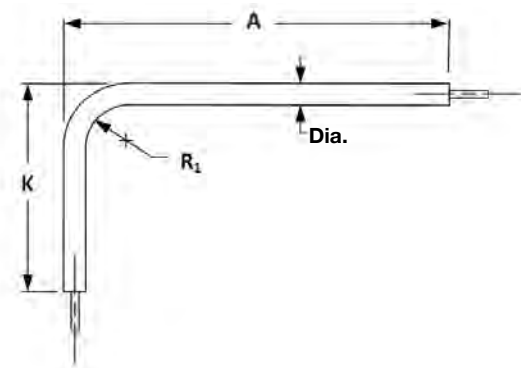
$$SL = 2A + 2B + 2K + \pi R_1 + 2\pi R_2 - R_1 - 4R_2$$

Figure 55



$$SL = A + 2C + 2M + (\#)L + (\# \text{ of } R_1)\pi + \pi R_2 - (\# \text{ of } R_1)R_1 - 2R_2$$

Figure 56



$$SL = A + K - 0.86R_1$$

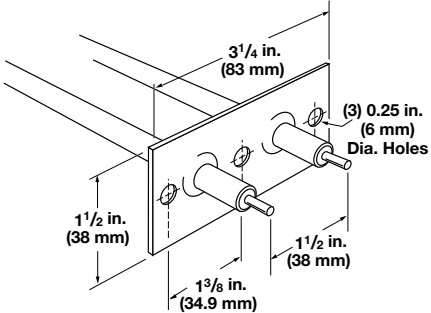
# Tubular Heaters



## WATROD Single/Double-Ended Heaters

### Mounting Methods

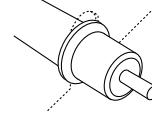
#### Brackets



A 0.065 in. (1.7 mm) thick stainless steel bracket provides element mounting in non-pressurized applications. Attached to the heater sheath, these brackets are not suited for liquid-tight mountings. The bracket is located 1/2 in. (13 mm) from the sheath's end, unless otherwise specified.

To order, specify **mounting bracket**.

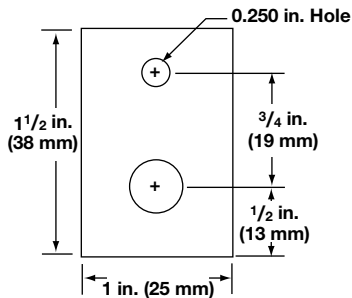
#### Locator Washers



Stainless steel locator washers retain the heated area of the sheath in the work zone, while allowing for expansion and contraction during cycling.

To order, specify **locator washer**, along with dimension from the heater's end.

#### Single Leg Bracket



A 1 1/2 in. (38 mm) x 1 in. (25 mm) wide x 16 gauge stainless steel bracket with one element hole and one mounting hole 1/2 in. (13 mm) from end.

To order, specify **single leg bracket**.



# Tubular Heaters



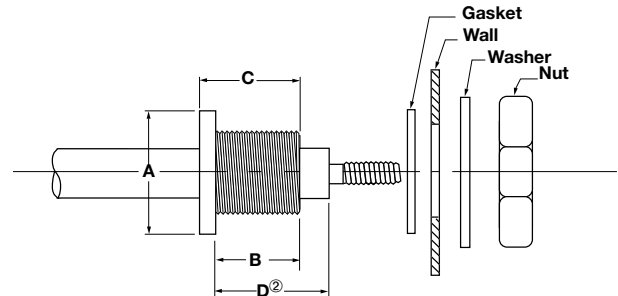
## WATROD Single/Double-Ended Heaters

### Mounting Methods (Continued)

#### Threaded Bulkheads

A threaded bushing with flange on the heater sheath provides rigid, leak-proof mounting through the walls of tanks. A gasket, plated steel washer and hex nut are included. The threaded end of the bushing is flush with the sheath's end unless otherwise specified. Threaded bulkheads are available in brass, steel or stainless steel as indicated in the table.

To order, specify **threaded bulkheads** and the specifications from the table.



#### Threaded Bulkhead Specifications

Element Diameter		Material	Thread Size	A ① Flange Size/Style		B Threaded Length		C Overall Length	
in.	(mm)			in.	(mm)	in.	(mm)	in.	(mm)
0.260	(6.6)	Brass	1/2 - 20 UNF	3/4 Round	(19.0)	5/8	(15.9)	3/4	(19.0)
0.260	(6.6)	Steel ③	1/2 - 20 UNF	3/4 Hex	(19.0)	5/8	(15.9)	3/4	(19.0)
0.260	(6.6)	SS	1/2 - 20 UNF	3/4 Round	(19.0)	5/8	(15.9)	3/4	(19.0)
0.315	(8.0)	Brass	1/2 - 20 UNF	3/4 Round	(19.0)	5/8	(15.9)	3/4	(19.0)
0.315	(8.0)	Steel	1/2 - 20 UNF	3/4 Hex	(19.0)	3/4	(19.0)	15/16	(23.8)
0.315	(8.0)	SS	1/2 - 20 UNF	3/4 Round	(19.0)	3/4	(19.0)	27/32	(21.4)
0.375	(9.5)	Brass	1/2 - 20 UNF	3/4 Round	(19.0)	5/8	(15.9)	3/4	(19.0)
0.375	(9.5)	Steel	1/2 - 20 UNF	3/4 Hex	(19.0)	3/4	(19.0)	15/16	(23.8)
0.375	(9.5)	SS	1/2 - 20 UNF	3/4 Round	(19.0)	3/4	(19.0)	27/32	(21.4)
0.430	(10.9)	Brass	5/8 - 18 UNF	7/8 Hex	(22.2)	3/4	(19.0)	15/16	(23.8)
0.430	(10.9)	Steel	5/8 - 18 UNF	7/8 Round	(22.2)	3/4	(19.0)	15/16	(23.8)
0.430	(10.9)	SS	5/8 - 18 UNF	1 Round	(25.0)	3/4	(19.0)	15/16	(23.8)
0.475	(12.1)	Brass	5/8 - 18 UNF	7/8 Round	(22.2)	3/4	(19.0)	15/16	(23.8)
0.475	(12.1)	Steel	5/8 - 18 UNF	1 Round	(25.0)	1	(25.0)	1 1/8	(28.6)
0.475	(12.1)	SS	5/8 - 18 UNF	1 Round	(25.0)	3/4	(19.0)	15/16	(23.8)

① Designates the dimension across flats for hex flange style and outside diameter for round flange style.

② Equal to "B" dimension unless otherwise specified.

③ Extended capability only.

# Tubular Heaters

## WATROD Single/Double-Ended Heaters

**EXTENDED  
CAPABILITY**



### Extended Capabilities/Options

#### Zoned Heaters

Multiple zone heaters with up to (5) zones are available.

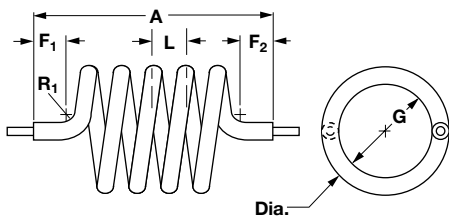
#### Features and Benefits

##### Standard sheath materials

- Optional materials available which include 304 SS, 316 SS, Alloy 600, Alloy 800, Alloy 840, copper clad steel, Inconel®/steel, and titanium

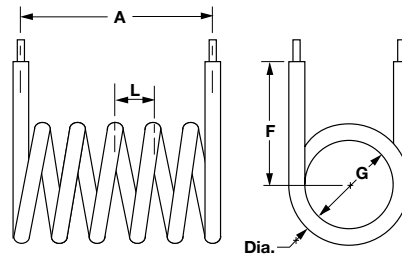
### Extended Capabilities/Bend Formations

Figure 33



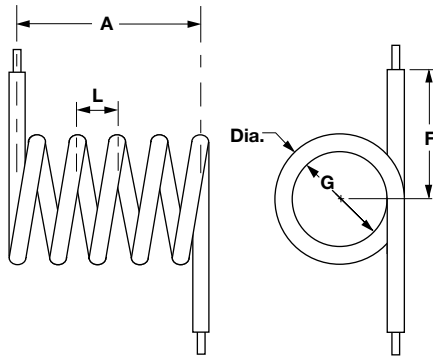
$$SL = [(G + \text{Dia.}) (3.14) (\text{Number of } 360^\circ\text{'s}) + F1 + F2]$$

Figure 34



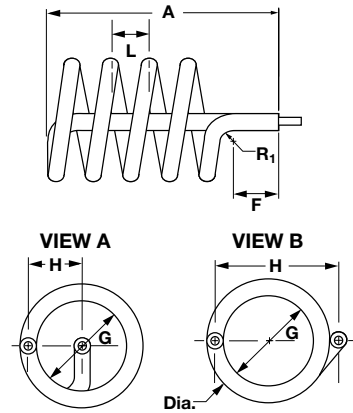
$$SL = [(G + \text{Dia.}) (3.14) (\text{Number of } 360^\circ\text{'s})] + 2F$$

Figure 35



$$SL = [(G + \text{Dia.}) (3.14) (\text{Number of } 360^\circ\text{'s}) + 2F]$$

Figure 36



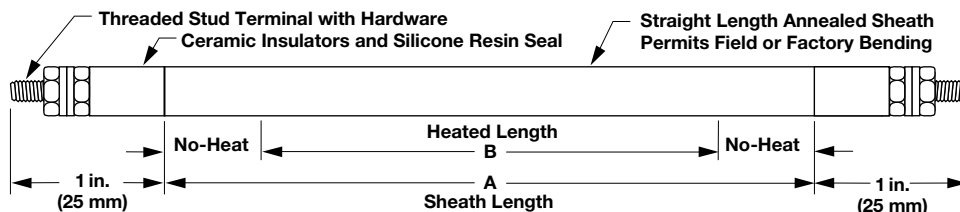
$$SL = [(G + \text{Dia.}) (3.14) (\text{Number of } 360^\circ\text{'s}) + (G \div 2) + A + F]$$

# Tubular Heaters



## WATROD Single/Double-Ended Heaters

### Double-Ended WATROD



WATROD Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number			Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	480VAC	lbs	(kg)

### Applications: Medium-Weight, Non-Circulating Oil, Heat-Transfer Oil

<b>15 W/in<sup>2</sup></b> <b>0.475 in. Dia.</b> <b>Steel</b> <b>(2.3 W/cm<sup>2</sup>)</b> <b>(12 mm)</b>	29 <sup>7</sup> / <sub>8</sub>	(758.8)	22 <sup>3</sup> / <sub>8</sub>	(568.4)	500	<b>RGSS29R10S</b>			1.0	(0.5)
	38 <sup>3</sup> / <sub>8</sub>	(974.7)	29 <sup>7</sup> / <sub>8</sub>	(758.8)	667	<b>RGSS38G10S</b>	<b>RGSS38G11S</b>		1.3	(0.6)
	44 <sup>3</sup> / <sub>4</sub>	(1137.0)	37 <sup>1</sup> / <sub>4</sub>	(946.0)	833	<b>RGSS44G10S</b>	<b>RGSS44G11S</b>		1.7	(0.8)
	53 <sup>3</sup> / <sub>8</sub>	(1355.7)	44 <sup>3</sup> / <sub>4</sub>	(1137.0)	1000	<b>RGSS53G10S</b>	<b>RGSS53G11S</b>		1.9	(0.9)
	68 <sup>3</sup> / <sub>8</sub>	(1736.7)	59 <sup>5</sup> / <sub>8</sub>	(1514.4)	1333	<b>RGSS68G10S</b>	<b>RGSS68G11S</b>		2.1	(1.0)
	83 <sup>3</sup> / <sub>8</sub>	(2117.7)	74 <sup>1</sup> / <sub>2</sub>	(1892.0)	1667	<b>RGSS83G10S</b>	<b>RGSS83G11S</b>		2.5	(1.1)
	98 <sup>3</sup> / <sub>8</sub>	(2498.7)	89 <sup>1</sup> / <sub>2</sub>	(2273.0)	2000	<b>RGSS98G10S</b>	<b>RGSS98G11S</b>		3.0	(1.4)
	120 <sup>3</sup> / <sub>8</sub>	(3057.5)	111 <sup>7</sup> / <sub>8</sub>	(2841.6)	2500	<b>RGSS120G10S</b>	<b>RGSS120G11S</b>		3.9	(1.8)
142 <sup>7</sup> / <sub>8</sub>	(3629.1)	134 <sup>1</sup> / <sub>4</sub>	(3410.0)	3000	<b>RGSS142R10S</b>	<b>RGSS142R11S</b>		4.1	(1.9)	

### Application: Air Heating

<b>20 W/in<sup>2</sup></b> <b>0.430 in. Dia.</b> <b>Alloy 840</b> <b>(3.1 W/cm<sup>2</sup>)</b> <b>(10.9 mm)</b>	48 <sup>3</sup> / <sub>4</sub>	(1238.0)	38 <sup>3</sup> / <sub>4</sub>	(984.0)	1000	<b>RCN48N10S</b>	<b>RCN48N11S</b>		1.0	(0.5)
	58 <sup>3</sup> / <sub>4</sub>	(1492.0)	48 <sup>3</sup> / <sub>4</sub>	(1238.0)	1250	<b>RCN58N10S</b>	<b>RCN58N11S</b>		1.1	(0.5)
	73 <sup>3</sup> / <sub>4</sub>	(1873.0)	63 <sup>3</sup> / <sub>4</sub>	(1619.0)	1667		<b>RCN73N11S</b>		1.4	(0.7)
	91 <sup>3</sup> / <sub>4</sub>	(2330.0)	81 <sup>3</sup> / <sub>4</sub>	(2076.0)	2083		<b>RCN91N11S</b>		1.7	(0.8)

### Applications: Caustic Solutions, Air Heating

<b>23 W/in<sup>2</sup></b> <b>0.315 in. Dia.</b> <b>Alloy 800</b> <b>(3.6 W/cm<sup>2</sup>)</b> <b>(8 mm)</b>	29	(737.0)	22	(559.0)	500	<b>RBN291S</b>			0.4	(0.2)	
	40	(1016.0)	33	(839.0)	750	<b>RBN401S</b>			0.5	(0.3)	
	51	(1296.0)	44	(1118.0)	1000	<b>RBN511S</b>			0.7	(0.4)	
<b>23 W/in<sup>2</sup></b> <b>0.475 in. Dia.</b> <b>Alloy 800</b> <b>(3.6 W/cm<sup>2</sup>)</b> <b>(12 mm)</b>	39	(991.0)	27	(686.0)	1000	<b>RGNA391S</b>	<b>RGNA3910S</b>	<b>RGNA3911S</b>	1.2	(0.6)	
	54	(1372.0)	42	(1067.0)	1500		<b>RGNA5410S</b>	<b>RGNA5411S</b>	1.6	(0.8)	
	69	(1753.0)	57	(1448.0)	2000		<b>RGNA6910S</b>	<b>RGNA6911S</b>	2.1	(1.0)	
	84	(2134.0)	72	(1829.0)	2500		<b>RGNA8410S</b>	<b>RGNA8411S</b>	2.5	(1.2)	
	99	(2515.0)	87	(2210.0)	3000		<b>RGNA9910S</b>	<b>RGNA9911S</b>	3.0	(1.4)	
	106	(2692.0)	94	(2388.0)	2778			<b>RGNA10611S</b>		3.2	(1.5)
	132	(3353.0)	120	(3048.0)	4167			<b>RGNA13210S</b>	<b>RGNA13211S</b>	4.0	(1.8)
157	(3988.0)	145	(3683.0)	5000		<b>RGNA15710S</b>	<b>RGNA15711S</b>	4.7	(2.2)		

### Applications: Light Oils, Greases, Heat-Transfer Oils

<b>23 W/in<sup>2</sup></b> <b>0.315 in. Dia.</b> <b>Steel</b> <b>(3.6 W/cm<sup>2</sup>)</b> <b>(8 mm)</b>	16	(406.0)	12	(305.0)	250	<b>RBS161S</b>	<b>RBS1610S</b>		0.2	(0.1)
	18	(457.0)	14	(356.0)	250	<b>RBS181S</b>			0.3	(0.2)
	21	(533.0)	17	(432.0)	350	<b>RBS211S</b>	<b>RBS2110S</b>		0.3	(0.2)
	23 <sup>3</sup> / <sub>8</sub>	(593.7)	19 <sup>3</sup> / <sub>8</sub>	(492.1)	375	<b>RBS23G1S</b>			0.3	(0.2)
	28 <sup>7</sup> / <sub>8</sub>	(733.4)	24 <sup>7</sup> / <sub>8</sub>	(631.8)	500	<b>RBS28R1S</b>			0.4	(0.2)
	29	(737.0)	24	(610.0)	500	<b>RBS291S</b>	<b>RBS2910S</b>		0.4	(0.2)
	42	(1067.0)	37	(940.0)	750	<b>RBS421S</b>	<b>RBS4210S</b>		0.6	(0.3)
	54	(1372.0)	49	(1245.0)	1000	<b>RBS541S</b>	<b>RBS5410S</b>		0.7	(0.4)
	77	(1956.0)	72	(1829.0)	1500	<b>RBS771S</b>	<b>RBS7710S</b>		1.0	(0.5)

CONTINUED

# Tubular Heaters



## WATROD Single/Double-Ended Heaters

### Double-Ended WATROD (Continued)

WATROD Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number			Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	480VAC	lbs	(kg)

#### Applications: Light Oils, Greases, Heat-Transfer Oils

<b>23 W/in<sup>2</sup></b> <b>0.475 in. Dia.</b> <b>Steel</b> <b>(3.6 W/cm<sup>2</sup>)</b> <b>(12 mm)</b>	23	(584)	14	(356)	500	<b>RGS231S</b>	<b>RGS2310S</b>		0.7	(0.4)
	31	(787)	22	(559)	750	<b>RGS311S</b>	<b>RGS3110S</b>		1.0	(0.5)
	39	(991)	27	(686)	1000	<b>RGS391S</b>	<b>RGS3910S</b>	<b>RGS3911S</b>	1.2	(0.6)
	45	(1143)	36	(914)	1250	<b>RGS451S</b>	<b>RGS4510S</b>		1.4	(0.7)
	54	(1372)	42	(1067)	1500	<b>RGS541S</b>	<b>RGS5410S</b>	<b>RGS5411S</b>	1.6	(0.8)
	69	(1753)	57	(1448)	2000	<b>RGS691S</b>	<b>RGS6910S</b>	<b>RGS6911S</b>	2.1	(1.0)
	84	(2134)	72	(1829)	2500	<b>RGS841S</b>	<b>RGS8410S</b>	<b>RGS8411S</b>	2.5	(1.2)
	99	(2515)	87	(2210)	3000		<b>RGS9910S</b>	<b>RGS9911S</b>	3.0	(1.4)
	106	(2692)	90	(2286)	2778			<b>RGS10611S</b>	3.2	(1.5)
	132	(3353)	120	(3048)	4167		<b>RGS13210S</b>	<b>RGS13211S</b>	4.0	(1.8)
	144	(3658)	128	(3251)	3889			<b>RGS14411S</b>	4.3	(2.0)
	157	(3988)	145	(3683)	5000		<b>RGS15710S</b>	<b>RGS15711S</b>	4.7	(2.2)

#### Application: Air Heating

<b>30 W/in<sup>2</sup></b> <b>0.260 in. Dia.</b> <b>Alloy 840</b> <b>(4.7 W/cm<sup>2</sup>)</b> <b>(6.6 mm)</b>	20	(508)	15	(381)	400		<b>RAN2010S</b>		0.2	(0.1)	
	25	(635)	20	(508)	500		<b>RAN2510S</b>		0.3	(0.2)	
	30	(762)	25	(635)	600		<b>RAN3010S</b>		0.3	(0.2)	
	35	(889)	30	(762)	800		<b>RAN3510S</b>		0.4	(0.2)	
	40	(1016)	35	(889)	900		<b>RAN4010S</b>		0.4	(0.2)	
	45	(1143)	40	(1016)	1000		<b>RAN4510S</b>		0.5	(0.3)	
	50	(1270)	45	(1143)	1200		<b>RAN5010S</b>		0.5	(0.3)	
	55	(1397)	50	(1270)	1200		<b>RAN5510S</b>		0.6	(0.3)	
	60	(1524)	55	(1397)	1400		<b>RAN6010S</b>		0.6	(0.3)	
	65	(1651)	60	(1524)	1600		<b>RAN6510S</b>		0.7	(0.4)	
	70	(1778)	65	(1651)	1800		<b>RAN7010S</b>		0.7	(0.4)	
	75	(1905)	70	(1778)	1800		<b>RAN7510S</b>		0.8	(0.4)	
	80	(2032)	75	(1905)	2000		<b>RAN8010S</b>		0.8	(0.4)	
	<b>30 W/in<sup>2</sup></b> <b>0.315 in. Dia.</b> <b>Alloy 840</b> <b>(4.7 W/cm<sup>2</sup>)</b> <b>(8 mm)</b>	15	(381)	10	(254)	300		<b>RBN1510S</b>		0.2	(0.1)
		20	(508)	15	(381)	400		<b>RBN2010S</b>		0.3	(0.2)
25		(635)	20	(508)	600		<b>RBN2510S</b>		0.4	(0.2)	
30		(762)	25	(635)	800		<b>RBN3010S</b>		0.4	(0.2)	
35		(889)	30	(762)	900		<b>RBN3510S</b>		0.5	(0.3)	
40		(1016)	35	(889)	1000		<b>RBN4010S</b>		0.5	(0.3)	
45		(1143)	40	(1016)	1200		<b>RBN4510S</b>		0.6	(0.3)	
50		(1270)	45	(1143)	1400		<b>RBN5010S</b>		0.7	(0.4)	
55		(1397)	50	(1270)	1600		<b>RBN5510S</b>		0.7	(0.4)	
60		(1524)	55	(1397)	1800		<b>RBN6010S</b>		0.8	(0.4)	
65		(1651)	60	(1524)	1800		<b>RBN6510S</b>		0.8	(0.4)	
70		(1778)	65	(1651)	2000		<b>RBN7010S</b>		0.9	(0.5)	
75		(1905)	70	(1778)	2200		<b>RBN7510S</b>		1.0	(0.5)	
80		(2032)	75	(1905)	2400		<b>RBN8010S</b>		1.0	(0.5)	
90		(2286)	85	(2159)	2600		<b>RBN9010S</b>		1.2	(0.6)	
100	(2540)	95	(2413)	3000		<b>RBN10010S</b>		1.3	(0.6)		

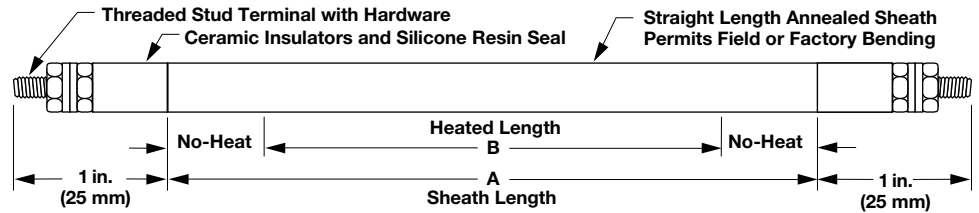
CONTINUED

# Tubular Heaters



## WATROD Single/Double-Ended Heaters

### Double-Ended WATROD (Continued)



WATROD Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number			Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	480VAC	lbs	(kg)

#### Application: Air Heating

<b>30 W/in<sup>2</sup></b> <b>0.430 in. Dia.</b> <b>Alloy 840</b> <b>(4.7 W/cm<sup>2</sup>)</b> <b>(10.9 mm)</b>	15	(381.0)	10	(254.0)	400	<b>RCN1510S</b>			0.3	(0.2)
	20	(508.0)	15	(381.0)	600	<b>RCN2010S</b>			0.4	(0.2)
	25	(635.0)	20	(508.0)	800	<b>RCN2510S</b>			0.5	(0.3)
	30	(762.0)	25	(635.0)	1000	<b>RCN3010S</b>			0.6	(0.3)
	35	(889.0)	30	(762.0)	1200	<b>RCN3510S</b>			0.7	(0.4)
	40	(1016.0)	35	(889.0)	1400	<b>RCN4010S</b>			0.8	(0.4)
	48 <sup>3/4</sup>	(1238.0)	38 <sup>3/4</sup>	(984.0)	1500	<b>RCNX48N10S</b>	<b>RCNX48N11S</b>		1.0	(0.5)
	45	(1143.0)	40	(1016.0)	1600	<b>RCN4510S</b>			0.9	(0.5)
	50	(1270.0)	45	(1143.0)	1800	<b>RCN5010S</b>			1.0	(0.5)
	58 <sup>3/4</sup>	(1492.0)	48 <sup>3/4</sup>	(1238.0)	1917	<b>RCNX58N10S</b>	<b>RCNX58N11S</b>		1.1	(0.5)
	55	(1397.0)	50	(1270.0)	2000	<b>RCN5510S</b>			1.0	(0.5)
	60	(1524.0)	55	(1397.0)	2200	<b>RCN6010S</b>			1.1	(0.5)
	65	(1651.0)	60	(1524.0)	2400	<b>RCN6510S</b>			1.2	(0.6)
	73 <sup>3/4</sup>	(1873.0)	63 <sup>3/4</sup>	(1619.0)	2500		<b>RCNX73N11S</b>		1.4	(0.7)
	70	(1778.0)	65	(1651.0)	2600	<b>RCN7010S</b>			1.3	(0.6)
	75	(1905.0)	70	(1778.0)	2800	<b>RCN7510S</b>			1.4	(0.7)
	80	(2032.0)	75	(1905.0)	3000	<b>RCN8010S</b>			1.5	(0.7)
	91 <sup>3/4</sup>	(2331.0)	81 <sup>3/4</sup>	(2077.0)	3167		<b>RCNX91N11S</b>		1.7	(0.8)
90	(2286.0)	85	(2159.0)	3500	<b>RCN9010S</b>			1.7	(0.8)	
100	(2540.0)	95	(2413.0)	4000	<b>RCN10010S</b>			1.9	(0.9)	
110	(2794.0)	105	(2667.0)	4500	<b>RCN11010S</b>			2.1	(1.0)	
120	(3048.0)	115	(2921.0)	5000	<b>RCN12010S</b>			2.3	(1.1)	

#### Application: Radiant Heating

<b>40 W/in<sup>2</sup></b> <b>0.375 in. Dia.</b> <b>Alloy 800</b> <b>(6.2 W/cm<sup>2</sup>)</b> <b>(9.5 mm)</b>	10 <sup>1/4</sup>	(260.0)	7 <sup>1/4</sup>	(184.0)	400	<b>RDN10E1S</b>			0.2	(0.1)
	16 <sup>5/8</sup>	(422.1)	13 <sup>5/8</sup>	(346.1)	650	<b>RDN16L1S</b>			0.3	(0.2)
	21 <sup>1/16</sup>	(535.0)	16 <sup>13/16</sup>	(427.0)	800	<b>RDN21B1S</b>	<b>RDN21B10S</b>		0.4	(0.2)
	27 <sup>1/8</sup>	(689.0)	22 <sup>7/8</sup>	(581.0)	1100	<b>RDN27C1S</b>	<b>RDN27C10S</b>		0.5	(0.3)
	32 <sup>1/8</sup>	(816.0)	27 <sup>7/8</sup>	(708.0)	1300		<b>RDN32C10S</b>	<b>RDN32C11S</b>	0.6	(0.3)
	42 <sup>7/8</sup>	(1089.0)	38 <sup>5/8</sup>	(981.1)	1800		<b>RDN42R10S</b>	<b>RDN42R11S</b>	0.8	(0.4)
	57 <sup>1/2</sup>	(1461.0)	53 <sup>1/4</sup>	(1353.0)	2500		<b>RDN57J10S</b>	<b>RDN57J11S</b>	1.1	(0.5)
	69 <sup>1/4</sup>	(1759.0)	65	(1651.0)	3000		<b>RDN69E10S</b>	<b>RDN69E11S</b>	1.3	(0.6)
	81 <sup>1/4</sup>	(2064.0)	77	(1956.0)	3600		<b>RDN81E10S</b>	<b>RDN81E11S</b>	1.6	(0.8)
	109 <sup>1/4</sup>	(2775.0)	105	(2667.0)	4000		<b>RDN109E10S</b>		2.1	(1.0)
	134 <sup>1/2</sup>	(3416.0)	127 <sup>3/4</sup>	(3245.0)	5000		<b>RDN134J10S</b>		2.6	(1.2)
	153 <sup>3/8</sup>	(3895.7)	145 <sup>7/8</sup>	(3705.2)	5500		<b>RDN153R10S</b>		2.9	(1.4)
	179 <sup>1/4</sup>	(4553.0)	171 <sup>1/4</sup>	(4350.0)	6500		<b>RDN179E10S</b>		3.4	(1.6)

CONTINUED

# Tubular Heaters



## WATROD Single/Double-Ended Heaters

### Double-Ended WATROD (Continued)

#### Special 208VAC and 277VAC Voltages

WATROD Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number		Est. Net Wt.	
	in.	(mm)	in.	(mm)		208VAC	277VAC	lbs	(kg)

#### Application: Radiant Heating

40 W/in <sup>2</sup> 0.375 in. Dia. Alloy 800	21 <sup>1</sup> / <sub>16</sub>	(535)	16 <sup>13</sup> / <sub>16</sub>	(427)	800	RDN21B2S	RDN21B4S	0.4	(0.2)
	27 <sup>1</sup> / <sub>8</sub>	(689)	22 <sup>7</sup> / <sub>8</sub>	(581)	1100	RDN27C2S	RDN27C4S	0.5	(0.3)
	42 <sup>7</sup> / <sub>8</sub>	(1089)	38 <sup>5</sup> / <sub>8</sub>	(981)	1800	RDN42R2S	RDN42R4S	0.8	(0.4)
(6.2 W/cm <sup>2</sup> ) (9.5 mm)	57 <sup>1</sup> / <sub>2</sub>	(1461)	53 <sup>1</sup> / <sub>4</sub>	(1353)	2500	RDN57J2S	RDN57J4S	1.1	(0.5)
	69 <sup>1</sup> / <sub>4</sub>	(1759)	65	(1651)	3000	RDN69E2S	RDN69E4S	1.3	(0.6)
	81 <sup>1</sup> / <sub>4</sub>	(2064)	77	(1956)	3600	RDN81E2S	RDN81E4S	1.6	(0.8)

WATROD Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number			Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	480VAC	lbs	(kg)

#### Application: Process Water

48 W/in <sup>2</sup> 0.475 in. Dia. Alloy 800 (7.4 W/cm <sup>2</sup> ) (12 mm)	23	(584)	14	(356)	1000	RGN231S	RGN2310S	RGN2311S	0.7	(0.4)
	30	(762)	21	(533)	1500	RGN301S	RGN3010S	RGN3011S	0.9	(0.5)
	39	(991)	27	(686)	2000	RGN391S	RGN3910S	RGN3911S	1.2	(0.6)
	44	(1118)	35	(889)	2500	RGN441S	RGN4410S	RGN4411S	1.3	(0.6)
	54	(1372)	42	(1067)	3000		RGN5410S	RGN5411S	1.6	(0.8)
	69	(1753)	57	(1448)	4000		RGN6910S	RGN6911S	2.1	(1.0)
	84	(2134)	72	(1829)	5000		RGN8410S	RGN8411S	2.5	(1.2)
	92	(2337)	76	(1930)	5556			RGN9211S	2.8	(1.3)
	99	(2515)	87	(2210)	6000		RGN9910S	RGN9911S	3.0	(1.4)
	149	(3785)	133	(3378)	9722			RGN14911S	4.5	(2.1)

#### Application: Hot Runner Molds (Manifolds)

60 W/in <sup>2</sup> 0.315 in. Dia. 316 SS (9.3 W/cm <sup>2</sup> ) (8 mm)	35	(889)	25	(635)	1500		RBR3510S		0.2	(0.1)
	44	(1118)	34	(864)	2000		RBR4410S		0.3	(0.2)
	52	(1321)	42	(1067)	2500		RBR5210S		0.3	(0.2)
	60	(1524)	50	(1270)	3000		RBR6010S		0.4	(0.2)
	69	(1753)	59	(1499)	3500		RBR6910S		0.4	(0.2)
	77	(1956)	67	(1702)	4000		RBR7710S		0.5	(0.3)
	85	(2159)	75	(1905)	4500		RBR8510S		0.6	(0.3)

#### Applications: Deionized Water, Demineralized Water

60 W/in <sup>2</sup> 0.475 in. Dia. 316 SS (9.3 W/cm <sup>2</sup> ) (12 mm)	20	(508)	11	(279)	1000	RGR201S	RGR2010S	RGR2011S	0.6	(0.3)
	26	(660)	17	(432)	1500	RGR261S	RGR2610S	RGR2611S	0.8	(0.4)
	34	(864)	22	(559)	2000		RGR3410S	RGR3411S	1.0	(0.5)
	40	(1016)	28	(711)	2500		RGR4010S	RGR4011S	1.2	(0.6)
	47	(1194)	31	(787)	2778			RGR4711S	1.4	(0.7)
	46	(1168)	34	(864)	3000		RGR4610S	RGR4611S	1.4	(0.7)
	57	(1448)	45	(1143)	4000		RGR5710S	RGR5711S	1.7	(0.8)
	68	(1727)	56	(1422)	5000		RGR6810S	RGR6811S	2.1	(1.0)
	79	(2007)	67	(1702)	6000		RGR7910S	RGR7911S	2.4	(1.1)
	105	(2667)	93	(2362)	8333			RGR10511S	3.2	(1.5)

# Tubular Heaters



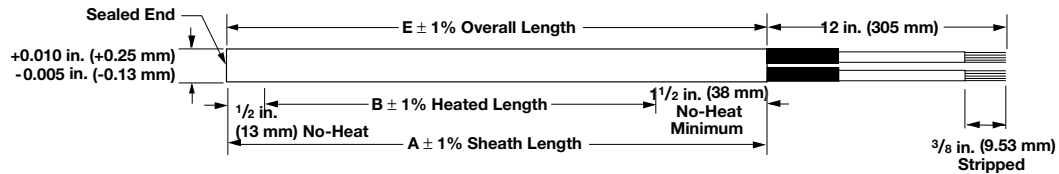
## WATROD Single/Double-Ended Heaters

### Single-Ended WATROD

#### Application Hints

The single-ended WATROD heater's construction limits its usefulness in some applications. The following are some guides to follow when considering a single-ended WATROD.

- When single-ended termination simplifies application wiring.
- The application requires lower wattage or a smaller package.
- Do not locate the end of the heated length within a bend, unless the radius is 3 in. (75 mm) or more. Field bending is not recommended.
- Bending is limited to bend Figures 1, 6, 22 and 28 (see pages 62 to 67 for details).
- Ensure termination temperatures do not exceed 390°F (200°C) or the seal's maximum rating.
- Keep terminations clean, dry and tight.



# Tubular Heaters

**EXTENDED  
CAPABILITY**



## WATROD Double-Ended Heaters

### *Extended Capabilities for High-Temperature Tubular Heaters*

Watlow manufactures high-temperature tubular heaters to bridge the gap between standard tubular heaters and Watlow MULTICELL™ heaters. This tubular is well suited for process air heating applications in excess of 1300°F (704°C), resulting in a maximum sheath temperature of 1800°F (983°C). Controlled lab testing between the new design and current tubular designs show an increase in life of approximately 50 percent.

The high-temperature tubular consists of an engineered tubing with an alloy 600 outer sheath and a special internal construction. The outer sheath offers high temperature capabilities, reduced oxidation as well as corrosion resistance.

The tubular offering is available in 0.430 and 0.375 inch diameters that are configurable either as formed tubulars or process heaters. The heaters can also be welded to flanges and plates for mounting purposes. Maximum sheath length available is 275 inches for the 0.430 inch and 0.375 inch diameters. A Watlow sales representative should be contacted for longer sheath lengths.

### Features and Benefits

#### **Alloy 600 sheath material and a special internal construction**

- Assures high temperature performance and corrosion protection in tough applications

#### **0.430 inch diameters\***

- Allows heater to be configured to existing tubular designs that may be experiencing short life

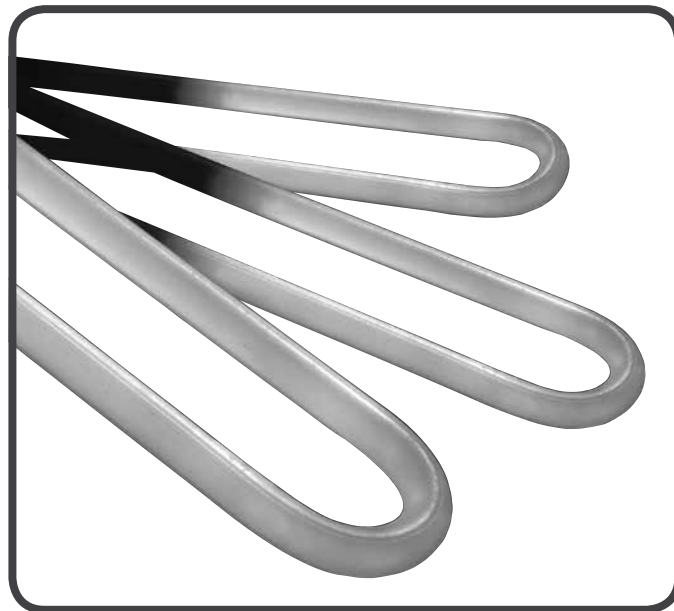
**\*Note: 0.375 diameters are available in Watlow's extended capabilities, contact your Watlow representative for details.**

#### **Dual-ended termination**

- Installs into flanges and screw plugs similarly to standard product configurations

#### **Bendable in standard formations**

- Makes the heater easy to apply in a wide variety of applications



### Typical Applications

- High temperature ovens and furnaces
- Radiant heating
- Drying
- Environmental—VOC abatement
- Process air heating: duct heaters, circulation heaters
- Vacuum applications
- Flue gas cleaning (desulphurization)
- Fluidized beds



# Tubular Heaters

**EXTENDED  
CAPABILITY**

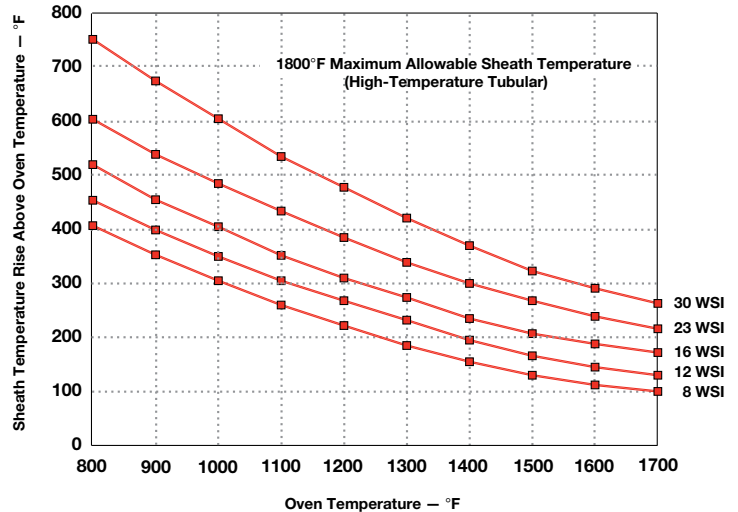


## WATROD Double-Ended Heaters

### Extended Capabilities for High-Temperature Tubular Heaters

#### Sheath Temperature Versus Oven Temperature at Various Watt Densities

This chart is used to verify the correct watt density for an oven application assuming no air flow. To use the chart, first select the oven process temperature on the X axis, using the chosen watt density read the sheath temperature rise above oven temperature from the Y axis. This number should then be added to oven temperature. If this number is greater than 1800°F (982°C), a lower watt density should be chosen.

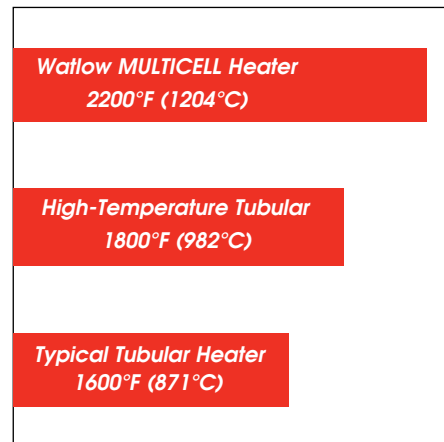


### Heater Life Estimate Service

Watlow now provides an industry first service with the offering of the high-temperature tubular. By providing operating parameters, Watlow provides customers with the estimated life of the heater. To get this information, the following information should be provided:

- Heater voltage
- Heater wattage
- Heater diameter 0.430 or 0.375 in. (10.9 or 9.5 mm)
- Heated length
- Bend configuration and dimensions (number of bends and radius)
- Application including process temperature
- Power switching device and cycle time (SCR, etc.)

### High-Temperature Heater Comparisons



\*Assuming normal design practices.

# Tubular Heaters

**EXTENDED  
CAPABILITY**



## WATROD Single/Double-Ended Heaters

### *Extended Capabilities for MULTICOIL™ Tubular Heaters*

The tubular element with multiple coils and/or thermocouples inside one sheath from Watlow answers the need for a versatile, innovative tubular heater. Watlow's patented method of packaging a thermocouple inside of a heater with one or more resistance coils, gives the ability to sense a heaters' internal temperature accurately, every time.

Moreover, this is the first tubular heater in the industry with three-phase capability. The three coil, three-phase heater will offer a compact package solution while delivering the full power required in a compact heater package. Previously three separate heaters would have been required to do the same job; therefore Watlow's MULTICOIL™ heater capabilities save money.

### **Performance Capabilities**

- Watt densities up to 60 W/in<sup>2</sup> (9.3 W/cm<sup>2</sup>)
- Sheath temperatures up to 1600°F (870°C)
- 304 and 316 stainless steel sheath temperatures up to 1200°F (650°C)

### **Features and Benefits**

#### **Three-phase capability**

- Results in one element versus three, lower amperage, reduced installation time and lower overall cost

#### **Multiple coil operations**

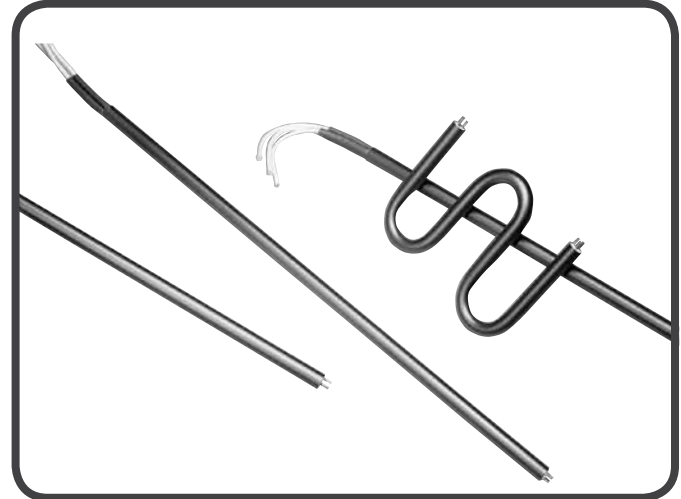
- Reduces inventory by allowing dual voltage capability

#### **Versatile forming capabilities**

- Forms into many configurations

#### **Internal construction with sensor**

- Allows space savings because drilling and tapping of flange is unnecessary; plus, the interior thermocouple eliminates contamination buildup around the external sensing tip, reducing the possibility of false readings



### **Typical Applications**

- Foodservice equipment
- Process
- Medical
- Milled groove
- Plastics
- Plating
- Oven heating
- Semiconductor

# Tubular Heaters

**EXTENDED  
CAPABILITY**

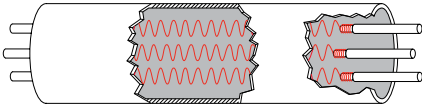


## WATROD Single/Double-Ended Heaters

### Extended Capabilities for MULTICOIL Tubular Heaters

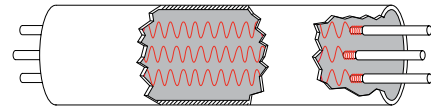
#### Options

##### Option A



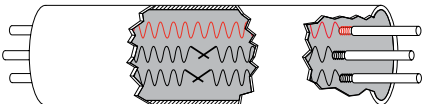
3-phase tubular, 0.475 inch diameter.

##### Option E



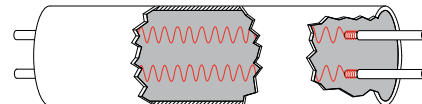
1-phase tubular with three different one phase circuits, 0.475 inch diameter.

##### Option C



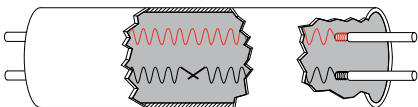
1-phase tubular with one resistance wire and two thermocouples, 0.475 inch diameter.

##### Option F



1-phase tubular with two resistance coils, 0.375, 0.430 and 0.475 inch diameter.

##### Option D



1-phase tubular with one resistance coil and one thermocouple, 0.375, 0.430 and 0.475 inch diameter.

## Specifications

### Termination styles

- Lead wires 392°F (200°C)  
Sil-A-Blend® or 482°F (250°C) GGS.

### Moisture seals

Moisture seals are required, options include:

- Epoxy with temperature rating to 356°F (180°C).  
Typical applications include water/oil immersion.
- Lavacone with temperature rating to 221°F (105°C).  
Typical application includes air heating.
- High-temperature ceramic rated to 2800°F (1538°C).
- Contact your Watlow representative for other moisture seal options.

### Mounting options

- Mounting brackets
- Locator washers
- Water-tight bulkheads

### Maximum trim length

- 237 in. (6020 mm), heater designs with trim length greater than 120 in. (3048 mm) must be reviewed with your Watlow representative.

### Sheath materials

- Alloy 600, 800, 840, 304 and 316 stainless steel, contact your Watlow representative for other sheath material options.

### Internal thermocouple options

- Type K is used, contact your Watlow representative for Type J thermocouple options.

# Tubular Heaters



## FIREBAR® Single/Double-Ended Heaters

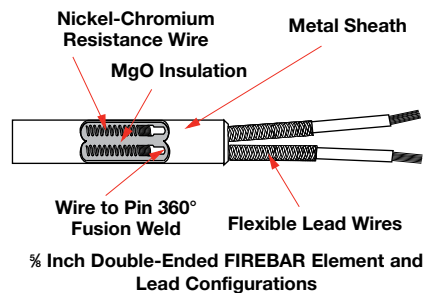
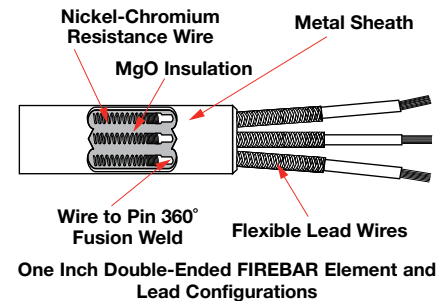
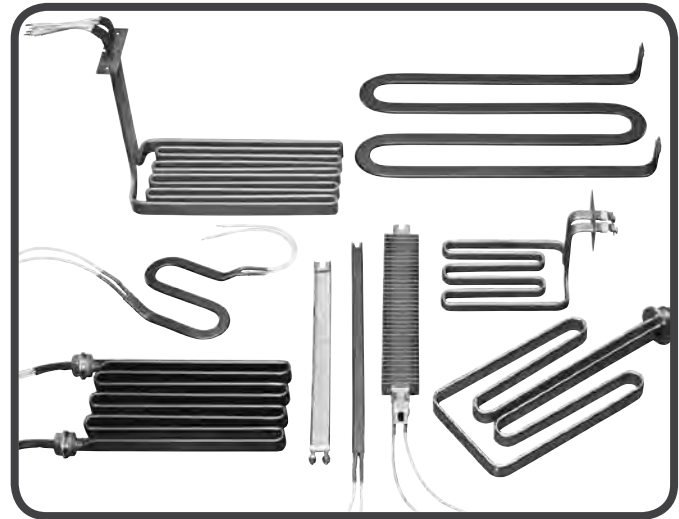
FIREBAR® heating elements provide added heating performance over standard round tubular heating elements—especially for immersion applications in petroleum based liquids requiring high kilowatts.

The FIREBAR's unique flat surface geometry packs more power in shorter elements and assemblies, along with a host of other performance improvements. These include:

- Minimizing coking and fluid degrading
- Enhancing the flow of fluid past the element's surface to carry heat from the sheath
- Improving heat transfer with a significantly larger boundary layer allowing much more liquid to flow up and across the sheath's surface

FIREBAR elements are available in single- and double-ended constructions with one inch or  $\frac{5}{8}$  inch heights. These two configuration variables make it possible to use FIREBAR elements instead of round tubular elements in virtually all applications.

FINBAR™ is a special version of the one inch, single-ended FIREBAR. FINBAR is specially modified with fins to further increase surface area for air and gas heating applications. Details are contained in the *FINBAR* section, starting on page 103.



### Double-Ended Performance Capabilities

#### One Inch

- Watt densities up to 120 W/in<sup>2</sup> (18.6 W/cm<sup>2</sup>)
- Alloy 800 sheath temperatures up to 1400°F (760°C)
- 304 stainless steel sheath temperatures up to 1200°F (650°C)
- Voltages up to 240VAC
- Amperages up to 48 amperes per heater or 16 amperes per coil

#### $\frac{5}{8}$ Inch

- Watt densities up to 90 W/in<sup>2</sup> (13.9 W/cm<sup>2</sup>)
- Alloy 840 sheath temperatures up to 1400°F (760°C)
- Voltages up to 240VAC
- Amperages up to 32 amperes per heater or 16 amperes per coil

### Single-Ended Performance Capabilities

#### One Inch

- Watt densities up to 60 W/in<sup>2</sup> (9.3 W/cm<sup>2</sup>)
- Alloy 800 sheath temperatures up to 1400°F (760°C)
- 304 stainless steel sheath temperatures up to 1200°F (650°C)
- Voltages up to 240VAC
- Amperages up to 48 amperes per heater or 16 amperes per coil

#### $\frac{5}{8}$ Inch

- Watt densities up to 80 W/in<sup>2</sup> (12.4 W/cm<sup>2</sup>)
- Alloy 840 sheath temperatures up to 1400°F (760°C)
- Voltages up to 240VAC
- Amperages up to 16 amperes per heater

# Tubular Heaters



## FIREBAR Double-Ended Heaters

### Specifications

#### One Inch FIREBAR



#### 5/8 Inch FIREBAR



<b>Applications</b>	Direct immersion; water, oils, etc. Clamp-on; hoppers, griddles Forced air heating (Also see FINBAR, page 103) Radiant heating	Direct immersion; water, oils, etc. Clamp-on; hoppers, griddles Forced air heating Radiant heating
<b>Watt Density</b> W/in <sup>2</sup> (W/cm <sup>2</sup> )	Standard: up to 90 (13.9) Made-to-Order (M-t-O): up to 120 (18.6)	Standard: up to 90 (13.9) Made-to-Order (M-t-O): up to 90 (13.9)
<b>Surface Area Per Linear In. (cm)</b>	2.3 in <sup>2</sup> (14.8 cm <sup>2</sup> )	1.52 in <sup>2</sup> (9.80 cm <sup>2</sup> )
<b>Cross Section</b> Height ± 0.015/0.010 in. (0.381/0.254 mm) Thickness ± 0.005/0.001 in. (0.127/0.025 mm)	1.010 (25.7)  0.235 (5.9)	0.650 (16.5)  0.235 (5.9)
<b>Sheath Material—Max.</b> Operating temperature	Standard: Alloy 800 1400°F (760°C) M-t-O: Alloy 800 1400°F (760°C) 304 SS 1200°F (650°C)	Standard: Alloy 840 1400°F (760°C) M-t-O: Alloy 840 1400°F (760°C) 304 SS 1200°F (650°C)
<b>Sheath Length</b> in. (mm)	Standard: 15 to 114 (381 to 2896) M-t-O: 11 to 180 (280 to 4572)	Standard: 15 to 51 (381 to 1295) M-t-O: 11 to 115 (280 to 2920)
<b>Straightness Tolerance</b> Major axis in./ft (cm/m): Minor axis in./ft (cm/m):	0.062 (0.52) 0.062 (0.52)	0.062 (0.52) 0.062 (0.52)
<b>No-Heat Length</b>	1 in. min., 12 in. max. (25/305 mm)	1 in. min., 12 in. max. (25/305 mm)
<b>Max. Voltage—Amperage</b> <b>Max. Hipotential</b> <b>Max. Current Leakage Per Coil (cold)</b> <b>Max. Amperage Per Coil</b> <b>Phase(s)</b> <b>Resistance Coils</b>	240VAC—48A 1480VAC 3mA 16A 1-ph parallel/series, 3-ph delta/wye 3 or 2	240VAC—32A 1480VAC 3mA 16A 1-ph parallel/series 2
<b>Ohms/In./Unit</b> <sup>①</sup> <b>Ohms/In./Coil</b> <sup>①</sup>	0.270Ω min.—2.833Ω max. 0.080Ω min.—8.500Ω max. per coil	0.040Ω min.—4.250Ω max. 0.080Ω min.—8.500Ω max. per coil
<b>Terminations</b>	Flexible lead wires Quick connect (spade) Screw lug (plate) Threaded stud	Flexible lead wires Quick connect (spade) Screw lug (plate) Threaded stud
<b>Seals</b>	Standard: Lavacone 221°F (105°C) M-t-O: Ceramic base 2800°F (1535°C) Silicone rubber 392°F (200°C) Lavacone 221°F (105°C) Epoxy resin 266/356°F (130/180°C)	Standard: Lavacone 221°F (105°C) M-t-O: Ceramic base 2800°F (1535°C) Silicone rubber 392°F (200°C) Lavacone 221°F (105°C) Epoxy resin 266/356°F (130/180°C)
<b>Min. Axis Bending Radius</b> in. (mm) (Do not field bend)	Major: 1 (25) Minor: ½ (13) 90° bend Minor: ¼ (4) 180° bend	Major: ¾ (19) Minor: ½ (13) 90° bend Minor: ¼ (4) 180° bend
<b>Mounting Options</b>	Brackets (Type 1, 2 and 3) Threaded bulkhead or fitting	Brackets (Type 1, 2 and 3) Threaded bulkhead or fitting
<b>Surface Finish Options</b>	Bright anneal, passivation	Bright anneal, passivation
<b>Agency Recognition</b>	UL® component recognition to 240VAC (File # E52951) CSA component recognition to 240VAC (File # 31388)	UL® component recognition to 240VAC (File # E52951) CSA component recognition to 240VAC (File # 31388)

① Resistance values valid for three coil 1 in. (25 mm) FIREBAR only.

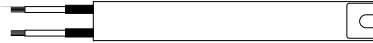
# Tubular Heaters



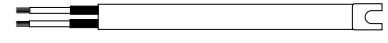
## FIREBAR Single-Ended Heaters

### Specifications (Continued)

#### One Inch Single-Ended FIREBAR



#### 5/8 Inch Single-Ended FIREBAR



<b>Applications</b>	Clamp-on; hoppers, griddles Forced or convection air heating (Also see FINBAR, page 103)	Clamp-on; hoppers, griddles Forced or convection air heating
<b>Watt Density</b> W/in <sup>2</sup> (W/cm <sup>2</sup> )	Standard: up to 40 (6.2) M-t-O: up to 60 (9.3)	Standard: up to 20 (3.1) M-t-O: up to 60 (12.4)
<b>Surface Area Per Linear In. (cm)</b>	2.3 in <sup>2</sup> (14.8 cm <sup>2</sup> )	1.52 in <sup>2</sup> (9.80 cm <sup>2</sup> )
<b>Cross Section</b> Height ± 0.015/0.010 in. (0.381/0.254 mm) Thickness ± 0.005/0.001 in. (0.127/0.025 mm)	1.010 (25.7) 0.235 (5.9)	0.650 (16.5) 0.235 (5.9)
<b>Sheath Material—Max.</b> Operating temperature	Standard: 304 SS 1200°F (650°C) M-t-O: Alloy 800 1400°F (760°C) 304 SS 1200°F (650°C)	Standard: Alloy 840 1400°F (760°C) M-t-O: Alloy 840 1400°F (760°C) 304 SS 1200°F (650°C)
<b>Sheath Length</b> in. (mm)	Standard: 11 to 46¼ (280 to 1175) M-t-O: 11 to 120 (280 to 3048)	Standard: 11½ to 52 (280 to 1321) M-t-O: 11 to 116 (280 to 2946)
<b>Straightness Tolerance</b> Major axis in./foot (cm/m): Minor axis in./foot (cm/m):	0.062 (0.52) 0.062 (0.52)	0.062 (0.52) 0.062 (0.52)
<b>No-Heat Length</b> Top cold end Bottom (blunt end) cold end	1 in. min., 12 in. max. (25/305 mm) 1 ph- 0.5 min., 2 in. max. (13/51 mm) 3 ph- 0.75 min., 2 in. max. (19/51 mm)	1 in. min., 12 in. max. (25/305 mm) Only available at 1.25 in. N/A
<b>Max. Voltage—Amperage</b> <b>Max. Hipotential</b> <b>Max. Current Leakage (cold)</b> <b>Max. Amperage Per Coil</b> <b>Phase(s)</b> <b>Resistance Coils</b>	240VAC—48A 1480VAC 3mA 16A 1-ph, 3-ph wye 3 or 1	240VAC—16A 1480VAC 3mA 16A 1-ph 1
<b>Ohms/In./Unit</b>	0.200Ω min. — 14.00Ω max. ①	0.200Ω min. — 14.00Ω max. ①
<b>Terminations</b>	Flexible lead wires Threaded stud Quick connect (spade) Screw lug (plate)	Flexible lead wires Quick connect (spade) Screw lug (plate)
<b>Seals</b>	Standard: Lavacone 221°F (105°C) M-t-O: Ceramic base 2800°F (1535°C) Silicone rubber 392°F (200°C) Lavacone 221°F (105°C) Epoxy resin 266/356°F (130/180°C)	Standard: Lavacone 221°F (105°C) M-t-O: Ceramic base 2800°F (1535°C) Silicone rubber 392°F (200°C) Lavacone 221°F (105°C) Epoxy resin 266/356°F (130/180°C)
<b>Min. Axis Bending Radius</b> in. (mm) (Do not field bend)	Major: 1 (25) Minor: ½ (13) 90° bend Minor: ¼ (4) 180° bend	Major: ¾ (19) Minor: ½ (13) 90° bend Minor: ¼ (4) 180° bend
<b>Mounting Options</b>	Bracket (Type 2) Threaded bulkhead	Bracket (Type 2) Threaded bulkhead
<b>Surface Finish Options</b>	Bright anneal	Bright anneal
<b>Optional Internal Thermocouple</b>	—	—
<b>Single-end Configuration</b>	Standard: Slotted M-t-O: Slotted, sealed or welded	Standard: Slotted M-t-O: Slotted, sealed or welded
<b>Agency Recognition</b>	UL® component recognition to 240VAC (File # E52951) CSA component recognition to 240VAC (File # 31388)	UL® component recognition to 240VAC (File # E52951) CSA component recognition to 240VAC (File # 31388)

① Based on 1-phase, single voltage heater.



## FIREBAR Single/Double-Ended Heaters

### Features and Benefits

#### One Inch Features and Benefits

##### Double-Ended

**Streamline, 0.235 x 1.010 in. (5.9 x 25.6 mm) normal to flow dimension**

- Reduces drag

**70 percent greater surface area per linear inch compared to a 0.430 in. (11 mm) diameter round tubular heater**

- Reduces watt density or packs more kilowatts in smaller bundles

##### Compacted MgO insulation

- Maximizes thermal conductivity and dielectric strength

##### Nickel-chromium resistance wires

- Precision wound

##### 0.040 in. (1 mm) thick MgO walls

- Transfers heat more efficiently away from the resistance wire to the sheath and media—conducts heat out of the element faster

##### Three resistance coil design

- Configurable to either one- or three-phase power, readily adapts to a variety of electrical sources and wattage outputs

##### Lavacone seals

- Provides protection against humid storage conditions, moisture retardant to 221°F (105°C)

##### Single-Ended

##### Single-ended termination

- Simplifies wiring and installation

**Streamline, 0.235 x 1.010 in. (5.9 x 25.6 mm) normal to flow dimension**

- Reduces drag

**70 percent greater surface area per linear inch**

- Reduces watt density from that of the 0.430 in. (11 mm) diameter round tubular

##### Slotted end

- Provides installation ease in clamp-on applications

##### Lavacone seals

- Provides protection against humid storage conditions, moisture retardant to 221°F (105°C)

#### 5/8 inch Features and Benefits

##### Double-Ended

**Special sheath dimensions, 0.235 x 0.650 in. (5.9 x 16.5 mm)**

- Results in a lower profile heater

**10 percent greater surface area per linear inch**

- Reduces watt density from that of the 0.430 in. (11 mm) diameter round tubular heater

##### 0.040 in. (1 mm) thick MgO walls

- Transfers heat efficiently away from the resistance wire to the heated media—conducts heat out of the element faster

##### Lavacone seals

- Provides protection against humid storage conditions, moisture retardant to 221°F (105°C)

##### Single-Ended

##### Single-ended termination

- Simplifies wiring and installation

**Special sheath dimensions, 0.235 x 0.650 in. (5.9 x 16.5 mm)**

- Results in a lower profile heater for more wattage in a smaller package

##### Slotted end

- Provides installation ease in clamp-on applications

##### Lavacone seals

- Provides protection against humid storage conditions, moisture retardant to 221°F (105°C)



## FIREBAR Single/Double-Ended Heaters

### Performance Features

FIREBAR's flat tubular element geometry produces performance features and benefits not possible with traditional round tubular technology. The following describes how and why the FIREBAR is functionally superior for many applications—especially those requiring large wattage with low watt density.

#### By using the FIREBAR element it will:

- Lower the element's watt density
- Reduce element size and keep the same watt density
- Increase element life by reducing sheath temperature

#### Flat Shape Produces Lower Sheath Temperature

The FIREBAR element operates at a lower sheath temperature than a round tubular element of equal watt density because of three factors.

#### 1. Flat Surface Geometry

FIREBAR's flat, vertical geometry is streamline. The liquid's flow past the heating element's surface is not impaired by back eddies inherent in the round tubular shape. The FIREBAR's streamline shape results in fluids flowing more freely with more heat carried away from the sheath.



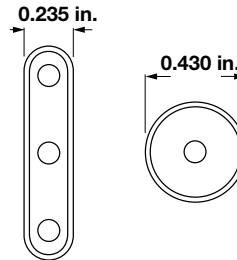
#### 2. Normal to the Flow

The element's width (thickness) of both 1 inch and 5/8 inch FIREBAR elements is just 0.235 in. (5.9 mm). Compared to a 0.430 in. (11 mm) round tubular element, this relative thinness further reduces drag on liquids or gases flowing past the heater.

#### 3. Buoyancy Force

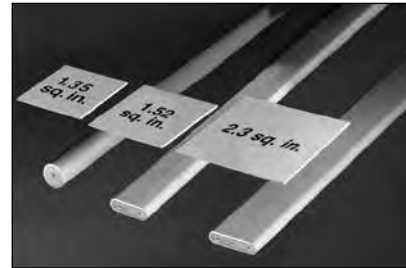
The FIREBAR element's boundary layer, or vertical side, is greater than virtually all round tubular elements. This is 1.010 and 0.650 in. (25.6 and 16.5 mm) for the one inch and 5/8 in. FIREBARs respectively, compared to a 0.430 in. (11 mm) diameter on a round tubular element. The FIREBAR element's increased height, relative to flow, increases the buoyancy force in viscous liquids. This buoyancy force can be as much as 10 times greater depending on the FIREBAR element and liquid used.

#### Comparative Widths



#### Watt Density and Surface Area Advantages

The surface area per linear inch of a 1 in. FIREBAR is 70 percent greater than the 0.430 in. (11 mm) diameter round tubular element. The 5/8 in. FIREBAR is nearly 10 percent greater.



Element Type	Surface Area Per Linear Inch (cm)	
	in <sup>2</sup>	cm <sup>2</sup>
1 in. FIREBAR	2.30 in <sup>2</sup>	(5.84 cm <sup>2</sup> )
5/8 in. FIREBAR	1.52 in <sup>2</sup>	(3.86 cm <sup>2</sup> )
0.430 in. Round	1.35 in <sup>2</sup>	(3.43 cm <sup>2</sup> )

#### Flat vs. Round Geometry Comparisons

The unique flat surface geometry of the FIREBAR element offers more versatility in solving heater problems than the conventional round tubular element. The following comparisons show how the FIREBAR element consistently outperforms round tubular heaters. FIREBAR elements can:

- Reduce coking and fluid degrading
- Increase heater power within application space parameters
- Provide superior heat transfer in clamp-on applications resulting from greater surface area contact
- Lower watt density

Reducing watt density or sheath temperature extends life. The FIREBAR element allows you to do either, without sacrificing equipment performance ... as is proven by the accompanying *Heater Oil Test, Air Flow and Watt Density vs. Sheath Temperature* graphs.



# Tubular Heaters

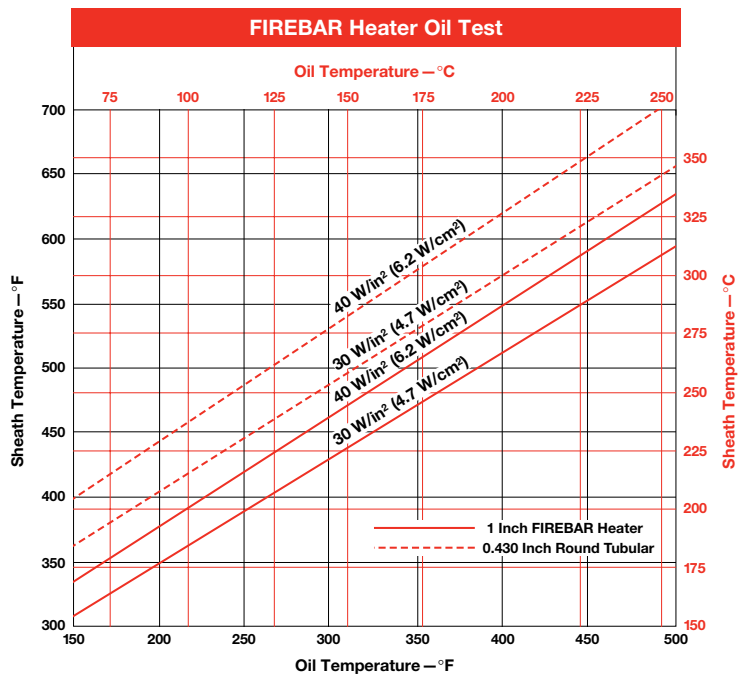


## FIREBAR Single/Double-Ended Heaters

### Technical Data

The *FIREBAR Heater Oil Test* graph compares sheath temperatures of 40 W/in<sup>2</sup> (6.7 W/cm<sup>2</sup>) flat and round tubular elements. The FIREBAR element consistently operates at a lower sheath temperature than the round tubular element, even when light oils are tested at different temperatures. This reduces the chance that coking and fluid degradation will occur.

In fact, the FIREBAR element's sheath temperature at 40 W/in<sup>2</sup> (6.7 W/cm<sup>2</sup>) is lower than a 30 W/in<sup>2</sup> (4.6 W/cm<sup>2</sup>) round tubular element.



### Heater Size and Power

The *Heater Size Comparison* chart shows, at the same wattage and watt density, the FIREBAR element is 38 percent shorter than a 0.430 in. (11 mm) round tubular element. The FIREBAR element requires less space in application and equipment designs.

#### Heater Size Comparison

Element	Heated Length in. (mm)	Wattage	W/in <sup>2</sup>	(W/cm <sup>2</sup> )
1 in. FIREBAR Element	19 <sup>7</sup> / <sub>8</sub> (504.8)	1000	23	(3.6)
0.430 in. Round Tubular Element	32 <sup>1</sup> / <sub>4</sub> (819.0)	1000	23	(3.6)

The *Heater Power Comparison* chart demonstrates equal watt density, element length and increased total wattage for the FIREBAR element. The power in the FIREBAR element is 70 percent greater.

#### Heater Power Comparison

Element	Heated Length in. (mm)	Wattage	W/in <sup>2</sup>	(W/cm <sup>2</sup> )
1 in. FIREBAR Element	32 <sup>1</sup> / <sub>4</sub> (819.0)	1700	23	(3.6)
0.430 in. Round Tubular Element	32 <sup>1</sup> / <sub>4</sub> (819.0)	1000	23	(3.6)

# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

**Technical Data** (Continued)

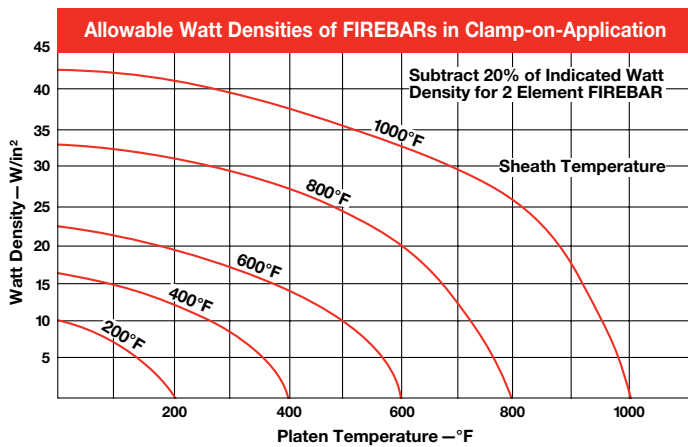
### Clamp-On Applications

Direct immersion in the liquid may not always be practical. In these instances the FIREBAR element can be clamped to a tank wall. Heat from the FIREBAR is conducted to the tank wall and into the media.

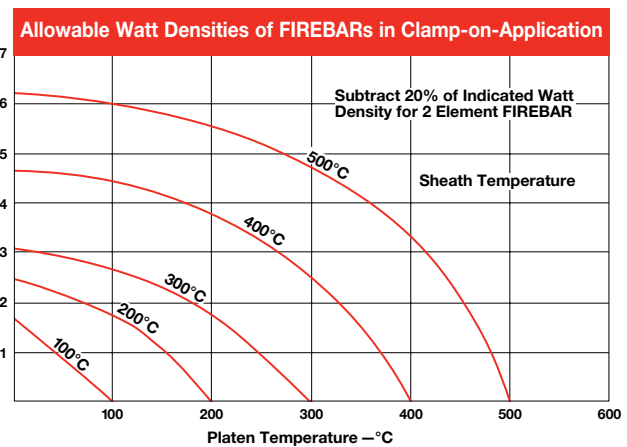
FIREBAR elements are also economical platen heaters. The *Platen Heating* graph shows FIREBAR's large, flat surface area allowing it to operate at twice the watt density of round tubular elements ... without sacrificing heater life.

Clamps should be placed approximately 6 in. (150 mm) apart and torqued down with 60 in.-lbs (6.8 Newton meters).

**Platen Heating (°F)**

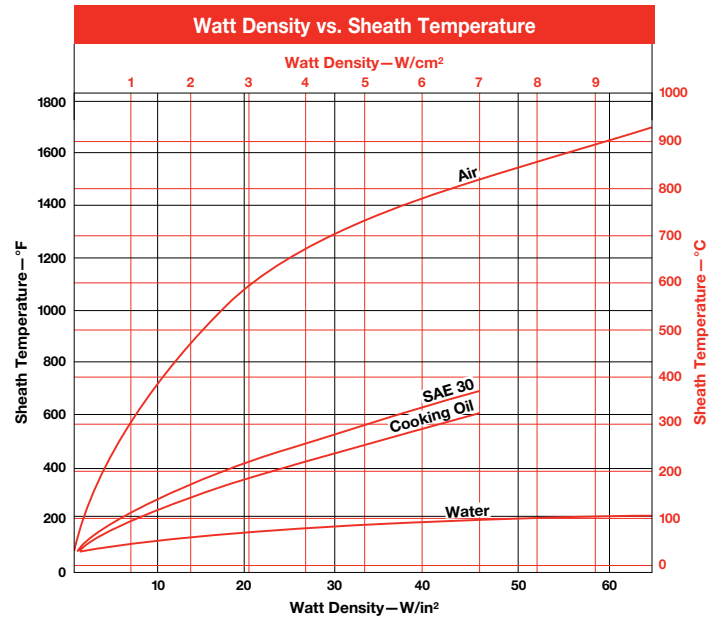


**Platen Heating (°C)**



### Watt Density vs. Sheath Temperature

The *Watt Density vs. Sheath Temperature* graph features sheath temperature curves for commonly heated substances. A FIREBAR element's watt density will result in the sheath temperature shown at the intersecting point of its vertical watt density line and substance curve.



# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

### Technical Data (Continued)

#### Air Heating

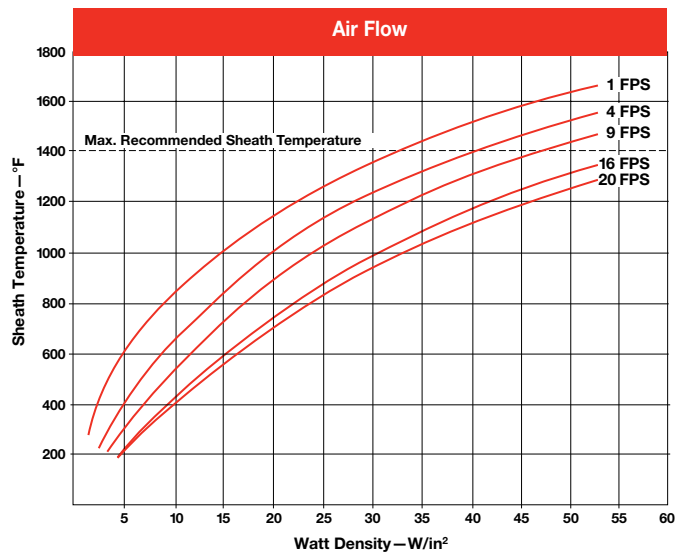
The Air Flow/Watt Density/Sheath Temperature graph shows the relationship between air flow, watt density and sheath temperature. Keep in mind that lower sheath temperature yields longer heater life.

To use the Air Flow graph, determine the air flow in feet per second (or meters per second). Then follow the curve to find the recommended sheath temperature and watt density.

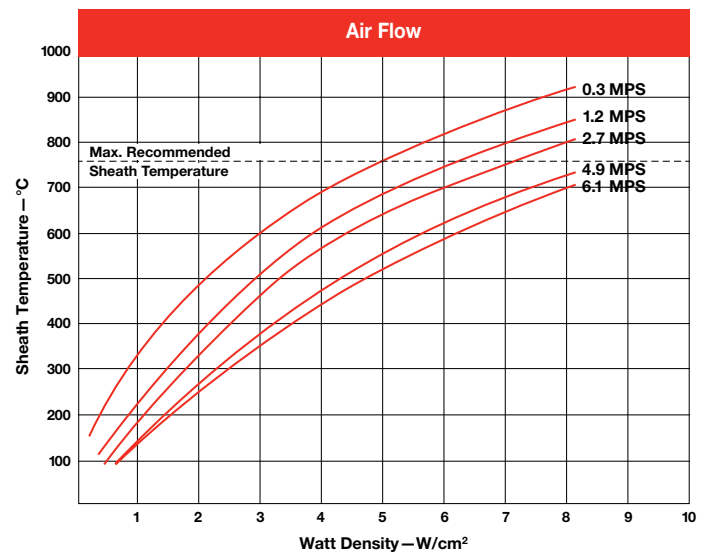


Air Flow Normal to Sheath Geometry

Air Flow/Watt Density/Sheath Temperature (°F)



Air Flow/Watt Density/Sheath Temperature (°C)



#### Moisture Resistant Seals

A lavacone seal is provided to prevent moisture and contaminants from entering the heater. Upon request, optional silicone rubber (RTV) and epoxy resin seals may be ordered.

##### Silicone Rubber (RTV) Seal

Silicone rubber RTV seals are 1/8 in. (3.2 mm) moisture barriers surrounding the terminal pins at the end of the sheath. Silicone rubber is effective to 392°F (200°C).

##### Epoxy Resin Seal

Epoxy resin seals are 1/8 in. (3.2 mm) moisture barriers surrounding the terminal pins at the end of the sheath. Epoxy resin is effective to 194°F (90°C) or 356°F (180°C), and recommended for water heating applications.

#### Application Hints

- Choose a FIREBAR heating element instead of an assembly when the application requires lower wattages or smaller system packages.
- Keep terminations clean, dry and tight.
- Extend the heated section completely into the media being heated at all times to maximize heat transfer and heater life.
- Do not locate the end of the heated length within a bend, unless the radius is 3 in. (76 mm) or larger.
- Ensure termination temperatures do not exceed 392°F (200°C) or the maximum temperature rating of the end seal, whichever is lower.

# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

### Technical Data (Continued)

All FIREBAR heaters are available with a variety of termination options. Contact your Watlow representative for availability.

#### Terminations

Part Number*	Termination	Phase	Wiring	1 in. FIREBAR		5/8 in. FIREBAR	
				Dual-Ended	S. End/FINBAR	Dual-Ended	Single-Ended
<b>A1</b>	Sil-A-Blend® 200°C lead wire	1	Parallel	Yes	Yes	Yes	Yes
<b>A2</b>	Sil-A-Blend® 200°C lead wire	1	Series	Yes	No	Yes	No
<b>A3</b>	Sil-A-Blend® 200°C lead wire	3	Delta	Yes	No	No	No
<b>A4</b>	Sil-A-Blend® 200°C lead wire	3	Wye	Yes	Yes	No	No
<b>B1</b>	TGGT 250°C lead wire	1	Parallel	Yes	Yes	Yes	Yes
<b>B2</b>	TGGT 250°C lead wire	1	Series	Yes	No	Yes	No
<b>B3</b>	TGGT 250°C lead wire	3	Delta	Yes	No	No	No
<b>B4</b>	TGGT 250°C lead wire	3	Wye	Yes	Yes	No	No
<b>C1</b>	1/4 in. quick connect (spade)	1	Parallel	Yes	Yes	Yes	Yes
<b>C2</b>	1/4 in. quick connect (spade)	1	Series	Yes	No	No	No
<b>D1</b>	Screw lug (plate) terminal	1	Parallel	Yes	Yes	Yes	Yes
<b>D2</b>	Screw lug (plate) terminal	1	Series	Yes	No	No	No
<b>D3</b>	Screw lug (plate) terminal	3	Delta	Yes	No	No	No
<b>E1</b>	#10-32 stud terminal	1	Parallel	Yes	Yes	Yes	Yes
<b>E2</b>	#10-32 stud terminal	1	Series	Yes	No	No	No
<b>E3</b>	#10-32 stud terminal	3	Delta	Yes	No	No	No

#### Termination Code Number Legend\*

- A = Silicone rubber insulation (Sil-A-Blend®) with fiberglass oversleeves Rated to 392°F (200°C)
- B = High-temperature TGGT insulation with fiberglass oversleeves Rated to 480°F (250°C)
- C = Nickel-plated steel quick connect

D = Nickel-plated steel screw lug with ceramic insulator and plated steel screw

E = #10-32 nickel-plated steel threaded stud with plated steel nuts and washers

#### Electrical Configuration

- 1 = 1-phase parallel, 2 = 1-phase series, 3 = 3-phase delta, 4 = 3-phase wye

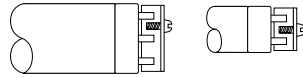
### Double-End/Single-End 1 in. FIREBAR

#### Flexible Lead Wire<sup>①</sup> A, B



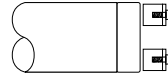
- Double-End 1 in. FIREBAR
- Single-End 1 in. FIREBAR
- FINBAR

#### Screw Lug (Plate) D1



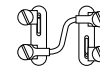
- Double-End 1 & 5/8 in. FIREBAR

#### Screw Lug (Plate) D3

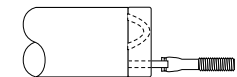


- Double-End 1 in. FIREBAR

3-phase delta wiring example

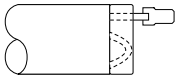


#### Threaded Stud E2



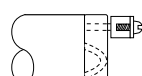
- Double-End 1 in. FIREBAR

#### Quick Connect (Spade) C2



- Double-End 1 in. FIREBAR

#### Screw Lug (Plate) D2



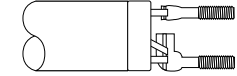
- Double-End 1 in. FIREBAR

#### Threaded Stud E1



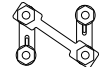
- Double-End 1 & 5/8 in. FIREBAR

#### Threaded Stud E3



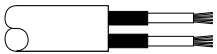
- Double-End 1 in. FIREBAR

3-phase delta wiring example



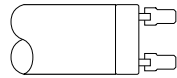
### Single-End FIREBAR, Double-End/Single-End FINBAR

#### Flexible Lead Wire<sup>①</sup> A, B



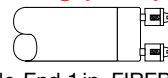
- Single-End 1 in. FIREBAR
- Double-End 5/8 in. FIREBAR
- Single-End 5/8 in. FIREBAR
- FINBAR

#### Quick Connect (Spade) C1



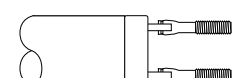
- Single-End 1 FIREBAR
- FINBAR
- Double-End 5/8 in. FIREBAR
- Single-End 5/8 in. FIREBAR

#### Screw Lug (Plate) D1



- Single-End 1 in. FIREBAR
- FINBAR
- Double-End 5/8 in. FIREBAR
- Single-End 5/8 in. FIREBAR

#### Threaded Stud E1



- Single-End 1 in. FIREBAR
- FINBAR

<sup>①</sup>Flexible lead wires are 12 in. (305 mm) long unless otherwise specified.

# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

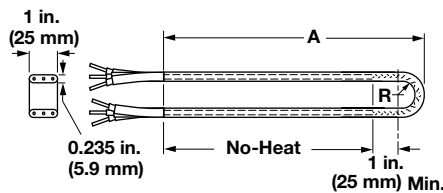
### Bending

#### Major and Minor Axis Bending Parameters

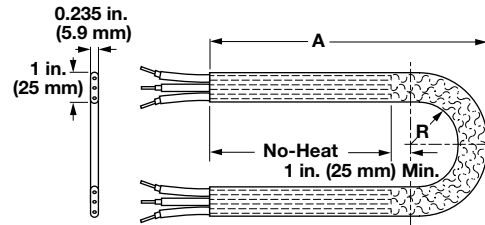
The following illustrations detail the recommended major and minor axis bend parameters for FIREBAR elements. These illustrations show the relationship between the type of bend and the location of heat and no-heat sections. See the next two pages for the 15 common bend formations.

**Note:** Watlow does not recommend field bending FIREBAR elements. If the element must be bent in the field, please contact your Watlow representative for assistance.

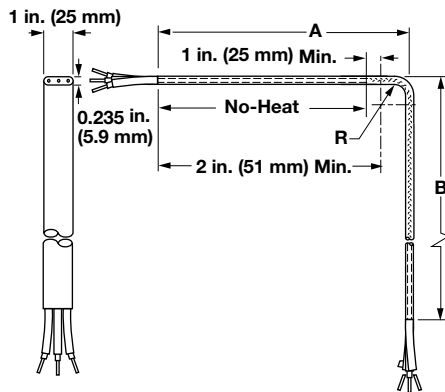
#### 180° Minor Axis Heated Bend



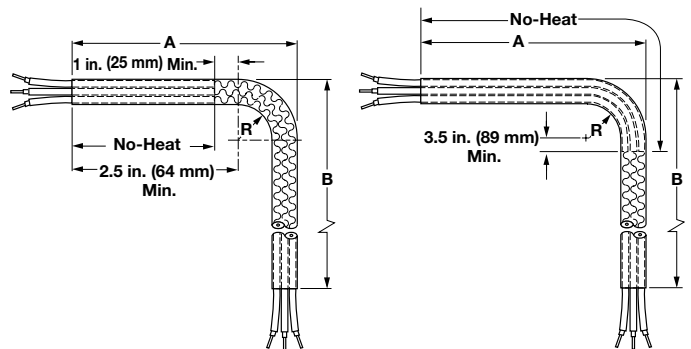
#### 180° Major Axis Heated Bend



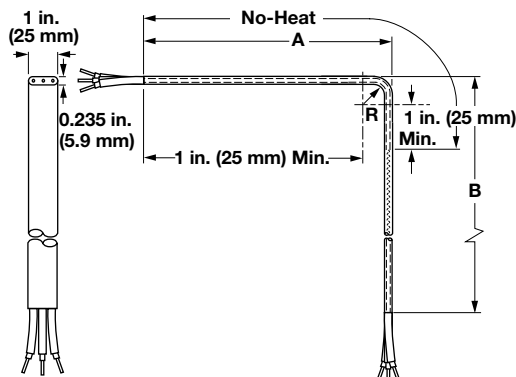
#### 90° Minor Axis Heated Bend



#### 90° Major Axis Heated Bend



#### 90° Minor Axis Un-Heated Bend



#### 180° Major Axis Bends

FIREBAR Size in.	(mm)	Radius in.	(mm)	Arc Length
5/8	(15.9)	3/4	(19.0)	3.125
5/8	(15.9)	1	(25.0)	3.900
5/8	(15.9)	1 1/4	(32.0)	4.620
5/8	(15.9)	1 1/2	(38.0)	5.600
1	(25.0)	1	(25.0)	4.335
1	(25.0)	1 1/4	(32.0)	5.121
1	(25.0)	1 1/2	(38.0)	5.906

# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

### Bend Formations

FIREBAR elements can be formed into compounds, multi-axis and multi-plane configurations from 15 common bends. Custom bending with tighter tolerances can be made to meet specific application needs.

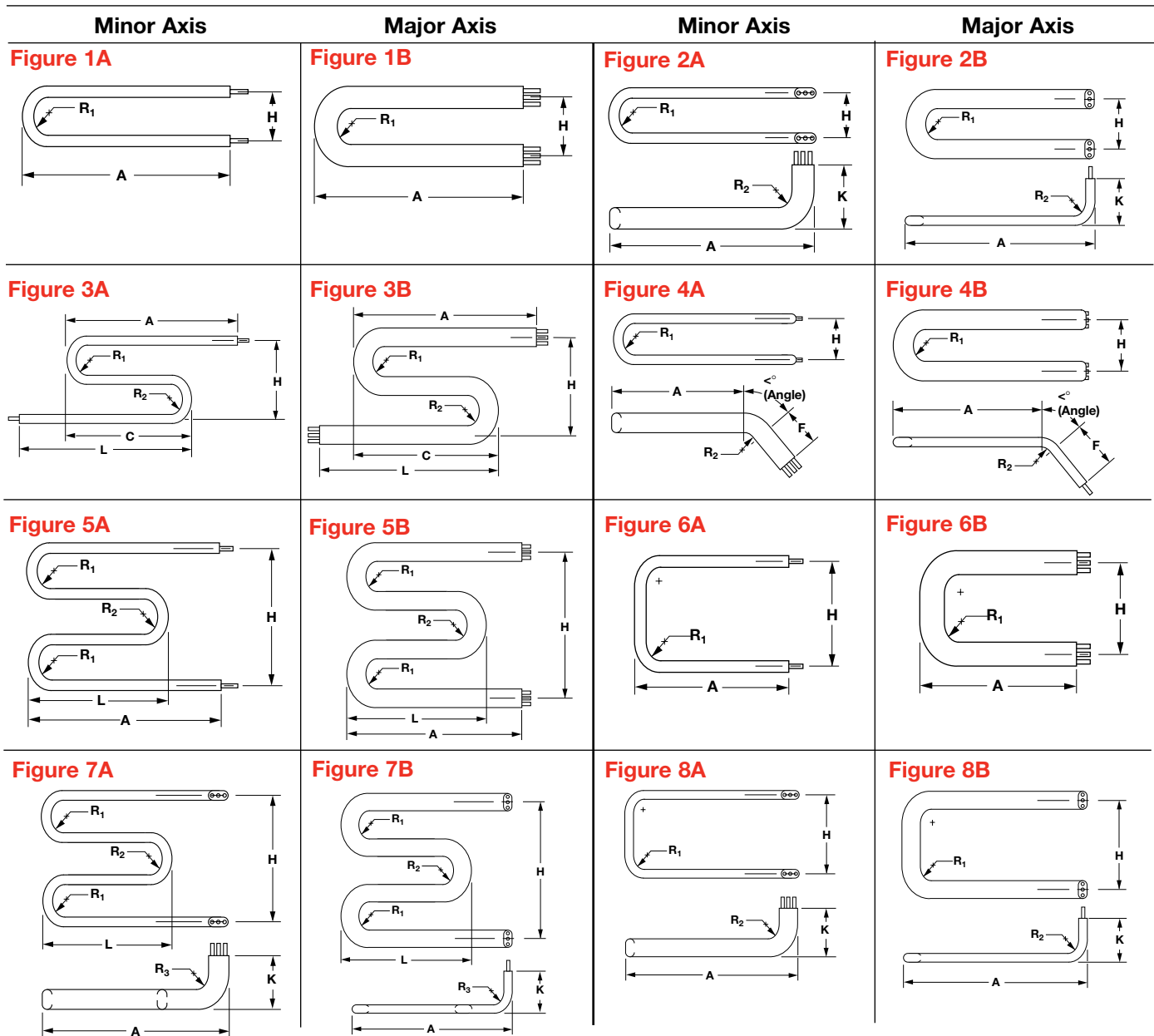
Formation is limited by bending parameters specified in the illustrations of major and minor axis bends on the previous page. On these illustrations, please note the no-heat end location.

The no-heat end junction must be located a minimum of 1 in. (25 mm) from any bend. If these parameters are not followed, the heater may fail prematurely. Field bending not recommended.

Illustrated below are the common bends that can be ordered for all FIREBAR heating elements.

To order a common bend, specify the **figure number** and **critical dimensions**.

**Note:** The alpha characters and symbols are used to designate specific dimensions within each illustration.



# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

Bend Formation (Continued)

Minor Axis	Major Axis	Minor Axis	Major Axis
<p><b>Figure 9A</b></p>	<p><b>Figure 9B</b></p>	<p><b>Figure 10A</b></p>	<p>Bend Figure 10B Not Available On Major Axis</p>
<p><b>Figure 11A</b></p>	<p>Bend Figure 11B Not Available On Major Axis</p>	<p><b>Figure 12A</b></p>	<p><b>Figure 12B</b></p>
<p><b>Figure 13A</b></p>	<p><b>Figure 13B</b></p>	<p><b>Figure 14A</b></p>	<p><b>Figure 14B</b></p>
<p><b>Figure 15A</b></p>	<p><b>Figure 15B</b></p>		

# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

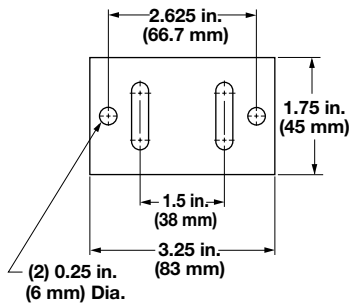
### Mounting Brackets

Steel brackets provide element mounting in non-pressurized applications. In air heating applications, an 18-gauge aluminized steel bracket is tack welded to the element. A 1/4 in. (6 mm) thick steel bracket is brazed or welded liquid-tight to the element for liquid heating. Upon request, stainless steel brackets can be provided. Special sizes also available.

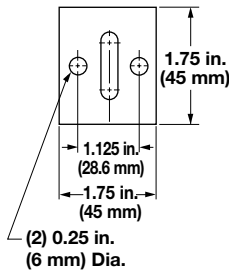
The bracket is located 1/2 in. (13 mm) from the sheath's end, 1/16 in. (1.6 mm) if welded. Available on 5/8 in. (15.9 mm) FIREBAR as **made-to-order** only.

To order, specify **mounting bracket** as well as type, location, material and size.

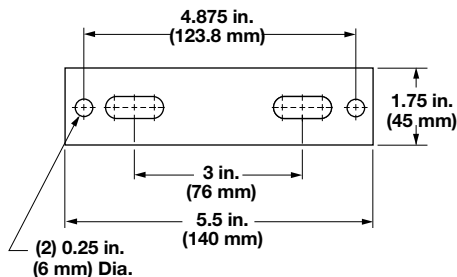
#### Type 1



#### Type 2



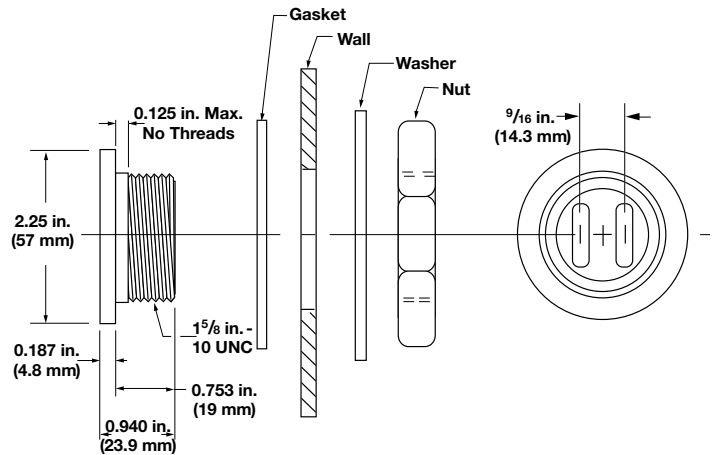
#### Type 3



### Water-Tight Double-Leg Threaded Fitting

A threaded 1 5/8 in.-10 UNC stainless steel fitting with flange on the heater sheath provides rigid, leak-proof mounting through tank walls. This fitting allows both legs of the heater to pass through the same opening. A gasket, plated steel washer and hex nut are included. The threaded end of the bulkhead is mounted flush with the sheath's end, unless otherwise specified. Available on **1 inch FIREBAR only (brazed only, available)**.

To order, specify **water-tight double-leg threaded fitting**.



### Surface Finish

#### Bright Annealing

Bright annealing is a process that produces a smooth, metallic finish. It is a special annealed finish created in a non-oxidizing atmosphere. This finish is popular in the pharmaceutical and foodservice/beverage markets.

To order, specify **bright annealing**.

#### Passivation

During manufacturing, particles of iron or tool steel may be embedded in the stainless steel or alloy sheath. If not removed, these particles may corrode and produce rust spots. For critical sheath applications, passivation will remove free iron from the sheath.

To order, specify **passivation**.



# Tubular Heaters

**EXTENDED  
CAPABILITY**

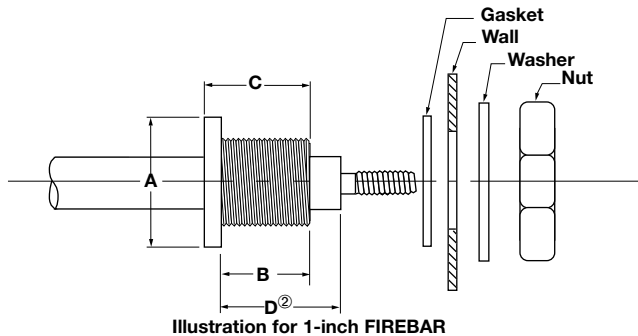


## Extended Capabilities for FIREBAR Single/Double-Ended Heaters

### Single Leg Threaded Bulkhead

A threaded stainless steel bushing with flange on the heater sheath provides rigid, leak-proof mounting through tank walls. A gasket, plated steel washer and hex nut are included (brazed only, available).

To order, specify **single leg threaded bulkhead**.



Heater Size in.	(mm)	Thread Size
5/8	(15.9)	7/8-14 UNF-2A
1	(25.0)	3/4-16 UNF-2A

Illustration for 5/8-inch FIREBAR

### Options for One-Inch and 5/8-Inch FIREBAR

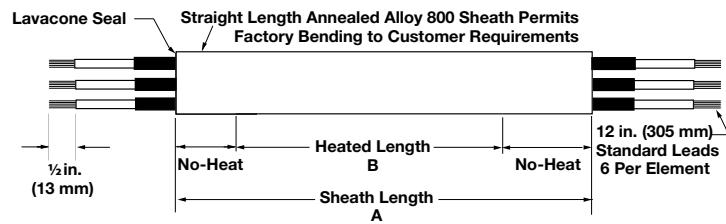
- Electropolished finish
- Bulkhead, single leg
- Custom formations
- Terminal enclosures (general purpose, moisture resistant, and moisture/corrosion resistant)
- Custom wattage tolerance ( $\pm 5\%$ )

# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

### One-Inch, Double-Ended FIREBAR



FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number		Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	lbs	(kg)

#### Applications: Asphalt, Paraffin (Solid), Bunker Oil, Clamp-On

<b>6 W/in<sup>2</sup></b> <b>Alloy 800</b> <b>(1 W/cm<sup>2</sup>)</b>	35	(889)	25	(635)	310	<b>FBN351WD</b>		1.3	(0.6)
	41	(1041)	31	(787)	410	<b>FBN411WD</b>		1.5	(0.7)
	51	(1295)	41	(1041)	530	<b>FBN511WD</b>	<b>FBN5110WD</b>	1.9	(0.9)
	62	(1574)	52	(1320)	650	<b>FBN621WD</b>	<b>FBN6210WD</b>	2.3	(1.1)
	72	(1828)	62	(1574)	800	<b>FBN721WD</b>	<b>FBN7210WD</b>	2.6	(1.2)
	93	(2362)	83	(2108)	1,060	<b>FBN931WD</b>	<b>FBN9310WD</b>	3.4	(1.6)
	114	(2895)	104	(2641)	1,350	<b>FBN1141WD</b>	<b>FBN11410WD</b>	4.2	(1.9)

#### Applications: Griddles, Fuel Oil, Clamp-On

<b>10 W/in<sup>2</sup></b> <b>Alloy 800</b> <b>(1.6 W/cm<sup>2</sup>)</b>	25	(635)	22	(558)	500	<b>FBN251WL</b>		0.9	(0.4)
	35	(889)	32	(812)	750	<b>FBN351WL</b>	<b>FBN3510WL</b>	1.3	(0.6)
	47	(1193)	43	(1092)	1,000	<b>FBN471WL</b>	<b>FBN4710WL</b>	1.7	(0.8)
	69	(1752)	65	(1651)	1,500	<b>FBN691WL</b>	<b>FBN6910WL</b>	2.5	(1.2)
	90	(2286)	86	(2184)	2,000	<b>FBN901WL</b>	<b>FBN9010WL</b>	3.3	(1.5)

#### Applications: Clamp-On, Medium Weight Oils, Liquid Paraffin, Low-Temperature Ovens 400°F (205°C)

<b>15 W/in<sup>2</sup> ①</b> <b>Alloy 800</b> <b>(2.3 W/cm<sup>2</sup>)</b>	29	(736)	19	(482)	670		<b>FBN2910WE</b>	1.1	(0.5)
	34	(863)	24	(609)	830		<b>FBN3410WE</b>	1.3	(0.6)
	39	(990)	29	(736)	1,000		<b>FBN3910WE</b>	1.4	(0.7)
	48	(1219)	38	(965)	1,330		<b>FBN4810WE</b>	1.8	(0.9)
	58	(1473)	48	(1219)	1,670		<b>FBN5810WE</b>	2.1	(1.0)
	68	(1727)	58	(1473)	2,000		<b>FBN6810WE</b>	2.5	(1.2)
	87	(2209)	77	(1955)	2,670		<b>FBN8710WE</b>	3.2	(1.5)
	106	(2692)	96	(2438)	3,330		<b>FBN10610WE</b>	3.9	(1.8)

#### Applications: Radiant, Platens, Dies, Low-Temperature Ovens 300°F (150°C)

<b>20 W/in<sup>2</sup></b> <b>Alloy 800</b> <b>(3.1 W/cm<sup>2</sup>)</b>	15	(381)	11	(279)	500	<b>FBN151WM</b>		0.6	(0.3)
	20	(508)	16	(406)	750	<b>FBN201WM</b>		0.8	(0.4)
	26	(660)	22	(558)	1,000	<b>FBN261WM</b>	<b>FBN2610WM</b>	1.0	(0.5)
	36	(914)	32	(812)	1,500	<b>FBN361WM</b>	<b>FBN3610WM</b>	1.3	(0.6)
	48	(1219)	43	(1092)	2,000	<b>FBN481WM</b>	<b>FBN4810WM</b>	1.8	(0.9)
	70	(1778)	65	(1651)	3,000		<b>FBN7010WM</b>	2.6	(1.2)
	91	(2311)	85	(2159)	4,000		<b>FBN9110WM</b>	3.3	(1.5)

#### Applications: Degreasing Solutions, Heat Transfer Oils

<b>23 W/in<sup>2</sup></b> <b>Alloy 800</b> <b>(3.6 W/cm<sup>2</sup>)</b>	35	(889)	25	(635)	1,250	<b>FBN351WT</b>	<b>FBN3510WT</b>	1.3	(0.6)
	41	(1041)	31	(787)	1,625	<b>FBN411WT</b>	<b>FBN4110WT</b>	1.5	(0.7)
	51	(1295)	41	(1041)	2,125	<b>FBN511WT</b>	<b>FBN5110WT</b>	1.9	(0.9)
	62	(1574)	52	(1320)	2,625	<b>FBN621WT</b>	<b>FBN6210WT</b>	2.3	(1.1)
	72	(1828)	62	(1574)	3,200	<b>FBN721WT</b>	<b>FBN7210WT</b>	2.6	(1.2)
	93	(2362)	83	(2108)	4,250	<b>FBN931WT</b>	<b>FBN9310WT</b>	3.4	(1.6)
	114	(2895)	104	(2641)	5,400	<b>FBN1141WT</b>	<b>FBN11410WT</b>	4.2	(1.9)

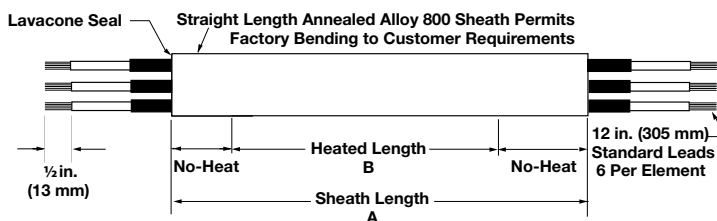
CONTINUED

# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

### One-Inch, Double-Ended FIREBAR (Continued)



FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number		Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	lbs	(kg)

#### Applications: Cooking Oils, Mild Caustic Solution, Ethylene Glycol (100%)

30 W/in <sup>2</sup> Alloy 800 (4.7 W/cm <sup>2</sup> )	16	(406)	10	(254)	750	FBN161WH		0.6	(0.3)
	20	(508)	14	(355)	1000	FBN201WH		0.8	(0.4)
	27	(685)	21	(533)	1500	FBN271WH	FBN2710WH	1.0	(0.5)
	34	(863)	28	(711)	2000	FBN341WH	FBN3410WH	1.3	(0.6)
	50	(1270)	43	(1092)	3000		FBN5010WH	1.8	(0.9)
	64	(1625)	57	(1447)	4000		FBN6410WH	2.4	(1.1)
	80	(2032)	72	(1828)	5000		FBN8010WH	2.9	(1.4)

#### Applications: Process Water, Ethylene Glycol (50%)

40 W/in <sup>2</sup> Alloy 800 (6.2 W/cm <sup>2</sup> )	25	(635)	22	(558)	2000		FBN2510WK	0.9	(0.4)
	35	(889)	32	(812)	3000		FBN3510WK	1.3	(0.6)
	47	(1193)	43	(1092)	4000		FBN4710WK	1.7	(0.8)
	69	(1752)	65	(1651)	6000		FBN6910WK	2.5	(1.2)
	90	(2286)	86	(2184)	8000		FBN9010WK	3.3	(1.5)
45 W/in <sup>2</sup> Alloy 800 (7 W/cm <sup>2</sup> )	29	(736)	19	(482)	2000		FBN2910WP	1.1	(0.5)
	34	(863)	24	(609)	2500		FBN3410WP	1.3	(0.6)
	39	(990)	29	(736)	3000		FBN3910WP	1.4	(0.7)
	48	(1219)	38	(965)	4000		FBN4810WP	1.8	(0.9)
	58	(1473)	48	(1219)	5000		FBN5810WP	2.1	(1.0)
	68	(1727)	58	(1473)	6000		FBN6810WP	2.5	(1.2)
	87	(2209)	77	(1955)	8000		FBN8710WP	3.2	(1.5)
106	(2692)	96	(2438)	10,000		FBN10610WP	3.9	(1.8)	

#### Applications: Clean and Potable Water

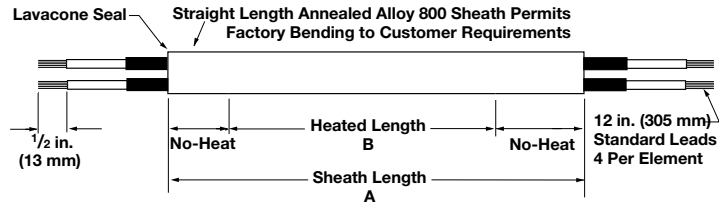
80 W/in <sup>2</sup> Alloy 800 (12.4 W/cm <sup>2</sup> )	15	(381)	11	(279)	2000		FBN1510WJ	0.6	(0.3)
	20	(508)	16	(406)	3000		FBN2010WJ	0.8	(0.4)
	26	(660)	22	(558)	4000		FBN2610WJ	1.0	(0.5)
	36	(914)	32	(812)	6000		FBN3610WJ	1.3	(0.6)
	48	(1219)	43	(1092)	8000		FBN4810WJ	1.8	(0.9)
	70	(1778)	65	(1651)	12,000			2.6	(1.2)
90 W/in <sup>2</sup> Alloy 800 (14 W/cm <sup>2</sup> )	91	(2311)	85	(2159)	16,000			3.3	(1.5)
	35	(889)	25	(635)	5000	FBN351WG	FBN3510WG	1.3	(0.6)
	41	(1041)	31	(787)	6500	FBN411WG	FBN4110WG	1.5	(0.7)
	51	(1295)	41	(1041)	8500		FBN5110WG	1.9	(0.9)
	62	(1574)	52	(1320)	10,500		FBN6210WG	2.3	(1.1)
	72	(1828)	62	(1574)	12,750		FBN7210WG	2.6	(1.2)
	93	(2362)	83	(2108)	17,000			3.4	(1.6)
114	(2895)	104	(2641)	21,500			3.4	(1.6)	

# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

### 5/8-Inch Double-Ended FIREBAR



FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number		Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	lbs	(kg)

#### Applications: Degreasing Fluids, Heat Transfer Oils

<b>23 W/in<sup>2</sup> ①</b> <b>Alloy 840</b> <b>(3.6 W/cm<sup>2</sup>)</b>	19	(483)	11	(279)	375	<b>FAN191WT</b>		0.5	(0.3)
	22	(559)	14	(356)	500	<b>FAN221WT</b>	<b>FAN2210WT</b>	0.5	(0.3)
	26	(660)	18	(457)	625	<b>FAN261WT</b>	<b>FAN2610WT</b>	0.6	(0.3)
	30	(762)	22	(559)	750	<b>FAN301WT</b>	<b>FAN3010WT</b>	0.7	(0.4)
	37	(940)	29	(737)	1000	<b>FAN371WT</b>	<b>FAN3710WT</b>	0.9	(0.5)
	44	(1118)	36	(914)	1250	<b>FAN441WT</b>	<b>FAN4410WT</b>	1.0	(0.5)
	51	(1295)	43	(1092)	1500	<b>FAN511WT</b>	<b>FAN5110WT</b>	1.2	(0.6)

#### Applications: Clean and Potable Water

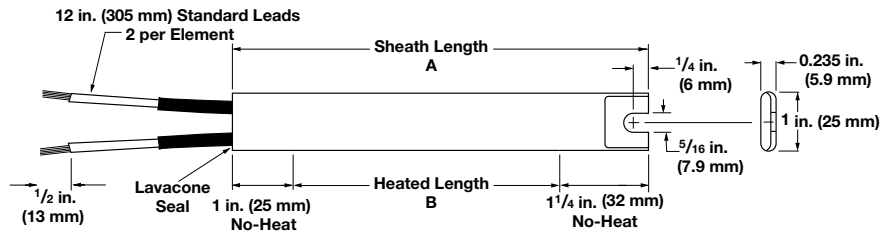
<b>90 W/in<sup>2</sup></b> <b>Alloy 840</b> <b>(14 W/cm<sup>2</sup>)</b>	15	(381)	7	(178)	1000	<b>FAN151WG</b>	<b>FAN1510WG</b>	0.4	(0.2)
	19	(483)	11	(279)	1500	<b>FAN191WG</b>	<b>FAN1910WG</b>	0.5	(0.3)
	22	(559)	14	(356)	2000	<b>FAN221WG</b>	<b>FAN2210WG</b>	0.5	(0.3)
	26	(660)	18	(457)	2500	<b>FAN261WG</b>	<b>FAN2610WG</b>	0.6	(0.3)
	30	(762)	22	(559)	3000	<b>FAN301WG</b>	<b>FAN3010WG</b>	0.7	(0.4)
	37	(940)	29	(737)	4000		<b>FAN3710WG</b>	0.9	(0.5)
	44	(1118)	36	(914)	5000		<b>FAN4410WG</b>	1.0	(0.5)
	51	(1295)	43	(1092)	6000		<b>FAN5110WG</b>	1.2	(0.6)

# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

### One-Inch, Single-Ended FIREBAR



FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number		Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	lbs	(kg)

#### Applications: Radiant, Platens, Dies, Low-Temperature Ovens 300°F (150°C)

20 W/in <sup>2</sup> 304 SS (3.1 W/cm <sup>2</sup> )	8 <sup>3</sup> / <sub>4</sub> (222.0)	6 <sup>1</sup> / <sub>2</sub> (165.0)	300	FSP91WM		0.4 (0.2)
	10 <sup>1</sup> / <sub>4</sub> (260.0)	7 <sup>1</sup> / <sub>2</sub> (203.0)	375	FSP101WM		0.4 (0.2)
	12 <sup>1</sup> / <sub>4</sub> (311.0)	10 (254.0)	450	FSP121WM		0.5 (0.3)
	13 <sup>1</sup> / <sub>2</sub> (343.0)	11 <sup>1</sup> / <sub>4</sub> (286.0)	500	FSP141WM		0.5 (0.3)
	16 <sup>1</sup> / <sub>8</sub> (408.6)	13 <sup>7</sup> / <sub>8</sub> (352.4)	650	FSP161WM	FSP1610WM	0.6 (0.3)
	17 <sup>3</sup> / <sub>4</sub> (451.0)	15 <sup>1</sup> / <sub>2</sub> (393.0)	725	FSP181WM	FSP1810WM	0.7 (0.4)
	19 <sup>1</sup> / <sub>4</sub> (489.0)	17 (431.0)	800	FSP191WM	FSP1910WM	0.7 (0.4)
	22 (558.0)	19 <sup>3</sup> / <sub>4</sub> (502.0)	900	FSP221WM	FSP2210WM	0.8 (0.4)
	23 <sup>3</sup> / <sub>4</sub> (603.0)	21 <sup>1</sup> / <sub>2</sub> (546.0)	1,000	FSP241WM	FSP2410WM	0.9 (0.4)
	25 (635.0)	22 <sup>3</sup> / <sub>4</sub> (578.0)	1,050	FSP251WM	FSP2510WM	0.9 (0.4)
	28 <sup>5</sup> / <sub>8</sub> (727.1)	26 <sup>3</sup> / <sub>8</sub> (670.0)	1,250	FSP291WM	FSP2910WM	1.1 (0.5)
	31 <sup>5</sup> / <sub>8</sub> (803.3)	29 <sup>3</sup> / <sub>8</sub> (746.1)	1,350	FSP321WM	FSP3210WM	1.2 (0.6)
	34 <sup>1</sup> / <sub>8</sub> (866.8)	31 <sup>7</sup> / <sub>8</sub> (809.6)	1,500		FSP3410WM	1.3 (0.6)
	36 <sup>7</sup> / <sub>8</sub> (936.6)	34 <sup>5</sup> / <sub>8</sub> (879.5)	1,600		FSP3710WM	1.4 (0.7)
	40 <sup>5</sup> / <sub>8</sub> (1031.9)	38 <sup>3</sup> / <sub>8</sub> (974.7)	1,800		FSP4110WM	1.5 (0.7)
	46 <sup>1</sup> / <sub>4</sub> (1175.0)	44 (1117.0)	2,000		FSP4610WM	1.7 (0.8)

#### Applications: Air Heating

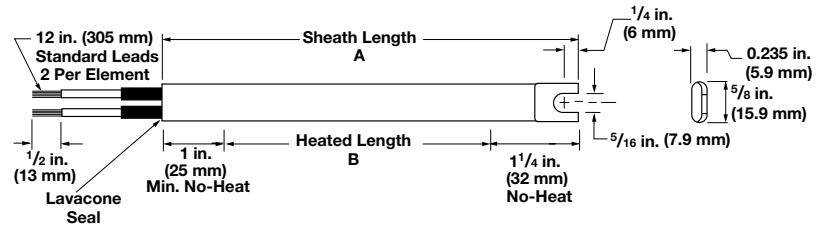
40 W/in <sup>2</sup> 304 SS (6.2 W/cm <sup>2</sup> )	8 <sup>3</sup> / <sub>4</sub> (222.0)	6 <sup>1</sup> / <sub>2</sub> (165.0)	600	FSP91WK		0.4 (0.2)
	10 <sup>1</sup> / <sub>4</sub> (260.0)	7 <sup>1</sup> / <sub>2</sub> (203.0)	750	FSP101WK		0.4 (0.2)
	12 <sup>1</sup> / <sub>4</sub> (311.0)	10 (254.0)	900	FSP121WK	FSP1210WK	0.5 (0.3)
	13 <sup>1</sup> / <sub>2</sub> (343.0)	11 <sup>1</sup> / <sub>4</sub> (286.0)	1,000	FSP131WK	FSP1310WK	0.5 (0.3)
	16 <sup>1</sup> / <sub>4</sub> (413.0)	13 <sup>7</sup> / <sub>8</sub> (352.4)	1,300	FSP161WK	FSP1610WK	0.6 (0.3)
	17 <sup>3</sup> / <sub>4</sub> (451.0)	15 <sup>1</sup> / <sub>2</sub> (393.0)	1,450	FSP181WK	FSP1810WK	0.7 (0.4)
	19 <sup>1</sup> / <sub>4</sub> (489.0)	17 (431.0)	1,600		FSP1910WK	0.7 (0.4)
	22 (558.0)	19 <sup>3</sup> / <sub>4</sub> (502.0)	1,800		FSP2210WK	0.8 (0.4)
	23 <sup>3</sup> / <sub>4</sub> (603.0)	21 <sup>1</sup> / <sub>2</sub> (546.0)	2,000		FSP2410WK	0.9 (0.4)
	25 (635.0)	22 <sup>3</sup> / <sub>4</sub> (578.0)	2,100		FSP2510WK	0.9 (0.4)
	28 <sup>5</sup> / <sub>8</sub> (727.1)	26 <sup>3</sup> / <sub>8</sub> (669.9)	2,500		FSP2910WK	1.1 (0.5)
	31 <sup>5</sup> / <sub>8</sub> (803.2)	29 <sup>3</sup> / <sub>8</sub> (746.1)	2,700		FSP3210WK	1.2 (0.6)
	34 <sup>1</sup> / <sub>8</sub> (866.8)	31 <sup>7</sup> / <sub>8</sub> (809.6)	3,000		FSP3410WK	1.3 (0.6)
	36 <sup>7</sup> / <sub>8</sub> (936.6)	34 <sup>5</sup> / <sub>8</sub> (879.5)	3,200		FSP3710WK	1.4 (0.7)
	40 <sup>5</sup> / <sub>8</sub> (1031.9)	38 <sup>3</sup> / <sub>8</sub> (974.7)	3,600		FSP4110WK	1.5 (0.7)
	46 <sup>1</sup> / <sub>4</sub> (1175.0)	44 (1117.0)	4,000		FSP4610WK	1.7 (0.8)

# Tubular Heaters



## FIREBAR Single/Double-Ended Heaters

### 5/8-Inch Single-Ended FIREBAR



FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number		Est. Net Weight	
	in.	(mm)	in.	(mm)		120VAC	240VAC	lbs	(kg)

Applications: Radiant, Platens, Dies, Low-Temperature Ovens 300°F (150°C)

20 W/in <sup>2</sup>	11 1/2	(292)	8	(203)	250	FSA121WM		0.3	(0.2)
Alloy 840	15 1/2	(394)	12	(304)	375	FSA161WM	FSA1610WM	0.4	(0.2)
(3.1 W/cm <sup>2</sup> )	19 1/2	(495)	16	(406)	500	FSA201WM	FSA2010WM	0.5	(0.3)
	28	(711)	24	(609)	750	FSA281WM	FSA2810WM	0.6	(0.3)
	36	(914)	32	(812)	1,000	FSA361WM	FSA3610WM	0.8	(0.4)
	52	(1321)	48	(1219)	1,500	FSA521WM	FSA5210WM	1.2	(0.6)

# Tubular Heaters



## FINBAR™ Single-Ended Heaters

Composed of aluminized steel fins press fitted to a one-inch single-ended FIREBAR element. The FINBAR™ is designed to improve heat transfer to the air and permits putting more power in tighter spaces—like forced air ducts, dryers, ovens and load bank resistors.

Heat transfer, lower sheath temperature and element life are all maximized by its finned construction. Installation is simplified by terminations exiting at one end and mounting accommodations on both ends.

### Performance Capabilities

- Watt densities up to 50 W/in<sup>2</sup> (7.7 W/cm<sup>2</sup>)
- 304 stainless steel sheath temperatures up to 1200°F (650°C)
- Voltages up to 480VAC
- Amperages up to 48 amperes per heater or 16 amperes per coil

### Features and Benefits

#### Rugged aluminized steel fins

- Provides an increase in surface area to approximately 16 square inches for every linear inch of element length. Fins press fitted to the heating element improve heat transfer to the air

#### Single-ended termination

- Simplifies wiring and installation

#### Stainless steel mounting bracket, welded to the terminal end, supplied with a slotted end

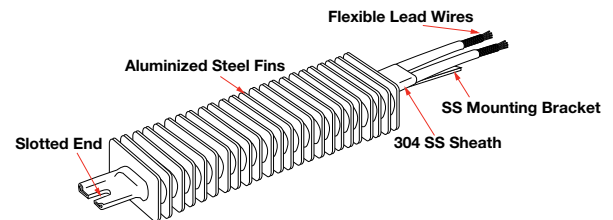
- Allows ease of installation

#### Lavacone seals

- Provides protection against humid storage conditions, moisture retardant to 221°F (105°C)

### Typical Applications

- Forced air heating for dryers, ovens, ducts
- Still air heating for ovens, comfort heating
- Incubators
- Ink drying
- Load bank resistors



### Construction Features

**Watt Density:** Up to 40 W/in<sup>2</sup> (6.2 W/cm<sup>2</sup>)

**Fin Surface Area:** 16 in<sup>2</sup>/linear in. (40.5 cm<sup>2</sup>/linear cm)

**Fin Cross Section:** 2 x 1 in. (50 x 25 mm)

**Maximum Operating Temperature:** Sheath material: 304 SS, 1200°F (650°C), fin material; aluminized steel; 1100°F (600°C)

**Heater Length:** 11 to 120 in. (280 to 3050 mm)

**No-Heat Length:** 1 in. (25 mm) min.,  
12 in. (305 mm) max.

**Voltages:** Up to 240VAC

**Phase:** 1-phase parallel or 3-phase wye

**Resistance Coils:** 1 or 3

**Terminations:** Flexible lead wires, quick connect (spade), screw lug (plate) and threaded stud

**Seal Material:** Lavacone, rated to 221°F (105°C)

**Single-End Configuration:** Slotted

# Tubular Heaters



## FINBAR Single-Ended Heaters

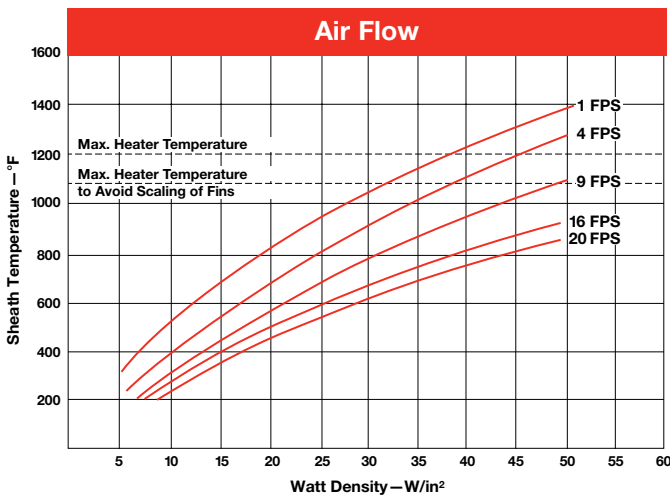
### Air Heating

The *Watt Density, Air Flow and Sheath Temperature* graph shows the relationship between watt density, air flow velocity and sheath temperature, along with a recommended temperature to avoid deteriorating the fins. Be aware that **lower sheath temperature yields longer heater life**.

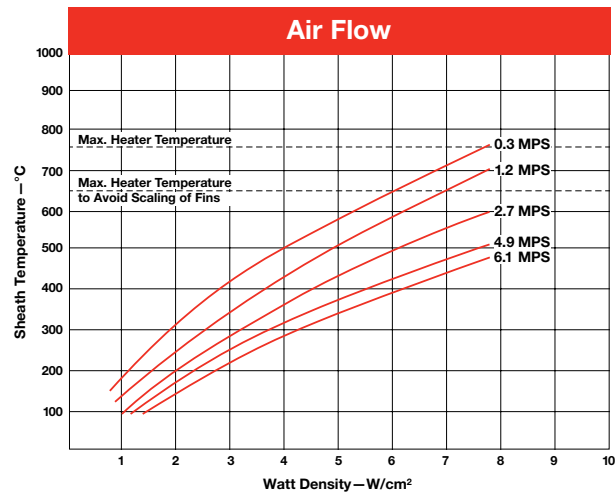
The graphic representation is based on a single-ended FINBAR, various air velocities (at 68°F/20°C inlet temperature) and different watt densities.

To determine, from the graph, the operating temperature of the FINBAR's sheath, identify the air velocity curve that approximates your application in feet per second (meters per second). Then, look at the vertical line that most closely approximates the FINBAR's watt density. From the intersecting point, read over to the temperature column to determine the sheath's operating temperature.

Watt Density, Air Flow and Sheath Temperature (°F)



Watt Density, Air Flow and Sheath Temperature (°C)



### Dual Ended FINBAR

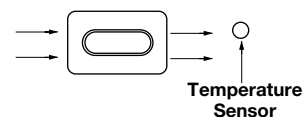
FINBAR elements are typically terminated at one end. Upon request, however, dual-ended FINBAR heaters can be ordered. To order, specify **dual-ended FINBAR** and lead length.

### Application Hints

- Avoid deteriorating the fins by not exceeding the recommended maximum fin temperature of 1100°F (600°C).
- Ensure proper air flow to prevent premature heater failure.
- Locate the temperature sensor downstream from heater(s) for process temperature sensing.

The following mounting parameters are recommended:

- Air flow over element must be parallel with the flat side.
- Element center line to element center line spacing must be a minimum of 1 1/2 in. (38 mm).



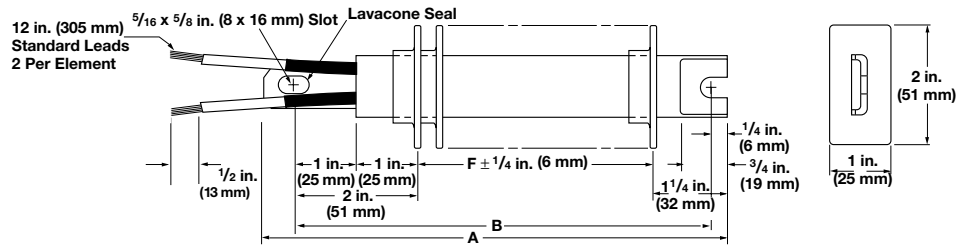
Proper air flow relative to the heater's sheath is parallel with the longer cross sectional axis.



# Tubular Heaters



## FINBAR Single-Ended Heaters



FINBAR Description	Overall A Dimension		Overall F Dimension		Mounting B Dimension		Watts	Part Number		Est. Net Wt.	
	in.	(mm)	in.	(mm)	in.	(mm)		120VAC	240VAC	lbs	(kg)
<b>Application: Forced Air</b>											
<b>20 W/in<sup>2</sup> 304 SS (3.1 W/cm<sup>2</sup>)</b>	10 <sup>1</sup> / <sub>4</sub>	(260.0)	6 <sup>1</sup> / <sub>2</sub>	(158.0)	9 <sup>1</sup> / <sub>2</sub>	(241.0)	300	<b>FSP91WMF</b>		1.4	(0.7)
	11 <sup>3</sup> / <sub>4</sub>	(298.0)	8	(203.0)	11	(279.0)	375	<b>FSP101WMF</b>		1.4	(0.7)
	13 <sup>3</sup> / <sub>4</sub>	(349.0)	10	(254.0)	13	(330.0)	450	<b>FSP121WMF</b>		1.5	(0.7)
	15	(381.0)	11 <sup>1</sup> / <sub>4</sub>	(285.0)	14 <sup>1</sup> / <sub>4</sub>	(362.0)	500	<b>FSP141WMF</b>		1.5	(0.7)
	17 <sup>5</sup> / <sub>8</sub>	(447.7)	13 <sup>7</sup> / <sub>8</sub>	(352.4)	16 <sup>7</sup> / <sub>8</sub>	(428.6)	650	<b>FSP161WMF</b>	<b>FSP1610WMF</b>	1.6	(0.8)
	19 <sup>1</sup> / <sub>4</sub>	(489.0)	15 <sup>1</sup> / <sub>2</sub>	(393.0)	18 <sup>1</sup> / <sub>2</sub>	(469.0)	725	<b>FSP181WMF</b>	<b>FSP1810WMF</b>	1.7	(0.8)
	20 <sup>3</sup> / <sub>4</sub>	(527.0)	17	(431.0)	20	(508.0)	800	<b>FSP191WMF</b>	<b>FSP1910WMF</b>	1.7	(0.8)
	23 <sup>1</sup> / <sub>2</sub>	(597.0)	19 <sup>3</sup> / <sub>4</sub>	(501.0)	22 <sup>3</sup> / <sub>4</sub>	(577.0)	900	<b>FSP221WMF</b>	<b>FSP2210WMF</b>	1.8	(0.9)
	25 <sup>1</sup> / <sub>4</sub>	(641.0)	21 <sup>1</sup> / <sub>2</sub>	(546.0)	24 <sup>1</sup> / <sub>2</sub>	(622.0)	1000	<b>FSP241WMF</b>	<b>FSP2410WMF</b>	1.9	(0.9)
	26 <sup>1</sup> / <sub>2</sub>	(673.0)	22 <sup>3</sup> / <sub>4</sub>	(577.0)	25 <sup>3</sup> / <sub>4</sub>	(654.0)	1050	<b>FSP251WMF</b>	<b>FSP2510WMF</b>	1.9	(0.9)
	30 <sup>1</sup> / <sub>8</sub>	(765.2)	26 <sup>3</sup> / <sub>8</sub>	(669.9)	29 <sup>3</sup> / <sub>8</sub>	(746.1)	1250	<b>FSP291WMF</b>	<b>FSP2910WMF</b>	2.1	(1.0)
	33 <sup>1</sup> / <sub>8</sub>	(841.4)	29 <sup>3</sup> / <sub>8</sub>	(746.1)	32 <sup>3</sup> / <sub>8</sub>	(822.3)	1350	<b>FSP321WMF</b>	<b>FSP3210WMF</b>	2.2	(1.0)
	35 <sup>5</sup> / <sub>8</sub>	(904.9)	31 <sup>7</sup> / <sub>8</sub>	(809.6)	34 <sup>7</sup> / <sub>8</sub>	(885.8)	1500		<b>FSP3410WMF</b>	2.3	(1.1)
	38 <sup>3</sup> / <sub>8</sub>	(974.7)	34 <sup>5</sup> / <sub>8</sub>	(879.5)	37 <sup>5</sup> / <sub>8</sub>	(955.7)	1600		<b>FSP3710WMF</b>	2.4	(1.1)
42 <sup>1</sup> / <sub>8</sub>	(1070.0)	38 <sup>3</sup> / <sub>8</sub>	(974.7)	41 <sup>3</sup> / <sub>8</sub>	(1051.0)	1800		<b>FSP4110WMF</b>	2.5	(1.2)	
47 <sup>3</sup> / <sub>4</sub>	(1213.0)	44	(1117.0)	47	(1193.0)	2000		<b>FSP4610WMF</b>	2.7	(1.3)	
<b>40 W/in<sup>2</sup> 304 SS (6.2 W/cm<sup>2</sup>)</b>	10 <sup>1</sup> / <sub>4</sub>	(260.0)	6 <sup>1</sup> / <sub>2</sub>	(158.0)	9 <sup>1</sup> / <sub>2</sub>	(241.0)	600	<b>FSP91WKF</b>		1.4	(0.7)
	11 <sup>3</sup> / <sub>4</sub>	(298.0)	8	(203.0)	11	(279.0)	750	<b>FSP101WKF</b>		1.4	(0.7)
	13 <sup>3</sup> / <sub>4</sub>	(349.0)	10	(254.0)	13	(330.0)	900	<b>FSP121WKF</b>	<b>FSP1210WKF</b>	1.5	(0.7)
	15	(381.0)	11 <sup>1</sup> / <sub>4</sub>	(285.0)	14 <sup>1</sup> / <sub>4</sub>	(362.0)	1000	<b>FSP131WKF</b>	<b>FSP1310WKF</b>	1.5	(0.7)
	17 <sup>5</sup> / <sub>8</sub>	(447.7)	13 <sup>7</sup> / <sub>8</sub>	(352.4)	16 <sup>7</sup> / <sub>8</sub>	(428.6)	1300	<b>FSP161WKF</b>	<b>FSP1610WKF</b>	1.6	(0.8)
	19 <sup>1</sup> / <sub>4</sub>	(489.0)	15 <sup>1</sup> / <sub>2</sub>	(393.0)	18 <sup>1</sup> / <sub>2</sub>	(469.0)	1450	<b>FSP181WKF</b>	<b>FSP1810WKF</b>	1.7	(0.8)
	20 <sup>3</sup> / <sub>4</sub>	(527.0)	17	(431.0)	20	(508.0)	1600		<b>FSP1910WKF</b>	1.7	(0.8)
	23 <sup>1</sup> / <sub>2</sub>	(597.0)	19 <sup>3</sup> / <sub>4</sub>	(501.0)	22 <sup>3</sup> / <sub>4</sub>	(577.0)	1800		<b>FSP2210WKF</b>	1.8	(0.9)
	25 <sup>1</sup> / <sub>4</sub>	(641.0)	21 <sup>1</sup> / <sub>2</sub>	(546.0)	24 <sup>1</sup> / <sub>2</sub>	(622.0)	2000		<b>FSP2410WKF</b>	1.9	(0.9)
	26 <sup>1</sup> / <sub>2</sub>	(673.0)	22 <sup>3</sup> / <sub>4</sub>	(577.0)	25 <sup>3</sup> / <sub>4</sub>	(654.0)	2100		<b>FSP2510WKF</b>	1.9	(0.9)
	30 <sup>1</sup> / <sub>8</sub>	(765.2)	26 <sup>3</sup> / <sub>8</sub>	(669.9)	29 <sup>3</sup> / <sub>8</sub>	(746.1)	2500		<b>FSP2910WKF</b>	2.1	(1.0)
	33 <sup>1</sup> / <sub>8</sub>	(841.4)	29 <sup>3</sup> / <sub>8</sub>	(746.1)	32 <sup>3</sup> / <sub>8</sub>	(822.3)	2700		<b>FSP3210WKF</b>	2.2	(1.0)
	35 <sup>5</sup> / <sub>8</sub>	(904.9)	31 <sup>7</sup> / <sub>8</sub>	(809.6)	34 <sup>7</sup> / <sub>8</sub>	(885.8)	3000		<b>FSP3410WKF</b>	2.3	(1.1)
	38 <sup>3</sup> / <sub>8</sub>	(974.7)	34 <sup>5</sup> / <sub>8</sub>	(879.4)	37 <sup>5</sup> / <sub>8</sub>	(955.7)	3200		<b>FSP3710WKF</b>	2.4	(1.1)
42 <sup>1</sup> / <sub>8</sub>	(1070.0)	38 <sup>3</sup> / <sub>8</sub>	(974.7)	41 <sup>3</sup> / <sub>8</sub>	(1050.9)	3600		<b>FSP4110WKF</b>	2.5	(1.2)	
47 <sup>3</sup> / <sub>4</sub>	(1213.0)	44	(1117.0)	47	(1193.0)	4000		<b>FSP4610WKF</b>	2.7	(1.3)	



# Flexible Heaters



Flexible Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
<b>Polyimide</b>	Polyimide	392	200	50.0	7.75	<b>111</b>
<b>Silicone Rubber</b>	Silicone rubber	500	260	80.0	12.50	<b>113</b>
<b>Line Heating</b>	Silicone rubber/cloth	392/482	200/250	2.5	0.39	<b>123</b>
<b>SERIES EHG<sup>®</sup> Controller</b>	N/A	158*	70*	N/A		<b>135</b>
<b>SERIES EHG SL10 Controller with Limit</b>	N/A	158*	70*	N/A		<b>137</b>

\* Ambient environment, not maximum controlling temperature.



Flexible Heaters



# Flexible Heaters



## Flexible Shapes and Geometries

Flexible heaters are thin, bendable and shaped to fit almost any type of equipment. Heat can be applied to complex shapes and geometries without sacrificing efficiency or dependability.

Excellent heat transfer results from the heater's thin design and direct bonding to an application. Flexible heaters provide fast heat-up and cool-down rates, uniform heat distribution and high watt densities.

### Features and Benefits

#### Flat geometry

- Permits holes, notches and unusual shapes

#### Option of two material types and two element styles

- Allow wider flexibility

#### Lightweight construction and low thermal mass

- Permit use in applications with limited space or weight requirements

#### Heating elements as close as 0.003 in. (0.08 mm)

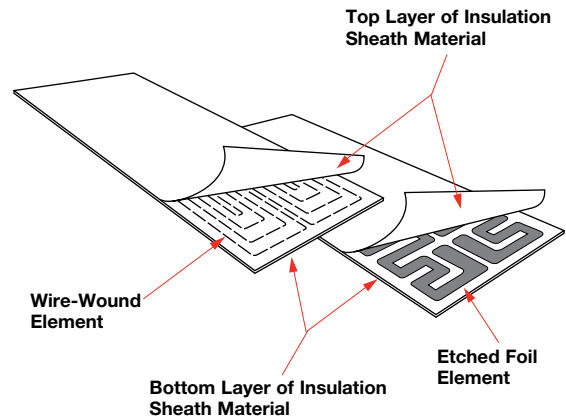
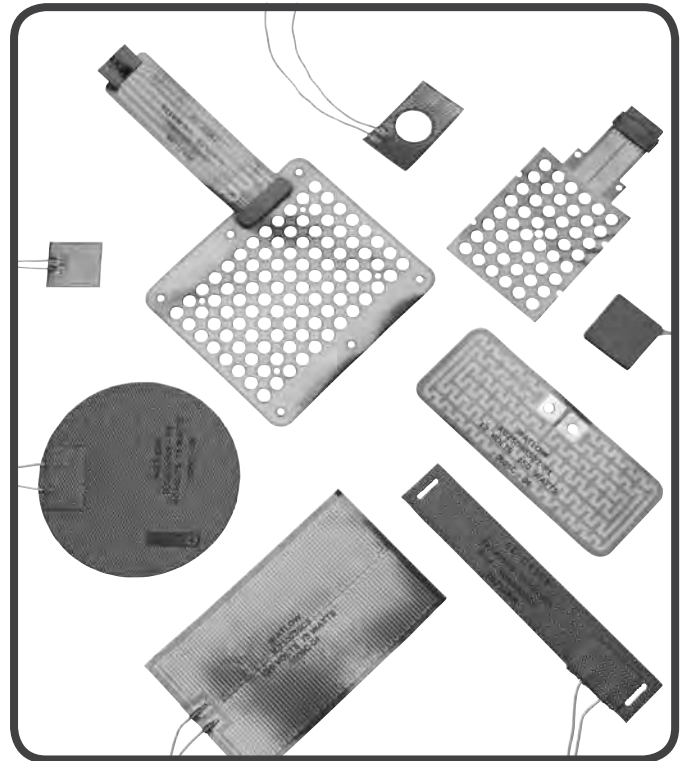
- Creates faster heat-up and cool-down time

#### Uniformly spaced element paths

- Distributes heat more evenly

### Typical Applications

- Medical equipment including blood analyzers, respiratory therapy units and hydrotherapy baths
- Semiconductor equipment, including vacuum and gas delivery lines and wafer processing equipment
- Foodservice equipment, including food holding and warming cabinets
- Battery heating
- Satellite and communication equipment
- Freeze protection for military hardware, aircraft instrumentation, hydraulic equipment, etc.
- Any application requiring a flexible shape or design





## Flexible Shapes and Geometries

### Applications and Technical Data

#### Two Material Types

##### Silicone Rubber

Rugged, moisture- and chemical-resistant material easily can be bonded to parts for effective heat transfer. Watlow silicone rubber heaters handle temperatures up to 500°F (260°C). Many heater styles are available with UR®, cUR®, VDE and CE recognition.

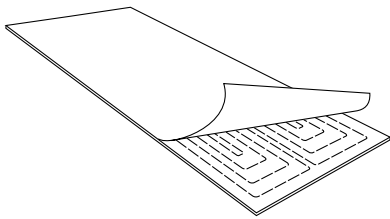
##### Polyimide

Polyimide is a thin, lightweight transparent material designed for precise heating requirements ranging from -319 to 392°F (-195 to 200°C). It is ideal for applications requiring low outgassing in a vacuum or resistance to radiation, fungus and chemicals. Many custom heaters can be UR® and cUR® recognized.

#### Two Element Types

Watlow offers wire-wound and etched foil resistance elements for silicone rubber heaters. Watlow can recommend the type best suited to your application.

##### Wire-Wound Elements

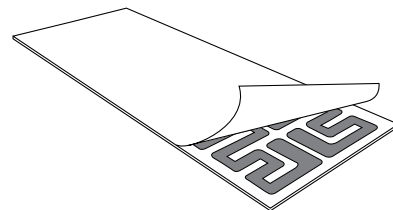


This element style is created by spiraling fine resistance wires around a fiberglass cord. The element is laid out in a pattern designed for a specific application. The benefits of wire-wound elements include:

- Excellent physical strength and flexibility. Repeated heater flexing has no harmful effects on its performance
- The ability to conform easily to curved surfaces, including small radius bends

Semiconductor pump line heaters are typical examples of applications that use the wire-wound method. These heaters are flexed repeatedly during removal and installation, but due to their wiring, no internal damage occurs.

##### Etched Foil Elements



This element type is created by acid etching a circuit in nickel alloy resistance foil. It is available in silicone rubber and polyimide heater types. The etched foil element is known for its excellent circuit pattern repeatability and superior heat transfer, which results from greater coverage of the element. Other benefits include:

- Delivery of more heat and up to twice the watt density of a wire-wound element provides longer heater life
- Complex heat distribution patterns

The etched foil element style is usually recommended for applications requiring high temperatures, watt densities, or multiple zoning.

# Flexible Heaters



## Polyimide Heaters

Polyimide is a thin, lightweight organic polymer film that provides excellent tensile strength, tear and solvent resistance and dimensional stability. The polyimide heater is ideal for applications requiring low outgassing in a vacuum or resistance to radiation, fungus and chemicals.

### Performance Capabilities

- For operating environments as low as -319°F (-195°C), heater temperature as high as 392°F (200°C)
- Watt densities up to 50 W/in<sup>2</sup> (7.75 W/cm<sup>2</sup>)<sup>①</sup>
- UR<sup>®</sup> and C-UR<sup>®</sup> recognitions

### Features and Benefits

#### Excellent physical and electrical properties

- Results in thermal stability over a wide temperature range

#### Transparent polyimide material

- Allows inspection of internal details

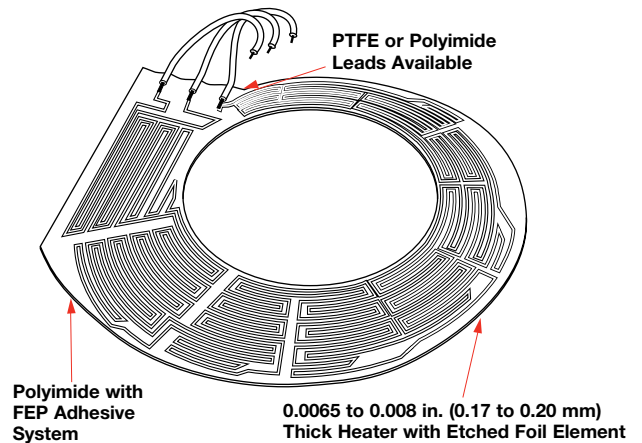
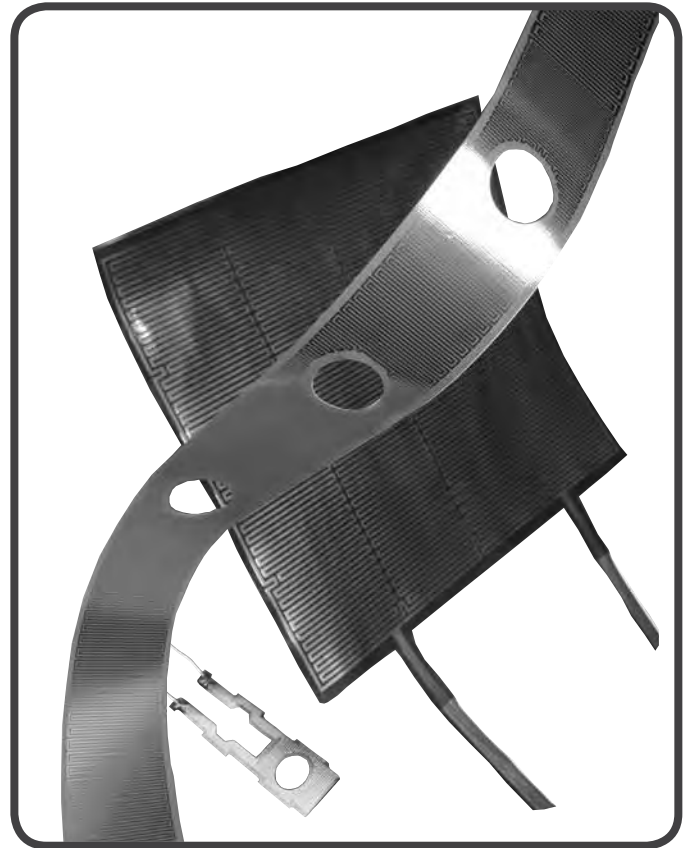
#### Resistance to radiation and fungus

- Allows it to be used in a wide range of applications

### Typical Applications

- Medical applications that require a clean, sterile environment
- Laboratory research
- Semiconductor processing equipment
- Optical equipment
- LCD displays
- Computer equipment
- Photographic equipment
- Aerospace/defense, where low outgassing properties are required

① Watt density limits are application dependent (operating temperatures, bonding method and heat sink).





## Polyimide Heaters

### Technical Data

#### Specifications

##### Thickness

- 0.007 in. (0.2 mm)

##### Flexibility (min. radius)

- 1/32 in. (0.8 mm)

##### Weight

- 1.5 oz/ft<sup>2</sup> (0.05 g/cm<sup>2</sup>)

##### Operating temperature

- Max.: 392°F (200°C)
- Min.: -319°F (-195°C)

##### Watt density rating on stock units

- 5 W/in<sup>2</sup> (0.8 W/cm<sup>2</sup>)

##### Dielectric strength

- Min. VAC: 1000

##### Flammability rating

- Self-extinguishing

##### Heater size limitations

- 18 x 26 in. (457 mm x 660 mm)

##### Weight loss (outgassing)

- 0.51%

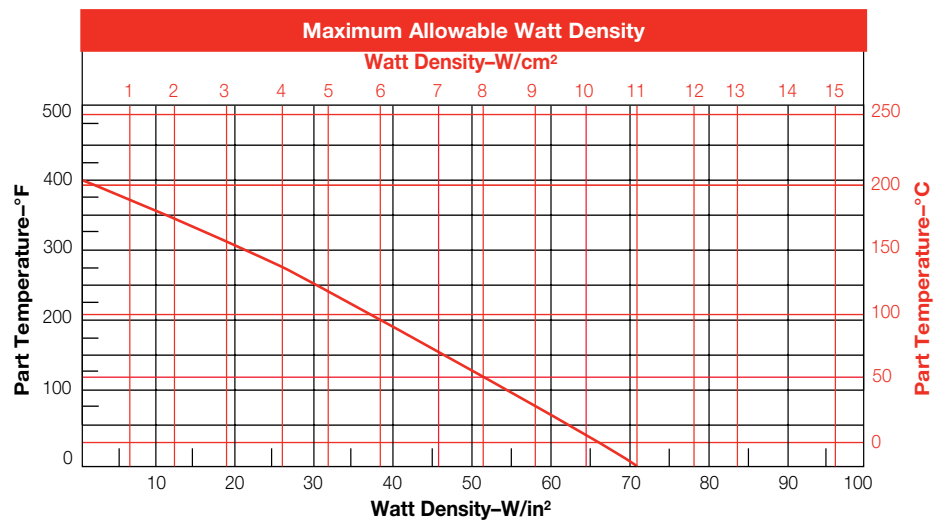
##### Lead length

- 12 in. (305 mm) PTFE E

### Maximum Allowable Watt Density Versus Temperature

To achieve optimum performance with your Watlow polyimide heater, use a proper watt density on the surface of the heater.

The graph recommends watt densities for temperatures using a temperature controller. It does not indicate the watt density needed to achieve a given part temperature.



**Note:** The maximum watt density (W/in<sup>2</sup>) in open air is 5 W/in<sup>2</sup>. The chart above assumes bonding the polyimide heater to a part.



# Flexible Heaters



## Silicone Rubber Heaters

Rugged, yet thin, lightweight and flexible — use of Watlow® silicone rubber heaters is limited only by the imagination. Heat can be put exactly where it is needed to improve heat transfer, speed warm ups and decrease wattage requirements in an application process.

Fiberglass-reinforced silicone rubber provides dimensional stability without sacrificing flexibility. Because very little material separates the element from the part, heat transfer is rapid and efficient. Heaters are constructed with a wire-wound element or with an etched foil element. Its thin construction allows it to fit into applications where space is limited.

### Performance Capabilities

- Operating temperatures up to 500°F (260°C)
- Watt densities up to 80 W/in<sup>2</sup> (12.5 W/cm<sup>2</sup>), dependent upon application temperature
- Wire-wound element thickness — 0.055 in. (1.4 mm)
- Etched foil element — 0.022 in. (0.56 mm)
- UR®, cUR®, VDE and CE recognitions are available on many designs up to 428°F (220°C)

### Features and Benefits

#### Designed to the exact shape and size needed

- Conforms to component and/or equipment

#### More than 80 designs available immediately from stock

- Reduces downtime

#### Constructed with wire-wound or etched foil elements

- Enables a thin, lightweight heater
- Provides the desired flexibility for many dynamic applications
- Delivers low mass and easily repeatable distributed watt densities

#### Moisture and chemical-resistant silicone rubber material

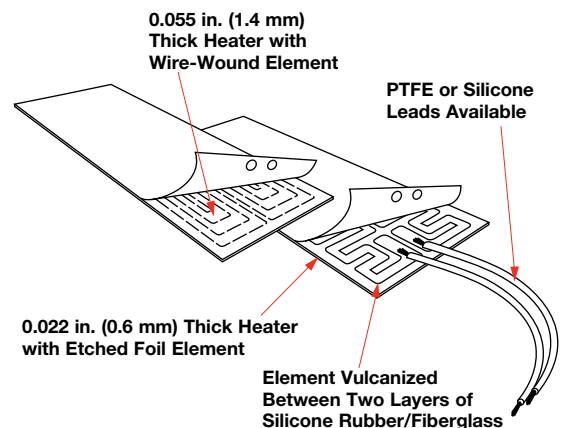
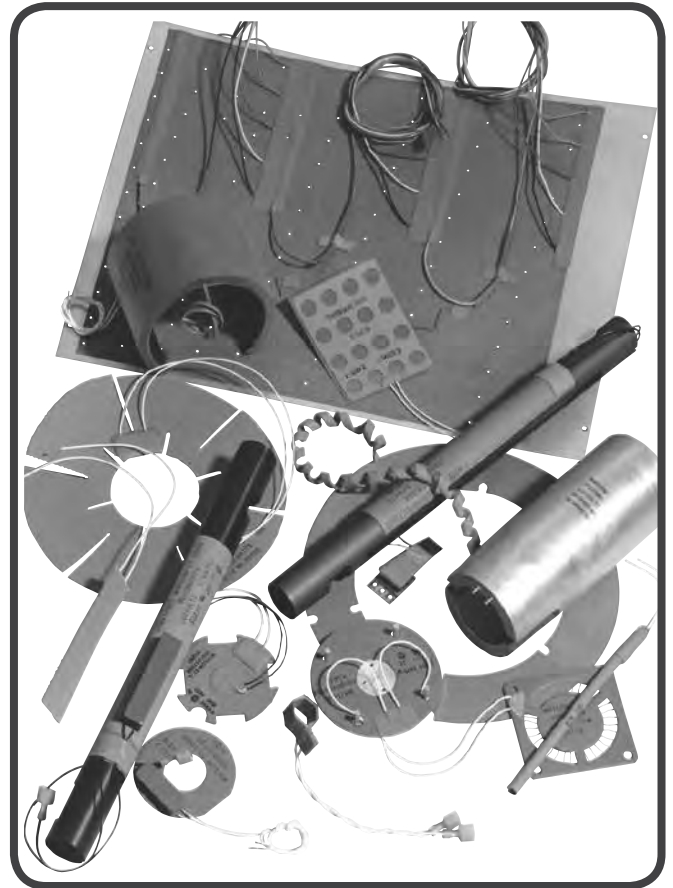
- Provides longer heater life

#### Vulcanizing adhesives or fasteners

- Allows heaters to be easily bonded to parts

### Typical Applications

- Semiconductor processing equipment
- Freeze protection and condensation prevention for many types of instrumentation and equipment
- Medical equipment such as blood analyzers and test tube heaters
- Computer peripherals such as laser printers
- Curing of plastic laminates
- Photo processing equipment





## Silicone Rubber Heaters

### Applications and Technical Data

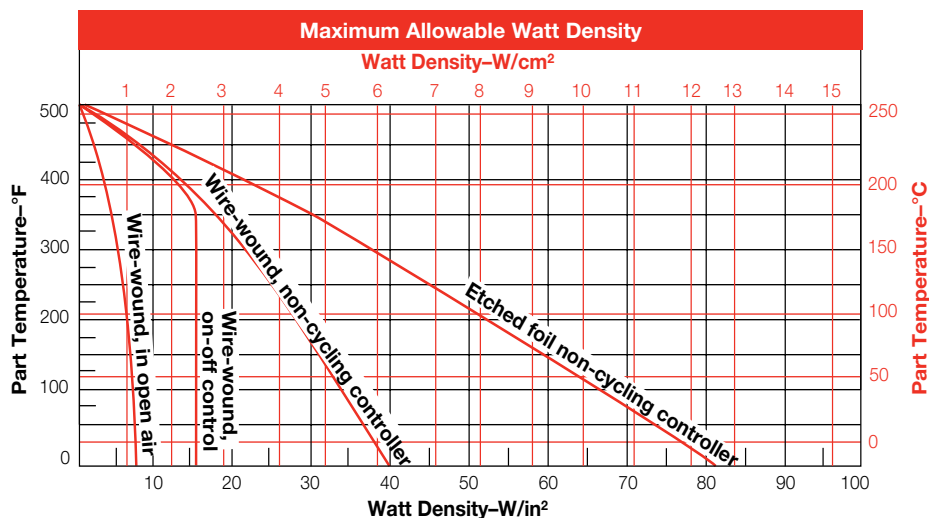
#### Determining Watt Density

The *Maximum Allowable Watt Density* graph illustrates the maximum recommended heater watt density at various metal parts or ambient air temperatures. However, it does not indicate the watt density necessary to achieve a given part temperature. See the *Surface Temperature vs. Time* graph on the next page for assistance with these calculations. When using this graph, consider:

- Part temperature is measured at the point where the heater contacts the metal part.
- Thermostats and on-off controllers are typically bimetal or capillary bulb.
- Non-cycling controllers are typically solid state, time-proportioning or silicone controlled rectifier (SCR) temperature controllers.

- Watt density values should be de-rated by one third if insulation is used.
- UL® recognition temperature limits are not detailed.
- Contact your Watlow representative prior to selecting high watt density etched-foil elements, or operating heaters with back side insulation or non-metallic parts, which are poor thermal conductors.

**Example:** A wire-wound heater with a non-cycling controller at a part temperature of 250°F (120°C) can be rated at 24 W/in<sup>2</sup> (3.7 W/cm<sup>2</sup>) maximum. An etched foil heater operating under the same conditions can be rated at 45 W/in<sup>2</sup> (7 W/cm<sup>2</sup>) maximum.



#### Silicone Rubber Specifications

##### Max. width x max. length

- Wire wound: 36 x 95 in. (914 mm x 2413 mm)
- Etched foil: 18 x 34 in. (457 mm x 863 mm)

##### Thickness

- Wire wound: 0.055 in. (1.4 mm)
- Etched foil: 0.022 in. (0.6 mm)

##### Weight

- Wire wound: 8 oz/ft<sup>2</sup> (0.24 g/cm<sup>2</sup>)
- Etched foil: 3 oz/ft<sup>2</sup> (0.09 g/cm<sup>2</sup>)

**Max. operating temperature:** 500°F (260°C)

**Max. temperature for UL® recognition:** 428°F (220°C)

**Min. ambient temperature:** -80°F (-62°C)

**Max. voltage:** 600V

**Max. wattage:** see watt density graph

**Lead size:** sized to load

**Lead length:** 12 +1½ -1/2 in. (305 mm +38 mm -13 mm)

##### Wattage tolerance

- Wire: ±5%
- Foil: +5% -10%

##### Dimensional tolerances

- 0 to 6 in. (0 to 152 mm): ±1/16 in. (1.59 mm)
- 6 to 18 in. (152 to 457 mm): ±1/8 in. (3.18 mm)
- 18 to 36 in. (457 mm to 914 mm): ±3/16 in. (4.76 mm)
- Over 36 in. (914 mm): ±1%

# Flexible Heaters



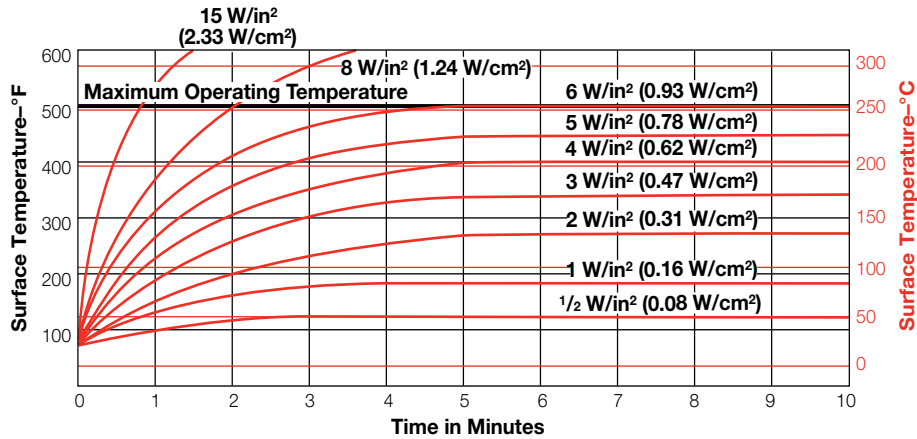
## Silicone Rubber Heaters

### Applications and Technical Data (Continued)

#### Surface Temperature vs. Time

This graph illustrates the surface temperature a silicone rubber heater will reach when uninsulated and suspended vertically in 70°F (20°C) still air.

Data is based on 0.055 in. (1.4 mm) thick construction and is offered as a reference tool.



#### UR®, cUR®, VDE and CE Recognition for Silicone Rubber Heaters

Watlow frequently works with customers requiring agency approvals such as UR®, cUR®, VDE and CE. Many silicone rubber heaters are available with one or more certifications.



**UL® Component Recognition (UR®)** of factory-bonded heaters is available up to 392°F (200°C) and for customer installed heaters up to 428°F (220°C) (UL® File No. E52951).

For Canadian recognition, Watlow offers **cUR® Recognized** silicone rubber heaters under UL® File #E52951. Several constructions are available with ratings to 600V and 428°F (220°C) maximum surface temperature. Contact your Watlow representative for further information.

**VDE Approval** is available on several constructions of both wire-wound (File No. 62533) and etched foil (File No. 62535) silicone rubber heaters. Maximum ratings are 440V and 428°F (220°C) surface temperature. Under VDE guidelines, minimum installed bend radius is 1/8 in. (3.2 mm) for etched foil and 1/4 in. (6 mm) for wire wound. VDE states that the user is responsible for the safe application, installation and wiring of heaters. Maximum working temperature must be maintained by an appropriate temperature controller.

The **CE mark** is available on UR® and/or VDE recognized heaters.

#### Options

Watlow offers options including attachment techniques, integrated controls, thermostats, special leads, holes and cutouts and three-dimensional shapes as described in the introduction to flexible heaters section.

# Flexible Heaters

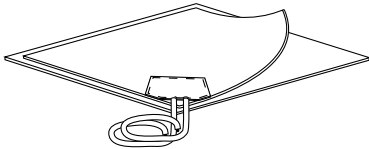


## Silicone Rubber Heaters

### Mounting Methods

Watlow offers various attachment techniques designed for fast installation.

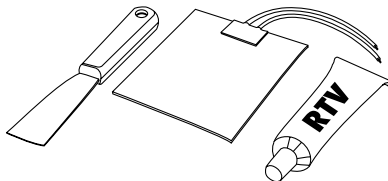
#### Pressure Sensitive Adhesive Surface (PSAS)



For speed, convenience and economy of installation, specify PSAS. Simply peel off the protective backing and roll the heater in place for an even bond to a clean, smooth surface. PSAS is not recommended for curved surfaces or for heaters rated above 10 W/in<sup>2</sup> (1.5 W/cm<sup>2</sup>). It should not be used for applications exceeding 400°F (205°C) on silicone rubber and 300°F (150°C) on polyimide.

**Note:** PSAS has a maximum six-month storage life at or below 86°F (30°C) before heater installation.

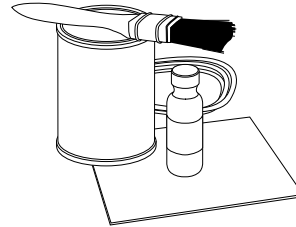
#### Field Applied Adhesive



For a stronger bond or when long storage is probable, room temperature vulcanizing (RTV) silicone adhesive works well. Watlow offers red RTV for temperatures up to 500°F (260°C). White RTV is available from adhesive suppliers for temperatures up to 400°F (205°C). Watlow's one-part RTV is self-priming and can be ordered in either 3 oz (90 ml) or 12 oz (355 ml) tubes. For larger heaters requiring longer adhesive working time, two-part RTV kits can be purchased from adhesive suppliers. These kits require primer on the surface prior to adhesive application.

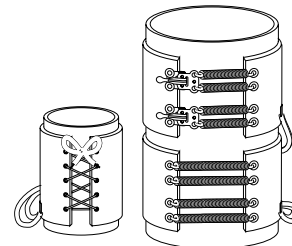
**Note:** Not recommended for polyimide heaters.

#### Silicone Contact Cement Kit



This two-part adhesive consists of a resin and catalyst that are easily mixed together and applied with a paintbrush. Recommended usage is for field cementing of silicone rubber heaters to customer parts. Available for immediate delivery, the cement kit handles temperatures up to 350°F (175°C). The resin is available in pint or quart containers. To order, specify **silicone contact cement** and the container size.

#### Mechanical Fasteners



When a wire-wound flexible heater must be detachable, any type of fastener normally used with fabrics can usually be built into the flexible heater's sheath material. The most common types are latch fasteners, boot hooks and grommets. Other styles include snap fasteners, springs and lacing cord. (Hook and loop style fastener strips are only available as part of the extended capabilities offering.) Grommets and boot hooks are commonly used with tension springs to compensate for slight variations in part size.

# Flexible Heaters

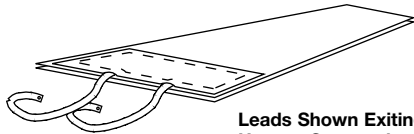


## Silicone Rubber Heaters

### Termination Styles

Watlow offers many types of leads and terminations. Leads can project from any position along the perimeter of the unit. **They are centered on the short side width of rectangular heaters unless specified.**

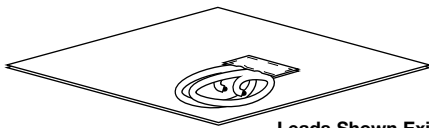
#### PTFE UL® 1180 CSA



Leads Shown Exiting End of Heater, Centered on Short Side

Watlow's leads are 12 in. (305 mm) long, white, PTFE insulated, flexible, plated copper UL® 1180 CSA wire. Leads are rated for 392°F (200°C)/300V. Lead connections on or at the heater are insulated with a cap of sheath material vulcanized to the heater body.

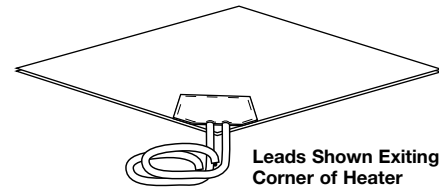
#### PTFE Leads



Leads Shown Exiting Middle of Heater.

PTFE Type E (MIL-W-16878) and PTFE UL® 1199 leads rated for 392°F (200°C)/600V are also available.

#### Silicone Insulated Leads

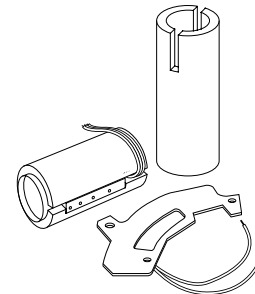


Leads Shown Exiting Corner of Heater

For a better moisture seal, specify UL® silicone insulated lead wires. This lead type is rated for 302°F (150°C)/600V. Any lead length is available. **Note:** Silicone rubber heaters are not designed to be waterproof. Excess exposure to moisture may facilitate premature heater failure.

### Option

#### Thermal Insulation



To increase heating efficiency of your application, silicone rubber heaters can be thermally insulated with silicone sponge rubber bonded to one side in the following thicknesses: 1/16, 1/8, 1/4, 3/8 or 1/2 in. (1.6, 3.2, 6, 9.5 or 13 mm).

An aluminized surface can be added to the back side of the heater to reduce radiated heat losses. This aluminized surface, called "low loss treatment," adds very little to the unit thickness or mass and maintains a very clean appearance.

# Flexible Heaters

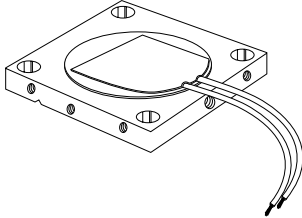
**EXTENDED  
CAPABILITY**



## Extended Capabilities for Silicone Rubber Heaters

### Mounting Methods

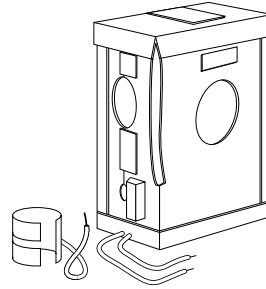
#### Factory Bonding



This attachment technique provides a strong, void-free bond for excellent heat transfer and extended heater life that has proven to be successful. Bonding is recommended for applications that reach maximum temperatures of 500°F (260°C) on silicone rubber and 300°F (150°C) on polyimide.

### Construction

#### Formed Heaters



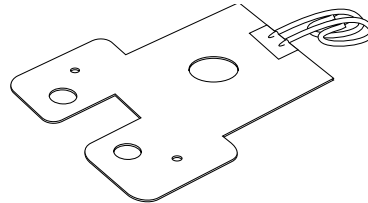
Many three-dimensional shapes, such as cylinders, cones and boxes, can be factory formed. Semi-rigid shapes can self-grip to the part. Special tooling may be required for some designs.

### Integrated Control



The SERIES EHG® is an integrated multi-function controller that is a key component in a powerful system that integrates a heater, an adjustable set point temperature controller, a high/low temperature alert, a power switching device and a high temperature safety limit. The agency recognized controller/safety limit meets UL® and CE requirements.

### Holes, Cutouts and Notches



Watlow provides flexible heaters with special holes, cutouts and notches in nearly any position required for your design. The resistance element can be brought to within 1/8 in. (3.2 mm) of all edges. Standard spacing is 1/4 in. (6 mm) from all edges.

# Flexible Heaters



## Silicone Rubber Heaters

### Wire-Wound Elements

Width		Length		Watts	120VAC Part Number	120/240VAC Part Number
in.	(mm)	in.	(mm)			
1	(25)	2	(51)	10	010020C1*	
		3	(76)	15	010030C1*	
		4	(102)	20	010040C1*	
		5	(127)	25	010050C1*	
		5	(127)	6.25/25		010050C2*
		10	(254)	50	010100C1	
		10	(254)	12.50/50		010100C2*
		15	(381)	75	010150C1	
		15	(381)	18.75/75		010150C2
		20	(508)	100	010200C1	
		20	(508)	25/100		010200C2
		25	(635)	125	010250C1	
		30	(762)	150	010300C1	
		35	(889)	175	010350C1	
		40	(1016)	200	010400C1	
2	(51)	80	(2032)	400	010800C1	
		120	(3048)	600	010F10C1	
		2	(51)	20	020020C1*	
		5	(127)	50	020050C1	
		5	(127)	12.50/50		020050C2*
		10	(254)	100	020100C1	
		10	(254)	25/100		020100C2
		15	(381)	150	020150C1	
		15	(381)	37.50/150		020150C2
		20	(508)	200	020200C1	
		20	(508)	50/200		020200C2
		25	(635)	250	020250C1	
		30	(762)	300	020300C1	
		35	(889)	350	020350C1	
		40	(1016)	400	020400C1	
3	(76)	3	(76)	45	030030C1	
		5	(127)	75	030050C1	
		5	(127)	18.75/75		030050C2
		10	(254)	150	030100C1	
		10	(254)	37.50/150		030100C2
		15	(381)	225	030150C1	
		15	(381)	56.25/225		030150C2
		20	(508)	300	030200C1	
		20	(508)	75/300		030200C2
		25	(635)	375	030250C1	
		30	(762)	450	030300C1	
		35	(889)	525	030350C1	
		40	(1016)	600	030400C1	

CONTINUED

\* Due to their high resistance, these heaters are not recommended for curved or flexing applications.

**Notes:**

- Thickness 0.055 in. (1.4 mm)
- UL<sup>®</sup> component recognition available
- Silicone rubber wire-wound elements rated at 5 W/in<sup>2</sup> (0.78 W/cm<sup>2</sup>)

# Flexible Heaters



## Silicone Rubber Heaters

### Wire-Wound Elements (Continued)

Width		Length		Watts	120VAC Part Number	120/240VAC Part Number
in.	(mm)	in.	(mm)			
4	(102)	4	(102)	80	<b>040040C1</b>	
		5	(127)	100	<b>040050C1</b>	
		5	(127)	25/100		<b>040050C2</b>
		10	(254)	200	<b>040100C1</b>	
		10	(254)	50/200		<b>040100C2</b>
		15	(381)	300	<b>040150C1</b>	
		15	(381)	75/300		<b>040150C2</b>
		20	(508)	400	<b>040200C1</b>	
		20	(508)	100/400		<b>040200C2</b>
		25	(635)	500	<b>040250C1</b>	
		30	(762)	600	<b>040300C1</b>	
		35	(889)	700	<b>040350C1</b>	
		40	(1016)	800	<b>040400C1</b>	
5	(127)	5	(127)	125	<b>050050C1</b>	
		5	(127)	31.25/125		<b>050050C2</b>
		10	(254)	250	<b>050100C1</b>	
		10	(254)	62.50/250		<b>050100C2</b>
		15	(381)	375	<b>050150C1</b>	
		15	(381)	9.38/375		<b>050150C2</b>
		20	(508)	500	<b>050200C1</b>	
		20	(508)	125/500		<b>050200C2</b>
		25	(635)	625	<b>050250C1</b>	
		30	(762)	750	<b>050300C1</b>	
		35	(889)	875	<b>050350C1</b>	
40	(1016)	1000	<b>050400C1</b>			
6	(152)	5	(127)	150	<b>060050C1</b>	
		5	(127)	37.50/150		<b>060050C2</b>
		10	(254)	300	<b>060100C1</b>	
		10	(254)	75/300		<b>060100C2</b>
		15	(381)	450	<b>060150C1</b>	
		15	(381)	112.50/450		<b>060150C2</b>
		20	(508)	600	<b>060200C1</b>	
		20	(508)	150/600		<b>060200C2</b>
		25	(635)	750	<b>060250C1</b>	
		30	(762)	900	<b>060300C1</b>	
		35	(889)	1050	<b>060350C1</b>	
40	(1016)	1200	<b>060400C1</b>			



# Flexible Heaters



## Silicone Rubber Heaters

### Wire-Wound Elements Configured Options

To order, complete the part number with the information below:

Wire Wound

0 - - - - -

Modification Options
0 = None
A = PSAS bottom
B = PSAS top
E = With plate, heater on side opposite flange
F = With plate, heater on flange side
G = Flaps + grommets
H = Flaps + boot hooks
J = Flaps + latch fasteners
K = PSAS and low loss
L = Low loss
M = Low loss + flaps + grommets
N = Low loss + flaps + boot hooks
P = Low loss + flaps + latch fasteners
R = 1/16 in. sponge
S = 1/8 in. sponge
T = 1/4 in. sponge
U = 3/8 in. sponge
V = 1/2 in. sponge
W = PSAS + 1/16 in. sponge
Y = PSAS + 1/8 in. sponge
1 = PSAS + 1/4 in. sponge
2 = PSAS + 3/8 in. sponge
3 = PSAS + 1/2 in. sponge

Sensors	LOC	WIR
0 = None		
L = T10	STD	STD
M = T10	STD	ALT
N = T10	ALT	STD
P = T10	ALT	ALT
R = T207	STD	STD
S = T207	STD	ALT
T = T207	ALT	STD
U = T207	ALT	ALT
V = T207E	On heater	STD
W = T207E	Remote	STD
4 = JSTD	STD	STD
6 = JALT	STD	STD
7 = KSTD	STD	STD

- For thermostats, standard location is as shown in catalog; standard wiring is integral or in series with the heater, alternate location is rotated parallel with heater width, alternate wiring is separate leads for pilot control.

- For thermocouples, Type J standard is PFA insulation, Type J alternate is fiberglass insulation, Type K standard is fiberglass insulation.

T10 Set °F*
0 = None
A = 125
B = 150
E = 175
F = 200
G = 225
H = 250
J = 275
K = 300

T207 Set °F*
0 = None
1 = 40/55
2 = 60/75
3 = 95/110
4 = 145/160

T/C Length
0 = None
A = 8 in.
B = 12 in.
E = 18 in.
F = 24 in.
G = 30 in.
H = 36 in.
J = 40 in.
K = 4 ft
L = 5 ft
M = 6 ft
N = 7 ft
P = 8 ft
R = 9 ft
S = 10 ft
T = 12 ft
U = 15 ft
V = 18 ft
W = 20 ft
Y = 22 ft
1 = 25 ft
2 = 30 ft

\* For all thermostats the heater must be a 2 in. (51 mm) min. width and 5 in. (127 mm) min. length.

Lead Insulation
0 = None
1 = 1180 UL® R/C
2 = 1180 C-UL® R/C
3 = 3133 22 Ga.
6 = 1199 CSA
7 = HPN
8 = 6 ft HPN set
9 = Type E PTFE
A = 1180VDE*
B = 1199VDE*
C = Silicone leads w/waterproof cap
E = SJO cord
F = 6 ft SJO set

\* 1180VDE denotes a C-UL® heater plus a VDE stamp.

Lead Length*
A = 8 in.
B = 12 in.
E = 18 in.
F = 24 in.
G = 30 in.
H = 36 in.
J = 40 in.
K = 4 ft
L = 5 ft
M = 6 ft
N = 7 ft
P = 8 ft
R = 9 ft
S = 10 ft
T = 12 ft
U = 15 ft
V = 18 ft
W = 20 ft
Y = 22 ft
1 = 25 ft
2 = 30 ft

\* Customer specified length must be noted in inches when ordering.

# Flexible Heaters



## Gas Delivery and Exhaust Thermal Solutions

Watlow has the knowledge, experience and product breadth to optimize the thermal performance of your gas delivery and exhaust systems. Watlow designs and manufactures all of the thermal components to work together to enhance the performance of our customers' wafer processing products. Incorporating thermal design of the gas systems early in the process will ensure maximum temperature uniformity, a reduction in particle buildup and minimal amount of tool downtime. We understand your system needs and can offer a customized solution to help improve tool yields.

Watlow works at your pace to help you remain competitive.

Watlow provides:

- Cleanroom compatible heaters that cover the entire line
- Heaters that fit tightly to line components, eliminating cold spots
- Heaters that can be customized for uniform heating
- Electronic temperature controllers and integral sensors to provide stable temperature control
- Communications and software that can network with the tool or plant-wide system
- ATSTM technology to simplify complex applications and reduce design iterations

Watlow offers:

- ASSURANT® cloth-type heaters
- Silicone rubber heaters
- Molded silicone foam rubber heaters
- FLUENT® in-line heaters
- Integrated sensing and control systems



### Features and Benefits

#### Moisture and chemical-resistant semiconductor-grade materials

- Provides longer heater life
- Ensures cleanroom compatibility

#### Flexible heater designs

- Allows thermal profile to be customized to meet specific needs
- Reduces system costs

#### Heaters fit tightly to line components

- Eliminates cold spots
- Provides uniform heating

#### Integrated control systems

- Provides multiple zones of control
- Eliminates the need for over-temperature protection

#### Agency approvals: UL®, SEMI-S2 and CE

- Meets necessary safety and industry regulations

# Flexible Heaters



## Line Heating

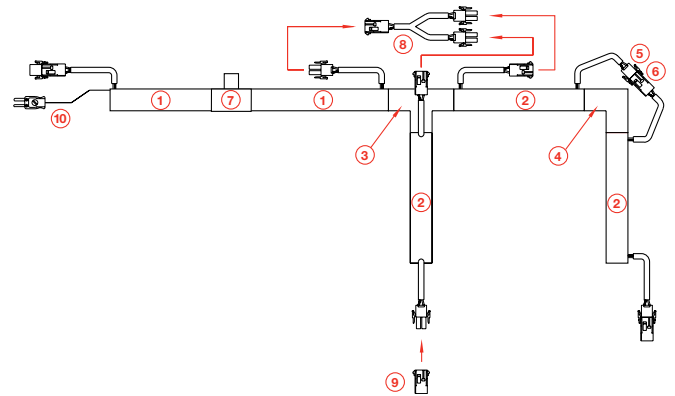
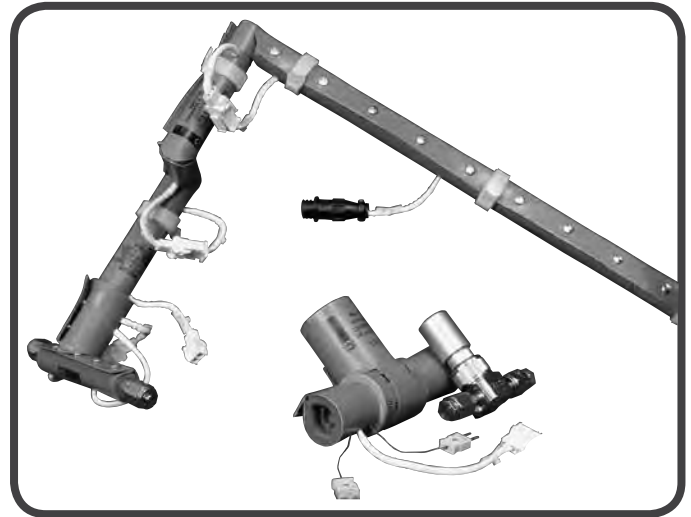
### Silicone Gas Line Heaters

#### Gas Delivery

Tetraethyl orthosilicate (TEOS), boron trichloride ( $\text{BCl}_3$ ), aluminum chloride ( $\text{AlCl}_3$ ), chlorine trifluoride ( $\text{ClF}_3$ ) and dichlorosilane (DCS) are gases that condense or liquefy due to a phase shift at low temperatures. In semiconductor processes, condensation occurs in the gas line and puddles in the shower head before being injected into the vacuum chamber. A substantial number of wafer defects will occur if liquefied gases are injected into the vacuum chamber. Uniform heating of the lines will prevent condensation. TEOS lines are typically heated above 194°F (90°C) and  $\text{BCl}_3$  above 86°F (30°C), depending on pressure and flow rate. The optimum line temperature will vary depending on the process parameters.

#### Specifications

- Watt density of 2.5 W/in<sup>2</sup> (0.4 W/cm<sup>2</sup>) on gas line O.D.
- UL<sup>®</sup> recognized for U.S. and Canadian safety standards
- Heaters and insulators meet UL<sup>®</sup> 94-HB flammability requirements
- Insulated straight fillers for 100 percent line coverage; elbows and tees are trim-to-fit to proper length
- I.D. available: 1/4, 3/8, 1/2, 3/4 in. (6, 9.5, 13, 19 mm)
- 120V standard, other voltages available
- Small metal snaps
- Heaters are insulated with a 3/8 in. (9.5 mm) wall, silicone rubber, closed cell sponge



#### Upstream Gas Line Heater Assembly (Example)

- ① 9 in. (229 mm) heater with thermocouple. Heater leads have a male plug on one end and a female cap on the other end. Heater materials are UL<sup>®</sup> rated to 392°F (200°C)
- ② 6 in. (152 mm) heater, heater leads, see 1
- ③ Union tee insulator
- ④ 90° union elbow insulator
- ⑤ Male plug, AMP MATE-N-LOK<sup>™</sup> connector part number 1-480698-0; with sockets AMP MATE-N-LOK<sup>™</sup> connector part number 350689-1
- ⑥ Female cap, AMP MATE-N-LOK<sup>™</sup> connector part number 1-480699-0; with pins AMP MATE-N-LOK<sup>™</sup> connector part number 350690-1
- ⑦ Valve or regulator
- ⑧ Y connector: one female cap on one end, two male plugs on the other end
- ⑨ Dead plug (sealed)
- ⑩ Type J thermocouple w/ male mini-plug (optional)



## Line Heating

### ASSURANT® SERIES TF Gas Line Heaters

Watlow's cloth heater jackets provide flexibility in designing optimum heating systems for gas lines. ASSURANT® TF heater jackets are ideal for high temperature / low outgassing for cleanroom applications.

Watlow's ASSURANT SERIES TF heater jackets maximize thermal uniformity and coverage by providing an efficient, easy-to-install heating solution for upstream gas line applications. The ASSURANT heater jackets optimize process tool uptime and chip yield by providing full coverage to the line eliminating cold spots that result in particle buildup.

ASSURANT heater jackets can be customized with distributed watt densities, so lighter and heavier component parts are heated uniformly.

This heater jacket can be supplied with integrated temperature sensors and controllers to assure accuracy and equipment longevity.

### Features and Benefits

#### Even heating for uniform temperature profiles over the entire heated line

- Eliminates cold spots that result in sublimation and solid particle buildup in the line

#### High operating temperatures up to 482°F (250°C)

- Prevents particle buildup in high-temperature applications such as certain atomic layer deposition (ALD) applications

#### PTFE construction

- Exhibits low outgassing and little to no particle generation
- Appropriate solution for cleanroom applications

#### UL®, SEMI S2 and CE agency approval

- Assures safety standard compliance

#### Environmental safety

- Reducing particle buildup decreases potential of exposure to hazardous materials during normal cleaning cycles

#### Easy-to-install system

- Conveniently fits on most gas line configurations
- Provides full line coverage for uniform heating
- Interconnection between heaters is easily accomplished using the mating electrical connectors



#### Integrated sensors and controllers

- Enables flexible control solutions using PID temperature algorithms to deliver accurate and precise temperature control

#### Flexible heater design

- Allows for heating typical vacuum line components and fittings including pipes, valves, clamps and elbows in the line
- Allows complex geometries to be combined, which reduces the number of components needed

#### Fiberglass insulation

- Provides high efficiency
- Lowers power consumption and the cost of ownership
- Yields low backside temperatures

### Typical Applications

Gas delivery lines

- Boron trichloride, BCl<sub>3</sub>
- Chlorine trifluoride, ClF<sub>3</sub>
- Dichlorosilane, (DCS), SiH<sub>2</sub>Cl<sub>2</sub>
- Tetra ethyl orthosilicate, TEOS
- Tungsten hexafluoride, WF<sub>6</sub>
- Process gas line qualification



## Line Heating

### **ASSURANT SERIES TF Gas Line Heaters** (Continued)

#### **Specifications**

##### **Operating temperature**

- Standard operating temperature up to 392°F (200°C) (recommended)
- Maximum operating temperature up to 482°F (250°C)
- Other options available (contact your Watlow representative)

##### **Agency approvals**

- UL® 499, File # E52951
- RoHS compliant
- CE
- SEMI S2

##### **Standard connectors**

- AMP MATE-N-LOK™
- 4-pin AMP CPC
- Other options available (contact your Watlow representative)

##### **Integrated sensor (optional)**

- Type K thermocouple
- Over-temperature mechanical thermostat 482°F (250°C) max.

##### **Voltage**

- 120, 208 or 240V standard, other voltages available

##### **Fastener**

- Hook and loop

##### **Inner jacket material options**

- 100% PTFE cloth

##### **Outer jacket material options**

- 100% PTFE cloth

##### **Dimensions**

- Available for pipe sizes 1/4 to 1 in. (6 to 25 mm) diameter.

For other sizes contact your Watlow representative.

# Flexible Heaters



## Line Heating

### **STRETCH-TO-LENGTH® Heaters**

During semiconductor processes, condensation of many critical gases occurs due to a phase shift at low temperatures. Burning of gases occurs if the delivery line is too hot. High or low temperature conditions may result in undesirable particulates, costly device defects and tool maintenance.

The Watlow STRETCH-TO-LENGTH® (S-T-L) gas line heater system is an easy-to-assemble temperature solution that delivers superior performance compared to heat tape. The heater's preformed construction allows an engineer to easily wrap it around the delivery line. It provides consistent heater/gas line contact to improve temperature uniformity. Due to its flexibility, the S-T-L gas line heater can compensate for variable component sizes to reduce the potential for hot and cold spots.

The S-T-L system includes a 2 W/in<sup>2</sup> S-T-L heater and silicone foam rubber insulation.

### **Features and Benefits**

#### **Easy to install two-part system**

- Conveniently fits most gas line configurations

#### **Flexible heater design**

- Easily customize the thermal profile for each gas line application
- Allows quick prototyping to determine energy distribution requirements for process improvements

#### **Flexible standard system components**

- Eliminates unnecessary lead times for custom designs

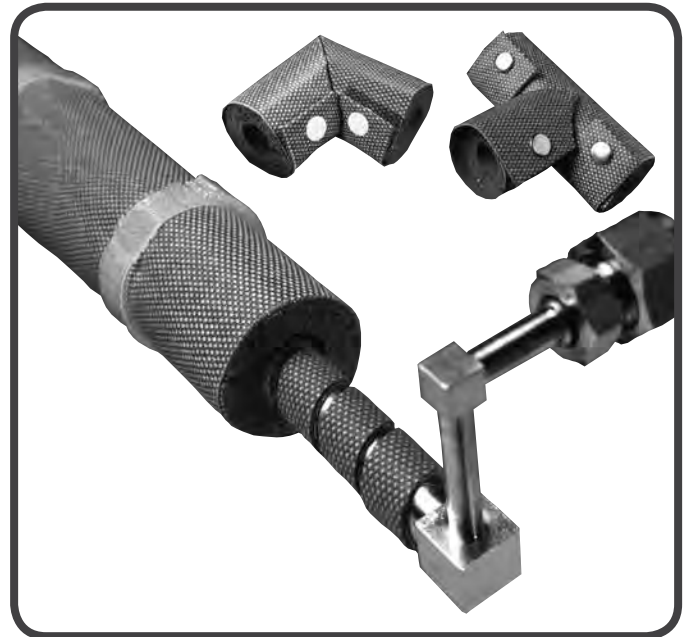
#### **Agency Certification, Recognition Compliance and Approvals**

- Semi S2-93 compatible with a high-limit thermocouple and controller
- UL® recognized for U.S. safety standards

### **Typical Applications**

#### **Gas delivery lines**

- Boron trichloride, BCl<sub>3</sub>
- Chlorine trifluoride, ClF<sub>3</sub>
- Dichlorosilane, (DCS), SiH<sub>2</sub>Cl<sub>2</sub>
- Tetra ethyl orthosilicate, TEOS
- Tungsten hexafluoride, WF<sub>6</sub>
- Process gas line qualification



### **Specifications**

- Heater material is reinforced silicone rubber fabric
  - Color:
    - Insulation and outer jacket – orange
    - Heater – orange
- Cleanroom strap fasteners
- Voltage: 120 and 240VAC
- Max. operating temperature: 392°F (200°C)
- Heater watt density: 2 W/in<sup>2</sup> (0.31 W/cm<sup>2</sup>) – Watlow recommends 80% line wrap for optimum performance
- Power lead wires: 12 in. (305 mm); #18 AWG UL® 1180 CSA, rated 10A, lead wire pair encapsulated in reinforced silicone rubber sleeving
- Heater interconnectable up to a 10A circuit
- Material rated UL® 94-HB
- Heater materials are UL® rated to 392°F (200°C)
- Insulation:
  - 3/8 in. (9.5 mm) wall, silicone rubber, closed cell sponge
  - Jacket material is reinforced silicone rubber fabric

# Flexible Heaters



## Line Heating

### STRETCH-TO-LENGTH Heaters (Continued)

S-T-L heaters are specified by their straight length. For actual applications, an engineer can wrap the heaters to achieve an optimum temperature profile. Coverage lengths of approximately 60 and 80 percent on ¼ in. (6 mm) and ½ in. (13 mm) diameter tubes are provided

as a guide to select heater lengths for actual gas line dimensions. A gas line with 100 percent coverage is approximately 2 W/in<sup>2</sup>, 80 percent coverage 1.6 W/in<sup>2</sup> or 60 percent coverage 1.2 W/in<sup>2</sup>.

#### S-T-L Heater Ranges - ¼ in. (6 mm) O.D. Tubing

0.25 60% Coverage	0.25 80% Coverage	120V Version Part Number	Amperes	240V Version Part Number	Amperes
10.20	8.04	005120500	0.10	N/A	N/A
14.45	11.39	005170500	0.14	N/A	N/A
18.70	14.74	005220500	0.18	005220501	0.09
23.80	18.76	005280500	0.23	005280501	0.12
30.60	24.12	005360500	0.30	005360501	0.15
39.95	31.49	005470500	0.39	005470501	0.20
51.00	40.20	005600502	0.50	005600503	0.25
63.75	50.25	005750500	0.63	005750501	0.31
76.50	60.30	005900500	0.75	005900501	0.38

#### S-T-L Heater Ranges - ½ in. (13 mm) O.D. Tubing

0.50 60% Coverage	0.50 80% Coverage	120V Version Part Number	Amperes	240V Version Part Number	Amperes
10.20	6.63	005170501	0.14	N/A	N/A
15.00	9.75	005250501	0.21	N/A	N/A
21.00	13.65	005350502	0.29	005350503	0.15
29.40	19.11	005490502	0.41	005490503	0.20
38.40	24.96	005640502	0.53	005640503	0.27
47.40	30.81	005790502	0.66	005790503	0.33
59.40	38.61	005990502	0.82	005990503	0.41
73.80	49.97	005F103502	1.02	005F103503	0.51
92.40	60.06	005F128502	1.28	005F128503	0.64

#### ¼ in. (6 mm) O.D. Tubing Insulators

¼ in. (6 mm) Heater I.D. x Length	Description	Part Number
18 in. (457 mm)	Straight insulator	012180500
36 in. (914 mm)	Straight insulator	012360500
Elbow	90° union elbow insulator	012020500
Tee	Union tee insulator	012030500
VCR	VCR fitting	015030500

#### ½ in. (13 mm) O.D. Tubing Insulators

½ in. (13 mm) Heater I.D. x Length	Description	Part Number
18 in. (457 mm)	Straight insulator	024180500
36 in. (914 mm)	Straight insulator	024360500
Elbow	90° union elbow insulator	020024500
Tee	Union tee insulator	024030500
VCR	VCR fitting	015042500

#### ¾ in. (9.5 mm) O.D. Tubing Insulators

¾ in. (9.5 mm) Heater I.D. x Length	Description	Part Number
18 in. (457 mm)	Straight insulator	016180500
36 in. (914 mm)	Straight insulator	016360500
Elbow	90° union elbow insulator	016020500
Tee	Union tee insulator	016030501
VCR	VCR fitting	015042500

# Flexible Heaters



## Line Heating

### *STRETCH-TO-LENGTH Heaters (Continued)*

#### Power Extensions

Description	Part Number
3 ft (914 mm)	<b>A000136</b>
6 ft (1829 mm)	<b>A000137</b>
10 ft (3048 mm)	<b>A000138</b>

#### Accessories

Description	Part Number
Power cord 6 ft 18-2 SJ	<b>Z5302-2</b>
Wiring Y connector – 1F-2M	<b>Z5303-2</b>
Wiring Y connector – 1M-2F	<b>Z6333</b>
Female termination plug	<b>Z5309-2</b>
Male termination plug	<b>Z6332</b>
12 in. 24 Ga. Type J T/C w/mini plug	<b>Z5786</b>
12 in. 24 Ga. Type K T/C w/mini plug	<b>Z5639</b>
Gender changer – M-F	<b>Z6334</b>
Gender changer – F-M	<b>Z6335</b>
6 in. power extension	<b>Z6374</b>
10 ft Type J T/C extension	<b>Z6271</b>

**Note:** All power connectors use AMP MATE-N-LOK™



# Flexible Heaters



## Line Heating

### Silicone Pump Line Heaters

The tight contact fit of Watlow's pump line heaters provide superior, uniform heating of transfer lines.

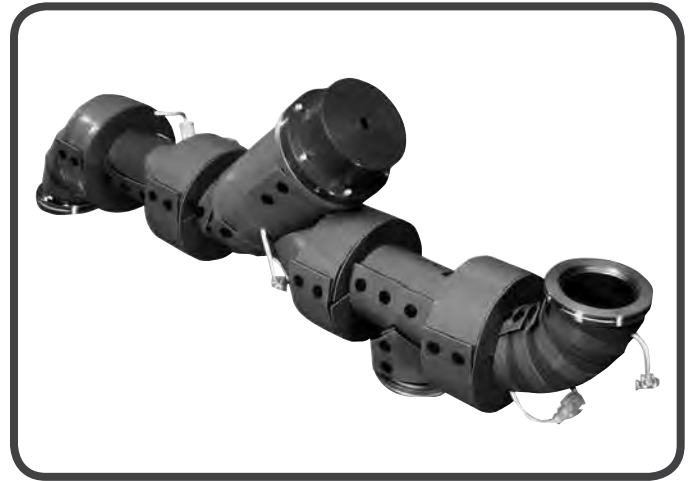
### Agency Certification, Recognition Compliance and Approvals

- Complies with SEMI S2-93 standards
- UL® recognized for U.S. and Canadian safety standards
- CE, VDE
- National Electrical Code (NEC), Article #427-23
- UL® Listed available

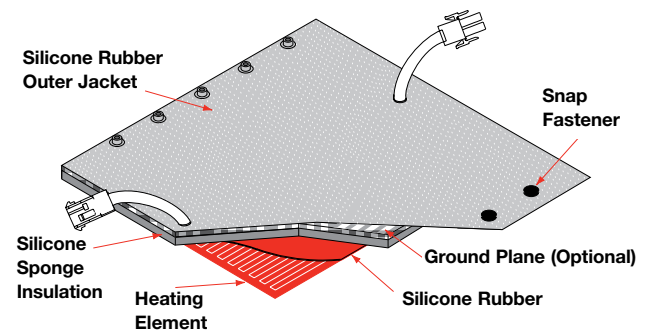
Contact your Watlow representative for specific applications and approvals.

### General Specifications

- The heater and jacket material are constructed using reinforced silicone rubber fabric.
- Insulation and outer jacket are gray. The heater is red-orange in color.



**Sensor Pocket Built-in to all Straight Length Heaters 3 in. (76 mm) Long and Greater; One Per Heater**



- Snap type fasteners are ½ in. (13 mm) with a nominal diameter metal construction and a nylon cover. The maximum operating temperature is 392°F (200°C).
- Hook and latch fasteners are available.
- 120 and 208VAC are standard. Contact your Watlow representative for other voltages.
- Power lead wires are 3 in. (76 mm) #18 AWG UL® 1180/CSA PTFE insulated and rated 10A. The lead wire pair is encapsulated in reinforced silicone rubber sleeving.
- Heaters are interconnectable up to a 10A circuit.
- Low watt density:
  - 1.5-2 in. (38-51 mm) diameter, 1.5 W/in<sup>2</sup> (0.23 W/cm<sup>2</sup>)
  - 3-4 in. (76-102 mm) diameter, 1.25 W/in<sup>2</sup> (0.19 W/cm<sup>2</sup>)



## Line Heating

### Molded Silicone Rubber Line Heaters

Watlow's molded silicone rubber pump line heaters are designed to provide improved temperature uniformity and increased heater performance, while working to decrease system downtime. Silicone foam insulation is bonded to the outside of a reinforced silicone heater mat. The unique molded design conforms to the exhaust line tubing, minimizing gaps and the resulting heat loss. The molded silicone not only ensures consistent and uniform heating, but it maintains a safe-to-touch temperature on the outside. Snap-on flange insulators keep the flanges hot, which eliminates cold spots due to exposure to the surrounding environment.

### Features and Benefits

#### Even heating for uniform temperature profiles over the entire heated line

- Eliminates cold spots that result in sublimation and solid particle buildup in the line

#### Easy-to-install system

- Conveniently fits on most pump line configurations
- Provides full line coverage for uniform heating
- Interconnection between heaters is easily accomplished using the mating electrical connectors

#### Integrated sensors and controllers

- Enables flexible control solutions using PID temperature algorithms to deliver accurate and precise temperature control

#### UL®, SEMI S2 and CE agency approval

- Assures safety standard compliance

#### Flexible heater design

- Allows for heating typical vacuum line components and fittings including pipes, valves, clamps and elbows in the line

### Typical Applications

- Semiconductor, PV, FPD and LED
- Fore lines, pump lines, exhaust lines and bypass lines
- Etch
- PECVD
- Nitride
- TEOS
- OEM tools
- Vacuum bake-out
- Abatement tools



### Specifications

**Pre-set temperature set points:** 302°F (150°C); or 221°F (105°C)

**Exterior range temperature:** Ambient to 185°F (85°C) dependent on set point

**Interior range temperature:** Ambient to 365°F (185°C)

**Foam thickness:** 0.5 in. (12.7 mm)

**Materials:** Molded silicone foam, fiberglass reinforced silicone, PTFE insulated wire

**Connectors:** Molex® Mini-fit Jr.

**Weight Range:** 0.5 to 6.2 lb (0.73 to 2.8 kg)

**Product Safety:** UL®/C-UL® listed, CE, Semi S2

# Flexible Heaters



## Line Heating

### ASSURANT SERIES TC Pump Line Heaters

Watlow's heater jackets provide flexibility in designing optimum heating systems for pump lines, fore lines and exhaust lines. ASSURANT TC heater jackets are ideal for high temperature/low outgassing for cleanroom applications.

Watlow's ASSURANT SERIES TC heater jackets maximize thermal uniformity and coverage by providing an efficient, easy-to-install heating solution for downstream exhaust line applications. The ASSURANT heater jackets optimize process tool uptime and chip yield by providing full coverage to the line eliminating cold spots that result in particle buildup.

ASSURANT heater jackets can be customized with distributed watt densities, so lighter and heavier component parts are heated uniformly.

This heater jacket can be supplied with integrated temperature sensors and controllers to assure accuracy and equipment longevity.

### Features and Benefits

#### Even heating for uniform temperature profiles over the entire heated line

- Eliminates cold spots that result in sublimation and solid particle buildup in the line

#### High operating temperatures up to 482°F (250°C)

- Prevents particle buildup in high-temperature applications such as certain atomic layer deposition (ALD) applications

#### PTFE construction

- Exhibits low out-gassing and little to no particle generation
- Appropriate solution for cleanroom applications

#### UL®, SEMI S2 and CE agency approval

- Assures safety standard compliance

#### Environmental safety

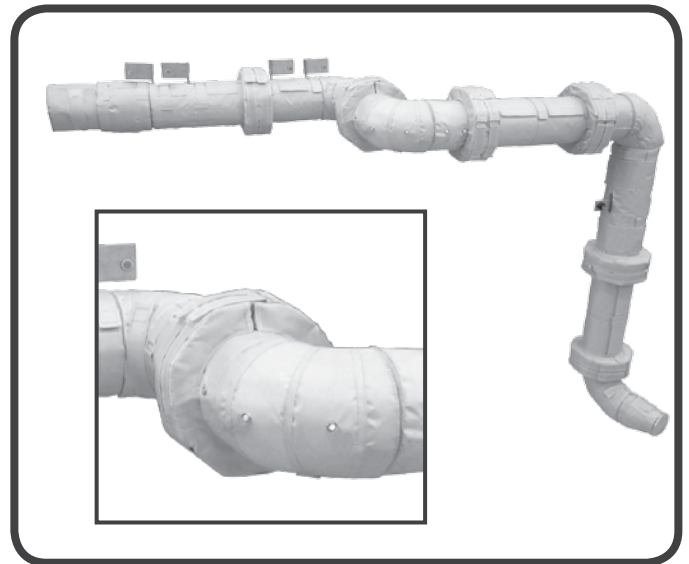
- Reducing particle buildup decreases potential of exposure to hazardous materials during normal cleaning cycles

#### Easy-to-install system

- Conveniently fits on most pump line configurations
- Provides full line coverage for uniform heating
- Interconnection between heaters is easily accomplished using the mating electrical connectors

#### Integrated sensors and controllers

- Enables flexible control solutions using PID temperature algorithms to deliver accurate and precise temperature control



### Flexible heater design

- Allows for heating typical vacuum line components and fittings including pipes, valves, clamps and elbows in the line
- Allows quick prototyping to determine energy distribution requirements for process improvements

### Fiberglass insulation

- Provides high efficiency
- Lowers power consumption and the cost of ownership
- Yields low backside temperatures

### Typical Applications

- Semiconductor, PV, FPD and LED
- Fore lines, pump lines, exhaust lines and bypass lines
- Etch
- PECVD
- Nitride
- TEOS
- OEM tools
- Vacuum bake-out
- Abatement tools

# Flexible Heaters



## Line Heating

### ASSURANT SERIES TC Pump Line Heaters (Continued)

#### Specifications

##### Operating temperature

- Standard operating temperature up to 356°F (180°C) (recommended)
- Maximum operating temperature up to 482°F (250°C)
- Other options available (contact your Watlow representative)

##### Agency approvals

- UL® 499, File # E52951
- RoHS compliant
- CE
- SEMI S2

##### Standard connectors

- AMP MATE-N-LOK™
- 4-pin AMP CPC
- Other options available (contact your Watlow representative)

##### Integrated sensor (optional)

- Type K thermocouple
- Over-temperature mechanical thermostat 392°F (200°C) max.

##### Voltage

- 120, 208 or 240V standard, other voltages available

##### Fastener

- Hook and loop

##### Inner jacket material options

- PTFE coated fiberglass

##### Outer jacket material options

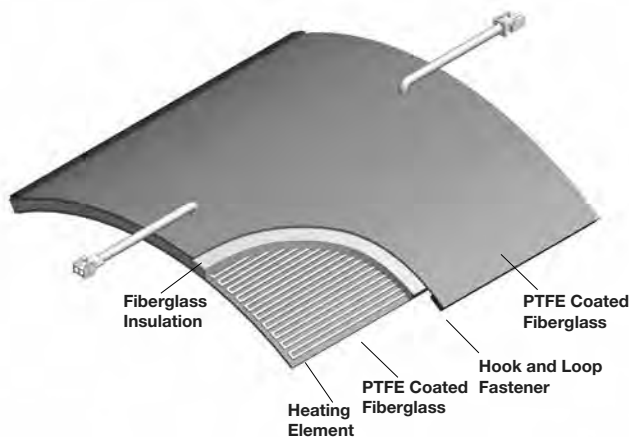
- PTFE coated fiberglass

##### Dimensions

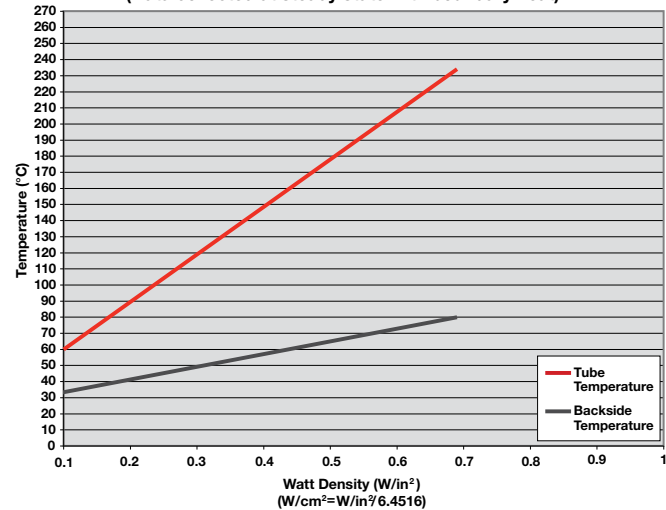
- Available for pipe sizes 1 to 6 in. (25 to 152 mm) diameter.

For other sizes contact your Watlow representative.

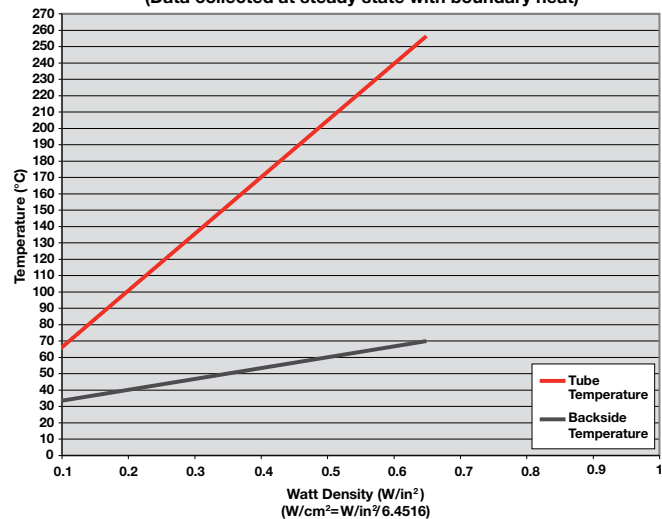
#### Heater Construction



Watt Density vs. Tube Temperature vs. Jacket Backside Temperature  
ASSURANT SERIES TC - 10 mm Insulation  
(Data collected at steady state with boundary heat)



Watt Density vs. Tube Temperature vs. Jacket Backside Temperature  
ASSURANT SERIES TC - 15 mm Insulation  
(Data collected at steady state with boundary heat)



**Note:** The data in the charts above represent nominal values derived from a test environment. Please consult a Watlow sales engineer to discuss your particular application.

# Flexible Heaters



## Line Heating

### ASSURANT SERIES TA Pump Line Heaters

Watlow's heater jackets provide flexibility in designing the optimum heating systems for pump lines, fore lines and exhaust lines. ASSURANT heater jackets solve the thermal challenges caused by varying mass and constricted spaces.

Watlow's ASSURANT SERIES TA heater jacket maximizes thermal uniformity and coverage by providing an efficient, easy-to-install heating solution for downstream exhaust line applications. The ASSURANT heater jackets optimize process tool uptime and chip yield by providing full coverage to the line eliminating cold spots that result in particle buildup.

ASSURANT heater jackets can be customized with distributed watt densities, so lighter and heavier component parts are heated uniformly.

This heater jacket can be supplied with integrated temperature sensors and controllers to assure accuracy and equipment longevity.

#### Features and Benefits

##### Even heating to 356°F (180°C) for uniform temperature profiles over the entire heated line

- Eliminates cold spots that result in sublimation and solid particle buildup in the line

##### Silicone coated fiberglass construction

- Provides economical solution for critical semiconductor processes

##### UL®, SEMI S2 and CE agency approval

- Assures safety standard compliance

##### Environmental safety

- Reducing particle buildup decreases potential of employee exposure to hazardous materials during normal cleaning cycles

##### Easy-to-install system

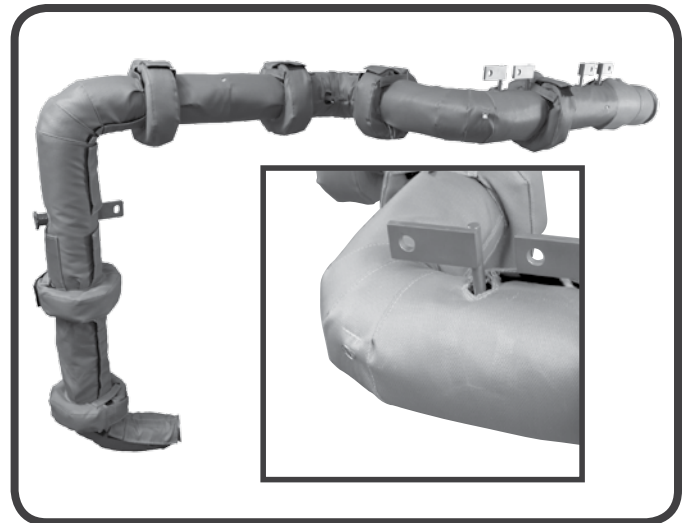
- Conveniently fits on most pump line configurations
- Provides full line coverage for uniform heating
- Interconnection between heaters is easily accomplished using the mating electrical connectors

##### Integrated sensors and controllers

- Enables flexible control solutions using PID temperature algorithms to deliver accurate and precise temperature control

##### Flexible heater design

- Allows for heating typical vacuum line components and fittings including pipes, valves, clamps and elbows in the line
- Allows quick prototyping to determine energy distribution requirements for process improvements



#### Fiberglass insulation

- Provides high efficiency
- Lowers power consumption and the cost of ownership
- Yields low backside temperatures

#### Typical Applications

- Semiconductor, PV, FPD and LED
- Fore lines, pump lines and exhaust lines
- Etch
- PECVD
- Nitride
- TEOS
- OEM tools
- Vacuum bake-out
- Abatement tools

# Flexible Heaters



## Line Heating

### ASSURANT SERIES TA Pump Line Heaters

#### Specifications

##### Operating temperature

- Standard operating temperature up to 302°F (150°C) (recommended)
- Maximum operating temperature up to 356°F (180°C)

##### Agency approvals

- UL® 499, File # E52951
- RoHS compliant
- CE
- SEMI S2

##### Standard connectors

- AMP MATE-N-LOK™
- 4-pin AMP CPC
- Other options available (contact your Watlow representative)

##### Integrated sensor (optional)

- Type K thermocouple
- Over-temperature mechanical thermostat

##### Voltage

- 120, 208 or 240V standard, other voltages available

##### Fastener

- Hook and loop

##### Inner jacket material options

- Silicone rubber coated fiberglass

##### Outer jacket material options

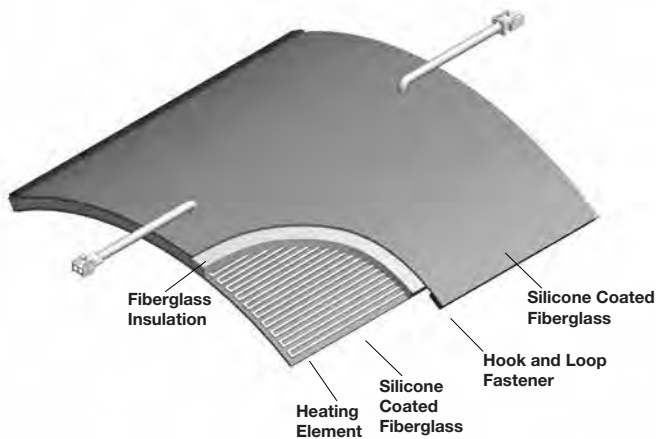
- Silicone rubber coated fiberglass

##### Dimensions

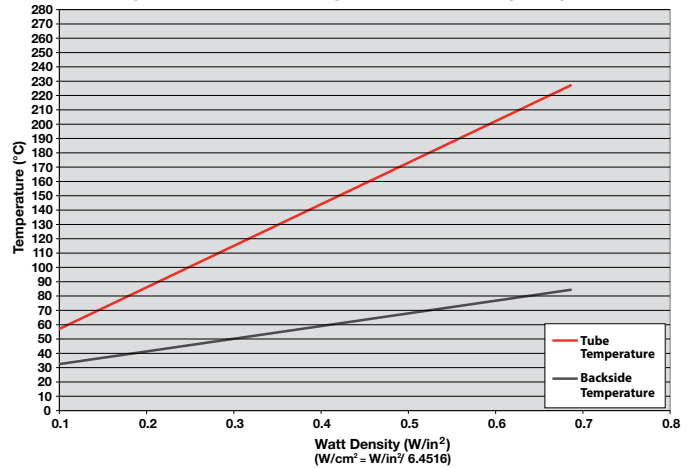
- Available for pipe sizes 1 to 6 in. (25 to 152 mm) diameter.

