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Heater Selection Matrix

Heating Solids

Heater Type	Application Description	Sheath Materials	Typical Max. Watt Densities W/in²	W/cm²	Max. Operating Temperatures °F	°C	Catalog Page
Cartridge/ Insertion Heaters	These heaters are inserted into a close fit hole (i.e. platens, dies and molds).	Alloy 800 Stainless steel	up to 400 up to 400	62.0 62.0	1400 1000	760 540	9
Tubular Heaters	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 Stainless steel Round: Alloy 800 Stainless steel	40 40 40 40	6.2 6.2 6.2 6.2	1400 1200 1600 1200	760 650 870 650	84 84 57 57
Flexible Heaters	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 Silicone rubber	20 10	3.1 1.6	390 500	200 260	111 109
High-Temperature Heaters	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.	Alloy 600 Alloy 800	60 60	9.3 9.3	2100 2100	1150 1150	411
	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.	Molded ceramic fiber	30	4.6	2200	1205	419
	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.	High emissivity alloy 800	100	15.5	1600	1000	33
Specialty Heaters	ULTRAMIC® advanced ceramic heaters are bonded or clamped to the object being heated.	Aluminum nitride	1000	155	1112	600	449
	Thick film conduction heaters are clamped to the part being heated.	Dielectric glass on 430 stainless steel substrate	75	11.6	1022	550	453
	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.	Stainless steel or alloy 600	30	4.6	1200	650	457
Strip/ Clamp-On Heaters	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 Stainless steel with mineral insulation	100 140	15.5 21.7	1100 1400	595 760	471 467
Band/ Barrel Heaters	These heaters are clamped to cylindrical surfaces (i.e. extrusion barrels and nozzles).	Stainless steel with mineral insulation	100	15.5	1400	760	483
Radiant Heaters	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

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Heater Selection Matrix

Heating Liquids/Surface Heating and Immersion

Heater Type	Application Description	Sheath Materials	Typical Max. Watt Densities W/in²	W/cm²	Max. Operating Temperatures °F	°C	Catalog Page
Cartridge/ Insertion Heaters	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
Tubular Heaters	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 Stainless steel Round: Alloy 800 Stainless steel Steel	60 60 60 60 60 60	9.3 9.3 9.3 9.3 9.3 9.3	1400 1200 350 1600 1200 750	760 650 180 870 650 400	84 84 57 57 57 57
Flexible Heaters	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 Silicone rubber	20 10	3.1 1.6	390 500	200 260	111 109
Immersion Heaters	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	100 760	145
Circulation Heaters	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 Stainless steel Steel	60 60 60 60	9.3 9.3 9.3 9.3	1600 350 1200 750	870 180 650 400	305
	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
Fluid Delivery Heaters	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
High-Temperature Heaters	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
Specialty Heaters	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
Strip/ Clamp-On Heaters	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 Stainless steel with mineral insulation	100 140	15.5 21.7	1100 1400	595 760	471 467
Band/ Barrel Heaters	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

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Heater Selection Matrix

Heating Gases

Heater Type	Application Description	Sheath Materials	Typical Max. Watt Densities W/in²	W/cm²	Max. Operating Temperatures °F	°C	Catalog Page
Cartridge/ Insertion Heaters	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
Tubular Heaters	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
Flexible Heaters	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
Circulation Heaters	Tubular heaters have multiple elements mounted in a screw plug or ANSI flange fitting and placed in a vessel through which fluid is passed.	Round: Alloy 800 Alloy 600	30 30	4.6 4.6	1600 1800	870 980	305
	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)	150	23	482 (internal)	250	445
Air Heaters	Duct heaters have multiple elements placed in a duct through which gases pass.	Alloy 800	20 to 30	3 to 4.6	1400	760	377
	Enclosure heaters prevent freezing and condensation in electrical and mechanical housings.	Stainless steel Aluminum	15 5	2.3 0.8	1200 150	650 66	403 405
	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.	Stainless steel Alloy 800	Up to 50	7.7	1200	650	103
	Finned strip have aluminized steel fins attached to a 375 heater. They are used for air heating, freeze protection and load bank resistors.	Aluminized steel	30	4.7	1100	595	395
High-Temperature Heaters	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.	Alloy 600 Alloy 800	60 60	9.3 9.3	2100 2100	1150 1150	411
	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.	Molded ceramic fiber	30	4.6	2200	1205	419
Specialty Heaters	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.	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)	150	23	482 (internal)	250	445

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Heater Selection Matrix

Heating Within a Vacuum

Heater Type	Application Description	Sheath Materials	Typical Max. Watt Densities W/in²	W/cm²	Max. Operating Temperatures °F	°C	Catalog Page
Cartridge/ Insertion Heaters	These heaters are mounted in a vacuum vessel for radiant energy transfer.	Alloy 800 Stainless steel	up to 35 up to 35	5.4 5.4	1400 1000	760 538	9
Tubular Heaters	These heaters are mounted in a vacuum vessel for radiant energy transfer.	Alloy 800 Alloy 600	30 30	4.6 4.6	1600 1800	870 980	57 57
Flexible Heaters	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
High-Temperature Heaters	MULTICELL heaters are mounted in a vacuum vessel for radiant energy transfer.	Alloy 600 Alloy 800	60 60	9.3 9.3	2250 2250	1230 1230	411
	Ceramic fiber heaters surround the exterior surface of a vacuum vessel, using radiant energy for heat transfer.	Molded ceramic fiber	30	4.6	2200	1205	419
Specialty Heaters	ULTRAMIC advanced ceramic heaters are bonded or clamped to the object being heated.	Aluminum nitride	1000	155	1112	600	449
	Coil/cable heaters are wound into a coil or sinuated pattern and mounted in a vacuum vessel for radiant energy transfer.	Alloy 600 or Stainless steel	20	3.1	1200	650	457
Band/Barrel Heaters	These heaters are applied to exterior surface of a pipe or vessel.	Stainless steel with mineral insulation	100	15.5	1400	760	483

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Cartridge/Insertion Heaters

Cartridge/Insertion Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
FIREROD®	Alloy 800	1400	760	400	62.0	9
	Stainless steel	1000	538	400	62.0	
High-Temperature FIREROD	Alloy 800	1600	982	100	15.5	33
Metric FIREROD	Alloy 800	1400	760	330	50.0	45
MULTICELL™	Alloy 800	2050	1120	30	4.6	54



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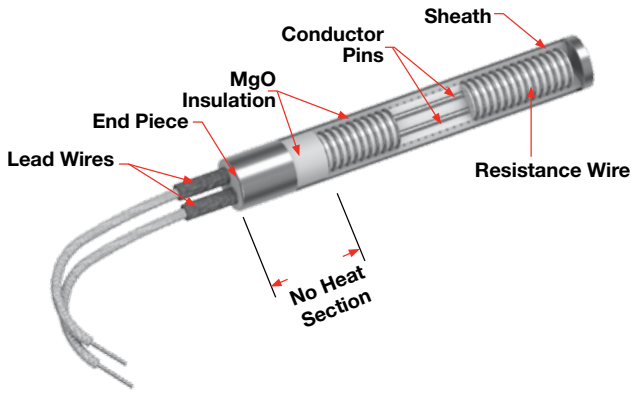
FIREROD® Cartridge Heaters

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^2 (62 W/cm^2)
- 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

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FIREROD Cartridge Heaters

Applications and Technical Data

Tolerances

Diameter

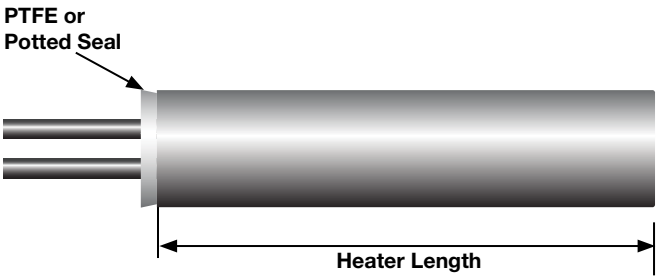
- 1 in. (25 mm) units: ±0.003 in. (±0.08 mm)
- All other units: ±0.002 in. (±0.05 mm)

Sheath Length

- All units up to 4 1/2 in. (114 mm) long: ±3/32 in. (±2.4 mm)
- 1/8 in. diameter units over 4 1/2 in. (114 mm) long: ±3%
- All other units over 4 1/2 in. (114 mm) long: ±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® 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®, CSA, VDE and CE marking is available upon request.

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FIREROD Cartridge Heaters

Applications and Technical Data

Dimensional Data

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

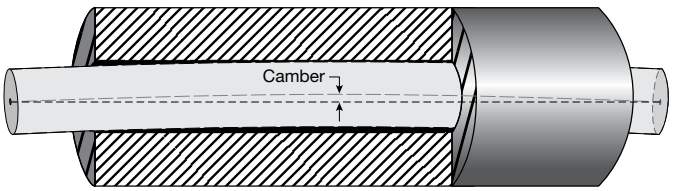
FIREROD Diameter			Length			
Nominal in.	Actual in.	(mm)	Min. in.	(mm)	Max. in.	(mm)
1/8	0.122	(3.1)	7/8	(22.2)	12	(305)
1/4	0.246	(6.3)	7/8	(22.2)	36	(915)
3/8	0.371	(9.4)	7/8	(22.2)	48	(1220)
1/2	0.496	(12.6)	7/8	(22.2)	60	(1520)
5/8	0.621	(15.8)	1	(25.0)	72	(1830)
3/4	0.746	(18.9)	1	(25.0)	72	(1830)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

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

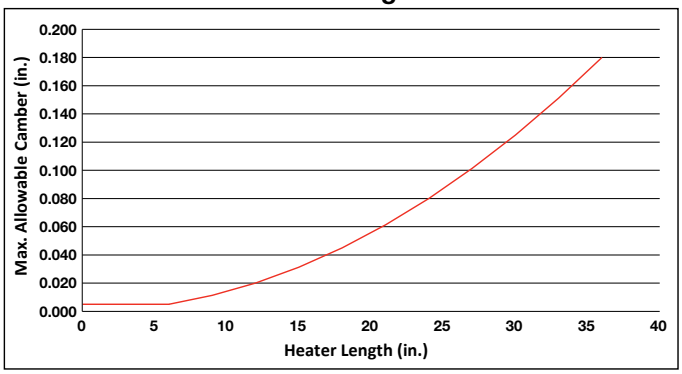
Camber

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)^2 or 0.005 in., whichever is greater.

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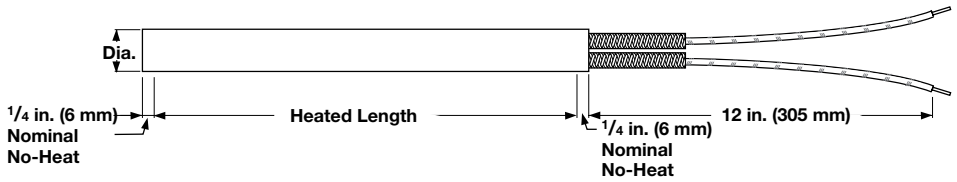
FIREROD Cartridge Heaters

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. ①	Min. Watts @ 120V ③ 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	4.4②	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	2760④	5520	11,000	9550	19,100
1⑦	480	23.0	—	15	10	2760④	5520	11,000	9550④	19,100④

Number Of Circuits ⑥		
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.

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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

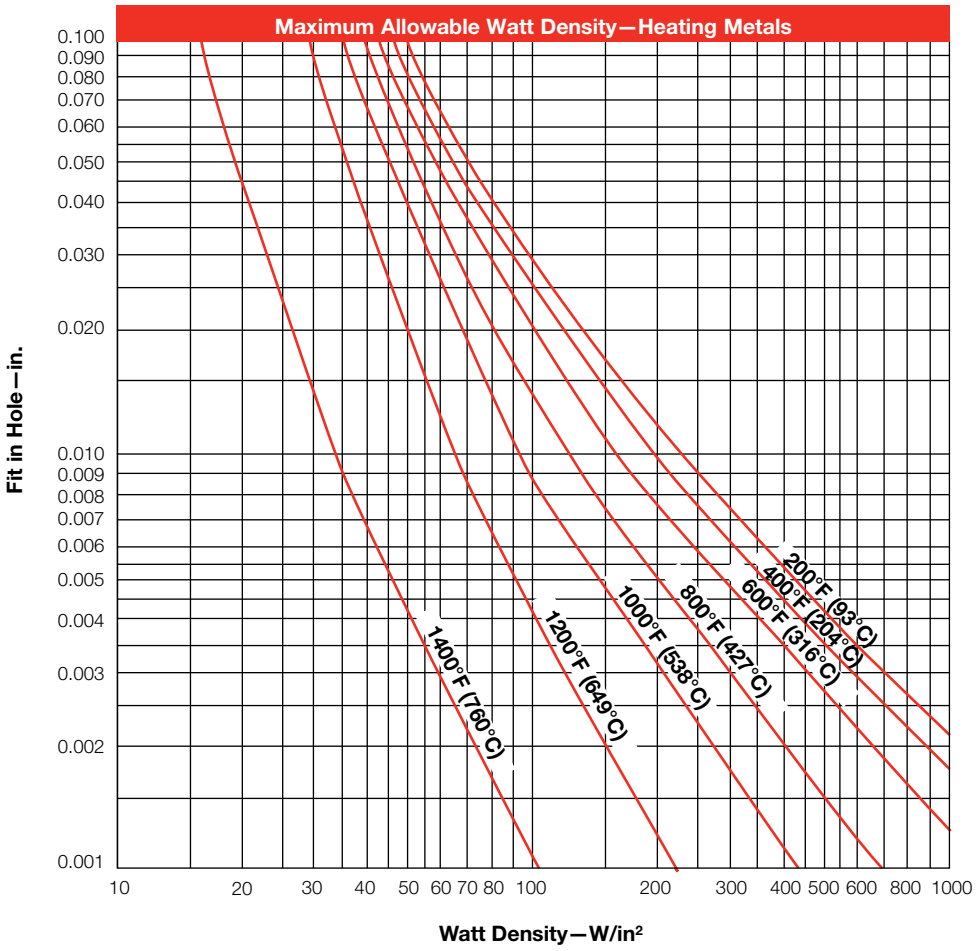
These graphs depict FIRERODs used in steel parts, therefore, for stainless steel, aluminum or brass, refer to applicable correction factors:

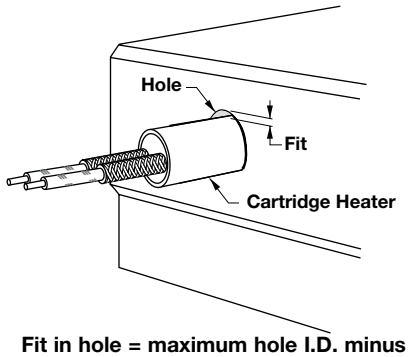
1. For stainless steel, enter the graph with a fit 0.0015 in. (0.04 mm) larger than actual fit.
2. For aluminum and brass, enter the graph with a temperature 100°F (38°C) above actual temperature.

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/in². Then, find the application temperature by reading up or over on the chart.

If the fit of the heater in the hole dimension is not known, it 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.

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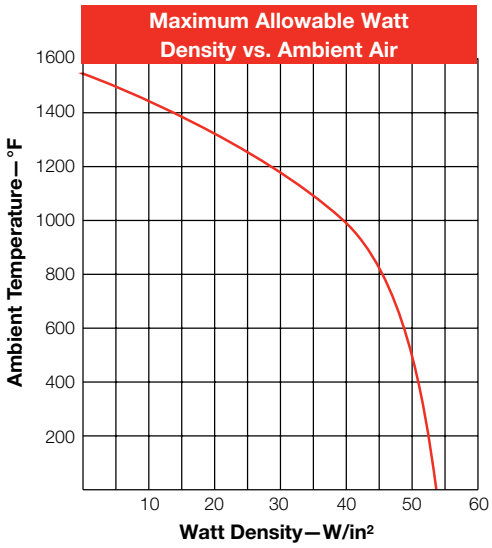
FIREROD Cartridge Heaters

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.

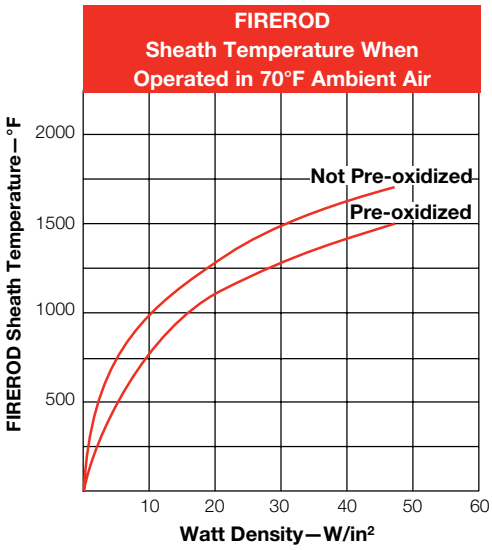


Sheath Temperature in Ambient Air

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

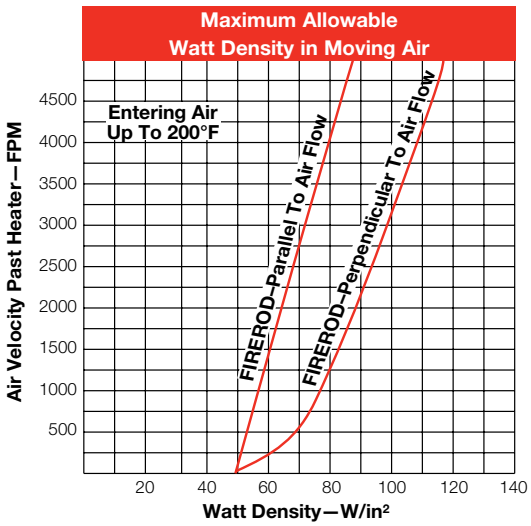
Higher temperatures result in reduced heater life.



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^2). The net-free area is the total area of the enclosure minus the area occupied by the heater.



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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

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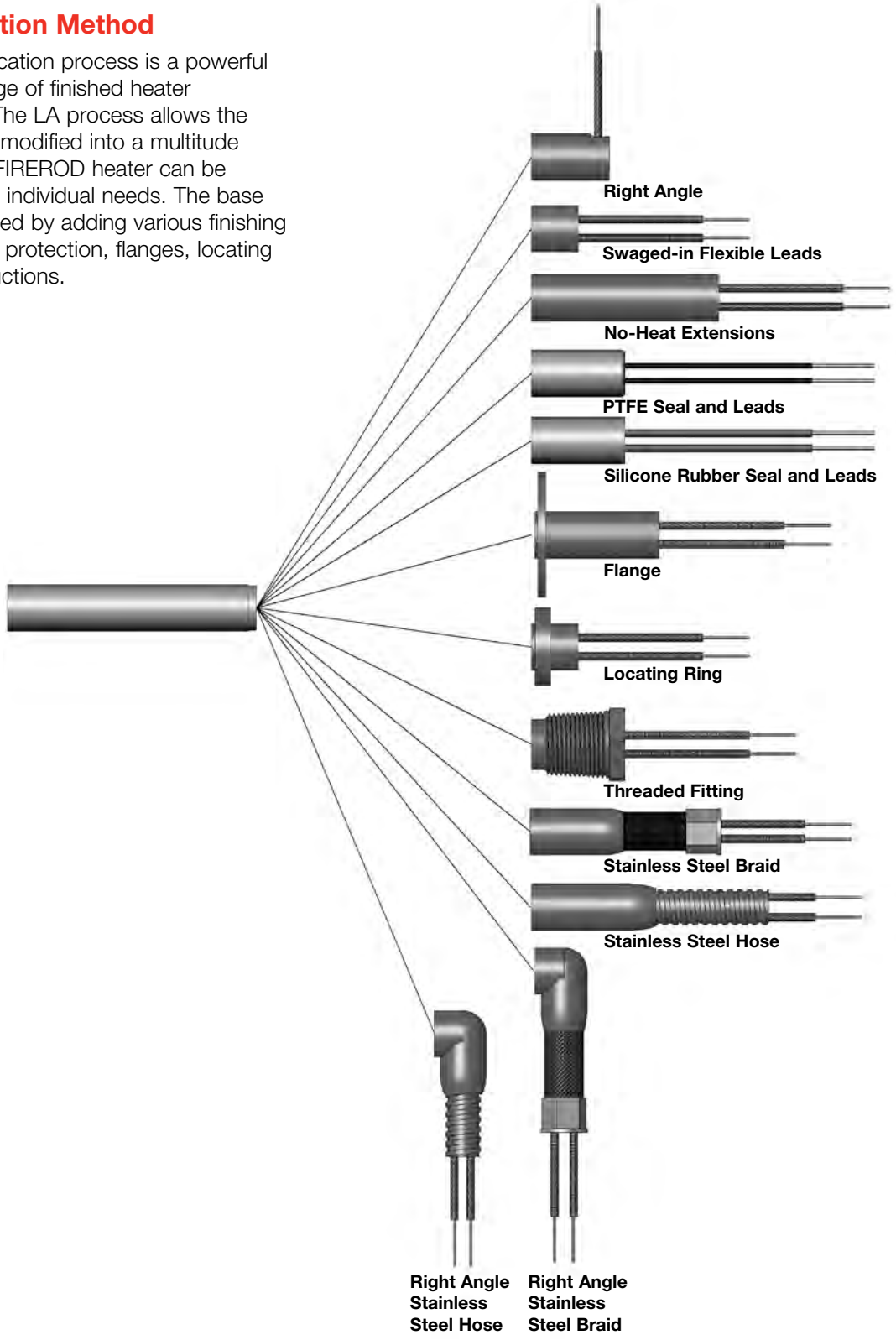
FIREROD Cartridge Heaters

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.



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FIREROD Cartridge Heaters

LA

Options *(Continued)*

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

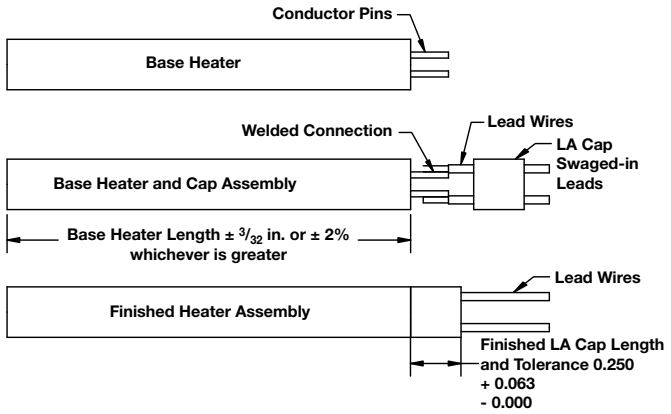
Watlow:

- 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)**

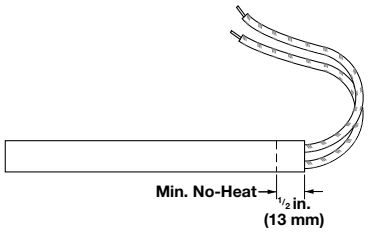
Length Tolerance for Stock Heaters With LA Options



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

Termination Options

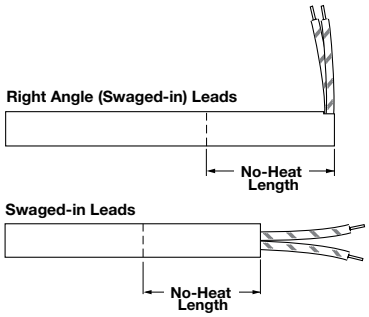
LA Swaged-in Flexible Leads



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.

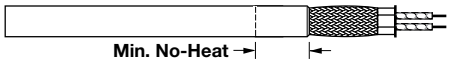
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FIREROD Cartridge Heaters

LA

Termination Options *(Continued)*

LA Straight Stainless Steel Braid

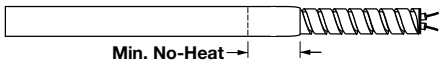


The LA straight stainless steel braid is designed to protect leads from abrasion against sharp edges. It is the most flexible Watlow protective lead arrangement.

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 3/4 in. (19 mm). This option adds 1/2 in. (13 mm) to the overall length. To order, specify **option code C**.

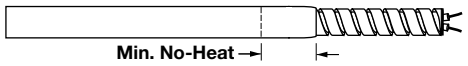
LA Straight Stainless Steel Hose



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 3/4 in. (19 mm). This option adds 1/2 in. (13 mm) to the overall length. To order, specify **option code H**.

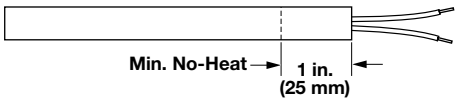
LA Straight Stainless Steel Hose with PTFE Leads and Seal



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 3/4 in. (19 mm) to the overall length. To order, specify **option code G**.

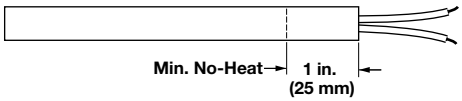
LA Silicone Rubber Seal and Leads



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 3/4 in. (19 mm) to the overall length. To order, specify **option code P**.

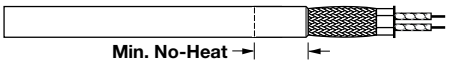
LA PTFE Seal and Leads



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 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 3/4 in. (19 mm) to the overall length. To order, specify **option code F**.

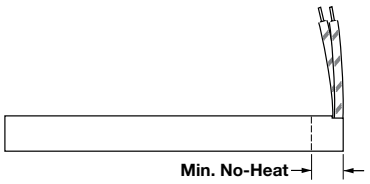
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FIREROD Cartridge Heaters

LA

Right Angle Options

LA Right Angle Leads



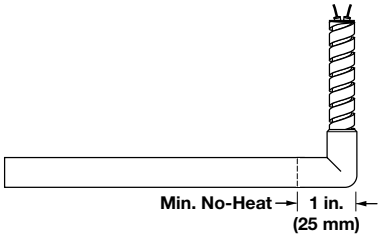
LA right angle leads are used in applications with a high degree of flexing and when space limitations are critical. Stranded lead wires are connected internally (swaged-in) and exit at a 90 degree angle at the end of the heater.

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.

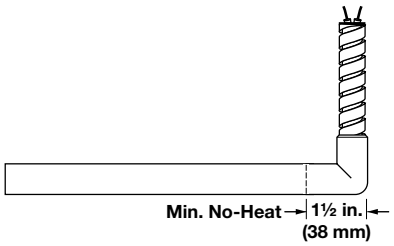
An LA right angle stainless steel hose is provided for wiring convenience. Like the LA straight stainless steel hose, it protects leads from abrasion against sharp edges. Unless specified, a 12 in. (305 mm) hose is supplied. Leads are 2 in. (51 mm) longer than the hose, but longer leads are available.

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.

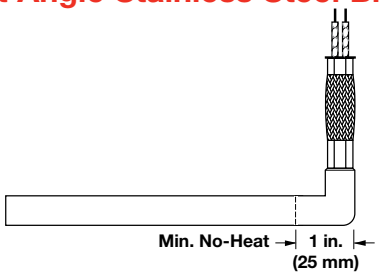
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FIREROD Cartridge Heaters

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.

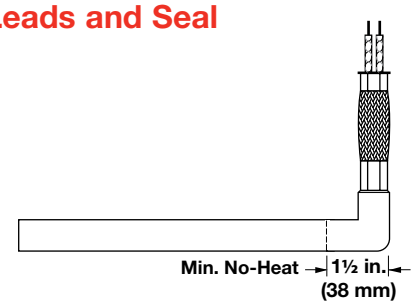
Unless specified, a 12 in. (305 mm) braid is supplied. Leads are 2 in. (51 mm) longer than the braid, but longer leads are available.

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.

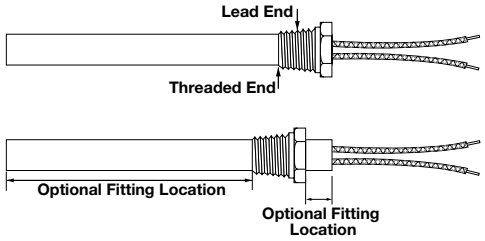
The minimum lead end no-heat required is 1 1/2 in. (38 mm). This option adds 1 1/4 in. (32 mm) to the overall length on stock units.

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 ① Between Threaded End and Lead End in.	(mm)
Crimped Leads	1/4	(6)
Swaged-in Leads	5/16 ②④	(8)
STR SS Hose	1/2 ③	(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.

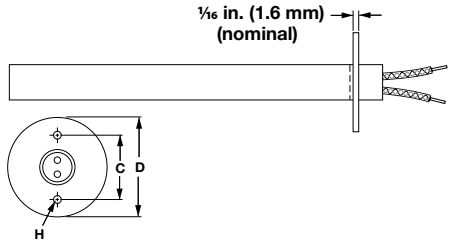
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FIREROD Cartridge Heaters

LA

Mounting Options *(Continued)*

Flanges



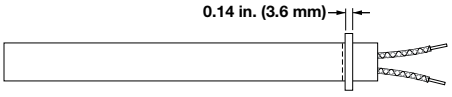
Stainless steel flanges are a convenient mounting method to position a heater within an application. The flange is staked on and located 1/4 in. (6 mm) from the lead end. The flange can be located up to 2 1/4 in. (57 mm) from the lead end if it is over a no-heat section. Use this option in combination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

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FIREROD Cartridge Heaters

LA

LA Options

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

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)	**None**
MGT	842°F (450°C)	**H**
PTFE	392°F (200°C)	**T**

Note: Available for LA fiberglass leads.

No-Heat Length Adder Codes

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

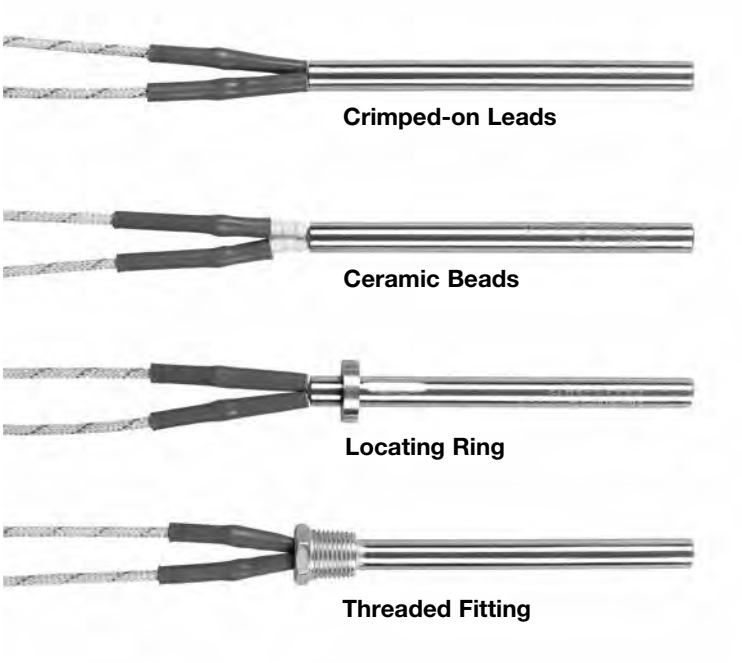
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FIREROD Cartridge Heaters

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)

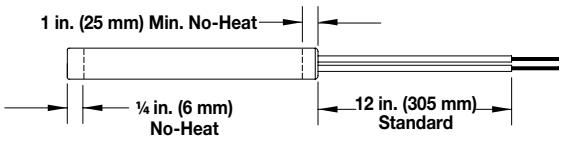
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FIREROD Cartridge Heaters

Made-to-Order

Straight Options

Swaged-in Flexible Leads

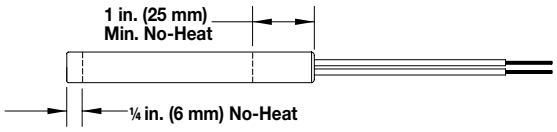


Swaged-in flexible leads are used in applications where a high degree of flexing exists or leads must be bent sharply adjacent to the heater without exposing or breaking the conductor. Stranded wire leads are connected internally and exit through the lead end.

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.

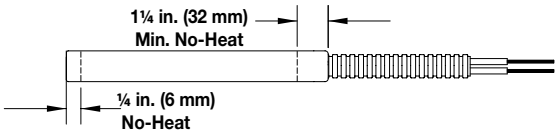
PTFE Seal and Leads



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

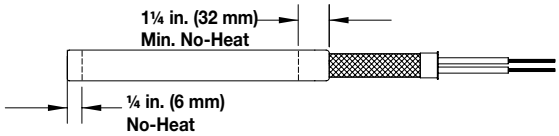


A straight stainless steel hose provides the best protection against abrasion from sharp edges. It also offers ease of handling and wiring in abrasive environments.

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.

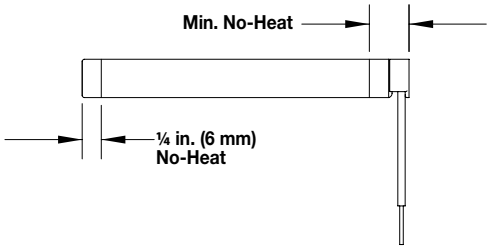
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FIREROD Cartridge Heaters

Made-to-Order

Right Angle Options

Right Angle Leads

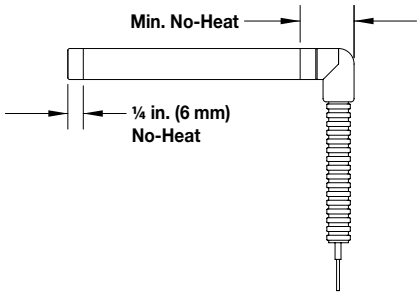


Right angle leads are used in applications with a high degree of flexing and when space limitations are critical. Standard lead wires are connected internally (swaged-in) and exit at a 90° angle at the end of the heater.

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.

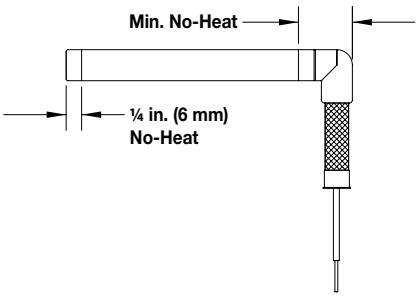
A right angle stainless steel hose is provided for wiring convenience. It protects leads from abrasion against sharp edges.

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.

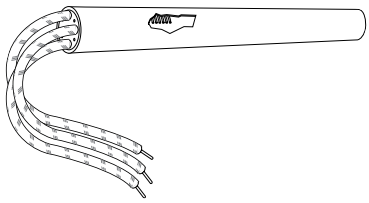
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FIREROD Cartridge Heaters

Made-to-Order

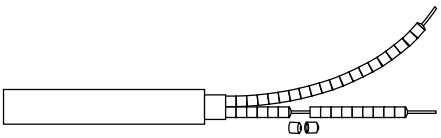
Termination Options

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



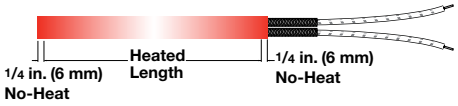
Ceramic bead insulation protects the leads from high ambient temperatures above 842°F (450°C).

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.

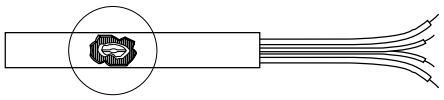
To order, specify **distributed wattage** and give the length and wattage for each section.

Thermocouple Types

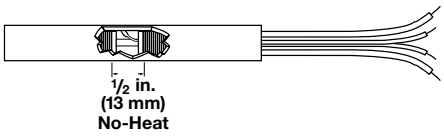
ASTM Code	Conductor Characteristics		Temperature Range °F (°C)
	Positive	Negative	
J	Iron (Magnetic) (White)	Constantan (Non-Magnetic) (Red)	0 to 1400 (-20 to 760)
K	Chromel® (Non Magnetic) (Yellow)	Alumel® (Magnetic) (Red)	0 to 2300 (-20 to 1260)

For other ISA types, contact your Watlow representative.

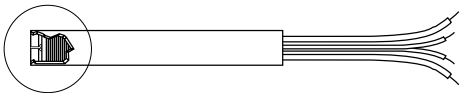
Style A



Style B



Style C



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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**.

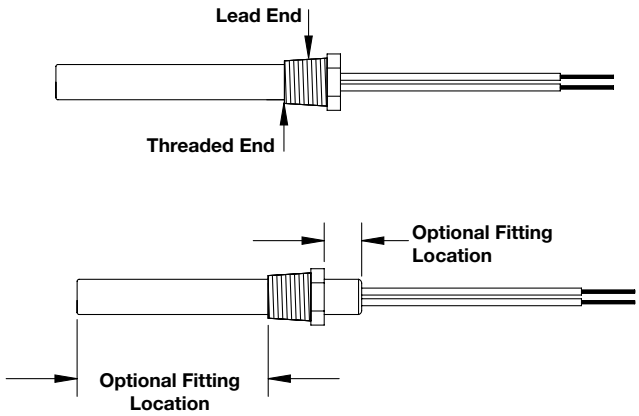
If not specified, 12 in. (305 mm) thermocouple leads are supplied.

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 5/16	(33)
1/2	3/8	(10)	3/4	(19)	1 3/8	(35)
5/8	1/2	(13)	7/8	(22)	1 13/16	(46)
3/4	3/4	(19)	1	(25)	1 13/16	(46)
1	1	(25)	1	(25)	1 1/2	(38)

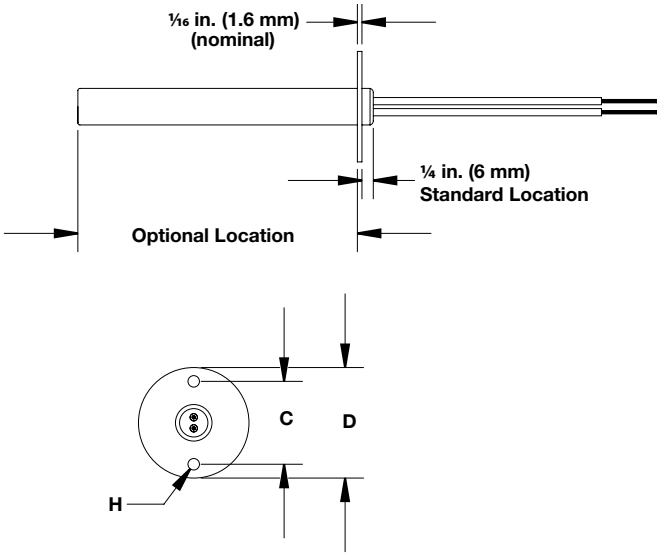
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FIREROD Cartridge Heaters

Made-to-Order

Mounting Options *(Continued)*

Flanges



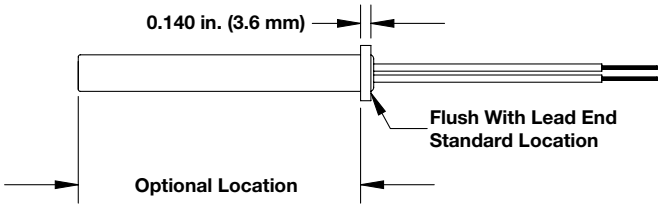
Stainless steel flanges are a convenient mounting method and can be used to position a heater within an application. The standard location is 1/4 in. (6 mm) from the lead end. However, a specific location may be requested in any location along the no-heat section. Unless specified, flanges are staked to the sheath.

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

Flange Specifications

FIREROD Diameter in.	Flange Size	D in.	D (mm)	C in.	C (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)

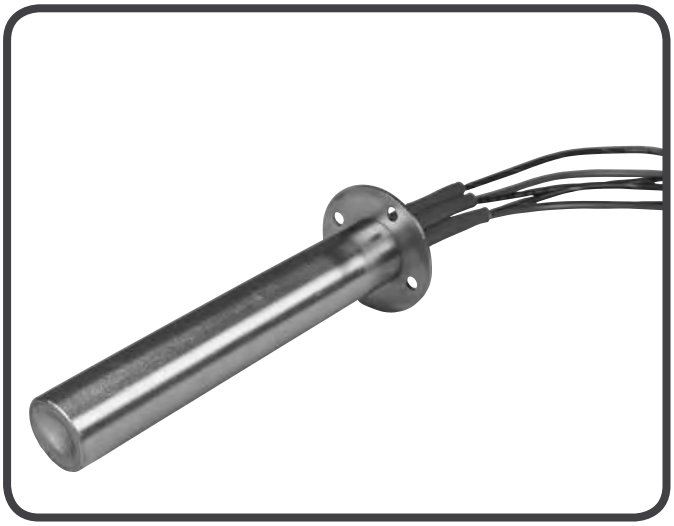
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EXTENDED CAPABILITY

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

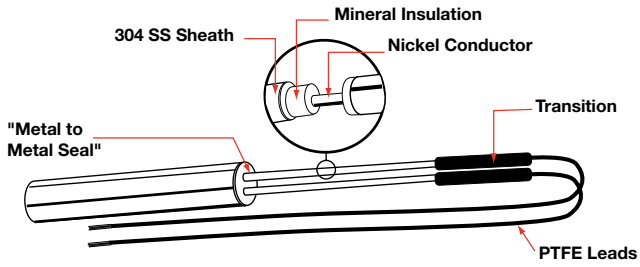
Watlow has developed a wide range of heaters and assemblies to meet requirements for the most demanding applications. Watlow can engineer and manufacture heaters with low leakage constructions, integrated temperature controls or limits and unique customer hardware and connectors.