For other sizes contact your Watlow representative.

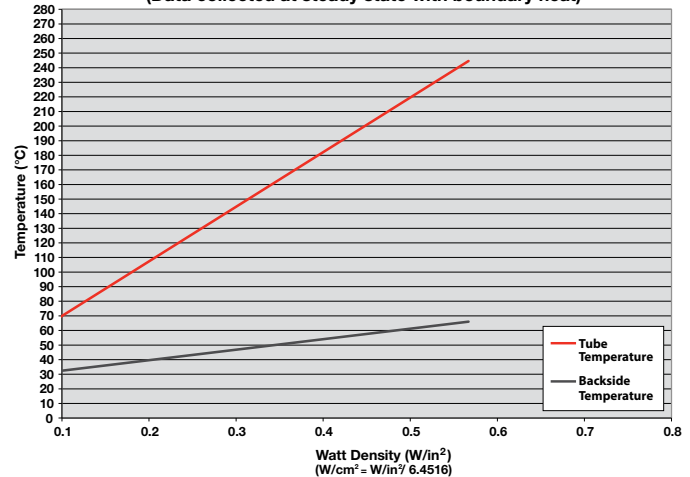
#### Heater Construction



Watt Density vs. Tube Temperature vs. Jacket Backside Temperature  
ASSURANT SERIES TA - 8 mm Insulation  
(Data collected at steady state with boundary heat)



Watt Density vs. Tube Temperature vs. Jacket Backside Temperature  
ASSURANT SERIES TA - 16 mm Insulation  
(Data collected at steady state with boundary heat)



**Note:** The data in the charts above represent nominal values derived from a test environment. Please consult a Watlow sales engineer to discuss your particular application.

# Flexible Heaters



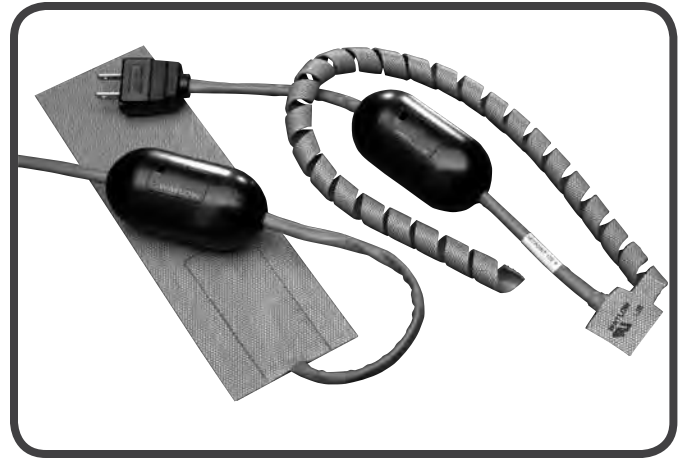
## SERIES EHG®

Many applications requiring a fixed temperature set point rely on a mechanical thermostat for thermal control. Thermostats have proven, however, to be inadequate for many applications due to long-term reliability issues, such as 100,000 cycle rating and poor temperature control.

The SERIES EHG® thermal solution includes a compact temperature controller, thermocouple sensor and power switching device integrated into the heater's power cord. The SERIES EHG reduces system costs and lasts substantially longer than a conventional thermostat solution.

The evolution of miniature microprocessor technology and Watlow switching technology fostered development of a small, versatile temperature controller and thermocouple sensor that is integrated with Watlow silicone rubber heater products. This device senses the temperature via input from a thermocouple strategically placed on the heater mat. The microprocessor is programmed prior to shipment with an application specific set point. This results in quick delivery of a custom, integrated system.

The small thermocouple mass provides superior response to changes in process temperature enabling higher watt density silicone rubber heater designs. These features offer an integrated custom set point temperature controller with superior life span, faster heat-up rates and improved accuracy. The SERIES EHG system has been tested to over four million cycles at rated amperage. Depending on the application, Watlow's power switching design can last up to 40 times longer than a conventional thermostat.



### Features and Benefits

#### Long operational life

- Improves system reliability

#### Tight temperature control

- Ensures process accuracy

#### Small sensor footprint

- Fits with almost any heater
- Responds quickly to temperature changes
- Controls high watt densities in low mass applications

#### A single EHG controller can be configured with multiple heaters

- Reduces system cost

#### Pre-wired, in-line control

- Simplifies installation
- Offers two-wire power connection

#### Durable housing with built-in strain relief

- Protects electronics
- Provides low risk of mechanical damage

#### Manufactured with proven Watlow components

- Assures reliable system performance

### Typical Applications

- Semiconductor processing
- Aerospace composite repair
- Foodservice equipment
- Freeze protection
- Life sciences
- Telecommunications



## SERIES EHG

### Technical Information

#### Specifications

##### Operational

- SERIES EHG silicone rubber heater UL<sup>®</sup> recognized to 428°F (220°C) operating temperature
- Factory programmed fixed set point
- On-off control with 6°F (3°C) switching hysteresis
- Temperature band LED indicator ON between ±36°F (±2°C) of set point

##### Electrical

- Voltage rating: 120 or 240VAC – 30/+10%, 50/60Hz
- Silicone rubber heater watt densities up to 80 W/in<sup>2</sup> (12.5 W/cm<sup>2</sup>) dependent on application temperature
- SERIES EHG system UL<sup>®</sup> recognized to 10A max.

##### Sensor

- Type K thermocouple

##### Mechanical

- Control dimensions 3.75 in. (95 mm) long by 1.75 in. (45 mm) diameter
- Heater per silicone rubber heater specifications

##### Agencies

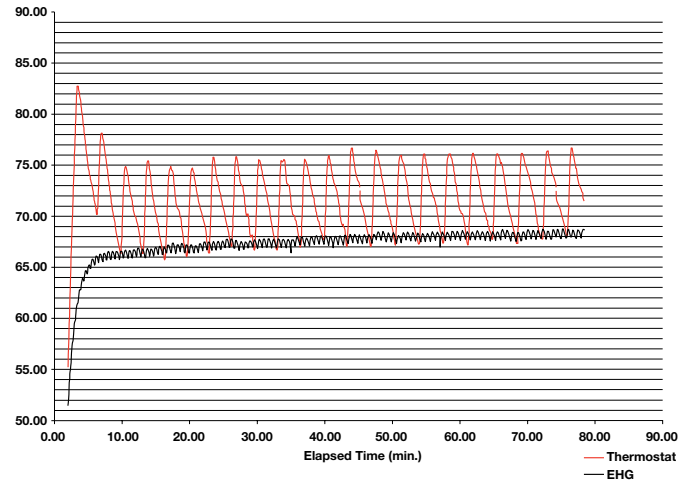
- Silicone rubber heater: UL<sup>®</sup> recognized File #E52951
- SERIES EHG control: TUV File DE 3-3068 to EN 61010-1:2001, UL<sup>®</sup> File E43684 to UL<sup>®</sup> 873 temperature indicating and regulating equipment

##### Environmental

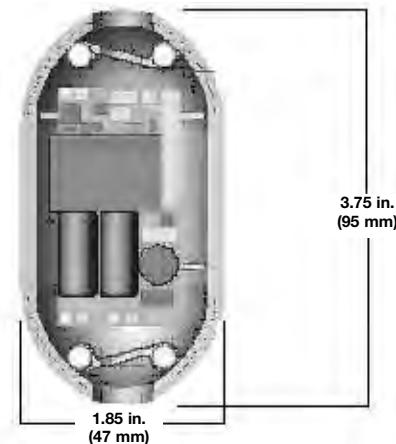
- Control operating temperature range 32 to 158°F (0 to 70°C)
- Control storage temperature range -40 to 158°F (-40 to 70°C)

Contact your Watlow representative for custom configurations.

**SERIES EHG Versus Thermostat (typical application)**



#### Dimensions



### Integrated SERIES EHG System Versus Integrated Thermostat System

	Integrated EHG System	Integrated Thermostat System	SERIES EHG Benefit
Life comparison at rated amperage	Tested to greater than 4,000,000 cycles with 10A load	Rated 100,000 cycles	Longer product life of SERIES EHG system and high application reliability
Switch hysteresis	6°F (3°C)	15°F (8°C)	Provides superior process control
Improved response time reduces overshoot on start-up	6°F (3°C) typical	25°F (14°C) typical	Responds to temperature changes faster than a thermostat
Warranty	2 years for material and workmanship	1 year on material and workmanship	Warranty can be extended due to longer life cycle
Zero cross switching	SERIES EHG has zero cross switching	Random switching during sign wave cycle	Reduces the possibility of electrical mechanical interference (EMI)



# Flexible Heaters



## SERIES EHG SL10

The SERIES EHG SL10 integrated, multi-function controller is a key component to a powerful system that integrates a heater, an adjustable set point temperature controller, a high/low temperature alert, a power switching device and a high temperature safety limit. Its agency recognized controller/safety limit meets UL® 1998 and CE 60730 requirements.

An optional display/communications module can be easily added in the field to provide a digital display indication, an adjustment of set point, RS485 Modbus® communications and other Human Machine Interface (HMI) features. As a scalable system, only what is needed can be purchased.

The EHG SL10 controllers' easy to install, compact design, inherent reliability and integrated limit functions offer unmatched value. It is designed for easy integration with Watlow heaters to simplify engineering, reduce component count for new equipment and decrease ownership cost. For original equipment manufacturers, (OEMs), CE, Semi-S2 compliance and UL® recognition, the EHG controller reduces time and costs associated with global agency testing and validation.

### Features and Benefits

#### Process controller and safety limit in one package

- Meets UL® 1998 and CE 60730 requirements
- Eliminates the need for a thermal fuse on a heater
- Eliminates replacement of heater when fuse fails

#### Optional display/communications module

- Allows easy upgrade to base device
- Offers low cost field upgrade
- Provides easy, snap-on installation

#### Accurate and flexible temperature process controller

- Replaces problematic bi-metal thermostats with accurate electronic temperature process controller
- Allows easy change of process parameters

#### Ambient operating temperature range 32 to 158°F (0 to 70°C)

- Increases reliability when mounting in harsh temperature environments or in close proximity to heaters

#### Integrated high/low temperature alert signal relay

- Provides dry contact output to activate external alarm or process function
- Signals control status with three integrated LEDs
- Allows a signal of up to two amperes 30VAC/MDC, Form A to alert if process temperature is out of range limits



#### Health check diagnostics

- Monitors maximum heater process temperature, maximum ambient temperature and thermocouple operation
- Provides health check signal to inform operator that the process is working correctly

#### Universal power supply

- Allows an input of 85 to 264VAC, 50/60Hz
- Provides safe control of up to 2400 watts with 10 amperes switching in both controller and safety limit

#### Can be switched from on-off and PID algorithm

- Increases product life (on-off control is default)
- Offers selectable PID control algorithm for tighter temperature control

#### Universal 1/8 turn mounting bracket

- Allows mounting to most surfaces
- Provides flexible mounting—either horizontally or vertically

### Typical Applications

#### Foodservice equipment

- Warming and serving equipment
- Food holding cabinets

#### Life sciences

- Laboratory equipment
- Medical equipment

#### Packaging

- Heat sealing bars
- Hot glue application equipment

#### Semiconductor processing

- Gas delivery lines
- Exhaust lines



## SERIES EHG SL10

### Technical Information

#### Specifications

##### Operational

- Two, Type K thermocouple inputs - process temperature control and safety limit
- Process temperature output - 10A NO-ARC relay
- Safety limit alarm - 10A relay
- High/low temperature alert - 2A 30VAC/VDC, Form A (single pole, normally open contact)
- On-off temperature controller algorithm, upgraded via communications to PID algorithm (min. cycle time 30 seconds)

##### Standard Molex® connectors

- Controllers are integral to the heater and are supplied by Watlow

##### Power

- Isolated universal power supply 85 to 264VAC, 50/60Hz
- Up to 2400 W with 10A switching capability

##### NO-ARC Relay

- 10A switching
- 4.5 million cycles

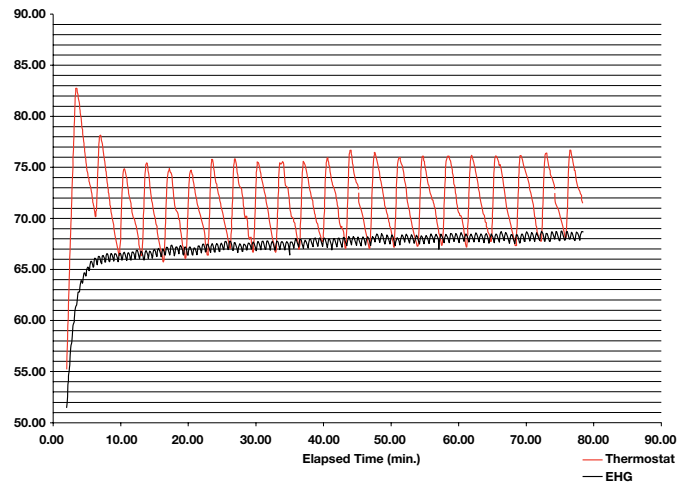
##### Environmental

- Ambient operating temperature range 32 to 158°F (0 to 70°C)

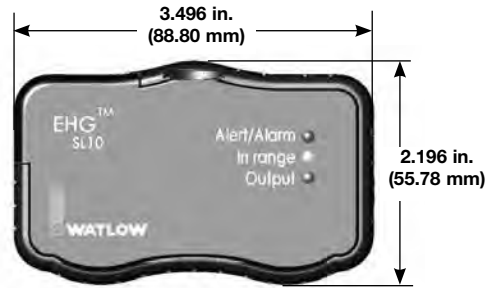
##### Agency Approvals

- UL® 1998/ C-UL®
- CE 60730
- Semi-S2

### SERIES EHG Versus Thermostat (typical application)



### Dimensions



Base Unit



Without Optional Module



With Optional Module

### Switching Device Comparison Chart

	T-Stat	Solid State Relay	Watlow NO-ARC Relay
Amperage at 77°F (25°C)	10A	10A	10A
Amperage at 158°F (70°C)	10A	De-rate significantly and add heat sink and air cooling	10A
Output device life at 10A	Rated 100,000 at 158°F (70°C)	Greater than 10 million cycles at 77°F (25°C)	Greater than 4.5 million cycles at 158°F (70°C)

# Flexible Heaters



## SERIES EHG SL10

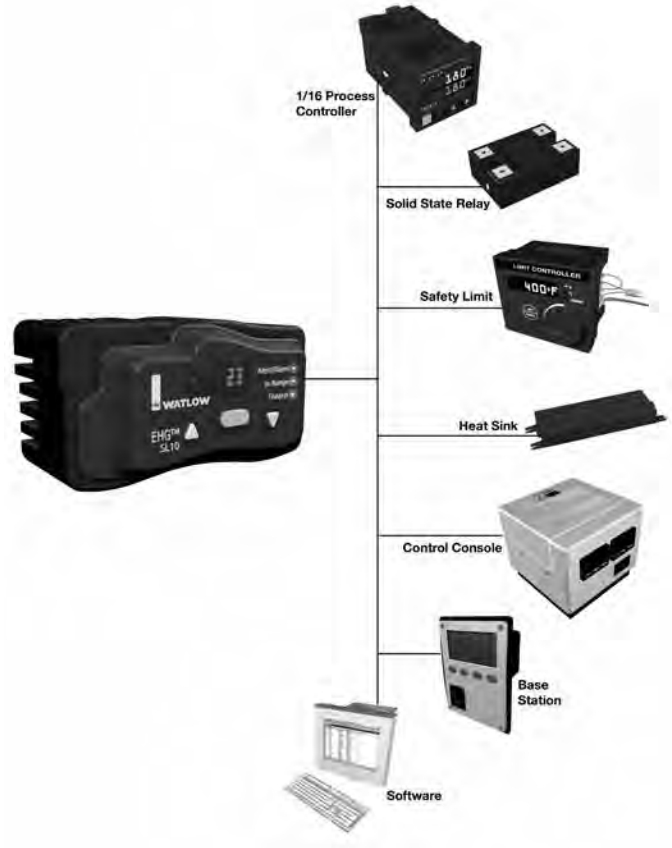
### Technical Information (Continued)

#### EHG SL10 Software

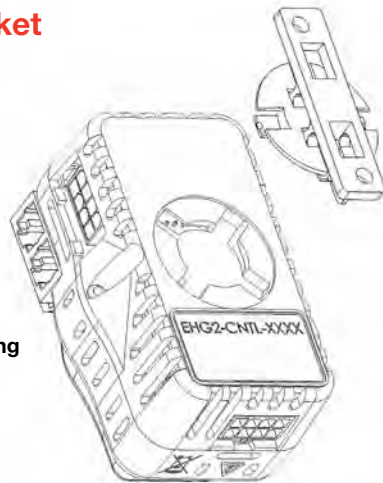
With the addition of an optional communication module, the EHG SL10 can be managed, monitored and manipulated via software. Change set points, label devices, change tuning parameters, check health status and much more all with the click of a key.



#### Reduces System Complexity and Cost



#### Mounting Bracket



The EHG SL10 mounting enables the controller to be mounted in four angles.



The EHG SL10 can be "daisy-chained" for gas line and other assemblies.



## SERIES EHG SL10

### Technical Information (Continued)

#### Using an SL10 with Flexible Heaters (Non Stretch-To-Length (S-T-L))

The EHG SL10 controller is designed to work with Watlow flexible heaters. It was originally designed to be added to custom designs only. Now, with the right accessories, it can be used with many of our flexible catalog heaters, which have the standard Mate-N-Lok™ plug for power.

This controller requires a dual Type K T/C to operate. The key to successful operation is that the two Type K T/Cs must be in the same location. A differential of greater than 20°C while the control is calling for heat will shut off the output. In order to allow its use with our standard catalog product, Watlow has created P/N A005867. This dual T/C assembly is a flexible pad with 18 inch leads, which will connect to a special “Y” adapter (P/N 265-000-911), which then connects to the SL10. The “Y” adapter also has a Mate-N-Lok™ receptacle to connect to our standard Mate-N-Lok™ power plug.

This configuration can be used in many applications where our standard flexible product is used. It is not suitable for gasoline applications where the .ID. of the heater is less than 1.5 inches due to the size of the pad on P/N A005867. For these applications you should consider using our stretch-to-length (S-T-L) product which can now also be used with the SL10.

#### Using an SL10 with S-T-L Heaters

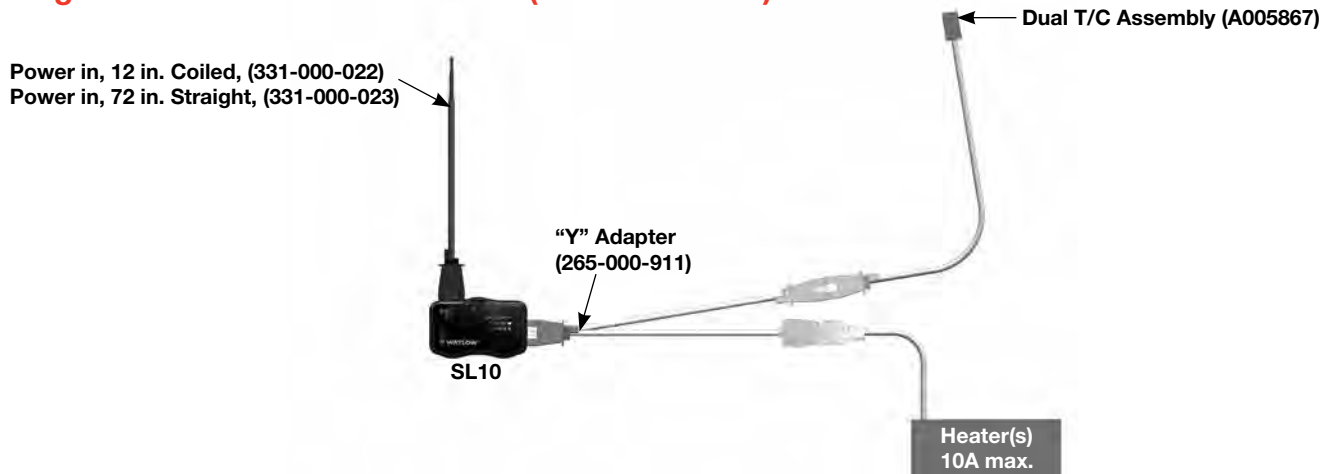
The EHG SL10 controller is designed to work with Watlow flexible heaters. It was originally designed to be added to custom designs only. Now, with the right accessories, it can be used with many of our flexible catalog heaters, which have the standard Mate-N-Lok™ plug for power.

This controller requires a dual Type K T/C to operate. The key to successful operation is that the two Type K T/Cs must be in the same location. A differential of greater than 20°C while the control is calling for heat will shut off the output. Watlow now offers a selection of S-T-L heaters, which have dual T/Cs built into them for use with our EHG SL10 controllers.

When you find the S-T-L heater for your needs in the catalog you can use the table below to select the appropriate heater shaded in gray from the table below. This new heater will include the necessary dual T/Cs built in and will have the necessary Molex® plug to connect directly to the SL10. If you need additional coverage, S-T-L heaters can be daisy chained in parallel as each includes parallel in and out connections on 12 inch leads. Only one of the new, dual T/C heaters is needed for each control zone.

New Part Number with Dual K T/C	Stock S-T-L in Catalog Part Numbers
005120523	005120500
005280525	005280500
005600535	005600502
005280526	005280501
005600536	005600503
005170522	005170501
005490524	005490502
005990515	005990502
005490525	005490503
005990516	005990503

#### Using an SL10 with a Stock Heater (No T/C Built In)



# Flexible Heaters







## SERIES EHG SL10

### Technical Information (Continued)

#### Optional Upgrade Modules

These upgrade modules are easy to install. There is no need to reconfigure, rewire or reorder the base unit. A technician is not needed for the installation, resulting in a seamless, cost-efficient system that can be upgraded.

		Diagnostics Memory Control Parameters	Ability to Change Temperature Parameters	Field Adjustable Set Point	3-Digit 7-Segment LED Display Illuminated	Diagnostic LEDs	User Interface Software	Modbus® RTU Communication	RS 485
Base Unit		✓	✓			✓			
Optional Display Module		✓	✓	✓	✓	✓			
Optional Communication Module		✓	✓	✓		✓	✓	✓	✓
Optional Display and Communication Module		✓	✓	✓	✓	✓	✓	✓	✓

### Ordering Information

#### Part Number

1 2 3 4 5 6	7 8 9
265 EG2	Modules

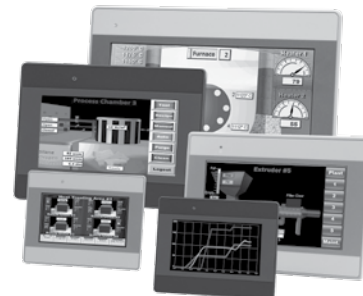
7	8	9	Modules
001	=		Base unit
007	=		Display module
008	=		Communications module
002	=		Display and communications module

#### Additional cables for wiring parallel heater circuits (daisy-chaining) in gas line and other assemblies

- 4800-0012 - Long cable
- 4800-0022 - Long terminating cable
- 4800-0011 - Short cable
- 4800-0021 - Short terminating cable

### Compatible Accessories

#### Operator Interface Terminals (OIT)



Silver Series EM touchscreen operator interface terminals provide a customizable user interface, email event notifications and log and graph data for Watlow controllers and other devices. A Silver Series EM operator interface terminal paired with Watlow controllers is the perfect solution for industrial processes or machine control applications.



# Immersion Heaters



Immersion Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
<b>WATROD and FIREBAR® Screw Plug</b>	Alloy 800/840	1600	870	120	18.6	<b>145</b>
	Stainless steel	1200	650	120	18.6	
	Steel	750	400	120	18.6	
<b>WATROD Screw Plug with Control Assembly</b>	Alloy 800	1600	870	60	9.3	<b>218</b>
<b>WATROD ANSI Flange</b>	Alloy 800	1600	870	100	15.5	<b>220</b>
	Stainless steel	1200	650	100	15.5	
	Steel	750	400	100	15.5	
<b>WATROD Plate Flange</b>	Alloy 800/840	1600	870	60	9.3	<b>282</b>
	304 stainless steel	1200	650	100	15.5	
	Steel	750	400	30	4.7	
<b>WATROD and FIREBAR Square Flange</b>	Alloy 800	1600	870	100	15.5	<b>288</b>
<b>WATROD and FIREBAR Bayonet/Pipe Insert</b>	Alloy 800	1600	870	10	1.6	<b>291</b>
	Steel	750	400	10	1.6	
<b>FIREROD®</b>	Alloy 800	212	100	300	46.5	<b>293</b>



Immersion Heaters





# Immersion Heaters



## WATROD™ and FIREBAR® Screw Plug Immersion Heaters

Screw plug immersion heaters are ideal for direct immersion heating of liquids, including all types of oils and heat transfer solutions.

Available in a variety of sizes, Watlow® screw plug immersion heaters feature both WATROD™ round and FIREBAR® flat tubular elements.

Heating elements are hairpin bent and either welded or brazed into the screw plug—depending on element sheath and plug material compatibility.

General purpose terminal enclosures are standard; with optional moisture resistant, explosion resistant and explosion/moisture resistant enclosures available to meet specific application needs.

Optional thermostats provide convenient process temperature regulation.

### Performance Capabilities

- Watt densities up to 120 W/in<sup>2</sup> (18.6 W/cm<sup>2</sup>)
- Wattages up to 38 kilowatts
- UL® and CSA component recognition up to 480VAC and 600VAC respectively
- Alloy 800/840 sheath temperatures up to 1600°F (870°C)
- Passivated 316 stainless steel sheath temperatures up to 1200°F (650°C)
- 304 stainless steel sheath temperatures up to 1200°F (650°C)
- Steel sheath temperatures up to 750°F (400°C)

### Features and Benefits

#### A variety of element sheath and screw plug materials

- Meets your application needs

#### Integral thermowells

- Provides convenient temperature sensor insertion and replacement without draining the fluid being heated

#### Terminal enclosures

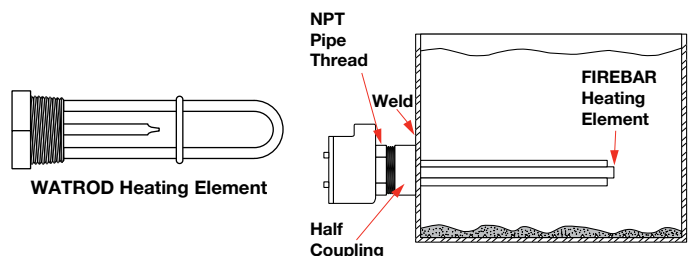
- Provides ability to be rotated to simplify connection with existing conduits

#### Welding or brazing WATROD and FIREBAR elements to the screw plug

- Provides a pressure tight seal

#### WATROD hairpins are repressed (recompacted)

- Maintains MgO density, dielectric strength, heat transfer and life



#### 2 1/2 in. (64 mm) NPT screw plug assemblies feature element support(s)

- Ensures proper spacing for maximizing heater performance and life

#### • Screw plug and element sizes:

1 in. NPT	0.260 and 0.315 in. WATROD
1 1/4 in. NPT	0.260 and 0.315 in. WATROD 1 in. FIREBAR
2 in. NPT	0.430 and 0.475 in. WATROD
2 1/2 in. NPT	0.430 and 0.475 in. WATROD 1 in. FIREBAR

#### • Phase capability:

1 in. NPT	1-Phase
1 1/4, 2, 2 1/2 in., NPT	1- or 3-Phase

UL® and CSA component recognition under File E52951 and 31388 respectively, see pages 559 to 562 for details.

# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters

### Typical Applications

- Water:
  - Deionized
  - Demineralized
  - Clean
  - Potable
  - Process
- Industrial water rinse tanks
- Vapor degreasers
- Hydraulic oil, crude, asphalt
- Lubricating oils at API specified watt densities
- Air and gas flow
- Caustic solutions
- Chemical baths
- Anti-freeze (glycol) solutions
- Paraffin

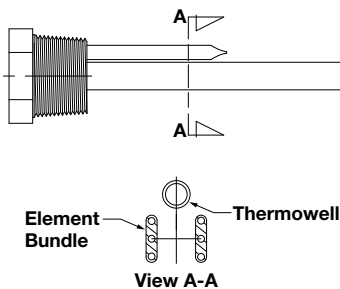
### Screw Plug Orientation

Correct element/thermowell orientation assures proper process temperature sensing.

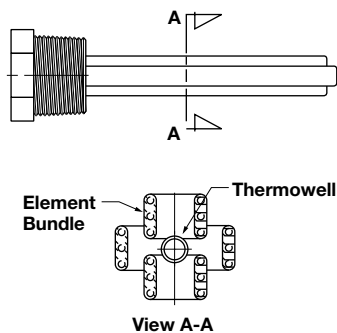
Correct horizontal mounting of WATROD and FIREBAR screw plugs is shown below. Correct orientation assures optimum performance and maximum heater life. Additional mounting information is provided in the *Installation and Maintenance Instructions*.

### FIREBAR Heating Elements

#### 1 1/4 in. NPT–One Element

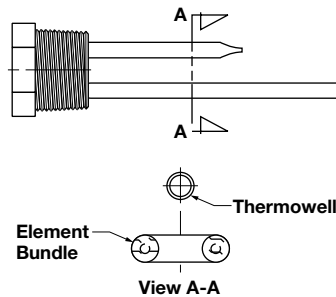


#### 2 1/2 in. NPT–Three Elements

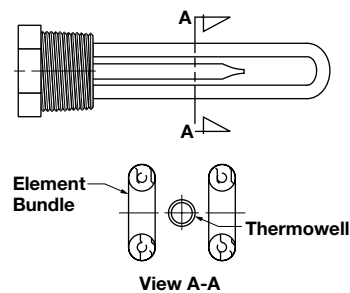


### WATROD Heating Element

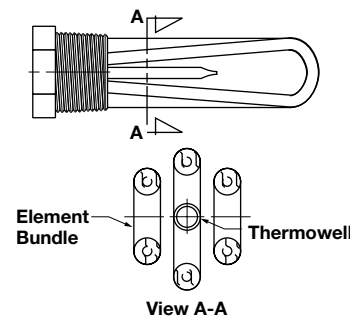
#### 1 in. NPT–One Element



#### 1 1/4 in. and 2 in. NPT–Two Elements



#### 2 in. and 2 1/2 in. NPT–Three Elements





## WATROD and FIREBAR Screw Plug Immersion Heaters

### Options

#### Terminal Enclosures

General purpose terminal enclosures, without thermostats, are available on all screw plug immersion heaters. To meet specific application requirements, Watlow offers the following optional terminal enclosures:

- General purpose with single- or double-pole thermostat
- Moisture-resistant or corrosion resistant—available with optional single- or double-pole thermostat
- Non-certified, explosion and moisture-resistant combination suitable for use in non-classified areas only—available with optional single- or double-pole thermostat

**Note:** Unless otherwise stated on the accompanying illustrations, both WATROD and FIREBAR screw plugs are centered on the terminal enclosure. To order, add the suffix letter(s) to the screw plug heater's base part number. This is depicted on the ordering example on page 217. Also, specify class and group, if applicable.

#### CSA Certified Enclosures

These enclosures are suitable for Class 1, Groups B, C and D classified areas. CSA certified enclosure 4 and/or explosion proof terminal enclosures protect wiring in hazardous gas environments. These terminal enclosures, covered under CSA File number 61707, are available on all WATROD and FIREBAR screw plug immersion heaters. For additional information, contact your Watlow representative.

To order, specify **CSA certified enclosure**, **process temperature** (°F), maximum **working pressure** of application (psig), **media** being heated and heater **mounting orientation** (horizontal or vertical) and **screw plug size**.

#### Pilot Light

The optional pilot light gives the operator visual indication of heater on or off power status.

The PL10 pilot light is configured to a maximum 250VAC and supplied with 6 in. (152 mm) leads.

The PL11 pilot light is rated for 480VAC and supplied with 4 in. (102 mm) leads.

#### Thermostats

To provide process temperature control, Watlow offers optional single-pole, single-throw (SPST) and double-pole, single-throw (DPST) thermostats.

Unless otherwise specified, thermostats are mounted inside the terminal enclosure. For details and ordering information, refer to *Thermostats* on pages 514 to 518. Please verify that the thermostat's sensing bulb O.D. is compatible with the screw plug's thermowell I.D.



#### Caution:

Certified explosion proof terminal enclosures are intended to provide explosion containment in the electrical termination/wiring enclosure only. No portion of the assembly outside of this enclosure is covered under this enclosure rating. Enclosure rating effectiveness may be compromised by abuse or misapplication.

# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters

### Options (Continued)

#### Thermocouples

ASTM Type J or K thermocouples offer extremely accurate sensing of process and/or sheath temperatures. A thermocouple may be inserted into the thermowell or attached to the heater's sheath.

Thermocouples are standardly supplied with 120 in. (3048 mm) leads. Unless otherwise specified, thermocouples are supplied with temperature ranges detailed on the *Thermocouple Types* chart.

Using a thermocouple requires an appropriate temperature and power controller and these must be purchased separately. Watlow offers a wide variety of temperature and power controllers to meet virtually all applications. Temperature controllers can be configured to accept process variable inputs, too. Contact your Watlow representative for details.

To order, specify **Type J** or **K** thermocouple and indicate if the thermocouple is for **process temperature sensing** or heater sheath **high-limit protection**. Please specify if the screw plug will be mounted **vertical** or **horizontal** in the tank. **If vertical, indicate if the housing is on top or bottom.**

If the screw plug heater is mounted in an in-line circulation heating application, indicate flow direction relative to the heater's enclosure.

#### Thermocouple Types

ASTM Type	Conductor Characteristics		Recommended ① Temperature Range	
	Positive	Negative	°F	(°C)
J	Iron (Magnetic)	Constantan (Non-Magnetic)	0 to 1000	(-20 to 540)
K	Chromel® (non-magnetic)	Alumel® (Magnetic)	0 to 2000	(-20 to 1100)

① Type J and Type K thermocouples are rated 32 to 1382°F and 32 to 2282°F (0-750°C and 0-1250°C), respectively. Watlow does not recommend exceeding temperature ranges shown on this chart for the tubular product line.

#### Wattages and Voltages

Watlow routinely supplies screw plug immersion heaters with 120 to 480VAC as well as wattages from 250 watts to 38kW.

#### Sheath Materials

The following sheath materials are available on WATROD and FIREBAR heating elements:

##### Standard Sheath Materials

<b>WATROD</b>	Alloy 800/840 316 SS Copper clad steel Steel
<b>FIREBAR</b>	Alloy 800

##### Exotic Sheath Materials

Contact your Watlow representative for details and availability.

#### External Finishing

##### Passivation

During the manufacturing process, particles of iron or tool steel may become embedded in the stainless steel or alloy sheath. If not removed, these particles may corrode, produce rust spots and/or contaminate the process. For critical applications, passivation will remove free iron from the sheath. To order, specify **passivation**.

##### Other Finishes

Bright annealing available to meet cosmetic demands.

#### Screw Plug Materials

The following screw plug materials are available:

##### Standard Screw Plug Materials

<b>WATROD</b>	304 SS, Brass, 316 SS Steel
<b>FIREBAR</b>	304 SS

To order, specify **screw plug size** and **material**.

##### Made-to-Order Plug Materials

For both WATROD and FIREBAR, contact your Watlow representative about details and availability.

# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters

### Options (Continued)

#### Screw Plug Sizes

American National Standard Taper Pipe Thread form (NPT) plugs are standard, and in sizes 1, 1¼, 2, and 2½.

To order, specify **size** and **material**.

#### Screw Plug to Flange Adapters

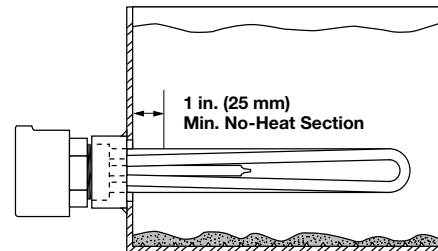
Screw plug to flange adapters permit replacing flange heaters with screw plug heaters. To order, specify the appropriate part number.

#### Screw Plug to Flange Adapters

Screw Plug to Flange Adapter Sizes	Material	Estimated Shipping Wt.		Part Number
		lbs	(kg)	
1¼ to 3 in.-150#	Steel	13	(5.9)	<b>125X3SA</b>
2½ to 3 in.-150#	Steel	11	(5.0)	<b>250X3SA</b>
2½ to 4 in.-150#	Steel	16	(7.3)	<b>250X4SA</b>
2½ to 5 in.-150#	Steel	25	(11.3)	<b>250X5SA</b>
2½ to 6 in.-150#	Steel	33	(15.0)	<b>250X6SA</b>

#### Application Hints

- Select the recommended sheath material and watt density for the substance being heated. Use the *Supplemental Applications Chart* on pages 550 to 553. If unable to determine the correct heater material and type, contact your Watlow representative.
- Extend the element's no-heat section completely into the fluid being heated to help prevent premature heater failure. See illustration below for proper no-heat section placement.
- Locate screw plug heater low in the tank, but above the sludge level.



- Choose a FIREBAR element when the application requires a smaller system package or lower watt density.
- Ensure wiring integrity by making sure terminal enclosure temperature does not exceed 400°F (205°C).
- Keep electrical connections clean, dry and tight.
- Size power feeder wires in accordance with National Electrical Code® guidelines and other applicable codes.
- Minimize problems associated with low liquid level conditions by using a low liquid level sensor or sheath temperature high-limit control.
- Periodically remove the screw plug assembly for inspection and clean the heating element(s). This preventive maintenance will reduce premature failure and optimize heater performance.
- Refer to the *Installation and Maintenance Instructions* for correct orientation of FIREBAR elements. Correct element orientation to flow minimizes pressure drop, increases buoyancy force and heater performance.

# Immersion Heaters

**EXTENDED  
CAPABILITY**



## Extended Capabilities for WATROD and FIREBAR Screw Plug Immersion Heaters

### Pilot Light

Pilot lights may be attached to either single or double pole thermostats with general purpose or moisture resistant enclosures. For combination moisture and explosion resistant enclosures, contact your Watlow representative..

To order, refer to the *Ordering Information* on page 217.

### Wattages and Voltages

Watlow routinely supplies screw plug immersion heaters with 120 to 480VAC as well as wattages from 250 watts to 38kW. If required, Watlow may configure heaters with voltages and wattages outside these parameters. For more information on special voltage and wattage configurations, contact your Watlow representative.

### Extended Sheath Materials

The following sheath materials are available on WATROD heating elements:

#### Extended Sheath Materials

<b>WATROD</b>	Hastelloy C276 Monel®
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### Screw Plug Materials

The following screw plug materials are available:

#### Extended Screw Plug Materials

<b>WATROD</b>	Brass Carbon steel 304 SS 316 SS
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To order, specify **screw plug size** and **material**.

# Immersion Heaters

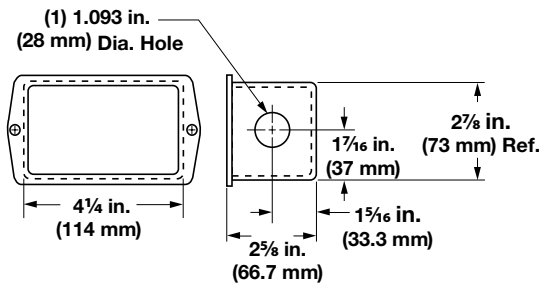


## WATROD and FIREBAR Screw Plug Immersion Heaters

### Optional Moisture Resistant Enclosures

#### With Single-Pole Thermostat

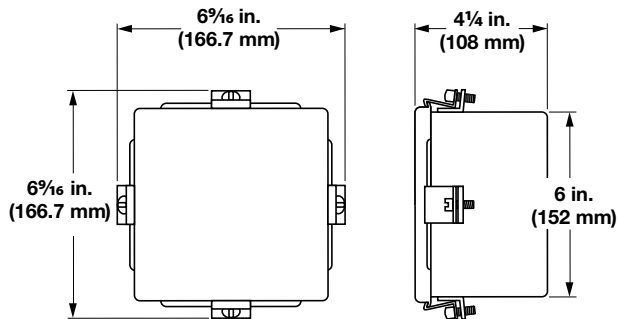
1 and 1 1/4 inch NPT-1 WATROD Element



**Note:** The enclosure is not centered on the WATROD screw plug heater.

#### With Single-Pole Thermostat

All 2 and 2 1/2 inch NPT



**Note:** The enclosure is not centered on the screw plug heater.

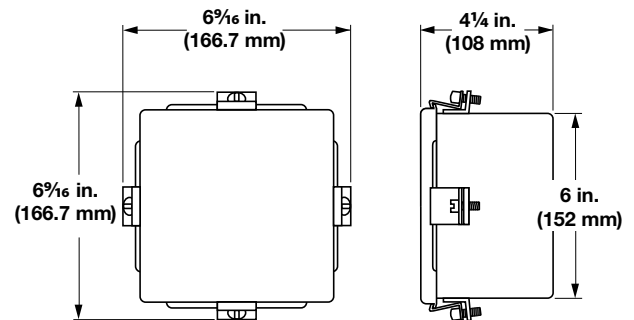
**To order:** Reference "W" in the *Ordering Information* section on page 217.

#### With Double-Pole Thermostat

1 1/4 inch NPT-2 WATROD Elements

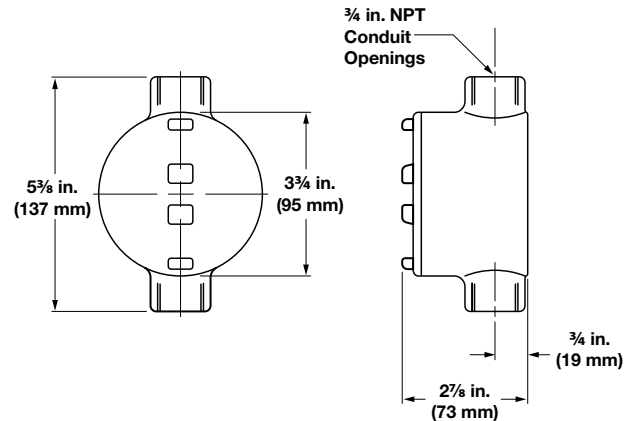
1 1/4 inch NPT-1 FIREBAR Element

All 2 and 2 1/2 inch NPT screw plugs



**Note:** The enclosure is not centered on the screw plug heater.

#### Without Thermostat



# Immersion Heaters

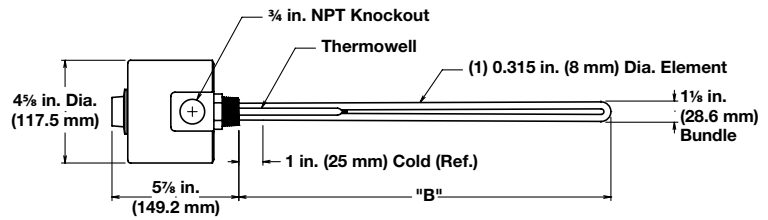


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Clean Water

- 1 inch NPT screw plug
- WATROD elements
- With thermostat (SPST), Type 2 or 3
- General purpose enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure
60 W/in <sup>2</sup> Brass Plug 1-Alloy 800 Element	120	0.50	1	4 1/2 (114.0)	3 (2)	BCN4J1S2	C/F	C/F	BCN4J1S3	C/F	C/F
	240	0.50	1	4 1/2 (114.0)	3 (2)	BCN4J10S2	C/F	C/F	BCN4J10S3	C/F	C/F
	120	0.75	1	6 1/2 (165.0)	3 (2)	BCN6J1S2	C/F	C/F	BCN6J1S3	C/F	C/F
	240	0.75	1	6 1/2 (165.0)	3 (2)	BCN6J10S2	C/F	C/F	BCN6J10S3	C/F	C/F
	120	1.00	1	6 5/8 (168.3)	3 (2)	BCN6L1S2	C/F	C/F	BCN6L1S3	C/F	C/F
	240	1.00	1	6 5/8 (168.3)	3 (2)	BCN6L10S2	C/F	C/F	BCN6L10S3	C/F	C/F
	120	1.25	1	8 (203.0)	4 (2)	BCN8A1S2	C/F	C/F	BCN8A1S3	C/F	C/F
	240	1.25	1	8 (203.0)	4 (2)	BCN8A10S2	C/F	C/F	BCN8A10S3	C/F	C/F
	120	1.50	1	10 5/8 (269.9)	4 (2)	BCN10L1S2	C/F	C/F	BCN10L1S3	C/F	C/F
	240	1.50	1	10 5/8 (269.9)	4 (2)	BCN10L10S2	C/F	C/F	BCN10L10S3	C/F	C/F
	120	2.00	1	12 1/2 (318.0)	5 (3)	BCN12J1S2	C/F	C/F	BCN12J1S3	C/F	C/F
	240	2.00	1	12 1/2 (318.0)	5 (3)	BCN12J10S2	C/F	C/F	BCN12J10S3	C/F	C/F
	120	2.50	1	14 3/4 (375.0)	5 (3)	BCN14N1S2	C/F	C/F	BCN14N1S3	C/F	C/F
	240	2.50	1	14 3/4 (375.0)	5 (3)	BCN14N10S2	C/F	C/F	BCN14N10S3	C/F	C/F
	120	3.00	1	16 3/4 (425.0)	6 (3)	BCN16N1S2	C/F	C/F	BCN16N1S3	C/F	C/F
	240	3.00	1	16 3/4 (425.0)	6 (3)	BCN16N10S2	C/F	C/F	BCN16N10S3	C/F	C/F
240	4.00	1	21 (533.0)	6 (3)	BCN21A10S2	C/F	C/F	BCN21A10S3	C/F	C/F	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

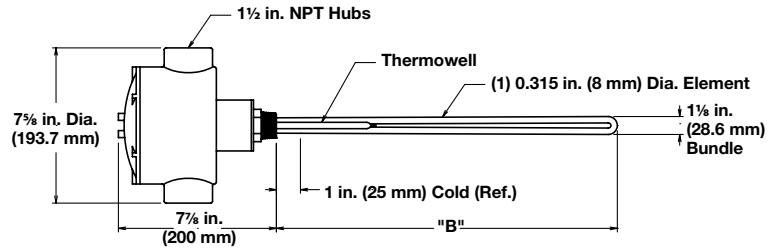




## WATROD and FIREBAR Screw Plug Immersion Heaters

### Application: Clean Water

- 1 inch NPT screw plug
- WATROD elements
- With thermostat (SPST), Type 2 or 3
- Moisture/explosion-resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							Moisture/ Explosion-Resistant Enclosure ⑤	Type J T/C		Type K T/C	Moisture/ Explosion-Resistant Enclosure ⑤
60 W/in <sup>2</sup> Brass Plug 1-Alloy 800 Element (9.3 W/cm <sup>2</sup> )	120	0.50	1	4 <sup>1</sup> / <sub>2</sub> (114.0)	3 (2)	BCN4J1C2	C/F	C/F	BCN4J1C3	C/F	C/F
	240	0.50	1	4 <sup>1</sup> / <sub>2</sub> (114.0)	3 (2)	BCN4J10C2	C/F	C/F	BCN4J10C3	C/F	C/F
	120	0.75	1	6 <sup>1</sup> / <sub>2</sub> (165.0)	3 (2)	BCN6J1C2	C/F	C/F	BCN6J1C3	C/F	C/F
	240	0.75	1	6 <sup>1</sup> / <sub>2</sub> (165.0)	3 (2)	BCN6J10C2	C/F	C/F	BCN6J10C3	C/F	C/F
	120	1.00	1	6 <sup>5</sup> / <sub>8</sub> (168.3)	3 (2)	BCN6L1C2	C/F	C/F	BCN6L1C3	C/F	C/F
	240	1.00	1	6 <sup>5</sup> / <sub>8</sub> (168.3)	3 (2)	BCN6L10C2	C/F	C/F	BCN6L10C3	C/F	C/F
	120	1.25	1	8 (203.0)	4 (2)	BCN8A1C2	C/F	C/F	BCN8A1C3	C/F	C/F
	240	1.25	1	8 (203.0)	4 (2)	BCN8A10C2	C/F	C/F	BCN8A10C3	C/F	C/F
	120	1.50	1	10 <sup>5</sup> / <sub>8</sub> (269.9)	4 (2)	BCN10L1C2	C/F	C/F	BCN10L1C3	C/F	C/F
	240	1.50	1	10 <sup>5</sup> / <sub>8</sub> (269.9)	4 (2)	BCN10L10C2	C/F	C/F	BCN10L10C3	C/F	C/F
	120	2.00	1	12 <sup>1</sup> / <sub>2</sub> (318.0)	5 (3)	BCN12J1C2	C/F	C/F	BCN12J1C3	C/F	C/F
	240	2.00	1	12 <sup>1</sup> / <sub>2</sub> (318.0)	5 (3)	BCN12J10C2	C/F	C/F	BCN12J10C3	C/F	C/F
	120	2.50	1	14 <sup>3</sup> / <sub>4</sub> (375.0)	5 (3)	BCN14N1C2	C/F	C/F	BCN14N1C3	C/F	C/F
	240	2.50	1	14 <sup>3</sup> / <sub>4</sub> (375.0)	5 (3)	BCN14N10C2	C/F	C/F	BCN14N10C3	C/F	C/F
	120	3.00	1	16 <sup>3</sup> / <sub>4</sub> (425.0)	6 (3)	BCN16N1C2	C/F	C/F	BCN16N1C3	C/F	C/F
	240	3.00	1	16 <sup>3</sup> / <sub>4</sub> (425.0)	6 (3)	BCN16N10C2	C/F	C/F	BCN16N10C3	C/F	C/F
240	4.00	1	21 (533.0)	6 (3)	BCN21A10C2	C/F	C/F	BCN21A10C3	C/F	C/F	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

# Immersion Heaters



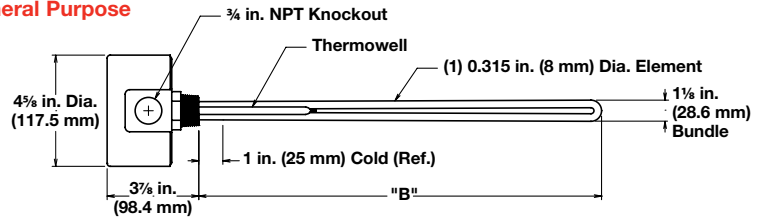
## WATROD and FIREBAR Screw Plug Immersion Heaters



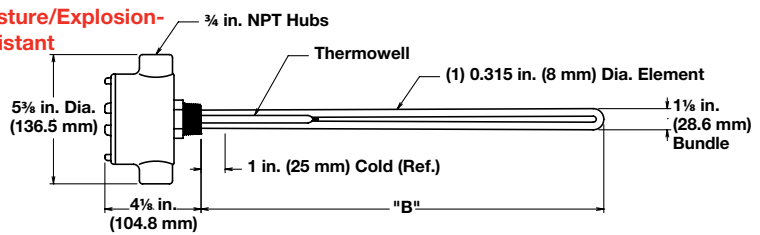
### Application: Clean Water

- 1 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. w(mm)	Part Number		WATCONNECT Part Number		Part Number ⑤		WATCONNECT Part Number	
					General Purpose Enclosure	Ship Wt. lbs (kg)	Type J T/C	Type K T/C	Moisture/Explosion- Resistant Enclosure	Ship Wt. lbs (kg)	Type J T/C	Type K T/C
60 W/in <sup>2</sup> Brass Plug 1-Alloy 800 Element (9.3 W/cm <sup>2</sup> )	120	0.50	1	4 1/2 (114.0)	BCN4J1S	3 (2)	C1-15	C1-12	BCN4J1C	6 (3)	C/F	C/F
	240	0.50	1	4 1/2 (114.0)	BCN4J10S	3 (2)	C1-17	C1-13	BCN4J10C	6 (3)	C/F	C/F
	120	0.75	1	6 1/2 (165.0)	BCN6J1S	3 (2)	C1-15	C1-12	BCN6J1C	6 (3)	C/F	C/F
	240	0.75	1	6 1/2 (165.0)	BCN6J10S	3 (2)	C1-17	C1-13	BCN6J10C	6 (3)	C/F	C/F
	120	1.00	1	6 5/8 (168.3)	BCN6L1S	3 (2)	C1-15	C1-12	BCN6L1C	6 (3)	C/F	C/F
	240	1.00	1	6 5/8 (168.3)	BCN6L10S	3 (2)	C1-17	C1-13	BCN6L10C	6 (3)	C/F	C/F
	120	1.25	1	8 (203.0)	BCN8A1S	4 (2)	C1-15	C1-12	BCN8A1C	7 (4)	C/F	C/F
	240	1.25	1	8 (203.0)	BCN8A10S	4 (2)	C1-17	C1-13	BCN8A10C	7 (4)	C/F	C/F
	120	1.50	1	10 5/8 (269.9)	BCN10L1S	4 (2)	C1-15	C1-12	BCN10L1C	7 (4)	C/F	C/F
	240	1.50	1	10 5/8 (269.9)	BCN10L10S	4 (2)	C1-17	C1-13	BCN10L10C	7 (4)	C/F	C/F
	120	2.00	1	12 1/2 (318.0)	BCN12J1S	5 (3)	C1-15	C1-12	BCN12J1C	8 (4)	C/F	C/F
	240	2.00	1	12 1/2 (318.0)	BCN12J10S	5 (3)	C1-17	C1-13	BCN12J10C	8 (4)	C/F	C/F
	120	2.50	1	14 3/4 (375.0)	BCN14N1S	5 (3)	C/F	C/F	BCN14N1C	8 (4)	C/F	C/F
	240	2.50	1	14 3/4 (375.0)	BCN14N10S	5 (3)	C1-17	C1-13	BCN14N10C	8 (4)	C/F	C/F
	120	3.00	1	16 3/4 (425.0)	BCN16N1S	6 (3)	C/F	C/F	BCN16N1C	9 (4)	C/F	C/F
	240	3.00	1	16 3/4 (425.0)	BCN16N10S	6 (3)	C1-17	C1-13	BCN16N10C	9 (4)	C/F	C/F
240	4.00	1	21 (533.0)	BCN21A10S	6 (3)	C1-17	C1-13	BCN21A10C	9 (4)	C/F	C/F	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

# Immersion Heaters



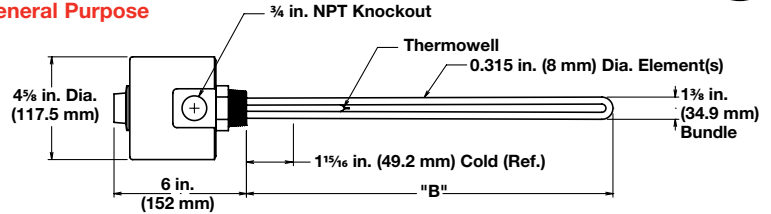
## WATROD and FIREBAR Screw Plug Immersion Heaters



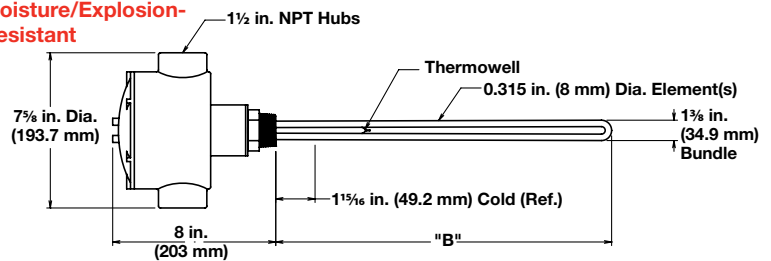
### Application: Clean Water

- 1 1/4 inch NPT screw plug
- WATROD elements
- With thermostat (SPST), Type 2 or 3
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure
60 W/in <sup>2</sup> Brass Plug 1-Alloy 800 Element (9.3 W/cm <sup>2</sup> )	120	0.50	1	4 <sup>3</sup> / <sub>8</sub> (111.1)	3 (2)	BDN4G1S2	C/F	C/F	BDN4G1S3	C/F	C/F
	240	0.50	1	4 <sup>3</sup> / <sub>8</sub> (111.1)	3 (2)	BDN4G10S2	C/F	C/F	BDN4G10S3	C/F	C/F
	120	0.75	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	3 (2)	BDN6G1S2	C/F	C/F	BDN6G1S3	C/F	C/F
	240	0.75	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	3 (2)	BDN6G10S2	C/F	C/F	BDN6G10S3	C/F	C/F
60 W/in <sup>2</sup> ④ Brass Plug 2-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	120/240	1.00	1	4 <sup>3</sup> / <sub>8</sub> (111.1)	4 (2)	BEN4G6S2	C/F	C/F	BEN4G6S3	C/F	C/F
	120/240	1.50	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	4 (2)	BEN6G6S2	C/F	C/F	BEN6G6S3	C/F	C/F
	120/240	2.00	1	8 <sup>1</sup> / <sub>2</sub> (216.0)	5 (3)	BEN8J6S2	C/F	C/F	BEN8J6S3	C/F	C/F
	120/240	2.50	1	10 <sup>3</sup> / <sub>4</sub> (273.0)	5 (3)	BEN10N6S2	C/F	C/F	BEN10N6S3	C/F	C/F
	120/240	3.00	1	15 (381.0)	6 (3)	BEN15A6S2	C/F	C/F	BEN15A6S3	C/F	C/F
	240	4.00	1	19 (483.0)	7 (4)	BEN19A10S2	C/F	C/F	BEN19A10S3	C/F	C/F
	240	5.00	1	23 <sup>1</sup> / <sub>2</sub> (597.0)	8 (4)	BEN23J10S2	C/F	C/F	BEN23J10S3	C/F	C/F
	240	6.00	1	27 <sup>1</sup> / <sub>2</sub> (699.0)	9 (4)	BEN27J10S2	C/F	C/F	BEN27J10S3	C/F	C/F
60 W/in <sup>2</sup> Brass Plug 1-Alloy 800 Element (9.3 W/cm <sup>2</sup> )	120	0.50	1	4 <sup>3</sup> / <sub>8</sub> (111.1)	7 (4)	BDN4G1C2	C/F	C/F	BDN4G1C3	C/F	C/F
	240	0.50	1	4 <sup>3</sup> / <sub>8</sub> (111.1)	7 (4)	BDN4G10C2	C/F	C/F	BDN4G10C3	C/F	C/F
	120	0.75	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	7 (4)	BDN6G1C2	C/F	C/F	BDN6G1C3	C/F	C/F
	240	0.75	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	7 (4)	BDN6G10C2	C/F	C/F	BDN6G10C3	C/F	C/F
60 W/in <sup>2</sup> ④ Brass Plug 2-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	120/240	1.00	1	4 <sup>3</sup> / <sub>8</sub> (111.1)	8 (4)	BEN4G6C2	C/F	C/F	BEN4G6C3	C/F	C/F
	120/240	1.50	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	8 (4)	BEN6G6C2	C/F	C/F	BEN6G6C3	C/F	C/F
	120/240	2.00	1	8 <sup>1</sup> / <sub>2</sub> (216.0)	9 (4)	BEN8J6C2	C/F	C/F	BEN8J6C3	C/F	C/F
	120/240	2.50	1	10 <sup>3</sup> / <sub>4</sub> (273.0)	9 (4)	BEN10N6C2	C/F	C/F	BEN10N6C3	C/F	C/F
	120/240	3.00	1	15 (381.0)	10 (5)	BEN15A6C2	C/F	C/F	BEN15A6C3	C/F	C/F
	240	4.00	1	19 (483.0)	11 (5)	BEN19A10C2	C/F	C/F	BEN19A10C3	C/F	C/F
	240	5.00	1	23 <sup>1</sup> / <sub>2</sub> (597.0)	12 (6)	BEN23J10C2	C/F	C/F	BEN23J10C3	C/F	C/F
	240	6.00	1	27 <sup>1</sup> / <sub>2</sub> (699.0)	13 (6)	BEN27J10C2	C/F	C/F	BEN27J10C3	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

④ Wired for higher voltage

⑤ No third party recognition

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters

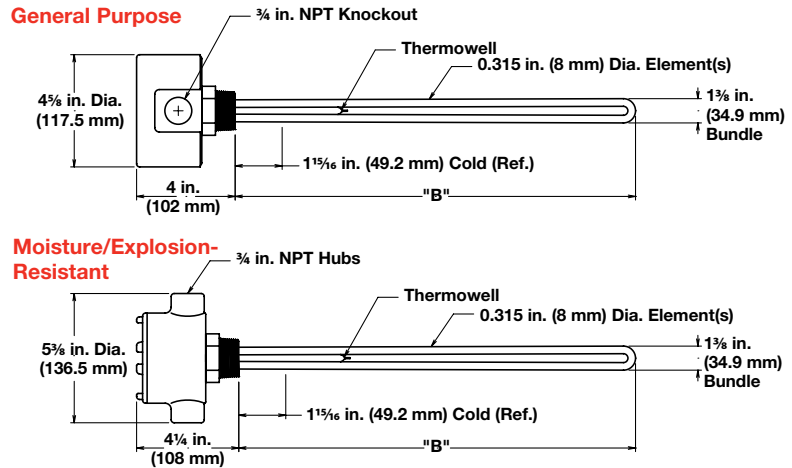


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Clean Water

- 1 1/4 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT		240V WATCONNECT		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT	
							Part Number	Part Number	Part Number	Part Number			Part Number	Part Number
					General Purpose Enclosure		Type J T/C	Type K T/C	Type J T/C	Type K T/C	Moisture/Explosion- Resistant Enclosure		Type J T/C	Type K T/C
60 W/in <sup>2</sup> Brass Plug 1-Alloy 800 Element (9.3 W/cm <sup>2</sup> )	120	0.50	1	4 <sup>3</sup> / <sub>8</sub> (111.1)	BDN4G1S	3 (2)	C1-15	C1-12	N/A	N/A	BDN4G1C	6 (3)	C/F	C/F
	240	0.50	1	4 <sup>3</sup> / <sub>8</sub> (111.1)	BDN4G10S	3 (2)	N/A	N/A	C1-17	C1-13	BDN4G10C	6 (3)	C/F	C/F
	120	0.75	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	BDN6G1S	3 (2)	C1-15	C1-12	N/A	N/A	BDN6G1C	6 (3)	C/F	C/F
	240	0.75	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	BDN6G10S	3 (2)	N/A	N/A	C1-17	C1-13	BDN6G10C	6 (3)	C/F	C/F
60 W/in <sup>2</sup> ④ Brass Plug 2-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	120/ 240	1.00	1	4 <sup>3</sup> / <sub>8</sub> (111.1)	BEN4G6S	4 (2)	C1-15	C1-12	C1-17	C1-13	BEN4G6C	7 (4)	C/F	C/F
	120/ 240	1.50	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	BEN6G6S	4 (2)	C1-15	C1-12	C1-17	C1-13	BEN6G6C	7 (4)	C/F	C/F
	120/ 240	2.00	1	8 <sup>1</sup> / <sub>2</sub> (216.0)	BEN8J6S	5 (3)	C1-15	C1-12	C1-17	C1-13	BEN8J6C	8 (4)	C/F	C/F
	120/ 240	2.50	1	10 <sup>3</sup> / <sub>4</sub> (273.0)	BEN10N6S	5 (3)	C/F	C/F	C1-17	C1-13	BEN10N6C	8 (4)	C/F	C/F
	120/ 240	3.00	1	15 (381.0)	BEN15A6S	6 (3)	C/F	C/F	C1-17	C1-13	BEN15A6C	9 (4)	C/F	C/F
	240	4.00	1	19 (483.0)	BEN19A10S	7 (4)	N/A	N/A	C1-17	C1-13	BEN19A10C	10 (5)	C/F	C/F
	240	5.00	1	23 <sup>1</sup> / <sub>2</sub> (597.0)	BEN23J10S	8 (4)	N/A	N/A	C/F	C/F	BEN23J10C	11 (5)	C/F	C/F
	240	6.00	1	27 <sup>1</sup> / <sub>2</sub> (699.0)	BEN27J10S	9 (4)	N/A	N/A	C/F	C/F	BEN27J10C	12 (6)	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)  
N/A - Not available

④ Wired for higher voltage

⑤ No third party recognition

# Immersion Heaters

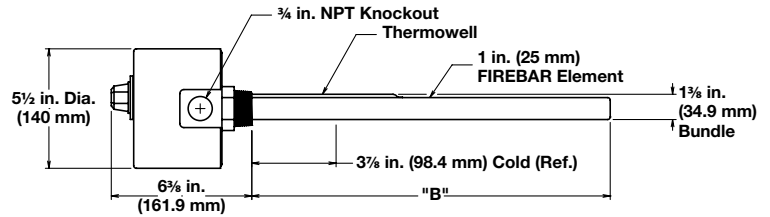


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Clean Water

- 1 1/4 inch NPT screw plug
- FIREBAR elements
- With thermostat (DPST), Type 5A or 7A
- General purpose enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure
90 W/in <sup>2</sup> ⑧ 304 SS Plug 1-Alloy 800 Element (14 W/cm <sup>2</sup> )	240	1.5	1	7 <sup>5</sup> / <sub>8</sub> (193.7)	6 (3)	BDNF7R10S5A	C/F	C/F	BDNF7R10S7A	C/F	C/F
	480	1.5	1	7 <sup>5</sup> / <sub>8</sub> (193.7)	6 (3)	BDNF7R11S5A	C/F	C/F	BDNF7R11S7A	C/F	C/F
	240	3.0	1	11 <sup>1</sup> / <sub>8</sub> (282.6)	7 (4)	BDNF11G10S5A	C/F	C/F	BDNF11G10S7A	C/F	C/F
	480	3.0	1	11 <sup>1</sup> / <sub>8</sub> (282.6)	7 (4)	BDNF11G11S5A	C/F	C/F	BDNF11G11S7A	C/F	C/F
	240	5.0	3	16 <sup>1</sup> / <sub>8</sub> (409.6)	8 (4)	BDNF16G3S5A	C/F	C/F	BDNF16G3S7A	C/F	C/F
	480	5.0	3	16 <sup>1</sup> / <sub>8</sub> (409.6)	8 (4)	BDNF16G5S5A	C/F	C/F	BDNF16G5S7A	C/F	C/F
	240	6.5	3	19 <sup>1</sup> / <sub>8</sub> (485.8)	9 (4)	BDNF19G3S5A	C/F	C/F	BDNF19G3S7A	C/F	C/F
	480	6.5	3	19 <sup>1</sup> / <sub>8</sub> (485.8)	9 (4)	BDNF19G5S5A	C/F	C/F	BDNF19G5S7A	C/F	C/F
	240	8.5	3	24 <sup>3</sup> / <sub>8</sub> (619.1)	10 (5)	BDNF24L3S5A	C/F	C/F	BDNF24L3S7A	C/F	C/F
	480	8.5	3	24 <sup>3</sup> / <sub>8</sub> (619.1)	10 (5)	BDNF24L5S5A	C/F	C/F	BDNF24L5S7A	C/F	C/F
	240	10.5	3	29 <sup>5</sup> / <sub>8</sub> (752.5)	11 (5)	BDNF29R3S5A	C/F	C/F	BDNF29R3S7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

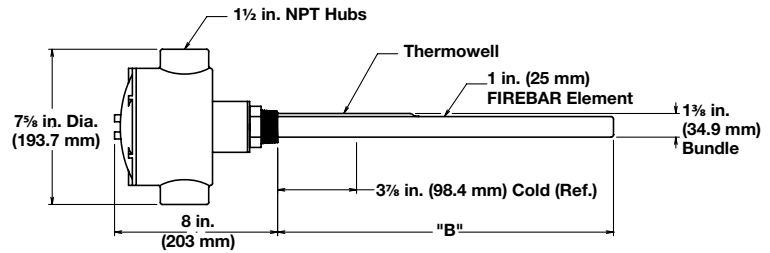
⑧ Can be wired for 1-phase operation



## WATROD and FIREBAR Screw Plug Immersion Heaters

### Application: Clean Water

- 1 1/4 inch NPT screw plug
  - FIREBAR elements
  - With thermostat (DPST), Type 5A or 7A
- Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.
- Moisture/explosion-resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C
90 W/in <sup>2</sup> ⑧ 304 SS Plug 1-Alloy 800 Element (14 W/cm <sup>2</sup> )	240	1.5	1	7 <sup>5</sup> / <sub>8</sub> (193.7)	9 (4)	BDNF7R10C5A	C/F	C/F	BDNF7R10C7A	C/F	C/F
	480	1.5	1	7 <sup>5</sup> / <sub>8</sub> (193.7)	9 (4)	BDNF7R11C5A	C/F	C/F	BDNF7R11C7A	C/F	C/F
	240	3.0	1	11 <sup>1</sup> / <sub>8</sub> (282.6)	10 (5)	BDNF11G10C5A	C/F	C/F	BDNF11G10C7A	C/F	C/F
	480	3.0	1	11 <sup>1</sup> / <sub>8</sub> (282.6)	10 (5)	BDNF11G11C5A	C/F	C/F	BDNF11G11C7A	C/F	C/F
	240	5.0	3	16 <sup>1</sup> / <sub>8</sub> (409.6)	11 (5)	BDNF16G3C5A	C/F	C/F	BDNF16G3C7A	C/F	C/F
	480	5.0	3	16 <sup>1</sup> / <sub>8</sub> (409.6)	11 (5)	BDNF16G5C5A	C/F	C/F	BDNF16G5C7A	C/F	C/F
	240	6.5	3	19 <sup>1</sup> / <sub>8</sub> (485.8)	12 (6)	BDNF19G3C5A	C/F	C/F	BDNF19G3C7A	C/F	C/F
	480	6.5	3	19 <sup>1</sup> / <sub>8</sub> (485.8)	12 (6)	BDNF19G5C5A	C/F	C/F	BDNF19G5C7A	C/F	C/F
	240	8.5	3	24 <sup>3</sup> / <sub>8</sub> (619.1)	13 (6)	BDNF24L3C5A	C/F	C/F	BDNF24L3C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

⑧ Can be wired for 1-phase operation

# Immersion Heaters

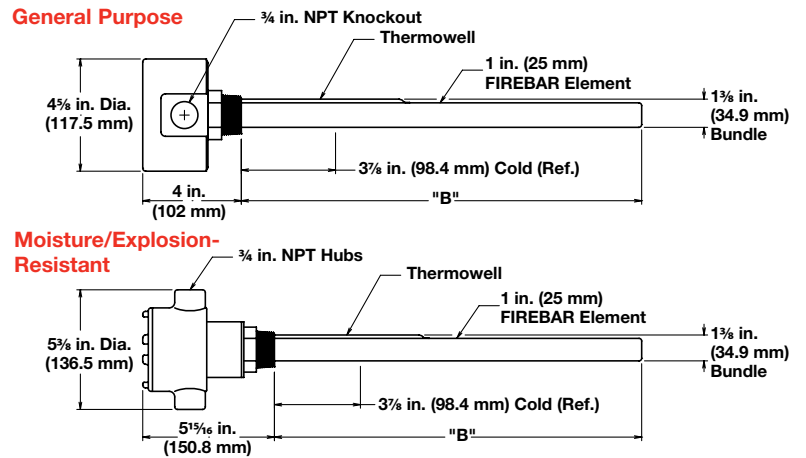


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Clean Water

- 1 1/4 inch NPT screw plug
- FIREBAR elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Moisture/Explosion- Resistant Enclosure	Type J T/C
90 W/in <sup>2</sup> ⑧ 304 SS Plug 1-Alloy 800 Element (9.3 W/cm <sup>2</sup> )	240	1.5	1	7 <sup>5</sup> / <sub>8</sub> (193.7)	General Purpose Enclosure		Type J C1-17	Type K C1-13	BDNF7R10C	8 (4)	Type J C/F	Type K C/F
	480	1.5	1	7 <sup>5</sup> / <sub>8</sub> (193.7)	BDNF7R11S	5 (3)	C/F	C/F		BDNF7R11C	8 (4)	C/F
	240	3.0	1	11 <sup>1</sup> / <sub>8</sub> (282.6)	General Purpose Enclosure		Type J C1-17	Type K C1-13	BDNF11G10C	9 (4)	Type J C/F	Type K C/F
	480	3.0	1	11 <sup>1</sup> / <sub>8</sub> (282.6)	BDNF11G11S	6 (3)	C/F	C/F		BDNF11G11C	9 (4)	C/F
	240	5.0	3	16 <sup>1</sup> / <sub>8</sub> (409.6)	General Purpose Enclosure		Type J C2-50	Type K C2-92	BDNF16G3C	10 (5)	C3-94	C3-93
	480	5.0	3	16 <sup>1</sup> / <sub>8</sub> (409.6)	BDNF16G5S	7 (4)	C2-43	C2-35		BDNF16G5C	10 (5)	C3-116
	240	6.5	3	19 <sup>1</sup> / <sub>8</sub> (485.8)	General Purpose Enclosure		Type J C2-50	Type K C2-92	BDNF19G3C	11 (5)	C3-94	C3-93
	480	6.5	3	19 <sup>1</sup> / <sub>8</sub> (485.8)	BDNF19G5S	8 (4)	C2-43	C2-35		BDNF19G5C	11 (5)	C3-116
	240	8.5	3	24 <sup>3</sup> / <sub>8</sub> (619.1)	General Purpose Enclosure		Type J C2-50	Type K C2-92	BDNF24L3C	12 (6)	C3-94	C3-93
	480	8.5	3	24 <sup>3</sup> / <sub>8</sub> (619.1)	BDNF24L5S	9 (4)	C2-43	C2-35		BDNF24L5C	12 (6)	C3-116
	240	10.5	3	29 <sup>5</sup> / <sub>8</sub> (752.5)	General Purpose Enclosure		Type J C2-236	Type K C2-214	BDNF29R3C	13 (6)	C3-114	C3-115
	480	10.5	3	29 <sup>5</sup> / <sub>8</sub> (752.5)	BDNF29R5S	10 (5)	C2-43	C2-35		BDNF29R5C	13 (6)	C3-116
	240	12.7	3	34 <sup>5</sup> / <sub>8</sub> (879.5)	General Purpose Enclosure		Type J C2-236	Type K C2-214	BDNF34R3C	14 (7)	C3-114	C3-115
	480	12.7	3	34 <sup>5</sup> / <sub>8</sub> (879.5)	BDNF34R5S	11 (5)	C2-43	C2-35		BDNF34R5C	14 (7)	C3-116
	240	17.0	3	45 <sup>1</sup> / <sub>8</sub> (1146.2)	General Purpose Enclosure		Type J C2-236	Type K C2-214	BDNF45G3C	16 (8)	C3-114	C3-115
	480	17.0	3	45 <sup>1</sup> / <sub>8</sub> (1146.2)	BDNF45G5S	13 (6)	C2-43	C2-35		BDNF45G5C	16 (8)	C3-116
480	21.5	3	55 <sup>5</sup> / <sub>8</sub> (1412.9)	General Purpose Enclosure		Type J C2-225	Type K C2-226	BDNF55R5C	18 (9)	C3-117	C3-119	
				BDNF55R5S	15 (7)							

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

⑧ Can be wired for 1-phase operation

# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters

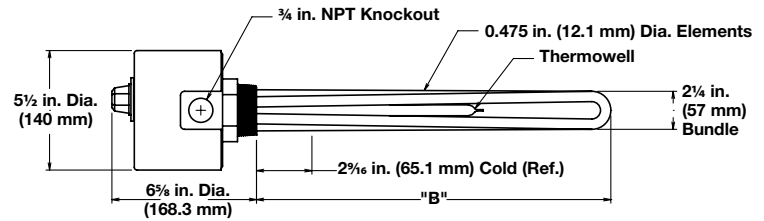


### Application: Clean Water

- 2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- General purpose enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C
60 W/in <sup>2</sup> ④ 304 SS Plug 2-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	120/240	2.0	1	8 <sup>1</sup> / <sub>8</sub> (206.4)	5 (3)	BGN78C6S4	C/F	C/F	BGN78C6S5A	C/F	C/F	BGN78C6S7A	C/F	C/F
	240/480	2.0	1	8 <sup>1</sup> / <sub>8</sub> (206.4)	5 (3)	BGN78C7S4	C/F	C/F	BGN78C7S5A	C/F	C/F	BGN78C7S7A	C/F	C/F
	120/240	3.0	1	11 <sup>1</sup> / <sub>8</sub> (282.6)	6 (3)	BGN711C6S4	C/F	C/F	BGN711C6S5A	C/F	C/F	BGN711C6S7A	C/F	C/F
	240/480	3.0	1	11 <sup>1</sup> / <sub>8</sub> (282.6)	6 (3)	BGN711C7S4	C/F	C/F	BGN711C7S5A	C/F	C/F	BGN711C7S7A	C/F	C/F
	120/240	4.0	1	15 <sup>1</sup> / <sub>8</sub> (384.2)	7 (4)	BGN715C6S4	C/F	C/F	BGN715C6S5A	C/F	C/F	BGN715C6S7A	C/F	C/F
	120/240	5.0	1	18 <sup>1</sup> / <sub>8</sub> (460.4)	7 (4)	BGN718C6S4	C/F	C/F	BGN718C6S5A	C/F	C/F	BGN718C6S7A	C/F	C/F
60 W/in <sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	240	3.0	3	8 <sup>1</sup> / <sub>8</sub> (206.4)	6 (3)	BHN78C3S4	C/F	C/F	BHN78C3S5A	C/F	C/F	BHN78C3S7A	C/F	C/F
	480	3.0	3	8 <sup>1</sup> / <sub>8</sub> (206.4)	6 (3)	BHN68C13S4	C/F	C/F	BHN68C13S5A	C/F	C/F	BHN68C13S7A	C/F	C/F
	240	4.5	3	11 <sup>1</sup> / <sub>8</sub> (282.6)	7 (4)	BHN711C3S4	C/F	C/F	BHN711C3S5A	C/F	C/F	BHN711C3S7A	C/F	C/F
	480	4.5	3	11 <sup>1</sup> / <sub>8</sub> (282.6)	7 (4)	BHN611C13S4	C/F	C/F	BHN611C13S5A	C/F	C/F	BHN611C13S7A	C/F	C/F
	240	6.0	3	15 <sup>1</sup> / <sub>8</sub> (384.2)	8 (4)	BHN715C3S4	C/F	C/F	BHN715C3S5A	C/F	C/F	BHN715C3S7A	C/F	C/F
	480	6.0	3	15 <sup>1</sup> / <sub>8</sub> (384.2)	8 (4)	BHN715C5S4	C/F	C/F	BHN715C5S5A	C/F	C/F	BHN715C5S7A	C/F	C/F
	240	7.5	3	18 <sup>1</sup> / <sub>8</sub> (460.4)	8 (4)	BHN718C3S4	C/F	C/F	BHN718C3S5A	C/F	C/F	BHN718C3S7A	C/F	C/F
	240	9.0	3	21 <sup>1</sup> / <sub>8</sub> (536.6)	9 (4)	BHN721C3S4	C/F	C/F	BHN721C3S5A	C/F	C/F	BHN721C3S7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

④ Wired for higher voltage





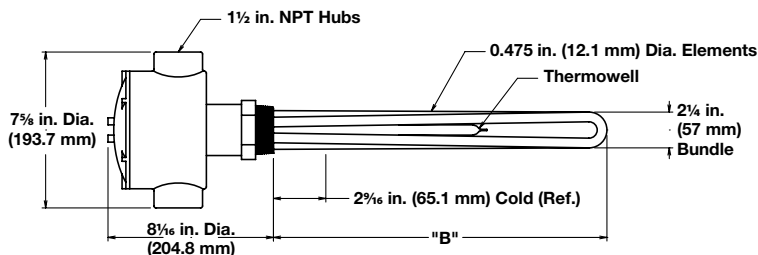
## WATROD and FIREBAR Screw Plug Immersion Heaters

### Application: Clean Water

- 2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- Moisture/explosion-resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C		Type K T/C	Moisture/Explosion-Resistant Enclosure ⑤		Type J T/C	Type K T/C
60 W/in <sup>2</sup> ④ 304 SS Plug 2-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	120/240	2.0	1	8 1/8 (206.4)	8 (4)	BGN78C6C4	C/F	C/F	BGN78C6C5A	C/F	C/F	BGN78C6C7A	C/F	C/F
	240/480	2.0	1	8 1/8 (206.4)	8 (4)	BGN78C7C4	C/F	C/F	BGN78C7C5A	C/F	C/F	BGN78C7C7A	C/F	C/F
	120/240	3.0	1	11 1/8 (282.6)	9 (4)	BGN711C6C4	C/F	C/F	BGN711C6C5A	C/F	C/F	BGN711C6C7A	C/F	C/F
	240/480	3.0	1	11 1/8 (282.6)	9 (4)	BGN711C7C4	C/F	C/F	BGN711C7C5A	C/F	C/F	BGN711C7C7A	C/F	C/F
	120/240	4.0	1	15 1/8 (384.2)	10 (5)	BGN715C6C4	C/F	C/F	BGN715C6C5A	C/F	C/F	BGN715C6C7A	C/F	C/F
	120/240	5.0	1	18 1/8 (460.4)	10 (5)	BGN718C6C4	C/F	C/F	BGN718C6C5A	C/F	C/F	BGN718C6C7A	C/F	C/F
60 W/in <sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	240	3.0	3	8 1/8 (206.4)	9 (4)	BHN78C3C4	C/F	C/F	BHN78C3C5A	C/F	C/F	BHN78C3C7A	C/F	C/F
	480	3.0	3	8 1/8 (206.4)	9 (4)	BHN68C13C4	C/F	C/F	BHN68C13C5A	C/F	C/F	BHN68C13C7A	C/F	C/F
	240	4.5	3	11 1/8 (282.6)	10 (5)	BHN711C3C4	C/F	C/F	BHN711C3C5A	C/F	C/F	BHN711C3C7A	C/F	C/F
	480	4.5	3	11 1/8 (282.6)	10 (5)	BHN611C13C4	C/F	C/F	BHN611C13C5A	C/F	C/F	BHN611C13C7A	C/F	C/F
	240	6.0	3	15 1/8 (384.2)	11 (5)	BHN715C3C4	C/F	C/F	BHN715C3C5A	C/F	C/F	BHN715C3C7A	C/F	C/F
	480	6.0	3	15 1/8 (384.2)	11 (5)	BHN715C5C4	C/F	C/F	BHN715C5C5A	C/F	C/F	BHN715C5C7A	C/F	C/F
	240	7.5	3	18 1/8 (460.4)	11 (5)	BHN718C3C4	C/F	C/F	BHN718C3C5A	C/F	C/F	BHN718C3C7A	C/F	C/F
	240	9.0	3	21 1/8 (536.6)	12 (6)	BHN721C3C4	C/F	C/F	BHN721C3C5A	C/F	C/F	BHN721C3C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

- ④ Wired for higher voltage
- ⑤ No third party recognition

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



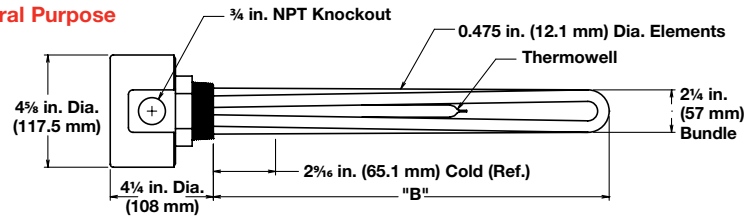
## WATROD and FIREBAR Screw Plug Immersion Heaters



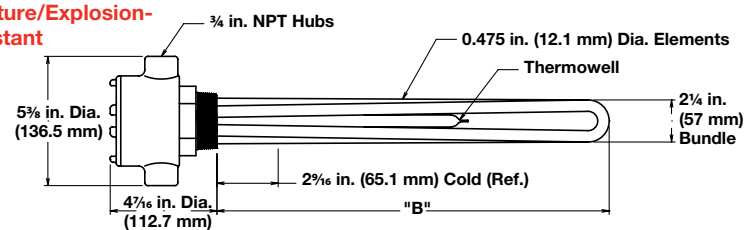
### Application: Clean Water

- 2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT		240V WATCONNECT		480V WATCONNECT	
							Part Number	Part Number	Part Number	Part Number	Part Number	Part Number
					<b>General Purpose Enclosure</b>		<b>Type J T/C</b>	<b>Type K T/C</b>	<b>Type J T/C</b>	<b>Type K T/C</b>	<b>Type J T/C</b>	<b>Type K T/C</b>
<b>60 W/in<sup>2</sup> ④ 304 SS Plug 2-Alloy 800 Elements (9.3 W/cm<sup>2</sup>)</b>	120/240	2.0	1	8 <sup>1</sup> / <sub>8</sub> (206.4)	<b>BGN78C6S</b>	4 (2)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>N/A</b>	<b>N/A</b>
	240/480	2.0	1	8 <sup>1</sup> / <sub>8</sub> (206.4)	<b>BGN78C7S</b>	4 (2)	<b>N/A</b>	<b>N/A</b>	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	3.0	1	11 <sup>1</sup> / <sub>8</sub> (282.6)	<b>BGN711C6S</b>	5 (3)	<b>C/F</b>	<b>C/F</b>	<b>C1-17</b>	<b>C1-13</b>	<b>N/A</b>	<b>N/A</b>
	240/480	3.0	1	11 <sup>1</sup> / <sub>8</sub> (282.6)	<b>BGN711C7S</b>	5 (3)	<b>N/A</b>	<b>N/A</b>	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	4.0	1	15 <sup>1</sup> / <sub>8</sub> (384.2)	<b>BGN715C6S</b>	6 (3)	<b>C/F</b>	<b>C/F</b>	<b>C1-17</b>	<b>C1-13</b>	<b>N/A</b>	<b>N/A</b>
	240/480	4.0	1	15 <sup>1</sup> / <sub>8</sub> (384.2)	<b>BGN715C7S</b>	6 (3)	<b>N/A</b>	<b>N/A</b>	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	5.0	1	18 <sup>1</sup> / <sub>8</sub> (460.4)	<b>BGN718C6S</b>	6 (3)	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>N/A</b>	<b>N/A</b>
	240/480	5.0	1	18 <sup>1</sup> / <sub>8</sub> (460.4)	<b>BGN718C7S</b>	6 (3)	<b>N/A</b>	<b>N/A</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>
	240/480	6.0	1	21 <sup>1</sup> / <sub>8</sub> (536.6)	<b>BGN721C7S</b>	7 (4)	<b>N/A</b>	<b>N/A</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>
	240/480	8.0	1	26 <sup>5</sup> / <sub>8</sub> (676.3)	<b>BGN726L7S</b>	7 (4)	<b>N/A</b>	<b>N/A</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>
	240/480	10.0	1	32 <sup>1</sup> / <sub>8</sub> (816.0)	<b>BGN732C7S</b>	8 (4)	<b>N/A</b>	<b>N/A</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>
<b>60 W/in<sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm<sup>2</sup>)</b>	120	3.0	1	8 <sup>1</sup> / <sub>8</sub> (206.4)	<b>BHN78C1S</b>	5 (3)	<b>C/F</b>	<b>C/F</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
	240	3.0	3	8 <sup>1</sup> / <sub>8</sub> (206.4)	<b>BHN78C3S</b>	5 (3)	<b>N/A</b>	<b>N/A</b>	<b>C2-50</b>	<b>C2-92</b>	<b>N/A</b>	<b>N/A</b>
	480	3.0	3	8 <sup>1</sup> / <sub>8</sub> (206.4)	<b>BHN68C13S</b>	5 (3)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
	120	4.5	1	11 <sup>1</sup> / <sub>8</sub> (282.6)	<b>BHN711C1S</b>	6 (3)	<b>C/F</b>	<b>C/F</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
	240	4.5	3	11 <sup>1</sup> / <sub>8</sub> (282.6)	<b>BHN711C3S</b>	6 (3)	<b>N/A</b>	<b>N/A</b>	<b>C2-50</b>	<b>C2-92</b>	<b>N/A</b>	<b>N/A</b>
	480	4.5	3	11 <sup>1</sup> / <sub>8</sub> (282.6)	<b>BHN611C13S</b>	6 (3)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
	240	6.0	3	15 <sup>1</sup> / <sub>8</sub> (384.2)	<b>BHN715C3S</b>	7 (4)	<b>N/A</b>	<b>N/A</b>	<b>C2-50</b>	<b>C2-92</b>	<b>N/A</b>	<b>N/A</b>
	480	6.0	3	15 <sup>1</sup> / <sub>8</sub> (384.2)	<b>BHN715C5S</b>	7 (4)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
	240	7.5	3	18 <sup>1</sup> / <sub>8</sub> (460.4)	<b>BHN718C3S</b>	7 (4)	<b>N/A</b>	<b>N/A</b>	<b>C2-50</b>	<b>C2-92</b>	<b>N/A</b>	<b>N/A</b>
	480	7.5	3	18 <sup>1</sup> / <sub>8</sub> (460.4)	<b>BHN718C5S</b>	7 (4)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
	240	9.0	3	21 <sup>1</sup> / <sub>8</sub> (536.6)	<b>BHN721C3S</b>	8 (4)	<b>N/A</b>	<b>N/A</b>	<b>C2-50</b>	<b>C2-92</b>	<b>N/A</b>	<b>N/A</b>
	480	9.0	3	21 <sup>1</sup> / <sub>8</sub> (536.6)	<b>BHN721C5S</b>	8 (4)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
	240	12.0	3	26 <sup>5</sup> / <sub>8</sub> (676.3)	<b>BHN726L3S</b>	8 (4)	<b>N/A</b>	<b>N/A</b>	<b>C2-236</b>	<b>C2-214</b>	<b>N/A</b>	<b>N/A</b>
	480	12.0	3	26 <sup>5</sup> / <sub>8</sub> (676.3)	<b>BHN726L5S</b>	8 (4)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
	240	15.0	3	32 <sup>1</sup> / <sub>8</sub> (816.0)	<b>BHN732C3S</b>	9 (4)	<b>N/A</b>	<b>N/A</b>	<b>C2-236</b>	<b>C2-214</b>	<b>N/A</b>	<b>N/A</b>
480	15.0	3	32 <sup>1</sup> / <sub>8</sub> (816.0)	<b>BHN732C5S</b>	9 (4)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)  
N/A - Not available

- ④ Wired for higher voltage
- ⑤ No third party recognition

# Immersion Heaters



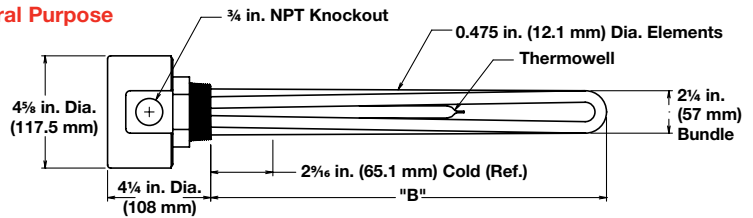
## WATROD and FIREBAR Screw Plug Immersion Heaters



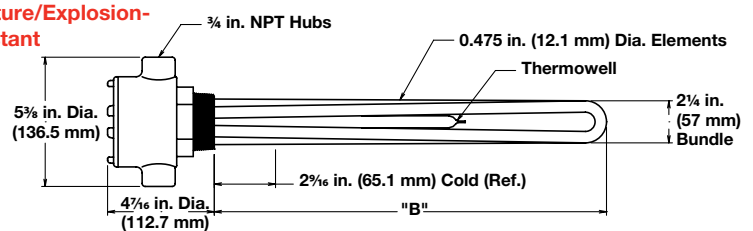
### Application: Clean Water

- 2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT		240V WATCONNECT		480V WATCONNECT	
							Type J T/C	Type K T/C	Type J T/C	Type K T/C	Type J T/C	Type K T/C
60 W/in <sup>2</sup> ④ 304 SS Plug 2-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	120/240	2.0	1	8 1/8 (206.4)	BGN78C6C	7 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	2.0	1	8 1/8 (206.4)	BGN78C7C	7 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	3.0	1	11 1/8 (282.6)	BGN711C6C	8 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	3.0	1	11 1/8 (282.6)	BGN711C7C	8 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	4.0	1	15 1/8 (384.2)	BGN715C6C	9 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	4.0	1	15 1/8 (384.2)	BGN715C7C	9 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	5.0	1	18 1/8 (460.4)	BGN718C6C	9 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	5.0	1	18 1/8 (460.4)	BGN718C7C	9 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	6.0	1	21 1/8 (536.6)	BGN721C7C	10 (5)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	8.0	1	26 5/8 (676.3)	BGN726L7C	10 (5)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	10.0	1	32 1/8 (816.0)	BGN732C7C	11 (5)	N/A	N/A	C/F	C/F	C/F	C/F
60 W/in <sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	120	3.0	1	8 1/8 (206.4)	BHN78C1C	8 (4)	C/F	C/F	N/A	N/A	N/A	N/A
	240	3.0	3	8 1/8 (206.4)	BHN78C3C	8 (4)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	3.0	3	8 1/8 (206.4)	BHN68C13C	8 (4)	N/A	N/A	N/A	N/A	C3-116	C3-118
	120	4.5	1	11 1/8 (282.6)	BHN711C1C	9 (4)	C/F	C/F	N/A	N/A	N/A	N/A
	240	4.5	3	11 1/8 (282.6)	BHN711C3C	9 (4)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	4.5	3	11 1/8 (282.6)	BHN611C13C	9 (4)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	6.0	3	15 1/8 (384.2)	BHN715C3C	10 (5)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	6.0	3	15 1/8 (384.2)	BHN715C5C	10 (5)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	7.5	3	18 1/8 (460.4)	BHN718C3C	10 (5)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	7.5	3	18 1/8 (460.4)	BHN718C5C	10 (5)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	9.0	3	21 1/8 (536.6)	BHN721C3C	11 (5)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	9.0	3	21 1/8 (536.6)	BHN721C5C	11 (5)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	12.0	3	26 5/8 (676.3)	BHN726L3C	11 (5)	N/A	N/A	C3-114	C3-115	N/A	N/A
	480	12.0	3	26 5/8 (676.3)	BHN726L5C	11 (5)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	15.0	3	32 1/8 (816.0)	BHN732C3C	12 (6)	N/A	N/A	C3-114	C3-115	N/A	N/A
480	15.0	3	32 1/8 (816.0)	BHN732C5C	12 (6)	N/A	N/A	N/A	N/A	C3-116	C3-118	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)  
N/A - Not available

- ④ Wired for higher voltage
- ⑤ No third party recognition

# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters



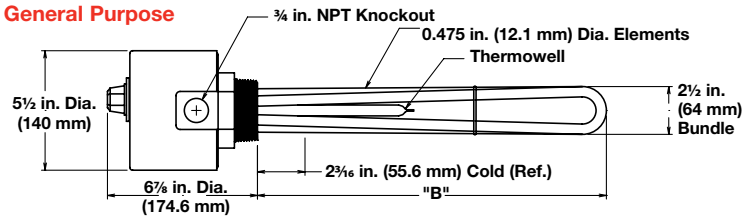
### Application: Clean Water

- 2 1/2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

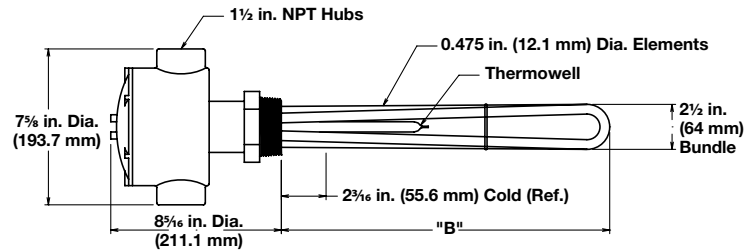
**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C
60 W/in <sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	240	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	7 (4)	BLN77L3S4	C/F	C/F	BLN77L3S5A	C/F	C/F	BLN77L3S7A	C/F	C/F
	480	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	7 (4)	BLN77L13S4	C/F	C/F	BLN77L13S5A	C/F	C/F	BLN77L13S7A	C/F	C/F
	240	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	8 (4)	BLN710L3S4	C/F	C/F	BLN710L3S5A	C/F	C/F	BLN710L3S7A	C/F	C/F
	480	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	8 (4)	BLN610K13S4	C/F	C/F	BLN610K13S5A	C/F	C/F	BLN610K13S7A	C/F	C/F
	240	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	10 (5)	BLN714L3S4	C/F	C/F	BLN714L3S5A	C/F	C/F	BLN714L3S7A	C/F	C/F
	480	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	10 (5)	BLN714L5S4	C/F	C/F	BLN714L5S5A	C/F	C/F	BLN714L5S7A	C/F	C/F
	240	7.5	3	17 <sup>5</sup> / <sub>8</sub> (447.7)	10 (5)	BLN717L3S4	C/F	C/F	BLN717L3S5A	C/F	C/F	BLN717L3S7A	C/F	C/F
	240	9.0	3	20 <sup>5</sup> / <sub>8</sub> (523.9)	12 (6)	BLN720L3S4	C/F	C/F	BLN720L3S5A	C/F	C/F	BLN720L3S7A	C/F	C/F
						Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C
60 W/in <sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	240	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	10 (5)	BLN77L3C4	C/F	C/F	BLN77L3C5A	C/F	C/F	BLN77L3C7A	C/F	C/F
	480	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	10 (5)	BLN77L13C4	C/F	C/F	BLN77L13C5A	C/F	C/F	BLN77L13C7A	C/F	C/F
	240	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	11 (5)	BLN710L3C4	C/F	C/F	BLN710L3C5A	C/F	C/F	BLN710L3C7A	C/F	C/F
	480	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	11 (5)	BLN610K13C4	C/F	C/F	BLN610K13C5A	C/F	C/F	BLN610K13C7A	C/F	C/F
	240	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	13 (6)	BLN714L3C4	C/F	C/F	BLN714L3C5A	C/F	C/F	BLN714L3C7A	C/F	C/F
	480	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	13 (6)	BLN714L5C4	C/F	C/F	BLN714L5C5A	C/F	C/F	BLN714L5C7A	C/F	C/F
	240	7.5	3	17 <sup>5</sup> / <sub>8</sub> (447.7)	13 (6)	BLN717L3C4	C/F	C/F	BLN717L3C5A	C/F	C/F	BLN717L3C7A	C/F	C/F
	240	9.0	3	20 <sup>5</sup> / <sub>8</sub> (523.9)	15 (7)	BLN720L3C4	C/F	C/F	BLN720L3C5A	C/F	C/F	BLN720L3C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

# Immersion Heaters

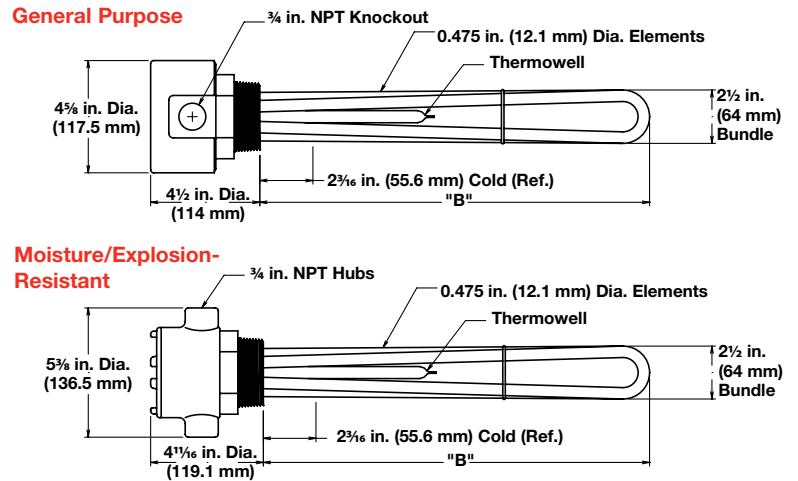


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Clean Water

- 2 1/2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Type J T/C	Type K T/C
60 W/in <sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	120	3.0	1	7 <sup>5</sup> / <sub>8</sub> (193.7)	BLN77L1S	6 (3)	C/F	C/F	BLN77L1C	9 (4)	C/F	C/F
	240	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	BLN77L3S	6 (3)	C2-50	C2-92	BLN77L3C	9 (4)	C3-94	C3-93
	480	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	BLN77L13S	6 (3)	C2-43	C2-35	BLN77L13C	9 (4)	C3-116	C3-118
	120	4.5	1	10 <sup>5</sup> / <sub>8</sub> (269.9)	BLN710L1S	7 (4)	C/F	C/F	BLN710L1C	10 (5)	C/F	C/F
	240	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	BLN710L3S	7 (4)	C2-50	C2-92	BLN710L3C	10 (5)	C3-94	C3-93
	480	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	BLN610K13S	7 (4)	C2-43	C2-35	BLN610K13C	10 (5)	C3-116	C3-118
	240	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	BLN714L3S	9 (4)	C2-50	C2-92	BLN714L3C	12 (6)	C3-94	C3-93
	480	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	BLN714L5S	9 (4)	C2-43	C2-35	BLN714L5C	12 (6)	C3-116	C3-118
	240	7.5	3	17 <sup>5</sup> / <sub>8</sub> (447.7)	BLN717L3S	9 (4)	C2-50	C2-92	BLN717L3C	12 (6)	C3-94	C3-93
	480	7.5	3	17 <sup>5</sup> / <sub>8</sub> (447.7)	BLN717L5S	9 (4)	C2-43	C2-35	BLN717L5C	12 (6)	C3-116	C3-118
	240	9.0	3	20 <sup>5</sup> / <sub>8</sub> (523.9)	BLN720L3S	11 (5)	C2-50	C2-92	BLN720L3C	14 (7)	C3-94	C3-93
	480	9.0	3	20 <sup>5</sup> / <sub>8</sub> (523.9)	BLN720L5S	11 (5)	C2-43	C2-35	BLN720L5C	14 (7)	C3-116	C3-118
	240	12.0	3	26 <sup>1</sup> / <sub>8</sub> (663.6)	BLN726C3S	12 (6)	C2-50	C2-92	BLN726C3C	15 (7)	C3-114	C3-115
	480	12.0	3	26 <sup>1</sup> / <sub>8</sub> (663.6)	BLN726C5S	12 (6)	C2-43	C2-35	BLN726C5C	15 (7)	C3-116	C3-118
	240	15.0	3	31 <sup>5</sup> / <sub>8</sub> (803.3)	BLN731L3S	14 (7)	C2-50	C2-92	BLN731L3C	17 (8)	C3-114	C3-115
	480	15.0	3	31 <sup>5</sup> / <sub>8</sub> (803.3)	BLN731L5S	14 (7)	C2-43	C2-35	BLN731L5C	17 (8)	C3-116	C3-118
240	18.0	3	37 <sup>1</sup> / <sub>8</sub> (943.0)	BLN737C3S	15 (7)	C2-50	C2-92	BLN737C3C	18 (9)	C3-114	C3-115	
480	18.0	3	37 <sup>1</sup> / <sub>8</sub> (943.0)	BLN737C5S	15 (7)	C2-43	C2-35	BLN737C5C	18 (9)	C3-116	C3-118	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

# Immersion Heaters



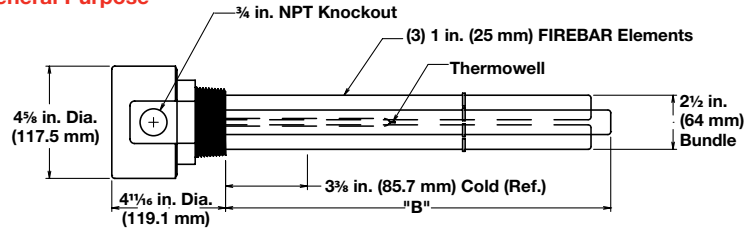
## WATROD and FIREBAR Screw Plug Immersion Heaters



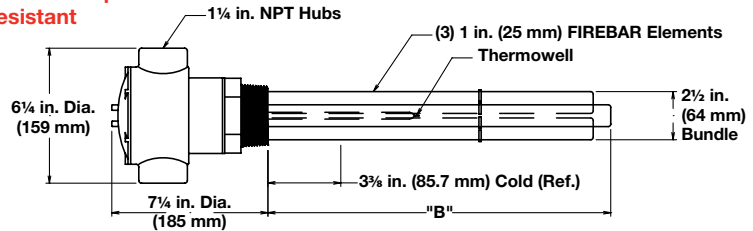
### Application: Clean Water

- 2<sup>1</sup>/<sub>2</sub> inch NPT screw plug
- FIREBAR elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Type J T/C	Type K T/C
90 W/in <sup>2</sup> ⑧ 304 SS Plug 3-Alloy 800 Elements (14 W/cm <sup>2</sup> )	240	15.0	3	15 <sup>1</sup> / <sub>8</sub> (384.2)	BLNF15C3S	11 (5)	C2-50	C2-92	BLNF15C3C	14 (7)	C3-114	C3-115
	480	15.0	3	15 <sup>1</sup> / <sub>8</sub> (384.2)	BLNF15C5S	11 (5)			C2-43	C2-35		
	240	20.0	3	18 <sup>1</sup> / <sub>8</sub> (460.4)	BLNF18C3S	12 (6)	C2-50	C2-92	BLNF18C3C	15 (7)	C3-114	C3-115
	480	20.0	3	18 <sup>1</sup> / <sub>8</sub> (460.4)	BLNF18C5S ③	12 (6)			C2-43	C2-35		
	480	25.0	3	23 <sup>1</sup> / <sub>8</sub> (587.4)	BLNF23C5S	14 (7)	C2-225	C2-226	BLNF23C5C	17 (8)	C3-117	C3-119
	480	32.0	3	28 <sup>5</sup> / <sub>8</sub> (727.1)	BLNF28L5S	17 (8)	C2-225	C2-226	BLNF28L5C	20 (9)	C3-117	C3-119
	480	38.0	3	33 <sup>5</sup> / <sub>8</sub> (854.1)	BLNF33L5S	18 (9)	C2-225	C2-226	BLNF33L5C	21 (10)	C3-117	C3-119

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

- ③ Wired for 3-phase operation only
- ⑤ No third party recognition
- ⑧ Can be wired for 1-phase operation

# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters

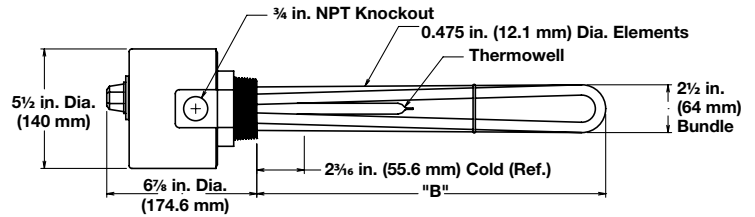


### Application: Deionized/ Demineralized Water

- 2 1/2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- General purpose enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure		Type J T/C	Type K T/C
60 W/in <sup>2</sup> 316 SS Plug 3-316 SS Elements (9.3 W/cm <sup>2</sup> ) (Passivated)	240	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	7 (4)	BLR77L3S4	C/F	C/F	BLR77L3S5A	C/F	C/F	BLR77L3S7A	C/F	C/F
	480	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	7 (4)	BLR77L5S4	C/F	C/F	BLR77L5S5A	C/F	C/F	BLR77L5S7A	C/F	C/F
	240	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	8 (4)	BLR710L3S4	C/F	C/F	BLR710L3S5A	C/F	C/F	BLR710L3S7A	C/F	C/F
	480	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	8 (4)	BLR710L5S4	C/F	C/F	BLR710L5S5A	C/F	C/F	BLR710L5S7A	C/F	C/F
	240	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	10 (5)	BLR714L3S4	C/F	C/F	BLR714L3S5A	C/F	C/F	BLR714L3S7A	C/F	C/F
	480	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	10 (5)	BLR714L5S4	C/F	C/F	BLR714L5S5A	C/F	C/F	BLR714L5S7A	C/F	C/F
	240	7.5	3	17 <sup>5</sup> / <sub>8</sub> (447.7)	10 (5)	BLR717L3S4	C/F	C/F	BLR717L3S5A	C/F	C/F	BLR717L3S7A	C/F	C/F
	240	9.0	3	20 <sup>5</sup> / <sub>8</sub> (523.9)	12 (6)	BLR720L3S4	C/F	C/F	BLR720L3S5A	C/F	C/F	BLR720L3S7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

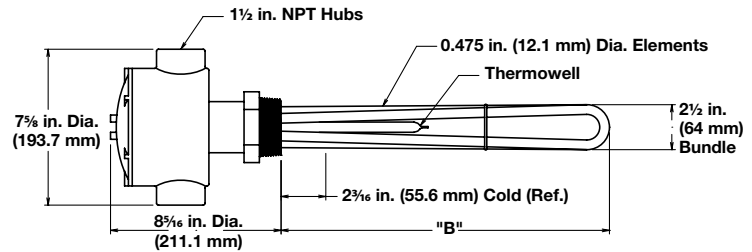
C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)



## WATROD and FIREBAR Screw Plug Immersion Heaters

### Application: Deionized/ Demineralized Water

- 2 1/2 inch NPT screw plug
  - WATROD elements
  - With thermostat (DPST), Type 4, 5A or 7A
- Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.
- Moisture/explosion-resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C		Type K T/C	Moisture/ Explosion- Resistant Enclosure ⑤		Type J T/C	Type K T/C
<b>60 W/in<sup>2</sup> 316 SS Plug 3-316 SS Elements (9.3 W/cm<sup>2</sup>) (Passivated)</b>	240	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	10 (5)	BLR77L3C4	C/F	C/F	BLR77L3C5A	C/F	C/F	BLR77L3C7A	C/F	C/F
	480	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	10 (5)	BLR77L5C4	C/F	C/F	BLR77L5C5A	C/F	C/F	BLR77L5C7A	C/F	C/F
	240	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	11 (5)	BLR710L3C4	C/F	C/F	BLR710L3C5A	C/F	C/F	BLR710L3C7A	C/F	C/F
	480	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	11 (5)	BLR710L5C4	C/F	C/F	BLR710L5C5A	C/F	C/F	BLR710L5C7A	C/F	C/F
	240	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	13 (6)	BLR714L3C4	C/F	C/F	BLR714L3C5A	C/F	C/F	BLR714L3C7A	C/F	C/F
	480	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	13 (6)	BLR714L5C4	C/F	C/F	BLR714L5C5A	C/F	C/F	BLR714L5C7A	C/F	C/F
	240	7.5	3	17 <sup>5</sup> / <sub>8</sub> (447.7)	13 (6)	BLR717L3C4	C/F	C/F	BLR717L3C5A	C/F	C/F	BLR717L3C7A	C/F	C/F
	240	9.0	3	20 <sup>5</sup> / <sub>8</sub> (523.9)	15 (7)	BLR720L3C4	C/F	C/F	BLR720L3C5A	C/F	C/F	BLR720L3C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

⑤ No third party recognition

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)



# Immersion Heaters



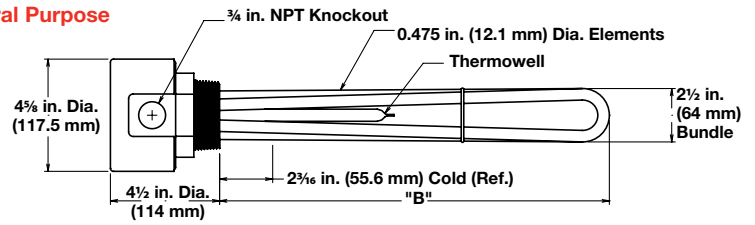
## WATROD and FIREBAR Screw Plug Immersion Heaters



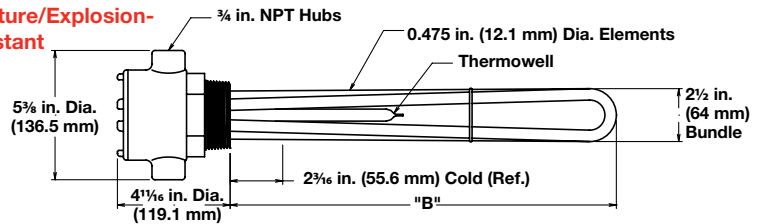
### Application: Deionized/ Demineralized Water

- 2 1/2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Moisture/Explosion- Resistant Enclosure	Type J T/C
60 W/in <sup>2</sup> 316 SS Plug 3-316 SS Elements (9.3 W/cm <sup>2</sup> ) (Passivated)	120	3.0	1	7 <sup>5</sup> / <sub>8</sub> (193.7)	BLR77L1S	6 (3)	C/F	C/F	BLR77L1C	9 (4)	C/F	C/F
	240	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	BLR77L3S	6 (3)	C2-50	C2-92	BLR77L3C	9 (4)	C3-94	C3-93
	480	3.0	3	7 <sup>5</sup> / <sub>8</sub> (193.7)	BLR77L5S	6 (3)	C2-43	C2-35	BLR77L5C	9 (4)	C3-116	C3-118
	120	4.5	1	10 <sup>5</sup> / <sub>8</sub> (269.9)	BLR710L1S	7 (4)	C/F	C/F	BLR710L1C	10 (5)	C/F	C/F
	240	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	BLR710L3S	7 (4)	C2-50	C2-92	BLR710L3C	10 (5)	C3-94	C3-93
	480	4.5	3	10 <sup>5</sup> / <sub>8</sub> (269.9)	BLR710L5S	7 (4)	C2-43	C2-35	BLR710L5C	10 (5)	C3-116	C3-118
	240	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	BLR714L3S	9 (4)	C2-50	C2-92	BLR714L3C	12 (6)	C3-94	C3-93
	480	6.0	3	14 <sup>5</sup> / <sub>8</sub> (371.5)	BLR714L5S	9 (4)	C2-43	C2-35	BLR714L5C	12 (6)	C3-116	C3-118
	240	7.5	3	17 <sup>5</sup> / <sub>8</sub> (447.7)	BLR717L3S	9 (4)	C2-50	C2-92	BLR717L3C	12 (6)	C3-94	C3-93
	480	7.5	3	17 <sup>5</sup> / <sub>8</sub> (447.7)	BLR717L5S	9 (4)	C2-43	C2-35	BLR717L5C	12 (6)	C3-116	C3-118
	240	9.0	3	20 <sup>5</sup> / <sub>8</sub> (523.9)	BLR720L3S	11 (5)	C2-50	C2-92	BLR720L3C	14 (7)	C3-94	C3-93
	480	9.0	3	20 <sup>5</sup> / <sub>8</sub> (523.9)	BLR720L5S	11 (5)	C2-43	C2-35	BLR720L5C	14 (7)	C3-116	C3-118
	240	12.0	3	26 <sup>1</sup> / <sub>8</sub> (663.6)	BLR726C3S	12 (6)	C2-236	C2-214	BLR726C3C	15 (7)	C3-114	C3-115
	480	12.0	3	26 <sup>1</sup> / <sub>8</sub> (663.6)	BLR726C5S	12 (6)	C2-43	C2-35	BLR726C5C	15 (7)	C3-116	C3-118
	240	15.0	3	31 <sup>5</sup> / <sub>8</sub> (803.3)	BLR731L3S	14 (7)	C2-236	C2-214	BLR731L3C	17 (8)	C3-114	C3-115
	480	15.0	3	31 <sup>5</sup> / <sub>8</sub> (803.3)	BLR731L5S	14 (7)	C2-43	C2-35	BLR731L5C	17 (8)	C3-116	C3-118
240	18.0	3	37 <sup>1</sup> / <sub>8</sub> (943.0)	BLR737C3S	15 (7)	C2-236	C2-214	BLR737C3C	18 (9)	C3-114	C3-115	
480	18.0	3	37 <sup>1</sup> / <sub>8</sub> (943.0)	BLR737C5S	15 (7)	C2-43	C2-35	BLR737C5C	18 (9)	C3-116	C3-118	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

# Immersion Heaters



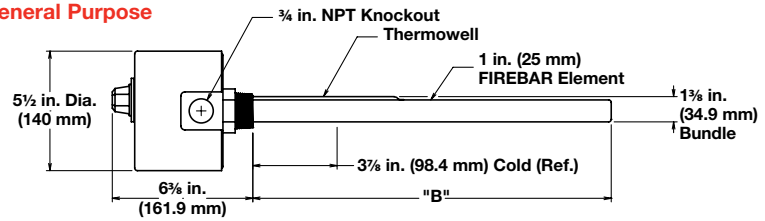
## WATROD and FIREBAR Screw Plug Immersion Heaters



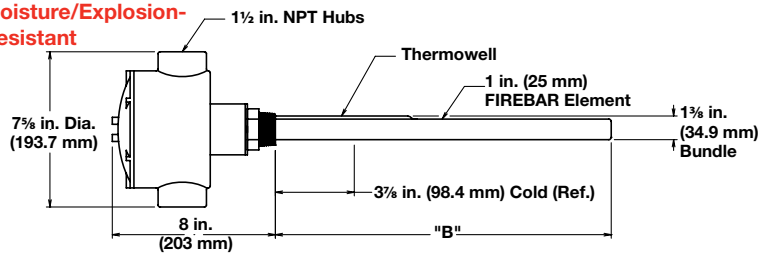
### Application: Process Water

- 1 1/4 inch NPT screw plug
  - FIREBAR elements
  - With thermostat (DPST), Type 5A or 7A
- Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.
- General purpose enclosure
  - Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C
45 W/in <sup>2</sup> ® 304 SS Plug 1-Alloy 800 Element (7 W/cm <sup>2</sup> )	240	2.0	3	13 (330)	7 (4)	BDNF13A27S5A	C/F	C/F	BDNF13A27S7A	C/F	C/F
	240	2.5	3	15 1/2 (394)	8 (4)	BDNF15J27S5A	C/F	C/F	BDNF15J27S7A	C/F	C/F
	240	3.0	3	18 (457)	9 (4)	BDNF18A27S5A	C/F	C/F	BDNF18A27S7A	C/F	C/F
	240	4.0	3	22 1/2 (572)	10 (5)	BDNF22J27S5A	C/F	C/F	BDNF22J27S7A	C/F	C/F
	480	4.0	3	22 1/2 (572)	10 (5)	BDNF22J28S5A	C/F	C/F	BDNF22J28S7A	C/F	C/F
	240	5.0	3	27 1/2 (699)	11 (5)	BDNF27J27S5A	C/F	C/F	BDNF27J27S7A	C/F	C/F
	480	5.0	3	27 1/2 (699)	11 (5)	BDNF27J28S5A	C/F	C/F	BDNF27J28S7A	C/F	C/F
	240	6.0	3	32 1/2 (826)	12 (6)	BDNF32J27S5A	C/F	C/F	BDNF32J27S7A	C/F	C/F
	480	6.0	3	32 1/2 (826)	12 (6)	BDNF32J28S5A	C/F	C/F	BDNF32J28S7A	C/F	C/F
	240	8.0	3	42 (1067)	14 (7)	BDNF42A27S5A	C/F	C/F	BDNF42A27S7A	C/F	C/F
240	10.0	3	51 1/2 (1308)	16 (8)	BDNF51J27S5A	C/F	C/F	BDNF51J27S7A	C/F	C/F	
						Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C
45 W/in <sup>2</sup> ® 304 SS Plug 1-Alloy 800 Element (7 W/cm <sup>2</sup> )	240	2.0	3	13 (330)	10 (5)	BDNF13A27C5A	C/F	C/F	BDNF13A27C7A	C/F	C/F
	240	2.5	3	15 1/2 (394)	11 (5)	BDNF15J27C5A	C/F	C/F	BDNF15J27C7A	C/F	C/F
	240	3.0	3	18 (457)	12 (6)	BDNF18A27C5A	C/F	C/F	BDNF18A27C7A	C/F	C/F
	240	4.0	3	22 1/2 (572)	13 (6)	BDNF22J27C5A	C/F	C/F	BDNF22J27C7A	C/F	C/F
	480	4.0	3	22 1/2 (572)	13 (6)	BDNF22J28C5A	C/F	C/F	BDNF22J28C7A	C/F	C/F
	240	5.0	3	27 1/2 (699)	14 (7)	BDNF27J27C5A	C/F	C/F	BDNF27J27C7A	C/F	C/F
	480	5.0	3	27 1/2 (699)	14 (7)	BDNF27J28C5A	C/F	C/F	BDNF27J28C7A	C/F	C/F
	240	6.0	3	32 1/2 (826)	15 (7)	BDNF32J27C5A	C/F	C/F	BDNF32J27C7A	C/F	C/F
	480	6.0	3	32 1/2 (826)	15 (7)	BDNF32J28C5A	C/F	C/F	BDNF32J28C7A	C/F	C/F
	240	8.0	3	42 (1067)	17 (8)	BDNF42A27C5A	C/F	C/F	BDNF42A27C7A	C/F	C/F
240	10.0	3	51 1/2 (1308)	19 (9)	BDNF51J27C5A	C/F	C/F	BDNF51J27C7A	C/F	C/F	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

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⑤ No third party recognition

⑧ Can be wired for 1-phase operation

# Immersion Heaters



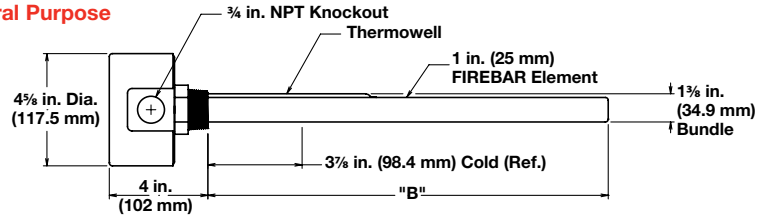
## WATROD and FIREBAR Screw Plug Immersion Heaters



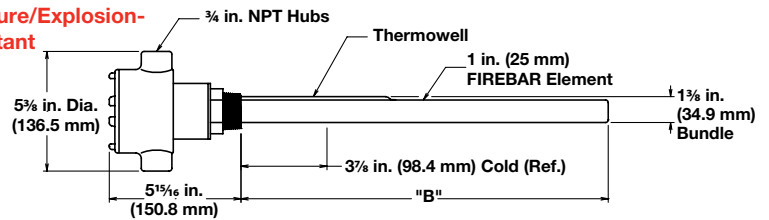
### Application: Process Water

- 1 1/4 inch NPT screw plug
- FIREBAR elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number		
							Type J T/C	Type K T/C			Moisture/Explosion- Resistant Enclosure	Type J T/C	Type K T/C
45 W/in <sup>2</sup> ⑧ 304 SS Plug 1-Alloy 800 Element (7 W/cm <sup>2</sup> )	General Purpose Enclosure							Type J T/C	Type K T/C	Moisture/Explosion- Resistant Enclosure		Type J T/C	Type K T/C
	240	2.0	3	13 (330)	BDNF13A27S	6 (3)	C2-50	C2-92	BDNF13A27C			9 (4)	C3-94
	240	2.5	3	15 1/2 (394)	BDNF15J27S	7 (4)	C2-50	C2-92	BDNF15J27C	10 (5)	C3-94	C3-93	
	240	3.0	3	18 (457)	BDNF18A27S	8 (4)	C2-50	C2-92	BDNF18A27C	11 (5)	C3-94	C3-93	
	240	4.0	3	22 1/2 (572)	BDNF22J27S	9 (4)	C2-50	C2-92	BDNF22J27C	12 (6)	C3-94	C3-93	
	480	4.0	3	22 1/2 (572)	BDNF22J28S	9 (4)	C2-43	C2-35	BDNF22J28C	12 (6)	C3-116	C3-118	
	240	5.0	3	27 1/2 (699)	BDNF27J27S	10 (5)	C2-50	C2-92	BDNF27J27C	13 (6)	C3-94	C3-93	
	480	5.0	3	27 1/2 (699)	BDNF27J28S	10 (5)	C2-43	C2-35	BDNF27J28C	13 (6)	C3-116	C3-118	
	240	6.0	3	32 1/2 (826)	BDNF32J27S	11 (5)	C2-50	C2-92	BDNF32J27C	14 (7)	C3-94	C3-93	
	480	6.0	3	32 1/2 (826)	BDNF32J28S	11 (5)	C2-43	C2-35	BDNF32J28C	14 (7)	C3-116	C3-118	
	240	8.0	3	42 (1067)	BDNF42A27S	13 (6)	C2-50	C2-92	BDNF42A27C	16 (8)	C3-94	C3-93	
	480	8.0	3	42 (1067)	BDNF42A28S	13 (6)	C2-43	C2-35	BDNF42A28C	16 (8)	C3-116	C3-118	
	240	10.0	3	51 1/2 (1308)	BDNF51J27S	15 (7)	C2-50	C2-92	BDNF51J27C	18 (9)	C3-94	C3-93	
	480	10.0	3	51 1/2 (1308)	BDNF51J28S	15 (7)	C2-43	C2-35	BDNF51J28C	18 (9)	C3-116	C3-118	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

⑤ No third party recognition

⑧ Can be wired for 1-phase operation

# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters

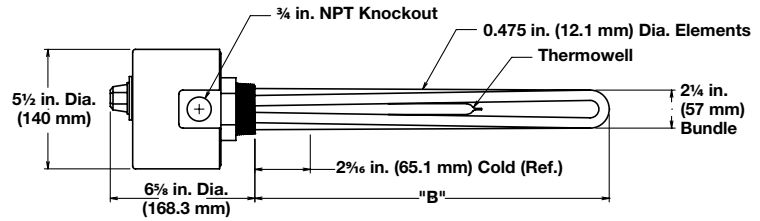


### Application: Process Water

- 2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- General purpose enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C
<b>48 W/in<sup>2</sup> ④ 304 SS Plug 2-Alloy 800 Elements (7.5 W/cm<sup>2</sup>)</b>	120/240	2.0	1	9 <sup>3</sup> / <sub>4</sub> (248)	5 (3)	BGN79N6S4	C/F	C/F	BGN79N6S5A	C/F	C/F	BGN79N6S7	C/F	C/F
	240/480	2.0	1	9 <sup>3</sup> / <sub>4</sub> (248)	5 (3)	BGN79N7S4	C/F	C/F	BGN79N7S5A	C/F	C/F	BGN79N7S7A	C/F	C/F
	120/240	3.0	1	13 <sup>1</sup> / <sub>4</sub> (337)	6 (3)	BGN713E6S4	C/F	C/F	BGN713E6S5A	C/F	C/F	BGN713E6S7A	C/F	C/F
	240/480	3.0	1	13 <sup>1</sup> / <sub>4</sub> (337)	6 (3)	BGN713E7S4	C/F	C/F	BGN713E7S5A	C/F	C/F	BGN713E7S7A	C/F	C/F
	120/240	4.0	1	17 <sup>3</sup> / <sub>4</sub> (451)	7 (4)	BGN717N6S4	C/F	C/F	BGN717N6S5A	C/F	C/F	BGN717N6S7A	C/F	C/F
	120/240	5.0	1	20 <sup>1</sup> / <sub>4</sub> (514)	8 (4)	BGN720E6S4	C/F	C/F	BGN720E6S5A	C/F	C/F	BGN720E6S7A	C/F	C/F
<b>48 W/in<sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (7.5 W/cm<sup>2</sup>)</b>	240	3.0	3	9 <sup>3</sup> / <sub>4</sub> (248)	6 (3)	BHN79N3S4	C/F	C/F	BHN79N3S5A	C/F	C/F	BHN79N3S7A	C/F	C/F
	480	3.0	3	9 <sup>3</sup> / <sub>4</sub> (248)	6 (3)	BHN79N5S4	C/F	C/F	BHN79N5S5A	C/F	C/F	BHN79N5S7A	C/F	C/F
	240	4.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	7 (4)	BHN713E3S4	C/F	C/F	BHN713E3S5A	C/F	C/F	BHN713E3S7A	C/F	C/F
	480	4.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	7 (4)	BHN713E5S4	C/F	C/F	BHN713E5S5A	C/F	C/F	BHN713E5S7A	C/F	C/F
	240	6.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	8 (4)	BHN717N3S4	C/F	C/F	BHN717N3S5A	C/F	C/F	BHN717N3S7A	C/F	C/F
	480	6.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	8 (4)	BHN717N5S4	C/F	C/F	BHN717N5S5A	C/F	C/F	BHN717N5S7A	C/F	C/F
	240	7.5	3	20 <sup>1</sup> / <sub>4</sub> (514)	9 (4)	BHN720E3S4	C/F	C/F	BHN720E3S5A	C/F	C/F	BHN720E3S7A	C/F	C/F
	240	9.0	3	25 <sup>1</sup> / <sub>4</sub> (641)	10 (5)	BHN725E3S4	C/F	C/F	BHN725E3S5A	C/F	C/F	BHN725E3S7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

- ④ Wired for higher voltage



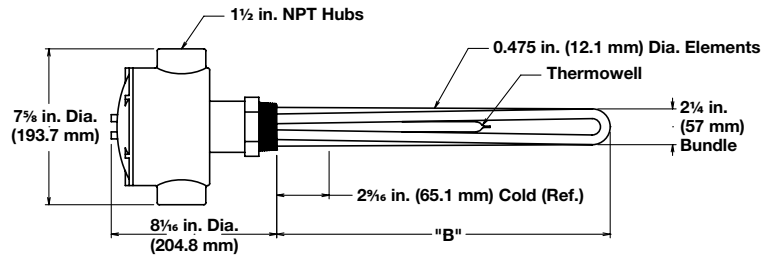
## WATROD and FIREBAR Screw Plug Immersion Heaters

### Application: Process Water

- 2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- Moisture/explosion-resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C		Type K T/C	Moisture/ Explosion- Resistant Enclosure ⑤		Type J T/C	Type K T/C
48 W/in <sup>2</sup> ④ 304 SS Plug 2-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	120/ 240	2.0	1	9 <sup>3</sup> / <sub>4</sub> (248)	8 (4)	BGN79N6C4	C/F	C/F	BGN79N6C5A	C/F	C/F	BGN79N6C7A	C/F	C/F
	240/ 480	2.0	1	9 <sup>3</sup> / <sub>4</sub> (248)	8 (4)	BGN79N7C4	C/F	C/F	BGN79N7C5A	C/F	C/F	BGN79N7C7A	C/F	C/F
	120/ 240	3.0	1	13 <sup>1</sup> / <sub>4</sub> (337)	9 (4)	BGN713E6C4	C/F	C/F	BGN713E6C5A	C/F	C/F	BGN713E6C7A	C/F	C/F
	240/ 480	3.0	1	13 <sup>1</sup> / <sub>4</sub> (337)	9 (4)	BGN713E7C4	C/F	C/F	BGN713E7C5A	C/F	C/F	BGN713E7C7A	C/F	C/F
	120/ 240	4.0	1	17 <sup>3</sup> / <sub>4</sub> (451)	10 (5)	BGN717N6C4	C/F	C/F	BGN717N6C5A	C/F	C/F	BGN717N6C7A	C/F	C/F
	120/ 240	5.0	1	20 <sup>1</sup> / <sub>4</sub> (514)	11 (5)	BGN720E6C4	C/F	C/F	BGN720E6C5A	C/F	C/F	BGN720E6C7A	C/F	C/F
48 W/in <sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	3.0	3	9 <sup>3</sup> / <sub>4</sub> (248)	9 (4)	BHN79N3C4	C/F	C/F	BHN79N3C5A	C/F	C/F	BHN79N3C7A	C/F	C/F
	480	3.0	3	9 <sup>3</sup> / <sub>4</sub> (248)	9 (4)	BHN79N5C4	C/F	C/F	BHN79N5C5A	C/F	C/F	BHN79N5C7A	C/F	C/F
	240	4.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	10 (5)	BHN713E3C4	C/F	C/F	BHN713E3C5A	C/F	C/F	BHN713E3C7A	C/F	C/F
	480	4.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	10 (5)	BHN713E5C4	C/F	C/F	BHN713E5C5A	C/F	C/F	BHN713E5C7A	C/F	C/F
	240	6.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	11 (5)	BHN717N3C4	C/F	C/F	BHN717N3C5A	C/F	C/F	BHN717N3C7A	C/F	C/F
	480	6.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	11 (5)	BHN717N5C4	C/F	C/F	BHN717N5C5A	C/F	C/F	BHN717N5C7A	C/F	C/F
	240	7.5	3	20 <sup>1</sup> / <sub>4</sub> (514)	12 (6)	BHN720E3C4	C/F	C/F	BHN720E3C5A	C/F	C/F	BHN720E3C7A	C/F	C/F
240	9.0	3	25 <sup>1</sup> / <sub>4</sub> (641)	13 (6)	BHN725E3C4	C/F	C/F	BHN725E3C5A	C/F	C/F	BHN725E3C7A	C/F	C/F	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

- ④ Wired for higher voltage
- ⑤ No third party recognition

# Immersion Heaters



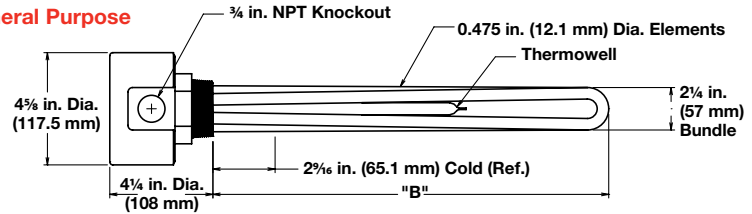
## WATROD and FIREBAR Screw Plug Immersion Heaters



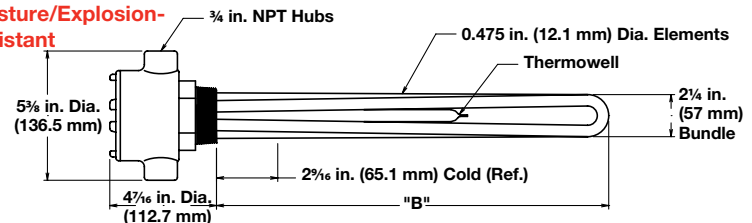
### Application: Process Water

- 2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT		240V WATCONNECT		480V WATCONNECT	
							Part Number	Part Number	Part Number	Part Number	Part Number	Part Number
					<b>General Purpose Enclosure</b>		<b>Type J T/C</b>	<b>Type K T/C</b>	<b>Type J T/C</b>	<b>Type K T/C</b>	<b>Type J T/C</b>	<b>Type K T/C</b>
<b>48 W/in<sup>2</sup> ④ 304 SS Plug 2-Alloy 800 Elements (7.5 W/cm<sup>2</sup>)</b>	120/240	2.0	1	9 <sup>3</sup> / <sub>4</sub> (248)	<b>BGN79N6S</b>	4 (2)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	N/A	N/A
	240/480	2.0	1	9 <sup>3</sup> / <sub>4</sub> (248)	<b>BGN79N7S</b>	4 (2)	N/A	N/A	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	3.0	1	13 <sup>1</sup> / <sub>4</sub> (337)	<b>BGN713E6S</b>	5 (3)	<b>C/F</b>	<b>C/F</b>	<b>C1-17</b>	<b>C1-13</b>	N/A	N/A
	240/480	3.0	1	13 <sup>1</sup> / <sub>4</sub> (337)	<b>BGN713E7S</b>	5 (3)	N/A	N/A	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	4.0	1	17 <sup>3</sup> / <sub>4</sub> (451)	<b>BGN717N6S</b>	6 (3)	<b>C/F</b>	<b>C/F</b>	<b>C1-17</b>	<b>C1-13</b>	N/A	N/A
	240/480	4.0	1	17 <sup>3</sup> / <sub>4</sub> (451)	<b>BGN717N7S</b>	6 (3)	N/A	N/A	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	5.0	1	20 <sup>1</sup> / <sub>4</sub> (514)	<b>BGN720E6S</b>	7 (4)	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	N/A	N/A
	240/480	5.0	1	20 <sup>1</sup> / <sub>4</sub> (514)	<b>BGN720E7S</b>	7 (4)	N/A	N/A	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>
	240/480	6.0	1	25 <sup>1</sup> / <sub>4</sub> (641)	<b>BGN725E7S</b>	7 (4)	N/A	N/A	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>
	240/480	8.0	1	32 <sup>3</sup> / <sub>4</sub> (832)	<b>BGN732N7S</b>	8 (4)	N/A	N/A	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>
240/480	10.0	1	40 <sup>1</sup> / <sub>4</sub> (1022)	<b>BGN740E7S</b>	9 (4)	N/A	N/A	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	
<b>48 W/in<sup>2</sup> 304 SS Plug 3-Alloy 800 Element (7.5 W/cm<sup>2</sup>)</b>	120	3.0	1	9 <sup>3</sup> / <sub>4</sub> (248)	<b>BHN79N1S</b>	5 (3)	<b>C/F</b>	<b>C/F</b>	N/A	N/A	N/A	N/A
	240	3.0	3	9 <sup>3</sup> / <sub>4</sub> (248)	<b>BHN79N3S</b>	5 (3)	N/A	N/A	<b>C2-50</b>	<b>C2-92</b>	N/A	N/A
	480	3.0	3	9 <sup>3</sup> / <sub>4</sub> (248)	<b>BHN79N5S</b>	5 (3)	N/A	N/A	N/A	N/A	<b>C2-43</b>	<b>C2-35</b>
	120	4.5	1	13 <sup>1</sup> / <sub>4</sub> (337)	<b>BHN713E1S</b>	6 (3)	<b>C/F</b>	<b>C/F</b>	N/A	N/A	N/A	N/A
	240	4.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	<b>BHN713E3S</b>	6 (3)	N/A	N/A	<b>C2-50</b>	<b>C2-92</b>	N/A	N/A
	480	4.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	<b>BHN713E5S</b>	6 (3)	N/A	N/A	N/A	N/A	<b>C2-43</b>	<b>C2-35</b>
	240	6.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	<b>BHN717N3S</b>	7 (4)	N/A	N/A	<b>C2-50</b>	<b>C2-92</b>	N/A	N/A
	480	6.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	<b>BHN717N5S</b>	7 (4)	N/A	N/A	N/A	N/A	<b>C2-43</b>	<b>C2-35</b>
	240	7.5	3	20 <sup>1</sup> / <sub>4</sub> (514)	<b>BHN720E3S</b>	8 (4)	N/A	N/A	<b>C2-50</b>	<b>C2-92</b>	N/A	N/A
	480	7.5	3	20 <sup>1</sup> / <sub>4</sub> (514)	<b>BHN720E5S</b>	8 (4)	N/A	N/A	N/A	N/A	<b>C2-43</b>	<b>C2-35</b>
	240	9.0	3	25 <sup>1</sup> / <sub>4</sub> (641)	<b>BHN725E3S</b>	9 (4)	N/A	N/A	<b>C2-50</b>	<b>C2-92</b>	N/A	N/A
	480	9.0	3	25 <sup>1</sup> / <sub>4</sub> (641)	<b>BHN725E5S</b>	9 (4)	N/A	N/A	N/A	N/A	<b>C2-43</b>	<b>C2-35</b>
	240	12.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	<b>BHN732N3S</b>	9 (4)	N/A	N/A	<b>C2-236</b>	<b>C2-214</b>	N/A	N/A
	480	12.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	<b>BHN732N5S</b>	9 (4)	N/A	N/A	N/A	N/A	<b>C2-43</b>	<b>C2-35</b>
	240	15.0	3	40 <sup>1</sup> / <sub>4</sub> (1022)	<b>BHN740E3S</b>	10 (5)	N/A	N/A	<b>C2-236</b>	<b>C2-214</b>	N/A	N/A
	480	15.0	3	40 <sup>1</sup> / <sub>4</sub> (1022)	<b>BHN740E5S</b>	10 (5)	N/A	N/A	N/A	N/A	<b>C2-43</b>	<b>C2-35</b>
	240	18.0	3	47 <sup>3</sup> / <sub>4</sub> (1213)	<b>BHN747N3S</b>	11 (5)	N/A	N/A	<b>C2-236</b>	<b>C2-214</b>	N/A	N/A
480	18.0	3	47 <sup>3</sup> / <sub>4</sub> (1213)	<b>BHN747N5S</b>	11 (5)	N/A	N/A	N/A	N/A	<b>C2-43</b>	<b>C2-35</b>	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)  
N/A - Not available

- ④ Wired for higher voltage
- ⑤ No third party recognition

# Immersion Heaters

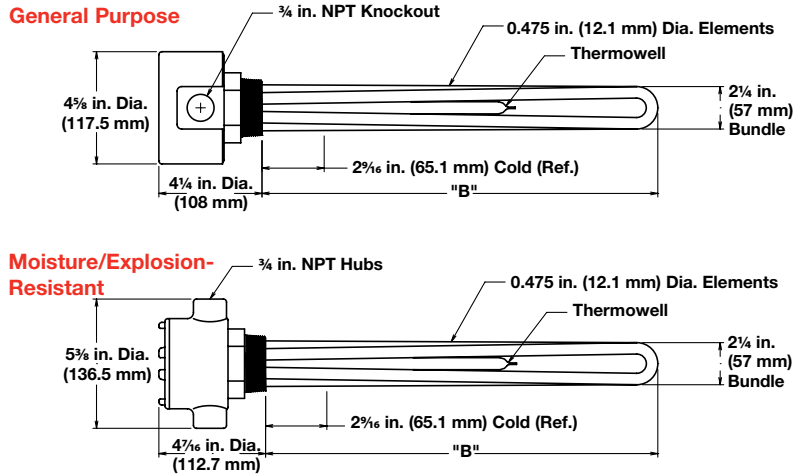


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Process Water

- 2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT		240V WATCONNECT		480V WATCONNECT	
							Part Number	Part Number	Part Number	Part Number	Part Number	Part Number
					Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C	Type J T/C	Type K T/C	Type J T/C	Type K T/C
48 W/in <sup>2</sup> ④ 304 SS Plug 2-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	120/240	2.0	1	9 <sup>3</sup> / <sub>4</sub> (248)	BGN79N6C	7 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	2.0	1	9 <sup>3</sup> / <sub>4</sub> (248)	BGN79N7C	7 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	3.0	1	13 <sup>1</sup> / <sub>4</sub> (337)	BGN713E6C	8 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	3.0	1	13 <sup>1</sup> / <sub>4</sub> (337)	BGN713E7C	8 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	4.0	1	17 <sup>3</sup> / <sub>4</sub> (451)	BGN717N6C	9 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	4.0	1	17 <sup>3</sup> / <sub>4</sub> (451)	BGN717N7C	9 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	5.0	1	20 <sup>1</sup> / <sub>4</sub> (514)	BGN720E6C	10 (5)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	5.0	1	20 <sup>1</sup> / <sub>4</sub> (514)	BGN720E7C	10 (5)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	6.0	1	25 <sup>1</sup> / <sub>4</sub> (641)	BGN725E7C	10 (5)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	8.0	1	32 <sup>3</sup> / <sub>4</sub> (832)	BGN732N7C	11 (5)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	10.0	1	40 <sup>1</sup> / <sub>4</sub> (1022)	BGN740E7C	12 (6)	N/A	N/A	C/F	C/F	C/F	C/F
48 W/in <sup>2</sup> 304 SS Plug 3-Alloy 800 Element (7.5 W/cm <sup>2</sup> )	120	3.0	1	9 <sup>3</sup> / <sub>4</sub> (248)	BHN79N1C	8 (4)	C/F	C/F	N/A	N/A	N/A	N/A
	240	3.0	3	9 <sup>3</sup> / <sub>4</sub> (248)	BHN79N3C	8 (4)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	3.0	3	9 <sup>3</sup> / <sub>4</sub> (248)	BHN79N5C	8 (4)	N/A	N/A	N/A	N/A	C3-116	C3-118
	120	4.5	1	13 <sup>1</sup> / <sub>4</sub> (337)	BHN713E1C	9 (4)	C/F	C/F	N/A	N/A	N/A	N/A
	240	4.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	BHN713E3C	9 (4)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	4.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	BHN713E5C	9 (4)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	6.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	BHN717N3C	10 (5)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	6.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	BHN717N5C	10 (5)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	7.5	3	20 <sup>1</sup> / <sub>4</sub> (514)	BHN720E3C	11 (5)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	7.5	3	20 <sup>1</sup> / <sub>4</sub> (514)	BHN720E5C	11 (5)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	9.0	3	25 <sup>1</sup> / <sub>4</sub> (641)	BHN725E3C	12 (6)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	9.0	3	25 <sup>1</sup> / <sub>4</sub> (641)	BHN725E5C	12 (6)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	12.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	BHN732N3C	12 (6)	N/A	N/A	C3-114	C3-115	N/A	N/A
	480	12.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	BHN732N5C	12 (6)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	15.0	3	40 <sup>1</sup> / <sub>4</sub> (1022)	BHN740E3C	13 (6)	N/A	N/A	C3-114	C3-115	N/A	N/A
	480	15.0	3	40 <sup>1</sup> / <sub>4</sub> (1022)	BHN740E5C	13 (6)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	18.0	3	47 <sup>3</sup> / <sub>4</sub> (1213)	BHN747N3C	14 (7)	N/A	N/A	C3-114	C3-115	N/A	N/A
	480	18.0	3	47 <sup>3</sup> / <sub>4</sub> (1213)	BHN747N5C	14 (7)	N/A	N/A	N/A	N/A	C3-116	C3-118

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)  
N/A - Not available

- ④ Wired for higher voltage
- ⑤ No third party recognition



# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters



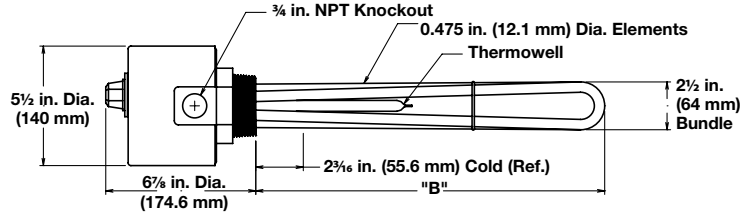
### Application: Process Water

- 2<sup>1</sup>/<sub>2</sub> inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

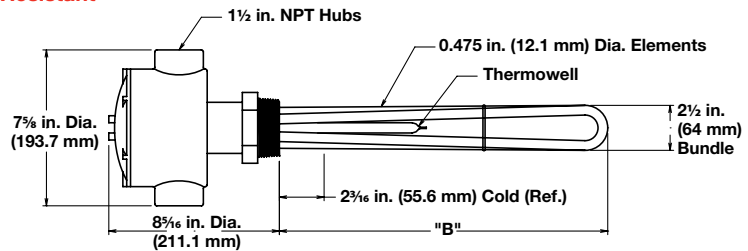
**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

### General Purpose



### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure		Type J T/C	Type K T/C
48 W/in <sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	3.0	3	9 <sup>3</sup> / <sub>8</sub> (238.1)	7 (4)	BLN79G3S4	C/F	C/F	BLN79G3S5A	C/F	C/F	BLN79G3S7A	C/F	C/F
	480	3.0	3	9 <sup>3</sup> / <sub>8</sub> (238.1)	7 (4)	BLN79G5S4	C/F	C/F	BLN79G5S5A	C/F	C/F	BLN79G5S7A	C/F	C/F
	240	4.5	3	12 <sup>7</sup> / <sub>8</sub> (327.0)	8 (4)	BLN712R3S4	C/F	C/F	BLN712R3S5A	C/F	C/F	BLN712R3S7A	C/F	C/F
	480	4.5	3	12 <sup>7</sup> / <sub>8</sub> (327.0)	8 (4)	BLN712R5S4	C/F	C/F	BLN712R5S5A	C/F	C/F	BLN712R5S7A	C/F	C/F
	240	6.0	3	17 <sup>3</sup> / <sub>8</sub> (441.3)	10 (5)	BLN717G3S4	C/F	C/F	BLN717G3S5A	C/F	C/F	BLN717G3S7A	C/F	C/F
	480	6.0	3	17 <sup>3</sup> / <sub>8</sub> (441.3)	10 (5)	BLN717G5S4	C/F	C/F	BLN717G5S5A	C/F	C/F	BLN717G5S7A	C/F	C/F
	240	7.5	3	19 <sup>7</sup> / <sub>8</sub> (504.8)	12 (6)	BLN719R3S4	C/F	C/F	BLN719R3S5A	C/F	C/F	BLN719R3S7A	C/F	C/F
	240	9.0	3	24 <sup>7</sup> / <sub>8</sub> (631.8)	13 (6)	BLN724R3S4	C/F	C/F	BLN724R3S5A	C/F	C/F	BLN724R3S7A	C/F	C/F
						Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C
48 W/in <sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	3.0	3	9 <sup>3</sup> / <sub>8</sub> (238.1)	10 (5)	BLN79G3C4	C/F	C/F	BLN79G3C5A	C/F	C/F	BLN79G3C7A	C/F	C/F
	480	3.0	3	9 <sup>3</sup> / <sub>8</sub> (238.1)	10 (5)	BLN79G5C4	C/F	C/F	BLN79G5C5A	C/F	C/F	BLN79G5C7A	C/F	C/F
	240	4.5	3	12 <sup>7</sup> / <sub>8</sub> (327.0)	11 (5)	BLN712R3C4	C/F	C/F	BLN712R3C5A	C/F	C/F	BLN712R3C7A	C/F	C/F
	480	4.5	3	12 <sup>7</sup> / <sub>8</sub> (327.0)	11 (5)	BLN712R5C4	C/F	C/F	BLN712R5C5A	C/F	C/F	BLN712R5C7A	C/F	C/F
	240	6.0	3	17 <sup>3</sup> / <sub>8</sub> (441.3)	13 (6)	BLN717G3C4	C/F	C/F	BLN717G3C5A	C/F	C/F	BLN717G3C7A	C/F	C/F
	480	6.0	3	17 <sup>3</sup> / <sub>8</sub> (441.3)	13 (6)	BLN717G5C4	C/F	C/F	BLN717G5C5A	C/F	C/F	BLN717G5C7A	C/F	C/F
	240	7.5	3	19 <sup>7</sup> / <sub>8</sub> (504.8)	15 (7)	BLN719R3C4	C/F	C/F	BLN719R3C5A	C/F	C/F	BLN719R3C7A	C/F	C/F
	240	9.0	3	24 <sup>7</sup> / <sub>8</sub> (631.8)	16 (8)	BLN724R3C4	C/F	C/F	BLN724R3C5A	C/F	C/F	BLN724R3C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

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⑤ No third party recognition



# Immersion Heaters



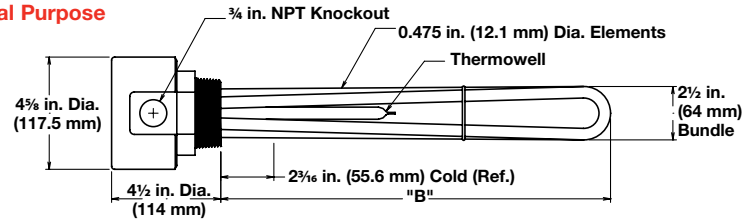
## WATROD and FIREBAR Screw Plug Immersion Heaters



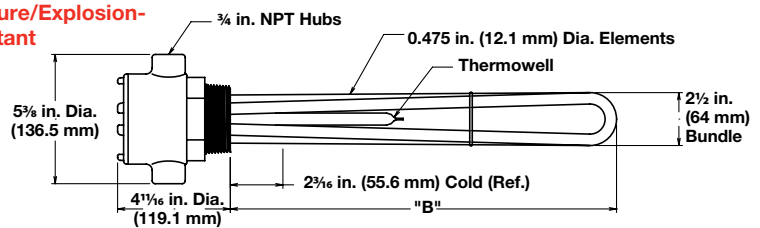
### Application: Process Water

- 2 1/2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Type J T/C	Type K T/C
48 W/in <sup>2</sup> 304 SS Plug 3-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	120	3.0	1	9 <sup>3</sup> / <sub>8</sub> (238.1)	<b>BLN79G1S</b>	6 (3)	C/F	C/F	<b>BLN79G1C</b>	9 (4)	C/F	C/F
	240	3.0	3	9 <sup>3</sup> / <sub>8</sub> (238.1)	<b>BLN79G3S</b>	6 (3)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN79G3C</b>	9 (4)	<b>C3-94</b>	<b>C3-93</b>
	480	3.0	3	9 <sup>3</sup> / <sub>8</sub> (238.1)	<b>BLN79G5S</b>	6 (3)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN79G5C</b>	9 (4)	<b>C3-116</b>	<b>C3-118</b>
	120	4.5	1	12 <sup>7</sup> / <sub>8</sub> (327.0)	<b>BLN712R1S</b>	7 (4)	C/F	C/F	<b>BLN712R1C</b>	10 (5)	C/F	C/F
	240	4.5	3	12 <sup>7</sup> / <sub>8</sub> (327.0)	<b>BLN712R3S</b>	7 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN712R3C</b>	10 (5)	<b>C3-94</b>	<b>C3-93</b>
	480	4.5	3	12 <sup>7</sup> / <sub>8</sub> (327.0)	<b>BLN712R5S</b>	7 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN712R5C</b>	10 (5)	<b>C3-116</b>	<b>C3-118</b>
	240	6.0	3	17 <sup>3</sup> / <sub>8</sub> (441.3)	<b>BLN717G3S</b>	9 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN717G3C</b>	12 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	6.0	3	17 <sup>3</sup> / <sub>8</sub> (441.3)	<b>BLN717G5S</b>	9 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN717G5C</b>	12 (6)	<b>C3-116</b>	<b>C3-118</b>
	240	7.5	3	19 <sup>7</sup> / <sub>8</sub> (504.8)	<b>BLN719R3S</b>	11 (5)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN719R3C</b>	14 (7)	<b>C3-94</b>	<b>C3-93</b>
	480	7.5	3	19 <sup>7</sup> / <sub>8</sub> (504.8)	<b>BLN719R5S</b>	11 (5)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN719R5C</b>	14 (7)	<b>C3-116</b>	<b>C3-118</b>
	240	9.0	3	24 <sup>7</sup> / <sub>8</sub> (631.8)	<b>BLN724R3S</b>	12 (6)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN724R3C</b>	15 (7)	<b>C3-94</b>	<b>C3-93</b>
	480	9.0	3	24 <sup>7</sup> / <sub>8</sub> (631.8)	<b>BLN724R5S</b>	12 (6)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN724R5C</b>	15 (7)	<b>C3-116</b>	<b>C3-118</b>
	240	12.0	3	32 <sup>3</sup> / <sub>8</sub> (822.3)	<b>BLN732G3S</b>	14 (7)	<b>C2-236</b>	<b>C2-214</b>	<b>BLN732G3C</b>	17 (8)	<b>C3-114</b>	<b>C3-115</b>
	480	12.0	3	32 <sup>3</sup> / <sub>8</sub> (822.3)	<b>BLN732G5S</b>	14 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN732G5C</b>	17 (8)	<b>C3-116</b>	<b>C3-118</b>
	240	15.0	3	39 <sup>7</sup> / <sub>8</sub> (1012.8)	<b>BLN739R3S</b>	15 (7)	<b>C2-236</b>	<b>C2-214</b>	<b>BLN739R3C</b>	18 (9)	<b>C3-114</b>	<b>C3-115</b>
	480	15.0	3	39 <sup>7</sup> / <sub>8</sub> (1012.8)	<b>BLN739R5S</b>	15 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN739R5C</b>	18 (9)	<b>C3-116</b>	<b>C3-118</b>
	240	18.0	3	47 <sup>3</sup> / <sub>8</sub> (1203.3)	<b>BLN747G3S</b>	17 (8)	<b>C2-236</b>	<b>C2-214</b>	<b>BLN747G3C</b>	20 (9)	<b>C3-114</b>	<b>C3-115</b>
	480	18.0	3	47 <sup>3</sup> / <sub>8</sub> (1203.3)	<b>BLN747G5S</b>	17 (8)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN747G5C</b>	20 (9)	<b>C3-116</b>	<b>C3-118</b>

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

# Immersion Heaters



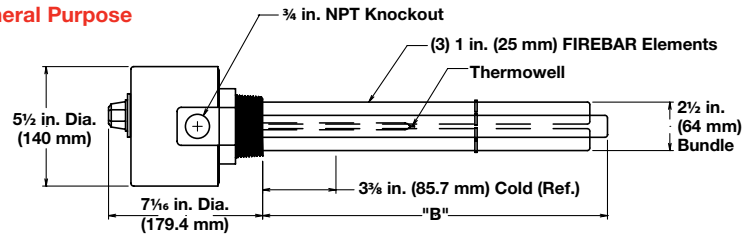
## WATROD and FIREBAR Screw Plug Immersion Heaters



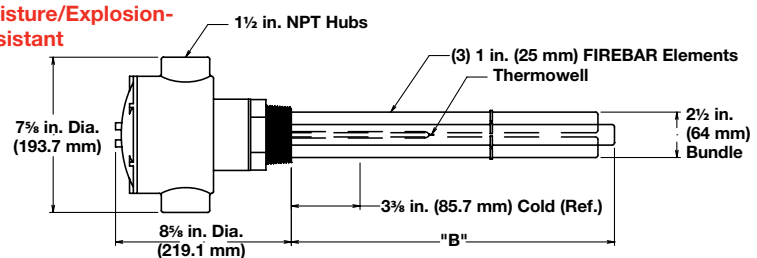
### Application: Process Water

- 2 1/2 inch NPT screw plug
  - FIREBAR elements
  - With thermostat (DPST), Type 5A or 7A
- Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.
- General purpose enclosure
  - Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure
45 W/in <sup>2</sup> Ⓢ 304 SS Plug 3-Alloy 800 Elements (7 W/cm <sup>2</sup> )	240	6.0	3	12 (305)	12 (6)	BLNF12A27S5A	C/F	C/F	BLNF12A27S7A	C/F	C/F
	240	7.5	3	14 1/2 (368)	12 (6)	BLNF14J27S5A	C/F	C/F	BLNF14J27S7A	C/F	C/F
	240	9.0	3	17 (432)	13 (6)	BLNF17A27S5A	C/F	C/F	BLNF17A27S7A	C/F	C/F
	240	12.0	3	21 1/2 (546)	15 (7)	BLNF21J27S5A	C/F	C/F	BLNF21J27S7A	C/F	C/F
45 W/in <sup>2</sup> Ⓢ 304 SS Plug 3-Alloy 800 Elements (7 W/cm <sup>2</sup> )	240	6.0	3	12 (305)	14 (7)	BLNF12A27C5A	C/F	C/F	BLNF12A27C7A	C/F	C/F
	240	7.5	3	14 1/2 (368)	15 (7)	BLNF14J27C5A	C/F	C/F	BLNF14J27C7A	C/F	C/F
	240	9.0	3	17 (432)	16 (8)	BLNF17A27C5A	C/F	C/F	BLNF17A27C7A	C/F	C/F
	240	12.0	3	21 1/2 (546)	18 (9)	BLNF21J27C5A	C/F	C/F	BLNF21J27C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

Ⓢ No third party recognition

Ⓢ Can be wired for 1-phase operation

# Immersion Heaters



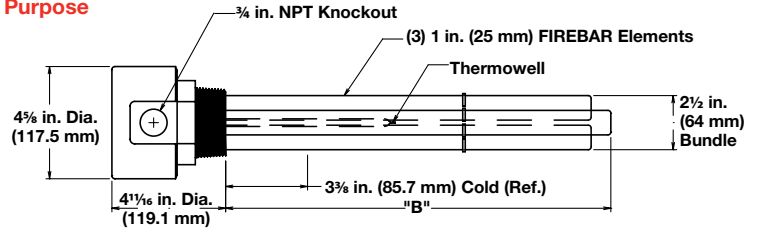
## WATROD and FIREBAR Screw Plug Immersion Heaters



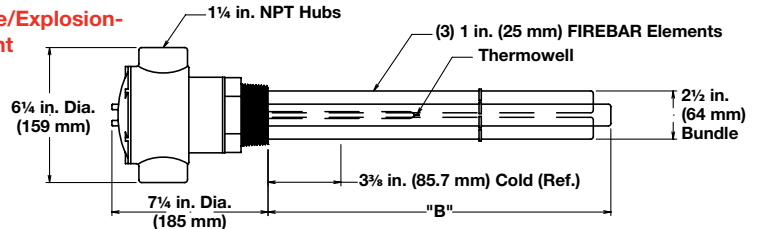
### Application: Process Water

- 2 1/2 inch NPT screw plug
- FIREBAR elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Moisture/Explosion- Resistant Enclosure	Type J T/C
45 W/in <sup>2</sup> ⑧ 304 SS Plug 3-Alloy 800 Elements (7 W/cm <sup>2</sup> )	240	6.0	3	12 (305)	BLNF12A27S	10 (5)	C2-50	C2-92	BLNF12A27C	13 (6)	C3-94	C3-93
	240	7.5	3	14 1/2 (368)	BLNF14J27S	11 (5)	C2-50	C2-92	BLNF14J27C	14 (7)	C3-94	C3-93
	240	9.0	3	17 (432)	BLNF17A27S	12 (6)	C2-50	C2-92	BLNF17A27C	15 (7)	C3-94	C3-93
	240	12.0	3	21 1/2 (546)	BLNF21J27S	14 (7)	C2-236	C2-214	BLNF21J27C	17 (8)	C3-114	C3-115
	480	12.0	3	21 1/2 (546)	BLNF21J28S	14 (7)	C2-43	C2-35	BLNF21J28C	17 (8)	C3-116	C3-118
	240	15.0	3	26 1/2 (673)	BLNF26J27S	17 (8)	C2-236	C2-214	BLNF26J27C	20 (9)	C3-114	C3-115
	480	15.0	3	26 1/2 (673)	BLNF26J28S	17 (8)	C2-43	C2-35	BLNF26J28C	20 (9)	C3-116	C3-118
	240	18.0	3	31 1/2 (800)	BLNF31J27S	18 (9)	C2-236	C2-214	BLNF31J27C	21 (10)	C3-114	C3-115
	480	18.0	3	31 1/2 (800)	BLNF31J28S	18 (9)	C2-43	C2-35	BLNF31J28C	21 (10)	C3-116	C3-118
	480	24.0	3	41 (1041)	BLNF41A28S	20 (9)	C2-225	C2-226	BLNF41A28C	23 (11)	C3-117	C3-119
	480	30.0	3	50 1/2 (1283)	BLNF50J28S	22 (10)	C2-225	C2-226	BLNF50J28C	25 (12)	C3-117	C3-119

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

⑤ No third party recognition

⑧ Can be wired for 1-phase operation

# Immersion Heaters

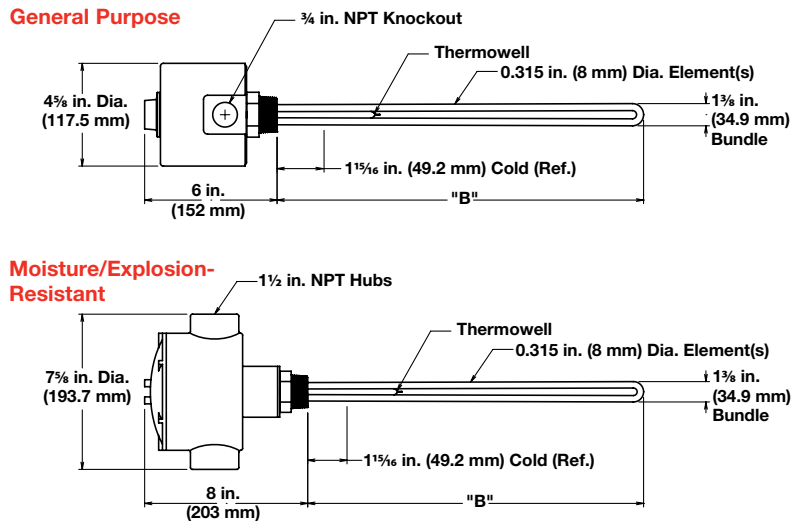


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Forced Air and Caustic Solutions

- 1 1/4 inch NPT screw plug
- WATROD elements
- With thermostat (SPST), Type 2 or 3
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure
<b>23 W/in<sup>2</sup> ④ 304 SS Plug 2-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	120/240	1.0	1	13 <sup>3</sup> / <sub>8</sub> (339.7)	6 (3)	<b>BEN13G6S2</b>	<b>C/F</b>	<b>C/F</b>	<b>BEN13G6S3</b>	<b>C/F</b>	<b>C/F</b>
	120/240	1.5	1	19 (483.0)	7 (4)	<b>BEN19A6S2</b>	<b>C/F</b>	<b>C/F</b>	<b>BEN19A6S3</b>	<b>C/F</b>	<b>C/F</b>
	120/240	2.0	1	24 <sup>3</sup> / <sub>8</sub> (619.1)	8 (4)	<b>BEN24G6S2</b>	<b>C/F</b>	<b>C/F</b>	<b>BEN24G6S3</b>	<b>C/F</b>	<b>C/F</b>
<b>23 W/in<sup>2</sup> ④ 304 SS Plug 2-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	120/240	1.0	1	13 <sup>3</sup> / <sub>8</sub> (339.7)	10 (5)	<b>BEN13G6C2</b>	<b>C/F</b>	<b>C/F</b>	<b>BEN13G6C3</b>	<b>C/F</b>	<b>C/F</b>
	120/240	1.5	1	19 (483.0)	11 (5)	<b>BEN19A6C2</b>	<b>C/F</b>	<b>C/F</b>	<b>BEN19A6C3</b>	<b>C/F</b>	<b>C/F</b>
	120/240	2.0	1	24 <sup>3</sup> / <sub>8</sub> (619.1)	12 (6)	<b>BEN24G6C2</b>	<b>C/F</b>	<b>C/F</b>	<b>BEN24G6C3</b>	<b>C/F</b>	<b>C/F</b>

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

- ④ Wired for higher voltage
- ⑤ No third party recognition

# Immersion Heaters



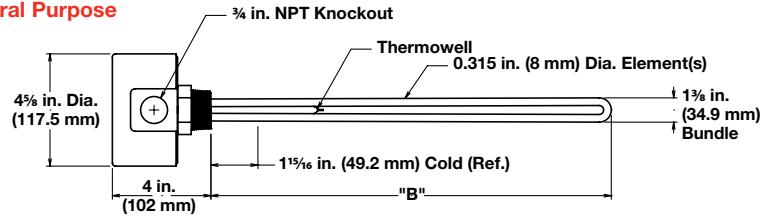
## WATROD and FIREBAR Screw Plug Immersion Heaters



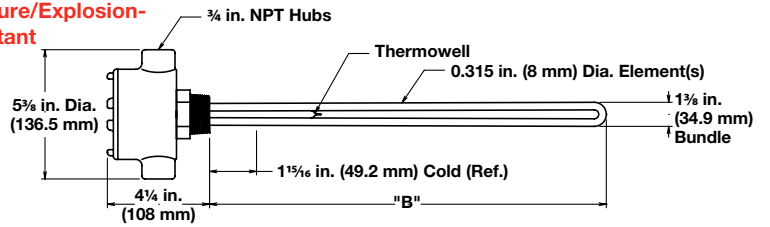
### Application: Forced Air and Caustic Solutions

- 1 1/4 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT		240V WATCONNECT		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT	
							Part Number	Part Number	Part Number	Part Number			Part Number	Part Number
					<b>General Purpose Enclosure</b>		<b>Type J T/C</b>	<b>Type K T/C</b>	<b>Type J T/C</b>	<b>Type K T/C</b>	<b>Moisture Explosion-Resistant Enclosure</b>		<b>Type J T/C</b>	<b>Type K T/C</b>
<b>23 W/in<sup>2</sup> ④</b>	120/240	1.0	1	13 <sup>3/8</sup> (339.7)	<b>BEN13G6S</b>	6 (3)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>BEN13G6C</b>	9 (4)	<b>C/F</b>	<b>C/F</b>
<b>304 SS Plug</b>	120/240	1.5	1	19 (483.0)	<b>BEN19A6S</b>	7 (4)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>BEN19A6C</b>	10 (5)	<b>C/F</b>	<b>C/F</b>
<b>2-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	120/240	2.0	1	24 <sup>3/8</sup> (619.1)	<b>BEN24G6S</b>	8 (4)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>BEN24G6C</b>	11 (5)	<b>C/F</b>	<b>C/F</b>

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

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④ Wired for higher voltage

⑤ No third party recognition

# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters



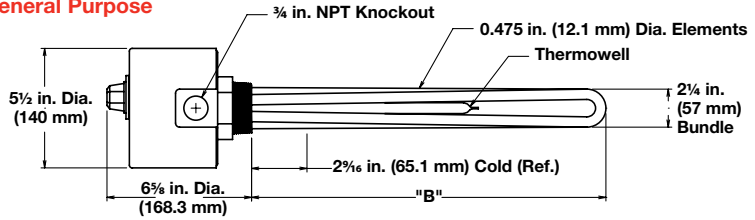
### Application: Forced Air and Caustic Solutions

- 2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

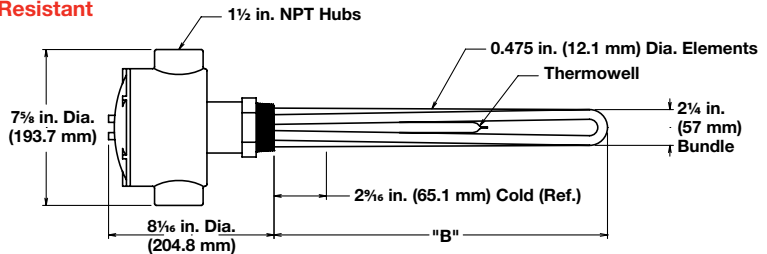
**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure		Type J T/C	Type K T/C
23 W/in <sup>2</sup> ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	3.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	8 (4)	BHNA17N3S4	C/F	C/F	BHNA17N3S5A	C/F	C/F	BHNA17N3S7A	C/F	C/F
	480	3.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	8 (4)	BHNA17N5S4	C/F	C/F	BHNA17N5S5A	C/F	C/F	BHNA17N5S7A	C/F	C/F
	240	4.5	3	25 <sup>1</sup> / <sub>4</sub> (641)	10 (5)	BHNA25E3S4	C/F	C/F	BHNA25E3S5A	C/F	C/F	BHNA25E3S7A	C/F	C/F
	480	4.5	3	25 <sup>1</sup> / <sub>4</sub> (641)	10 (5)	BHNA25E5S4	C/F	C/F	BHNA25E5S5A	C/F	C/F	BHNA25E5S7A	C/F	C/F
	240	6.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	10 (5)	BHNA32N3S4	C/F	C/F	BHNA32N3S5A	C/F	C/F	BHNA32N3S7A	C/F	C/F
	480	6.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	10 (5)	BHNA32N5S4	C/F	C/F	BHNA32N5S5A	C/F	C/F	BHNA32N5S7A	C/F	C/F
	240	7.5	3	40 <sup>1</sup> / <sub>4</sub> (1022)	11 (5)	BHNA40E3S4	C/F	C/F	BHNA40E3S5A	C/F	C/F	BHNA40E3S7A	C/F	C/F
	240	9.0	3	47 <sup>3</sup> / <sub>4</sub> (1213)	12 (6)	BHNA47N3S4	C/F	C/F	BHNA47N3S5A	C/F	C/F	BHNA47N3S7A	C/F	C/F
						Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	3.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	11 (5)	BHNA17N3C4	C/F	C/F	BHNA17N3C5A	C/F	C/F	BHNA17N3C7A	C/F	C/F
	480	3.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	11 (5)	BHNA17N5C4	C/F	C/F	BHNA17N5C5A	C/F	C/F	BHNA17N5C7A	C/F	C/F
	240	4.5	3	25 <sup>1</sup> / <sub>4</sub> (641)	13 (6)	BHNA25E3C4	C/F	C/F	BHNA25E3C5A	C/F	C/F	BHNA25E3C7A	C/F	C/F
	480	4.5	3	25 <sup>1</sup> / <sub>4</sub> (641)	13 (6)	BHNA25E5C4	C/F	C/F	BHNA25E5C5A	C/F	C/F	BHNA25E5C7A	C/F	C/F
	240	6.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	13 (6)	BHNA32N3C4	C/F	C/F	BHNA32N3C5A	C/F	C/F	BHNA32N3C7A	C/F	C/F
	480	6.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	13 (6)	BHNA32N5C4	C/F	C/F	BHNA32N5C5A	C/F	C/F	BHNA32N5C7A	C/F	C/F
	240	7.5	3	40 <sup>1</sup> / <sub>4</sub> (1022)	14 (7)	BHNA40E3C4	C/F	C/F	BHNA40E3C5A	C/F	C/F	BHNA40E3C7A	C/F	C/F
	240	9.0	3	47 <sup>3</sup> / <sub>4</sub> (1213)	15 (7)	BHNA47N3C4	C/F	C/F	BHNA47N3C5A	C/F	C/F	BHNA47N3C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

# Immersion Heaters

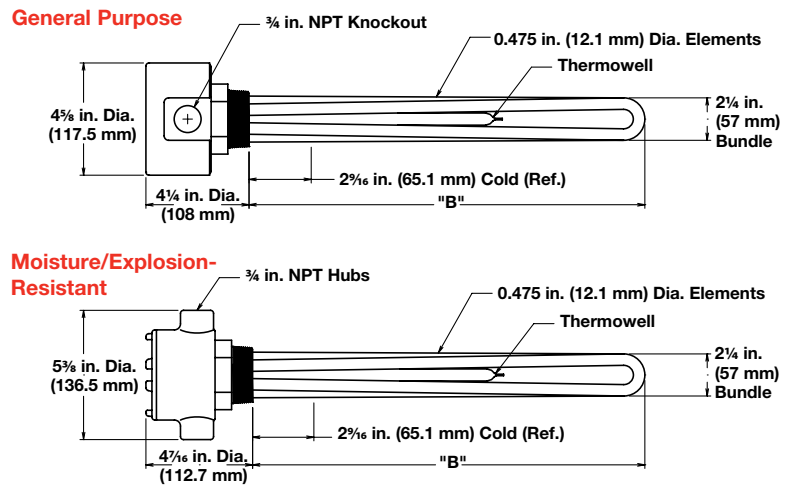


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Forced Air and Caustic Solutions

- 2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Moisture/Explosion-Resistant Enclosure	Type J T/C
23 W/in <sup>2</sup> ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	120	3.0	1	17 <sup>3</sup> / <sub>4</sub> (451)	BHNA17N1S	7 (4)	C/F	C/F	BHNA17N1C	10 (5)	C/F	C/F
	240	3.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	BHNA17N3S	7 (4)	C2-50	C2-92	BHNA17N3C	10 (5)	C3-94	C3-93
	480	3.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	BHNA17N5S	7 (4)	C2-43	C2-35	BHNA17N5C	10 (5)	C3-116	C3-118
	120	4.5	1	25 <sup>1</sup> / <sub>4</sub> (641)	BHNA25E1S	8 (4)	C/F	C/F	BHNA25E1C	11 (5)	C/F	C/F
	240	4.5	3	25 <sup>1</sup> / <sub>4</sub> (641)	BHNA25E3S	8 (4)	C2-50	C2-92	BHNA25E3C	11 (5)	C3-94	C3-93
	480	4.5	3	25 <sup>1</sup> / <sub>4</sub> (641)	BHNA25E5S	8 (4)	C2-43	C2-35	BHNA25E5C	11 (5)	C3-116	C3-118
	240	6.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	BHNA32N3S	9 (4)	C2-50	C2-92	BHNA32N3C	12 (6)	C3-94	C3-93
	480	6.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	BHNA32N5S	9 (4)	C2-43	C2-35	BHNA32N5C	12 (6)	C3-116	C3-118
	240	7.5	3	40 <sup>1</sup> / <sub>4</sub> (1022)	BHNA40E3S	10 (5)	C2-50	C2-92	BHNA40E3C	13 (6)	C3-94	C3-93
	480	7.5	3	40 <sup>1</sup> / <sub>4</sub> (1022)	BHNA40E5S	10 (5)	C2-43	C2-35	BHNA40E5C	13 (6)	C3-116	C3-118
	240	9.0	3	47 <sup>3</sup> / <sub>4</sub> (1213)	BHNA47N3S	11 (5)	C2-50	C2-92	BHNA47N3C	14 (7)	C3-94	C3-93
	480	9.0	3	47 <sup>3</sup> / <sub>4</sub> (1213)	BHNA47N5S	11 (5)	C2-43	C2-35	BHNA47N5C	14 (7)	C3-116	C3-118
	240	12.5	3	64 <sup>1</sup> / <sub>4</sub> (1632)	BHNA64E3S	15 (7)	C2-236	C2-214	BHNA64E3C	18 (9)	C3-114	C3-115
	480	12.5	3	64 <sup>1</sup> / <sub>4</sub> (1632)	BHNA64E5S	15 (7)	C2-43	C2-35	BHNA64E5C	18 (9)	C3-116	C3-118
	240	15.0	3	76 <sup>3</sup> / <sub>4</sub> (1950)	BHNA76E3S	18 (9)	C2-236	C2-214	BHNA76E3C	21 (10)	C3-114	C3-115
	480	15.0	3	76 <sup>3</sup> / <sub>4</sub> (1950)	BHNA76E5S	18 (9)	C2-43	C2-35	BHNA76E5C	21 (10)	C3-116	C3-118

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

# Immersion Heaters



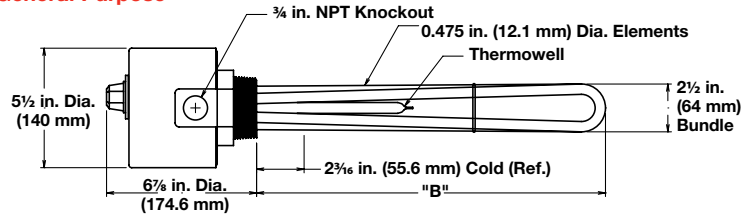
## WATROD and FIREBAR Screw Plug Immersion Heaters



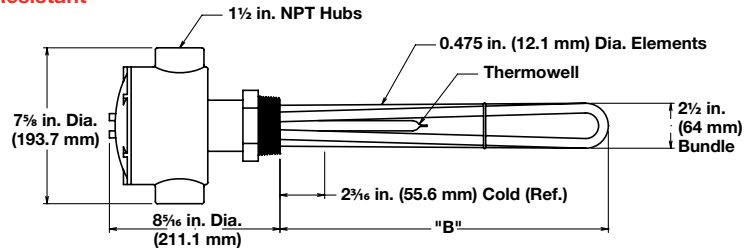
### Application: Forced Air and Caustic Solutions

- 2 1/2 inch NPT screw plug
  - WATROD elements
  - With thermostat (DPST), Type 4, 5A or 7A
- Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.
- General purpose enclosure
  - Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number	Type J T/C	Type K T/C	Part Number	WATCONNECT Part Number	Type J T/C	Type K T/C	Part Number
23 W/in <sup>2</sup> ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	3.0	3	1 7/8 (441.3)	10 (5)	General Purpose Enclosure			General Purpose Enclosure			General Purpose Enclosure		
	480	3.0	3	1 7/8 (441.3)	10 (5)	BLNA17G3S4	C/F	C/F	BLNA17G3S5A	C/F	C/F	BLNA17G3S7A	C/F	C/F
	240	4.5	3	2 7/8 (631.8)	13 (6)	BLNA17G5S4	C/F	C/F	BLNA17G5S5A	C/F	C/F	BLNA17G5S7A	C/F	C/F
	480	4.5	3	2 7/8 (631.8)	13 (6)	BLNA24R3S4	C/F	C/F	BLNA24R3S5A	C/F	C/F	BLNA24R3S7A	C/F	C/F
	240	6.0	3	3 23/8 (822.3)	15 (7)	BLNA24R5S4	C/F	C/F	BLNA24R5S5A	C/F	C/F	BLNA24R5S7A	C/F	C/F
	480	6.0	3	3 23/8 (822.3)	15 (7)	BLNA32G3S4	C/F	C/F	BLNA32G3S5A	C/F	C/F	BLNA32G3S7A	C/F	C/F
	240	7.5	3	3 39/8 (1012.8)	16 (8)	BLNA32G5S4	C/F	C/F	BLNA32G5S5A	C/F	C/F	BLNA32G5S7A	C/F	C/F
	240	9.0	3	4 73/8 (1203.3)	18 (9)	BLNA39R3S4	C/F	C/F	BLNA39R3S5A	C/F	C/F	BLNA39R3S7A	C/F	C/F
						BLNA47G3S4	C/F	C/F	BLNA47G3S5A	C/F	C/F	BLNA47G3S7A	C/F	C/F
						Moisture/Explosion-Resistant Enclosure ⑤			Moisture/Explosion-Resistant Enclosure ⑤			Moisture/Explosion-Resistant Enclosure ⑤		
23 W/in <sup>2</sup> ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	3.0	3	1 7/8 (441.3)	13 (6)	General Purpose Enclosure			General Purpose Enclosure			General Purpose Enclosure		
	480	3.0	3	1 7/8 (441.3)	13 (6)	BLNA17G3C4	C/F	C/F	BLNA17G3C5A	C/F	C/F	BLNA17G3C7A	C/F	C/F
	240	4.5	3	2 7/8 (631.8)	16 (8)	BLNA17G5C4	C/F	C/F	BLNA17G5C5A	C/F	C/F	BLNA17G5C7A	C/F	C/F
	480	4.5	3	2 7/8 (631.8)	16 (8)	BLNA24R3C4	C/F	C/F	BLNA24R3C5A	C/F	C/F	BLNA24R3C7A	C/F	C/F
	240	6.0	3	3 23/8 (822.3)	18 (9)	BLNA24R5C4	C/F	C/F	BLNA24R5C5A	C/F	C/F	BLNA24R5C7A	C/F	C/F
	480	6.0	3	3 23/8 (822.3)	18 (9)	BLNA32G3C4	C/F	C/F	BLNA32G3C5A	C/F	C/F	BLNA32G3C7A	C/F	C/F
	240	7.5	3	3 39/8 (1012.8)	19 (9)	BLNA32G5C4	C/F	C/F	BLNA32G5C5A	C/F	C/F	BLNA32G5C7A	C/F	C/F
	240	9.0	3	4 73/8 (1203.3)	21 (10)	BLNA39R3C4	C/F	C/F	BLNA39R3C5A	C/F	C/F	BLNA39R3C7A	C/F	C/F
						BLNA47G3C4	C/F	C/F	BLNA47G3C5A	C/F	C/F	BLNA47G3C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)



# Immersion Heaters



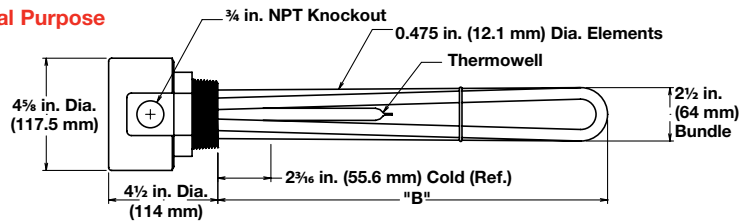
## WATROD and FIREBAR Screw Plug Immersion Heaters



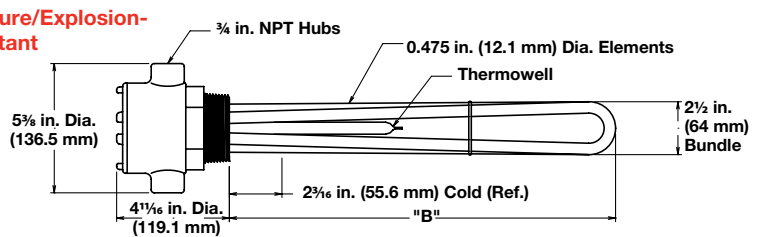
### Application: Forced Air and Caustic Solutions

- 2 1/2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	General Purpose Enclosure		WATCONNECT Part Number		Moisture/Explosion-Resistant Enclosure		WATCONNECT Part Number	
					Part Number	Ship Wt. lbs (kg)	Type J T/C	Type K T/C	Part Number ⑤	Ship Wt. lbs (kg)	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	120	3.0	1	1 7 <sup>3</sup> / <sub>8</sub> (441.3)	BLNA17G1S	9 (4)	C/F	C/F	BLNA17G1C	12 (6)	C/F	C/F
	240	3.0	3	1 7 <sup>3</sup> / <sub>8</sub> (441.3)	BLNA17G3S	9 (4)	C2-50	C2-92	BLNA17G3C	12 (6)	C3-94	C3-93
	480	3.0	3	1 7 <sup>3</sup> / <sub>8</sub> (441.3)	BLNA17G5S	9 (4)	C2-43	C2-35	BLNA17G5C	12 (6)	C3-116	C3-118
	120	4.5	1	2 4 <sup>7</sup> / <sub>8</sub> (631.8)	BLNA24R1S	12 (6)	C/F	C/F	BLNA24R1C	15 (7)	C/F	C/F
	240	4.5	3	2 4 <sup>7</sup> / <sub>8</sub> (631.8)	BLNA24R3S	12 (6)	C2-50	C2-92	BLNA24R3C	15 (7)	C3-94	C3-93
	480	4.5	3	2 4 <sup>7</sup> / <sub>8</sub> (631.8)	BLNA24R5S	12 (6)	C2-43	C2-35	BLNA24R5C	15 (7)	C3-116	C3-118
	240	6.0	3	3 2 <sup>3</sup> / <sub>8</sub> (822.3)	BLNA32G3S	14 (7)	C2-50	C2-92	BLNA32G3C	17 (8)	C3-94	C3-93
	480	6.0	3	3 2 <sup>3</sup> / <sub>8</sub> (822.3)	BLNA32G5S	14 (7)	C2-43	C2-35	BLNA32G5C	17 (8)	C3-116	C3-118
	240	7.5	3	3 9 <sup>7</sup> / <sub>8</sub> (1012.8)	BLNA39R3S	15 (7)	C2-50	C2-92	BLNA39R3C	18 (9)	C3-94	C3-93
	480	7.5	3	3 9 <sup>7</sup> / <sub>8</sub> (1012.8)	BLNA39R5S	15 (7)	C2-43	C2-35	BLNA39R5C	18 (9)	C3-116	C3-118
	240	9.0	3	4 7 <sup>3</sup> / <sub>8</sub> (1203.3)	BLNA47G3S	17 (8)	C2-50	C2-92	BLNA47G3C	20 (9)	C3-94	C3-93
	480	9.0	3	4 7 <sup>3</sup> / <sub>8</sub> (1203.3)	BLNA47G5S	17 (8)	C2-43	C2-35	BLNA47G5C	20 (9)	C3-116	C3-118
	240	12.5	3	6 3 <sup>7</sup> / <sub>8</sub> (1622.4)	BLNA63R3S	20 (9)	C2-236	C2-214	BLNA63R3C	23 (11)	C3-114	C3-115
	480	12.5	3	6 3 <sup>7</sup> / <sub>8</sub> (1622.4)	BLNA63R5S	20 (9)	C2-43	C2-35	BLNA63R5C	23 (11)	C3-116	C3-118
	240	15.0	3	7 6 <sup>3</sup> / <sub>8</sub> (1939.9)	BLNA76G3S	23 (11)	C2-236	C2-214	BLNA76G3C	26 (12)	C3-114	C3-115
	480	15.0	3	7 6 <sup>3</sup> / <sub>8</sub> (1939.9)	BLNA76G5S	23 (11)	C2-43	C2-35	BLNA76G5C	26 (12)	C3-116	C3-118

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

# Immersion Heaters

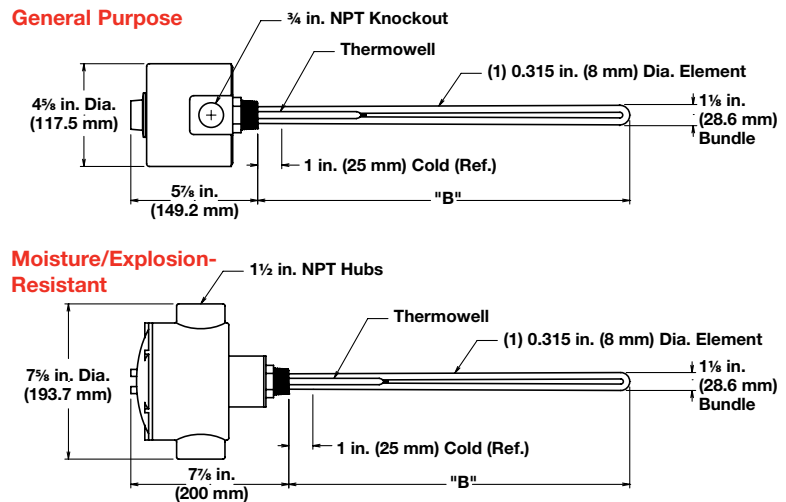


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Lightweight Oils and Heat Transfer Oils

- 1 inch NPT screw plug
- WATROD elements
- With thermostat (SPST), Type 2 or 3
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure
23 W/in <sup>2</sup> Steel Plug 1-Steel Element (3.6 W/cm <sup>2</sup> )	120	0.25	1	6 1/2 (165)	3 (2)	BCS6J1S2	C/F	C/F	BCS6J1S3	C/F	C/F
	240	0.25	1	6 1/2 (165)	3 (2)	BCS6J10S2	C/F	C/F	BCS6J10S3	C/F	C/F
	120	0.35	1	9 1/4 (235)	4 (2)	BCS9E1S2	C/F	C/F	BCS9E1S3	C/F	C/F
	240	0.35	1	9 1/4 (235)	4 (2)	BCS9E10S2	C/F	C/F	BCS9E10S3	C/F	C/F
	120	0.50	1	9 3/8 (238)	4 (2)	BCS9G1S2	C/F	C/F	BCS9G1S3	C/F	C/F
	240	0.50	1	9 3/8 (238)	4 (2)	BCS9G10S2	C/F	C/F	BCS9G10S3	C/F	C/F
	120	0.75	1	13 1/2 (343)	5 (3)	BCS13J1S2	C/F	C/F	BCS13J1S3	C/F	C/F
	240	0.75	1	13 1/2 (343)	5 (3)	BCS13J10S2	C/F	C/F	BCS13J10S3	C/F	C/F
	120	1.00	1	16 3/4 (426)	6 (3)	BCS16N1S2	C/F	C/F	BCS16N1S3	C/F	C/F
	240	1.00	1	16 3/4 (426)	6 (3)	BCS16N10S2	C/F	C/F	BCS16N10S3	C/F	C/F
	120	1.50	1	23 3/4 (603)	7 (4)	BCS23N1S2	C/F	C/F	BCS23N1S3	C/F	C/F
	240	1.50	1	23 3/4 (603)	7 (4)	BCS23N10S2	C/F	C/F	BCS23N10S3	C/F	C/F
23 W/in <sup>2</sup> Steel Plug 1-Steel Element (3.6 W/cm <sup>2</sup> )	120	0.25	1	6 1/2 (165)	3 (2)	BCS6J1C2	C/F	C/F	BCS6J1C3	C/F	C/F
	240	0.25	1	6 1/2 (165)	3 (2)	BCS6J10C2	C/F	C/F	BCS6J10C3	C/F	C/F
	120	0.35	1	9 1/4 (235)	4 (2)	BCS9E1C2	C/F	C/F	BCS9E1C3	C/F	C/F
	240	0.35	1	9 1/4 (235)	4 (2)	BCS9E10C2	C/F	C/F	BCS9E10C3	C/F	C/F
	120	0.50	1	9 3/8 (238)	4 (2)	BCS9G1C2	C/F	C/F	BCS9G1C3	C/F	C/F
	240	0.50	1	9 3/8 (238)	4 (2)	BCS9G10C2	C/F	C/F	BCS9G10C3	C/F	C/F
	120	0.75	1	13 1/2 (343)	5 (3)	BCS13J1C2	C/F	C/F	BCS13J1C3	C/F	C/F
	240	0.75	1	13 1/2 (343)	5 (3)	BCS13J10C2	C/F	C/F	BCS13J10C3	C/F	C/F
	120	1.00	1	16 3/4 (426)	6 (3)	BCS16N1C2	C/F	C/F	BCS16N1C3	C/F	C/F
	240	1.00	1	16 3/4 (426)	6 (3)	BCS16N10C2	C/F	C/F	BCS16N10C3	C/F	C/F
	120	1.50	1	23 3/4 (603)	7 (4)	BCS23N1C2	C/F	C/F	BCS23N1C3	C/F	C/F
	240	1.50	1	23 3/4 (603)	7 (4)	BCS23N10C2	C/F	C/F	BCS23N10C3	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

# Immersion Heaters

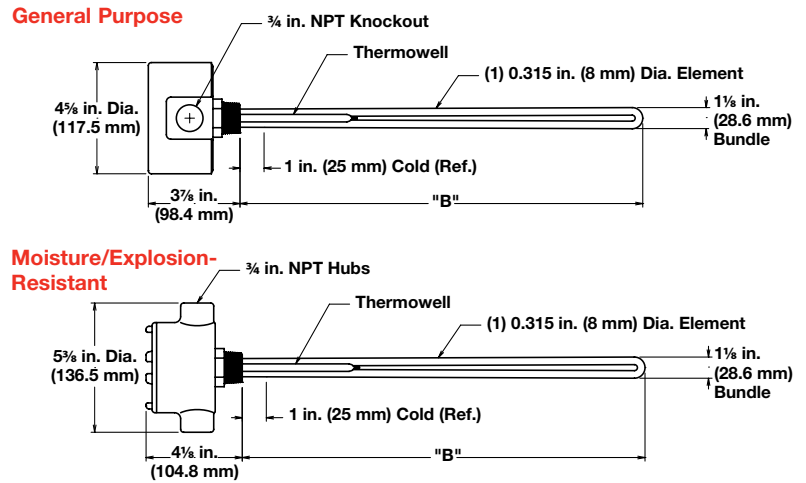


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Lightweight Oils and Heat Transfer Oils

- 1 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Moisture/Explosion- Resistant Enclosure	Type J T/C
<b>23 W/in<sup>2</sup> Steel Plug 1-Steel Element (3.6 W/cm<sup>2</sup>)</b>	120	0.25	1	6 1/2 (165)	<b>BCS6J1S</b>	3 (2)	<b>C1-15</b>	<b>C1-12</b>	<b>BCS6J1C</b>	6 (3)	<b>C/F</b>	<b>C/F</b>
	240	0.25	1	6 1/2 (165)	<b>BCS6J10S</b>	3 (2)	<b>C1-17</b>	<b>C1-13</b>	<b>BCS6J10C</b>	6 (3)	<b>C/F</b>	<b>C/F</b>
	120	0.35	1	9 1/4 (235)	<b>BCS9E1S</b>	4 (2)	<b>C1-15</b>	<b>C1-12</b>	<b>BCS9E1C</b>	7 (4)	<b>C/F</b>	<b>C/F</b>
	240	0.35	1	9 1/4 (235)	<b>BCS9E10S</b>	4 (2)	<b>C1-17</b>	<b>C1-13</b>	<b>BCS9E10C</b>	7 (4)	<b>C/F</b>	<b>C/F</b>
	120	0.50	1	9 3/8 (238)	<b>BCS9G1S</b>	4 (2)	<b>C1-15</b>	<b>C1-12</b>	<b>BCS9G1C</b>	7 (4)	<b>C/F</b>	<b>C/F</b>
	240	0.50	1	9 3/8 (238)	<b>BCS9G10S</b>	4 (2)	<b>C1-17</b>	<b>C1-13</b>	<b>BCS9G10C</b>	7 (4)	<b>C/F</b>	<b>C/F</b>
	120	0.75	1	13 1/2 (343)	<b>BCS13J1S</b>	5 (3)	<b>C1-15</b>	<b>C1-12</b>	<b>BCS13J1C</b>	8 (4)	<b>C/F</b>	<b>C/F</b>
	240	0.75	1	13 1/2 (343)	<b>BCS13J10S</b>	5 (3)	<b>C1-17</b>	<b>C1-13</b>	<b>BCS13J10C</b>	8 (4)	<b>C/F</b>	<b>C/F</b>
	120	1.00	1	16 3/4 (426)	<b>BCS16N1S</b>	6 (3)	<b>C1-15</b>	<b>C1-12</b>	<b>BCS16N1C</b>	9 (4)	<b>C/F</b>	<b>C/F</b>
	240	1.00	1	16 3/4 (426)	<b>BCS16N10S</b>	6 (3)	<b>C1-17</b>	<b>C1-13</b>	<b>BCS16N10C</b>	9 (4)	<b>C/F</b>	<b>C/F</b>
	120	1.50	1	23 3/4 (603)	<b>BCS23N1S</b>	7 (4)	<b>C1-15</b>	<b>C1-12</b>	<b>BCS23N1C</b>	10 (5)	<b>C/F</b>	<b>C/F</b>
	240	1.50	1	23 3/4 (603)	<b>BCS23N10S</b>	7 (4)	<b>C1-17</b>	<b>C1-13</b>	<b>BCS23N10C</b>	10 (5)	<b>C/F</b>	<b>C/F</b>

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑤ No third party recognition

# Immersion Heaters



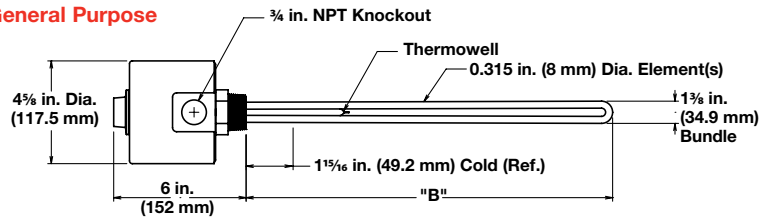
## WATROD and FIREBAR Screw Plug Immersion Heaters



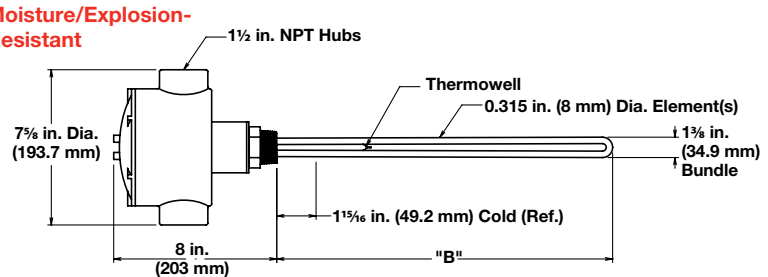
### Application: Lightweight Oils and Heat Transfer Oils

- 1 1/4 inch NPT screw plug
- WATROD elements
- With thermostat (SPST), Type 2 or 3
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ④ Steel Plug 2-Steel Elements (3.6 W/cm <sup>2</sup> )	120/240	0.50	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	4 (2)	BES6G6S2	C/F	C/F	BES6G6S3	C/F	C/F
	120/240	0.50	1	7 <sup>3</sup> / <sub>8</sub> (187.3)	4 (2)	BES7G6S2	C/F	C/F	BES7G6S3	C/F	C/F
	120/240	0.70	1	8 <sup>7</sup> / <sub>8</sub> (225.4)	5 (3)	BES8R6S2	C/F	C/F	BES8R6S3	C/F	C/F
	120/240	0.75	1	10 <sup>1</sup> / <sub>16</sub> (255.6)	5 (3)	BES10B6S2	C/F	C/F	BES10B6S3	C/F	C/F
	120/240	1.00	1	12 <sup>3</sup> / <sub>4</sub> (324.0)	6 (3)	BES12N6S2	C/F	C/F	BES12N6S3	C/F	C/F
	120/240	1.50	1	19 <sup>3</sup> / <sub>8</sub> (492.1)	7 (4)	BES19G6S2	C/F	C/F	BES19G6S3	C/F	C/F
	120/240	2.00	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	8 (4)	BES25G6S2	C/F	C/F	BES25G6S3	C/F	C/F
	120/240	3.00	1	36 <sup>7</sup> / <sub>8</sub> (936.6)	9 (4)	BES36R6S2	C/F	C/F	BES36R6S3	C/F	C/F
						Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ④ Steel Plug 2-Steel Elements (3.6 W/cm <sup>2</sup> )	120/240	0.50	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	8 (4)	BES6G6C2	C/F	C/F	BES6G6C3	C/F	C/F
	120/240	0.50	1	7 <sup>3</sup> / <sub>8</sub> (187.3)	8 (4)	BES7G6C2	C/F	C/F	BES7G6C3	C/F	C/F
	120/240	0.70	1	8 <sup>7</sup> / <sub>8</sub> (225.6)	9 (4)	BES8R6C2	C/F	C/F	BES8R6C3	C/F	C/F
	120/240	0.75	1	10 <sup>1</sup> / <sub>16</sub> (256.0)	9 (4)	BES10B6C2	C/F	C/F	BES10B6C3	C/F	C/F
	120/240	1.00	1	12 <sup>3</sup> / <sub>4</sub> (324.0)	10 (5)	BES12N6C2	C/F	C/F	BES12N6C3	C/F	C/F
	120/240	1.50	1	19 <sup>3</sup> / <sub>8</sub> (492.1)	11 (5)	BES19G6C2	C/F	C/F	BES19G6C3	C/F	C/F
	120/240	2.00	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	12 (6)	BES25G6C2	C/F	C/F	BES25G6C3	C/F	C/F
	120/240	3.00	1	36 <sup>7</sup> / <sub>8</sub> (936.7)	13 (6)	BES36R6C2	C/F	C/F	BES36R6C3	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

④ Wired for higher voltage

⑤ No third party recognition

# Immersion Heaters



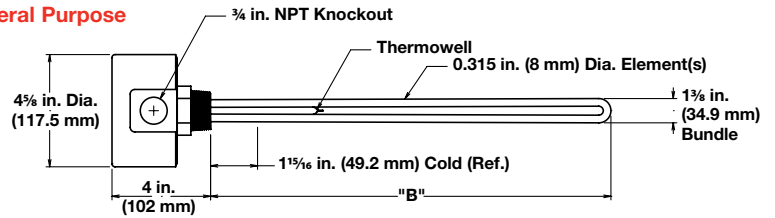
## WATROD and FIREBAR Screw Plug Immersion Heaters



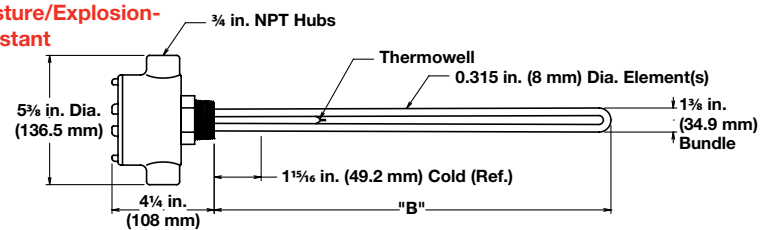
### Application: Lightweight Oils and Heat Transfer Oils

- 1 1/4 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT		240V WATCONNECT		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT	
							Part Number	Part Number	Part Number	Part Number			Type J T/C	Type K T/C
<b>23 W/in<sup>2</sup> ④ Steel Plug 2-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	120/ 240	0.50	1	6 <sup>3</sup> / <sub>8</sub> (161.9)	<b>BES6G6S</b>	4 (2)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>BES6G6C</b>	7 (4)	<b>C/F</b>	<b>C/F</b>
	120/ 240	0.50	1	7 <sup>3</sup> / <sub>8</sub> (187.3)	<b>BES7G6S</b>	4 (2)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>BES7G6C</b>	7 (4)	<b>C/F</b>	<b>C/F</b>
	120/ 240	0.70	1	8 <sup>7</sup> / <sub>8</sub> (225.4)	<b>BES8R6S</b>	5 (3)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>BES8R6C</b>	8 (4)	<b>C/F</b>	<b>C/F</b>
	120/ 240	0.75	1	10 <sup>1</sup> / <sub>16</sub> (255.6)	<b>BES10B6S</b>	5 (3)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>BES10B6C</b>	8 (4)	<b>C/F</b>	<b>C/F</b>
	120/ 240	1.00	1	12 <sup>3</sup> / <sub>4</sub> (324.0)	<b>BES12N6S</b>	6 (3)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>BES12N6C</b>	9 (4)	<b>C/F</b>	<b>C/F</b>
	120/ 240	1.50	1	19 <sup>3</sup> / <sub>8</sub> (492.1)	<b>BES19G6S</b>	7 (4)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>BES19G6C</b>	10 (5)	<b>C/F</b>	<b>C/F</b>
	120/ 240	2.00	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	<b>BES25G6S</b>	8 (4)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>BES25G6C</b>	11 (5)	<b>C/F</b>	<b>C/F</b>
	120/ 240	3.00	1	36 <sup>7</sup> / <sub>8</sub> (936.6)	<b>BES36R6S</b>	9 (4)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>BES36R6C</b>	12 (6)	<b>C/F</b>	<b>C/F</b>

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

④ Wired for higher voltage

⑤ No third party recognition

# Immersion Heaters

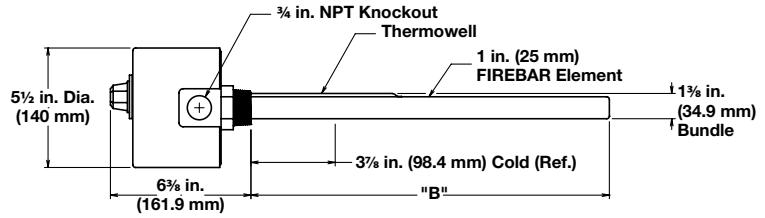


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Lightweight Oils and Heat Transfer Oils

- 1 1/4 inch NPT screw plug
  - FIREBAR elements
  - With thermostat (DPST), Type 5A or 7A
- Note:** Higher amperage products require a pilot duty thermostat with separate power controller, please see following pages for available heaters without thermostats
- General purpose enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C
<b>30 W/in<sup>2</sup> ③</b> <b>304 SS Plug 1-Alloy 800 Element</b> <b>(4.7 W/cm<sup>2</sup>)</b>	240	1.70	3	16 1/8 (409.6)	8 (4)	BDNF16G12S5A	C/F	C/F	BDNF16G12S7A	C/F	C/F
	480	1.70	3	16 1/8 (409.6)	8 (4)	BDNF16G13S5A	C/F	C/F	BDNF16G13S7A	C/F	C/F
	240	2.20	3	19 1/8 (485.8)	9 (4)	BDNF19G12S5A	C/F	C/F	BDNF19G12S7A	C/F	C/F
	480	2.20	3	19 1/8 (485.8)	9 (4)	BDNF19G13S5A	C/F	C/F	BDNF19G13S7A	C/F	C/F
	240	2.80	3	24 3/8 (619.1)	10 (5)	BDNF24L12S5A	C/F	C/F	BDNF24L12S7A	C/F	C/F
	480	2.80	3	24 3/8 (619.1)	10 (5)	BDNF24L13S5A	C/F	C/F	BDNF24L13S7A	C/F	C/F
	240	3.50	3	29 5/8 (752.5)	11 (5)	BDNF29R12S5A	C/F	C/F	BDNF29R12S7A	C/F	C/F
	480	3.50	3	29 5/8 (752.5)	11 (5)	BDNF29R13S5A	C/F	C/F	BDNF29R13S7A	C/F	C/F
	240	4.25	3	34 5/8 (879.5)	12 (6)	BDNF34R12S5A	C/F	C/F	BDNF34R12S7A	C/F	C/F
	480	4.25	3	34 5/8 (879.5)	12 (6)	BDNF34R13S5A	C/F	C/F	BDNF34R13S7A	C/F	C/F
	240	5.70	3	45 1/8 (1146.2)	14 (7)	BDNF45G12S5A	C/F	C/F	BDNF45G12S7A	C/F	C/F
	480	5.70	3	45 1/8 (1146.2)	14 (7)	BDNF45G13S5A	C/F	C/F	BDNF45G13S7A	C/F	C/F
240	7.20	3	55 5/8 (1412.9)	16 (8)	BDNF55R12S5A	C/F	C/F	BDNF55R12S7A	C/F	C/F	
<b>23 W/in<sup>2</sup> ⑧</b> <b>304 SS Plug 1-Alloy 800 Element</b> <b>(3.6 W/cm<sup>2</sup>)</b>	240	1.25	3	16 1/8 (409.6)	8 (4)	BDNF16G20S5A	C/F	C/F	BDNF16G20S7A	C/F	C/F
	240	1.65	3	19 1/8 (485.8)	9 (4)	BDNF19G20S5A	C/F	C/F	BDNF19G20S7A	C/F	C/F
	240	2.15	3	24 3/8 (619.1)	10 (5)	BDNF24L20S5A	C/F	C/F	BDNF24L20S7A	C/F	C/F
	480	2.15	3	24 3/8 (619.1)	10 (5)	BDNF24L19S5A	C/F	C/F	BDNF24L19S7A	C/F	C/F
	240	2.65	3	29 5/8 (752.5)	11 (5)	BDNF29R20S5A	C/F	C/F	BDNF29R20S7A	C/F	C/F
	480	2.65	3	29 5/8 (752.5)	11 (5)	BDNF29R19S5A	C/F	C/F	BDNF29R19S7A	C/F	C/F
	240	3.20	3	34 5/8 (879.5)	12 (6)	BDNF34R20S5A	C/F	C/F	BDNF34R20S7A	C/F	C/F
	480	3.20	3	34 5/8 (879.5)	12 (6)	BDNF34R19S5A	C/F	C/F	BDNF34R19S7A	C/F	C/F
	240	4.25	3	45 1/8 (1146.2)	14 (7)	BDNF45G20S5A	C/F	C/F	BDNF45G20S7A	C/F	C/F
	480	4.25	3	45 1/8 (1146.2)	14 (7)	BDNF45G19S5A	C/F	C/F	BDNF45G19S7A	C/F	C/F
	240	5.40	3	55 5/8 (1412.9)	16 (8)	BDNF55R20S5A	C/F	C/F	BDNF55R20S7A	C/F	C/F
	480	5.40	3	55 5/8 (1412.9)	16 (8)	BDNF55R19S5A	C/F	C/F	BDNF55R19S7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