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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: $1\frac{1}{8}$ 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.	Cable Length 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.

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EXTENDED CAPABILITY

Extended Capabilities for Custom Cartridge Heaters

Termination Options

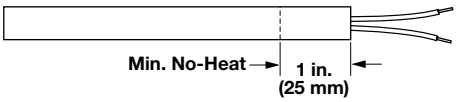
Low Electrical Leakage

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 3/8, 1/2, 5/8 and 3/4 in. (10, 13, 16 and 19 mm) diameter FIREROD heaters.

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

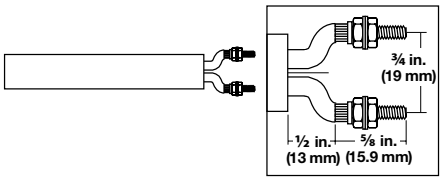
Silicone Rubber Seal and Leads



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.

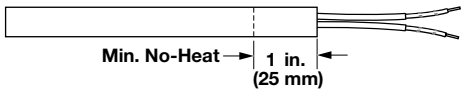
Post Terminals



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 5/8, 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 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 5/8, 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.

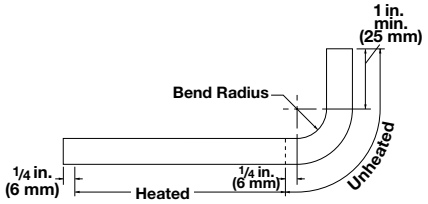
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EXTENDED CAPABILITY

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.

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EXTENDED CAPABILITY

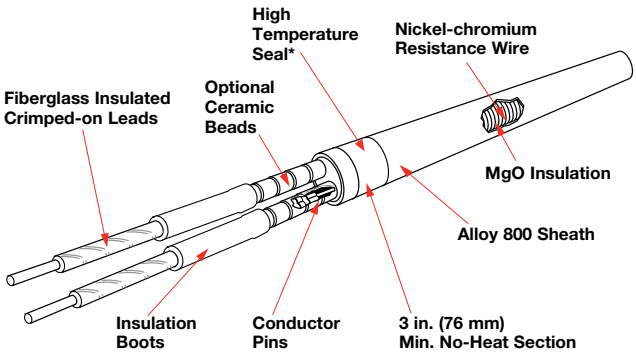
Extended Capabilities for High-Temperature (HT) FIREROD Heaters

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





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

Performance Capabilities

- Platen temperatures up to 1600°F (871°C)
- Maximum watt density up to 100 W/in² (15.5 W/cm²)
- 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 23
3/4	0.710 ± 0.004 0.746 ± 0.004	46 46
1	0.960 ± 0.006 0.996 ± 0.006	46 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

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.

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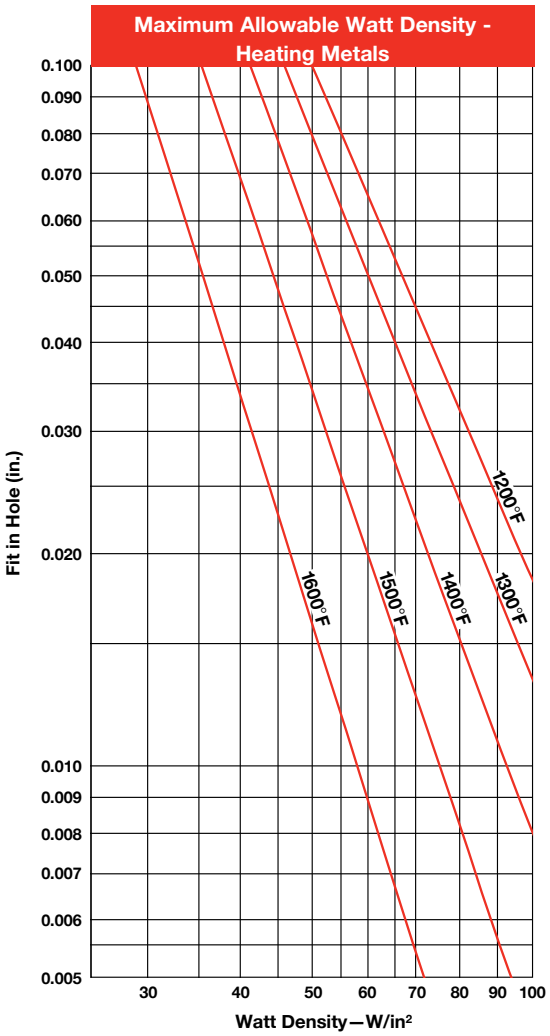
EXTENDED CAPABILITY

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.

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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 in.	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Part Number
1/8	1	(25.0)	24	20	104	(16)	0.02	(0.009)	C1A-9600①
	1	(25.0)	24	25	130	(20)	0.02	(0.009)	C1A-9601①
	1	(25.0)	24	30	157	(24)	0.02	(0.009)	C1A-9602①
	1	(25.0)	48	20	104	(16)	0.02	(0.009)	C1A-9603①
	1	(25.0)	48	40	208	(32)	0.02	(0.009)	C1A-9604①
	1	(25.0)	50	50	260	(40)	0.02	(0.009)	C1A-9605①
	1 1/4	(32.0)	120	25	87	(13)	0.02	(0.009)	C1E14
	1 1/4	(32.0)	120	50	174	(18)	0.02	(0.009)	C1E13
	1 1/4	(32.0)	240	35	113	(27)	0.02	(0.009)	C1E42
	1 1/2	(38.0)	120	30	78	(12)	0.02	(0.009)	C1J5
	1 1/2	(38.0)	120	60	156	(24)	0.02	(0.009)	C1J6
	2	(51.0)	120	50	87	(13)	0.02	(0.009)	C2A4
	2	(51.0)	120	100	174	(27)	0.02	(0.009)	C2A5
1/4	1	(25.0)	120	80	208	(32)	0.02	(0.009)	E1A51
	1	(25.0)	120	100	260	(40)	0.02	(0.009)	E1A52
	1	(25.0)	120	150	390	(60)	0.02	(0.009)	E1A53
	1	(25.0)	240	100	250	(39)	0.02	(0.009)	E1A66
	1 1/4	(32.0)	120	75	130	(20)	0.02	(0.009)	E1E41
	1 1/4	(32.0)	120	100	173	(27)	0.02	(0.009)	E1E42
	1 1/4	(32.0)	120	150	260	(40)	0.02	(0.009)	E1E43
	1 1/4	(32.0)	240	225	390	(60)	0.02	(0.009)	E1E61
	1 1/2	(38.0)	120	50	65	(10)	0.02	(0.009)	E1J39
	1 1/2	(38.0)	120	100	130	(20)	0.02	(0.009)	E1J40
	1 1/2	(38.0)	120	150	195	(30)	0.02	(0.009)	E1J41
	1 1/2	(38.0)	240	175	228	(35)	0.02	(0.009)	E1J49
	1 1/2	(38.0)	120	200	260	(40)	0.02	(0.009)	E1J42
	1 1/2	(38.0)	240	200	260	(40)	0.02	(0.009)	E1J52
	1 1/2	(38.0)	240	250	325	(50)	0.02	(0.009)	E1J35
	2	(51.0)	120	80	68	(11)	0.03	(0.014)	E2A136
	2	(51.0)	120	100	87	(13)	0.03	(0.014)	E2A55
	2	(51.0)	240	125	108	(17)	0.03	(0.014)	E2A82
	2	(51.0)	120	150	130	(20)	0.03	(0.014)	E2A56
	2	(51.0)	240	150	130	(20)	0.03	(0.014)	E2A77
	2	(51.0)	120	200	173	(27)	0.03	(0.014)	E2A57
	2	(51.0)	240	200	173	(27)	0.03	(0.014)	E2A50
	2	(51.0)	120	250	217	(33)	0.03	(0.014)	E2A72
	2	(51.0)	240	250	215	(33)	0.03	(0.014)	E2A76
	2	(51.0)	240	300	260	(40)	0.03	(0.014)	E2A83
	2 1/2	(64.0)	120	250	159	(25)	0.03	(0.014)	E2J80
	2 1/2	(64.0)	240	250	159	(25)	0.03	(0.014)	E2J49
	3	(76.0)	120	100	52	(8)	0.04	(0.018)	E3A48
	3	(76.0)	120	200	104	(16)	0.04	(0.018)	E3A49
	3	(76.0)	240	200	104	(16)	0.04	(0.018)	E3A60
	3	(76.0)	240	250	128	(20)	0.04	(0.018)	E3A124
	3	(76.0)	120	300	156	(24)	0.04	(0.018)	E3A50
	3	(76.0)	240	300	156	(24)	0.04	(0.018)	E3A51
	4	(102.0)	120	100	37	(6)	0.04	(0.018)	E4A28
	4	(102.0)	120	200	74	(11)	0.04	(0.018)	E4A29
	4	(102.0)	240	200	74	(11)	0.04	(0.018)	E4A32
	4	(102.0)	120	300	111	(17)	0.04	(0.018)	E4A30
	4	(102.0)	240	300	111	(17)	0.04	(0.018)	E4A6

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

①12 inch GGS swaged-in leads, no additional options available.

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FIREROD Cartridge Heaters

Heater Part Numbers

Diameter in.	Sheath Length in.	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Part Number
1/4	4 1/2	(114.0)	120	200	64	(10)	0.05	(0.023)	**E4J30**
	5	(127.0)	240	350	101	(16)	0.05	(0.023)	**E5A45**
	5	(127.0)	120	400	113	(18)	0.05	(0.023)	**E5A57**
	5	(127.0)	240	400	113	(18)	0.05	(0.023)	**E5A34**
	6	(152.0)	240	400	94	(14)	0.06	(0.027)	**E6A46**
	8	(203.0)	240	800	136	(21)	0.08	(0.036)	**E8A76**
3/8	1	(25.0)	120	55	95	(15)	0.03	(0.014)	**G1A71**
	1	(25.0)	120	100	172	(26)	0.03	(0.014)	**G1A29**
	1	(25.0)	120	150	259	(40)	0.03	(0.014)	**G1A38**
	1	(25.0)	240	200	344	(53)	0.03	(0.014)	**G1A83**
	1 1/4	(32.0)	120	100	115	(18)	0.03	(0.014)	**G1E91**
	1 1/4	(32.0)	120	125	144	(22)	0.03	(0.014)	**G1E74**
	1 1/4	(32.0)	120	150	172	(27)	0.03	(0.014)	**G1E92**
	1 1/4	(32.0)	240	150	172	(27)	0.03	(0.014)	**G1E93**
	1 1/4	(32.0)	120	200	230	(35)	0.03	(0.014)	**G1E94**
	1 1/4	(32.0)	240	200	230	(35)	0.03	(0.014)	**G1E95**
	1 1/4	(32.0)	120	400	426	(66)	0.03	(0.014)	**G1E99**
	1 1/2	(38.0)	120	50	43	(7)	0.04	(0.018)	**G1J25**
	1 1/2	(38.0)	120	75	65	(10)	0.04	(0.018)	**G1J70**
	1 1/2	(38.0)	120	80	68	(11)	0.04	(0.018)	**G1J66**
	1 1/2	(38.0)	120	100	86	(13)	0.04	(0.018)	**G1J59**
	1 1/2	(38.0)	240	100	86	(13)	0.04	(0.018)	**G1J110**
	1 1/2	(38.0)	240	125	106	(16)	0.04	(0.018)	**G1J182**
	1 1/2	(38.0)	120	150	129	(20)	0.04	(0.018)	**G1J31**
	1 1/2	(38.0)	240	150	129	(20)	0.04	(0.018)	**G1J39**
	1 1/2	(38.0)	120	200	173	(27)	0.04	(0.018)	**G1J85**
	1 1/2	(38.0)	240	200	173	(27)	0.04	(0.018)	**G1J73**
	1 1/2	(38.0)	120	250	216	(33)	0.04	(0.018)	**G1J86**
	1 1/2	(38.0)	240	250	216	(33)	0.04	(0.018)	**G1J54**
	1 3/4	(45.0)	120	125	86	(13)	0.05	(0.023)	**G1N45**
	1 3/4	(45.0)	120	175	122	(19)	0.05	(0.023)	**G1N46**
	1 3/4	(45.0)	120	250	172	(27)	0.05	(0.023)	**G1N43**
	1 3/4	(45.0)	240	250	172	(27)	0.05	(0.023)	**G1N32**
	2	(51.0)	120	50	29	(5)	0.06	(0.027)	**G2A53**
	2	(51.0)	120	75	42	(7)	0.06	(0.027)	**G2A192**
	2	(51.0)	120	100	57	(9)	0.06	(0.027)	**G2A84**
	2	(51.0)	240	100	57	(9)	0.06	(0.027)	**G2A76**
	2	(51.0)	120	150	86	(13)	0.06	(0.027)	**G2A56**
	2	(51.0)	240	150	86	(13)	0.06	(0.027)	**G2A81**
	2	(51.0)	120	200	115	(18)	0.06	(0.027)	**G2A127**
	2	(51.0)	240	200	115	(18)	0.06	(0.027)	**G2A37**
	2	(51.0)	120	250	144	(22)	0.06	(0.027)	**G2A47**
	2	(51.0)	240	250	144	(22)	0.06	(0.027)	**G2A73**
	2	(51.0)	120	300	172	(27)	0.06	(0.027)	**G2A139**
	2	(51.0)	240	300	172	(27)	0.06	(0.027)	**G2A98**
	2	(51.0)	120	400	230	(36)	0.06	(0.027)	**G2A153**
	2	(51.0)	240	400	230	(36)	0.06	(0.027)	**G2A146**
	2	(51.0)	120	500	282	(44)	0.06	(0.027)	**G2A95**
	2	(51.0)	240	500	282	(44)	0.06	(0.027)	**G2A97**
	2 1/4	(57.0)	120	75	37	(6)	0.07	(0.032)	**G2E88**
	2 1/4	(57.0)	120	125	62	(10)	0.07	(0.032)	**G2E89**

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FIREROD Cartridge Heaters

Heater Part Numbers

Diameter in.	Sheath Length in.	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Part Number
3/8	2 1/4	(57.0)	240	125	62	(10)	0.07	(0.032)	G2E138
	2 1/4	(57.0)	240	150	73	(11)	0.07	(0.032)	G2E68
	2 1/4	(57.0)	120	175	86	(13)	0.07	(0.032)	G2E90
	2 1/4	(57.0)	120	250	123	(19)	0.07	(0.032)	G2E2
	2 1/4	(57.0)	240	250	123	(19)	0.07	(0.032)	G2E78
	2 1/4	(57.0)	120	300	148	(23)	0.07	(0.032)	G2E108
	2 1/4	(57.0)	240	300	148	(23)	0.07	(0.032)	G2E12
	2 1/4	(57.0)	120	350	173	(27)	0.07	(0.032)	G2E91
	2 1/4	(57.0)	240	350	173	(27)	0.07	(0.032)	G2E75
	2 1/2	(64.0)	120	200	87	(13)	0.07	(0.032)	G2J110
	2 1/2	(64.0)	240	200	87	(13)	0.07	(0.032)	G2J81
	2 1/2	(64.0)	120	250	108	(17)	0.07	(0.032)	G2J46
	2 1/2	(64.0)	240	250	108	(17)	0.07	(0.032)	G2J80
	2 1/2	(64.0)	120	300	130	(20)	0.07	(0.032)	G2J118
	2 1/2	(64.0)	240	300	130	(20)	0.07	(0.032)	G2J119
	2 1/2	(64.0)	120	400	174	(27)	0.07	(0.032)	G2J26
	2 1/2	(64.0)	240	400	174	(27)	0.07	(0.032)	G2J146
	2 1/2	(64.0)	120	500	216	(33)	0.07	(0.032)	G2J109
	2 1/2	(64.0)	240	500	216	(33)	0.07	(0.032)	G2J52
	3	(76.0)	120	100	34	(5)	0.08	(0.036)	G3A55
	3	(76.0)	240	100	34	(5)	0.08	(0.036)	G3A137
	3	(76.0)	120	150	52	(8)	0.08	(0.036)	G3A121
	3	(76.0)	120	200	69	(11)	0.08	(0.036)	G3A61
	3	(76.0)	240	200	69	(11)	0.08	(0.036)	G3A39
	3	(76.0)	120	250	86	(13)	0.08	(0.036)	G3A52
	3	(76.0)	240	250	86	(13)	0.08	(0.036)	G3A54
	3	(76.0)	120	300	104	(16)	0.08	(0.036)	G3A73
	3	(76.0)	240	300	104	(16)	0.08	(0.036)	G3A92
	3	(76.0)	120	400	138	(21)	0.08	(0.036)	G3A44
	3	(76.0)	240	400	138	(21)	0.08	(0.036)	G3A65
	3	(76.0)	120	500	173	(27)	0.08	(0.036)	G3A119
	3	(76.0)	240	500	173	(27)	0.08	(0.036)	G3A120
	3	(76.0)	240	600	208	(32)	0.08	(0.036)	G3A133
	3 1/2	(89.0)	120	250	72	(11)	0.09	(0.041)	G3J77
	3 1/2	(89.0)	240	250	72	(11)	0.09	(0.041)	G3J65
	3 1/2	(89.0)	120	300	87	(13)	0.09	(0.041)	G3J87
	3 1/2	(89.0)	240	300	87	(13)	0.09	(0.041)	G3J68
	3 1/2	(89.0)	120	500	144	(22)	0.09	(0.041)	G3J22
	3 1/2	(89.0)	240	500	144	(22)	0.09	(0.041)	G3J63
	4	(102.0)	120	125	31	(5)	0.09	(0.041)	G4A54
	4	(102.0)	240	125	31	(5)	0.09	(0.041)	G4A163
	4	(102.0)	120	150	37	(6)	0.09	(0.041)	G4A78
	4	(102.0)	120	175	43	(7)	0.09	(0.041)	G4A191
	4	(102.0)	120	250	62	(10)	0.09	(0.041)	G4A40
	4	(102.0)	240	250	62	(10)	0.09	(0.041)	G4A87
	4	(102.0)	120	300	74	(11)	0.09	(0.041)	G4A94
	4	(102.0)	240	300	74	(11)	0.09	(0.041)	G4A95
	4	(102.0)	120	400	99	(15)	0.09	(0.041)	G4A48
	4	(102.0)	240	400	99	(15)	0.09	(0.041)	G4A44
	4	(102.0)	240	450	109	(17)	0.09	(0.041)	G4A64
	4	(102.0)	120	500	123	(19)	0.09	(0.041)	G4A96
	4	(102.0)	240	500	123	(19)	0.09	(0.041)	G4A92

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Heater Part Numbers

Diameter in.	Sheath Length in.	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Part Number
3/8	4	(102.0)	120	550	134	(21)	0.09	(0.041)	**G4A200**
	4 1/4	(108.0)	240	300	67	(10)	0.09	(0.041)	**G4E25**
	4 1/4	(108.0)	240	750	167	(26)	0.09	(0.041)	**G4E15**
	4 1/2	(114.0)	120	300	65	(10)	0.10	(0.045)	**G4J54**
	4 1/2	(114.0)	240	300	65	(10)	0.10	(0.045)	**G4J33**
	4 1/2	(114.0)	120	500	108	(17)	0.10	(0.045)	**G4J55**
	4 1/2	(114.0)	240	500	108	(17)	0.10	(0.045)	**G4J37**
	5	(127.0)	120	150	29	(4)	0.11	(0.050)	**G5A68**
	5	(127.0)	240	150	29	(4)	0.11	(0.050)	**G5A56**
	5	(127.0)	120	300	58	(9)	0.11	(0.050)	**G5A69**
	5	(127.0)	240	300	58	(9)	0.11	(0.050)	**G5A70**
	5	(127.0)	120	500	96	(15)	0.11	(0.050)	**G5A38**
	5	(127.0)	240	500	96	(15)	0.11	(0.050)	**G5A71**
	5	(127.0)	240	750	144	(22)	0.11	(0.050)	**G5A67**
	5	(127.0)	240	1000	192	(30)	0.11	(0.050)	**G5A115**
	5 1/4	(133.0)	240	200	45	(7)	0.12	(0.054)	**G5E16**
	5 1/2	(140.0)	240	600	104	(16)	0.12	(0.054)	**G5J36**
	5 1/2	(140.0)	240	1000	173	(27)	0.12	(0.054)	**G5J45**
	6	(152.0)	120	200	31	(5)	0.13	(0.059)	**G6A80**
	6	(152.0)	120	250	39	(6)	0.13	(0.059)	**G6A40**
	6	(152.0)	240	250	39	(6)	0.13	(0.059)	**G6A92**
	6	(152.0)	120	400	63	(10)	0.13	(0.059)	**G6A81**
	6	(152.0)	240	400	63	(10)	0.13	(0.059)	**G6A82**
	6	(152.0)	120	500	79	(12)	0.13	(0.059)	**G6A125**
	6	(152.0)	240	500	79	(12)	0.13	(0.059)	**G6A59**
	6	(152.0)	120	600	94	(15)	0.13	(0.059)	**G6A56**
	6	(152.0)	240	600	94	(15)	0.13	(0.059)	**G6A51**
	6	(152.0)	240	750	117	(18)	0.13	(0.059)	**G6A46**
	6	(152.0)	240	1000	157	(24)	0.13	(0.059)	**G6A83**
	6 1/2	(165.0)	240	600	86	(13)	0.14	(0.064)	**G6J23**
	6 1/2	(165.0)	240	1000	144	(22)	0.14	(0.064)	**G6J33**
	7	(178.0)	120	250	33	(5)	0.14	(0.064)	**G7A40**
	7	(178.0)	240	250	33	(5)	0.14	(0.064)	**G7A32**
	7	(178.0)	240	500	65	(10)	0.14	(0.064)	**G7A30**
	7	(178.0)	120	600	80	(12)	0.14	(0.064)	**G7A41**
	7	(178.0)	240	600	80	(12)	0.14	(0.064)	**G7A42**
	7	(178.0)	240	1000	133	(21)	0.14	(0.064)	**G7A43**
	7 1/2	(191.0)	240	600	74	(11)	0.15	(0.068)	**G7J27**
	7 1/2	(191.0)	240	1000	124	(19)	0.15	(0.068)	**G7J28**
	8	(203.0)	120	300	34	(5)	0.16	(0.073)	**G8A54**
	8	(203.0)	240	300	34	(5)	0.16	(0.073)	**G8A47**
	8	(203.0)	120	400	45	(7)	0.16	(0.073)	**G8A109**
	8	(203.0)	120	500	58	(9)	0.16	(0.073)	**G8A81**
	8	(203.0)	240	500	58	(9)	0.16	(0.073)	**G8A32**
	8	(203.0)	120	600	69	(11)	0.16	(0.073)	**G8A53**
	8	(203.0)	240	600	69	(11)	0.16	(0.073)	**G8A37**
	8	(203.0)	240	700	79	(12)	0.16	(0.073)	**G8A98**
	8	(203.0)	240	1000	115	(18)	0.16	(0.073)	**G8A45**
	9	(229.0)	240	1000	100	(16)	0.18	(0.082)	**G9A37**
	9 1/2	(241.0)	240	600	57	(9)	0.19	(0.086)	**G9J20**
	9 1/2	(241.0)	240	1000	96	(15)	0.19	(0.086)	**G9J12**
	10	(254.0)	120	400	36	(6)	0.19	(0.086)	**G10A48**

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

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

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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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FIREROD Cartridge Heaters

Heater Part Numbers

Diameter in.	Sheath Length in.	Sheath Length (mm)	Volts	Watts	Watt Density W/in²	Watt Density (W/cm²)	Approx. Net Wt. lbs	Approx. Net Wt. (kg)	Part Number
1/2	14	(356.0)	240	2300	110	(17)	0.48	(0.218)	**J14A39**
	15	(381.0)	240	1500	66	(10)	0.50	(0.227)	**J15A19**
	16	(406.0)	240	1000	41	(7)	0.52	(0.236)	**J16A12**
	18	(457.0)	240	1500	55	(9)	0.57	(0.259)	**J18A19**
	18	(457.0)	240	1700	62	(9)	0.57	(0.259)	**J18A23**
5/8	1 1/4	(32.0)	120	50	34	(5)	0.10	(0.045)	**L1E26**
	1 1/4	(32.0)	120	200	137	(21)	0.10	(0.045)	**L1E24**
	1 1/4	(32.0)	120	250	171	(27)	0.10	(0.045)	**L1E27**
	1 1/2	(38.0)	120	250	128	(20)	0.11	(0.050)	**L1J23**
	1 1/2	(38.0)	240	250	128	(20)	0.11	(0.050)	**L1J24**
	2	(51.0)	120	100	34	(5)	0.13	(0.059)	**L2A48**
	2	(51.0)	120	200	68	(11)	0.13	(0.059)	**L2A49**
	2	(51.0)	240	500	170	(26)	0.13	(0.059)	**L2A54**
	2 1/4	(57.0)	120	100	29	(4)	0.14	(0.064)	**L2E49**
	2 1/4	(57.0)	120	250	73	(11)	0.14	(0.064)	**L2E50**
	2 1/4	(57.0)	240	250	73	(11)	0.14	(0.064)	**L2E12**
	2 1/4	(57.0)	120	350	103	(16)	0.14	(0.064)	**L2E40**
	2 1/4	(57.0)	240	350	103	(16)	0.14	(0.064)	**L2E51**
	3	(76.0)	120	150	31	(5)	0.20	(0.091)	**L3A81**
	3	(76.0)	120	250	51	(8)	0.20	(0.091)	**L3A82**
	3	(76.0)	240	250	51	(8)	0.20	(0.091)	**L3A9**
	3	(76.0)	120	400	81	(13)	0.20	(0.091)	**L3A94**
	3	(76.0)	120	500	102	(16)	0.20	(0.091)	**L3A113**
	3	(76.0)	240	500	103	(16)	0.20	(0.091)	**L3A33**
	3	(76.0)	240	750	154	(24)	0.20	(0.091)	**L3A71**
	3 3/4	(95.0)	120	525	82	(13)	0.24	(0.109)	**L3N12**
	3 3/4	(95.0)	240	525	82	(13)	0.24	(0.109)	**L3N1**
	4	(102.0)	120	250	37	(6)	0.26	(0.118)	**L4A99**
	4	(102.0)	240	250	37	(6)	0.26	(0.118)	**L4A104**
	4	(102.0)	240	400	58	(9)	0.26	(0.118)	**L4A47**
	4	(102.0)	240	500	73	(11)	0.26	(0.118)	**L4A53**
	4	(102.0)	240	600	88	(14)	0.26	(0.118)	**L4A44**
	4	(102.0)	240	750	110	(17)	0.26	(0.118)	**L4A100**
	4	(102.0)	240	1000	146	(23)	0.26	(0.118)	**L4A71**
	5	(127.0)	120	250	28	(4)	0.29	(0.132)	**L5A76**
	5	(127.0)	240	250	28	(4)	0.29	(0.132)	**L5A107**
	5	(127.0)	240	500	57	(9)	0.29	(0.132)	**L5A24**
	5	(127.0)	240	750	86	(13)	0.29	(0.132)	**L5A31**
	5	(127.0)	240	1000	114	(18)	0.29	(0.132)	**L5A77**
	6	(152.0)	120	300	28	(4)	0.34	(0.154)	**L6A28**
	6	(152.0)	240	300	28	(4)	0.34	(0.154)	**L6A64**
	6	(152.0)	240	500	47	(7)	0.34	(0.154)	**L6A73**
	6	(152.0)	240	750	70	(11)	0.34	(0.154)	**L6A70**
	6	(152.0)	240	1000	93	(14)	0.34	(0.154)	**L6A71**
	6	(152.0)	120	1500	139	(22)	0.34	(0.154)	**L6A163**
	6	(152.0)	240	1500	140	(22)	0.34	(0.154)	**L6A94**
	6 1/2	(165.0)	120	500	43	(7)	0.38	(0.172)	**L6J43**
	6 1/2	(165.0)	240	500	43	(7)	0.38	(0.172)	**L6J55**
	7	(178.0)	120	500	39	(6)	0.40	(0.181)	**L7A42**
	7	(178.0)	240	500	39	(6)	0.40	(0.181)	**L7A15**
	7	(178.0)	240	1000	79	(12)	0.40	(0.181)	**L7A37**
	7	(178.0)	240	1500	118	(18)	0.40	(0.181)	**L7A12**

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Heater Part Numbers

Diameter in.	Sheath Length in.	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Part Number
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**

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FIREROD Cartridge Heaters

Heater Part Numbers

Diameter in.	Sheath Length in.	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Part Number
3/4	6	(152.0)	240	1500	116	(18)	0.44	(0.200)	**N6A82**
	6	(152.0)	240	2000	155	(24)	0.44	(0.200)	**N6A22**
	7	(178.0)	120	500	33	(5)	0.51	(0.231)	**N7A15**
	7	(178.0)	240	500	33	(5)	0.51	(0.231)	**N7A1**
	7	(178.0)	240	1000	66	(10)	0.51	(0.231)	**N7A16**
	8	(203.0)	120	500	28	(4)	0.58	(0.263)	**N8A19**
	8	(203.0)	240	500	28	(4)	0.58	(0.263)	**N8A20**
	8	(203.0)	240	1000	57	(9)	0.58	(0.263)	**N8A21**
	8	(203.0)	240	2000	114	(17)	0.58	(0.263)	**N8A22**
	10	(254.0)	240	1000	45	(7)	0.72	(0.327)	**N10A15**
	10	(254.0)	240	2000	90	(14)	0.72	(0.327)	**N10A14**
	12	(305.0)	240	1000	37	(6)	0.84	(0.381)	**N12A15**
	12	(305.0)	240	2000	74	(11)	0.84	(0.381)	**N12A24**
	12	(305.0)	480	2000	74	(11)	0.84	(0.381)	**N12A198**
	12	(305.0)	240	4000	148	(23)	0.84	(0.381)	**N12A25**
	13	(330.0)	240	1000	34	(5)	0.93	(0.422)	**N13A26**
	14	(356.0)	240	1250	40	(6)	1.03	(0.467)	**N14A22**
	14	(356.0)	240	2500	79	(12)	1.03	(0.467)	**N14A20**
	14	(356.0)	240	4500	142	(22)	1.03	(0.467)	**N14A21**
	15	(381.0)	240	1500	44	(7)	1.09	(0.494)	**N15A26**
	16	(406.0)	240	1800	49	(8)	1.14	(0.517)	**N16A26**
	16	(406.0)	240	4700	129	(20)	1.14	(0.517)	**N16A18**
	18	(457.0)	240	2000	49	(8)	1.25	(0.567)	**N18A13**
	18	(457.0)	240	5000	122	(19)	1.25	(0.567)	**N18A15**
	20	(508.0)	240	1150	25	(4)	1.40	(0.635)	**N20A21**
	20	(508.0)	240	2250	49	(8)	1.40	(0.635)	**N20A22**
	20	(508.0)	240	5250	115	(18)	1.40	(0.635)	**N20A10**
	24	(610.0)	240	1375	25	(4)	1.80	(0.816)	**N24A24**
	24	(610.0)	240	2750	50	(8)	1.80	(0.816)	**N24A23**
	24	(610.0)	480	2750	50	(8)	1.80	(0.816)	**N24A78**
	24	(610.0)	240	5500	100	(16)	1.80	(0.816)	**N24A13**
	36	(914.0)	240	2500	30	(6)	2.50	(1.13)	**N36A4**

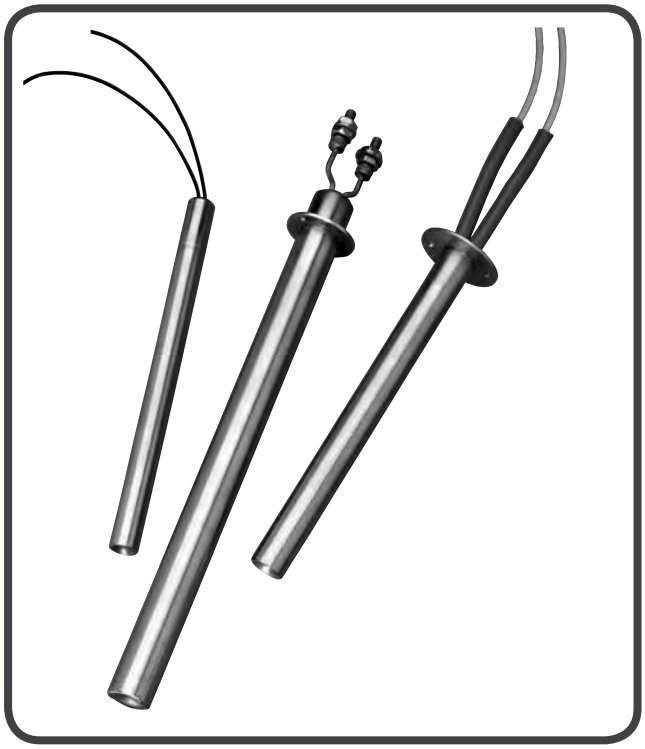
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Metric FIREROD Cartridge Heaters

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^2 (330 W/in^2)

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

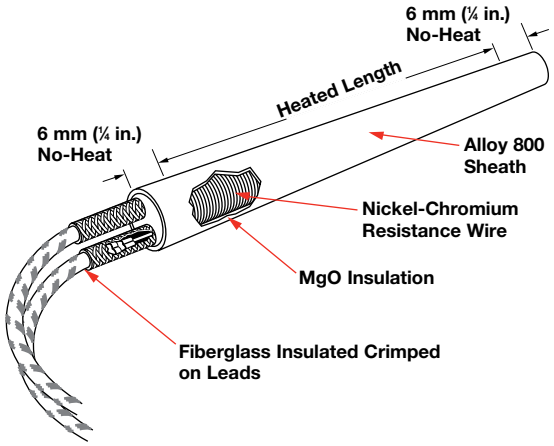
- Resists oxidation and corrosion from many chemicals, heat or atmospheres

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

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Metric FIREROD Cartridge Heaters

Applications and Technical Data

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

Electrical Data

Heater Diameter (mm)	6.5	8	10	12.5	16	20
Nominal Diameter (in.)	0.256	0.315	0.394	0.492	0.630	0.787
Max. Voltage	250	250	250	400	480	480
Crimped on Leads						
Max. Amperes	7.2	7.2	16.1	16.1	21	21
Max. Wattage @ 230V	1650	1650	3700	3700	4830	4830
Max. Wattage @ 400V				6440	8400	8400
Swaged-in Leads						
Max. Amperes	5.2/7.2[①]	5.2/7.2[①]	12.6	12.6	12.6/21[①]	21
Max. Wattage @ 230V	1190/1650	1190/1650	2890	2890	2890/4830	4830
Max. Wattage @ 400V	—	—	—	5040	5040/8400	8400

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

Tolerances

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

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

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

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

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

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

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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.

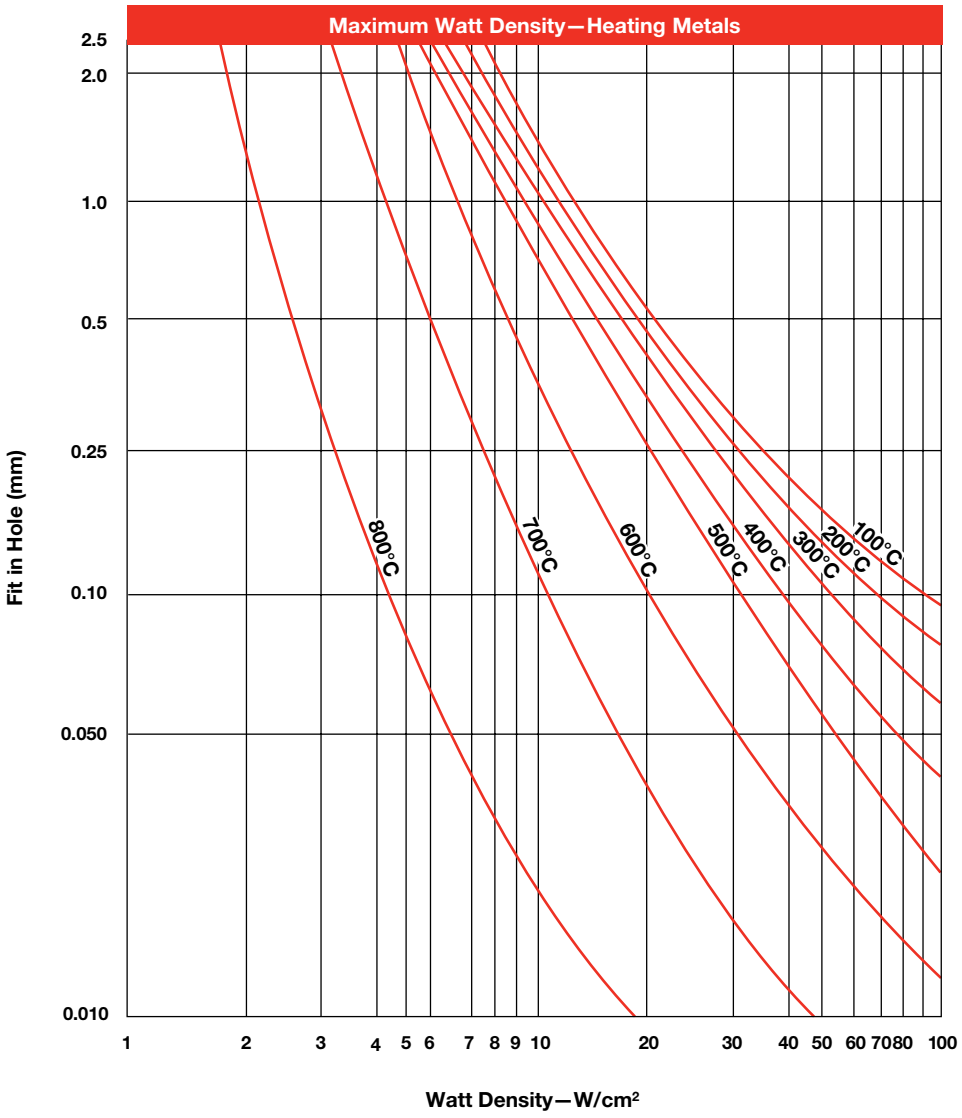
Heating Metals

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 ① and ②.



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

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

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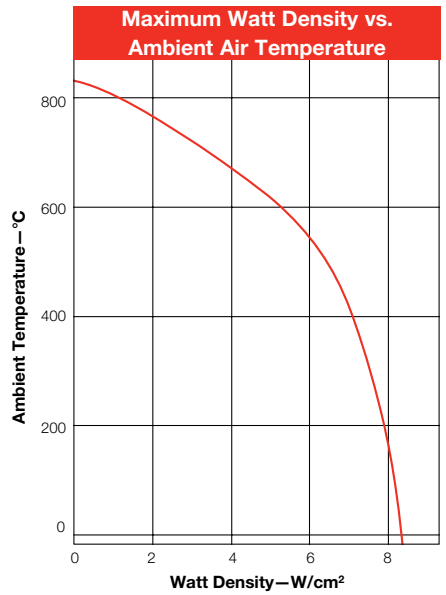
Metric FIREROD Cartridge Heaters

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.