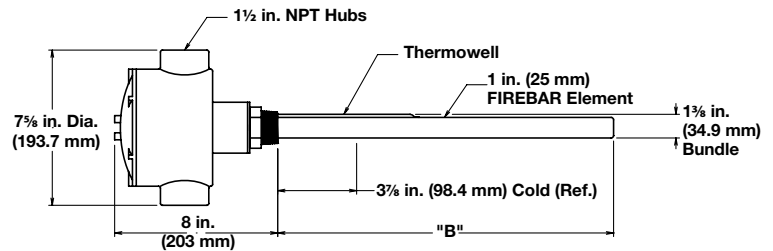
- ③ Wired for 3-phase operation only
- ⑧ Can be wired for 1-phase operation



## WATROD and FIREBAR Screw Plug Immersion Heaters

### Application: Lightweight Oils and Heat Transfer Oils

- 1 1/4 inch NPT screw plug
  - FIREBAR elements
  - With thermostat (DPST), Type 5A or 7A
- Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.
- Moisture/explosion-resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						Moisture/ Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/ Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C
<b>30 W/in<sup>2</sup> ③</b> <b>304 SS Plug</b> <b>1-Alloy 800</b> <b>Element</b> <b>(4.7 W/cm<sup>2</sup>)</b>	240	1.70	3	16 1/8 (409.6)	11 (5)	BDNF16G12C5A	C/F	C/F	BDNF16G12C7A	C/F	C/F
	480	1.70	3	16 1/8 (409.6)	11 (5)	BDNF16G13C5A	C/F	C/F	BDNF16G13C7A	C/F	C/F
	240	2.20	3	19 1/8 (485.8)	12 (6)	BDNF19G12C5A	C/F	C/F	BDNF19G12C7A	C/F	C/F
	480	2.20	3	19 1/8 (485.8)	12 (6)	BDNF19G13C5A	C/F	C/F	BDNF19G13C7A	C/F	C/F
	240	2.80	3	24 3/8 (619.1)	13 (6)	BDNF24L12C5A	C/F	C/F	BDNF24L12C7A	C/F	C/F
	480	2.80	3	24 3/8 (619.1)	13 (6)	BDNF24L13C5A	C/F	C/F	BDNF24L13C7A	C/F	C/F
	240	3.50	3	29 5/8 (752.5)	14 (7)	BDNF29R12C5A	C/F	C/F	BDNF29R12C7A	C/F	C/F
	480	3.50	3	29 5/8 (752.5)	14 (7)	BDNF29R13C5A	C/F	C/F	BDNF29R13C7A	C/F	C/F
	240	4.25	3	34 5/8 (879.5)	15 (7)	BDNF34R12C5A	C/F	C/F	BDNF34R12C7A	C/F	C/F
	480	4.25	3	34 5/8 (879.5)	15 (7)	BDNF34R13C5A	C/F	C/F	BDNF34R13C7A	C/F	C/F
	240	5.70	3	45 1/8 (1146.2)	17 (8)	BDNF45G12C5A	C/F	C/F	BDNF45G12C7A	C/F	C/F
	480	5.70	3	45 1/8 (1146.2)	17 (8)	BDNF45G13C5A	C/F	C/F	BDNF45G13C7A	C/F	C/F
240	7.20	3	55 5/8 (1412.9)	19 (9)	BDNF55R12C5A	C/F	C/F	BDNF55R12C7A	C/F	C/F	
<b>23 W/in<sup>2</sup> ⑧</b> <b>304 SS Plug</b> <b>1-Alloy 800</b> <b>Element</b> <b>(3.6 W/cm<sup>2</sup>)</b>	240	1.25	3	16 1/8 (409.6)	11 (5)	BDNF16G20C5A	C/F	C/F	BDNF16G20C7A	C/F	C/F
	240	1.65	3	19 1/8 (485.8)	12 (6)	BDNF19G20C5A	C/F	C/F	BDNF19G20C7A	C/F	C/F
	240	2.15	3	24 3/8 (619.1)	13 (6)	BDNF24L20C5A	C/F	C/F	BDNF24L20C7A	C/F	C/F
	480	2.15	3	24 3/8 (619.1)	13 (6)	BDNF24L19C5A	C/F	C/F	BDNF24L19C7A	C/F	C/F
	240	2.65	3	29 5/8 (752.5)	14 (7)	BDNF29R20C5A	C/F	C/F	BDNF29R20C7A	C/F	C/F
	480	2.65	3	29 5/8 (752.5)	14 (7)	BDNF29R19C5A	C/F	C/F	BDNF29R19C7A	C/F	C/F
	240	3.20	3	34 5/8 (879.5)	15 (7)	BDNF34R20C5A	C/F	C/F	BDNF34R20C7A	C/F	C/F
	480	3.20	3	34 5/8 (879.5)	15 (7)	BDNF34R19C5A	C/F	C/F	BDNF34R19C7A	C/F	C/F
	240	4.25	3	45 1/8 (1146.2)	17 (8)	BDNF45G20C5A	C/F	C/F	BDNF45G20C7A	C/F	C/F
	480	4.25	3	45 1/8 (1146.2)	17 (8)	BDNF45G19C5A	C/F	C/F	BDNF45G19C7A	C/F	C/F
	240	5.40	3	55 5/8 (1412.9)	19 (9)	BDNF55R20C5A	C/F	C/F	BDNF55R20C7A	C/F	C/F
	480	5.40	3	55 5/8 (1412.9)	19 (9)	BDNF55R19C5A	C/F	C/F	BDNF55R19C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

- ③ Wired for 3-phase operation only
- ⑤ No third party recognition
- ⑧ Can be wired for 1-phase operation

# Immersion Heaters

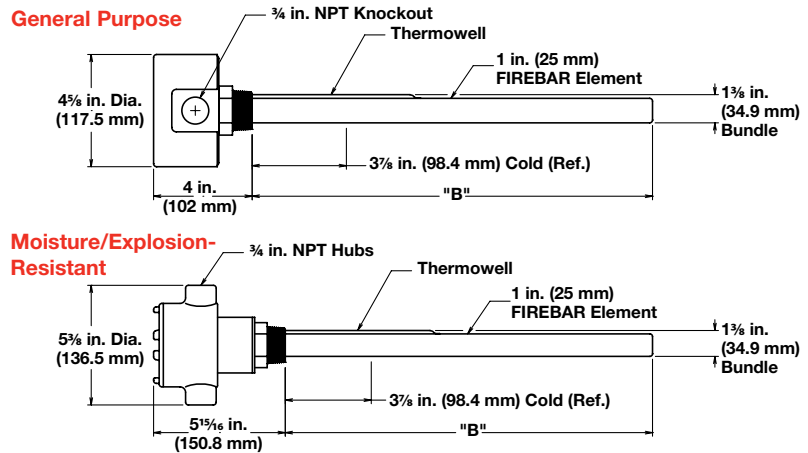


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Lightweight Oils and Heat Transfer Oils

- 1 1/4 inch NPT screw plug
- FIREBAR elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	General Purpose Enclosure		WATCONNECT Part Number		Moisture/Explosion-Resistant Enclosure		WATCONNECT Part Number	
					Part Number	Ship Wt. lbs (kg)	Type J T/C	Type K T/C	Part Number ⑤	Ship Wt. lbs (kg)	Type J T/C	Type K T/C
30 W/in <sup>2</sup> ③ 304 SS Plug 1-Alloy 800 Element (4.7 W/cm <sup>2</sup> )	240	1.70	3	16 <sup>1</sup> / <sub>8</sub> (409.6)	BDNF16G12S	7 (4)	C2-50	C2-92	BDNF16G12C	10 (5)	C3-94	C3-93
	480	1.70	3	16 <sup>1</sup> / <sub>8</sub> (409.6)	BDNF16G13S	7 (4)	C2-43	C2-35	BDNF16G13C	10 (5)	C3-116	C3-118
	240	2.20	3	19 <sup>1</sup> / <sub>8</sub> (485.8)	BDNF19G12S	8 (4)	C2-50	C2-92	BDNF19G12C	11 (5)	C3-94	C3-93
	480	2.20	3	19 <sup>1</sup> / <sub>8</sub> (485.8)	BDNF19G13S	8 (4)	C2-43	C2-35	BDNF19G13C	11 (5)	C3-116	C3-118
	240	2.80	3	24 <sup>3</sup> / <sub>8</sub> (619.1)	BDNF24L12S	9 (4)	C2-50	C2-92	BDNF24L12C	12 (6)	C3-94	C3-93
	480	2.80	3	24 <sup>3</sup> / <sub>8</sub> (619.1)	BDNF24L13S	9 (4)	C2-43	C2-35	BDNF24L13C	12 (6)	C3-116	C3-118
	240	3.50	3	29 <sup>5</sup> / <sub>8</sub> (752.5)	BDNF29R12S	10 (5)	C2-50	C2-92	BDNF29R12C	13 (6)	C3-94	C3-93
	480	3.50	3	29 <sup>5</sup> / <sub>8</sub> (752.5)	BDNF29R13S	10 (5)	C2-43	C2-35	BDNF29R13C	13 (6)	C3-116	C3-118
	240	4.25	3	34 <sup>5</sup> / <sub>8</sub> (879.5)	BDNF34R12S	11 (5)	C2-50	C2-92	BDNF34R12C	14 (7)	C3-94	C3-93
	480	4.25	3	34 <sup>5</sup> / <sub>8</sub> (879.5)	BDNF34R13S	11 (5)	C2-43	C2-35	BDNF34R13C	14 (7)	C3-116	C3-118
	240	5.70	3	45 <sup>1</sup> / <sub>8</sub> (1146.2)	BDNF45G12S	13 (6)	C2-50	C2-92	BDNF45G12C	16 (8)	C3-94	C3-93
	480	5.70	3	45 <sup>1</sup> / <sub>8</sub> (1146.2)	BDNF45G13S	13 (6)	C2-43	C2-35	BDNF45G13C	16 (8)	C3-116	C3-118
	240	7.20	3	55 <sup>5</sup> / <sub>8</sub> (1412.9)	BDNF55R12S	15 (7)	C2-50	C2-92	BDNF55R12C	18 (9)	C3-94	C3-93
	480	7.20	3	55 <sup>5</sup> / <sub>8</sub> (1412.9)	BDNF55R13S	15 (7)	C2-43	C2-35	BDNF55R13C	18 (9)	C3-116	C3-118
23 W/in <sup>2</sup> ⑧ 304 SS Plug 1-Alloy 800 Element (3.6 W/cm <sup>2</sup> )	240	1.25	3	16 <sup>1</sup> / <sub>8</sub> (409.6)	BDNF16G20S	7 (4)	C2-50	C2-92	BDNF16G20C	10 (5)	C3-94	C3-93
	240	1.65	3	19 <sup>1</sup> / <sub>8</sub> (485.8)	BDNF19G20S	8 (4)	C2-50	C2-92	BDNF19G20C	11 (5)	C3-94	C3-93
	240	2.15	3	24 <sup>3</sup> / <sub>8</sub> (619.1)	BDNF24L20S	9 (4)	C2-50	C2-92	BDNF24L20C	12 (6)	C3-94	C3-93
	480	2.15	3	24 <sup>3</sup> / <sub>8</sub> (619.1)	BDNF24L19S	9 (4)	C2-43	C2-35	BDNF24L19C	12 (6)	C3-116	C3-118
	240	2.65	3	29 <sup>5</sup> / <sub>8</sub> (752.5)	BDNF29R20S	10 (5)	C2-50	C2-92	BDNF29R20C	13 (6)	C3-94	C3-93
	480	2.65	3	29 <sup>5</sup> / <sub>8</sub> (752.5)	BDNF29R19S	10 (5)	C2-43	C2-35	BDNF29R19C	13 (6)	C3-116	C3-118
	240	3.20	3	34 <sup>5</sup> / <sub>8</sub> (879.5)	BDNF34R20S	11 (5)	C2-50	C2-92	BDNF34R20C	14 (7)	C3-94	C3-93
	480	3.20	3	34 <sup>5</sup> / <sub>8</sub> (879.5)	BDNF34R19S	11 (5)	C2-43	C2-35	BDNF34R19C	14 (7)	C3-116	C3-118
	240	4.25	3	45 <sup>1</sup> / <sub>8</sub> (1146.2)	BDNF45G20S	13 (6)	C2-50	C2-92	BDNF45G20C	16 (8)	C3-94	C3-93
	480	4.25	3	45 <sup>1</sup> / <sub>8</sub> (1146.2)	BDNF45G19S	13 (6)	C2-43	C2-35	BDNF45G19C	16 (8)	C3-116	C3-118
	240	5.40	3	55 <sup>5</sup> / <sub>8</sub> (1412.9)	BDNF55R20S	15 (7)	C2-50	C2-92	BDNF55R20C	18 (9)	C3-94	C3-93
	480	5.40	3	55 <sup>5</sup> / <sub>8</sub> (1412.9)	BDNF55R19S	15 (7)	C2-43	C2-35	BDNF55R19C	18 (9)	C3-116	C3-118

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

- ③ Wired for 3-phase operation only
- ⑤ No third party recognition
- ⑧ Can be wired for 1-phase operation



# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters

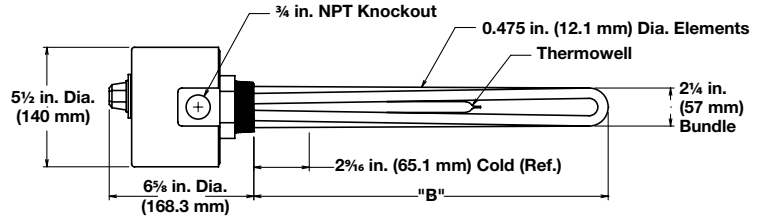


### Application: Lightweight Oils and Heat Transfer Oils

- 2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- General purpose enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ④ Steel Plug 2-Steel Elements (3.6 W/cm <sup>2</sup> )	120/240	1.0	1	9 1/2 (241)	5 (3)	BGS79J6S4	C/F	C/F	BGS79J6S5A	C/F	C/F	BGS79J6S7A	C/F	C/F
	240/480	1.0	1	9 1/2 (241)	5 (3)	BGS79J7S4	C/F	C/F	BGS79J7S5A	C/F	C/F	BGS79J7S7A	C/F	C/F
	120/240	1.5	1	13 1/2 (343)	6 (3)	BGS713J6S4	C/F	C/F	BGS713J6S5A	C/F	C/F	BGS713J6S7A	C/F	C/F
	240/480	1.5	1	13 1/2 (343)	6 (3)	BGS713J7S4	C/F	C/F	BGS713J7S5A	C/F	C/F	BGS713J7S7A	C/F	C/F
	120/240	2.0	1	17 1/2 (445)	7 (4)	BGS717J6S4	C/F	C/F	BGS717J6S5A	C/F	C/F	BGS717J6S7A	C/F	C/F
	240/480	2.0	1	17 1/2 (445)	7 (4)	BGS717J7S4	C/F	C/F	BGS717J7S5A	C/F	C/F	BGS717J7S7A	C/F	C/F
	120/240	2.5	1	20 1/2 (521)	8 (4)	BGS720J6S4	C/F	C/F	BGS720J6S5A	C/F	C/F	BGS720J6S7A	C/F	C/F
	240/480	2.5	1	20 1/2 (521)	8 (4)	BGS720J7S4	C/F	C/F	BGS720J7S5A	C/F	C/F	BGS720J7S7A	C/F	C/F
	120/240	3.0	1	25 (635)	8 (4)	BGS725A6S4	C/F	C/F	BGS725A6S5A	C/F	C/F	BGS725A6S7A	C/F	C/F
	240/480	3.0	1	25 (635)	8 (4)	BGS725A7S4	C/F	C/F	BGS725A7S5A	C/F	C/F	BGS725A7S7A	C/F	C/F
	120/240	4.0	1	32 1/2 (826)	9 (4)	BGS732J6S4	C/F	C/F	BGS732J6S5A	C/F	C/F	BGS732J6S7A	C/F	C/F
	120/240	5.0	1	40 (1016)	10 (5)	BGS740A6S4	C/F	C/F	BGS740A6S5A	C/F	C/F	BGS740A6S7A	C/F	C/F
23 W/in <sup>2</sup> Steel Plug 3-Steel Elements (3.6 W/cm <sup>2</sup> )	120	1.5	1	9 1/2 (241)	6 (3)	BHS79J1S4	C/F	C/F	BHS79J1S5A	C/F	C/F	BHS79J1S7A	C/F	C/F
	240	1.5	3	9 1/2 (241)	6 (3)	BHS79J3S4	C/F	C/F	BHS79J3S5A	C/F	C/F	BHS79J3S7A	C/F	C/F
	480	1.5	3	9 1/2 (241)	6 (3)	BHS79J13S4	C/F	C/F	BHS79J13S5A	C/F	C/F	BHS79J13S7A	C/F	C/F
	240	3.0	3	17 1/2 (445)	8 (4)	BHS717J3S4	C/F	C/F	BHS717J3S5A	C/F	C/F	BHS717J3S7A	C/F	C/F
	480	3.0	3	17 1/2 (445)	8 (4)	BHS717J5S4	C/F	C/F	BHS717J5S5A	C/F	C/F	BHS717J5S7A	C/F	C/F
	240	4.5	3	25 (635)	10 (5)	BHS725A3S4	C/F	C/F	BHS725A3S5A	C/F	C/F	BHS725A3S7A	C/F	C/F
	480	4.5	3	25 (635)	10 (5)	BHS725A5S4	C/F	C/F	BHS725A5S5A	C/F	C/F	BHS725A5S7A	C/F	C/F
	240	6.0	3	32 1/2 (826)	13 (6)	BHS732J3S4	C/F	C/F	BHS732J3S5A	C/F	C/F	BHS732J3S7A	C/F	C/F
	480	6.0	3	32 1/2 (826)	13 (6)	BHS732J5S4	C/F	C/F	BHS732J5S5A	C/F	C/F	BHS732J5S7A	C/F	C/F
	240	7.5	3	40 (1016)	14 (7)	BHS740A3S4	C/F	C/F	BHS740A3S5A	C/F	C/F	BHS740A3S7A	C/F	C/F
	480	7.5	3	40 (1016)	14 (7)	BHS740A5S4	C/F	C/F	BHS740A5S5A	C/F	C/F	BHS740A5S7A	C/F	C/F
	240	9.0	3	47 1/2 (1207)	14 (7)	BHS747J3S4	C/F	C/F	BHS747J3S5A	C/F	C/F	BHS747J3S7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

④ Wired for higher voltage



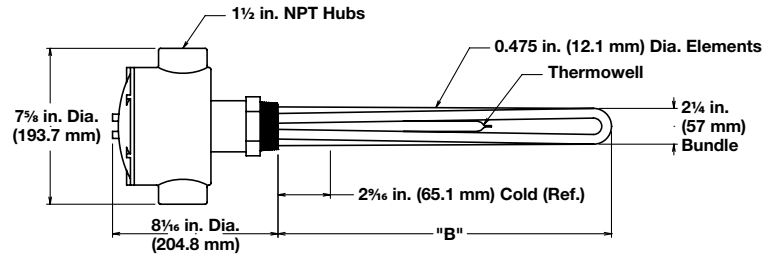
## WATROD and FIREBAR Screw Plug Immersion Heaters

### Application: Lightweight Oils and Heat Transfer Oils

- 2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- Moisture/explosion-resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)				Type 5A (60 to 250°F)				Type 7A (100 to 550°F)			
						Part Number		WATCONNECT Part Number		Part Number		WATCONNECT Part Number		Part Number		WATCONNECT Part Number	
						Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C	Type K T/C
<b>23 W/in<sup>2</sup> ④ Steel Plug 2-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	120/240	1.0	1	9 1/2 (241)	8 (4)	BGS79J6C4	C/F	C/F	BGS79J6C5A	C/F	C/F	BGS79J6C7A	C/F	C/F			
	240/480	1.0	1	9 1/2 (241)	8 (4)	BGS79J7C4	C/F	C/F	BGS79J7C5A	C/F	C/F	BGS79J7C7A	C/F	C/F			
	120/240	1.5	1	13 1/2 (343)	9 (4)	BGS713J6C4	C/F	C/F	BGS713J6C5A	C/F	C/F	BGS713J6C7A	C/F	C/F			
	240/480	1.5	1	13 1/2 (343)	9 (4)	BGS713J7C4	C/F	C/F	BGS713J7C5A	C/F	C/F	BGS713J7C7A	C/F	C/F			
	120/240	2.0	1	17 1/2 (445)	10 (5)	BGS717J6C4	C/F	C/F	BGS717J6C5A	C/F	C/F	BGS717J6C7A	C/F	C/F			
	240/480	2.0	1	17 1/2 (445)	10 (5)	BGS717J7C4	C/F	C/F	BGS717J7C5A	C/F	C/F	BGS717J7C7A	C/F	C/F			
	120/240	2.5	1	20 1/2 (521)	11 (5)	BGS720J6C4	C/F	C/F	BGS720J6C5A	C/F	C/F	BGS720J6C7A	C/F	C/F			
	240/480	2.5	1	20 1/2 (521)	11 (5)	BGS720J7C4	C/F	C/F	BGS720J7C5A	C/F	C/F	BGS720J7C7A	C/F	C/F			
	120/240	3.0	1	25 (635)	11 (5)	BGS725A6C4	C/F	C/F	BGS725A6C5A	C/F	C/F	BGS725A6C7A	C/F	C/F			
	240/480	3.0	1	25 (635)	11 (5)	BGS725A7C4	C/F	C/F	BGS725A7C5A	C/F	C/F	BGS725A7C7A	C/F	C/F			
	120/240	4.0	1	32 1/2 (826)	12 (6)	BGS732J6C4	C/F	C/F	BGS732J6C5A	C/F	C/F	BGS732J6C7A	C/F	C/F			
	120/240	5.0	1	40 (1016)	13 (6)	BGS740A6C4	C/F	C/F	BGS740A6C5A	C/F	C/F	BGS740A6C7A	C/F	C/F			
<b>23 W/in<sup>2</sup> Steel Plug 3-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	120	1.5	1	9 1/2 (241)	9 (4)	BHS79J1C4	C/F	C/F	BHS79J1C5A	C/F	C/F	BHS79J1C7A	C/F	C/F			
	240	1.5	3	9 1/2 (241)	9 (4)	BHS79J3C4	C/F	C/F	BHS79J3C5A	C/F	C/F	BHS79J3C7A	C/F	C/F			
	480	1.5	3	9 1/2 (241)	9 (4)	BHS79J13C4	C/F	C/F	BHS79J13C5A	C/F	C/F	BHS79J13C7A	C/F	C/F			
	240	3.0	3	17 1/2 (445)	11 (5)	BHS717J3C4	C/F	C/F	BHS717J3C5A	C/F	C/F	BHS717J3C7A	C/F	C/F			
	480	3.0	3	17 1/2 (445)	11 (5)	BHS717J5C4	C/F	C/F	BHS717J5C5A	C/F	C/F	BHS717J5C7A	C/F	C/F			
	240	4.5	3	25 (635)	13 (6)	BHS725A3C4	C/F	C/F	BHS725A3C5A	C/F	C/F	BHS725A3C7A	C/F	C/F			
	480	4.5	3	25 (635)	13 (6)	BHS725A5C4	C/F	C/F	BHS725A5C5A	C/F	C/F	BHS725A5C7A	C/F	C/F			
	240	6.0	3	32 1/2 (826)	16 (8)	BHS732J3C4	C/F	C/F	BHS732J3C5A	C/F	C/F	BHS732J3C7A	C/F	C/F			
	480	6.0	3	32 1/2 (826)	16 (8)	BHS732J5C4	C/F	C/F	BHS732J5C5A	C/F	C/F	BHS732J5C7A	C/F	C/F			
	240	7.5	3	40 (1016)	17 (8)	BHS740A3C4	C/F	C/F	BHS740A3C5A	C/F	C/F	BHS740A3C7A	C/F	C/F			
	480	7.5	3	40 (1016)	17 (8)	BHS740A5C4	C/F	C/F	BHS740A5C5A	C/F	C/F	BHS740A5C7A	C/F	C/F			
	240	9.0	3	47 1/2 (1207)	17 (8)	BHS747J3C4	C/F	C/F	BHS747J3C5A	C/F	C/F	BHS747J3C7A	C/F	C/F			

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

④ Wired for higher voltage

⑤ No third party recognition

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters

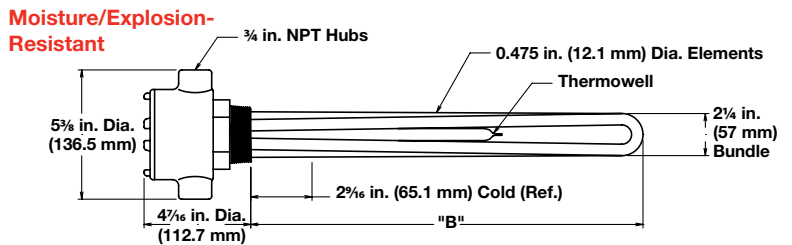
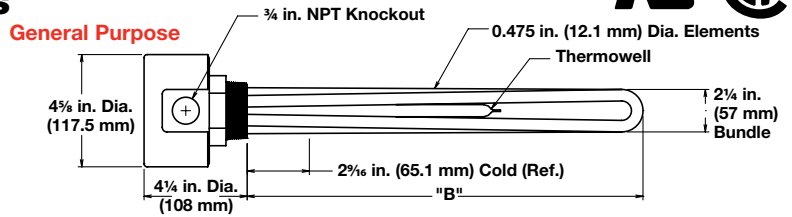


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Lightweight Oils and Heat Transfer Oils

- 2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT		240V WATCONNECT		480V WATCONNECT	
							Type J T/C	Type K T/C	Type J T/C	Type K T/C	Type J T/C	Type K T/C
							<b>General Purpose Enclosure</b>					
<b>23 W/in<sup>2</sup> ④ Steel Plug 2-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	120/240	1.0	1	9 1/2 (241)	<b>BGS79J6S</b>	4 (2)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>N/A</b>	<b>N/A</b>
	240/480	1.0	1	9 1/2 (241)	<b>BGS79J7S</b>	4 (2)	<b>N/A</b>	<b>N/A</b>	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	1.5	1	13 1/2 (343)	<b>BGS713J6S</b>	5 (3)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>N/A</b>	<b>N/A</b>
	240/480	1.5	1	13 1/2 (343)	<b>BGS713J7S</b>	5 (3)	<b>N/A</b>	<b>N/A</b>	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	2.0	1	17 1/2 (445)	<b>BGS717J6S</b>	6 (3)	<b>C1-15</b>	<b>C1-12</b>	<b>C1-17</b>	<b>C1-13</b>	<b>N/A</b>	<b>N/A</b>
	240/480	2.0	1	17 1/2 (445)	<b>BGS717J7S</b>	6 (3)	<b>N/A</b>	<b>N/A</b>	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	2.5	1	20 1/2 (521)	<b>BGS720J6S</b>	7 (4)	<b>C/F</b>	<b>C/F</b>	<b>C1-17</b>	<b>C1-13</b>	<b>N/A</b>	<b>N/A</b>
	240/480	2.5	1	20 1/2 (521)	<b>BGS720J7S</b>	7 (4)	<b>N/A</b>	<b>N/A</b>	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	3.0	1	25 (635)	<b>BGS725A6S</b>	7 (4)	<b>C/F</b>	<b>C/F</b>	<b>C1-17</b>	<b>C1-13</b>	<b>N/A</b>	<b>N/A</b>
	240/480	3.0	1	25 (635)	<b>BGS725A7S</b>	7 (4)	<b>N/A</b>	<b>N/A</b>	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	4.0	1	32 1/2 (826)	<b>BGS732J6S</b>	8 (4)	<b>C/F</b>	<b>C/F</b>	<b>C1-17</b>	<b>C1-13</b>	<b>N/A</b>	<b>N/A</b>
	240/480	4.0	1	32 1/2 (826)	<b>BGS732J7S</b>	8 (4)	<b>N/A</b>	<b>N/A</b>	<b>C1-17</b>	<b>C1-13</b>	<b>C/F</b>	<b>C/F</b>
	120/240	5.0	1	40 (1016)	<b>BGS740A6S</b>	9 (4)	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>N/A</b>	<b>N/A</b>
	240/480	5.0	1	40 (1016)	<b>BGS740A7S</b>	9 (4)	<b>N/A</b>	<b>N/A</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>
	240/480	6.0	1	47 1/2 (1207)	<b>BGS747J7S</b>	10 (5)	<b>N/A</b>	<b>N/A</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>	<b>C/F</b>
<b>23 W/in<sup>2</sup> Steel Plug 3-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	120	1.5	1	9 1/2 (241)	<b>BHS79J1S</b>	5 (3)	<b>C1-15</b>	<b>C1-12</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
	240	1.5	3	9 1/2 (241)	<b>BHS79J3S</b>	5 (3)	<b>N/A</b>	<b>N/A</b>	<b>C2-50</b>	<b>C2-92</b>	<b>N/A</b>	<b>N/A</b>
	480	1.5	3	9 1/2 (241)	<b>BHS79J13S</b>	5 (3)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
	120	3.0	1	17 1/2 (445)	<b>BHS717J1S</b>	7 (4)	<b>C/F</b>	<b>C/F</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
	240	3.0	3	17 1/2 (445)	<b>BHS717J3S</b>	7 (4)	<b>N/A</b>	<b>N/A</b>	<b>C2-50</b>	<b>C2-92</b>	<b>N/A</b>	<b>N/A</b>
	480	3.0	3	17 1/2 (445)	<b>BHS717J5S</b>	7 (4)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
	120	4.5	1	25 (635)	<b>BHS725A1S</b>	9 (4)	<b>C/F</b>	<b>C/F</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>
	240	4.5	3	25 (635)	<b>BHS725A3S</b>	9 (4)	<b>N/A</b>	<b>N/A</b>	<b>C2-50</b>	<b>C2-92</b>	<b>N/A</b>	<b>N/A</b>
	480	4.5	3	25 (635)	<b>BHS725A5S</b>	9 (4)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
	240	6.0	3	32 1/2 (826)	<b>BHS732J3S</b>	12 (6)	<b>N/A</b>	<b>N/A</b>	<b>C2-50</b>	<b>C2-92</b>	<b>N/A</b>	<b>N/A</b>
	480	6.0	3	32 1/2 (826)	<b>BHS732J5S</b>	12 (6)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
	240	7.5	3	40 (1016)	<b>BHS740A3S</b>	13 (6)	<b>N/A</b>	<b>N/A</b>	<b>C2-50</b>	<b>C2-92</b>	<b>N/A</b>	<b>N/A</b>
	480	7.5	3	40 (1016)	<b>BHS740A5S</b>	13 (6)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
	240	9.0	3	47 1/2 (1207)	<b>BHS747J3S</b>	13 (6)	<b>N/A</b>	<b>N/A</b>	<b>C2-50</b>	<b>C2-92</b>	<b>N/A</b>	<b>N/A</b>
	480	9.0	3	47 1/2 (1207)	<b>BHS747J5S</b>	13 (6)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>
240	12.5	3	64 (1626)	<b>BHS764A3S</b>	17 (8)	<b>N/A</b>	<b>N/A</b>	<b>C2-236</b>	<b>C2-214</b>	<b>N/A</b>	<b>N/A</b>	
480	12.5	3	64 (1626)	<b>BHS764A5S</b>	17 (8)	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>C2-43</b>	<b>C2-35</b>	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)  
N/A - Not available

- ④ Wired for higher voltage
- ⑤ No third party recognition

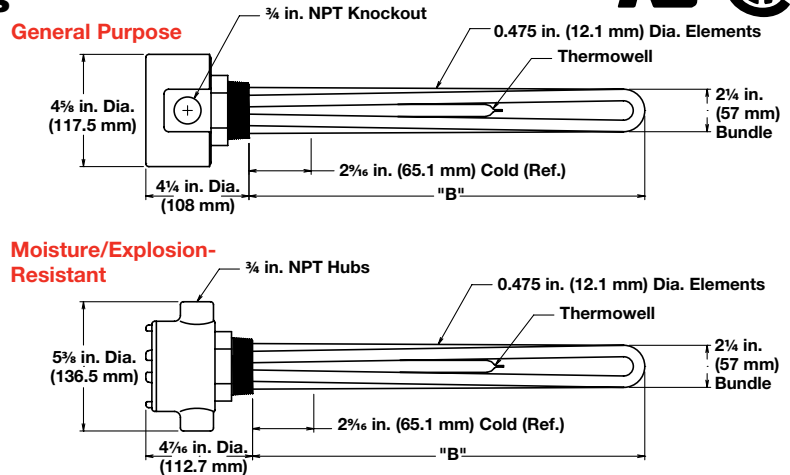
# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters

### Application: Lightweight Oils and Heat Transfer Oils

- 2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT		240V WATCONNECT		480V WATCONNECT	
							Part Number	Part Number	Part Number	Part Number	Part Number	Part Number
					<b>Moisture/Explosion-Resistant Enclosures</b>		Type J T/C	Type K T/C	Type J T/C	Type K T/C	Type J T/C	Type K T/C
<b>23 W/in<sup>2</sup> ④ Steel Plug 2-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	120/240	1.0	1	9 1/2 (241)	BGS79J6C	7 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	1.0	1	9 1/2 (241)	BGS79J7C	7 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	1.5	1	13 1/2 (343)	BGS713J6C	8 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	1.5	1	13 1/2 (343)	BGS713J7C	8 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	2.0	1	17 1/2 (445)	BGS717J6C	9 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	2.0	1	17 1/2 (445)	BGS717J7C	9 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	2.5	1	20 1/2 (521)	BGS720J6C	10 (5)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	2.5	1	20 1/2 (521)	BGS720J7C	10 (5)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	3.0	1	25 (635)	BGS725A6C	10 (5)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	3.0	1	25 (635)	BGS725A7C	10 (5)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	4.0	1	32 1/2 (826)	BGS732J6C	11 (5)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	4.0	1	32 1/2 (826)	BGS732J7C	11 (5)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	5.0	1	40 (1016)	BGS740A6C	12 (6)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	5.0	1	40 (1016)	BGS740A7C	12 (6)	N/A	N/A	C/F	C/F	C/F	C/F
240/480	6.0	1	47 1/2 (1207)	BGS747J7C	13 (6)	N/A	N/A	C/F	C/F	C/F	C/F	
<b>23 W/in<sup>2</sup> Steel Plug 3-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	120	1.5	1	9 1/2 (241)	BHS79J1C	8 (4)	C/F	C/F	N/A	N/A	N/A	N/A
	240	1.5	3	9 1/2 (241)	BHS79J3C	8 (4)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	1.5	3	9 1/2 (241)	BHS79J13C	8 (4)	N/A	N/A	N/A	N/A	C3-116	C3-118
	120	3.0	1	17 1/2 (445)	BHS717J1C	10 (5)	C/F	C/F	N/A	N/A	N/A	N/A
	240	3.0	3	17 1/2 (445)	BHS717J3C	10 (5)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	3.0	3	17 1/2 (445)	BHS717J5C	10 (5)	N/A	N/A	N/A	N/A	C3-116	C3-118
	120	4.5	1	25 (635)	BHS725A1C	12 (6)	C/F	C/F	N/A	N/A	N/A	N/A
	240	4.5	3	25 (635)	BHS725A3C	12 (6)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	4.5	3	25 (635)	BHS725A5C	12 (6)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	6.0	3	32 1/2 (826)	BHS732J3C	15 (7)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	6.0	3	32 1/2 (826)	BHS732J5C	15 (7)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	7.5	3	40 (1016)	BHS740A3C	16 (8)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	7.5	3	40 (1016)	BHS740A5C	16 (8)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	9.0	3	47 1/2 (1207)	BHS747J3C	16 (8)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	9.0	3	47 1/2 (1207)	BHS747J5C	16 (8)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	12.5	3	64 (1626)	BHS764A3C	20 (9)	N/A	N/A	C3-114	C3-115	N/A	N/A
480	12.5	3	64 (1626)	BHS764A5C	20 (9)	N/A	N/A	N/A	N/A	C3-116	C3-118	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)  
N/A - Not available

- ④ Wired for higher voltage
- ⑤ No third party recognition

# Immersion Heaters



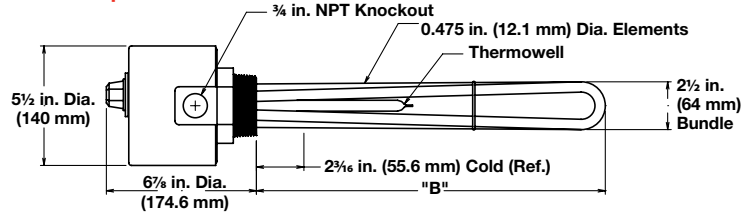
## WATROD and FIREBAR Screw Plug Immersion Heaters



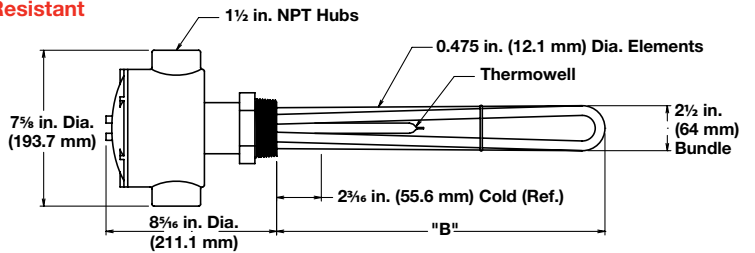
### Application: Lightweight Oils and Heat Transfer Oils

- 2 1/2 inch NPT screw plug
  - WATROD elements
  - With thermostat (DPST), Type 4, 5A or 7A
- Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.
- General purpose enclosure
  - Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ® Steel Plug 3-Steel Elements (3.6 Wcm <sup>2</sup> )	240	3.0	3	17 1/4 (438)	10 (5)	BLS717E3S4	C/F	C/F	BLS717E3S5A	C/F	C/F	BLS717E3S7A	C/F	C/F
	480	3.0	3	17 1/4 (438)	10 (5)	BLS717E5S4	C/F	C/F	BLS717E5S5A	C/F	C/F	BLS717E5S7A	C/F	C/F
	240	4.5	3	24 3/4 (629)	13 (6)	BLS724N3S4	C/F	C/F	BLS724N3S5A	C/F	C/F	BLS724N3S7A	C/F	C/F
	480	4.5	3	24 3/4 (629)	13 (6)	BLS724N5S4	C/F	C/F	BLS724N5S5A	C/F	C/F	BLS724N5S7A	C/F	C/F
	240	6.0	3	32 1/4 (819)	15 (7)	BLS732E3S4	C/F	C/F	BLS732E3S5A	C/F	C/F	BLS732E3S7A	C/F	C/F
	480	6.0	3	32 1/4 (819)	15 (7)	BLS732E5S4	C/F	C/F	BLS732E5S5A	C/F	C/F	BLS732E5S7A	C/F	C/F
	240	7.5	3	39 3/4 (1010)	16 (8)	BLS739N3S4	C/F	C/F	BLS739N3S5A	C/F	C/F	BLS739N3S7A	C/F	C/F
	480	7.5	3	39 3/4 (1010)	16 (8)	BLS739N5S4	C/F	C/F	BLS739N5S5A	C/F	C/F	BLS739N5S7A	C/F	C/F
240	9.0	3	47 1/4 (1200)	18 (9)	BLS747E3S4	C/F	C/F	BLS747E3S5A	C/F	C/F	BLS747E3S7A	C/F	C/F	
						Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ® Steel Plug 3-Steel Elements (3.6 Wcm <sup>2</sup> )	240	3.0	3	17 1/4 (438)	13 (6)	BLS717E3C4	C/F	C/F	BLS717E3C5A	C/F	C/F	BLS717E3C7A	C/F	C/F
	480	3.0	3	17 1/4 (438)	13 (6)	BLS717E5C4	C/F	C/F	BLS717E5C5A	C/F	C/F	BLS717E5C7A	C/F	C/F
	240	4.5	3	24 3/4 (629)	16 (8)	BLS724N3C4	C/F	C/F	BLS724N3C5A	C/F	C/F	BLS724N3C7A	C/F	C/F
	480	4.5	3	24 3/4 (629)	16 (8)	BLS724N5C4	C/F	C/F	BLS724N5C5A	C/F	C/F	BLS724N5C7A	C/F	C/F
	240	6.0	3	32 1/4 (819)	18 (9)	BLS732E3C4	C/F	C/F	BLS732E3C5A	C/F	C/F	BLS732E3C7A	C/F	C/F
	480	6.0	3	32 1/4 (819)	18 (9)	BLS732E5C4	C/F	C/F	BLS732E5C5A	C/F	C/F	BLS732E5C7A	C/F	C/F
	240	7.5	3	39 3/4 (1010)	19 (9)	BLS739N3C4	C/F	C/F	BLS739N3C5A	C/F	C/F	BLS739N3C7A	C/F	C/F
	480	7.5	3	39 3/4 (1010)	19 (9)	BLS739N5C4	C/F	C/F	BLS739N5C5A	C/F	C/F	BLS739N5C7A	C/F	C/F
240	9.0	3	47 1/4 (1200)	21 (10)	BLS747E3C4	C/F	C/F	BLS747E3C5A	C/F	C/F	BLS747E3C7A	C/F	C/F	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

⑤ No third party recognition

⑥ Can be rewired to produce 1/3 of original kW and watt density (3-phase only)

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



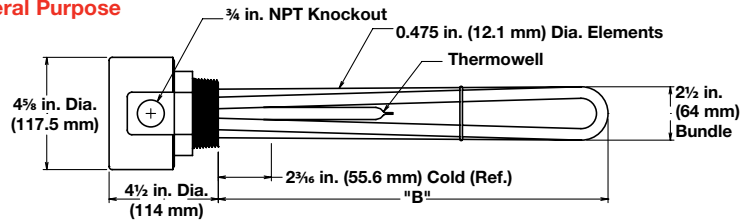
## WATROD and FIREBAR Screw Plug Immersion Heaters



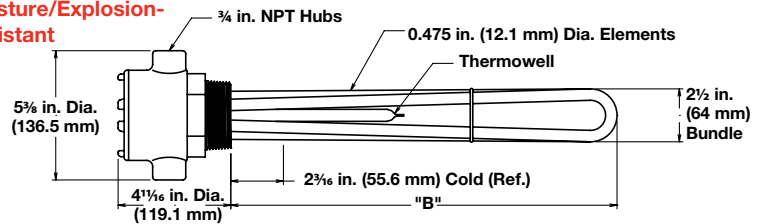
### Application: Lightweight Oils and Heat Transfer Oils

- 2 1/2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Moisture /Explosion- Resistant Enclosure	Type J T/C
23 W/in <sup>2</sup> ⑥ Steel Plug 3-Steel Elements (3.6 Wcm <sup>2</sup> )	120	3.0	1	17 1/4 (438)	<b>BLS717E1S</b>	9 (4)	C/F	C/F	<b>BLS717E1C</b>	12 (6)	C/F	C/F
	240	3.0	3	17 1/4 (438)	<b>BLS717E3S</b>	9 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS717E3C</b>	12 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	3.0	3	17 1/4 (438)	<b>BLS717E5S</b>	9 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS717E5C</b>	12 (6)	<b>C3-116</b>	<b>C3-118</b>
	120	4.5	1	24 3/4 (629)	<b>BLS724N1S</b>	12 (6)	C/F	C/F	<b>BLS724N1C</b>	15 (7)	C/F	C/F
	240	4.5	3	24 3/4 (629)	<b>BLS724N3S</b>	12 (6)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS724N3C</b>	15 (7)	<b>C3-94</b>	<b>C3-93</b>
	480	4.5	3	24 3/4 (629)	<b>BLS724N5S</b>	12 (6)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS724N5C</b>	15 (7)	<b>C3-116</b>	<b>C3-118</b>
	240	6.0	3	32 1/4 (819)	<b>BLS732E3S</b>	14 (7)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS732E3C</b>	17 (8)	<b>C3-94</b>	<b>C3-93</b>
	480	6.0	3	32 1/4 (819)	<b>BLS732E5S</b>	14 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS732E5C</b>	17 (8)	<b>C3-116</b>	<b>C3-118</b>
	240	7.5	3	39 3/4 (1010)	<b>BLS739N3S</b>	15 (7)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS739N3C</b>	18 (9)	<b>C3-94</b>	<b>C3-93</b>
	480	7.5	3	39 3/4 (1010)	<b>BLS739N5S</b>	15 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS739N5C</b>	18 (9)	<b>C3-116</b>	<b>C3-118</b>
	240	9.0	3	47 1/4 (1200)	<b>BLS747E3S</b>	17 (8)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS747E3C</b>	20 (9)	<b>C3-94</b>	<b>C3-93</b>
	480	9.0	3	47 1/4 (1200)	<b>BLS747E5S</b>	17 (8)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS747E5C</b>	20 (9)	<b>C3-116</b>	<b>C3-118</b>
	240	12.5	3	63 3/4 (1619)	<b>BLS763N3S</b>	20 (9)	<b>C2-236</b>	<b>C2-214</b>	<b>BLS763N3C</b>	23 (11)	<b>C3-114</b>	<b>C3-115</b>
	480	12.5	3	63 3/4 (1619)	<b>BLS763N5S</b>	20 (9)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS763N5C</b>	23 (11)	<b>C3-116</b>	<b>C3-118</b>
	240	15.0	3	76 1/4 (1937)	<b>BLS776E3S</b>	23 (11)	<b>C2-236</b>	<b>C2-214</b>	<b>BLS776E3C</b>	26 (12)	<b>C3-114</b>	<b>C3-115</b>
	480	15.0	3	76 1/4 (1937)	<b>BLS776E5S</b>	23 (11)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS776E5C</b>	26 (12)	<b>C3-116</b>	<b>C3-118</b>

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

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⑤ No third party recognition

⑥ Can be rewired to produce 1/3 of original kW and watt density (3-phase only)

# Immersion Heaters



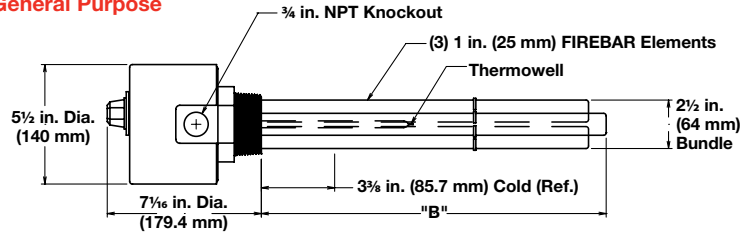
## WATROD and FIREBAR Screw Plug Immersion Heaters



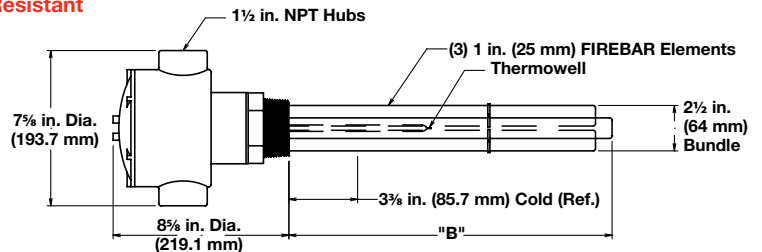
### Application: Lightweight Oils and Heat Transfer Oils

- 2 1/2 inch NPT screw plug
  - FIREBAR elements
  - With thermostat (DPST), Type 5A or 7A
- Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.
- General purpose enclosure
  - Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure
30 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (4.7 W/cm <sup>2</sup> )	240	5.0	3	15 1/8 (384.2)	12 (6)	BLNF15C12S5A	C/F	C/F	BLNF15C12S7A	C/F	C/F
	480	5.0	3	15 1/8 (384.2)	12 (6)	BLNF15C13S5A	C/F	C/F	BLNF15C13S7A	C/F	C/F
	240	6.5	3	18 1/8 (460.4)	13 (6)	BLNF18C12S5A	C/F	C/F	BLNF18C12S7A	C/F	C/F
	480	6.5	3	18 1/8 (460.4)	13 (6)	BLNF18C13S5A	C/F	C/F	BLNF18C13S7A	C/F	C/F
	240	8.5	3	23 1/8 (587.4)	15 (7)	BLNF23C12S5A	C/F	C/F	BLNF23C12S7A	C/F	C/F
23 W/in <sup>2</sup> ⑧ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	3.8	3	15 1/8 (384.2)	12 (6)	BLNF15C20S5A	C/F	C/F	BLNF15C20S7A	C/F	C/F
	240	4.9	3	18 1/8 (460.4)	13 (6)	BLNF18C20S5A	C/F	C/F	BLNF18C20S7A	C/F	C/F
	240	6.4	3	23 1/8 (587.4)	15 (7)	BLNF23C20S5A	C/F	C/F	BLNF23C20S7A	C/F	C/F
	480	6.4	3	23 1/8 (587.4)	15 (7)	BLNF23C19S5A	C/F	C/F	BLNF23C19S7A	C/F	C/F
	240	7.9	3	28 5/8 (727.1)	18 (9)	BLNF28L20S5A	C/F	C/F	BLNF28L20S7A	C/F	C/F
	240	9.6	3	33 5/8 (854.1)	19 (9)	BLNF33L20S5A	C/F	C/F	BLNF33L20S7A	C/F	C/F
						Moisture/ Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/ Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C
30 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (4.7 W/cm <sup>2</sup> )	240	5.0	3	15 1/8 (384.2)	14 (7)	BLNF15C12C5A	C/F	C/F	BLNF15C12C7A	C/F	C/F
	480	5.0	3	15 1/8 (384.2)	14 (7)	BLNF15C13C5A	C/F	C/F	BLNF15C13C7A	C/F	C/F
	240	6.5	3	18 1/8 (460.4)	16 (8)	BLNF18C12C5A	C/F	C/F	BLNF18C12C7A	C/F	C/F
	480	6.5	3	18 1/8 (460.4)	16 (8)	BLNF18C13C5A	C/F	C/F	BLNF18C13C7A	C/F	C/F
	240	8.5	3	23 1/8 (587.4)	18 (9)	BLNF23C12C5A	C/F	C/F	BLNF23C12C7A	C/F	C/F
23 W/in <sup>2</sup> ⑧ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	3.8	3	15 1/8 (384.2)	14 (7)	BLNF15C20C5A	C/F	C/F	BLNF15C20C7A	C/F	C/F
	240	4.9	3	18 1/8 (460.4)	16 (8)	BLNF18C20C5A	C/F	C/F	BLNF18C20C7A	C/F	C/F
	240	6.4	3	23 1/8 (587.4)	18 (9)	BLNF23C20C5A	C/F	C/F	BLNF23C20C7A	C/F	C/F
	480	6.4	3	23 1/8 (587.4)	18 (9)	BLNF23C19C5A	C/F	C/F	BLNF23C19C7A	C/F	C/F
	240	7.9	3	28 5/8 (727.1)	21 (10)	BLNF28L20C5A	C/F	C/F	BLNF28L20C7A	C/F	C/F
	240	9.6	3	33 5/8 (854.1)	22 (10)	BLNF33L20C5A	C/F	C/F	BLNF33L20C7A	C/F	C/F

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# Immersion Heaters



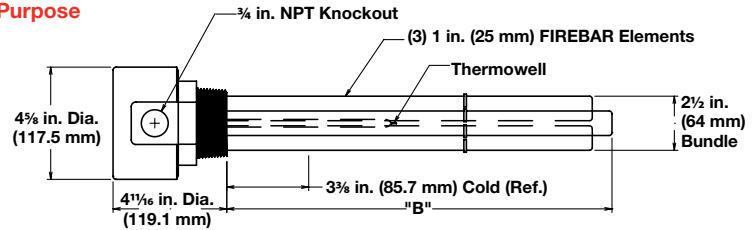
## WATROD and FIREBAR Screw Plug Immersion Heaters



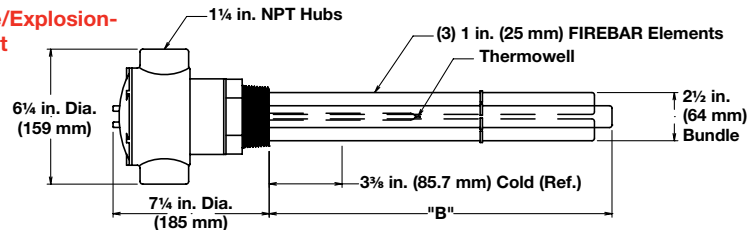
### Application: Lightweight Oils and Heat Transfer Oils

- 2 1/2 inch NPT screw plug
- FIREBAR elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Type J T/C	Type K T/C
<b>30 W/in<sup>2</sup> ③</b> <b>304 SS Plug</b> <b>3-Alloy 800</b> <b>Elements</b> <b>(4.7 W/cm<sup>2</sup>)</b>	240	5.0	3	15 1/8 (384.2)	<b>BLNF15C12S</b>	11 (5)	<b>C2-50</b>	<b>C2-92</b>	<b>BLNF15C12C</b>	14 (7)	<b>C3-94</b>	<b>C3-93</b>
	480	5.0	3	15 1/8 (384.2)	<b>BLNF15C13S</b>	11 (5)	<b>C2-43</b>	<b>C2-35</b>	<b>BLNF15C13C</b>	14 (7)	<b>C3-116</b>	<b>C3-118</b>
	240	6.5	3	18 1/8 (460.4)	<b>BLNF18C12S</b>	12 (6)	<b>C2-50</b>	<b>C2-92</b>	<b>BLNF18C12C</b>	15 (7)	<b>C3-94</b>	<b>C3-93</b>
	480	6.5	3	18 1/8 (460.4)	<b>BLNF18C13S</b>	12 (6)	<b>C2-43</b>	<b>C2-35</b>	<b>BLNF18C13C</b>	15 (7)	<b>C3-116</b>	<b>C3-118</b>
	240	8.5	3	23 1/8 (587.4)	<b>BLNF23C12S</b>	14 (7)	<b>C2-50</b>	<b>C2-92</b>	<b>BLNF23C12C</b>	17 (8)	<b>C3-94</b>	<b>C3-93</b>
	480	8.5	3	23 1/8 (587.4)	<b>BLNF23C13S</b>	14 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BLNF23C13C</b>	17 (8)	<b>C3-116</b>	<b>C3-118</b>
	240	10.5	3	28 5/8 (727.1)	<b>BLNF28L12S</b>	17 (8)	<b>C2-236</b>	<b>C2-214</b>	<b>BLNF28L12C</b>	20 (9)	<b>C3-114</b>	<b>C3-115</b>
	480	10.5	3	28 5/8 (727.1)	<b>BLNF28L13S</b>	17 (8)	<b>C2-43</b>	<b>C2-35</b>	<b>BLNF28L13C</b>	20 (9)	<b>C3-116</b>	<b>C3-118</b>
	240	12.8	3	33 5/8 (854.1)	<b>BLNF33L12S</b>	18 (9)	<b>C2-236</b>	<b>C2-214</b>	<b>BLNF33L12C</b>	21 (10)	<b>C3-114</b>	<b>C3-115</b>
	480	12.8	3	33 5/8 (854.1)	<b>BLNF33L13S</b>	18 (9)	<b>C2-43</b>	<b>C2-35</b>	<b>BLNF33L13C</b>	21 (10)	<b>C3-116</b>	<b>C3-118</b>
	240	17.0	3	44 1/8 (1120.8)	<b>BLNF44C12S</b>	20 (9)	<b>C2-236</b>	<b>C2-214</b>	<b>BLNF44C12C</b>	23 (11)	<b>C3-114</b>	<b>C3-115</b>
	480	17.0	3	44 1/8 (1120.8)	<b>BLNF44C13S</b>	20 (9)	<b>C2-43</b>	<b>C2-35</b>	<b>BLNF44C13C</b>	23 (11)	<b>C3-116</b>	<b>C3-118</b>
	480	21.5	3	54 5/8 (1387.5)	<b>BLNF54L13S</b>	22 (10)	<b>C2-225</b>	<b>C2-226</b>	<b>BLNF54L13C</b>	25 (12)	<b>C3-117</b>	<b>C3-119</b>
	<b>23 W/in<sup>2</sup> ⑧</b> <b>304 SS Plug</b> <b>3-Alloy 800</b> <b>Elements</b> <b>(3.6 W/cm<sup>2</sup>)</b>	240	3.8	3	15 1/8 (384.2)	<b>BLNF15C20S</b>	11 (5)	<b>C2-50</b>	<b>C2-92</b>	<b>BLNF15C20C</b>	14 (7)	<b>C3-94</b>
240		4.9	3	18 1/8 (460.4)	<b>BLNF18C20S</b>	12 (6)	<b>C2-50</b>	<b>C2-92</b>	<b>BLNF18C20C</b>	15 (7)	<b>C3-94</b>	<b>C3-93</b>
240		6.4	3	23 1/8 (587.4)	<b>BLNF23C20S</b>	14 (7)	<b>C2-50</b>	<b>C2-92</b>	<b>BLNF23C20C</b>	17 (8)	<b>C3-94</b>	<b>C3-93</b>
480		6.4	3	23 1/8 (587.4)	<b>BLNF23C19S</b>	14 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BLNF23C19C</b>	17 (8)	<b>C3-116</b>	<b>C3-118</b>
240		7.9	3	28 5/8 (727.1)	<b>BLNF28L20S</b>	17 (8)	<b>C2-50</b>	<b>C2-92</b>	<b>BLNF28L20C</b>	20 (9)	<b>C3-94</b>	<b>C3-93</b>
480		7.9	3	28 5/8 (727.1)	<b>BLNF28L19S</b>	17 (8)	<b>C2-43</b>	<b>C2-35</b>	<b>BLNF28L19C</b>	20 (9)	<b>C3-116</b>	<b>C3-118</b>
240		9.6	3	33 5/8 (854.1)	<b>BLNF33L20S</b>	18 (9)	<b>C2-50</b>	<b>C2-92</b>	<b>BLNF33L20C</b>	21 (10)	<b>C3-94</b>	<b>C3-93</b>
480		9.6	3	33 5/8 (854.1)	<b>BLNF33L19S</b>	18 (9)	<b>C2-43</b>	<b>C2-35</b>	<b>BLNF33L19C</b>	21 (10)	<b>C3-116</b>	<b>C3-118</b>
240		12.8	3	44 1/8 (1120.8)	<b>BLNF44C20S</b>	20 (9)	<b>C2-236</b>	<b>C2-214</b>	<b>BLNF44C20C</b>	23 (11)	<b>C3-114</b>	<b>C3-115</b>
480		12.8	3	44 1/8 (1120.8)	<b>BLNF44C19S</b>	20 (9)	<b>C2-43</b>	<b>C2-35</b>	<b>BLNF44C19C</b>	23 (11)	<b>C3-116</b>	<b>C3-118</b>
240		16.1	3	54 5/8 (1387.5)	<b>BLNF54L20S</b>	22 (10)	<b>C2-236</b>	<b>C2-214</b>	<b>BLNF54L20C</b>	25 (12)	<b>C3-114</b>	<b>C3-115</b>
480		16.1	3	54 5/8 (1387.5)	<b>BLNF54L19S</b>	22 (10)	<b>C2-43</b>	<b>C2-35</b>	<b>BLNF54L19C</b>	25 (12)	<b>C3-116</b>	<b>C3-118</b>

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

- ③ Wired for 3-phase operation only
- ⑤ No third party recognition
- ⑧ Can be wired for 1-phase operation



# Immersion Heaters

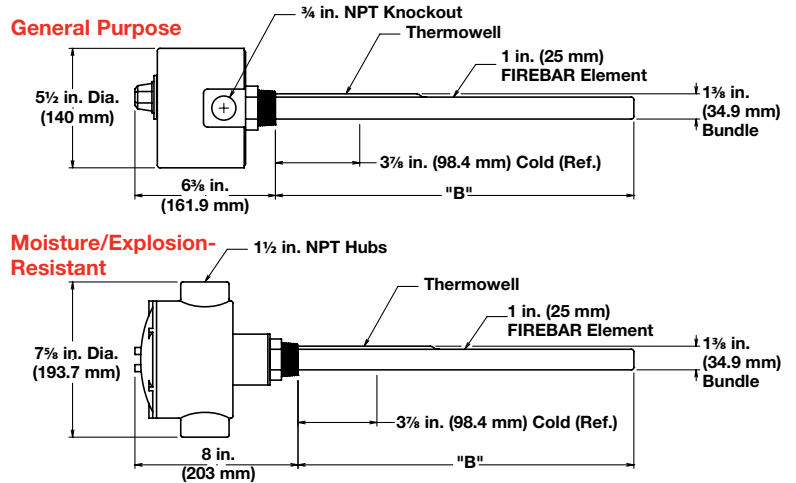


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Medium Weight Oils and Heat Transfer Oils

- 1 1/4 inch NPT screw plug
- FIREBAR elements
- With thermostat (DPST), Type 5A or 7A
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure
15 W/in <sup>2</sup> ③ 304 SS Plug 1-Alloy 800 Element (2.3 W/cm <sup>2</sup> )	240	0.67	3	13 (330)	7 (4)	BDNF13A29S5A	C/F	C/F	BDNF13A29S7A	C/F	C/F
	240	0.83	3	15 1/2 (394)	8 (4)	BDNF15J29S5A	C/F	C/F	BDNF15J29S7A	C/F	C/F
	240	1.00	3	18 (457)	9 (4)	BDNF18A29S5A	C/F	C/F	BDNF18A29S7A	C/F	C/F
	240	1.33	3	22 1/2 (572)	10 (5)	BDNF22J29S5A	C/F	C/F	BDNF22J29S7A	C/F	C/F
	480	1.33	3	22 1/2 (572)	10 (5)	BDNF22J30S5A	C/F	C/F	BDNF22J30S7A	C/F	C/F
	240	1.67	3	27 1/2 (699)	11 (5)	BDNF27J29S5A	C/F	C/F	BDNF27J29S7A	C/F	C/F
	480	1.67	3	27 1/2 (699)	11 (5)	BDNF27J30S5A	C/F	C/F	BDNF27J30S7A	C/F	C/F
	240	2.00	3	32 1/2 (826)	12 (6)	BDNF32J29S5A	C/F	C/F	BDNF32J29S7A	C/F	C/F
	480	2.00	3	32 1/2 (826)	12 (6)	BDNF32J30S5A	C/F	C/F	BDNF32J30S7A	C/F	C/F
	240	2.67	3	42 (1067)	14 (7)	BDNF42A29S5A	C/F	C/F	BDNF42A29S7A	C/F	C/F
	480	2.67	3	42 (1067)	14 (7)	BDNF42A30S5A	C/F	C/F	BDNF42A30S7A	C/F	C/F
	240	3.33	3	51 1/2 (1308)	16 (8)	BDNF51J29S5A	C/F	C/F	BDNF51J29S7A	C/F	C/F
480	3.33	3	51 1/2 (1308)	16 (8)	BDNF51J30S5A	C/F	C/F	BDNF51J30S7A	C/F	C/F	
15 W/in <sup>2</sup> ③ 304 SS Plug 1-Alloy 800 Element (2.3 W/cm <sup>2</sup> )	240	0.67	3	13 (330)	10 (5)	BDNF13A29C5A	C/F	C/F	BDNF13A29C7A	C/F	C/F
	240	0.83	3	15 1/2 (394)	11 (5)	BDNF15J29C5A	C/F	C/F	BDNF15J29C7A	C/F	C/F
	240	1.00	3	18 (457)	12 (6)	BDNF18A29C5A	C/F	C/F	BDNF18A29C7A	C/F	C/F
	240	1.33	3	22 1/2 (572)	13 (6)	BDNF22J29C5A	C/F	C/F	BDNF22J29C7A	C/F	C/F
	480	1.33	3	22 1/2 (572)	13 (6)	BDNF22J30C5A	C/F	C/F	BDNF22J30C7A	C/F	C/F
	240	1.67	3	27 1/2 (699)	14 (7)	BDNF27J29C5A	C/F	C/F	BDNF27J29C7A	C/F	C/F
	480	1.67	3	27 1/2 (699)	14 (7)	BDNF27J30C5A	C/F	C/F	BDNF27J30C7A	C/F	C/F
	240	2.00	3	32 1/2 (826)	15 (7)	BDNF32J29C5A	C/F	C/F	BDNF32J29C7A	C/F	C/F
	480	2.00	3	32 1/2 (826)	15 (7)	BDNF32J30C5A	C/F	C/F	BDNF32J30C7A	C/F	C/F
	240	2.67	3	42 (1067)	17 (8)	BDNF42A29C5A	C/F	C/F	BDNF42A29C7A	C/F	C/F
	480	2.67	3	42 (1067)	17 (8)	BDNF42A30C5A	C/F	C/F	BDNF42A30C7A	C/F	C/F
	240	3.33	3	51 1/2 (1308)	19 (9)	BDNF51J29C5A	C/F	C/F	BDNF51J29C7A	C/F	C/F
480	3.33	3	51 1/2 (1308)	19 (9)	BDNF51J30C5A	C/F	C/F	BDNF51J30C7A	C/F	C/F	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

③ Wired for 3-phase operation only

⑤ No third party recognition

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



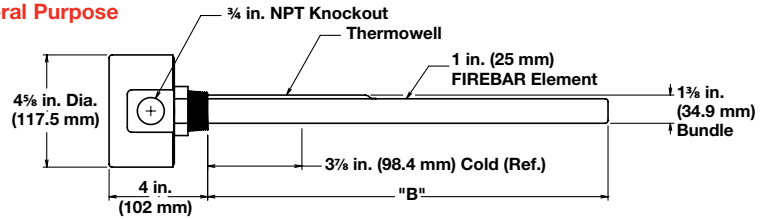
## WATROD and FIREBAR Screw Plug Immersion Heaters



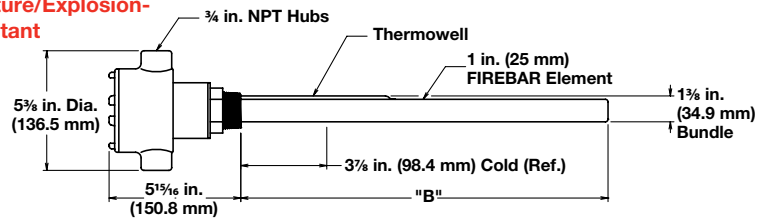
### Application: Medium Weight Oils and Heat Transfer Oils

- 1 1/4 inch NPT screw plug
- FIREBAR elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Moisture/Explosion- Resistant Enclosure	Type J T/C
<b>15 W/in<sup>2</sup> ③ 304 SS Plug 1-Alloy 800 Element (2.3 W/cm<sup>2</sup>)</b>	240	0.67	3	13 (330)	<b>BDNF13A29S</b>	6 (3)	<b>C2-50</b>	<b>C2-92</b>	<b>BDNF13A29C</b>	9 (4)	<b>C3-94</b>	<b>C3-93</b>
	240	0.83	3	15 1/2 (394)	<b>BDNF15J29S</b>	7 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BDNF15J29C</b>	10 (5)	<b>C3-94</b>	<b>C3-93</b>
	240	1.00	3	18 (457)	<b>BDNF18A29S</b>	8 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BDNF18A29C</b>	11 (5)	<b>C3-94</b>	<b>C3-93</b>
	240	1.33	3	22 1/2 (572)	<b>BDNF22J29S</b>	9 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BDNF22J29C</b>	12 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	1.33	3	22 1/2 (572)	<b>BDNF22J30S</b>	9 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BDNF22J30C</b>	12 (6)	<b>C3-116</b>	<b>C3-118</b>
	240	1.67	3	27 1/2 (699)	<b>BDNF27J29S</b>	10 (5)	<b>C2-50</b>	<b>C2-92</b>	<b>BDNF27J29C</b>	13 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	1.67	3	27 1/2 (699)	<b>BDNF27J30S</b>	10 (5)	<b>C2-43</b>	<b>C2-35</b>	<b>BDNF27J30C</b>	13 (6)	<b>C3-116</b>	<b>C3-118</b>
	240	2.00	3	32 1/2 (826)	<b>BDNF32J29S</b>	11 (5)	<b>C2-50</b>	<b>C2-92</b>	<b>BDNF32J29C</b>	14 (7)	<b>C3-94</b>	<b>C3-93</b>
	480	2.00	3	32 1/2 (826)	<b>BDNF32J30S</b>	11 (5)	<b>C2-43</b>	<b>C2-35</b>	<b>BDNF32J30C</b>	14 (7)	<b>C3-116</b>	<b>C3-118</b>
	240	2.67	3	42 (1067)	<b>BDNF42A29S</b>	13 (6)	<b>C2-50</b>	<b>C2-92</b>	<b>BDNF42A29C</b>	16 (8)	<b>C3-94</b>	<b>C3-93</b>
	480	2.67	3	42 (1067)	<b>BDNF42A30S</b>	13 (6)	<b>C2-43</b>	<b>C2-35</b>	<b>BDNF42A30C</b>	16 (8)	<b>C3-116</b>	<b>C3-118</b>
	240	3.33	3	51 1/2 (1308)	<b>BDNF51J29S</b>	15 (7)	<b>C2-50</b>	<b>C2-92</b>	<b>BDNF51J29C</b>	18 (9)	<b>C3-94</b>	<b>C3-93</b>
480	3.33	3	51 1/2 (1308)	<b>BDNF51J30S</b>	15 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BDNF51J30C</b>	18 (9)	<b>C3-116</b>	<b>C3-118</b>	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

③ Wired for 3-phase operation only

⑤ No third party recognition

# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters

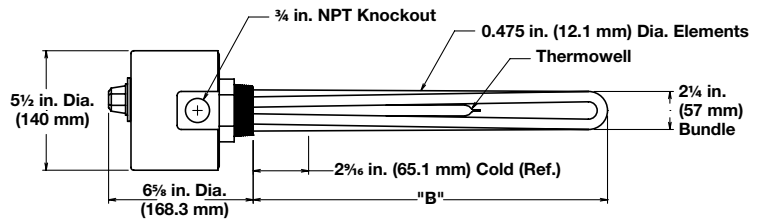


### Application: Medium Weight Oils and Heat Transfer Oils

- 2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- General purpose enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30-110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure		Type J T/C	Type K T/C
16 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	1.0	3	9 <sup>3</sup> / <sub>4</sub> (248)	6 (3)	BHN79N12S4	C/F	C/F	BHN79N12S5A	C/F	C/F	BHN79N12S7A	C/F	C/F
	480	1.0	3	9 <sup>3</sup> / <sub>4</sub> (248)	6 (3)	BHN79N13S4	C/F	C/F	BHN79N13S5A	C/F	C/F	BHN79N13S7A	C/F	C/F
	240	1.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	7 (4)	BHN713E12S4	C/F	C/F	BHN713E12S5A	C/F	C/F	BHN713E12S7A	C/F	C/F
	480	1.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	7 (4)	BHN713E13S4	C/F	C/F	BHN713E13S5A	C/F	C/F	BHN713E13S7A	C/F	C/F
	240	2.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	8 (4)	BHN717N12S4	C/F	C/F	BHN717N12S5A	C/F	C/F	BHN717N12S7A	C/F	C/F
	480	2.0	3	17 <sup>3</sup> / <sub>4</sub> (451)	8 (4)	BHN717N13S4	C/F	C/F	BHN717N13S5A	C/F	C/F	BHN717N13S7A	C/F	C/F
	240	2.5	3	20 <sup>1</sup> / <sub>4</sub> (514)	9 (4)	BHN720E12S4	C/F	C/F	BHN720E12S5A	C/F	C/F	BHN720E12S7A	C/F	C/F
	480	2.5	3	20 <sup>1</sup> / <sub>4</sub> (514)	9 (4)	BHN720E13S4	C/F	C/F	BHN720E13S5A	C/F	C/F	BHN720E13S7A	C/F	C/F
	240	3.0	3	25 <sup>1</sup> / <sub>4</sub> (641)	10 (5)	BHN725E12S4	C/F	C/F	BHN725E12S5A	C/F	C/F	BHN725E12S7A	C/F	C/F
	480	3.0	3	25 <sup>1</sup> / <sub>4</sub> (641)	10 (5)	BHN725E13S4	C/F	C/F	BHN725E13S5A	C/F	C/F	BHN725E13S7A	C/F	C/F
	240	4.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	10 (5)	BHN732N12S4	C/F	C/F	BHN732N12S5A	C/F	C/F	BHN732N12S7A	C/F	C/F
	480	4.0	3	32 <sup>3</sup> / <sub>4</sub> (832)	10 (5)	BHN732N13S4	C/F	C/F	BHN732N13S5A	C/F	C/F	BHN732N13S7A	C/F	C/F
	240	5.0	3	40 <sup>1</sup> / <sub>4</sub> (1022)	11 (5)	BHN740E12S4	C/F	C/F	BHN740E12S5A	C/F	C/F	BHN740E12S7A	C/F	C/F
	480	5.0	3	40 <sup>1</sup> / <sub>4</sub> (1022)	11 (5)	BHN740E13S4	C/F	C/F	BHN740E13S5A	C/F	C/F	BHN740E13S7A	C/F	C/F
	240	6.0	3	47 <sup>3</sup> / <sub>4</sub> (1213)	12 (6)	BHN747N12S4	C/F	C/F	BHN747N12S5A	C/F	C/F	BHN747N12S7A	C/F	C/F
	480	6.0	3	47 <sup>3</sup> / <sub>4</sub> (1213)	12 (6)	BHN747N13S4	C/F	C/F	BHN747N13S5A	C/F	C/F	BHN747N13S7A	C/F	C/F
15 W/in <sup>2</sup> Steel Plug 3-Steel Elements (2.3 W/cm <sup>2</sup> )	240	1.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	7 (4)	BHSS13E3S4	C/F	C/F	BHSS13E3S5A	C/F	C/F	BHSS13E3S7A	C/F	C/F
	480	1.5	3	13 <sup>1</sup> / <sub>4</sub> (337)	7 (4)	BHSS13E13S4	C/F	C/F	BHSS13E13S5A	C/F	C/F	BHSS13E13S7A	C/F	C/F
	240	2.0	3	17 <sup>1</sup> / <sub>2</sub> (445)	8 (4)	BHSS17J3S4	C/F	C/F	BHSS17J3S5A	C/F	C/F	BHSS17J3S7A	C/F	C/F
	480	2.0	3	17 <sup>1</sup> / <sub>2</sub> (445)	8 (4)	BHSS17J5S4	C/F	C/F	BHSS17J5S5A	C/F	C/F	BHSS17J5S7A	C/F	C/F
	240	2.5	3	20 <sup>1</sup> / <sub>2</sub> (521)	9 (4)	BHSS20J3S4	C/F	C/F	BHSS20J3S5A	C/F	C/F	BHSS20J3S7A	C/F	C/F
	480	2.5	3	20 <sup>1</sup> / <sub>2</sub> (521)	9 (4)	BHSS20J5S4	C/F	C/F	BHSS20J5S5A	C/F	C/F	BHSS20J5S7A	C/F	C/F
	240	3.0	3	25 (635)	10 (5)	BHSS25A3S4	C/F	C/F	BHSS25A3S5A	C/F	C/F	BHSS25A3S7A	C/F	C/F
	480	3.0	3	25 (635)	10 (5)	BHSS25A5S4	C/F	C/F	BHSS25A5S5A	C/F	C/F	BHSS25A5S7A	C/F	C/F
	240	4.0	3	32 <sup>1</sup> / <sub>2</sub> (826)	13 (6)	BHSS32J3S4	C/F	C/F	BHSS32J3S5A	C/F	C/F	BHSS32J3S7A	C/F	C/F
	480	4.0	3	32 <sup>1</sup> / <sub>2</sub> (826)	13 (6)	BHSS32J5S4	C/F	C/F	BHSS32J5S5A	C/F	C/F	BHSS32J5S7A	C/F	C/F
	240	5.0	3	40 (1016)	14 (7)	BHSS40A3S4	C/F	C/F	BHSS40A3S5A	C/F	C/F	BHSS40A3S7A	C/F	C/F
	480	5.0	3	40 (1016)	14 (7)	BHSS40A5S4	C/F	C/F	BHSS40A5S5A	C/F	C/F	BHSS40A5S7A	C/F	C/F
	240	6.0	3	47 <sup>1</sup> / <sub>2</sub> (1207)	14 (7)	BHSS47J3S4	C/F	C/F	BHSS47J3S5A	C/F	C/F	BHSS47J3S7A	C/F	C/F
	480	6.0	3	47 <sup>1</sup> / <sub>2</sub> (1207)	14 (7)	BHSS47J5S4	C/F	C/F	BHSS47J5S5A	C/F	C/F	BHSS47J5S7A	C/F	C/F
	240	7.5	3	58 <sup>1</sup> / <sub>2</sub> (1486)	17 (8)	BHSS58J3S4	C/F	C/F	BHSS58J3S5A	C/F	C/F	BHSS58J3S7A	C/F	C/F
	480	9.0	3	69 <sup>3</sup> / <sub>4</sub> (1772)	21 (10)	BHSS69N3S4	C/F	C/F	BHSS69N3S5A	C/F	C/F	BHSS69N3S7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

- ③ Wired for 3-phase operation only

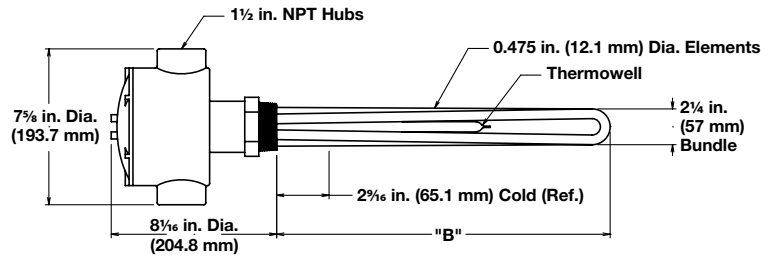


## WATROD and FIREBAR Screw Plug Immersion Heaters

### Application: Medium Weight Oils and Heat Transfer Oils

- 2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A

**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.



- Moisture/explosion-resistant enclosure (suitable for use in non-classified areas only)

Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C		Type K T/C	Moisture/Explosion-Resistant Enclosure ⑤		Type J T/C	Type K T/C
16 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	1.0	3	9 3/4 (248)	9 (4)	BHN79N12C4	C/F	C/F	BHN79N12C5A	C/F	C/F	BHN79N12C7A	C/F	C/F
	480	1.0	3	9 3/4 (248)	9 (4)	BHN79N13C4	C/F	C/F	BHN79N13C5A	C/F	C/F	BHN79N13C7A	C/F	C/F
	240	1.5	3	13 1/4 (337)	10 (5)	BHN713E12C4	C/F	C/F	BHN713E12C5A	C/F	C/F	BHN713E12C7A	C/F	C/F
	480	1.5	3	13 1/4 (337)	10 (5)	BHN713E13C4	C/F	C/F	BHN713E13C5A	C/F	C/F	BHN713E13C7A	C/F	C/F
	240	2.0	3	17 3/4 (451)	11 (5)	BHN717N12C4	C/F	C/F	BHN717N12C5A	C/F	C/F	BHN717N12C7A	C/F	C/F
	480	2.0	3	17 3/4 (451)	11 (5)	BHN717N13C4	C/F	C/F	BHN717N13C5A	C/F	C/F	BHN717N13C7A	C/F	C/F
	240	2.5	3	20 1/4 (514)	12 (6)	BHN720E12C4	C/F	C/F	BHN720E12C5A	C/F	C/F	BHN720E12C7A	C/F	C/F
	480	2.5	3	20 1/4 (514)	12 (6)	BHN720E13C4	C/F	C/F	BHN720E13C5A	C/F	C/F	BHN720E13C7A	C/F	C/F
	240	3.0	3	25 1/4 (641)	13 (6)	BHN725E12C4	C/F	C/F	BHN725E12C5A	C/F	C/F	BHN725E12C7A	C/F	C/F
	480	3.0	3	25 1/4 (641)	13 (6)	BHN725E13C4	C/F	C/F	BHN725E13C5A	C/F	C/F	BHN725E13C7A	C/F	C/F
	240	4.0	3	32 3/4 (832)	13 (6)	BHN732N12C4	C/F	C/F	BHN732N12C5A	C/F	C/F	BHN732N12C7A	C/F	C/F
	480	4.0	3	32 3/4 (832)	13 (6)	BHN732N13C4	C/F	C/F	BHN732N13C5A	C/F	C/F	BHN732N13C7A	C/F	C/F
	240	5.0	3	40 1/4 (1022)	14 (7)	BHN740E12C4	C/F	C/F	BHN740E12C5A	C/F	C/F	BHN740E12C7A	C/F	C/F
	480	5.0	3	40 1/4 (1022)	14 (7)	BHN740E13C4	C/F	C/F	BHN740E13C5A	C/F	C/F	BHN740E13C7A	C/F	C/F
	240	6.0	3	47 3/4 (1213)	15 (7)	BHN747N12C4	C/F	C/F	BHN747N12C5A	C/F	C/F	BHN747N12C7A	C/F	C/F
	480	6.0	3	47 3/4 (1213)	15 (7)	BHN747N13C4	C/F	C/F	BHN747N13C5A	C/F	C/F	BHN747N13C7A	C/F	C/F
15 W/in <sup>2</sup> Steel Plug 3-Steel Elements (2.5 W/cm <sup>2</sup> )	240	1.5	3	13 1/4 (337)	10 (5)	BHSS13E3C4	C/F	C/F	BHSS13E3C5A	C/F	C/F	BHSS13E3C7A	C/F	C/F
	480	1.5	3	13 1/4 (337)	10 (5)	BHSS13E13C4	C/F	C/F	BHSS13E13C5A	C/F	C/F	BHSS13E13C7A	C/F	C/F
	240	2.0	3	17 1/2 (445)	11 (5)	BHSS17J3C4	C/F	C/F	BHSS17J3C5A	C/F	C/F	BHSS17J3C7A	C/F	C/F
	480	2.0	3	17 1/2 (445)	11 (5)	BHSS17J5C4	C/F	C/F	BHSS17J5C5A	C/F	C/F	BHSS17J5C7A	C/F	C/F
	240	2.5	3	20 1/2 (521)	12 (6)	BHSS20J3C4	C/F	C/F	BHSS20J3C5A	C/F	C/F	BHSS20J3C7A	C/F	C/F
	480	2.5	3	20 1/2 (521)	12 (6)	BHSS20J5C4	C/F	C/F	BHSS20J5C5A	C/F	C/F	BHSS20J5C7A	C/F	C/F
	240	3.0	3	25 (635)	13 (6)	BHSS25A3C4	C/F	C/F	BHSS25A3C5A	C/F	C/F	BHSS25A3C7A	C/F	C/F
	480	3.0	3	25 (635)	13 (6)	BHSS25A5C4	C/F	C/F	BHSS25A5C5A	C/F	C/F	BHSS25A5C7A	C/F	C/F
	240	4.0	3	32 1/2 (826)	16 (8)	BHSS32J3C4	C/F	C/F	BHSS32J3C5A	C/F	C/F	BHSS32J3C7A	C/F	C/F
	480	4.0	3	32 1/2 (826)	16 (8)	BHSS32J5C4	C/F	C/F	BHSS32J5C5A	C/F	C/F	BHSS32J5C7A	C/F	C/F
	240	5.0	3	40 (1016)	17 (8)	BHSS40A3C4	C/F	C/F	BHSS40A3C5A	C/F	C/F	BHSS40A3C7A	C/F	C/F
	480	5.0	3	40 (1016)	17 (8)	BHSS40A5C4	C/F	C/F	BHSS40A5C5A	C/F	C/F	BHSS40A5C7A	C/F	C/F
	240	6.0	3	47 1/2 (1207)	17 (8)	BHSS47J3C4	C/F	C/F	BHSS47J3C5A	C/F	C/F	BHSS47J3C7A	C/F	C/F
	480	6.0	3	47 1/2 (1207)	17 (8)	BHSS47J5C4	C/F	C/F	BHSS47J5C5A	C/F	C/F	BHSS47J5C7A	C/F	C/F
	240	7.5	3	58 1/2 (1486)	20 (9)	BHSS58J3C4	C/F	C/F	BHSS58J3C5A	C/F	C/F	BHSS58J3C7A	C/F	C/F
	240	9.0	3	69 3/4 (1772)	24 (11)	BHSS69N3C4	C/F	C/F	BHSS69N3C5A	C/F	C/F	BHSS69N3C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

③ Wired for 3-phase operation only

⑤ No third party recognition

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



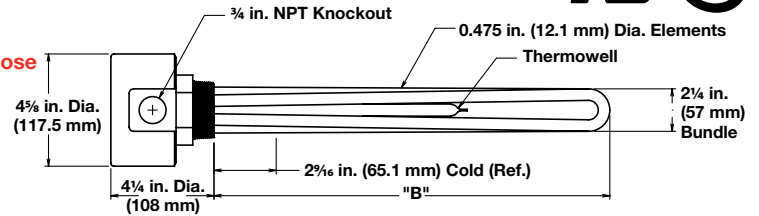
## WATROD and FIREBAR Screw Plug Immersion Heaters



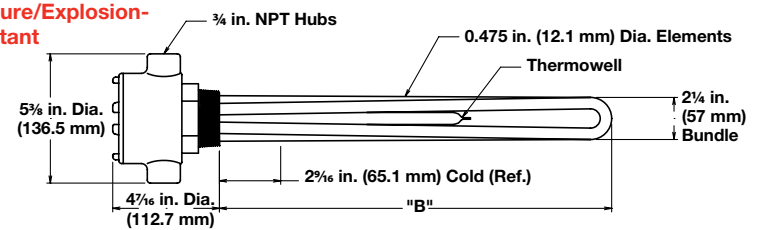
### Application: Medium Weight Oils and Heat Transfer Oils

- 2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Moisture/Explosion- Resistant Enclosure	Type J T/C
<b>16 W/in<sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm<sup>2</sup>)</b>	240	1.0	3	9 <sup>3/4</sup> (248)	<b>BHN79N12S</b>	5 (3)	<b>C2-50</b>	<b>C2-92</b>	<b>BHN79N12C</b>	8 (4)	<b>C3-94</b>	<b>C3-93</b>
	480	1.0	3	9 <sup>3/4</sup> (248)	<b>BHN79N13S</b>	5 (3)	<b>C2-43</b>	<b>C2-35</b>	<b>BHN79N13C</b>	8 (4)	<b>C3-116</b>	<b>C3-118</b>
	240	1.5	3	13 <sup>1/4</sup> (337)	<b>BHN713E12S</b>	6 (3)	<b>C2-50</b>	<b>C2-92</b>	<b>BHN713E12C</b>	9 (4)	<b>C3-94</b>	<b>C3-93</b>
	480	1.5	3	13 <sup>1/4</sup> (337)	<b>BHN713E13S</b>	6 (3)	<b>C2-43</b>	<b>C2-35</b>	<b>BHN713E13C</b>	9 (4)	<b>C3-116</b>	<b>C3-118</b>
	240	2.0	3	17 <sup>3/4</sup> (451)	<b>BHN717N12S</b>	7 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BHN717N12C</b>	10 (5)	<b>C3-94</b>	<b>C3-93</b>
	480	2.0	3	17 <sup>3/4</sup> (451)	<b>BHN717N13S</b>	7 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BHN717N13C</b>	10 (5)	<b>C3-116</b>	<b>C3-118</b>
	240	2.5	3	20 <sup>1/4</sup> (514)	<b>BHN720E12S</b>	8 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BHN720E12C</b>	11 (5)	<b>C3-94</b>	<b>C3-93</b>
	480	2.5	3	20 <sup>1/4</sup> (514)	<b>BHN720E13S</b>	8 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BHN720E13C</b>	11 (5)	<b>C3-116</b>	<b>C3-118</b>
	240	3.0	3	25 <sup>1/4</sup> (641)	<b>BHN725E12S</b>	9 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BHN725E12C</b>	12 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	3.0	3	25 <sup>1/4</sup> (641)	<b>BHN725E13S</b>	9 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BHN725E13C</b>	12 (6)	<b>C3-116</b>	<b>C3-118</b>
	240	4.0	3	32 <sup>3/4</sup> (832)	<b>BHN732N12S</b>	9 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BHN732N12C</b>	12 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	4.0	3	32 <sup>3/4</sup> (832)	<b>BHN732N13S</b>	9 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BHN732N13C</b>	12 (6)	<b>C3-116</b>	<b>C3-118</b>
	240	5.0	3	40 <sup>1/4</sup> (1022)	<b>BHN740E12S</b>	10 (5)	<b>C2-50</b>	<b>C2-92</b>	<b>BHN740E12C</b>	13 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	5.0	3	40 <sup>1/4</sup> (1022)	<b>BHN740E13S</b>	10 (5)	<b>C2-43</b>	<b>C2-35</b>	<b>BHN740E13C</b>	13 (6)	<b>C3-116</b>	<b>C3-118</b>
	240	6.0	3	47 <sup>3/4</sup> (1213)	<b>BHN747N12S</b>	11 (5)	<b>C2-50</b>	<b>C2-92</b>	<b>BHN747N12C</b>	14 (7)	<b>C3-94</b>	<b>C3-93</b>
	480	6.0	3	47 <sup>3/4</sup> (1213)	<b>BHN747N13S</b>	11 (5)	<b>C2-43</b>	<b>C2-35</b>	<b>BHN747N13C</b>	14 (7)	<b>C3-116</b>	<b>C3-118</b>
<b>15 W/in<sup>2</sup> Steel Plug 3-Steel Elements (2.3 W/cm<sup>2</sup>)</b>	240	1.5	3	13 <sup>1/4</sup> (337)	<b>BHSS13E3S</b>	6 (3)	<b>C2-50</b>	<b>C2-92</b>	<b>BHSS13E3C</b>	9 (4)	<b>C3-94</b>	<b>C3-93</b>
	480	1.5	3	13 <sup>1/4</sup> (337)	<b>BHSS13E13S</b>	6 (3)	<b>C2-43</b>	<b>C2-35</b>	<b>BHSS13E13C</b>	9 (4)	<b>C3-116</b>	<b>C3-118</b>
	240	2.0	3	17 <sup>1/2</sup> (445)	<b>BHSS17J3S</b>	7 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BHSS17J3C</b>	10 (5)	<b>C3-94</b>	<b>C3-93</b>
	480	2.0	3	17 <sup>1/2</sup> (445)	<b>BHSS17J5S</b>	7 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BHSS17J5C</b>	10 (5)	<b>C3-116</b>	<b>C3-118</b>
	240	2.5	3	20 <sup>1/2</sup> (521)	<b>BHSS20J3S</b>	8 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BHSS20J3C</b>	11 (5)	<b>C3-94</b>	<b>C3-93</b>
	480	2.5	3	20 <sup>1/2</sup> (521)	<b>BHSS20J5S</b>	8 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BHSS20J5C</b>	11 (5)	<b>C3-116</b>	<b>C3-118</b>
	240	3.0	3	25 (635)	<b>BHSS25A3S</b>	9 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BHSS25A3C</b>	12 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	3.0	3	25 (635)	<b>BHSS25A5S</b>	9 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BHSS25A5C</b>	12 (6)	<b>C3-116</b>	<b>C3-118</b>
	240	4.0	3	32 <sup>1/2</sup> (826)	<b>BHSS32J3S</b>	9 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BHSS32J3C</b>	12 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	4.0	3	32 <sup>1/2</sup> (826)	<b>BHSS32J5S</b>	9 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BHSS32J5C</b>	12 (6)	<b>C3-116</b>	<b>C3-118</b>
	240	5.0	3	40 (1016)	<b>BHSS40A3S</b>	10 (5)	<b>C2-50</b>	<b>C2-92</b>	<b>BHSS40A3C</b>	13 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	5.0	3	40 (1016)	<b>BHSS40A5S</b>	10 (5)	<b>C2-43</b>	<b>C2-35</b>	<b>BHSS40A5C</b>	13 (6)	<b>C3-116</b>	<b>C3-118</b>
	240	6.0	3	47 <sup>1/2</sup> (1207)	<b>BHSS47J3S</b>	11 (5)	<b>C2-50</b>	<b>C2-92</b>	<b>BHSS47J3C</b>	14 (7)	<b>C3-94</b>	<b>C3-93</b>
	480	6.0	3	47 <sup>1/2</sup> (1207)	<b>BHSS47J5S</b>	11 (5)	<b>C2-43</b>	<b>C2-35</b>	<b>BHSS47J5C</b>	14 (7)	<b>C3-116</b>	<b>C3-118</b>
	240	7.5	3	58 <sup>1/2</sup> (1486)	<b>BHSS58J3S</b>	14 (7)	<b>C2-50</b>	<b>C2-92</b>	<b>BHSS58J3C</b>	17 (8)	<b>C3-94</b>	<b>C3-93</b>
	480	7.5	3	58 <sup>1/2</sup> (1486)	<b>BHSS58J5S</b>	14 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BHSS58J5C</b>	17 (8)	<b>C3-116</b>	<b>C3-118</b>
240	9.0	3	69 <sup>3/4</sup> (1772)	<b>BHSS69N3S</b>	16 (8)	<b>C2-50</b>	<b>C2-92</b>	<b>BHSS69N3C</b>	19 (9)	<b>C3-94</b>	<b>C3-93</b>	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

③ Wired for 3-phase operation only    ⑤ No third party recognition

# Immersion Heaters

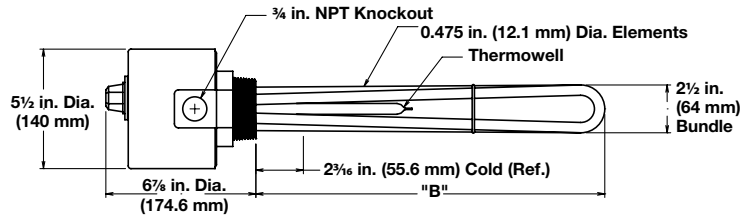


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Medium Weight Oils and Heat Transfer Oils

- 2 1/2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A
- General purpose enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30-110°F)			Type 5A (60-250°F)			Type 7A (100-550°F)		
						Part Number	WATCONNECT		Part Number	WATCONNECT		Part Number	WATCONNECT	
							Type J T/C	Type K T/C		Type J T/C	Type K T/C		Type J T/C	Type K T/C
16 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	1.0	3	9 <sup>3</sup> / <sub>8</sub> (238.1)	7 (4)	BLN79G12S4	C/F	C/F	BLN79G12S5A	C/F	C/F	BLN79G12S7A	C/F	C/F
	480	1.0	3	9 <sup>3</sup> / <sub>8</sub> (238.1)	7 (4)	BLN79G13S4	C/F	C/F	BLN79G13S5A	C/F	C/F	BLN79G13S7A	C/F	C/F
	240	1.5	3	12 <sup>7</sup> / <sub>8</sub> (327.0)	8 (4)	BLN712R12S4	C/F	C/F	BLN712R12S5A	C/F	C/F	BLN712R12S7A	C/F	C/F
	480	1.5	3	12 <sup>7</sup> / <sub>8</sub> (327.0)	8 (4)	BLN712R13S4	C/F	C/F	BLN712R13S5A	C/F	C/F	BLN712R13S7A	C/F	C/F
	240	2.0	3	17 <sup>3</sup> / <sub>8</sub> (441.3)	10 (5)	BLN717G12S4	C/F	C/F	BLN717G12S5A	C/F	C/F	BLN717G12S7A	C/F	C/F
	480	2.0	3	17 <sup>3</sup> / <sub>8</sub> (441.3)	10 (5)	BLN717G13S4	C/F	C/F	BLN717G13S5A	C/F	C/F	BLN717G13S7A	C/F	C/F
	240	2.5	3	19 <sup>7</sup> / <sub>8</sub> (504.8)	12 (6)	BLN719R12S4	C/F	C/F	BLN719R12S5A	C/F	C/F	BLN719R12S7A	C/F	C/F
	480	2.5	3	19 <sup>7</sup> / <sub>8</sub> (504.8)	12 (6)	BLN719R13S4	C/F	C/F	BLN719R13S5A	C/F	C/F	BLN719R13S7A	C/F	C/F
	240	3.0	3	24 <sup>7</sup> / <sub>8</sub> (631.8)	13 (6)	BLN724R12S4	C/F	C/F	BLN724R12S5A	C/F	C/F	BLN724R12S7A	C/F	C/F
	480	3.0	3	24 <sup>7</sup> / <sub>8</sub> (631.8)	13 (6)	BLN724R13S4	C/F	C/F	BLN724R13S5A	C/F	C/F	BLN724R13S7A	C/F	C/F
	240	4.0	3	32 <sup>3</sup> / <sub>8</sub> (822.3)	15 (7)	BLN732G12S4	C/F	C/F	BLN732G12S5A	C/F	C/F	BLN732G12S7A	C/F	C/F
	480	4.0	3	32 <sup>3</sup> / <sub>8</sub> (822.3)	15 (7)	BLN732G13S4	C/F	C/F	BLN732G13S5A	C/F	C/F	BLN732G13S7A	C/F	C/F
	240	5.0	3	39 <sup>7</sup> / <sub>8</sub> (1012.8)	16 (8)	BLN739R12S4	C/F	C/F	BLN739R12S5A	C/F	C/F	BLN739R12S7A	C/F	C/F
	480	5.0	3	39 <sup>7</sup> / <sub>8</sub> (1012.8)	16 (8)	BLN739R13S4	C/F	C/F	BLN739R13S5A	C/F	C/F	BLN739R13S7A	C/F	C/F
	240	6.0	3	47 <sup>3</sup> / <sub>8</sub> (1203.3)	18 (9)	BLN747G12S4	C/F	C/F	BLN747G12S5A	C/F	C/F	BLN747G12S7A	C/F	C/F
	480	6.0	3	47 <sup>3</sup> / <sub>8</sub> (1203.3)	18 (9)	BLN747G13S4	C/F	C/F	BLN747G13S5A	C/F	C/F	BLN747G13S7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

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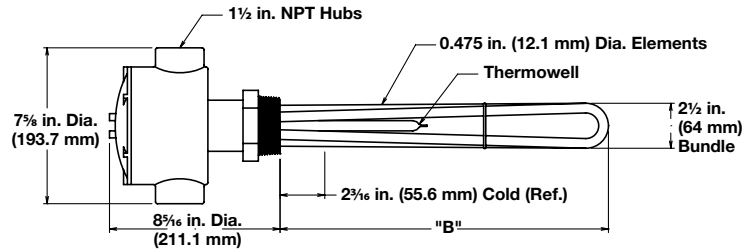
# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters

### Application: Medium Weight Oils and Heat Transfer Oils

- 2 1/2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A
- Moisture/explosion-resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30-110°F)			Type 5A (60-250°F)			Type 7A (100-550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							Moisture/ Explosion- Resistant Enclosure ⑤	Type J T/C		Type K T/C	Moisture/ Explosion- Resistant Enclosure ⑤		Type J T/C	Type K T/C
16 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	1.0	3	9 3/8 (238.1)	10 (5)	BLN79G12C4	C/F	C/F	BLN79G12C5A	C/F	C/F	BLN79G12C7A	C/F	C/F
	480	1.0	3	9 3/8 (238.1)	10 (5)	BLN79G13C4	C/F	C/F	BLN79G13C5A	C/F	C/F	BLN79G13C7A	C/F	C/F
	240	1.5	3	12 7/8 (327.0)	11 (5)	BLN712R12C4	C/F	C/F	BLN712R12C5A	C/F	C/F	BLN712R12C7A	C/F	C/F
	480	1.5	3	12 7/8 (327.0)	11 (5)	BLN712R13C4	C/F	C/F	BLN712R13C5A	C/F	C/F	BLN712R13C7A	C/F	C/F
	240	2.0	3	17 3/8 (441.3)	13 (6)	BLN717G12C4	C/F	C/F	BLN717G12C5A	C/F	C/F	BLN717G12C7A	C/F	C/F
	480	2.0	3	17 3/8 (441.3)	13 (6)	BLN717G13C4	C/F	C/F	BLN717G13C5A	C/F	C/F	BLN717G13C7A	C/F	C/F
	240	2.5	3	19 7/8 (504.8)	15 (7)	BLN719R12C4	C/F	C/F	BLN719R12C5A	C/F	C/F	BLN719R12C7A	C/F	C/F
	480	2.5	3	19 7/8 (504.8)	15 (7)	BLN719R13C4	C/F	C/F	BLN719R13C5A	C/F	C/F	BLN719R13C7A	C/F	C/F
	240	3.0	3	24 7/8 (631.8)	16 (8)	BLN724R12C4	C/F	C/F	BLN724R12C5A	C/F	C/F	BLN724R12C7A	C/F	C/F
	480	3.0	3	24 7/8 (631.8)	16 (8)	BLN724R13C4	C/F	C/F	BLN724R13C5A	C/F	C/F	BLN724R13C7A	C/F	C/F
	240	4.0	3	32 3/8 (822.3)	18 (9)	BLN732G12C4	C/F	C/F	BLN732G12C5A	C/F	C/F	BLN732G12C7A	C/F	C/F
	480	4.0	3	32 3/8 (822.3)	18 (9)	BLN732G13C4	C/F	C/F	BLN732G13C5A	C/F	C/F	BLN732G13C7A	C/F	C/F
	240	5.0	3	39 7/8 (1012.8)	19 (9)	BLN739R12C4	C/F	C/F	BLN739R12C5A	C/F	C/F	BLN739R12C7A	C/F	C/F
	480	5.0	3	39 7/8 (1012.8)	19 (9)	BLN739R13C4	C/F	C/F	BLN739R13C5A	C/F	C/F	BLN739R13C7A	C/F	C/F
	240	6.0	3	47 3/8 (1203.3)	21 (10)	BLN747G12C4	C/F	C/F	BLN747G12C5A	C/F	C/F	BLN747G12C7A	C/F	C/F
	480	6.0	3	47 3/8 (1203.3)	21 (10)	BLN747G13C4	C/F	C/F	BLN747G13C5A	C/F	C/F	BLN747G13C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

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⑤ No third party recognition

# Immersion Heaters

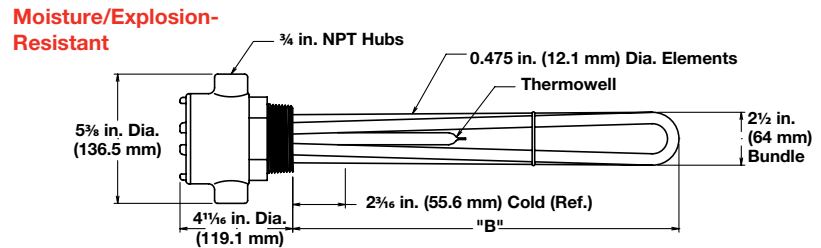
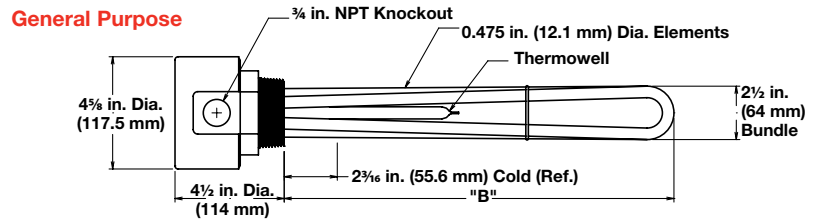


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Medium Weight Oils and Heat Transfer Oils

- 2 1/2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Moisture/Explosion- Resistant Enclosure	Type J T/C
<b>16 W/in<sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm<sup>2</sup>)</b>	240	1.0	3	9 <sup>3</sup> / <sub>8</sub> (238.1)	<b>BLN79G12S</b>	6 (3)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN79G12C</b>	9 (4)	<b>C3-94</b>	<b>C3-93</b>
	480	1.0	3	9 <sup>3</sup> / <sub>8</sub> (238.1)	<b>BLN79G13S</b>	6 (3)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN79G13C</b>	9 (4)	<b>C3-116</b>	<b>C3-118</b>
	240	1.5	3	12 <sup>7</sup> / <sub>8</sub> (327.0)	<b>BLN712R12S</b>	7 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN712R12C</b>	10 (5)	<b>C3-94</b>	<b>C3-93</b>
	480	1.5	3	12 <sup>7</sup> / <sub>8</sub> (327.0)	<b>BLN712R13S</b>	7 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN712R13C</b>	10 (5)	<b>C3-116</b>	<b>C3-118</b>
	240	2.0	3	17 <sup>3</sup> / <sub>8</sub> (441.3)	<b>BLN717G12S</b>	9 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN717G12C</b>	12 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	2.0	3	17 <sup>3</sup> / <sub>8</sub> (441.3)	<b>BLN717G13S</b>	9 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN717G13C</b>	12 (6)	<b>C3-116</b>	<b>C3-118</b>
	240	2.5	3	19 <sup>7</sup> / <sub>8</sub> (504.8)	<b>BLN719R12S</b>	11 (5)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN719R12C</b>	14 (7)	<b>C3-94</b>	<b>C3-93</b>
	480	2.5	3	19 <sup>7</sup> / <sub>8</sub> (504.8)	<b>BLN719R13S</b>	11 (5)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN719R13C</b>	14 (7)	<b>C3-116</b>	<b>C3-118</b>
	240	3.0	3	24 <sup>7</sup> / <sub>8</sub> (631.8)	<b>BLN724R12S</b>	12 (6)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN724R12C</b>	15 (7)	<b>C3-94</b>	<b>C3-93</b>
	480	3.0	3	24 <sup>7</sup> / <sub>8</sub> (631.8)	<b>BLN724R13S</b>	12 (6)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN724R13C</b>	15 (7)	<b>C3-116</b>	<b>C3-118</b>
	240	4.0	3	32 <sup>3</sup> / <sub>8</sub> (822.3)	<b>BLN732G12S</b>	14 (7)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN732G12C</b>	17 (8)	<b>C3-94</b>	<b>C3-93</b>
	480	4.0	3	32 <sup>3</sup> / <sub>8</sub> (822.3)	<b>BLN732G13S</b>	14 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN732G13C</b>	17 (8)	<b>C3-116</b>	<b>C3-118</b>
	240	5.0	3	39 <sup>7</sup> / <sub>8</sub> (1012.8)	<b>BLN739R12S</b>	15 (7)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN739R12C</b>	18 (9)	<b>C3-94</b>	<b>C3-93</b>
	480	5.0	3	39 <sup>7</sup> / <sub>8</sub> (1012.8)	<b>BLN739R13S</b>	15 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN739R13C</b>	18 (9)	<b>C3-116</b>	<b>C3-118</b>
	240	6.0	3	47 <sup>3</sup> / <sub>8</sub> (1203.3)	<b>BLN747G12S</b>	17 (8)	<b>C2-50</b>	<b>C2-92</b>	<b>BLN747G12C</b>	20 (9)	<b>C3-94</b>	<b>C3-93</b>
	480	6.0	3	47 <sup>3</sup> / <sub>8</sub> (1203.3)	<b>BLN747G13S</b>	17 (8)	<b>C2-43</b>	<b>C2-35</b>	<b>BLN747G13C</b>	20 (9)	<b>C3-116</b>	<b>C3-118</b>

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

③ Wired for 3-phase operation only

⑤ No third party recognition



# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters



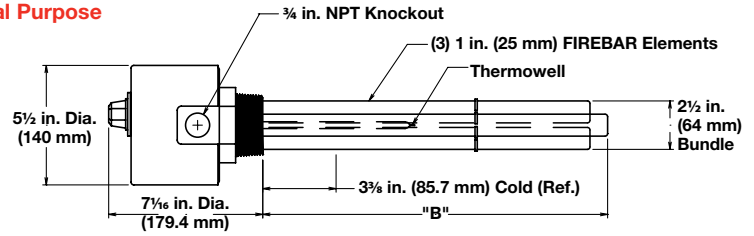
### Application: Medium Weight Oils and Heat Transfer Oils

- 2 1/2 inch NPT screw plug
- FIREBAR elements
- With thermostat (DPST), Type 5A or 7A

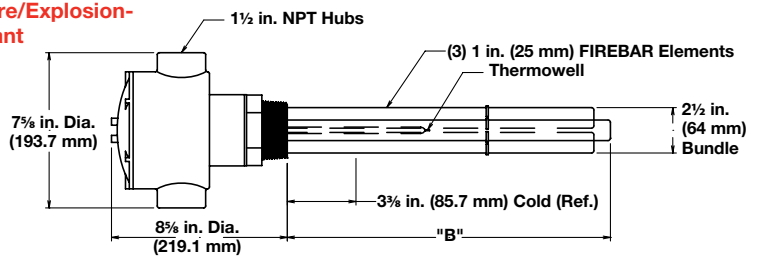
**Note:** Higher amperage products require a pilot duty thermostat with separate power controller. Please see following pages for available heaters without thermostats.

- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 5A (60-250°F)			Type 7A (100-550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C
15 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (2.3 W/cm <sup>2</sup> )	240	2.0	3	12 (305)	11 (5)	BLNF12A29S5A	C/F	C/F	BLNF12A29S7A	C/F	C/F
	240	2.5	3	14 1/2 (368)	12 (6)	BLNF14J29S5A	C/F	C/F	BLNF14J29S7A	C/F	C/F
	240	3.0	3	17 (432)	13 (6)	BLNF17A29S5A	C/F	C/F	BLNF17A29S7A	C/F	C/F
	240	4.0	3	21 1/2 (546)	15 (7)	BLNF21J29S5A	C/F	C/F	BLNF21J29S7A	C/F	C/F
	480	4.0	3	21 1/2 (546)	15 (7)	BLNF21J30S5A	C/F	C/F	BLNF21J30S7A	C/F	C/F
	240	5.0	3	26 1/2 (673)	18 (9)	BLNF26J29S5A	C/F	C/F	BLNF26J29S7A	C/F	C/F
	480	5.0	3	26 1/2 (673)	18 (9)	BLNF26J30S5A	C/F	C/F	BLNF26J30S7A	C/F	C/F
	240	6.0	3	31 1/2 (800)	19 (9)	BLNF31J29S5A	C/F	C/F	BLNF31J29S7A	C/F	C/F
	480	6.0	3	31 1/2 (800)	19 (9)	BLNF31J30S5A	C/F	C/F	BLNF31J30S7A	C/F	C/F
	240	8.0	3	41 (1041)	21 (10)	BLNF41A29S5A	C/F	C/F	BLNF41A29S7A	C/F	C/F
	240	10.0	3	50 1/2 (1283)	23 (11)	BLNF50J29S5A	C/F	C/F	BLNF50J29S7A	C/F	C/F
						Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure ⑤	Type J T/C	Type K T/C
15 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (2.3 W/cm <sup>2</sup> )	240	2.0	3	12 (305)	14 (7)	BLNF12A29C5A	C/F	C/F	BLNF12A29C7A	C/F	C/F
	240	2.5	3	14 1/2 (368)	15 (7)	BLNF14J29C5A	C/F	C/F	BLNF14J29C7A	C/F	C/F
	240	3.0	3	17 (432)	16 (8)	BLNF17A29C5A	C/F	C/F	BLNF17A29C7A	C/F	C/F
	240	4.0	3	21 1/2 (546)	18 (9)	BLNF21J29C5A	C/F	C/F	BLNF21J29C7A	C/F	C/F
	480	4.0	3	21 1/2 (546)	18 (9)	BLNF21J30C5A	C/F	C/F	BLNF21J30C7A	C/F	C/F
	240	5.0	3	26 1/2 (673)	21 (10)	BLNF26J29C5A	C/F	C/F	BLNF26J29C7A	C/F	C/F
	480	5.0	3	26 1/2 (673)	21 (10)	BLNF26J30C5A	C/F	C/F	BLNF26J30C7A	C/F	C/F
	240	6.0	3	31 1/2 (800)	22 (10)	BLNF31J29C5A	C/F	C/F	BLNF31J29C7A	C/F	C/F
	480	6.0	3	31 1/2 (800)	22 (10)	BLNF31J30C5A	C/F	C/F	BLNF31J30C7A	C/F	C/F
	240	8.0	3	41 (1041)	24 (11)	BLNF41A29C5A	C/F	C/F	BLNF41A29C7A	C/F	C/F
	240	10.0	3	50 1/2 (1283)	26 (11)	BLNF50J29C5A	C/F	C/F	BLNF50J29C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

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# Immersion Heaters



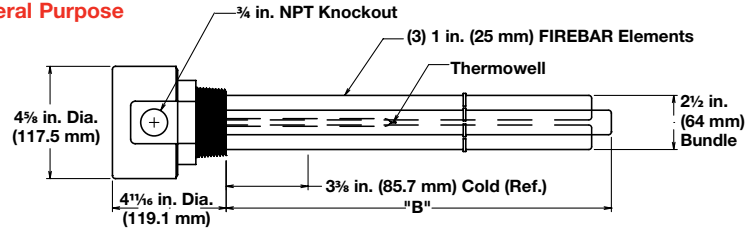
## WATROD and FIREBAR Screw Plug Immersion Heaters



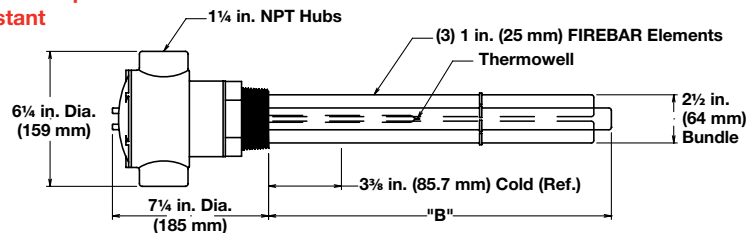
### Application: Medium Weight Oils and Heat Transfer Oils

- 2 1/2 inch NPT screw plug
- FIREBAR elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. In. (mm)	Part Number		WATCONNECT Part Number		Part Number ⑤		WATCONNECT Part Number	
					General Purpose Enclosure	Ship Wt. lbs (kg)	Type J T/C	Type K T/C	Moisture/Explosion- Resistant Enclosure	Ship Wt. lbs (kg)	Type J T/C	Type K T/C
15 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (2.3 W/cm <sup>2</sup> )	240	2.0	3	12 (305)	BLNF12A29S	10 (5)	C2-50	C2-92	BLNF12A29C	13 (6)	C3-94	C3-93
	240	2.5	3	14 1/2 (368)	BLNF14J29S	11 (5)	C2-50	C2-92	BLNF14J29C	14 (7)	C3-94	C3-93
	240	3.0	3	17 (432)	BLNF17A29S	12 (6)	C2-50	C2-92	BLNF17A29C	15 (7)	C3-94	C3-93
	240	4.0	3	21 1/2 (546)	BLNF21J29S	14 (7)	C2-50	C2-92	BLNF21J29C	17 (8)	C3-94	C3-93
	480	4.0	3	21 1/2 (546)	BLNF21J30S	14 (7)	C2-43	C2-35	BLNF21J30C	17 (8)	C3-116	C3-118
	240	5.0	3	26 1/2 (673)	BLNF26J29S	17 (8)	C2-50	C2-92	BLNF26J29C	20 (9)	C3-94	C3-93
	480	5.0	3	26 1/2 (673)	BLNF26J30S	17 (8)	C2-43	C2-35	BLNF26J30C	20 (9)	C3-116	C3-118
	240	6.0	3	31 1/2 (800)	BLNF31J29S	18 (9)	C2-50	C2-92	BLNF31J29C	21 (10)	C3-94	C3-93
	480	6.0	3	31 1/2 (800)	BLNF31J30S	18 (9)	C2-43	C2-35	BLNF31J30C	21 (10)	C3-116	C3-118
	240	8.0	3	41 (1041)	BLNF41A29S	20 (9)	C2-50	C2-92	BLNF41A29C	23 (11)	C3-94	C3-93
	480	8.0	3	41 (1041)	BLNF41A30S	20 (9)	C2-43	C2-35	BLNF41A30C	23 (11)	C3-116	C3-118
	240	10.0	3	50 1/2 (1283)	BLNF50J29S	22 (10)	C2-50	C2-92	BLNF50J29C	25 (12)	C3-94	C3-93
480	10.0	3	50 1/2 (1283)	BLNF50J30S	22 (10)	C2-43	C2-35	BLNF50J30C	25 (12)	C3-116	C3-118	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

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# Immersion Heaters

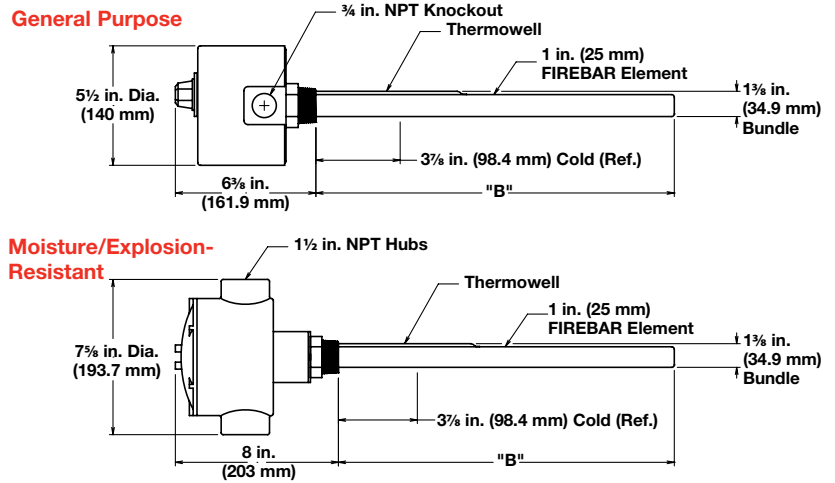


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Bunker C, Asphalt and #6 Fuel Oil

- 1 1/4 inch NPT screw plug
- FIREBAR elements
- With thermostat (DPST), Type 5A or 7A
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 5A (60-250°F)			Type 7A (100-550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose	Type J T/C		Type K T/C	General Purpose
8 W/in <sup>2</sup> ③ 304 SS Plug 1-Alloy 800 Element (1.3 W/cm <sup>2</sup> )	240	0.43	3	16 1/8 (409.6)	8 (4)	BDNF16G22S5A	C/F	C/F	BDNF16G22S7A	C/F	C/F
	240	0.55	3	19 1/8 (485.8)	9 (4)	BDNF19G22S5A	C/F	C/F	BDNF19G22S7A	C/F	C/F
	240	0.70	3	24 3/8 (619.1)	10 (5)	BDNF24L22S5A	C/F	C/F	BDNF24L22S7A	C/F	C/F
	480	0.70	3	24 3/8 (619.1)	10 (5)	BDNF24L21S5A	C/F	C/F	BDNF24L21S7A	C/F	C/F
	240	0.88	3	29 5/8 (752.5)	11 (5)	BDNF29R22S5A	C/F	C/F	BDNF29R22S7A	C/F	C/F
	480	0.88	3	29 5/8 (752.5)	11 (5)	BDNF29R21S5A	C/F	C/F	BDNF29R21S7A	C/F	C/F
	240	1.08	3	34 5/8 (879.5)	12 (6)	BDNF34R22S5A	C/F	C/F	BDNF34R22S7A	C/F	C/F
	480	1.08	3	34 5/8 (879.5)	12 (6)	BDNF34R21S5A	C/F	C/F	BDNF34R21S7A	C/F	C/F
	240	1.40	3	45 1/8 (1146.2)	14 (7)	BDNF45G22S5A	C/F	C/F	BDNF45G22S7A	C/F	C/F
	480	1.40	3	45 1/8 (1146.2)	14 (7)	BDNF45G21S5A	C/F	C/F	BDNF45G21S7A	C/F	C/F
	240	1.80	3	55 5/8 (1412.9)	16 (8)	BDNF55R22S5A	C/F	C/F	BDNF55R22S7A	C/F	C/F
	480	1.80	3	55 5/8 (1412.9)	16 (8)	BDNF55R21S5A	C/F	C/F	BDNF55R21S7A	C/F	C/F
8 W/in <sup>2</sup> ③ 304 SS Plug 1-Alloy 800 Element (1.3 W/cm <sup>2</sup> )	240	0.43	3	16 1/8 (409.6)	11 (5)	BDNF16G22C5A	C/F	C/F	BDNF16G22C7A	C/F	C/F
	240	0.55	3	19 1/8 (485.8)	12 (6)	BDNF19G22C5A	C/F	C/F	BDNF19G22C7A	C/F	C/F
	240	0.70	3	24 3/8 (619.1)	13 (6)	BDNF24L22C5A	C/F	C/F	BDNF24L22C7A	C/F	C/F
	480	0.70	3	24 3/8 (619.1)	13 (6)	BDNF24L21C5A	C/F	C/F	BDNF24L21C7A	C/F	C/F
	240	0.88	3	29 5/8 (752.5)	14 (7)	BDNF29R22C5A	C/F	C/F	BDNF29R22C7A	C/F	C/F
	480	0.88	3	29 5/8 (752.5)	14 (7)	BDNF29R21C5A	C/F	C/F	BDNF29R21C7A	C/F	C/F
	240	1.08	3	34 5/8 (879.5)	15 (7)	BDNF34R22C5A	C/F	C/F	BDNF34R22C7A	C/F	C/F
	480	1.08	3	34 5/8 (879.5)	15 (7)	BDNF34R21C5A	C/F	C/F	BDNF34R21C7A	C/F	C/F
	240	1.40	3	45 1/8 (1146.2)	17 (8)	BDNF45G22C5A	C/F	C/F	BDNF45G22C7A	C/F	C/F
	480	1.40	3	45 1/8 (1146.2)	17 (8)	BDNF45G21C5A	C/F	C/F	BDNF45G21C7A	C/F	C/F
	240	1.80	3	55 5/8 (1412.9)	19 (9)	BDNF55R22C5A	C/F	C/F	BDNF55R22C7A	C/F	C/F
	480	1.80	3	55 5/8 (1412.9)	19 (9)	BDNF55R21C5A	C/F	C/F	BDNF55R21C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

③ Wired for 3-phase operation only

⑤ No third party recognition

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# Immersion Heaters



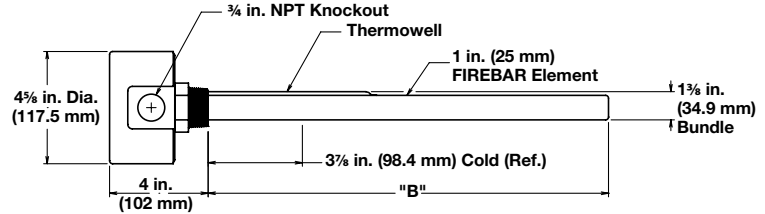
## WATROD and FIREBAR Screw Plug Immersion Heaters



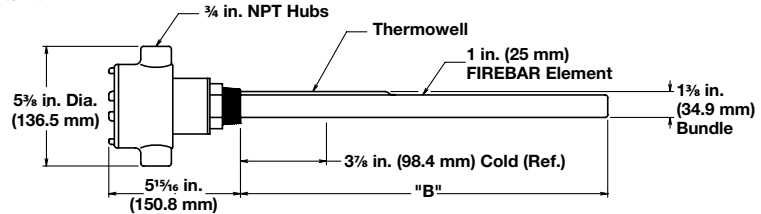
### Application: Bunker C, Asphalt and #6 Fuel Oil

- 1 1/4 inch NPT screw plug
- FIREBAR elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Moisture/Explosion- Resistant Enclosure	Type J T/C
8 W/in <sup>2</sup> ③ 304 SS Plug 1-Alloy 800 Element (1.3 W/cm <sup>2</sup> )	240	0.43	3	16 1/8 (409.6)	BDNF16G22S	7 (4)	C2-50	C2-92	BDNF16G22C	10 (5)	C3-94	C3-93
	240	0.55	3	19 1/8 (485.8)	BDNF19G22S	8 (4)	C2-50	C2-92	BDNF19G22C	11 (5)	C3-94	C3-93
	240	0.70	3	24 3/8 (619.1)	BDNF24L22S	9 (4)	C2-50	C2-92	BDNF24L22C	12 (6)	C3-94	C3-93
	480	0.70	3	24 3/8 (619.1)	BDNF24L21S	9 (4)	C2-43	C2-35	BDNF24L21C	12 (6)	C3-116	C3-118
	240	0.88	3	29 5/8 (752.5)	BDNF29R22S	10 (5)	C2-50	C2-92	BDNF29R22C	13 (6)	C3-94	C3-93
	480	0.88	3	29 5/8 (752.5)	BDNF29R21S	10 (5)	C2-43	C2-35	BDNF29R21C	13 (6)	C3-116	C3-118
	240	1.08	3	34 5/8 (879.5)	BDNF34R22S	11 (5)	C2-50	C2-92	BDNF34R22C	14 (7)	C3-94	C3-93
	480	1.08	3	34 5/8 (879.5)	BDNF34R21S	11 (5)	C2-43	C2-35	BDNF34R21C	14 (7)	C3-116	C3-118
	240	1.40	3	45 1/8 (1146.2)	BDNF45G22S	13 (6)	C2-50	C2-92	BDNF45G22C	16 (8)	C3-94	C3-93
	480	1.40	3	45 1/8 (1146.2)	BDNF45G21S	13 (6)	C2-43	C2-35	BDNF45G21C	16 (8)	C3-116	C3-118
	240	1.80	3	55 5/8 (1412.9)	BDNF55R22S	15 (7)	C2-50	C2-92	BDNF55R22C	18 (9)	C3-94	C3-93
	480	1.80	3	55 5/8 (1412.9)	BDNF55R21S	15 (7)	C2-43	C2-35	BDNF55R21C	18 (9)	C3-116	C3-118

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

③ Wired for 3-phase operation only

⑤ No third party recognition

# Immersion Heaters



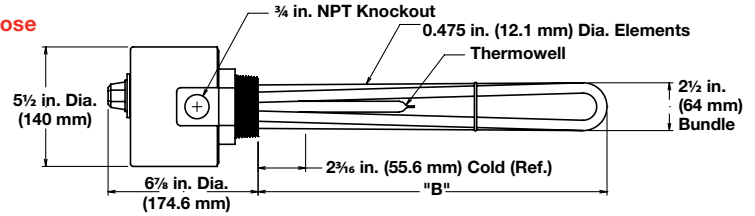
## WATROD and FIREBAR Screw Plug Immersion Heaters



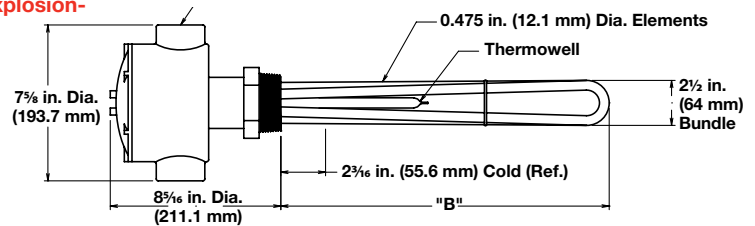
### Application: Bunker C, Asphalt and #6 Fuel Oil

- 2 1/2 inch NPT screw plug
- WATROD elements
- With thermostat (DPST), Type 4, 5A or 7A
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 4 (30-110°F)		Type 5A (60-250°F)		Type 7A (100-550°F)					
						Part Number	WATCONNECT Part Number	Part Number	WATCONNECT Part Number	Part Number	WATCONNECT Part Number				
						General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C	General Purpose Enclosure	Type J T/C	Type K T/C	
8 W/in <sup>2</sup> ③ Steel Plug 3-Steel Elements (1.3 W/cm <sup>2</sup> )	240	1.0	3	17 1/4 (438)	10 (5)	BLS717E12S4	C/F	C/F	BLS717E12S5A	C/F	C/F	BLS717E12S7	C/F	C/F	
	480	1.0	3	17 1/4 (438)	10 (5)	BLS717E13S4	C/F	C/F	BLS717E13S5A	C/F	C/F	BLS717E13S7	C/F	C/F	
	240	1.5	3	24 3/4 (629)	13 (6)	BLS724N12S4	C/F	C/F	BLS724N12S5A	C/F	C/F	BLS724N12S7	C/F	C/F	
	480	1.5	3	24 3/4 (629)	13 (6)	BLS724N13S4	C/F	C/F	BLS724N13S5A	C/F	C/F	BLS724N13S7	C/F	C/F	
	240	2.0	3	32 1/4 (819)	15 (7)	BLS732E12S4	C/F	C/F	BLS732E12S5A	C/F	C/F	BLS732E12S7	C/F	C/F	
	480	2.0	3	32 1/4 (819)	15 (7)	BLS732E13S4	C/F	C/F	BLS732E13S5A	C/F	C/F	BLS732E13S7	C/F	C/F	
	240	2.5	3	39 3/4 (1010)	16 (8)	BLS739N12S4	C/F	C/F	BLS739N12S5A	C/F	C/F	BLS739N12S7	C/F	C/F	
	480	2.5	3	39 3/4 (1010)	16 (8)	BLS739N13S4	C/F	C/F	BLS739N13S5A	C/F	C/F	BLS739N13S7	C/F	C/F	
	240	3.0	3	47 1/4 (1200)	18 (9)	BLS747E12S4	C/F	C/F	BLS747E12S5A	C/F	C/F	BLS747E12S7	C/F	C/F	
	480	3.0	3	47 1/4 (1200)	18 (9)	BLS747E13S4	C/F	C/F	BLS747E13S5A	C/F	C/F	BLS747E13S7	C/F	C/F	
	240	4.0	3	63 3/4 (1619)	21 (10)	BLS763N12S4	C/F	C/F	BLS763N12S5A	C/F	C/F	BLS763N12S7	C/F	C/F	
	480	4.0	3	63 3/4 (1619)	21 (10)	BLS763N13S4	C/F	C/F	BLS763N13S5A	C/F	C/F	BLS763N13S7	C/F	C/F	
	240	5.0	3	76 1/4 (1937)	24 (11)	BLS776E12S4	C/F	C/F	BLS776E12S5A	C/F	C/F	BLS776E12S7	C/F	C/F	
	480	5.0	3	76 1/4 (1937)	24 (11)	BLS776E13S4	C/F	C/F	BLS776E13S5A	C/F	C/F	BLS776E13S7	C/F	C/F	
	8 W/in <sup>2</sup> ③ Steel Plug 3-Steel Elements (1.3 W/cm <sup>2</sup> )	240	1.0	3	17 1/4 (438)	13 (6)	BLS717E12C4	C/F	C/F	BLS717E12C5A	C/F	C/F	BLS717E12C7A	C/F	C/F
		480	1.0	3	17 1/4 (438)	13 (6)	BLS717E13C4	C/F	C/F	BLS717E13C5A	C/F	C/F	BLS717E13C7A	C/F	C/F
240		1.5	3	24 3/4 (629)	16 (8)	BLS724N12C4	C/F	C/F	BLS724N12C5A	C/F	C/F	BLS724N12C7A	C/F	C/F	
480		1.5	3	24 3/4 (629)	16 (8)	BLS724N13C4	C/F	C/F	BLS724N13C5A	C/F	C/F	BLS724N13C7A	C/F	C/F	
240		2.0	3	32 1/4 (819)	18 (9)	BLS732E12C4	C/F	C/F	BLS732E12C5A	C/F	C/F	BLS732E12C7A	C/F	C/F	
480		2.0	3	32 1/4 (819)	18 (9)	BLS732E13C4	C/F	C/F	BLS732E13C5A	C/F	C/F	BLS732E13C7A	C/F	C/F	
240		2.5	3	39 3/4 (1010)	19 (9)	BLS739N12C4	C/F	C/F	BLS739N12C5A	C/F	C/F	BLS739N12C7A	C/F	C/F	
480		2.5	3	39 3/4 (1010)	19 (9)	BLS739N13C4	C/F	C/F	BLS739N13C5A	C/F	C/F	BLS739N13C7A	C/F	C/F	
240		3.0	3	47 1/4 (1200)	21 (10)	BLS747E12C4	C/F	C/F	BLS747E12C5A	C/F	C/F	BLS747E12C7A	C/F	C/F	
480		3.0	3	47 1/4 (1200)	21 (10)	BLS747E13C4	C/F	C/F	BLS747E13C5A	C/F	C/F	BLS747E13C7A	C/F	C/F	
240		4.0	3	63 3/4 (1619)	24 (11)	BLS763N12C4	C/F	C/F	BLS763N12C5A	C/F	C/F	BLS763N12C7A	C/F	C/F	
480		4.0	3	63 3/4 (1619)	24 (11)	BLS763N13C4	C/F	C/F	BLS763N13C5A	C/F	C/F	BLS763N13C7A	C/F	C/F	
240		5.0	3	76 1/4 (1937)	27 (13)	BLS776E12C4	C/F	C/F	BLS776E12C5A	C/F	C/F	BLS776E12C7A	C/F	C/F	
480		5.0	3	76 1/4 (1937)	27 (13)	BLS776E13C4	C/F	C/F	BLS776E13C5A	C/F	C/F	BLS776E13C7A	C/F	C/F	

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

- ③ Wired for 3-phase operation only
- ⑤ No third party recognition

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters

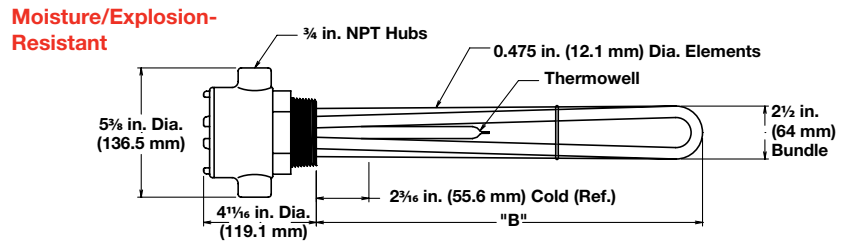
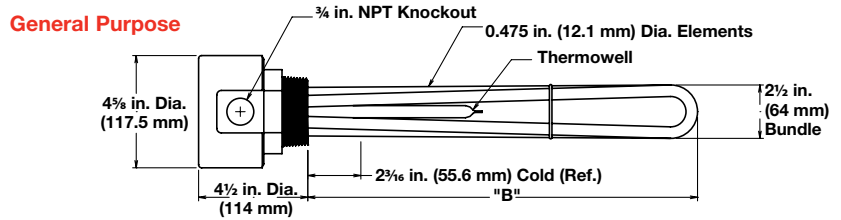


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Bunker C, Asphalt and #6 Fuel Oil

- 2 1/2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
							Type J T/C	Type K T/C			Type J T/C	Type K T/C
<b>8 W/in<sup>2</sup> ③ Steel Plug 3-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	1.0	3	17 1/4 (438)	<b>BLS717E12S</b>	9 (4)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS717E12C</b>	12 (6)	<b>C3-94</b>	<b>C3-93</b>
	480	1.0	3	17 1/4 (438)	<b>BLS717E13S</b>	9 (4)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS717E13C</b>	12 (6)	<b>C3-116</b>	<b>C3-118</b>
	240	1.5	3	24 3/4 (629)	<b>BLS724N12S</b>	12 (6)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS724N12C</b>	15 (7)	<b>C3-94</b>	<b>C3-93</b>
	480	1.5	3	24 3/4 (629)	<b>BLS724N13S</b>	12 (6)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS724N13C</b>	15 (7)	<b>C3-116</b>	<b>C3-118</b>
	240	2.0	3	32 1/4 (819)	<b>BLS732E12S</b>	14 (7)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS732E12C</b>	17 (8)	<b>C3-94</b>	<b>C3-93</b>
	480	2.0	3	32 1/4 (819)	<b>BLS732E13S</b>	14 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS732E13C</b>	17 (8)	<b>C3-116</b>	<b>C3-118</b>
	240	2.5	3	39 3/4 (1010)	<b>BLS739N12S</b>	15 (7)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS739N12C</b>	18 (9)	<b>C3-94</b>	<b>C3-93</b>
	480	2.5	3	39 3/4 (1010)	<b>BLS739N13S</b>	15 (7)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS739N13C</b>	18 (9)	<b>C3-116</b>	<b>C3-118</b>
	240	3.0	3	47 1/4 (1200)	<b>BLS747E12S</b>	17 (8)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS747E12C</b>	20 (9)	<b>C3-94</b>	<b>C3-93</b>
	480	3.0	3	47 1/4 (1200)	<b>BLS747E13S</b>	17 (8)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS747E13C</b>	20 (9)	<b>C3-116</b>	<b>C3-118</b>
	240	4.0	3	63 3/4 (1619)	<b>BLS763N12S</b>	20 (9)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS763N12C</b>	23 (11)	<b>C3-94</b>	<b>C3-93</b>
	480	4.0	3	63 3/4 (1619)	<b>BLS763N13S</b>	20 (9)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS763N13C</b>	23 (11)	<b>C3-116</b>	<b>C3-118</b>
	240	5.0	3	76 1/4 (1937)	<b>BLS776E12S</b>	23 (11)	<b>C2-50</b>	<b>C2-92</b>	<b>BLS776E12C</b>	26 (12)	<b>C3-94</b>	<b>C3-93</b>
	480	5.0	3	76 1/4 (1937)	<b>BLS776E13S</b>	23 (11)	<b>C2-43</b>	<b>C2-35</b>	<b>BLS776E13C</b>	26 (12)	<b>C3-116</b>	<b>C3-118</b>

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

- ③ Wired for 3-phase operation only
- ⑤ No third party recognition

# Immersion Heaters



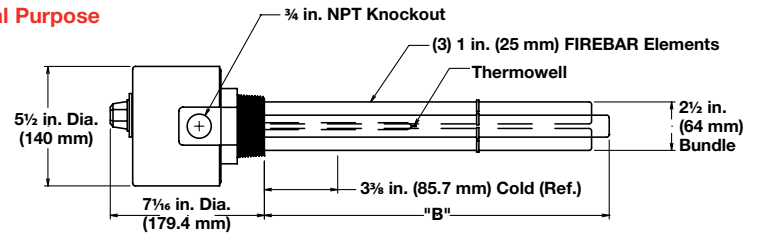
## WATROD and FIREBAR Screw Plug Immersion Heaters



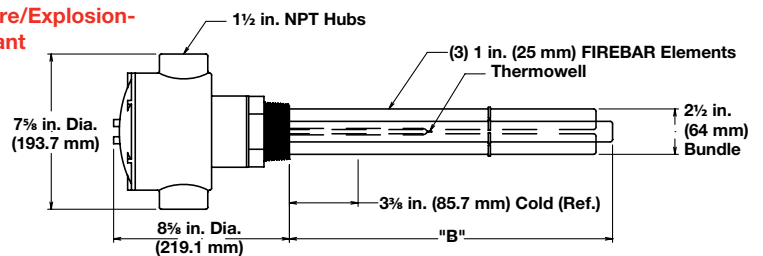
### Application: Bunker C, Asphalt and #6 Fuel Oil

- 2 1/2 inch NPT screw plug
- FIREBAR elements
- With thermostat (DPST), Type 5A or 7A
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

#### General Purpose



#### Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Type 5A (60-250°F)			Type 7A (100-550°F)		
						Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Type J T/C		Type K T/C	General Purpose Enclosure
8 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (1.3 W/cm <sup>2</sup> )	240	1.25	3	15 1/8 (384.2)	11 (5)	BLNF15C22S5A	C/F	C/F	BLNF15C22S7A	C/F	C/F
	240	1.63	3	18 1/8 (460.4)	13 (6)	BLNF18C22S5A	C/F	C/F	BLNF18C22S7A	C/F	C/F
	240	2.13	3	23 1/8 (587.4)	15 (7)	BLNF23C22S5A	C/F	C/F	BLNF23C22S7A	C/F	C/F
	480	2.13	3	23 1/8 (587.4)	15 (7)	BLNF23C21S5A	C/F	C/F	BLNF23C21S7A	C/F	C/F
	240	2.63	3	28 5/8 (727.1)	18 (9)	BLNF28L22S5A	C/F	C/F	BLNF28L22S7A	C/F	C/F
	480	2.63	3	28 5/8 (727.1)	18 (9)	BLNF28L21S5A	C/F	C/F	BLNF28L21S7A	C/F	C/F
	240	3.19	3	33 5/8 (854.1)	19 (9)	BLNF33L22S5A	C/F	C/F	BLNF33L22S7A	C/F	C/F
	480	3.19	3	33 5/8 (854.1)	19 (9)	BLNF33L21S5A	C/F	C/F	BLNF33L21S7A	C/F	C/F
	240	4.25	3	44 1/8 (1120.8)	21 (10)	BLNF44C22S5A	C/F	C/F	BLNF44C22S7A	C/F	C/F
	480	4.25	3	44 1/8 (1120.8)	21 (10)	BLNF44C21S5A	C/F	C/F	BLNF44C21S7A	C/F	C/F
	240	5.38	3	54 5/8 (1387.5)	23 (11)	BLNF54L22S5A	C/F	C/F	BLNF54L22S7A	C/F	C/F
	480	5.38	3	54 5/8 (1387.5)	23 (11)	BLNF54L21S5A	C/F	C/F	BLNF54L21S7A	C/F	C/F
8 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (1.3 W/cm <sup>2</sup> )	240	1.25	3	15 1/8 (384.2)	14 (7)	BLNF15C22C5A	C/F	C/F	BLNF15C22C7A	C/F	C/F
	240	1.63	3	18 1/8 (460.4)	16 (8)	BLNF18C22C5A	C/F	C/F	BLNF18C22C7A	C/F	C/F
	240	2.13	3	23 1/8 (587.4)	18 (9)	BLNF23C22C5A	C/F	C/F	BLNF23C22C7A	C/F	C/F
	480	2.13	3	23 1/8 (587.4)	18 (9)	BLNF23C21C5A	C/F	C/F	BLNF23C21C7A	C/F	C/F
	240	2.63	3	28 5/8 (727.1)	21 (10)	BLNF28L22C5A	C/F	C/F	BLNF28L22C7A	C/F	C/F
	480	2.63	3	28 5/8 (727.1)	21 (10)	BLNF28L21C5A	C/F	C/F	BLNF28L21C7A	C/F	C/F
	240	3.19	3	33 5/8 (854.1)	22 (10)	BLNF33L22C5A	C/F	C/F	BLNF33L22C7A	C/F	C/F
	480	3.19	3	33 5/8 (854.1)	22 (10)	BLNF33L21C5A	C/F	C/F	BLNF33L21C7A	C/F	C/F
	240	4.25	3	44 1/8 (1120.8)	24 (11)	BLNF44C22C5A	C/F	C/F	BLNF44C22C7A	C/F	C/F
	480	4.25	3	44 1/8 (1120.8)	24 (11)	BLNF44C21C5A	C/F	C/F	BLNF44C21C7A	C/F	C/F
	240	5.38	3	54 5/8 (1387.5)	26 (11)	BLNF54L22C5A	C/F	C/F	BLNF54L22C7A	C/F	C/F
	480	5.38	3	54 5/8 (1387.5)	26 (11)	BLNF54L21C5A	C/F	C/F	BLNF54L21C7A	C/F	C/F

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

③ Wired for 3-phase operation only    ⑤ No third party recognition  
C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters

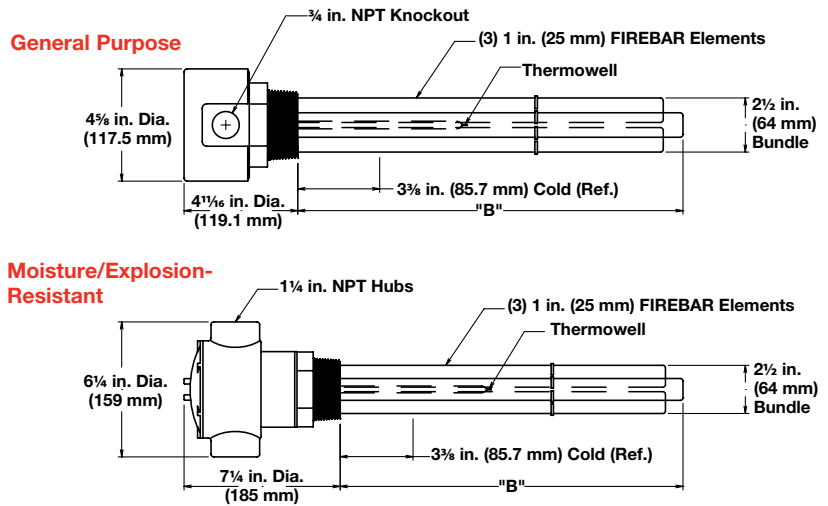


## WATROD and FIREBAR Screw Plug Immersion Heaters



### Application: Bunker C, Asphalt and #6 Fuel Oil

- 2 1/2 inch NPT screw plug
- FIREBAR elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)



Description	Volts	kW	Ph	"B" Dim. in. (mm)	General Purpose Enclosure		WATCONNECT Part Number		Moisture/Explosion-Resistant Enclosure		WATCONNECT Part Number	
					Part Number	Ship Wt. lbs (kg)	Type J T/C	Type K T/C	Part Number ⑤	Ship Wt. lbs (kg)	Type J T/C	Type K T/C
8 W/in <sup>2</sup> ③ 304 SS Plug 3-Alloy 800 Elements (1.3 W/cm <sup>2</sup> )	240	1.25	3	15 1/8 (384.2)	BLNF15C22S	11 (5)	C2-50	C2-92	BLNF15C22C	14 (7)	C3-94	C3-93
	240	1.63	3	18 1/8 (460.4)	BLNF18C22S	12 (6)	C2-50	C2-92	BLNF18C22C	15 (7)	C3-94	C3-93
	240	2.13	3	23 1/8 (587.4)	BLNF23C22S	14 (7)	C2-50	C2-92	BLNF23C22C	17 (8)	C3-94	C3-93
	480	2.13	3	23 1/8 (587.4)	BLNF23C21S	14 (7)	C2-43	C2-35	BLNF23C21C	17 (8)	C3-116	C3-118
	240	2.63	3	28 5/8 (727.1)	BLNF28L22S	17 (8)	C2-50	C2-92	BLNF28L22C	20 (9)	C3-94	C3-93
	480	2.63	3	28 5/8 (727.1)	BLNF28L21S	17 (8)	C2-43	C2-35	BLNF28L21C	20 (9)	C3-116	C3-118
	240	3.19	3	33 5/8 (854.1)	BLNF33L22S	18 (9)	C2-50	C2-92	BLNF33L22C	21 (10)	C3-94	C3-93
	480	3.19	3	33 5/8 (854.1)	BLNF33L21S	18 (9)	C2-43	C2-35	BLNF33L21C	21 (10)	C3-116	C3-118
	240	4.25	3	44 1/8 (1120.8)	BLNF44C22S	20 (9)	C2-50	C2-92	BLNF44C22C	23 (11)	C3-94	C3-93
	480	4.25	3	44 1/8 (1120.8)	BLNF44C21S	20 (9)	C2-43	C2-35	BLNF44C21C	23 (11)	C3-116	C3-118
	240	5.38	3	54 5/8 (1387.5)	BLNF54L22S	22 (10)	C2-50	C2-92	BLNF54L22C	25 (12)	C3-94	C3-93
	480	5.38	3	54 5/8 (1387.5)	BLNF54L21S	22 (10)	C2-43	C2-35	BLNF54L21C	25 (12)	C3-116	C3-118

**Note:** All screw plug bundles are designed to fit the inside diameter of the equivalent mating coupling. They will not fit into the equivalent pipe inside diameter.

③ Wired for 3-phase operation only

⑤ No third party recognition



# Immersion Heaters



## WATROD and FIREBAR Screw Plug Immersion Heaters

### Part Number

Stock Screw Plug Part Number	Optional Terminal Enclosures	Optional Process Sensors	Sheath Limit Sensors

#### Stock Screw Plug Part Number

**Note:** Catalog part numbers include standard option enclosures and process sensors. To order optional enclosures or sensors, substitute the appropriate suffix.

#### Optional Terminal Enclosures

S =	General purpose enclosure
W =	NEMA 4 enclosure
C =	CSA Type 4/Explosion proof enclosure

**Note:** Catalog listings include either a general purpose enclosure or moisture/explosion-resistant enclosure. Substitute enclosure options are noted.

#### Optional Bulb & Capillary Thermostats or Thermocouple Process Sensors

2 =	30 to 250°F, (-1 to 121°C) SPST
3 =	175 to 550°F, (79 to 288°C) SPST
4 =	30 to 110°F, (-1 to 43°C) DPST
5A =	60 to 250°F, (16 to 121°C) DPST (FIREBAR)
7A =	100 to 550°F, (38 to 288°C) DPST (FIREBAR)
PJ =	Type J process thermocouple in thermowell
PK =	Type K process thermocouple in thermowell

**Note:** Thermostat part numbers are shown in the *Thermostat Chart* on page 517.

**Example Part Number:** BHC78C6 S 1 HJ

#### Sheath Limit Sensors

HJ =	Type J high-limit thermocouple, horizontal mount
TJ =	Type J high-limit thermocouple, vertical/housing at top
BJ =	Type J high-limit thermocouple, vertical/housing at bottom
HK =	Type K high-limit thermocouple, horizontal mount
TK =	Type K high-limit thermocouple, vertical/housing at top
BK =	Type K high-limit thermocouple, vertical/housing at bottom

**Note:** Heater orientation is critical to accurate sensing of limit conditions. Use the appropriate code to indicate heater mounting orientation.

# Immersion Heaters



## WATROD™ and FIREBAR® Screw Plug Immersion Heaters

### WATROD™ Screw Plug with Control Assembly

Constructed from a WATROD screw plug heater, a moisture resistant terminal enclosure and built-in temperature sensor and power controller, this assembly comes pre-wired and ready for hook-up to any 120VAC control circuit.

Optional sheath materials, NPT screw plug sizes and materials, wattages, voltages and terminal enclosures extend application versatility.

### Performance Capabilities

- Watt densities up to 60 W/in<sup>2</sup> (9.3 W/cm<sup>2</sup>)
- Wattages up to 20 kilowatts
- Voltages up to 600VAC
- Alloy 800/840 sheath temperatures up to 1600°F (870°C)

### Features and Benefits

**Three 0.475 in. (12 mm) diameter WATROD elements brazed to a 2 in. NPT brass screw plug**

- Produces a pressure-tight seal

**WATROD hairpins are repressed (recompacted) after bending**

- Maintains MgO density, dielectric strength, heat transfer and life

**Two built-in thermostats, one on-off with manual reset**

- Helps ensure safe operation by automatically cycling on and off when process or sheath temperatures reach a predetermined set point selectable from 30° to 250°F (0° to 120°C)

**Internal mechanical contactor**

- Works on a 120VAC control circuit to switch higher volts/amps to the heating elements

**Hinged, moisture resistant terminal enclosure has two conduit openings**

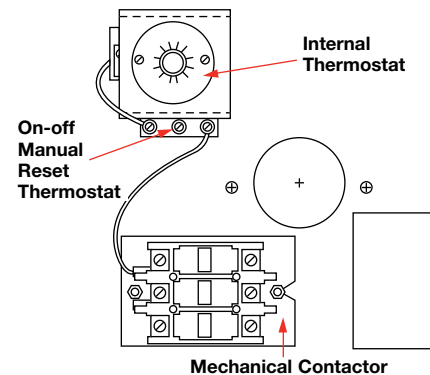
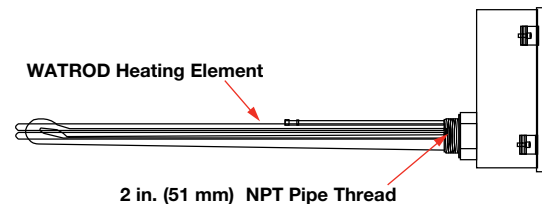
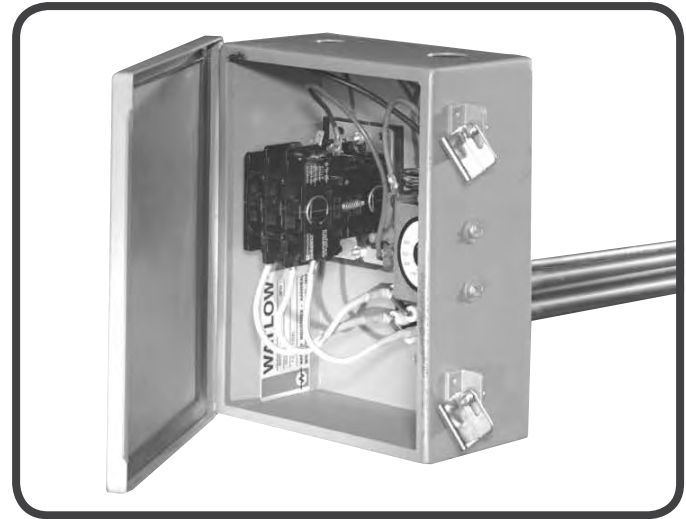
- Accommodates 3/4 in. (19 mm) NPT conduit fittings

**Terminal enclosures can be rotated to mate with existing conduits**

- Minimal fastener adjustment required

**Thermowells allow replacing the thermostat sensing element without draining the fluid being heated**

- Labor required to maintain and repair is minimized



### Typical Applications

- Water heating
- Commercial dishwashers and glass washers
- Sterilizing equipment

### Application Hints

Same as *Screw Plug Immersion Heaters*. See page 149 for details.

### Accessories

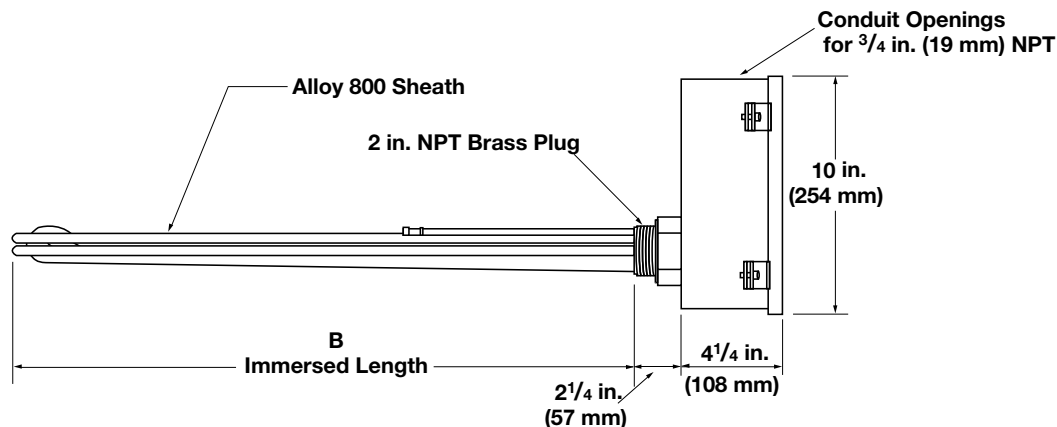
*Clamping Nut, Gasket and Washers*—for mounting to thin-wall tanks, use optional clamping nut, gasket and washers. To order, specify **NGW**.

# Immersion Heaters



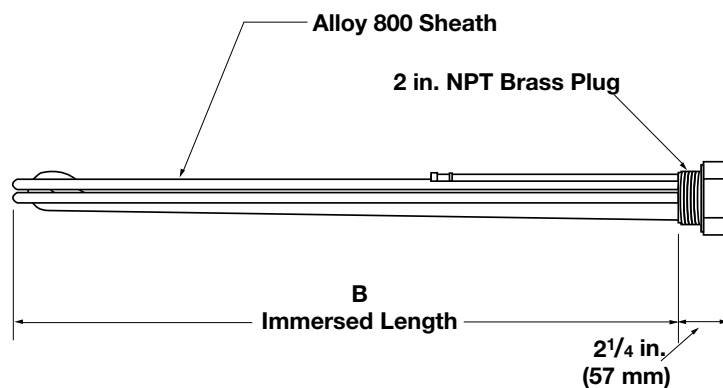
## WATROD and FIREBAR Screw Plug Immersion Heaters

### WATROD Screw Plug with Control Assembly (Continued)



### 2 in. NPT Brass Screw Plug With Control Box (Assembly Stock)

WATROD Desc.	kW	Immersed Length in. (mm)	Part Number					Est. Net Wt. lbs (kg)
			208VAC 3-Phase	240VAC 3-Phase	380VAC 3-Phase	480VAC 3-Phase	575VAC 3-Phase	
50 W/in <sup>2</sup>	9	24% (629.0)		BHNB24N3W2C11		BHNB24N5W2C11	BHNB24N16W2C11	23 (10)
Brass Plug	12	30 (762.0)	BHNB30A2W2C11	BHNB30A3W2C11	BHNB30A8W2C11	BHNB30A5W2C11	BHNB30A16W2C11	24 (11)
3-Alloy 800	16	35% (904.8)	BHNB35L2W2C11	BHNB35L3W2C11	BHNB35L8W2C11	BHNB35L5W2C11	BHNB35L16W2C11	25 (11)
(7.8 W/cm <sup>2</sup> )	20	45% (1158.8)		BHNB45L3W2C11	BHNB45L8W2C11	BHNB45L5W2C11	BHNB45L16W2C11	27 (12)



### 2 in. NPT Brass Screw Plug With Control Box (Replacement Heater Only)

WATROD Desc.	kW	Immersed Length in. (mm)	Part Number					Est. Net Wt. lbs (kg)
			208VAC 3-Phase	240VAC 3-Phase	380VAC 3-Phase	480VAC 3-Phase	575VAC 3-Phase	
50 W/in <sup>2</sup>	9	24% (628.7)		BHNB24N3		BHNB24N5	BHNB24N16	21 (9)
Brass Plug	12	30 (762.0)	BHNB30A2	BHNB30A3	BHNB30A8	BHNB30A5	BHNB30A16	22 (10)
Alloy 800	16	35% (904.8)	BHNB35L2	BHNB35L3	BHNB35L8	BHNB35L5	BHNB35L16	23 (10)
(7.8 W/cm <sup>2</sup> )	20	45% (1158.8)		BHNB45L3	BHNB45L8	BHNB45L5	BHNB45L16	25 (11)

# Immersion Heaters



## WATROD™ ANSI Flange Immersion Heaters

Watlow® flange heaters are easy to install and maintain. Designed for heating liquids and gases in tanks and pressure vessels, flange immersion heaters are ideal for applications requiring higher kilowatts.

Watlow flange heaters are made with WATROD tubular elements brazed or welded to a flange. Stock flange heaters are equipped with a general purpose terminal enclosure.

### Performance Capabilities

- Watt densities up to 100 W/in<sup>2</sup> (15.5 W/cm<sup>2</sup>)
- Wattages up to three megawatts
- UL® and CSA component recognition up to 600VAC
- Alloy 800/840 sheath temperatures up to 1600°F (870°C)
- Passivated 316 stainless steel sheath temperatures up to 1200°F (650°C)
- 304 stainless steel sheath temperatures up to 1200°F (650°C)
- Steel sheath temperatures up to 750°F (400°C)

### Features and Benefits

#### ANSI and ANSI compatible 2, 2½, 3 thru 48 inch flanges

- Provides appropriate heater size-to-application and fit

#### Element sheath and flange materials

- Meets your application needs

#### Integral thermowells

- Provides convenient temperature sensor insertion and replacement without draining the fluid being heated

#### Standard, general purpose terminal enclosure

- Offers easy access to wiring

#### Element support(s)

- Provides proper element spacing to maximize heater performance and life

#### All units are inspected and/or tested

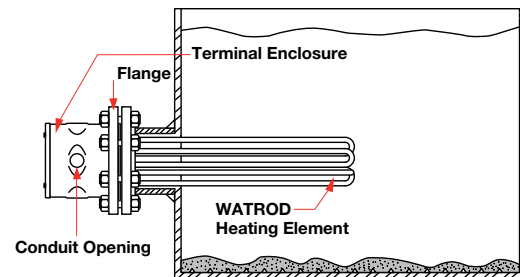
- Ensures element-to-flange pressure seals do not leak

#### Drilled and tapped eyebolt holes or lift lugs for eye bolts on three inch and larger flange heaters

- Facilitates lifting during installation

#### WATROD hairpins are repressed (recompacted)

- Provides improved heater life, insulation resistance and heat transfer



#### Branch circuits are designed for 48 amperes per circuit maximum

- Reduces risk of failure due to excessive temperatures generated by high amperage

#### UL® and CSA component recognition under file numbers E52951 and 31388 respectively

- Simplifies obtaining third-party recognition for assembly

# Immersion Heaters



## WATROD ANSI Flange Immersion Heaters

### Typical Applications

- Water:
  - Deionized
  - Demineralized
  - Clean
  - Potable
  - Process
- Industrial water rinse tanks
- Vapor degreasers
- Hydraulic oil, crude, asphalt
- Lubricating oils at API specified watt densities
- Air and gas flow
- Caustic solutions
- Chemical baths
- Process air equipment
- Boiler equipment
- Freeze protection of any fluid
- Anti-freeze (glycol) solutions
- Paraffin

### Options

#### WATCONNECT® Standard Control Panels



WATCONNECT® standard control panels are configured to work with Watlow's ANSI flange immersion heaters. They are quickly configured for process heating applications and delivered within two weeks. WATCONNECT panels integrate Watlow's high-quality heater, sensor, temperature

controller and power controller products for a complete thermal solution. Normally, competitive custom panels require significantly longer lead times. The broad range of standard features allow customers to quickly configure panels for each process heater included in this catalog.

#### Features and Benefits

##### Lead times of two weeks or less

- Provides faster delivery than competition

##### Full documentation provided for WATCONNECT control panels at the time of quotation

- Eliminates lengthy approval process and phone calls

##### Incorporates Watlow's temperature and power controllers

- Provides a turnkey solution for process heating applications

##### Range of standard input/output (I/O) options

- Provides the user with a higher level of monitoring and control assuring an efficient and safe operation

##### WATCONNECT enclosure easily mounts to wall or frame

- Decreases installation time

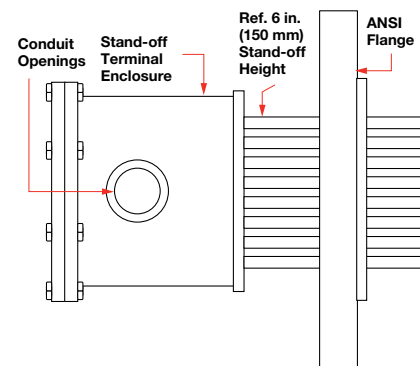
### Options (Continued)

**Note:** The WATCONNECT part number associated with a heater is only a suggestion. The following installation details need to be compared to panel capabilities to assure a compatible match:

- Minimum and maximum ambient temperature where panel will be installed
- Statutory and regulatory requirements at installation site
- Sun loading, if any, at installation site
- Presence of any hazardous gases, dusts or fibers, if any
- Verification of process sensor type
- Verification of limit sensor type
- Input/Output (I/O) requirements

**For additional product information see the WATCONNECT landing page at [www.watlow.com/watconnect](http://www.watlow.com/watconnect).** On the WATCONNECT landing page you will find a complete specification sheet along with other tools to help you properly select your control panel. If you would like to know the specific configuration of a WATCONNECT part number, please use the Product Configuration Lookup Tool on Watlow.com.

### Stand-off Terminal Enclosures



Stand-off terminal enclosures provide an air-insulating barrier between the flange and terminal enclosure by mounting the terminations and wiring away from the flange. Stand-off terminal enclosures are recommended whenever a process operating temperature exceeds 210°F (100°C). This helps minimize terminal enclosure temperatures.

To order, specify **stand-off terminal enclosure**.



## WATROD ANSI Flange Immersion Heaters

### Options (Continued)

#### Terminal Enclosures

General purpose terminal enclosures, without thermostats, are standard on all flange immersion heaters. Optional terminal enclosures include:

- General purpose with a single or double-pole thermostat
- Moisture resistant—available with or without a single- or double-pole thermostat
- Corrosion resistant—available with or without a single- or double-pole thermostat
- Non-certified, explosion and moisture resistant combination suitable for use in non-classified areas only—available with or without a single- or double-pole thermostat

Prior to ordering, refer to the terminal enclosure dimensions on page 226. Order by adding the appropriate suffix letter(s) to the base flange heater part number, as shown on the ordering information chart. Heater part numbers and suffix letters are depicted on the charts, pages 227 to 280. Specify class and group, if applicable.



#### Caution

Certified explosion proof and/or flame proof terminal enclosures are intended to provide explosion containment in the electrical termination/wiring enclosure only. No portion of the assembly outside of this enclosure is covered under this rating. Rating effectiveness may be compromised by abuse or misapplication.

#### Thermostats

To provide process temperature control, Watlow offers optional single pole, single throw (SPST) and double pole, single throw (DPST) thermostats.

Unless otherwise specified, thermostats are mounted inside the terminal enclosure. For details and ordering information, refer to *Thermostats* on pages 514 to 518.

#### Certified Enclosures

CSA, ATEX or IECEx certified enclosures protect wiring in hazardous gas environments. These terminal enclosures, covered under CSA file number 61707, ATEX certificate # SIRA 10ATEX1155X or IECEx certificate # IECEx CSA 09.0010X are available on WATROD flange heaters. For additional information, see page 561 and 562 or contact your Watlow representative.

For products that will be installed in hazardous locations, please provide the following information:

- Operating conditions
- Minimum and maximum ambient temperatures for the installation location
- Mounting orientation
- Process temperature (°F)
- Maximum working pressure (MWP) of application (psig)
- Media being heated

Watlow must understand this information so that an appropriate design can be provided.

#### ASME Pressure Vessel Code Welding

Flange assemblies can be provided with an ASME Section VIII, Div. I pressure vessel stamp upon request.

#### Wattages and Voltages

Watlow routinely supplies flange immersion heaters with 240 to 480VAC as well as wattages from 150 watts to one megawatt.

#### Sheath Materials

The following sheath materials are available on WATROD flange heaters:

##### Standard Sheath Materials

<b>WATROD</b>	Alloy 800, 840 316 SS Copper clad steel Steel
---------------	--

##### Exotic Sheath Materials

Contact your Watlow representative for details and availability.

# Immersion Heaters



## WATROD ANSI Flange Immersion Heaters

### Options (Continued)

#### Thermocouples

ASTM Type J or K thermocouples offer more accurate sensing of process and/or sheath temperatures. A thermocouple may be inserted into the thermowell or attached to the heater's sheath.

Thermocouples are standardly supplied with 120 in. (3050 mm) leads. Unless otherwise specified, thermocouples are supplied with temperature ranges detailed on the *Thermocouple Types* chart.

Using a thermocouple requires an appropriate temperature and power controller. These must be purchased separately. Watlow offers a wide variety of temperature and power controllers to meet virtually all applications. Temperature controllers can be configured to accept process variable inputs, too. Contact your Watlow representative for details.

To order, specify **Type J** or **K** thermocouple and indicate if the thermocouple is for **process temperature sensing** or heater sheath **high-limit protection**. Please specify if the flange heater will be mounted **vertical** or **horizontal** in the tank. **If vertical, specify if the housing is on top or bottom.**

If the flange heater is part of an in-line circulation heating application, indicate flow direction relative to the heater's enclosure.

#### Thermocouple Types

ASTM Type	Conductor Characteristics		Recommended <sup>①</sup> Temperature Range °F (°C)
	Positive	Negative	
J	Iron (Magnetic)	Constantan (Non-magnetic)	0 to 1000 (-20 to 540)
K	Chromel® (Non-magnetic)	Alumel® (Magnetic)	0 to 2000 (-20 to 1100)

① Type J and Type K thermocouples are rated 32 to 1382°F and 32 to 2282°F (0-750°C and 0-1250°C), respectively. Watlow does not recommend exceeding temperature ranges shown on this chart for the tubular product line.

#### Flanges

##### Flange Sizes and Styles

**Standard:** 2<sup>①</sup>, 2<sup>1/2</sup><sup>①</sup>, 3 to 14 inch ANSI raised face/blind flanges.

**Made-to-Order:** 16 to 48 inch in any recognized configuration, as well as customer specified. Over 48 inch ANSI flange, contact your Watlow representative.

##### Flange Materials

Standard	
	Carbon steel
	316 SS
	304 SS

##### Pressure Classes

Standard	
	150 lb
	300 lb

① ANSI bolt pattern only

#### Gaskets

Rubber, asbestos-free and spiral wound gaskets are available for all flange sizes. Order by specifying gasket type, flange size/rating, process operating temperature and pressure.

To make the correct selection, see the *Gasket Selection* chart. It provides a recommended gasket type and effective temperature rating.

To use this chart, multiply operating temperature by the operating pressure to arrive at "Maximum PSIG x °F." This is listed in the chart's first column.

#### Gasket Selection

Maximum PSIG x °F	Gasket Temperature °F	Gasket Type
Up to 15,000	300	Rubber
Over 250,000	700	Asbestos-Free
Over 250,000	③	Spiral Wound

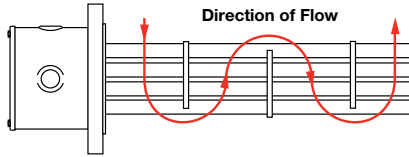
③ Depends on metal gasket material.



## WATROD ANSI Flange Immersion Heaters

### Options (Continued)

#### Baffles



For forced circulation applications, 316 stainless steel baffles can be arranged on the heating element bundle to enhance and/or modify fluid or gas flow for better heat transfer.

For open tank or convection heating applications, standard element supports will be supplied.

To order, specify:

- Baffles
- Inlet and outlet orientation
- Inlet location in relation to flange, (Inlet near flange or Inlet away from flange)

#### External Finishing

##### Passivation

During the manufacturing process, particles of iron or tool steel may become embedded in the stainless steel or alloy sheath. If not removed, these particles may corrode, produce rust spots and/or contaminate the process. For critical sheath applications, passivation will remove free iron from the sheath. To order, specify **passivation**.

##### Other Finishes

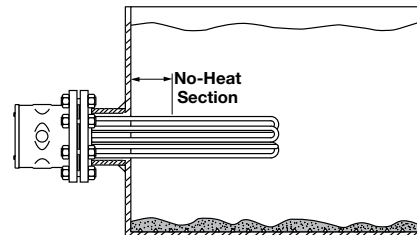
Bright annealing available to meet cosmetic demands.

#### ANSI Raised Face Blind Flange, 150# Class Dimensions

Pipe Size	Outside Diameter	Flange Thickness	Diameter of Bolt Circle	Diameter of Bolt Holes	Number of Bolt Holes
3	7.50	0.94	6.00	0.75	4
4	9.00	0.94	7.50	0.75	8
5	10.00	0.94	8.50	0.88	8
6	11.00	1.00	9.50	0.88	8
8	13.50	1.12	11.75	0.88	8
10	16.00	1.19	14.25	1.00	12
12	19.00	1.25	17.00	1.00	12
14	21.00	1.38	18.75	1.12	12
16	23.50	1.44	21.25	1.12	16
18	25.00	1.56	22.75	1.25	16
20	27.50	1.69	25.00	1.25	20
24	32.00	1.88	29.50	1.38	20

#### Application Hints

- Select the recommended heating element sheath material and watt density for the substance being heated. Use the *Supplemental Applications Chart* on pages 550 to 553. If unable to determine the correct heating element sheath material and type, contact your Watlow representative.
- Extend the element no-heat section completely into the fluid being heated to help prevent premature heater failure. See accompanying illustration for proper no-heat section placement.
- Locate flange heater low in the tank, but above the sludge level.
- Ensure wiring integrity by keeping terminal enclosure temperature below 400°F (205°C).
- Size power feeder wires in accordance with National Electrical Code guidelines and other applicable codes.
- Keep electrical connections clean, dry and tight.
- Minimize problems associated with low liquid level conditions by using low liquid level sensor or sheath temperature high-limit control.



- Periodically remove the flange assembly to inspect and clean the heating element(s). This preventive maintenance will reduce premature failure and optimize heater performance.



# Immersion Heaters

**EXTENDED  
CAPABILITY**



## Extended Capabilities for WATROD ANSI Flange Immersion Heaters

### Options

#### Enclosure Enhancements

- Enclosure heater to solve condensation and freeze problems.
- Power distribution blocks to facilitate power feed line wiring.

#### RTDs

If the process requires greater temperature sensing accuracy than is possible with thermocouples, Watlow can also supply RTDs in DIN or JIS calibrations. Contact your Watlow representative for details.

#### Wattages and Voltages

If required, Watlow will make heaters with voltage up to 600VAC and wattage beyond one megawatt. For more information on special voltage and wattage configurations, contact your Watlow representative.

#### Sheath Materials

The following sheath materials are available on WATROD flange heaters:

##### Extended Sheath Materials

<b>WATROD</b>	Titanium 304 and 321 SS Hastelloy C276 Alloy 600 Inconel®/Steel Monel®
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#### Flanges

##### Flange Materials

<b>Extended</b>	Exotic materials to meet specific application needs ①
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##### Pressure Classes

<b>Extended</b>	Over 300 lb ①
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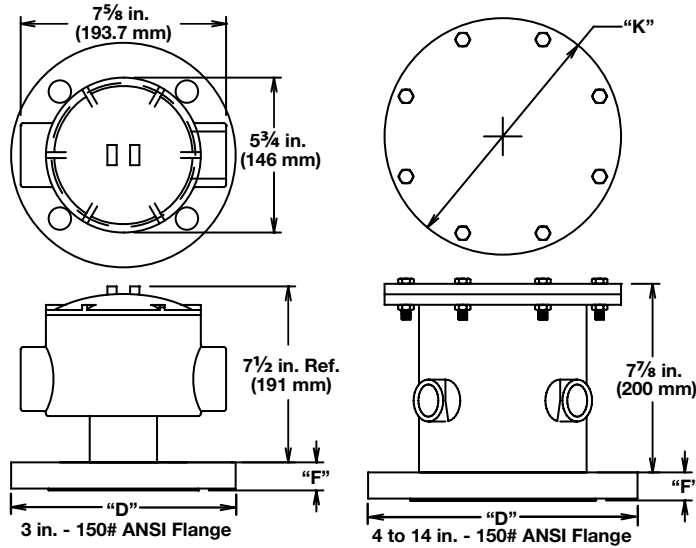
① Contact your Watlow representative

# Immersion Heaters



## WATROD ANSI Flange Immersion Heaters

### Optional CSA Type 4/Explosion Proof Enclosure Without Thermostat



### Terminal Enclosure Dimensions

#### General Purpose or NEMA 4 Enclosure

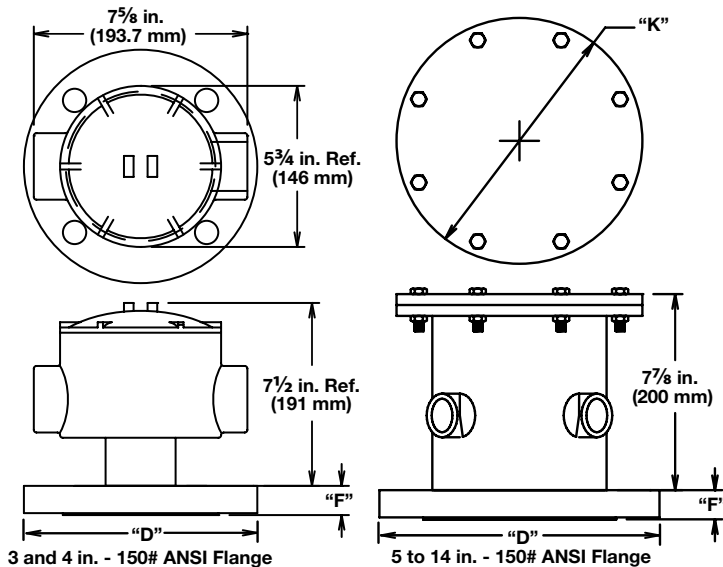
ANSI Flange Size in.	"F" Thickness in. (mm)	"K" With Thermostat	"K" Without Thermostat	"D" in. (mm)
3	15/16 (23.8)	5 3/4 (146)	See heater dwg.	7 1/2 (191)
4	15/16 (23.8)	5 3/4 (146)	See heater dwg.	9 (229)

**Note:** 5 thru 12 in. (127 thru 305 mm) flange dimensions are on catalog heater drawings.

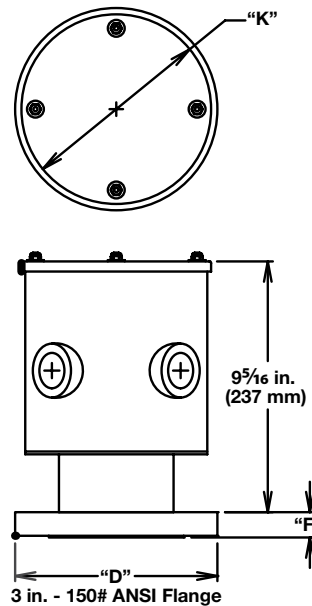
#### CSA Type 4/Explosion Proof Enclosures

ANSI Flange Size in.	"F" Thickness in. (mm)	"K" With Thermostat	"K" Without Thermostat	"D" in. (mm)
3	15/16 (23.8)	N/A	N/A	7 1/2 (191)
4	15/16 (23.8)	N/A	7 7/8 (200.0)	9 (229)
5	15/16 (23.8)	8 7/8 (225.4)	8 7/8 (225.4)	10 (254)
6	1 (25.0)	9 7/8 (250.8)	9 7/8 (250.8)	11 (280)
8	1 1/8 (28.6)	12 1/8 (308.0)	12 1/8 (308.0)	13 1/2 (343)
10	1 3/16 (30.2)	14 5/8 (371.5)	14 5/8 (371.5)	16 (407)
12	1 1/4 (32.0)	17 1/4 (438.0)	17 1/4 (438.0)	19 (483)
14	1 3/8 (34.9)	19 3/8 (492.1)	19 3/8 (492.1)	21 (534)

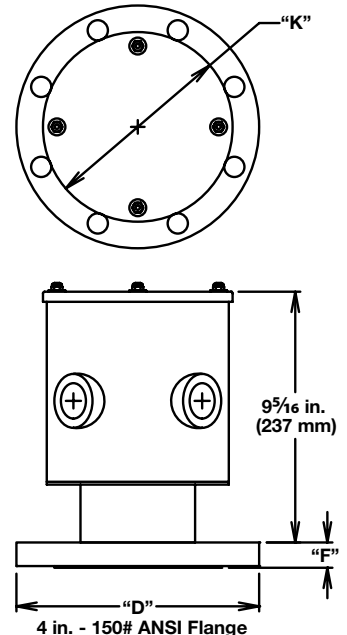
### Optional CSA Type 4/Explosion Proof Enclosure With Thermostat



### Optional General Purpose/or NEMA 4 Enclosure With Thermostat



### Optional NEMA 4 Enclosure With Thermostat



**To order:** Reference the *Ordering Information* on page 281.

**Note:** Dimensions for all 5 to 14 in. flange heaters with General Purpose or NEMA 4 Enclosure with thermostats are identical to units supplied without thermostats.

# Immersion Heaters

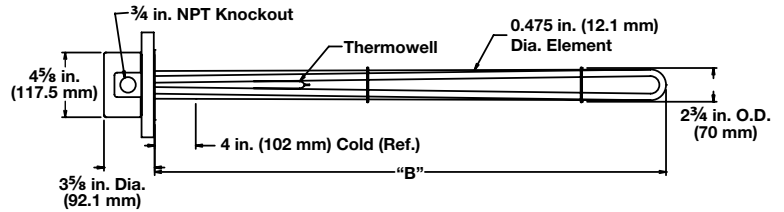


## WATROD ANSI Flange Immersion Heaters

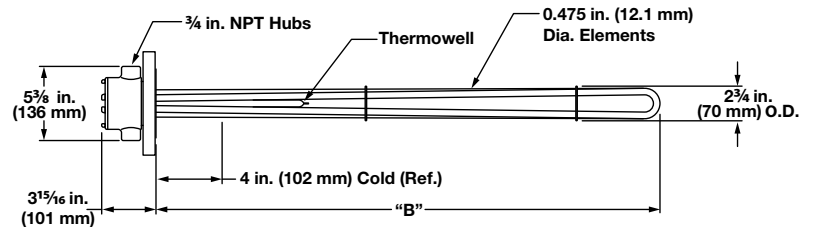
### Application: Clean Water

- 3 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure
- Single circuit

#### General Purpose



#### NEMA 4 Enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
						General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
60 W/in <sup>2</sup> Steel Flange 3-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	120	6.0	1	15 1/2 (394)	22 (10)	FMN715J10S	FMN715J10W	C/F	C/F
	240	6.0	3	15 1/2 (394)	22 (10)	FMN715J3S	FMN715J3W	C2-50	C2-92
	480	6.0	1	15 1/2 (394)	22 (10)	FMN715J11S	FMN715J11W	C/F	C/F
	480	6.0	3	15 1/2 (394)	22 (10)	FMN715J5S	FMN715J5W	C2-43	C2-35
	120	9.0	1	21 1/2 (546)	25 (12)	FMN721J10S	FMN721J10W	C/F	C/F
	240	9.0	3	21 1/2 (546)	25 (12)	FMN721J3S	FMN721J3W	C2-50	C2-92
	480	9.0	1	21 1/2 (546)	25 (12)	FMN721J11S	FMN721J11W	C/F	C/F
	480	9.0	3	21 1/2 (546)	25 (12)	FMN721J5S	FMN721J5W	C2-43	C2-35
	240	12.0	3	27 (686)	27 (13)	FMN727A3S	FMN727A3W	C2-236	C2-214
	480	12.0	1	27 (686)	27 (13)	FMN727A11S	FMN727A11W	C/F	C/F
	480	12.0	3	27 (686)	27 (13)	FMN727A5S	FMN727A5W	C2-43	C2-35
	240	15.0	3	32 1/2 (826)	28 (13)	FMN732J3S	FMN732J3W	C2-236	C2-214
	480	15.0	1	32 1/2 (826)	28 (13)	FMN732J11S	FMN732J11W	C/F	C/F
	480	15.0	3	32 1/2 (826)	28 (13)	FMN732J5S	FMN732J5W	C2-43	C2-35
	240	18.0	3	38 (965)	30 (14)	FMN738A3S	FMN738A3W	C2-236	C2-236
	480	18.0	1	38 (965)	30 (14)	FMN738A11S	FMN738A11W	C/F	C/F
	480	18.0	3	38 (965)	30 (14)	FMN738A5S	FMN738A5W	C2-43	C2-35
	480	25.0	1	51 (1295)	34 (16)	FMN751A11S	FMN751A11W	C/F	C/F
	480	25.0	3	51 (1295)	34 (16)	FMN751A5S	FMN751A5W	C2-225	C2-226
	480	30.0	1	60 1/2 (1537)	36 (17)	FMN760J11S	FMN760J11W	C/F	C/F
480	30.0	3	60 1/2 (1537)	36 (17)	FMN760J5S	FMN760J5W	C2-225	C2-226	

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



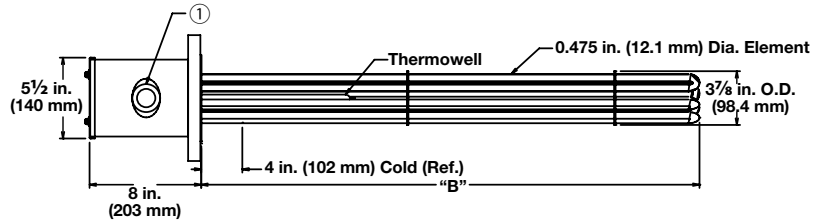
## WATROD ANSI Flange Immersion Heaters



### Application: Clean Water

- 4 inch - 150 lb ANSI flange
- WATROD element
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
60 W/in <sup>2</sup> Steel Flange 6-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	240	12.0	1	2	15 1/2 (394)	31 (14)	FON715J10S	FON715J10W	C/F	C/F
	240	12.0	3	1	15 1/2 (394)	31 (14)	FON715J3S	FON715J3W	C2-236	C2-214
	480	12.0	1	1	15 1/2 (394)	31 (14)	FON715J11S	FON715J11W	C/F	C/F
	480	12.0	3	1	15 1/2 (394)	31 (14)	FON715J5S	FON715J5W	C2-43	C2-35
	240	18.0	1	2	21 1/2 (546)	34 (16)	FON721J10S	FON721J10W	C/F	C/F
	240	18.0	3	1	21 1/2 (546)	34 (16)	FON721J3S	FON721J3W	C2-236	C2-214
	480	18.0	1	1	21 1/2 (546)	34 (16)	FON721J11S	FON721J11W	C/F	C/F
	480	18.0	3	1	21 1/2 (546)	34 (16)	FON721J5S	FON721J5W	C2-43	C2-35
	240	24.0	1	2	27 (686)	36 (17)	FON727A10S	FON727A10W	C/F	C/F
	240	24.0	3	2	27 (686)	36 (17)	FON727A3S	FON727A3W	C2-218	C2-224
	480	24.0	1	1	27 (686)	36 (17)	FON727A11S	FON727A11W	C/F	C/F
	480	24.0	3	1	27 (686)	36 (17)	FON727A5S	FON727A5W	C2-225	C2-226
	240	30.0	3	2	32 1/2 (826)	39 (18)	FON732J3S	FON732J3W	C2-218	C2-224
	480	30.0	1	2	32 1/2 (826)	39 (18)	FON732J11S	FON732J11W	C/F	C/F
	480	30.0	3	1	32 1/2 (826)	39 (18)	FON732J5S	FON732J5W	C2-225	C2-226
	240	36.0	3	2	38 (965)	43 (20)	FON738A3S	FON738A3W	C2-218	C2-224
	480	36.0	1	2	38 (965)	43 (20)	FON738A11S	FON738A11W	C/F	C/F
	480	36.0	3	1	38 (965)	43 (20)	FON738A5S	FON738A5W	C2-225	C2-226
	480	50.0	3	2	51 (1295)	48 (22)	FON751A5S	FON751A5W	C2-229	C2-230
	480	60.0	3	2	60 1/2 (1537)	52 (24)	FON760J5S	FON760J5W	C2-229	C2-230

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



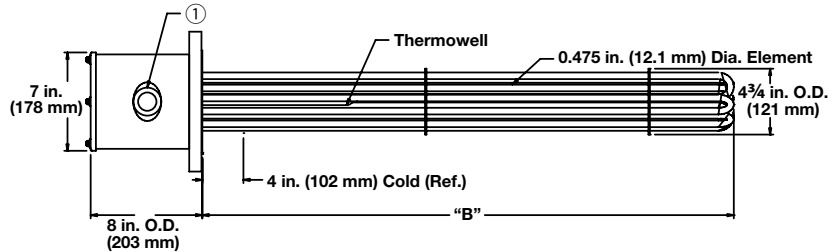
## WATROD ANSI Flange Immersion Heaters



### Application: Clean Water

- 5 inch - 150 lb ANSI flange
- WATROD element
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
60 W/in <sup>2</sup> Steel Flange 6-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	240	12.0	1	2	15 1/2 (394)	35 (16)	FNN715J10S	FNN715J10W	C/F	C/F
	240	12.0	3	1	15 1/2 (394)	35 (16)	FNN715J3S	FNN715J3W	C2-236	C2-214
	480	12.0	1	1	15 1/2 (394)	35 (16)	FNN715J11S	FNN715J11W	C/F	C/F
	480	12.0	3	1	15 1/2 (394)	35 (16)	FNN715J5S	FNN715J5W	C2-43	C2-35
	240	18.0	1	2	21 1/2 (546)	38 (18)	FNN721J10S	FNN721J10W	C/F	C/F
	240	18.0	3	1	21 1/2 (546)	38 (18)	FNN721J3S	FNN721J3W	C2-236	C2-214
	480	18.0	1	1	21 1/2 (546)	38 (18)	FNN721J11S	FNN721J11W	C/F	C/F
	480	18.0	3	1	21 1/2 (546)	38 (18)	FNN721J5S	FNN721J5W	C2-43	C2-35
	240	24.0	1	3	27 (686)	40 (19)	FNN727A10S	FNN727A10W	C/F	C/F
	240	24.0	3	2	27 (686)	40 (19)	FNN727A3S	FNN727A3W	C2-218	C2-224
	480	24.0	1	3	27 (686)	40 (19)	FNN727A11S	FNN727A11W	C/F	C/F
	480	24.0	3	1	27 (686)	40 (19)	FNN727A5S	FNN727A5W	C2-225	C2-226
	240	30.0	3	2	32 1/2 (826)	43 (20)	FNN732J3S	FNN732J3W	C2-218	C2-224
	480	30.0	1	2	32 1/2 (826)	43 (20)	FNN732J11S	FNN732J11W	C/F	C/F
	480	30.0	3	1	32 1/2 (826)	43 (20)	FNN732J5S	FNN732J5W	C2-225	C2-226
	240	36.0	3	2	38 (965)	47 (22)	FNN738A3S	FNN738A3W	C2-218	C2-224
	480	36.0	1	2	38 (965)	47 (22)	FNN738A11S	FNN738A11W	C/F	C/F
	480	36.0	3	1	38 (965)	47 (22)	FNN738A5S	FNN738A5W	C2-224	C2-226
	480	50.0	3	2	51 (1295)	52 (24)	FNN751A5S	FNN751A5W	C2-229	C2-230
	480	60.0	3	2	60 1/2 (1537)	56 (26)	FNN760J5S	FNN760J5W	C2-229	C2-230

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



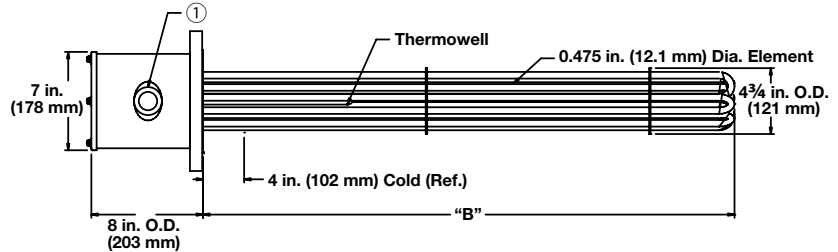
## WATROD ANSI Flange Immersion Heaters



### Application: Clean Water

- 5 inch - 150 lb ANSI flange
- WATROD element
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
60 W/in <sup>2</sup> Steel Flange 9-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	240	18.0	1	3	15 1/2 (394)	38 (18)	FNN715J10XS	FNN715J10XW	C/F	C/F
	240	18.0	3	1	15 1/2 (394)	38 (18)	FNN715J3XS	FNN715J3XW	C2-236	C2-214
	480	18.0	1	1	15 1/2 (394)	38 (18)	FNN715J11XS	FNN715J11XW	C/F	C/F
	480	18.0	3	1	15 1/2 (394)	38 (18)	FNN715J5XS	FNN715J5XW	C2-43	C2-35
	240	27.0	1	3	21 1/2 (546)	42 (19)	FNN721J10XS	FNN721J10XW	C/F	C/F
	240	27.0	3	3	21 1/2 (546)	42 (19)	FNN721J3XS	FNN721J3XW	C4-143	C4-142
	480	27.0	1	3	21 1/2 (546)	42 (19)	FNN721J11XS	FNN721J11XW	C/F	C/F
	480	27.0	3	1	21 1/2 (546)	42 (19)	FNN721J5XS	FNN721J5XW	C2-225	C2-226
	240	36.0	3	3	27 (686)	45 (21)	FNN727A3XS	FNN727A3XW	C4-144	C4-145
	480	36.0	1	3	27 (686)	45 (21)	FNN727A11XS	FNN727A11XW	C/F	C/F
	480	36.0	3	1	27 (686)	45 (21)	FNN727A5XS	FNN727A5XW	C2-225	C2-226
	240	45.0	3	3	32 1/2 (826)	48 (22)	FNN732J3XS	FNN732J3XW	C4-144	C4-145
	480	45.0	1	3	32 1/2 (826)	48 (22)	FNN732J11XS	FNN732J11XW	C/F	C/F
	480	45.0	3	3	32 1/2 (826)	48 (22)	FNN732J5XS	FNN732J5XW	C4-150	C4-151
	240	54.0	3	3	38 (965)	53 (24)	FNN738A3XS	FNN738A3XW	C4-144	C4-145
	480	54.0	1	3	38 (965)	53 (24)	FNN738A11XS	FNN738A11XW	C/F	C/F
	480	54.0	3	3	38 (965)	53 (24)	FNN738A5XS	FNN738A5XW	C4-150	C4-151
	480	75.0	3	3	51 (1295)	60 (28)	FNN751A5XS	FNN751A5XW	C4-152	C4-153
	480	90.0	3	3	60 1/2 (1537)	66 (30)	FNN760J5XS	FNN760J5XW	C4-152	C4-153

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



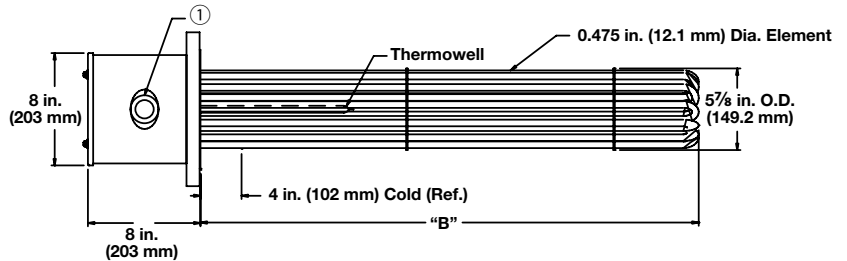
## WATROD ANSI Flange Immersion Heaters



### Application: Clean Water

- 6 inch - 150 lb ANSI flange
- WATROD element
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
60 W/in <sup>2</sup> Steel Flange 12-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	240	24.0	1	3	15 <sup>3</sup> / <sub>8</sub> (390.5)	73 (33)	FPN715G10S	FPN715G10W	C/F	C/F
	240	24.0	3	2	15 <sup>3</sup> / <sub>8</sub> (390.5)	73 (33)	FPN715G3S	FPN715G3W	C2-218	C2-224
	480	24.0	1	2	15 <sup>3</sup> / <sub>8</sub> (390.5)	73 (33)	FPN715G11S	FPN715G11W	C/F	C/F
	480	24.0	3	1	15 <sup>3</sup> / <sub>8</sub> (390.5)	73 (33)	FPN715G5S	FPN715G5W	C2-225	C2-226
	240	36.0	1	4	21 <sup>3</sup> / <sub>8</sub> (542.9)	78 (36)	FPN721G10S	FPN721G10W	C/F	C/F
	240	36.0	3	2	21 <sup>3</sup> / <sub>8</sub> (542.9)	78 (36)	FPN721G3S	FPN721G3W	C2-218	C2-224
	480	36.0	1	2	21 <sup>3</sup> / <sub>8</sub> (542.9)	78 (36)	FPN721G11S	FPN721G11W	C/F	C/F
	480	36.0	3	1	21 <sup>3</sup> / <sub>8</sub> (542.9)	78 (36)	FPN721G5S	FPN721G5W	C2-225	C2-226
	240	48.0	3	4	26 <sup>7</sup> / <sub>8</sub> (682.6)	81 (37)	FPN726R3S	FPN726R3W	C4-148	C4-149
	480	48.0	1	3	26 <sup>7</sup> / <sub>8</sub> (682.6)	81 (37)	FPN726R11S	FPN726R11W	C/F	C/F
	480	48.0	3	2	26 <sup>7</sup> / <sub>8</sub> (682.6)	81 (37)	FPN726R5S	FPN726R5W	C2-229	C2-230
	240	60.0	3	4	32 <sup>3</sup> / <sub>8</sub> (822.3)	85 (39)	FPN732G3S	FPN732G3W	C4-148	C4-149
	480	60.0	1	3	32 <sup>3</sup> / <sub>8</sub> (822.3)	85 (39)	FPN732G11S	FPN732G11W	C/F	C/F
	480	60.0	3	2	32 <sup>3</sup> / <sub>8</sub> (822.3)	85 (39)	FPN732G5S	FPN732G5W	C2-229	C2-230
	240	72.0	3	4	37 <sup>7</sup> / <sub>8</sub> (962.0)	92 (42)	FPN737R3S	FPN737R3W	C4-148	C4-149
	480	72.0	3	2	37 <sup>7</sup> / <sub>8</sub> (962.0)	92 (42)	FPN737R5S	FPN737R5W	C2-229	C2-230
480	100.0	3	4	50 <sup>7</sup> / <sub>8</sub> (1292.2)	100 (45)	FPN750R5S	FPN750R5W	C4-156	C4-157	
480	120.0	3	4	60 <sup>3</sup> / <sub>8</sub> (1533.5)	110 (50)	FPN760G5S	FPN760G5W	C4-156	C4-157	

**Notes:**

- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
- For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



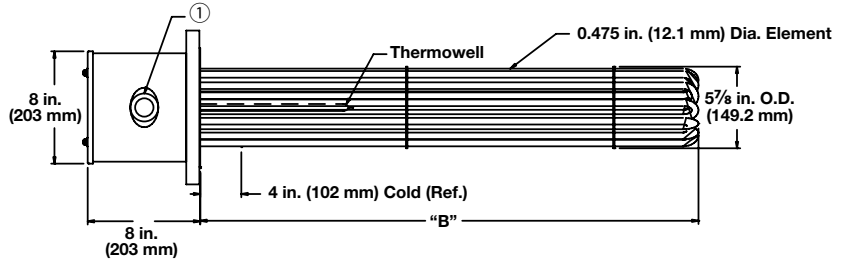
## WATROD ANSI Flange Immersion Heaters



### Application: Clean Water

- 6 inch - 150 lb ANSI flange
- WATROD element
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lb (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
60 W/in <sup>2</sup> Steel Flange 15-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	240	30.0	1	3	15 <sup>3</sup> / <sub>8</sub> (390.5)	76 (35)	FPN715G10XS	FPN715G10XW	C/F	C/F
	240	30.0	3	5	15 <sup>3</sup> / <sub>8</sub> (390.5)	76 (35)	FPN715G3XS	FPN715G3XW	C4-144	C4-145
	480	30.0	1	3	15 <sup>3</sup> / <sub>8</sub> (390.5)	76 (35)	FPN715G11XS	FPN715G11XW	C/F	C/F
	480	30.0	3	1	15 <sup>3</sup> / <sub>8</sub> (390.5)	76 (35)	FPN715G5XS	FPN715G5XW	C2-225	C2-226
	240	45.0	1	5	21 <sup>3</sup> / <sub>8</sub> (542.9)	82 (38)	FPN721G10XS	FPN721G10XW	C/F	C/F
	240	45.0	3	5	21 <sup>3</sup> / <sub>8</sub> (542.9)	82 (38)	FPN721G3XS	FPN721G3XW	C4-144	C4-145
	480	45.0	1	3	21 <sup>3</sup> / <sub>8</sub> (542.9)	82 (38)	FPN721G11XS	FPN721G11XW	C/F	C/F
	480	45.0	3	5	21 <sup>3</sup> / <sub>8</sub> (542.9)	82 (38)	FPN721G5XS	FPN721G5XW	C4-150	C4-151
	240	60.0	3	5	26 <sup>7</sup> / <sub>8</sub> (682.6)	85 (39)	FPN726R3XS	FPN726R3XW	C/F	C/F
	480	60.0	1	3	26 <sup>7</sup> / <sub>8</sub> (682.6)	85 (39)	FPN726R11XS	FPN726R11XW	C/F	C/F
	480	60.0	3	5	26 <sup>7</sup> / <sub>8</sub> (682.6)	85 (39)	FPN726R5XS	FPN726R5XW	C4-152	C4-153
	240	75.0	3	5	32 <sup>3</sup> / <sub>8</sub> (822.3)	90 (41)	FPN732G3XS	FPN732G3XW	C/F	C/F
	480	75.0	1	5	32 <sup>3</sup> / <sub>8</sub> (822.3)	90 (41)	FPN732G11XS	FPN732G11XW	C/F	C/F
	480	75.0	3	5	32 <sup>3</sup> / <sub>8</sub> (822.3)	90 (41)	FPN732G5XS	FPN732G5XW	C4-152	C4-153
	240	90.0	3	5	37 <sup>7</sup> / <sub>8</sub> (962.0)	98 (45)	FPN737R3XS	FPN737R3XW	C/F	C/F
	480	90.0	3	5	37 <sup>7</sup> / <sub>8</sub> (962.0)	98 (45)	FPN737R5XS	FPN737R5XW	C4-152	C4-153
	480	125.0	3	5	50 <sup>7</sup> / <sub>8</sub> (1292.2)	108 (49)	FPN750R5XS	FPN750R5XW	C/F	C/F
	480	150.0	3	5	60 <sup>3</sup> / <sub>8</sub> (1533.5)	120 (55)	FPN760G5XS	FPN760G5XW	C/F	C/F

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)



# Immersion Heaters

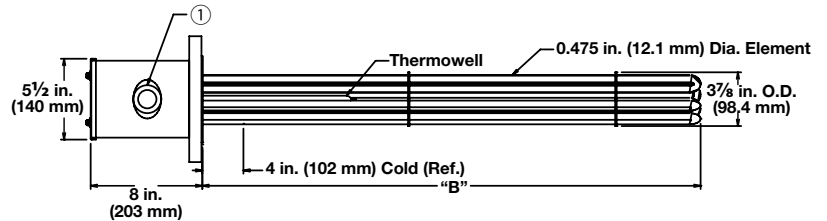


## WATROD ANSI Flange Immersion Heaters

### Application: Deionized or Demineralized Water

- 4 inch - 150 lb ANSI flange
- WATROD element
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
60 W/in <sup>2</sup> 316 SS Flange 6-316 SS Elements (9.3 W/cm <sup>2</sup> ) Passivated	240	12.0	1	2	16 (406)	31 (14)	FOR716A10S	FOR716A10W	C/F	C/F
	240	12.0	3	1	16 (406)	31 (14)	FOR716A3S	FOR716A3W	C2-236	C2-214
	480	12.0	1	1	16 (406)	31 (14)	FOR716A11S	FOR716A11W	C/F	C/F
	480	12.0	3	1	16 (406)	31 (14)	FOR716A5S	FOR716A5W	C2-43	C2-35
	240	18.0	1	2	22 (559)	34 (16)	FOR722A10S	FOR722A10W	C/F	C/F
	240	18.0	3	1	22 (559)	34 (16)	FOR722A3S	FOR722A3W	C2-236	C2-214
	480	18.0	1	1	22 (559)	34 (16)	FOR722A11S	FOR722A11W	C/F	C/F
	480	18.0	3	1	22 (559)	34 (16)	FOR722A5S	FOR722A5W	C2-43	C2-35
	240	24.0	1	2	27 1/2 (699)	36 (17)	FOR727J10S	FOR727J10W	C/F	C/F
	240	24.0	3	2	27 1/2 (699)	36 (17)	FOR727J3S	FOR727J3W	C2-218	C2-224
	480	24.0	1	1	27 1/2 (699)	36 (17)	FOR727J11S	FOR727J11W	C/F	C/F
	480	24.0	3	1	27 1/2 (699)	36 (17)	FOR727J5S	FOR727J5W	C2-225	C2-226
	240	30.0	3	2	33 (838)	39 (18)	FOR733A3S	FOR733A3W	C2-218	C2-224
	480	30.0	1	2	33 (838)	39 (18)	FOR733A11S	FOR733A11W	C/F	C/F
	480	30.0	3	1	33 (838)	39 (18)	FOR733A5S	FOR733A5W	C2-225	C2-226
	240	36.0	3	2	38 1/2 (978)	43 (20)	FOR738J3S	FOR738J3W	C2-218	C2-226
	480	36.0	1	2	38 1/2 (978)	43 (20)	FOR738J11S	FOR738J11W	C/F	C/F
	480	36.0	3	1	38 1/2 (978)	43 (20)	FOR738J5S	FOR738J5W	C2-225	C2-226
	480	50.0	3	2	51 1/2 (1308)	48 (22)	FOR751J5S	FOR751J5W	C2-229	C2-230
	480	60.0	3	2	61 (1549)	52 (24)	FOR761A5S	FOR761A5W	C2-229	C2-230

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



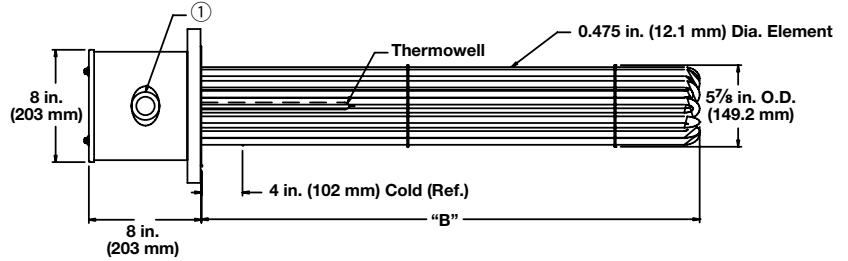
## WATROD ANSI Flange Immersion Heaters



### Application: Deionized or Demineralized Water

- 6 inch - 150 lb ANSI flange
- WATROD element
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
60 W/in <sup>2</sup> 316 SS Flange 12-316 SS Elements (9.3 W/cm <sup>2</sup> ) (Passivated)	240	24.0	1	3	15 <sup>3</sup> / <sub>4</sub> (400)	73 (33)	FPR715N10S	FPR715N10W	C/F	C/F
	240	24.0	3	2	15 <sup>3</sup> / <sub>4</sub> (400)	73 (33)	FPR715N3S	FPR715N3W	C2-218	C2-224
	480	24.0	1	2	15 <sup>3</sup> / <sub>4</sub> (400)	73 (33)	FPR715N11S	FPR715N11W	C/F	C/F
	480	24.0	3	1	15 <sup>3</sup> / <sub>4</sub> (400)	73 (33)	FPR715N5S	FPR715N5W	C2-225	C2-226
	240	36.0	1	4	21 <sup>3</sup> / <sub>4</sub> (552)	78 (36)	FPR721N10S	FPR721N10W	C/F	C/F
	240	36.0	3	2	21 <sup>3</sup> / <sub>4</sub> (552)	78 (36)	FPR721N3S	FPR721N3W	C2-218	C2-224
	480	36.0	1	2	21 <sup>3</sup> / <sub>4</sub> (552)	78 (36)	FPR721N11S	FPR721N11W	C/F	C/F
	480	36.0	3	1	21 <sup>3</sup> / <sub>4</sub> (552)	78 (36)	FPR721N5S	FPR721N5W	C2-225	C2-226
	240	48.0	3	4	27 <sup>1</sup> / <sub>4</sub> (692)	81 (37)	FPR727E3S	FPR727E3W	C4-148	C4-149
	480	48.0	1	3	27 <sup>1</sup> / <sub>4</sub> (692)	81 (37)	FPR727E11S	FPR727E11W	C/F	C/F
	480	48.0	3	2	27 <sup>1</sup> / <sub>4</sub> (692)	81 (37)	FPR727E5S	FPR727E5W	C2-229	C2-230
	240	60.0	3	4	32 <sup>3</sup> / <sub>4</sub> (832)	85 (39)	FPR732N3S	FPR732N3W	C4-148	C4-149
	480	60.0	1	3	32 <sup>3</sup> / <sub>4</sub> (832)	85 (39)	FPR732N11S	FPR732N11W	C/F	C/F
	480	60.0	3	2	32 <sup>3</sup> / <sub>4</sub> (832)	85 (39)	FPR732N5S	FPR732N5W	C2-229	C2-230
	240	72.0	3	4	38 <sup>1</sup> / <sub>4</sub> (972)	92 (42)	FPR738E3S	FPR738E3W	C4-148	C4-149
	480	72.0	3	2	38 <sup>1</sup> / <sub>4</sub> (972)	92 (42)	FPR738E5S	FPR738E5W	C2-229	C2-230
480	100.0	3	4	51 <sup>1</sup> / <sub>4</sub> (1302)	100 (45)	FPR751E5S	FPR751E5W	C4-156	C4-157	
480	120.0	3	4	60 <sup>3</sup> / <sub>4</sub> (1543)	110 (50)	FPR760N5S	FPR760N5W	C4-156	C4-157	

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters

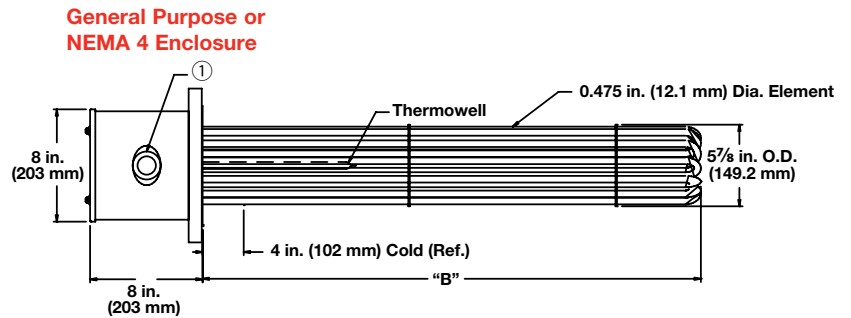


## WATROD ANSI Flange Immersion Heaters



### Application: Deionized or Demineralized Water

- 6 inch - 150 lb ANSI flange
- WATROD element
- Without thermostat
- General purpose or NEMA 4 enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
60 W/in <sup>2</sup> 316 SS Flange 15-316 SS Elements (9.3 W/cm <sup>2</sup> ) (Passivated)	240	30.0	1	3	15 <sup>3</sup> / <sub>4</sub> (400)	76 (35)	FPR715N10XS	FPR715N10XW	C/F	C/F
	240	30.0	3	5	15 <sup>3</sup> / <sub>4</sub> (400)	76 (35)	FPR715N3XS	FPR715N3XW	C4-144	C4-145
	480	30.0	1	3	15 <sup>3</sup> / <sub>4</sub> (400)	76 (35)	FPR715N11XS	FPR715N11XW	C/F	C/F
	480	30.0	3	1	15 <sup>3</sup> / <sub>4</sub> (400)	76 (35)	FPR715N5XS	FPR715N5XW	C2-225	C2-226
	240	45.0	1	5	21 <sup>3</sup> / <sub>4</sub> (552)	82 (38)	FPR721N10XS	FPR721N10XW	C/F	C/F
	240	45.0	3	5	21 <sup>3</sup> / <sub>4</sub> (552)	82 (38)	FPR721N3XS	FPR721N3XW	C4-144	C4-145
	480	45.0	1	3	21 <sup>3</sup> / <sub>4</sub> (552)	82 (38)	FPR721N11XS	FPR721N11XW	C/F	C/F
	480	45.0	3	5	21 <sup>3</sup> / <sub>4</sub> (552)	82 (38)	FPR721N5XS	FPR721N5XW	C4-150	C4-151
	240	60.0	3	5	27 <sup>1</sup> / <sub>4</sub> (692)	85 (39)	FPR727E3XS	FPR727E3XW	C/F	C/F
	480	60.0	1	3	27 <sup>1</sup> / <sub>4</sub> (692)	85 (39)	FPR727E11XS	FPR727E11XW	C/F	C/F
	480	60.0	3	5	27 <sup>1</sup> / <sub>4</sub> (692)	85 (39)	FPR727E5XS	FPR727E5XW	C4-152	C4-153
	240	75.0	3	5	32 <sup>3</sup> / <sub>4</sub> (832)	90 (41)	FPR732N3XS	FPR732N3XW	C/F	C/F
	480	75.0	1	5	32 <sup>3</sup> / <sub>4</sub> (832)	90 (41)	FPR732N11XS	FPR732N11XW	C/F	C/F
	480	75.0	3	5	32 <sup>3</sup> / <sub>4</sub> (832)	90 (41)	FPR732N5XS	FPR732N5XW	C4-152	C4-153
	240	90.0	3	5	38 <sup>1</sup> / <sub>4</sub> (972)	98 (45)	FPR738E3XS	FPR738E3XW	C/F	C/F
	480	90.0	3	5	38 <sup>1</sup> / <sub>4</sub> (972)	98 (45)	FPR738E5XS	FPR738E5XW	C4-152	C4-153
480	125.0	3	5	51 <sup>1</sup> / <sub>4</sub> (1302)	108 (49)	FPR751E5XS	FPR751E5XW	C/F	C/F	
480	150.0	3	5	60 <sup>3</sup> / <sub>4</sub> (1543)	120 (55)	FPR760N5XS	FPR760N5XW	C/F	C/F	

**Notes:** • All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe  
• For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



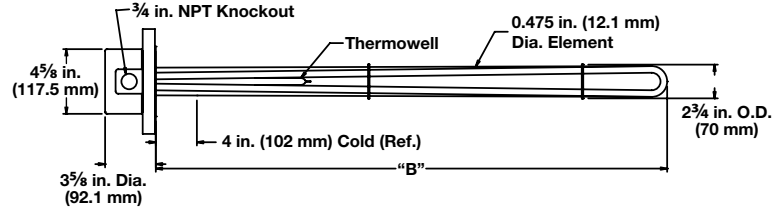
## WATROD ANSI Flange Immersion Heaters



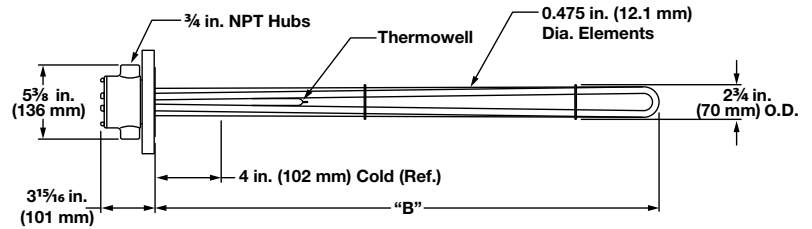
### Application: Process Water

- 3 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure
- Single circuit

#### General Purpose



#### NEMA 4 Enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
						General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
48 W/in <sup>2</sup> ® Steel Flange 3-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	4.5	1	13 1/2 (343)	22 (10)	FMN713J10S	FMN713J10W	C/F	C/F
	240	4.5	3	13 1/2 (343)	22 (10)	FMN713J3S	FMN713J3W	C2-50	C2-92
	480	4.5	1	13 1/2 (343)	22 (10)	FMN713J11S	FMN713J11W	C/F	C/F
	480	4.5	3	13 1/2 (343)	22 (10)	FMN713J5S	FMN713J5W	C2-43	C2-35
	240	6.0	1	18 (457)	23 (11)	FMN718A10S	FMN718A10W	C/F	C/F
	240	6.0	3	18 (457)	23 (11)	FMN718A3S	FMN718A3W	C2-50	C2-92
	480	6.0	1	18 (457)	23 (11)	FMN718A11S	FMN718A11W	C/F	C/F
	480	6.0	3	18 (457)	23 (11)	FMN718A5S	FMN718A5W	C2-43	C2-35
	240	7.5	1	20 1/2 (521)	25 (12)	FMN720J10S	FMN720J10W	C/F	C/F
	240	7.5	3	20 1/2 (521)	25 (12)	FMN720J3S	FMN720J3W	C2-50	C2-92
	480	7.5	1	20 1/2 (521)	25 (12)	FMN720J11S	FMN720J11W	C/F	C/F
	480	7.5	3	20 1/2 (521)	25 (12)	FMN720J5S	FMN720J5W	C2-43	C2-35
	240	9.0	1	25 1/2 (648)	27 (13)	FMN725J10S	FMN725J10W	C/F	C/F
	240	9.0	3	25 1/2 (648)	27 (13)	FMN725J3S	FMN725J3W	C2-50	C2-92
	480	9.0	1	25 1/2 (648)	27 (13)	FMN725J11S	FMN725J11W	C/F	C/F
	480	9.0	3	25 1/2 (648)	27 (13)	FMN725J5S	FMN725J5W	C2-43	C2-35
	240	12.0	3	33 (838)	28 (13)	FMN733A3S	FMN733A3W	C2-236	C2-214
	480	12.0	1	33 (838)	28 (13)	FMN733A11S	FMN733A11W	C/F	C/F
	480	12.0	3	33 (838)	28 (13)	FMN733A5S	FMN733A5W	C2-43	C2-35
	240	15.0	3	40 1/2 (1029)	30 (14)	FMN740J3S	FMN740J3W	C2-236	C2-214
	480	15.0	1	40 1/2 (1029)	30 (14)	FMN740J11S	FMN740J11W	C/F	C/F
	480	15.0	3	40 1/2 (1029)	30 (14)	FMN740J5S	FMN740J5W	C2-43	C2-35
	240	18.0	3	48 (1219)	32 (15)	FMN748A3S	FMN748A3W	C2-236	C2-214
	480	18.0	1	48 (1219)	32 (15)	FMN748A11S	FMN748A11W	C/F	C/F
480	18.0	3	48 (1219)	32 (15)	FMN748A5S	FMN748A5W	C2-43	C2-35	

**Notes:** • All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe  
 • For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

® Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

# Immersion Heaters

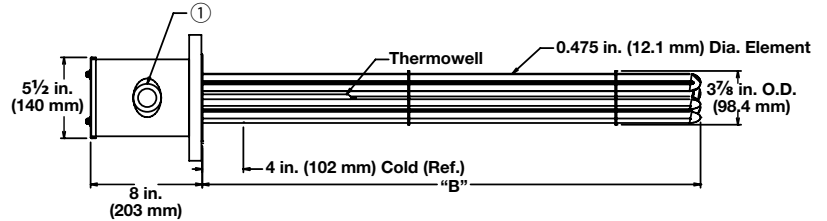


## WATROD ANSI Flange Immersion Heaters

### Application: Process Water

- 4 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
48 W/in <sup>2</sup> © Steel Flange 6-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	9.0	1	1	13 <sup>1</sup> / <sub>2</sub> (343)	29 (14)	FON713J10S	FON713J10W	C/F	C/F
	240	9.0	3	1	13 <sup>1</sup> / <sub>2</sub> (343)	29 (14)	FON713J3S	FON713J3W	C2-50	C2-92
	480	9.0	1	1	13 <sup>1</sup> / <sub>2</sub> (343)	29 (14)	FON713J11S	FON713J11W	C/F	C/F
	480	9.0	3	1	13 <sup>1</sup> / <sub>2</sub> (343)	29 (14)	FON713J5S	FON713J5W	C2-43	C2-35
	240	12.0	1	2	18 (457)	32 (15)	FON718A10S	FON718A10W	C/F	C/F
	240	12.0	3	1	18 (457)	32 (15)	FON718A3S	FON718A3W	C2-236	C2-214
	480	12.0	1	1	18 (457)	32 (15)	FON718A11S	FON718A11W	C/F	C/F
	480	12.0	3	1	18 (457)	32 (15)	FON718A5S	FON718A5W	C2-43	C2-35
	240	15.0	1	2	20 <sup>1</sup> / <sub>2</sub> (521)	34 (16)	FON720J10S	FON720J10W	C/F	C/F
	240	15.0	3	1	20 <sup>1</sup> / <sub>2</sub> (521)	34 (16)	FON720J3S	FON720J3W	C2-236	C2-214
	480	15.0	1	1	20 <sup>1</sup> / <sub>2</sub> (521)	34 (16)	FON720J11S	FON720J11W	C/F	C/F
	480	15.0	3	1	20 <sup>1</sup> / <sub>2</sub> (521)	34 (16)	FON720J5S	FON720J5W	C2-225	C2-226
	240	18.0	1	2	25 <sup>1</sup> / <sub>2</sub> (648)	36 (17)	FON725J10S	FON725J10W	C/F	C/F
	240	18.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	36 (17)	FON725J3S	FON725J3W	C2-236	C2-214
	480	18.0	1	1	25 <sup>1</sup> / <sub>2</sub> (648)	36 (17)	FON725J11S	FON725J11W	C/F	C/F
	480	18.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	36 (17)	FON725J5S	FON725J5W	C2-43	C2-35
	240	24.0	1	2	33 (838)	39 (18)	FON733A10S	FON733A10W	C/F	C/F
	240	24.0	3	2	33 (838)	39 (18)	FON733A3S	FON733A3W	C2-218	C2-224
	480	24.0	1	1	33 (838)	39 (18)	FON733A11S	FON733A11W	C/F	C/F
	480	24.0	3	1	33 (838)	39 (18)	FON733A5S	FON733A5W	C2-225	C2-226
240	30.0	3	2	40 <sup>1</sup> / <sub>2</sub> (1029)	43 (20)	FON740J3S	FON740J3W	C2-218	C2-224	
480	30.0	1	2	40 <sup>1</sup> / <sub>2</sub> (1029)	43 (20)	FON740J11S	FON740J11W	C/F	C/F	
480	30.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	43 (20)	FON740J5S	FON740J5W	C2-225	C2-226	
240	36.0	3	2	48 (1219)	48 (22)	FON748A3S	FON748A3W	C2-218	C2-224	
480	36.0	1	2	48 (1219)	48 (22)	FON748A11S	FON748A11W	C/F	C/F	
480	36.0	3	1	48 (1219)	48 (22)	FON748A5S	FON748A5W	C2-225	C2-226	

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

© Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

# Immersion Heaters



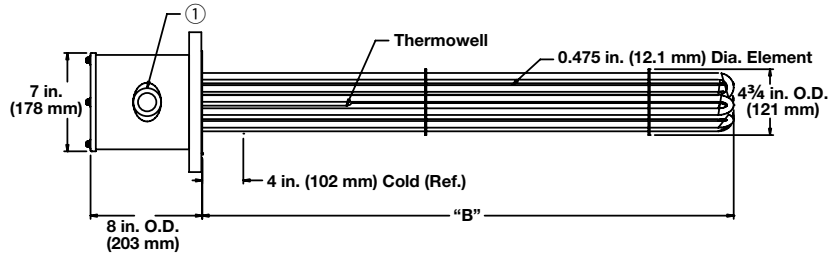
## WATROD ANSI Flange Immersion Heaters



### Application: Process Water

- 5 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
48 W/in <sup>2</sup> Steel Flange 6-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	9.0	1	1	13 <sup>1</sup> / <sub>2</sub> (343)	33 (15)	FNN713J10S	FNN713J10W	C/F	C/F
	240	9.0	3	1	13 <sup>1</sup> / <sub>2</sub> (343)	33 (15)	FNN713J3S	FNN713J3W	C2-50	C2-92
	480	9.0	1	1	13 <sup>1</sup> / <sub>2</sub> (343)	33 (15)	FNN713J11S	FNN713J11W	C/F	C/F
	480	9.0	3	1	13 <sup>1</sup> / <sub>2</sub> (343)	33 (15)	FNN713J5S	FNN713J5W	C2-43	C2-35
	240	12.0	1	2	18 (457)	36 (17)	FNN718A10S	FNN718A10W	C/F	C/F
	240	12.0	3	1	18 (457)	36 (17)	FNN718A3S	FNN718A3W	C2-236	C2-214
	480	12.0	1	1	18 (457)	36 (17)	FNN718A11S	FNN718A11W	C/F	C/F
	480	12.0	3	1	18 (457)	36 (17)	FNN718A5S	FNN718A5W	C2-43	C2-35
	240	15.0	1	2	20 <sup>1</sup> / <sub>2</sub> (521)	38 (18)	FNN720J10S	FNN720J10W	C/F	C/F
	240	15.0	3	1	20 <sup>1</sup> / <sub>2</sub> (521)	38 (18)	FNN720J3S	FNN720J3W	C2-236	C2-214
	480	15.0	1	1	20 <sup>1</sup> / <sub>2</sub> (521)	38 (18)	FNN720J11S	FNN720J11W	C/F	C/F
	480	15.0	3	1	20 <sup>1</sup> / <sub>2</sub> (521)	38 (18)	FNN720J5S	FNN720J5W	C2-43	C2-35
	240	18.0	1	2	25 <sup>1</sup> / <sub>2</sub> (648)	40 (19)	FNN725J10S	FNN725J10W	C/F	C/F
	240	18.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	40 (19)	FNN725J3S	FNN725J3W	C2-236	C2-214
	480	18.0	1	1	25 <sup>1</sup> / <sub>2</sub> (648)	40 (19)	FNN725J11S	FNN725J11W	C/F	C/F
	480	18.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	40 (19)	FNN725J5S	FNN725J5W	C2-43	C2-35
	240	24.0	1	3	33 (838)	43 (20)	FNN733A10S	FNN733A10W	C/F	C/F
	240	24.0	3	2	33 (838)	43 (20)	FNN733A3S	FNN733A3W	C2-218	C2-224
	480	24.0	1	1	33 (838)	43 (20)	FNN733A11S	FNN733A11W	C/F	C/F
	480	24.0	3	1	33 (838)	43 (20)	FNN733A5S	FNN733A5W	C2-225	C2-226
	240	30.0	3	2	40 <sup>1</sup> / <sub>2</sub> (1029)	47 (22)	FNN740J3S	FNN740J3W	C2-218	C2-224
	480	30.0	1	2	40 <sup>1</sup> / <sub>2</sub> (1029)	47 (22)	FNN740J11S	FNN740J11W	C/F	C/F
	480	30.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	47 (22)	FNN740J5S	FNN740J5W	C2-225	C2-226
	240	36.0	3	2	48 (1219)	52 (24)	FNN748A3S	FNN748A3W	C2-218	C2-224
480	36.0	1	2	48 (1219)	52 (24)	FNN748A11S	FNN748A11W	C/F	C/F	
480	36.0	3	1	48 (1219)	52 (24)	FNN748A5S	FNN748A5W	C2-225	C2-226	

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



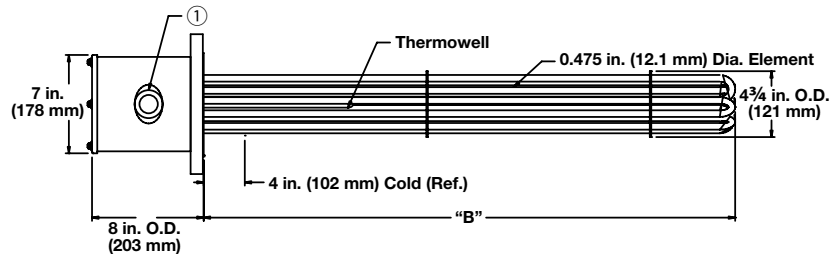
## WATROD ANSI Flange Immersion Heaters



### Application: Process Water

- 5 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
48 W/in <sup>2</sup> Steel Flange 9-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	14.0	1	3	13 1/2 (343)	35 (16)	FNN713J10XS	FNN713J10XW	C/F	C/F
	240	14.0	3	1	13 1/2 (343)	35 (16)	FNN713J3XS	FNN713J3XW	C2-236	C2-214
	480	14.0	1	1	13 1/2 (343)	35 (16)	FNN713J11XS	FNN713J11XW	C/F	C/F
	480	14.0	3	1	13 1/2 (343)	35 (16)	FNN713J5XS	FNN713J5XW	C2-43	C2-35
	240	18.0	1	3	18 (457)	39 (18)	FNN718A10XS	FNN718A10XW	C/F	C/F
	240	18.0	3	1	18 (457)	39 (18)	FNN718A3XS	FNN718A3XW	C2-236	C2-214
	480	18.0	1	1	18 (457)	39 (18)	FNN718A11XS	FNN718A11XW	C/F	C/F
	480	18.0	3	1	18 (457)	39 (18)	FNN718A5XS	FNN718A5XW	C2-43	C2-35
	240	23.0	1	3	20 1/2 (521)	42 (19)	FNN720J10XS	FNN720J10XW	C/F	C/F
	240	23.0	3	3	20 1/2 (521)	42 (19)	FNN720J3XS	FNN720J3XW	C4-143	C4-142
	480	23.0	1	1	20 1/2 (521)	42 (19)	FNN720J11XS	FNN720J11XW	C/F	C/F
	480	23.0	3	1	20 1/2 (521)	42 (19)	FNN720J5XS	FNN720J5XW	C2-225	C2-226
	240	27.0	1	3	25 1/2 (648)	45 (21)	FNN725J10XS	FNN725J10XW	C/F	C/F
	240	27.0	3	3	25 1/2 (648)	45 (21)	FNN725J3XS	FNN725J3XW	C4-143	C4-142
	480	27.0	1	3	25 1/2 (648)	45 (21)	FNN725J11XS	FNN725J11XW	C/F	C/F
	480	27.0	3	1	25 1/2 (648)	45 (21)	FNN725J5XS	FNN725J5XW	C2-225	C2-226
	240	36.0	3	3	33 (838)	48 (22)	FNN733A3XS	FNN733A3XW	C4-144	C4-145
	480	36.0	1	3	33 (838)	48 (22)	FNN733A11XS	FNN733A11XW	C/F	C/F
	480	36.0	3	1	33 (838)	48 (22)	FNN733A5XS	FNN733A5XW	C2-225	C2-226
	240	45.0	3	3	40 1/2 (1029)	53 (24)	FNN740J3XS	FNN740J3XW	C4-144	C4-145
480	45.0	1	3	40 1/2 (1029)	53 (24)	FNN740J11XS	FNN740J11XW	C/F	C/F	
480	45.0	3	3	40 1/2 (1029)	53 (24)	FNN740J5XS	FNN740J5XW	C4-150	C4-151	
240	54.0	3	3	48 (1219)	60 (28)	FNN748A3XS	FNN748A3XW	C4-144	C4-145	
480	54.0	1	3	48 (1219)	60 (28)	FNN748A11XS	FNN748A11XW	C/F	C/F	
480	54.0	3	3	48 (1219)	60 (28)	FNN748A5XS	FNN748A5XW	C4-150	C4-151	

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



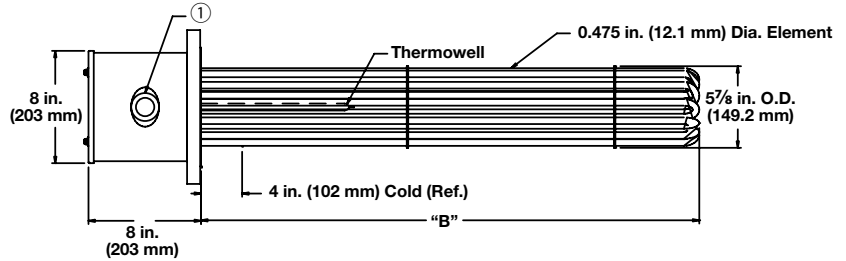
## WATROD ANSI Flange Immersion Heaters



### Application: Process Water

- 6 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
48 W/in <sup>2</sup> Steel Flange 12-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	18.0	1	2	13 <sup>3</sup> / <sub>8</sub> (339.7)	73 (33)	FPN713G10S	FPN713G10W	C/F	C/F
	240	18.0	3	1	13 <sup>3</sup> / <sub>8</sub> (339.7)	73 (33)	FPN713G3S	FPN713G3W	C2-236	C2-214
	480	18.0	1	1	13 <sup>3</sup> / <sub>8</sub> (339.7)	73 (33)	FPN713G11S	FPN713G11W	C/F	C/F
	480	18.0	3	1	13 <sup>3</sup> / <sub>8</sub> (339.7)	73 (33)	FPN713G5S	FPN713G5W	C2-43	C2-35
	240	24.0	1	3	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPN717R10S	FPN717R10W	C/F	C/F
	240	24.0	3	2	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPN717R3S	FPN717R3W	C2-218	C2-224
	480	24.0	1	2	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPN717R11S	FPN717R11W	C/F	C/F
	480	24.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPN717R5S	FPN717R5W	C2-225	C2-226
	240	30.0	1	3	20 <sup>3</sup> / <sub>8</sub> (517.5)	78 (36)	FPN720G10S	FPN720G10W	C/F	C/F
	240	30.0	3	2	20 <sup>3</sup> / <sub>8</sub> (517.5)	78 (36)	FPN720G3S	FPN720G3W	C2-218	C2-224
	480	30.0	1	2	20 <sup>3</sup> / <sub>8</sub> (517.5)	78 (36)	FPN720G11S	FPN720G11W	C/F	C/F
	480	30.0	3	1	20 <sup>3</sup> / <sub>8</sub> (517.5)	78 (36)	FPN720G5S	FPN720G5W	C2-225	C2-226
	240	36.0	1	4	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPN725G10S	FPN725G10W	C/F	C/F
	240	36.0	3	2	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPN725G3S	FPN725G3W	C2-218	C2-224
	480	36.0	1	2	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPN725G11S	FPN725G11W	C/F	C/F
	480	36.0	3	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPN725G5S	FPN725G5W	C2-225	C2-226
	240	48.0	3	4	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPN732R3S	FPN732R3W	C4-148	C4-149
	480	48.0	1	3	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPN732R11S	FPN732R11W	C/F	C/F
	480	48.0	3	2	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPN732R5S	FPN732R5W	C2-229	C2-230
	240	60.0	3	4	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPN740G3S	FPN740G3W	C4-148	C4-149
480	60.0	1	3	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPN740G11S	FPN740G11W	C/F	C/F	
480	60.0	3	2	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPN740G5S	FPN740G5W	C2-229	C2-230	
240	72.0	3	4	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPN747R3S	FPN747R3W	C4-148	C4-149	
480	72.0	3	2	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPN747R5S	FPN747R5W	C2-229	C2-230	

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



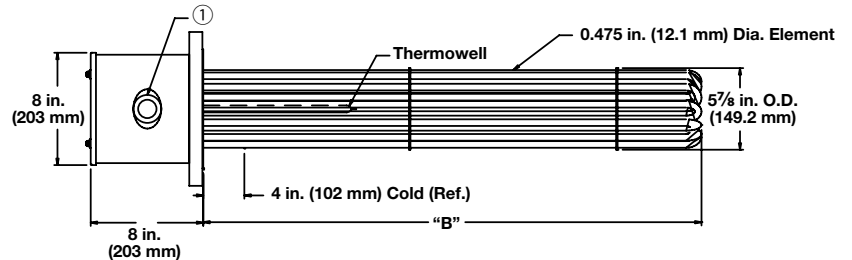
## WATROD ANSI Flange Immersion Heaters



### Application: Process Water

- 6 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
48 W/in <sup>2</sup> Steel Flange 15-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	23.0	1	3	13 <sup>3</sup> / <sub>8</sub> (339.7)	76 (35)	FPN713G10XS	FPN713G10XW	C/F	C/F
	240	23.0	3	5	13 <sup>3</sup> / <sub>8</sub> (339.7)	76 (35)	FPN713G3XS	FPN713G3XW	C4-143	C4-142
	480	23.0	1	1	13 <sup>3</sup> / <sub>8</sub> (339.7)	76 (35)	FPN713G11XS	FPN713G11XW	C/F	C/F
	480	23.0	3	1	13 <sup>3</sup> / <sub>8</sub> (339.7)	76 (35)	FPN713G5XS	FPN713G5XW	C2-225	C2-226
	240	30.0	1	3	17 <sup>7</sup> / <sub>8</sub> (441.3)	78 (36)	FPN717R10XS	FPN717R10XW	C/F	C/F
	240	30.0	3	5	17 <sup>7</sup> / <sub>8</sub> (441.3)	78 (36)	FPN717R3XS	FPN717R3XW	C4-144	C4-145
	480	30.0	1	3	17 <sup>7</sup> / <sub>8</sub> (441.3)	78 (36)	FPN717R11XS	FPN717R11XW	C/F	C/F
	480	30.0	3	1	17 <sup>7</sup> / <sub>8</sub> (441.3)	78 (36)	FPN717R5XS	FPN717R5XW	C2-225	C2-226
	240	38.0	1	5	20 <sup>3</sup> / <sub>8</sub> (517.5)	82 (38)	FPN720G10XS	FPN720G10XW	C/F	C/F
	240	38.0	3	5	20 <sup>3</sup> / <sub>8</sub> (517.5)	82 (38)	FPN720G3XS	FPN720G3XW	C4-144	C4-145
	480	38.0	1	3	20 <sup>3</sup> / <sub>8</sub> (517.5)	82 (38)	FPN720G11XS	FPN720G11XW	C/F	C/F
	480	38.0	3	1	20 <sup>3</sup> / <sub>8</sub> (517.5)	82 (38)	FPN720G5XS	FPN720G5XW	C2-225	C2-226
	240	45.0	1	5	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPN725G10XS	FPN725G10XW	C/F	C/F
	240	45.0	3	5	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPN725G3XS	FPN725G3XW	C4-144	C4-145
	480	45.0	1	3	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPN725G11XS	FPN725G11XW	C/F	C/F
	480	45.0	3	5	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPN725G5XS	FPN725G5XW	C4-150	C4-151
	240	60.0	3	5	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPN732R3XS	FPN732R3XW	C/F	C/F
	480	60.0	1	3	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPN732R11XS	FPN732R11XW	C/F	C/F
	480	60.0	3	5	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPN732R5XS	FPN732R5XW	C4-152	C4-153
	240	75.0	3	5	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPN740G3XS	FPN740G3XW	C/F	C/F
480	75.0	1	5	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPN740G11XS	FPN740G11XW	C/F	C/F	
480	75.0	3	5	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPN740G5XS	FPN740G5XW	C4-152	C4-153	
240	90.0	3	5	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPN747R3XS	FPN747R3XW	C/F	C/F	
480	90.0	3	5	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPN747R5XS	FPN747R5XW	C4-152	C4-153	

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



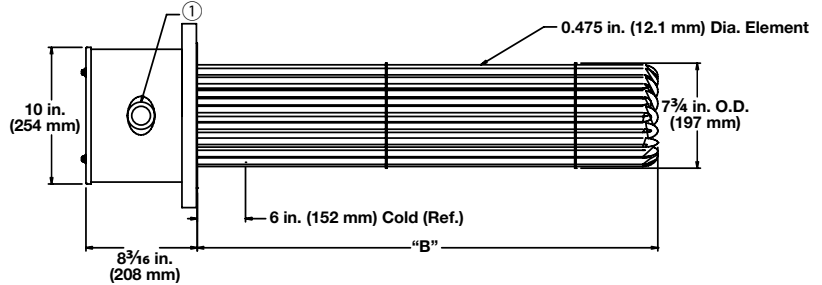
## WATROD ANSI Flange Immersion Heaters



### Application: Process Water

- 8 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
48 W/in <sup>2</sup> Steel Flange 18-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	50.0	3	3	25 <sup>3</sup> / <sub>4</sub> (654.0)	121 (55)	FRN725N3S	FRN725N3W	C4-144	C4-145
	480	50.0	1	3	25 <sup>3</sup> / <sub>4</sub> (654.0)	121 (55)	FRN725N11S	FRN725N11W	C/F	C/F
	480	50.0	3	2	25 <sup>3</sup> / <sub>4</sub> (654.0)	121 (55)	FRN725N5S	FRN725N5W	C2-229	C2-230
	240	75.0	3	6	35 <sup>3</sup> / <sub>4</sub> (908.0)	130 (59)	FRN735N3S	FRN735N3W	C/F	C/F
	480	75.0	3	2	35 <sup>3</sup> / <sub>4</sub> (908.0)	130 (59)	FRN735N5S	FRN735N5W	C2-229	C2-230
	240	100.0	3	6	44 <sup>1</sup> / <sub>4</sub> (1124.0)	132 (60)	FRN744E3S	FRN744E3W	C/F	C/F
	480	100.0	3	3	44 <sup>1</sup> / <sub>4</sub> (1124.0)	132 (60)	FRN744E5S	FRN744E5W	C2-229	C2-230
	240	125.0	3	6	54 <sup>11</sup> / <sub>16</sub> (1389.1)	140 (64)	FRN754M3S	FRN754M3W	C/F	C/F
	480	125.0	3	6	54 <sup>11</sup> / <sub>16</sub> (1389.1)	140 (64)	FRN754M5S	FRN754M5W	C/F	C/F
	480	150.0	3	6	63 <sup>11</sup> / <sub>16</sub> (1617.6)	145 (66)	FRN763M5S	FRN763M5W	C/F	C/F
	480	175.0	3	6	73 <sup>3</sup> / <sub>16</sub> (1859.0)	151 (69)	FRN773D5S	FRN773D5W	C/F	C/F
	480	200.0	3	6	82 <sup>11</sup> / <sub>16</sub> (2100.3)	157 (72)	FRN782M5S	FRN782M5W	C/F	C/F
48 W/in <sup>2</sup> Steel Flange 24-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	67.0	3	4	26 <sup>3</sup> / <sub>16</sub> (665.2)	129 (59)	FRN726D3XS	FRN726D3XW	C4-148	C4-149
	480	67.0	1	3	26 <sup>3</sup> / <sub>16</sub> (665.2)	129 (59)	FRN726D11XS	FRN726D11XW	C/F	C/F
	480	67.0	3	2	26 <sup>3</sup> / <sub>16</sub> (665.2)	129 (59)	FRN726D5XS	FRN726D5XW	C2-229	C2-230
	240	100.0	3	8	36 <sup>3</sup> / <sub>16</sub> (919.2)	142 (65)	FRN736D3XS	FRN736D3XW	C/F	C/F
	480	100.0	3	4	36 <sup>3</sup> / <sub>16</sub> (919.2)	142 (65)	FRN736D5XS	FRN736D5XW	C4-156	C4-157
	240	133.0	3	8	44 <sup>11</sup> / <sub>16</sub> (1135.1)	147 (67)	FRN744M3XS	FRN744M3XW	C/F	C/F
	480	133.0	3	4	44 <sup>11</sup> / <sub>16</sub> (1135.1)	147 (67)	FRN744M5XS	FRN744M5XW	C4-156	C4-157
	240	167.0	3	8	54 <sup>11</sup> / <sub>16</sub> (1389.1)	158 (72)	FRN754M3XS	FRN754M3XW	C/F	C/F
	480	167.0	3	8	54 <sup>11</sup> / <sub>16</sub> (1389.1)	158 (72)	FRN754M5XS	FRN754M5XW	C/F	C/F
	480	200.0	3	8	63 <sup>11</sup> / <sub>16</sub> (1617.6)	166 (76)	FRN763M5XS	FRN763M5XW	C/F	C/F
	480	233.0	3	8	73 <sup>3</sup> / <sub>16</sub> (1859.0)	175 (80)	FRN773D5XS	FRN773D5XW	C/F	C/F
	480	267.0	3	8	82 <sup>11</sup> / <sub>16</sub> (2100.3)	184 (84)	FRN782M5XS	FRN782M5XW	C/F	C/F

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters

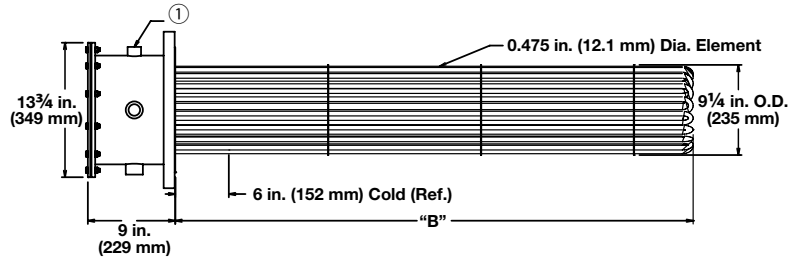


## WATROD ANSI Flange Immersion Heaters

### Application: Process Water

- 10 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



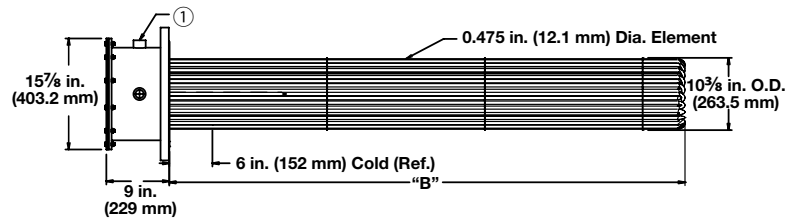
① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
48 W/in <sup>2</sup> Steel Flange 27-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	480	190.0	3	9	54 <sup>3</sup> / <sub>4</sub> (1391)	240 (109)	FSN754N5S	FSN754N5W	C/F	C/F
	480	262.0	3	9	73 <sup>1</sup> / <sub>4</sub> (1861)	260 (118)	FSN773E5S	FSN773E5W	C/F	C/F

### Application: Process Water

- 12 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
48 W/in <sup>2</sup> Steel Flange 36-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	480	250.0	3	6	54 <sup>5</sup> / <sub>8</sub> (1387.5)	280 (127)	FTN754L5S	FTN754L5W	C/F	C/F
	480	350.0	3	12	73 <sup>1</sup> / <sub>8</sub> (1857.4)	291 (132)	FTN773C5S	FTN773C5W	C/F	C/F

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



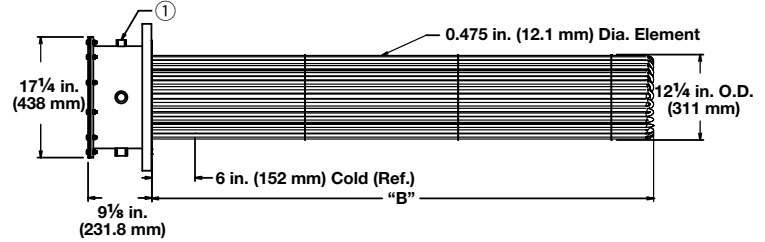
## WATROD ANSI Flange Immersion Heaters



### Application: Process Water

- 14 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
48 W/in <sup>2</sup> Steel Flange 45-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	480	315.0	3	15	54 1/2 (1384)	300 (136)	FWN754J5S	FWN754J5W	C/F	C/F
	480	375.0	3	15	63 1/2 (1613)	310 (141)	FWN763J5S	FWN763J5W	C/F	C/F

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



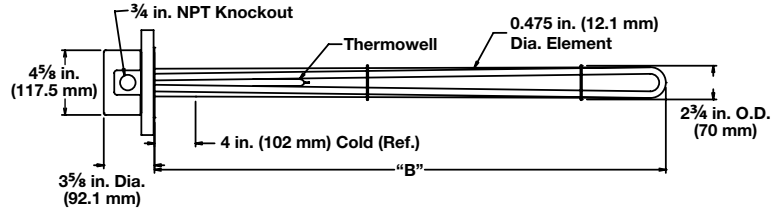
## WATROD ANSI Flange Immersion Heaters



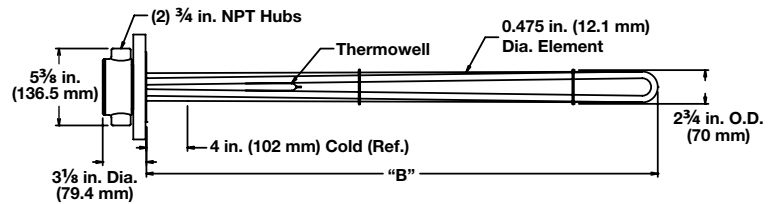
### Application: Forced Air and Caustic Solutions

- 3 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure
- Single circuit

#### General Purpose



#### NEMA 4 Enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
						General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ⑥ Steel Flange 3-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	3.0	1	18 (457)	23 (11)	FMNA18A10S	FMNA18A10W	C1-17	C1-13
	240	3.0	3	18 (457)	23 (11)	FMNA18A3S	FMNA18A3W	C2-50	C2-92
	480	3.0	1	18 (457)	23 (11)	FMNA18A11S	FMNA18A11W	C/F	C/F
	480	3.0	3	18 (457)	23 (11)	FMNA18A5S	FMNA18A5W	C2-43	C2-35
	240	4.5	1	25½ (648)	27 (13)	FMNA25J10S	FMNA25J10W	C/F	C/F
	240	4.5	3	25½ (648)	27 (13)	FMNA25J3S	FMNA25J3W	C2-50	C2-92
	480	4.5	1	25½ (648)	27 (13)	FMNA25J11S	FMNA25J11W	C/F	C/F
	480	4.5	3	25½ (648)	27 (13)	FMNA25J5S	FMNA25J5W	C2-43	C2-35
	240	6.0	1	33 (838)	28 (13)	FMNA33A10S	FMNA33A10W	C/F	C/F
	240	6.0	3	33 (838)	28 (13)	FMNA33A3S	FMNA33A3W	C2-50	C2-92
	480	6.0	1	33 (838)	28 (13)	FMNA33A11S	FMNA33A11W	C/F	C/F
	480	6.0	3	33 (838)	28 (13)	FMNA33A5S	FMNA33A5W	C2-43	C2-35
	240	7.5	1	40½ (1029)	30 (14)	FMNA40J10S	FMNA40J10W	C/F	C/F
	240	7.5	3	40½ (1029)	30 (14)	FMNA40J3S	FMNA40J3W	C2-50	C2-92
	480	7.5	1	40½ (1029)	30 (14)	FMNA40J11S	FMNA40J11W	C/F	C/F
	480	7.5	3	40½ (1029)	30 (14)	FMNA40J5S	FMNA40J5W	C2-43	C2-35
	240	9.0	1	48 (1219)	32 (15)	FMNA48A10S	FMNA48A10W	C/F	C/F
	240	9.0	3	48 (1219)	32 (15)	FMNA48A3S	FMNA48A3W	C2-50	C2-92
	480	9.0	1	48 (1219)	32 (15)	FMNA48A11S	FMNA48A11W	C/F	C/F
	480	9.0	3	48 (1219)	32 (15)	FMNA48A5S	FMNA48A5W	C2-43	C2-35
	240	12.5	3	64½ (1638)	37 (17)	FMNA64J3S	FMNA64J3W	C2-236	C2-214
	480	12.5	1	64½ (1638)	37 (17)	FMNA64J11S	FMNA64J11W	C/F	C/F
	480	12.5	3	64½ (1638)	37 (17)	FMNA64J5S	FMNA64J5W	C2-43	C2-35
	240	15.0	3	77 (1956)	42 (19)	FMNA77A3S	FMNA77A3W	C2-236	C2-214
	480	15.0	1	77 (1956)	42 (19)	FMNA77A11S	FMNA77A11W	C/F	C/F
	480	15.0	3	77 (1956)	42 (19)	FMNA77A5S	FMNA77A5W	C2-43	C2-35

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

# Immersion Heaters



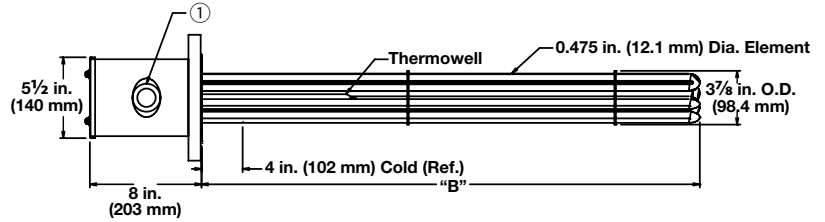
## WATROD ANSI Flange Immersion Heaters



### Application: Forced Air and Caustic Solutions

- 4 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ⑥ Steel Flange 6-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	6.0	1	1	18 (457)	32 (15)	FONA18A10S	FONA18A10W	C/F	C/F
	240	6.0	3	1	18 (457)	32 (15)	FONA18A3S	FONA18A3W	C2-50	C2-92
	480	6.0	1	1	18 (457)	32 (15)	FONA18A11S	FONA18A11W	C/F	C/F
	480	6.0	3	1	18 (457)	32 (15)	FONA18A5S	FONA18A5W	C2-43	C2-35
	240	9.0	1	1	25 1/2 (648)	36 (17)	FONA25J10S	FONA25J10W	C/F	C/F
	240	9.0	3	1	25 1/2 (648)	36 (17)	FONA25J3S	FONA25J3W	C2-50	C2-92
	480	9.0	1	1	25 1/2 (648)	36 (17)	FONA25J11S	FONA25J11W	C/F	C/F
	480	9.0	3	1	25 1/2 (648)	36 (17)	FONA25J5S	FONA25J5W	C2-43	C2-35
	240	12.0	1	2	33 (838)	39 (18)	FONA33A10S	FONA33A10W	C/F	C/F
	240	12.0	3	1	33 (838)	39 (18)	FONA33A3S	FONA33A3W	C2-236	C2-214
	480	12.0	1	1	33 (838)	39 (18)	FONA33A11S	FONA33A11W	C/F	C/F
	480	12.0	3	1	33 (838)	39 (18)	FONA33A5S	FONA33A5W	C2-43	C2-35
	240	15.0	1	2	40 1/2 (1029)	43 (20)	FONA40J10S	FONA40J10W	C/F	C/F
	240	15.0	3	1	40 1/2 (1029)	43 (20)	FONA40J3S	FONA40J3W	C2-236	C2-214
	480	15.0	1	1	40 1/2 (1029)	43 (20)	FONA40J11S	FONA40J11W	C/F	C/F
	480	15.0	3	1	40 1/2 (1029)	43 (20)	FONA40J5S	FONA40J5W	C2-43	C2-35
	240	18.0	1	2	48 (1219)	48 (22)	FONA48A10S	FONA48A10W	C/F	C/F
	240	18.0	3	1	48 (1219)	48 (22)	FONA48A3S	FONA48A3W	C2-236	C2-214
	480	18.0	1	1	48 (1219)	48 (22)	FONA48A11S	FONA48A11W	C/F	C/F
	480	18.0	3	1	48 (1219)	48 (22)	FONA48A5S	FONA48A5W	C2-43	C2-35
	240	25.0	3	2	64 1/2 (1638)	53 (24)	FONA64J3S	FONA64J3W	C2-236	C2-214
	480	25.0	1	2	64 1/2 (1638)	53 (24)	FONA64J11S	FONA64J11W	C/F	C/F
	480	25.0	3	1	64 1/2 (1638)	53 (24)	FONA64J5S	FONA64J5W	C2-225	C2-226
	240	30.0	3	2	77 (1956)	61 (28)	FONA77A3S	FONA77A3W	C2-236	C2-214
480	30.0	1	2	77 (1956)	61 (28)	FONA77A11S	FONA77A11W	C/F	C/F	
480	30.0	3	1	77 (1956)	61 (28)	FONA77A5S	FONA77A5W	C2-225	C2-226	

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

# Immersion Heaters

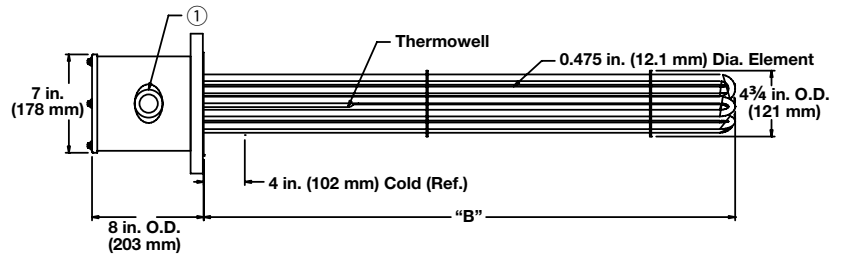


## WATROD ANSI Flange Immersion Heaters

### Application: Forced Air and Caustic Solutions

- 5 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ⑥ Steel Flange 6-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	6.0	1	1	18 (457)	36 (17)	FNNA18A10S	FNNA18A10W	C/F	C/F
	240	6.0	3	1	18 (457)	36 (17)	FNNA18A3S	FNNA18A3W	C2-50	C2-92
	480	6.0	1	1	18 (457)	36 (17)	FNNA18A11S	FNNA18A11W	C/F	C/F
	480	6.0	3	1	18 (457)	36 (17)	FNNA18A5S	FNNA18A5W	C2-43	C2-35
	240	9.0	1	1	25 1/2 (648)	40 (19)	FNNA25J10S	FNNA25J10W	C/F	C/F
	240	9.0	3	1	25 1/2 (648)	40 (19)	FNNA25J3S	FNNA25J3W	C2-50	C2-92
	480	9.0	1	1	25 1/2 (648)	40 (19)	FNNA25J11S	FNNA25J11W	C/F	C/F
	480	9.0	3	1	25 1/2 (648)	40 (19)	FNNA25J5S	FNNA25J5W	C2-43	C2-35
	240	12.0	1	2	33 (838)	43 (20)	FNNA33A10S	FNNA33A10W	C/F	C/F
	240	12.0	3	1	33 (838)	43 (20)	FNNA33A3S	FNNA33A3W	C2-236	C2-214
	480	12.0	1	1	33 (838)	43 (20)	FNNA33A11S	FNNA33A11W	C/F	C/F
	480	12.0	3	1	33 (838)	43 (20)	FNNA33A5S	FNNA33A5W	C2-43	C2-35
	240	15.0	1	2	40 1/2 (1029)	47 (22)	FNNA40J10S	FNNA40J10W	C/F	C/F
	240	15.0	3	1	40 1/2 (1029)	47 (22)	FNNA40J3S	FNNA40J3W	C2-236	C2-214
	480	15.0	1	1	40 1/2 (1029)	47 (22)	FNNA40J11S	FNNA40J11W	C/F	C/F
	480	15.0	3	1	40 1/2 (1029)	47 (22)	FNNA40J5S	FNNA40J5W	C2-43	C2-35
	240	18.0	1	2	48 (1219)	52 (24)	FNNA48A10S	FNNA48A10W	C/F	C/F
	240	18.0	3	1	48 (1219)	52 (24)	FNNA48A3S	FNNA48A3W	C2-236	C2-214
	480	18.0	1	1	48 (1219)	52 (24)	FNNA48A11S	FNNA48A11W	C/F	C/F
	480	18.0	3	1	48 (1219)	52 (24)	FNNA48A5S	FNNA48A5W	C2-43	C2-35
	240	25.0	3	2	64 1/2 (1638)	57 (26)	FNNA64J3S	FNNA64J3W	C2-218	C2-224
	480	25.0	1	2	64 1/2 (1638)	57 (26)	FNNA64J11S	FNNA64J11W	C/F	C/F
	480	25.0	3	1	64 1/2 (1638)	57 (26)	FNNA64J5S	FNNA64J5W	C2-225	C2-226
	240	30.0	3	2	77 (1956)	65 (30)	FNNA77A3S	FNNA77A3W	C2-218	C2-224
480	30.0	1	2	77 (1956)	65 (30)	FNNA77A11S	FNNA77A11W	C/F	C/F	
480	30.0	3	1	77 (1956)	65 (30)	FNNA77A5S	FNNA77A5W	C2-225	C2-226	

**Notes:** • All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe  
 • For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

# Immersion Heaters



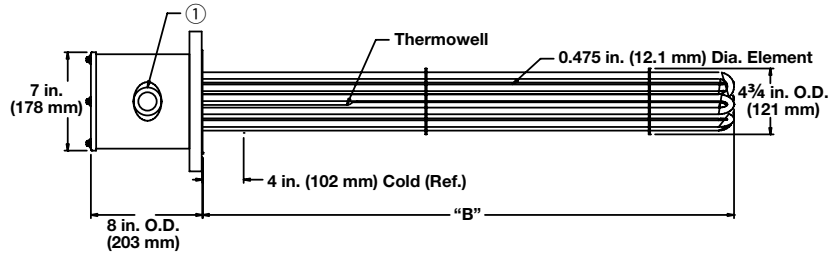
## WATROD ANSI Flange Immersion Heaters



### Application: Forced Air and Caustic Solutions

- 5 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
<b>23 W/in<sup>2</sup> ⑥ Steel Flange 9-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	240	9.0	1	1	18 (457)	39 (18)	<b>FNNA18A10XS</b>	<b>FNNA18A10XW</b>	<b>C/F</b>	<b>C/F</b>
	240	9.0	3	1	18 (457)	39 (18)	<b>FNNA18A3XS</b>	<b>FNNA18A3XW</b>	<b>C2-50</b>	<b>C2-92</b>
	480	9.0	1	1	18 (457)	39 (18)	<b>FNNA18A11XS</b>	<b>FNNA18A11XW</b>	<b>C/F</b>	<b>C/F</b>
	480	9.0	3	1	18 (457)	39 (18)	<b>FNNA18A5XS</b>	<b>FNNA18A5XW</b>	<b>C2-43</b>	<b>C2-35</b>
	240	14.0	1	3	25 <sup>1/2</sup> (648)	45 (21)	<b>FNNA25J10XS</b>	<b>FNNA25J10XW</b>	<b>C/F</b>	<b>C/F</b>
	240	14.0	3	1	25 <sup>1/2</sup> (648)	45 (21)	<b>FNNA25J3XS</b>	<b>FNNA25J3XW</b>	<b>C2-236</b>	<b>C2-214</b>
	480	14.0	1	1	25 <sup>1/2</sup> (648)	45 (21)	<b>FNNA25J11XS</b>	<b>FNNA25J11XW</b>	<b>C/F</b>	<b>C/F</b>
	480	14.0	3	1	25 <sup>1/2</sup> (648)	45 (21)	<b>FNNA25J5XS</b>	<b>FNNA25J5XW</b>	<b>C2-43</b>	<b>C2-35</b>
	240	18.0	1	3	33 (838)	48 (22)	<b>FNNA33A10XS</b>	<b>FNNA33A10XW</b>	<b>C/F</b>	<b>C/F</b>
	240	18.0	3	1	33 (838)	48 (22)	<b>FNNA33A3XS</b>	<b>FNNA33A3XW</b>	<b>C2-236</b>	<b>C2-214</b>
	480	18.0	1	1	33 (838)	48 (22)	<b>FNNA33A11XS</b>	<b>FNNA33A11XW</b>	<b>C/F</b>	<b>C/F</b>
	480	18.0	3	1	33 (838)	48 (22)	<b>FNNA33A5XS</b>	<b>FNNA33A5XW</b>	<b>C2-43</b>	<b>C2-35</b>
	240	23.0	1	3	40 <sup>1/2</sup> (1029)	53 (24)	<b>FNNA40J10XS</b>	<b>FNNA40J10XW</b>	<b>C/F</b>	<b>C/F</b>
	240	23.0	3	3	40 <sup>1/2</sup> (1029)	53 (24)	<b>FNNA40J3XS</b>	<b>FNNA40J3XW</b>	<b>C4-143</b>	<b>C4-142</b>
	480	23.0	1	1	40 <sup>1/2</sup> (1029)	53 (24)	<b>FNNA40J11XS</b>	<b>FNNA40J11XW</b>	<b>C/F</b>	<b>C/F</b>
	480	23.0	3	1	40 <sup>1/2</sup> (1029)	53 (24)	<b>FNNA40J5XS</b>	<b>FNNA40J5XW</b>	<b>C2-225</b>	<b>C2-226</b>
	240	27.0	1	3	48 (1219)	60 (28)	<b>FNNA48A10XS</b>	<b>FNNA48A10XW</b>	<b>C/F</b>	<b>C/F</b>
	240	27.0	3	3	48 (1219)	60 (28)	<b>FNNA48A3XS</b>	<b>FNNA48A3XW</b>	<b>C4-143</b>	<b>C4-142</b>
	480	27.0	1	3	48 (1219)	60 (28)	<b>FNNA48A11XS</b>	<b>FNNA48A11XW</b>	<b>C/F</b>	<b>C/F</b>
	480	27.0	3	1	48 (1219)	60 (28)	<b>FNNA48A5XS</b>	<b>FNNA48A5XW</b>	<b>C2-225</b>	<b>C2-226</b>
	240	38.0	3	3	64 <sup>1/2</sup> (1638)	68 (31)	<b>FNNA64J3XS</b>	<b>FNNA64J3XW</b>	<b>C4-144</b>	<b>C4-145</b>
	480	38.0	1	3	64 <sup>1/2</sup> (1638)	68 (31)	<b>FNNA64J11XS</b>	<b>FNNA64J11XW</b>	<b>C/F</b>	<b>C/F</b>
	480	38.0	3	1	64 <sup>1/2</sup> (1638)	68 (31)	<b>FNNA64J5XS</b>	<b>FNNA64J5XW</b>	<b>C2-225</b>	<b>C2-226</b>
	240	45.0	3	3	77 (1956)	78 (36)	<b>FNNA77A3XS</b>	<b>FNNA77A3XW</b>	<b>C4-144</b>	<b>C4-145</b>
480	45.0	1	3	77 (1956)	78 (36)	<b>FNNA77A11XS</b>	<b>FNNA77A11XW</b>	<b>C/F</b>	<b>C/F</b>	
480	45.0	3	3	77 (1956)	78 (36)	<b>FNNA77A5XS</b>	<b>FNNA77A5XW</b>	<b>C4-150</b>	<b>C4-151</b>	

**Notes:** • All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe  
 • For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)



# Immersion Heaters

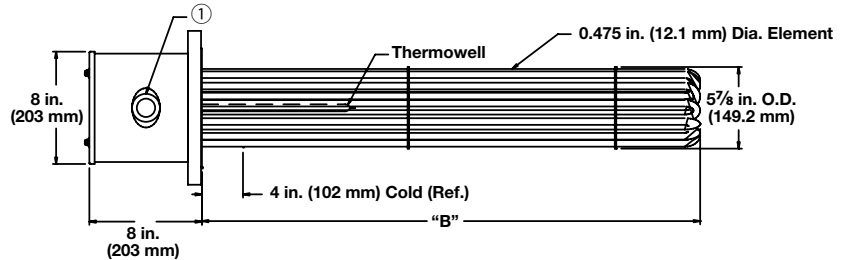


## WATROD ANSI Flange Immersion Heaters

### Application: Forced Air and Caustic Solutions

- 6 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ® Steel Flange 12-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	12.0	1	2	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPNA17R10S	FPNA17R10W	C/F	C/F
	240	12.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPNA17R3S	FPNA17R3W	C2-236	C2-214
	480	12.0	1	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPNA17R11S	FPNA17R11W	C/F	C/F
	480	12.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPNA17R5S	FPNA17R5W	C2-43	C2-35
	240	18.0	1	2	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPNA25G10S	FPNA25G10W	C/F	C/F
	240	18.0	3	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPNA25G3S	FPNA25G3W	C2-236	C2-214
	480	18.0	1	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPNA25G11S	FPNA25G11W	C/F	C/F
	480	18.0	3	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPNA25G5S	FPNA25G5W	C2-43	C2-35
	240	24.0	1	3	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPNA32R10S	FPNA32R10W	C/F	C/F
	240	24.0	3	2	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPNA32R3S	FPNA32R3W	C2-218	C2-224
	480	24.0	1	2	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPNA32R11S	FPNA32R11W	C/F	C/F
	480	24.0	3	1	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPNA32R5S	FPNA32R5W	C2-225	C2-226
	240	30.0	1	3	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPNA40G10S	FPNA40G10W	C/F	C/F
	240	30.0	3	2	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPNA40G3S	FPNA40G3W	C2-218	C2-224
	480	30.0	1	2	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPNA40G11S	FPNA40G11W	C/F	C/F
	480	30.0	3	1	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPNA40G5S	FPNA40G5W	C2-225	C2-226
	240	36.0	1	4	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPNA47R10S	FPNA47R10W	C/F	C/F
	240	36.0	3	2	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPNA47R3S	FPNA47R3W	C2-218	C2-224
	480	36.0	1	2	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPNA47R11S	FPNA47R11W	C/F	C/F
	480	36.0	3	1	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPNA47R5S	FPNA47R5W	C2-225	C2-226
240	50.0	3	4	64 <sup>3</sup> / <sub>8</sub> (1635.1)	110 (50)	FPNA64G3S	FPNA64G3W	C4-148	C4-149	
480	50.0	1	3	64 <sup>3</sup> / <sub>8</sub> (1635.1)	110 (50)	FPNA64G11S	FPNA64G11W	C/F	C/F	
480	50.0	3	2	64 <sup>3</sup> / <sub>8</sub> (1635.1)	110 (50)	FPNA64G5S	FPNA64G5W	C2-229	C2-230	
240	60.0	3	4	76 <sup>7</sup> / <sub>8</sub> (1952.4)	118 (54)	FPNA76R3S	FPNA76R3W	C4-148	C4-149	
480	60.0	1	3	76 <sup>7</sup> / <sub>8</sub> (1952.4)	118 (54)	FPNA76R11S	FPNA76R11W	C/F	C/F	
480	60.0	3	2	76 <sup>7</sup> / <sub>8</sub> (1952.4)	118 (54)	FPNA76R5S	FPNA76R5W	C2-229	C2-230	

**Notes:** • All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe  
 • For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

® Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

# Immersion Heaters



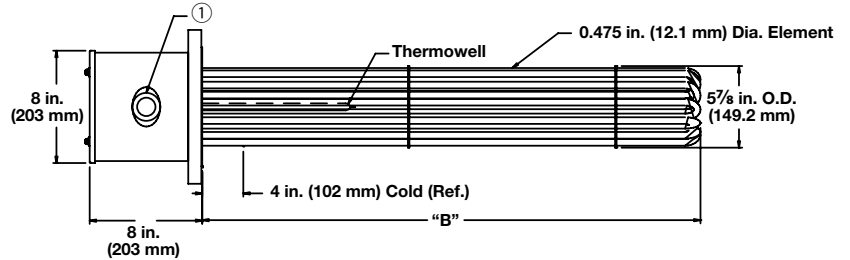
## WATROD ANSI Flange Immersion Heaters



### Application: Forced Air and Caustic Solutions

- 6 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

#### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ® Steel Flange 15-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	15.0	1	3	17 <sup>7</sup> / <sub>8</sub> (454.0)	78 (36)	FPNA17R10XS	FPNA17R10XW	C/F	C/F
	240	15.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	78 (36)	FPNA17R3XS	FPNA17R3XW	C2-236	C2-214
	480	15.0	1	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	78 (36)	FPNA17R11XS	FPNA17R11XW	C/F	C/F
	480	15.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	78 (36)	FPNA17R5XS	FPNA17R5XW	C2-43	C2-35
	240	23.0	1	3	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPNA25G10XS	FPNA25G10XW	C/F	C/F
	240	23.0	3	5	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPNA25G3XS	FPNA25G3XW	C4-143	C4-142
	480	23.0	1	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPNA25G11XS	FPNA25G11XW	C/F	C/F
	480	23.0	3	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPNA25G5XS	FPNA25G5XW	C2-225	C2-226
	240	30.0	1	3	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPNA32R10XS	FPNA32R10XW	C/F	C/F
	240	30.0	3	5	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPNA32R3XS	FPNA32R3XW	C4-144	C4-145
	480	30.0	1	3	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPNA32R11XS	FPNA32R11XW	C/F	C/F
	480	30.0	3	1	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPNA32R5XS	FPNA32R5XW	C2-224	C2-226
	240	38.0	1	5	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPNA40G10XS	FPNA40G10XW	C/F	C/F
	240	38.0	3	5	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPNA40G3XS	FPNA40G3XW	C4-144	C4-145
	480	38.0	1	3	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPNA40G11XS	FPNA40G11XW	C/F	C/F
	480	38.0	3	1	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPNA40G5XS	FPNA40G5XW	C2-225	C2-226
	240	45.0	1	5	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPNA47R10XS	FPNA47R10XW	C/F	C/F
	240	45.0	3	5	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPNA47R3XS	FPNA47R3XW	C4-144	C4-145
	480	45.0	1	3	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPNA47R11XS	FPNA47R11XW	C/F	C/F
	480	45.0	3	5	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPNA47R5XS	FPNA47R5XW	C4-152	C4-153
240	63.0	3	5	64 <sup>3</sup> / <sub>8</sub> (1635.1)	120 (55)	FPNA64G3XS	FPNA64G3XW	C/F	C/F	
480	63.0	1	3	64 <sup>3</sup> / <sub>8</sub> (1635.1)	120 (55)	FPNA64G11XS	FPNA64G11XW	C/F	C/F	
480	63.0	3	5	64 <sup>3</sup> / <sub>8</sub> (1635.1)	120 (55)	FPNA64G5XS	FPNA64G5XW	C4-152	C4-153	
240	75.0	3	5	76 <sup>7</sup> / <sub>8</sub> (1952.4)	131 (60)	FPNA76R3XS	FPNA76R3XW	C/F	C/F	
480	75.0	1	5	76 <sup>7</sup> / <sub>8</sub> (1952.4)	131 (60)	FPNA76R11XS	FPNA76R11XW	C/F	C/F	
480	75.0	3	5	76 <sup>7</sup> / <sub>8</sub> (1952.4)	131 (60)	FPNA76R5XS	FPNA76R5XW	C4-152	C4-153	

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

Ⓞ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

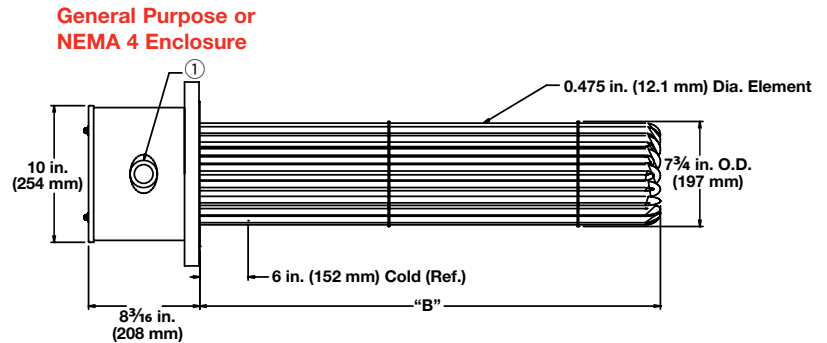
# Immersion Heaters



## WATROD ANSI Flange Immersion Heaters

### Application: Forced Air and Caustic Solutions

- 8 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> ⑥ Steel Flange 18-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	30.0	1	3	32 <sup>3</sup> / <sub>4</sub> (832.0)	130 (59)	FRNA32N10S	FRNA32N10W	C/F	C/F
	240	30.0	3	2	32 <sup>3</sup> / <sub>4</sub> (832.0)	130 (59)	FRNA32N3S	FRNA32N3W	C2-218	C2-224
	480	30.0	1	2	32 <sup>3</sup> / <sub>4</sub> (832.0)	130 (59)	FRNA32N11S	FRNA32N11W	C/F	C/F
	480	30.0	3	1	32 <sup>3</sup> / <sub>4</sub> (832.0)	130 (59)	FRNA32N5S	FRNA32N5W	C2-225	C2-226
	240	40.0	3	3	43 <sup>1</sup> / <sub>4</sub> (1099.0)	132 (60)	FRNA43E3S	FRNA43E3W	C4-144	C4-145
	480	40.0	1	2	43 <sup>1</sup> / <sub>4</sub> (1099.0)	132 (60)	FRNA43E11S	FRNA43E11W	C/F	C/F
	480	40.0	3	3	43 <sup>1</sup> / <sub>4</sub> (1099.0)	132 (60)	FRNA43E5S	FRNA43E5W	C4-150	C4-151
	240	50.0	3	3	51 <sup>11</sup> / <sub>16</sub> (1312.9)	137 (63)	FRNA51M3S	FRNA51M3W	C4-144	C4-145
	480	50.0	1	3	51 <sup>11</sup> / <sub>16</sub> (1312.9)	137 (63)	FRNA51M11S	FRNA51M11W	C/F	C/F
	480	50.0	3	2	51 <sup>11</sup> / <sub>16</sub> (1312.9)	137 (63)	FRNA51M5S	FRNA51M5W	C2-229	C2-230
23 W/in <sup>2</sup> ⑥ Steel Flange 24-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	40.0	1	4	33 <sup>3</sup> / <sub>16</sub> (843.0)	142 (65)	FRNA33D10XS	FRNA33D10XW	C/F	C/F
	240	40.0	3	4	33 <sup>3</sup> / <sub>16</sub> (843.0)	142 (65)	FRNA33D3XS	FRNA33D3XW	C4-146	C4-147
	480	40.0	1	2	33 <sup>3</sup> / <sub>16</sub> (843.0)	142 (65)	FRNA33D11XS	FRNA33D11XW	C/F	C/F
	480	40.0	3	2	33 <sup>3</sup> / <sub>16</sub> (843.0)	142 (65)	FRNA33D5XS	FRNA33D5XW	C2-227	C2-228
	240	53.0	3	4	43 <sup>11</sup> / <sub>16</sub> (1109.7)	147 (67)	FRNA43M3XS	FRNA43M3XW	C4-148	C4-149
	480	53.0	1	3	43 <sup>11</sup> / <sub>16</sub> (1109.7)	147 (67)	FRNA43M11XS	FRNA43M11XW	C/F	C/F
	480	53.0	3	2	43 <sup>11</sup> / <sub>16</sub> (1109.7)	147 (67)	FRNA43M5XS	FRNA43M5XW	C2-229	C2-230
	240	67.0	3	4	51 <sup>11</sup> / <sub>16</sub> (1312.9)	154 (70)	FRNA51M3XS	FRNA51M3XW	C4-148	C4-149
	480	67.0	1	3	51 <sup>11</sup> / <sub>16</sub> (1312.9)	154 (70)	FRNA51M11XS	FRNA51M11XW	C/F	C/F
	480	67.0	3	2	51 <sup>11</sup> / <sub>16</sub> (1312.9)	154 (70)	FRNA51M5XS	FRNA51M5XW	C2-229	C2-230

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

# Immersion Heaters



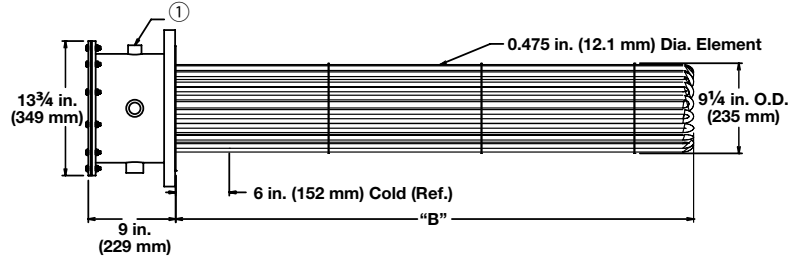
## WATROD ANSI Flange Immersion Heaters



### Application: Forced Air and Caustic Solutions

- 10 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 27-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	45.0	3	3	33 <sup>1</sup> / <sub>4</sub> (845)	165 (75)	FSNA33E3S	FSNA33E3W	C4-144	C4-145
	480	45.0	3	3	33 <sup>1</sup> / <sub>4</sub> (845)	165 (75)	FSNA33E5S	FSNA33E5W	C4-150	C4-151
	240	60.0	3	3	43 <sup>3</sup> / <sub>4</sub> (1111)	195 (89)	FSNA43N3S	FSNA43N3W	C4-144	C4-145
	480	60.0	3	3	43 <sup>3</sup> / <sub>4</sub> (1111)	195 (89)	FSNA43N5S	FSNA43N5W	C4-150	C4-151
	240	75.0	3	9	51 <sup>3</sup> / <sub>4</sub> (1314)	230 (105)	FSNA51N3S	FSNA51N3W	C/F	C/F
	480	75.0	3	3	51 <sup>3</sup> / <sub>4</sub> (1314)	230 (105)	FSNA51N5S	FSNA51N5W	C4-152	C4-153

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



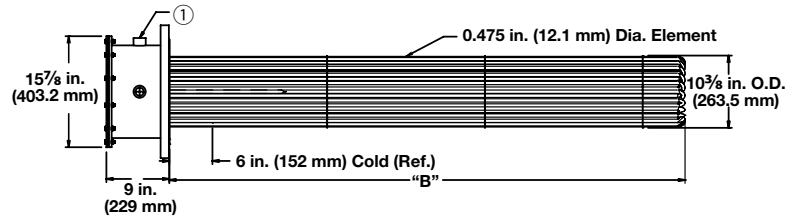
## WATROD ANSI Flange Immersion Heaters



### Application: Forced Air and Caustic Solutions

- 12 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 36-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	480	60.0	3	3	33 <sup>1</sup> / <sub>8</sub> (841.4)	205 (93)	FTNA33C5S	FTNA33C5W	C4-150	C4-151
	480	80.0	3	3	43 <sup>5</sup> / <sub>8</sub> (1108.1)	240 (109)	FTNA43L5S	FTNA43L5W	C4-152	C4-153
	480	100.0	3	3	51 <sup>5</sup> / <sub>8</sub> (1311.3)	280 (127)	FTNA51L5S	FTNA51L5W	C4-152	C4-153

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



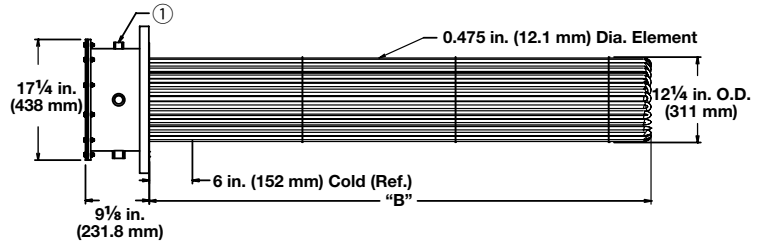
## WATROD ANSI Flange Immersion Heaters



### Application: Forced Air and Caustic Solutions

- 14 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 45-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	480	75.0	3	3	33 (838)	225 (102)	FWNA33A5S	FWNA33A5W	C4-152	C4-153
	480	100.0	3	3	43 1/2 (1105)	255 (116)	FWNA43J5S	FWNA43J5W	C4-152	C4-153
	480	125.0	3	5	51 1/2 (1308)	300 (136)	FWNA51J5S	FWNA51J5W	C/F	C/F

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters

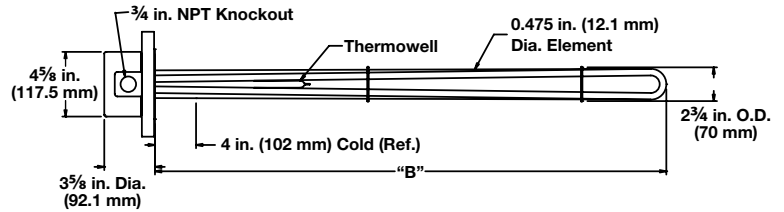


## WATROD ANSI Flange Immersion Heaters

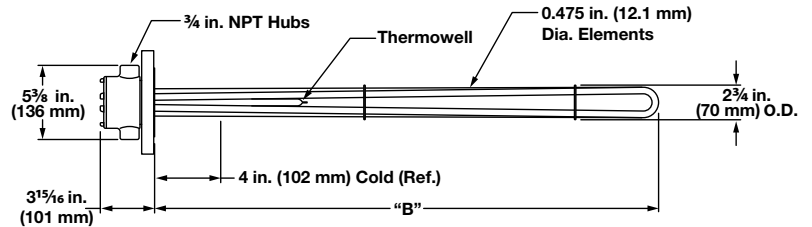
### Application: Lightweight Oils and Heat Transfer Oils

- 3 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure
- Single circuit

#### General Purpose



#### NEMA 4 Enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
						General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 3-Steel Elements (3.6 W/cm <sup>2</sup> )	240	3.0	1	18 (457)	23 (11)	FMS718A10S	FMS718A10W	C1-17	C1-13
	240	3.0	3	18 (457)	23 (11)	FMS718A3S	FMS718A3W	C2-50	C2-92
	480	3.0	1	18 (457)	23 (11)	FMS718A11S	FMS718A11W	C/F	C/F
	480	3.0	3	18 (457)	23 (11)	FMS718A5S	FMS718A5W	C2-43	C2-35
	240	4.5	1	25 1/2 (648)	27 (13)	FMS725J10S	FMS725J10W	C/F	C/F
	240	4.5	3	25 1/2 (648)	27 (13)	FMS725J3S	FMS725J3W	C2-50	C2-92
	480	4.5	1	25 1/2 (648)	27 (13)	FMS725J11S	FMS725J11W	C/F	C/F
	480	4.5	3	25 1/2 (648)	27 (13)	FMS725J5S	FMS725J5W	C2-43	C2-35
	240	6.0	1	33 (838)	28 (13)	FMS733A10S	FMS733A10W	C/F	C/F
	240	6.0	3	33 (838)	28 (13)	FMS733A3S	FMS733A3W	C2-50	C2-92
	480	6.0	1	33 (838)	28 (13)	FMS733A11S	FMS733A11W	C/F	C/F
	480	6.0	3	33 (838)	28 (13)	FMS733A5S	FMS733A5W	C2-43	C2-35
	240	7.5	1	40 1/2 (1029)	30 (14)	FMS740J10S	FMS740J10W	C/F	C/F
	240	7.5	3	40 1/2 (1029)	30 (14)	FMS740J3S	FMS740J3W	C2-50	C2-92
	480	7.5	1	40 1/2 (1029)	30 (14)	FMS740J11S	FMS740J11W	C/F	C/F
	480	7.5	3	40 1/2 (1029)	30 (14)	FMS740J5S	FMS740J5W	C2-43	C2-35
	240	9.0	1	48 (1219)	32 (15)	FMS748A10S	FMS748A10W	C/F	C/F
	240	9.0	3	48 (1219)	32 (15)	FMS748A3S	FMS748A3W	C2-50	C2-92
	480	9.0	1	48 (1219)	32 (15)	FMS748A11S	FMS748A11W	C/F	C/F
	480	9.0	3	48 (1219)	32 (15)	FMS748A5S	FMS748A5W	C2-43	C2-35
	240	12.5	3	64 1/2 (1638)	37 (17)	FMS764J3S	FMS764J3W	C2-236	C2-214
	480	12.5	1	64 1/2 (1638)	37 (17)	FMS764J11S	FMS764J11W	C/F	C/F
	480	12.5	3	64 1/2 (1638)	37 (17)	FMS764J5S	FMS764J5W	C2-43	C2-35
	240	15.0	3	77 (1956)	42 (19)	FMS777A3S	FMS777A3W	C2-236	C2-214
	480	15.0	1	77 (1956)	42 (19)	FMS777A11S	FMS777A11W	C/F	C/F
	480	15.0	3	77 (1956)	42 (19)	FMS777A5S	FMS777A5W	C2-43	C2-35

**Notes:**

- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
- For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



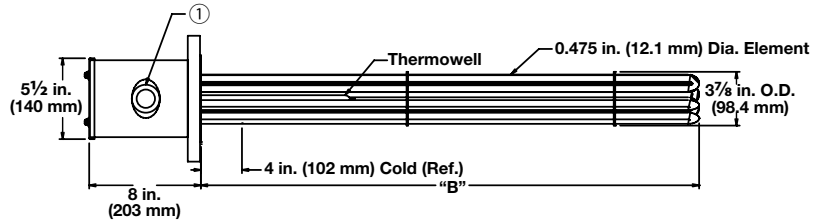
## WATROD ANSI Flange Immersion Heaters



### Application: Lightweight Oils and Heat Transfer Oils

- 4 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 6-Steel Elements (3.6 W/cm <sup>2</sup> )	240	6.0	1	1	18 (457)	32 (15)	FOS718A10S	FOS718A10W	C/F	C/F
	240	6.0	3	1	18 (457)	32 (15)	FOS718A3S	FOS718A3W	C2-50	C2-92
	480	6.0	1	1	18 (457)	32 (15)	FOS718A11S	FOS718A11W	C/F	C/F
	480	6.0	3	1	18 (457)	32 (15)	FOS718A5S	FOS718A5W	C2-43	C2-35
	240	9.0	1	1	25 1/2 (648)	36 (17)	FOS725J10S	FOS725J10W	C/F	C/F
	240	9.0	3	1	25 1/2 (648)	36 (17)	FOS725J3S	FOS725J3W	C2-50	C2-92
	480	9.0	1	1	25 1/2 (648)	36 (17)	FOS725J11S	FOS725J11W	C/F	C/F
	480	9.0	3	1	25 1/2 (648)	36 (17)	FOS725J5S	FOS725J5W	C2-43	C2-35
	240	12.0	1	2	33 (838)	39 (18)	FOS733A10S	FOS733A10W	C/F	C/F
	240	12.0	3	1	33 (838)	39 (18)	FOS733A3S	FOS733A3W	C2-236	C2-214
	480	12.0	1	1	33 (838)	39 (18)	FOS733A11S	FOS733A11W	C/F	C/F
	480	12.0	3	1	33 (838)	39 (18)	FOS733A5S	FOS733A5W	C2-43	C2-35
	240	15.0	1	2	40 1/2 (1029)	43 (20)	FOS740J10S	FOS740J10W	C/F	C/F
	240	15.0	3	1	40 1/2 (1029)	43 (20)	FOS740J3S	FOS740J3W	C2-236	C2-214
	480	15.0	1	1	40 1/2 (1029)	43 (20)	FOS740J11S	FOS740J11W	C/F	C/F
	480	15.0	3	1	40 1/2 (1029)	43 (20)	FOS740J5S	FOS740J5W	C2-43	C2-35
	240	18.0	1	2	48 (1219)	48 (22)	FOS748A10S	FOS748A10W	C/F	C/F
	240	18.0	3	1	48 (1219)	48 (22)	FOS748A3S	FOS748A3W	C2-236	C2-214
	480	18.0	1	1	48 (1219)	48 (22)	FOS748A11S	FOS748A11W	C/F	C/F
	480	18.0	3	1	48 (1219)	48 (22)	FOS748A5S	FOS748A5W	C2-43	C2-35
240	25.0	3	2	64 1/2 (1638)	53 (24)	FOS764J3S	FOS764J3W	C2-218	C2-224	
480	25.0	1	2	64 1/2 (1638)	53 (24)	FOS764J11S	FOS764J11W	C/F	C/F	
480	25.0	3	1	64 1/2 (1638)	53 (24)	FOS764J5S	FOS764J5W	C2-225	C2-226	
240	30.0	3	2	77 (1956)	61 (28)	FOS777A3S	FOS777A3W	C2-218	C2-224	
480	30.0	1	2	77 (1956)	61 (28)	FOS777A11S	FOS777A11W	C/F	C/F	
480	30.0	3	1	77 (1956)	61 (28)	FOS777A5S	FOS777A5W	C2-225	C2-226	

**Notes:**

- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
- For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters

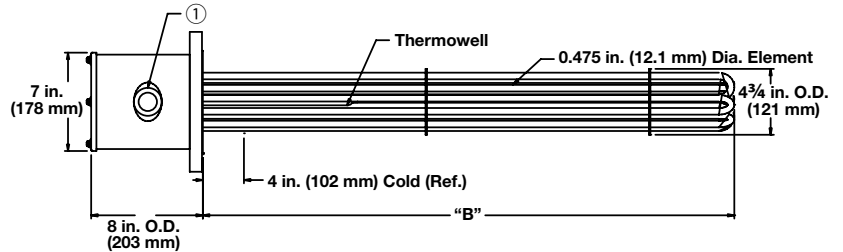


## WATROD ANSI Flange Immersion Heaters

### Application: Lightweight Oils and Heat Transfer Oils

- 5 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 6-Steel Elements (3.6 W/cm <sup>2</sup> )	240	6.0	1	1	18 (457)	36 (17)	FNS718A10S	FNS718A10W	C/F	C/F
	240	6.0	3	1	18 (457)	36 (17)	FNS718A3S	FNS718A3W	C2-50	C2-92
	480	6.0	1	1	18 (457)	36 (17)	FNS718A11S	FNS718A11W	C/F	C/F
	480	6.0	3	1	18 (457)	36 (17)	FNS718A5S	FNS718A5W	C2-43	C2-35
	240	9.0	1	1	25 <sup>1</sup> / <sub>2</sub> (648)	40 (19)	FNS725J10S	FNS725J10W	C/F	C/F
	240	9.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	40 (19)	FNS725J3S	FNS725J3W	C2-50	C2-92
	480	9.0	1	1	25 <sup>1</sup> / <sub>2</sub> (648)	40 (19)	FNS725J11S	FNS725J11W	C/F	C/F
	480	9.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	40 (19)	FNS725J5S	FNS725J5W	C2-43	C2-35
	240	12.0	1	2	33 (838)	43 (20)	FNS733A10S	FNS733A10W	C/F	C/F
	240	12.0	3	1	33 (838)	43 (20)	FNS733A3S	FNS733A3W	C2-236	C2-214
	480	12.0	1	1	33 (838)	43 (20)	FNS733A11S	FNS733A11W	C/F	C/F
	480	12.0	3	1	33 (838)	43 (20)	FNS733A5S	FNS733A5W	C2-43	C2-35
	240	15.0	1	2	40 <sup>1</sup> / <sub>2</sub> (1029)	47 (22)	FNS740J10S	FNS740J10W	C/F	C/F
	240	15.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	47 (22)	FNS740J3S	FNS740J3W	C2-236	C2-214
	480	15.0	1	1	40 <sup>1</sup> / <sub>2</sub> (1029)	47 (22)	FNS740J11S	FNS740J11W	C/F	C/F
	480	15.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	47 (22)	FNS740J5S	FNS740J5W	C2-43	C2-35
	240	18.0	1	2	48 (1219)	52 (24)	FNS748A10S	FNS748A10W	C/F	C/F
	240	18.0	3	1	48 (1219)	52 (24)	FNS748A3S	FNS748A3W	C2-236	C2-214
	480	18.0	1	1	48 (1219)	52 (24)	FNS748A11S	FNS748A11W	C/F	C/F
	480	18.0	3	1	48 (1219)	52 (24)	FNS748A5S	FNS748A5W	C2-43	C2-35
	240	25.0	3	2	64 <sup>1</sup> / <sub>2</sub> (1638)	57 (26)	FNS764J3S	FNS764J3W	C2-218	C2-224
	480	25.0	1	2	64 <sup>1</sup> / <sub>2</sub> (1638)	57 (26)	FNS764J11S	FNS764J11W	C/F	C/F
	480	25.0	3	1	64 <sup>1</sup> / <sub>2</sub> (1638)	57 (26)	FNS764J5S	FNS764J5W	C2-225	C2-226
	240	30.0	3	2	77 (1956)	65 (30)	FNS777A3S	FNS777A3W	C2-218	C2-224
480	30.0	1	2	77 (1956)	65 (30)	FNS777A11S	FNS777A11W	C/F	C/F	
480	30.0	3	1	77 (1956)	65 (30)	FNS777A5S	FNS777A5W	C2-225	C2-226	

**Notes:**

- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
- For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



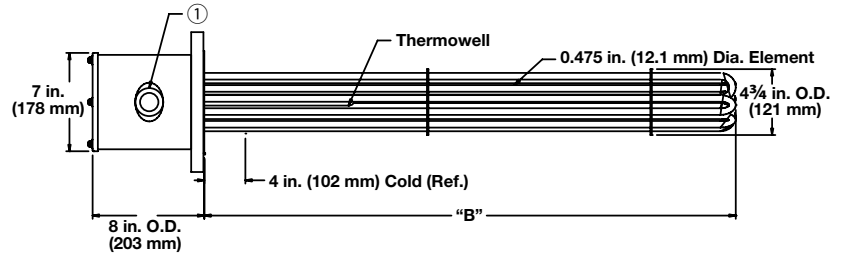
## WATROD ANSI Flange Immersion Heaters



### Application: Lightweight Oils and Heat Transfer Oils

- 5 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lb (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 9-Steel Elements (3.6 W/cm <sup>2</sup> )	240	9.0	1	1	18 (457)	39 (18)	FNS718A10XS	FNS718A10XW	C/F	C/F
	240	9.0	3	1	18 (457)	39 (18)	FNS718A3XS	FNS718A3XW	C2-50	C2-92
	480	9.0	1	1	18 (457)	39 (18)	FNS718A11XS	FNS718A11XW	C/F	C/F
	480	9.0	3	1	18 (457)	39 (18)	FNS718A5XS	FNS718A5XW	C2-43	C2-35
	240	14.0	1	3	25 1/2 (648)	45 (21)	FNS725J10XS	FNS725J10XW	C/F	C/F
	240	14.0	3	1	25 1/2 (648)	45 (21)	FNS725J3XS	FNS725J3XW	C2-236	C2-214
	480	14.0	1	1	25 1/2 (648)	45 (21)	FNS725J11XS	FNS725J11XW	C/F	C/F
	480	14.0	3	1	25 1/2 (648)	45 (21)	FNS725J5XS	FNS725J5XW	C2-43	C2-35
	240	18.0	1	3	33 (838)	48 (22)	FNS733A10XS	FNS733A10XW	C/F	C/F
	240	18.0	3	1	33 (838)	48 (22)	FNS733A3XS	FNS733A3XW	C2-236	C2-214
	480	18.0	1	1	33 (838)	48 (22)	FNS733A11XS	FNS733A11XW	C/F	C/F
	480	18.0	3	1	33 (838)	48 (22)	FNS733A5XS	FNS733A5XW	C2-43	C2-35
	240	23.0	1	3	40 1/2 (1029)	53 (24)	FNS740J10XS	FNS740J10XW	C/F	C/F
	240	23.0	3	3	40 1/2 (1029)	53 (24)	FNS740J3XS	FNS740J3XW	C4-143	C4-142
	480	23.0	1	1	40 1/2 (1029)	53 (24)	FNS740J11XS	FNS740J11XW	C/F	C/F
	480	23.0	3	1	40 1/2 (1029)	53 (24)	FNS740J5XS	FNS740J5XW	C2-225	C2-226
	240	27.0	1	3	48 (1219)	60 (28)	FNS748A10XS	FNS748A10XW	C/F	C/F
	240	27.0	3	3	48 (1219)	60 (28)	FNS748A3XS	FNS748A3XW	C4-143	C4-142
	480	27.0	1	3	48 (1219)	60 (28)	FNS748A11XS	FNS748A11XW	C/F	C/F
	480	27.0	3	1	48 (1219)	60 (28)	FNS748A5XS	FNS748A5XW	C2-225	C2-226
240	38.0	3	3	64 1/2 (1638)	68 (31)	FNS764J3XS	FNS764J3XW	C4-144	C4-145	
480	38.0	1	3	64 1/2 (1638)	68 (31)	FNS764J11XS	FNS764J11XW	C/F	C/F	
480	38.0	3	1	64 1/2 (1638)	68 (31)	FNS764J5XS	FNS764J5XW	C2-225	C2-226	
240	45.0	3	3	77 (1956)	78 (36)	FNS777A3XS	FNS777A3XW	C4-144	C4-145	
480	45.0	1	3	77 (1956)	78 (36)	FNS777A11XS	FNS777A11XW	C/F	C/F	
480	45.0	3	3	77 (1956)	78 (36)	FNS777A5XS	FNS777A5XW	C4-150	C4-151	

**Notes:** • All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe  
 • For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



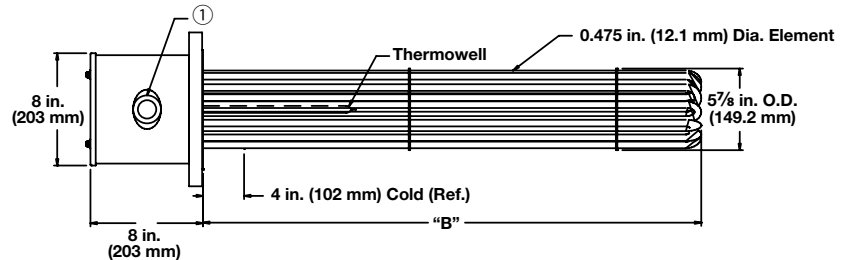
## WATROD ANSI Flange Immersion Heaters



### Application: Lightweight Oils and Heat Transfer Oils

- 6 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 12-Steel Elements (3.6 W/cm <sup>2</sup> )	240	12.0	1	2	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPS717R10S	FPS717R10W	C/F	C/F
	240	12.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPS717R3S	FPS717R3W	C2-236	C2-214
	480	12.0	1	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPS717R11S	FPS717R11W	C/F	C/F
	480	12.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPS717R5S	FPS717R5W	C2-43	C2-35
	240	18.0	1	2	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPS725G10S	FPS725G10W	C/F	C/F
	240	18.0	3	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPS725G3S	FPS725G3W	C2-236	C2-214
	480	18.0	1	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPS725G11S	FPS725G11W	C/F	C/F
	480	18.0	3	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPS725G5S	FPS725G5W	C2-43	C2-35
	240	24.0	1	3	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPS732R10S	FPS732R10W	C/F	C/F
	240	24.0	3	2	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPS732R3S	FPS732R3W	C2-218	C2-224
	480	24.0	1	2	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPS732R11S	FPS732R11W	C/F	C/F
	480	24.0	3	1	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPS732R5S	FPS732R5W	C2-225	C2-226
	240	30.0	1	3	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPS740G10S	FPS740G10W	C/F	C/F
	240	30.0	3	2	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPS740G3S	FPS740G3W	C2-218	C2-224
	480	30.0	1	2	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPS740G11S	FPS740G11W	C/F	C/F
	480	30.0	3	1	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPS740G5S	FPS740G5W	C2-225	C2-226
	240	36.0	1	4	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPS747R10S	FPS747R10W	C/F	C/F
	240	36.0	3	2	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPS747R3S	FPS747R3W	C2-218	C2-224
	480	36.0	1	2	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPS747R11S	FPS747R11W	C/F	C/F
	480	36.0	3	1	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPS747R5S	FPS747R5W	C2-225	C2-226
240	50.0	3	4	64 <sup>3</sup> / <sub>8</sub> (1635.1)	110 (50)	FPS764G3S	FPS764G3W	C4-148	C40149	
480	50.0	1	3	64 <sup>3</sup> / <sub>8</sub> (1635.1)	110 (50)	FPS764G11S	FPS764G11W	C/F	C/F	
480	50.0	3	2	64 <sup>3</sup> / <sub>8</sub> (1635.1)	110 (50)	FPS764G5S	FPS764G5W	C2-229	C2-230	
240	60.0	3	4	76 <sup>7</sup> / <sub>8</sub> (1952.4)	118 (54)	FPS776R3S	FPS776R3W	C4-148	C4-149	
480	60.0	1	3	76 <sup>7</sup> / <sub>8</sub> (1952.4)	118 (54)	FPS776R11S	FPS776R11W	C/F	C/F	
480	60.0	3	2	76 <sup>7</sup> / <sub>8</sub> (1952.4)	118 (54)	FPS776R5S	FPS776R5W	C2-229	C2-230	

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



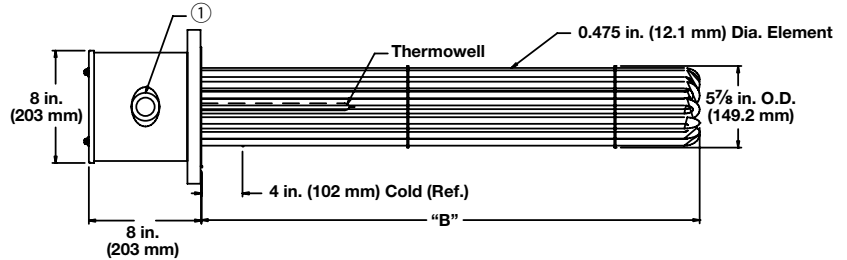
## WATROD ANSI Flange Immersion Heaters



### Application: Lightweight Oils and Heat Transfer Oils

- 6 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 15-Steel Elements (3.6 W/cm <sup>2</sup> )	240	15.0	1	3	17 <sup>7</sup> / <sub>8</sub> (454.0)	78 (36)	FPS717R10XS	FPS717R10XW	C/F	C/F
	240	15.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	78 (36)	FPS717R3XS	FPS717R3XW	C2-236	C2-214
	480	15.0	1	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	78 (36)	FPS717R11XS	FPS717R11XW	C/F	C/F
	480	15.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	78 (36)	FPS717R5XS	FPS717R5XW	C2-43	C2-35
	240	23.0	1	3	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPS725G10XS	FPS725G10XW	C/F	C/F
	240	23.0	3	5	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPS725G3XS	FPS725G3XW	C4-143	C4-142
	480	23.0	1	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPS725G11XS	FPS725G11XW	C/F	C/F
	480	23.0	3	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPS725G5XS	FPS725G5XW	C2-225	C2-226
	240	30.0	1	3	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPS732R10XS	FPS732R10XW	C/F	C/F
	240	30.0	3	5	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPS732R3XS	FPS732R3XW	C4-144	C4-145
	480	30.0	1	3	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPS732R11XS	FPS732R11XW	C/F	C/F
	480	30.0	3	1	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPS732R5XS	FPS732R5XW	C2-225	C2-226
	240	38.0	1	5	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPS740G10XS	FPS740G10XW	C/F	C/F
	240	38.0	3	5	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPS740G3XS	FPS740G3XW	C4-144	C4-145
	480	38.0	1	3	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPS740G11XS	FPS740G11XW	C/F	C/F
	480	38.0	3	1	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPS740G5XS	FPS740G5XW	C2-225	C2-226
	240	45.0	1	5	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPS747R10XS	FPS747R10XW	C/F	C/F
	240	45.0	3	5	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPS747R3XS	FPS747R3XW	C4-144	C4-145
	480	45.0	1	3	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPS747R11XS	FPS747R11XW	C/F	C/F
	480	45.0	3	5	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPS747R5XS	FPS747R5XW	C4-150	C4-151
	240	63.0	3	5	64 <sup>3</sup> / <sub>8</sub> (1635.1)	120 (55)	FPS764G3XS	FPS764G3XW	C/F	C/F
	480	63.0	1	3	64 <sup>3</sup> / <sub>8</sub> (1635.1)	120 (55)	FPS764G11XS	FPS764G11XW	C/F	C/F
	480	63.0	3	5	64 <sup>3</sup> / <sub>8</sub> (1635.1)	120 (55)	FPS764G5XS	FPS764G5XW	C4-152	C4-153
	240	75.0	3	5	76 <sup>7</sup> / <sub>8</sub> (1952.4)	131 (60)	FPS776R3XS	FPS776R3XW	C/F	C/F
	480	75.0	1	5	76 <sup>7</sup> / <sub>8</sub> (1952.4)	131 (60)	FPS776R11XS	FPS776R11XW	C/F	C/F
	480	75.0	3	5	76 <sup>7</sup> / <sub>8</sub> (1952.4)	131 (60)	FPS776R5XS	FPS776R5XW	C4-152	C4-153

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



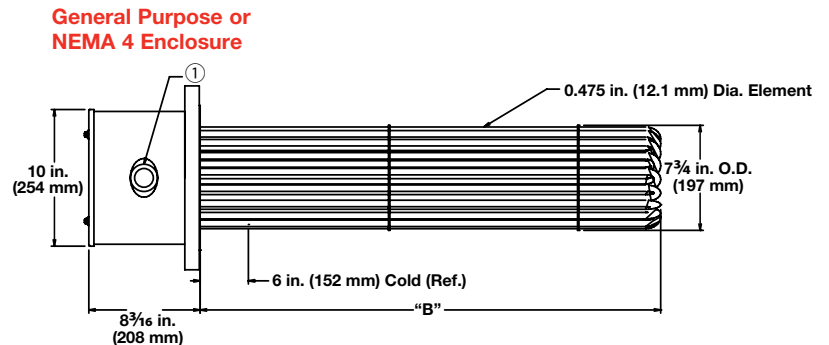
## WATROD ANSI Flange Immersion Heaters



### Application: Lightweight Oils and Heat Transfer Oils

- 8 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

① The number and size of the conduit opening will comply with the National Electrical Code® standards.



Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 18-Steel Elements (3.6 W/cm <sup>2</sup> )	240	30.0	1	3	32 <sup>3</sup> / <sub>4</sub> (832.0)	130 (59)	FRS732N10S	FRS732N10W	C/F	C/F
	240	30.0	3	2	32 <sup>3</sup> / <sub>4</sub> (832.0)	130 (59)	FRS732N3S	FRS732N3W	C2-218	C2-224
	480	30.0	1	2	32 <sup>3</sup> / <sub>4</sub> (832.0)	130 (59)	FRS732N11S	FRS732N11W	C/F	C/F
	480	30.0	3	1	32 <sup>3</sup> / <sub>4</sub> (832.0)	130 (59)	FRS732N5S	FRS732N5W	C2-225	C2-226
	240	40.0	3	3	43 <sup>1</sup> / <sub>4</sub> (1099.0)	132 (60)	FRS743E3S	FRS743E3W	C4-144	C4-145
	480	40.0	1	2	43 <sup>1</sup> / <sub>4</sub> (1099.0)	132 (60)	FRS743E11S	FRS743E11W	C/F	C/F
	480	40.0	3	2	43 <sup>1</sup> / <sub>4</sub> (1099.0)	132 (60)	FRS743E5S	FRS743E5W	C2-227	C2-228
	240	50.0	3	3	51 <sup>11</sup> / <sub>16</sub> (1312.9)	137 (63)	FRS751M3S	FRS751M3W	C4-144	C4-145
	480	50.0	1	3	51 <sup>11</sup> / <sub>16</sub> (1312.9)	137 (63)	FRS751M11S	FRS751M11W	C/F	C/F
	480	50.0	3	2	51 <sup>11</sup> / <sub>16</sub> (1312.9)	137 (63)	FRS751M5S	FRS751M5W	C2-229	C2-230
	240	60.0	3	6	62 <sup>3</sup> / <sub>16</sub> (1579.6)	154 (70)	FRS762D3S	FRS762D3W	C4-144	C4-145
	480	60.0	1	3	62 <sup>3</sup> / <sub>16</sub> (1579.6)	154 (70)	FRS762D11S	FRS762D11W	C/F	C/F
	480	60.0	3	2	62 <sup>3</sup> / <sub>16</sub> (1579.6)	154 (70)	FRS762D5S	FRS762D5W	C2-229	C2-230
	240	70.0	3	6	70 <sup>11</sup> / <sub>16</sub> (1795.5)	160 (73)	FRS770M3S	FRS770M3W	C/F	C/F
	480	70.0	1	6	70 <sup>11</sup> / <sub>16</sub> (1795.5)	160 (73)	FRS770M11S	FRS770M11W	C/F	C/F
	480	70.0	3	2	70 <sup>11</sup> / <sub>16</sub> (1795.5)	160 (73)	FRS770M5S	FRS770M5W	C2-229	C2-230
	240	80.0	3	6	79 <sup>11</sup> / <sub>16</sub> (2024.1)	172 (78)	FRS779M3S	FRS779M3W	C/F	C/F
	480	80.0	3	3	79 <sup>11</sup> / <sub>16</sub> (2024.1)	172 (78)	FRS779M5S	FRS779M5W	C4-152	C4-153
23 W/in <sup>2</sup> Steel Flange 24-Steel Elements (3.6 W/cm <sup>2</sup> )	240	40.0	1	4	33 <sup>3</sup> / <sub>16</sub> (843.0)	142 (65)	FRS733D10XS	FRS733D10XW	C/F	C/F
	240	40.0	3	4	33 <sup>3</sup> / <sub>16</sub> (843.0)	142 (65)	FRS733D3XS	FRS733D3XW	C4-146	C4-147
	480	40.0	1	2	33 <sup>3</sup> / <sub>16</sub> (843.0)	142 (65)	FRS733D11XS	FRS733D11XW	C/F	C/F
	480	40.0	3	2	33 <sup>3</sup> / <sub>16</sub> (843.0)	142 (65)	FRS733D5XS	FRS733D5XW	C2-227	C2-228
	240	53.0	3	4	43 <sup>11</sup> / <sub>16</sub> (1109.7)	147 (67)	FRS743M3XS	FRS743M3XW	C4-148	C4-149
	480	53.0	1	3	43 <sup>11</sup> / <sub>16</sub> (1109.7)	147 (67)	FRS743M11XS	FRS743M11XW	C/F	C/F
	480	53.0	3	2	43 <sup>11</sup> / <sub>16</sub> (1109.7)	147 (67)	FRS743M5XS	FRS743M5XW	C2-229	C2-230
	240	67.0	3	4	51 <sup>11</sup> / <sub>16</sub> (1312.9)	154 (70)	FRS751M3XS	FRS751M3XW	C4-148	C4-149
	480	67.0	1	3	51 <sup>11</sup> / <sub>16</sub> (1312.9)	154 (70)	FRS751M11XS	FRS751M11XW	C/F	C/F
	480	67.0	3	2	51 <sup>11</sup> / <sub>16</sub> (1312.9)	154 (70)	FRS751M5XS	FRS751M5XW	C2-229	C2-230
	240	80.0	3	8	62 <sup>3</sup> / <sub>16</sub> (1579.6)	166 (76)	FRS762D3XS	FRS762D3XW	C4-148	C4-149
	480	80.0	1	4	62 <sup>3</sup> / <sub>16</sub> (1579.6)	166 (76)	FRS762D11XS	FRS762D11XW	C/F	C/F
	480	80.0	3	4	62 <sup>3</sup> / <sub>16</sub> (1579.6)	166 (76)	FRS762D5XS	FRS762D5XW	C4-154	C4-155
	240	93.0	3	8	70 <sup>11</sup> / <sub>16</sub> (1795.5)	175 (80)	FRS770M3XS	FRS770M3XW	C/F	C/F
	480	93.0	1	6	70 <sup>11</sup> / <sub>16</sub> (1795.5)	175 (80)	FRS770M11XS	FRS770M11XW	C/F	C/F
	480	93.0	3	4	70 <sup>11</sup> / <sub>16</sub> (1795.5)	175 (80)	FRS770M5XS	FRS770M5XW	C4-156	C4-157
	240	107.0	3	8	79 <sup>11</sup> / <sub>16</sub> (2024.1)	181 (82)	FRS779M3XS	FRS779M3XW	C/F	C/F
	480	107.0	3	4	79 <sup>11</sup> / <sub>16</sub> (2024.1)	181 (82)	FRS779M5XS	FRS779M5XW	C4-156	C4-157

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

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# Immersion Heaters



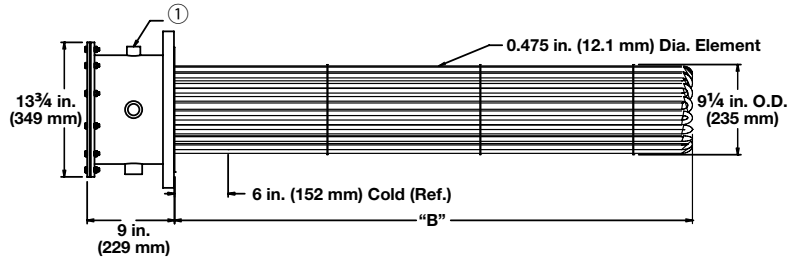
## WATROD ANSI Flange Immersion Heaters



### Application: Light Weight Oils and Heat Transfer Oils

- 10 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

#### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 27-Steel Elements (3.6 W/cm <sup>2</sup> )	240	45.0	3	3	33 <sup>1</sup> / <sub>4</sub> (845)	165 (75)	FSS733E3S	FSS733E3W	C4-144	C4-145
	480	45.0	3	3	33 <sup>1</sup> / <sub>4</sub> (845)	165 (75)	FSS733E5S	FSS733E5W	C4-150	C4-151
	240	60.0	3	3	43 <sup>3</sup> / <sub>4</sub> (1111)	195 (89)	FSS743N3S	FSS743N3W	C4-144	C4-145
	480	60.0	3	3	43 <sup>3</sup> / <sub>4</sub> (1111)	195 (89)	FSS743N5S	FSS743N5W	C4-150	C4-151
	240	75.0	3	9	51 <sup>3</sup> / <sub>4</sub> (1314)	230 (105)	FSS751N3S	FSS751N3W	C/F	C/F
	480	75.0	3	3	51 <sup>3</sup> / <sub>4</sub> (1314)	230 (105)	FSS751N5S	FSS751N5W	C4-152	C4-153
	480	90.0	3	3	62 <sup>1</sup> / <sub>4</sub> (1581)	250 (114)	FSS762E5S	FSS762E5W	C4-152	C4-153
	480	105.0	3	3	70 <sup>3</sup> / <sub>4</sub> (1797)	258 (117)	FSS770N5S	FSS770N5W	C4-152	C4-153
	480	120.0	3	3	78 <sup>3</sup> / <sub>4</sub> (2000)	265 (121)	FSS778N5S	FSS778N5W	C4-152	C4-153

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Immersion Heaters



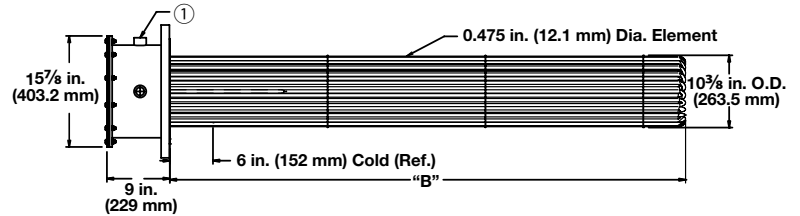
## WATROD ANSI Flange Immersion Heaters



### Application: Light Weight Oils and Heat Transfer Oils

- 12 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lb (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 36-Steel Elements (3.6 W/cm <sup>2</sup> )	480	60.0	3	3	33 <sup>1</sup> / <sub>8</sub> (841.4)	205 (93)	FTS733C5S	FTS733C5W	C4-150	C4-151
	480	80.0	3	3	43 <sup>5</sup> / <sub>8</sub> (1108.1)	240 (109)	FTS743L5S	FTS743L5W	C4-152	C4-153
	480	100.0	3	3	51 <sup>5</sup> / <sub>8</sub> (1311.3)	280 (127)	FTS751L5S	FTS751L5W	C4-152	C4-153
	480	120.0	3	3	62 <sup>1</sup> / <sub>8</sub> (1578.0)	285 (130)	FTS762C5S	FTS762C5W	C4-152	C4-153
	480	140.0	3	4	70 <sup>5</sup> / <sub>8</sub> (1793.9)	290 (132)	FTS770L5S	FTS770L5W	C4-156	C4-157
	480	160.0	3	4	78 <sup>5</sup> / <sub>8</sub> (1997.1)	300 (136)	FTS778L5S	FTS778L5W	C4-156	C4-157

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

# Immersion Heaters



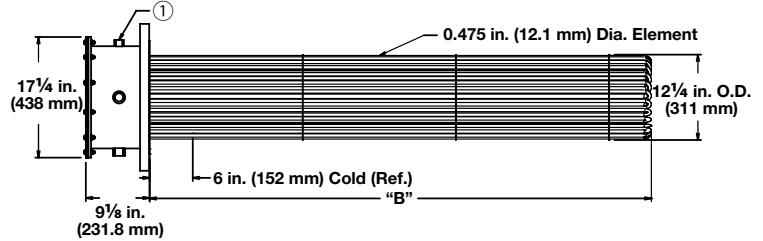
## WATROD ANSI Flange Immersion Heaters



### Application: Light Weight Oils and Heat Transfer Oils

- 14 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

#### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in <sup>2</sup> Steel Flange 45-Steel Elements (3.6 W/cm <sup>2</sup> )	480	75.0	3	3	33 (838)	225 (102)	FWS733A5S	FWS733A5W	C4-152	C4-153
	480	100.0	3	3	43 1/2 (1105)	255 (116)	FWS743J5S	FWS743J5W	C4-152	C4-153
	480	125.0	3	5	51 1/2 (1308)	300 (136)	FWS751J5S	FWS751J5W	C/F	C/F
	480	150.0	3	5	62 (1575)	310 (141)	FWS762A5S	FWS762A5W	C/F	C/F
	480	175.0	3	5	70 1/2 (1791)	318 (145)	FWS770J5S	FWS770J5W	C/F	C/F
	480	200.0	3	5	78 1/2 (1994)	330 (150)	FWS778J5S	FWS778J5W	C/F	C/F

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)



# Immersion Heaters

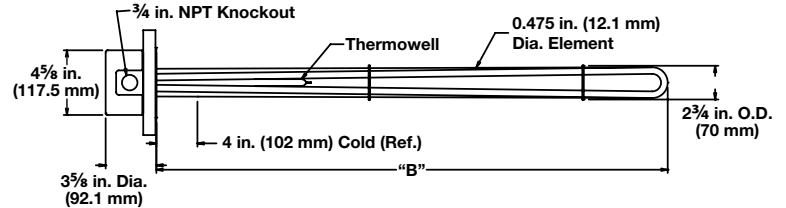


## WATROD ANSI Flange Immersion Heaters

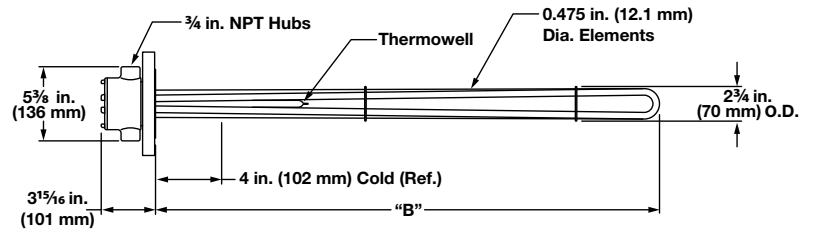
### Application: Medium Weight Oils and Heat Transfer Oils

- 3 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure
- Single circuit

#### General Purpose



#### NEMA 4 Enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
						General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 W/in <sup>2</sup> <sup>③</sup> Steel Flange 3-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	1.5	3	13 <sup>1</sup> / <sub>2</sub> (343)	22 (10)	FMN713J12S	FMN713J12W	C2-50	C2-92
	480	1.5	3	13 <sup>1</sup> / <sub>2</sub> (343)	22 (10)	FMN713J13S	FMN713J13W	C2-43	C2-35
	240	2.0	3	18 (457)	23 (11)	FMN718A12S	FMN718A12W	C2-50	C2-92
	480	2.0	3	18 (457)	23 (11)	FMN718A13S	FMN718A13W	C2-43	C2-35
	240	2.5	3	20 <sup>1</sup> / <sub>2</sub> (521)	25 (12)	FMN720J12S	FMN720J12W	C2-50	C2-92
	480	2.5	3	20 <sup>1</sup> / <sub>2</sub> (521)	25 (12)	FMN720J13S	FMN720J13W	C2-43	C2-35
	240	3.0	3	25 <sup>1</sup> / <sub>2</sub> (648)	27 (13)	FMN725J12S	FMN725J12W	C2-50	C2-92
	480	3.0	3	25 <sup>1</sup> / <sub>2</sub> (648)	27 (13)	FMN725J13S	FMN725J13W	C2-43	C2-35
	240	4.0	3	33 (838)	28 (13)	FMN733A12S	FMN733A12W	C2-50	C2-92
	480	4.0	3	33 (838)	28 (13)	FMN733A13S	FMN733A13W	C2-43	C2-35
	240	5.0	3	40 <sup>1</sup> / <sub>2</sub> (1029)	30 (14)	FMN740J12S	FMN740J12W	C2-50	C2-92
	480	5.0	3	40 <sup>1</sup> / <sub>2</sub> (1029)	30 (14)	FMN740J13S	FMN740J13W	C2-43	C2-35
	240	6.0	3	48 (1219)	32 (15)	FMN748A12S	FMN748A12W	C2-50	C2-92
	480	6.0	3	48 (1219)	32 (15)	FMN748A13S	FMN748A13W	C2-43	C2-35

**Notes:**

- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
- For ANSI flange dimensions, reference chart on page 224

<sup>③</sup> Wired for 3-phase operation only

# Immersion Heaters



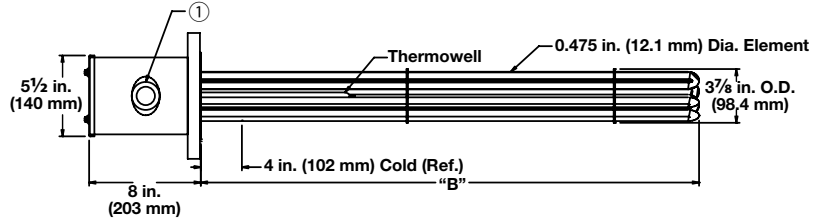
## WATROD ANSI Flange Immersion Heaters



### Application: Medium Weight Oils and Heat Transfer Oils

- 4 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lb (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
<b>16 W/in<sup>2</sup> ③ Steel Flange 6-Alloy 800 Elements (2.5 W/cm<sup>2</sup>)</b>	240	3.0	3	1	13 <sup>1</sup> / <sub>2</sub> (343)	29 (14)	FON713J12S	FON713J12W	C2-50	C2-92
	480	3.0	3	1	13 <sup>1</sup> / <sub>2</sub> (343)	29 (14)	FON713J13S	FON713J13W	C2-43	C2-35
	240	4.0	3	1	18 (457)	32 (15)	FON718A12S	FON718A12W	C2-50	C2-92
	480	4.0	3	1	18 (457)	32 (15)	FON718A13S	FON718A13W	C2-43	C2-35
	240	5.0	3	1	20 <sup>1</sup> / <sub>2</sub> (521)	34 (16)	FON720J12S	FON720J12W	C2-50	C2-92
	480	5.0	3	1	20 <sup>1</sup> / <sub>2</sub> (521)	34 (16)	FON720J13S	FON720J13W	C2-43	C2-35
	240	6.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	36 (17)	FON725J12S	FON725J12W	C2-50	C2-92
	480	6.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	36 (17)	FON725J13S	FON725J13W	C2-43	C2-35
	240	8.0	3	1	33 (838)	39 (18)	FON733A12S	FON733A12W	C2-50	C2-92
	480	8.0	3	1	33 (838)	39 (18)	FON733A13S	FON733A13W	C2-43	C2-35
	240	10.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	43 (20)	FON740J12S	FON740J12W	C2-50	C2-92
	480	10.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	43 (20)	FON740J13S	FON740J13W	C2-43	C2-35
	240	12.0	3	1	48 (1219)	48 (22)	FON748A12S	FON748A12W	C2-236	C2-214
	480	12.0	3	1	48 (1219)	48 (22)	FON748A13S	FON748A13W	C2-43	C2-35

**Notes:**

- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
- For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

# Immersion Heaters



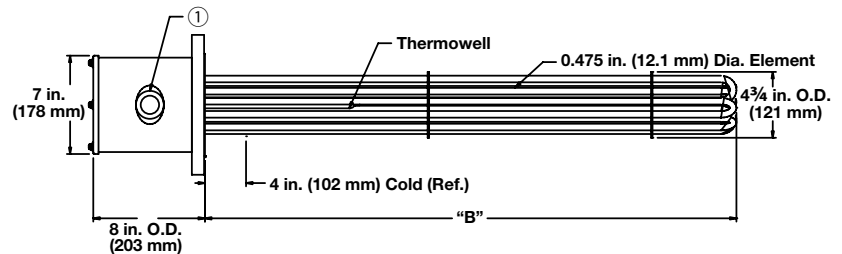
## WATROD ANSI Flange Immersion Heaters



### Application: Medium Weight Oils and Heat Transfer Oils

- 5 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 W/in <sup>2</sup> ③ Steel Flange 6-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	3.0	3	1	13 <sup>1</sup> / <sub>2</sub> (343)	36 (17)	FNN713J12S	FNN713J12W	C2-50	C2-92
	480	3.0	3	1	13 <sup>1</sup> / <sub>2</sub> (343)	36 (17)	FNN713J13S	FNN713J13W	C2-43	C2-35
	240	4.0	3	1	18 (457)	40 (19)	FNN718A12S	FNN718A12W	C2-50	C2-92
	480	4.0	3	1	18 (457)	40 (19)	FNN718A13S	FNN718A13W	C2-43	C2-35
	240	5.0	3	1	20 <sup>1</sup> / <sub>2</sub> (521)	43 (20)	FNN720J12S	FNN720J12W	C2-50	C2-92
	480	5.0	3	1	20 <sup>1</sup> / <sub>2</sub> (521)	43 (20)	FNN720J13S	FNN720J13W	C2-43	C2-35
	240	6.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	47 (22)	FNN725J12S	FNN725J12W	C2-50	C2-92
	480	6.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	47 (22)	FNN725J13S	FNN725J13W	C2-43	C2-35
	240	8.0	3	1	33 (838)	52 (24)	FNN733A12S	FNN733A12W	C2-50	C2-92
	480	8.0	3	1	33 (838)	52 (24)	FNN733A13S	FNN733A13W	C2-43	C2-35
	240	10.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	57 (26)	FNN740J12S	FNN740J12W	C2-50	C2-92
	480	10.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	57 (26)	FNN740J13S	FNN740J13W	C2-43	C2-35
	240	12.0	3	1	48 (1219)	65 (30)	FNN748A12S	FNN748A12W	C2-236	C2-214
	480	12.0	3	1	48 (1219)	65 (30)	FNN748A13S	FNN748A13W	C2-43	C2-35
16 W/in <sup>2</sup> ③ Steel Flange 9-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	4.5	3	1	13 <sup>1</sup> / <sub>2</sub> (343)	39 (18)	FNN713J12XS	FNN713J12XW	C2-50	C2-92
	480	4.5	3	1	13 <sup>1</sup> / <sub>2</sub> (343)	39 (18)	FNN713J13XS	FNN713J13XW	C2-43	C2-35
	240	6.0	3	1	18 (457)	45 (21)	FNN718A12XS	FNN718A12XW	C2-50	C2-92
	480	6.0	3	1	18 (457)	45 (21)	FNN718A13XS	FNN718A13XW	C2-43	C2-35
	240	7.5	3	1	20 <sup>1</sup> / <sub>2</sub> (521)	48 (22)	FNN720J12XS	FNN720J12XW	C2-50	C2-92
	480	7.5	3	1	20 <sup>1</sup> / <sub>2</sub> (521)	48 (22)	FNN720J13XS	FNN720J13XW	C2-43	C2-35
	240	9.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	53 (24)	FNN725J12XS	FNN725J12XW	C2-50	C2-92
	480	9.0	3	1	25 <sup>1</sup> / <sub>2</sub> (648)	53 (24)	FNN725J13XS	FNN725J13XW	C2-43	C2-35
	240	12.0	3	1	33 (838)	60 (28)	FNN733A12XS	FNN733A12XW	C2-236	C2-214
	480	12.0	3	1	33 (838)	60 (28)	FNN733A13XS	FNN733A13XW	C2-43	C2-35
	240	15.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	68 (31)	FNN740J12XS	FNN740J12XW	C2-236	C2-214
	480	15.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	68 (31)	FNN740J13XS	FNN740J13XW	C2-43	C2-35
	240	18.0	3	1	48 (1219)	78 (36)	FNN748A12XS	FNN748A12XW	C2-236	C2-214
	480	18.0	3	1	48 (1219)	78 (36)	FNN748A13XS	FNN748A13XW	C2-43	C2-35

**Notes:** • All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe  
 • For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

# Immersion Heaters



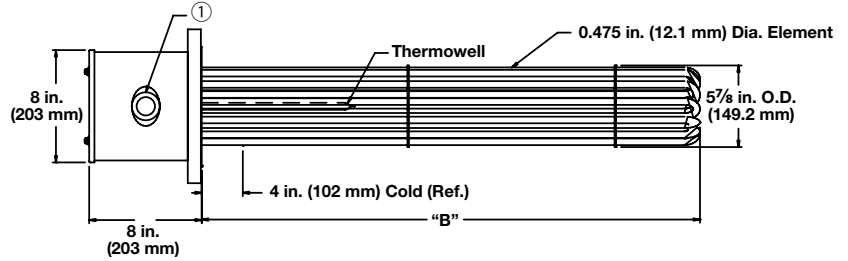
## WATROD ANSI Flange Immersion Heaters



### Application: Medium Weight Oils and Heat Transfer Oils

- 6 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 W/in <sup>2</sup> ③ Steel Flange 12-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	6.0	3	1	13 <sup>3</sup> / <sub>8</sub> (339.7)	73 (33)	FPN713G12S	FPN713G12W	C2-50	C2-92
	480	6.0	3	1	13 <sup>3</sup> / <sub>8</sub> (339.7)	73 (33)	FPN713G13S	FPN713G13W	C2-43	C2-35
	240	8.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPN717R12S	FPN717R12W	C2-50	C2-92
	480	8.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	75 (34)	FPN717R13S	FPN717R13W	C2-43	C2-35
	240	10.0	3	1	20 <sup>3</sup> / <sub>8</sub> (517.5)	78 (36)	FPN720G12S	FPN720G12W	C2-50	C2-92
	480	10.0	3	1	20 <sup>3</sup> / <sub>8</sub> (517.5)	78 (36)	FPN720G13S	FPN720G13W	C2-43	C2-35
	240	12.0	3	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPN725G12S	FPN725G12W	C2-236	C2-214
	480	12.0	3	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	81 (37)	FPN725G13S	FPN725G13W	C2-43	C2-35
	240	16.0	3	1	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPN732R12S	FPN732R12W	C2-236	C2-214
	480	16.0	3	1	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPN732R13S	FPN732R13W	C2-43	C2-35
	240	20.0	3	2	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPN740G12S	FPN740G12W	C2-219	C2-220
	480	20.0	3	1	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPN740G13S	FPN740G13W	C2-43	C2-35
	240	24.0	3	2	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPN747R12S	FPN747R12W	C2-219	C2-220
	480	24.0	3	1	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPN747R13S	FPN747R13W	C2-225	C2-226
16 W/in <sup>2</sup> ③ Steel Flange 15-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	7.5	3	1	13 <sup>3</sup> / <sub>8</sub> (339.7)	76 (35)	FPN713G12XS	FPN713G12XW	C2-50	C2-92
	480	7.5	3	1	13 <sup>3</sup> / <sub>8</sub> (339.7)	76 (35)	FPN713G13XS	FPN713G13XW	C2-43	C2-35
	240	10.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	78 (36)	FPN717R12XS	FPN717R12XW	C2-50	C2-92
	480	10.0	3	1	17 <sup>7</sup> / <sub>8</sub> (454.0)	78 (36)	FPN717R13XS	FPN717R13XW	C2-43	C2-35
	240	12.5	3	1	20 <sup>3</sup> / <sub>8</sub> (517.5)	82 (38)	FPN720G12XS	FPN720G12XW	C2-236	C2-214
	480	12.5	3	1	20 <sup>3</sup> / <sub>8</sub> (517.5)	82 (38)	FPN720G13XS	FPN720G13XW	C2-43	C2-35
	240	15.0	3	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPN725G12XS	FPN725G12XW	C2-236	C2-214
	480	15.0	3	1	25 <sup>3</sup> / <sub>8</sub> (644.5)	85 (39)	FPN725G13XS	FPN725G13XW	C2-43	C2-35
	240	20.0	3	5	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPN732R12XS	FPN732R12XW	C4-143	C4-142
	480	20.0	3	1	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPN732R13XS	FPN732R13XW	C2-43	C2-35
	240	25.0	3	5	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPN740G12XS	FPN740G12XW	C4-143	C4-142
	480	25.0	3	1	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPN740G13XS	FPN740G13XW	C2-225	C2-226
	240	30.0	3	5	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPN747R12XS	FPN747R12XW	C4-144	C4-145
	480	30.0	3	1	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPN747R13XS	FPN747R13XW	C2-225	C2-226

Notes: • All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe  
 • For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

# Immersion Heaters



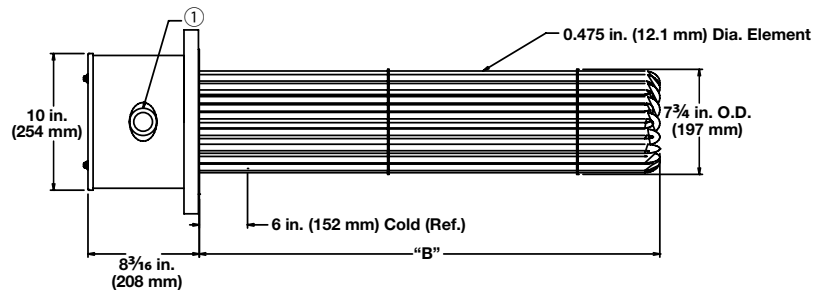
## WATROD ANSI Flange Immersion Heaters



### Application: Medium Weight Oils and Heat Transfer Oils

- 8 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 W/in <sup>2</sup> ③ Steel Flange 18-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	17.0	3	1	25 3/4 (654.0)	121 (55)	FRN725N12S	FRN725N12W	C2-236	C2-214
	480	17.0	3	1	25 3/4 (654.0)	121 (55)	FRN725N13S	FRN725N13W	C2-43	C2-35
	240	25.0	3	2	35 3/4 (908.0)	130 (59)	FRN735N12S	FRN735N12W	C2-219	C2-220
	480	25.0	3	1	35 3/4 (908.0)	130 (59)	FRN735N13S	FRN735N13W	C2-225	C2-226
	240	33.0	3	2	44 1/4 (1124.0)	132 (60)	FRN744E12S	FRN744E12W	C2-218	C2-224
	480	33.0	3	1	44 1/4 (1124.0)	132 (60)	FRN744E13S	FRN744E13W	C2-225	C2-226
	240	42.0	3	3	54 1/16 (1389.1)	140 (64)	FRN754M12S	FRN754M12W	C4-144	C4-145
	480	42.0	3	2	54 1/16 (1389.1)	140 (64)	FRN754M13S	FRN754M13W	C2-229	C2-230
	480	50.0	3	2	63 1/16 (1617.6)	145 (66)	FRN763M13S	FRN763M13W	C2-229	C2-230
	480	58.0	3	2	73 3/16 (1859.0)	151 (69)	FRN773D13S	FRN773D13W	C2-229	C2-230
480	67.0	3	2	82 1/16 (2100.3)	157 (72)	FRN782M13S	FRN782M13W	C2-229	C2-230	
16 W/in <sup>2</sup> ③ Steel Flange 24-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	23.0	3	2	26 3/16 (665.2)	129 (59)	FRN726D12XS	FRN726D12XW	C2-218	C2-224
	480	23.0	3	1	26 3/16 (665.2)	129 (59)	FRN726D13XS	FRN726D13XW	C2-225	C2-226
	240	33.0	3	2	36 3/16 (919.2)	142 (65)	FRN736D12XS	FRN736D12XW	C2-218	C2-224
	480	33.0	3	1	36 3/16 (919.2)	142 (65)	FRN736D13XS	FRN736D13XW	C2-225	C2-226
	240	44.0	3	4	44 1/16 (1135.1)	147 (67)	FRN744M12XS	FRN744M12XW	C4-148	C4-149
	480	44.0	3	2	44 1/16 (1135.1)	147 (67)	FRN744M13XS	FRN744M13XW	C2-229	C2-230
	240	56.0	3	4	54 1/16 (1389.1)	158 (72)	FRN754M12XS	FRN754M12XW	C4-148	C4-149
	480	56.0	3	2	54 1/16 (1389.1)	158 (72)	FRN754M13XS	FRN754M13XW	C2-229	C2-230
	480	67.0	3	2	63 1/16 (1617.6)	166 (76)	FRN763M13XS	FRN763M13XW	C2-229	C2-230
	480	77.0	3	2	73 3/16 (1859.0)	175 (80)	FRN773D13XS	FRN773D13XW	C2-229	C2-230
480	89.0	3	4	82 1/16 (2100.3)	184 (84)	FRN782M13XS	FRN782M13XW	C4-156	C4-157	

Notes: • All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe  
 • For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

# Immersion Heaters



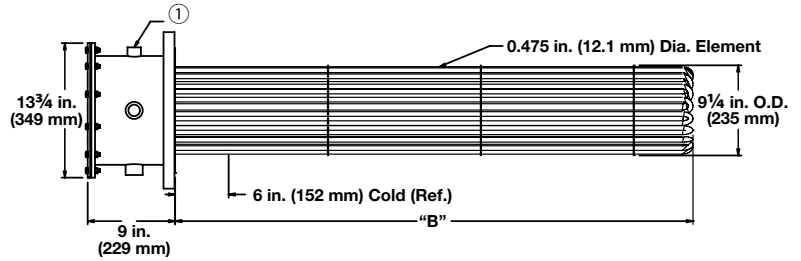
## WATROD ANSI Flange Immersion Heaters



### Application: Medium Weight Oils and Heat Transfer Oils

- 10 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 W/in <sup>2</sup> ③ Steel Flange 27-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	480	63.0	3	3	54 <sup>3</sup> / <sub>4</sub> (1391)	240 (109)	FSN754N13S	FSN754N13W	C4-152	C4-153
	480	75.0	3	3	63 <sup>3</sup> / <sub>4</sub> (1619)	250 (114)	FSN763N13S	FSN763N13W	C4-152	C4-153
	480	87.0	3	3	73 <sup>1</sup> / <sub>4</sub> (1861)	260 (118)	FSN773E13S	FSN773E13W	C4-152	C4-153

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

# Immersion Heaters



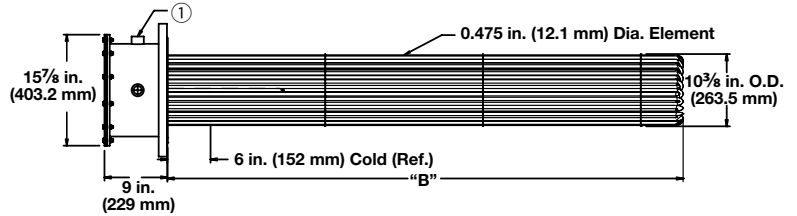
## WATROD ANSI Flange Immersion Heaters



### Application: Medium Weight Oils and Heat Transfer Oils

- 12 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

#### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 W/in <sup>2</sup> ③ Steel Flange 36-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	480	83.0	3	3	54 <sup>5</sup> / <sub>8</sub> (1387.5)	280 (127)	FTN754L13S	FTN754L13W	C4-152	C4-153
	480	117.0	3	3	73 <sup>1</sup> / <sub>8</sub> (1857.4)	291 (132)	FTN773C13S	FTN773C13W	C4-152	C4-153

**Notes:**

- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
- For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

# Immersion Heaters



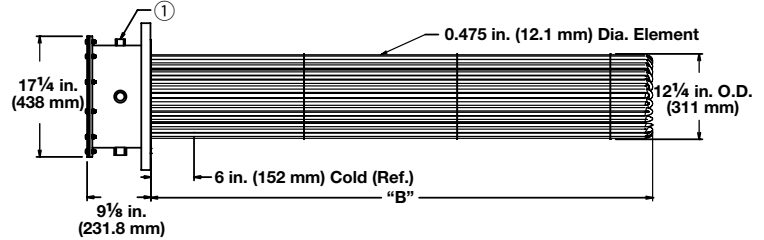
## WATROD ANSI Flange Immersion Heaters



### Application: Medium Weight Oils and Heat Transfer Oils

- 14 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 Win <sup>2</sup> ③ Steel Flange 45-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	480	105.0	3	3	54 1/2 (1384)	300 (136)	FWN754J13S	FWN754J13W	C4-152	C4-153
	480	125.0	3	5	63 1/2 (1613)	310 (141)	FWN763J13S	FWN763J13W	C/F	C/F

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

③ Wired for 3-phase operation only



# Immersion Heaters

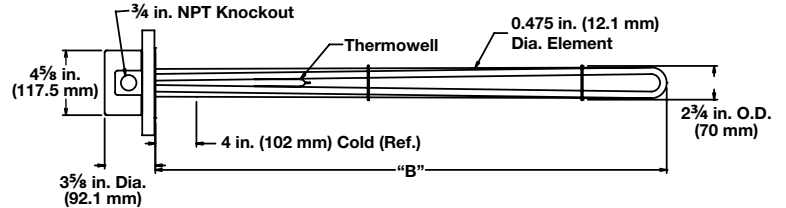


## WATROD ANSI Flange Immersion Heaters

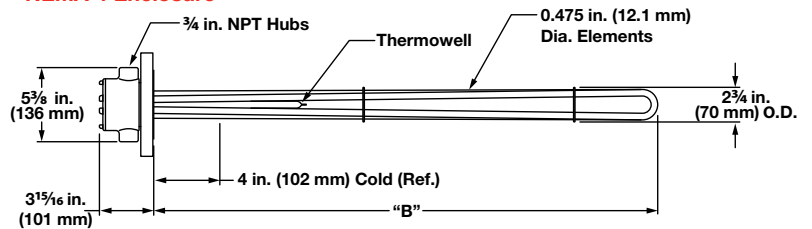
### Application: Bunker C, Asphalt and #6 Fuel Oil

- 3 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure
- Single circuit

#### General Purpose



#### NEMA 4 Enclosure



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
						General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
8 W/in <sup>2</sup> ③ Steel Flange 3-Steel Elements (1.3 W/cm <sup>2</sup> )	240	2.0	3	33 (838)	28 (13)	FMS733A12S	FMS733A12W	C2-50	C2-92
	480	2.0	3	33 (838)	28 (13)	FMS733A13S	FMS733A13W	C2-43	C2-35
	240	3.0	3	48 (1219)	32 (15)	FMS748A12S	FMS748A12W	C2-50	C2-92
	480	3.0	3	48 (1219)	32 (15)	FMS748A13S	FMS748A13W	C2-43	C2-35
	240	4.0	3	64 1/2 (1638)	37 (17)	FMS764J12S	FMS764J12W	C2-50	C2-92
	480	4.0	3	64 1/2 (1638)	37 (17)	FMS764J13S	FMS764J13W	C2-43	C2-35
	240	5.0	3	77 (1956)	42 (19)	FMS777A12S	FMS777A12W	C2-50	C2-92
	480	5.0	3	77 (1956)	42 (19)	FMS777A13S	FMS777A13W	C2-43	C2-35

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

# Immersion Heaters



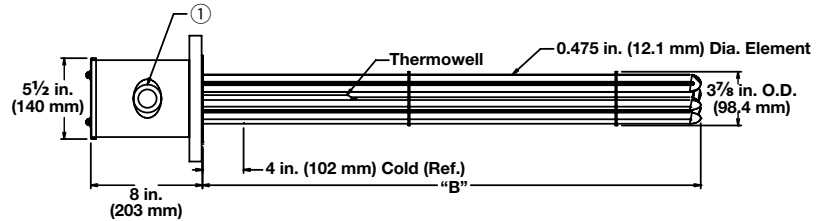
## WATROD ANSI Flange Immersion Heaters



### Application: Bunker C, Asphalt and #6 Fuel Oil

- 4 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
8 W/in <sup>2</sup> ③ Steel Flange 6-Steel Elements (1.3 W/cm <sup>2</sup> )	240	5.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	43 (20)	FOS740J12S	FOS740J12W	C2-50	C2-92
	480	5.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	43 (20)	FOS740J13S	FOS740J13W	C2-43	C2-35
	240	6.0	3	1	48 (1219)	48 (22)	FOS748A12S	FOS748A12W	C2-50	C2-92
	480	6.0	3	1	48 (1219)	48 (22)	FOS748A13S	FOS748A13W	C2-43	C2-35
	240	8.0	3	1	64 <sup>1</sup> / <sub>2</sub> (1638)	53 (24)	FOS764J12S	FOS764J12W	C2-50	C2-92
	480	8.0	3	1	64 <sup>1</sup> / <sub>2</sub> (1638)	53 (24)	FOS764J13S	FOS764J13W	C2-43	C2-35
	240	10.0	3	1	77 (1956)	61 (28)	FOS777A12S	FOS777A12W	C2-50	C2-92
	480	10.0	3	1	77 (1956)	61 (28)	FOS777A13S	FOS777A13W	C2-43	C2-35

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

# Immersion Heaters



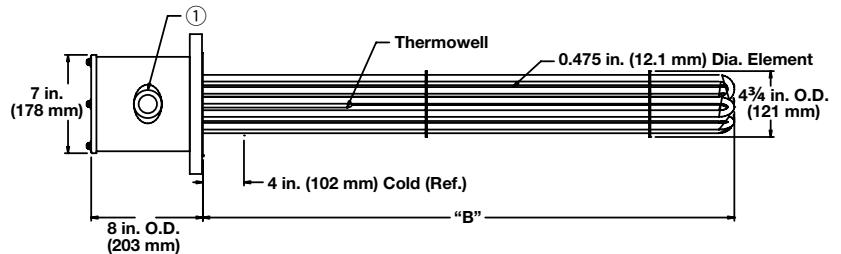
## WATROD ANSI Flange Immersion Heaters



### Application: Bunker C, Asphalt and #6 Fuel Oil

- 5 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

#### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
8 W/in <sup>2</sup> ③ Steel Flange 6-Steel Elements (1.3 W/cm <sup>2</sup> )	240	5.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	47 (22)	FNS740J12S	FNS740J12W	C2-50	C2-92
	480	5.0	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	47 (22)	FNS740J13S	FNS740J13W	C2-43	C2-35
	240	6.0	3	1	48 (1219)	52 (24)	FNS748A12S	FNS748A12W	C2-50	C2-92
	480	6.0	3	1	48 (1219)	52 (24)	FNS748A13S	FNS748A13W	C2-43	C2-35
	240	8.0	3	1	64 <sup>1</sup> / <sub>2</sub> (1638)	57 (26)	FNS764J12S	FNS764J12W	C2-50	C2-92
	480	8.0	3	1	64 <sup>1</sup> / <sub>2</sub> (1638)	57 (26)	FNS764J13S	FNS764J13W	C2-43	C2-35
	240	10.0	3	1	77 (1956)	65 (28)	FNS777A12S	FNS777A12W	C2-50	C2-92
	480	10.0	3	1	77 (1956)	65 (28)	FNS777A13S	FNS777A13W	C2-43	C2-35
8 W/in <sup>2</sup> ③ Steel Flange 9-Steel Elements (1.3 W/cm <sup>2</sup> )	240	7.5	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	53 (24)	FNS740J12XS	FNS740J12XW	C2-50	C2-92
	480	7.5	3	1	40 <sup>1</sup> / <sub>2</sub> (1029)	53 (24)	FNS740J13XS	FNS740J13XW	C2-43	C2-35
	240	9.0	3	1	48 (1219)	60 (28)	FNS748A12XS	FNS748A12XW	C2-50	C2-92
	480	9.0	3	1	48 (1219)	60 (28)	FNS748A13XS	FNS748A13XW	C2-43	C2-35
	240	12.0	3	1	64 <sup>1</sup> / <sub>2</sub> (1638)	68 (31)	FNS764J12XS	FNS764J12XW	C2-236	C2-214
	480	12.0	3	1	64 <sup>1</sup> / <sub>2</sub> (1638)	68 (31)	FNS764J13XS	FNS764J13XW	C2-43	C2-35
	240	15.0	3	1	77 (1956)	78 (36)	FNS777A12XS	FNS777A12XW	C2-236	C2-214
	480	15.0	3	1	77 (1956)	78 (36)	FNS777A13XS	FNS777A13XW	C2-225	C2-226

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

# Immersion Heaters



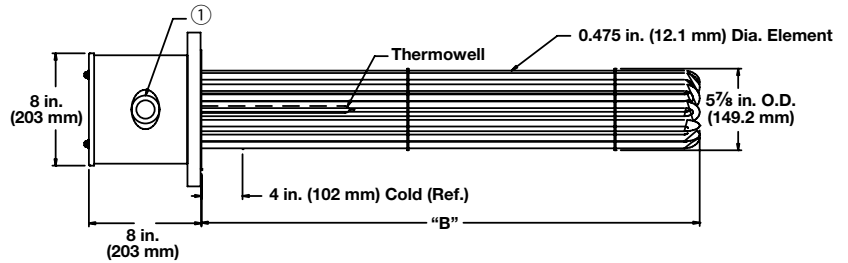
## WATROD ANSI Flange Immersion Heaters



### Application: Bunker C, Asphalt and #6 Fuel Oil

- 6 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

#### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
8 W/in <sup>2</sup> ③ Steel Flange 12-Steel Elements (1.3 W/cm <sup>2</sup> )	240	8.0	3	1	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPS732R12S	FPS732R12W	C2-50	C2-92
	480	8.0	3	1	32 <sup>7</sup> / <sub>8</sub> (835.0)	85 (39)	FPS732R13S	FPS732R13W	C2-43	C2-35
	240	10.0	3	1	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPS740G12S	FPS740G12W	C2-50	C2-92
	480	10.0	3	1	40 <sup>3</sup> / <sub>8</sub> (1025.5)	92 (42)	FPS740G13S	FPS740G13W	C2-43	C2-35
	240	12.0	3	1	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPS747R12S	FPS747R12W	C2-236	C2-214
	480	12.0	3	1	47 <sup>7</sup> / <sub>8</sub> (1216.0)	100 (46)	FPS747R13S	FPS747R13W	C2-43	C2-35
	240	16.5	3	1	64 <sup>3</sup> / <sub>8</sub> (1635.1)	110 (50)	FPS764G12S	FPS764G12W	C2-236	C2-214
	480	16.5	3	1	64 <sup>3</sup> / <sub>8</sub> (1635.1)	110 (50)	FPS764G13S	FPS764G13W	C2-43	C2-35
	240	20.0	3	2	76 <sup>7</sup> / <sub>8</sub> (1952.4)	118 (54)	FPS776R12S	FPS776R12W	C2-236	C2-214
	480	20.0	3	1	76 <sup>7</sup> / <sub>8</sub> (1952.4)	118 (54)	FPS776R13S	FPS776R13W	C2-43	C2-35
8 W/in <sup>2</sup> ③ Steel Flange 15-Steel Elements (1.3 W/cm <sup>2</sup> )	240	10.0	3	1	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPS732R12XS	FPS732R12XW	C2-50	C2-92
	480	10.0	3	1	32 <sup>7</sup> / <sub>8</sub> (835.0)	90 (41)	FPS732R13XS	FPS732R13XW	C2-43	C2-35
	240	12.5	3	1	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPS740G12XS	FPS740G12XW	C2-236	C2-214
	480	12.5	3	1	40 <sup>3</sup> / <sub>8</sub> (1025.5)	98 (45)	FPS740G13XS	FPS740G13XW	C2-43	C2-35
	240	15.0	3	1	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPS747R12XS	FPS747R12XW	C2-236	C2-214
	480	15.0	3	1	47 <sup>7</sup> / <sub>8</sub> (1216.0)	108 (49)	FPS747R13XS	FPS747R13XW	C2-43	C2-35
	240	21.0	3	5	64 <sup>3</sup> / <sub>8</sub> (1635.1)	120 (55)	FPS764G12XS	FPS764G12XW	C4-143	C4-142
	480	21.0	3	1	64 <sup>3</sup> / <sub>8</sub> (1635.1)	120 (55)	FPS764G13XS	FPS764G13XW	C2-225	C2-226
	240	25.0	3	5	76 <sup>7</sup> / <sub>8</sub> (1952.4)	131 (60)	FPS776R12XS	FPS776R12XW	C4-143	C4-142
	480	25.0	3	1	76 <sup>7</sup> / <sub>8</sub> (1952.4)	131 (60)	FPS776R13XS	FPS776R13XW	C2-224	C2-226

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224
- ③ Wired for 3-phase operation only

# Immersion Heaters

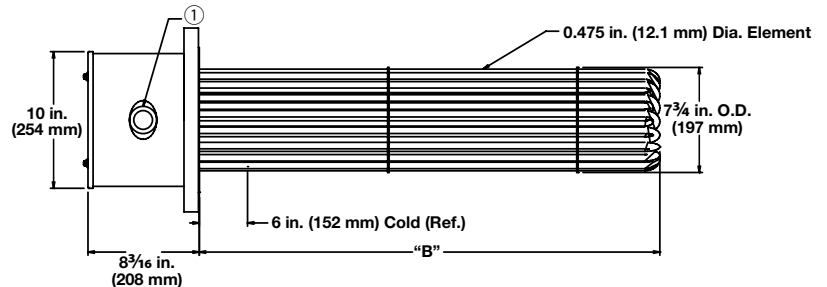


## WATROD ANSI Flange Immersion Heaters

### Application: Bunker C, Asphalt and #6 Fuel Oil

- 8 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
8 W/in <sup>2</sup> ③ Steel Flange 18-Steel Elements (1.3 W/cm <sup>2</sup> )	240	12.5	3	1	43 <sup>1</sup> / <sub>4</sub> (1099.0)	132 (60)	FRS743E12S	FRS743E12W	C2-236	C2-214
	480	12.5	3	1	43 <sup>1</sup> / <sub>4</sub> (1099.0)	132 (60)	FRS743E13S	FRS743E13W	C2-43	C2-35
	240	16.5	3	1	51 <sup>11</sup> / <sub>16</sub> (1312.9)	137 (63)	FRS751M12S	FRS751M12W	C2-236	C2-214
	480	16.5	3	1	51 <sup>11</sup> / <sub>16</sub> (1312.9)	137 (63)	FRS751M13S	FRS751M13W	C2-43	C2-35
	240	20.0	3	2	62 <sup>3</sup> / <sub>16</sub> (1579.6)	154 (70)	FRS762D12S	FRS762D12W	C2-219	C2-220
	480	20.0	3	1	62 <sup>3</sup> / <sub>16</sub> (1579.6)	154 (70)	FRS762D13S	FRS762D13W	C2-43	C2-50
	240	24.0	3	2	70 <sup>11</sup> / <sub>16</sub> (1795.5)	160 (73)	FRS770M12S	FRS770M12W	C2-218	C2-224
	480	24.0	3	1	70 <sup>11</sup> / <sub>16</sub> (1795.5)	160 (73)	FRS770M13S	FRS770M13W	C2-225	C2-226
	240	27.0	3	2	79 <sup>11</sup> / <sub>16</sub> (2024.1)	172 (78)	FRS779M12S	FRS779M12W	C2-218	C2-224
480	27.0	3	1	79 <sup>11</sup> / <sub>16</sub> (2024.1)	172 (78)	FRS779M13S	FRS779M13W	C2-225	C2-226	
8 W/in <sup>2</sup> ③ Steel Flange 24-Steel Elements (1.3 W/cm <sup>2</sup> )	240	17.0	3	1	43 <sup>11</sup> / <sub>16</sub> (1109.7)	147 (67)	FRS743M12XS	FRS743M12XW	C2-236	C2-214
	480	17.0	3	1	43 <sup>11</sup> / <sub>16</sub> (1109.7)	147 (67)	FRS743M13XS	FRS743M13XW	C2-43	C2-35
	240	22.0	3	2	51 <sup>11</sup> / <sub>16</sub> (1312.9)	154 (70)	FRS751M12XS	FRS751M12XW	C2-218	C2-224
	480	22.0	3	1	51 <sup>11</sup> / <sub>16</sub> (1312.9)	154 (70)	FRS751M13XS	FRS751M13XW	C2-225	C2-226
	240	27.0	3	2	62 <sup>3</sup> / <sub>16</sub> (1579.6)	166 (76)	FRS762D12XS	FRS762D12XW	C2-218	C2-224
	480	27.0	3	1	62 <sup>3</sup> / <sub>16</sub> (1579.6)	166 (76)	FRS762D13XS	FRS762D13XW	C2-225	C2-226
	240	32.0	3	2	70 <sup>11</sup> / <sub>16</sub> (1795.5)	175 (80)	FRS770M12XS	FRS770M12XW	C2-218	C2-224
	480	32.0	3	1	70 <sup>11</sup> / <sub>16</sub> (1795.5)	175 (80)	FRS770M13XS	FRS770M13XW	C2-225	C2-226
	240	36.0	3	2	79 <sup>11</sup> / <sub>16</sub> (2024.1)	181 (82)	FRS779M12XS	FRS779M12XW	C2-218	C2-224
480	36.0	3	1	79 <sup>11</sup> / <sub>16</sub> (2024.1)	181 (82)	FRS779M13XS	FRS779M13XW	C2-224	C2-226	

**Notes:**

- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
- For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

# Immersion Heaters



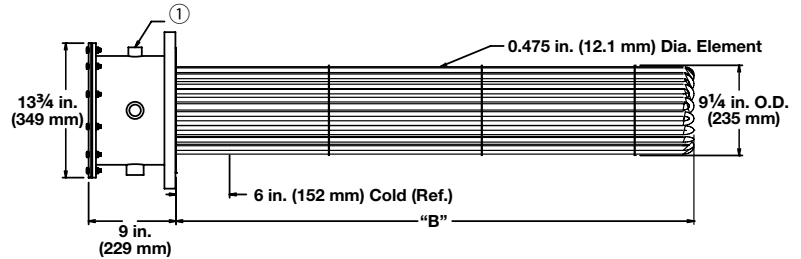
## WATROD ANSI Flange Immersion Heaters



### Application: Bunker C, Asphalt and #6 Fuel Oil

- 10 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
<b>8 W/in<sup>2</sup> ③ Steel Flange 27-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	25.0	3	3	51 <sup>3</sup> / <sub>4</sub> (1314)	230 (105)	<b>FSS751N12S</b>	<b>FSS751N12W</b>	<b>C4-143</b>	<b>C4-142</b>
	480	25.0	3	1	51 <sup>3</sup> / <sub>4</sub> (1314)	230 (105)	<b>FSS751N13S</b>	<b>FSS751N13W</b>	<b>C2-225</b>	<b>C2-226</b>
	240	30.0	3	3	62 <sup>1</sup> / <sub>4</sub> (1581)	250 (114)	<b>FSS762E12S</b>	<b>FSS762E12W</b>	<b>C4-143</b>	<b>C4-142</b>
	480	30.0	3	1	62 <sup>1</sup> / <sub>4</sub> (1581)	250 (114)	<b>FSS762E13S</b>	<b>FSS762E13W</b>	<b>C2-225</b>	<b>C2-226</b>
	240	35.0	3	3	70 <sup>3</sup> / <sub>4</sub> (1797)	258 (117)	<b>FSS770N12S</b>	<b>FSS770N12W</b>	<b>C4-144</b>	<b>C4-145</b>
	480	35.0	3	1	70 <sup>3</sup> / <sub>4</sub> (1797)	258 (117)	<b>FSS770N13S</b>	<b>FSS770N13W</b>	<b>C2-225</b>	<b>C2-226</b>
	240	40.0	3	3	78 <sup>3</sup> / <sub>4</sub> (2000)	265 (121)	<b>FSS778N12S</b>	<b>FSS778N12W</b>	<b>C4-144</b>	<b>C4-145</b>
	480	40.0	3	1	78 <sup>3</sup> / <sub>4</sub> (2000)	265 (121)	<b>FSS778N13S</b>	<b>FSS778N13W</b>	<b>C2-225</b>	<b>C2-226</b>

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

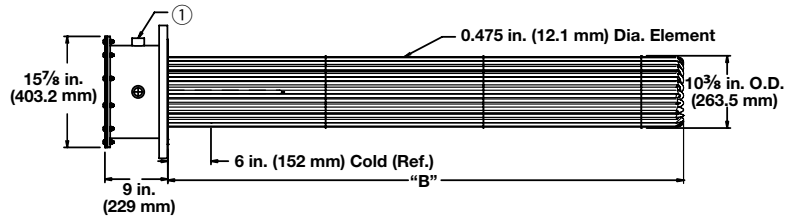


## WATROD ANSI Flange Immersion Heaters

### Application: Bunker C, Asphalt and #6 Fuel Oil

- 12 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

#### General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number		WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
8 W/in <sup>2</sup> ③ Steel Flange 27-Steel Elements (1.3 W/cm <sup>2</sup> )	240	34.0	3	2	51 <sup>5</sup> / <sub>8</sub> (1311.3)	280 (127)	FTS751L12S	FTS751L12W	C2-218	C2-224
	480	34.0	3	1	51 <sup>5</sup> / <sub>8</sub> (1311.3)	280 (127)	FTS751L13S	FTS751L13W	C2-225	C2-226
	240	40.0	3	2	62 <sup>1</sup> / <sub>8</sub> (1578.0)	285 (130)	FTS762C12S	FTS762C12W	C2-218	C2-224
	480	40.0	3	1	62 <sup>1</sup> / <sub>8</sub> (1578.0)	285 (130)	FTS762C13S	FTS762C13W	C2-225	C2-226
	240	47.0	3	3	70 <sup>5</sup> / <sub>8</sub> (1793.9)	290 (132)	FTS770L12S	FTS770L12W	C4-144	C4-145
	480	47.0	3	2	70 <sup>5</sup> / <sub>8</sub> (1793.9)	290 (132)	FTS770L13S	FTS770L13W	C2-229	C2-230
	240	54.0	3	3	78 <sup>5</sup> / <sub>8</sub> (1997.1)	300 (136)	FTS778L12S	FTS778L12W	C4-144	C4-145
	480	54.0	3	2	78 <sup>5</sup> / <sub>8</sub> (1997.1)	300 (136)	FTS778L13S	FTS778L13W	C2-229	C2-230

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

③ Wired for 3-phase operation only

# Immersion Heaters



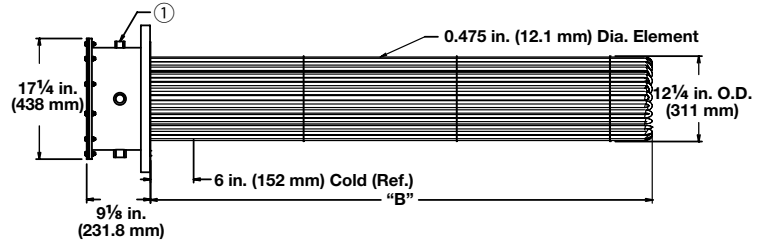
## WATROD ANSI Flange Immersion Heaters



### Application: Bunker C, Asphalt and #6 Fuel Oil

- 14 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

General Purpose or NEMA 4 Enclosure



① The number and size of the conduit opening will comply with the National Electrical Code® standards.

Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	Moisture-Resistant Enclosure	Type J T/C	Type K T/C
8 W/in <sup>2</sup> ③ Steel Flange 27-Steel Elements (1.3 W/cm <sup>2</sup> )	240	42.0	3	3	51 1/2 (1308)	300 (136)	FWS751J12S	FWS751J12W	C4-144	C4-145
	480	42.0	3	3	51 1/2 (1308)	300 (136)	FWS751J13S	FWS751J13W	C4-150	C4-151
	240	50.0	3	3	62 (1575)	310 (141)	FWS762A12S	FWS762A12W	C4-144	C4-145
	480	50.0	3	3	62 (1575)	310 (141)	FWS762A13S	FWS762A13W	C4-150	C4-151
	240	60.0	3	3	70 1/2 (1791)	318 (145)	FWS770J12S	FWS770J12W	C4-144	C4-145
	480	60.0	3	3	70 1/2 (1791)	318 (145)	FWS770J13S	FWS770J13W	C4-150	C4-151
	240	67.0	3	5	78 1/2 (1994)	330 (150)	FWS778J12S	FWS778J12W	C/F	C/F
	480	67.0	3	3	78 1/2 (1994)	330 (150)	FWS778J13S	FWS778J13W	C4-152	C4-153

- Notes:**
- All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe
  - For ANSI flange dimensions, reference chart on page 224

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

③ Wired for 3-phase operation only



# Immersion Heaters



## WATROD ANSI Flange Immersion Heaters

### Part Number

Stock ANSI Flange Part Number	Optional Terminal Enclosures	Optional Process Sensors	Sheath Limit Sensors

#### Stock ANSI Flange Part Number

**Note:** Catalog part numbers include optional enclosures and process sensors. To order optional enclosures or sensors, substitute the appropriate suffix.

#### Optional Terminal Enclosures

S =	General purpose enclosure
W =	NEMA 4 enclosure
C =	CSA Type 4/explosion proof enclosure

**Note:** Catalog listings include either a general purpose enclosure or NEMA 4 enclosure. Substitute enclosure options are noted.

#### Optional Bulb & Capillary Thermostats or Thermocouple Process Sensors

2 =	30 to 250°F, (-1 to 121°C) SPST
3 =	175 to 550°F, (79 to 288°C) SPST
4 =	30 to 110°F, (-1 to 43°C) DPST
5A=	60 to 250°F, (16 to 121°C) DPST
7A=	100 to 550°F, (38 to 288°C) DPST
PJ=	Type J process thermocouple in thermowell
PK=	Type K process thermocouple in thermowell

**Note:** Thermostat part numbers are shown in the *Thermostat Chart* on page 517.

#### Sheath Limit Sensors

HJ=	Type J high-limit thermocouple, horizontal mount
TJ=	Type J high-limit thermocouple, vertical/housing at top
BJ=	Type J high-limit thermocouple, vertical/housing at bottom
HK=	Type K high-limit thermocouple, horizontal mount
TK=	Type K high-limit thermocouple, vertical/housing at top
BK=	Type K high-limit thermocouple, vertical/housing at bottom

**Note:** Heater orientation is critical to accurate sensing of limit conditions. Use the appropriate code to indicate heater mounting orientation.

**Example Part Number:** FPS732R12 S 2 HJ

# Immersion Heaters



## WATROD™ Plate Flange Immersion Heaters

Watlow plate flange heaters are easy to install and maintain. These products are designed for heating heat transfer fluids, medium and lightweight oils and water in tanks and pressure vessels. Plate flange heaters are ideal for applications requiring low to medium wattage requirements.

Watlow plate flange heaters are made with WATROD tubular elements that are brazed or welded to the flange. Stock plate flange heaters are supplied with general purpose or moisture-resistant terminal enclosures.

### Performance Capabilities

- Watt densities up to 100 W/in<sup>2</sup> (15.5 W/cm<sup>2</sup>)
- Wattages up to 18 kilowatts
- Alloy 800/840 sheath temperatures up to 1600°F (870°C)
- 304 stainless steel sheath temperatures up to 1200°F (650°C)
- Steel sheath temperatures up to 750°F (400°C)

### Features and Benefits

#### Direct replacement for many OEM mold temperature control units

- Provides a single source supplier for many OEM applications

#### ANSI compatible 2 and 2½ inch flanges

- Provides appropriate heater size-to-application fit

#### Standard general purpose or moisture resistant terminal enclosures

- Offers easy access to wiring
- Limits accidental contact with termination
- Denies access to wiring connection in local environment



# Immersion Heaters

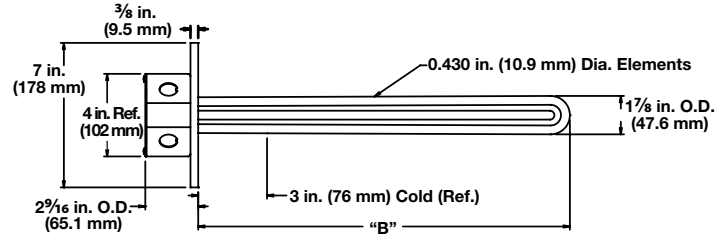


## WATROD Plate Flange Immersion Heaters

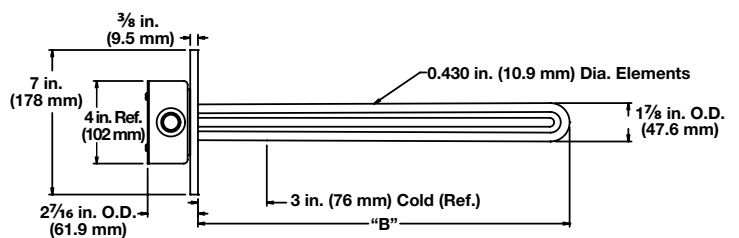
### Application: Clean Water

- 2 1/2 inch plate flange (bolt pattern matches 2 1/2 inch - 150 lb ANSI flange)
- WATROD elements
- Not available with thermowell or thermostat
- General purpose or moisture-resistant enclosures

### General Purpose



### Moisture Resistant



Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	
							General Purpose Enclosure	Moisture-Resistant Enclosure
100 W/in <sup>2</sup> Steel Flange 3-304 SS Elements (15.5 W/cm <sup>2</sup> )	240	12.0	1	3	18 (457)	22 (10)	FLN18A10S	FLN18A10W
	240	12.0	3	1	18 (457)	22 (10)	FLN18A3S	FLN18A3W
	480	12.0	1	1	18 (457)	22 (10)	FLN18A11S	FLN18A11W
	480	12.0	3	1	18 (457)	22 (10)	FLN18A5S	FLN18A5W
80 W/in <sup>2</sup> Steel Flange 3-304 SS Elements (12.4 W/cm <sup>2</sup> )	240	9.0	1	1	17 <sup>3</sup> / <sub>4</sub> (451)	22 (10)	FLN17N10S	FLN17N10W
	240	9.0	3	1	17 <sup>3</sup> / <sub>4</sub> (451)	22 (10)	FLN17N3S	FLN17N3W
	480	9.0	1	1	17 <sup>3</sup> / <sub>4</sub> (451)	22 (10)	FLN17N11S	FLN17N11W
	480	9.0	3	1	17 <sup>3</sup> / <sub>4</sub> (451)	22 (10)	FLN17N5S	FLN17N5W
	240	18.0	1	3	30 (762)	27 (13)	FLN30A10S	FLN30A10W
	240	18.0	3	1	30 (762)	27 (13)	FLN30A3S	FLN30A3W
	480	18.0	1	1	30 (762)	27 (13)	FLN30A11S	FLN30A11W
	480	18.0	3	1	30 (762)	27 (13)	FLN30A5S	FLN30A5W
60 W/in <sup>2</sup> Steel Flange 3-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	240	4.5	1	1	12 <sup>1</sup> / <sub>2</sub> (318)	21 (10)	FLN12J10S	FLN12J10W
	240	4.5	3	1	12 <sup>1</sup> / <sub>2</sub> (318)	21 (10)	FLN12J3S	FLN12J3W
	480	4.5	1	1	12 <sup>1</sup> / <sub>2</sub> (318)	21 (10)	FLN12J11S	FLN12J11W
	480	4.5	3	1	12 <sup>1</sup> / <sub>2</sub> (318)	21 (10)	FLN12J5S	FLN12J5W

**Note:** All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe

# Immersion Heaters

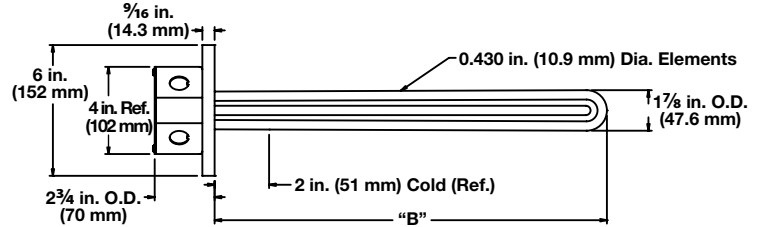


## WATROD Plate Flange Immersion Heaters

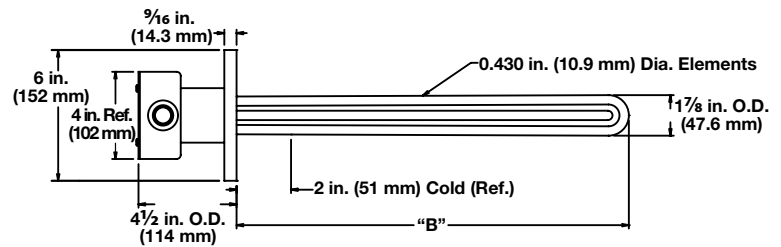
### Application: Process Water

- 2 inch flange (bolt pattern matches 2 inch - 150 lb ANSI flange)
- WATROD elements
- Not available with thermowell or thermostat
- General purpose or moisture-resistant enclosures

#### General Purpose



#### Moisture Resistant



Description	Volts	kW	PH	# Circ.	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	
							General Purpose Enclosure	Moisture-Resistant Enclosure
45 W/in <sup>2</sup> Steel Flange 3-Alloy 800 Elements (7 W/cm <sup>2</sup> )	240	4.5	1	1	16 (406)	22 (10)	FKN16A10S	FKN16A10W
	240	4.5	3	1	16 (406)	22 (10)	FKN16A3S	FKN16A3W
	480	4.5	1	1	16 (406)	22 (10)	FKN16A11S	FKN16A11W
	480	4.5	3	1	16 (406)	22 (10)	FKN16A5S	FKN16A5W
	240	9.0	1	1	29 (737)	27 (13)	FKN29A10S	FKN29A10W
	240	9.0	3	1	29 (737)	27 (13)	FKN29A3S	FKN29A3W
	480	9.0	1	1	29 (737)	27 (13)	FKN29A11S	FKN29A11W
	480	9.0	3	1	29 (737)	27 (13)	FKN29A5S	FKN29A5W
45 W/in <sup>2</sup> Steel Flange 3-Alloy 800 Elements (7 W/cm <sup>2</sup> )	240	9.0	1	1	28 (711)	27 (13)	FKN28A10S	FKN28A10W
	240	9.0	3	1	28 (711)	27 (13)	FKN28A3S	FKN28A3W
	480	9.0	1	1	28 (711)	27 (13)	FKN28A11S	FKN28A11W
	480	9.0	3	1	28 (711)	27 (13)	FKN28A5S	FKN28A5W

**Note:** All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe

# Immersion Heaters

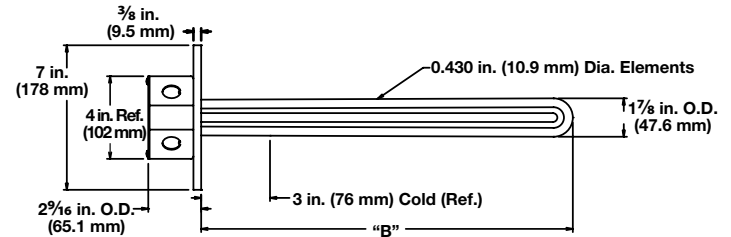


## WATROD Plate Flange Immersion Heaters

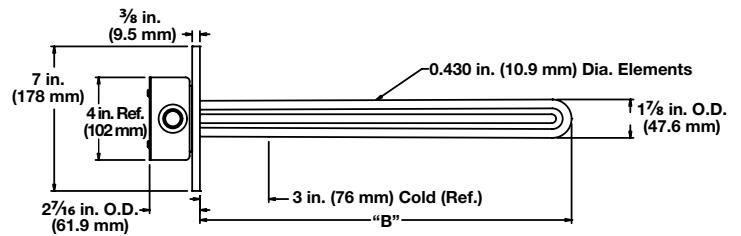
### Application: Forced Air and Caustic Solutions

- 2 1/2 inch flange (bolt pattern matches 2 1/2 inch - 150 lb ANSI flange)
- WATROD elements
- Not available with thermowell or thermostat
- General purpose or moisture-resistant enclosures

#### General Purpose



#### Moisture Resistant



Description	Volts	kW	Ph	# Circ.	"B" Dim.		Ship Wt.		Part Number	Part Number
					in.	(mm)	lbs	(kg)	General Purpose Enclosure	Moisture-Resistant Enclosure
30 W/in <sup>2</sup> Steel Flange 3-Alloy 800 Elements (4.7 W/cm <sup>2</sup> )	240	3.0	3	1	17 <sup>3</sup> / <sub>4</sub>	(451)	22	(10)	FLN17N12S	FLN17N12W
	480	3.0	3	1	17 <sup>3</sup> / <sub>4</sub>	(451)	22	(10)	FLN17N13S	FLN17N13W
	240	4.0	3	1	18	(457)	22	(10)	FLN18A12S	FLN18A12W
	480	4.0	3	1	18	(457)	22	(10)	FLN18A13S	FLN18A13W
	240	6.0	3	1	30	(762)	27	(13)	FLN30A12S	FLN30A12W
	480	6.0	3	1	30	(762)	27	(13)	FLN30A13S	FLN30A13W

**Note:** All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe

# Immersion Heaters

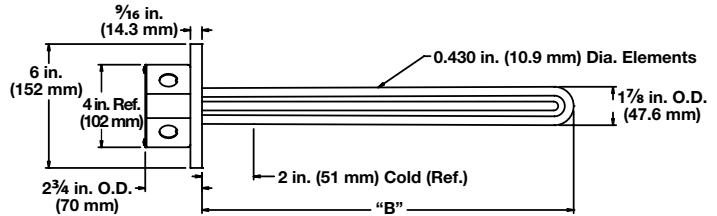


## WATROD Plate Flange Immersion Heaters

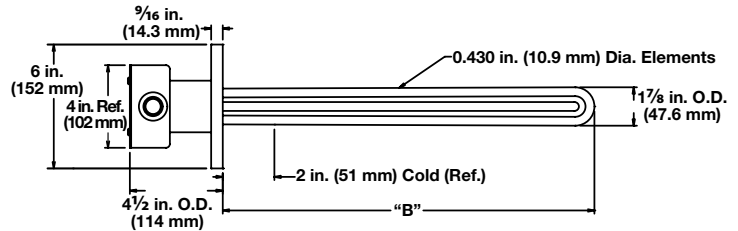
### Application: Lightweight Oils and Ethylene Glycol (100%)

- 2 inch flange (bolt pattern matches 2 inch - 150 lb ANSI flange)
- WATROD elements
- Not available with thermowell or thermostat
- General purpose or moisture-resistant enclosures

#### General Purpose



#### Moisture Resistant



Description	Volts	kW	Ph	# Circ.	"B" Dim.		Ship Wt.		Part Number	Part Number
					in.	(mm)	lbs	(kg)	General Purpose Enclosure	Moisture-Resistant Enclosure
30 W/in <sup>2</sup> Steel Flange 3-Steel Elements (4.7 W/cm <sup>2</sup> )	240	6.0	1	1	29	(737)	27	(13)	<b>FKS29A10S</b>	<b>FKS29A10W</b>
	240	6.0	3	1	29	(737)	27	(13)	<b>FKS29A3S</b>	<b>FKS29A3W</b>
	480	6.0	1	1	29	(737)	27	(13)	<b>FKS29A11S</b>	<b>FKS29A11W</b>
	480	6.0	3	1	29	(737)	27	(13)	<b>FKS29A5S</b>	<b>FKS29A5W</b>

**Note:** All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe

# Immersion Heaters

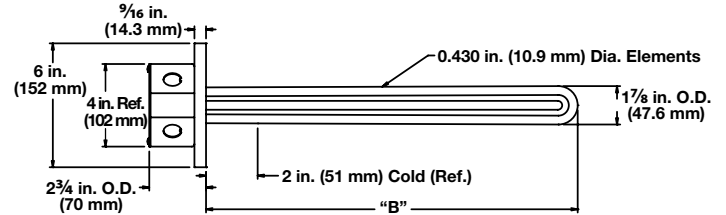


## WATROD Plate Flange Immersion Heaters

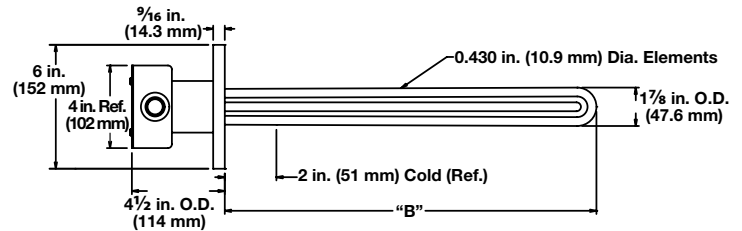
### Application: Medium Weight Oils and Heat Transfer Oils

- 2 inch flange (bolt pattern matches 2 inch - 150 lb ANSI flange)
- WATROD elements
- Not available with thermowell or thermostat
- General purpose or moisture-resistant enclosures

#### General Purpose



#### Moisture Resistant



Description	Volts	kW	Ph	# Circ.	"B" Dim. in. (mm)		Ship Wt. lbs (kg)		Part Number	Part Number
									General Purpose Enclosure	Moisture-Resistant Enclosure
<b>15 W/in<sup>2</sup></b> <b>Steel Flange</b> <b>3-Alloy 800 Elements</b> <b>(2.3 W/cm<sup>2</sup>)</b>	240	3.0	3	1	28	(711)	27	(13)	<b>FKN28A12S</b>	<b>FKN28A12W</b>
	480	3.0	3	1	28	(711)	27	(13)	<b>FKN28A13S</b>	<b>FKN28A13W</b>
<b>10 W/in<sup>2</sup></b> <b>Steel Flange</b> <b>3-Steel Elements</b> <b>(1.6 W/cm<sup>2</sup>)</b>	240	2.0	3	1	29	(737)	27	(13)	<b>FKS29A12S</b>	<b>FKS29A12W</b>
	480	2.0	3	1	29	(737)	27	(13)	<b>FKS29A13S</b>	<b>FKS29A13W</b>

**Note:** All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe

# Immersion Heaters



## WATROD™ and FIREBAR® Square Flange Immersion Heaters

Designed for use in boilers and industrial storage tanks, the square flange immersion heater from Watlow® offers an energy efficient solution to heating water, oils and degreasing solutions.

Consisting of WATROD™ or FIREBAR® elements brazed, staked or welded to a four- or six-bolt flange, these heaters mount directly to a mating flange that is welded to a tank wall or nozzle.

Installation and maintenance is easy. Heater change-out is also simple-unbolt the flange and replace it with another-without extensive equipment downtime.

### Performance Capabilities

- Watt densities up to 100 W/in<sup>2</sup> (15.5 W/cm<sup>2</sup>)
- Wattages up to 24 kilowatts
- Voltages up to 480VAC
- Alloy 800/840 sheath temperatures up to 1600°F (870°C)

### Features and Benefits

#### 2 1/2, 3 1/8 and 4 1/2 inch square flanges

- Adapts easily to application needs

#### Asbestos-free gaskets

- Come wire-tied to each flange. Spare gaskets also available

#### Epoxy or silicone resin seals rated to 250°F (120°C) or 390°F (200°C)

- Protects elements against moisture and other contaminants

#### WATROD hairpins are repressed (recompacted)

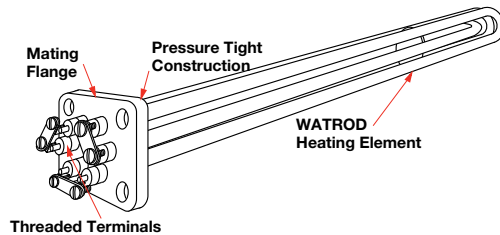
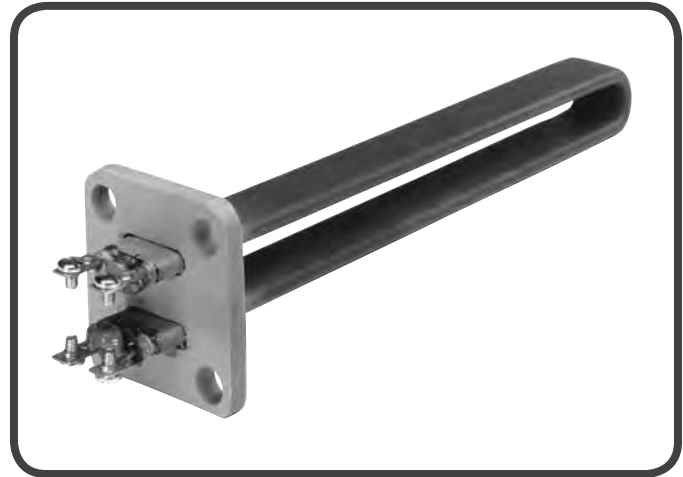
- Helps maintain MgO density, dielectric strength, heat transfer and life

#### UL® and CSA component recognition under file numbers E52951 and 31388

- Meets industry safety standards

### Typical Applications

- Water
- Boiler equipment
- Vapor degreasers
- Fuel oils
- Heat transfer fluids
- Caustic solutions



### Flange Materials

WATROD	Steel 304 SS
FIREBAR	Steel

### Available on Request

- **Sheath materials** in steel, 304 and 316 stainless steel and titanium
- **Flange materials** in titanium and 316 stainless steel
- **Flange sizes** to meet specific application needs
- **External finishes** such as passivation, belt polishing and glass beading
- **Other voltage and wattage ratings**  
Contact your Watlow representative for details



# Immersion Heaters

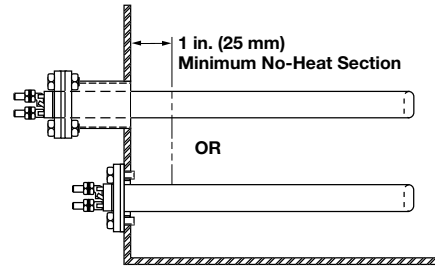


## WATROD and FIREBAR Square Flange Immersion Heaters

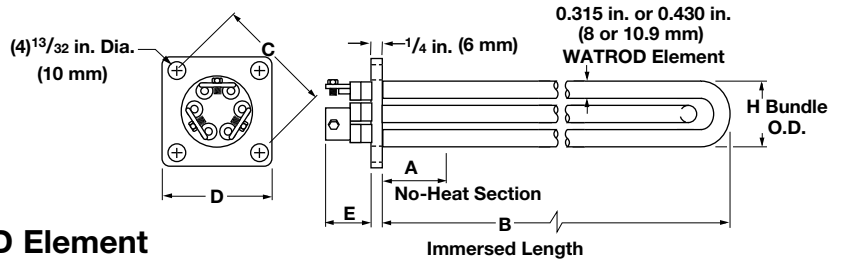
### Application Hints

- Determine recommended sheath materials and watt densities by using the *Element and Assembly Selection Guide* on pages 549 to 550. If wattage is not known, contact your Watlow representative.
- Extend the element's no-heat section completely in the fluid at all times to prevent premature heater failure. See the accompanying illustration for proper placement of the no-heat section.
- Mount WATROD and FIREBAR square flange heaters horizontally and low in the tank, but above sludge level.

- Periodically remove heaters to inspect and clean the elements.
- Keep terminations clean, dry and tight.
- Minimize problems associated with low liquid level conditions by using a low liquid level sensor.



Heater Dimension	in.	(mm)
A	1 1/2	(38)
C	2 1/2	(64)
D	2 1/2	(64)
E	1	(25)
H	1 1/2	(38)



### 2 1/2 inch Square Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension in. (mm)	Part Number				Est. Ship. Wt. lbs (kg)
			240VAC 1-Phase	240VAC 3-Phase	480VAC 1-Phase	480VAC 3-Phase	

#### Applications: Clean and Potable Water

100 W/in <sup>2</sup> Steel Flange 3-Alloy 800 (15.5 W/cm <sup>2</sup> )	8.0	11 3/4 (298.0)	FHN11N10	FHN11N3	FHN11N11	FHN11N5	18 (9)
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#### Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions

30 W/in <sup>2</sup> 304 SS Flange 3-Alloy 800 (4.7 W/cm <sup>2</sup> )	3.0 3.75	18 1/2 (470.0) 23 1/16 (585.8)	FHN18J10 FHN23B10	FHN18J3 FHN23B3	FHN18J11 FHN23B11	FHN18J5 FHN23B5	19 (9) 20 (9)
25 W/in <sup>2</sup> 304 SS Flange 3-Alloy 800 (3.9 W/cm <sup>2</sup> )	1.5	12 (305.0)	FHN12A10	FHN12A3	FHN12A11	FHN12A5	18 (8)

#### Applications: Bunker C and #6 Fuel Oils

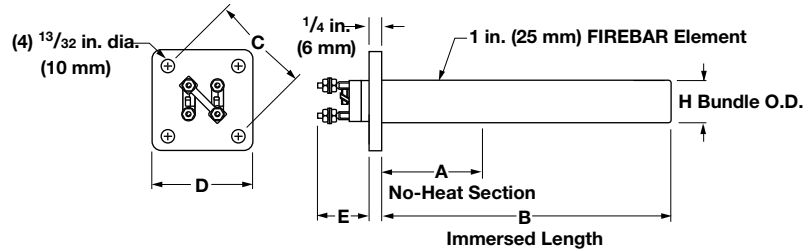
10 W/in <sup>2</sup> 304 SS Flange 3-Alloy 800 (1.6 W/cm <sup>2</sup> )	1.0 1.25	18 1/2 (470.0) 23 1/16 (585.8)		FHN18J12 FHN23B12		FHN18J13 FHN23B13	19 (9) 20 (9)
8 W/in <sup>2</sup> 304 SS Flange 3-Alloy 800 (1.3 W/cm <sup>2</sup> )	0.5	12 (305.0)		FHN12A12		FHN12A13	18 (8)

# Immersion Heaters



## WATROD and FIREBAR Square Flange Immersion Heaters

Heater Dimension	in.	(mm)
A	1 1/2	(38)
C	2 1/2	(64)
D	2 1/2	(64)
E	1 3/4	(44)
H	1 5/16	(33)



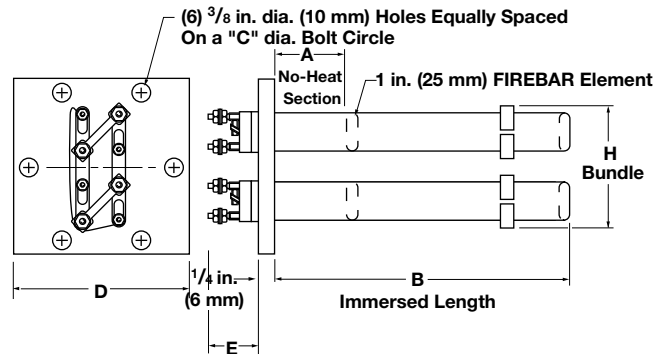
### 2 1/2 inch Square Flange—FIREBAR Element

FIREBAR Description	kW	Immersed B Dimension in. (mm)	Part Number					Est. Ship.	
			208VAC 3-Phase	240VAC 1-Phase	240VAC 3-Phase	480VAC 1-Phase	480VAC 3-Phase	lbs	Wt. (kg)

#### Applications: Clean and Potable Water

100 W/in <sup>2</sup> Steel Flange 1-Alloy 800 (15.5 W/cm <sup>2</sup> )	5	11 1/2 (292)	FHNFA11J26N	FHNFA11J10N	FHNFA11J3N	FHNFA11J11N	FHNFA11J5N	5	(3)
	8	20 3/4 (527)	FHNFA20N26N	FHNFA20N10N	FHNFA20N3N	FHNFA20N11N	FHNFA20N5N	7	(4)
	10	24 3/8 (619)	FHNFA24G26N	FHNFA24G10N	FHNFA24G3N	FHNFA24G11N	FHNFA24G5N	8	(4)
	15	33 15/16 (862)	FHNFA33S26N		FHNFA33S3N	FHNFA33S11N	FHNFA33S5N	9	(5)
80 W/in <sup>2</sup> Steel Flange 1-Alloy 800 (12.4 W/cm <sup>2</sup> )	16	22 5/8 (575)	FHNFB22L26J	FHNFB22L10J	FHNFB22L3J	FHNFB22L11J	FHNFB22L5J	10	(5)

Heater Dimension	in.	(mm)
A	1	(25.0)
C	3 13/16	(96.8)
D	4 1/2	(114.0)
E	2 1/4	(57.0)
H	3 7/32	(81.8)



### 4 1/2 inch Square Flange—FIREBAR Element

FIREBAR Description	kW	Immersed B Dimension in. (mm)	Part Number			Est. Ship.	
			208VAC 3-Phase	240VAC 3-Phase	480VAC 3-Phase	lbs	Wt. (kg)

#### Applications: Clean and Potable Water

100 W/in <sup>2</sup> Steel Flange 2-Alloy 800 (15.5 W/cm <sup>2</sup> )	18	10 1/2 (267)	FGNFB10J26N	FGNFB10J3N	FGNFB10J5N	16	(8)
70 W/in <sup>2</sup> Steel Flange 2-Alloy 800 (10.9 W/cm <sup>2</sup> )	12	10 1/2 (267)	FGNFB10J26P	FGNFB10J3P	FGNFB10J5P	16	(8)

# Immersion Heaters

**EXTENDED  
CAPABILITY**

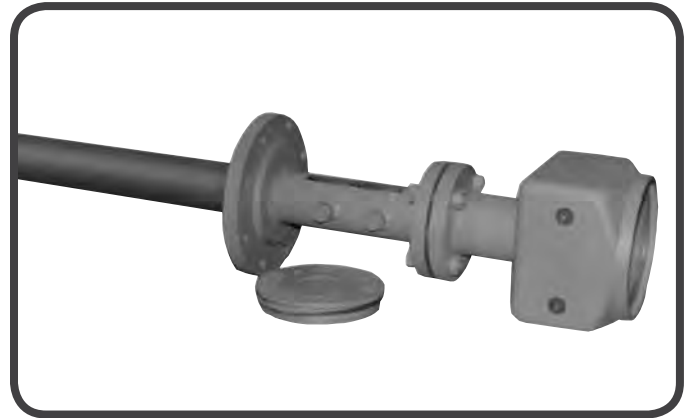


## WATROD™ and FIREBAR® Flange Immersion Heaters

### Extended Capabilities for Bayonet/Pipe Insert Immersion Heaters

Bayonet/Pipe insert immersion heaters permit removing and servicing the heater bundle without draining the liquid being heated.

Heating is accomplished by mounting a flange or screw plug immersion heater inside a pressure-tight bayonet pipe vessel. The pipe vessel then mates to a flange connection on a storage tank's side. Heat transfer between element(s) and tank contents is accomplished by heating the air or heat transfer fluid inside the bayonet pipe for conduction to the tank's contents.



### Performance Capabilities

- Wattages up to 100 kilowatts
- Voltages up to 600VAC
- Ratings up to 600 lb pressure class
- Alloy 800 sheath temperatures up to 1400°F (760°C)
- Stainless steel sheath temperatures up to 1200°F (650°C)
- Steel sheath temperatures up to 750°F (400°C)

### Features and Benefits

#### Low watt density screw plug or flange heaters mounted in the bayonet vessel

- Provides long life

#### Carbon steel, 304 and 316 stainless steel bayonet vessels

- Offers compatibility with a wide range of liquids

#### Welded flange on pipe vessel

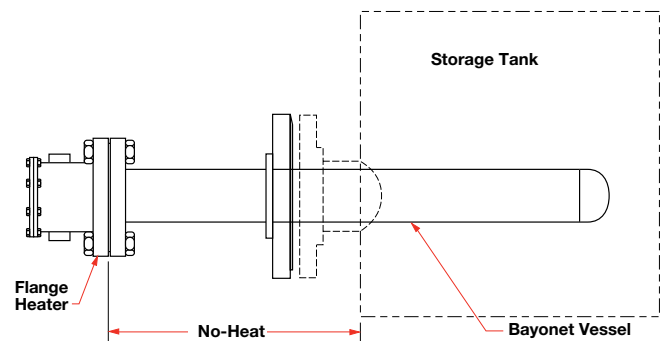
- Ensures pressure seal

#### Heating elements support(s)

- Ensures proper element spacing and maximum heater performance

### Typical Applications

- Indirect heating of viscous fluids:
  - Asphalt
  - Tar
  - Molasses
  - Syrup
  - Glue
- Corrosive liquids
- Degreasing fluids



# Immersion Heaters

**EXTENDED  
CAPABILITY**



## WATROD and FIREBAR Flange Immersion Heaters

### *Extended Capabilities for Bayonet/Pipe Insert Immersion Heaters (Continued)*

#### Options

Pipe insert heaters can be supplied with a variety of options, including:

- Appropriate gasket materials
- Passivation cleaning on pipe insert
- European screw plug to flange adapters
- CSA certified terminal enclosures
- Stand-off terminal enclosures
- Thermocouple temperature sensors
- Thermostats
- Customer specified materials, sizes and pressure class ratings

For descriptions and ordering information about these options, please refer to *Flange Immersion Heaters*, pages 220 to 281, or *Screw Plug Immersion Heaters*, pages 145 to 219.

#### Flanges

Flanges to 24 in. (610 mm) nominal pipe size are available in materials compatible with specific application needs. For information on flange materials and ratings, consult your Watlow representative.

#### Bayonet Vessels

Bayonet vessels are available up to 14 in. (356 mm) nominal pipe size and 20 feet long. Vessel size is dependent upon the kilowatt requirement and element watt density. For more information, contact your Watlow representative.

#### Application Hints

- Mount pipe insert heater horizontally
- Locate pipe insert heaters low in the tank, but above the sludge level
- Consider a low liquid level sensor to protect against low liquid level conditions
- Select a watt density that is compatible with the heat transfer media being used
- Insulate the pipe insert heater's exterior to minimize heat loss



#### **Caution:**

Do not insulate the terminal enclosure.

# Immersion Heaters



## FIREROD® Immersion Heaters

FIREROD® immersion heaters are ideal to replace large screw-plug immersion heaters. Packaging up to 300 W/in<sup>2</sup> (46.5 W/cm<sup>2</sup>) in a compact unit, these heaters are versatile when designed into a heating system.

FIREROD immersion heaters are complete with a stainless steel <sup>3</sup>/<sub>4</sub> inch National Pipe Thread Taper (NPT) double-threaded fitting, which allows conduit boxes to be added. They are also sealed at the lead end with a silicone rubber seal.

Solid copper leads with silicone rubber sleeves are provided for unrestricted wiring. These heaters are recommended for immersion in water of 90+ percent water soluble solutions.

### Performance Capabilities

- Maximum operating temperature in water up to 212°F (100°C) at atmospheric pressure
- Maximum watt density up to 300 W/in<sup>2</sup> (46.5 W/cm<sup>2</sup>)
- Maximum voltage up to 480VAC

### Features and Benefits

#### Nickel-chromium resistance wire precisely centered in the unit

- Ensures even, efficient distribution of heat to the sheath

#### Magnesium oxide (MgO) insulation compacted to the proper density

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

#### Alloy 800 sheath

- Resists water corrosion

#### Metallurgically-bonded conductor pins

- Overlap the resistance wire inside of the core to ensure trouble-free electrical continuity

#### Lead end with silicone rubber seal

- Protects the heater against moisture contamination

#### Stainless steel fittings

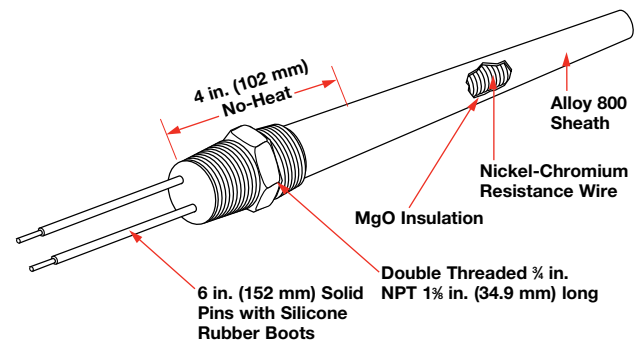
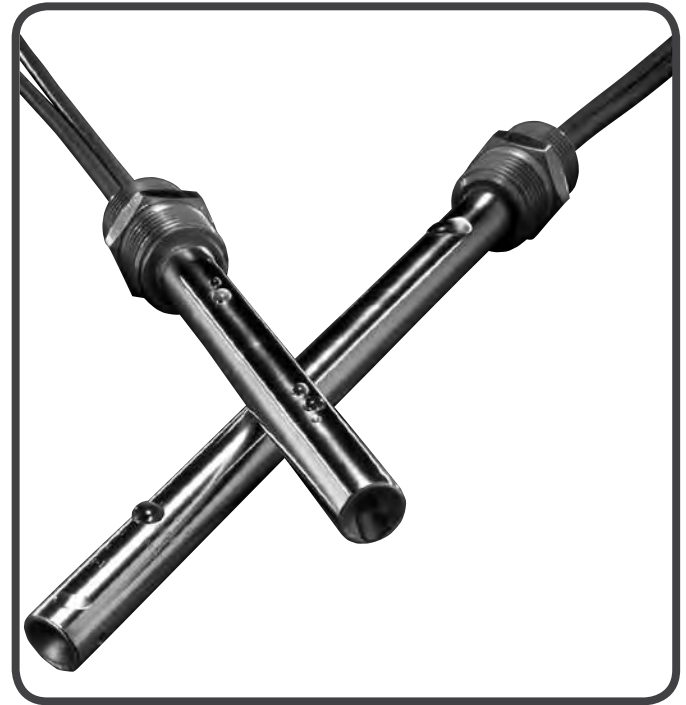
- Offer availability for use in corrosive applications

#### Horizontal through the wall tank mounting

- Provides faster set-up

#### 240 and 480VAC voltage

- Allows wiring flexibility for heater use in particular applications



### Typical Applications

- Plastic reclamation
- Food preparation
- Lab equipment

# Immersion Heaters



## FIREROD Immersion Heaters

### Applications and Technical Data

The small size and large capacity of FIREROD immersion heaters are ideal for use in cramped quarters. When heating liquids of low viscosity, FIREROD heaters have high watt density to pack more heat into tight spots. For water heating applications, a rating of 150 to 300 W/in<sup>2</sup> is recommended. Laboratory tests show that under certain conditions, ratings as high as 700 W/in<sup>2</sup> are safe. For longer life at high watt densities, the FIREROD heater:

- Should not be contained in the main body of the liquid or in a restricted space
- Should be covered with liquid at all times
- Should not be allowed to cycle on and off too frequently
- Should not form scale build up

When heating viscous liquids, such as oils, watt densities must be kept low to prevent carbonization at the heater sheath. FIREROD cartridges offer advantages for heating viscous materials where long life and high quality outweigh usual economic considerations.

As in all immersion applications, scale build-up on the sheath and sludge on the bottom of the tank must be carefully controlled to ensure long heater life.

Equipped with smaller threaded fittings than conventional immersion heaters, FIREROD heaters leave space for more units in the same location. Replacement of single FIREROD units in multi-heater assemblies is fast and easy to avoid discarding the complete assembly.

Moisture resistant seals are available for protection against damp atmospheres.

Threaded fittings are furnished in stainless steel. FIREROD heaters are designed with alloy 800 sheaths; however, other sheath materials can be provided on made-to-order FIREROD units.

Fittings and sheath material should be appropriate for the specific liquid material being heated.

### Sheath Material Compositions

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

① Maximum

# Immersion Heaters



## FIREROD Immersion Heaters

### Heater Part Numbers With Stainless Steel Fittings

Diameter in.	Overall Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
5/8	6 <sup>1</sup> / <sub>4</sub>	(159)	120	500	127	(19.7)	0.58	(0.26)	<b>L6EX12B</b>
	6 <sup>1</sup> / <sub>4</sub>	(159)	240	500	127	(19.7)	0.58	(0.26)	<b>L6EX13B</b>
	6 <sup>1</sup> / <sub>4</sub>	(159)	120	750	191	(29.6)	0.58	(0.26)	<b>L6EX14B</b>
	6 <sup>1</sup> / <sub>4</sub>	(159)	240	750	191	(29.6)	0.58	(0.26)	<b>L6EX15B</b>
	6 <sup>1</sup> / <sub>4</sub>	(159)	120	1,000	254	(39.4)	0.58	(0.26)	<b>L6EX16B</b>
	6 <sup>1</sup> / <sub>4</sub>	(159)	240	1,000	254	(39.4)	0.58	(0.26)	<b>L6EX17B</b>
	6 <sup>3</sup> / <sub>4</sub>	(172)	240	1,500	300	(46.5)	0.60	(0.27)	<b>L6NX7B</b>
	6 <sup>3</sup> / <sub>4</sub>	(172)	480	1,500	300	(46.5)	0.60	(0.27)	<b>L6NX8B</b>
	7 <sup>3</sup> / <sub>4</sub>	(197)	240	2,000	291	(45.1)	0.66	(0.30)	<b>L7NX5B</b>
	7 <sup>3</sup> / <sub>4</sub>	(197)	480	2,000	291	(45.1)	0.66	(0.30)	<b>L7NX6B</b>
	8 <sup>1</sup> / <sub>2</sub>	(216)	240	2,500	300	(46.5)	0.68	(0.31)	<b>L8JX16B</b>
	8 <sup>1</sup> / <sub>2</sub>	(216)	480	2,500	300	(46.5)	0.68	(0.31)	<b>L8JX17B</b>
	9 <sup>1</sup> / <sub>4</sub>	(235)	240	3,000	300	(46.5)	0.72	(0.33)	<b>L9EX11B</b>
	9 <sup>1</sup> / <sub>4</sub>	(235)	480	3,000	300	(46.5)	0.72	(0.33)	<b>L9EX12B</b>
	11	(279)	240	4,000	300	(46.5)	0.80	(0.36)	<b>L11AX59B</b>
	11	(279)	480	4,000	300	(46.5)	0.80	(0.36)	<b>L11AX60B</b>
	12 <sup>3</sup> / <sub>4</sub>	(324)	240	5,000	300	(46.5)	0.89	(0.41)	<b>L12NX4B</b>
	12 <sup>3</sup> / <sub>4</sub>	(324)	480	5,000	300	(46.5)	0.89	(0.41)	<b>L12NX5B</b>
	14 <sup>1</sup> / <sub>2</sub>	(368)	240	6,000	300	(46.5)	0.95	(0.43)	<b>L14JX8B</b>
	14 <sup>1</sup> / <sub>2</sub>	(368)	480	6,000	300	(46.5)	0.95	(0.43)	<b>L14JX9B</b>
	18	(457)	240	8,000	295	(45.7)	1.14	(0.52)	<b>L18AX43B</b>
	18	(457)	480	8,000	295	(45.7)	1.14	(0.52)	<b>L18AX44B</b>
	21 <sup>1</sup> / <sub>4</sub>	(540)	240	10,000	300	(46.5)	1.30	(0.59)	<b>L21EX1B</b>
	21 <sup>1</sup> / <sub>4</sub>	(540)	480	10,000	300	(46.5)	1.30	(0.59)	<b>L21EX2B</b>
	24 <sup>3</sup> / <sub>4</sub>	(629)	480	12,000	300	(46.5)	1.50	(0.68)	<b>L24NX1B</b>
	29 <sup>3</sup> / <sub>4</sub>	(756)	480	15,000	300	(46.5)	1.80	(0.82)	<b>L29NX5B</b>
	35	(889)	480	18,000	300	(46.5)	2.00	(0.91)	<b>L35AX5B</b>





# Circulation Heaters



Circulation Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
<b>HYDROSAFE® Heat Exchanger</b>	316/316L stainless steel, Inconel® 625, super duplex 2507 stainless steel	572	300	N/A	N/A	<b>299</b>
<b>STARFLOW™</b>	316L stainless steel	1000	537	30	4.6	<b>303</b>
<b>WATROD™ and FIREBAR®</b>	Alloy 800/840	1600	870	120	18.6	<b>305</b>
	Stainless steel	1200	650	120	18.6	
	Steel	750	400	120	18.6	
	Alloy 800	350	175	120	18.6	
<b>Booster Heaters</b>	Alloy 800	350	175	60	9.3	<b>360</b>
	Steel	750	400	23	3.6	
<b>Engine Preheaters</b>	Alloy 800	1600	870	90	13.9	<b>362</b>
<b>FLUENT® In-line</b>	444 stainless steel (substrate tube), 316L stainless steel (baffle and fittings)	212 (in water)	100	450	70	<b>365</b>

Circulation Heaters





# Circulation Heaters



## HYDROSAFE® Heat Exchanger

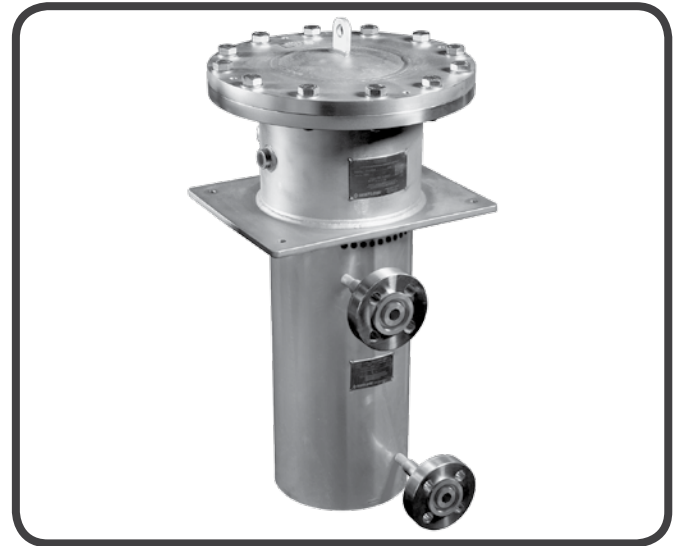
HYDROSAFE®, Watlow's indirect electric heat exchanger for dry gas seal applications, has been designed as a standardized thermal solution that minimizes custom engineering requirements because it can be adapted to a variety of conditions. The HYDROSAFE provides very flexible heating capabilities (12 to 31.2kW) to compensate for changes in gas flow rates, or changes in gas composition, when interconnected to our purpose engineered WATCONNECT® control panel. Multiple units may be connected in series for higher kW needs.

The HYDROSAFE holds complete assembly hazardous certifications with a "touch-safe" exterior versus competitors that offer enclosure-only certifications.

The seal gas is heated inside a small diameter seamless formed cylinder to allow for high system pressure capability requirements. In addition to high pressure capabilities, up to 6800 psi (469 bar) in the standard offering, the heater is up to 50 percent smaller than comparable circulation heaters. The empty weight of the HYDROSAFE heater is about 300 pounds (136 kgs) maximum. This small footprint and weight allow the user to reduce the cost of the supporting super structure on rigs, platforms, FPSOs, vessels, etc.

Indirect technology means there is no concern about your seal gas stream ever coming into contact with the heating elements, especially when elements reach end-of-life conditions and are typically more susceptible to corrosion. The small diameter and low volume pressure boundary allow use in many countries without the need for further pressure vessel certifications.

HYDROSAFE is extremely reliable and has been tested in both the Watlow lab and in the field. It also holds all necessary certifications including IECEx, ATEX, ASME and CSA/NRTL. The formed cylinder raw material is listed in accordance with NACE and ISO standards including MR 0175/ISO 15156/MR 0103.



### Standard Performance Capabilities

- **Wattages:** from 12 to 31.2kW
- **Voltages:** from 380 to 600VAC
- **Design temperature:** -58 to 572°F (-50 to +300°C)
- **Design pressure:** up to 6800 psi (469 bar)\*
- **Inlet temperature:** user specified
- **Outlet temperature:** maximum 450°F (232°C)\*\*
- **Working pressure:** user specified
- **Flow rate:** user specified
- **Maximum back pressure:** user specified
- **Maximum ambient temperature:** 122°F (50°C) for North American certifications, 176°F (80°C) for IEC and ATEX certifications
- **Media phase:** liquid or gas
- **Typical media:** methane, natural gas (methane, butane, propane, ethane and water vapor) and nitrogen
- **Environment T code rating:** none, T2, T3 and T4

### Features and Benefits

#### Fluid path constructed independent from the sheath

- Allows sensitive materials to be heated safely and effectively
- Assures safety because heater failure will not cause leaks or significant damage
- Prevents fluid contamination

#### Seamless fluid path construction

- Offers economical package price
- Minimizes potential leakage
- Allows high-pressure operation

#### Standard 316L SS fluid path

- Provides compatibility with different materials
- Assures high-pressure application reliability

\* Higher custom pressures available

\*\* T code dependent

# Circulation Heaters



## HYDROSAFE Heat Exchanger Heater Assembly Specifications

HYDROSAFE Assembly	Standard Offering	Standard Options	Other Available Options
<b>Base Construction</b>	Fully certified indirect electric heat exchanger assembly - flow coil and tubular elements cast into an aluminum cylinder. Complete with sensors, enclosure, insulation, nozzles and shroud.		
Control Configuration	Cascade using one internal cascade sensor per heater assembly (included) and separate process temperature sensor (not included)		
Casting Material	Al Alloy 356		
Corrosion Protection on Casting	Corrosion and weather protectant high temperature coating to 1000°F (538°C)		
Number of Flow Coils	1		
Heater Element	Tubular elements - 0.430 in. O.D. x 0.035 in. wall, 316 SS, NiCr resistance element, welded wire connection, bright annealed		
Heater Element Moisture Seal	Epoxy (180°C) rated		
Casting Insulation	Aerogel insulation		
Baseplate, Top Plate, Stand-off Shroud, Casting Shroud Material	316 SS		
HYDROSAFE Assembly Area Classification - Certification	North American (Class 1, Div. 1 & 2, Groups B, C, D)	ATEX (Ex d IIC) and/or IEC (Ex d IIC)	—
HYDROSAFE Assembly T Code Rating	None, T2 or T3	—	—
Maximum Casting Temperature Limit	302°F (150°C) for T3, 482°F (250°C), for T2	—	—
Pressure Boundary Compliance	Design, calculation and production acc. to ASME VIII Div. 1	—	Contact Watlow
<b>Electrical</b>			
Voltage	480V or 400V	380, 415, 440, 460, 575, or 600	—
Voltage Supply	3-phase AC + ground, with or without neutral connection (assembly is universally configured for both)		
Frequency	50 or 60Hz		
Wattage (at specified voltage)	31.2kW (480V and 600V) or 28.9kW (400V)	26.07kW (380V), 31.1kW (415V), 28.65kW (460V and 575V), 26.22kW (440V)	10.4kW (480V), 7.22kW (400V), 6.52kW (380V)
Number of Heater Supply Circuits	1		
Max Amperage per Circuit	Voltage/wattage dependent (max. 45 amps in any configuration)		
Power Connection Entry Size	1 in. NPT coupling or 1 in NPT x M32 x 1.5 (See Item 9, Ordering Information on page 302)		
Power Connection within Enclosure	Compression type, screw style distribution terminal block on DIN-rail within enclosure (3-phase + neutral) Compression type, screw style ground terminal block in enclosure (ground) Split bolt ground termination on external enclosure (with ATEX or IEC option)		
<b>Flow Coil</b>			
Vessel Coil Material	316/316L (dual rated)	—	Inconel® 625, Super Duplex 2507
Vessel Coil Raw Material Certifications	NACE MR-0175 / ISO15156 and MR-0103 with applicable technical circulars and addendas		
<b>Inlet/Outlet</b>			
Inlet/Outlet Connection Type	Standard flange	—	High pressure hub type connector
Inlet/Outlet Connection Material (match flow coil)	316/316L (dual rated)	—	Inconel® 625, Super Duplex 2507
Inlet/Outlet Connection	ANSI 1 in., Class 600, RF, sched 80 bore	ANSI 1 in., Class 2500, RTJ, sched 160 bore	Clamp hub
Inlet/Outlet Nozzle Connection Gaskets	—	Spiral wound or ring joint	—
<b>Enclosure</b>			
Enclosure Type	304 SS (North America) painted carbon steel (IEC/ATEX)	316 SS (North America) or (IEC/ATEX)	—
Enclosure Paint Color (only if Painted Carbon Steel)	RAL 7035 light grey	—	Other - custom color to be reviewed by factory (painted carbon steel enclosure only)
Enclosure Rating	See Item 7, Ordering Information on page 302		
Enclosure Anti Condensation Heater	None	—	Enclosure heater
Hazardous/Non-Hazardous Area Classification	Per assembly hazardous location rating		
External Enclosure Hardware	316 SS		

# Circulation Heaters



## HYDROSAFE Heat Exchanger

### Heater Assembly Specifications (Continued)

HYDROSAFE Assembly	Standard Offering	Standard Options	Other Available Options
<b>Sensors</b>			
Process and Limit Temperature Sensor Type	Duplex Pt 100, 3 wire RTDs 300 series SS sheath	—	Duplex thermocouple - Type K 300 series SS sheath
Number of Sensors	3		
Sensor Junctions	(1) Cascade process sensor, (1) Spare (1) Internal casting high limit, (1) Spare (1) Enclosure high limit, (1) Spare		
Inlet or Outlet Sensors	Customer supplied (not included)		
Sensor Connection Entry Size	See Item 9, Ordering Information on page 302		
Sensor Connections within Control Panel	3 wire RTD terminal blocks within heater enclosure	—	Type K thermocouple terminal blocks within heater enclosure (when thermocouple option selected)
<b>Testing</b>			
Pressure Testing (Hydro)	Standard on all assemblies per pressure vessel code requirements (15 minutes @ 1.3 x MAWP x LSR)	—	Custom time for hydro test
<b>Other Options</b>			
Country of Origin Materials	Watlow standard vendors - no restrictions	—	Certified countries

### Specifications

#### Design temperature

- -58 to 572°F (-50 to +300°C)

#### Design pressure

- Up to 6800 psi (469 bar)

#### Weight (empty) maximum

- 300 lbs (136kg)

#### Inlet temperature

- User specified

#### Outlet temperature

- Max. 450°F (232°C)

#### Working pressure

- User specified

#### Flow rate

- User specified

#### Maximum back pressure

- User specified

#### Maximum ambient temperature

- 122°F (50°C) for North American certifications, 176°F (80°C) for IEC and ATEX certifications

#### Media type

- Liquid or gas

#### Media

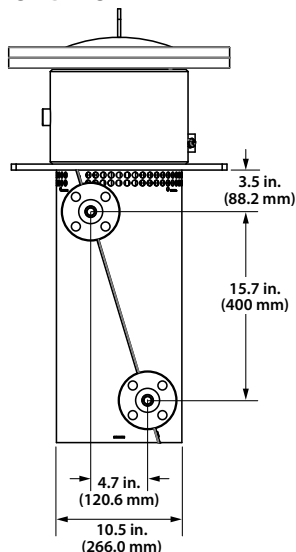
- Methane, natural gas (methane, butane, propane, ethane and water vapor) and nitrogen

#### Environment T code rating

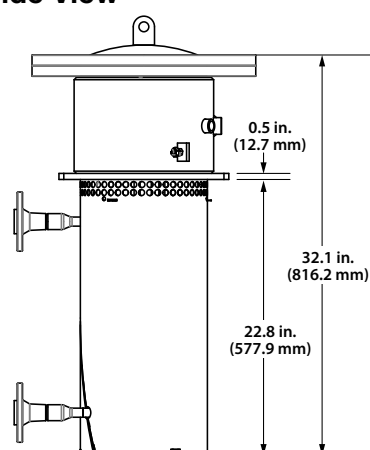
- None, T2, T3 or T4

### Dimensional Drawings

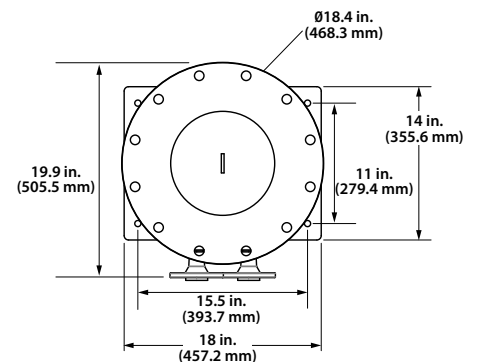
#### Front View



#### Side View



#### Top View



**Note:** Dimensions shown are approximate. Configuration GA drawing available with order or quote.

# Circulation Heaters



## HYDROSAFE Heat Exchanger

### Ordering Information

#### Part Number

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬ ⑭ ⑮
	Gen. Size & Power	Input Voltage/Phase	In/Out & Gasket	Connect & Coil Material	Temperature Sensors	Assembly Cert. & Encl. Matl.	Design & Fab.	Power & Sensor Connections	Elec. Encl. Htr.	Testing Options	Material C.O.O.	Custom Options
H												AAA

② General Size & Power	
S =	Future option
M =	Medium (12 to 31.2kW)
L =	Future option

③ Input Voltage/Phase	
A =	Future option
B =	Future option
C =	Future option
D =	Future option
E =	Future option
F =	26.07kW, 380V (medium size only)
G =	28.65kW, 460V or 575V (medium size only)
H =	28.9kW, 400V (medium size only)
J =	31.1kW, 415V (medium size only)
K =	31.2kW, 480V or 600V (medium size only)

④ Inlet & Outlet Connection & Gasket Selection	
A =	Future option
B =	Future option
C =	Clamp hub 1 in. NPS 4 bolt without gasket
D =	ANSI 1 in. CI 600 RF, sched 80 bore without gasket
E =	Future option
F =	Future option
G =	ANSI 1 in. 2500 RTJ, sched 160 bore without gasket
H =	Clamp hub 1 in. NPS 4 bolt with gasket
J =	ANSI 1 in. CI 600 RF, sched 80 bore with spiral wound gasket
K =	ANSI 1 in. 2500 RTJ, sched 160 bore with ring joint gasket

⑤ Connection & Flow Coil Material	
A =	316/L SS
B =	Inconel® 625 or equivalent
C =	Duplex stainless 2507

⑥ Temperature Sensors	
1 =	RTD 3 wire 100 ohm
2 =	Thermocouple Type K

⑦ Assembly Certification & Enclosure Material	
1 =	CI 1, Div. 1 & 2, Groups B, C & D; 304 SS, Type 4X
2 =	CI 1, Div. 1 & 2, Groups B, C & D; 316 SS, Type 4X
3 =	IEC & ATEX Dual Rated Ex d IIC; painted carbon steel, IP66
4 =	IEC & ATEX Dual Rated Ex d IIC; 316 SS, IP66
5 =	Future option

⑧ Design and Fabrication	
A =	Design/Calculations in accordance to ASME VIII Div. 1
B =	Design/Calculation/Fabrication in accordance to ASME VIII Div. 1
C =	Design/Calculations in accordance to PED
D =	Design/Calculation/Fabrication in accordance to PED
E =	CRN (per ASME VIII Div. 1) + B

⑨ Power & Sensor Connection Entries (female couplings)	
1 =	(1) 1 in. NPT coupling for power, (3) 3/4 in. NPT couplings for sensors
2 =	(1) M32 x 1.5 coupling for power, (3) M25 x 1.5 couplings for sensors
3 =	(1) 1 in. NPT coupling for power, (3) 1/2 in. NPT couplings for sensors
4 =	(1) M32 x 1.5 coupling for power, (3) M20 x 1.5 couplings for sensors

⑩ Electrical Enclosure Heater	
1 =	Yes, 220V
2 =	No

⑪ Testing Options	
A =	Watlow standard tests
B =	Custom time length hydrostatic pressure (includes option A)
C =	Radiography of heating coil weld joints (includes option A)
D =	Dye penetrant of heating coil weld joints (includes option A)
E =	PMI of pressure boundary materials (includes option A)
F =	A + B + C + E
G =	A + B + D + E

⑫ Material Country of Origin	
1 =	Watlow standard
2 =	Watlow standard with no China origin
3 =	Watlow standard with no India Origin
4 =	Watlow standard with no Indonesia Origin
5 =	Watlow standard with no Russia Origin

⑬ ⑭ ⑮ Custom Options	
AAA =	Standard

# Circulation Heaters



## STARFLOW™ Heaters

The STARFLOW™ circulation heater is engineered to heat a flowing gas stream to 1000°F (537°C). The 316L stainless steel chamber houses a small diameter sheathed element, which allows for quick response to both heat-up and cool down cycles.