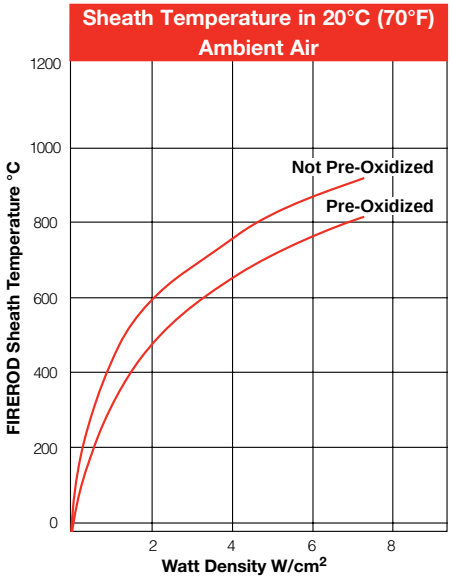
For metric FIRERODs grouped in a single row, with no less than one diameter between elements, multiply value from graph by 0.95. When a reflector is placed behind the heaters, multiply the maximum allowable watt density value from the graph by 0.85.



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.

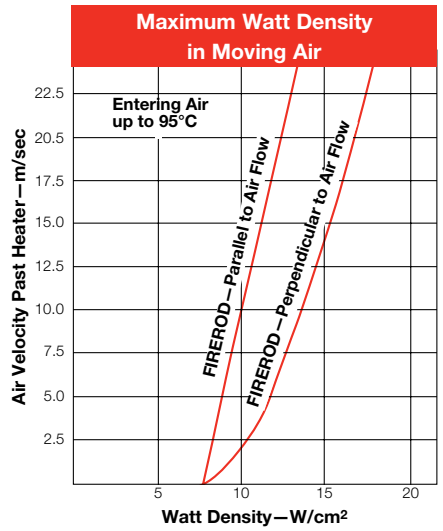
At 7 W/cm^2 (44 W/in^2), the sheath temperature will be 790°C (1450°F). At this temperature, one year of heater life would be expected, provided cycling is not too frequent. Higher temperatures would result in reduced heater life.



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

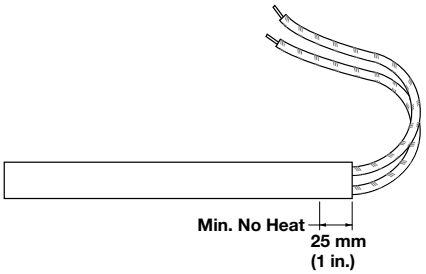


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Metric FIREROD Cartridge Heaters

Termination Options

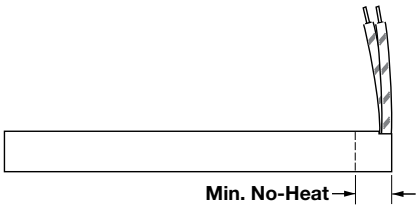
Swaged-in Flexible Leads



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**.

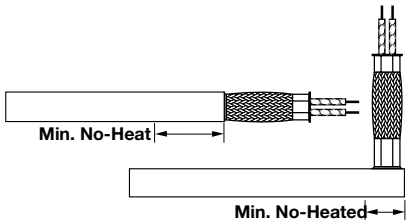
Right Angle Leads



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



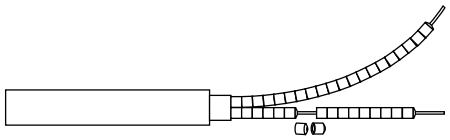
A stainless steel braid is designed to protect leads from abrasion against sharp edges. It is the most flexible of Watlow's protective lead arrangements.

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 (11/16)
16.0	30 (1 1/8)	20 (3/4)
20.0	30 (1 1/8)	21 (13/16)

Ceramic Bead Insulation



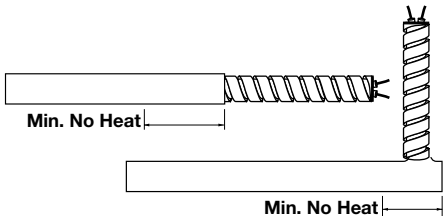
Ceramic bead insulation protects the leads from high temperature ambients above 450°C (840°F). The beads fit over solid conductors and are extended long enough to reach a cooler area where flexible wires can be attached. To order, specify **ceramic beads** and length, and additional lead length.

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Metric FIREROD Cartridge Heaters

Termination Options *(Continued)*

Stainless Steel Hose

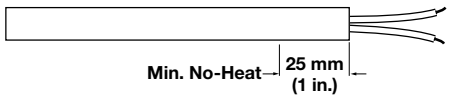


Stainless steel hose provides the best protection against abrasion from sharp edges or abrasive equipment. It also offers ease of handling and wiring in abrasive environments.

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 1/8)	N/A	4.7 (3/16)
8.0	30 (1 1/8)	15 (9/16)	5.7 (7/32)
10.0	30 (1 1/8)	17 (2/3)	7.6 (3/10)
12.5	30 (1 1/8)	18 (11/16)	9.5 (3/8)
16.0	30 (1 1/8)	20 (3/4)	12.7 (1/2)
20.0	30 (1 1/8)	21 (13/16)	15.8 (5/8)

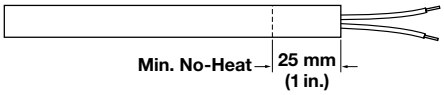
PTFE Seal and Leads



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.

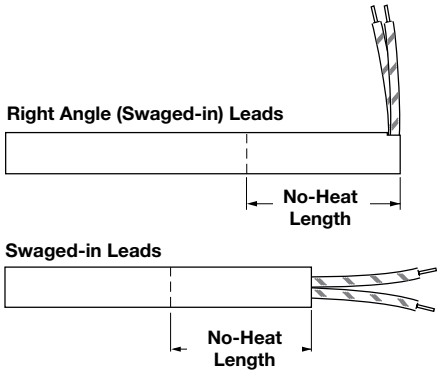
Silicone Rubber Seal and Leads



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



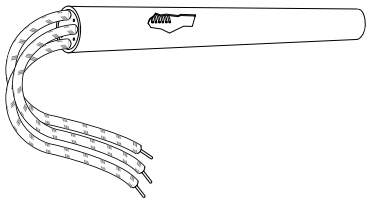
No-heat sections are recommended in applications where leads may be exposed to excessive heat, thus requiring a cooler lead end. Also use when heat is not required along the entire length of the metric FIREROD. No-heat extensions are available on all diameters with both pin style and swaged-in leads.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

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Metric FIREROD Cartridge Heaters

Termination Options *(Continued)*

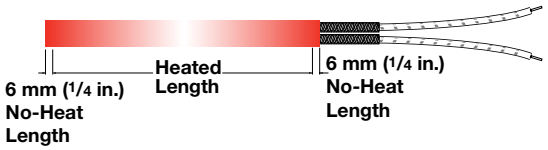
Ground Lead



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

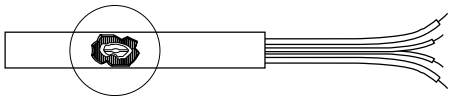


Distributed wattage varies the watt density along the length of the heater. This construction technique is used to compensate for heat losses along the edges of heated parts. To order, specify **distributed wattage** and give the length and wattage for each section.

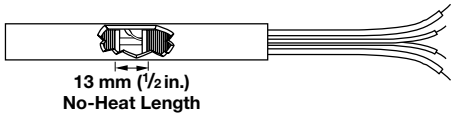
Options *(Continued)*

Internal Thermocouple Sensors

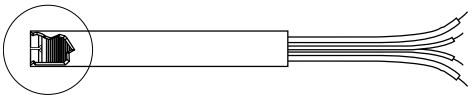
Style A



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)

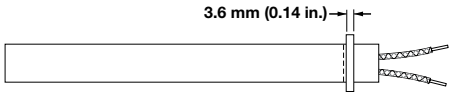
For other thermocouple types, contact your Watlow representative.

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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.

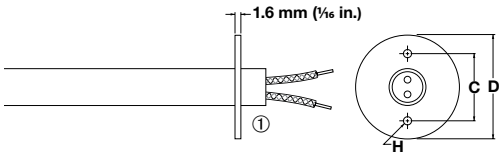
For LA, specify the location if the no-heat extension option is requested. On FIRERODs with crimped on leads without the LA option, the locating ring will be located on the last 1/4 in. (6 mm).

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



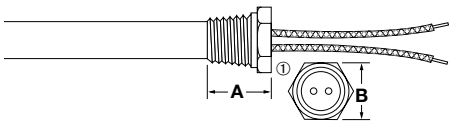
Stainless steel flanges are a convenient mounting method as well as a way to position a heater within an application. These flanges can be located in any no-heat section of the heater sheath. To order, specify **flange**, flange size and location.

Metric FIREROD Diameter mm	Flange Size	D mm (in.)	C mm (in.)	H mm (in.)
6.5, 8, 10,12.5, 16②	FS	25.4 (1)	19.1 (3/4)	3.7 (9/64)
6.5, 8, 10, 12.5, 16, 20	FM	38.1 (1 1/2)	28.6 (1 1/8)	4.3 (3/16)
16, 20	FL	51.0 (2)	38.1 (1 1/2)	5.3 (13/64

① Swaged-in unit pictured.
② FS flange for 16 mm diameter is without holes.

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 (11/16)	M14 X 1.5	11.5 (7/16)	17 (5/8)	6.5 (1/4)
12.5	19 (3/4)	M16 X 1.5	12.0 (7/16)	19 (3/4)	6.5 (1/4)
16.0	20 (3/4)	M20 X 1.5	15.0 (3/5)	24 (15/16)	9.0 (3/8)
20.0	22 (7/8)	M26 X 1.5	16.0 (5/8)	30 (1 3/16)	10.0 (3/8)

①Swaged-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 (11/20)	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 (11/16)	14.0 (11/20)
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)

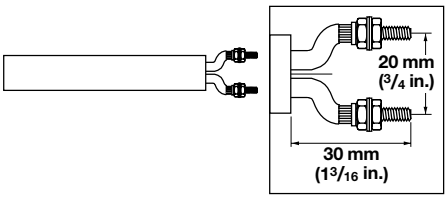
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EXTENDED CAPABILITY

Extended Capabilities for Metric FIREROD Cartridge Heaters

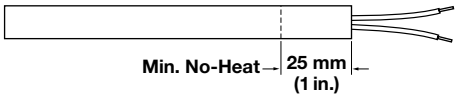
Termination Options

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

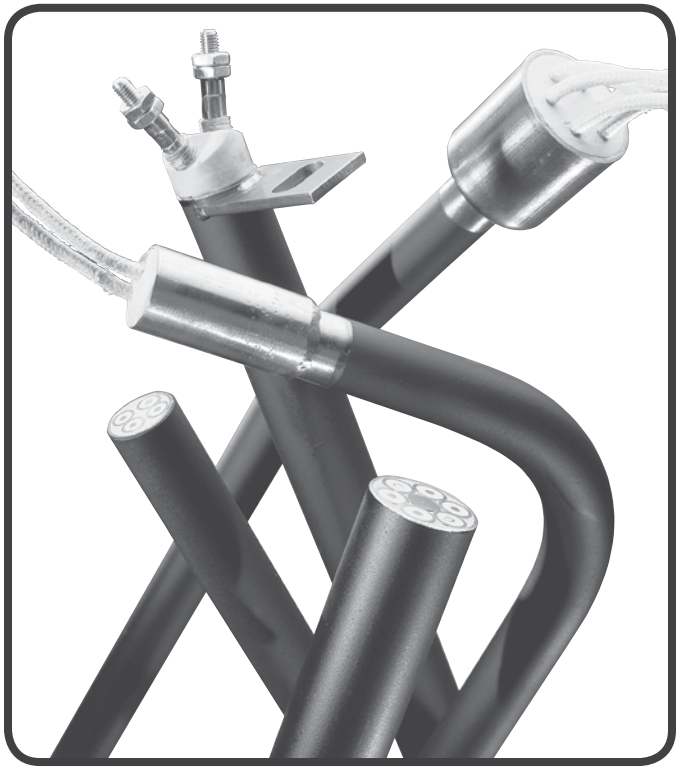
Individually controlled heat zones give the flexibility of controlling temperature by zones, along the length of the metric FIREROD. This is an advantage for heating requirements of certain applications, like seal bars. This internal construction can be ordered on 12.5, 16 and 20 mm diameter units. If 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.

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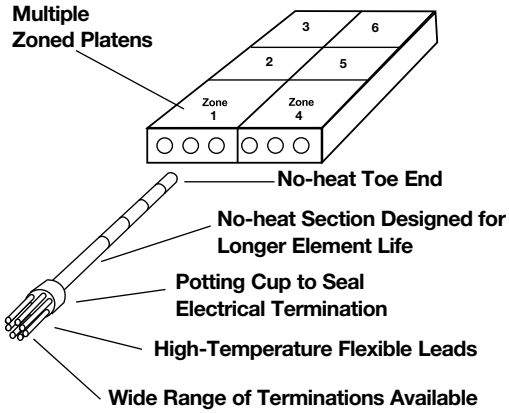
MULTICELL™ Heaters

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

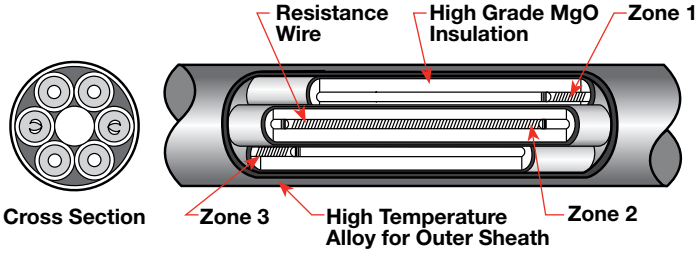
Oxidized sheath

- 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

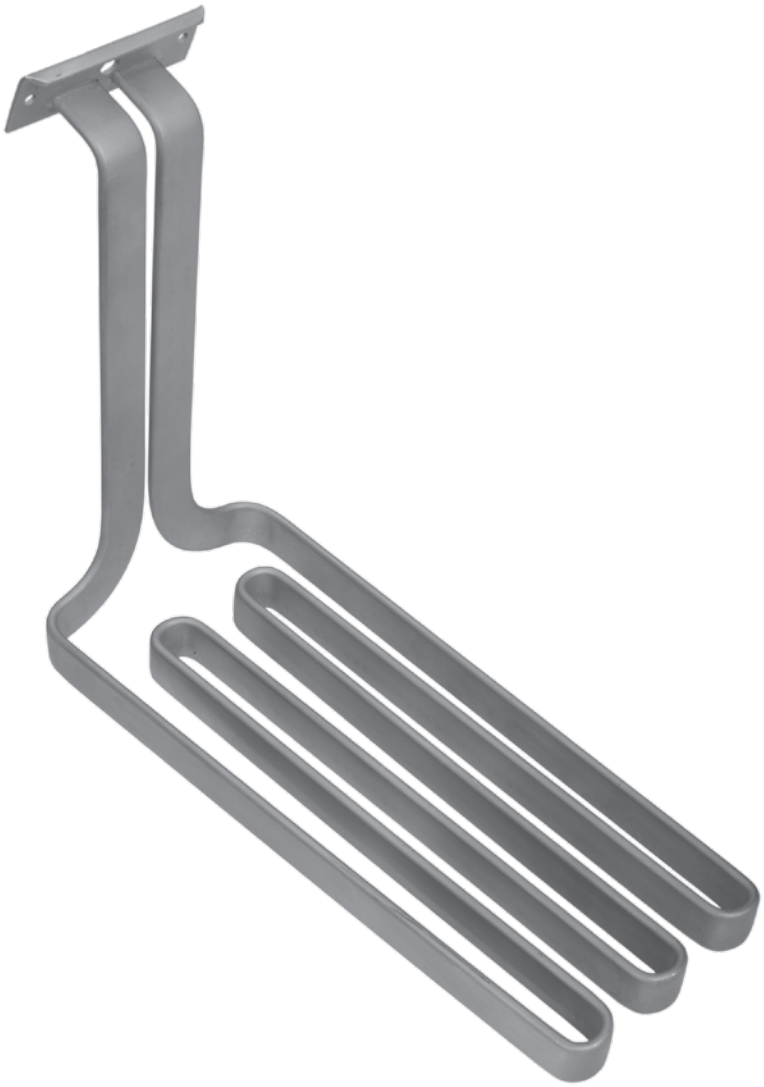


For detailed product and technical data, see the full MULTICELL product section located on pages 411 through 416.

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Tubular Heaters

Tubular Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
WATROD™ Single-Ended Double-Ended	Alloy 800/840	1600	870	45	6.9	57
	Stainless steel	1200	650	60	9.3	
	Steel	750	400	45	6.9	
	Alloy 600	1800	982	45	6.9	
High-Temperature	Alloy 600	1800	982	45	6.9	80
MULTICOIL™	Alloy 800	1400	760	45	6.9	82
	304 stainless steel	1200	650	45	6.9	
	316 stainless steel	1200	650	45	6.9	
FIREBAR® Single-Ended Double-Ended	Alloy 800/840	1400	760	60	9.3	84
	304 stainless steel	1200	650	60	9.3	
FINBAR™ Single-Ended	304 stainless steel	1200	650	50	7.7	103



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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.

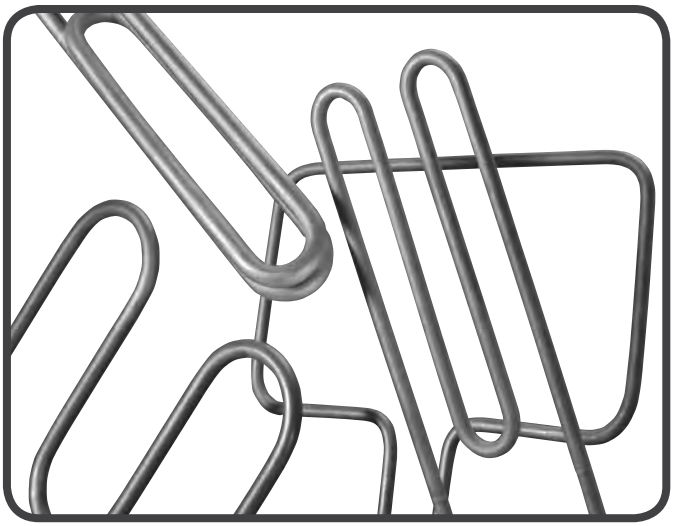
WATROD heating elements have a variety of mounting and termination options making them highly popular among industrial customers.