Watlow's starwound, coiled cable heater provides extremely efficient and reliable heating by maximizing the contact area of the gas or fluid with the element. Because the element is sheathed, the unit can operate in gas streams requiring a clean environment as well as atmospheres containing contaminants and moisture. This provides superior performance compared to units with internally exposed or open element wires.

### Performance Capabilities

- Temperatures up to 1000°F (537°C), 316L stainless steel sheath
- Maximum watt densities up to 30 W/in<sup>2</sup> (4.7 W/cm<sup>2</sup>)
- Maximum voltage up to 240V

### Features and Benefits

#### Small diameter heater

- Allows for quick response time

#### Internal starwound element

- Provides fast, efficient heating

#### Sheathed element

- Provides the ability to heat in clean or impure streams

#### Flexibility in configurations

- Allows for adaptability to any process

#### 316L stainless steel

- Provides a rugged and corrosion resistant construction

#### Electropolishing available on all wetted surface

- Reduces particulate contamination

**Note:** Contact your Watlow representative for ultra-high purity applications

#### Low pressure loss

- Minimizes flow restriction

**Note:** Not suitable for use as a pressure vessel

#### Type J or K thermocouples

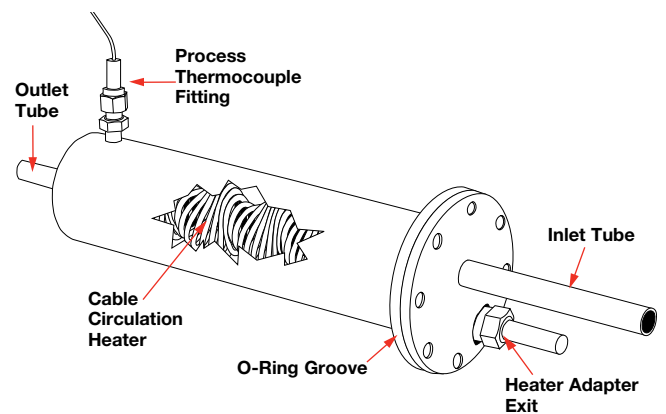
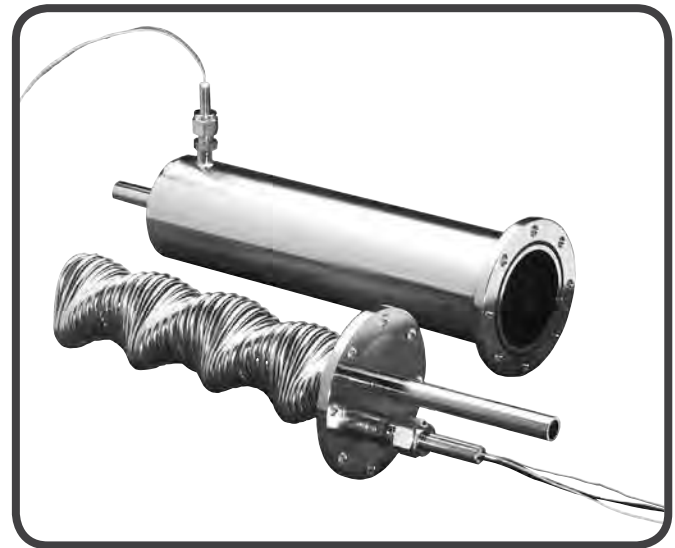
- Provide precise control and high-limit safety

#### Replaceable heater and thermocouple

- Reduces replacement cost

#### Shipment from stock

- Reduces downtime



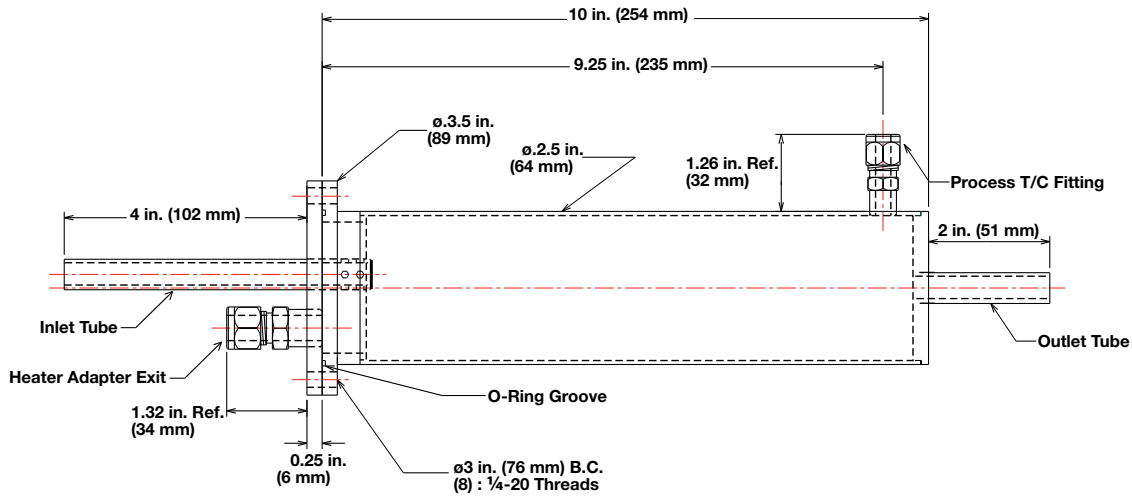
### Typical Applications

- Semiconductor processing
- Curing and drying
- Electronics
- Heat shrinking
- Thermoforming/sealing

# Circulation Heaters



## STARFLOW Heaters



### Ordering Information

#### Part Number

①	②	③ ④	⑤ ⑥	⑦ ⑧ ⑨ ⑩	⑪	⑫	⑬	⑭
C	H	Type of Inlet	Type of Outlet	Heater Wattage	Internal T/C Calibration (Heater)	Surface Finish of Assembly and Heater	Process T/C Calibration (Assembly)	O-Ring Material

③ ④	Type of Inlet
ET =	1/4 in. (6 mm) O.D. tube
JT =	1/2 in. (13 mm) O.D. tube

⑤ ⑥	Type of Outlet
ET =	1/4 in. (6 mm) O.D. tube
JT =	1/2 in. (13 mm) O.D. tube

⑦ ⑧ ⑨ ⑩	Heater Wattage
0375 =	120V, 375 W
0500 =	120V, 500 W
0750 =	120V, 750 W
1500 =	240V, 1500 W
2000 =	240V, 2000 W
3000 =	240V, 3000 W

⑪	Internal Thermocouple Calibration (Heater)
J =	Type J
K =	Type K

⑫	Surface Finish of Assembly and Heater
X =	Unfinished
E =	Electropolished

⑬	Process Thermocouple Calibration (Assembly)
J =	Type J
K =	Type K

⑭	O-Ring Material
A =	FKM (FPM) 500°F (260°C)
M =	Alloy X750 1300°F (704°C)
T =	PTFE encapsulated FKM (FPM) 392°F (200°C)



# Circulation Heaters



## WATROD™ and FIREBAR® Circulation Heaters

Circulation heaters provide a ready-made means to install electric heating with a minimal amount of time and labor. This is accomplished by combining heating elements, vessel, insulation, terminal enclosure, mounting brackets and inlet and outlet connections into a complete assembly.

Made from NPT screw plug or ANSI flange heater assemblies mated with a pressure vessel (tank), circulation heaters are designed to heat forced-circulation air, gases or liquids. Ideal for either in-line or side-arm operations, these assemblies direct fluids past FIREBAR® or WATROD™ heating elements, to deliver fast response and even heat distribution.

Watlow® meets virtually all your circulation heater assembly needs with made-to-order units. These units can be made from a wide range of heating element sheath materials, wattages, vessel sizes and materials, pressure ratings, terminal enclosures and controls.

### Performance Capabilities

- Watt densities up to 120 W/in<sup>2</sup> (18.6 W/cm<sup>2</sup>)
- Wattages up to three megawatts
- UL® and CSA component recognition up to 690VAC
- Ratings up to ANSI Class 300 pressure class
- Alloy 800/840 sheath temperatures up to 1600°F (870°C)
- Passivated 316 stainless steel sheath temperatures up to 1200°F (650°C)
- Steel sheath temperatures up to 750°F (400°C)

### Features and Benefits

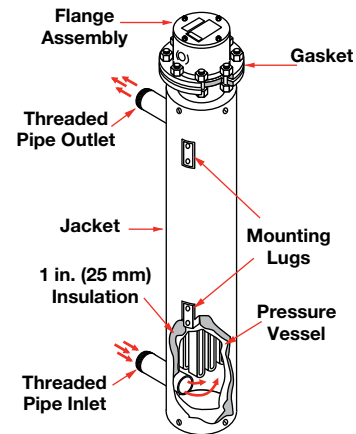
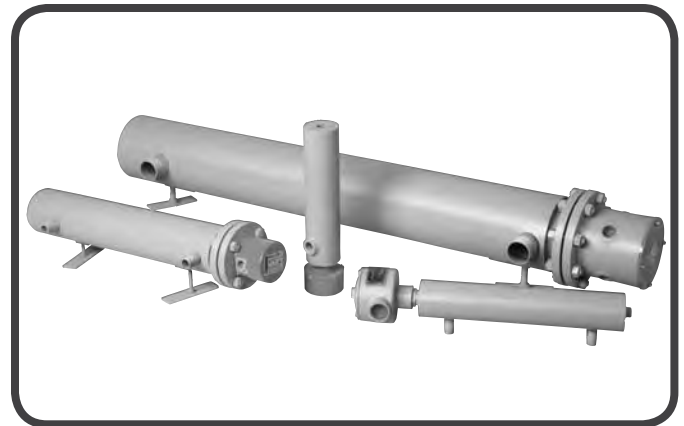
#### Catalog screw plug and flange part numbers

- Provides a wide selection of WATROD and FIREBAR elements to meet specific application requirements

Type	Sizes (in.)
NPT Screw Plugs	1 1/4, 2 1/2
ANSI flanges	3, 4, 5, 6, 8, 10, 12, 14

#### ANSI B16.5, Class 150 on 3 to 14 inch WATROD element flanges

- Meets recognized agency standards



#### Compacted MgO insulation filled elements

- Maximizes dielectric strength, heat transfer and life

#### 1 inch (25 mm) thermal insulation rated to 750°F (400°C)

- Reduces heat loss from the vessel

#### Heavy-gauge steel jacket (shroud)

- Protects thermal insulation and heating vessel and comes with protective primer coating



## WATROD and FIREBAR Circulation Heaters

### Features and Benefits *(Continued)*

#### All catalog units rated to ANSI pressure Class 150

- Provides pressure vessels (tanks) that are either carbon or 316 stainless steel

#### Standard offering includes units rated for up to and including ANSI pressure class (application review required)

- Provides pressure vessels (tanks) available in carbon steel, 304 or 316 stainless steel materials
- Includes schedule 40, standard and 80 pipe used in the pressure vessel construction

#### Catalog units provided with NPT or ANSI Class 150 nozzle connection

- Makes installation easy. Inlet and outlet nozzle connections are threaded MNPT on 8 in. (203 mm) and smaller tanks. Class 150 flanged connections on 10 in. (254 mm) and larger tanks

#### Mounting lugs are welded onto the tank wall of all 2 1/2 in. (64 mm) NPT and larger units

- Provides mounting support

#### General purpose or NEMA 4 enclosures available

- Offers easy access to terminal wiring

#### Flange mounting holes

- Straddles centerline to comply with industry standards

#### UL® and CSA component recognition under file numbers E52951 and 31388 respectively

- Meets industry safety standards

### Typical Applications

#### Water:

- Deionized
- Demineralized
- Clean
- Potable
- Process
- Industrial water rinse tanks
- Hydraulic oil, crude, asphalt
- Lubricating oils at API specified watt densities
- Heat transfer oil
- Paraffin
- Caustic cleaners
- Nitrogen, hydrogen and other air/gas systems
- Superheating steam

### Options

#### WATCONNECT® Standard Control Panels



WATCONNECT® standard control panels are configured to work with Watlow's circulation heaters. They are quickly configured for process heating applications and delivered within two weeks. WATCONNECT panels integrate Watlow's high-quality heater, sensor, temperature

controller and power controller products for a complete thermal solution. Normally, competitive custom panels require significantly longer lead times. The broad range of standard features allow customers to quickly configure panels for each process heater included in this catalog.

#### Features and Benefits

##### Lead times of two weeks or less

- Provides faster delivery than competition

##### Full documentation provided for WATCONNECT control panels at the time of quotation

- Eliminates lengthy approval process and phone calls

##### Incorporates Watlow's temperature and power controllers

- Provides a turnkey solution for process heating applications

#### Range of standard input/output (I/O) options

- Provides the user with a higher level of monitoring and control assuring an efficient and safe operation

#### WATCONNECT enclosure easily mounts to wall or frame

- Decreases installation time

**Note:** The WATCONNECT part number associated with a heater is only a suggestion. The following installation details need to be compared to panel capabilities to assure a compatible match:

- Minimum and maximum ambient temperature where panel will be installed
- Statutory and regulatory requirements at installation site
- Sun loading, if any, at installation site
- Presence of any hazardous gases, dusts or fibers, if any
- Verification of process sensor type
- Verification of limit sensor type
- Input/Output (I/O) requirements

#### For additional product information see the

#### WATCONNECT landing page at [www.watlow.com/watconnect](http://www.watlow.com/watconnect).

On the WATCONNECT landing page you will find a complete specification sheet along with other tools to help you properly select your control panel. If you would like to know the specific configuration of a WATCONNECT part number, please use the Product Configuration Lookup Tool on Watlow.com.

# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters

### Options (Continued)

#### Terminal Enclosures

General purpose terminal enclosures, without thermostats, are supplied on all Watlow circulation heaters. Moisture and explosion resistant ratings are available to meet specific application needs. For screw plug terminal enclosures, refer to page 151. For flange terminal enclosures, refer to page 226.

#### Stand-off Terminal Enclosures

Stand-off terminal enclosures help protect terminal enclosures against excessive temperatures. For details, refer to page 221.

#### ASME Pressure Vessel Code Welding

Flange or screw plug assemblies can be provided with an ASME Section VIII, Div. I pressure vessel stamp upon request.

#### Branch Circuits

Branch circuits are designed for 48 amperes per circuit maximum. Contact your Watlow representative for circuit requirements other than those listed in the part number tables.

#### Certified Enclosures

CSA, ATEX or IECEx certified enclosures protect wiring in hazardous gas environments. These terminal enclosures, covered under CSA file number 61707, ATEX certificate # SIRA 10ATEX 1155X or IECEx certificate # IECEx CSA 09.0010 are available on WATROD flange heaters. For additional information, see page 561 and 562 or contact your Watlow representative.

For products that will be installed in hazardous locations, please provide the following information:

- Operating conditions
- Minimum and maximum ambient temperatures for the installation location
- Mounting orientation
- Process temperature (°F)
- Maximum working pressure (MWP) of application (psig)
- Media being heated

Watlow must understand this information so that an appropriate design can be provided.

#### Thermocouples

To sense process or element sheath temperature, ASTM Type J or K thermocouples are available.

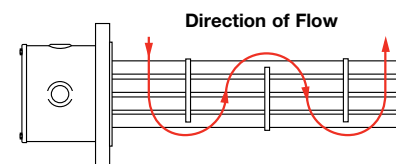
See *Screw Plug Immersion Heaters*, page 148 and *Flange Immersion Heaters*, on page 223 for details.

#### Thermostats

To provide process temperature control, Watlow offers optional single- and double-pole thermostats. Thermostats are typically mounted in the terminal enclosure.

See *Screw Plug Immersion Heaters*, page 147 and *Flange Immersion Heaters*, on page 222 for details.

#### Baffles



Baffles mounted on the heating element bundle enhance and/or modify liquid or gas flow for better heat transfer.

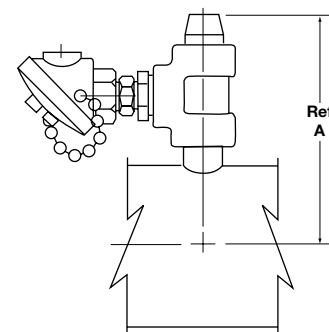
For critical sheath temperature and low flow conditions, baffles may be required.

Contact your Watlow representative for details.

#### Process Thermocouple in Nozzle

**Note:** Must specify which nozzle:

- Nozzle nearest flange or plug
- Nozzle away from flange or plug



Ref. Tank Size	Ref. Nozzle Size	Dimension "A"
1 <sup>1</sup> / <sub>4</sub>	3/4 NPT	8 <sup>3</sup> / <sub>16</sub>
2 <sup>1</sup> / <sub>2</sub>	1 NPT	8 <sup>3</sup> / <sub>16</sub>
3	1 NPT	8 <sup>3</sup> / <sub>16</sub>
4	1 <sup>1</sup> / <sub>2</sub> NPT	10 <sup>3</sup> / <sub>8</sub>
5	2 NPT	11 <sup>1</sup> / <sub>16</sub>
6	2 <sup>1</sup> / <sub>2</sub> NPT	13 <sup>3</sup> / <sub>8</sub>
8	2 <sup>1</sup> / <sub>2</sub> NPT	14 <sup>3</sup> / <sub>8</sub>

For 10 in. (254 mm) and larger tanks contact your Watlow representative for dimension.



## WATROD and FIREBAR Circulation Heaters

### Options (Continued)

#### Sheath Materials

The following sheath materials are available on WATROD and FIREBAR heating elements:

#### Standard Sheath Materials

<b>WATROD</b>	Alloy 800/840 316 SS Copper clad steel
<b>FIREBAR</b>	Steel Alloy 800, 304 SS

#### Made-to-Order Sheath Materials

<b>WATROD</b>	304 SS Alloy 600 Titanium Hastelloy C276 Inconel®/Steel Monel®
---------------	---

#### Wattages and Voltages

Watlow routinely supplies circulation heaters with 120 to 690VAC as well as wattages from 500 watts to one megawatt. If required, Watlow will configure circulation heaters with voltages and wattages outside these parameters.

For more information on special voltage and wattage configurations, contact your Watlow representative.

#### Pressure Vessels

All catalog pressure vessel (tank) materials consist of standard schedule and 150# class forged fittings and are made from one of the following materials:

- Carbon steel
- 316 stainless steel

All catalog pressure vessels (tanks) are steel unless otherwise noted.

316 stainless steel pressure vessels (tanks) are passivated on all wetted surfaces. Available on 2<sup>1</sup>/<sub>2</sub> inch NPT and 4 or 6 inch ANSI flange circulation heaters.

#### Passivated Finish

For critical applications, passivation will remove free iron from all wetted surfaces.

Contact your Watlow representative for details.

#### Gaskets

Rubber, asbestos-free and spiral wound gaskets are available for all heater flanges, and inlet and outlet flange sizes.

Watlow recommends ordering spares in case replacement becomes necessary.

To order, specify **gasket type, flange size/rating** and **process operating temperature**.

For details on gasket materials and temperature ratings, see page 223.

#### Inlet and Outlet Nozzle Connections

All inlet and outlet materials are compatible with the pressure vessel material and pressure class rating.

Vessel sizes from 1<sup>1</sup>/<sub>4</sub> to 8 inches are typically configured with MNPT (Male National Taper Pipe Thread) nozzles. Optional NPT and flange sizes can be supplied to mate with existing piping.

10 inch and larger vessels are supplied with Class 150 inlet and outlet flanges. Optional Class 300 or Class 600 can be provided to mate with existing piping.

To order, specify **type, size** and **pressure class** rating for both inlet and outlet nozzle/flange connections.

#### Protective Jacket (Shroud)

To protect circulation heaters from weather or wash-down conditions, welded (standard) outer protective jackets are available. Standard steel, or made-to-order 304 or 316 stainless steel or aluminum can be supplied. Jacket diameter is dependent upon thermal insulation thickness.

To order, specify **protective jacket, material type** and **weatherproof**, if desired.

# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters

### Technical Data

#### Maximum Velocities

The rate at which a gas or liquid flows through inlet and outlet pipes is critical to maintaining the desired output temperature. Pressure drop through the circulation heater must be considered to properly size blowers or pumps. The *Maximum Velocity to Avoid Excessive Pressure Drop* chart gives recommended maximum velocities, in feet per second and meters per second of gas or liquid being heated and nominal pipe size.

#### Maximum Velocity to Avoid Excessive Pressure Drop

Fluid	Nominal Pipe Size in.	Maximum Velocity	
		ft/sec	(m/sec)
Gases	All	200	(61.0)
Liquid	4 and smaller	10	(3.0)
Liquid	6-8	15	(5.0)
Liquid	10-12	19	(6.0)
Liquid	14-16	21	(6.4)
Liquid	18-20	23	(7.0)
Liquid	24	24	(7.3)

#### Vessel Orientation Guidelines

Correctly orienting the heating vessel assures lower terminal enclosure temperatures and element immersion. Detailed instructions on vessel orientation are contained in the *Installation and Maintenance Instructions* that accompanies all circulation heaters.

The following are guidelines for vessel orientation in liquid and gas heating applications.

#### Liquids

Orient circulation heater:

- Horizontally with inlet and outlet pipes pointing up
- Vertically with the terminal enclosure up and the inlet pipe on the bottom

These orientations ensure the heating elements will be immersed at all times and help prevent premature failure.

#### Air or Gases

Orient circulation heater:

- Horizontally with the inlet nozzle closest to the terminal enclosure
- Vertically with terminal enclosure at the bottom of the tank. Use the nozzle nearest the bottom as the inlet connection

If installation constraints do not allow mounting in accordance with these guidelines, contact your Watlow representative.

### Application Hints

- Select the recommended heating element sheath material and watt density for the substance being heated. Use the *Supplemental Applications Chart* on pages 550 to 553. If unable to determine the correct heating element type and material, contact your Watlow representative.
- Assure selecting proper vessel by considering the pressure or flow rate, process temperature and corrosiveness of the media being heated. If assistance with vessel selection is required, contact your Watlow representative.
- For maintenance/replacement procedures, retain an area twice the circulation heater's overall length to permit easy removal and inspection of screw plug or flange heater assemblies.
- Choose a FIREBAR assembly when you require:
  - A smaller package
  - More kilowatts or lower watt density in an equally sized WATROD circulation tank
- Minimize problems associated with low flow or low liquid level conditions with a low liquid level sensor and/or sheath high-limit control.
- Ensure wiring integrity by making sure terminal enclosure temperature does not exceed 400°F (205°C).
- Size power feeder wires in accordance with National Electrical Code (NEC) guidelines and other applicable codes.
- Protect against electrical shock by properly grounding the unit per NEC requirements.
- One or more circulation heaters may be connected in series to achieve the desired total kilowatt or temperature output.

# Circulation Heaters

**EXTENDED  
CAPABILITY**



## Extended Capabilities for WATROD and FIREBAR Circulation Heaters

### Performance Capabilities

- Up to 3000psi design pressure

### Features and Benefits

Offering includes units rated above ANSI pressure class 300

- Pressure vessel tanks are available in 304 and 316 “H” series stainless steel, Alloy 600, Alloy 800, Chrome Moly, Monel®, Duplex and 321 stainless steel.

### Options

#### Exotic Sheath Materials

Contact your Watlow representative for details and availability.

#### Pressure Vessels

Made-to-order units can be made in a variety of materials, flange sizes and pressure classes.

To order, specify **pressure vessel (tank) size, material and pressure class**.

Ratings to ANSI class 2500 pressure class are available for high-pressure applications.

#### High-Temperature Thermal Insulation

To further minimize heat loss, the pressure vessel’s standard one inch thermal insulation wrap may be replaced with thicker or higher temperature insulation. For more information, contact your Watlow representative.

To order, specify **insulation thickness, standard or high temperature insulation and temperature rating**.

Vessels may be supplied with a primer coating without insulation.

To order, specify **no insulation**.

#### Support Saddles

To mate with an existing installation, customized support saddle(s) and/or mounting lugs are available.

To order, specify **mounting lugs or support saddles** and supply a dimensional drawing.

# Circulation Heaters



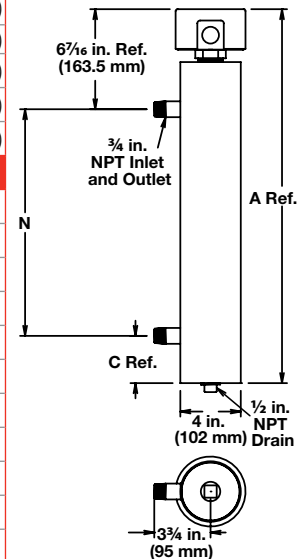
## WATROD and FIREBAR Circulation Heaters

### Application: Clean Water®

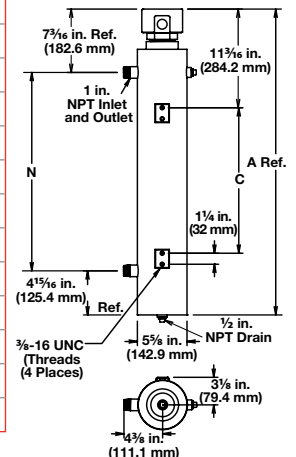
- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>1 1/4 inch NPT Screw Plug (WATROD)</b>											
<b>60 W/in<sup>2</sup> Steel Tank 2-Alloy 800 Elements (9.3 W/cm<sup>2</sup>)</b>	120	3.0	1	1	<b>CBEN15A6S</b>	<b>C1-15</b>	<b>C1-12</b>	23 (11)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	3.0	1	1	<b>CBEN15A6S</b>	<b>C1-17</b>	<b>C1-13</b>	23 (11)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	4.0	1	1	<b>CBEN19A10S</b>	<b>C1-17</b>	<b>C1-13</b>	29 (14)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	5.0	1	1	<b>CBEN23J10S</b>	<b>C/F</b>	<b>C/F</b>	29 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	6.0	1	1	<b>CBEN27J10S</b>	<b>C/F</b>	<b>C/F</b>	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
<b>1 1/4 inch NPT Screw Plug (FIREBAR)</b>											
<b>90 W/in<sup>2</sup> Steel Tank 1-Alloy 800 Element (14 W/cm<sup>2</sup>)</b>	240	1.5	1	1	<b>CBDNF7R10S</b>	<b>C1-17</b>	<b>C1-13</b>	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	480	1.5	1	1	<b>CBDNF7R11S</b>	<b>C/F</b>	<b>C/F</b>	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	3.0	1	1	<b>CBDNF11G10S</b>	<b>C1-17</b>	<b>C1-13</b>	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	480	3.0	1	1	<b>CBDNF11G11S</b>	<b>C/F</b>	<b>C/F</b>	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	5.0	3	1	<b>CBDNF16G3S</b>	<b>C2-50</b>	<b>C2-92</b>	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	480	5.0	3	1	<b>CBDNF16G5S</b>	<b>C2-43</b>	<b>C2-35</b>	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	6.5	3	1	<b>CBDNF19G3S</b>	<b>C2-50</b>	<b>C2-92</b>	30 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	480	6.5	3	1	<b>CBDNF19G5S</b>	<b>C2-43</b>	<b>C2-35</b>	30 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	8.5	3	1	<b>CBDNF24L3S</b>	<b>C2-50</b>	<b>C2-92</b>	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	480	8.5	3	1	<b>CBDNF24L5S</b>	<b>C2-43</b>	<b>C2-35</b>	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	10.5	3	1	<b>CBDNF29R3S</b>	<b>C2-236</b>	<b>C2-214</b>	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	10.5	3	1	<b>CBDNF29R5S</b>	<b>C2-43</b>	<b>C2-35</b>	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	12.7	3	1	<b>CBDNF34R3S</b>	<b>C2-236</b>	<b>C2-214</b>	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	12.7	3	1	<b>CBDNF34R5S</b>	<b>C2-43</b>	<b>C2-35</b>	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	17.0	3	1	<b>CBDNF45G3S</b>	<b>C2-236</b>	<b>C2-214</b>	69 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
480	17.0	3	1	<b>CBDNF45G5S</b>	<b>C2-43</b>	<b>C2-35</b>	69 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)	
480	21.5	3	1	<b>CBDNF55R5S</b>	<b>C2-225</b>	<b>C2-226</b>	71 (33)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)	
<b>2 1/2 inch NPT Screw Plug (WATROD)</b>											
<b>60 W/in<sup>2</sup> Steel Tank 3-Alloy 800 Elements (9.3 W/cm<sup>2</sup>)</b>	240	6.0	3	1	<b>CBLN714L3S</b>	<b>C2-50</b>	<b>C2-92</b>	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	6.0	3	1	<b>CBLN714L5S</b>	<b>C2-43</b>	<b>C2-35</b>	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	7.5	3	1	<b>CBLN717L3S</b>	<b>C2-50</b>	<b>C2-92</b>	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	7.5	3	1	<b>CBLN717L5S</b>	<b>C2-43</b>	<b>C2-35</b>	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	9.0	3	1	<b>CBLN720L3S</b>	<b>C2-50</b>	<b>C2-92</b>	26 (12)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	9.0	3	1	<b>CBLN720L5S</b>	<b>C2-43</b>	<b>C2-35</b>	26 (12)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	12.0	3	1	<b>CBLN726C3S</b>	<b>C2-236</b>	<b>C2-214</b>	27 (13)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	12.0	3	1	<b>CBLN726C5S</b>	<b>C2-43</b>	<b>C2-35</b>	27 (13)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	15.0	3	1	<b>CBLN731L3S</b>	<b>C2-236</b>	<b>C2-214</b>	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	15.0	3	1	<b>CBLN731L5S</b>	<b>C2-43</b>	<b>C2-35</b>	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	18.0	3	1	<b>CBLN737C3S</b>	<b>C2-236</b>	<b>C2-214</b>	30 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	18.0	3	1	<b>CBLN737C5S</b>	<b>C2-43</b>	<b>C2-35</b>	30 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)

1 1/4 inch NPT Screw Plug



2 1/2 inch NPT Screw Plug



④ Wired for higher voltage

⑤ When steel vessel materials are used in this application, some rust may be present in the process media

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# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters

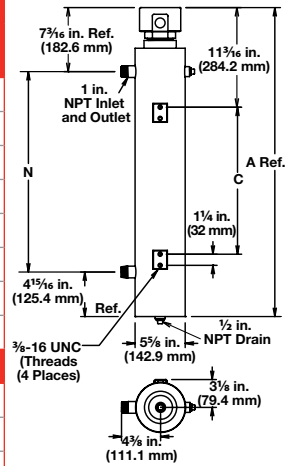


### Application: Clean Water®

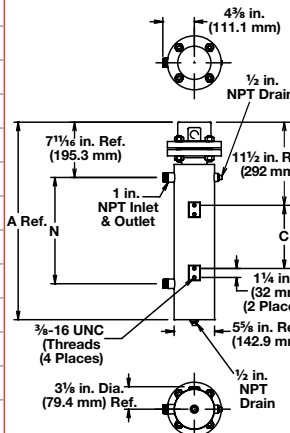
- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	Circ.	#	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
							Type J T/C	Type K T/C				
<b>2 1/2 inch NPT Screw Plug (FIREBAR)</b>												
<b>90 W/in<sup>2</sup> Steel Tank 3-Alloy 800 Elements (14 W/cm<sup>2</sup>)</b>	240	15.0	3	1	1	CBLNF15C3S	C2-236	C2-214	22 (10)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	15.0	3	1	1	CBLNF15C5S	C2-43	C2-35	22 (10)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	20.0	3	1	1	CBLNF18C3S	C2-236	C2-214	23 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	20.0	3	1	1	CBLNF18C5S	C2-43	C2-35	23 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	25.0	3	1	1	CBLNF23C5S	C2-225	C2-226	31 (14)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	32.0	3	1	1	CBLNF28L5S	C2-225	C2-226	34 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
480	38.0	3	1	1	CBLNF33L5S	C2-225	C2-226	35 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)	
<b>3 inch - 150 lb ANSI Flange (WATROD)</b>												
<b>60 W/in<sup>2</sup> Steel Tank 3-Alloy 800 Elements (9.3 W/cm<sup>2</sup>)</b>	120	6.0	1	1	1	CFMN715J10S	C/F	C/F	66 (30)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	6.0	3	1	1	CFMN715J3S	C2-50	C2-92	66 (30)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	6.0	1	1	1	CFMN715J11S	C/F	C/F	66 (30)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	6.0	3	1	1	CFMN715J5S	C2-43	C2-35	66 (30)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	120	9.0	1	1	1	CFMN721J10S	C/F	C/F	70 (32)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	9.0	3	1	1	CFMN721J3S	C2-50	C2-92	70 (32)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	9.0	1	1	1	CFMN721J11S	C/F	C/F	70 (32)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	9.0	3	1	1	CFMN721J5S	C2-43	C2-35	70 (32)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	12.0	3	1	1	CFMN727A3S	C2-236	C2-214	80 (37)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	12.0	1	1	1	CFMN727A11S	C/F	C/F	80 (37)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	12.0	3	1	1	CFMN727A5S	C2-43	C2-35	80 (37)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	15.0	3	1	1	CFMN732J3S	C2-236	C2-214	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	15.0	1	1	1	CFMN732J11S	C/F	C/F	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	15.0	3	1	1	CFMN732J5S	C2-43	C2-35	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	18.0	3	1	1	CFMN738A3S	C2-236	C2-236	98 (45)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	18.0	1	1	1	CFMN738A11S	C/F	C/F	98 (45)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	18.0	3	1	1	CFMN738A5S	C2-43	C2-35	98 (45)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)

2 1/2 inch NPT Screw Plug



3 inch - 150 lb ANSI Flange



- ③ Wired for 3-phase operation only
  - ⑤ When steel vessel materials are used in this application, some rust may be present in the process media
  - ⑧ Can be wired for 1-phase operation
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# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters

### Application: Clean Water®

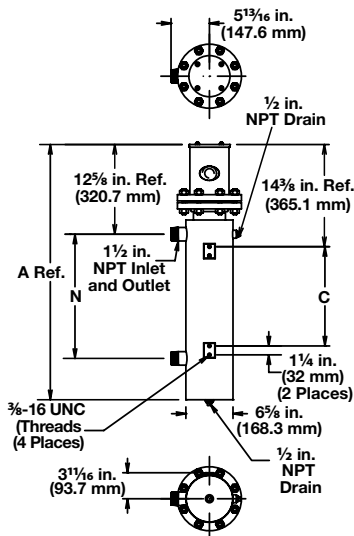
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)		"N" Dim. in. (mm)		"C" Dim. in. (mm)	
						Type J T/C	Type K T/C							
<b>4 inch - 150 lb ANSI Flange (WATROD)</b>														
60 W/in <sup>2</sup> Steel Tank 6-Alloy 800 Elements (9.3 W/cm <sup>2</sup> )	240	12.0	1	2	CFON715J10S	C/F	C/F	124 (57)	39 (989)	20 1/2 (521)	17 (432)			
	240	12.0	3	1	CFON715J3S	C2-236	C2-214	124 (57)	39 (989)	20 1/2 (521)	17 (432)			
	480	12.0	1	1	CFON715J11S	C/F	C/F	124 (57)	39 (989)	20 1/2 (521)	17 (432)			
	480	12.0	3	1	CFON715J5S	C2-43	C2-35	124 (57)	39 (989)	20 1/2 (521)	17 (432)			
	240	18.0	1	2	CFON721J10S	C/F	C/F	127 (58)	39 (989)	20 1/2 (521)	17 (432)			
	240	18.0	3	1	CFON721J3S	C2-236	C2-214	127 (58)	39 (989)	20 1/2 (521)	17 (432)			
	480	18.0	1	1	CFON721J11S	C/F	C/F	127 (58)	39 (989)	20 1/2 (521)	17 (432)			
	480	18.0	3	1	CFON721J5S	C2-43	C2-35	127 (58)	39 (989)	20 1/2 (521)	17 (432)			
	240	24.0	1	2	CFON727A10S	C/F	C/F	160 (73)	49 1/2 (1256)	31 (787)	27 1/2 (699)			
	240	24.0	3	2	CFON727A3S	C2-218	C2-224	160 (73)	49 1/2 (1256)	31 (787)	27 1/2 (699)			
	480	24.0	1	1	CFON727A11S	C/F	C/F	160 (73)	49 1/2 (1256)	31 (787)	27 1/2 (699)			
	480	24.0	3	1	CFON727A5S	C2-225	C2-226	160 (73)	49 1/2 (1256)	31 (787)	27 1/2 (699)			
	240	30.0	3	2	CFON732J3S	C2-218	C2-224	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)			
	480	30.0	1	2	CFON732J11S	C/F	C/F	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)			
	480	30.0	3	1	CFON732J5S	C2-225	C2-226	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)			
	240	36.0	3	2	CFON738A3S	C2-218	C2-224	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)			
	480	36.0	1	2	CFON738A11S	C/F	C/F	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)			
	480	36.0	3	1	CFON738A5S	C2-225	C2-226	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)			
	480	50.0	3	2	CFON751A5S	C2-229	C2-230	234 (107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)			
	480	60.0	3	2	CFON760J5S	C2-229	C2-230	297 (135)	91 1/2 (2326)	73 (1854)	66 (1676)			

⑤ When steel vessel materials are used in this application, some rust may be present in the process media

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### 4 inch - 150 lb ANSI Flange



## WATROD and FIREBAR Circulation Heaters



### Application: Clean Water®

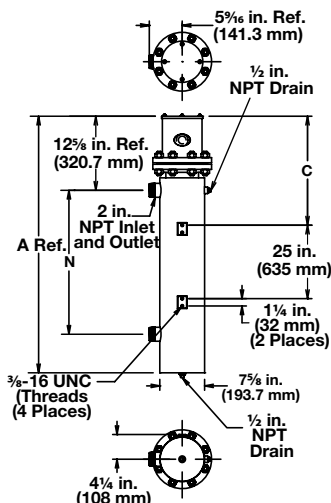
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>60 W/in<sup>2</sup> Steel Tank 6-Alloy 800 Elements (9.3 W/cm<sup>2</sup>)</b>	240	24.0	1	3	CFNN727A10S	C/F	C/F	140 (64)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	240	24.0	3	2	CFNN727A3S	C2-218	C2-224	140 (64)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	480	24.0	1	3	CFNN727A11S	C/F	C/F	140 (64)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	480	24.0	3	1	CFNN727A5S	C2-225	C2-226	140 (64)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	240	30.0	3	2	CFNN732J3S	C2-218	C2-224	142 (65)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	480	30.0	1	2	CFNN732J11S	C/F	C/F	142 (65)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	480	30.0	3	1	CFNN732J5S	C2-225	C2-226	142 (65)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	240	36.0	3	2	CFNN738A3S	C2-218	C2-224	160 (73)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	36.0	1	2	CFNN738A11S	C/F	C/F	160 (73)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	36.0	3	1	CFNN738A5S	C2-224	C2-226	160 (73)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	50.0	3	2	CFNN751A5S	C2-229	C2-230	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)
	480	60.0	3	2	CFNN760J5S	C2-229	C2-230	190 (87)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1572)	30 <sup>7</sup> / <sub>8</sub> (784.2)
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>60 W/in<sup>2</sup> Steel Tank 9-Alloy 800 Elements (9.3 W/cm<sup>2</sup>)</b>	240	36.0	3	3	CFNN727A3XS	C4-144	C4-145	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	480	36.0	1	3	CFNN727A11XS	C/F	C/F	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	480	36.0	3	1	CFNN727A5XS	C2-225	C2-226	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	240	45.0	3	3	CFNN732J3XS	C4-144	C4-145	147 (67)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	480	45.0	1	3	CFNN732J11XS	C/F	C/F	147 (67)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	480	45.0	3	3	CFNN732J5XS	C4-150	C4-151	147 (67)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (378.8)
	240	54.0	3	3	CFNN738A3XS	C4-144	C4-145	166 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	54.0	1	3	CFNN738A11XS	C/F	C/F	166 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	54.0	3	3	CFNN738A5XS	C4-150	C4-151	166 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	75.0	3	3	CFNN751A5XS	C4-152	C4-153	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)
	480	90.0	3	3	CFNN760J5XS	C4-152	C4-153	200 (91)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1572)	30 <sup>7</sup> / <sub>8</sub> (784.2)

⑤ When steel vessel materials are used in this application, some rust may be present in the process media

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### 5 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



### Application: Clean Water®

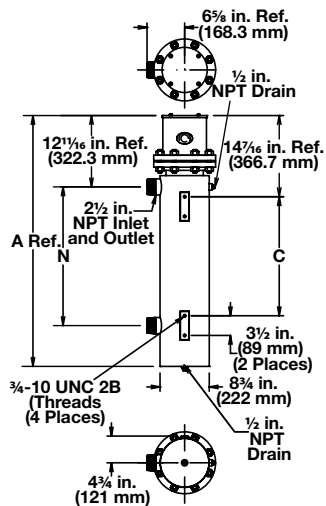
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>60 W/in<sup>2</sup> Steel Tank 12-Alloy 800 Elements (9.3 W/cm<sup>2</sup>)</b>	240	24.0	1	3	CFPN715G10S	C/F	C/F	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	24.0	3	2	CFPN715G3S	C2-218	C2-224	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	24.0	1	2	CFPN715G11S	C/F	C/F	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	24.0	3	1	CFPN715G5S	C2-225	C2-226	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	36.0	1	4	CFPN721G10S	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	36.0	3	2	CFPN721G3S	C2-218	C2-224	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	36.0	1	2	CFPN721G11S	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	36.0	3	1	CFPN721G5S	C2-225	C2-226	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	48.0	3	4	CFPN726R3S	C4-148	C4-149	222 (101)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	48.0	1	3	CFPN726R11S	C/F	C/F	222 (101)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	48.0	3	2	CFPN726R5S	C2-229	C2-230	222 (101)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	60.0	3	4	CFPN732G3S	C4-148	C4-149	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	60.0	1	3	CFPN732G11S	C/F	C/F	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	60.0	3	2	CFPN732G5S	C2-229	C2-230	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	72.0	3	4	CFPN737R3S	C4-148	C4-149	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	72.0	3	2	CFPN737R5S	C2-229	C2-230	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	100.0	3	4	CFPN750R5S	C4-156	C4-157	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
480	120.0	3	4	CFPN760G5S	C4-156	C4-157	360 (164)	93 (2361)	73 (1854)	66 (1676)	

Ⓢ When steel vessel materials are used in this application, some rust may be present in the process media

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### 6 inch - 150 lb ANSI Flange



## WATROD and FIREBAR Circulation Heaters



### Application: Clean Water®

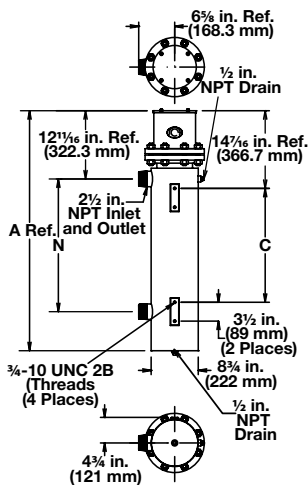
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>60 W/in<sup>2</sup> Steel Tank 15-Alloy 800 Elements (9.3 W/cm<sup>2</sup>)</b>	240	30.0	1	3	CFPN715G10XS	C/F	C/F	215 (98)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	30.0	3	5	CFPN715G3XS	C4-144	C4-145	215 (98)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	30.0	1	3	CFPN715G11XS	C/F	C/F	215 (98)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	30.0	3	1	CFPN715G5XS	C2-225	C2-226	215 (98)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	45.0	1	5	CFPN721G10XS	C/F	C/F	223 (102)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	45.0	3	5	CFPN721G3XS	C4-144	C4-145	223 (102)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	45.0	1	3	CFPN721G11XS	C/F	C/F	223 (102)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	45.0	3	5	CFPN721G5XS	C4-150	C4-151	223 (102)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	60.0	3	5	CFPN726R3XS	C/F	C/F	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	60.0	1	3	CFPN726R11XS	C/F	C/F	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	60.0	3	5	CFPN726R5XS	C4-152	C4-153	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	75.0	3	5	CFPN732G3XS	C/F	C/F	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	75.0	1	5	CFPN732G11XS	C/F	C/F	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	75.0	3	5	CFPN732G5XS	C4-152	C4-153	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	90.0	3	5	CFPN737R3XS	C/F	C/F	296 (134)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	90.0	3	5	CFPN737R5XS	C4-152	C4-153	296 (134)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	125.0	3	5	CFPN750R5XS	C/F	C/F	306 (139)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
480	150.0	3	5	CFPN760G5XS	C/F	C/F	370 (168)	93 (2361)	73 (1854)	66 (1676)	

⑤ When steel vessel materials are used in this application, some rust may be present in the process media

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### 6 inch - 150 lb ANSI Flange



# Circulation Heaters



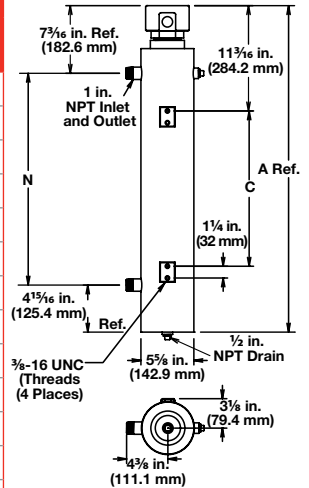
## WATROD and FIREBAR Circulation Heaters

### Application: Deionized or Demineralized Water

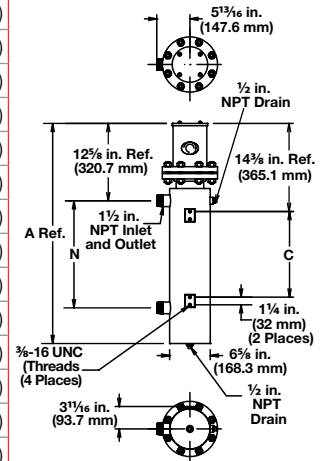
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)	
						Type J T/C	Type K T/C					
<b>2 1/2 inch NPT Screw Plug (WATROD)</b>												
60 W/in <sup>2</sup> 316 SS Tank 3-316 SS Elements (9.3 W/cm <sup>2</sup> ) Passivated	240	6.0	3	1	CBLR714L3S	C2-50	C2-92	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)	
	480	6.0	3	1	CBLR714L5S	C2-43	C2-35	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)	
	240	7.5	3	1	CBLR717L3S	C2-50	C2-92	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)	
	480	7.5	3	1	CBLR717L5S	C2-43	C2-35	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)	
	240	9.0	3	1	CBLR720L3S	C2-50	C2-92	26 (12)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)	
	480	9.0	3	1	CBLR720L5S	C2-43	C2-35	26 (12)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)	
	240	12.0	3	1	CBLR726C3S	C2-236	C2-214	27 (13)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)	
	480	12.0	3	1	CBLR726C5S	C2-43	C2-35	27 (13)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)	
	240	15.0	3	1	CBLR731L3S	C2-236	C2-214	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)	
	480	15.0	3	1	CBLR731L5S	C2-43	C2-35	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)	
	240	18.0	3	1	CBLR737C3S	C2-236	C2-214	30 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)	
	480	18.0	3	1	CBLR737C5S	C2-43	C2-35	30 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)	
	<b>4 inch - 150 lb ANSI Flange (WATROD)</b>											
	60 W/in <sup>2</sup> 316 SS Tank 6-316 SS Elements (9.3 W/cm <sup>2</sup> ) Passivated	240	12.0	1	2	CFOR716A10S	C/F	C/F	124 (57)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
240		12.0	3	1	CFOR716A3S	C2-236	C2-214	124 (57)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
480		12.0	1	1	CFOR716A11S	C/F	C/F	124 (57)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
480		12.0	3	1	CFOR716A5S	C2-43	C2-35	124 (57)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
240		18.0	1	2	CFOR722A10S	C/F	C/F	127 (58)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
240		18.0	3	1	CFOR722A3S	C2-236	C2-214	127 (58)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
480		18.0	1	1	CFOR722A11S	C/F	C/F	127 (58)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
480		18.0	3	1	CFOR722A5S	C2-43	C2-35	127 (58)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
240		24.0	1	2	CFOR727J10S	C/F	C/F	160 (73)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)	
240		24.0	3	2	CFOR727J3S	C2-218	C2-224	160 (73)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)	
480		24.0	1	1	CFOR727J11S	C/F	C/F	160 (73)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)	
480		24.0	3	1	CFOR727J5S	C2-225	C2-226	160 (73)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)	
240		30.0	3	2	CFOR733A3S	C2-218	C2-224	163 (74)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)	
480		30.0	1	2	CFOR733A11S	C/F	C/F	163 (74)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)	
480		30.0	3	1	CFOR733A5S	C2-225	C2-226	163 (74)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)	
240		36.0	3	2	CFOR738J3S	C2-218	C2-226	229(104)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
480		36.0	1	2	CFOR738J11S	C/F	C/F	229(104)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
480		36.0	3	1	CFOR738J5S	C2-225	C2-226	229(104)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
480		50.0	3	2	CFOR751J5S	C2-229	C2-230	234(107)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
480		60.0	3	2	CFOR761A5S	C2-229	C2-230	297(135)	91 <sup>1</sup> / <sub>2</sub> (2326)	73 (1854)	66 (1676)	

2 1/2 inch NPT Screw Plug



4 inch - 150 lb ANSI Flange



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# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



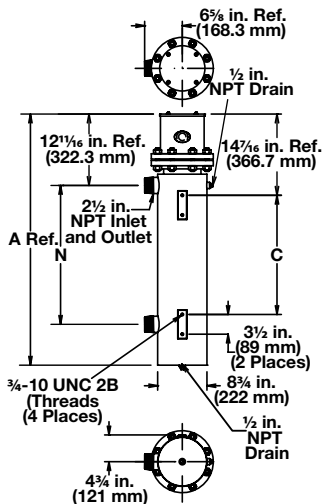
### Application: Deionized or Demineralized Water

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>60 W/in<sup>2</sup> 316 SS Tank 12-316 SS Elements (9.3 W/cm<sup>2</sup>) Passivated</b>	240	24.0	1	3	CFPR715N10S	C/F	C/F	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	24.0	3	2	CFPR715N3S	C2-218	C2-224	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	24.0	1	2	CFPR715N11S	C/F	C/F	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	24.0	3	1	CFPR715N5S	C2-225	C2-226	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	36.0	1	4	CFPR721N10S	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	36.0	3	2	CFPR721N3S	C2-218	C2-224	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	36.0	1	2	CFPR721N11S	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	36.0	3	1	CFPR721N5S	C2-225	C2-226	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	48.0	3	4	CFPR727E3S	C4-148	C4-149	222 (101)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	48.0	1	3	CFPR727E11S	C/F	C/F	222 (101)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	48.0	3	2	CFPR727E5S	C2-229	C2-230	222 (101)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	60.0	3	4	CFPR732N3S	C4-148	C4-149	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	60.0	1	3	CFPR732N11S	C/F	C/F	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	60.0	3	2	CFPR732N5S	C2-229	C2-230	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	72.0	3	4	CFPR738E3S	C4-148	C4-149	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	72.0	3	2	CFPR738E5S	C2-229	C2-230	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	100.0	3	4	CFPR751E5S	C4-156	C4-157	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	120.0	3	4	CFPR760N5S	C4-156	C4-157	360 (164)	93 (2361)	73 (1854)	66 (1676)

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### 6 inch - 150 lb ANSI Flange





# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters

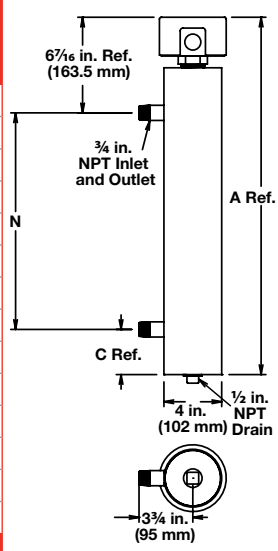


### Application: Process Water<sup>®</sup>

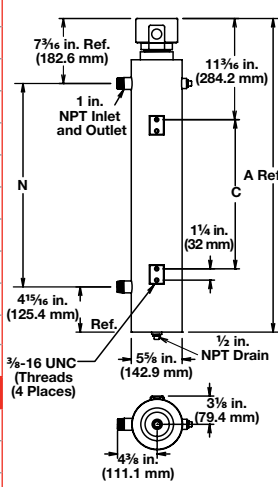
- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	Circ.	#	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
							Type J T/C	Type K T/C				
<b>1 1/4 inch NPT Screw Plug (FIREBAR)</b>												
45 W/in <sup>2</sup> <sup>®</sup> Steel Tank 1-Alloy 800 Element (7 W/cm <sup>2</sup> )	240	2.0	3	1	1	CBDNF13A27S	C2-50	C2-92	25 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	2.5	3	1	1	CBDNF15J27S	C2-50	C2-92	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	3.0	3	1	1	CBDNF18A27S	C2-50	C2-92	30 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	4.0	3	1	1	CBDNF22J27S	C2-50	C2-92	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	480	4.0	3	1	1	CBDNF22J28S	C2-43	C2-35	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	5.0	3	1	1	CBDNF27J27S	C2-50	C2-92	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	5.0	3	1	1	CBDNF27J28S	C2-43	C2-35	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	6.0	3	1	1	CBDNF32J27S	C2-50	C2-92	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	6.0	3	1	1	CBDNF32J28S	C2-43	C2-35	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	8.0	3	1	1	CBDNF42A27S	C2-50	C2-92	69 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	8.0	3	1	1	CBDNF42A28S	C2-43	C2-35	69 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	10.0	3	1	1	CBDNF51J27S	C2-50	C2-92	71 (33)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	10.0	3	1	1	CBDNF51J28S	C2-43	C2-35	71 (33)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
<b>2 1/2 inch NPT Screw Plug (WATROD)</b>												
48 W/in <sup>2</sup> <sup>®</sup> Steel Tank 3-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	6.0	3	1	1	CBLN717G3S	C2-50	C2-92	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	6.0	3	1	1	CBLN717G5S	C2-43	C2-35	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	7.5	3	1	1	CBLN719R3S	C2-50	C2-92	26 (12)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	7.5	3	1	1	CBLN719R5S	C2-43	C2-35	26 (12)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	9.0	3	1	1	CBLN724R3S	C2-50	C2-92	27 (13)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	9.0	3	1	1	CBLN724R5S	C2-43	C2-35	27 (13)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	12.0	3	1	1	CBLN732G3S	C2-236	C2-214	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	12.0	3	1	1	CBLN732G5S	C2-43	C2-35	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	15.0	3	1	1	CBLN739R3S	C2-236	C2-214	31 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	15.0	3	1	1	CBLN739R5S	C2-43	C2-35	31 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	240	18.0	3	1	1	CBLN747G3S	C2-236	C2-214	32 (15)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	18.0	3	1	1	CBLN747G5S	C2-43	C2-35	32 (15)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
<b>2 1/2 inch NPT Screw Plug (FIREBAR)</b>												
45 W/in <sup>2</sup> <sup>®</sup> Steel Tank 3-Alloy 800 Elements (7 W/cm <sup>2</sup> )	240	6.0	3	1	1	CBLNF12A27S	C2-50	C2-92	21 (10)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	7.5	3	1	1	CBLNF14J27S	C2-50	C2-92	22 (10)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	9.0	3	1	1	CBLNF17A27S	C2-50	C2-92	23 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	12.0	3	1	1	CBLNF21J27S	C2-236	C2-214	31 (14)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	12.0	3	1	1	CBLNF21J28S	C2-43	C2-35	31 (14)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	15.0	3	1	1	CBLNF26J27S	C2-236	C2-214	34 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	15.0	3	1	1	CBLNF26J28S	C2-43	C2-35	34 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	18.0	3	1	1	CBLNF31J27S	C2-236	C2-214	35 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	18.0	3	1	1	CBLNF31J28S	C2-43	C2-35	35 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	24.0	3	1	1	CBLNF41A28S	C2-225	C2-226	44 (20)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	30.0	3	1	1	CBLNF50J28S	C2-225	C2-226	52 (24)	63 <sup>3</sup> / <sub>4</sub> (1618)	51 <sup>1</sup> / <sub>2</sub> (1308)	46 <sup>1</sup> / <sub>2</sub> (1181)

1 1/4 inch NPT Screw Plug



2 1/2 inch NPT Screw Plug



® When steel vessel materials are used in this application, some rust may be present in the process media  
 ® Can be wired for 1-phase operation



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



### Application: Process Water<sup>®</sup>

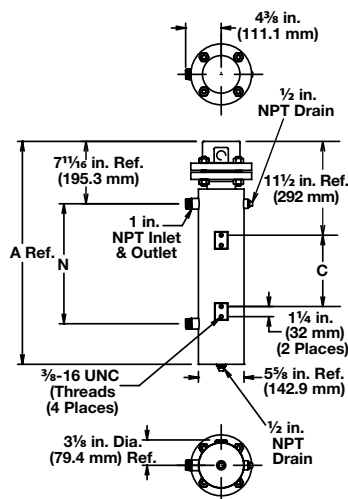
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>3 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>48 W/in<sup>2</sup> Steel Tank 3-Alloy 800 Elements (7.5 W/cm<sup>2</sup>)</b>	240	6.0	1	1	CFMN718A10S	C/F	C/F	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	6.0	3	1	CFMN718A3S	C2-50	C2-92	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	6.0	1	1	CFMN718A11S	C/F	C/F	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	6.0	3	1	CFMN718A5S	C2-43	C2-35	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	7.5	1	1	CFMN720J10S	C/F	C/F	70 (32)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	7.5	3	1	CFMN720J3S	C2-50	C2-92	70 (32)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	7.5	1	1	CFMN720J11S	C/F	C/F	70 (32)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	7.5	3	1	CFMN720J5S	C2-43	C2-35	70 (32)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	9.0	1	1	CFMN725J10S	C/F	C/F	78 (36)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	9.0	3	1	CFMN725J3S	C2-50	C2-92	78 (36)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	9.0	1	1	CFMN725J11S	C/F	C/F	78 (36)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	9.0	3	1	CFMN725J5S	C2-43	C2-35	78 (36)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	12.0	3	1	CFMN733A3S	C2-236	C2-214	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	12.0	1	1	CFMN733A11S	C/F	C/F	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	12.0	3	1	CFMN733A5S	C2-43	C2-35	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	15.0	3	1	CFMN740J3S	C2-236	C2-214	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	15.0	1	1	CFMN740J11S	C/F	C/F	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	15.0	3	1	CFMN740J5S	C2-43	C2-35	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	240	18.0	3	1	CFMN748A3S	C2-236	C2-214	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	18.0	1	1	CFMN748A11S	C/F	C/F	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
480	18.0	3	1	CFMN748A5S	C2-43	C2-35	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)	

® When steel vessel materials are used in this application, some rust may be present in the process media

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### 3 inch - 150 lb ANSI Flange





# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



### Application: Process Water<sup>®</sup>

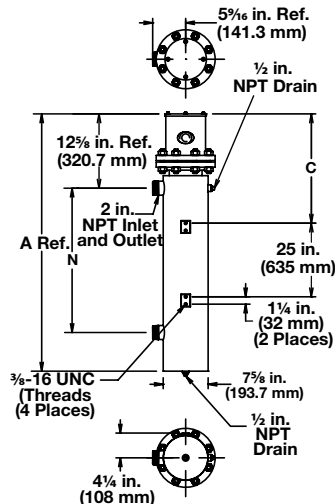
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>48 W/in<sup>2</sup> Steel Tank 6-Alloy 800 Elements (7.5 W/cm<sup>2</sup>)</b>	240	24.0	1	3	CFNN733A10S	C/F	C/F	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (377.8)
	240	24.0	3	2	CFNN733A3S	C2-218	C2-224	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (377.8)
	480	24.0	1	2	CFNN733A11S	C/F	C/F	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (377.8)
	480	24.0	3	1	CFNN733A5S	C2-225	C2-226	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (377.8)
	240	30.0	3	2	CFNN740J3S	C2-218	C2-224	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	30.0	1	2	CFNN740J11S	C/F	C/F	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	30.0	3	1	CFNN740J5S	C2-225	C2-226	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	36.0	3	2	CFNN748A3S	C2-218	C2-224	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)
	480	36.0	1	2	CFNN748A11S	C/F	C/F	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)
	480	36.0	3	1	CFNN748A5S	C2-225	C2-226	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>48 W/in<sup>2</sup> Steel Tank 9-Alloy 800 Elements (7.5 W/cm<sup>2</sup>)</b>	240	36.0	3	3	CFNN733A3XS	C4-144	C4-145	150 (68)	49 <sup>1</sup> / <sub>4</sub> (1249)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (377.8)
	480	36.0	1	3	CFNN733A11XS	C/F	C/F	150 (68)	49 <sup>1</sup> / <sub>4</sub> (1249)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (377.8)
	480	36.0	3	1	CFNN733A5XS	C2-225	C2-226	150 (68)	49 <sup>1</sup> / <sub>4</sub> (1249)	30 (762)	14 <sup>7</sup> / <sub>8</sub> (377.8)
	240	45.0	3	3	CFNN740J3XS	C4-144	C4-145	173 (79)	56 <sup>1</sup> / <sub>4</sub> (1427)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	45.0	1	3	CFNN740J11XS	C/F	C/F	173 (79)	56 <sup>1</sup> / <sub>4</sub> (1427)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	45.0	3	3	CFNN740J5XS	C4-150	C4-151	173 (79)	56 <sup>1</sup> / <sub>4</sub> (1427)	37 (940)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	54.0	3	3	CFNN748A3XS	C4-144	C4-145	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)
	480	54.0	1	3	CFNN748A11XS	C/F	C/F	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)
	480	54.0	3	3	CFNN748A5XS	C4-150	C4-151	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)

® When steel vessel materials are used in this application, some rust may be present in the process media

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### 5 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters

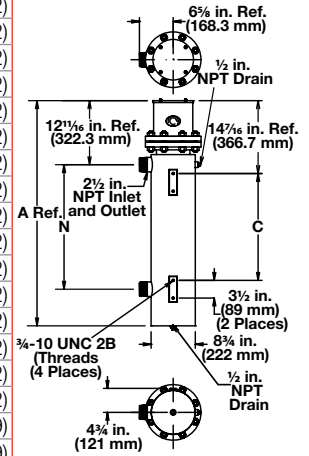


### Application: Process Water<sup>Ⓢ</sup>

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>											
48 W/in <sup>2</sup> Steel Tank	240	18.0	1	2	CFPN713G10S	C/F	C/F	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
12-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	18.0	3	1	CFPN713G3S	C2-236	C2-214	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	18.0	1	1	CFPN713G11S	C/F	C/F	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	18.0	3	1	CFPN713G5S	C2-43	C2-35	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	24.0	1	3	CFPN717R10S	C/F	C/F	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	24.0	3	2	CFPN717R3S	C2-218	C2-224	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	24.0	1	2	CFPN717R11S	C/F	C/F	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	24.0	3	1	CFPN717R5S	C2-225	C2-226	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	30.0	1	3	CFPN720G10S	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	30.0	3	2	CFPN720G3S	C2-218	C2-224	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	30.0	1	2	CFPN720G11S	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	30.0	3	1	CFPN720G5S	C2-225	C2-226	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	36.0	1	4	CFPN725G10S	C/F	C/F	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	36.0	3	2	CFPN725G3S	C2-218	C2-224	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	36.0	1	2	CFPN725G11S	C/F	C/F	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	36.0	3	1	CFPN725G5S	C2-225	C2-226	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	48.0	3	4	CFPN732R3S	C4-148	C4-149	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	48.0	1	3	CFPN732R11S	C/F	C/F	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	48.0	3	2	CFPN732R5S	C2-229	C2-230	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	60.0	3	4	CFPN740G3S	C4-148	C4-149	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	60.0	1	3	CFPN740G11S	C/F	C/F	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	60.0	3	2	CFPN740G5S	C2-229	C2-230	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	72.0	3	4	CFPN747R3S	C4-148	C4-149	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	72.0	3	2	CFPN747R5S	C2-229	C2-230	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>											
48 W/in <sup>2</sup> Steel Tank	240	23.0	1	3	CFPN713G10XS	C/F	C/F	215 (98)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
15-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	23.0	3	5	CFPN713G3XS	C4-143	C4-142	215 (98)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	23.0	1	1	CFPN713G11XS	C/F	C/F	215 (98)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	23.0	3	1	CFPN713G5XS	C2-225	C2-226	215 (98)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	30.0	1	3	CFPN717R10XS	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	30.0	3	5	CFPN717R3XS	C4-144	C4-145	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	30.0	1	3	CFPN717R11XS	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	30.0	3	1	CFPN717R5XS	C2-225	C2-226	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	38.0	1	5	CFPN720G10XS	C/F	C/F	223 (102)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	38.0	3	5	CFPN720G3XS	C4-144	C4-145	223 (102)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	38.0	1	3	CFPN720G11XS	C/F	C/F	223 (102)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	38.0	3	1	CFPN720G5XS	C2-225	C2-226	223 (102)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	45.0	1	5	CFPN725G10XS	C/F	C/F	226 (103)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	45.0	3	5	CFPN725G3XS	C4-144	C4-145	226 (103)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	45.0	1	3	CFPN725G11XS	C/F	C/F	226 (103)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	45.0	3	5	CFPN725G5XS	C4-150	C4-151	226 (103)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	60.0	3	5	CFPN732R3XS	C/F	C/F	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	60.0	1	3	CFPN732R11XS	C/F	C/F	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	60.0	3	5	CFPN732R5XS	C4-152	C4-153	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	75.0	3	5	CFPN740G3XS	C/F	C/F	296 (135)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	75.0	1	5	CFPN740G11XS	C/F	C/F	296 (135)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	75.0	3	5	CFPN740G5XS	C4-152	C4-153	296 (135)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	90.0	3	5	CFPN747R3XS	C/F	C/F	306 (139)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	90.0	3	5	CFPN747R5XS	C4-152	C4-153	306 (139)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)

6 inch - 150 lb ANSI Flange



<sup>Ⓢ</sup> When steel vessel materials are used in this application, some rust may be present in the process media  
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# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



### Application: Process Water<sup>®</sup>

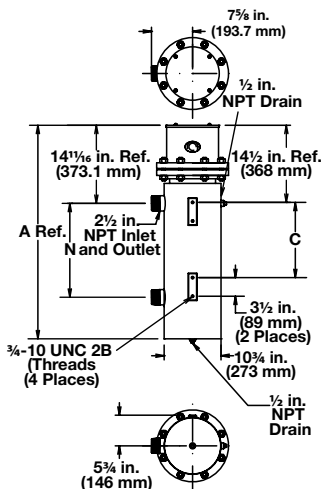
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	# Ph	Circ.	#	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
							Type J T/C	Type K T/C				
<b>8 inch - 150 lb ANSI Flange (WATROD)</b>												
48 W/in <sup>2</sup> Steel Tank 18-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	50.0	3	3	CFRN725N3S	C4-144	C4-145	350 (159)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)	
	480	50.0	1	3	CFRN725N11S	C/F	C/F	350 (159)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)	
	480	50.0	3	2	CFRN725N5S	C2-229	C2-230	350 (159)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)	
	240	75.0	3	6	CFRN735N3S	C/F	C/F	380 (173)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)	
	480	75.0	3	2	CFRN735N5S	C2-229	C2-230	380 (173)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)	
	240	100.0	3	6	CFRN744E3S	C/F	C/F	410 (186)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)	
	480	100.0	3	3	CFRN744E5S	C2-229	C2-230	410 (186)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)	
	240	125.0	3	6	CFRN754M3S	C/F	C/F	445 (202)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)	
	480	125.0	3	6	CFRN754M5S	C/F	C/F	445 (202)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)	
	480	150.0	3	6	CFRN763M5S	C/F	C/F	490 (223)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)	
	480	175.0	3	6	CFRN773D5S	C/F	C/F	530 (241)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)	
	480	200.0	3	6	CFRN782M5S	C/F	C/F	560 (254)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)	
	<b>8 inch - 150 lb ANSI Flange (WATROD)</b>											
48 W/in <sup>2</sup> Steel Tank 24-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	240	67.0	3	4	CFRN726D3XS	C4-148	C4-149	358 (163)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)	
	480	67.0	1	3	CFRN726D11XS	C/F	C/F	358 (163)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)	
	480	67.0	3	2	CFRN726D5XS	C2-229	C2-230	358 (163)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)	
	240	100.0	3	8	CFRN736D3XS	C/F	C/F	392 (178)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)	
	480	100.0	3	4	CFRN736D5XS	C4-156	C4-157	392 (178)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)	
	240	133.0	3	8	CFRN744M3XS	C/F	C/F	425 (193)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)	
	480	133.0	3	4	CFRN744M5XS	C4-156	C4-157	425 (193)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)	
	240	167.0	3	8	CFRN754M3XS	C/F	C/F	463 (210)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)	
	480	167.0	3	8	CFRN754M5XS	C/F	C/F	463 (210)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)	
	480	200.0	3	8	CFRN763M5XS	C/F	C/F	511 (232)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)	
	480	233.0	3	8	CFRN773D5XS	C/F	C/F	554 (252)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)	
	480	267.0	3	8	CFRN782M5XS	C/F	C/F	587 (267)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)	

⑤ When steel vessel materials are used in this application, some rust may be present in the process media

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### 8 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



### Application: Process Water<sup>⑤</sup>

- WATROD elements
- Without thermostat
- General purpose enclosure

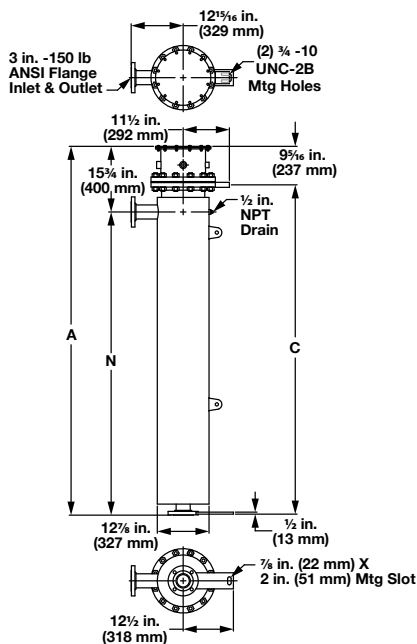
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)		"N" Dim. in. (mm)		"C" Dim. in. (mm)	
						Type J T/C	Type K T/C							
<b>10 inch - 150 lb ANSI Flange (WATROD)</b>														
48 W/in <sup>2</sup> <sup>⑧</sup> Steel Tank 27-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	480	262.0	3	9	CFSN773E5S	C/F	C/F	600 (273)	106 <sup>5</sup> / <sub>8</sub> (2708.3)	90 <sup>7</sup> / <sub>8</sub> (2308.2)	97 <sup>5</sup> / <sub>16</sub> (2471.7)			
<b>12 inch, 150 lb ANSI Flange (WATROD)</b>														
48 W/in <sup>2</sup> Steel Tank 36-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	480	350.0	3	12	CFTN773C5S	C/F	C/F	650 (295)	106 <sup>1</sup> / <sub>2</sub> (2705)	90 <sup>3</sup> / <sub>8</sub> (2295.5)	97 <sup>1</sup> / <sub>8</sub> (2467.0)			
<b>14 inch - 150 lb ANSI Flange (WATROD)</b>														
48 W/in <sup>2</sup> Steel Tank 45-Alloy 800 Elements (7.5 W/cm <sup>2</sup> )	480	315.0	3	15	CFWN754J5S	C/F	C/F	600 (273)	83 <sup>1</sup> / <sub>4</sub> (2115)	67 (1700)	73 <sup>11</sup> / <sub>16</sub> (1871.7)			
	480	375.0	3	15	CFWN763J5S	C/F	C/F	650 (295)	90 <sup>3</sup> / <sub>4</sub> (2305)	74 <sup>1</sup> / <sub>2</sub> (1891)	81 <sup>3</sup> / <sub>16</sub> (2062.2)			

⑤ When steel vessel materials are used in this application, some rust may be present in the process media

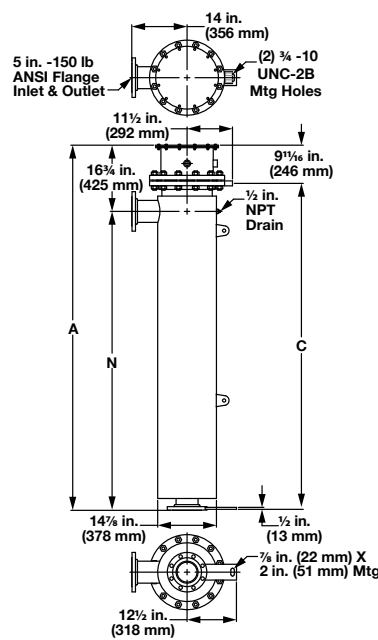
⑧ Can be wired for 1-phase operation

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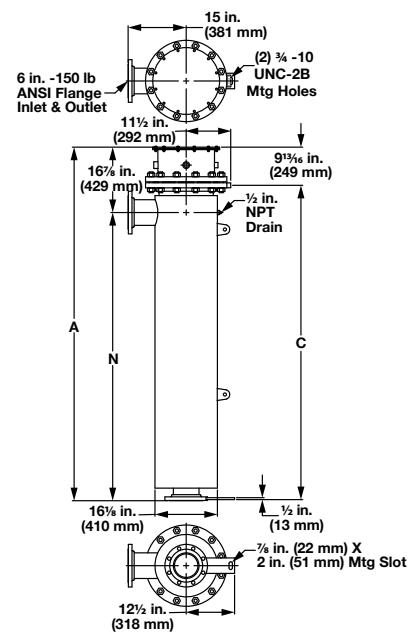
### 10 inch - 150 lb ANSI Flange



### 12 inch - 150 lb ANSI Flange



### 14 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



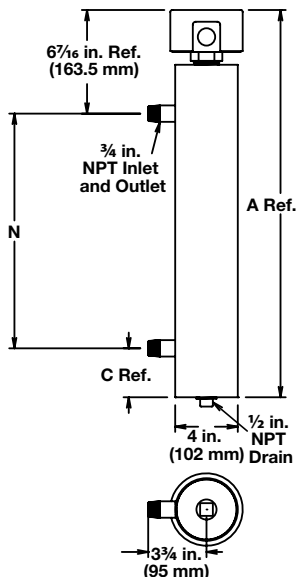
### Application: Forced Air and Caustic Solutions

- WATROD elements
- Without thermostat
- General purpose enclosure

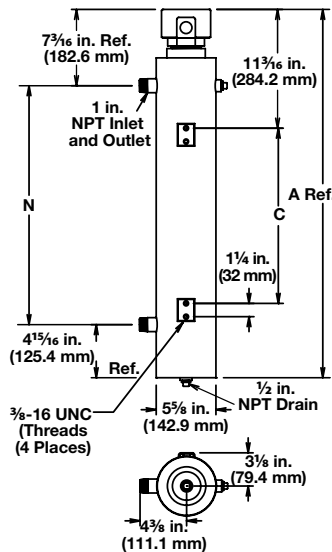
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>1 1/4 inch NPT Screw Plug (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 2-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	120	1.0	1	1	CBEN13G6S	C1-15	C1-12	21 (10)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	1.0	1	1	CBEN13G6S	C1-17	C1-13	21 (10)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	120	1.5	1	1	CBEN19A6S	C1-15	C1-12	29 (14)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	1.5	1	1	CBEN19A6S	C1-17	C1-13	29 (14)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	120	2.0	1	1	CBEN24G6S	C1-15	C1-12	29 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	2.0	1	1	CBEN24G6S	C1-17	C1-13	29 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
<b>2 1/2 inch NPT Screw Plug (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 3-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	240	3.0	3	1	CBLNA17G3S	C2-50	C2-92	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	3.0	3	1	CBLNA17G5S	C2-43	C2-35	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	4.5	3	1	CBLNA24R3S	C2-50	C2-92	27 (13)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	4.5	3	1	CBLNA24R5S	C2-43	C2-35	27 (13)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	6.0	3	1	CBLNA32G3S	C2-50	C2-92	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	6.0	3	1	CBLNA32G5S	C2-43	C2-35	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	7.5	3	1	CBLNA39R3S	C2-50	C2-92	31 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	7.5	3	1	CBLNA39R5S	C2-43	C2-35	31 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	240	9.0	3	1	CBLNA47G3S	C2-50	C2-92	32 (15)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	9.0	3	1	CBLNA47G5S	C2-43	C2-35	32 (15)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)

④ Wired for higher voltage

**1 1/4 inch NPT Screw Plug**



**2 1/2 inch NPT Screw Plug**



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



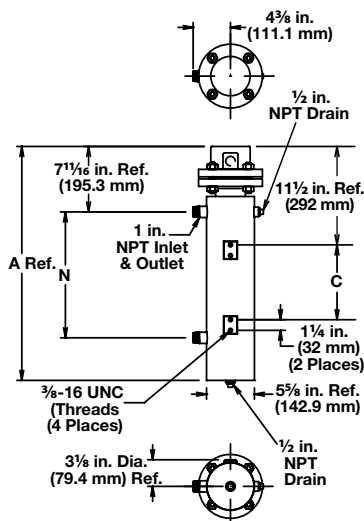
### Application: Forced Air and Caustic Solutions

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>3 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 3-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	240	3.0	1	1	CFMNA18A10S	C1-17	C1-13	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	3.0	3	1	CFMNA18A3S	C2-50	C2-92	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	3.0	1	1	CFMNA18A11S	C/F	C/F	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	3.0	3	1	CFMNA18A5S	C2-43	C2-35	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	4.5	1	1	CFMNA25J10S	C/F	C/F	78 (36)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	4.5	3	1	CFMNA25J3S	C2-50	C2-92	78 (36)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	4.5	1	1	CFMNA25J11S	C/F	C/F	78 (36)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	4.5	3	1	CFMNA25J5S	C2-43	C2-35	78 (36)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	6.0	1	1	CFMNA33A10S	C/F	C/F	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	6.0	3	1	CFMNA33A3S	C2-50	C2-92	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	6.0	1	1	CFMNA33A11S	C/F	C/F	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	6.0	3	1	CFMNA33A5S	C2-43	C2-35	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	7.5	1	1	CFMNA40J10S	C/F	C/F	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	240	7.5	3	1	CFMNA40J3S	C2-50	C2-92	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	7.5	1	1	CFMNA40J11S	C/F	C/F	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	7.5	3	1	CFMNA40J5S	C2-43	C2-35	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	240	9.0	1	1	CFMNA48A10S	C/F	C/F	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	240	9.0	3	1	CFMNA48A3S	C2-50	C2-92	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
480	9.0	1	1	CFMNA48A11S	C/F	C/F	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)	
480	9.0	3	1	CFMNA48A5S	C2-43	C2-35	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)	

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### 3 inch - 150 lb ANSI Flange







# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



### Application: Forced Air and Caustic Solutions

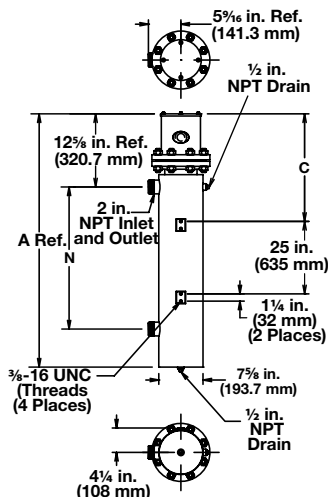
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>23 W/in<sup>2</sup> ⑥ Steel Tank 6-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	240	9.0	1	1	CFNNA25J10S	C/F	C/F	140 (64)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762.0)	14 <sup>7</sup> / <sub>8</sub> (377.8)
	240	9.0	3	1	CFNNA25J3S	C2-50	C2-92	140 (64)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762.0)	14 <sup>7</sup> / <sub>8</sub> (377.8)
	480	9.0	1	1	CFNNA25J11S	C/F	C/F	140 (64)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762.0)	14 <sup>7</sup> / <sub>8</sub> (377.8)
	480	9.0	3	1	CFNNA25J5S	C2-43	C2-35	140 (64)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30 (762.0)	14 <sup>7</sup> / <sub>8</sub> (377.8)
	240	12.0	1	2	CFNNA33A10S	C/F	C/F	145 (66)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	12.0	3	1	CFNNA33A3S	C2-236	C2-214	145 (66)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	12.0	1	1	CFNNA33A11S	C/F	C/F	145 (66)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	12.0	3	1	CFNNA33A5S	C2-43	C2-35	145 (66)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	15.0	1	2	CFNNA40J10S	C/F	C/F	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	15.0	3	1	CFNNA40J3S	C2-236	C2-214	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	15.0	1	1	CFNNA40J11S	C/F	C/F	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	15.0	3	1	CFNNA40J5S	C2-43	C2-35	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	18.0	1	2	CFNNA48A10S	C/F	C/F	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	240	18.0	3	1	CFNNA48A3S	C2-236	C2-214	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	480	18.0	1	1	CFNNA48A11S	C/F	C/F	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	480	18.0	3	1	CFNNA48A5S	C2-43	C2-35	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	240	25.0	3	2	CFNNA64J3S	C2-218	C2-224	195 (89)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	480	25.0	1	2	CFNNA64J11S	C/F	C/F	195 (89)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	480	25.0	3	1	CFNNA64J5S	C2-225	C2-226	195 (89)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	240	30.0	3	2	CFNNA77A3S	C2-218	C2-224	220 (100)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)
480	30.0	1	2	CFNNA77A11S	C/F	C/F	220 (100)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)	
480	30.0	3	1	CFNNA77A5S	C2-225	C2-226	220 (100)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)	

⑥ Can be wired 3-phase wye to produce 1/3 of the rated kW and watt density

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### 5 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



### Application: Forced Air and Caustic Solutions

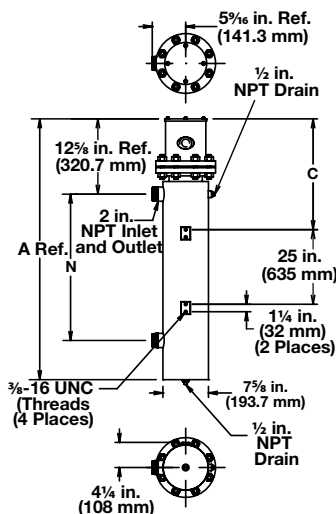
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)		"N" Dim. in. (mm)		"C" Dim. in. (mm)	
						Type J T/C	Type K T/C							
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>														
<b>23 W/in<sup>2</sup> ® Steel Tank 9-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	240	14.0	1	3	CFNNA25J10XS	C/F	C/F	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30	(762.0)	14 <sup>7</sup> / <sub>8</sub> (377.8)		
	240	14.0	3	1	CFNNA25J3XS	C2-236	C2-214	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30	(762.0)	14 <sup>7</sup> / <sub>8</sub> (377.8)		
	480	14.0	1	1	CFNNA25J11XS	C/F	C/F	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30	(762.0)	14 <sup>7</sup> / <sub>8</sub> (377.8)		
	480	14.0	3	1	CFNNA25J5XS	C2-43	C2-35	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249.0)	30	(762.0)	14 <sup>7</sup> / <sub>8</sub> (377.8)		
	240	18.0	1	3	CFNNA33A10XS	C/F	C/F	150 (68)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37	(940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)		
	240	18.0	3	1	CFNNA33A3XS	C2-236	C2-214	150 (68)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37	(940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)		
	480	18.0	1	1	CFNNA33A11XS	C/F	C/F	150 (68)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37	(940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)		
	480	18.0	3	1	CFNNA33A5XS	C2-43	C2-35	150 (68)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37	(940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)		
	240	23.0	1	3	CFNNA40J10XS	C/F	C/F	174 (79)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37	(940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)		
	240	23.0	3	3	CFNNA40J3XS	C4-143	C4-142	174 (79)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37	(940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)		
	480	23.0	1	1	CFNNA40J11XS	C/F	C/F	174 (79)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37	(940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)		
	480	23.0	3	1	CFNNA40J5XS	C2-225	C2-226	174 (79)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37	(940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)		
	240	27.0	1	3	CFNNA48A10XS	C/F	C/F	189 (86)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)		25 (633.0)		
	240	27.0	3	3	CFNNA48A3XS	C4-143	C4-142	189 (86)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)		25 (633.0)		
	480	27.0	1	3	CFNNA48A11XS	C/F	C/F	189 (86)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)		25 (633.0)		
	480	27.0	3	1	CFNNA48A5XS	C2-225	C2-226	189 (86)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)		25 (633.0)		
	240	38.0	3	3	CFNNA64J3XS	C4-144	C4-145	207 (94)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)		25 (633.0)		
	480	38.0	1	3	CFNNA64J11XS	C/F	C/F	207 (94)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)		25 (633.0)		
	480	38.0	3	1	CFNNA64J5XS	C2-225	C2-226	207 (94)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)		25 (633.0)		
	240	45.0	3	3	CFNNA77A3XS	C4-144	C4-145	233 (106)	94 <sup>1</sup> / <sub>8</sub> (2389.0)	75 (1902.0)		25 (633.0)		
480	45.0	1	3	CFNNA77A11XS	C/F	C/F	233 (106)	94 <sup>1</sup> / <sub>8</sub> (2389.0)	75 (1902.0)		25 (633.0)			
480	45.0	3	3	CFNNA77A5XS	C4-150	C4-151	233 (106)	94 <sup>1</sup> / <sub>8</sub> (2389.0)	75 (1902.0)		25 (633.0)			

® Can be wired 3-phase wye to produce 1/3 of the rated kW and watt density

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### 5 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



### Application: Forced Air and Caustic Solutions

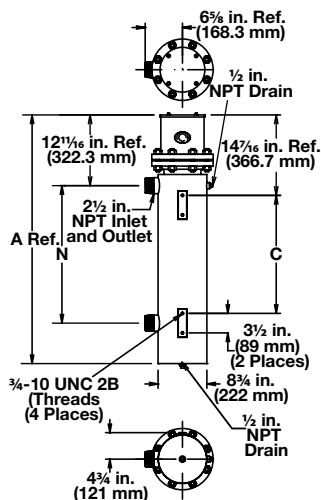
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)	
						Type J T/C	Type K T/C					
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>												
<b>23 W/in<sup>2</sup> © Steel Tank 12-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	240	12.0	1	2	CFPNA17R10S	C/F	C/F	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
	240	12.0	3	1	CFPNA17R3S	C2-236	C2-214	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
	480	12.0	1	1	CFPNA17R11S	C/F	C/F	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
	480	12.0	3	1	CFPNA17R5S	C2-43	C2-35	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
	240	18.0	1	2	CFPNA25G10S	C/F	C/F	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
	240	18.0	3	1	CFPNA25G3S	C2-236	C2-214	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
	480	18.0	1	1	CFPNA25G11S	C/F	C/F	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
	480	18.0	3	1	CFPNA25G5S	C2-43	C2-35	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	
	240	24.0	1	3	CFPNA32R10S	C/F	C/F	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)	
	240	24.0	3	2	CFPNA32R3S	C2-218	C2-224	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)	
	480	24.0	1	2	CFPNA32R11S	C/F	C/F	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)	
	480	24.0	3	1	CFPNA32R5S	C2-225	C2-226	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)	
	240	30.0	1	3	CFPNA40G10S	C/F	C/F	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
	240	30.0	3	2	CFPNA40G3S	C2-218	C2-224	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
	480	30.0	1	2	CFPNA40G11S	C/F	C/F	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
	480	30.0	3	1	CFPNA40G5S	C2-225	C2-226	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
	240	36.0	1	4	CFPNA47R10S	C/F	C/F	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
	240	36.0	3	2	CFPNA47R3S	C2-218	C2-224	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
	480	36.0	1	2	CFPNA47R11S	C/F	C/F	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
	480	36.0	3	1	CFPNA47R5S	C2-225	C2-226	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)	
	240	50.0	3	4	CFPNA64G3S	C4-148	C4-149	360 (164)	93 (2361)	73 (1854)	66 (1676)	
	480	50.0	1	3	CFPNA64G11S	C/F	C/F	360 (164)	93 (2361)	73 (1854)	66 (1676)	
	480	50.0	3	2	CFPNA64G5S	C2-229	C2-230	360 (164)	93 (2361)	73 (1854)	66 (1676)	
	240	60.0	3	4	CFPNA76R3S	C4-148	C4-149	368 (167)	93 (2361)	73 (1854)	66 (1676)	
480	60.0	1	3	CFPNA76R11S	C/F	C/F	368 (167)	93 (2361)	73 (1854)	66 (1676)		
480	60.0	3	2	CFPNA76R5S	C2-229	C2-230	368 (167)	93 (2361)	73 (1854)	66 (1676)		

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### 6 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



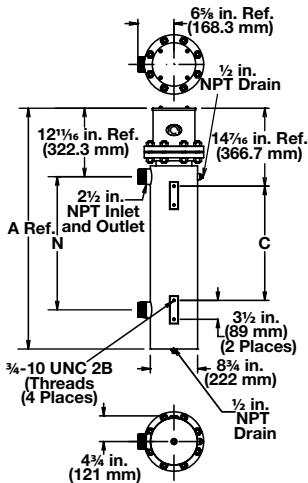
### Application: Forced Air and Caustic Solutions

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)		"N" Dim. in. (mm)		"C" Dim. in. (mm)	
						Type J T/C	Type K T/C							
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>														
<b>23 W/in<sup>2</sup> Steel Tank 15-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	240	15.0	1	3	CFPNA17R10XS	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)		
	240	15.0	3	1	CFPNA17R3XS	C2-236	C2-214	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)		
	480	15.0	1	1	CFPNA17R11XS	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)		
	480	15.0	3	1	CFPNA17R5XS	C2-43	C2-35	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)		
	240	23.0	1	3	CFPNA25G10XS	C/F	C/F	226 (103)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)		
	240	23.0	3	5	CFPNA25G3XS	C4-143	C4-142	226 (103)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)		
	480	23.0	1	1	CFPNA25G11XS	C/F	C/F	226 (103)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)		
	480	23.0	3	1	CFPNA25G5XS	C2-225	C2-226	226 (103)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)		
	240	30.0	1	3	CFPNA32R10XS	C/F	C/F	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub>	(699)		
	240	30.0	3	5	CFPNA32R3XS	C4-144	C4-145	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub>	(699)		
	480	30.0	1	3	CFPNA32R11XS	C/F	C/F	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub>	(699)		
	480	30.0	3	1	CFPNA32R5XS	C2-224	C2-226	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub>	(699)		
	240	38.0	1	5	CFPNA40G10XS	C/F	C/F	296 (135)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)		
	240	38.0	3	5	CFPNA40G3XS	C4-144	C4-145	296 (135)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)		
	480	38.0	1	3	CFPNA40G11XS	C/F	C/F	296 (135)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)		
	480	38.0	3	1	CFPNA40G5XS	C2-225	C2-226	296 (135)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)		
	240	45.0	1	5	CFPNA47R10XS	C/F	C/F	306 (139)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)		
	240	45.0	3	5	CFPNA47R3XS	C4-144	C4-145	306 (139)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)		
	480	45.0	1	3	CFPNA47R11XS	C/F	C/F	306 (139)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)		
	480	45.0	3	5	CFPNA47R5XS	C4-152	C4-153	306 (139)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)		
240	63.0	3	5	CFPNA64G3XS	C/F	C/F	370 (168)	93 (2361)	73 (1854)	66	(1676)			
480	63.0	1	3	CFPNA64G11XS	C/F	C/F	370 (168)	93 (2361)	73 (1854)	66	(1676)			
480	63.0	3	5	CFPNA64G5XS	C4-152	C4-153	370 (168)	93 (2361)	73 (1854)	66	(1676)			
240	75.0	3	5	CFPNA76R3XS	C/F	C/F	381 (173)	93 (2361)	73 (1854)	66	(1676)			
480	75.0	1	5	CFPNA76R11XS	C/F	C/F	381 (173)	93 (2361)	73 (1854)	66	(1676)			
480	75.0	3	5	CFPNA76R5XS	C4-152	C4-153	381 (173)	93 (2361)	73 (1854)	66	(1676)			

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### 6 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



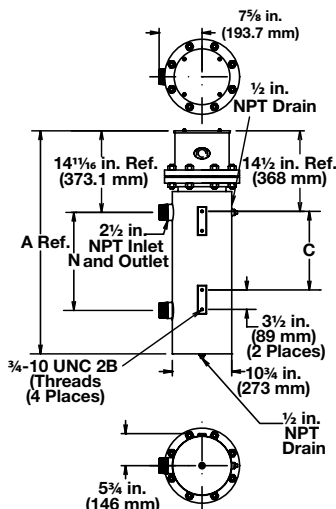
### Application: Forced Air and Caustic Solutions

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>8 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 18-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	240	30.0	1	3	CFRNA32N10S	C/F	C/F	370 (168)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	240	30.0	3	2	CFRNA32N3S	C2-218	C2-224	370 (168)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	480	30.0	1	2	CFRNA32N11S	C/F	C/F	370 (168)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	480	30.0	3	1	CFRNA32N5S	C2-225	C2-226	370 (168)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	240	40.0	3	3	CFRNA43E3S	C4-144	C4-145	410 (186)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	40.0	1	2	CFRNA43E11S	C/F	C/F	410 (186)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	40.0	3	3	CFRNA43E5S	C4-150	C4-151	410 (186)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	240	50.0	3	3	CFRNA51M3S	C4-144	C4-145	440 (200)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	480	50.0	1	3	CFRNA51M11S	C/F	C/F	440 (200)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
480	50.0	3	2	CFRNA51M5S	C2-229	C2-230	440 (200)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)	
<b>8 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 24-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	240	40.0	1	4	CFRNA33D10XS	C/F	C/F	382 (174)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	240	40.0	3	4	CFRNA33D3XS	C4-146	C4-147	382 (174)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	480	40.0	1	2	CFRNA33D11XS	C/F	C/F	382 (174)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	480	40.0	3	2	CFRNA33D5XS	C2-227	C2-228	382 (174)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	240	53.0	3	4	CFRNA43M3XS	C4-148	C4-149	425 (193)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	53.0	1	3	CFRNA43M11XS	C/F	C/F	425 (193)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	53.0	3	2	CFRNA43M5XS	C2-229	C2-230	425 (193)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	240	67.0	3	4	CFRNA51M3XS	C4-148	C4-149	457 (207)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	480	67.0	1	3	CFRNA51M11XS	C/F	C/F	457 (207)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
480	67.0	3	2	CFRNA51M5XS	C2-229	C2-230	457 (207)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)	

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### 8 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



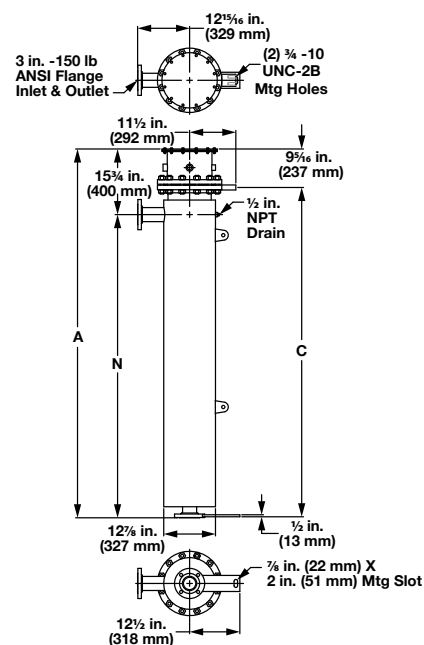
### Application: Forced Air and Caustic Solutions

- WATROD elements
- Without thermostat
- General purpose enclosure

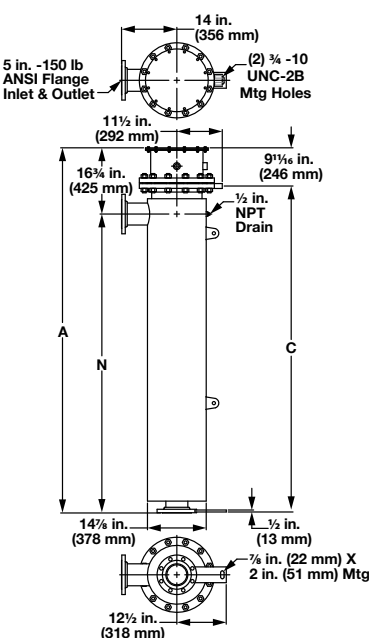
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>10 inch - 150 lb ANSI Flange (WATROD)</b>											
23 W/in <sup>2</sup> Steel Tank 27-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	240	60.0	3	3	CFSNA43N3S	C4-144	C4-145	515 (234)	76 <sup>5</sup> / <sub>8</sub> (1946.3)	60 <sup>7</sup> / <sub>8</sub> (1546.2)	67 <sup>5</sup> / <sub>16</sub> (1709.7)
	480	60.0	3	3	CFSNA43N5S	C4-150	C4-151	515 (234)	76 <sup>5</sup> / <sub>8</sub> (1946.3)	60 <sup>7</sup> / <sub>8</sub> (1546.2)	67 <sup>5</sup> / <sub>16</sub> (1709.7)
	240	75.0	3	9	CFSNA51N3S	C/F	C/F	530 (241)	84 <sup>1</sup> / <sub>8</sub> (2136.8)	68 <sup>3</sup> / <sub>8</sub> (1736.2)	74 <sup>13</sup> / <sub>16</sub> (1900.2)
	480	75.0	3	3	CFSNA51N5S	C4-152	C4-153	530 (241)	84 <sup>1</sup> / <sub>8</sub> (2136.8)	68 <sup>3</sup> / <sub>8</sub> (1736.2)	74 <sup>13</sup> / <sub>16</sub> (1900.2)
<b>12 inch - 150 lb ANSI Flange (WATROD)</b>											
23 W/in <sup>2</sup> Steel Tank 36-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	480	80.0	3	3	CFTNA43L5S	C4-152	C4-153	565 (257)	76 <sup>7</sup> / <sub>8</sub> (1952.6)	60 <sup>3</sup> / <sub>4</sub> (1541)	67 <sup>1</sup> / <sub>2</sub> (1714.0)
	480	100.0	3	3	CFTNA51L5S	C4-152	C4-153	585 (266)	84 <sup>3</sup> / <sub>8</sub> (2143.1)	68 <sup>1</sup> / <sub>4</sub> (1732)	75 (1905.0)
<b>14 inch - 150 lb ANSI Flange (WATROD)</b>											
23 W/in <sup>2</sup> Steel Tank 45-Alloy 800 Elements (3.6 W/cm <sup>2</sup> )	480	100.0	3	3	CFWNA43J5S	C4-152	C4-153	570 (259)	75 <sup>3</sup> / <sub>4</sub> (1924)	59 <sup>1</sup> / <sub>2</sub> (1510)	66 <sup>3</sup> / <sub>16</sub> (1681.2)
	480	125.0	3	5	CFWNA51J5S	C/F	C/F	590 (268)	83 <sup>1</sup> / <sub>4</sub> (2115)	67 (1700)	73 <sup>11</sup> / <sub>16</sub> (1871.7)

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

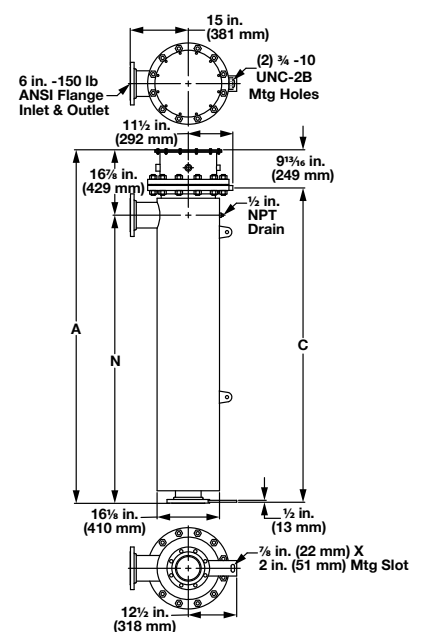
### 10 inch - 150 lb ANSI Flange



### 12 inch - 150 lb ANSI Flange



### 14 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters

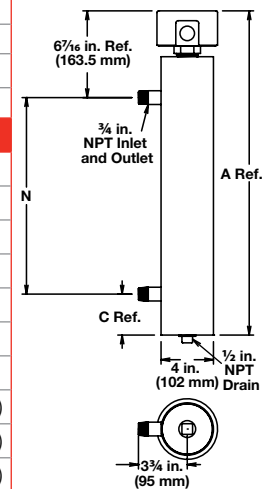


### Application: Lightweight Oils and Heat Transfer Oils

- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>1 1/4 inch NPT Screw Plug (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank</b>	120	1.5	1	1	CBES19G6S	C1-15	C1-12	29 (14)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	1.5	1	1	CBES19G6S	C1-17	C1-13	29 (14)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
<b>2-Steel Element (3.6 W/cm<sup>2</sup>)</b>	120	2.0	1	1	CBES25G6S	C1-15	C1-12	29 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 (76.0)
	240	2.0	1	1	CBES25G6S	C1-17	C1-13	29 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 (76.0)
<b>1 1/4 inch NPT Screw Plug (FIREBAR)</b>											
<b>30 W/in<sup>2</sup> Steel Tank</b>	240	1.7	3	1	CBDNF16G12S	C2-50	C2-92	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	480	1.7	3	1	CBDNF16G13S	C2-43	C2-35	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
<b>1-Alloy 800 Element (4.7 W/cm<sup>2</sup>)</b>	240	2.2	3	1	CBDNF19G12S	C2-50	C2-92	30 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	480	2.2	3	1	CBDNF19G13S	C2-43	C2-35	30 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	2.8	3	1	CBDNF24L12S	C2-50	C2-92	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	480	2.8	3	1	CBDNF24L13S	C2-43	C2-35	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	3.5	3	1	CBDNF29R12S	C2-50	C2-92	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	3.5	3	1	CBDNF29R13S	C2-43	C2-35	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	4.3	3	1	CBDNF34R12S	C2-50	C2-92	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	4.3	3	1	CBDNF34R13S	C2-43	C2-35	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	5.7	3	1	CBDNF45G12S	C2-50	C2-92	69 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	5.7	3	1	CBDNF45G13S	C2-43	C2-35	69 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	7.2	3	1	CBDNF55R12S	C2-50	C2-92	71 (33)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	7.2	3	1	CBDNF55R13S	C2-43	C2-35	71 (33)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
<b>1 1/4 inch NPT Screw Plug (FIREBAR)</b>											
<b>23 W/in<sup>2</sup> Steel Tank</b>	240	1.25	3	1	CBDNF16G20S	C2-50	C2-92	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	1.65	3	1	CBDNF19G20S	C2-50	C2-92	30 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
<b>1-Alloy 800 Element (3.6 W/cm<sup>2</sup>)</b>	240	2.15	3	1	CBDNF24L20S	C2-50	C2-92	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	480	2.15	3	1	CBDNF24L19S	C2-43	C2-35	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	2.65	3	1	CBDNF29R20S	C2-50	C2-92	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	2.65	3	1	CBDNF29R19S	C2-43	C2-35	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	3.20	3	1	CBDNF34R20S	C2-50	C2-92	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	3.20	3	1	CBDNF34R19S	C2-43	C2-35	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	4.25	3	1	CBDNF45G20S	C2-50	C2-92	69 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	4.25	3	1	CBDNF45G19S	C2-43	C2-35	69 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	5.40	3	1	CBDNF55R20S	C2-50	C2-92	71 (33)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	5.40	3	1	CBDNF55R19S	C2-43	C2-35	71 (33)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)

1 1/4 inch NPT Screw Plug



④ Wired for higher voltage



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters

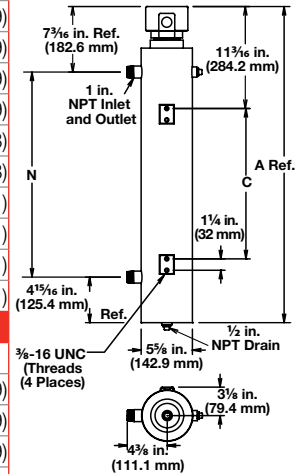


### Application: Lightweight Oils and Heat Transfer Oils

- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>2 1/2 inch NPT Screw Plug (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 3-Steel (3.6 W/cm<sup>2</sup>)</b>	240	3.0	3	1	CBL5717E3S	C2-50	C2-92	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	3.0	3	1	CBL5717E5S	C2-43	C2-35	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	4.5	3	1	CBL5724N3S	C2-50	C2-92	27 (13)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	4.5	3	1	CBL5724N5S	C2-43	C2-35	27 (13)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	6.0	3	1	CBL5732E3S	C2-50	C2-92	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	6.0	3	1	CBL5732E5S	C2-43	C2-35	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	7.5	3	1	CBL5739N3S	C2-50	C2-92	31 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	7.5	3	1	CBL5739N5S	C2-43	C2-35	31 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	240	9.0	3	1	CBL5747E3S	C2-50	C2-92	32 (15)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
480	9.0	3	1	CBL5747E5S	C2-43	C2-35	32 (15)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)	
<b>2 1/2 inch NPT Screw Plug (FIREBAR)</b>											
<b>30 W/in<sup>2</sup> Steel Tank 3-Alloy 800 Elements (4.7 W/cm<sup>2</sup>)</b>	240	5.0	3	1	CBLNF15C12S	C2-50	C2-92	22 (10)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	5.0	3	1	CBLNF15C13S	C2-43	C2-35	22 (10)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	6.5	3	1	CBLNF18C12S	C2-50	C2-92	23 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	6.5	3	1	CBLNF18C13S	C2-43	C2-35	23 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	8.5	3	1	CBLNF23C12S	C2-50	C2-92	31 (14)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	8.5	3	1	CBLNF23C13S	C2-43	C2-35	31 (14)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	10.5	3	1	CBLNF28L12S	C2-236	C2-214	34 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	10.5	3	1	CBLNF28L13S	C2-43	C2-35	34 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	12.8	3	1	CBLNF33L12S	C2-236	C2-214	35 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	12.8	3	1	CBLNF33L13S	C2-43	C2-35	35 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	17.0	3	1	CBLNF44C12S	C2-236	C2-214	44 (20)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	17.0	3	1	CBLNF44C13S	C2-43	C2-35	44 (20)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	21.5	3	1	CBLNF54L13S	C2-225	C2-226	52 (24)	63 <sup>3</sup> / <sub>4</sub> (1618)	51 <sup>1</sup> / <sub>2</sub> (1308)	46 <sup>1</sup> / <sub>2</sub> (1181)
<b>2 1/2 inch NPT Screw Plug (FIREBAR)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 3-Alloy 800 Elements (3.6 W/cm<sup>2</sup>)</b>	240	3.80	3	1	CBLNF15C20S	C2-50	C2-92	22 (10)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	4.90	3	1	CBLNF18C20S	C2-50	C2-92	23 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	6.40	3	1	CBLNF23C20S	C2-50	C2-92	31 (14)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	6.40	3	1	CBLNF23C19S	C2-43	C2-35	31 (14)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	7.90	3	1	CBLNF28L20S	C2-50	C2-92	34 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	7.90	3	1	CBLNF28L19S	C2-43	C2-35	34 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	9.60	3	1	CBLNF33L20S	C2-50	C2-92	35 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	9.60	3	1	CBLNF33L19S	C2-43	C2-35	35 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	12.80	3	1	CBLNF44C20S	C2-236	C2-214	44 (20)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	12.80	3	1	CBLNF44C19S	C2-43	C2-35	44 (20)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	240	16.10	3	1	CBLNF54L20S	C2-236	C2-214	52 (24)	63 <sup>3</sup> / <sub>4</sub> (1618)	51 <sup>1</sup> / <sub>2</sub> (1308)	46 <sup>1</sup> / <sub>2</sub> (1181)
	480	16.10	3	1	CBLNF54L19S	C2-43	C2-35	52 (24)	63 <sup>3</sup> / <sub>4</sub> (1618)	51 <sup>1</sup> / <sub>2</sub> (1308)	46 <sup>1</sup> / <sub>2</sub> (1181)

2 1/2 inch NPT Screw Plug



③ Wired for 3-phase operation only  
 ⑧ Can be wired for 1-phase operation

# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters

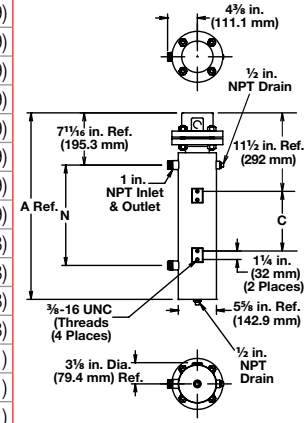


### Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

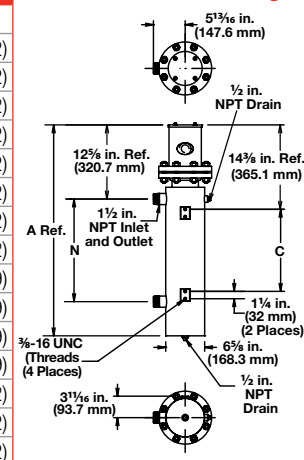
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>3 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 3-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	240	3.0	1	1	CFMS718A10S	C1-17	C1-13	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	3.0	3	1	CFMS718A3S	C2-50	C2-92	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	3.0	1	1	CFMS718A11S	C/F	C/F	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	3.0	3	1	CFMS718A5S	C2-43	C2-35	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	4.5	1	1	CFMS725J10S	C/F	C/F	78 (36)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	4.5	3	1	CFMS725J3S	C2-50	C2-92	78 (36)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	4.5	1	1	CFMS725J11S	C/F	C/F	78 (36)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	4.5	3	1	CFMS725J5S	C2-43	C2-35	78 (36)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	6.0	1	2	CFMS733A10S	C/F	C/F	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	6.0	3	1	CFMS733A3S	C2-50	C2-92	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	6.0	1	1	CFMS733A11S	C/F	C/F	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	6.0	3	1	CFMS733A5S	C2-43	C2-35	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	7.5	1	2	CFMS740J10S	C/F	C/F	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	240	7.5	3	1	CFMS740J3S	C2-50	C2-92	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	7.5	1	1	CFMS740J11S	C/F	C/F	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	7.5	3	1	CFMS740J5S	C2-43	C2-35	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	240	9.0	1	2	CFMS748A10S	C/F	C/F	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	240	9.0	3	1	CFMS748A3S	C2-50	C2-92	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	9.0	1	1	CFMS748A11S	C/F	C/F	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	9.0	3	1	CFMS748A5S	C2-43	C2-35	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)

### 3 inch - 150 lb ANSI Flange



<b>4 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 6-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	240	6.0	1	1	CFOS718A10S	C/F	C/F	125 (57)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	6.0	3	1	CFOS718A3S	C2-50	C2-92	125 (57)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	6.0	1	1	CFOS718A11S	C/F	C/F	125 (57)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	6.0	3	1	CFOS718A5S	C2-43	C2-35	125 (57)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	9.0	1	1	CFOS725J10S	C/F	C/F	160 (73)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	9.0	3	1	CFOS725J3S	C2-50	C2-92	160 (73)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	9.0	1	1	CFOS725J11S	C/F	C/F	160 (73)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	9.0	3	1	CFOS725J5S	C2-43	C2-35	160 (73)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	12.0	1	2	CFOS733A10S	C/F	C/F	163 (74)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	12.0	3	1	CFOS733A3S	C2-236	C2-214	163 (74)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	12.0	1	1	CFOS733A11S	C/F	C/F	163 (74)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	12.0	3	1	CFOS733A5S	C2-43	C2-35	163 (74)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	15.0	1	2	CFOS740J10S	C/F	C/F	229(104)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	15.0	3	1	CFOS740J3S	C2-236	C2-214	229(104)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	15.0	1	1	CFOS740J11S	C/F	C/F	229(104)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	15.0	3	1	CFOS740J5S	C2-43	C2-35	229(104)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	18.0	1	2	CFOS748A10S	C/F	C/F	234(107)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	18.0	3	1	CFOS748A3S	C2-236	C2-214	234(107)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	18.0	1	1	CFOS748A11S	C/F	C/F	234(107)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	18.0	3	1	CFOS748A5S	C2-43	C2-35	234(107)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	25.0	3	2	CFOS764J3S	C2-218	C2-224	298(136)	91 <sup>1</sup> / <sub>2</sub> (2326)	73 (1854)	66 (1676)
	480	25.0	1	2	CFOS764J11S	C/F	C/F	298(136)	91 <sup>1</sup> / <sub>2</sub> (2326)	73 (1854)	66 (1676)
	480	25.0	3	1	CFOS764J5S	C2-225	C2-226	298(136)	91 <sup>1</sup> / <sub>2</sub> (2326)	73 (1854)	66 (1676)
	240	30.0	3	2	CFOS777A3S	C2-218	C2-224	306(139)	91 <sup>1</sup> / <sub>2</sub> (2326)	73 (1854)	66 (1676)
	480	30.0	1	2	CFOS777A11S	C/F	C/F	306(139)	91 <sup>1</sup> / <sub>2</sub> (2326)	73 (1854)	66 (1676)
	480	30.0	3	1	CFOS777A5S	C2-225	C2-226	306(139)	91 <sup>1</sup> / <sub>2</sub> (2326)	73 (1854)	66 (1676)

### 4 inch - 150 lb ANSI Flange



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# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



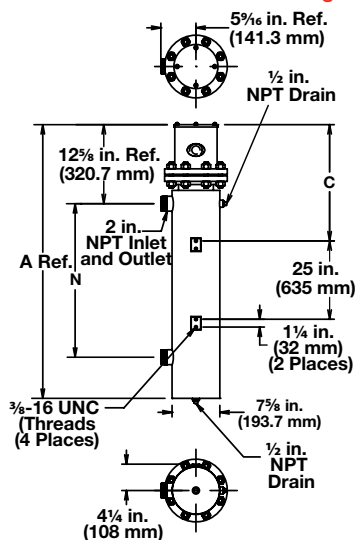
### Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 6-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	240	12.0	1	2	CFNS733A10S	C/F	C/F	145 (66)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	12.0	3	1	CFNS733A3S	C2-236	C2-214	145 (66)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	12.0	1	1	CFNS733A11S	C/F	C/F	145 (66)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	12.0	3	1	CFNS733A5S	C2-43	C2-35	145 (66)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	15.0	1	2	CFNS740J10S	C/F	C/F	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	15.0	3	1	CFNS740J3S	C2-236	C2-214	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	15.0	1	1	CFNS740J11S	C/F	C/F	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	15.0	3	1	CFNS740J5S	C2-43	C2-35	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	18.0	1	2	CFNS748A10S	C/F	C/F	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	18.0	3	1	CFNS748A3S	C2-236	C2-214	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	18.0	1	1	CFNS748A11S	C/F	C/F	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	480	18.0	3	1	CFNS748A5S	C2-43	C2-35	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	18 <sup>5</sup> / <sub>8</sub> (473.1)
	240	25.0	3	2	CFNS764J3S	C2-218	C2-224	195 (89)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	480	25.0	1	2	CFNS764J11S	C/F	C/F	195 (89)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	480	25.0	3	1	CFNS764J5S	C2-225	C2-226	195 (89)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	240	30.0	3	2	CFNS777A3S	C2-218	C2-224	220 (100)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)
480	30.0	1	2	CFNS777A11S	C/F	C/F	220 (100)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)	
480	30.0	3	1	CFNS777A5S	C2-225	C2-226	220 (100)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)	

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### 5 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



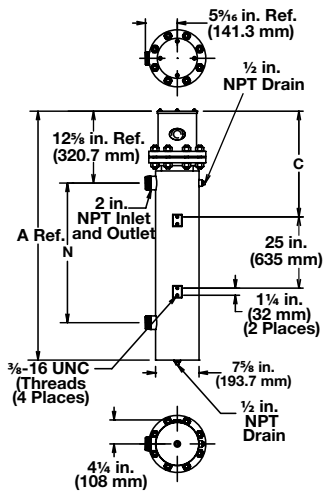
### Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	#	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 9-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	240	18.0	1	3	CFNS733A10XS	C/F	C/F	150 (68)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (471.1)
	240	18.0	3	1	CFNS733A3XS	C2-236	C2-214	150 (68)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (471.1)
	480	18.0	1	1	CFNS733A11XS	C/F	C/F	150 (68)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (471.1)
	480	18.0	3	1	CFNS733A5XS	C2-43	C2-35	150 (68)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (471.1)
	240	23.0	1	3	CFNS740J10XS	C/F	C/F	173 (79)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (471.1)
	240	23.0	3	3	CFNS740J3XS	C4-143	C4-142	173 (79)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (471.1)
	480	23.0	1	1	CFNS740J11XS	C/F	C/F	173 (79)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (471.1)
	480	23.0	3	1	CFNS740J5XS	C2-225	C2-226	173 (79)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	18 <sup>5</sup> / <sub>8</sub> (471.1)
	240	27.0	1	3	CFNS748A10XS	C/F	C/F	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	240	27.0	3	3	CFNS748A3XS	C4-143	C4-142	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	480	27.0	1	3	CFNS748A11XS	C/F	C/F	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	480	27.0	3	1	CFNS748A5XS	C2-225	C2-226	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	240	38.0	3	3	CFNS764J3XS	C4-144	C4-145	206 (94)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	480	38.0	1	3	CFNS764J11XS	C/F	C/F	206 (94)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	480	38.0	3	1	CFNS764J5XS	C2-225	C2-226	206 (94)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	240	45.0	3	3	CFNS777A3XS	C4-144	C4-145	233 (106)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)
480	45.0	1	3	CFNS777A11XS	C/F	C/F	233 (106)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)	
480	45.0	3	3	CFNS777A5XS	C4-150	C4-151	233 (106)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)	

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### 5 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



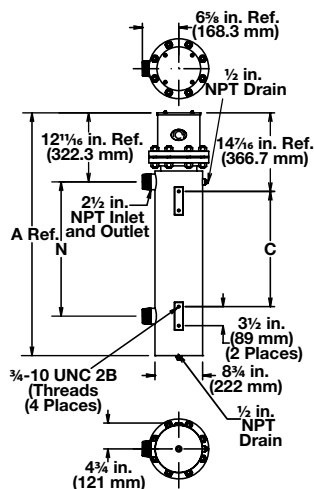
### Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 12-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	240	12.0	1	2	CFPS717R10S	C/F	C/F	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	12.0	3	1	CFPS717R3S	C2-236	C2-214	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	12.0	1	1	CFPS717R11S	C/F	C/F	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	12.0	3	1	CFPS717R5S	C2-43	C2-35	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	18.0	1	2	CFPS725G10S	C/F	C/F	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	18.0	3	1	CFPS725G3S	C2-236	C2-214	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	18.0	1	1	CFPS725G11S	C/F	C/F	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	18.0	3	1	CFPS725G5S	C2-43	C2-35	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	24.0	1	3	CFPS732R10S	C/F	C/F	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	24.0	3	2	CFPS732R3S	C2-218	C2-224	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	24.0	1	2	CFPS732R11S	C/F	C/F	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	24.0	3	1	CFPS732R5S	C2-225	C2-226	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	30.0	1	3	CFPS740G10S	C/F	C/F	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	30.0	3	2	CFPS740G3S	C2-218	C2-224	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	30.0	1	2	CFPS740G11S	C/F	C/F	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	30.0	3	1	CFPS740G5S	C2-225	C2-226	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	36.0	1	4	CFPS747R10S	C/F	C/F	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	36.0	3	2	CFPS747R3S	C2-218	C2-224	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	36.0	1	2	CFPS747R11S	C/F	C/F	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	36.0	3	1	CFPS747R5S	C2-225	C2-226	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	50.0	3	4	CFPS764G3S	C4-148	C4-149	360 (164)	93 (2361)	73 (1854)	66 (1676)
	480	50.0	1	3	CFPS764G11S	C/F	C/F	360 (164)	93 (2361)	73 (1854)	66 (1676)
	480	50.0	3	2	CFPS764G5S	C2-225	C2-226	360 (164)	93 (2361)	73 (1854)	66 (1676)
	240	60.0	3	4	CFPS776R3S	C4-148	C4-149	368 (167)	93 (2361)	73 (1854)	66 (1676)
480	60.0	1	3	CFPS776R11S	C/F	C/F	368 (167)	93 (2361)	73 (1854)	66 (1676)	
480	60.0	3	2	CFPS776R5S	C2-225	C2-226	368 (167)	93 (2361)	73 (1854)	66 (1676)	

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### 6 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



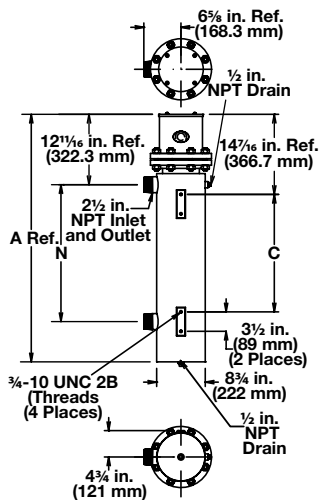
### Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)	
						Type J T/C	Type K T/C					
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>												
<b>23 W/in<sup>2</sup> Steel Tank 15-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	240	15.0	1	3	CFPS717R10XS	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)
	240	15.0	3	1	CFPS717R3XS	C2-236	C2-214	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)
	480	15.0	1	1	CFPS717R11XS	C/F	C/F	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)
	480	15.0	3	1	CFPS717R5XS	C2-43	C2-35	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)
	240	23.0	1	3	CFPS725G10XS	C/F	C/F	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)
	240	23.0	3	5	CFPS725G3XS	C4-143	C4-142	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)
	480	23.0	1	1	CFPS725G11XS	C/F	C/F	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)
	480	23.0	3	1	CFPS725G5XS	C2-225	C2-226	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17	(432)
	240	30.0	1	3	CFPS732R10XS	C/F	C/F	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub>	(699)
	240	30.0	3	5	CFPS732R3XS	C4-144	C4-145	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub>	(699)
	480	30.0	1	3	CFPS732R11XS	C/F	C/F	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub>	(699)
	480	30.0	3	1	CFPS732R5XS	C2-225	C2-226	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub>	(699)
	240	38.0	1	5	CFPS740G10XS	C/F	C/F	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)
	240	38.0	3	5	CFPS740G3XS	C4-144	C4-145	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)
	480	38.0	1	3	CFPS740G11XS	C/F	C/F	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)
	480	38.0	3	1	CFPS740G5XS	C2-225	C2-226	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)
	240	45.0	1	5	CFPS747R10XS	C/F	C/F	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)
	240	45.0	3	5	CFPS747R3XS	C4-144	C4-145	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)
	480	45.0	1	3	CFPS747R11XS	C/F	C/F	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)
	480	45.0	3	5	CFPS747R5XS	C4-150	C4-151	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub>	(1232)
240	63.0	3	5	CFPS764G3XS	C/F	C/F	360 (164)	93 (2361)	73 (1854)	66 (1676)		
480	63.0	1	3	CFPS764G11XS	C/F	C/F	360 (164)	93 (2361)	73 (1854)	66 (1676)		
480	63.0	3	5	CFPS764G5XS	C4-152	C4-153	360 (164)	93 (2361)	73 (1854)	66 (1676)		
240	75.0	3	5	CFPS776R3XS	C/F	C/F	368 (167)	93 (2361)	73 (1854)	66 (1676)		
480	75.0	1	5	CFPS776R11XS	C/F	C/F	368 (167)	93 (2361)	73 (1854)	66 (1676)		
480	75.0	3	5	CFPS776R5XS	C4-152	C4-153	368 (167)	93 (2361)	73 (1854)	66 (1676)		

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### 6 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



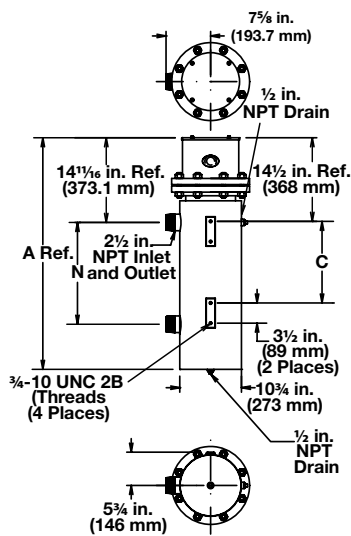
### Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>8 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 18-Steel Elements (3.6 W/cm<sup>2</sup>)</b>	240	30.0	1	3	CFRS732N10S	C/F	C/F	370 (168)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	240	30.0	3	2	CFRS732N3S	C2-218	C2-224	370 (168)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	480	30.0	1	2	CFRS732N11S	C/F	C/F	370 (168)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	480	30.0	3	1	CFRS732N5S	C2-225	C2-226	370 (168)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	240	40.0	3	3	CFRS743E3S	C4-144	C4-145	410 (186)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	40.0	1	2	CFRS743E11S	C/F	C/F	410 (186)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	40.0	3	2	CFRS743E5S	C2-227	C2-228	410 (186)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	240	50.0	3	3	CFRS751M3S	C4-144	C4-145	440 (200)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	480	50.0	1	3	CFRS751M11S	C/F	C/F	440 (200)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	480	50.0	3	2	CFRS751M5S	C2-229	C2-230	440 (200)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	240	60.0	3	6	CFRS762D3S	C4-144	C4-145	480 (218)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	480	60.0	1	3	CFRS762D11S	C/F	C/F	480 (218)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	480	60.0	3	2	CFRS762D5S	C2-229	C2-230	480 (218)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	240	70.0	3	6	CFRS770M3S	C/F	C/F	530 (241)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
	480	70.0	1	6	CFRS770M11S	C/F	C/F	530 (241)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
	480	70.0	3	2	CFRS770M5S	C2-229	C2-230	530 (241)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
240	80.0	3	6	CFRS779M3S	C/F	C/F	610 (277)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)	
480	80.0	3	3	CFRS779M5S	C4-152	C4-153	610 (277)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)	

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### 8 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



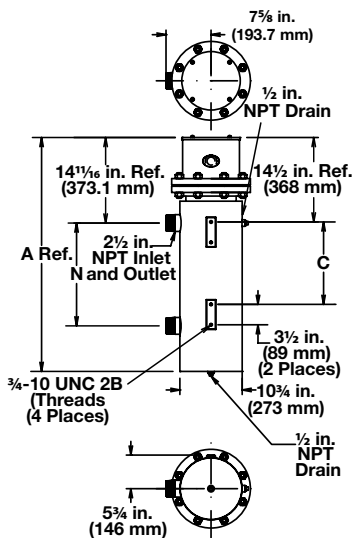
### Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>8 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>23 W/in<sup>2</sup> Steel Tank 24-Steel (3.6 W/cm<sup>2</sup>)</b>	240	40.0	1	4	CFRS733D10XS	C/F	C/F	382 (174)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	240	40.0	3	4	CFRS733D3XS	C4-146	C4-147	382 (174)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	480	40.0	1	2	CFRS733D11XS	C/F	C/F	382 (174)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	480	40.0	3	2	CFRS733D5XS	C2-227	C2-228	382 (174)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	240	53.0	3	4	CFRS743M3XS	C4-148	C4-149	425 (193)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	53.0	1	3	CFRS743M11XS	C/F	C/F	425 (193)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	53.0	3	2	CFRS743M5XS	C2-229	C2-230	425 (193)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	240	67.0	3	4	CFRS751M3XS	C4-148	C4-149	457 (208)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>7</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	480	67.0	1	3	CFRS751M11XS	C/F	C/F	457 (208)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>7</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	480	67.0	3	2	CFRS751M5XS	C2-229	C2-230	457 (208)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>7</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	240	80.0	3	8	CFRS762D3XS	C4-148	C4-149	461 (209)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	480	80.0	1	4	CFRS762D11XS	C/F	C/F	461 (209)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	480	80.0	3	4	CFRS762D5XS	C4-154	C4-155	461 (209)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	240	93.0	3	8	CFRS770M3XS	C/F	C/F	554 (252)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
	480	93.0	1	6	CFRS770M11XS	C/F	C/F	554 (252)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
	480	93.0	3	4	CFRS770M5XS	C4-156	C4-157	554 (252)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
	240	107.0	3	8	CFRS779M3XS	C/F	C/F	636 (289)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)
	480	107.0	3	4	CFRS779M5XS	C4-156	C4-157	636 (289)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)

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### 8 inch - 150 lb ANSI Flange





# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



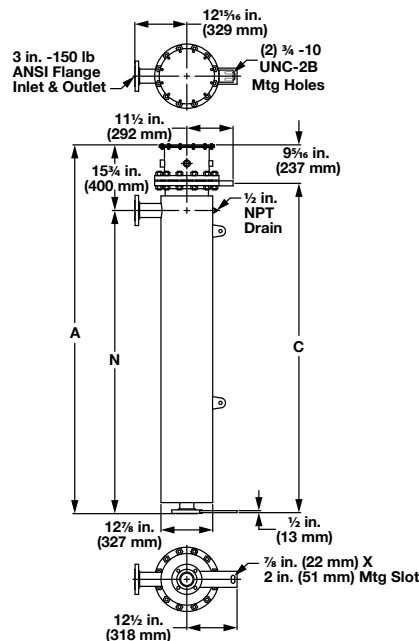
### Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

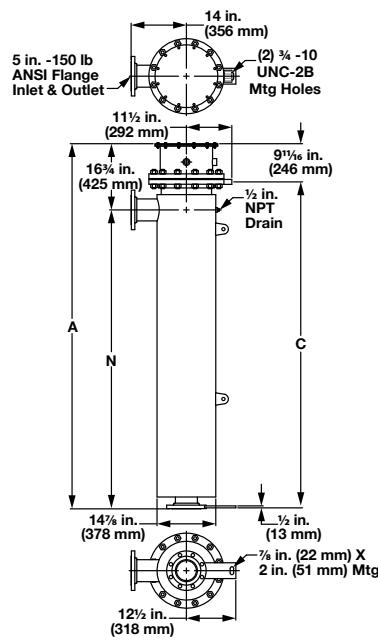
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>10 inch - 150 lb ANSI Flange (WATROD)</b>											
23 W/in <sup>2</sup> Steel Tank 27-Steel Elements (3.6 W/cm <sup>2</sup> )	480	90.0	3	3	CFSS762E5S	C4-152	C4-153	540 (245)	91 <sup>1</sup> / <sub>4</sub> (2316.0)	75 <sup>1</sup> / <sub>2</sub> (1916.0)	81 <sup>15</sup> / <sub>16</sub> (2081.2)
	480	105.0	3	3	CFSS770N5S	C4-152	C4-153	600 (645)	99 <sup>1</sup> / <sub>8</sub> (2517.8)	83 <sup>3</sup> / <sub>8</sub> (2117.7)	89 <sup>13</sup> / <sub>16</sub> (2281.2)
	480	120.0	3	3	CFSS778N5S	C4-152	C4-153	645 (293)	106 <sup>5</sup> / <sub>8</sub> (2708.3)	90 <sup>7</sup> / <sub>8</sub> (2308.2)	97 <sup>5</sup> / <sub>16</sub> (2471.7)
<b>12 inch - 150 lb ANSI Flange (WATROD)</b>											
23 W/in <sup>2</sup> Steel Tank 36-Steel Elements (3.6 W/cm <sup>2</sup> )	480	140.0	3	4	CFTS770L5S	C4-156	C4-157	650 (295)	99 (2515)	82 <sup>7</sup> / <sub>8</sub> (2105.0)	89 <sup>5</sup> / <sub>8</sub> (2276.5)
	480	160.0	3	4	CFTS778L5S	C4-156	C4-157	700 (318)	106 <sup>1</sup> / <sub>2</sub> (2705)	90 <sup>3</sup> / <sub>8</sub> (2295.5)	97 <sup>1</sup> / <sub>8</sub> (2467.0)
<b>14 inch - 150 lb ANSI Flange (WATROD)</b>											
23 W/in <sup>2</sup> Steel Tank 45-Steel Elements (3.6 W/cm <sup>2</sup> )	480	150.0	3	5	CFWS762A5S	C/F	C/F	650 (295)	90 <sup>3</sup> / <sub>4</sub> (2305)	74 <sup>1</sup> / <sub>2</sub> (1891)	81 <sup>3</sup> / <sub>16</sub> (2062.2)
	480	175.0	3	5	CFWS770J5S	C/F	C/F	700 (318)	98 <sup>1</sup> / <sub>4</sub> (2496)	82 (2081)	88 <sup>11</sup> / <sub>16</sub> (2252.7)
	480	200.0	3	5	CFWS778J5S	C/F	C/F	780 (354)	105 <sup>3</sup> / <sub>4</sub> (2686)	89 <sup>1</sup> / <sub>2</sub> (2272)	96 <sup>3</sup> / <sub>16</sub> (2443.2)

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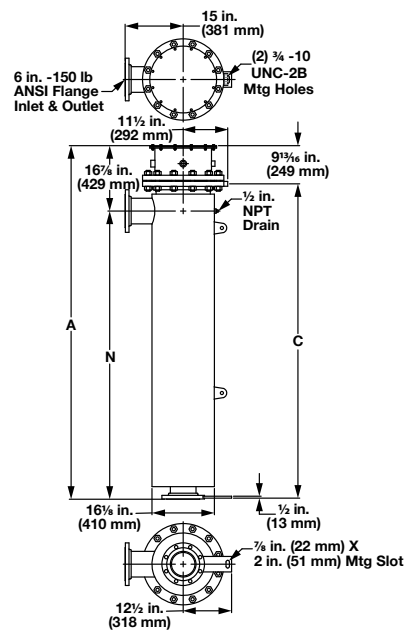
#### 10 inch - 150 lb ANSI Flange



#### 12 inch - 150 lb ANSI Flange



#### 14 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters

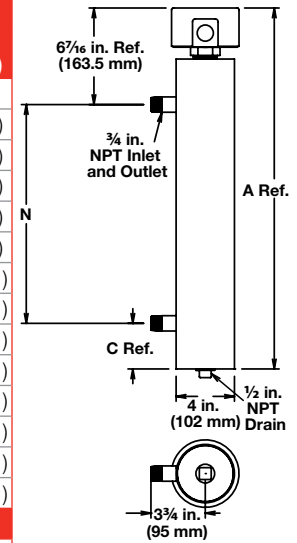


### Application: Medium Weight Oils and Heat Transfer Oils

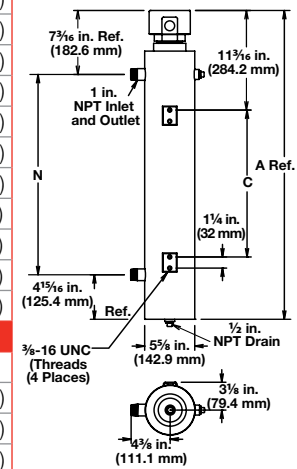
- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)		"N" Dim. in. (mm)		"C" Dim. in. (mm)	
						Type J T/C	Type K T/C							
<b>1 1/4 inch NPT Screw Plug (FIREBAR)</b>														
15 W/in <sup>2</sup> ③ Steel Tank 1-Alloy 800 Elements (2.3 W/cm <sup>2</sup> )	240	0.67	3	1	CBDNF13A29S	C2-50	C2-92	25 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15	381	3 <sup>1</sup> / <sub>8</sub> (79.4)		
	240	0.83	3	1	CBDNF15J29S	C2-50	C2-92	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15	381	3 <sup>1</sup> / <sub>8</sub> (79.4)		
	240	1.00	3	1	CBDNF18A29S	C2-50	C2-92	30 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23	584	3 <sup>1</sup> / <sub>8</sub> (79.4)		
	240	1.33	3	1	CBDNF22J29S	C2-50	C2-92	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23	584	3 <sup>1</sup> / <sub>8</sub> (79.4)		
	480	1.33	3	1	CBDNF22J30S	C2-43	C2-35	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23	584	3 <sup>1</sup> / <sub>8</sub> (79.4)		
	240	1.67	3	1	CBDNF27J29S	C2-50	C2-92	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32	813	4 <sup>3</sup> / <sub>8</sub> (111.1)		
	480	1.67	3	1	CBDNF27J30S	C2-43	C2-35	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32	813	4 <sup>3</sup> / <sub>8</sub> (111.1)		
	240	2.00	3	1	CBDNF32J29S	C2-50	C2-92	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32	813	4 <sup>3</sup> / <sub>8</sub> (111.1)		
	480	2.00	3	1	CBDNF32J30S	C2-43	C2-35	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32	813	4 <sup>3</sup> / <sub>8</sub> (111.1)		
	240	2.67	3	1	CBDNF42A29S	C2-50	C2-92	69 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53	1346	4 <sup>3</sup> / <sub>8</sub> (111.1)		
	480	2.67	3	1	CBDNF42A30S	C2-43	C2-35	69 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53	1346	4 <sup>3</sup> / <sub>8</sub> (111.1)		
	240	3.33	3	1	CBDNF51J29S	C2-50	C2-92	71 (33)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53	1346	4 <sup>3</sup> / <sub>8</sub> (111.1)		
480	3.33	3	1	CBDNF51J30S	C2-43	C2-35	71 (33)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53	1346	4 <sup>3</sup> / <sub>8</sub> (111.1)			
<b>2 1/2 inch NPT Screw Plug (WATROD)</b>														
16 W/in <sup>2</sup> ③ Steel Tank 3-Alloy 800 Elements (2.5 W/cm <sup>2</sup> )	240	2.0	3	1	CBLN717G12S	C2-50	C2-92	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)			
	480	2.0	3	1	CBLN717G13S	C2-43	C2-35	24 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)			
	240	2.5	3	1	CBLN719R12S	C2-50	C2-92	26 (12)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)			
	480	2.5	3	1	CBLN719R13S	C2-43	C2-35	26 (12)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)			
	240	3.0	3	1	CBLN724R12S	C2-50	C2-92	27 (13)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)			
	480	3.0	3	1	CBLN724R13S	C2-43	C2-35	27 (13)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)			
	240	4.0	3	1	CBLN732G12S	C2-50	C2-92	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)			
	480	4.0	3	1	CBLN732G13S	C2-43	C2-35	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)			
	240	5.0	3	1	CBLN739R12S	C2-50	C2-92	31 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)			
	480	5.0	3	1	CBLN739R13S	C2-43	C2-35	31 (14)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)			
	240	6.0	3	1	CBLN747G12S	C2-50	C2-92	32 (15)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)			
	480	6.0	3	1	CBLN747G13S	C2-43	C2-35	32 (15)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)			
<b>2 1/2 inch NPT Screw Plug (FIREBAR)</b>														
15 W/in <sup>2</sup> ③ Steel Tank 3-Alloy 800 Elements (2.3 W/cm <sup>2</sup> )	240	2.00	3	1	CBLNF12A29S	C2-50	C2-92	21 (10)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)			
	240	2.50	3	1	CBLNF14J29S	C2-50	C2-92	22 (10)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)			
	240	3.00	3	1	CBLNF17A29S	C2-50	C2-92	23 (11)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)			
	240	4.00	3	1	CBLNF21J29S	C2-50	C2-92	31 (14)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)			
	480	4.00	3	1	CBLNF21J30S	C2-43	C2-35	31 (14)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)			
	240	5.00	3	1	CBLNF26J29S	C2-50	C2-92	34 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)			
	480	5.00	3	1	CBLNF26J30S	C2-43	C2-35	34 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)			
	240	6.00	3	1	CBLNF31J29S	C2-50	C2-92	35 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)			
	480	6.00	3	1	CBLNF31J30S	C2-43	C2-35	35 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)			
	240	8.00	3	1	CBLNF41A29S	C2-50	C2-92	44 (20)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)			
	480	8.00	3	1	CBLNF41A30S	C2-43	C2-35	44 (20)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)			
	240	10.00	3	1	CBLNF50J29S	C2-50	C2-92	52 (24)	63 <sup>3</sup> / <sub>4</sub> (1618)	51 <sup>1</sup> / <sub>2</sub> (1308)	46 <sup>1</sup> / <sub>2</sub> (1181)			
480	10.00	3	1	CBLNF50J30S	C2-43	C2-35	52 (24)	63 <sup>3</sup> / <sub>4</sub> (1618)	51 <sup>1</sup> / <sub>2</sub> (1308)	46 <sup>1</sup> / <sub>2</sub> (1181)				

1 1/4 inch NPT Screw Plug



2 1/2 inch NPT Screw Plug



③ Wired for 3-phase operation only

# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



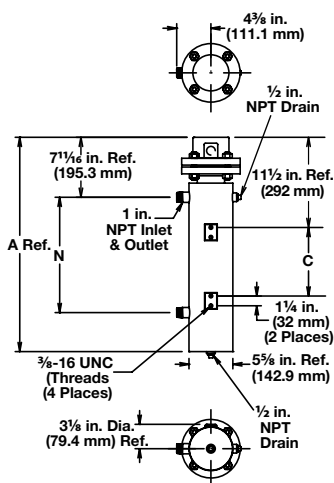
### Application: Medium Weight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

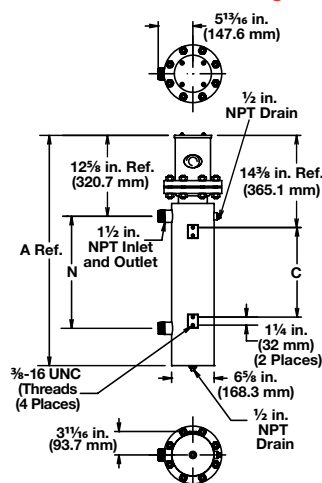
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)		"N" Dim. in. (mm)		"C" Dim. in. (mm)	
						Type J T/C	Type K T/C							
<b>3 inch - 150 lb ANSI Flange (WATROD)</b>														
<b>16 W/in<sup>2</sup> ③ Steel Tank 3-Alloy 800 Elements (2.6 W/cm<sup>2</sup>)</b>	240	2.00	3	1	CFMN718A12S	C2-50	C2-92	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)			
	480	2.00	3	1	CFMN718A13S	C2-43	C2-35	68 (31)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)			
	240	2.50	3	1	CFMN720J12S	C2-50	C2-92	70 (32)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)			
	480	2.50	3	1	CFMN720J13S	C2-43	C2-35	70 (32)	35 <sup>1</sup> / <sub>4</sub> (894)	22 <sup>1</sup> / <sub>2</sub> (573)	16 <sup>1</sup> / <sub>2</sub> (419)			
	240	3.00	3	1	CFMN725J12S	C2-50	C2-92	78 (36)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)			
	480	3.00	3	1	CFMN725J13S	C2-43	C2-35	78 (36)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)			
	240	4.00	3	1	CFMN733A12S	C2-50	C2-92	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)			
	480	4.00	3	1	CFMN733A13S	C2-43	C2-35	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)			
	240	5.00	3	1	CFMN740J12S	C2-50	C2-92	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)			
	480	5.00	3	1	CFMN740J13S	C2-43	C2-35	100 (46)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)			
	240	6.00	3	1	CFMN748A12S	C2-50	C2-92	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)			
	480	6.00	3	1	CFMN748A13S	C2-43	C2-35	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)			
<b>4 inch - 150 lb ANSI Flange (WATROD)</b>														
<b>16 W/in<sup>2</sup> ③ Steel Tank 6-Alloy 800 Elements (2.5 W/cm<sup>2</sup>)</b>	240	3.0	3	1	CFON713J12S	C2-50	C2-92	122 (56)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)			
	480	3.0	3	1	CFON713J13S	C2-43	C2-35	122 (56)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)			
	240	4.0	3	1	CFON718A12S	C2-50	C2-92	125 (57)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)			
	480	4.0	3	1	CFON718A13S	C2-43	C2-35	125 (57)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)			
	240	5.0	3	1	CFON720J12S	C2-50	C2-92	127 (58)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)			
	480	5.0	3	1	CFON720J13S	C2-43	C2-35	127 (58)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)			
	240	6.0	3	1	CFON725J12S	C2-50	C2-92	160 (73)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)			
	480	6.0	3	1	CFON725J13S	C2-43	C2-35	160 (73)	39 (989)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)			
	240	8.0	3	1	CFON733A12S	C2-50	C2-92	163 (74)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)			
	480	8.0	3	1	CFON733A13S	C2-43	C2-35	163 (74)	49 <sup>1</sup> / <sub>2</sub> (1256)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)			
	240	10.0	3	1	CFON740J12S	C2-50	C2-92	229 (104)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)			
	480	10.0	3	1	CFON740J13S	C2-43	C2-35	229 (104)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)			
	240	12.0	3	1	CFON748A12S	C2-236	C2-214	234 (107)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)			
	480	12.0	3	1	CFON748A13S	C2-43	C2-35	234 (107)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)			

③ Wired for 3-phase operation only

#### 3 inch - 150 lb ANSI Flange



#### 4 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



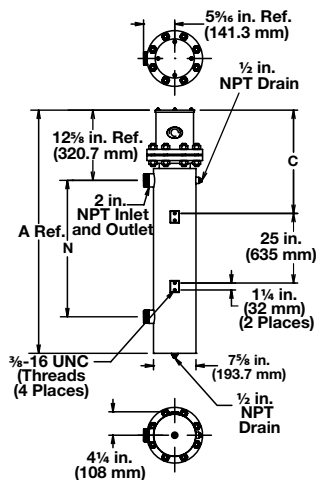
### Application: Medium Weight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>16 W/in<sup>2</sup> ③ Steel Tank 6-Alloy 800 Elements (2.6 W/cm<sup>2</sup>)</b>	240	8.0	3	1	CFNN733A12S	C2-50	C2-92	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249)	30 (762)	25 (633.0)
	480	8.0	3	1	CFNN733A13S	C2-43	C2-35	145 (66)	49 <sup>1</sup> / <sub>4</sub> (1249)	30 (762)	25 (633.0)
	240	10.0	3	1	CFNN740J12S	C2-50	C2-92	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427)	37 (940)	25 (633.0)
	480	10.0	3	1	CFNN740J13S	C2-43	C2-35	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427)	37 (940)	25 (633.0)
	240	12.0	3	1	CFNN748A12S	C2-236	C2-214	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)
	480	12.0	3	1	CFNN748A13S	C2-43	C2-35	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>16 W/in<sup>2</sup> ③ Steel Tank 9-Alloy 800 Elements (2.6 W/cm<sup>2</sup>)</b>	240	12.0	3	1	CFNN733A12XS	C2-236	C2-214	150 (68)	49 <sup>1</sup> / <sub>4</sub> (1249)	30 (762)	25 (633.0)
	480	12.0	3	1	CFNN733A13XS	C2-43	C2-35	150 (68)	49 <sup>1</sup> / <sub>4</sub> (1249)	30 (762)	25 (633.0)
	240	15.0	3	1	CFNN740J12XS	C2-236	C2-214	173 (79)	56 <sup>1</sup> / <sub>4</sub> (1427)	37 (940)	25 (633.0)
	480	15.0	3	1	CFNN740J13XS	C2-43	C2-35	173 (79)	56 <sup>1</sup> / <sub>4</sub> (1427)	37 (940)	25 (633.0)
	240	18.0	3	1	CFNN748A12XS	C2-236	C2-214	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)
	480	18.0	3	1	CFNN748A13XS	C2-43	C2-35	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719)	48 <sup>1</sup> / <sub>2</sub> (1232)	25 (633.0)

③ Wired for 3-phase operation only

### 5 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



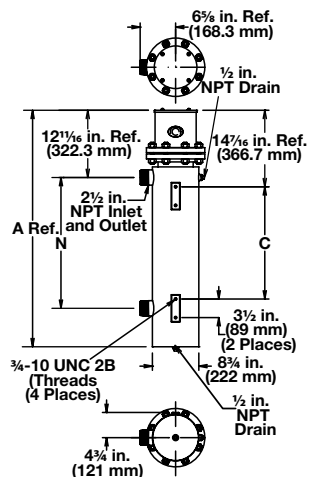
### Application: Medium Weight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>16 W/in<sup>2</sup> ③ Steel Tank 12-Alloy 800 Elements (2.6 W/cm<sup>2</sup>)</b>	240	6.0	3	1	CFPN713G12S	C2-50	C2-92	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	6.0	3	1	CFPN713G13S	C2-43	C2-35	212 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	8.0	3	1	CFPN717R12S	C2-50	C2-92	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	8.0	3	1	CFPN717R13S	C2-43	C2-35	214 (97)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	10.0	3	1	CFPN720G12S	C2-50	C2-92	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	10.0	3	1	CFPN720G13S	C2-43	C2-35	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	12.0	3	1	CFPN725G12S	C2-236	C2-214	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	12.0	3	1	CFPN725G13S	C2-43	C2-35	222 (101)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	16.0	3	1	CFPN732R12S	C2-236	C2-214	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	16.0	3	1	CFPN732R13S	C2-43	C2-35	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	20.0	3	2	CFPN740G12S	C2-219	C2-220	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	20.0	3	1	CFPN740G13S	C2-43	C2-35	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	24.0	3	2	CFPN747R12S	C2-219	C2-220	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	24.0	3	1	CFPN747R13S	C2-225	C2-226	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>16 W/in<sup>2</sup> ③ Steel Tank 15-Alloy 800 Elements (2.6 W/cm<sup>2</sup>)</b>	240	7.50	3	1	CFPN713G12XS	C2-50	C2-92	215 (98)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	7.50	3	1	CFPN713G13XS	C2-43	C2-35	215 (98)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	10.0	3	1	CFPN717R12XS	C2-50	C2-92	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	10.0	3	1	CFPN717R13XS	C2-43	C2-35	217 (99)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	12.5	3	1	CFPN720G12XS	C2-236	C2-214	223 (102)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	12.5	3	1	CFPN720G13XS	C2-43	C2-35	223 (102)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	15.0	3	1	CFPN725G12XS	C2-236	C2-214	226 (103)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	480	15.0	3	1	CFPN725G13XS	C2-43	C2-35	226 (103)	40 <sup>1</sup> / <sub>2</sub> (1027)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)
	240	20.0	3	5	CFPN732R12XS	C4-143	C4-142	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	20.0	3	1	CFPN732R13XS	C2-43	C2-35	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	25.0	3	5	CFPN740G12XS	C4-143	C4-142	296 (135)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	25.0	3	1	CFPN740G13XS	C2-225	C2-226	296 (135)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	30.0	3	5	CFPN747R12XS	C4-144	C4-145	306 (139)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	30.0	3	1	CFPN747R13XS	C2-225	C2-226	306 (139)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)

③ Wired for 3-phase operation only

### 6 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



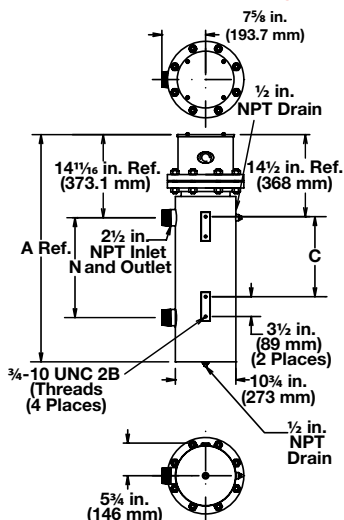
### Application: Medium Weight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>8 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>16 W/in<sup>2</sup> ③ Steel Tank 18-Alloy 800 Elements (2.6 W/cm<sup>2</sup>)</b>	240	17.00	3	1	CFRN725N12S	C2-236	C2-214	350 (159)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	480	17.00	3	1	CFRN725N13S	C2-43	C2-35	350 (159)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	240	25.00	3	2	CFRN735N12S	C2-219	C2-220	380 (173)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	25.00	3	1	CFRN735N13S	C2-225	C2-226	380 (173)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	240	33.00	3	2	CFRN744E12S	C2-218	C2-224	410 (186)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	480	33.00	3	1	CFRN744E13S	C2-225	C2-226	410 (186)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	240	42.00	3	3	CFRN754M12S	C4-144	C4-145	445 (202)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	480	42.00	3	2	CFRN754M13S	C2-229	C2-230	445 (202)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	480	50.00	3	2	CFRN763M13S	C2-229	C2-230	490 (223)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
	480	58.00	3	2	CFRN773D13S	C2-229	C2-230	530 (241)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)
480	67.00	3	2	CFRN782M13S	C2-229	C2-230	560 (254)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)	
<b>8 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>16 W/in<sup>2</sup> ③ Steel Tank 24-Alloy 800 Elements (2.6 W/cm<sup>2</sup>)</b>	240	23.0	3	2	CFRN726D12XS	C2-218	C2-224	358 (163)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	480	23.0	3	1	CFRN726D13XS	C2-225	C2-226	358 (163)	55 <sup>1</sup> / <sub>4</sub> (1402.0)	32 <sup>3</sup> / <sub>4</sub> (830.0)	29 <sup>1</sup> / <sub>4</sub> (741.0)
	240	33.0	3	2	CFRN736D12XS	C2-218	C2-224	392 (178)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	33.0	3	1	CFRN736D13XS	C2-225	C2-226	392 (178)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	240	44.0	3	4	CFRN744M12XS	C4-148	C4-149	425 (193)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	480	44.0	3	2	CFRN744M13XS	C2-229	C2-230	425 (193)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	240	56.0	3	4	CFRN754M12XS	C4-148	C4-149	463 (210)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	480	56.0	3	2	CFRN754M13XS	C2-229	C2-230	463 (210)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	480	67.0	3	2	CFRN763M13XS	C2-229	C2-230	511 (232)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
	480	77.0	3	2	CFRN773D13XS	C2-229	C2-230	554 (252)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)
480	89.0	3	4	CFRN782M13XS	C4-156	C4-157	587 (267)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)	

③ Wired for 3-phase operation only

### 8 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



### Application: Medium Weight Oils and Heat Transfer Oils

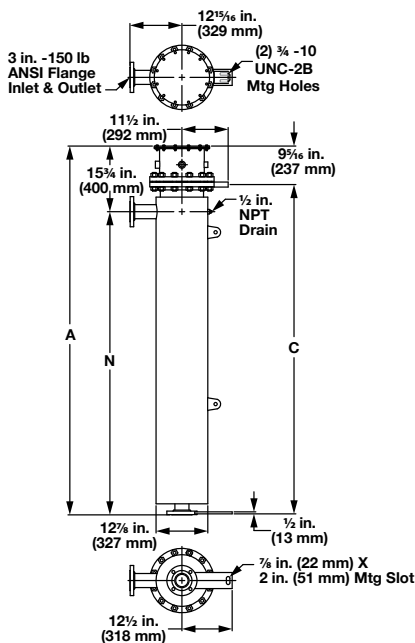
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>10 inch - 150 lb ANSI Flange (WATROD)</b>											
16 W/in <sup>2</sup> ③ Steel Tank 27-Alloy 800 Elements (2.6 W/cm <sup>2</sup> )	480	75.0	3	3	CFSN763N13S	C4-152	C4-153	540 (245)	91 <sup>3</sup> / <sub>16</sub> (2316)	75 <sup>7</sup> / <sub>16</sub> (1916)	81 <sup>15</sup> / <sub>16</sub> (2081)
	480	87.0	3	3	CFSN773E13S	C4-152	C4-153	600 (273)	106 <sup>9</sup> / <sub>16</sub> (2707)	90 <sup>13</sup> / <sub>16</sub> (1037)	97 <sup>5</sup> / <sub>16</sub> (2471)
<b>12 inch - 150 lb ANSI Flange (WATROD)</b>											
16 W/in <sup>2</sup> ③ Steel Tank 36-Alloy 800 Elements (2.6 W/cm <sup>2</sup> )	480	117.0	3	3	CFTN773C13S	C4-152	C4-153	650 (295)	106 <sup>1</sup> / <sub>2</sub> (2705)	90 <sup>3</sup> / <sub>8</sub> (2295.5)	97 <sup>3</sup> / <sub>16</sub> (2468.6)
<b>14 inch - 150 lb ANSI Flange (WATROD)</b>											
16 W/in <sup>2</sup> ③ Steel Tank 45-Alloy 800 Elements (2.6 W/cm <sup>2</sup> )	480	105.0	3	3	CFWN754J13S	C4-152	C4-153	600 (273)	83 <sup>1</sup> / <sub>4</sub> (2115)	67 (1700)	73 <sup>11</sup> / <sub>16</sub> (1872)
	480	125.0	3	5	CFWN763J13S	C/F	C/F	650 (295)	90 <sup>3</sup> / <sub>4</sub> (2305)	74 <sup>1</sup> / <sub>2</sub> (1891)	81 <sup>3</sup> / <sub>16</sub> (2062)

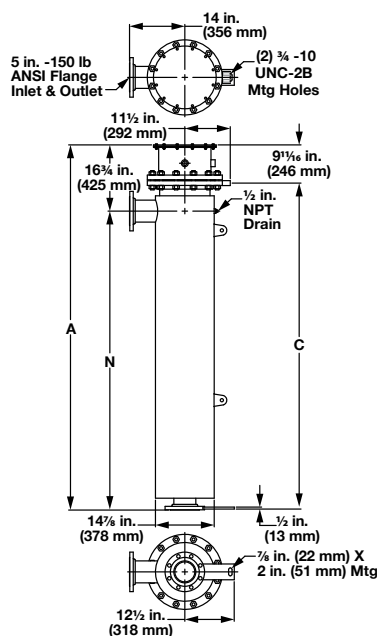
③ Wired for 3-phase operation only

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

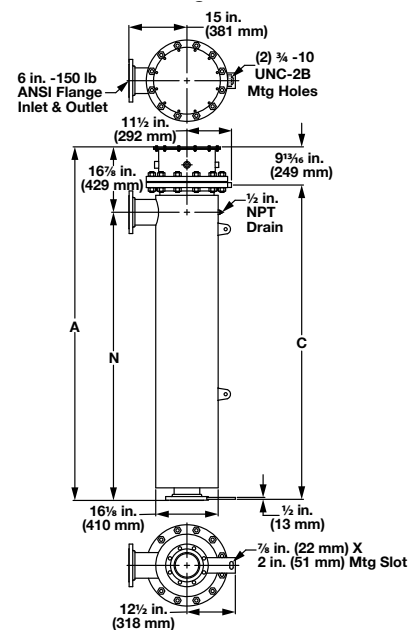
#### 10 inch - 150 lb ANSI Flange



#### 12 inch - 150 lb ANSI Flange



#### 14 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



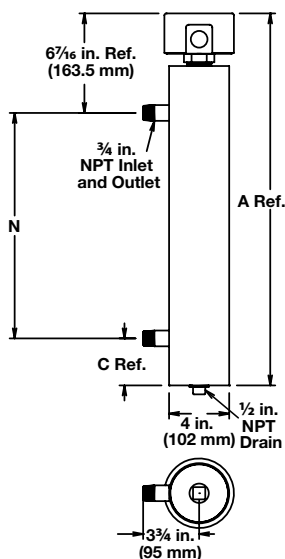
### Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

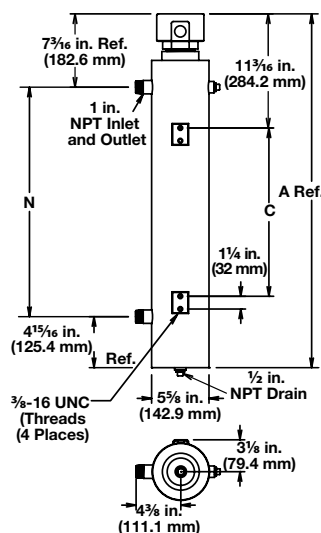
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>1 1/4 inch NPT Screw Plug (FIREBAR)</b>											
<b>8 W/in<sup>2</sup> ③ Steel Tank 1-Alloy 800 Element (1.3 W/cm<sup>2</sup>)</b>	240	0.43	3	1	<b>CBDNF16G22S</b>	<b>C2-50</b>	<b>C2-92</b>	26 (12)	24 <sup>5</sup> / <sub>8</sub> (625.5)	15 (381)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	0.55	3	1	<b>CBDNF19G22S</b>	<b>C2-50</b>	<b>C2-92</b>	30 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	0.70	3	1	<b>CBDNF24L22S</b>	<b>C2-50</b>	<b>C2-92</b>	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	480	0.70	3	1	<b>CBDNF24L21S</b>	<b>C2-43</b>	<b>C2-35</b>	31 (14)	32 <sup>5</sup> / <sub>8</sub> (828.7)	23 (584)	3 <sup>1</sup> / <sub>8</sub> (79.4)
	240	0.88	3	1	<b>CBDNF29R22S</b>	<b>C2-50</b>	<b>C2-92</b>	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	0.88	3	1	<b>CBDNF29R21S</b>	<b>C2-43</b>	<b>C2-35</b>	43 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	1.08	3	1	<b>CBDNF34R22S</b>	<b>C2-50</b>	<b>C2-92</b>	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	1.08	3	1	<b>CBDNF34R21S</b>	<b>C2-43</b>	<b>C2-35</b>	44 (20)	42 <sup>5</sup> / <sub>8</sub> (1082.7)	32 (813)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	1.40	3	1	<b>CBDNF45G22S</b>	<b>C2-50</b>	<b>C2-92</b>	69 (31)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	480	1.40	3	1	<b>CBDNF45G21S</b>	<b>C2-43</b>	<b>C2-35</b>	69 (31)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
	240	1.80	3	1	<b>CBDNF55R22S</b>	<b>C2-50</b>	<b>C2-92</b>	71 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)
480	1.80	3	1	<b>CBDNF55R21S</b>	<b>C2-43</b>	<b>C2-35</b>	71 (32)	63 <sup>5</sup> / <sub>8</sub> (1616.1)	53 (1346)	4 <sup>3</sup> / <sub>8</sub> (111.1)	
<b>2 1/2 inch NPT Screw Plug (WATROD)</b>											
<b>8 W/in<sup>2</sup> ③ Steel Tank 3-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	2.0	3	1	<b>CBLS732E12S</b>	<b>C2-50</b>	<b>C2-92</b>	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	2.0	3	1	<b>CBLS732E13S</b>	<b>C2-43</b>	<b>C2-35</b>	29 (14)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	3.0	3	1	<b>CBLS747E12S</b>	<b>C2-50</b>	<b>C2-92</b>	32 (15)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	3.0	3	1	<b>CBLS747E13S</b>	<b>C2-43</b>	<b>C2-35</b>	32 (15)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)

③ Wired for 3-phase operation only

**1 1/4 inch NPT Screw Plug**



**2 1/2 inch NPT Screw Plug**





# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



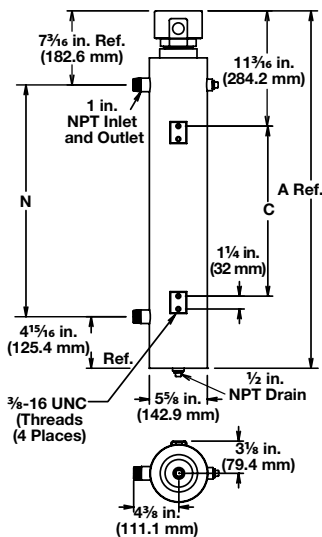
### Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

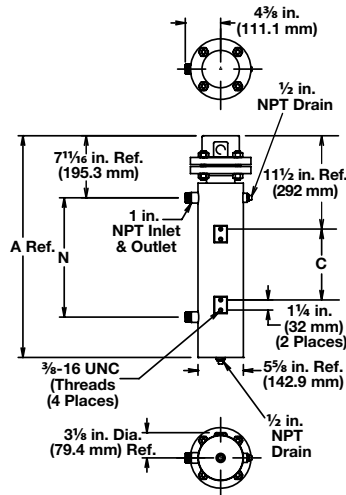
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>2 1/2 inch NPT Screw Plug (FIREBAR)</b>											
<b>8 W/in<sup>2</sup> ③ Steel Tank 3-Alloy 800 Elements (1.3 W/cm<sup>2</sup>)</b>	240	1.25	3	1	CBLNF15C22S	C2-50	C2-92	22 (10)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	1.63	3	1	CBLNF18C22S	C2-50	C2-92	23 (10)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	2.13	3	1	CBLNF23C22S	C2-50	C2-92	31 (14)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	480	2.13	3	1	CBLNF23C21S	C2-43	C2-35	31 (14)	34 <sup>3</sup> / <sub>4</sub> (881)	22 <sup>1</sup> / <sub>2</sub> (572)	16 <sup>1</sup> / <sub>2</sub> (419)
	240	2.63	3	1	CBLNF28L22S	C2-50	C2-92	34 (15)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	2.63	3	1	CBLNF28L21S	C2-43	C2-35	34 (15)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	3.19	3	1	CBLNF33L22S	C2-50	C2-92	35 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	3.19	3	1	CBLNF33L21S	C2-43	C2-35	35 (16)	44 <sup>3</sup> / <sub>4</sub> (1135)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	4.25	3	1	CBLNF44C22S	C2-50	C2-92	44 (20)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	480	4.25	3	1	CBLNF44C21S	C2-43	C2-35	44 (20)	57 <sup>1</sup> / <sub>4</sub> (1453)	45 (1143)	39 (991)
	240	5.38	3	1	CBLNF54L22S	C2-50	C2-92	52 (24)	63 <sup>3</sup> / <sub>4</sub> (1453)	51 <sup>1</sup> / <sub>2</sub> (1308)	46 <sup>1</sup> / <sub>2</sub> (1181)
480	5.38	3	1	CBLNF54L21S	C2-43	C2-35	52 (24)	63 <sup>3</sup> / <sub>4</sub> (1453)	51 <sup>1</sup> / <sub>2</sub> (1308)	46 <sup>1</sup> / <sub>2</sub> (1181)	
<b>3 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>8 W/in<sup>2</sup> ③ Steel Tank 3-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	2.0	3	1	CFMS733A12S	C2-50	C2-92	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	480	2.0	3	1	CFMS733A13S	C2-43	C2-35	96 (44)	45 <sup>1</sup> / <sub>4</sub> (1148)	32 <sup>1</sup> / <sub>2</sub> (826)	26 <sup>1</sup> / <sub>2</sub> (673)
	240	3.0	3	1	CFMS748A12S	C2-50	C2-92	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)
	480	3.0	3	1	CFMS748A13S	C2-43	C2-35	107 (49)	57 <sup>3</sup> / <sub>4</sub> (1465)	45 (1143)	39 (991)

③ Wired for 3-phase operation only

**2 1/2 inch NPT Screw Plug**



**3 inch - 150 lb ANSI Flange**



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



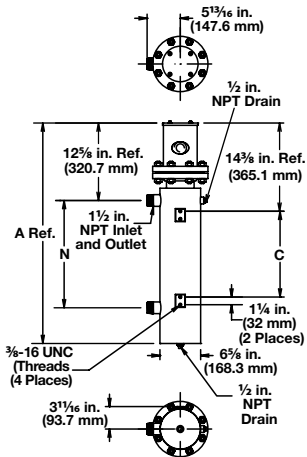
### Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD elements
- Without thermostat
- General purpose enclosure

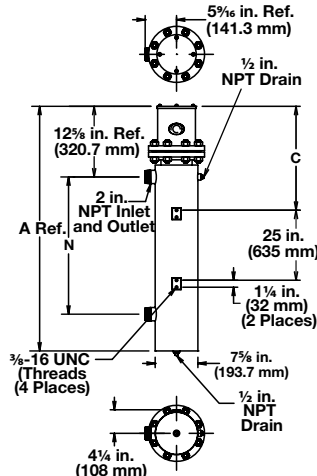
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>4 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>8 W/in<sup>2</sup> ③ Steel Tank 6-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	5.00	3	1	CFOS740J12S	C2-50	C2-92	229 (104)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	5.00	3	1	CFOS740J13S	C2-43	C2-35	229 (104)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	6.00	3	1	CFOS748A12S	C2-50	C2-92	234 (106)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	6.00	3	1	CFOS748A13S	C2-43	C2-35	234 (106)	70 <sup>1</sup> / <sub>2</sub> (1789)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	8.00	3	1	CFOS764J12S	C2-50	C2-92	298 (135)	91 <sup>1</sup> / <sub>2</sub> (2326)	73 (1854)	66 (1676)
	480	8.00	3	1	CFOS764J13S	C2-43	C2-35	298 (135)	91 <sup>1</sup> / <sub>2</sub> (2326)	73 (1854)	66 (1676)
	240	10.00	3	1	CFOS777A12S	C2-50	C2-92	306 (139)	91 <sup>1</sup> / <sub>2</sub> (2326)	73 (1854)	66 (1676)
480	10.00	3	1	CFOS777A13S	C2-43	C2-35	306 (139)	91 <sup>1</sup> / <sub>2</sub> (2326)	73 (1854)	66 (1676)	
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>8 W/in<sup>2</sup> ③ Steel Tank 6-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	5.00	3	1	CFNS740J12S	C2-50	C2-92	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	25 (633.0)
	480	5.00	3	1	CFNS740J13S	C2-43	C2-35	167 (76)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	25 (633.0)
	240	6.00	3	1	CFNS748A12S	C2-50	C2-92	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	480	6.00	3	1	CFNS748A13S	C2-43	C2-35	180 (82)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	240	8.00	3	1	CFNS764J12S	C2-50	C2-92	195 (89)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	480	8.00	3	1	CFNS764J13S	C2-43	C2-35	195 (89)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	240	10.00	3	1	CFNS777A12S	C2-50	C2-92	220 (100)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)
480	10.00	3	1	CFNS777A13S	C2-43	C2-35	220 (100)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)	
<b>5 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>8 W/in<sup>2</sup> ③ Steel Tank 9-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	7.5	3	1	CFNS740J12XS	C2-50	C2-92	173 (79)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	25 (633.0)
	480	7.5	3	1	CFNS740J13XS	C2-43	C2-35	173 (79)	56 <sup>1</sup> / <sub>4</sub> (1427.0)	37 (940.0)	25 (633.0)
	240	9.0	3	1	CFNS748A12XS	C2-50	C2-92	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	480	9.0	3	1	CFNS748A13XS	C2-43	C2-35	188 (86)	67 <sup>3</sup> / <sub>4</sub> (1719.0)	48 <sup>1</sup> / <sub>2</sub> (1232.0)	25 (633.0)
	240	12.0	3	1	CFNS764J12XS	C2-236	C2-214	206 (94)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	480	12.0	3	1	CFNS764J13XS	C2-43	C2-35	206 (94)	81 <sup>1</sup> / <sub>8</sub> (2060.6)	61 <sup>7</sup> / <sub>8</sub> (1571.6)	25 (633.0)
	240	15.0	3	1	CFNS777A12XS	C2-236	C2-214	233 (106)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)
480	15.0	3	1	CFNS777A13XS	C2-225	C2-226	233 (106)	94 <sup>1</sup> / <sub>8</sub> (2390.8)	75 (1902.0)	25 (633.0)	

③ Wired for 3-phase operation only

#### 4 inch - 150 lb ANSI Flange



#### 5 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



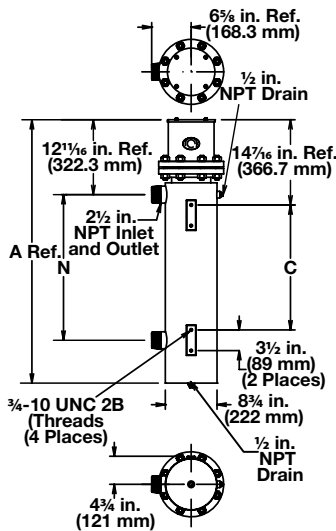
### Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>8 W/in<sup>2</sup> ③ Steel Tank 12-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	8.0	3	1	CFPS732R12S	C2-50	C2-92	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	8.0	3	1	CFPS732R13S	C2-43	C2-35	226 (103)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	10.0	3	1	CFPS740G12S	C2-50	C2-92	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	10.0	3	1	CFPS740G13S	C2-43	C2-35	290 (132)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	12.0	3	1	CFPS747R12S	C2-236	C2-214	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	12.0	3	1	CFPS747R13S	C2-43	C2-35	298 (136)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	16.5	3	1	CFPS764G12S	C2-236	C2-214	360 (164)	93 (2361)	73 (1854)	66 (1676)
	480	16.5	3	1	CFPS764G13S	C2-43	C2-35	360 (164)	93 (2361)	73 (1854)	66 (1676)
	480	20.0	3	1	CFPS776R13S	C2-43	C2-35	368 (167)	93 (2361)	73 (1854)	66 (1676)
<b>6 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>8 W/in<sup>2</sup> ③ Steel Tank 15-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	10.0	3	1	CFPS732R12XS	C2-50	C2-92	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	480	10.0	3	1	CFPS732R13XS	C2-43	C2-35	288 (131)	51 (1294)	31 (787)	27 <sup>1</sup> / <sub>2</sub> (699)
	240	12.5	3	1	CFPS740G12XS	C2-236	C2-214	296 (135)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	12.5	3	1	CFPS740G13XS	C2-43	C2-35	296 (135)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	15.0	3	1	CFPS747R12XS	C2-236	C2-214	306 (139)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	480	15.0	3	1	CFPS747R13XS	C2-43	C2-35	306 (139)	72 (1827)	52 (1321)	48 <sup>1</sup> / <sub>2</sub> (1232)
	240	21.0	3	5	CFPS764G12XS	C4-143	C4-142	370 (168)	93 (2361)	73 (1854)	66 (1676)
	480	21.0	3	1	CFPS764G13XS	C2-225	C2-226	370 (168)	93 (2361)	73 (1854)	66 (1676)
	240	25.0	3	5	CFPS776R12XS	C4-143	C4-142	381 (173)	93 (2361)	73 (1854)	66 (1676)
	480	25.0	3	1	CFPS776R13XS	C2-224	C2-226	381 (173)	93 (2361)	73 (1854)	66 (1676)

③ Wired for 3-phase operation only

### 6 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



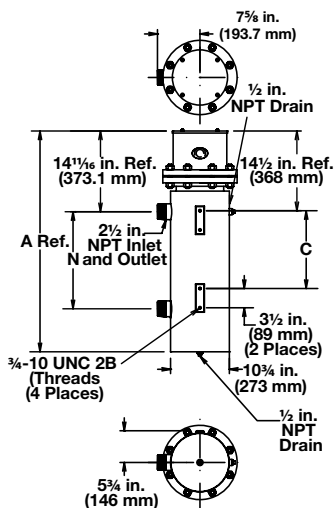
### Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>8 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>8 W/in<sup>2</sup> ③ Steel Tank 18-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	12.5	3	1	CFRS743E12S	C2-236	C2-214	410 (186)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	12.5	3	1	CFRS743E13S	C2-43	C2-35	410 (186)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	240	16.5	3	1	CFRS751M12S	C2-236	C2-214	440 (200)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	480	16.5	3	1	CFRS751M13S	C2-43	C2-35	440 (200)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	240	20.0	3	2	CFRS762D12S	C2-219	C2-220	480 (218)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	480	20.0	3	1	CFRS762D13S	C2-43	C2-50	480 (218)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	240	24.0	3	2	CFRS770M12S	C2-218	C2-224	530 (241)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
	480	24.0	3	1	CFRS770M13S	C2-225	C2-226	530 (241)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
	240	27.0	3	2	CFRS779M12S	C2-218	C2-224	610 (277)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)
480	27.0	3	1	CFRS779M13S	C2-225	C2-226	610 (277)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)	
<b>8 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>8 W/in<sup>2</sup> ③ Steel Tank 24-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	17.0	3	1	CFRS743M12XS	C2-236	C2-214	425 (193)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	480	17.0	3	1	CFRS743M13XS	C2-43	C2-35	425 (193)	62 <sup>1</sup> / <sub>4</sub> (1580.0)	39 <sup>3</sup> / <sub>4</sub> (1008.0)	36 <sup>1</sup> / <sub>4</sub> (919.0)
	240	22.0	3	2	CFRS751M12XS	C2-218	C2-224	457 (208)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	480	22.0	3	1	CFRS751M13XS	C2-225	C2-226	457 (208)	69 <sup>7</sup> / <sub>8</sub> (1774.8)	47 <sup>3</sup> / <sub>8</sub> (1203.3)	43 <sup>7</sup> / <sub>8</sub> (1114.4)
	240	27.0	3	2	CFRS762D12XS	C2-218	C2-224	461 (209)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	480	27.0	3	1	CFRS762D13XS	C2-225	C2-226	461 (209)	79 <sup>3</sup> / <sub>8</sub> (2016.1)	56 <sup>7</sup> / <sub>8</sub> (1444.6)	53 <sup>3</sup> / <sub>8</sub> (1355.7)
	240	32.0	3	2	CFRS770M12XS	C2-218	C2-224	554 (252)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
	480	32.0	3	1	CFRS770M13XS	C2-225	C2-226	554 (252)	88 <sup>3</sup> / <sub>8</sub> (2244.7)	65 <sup>7</sup> / <sub>8</sub> (1673.2)	62 <sup>3</sup> / <sub>8</sub> (1584.3)
	240	36.0	3	2	CFRS779M12XS	C2-218	C2-224	636 (289)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)
480	36.0	3	1	CFRS779M13XS	C2-224	C2-226	636 (289)	98 <sup>3</sup> / <sub>8</sub> (2498.7)	75 <sup>7</sup> / <sub>8</sub> (1927.2)	72 <sup>3</sup> / <sub>8</sub> (1838.3)	

③ Wired for 3-phase operation only

### 8 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



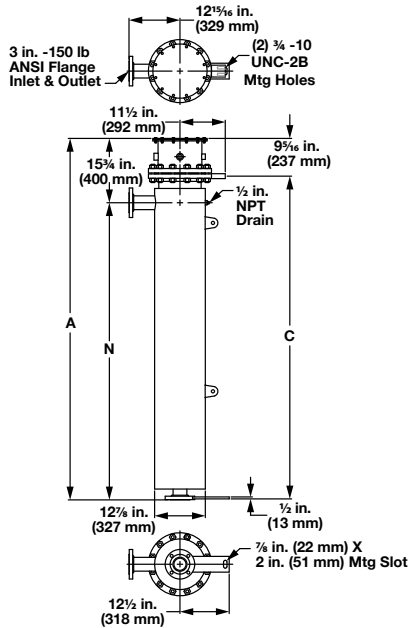
### Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
						Type J T/C	Type K T/C				
<b>10 inch - 150 lb ANSI Flange (WATROD)</b>											
<b>8 W/in<sup>2</sup> <sup>③</sup> Steel Tank 27-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	30.0	3	3	<b>CFSS762E12S</b>	<b>C4-143</b>	<b>C4-142</b>	540 (245)	91 <sup>1</sup> / <sub>4</sub> (2316.0)	75 <sup>1</sup> / <sub>2</sub> (1916.0)	82 <sup>1</sup> / <sub>4</sub> (2088.0)
	480	30.0	3	1	<b>CFSS762E13S</b>	<b>C2-225</b>	<b>C2-226</b>	540 (245)	91 <sup>1</sup> / <sub>4</sub> (2316.0)	75 <sup>1</sup> / <sub>2</sub> (1916.0)	82 <sup>1</sup> / <sub>4</sub> (2088.0)
	240	35.0	3	3	<b>CFSS770N12S</b>	<b>C4-144</b>	<b>C4-145</b>	600 (273)	99 <sup>1</sup> / <sub>8</sub> (2517.8)	83 <sup>3</sup> / <sub>8</sub> (2117.7)	89 <sup>13</sup> / <sub>16</sub> (2281.2)
	480	35.0	3	1	<b>CFSS770N13S</b>	<b>C2-225</b>	<b>C2-226</b>	600 (273)	99 <sup>1</sup> / <sub>8</sub> (2517.8)	83 <sup>3</sup> / <sub>8</sub> (2117.7)	89 <sup>13</sup> / <sub>16</sub> (2281.2)
	240	40.0	3	3	<b>CFSS778N12S</b>	<b>C4-144</b>	<b>C4-145</b>	645 (293)	106 <sup>5</sup> / <sub>8</sub> (2708.3)	90 <sup>7</sup> / <sub>8</sub> (2308.2)	97 <sup>5</sup> / <sub>16</sub> (2471.7)
	480	40.0	3	1	<b>CFSS778N13S</b>	<b>C2-225</b>	<b>C2-226</b>	645 (293)	106 <sup>5</sup> / <sub>8</sub> (2708.3)	90 <sup>7</sup> / <sub>8</sub> (2308.2)	97 <sup>5</sup> / <sub>16</sub> (2471.7)

③ Wired for 3-phase operation only

### 10 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters



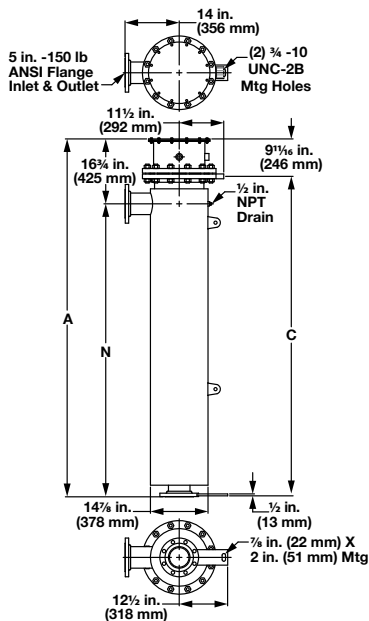
### Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD elements
- Without thermostat
- General purpose enclosure

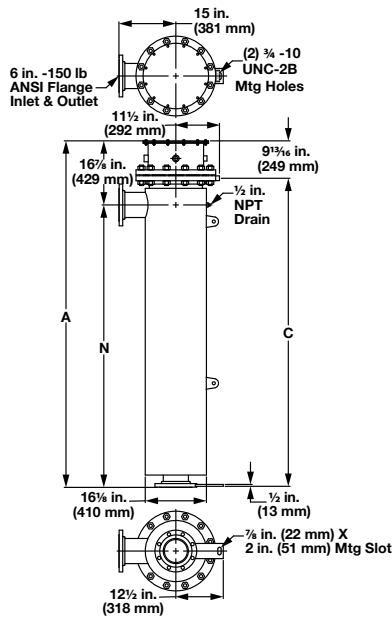
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number		Ship Wt. lbs (kg)	"A" Dim. in. (mm)		"N" Dim. in. (mm)		"C" Dim. in. (mm)	
						Type J T/C	Type K T/C							
<b>12 inch - 150 lb ANSI Flange (WATROD)</b>														
<b>8 W/in<sup>2</sup> ③ Steel Tank 36-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	47.0	3	3	CFTS770L12S	C4-144	C4-145	700 (318)	99	(2515)	82 <sup>7</sup> / <sub>8</sub>	(2105.0)	89 <sup>5</sup> / <sub>8</sub>	(2277)
	480	47.0	3	2	CFTS770L13S	C2-229	C2-230	700 (318)	99	(2515)	82 <sup>7</sup> / <sub>8</sub>	(2105.0)	89 <sup>5</sup> / <sub>8</sub>	(2277)
	240	54.0	3	3	CFTS778L12S	C4-144	C4-145	750 (341)	106 <sup>1</sup> / <sub>2</sub>	(2705)	90 <sup>3</sup> / <sub>8</sub>	(2295.5)	97 <sup>1</sup> / <sub>8</sub>	(2467)
	480	54.0	3	2	CFTS778L13S	C2-229	C2-230	750 (341)	106 <sup>1</sup> / <sub>2</sub>	(2705)	90 <sup>3</sup> / <sub>8</sub>	(2295.5)	97 <sup>1</sup> / <sub>8</sub>	(2467)
<b>14 inch - 150 lb ANSI Flange (WATROD)</b>														
<b>8 W/in<sup>2</sup> ③ Steel Tank 45-Steel Elements (1.3 W/cm<sup>2</sup>)</b>	240	60.0	3	3	CFWS770J12S	C4-144	C4-145	700 (318)	98 <sup>1</sup> / <sub>4</sub>	(2496)	82	(2081)	88 <sup>11</sup> / <sub>16</sub>	(2253)
	480	60.0	3	3	CFWS770J13S	C4-150	C4-151	700 (318)	98 <sup>1</sup> / <sub>4</sub>	(2496)	82	(2081)	88 <sup>11</sup> / <sub>16</sub>	(2253)
	240	67.0	3	5	CFWS778J12S	C/F	C/F	780 (354)	105 <sup>3</sup> / <sub>4</sub>	(2686)	89 <sup>1</sup> / <sub>2</sub>	(2272)	96 <sup>3</sup> / <sub>16</sub>	(2443)
	480	67.0	3	3	CFWS778J13S	C4-152	C4-153	780 (354)	105 <sup>3</sup> / <sub>4</sub>	(2686)	89 <sup>1</sup> / <sub>2</sub>	(2272)	96 <sup>3</sup> / <sub>16</sub>	(2443)

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

#### 12 inch - 150 lb ANSI Flange



#### 14 inch - 150 lb ANSI Flange



# Circulation Heaters



## WATROD and FIREBAR Circulation Heaters

### Part Number

Stock Plug or ANSI Flange Part Number	Optional Terminal Enclosures	Optional Process Sensors	Sheath Limit Sensors

Stock Plug or ANSI Flange Part Number
<p><b>Note:</b> Catalog part numbers include optional enclosures and process sensors. To order optional enclosures or sensors, substitute the appropriate suffix.</p>

Optional Terminal Enclosures	
S =	General purpose enclosure
W =	NEMA 4 enclosure
C =	Moisture/explosion resistant enclosure
<p><b>Note:</b> Catalog listings include either a general purpose enclosure or NEMA 4 enclosure. Substitute enclosure options are noted.</p>	

Optional Bulb and Capillary Thermostats or Thermocouple Process Sensors	
2 =	30 to 250°F, (-1 to 121°C) SPST
3 =	175 to 550°F, (79 to 288°C) SPST
4 =	40 to 110°F, (-1 to 43°C) DPST
5A=	60 to 250°F, (16 to 121°C) DPST (FIREBAR)
7A=	100 to 550°F, (38 to 288°C) DPST (FIREBAR)
J =	Type J process thermocouple in thermowell
K =	Type K process thermocouple in thermowell
<p><b>Note:</b> Thermostat part numbers are shown in the <i>Thermostat Chart</i> on page 517.</p>	

Sheath Limit Sensors	
HJ=	Type J high-limit thermocouple, horizontal mount
TJ=	Type J high-limit thermocouple, vertical/housing at top
BJ=	Type J high-limit thermocouple, vertical/housing at bottom
HK=	Type K high-limit thermocouple, horizontal mount
TK=	Type K high-limit thermocouple, vertical/housing at top
BK=	Type K high-limit thermocouple, vertical/housing at bottom
<p><b>Note:</b> Heater orientation is critical to accurate sensing of limit conditions. Use the appropriate code to indicate heater mounting orientation.</p>	

**Example Part Number:** CFONA18A10 S 5 HJ

# Circulation Heaters



## WATROD™ and FIREBAR® Heaters

### Booster Heaters

Booster heaters are ideal for circulating applications requiring less kilowatts, including engine preheating.

Booster heaters are made from a steel or brass 1 1/4 in. (32 mm) NPT screw plug heater and insulated pressure vessel with 1 in. (25 mm) FNPT inlet and outlet. This assembly also contains an integral thermostat.

### Performance Capabilities

- Watt densities up to 60 W/in<sup>2</sup> (9.3 W/cm<sup>2</sup>)
- Wattages up to 3 kilowatts
- Voltages up to 480VAC
- Steel sheath temperatures up to 750°F (400°C)
- Alloy 800 sheath temperatures up to 350°F (175°C)

### Features and Benefits

#### Dual voltages

- Simplifies stocking and wiring

#### Carbon steel, standard pipe wall vessel

- Assures compatibility with many applications

#### One inch thick (25 mm) fiberglass thermal insulation rated to 750°F (400°C)

- Reduces heat loss

#### Steel jacket (shroud)

- Provides a fully welded and painted shroud to protect thermal insulation

#### Inlet and outlet nozzle connections

- Includes threaded FNPT connections to meet OEM standards

#### General purpose terminal enclosures

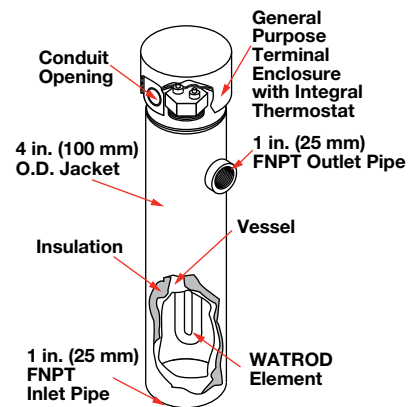
- Protects terminals and thermostat

#### Integral thermostat controls process temperatures from: 60 to 160°F (15 to 70°C) on alloy 800 sheath elements and 175 to 550°F (80 to 290°C) on steel sheath elements

- Minimizes the amount of time that the heater operates while the engine is running

### Typical Applications

- Stand by generators
- Peak power trimming generators
- Mobile generator sets
- Earth moving equipment
- Water heaters
- Lightweight oils





# Circulation Heaters



## WATROD and FIREBAR Heaters

### Booster Heaters

#### Terminal Enclosure

General purpose terminal enclosures with integral thermostats are supplied on all Watlow booster heaters. Optional moisture resistant terminal enclosures protect wiring and thermostat from liquid contaminants. To order, request the **moisture resistant enclosure option**.

For explosion resistant and explosion/moisture resistant terminal enclosures, request the **explosion/moisture resistant option**.

Description	kW	Phase	Part Number 120/240VAC	Est. Ship. Wt. lbs (kg)
-------------	----	-------	---------------------------	----------------------------

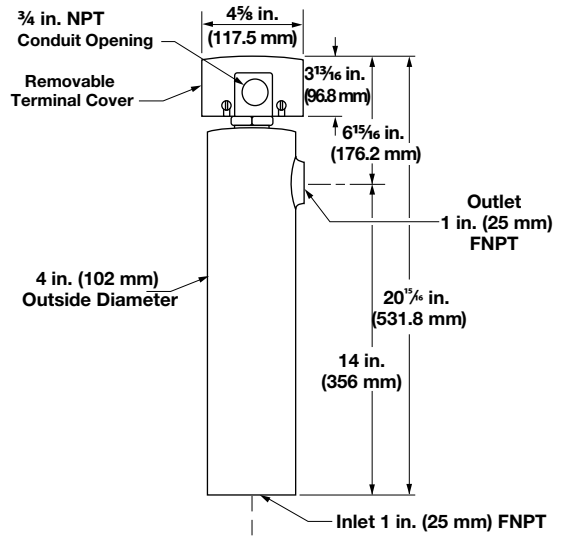
#### Application: Aqueous Solutions

60 W/in <sup>2</sup>	1.50	1	CBEN8G6	18 (8.2)
Brass Plug	2.00	1	CBEN10F6	18 (8.2)
2-Alloy 800	2.50	1	CBEN12F6	18 (8.2)
(9.3 W/cm <sup>2</sup> )	3.00	1	CBEN15A6X	18 (8.2)

#### Application: Lightweight Oils

23 W/in <sup>2</sup>	0.50	1	CBES7G6	18 (8.2)
Steel Plug	0.75	1	CBES10B6	18 (8.2)
2-Steel	1.00	1	CBES12P6	18 (8.2)
(3.6 W/cm <sup>2</sup> )				

For optional housing adders, use circulation heater adders.



# Circulation Heaters



## WATROD™ and FIREBAR® Heaters

### Engine Preheaters

Watlow engine preheaters help maintain a desired minimum engine temperature to make starting fast and easy. They also reduce engine wear caused by cold engine starting.

Engine preheaters mount conveniently on an engine or rail. The internal thermostat constantly adjusts to ambient temperature changes to keep engine coolant warm at all times.

An internal tank temperature sensor protects Watlow engine preheaters from dry-fire conditions caused by low coolant levels or blocked flow.

Installation is easy with just two mounting bolts and inlet and outlet hose connections.

### Performance Capabilities

- Watt densities from 45 to 90 W/in<sup>2</sup> (7 to 14 W/cm<sup>2</sup>)
- Wattages up to 5 kilowatts
- UL® and CSA component recognition up to 480VAC and 600VAC respectively
- Thermostatically controlled from 60 to 160°F (15 to 70°C)
- Alloy 800 sheath temperatures up to 1600°F (870°C)

### Features and Benefits

#### Alloy 800 sheath

- Minimizes the risk of premature failure in the event of a dry-fire condition

#### Integral, prewired adjustable thermostat mounted in a general purpose terminal enclosure

- Provides a ready to install unit

#### Easy installation with standard 1 in. (25 mm) diameter beaded inlet and outlet nozzles

- Provides rubber hose connections eliminating the need for threaded fittings and adapters

#### 120/240VAC or 240/480VAC dual voltages

- Makes field wiring flexible
- Minimizes stocking multiple voltages

#### Mounting bracket

- Isolates harmful engine vibration

#### Heavy-duty welded carbon steel tank

- Resists corrosion and extends life

#### Integral check valve

- Assures proper coolant flow and correct thermostat operation. Check valve will not interfere with adequate thermo-siphoning

#### UL® and CSA component

Recognition under file numbers E52951 and 31388 respectively



### Typical Applications

- Stand by generators
- Primary power generators
- Fire pump engines

### Options

#### Terminal Enclosure

The following terminal enclosures are available:

- Standard, general purpose
- Moisture resistant

# Circulation Heaters



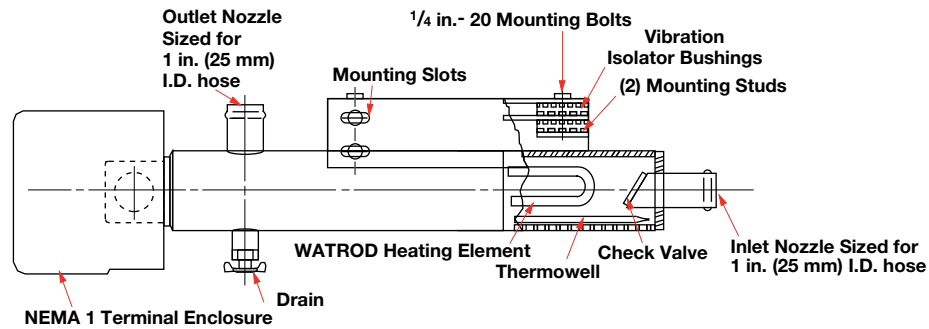
## WATROD and FIREBAR Heaters

### Engine Preheaters

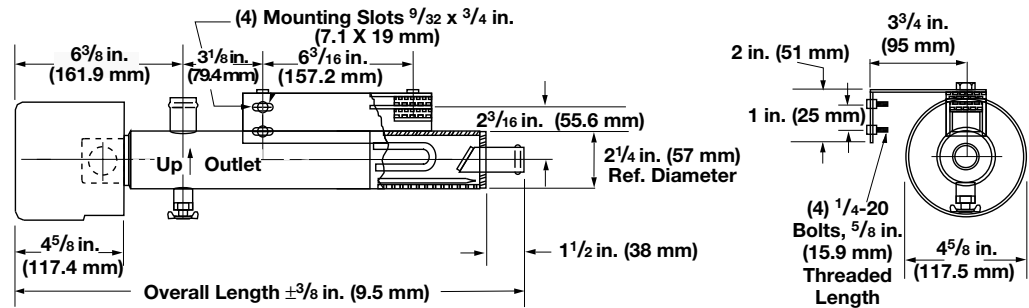
- Mount engine preheaters in horizontal position only (as shown in Figures 1, 2 and 3). Contact your Watlow representative if vertical mounting is unavoidable.
- Mount the heater near or below the lowest point on the engine block. Keep outlet nozzle pointed up, as indicated on the tank.

- Estimate kilowatt requirements with the following formula. First determine the engine displacement, then multiply:

<b>English</b>
Cubic inches X 3 = estimated wattage
<b>Metric</b>
Liters X 183 = estimated wattage



**Figure 1**



kW	Overall Length in. (mm)	Part Number			Est. Ship.	
		120/240VAC 1-Phase	208VAC 1-Phase	240/480VAC 1-Phase	lbs	Wt. (kg)

**Application: Ethylene Glycol/Engine Coolant**

1.13	20 <sup>7</sup> / <sub>8</sub> (530.2)		CPBPL2S12		12	(6)
1.50	20 <sup>7</sup> / <sub>8</sub> (530.2)	CPBPB6S12	CPBPB2S12		12	(6)
1.69	20 <sup>7</sup> / <sub>8</sub> (530.2)		CPBPM2S12		12	(6)
1.88	20 <sup>7</sup> / <sub>8</sub> (530.2)		CPBPN2S12		12	(6)
2.00	20 <sup>7</sup> / <sub>8</sub> (530.2)	CPBPC6S12			12	(6)
2.25	20 <sup>7</sup> / <sub>8</sub> (530.2)	CPBPD6S12			12	(6)
2.25	26 <sup>11</sup> / <sub>16</sub> (677.9)		CPBPD2S12		15	(7)
2.50	20 <sup>7</sup> / <sub>8</sub> (530.2)	CPBPE6S12			12	(6)
3.00	26 <sup>11</sup> / <sub>16</sub> (677.9)		CPBPF2S12	CPBPF7S12	15	(7)
3.75	26 <sup>11</sup> / <sub>16</sub> (677.9)		CPBPG2S12		15	(7)
4.00	26 <sup>11</sup> / <sub>16</sub> (677.9)			CPBPH7S12	15	(7)
5.00	26 <sup>11</sup> / <sub>16</sub> (677.9)			CPBPJ7S12	15	(7)

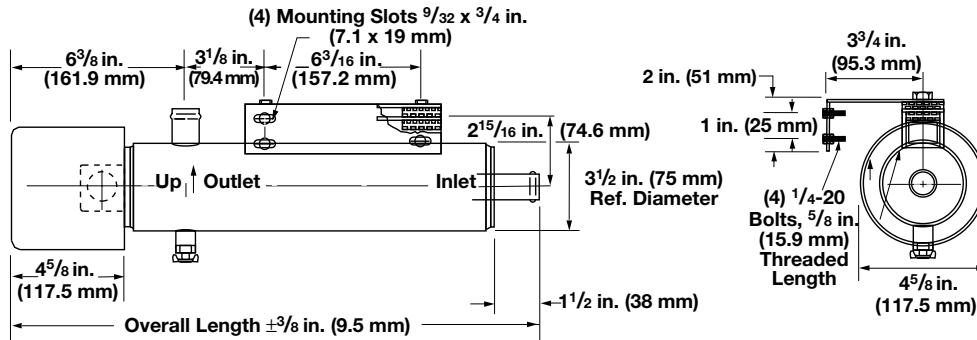
# Circulation Heaters



## WATROD and FIREBAR Heaters

### Engine Preheaters

Figure 2

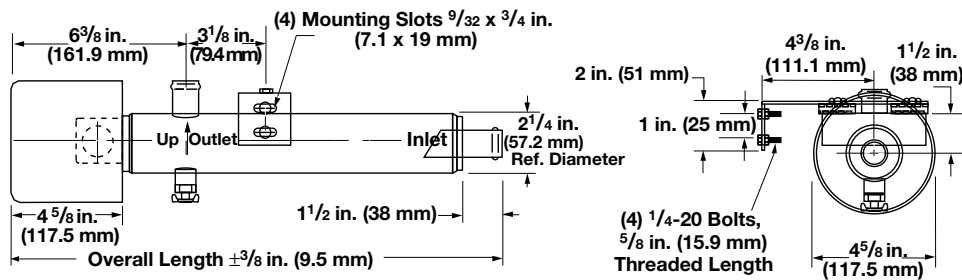


kW	Overall Length in. (mm)	Part Number		Est. Ship.	
		277VAC 1-Phase	480VAC 3-Phase	lbs	Wt. (kg)

Application: Ethylene Glycol/Engine Coolant

1.50	20 7/8 (530.2)	CPCPB4S12	CPCPB13S12	12	(6)
2.00	20 7/8 (530.2)	CPCPC4S12	CPCPC13S12	12	(6)
2.50	20 7/8 (530.2)	CPCPE4S12	CPCPE13S12	12	(6)
3.75	20 7/8 (530.2)	CPCPG4S12	CPCPG13S12	12	(6)
4.00	20 7/8 (530.2)	CPCPH4S12	CPCPH13S12	12	(6)
5.00	20 7/8 (530.2)	CPCPJ4S12	CPCPJ13S12	12	(6)

Figure 3



kW	Overall Length in. (mm)	Part Number		Est. Ship.	
		120/240VAC 1-Phase	208VAC 1-Phase	lbs	Wt. (kg)

Application: Ethylene Glycol/Engine Coolant

0.75	15 5/8 (396.9)		CPBPK2S12	9	(4)
1.00	15 5/8 (396.9)	CPBPA6S12		9	(4)

# Circulation Heaters



## FLUENT® In-line Heaters

Watlow's FLUENT® in-line fluid heater is a small, lightweight, high-performance heater that can replace both a traditional immersion type heater or a heater wrapped around a tube as part of a thermal system. Watlow's FLUENT heater is designed as an integrated solution that replaces multiple components in a system. This heater design reduces overall system cost and complexity. Because of its high watt density, it offers ultra-fast response leading to higher system performance. Featuring Watlow's patented layered heater technology, the heater makes use of its entire surface to produce heat, which optimizes heat transfer and temperature uniformity.

### Features and Benefits

#### Small, lightweight, robust heater construction

- Replaces multiple components in a system
- Reduces overall system size
- Lowers total cost of ownership

#### Patented circuit patterning process

- Facilitates customizable heating profiles
- Enables distributed wattage and/or multiple zones
- Assures precise and repeatable power distribution

#### High watt density, low mass heater

- Contributes to fast response time
- Allows for efficient heat transfer
- Enables on-demand process start-up



### Typical Applications

- Hemodialysis fluid heating
- Food cooking equipment
- Semiconductor purge and carrier gas heating
- Ink preheating systems
- On-demand fluid heating

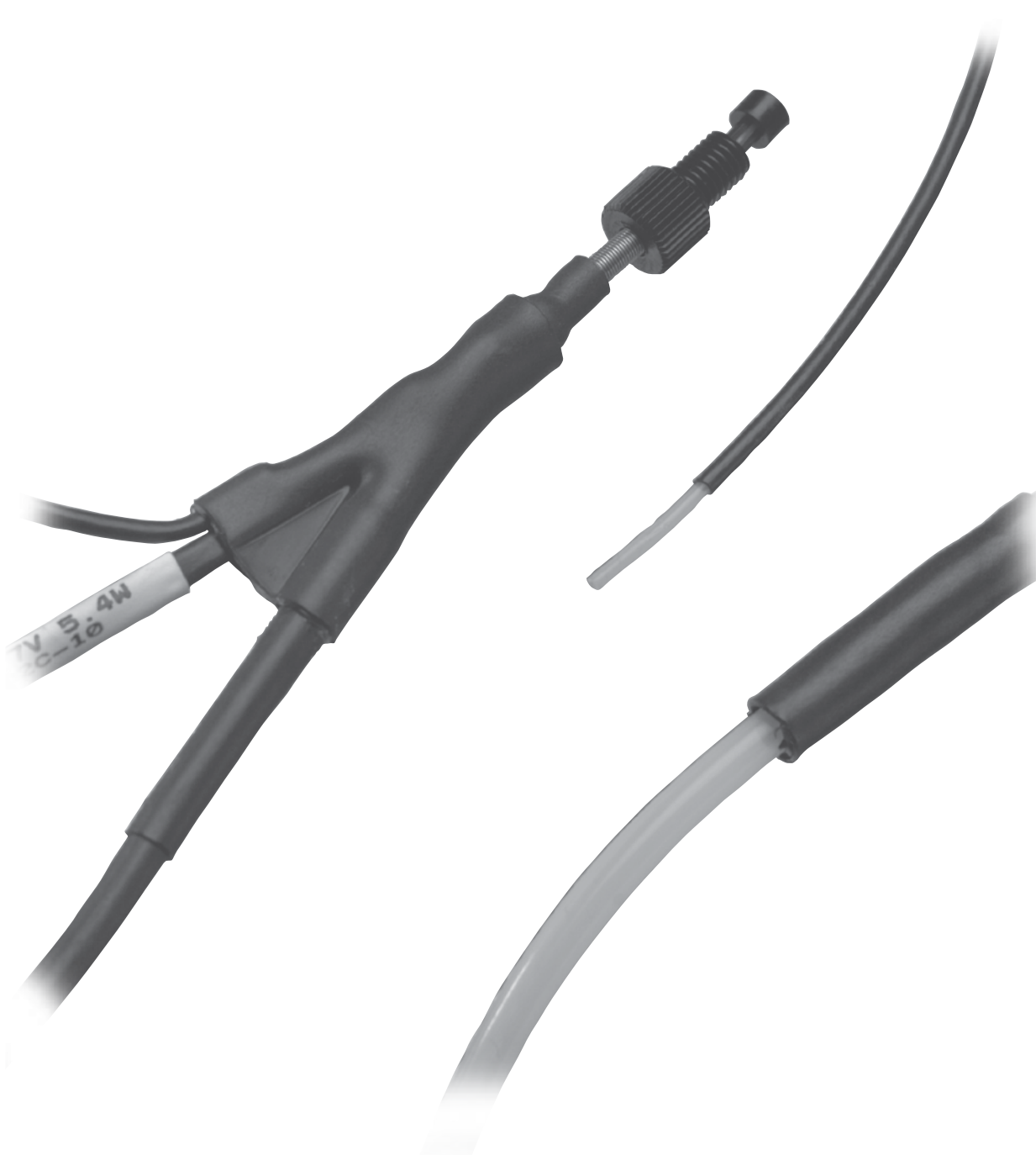
**For detailed product and technical data,  
see the full FLUENT In-line product  
section located on pages 445 through 448.**



# Fluid Delivery Heaters



Fluid Delivery Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
<b>FREEFLEX®</b>	Polymeric	212	100	10	1.5	<b>369</b>
<b>Syringe</b>	Polycarbonate laminate	185	85	2	0.3	<b>372</b>
<b>FLUENT® In-line</b>	444 stainless steel (substrate tube), 316L stainless steel (baffle and fittings)	212 (in water)	100	450	70	<b>373</b>



Fluid Delivery Heaters





# Fluid Delivery Heaters

**EXTENDED  
CAPABILITY**



## Extended Capabilities for FREEFLEX® Heaters

Watlow's miniature heated polymeric tubing assemblies provide a flexible heat-up and transport system for moving fluids within diameters as small as 1/32 in. (0.8 mm). The FREEFLEX® heater heats fluids up to 212°F (100°C) and maintains temperature during transfer from a reservoir to a point of use. In some applications, the tubing can actually serve as the reservoir for limited volumes of fluid, helping to reduce start-up times. For higher temperatures, contact your Watlow representative.

Watlow's innovative design places the heating element and sensor directly in contact with the perimeter of the tubing to produce efficient, responsive heating and temperature control of the tube contents. The element is evenly wound to ensure reliable, close contact for uniform heating along a portion or the entire length of the line. A flexible, durable jacket covers the wound element to let the tubing flex and move in a dynamic system. This allows for fluid delivery to multiple locations from a single supply source. In stationary applications, the FREEFLEX heated tubing is conveniently routed through available space or around other system components. This saves space and provides an uncomplicated retrofit in existing systems.

The FREEFLEX heater's efficient heating element design can incorporate an optional thermocouple, thermistor or resistance temperature detector (RTD) temperature sensor into the thermal package. Users can select leads to exit from one or both ends of the assembly. Typical standard PTFE tubing is available in 1/32, 1/16, 1/8 or 3/16 in. (0.8, 1.6, 3.2, 4.8 mm) inside diameters. Contact your Watlow representative for other sizes and materials.

### Features and Benefits

#### Flexible heat-up and transport system

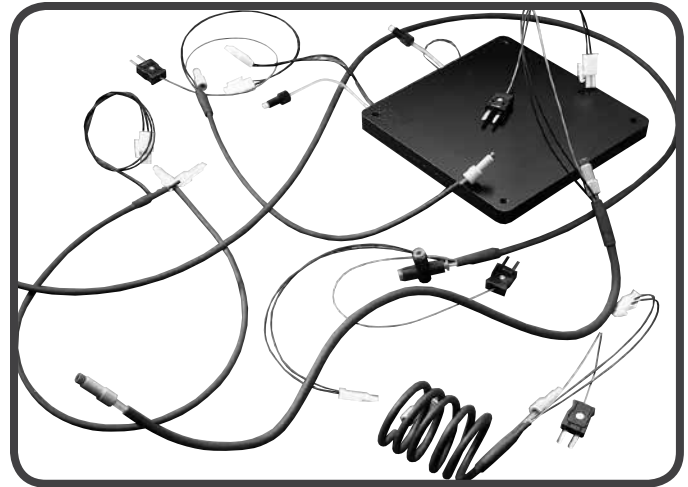
- Eliminates the need for heated reservoir systems in many applications

#### Direct contact between the heating element and tubing

- Provides fast, efficient, highly responsive heating

#### Available in three configurations

- FREEFLEX design allows tubing to flex, coil or bend around system components, enabling convenient retrofits
- Pre-formed design allows a longer tube length in a smaller volume
- Molded design provides a compact heating assembly for easy installation



#### Integral sensors

- Maintain close control of heater and fluid temperatures

#### Low voltage design

- Ensures safety

#### Miniature sizes as small as 1/32 in. (0.8 mm) inside diameter

- Heats and transports fluids within tiny spaces

#### Convenient retrofit

- Allows for routing flexible tubing around system components and using existing control system

#### UL® recognition

- Available on qualified designs by request

### Typical Applications

- **Clinical:** automated clinical analyzers, tissue processing equipment
- **Analytical:** sample preheating for LC and HPLC systems, breathalyzers, immunoassays
- **Semiconductor processing:** wafer drying equipment, DI water heating
- **Printing:** additive manufacturing/3D printing
- **General process:** wax/paraffin processing and non-combustible gas heating
- **Water purification systems**
- **Precision cleaning equipment**
- **Aerospace**
- **Military**

# Fluid Delivery Heaters

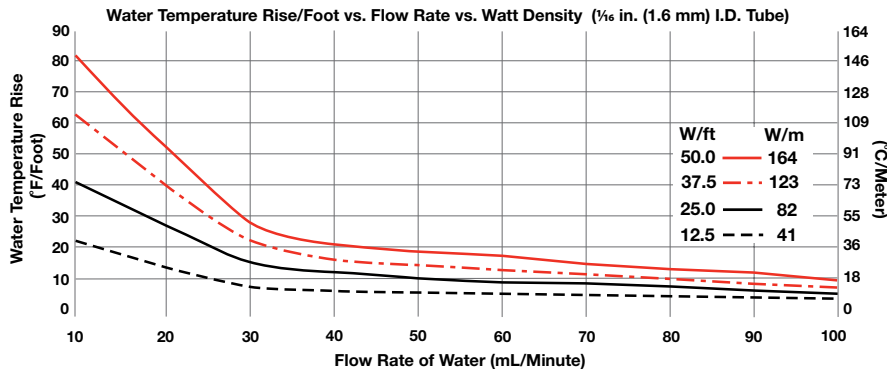
**EXTENDED  
CAPABILITY**



## Extended Capabilities for FREEFLEX Heaters

### Technical Data

### Water Temperature Rise/Length Versus Flow Rate Versus Watt Density



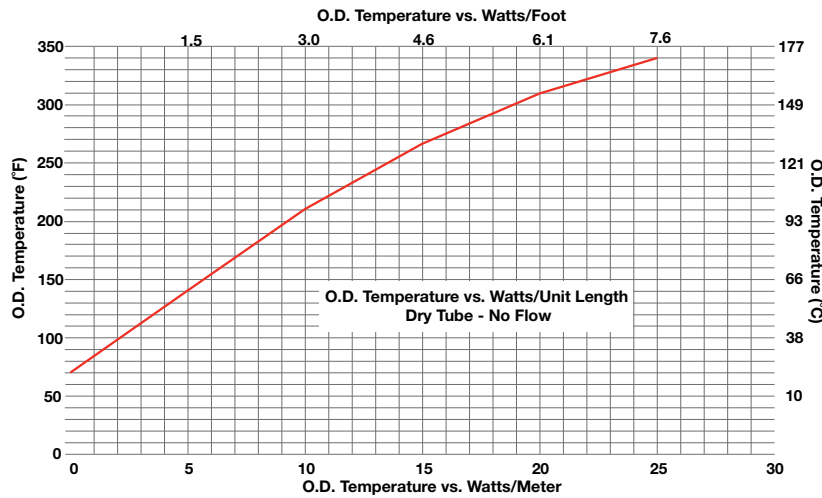
#### Water Temperature Rise °F/Foot

W/ft	10	30	50	100
50.0	82	29	19	10
37.5	64	22	14	7
25.0	41	16	10	5
12.5	22	8	5	3

#### Water Temperature Rise °C/Meter

W/m	10	30	50	100
164	149	52	35	18
123	116	40	26	13
82	75	29	18	9
41	40	15	9	5

### FREEFLEX Outside Diameter Temperature Versus Watts/Length



W/ft	W/m	O.D. Temperature °F	O.D. Temperature (°C) (Ambient)
0	0	70	(21)
1.5	5	140	(60)
3.0	10	210	(99)
4.6	15	265	(129)
6.1	20	310	(154)
7.6	25	340	(171)

# Fluid Delivery Heaters

**EXTENDED  
CAPABILITY**



## Extended Capabilities for FREEFLEX Heaters

### Typical Application Requirements

When requesting a quote please specify:

- **Fluid type**
- **Inlet temperature**
- **Outlet temperature**
- **Flow rate**
- **Voltage** - Typically less than 36V
- **Watts/ft** - See chart on previous page for typical values
- **Maximum allowable outside surface Temperature**
- **Tube size**
  - 1/32 in. (0.8 mm) I.D. x 1/16 in. (1.6 mm) O.D.
  - 1/16 in. (1.6 mm) I.D. x 1/8 in. (3.2 mm) O.D.
  - 1/8 in. (3.2 mm) I.D. x 3/16 in. (4.8 mm) O.D.
  - 3/16 in. (4.8 mm) I.D. x 1/4 in. (6 mm) O.D.
  - Other (specify size)
- **Tube material**
  - PTFE standard
  - Others upon request
- **Tube length** - 24 to 165 in. (610 to 4191 mm) typical
  - Total
  - Heated
  - Unheated (specify)
- **Tube fittings**
  - No fittings (1 in. [25 mm] bare tubing each end)
  - Other (specify)
- **Tube flexing**
  - Static (to route around components in system)
  - Dynamic (subject to more continuous flexing)
  - Occasional, frequent or continuous

**Note:** Min. recommended flexing radius

- 1/32 in. (0.8 mm) I.D. x 1/16 in. (1.6 mm) O.D. PTFE  
1 in. (25 mm)
- 1/16 in. (1.6 mm) I.D. x 1/8 in. (3.2 mm) O.D. PTFE  
1 1/2 in. (38 mm)
- 1/8 in. (3.2 mm) I.D. x 3/16 in. (4.8 mm) O.D. PTFE  
2 in. (51 mm)
- 3/16 in. (4.8 mm) I.D. x 1/4 in. (6 mm) O.D. PTFE  
3 in. (76 mm)

### Heater leads

- One at each end
- Both at one end
- Standard lead insulation (UL® Style 1180 CSA white PTFE)
- Other insulation (specify)

### Heater lead length

- Standard 12 in. (305 mm) w/customer end stripped/tinned 1/2 in. (13 mm)
- Other (specify)

### Heater lead exit direction

- Inboard/outboard

### Temperature sensor

- Thermocouple (#30 AWG PFA - Type J)
- Thermistor (specify) 10KΩ at 72°F (25°C) standard
- Other temperature sensors size/types (specify)
- Sense heater element or tube temperature

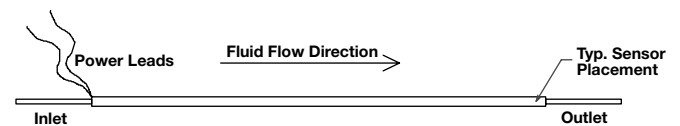
### Sensor lead exit direction

- Inboard/outboard

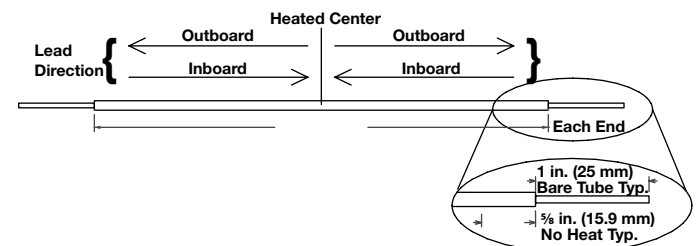
### Temperature sensor lead length

- 12 in. (305 mm)
- Other (specify)

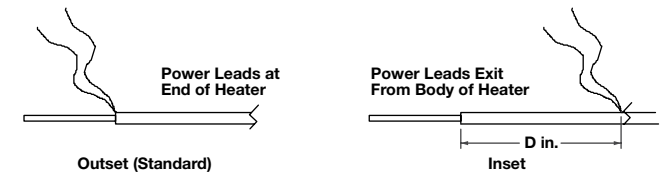
## Typical FREEFLEX Layout



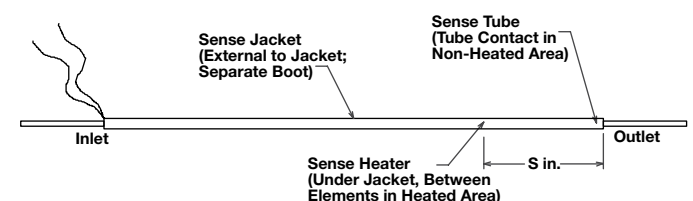
## Lead Orientation



## Lead Location



## Sensor Location/Mounting Description



# Fluid Delivery Heaters

**EXTENDED  
CAPABILITY**



## Extended Capabilities for Syringe Heaters

The Watlow syringe heater was developed to match the unique needs of medical injection applications. It produces consistent results by reducing temperature and viscosity variations. Fluid and drug delivery that maintain precise liquid temperatures and reduce fluid viscosity maximize patient comfort and reduce risk. Body temperature injections are more easily introduced, particularly for patients in a frail or distressed condition.

The Watlow syringe heater is available in two configuration types with an optional, repeatable temperature sensing controller. The silicone/wire configuration accommodates varying syringe size needs. The translucent, high-tech laminate construction of the polycarbonate/foil design enables fluid levels and air bubbles to be easily viewed and monitored. Both heater forms are designed to “snap” on to the syringe with one hand and hold firmly during a procedure.

An overmold design houses the optional electronic controller and/or temperature sensor to allow trouble-free servicing and extend heater life. The overmold can be modified and color matched for seamless, integrated appearance.

### Features and Benefits

#### Long operational life

- Improves system reliability
- Reduces equipment down time and minimizes the need to reschedule procedures

#### Two heater configurations provide flexibility and adaptability

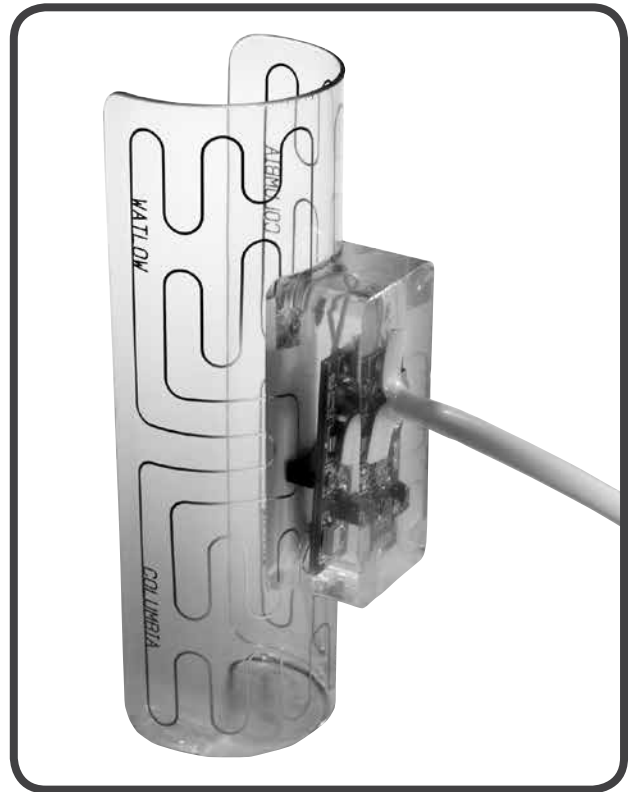
- Silicone wire enables maximum flexibility to accommodate various syringe sizes
- Polycarbonate/foil provides high tech appearance and functionality

#### Customizable to most OEM requirements

- Allows over-mold to be modified and color matched for a seamless, integrated appearance

#### Optional precise, repeatable temperature sensing control

- Maximizes patient comfort
- Minimizes patient risk
- Increases the consistency of test results by eliminating temperature and viscosity variations
- Carries a longer product life than bimetal thermostats



### Specifications

#### Silicone/Wire and Polycarbonate/Foil

- Length: 5 in. (127 mm) max.
- Formed heater diameter: formed to fit syringe. Typical diameter is 2 in. (50 mm) to 6 in. (150 mm)\*
- Voltage: dependent on application, over 48V may impact agency approvals
- Control accuracy: 5.4°F (±3°C)
- Max. operating surface temperature: 185°F (85°C)
- Approximate control pod dimensions: 1 x 1 x 2.75 in. (25 x 25 x 70 mm)\*
- Cord pull strength: Up to 89 N (20 lb<sub>F</sub>)\*

\* Dependent on design requirements.

# Fluid Delivery Heaters



## FLUENT® In-line Heaters

Watlow's FLUENT® in-line fluid heater is a small, lightweight, high-performance heater that can replace both a traditional immersion type heater or a heater wrapped around a tube as part of a thermal system. Watlow's FLUENT heater is designed as an integrated solution that replaces multiple components in a system. This heater design reduces overall system cost and complexity. Because of its high watt density, it offers ultra-fast response leading to higher system performance. Featuring Watlow's patented layered heater technology, the heater makes use of its entire surface to produce heat, which optimizes heat transfer and temperature uniformity.

### Features and Benefits

#### Small, lightweight, robust heater construction

- Replaces multiple components in a system
- Reduces overall system size
- Lowers total cost of ownership

#### Patented circuit patterning process

- Facilitates customizable heating profiles
- Enables distributed wattage and/or multiple zones
- Assures precise and repeatable power distribution

#### High watt density, low mass heater

- Contributes to fast response time
- Allows for efficient heat transfer
- Enables on-demand process start-up



### Typical Applications

- Hemodialysis fluid heating
- Food cooking equipment
- Semiconductor purge and carrier gas heating
- Ink preheating systems
- On-demand fluid heating

**For detailed product and technical data,  
see the full FLUENT in-line product  
section located on pages 445 through 448.**





Air Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
<b>Duct Heaters</b>						
<b>LDH SERIES and D SERIES</b>	Alloy 840	1200	650	30	4.7	<b>377</b>
<b>MDH SERIES</b>	Alloy 840	1200	650	26	4.0	<b>391</b>
<b>Finned</b>						
<b>375 Fined Strip</b>	Aluminized steel	1100	595	33	5.1	<b>395</b>
<b>FINBAR™ Single-Ended</b>	304 stainless steel	1200	650	50	7.7	<b>401</b>
<b>FIREROD® Cartridge</b>	Alloy 800	Application Specific		100	15.5	<b>402</b>
<b>Enclosure Heaters</b>						
<b>WATROD™</b>	Alloy 840	390	200	15	2.3	<b>403</b>
<b>Silicone Rubber</b>	Fiberglass reinforced silicone rubber	500	260	5	0.8	<b>405</b>
<b>FLUENT® In-line</b>	444 stainless steel (substrate tube), 316L stainless steel (baffle and fittings)	482 (internal)	250	150	23	<b>408</b>



Air Heaters





# Air Heaters



## Duct Heaters

### LDH SERIES and D SERIES

Constructed of sturdy 0.430 in. (11 mm) diameter WATROD™ heating elements mounted to a 1/4 in. (6 mm) thick steel flange, duct heaters are easily adapted to many non-pressurized air-heating systems.

They are easily installed in applications requiring a wide range of temperature versus air flow combinations.

The modular duct heater offers increased reliability. The individual modules are removable through the housing of the assembly, which eliminates the need to pull the complete heater from the duct work. This reduces downtime costs because the heating elements can be replaced individually. Performance improvements include quicker response time and reduced infiltration from the air stream being heated into the electrical enclosure.

Watlow® duct heaters offer advantages over gas or oil fired and open coil electric units with:

- Installation flexibility—no flues or fuel lines
- 100 percent energy efficient—no energy loss up the flue
- Universal availability of electricity
- Resistance coil in sheath is protected from corrosive environments

### Performance Capabilities

- Watt densities up to 40 W/in<sup>2</sup> (6.2 W/cm<sup>2</sup>)
- Recommended process temperatures from -20 to 1200°F (-29 to 650°C)
- Catalog P/N wattages up to 225kW
- Voltages up to 600VAC

### Features and Benefits

#### Long life alloy 840 sheath

- Resists corrosion/oxidation while protecting resistance coils against contamination

#### MgO insulation filled elements compacted to rock hard density

- Maximizes dielectric strength, heat transfer and life

#### Field replaceable heating elements

- Permits easy service and reduces downtime. Element change-out is made simple by a single screw clamp (D SERIES only)

#### 3 1/2 in. (90 mm) thick mineral insulation

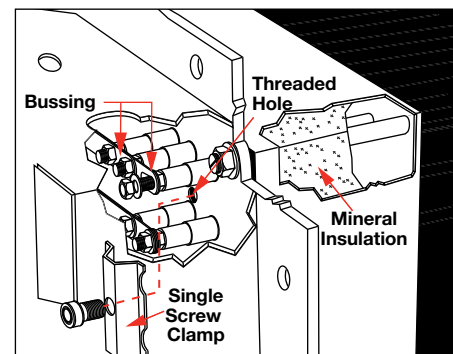
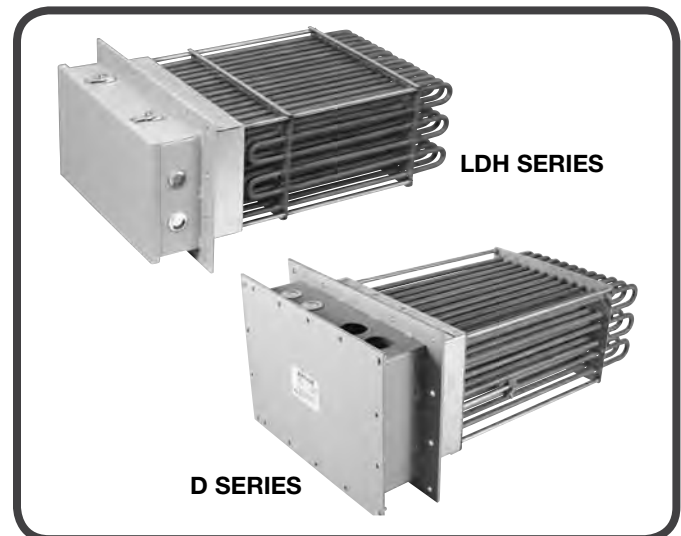
- Keeps wiring cooler and reduces heat loss

#### Silicone resin seals rated to 221°F (105°C)

- Protects elements against moisture and other contaminants

#### General purpose terminal enclosure

- Offers easy access to wiring



#### 1/4 in. (6 mm) inside diameter thermowell

- Accepts an optional Type J or K thermocouple for accurate sheath temperature sensing (D SERIES only)

#### Rigid stainless steel supports

- Prevents element sagging or deformation in various mounting positions

#### 1/4 in. (6 mm) thick steel flange with 3/8 in. (9.5 mm) diameter mounting holes

- Easily bolts to the duct wall

#### WATROD hairpins are repressed (recompacted) after bending to assure MgO density

- Eliminates hot spots and electrical insulation voids

#### Stock heaters feature from three to 60 elements

- Meets a wide variety of kilowatt demands

#### One or three phase voltages

- Meets local power supplies

#### Maximum 48 amperes per circuit

- Complies with National Electrical Code (NEC)

Duct heaters with general purpose enclosures meet UL® and CSA component recognition to 480 and 600VAC maximum respectively—UL® and CSA file numbers are E52951 and 31388



## Duct Heaters

### LDH SERIES and D SERIES

#### Typical Applications

- Drying ovens
- Autoclaves
- Furnaces
- Load banks
- Heat treating
- Reheating
- HVAC
- Paint drying

#### Choosing a Duct Heater

The English and metric graphs, shown on the following pages, will help you to select the correct duct heater. These graphs include: *Watt Density vs. Air Temperature/Velocity*, *Watt Density vs. Sheath Temperature and Pressure Drop vs. Air Velocity*.

These graphs, with the quick formulas on this page, along with information specific to your application, will determine the correct duct heater specifications. However, if engineering assistance is needed, contact your Watlow representative.

#### Required Application Information

- Desired outlet air temperature
- Inlet air temperature
- Delta T—the temperature difference between inlet and desired outlet temperature
- Air volume (CFM/CMM) measured at both inlet temperature and pressure
- Air velocity in feet per minute (FPM); meters per minute (MPM) which equals:

<b>English</b>	
$\text{FPM} = \frac{\text{CFM measured at standard conditions}}{\text{Duct cross section area at heater in ft}^2}$	
<b>Metric</b>	
$\text{MPM} = \frac{\text{CMM measured at normal conditions}}{\text{Duct cross section area at heater in m}^2}$	

- Minimum duct heater wattage (kW). This can be determined by:

<b>English</b>	
$\text{kW} = \frac{\text{CFM} \times \text{Delta T (}^\circ\text{F)} \times 1.1 \text{ (safety factor)}}{3000}$	
<b>Metric</b>	
$\text{kW} = \frac{\text{CMM} \times \text{Delta T (}^\circ\text{C)} \times 1.1 \text{ (safety factor)}}{48}$	

**Note:** The duct heater, or combination of duct heaters, used for the process should be equal to or exceed the minimum wattage calculation.

# Air Heaters



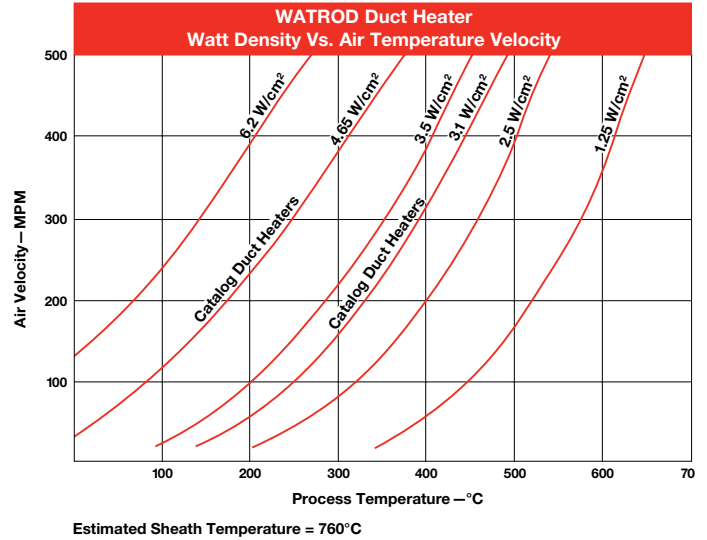
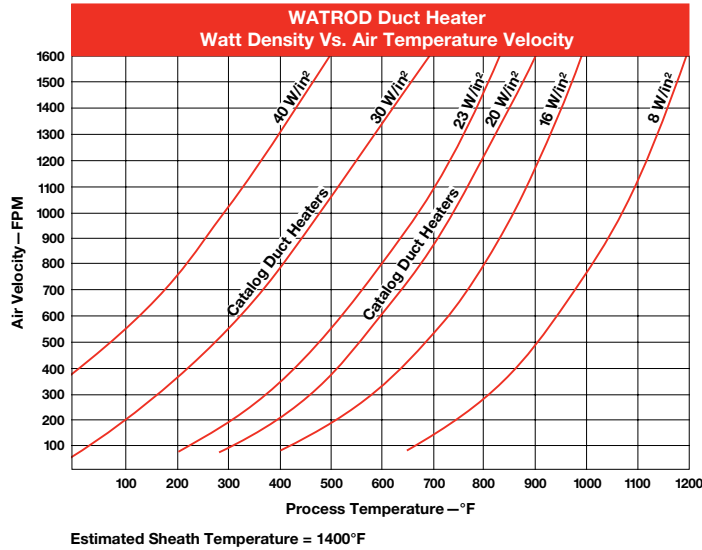
## Duct Heaters

### LDH SERIES and D SERIES

#### Watt Density vs. Air Temperature/Velocity

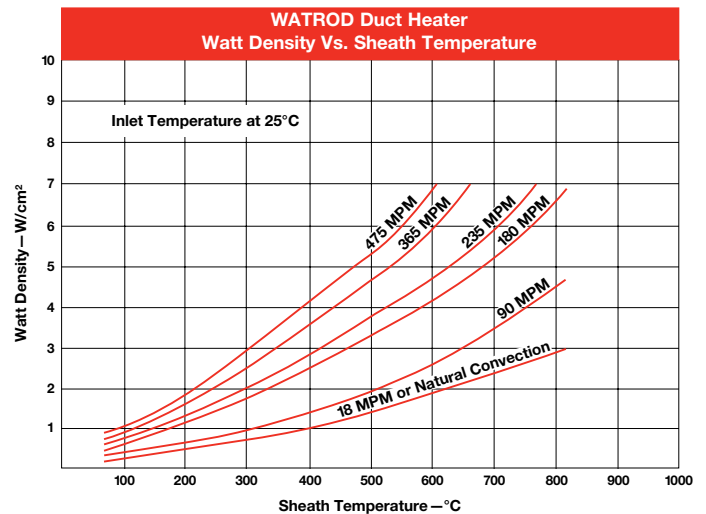
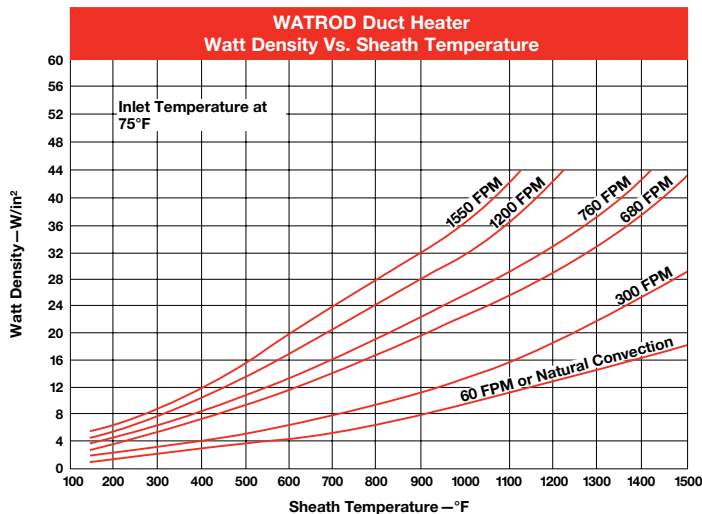
To decide watt density requirements, first determine the desired outlet air temperature and velocity in feet per minute. Then, follow the lines on the graph for velocity and process temperature to the watt density

curve's intersecting point. This shows the recommended watt density based on a maximum sheath temperature of 1400°F (760°C). **For longer heater life, lower watt densities should be chosen.**



#### Watt Density vs. Sheath Temperature

The *Watt Density vs. Sheath Temperature* graph shows the air velocity (FPM or MPM) required to operate a WATROD duct heater at specific watt densities or sheath temperatures. Also depicted is the appropriate watt density vs. sheath temperature at a specified air flow.





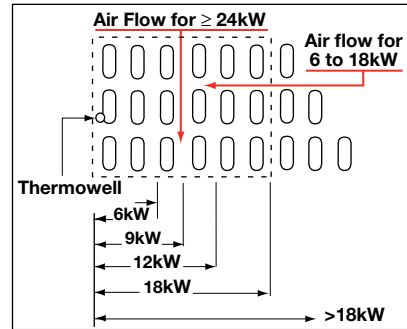
## Duct Heaters

### LDH SERIES and D SERIES

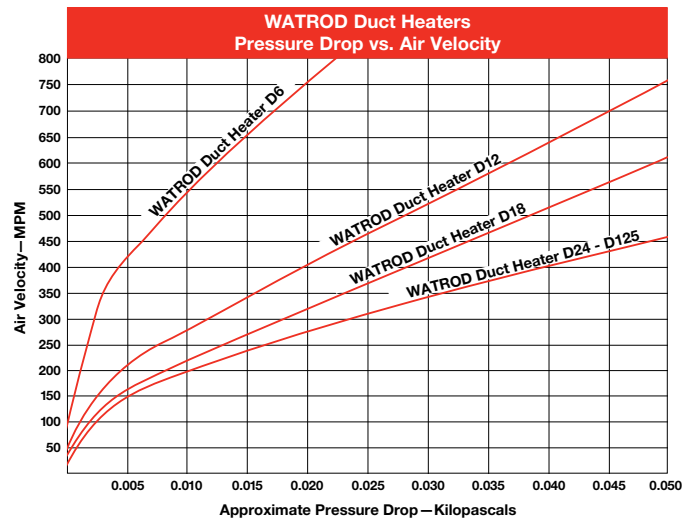
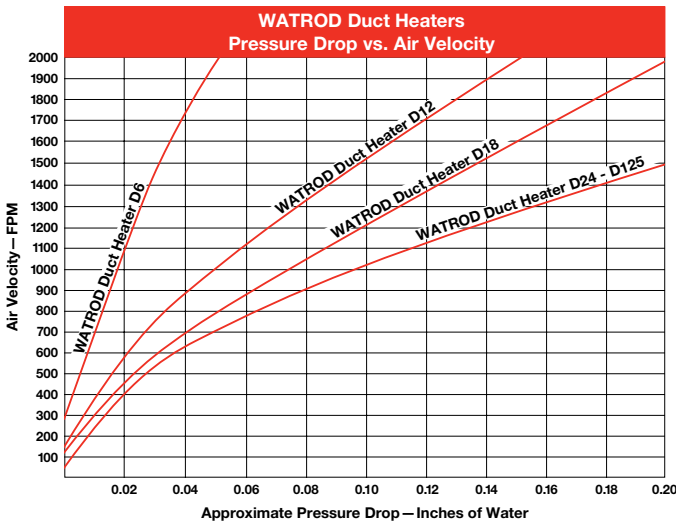
#### Pressure Drop vs. Air Velocity

The rate at which pressure drops through the duct heater is critical for properly sizing blowers and pumps. *The Pressure Drop vs. Air Velocity* graph gives recommended maximum velocities in feet per minute and meters per minute according to the air velocity and duct heater size.

To determine the pressure drop through the duct heater, follow the air velocity (FPM or MPM) over to the appropriate curve, which identifies the duct heater size. Then, take the intersecting point down to the approximate pressure drop value.



**Note:** Viewing from the element ends—the recommended air flow direction through element bundle changes at >18kW.



## Options

### WATCONNECT® Standard Control Panels



WATCONNECT® standard control panels are configured to work with Watlow's duct heaters. They are quickly configured for process heating applications and delivered within two weeks. WATCONNECT panels integrate Watlow's high-quality heater, sensor,

temperature controller and power controller products for a complete thermal solution. Normally, competitive custom panels require significantly longer lead times. The broad range of standard features allow customers to quickly configure panels for each process heater included in this catalog.

### Features and Benefits

#### Lead times of two weeks or less

- Provides faster delivery than competition

#### Full documentation provided for WATCONNECT control panels at the time of quotation

- Eliminates lengthy approval process and phone calls

#### Incorporates Watlow's temperature and power controllers

- Provides a turnkey solution for process heating applications

#### Range of standard input/output (I/O) options

- Provides the user with a higher level of monitoring and control assuring an efficient and safe operation

#### WATCONNECT enclosure easily mounts to wall or frame

- Decreases installation time



## Duct Heaters

### LDH SERIES and D SERIES

#### Options (Continued)

**Note:** The WATCONNECT part number associated with a heater is only a suggestion. The following installation details need to be compared to panel capabilities to assure a compatible match:

- Minimum and maximum ambient temperature where panel will be installed
- Statutory and regulatory requirements at installation site
- Sun loading, if any, at installation site
- Presence of any hazardous gases, dusts or fibers, if any
- Verification of process sensor type
- Verification of limit sensor type
- Input/Output (I/O) requirements

**For additional product information see the WATCONNECT landing page at [www.watlow.com/watconnect](http://www.watlow.com/watconnect).** On the WATCONNECT landing page you will find a complete specification sheet along with other tools to help you properly select your control panel. If you would like to know the specific configuration of a WATCONNECT part number, please use the Product Configuration Lookup Tool on Watlow.com.

#### Wattages/Voltages

To meet specific application needs, voltage and wattage combinations outside stock product parameters are available.

For more information about this option, contact your Watlow representative.

#### Terminal Enclosures

In addition to the standard, general purpose terminal enclosure, Watlow offers a moisture resistant optional terminal enclosure to meet specific application requirements.

#### Thermocouples

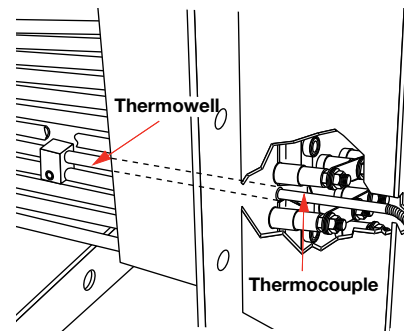
**Type J** or **K** thermocouples, inserted in the thermowell, accurately sense element sheath temperature for over-temperature conditions.

To sense process temperature, the sensing element should be located downstream from the duct heater. This will eliminate incorrect sensing caused by radiant heat.

Thermocouples are supplied with 120 in. (3050 mm) leads, longer lead lengths are available (this applies to “D” SERIES only). Unless otherwise specified, thermocouples are supplied with temperature ranges detailed on the *Thermocouple Types* chart.

Using a thermocouple requires an appropriate temperature and power controller. These must be purchased separately. Watlow offers a wide variety of temperature and power controllers to meet virtually all applications. Temperature controllers can be configured to accept process variable inputs, too. Contact your Watlow representative for details.

To order a thermocouple, add the appropriate suffix letter to the duct heater’s base part number, as indicated on the *Ordering Information* chart on page 390.



**Duct heater thermowell holds thermocouple for sensing sheath temperature.**

#### Thermocouple Types

ASTM Type	Conductor Characteristics		Recommended <sup>①</sup> Temperature Range	
	Positive	Negative	°F	(°C)
J	Iron (Magnetic)	Constantan (Non-magnetic)	0 to 1000	(-20 to 540)
K	Chromel <sup>®</sup> (Non-magnetic)	Alumel <sup>®</sup> (Magnetic)	0 to 2000	(-20 to 1100)

<sup>①</sup>**Type J** and **Type K** thermocouples are rated 32 to 1382°F and 32 to 2282°F (0-750°C and 0-1250°C), respectively. Watlow does not recommend exceeding temperature ranges shown on this chart for the tubular product line.

#### Application Hints

- Mount duct heaters horizontally to lower enclosure temperatures and promote unit life.
- Orient heating elements as per the air flow illustration on page 380.
- Promote heater life by keeping sheath temperature below the 1400°F (760°C) maximum.
- Measure process temperature in the outlet stream, away from the heater.
- Maintain wiring integrity by keeping enclosure temperature below 400°F (205°C).
- Thermal cycling can cause terminations to loosen. Periodically check and tighten all electrical connections.
- Size power feeder wires in accordance with NEC and other applicable codes.
- Protect employees against electrical shock by properly grounding the unit per NEC specifications.



## Extended Capabilities for Duct Heaters

### Performance Capabilities

- Wattages to 2.2 megawatts

### Features and Benefits

#### Ceramic fiber insulation available

- Keeps wiring cooler and reduces heat loss

#### Greater than 1/4 in. (6 mm) with 304 or 316 stainless steel flange material

- Easily bolts to the duct wall

#### 60 plus element designs available

- Meets a wide variety of kilowatt demands

### Options

#### Sheath Material

Watlow duct heaters can be made with the following sheath materials:

- 304, 316, 321 SS
- Alloy 800
- Laminated alloy 600 (hi-temp)
- Hastelloy C276

Contact your Watlow representative for details and availability.

#### Terminal Enclosures

In addition to the standard, general purpose terminal enclosure, Watlow offers the following optional terminal enclosures to meet specific application requirements:

- Explosion resistant (contact your Watlow representative)
- High-temperature stand-off enclosures

# Air Heaters



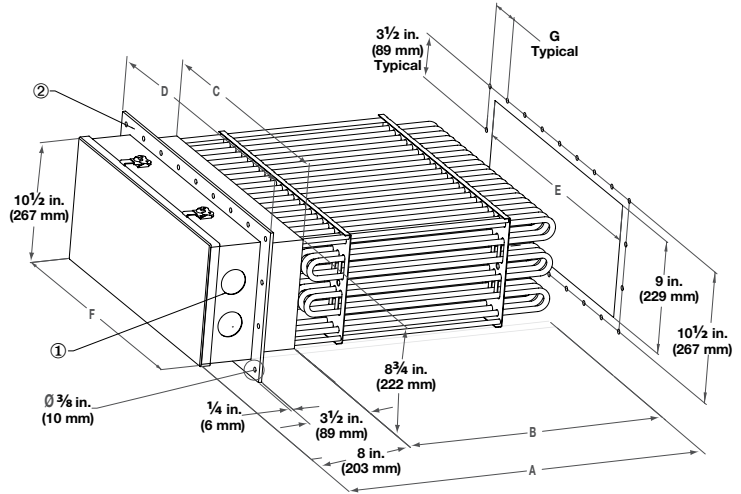
## Duct Heaters



### LDH SERIES

#### Application: High Temperature Air 800°F (427°C)

- Welded alloy 840 WATROD elements
  - Without thermostat
  - General purpose enclosure
  - Steel flange
- ① 3 and 6 element heaters have (1) 1 inch NPT conduit opening; 9, 12 and 15 element heaters have (2) 1 inch NPT conduit openings; 18 element heaters have (2) 1 1/2 inch NPT conduit openings; 21 element (B= 20 1/4 in.) heaters have (2) 1 1/2 inch NPT conduit openings; remaining 21 and 24 element heaters have (3) 1 1/2 inch NPT conduit openings
- ② All flanges are 12 inches wide



# of Elem	Volts	kW	# Ph	# Circ	Part Number	WATCONNECT P/N		Ship Wt. lbs (kg)	"A" Dim.	"B" Dim.	"C" Dim.	"D" Dim.	"E" Dim.	"F" Dim.	"G" Dim.
						J T/C	K T/C		in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)
<b>20 W/in<sup>2</sup> (3.1 W/cm<sup>2</sup>)</b>															
3	240	9.0	1	1	LDH9S10S	C/F	C/F	55 (25)	28 1/4 (718)	20 1/4 (514)	3 3/4 (95)	7 1/2 (191)	4 (102)	4 5/8 (117.5)	3 (76)
3	240	9.0	3	1	LDH9S3S	C2-50	C2-92	55 (25)	28 1/4 (718)	20 1/4 (514)	3 3/4 (95)	7 1/2 (191)	4 (102)	4 5/8 (117.5)	3 (76)
3	480	9.0	1	1	LDH9S11S	C/F	C/F	55 (25)	28 1/4 (718)	20 1/4 (514)	3 3/4 (95)	7 1/2 (191)	4 (102)	4 5/8 (117.5)	3 (76)
3	480	9.0	3	1	LDH9S5S	C2-43	C2-35	55 (25)	28 1/4 (718)	20 1/4 (514)	3 3/4 (95)	7 1/2 (191)	4 (102)	4 5/8 (117.5)	3 (76)
6	240	18.0	1	2	LDH18S10S	C/F	C/F	65 (30)	28 1/4 (718)	20 1/4 (514)	6 3/4 (171)	10 1/2 (267)	7 (178)	7 5/8 (193.7)	3 (76)
6	240	18.0	3	1	LDH18S3S	C2-236	C2-214	65 (30)	28 1/4 (718)	20 1/4 (514)	6 3/4 (171)	10 1/2 (267)	7 (178)	7 5/8 (193.7)	3 (76)
6	480	18.0	1	1	LDH18S11S	C/F	C/F	65 (30)	28 1/4 (718)	20 1/4 (514)	6 3/4 (171)	10 1/2 (267)	7 (178)	7 5/8 (193.7)	3 (76)
6	480	18.0	3	1	LDH18S5S	C2-43	C2-35	65 (30)	28 1/4 (718)	20 1/4 (514)	6 3/4 (171)	10 1/2 (267)	7 (178)	7 5/8 (193.7)	3 (76)
9	240	27.0	1	3	LDH27S10S	C/F	C/F	120 (55)	28 1/4 (718)	20 1/4 (514)	9 3/4 (248)	13 1/2 (343)	10 (254)	10 5/8 (269.9)	3 (76)
9	240	27.0	3	3	LDH27S3S	C4-143	C4-142	120 (55)	28 1/4 (718)	20 1/4 (514)	9 3/4 (248)	13 1/2 (343)	10 (254)	10 5/8 (269.9)	3 (76)
9	480	27.0	1	3	LDH27S11S	C/F	C/F	120 (55)	28 1/4 (718)	20 1/4 (514)	9 3/4 (248)	13 1/2 (343)	10 (254)	10 5/8 (269.9)	3 (76)
9	480	27.0	3	1	LDH27S5S	C2-225	C2-226	120 (55)	28 1/4 (718)	20 1/4 (514)	9 3/4 (248)	13 1/2 (343)	10 (254)	10 5/8 (269.9)	3 (76)
12	240	36.0	1	4	LDH36S10S	C/F	C/F	135 (62)	28 1/4 (718)	20 1/4 (514)	12 3/4 (324)	16 1/2 (419)	13 (330)	13 5/8 (346.1)	3 (76)
12	240	36.0	3	2	LDH36S3S	C2-218	C2-224	135 (62)	28 1/4 (718)	20 1/4 (514)	12 3/4 (324)	16 1/2 (419)	13 (330)	13 5/8 (346.1)	3 (76)
12	480	36.0	1	2	LDH36S11S	C/F	C/F	135 (62)	28 1/4 (718)	20 1/4 (514)	12 3/4 (324)	16 1/2 (419)	13 (330)	13 5/8 (346.1)	3 (76)
12	480	36.0	3	1	LDH36S5S	C2-225	C2-226	135 (62)	28 1/4 (718)	20 1/4 (514)	12 3/4 (324)	16 1/2 (419)	13 (330)	13 5/8 (346.1)	3 (76)
15	240	45.0	3	5	LDH45S3S	C4-144	C4-145	195 (89)	28 1/4 (718)	20 1/4 (514)	15 3/4 (400)	19 1/2 (495)	16 (406)	17 7/8 (454.0)	3 (76)
15	480	45.0	1	3	LDH45S11S	C/F	C/F	195 (89)	28 1/4 (718)	20 1/4 (514)	15 3/4 (400)	19 1/2 (495)	16 (406)	17 7/8 (454.0)	3 (76)
15	480	45.0	3	5	LDH45S5S	C4-150	C4-151	195 (89)	28 1/4 (718)	20 1/4 (514)	15 3/4 (400)	19 1/2 (495)	16 (406)	17 7/8 (454.0)	3 (76)
18	240	54.0	3	3	LDH54S3S	C4-144	C4-145	205 (93)	28 1/4 (718)	20 1/4 (514)	18 3/4 (476)	22 1/2 (572)	19 (483)	20 7/8 (530.2)	3 (76)
18	480	54.0	1	3	LDH54S11S	C/F	C/F	205 (93)	28 1/4 (718)	20 1/4 (514)	18 3/4 (476)	22 1/2 (572)	19 (483)	20 7/8 (530.2)	3 (76)
18	480	54.0	3	2	LDH54S5S	C2-229	C2-230	205 (93)	28 1/4 (718)	20 1/4 (514)	18 3/4 (476)	22 1/2 (572)	19 (483)	20 7/8 (530.2)	3 (76)
21	240	63.0	3	7	LDH63S3S	C4-148	C4-149	235 (107)	28 1/4 (718)	20 1/4 (514)	21 3/4 (552)	25 1/2 (848)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	63.0	1	3	LDH63S11S	C/F	C/F	235 (107)	28 1/4 (718)	20 1/4 (514)	21 3/4 (552)	25 1/2 (848)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	63.0	3	7	LDH63S5S	C4-154	C4-155	235 (107)	28 1/4 (718)	20 1/4 (514)	21 3/4 (552)	25 1/2 (848)	22 (559)	23 7/8 (606.4)	3 (76)
21	240	79.0	3	7	LDH79S3S	C/F	C/F	260 (118)	33 (838)	25 (635)	21 3/4 (552)	25 1/2 (848)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	79.0	1	7	LDH79S11S	C/F	C/F	260 (118)	33 (838)	25 (635)	21 3/4 (552)	25 1/2 (848)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	79.0	3	7	LDH79S5S	C4-156	C4-157	260 (118)	33 (838)	25 (635)	21 3/4 (552)	25 1/2 (848)	22 (559)	23 7/8 (606.4)	3 (76)
21	240	105.0	3	7	LDH105S3S	C/F	C/F	290 (132)	40 1/2 (1029)	32 1/2 (826)	21 3/4 (552)	25 1/2 (848)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	105.0	1	7	LDH105S11S	C/F	C/F	290 (132)	40 1/2 (1029)	32 1/2 (826)	21 3/4 (552)	25 1/2 (848)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	105.0	3	7	LDH105S5S	C4-156	C4-157	290 (132)	40 1/2 (1029)	32 1/2 (826)	21 3/4 (552)	25 1/2 (848)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	131.0	3	7	LDH131S5S	C4-156	C4-157	310 (141)	49 1/2 (1257)	41 1/2 (1054)	21 3/4 (552)	25 1/2 (848)	22 (559)	23 7/8 (606.4)	3 (76)
24	480	150.0	3	4	LDH150S5S	C4-156	C4-157	330 (150)	49 1/2 (1257)	41 1/2 (1054)	24 3/4 (629)	28 1/2 (724)	25 (635)	26 7/8 (682.6)	3 (76)

#### Notes:

- See Watt Density vs. Air Temperature/Velocity charts on page 379 to confirm suitability in the application.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Air Heaters



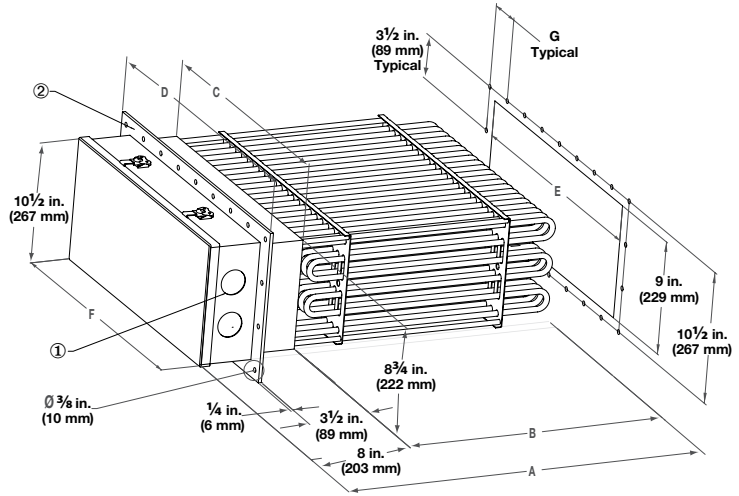
## Duct Heaters



### LDH SERIES

#### Application: Medium Temperature Air 750°F (399°C)

- Welded alloy 840 WATROD elements
  - Without thermostat
  - General purpose enclosure
  - Steel flange
- 3 and 6 element heaters have (1) 1 inch NPT conduit opening; 9, 12 and 15 element heaters have (2) 1 inch NPT conduit openings; 18 element heaters have (2) 1 1/2 inch NPT conduit openings; 21 element (B= 20 1/4 in.) heaters have (2) 1 1/2 inch NPT conduit openings; remaining 21 and 24 element heaters have (3) 1 1/2 inch NPT conduit openings
  - All flanges are 12 inches wide



# of Elem	Volts	kW	# Ph	# Circ	Part Number	WATCONNECT P/N		Ship Wt. lbs. (kg)	"A" Dim.	"B" Dim.	"C" Dim.	"D" Dim.	"E" Dim.	"F" Dim.	"G" Dim.
						J T/C	K T/C		in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	
<b>30 W/in<sup>2</sup> (4.7 W/cm<sup>2</sup>)</b>															
3	240	14.0	1	3	LDH14SX10S	C/F	C/F	55 (25)	28 1/4 (718)	20 1/4 (514)	3 3/4 (95)	7 1/2 (191)	4 (102)	4 5/8 (117.5)	3 (76)
3	240	14.0	3	1	LDH14SX3S	C2-236	C2-214	55 (25)	28 1/4 (718)	20 1/4 (514)	3 3/4 (95)	7 1/2 (191)	4 (102)	4 5/8 (117.5)	3 (76)
3	480	14.0	1	1	LDH14SX11S	C/F	C/F	55 (25)	28 1/4 (718)	20 1/4 (514)	3 3/4 (95)	7 1/2 (191)	4 (102)	4 5/8 (117.5)	3 (76)
3	480	14.0	3	1	LDH14SX5S	C2-43	C2-35	55 (25)	28 1/4 (718)	20 1/4 (514)	3 3/4 (95)	7 1/2 (191)	4 (102)	4 5/8 (117.5)	3 (76)
6	240	27.0	1	3	LDH27SX10S	C/F	C/F	65 (30)	28 1/4 (718)	20 1/4 (514)	6 3/4 (171)	10 1/2 (267)	7 (178)	7 5/8 (193.7)	3 (76)
6	240	27.0	3	2	LDH27SX3X	C2-218	C2-224	65 (30)	28 1/4 (718)	20 1/4 (514)	6 3/4 (171)	10 1/2 (267)	7 (178)	7 5/8 (193.7)	3 (76)
6	480	27.0	1	2	LDH27SX11S	C/F	C/F	65 (30)	28 1/4 (718)	20 1/4 (514)	6 3/4 (171)	10 1/2 (267)	7 (178)	7 5/8 (193.7)	3 (76)
6	480	27.0	3	1	LDH27SX5S	C2-225	C2-226	65 (30)	28 1/4 (718)	20 1/4 (514)	6 3/4 (171)	10 1/2 (267)	7 (178)	7 5/8 (193.7)	3 (76)
9	240	41.0	3	3	LDH41SX3S	C4-144	C4-145	120 (55)	28 1/4 (718)	20 1/4 (514)	9 3/4 (248)	13 1/2 (343)	10 (254)	10 5/8 (269.9)	3 (76)
9	480	41.0	1	3	LDH41SX11S	C/F	C/F	120 (55)	28 1/4 (718)	20 1/4 (514)	9 3/4 (248)	13 1/2 (343)	10 (254)	10 5/8 (269.9)	3 (76)
9	480	41.0	3	3	LDH41SX5S	C4-150	C4-151	120 (55)	28 1/4 (718)	20 1/4 (514)	9 3/4 (248)	13 1/2 (343)	10 (254)	10 5/8 (269.9)	3 (76)
12	240	54.0	3	4	LDH54SX3S	C4-148	C4-149	135 (62)	28 1/4 (718)	20 1/4 (514)	12 3/4 (324)	16 1/2 (419)	13 (330)	13 5/8 (346.1)	3 (76)
12	480	54.0	1	3	LDH54SX11S	C/F	C/F	135 (62)	28 1/4 (718)	20 1/4 (514)	12 3/4 (324)	16 1/2 (419)	13 (330)	13 5/8 (346.1)	3 (76)
12	480	54.0	3	2	LDH54SX5S	C2-229	C2-230	135 (62)	28 1/4 (718)	20 1/4 (514)	12 3/4 (324)	16 1/2 (419)	13 (330)	13 5/8 (346.1)	3 (76)
15	240	68.0	3	5	LDH68SX3S	C/F	C/F	195 (89)	28 1/4 (718)	20 1/4 (514)	15 3/4 (400)	19 1/2 (495)	16 (406)	17 7/8 (454.0)	3 (76)
15	480	68.0	1	3	LDH68SX11S	C/F	C/F	195 (89)	28 1/4 (718)	20 1/4 (514)	15 3/4 (400)	19 1/2 (495)	16 (406)	17 7/8 (454.0)	3 (76)
15	480	68.0	3	5	LDH68SX5S	C4-152	C4-153	195 (89)	28 1/4 (718)	20 1/4 (514)	15 3/4 (400)	19 1/2 (495)	16 (406)	17 7/8 (454.0)	3 (76)
18	240	80.0	3	6	LDH80SX3S	C/F	C/F	205 (93)	28 1/4 (718)	20 1/4 (514)	18 3/4 (476)	22 1/2 (572)	19 (483)	20 7/8 (530.2)	3 (76)
18	480	80.0	1	6	LDH80SX11S	C/F	C/F	205 (93)	28 1/4 (718)	20 1/4 (514)	18 3/4 (476)	22 1/2 (572)	19 (483)	20 7/8 (530.2)	3 (76)
18	480	80.0	3	3	LDH80SX5S	C4-152	C4-153	205 (93)	28 1/4 (718)	20 1/4 (514)	18 3/4 (476)	22 1/2 (572)	19 (483)	20 7/8 (530.2)	3 (76)
21	240	95.0	3	7	LDH95SX3S	C/F	C/F	235 (107)	28 1/4 (718)	20 1/4 (514)	21 3/4 (552)	25 1/2 (648)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	95.0	1	7	LDH95SX11S	C/F	C/F	235 (107)	28 1/4 (718)	20 1/4 (514)	21 3/4 (552)	25 1/2 (648)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	95.0	3	7	LDH95SX5S	C4-156	C4-157	235 (107)	28 1/4 (718)	20 1/4 (514)	21 3/4 (552)	25 1/2 (648)	22 (559)	23 7/8 (606.4)	3 (76)
21	240	120.0	3	7	LDH120SX3S	C/F	C/F	260 (118)	33 (838)	25 (635)	21 3/4 (552)	25 1/2 (648)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	120.0	1	7	LDH120SX11S	C/F	C/F	260 (118)	33 (838)	25 (635)	21 3/4 (552)	25 1/2 (648)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	120.0	3	7	LDH120SX5S	C4-156	C4-157	260 (118)	33 (838)	25 (635)	21 3/4 (552)	25 1/2 (648)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	160.0	3	7	LDH160SX5S	C/F	C/F	290 (132)	40 1/2 (1029)	32 1/2 (826)	21 3/4 (552)	25 1/2 (648)	22 (559)	23 7/8 (606.4)	3 (76)
21	480	200.0	3	7	LDH200SX5S	C/F	C/F	310 (141)	49 1/2 (1257)	41 1/2 (1054)	21 3/4 (552)	25 1/2 (648)	22 (559)	23 7/8 (606.4)	3 (76)
24	480	225.0	3	8	LDH225SX5S	C/F	C/F	330 (150)	49 1/2 (1257)	41 1/2 (1054)	24 3/4 (629)	28 1/2 (724)	25 (635)	26 7/8 (682.6)	3 (76)

**Notes:**

- See *Watt Density vs. Air Temperature/Velocity* charts on page 379 to confirm suitability in the application.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)



# Air Heaters



## Duct Heaters

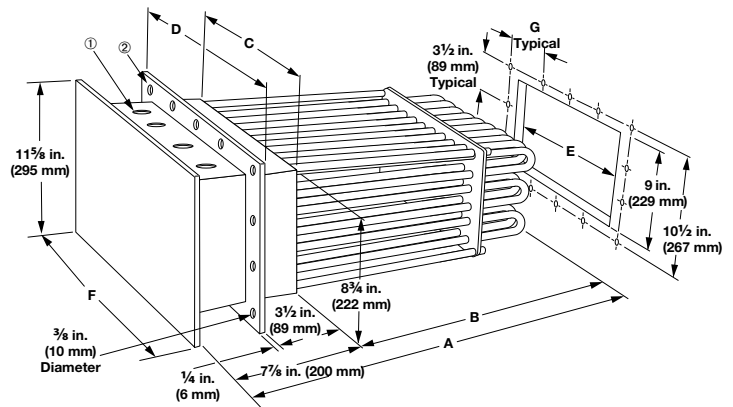


### D SERIES

#### Application: High Temperature Air 800°F (427°C)

- Removable alloy 840 WATROD elements
- Without thermostat
- General purpose enclosure
- Steel flange

- ① 6 and 12 element heaters have (1) 1 inch NPT conduit opening; 18, 24, 30 and 42 element heaters have (2) 1 inch NPT conduit openings; 36, 48, 54 and 60 element heaters have (2) 1 inch NPT and (2) 1 1/4 inch conduit openings
- ② All flanges are 12 inches wide



# of Elem.	Volts	kW	Ph	# Circ	Part Number	WATCONNECT P/N		Ship Wt. lbs. (kg)	"A" Dim.	"B" Dim.	"C" Dim.	"D" Dim.	"E" Dim.	"F" Dim.	"G" Dim.
						J T/C	K T/C		in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)
<b>20 W/in<sup>2</sup> (3.1 W/cm<sup>2</sup>)</b>															
6	240	6.0	1	1	<b>D6S10S</b>	<b>C/F</b>	<b>C/F</b>	50 (23)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	2 <sup>3</sup> / <sub>4</sub> (70)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	5 <sup>3</sup> / <sub>4</sub> (146)	2 <sup>1</sup> / <sub>2</sub> (64)
6	240	6.0	3	1	<b>D6S3S</b>	<b>C2-50</b>	<b>C2-92</b>	50 (23)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	2 <sup>3</sup> / <sub>4</sub> (70)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	5 <sup>3</sup> / <sub>4</sub> (146)	2 <sup>1</sup> / <sub>2</sub> (64)
6	480	6.0	1	1	<b>D6S11S</b>	<b>C/F</b>	<b>C/F</b>	50 (23)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	2 <sup>3</sup> / <sub>4</sub> (70)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	5 <sup>3</sup> / <sub>4</sub> (146)	2 <sup>1</sup> / <sub>2</sub> (64)
6	480	6.0	3	1	<b>D6S5S</b>	<b>C2-43</b>	<b>C2-35</b>	50 (23)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	2 <sup>3</sup> / <sub>4</sub> (70)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	5 <sup>3</sup> / <sub>4</sub> (146)	2 <sup>1</sup> / <sub>2</sub> (64)
12	240	12.0	1	1	<b>D12S10S</b>	<b>C/F</b>	<b>C/F</b>	55 (25)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	4 <sup>3</sup> / <sub>4</sub> (121)	8 <sup>1</sup> / <sub>2</sub> (215)	5 (127)	7 <sup>3</sup> / <sub>4</sub> (197)	3 <sup>1</sup> / <sub>2</sub> (89)
12	240	12.0	3	1	<b>D12S3S</b>	<b>C2-236</b>	<b>C2-214</b>	55 (25)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	4 <sup>3</sup> / <sub>4</sub> (121)	8 <sup>1</sup> / <sub>2</sub> (215)	5 (127)	7 <sup>3</sup> / <sub>4</sub> (197)	3 <sup>1</sup> / <sub>2</sub> (89)
12	480	12.0	1	1	<b>D12S11S</b>	<b>C/F</b>	<b>C/F</b>	55 (25)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	4 <sup>3</sup> / <sub>4</sub> (121)	8 <sup>1</sup> / <sub>2</sub> (215)	5 (127)	7 <sup>3</sup> / <sub>4</sub> (197)	3 <sup>1</sup> / <sub>2</sub> (89)
12	480	12.0	3	1	<b>D12S5S</b>	<b>C2-43</b>	<b>C2-35</b>	55 (25)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	4 <sup>3</sup> / <sub>4</sub> (121)	8 <sup>1</sup> / <sub>2</sub> (215)	5 (127)	7 <sup>3</sup> / <sub>4</sub> (197)	3 <sup>1</sup> / <sub>2</sub> (89)
18	240	18.0	1	2	<b>D18S10S</b>	<b>C/F</b>	<b>C/F</b>	65 (30)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	6 <sup>3</sup> / <sub>4</sub> (171)	10 <sup>1</sup> / <sub>2</sub> (267)	7 (178)	9 <sup>3</sup> / <sub>4</sub> (248)	3 (76)
18	240	18.0	3	1	<b>D18S3S</b>	<b>C2-236</b>	<b>C2-214</b>	65 (30)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	6 <sup>3</sup> / <sub>4</sub> (171)	10 <sup>1</sup> / <sub>2</sub> (267)	7 (178)	9 <sup>3</sup> / <sub>4</sub> (248)	3 (76)
18	480	18.0	1	1	<b>D18S11S</b>	<b>C/F</b>	<b>C/F</b>	65 (30)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	6 <sup>3</sup> / <sub>4</sub> (171)	10 <sup>1</sup> / <sub>2</sub> (267)	7 (178)	9 <sup>3</sup> / <sub>4</sub> (248)	3 (76)
18	480	18.0	3	1	<b>D18S5S</b>	<b>C2-43</b>	<b>C2-35</b>	65 (30)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	6 <sup>3</sup> / <sub>4</sub> (171)	10 <sup>1</sup> / <sub>2</sub> (267)	7 (178)	9 <sup>3</sup> / <sub>4</sub> (248)	3 (76)
24	240	24.0	1	2	<b>D24S10S</b>	<b>C/F</b>	<b>C/F</b>	95 (43)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	8 <sup>3</sup> / <sub>4</sub> (222)	12 <sup>1</sup> / <sub>2</sub> (318)	9 (229)	11 <sup>3</sup> / <sub>4</sub> (298)	2 <sup>3</sup> / <sub>4</sub> (70)
24	240	24.0	3	2	<b>D24S3S</b>	<b>C2-218</b>	<b>C2-224</b>	95 (43)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	8 <sup>3</sup> / <sub>4</sub> (222)	12 <sup>1</sup> / <sub>2</sub> (318)	9 (229)	11 <sup>3</sup> / <sub>4</sub> (298)	2 <sup>3</sup> / <sub>4</sub> (70)
24	480	24.0	1	1	<b>D24S11S</b>	<b>C/F</b>	<b>C/F</b>	95 (43)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	8 <sup>3</sup> / <sub>4</sub> (222)	12 <sup>1</sup> / <sub>2</sub> (318)	9 (229)	11 <sup>3</sup> / <sub>4</sub> (298)	2 <sup>3</sup> / <sub>4</sub> (70)
24	480	24.0	3	1	<b>D24S5S</b>	<b>C2-225</b>	<b>C2-226</b>	95 (43)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	8 <sup>3</sup> / <sub>4</sub> (222)	12 <sup>1</sup> / <sub>2</sub> (318)	9 (229)	11 <sup>3</sup> / <sub>4</sub> (298)	2 <sup>3</sup> / <sub>4</sub> (70)
30	240	30.0	3	2	<b>D30S3S</b>	<b>C2-218</b>	<b>C2-224</b>	120 (55)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	10 <sup>3</sup> / <sub>4</sub> (273)	14 <sup>1</sup> / <sub>2</sub> (368)	11 (279)	13 <sup>3</sup> / <sub>4</sub> (349)	3 <sup>1</sup> / <sub>4</sub> (83)
30	480	30.0	1	2	<b>D30S11S</b>	<b>C/F</b>	<b>C/F</b>	120 (55)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	10 <sup>3</sup> / <sub>4</sub> (273)	14 <sup>1</sup> / <sub>2</sub> (368)	11 (279)	13 <sup>3</sup> / <sub>4</sub> (349)	3 <sup>1</sup> / <sub>4</sub> (83)
30	480	30.0	3	1	<b>D30S5S</b>	<b>C2-225</b>	<b>C2-226</b>	120 (55)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	10 <sup>3</sup> / <sub>4</sub> (273)	14 <sup>1</sup> / <sub>2</sub> (368)	11 (279)	13 <sup>3</sup> / <sub>4</sub> (349)	3 <sup>1</sup> / <sub>4</sub> (83)

CONTINUED

#### Notes:

- See *Watt Density vs. Air Temperature/Velocity* charts on page 379 to confirm suitability in the application.
- C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Air Heaters



## Duct Heaters

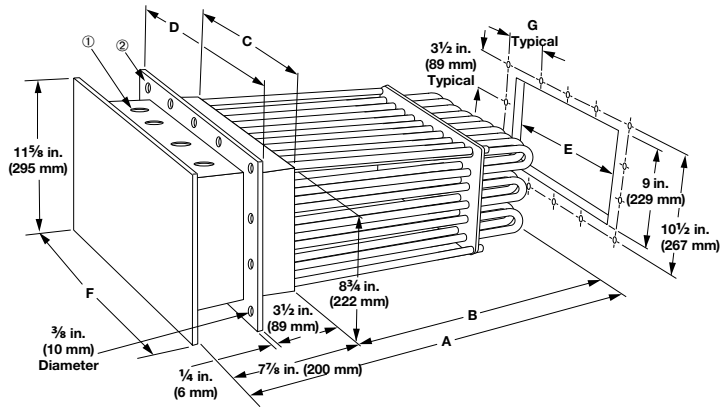


### D SERIES

#### Application: High Temperature Air 800°F (427°C)

- Removable alloy 840 WATROD elements
- Without thermostat
- General purpose enclosure
- Steel flange

- ① 6 and 12 element heaters have (1) 1 inch NPT conduit opening; 18, 24, 30 and 42 element heaters have (2) 1 inch NPT conduit openings; 36, 48, 54, and 60 element heaters have (2) 1 inch NPT and (2) 1 1/4 inch conduit openings
- ② All flanges are 12 inches wide



# of Elem.	Volts	kW	# Ph	# Circ	Part Number	WATCONNECT P/N		Ship Wt. lbs. (kg)	"A" Dim.	"B" Dim.	"C" Dim.	"D" Dim.	"E" Dim.	"F" Dim.	"G" Dim.
						J T/C	K T/C		in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)
<b>20 W/in<sup>2</sup> (3.1 W/cm<sup>2</sup>)</b>															
36	240	36.0	3	2	D36S3S	C2-218	C2-219	135 (62)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	12 <sup>3</sup> / <sub>4</sub> (324)	16 <sup>1</sup> / <sub>2</sub> (419)	13 (330)	15 <sup>3</sup> / <sub>4</sub> (400)	3 <sup>3</sup> / <sub>4</sub> (95)
36	480	36.0	1	2	D36S11S	C/F	C/F	135 (62)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	12 <sup>3</sup> / <sub>4</sub> (324)	16 <sup>1</sup> / <sub>2</sub> (419)	13 (330)	15 <sup>3</sup> / <sub>4</sub> (400)	3 <sup>3</sup> / <sub>4</sub> (95)
36	480	36.0	3	1	D36S5S	C2-225	C2-226	135 (62)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	12 <sup>3</sup> / <sub>4</sub> (324)	16 <sup>1</sup> / <sub>2</sub> (419)	13 (330)	15 <sup>3</sup> / <sub>4</sub> (400)	3 <sup>3</sup> / <sub>4</sub> (95)
42	240	42.0	3	2	D42S3S	C/F	C/F	155 (71)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	14 <sup>3</sup> / <sub>4</sub> (375)	18 <sup>1</sup> / <sub>2</sub> (470)	15 (381)	17 <sup>3</sup> / <sub>4</sub> (451)	4 <sup>1</sup> / <sub>4</sub> (108)
42	480	42.0	1	2	D42S11S	C/F	C/F	155 (71)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	14 <sup>3</sup> / <sub>4</sub> (375)	18 <sup>1</sup> / <sub>2</sub> (470)	15 (381)	17 <sup>3</sup> / <sub>4</sub> (451)	4 <sup>1</sup> / <sub>4</sub> (108)
42	480	42.0	3	2	D42S5S	C2-229	C2-230	155 (71)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	14 <sup>3</sup> / <sub>4</sub> (375)	18 <sup>1</sup> / <sub>2</sub> (470)	15 (381)	17 <sup>3</sup> / <sub>4</sub> (451)	4 <sup>1</sup> / <sub>4</sub> (108)
48	240	48.0	3	4	D48S3S	C4-148	C4-149	195 (89)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	16 <sup>3</sup> / <sub>4</sub> (425)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	19 <sup>3</sup> / <sub>4</sub> (502)	4 <sup>3</sup> / <sub>4</sub> (121)
48	480	48.0	1	2	D48S11S	C/F	C/F	195 (89)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	16 <sup>3</sup> / <sub>4</sub> (425)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	19 <sup>3</sup> / <sub>4</sub> (502)	4 <sup>3</sup> / <sub>4</sub> (121)
48	480	48.0	3	2	D48S5S	C2-229	C2-230	195 (89)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	16 <sup>3</sup> / <sub>4</sub> (425)	20 <sup>1</sup> / <sub>2</sub> (521)	17 (432)	19 <sup>3</sup> / <sub>4</sub> (502)	4 <sup>3</sup> / <sub>4</sub> (121)
54	240	54.0	3	3	D54S3S	C4-144	C4-145	205 (93)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	18 <sup>3</sup> / <sub>4</sub> (476)	22 <sup>1</sup> / <sub>2</sub> (572)	19 (483)	21 <sup>3</sup> / <sub>4</sub> (552)	5 <sup>1</sup> / <sub>4</sub> (133)
54	480	54.0	1	3	D54S11S	C/F	C/F	205 (93)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	18 <sup>3</sup> / <sub>4</sub> (476)	22 <sup>1</sup> / <sub>2</sub> (572)	19 (483)	21 <sup>3</sup> / <sub>4</sub> (552)	5 <sup>1</sup> / <sub>4</sub> (133)
54	480	54.0	3	2	D54S5S	C2-229	C2-230	205 (93)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	18 <sup>3</sup> / <sub>4</sub> (476)	22 <sup>1</sup> / <sub>2</sub> (572)	19 (483)	21 <sup>3</sup> / <sub>4</sub> (552)	5 <sup>1</sup> / <sub>4</sub> (133)
60	240	60.0	3	4	D60S3S	C4-148	C4-149	235 (107)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	20 <sup>3</sup> / <sub>4</sub> (527)	24 <sup>1</sup> / <sub>2</sub> (622)	21 (533)	23 <sup>3</sup> / <sub>4</sub> (603)	5 <sup>3</sup> / <sub>4</sub> (146)
60	480	60.0	1	4	D60S11S	C/F	C/F	235 (107)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	20 <sup>3</sup> / <sub>4</sub> (527)	24 <sup>1</sup> / <sub>2</sub> (622)	21 (533)	23 <sup>3</sup> / <sub>4</sub> (603)	5 <sup>3</sup> / <sub>4</sub> (146)
60	480	60.0	3	2	D60S5S	C2-229	C2-230	235 (107)	27 <sup>7</sup> / <sub>8</sub> (708.0)	20 (508)	20 <sup>3</sup> / <sub>4</sub> (527)	24 <sup>1</sup> / <sub>2</sub> (622)	21 (533)	23 <sup>3</sup> / <sub>4</sub> (603)	5 <sup>3</sup> / <sub>4</sub> (146)
60	240	75.0	3	4	D75S3S	C4-148	C4-149	260 (118)	32 <sup>7</sup> / <sub>8</sub> (835.0)	25 (635)	20 <sup>3</sup> / <sub>4</sub> (527)	24 <sup>1</sup> / <sub>2</sub> (622)	21 (533)	23 <sup>3</sup> / <sub>4</sub> (603)	5 <sup>3</sup> / <sub>4</sub> (146)
60	480	75.0	1	4	D75S11S	C/F	C/F	260 (118)	32 <sup>7</sup> / <sub>8</sub> (835.0)	25 (635)	20 <sup>3</sup> / <sub>4</sub> (527)	24 <sup>1</sup> / <sub>2</sub> (622)	21 (533)	23 <sup>3</sup> / <sub>4</sub> (603)	5 <sup>3</sup> / <sub>4</sub> (146)
60	480	75.0	3	2	D75S5S	C2-229	C2-230	260 (118)	32 <sup>7</sup> / <sub>8</sub> (835.0)	25 (635)	20 <sup>3</sup> / <sub>4</sub> (527)	24 <sup>1</sup> / <sub>2</sub> (622)	21 (533)	23 <sup>3</sup> / <sub>4</sub> (603)	5 <sup>3</sup> / <sub>4</sub> (146)
60	480	100.0	3	4	D100S5S	C4-156	C4-157	290 (132)	40 <sup>3</sup> / <sub>8</sub> (1025.5)	32 <sup>1</sup> / <sub>2</sub> (826)	20 <sup>3</sup> / <sub>4</sub> (527)	24 <sup>1</sup> / <sub>2</sub> (622)	21 (533)	23 <sup>3</sup> / <sub>4</sub> (603)	5 <sup>3</sup> / <sub>4</sub> (146)
60	480	125.0	3	4	D125S5S	C4-156	C4-157	310 (141)	49 <sup>3</sup> / <sub>8</sub> (1254.1)	41 <sup>1</sup> / <sub>2</sub> (1054)	20 <sup>3</sup> / <sub>4</sub> (527)	24 <sup>1</sup> / <sub>2</sub> (622)	21 (533)	23 <sup>3</sup> / <sub>4</sub> (603)	5 <sup>3</sup> / <sub>4</sub> (146)

**Notes:**

- See *Watt Density vs. Air Temperature/Velocity* charts on page 379 to confirm suitability in the application.
- C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Air Heaters



## Duct Heaters

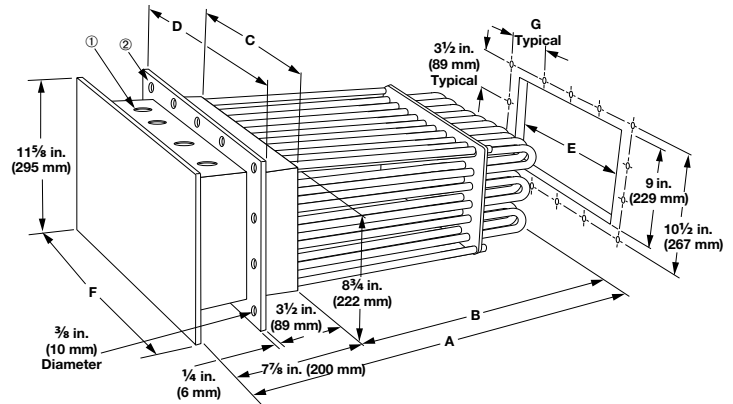


### D SERIES

#### Application: Medium Temperature Air 750°F (399°C)

- Removable alloy 840 WATROD elements
- Without thermostat
- General purpose enclosure
- Steel flange

- ① 6 and 12 element heaters have (1) 1 inch NPT conduit opening; 18, 24, 30 and 42 element heaters have (2) 1 inch NPT conduit openings; 36, 48, 54, and 60 element heaters have (2) 1 inch NPT and (2) 1 1/4 inch conduit openings
- ② All flanges are 12 inches wide



# of Elem.	Volts	kW	Ph	# Circ	Part Number	WATCONNECT P/N		Ship Wt. lbs. (kg)	"A" Dim.	"B" Dim.	"C" Dim.	"D" Dim.	"E" Dim.	"F" Dim.	"G" Dim.
						J T/C	K T/C		in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)
<b>30 W/in<sup>2</sup> (4.7 W/cm<sup>2</sup>)</b>															
6	240	9.0	1	1	D6SX10S	C/F	C/F	50 (23)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	2 <sup>3</sup> / <sub>4</sub> (70)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	5 <sup>3</sup> / <sub>4</sub> (146)	2 <sup>1</sup> / <sub>2</sub> (64)
6	240	9.0	3	1	D6SX3S	C2-50	C2-92	50 (23)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	2 <sup>3</sup> / <sub>4</sub> (70)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	5 <sup>3</sup> / <sub>4</sub> (146)	2 <sup>1</sup> / <sub>2</sub> (64)
6	480	9.0	1	1	D6SX11S	C/F	C/F	50 (23)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	2 <sup>3</sup> / <sub>4</sub> (70)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	5 <sup>3</sup> / <sub>4</sub> (146)	2 <sup>1</sup> / <sub>2</sub> (64)
6	480	9.0	3	1	D6SX5S	C2-43	C2-35	50 (23)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	2 <sup>3</sup> / <sub>4</sub> (70)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	5 <sup>3</sup> / <sub>4</sub> (146)	2 <sup>1</sup> / <sub>2</sub> (64)
12	240	18.0	1	2	D12SX10S	C/F	C/F	55 (25)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	4 <sup>3</sup> / <sub>4</sub> (121)	8 <sup>1</sup> / <sub>2</sub> (215)	5 (127)	7 <sup>3</sup> / <sub>4</sub> (197)	3 <sup>1</sup> / <sub>2</sub> (89)
12	240	18.0	3	1	D12SX3S	C2-236	C2-214	55 (25)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	4 <sup>3</sup> / <sub>4</sub> (121)	8 <sup>1</sup> / <sub>2</sub> (215)	5 (127)	7 <sup>3</sup> / <sub>4</sub> (197)	3 <sup>1</sup> / <sub>2</sub> (89)
12	480	18.0	1	1	D12SX11S	C/F	C/F	55 (25)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	4 <sup>3</sup> / <sub>4</sub> (121)	8 <sup>1</sup> / <sub>2</sub> (215)	5 (127)	7 <sup>3</sup> / <sub>4</sub> (197)	3 <sup>1</sup> / <sub>2</sub> (89)
12	480	18.0	3	1	D12SX5S	C2-43	C2-35	55 (25)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	4 <sup>3</sup> / <sub>4</sub> (121)	8 <sup>1</sup> / <sub>2</sub> (215)	5 (127)	7 <sup>3</sup> / <sub>4</sub> (197)	3 <sup>1</sup> / <sub>2</sub> (89)
18	240	27.0	1	3	D18SX10S	C/F	C/F	65 (30)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	6 <sup>3</sup> / <sub>4</sub> (171)	10 <sup>1</sup> / <sub>2</sub> (267)	7 (178)	9 <sup>3</sup> / <sub>4</sub> (248)	3 (76)
18	240	27.0	3	2	D18SX3S	C2-218	C2-224	65 (30)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	6 <sup>3</sup> / <sub>4</sub> (171)	10 <sup>1</sup> / <sub>2</sub> (267)	7 (178)	9 <sup>3</sup> / <sub>4</sub> (248)	3 (76)
18	480	27.0	1	2	D18SX11S	C/F	C/F	65 (30)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	6 <sup>3</sup> / <sub>4</sub> (171)	10 <sup>1</sup> / <sub>2</sub> (267)	7 (178)	9 <sup>3</sup> / <sub>4</sub> (248)	3 (76)
18	480	27.0	3	1	D18SX5S	C2-225	C2-226	65 (30)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	6 <sup>3</sup> / <sub>4</sub> (171)	10 <sup>1</sup> / <sub>2</sub> (267)	7 (178)	9 <sup>3</sup> / <sub>4</sub> (248)	3 (76)
24	240	36.0	1	4	D24SX10S	C/F	C/F	95 (43)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	8 <sup>3</sup> / <sub>4</sub> (222)	12 <sup>1</sup> / <sub>2</sub> (318)	9 (229)	11 <sup>3</sup> / <sub>4</sub> (298)	2 <sup>3</sup> / <sub>4</sub> (70)
24	240	36.0	3	2	D24SX3S	C2-218	C2-219	95 (43)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	8 <sup>3</sup> / <sub>4</sub> (222)	12 <sup>1</sup> / <sub>2</sub> (318)	9 (229)	11 <sup>3</sup> / <sub>4</sub> (298)	2 <sup>3</sup> / <sub>4</sub> (70)
24	480	36.0	1	2	D24SX11S	C/F	C/F	95 (43)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	8 <sup>3</sup> / <sub>4</sub> (222)	12 <sup>1</sup> / <sub>2</sub> (318)	9 (229)	11 <sup>3</sup> / <sub>4</sub> (298)	2 <sup>3</sup> / <sub>4</sub> (70)
24	480	36.0	3	1	D24SX5S	C2-225	C2-226	95 (43)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	8 <sup>3</sup> / <sub>4</sub> (222)	12 <sup>1</sup> / <sub>2</sub> (318)	9 (229)	11 <sup>3</sup> / <sub>4</sub> (298)	2 <sup>3</sup> / <sub>4</sub> (70)
30	240	45.0	3	5	D30SX3S	C4-144	C4-145	120 (55)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	10 <sup>3</sup> / <sub>4</sub> (273)	14 <sup>1</sup> / <sub>2</sub> (368)	11 (279)	13 <sup>3</sup> / <sub>4</sub> (349)	3 <sup>1</sup> / <sub>4</sub> (83)
30	480	45.0	1	2	D30SX11S	C/F	C/F	120 (55)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	10 <sup>3</sup> / <sub>4</sub> (273)	14 <sup>1</sup> / <sub>2</sub> (368)	11 (279)	13 <sup>3</sup> / <sub>4</sub> (349)	3 <sup>1</sup> / <sub>4</sub> (83)
30	480	45.0	3	2	D30SX5S	C2-229	C2-230	120 (55)	27 <sup>7</sup> / <sub>8</sub> (708)	20 (508)	10 <sup>3</sup> / <sub>4</sub> (273)	14 <sup>1</sup> / <sub>2</sub> (368)	11 (279)	13 <sup>3</sup> / <sub>4</sub> (349)	3 <sup>1</sup> / <sub>4</sub> (83)

CONTINUED

#### Notes:

- See *Watt Density vs. Air Temperature/Velocity* charts on page 379 to confirm suitability in the application.
- C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Air Heaters



## Duct Heaters

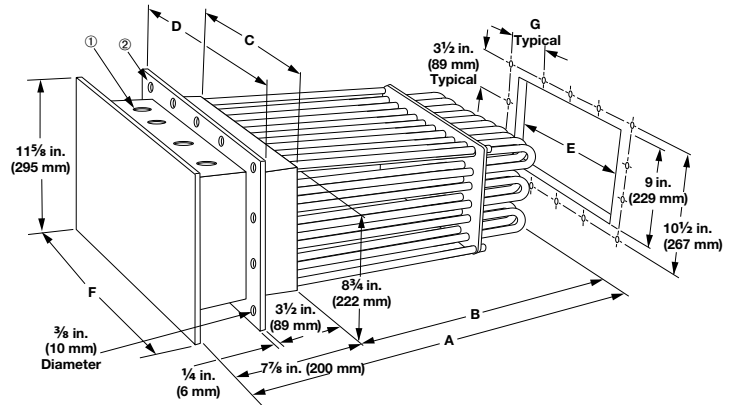


### D SERIES

#### Application: Medium Temperature Air 750°F (399°C)

- Removable alloy 840 WATROD elements
- Without thermostat
- General purpose enclosure
- Steel flange

- ① 6 and 12 element heaters have (1) 1 inch NPT conduit opening; 18, 24, 30 and 42 element heaters have (2) 1 inch NPT conduit openings; 36, 48, 54, and 60 element heaters have (2) 1 inch NPT and (2) 1 1/4 inch conduit openings
- ② All flanges are 12 inches wide



# of Elem.	Volts	kW	Ph	# Circ	# Part Number	WATCONNECT P/N		Ship Wt. lbs. (kg)	"A" Dim. in. (mm)		"B" Dim. in. (mm)		"C" Dim. in. (mm)		"D" Dim. in. (mm)		"E" Dim. in. (mm)		"F" Dim. in. (mm)		"G" Dim. in. (mm)	
						J T/C	K T/C		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)
<b>30 W/in<sup>2</sup> (4.7 W/cm<sup>2</sup>)</b>																						
36	240	54.0	3	3	D36SX3S	C4-144	C4-145	135 (62)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	12 <sup>3</sup> / <sub>4</sub>	(324)	16 <sup>1</sup> / <sub>2</sub>	(419)	13	(330)	15 <sup>3</sup> / <sub>4</sub>	(400)	3 <sup>3</sup> / <sub>4</sub>	(95)
36	480	54.0	1	3	D36SX11S	C/F	C/F	135 (62)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	12 <sup>3</sup> / <sub>4</sub>	(324)	16 <sup>1</sup> / <sub>2</sub>	(419)	13	(330)	15 <sup>3</sup> / <sub>4</sub>	(400)	3 <sup>3</sup> / <sub>4</sub>	(95)
36	480	54.0	3	2	D36SX5S	C2-229	C2-230	135 (62)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	12 <sup>3</sup> / <sub>4</sub>	(324)	16 <sup>1</sup> / <sub>2</sub>	(419)	13	(330)	15 <sup>3</sup> / <sub>4</sub>	(400)	3 <sup>3</sup> / <sub>4</sub>	(95)
42	240	63.0	3	7	D42SX3S	C4-148	C4-149	155 (71)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	14 <sup>3</sup> / <sub>4</sub>	(375)	18 <sup>1</sup> / <sub>2</sub>	(470)	15	(381)	17 <sup>3</sup> / <sub>4</sub>	(451)	4 <sup>1</sup> / <sub>4</sub>	(108)
42	480	63.0	1	3	D42SX11S	C/F	C/F	155 (71)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	14 <sup>3</sup> / <sub>4</sub>	(375)	18 <sup>1</sup> / <sub>2</sub>	(470)	15	(381)	17 <sup>3</sup> / <sub>4</sub>	(451)	4 <sup>1</sup> / <sub>4</sub>	(108)
42	480	63.0	3	2	D42SX5S	C2-229	C2-230	155 (71)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	14 <sup>3</sup> / <sub>4</sub>	(375)	18 <sup>1</sup> / <sub>2</sub>	(470)	15	(381)	17 <sup>3</sup> / <sub>4</sub>	(451)	4 <sup>1</sup> / <sub>4</sub>	(108)
48	240	72.0	3	4	D48SX3S	C4-148	C4-149	195 (89)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	16 <sup>3</sup> / <sub>4</sub>	(425)	20 <sup>1</sup> / <sub>2</sub>	(521)	17	(432)	19 <sup>3</sup> / <sub>4</sub>	(502)	4 <sup>3</sup> / <sub>4</sub>	(121)
48	480	72.0	1	4	D48SX11S	C/F	C/F	195 (89)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	16 <sup>3</sup> / <sub>4</sub>	(425)	20 <sup>1</sup> / <sub>2</sub>	(521)	17	(432)	19 <sup>3</sup> / <sub>4</sub>	(502)	4 <sup>3</sup> / <sub>4</sub>	(121)
48	480	72.0	3	2	D48SX5S	C2-229	C2-230	195 (89)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	16 <sup>3</sup> / <sub>4</sub>	(425)	20 <sup>1</sup> / <sub>2</sub>	(521)	17	(432)	19 <sup>3</sup> / <sub>4</sub>	(502)	4 <sup>3</sup> / <sub>4</sub>	(121)
54	240	81.0	3	6	D54SX3S	C/F	C/F	205 (93)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	18 <sup>3</sup> / <sub>4</sub>	(476)	22 <sup>1</sup> / <sub>2</sub>	(572)	19	(483)	21 <sup>3</sup> / <sub>4</sub>	(552)	5 <sup>1</sup> / <sub>4</sub>	(133)
54	480	81.0	1	6	D54SX11S	C/F	C/F	205 (93)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	18 <sup>3</sup> / <sub>4</sub>	(476)	22 <sup>1</sup> / <sub>2</sub>	(572)	19	(483)	21 <sup>3</sup> / <sub>4</sub>	(552)	5 <sup>1</sup> / <sub>4</sub>	(133)
54	480	81.0	3	3	D54SX5S	C4-152	C4-153	205 (93)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	18 <sup>3</sup> / <sub>4</sub>	(476)	22 <sup>1</sup> / <sub>2</sub>	(572)	19	(483)	21 <sup>3</sup> / <sub>4</sub>	(552)	5 <sup>1</sup> / <sub>4</sub>	(133)
60	240	90.0	3	5	D60SX3S	C/F	C/F	235 (107)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	20 <sup>3</sup> / <sub>4</sub>	(527)	24 <sup>1</sup> / <sub>2</sub>	(622)	21	(533)	23 <sup>3</sup> / <sub>4</sub>	(603)	5 <sup>3</sup> / <sub>4</sub>	(146)
60	480	90.0	1	4	D60SX11S	C/F	C/F	235 (107)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	20 <sup>3</sup> / <sub>4</sub>	(527)	24 <sup>1</sup> / <sub>2</sub>	(622)	21	(533)	23 <sup>3</sup> / <sub>4</sub>	(603)	5 <sup>3</sup> / <sub>4</sub>	(146)
60	480	90.0	3	4	D60SX5S	C4-156	C4-157	235 (107)	27 <sup>7</sup> / <sub>8</sub>	(708.0)	20	(508)	20 <sup>3</sup> / <sub>4</sub>	(527)	24 <sup>1</sup> / <sub>2</sub>	(622)	21	(533)	23 <sup>3</sup> / <sub>4</sub>	(603)	5 <sup>3</sup> / <sub>4</sub>	(146)
60	240	115.0	3	10	D75SX3S	C/F	C/F	260 (118)	32 <sup>7</sup> / <sub>8</sub>	(835.0)	25	(635)	20 <sup>3</sup> / <sub>4</sub>	(527)	24 <sup>1</sup> / <sub>2</sub>	(622)	21	(533)	23 <sup>3</sup> / <sub>4</sub>	(603)	5 <sup>3</sup> / <sub>4</sub>	(146)
60	480	115.0	1	5	D75SX11S	C/F	C/F	260 (118)	32 <sup>7</sup> / <sub>8</sub>	(835.0)	25	(635)	20 <sup>3</sup> / <sub>4</sub>	(527)	24 <sup>1</sup> / <sub>2</sub>	(622)	21	(533)	23 <sup>3</sup> / <sub>4</sub>	(603)	5 <sup>3</sup> / <sub>4</sub>	(146)
60	480	115.0	3	4	D75SX5S	C4-156	C4-157	260 (118)	32 <sup>7</sup> / <sub>8</sub>	(835.0)	25	(635)	20 <sup>3</sup> / <sub>4</sub>	(527)	24 <sup>1</sup> / <sub>2</sub>	(622)	21	(533)	23 <sup>3</sup> / <sub>4</sub>	(603)	5 <sup>3</sup> / <sub>4</sub>	(146)
60	480	150.0	3	4	D100SX5S	C4-156	C4-157	290 (132)	40 <sup>3</sup> / <sub>8</sub>	(1025.5)	32 <sup>1</sup> / <sub>2</sub>	(826)	20 <sup>3</sup> / <sub>4</sub>	(527)	24 <sup>1</sup> / <sub>2</sub>	(622)	21	(533)	23 <sup>3</sup> / <sub>4</sub>	(603)	5 <sup>3</sup> / <sub>4</sub>	(146)
60	480	190.0	3	5	D125SX5S	C/F	C/F	310 (141)	49 <sup>3</sup> / <sub>8</sub>	(1254.1)	41 <sup>1</sup> / <sub>2</sub>	(1054)	20 <sup>3</sup> / <sub>4</sub>	(527)	24 <sup>1</sup> / <sub>2</sub>	(622)	21	(533)	23 <sup>3</sup> / <sub>4</sub>	(603)	5 <sup>3</sup> / <sub>4</sub>	(146)

#### Notes:

- See *Watt Density vs. Air Temperature/Velocity* charts on page 379 to confirm suitability in the application. C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

# Air Heaters



## Duct Heaters

### LDH SERIES and D SERIES

#### Replacement Elements

Replaceable heating elements provide easy field service and reduce downtime. Element change-out is made simple by a single screw clamp.

To order replacement elements, specify the **replacement element part number** (from the table) that corresponds to the original Watlow duct heater part number. Then, specify **quantity**.

#### Replacement Elements

Original Duct Heater Part Numbers	Replacement Element		A Dimension		Replacement Element Part Number	Est. Net Wt.	
	Volts	Watts	in.	(mm)		lbs	(kg)
<b>20 W/in<sup>2</sup> (3.1 W/cm<sup>2</sup>)</b>							
<b>D6S3 to D60S3</b>	240	1000	27 <sup>7</sup> / <sub>8</sub>	(708.0)	<b>D6240</b>	1.0	(0.5)
<b>D6S5 to D60S5</b>	480	1000	27 <sup>7</sup> / <sub>8</sub>	(708.0)	<b>D6480</b>	1.0	(0.5)
<b>D75S3</b>	240	1250	32 <sup>7</sup> / <sub>8</sub>	(835.0)	<b>D75240</b>	1.0	(0.5)
<b>D75S5</b>	480	1250	32 <sup>7</sup> / <sub>8</sub>	(835.0)	<b>D75480</b>	1.0	(0.5)
<b>D100S5</b>	480	1667	40 <sup>3</sup> / <sub>8</sub>	(1025.5)	<b>D100480</b>	1.4	(0.7)
<b>D125S5</b>	480	2083	49 <sup>3</sup> / <sub>8</sub>	(1254.1)	<b>D125480</b>	1.7	(0.8)
<b>30 W/in<sup>2</sup> (4.7 W/cm<sup>2</sup>)</b>							
<b>D6SX3 to D60SX3</b>	240	1500	27 <sup>7</sup> / <sub>8</sub>	(708.0)	<b>D6X240</b>	1.0	(0.5)
<b>D6SX5 to D60SX5</b>	480	1500	27 <sup>7</sup> / <sub>8</sub>	(708.0)	<b>D6X480</b>	1.0	(0.5)
<b>D75SX3</b>	240	1917	32 <sup>7</sup> / <sub>8</sub>	(835.0)	<b>D75X240</b>	1.0	(0.5)
<b>D75SX5</b>	480	1917	32 <sup>7</sup> / <sub>8</sub>	(835.0)	<b>D75X480</b>	1.0	(0.5)
<b>D100SX5</b>	480	2500	40 <sup>3</sup> / <sub>8</sub>	(1025.5)	<b>D100X480</b>	1.4	(0.7)
<b>D125SX5</b>	480	3167	49 <sup>3</sup> / <sub>8</sub>	(1254.1)	<b>D125X480</b>	1.7	(0.8)

# Air Heaters



## Duct Heaters

### LDH SERIES and D SERIES

#### Part Number

Stock Duct Part Number	Optional Terminal Enclosures	Optional Process Sensors	Sheath Limit Sensors

#### Stock Duct Part Number

**Note:** Catalog part numbers include optional enclosures. To order optional enclosures or sensors, substitute the appropriate suffix.

#### Optional Terminal Enclosures

S = General purpose enclosure

W = Moisture resistant enclosure

**Note:** Catalog listing is a general purpose enclosure. Substitute enclosure options are noted.

#### Optional Bulb & Capillary Thermostats or Thermocouple Process Sensors

PJ = Type J process thermocouple in thermowell

PK = Type K process thermocouple in thermowell

#### Sheath Limit Sensors

HJ = Type J high-limit thermocouple

HK = Type K high-limit thermocouple

**Example Part Number:** D6SX10 S J HJ

# Air Heaters



## Duct Heaters

### MDH SERIES

Watlow's line of process air heaters offer improved performance and increased versatility in medium to low temperature applications.

The duct heaters are modular and consist of two parts. The first is a six kilowatt heater available in either 240 or 480 volts, single- or three-phase.

The second part of the heater consists of the electrical terminal enclosure protecting each module's termination area and a main flange that bolts into the user's ductwork. The heater modules are installed in the housing and main flange via rectangular slots in the main flange. The range of modules that can be accommodated in various duct heater assemblies range from one to 10 modules. A range of six to 60 kilowatts, in six kilowatt increments is achieved.

The new design of the modular duct heater offers increased reliability. The individual modules are removable through the terminal enclosure of the assembly, which eliminates the need to pull the complete heater from the ductwork. This reduces downtime and costs because the heating elements can be replaced individually.

Performance improvements include quicker response time and reduced infiltration from the air stream being heated into the electrical enclosure.

### Features and Benefits

#### Individual modules removable through housing

- Reduces downtime for replacement of module

#### Smaller diameter elements (0.315 inch)

- Results in a 25 percent lower energy usage on initial heat-up

#### 27 percent reduction in heat-up time as compared to traditional 0.430 inch diameter duct heater elements

- Results in faster response time

#### 31 percent lighter weight than traditional tubular duct heaters

- Reduces shipping costs and increases worker safety

#### Greater free cross sectional area

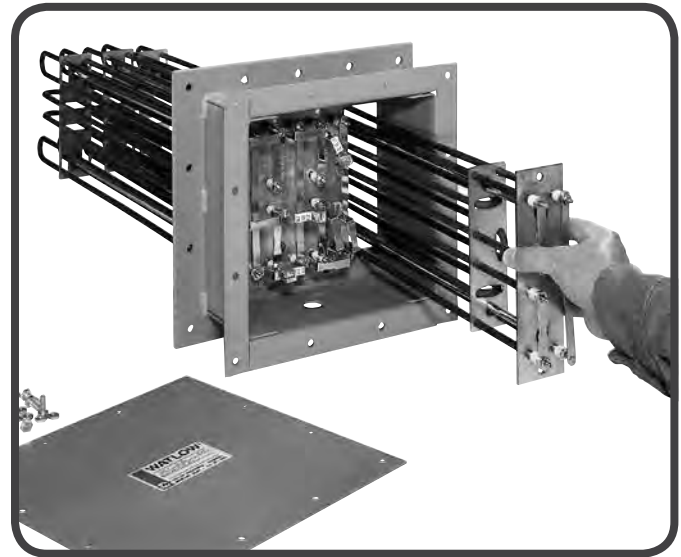
- Results in lower pressure drop

#### Improved seal between element and electrical terminal enclosure

- Results in lower electrical terminal enclosure temperature

#### Flexible module wiring

- Allows user to sequentially stage modules



### Typical Applications

- Low temperature ovens
- Parts drying
- Semiconductor cleanroom environmental heating
- Plastic curing
- Load banks
- Heated air knives
- Food dehydration
- Heat shrink tunnels

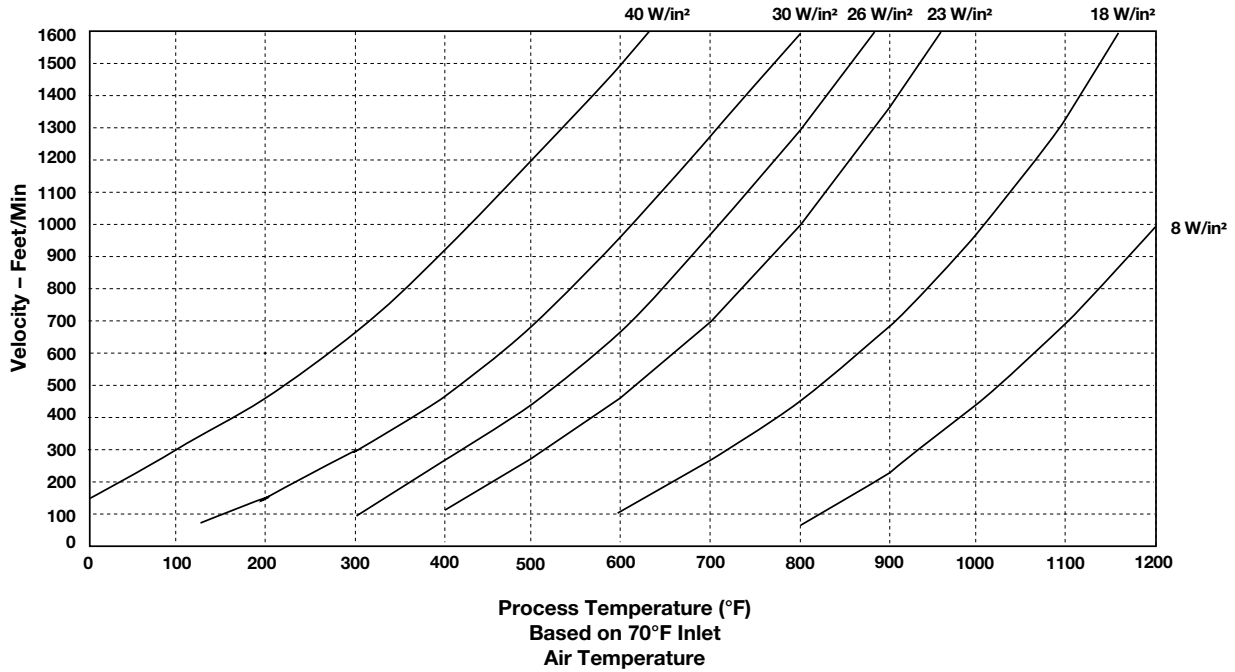
# Air Heaters



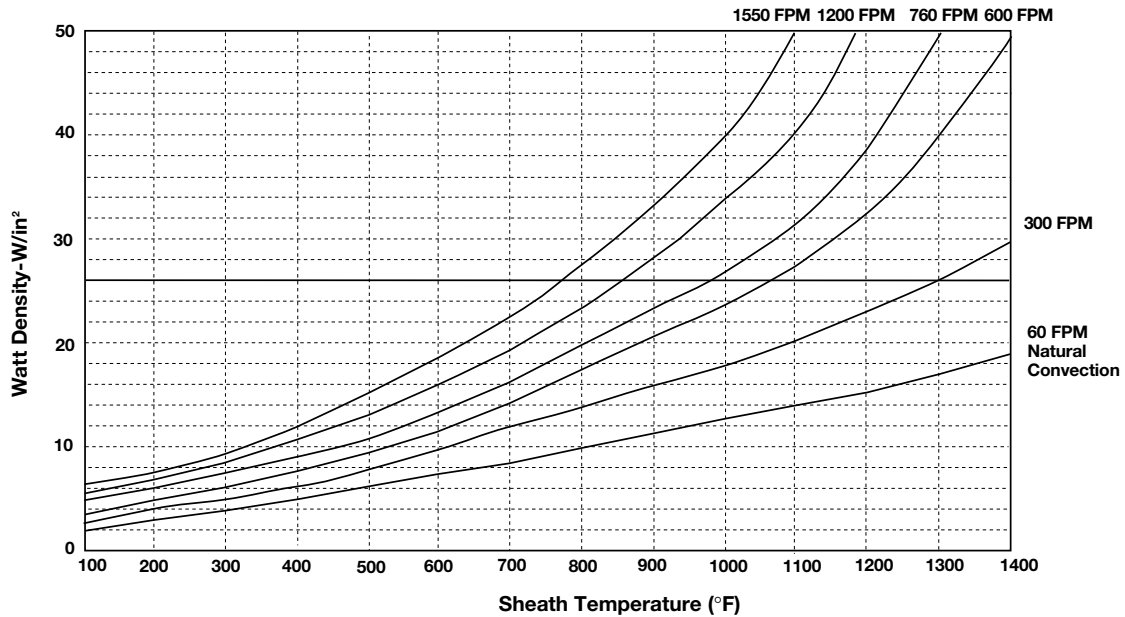
## Duct Heaters

### MDH SERIES

#### Velocity vs. Process Temperature



#### Watt Density vs. Sheath Temperature





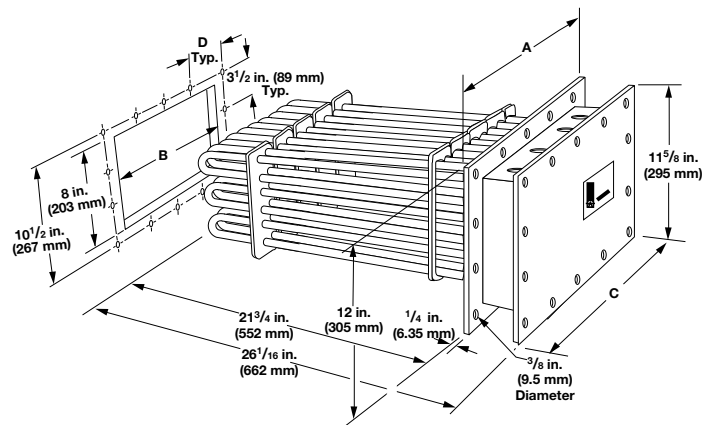
# Air Heaters



## Duct Heaters



### MDH SERIES



Application: Air Heating – Maximum Outlet Temperature – 750°F (399°C)

								WATCONNECT P/N		Dimensions in.			
Watt Density W/in <sup>2</sup>	kW	Volts	Phase	No. of Circuits	No. of Modules	Est. Shipping Wt. lbs	Part Number	J T/C	K T/C	A	B	C	D
26	6	240	1	1	1	35	MDH6SI0	C/F	C/F	6.50	2.50	5.75	2.50
26	6	240	3	1	1	35	MDH6S3	C2-50	C2-92	6.50	2.50	5.75	2.50
26	6	480	1	1	1	35	MDH6S11	C/F	C/F	6.50	2.50	5.75	2.50
26	6	480	3	1	1	35	MDH6S5	C2-43	C2-35	6.50	2.50	5.75	2.50
26	12	240	1	2	2	39	MDH12SI0	C/F	C/F	8.50	4.75	7.75	3.50
26	12	240	3	1	2	39	MDH12S3	C2-236	C2-214	8.50	4.75	7.75	3.50
26	12	480	1	1	2	39	MDH12S11	C/F	C/F	8.50	4.75	7.75	3.50
26	12	480	3	1	2	39	MDH12S5	C2-43	C2-35	8.50	4.75	7.75	3.50
26	18	240	1	3	3	46	MDH18SI0	C/F	C/F	10.50	7.00	9.75	3.00
26	18	240	3	1	3	46	MDH18S3	C2-236	C2-214	10.50	7.00	9.75	3.00
26	18	480	1	1	3	46	MDH18S11	C/F	C/F	10.50	7.00	9.75	3.00
26	18	480	3	1	3	46	MDH18S5	C2-43	C2-35	10.50	7.00	9.75	3.00
26	24	240	1	4	4	67	MDH24SI0	C/F	C/F	12.50	9.25	11.75	2.75
26	24	240	3	2	4	67	MDH24S3	C2-218	C2-224	12.50	9.25	11.75	2.75
26	24	480	1	2	4	67	MDH24S11	C/F	C/F	12.50	9.25	11.75	2.75
26	24	480	3	1	4	67	MDH24S5	C2-225	C2-226	12.50	9.25	11.75	2.75
26	30	240	3	2	5	84	MDH30S3	C2-218	C2-224	15.75	11.50	15.00	3.56
26	30	480	1	2	5	84	MDH30S11	C/F	C/F	15.75	11.50	15.00	3.56
26	30	480	3	1	5	84	MDH30S5	C2-225	C2-226	15.75	11.50	15.00	3.56
26	36	240	3	2	6	95	MDH36S3	C2-218	C2-224	18.00	13.75	17.25	4.13
26	36	480	1	2	6	95	MDH36S11	C/F	C/F	18.00	13.75	17.25	4.13
26	36	480	3	1	6	95	MDH36S5	C2-225	C2-226	18.00	13.75	17.25	4.13
26	42	240	3	3	7	109	MDH42S3	C4-144	C4-145	20.25	16.00	19.50	4.69
26	42	480	1	3	7	109	MDH42S11	C/F	C/F	20.25	16.00	19.50	4.69
26	42	480	3	2	7	109	MDH42S5	C2-229	C2-230	20.25	16.00	19.50	4.69
26	48	240	3	4	8	137	MDH48S3	C4-148	C4-149	22.50	18.25	21.75	5.25
26	48	480	1	3	8	137	MDH48S11	C/F	C/F	22.50	18.25	21.75	5.25
26	48	480	3	2	8	137	MDH48S5	C2-229	C2-230	22.50	18.25	21.75	5.25
26	54	240	3	3	9	144	MDH54S3	C4-144	C4-145	24.75	20.50	24.00	5.81
26	54	480	1	3	9	144	MDH54S11	C/F	C/F	24.75	20.50	24.00	5.81
26	54	480	3	2	9	144	MDH54S5	C2-229	C2-230	24.75	20.50	24.00	5.81
26	60	240	3	4	10	165	MDH60S3	C4-148	C4-149	27.00	22.75	26.25	6.38
26	60	480	1	4	10	165	MDH60S11	C/F	C/F	27.00	22.75	26.25	6.38
26	60	480	3	2	10	165	MDH60S5	C2-229	C2-230	27.00	22.75	26.25	6.38

Options include individual modules with optional general purpose terminal enclosure, high-temperature thermocouple kit and blank flange modules.

C/F - Contact factory, go to [www.watlow.com/en/contact-us](http://www.watlow.com/en/contact-us)

Modular duct heaters with **1** and **2** modules have conduit openings for **one**, 1 inch NPT fitting.

Modular duct heaters with **3**, **4**, **5**, and **7** modules have conduit openings for **two**, 1 inch NPT fittings.

Modular duct heaters with **6**, **8**, **9**, and **10** modules have conduit openings for **two**, 1 1/4 inch NPT and **two**, 1 inch NPT fittings.



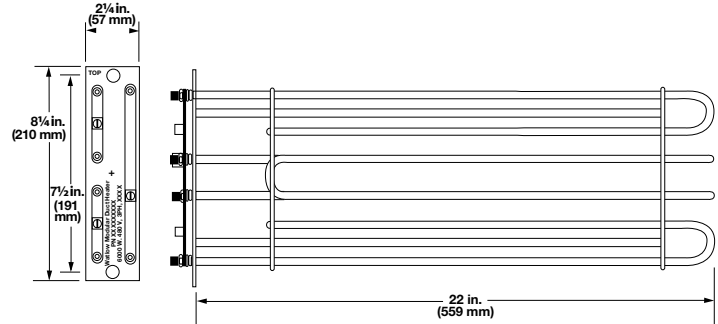
## Duct Heaters

### MDH SERIES

#### Individual Module Dimensions

##### Specifications

- Module rating - 240 or 480VAC, 6kW, three-phase or one-phase
- Watt density - 26 W/in<sup>2</sup>
- Elements - 0.315 inch dia. alloy 840 elements
- High-limit thermocouple installed by drilling premarked hole in flange
- 6-60kW range when mounted in duct heater assembly



##### Application Information

- Maximum sheath temperature = 1200°F (649°C)
- Maximum outlet temperature = 750°F (399°C)

## Options

### Terminal Enclosures

Terminal enclosures are available in general purpose and moisture resistant configurations.

### High-Limit Thermocouples

High-limit thermocouples can be supplied on specified modules or shipped as a kit. Available thermocouples are Types J and K.

### Blank Module Covers

Module covers are available for covering blank slots on the main flange. This allows for adding heater modules at a later time to allow higher wattage outputs.

### Replacement Modules

Replacement modules provide easy field service and reduce downtime. To order replacement modules specify the **replacement module** part number (from the table), then specify the **quantity**.

Watlow Part Number	Description
<b>Replacement Modules</b>	
<b>M63</b>	6kW, 240V, 3 phase
<b>M610</b>	6kW, 240V, 1 phase
<b>M65</b>	6kW, 480V, 3 phase
<b>M611</b>	6kW, 480V, 1 phase
<b>High Limit Thermocouple Kits</b>	
<b>MTCJ</b>	Type J (0-1000°F)
<b>MTCK</b>	Type K (0-2000°F)
<b>Blank Module Covers</b>	
<b>MBLK</b>	Cover slots in main flange

# Air Heaters



## Finned Heaters

### 375 Finned Strip Heaters

Watlow's 375 finned strip heater is constructed of highly-compacted magnesium oxide (MgO) based insulation, which conducts heat efficiently from the nickel chromium element wire to the sheath. Two-inch wide (51 mm) nickel plated fins are attached to maximize surface contact allowing heat to transfer into the air faster. Lower sheath temperature and element life are maximized by this finned construction.

### Performance Capabilities

- Aluminized steel sheath temperatures up to 1100°F (595°C)
- Watt density up to 33 W/in<sup>2</sup> (5.1 W/cm<sup>2</sup>)
- UL<sup>®</sup> approved up to 240VAC (File No. E52951)
- CSA approved up to 480VAC (File No. LR7392)

### Features and Benefits

#### Nickel chromium element wire is centered in the heater

- Ensures temperature uniformity

#### Aluminized steel sheath

- Operates at higher temperatures
- Resists corrosion more effectively than iron-sheathed heaters

#### Optional 430 stainless steel sheath

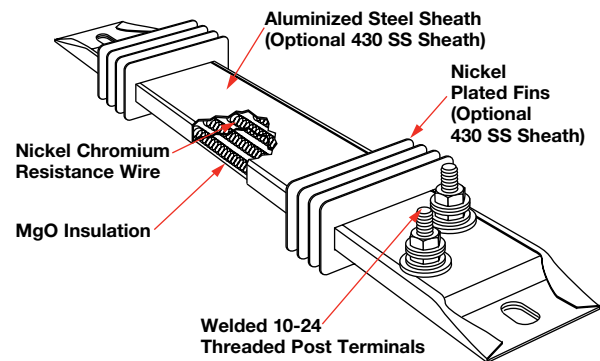
- Provides a durable solution for highly-corrosive environments

#### Welded post terminals

- Produces strong, trouble-free connections

#### Available lengths from 5<sup>1</sup>/<sub>2</sub> to 48 in. (140 to 1220 mm)

- Fits a variety of application needs



### Typical Applications

- Enclosure heating
- Load bank resistors
- Shrink tunnels
- Duct heaters
- Space heaters
- Drying ovens
- Incubators
- Air heating
- Heat curing
- Ink drying
- Food warmers
- Moisture protection
- Dehumidifiers
- Stress relieving ovens



## Finned Heaters

### 375 Finned Strip Heaters

#### Applications and Technical Data

#### Calculating Watt Density

Use the graph and formulas to ensure that the maximum allowable watt density for the heater is not exceeded in the application.

Open air watt density is calculated for the total heated surface area.

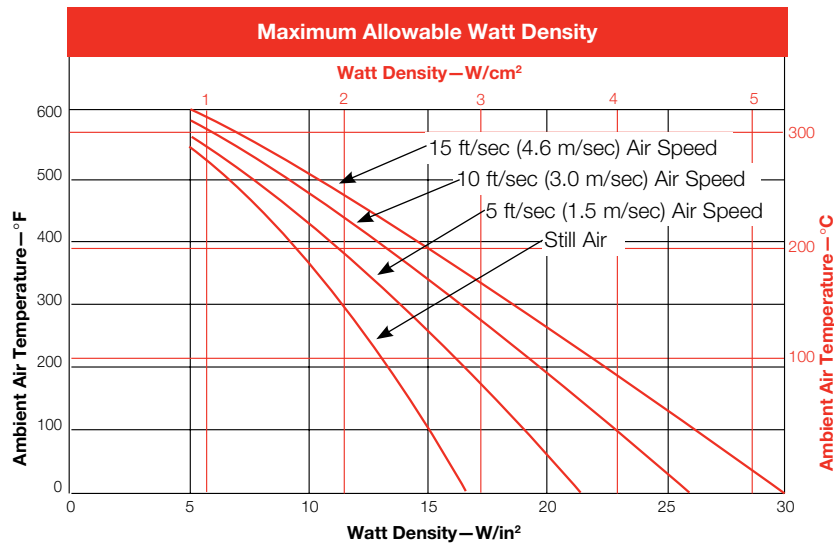
#### Formulas

$$\text{Watt Density} = \frac{\text{Wattage}}{\text{Heated Area}}$$

$$\begin{aligned} \text{Heated Area} \\ (\text{Offset Terminals}) &= [\text{Overall Length (A)} - 4 \text{ in.}] \\ &\quad \times 3.75 \text{ in.} \\ &= [\text{Overall Length (A)} - 102 \text{ mm}] \\ &\quad \times 95.3 \text{ mm} \end{aligned}$$

$$\begin{aligned} \text{Heated Area} \\ (\text{Parallel Terminals}) &= [\text{Overall Length (A)} - 3.12 \text{ in.}] \\ &\quad \times 3.75 \text{ in.} \\ &= [\text{Overall Length (A)} - 79.3 \text{ mm}] \\ &\quad \times 95.3 \text{ mm} \end{aligned}$$

$$\begin{aligned} \text{Heated Area} \\ (\text{One-on-One Terminals}) &= [\text{Overall Length (A)} - 4.25 \text{ in.}] \\ &\quad \times 3.75 \text{ in.} \\ &= [\text{Overall Length (A)} - 108 \text{ mm}] \\ &\quad \times 95.3 \text{ mm} \end{aligned}$$



# Air Heaters

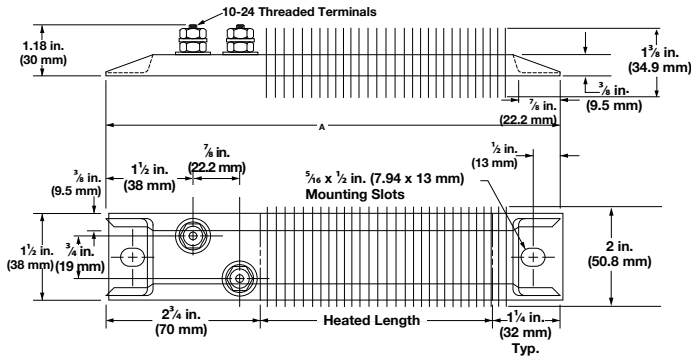


## Finned Heaters

### 375 Finned Strip Heaters

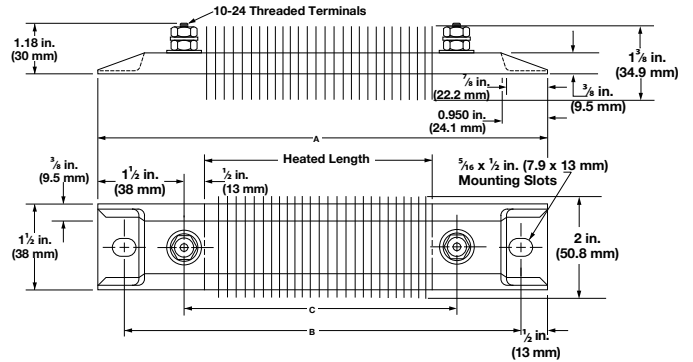
#### Termination Options

##### Offset Terminals



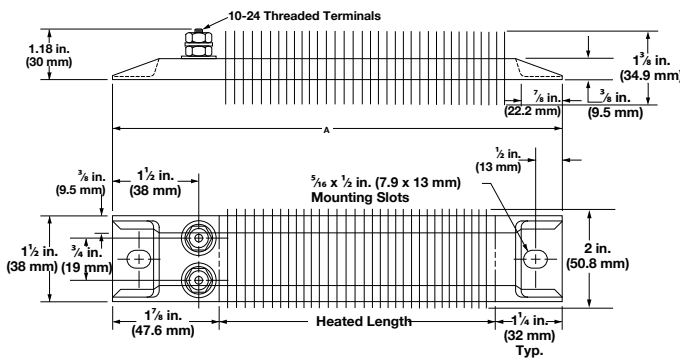
Two 10-24 threaded post terminals are offset from each other on the same end.

##### One-on-One Terminals



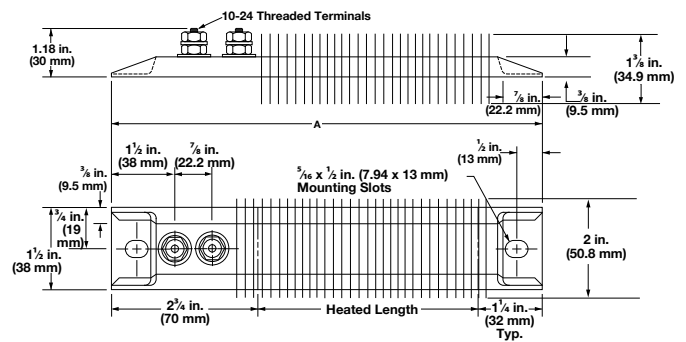
Two 10-24 threaded post terminals are placed one on each end.

##### Parallel Terminals



Two 10-24 threaded post terminals are used; both terminals on one end.

##### In-Line Terminals



Two 10-24 threaded post terminals are in-line with each other on the same end.



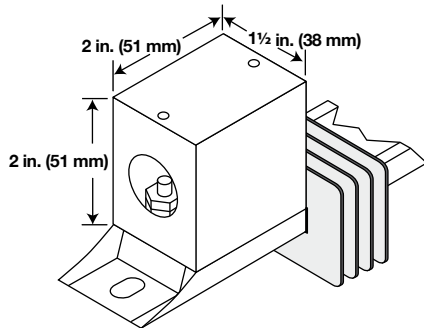
## Finned Heaters

### 375 Finned Strip Heaters

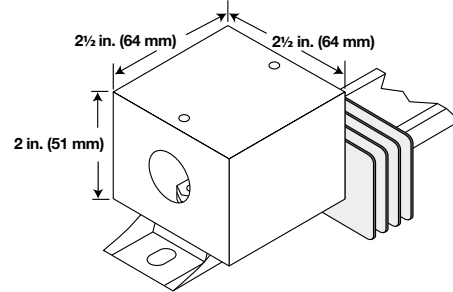
#### Termination Options *(Continued)*

#### Metallic Terminal Boxes - Variations

Metallic terminal boxes are available from stock on offset terminals. Terminal boxes act as a safety feature by covering the terminals. A conduit may be attached to the box through  $\frac{7}{8}$  in. (22.2 mm) diameter holes in the ends of the box. To order, specify **terminal box**.



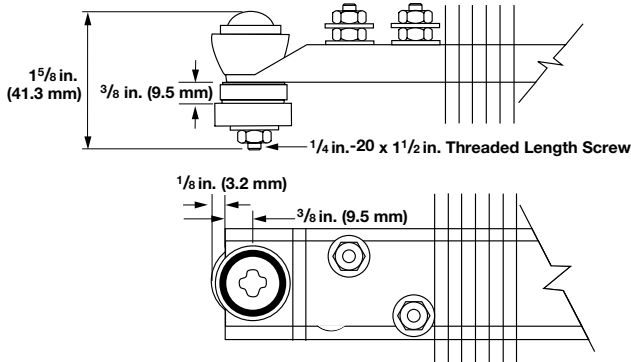
Available on in-line terminals only.



Available on offset terminals from stock and manufactured.

## Accessories

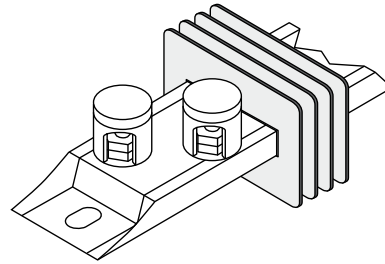
### Secondary Insulation Bushings



Insulators are suitable when air heating and/or voltage to ground is a concern. A secondary insulation bushing kit, part number **Z-5230**, contains one set of bushings for one heater. To accommodate bushings,  $\frac{17}{32} \times \frac{11}{16}$  inch diameter mounting holes **must** be specified when ordering.

**Note:** Number of fins are dependent on length of heater.

### Ceramic Terminal Covers



Ceramic terminal covers offer a convenient and economical method to insulate post terminals. A 10-24 screw thread is sized for standard length posts and is supplied as an accessory item and shipped separately. Specify **Z-4918** and quantity.

# Air Heaters



## Finned Heaters

### 375 Finned Strip Heaters

#### Heater Part Numbers

Width in. (mm)	Termination	Length in. (mm)	Volts	Power (Watts)	W/in <sup>2</sup> (W/cm <sup>2</sup> )	Approx. Net Wt. lbs (kg)	Part Number
1 1/2 (38)	Parallel	5 1/2 (140)	120	125	14 (2.1)	0.5 (0.23)	<b>SGA1J5JY2</b>
	Parallel	5 1/2 (140)	120	250	28 (4.3)	0.5 (0.23)	<b>SGA1J5JY3</b>
	Parallel	6 (152)	120	150	14 (2.1)	0.5 (0.23)	<b>SGA1J6AY1</b>
	Parallel	6 (152)	240	150	14 (2.1)	0.5 (0.23)	<b>SGA1J6AY2</b>
	Parallel	6 (152)	120	300	28 (4.3)	0.5 (0.23)	<b>SGA1J6AY3</b>
	Parallel	6 (152)	240	300	28 (4.3)	0.5 (0.23)	<b>SGA1J6AY4</b>
	Offset	7 1/2 (191)	120	150	12 (1.8)	0.7 (0.32)	<b>SGA1J7JW1</b>
	Offset	7 1/2 (191)	240	150	12 (1.8)	0.7 (0.32)	<b>SGA1J7JW2</b>
	Offset	7 1/2 (191)	240	200	15 (2.3)	0.7 (0.32)	<b>SGA1J7JW3</b>
	Offset	8 (203)	120	150	10 (1.5)	0.7 (0.32)	<b>SGA1J8AW2</b>
	Offset	8 (203)	240	150	10 (1.5)	0.7 (0.32)	<b>SGA1J8AW3</b>
	Offset	8 (203)	120	175	12 (1.8)	0.7 (0.32)	<b>SGA1J8AW4</b>
	Offset	8 (203)	240	175	12 (1.8)	0.7 (0.32)	<b>SGA1J8AW5</b>
	Offset	8 (203)	120	250	17 (2.6)	0.7 (0.32)	<b>SGA1J8AW6</b>
	Offset	8 (203)	240	250	17 (2.6)	0.7 (0.32)	<b>SGA1J8AW7</b>
	Offset	8 (203)	120	400	27 (4.2)	0.7 (0.32)	<b>SGA1J8AW8</b>
	Offset	8 (203)	240	400	27 (4.2)	0.7 (0.32)	<b>SGA1J8AW9</b>
	Offset	8 (203)	120	500	33 (5.1)	0.7 (0.32)	<b>SGA1J8AW10</b>
	Offset	8 (203)	240	500	33 (5.1)	0.7 (0.32)	<b>SGA1J8AW11</b>
	Offset	10 1/2 (267)	120	250	10 (1.5)	0.9 (0.40)	<b>SGA1J10JW1</b>
	Offset	10 1/2 (267)	240	250	10 (1.5)	0.9 (0.40)	<b>SGA1J10JW2</b>
	Offset	10 1/2 (267)	120	350	14 (2.1)	0.9 (0.40)	<b>SGA1J10JW3</b>
	Offset	10 1/2 (267)	240	350	14 (2.1)	0.9 (0.40)	<b>SGA1J10JW4</b>
	Offset	10 1/2 (267)	120	400	16 (2.5)	0.9 (0.40)	<b>SGA1J10JW5</b>
	Offset	10 1/2 (267)	240	400	16 (2.5)	0.9 (0.40)	<b>SGA1J10JW6</b>
	Offset	12 (305)	120	250	8 (1.2)	1.0 (0.45)	<b>SGA1J12AW1</b>
	Offset	12 (305)	240	250	8 (1.2)	1.0 (0.45)	<b>SGA1J12AW2</b>
	Offset	12 (305)	120	350	12 (1.8)	1.0 (0.45)	<b>SGA1J12AW3</b>
	Offset	12 (305)	240	350	12 (1.8)	1.0 (0.45)	<b>SGA1J12AW4</b>
	Offset	12 (305)	120	500	17 (2.6)	1.0 (0.45)	<b>SGA1J12AW5</b>
	Offset	12 (305)	240	500	17 (2.6)	1.0 (0.45)	<b>SGA1J12AW6</b>
	Offset	14 (356)	120	300	8 (1.2)	1.2 (0.54)	<b>SGA1J14AW1</b>
	Offset	14 (356)	240	300	8 (1.2)	1.2 (0.54)	<b>SGA1J14AW2</b>
Offset	14 (356)	120	500	13 (2.0)	1.2 (0.54)	<b>SGA1J14AW3</b>	
Offset	14 (356)	240	500	13 (2.0)	1.2 (0.54)	<b>SGA1J14AW4</b>	
Offset	15 1/4 (387)	120	325	8 (1.2)	1.4 (0.64)	<b>SGA1J15EW1</b>	
Offset	15 1/4 (387)	240	325	8 (1.2)	1.4 (0.64)	<b>SGA1J15EW2</b>	
Offset	15 1/4 (387)	240	500	12 (1.8)	1.4 (0.64)	<b>SGA1J15EW3</b>	

CONTINUED

**Note:** 375 finned strip heaters with one-on-one terminations are available as a manufactured item only. Please contact your Watlow representative for additional information.

**Note:** Above heaters are modified stock and may not be returned for a restocking charge.

**Note:** 5/16 x 1/2 in. (7.9 x 13 mm) mounting holes are supplied on all 375 finned strip heaters as standard, larger mounting holes may be provided 17/32 in. x 11/16 in. (13.5 mm x 17.5 mm).

**Note:** Heaters can be customized given a business case review. Contact the factory for details.

# Air Heaters



## Finned Heaters

### 375 Finned Strip Heaters

#### Heater Part Numbers (Continued)

Width in. (mm)	Termination	Length in. (mm)	Volts	Power (Watts)	W/in <sup>2</sup> (W/cm <sup>2</sup> )	Approx. Net Wt. lbs (kg)	Part Number
1 1/2 (38)	Offset	17 <sup>7</sup> / <sub>8</sub> (454)	120	350	8 (1.2)	1.6 (0.73)	<b>SGA1J17RW1</b>
	Offset	17 <sup>7</sup> / <sub>8</sub> (454)	240	350	8 (1.2)	1.6 (0.73)	<b>SGA1J17RW2</b>
	Offset	17 <sup>7</sup> / <sub>8</sub> (454)	120	375	9 (1.4)	1.6 (0.73)	<b>SGA1J17RW3</b>
	Offset	17 <sup>7</sup> / <sub>8</sub> (454)	240	375	9 (1.4)	1.6 (0.73)	<b>SGA1J17RW4</b>
	Offset	17 <sup>7</sup> / <sub>8</sub> (454)	120	500	12 (1.8)	1.6 (0.73)	<b>SGA1J17RW5</b>
	Offset	17 <sup>7</sup> / <sub>8</sub> (454)	240	500	12 (1.8)	1.6 (0.73)	<b>SGA1J17RW6</b>
	Offset	17 <sup>7</sup> / <sub>8</sub> (454)	120	750	18 (2.8)	1.6 (0.73)	<b>SGA1J17RW7</b>
	Offset	17 <sup>7</sup> / <sub>8</sub> (454)	240	750	18 (2.8)	1.6 (0.73)	<b>SGA1J17RW8</b>
	Offset	17 <sup>7</sup> / <sub>8</sub> (454)	120	1000	24 (3.7)	1.6 (0.73)	<b>SGA1J17RW9</b>
	Offset	17 <sup>7</sup> / <sub>8</sub> (454)	240	1000	24 (3.7)	1.6 (0.73)	<b>SGA1J17RW10</b>
	Offset	19 <sup>1</sup> / <sub>2</sub> (495)	240	350	6 (.9)	1.7 (0.77)	<b>SGA1J19JW2</b>
	Offset	19 <sup>1</sup> / <sub>2</sub> (495)	120	500	9 (1.4)	1.7 (0.77)	<b>SGA1J19JW3</b>
	Offset	19 <sup>1</sup> / <sub>2</sub> (495)	240	500	9 (1.4)	1.7 (0.77)	<b>SGA1J19JW4</b>
	Offset	19 <sup>1</sup> / <sub>2</sub> (495)	240	750	13 (2.0)	1.7 (0.77)	<b>SGA1J19JW5</b>
	Offset	19 <sup>1</sup> / <sub>2</sub> (495)	240	1000	17 (2.6)	1.7 (0.77)	<b>SGA1J19JW6</b>
	Offset	21 (533)	120	500	8 (1.2)	1.9 (0.86)	<b>SGA1J21AW3</b>
	Offset	21 (533)	240	500	8 (1.2)	1.9 (0.86)	<b>SGA1J21AW4</b>
	Offset	21 (533)	120	750	12 (1.8)	1.9 (0.86)	<b>SGA1J21AW5</b>
	Offset	21 (533)	240	750	12 (1.8)	1.9 (0.86)	<b>SGA1J21AW6</b>
	Offset	23 <sup>3</sup> / <sub>4</sub> (603)	240	500	7 (1.0)	2.1 (0.95)	<b>SGA1J23NW3</b>
	Offset	23 <sup>3</sup> / <sub>4</sub> (603)	240	750	10 (1.5)	2.1 (0.95)	<b>SGA1J23NW5</b>
	Offset	23 <sup>3</sup> / <sub>4</sub> (603)	120	1000	14 (2.1)	2.1 (0.95)	<b>SGA1J23NW6</b>
	Offset	23 <sup>3</sup> / <sub>4</sub> (603)	240	1000	14 (2.1)	2.1 (0.95)	<b>SGA1J23NW7</b>
	Offset	23 <sup>3</sup> / <sub>4</sub> (603)	240	1500	20 (3.1)	2.1 (0.95)	<b>SGA1J23NW8</b>
	Offset	25 <sup>1</sup> / <sub>2</sub> (648)	120	500	6 (0.9)	2.3 (1.00)	<b>SGA1J25JW2</b>
	Offset	25 <sup>1</sup> / <sub>2</sub> (648)	240	500	6 (0.9)	2.3 (1.00)	<b>SGA1J25JW3</b>
	Offset	25 <sup>1</sup> / <sub>2</sub> (648)	120	750	9 (1.4)	2.3 (1.00)	<b>SGA1J25JW4</b>
	Offset	25 <sup>1</sup> / <sub>2</sub> (648)	240	750	9 (1.4)	2.3 (1.00)	<b>SGA1J25JW5</b>
	Offset	25 <sup>1</sup> / <sub>2</sub> (648)	240	1000	12 (1.8)	2.3 (1.00)	<b>SGA1J25JW6</b>
	Offset	26 <sup>3</sup> / <sub>4</sub> (680)	240	700	8 (1.2)	2.4 (1.10)	<b>SGA1J26NW2</b>
	Offset	26 <sup>3</sup> / <sub>4</sub> (680)	240	1000	12 (1.8)	2.4 (1.10)	<b>SGA1J26NW3</b>
	Offset	30 <sup>1</sup> / <sub>2</sub> (775)	120	750	8 (1.2)	2.7 (1.20)	<b>SGA1J30JW1</b>
	Offset	30 <sup>1</sup> / <sub>2</sub> (775)	240	750	8 (1.2)	2.7 (1.20)	<b>SGA1J30JW2</b>
	Offset	33 <sup>1</sup> / <sub>2</sub> (851)	240	750	7 (1.0)	3.0 (1.40)	<b>SGA1J33JW1</b>
	Offset	35 <sup>7</sup> / <sub>8</sub> (911)	120	1000	8 (1.2)	3.2 (1.50)	<b>SGA1J35RW1</b>
	Offset	35 <sup>7</sup> / <sub>8</sub> (911)	240	1000	8 (1.2)	3.2 (1.50)	<b>SGA1J35RW2</b>
	Offset	35 <sup>7</sup> / <sub>8</sub> (911)	240	1500	13 (2.0)	3.2 (1.50)	<b>SGA1J35RW3</b>
	Offset	38 <sup>1</sup> / <sub>2</sub> (978)	120	1000	8 (1.2)	3.4 (1.50)	<b>SGA1J38JW2</b>
	Offset	38 <sup>1</sup> / <sub>2</sub> (978)	240	1500	11 (1.7)	3.4 (1.50)	<b>SGA1J38JW3</b>
	Offset	42 <sup>1</sup> / <sub>2</sub> (1080)	240	1500	10 (1.5)	3.8 (1.70)	<b>SGA1J42JW1</b>
Offset	47 <sup>7</sup> / <sub>8</sub> (1216)	240	2250	16 (2.4)	4.3 (2.00)	<b>SGA1J47RW2</b>	

**Note:** 375 finned strip heaters with one-on-one terminations are available as a manufactured item only. Please contact your Watlow representative for additional information.

**Note:** Above heaters are modified stock and may not be returned for a restocking charge.

**Note:** <sup>5</sup>/<sub>16</sub> x 1/2 in. (7.9 x 13 mm) mounting holes are supplied on all 375 finned strip heaters as standard, larger mounting holes may be provided <sup>17</sup>/<sub>32</sub> in. x <sup>11</sup>/<sub>16</sub> in. (13.5 mm x 17.5 mm).



# Air Heaters



## Finned Heaters

### FINBAR™ Single-Ended Heaters

Composed of aluminized steel fins press fitted to a one-inch single-ended FIREBAR element. The FINBAR™ is designed to improve heat transfer to the air and permits putting more power in tighter spaces—like forced air ducts, dryers, ovens and load bank resistors.

Heat transfer, lower sheath temperature and element life are all maximized by its finned construction. Installation is simplified by terminations exiting at one end and mounting accommodations on both ends.

### Performance Capabilities

- Watt densities up to 50 W/in<sup>2</sup> (7.7 W/cm<sup>2</sup>)
- 304 stainless steel sheath temperatures up to 1200°F (650°C)
- Voltages up to 480VAC
- Amperages up to 48 amperes per heater or 16 amperes per coil

### Features and Benefits

#### Rugged aluminized steel fins

- Provides an increase in surface area to approximately 16 square inches for every linear inch of element length. Fins press fitted to the heating element improve heat transfer to the air

#### Single-ended termination

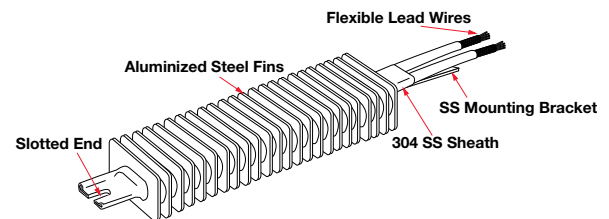
- Simplifies wiring and installation

#### Stainless steel mounting bracket, welded to the terminal end, supplied with a slotted end

- Allows ease of installation

#### Lavacone seals

- Provides protection against humid storage conditions, moisture retardant to 221°F (105°C)



### Typical Applications

- Forced air heating for dryers, ovens, ducts
- Still air heating for ovens, comfort heating
- Incubators
- Ink drying
- Load bank resistors

For detailed product and technical data,  
see the full FINBAR product  
section located on pages 103 through 105.

# Air Heaters



## FIREROD® CARTRIDGE Heaters

The Watlow® FIREROD® cartridge heater incorporates engineering excellence and is supported by over 60 years of solid industry performance across a broad range of simple and complex applications. As the premier choice in swaged cartridge heating, thousands of industrial manufacturers continue to choose Watlow as their trusted thermal partner and certified cartridge heater supplier.

Built using 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. Every system component that leaves our manufacturing facilities meets our strict quality assurance specifications, in addition to those set forth by leading standards and regulating industries.

To meet our customer's individual needs, there are many delivery options available for FIREROD heaters.

### Performance Capabilities

- Part temperatures up to 1400°F (760°C) on alloy 800 sheath
- Watt densities up to 400 W/in<sup>2</sup> (62 W/cm<sup>2</sup>)
- Maximum voltage up to 480V

### Features and Benefits

#### Nickel-chromium resistance wire

- Ensures even and efficient distribution of heat to the sheath

#### Metalurgically-bonded conductor pins

- Ensures a trouble-free electrical connection

#### Magnesium oxide insulation of specific grain and purity

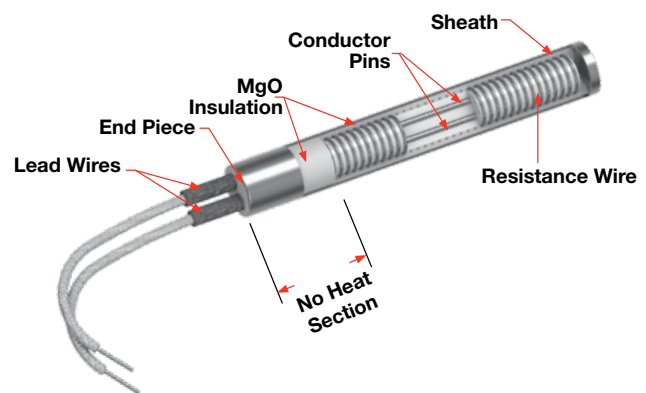
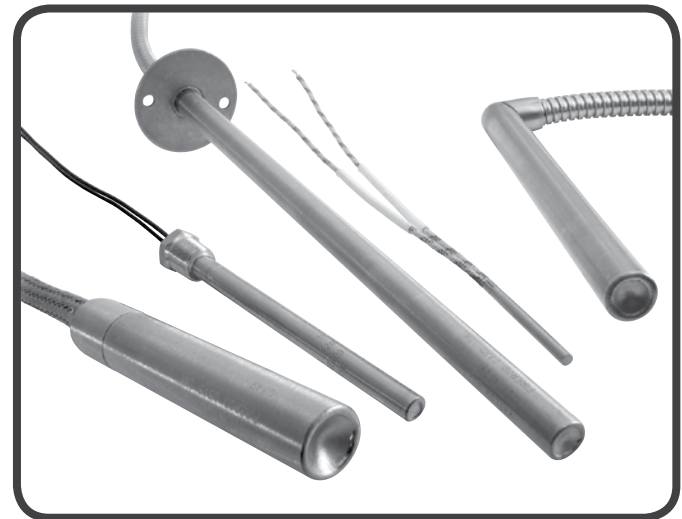
- Results in high dielectric strength and contributes to faster heat-up

#### Alloy 800 sheath

- Resists oxidation and corrosion from heat, many chemicals 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



#### International Organization for Standardization (ISO) 9001 certified

- Provides confidence that quality and reliability expectations are met

#### UL® and CSA approved flexible stranded wires

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

#### Patented lead adapter (LA) method

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

**For detailed product and technical data,  
see the full FIREROD product  
section located on pages 9 through 44.**

# Air Heaters



## Enclosure Heaters

### WATROD™ Heaters

Designed to prevent freezing and condensation in electrical and mechanical enclosures, the WATROD™ element is enclosed in a perforated, aluminized-steel bracket.

#### Performance Capabilities

- Watt densities up to 15 W/in<sup>2</sup> (2.3 W/cm<sup>2</sup>)
- Wattages up to 1000 watts
- UL® and CSA component recognition up to 250VAC

#### Features and Benefits

##### Stainless steel sheath wall

- Resists corrosion and protects the heating coil from exposure

##### Silicone resin seal

- Provides protection against humid storage conditions and is effective to 390°F (200°C)

##### Perforated aluminized-steel mounting bracket

- Eases installation and helps prevent direct contact with the heating element

##### Stock straight projection Type B #10-32 screw lug terminals

- Provides easy electrical connection

##### Made-to-order threaded stud

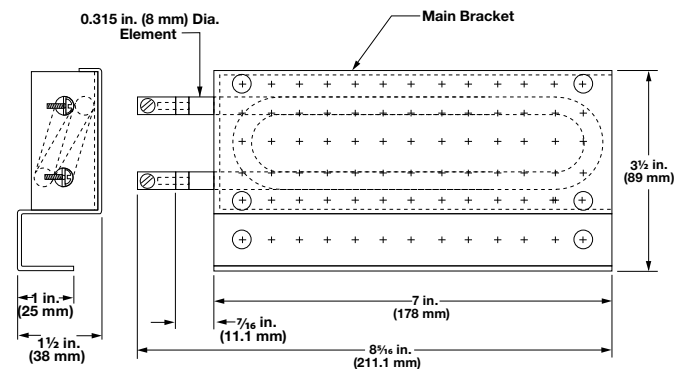
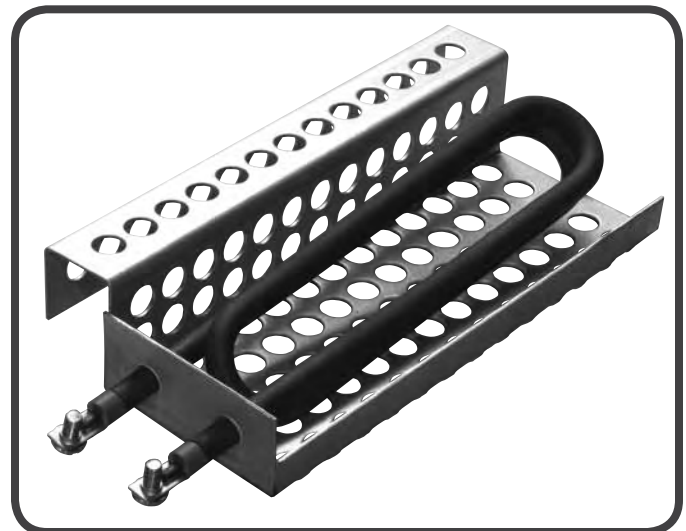
- Provides quick connect and flexible lead wire termination options

#### Typical Applications

- Control panels
- Traffic signal boxes
- Automated teller machines
- Switch gear
- Electronic equipment

#### Application Hints

- Locate heater(s) in the lowest portion of the enclosure to maximize convection heating
- Place thermostat(s) in the upper half of the enclosure, away from the heater(s)



# Air Heaters



## Enclosure Heaters

### WATROD Heaters

### Technical Heaters

Watts	Watt Density		Part Number		Est. Net Wt.	
	W/in <sup>2</sup>	(W/cm <sup>2</sup> )	125VAC	250VAC	lbs	(kg)
95	4	(0.6)	<b>EN951</b>		1.5	(0.7)
100	4	(0.6)		<b>EN10010</b>	1.5	(0.7)
250	10	(1.6)	<b>EN2501</b>	<b>EN25010</b>	1.5	(0.7)
375	15	(2.3)	<b>EN3751</b>	<b>EN37510</b>	1.5	(0.7)

# Air Heaters



## Enclosure Heaters

### Silicone Rubber Heaters

Designed for freeze and condensation protection, Watlow's enclosure heaters are rugged, reliable and safe to operate. These rectangular-shaped, wire-wound silicone rubber heaters can be ordered individually with adhesive or vulcanized to an aluminum mounting plate. A thermostat can be attached to the heater or mounted separately as shown.

### Performance Capabilities

- Watt density rating of 5 W/in<sup>2</sup> (0.8 W/cm<sup>2</sup>)
- Temperature up to 150°F (66°C)

### Features and Benefits

#### Pressure-sensitive adhesive mounting to an aluminum plate or customer cementing

- Reduces installation time
- Creates easy installation

#### Several standard thermostat set points

- Ensures protection against freezing with minimal energy consumption

#### Variety of installation options

- Provide the option to utilize cement installation to ensure permanent heater attachment
- The pressure sensitive adhesive installation option saves assembly time
- Facilitate assembly and disassembly with factory installed aluminum plate mount

#### Remote thermostat option

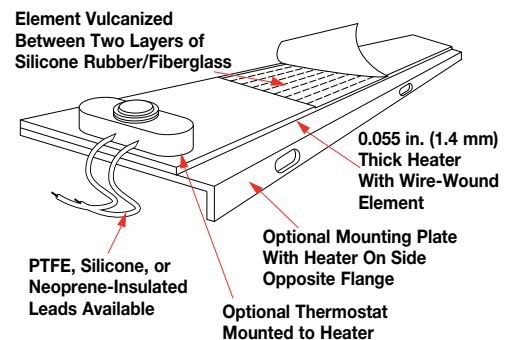
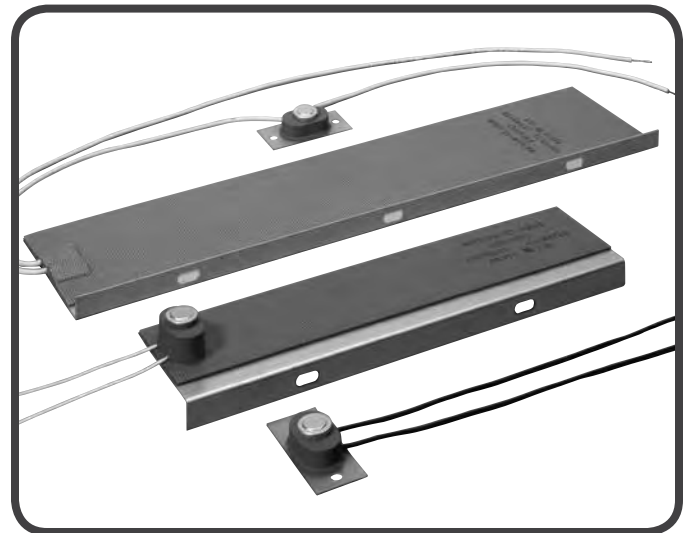
- Provides optimal choice of heater location versus temperature control location

#### Lead options

- Allows for a variety of applications
- Allows different lead lengths for a variety of wiring requirements

#### Factory pre-wired heater and thermostat

- Ensures safety and reliability as there are no exposed electrical connections



### Typical Applications

Freeze or condensation prevention in housings containing electronic equipment including:

- Traffic signal boxes
- Automated teller machines
- Temperature control panels
- Gas or liquid control valve housings



## Enclosure Heaters

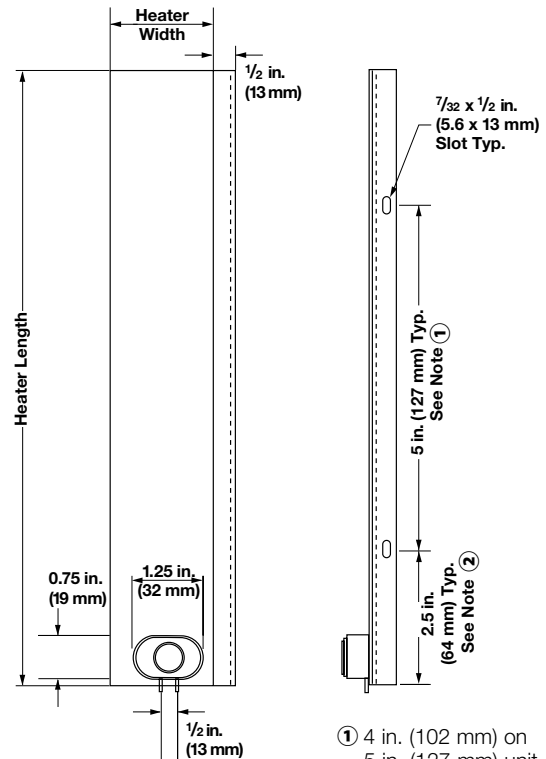
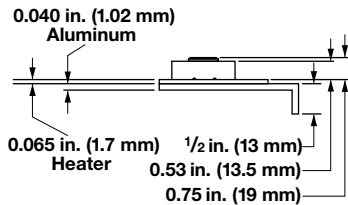
### Silicone Rubber Heaters

#### Options

#### Aluminum Mounting Plate

Both vertical and horizontal mounting can be accomplished with enclosure heaters. Mounting plates are 0.040 in. (1.02 mm) thick, specified as #3003 H14 aluminum. The preferred orientation is vertical with a thermostat attached at the lower end (as shown in the drawing).

For horizontal mounting, a remote thermostat is recommended. An enclosure heater can be ordered by itself, with PSAS or vulcanized to an aluminum mounting plate. See the *Thermostat* section below for more information.



- ① 4 in. (102 mm) on 5 in. (127 mm) unit.
- ② 0.5 in. (13 mm) on 5 in. (127 mm) unit.

## Thermostats

### Mounted on Heater

Built-in snap action thermostats from Watlow sense air temperature. See the ordering chart on the following page for available settings.

### Remote From Heater

For an air sensing thermostat that is separate from the heater, the ST-207E is ideal. It is a modified ST-207 mounted on a 1/32 in. (0.8 mm) thick G-10 circuit board with the thermostat's metal cap exposed to sense air temperature. The thermostat is placed at the midpoint of the lead length. The sensor can be preset at the temperatures listed for integral sensors.

#### Notes:

- On both integral and remote sensors, the thermostat's exposed metal cap is vulnerable to impact. This could defeat the thermostat's switching action and cause heater malfunction.
- T-10 thermostats are not recommended for enclosure heating applications.



## Enclosure Heaters

### Silicone Rubber Heaters

#### Technical Data

##### Determining Minimum Wattage Requirements For Enclosures

This chart is an excellent guide for determining total wattage requirements for both insulated and uninsulated enclosures, assuming the box is relatively airtight.

For windy conditions, add an additional 50 percent to the wattage requirement listed.

		Total Enclosure Surface Area — Square Feet (Square Meters)													
		2 (0.2)	3 (0.3)	4 (0.4)	5 (0.5)	6 (0.6)	7.5 (0.7)	9 (0.8)	10 (0.9)	15 (1.4)	20 (1.9)	25 (2.3)	30 (2.8)	40 (3.7)	50 (4.7)
Temperature Rise from Ambient °F (°C)	20 (11)	30	40	55	70	80	100	120	135	205	270	335	405	540	670
		10	10	15	20	20	25	30	35	50	65	80	100	130	160
	40 (22)	55	80	110	135	160	200	245	270	405	540	670	805	1075	1340
		15	20	30	35	40	50	60	65	100	130	160	195	260	320
	60 (33)	90	120	160	205	245	300	365	405	605	805	1005	1210	1610	2010
		20	30	55	50	60	75	90	100	145	195	240	290	385	480
	80 (44)	110	160	215	270	325	400	485	540	805	1075	1340	1610	2145	2680
		30	40	55	65	80	100	115	130	195	260	320	385	515	640
	100 (56)	135	200	270	335	405	500	605	670	1005	1340	1675	2010	2680	3350
		35	50	65	80	100	125	145	160	240	320	400	480	640	800
	120 (67)	165	240	320	405	485	600	725	805	1210	1610	2010	2415	3220	4020
		40	60	80	100	115	150	175	195	290	385	480	580	770	960
	140 (78)	190	280	375	470	565	700	845	940	1410	1880	2345	2815	3755	4690
		45	70	90	115	135	175	205	225	340	450	560	675	900	1120

□ Uninsulated boxes    □ Insulated boxes

### Silicone Rubber Enclosure Heaters Offering

For a complete list of silicone rubber product offerings available for use as an enclosure heater with a thermostat, please refer to the offerings on page 119.

# Air Heaters



## FLUENT® In-line Heaters

Watlow's FLUENT® in-line fluid heater is a small, lightweight, high-performance heater that can replace both a traditional immersion type heater or a heater wrapped around a tube as part of a thermal system. Watlow's FLUENT heater is designed as an integrated solution that replaces multiple components in a system. This heater design reduces overall system cost and complexity. Because of its high watt density, it offers ultra-fast response leading to higher system performance. Featuring Watlow's patented layered heater technology, the heater makes use of its entire surface to produce heat, which optimizes heat transfer and temperature uniformity.

### Features and Benefits

#### Small, lightweight, robust heater construction

- Replaces multiple components in a system
- Reduces overall system size
- Lowers total cost of ownership

#### Patented circuit patterning process

- Facilitates customizable heating profiles
- Enables distributed wattage and/or multiple zones
- Assures precise and repeatable power distribution

#### High watt density, low mass heater

- Contributes to fast response time
- Allows for efficient heat transfer
- Enables on-demand process start-up



### Typical Applications

- Hemodialysis fluid heating
- Food cooking equipment
- Semiconductor purge and carrier gas heating
- Ink preheating systems
- On-demand fluid heating

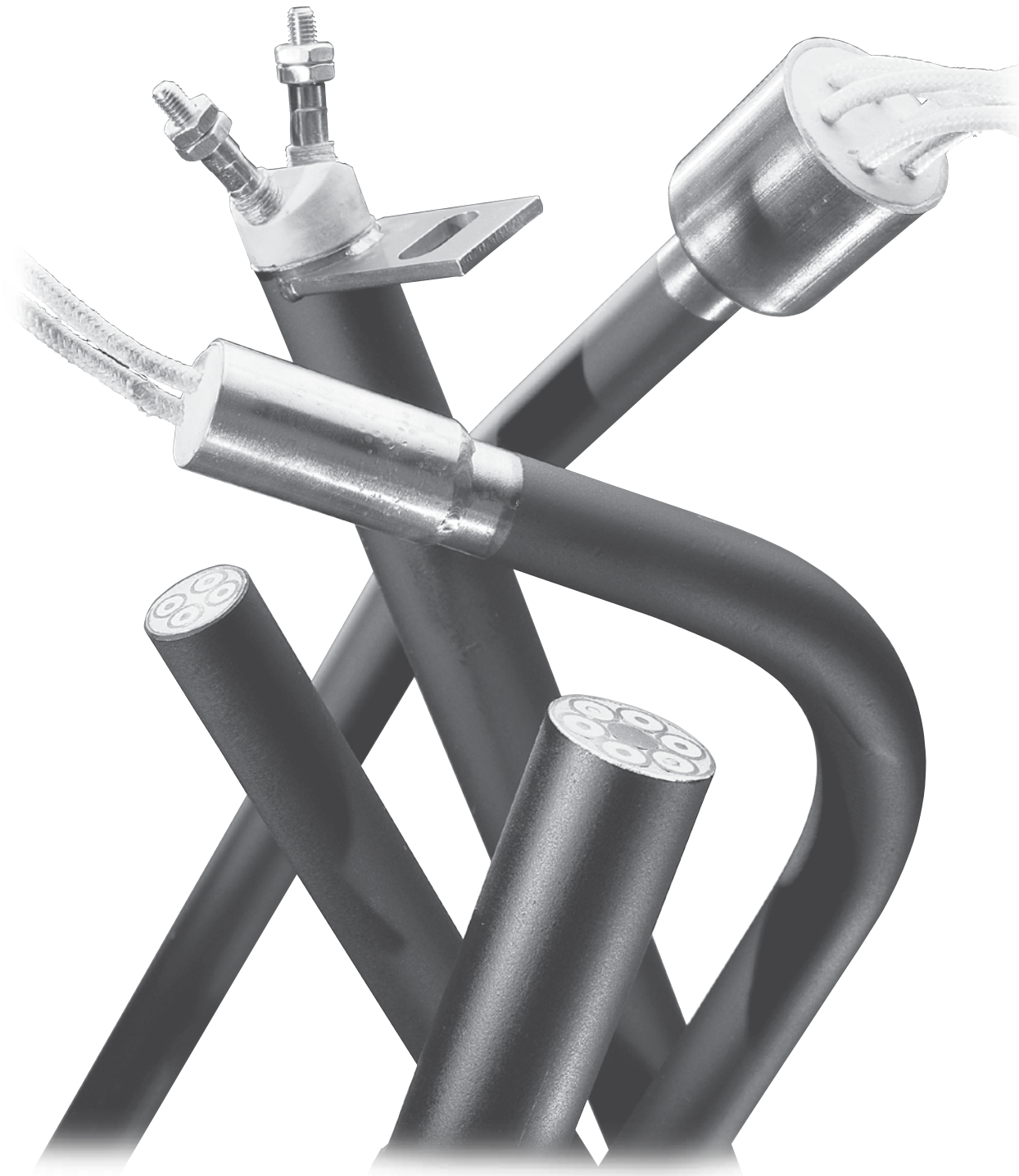
**For detailed product and technical data,  
see the full FLUENT in-line product  
section located on pages 445 through 448.**



# High-Temperature Heaters



High-Temperature Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
MULTICELL™	Alloy 800	2050	1120	30	4.6	411
High-Temperature FIREROD®	Platen	1800	982	100	15.5	417
High-Temperature Tubular	Alloy 800	1800	983	30	4.6	418
Ceramic Fiber	Ceramic fiber	2200	1204	30	4.6	419



High-Temperature Heaters



# High-Temperature Heaters

**EXTENDED  
CAPABILITY**

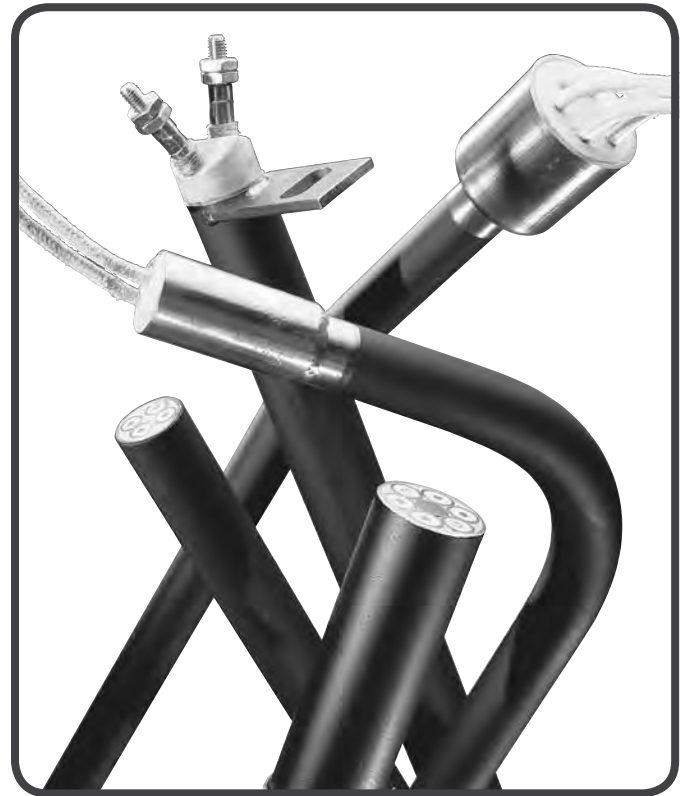
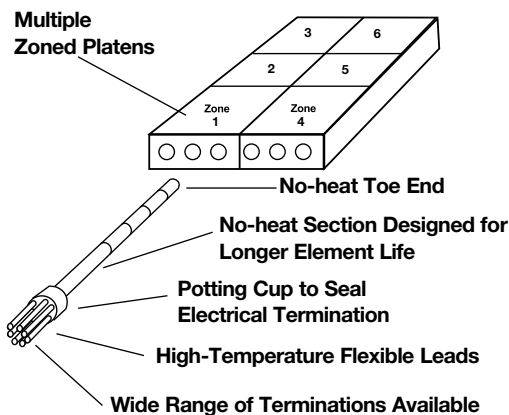


## Extended Capabilities for MULTICELL™ Heaters

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.

### Performance Capabilities

- Engineered to achieve sheath temperatures up to 2050°F (1120°C)
- Up to six independently controllable zones



### 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

#### Individual 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

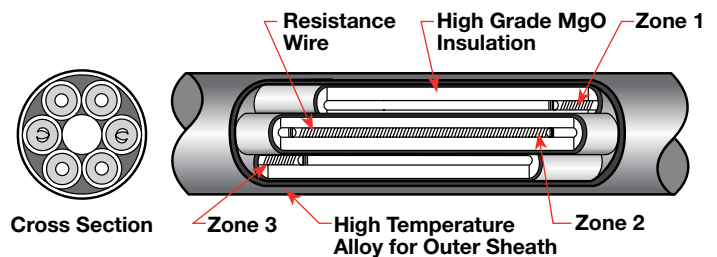
#### Special bending capabilities

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

#### Flexible leads up to 842°F (450°C)

- Protects termination from high temperature environments

#### Independently Controllable Heated Zones



### Typical Applications

- Hot isothermal forming
- Soil remediation
- Hot forging dies
- Heated platens
- Super plastic forming
- Heated platens (single and multiple zones)
- Heat treating processes
- Super plastic forming with diffusion bonding
- Polysilicon ingots
- Hot gas generation
- Hazardous waste treatment systems

# High-Temperature Heaters

**EXTENDED  
CAPABILITY**



## Extended Capabilities for MULTICELL™ Heaters

### Applications and Technical Data

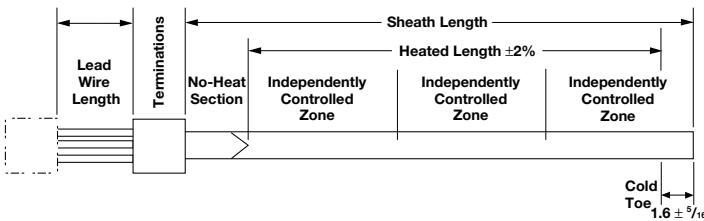
#### Definition of Terms

**Cold Toe:** A physical minimum requirement of  $1\frac{5}{8} \pm \frac{5}{16}$  inch

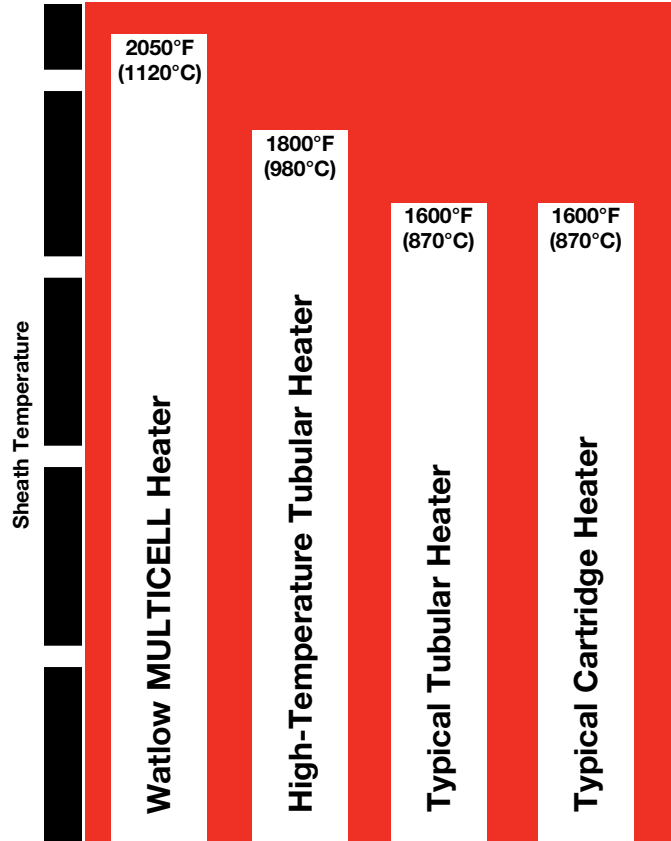
**Independent Zone:** Up to three, separately controlled zones, which can be of varying lengths and wattages

**Heated Length:** The combined sum of all independent zones

**Wattage:** Ratings are the combined sum of all independent zones



### MULTICELL Heaters: The High Temperature Choice



# High-Temperature Heaters

**EXTENDED  
CAPABILITY**



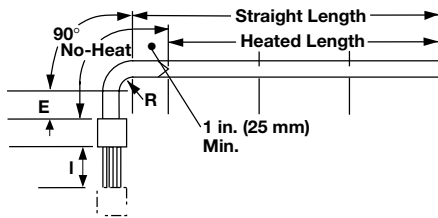
## Extended Capabilities for MULTICELL™ Heaters

### Applications and Technical Data (Continued)

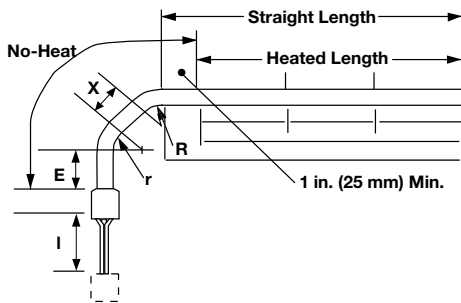
#### Physical Design Parameters

All bending of a MULTICELL heater is restricted to the cold area of the heater. All bend radii points must be 1 in. (25 mm) from the hot/cold junction.

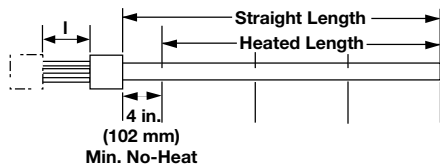
#### “L”



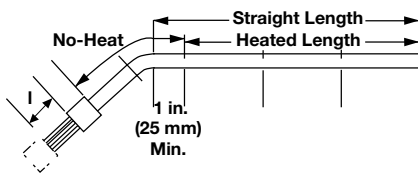
#### Droop



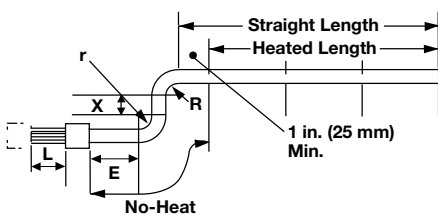
#### Straight



#### Angle



#### Crank



#### 0.935 Inch Diameter MULTICELL Heater

Diameter in.	Bending Style	Sheath Length Min./Max. in. (mm)	Min. No-Heat Length in. (mm)	Total Heated Length Min./Max. in. (mm)
0.935	Straight	14 (356)	Contact Watlow	6 (152)
		225 (5715)	Contact Watlow	160 (4064)
0.935	Angle	17 (432)	Contact Watlow	6 (152)
		225 (5715)	Contact Watlow	172 1/2 (4382)
0.935	L	18 (457)	Contact Watlow	6 (152)
		225 (5715)	Contact Watlow	170 1/4 (4324)
0.935	Crank	23 (584)	Contact Watlow	6 (152)
		225 (5715)	Contact Watlow	163 (4140)
0.935	Droop	18 (457)	Contact Watlow	6 (152)
		225 (5715)	Contact Watlow	168 (4267)

Symbol	E	r	X	R	I
Min. Length in. (mm)	4 (102)	2 1/2 (38)	1 1/2 (38)	2 1/2 (38)	12 (305)

Zones	1	2	3
Min. Heated in. (mm)	6 (152)	6 (152)	6 (152)

#### 0.685 Inch Diameter MULTICELL Heater

Diameter in.	Bending Style	Sheath Length Min./Max. in. (mm)	Min. No-Heat Length in. (mm)	Total Heated Length Min./Max. in. (mm)
0.685	Straight	14 (356)	Contact Watlow	6 (152)
		225 (5715)	Contact Watlow	178 (4521)
0.685	Angle	17 (432)	Contact Watlow	6 (152)
		225 (5715)	Contact Watlow	173 1/2 (4407)
0.685	L	18 (457)	Contact Watlow	6 (152)
		225 (5715)	Contact Watlow	172 (4369)
0.685	Crank	18 (457)	Contact Watlow	6 (152)
		225 (5715)	Contact Watlow	163 (4267)
0.685	Droop	15 1/2 (394)	Contact Watlow	6 (152)
		225 (5715)	Contact Watlow	170 (4331)

Symbol	E	r	X	R	I
Min. Length in. (mm)	4 (102)	1 1/2 (38)	1 1/2 (38)	1 1/2 (38)	12 (305)

Zones	1	2	3
Min. Heated in. (mm)	6 (152)	6 (152)	6 (152)

# High-Temperature Heaters

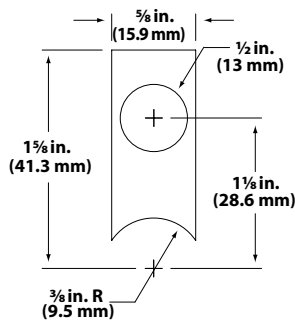
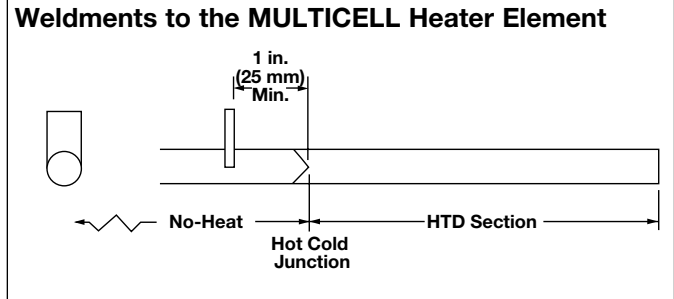
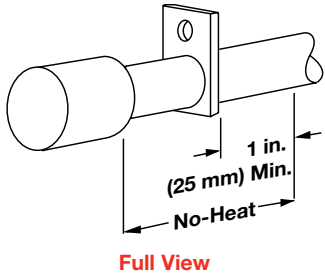
**EXTENDED  
CAPABILITY**



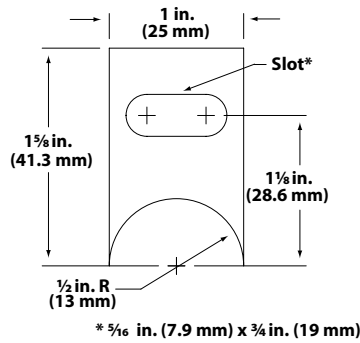
## Extended Capabilities for MULTICELL™ Heaters

*Applications and Technical Data (Continued)*

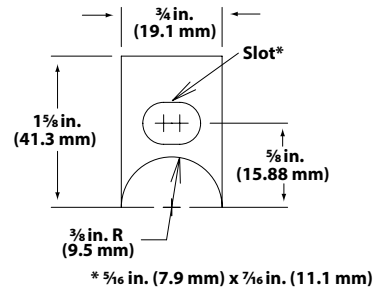
### Tab Styles



**Style S1**



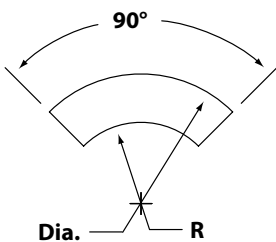
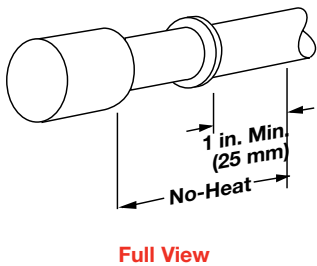
**Style S2**



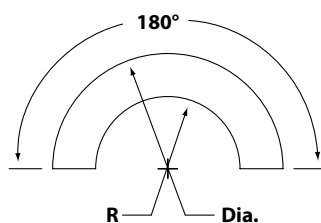
**Style S3**

Tabs and rings are used to hold the heater in place and keep it from creeping. Available in carbon steel, 304 and 316 SS.

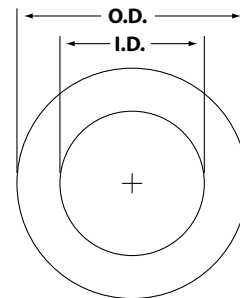
### Ring Styles



**Style S4**



**Style S5**



**Style H1**

# High-Temperature Heaters

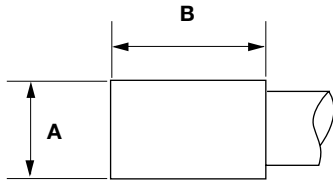
**EXTENDED  
CAPABILITY**



## Extended Capabilities for MULTICELL™ Heaters

### Termination Standards

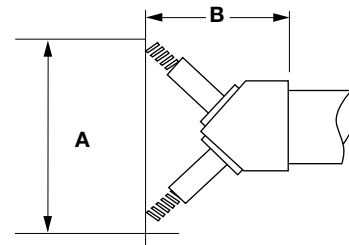
#### Potting Sleeves



Heater O.D. in.	Dimension A in. (mm)	Dimension B in. (mm)	Zone	Phase	Type No.
0.685	3/4 (19)	1 1/2 (38)	1	1	61L
0.935	1 1/16 (27)	1 1/2 (38)	1	1	91L
0.935	1 1/16 (27)	1 1/2 (38)	1	3 <sup>①</sup>	91L

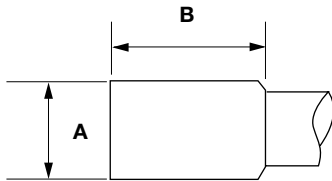
① 3 wire only

#### Ceramic Wedge with 10-32 Threaded Terminals



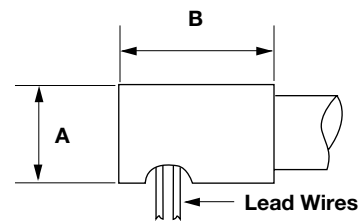
Heater O.D. in.	Dimension A in. (mm)	Dimension B in. (mm)	Zone	Phase	Type No.
0.685	1 1/4 (32)	1 1/4 (32)	1	1	61T
0.935	1 5/8 (41)	1 5/8 (41)	1	1	91T

#### Potting Cups



Heater O.D. in.	Dimension A in. (mm)	Dimension B in. (mm)	Zone	Phase	Type No.
0.685	1 3/8 (35)	1 3/8 (35)	2	1	62L
0.685	1 3/8 (35)	1 3/8 (35)	3	1	62L
0.685	1 3/8 (35)	1 3/8 (35)	1	3	62L
0.685	1 3/8 (35)	1 3/8 (35)	2	3	62L
0.935	1 3/8 (35)	1 3/8 (35)	2	1	92L
0.935	1 3/8 (35)	1 3/8 (35)	3	1	92L
0.935	1 3/8 (35)	1 3/8 (35)	1	3	92L
0.935	1 3/8 (35)	1 3/8 (35)	2	3	92L

#### Potting Cup for Right Angle Exit



Heater O.D. in.	Dimension A in. (mm)	Dimension B in. (mm)	Zone	Phase	Type No.
0.685	3/4 (19)	1 1/2 (38)	1	1 or 3	RAE1
0.935	1 1/16 (27)	1 1/2 (38)	1	1 or 3	RAE2

# High-Temperature Heaters

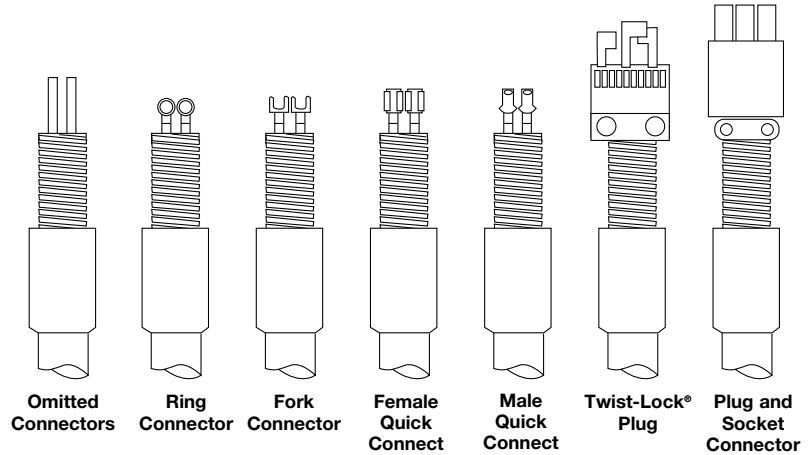
**EXTENDED  
CAPABILITY**



## Extended Capabilities for MULTICELL™ Heaters

### Termination Assemblies

All termination assemblies are available with potting sleeves or cups, with or without armor flex lead wire protection. Please specify **potting vessel** and **lead cover option** when ordering.



Termination illustrations shown with armor flex covering.

### Options

#### Plug and Socket and Twist-Lock® Plug Variations

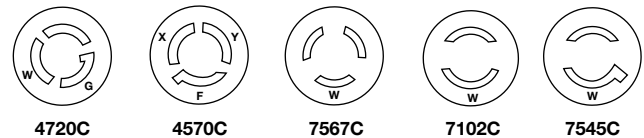
Three zone heaters requiring a quick disconnect plug will typically be supplied with a six contact Plug and Socket. Twist-Lock® plug variations are typically supplied with single zone MULTICELL heaters. When ordering a Twist-Lock® plug, please specify the type as shown in table and views.

For any other plug variations, please contact your Watlow representative.

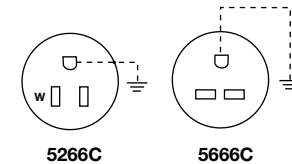
**Note:** Mating connectors are also available for plug terminations listed. Contact your Watlow representative.

Male Plug	Zones	Type	Voltage	Amperage	Blade Type
P406-CCT	3	6 wire	600	15	Straight
4570C	1	3 wire	250	15	Twist-Lock®
4720C	1	3 wire	125	15	Twist-Lock®
5266C	1	3 wire	125	15	Straight
5666C	1	3 wire	250	15	Straight
7102C	1	2 wire	250	20	Twist-Lock®
7545C	1	2 wire	250	15	Twist-Lock®
7567C	1	3 wire	125	10	Twist-Lock®

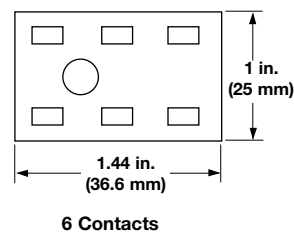
#### Twist-Lock®



#### Straight



#### Plug and Socket





# High-Temperature 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 1600°F (871°C). The HT FIREROD heater utilizes the same industry leading design principles used on all Watlow FIREROD products. Advancing the FIREROD heater enables it to withstand application temperatures up to 400°F (204°C) higher than standard cartridge heaters. HT FIREROD design features, which are important in high temperature applications, include:

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

### Performance Capabilities

- Platen temperatures up to 1600°F (871°C)
- Maximum watt density up to 100 W/in<sup>2</sup> (15.5 W/cm<sup>2</sup>)
- Maximum voltage up to 277VAC ground
- Length tolerance of +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

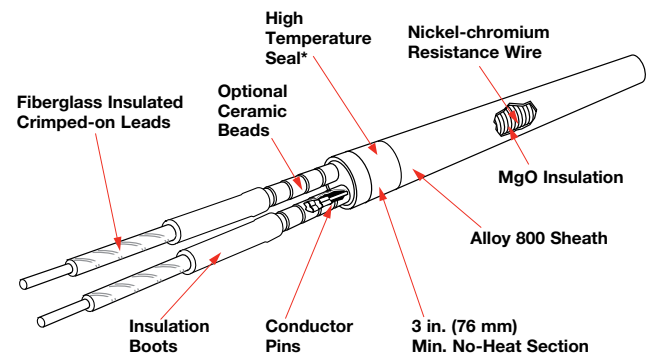
Contact your Watlow representative for special diameter requests.

### Features and Benefits

#### High-temperature seal

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

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



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

#### Alloy 800 sheath

- Transfers heat more efficiently

#### High emissivity sheath

- Provides better heat transfer and longer life

**For detailed product and technical data, see the full High-Temperature FIREROD product section located on pages 33 through 34.**

# High-Temperature Heaters



## High-Temperature Tubular Heaters

Watlow manufactures high-temperature tubular heaters to bridge the gap between standard tubular heaters and Watlow MULTICELL™ heaters. This tubular is well suited for process air heating applications in excess of 1300°F (704°C), resulting in a maximum sheath temperature of 1800°F (983°C). Controlled lab testing between the new design and current tubular designs show an increase in life of approximately 50 percent.

The high-temperature tubular consists of an engineered tubing with an outer sheath of alloy 600 and a special internal construction. The outer sheath offers high temperature capabilities, reduced oxidation as well as corrosion resistance.

The tubular offering is available in 0.430 and 0.375 inch diameters that are configurable either as formed tubulars or process heaters. The heaters can also be welded to flanges and plates for mounting purposes. Maximum sheath length available is 275 inches for the 0.430 inch and 0.375 inch diameters. The factory should be contacted for longer sheath lengths.

### Features and Benefits

#### Alloy 600 sheath material and a special internal construction

- Assures high temperature performance and corrosion protection in tough applications

#### 0.430 inch diameters\*

- Allows heater to be configured to existing tubular designs that may be experiencing short life

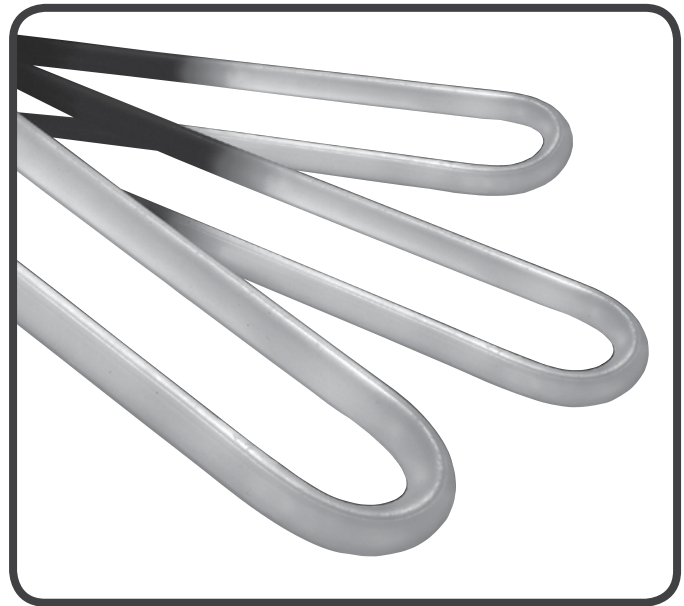
**\*Note: 0.375 diameters are available in Watlow's extended capabilities, contact your Watlow representative for details.**

#### Dual-ended termination

- Installs into flanges and screw plugs similarly to standard product configurations

#### Bendable in standard formations

- Makes the heater easy to apply in a wide variety of applications



### Typical Applications

- High temperature ovens and furnaces
- Radiant heating
- Drying
- Environmental—VOC abatement
- Process air heating: duct heaters, circulation heaters
- Vacuum applications
- Flue gas cleaning (desulphurization)
- Fluidized beds

**For detailed product and technical data, see the full High-Temperature Tubular product section located on pages 80 through 81.**

# High-Temperature Heaters



## Ceramic Fiber Heaters

Ceramic fiber heaters offer some of the highest temperature heating element capabilities available in the Watlow family of heaters. Heating units constructed of ceramic fiber insulation isolate the heating chamber from the outside. Ceramic fiber heaters are extremely low mass, high insulation value units with self-supported heating elements. Many applications can benefit from the convenience of the heating element and insulation combined into one package. Its lightweight, low-density properties are ideally suited for high temperature applications requiring low thermal mass.

### Performance Capabilities

- Operating temperatures up to 2200°F (1204°C)
- Watt densities from 5 up to 30 W/in<sup>2</sup> (0.8 to 4.6 W/cm<sup>2</sup>)
- Uses “radiant” heat transfer exclusively

### Features and Benefits

#### High temperature ICA resistance elements

- Bounds integrally into required position
- Allows five element configurations

#### Lightweight, low-density alumina-silica composition molded into shape

- Acts as insulation to isolate the heating chamber from the outside
- Provides low shrinkage fiber and inorganic binder
- Ensures a firm, thermal shock resistant, self-supporting unit at all operating temperatures

#### Operating temperatures up to 2200°F (1204°C)

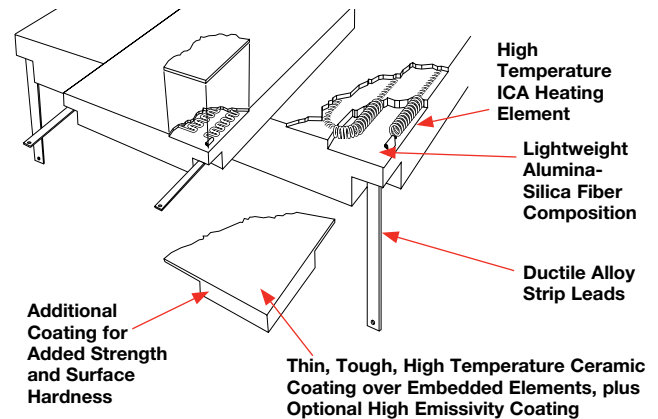
- Provides high temperature performance that is not possible with many other heater types (See page 423 for detailed limits)

#### Low mass ceramic fiber insulation of 10 to 15 lb/ft<sup>3</sup> (160 to 240 kg/m<sup>3</sup>)

- Allows the heater to reach process temperature quickly
- Allows the energy to heat the load instead of wasting energy on itself

#### Works directly off of common power line voltages

- Eliminates the need for expensive transformers or complex power control systems
- Enables compatibility with the full range of Watlow temperature controllers and power switching devices



### Typical Applications

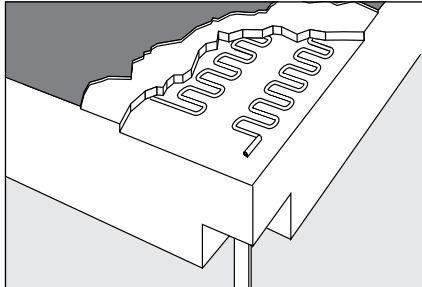
- High temperature furnaces
- Metal melting, holding and transfer
- Semiconductor processing
- Glass, ceramic and wire processing
- Analytical instrumentation



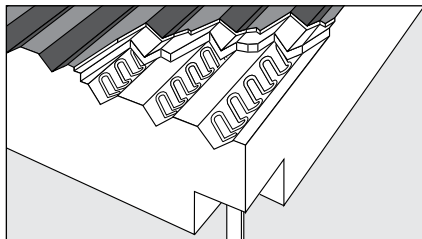
## Ceramic Fiber Heaters

### Options

#### Embedded Sinuated Elements

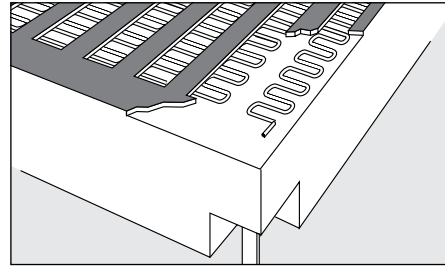


**Flat Sinuated**

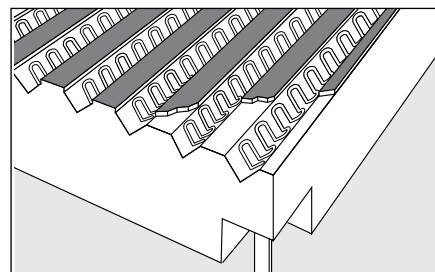


**V-Sinuated**

#### Exposed Sinuated Elements



**Flat Sinuated**



**V-Sinuated**

- Available in either flat or V-sinuated element configurations
- Advanced V-sinuated element configuration allows up to 27 percent additional watt density over embedded flat sinuated elements
- Performs best at medium to high temperatures at medium watt density power requirements
- Use in partially enclosed to fully enclosed applications
- Especially well suited for large, flat units; semi-cylindrical units above 5 in. (125 mm) I.D.; and full cylinders above 4 in. (100 mm) I.D.
- Offers greater effective insulation thickness than coiled element designs
- Enhances “heated insulation” concept of operational use
- Features high emissivity coating on new high watt density series units. When ordering, refer to charts on pages 438 to 440.

- Available in either flat or V-sinuated element configurations
- Advanced V-sinuated element configuration allows up to 20 percent additional watt density compared to exposed flat sinuated elements
- Offers the lowest possible wire-to-chamber temperature difference for maximum heater life
- Provides optimum heat-up/cool-down and recovery times as well as maximum operational efficiency
- Higher current handling capabilities are possible
- Minimizes the number of circuits and connections in large furnaces
- Especially well suited for large, flat surface area units and large I.D. curved units
- Exposed elements are available on special order as a variation of the embedded sinuated element normally provided on stock and standard units. When ordering, refer to charts on pages 438 to 440.

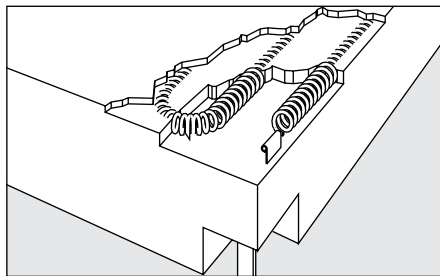


## Ceramic Fiber Heaters

### Application Hints

#### Applications

- High temperature furnaces
- Metal melting, holding and transfer
- Semiconductor processing
- Glass, ceramic and wire processing
- Analytical instrumentation
- Fluidized beds
- Laboratory and R&D
- Other high temperature process applications
- Optimum performance for high temperature, enclosed furnace chambers
- Coiled elements readily conform to complex curved surfaces, especially small custom chamber shapes
- Coiled element design works best in higher voltage, lower current situations
- Use where lower watt density requirements and low duty cycle operations are expected
- Available in stock and standard units of medium watt density, rated up to 2000°F (1093°C). When ordering, refer to charts on pages 435 to 437.



Embedded Coil Elements

- Use low mass thermocouples that are responsive to rapidly changing radiant energy transfer conditions. Without proper temperature control, ceramic fiber heaters can generate sufficient heat for self destruction.
- Mount a thermocouple junction directly above an element and within  $\frac{1}{16}$  in. (1.6 mm) of the heated surface. Embedded ceramic mounting tubes are available as an option to position 0.125 in. (3.2 mm) diameter thermocouples inside the fiber, directly behind and between the elements. Heater wire operating temperatures are critical and wires should be monitored at the hottest point within the application.
- Electrical connections made in heated portions of the application must be rated for the appropriate currents and anticipate ambient temperatures. To ensure good electrical connections, use compression-type connection devices located as far away from the hottest area of the application. This minimizes the possibility of electrical connection degradation caused by thermal expansion, contraction and high temperature oxidation.
- Ceramic fiber products shrink at high temperatures. During the first 24 hours of operation at temperatures between 1600 and 2200°F (870 to 1204°C), shrinkage of up to four percent can occur. Fill all gaps between units created by shrinkage with loose ceramic fiber insulation. Watlow offers a “pre-firing” process that pre-shrinks and dimensionally stabilizes units before shipping. Contact your Watlow representative for further details.
- Use additional back-up insulation for maximum energy efficiency and appropriate safety considerations. Use only insulation with inorganic fibers and binders to avoid corrosive fumes that could damage heater elements.
- Handle all units and leads with care. Ceramic fiber heaters are very resistant to thermal cycling and thermal shock, but are easily subject to mechanical damage from careless handling.
- Repair of minor mechanical damage, made with unapproved or unknown cements, could damage the wire elements at high temperatures. If unsure, contact your Watlow representative before making repairs. Several accessory items are available from the factory for repair purposes.



- Never use ceramic fiber heaters for conduction heating applications. These heaters are designed for **radiant heat transfer only**.

- Use appropriate mounting methods including pins, washers, clamping straps, overlapping edge clamps, interlocking edges, etc. Generally, these methods work better than cementing ceramic fiber heaters, as cementing will not accommodate the expansion and contraction caused by thermal cycling of surrounding metal structures.
- Keep furnace loads free of oils, lubricants and other contaminants that can vaporize at high temperatures. Ceramic fiber heaters have a porosity exceeding 90 percent and cannot be sealed against contamination infiltration and possible damage to the heating element wire.

# High-Temperature Heaters



## Ceramic Fiber Heaters

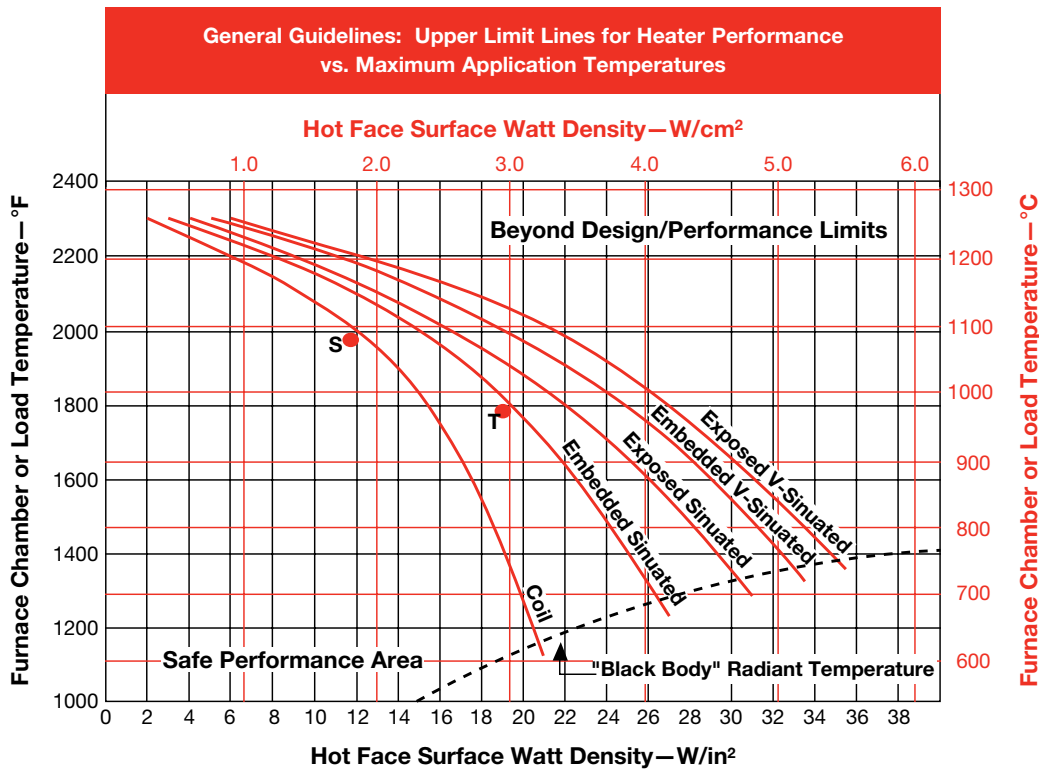
### Performance Data

#### Performance Capabilities

The *Performance* graph shown below represents capabilities of the five heater element configurations. The curves compare upper temperature limits versus permissible design watt densities to achieve a standard heater life expectation of 2,000 hours.

As with all Watlow heaters, the major application concern is the heater's surface watt density as it relates to the application temperature, such as with the furnace chamber temperature or the radiant surface temperature. When evaluating an application for temperature and watt density requirements, it should fall to the left of and below the performance limit lines. If the application falls

into this area, then it is in the safe performance area. The further into this safe performance area, the higher the life expectancy of the heater. If an application requires temperatures or watt densities that fall into the area to the right of and above the lines, then the application operates beyond the heater's typical design or performance limits. Using a heater required to perform in this area of the graph may result in a shorter life expectancy. For information specific to an application, contact your Watlow representative.



# High-Temperature Heaters



## Ceramic Fiber Heaters

### Performance Data (Continued)

The following graphs provide technical data to help evaluate performance and select the correct ceramic fiber heater for an application.

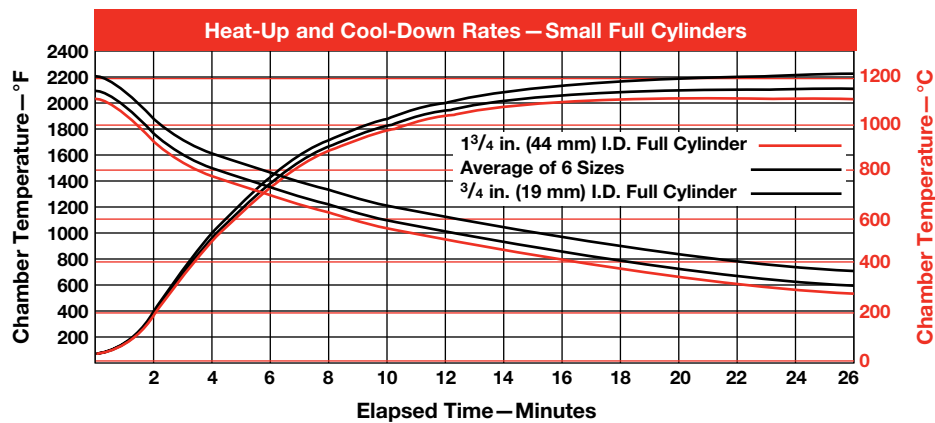
The four graphs shown represent performance data for heat-up/cool-down rates and power requirements

to maintain furnace temperature. This data averages test results performed for two typical types of furnace chambers, and should not be used for specification purposes.

### Small, Full Cylinder, Heated Chambers

Test conditions for small, full-cylinder heated chambers are typical of analytical instrumentation furnaces. Several stock sizes are represented. Units tested were 6 in. (150 mm) long, mounted in a vertical orientation. Both ends were capped with 1 in. (25 mm) of ceramic fiber

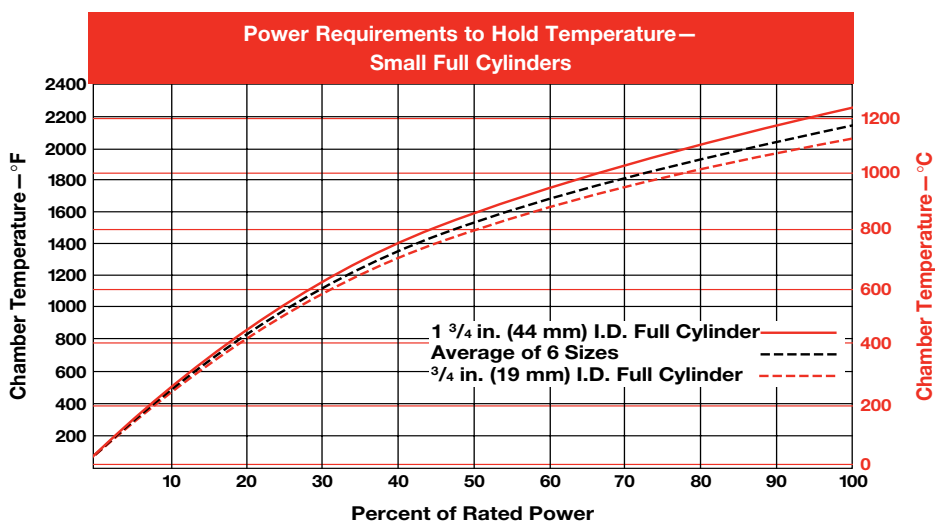
insulation. No additional insulation or metal sheath was added to the outside diameter. Temperature was measured by a thermocouple located in the geometric center of the chamber.



### Power Requirements

Shown below are percentages of rated power needed to achieve and hold specific temperatures inside the full cylinder chambers tested.

This represents the efficiency of these heaters in this mounting configuration.



# High-Temperature Heaters



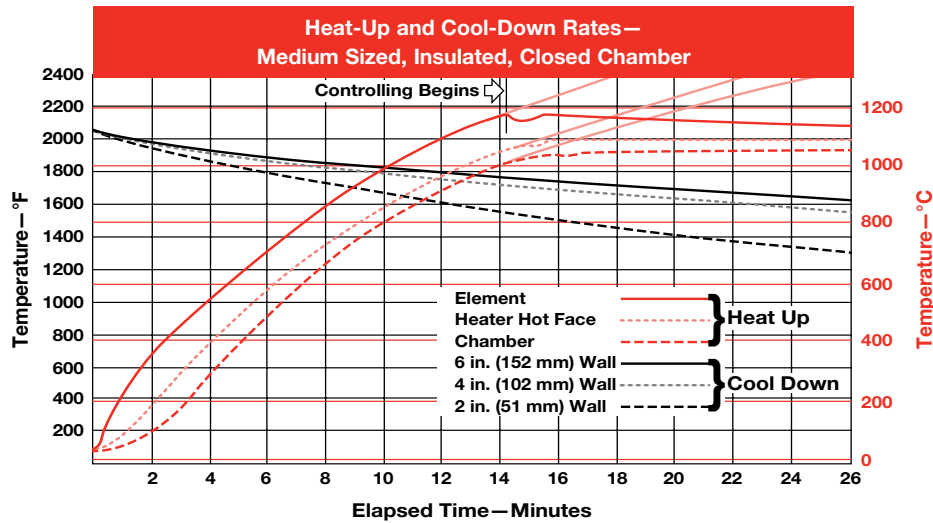
## Ceramic Fiber Heaters

### Performance Data (Continued)

#### Medium Sized, Insulated Closed Chambers

Test conditions for medium-sized, insulated chambers are typical of pit and box furnaces, large tube furnaces and pipe and reactor heating. Standard embedded coil units (Watlow part number **VS412A12S**) were used and rated for 2000°F (1093°C). The test chamber size was 12 in. long and 12 in. I.D. (305 X 305 mm). The volume was approximately 0.75 ft<sup>3</sup> (0.02 m<sup>3</sup>).

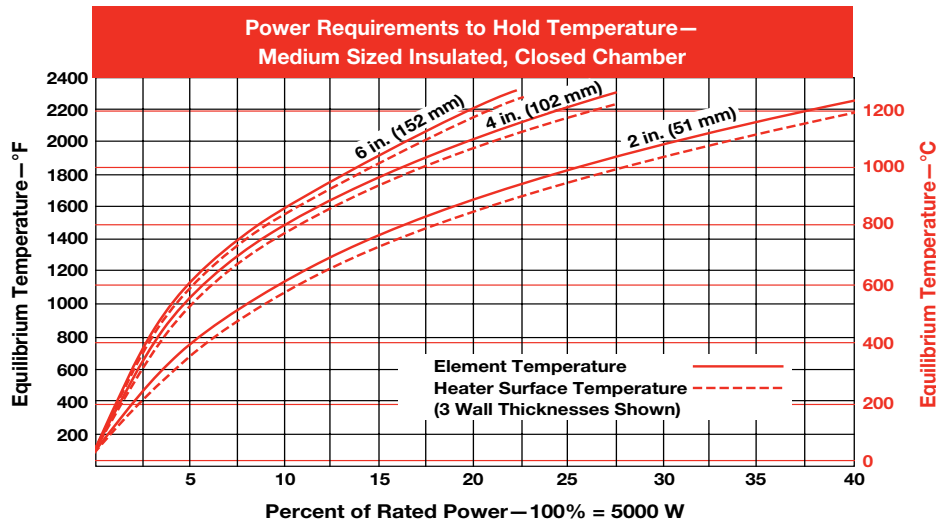
Temperature heat-up rates were measured by thermocouples in three places: at the element, on the heater surface and at the center-of-chamber. Data for various additional wall thicknesses is also shown. This is typical of how large, flat and semi-cylindrical units are used. The chamber was oriented vertically with top and bottom disks of ceramic fiber insulation equal to wall thickness.



### Power Requirements

Shown below are the percentages of rated power needed to achieve and hold specific temperatures inside of

medium-sized, insulated chambers. This represents the efficiency of these heaters in this mounting configuration.





# High-Temperature Heaters

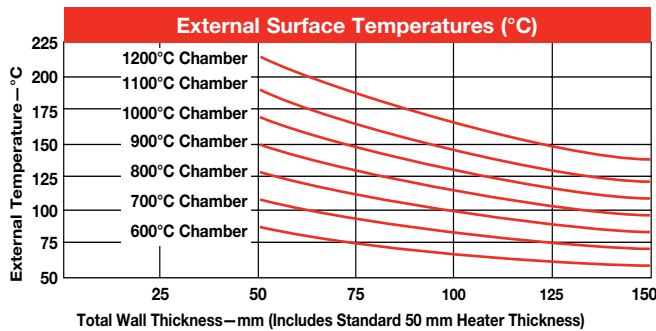
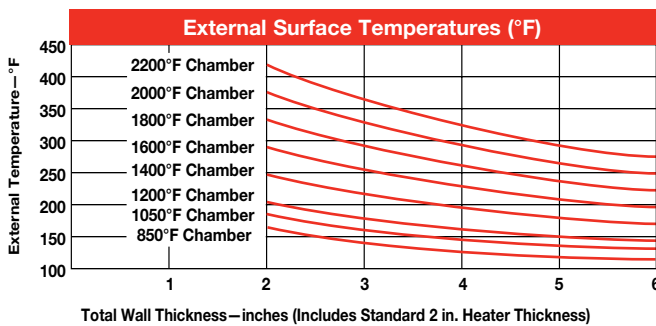


## Ceramic Fiber Heaters

### Performance Data (Continued)

#### Insulation Effectiveness

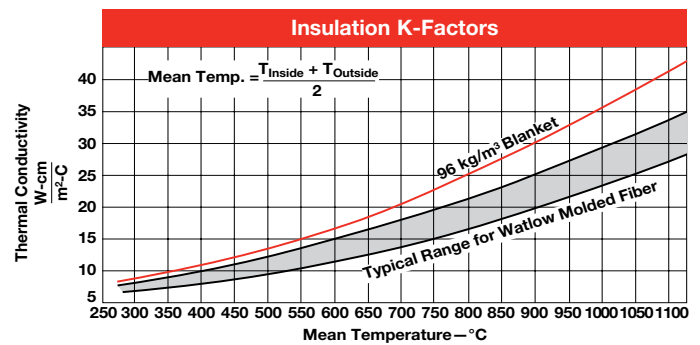
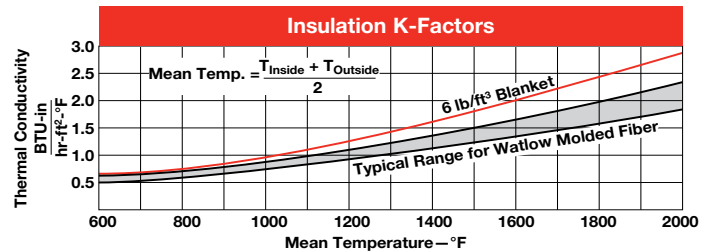
The graphs below illustrate the effectiveness of adding 6 lb/ft<sup>3</sup> (96 kg/m<sup>3</sup>) blanket insulation to the backside of standard 2 in. (50 mm) thick ceramic fiber heaters. Total wall thickness of up to 6 in. (152 mm) is shown. Data is for vertical sides without metal sheathing. Top and bottom surfaces and surfaces with metal sheaths covering ceramic fiber insulation will vary.