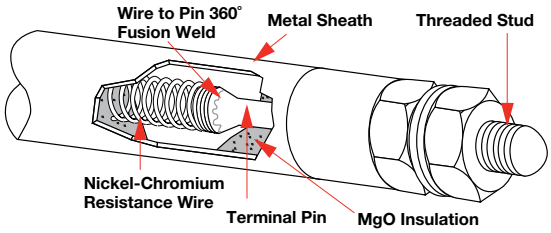
Single-Ended WATROD Performance Capabilities

- Watt densities up to 45 W/in^2 (6.9 W/cm^2)
- 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^2 (18.6 W/cm^2)
- 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

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WATROD Single/Double-Ended Heaters

Specifications

Double-Ended



Single-Ended



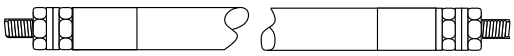
Applications	Direct immersion Hot runner mold (manifold) Forced air Ovens Radiant Clamp-on		Vacuums Semiconductor		Platens Forced air Deicing antennas Plastic wrap cutting Seal bars				
Watt Density W/in² (W/cm²)	Catalog P/N: Standard:		up to 60 up to 120	(9.3) (18.6)	Catalog P/N: Standard:		up to 20 up to 45	(3.1) (6.9)	
Element Diameters in. (mm) **and Surface Area per Linear** in² (cm²) Diameter Tolerance ± 0.005 in. (0.13 mm)	**Dia.** 0.210 0.260 0.315 0.375 0.430 0.475	**in²** 0.660 0.817 0.990 1.178 1.351 1.492	**Dia. (mm)** (5.33) (6.60) (8.00) (9.53) (10.92) (12.07)	**cm²** (4.26) (5.27) (6.38) (7.60) (8.72) (9.63)	**Dia.** 0.375 0.430 0.475	**in²** 1.178 1.351 1.492	**Dia. (mm)** (9.53) (10.92) (12.07)	**cm²** (7.600) (8.717) (9.626)	
Sheath Materials **Max. Operating** **Temperature**	Standard: 	Alloy 800/840 316 SS Steel 304 SS Alloy 600	1600°F 1200°F 750°F 1200°F 1800°F	(870°C) (650°C) (400°C) (650°C) (980°C)	Standard: 	Alloy 800/840 316 SS 304 SS	1200°F 1200°F 1200°F	(650°C) (650°C) (650°C)	
Sheath Length By Diameter in. (mm)	**Dia.** Standard: 0.210 0.260 0.315 0.375 0.430 0.475	**Sheath Length (in.)** 9 to 130 9 to 270 9 to 270 11 to 360 11 to 360 11 to 275	**Dia. (mm)** (5.33) (6.60) (8.00) (9.53) (10.92) (12.07)	**Sheath Length (mm)** (230 to 3300) (230 to 6858) (230 to 6858) (280 to 9144) (280 to 9144) (280 to 6985)	**Dia.** Standard: 0.375 0.430 0.475	**Sheath Length (in.)** 11 to 125 11 to 106 11 to 125	**Dia. (mm)** (9.53) (10.92) (12.07)	**Sheath Length (mm)** (280 to 3175) (280 to 2690) (280 to 3175)	
Min. No-Heat Length in. (mm)	**Sheath Length** 11 to 20 21 to 50 51 to 80 81 to 110 111 to 140 141 to 170 171 to 200 201 & up	**No-Heat Length** 1 1 1/4 1 1/2 1 5/8 1 3/4 2 2 1/4 2 1/2	**Sheath Length** (280 to 510) (535 to 1270) (1295 to 2030) (2055 to 2795) (2820 to 3555) (3580 to 4320) (4345 to 5080) (5105 & up)	**No-Heat Length** (25) (32) (38) (42) (44) (51) (57) (64)	**Sheath Length** 11 to 20 21 to 50 51 to 80 81 to 110 111 to 125	**No-Heat Length** 1 1/2 1 3/4 2 1/8 2 3/8 2 5/8	**Sheath Length** (280 to 5100) (533 to 1270) (1295 to 2030) (2055 to 2795) (2820 to 3175)	**No-Heat Length** (38) (44) (54) (60) (67)	**½ in. (13 mm) No-heat length on all blunt ends**
Max. Voltage/Amperage By Dia. in. (mm)	**Dia.** 0.260 (6.6) 0.315 (8.0) 0.375 (9.53) 0.430 (10.92) 0.475 (12.07)	**Volts** 250VAC 480VAC 480VAC 600VAC 600VAC	**Amperes** 15 30 30 40 40		**Dia.** 0.375 (9.53) 0.430 (10.92) 0.475 (12.07)	**Volts** 480VAC 480VAC 480VAC	**Ampere** 30 30 30		

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WATROD Single/Double-Ended Heaters

Specifications *(Continued)*

Double-Ended



Single-Ended



Ohms Per Heated Inch By Dia. in.	**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					
Terminations	Standard:	Threaded stud Screw lug (plate) Quick connect (spade) Flexible lead wires			Standard:	Flexible lead wires		
Seals	Standard:	Silicone resin	221°F	(105°C)	Standard:	Silicone resin	221°F	(105°C)
		Ceramic base	2800°F	(1535°C)		Silicone rubber (RTV)	500°F	(260°C)
		Ceramic-to-metal	482°F	(250°C)		Epoxy resin	194/356°F	(90/180°C)
		Silicone rubber (RTV)	392°F	(200°C)				
		Silicone resin	392°F	(200°C)				
		Epoxy resin	194/356°F	(90/180°C)				
Mounting Options	Threaded bulkheads Mounting brackets Locator washers				Threaded bulkhead Locator washers Single leg bracket			
Surface Finish Options	Oxide anneal Bright anneal Passivation				Oxide anneal Bright anneal Passivation			
Agency Recognition	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			

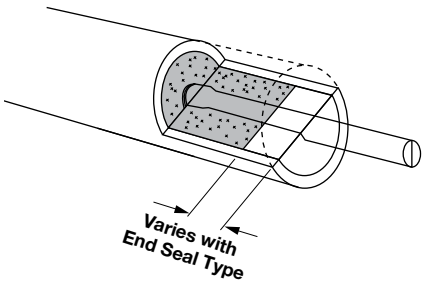
① Not applicable to 0.375 inch diameter single-ended WATROD.

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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.

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**.

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

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WATROD Single/Double-Ended Heaters

Terminations

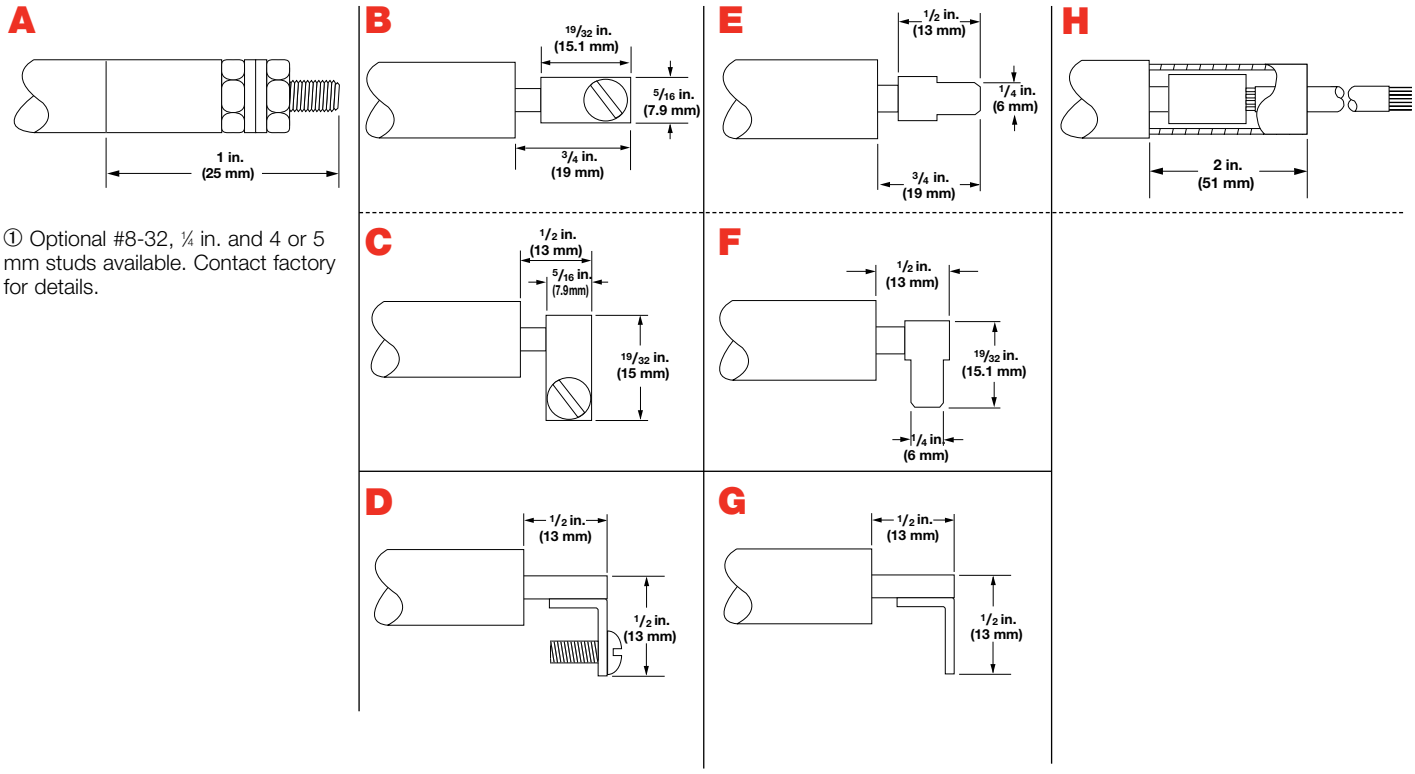
Double-ended WATROD elements are available with a variety of terminations. Single-ended WATROD elements are available with only flexible lead wires.

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

Threaded Stud | **Screw Lug (Plate)** | **Quick Connect (Spade)** | **Flexible Lead Wires**



① Optional #8-32, ¼ in. and 4 or 5 mm studs available. Contact factory for details.

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WATROD Single/Double-Ended Heaters

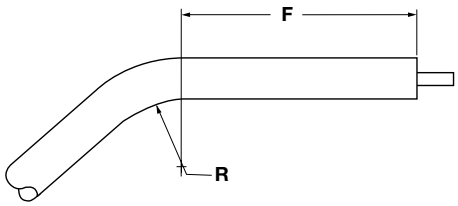
Bend Formations

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.



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

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.

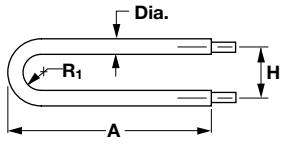
The four common bend configurations available for standard and made-to-order single-ended WATROD elements are Figures 1, 6, 22 and 28.

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

WATROD Minimum Radius							
Sheath Diameter in.	(mm)	Field Bend R① in.	(mm)	Factory R① in.	(mm)	F② 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)

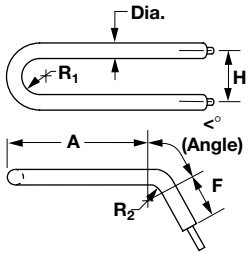
① R is the inside radius of a bend.
② F is the distance from the sheath's end to the start of the first bend.

Figure 1



$SL = 2A + 1.14R_1 - 0.43\ Dia.$

Figure 2



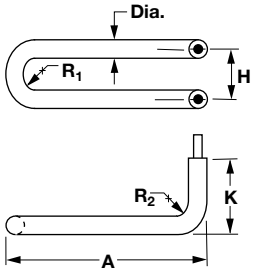
$SL = 2A + 2F + 1.14R_1 + 0.0175\ (<°)\ (2R_2 + Dia.) - 0.43\ Dia.$

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WATROD Single/Double-Ended Heaters

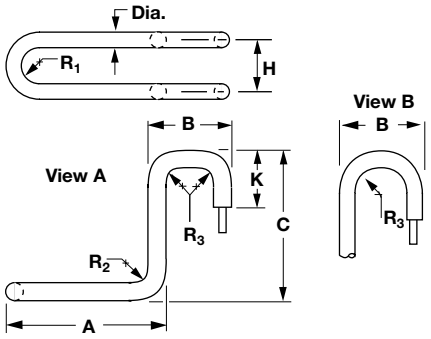
Bend Formations *(Continued)*

Figure 3



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

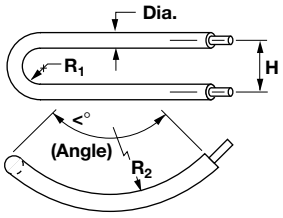
Figure 4



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

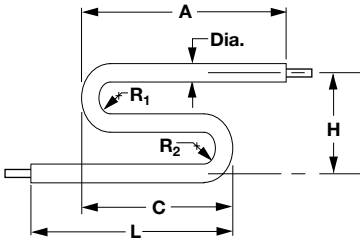
View B: $SL = 2K - 2.28R_3 - 3.72\ Dia. + 2C - 0.86R_2 + 2A + 1.14R_1$

Figure 5



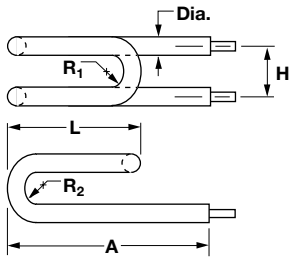
$SL = 0.0175(<^{\circ})(2R_2 + Dia.) + 1.14R_1 + 0.43\ Dia.$

Figure 6



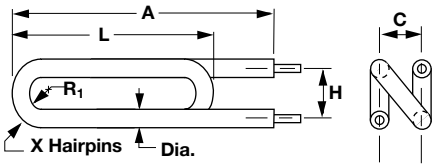
$SL = L + 1.14R_2 - 0.86\ Dia. + C + 1.14R_1 + A$

Figure 7



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

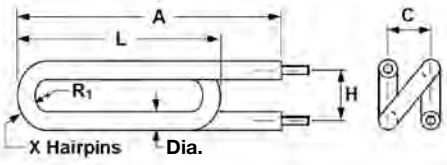
Figure 8



X = number of outside hairpins

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

Figure 8 Reverse

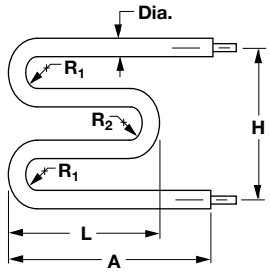


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WATROD Single/Double-Ended Heaters

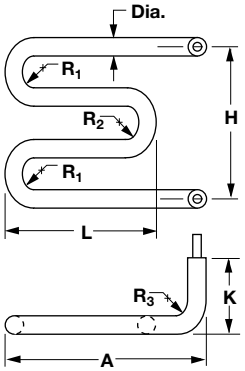
Bend Formations *(Continued)*

Figure 9



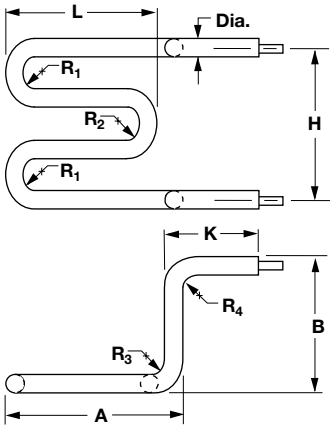
SL = 2A + 2.28R_1 - 1.29 Dia. + 2L + 1.14R_2

Figure 10



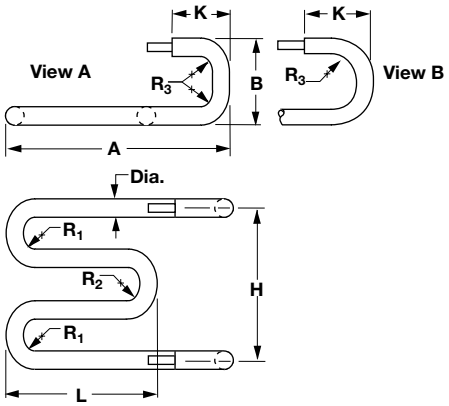
SL = 2K - 0.86R_3 - 3.72 Dia. + 2A + 2L
+ 2.28R_1 + 1.14R_2

Figure 11



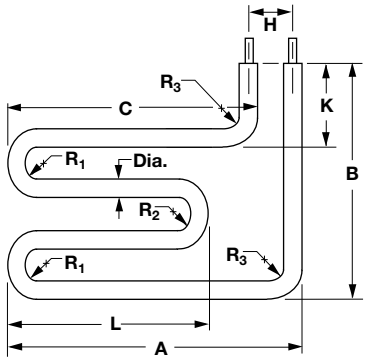
SL = 2K - 086R_3 - 0.86R_4 - 6.15 Dia. + 2B + 2A
+ 2L + 2.28R_1 + 1.14R_2

Figure 12



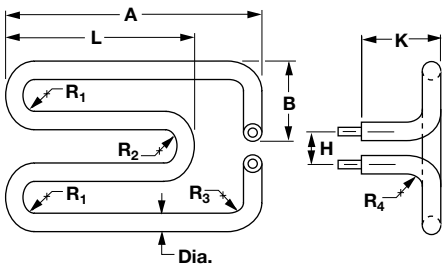
View A: SL = 2K + 2B + 2A + 2L + 2.28R_1
+ 1.14R_2 - 1.72R_3 - 6.15 Dia.
View B: SL = 2K + 2A + 2L + 2.28R_1+ 1.14R_2
- 2.28R_3 - 2.15 Dia.

Figure 13



SL = 2B + 2A + 2L - 6.717 Dia. - 1.717R_1
- H - 0.858R_2 - 0.858R_3

Figure 14



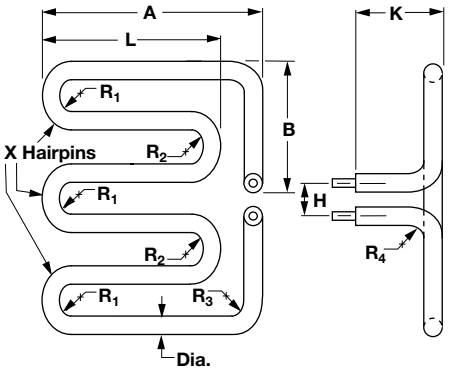
SL+2K+2A+2L+2.28R_1+1.14R_2+2B
-6.15 Dia. -0.86R_3+0.86R_4

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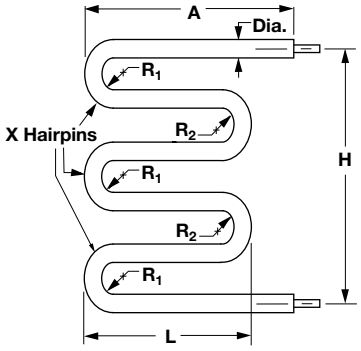
Bend Formations *(Continued)*

Figure 15



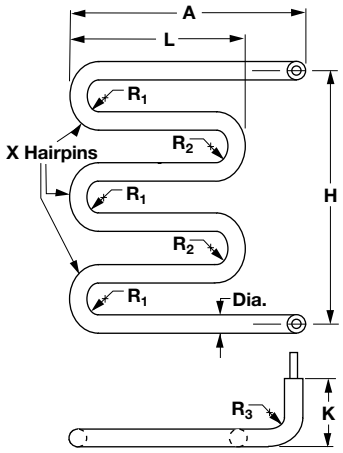
X = number of outside hairpins
SL = 2K + 2A + 2K(X - 1) + 2B - 0.86R_3 - 0.86R_4 + 1.14R_1 (X) + 1.14R_2 (X - 1) - 4.86 Dia. - (2X - 1) 0.43 Dia.

Figure 16



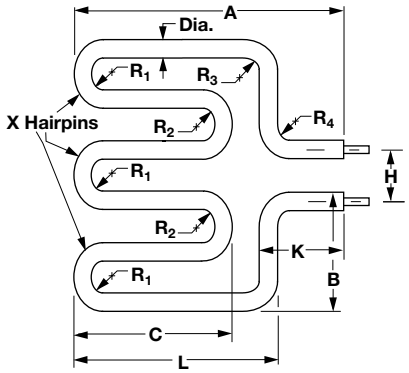
X = number of outside hairpins
SL = 2A + 0.43 Dia. (1 - 2X) + 2L (X - 1) + 1.14R_1 + 1.14R_2 (X - 1)

Figure 17



X = number of outside hairpins
SL = 1.14R_2 X - 0.88 Dia. X - 1.14R_2 - 2 Dia. + 1.14R_1 X -0.86R_3 + 2L X - 2L + 2A + 2K

Figure 18



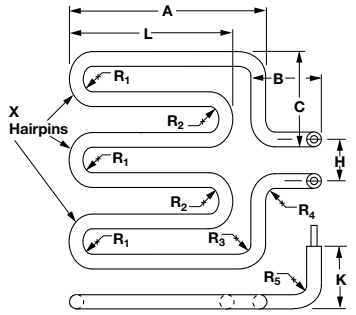
X = number of outside hairpins
SL = 2L + 2K + 2B + 2C (X - 1) - 0.86R_3 - 0.86R_4 - 4.86 Dia. + 1.14R_1 (X) + 1.14R_2 (X - 1) - (2X - 1) 0.43 Dia.

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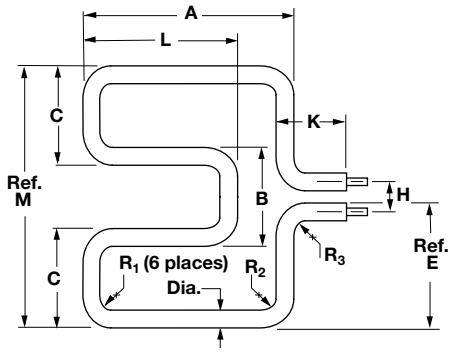
Bend Formations *(Continued)*

Figure 19



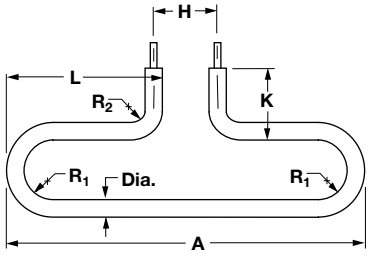
X = number of outside hairpins
SL = 2K + 2A + 2B + 2C + 2L (X - 1) + 1.14R_1 (X) + 1.14R_2 (X - 1) - 0.86R_3 - 0.86R_4 - 0.86R_5 - 7.29 Dia. - (2X - 1) 0.43 Dia.

Figure 20



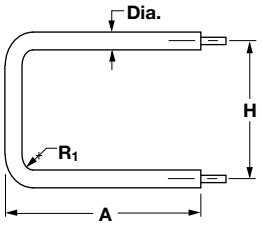
SL = 2K + 2C + B + 2A + 2L - 2.58R_1 - 0.86R_2 - 0.86R_3 - 12.15 Dia.