#### Heat Loss and Energy Transfer

For general calculations of heat loss and energy transfer, the *Insulation K-Factors* and *Emissivity* graphs are helpful.

The *K-Factors* graph is for ceramic fiber heaters and the ceramic fiber insulation blanket typically used with the heaters. This blanket is offered as an accessory by Watlow.



#### Application Hints

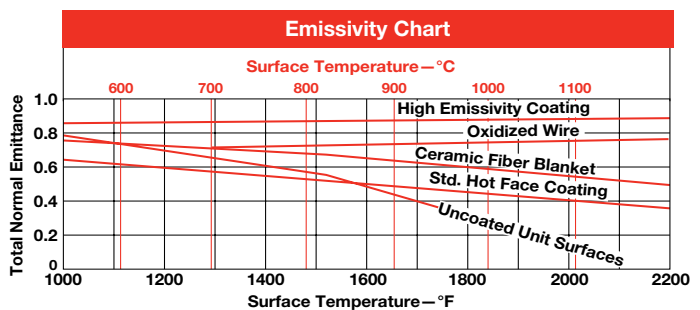
For wall thicknesses (T) in cylindrical situations use the “equivalent thickness” conversion.

$$T_{\text{cyl.}} = r_{\text{out}} \log_e \left( \frac{r_{\text{out}}}{r_{\text{in}}} \right)$$

Where  $r_{\text{out}}$  is outer radius  
 $r_{\text{in}}$  is inner radius

#### Emissivity of Heater Surface

The *Emissivity* graph details the normalized emittance values for the four surfaces most likely to be encountered when planning Watlow ceramic fiber heater applications.





## Ceramic Fiber Heaters

### Termination Options

Watlow offers many variations of electric leads to meet particular wiring requirements. To understand termination options available, it is necessary to understand the various methods for applying electrical leads.

Ceramic fiber heater electrical leads are welded to stubs – the metal parts that interface between the heating element wire and the add-on electrical leads. These stubs exit the heater at the lead pockets. Pockets are small cavities below the cold face plane (outside surface) and usually located at or near the corners.

Watlow ceramic fiber heaters are equipped with either strip leads or double twisted wire leads. Strip leads are most commonly used, unless otherwise specified. The various lead styles refer to the lead's exit orientation relative to the pocket used on a given type of heater. See illustrations for specific details.

### Strip Leads

Flat and semi-cylindrical ceramic fiber heaters are available with the termination options shown here. When ordering termination options for catalog units, the specific strip lead **Style** must be specified. To determine the desired style, refer to the following illustrations. If a style is not specified, **Style A** leads, 12 in. (305 mm) in length will be provided. Additional lengths are available using add-on leads which are priced per pair, per inch, for the three different widths. See ordering charts for which lead width is used on a specific heater.

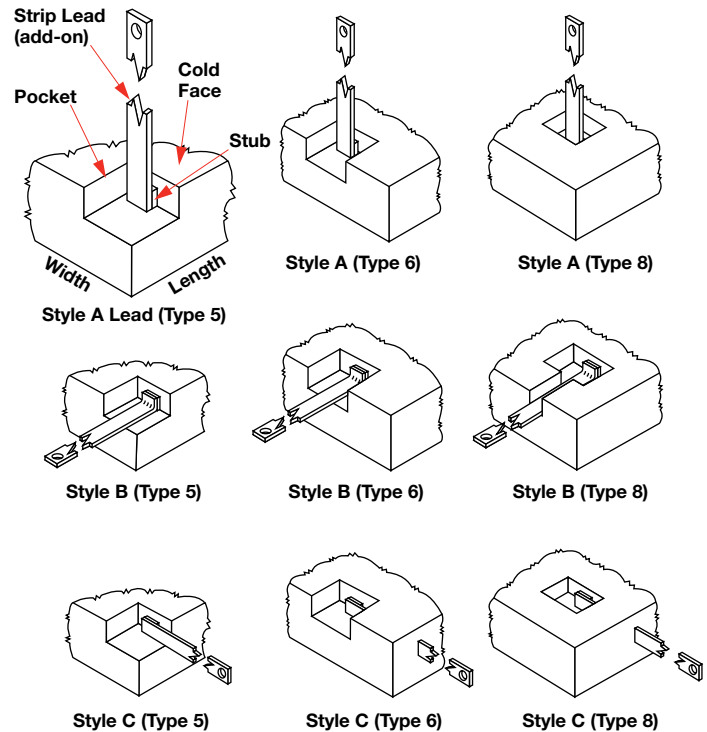
Strip leads are shipped with a  $1\frac{3}{64}$  in. (5 mm) hole at the end of the lead. Use #10-24 screws, nuts and washers, or other wiring connections. Caution should be exercised when making connections. Leads are susceptible to loosening due to thermal expansion and contraction as the heater cycles.



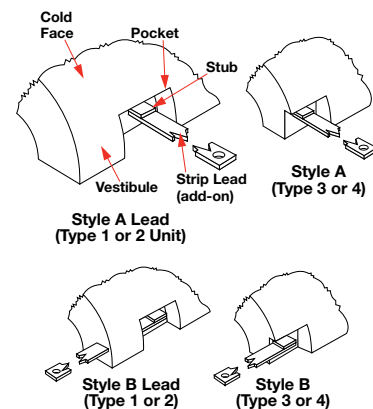
### Important

Inspect the carton and its contents for damage prior to discarding packaging material. If there is any damage, contact your Watlow representative immediately for a Returned Material Authorization (RMA) number. All damaged goods are to be returned in the original packaging to reduce the possibility of further damage to the product.

### Flat Units



### Semi-Cylindrical Units



# High-Temperature Heaters



## Ceramic Fiber Heaters

### Termination Options (Continued)

#### Special Lead Orientation

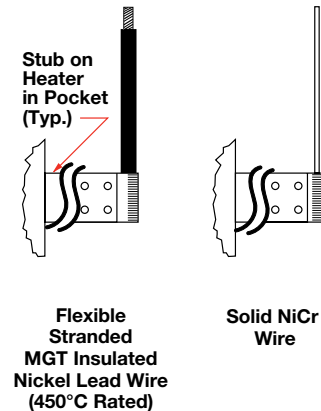
If the various standard strip lead orientations and pocket configurations are not suitable, special designs are available. When ordering, please include drawings that show proposed locations.

#### Leads Bent 90 Degrees

The double twisted leads of full cylinder heaters can bend 90 degrees to lay into slots and exit to the sides of the unit.

#### Special Add-On Lead Configurations

The two options illustrated can be welded onto the stub at the heater pocket, or for a better installation, welded to the end of a specified length of the regular strip lead. The strip lead length can vary from zero to the value necessary to distance it from the hot zone. The length of the add-on lead option eliminates the need for a custom product and satisfies a greater range of wiring requirements. Contact your Watlow representative for technical details and price.



## Accessories

Ceramic fiber heater orders can include the accessory items described in this section. Please specify the Watlow part number when ordering.

### Rigidizer

Rigidizer is primarily used to recoat soft, cut edges of ceramic fiber heaters and ceramic fiber insulation panels. Various degrees of hardening can be achieved with additional applications. Rigidizer can be ordered by the pint (0.47 L) by specifying part number **CFRGDPT** or gallon (3.78 L), part number **CFRGDGL**.

### B.T.E. Closed-End Thermocouple Tubes

A horizontal thermocouple tube between the elements is available in two sizes: 0.140 in. (3.6 mm) and 0.265 in. (6.7 mm), both 6 in. (152 mm) long with closed end.

### Black Surface Coat

Black high emissivity coating is used to raise emissivity closer to 1.0. The container size is 4 ounces. Order **CFBSC**.

## Ceramic Tubes

Ceramic tubes are available in four nominal sizes: 1/8, 1/4, 3/8 and 1/2 in. (3.2, 6, 9.5 and 13 mm) I.D. and lengths including 0.9 in. (22 mm) and 1.9 in. (48 mm) long. Ceramic tubes have several uses, including thermocouple mounting holes, mounting pin sleeves and lead coverings. The table below lists part numbers and exact sizes.

Inside Diameter		Length		Part Number
in.	(mm)	in.	(mm)	
0.140	(3.6)	0.90	(22)	<b>CC405-1</b>
0.265	(6.7)	0.90	(22)	<b>CC405-2</b>
0.390	(9.9)	0.74	(19)	<b>CC405-3</b>
0.515	(13.1)	0.90	(22)	<b>CC405-9</b>
0.140	(3.6)	1.90	(48)	<b>CC405-4</b>
0.265	(6.7)	1.90	(48)	<b>CC405-5</b>
0.390	(9.9)	1.60	(41)	<b>CC405-6</b>
0.515	(13.1)	1.90	(48)	<b>CC405-8</b>



## Ceramic Fiber Heaters

### Accessories (Continued)

#### Dry Heating Surface Mix

Dry heating surface mix is used to make the hot face of all heaters, including those with the high emissivity coating. It can also be used with rigidizer to make a very high temperature paste for touch ups of the hot face area. Order by the pint (0.47 L), part number **CFHTGSURMX**, or gallon (3.78 L), part number **CFHTGMXGAL**.

#### Patch Kit

To easily repair small breaks or cracks, the patch kit contains one pint (0.47 L) of powdered ceramic fiber and four ounces (0.118 L) of black surface coat. Order **CFPATCHKIT**.

#### Ceramic Fiber Insulation Blanket

Additional insulation value for ceramic fiber heaters is available with ceramic fiber insulation blanket. This 6 lb/ft<sup>3</sup> (96 kg/m<sup>3</sup>) ceramic fiber blanket contains no organic binders. It is suitable for applications up to 2300°F (1260°C) and sold in full rolls or cut by the square foot. These blankets are available in the following sizes:

Size (U.S.)	Size (metric)	Part No.
24 in. X 25 ft X 1/4 in.	610 mm X 7.6 m X 6 mm	<b>CFBLKT1/4</b> <sup>①</sup>
24 in. X 25 ft X 1/2 in.	610 mm X 7.6 m X 13 mm	<b>CFBLKT1/2</b> <sup>①</sup>
24 in. X 25 ft X 1 in.	610 mm X 7.6 m X 25 mm	<b>CFBLKT-1</b> <sup>①</sup>

<sup>①</sup> Add ...R to end of part number for full roll.

#### Powdered Ceramic Fiber

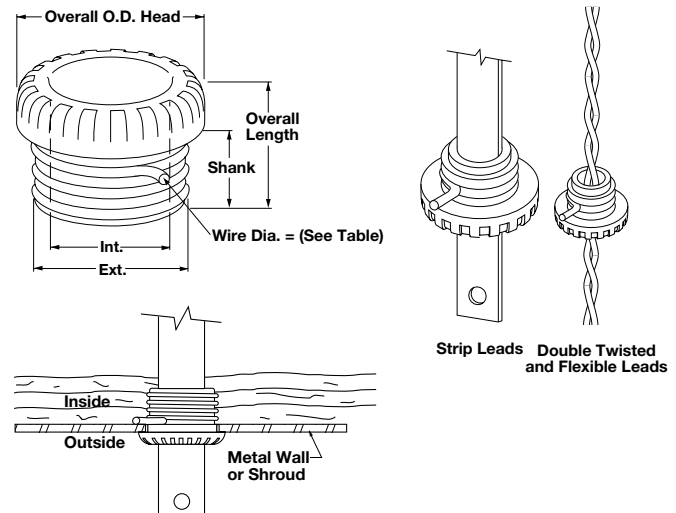
Powdered ceramic fiber is used primarily to improve surface finish in critical areas. It can also be used to fill voids, cracks and broken corners in damaged units. Use powdered ceramic fiber with rigidizer to make an easy to apply paste. A standard container size is one pint (0.47 L). Order part number **CFPDRFPT**.

#### High Temperature Coating and Electrical Potting Cement

Two different high purity, high temperature cements can be used to mount thermocouple tubes, provide extra surface hardening, bond ceramic fiber gaskets and affix lightweight ceramic fiber insulation blanket to panels, as well as attach edge-spacer blocks and custom vestibules. Potting cement is packaged in a 1/4 pint (116 mL) jar, and may be ordered by specifying part number **CFPTGCMT**. The high temperature coating cement is available in pints or gallons, and can be ordered by using part numbers **CFCTGCMTPT** and **CFCTGCMTGAL**.

#### Strip Lead Porcelain Bushings

Strip lead porcelain bushings are primarily used to protect heater power leads when passing through metal walls and furnace structures. Bushings are available with inside diameters listed below for use with double twisted leads and the three standard strip lead widths. To select the appropriate inside diameter lead bushing, reference the heater selection tables on pages 435 through 440. The strip lead width for each heater is listed therein.



#### Porcelain Bushings Specifications

Conduit K.O. Size in. (mm)	Shank Dia. without Wire Nut		Wire Nut Dia. in. (mm)	Shank Length in. (mm)	Overall Length in. (mm)	Overall Head O.D. (Ref.)		Use With:	Part Number
	Int. in. (mm)	Ext. in. (mm)				in. (mm)	in. (mm)		
3/8 (9.5)	3/8 (9.5)	21/32 (16.7)	0.080 (2.032)	9/16 (14.3)	7/8 (22.2)	7/8 (22.2)		All double twist	<b>CS45-11</b>
1/2 (13.0)	7/16 (11.1)	13/16 (20.6)	0.080 (2.032)	3/4 (19.0)	1 1/8 (28.6)	1 1/8 (28.6)		3/8 (9.5 mm) Strip	<b>CS45-20</b>
3/4 (19.0)	9/16 (14.3)	1 (25.0)	0.106 (2.692)	7/8 (22.2)	1 5/16 (33.3)	1 5/16 (33.3)		1/2 (13.0 mm) Strip	<b>CS45-30</b>

# High-Temperature Heaters



## Ceramic Fiber Heaters

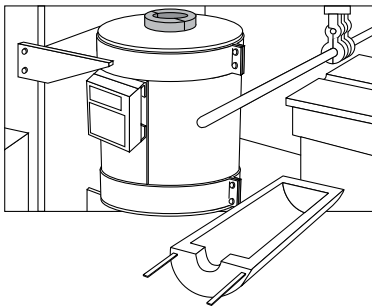
### Mounting Methods

The Watlow ceramic fiber heater is available in a wide range of heater shapes and configurations to solve high temperature process applications. The modularity and range of sizes and wattages provide the greatest possible flexibility. Watlow has developed and can recommend many appropriate specific and generalized mounting systems for mounting heaters. Ceramic fiber heaters have been organized into seven major mounting categories or heater system configurations as shown in the following illustrations.

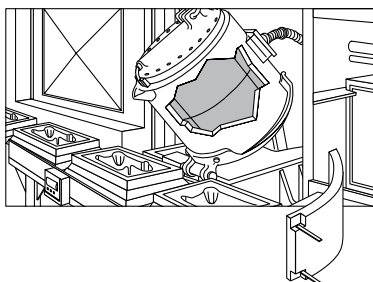
#### 1. Full Cylinder Heaters



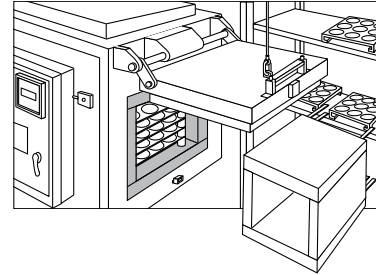
#### 2. Semi-Cylindrical (180° section) Heaters



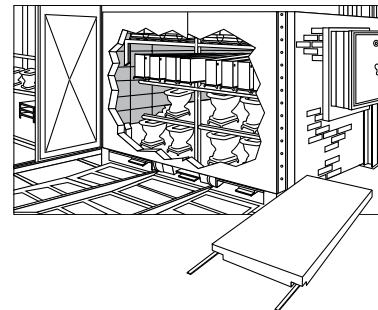
#### 3. Arc-Section Arrays of Heaters (3 or more units of 120° or less each)



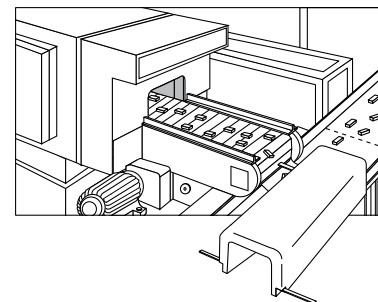
#### 4. Flat Panels, with One Panel on Each Side



#### 5. Flat Wall Array with Minimum Two-by-Two Units per Wall



#### 6. Made-to-Order Molded Shapes with Up to Five Sides of a Box Molded as One Piece, Including Complex Curves





## Ceramic Fiber Heaters

### *Molded Ceramic Fiber Insulation Modules*

For heating applications requiring insulation panels, Watlow offers many shapes and sizes of molded ceramic fiber insulation modules. These insulation modules are constructed using the same high quality, high temperature, low mass ceramic fiber material used in our heaters.

As a complement to the overall product line, these modules offer additional solutions for high temperature industrial insulation problems. Without heating elements, molded ceramic fiber insulation modules are available in complex shapes to conform to application requirements.

Molded-to-shape insulation modules also make handling and installation easier compared to other insulation methods. Since they are molded to shape, sanding, cutting and grinding of blocks to achieve the desired configuration is not required.

Highly resistant to thermal shock and chemical attack, except for hydrofluoric and phosphoric acids and strong alkalis, insulation modules are unaffected by oil and water. If the insulation becomes wet, physical and thermal properties can be fully restored when dried.

**Note:** If using molded ceramic fiber insulation modules along with other Watlow ceramic fiber heaters, oil, water and other contaminants will negatively affect the heating element portion of the ceramic fiber heater.

Molded insulation modules are rated for up to 2300°F (1260°C) continuous duty. The inorganic binder eliminates smoke or combustion during initial heating to 300°F (150°C) and higher. Vacuum molded density is 10 to 15 lbs/ft<sup>3</sup> (160 to 240 kg/m<sup>3</sup>), the same as the ceramic fiber heaters.

**Size Limits:** Maximum flat size is 34 x 52 in. (860 x 1320 mm) with a molded thickness of more than 4 in. (102 mm). Maximum inside diameter for semi-cylindrical modules is 24 in. (610 mm). For applications requiring curved insulation pieces in excess of 180 degrees, consider using multiple arc-section modules or an array system of multiple flat units.



### **Application and Technical Data**

The same insulation performance and technical data for ceramic fiber heaters applies to molded ceramic fiber insulation modules. For specific information on insulation performance properties, see the *Heat Loss and Energy Transfer* portion of the ceramic fiber heaters section on page 425.

### **Accessories**

Where appropriate, many of the same accessories available for ceramic fiber heaters are available for use with molded ceramic fiber insulation modules. Accessories can be used to modify, provide mounting options and for minor repairs and maintenance.

### **Ordering Information**

Molded ceramic fiber insulation modules are available in exactly the same sizes and shapes as the ceramic fiber heaters listed in the ordering tables. In general, the ordering part numbers are derived by replacing the second alpha character in the heater part number (i.e., F, S, C, R, etc.) with **N** to designate **no-element**.

**Extended Capabilities:** Watlow representatives can work with your customers to design and manufacture modules to meet specific insulation needs.

# High-Temperature Heaters



## Ceramic Fiber Heaters

### Molded Ceramic Fiber Insulation Modules

#### Ordering Information

#### VN - No-Heat Panels

Part Number

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭
Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Modification Options				
V	N	5	1	2	A	1	2	A		0	0	0	0

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ Base Code Number

⑩	Modification Options
0 =	None
A =	0.140 thermocouple tube I.D. center on unit
B =	0.265 thermocouple tube I.D. center on unit
E =	Black surface coat one side
F =	Black surface coat 0.140 thermocouple tube I.D. center on unit
G =	Black surface coat 0.265 thermocouple tube I.D. center on unit



## Ceramic Fiber Heaters

### Modifications

It is possible to order certain special modifications for catalog units prior to shipment. Some of these are listed below, with a brief description.

**Beveled and trimmed edges:** The unheated edges of Type 6, 7 and 8 units can be factory modified to provide in-between overall sizes, and can be angle cut to form regular polygon shapes around objects. Angles between zero degrees and 45 degrees can be accommodated.

**Black surface coating:** Improves the emissivity of the heater's hotface. See the graph on page 425 for emissivity values, contact the factory for pricing adders.

**Leads:** See page 427 for other "Special Add-On Lead" configurations.

**Thermocouple holes:** Ceramic tubes on page 427 are used to make electrically isolated holes through heaters. To order, the inside **diameter** and **location** must be specified. A special "behind-the-element" horizontal thermocouple tube is available to very closely track element temperature for over-temperature protection and improved heater life.

### Notches or long slots in no-heat areas of

**units:** Rectangular and semi-circular notches can be cut into no-heat areas and vestibules on most units. Usually, a sketch or drawing that specifies exact location must be included with your order. Fax numbers to send drawings to are available.

**Shortened vestibule lengths:** Modified vestibule lengths require retention of at least 1/2 in. (13 mm) of insulation for adequate strength or complete removal ("0" length) to make Type 1 units into left vestibule (i.e., Type 2) or right vestibule (i.e., Type 3) units.



### Warning

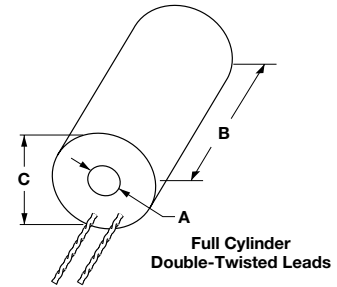
This product contains refractory ceramic fibers (RCF) which have been identified by the International Agency for Research on Cancer (IARC) as a possible human carcinogen (class 2B). Before using these products, read the material data safety sheet (MSDS) which includes the detailed precautionary measures and handling instructions.



# High-Temperature Heaters

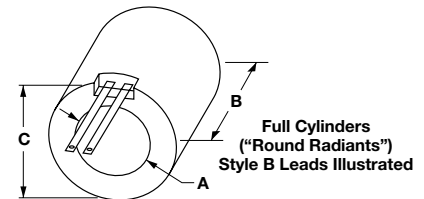
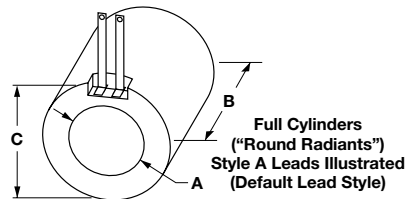


## Ceramic Fiber Heaters



### Full Cylinder Units

Dimensions, in. (mm)			Electrical Ratings			Lead Width	Approx. Net Wt. oz (kg)	Part Number ②
Heated Area		Overall	Volts	Power (Watts) ±5%	Surface Loading ① W/in <sup>2</sup> (W/cm <sup>2</sup> )			
I.D. (A) in. (mm) ± <sup>1</sup> / <sub>16</sub> (±1.6)	Length (B) in. (mm) ± <sup>1</sup> / <sub>16</sub> (±1.6)	O.D. (C) in. (mm) ± <sup>1</sup> / <sub>8</sub> (±3.2)						
1/2 (13)	6 (152)	2 (51)	60	175	18.6 (2.9)	Double Twisted Leads	5 (0.14)	VC400J06A
1/2 (13)	12 (305)	2 (51)	120	350	18.6 (2.9)		10 (0.28)	VC400J12A
3/4 (19)	6 (152)	3 (76)	60	200	14.2 (2.2)		8 (0.23)	VC400N06A
3/4 (19)	12 (305)	3 (76)	120	400	14.2 (2.2)		13 (0.37)	VC400N12A
1 (25)	6 (152)	3 (76)	60	220	11.7 (1.8)		9 (0.26)	VC401A06A
1 (25)	12 (305)	3 (76)	120	440	11.7 (1.8)		13 (0.37)	VC401A12A
1 1/4 (32)	6 (152)	3 1/2 (89)	60	275	11.7 (1.8)		11 (0.31)	VC401E06A
1 1/4 (32)	12 (305)	3 1/2 (89)	120	550	11.7 (1.8)		18 (0.51)	VC401E12A
1 1/2 (38)	6 (152)	3 1/2 (89)	60	300	10.6 (1.6)		12 (0.34)	VC401J06A
1 1/2 (38)	12 (305)	3 1/2 (89)	120	600	10.6 (1.6)		20 (0.57)	VC401J12A
1 3/4 (45)	6 (152)	4 (102)	120	350	10.6 (1.6)		12 (0.34)	VC401N06A
1 3/4 (45)	12 (305)	4 (102)	120	700	10.6 (1.6)		23 (0.65)	VC401N12A
2 (51)	6 (152)	4 (102)	120	425	11.3 (1.8)		13 (0.37)	VC402A06A
2 (51)	12 (305)	4 (102)	120	850	11.3 (1.8)		25 (0.71)	VC402A12A



### Full Cylinder Units

Dimensions, in. (mm)			Electrical Ratings			Lead Width in. (mm)	Approx. Net Wt. lbs (kg)	Part Number ②
Heated Area		Overall	Volts	Power (Watts) ±5%	Surface Loading ① W/in <sup>2</sup> (W/cm <sup>2</sup> )			
I.D. (A) in. (mm) ± <sup>1</sup> / <sub>16</sub> (±1.6)	Length (B) in. (mm) ± <sup>1</sup> / <sub>16</sub> (±1.6)	O.D. (C) in. (mm) ± <sup>1</sup> / <sub>8</sub> (±3.2)						
3 (76)	6 (152)	7 (178)	120	650	11.5 (1.8)	3/8 (10)	2.5 (1.1)	VC403A06A
4 (102)	6 (152)	8 (203)	120	900	11.9 (1.8)	1/2 (13)	3.1 (1.4)	VC404A06A
4 (102)	6 (152)	8 (203)	120	1100	14.6 (2.3)	3/8 (10)	3.1 (1.4)	VC404A06T
5 (127)	6 (152)	9 (229)	120	1250	13.7 (2.1)	1/2 (13)	3.5 (1.6)	VC405A06A
5 (127)	6 (152)	9 (229)	120	1400	14.9 (2.3)	3/8 (10)	3.6 (1.6)	VC405A06T
6 1/2 (165)	6 (152)	10 1/2 (267)	120	1500	12.2 (1.9)	3/4 (19)	4.9 (2.2)	VC406J06A
6 1/2 (165)	6 (152)	10 1/2 (267)	120	2000	16.3 (2.5)	1/2 (13)	4.9 (2.2)	VC406J06T
8 (203)	6 (152)	12 (305)	120	1800	11.9 (1.8)	3/4 (19)	5.7 (2.6)	VC408A06A
8 (203)	6 (152)	12 (305)	120	2600	17.2 (2.7)	3/4 (19)	5.8 (2.6)	VC408A06T

① Units with part numbers ending in ...**OA**, watt densities between 10.6 to 14.2 W/in<sup>2</sup> (1.6 to 2.2 W/cm<sup>2</sup>), are coil designs suitable for use up to 2000°F (1093°C) maximum surface temperature. Units with part numbers ending in ...**T**, watt densities between 14.6 to 17.2 W/in<sup>2</sup> (2.3 to 2.7 W/cm<sup>2</sup>) are "round radiants" with sinuated element designs and high emissivity coating that are suitable for use up to 1800°F (982°C) maximum surface temperature.

② For unheated insulation tubes, substitute "**VN**" for "**VC**" in the part number of the appropriate size unit. No heats are manufacturing lead times.

# High-Temperature Heaters



## Ceramic Fiber Heaters

### Ordering Information

#### VC - Full Cylindrical

##### Part Number

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Modification Options			Lead Options	Lead Length
V	C	4	0	5	A	0	6	A		0	0		

##### 1 2 3 4 5 6 7 8 9 Base Code Number

10	Modification Options
0 =	None
A =	0.140 thermocouple tube I.D. opposite leads, centered on height
B =	0.140 thermocouple tube I.D. lead side, centered on height
E =	Black surface coat
F =	Black surface coat 0.140 thermocouple tube I.D. opposite leads, centered on height
G =	Black surface coat 0.140 thermocouple tube I.D. lead side, centered on height

13	Lead Options
0 =	Fixed (built-in) standard double-twisted*
1 =	601 Alloy 600 strip A style
2 =	601 Alloy 600 strip B style
9 =	Flex NI, MGT A style
A =	Flex NI, MGT B style
E =	Chromel® A / NI, A style
F =	Chromel® A / NI, B style

\* Double -twisted leads are only available on 1/2 thru 2 in. I.D. heaters.

##### 14 Lead Length

A =	0 in.	T =	14 in.
B =	1 in.	U =	15 in.
E =	2 in.	V =	16 in.
F =	3 in.	W =	17 in.
G =	4 in.	X =	18 in.
H =	5 in.	Y =	19 in.
J =	6 in.	1 =	20 in.
K =	7 in.	2 =	21 in.
L =	8 in.	3 =	22 in.
M =	9 in.	4 =	23 in.
N =	10 in.	6 =	24 in.
P =	11 in.	7 =	30 in.
R =	12 in.	8 =	36 in.
S =	13 in.	9 =	42 in.

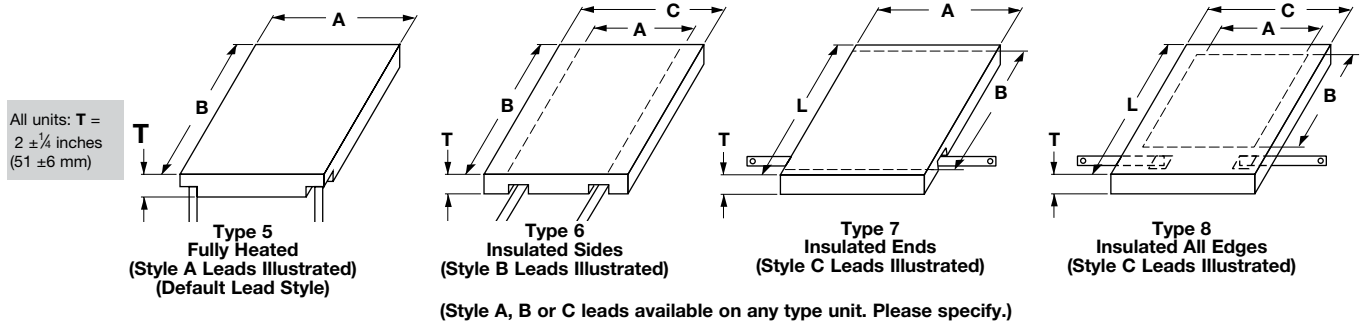
##### Notes:

- If the order is placed before 11:00 AM CST, heaters with standard leads (...OR) ship the same day. Heaters with non-standard leads ship the next day.
- The BTE (between-the-element) is NOT covered in this system yet. Please contact your Watlow representative for availability.

# High-Temperature Heaters



## Ceramic Fiber Heaters



### Flat Units — Embedded Coiled Elements (see page 421)

Dimensions, in. (mm)				Electrical Rating			Strip Lead Width in. (mm)	Approximate Net Wt.			Part Number
Heated Size	Type 6 & 8	Type 7 & 8	Volts	Power (Watts) ±5%	Surface Loading W/in <sup>2</sup> (W/cm <sup>2</sup> )	Type 5 lbs (kg)		Type 6 & 7 lbs (kg)	Type 8 lbs (kg)		
Width (A) in. (mm)	Length (B) in. (mm)	Width (C) in. (mm)	Length (L) in. (mm)								
4 (102)	6 (152)	8 (203)	10 (254)	60	275	11.5 (1.8)	3/8 (10)	0.6 (0.3)	1.1 (0.5)	1.7 (0.8)	VF004A06S
	12 (305)	8 (203)	16 (406)	60	550	11.5 (1.8)	1/2 (13)	1.2 (0.5)	2.2 (1.0)	2.8 (1.3)	VF004A12S
	18 (457)	8 (203)	22 (559)	120	750	10.4 (1.6)	3/8 (10)	1.9 (0.9)	3.4 (1.5)	4.5 (2.0)	VF004A18S
	24 (610)	8 (203)	28 (711)	120	1100	11.5 (1.8)	1/2 (13)	2.4 (1.1)	4.4 (2.0)	5.6 (2.5)	VF004A24S
6 (152)	6 (152)	10 (254)	10 (254)	60	375	10.4 (1.6)	3/8 (10)	0.9 (0.4)	1.5 (0.7)	2.4 (1.1)	VF006A06S
	12 (305)	10 (254)	16 (406)	120	750	10.4 (1.6)	3/8 (10)	1.8 (0.8)	2.8 (1.3)	3.7 (1.7)	VF006A12S
	18 (457)	10 (254)	22 (559)	120	1250	11.6 (1.8)	1/2 (13)	3.0 (1.4)	4.1 (1.9)	5.0 (2.3)	VF006A18S
	24 (610)	10 (254)	28 (711)	240	1500	10.4 (1.6)	3/8 (10)	3.5 (1.6)	5.3 (2.4)	6.2 (2.8)	VF006A24S
	30 (762)	10 (254)	34 (864)	240	2000	11.2 (1.7)	1/2 (13)	4.5 (2.0)	6.6 (3.0)	8.4 (3.8)	VF006A30S
	36 (914)	10 (254)	40 (1016)	240	2500	11.6 (1.8)	1/2 (13)	6.1 (2.8)	8.3 (3.8)	10.2 (4.6)	VF006A36S
8 (203)	12 (305)	12 (305)	16 (406)	120	1100	11.5 (1.8)	1/2 (13)	2.5 (1.1)	3.2 (1.5)	4.1 (1.9)	VF008A12S
	18 (457)	12 (305)	22 (559)	240	1500	10.4 (1.6)	3/8 (10)	3.6 (1.6)	4.7 (2.1)	5.6 (2.5)	VF008A18S
	24 (610)	12 (305)	28 (711)	240	2200	11.5 (1.8)	1/2 (13)	4.8 (2.2)	6.5 (2.9)	7.4 (3.4)	VF008A24S
	30 (762)	12 (305)	34 (864)	240	2500	10.4 (1.6)	1/2 (13)	6.2 (2.8)	8.0 (3.6)	9.7 (4.4)	VF008A30S
	36 (914)	12 (305)	40 (1016)	240	3000	10.4 (1.6)	3/4 (19)	7.8 (3.5)	10.0 (4.5)	11.8 (5.4)	VF008A36S
10 (254)	12 (305)	14 (356)	16 (406)	240	1250	10.4 (1.6)	3/8 (10)	2.6 (1.2)	3.9 (1.8)	5.0 (2.3)	VF010A12S
	18 (457)	14 (356)	22 (559)	240	1800	10.0 (1.6)	1/2 (13)	4.2 (1.9)	5.4 (2.4)	6.5 (2.9)	VF010A18S
	24 (610)	14 (356)	28 (711)	240	2500	10.4 (1.6)	1/2 (13)	5.2 (2.4)	7.7 (3.5)	8.8 (4.0)	VF010A24S
	30 (762)	14 (356)	34 (864)	240	3000	10.0 (1.6)	3/4 (19)	7.0 (3.2)	9.5 (4.3)	11.7 (5.3)	VF010A30S
	36 (914)	14 (356)	40 (1016)	240	3600	10.0 (1.6)	3/4 (19)	9.1 (4.1)	11.5 (5.2)	13.7 (6.2)	VF010A36S
	12 (305)	12 (305)	16 (406)	16 (406)	240	1500	10.4 (1.6)	3/8 (10)	3.2 (1.5)	4.6 (2.1)	5.8 (2.6)
18 (457)		16 (406)	22 (559)	240	2200	10.2 (1.6)	1/2 (13)	4.9 (2.2)	6.5 (2.9)	7.7 (3.5)	VF012A18S
24 (610)		16 (406)	28 (711)	240	3000	10.4 (1.6)	3/4 (19)	7.5 (3.4)	9.5 (4.3)	10.7 (4.9)	VF012A24S
30 (762)		16 (406)	34 (864)	240	3600	10.0 (1.6)	3/4 (19)	9.1 (4.1)	11.7 (5.3)	12.9 (5.9)	VF012A30S
36 (914)		16 (406)	40 (1016)	240	4400	10.2 (1.6)	3/4 (19)	12.4 (5.6)	15.5 (7.0)	16.7 (7.6)	VF012A36S
14 (356)		12 (305)	18 (457)	16 (406)	240	1750	10.4 (1.6)	1/2 (13)	4.7 (2.1)	6.1 (2.8)	7.6 (3.4)
	18 (457)	18 (457)	22 (559)	240	2550	10.6 (1.6)	1/2 (13)	6.8 (3.1)	8.5 (3.9)	10.0 (4.5)	VF014A18S
	24 (610)	18 (457)	28 (711)	240	3500	10.4 (1.6)	3/4 (19)	10.0 (4.5)	11.9 (5.4)	13.4 (6.1)	VF014A24S
	30 (762)	18 (457)	34 (864)	240	4300	10.2 (1.6)	3/4 (19)	12.5 (5.7)	15.0 (6.8)	16.5 (7.5)	VF014A30S
	36 (914)	18 (457)	40 (1016)	240/240	5200	10.3 (1.6)	1/2 (13)	14.2 (6.4)	17.2 (7.8)	18.7 (8.5)	VF014A36S <sup>②</sup>
	16 (406)	12 (305)	20 (508)	16 (406)	240	2100	10.9 (1.7)	1/2 (13)	5.2 (2.4)	6.7 (3.0)	8.4 (3.8)
18 (457)		20 (508)	22 (559)	240	3000	10.4 (1.6)	3/4 (19)	8.2 (3.7)	9.9 (4.5)	11.6 (5.3)	VF016A18S
24 (610)		20 (508)	28 (711)	240	4200	10.9 (1.7)	3/4 (19)	11.9 (5.4)	13.8 (6.3)	15.5 (7.0)	VF016A24S
30 (762)		20 (508)	34 (864)	240/240	5000	10.4 (1.6)	1/2 (13)	15.2 (6.9)	17.7 (8.0)	19.4 (8.8)	VF016A30S <sup>②</sup>
36 (914)		20 (508)	40 (1016)	240/240	6000	10.4 (1.6)	3/4 (19)	17.9 (8.1)	20.9 (9.5)	22.6 (10.3)	VF016A36S <sup>②</sup>

All units in this table are suitable for use up to 2000°F (1093°C) maximum surface temperature.

① Add Type number (Type 5 - 8) in the blank position in the part number. Example: **VS704A06S**.

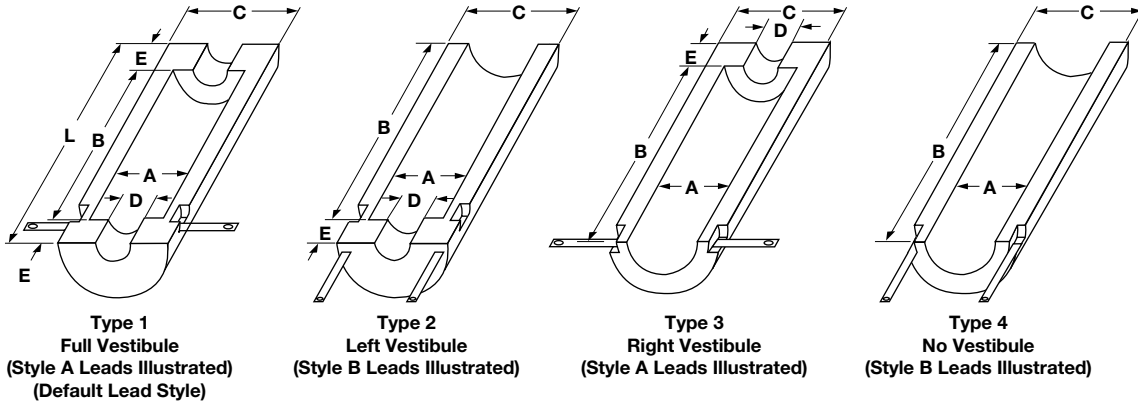
For unheated units, see catalog page 430.

② These units have dual elements to use in "parallel" for 240V usage. Alternate designs are available for 480V, 277V and three-phase (internally wired). Contact your Watlow representative.

# High-Temperature Heaters



## Ceramic Fiber Heaters



(Style A or B leads available on any type unit. Please specify.)

### Semi-Cylindrical Units — Embedded Coiled Elements (see page 421)

Dimensions, in. (mm)						Electrical Ratings			Approx. Net Wt.		Part Number	
Heated Size			Type 1, 2, & 3 Sizes			Power (Watts) ±5%	Surface Loading W/in <sup>2</sup> (W/cm <sup>2</sup> )	Strip Lead Width in. (mm)	Type 1 Full Vest. lbs (kg)	Type 4 No Vest. lbs (kg)		
I.D. (A) in. (mm) ±1/8 (±3.2)	Length (B) in. (mm) +1/16 -1/8 (+1.6 - 3.2)	O.D. (C) in. (mm) (Ref)	Vestibule Sizes									
			Length (L) in. (mm) +1/16 -1/8 (+1.6 - 3.2)	Dia. (D) in. (mm) ±1/8 (±3.2)	Length (E) in. (mm) +1/16 -1/8 (+1.6 - 3.2)	Volts						
2 (51)	6 (152)	6 (152)	8 (203)	1 (25)	1 (25)	60	275	14.6 (2.3)	3/8 (10)	1.1 (0.5)	1.1 (0.5)	VS <sup>®</sup> 02A06S
	12 (305)	6 (152)	14 (356)	1 (25)	1 (25)	120	550	14.6 (2.3)	3/8 (10)	1.8 (0.8)	1.8 (0.8)	VS <sup>®</sup> 02A12S
	18 (457)	6 (152)	20 (508)	1 (25)	1 (25)	120	750	13.3 (2.1)	3/8 (10)	2.3 (1.0)	2.3 (1.0)	VS <sup>®</sup> 02A18S
	24 (610)	6 (152)	26 (660)	1 (25)	1 (25)	240	1100	14.6 (2.3)	3/8 (10)	3.5 (1.6)	3.5 (1.6)	VS <sup>®</sup> 02A24S
3 1/2 (89)	6 (152)	7 1/2 (191)	9 1/2 (241)	2 (51)	1 3/4 (45)	60	450	13.6 (2.1)	1/2 (13)	2.0 (0.9)	1.5 (0.7)	VS <sup>®</sup> 03J06S
	12 (305)	7 1/2 (191)	15 1/2 (394)	2 (51)	1 3/4 (45)	120	900	13.6 (2.1)	1/2 (13)	3.1 (1.4)	2.6 (1.2)	VS <sup>®</sup> 03J12S
	18 (457)	7 1/2 (191)	21 1/2 (546)	2 (51)	1 3/4 (45)	120	1250	12.6 (2.0)	1/2 (13)	4.5 (2.0)	4.0 (1.8)	VS <sup>®</sup> 03J18S
	24 (610)	7 1/2 (191)	27 1/2 (699)	2 (51)	1 3/4 (45)	240	1800	13.6 (2.1)	1/2 (13)	5.4 (2.4)	4.9 (2.2)	VS <sup>®</sup> 03J24S
5 (127)	6 (152)	9 (229)	11 (279)	3 1/2 (89)	2 1/2 (64)	60	625	13.3 (2.1)	1/2 (13)	3.4 (1.5)	2.5 (1.1)	VS <sup>®</sup> 05A06S
	12 (305)	9 (229)	17 (432)	3 1/2 (89)	2 1/2 (64)	120	1250	13.3 (2.1)	1/2 (13)	4.9 (2.2)	4.0 (1.8)	VS <sup>®</sup> 05A12S
	18 (457)	9 (229)	23 (584)	3 1/2 (89)	2 1/2 (64)	240	1775	12.6 (2.0)	1/2 (13)	5.7 (2.6)	4.8 (2.2)	VS <sup>®</sup> 05A18S
	24 (610)	9 (229)	29 (737)	3 1/2 (89)	2 1/2 (64)	240	2500	13.3 (2.1)	1/2 (13)	7.9 (3.6)	6.9 (3.1)	VS <sup>®</sup> 05A24S
	30 (762)	9 (229)	35 (889)	3 1/2 (89)	2 1/2 (64)	240	3100	13.2 (2.0)	3/4 (19)	10.9 (4.9)	9.2 (4.2)	VS <sup>®</sup> 05A30S
	36 (914)	9 (229)	41 (1041)	3 1/2 (89)	2 1/2 (64)	240	3550	12.6 (2.0)	3/4 (19)	13.2 (6.0)	11.5 (5.2)	VS <sup>®</sup> 05A36S
6 1/2 (165)	6 (152)	10 1/2 (267)	12 (305)	5 (127)	3 (76)	120	750	12.2 (1.9)	3/8 (10)	3.8 (1.7)	2.6 (1.2)	VS <sup>®</sup> 06J06S
	12 (305)	10 1/2 (267)	18 (457)	5 (127)	3 (76)	240	1500	12.2 (1.9)	3/8 (10)	5.4 (2.4)	4.2 (1.9)	VS <sup>®</sup> 06J12S
	18 (457)	10 1/2 (267)	24 (610)	5 (127)	3 (76)	240	2100	11.4 (1.8)	1/2 (13)	7.5 (3.4)	6.2 (2.8)	VS <sup>®</sup> 06J18S
	24 (610)	10 1/2 (267)	30 (762)	5 (127)	3 (76)	240	3000	12.2 (1.9)	3/4 (19)	10.9 (4.9)	8.9 (4.0)	VS <sup>®</sup> 06J24S
	30 (762)	10 1/2 (267)	36 (914)	5 (127)	3 (76)	240	3750	12.2 (1.9)	3/4 (19)	13.5 (6.1)	11.4 (5.2)	VS <sup>®</sup> 06J30S
	36 (914)	10 1/2 (267)	42 (1067)	5 (127)	3 (76)	240	4200	11.4 (1.8)	3/4 (19)	16.4 (7.4)	14.3 (6.5)	VS <sup>®</sup> 06J36S
8 (203)	6 (152)	12 (305)	12 (305)	6 1/2 (165)	3 (76)	120	900	11.6 (1.8)	1/2 (13)	5.0 (2.3)	2.8 (1.3)	VS <sup>®</sup> 08A06S
	12 (305)	12 (305)	18 (457)	6 1/2 (165)	3 (76)	240	1800	11.6 (1.8)	1/2 (13)	7.6 (3.4)	5.0 (2.3)	VS <sup>®</sup> 08A12S
	18 (457)	12 (305)	24 (610)	6 1/2 (165)	3 (76)	240	2500	11.1 (1.7)	1/2 (13)	10.5 (4.8)	8.1 (3.7)	VS <sup>®</sup> 08A18S
	24 (610)	12 (305)	30 (762)	6 1/2 (165)	3 (76)	240	3500	11.6 (1.8)	3/4 (19)	13.9 (6.3)	12.4 (5.6)	VS <sup>®</sup> 08A24S
	30 (762)	12 (305)	36 (914)	6 1/2 (165)	3 (76)	240	4200	11.1 (1.7)	3/4 (19)	16.6 (7.5)	14.1 (6.4)	VS <sup>®</sup> 08A30S
	36 (914)	12 (305)	42 (1067)	6 1/2 (165)	3 (76)	240/240	5000	11.1 (1.7)	1/2 (13)	18.0 (8.2)	15.6 (7.1)	VS <sup>®</sup> 08A36S <sup>®</sup>

CONTINUED

All units have 2 ±1/4 inch thick walls.

All units in this table are suitable for use up to 2000°F (1093°C) maximum surface temperature.

① Add Type number (Type 1 - 4) in the blank position in the part number. Example: VS<sup>®</sup>102A06S. For unheated units, see catalog page 430.

Overall length applies only to the full vestibule (Type 1) units. Types 2 and 3 are shorter by one vestibule length. Type 4 length equals (B).

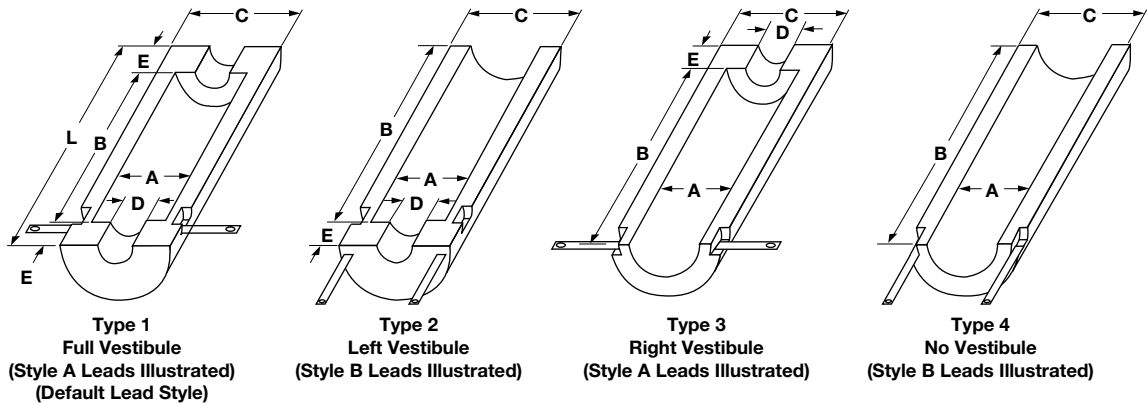
Type 2 (left vestibule) and Type 3 (right vestibule) style units are not stocked. They are, however, still standard units and designs are kept on file.

② These units have dual elements to use in "parallel" for 240V usage. Alternate designs are available for 480V, 277V and three-phase (internally wired). Contact your Watlow representative.

# High-Temperature Heaters



## Ceramic Fiber Heaters



(Style A or B leads available on any type unit. Please specify.)

### Semi-Cylindrical Units — Embedded Coiled Elements (Con't.) (see page 421)

Dimensions, in. (mm)						Electrical Ratings				Approx. Net Wt.		Part Number
Heated Size			Type 1, 2, & 3 Sizes			Volts	Power (Watts) ±5%	Surface Loading W/in <sup>2</sup> (W/cm <sup>2</sup> )	Strip Lead Width in. (mm)	Approx. Net Wt.		
I.D. (A) in. (mm) ±1/8 (±3.2)	Length (B) in. (mm) +1/16 -1/8 (+1.6 - 3.2)	O.D. (C) in. (mm) (Ref)	Vestibule Sizes							Type 1 Full Vest. lbs (kg)	Type 4 No Vest. lbs (kg)	
			Length (L) in. (mm) +1/16 -1/8 (+1.6 - 3.2)	Dia. (D) in. (mm) ±1/8 (±3.2)	Length (E) in. (mm) +1/16 -1/8 (+1.6 - 3.2)							
10 (254)	12 (305)	14 (356)	18 (457)	8 (203)	3 (76)	240	2100	11.1 (1.7)	1/2 (13)	9.2 (4.2)	6.5 (2.9)	<b>VS<sub>10</sub>A12S</b>
	18 (457)	14 (356)	24 (610)	8 (203)	3 (76)	240	3000	10.6 (1.6)	3/4 (19)	13.3 (6.0)	10.6 (4.8)	<b>VS<sub>10</sub>A18S</b>
	24 (610)	14 (356)	30 (762)	8 (203)	3 (76)	240	4200	11.1 (1.7)	3/4 (19)	15.5 (7.0)	12.8 (5.8)	<b>VS<sub>10</sub>A24S</b>
	30 (762)	14 (356)	36 (914)	8 (203)	3 (76)	240/240	5000	10.6 (1.6)	1/2 (13)	18.7 (8.5)	15.4 (7.0)	<b>VS<sub>10</sub>A30S<sup>2</sup></b>
	36 (914)	14 (356)	42 (1067)	8 (203)	3 (76)	240/240	6000	10.6 (1.6)	3/4 (19)	22.6(10.3)	19.3 (8.8)	<b>VS<sub>10</sub>A36S<sup>2</sup></b>
12 (305)	12 (305)	16 (406)	18 (457)	10 (254)	3 (76)	240	2500	11.1 (1.7)	1/2 (13)	9.9 (4.5)	6.8 (3.1)	<b>VS<sub>12</sub>A12S</b>
	18 (457)	16 (406)	24 (610)	10 (254)	3 (76)	240	3500	10.3 (1.6)	3/4 (19)	13.0 (5.9)	9.9 (4.5)	<b>VS<sub>12</sub>A18S</b>
	24 (610)	16 (406)	30 (762)	10 (254)	3 (76)	240	4200	9.3 (1.4)	3/4 (19)	18.5 (8.4)	15.4 (7.0)	<b>VS<sub>12</sub>A24S</b>
	30 (762)	16 (406)	36 (914)	10 (254)	3 (76)	240/240	6000	10.6 (1.6)	3/4 (19)	22.5(10.2)	18.6 (8.4)	<b>VS<sub>12</sub>A30S<sup>2</sup></b>
	36 (914)	16 (406)	42 (1067)	10 (254)	3 (76)	240/240	7000	10.3 (1.6)	3/4 (19)	26.9(12.2)	23.1(10.5)	<b>VS<sub>12</sub>A36S<sup>2</sup></b>
14 (356)	12 (305)	18 (457)	18 (457)	12 (305)	3 (76)	240	3000	11.4 (1.8)	3/4 (19)	12.6 (5.7)	9.0 (4.1)	<b>VS<sub>14</sub>A12S</b>
	18 (457)	18 (457)	24 (610)	12 (305)	3 (76)	240	4200	10.6 (1.6)	3/4 (19)	15.3 (6.9)	11.7 (5.3)	<b>VS<sub>14</sub>A18S</b>
	24 (610)	18 (457)	30 (762)	12 (305)	3 (76)	240/240	6000	11.4 (1.8)	3/4 (19)	18.8 (8.5)	15.2 (6.9)	<b>VS<sub>14</sub>A24S</b>
	30 (762)	18 (457)	36 (914)	12 (305)	3 (76)	240/240	7000	10.6 (1.6)	3/4 (19)	26.7(12.1)	22.2(10.1)	<b>VS<sub>14</sub>A30S<sup>2</sup></b>
	36 (914)	18 (457)	42 (1067)	12 (305)	3 (76)	240/240	8400	10.6 (1.6)	3/4 (19)	31.8(14.4)	27.3(12.4)	<b>VS<sub>14</sub>A36S<sup>2</sup></b>
16 (406)	12 (305)	20 (508)	18 (457)	14 (356)	3 (76)	240	3500	11.6 (1.8)	3/4 (19)	14.0 (6.4)	10.2 (4.6)	<b>VS<sub>16</sub>A12S</b>
	18 (457)	20 (508)	24 (610)	14 (356)	3 (76)	240	4200	9.3 (1.4)	3/4 (19)	16.9 (7.7)	13.1 (5.9)	<b>VS<sub>16</sub>A18S</b>
	24 (610)	20 (508)	30 (762)	14 (356)	3 (76)	240/240	7000	11.6 (1.8)	3/4 (19)	20.8 (9.4)	17.0 (7.7)	<b>VS<sub>16</sub>A24S</b>
	30 (762)	20 (508)	36 (914)	14 (356)	3 (76)	240/240	7600	10.1 (1.6)	3/4 (19)	30.1(13.7)	24.2(11.0)	<b>VS<sub>16</sub>A30S<sup>2</sup></b>
	36 (914)	20 (508)	42 (1067)	14 (356)	3 (76)	240/240	9000	9.9 (1.5)	3/4 (19)	34.4(15.6)	28.5(12.9)	<b>VS<sub>16</sub>A36S<sup>2</sup></b>

All units in this table have 2 ±1/4 inch thick walls.

All units in this table are suitable for use up to 2000°F (1093°C) maximum surface temperature.

① Add Type number (Type 1 - 4) in the blank position in the part number. Example: **VS<sub>10</sub>A06S**.

For unheated units, see catalog page 430.

Overall length applies only to the full vestibule (Type 1) Units. Types 2 and 3 are shorter by one vestibule length. Type 4 length equals (B).

Type 2 (left vestibule) and Type 3 (right vestibule) style units are not stocked. They are, however, still standard units and designs are kept on file.

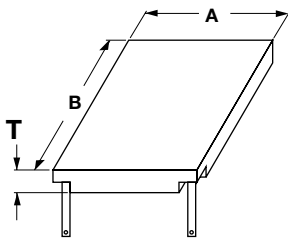
② These units have dual elements to use in "parallel" for 240V usage. Alternate designs are available for 480V, 277V and three-phase (internally wired). Contact your Watlow representative.

# High-Temperature Heaters

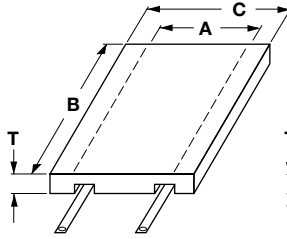


## Ceramic Fiber Heaters

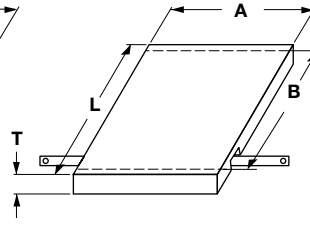
All units: T =  
2 ± 1/4 inches  
(51 ± 6 mm)



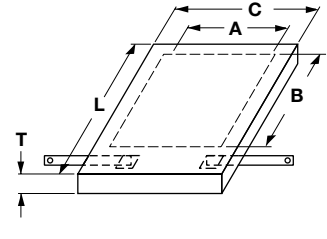
**Type 5**  
Fully Heated  
(Style A Leads Illustrated)  
(Default Lead Style)



**Type 6**  
Insulated Sides  
(Style B Leads Illustrated)



**Type 7**  
Insulated Ends  
(Style C Leads Illustrated)



**Type 8**  
Insulated All Edges  
(Style C Leads Illustrated)

(Style A, B or C leads available on any type unit. Please specify.)

### Flat Units—High Watt Density Sinuated Elements (see page 420)

Dimensions, in. (mm)				Electrical Rating			Strip Lead Width in. (mm)	Approximate Net Wt.			Part Number
Heated Size		Type 6 & 8	Type 7 & 8	Volts	Power (Watts) ±5%	Surface Loading W/in <sup>2</sup> (W/cm <sup>2</sup> )		Type 5	Type 6 & 7	Type 8	
Width (A) in. (mm)	Length (B) in. (mm)	Width (C) in. (mm)	Length (L) in. (mm)				lbs (kg)	lbs (kg)	lbs (kg)		
6 (152)	12 (305)	10 (254)	16 (406)	60	1250	17.4 (2.7)	1/2 (13)	1.7 (0.8)	2.7 (1.6)	3.6 (1.2)	VF006A12T
	18 (457)	10 (254)	22 (559)	120	2000	18.5 (2.9)	1/2 (13)	2.6 (1.2)	3.7 (2.1)	4.6 (1.7)	VF006A18T
	24 (610)	10 (254)	28 (711)	120	2500	17.4 (2.7)	1/2 (13)	3.2 (1.5)	5.0 (2.7)	5.9 (2.3)	VF006A24T
	24 (610)	10 (254)	28 (711)	240	2500	17.4 (2.7)	1/2 (13)	3.2 (1.5)	5.0 (2.7)	5.9 (2.3)	VF006A24U
	30 (762)	10 (254)	34 (864)	240	3400	18.9 (2.9)	1/2 (13)	4.5 (2.0)	7.1 (3.6)	7.9 (3.2)	VF006A30T
	36 (914)	10 (254)	40 (1016)	240	4000	18.5 (2.9)	1/2 (13)	5.5 (2.5)	8.5 (4.2)	9.3 (3.9)	VF006A36T
8 (203)	12 (305)	12 (305)	16 (406)	60	1800	18.7 (2.9)	3/4 (19)	2.3 (1.0)	3.0 (1.8)	3.9 (1.4)	VF008A12T
	18 (457)	12 (305)	22 (559)	120	3000	20.8 (3.2)	3/4 (19)	3.5 (1.6)	4.6 (2.5)	5.5 (2.1)	VF008A18T
	24 (610)	12 (305)	28 (711)	120	3600	18.7 (2.9)	3/4 (19)	4.4 (2.0)	6.1 (3.2)	7.0 (2.8)	VF008A24T
	30 (762)	12 (305)	34 (864)	240	5000	20.8 (3.2)	1/2 (13)	6.1 (2.8)	8.7 (4.4)	9.7 (4.0)	VF008A30T
	36 (914)	12 (305)	40 (1016)	240	6000	20.8 (3.2)	3/4 (19)	7.0 (3.2)	10.0 (5.0)	11.0 (4.5)	VF008A36T
	10 (254)	12 (305)	14 (356)	16 (406)	120	2000	16.7 (2.6)	1/2 (13)	2.4 (1.1)	3.7 (2.2)	4.8 (1.7)
18 (457)		14 (356)	22 (559)	120	3600	20.0 (3.1)	3/4 (19)	4.0 (1.8)	5.2 (2.9)	6.3 (2.4)	VF010A18T
24 (610)		14 (356)	28 (711)	240	4500	17.9 (2.8)	1/2 (13)	4.7 (2.1)	7.2 (3.8)	8.3 (3.3)	VF010A24T
30 (762)		14 (356)	34 (864)	240	6000	20.0 (3.1)	3/4 (19)	6.7 (3.0)	9.3 (4.8)	10.5 (4.2)	VF010A30T
36 (914)		14 (356)	40 (1016)	240	7200	20.0 (3.1)	3/4 (19)	8.5 (3.9)	11.5 (5.8)	12.7 (5.2)	VF010A36T
12 (305)		12 (305)	16 (406)	16 (406)	120	2500	17.4 (2.7)	1/2 (13)	2.9 (1.3)	4.3 (2.5)	5.5 (2.0)
	12 (305)	16 (406)	16 (406)	240	2500	17.4 (2.7)	3/8 (10)	2.9 (1.3)	4.3 (2.5)	5.5 (2.0)	VF012A12U
	18 (457)	16 (406)	22 (559)	240	4000	18.5 (2.9)	1/2 (13)	4.5 (2.0)	6.1 (3.3)	7.3 (2.8)	VF012A18T
	24 (610)	16 (406)	28 (711)	240	6000	20.8 (3.2)	3/4 (19)	6.6 (3.0)	8.6 (4.4)	9.8 (3.9)	VF012A24T
	30 (762)	16 (406)	34 (864)	240	7200	20.0 (3.1)	3/4 (19)	8.6 (3.9)	11.2 (5.7)	12.6 (5.1)	VF012A30T
	36 (914)	16 (406)	40 (1016)	240/240	8400	19.4 (3.0)	1/2 (13)	10.2 (4.6)	13.2 (6.6)	14.6 (6.0)	VF012A36T <sup>2</sup>
14 (356)	12 (305)	18 (457)	16 (406)	120	3500	20.8 (3.2)	3/4 (19)	4.2 (1.9)	5.3 (3.0)	6.7 (2.4)	VF014A12T
	18 (457)	18 (457)	22 (559)	240	4900	19.4 (3.0)	1/2 (13)	6.1 (2.8)	7.6 (4.1)	9.1 (3.4)	VF014A18T
	24 (610)	18 (457)	28 (711)	240	7000	20.8 (3.2)	3/4 (19)	8.5 (3.9)	10.5 (5.4)	11.9 (4.8)	VF014A24T
	30 (762)	18 (457)	34 (864)	240/240	8400	20.0 (3.1)	1/2 (13)	10.7 (4.9)	13.2 (6.6)	14.6 (6.0)	VF014A30T <sup>2</sup>
	36 (914)	18 (457)	40 (1016)	240/240	9800	19.4 (3.0)	1/2 (13)	12.2 (5.5)	15.2 (7.5)	16.6 (6.9)	VF014A36T <sup>2</sup>
	16 (406)	12 (305)	20 (508)	16 (406)	120	3550	18.5 (2.9)	3/4 (19)	4.7 (2.1)	5.7 (3.4)	7.4 (2.6)
18 (457)		20 (508)	22 (559)	240	5750	20.0 (3.1)	3/4 (19)	7.1 (3.2)	8.6 (4.7)	10.3 (3.9)	VF016A18T
24 (610)		20 (508)	28 (711)	240	7100	18.5 (2.9)	3/4 (19)	9.5 (4.3)	11.5 (6.0)	13.2 (5.2)	VF016A24T
30 (762)		20 (508)	34 (864)	240/240	9600	20.0 (3.1)	1/2 (13)	11.7 (5.3)	14.2 (7.2)	15.9 (6.4)	VF016A30T <sup>2</sup>
36 (914)		20 (508)	40 (1016)	240/240	11,500	20.0 (3.1)	3/4 (19)	14.2 (6.4)	17.2 (8.6)	18.9 (7.8)	VF016A36T <sup>2</sup>

All units in this table are suitable for use up to 1800°F (982°C) maximum surface temperature.

① Add Type number (Type 5 - 8) in the blank position in the part number. Example: **VF806A12T**. For unheated units, see catalog page 430.

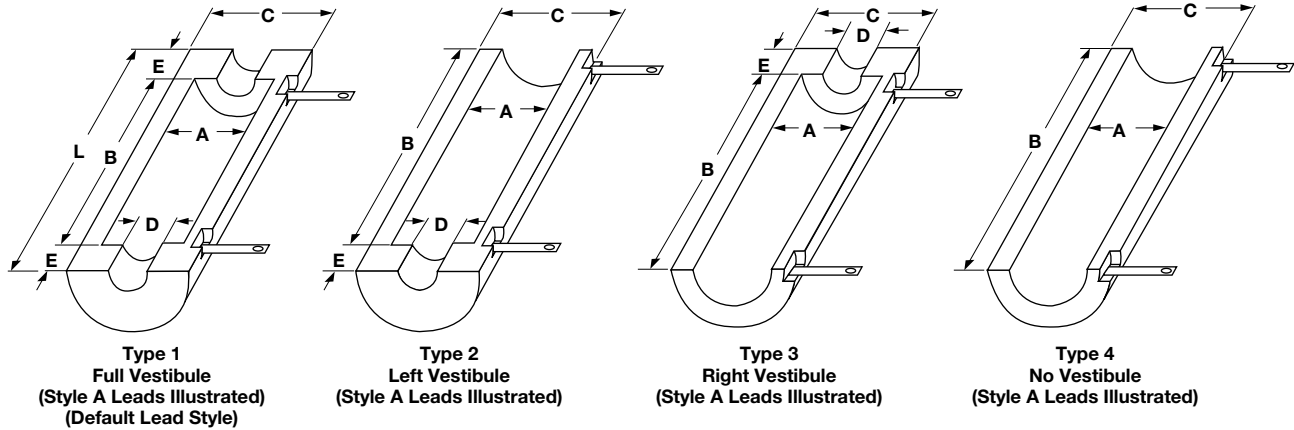
Sinuated wire, high watt density units are provided with embedded sinuated elements and high emissivity coating unless exposed sinuated is specified when manufactured. (These are not stocked.) Contact your Watlow representative.

② These units have dual elements to use in "parallel" for 240V usage. Alternate designs are available for 480V, 277V and three-phase (internally wired). Contact your Watlow representative.

# High-Temperature Heaters



## Ceramic Fiber Heaters



### Semi-Cylindrical Units—High Watt Density Sinuated Elements (see page 420)

Dimensions, in. (mm)						Electrical Ratings			Strip Lead Width in. (mm)	Approx. Net Wt.		Part Number
Heated Size			Type 1, 2, & 3 Sizes			Volts	Power (Watts) ±5%	Surface Loading W/in <sup>2</sup> (W/cm <sup>2</sup> )		Type 1 Full Vest.	Type 4 No Vest.	
I.D. (A) in. (mm) ± <sup>1</sup> / <sub>8</sub> (±3.2)	Length (B) in. (mm) + <sup>1</sup> / <sub>16</sub> - <sup>1</sup> / <sub>8</sub> (+1.6 - 3.2)	O.D. (C) in. (mm) (Ref)	Vestibule Sizes							lbs (kg)	lbs (kg)	
			Length (L) in. (mm) + <sup>1</sup> / <sub>16</sub> - <sup>1</sup> / <sub>8</sub> (+1.6 - 3.2)	Dia. (D) in. (mm) ± <sup>1</sup> / <sub>8</sub> (±3.2)	Length (E) in. (mm) + <sup>1</sup> / <sub>16</sub> - <sup>1</sup> / <sub>8</sub> (+1.6 - 3.2)							
5 (127)	6 (152)	9 (229)	11 (279)	3 <sup>1</sup> / <sub>2</sub> (89)	2 <sup>1</sup> / <sub>2</sub> (64)	60	750	15.9 (2.5)	3/8 (10)	3.1 (1.4)	2.3 (1.0)	VS <sup>®</sup> 05A06T
	12 (305)	9 (229)	17 (432)	3 <sup>1</sup> / <sub>2</sub> (89)	2 <sup>1</sup> / <sub>2</sub> (64)	60	1400	14.9 (2.3)	3/4 (19)	4.5 (2.0)	3.6 (1.6)	VS <sup>®</sup> 05A12T
	18 (457)	9 (229)	23 (584)	3 <sup>1</sup> / <sub>2</sub> (89)	2 <sup>1</sup> / <sub>2</sub> (64)	120	2100	14.9 (2.3)	1/2 (13)	5.2 (2.4)	4.3 (2.0)	VS <sup>®</sup> 05A18T
	24 (610)	9 (229)	29 (737)	3 <sup>1</sup> / <sub>2</sub> (89)	2 <sup>1</sup> / <sub>2</sub> (64)	120	2800	14.9 (2.3)	3/4 (19)	6.9 (3.1)	6.0 (2.7)	VS <sup>®</sup> 05A24T
	30 (762)	9 (229)	35 (889)	3 <sup>1</sup> / <sub>2</sub> (89)	2 <sup>1</sup> / <sub>2</sub> (64)	240	3500	14.9 (2.3)	1/2 (13)	8.3 (3.8)	7.4 (3.4)	VS <sup>®</sup> 05A30T
	36 (914)	9 (229)	41 (102)	3 <sup>1</sup> / <sub>2</sub> (89)	2 <sup>1</sup> / <sub>2</sub> (64)	240	4200	14.9 (2.3)	1/2 (13)	9.6 (4.4)	8.7 (3.9)	VS <sup>®</sup> 05A36T
6 <sup>1</sup> / <sub>2</sub> (165)	6 (152)	10 <sup>1</sup> / <sub>2</sub> (267)	12 (305)	5 (127)	3 (76)	60	1000	16.3 (2.5)	1/2 (13)	3.6 (1.6)	2.4 (1.1)	VS <sup>®</sup> 06J06T
	12 (305)	10 <sup>1</sup> / <sub>2</sub> (267)	18 (457)	5 (127)	3 (76)	120	2000	16.3 (2.5)	1/2 (13)	5.1 (2.3)	3.9 (1.8)	VS <sup>®</sup> 06J12T
	18 (457)	10 <sup>1</sup> / <sub>2</sub> (267)	24 (610)	5 (127)	3 (76)	120	3000	16.3 (2.5)	3/4 (19)	6.8 (3.1)	5.6 (2.5)	VS <sup>®</sup> 06J18T
	24 (610)	10 <sup>1</sup> / <sub>2</sub> (267)	30 (762)	5 (127)	3 (76)	240	4000	16.3 (2.5)	1/2 (13)	9.5 (4.3)	7.4 (3.4)	VS <sup>®</sup> 06J24T
	30 (762)	10 <sup>1</sup> / <sub>2</sub> (267)	36 (914)	5 (127)	3 (76)	240	5000	16.3 (2.5)	3/4 (19)	11.0 (5.0)	9.3 (4.2)	VS <sup>®</sup> 06J30T
	36 (914)	10 <sup>1</sup> / <sub>2</sub> (267)	42 (1067)	5 (127)	3 (76)	240	6000	16.3 (2.5)	3/4 (19)	12.4 (5.6)	11.2 (5.1)	VS <sup>®</sup> 06J36T
8 (203)	6 (152)	12 (305)	12 (305)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	60	1300	17.2 (2.7)	1/2 (13)	4.1 (1.9)	2.6 (1.2)	VS <sup>®</sup> 08A06T
	12 (305)	12 (305)	18 (457)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	120	2600	17.2 (2.7)	3/4 (19)	6.9 (3.1)	5.4 (2.4)	VS <sup>®</sup> 08A12T
	18 (457)	12 (305)	24 (610)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	240	3900	17.2 (2.7)	1/2 (13)	8.5 (3.9)	7.0 (3.2)	VS <sup>®</sup> 08A18T
	24 (610)	12 (305)	30 (762)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	240	5200	17.2 (2.7)	1/2 (13)	12.0 (5.4)	10.5 (4.8)	VS <sup>®</sup> 08A24T
	30 (762)	12 (305)	36 (914)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	240	6250	16.7 (2.6)	3/4 (19)	13.8 (6.3)	12.3 (5.6)	VS <sup>®</sup> 08A30T
	36 (914)	12 (305)	42 (1067)	6 <sup>1</sup> / <sub>2</sub> (165)	3 (76)	240/240	7800	17.2 (2.7)	1/2 (13)	15.6 (7.1)	14.1 (6.4)	VS <sup>®</sup> 08A36T <sup>®</sup>

CONTINUED

All units in this table have 2 ±<sup>1</sup>/<sub>4</sub> inch thick walls.

All units in this table are suitable for use up to 1800°F (982°C) maximum surface temperature.

① Add Type number (Type 1 - 4) in the blank position in the part number. Example: **VS106J06T**. For unheated units, see catalog page 430.

Sinuated wire, high watt density units are provided with embedded sinuated elements and high emissivity coating unless exposed sinuated is specified when manufactured. (These are not stocked.) Contact your Watlow representative.

Overall length applies only to the full vestibule (Type 1) units. Types 2 and 3 are shorter by one vestibule length. Type 4 length equals (B).

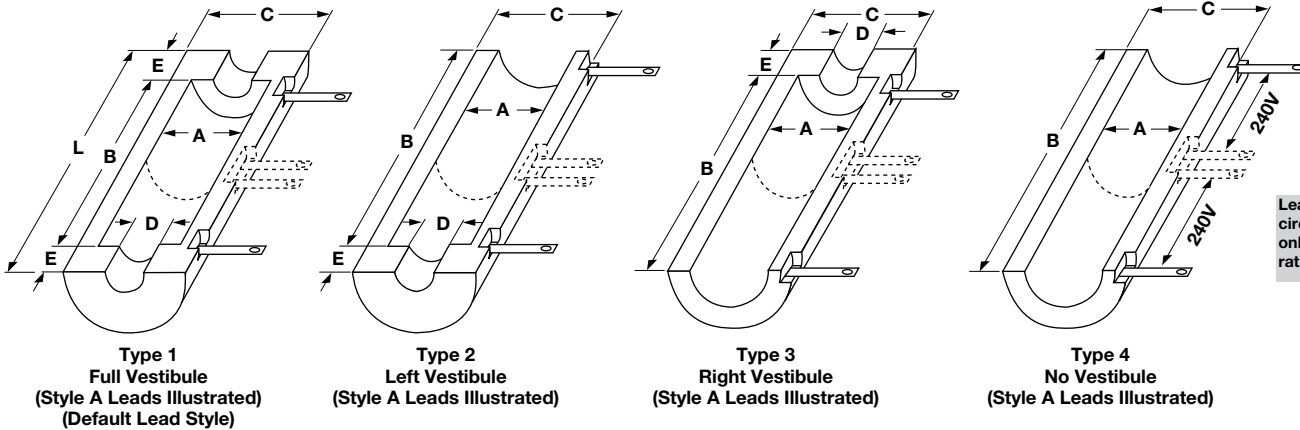
Type 2 (left vestibule) and Type 3 (right vestibule) style units are not stocked. They are, however, still standard units and designs are kept on file.

② These units have dual elements to use in "parallel" for 240V usage. Alternate designs are available for 480V, 277V and three-phase (internally wired). Contact your Watlow representative.

# High-Temperature Heaters



## Ceramic Fiber Heaters



Leads on dual circuit units only. See ratings below.

### Semi-Cylindrical Units—High Watt Density Sinuated Elements (Con't.) (see page 420)

Dimensions, in. (mm)						Electrical Ratings			Strip Lead Width in. (mm)	Approx. Net Wt.		Part Number
Heated Size			Type 1, 2, & 3 Sizes			Power (Watts) ±5%	Surface Loading W/in <sup>2</sup> (W/cm <sup>2</sup> )	Type 1 Full Vest. lbs (kg)		Type 4 No Vest. lbs (kg)		
I.D. (A) in. (mm) ±1/8 (±3.2)	Length (B) in. (mm) +1/16 -1/8 (+1.6 - 3.2)	O.D. (C) in. (mm) (Ref)	Vestibule Sizes									
			Length (L) in. (mm) +1/16 -1/8 (+1.6 - 3.2)	Dia. (D) in. (mm) ±1/8 (±3.2)	Length (E) in. (mm) +1/16 -1/8 (+1.6 - 3.2)	Volts						
10 (254)	12 (305)	14 (356)	18 (457)	8 (203)	3 (76)	240	3200	17.0 (2.6)	1/2 (13)	8.5 (3.9)	5.8 (2.6)	VS <sup>①</sup> 10A12T
	18 (457)	14 (356)	24 (610)	8 (203)	3 (76)	240	4800	17.0 (2.6)	1/2 (13)	12.0 (5.4)	9.3 (4.2)	VS <sup>①</sup> 10A18T
	24 (610)	14 (356)	30 (762)	8 (203)	3 (76)	240	6400	17.0 (2.6)	3/4 (19)	13.8 (6.3)	11.1 (5.0)	VS <sup>①</sup> 10A24T
	30 (762)	14 (356)	36 (914)	8 (203)	3 (76)	240/240	8000	17.0 (2.6)	1/2 (13)	17.6 (8.0)	14.9 (6.8)	VS <sup>①</sup> 10A30T <sup>②</sup>
	36 (914)	14 (356)	42 (1067)	8 (203)	3 (76)	240/240	9600	17.0 (2.6)	1/2 (13)	21.3 (9.7)	18.6 (8.4)	VS <sup>①</sup> 10A36T <sup>②</sup>
12 (305)	12 (305)	16 (406)	18 (457)	10 (254)	3 (76)	240	3800	16.8 (2.6)	1/2 (13)	8.9 (4.0)	5.9 (2.7)	VS <sup>①</sup> 12A12T
	18 (457)	16 (406)	24 (610)	10 (254)	3 (76)	240	5700	16.8 (2.6)	3/4 (19)	11.2 (5.1)	8.1 (3.7)	VS <sup>①</sup> 12A18T
	24 (610)	16 (406)	30 (762)	10 (254)	3 (76)	240	7600	16.8 (2.6)	3/4 (19)	16.7 (7.6)	13.6 (6.2)	VS <sup>①</sup> 12A24T
	30 (762)	16 (406)	36 (914)	10 (254)	3 (76)	240/240	9600	17.0 (2.6)	1/2 (13)	18.0 (8.2)	14.9 (6.8)	VS <sup>①</sup> 12A30T <sup>②</sup>
	36 (914)	16 (406)	42 (1067)	10 (254)	3 (76)	240/240	11400	16.8 (2.6)	3/4 (19)	19.2 (8.7)	16.1 (7.3)	VS <sup>①</sup> 12A36T <sup>②</sup>
14 (356)	12 (305)	18 (457)	18 (457)	12 (305)	3 (76)	240	4400	16.7 (2.6)	1/2 (13)	11.4 (5.2)	7.7 (3.5)	VS <sup>①</sup> 14A12T
	18 (457)	18 (457)	24 (610)	12 (305)	3 (76)	240	6600	16.7 (2.6)	3/4 (19)	12.9 (5.9)	9.4 (4.3)	VS <sup>①</sup> 14A18T
	24 (610)	18 (457)	30 (762)	12 (305)	3 (76)	240/240	8800	16.7 (2.6)	1/2 (13)	16.3 (7.4)	12.7 (5.8)	VS <sup>①</sup> 14A24T <sup>②</sup>
	30 (762)	18 (457)	36 (914)	12 (305)	3 (76)	240/240	11400	17.3 (2.7)	3/4 (19)	19.4 (8.8)	15.8 (7.2)	VS <sup>①</sup> 14A30T <sup>②</sup>
	36 (914)	18 (457)	42 (1067)	12 (305)	3 (76)	240/240	13200	16.7 (2.6)	3/4 (19)	22.4 (10.2)	18.8 (8.5)	VS <sup>①</sup> 14A36T <sup>②</sup>
16 (406)	12 (305)	20 (508)	18 (457)	14 (356)	3 (76)	240	5000	16.6 (2.6)	3/4 (19)	11.8 (5.4)	8.0 (3.6)	VS <sup>①</sup> 16A12T
	18 (457)	20 (508)	24 (610)	14 (356)	3 (76)	240/240	7500	16.6 (2.6)	1/2 (13)	15.1 (6.8)	11.3 (5.1)	VS <sup>①</sup> 16A18T
	24 (610)	20 (508)	30 (762)	14 (356)	3 (76)	240/240	10,000	16.6 (2.6)	1/2 (13)	18.1 (8.2)	14.3 (6.5)	VS <sup>①</sup> 16A24T <sup>②</sup>
	30 (762)	20 (508)	36 (914)	14 (356)	3 (76)	240/240	12,800	16.8 (2.6)	3/4 (19)	22.3 (10.1)	18.5 (8.4)	VS <sup>①</sup> 16A30T <sup>②</sup>
	36 (914)	20 (508)	42 (1067)	14 (356)	3 (76)	240/240	15,000	16.6 (2.6)	3/4 (19)	26.4 (12.0)	22.6 (10.3)	VS <sup>①</sup> 16A36T <sup>②</sup>

All units in this table have 2 ±1/4 inch thick walls.

All units in this table are suitable for use up to 1800°F (982°C) maximum surface temperature.

① Add Type number (Type 1 through 4) in the blank position in the part number. Example **VS106J06T**. For unheated units, see catalog page 430.

Sinuated wire, high watt density units are provided with embedded sinuated elements and high emissivity coating unless exposed sinuated is specified when manufactured. (These are not stocked.) Contact your Watlow representative.

Overall length applies only to the full vestibule (Type 1) units. Types 2 and 3 are shorter by one Vestibule length. Type 4 length equals (B).

Type 2 (left vestibule) and Type 3 (right vestibule) style units are not stocked. They are, however, still standard units and designs are kept on file.

② These units have dual elements to use in "parallel" for 240V usage. Alternate designs are available for 480V, 277V and three-phase (internally wired). Contact your Watlow representative.



# High-Temperature Heaters



## Ceramic Fiber Heaters

### Ordering Information

VF - Flat

VS - Semi-Cylindrical

#### Part Number

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭
Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Base Code Nbr.	Modification Options			Lead Options	Lead Length
V	F	5	1	2	A	1	2	S		0	0		

#### ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ Base Code Number

⑩ Modification Options	
0 =	None
A =	0.140 thermocouple tube I.D. center of heated length of unit
B =	0.265 thermocouple tube I.D. center of heated length of unit
E =	Black surface coat
F =	Black surface coat 0.140 thermocouple tube I.D. center of heated length of unit
G =	Black surface coat 0.265 thermocouple tube I.D. center of heated length of unit

⑬ Lead Options	
0 =	None
1 =	601 Alloy 600 strip A style
2 =	601 Alloy 600 strip B style
3 =	601 Alloy 600 strip C style
9 =	Flex NI, MGT A style
A =	Flex NI, MGT B style
B =	Flex NI, MGT C style
E =	Chromel® -A / NI, A style
F =	Chromel® -A / NI, B style
G =	Chromel® -A / NI, C style

⑭ Lead Length			
A =	0 in.	T =	14 in.
B =	1 in.	U =	15 in.
E =	2 in.	V =	16 in.
F =	3 in.	W =	17 in.
G =	4 in.	X =	18 in.
H =	5 in.	Y =	19 in.
J =	6 in.	1 =	20 in.
K =	7 in.	2 =	21 in.
L =	8 in.	3 =	22 in.
M =	9 in.	4 =	23 in.
N =	10 in.	6 =	24 in.
P =	11 in.	7 =	30 in.
R =	12 in.	8 =	36 in.
S =	13 in.	9 =	42 in.



## Ceramic Fiber Heaters

### How to Order

#### Made-to-Order

##### Ordering Information

**Quantity:** When ordering, specify quantity of units desired. Semi-cylindrical units are sold as “each half.” Two halves to make a pair are usually required. Please include the number of desired spares or extras in the total quantity.

**Part number:** Use the part number if an exact re-order of a previously designed made-to-order unit is needed. Please reconfirm volts and watts, lead orientation and length. Most heaters allow selection of several stock modifications (see page 432) and termination options (see pages 426 and 427).

**Dimensions for made-to-order units:** Include a drawing if possible. Specify the heated area, width and length, overall width/length, thickness, electrical ratings, etc.

**Wattage:** 6.5 to 25 W/in<sup>2</sup> (1.0 - 3.9 W/cm<sup>2</sup>) on the heating surface is the recommended watt density range for operation in the 1500 to 2200°F (815 - 1204°C) range. (Note: At the higher temperatures, lower watt densities must be employed.) Please provide operating temperatures and conditions. Contact your Watlow representative for higher watt densities at other temperatures. Generally, for higher operating temperature limits, lower watt densities must be used.

**Voltage:** 60, 120 and 240VAC are offered on units. However, up to 600 volts is possible with extended capabilities. Internally connected three-lead, three-phase units are also available on made-to-order units (these are normally internally wye-connected). Contact your Watlow representative on special voltage requirements.

**Leads:** Lead length and orientation (i.e. **Style A, B or C**). Lead **Style A**, 12 in. (305 mm) long.

**Shipping weight:** The product listing tables show net weights per unit. To estimate gross shipping weight, add 30 percent to the total. Additional shipping/packaging charges may be incurred for certain large orders. Due to the light weight but large size of these heaters, dimensional box weighting may occur on expedited air shipments.

##### Ordering Hints

Ordering ceramic fiber heaters is easy. However, it is very important to pay attention to part numbers and special modifications details.

- Always fill in the “...\_...” (blank) code position with the correct Type number (see illustrations above the charts).
- Always provide the correct Lead Style letter. (See suggested illustrations above the charts, but Style A-12 will be the default lead if not otherwise specified.)
- Supply a drawing or sketch whenever possible to eliminate confusion.
- When ordering Type 6, 7, 8 units, be certain of the heated area and no-heat area orientations desired.
- When planning to order Type 2 and/or Type 3 units (left or right vestibule), there are three options to consider—two of which could be used on the Type 1 items:
  1. Order the appropriate full vestibule unit. The customer can carefully remove the unneeded vestibule.
  2. Order the full vestibule unit. Prior to shipping Watlow will remove the unneeded vestibule as a stock modification. There is a small additional charge for this.
  3. Special order the desired Type 2 or 3 unit. This requires extended manufacturing of the heater and increases delivery time, but will minimize costs.

# Specialty Heaters



Specialty Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
<b>FLUENT® In-line</b>	444 stainless steel (substrate tube), 316L stainless steel (baffle and fittings)	482	250	450	70	<b>445</b>
<b>ULTRAMIC® Advanced Ceramic</b>	Aluminum nitride	1112	600	1000	155	<b>449</b>
<b>Thick Film Conduction</b>	430 stainless steel	1022	550	75	11.6	<b>453</b>
<b>Coil/Cable</b>	304 stainless steel or alloy 600	1200	650	30	4.6	<b>457</b>





# Specialty Heaters



## FLUENT® In-line Heaters

Watlow's FLUENT® in-line fluid heater is a small, lightweight, high-performance heater that can replace both a traditional immersion type heater or a heater wrapped around a tube as part of a thermal system. Watlow's FLUENT heater is designed as an integrated solution that replaces multiple components in a system. This heater design reduces overall system cost and complexity. Because of its high watt density, it offers ultra-fast response leading to higher system performance. Featuring Watlow's patented layered heater technology, the heater makes use of its entire surface to produce heat, which optimizes heat transfer and temperature uniformity.

### Features and Benefits

#### Small, lightweight, robust heater construction

- Replaces multiple components in a system
- Reduces overall system size
- Lowers total cost of ownership

#### Patented circuit patterning process

- Facilitates customizable heating profiles
- Enables distributed wattage and/or multiple zones
- Assures precise and repeatable power distribution

#### High watt density, low mass heater

- Contributes to fast response time
- Allows for efficient heat transfer
- Enables on-demand process start-up



### Typical Applications

- Hemodialysis fluid heating
- Food cooking equipment
- Semiconductor purge and carrier gas heating
- Ink preheating systems
- On-demand fluid heating

# Specialty Heaters

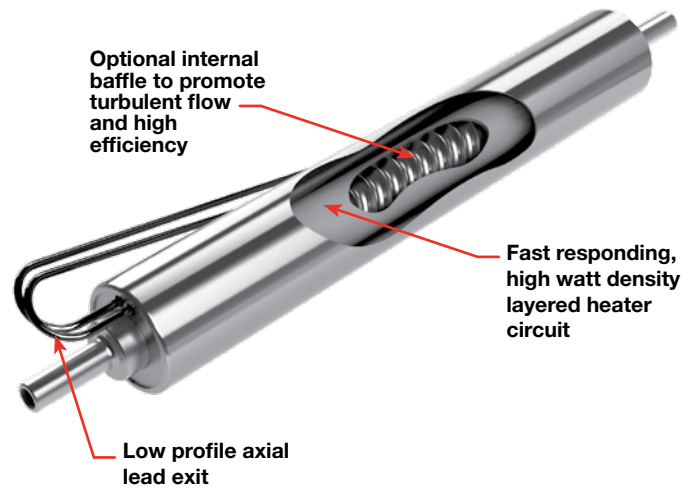


## FLUENT In-line Heaters

### Technical Information

#### Specifications

- Substrate tube material: 444 SS
- Fitting and baffle material: 316L SS
- Voltage up to 240V
- Amperage up to 15A per zone
- Resistance tolerance +10%, -5%
- Typical maximum watt densities
  - Air 150 W/in<sup>2</sup> (23 W/cm<sup>2</sup>)
  - Water 450 W/in<sup>2</sup> (70 W/cm<sup>2</sup>)
- Maximum pressure: 150psi (10.2 bar)
- Maximum temperature: 482°F (250°C) as measured by internal T/C
- UL®/cUL® and CE



#### Application Orientation

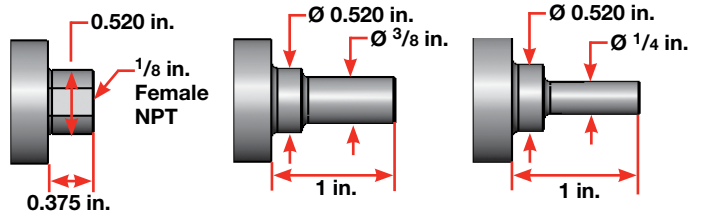
**Gas Heating—**  
(Any orientation)



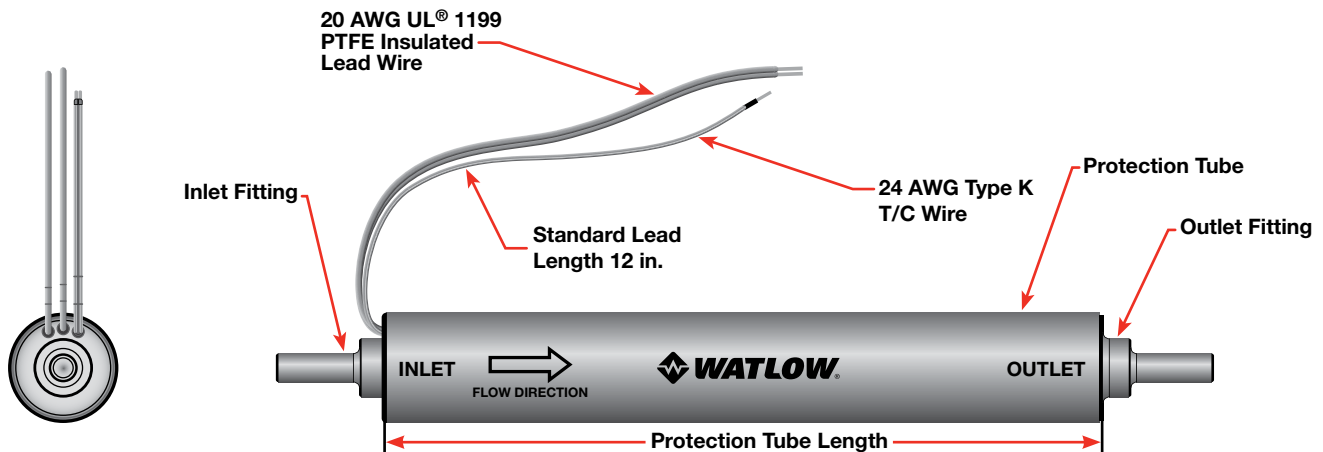
**Liquid Heating—**  
(Heater must be vertical with inlet at the bottom)



#### Inlet/Outlet Fitting Options



#### Standard Construction





## FLUENT In-line Heaters

### Technical Information

#### Standard Product Offering: Base Heaters

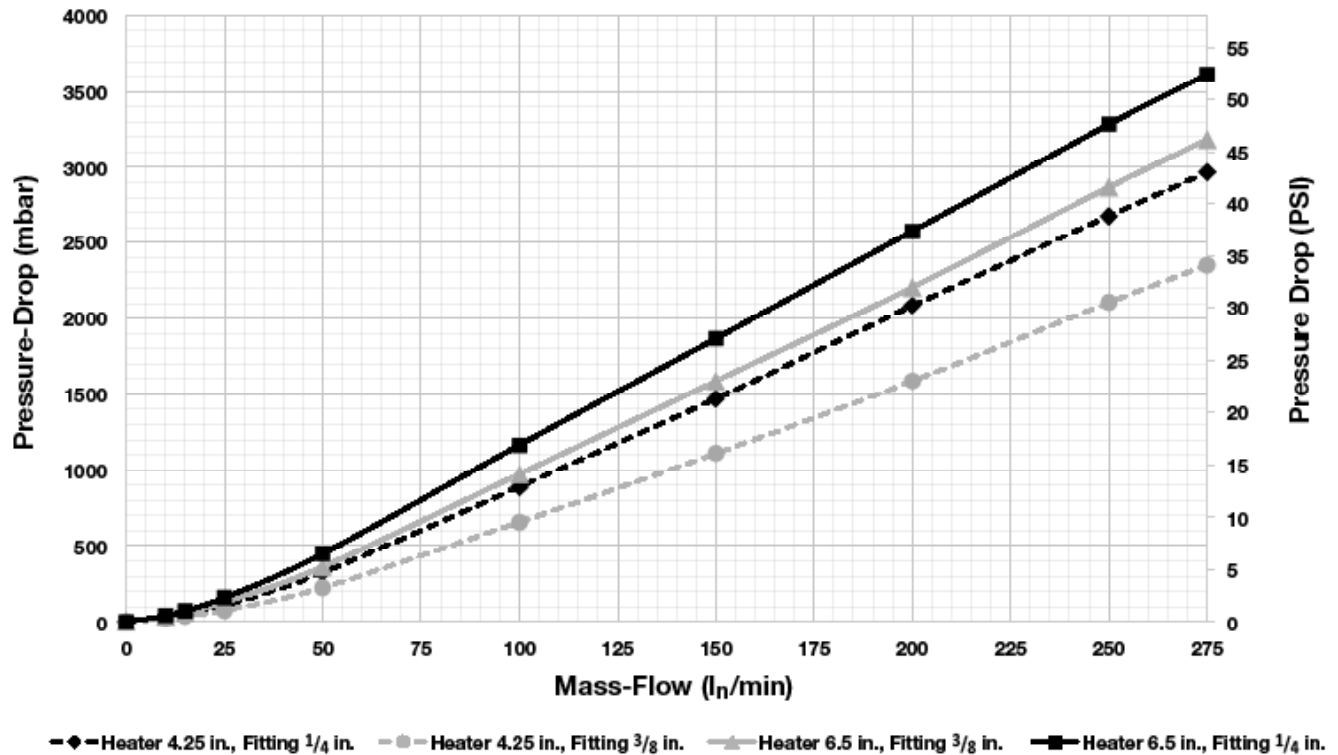
Volts	Watts	Protection Tube Length in. (mm)	Number of Heating Circuits	Watt Density (W/in <sup>2</sup> )
240	500	3.00 (76)	1	210
120	250	4.25 (108)	1	57
240	1,000	4.25 (108)	1	228
120	375	5.25 (133)	1	62
240	1,500	5.25 (133)	1	247
120	500	6.50 (165)	1	63
240	2,000	6.50 (165)	1	250
120	750	6.50 (165)	2	94
240	3,000	6.50 (165)	2	375
120	1,000	7.75 (197)	2	100
240	4,000	7.75 (197)	2	400
240	500	6.50 (165)	1	63

#### How to Specify a Standard Product:

- Select a base heater from the chart to the left.
- Choose the desired inlet and outlet fittings from page 446.

**Note:** Visit [www.watlow.com/fluent](http://www.watlow.com/fluent) for the latest list of standard designs and product information.

#### Pressure Drop - Air - With Internal Baffle @ 250°C



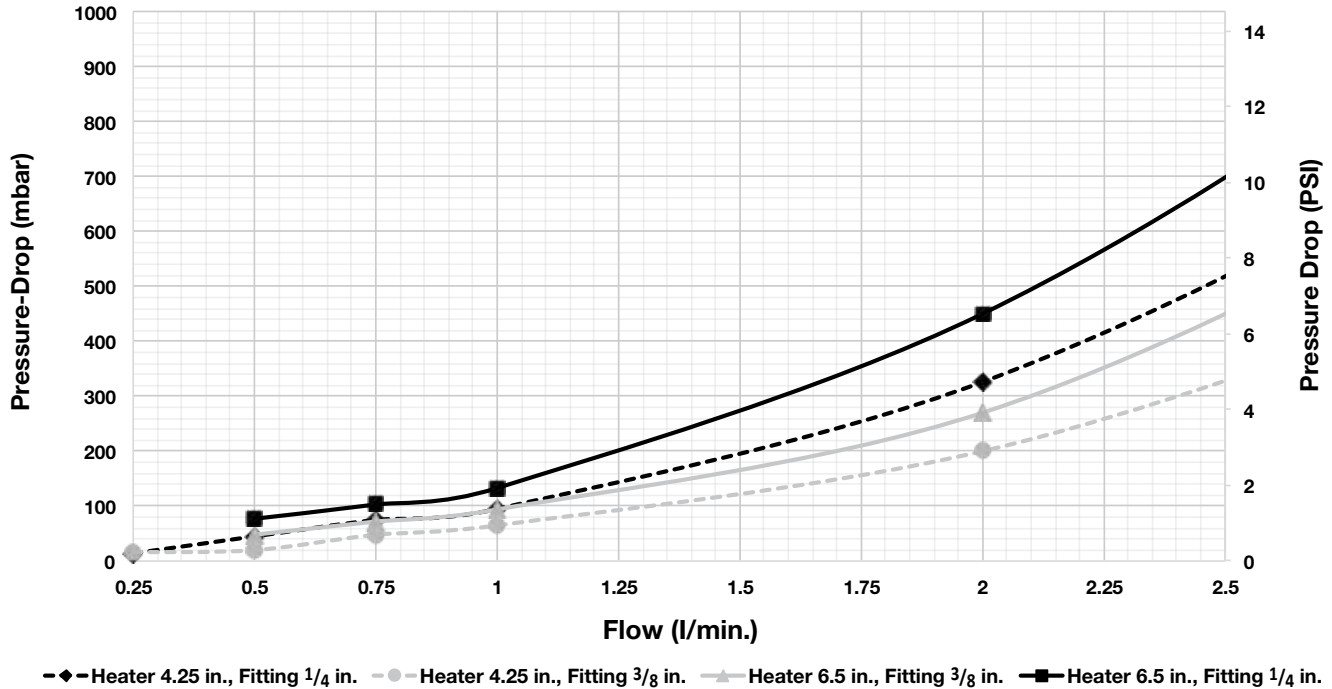
**Note:** Internal baffle is required for all gas heating applications.



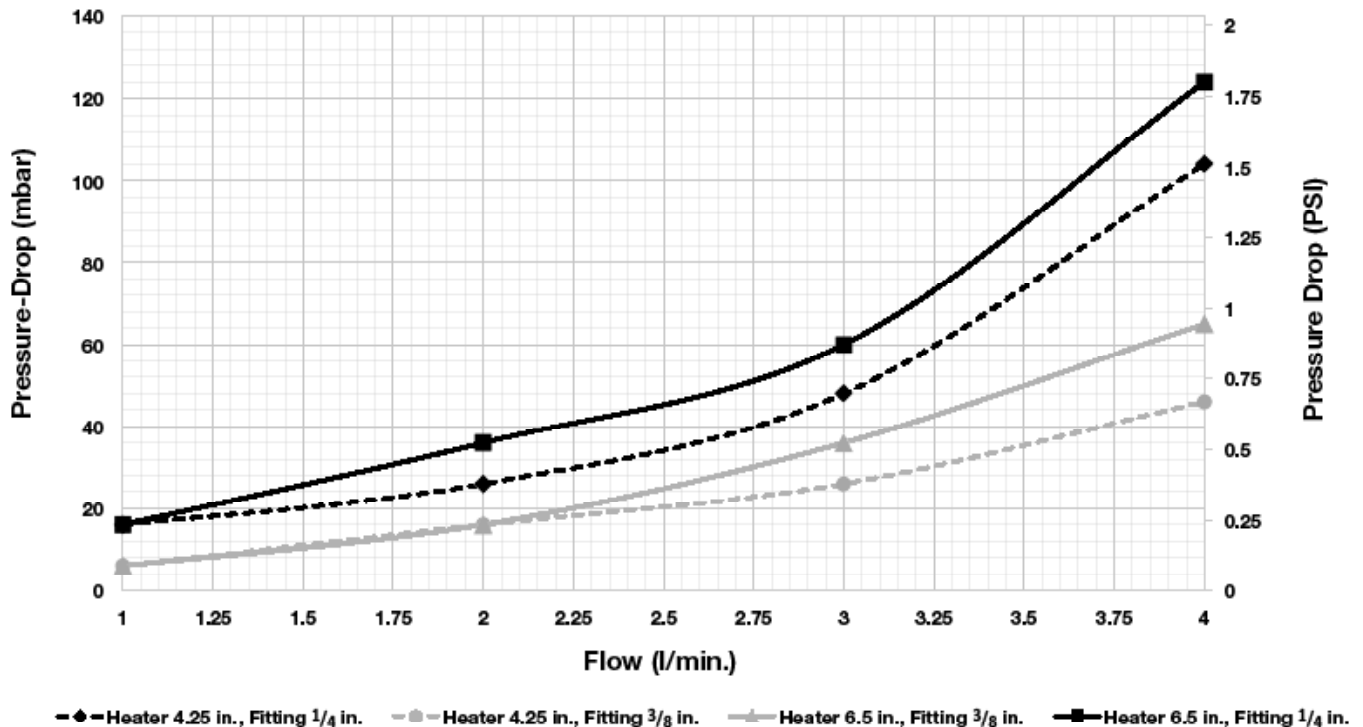
## FLUENT In-line Heaters

### Technical Information

#### Pressure Drop - Water - With Internal Baffle



#### Pressure Drop - Water - Without Internal Baffle



Heater internal temperature will vary based on flow rate, heater watt density and presence of the internal baffle, which increases turbulent flow. General guidelines for baffle consideration:

- For flow rates below 1 l/min, baffle should always be used to prevent an over-temperature condition.
- For flow rates over 1 l/min, removing the baffle is possible but will result in a higher internal temperature.



# Specialty Heaters



## ULTRAMIC® Advanced Ceramic Heaters

Watlow's high performance ULTRAMIC® advanced ceramic heaters are designed for thermal applications that require optimal effectiveness of equipment and processes.

Constructed with aluminum nitride (AlN), ULTRAMIC heaters' thermally matched proprietary heating element provides maximum performance in challenging applications. AlN is especially suitable for applications that require a clean, non-contaminating heat source. Its excellent geometric stability ensures consistent part-to-part thermal contact during heating cycles.

Watlow AlN heaters operate up to 400°C (752°F)<sup>①</sup> with an ultra-fast ramp rate of up to 150°C (270°F) per second depending on the application, heater design and process parameters. In addition to its excellent thermal characteristics, the ULTRAMIC provides high electrical isolation and typically provides superior chemical resistance compared to traditional metal heaters.

### Performance Capabilities

- Standard operating temperature up to 400°C (752°F)<sup>①</sup>
- Watt densities up to 155 W/cm<sup>2</sup> (1000 W/in<sup>2</sup>)
- Temperature ramp rate up to 150°C (270°F) per second (depending on application parameters)

### Features and Benefits

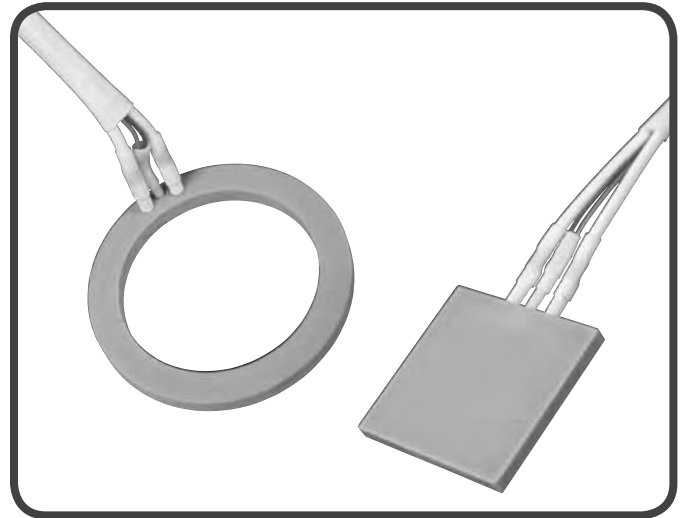
#### Robust AlN ceramic

- Creates a homogeneous assembly for atmospheric and vacuum applications
- Provides durable heater construction and thermal transfer necessary for high temperature and long heater life
- Supports the design of a high watt density, fast responding heater in a very small package
- Ensures geometric stability due to low coefficient of thermal expansion

#### Superior electrical performance

- Assures low leakage current
- Enables high breakdown voltage

<sup>①</sup> 400°C (752°F) maximum operating temperature is standard. Higher temperature operation up to 600°C (1112°F) is available as an extended capability. Contact your Watlow representative for information.



### High thermal conductivity

- Makes for an ultra-fast temperature ramp rate of up to 150°C (270°F) per second (depending on application parameters)
- Allows for quick cool-down
- Provides extremely uniform temperatures over the heater's surface

### Type K thermocouple integrated into assembly

- Ensures reliable heater/sensor interface
- Improves accuracy with optimized temperature sensing
- Provides ramping applications with a high response rate

### UL® and CE agency compliance

- Meets global safety standards
- Includes RoHS compliance

### Typical Applications

- Wire and die bonding
- Integrated circuit (IC) chip testing
- Mass spectrometry
- Clinical diagnostic equipment
- High speed packaging/sealing
- Respiratory therapy equipment



## ULTRAMIC Advanced Ceramic Heaters

### Technical Data

#### Mounting Guidelines

- Temperature <math><200^{\circ}\text{C}</math> (392°F): bond with high-temperature epoxy adhesive
- Clamp using single or multiple-point fasteners

#### Optional Thermocouple

- Bonded Type K thermocouple for <math><400^{\circ}\text{C}</math> (752°F)

#### Specifications and Tolerances

##### Surface Finish

- Flatness: <math><0.05\text{ mm}</math> (0.002 in.)
- Parallelism: <math><0.05\text{ mm}</math> (0.002 in.)
- Surface roughness (Ra): <math><1.5\text{ }\mu\text{m}</math>

##### Dimensional Tolerance (length/width/diameter)

- $\pm 1\%$  of dimension ( $\pm 0.13\text{ mm}$  minimum)

##### Electrical Properties

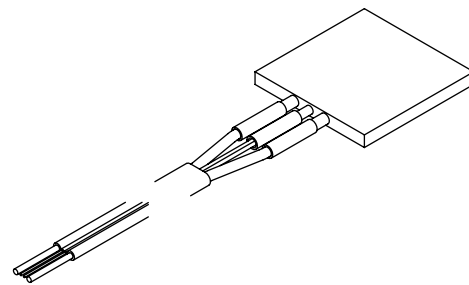
- TCR:  $0.0015/^{\circ}\text{C}$
- Resistance tolerance:  $\pm 25\%$

##### Intellectual Property

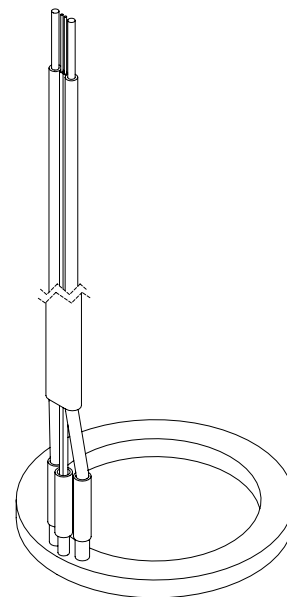
- U.S. Patents 7,696,455, 7,832,616 and 8,242,416

#### Lead Wire and Terminations

- Power terminals exit locations — extended from side edge or top face
- PTFE insulated silver-plated copper lead extension
- Lead extension length — standard length 305 mm (12 in.)
- Optional length of ceramic beads



Side Lead Exit



Top Lead Exit

# Specialty Heaters

**EXTENDED  
CAPABILITY**



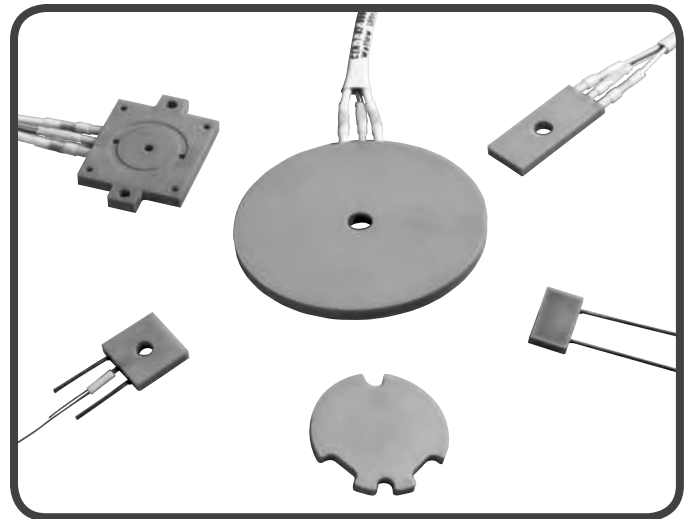
## Extended Capabilities for ULTRAMIC Advanced Ceramic Heaters

### Mounting Guidelines<sup>①</sup>

- In addition to the options listed on the previous page, a screw hole can be provided on custom designs (recommend insulation buffer such as mica spacer)

### Optional Sensors

- In addition to, or in place of the standard bonded thermocouple, a drilled hole or slot can be provided for installing an externally mounted sensor



### Configurations and Dimensions

Dimensional Features				
	Length	Width	Thickness	Aspect Ratio
<b>Flat Square</b>	Min: 8 mm (0.315 in.) Max: 100 mm (3.94 in.)		Min: 2.5 mm (0.098 in.) Max: 5 mm (0.196 in.)	1
<b>Rectangular</b>	Max: 100 mm (3.94 in.)	Min: 8 mm (0.315 in.)	Min: 2.5 mm (0.098 in.) Max: 5 mm (0.196 in.)	<10
	Inside Diameter I.D.	Outside Diameter O.D.	Thickness	Ring Wall Thickness
<b>Ring</b>	Min: 0	Max: O.D. 100 mm (3.94 in.)	Min: 2.5 mm (0.098 in.) Max: 5 mm (0.196 in.)	Min wall thickness: 3 mm (0.118 in.)
Machined Features				
Straight Groove Custom Feature			Hole Size Round Diameter	
Width: 0.5 mm (0.019 in.)			Min: 0.5 mm (0.019 in.)	
Electrical Properties				
Voltage			Max. Temperature	
12 to 480V			400°C (752°F) standard, 600°C (1112°F) extended capability	

<sup>①</sup> See [www.watlow.com/ultramic](http://www.watlow.com/ultramic) for detailed mounting guide.



## ULTRAMIC Advanced Ceramic Heaters

### Technical Data

#### Product Ordering Information

Part Number	Dimensions mm (in.)	Thickness mm (in.)	Watt Density	Watts	Volts	Lead Exit
<b>Square</b>						
CER-1-01-00002	25 mm x 25 mm (0.98 in. x 0.98 in.)	2.5 mm (0.10 in.)	High	967	240	Side
CER-1-01-00374	50 mm x 50 mm (1.97 in. x 1.97 in.)	3.0 mm (0.12 in.)	Medium	1938	240	Side
CER-1-01-00093	25 mm x 25 mm (0.98 in. x 0.98 in.)	2.5 mm (0.10 in.)	Low	150	120	Side
CER-1-01-00097	19 mm x 19 mm (0.75 in. x 0.75 in.)	2.5 mm (0.10 in.)	Low	200	120	Side
CER-1-01-00333	15 mm x 15 mm (0.59 in. x 0.59 in.)	2.5 mm (0.10 in.)	Medium	150	48	Side
CER-1-01-00334	12 mm x 12 mm (0.47 in. x 0.47 in.)	2.5 mm (0.10 in.)	High	200	48	Side
CER-1-01-00335	8 mm x 8 mm (0.31 in. x 0.31 in.)	3.0 mm (0.12 in.)	Low	21.5	12	Top
<b>Heaters With Holes</b>						
CER-1-01-00540	12 mm x 12 mm <sup>①</sup> (0.47 in. x 0.47 in.)	2.5 mm (0.10 in.)	Medium	100	24	Side
CER-1-01-00541	25 mm x 25 mm <sup>②</sup> (0.98 in. x 0.98 in.)	2.5 mm (0.10 in.)	High	800	120	Side
CER-1-01-00542	50 mm x 50 mm <sup>②</sup> (1.97 in. x 1.97 in.)	3.0 mm (0.12 in.)	Medium	1500	240	Side
<b>Rectangular</b>						
CER-1-01-00001	25 mm x 15 mm (0.98 in. x 0.6 in.)	2.5 mm (0.10 in.)	High	580	120	Side
CER-1-01-00003	50 mm x 10 mm (1.97 in. x 0.39 in.)	2.5 mm (0.10 in.)	Medium	582	120	Side
CER-1-01-00004	50 mm x 10 mm (1.97 in. x 0.39 in.)	2.5 mm (0.10 in.)	High	770	240	Side
CER-1-01-00005	50 mm x 25 mm (1.97 in. x 0.98 in.)	2.5 mm (0.10 in.)	Medium	1453	240	Side
CER-1-01-00007	75 mm x 25 mm (2.95 in. x 0.98 in.)	2.5 mm (0.10 in.)	Medium	1455	240	Side
CER-1-01-00098	25 mm x 15 mm (0.98 in. x 0.6 in.)	2.5 mm (0.10 in.)	Low	180	120	Side
CER-1-01-00105	50 mm x 25 mm (1.97 in. x 0.98 in.)	2.5 mm (0.10 in.)	Low	100	120	Side
<b>Ring</b>						
CER-1-02-00001	38 mm x 29 mm (1.50 in. x 1.14 in.)	3.0 mm (0.12 in.)	High	733	120	Top
CER-1-02-00002	77.5 mm x 59 mm (3.05 in. x 2.32 in.)	3.0 mm (0.12 in.)	Medium	770	240	Top
CER-1-02-00074	25.4 mm solid disk (1 in.)	2.5 mm (0.10 in.)	Medium	300	120	Side

<sup>①</sup> 3 mm (0.12 in.) hole in center of heater

<sup>②</sup> 5 mm (0.19 in.) hole in center of heater

See page 450 for lead exit details (full drawings and current list of standard designs available at [www.watlow.com/ultramic](http://www.watlow.com/ultramic))

#### Configurations include:

- Power lead wires with 305 mm (12 in.) of PTFE insulation
- Bonded Type K thermocouple with 305 mm (12 in.) PTFE insulated lead wires

**Note:** Maximum temperature is 400°C (752°F). Lead wires are rated to 205°C (401°F).

If ceramic beads are required, please contact your Watlow representative for a quote.

# Specialty Heaters



## Thick Film Conduction Heaters

The Watlow 430 stainless steel thick film conduction heater is ideal for many applications where fast response and uniformity are essential. A clamp-on, thick film heater provides the best possible combination of heat transfer, thermal efficiency, temperature response and uniformity in a low profile package.

This high-performance heater can be used in areas where space is limited or where conventional heaters cannot be used due to limited voltage and wattage combinations.

Thick film conduction heaters provide a low profile in a variety of shapes including two-dimensional circular and rectangular forms. Direct contact of thick film heaters to surfaces ensures efficient heat transfer through thermally stable substrates and precise resistance trace patterns.

### Performance Capabilities

- Maximum substrate temperature up to 1022°F (550°C). Contact your Watlow representative for applications over 842°F (450°C)
- Watt densities up to 75 W/in<sup>2</sup> (11.6 W/cm<sup>2</sup>)
- Voltages up to 240V

### Features and Benefits

#### Watt densities up to 75 W/in<sup>2</sup> (11.6 W/cm<sup>2</sup>) for clamp-on applications

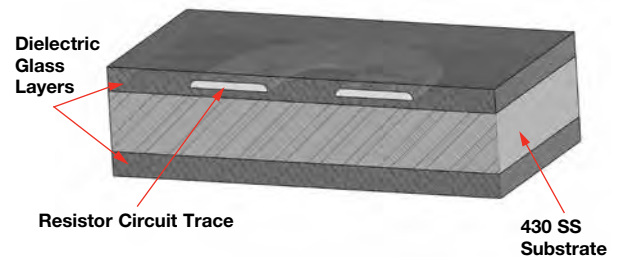
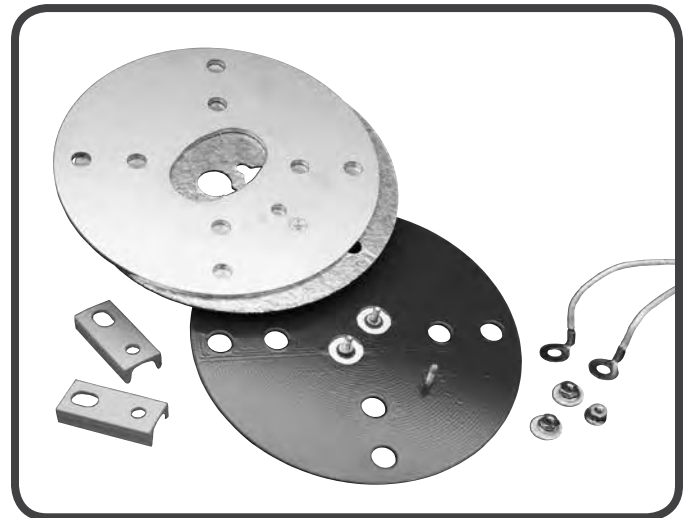
- Allows precise, repeatable wattage distribution and uniform temperature profile

#### Threaded stud termination

- Produces strong, trouble-free connections, see *Termination Assembly* drawing on page 454

#### Agency approvals

- UL<sup>®</sup> component recognition available upon request



### Typical Applications

- Food warming cabinets
- Load dump resistors
- Seal bars
- Deposition chamber lids

# Specialty Heaters



## Thick Film Conduction Heaters

### Technical Information

#### Specifications

**Min. length**

- 2.25 in. (57 mm)

**Max. length**

- 24 in. (610 mm)

**Max. voltage**

- 240VAC

**Max. amperage**

- 25A

**Terminations**

- Stud terminals

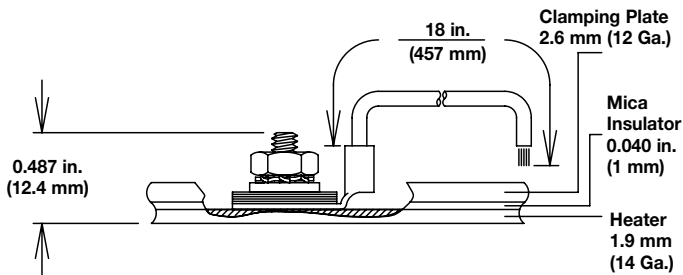
**Substrate**

- 14 ga. typical

**Features**

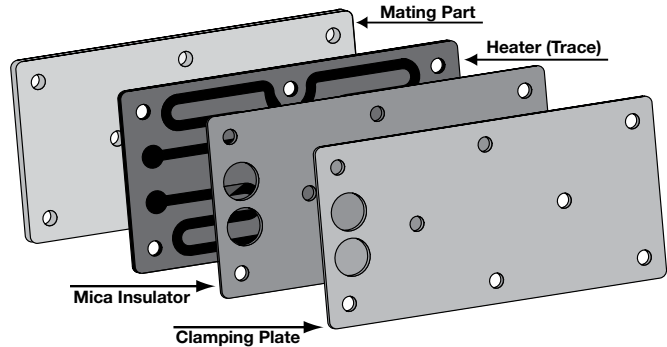
- Holes/slots up to 15% of area

#### Termination Assembly



To install, mount the heater to the surface being heated and assemble mounting hardware. Standard measurements of assembly hardware are illustrated in the *Termination Assembly* drawing above. Please refer to the *Installation and Maintenance Manual (316-42-32-1)* that is supplied with the heater for proper mounting instructions.

#### Construction



Thick film conduction heaters, designed for clamp-on applications, are supplied as a multi-part assembly: heater, mica insulator, clamping plate and mounting hardware.

The mica insulator acts as a thermal barrier to effectively force heat into the part being heated and as an additional protective layer for the heater.

The clamping plate distributes pressure evenly across the entire surface of the heater to promote close contact between the thick film heater and the part to be heated.

The mounting hardware is designed to effectively clamp to the part requiring heat, based on the heater size.

# Specialty Heaters

**EXTENDED  
CAPABILITY**



## Extended Capabilities for Thick Film Conduction Heaters

### Specifications

#### Min. Length

- 2.25 in. (57 mm)

#### Max. Length

- 24 in. (610 mm)

#### Max. Voltage

- 240VAC

#### Max. Amperage

- 25A

#### Terminations

- Stud terminals , soldered leads 480°F (250°C),  
rubber molded flexible leads 480°F (250°C)

#### Substrate

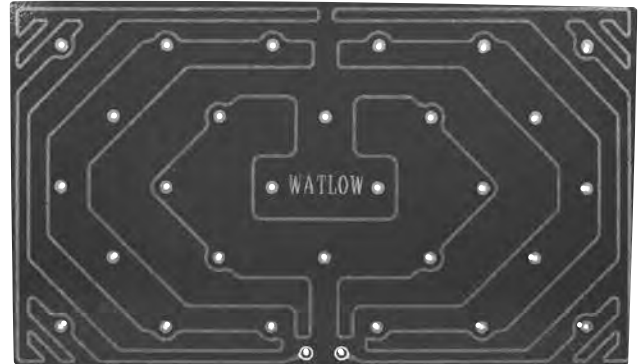
- 10 to 18 ga. 430 SS, Alumina

#### Features

- Holes/slots up to 15% of area

#### Sensor

- Bolted ring-style thermocouple



# Specialty Heaters



## Thick Film Conduction Heaters

### Technical Information

#### Heater Part Numbers

Heater Size in. (mm)		Voltage	Wattage <sup>①</sup>	W/in <sup>2</sup> (W/cm <sup>2</sup> )		Approximate Assembly Weight lbs (kg)		Watlow Part Number <sup>②</sup>
<b>Round</b>								
4.5 dia.	(114)	120	325	20.4	(3.2)	1.10	(0.50)	<b>TFA004JA03EL18B</b>
6.0 dia.	(152)	120	850	30.1	(4.7)	2.74	(1.24)	<b>TFA006AA08KL18C</b>
6.0 dia.	(152)	240	1125	39.8	(6.2)	2.74	(1.24)	<b>TFA006AE11EL18C</b>
8.0 dia.	(203)	240	2000	39.8	(6.2)	4.91	(2.23)	<b>TFA008AE200L18C</b>
10.0 dia.	(254)	240	3000	38.2	(5.9)	7.24	(3.28)	<b>TFA010AE300L18C</b>
<b>Square</b>								
2.25 x 2.25	(57 x 57)	120	100	19.8	(3.1)	0.27	(0.12)	<b>TFA2E2EA010L18B</b>
3.00 x 3.00	(76 x 76)	120	225	25.0	(3.8)	0.50	(0.23)	<b>TFA3A3AA02EL18B</b>
4.00 x 4.00	(102 x 102)	120	400	25.0	(3.8)	1.61	(0.73)	<b>TFA4A4AA040L18C</b>
6.00 x 6.00	(152 x 152)	120	1250	34.7	(5.4)	3.74	(1.70)	<b>TFA6A6AA12KL18C</b>
6.00 x 6.00	(152 x 152)	240	1450	40.3	(6.3)	3.74	(1.70)	<b>TFA6A6AE14KL18C</b>
8.00 x 8.00	(203 x 203)	240	2500	39.1	(6.1)	6.36	(2.88)	<b>TFA8A8AE250L18C</b>
<b>Rectangle</b>								
2.0 X 4.0	(51 x 102)	120	240	30.0	(4.6)	0.47	(0.21)	<b>TFA2A4AA02HL18B</b>
4.0 X 6.0	(102 x 152)	120	725	30.2	(4.7)	2.46	(1.12)	<b>TFA4A6AA07EL18C</b>
6.0 X 8.0	(152 x 203)	240	1920	40.0	(6.2)	5.01	(2.27)	<b>TFA6A8AE19DL18C</b>

<sup>①</sup>Wattage output at 77°F (25°C).

<sup>②</sup>Includes clamping plate, mica insulator and mounting hardware. Replace the last letter of the part number with "O" for heater only.



# Specialty Heaters



## Coil/Cable Heaters

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

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

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

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

### Performance Capabilities

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

### Features and Benefits

#### High ductility

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

#### Low mass

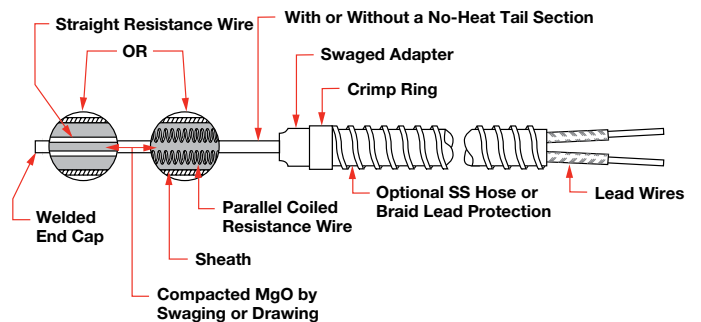
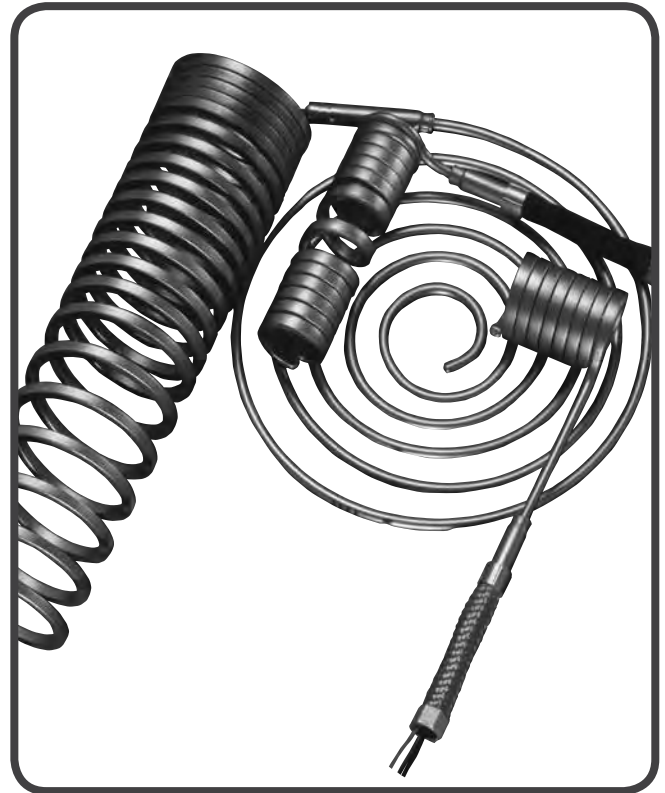
- Allows quick response in both heating and cooling

#### Constructed with no open seams

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

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

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



#### Heater sheath can be brazed

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

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

- Delivers a high volume of heat into a tiny space

#### Internal construction options

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



## Coil/Cable Heaters

### Typical Applications

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

### Electrical Data and Coiling Limits

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

In most cases 30 W/in<sup>2</sup> (4.65 W/cm<sup>2</sup>) is the safe allowable limit for cable watt density. Please contact your Watlow representative prior to ordering >30 W/in<sup>2</sup> cables.

#### Resistance/Wattage Tolerance ±10%.

Cable heaters can run on both ac and dc. Contact your Watlow representative for amperage limitations.

### Coiling Tolerances

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

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

### Cable Straight Length Tolerances

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

# Specialty Heaters



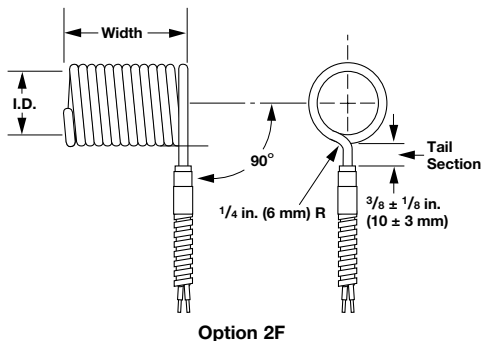
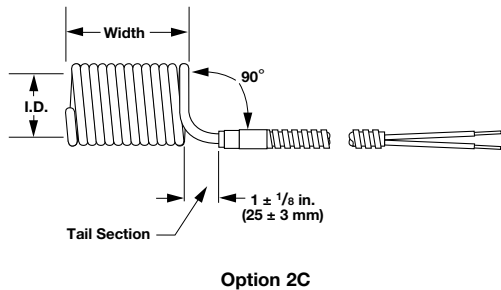
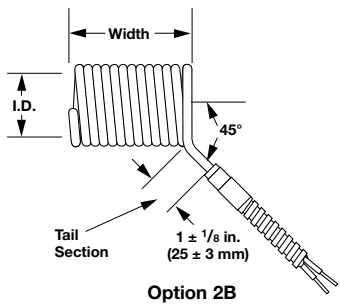
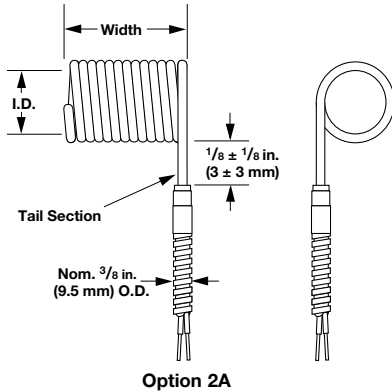
## Coil/Cable Heaters

### Formation Options

#### Coil Heaters

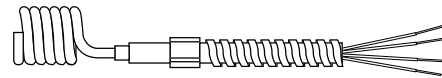
The coil heater can be tight wound or open pitch.

#### Lead Orientation Options for Coiled Cable Heaters



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

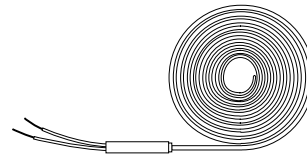
#### Closed Coil without Distributed Wattage



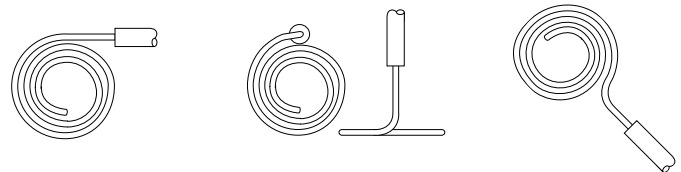
#### Closed Coil with Distributed Wattage



#### Flat Spiral



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



**Flat Spiral with 2A Type Lead Orientation**

**Flat Spiral with 2C Type Lead Orientation**

**Flat Spiral with 2F Type Lead Orientation**

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

**Note:** Maximum outside diameter is 6 inches.

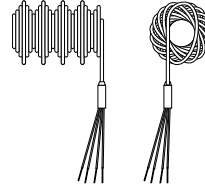


## Coil/Cable Heaters

### Formation Options (Continued)

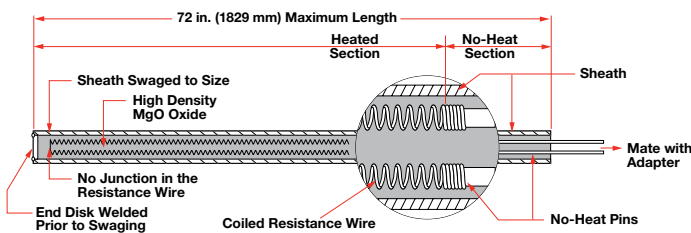
#### Star Wound

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



### Internal Construction

#### Sheath with Coiled Internal Resistance Wire

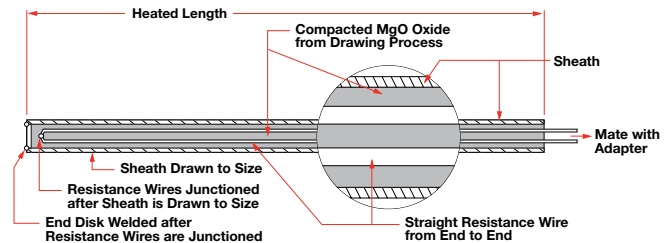


Resistance wire wound into a small coil is loaded into insulating cores, then into metal tubing and swaged to final size. This construction method is called **coil wire or parallel coil**.

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

- Variable ohms/foot within a minimum and maximum range
- Variable location of the thermocouple junction
- Grounded or ungrounded thermocouple junction
- No-heat sections
- 304 stainless steel
- A variety of diameters and shapes:
  - 0.094 in. (2.4 mm) round
  - 0.125 in. (3.2 mm) round (minimum diameter with internal thermocouple)
  - 0.102 in. (2.6 mm) square
  - 0.128 in. (3.3 mm) square
  - 0.102 in. X 0.156 in. (2.6 mm X 4 mm) rectangular

#### Sheath with Straight (Uncoiled) Resistance Wire



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

- Essentially no limit on cable length
- Thermocouple junction only at the disk end of the sheath
- Grounded or ungrounded thermocouple junction
- Full length of the sheath is heated
- 304 stainless steel
- A variety of diameters and shapes:
  - 0.040 in. (1.0 mm) round
  - 0.062 in. (1.6 mm) round
  - 0.094 in. (2.4 mm) round
  - 0.125 in. (3.2 mm) round (minimum diameter with internal thermocouple)
  - 0.157 in. (4.0 mm) round
  - 0.188 in. (4.8 mm) round
  - 0.128 in. (3.3 mm) square\*
  - 0.102 in. X 0.156 in.\* (2.6 mm X 4 mm) rectangular

\* Maximum length is 140 in. (3556 mm)

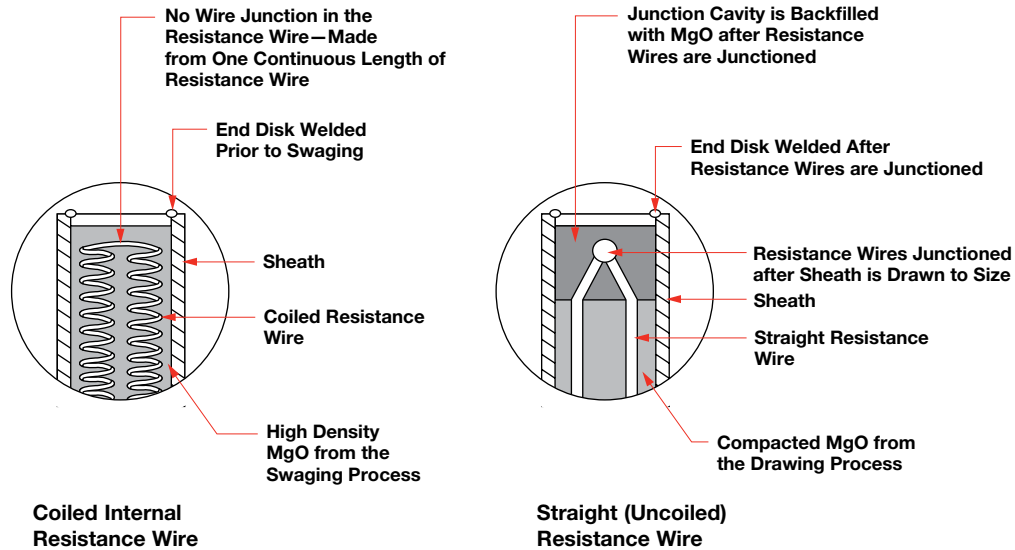
# Specialty Heaters



## Coil/Cable Heaters

### Internal Construction (Continued)

#### Disk End of Sheath



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

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

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

## Thermocouples

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

### Coil:

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

### Straight:

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

# Specialty Heaters



## Coil/Cable Heaters

### Options—Internal Construction

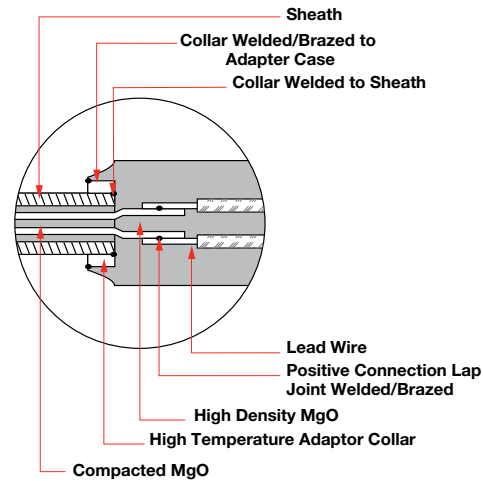
#### Adapters

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

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

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

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



#### External Construction

##### Lead Wire

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

##### Insulation

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

##### Lead Protection

Stainless steel hose, stainless steel braid or fiberglass braid

Contact your Watlow representative for details.

# Specialty Heaters



## Coil/Cable Heaters

### Cable Heater Units (Internal thermocouple is not available)

Straight Cable Length in. (mm)	Volts	Watts	Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )	No-Heat Length in. (mm)	Lead Wire	Part Number
<b>0.062 in. (1.6 mm) Diameter Round</b> (with ±10% wattage tolerance) 0.250 in. x 1.125 in. adapter						
24 (610)	120	240	51 (7.9)	0 (0)	36 in. (914) mm swaged-in fiberglass	<b>62H24A6X-1138</b>
36 (914)	120	400	57 (8.8)	0 (0)		<b>62H36A5X-1015</b>
56 (1422)	120	330	30 (4.7)	0 (0)		<b>62H56A4X-942</b>
65 (1651)	120	500	39 (6.0)	0 (0)		<b>62H65A3X-1111</b>
<b>0.094 in. (2.4 mm) Diameter Round</b> (with ±5% wattage tolerance) 0.132 in. x 1.250 in. adapter— <b>Lead protection not available</b>						
30 (762)	230	125	17 (2.6)	5 (127)	48 in. (1219) mm swaged-in PTFE leads only	<b>94PC30A1X</b>
30 (762)	230	250	34 (5.3)	5 (127)		<b>94PC30A2X</b>
<b>0.125 in. (3.2 mm) Diameter Round</b> (with ±10% wattage tolerance) 0.250 in. x 1.125 in. adapter, *0.375 in. x 2.000 in. adapter						
18 (457)	240	250	35 (5.4)	1.5 (38)	36 in. (914) mm swaged-in fiberglass	<b>125CH18A4X-1066</b>
19 (483)	120	165	21 (3.3)	1.5 (38)		<b>125CH19A1X-879</b>
24 (610)	120	275	29 (4.5)	1.5 (38)		<b>125CH24A1X-1049</b>
24 (610)	240	275	29 (4.5)	1.5 (38)		<b>125CH24A14X-806</b>
38 (965)	240	325	21 (3.3)	1.5 (38)		<b>125CH38A1X-631</b>
38 (965)	120	175	12 (1.9)	1.5 (38)		<b>125CH38A2X-246</b>
47 (1194)	240	260	14 (2.2)	1.5 (38)		<b>125CH47A1X-108</b>
47 (1194)	120	235	12 (1.9)	1.5 (38)		<b>125CH47A2X-182</b>
47 (1194)	120	375	20 (3.1)	1.5 (38)		<b>125CH47A3X-986</b>
47 (1194)	240	345	19 (2.9)	1.5 (38)		<b>125CH47A4X-1081</b>
65 (1651)	240	420	16 (2.5)	1.5 (38)		<b>125CH65A1X-940</b>
65 (1651)	240	675	27 (4.2)	1.5 (38)		<b>125CH65A2X-1115</b>
95 (2413)	240	1000	28 (4.3)	0 (0)		<b>125CH93A1X-1154</b>
126 (3200)	240	1500	30 (4.7)	0 (0)		48 in. (1219) mm swaged-in fiberglass
150 (3810)	240	2000	34 (5.3)	0 (0)	<b>125H150A3A-1168*</b>	
223 (5664)	240	3000	34 (5.3)	0 (0)	<b>125H223A1A-1057*</b>	
<b>0.128 in. (3.3 mm) Square Cross-Section</b> (with ±10% wattage tolerance) 0.250 in. x 1.125 in. adapter						
12 (305)	120	200	36 (5.6)	1.5 (38)	36 in. (914) mm swaged-in fiberglass	<b>125PS12A24A-647</b>
12 (305)	240	200	36 (5.6)	1.5 (38)		<b>125PS12A23A-155</b>
20 (508)	120	300	31 (4.8)	1.5 (38)		<b>125PS20A37A-537</b>
20 (508)	240	300	31 (4.8)	1.5 (38)		<b>125PS20A38A-142</b>
30 (762)	120	450	30 (4.7)	1.5 (38)		<b>125PS30A47A-159</b>
30 (762)	240	450	30 (4.7)	1.5 (38)		<b>125PS30A48A1019</b>
38 (965)	240	600	31 (4.8)	1.5 (38)		<b>125PS38A23A-562</b>

**Note:** Lead protection is available upon request.



## Coil/Cable Heaters

### Cable Heater Units (Type J internal thermocouple)

Straight Cable Length in. (mm)	Volts	Watts	Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )	No-Heat Length in. (mm)	Lead Wire	Part Number
<b>0.125 in. (3.2 mm) Diameter Round</b> (with ±10% wattage tolerance), thermocouple located in center of heated section, 0.250 in. x 1.125 in. adapter						
24 (610)	120	275	29 (4.5)	1.5 (38)	48 in. (1219) mm swaged-in fiberglass	<b>125CH24A13X</b>
38 (965)	120	175	12 (1.9)	1.5 (38)		<b>125CH38A18X</b>
47 (1194)	120	235	13 (2.0)	1.5 (38)		<b>125CH47A21X</b>
65 (1651)	240	675	26 (4.0)	1.5 (38)		<b>125CH65A26X</b>
<b>0.157 in. (4 mm) Diameter Round</b> (with ±10% wattage tolerance), thermocouple located at the disk end of the cable, 0.375 in. x 2.000 in. adapter						
124 (3150)	240	1500	25 (3.9)	0 (0)	48 in. (1219) mm swaged-in fiberglass	<b>157CH124AX</b>
150 (3810)	240	2000	27 (4.2)	0 (0)		<b>157CH150AX</b>
220 (5588)	240	3000	28 (4.3)	0 (0)		<b>157CH220AX</b>
<b>0.128 in. (3.3 mm) Square Cross-Section</b> (with ±10% wattage tolerance), thermocouple located in center of heated section, 0.250 in. x 1.125 in. adapter						
12 (305)	240	200	36 (5.6)	1.5 (38)	48 in. (1219) mm swaged-in fiberglass	<b>125PS12A22A</b>
20 (508)	120	300	31 (4.8)	1.5 (38)		<b>125PS20A35A</b>
20 (508)	240	300	31 (4.8)	1.5 (38)		<b>125PS20A36A</b>
30 (762)	240	450	30 (4.7)	1.5 (38)		<b>125PS30A46A</b>
38 (965)	240	600	31 (4.8)	1.5 (38)		<b>125PS38A24A</b>

**Note:** Lead protection is available upon request.



# Strip/Clamp-On Heaters



Strip/Clamp-On Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
<b>Mineral Insulated (MI)</b>	304 stainless steel	1400	760	140	21.7	<b>467</b>
<b>375 High-Temperature</b>	Aluminized steel	1100	595	100	15.5	<b>471</b>
<b>FIREBAR® Clamp-On</b>	Alloy 800	1400	760	120	18.6	<b>478</b>
	304 stainless steel	1200	650	120	18.6	
<b>Thick Film Conduction</b>	430 stainless steel	1025	550	75	11.6	<b>479</b>



Strip/Clamp-On Heaters



# Strip/Clamp-On Heaters



## Mineral Insulated (MI) Strip Heaters

The MI strip heater is a thin, responsive heater that uses the most advanced heater construction techniques. A nickel-chromium element wire is embedded in Watlow's exclusive mineral insulation material, which has a much higher thermal conductivity than the mica and hard ceramic insulators used in conventional heaters. This thin layer of insulation brings the element wire closer to the heater sheath. The result is heat flows easily from the element wire to the sheath allowing the wire to run cooler than conventional heaters and increasing heater life.

### Performance Capabilities

- Sheath temperatures up to 1400°F (760°C)
- Watt densities up to 140 W/in<sup>2</sup> (21.7 W/cm<sup>2</sup>)
- Maximum voltage up to 480VAC
- UL® component recognition for most 240VAC or less designs (UL® File #E52951)

### Features and Benefits

#### Higher watt densities than any other strip heater

- Provides faster heat up

#### Exclusive mineral insulation

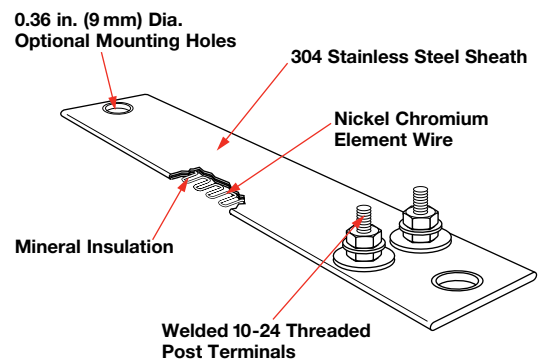
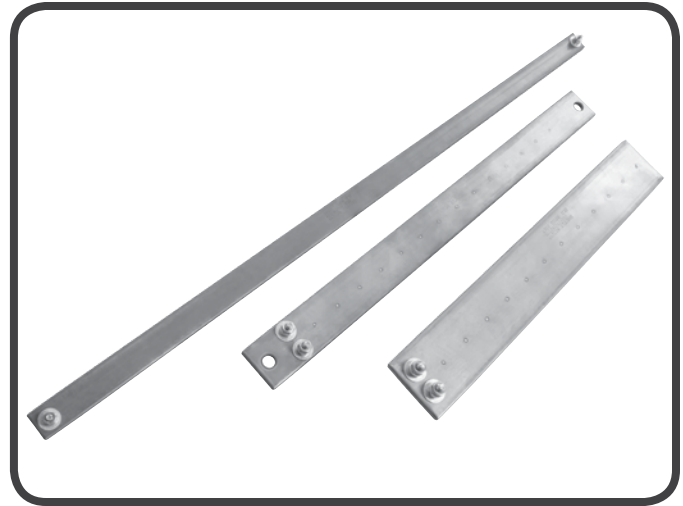
- Combines dielectric strength and superior thermal conductivity
- Transfers heat rapidly to the sheath

#### 304 stainless steel sheath

- Maintains the high compaction of mineral insulation
- Produces a rigid heater

### Typical Applications

- Solder pots
- Zinc die-casting equipment
- Die and mold heating
- High-temperature resins
- Tank and platen heating
- Ovens
- Packaging equipment
- Semiconductor chamber heating



# Strip/Clamp-On Heaters



## Mineral Insulated (MI) Strip Heaters

### Applications and Technical Data

#### Calculating Watt Density

Watt density is the amount of wattage per square inch of heated area. To determine watt density, divide the total wattage by the heated area.

$$\text{Watt Density} = \frac{\text{Wattage}}{\text{Heated Area}}$$

To apply this equation, the heated area is the total contact surface of the heater less areas of no-heat found around terminals, mounting holes, etc.

**Heated Area = Total Contact Area - No-Heat Area**

**To calculate the heated area:**

1. Using the chart below, locate the **no-heat factor** corresponding to the type of heater being considered.
2. To use the formula below, insert the no-heat factors, length and width (in inches).

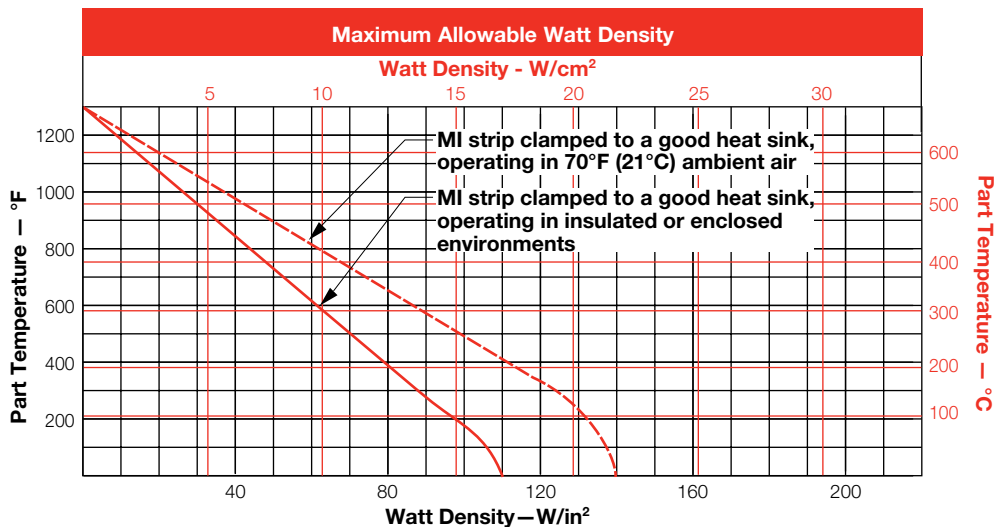
$$\text{Heated Area} = (\text{Overall Length} - \text{No-Heat Factor}) \times \text{Width}$$

Type	No-Heat Factor (in.)
<b>1 in. wide</b>	
1 in. wide post terminal 1 on 1	1.75
1 in. wide post terminal 1 on 1 with mounting holes	3.00
<b>For all other widths</b>	
2 on 1 post terminal	1.18
2 on 1 with mounting holes	3.18

The drawings on the next page and the graph on this page will help in selecting the correct watt density for a particular application. First, refer to the drawings to determine the heated area of the heater. Then, use the

watt density formula and graph to ensure that the maximum watt density of the heater does not exceed the specific application requirements.

$$\text{Watt Density} = \frac{\text{Wattage}}{\text{Heated Area}}$$



# Strip/Clamp-On Heaters



## Mineral Insulated (MI) Strip Heaters

### Applications and Technical Data (Continued)

#### Specifications

##### Width

- 1, 1½ and 2 in. (25, 38, 51 mm), tolerance  $\pm 1/32$

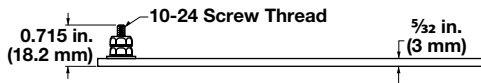
##### Length

- 8 to 30 in. (203 to 762 mm), tolerance  $\pm 1/8$

##### Terminations

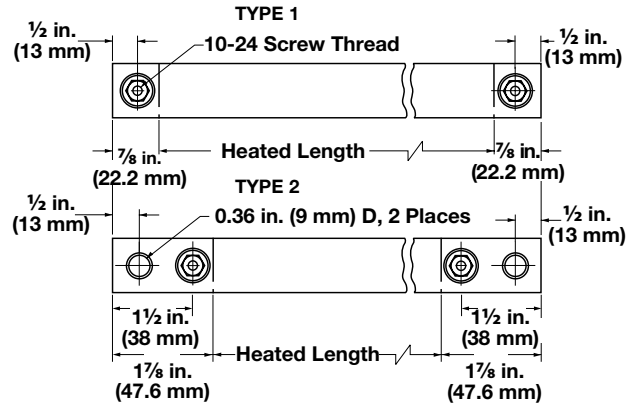
- 1 in. (25 mm) wide—post terminals one-on-one  
1½ to 2 in. (38 to 51 mm)—post terminals two-on-one

#### All Widths

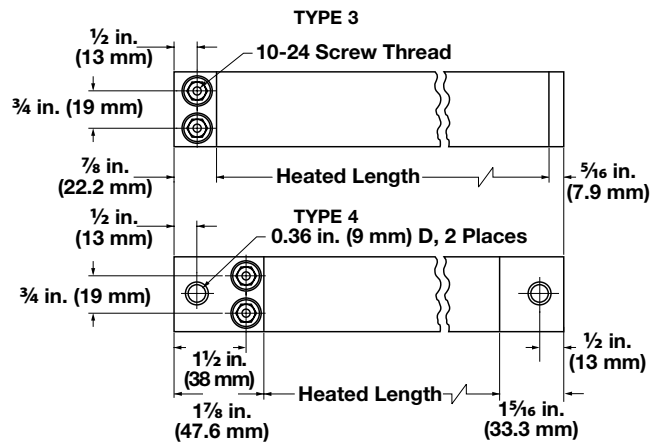


**Note:** In most applications, mounting holes alone do not provide adequate clamping. A clamp bar should be used for each 4 in. (102 mm) of heater length.

#### 1 in. (25 mm) Wide



#### 1½ in. – 2 in. (38 – 51 mm) Wide



# Strip/Clamp-On Heaters

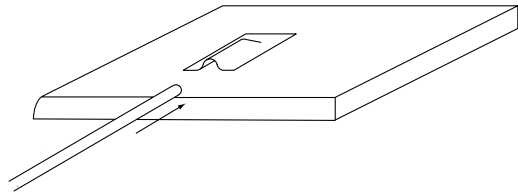


## Mineral Insulated (MI) Strip Heaters

### Applications and Technical Data (Continued)

#### Options

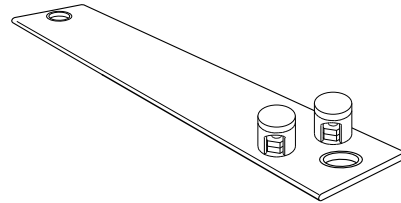
##### Thermocouple Pocket



A thermocouple pocket welded to the back surface accepts a 0.063 in. (1.6 mm) diameter thermocouple. This option provides accurate temperature sensing and easy thermocouple replacement. Thermocouple not included.

#### Accessories

##### Ceramic Terminal Covers



Ceramic terminal covers offer a convenient and economic method to insulate post terminals. They are sized for standard length posts with 10-24 screw thread size, supplied as an accessory item and shipped separately. Specify Z4918 and quantity.

### Parallel Terminals Part Numbers—Type 3 and 4

Width in. (mm)	Length in. (mm)	Volts	Power (Watts)	Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )	Approx. Net Wt. lbs (kg)	Type	Part Number
1 1/2 (38)	8 (203)	240	500	50 (7.8)	0.3 (0.15)	3	<b>MS1J8AS3</b>
1 1/2 (38)	12 (305)	120	350	26 (4.0)	0.5 (0.2)	4	<b>MS1J12AV2<sup>①</sup></b>
1 1/2 (38)	12 (305)	240	350	26 (4.0)	0.5 (0.2)	4	<b>MS1J12AV3<sup>①</sup></b>
1 1/2 (38)	12 (305)	240	800	49 (7.6)	0.5 (0.2)	3	<b>MS1J12AS2</b>
1 1/2 (38)	18 (457)	120	1000	40 (6.2)	0.8 (0.3)	3	<b>MS1J18AS1</b>
1 1/2 (38)	18 (457)	240	1000	40 (6.2)	0.8 (0.3)	3	<b>MS1J18AS2</b>

<sup>①</sup> Denotes units with mounting holes. Mounting holes are 0.36 in. (9 mm) in diameter and are intended for use with 1/4 in. (6 mm) bolts.

Centers of mounting holes are located 1/2 in. (13 mm) from the ends of the heater.

# Strip/Clamp-On Heaters



## 375 High-Temperature Strip Heaters

Named for its 0.375 in. (9.5 mm) thickness, the rugged Watlow 375 strip heater is capable of both high temperatures and high watt densities.

Watlow® begins construction by accurately placing a coiled, nickel-chromium element wire in the center of the heater. The element wire is then embedded in magnesium oxide (MgO)-based insulation compacted into a solid mass creating excellent heat conductivity and high dielectric strength. The heater is then enclosed in aluminized steel or 430 stainless steel sheathing.

### Performance Capabilities

- Aluminized steel sheath temperatures up to 1100°F (595°C)
- 430 stainless steel sheath temperatures up to 1200°F (650°C)
- Watt densities up to 100 W/in<sup>2</sup> (15.5 W/cm<sup>2</sup>)
- UL® approved up to 240VAC (File No. E52951)
- CSA approved up to 480VAC (File No. LR7392)

### Features and Benefits

#### Nickel-chromium element wire is centered in the heater

- Assures uniform heat

#### Aluminized steel sheath

- Operates at higher temperatures and resists corrosion better than iron-sheathed heaters
- Minimizes heat-up time

#### Optional 430 stainless steel sheath

- Meets temperature requirements that reach up to 1200°F (650°C)

#### Post terminals, welded to the element wire

- Produces strong, trouble-free connections

#### Rigid 3/8 in. (9.5 mm) thick design

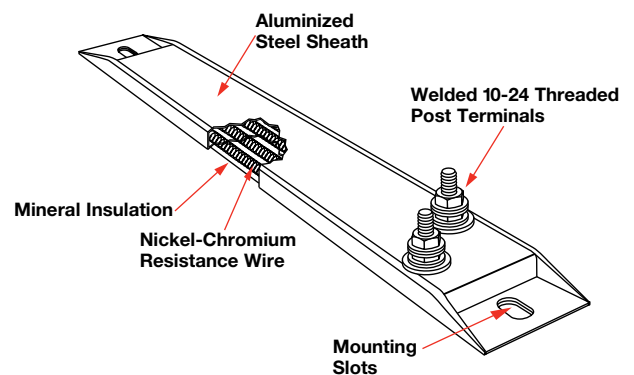
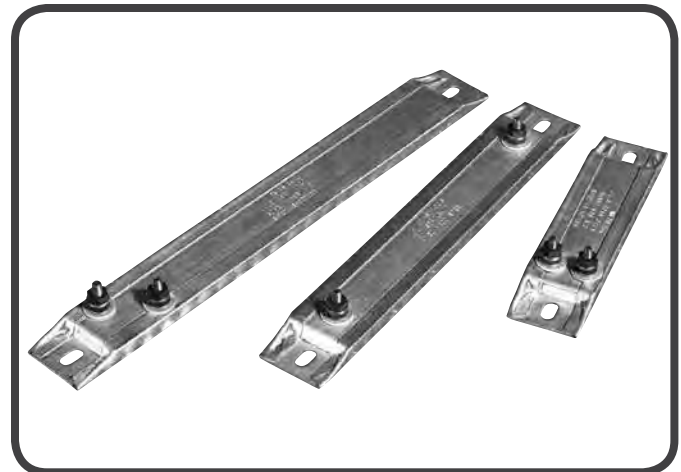
- Enables the heater to fit into many existing applications

#### Over 100 in-stock models in popular sizes and ratings

- Allows next day shipment

#### Available dimensions are 1 1/2 in. (38 mm) wide and 5 1/2 to 48 in. (140 to 1219 mm) long

- Fits a variety of application needs



### Typical Applications

- Food warming
- Freeze and moisture protection
- Tank and platen heating
- Packaging
- Dies and mold heating
- Autoclaves
- Ovens
- Telecom

# Strip/Clamp-On Heaters



## 375 High-Temperature Strip Heaters

### Applications and Technical Data

#### Calculating Watt Density

Use the *Maximum Allowable Watt Density* graphs and formulas to ensure the allowable watt density for the heater does not exceed the specific application requirements. **Watt density is calculated for one side of the heater only.**

#### Formulas

$$\text{Watt Density} = \frac{\text{Wattage}}{\text{Heated Area}}$$

Heated Area

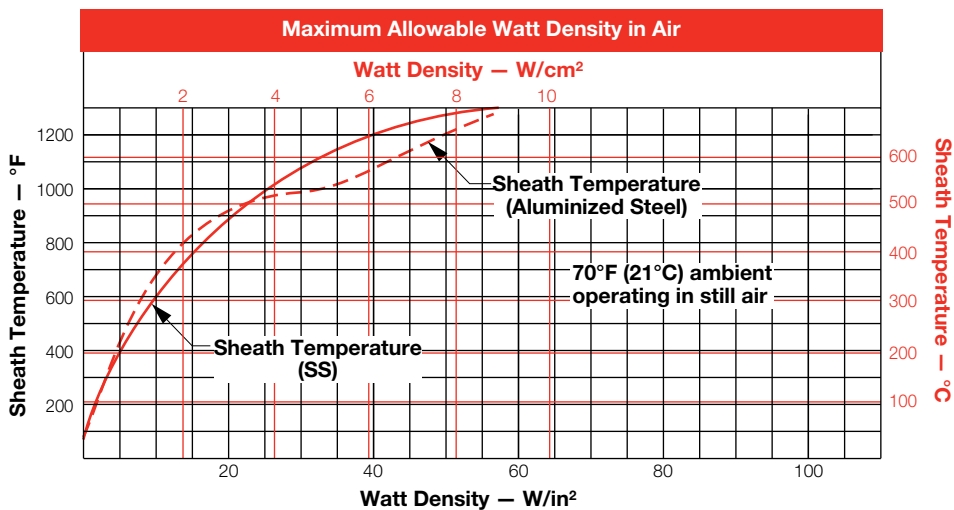
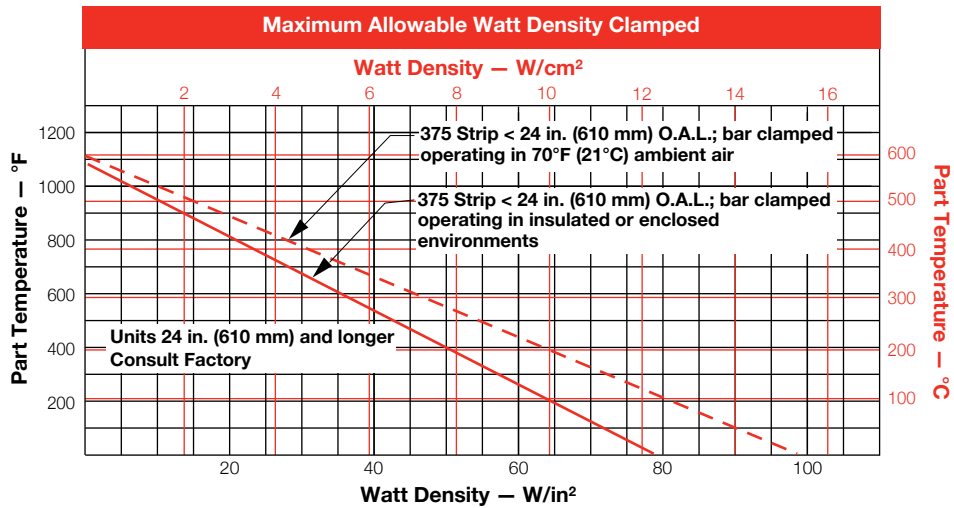
$$\begin{aligned} \text{(Offset Terminals)} &= [\text{Overall Length (A)} \times 1.5 \text{ in.}] - 6 \text{ in}^2 \\ &= [\text{Overall Length (A)} \times 38 \text{ mm}] - 38.7 \text{ cm}^2 \end{aligned}$$

Heated Area

$$\begin{aligned} \text{(Parallel Terminals)} &= [\text{Overall Length (A)} \times 1.5 \text{ in.}] - 4.7 \text{ in}^2 \\ &= [\text{Overall Length (A)} \times 38 \text{ mm}] - 30.3 \text{ cm}^2 \end{aligned}$$

Heated Area

$$\begin{aligned} \text{(One-on-One Terminals)} &= [\text{Overall Length (A)} \times 1.5 \text{ in.}] - 6 \text{ in}^2 \\ &= [\text{Overall Length (A)} \times 38 \text{ mm}] - 38.7 \text{ cm}^2 \end{aligned}$$





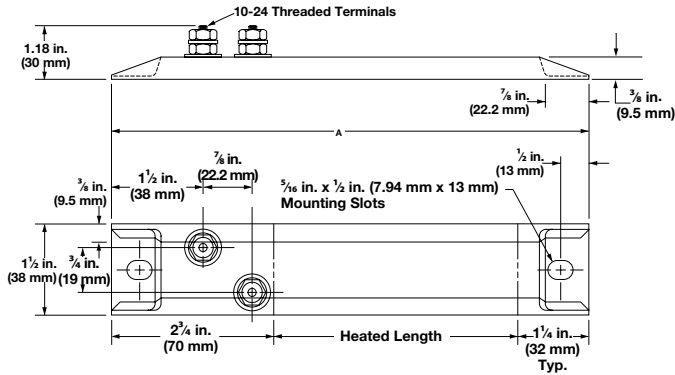
# Strip/Clamp-On Heaters



## 375 High-Temperature Strip Heaters

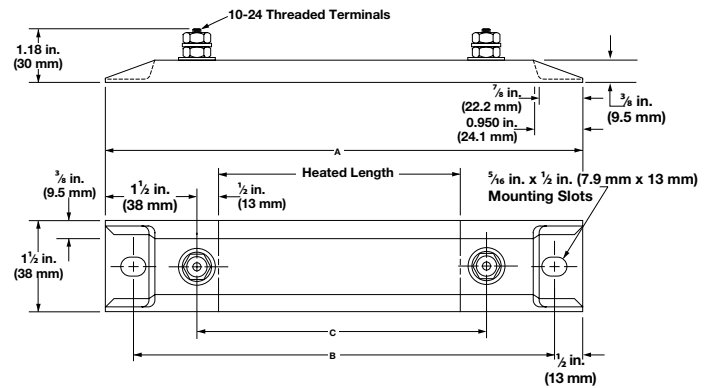
### Termination Options

#### Offset Terminals



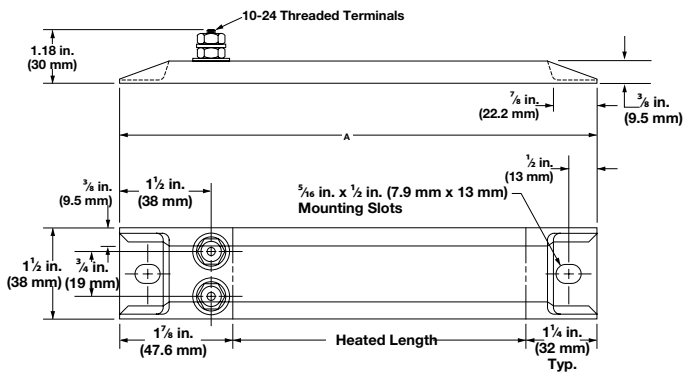
Two 10-24 threaded post terminals are offset from each other on the same end.

#### One-on-One Terminals



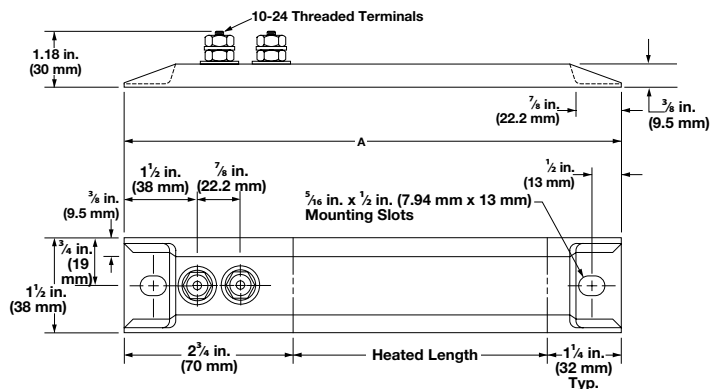
Two 10-24 threaded post terminals are placed one on each end.

#### Parallel Terminals



Two 10-24 threaded post terminals are used; both terminals on one end.

#### In-Line Terminals



Two 10-24 threaded post terminals are in-line with each other on the same end.

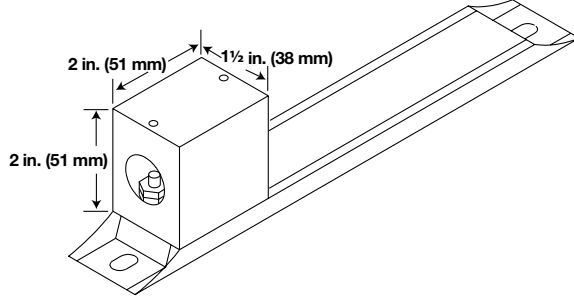
# Strip/Clamp-On Heaters



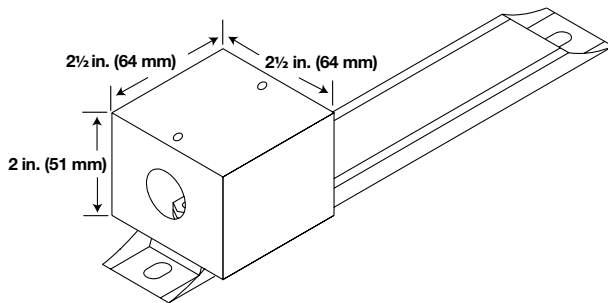
## 375 High-Temperature Strip Heaters

### Termination Options (Continued)

#### Metallic Terminal Boxes - Variations



Available on in-line terminals only.

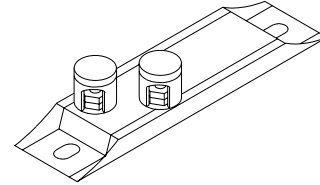


Available on offset terminals from stock and manufactured.

Metallic terminal boxes are available from stock on offset terminals. Terminal boxes act as a safety feature by covering the terminals. A conduit may be attached to the box through  $\frac{7}{8}$  in. (22.2 mm) diameter holes in the ends of the box. To order, specify **terminal box**.

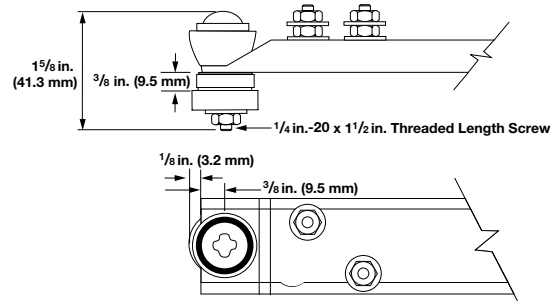
### Accessories

#### Ceramic Terminal Covers



Ceramic terminal covers offer a convenient and economic method to insulate post terminals. They are sized for standard length posts with 10-24 screw thread size, supplied as an accessory item and shipped separately. Specify **Z4918** and quantity.

#### Secondary Insulation Bushings



Insulators are suitable when air heating and/or voltage to ground is a concern. A secondary insulation bushing kit, part number **Z5230**, contains one set of bushings for one heater. To accommodate bushings,  $\frac{17}{32} \times \frac{11}{16}$  inch diameter mounting holes **must** be specified when ordering the heater.

# Strip/Clamp-On Heaters



## 375 High-Temperature Strip Heaters

### Heater Part Numbers

Width in. (mm)	Length in. (mm)	Term.	Volts	Power (Watts)	Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )	Approx. Net Wt. lbs (kg)	Part Number	Chromalox® Part No. ①		Wellman® Part No. ①	
								Rust Resist. Iron Sheath	Chrome Stl. Sheath	Aluminized Steel Sheath	Chrome Stl. Sheath
1 1/2 (38)	5 1/2 (140)	Parallel	120	125	35 (5.4)	0.4 (0.18)	SGA1J5JP1	PT-512	—	—	—
	5 1/2 (140)	Parallel	120	250	70 (10.8)	0.4 (0.18)	SGA1J5JP2	—	PT-502	—	—
	6 (152)	Parallel	120	150	35 (5.4)	0.4 (0.18)	SGA1J6AP2	PT-615	—	—	—
	6 (152)	Parallel	240	150	35 (5.4)	0.4 (0.18)	SGA1J6AP3	PT-615	—	—	—
	6 (152)	Parallel	120	300	70 (10.8)	0.4 (0.18)	SGA1J6AP4	—	PT-603	—	—
	6 (152)	Parallel	240	300	70 (10.8)	0.4 (0.18)	SGA1J6AP5	—	PT-603	—	—
	7 1/2 (191)	Offset	120	150	29 (4.5)	0.5 (0.23)	SGA1J7JO1	OT-715	—	SS1041	—
	7 1/2 (191)	Offset	240	150	29 (4.5)	0.5 (0.23)	SGA1J7JO2	OT-715	—	SS1052	—
	7 1/2 (191)	Offset	240	200	38 (5.9)	0.5 (0.23)	SGA1J7JO3	—	OT-702	—	SS2052
	8 (203)	Offset	120	150	25 (3.9)	0.5 (0.23)	SGA1J8AO1	OT-815	—	SS1061	—
	8 (203)	Offset	240	150	25 (3.9)	0.5 (0.23)	SGA1J8AO5	OT-815	—	SS1072	—
	8 (203)	Offset	120	175	29 (4.5)	0.5 (0.23)	SGA1J8AO6	OT-817	—	SS1081	—
	8 (203)	Offset	240	175	29 (4.5)	0.5 (0.23)	SGA1J8AO7	OT-817	—	SS1092	—
	8 (203)	Offset	120	250	42 (6.5)	0.5 (0.23)	SGA1J8AO2	—	OT-802	—	SS2061
	8 (203)	Offset	240	250	42 (6.5)	0.5 (0.23)	SGA1J8AO8	—	OT-802	—	SS2072
	8 (203)	Offset	120	400	67 (10.4)	0.5 (0.23)	SGA1J8AO9	—	OT-804	—	SS2081
	8 (203)	Offset	240	400	67 (10.4)	0.5 (0.23)	SGA1J8AO10	—	OT-804	—	SS2092
	8 (203)	Offset	120	500	83 (12.9)	0.5 (0.23)	SGA1J8AO3	—	—	—	—
	8 (203)	Offset	240	500	83 (12.9)	0.5 (0.23)	SGA1J8AO4	—	—	—	—
	8 (203)	1-on-1	120	150	24 (3.7)	0.5 (0.23)	SGA1J8AT1	S-815	—	SD1021	—
	8 (203)	1-on-1	240	150	24 (3.7)	0.5 (0.23)	SGA1J8AT2	S-815	—	SD1032	—
	9 1/2 (241)	1-on-1	120	200	23 (3.6)	0.6 (0.27)	SGA1J9JT1	S-920	—	SD1041	—
	10 1/2 (267)	Offset	120	250	26 (4.0)	0.7 (0.32)	SGA1J10JO1	OT-1025	—	SS1101	—
	10 1/2 (267)	Offset	240	250	26 (4.0)	0.7 (0.32)	SGA1J10JO2	OT-1025	—	SS1102	—
	10 1/2 (267)	Offset	120	350	36 (5.6)	0.7 (0.32)	SGA1J10JO8	—	OT-1003	—	SS2101
	10 1/2 (267)	Offset	240	350	36 (5.6)	0.7 (0.32)	SGA1J10JO5	—	OT-1003	—	SS2112
	10 1/2 (267)	Offset	120	400	41 (6.4)	0.7 (0.32)	SGA1J10JO6	—	OT-1004	—	SS2131
	10 1/2 (267)	Offset	240	400	41 (6.4)	0.7 (0.32)	SGA1J10JO7	—	OT-1004	—	SS2132
	12 (305)	Offset	120	250	21 (3.3)	0.8 (0.32)	SGA1J12AO1	OT-1225	OT-1202	SS1141	—
	12 (305)	Offset	240	250	21 (3.3)	0.8 (0.32)	SGA1J12AO2	OT-1225	OT-1202	SS1152	—
	12 (305)	Offset	120	350	29 (4.5)	0.8 (0.36)	SGA1J12AO5	—	OT-1203	—	SS2141
	12 (305)	Offset	240	350	29 (4.5)	0.8 (0.36)	SGA1J12AO6	—	OT-1203	—	SS2152
12 (305)	Offset	120	500	42 (6.5)	0.8 (0.36)	SGA1J12AO3	—	OT-1205	—	SS2161	
12 (305)	Offset	240	500	42 (6.5)	0.8 (0.36)	SGA1J12AO4	—	OT-1205	—	SS2172	
12 (305)	1-on-1	120	250	20 (3.1)	0.8 (0.36)	SGA1J12AT1	S-1225	S-1202	SD1061	SD2071	
12 (305)	1-on-1	240	250	20 (3.1)	0.8 (0.36)	SGA1J12AT2	S-1225	S-1202	SD1072	SD2082	
12 (305)	1-on-1	240	500	40 (6.2)	0.8 (0.36)	SGA1J12AT3	—	S-1205	—	SD2122	
14 (356)	Offset	120	300	20 (3.1)	0.9 (0.41)	SGA1J14AO2	OT-1430	—	SS1181	—	
14 (356)	Offset	240	300	20 (3.1)	0.9 (0.41)	SGA1J14AO1	OT-1430	—	SS1192	—	
14 (356)	Offset	120	500	33 (5.1)	0.9 (0.41)	SGA1J14AO3	—	OT-1405	—	SS2181	
14 (356)	Offset	240	500	33 (5.1)	0.9 (0.41)	SGA1J14AO4	—	OT-1405	—	SS2192	
14 (356)	1-on-1	120	300	20 (3.1)	0.9 (0.41)	SGA1J14AT1	S-1430	—	SD1131	—	
15 1/4 (387)	Offset	120	325	19 (2.9)	1.0 (0.45)	SGA1J15EO2	OT-1532	—	SS1201	—	
15 1/4 (387)	Offset	240	325	19 (2.9)	1.0 (0.45)	SGA1J15EO3	OT-1532	—	SS1212	—	
15 1/4 (387)	Offset	240	500	30 (4.6)	1.0 (0.45)	SGA1J15EO4	—	OT-1505	—	SS2212	

CONTINUED

①Chromalox® and Wellman® part numbers are used as a cross reference to help select the equivalent Watlow part number. Chromalox® sizes 27 in. (686 mm) and longer, and all Wellman® sizes have mounting slot center to center distances 1/8 in. (3.2 mm) less than Watlow spacing.

**Note:** 5/16 in. x 1/2 in. (7.9 mm x 13 mm) mounting holes are supplied on all 375 strip heaters as standard, larger mounting holes may be provided 17/32 in. x 11/16 in. (13.5 mm x 17.5 mm).

Note that the Watlow part number specifies that the 375 strip heater includes an aluminized steel sheath. If a special sheath material is required, such as stainless steel, please contact your Watlow representative for material availability.

# Strip/Clamp-On Heaters



## 375 High-Temperature Strip Heaters

### Heater Part Numbers (Continued)

Width in. (mm)	Length in. (mm)	Term.	Volts	Power (Watts)	Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )	Approx. Net Wt. lbs (kg)	Part Number	Chromalox® Part No. ①		Wellman® Part No. ①	
								Rust Resist. Iron Sheath	Chrome Stl. Sheath	Aluminized Steel Sheath	Chrome Stl. Sheath
1 1/2 (38)	17 7/8 (454)	Offset	120	350	17 (2.6)	1.2 (0.54)	SGA1J17RO4	OT-1835	—	SS1221	SS2221
	17 7/8 (454)	Offset	240	350	17 (2.6)	1.2 (0.54)	SGA1J17RO5	OT-1835	—	SS1232	SS2232
	17 7/8 (454)	Offset	120	375	18 (2.8)	1.2 (0.54)	SGA1J17RO6	OT-1837	—SS1261	SS2241	—
	17 7/8 (454)	Offset	240	375	18 (2.8)	1.2 (0.54)	SGA1J17RO7	OT-1837	—	SS1252	—
	17 7/8 (454)	Offset	120	500	24 (3.7)	1.2 (0.54)	SGA1J17RO1	OT-1850	—	SS1261	SS2241
	17 7/8 (454)	Offset	240	500	24 (3.7)	1.2 (0.54)	SGA1J17RO2	OT-1850	—	SS1272	SS2252
	17 7/8 (454)	Offset	120	750	36 (5.6)	1.2 (0.54)	SGA1J17RO9	—	OT-1807	— SS2261	
	17 7/8 (454)	Offset	240	750	36 (5.6)	1.2 (0.54)	SGA1J17RO8	—	OT-1807	— SS2272	
	17 7/8 (454)	Offset	120	1000	48 (7.4)	1.2 (0.54)	SGA1J17RO10	—	OT-1801	— SS2281	
	17 7/8 (454)	Offset	240	1000	48 (7.4)	1.2 (0.54)	SGA1J17RO3	—	OT-1801	— SS2292	
	17 7/8 (454)	1-on-1	120	500	24 (3.7)	1.2 (0.54)	SGA1J17RT1	S-1850	S-1805	SD1211	SD2171
	17 7/8 (454)	1-on-1	240	500	24 (3.7)	1.2 (0.54)	SGA1J17RT2	S-1850	S-1805	SD1222	SD2182
	17 7/8 (454)	1-on-1	240	750	35 (5.4)	1.2 (0.54)	SGA1J17RT3	—	S-1807	— SD2202	
	17 7/8 (454)	1-on-1	120	1000	47 (7.3)	1.2 (0.54)	SGA1J17RT4	—	S-1801	— SD2211	
	17 7/8 (454)	1-on-1	240	1000	47 (7.3)	1.2 (0.54)	SGA1J17RT5	—	S-1801	— SD2222	
	19 1/2 (496)	Offset	240	350	15 (2.3)	1.3 (0.59)	SGA1J19JO6	OT-1935	—	SS1301	—
	19 1/2 (496)	Offset	120	500	22 (3.4)	1.3 (0.59)	SGA1J19JO7	OT-1950	OT-1905	— SS2301	
	19 1/2 (496)	Offset	240	500	22 (3.4)	1.3 (0.59)	SGA1J19JO4	OT-1950	OT-1905	— SS2312	
	19 1/2 (496)	Offset	240	750	32 (5.0)	1.3 (0.59)	SGA1J19JO8	—	OT-1907	— —	
	19 1/2 (496)	Offset	240	1000	43 (6.7)	1.3 (0.59)	SGA1J19JO1	—	OT-1901	— SS2332	
	19 1/2 (496)	1-on-1	240	750	32 (5.0)	1.3 (0.59)	SGA1J19JT1	—	S-1907	— SD2262	
	21 (533)	Offset	120	500	20 (3.1)	1.4 (0.64)	SGA1J21AO1	OT-2150	—	SS1341	—
	21 (533)	Offset	240	500	20 (3.1)	1.4 (0.64)	SGA1J21AO2	OT-2150	—	SS1352	—
	21 (533)	Offset	120	750	29 (4.5)	1.4 (0.64)	SGA1J21AO3	—	OT-2107	— SS2341	
	21 (533)	Offset	240	750	29 (4.5)	1.4 (0.64)	SGA1J21AO4	—	OT-2107	— SS2352	
	21 (533)	1-on-1	120	500	19 (2.9)	1.4 (0.64)	SGA1J21AT1	S-2050	S-2005	SD1291	SD2291
	23 3/4 (603)	Offset	120	500	17 (2.6)	1.5 (0.68)	SGA1J23NO5	OT-2450	OT-2405	SS1361	SS2361
	23 3/4 (603)	Offset	240	500	17 (2.6)	1.5 (0.68)	SGA1J23NO6	OT-2450	OT-2405	SS1372	SS2372
	23 3/4 (603)	Offset	120	750	25 (3.9)	1.5 (0.68)	SGA1J23NO1	OT-2475	OT-2407	SS1391	SS2381
	23 3/4 (603)	Offset	240	750	25 (3.9)	1.5 (0.68)	SGA1J23NO2	OT-2475	OT-2407	SS1402	SS2392
	23 3/4 (603)	Offset	120	1000	34 (5.3)	1.5 (0.68)	SGA1J23NO7	—	OT-2401	— SS2401	
	23 3/4 (603)	Offset	240	1000	34 (5.3)	1.5 (0.68)	SGA1J23NO3	—	OT-2401	— SS2412	
	23 3/4 (603)	Offset	240	1500	51 (7.9)	1.5 (0.68)	SGA1J23NO4	—	OT-2415	— —	
	23 3/4 (603)	1-on-1	240	250	8 (1.2)	1.5 (0.68)	SGA1J23NT1	S-2425	—	SD1322	—
	23 3/4 (603)	1-on-1	240	500	17 (2.6)	1.5 (0.68)	SGA1J23NT3	S-2450	S-2404	SD1342	SD2322
	23 3/4 (603)	1-on-1	240	750	25 (3.9)	1.5 (0.68)	SGA1J23NT5	—	S-2407	— SD2352	
	23 3/4 (603)	1-on-1	120	1000	33 (5.1)	1.5 (0.68)	SGA1J23NT6	—	S-2401	— SD2361	
	23 3/4 (603)	1-on-1	240	1000	33 (5.1)	1.5 (0.68)	SGA1J23NT7	—	S-2401	— SD2372	
	23 3/4 (603)	1-on-1	240	1500	50 (7.8)	1.5 (0.68)	SGA1J23NT8	—	S-2415	— —	
	25 1/2 (648)	Offset	120	500	16 (2.5)	1.7 (0.77)	SGA1J25JO1	OT-2550	—	SS1421	—
	25 1/2 (648)	Offset	240	500	16 (2.5)	1.7 (0.77)	SGA1J25JO2	OT-2550	—	SS1432	—
	25 1/2 (648)	Offset	120	750	23 (3.6)	1.7 (0.77)	SGA1J25JO3	OT-2575	OT2507	SS1441	SS2421
	25 1/2 (648)	Offset	240	750	23 (3.6)	1.7 (0.77)	SGA1J25JO4	OT-2575	OT-2507	SS1452	SS2432
	25 1/2 (648)	Offset	240	1000	31 (4.8)	1.7 (0.77)	SGA1J25JO5	—	OT-2501	— SS2452	

CONTINUED

①Chromalox® and Wellman® part numbers are used as a cross reference to help select the equivalent Watlow part number. Chromalox® sizes 27 in. (686 mm) and longer, and all Wellman® sizes have mounting slot center to center distances 1/8 in. (3.2 mm) less than Watlow spacing.

**Note:** 5/16 in. x 1/2 in. (7.9 mm x 13 mm) mounting holes are supplied on all 375 strip heaters as standard, larger mounting holes may be provided 17/32 in. x 11/16 in. (13.5 mm x 17.5 mm).

Note that the Watlow part number specifies that the 375 strip heater includes an aluminized steel sheath. If a special sheath material is required, such as stainless steel, please contact your Watlow representative for material availability.

# Strip/Clamp-On Heaters



## 375 High-Temperature Strip Heaters

### Heater Part Numbers (Continued)

Width in. (mm)	Length in. (mm)	Term.	Volts	Power (Watts)	Watt Density		Approx. Net Wt. lbs (kg)	Part Number	Chromalox® Part No. ①		Wellman® Part No. ①	
					W/in²	(W/cm²)			Rust Resist. Iron Sheath	Chrome Stl. Sheath	Aluminized Steel Sheath	Chrome Stl. Sheath
1 1/2 (38)	26 3/4 (680)	Offset	240	700	21	(3.3)	1.7 (0.77)	<b>SGA1J26NO1</b>	OT-2670	—	SS1472	—
	26 3/4 (680)	Offset	240	1000	29	(4.5)	1.7 (0.77)	<b>SGA1J26NO2</b>	—	OT-2601	—	SS2472
	30 1/2 (775)	Offset	120	750	19	(2.9)	2.0 (0.91)	<b>SGA1J30JO2</b>	OT-3075	OT-3007	SS1481	—
	30 1/2 (775)	Offset	240	750	19	(2.9)	2.0 (0.91)	<b>SGA1J30JO3</b>	OT-3075	OT-3007	SS1492	SS2482
	30 1/2 (775)	1-on-1	240	750	19	(2.9)	2.0 (0.91)	<b>SGA1J30JT1</b>	S-3075	S-3007	SD1452	—
	33 1/2 (851)	Offset	240	750	17	(2.6)	2.2 (1.0)	<b>SGA1J33JO1</b>	OT-3375	OT-3307	SS1522	SS2522
	33 1/2 (851)	1-on-1	240	1000	22	(3.4)	2.2 (1.0)	<b>SGA1J33JT1</b>	—	S-3301	—	SD2472
	35 7/8 (911)	Offset	120	1000	21	(3.3)	2.3 (1.0)	<b>SGA1J35RO4</b>	OT-3610	—	SS1531	—
	35 7/8 (911)	Offset	240	1000	21	(3.3)	2.3 (1.0)	<b>SGA1J35RO3</b>	OT-3610	—	SS1542	SS2532
	35 7/8 (911)	Offset	240	1500	31	(4.8)	2.3 (1.0)	<b>SGA1J35RO1</b>	—	OT-3601	SS2552	—
	35 7/8 (911)	1-on-1	240	1000	21	(3.3)	2.3 (1.0)	<b>SGA1J35RT1</b>	S-3610	S-3601	SD1492	SD2492
	38 1/2 (978)	Offset	120	1000	19	(2.9)	2.5 (1.1)	<b>SGA1J38JO2</b>	OT-3810	OT-3801	SS1581	SS2561
	38 1/2 (978)	Offset	240	1500	29	(4.5)	2.5 (1.1)	<b>SGA1J38JO3</b>	—	OT-3815	—	—
	42 1/2 (1080)	Offset	240	1500	26	(4.0)	2.8 (1.3)	<b>SGA1J42JO1</b>	—	OT-4315	SS1632	SS2632
	47 7/8 (1216)	Offset	240	2250	34	(5.3)	3.1 (1.4)	<b>SGA1J47RO1</b>	—	OT-4822	—	—

①Chromalox® and Wellman® part numbers are used as a cross reference to help select the equivalent Watlow part number. Chromalox® sizes 27 in. (686 mm) and longer, and all Wellman® sizes have mounting slot center to center distances 1/8 in. (3.2 mm) less than Watlow spacing.

**Note:** 5/16 in. x 1/2 in. (7.9 mm x 13 mm) mounting holes are supplied on all 375 strip heaters as standard, larger mounting holes may be provided 17/32 in. x 11/16 in. (13.5 mm x 17.5 mm).

Note that the Watlow part number specifies that the 375 strip heater includes an aluminized steel sheath. If a special sheath material is required, such as stainless steel, please contact your Watlow representative for material availability.

# Strip/Clamp-On Heaters



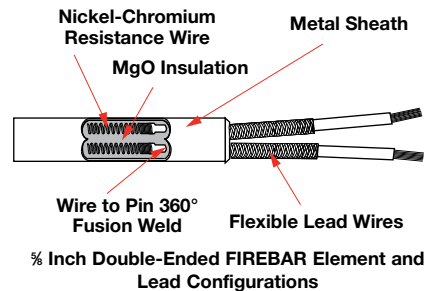
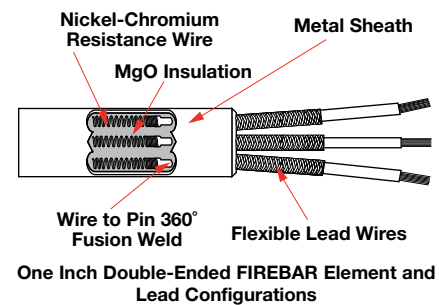
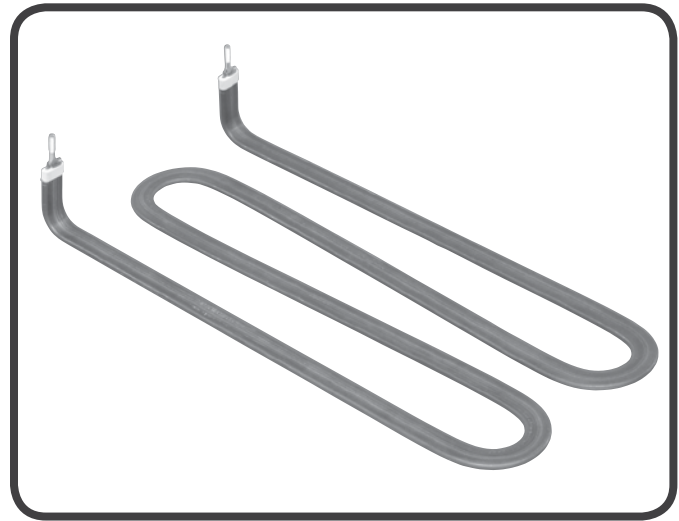
## FIREBAR® Clamp-On Heaters

FIREBAR® heating elements provide added heating performance over standard round tubular heating elements—especially for immersion applications in petroleum based liquids requiring high kilowatts.

The FIREBAR's unique flat surface geometry packs more power in shorter elements and assemblies, along with a host of other performance improvements. These include:

- Minimizing coking and fluid degrading
- Enhancing the flow of fluid past the element's surface to carry heat from the sheath
- Improving heat transfer with a significantly larger boundary layer allowing much more liquid to flow up and across the sheath's surface

FIREBAR elements are available in single- and double-ended constructions with one inch or  $\frac{5}{8}$  inch heights. These two configuration variables make it possible to use FIREBAR elements instead of round tubular elements in virtually all applications.



**For detailed product and technical data,  
see the full FIREBAR product  
section located on pages 84 through 102.**

# Strip/Clamp-On Heaters



## Thick Film Conduction Heaters

The Watlow 430 stainless steel thick film conduction heater is ideal for many applications where fast response and uniformity are essential. A clamp-on, thick film heater provides the best possible combination of heat transfer, thermal efficiency, temperature response and uniformity in a low profile package.

This high-performance heater can be used in areas where space is limited or where conventional heaters cannot be used due to limited voltage and wattage combinations.

Thick film conduction heaters provide a low profile in a variety of shapes including two-dimensional circular and rectangular forms. Direct contact of thick film heaters to surfaces ensures efficient heat transfer through thermally stable substrates and precise resistance trace patterns.

### Performance Capabilities

- Maximum substrate temperature up to 1022°F (550°C). Contact your Watlow representative for applications over 842°F (450°C)
- Watt densities up to 75 W/in<sup>2</sup> (11.6 W/cm<sup>2</sup>)
- Voltages up to 240V

### Features and Benefits

#### Watt densities up to 75 W/in<sup>2</sup> (11.6 W/cm<sup>2</sup>) for clamp-on applications

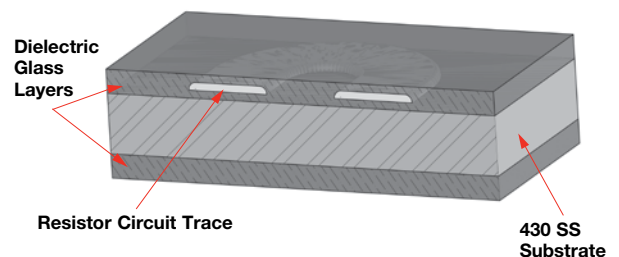
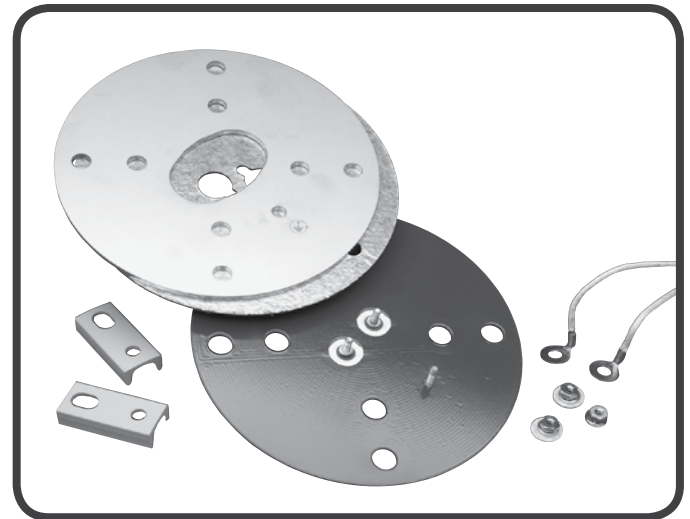
- Allows precise, repeatable wattage distribution and uniform temperature profile

#### Threaded stud termination

- Produces strong, trouble-free connections, see *Termination Assembly* drawing on page 454

#### Agency approvals

- UL<sup>®</sup> component recognition available upon request



### Typical Applications

- Food warming cabinets
- Load dump resistors
- Seal bars
- Deposition chamber lids

**For detailed product and technical data, see the full Thick Film Conduction product section located on pages 453 through 456.**





# Band/Barrel Heaters



Band/Barrel Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
Mineral Insulated (MI)	Stainless steel	1400	760	100	15.5	483



Band/Barrel Heaters



# Band/Barrel Heaters



## Mineral Insulated (MI) Band Heaters

The mineral insulated (MI) band heater from Watlow® is a high-performance heater that incorporates Watlow's exclusive mineral insulation. This material offers much higher thermal conductivity than mica and hard ceramic insulators that are used in conventional heaters.

A thin layer of the "high" thermally conductive MI material electrically insulates the element wire from the inside diameter of the heater sheath. The result is more efficient heat transfer, which lowers element wire temperatures and increases heater life.

### Performance Capabilities

- Heater operating temperatures up to 1400°F (760°C)
- Watt densities up to 100 W/in<sup>2</sup> (15.5 W/cm<sup>2</sup>) available on large diameter barrel bands
- Maximum voltage of 480V

### Features and Benefits

#### High thermal conductivity of MI and low mass construction

- Provides an almost instant response to temperature control
- Eliminates thermal lag and temperature overshoot associated with ceramic insulated heaters
- Lasts longer at higher watt densities/temperatures than mica band heaters

#### Operating temperatures up to 1400°F (760°C)

- Allows safe melting of resins such as PEEK™, Teflon®, Ultem® and Zytel®

#### Higher watt densities

- Contributes to faster heat-up and throughput for increased productivity

#### Stainless steel cover and side fold design

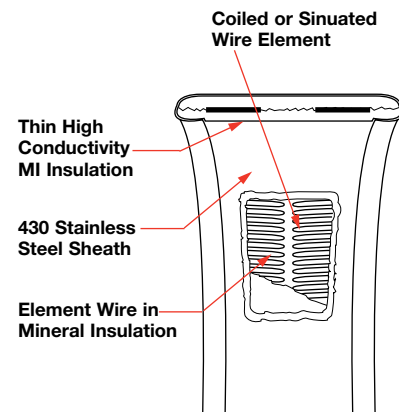
- Resists contamination from overflow of plastic or other free-flowing materials

#### Attached clamp bars

- Eliminates cumbersome clamping straps to ease installation

### Typical Applications

- Extruders
- Blown film dies
- Injection molding machines
- Other cylinder heating applications
- External tank and vessel heating



# Band/Barrel Heaters



## Mineral Insulated (MI) Band Heaters

### Applications and Technical Data

The *Physical Limitations of Variations* table shows the availability of widths, inside diameters and terminations for Watlow's MI band, barrel and nozzle heaters. To ensure available terminations meet application needs, refer to the termination variation illustrations in this section.

If the application requires a heater exceeding limitations shown, contact your Watlow representative.

### Physical Limitations of Variations

Width in. (mm)		I.D. Available – in. (mm)						Available Terminations
		1 pc. Construction		Expandable		2 pc. Construction		
in.	(mm)	Min. in.	Max. (mm)	Min. in.	Max. (mm)	Min. in.	Max. (mm)	
1	(25)	1	(25) – 6	3	(76) – 12	3	(76) – 12	All
1 <sup>3</sup> / <sub>8</sub>	(35)	1	(25) – 3	3	(76) – 6	3	(76) – 6	All - Except SLE
1 <sup>1</sup> / <sub>2</sub>	(38)	1	(25) – 14	3	(76) – 14	3	(76) – 28	All
2	(51)	1 <sup>1</sup> / <sub>4</sub>	(32) – 14	3	(76) – 14	3	(76) – 28	All
2 <sup>1</sup> / <sub>2</sub>	(64)	1 <sup>1</sup> / <sub>4</sub>	(32) – 14	3	(76) – 14	3	(76) – 28	All
3	(76)	1 <sup>1</sup> / <sub>2</sub>	(38) – 14	3	(76) – 14	3	(76) – 28	All
3 <sup>1</sup> / <sub>2</sub>	(89)	1 <sup>3</sup> / <sub>4</sub>	(45) – 14	3	(76) – 14	3	(76) – 28	All
4	(102)	2	(51) – 14	3	(76) – 14	3	(76) – 28	All
4 <sup>1</sup> / <sub>2</sub>	(114)	2 <sup>1</sup> / <sub>4</sub>	(57) – 14	3	(76) – 14	3	(76) – 28	All
5	(127)	2 <sup>1</sup> / <sub>2</sub>	(64) – 14	3	(76) – 14	4	(102) – 28	All
5 <sup>1</sup> / <sub>2</sub>	(140)	2 <sup>3</sup> / <sub>4</sub>	(70) – 14	3	(76) – 14	4	(102) – 28	All - Except 90° "B" Leads
6	(152)	3	(76) – 14	3	(76) – 14	4	(102) – 28	All

### General Limitations

- Maximum width of 1 in. (25 mm) diameter heater: 1<sup>1</sup>/<sub>2</sub> in. (38 mm)
- Maximum heater width: 2x heater diameter
- Minimum I.D. for Type B, C, E and H leads: 1 in. (25 mm)
- Minimum I.D. for Type B—90° leads: 1<sup>1</sup>/<sub>8</sub> in. (29 mm)
- Maximum lead amperes: 12.5A per pair
- SLE maximum: 17.0A
- Maximum amperes (post terminals): 30A per pair
- Minimum diameter and width for SLE: 4 in. x 1<sup>1</sup>/<sub>2</sub> in. (102 mm x 38 mm) width
- 90° leads not available over 250VAC
- Minimum I.D. for post terminals: 1<sup>1</sup>/<sub>4</sub> in. (32 mm)

### Gaps

- ≤ 3 in. = 1/8 in. nominal
- 3 in. ≤ 6 in. = 1/4 in. nominal ± 1/8 in.
- 6 in. ≤ 14 in. = 3/8 in. nominal ± 1/8 in.
- >14 in. = 1/2 in. nominal ± 1/4 in.

# Band/Barrel Heaters



## Mineral Insulated (MI) Band Heaters

### Applications and Technical Data (Continued)

#### Calculating Watt Density

Watt density is the amount of wattage per square inch of heated area. To determine watt density, divide the total wattage by the heated area.

$$\text{Watt Density} = \frac{\text{Total Watts}}{\text{Heated Area}}$$

To apply this equation, the term “heated area” must be defined. Heated area is the total contact surface of the heater less the areas of no-heat found around terminals, mounting holes, etc.

$$\text{Heated Area} = \text{Total Contact Area} - \text{No-Heat Area}$$

#### To calculate the heated area:

1. Locate the **no-heat factor** from the chart below that corresponds to the type of heater being considered.

Type	No-Heat Factor in.
1 pc. lead unit Type B, C, H, E or 90°B	1.37
1 pc. post terminal	1.60
1 pc. expandable post term	3.18
1 pc. expandable lead unit	3.00
True 2 pc. post term	3.20
True 2 pc. leads	2.74
SLE	3.68

2. To use the formula below, insert the no-heat factors, diameter and width (in inches).

$$\text{Heated Area} = (3.14 \times \text{Diameter} - \text{No-Heat Factor}) \times \text{Width}$$

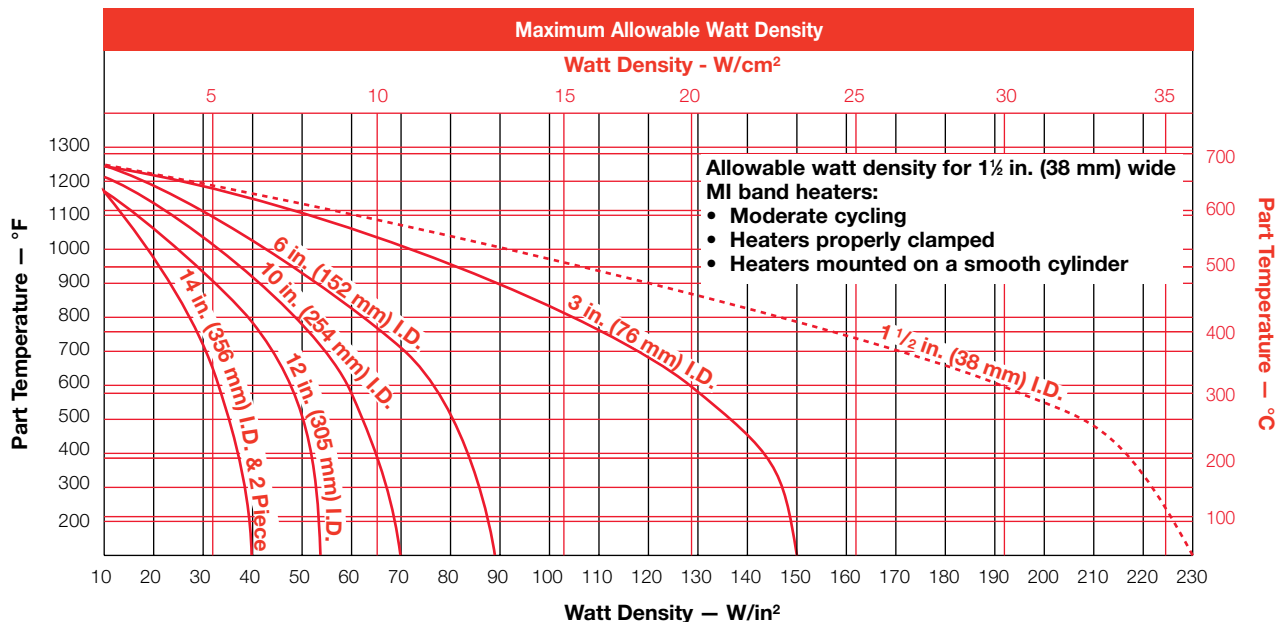
#### Maximum Allowable Watt Density

The following derating factors apply to the *Maximum Allowable Watt Density* chart, which are displayed in both inches and millimeters. Review these factors and the chart to determine the correct watt density curve for the application.

#### Derating Factors:

- For units over 2 in. (51 mm) in width, multiply the watt density by 0.80.

- For applications where unusual operating conditions are present, such as irregular mounting surfaces, contact your Watlow representative for watt density limitations.
- For barrel heaters used in vertical applications, spring loaded clamping is recommended.
- For applications where insulating blankets are used, multiply watt density by 0.75.



# Band/Barrel Heaters

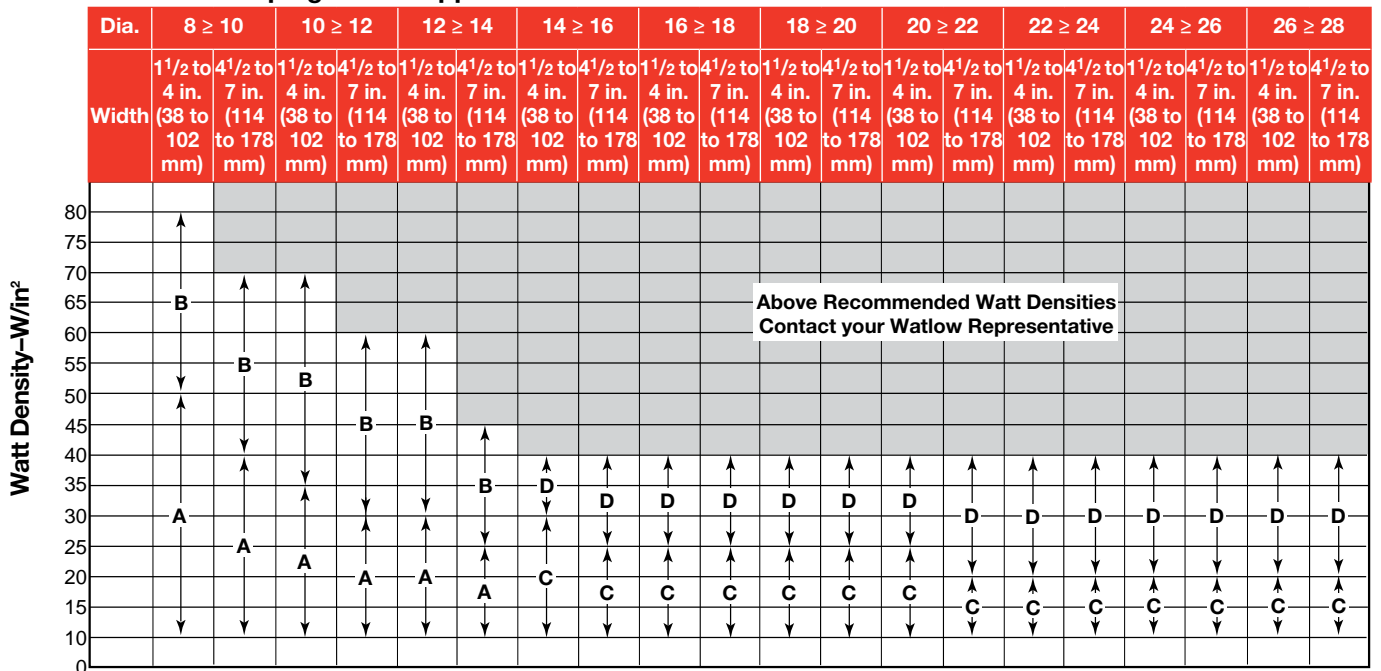


## Mineral Insulated (MI) Band Heaters

### Applications and Technical Data (Continued)

- Review the *Watt Density* chart to ensure the application does not exceed the maximum watt density at operating temperature after applying derating factors.
- Locate clamping guideline for unit diameter, width and watt density.
- Description of guideline letters are at the bottom of the *MI Band Clamping Matrix Application Guide*.
- Note:** Upward arrows are up to and not including specified watt density. Downward arrows are greater than or equal to specified watt density.