Figure 21



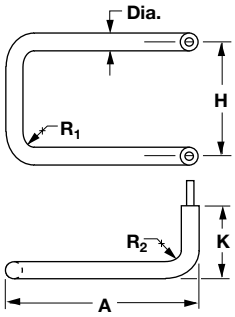
SL = 2A + 2K - H - 2.28R_1 - 0.86R_2 - 3.29 Dia.

Figure 22



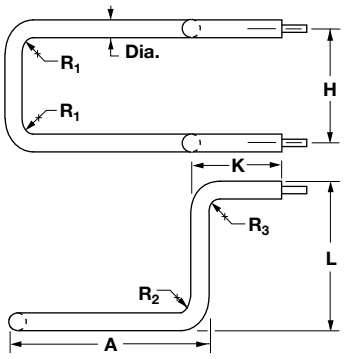
SL = 2A - 0.86R_1 - 1.43 Dia. + H

Figure 23



SL = 2K - 0.86R_2 - 3.86 Dia. + 2A - 0.86R_1 + H

Figure 24



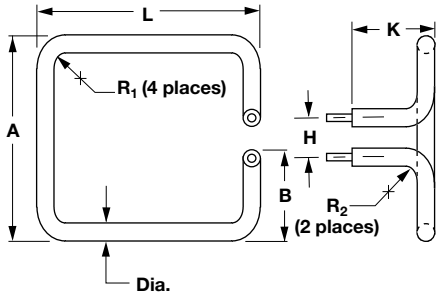
SL = 2K + 2L + H - 0.86R_1 - 0.86R_2 - 0.86R_3 - 7.29 Dia.

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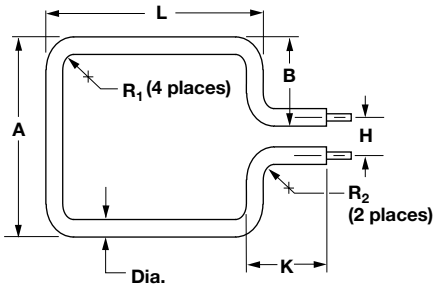
Bend Formations *(Continued)*

Figure 25



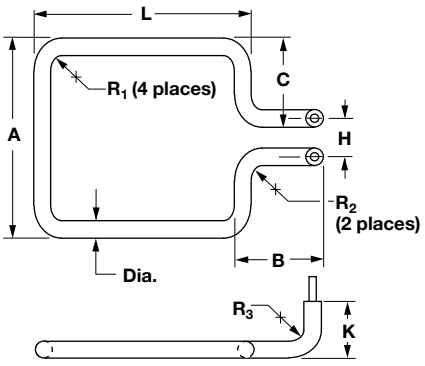
SL = 2K + 2A + 2L - H - 1.72R_1 - 0.86R_2 - 6.92 Dia.

Figure 26



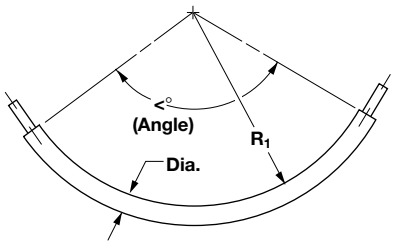
SL = 2K + 2A + 2L - H - 1.72R_1 - 0.86R_2 - 6.29 Dia.

Figure 27



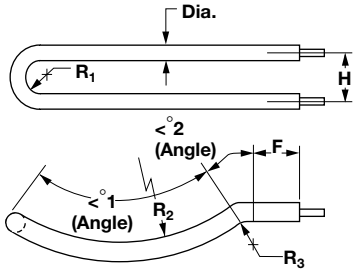
SL = 2K + 2A + 2L + 2B - H - 1.72R_1 - 1.72R_2 - 8.72 Dia.

Figure 28



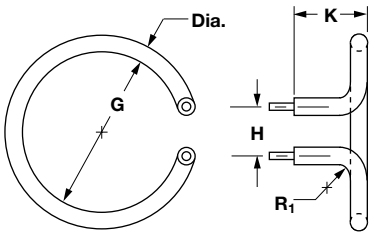
SL = 0.0175 <° (R_1 + 0.5 Dia.)

Figure 29



SL = 0.0175 <°1 (2R_2 + Dia.) + 2F + 1.14R_1 + 0.0175 <°2 (2R_3 + Dia.) - 0.43 Dia.

Figure 30



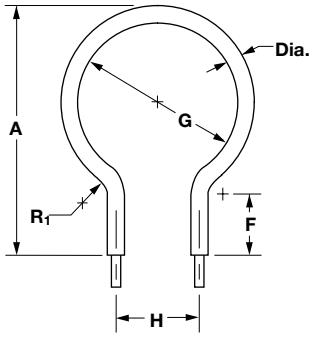
SL = (G + Dia.) 3.14 + 1.14R_1 + 2K + 3.28 Dia. - H

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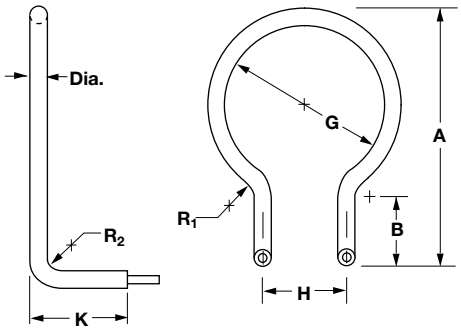
Bend Formations *(Continued)*

Figure 31



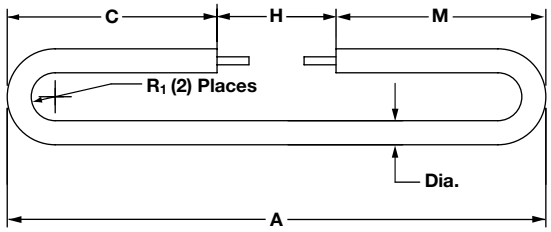
SL = (G + Dia.) 3.14 + 1.14R_1 + 2F
+ 3.71 Dia. - H

Figure 32



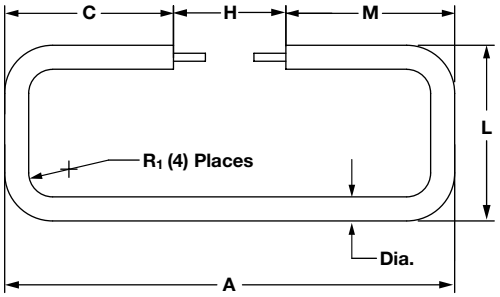
SL = (G + Dia.) 3.14 + 1.14R_1 + 2B + 1.14R_2 +
2K + 3.28 Dia. - H

Figure 37



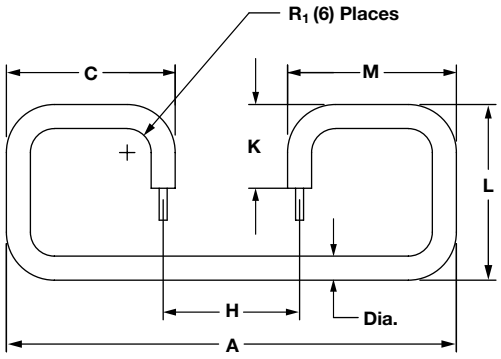
SL = (2A - H) + 2πR_1 - 2R_1

Figure 38



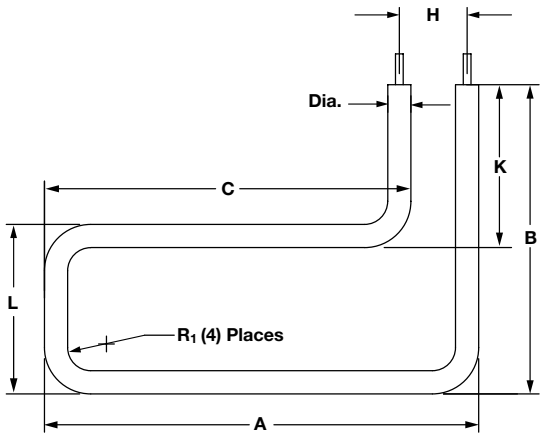
SL = (2A - H) + 2L + 2πR_1 - 4R_1

Figure 39



SL = (2A - H) + 2L + 2K + 3πR_1 - 6R_1

Figure 40



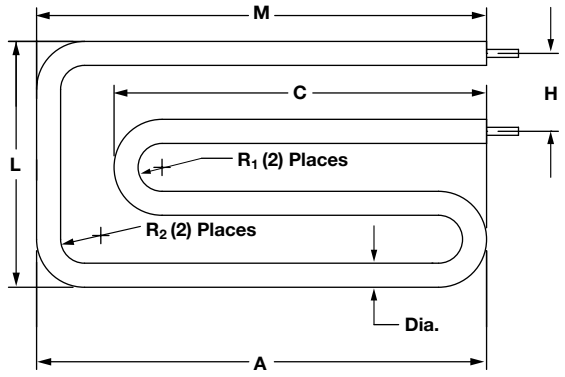
SL = (2A - H) + 2B + 2πR_1 - 4R_1

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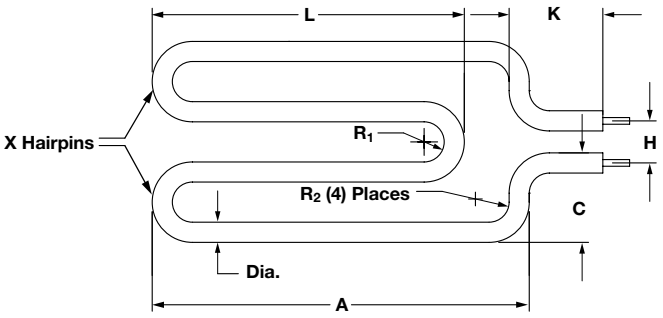
Bend Formations *(Continued)*

Figure 41



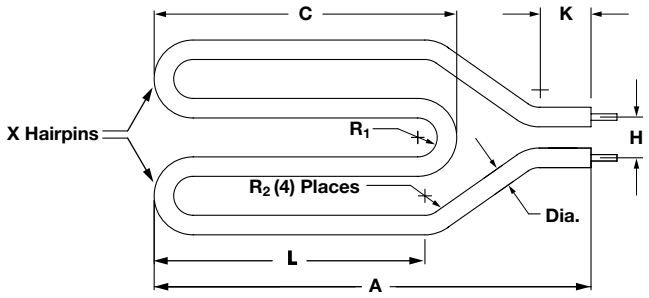
$SL = 2A + 2C + L - H + 2\pi R_1 + \pi R_2 - 2R_1 - 2R_2$

Figure 42



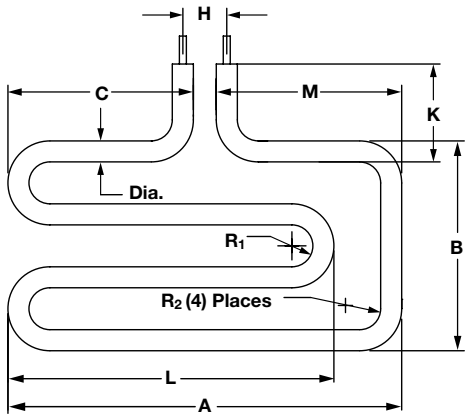
$SL = 2A + (\#)L + 2K + 2C + 2\pi R_2 + (\#\text{ of } R_1)\ \pi R_1 - (\#\text{ of } R_1)\ R_1$

Figure 43



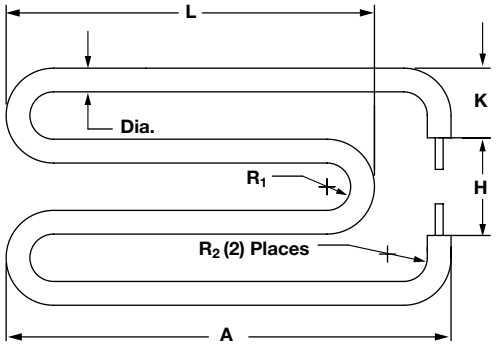
$SL = 2A + (\#)C + (\#\text{ of } R_1)\ \pi + 2\pi R_2 - (\#\text{ of } R_1)\ R_1 - 4R_2$

Figure 44



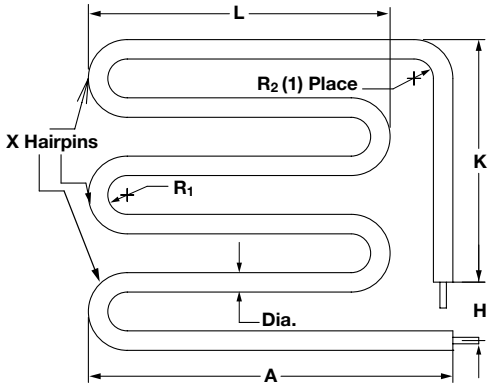
$SL = 2A + 2L + B + 2K + 2\pi R_2 + 3\pi R_1 - 4R_2 - 3R_1$

Figure 45



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

Figure 46



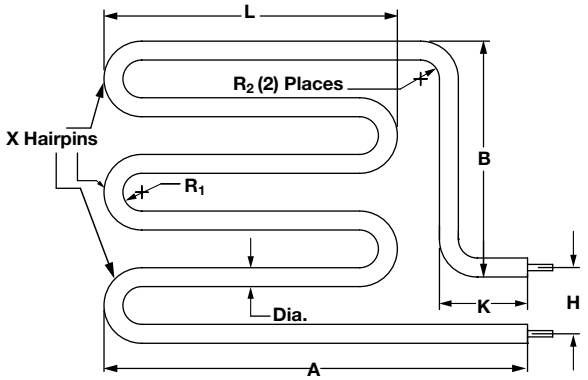
$SL = 2A + (\#)L + K + (\#\text{ of } R_1)\ \pi + \frac{\pi R_2}{2} - (\#\text{ of} R_1)\ R_1 - R_2$

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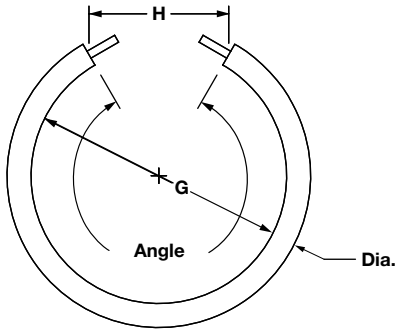
Bend Formations *(Continued)*

Figure 47



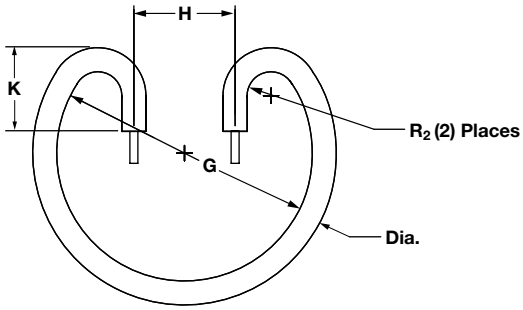
SL = 2A + (#)L + B + K + (# of R_1) π + πR_2 - (# of R_1) R_1- 2R_2

Figure 48



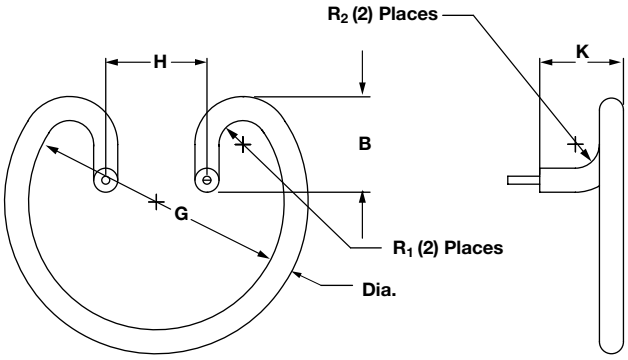
SL = πG - H

Figure 49



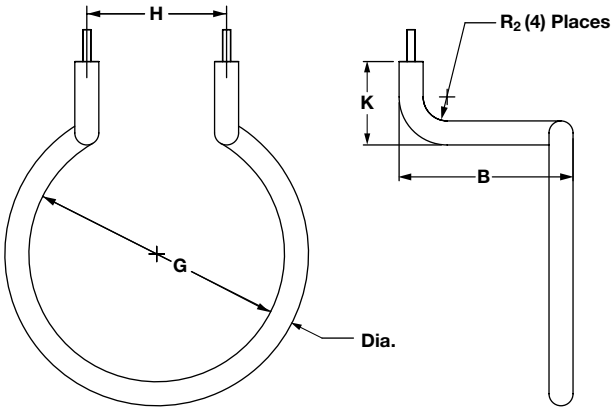
SL = πG - H + 2K + 2πR_2 - 2R_2

Figure 50



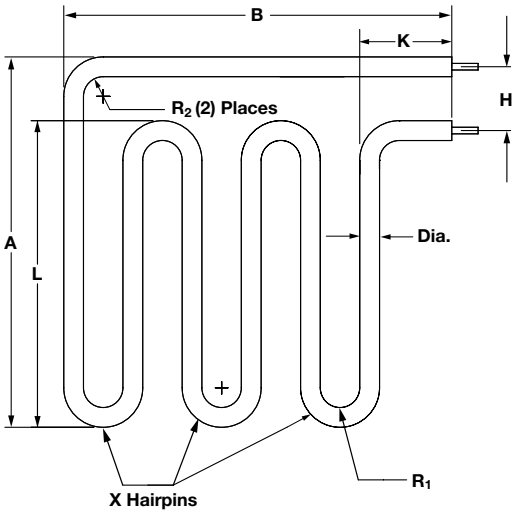
SL = πG - H + 2B + 2K + πR_2 + 2πR_1 - 2R_1- 2R_2

Figure 51



SL = πG - H + 2B + 2K + 2πR_2 - 4R_2

Figure 52



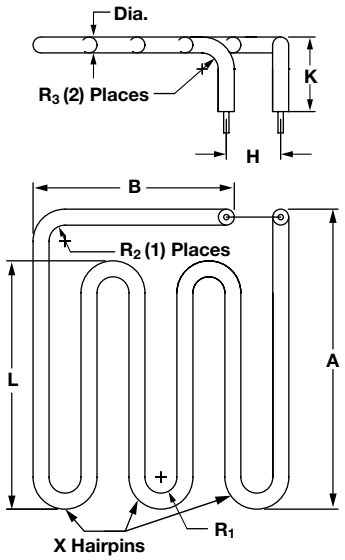
SL = 2A + B + (#)L - H + (# of R_1) π + πR_2 - (# of R_1) R_1- 2R_2

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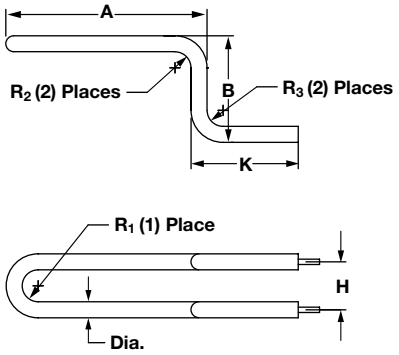
Bend Formations *(Continued)*

Figure 53



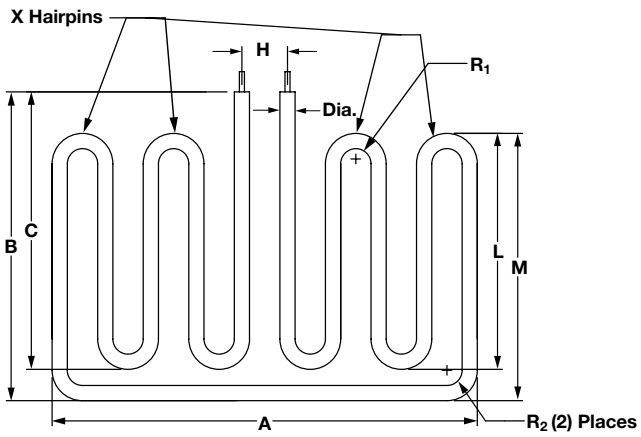
$SL = 2A + (\#)L + B + 2K + (\#\text{ of } R_1)\,\pi + 2\,\frac{(\pi R_3)}{2} - (\#\text{ of } R_1)\,R_1 - 2R_3 - R_2$

Figure 54



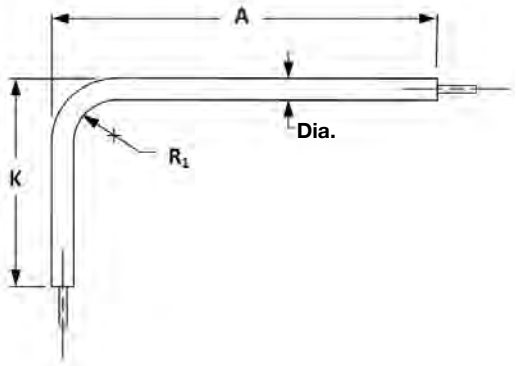
$SL = 2A + 2B + 2K + \pi R_1 + 2\pi R_2 - R_1 - 4R_2$

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



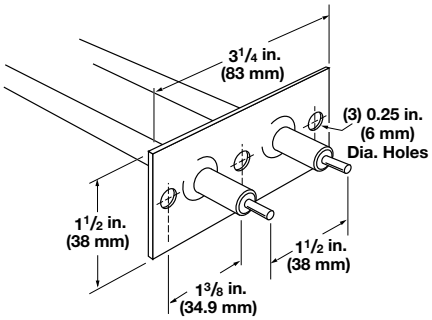
$SL = A + K - 0.86R_1$

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Mounting Methods

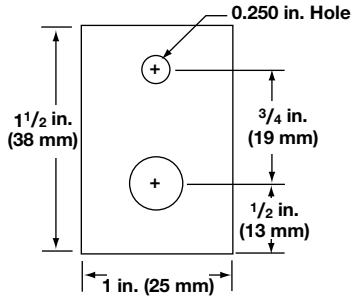
Brackets



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**.