### MI Band Clamping Matrix Application Guide



- A = Clamp bars, expandable, one piece or two piece construction
- B = Spring clamps, expandable, one piece or two piece construction
- C = Spring clamps, at one gap, welded barrel nuts at other gap
- D = Spring clamps at all gaps

Width	Clamp Points at Each Gap
≥ 5 in. (127 mm)	3
≥ 3 in. (76 mm)	2
< 3 in. (76 mm)	1

**Note:** 1 in. (25 mm) wide heaters use welded barrel nuts rather than clamp bars.

# Band/Barrel Heaters

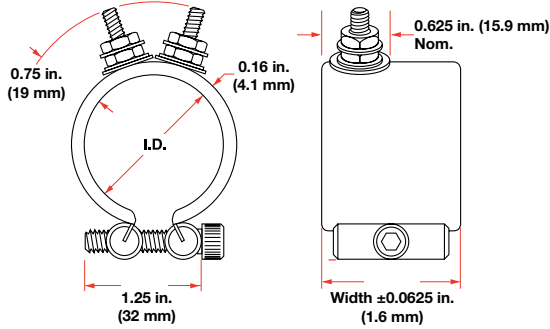


## Mineral Insulated (MI) Band Heaters

### Termination Variations

#### Post Terminals

Stock



Post terminals provide optimum connections. Screw thread is 10-24. To order, specify **post terminals** (metric threads available).

#### Lead Wire

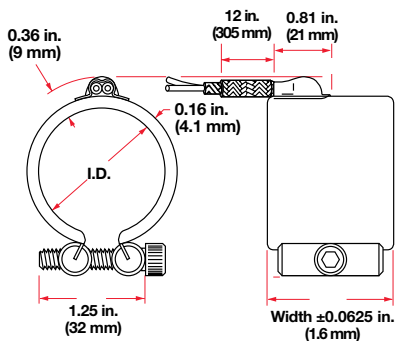
Heaters rated at less than 250VAC use UL<sup>®</sup> approved lead insulation for operations to 480°F (250°C) as standard. Lead insulation UL<sup>®</sup> rated for operation to 840°F (450°C) is available for high-temperature applications where the leads are shrouded or enclosed with the heater. These leads are available in any of the Type B with loose braid as well as Types E, F and H lead configurations. All heaters rated at more than 250VAC use this wire. When ordering, specify **850°F (450°C) wire**.

#### Type B and C

Leads Type B, Type B - 90° rotation, Type B - 180° rotation or Type C: Two fiberglass-insulated lead wires exit in a single metal braid for good abrasion protection, lead flexibility and wiring convenience. Leads are 2 in. (51 mm) longer than braid. Shipped with 12 in. (305 mm) leads, unless longer length is specified. To order, specify **type** and **length**.

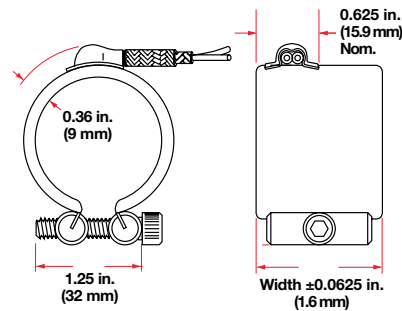
#### Type B

Stock



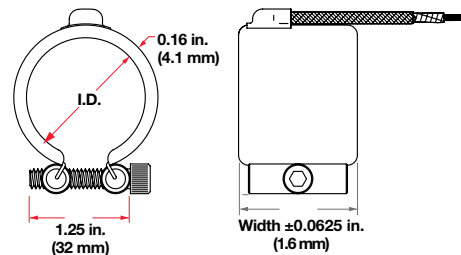
#### Type B - 90° Rotation

Non-Stock



#### Type B - 180° Rotation

Stock



# Band/Barrel Heaters

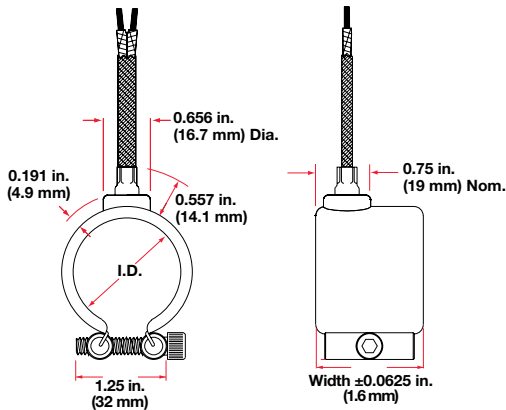


## Mineral Insulated (MI) Band Heaters

### Termination Variations (Continued)

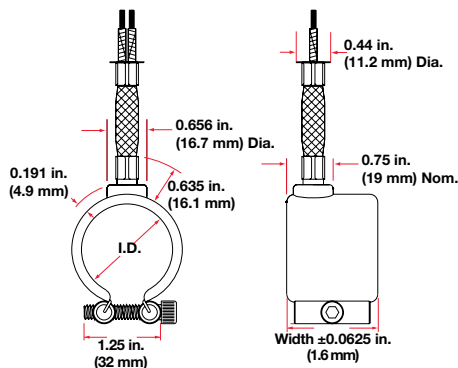
#### Lead Wire (Continued)

#### Type C Stock



**Note:** Heater width dimensions and tolerances apply to functional heated portion of band heaters only. Larger variation at end closures and hinge locations due to deformation of the sheath metal may occur. Contact your Watlow representative for critical width applications.

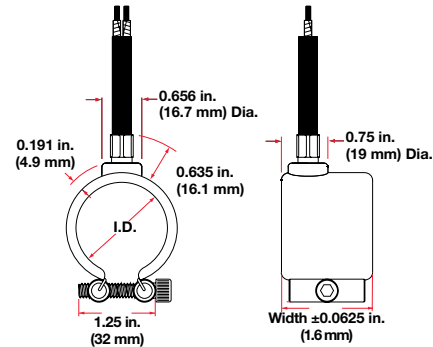
#### Type E Stock



Type E: Loose metal braid encloses two fiberglass leads for good abrasion protection, lead flexibility and wiring convenience. Leads are 2 in. (51 mm) longer than the braid. Shipped with 12 in. (305 mm) leads, unless longer length is specified. To order, specify **Type E** and **length**.

**Note:** Heater width dimensions and tolerances apply to functional heated portion of band heaters only. Larger variation at end closures and hinge locations due to deformation of the sheath metal may occur. Contact your Watlow representative for critical width applications.

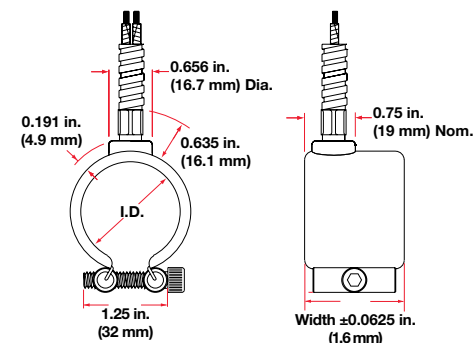
#### Type F Stock



Type F: Loose fiberglass sleeving encloses two fiberglass leads for additional insulation protection where high temperature or minor abrasion is present. Leads are 2 in. (51 mm) longer than the sleeving. Shipped with 12 in. (305 mm) leads, unless longer length is specified. To order, specify **Type F** and **length**.

**Note:** Heater width dimensions and tolerances apply to functional heated portion of band heaters only. Larger variation at end closures and hinge locations due to deformation of the sheath metal may occur. Contact your Watlow representative for critical width applications.

#### Type H Stock



Type H: A flexible steel hose encloses the leads for maximum abrasion protection. Leads are 2 in. (51 mm) longer than hose. Shipped with 12 in. (305 mm) leads, unless longer length is specified. To order, specify **Type H** and **length**.

**Note:** Heater width dimensions and tolerances apply to functional heated portion of band heaters only. Larger variation at end closures and hinge locations due to deformation of the sheath metal may occur. Contact your Watlow representative for critical width applications.



# Band/Barrel Heaters

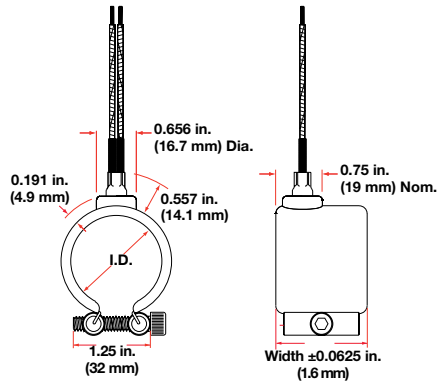


## Mineral Insulated (MI) Band Heaters

### Termination Variations (Continued)

#### Lead Wire (Continued)

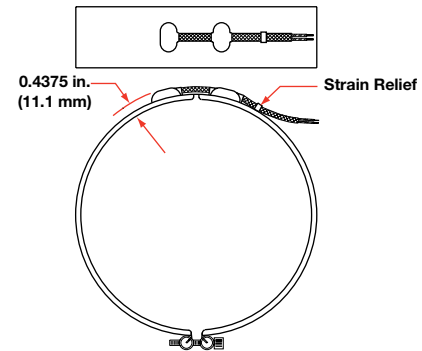
##### Type K Stock



Type K: Flexible lead wires exit vertically from the heater. These leads can be bent adjacent to the heater for a quick and easy connection. Shipped with 12 in. (305 mm) leads, unless longer length is specified. To order, specify **Type K** and **length**.

**Note:** Heater width dimensions and tolerances apply to functional heated portion of band heaters only. Larger variation at end closures and hinge locations due to deformation of the sheath metal may occur. Contact your Watlow representative for critical width applications.

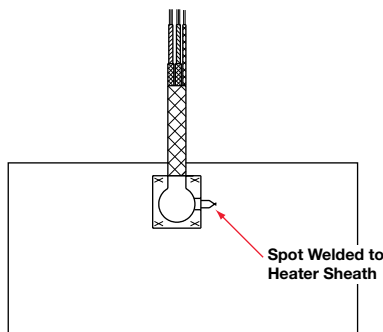
##### Type SLE



Available only on expandable construction. Two fiberglass leads with woven metal lead protection exit at a right angle. The minimum diameter capability is 4 in. (102 mm). Minimum heater width is 1.5 in. (38 mm). To order specify **Type SLE** and **length**.

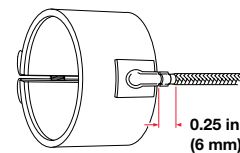
### Variations

#### Thermocouple



ASTM Type J or K thermocouples are available on lead Type B with loose braid and fiberglass sleeving. They are also available on E, F and H leads. The thermocouple junction, spot-welded to the heater sheath, provides a signal for measuring relative heater temperature. A separate thermocouple is available.

#### Heavy Duty Strain Relief



Heavy duty strain relief is recommended for applications where there is great stress or continued flexing of the leads. The strain relief is available on Type B, Type B - 90° and Type B - 180° leads only. To order, specify **heavy-duty strain relief**. **Note:** not available with loose braid or fiberglass sleeving.

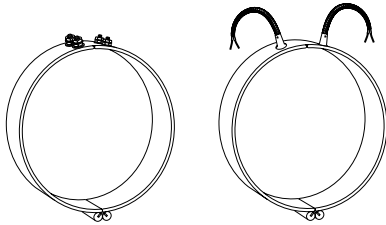
# Band/Barrel Heaters



## Mineral Insulated (MI) Band Heaters

**Variations** (Continued)

### Expandable Heaters With Post Terminals or Leads

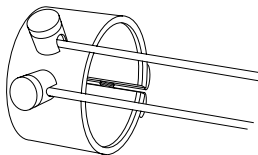


Expandable heaters are two-piece units with a common top metal allowing the heater to expand open to the full diameter of the barrel. On expandable bands, each half will be one half of the total wattage. Plus, on both expandable and two-piece bands, each half will be rated at full operating voltage, unless otherwise specified.

**MI band heaters 1 1/2 in. (38 mm) wide** or greater have post terminals located next to the expansion joint. Leads may be located anywhere along the circumference except near the gap and at the expansion joint. Two sets of leads required.

**On 1 in. (25 mm) wide** MI band heaters, post terminals will be located 90° from the expansion joint.

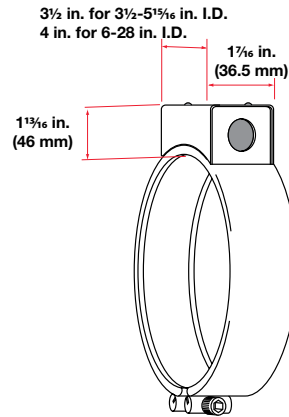
### Ceramic Terminal Cover



Ceramic covers, with openings for leads, are screwed on to post terminals, providing a convenient, economical insulator. To order, specify part number **Z-4918** and **quantity**. For metric sizes specify thread needed.

**Note:** Ceramic terminal covers will not fit on some stock expandable MI bands or nozzles. Contact your Watlow representative for more information.

### Metallic Terminal Box



Metallic terminal boxes are available from stock on 3 1/2 in. inside diameter x 1 1/2 in. wide (89 mm x 38 mm) or larger heaters. Terminal boxes, which attach directly to the heater, act as a safety feature by covering the terminals. Conduit may be attached to the box through 7/8 in. (22 mm) diameter holes in the ends of the box. Two-piece heaters require two boxes. To order, specify **terminal box**.

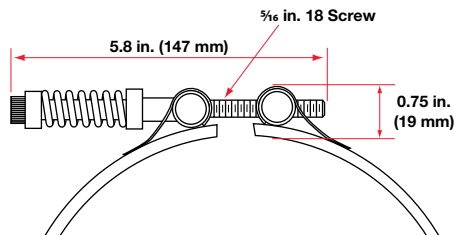
# Band/Barrel Heaters



## Mineral Insulated (MI) Band Heaters

### Clamping Variations

#### Tig-Welded Barrel Nuts with Spring Loaded Clamping

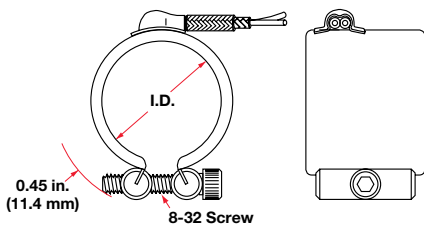


Welded barrel nuts with spring loaded clamping are used to maintain a tight heater fit on large barrels during start-up. This clamping variation is recommended for all MI band heaters greater than 14 in. (356 mm) in diameter and 1 1/2 in. (38 mm) or greater in width. Refer to *MI Band Clamping Matrix Application Guide*. For smaller diameter heaters, it is an option and must be ordered separately. To order, specify **spring loaded clamping**.

#### Low-Profile Tig-Welded Barrel Nuts

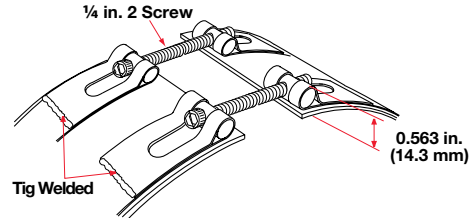
Low-profile barrel nuts are available on all widths and provide a clearance of 0.470 in. (12 mm). However, this value can be higher depending on how far the clamp screw extends past the barrel nut. To order, specify **low-profile tig-welded barrel nuts**.

#### Low-Profile Clamp Bars



Low-profile clamp bars are available on both 1 in. (25 mm) and 1 1/2 in. (38 mm) wide heaters, for wider widths contact your Watlow representative. Watlow recommends not using low-profile clamping on diameters and widths greater than 3 in. (76 mm). The bars are 1/4 in. (6 mm) diameter with an 8-32 screw. To order, specify **low-profile clamp bars**.

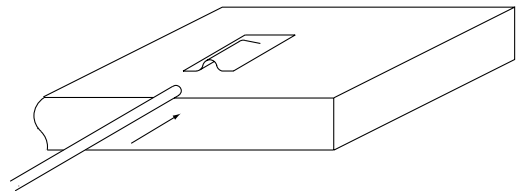
#### Tig-Welded Barrel Nuts



Tig-welded barrel nuts can function like a hinge to allow two-piece heaters to be more easily installed. If a large gap is specified to provide access for instrumentation, tig-welded barrel nuts can be situated in such a way that the clamp screws do not interfere with the sensor. To order, specify **gap size and sensor location**. **Note:** a gap greater than 1 in. (25 mm) wide is considered extended capability.

### Options

#### Thermocouple Pocket



A thermocouple pocket welded to the surface accepts a 0.063 in. (2 mm) diameter thermocouple (not included). This option provides accurate temperature sensing of the heater and easy thermocouple replacement.

# Band/Barrel Heaters



## Mineral Insulated (MI) Band Heaters

The following tables contain lists of standard base MI band heater constructions. Watlow's configurator offers millions of potential MI band heater configurations to meet your thermal needs, many of those configurations available in one or five days. Please contact your local Watlow distributor or sales office to configure your MI band heater.

### Heater Part Numbers

I.D. in. (mm)	Width in. (mm)	Construction	Volts	Watts	Watt Density		Termination	Approx. Net Wt.		Part Number
					W/in <sup>2</sup>	(W/cm <sup>2</sup> )		lbs	(kg)	
1 (25)	1 (25)	1 pc	120	150	92	(14.2)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1A1AN1</b>
	1 (25)	1 pc	120	100	61	(9.4)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1A1AN2</b>
	1 (25)	1 pc	120	200	122	(18.9)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1A1AN3</b>
	1 (25)	1 pc	240	200	122	(18.9)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1A1AN4</b>
	1 1/2 (38)	1 pc	240	300	106	(16.4)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1A1JN1</b>
	1 1/2 (38)	1 pc	120	300	106	(16.4)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1A1JN2</b>
	1 1/2 (38)	1 pc	240	200	70	(10.8)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1A1JN3</b>
	1 1/2 (38)	1 pc	120	200	70	(10.8)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1A1JN4</b>
1 1/4 (32)	1 1/2 (38)	1 pc	240	400	141	(21.8)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1A1JN5</b>
	1 (25)	1 pc	240	250	104	(16.1)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1E1AN1</b>
	1 (25)	1 pc	120	250	104	(16.1)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1E1AN2</b>
	1 (25)	1 pc	240	300	124	(19.2)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1E1AN3</b>
	1 1/2 (38)	1 pc	240	350	87	(13.5)	Type B,C,E, F or H	0.2	(0.09)	<b>MB1E1JN1</b>
	1 1/2 (38)	1 pc	120	350	87	(13.5)	Type B,C,E, F or H	0.2	(0.09)	<b>MB1E1JN2</b>
1 1/2 (38)	1 1/2 (38)	1 pc	240	450	112	(17.3)	Type B,C,E, F or H	0.2	(0.09)	<b>MB1E1JN3</b>
	1 (25)	1 pc	240	300	93	(14.4)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1J1AN1</b>
	1 (25)	1 pc	120	300	93	(14.4)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1J1AN2</b>
	1 (25)	1 pc	240	200	62	(9.6)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1J1AN3</b>
	1 (25)	1 pc	120	200	62	(9.6)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1J1AN4</b>
	1 (25)	1 pc	240	400	125	(19.3)	Type B,C,E, F or H	0.1	(0.05)	<b>MB1J1AN5</b>
	1 1/2 (38)	1 pc	120	300	62	(9.6)	Type B,C,E, F or H	0.2	(0.09)	<b>MB1J1JN1</b>
	1 1/2 (38)	1 pc	240	450	87	(13.5)	Type B,C,E, F or H	0.2	(0.09)	<b>MB1J1JN2</b>
	1 1/2 (38)	1 pc	240	300	62	(9.6)	Type B,C,E, F or H	0.2	(0.09)	<b>MB1J1JN3</b>
	1 1/2 (38)	1 pc	240	600	116	(17.9)	Type B,C,E, F or H	0.2	(0.09)	<b>MB1J1JN4</b>
	1 1/2 (38)	1 pc	240	300	62	(9.6)	Post	0.2	(0.09)	<b>MB1J1JP4</b>
	1 1/2 (38)	1 pc	240	450	96	(14.8)	Post	0.2	(0.09)	<b>MB1J1JP6</b>
	2 (51)	1 pc	240	450	57	(8.8)	Type B,C,E, F or H	0.3	(0.14)	<b>MB1J2AN1</b>
	2 (51)	1 pc	240	300	42	(6.5)	Type B,C,E, F or H	0.3	(0.14)	<b>MB1J2AN2</b>
	2 (51)	1 pc	240	900	125	(19.3)	Type B,C,E, F or H	0.3	(0.14)	<b>MB1J2AN3</b>
	1 3/4 (45)	3 (76)	1 pc	240	500	45	(7.0)	Type B,C,E, F or H	0.4	(0.18)
3 (76)		1 pc	240	350	31	(4.8)	Type B,C,E, F or H	0.4	(0.18)	<b>MB1J3AN2</b>
3 (76)		1 pc	240	1000	104	(16.1)	Type B,C,E, F or H	0.4	(0.18)	<b>MB1J3AN3</b>
1 3/8 (35)		1 pc	240	450	83	(12.9)	36 in. 90° Type B braid w/HD strain relief	0.2	(0.09)	<b>MB1N1GX3A</b>
1 1/2 (38)		1 pc	240	300	47	(7.3)	Type B,C,E, F or H	0.2	(0.09)	<b>MB1N1JN1</b>
2 (51)	1 1/2 (38)	1 pc	120	300	50	(7.7)	Type B,C,E, F or H	0.2	(0.09)	<b>MB1N1JN2</b>
	1 1/2 (38)	1 pc	240	700	110	(17.0)	Type B,C,E, F or H	0.2	(0.09)	<b>MB1N1JN3</b>
	2 (51)	1 pc	240	750	86	(13.3)	Type B,C,E, F or H	0.3	(0.14)	<b>MB1N2AN1</b>
	1 (25)	1 pc	240	350	73	(11.3)	Type B,C,E, F or H	0.2	(0.09)	<b>MB2A1AN1</b>
	1 (25)	1 pc	120	350	73	(11.3)	Type B,C,E, F or H	0.2	(0.09)	<b>MB2A1AN2</b>
2 (51)	1 (25)	1 pc	240	450	94	(14.5)	Type B,C,E, F or H	0.2	(0.09)	<b>MB2A1AN3</b>
	1 (25)	1 pc	240	350	73	(10.3)	36 in. 90° Type B braid w/HD strain relief	0.2	(0.09)	<b>MB2A1AX6B</b>

CONTINUED

### Notes:

All lead units are available with any length Type B, C, E, F or Type H leads.

# Band/Barrel Heaters



## Mineral Insulated (MI) Band Heaters

### Heater Part Numbers (Continued)

I.D. in. (mm)	Width in. (mm)	Construction	Volts	Watts	Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )	Termination	Approx. Net Wt. lbs (kg)	Part Number
2 (51)	1 1/2 (38)	1pc	240	400	53 (8.2)	Type B,C,E, F or H	0.3 (0.14)	<b>MB2A1JN1</b>
	1 1/2 (38)	1pc	240	1000	132 (20.4)	Type B,C,E, F or H	0.3 (0.14)	<b>MB2A1JN2</b>
	2 (51)	1pc	240	750	75 (11.6)	Type B,C,E, F or H	0.4 (0.18)	<b>MB2A2AN1</b>
	2 (51)	1pc	240	1200	125 (19.3)	Type B,C,E, F or H	0.4 (0.18)	<b>MB2A2AN2</b>
	2 (51)	1pc	240	750	75 (11.6)	36 in. 90° Type B braid w/HD strain relief	0.2 (0.09)	<b>MB2A2AX2A</b>
2 1/4 (57)	2 (51)	1pc	240	750	63 (9.7)	120 in. 180° Type B braid w/HD strain relief	0.2 (0.09)	<b>MB2E2AX7</b>
	2 1/2 (64)	1 pc	240	1000	72 (11.2)	Type B,C,E, F or H	0.5 (0.23)	<b>MB2E2JN1</b>
2 1/2 (64)	1 (25)	1 pc	240	400	63 (9.7)	Type B,C,E, F or H	0.2 (0.09)	<b>MB2J1AN1</b>
	1 1/2 (38)	1 pc	240	500	50 (7.7)	Type B,C,E, F or H	0.4 (0.18)	<b>MB2J1JN1</b>
3 (76)	1 (25)	1 pc	240	400	54 (8.4)	Post	0.3 (0.14)	<b>MB3A1AP1</b>
	1 1/2 (38)	1 pc	240	500	40 (6.2)	Post	0.4 (0.18)	<b>MB3A1JP1</b>
	1 1/2 (38)	2 pc exp	230/460	525	53 (8.2)	Post	0.4 (0.18)	<b>ME3A1JP10</b>
3 1/2 (89)	2 (51)	1 pc	240	800	42 (6.5)	Post	0.7 (0.32)	<b>MB3J2AP2</b>
3 5/8 (92)	1 1/2 (38)	2 pc exp	230/460	650	51 (7.9)	Post	0.5 (0.23)	<b>ME3L1JP5</b>
4 (102)	1 (25)	1 pc	240	700	62 (9.6)	Post	0.4 (0.18)	<b>MB4A1AP1</b>
	1 1/2 (38)	1 pc	240	800	48 (7.4)	Post	0.6 (0.27)	<b>MB4A1JP2</b>
	1 1/2 (38)	2 pc exp	230/460	625	43 (6.7)	Post	0.6 (0.27)	<b>ME4A1JP11</b>
	1 1/2 (38)	2 pc exp	230/460	725	50 (7.8)	Post	0.6 (0.27)	<b>ME4A1JP12</b>
4 1/2 (114)	2 1/2 (64)	1pc	240	1250	40 (6.2)	Post	1.0 (0.45)	<b>MB4J2JP1</b>
5 (127)	1 1/2 (38)	2 pc exp	240/480	1000	52 (8.1)	Post	0.8 (0.36)	<b>ME5A1JP8</b>
5 1/4 (133)	1 1/2 (38)	2 pc exp	240/480	1000	48 (7.4)	Post	0.8 (0.36)	<b>ME5E1JP1</b>
	1 1/2 (38)	2 pc exp	230/460	600	29 (4.5)	Post	0.7 (0.32)	<b>ME5E1JP9</b>
	3 (76)	2 pc exp	230/460	1700	40 (6.2)	Post	1.5 (0.68)	<b>ME5E3AP5</b>
	4 1/2 (114)	2 pc exp	230/460	2400	38 (5.9)	Post	2.2 (1.00)	<b>ME5E4JP2</b>
	4 1/2 (114)	2 pc exp	230/460	2700	43 (6.6)	Post	2.2 (1.00)	<b>ME5E4JP3</b>
5 1/2 (140)	1 1/2 (38)	2 pc exp	240/480	1000	46 (7.1)	Post	0.9 (0.40)	<b>ME5J1JP1</b>
6 (152)	1 1/2 (38)	2 pc exp	240/480	1000	41 (6.4)	Post	0.9 (0.40)	<b>ME6A1JP2</b>
6 1/2 (165)	1 1/2 (38)	2 pc exp	240/480	1250	47 (7.3)	Post	1.0 (0.45)	<b>ME6J1JP5</b>
6 3/4 (171)	1 1/2 (38)	2 pc exp	230/460	815	29 (4.5)	Post	0.9 (0.40)	<b>ME6N1JP6</b>
	1 1/2 (38)	2 pc exp	230/460	1000	36 (5.6)	Post	0.9 (0.40)	<b>ME6N1JP7</b>
	4 (102)	2 pc exp	230/460	2600	35 (5.4)	Post	2.5 (1.10)	<b>ME6N4AP2</b>
	5 (127)	2 pc exp	230/460	3700	40 (6.2)	Post	3.2 (1.50)	<b>ME6N5AP3</b>
	6 (152)	2 pc exp	230/460	3750	33 (5.1)	Post	3.8 (1.70)	<b>ME6N6AP5</b>
7 (178)	1 1/2 (38)	2 pc exp	240/480	1250	43 (6.6)	Post	1.1 (0.50)	<b>ME7A1JP4</b>
7 1/2 (191)	1 1/2 (38)	2 pc exp	240/480	1500	47 (7.3)	Post	1.1 (0.50)	<b>ME7J1JP4</b>
7 5/8 (194)	3 (76)	2 pc exp	230/460	1800	28 (4.3)	Post	2.2 (1.00)	<b>ME7L3AP1</b>
8 (203)	1 1/2 (38)	2 pc exp	240/480	1250	37 (5.7)	Post	1.2 (0.54)	<b>ME8A1JP4</b>
9 (229)	1 1/2 (38)	2 pc exp	240/480	1500	39 (6.0)	Post	1.4 (0.64)	<b>ME9A1JP1</b>
9 1/2 (241)	3 (76)	2 pc exp	230/460	3000	37 (5.7)	Post	2.6 (1.20)	<b>ME9J3AP2</b>
11 1/4 (286)	3 (76)	2 pc exp	230/460	2400	24 (3.7)	Post	3.2 (1.50)	<b>ME11E3AP2</b>
	5 (127)	2 pc exp	230/460	5100	31 (4.8)	Post	5.2 (2.40)	<b>ME11E5AP1</b>

**Notes:**

All lead units are available with any length Type B, C, E, F or Type H leads.



# Nozzle Heaters



Nozzle Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
<b>Mineral Insulated (MI)</b>	Stainless steel	1400	760	230	35.6	<b>497</b>







# Nozzle Heaters



## Mineral Insulated (MI) Nozzle Heaters

The mineral insulated (MI) nozzle heater is a high-performance heater that incorporates Watlow's exclusive mineral insulation technology. This material offers much higher thermal conductivity than mica and hard ceramic insulators used in conventional heaters.

A thin layer of the high thermal conductive MI material electrically insulates the element wire from the inside diameter of the heater sheath. A thicker, low thermal conductivity layer backs up the element wire, directing the heat inward toward the heated part. The result is more efficient heat transfer—a performance solution that lowers element wire temperatures and increases heater life.

### Performance Capabilities

- Heater operating temperatures up to 1400°F (760°C)
- Watt densities up to 230 W/in<sup>2</sup> (35.6 W/cm<sup>2</sup>) are available on small diameter nozzle
- Maximum voltage up to 240V

### Features and Benefits

#### Operating temperatures up to 1400°F (760°C)

- Melts resins such as PEEK®, Teflon®, Ultem® and Zytel® safely

#### Higher watt densities

- Contributes to faster heat-up and throughput for increased productivity

#### High thermal conductivity of MI and low mass construction

- Provides an almost instant response to temperature control
- Eliminates thermal lag and temperature overshoot

#### Stainless steel cover and side fold design

- Resists contamination by overflow of plastic or other free-flowing materials

#### Permanently attached clamp bars

- Eliminates cumbersome clamping straps to ease installation



### Typical Applications

- Extruders
- Blown film dies
- Injection molding machines
- Other cylinder heating applications

**For MI nozzle heater part numbers see next page.  
For detailed product and technical data,  
see the full MI Band Heater product  
section located on pages 483 through 493.**

# Nozzle Heaters



## Mineral Insulated (MI) Nozzle Heaters

### Heater Part Numbers

I.D. in. (mm)	Width		Construction	Volts	Watts	Watt Density		Termination	Approx. Net Wt.		Part Number
	in. (mm)	(mm)				W/in <sup>2</sup>	(W/cm <sup>2</sup> )		lbs.	(kg)	
1 (25)	1 (25)	(25)	1 pc	120	150	92	(14)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1A1AN1</b>
	1 (25)	(25)	1 pc	120	100	61	(9)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1A1AN2</b>
	1 (25)	(25)	1 pc	120	200	122	(19)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1A1AN3</b>
	1 (25)	(25)	1 pc	240	200	122	(19)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1A1AN4</b>
	1 1/2 (38)	(38)	1 pc	240	300	106	(16)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1A1JN1</b>
	1 1/2 (38)	(38)	1 pc	120	300	106	(16)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1A1JN2</b>
	1 1/2 (38)	(38)	1 pc	240	200	70	(11)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1A1JN3</b>
	1 1/2 (38)	(38)	1 pc	120	200	70	(11)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1A1JN4</b>
1 1/4 (32)	1 1/2 (38)	(38)	1 pc	240	400	141	(22)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1A1JN5</b>
	1 (25)	(25)	1 pc	240	250	104	(16)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1E1AN1</b>
	1 (25)	(25)	1 pc	120	250	104	(16)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1E1AN2</b>
	1 (25)	(25)	1 pc	240	300	124	(19)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1E1AN3</b>
	1 1/2 (38)	(38)	1 pc	240	350	87	(13)	Type B, C, E, F or H	0.2	(0.09)	<b>MB1E1JN1</b>
	1 1/2 (38)	(38)	1 pc	120	350	87	(13)	Type B, C, E, F or H	0.2	(0.09)	<b>MB1E1JN2</b>
1 1/2 (38)	1 1/2 (38)	(38)	1 pc	240	450	112	(17)	Type B, C, E, F or H	0.2	(0.09)	<b>MB1E1JN3</b>
	1 (25)	(25)	1 pc	240	300	93	(14)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1J1AN1</b>
	1 (25)	(25)	1 pc	120	300	93	(14)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1J1AN2</b>
	1 (25)	(25)	1 pc	240	200	62	(10)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1J1AN3</b>
	1 (25)	(25)	1 pc	120	200	62	(10)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1J1AN4</b>
	1 (25)	(25)	1 pc	240	400	125	(19)	Type B, C, E, F or H	0.1	(0.05)	<b>MB1J1AN5</b>
	1 1/2 (38)	(38)	1 pc	120	300	58	(9)	Type B, C, E, F or H	0.2	(0.09)	<b>MB1J1JN1</b>
	1 1/2 (38)	(38)	1 pc	240	450	87	(14)	Type B, C, E, F or H	0.2	(0.09)	<b>MB1J1JN2</b>
	1 1/2 (38)	(38)	1 pc	240	300	58	(9.0)	Type B, C, E, F or H	0.2	(0.09)	<b>MB1J1JN3</b>
	1 1/2 (38)	(38)	1 pc	240	600	116	(18)	Type B, C, E, F or H	0.2	(0.09)	<b>MB1J1JN4</b>
	1 1/2 (38)	(38)	1 pc	240	300	64	(10)	Post	0.2	(0.09)	<b>MB1J1JP4</b>
	1 1/2 (38)	(38)	1 pc	240	450	96	(15)	Post	0.2	(0.09)	<b>MB1J1JP6</b>
	2 (51)	(51)	1 pc	240	450	57	(9)	Type B, C, E, F or H	0.3	(0.14)	<b>MB1J2AN1</b>
	2 (51)	(51)	1 pc	240	300	42	(7)	Type B, C, E, F or H	0.3	(0.14)	<b>MB1J2AN2</b>
	2 (51)	(51)	1 pc	240	900	125	(19)	Type B, C, E, F or H	0.3	(0.14)	<b>MB1J2AN3</b>
	3 (76)	(76)	1 pc	240	500	45	(7)	Type B, C, E, F or H	0.4	(0.18)	<b>MB1J3AN1</b>
3 (76)	(76)	1 pc	240	350	31	(5)	Type B, C, E, F or H	0.4	(0.18)	<b>MB1J3AN2</b>	
3 (76)	(76)	1 pc	240	1000	104	(16)	Type B, C, E, F or H	0.4	(0.18)	<b>MB1J3AN3</b>	
1 3/4 (45)	1 3/8 (35)	(35)	1 pc	240	450	83	(13)	36 in. 90° Type B braid w/HD strain relief	0.2	(0.09)	<b>MB1N1GX3A</b>
	1 1/2 (38)	(38)	1 pc	240	300	47	(7)	Type B, C, E, F or H	0.2	(0.09)	<b>MB1N1JN1</b>
	1 1/2 (38)	(38)	1 pc	120	300	50	(8)	Type B, C, E, F or H	0.2	(0.09)	<b>MB1N1JN2</b>
	1 1/2 (38)	(38)	1 pc	240	700	110	(17)	Type B, C, E, F or H	0.2	(0.09)	<b>MB1N1JN3</b>
	2 (51)	(51)	1 pc	240	750	86	(13)	Type B, C, E, F or H	0.3	(0.14)	<b>MB1N2AN1</b>
2 (51)	1 (25)	(25)	1 pc	240	350	73	(11)	Type B, C, E, F or H	0.2	(0.09)	<b>MB2A1AN1</b>
	1 (25)	(25)	1 pc	120	350	73	(11)	Type B, C, E, F or H	0.2	(0.09)	<b>MB2A1AN2</b>
	1 (25)	(25)	1 pc	240	450	94	(15)	Type B, C, E, F or H	0.2	(0.09)	<b>MB2A1AN3</b>
	1 (25)	(25)	1 pc	240	350	79	(12)	36 in. 90° Type B braid w/HD strain relief	0.2	(0.09)	<b>MB2A1AX6B</b>
	1 1/2 (38)	(38)	1 pc	240	400	53	(8)	Type B, C, E, F or H	0.3	(0.14)	<b>MB2A1JN1</b>
	1 1/2 (38)	(38)	1 pc	240	1000	132	(21)	Type B, C, E, F or H	0.3	(0.14)	<b>MB2A1JN2</b>
	2 (51)	(51)	1 pc	240	750	73	(11)	Type B, C, E, F or H	0.4	(0.18)	<b>MB2A2AN1</b>
	2 (51)	(51)	1 pc	240	1200	125	(19)	Type B, C, E, F or H	0.4	(0.18)	<b>MB2A2AN2</b>
2 1/4 (57)	2 (51)	(51)	1 pc	240	750	75	(12)	36 in. 90° Type B braid w/HD strain relief	0.2	(0.09)	<b>MB2A2AX2A</b>
	2 (51)	(51)	1 pc	240	750	63	(10)	120 in. 180° Type B braid w/HD strain relief	0.2	(0.09)	<b>MB2E2AX7</b>
2 1/2 (64)	2 1/2 (64)	(64)	1 pc	240	1000	72	(11)	Type B, C, E, F or H	0.5	(0.23)	<b>MB2E2JN1</b>
	1 (25)	(25)	1 pc	240	400	63	(10)	Type B, C, E, F or H	0.2	(0.09)	<b>MB2J1AN1</b>
1 1/2 (38)	(38)	1 pc	240	500	50	(8)	Type B, C, E, F or H	0.4	(0.18)	<b>MB2J1JN1</b>	

# Radiant Heaters



Radiant Heaters	Sheath Materials	Max. Operating Temperatures		Typical Max. Watt Densities		Page
		°F	°C	W/in <sup>2</sup>	W/cm <sup>2</sup>	
<b>RAYMAX® Panel</b>	Stainless steel/ Alumized steel	2000	1095	30	4.7	<b>501</b>

Radiant Heaters





# Radiant Heaters



## RAYMAX® Panel Heaters

The RAYMAX® radiant panel heater product line from Watlow® solves virtually any application requiring radiant heat from contamination-resistant surfaces to fast responding high-temperature panels.

Watlow's engineering staff has the training and expertise required to meet the most complicated application requirements. Technical support includes calculating watt density and temperature requirements and recommending system components such as sensors and controllers.

### Performance Capabilities

- Maximum face temperature up to 2000°F (1095°C)
- Maximum watt densities up to 30 W/in<sup>2</sup> (4.7 W/cm<sup>2</sup>)

### Features and Benefits

#### Variety of styles

- Match the ideal temperature and watt density requirements of the application

#### Watlow engineering and application support

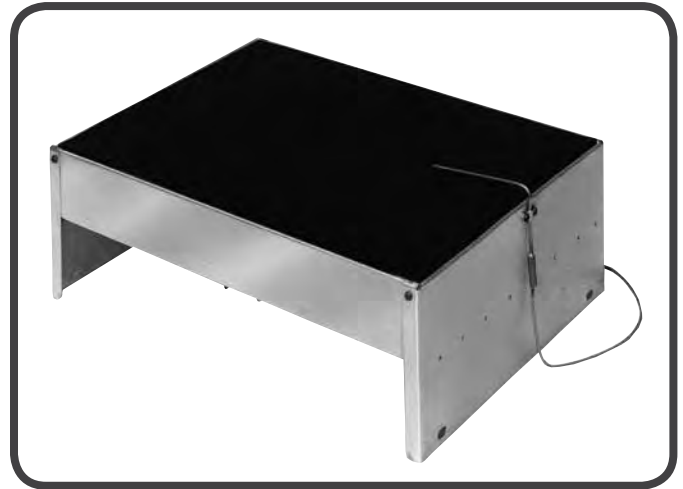
- Assures projects run smoothly

#### Custom designs

- Adapts to specific needs

#### Watlow sensors and controllers are compatible with RAYMAX heaters

- Offers a single-source thermal system that is reliable and designed for your application



### Typical Applications

- Thermoforming
- Food warming
- Paint and epoxy curing
- Heat treating
- High-temperature furnaces
- Tempering and annealing processes



#### **Caution: Fire Hazard**

Radiant heaters must not be operated in the presence of flammable vapors, gases or combustible materials without proper ventilation and safety precautions. Radiant heaters must be properly wired and controlled to comply with all applicable electrical codes.

# Radiant Heaters



## RAYMAX Panel Heaters

### RAYMAX 1220 and 2030

Easy to install and capable of high surface temperatures, the RAYMAX 1220 and 2030 panel heaters are ideal for many process heating applications requiring “hot-face” temperatures above 1000°F (540°C).

Each unit consists of a ceramic fiber heater mounted in a 2½ in. (64 mm) deep sheet metal case providing thermal insulation. The case includes post terminals for electrical connections and a mounting system that can be used with virtually any flat ceramic fiber unit. Since any flat unit heating element configuration can be used—exposed sinuated, embedded coil or foil elements—watt density and temperature capabilities can be tailored to meet a specific radiant application.

### Performance Capabilities

- RAYMAX 2030 (uses sinuated or coil elements): temperatures up to 2000°F (1095°C); watt densities up to 30 W/in<sup>2</sup> (4.7 W/cm<sup>2</sup>)
- RAYMAX 1220 (uses an etched foil element): temperatures up to 1200°F (650°C); watt densities up to 20 W/in<sup>2</sup> (3 W/cm<sup>2</sup>)
- Maximum voltage up to 600V

### Features and Benefits

#### Lightweight, low mass design

- Allows fast response to controllers

#### Self insulation with 2½ in. (64 mm) thick mounting case

- Provides high efficiency

#### Thermocouple mounting clamp

- Makes process system control easier

#### Aluminized steel case

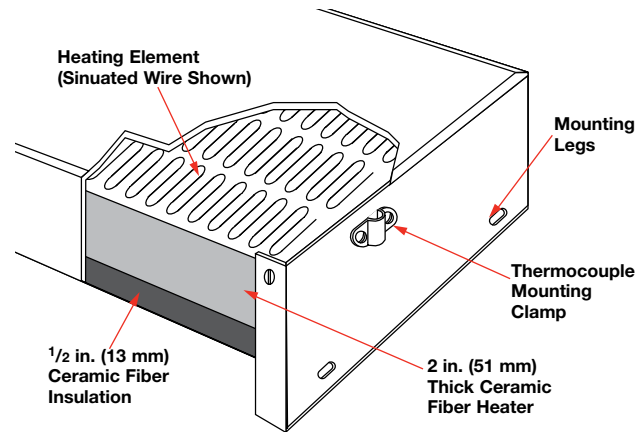
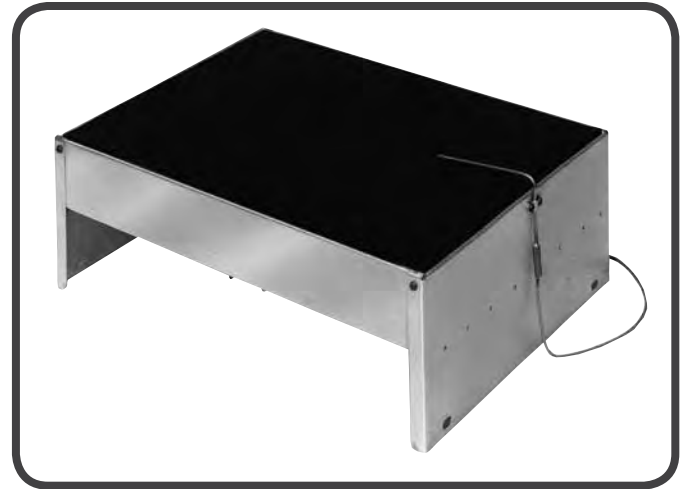
- Handles temperatures up to 1100°F (595°C)

#### Special hot-face heating patterns

- Provides a design made specifically for an application using an etched foil RAYMAX 1220

### Typical Applications

- Conveyor furnaces
- High-temperature vessel heating
- Tempering and annealing processes for glass, wire, ceramics and metals
- Coating, curing and drying of inks, paints, plastics and films



# Radiant Heaters



## RAYMAX Panel Heaters

### RAYMAX 1220 and 2030

#### Applications and Technical Data

#### Application Hints

A thermocouple mounting clamp is provided on one end of the case, with holes on both ends for alternate locations. The clamp can be used with  $\frac{1}{8}$  in. (3.2 mm) outside diameter sheath thermocouples. The clamp is  $\frac{3}{16}$  in. (4.8 mm) high, but can be removed for flush mounting\*.

The heater's maximum recommended surface temperature is based on the rating of the ceramic fiber heater module. This can vary from 2000°F (1095°C) at lower watt densities, to higher watt densities at reduced surface temperatures.

**Note:** Maximum wattages cannot be achieved at the maximum temperatures simultaneously.

\*  $\frac{13}{16}$  in. (4.8 mm) and  $\frac{1}{4}$  in. (6 mm) are available upon request.

#### Specifications

**Weight:** Under 6.5 lbs/ft<sup>2</sup> (31.75 kg/m<sup>2</sup>)

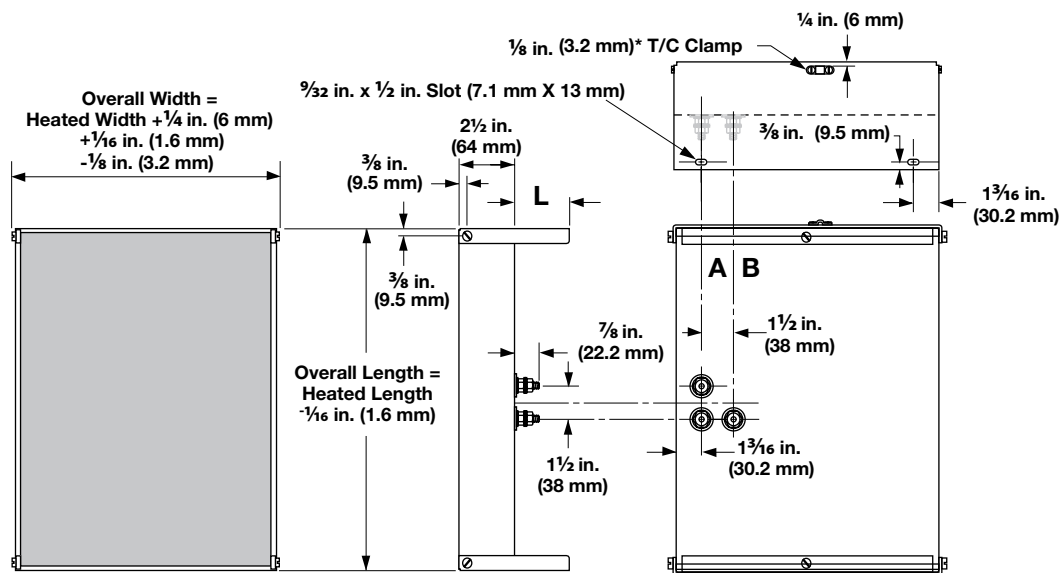
**Voltage and Wattage:** Ratings are based on the ceramic fiber heater module mounted inside of the case. Up to 600VAC is possible.

**Terminals:** Terminals are  $\frac{1}{4}$ -20 threaded studs. Two terminals plus ground for single-phase, and three terminals plus ground for 3-phase. These are located on the center line of the length unless otherwise specified. Terminals can be located anywhere along lines A and B (see illustration below), but not closer than 2 in. (51 mm) to the case ends.

**Mounting Legs:** Mounting legs are available in either 1 in. (25 mm) or 3 in. (76 mm) length options. For made-to-order units, mounting legs can be supplied in any incremental length **L** from  $\frac{1}{2}$  in. (13 mm) to 3 in. (76 mm). Slots are not provided in legs less than 1 in. (25 mm) long.

Heater Dimensions	Min.	Max.	Increments
Width: in. (mm)	2 (51)	30 (762)	Any
Length: in. (mm)	6 (152)	52 (1320)	Any

**Note:** Units are  $\frac{1}{4}$  in. (6 mm) wider than the nominal size of the ceramic fiber heater. Overall length is equal to heater length, but a thermocouple clamp is not included in the length.



#### Options

Several options are available with RAYMAX 1220 and 2030 models. Contact your Watlow representative for more information on options.

- Single-phase, non-standard location power terminals
- Terminal box
- Zoning

- Mounting studs and legs
- 3-phase construction
- Thermocouple mounting tubes
- Alternate case materials

# Radiant Heaters



## RAYMAX Panel Heaters

### RAYMAX 1220

#### Ceramic Fiber with Foil Element

Panel Overall Size ±1/16 in. (1.5 mm)		Panel Nominal Heated Size in. (mm)		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
Width	Length	Width	Length			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
4 1/4 (108)	12 (305)	4 (102)	12 (305)	120	950	19.8	(3.1)	2.8	(1.3)	VP504A12F
4 1/4 (108)	24 (610)	4 (102)	24 (610)	240	1900	19.8	(3.1)	4.8	(2.2)	VP504A24F
8 1/4 (210)	12 (305)	8 (203)	12 (305)	240	1900	19.8	(3.1)	4.5	(2.1)	VP508A12F <sup>①</sup>
8 1/4 (210)	24 (610)	8 (203)	24 (610)	240	3800	19.8	(3.1)	7.7	(3.5)	VP508A24F

All units in this table are suitable for use up to 1200°F (650°C) maximum surface temperature.

<sup>①</sup> Thermocouple clasp is not included in the length.

### RAYMAX 2030

#### Ceramic Fiber with Sinuated Element

Nominal Heated Width in. (mm)	Nominal Heated Length in. (mm)	Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
				W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
4 (102)	6 (152)	30	500	20.8	(3.2)	1.9	(0.9)	VP504A06T
	12 (305)	120	925	19.3	(3.0)	3.1	(1.4)	VP504A12T <sup>①</sup>
	18 (457)	120	1400	19.4	(3.0)	4.1	(1.9)	VP504A18T <sup>①</sup>
	24 (610)	240	1850	19.5	(3.0)	5.2	(2.4)	VP504A24T <sup>①</sup>
	30 (762)	240	2250	19.6	(3.1)	6.3	(2.9)	VP504A30T <sup>①</sup>
	36 (914)	240	3200	22.2	(3.4)	7.4	(3.3)	VP504A36T <sup>①</sup>
6 (152)	6 (152)	60	650	18.1	(2.8)	2.4	(1.1)	VP506A06T <sup>①</sup>
	12 (305)	120	1250	17.4	(2.7)	4.1	(1.9)	VP506A12T
	18 (457)	240	2000	18.5	(2.9)	5.8	(2.6)	VP506A18T
	24 (610)	120	2500	17.4	(2.7)	7.4	(3.3)	VP506A24T
	24 (610)	240	2500	17.4	(2.7)	7.4	(3.3)	VP506A24U
	30 (762)	240	3400	18.9	(2.9)	9.0	(4.1)	VP506A30T
8 (203)	36 (914)	240	4000	18.5	(2.9)	10.6	(4.8)	VP506A36T
	12 (305)	120	1800	18.8	(2.9)	4.7	(2.4)	VP508A12T
	18 (457)	240	3000	20.8	(3.2)	7.4	(3.3)	VP508A18U <sup>①</sup>
	24 (610)	240	3600	18.8	(2.9)	9.5	(4.3)	VP508A24T
	30 (762)	240	5000	20.8	(3.2)	11.7	(5.3)	VP508A30T
10 (254)	36 (914)	240	6000	20.8	(3.2)	13.9	(6.3)	VP508A36T
	12 (305)	120	2000	16.7	(2.6)	6.3	(2.9)	VP510A12T
	18 (457)	120	3600	20.0	(3.1)	9.0	(4.1)	VP510A18T
	24 (610)	240	4500	17.9	(2.8)	11.7	(5.3)	VP510A24T
	30 (762)	240	6000	20.0	(3.1)	14.4	(6.5)	VP510A30T
	36 (914)	240	7200	19.4	(3.0)	17.1	(7.8)	VP510A36T

CONTINUED

All units in this table are suitable for use up to 1800°F (982°C) maximum surface temperature.

<sup>①</sup>Vee sinuated



# Radiant Heaters



## RAYMAX Panel Heaters

RAYMAX 2030 (Continued)

### Ceramic Fiber with Sinuated Element

Nominal Heated Width		Nominal Heated Length		Volts	Watts	Watt Density		Approx. Net Wt.		Part Number
in.	(mm)	in.	(mm)			W/in <sup>2</sup>	(W/cm <sup>2</sup> )	lbs	(kg)	
12	(305)	12	(305)	120	2500	17.4	(2.7)	7.4	(3.3)	VP512A12T
		12	(305)	240	2500	17.4	(2.7)	7.4	(3.3)	VP512A12U <sup>①</sup>
		18	(457)	240	4000	18.5	(2.9)	10.6	(4.8)	VP512A18T
		24	(610)	240	6000	20.8	(3.2)	13.9	(6.3)	VP512A24T
		30	(762)	240	7200	20.0	(3.1)	17.1	(7.8)	VP512A30T
		36	(914)	240	8400	19.4	(3.0)	20.3	(9.2)	VP512A36T <sup>①</sup>
14	(356)	12	(305)	240	3500	20.8	(3.2)	8.5	(3.8)	VP514A12T
		18	(457)	240	4900	19.4	(3.0)	12.2	(5.5)	VP514A18T
		24	(610)	240	7000	20.8	(3.2)	16.0	(7.3)	VP514A24T
		30	(762)	240	8400	20.0	(3.1)	19.8	(9.0)	VP514A30T <sup>①</sup>
		36	(914)	240/240	9800	19.4	(3.0)	23.6	(10.7)	VP514A36T
		16	(406)	12	(305)	240	3600	18.8	(2.9)	9.5
16	(406)	18	(457)	240	5700	19.8	(3.1)	13.9	(6.3)	VP516A18T
		24	(610)	240	7100	18.5	(2.9)	18.2	(8.2)	VP516A24T
		30	(762)	240/240	9600	20.0	(3.1)	22.5	(10.2)	VP516A30T
		36	(914)	240/240	11500	20.0	(3.1)	26.8	(12.2)	VP516A36T

All units in this table are suitable for use up to 1800°F (982°C) maximum surface temperature.

<sup>①</sup>Vee sinuated

### Part Number

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭
V	P	5	0	8	A	1	2	T	Modification Options	0	0	0	0

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨	Base Part Number
VP508A12T	

⑩	Modification Options
1 =	3 in. (76 mm) leg height and terminal box
4 =	1/4 / 20 mounting studs
5 =	1/4 / 20 mounting studs and terminal box
M =	1 in. (25 mm) leg height
R =	1 in. (25 mm) leg height and terminal box
W =	Terminal box in standard location
Y =	3 in. (76 mm) leg height

# Radiant Heaters



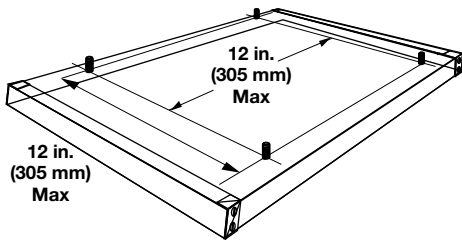
## RAYMAX Panel Heaters

### Mounting Accessories

#### Mounting Studs

Standard 1/4-20 x 1 1/2 in. (38 mm) or (M6-1 x 40) steel studs are welded to the case. For best support, studs should be approximately located on 12 in. (305 mm) centers. Contact your Watlow representative for exact locations on specific heaters.

**Available with RAYMAX 1220 and 2030.**

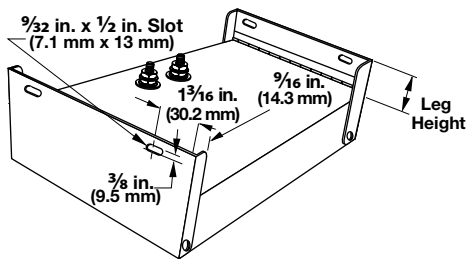


#### Mounting Legs

Mounting legs are extensions of the steel end caps with mounting slots for bolting directly to field support members. There is no extra charge for legs. They can be supplied in half inch increments from 0.5 in. (13 mm) to 3 in. (76 mm). Slots are not provided in legs less than 1 in. (25 mm) long.

For panels over 24 in. (610 mm) long, mounting studs are recommended for the best panel support.

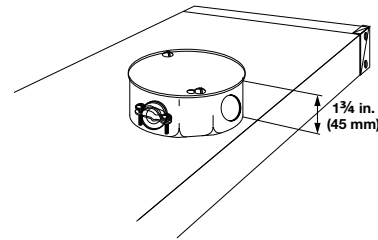
**Available with RAYMAX 1220 and 2030**



**Application note:** Allow for some thermal expansion of the heater case during operation. An expansion of up to one percent can occur when the case reaches its normal maximum limit of 1100°F (595°C). If the equipment has mounting screws to connect to the slots in the mounting legs, allow for a small amount of extra length. If mounting holes are used to interface with the mounting studs on the back of the RAYMAX case, make sure that the holes are oversized. Use washers and avoid overtightening the screws.

### Terminal Accessories

#### Terminal Box

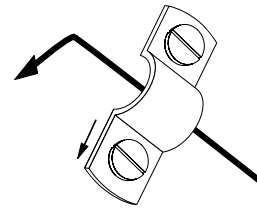


To protect electrical connections, a standard NEMA octagon terminal box is available. The standard size is 3<sup>9</sup>/<sub>16</sub> x 3<sup>9</sup>/<sub>16</sub> x 1 1/2 in. (90.5 x 90.5 x 38 mm) with knockouts for 1/2 in. (13 mm) conduit. Other NEMA sizes are available as an extended capability.

Care should be taken to use lead wire capable of withstanding the ambient temperatures.

**Available with RAYMAX 1220 and 2030.**

#### Thermocouple Clamps



A thermocouple mounting clamp can be provided on the end of the heater case. The clamp is suitable for 1/8 in. (3.2 mm) and 1/4 in. (6 mm) outside diameter sheath thermocouples bent to 90° so that the sensing tip is just above and lightly touching the hot face at an element location.

**Available with RAYMAX 1220 and 2030.**

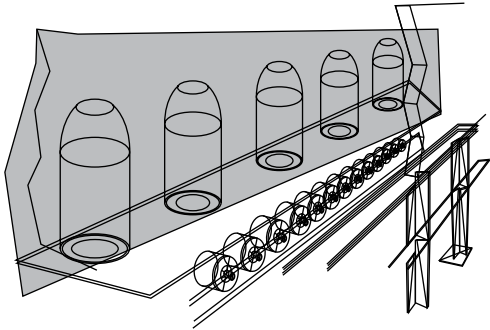
# Radiant Heaters

**EXTENDED  
CAPABILITY**



## Extended Capabilities for RAYMAX Panel Heaters

### Zoning

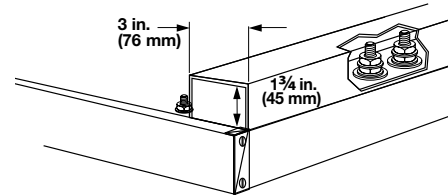


Watt densities can be varied across the entire width of RAYMAX heaters. If desired, each zone can have an individually controlled power supply.

Zoning can be very valuable when part of the product requires more heat, or when it must compensate for heat losses at the edges. Separately turning off part of the heated width enables the heater to adjust for various widths of material.

**Available as an extended capability for RAYMAX 1220 and 2030.**

### Wiring Raceway



A steel raceway provides electrical and physical protection for all terminal connections. This can be particularly useful for multi-zone panels.

**Available as an extended capability for RAYMAX 1220 and 2030.**



# Thermostats and Accessories



Thermostats and Accessories	Description	Page
<b>ST10 and ST207</b>	Pre-set thermostats used with flexible heaters are available mounted to the heater or as a separate device used to control process.	<b>511</b>
<b>Bulb and Capillary</b>	Regulates temperature in non-critical applications within a preset range and cycles heaters on and off.	<b>514</b>
<b>Protective Wells</b>	Provides protection for thermostat bulbs and other sensors while directly immersed in process fluids.	<b>519</b>



Thermostats and Accessories



# Thermostats and Accessories



## ST10 and ST207

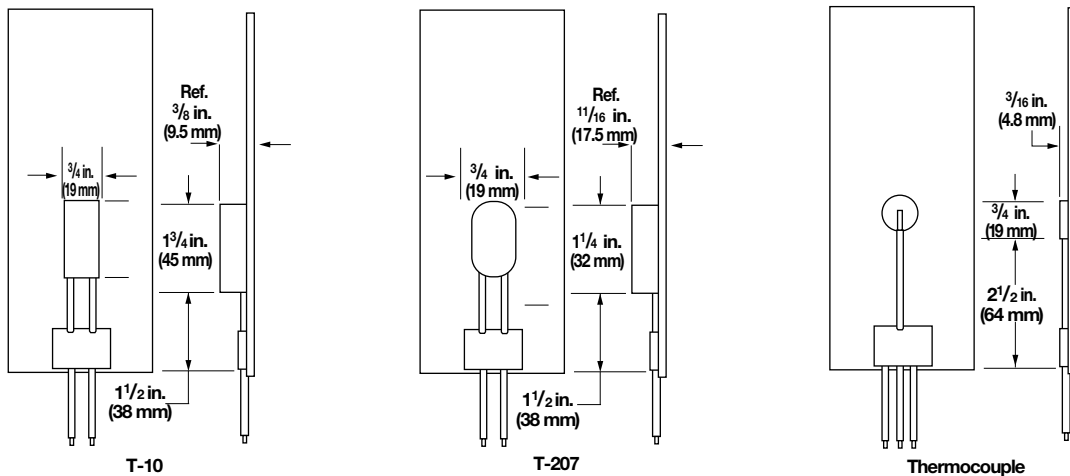
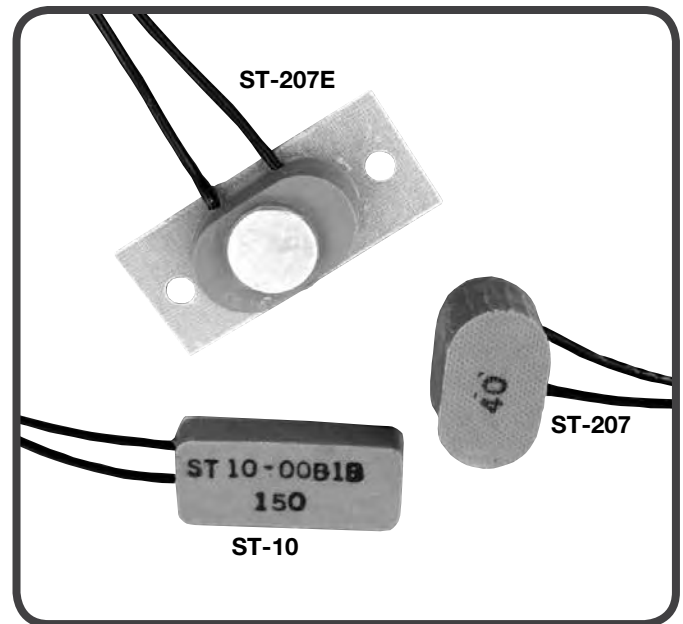
Watlow® offers several styles of sensors for use with flexible heaters. These sensors are available as preset or adjustable thermostats, thermocouples, thermistors, RTDs or thermal fuses. They can be integrally mounted (encapsulated in silicone rubber) to sense the temperature of either the part or the heater sheath. The thermostats can also be ordered separate from the heater, allowing direct control of your process temperature, if desired.

### Pre-Set Thermostats

Several styles of non-adjustable, pre-set thermostats are available from Watlow. Thermostats separate from the heater are encapsulated in silicone rubber, and are available with standard 12 in. (305 mm) leads unless otherwise specified.

Thermocouples, thermistors, RTDs and thermal fuses are usually mounted to the heater under a vulcanized protective cap of silicone rubber sheath material. This drawing shows a typical mounting style for a thermocouple.

**Note:** Precise part temperature control with preset thermostats requires prototyping and field testing.



### Pre-Set Thermostats (Non-Adjustable)

Thermostat Model	Maximum Watts	Volts AC	Temperature Settings Available °F (°C)	Agency Approvals		
				UR	cUR	VDE
<b>T-10</b>	600/960	120/240	125-300±10 (50-149±5)	yes	yes	yes
<b>T-207</b>	1500	120/240	40/55±8 (4/13±4.4)	yes	yes	yes
	1500	120/240	60/75±8 (16/24±4.4)	yes	yes	yes
	1500	120/240	95/110±8 (35/43±4.4)	yes	yes	yes
	1500	120/240	145/160±8 (63/71±4.4)	yes	yes	yes

**Notes:**

- When ordering a pre-set thermostat separate from the heater, simply add the prefix **S** to the model number. (Example: ST-10) See next page.
- Snap action preset temperatures on the T-207 are close/open settings.
- T-10 thermostats are manufactured for specific preset temperatures. Available in 25°F increments.
- Other temperature ranges and voltages are available on special order. Minimum quantities apply, contact your Watlow representative before ordering.

# Thermostats and Accessories



## ST10 and ST207

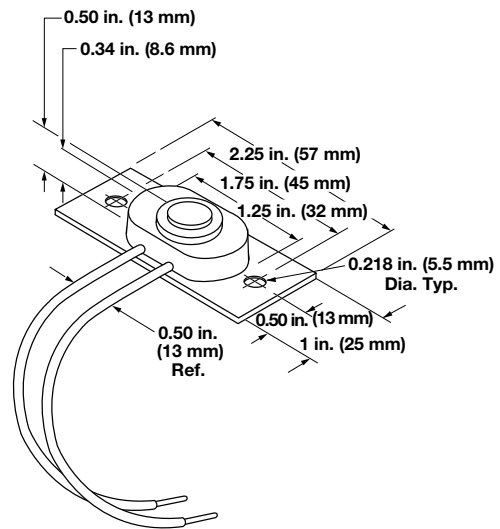
### Temperature Sensors (Continued)

#### Separate Heater Accessories Available — Pre-Set Thermostats Separate From Heater

These are offered to allow direct control of your process temperature, so you are not limited to controlling only the heater temperature when using catalog heaters. Pre-set thermostats are encapsulated in silicone rubber with standard 12 inch leads.

The same temperature ranges, ratings and sizes are available on these thermostats. When ordering, add “S” prefix to the model number to indicate “separate” item. (Examples: ST-10 and ST-207)

Standard leads are 12 in. (305 mm) 18 gauge UL® 1180 black leads.



**Note:** For direct control of air temperature as is required in enclosure heating applications, specify thermostat model number ST-207E. This is a modified ST-207 mounted on  $\frac{1}{32}$  inch thick G-10 circuit board with the thermostat's metal cap exposed to sense air temperature.



# Thermostats and Accessories

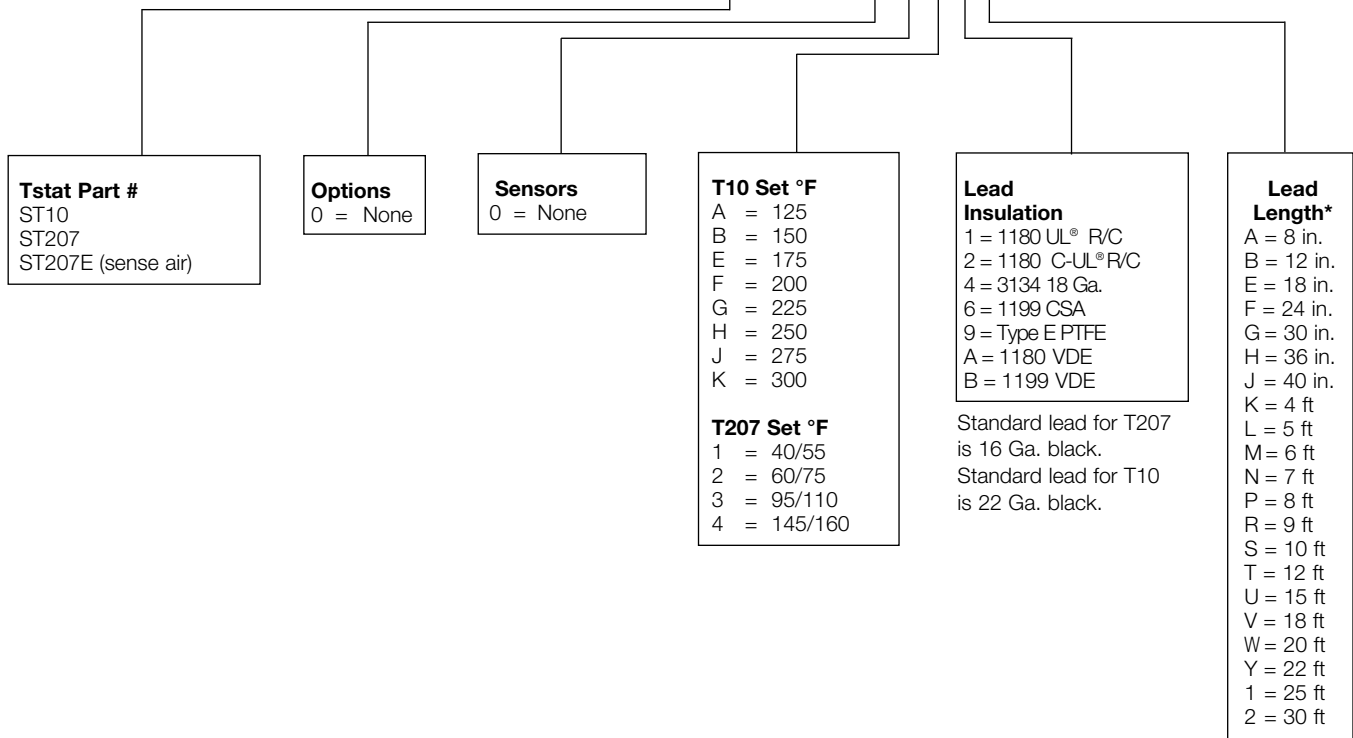


## ST10 and ST207

### Thermostat Ordering Information

To order, complete the part number with the information below:

**Tstat Part #- 0 0**



\* Customer specified length must be noted in inches when ordering.

# Thermostats and Accessories



## Bulb and Capillary

Thermostats regulate temperature in non-critical applications. They sense temperature, within a preset range and cycle heaters on and off to maintain the set point.

Thermostats may be mounted inside a terminal enclosure or remote mounted (separate from the heater assembly). If using a remote mounted thermostat, be sure to order the sufficient capillary tube length to permit installation.

All Watlow® thermostats are normally closed circuit and either single-pole, single-throw (SPST) or double pole, single-throw (DPST). They can be used with or without an enclosure.

Thermostat selection should be based on temperature range, capillary tube length and sensor bulb size (diameter/length).

### Remote Mount Thermostat Assemblies

Remote mounted thermostat assemblies can be supplied with the following enclosures:

- General purpose
- Moisture resistant

### Pilot Light

An optional pilot light gives visual indication whether the power supplied to the heating element(s) is on or off.

To order, please specify suffix part **PL11**.

### Thermostat Conversion Kits

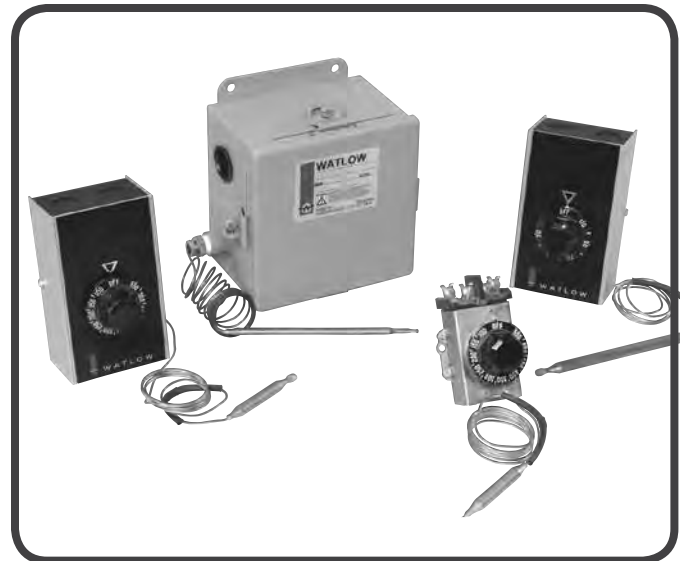
Kits are available to convert a heater's general purpose terminal enclosure to accept either a single- or double-pole thermostat. The kit contains all the necessary parts to change out the existing terminal enclosure cover and mount the thermostat inside. These are **hardware and wiring kits** only.

**Single-pole conversion kits** are for 1, 1<sup>1</sup>/<sub>4</sub>, 2 and 2<sup>1</sup>/<sub>2</sub> inch NPT screw plugs. To order, specify part number; **K492-000-35-(thermostat part number)**.

① **Double-pole conversion kits are for 2 and 2<sup>1</sup>/<sub>2</sub> inch NPT screw plugs. To order, specify part number; **K492-000-34-(thermostat part number)**.**

Thermostat Conversion Kit Single-Pole Thermostat Part Number	Thermostat Conversion Kit Double-Pole Thermostat Part Number
<b>K492-000-35-2</b>	<b>K492-000-34-4</b>
<b>K492-000-35-2A</b>	<b>K492-000-34-5A</b>
<b>K492-000-35-3</b>	<b>K492-000-34-7A</b>
<b>K492-000-35-3A</b>	
<b>K492-000-35-12A</b>	

① Double-pole conversion kits not available for 2<sup>1</sup>/<sub>2</sub> inch NPT FIREBAR screw plugs.



### Thermostat Dial Scales

All single-pole thermostats will be provided with a dual scale (both °C and °F) dial. All double-pole thermostats will be provided with a Fahrenheit (°F) scale dial. If your application requires a Celsius (°C) scale, order the optional dial.

To order, specify code **CD**. Scale will match thermostat temperature range.

### Warning

Do not use thermostats for high-limit sheath protection. Thermostats fail in a closed circuit mode and will not cut power to the heaters. Limit control should be provided by an isolated, redundant sensor and control system of the appropriate type, design and installation.

Thermostats are precalibrated at the factory. No adjustment, other than selecting the desired operating temperature, is required. All wiring should be performed by qualified personnel and comply with the National Electrical Code and other applicable state and local codes.

To help assure the correct thermostat is selected as well as installed and wired properly, here are a few helpful hints. Schematics are provided for interconnecting thermostats to single- and three-phase heaters.



## Bulb and Capillary

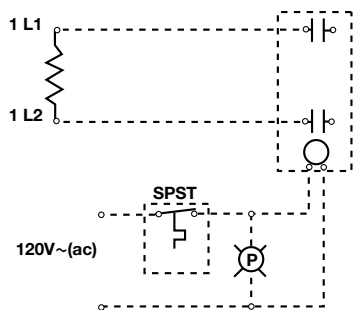
### Technical Information

#### Application Hints

- Locate the thermostat where ambient temperatures do not exceed 150°F (65°C).
- Mount the thermostat in an enclosure that is compatible with the surrounding environment.
- Immerse the entire sensing bulb in the media being heated.
- Make sure the sensing bulb is mounted away from the heating element(s) to negate any undue influence on the sensing bulb's temperature "reading."
- Keep the capillary tube insulated from electrical connections.
- Do not use a thermostat for high-accuracy temperature sensing. Use an appropriate thermocouple, RTD or thermistor and temperature control.
- Do not use thermostats as a primary power switching device. Use a disconnect switch or circuit breaker to cut power when servicing.
- Interconnect the thermostat to the heater only if:
  - The heater has one circuit
  - The heater's ampere draw is lower than the thermostat's rated ampacity at prescribed voltage.
- Interconnect either a single- or double-pole thermostat with a single-phase heater when the supply voltage does not exceed 250VAC for SPST or 480VAC for DPST.
- Only interconnect three-phase delta heaters to DPST thermostats.
- Use a single-pole thermostat for pilot duty where the thermostat is not interconnected with the heater, or heater exceeds the volt/amp rating.

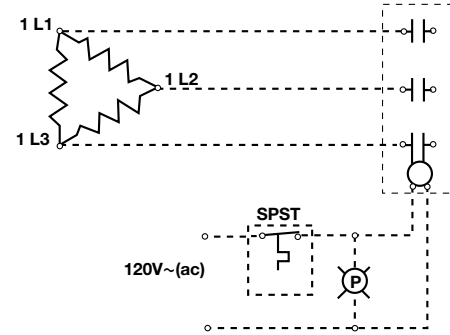
#### Pilot Duty Wiring

##### SPST, 1-phase

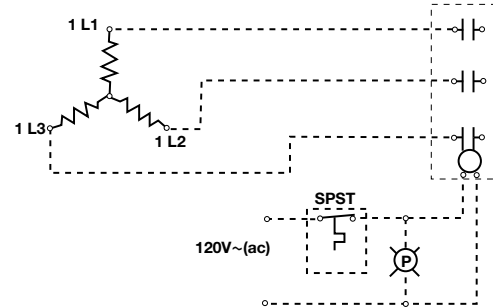


#### Pilot Duty Wiring (Continued)

##### SPST, 3-phase delta

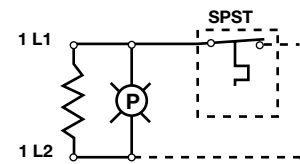


##### SPST, 3-phase wye

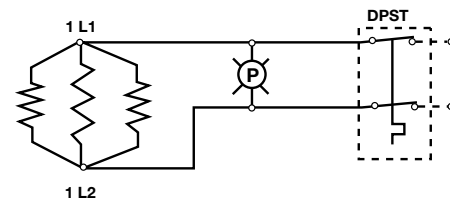


#### Interconnected Wiring

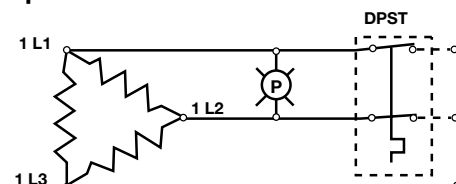
##### SPST, 1-phase



##### DPST, 1-phase



##### DPST, 3-phase delta



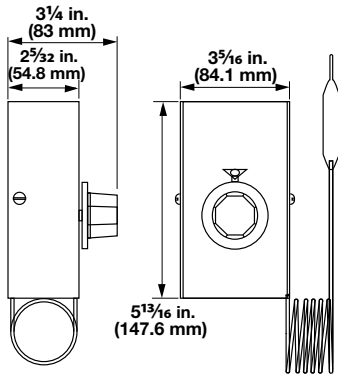


## Bulb and Capillary

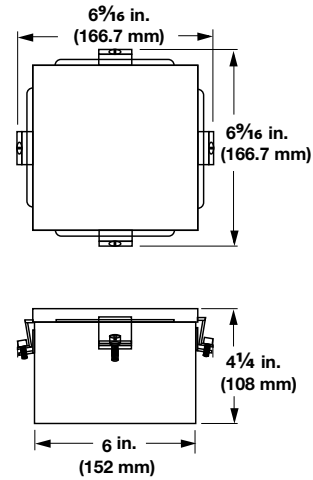
Technical Information (Continued)

### Thermostats with Enclosures

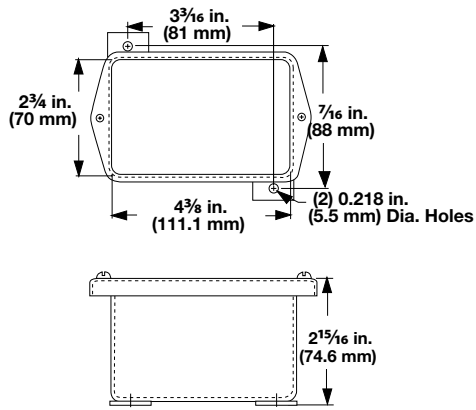
#### General Purpose Single- and Double-Pole



#### Moisture Resistant Double-Pole



#### Moisture Resistant Single-Pole



General Purpose Enclosure SPST or DPST Thermostat Part Number	Moisture Resistant Enclosure SPST Thermostat Part Number	Moisture Resistant Enclosure DPST Thermostat Part Number
2S	2W	4W
2AS	2AW	5AW
3S	3W	7AW
3AS	3AW	
12AS	12AW	
4S		
5AS		
7AS		

# Thermostats and Accessories



## Bulb and Capillary

### Technical Information (Continued)

#### Thermostats

Control Mode	Type	Temperature Range		Differential °F (°C)	Ampacity @ Line Voltage				Bulb Diameter in. (mm)	Bulb Length in. (mm)	Capillary Length in. (mm)	Terminal Type	Part No.	Est. Net Wt. lbs (kg)
		°F	(°C)		120	240	277	480						
On-off Temp Control	Single-Pole	30-250	(0-120)	13 (7)	25	25	22	—	0.250 (6)	3 1/2 (89)	18 (455)	#12 AWG	<b>2</b>	1 (0.4)
		30-250	(0-120)	13 (7)	25	25	22	—	0.250 (6)	3 1/4 (85)	84 (2135)	Stranded	<b>2A</b>	1 (0.4)
	Single-Throw (SPST)	175-550	(80-290)	23 (13)	25	25	22	—	0.250 (6)	2 3/4 (70)	18 (455)	Leads or	<b>3</b>	1 (0.4)
		175-550	(80-290)	23 (13)	25	25	22	—	0.250 (6)	2 3/4 (70)	84 (2135)	#8-32 screw lug	<b>3A</b>	1 (0.4)
On-off Temp Control	Double-Pole	30-110	(0-40)	12 (7)	30	30	30	10	0.375 (10)	6 9/16 (167)	36 (915)	Screw Lug	<b>4</b>	2 (0.9)
		60-250	(15-120)	12 (7)	30	30	30	10	0.250 (6)	6 1/2 (165)	48 (1220)		<b>5A</b>	2 (0.9)
	Single-Throw (DPST)	100-550	(40-290)	22 (12)	30	30	30	10	0.250 (6)	7 1/16 (179)	48 (1220)		<b>7A</b>	2 (0.9)
On-off with Manual Reset	(SPST)	350 <sup>®</sup>	(180)	—	30	30	20	—	0.250 (6)	3 1/2 (90)	36 (915)	#10-32 Screw Lug	<b>11</b>	1 (0.4)

<sup>®</sup> Fixed temperature rating

**Note:** All thermostats certified by UL<sup>®</sup> and/or CSA for use in the United States and Canada.

# Thermostats and Accessories



## Bulb and Capillary

### Ordering Information

#### Part Number

Thermostat Part Number	Enclosure (Remote Mount Only)	Options

#### Thermostat Part Number

**Note:** See chart on previous page.

#### Enclosure (Remote Mount Only)

S =	General purpose
W =	Moisture resistant

#### Options

CD =	Celsius dial scale (Double pole only)
CB =	Chrome bezel (Double pole only)
LTB =	Liquid-tight brass fitting ( $\frac{3}{8}$ in. - 18 NPT)
PL11 =	Pilot light, 120V only available on moisture/explosion resistant and explosion resistant enclosures

**Example Part Number:** 2 W LTB

# Thermostats and Accessories



## Protective Wells

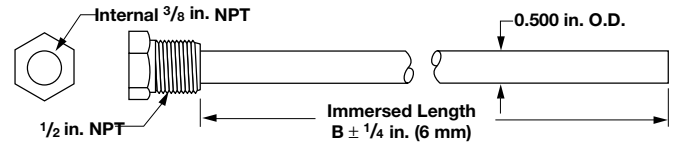
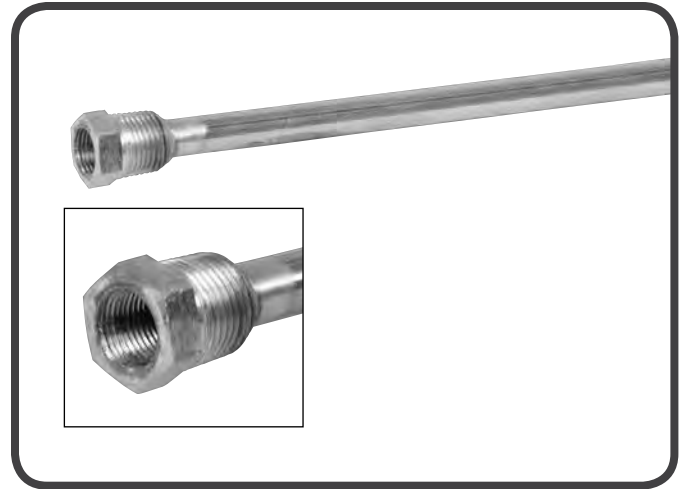
Protective wells isolate and protect thermostat bulbs and other temperature sensors (thermocouples, RTDs or thermistors). They allow inserting the sensing element sufficiently into the media being heated without being damaged.

Steel or stainless steel protective wells are available in three lengths. They are supplied with 1/2 inch NPT mounting and 3/8 inch-18 NPT internal thread for mating to a liquid-tight bushing (LTB).

To order, specify the appropriate part number from the table below.

### Protective Wells

Plug and Thermowell Material	Immersed B Dimension		Part Number	Est. Ship. Wt.	
	in.	(mm)		lb	(kg)
Steel	12	(305)	<b>PWS12</b>	1	(0.5)
	24	(610)	<b>PWS24</b>	2	(1.0)
	36	(915)	<b>PWS36</b>	2	(1.0)
Stainless Steel	12	(305)	<b>PWSS12</b>	1	(0.5)
	24	(610)	<b>PWSS24</b>	2	(1.0)
	36	(915)	<b>PWSS36</b>	2	(1.0)









## Reference Data

Power Calculations (Imperial Unit) .....	523
Equations (Imperial Unit) .....	532
Wattage Requirements (Imperial Unit) .....	534
Power Calculations (SI Unit) .....	536
Equations (SI Unit) .....	544
Wattage Requirements (SI Unit) .....	546
Tubular Elements and Assembly Selection Guide .....	548





## Power Calculations

### Calculations for Required Heat Energy

The total heat energy (kWh or BTU) required to satisfy the system needs will be either of the two values shown below depending on which calculated result is larger.

1. Heat required for start up
2. Heat required to maintain the desired temperature

The power required (kW) will be the heat energy value (kWh) divided by the required start up or working cycle time. The kW rating of the heater will be the greater of these values plus a safety factor.

The calculation of start-up and operating requirements consist of several distinct parts that are best handled separately. However, a short method can also be used for a quick estimate of heat energy required. Both methods are defined and then evaluated using the following formulas and methods:

### Short Method

Start-up watts =  $(P_A + P_C + \frac{2}{3} P_L) \times (1 + S.F.)$

Operating watts =  $(P_B + P_D + P_L) \times (1 + S.F.)$

$P_A$  = Watts required to raise the temperature of material and equipment to the operating point, within the time desired

$P_B$  = Watts required to maintain temperature of the material during the working cycle

$P_C$  = Watts required to melt or vaporize load material during start-up period

$P_D$  = Watts required to melt or vaporize load material during working cycle

$P_L$  = Watts lost from surfaces by:

- Conduction-use equation to the right
- Radiation-use heat loss curves on pages 529 and 531, Reference 1, 2, 5, 6 and 7.
- Convection-use heat loss curves on pages 529 and 531, Reference 1, 2, 5, 6 and 7.

S.F. = Safety Factor is normally 10 to 35 percent based on application

\*: 3.412 is a conversion factor: 3.412 BTU = 1 Wh

### Equation for $P_A$ and $P_B$ (Absorbed watts-raising temperature)

$$P_A \text{ or } P_B = \frac{w \times C_p \times \Delta T}{(t \times 3.412)}$$

- $w$  = weight of material (lb)
- $C_p$  = specific heat of material (BTU/(lb•°F))
- $\Delta T$  = temperature rise of material ( $T_{\text{Final}} - T_{\text{Initial}}$ ) (°F)
- $t$  = start-up or cycle time (hr)

### Equation for $C$ and $D$ (Absorbed watts-melting or vaporizing)

$$P_C \text{ or } P_D = \frac{w \times H_f}{(t \times 3.412)}$$

- $w$  = weight of material (lb)
- $H_f$  = Heat of fusion or vaporization (BTU/lb)
- $t$  = start-up or cycle time (hr)

### Equation for $L$ (Lost conducted watts)

$$P_L = \frac{k \times A \times \Delta T}{(d \times 3.412)}$$

- $k$  = thermal conductivity (BTU • in./ft<sup>2</sup>•°F •hr)
- $A$  = surface area (ft<sup>2</sup>)
- $\Delta T$  = temperature differential to ambient (°F)
- $d$  = thickness of material (in.)



## Power Calculations

### Conduction and Convection Heating

#### Absorbed Energy, Heat Required to Raise the Temperature of a Material

Because substances all heat differently, different amounts of heat are required in making a temperature change. The specific heat capacity of a substance is the quantity of heat needed to raise the temperature of a unit quantity of the substance by one degree. Calling the amount of heat added **Q**, which will cause a change in temperature  $\Delta T$  to a weight of substance **w**, at a specific heat of material **C<sub>p</sub>**, then  $Q = w \times C_p \times \Delta T$ .

Since all calculations are in watts, an additional conversion of 3.412 BTU = 1 Wh is introduced yielding:

#### Equation 1

$$Q_A \text{ or } Q_B = \frac{w \times C_p \times \Delta T}{3.412}$$

$Q_A$  = heat required to raise temperature of materials during heat-up (Wh)

$Q_B$  = heat required to raise temperature of materials processed in working cycle (Wh)

$w$  = weight of material (lb)

$C_p$  = specific heat of material (BTU/(lb•°F))

$\Delta T$  = temperature rise of material ( $T_{Final} - T_{Initial}$ )(°F)

This equation should be applied to all materials absorbing heat in the application. Heated media, work being processed, vessels, racks, belts and ventilation air should be included.

**Example:** How much heat energy is needed to change the temperature of 50 lbs of copper from 10 to 70°F?

$$\begin{aligned} Q &= \frac{w \times C_p \times \Delta T}{3.412} \\ &= \frac{(50 \text{ lb}) \times (0.10 \text{ BTU}/[\text{lb}\cdot\text{°F}]) \times (60\text{°F})}{3.412} = 88 \text{ (Wh)} \end{aligned}$$

#### Heat Required to Melt or Vaporize a Material

In considering adding heat to a substance, it is also necessary to anticipate changes in state that might occur during this heating such as melting and vaporizing. The heat needed to melt a material is known as the latent heat of fusion and represented by **H<sub>f</sub>**. Another state change is involved in vaporization and condensation. The latent heat of vaporization **H<sub>v</sub>** of the substance is the energy required to change a substance from a liquid to a vapor. This same amount of energy is released as the vapor condenses back to a liquid.

#### Equation 2

$$Q_C \text{ or } Q_D = \frac{w \times H_f}{3.412} \quad \text{OR} \quad \frac{w \times H_v}{3.412}$$

$Q_C$  = heat required to melt/vaporize materials during heat-up (Wh)

$Q_D$  = heat required to melt/vaporize materials processed in working cycle (Wh)

$w$  = weight of material (lb)

$H_f$  = latent heat of fusion (BTU/lb)

$H_v$  = latent heat of vaporization (BTU/lb)

**Example:** How much energy is required to melt 50 lbs of lead?

$$\begin{aligned} Q &= \frac{w \times H_f}{3.412} \\ &= \frac{(50 \text{ lbs}) \times (9.8 \text{ BTU}/\text{lb})}{3.412 \text{ BTU}/(\text{Wh})} = 144 \text{ (Wh)} \end{aligned}$$

Changing state (melting and vaporizing) is a constant temperature process. The **C<sub>p</sub>** value (from Equation 1) of a material also changes with a change in state. Separate calculations are thus required using Equation 1 for the material below and above the phase change temperature.



## Power Calculations

### Conduction and Convection Heating (Continued)

#### Conduction Heat Losses

Heat transfer by conduction is the contact exchange of heat from one body at a higher temperature to another body at a lower temperature, or between portions of the same body at different temperatures.

#### Equation 3A—Heat Required to Replace Conduction Losses

$$Q_{L1} = \frac{k \times A \times \Delta T \times t_e}{3.412 \times L}$$

$Q_{L1}$  = conduction heat losses (Wh)

$k$  = thermal conductivity  
(BTU x in./[ft<sup>2</sup> x °F x hour])

$A$  = heat transfer surface area (ft<sup>2</sup>)

$L$  = thickness of material (in.)

$\Delta T$  = temperature difference across material  
( $T_2 - T_1$ ) (°F)

$t_e$  = exposure time (hr)

This expression can be used to calculate losses through insulated walls of containers or other plane surfaces where the temperature of both surfaces can be determined or estimated.

#### Convection Heat Losses

Convection is a special case of conduction. Convection is defined as the transfer of heat from a high temperature region in a gas or liquid as a result of movement of the masses of the fluid.

#### Equation 3B—Convection Losses

$$Q_{L2} = A \times F_{SL} \times C_F \times t_e$$

$Q_{L2}$  = convection heat losses (Wh)

$A$  = surface area (in<sup>2</sup>)

$F_{SL}$  = vertical surface convection loss factor  
(W/in<sup>2</sup>) evaluated at surface temperature (see page 529, Reference 1).

$C_F$  = surface orientation factor  
heated surface faces up horizontally = 1.29  
vertical = 1.00  
heated surface faces down horizontally = 0.63

#### Radiation Heat Losses

Radiation losses are not dependent on orientation of the surface. Emissivity is used to adjust for a material's ability to radiate heat energy.

#### Equation 3C—Radiation Losses

$$Q_{L3} = A \times F_{SL} \times e \times t_e$$

$Q_{L3}$  = radiation heat losses (Wh)

$A$  = surface area (in<sup>2</sup>)

$F_{SL}$  = blackbody radiation loss factor at surface temperature (W/in<sup>2</sup>) (see page 529, Reference 1).

$e$  = emissivity of material surface

#### Example:

We find that a blackbody radiator (perfect radiator) at 500°F, has heat losses of 2.95 W/in<sup>2</sup>. Polished aluminum, in contrast, ( $e = 0.09$ ) only has heat losses of 0.27 W/in<sup>2</sup> at the same temperature ( $2.95 \text{ W/in}^2 \cdot 0.09 = 0.27 \text{ W/in}^2$ ).

#### Combined Convection and Radiation Heat Losses

Some curves combine both radiation and convection losses. This saves you from having to use both Equations 3B and 3C. If only the convection component is required, then the radiation component must be determined separately and subtracted from the combined curve.

#### Equation 3D—Combined Convection and Radiation Heat Losses

$$Q_{L4} = A \times F_{SL} \times t_e$$

$Q_{L4}$  = surface heat losses combined convection and radiation (Wh)

$A$  = surface area (in<sup>2</sup>)

$F_{SL}$  = combined surface loss factor at surface temperature (W/in<sup>2</sup>) (see pages 529 and 531, Reference 1, 2, 5, 6 and 7).

This equation assumes a constant surface temperature.



## Power Calculations

### Conduction and Convection Heating (Continued)

#### Total Heat Losses

The total conduction, convection and radiation heat losses are summed together to allow for all losses in the power equations. Depending on the application, heat losses may make up only a small fraction of total power required or it may be the largest portion of the total. Therefore, do not ignore heat losses unless previous experience tells you it is alright to do.

#### Equation 3E—Total Losses

$Q_L = Q_{L1} + Q_{L2} + Q_{L3}$  If convection and radiation losses are calculated separately. (Surfaces are not uniformly insulated and losses must be calculated separately.)

OR

$Q_L = Q_{L1} + Q_{L4}$  If combined radiation and convection curves are used. (Pipes, ducts, uniformly insulated bodies.)

#### Start-Up and Operating Power Required

Both of these equations estimate required energy and convert it to power. Since power (watts) specifies an energy rate, we can use power to select electric heater requirements. Both the start-up power and the operating power must be analyzed before heater selection can take place.

#### Equation 4—Start-Up Power (Watts)

$$P_s = \frac{Q_A + Q_C + \frac{2}{3}Q_L}{t_s} (1 + S.F.)$$

$Q_A$  = heat absorbed by materials during heat-up (Wh)

$Q_C$  = latent heat absorbed during heat-up (Wh)

$Q_L$  = conduction, convection, radiation losses (Wh)

S.F. = safety factor

$t_s$  = start-up (heat-up) time required (hr)

During start up of a system the losses are zero, and rise to 100 percent at process temperature. A good approximation of actual losses is obtained when heat losses ( $Q_L$ ) are multiplied by  $\frac{2}{3}$ .

#### Equation 5—Operating Power (Watts)

$$P_C = \frac{Q_B + Q_D + Q_L}{t_c} (1 + S.F.)$$

$Q_B$  = heat absorbed by processed materials in working cycle (Wh)

$Q_D$  = latent heat absorbed by materials heated in working cycle (Wh)

$Q_L$  = conduction, convection, radiation losses (Wh)

S.F. = safety factor

$t_c$  = cycle time required (hr)



## Power Calculations

### Conduction and Convection Heating (Continued)

#### Radiant Heating

When the primary mode of heat transfer is radiation, we add a step after Equation 5.

Equation 6 is used to calculate the net radiant heat transfer between two bodies. We use this to calculate either the radiant heater temperature required or (if we know the heater temperature, but not the power required) the maximum power which can be transferred to the load.

#### Equation 6—Radiation Heat Transfer

##### Between Infinite Size Parallel Surfaces

$$\frac{P_R}{A} = \frac{\sigma (T_1^4 - T_2^4) \left(\frac{1}{e_f}\right) F}{(144 \text{ in}^2/\text{ft}^2) (3.412 \text{ BTU/Wh})}$$

- $P_R$  = power absorbed by the load (w) - from equation 4 or 5
- $A$  = area of heater (in<sup>2</sup>) - known or assumed
- $\sigma$  = Stephan Boltzman constant  
=  $0.1714 \cdot 10^{-8}$  (BTU/hr. sq. ft. °R<sup>4</sup>)
- $T_1$ (°R) = emitter temperature (°F + 460)
- $T_2$ (°R) = load temperature (°F + 460)
- $e_f$  = emissivity correction factor - see Emissivity Correction Factor information to the right
- $F$  = shape factor (0 to 1.0) - see Shape Factor for Radiant Application graph to the right

#### Emissivity Correction Factor ( $e_f$ )

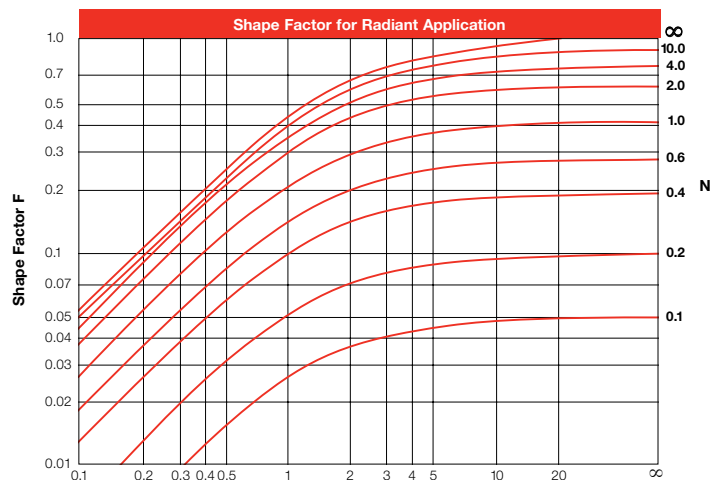
$$e_f = \frac{1}{e_S} + \frac{1}{e_L} - 1 \quad \text{plane surfaces}$$

$$e_f = \frac{1}{e_S} + \frac{D_S}{D_L} \left( \frac{1}{e_L} - 1 \right) \quad \text{concentric cylinders inner radiating outward}$$

$$e_f = \frac{1}{e_S} + \left( \frac{D_S}{D_L} \times \frac{1}{e_L} \right) - 1 \quad \text{concentric cylinders outer radiating inward}$$

- $e_S$  = heater emissivity (from material emissivity tables)
- $e_L$  = load emissivity (from material emissivity tables)
- $D_S$  = heater diameter
- $D_L$  = load diameter

#### Shape Factor for Radiant Application



For Two Facing Panels:

$$N = \frac{\text{Heated Length}}{\left( \text{Distance to Material} \right)}$$

$$M = \frac{\text{Heated Width}}{\left( \text{Distance to Material} \right)}$$



## Power Calculations

### Conduction and Convection Heating (Continued)

#### Power Evaluation

After calculating the start up and operating power requirements, a comparison must be made and various options evaluated.

Shown in the graph below are the start up and operating watts displayed in a graphic format to help you see how power requirements add up.

With this graphic aid in mind, the following evaluations are possible:

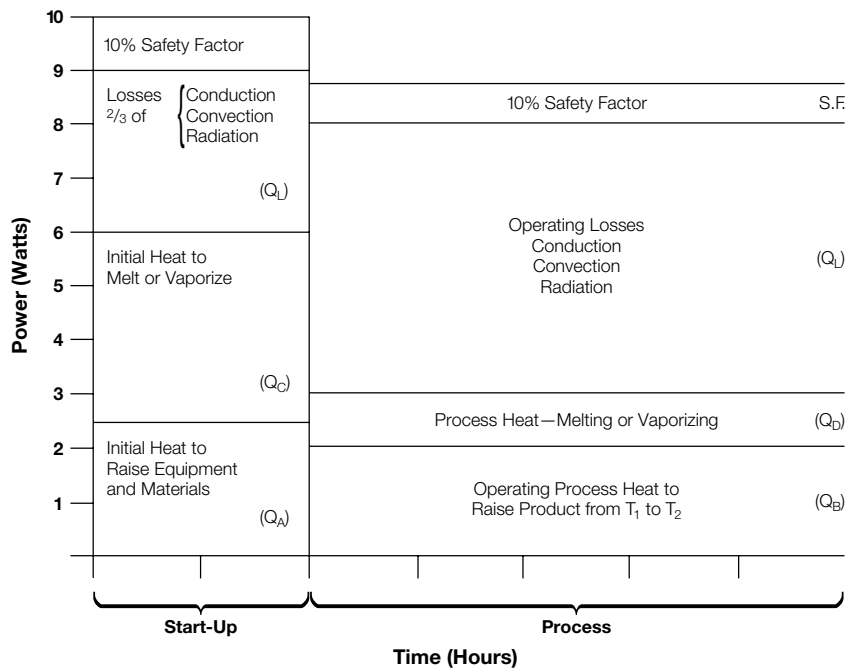
- Compare start up watts to operating watts.
- Evaluate effects of lengthening start-up time such that start-up watts equals operating watts (use timer to start system before shift).

- Recognize that more heating capacity exists than is being utilized. (A short start-up time requirement needs more wattage than the process in wattage.)

- Identify where most energy is going and redesign or add insulation to reduce wattage requirements.

Having considered the entire system, a reevaluation of start-up time, production capacity and insulating methods should be made.

**Comparison of Start Up and Operating Power Requirements**







## Power Calculations

### Heat Loss Curves

#### Ref. 1—Convection curve correction factors:

For losses from top surfaces or from horizontal pipes Multiply convection curve by 1.29

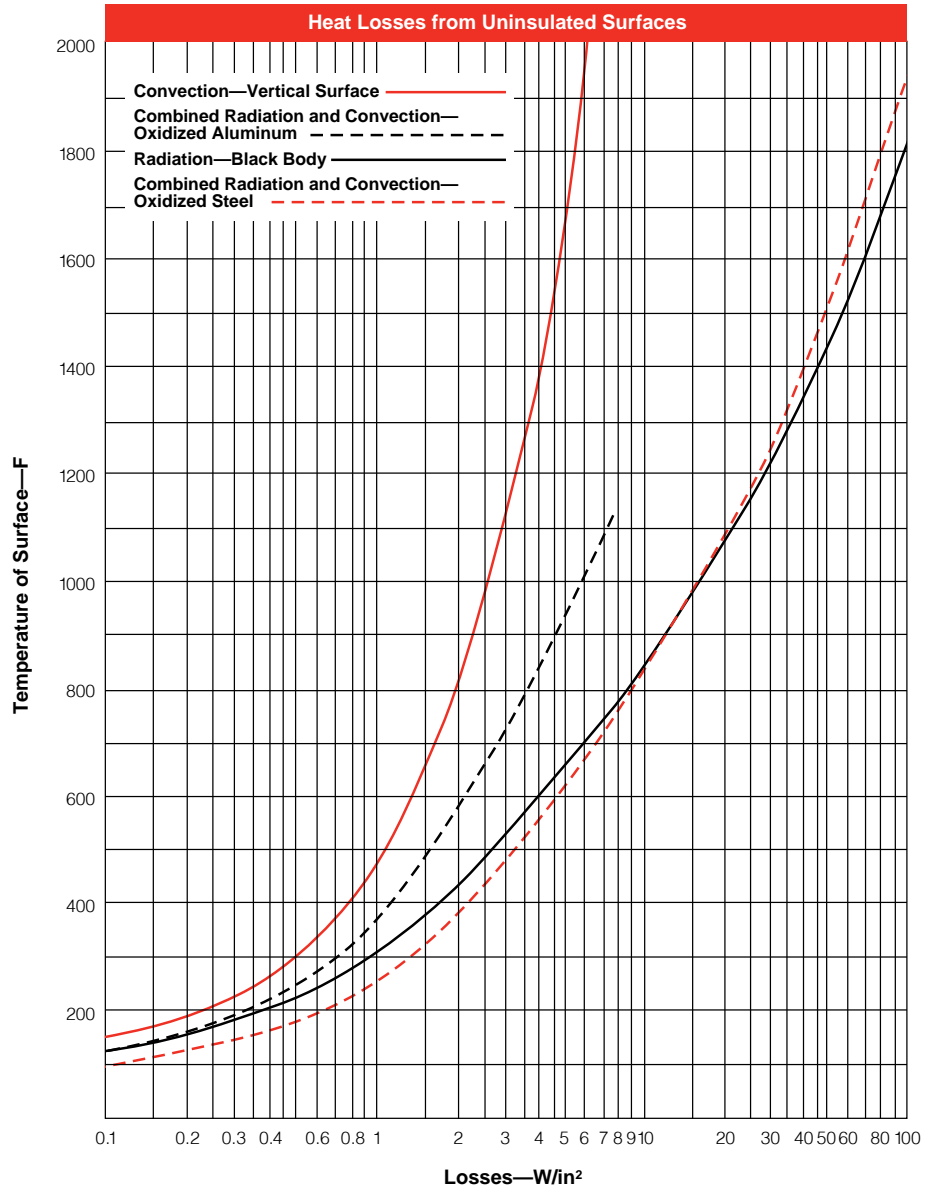
For side surfaces and vertical pipes Use convection curve directly

For bottom surfaces Multiply convection curve value by 0.63

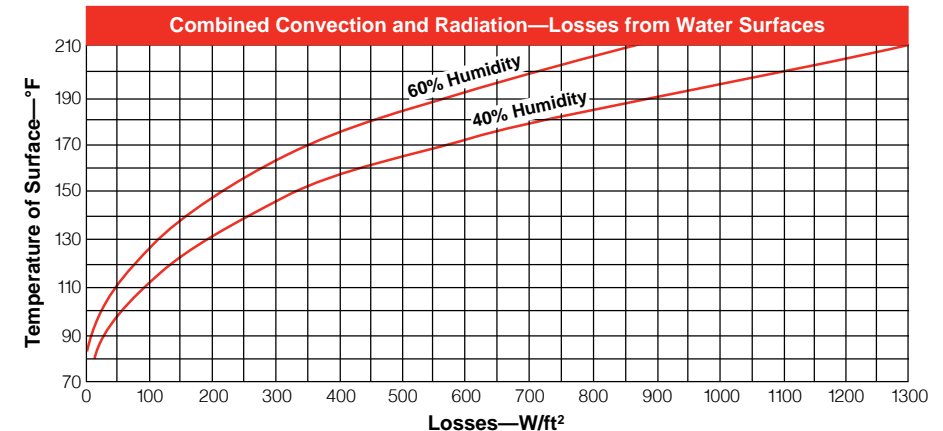
#### Radiation Curve Correction Factors

The radiation curve shows losses from a perfect blackbody and are not dependent upon position. Commonly used block materials lose less heat by radiation than a blackbody, so correction factors are applied. These corrections are the emissivity ( $\epsilon$ ) values listed on page 530.

Ref. 1



Ref. 2



# Reference Data (Imperial Unit)



## Power Calculations

### Heat Loss Curves

#### Some Material Emissivities/Metals - Ref. 3

Material	Specific Heat Btu/lb - °F	Emissivity		
		Polished Surface	Medium Oxide	Heavy Oxide
Blackbody			0.75	1.00
Aluminum	0.24	0.09	0.11	0.22
Brass	0.10	0.04	0.35	0.60
Copper	0.10	0.04	0.03	0.65
Incoloy® 800	0.12	0.20	0.60	0.92
Inconel® 600	0.11	0.20	0.60	0.92
Iron, Cast	0.12	—	0.80	0.85
Lead, solid	0.03	—	0.28	—
Magnesium	0.23	—	—	—
Nickel 200	0.11	—	—	—
Nichrome, 80-20	0.11	—	—	—
Solder, 50-50	0.04	—	—	—
Steel				
mild	0.12	0.10	0.75	0.85
stainless 304	0.11	0.17	0.57	0.85
stainless 430	0.11	0.17	0.57	0.85
Tin	0.056	—	—	—
Zinc	0.10	—	0.25	—

#### Some Material Emissivities/Non-Metals - Ref. 4

Material	Specific Heat Btu/lb - °F	Emissivity
Asbestos	0.25	Most non-metals: 0.90
Asphalt	0.40	
Brickwork	0.22	
Carbon	0.20	
Glass	0.20	
Paper	0.45	
Plastic	0.2-0.5	
Rubber	0.40	
Silicone Carbide	0.20-0.23	
Textiles	—	
Wood, Oak	0.57	

# Reference Data (Imperial Unit)

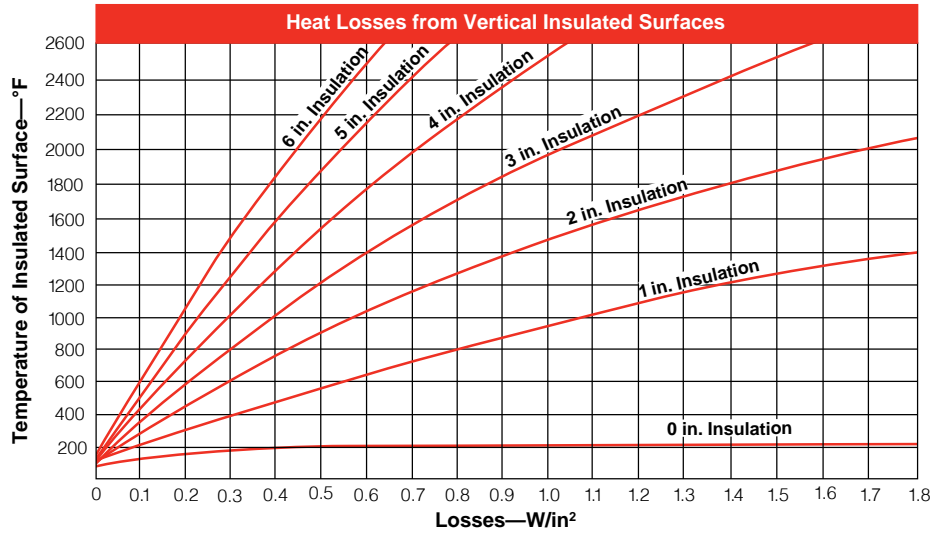


## Power Calculations

### Heat Loss Curves

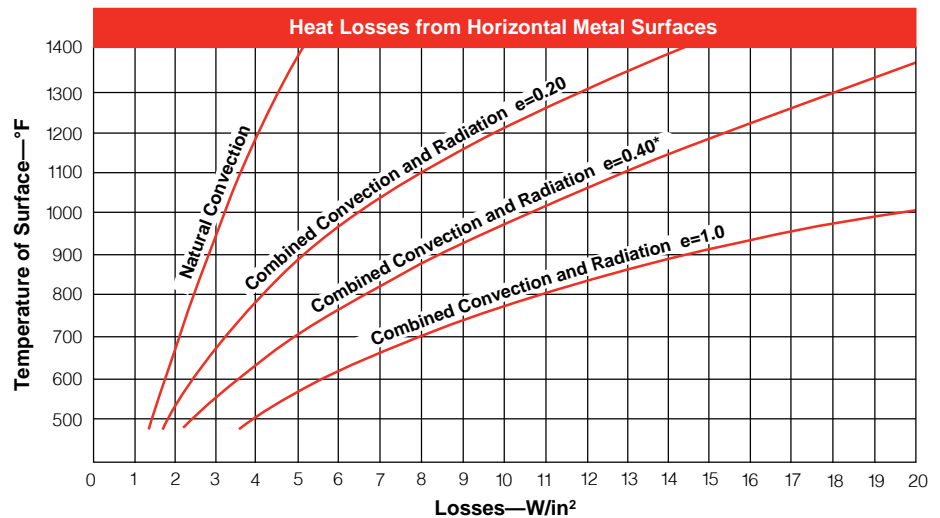
1. Based upon combined natural convection and radiation losses into 70°F environment.
2. Insulation characteristics  
 $k = 0.67$  @ 200°F  
 $k = 0.83$  @ 1000°F
3. For molded ceramic fiber products and packed or tightly packed insulation, losses will be lower than values shown.  
 For 2 or 3 inches insulation multiply by 0.84.  
 For 4 or 5 inches insulation multiply by 0.81.  
 For 6 inches insulation multiply by 0.79.

Ref. 5

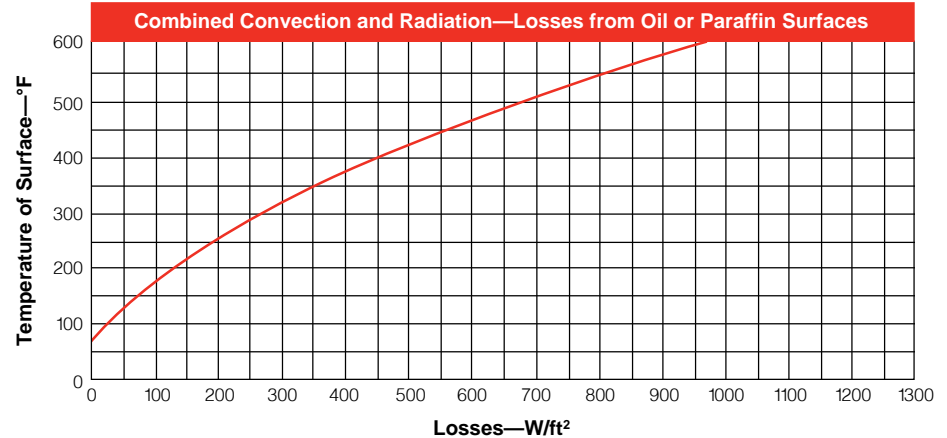


Ref. 6

\*For losses of molten metal surfaces, use the curve  $e=0.40$ .



Ref. 7



# Reference Data (Imperial Unit)



## Equations

### Ohms Law

**Volts**

$$\text{Volts} = \sqrt{\text{Watts} \times \text{Ohms}}$$

$$\text{Volts} = \frac{\text{Watts}}{\text{Amperes}}$$

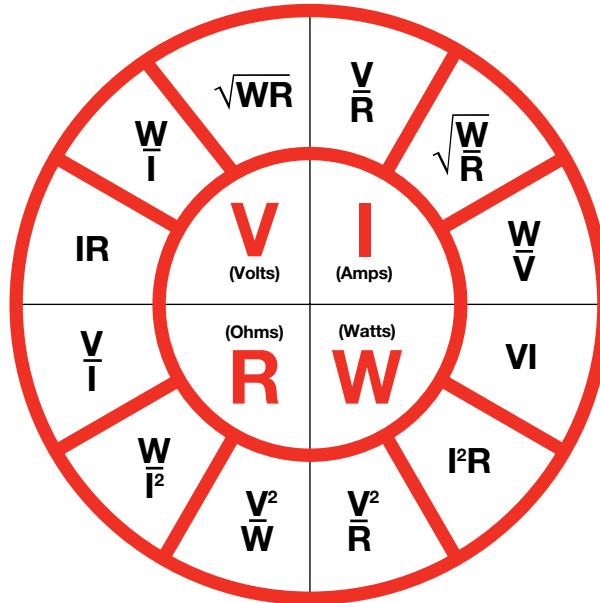
$$\text{Volts} = \text{Amperes} \times \text{Ohms}$$

**Ohms**

$$\text{Ohms} = \frac{\text{Volts}}{\text{Amperes}}$$

$$\text{Ohms} = \frac{\text{Volts}^2}{\text{Watts}}$$

$$\text{Ohms} = \frac{\text{Watts}}{\text{Amperes}^2}$$



**Amperes**

$$\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}}$$

$$\text{Amperes} = \frac{\text{Watts}}{\text{Volts}}$$

$$\text{Amperes} = \sqrt{\frac{\text{Watts}}{\text{Ohms}}}$$

**Watts**

$$\text{Watts} = \frac{\text{Volts}^2}{\text{Ohms}}$$

$$\text{Watts} = \text{Amperes}^2 \times \text{Ohms}$$

$$\text{Watts} = \text{Volts} \times \text{Amperes}$$

Wattage varies directly as ratio of voltages squared

$$W_2 = W_1 \times \left(\frac{V_2}{V_1}\right)^2$$

$$3 \text{ Phase Amperes} = \frac{\text{Total Watts}}{\text{Volts} \times 1.732}$$



## Equations

### Typical 3-Phase Wiring Diagrams and Equations for Resistive Heaters

#### Definitions

#### For Both Wye and Delta (Balanced Loads)

$V_p$  = Phase voltage

$V_L$  = Line voltage

$I_p$  = Phase current

$I_L$  = Line current

$R = R_1 = R_2 = R_3 =$   
Resistance of each branch

$W$  = Wattage

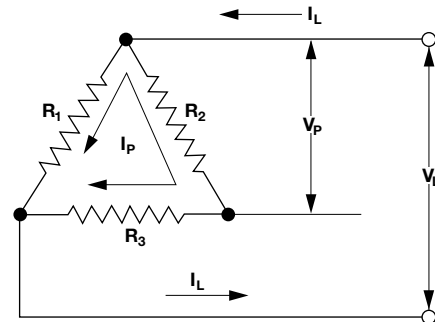
#### Wye and Delta Equivalent

$$W_{\text{DELTA}} = 3 W_{\text{WYE}}$$

$$W_{\text{ODELTA}} = \frac{2}{3} W_{\text{DELTA}}$$

$$W_{\text{OWYE}} = \frac{1}{2} W_{\text{WYE}}$$

### 3-Phase Delta (Balanced Load)



#### Equations For Delta Only

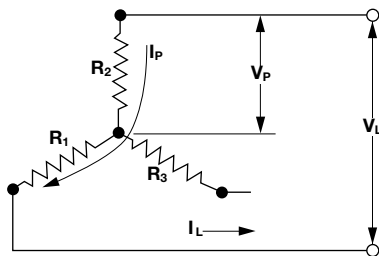
$$I_p = I_L / 1.73$$

$$V_p = V_L$$

$$W_{\text{DELTA}} = 3(V_L^2)/R$$

$$W_{\text{DELTA}} = 1.73 V_L I_L$$

### 3-Phase Wye (Balanced Load)



#### Equations For Wye Only

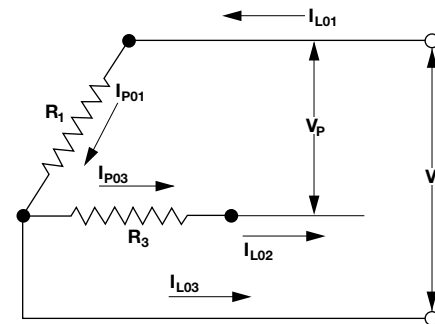
$$I_p = I_L$$

$$V_p = V_L / 1.73$$

$$W_{\text{WYE}} = V_L^2 / R = 3(V_p^2) / R$$

$$W_{\text{WYE}} = 1.73 V_L I_L$$

### 3-Phase Open Delta



#### Equations For Open Delta Only

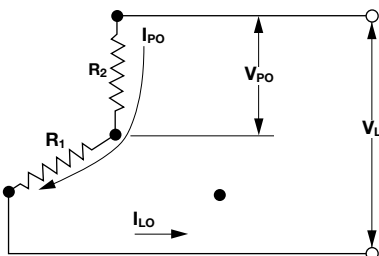
$$V_p = V_L$$

$$I_{p01} = I_{p03} = I_{L02}$$

$$I_{L03} = 1.73 I_{p01}$$

$$W_{\text{ODELTA}} = 2(V_L^2)/R$$

### 3-Phase Open Wye (No Neutral)



#### Equations For Open Wye Only

$$I_{p0} = I_{L0}$$

$$V_{p0} = V_L / 2$$

$$W_{\text{OWYE}} = \frac{1}{2} (V_L^2) / R$$

$$W_{\text{OWYE}} = 2 (V_{p0}^2) / R$$

$$W_{\text{OWYE}} = V_L I_{L0}$$

# Reference Data (Imperial Unit)



## Wattage Requirements

The following equations can be used to make quick estimates of wattage requirements.

### For Steel

Use equation:

$$kW = \frac{\text{pounds} \times \text{temperature rise } (^\circ\text{F})}{20,000 \times \text{heat-up time (hrs.)}}$$

1 cu. ft. = 7.49 gallons

---

### For Heating Water in Tanks

Use equation:

$$kW = \frac{\text{gallons} \times \text{temperature rise } (^\circ\text{F})}{375 \times \text{heat-up time (hrs.)}}$$

1 cu. ft. = 7.49 gallons

---

### For Air

Use equation:

$$kW = \frac{\text{CFM}^{**\textcircled{1}} \times \text{temperature rise } (^\circ\text{F})}{3000}$$

\* Gallons per minute

\*\* Cubic feet per minute

<sup>①</sup> Measured at normal temperature and pressure

<sup>②</sup> Measured at heater system inlet temperature and pressure

### For Oil

Use equation:

$$kW = \frac{\text{gallons} \times \text{temperature rise } (^\circ\text{F})}{800 \times \text{heat-up time (hrs.)}}$$

---

### For Heating Flowing Water

Use equation:

$$kW = \text{GPM}^* \times \text{temperature rise } (^\circ\text{F}) \times 0.16$$

---

### For Compressed Air

Use equation:

$$kW = \frac{\text{CFM}^{**\textcircled{2}} \times \text{density}^{\textcircled{2}} \times \text{temperature rise } (^\circ\text{F})}{228}$$

# Reference Data (Imperial Unit)



## Wattage Requirements

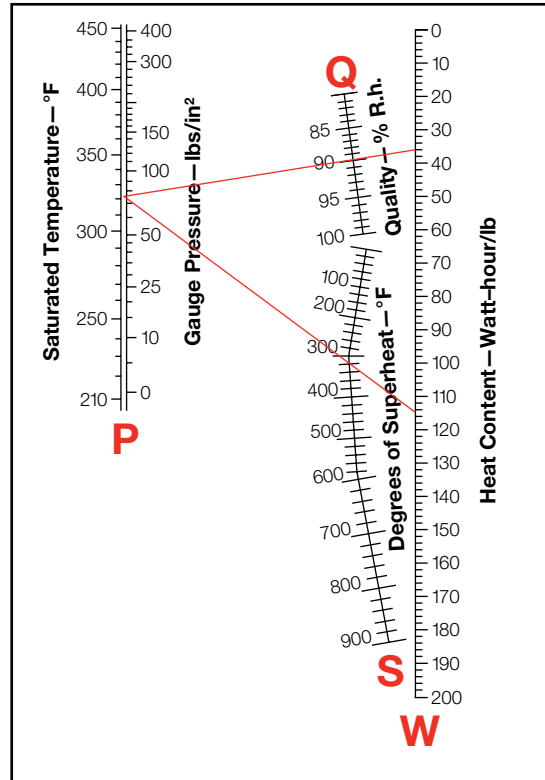
### Kilowatt-Hours to Superheat Steam

1. Plot points on lines **P**, **Q** and **S**. **P** represents the inlet temperature (and saturation pressure) of the system.  
**Q** represents the liquid content of the water vapor.  
**S** indicates the outlet temperature minus the saturated temperature.  
**W** indicates the heat content of the water vapor.
2. Draw a straight line from **P** through **Q** to **W**. Read  $W_1$ .
3. Draw a straight line from **P** through **S** to **W**. Read  $W_2$ .
4. Required watts = Weight (lbs) of steam/hour x ( $W_2 - W_1$ )  
Watt density is critical. Review temperature and velocity prior to heater selection.

#### Example Shown:

Q = 90% quality (% R.H.)  
P = 75 psig  
S = 320°F

### Superheat Steam



**Note:** Reference is based on >80% steam quality at >20 psig.



## Power Calculations

### Calculations for Required Heat Energy

The total heat energy (kWh or BTU) required to satisfy the system needs will be either of the two values shown below depending on which calculated result is larger.

1. Heat required for start up
2. Heat required to maintain the desired temperature

The power required (kW) will be the heat energy value (kWh) divided by the required start up or working cycle time. The kW rating of the heater will be the greater of these values plus a safety factor.

The calculation of start-up and operating requirements consist of several distinct parts that are best handled separately. However, a short method can also be used for a quick estimate of heat energy required. Both methods are defined and then evaluated using the following formulas and methods:

### Short Method

$$\text{Start-up watts} = (P_A + P_C + \frac{2}{3} P_L) \times (1 + \text{S.F.})$$

$$\text{Operating watts} = (P_B + P_D + P_L) \times (1 + \text{S.F.})$$

$P_A$  = Watts required to raise the temperature of material and equipment to the operating point, within the time desired

$P_B$  = Watts required to maintain temperature of the material during the working cycle

$P_C$  = Watts required to melt or vaporize load material during start-up period

$P_D$  = Watts required to melt or vaporize load material during working cycle

$P_L$  = Watts lost from surfaces by:

- Conduction-use equation to the right
- Radiation-use heat loss curves on pages 542 and 543, Reference 1, 2, 5, 6 and 7.
- Convection-use heat loss curves on pages 542 and 543, Reference 1, 2, 5, 6 and 7.

S.F. = Safety Factor is normally 10 to 35 percent based on application

### Equation for $P_A$ and $P_B$ (Absorbed watts-raising temperature)

$$P_A \text{ or } P_B = \frac{(w \times C_p \times \Delta T)}{t}$$

- $w$  = weight of material (kg)
- $C_p$  = specific heat of material (J/(kg•°C))
- $\Delta T$  = temperature rise of material ( $T_{\text{Final}} - T_{\text{Initial}}$ ) (°C)
- $t$  = start-up or cycle time (s)

### Equation for $C$ and $D$ (Absorbed watts-melting or vaporizing)

$$P_C \text{ or } P_D = \frac{w \times H_f}{t}$$

- $w$  = weight of material (kg)
- $H_f$  = Heat of fusion or vaporization (J/kg)
- $t$  = start-up or cycle time (s)

### Equation for $L$ (Lost conducted watts)

$$P_L = \frac{k \times A \times \Delta T}{d}$$

- $k$  = thermal conductivity (W/m °C)
- $A$  = surface area (m<sup>2</sup>)
- $\Delta T$  = temperature differential to ambient (°C)
- $d$  = thickness of material (m)





## Power Calculations

### Conduction and Convection Heating

#### Absorbed Energy, Heat Required to Raise the Temperature of a Material

Because substances all heat differently, different amounts of heat are required in making a temperature change. The specific heat capacity of a substance is the quantity of heat needed to raise the temperature of a unit quantity of the substance by one degree. Calling the amount of heat added **Q**, which will cause a change in temperature **ΔT** to a weight of substance **w**, at a specific heat of material **C<sub>p</sub>**, then  $Q = w \times C_p \times \Delta T$ .

Since all calculations are in watts, an additional conversion of 3600 Ws (J) = 1 Wh is introduced yielding:

#### Equation 1

$$Q_A \text{ or } Q_B = \frac{w \times C_p \times \Delta T}{3600}$$

$Q_A$  = heat required to raise temperature of materials during heat-up (Wh)

$Q_B$  = heat required to raise temperature of materials processed in working cycle (Wh)

$w$  = weight of material (kg)

$C_p$  = specific heat of material (J/(kg•°C))

$\Delta T$  = temperature rise of material ( $T_{\text{Final}} - T_{\text{Initial}}$ )(°C)

This equation should be applied to all materials absorbing heat in the application. Heated media, work being processed, vessels, racks, belts and ventilation air should be included.

**Example:** How much heat energy is needed to change the temperature of 25 kg of copper from 25 to 60°C?

$$\begin{aligned} Q &= \frac{w \times C_p \times \Delta T}{3600} \\ &= \frac{(25 \text{ kg}) \times (385 \text{ J}/[\text{kg}\cdot\text{°C}]) \times (35\text{°C})}{3600} = 94 \text{ (Wh)} \end{aligned}$$

#### Heat Required to Melt or Vaporize a Material

In considering adding heat to a substance, it is also necessary to anticipate changes in state that might occur during this heating such as melting and vaporizing. The heat needed to melt a material is known as the latent heat of fusion and represented by **H<sub>f</sub>**. Another state change is involved in vaporization and condensation. The latent heat of vaporization **H<sub>v</sub>** of the substance is the energy required to change a substance from a liquid to a vapor. This same amount of energy is released as the vapor condenses back to a liquid.

#### Equation 2

$$Q_C \text{ or } Q_D = \frac{w \times H_f}{3600} \quad \text{OR} \quad \frac{w \times H_v}{3600}$$

$Q_C$  = heat required to melt/vaporize materials during heat-up (Wh)

$Q_D$  = heat required to melt/vaporize materials processed in working cycle (Wh)

$w$  = weight of material (kg)

$H_f$  = latent heat of fusion (J/kg)

$H_v$  = latent heat of vaporization (J/kg)

**Example:** How much energy is required to melt 25 kg of lead?

$$\begin{aligned} Q &= \frac{w \times H_f}{3600} \\ &= \frac{(25 \text{ kg}) \times (22800 \text{ J}/\text{kg})}{3600} = 158 \text{ (Wh)} \end{aligned}$$

Changing state (melting and vaporizing) is a constant temperature process. The **C<sub>p</sub>** value (from Equation 1) of a material also changes with a change in state. Separate calculations are thus required using Equation 1 for the material below and above the phase change temperature.



## Power Calculations

### Conduction and Convection Heating (Continued)

#### Conduction Heat Losses

Heat transfer by conduction is the contact exchange of heat from one body at a higher temperature to another body at a lower temperature, or between portions of the same body at different temperatures.

#### Equation 3A—Heat Required to Replace Conduction Losses

$$Q_{L1} = \frac{k \times A \times \Delta T \times t_e}{L}$$

$Q_{L1}$  = conduction heat losses (Wh)

$k$  = thermal conductivity (W/(m•°C))

$A$  = heat transfer surface area (m<sup>2</sup>)

$L$  = thickness of material (m)

$\Delta T$  = temperature difference across material (T<sub>2</sub>-T<sub>1</sub>) (°C)

$t_e$  = exposure time (hr)

This expression can be used to calculate losses through insulated walls of containers or other plane surfaces where the temperature of both surfaces can be determined or estimated.

#### Convection Heat Losses

Convection is a special case of conduction. Convection is defined as the transfer of heat from a high temperature region in a gas or liquid as a result of movement of the masses of the fluid.

#### Equation 3B—Convection Losses

$$Q_{L2} = A \times F_{SL} \times C_F \times t_e$$

$Q_{L2}$  = convection heat losses (Wh)

$A$  = surface area (m<sup>2</sup>)

$F_{SL}$  = vertical surface convection loss factor (W/m<sup>2</sup>) evaluated at surface temperature (see page 542, Reference 1.)

$C_F$  = surface orientation factor  
heated surface faces up horizontally = 1.29  
vertical = 1.00  
heated surface faces down horizontally = 0.63

#### Radiation Heat Losses

Radiation losses are not dependent on orientation of the surface. Emissivity is used to adjust for a material's ability to radiate heat energy.

#### Equation 3C—Radiation Losses

$$Q_{L3} = A \times F_{SL} \times e \times t_e$$

$Q_{L3}$  = radiation heat losses (Wh)

$A$  = surface area (m<sup>2</sup>)

$F_{SL}$  = blackbody radiation loss factor at surface temperature (W/m<sup>2</sup>) (see page 542, Reference 1.)

$e$  = emissivity of material surface

#### Example:

We find that a blackbody radiator (perfect radiator) at 260°C, has heat losses of 4851 W/m<sup>2</sup>. Polished aluminum, in contrast, ( $e = 0.09$ ) only has heat losses of 412 W/m<sup>2</sup> at the same temperature (4851 W/m<sup>2</sup> · 0.09 = 412 W/m<sup>2</sup>).

#### Combined Convection and Radiation Heat Losses

Some curves combine both radiation and convection losses. This saves you from having to use both Equations 3B and 3C. If only the convection component is required, then the radiation component must be determined separately and subtracted from the combined curve.

#### Equation 3D—Combined Convection and Radiation Heat Losses

$$Q_{L4} = A \times F_{SL} \times t_e$$

$Q_{L4}$  = surface heat losses combined convection and radiation (Wh)

$A$  = surface area (m<sup>2</sup>)

$F_{SL}$  = combined surface loss factor at surface temperature (W/m<sup>2</sup>) (see pages 542 and 543, Reference 1, 2, 5, 6 and 7.)

This equation assumes a constant surface temperature.



## Power Calculations

### Conduction and Convection Heating (Continued)

#### Total Heat Losses

The total conduction, convection and radiation heat losses are summed together to allow for all losses in the power equations. Depending on the application, heat losses may make up only a small fraction of total power required or it may be the largest portion of the total. Therefore, do not ignore heat losses unless previous experience tells you it is alright to do.

#### Equation 3E—Total Losses

$Q_L = Q_{L1} + Q_{L2} + Q_{L3}$  If convection and radiation losses are calculated separately. (Surfaces are not uniformly insulated and losses must be calculated separately.)

OR

$Q_L = Q_{L1} + Q_{L4}$  If combined radiation and convection curves are used. (Pipes, ducts, uniformly insulated bodies.)

#### Start-Up and Operating Power Required

Both of these equations estimate required energy and convert it to power. Since power (watts) specifies an energy rate, we can use power to select electric heater requirements. Both the start-up power and the operating power must be analyzed before heater selection can take place.

#### Equation 4—Start-Up Power (Watts)

$$P_s = \frac{Q_A + Q_C + \frac{2}{3}Q_L}{t_s} (1 + S.F.)$$

$Q_A$  = heat absorbed by materials during heat-up (Wh)

$Q_C$  = latent heat absorbed during heat-up (Wh)

$Q_L$  = conduction, convection, radiation losses (Wh)

S.F. = safety factor

$t_s$  = start-up (heat-up) time required (hr)

During start up of a system the losses are zero, and rise to 100 percent at process temperature. A good approximation of actual losses is obtained when heat losses ( $Q_L$ ) are multiplied by  $\frac{2}{3}$ .

#### Equation 5—Operating Power (Watts)

$$P_C = \frac{Q_B + Q_D + Q_L}{t_c} (1 + S.F.)$$

$Q_B$  = heat absorbed by processed materials in working cycle (Wh)

$Q_D$  = latent heat absorbed by materials heated in working cycle (Wh)

$Q_L$  = conduction, convection, radiation losses (Wh)

S.F. = safety factor

$t_c$  = cycle time required (hr)



## Power Calculations

### Conduction and Convection Heating (Continued)

#### Radiant Heating

When the primary mode of heat transfer is radiation, we add a step after Equation 5.

Equation 6 is used to calculate the net radiant heat transfer between two bodies. We use this to calculate either the radiant heater temperature required or (if we know the heater temperature, but not the power required) the maximum power which can be transferred to the load.

#### Equation 6—Radiation Heat Transfer

##### Between Infinite Size Parallel Surfaces

$$\frac{P_R}{A} = \sigma (T_1^4 - T_2^4) \left( \frac{1}{e_f} \right) F$$

- $P_R$  = power absorbed by the load (w) - from equation 4 or 5
- $A$  = area of heater (m<sup>2</sup>) - known or assumed
- $\sigma$  = Stephan Boltzman constant  
=  $5.67 \cdot 10^{-8}$  (W/m<sup>2</sup>•K<sup>4</sup>)
- $T_1$ (K) = emitter temperature (°C + 273.15)
- $T_2$ (K) = load temperature (°C + 273.15)
- $e_f$  = emissivity correction factor - see Emissivity Correction Factor information to the right
- $F$  = shape factor (0 to 1.0) - see Shape Factor for Radiant Application graph to the right

#### Emissivity Correction Factor ( $e_f$ )

$$e_f = \frac{1}{e_S} + \frac{1}{e_L} - 1 \quad \text{plane surfaces}$$

$$e_f = \frac{1}{e_S} + \frac{D_S}{D_L} \left( \frac{1}{e_L} - 1 \right) \quad \text{concentric cylinders inner radiating outward}$$

$$e_f = \frac{1}{e_S} + \left( \frac{D_S}{D_L} \times \frac{1}{e_L} \right) - 1 \quad \text{concentric cylinders outer radiating inward}$$

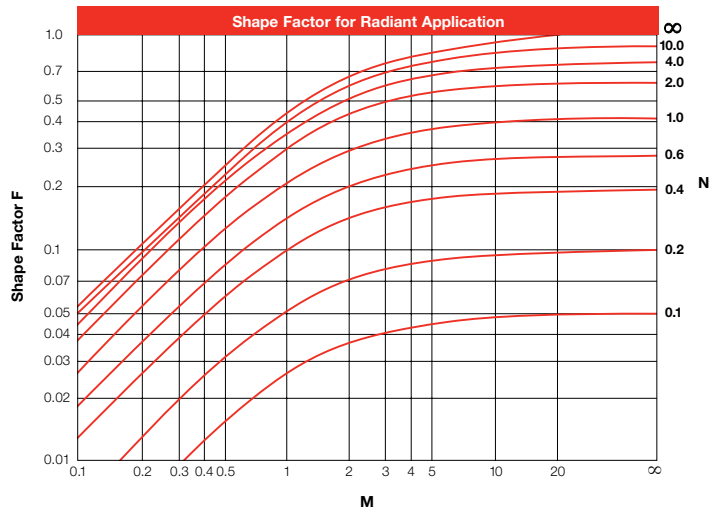
$e_S$  = heater emissivity (from material emissivity tables)

$e_L$  = load emissivity (from material emissivity tables)

$D_S$  = heater diameter

$D_L$  = load diameter

#### Shape Factor for Radiant Application



#### For Two Facing Panels:

$$N = \left( \frac{\text{Heated Length}}{\text{Distance to Material}} \right)$$

$$M = \left( \frac{\text{Heated Width}}{\text{Distance to Material}} \right)$$



## Power Calculations

### Conduction and Convection Heating (Continued)

#### Power Evaluation

After calculating the start up and operating power requirements, a comparison must be made and various options evaluated.

Shown in the graph below are the start up and operating watts displayed in a graphic format to help you see how power requirements add up.

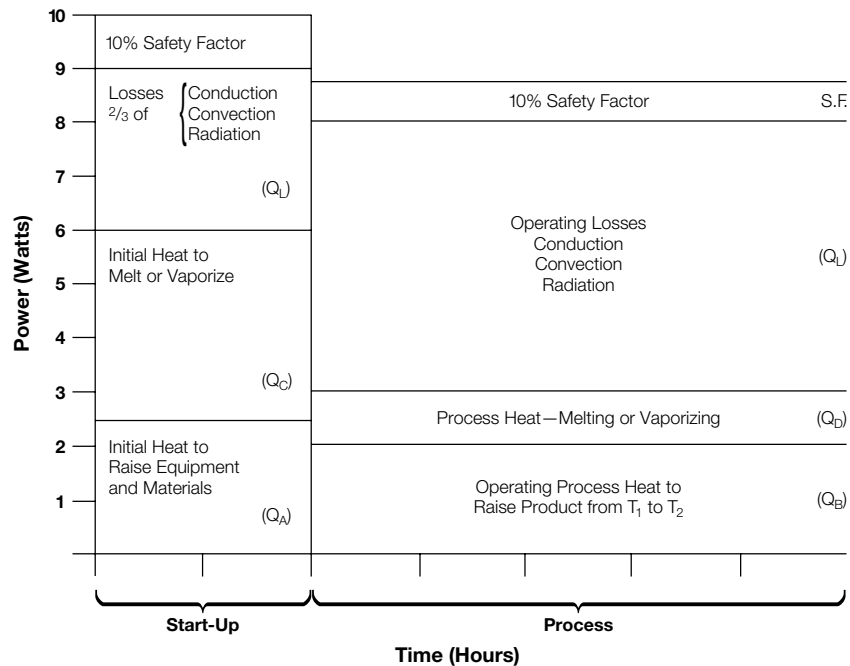
With this graphic aid in mind, the following evaluations are possible:

- Compare start up watts to operating watts.
- Evaluate effects of lengthening start-up time such that start-up watts equals operating watts (use timer to start system before shift).

- Recognize that more heating capacity exists than is being utilized. (A short start-up time requirement needs more wattage than the process in wattage.)
- Identify where most energy is going and redesign or add insulation to reduce wattage requirements.

Having considered the entire system, a reevaluation of start-up time, production capacity and insulating methods should be made.

**Comparison of Start Up and Operating Power Requirements**





## Power Calculations

### Heat Loss Curves

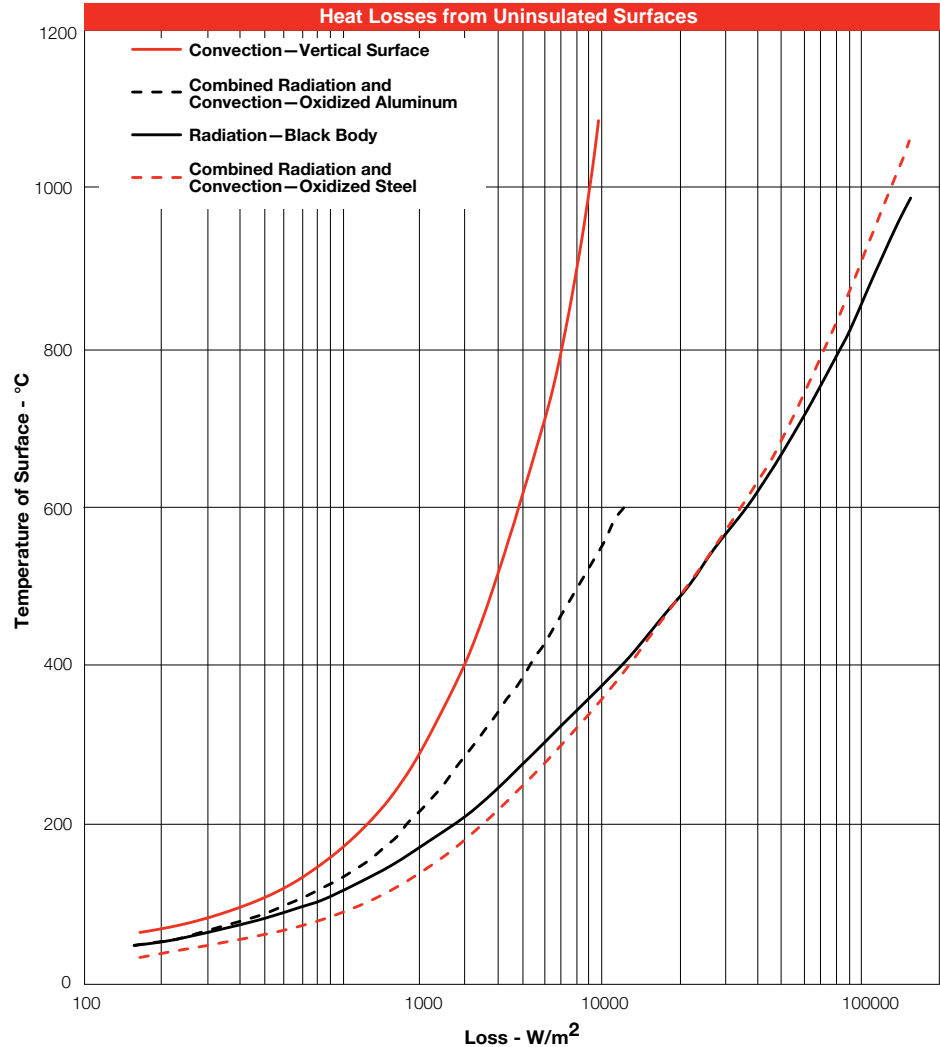
#### Ref. 1—Convection curve correction factors:

For losses from top surfaces or from horizontal pipes	Multiply convection curve by 1.29
For side surfaces and vertical pipes	Use convection curve directly
For bottom surfaces	Multiply convection curve value by 0.63

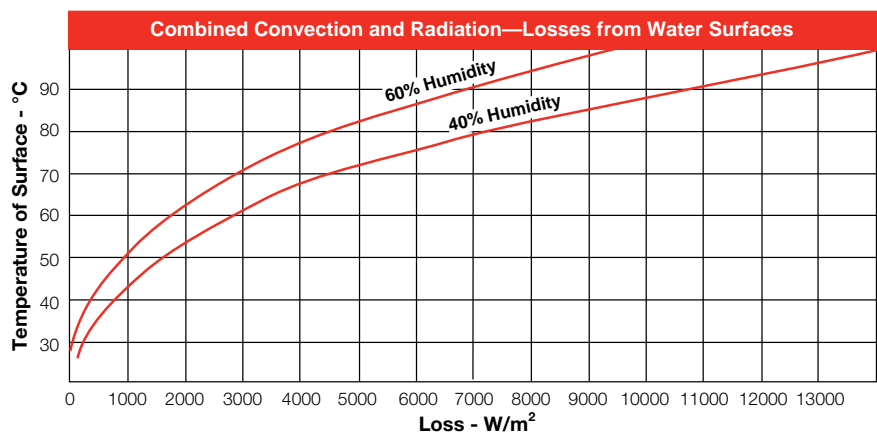
#### Radiation Curve Correction Factors

The radiation curve shows losses from a perfect blackbody and are not dependent upon position. Commonly used block materials lose less heat by radiation than a blackbody, so correction factors are applied. These corrections are the emissivity ( $\epsilon$ ) values listed in the reference data section on page 530.

Ref. 1



Ref. 2



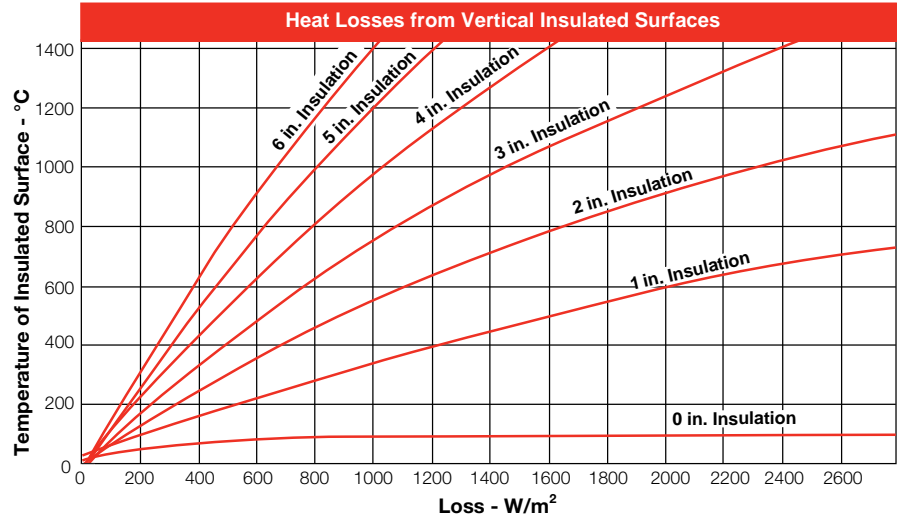


## Power Calculations

### Heat Loss Curves

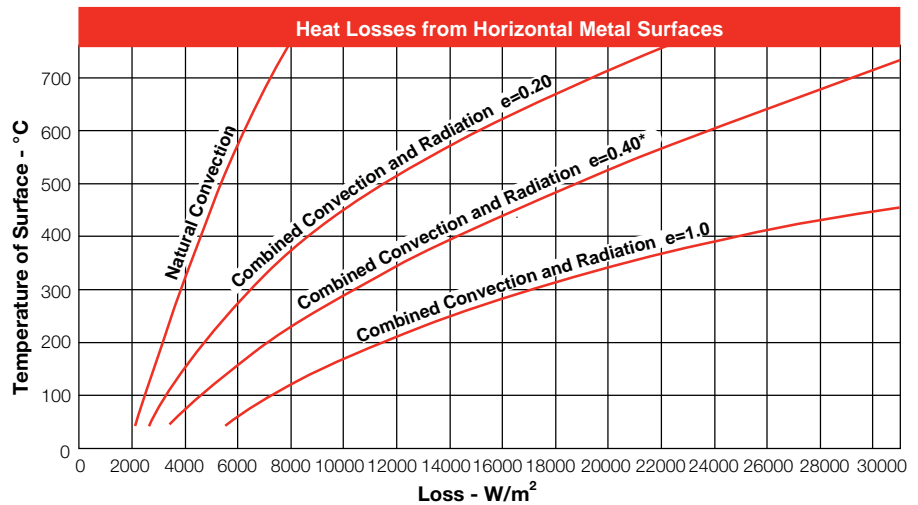
Ref. 5

- Based upon combined natural convection and radiation losses into 21°C environment.
- Insulation characteristics  
 $k = 0.097 \text{ W/m K @ } 93^\circ\text{C}$   
 $k = 0.120 \text{ W/m K @ } 538^\circ\text{C}$
- For molded ceramic fiber products and packed or tightly packed insulation, losses will be lower than values shown.  
 For 50.8 or 76.2 mm insulation multiply by 0.84.  
 For 102 or 127 mm insulation multiply by 0.81.  
 For 152 inches insulation multiply by 0.79.

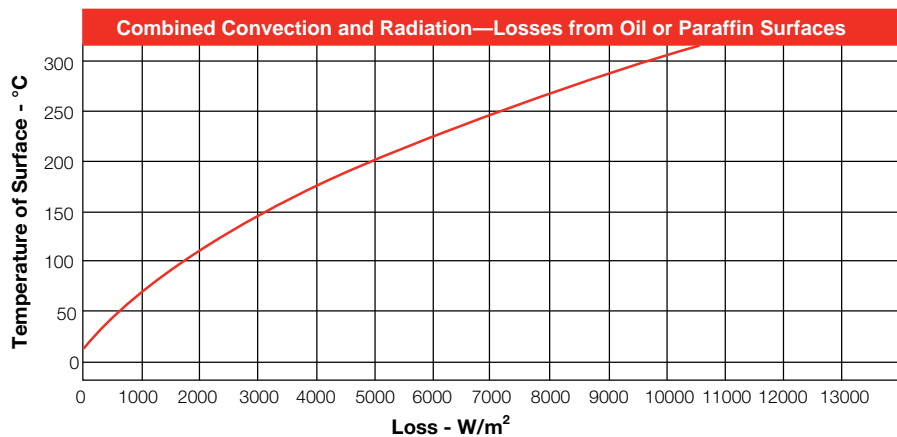


Ref. 6

\*For losses of molten metal surfaces, use the curve  $e=0.40$ .



Ref. 7





## Equations

### Ohm's Law

**Volts**

$$\text{Volts} = \sqrt{\text{Watts} \times \text{Ohms}}$$

$$\text{Volts} = \frac{\text{Watts}}{\text{Amperes}}$$

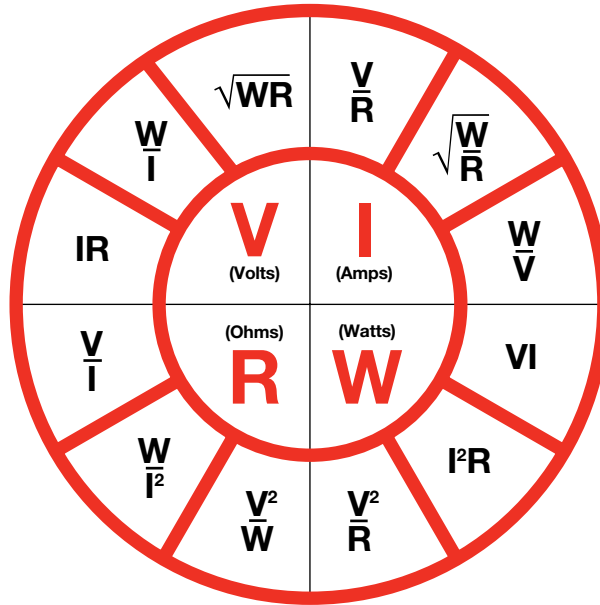
$$\text{Volts} = \text{Amperes} \times \text{Ohms}$$

**Ohms**

$$\text{Ohms} = \frac{\text{Volts}}{\text{Amperes}}$$

$$\text{Ohms} = \frac{\text{Volts}^2}{\text{Watts}}$$

$$\text{Ohms} = \frac{\text{Watts}}{\text{Amperes}^2}$$



**Amperes**

$$\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}}$$

$$\text{Amperes} = \frac{\text{Watts}}{\text{Volts}}$$

$$\text{Amperes} = \sqrt{\frac{\text{Watts}}{\text{Ohms}}}$$

**Watts**

$$\text{Watts} = \frac{\text{Volts}^2}{\text{Ohms}}$$

$$\text{Watts} = \text{Amperes}^2 \times \text{Ohms}$$

$$\text{Watts} = \text{Volts} \times \text{Amperes}$$

Wattage varies directly as ratio of voltages squared

$$W_2 = W_1 \times \left(\frac{V_2}{V_1}\right)^2$$

$$3 \text{ Phase Amperes} = \frac{\text{Total Watts}}{\text{Volts} \times 1.732}$$





## Equations

### Typical 3-Phase Wiring Diagrams and Equations for Resistive Heaters

#### Definitions

#### For Both Wye and Delta (Balanced Loads)

$V_p$  = Phase voltage

$V_L$  = Line voltage

$I_p$  = Phase current

$I_L$  = Line current

$R = R_1 = R_2 = R_3 =$   
Resistance of each branch

$W$  = Wattage

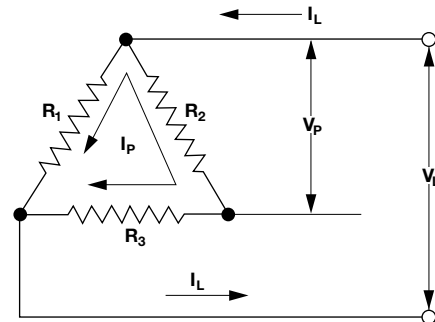
#### Wye and Delta Equivalent

$$W_{\text{DELTA}} = 3 W_{\text{WYE}}$$

$$W_{\text{ODELTA}} = \frac{2}{3} W_{\text{DELTA}}$$

$$W_{\text{OWYE}} = \frac{1}{2} W_{\text{WYE}}$$

### 3-Phase Delta (Balanced Load)



#### Equations For Delta Only

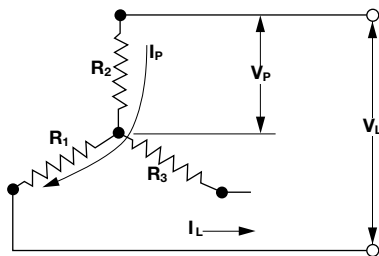
$$I_p = I_L / 1.73$$

$$V_p = V_L$$

$$W_{\text{DELTA}} = 3(V_L^2)/R$$

$$W_{\text{DELTA}} = 1.73 V_L I_L$$

### 3-Phase Wye (Balanced Load)



#### Equations For Wye Only

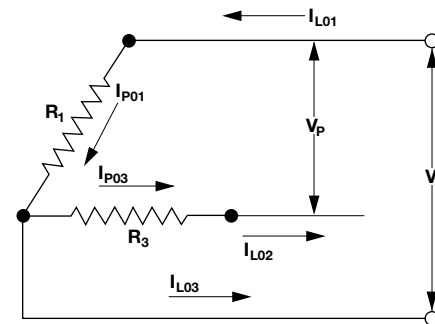
$$I_p = I_L$$

$$V_p = V_L / 1.73$$

$$W_{\text{WYE}} = V_L^2 / R = 3(V_p^2) / R$$

$$W_{\text{WYE}} = 1.73 V_L I_L$$

### 3-Phase Open Delta



#### Equations For Open Delta Only

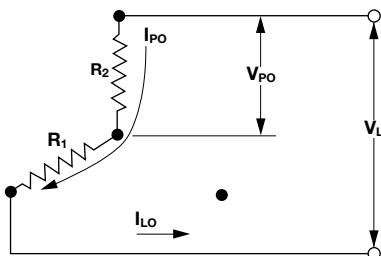
$$V_p = V_L$$

$$I_{p01} = I_{p03} = I_{L02}$$

$$I_{L03} = 1.73 I_{p01}$$

$$W_{\text{ODELTA}} = 2(V_L^2)/R$$

### 3-Phase Open Wye (No Neutral)



#### Equations For Open Wye Only

$$I_{p0} = I_{L0}$$

$$V_{p0} = V_L / 2$$

$$W_{\text{OWYE}} = \frac{1}{2} (V_L^2) / R$$

$$W_{\text{OWYE}} = 2 (V_{p0}^2) / R$$

$$W_{\text{OWYE}} = V_L I_{L0}$$



## Wattage Requirements

The following equations can be used to make quick estimates of wattage requirements.

### For Steel

Use equation:

$$\text{kW} = \frac{\text{kilograms} \times \text{temperature rise } (^{\circ}\text{C})}{5040 \times \text{heat-up time (hrs.)}}$$

### For Oil

Use equation:

$$\text{kW} = \frac{\text{liters} \times \text{temperature rise } (^{\circ}\text{C})}{1680 \times \text{heat-up time (hrs.)}}$$

### For Heating Water in Tanks

Use equation:

$$\text{kW} = \frac{\text{liters} \times \text{temperature rise } (^{\circ}\text{C})}{790 \times \text{heat-up time (hrs.)}}$$

### For Heating Flowing Water

Use equation:

$$\text{kW} = \text{liters/min.} \times \text{temperature rise } (^{\circ}\text{C}) \times 0.076$$

### For Air

Use equation:

$$\text{kW} = \frac{\text{cubic meters/min}^{\text{①}} \times \text{temperature rise } (^{\circ}\text{C})}{47}$$

### For Compressed Air

Use equation:

$$\text{kW} = \frac{\text{cubic meters/min.}^{\text{②}} \times \text{temperature rise } (^{\circ}\text{C}) \times \text{density (kg/m}^{\text{③}})^{\text{②}}}{57}$$

<sup>①</sup> Measured at normal temperature and pressure

<sup>②</sup> Measured at heater system inlet temperature and pressure

# Reference Data (SI Unit)



## Wattage Requirements

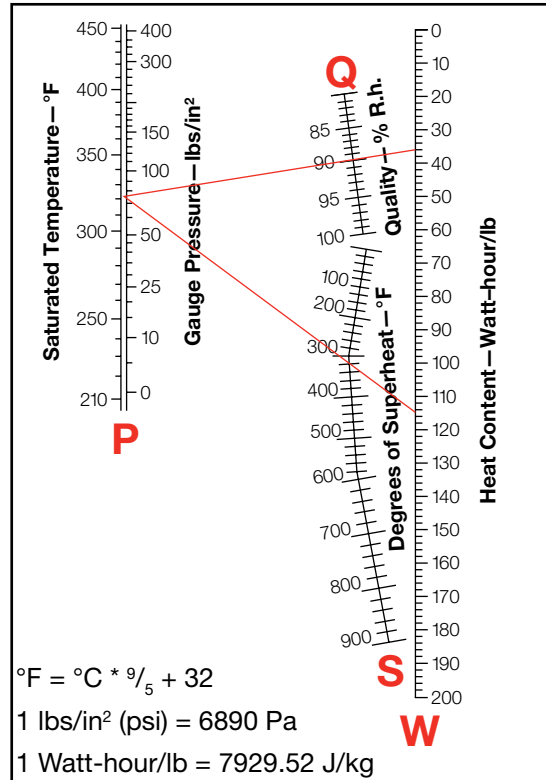
### Kilowatt-Hours to Superheat Steam

1. Plot points on lines **P**, **Q** and **S**. **P** represents the inlet temperature (and saturation pressure) of the system.  
**Q** represents the liquid content of the water vapor.  
**S** indicates the outlet temperature minus the saturated temperature.  
**W** indicates the heat content of the water vapor.
2. Draw a straight line from **P** through **Q** to **W**. Read  $W_1$ .
3. Draw a straight line from **P** through **S** to **W**. Read  $W_2$ .
4. Required watts = Weight (lbs) of steam/hour x ( $W_2 - W_1$ )  
Watt density is critical. Review temperature and velocity prior to heater selection.

#### Example Shown:

- Q = 90% quality (% R.H.)
- P = 75 psig
- S = 320°F

### Superheat Steam



**Note:** Reference is based on >80% steam quality at >20 psig.



## Tubular Elements and Assembly Selection Guide

Watlow® tubular elements and assemblies are primarily used for direct immersion in water, oils, viscous materials, solvents, process solutions and molten materials as well as air and gases.

Additionally, round and flat surface tubular elements (WATROD™ and FIREBAR® heaters respectively) can be used for surface heating.

WATROD and FIREBAR heating elements may be purchased separately, or fabricated into process heating assemblies, including:

- Screw plug
- Flange
- Circulation
- Booster
- Engine preheater
- Duct

Both elements and assemblies are available from stock. They can be configured with a variety of watt and volt ratings, terminations, sheath materials and mounting options to satisfy the most demanding applications.

If our stock products do not meet your application needs, Watlow can custom engineer the optimum heater.

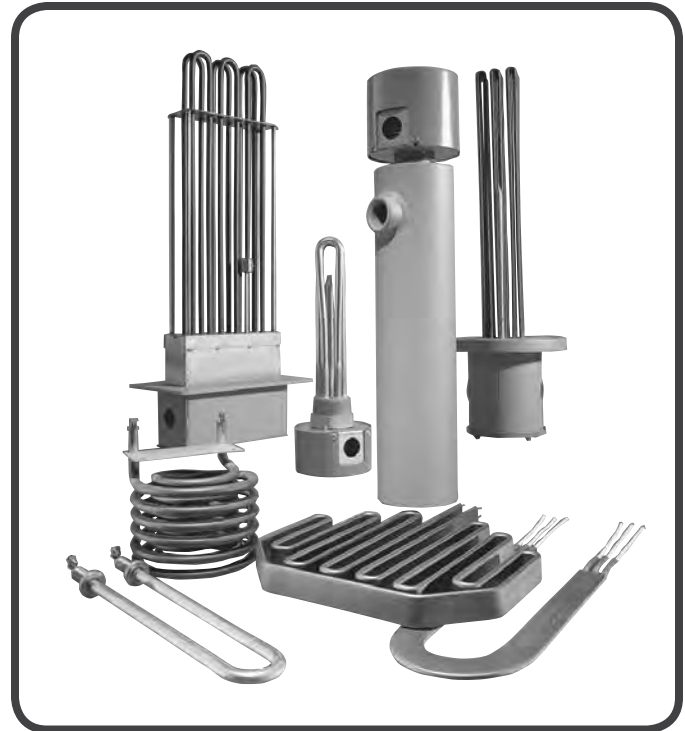
### Performance Capabilities

- Sheath temperatures up to 1800°F (983°C)
- Assembly wattages to 3 megawatts
- Process assembly ratings up to 3000psi
- Watt densities up to 120 W/in<sup>2</sup> (18.6 W/cm<sup>2</sup>)
- Enhanced performance beyond these specifications is available upon request
- Watlow can design thermal systems to meet specific performance criteria. Contact your local Watlow representative for assistance.

### Features and Benefits

#### 53 standard bend formations

- Enables designing of the heating element around available space to maximize heating efficiency



#### FIREBAR flat surface geometry

- Enhances heat transfer in both immersion and air applications and also surface heating
- Increases surface area per linear inch allowing heaters to run cooler in viscous materials

#### Wattages from 95 watts to 3 megawatts (on individual elements and assemblies respectively)

- Makes tubular heaters one of the most versatile electric heating sources available

#### Typical Applications

- Liquids
- Air
- Gases
- Molten materials
- Contact surface heating
- Radiant surface heating

# Reference Data



## Tubular Elements and Assembly Selection Guide

The following two charts will help you select an appropriate heater based on your application and watt density restrictions. These charts are application driven. The total wattage required by your application should be known before selecting a specific heater type(s) from the stock tables. If your required wattage is not known, please contact your Watlow representative.

Once the heater type has been identified, turn to the appropriate product section for information on the element or assembly.

### Element and Assembly Selection Guide

To identify the tubular heater type best suited to your application, consult the *Element and Assembly Selection Guide*.

In most cases Watlow recommends using single tubular heating elements for low kilowatt applications.

Assemblies are better suited for large kilowatt applications to heat liquids, air or gases.

When selecting a heater according to watt density, be sure to consider the following:

- Liquid viscosity at start up and at process temperature
- Operating temperature
- Chemical composition

Under the “**Heating Method**” column in the *Element and Assembly Selection Guide* locate the method that applies to your application to find the recommended “Heater Type.”

After identifying the heater type(s) suitable for your application, refer to the *Supplemental Applications Chart* for further application data. This chart will assist you in selecting the appropriate watt density and sheath material for your specific application. It also presents the performance characteristics for both WATROD and FIREBAR elements.

### Element and Assembly Selection Guide

Application	Heating Method	Heater Type
<b>Liquids:</b>		
Acids	Direct immersion (circulating/non-circulating)	FIREBAR, WATROD, screw plug, flange and pipe insert
Caustic soda 12% concentrate 10% concentrate 75% concentrate	Direct immersion (circulating/non-circulating)	WATROD, screw plug, square flange, flange, circulation and pipe insert
Degreasing solutions	Direct immersion (circulating/non-circulating)	FIREBAR, WATROD, screw plug, square flange, flange and pipe insert
Electroplating	Direct immersion (circulating/non-circulating)	FIREBAR, WATROD, screw plug, square flange, flange and pipe insert
Ethylene glycol 50% concentrate 100% concentrate	Direct immersion (circulating/non-circulating)	FIREBAR, WATROD, screw plug, flange, circulation, booster and engine preheater
Oils Asphalt Fuel oils Light grades 1 and 2 Medium grades 4 and 5 Heavy grade 6 and Bunker C Heat transfer Lubricating SAE 10, 20, 30 SAE 40, 50 API STD 614 Vegetable (cooking)	Direct immersion (circulating/non-circulating)	FIREBAR, WATROD, screw plug, square flange, flange, circulation, booster and pipe insert
Paraffin or wax	Direct immersion (circulating/non-circulating)	FIREBAR, WATROD, screw plug, square flange, flange, over-the-side, drum and pipe insert

CONTINUED



## Tubular Elements and Assembly Selection Guide

### Element and Assembly Selection Guide (Continued)

Application	Heating Method	Heater Type
Water Clean Deionized Demineralized Potable Process	Direct immersion (circulating/non-circulating)	FIREBAR (non-process water only) WATROD, screw plug, screw plug with control assembly, square flange, flange, circulation, booster, engine preheater and pipe insert
<b>Air:</b>	Direct (forced or natural convection)	FIREBAR, WATROD, FINBAR, WATROD enclosure heater, screw plug, flange, circulation and duct
<b>Gas:</b> Hydrocarbons, Nitrogen, Oxygen Ozone, Steam	Direct (forced convection)	FIREBAR, WATROD, screw plug, flange and circulation
<b>Molten Materials:</b> Aluminum Lead Salt Solder	Indirect (radiant) Direct (non-circulating) Direct (non-circulating) Direct (non-circulating)	WATROD FIREBAR and WATROD FIREBAR and WATROD FIREBAR and WATROD
<b>Surface Heating:</b> Dies, griddles, molds, platens	Direct	FIREBAR and WATROD

### Supplemental Applications Chart

This *Supplemental Applications Chart* is provided in addition to the *Element and Assembly Selection Guide*. This chart will help you select watt density and sheath materials for either WATROD or FIREBAR heating elements according to the specific media being heated.

For example, if you are heating vegetable oil, either WATROD or FIREBAR elements at 30 and 40 W/in<sup>2</sup> respectively (4.6 and 6.2 W/cm<sup>2</sup>) with 304 stainless steel, sheath can be used.

### Supplemental Applications Chart

Heated Material	Max. Operating Temperature °F (°C)		WATROD Element		FIREBAR Element			
			Max. Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )	Sheath Material	Max. Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )	Sheath Material		
<b>Acid Solutions (Mild)</b>								
Acetic	180	(82)	40	(6.2)	316 SS	40	(6.2)	Alloy 800
Boric (30% max.)	257	(125)	40	(6.2)	Titanium	40	(6.2)	304 SS
Carbonic	180	(82)	40	(6.2)	Alloy 600	40	(6.2)	304 SS
Chromic	180	(82)	40	(6.2)	Titanium	N/A	N/A	N/A
Citric	180	(82)	23	(3.6)	Alloy 800	30	(4.6)	Alloy 800
Fatty Acids	150	(65)	20	(3.1)	316 SS	30	(4.6)	Alloy 800
Lactic	122	(50)	10	(1.6)	316 SS	N/A	N/A	N/A
Levulinic	180	(82)	40	(6.2)	Alloy 600	40	(6.2)	304 SS
Malic	122	(50)	10	(1.6)	316 SS	16	(2.5)	Alloy 800
Nitric (30% max.)	167	(75)	20	(3.1)	316 SS	30	(4.6)	Alloy 800
Phenol—2-4								
Disulfonic	180	(82)	40	(6.2)	316 SS	40	(6.2)	Alloy 800
Phosphoric	180	(82)	23	(3.6)	Alloy 800	30	(4.6)	Alloy 800
Phosphoric (Aerated)	180	(82)	23	(3.6)	304 SS	30	(4.6)	304 SS

CONTINUED

# Reference Data



## Tubular Elements and Assembly Selection Guide

### Supplemental Applications Chart (Continued)

Heated Material	Max. Operating Temperature °F (°C)		WATROD Element		FIREBAR Element			
			Max. Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )		Sheath Material	Max. Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )		Sheath Material
Proponic (10% max.)	180	(82)	40	(6.2)	Alloy 800	40	(6.2)	304 SS
Tannic	167/180	(75/82)	23/40	(3.6/6.2)	Steel/304 SS	40	(6.2)	304 SS
Tartaric	180	(82)	40	(6.2)	316 SS	40	(6.2)	Alloy 800
Acetaldehyde	180	(82)	10	(1.6)	Alloy 800	16	(2.4)	Alloy 800
Acetone	130	(54)	10	(1.6)	304 SS	16	(2.4)	304 SS
Air			①	①	Alloy 800	①	①	Alloy 800
Alcyl alcohol	200	(93)	10	(1.6)	Alloy 800	16	(2.4)	Alloy 800
Alkaline solutions	212	(100)	40	(6.2)	Steel	48	(7.4)	304 SS
Aluminum acetate	122	(50)	10	(1.6)	316 SS	16	(2.5)	Alloy 800
Aluminum potassium sulfate	212	(100)	40	(6.2)	Alloy 800	N/A	N/A	N/A
Ammonia gas	①	①	①	①	Steel	①	①	304 SS
Ammonium acetate	167	(75)	23	(3.6)	Alloy 800	30	(4.6)	Alloy 800
Amyl acetate	240	(115)	23	(3.6)	Alloy 800	30	(4.6)	Alloy 800
Amyl alcohol	212	(100)	20	(3.1)	304 SS	30	(4.6)	304 SS
Aniline	350	(176)	23	(3.6)	304 SS	30	(4.6)	304 SS
Asphalt	200-500	(93-260)	4-10	(0.6 - 1.6)	Steel	6-12	(0.9 - 1.8)	304 SS
Barium hydroxide	212	(100)	40	(6.2)	316 SS	40	(6.2)	Alloy 800
Benzene, liquid	150	(65)	10	(1.6)	Alloy 800	16	(2.5)	304 SS
Butyl acetate	225	(107)	10	(1.6)	316 SS	16	(2.5)	Alloy 800
Calcium bisulfate	400	(204)	20	(3.1)	316 SS	N/A	N/A	N/A
Calcium chloride	200	(93)	5-8	(0.8 - 1.2)	Alloy 600	N/A	N/A	N/A
Carbon monoxide	—	—	①	①	Alloy 800	①	①	Alloy 800
Carbon tetrachloride	160	(71)	23	(3.6)	Alloy 800	30	(4.6)	Alloy 800
Caustic soda:								
2%	210	(98)	48	(7.4)	Alloy 800	—	—	Contact Watlow
10% concentrate	210	(98)	23	(3.6)	Alloy 800	—	—	Contact Watlow
75%	180	(82)	23	(3.6)	Alloy 800	—	—	Contact Watlow
Citric juices	185	(85)	23	(3.6)	Alloy 800	30	(4.6)	Alloy 800
Degreasing solution	275	(135)	23	(3.6)	Steel	30	(4.6)	304 SS
Dextrose	212	(100)	20	(3.1)	304 SS	30	(4.6)	304 SS
Dyes and pigments	212	(100)	23	(3.6)	304 SS	30	(4.6)	304 SS

#### Electroplating Baths:

Cadmium	180	(82)	40	(6.2)	304 SS	40	(6.2)	304 SS
Alloy 800	180	(82)	40	(6.2)	316 SS	N/A	N/A	N/A
Dilute cyanide	180	(82)	40	(6.2)	316 SS	N/A	N/A	N/A
Rochelle cyanide	180	(82)	40	(6.2)	316 SS	N/A	N/A	N/A
Sodium cyanide	180	(82)	40	(6.2)	316 SS	N/A	N/A	N/A
Potassium cyanide	180	(82)	40	(6.2)	316 SS	40	(6.2)	304 SS
Ethylene glycol	300	(148)	30	(4.6)	Steel	40	(6.2)	304 SS
Formaldehyde	180	(82)	10	(1.6)	304 SS	16	(2.5)	304 SS
Freon® gas	300	(148)	2-5	(0.3 - 0.8)	Steel			304 SS
Gasoline	300	(148)	23	(3.6)	Steel	30	(4.6)	304 SS

CONTINUED

① Contact your Watlow representative.



## Tubular Elements and Assembly Selection Guide

### Supplemental Applications Chart (Continued)

Heated Material	Max. Operating Temperature °F (°C)		WATROD Element			FIREBAR Element		
			Max. Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )		Sheath Material	Max. Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )		Sheath Material
Gelatin liquid	150	(65)	23	(3.6)		304 SS	30	
Gelatin solid	150	(65)	5	(0.8)	304 SS	7	(1.0)	304 SS
Glycerin	500	(260)	10	(1.6)	Alloy 800	12	(1.9)	304 SS
Glycerol	212	(100)	23	(3.6)	Alloy 800	30	(4.6)	304 SS
Grease:								
Liquid	—	—	23	(3.6)	Steel	30	(4.6)	304 SS
Solid	—	—	5	(0.8)	Steel	7	(1.0)	304 SS
Hydrazine	212	(100)	16	(2.5)	304 SS	20	(3.1)	304 SS
Hydrogen	①	①	—	—	Alloy 800	①	①	Alloy 800
Hydrogen chloride	①	①	—	—	Alloy 600	①	①	N/A
Hydrogen sulfide	①	①	—	—	316 SS (heavy wall)	①	①	N/A
Magnesium chloride	212	(100)	40	(6.2)	Alloy 600	40	(6.2)	Alloy 800
Magnesium sulfate	212	(100)	40	(6.2)	304 SS	40	(6.2)	304 SS
Magnesium sulfate	212	(100)	40	(6.2)	316 SS	40	(6.2)	304 SS
Methanol gas	①	①	—	—	304 SS	①	①	304 SS
Methylamine	180	(82)	20	(3.1)	Alloy 600	30	(4.6)	304 SS
Methylchloride	180	(82)	20	(3.1)	Alloy 800	N/A	N/A	N/A
Molasses	100	(37)	4-5	(0.6 - 0.8)	304 SS	5-8	(0.8 - 1.2)	304 SS
Molten salt bath	800-900	(426-482)	25-30	(3.8 - 4.6)	Alloy 400	N/A	N/A	N/A
Naphtha	212	(100)	10	(1.6)	Steel	16	(2.5)	304 SS

### Oils

Fuel oils:								
Grades 1 and 2 (distillate)	200	(93)	23	(3.6)	Steel	30	(4.6)	304 SS
Grades 4 and 5 (residual)	200	(93)	13	(2.0)	Steel	16	(2.5)	304 SS
Grades 6 and Bunker C (residual)	160	(71)	8	(1.2)	Steel	10	(1.6)	304 SS
Heat transfer oils: ②								
Static	500	(260)	16	(2.5)	Steel	23	(3.6)	304 SS
	600	(315)	10	(1.6)	Steel	16	(2.5)	304 SS
Circulating	500	(260)	23	(3.6)	Steel	30	(4.6)	304 SS
	600	(315)	15	(2.3)	Steel	20	(3.1)	304 SS
Lubrication oils:								
SAE 10, 90-100 SSU @ 130°F	250	(121)	23	(3.6)	Steel	30	(4.6)	304 SS
SAE 20, 120-185 SSU @ 130°F	250	(121)	23	(3.6)	Steel	30	(4.6)	304 SS
SAE 30, 185-255 SSU @ 130°F	250	(121)	23	(3.6)	Steel	30	(4.6)	304 SS
SAE 40, -80 SSU @ 210°F	250	(121)	13	(2.0)	Steel	18	(2.7)	304 SS
SAE 50, 80-105 SSU @ 210°F	250	(121)	13	(2.0)	Steel	18	(2.7)	304 SS

CONTINUED

① Contact your Watlow representative.

② Maximum operating temperatures and watt densities are detailed in *Heat Transfer Oil* charts on page 555.



# Reference Data



## Tubular Elements and Assembly Selection Guide

### Supplemental Applications Chart (Continued)

Heated Material	Max. Operating Temperature °F (°C)		WATROD Element		FIREBAR Element			
			Max. Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )	Sheath Material	Max. Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )	Sheath Material		
Miscellaneous oils:								
Draw bath	600	(315)	23	(3.6)	Steel	30	(4.6)	304 SS
Hydraulic	—	—	15	③ (2.3)	Steel	15	③ (2.3)	304 SS
Linseed	150	(65)	50	(7.7)	Steel	60	(9.3)	304 SS
Mineral	200	(93)	23	(3.6)	Steel	30	(4.6)	304 SS
	400	(204)	16	(2.5)	Steel	23	(3.6)	304 SS
Vegetable/shortening	400	(204)	30	(4.6)	304 SS	40	(6.2)	304 SS
Paraffin or wax (liquid)	150	(65)	16	(2.4)	Steel	20	(3.1)	304 SS
Perchloroethylene	200	(93)	23	(3.6)	Steel	30	(4.6)	304 SS
Potassium chlorate	212	(100)	40	(6.2)	316 SS	N/A	N/A	N/A
Potassium chloride	212	(100)	40	(6.2)	316 SS	N/A	N/A	N/A
Potassium hydroxide	160	(71)	23	(3.6)	Alloy 400	N/A	N/A	N/A
Soap, liquid	212	(100)	20	(3.1)	304 SS	30	(4.6)	304 SS
Sodium acetate	212	(100)	40	(6.2)	Steel	50	(7.7)	304 SS
Sodium cyanide	140	(60)	40	(6.2)	Alloy 800	50	(7.7)	Alloy 800
Sodium hydride	720	(382)	28	(4.3)	Alloy 800	36	(5.5)	Alloy 800
Sodium hydroxide	—	—	—	—	See Caustic Soda	—	—	—
Sodium phosphate	212	(100)	40	(6.2)	Alloy 800	50	(7.7)	304 SS
Steam, flowing	300	(148)	10	(1.6)	Alloy 800	①	①	Alloy 800
	500	(260)	5-10	(0.8-1.6)	Alloy 800	①	①	Alloy 800
	700	(371)	5	(0.8)	Alloy 800	①	①	Alloy 800
Sulfur, molten	600	(315)	10	(1.6)	Alloy 800	12	(1.8)	Alloy 800
Toluene	212	(100)	23	(3.6)	Steel	30	(4.6)	304 SS
Trichlorethylene	150	(65)	23	(3.6)	Steel	30	(4.6)	304 SS
Turpentine	300	(148)	20	(3.1)	304 SS	25	(3.8)	304 SS

#### Water

Clean	212	(100)	60	(9.3)	Alloy 800	45	(7)	Alloy 800
Deionized	212	(100)	60	(9.3)	316 SS (passivated)	90	(14)	Alloy 800
Demineralized	212	(100)	60	(9.3)	316 SS (passivated)	90	(14)	Alloy 800
Potable	212	(100)	60	(9.3)	Alloy 800	45	(7)	Alloy 800
Process	212	(100)	48	(9.3)	Alloy 800			Contact Watlow

① Contact your Watlow representative.

③ Per API standards.



## Tubular Elements and Assembly Selection Guide

### Free Cross Sectional Area of WATROD and FIREBAR Circulation Heaters

Free cross sectional areas from the chart are in square feet. Calculations are based on:

- Flange 12 inches and under, pipes are schedule 40
- Flanges 14 inches and above, pipes are standard wall thickness 0.375 in. (9.5 mm)
- All WATROD heating elements are 0.475 in. (12 mm) diameter

Circulation Heater Size in.	Free Cross Sectional Area in Square Feet (Number of Elements in Parenthesis)		
<b>WATROD</b>			
2½ NPT	0.044 (3)		
3 Flange	0.044 (3)	0.037 (6)	
4 Flange	0.074 (6)		
5 Flange	0.124 (6)	0.117 (9)	
6 Flange	0.172 (12)	0.164 (15)	
8 Flange	0.303 (18)	0.296 (21)	0.288 (24)
10 Flange	0.481 (27)	0.460 (36)	
12 Flange	0.697 (36)	0.652 (54)	
14 Flange	0.848 (45)	0.781 (72)	
16 Flange	1.091 (72)	1.054 (87)	1.017 (102)
18 Flange	1.372 (102)	1.357 (108)	1.342 (114)
20 Flange	1.748 (108)	1.733 (114)	1.704 (126)
<b>FIREBAR</b>			
2½ NPT	0.0417 (3)		

# Reference Data



## Tubular Elements and Assembly Selection Guide

### Heat Transfer Oil Chart

Heat Transfer Fluid	Recommended		Flammability Data °F (°C)				Min. Velocity Thru Heater in Feet/second at W/in <sup>2</sup> (M/second at W/cm <sup>2</sup> )							
	Max. Temperature °F (°C)		Flash Point		Fire Point		8 (1.2)		16 (2.8)		23 (3.6)		30 (4.7)	
	Process F (°C)	Sheath °F (°C)	°F (°C)	°F (°C)	°F (°C)	°F (°C)	W/in <sup>2</sup> (W/cm <sup>2</sup> )	W/in <sup>2</sup> (W/cm <sup>2</sup> )	W/in <sup>2</sup> (W/cm <sup>2</sup> )	W/in <sup>2</sup> (W/cm <sup>2</sup> )	W/in <sup>2</sup> (W/cm <sup>2</sup> )	W/in <sup>2</sup> (W/cm <sup>2</sup> )		
Calflo HTF	600 (316)	650 (343)	414 (212)	462 (239)	670 (354)	1.5 (0.5)	3.0 (0.9)	5.0 (1.52)	7.0 (2.1)					
Calflo AF	550 (288)	600 (316)	400 (204)	437 (225)	650 (343)	1.5 (0.5)	3.0 (0.9)	5.0 (1.52)	7.0 (2.1)					
Dowtherm® A	750 (399)	835 (446)	255 (124)	275 (135)	1150 (621)	0.5 (0.15)	1.0 (0.3)	2.0 (0.61)	3.0 (0.9)					
Dowtherm® G	700 (371)	775 (413)	305 (152)	315 (157)	1150 (621)	0.7 (0.2)	1.5 (0.5)	2.5 (0.75)	3.5 (1.1)					
Dowtherm® J	575 (302)	650 (343)	145 (63)	155 (68)	806 (430)	1.0 (0.3)	2.0 (0.61)	3.0 (0.9)	4.5 (1.37)					
Dowtherm® LF	600 (316)	675 (357)	260 (127)	280 (138)	1020 (549)	0.7 (0.2)	1.5 (0.5)	2.5 (1.75)	3.5 (1.1)					
Dowtherm® HT	650 (343)	700 (371)	no data no data	no data no data	no data no data	1.5 (0.5)	2.5 (0.75)	3.5 (1.1)	5.0 (1.52)					
Dowtherm® Q	625 (329)	700 (371)	no data no data	no data no data	773 (412)	0.7 (0.2)	1.5 (0.5)	2.5 (0.75)	3.5 (1.1)					
Marlotherm S	662 (350)	698 (370)	374 (190)	no data no data	932 (500)	1.5 (0.5)	3.0 (0.9)	5.0 (1.52)	7.0 (2.1)					
Mobiltherm 603	590 (310)	625 (329)	380 (193)	no data no data	no data no data	1.5 (0.5)	3.0 (0.9)	5.0 (1.52)	7.0 (2.1)					
Multitherm IG-2	600 (316)	650 (343)	440 (227)	500 (260)	700 (371)	0.8 (0.24)	1.7 (0.52)	2.3 (0.7)	3.0 (0.9)					
Multitherm PG-1	600 (316)	640 (338)	340 (171)	385 (196)	690 (368)	1.0 (0.3)	2.0 (0.61)	3.0 (0.9)	4.0 (1.22)					
Para Cymene	600 (316)	650 (343)	117 (47)	152 (72)	817 (438)	0.7 (0.2)	1.5 (0.5)	2.5 (0.75)	3.5 (1.1)					
Syltherm 800	750 (399)	800 (427)	350 (177)	380 (193)	725 (385)	1.5 (0.5)	3.0 (0.9)	5.0 (1.52)	7.0 (2.1)					
Syltherm XLT	500 (260)	550 (288)	116 (47)	130 (54)	662 (350)	1.5 (0.5)	2.5 (0.75)	4.0 (1.22)	5.0 (1.52)					
Texatherm	600 (316)	640 (338)	430 (221)	no data no data	no data no data	2.0 (0.61)	4.0 (1.22)	6.0 (1.83)	8.0 (2.4)					
Thermia 33	600 (316)	650 (343)	455 (235)	495 (257)	no data no data	1.5 (0.5)	3.0 (0.9)	5.0 (1.52)	7.0 (2.1)					
Therminol 44	400 (204)	475 (246)	405 (207)	438 (228)	705 (374)	1.0 (0.3)	2.0 (0.61)	3.0 (0.9)	4.0 (1.22)					
Therminol 55	550 (288)	605 (318)	350 (177)	410 (210)	675 (357)	1.5 (0.5)	2.5 (0.75)	3.5 (1.1)	5.0 (1.52)					
Therminol 59	600 (316)	650 (343)	302 (150)	335 (168)	770 (410)	1.5 (0.5)	2.5 (0.75)	3.5 (1.1)	5.0 (1.52)					
Therminol 60	620 (327)	655 (346)	310 (154)	320 (160)	835 (448)	1.5 (0.5)	3.0 (0.9)	5.0 (1.52)	7.0 (2.1)					
Therminol 68	650 (343)	705 (374)	350 (177)	380 (183)	705 (374)	1.5 (0.5)	2.5 (0.75)	3.0 (0.9)	4.5 (1.37)					
Therminol 75	750 (399)	805 (429)	390 (199)	440 (227)	1000 (538)	1.0 (0.3)	2.0 (0.61)	3.0 (0.9)	4.0 (1.22)					
Therminol LT	600 (316)	650 (343)	134 (57)	150 (66)	805 (429)	1.5 (0.5)	2.5 (0.75)	4.0 (1.22)	5.0 (1.52)					
Therminol VP-1	750 (399)	800 (427)	255 (124)	280 (127)	1150 (621)	1.0 (0.3)	2.0 (0.61)	3.0 (0.9)	4.0 (1.22)					
U-Con 500	500 (260)	550 (288)	540 (282)	600 (316)	750 (399)	1.0 (0.3)	2.0 (0.61)	3.0 (0.9)	4.0 (1.22)					



# Agency Certifications, Recognition and Approvals



## Agency Certifications, Recognition and Approvals

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# Agency Certifications, Recognition and Approvals



## WATROD™ and FIREBAR® Element and Assemblies

### Agency Recognition

UL® and CSA recognition information charts are provided to ensure:

- Safety parameters in relationship to stated voltage and amperage
- Approved sheath materials, end seals and assembly electrical enclosures

Watlow® believes that UL® and CSA recognition information is necessary to confirm the reliability of our heating products in relationship to your application. As such, the accompanying *Agency Recognition* charts illustrate the extent of coverage each heater type provides. Specific end use application information is required for each agency marking. Some products carry U.S. and Canada approvals.



### UL® Recognition and Listing

#### File Number E52951 (UL® 499) – Component Recognition

All information for UL® File #E52951 can be found in the UL® Directory, Volume 2 under “Heaters Miscellaneous” (Classification KSOT2).

#### Elements (Volume 2, Section 1)

WATROD Diameter		Allowable Part Numbers	Max. Volts	Max. Watt Density		Min. Bend Radius	Allowable Sheath Materials	End Seal Types
in.	(mm)			W/in <sup>2</sup>	W/cm <sup>2</sup>			
0.210	(6.0)	<b>RK</b> series	<b>U0-xx</b>	250	①	①	Nickel alloy 400, 600, 800, 840, 800H, 304, 316 SS, Steel, Titanium, Copper coated steel, Hastelloy C22, C276	Epoxy resin, Lavacone, Silicone resin, Silicone rubber, Silicone fluid, Ceramic potting
0.260	(6.6)	<b>RA</b> series	<b>U1-xx</b>	250				
0.315	(8.0)	<b>RB</b> series	<b>U3-xx</b>	480				
0.375	(9.5)	<b>RD, RS</b> series	<b>U5-xx</b>	480				
0.430	(10.9)	<b>RC</b> series	<b>U6-xx</b>	600				
0.475	(12.0)	<b>RG</b> series	<b>U7-xx</b>	600				

① Dependent on application, contact your Watlow representative.

**Note:** All end seal types apply to all diameter heaters.

#### Elements (Volume 2, Section 6)

MULTICOIL Diameter		Allowable Part Numbers	Max. Volts	Max. Watt Density		Min. Bend Radius	Allowable Sheath Materials	End Seal Types
in.	(mm)			W/in <sup>2</sup>	W/cm <sup>2</sup>			
0.375	(9.5)	<b>U5M</b> series	①	①	①	Nickel alloy 800, 840, 304, 316 SS, Steel, Titanium	Epoxy resin, Silicone resin, Silicone rubber, Lavacone, Ceramic potting, Silicone fluid	
0.430	(10.9)	<b>U6M</b> series						
0.475	(12.0)	<b>U7M</b> series						

① Dependent on application, contact your Watlow representative.

**Notes:** All end seal types apply to all diameter heaters.

UL® and CSA must be requested at the time order is placed.



## WATROD and FIREBAR Element and Assemblies

### UL® Recognition and Listing (Continued)

#### Elements (Volume 2, Section 4)

FIREBAR Height in. (mm)	Allowable Part Numbers	Max. Volts	Max. Watt Density W/in <sup>2</sup> W/cm <sup>2</sup>	Min. Bend Radius		Allowable Sheath Materials	End Seal Types
				Major Axis in. (mm)	Minor Axis in. (mm)		
<b>Air or Immersion Heating</b>							
5/8 (16)	<b>FA, FS series Axxx</b>	480	①	1 (25)	①	Nickel alloy 800, 840, 304 SS	Epoxy resin, Lavacone, Silicone resin, Silicone rubber, Silicone fluid, Ceramic potting
1 (25)	<b>FS series</b>	480		1 (25)			
<b>Liquid Immersion Heating Only</b>							
5/8 (16)	<b>FA, FS series Uxxx</b>	480	①	1 (25)	①	Nickel alloy 800, 840, 304 SS	Epoxy resin, Lavacone, Silicone resin, Silicone rubber, Silicone fluid, Ceramic potting
1 (25)	<b>FS series</b>	480		1 (25)			

① Dependent on application, contact your Watlow representative.

**Notes:** All sheath materials and end seal types apply to all diameter heaters. UL® and CSA must be requested at the time order is placed.

### Assemblies

Refer to applicable WATROD and FIREBAR elements for maximum voltage, watt density and sheath materials.

Heater Type	Allowable Part Numbers	Electrical Enclosure Options
Screw Plug	All catalog models <b>B</b> Series <b>U1</b> to <b>U7</b>	General purpose or moisture resistant with or without thermostat
Flange	All catalog models <b>FE, FG, FH, FK, FL, FM, FN, FO, FP, FR, FS, FT, FW</b> —Series <b>U1</b> to <b>U9</b>	General purpose or moisture resistant with or without thermostat
Circulation	All catalog models <b>CB, CF, CP</b> Series <b>U1</b> to <b>U7</b>	General purpose or moisture resistant with or without thermostat
Over-the-Side	All catalog models <b>OL</b> and <b>OR</b> Series <b>U1</b> to <b>U7</b> , except <b>U2</b> and <b>U4</b>	Moisture resistant with or without thermostat
Duct	All catalog models <b>D6</b> to <b>D125</b> , <b>MDH6</b> to <b>MDH60</b> , <b>LDH9</b> to <b>LDH225</b> Series <b>U0</b> to <b>U7</b>	General purpose enclosure only

**Note:** If CE Marking to the 2014/35/EU European Low Voltage Directive (LVD) is required please contact your Watlow representative.



# Agency Certifications, Recognition and Approvals



## WATROD and FIREBAR Element and Assemblies

### CSA Certification

File Number LR 31388

All information for CSA file LR 31388 can be found in the *CSA List of Certified Electrical Equipment* catalog, Volume II, under Heaters—Miscellaneous.

### Elements

Heater Type— Diameter/Height in. (mm)	Allowable Part Numbers	Max. Volts	Max. Watt Density W/in <sup>2</sup> (W/cm <sup>2</sup> )		Allowable Sheath Materials <sup>④</sup>	End Seal Type (All Diameters)
<b>WATROD:</b>						
0.260 (6.6)	<b>All catalog models, 1-xx</b>	250	120	(18.5)	Nickel alloy 400, 600, 800, 840, 304, 316 SS, Steel, Copper coated steel	Epoxy resin, Lavacone, Silicone resin, Silicone rubber, Ceramic, Silicone fluid
0.315 (8.0)	<b>All catalog models, 3-xx</b>	480	120	(18.5)		
0.375 (9.5)	<b>All catalog models, 5-xx</b>	600	120	(18.5)		
0.430 (10.9)	<b>All catalog models, 6-xx</b>	600	120	(18.5)		
0.475 (12.0)	<b>All catalog models, 7-xx</b>	600	120	(18.5)		
<b>FIREBAR:</b>						
<sup>5</sup> / <sub>8</sub> (15.9)	<b>FA, FS models, 4-xx</b>	480	120	(18.5)	Nickel alloy 800, 840 304 SS	Epoxy resin, Lavacone, Silicone resin, Silicone rubber Ceramic, Silicone fluid
1 (25.0)	<b>FB, FS models, 2-xx</b>	480	120	(18.5)		
<b>MULTICELL: Contact Watlow</b>						

<sup>④</sup> Some sheath materials not available on all diameters. Contact your Watlow representative.

**Note:** Heating elements are certified only for use in equipment where the acceptability of the construction combination is determined by the Canadian Standards Association.

**Note:** All sheath materials and end seal types apply to all diameter heaters.

### Assemblies

Heater Type	Allowable Part Numbers	Electrical Enclosure Options
Screw Plug	Catalog series “ <b>B</b> ” Series <b>1-xx</b> to <b>7-xx</b>	General purpose with or without thermostat Enclosure 4 with or without thermostat
Flange	Catalog series “ <b>F</b> ” Series <b>1-xx</b> to <b>7-xx</b>	General purpose with or without thermostat Enclosure 4 with or without thermostat <sup>⑤</sup>
Circulation	Catalog series “ <b>C</b> ” Series <b>1-10</b> to <b>7-10</b>	General purpose with or without thermostat Enclosure 4 with or without thermostat <sup>⑤</sup>
Over-the-Side	Catalog series “ <b>OL</b> ” and “ <b>OR</b> ” Series <b>1-30</b> to <b>7-30</b>	Enclosure 4 with or without thermostat
Duct	Catalog series “ <b>D</b> ”, “ <b>LDH</b> ” and “ <b>MDH</b> ” Series <b>1-1</b> to <b>7-1</b>	General purpose enclosure only

<sup>⑤</sup> 4, 5, 6 and 8 inch flange size only.

### File Number LR 61707—Heater Assemblies—Miscellaneous—For Hazardous Locations

Heater Type	Allowable Part Numbers	Electrical Enclosure Options
Screw Plug	Catalog series “ <b>B</b> ” Series <b>1-xx</b> to <b>7-xx</b>	Class 1, Div. 1 and 2, Groups B, C and D and enclosure 4 with or without thermostat
Flange	Catalog series “ <b>F</b> ” Series <b>1-xx</b> to <b>7-xx</b> , <b>700</b> , <b>701</b> , <b>702</b> , <b>703</b> , <b>704</b> , <b>713</b> , <b>714</b>	Class 1, Div. 1 and 2, Groups B, C and D and enclosure 4 with or without thermostat
Circulation	Catalog series “ <b>C</b> ” Series <b>1-10</b> to <b>7-10</b>	Class 1, Div. 1 and 2, Groups B, C and D and enclosure 4 with or without thermostat

**Note:** UL<sup>®</sup> and CSA must be requested at the time the order is placed.



## WATROD Element Assemblies

Watlow can provide flange heaters with European ATEX or International IECEx certifications for Flameproof (Ex 'd') and increased safety (Ex 'e') protection methods. Contact your Watlow representative for details.

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### **SERIES F Flange Heaters:**

IECEx Certification IECEx CSA 09.0010X

ATEX Certification SIRA10ATEX1155X

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### **SERIES FE Flange Heaters:**

IECEx Certification IECEx SIR 12.0056X

ATEX Certification SIRA12ATEX3082X



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## Part Number Index

### How To Use This Index

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**Note:** This lookup table is provided to help identify the product type of a legacy part. Starting in 2018 and going forward, new product designs will be transitioned to a common sequential, numerical part numbering system. Part numbers will follow a format of #####-####. Legacy part numbers can continue to be used for ordering purposes.

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# Terms and Conditions of Sale



## Quantity and Weights:

Products purchased and sold hereunder shall be those for which buyer submits an order which is accepted by Watlow®. Watlow's quantities shall govern unless proved to be in error. On orders for products carried in stock, Watlow will deliver the ordered quantity specified. However, in the manufacture of products it is agreed that Watlow will be allowed production losses. Watlow shall have the right to manufacture, deliver and invoice for partial deliveries of products as stated below:

Quantity Ordered	Delivery Variation
1-4	No variation
5-24	± 1 unit
25-74	± 2 units
75-99	± 3 units
100+	± 3 percent

SERV-RITE® Insulated

Wire and Cable ± 10 percent

XACTPAK® Sheathed Wire ± 10 percent

**Note: Watlow will deliver exact quantities on products with a net price of \$100.00 or more. If buyer expressly requests no variation in delivered quantity of products with a total net price under \$100.00, a ten percent (10%) surcharge will be added to the net billing on the invoice for such order.**

## Delivery:

FCA (Incoterms® 2010) - Watlow's Pickup Plant. Risk of loss and title transfer pass to buyer on delivery at the FCA point. Watlow shall prepay freight, assure the shipment and select the means of transportation unless buyer provides specific written instructions otherwise with buyer's order. Watlow shall not be bound to tender delivery of any quantities for which buyer has not given shipping instructions. Watlow shall be entitled to designate from time to time the locations from which buyer may receive or pick up products.

## Payment Terms:

Terms are net 30 days from date of invoice with approved credit. Prices and discounts are subject to change without notice. All quotations are valid for 30 days unless otherwise stated.

## Restocking Charges:

Stock heaters, controllers, sensors and accessories which have not been used or modified may be returned to the relevant Watlow plant for a twenty percent (20%) restocking charge. For Watlow's Hannibal plant products only, modified-stock products may be returned if not permanently modified, for a minimum thirty percent (30%) restocking charge. All stock and modified-stock products require Watlow's prior authorization to be returned and must be returned within one hundred twenty (120) days from the date of delivery. Controllers may not be returned if the packaging seal is broken. Non-stock (custom) heaters, controls, sensors and accessories are not returnable.

## Price Revision:

Prices are subject to change without advance notice. If Watlow desires to revise the discounts, prices, points of delivery, service allowances or terms of payment but is restricted to any extent against so doing by reason of any governmental request, law, regulation, order or action, or if the discounts, prices, points of delivery, service allowances or terms of payment then in effect are altered by reason of governmental request, law, regulation, order or action, Watlow shall have the right (i) to terminate this order by notice to buyer, (ii) to suspend deliveries

for the duration of such restriction or alteration or (iii) to have applied to this order (as of the effective date of such restriction or alteration) any discounts, prices, points of delivery, service allowances or terms of payment governmentally acceptable. Any delivery suspended under this section may be canceled without liability.

## Return Policy:

Prior approval must be obtained from the relevant Watlow plant to return any product. Watlow will assign a return authorization number and record the reason for the return. Watlow will examine returned product to determine the actual cause, if any, leading to buyer's return. If product has a manufacturing defect, Watlow, in its sole discretion, may issue a credit for the returned product or repair or replace with like product. If returned product is not subject to Watlow's warranty, buyer will be notified of the estimated cost of repair, if possible. Thereafter, buyer must advise Watlow whether or not buyer chooses to have product repaired at buyer's expense.

## Order Changes:

Buyer must notify Watlow in writing of requested changes in the quantity, drawings, designs or specifications for products which are ordered but not yet in the process of manufacture. After receipt of such notice, Watlow will inform buyer of any adjustments to be made in price, delivery schedules, etc. resulting from buyer's requested changes prior to incorporating requested changes into manufactured products. Controller products require written notice of requested changes not less than sixty (60) days prior to last scheduled shipping date.

## Freight and Taxes:

Prices do not include prepaid freight, federal, state or local taxes. Any increase in freight rates paid by Watlow on deliveries covered by this order and hereafter becoming effective and any tax or governmental charge or increase in same (excluding any franchise or income tax or other tax or charge based on income) (i) increasing the cost to Watlow of producing, selling or delivering products or of procuring products used therein or, (ii) payable by Watlow because of the production, sale or delivery of products, such as Sales Tax, Use Tax, Retailer's Occupational Tax, Gross Receipts Tax, Value Added Tax (VAT), and Ways Fees may, at Watlow's option, be added to the prices herein specified and be added to invoices.

## Engineering Charge:

On complex products, systems or controller software modifications, an engineering charge shall be applied or included in the price of prototypes. This charge is not subject to discounts.

## Tooling:

All tooling and fixtures are the property of Watlow. Watlow will accept buyer's special tooling if sent freight prepaid. Watlow will maintain this tooling, exercising reasonable care, in order to produce buyer's products. Permanent molds for aluminum cast-in and polymer products shall be the property and responsibility of buyer.

## Cancellation Charges:

There will be no cancellation charge for non-modified stock products. Non-stock and modified-stock products may be subject to a cancellation charge to be determined by Watlow depending upon the portion of product completed at the time of such cancellation.



# Terms and Conditions of Sale



## **Excuse of Performance:**

(A) Deliveries may be suspended by either party in the event of: Act of God, war, riot, fire, explosion, accident, flood, sabotage; lack of adequate fuel, power, raw materials, labor, containers or transportation facilities; compliance with governmental requirements (as hereinafter defined); breakage or failure of machinery or apparatus; national defense requirements or any other event, whether or not of the class or kind enumerated herein, beyond the reasonable control of such party; or in the event of labor trouble, strike, lockout or injunction (provided that neither party shall be required to settle a labor dispute against its own best judgment); which event makes impracticable the manufacture, transportation, sale, purchase, acceptance, use or resale of products or a material upon which the manufacture of products is dependent. (B) If Watlow determines that its ability to supply the total demand for products, or obtain any or a sufficient quantity of any material used directly or indirectly in the manufacture of products, is hindered, limited or made impracticable, Watlow may allocate its available supply of products or such material (without obligation to acquire other supplies of any such products or material) among itself and its purchasers on such basis as Watlow determines to be equitable without liability for any failure of performance which may result therefrom. (C) Deliveries suspended or not made by reason of this Section shall be canceled without liability, but this agreement and/or order shall otherwise remain unaffected.

## **Prototypes:**

If buyer orders and/or Watlow delivers a product designated as a "prototype", no guarantees, warranties or representations as to fitness for a particular purpose or merchantability are made with respect to such prototype. Buyer shall have the duty and sole responsibility to test a prototype prior to acceptance and/or incorporation into end-use applications. Further, a production product based on a prototype design may differ in assembly methods and materials from the prototype. Buyer, therefore, shall have the duty and sole responsibility for testing and acceptance of production products which are based on prototype designs.

## **Warranty and Limitation of Liability:**

Watlow warrants its products against defects in material and workmanship for at least one (1) year (three (3) years on some controls) from the date of delivery, provided such product is properly applied, used and maintained. Refer to the express written warranty time period for each individual product or contact the relevant Watlow plant for such warranty time period information. Watlow does not warrant any product against damage from corrosion, contamination, misapplication, improper specification or wear and tear and operational conditions beyond Watlow's control. The terms of this warranty are the exclusive terms available to buyer and to any other person or entity to whom products are transferred during the period of this warranty. No person has authority to bind Watlow to a representation or warranty other than this express warranty. Watlow shall not be liable for incidental or consequential damages resulting from the use of products whether a claim for such damages is based upon warranty, contract, negligence or other cause of action. Should any product fail while subject to this warranty, such product shall be repaired or a substitute product shall be provided, at Watlow's option, at no charge to buyer or to any other person or entity to whom product is transferred during the period of this warranty.

Watlow must be notified of the alleged failure of product within thirty (30) days of such event and advanced authorization for repair or replacement must be obtained in writing from Watlow. **THIS WARRANTY IS MADE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTY ARISING FROM A COURSE OF DEALING OR USAGE OF TRADE, AND ALL OTHER SUCH WARRANTIES ARE SPECIFICALLY EXCLUDED. THE CORRECTION OF ANY DEFECT IN OR FAILURE OF PRODUCTS BY REPAIR OR REPLACEMENT TO THE EXTENT SET FORTH ABOVE, SHALL BE WATLOW'S LIMIT OF LIABILITY AND THE EXCLUSIVE REMEDY FOR ANY AND ALL LOSSES, DELAYS OR DAMAGES RESULTING FROM THE PURCHASE OR USE OF THE PRODUCTS. IN NO EVENT SHALL WATLOW BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES. WATLOW SHALL NOT BE LIABLE FOR, AND BUYER AND ANY OTHER PERSON OR ENTITY TO WHOM PRODUCTS ARE TRANSFERRED DURING THE PERIOD OF THIS WARRANTY ASSUMES RESPONSIBILITY FOR, ALL PERSONAL INJURY AND PROPERTY DAMAGE RESULTING FROM OR RELATED TO THE HANDLING, POSSESSION OR USE OF PRODUCTS AND PRODUCTS MANUFACTURED AND SOLD BY WATLOW HEREUNDER.**

## **Miscellaneous:**

THE VALIDITY, INTERPRETATION AND PERFORMANCE OF THIS AGREEMENT AND/OR ORDER AND ANY DISPUTE CONNECTED HERewith SHALL BE GOVERNED AND CONSTRUED IN ACCORDANCE WITH THE LAWS OF THE STATE OF MISSOURI. These Terms and Conditions constitute the full understanding of the parties, a complete allocation of risks between them and a complete and exclusive statement of the terms and conditions of their agreement and/or order relating to the subject matter herein. Except as otherwise expressly provided herein, no conditions, usage of trade, course of dealing or performance, understanding or agreement and/or order purporting to modify, vary, explain or supplement the terms or conditions of this agreement and/or order shall be binding unless hereafter made in writing and signed by the party to be bound, and no modification shall be effected by the acknowledgment or acceptance of any purchase order or shipping instruction forms containing terms or conditions at variance with or in addition to those set forth herein. No waiver by either party with respect to any breach or default or of any right or remedy and no course of dealing or performance shall be deemed to constitute a continuing waiver of any other breach or default or of any other right or remedy, unless such waiver be expressed in writing signed by the party to be bound. If any term, condition or provision of this agreement and/or order or the application thereof is judicially or otherwise determined to be invalid or unenforceable, or if the parties mutually agree in writing to any revision of this agreement and/or order, the remainder of this agreement and/or order and the application thereof shall not be affected, and this agreement and/or order shall otherwise remain in full force and effect.

Rev. 11/07/11