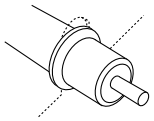
Single Leg Bracket



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**.

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.

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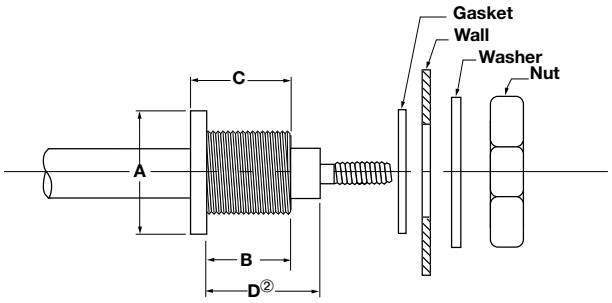
WATROD Single/Double-Ended Heaters

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 in.	Element Diameter (mm)	Material	Thread Size	A ① Flange Size/Style in.	A ① Flange Size/Style (mm)	B Threaded Length in.	B Threaded Length (mm)	C Overall Length in.	C Overall Length (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.

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EXTENDED CAPABILITY

WATROD Single/Double-Ended Heaters

Extended Capabilities/Options

Zoned Heaters

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

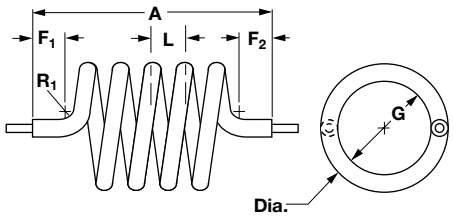
Features and Benefits

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

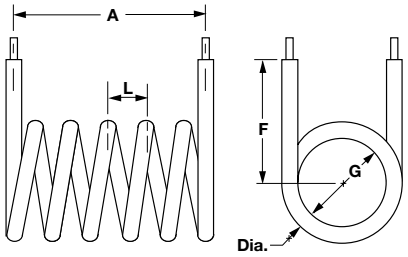
Extended Capabilities/Bend Formations

Figure 33



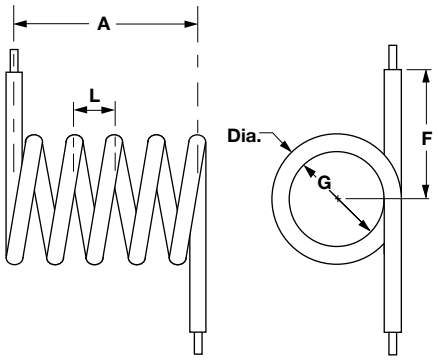
SL = [(G + Dia.) (3.14) (Number of 360°'s)] + F1 + F2

Figure 34



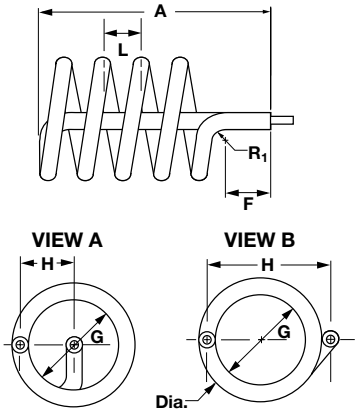
SL = [(G + Dia.) (3.14) (Number of 360°'s)] + 2F

Figure 35



SL = [(G + Dia.) (3.14) (Number of 360°'s)] + 2F

Figure 36

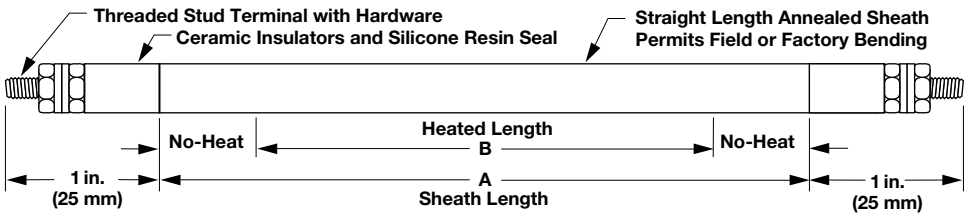


SL = [(G + Dia.) (3.14) (Number of 360°'s)] + (G ÷ 2) + A + F

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WATROD Single/Double-Ended Heaters

Double-Ended WATROD



WATROD Description	Sheath A Dimension in.	Sheath A Dimension (mm)	Heated B Dimension in.	Heated B Dimension (mm)	Watts	Part Number 120VAC	Part Number 240VAC	Part Number 480VAC	Est. Net Wt. lbs	Est. Net Wt. (kg)
Applications: Medium-Weight, Non-Circulating Oil, Heat-Transfer Oil										
15 W/in² 0.475 in. Dia. Steel (2.3 W/cm²) (12 mm)	29 7/8	(758.8)	22 3/8	(568.4)	500		**RGSS29R10S**		1.0	(0.5)
	38 3/8	(974.7)	29 7/8	(758.8)	667		**RGSS38G10S**	**RGSS38G11S**	1.3	(0.6)
	44 3/4	(1137.0)	37 1/4	(946.0)	833		**RGSS44G10S**	**RGSS44G11S**	1.7	(0.8)
	53 3/8	(1355.7)	44 3/4	(1137.0)	1000		**RGSS53G10S**	**RGSS53G11S**	1.9	(0.9)
	68 3/8	(1736.7)	59 5/8	(1514.4)	1333		**RGSS68G10S**	**RGSS68G11S**	2.1	(1.0)
	83 3/8	(2117.7)	74 1/2	(1892.0)	1667		**RGSS83G10S**	**RGSS83G11S**	2.5	(1.1)
	98 3/8	(2498.7)	89 1/2	(2273.0)	2000		**RGSS98G10S**	**RGSS98G11S**	3.0	(1.4)
	120 3/8	(3057.5)	111 7/8	(2841.6)	2500		**RGSS120G10S**	**RGSS120G11S**	3.9	(1.8)
	142 7/8	(3629.1)	134 1/4	(3410.0)	3000		**RGSS142R10S**	**RGSS142R11S**	4.1	(1.9)
Application: Air Heating										
20 W/in² 0.430 in. Dia. Alloy 840 (3.1 W/cm²) (10.9 mm)	48 3/4	(1238.0)	38 3/4	(984.0)	1000		**RCN48N10S**	**RCN48N11S**	1.0	(0.5)
	58 3/4	(1492.0)	48 3/4	(1238.0)	1250		**RCN58N10S**	**RCN58N11S**	1.1	(0.5)
	73 3/4	(1873.0)	63 3/4	(1619.0)	1667			**RCN73N11S**	1.4	(0.7)
	91 3/4	(2330.0)	81 3/4	(2076.0)	2083			**RCN91N11S**	1.7	(0.8)
Applications: Caustic Solutions, Air Heating										
23 W/in² 0.315 in. Dia. Alloy 800 (3.6 W/cm²) (8 mm)	29	(737.0)	22	(559.0)	500	**RBN291S**			0.4	(0.2)
	40	(1016.0)	33	(839.0)	750	**RBN401S**			0.5	(0.3)
	51	(1296.0)	44	(1118.0)	1000	**RBN511S**			0.7	(0.4)
23 W/in² 0.475 in. Dia. Alloy 800 (3.6 W/cm²) (12 mm)	39	(991.0)	27	(686.0)	1000	**RGNA391S**	**RGNA3910S**	**RGNA3911S**	1.2	(0.6)
	54	(1372.0)	42	(1067.0)	1500		**RGNA5410S**	**RGNA5411S**	1.6	(0.8)
	69	(1753.0)	57	(1448.0)	2000		**RGNA6910S**	**RGNA6911S**	2.1	(1.0)
	84	(2134.0)	72	(1829.0)	2500		**RGNA8410S**	**RGNA8411S**	2.5	(1.2)
	99	(2515.0)	87	(2210.0)	3000		**RGNA9910S**	**RGNA9911S**	3.0	(1.4)
	106	(2692.0)	94	(2388.0)	2778			**RGNA10611S**	3.2	(1.5)
	132	(3353.0)	120	(3048.0)	4167		**RGNA13210S**	**RGNA13211S**	4.0	(1.8)
	157	(3988.0)	145	(3683.0)	5000		**RGNA15710S**	**RGNA15711S**	4.7	(2.2)
Applications: Light Oils, Greases, Heat-Transfer Oils										
23 W/in² 0.315 in. Dia. Steel (3.6 W/cm²) (8 mm)	16	(406.0)	12	(305.0)	250	**RBS161S**	**RBS1610S**		0.2	(0.1)
	18	(457.0)	14	(356.0)	250	**RBS181S**			0.3	(0.2)
	21	(533.0)	17	(432.0)	350	**RBS211S**	**RBS2110S**		0.3	(0.2)
	23 3/8	(593.7)	19 3/8	(492.1)	375	**RBS23G1S**			0.3	(0.2)
	28 7/8	(733.4)	24 7/8	(631.8)	500	**RBS28R1S**			0.4	(0.2)
	29	(737.0)	24	(610.0)	500	**RBS291S**	**RBS2910S**		0.4	(0.2)
	42	(1067.0)	37	(940.0)	750	**RBS421S**	**RBS4210S**		0.6	(0.3)
	54	(1372.0)	49	(1245.0)	1000	**RBS541S**	**RBS5410S**		0.7	(0.4)
	77	(1956.0)	72	(1829.0)	1500	**RBS771S**	**RBS7710S**		1.0	(0.5)

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WATROD Single/Double-Ended Heaters

Double-Ended WATROD (Continued)

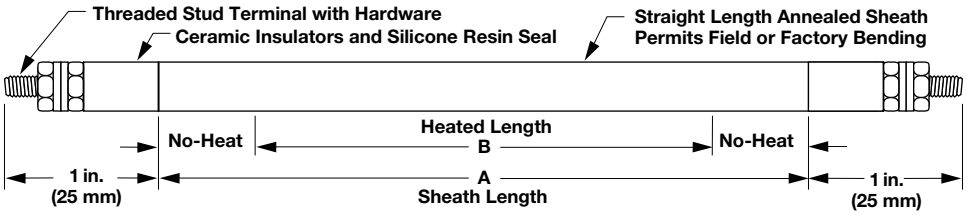
WATROD Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number			Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	480VAC	lbs	(kg)
Applications: Light Oils, Greases, Heat-Transfer Oils										
23 W/in²	23	(584)	14	(356)	500	**RGS231S**	**RGS2310S**		0.7	(0.4)
0.475 in. Dia.	31	(787)	22	(559)	750	**RGS311S**	**RGS3110S**		1.0	(0.5)
Steel	39	(991)	27	(686)	1000	**RGS391S**	**RGS3910S**	**RGS3911S**	1.2	(0.6)
(3.6 W/cm²)	45	(1143)	36	(914)	1250	**RGS451S**	**RGS4510S**		1.4	(0.7)
(12 mm)	54	(1372)	42	(1067)	1500	**RGS541S**	**RGS5410S**	**RGS5411S**	1.6	(0.8)
	69	(1753)	57	(1448)	2000	**RGS691S**	**RGS6910S**	**RGS6911S**	2.1	(1.0)
	84	(2134)	72	(1829)	2500	**RGS841S**	**RGS8410S**	**RGS8411S**	2.5	(1.2)
	99	(2515)	87	(2210)	3000		**RGS9910S**	**RGS9911S**	3.0	(1.4)
	106	(2692)	90	(2286)	2778			**RGS10611S**	3.2	(1.5)
	132	(3353)	120	(3048)	4167		**RGS13210S**	**RGS13211S**	4.0	(1.8)
	144	(3658)	128	(3251)	3889			**RGS14411S**	4.3	(2.0)
	157	(3988)	145	(3683)	5000		**RGS15710S**	**RGS15711S**	4.7	(2.2)
Application: Air Heating										
30 W/in²	20	(508)	15	(381)	400		**RAN2010S**		0.2	(0.1)
0.260 in. Dia.	25	(635)	20	(508)	500		**RAN2510S**		0.3	(0.2)
Alloy 840	30	(762)	25	(635)	600		**RAN3010S**		0.3	(0.2)
(4.7 W/cm²)	35	(889)	30	(762)	800		**RAN3510S**		0.4	(0.2)
(6.6 mm)	40	(1016)	35	(889)	900		**RAN4010S**		0.4	(0.2)
	45	(1143)	40	(1016)	1000		**RAN4510S**		0.5	(0.3)
	50	(1270)	45	(1143)	1200		**RAN5010S**		0.5	(0.3)
	55	(1397)	50	(1270)	1200		**RAN5510S**		0.6	(0.3)
	60	(1524)	55	(1397)	1400		**RAN6010S**		0.6	(0.3)
	65	(1651)	60	(1524)	1600		**RAN6510S**		0.7	(0.4)
	70	(1778)	65	(1651)	1800		**RAN7010S**		0.7	(0.4)
	75	(1905)	70	(1778)	1800		**RAN7510S**		0.8	(0.4)
	80	(2032)	75	(1905)	2000		**RAN8010S**		0.8	(0.4)
30 W/in²	15	(381)	10	(254)	300		**RBN1510S**		0.2	(0.1)
0.315 in. Dia.	20	(508)	15	(381)	400		**RBN2010S**		0.3	(0.2)
Alloy 840	25	(635)	20	(508)	600		**RBN2510S**		0.4	(0.2)
(4.7 W/cm²)	30	(762)	25	(635)	800		**RBN3010S**		0.4	(0.2)
(8 mm)	35	(889)	30	(762)	900		**RBN3510S**		0.5	(0.3)
	40	(1016)	35	(889)	1000		**RBN4010S**		0.5	(0.3)
	45	(1143)	40	(1016)	1200		**RBN4510S**		0.6	(0.3)
	50	(1270)	45	(1143)	1400		**RBN5010S**		0.7	(0.4)
	55	(1397)	50	(1270)	1600		**RBN5510S**		0.7	(0.4)
	60	(1524)	55	(1397)	1800		**RBN6010S**		0.8	(0.4)
	65	(1651)	60	(1524)	1800		**RBN6510S**		0.8	(0.4)
	70	(1778)	65	(1651)	2000		**RBN7010S**		0.9	(0.5)
	75	(1905)	70	(1778)	2200		**RBN7510S**		1.0	(0.5)
	80	(2032)	75	(1905)	2400		**RBN8010S**		1.0	(0.5)
	90	(2286)	85	(2159)	2600		**RBN9010S**		1.2	(0.6)
	100	(2540)	95	(2413)	3000		**RBN10010S**		1.3	(0.6)

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WATROD Single/Double-Ended Heaters

Double-Ended WATROD (Continued)



WATROD Description	Sheath A Dimension in.	Sheath A Dimension (mm)	Heated B Dimension in.	Heated B Dimension (mm)	Watts	Part Number 120VAC	Part Number 240VAC	Part Number 480VAC	Est. Net Wt. lbs	Est. Net Wt. (kg)
Application: Air Heating										
30 W/in² 0.430 in. Dia. Alloy 840 (4.7 W/cm²) (10.9 mm)	15	(381.0)	10	(254.0)	400		**RCN1510S**		0.3	(0.2)
	20	(508.0)	15	(381.0)	600		**RCN2010S**		0.4	(0.2)
	25	(635.0)	20	(508.0)	800		**RCN2510S**		0.5	(0.3)
	30	(762.0)	25	(635.0)	1000		**RCN3010S**		0.6	(0.3)
	35	(889.0)	30	(762.0)	1200		**RCN3510S**		0.7	(0.4)
	40	(1016.0)	35	(889.0)	1400		**RCN4010S**		0.8	(0.4)
	48 3/4	(1238.0)	38 3/4	(984.0)	1500		**RCNX48N10S**	**RCNX48N11S**	1.0	(0.5)
	45	(1143.0)	40	(1016.0)	1600		**RCN4510S**		0.9	(0.5)
	50	(1270.0)	45	(1143.0)	1800		**RCN5010S**		1.0	(0.5)
	58 3/4	(1492.0)	48 3/4	(1238.0)	1917		**RCNX58N10S**	**RCNX58N11S**	1.1	(0.5)
	55	(1397.0)	50	(1270.0)	2000		**RCN5510S**		1.0	(0.5)
	60	(1524.0)	55	(1397.0)	2200		**RCN6010S**		1.1	(0.5)
	65	(1651.0)	60	(1524.0)	2400		**RCN6510S**		1.2	(0.6)
	73 3/4	(1873.0)	63 3/4	(1619.0)	2500			**RCNX73N11S**	1.4	(0.7)
	70	(1778.0)	65	(1651.0)	2600		**RCN7010S**		1.3	(0.6)
	75	(1905.0)	70	(1778.0)	2800		**RCN7510S**		1.4	(0.7)
	80	(2032.0)	75	(1905.0)	3000		**RCN8010S**		1.5	(0.7)
	91 3/4	(2331.0)	81 3/4	(2077.0)	3167			**RCNX91N11S**	1.7	(0.8)
	90	(2286.0)	85	(2159.0)	3500		**RCN9010S**		1.7	(0.8)
	100	(2540.0)	95	(2413.0)	4000		**RCN10010S**		1.9	(0.9)
	110	(2794.0)	105	(2667.0)	4500		**RCN11010S**		2.1	(1.0)
	120	(3048.0)	115	(2921.0)	5000		**RCN12010S**		2.3	(1.1)
Application: Radiant Heating										
40 W/in² 0.375 in. Dia. Alloy 800 (6.2 W/cm²) (9.5 mm)	10 1/4	(260.0)	7 1/4	(184.0)	400	**RDN10E1S**			0.2	(0.1)
	16 5/8	(422.1)	13 5/8	(346.1)	650	**RDN16L1S**			0.3	(0.2)
	21 1/16	(535.0)	16 13/16	(427.0)	800	**RDN21B1S**	**RDN21B10S**		0.4	(0.2)
	27 1/8	(689.0)	22 7/8	(581.0)	1100	**RDN27C1S**	**RDN27C10S**		0.5	(0.3)
	32 1/8	(816.0)	27 7/8	(708.0)	1300		**RDN32C10S**	**RDN32C11S**	0.6	(0.3)
	42 7/8	(1089.0)	38 5/8	(981.1)	1800		**RDN42R10S**	**RDN42R11S**	0.8	(0.4)
	57 1/2	(1461.0)	53 1/4	(1353.0)	2500		**RDN57J10S**	**RDN57J11S**	1.1	(0.5)
	69 1/4	(1759.0)	65	(1651.0)	3000		**RDN69E10S**	**RDN69E11S**	1.3	(0.6)
	81 1/4	(2064.0)	77	(1956.0)	3600		**RDN81E10S**	**RDN81E11S**	1.6	(0.8)
	109 1/4	(2775.0)	105	(2667.0)	4000		**RDN109E10S**		2.1	(1.0)
	134 1/2	(3416.0)	127 3/4	(3245.0)	5000		**RDN134J10S**		2.6	(1.2)
	153 3/8	(3895.7)	145 7/8	(3705.2)	5500		**RDN153R10S**		2.9	(1.4)
	179 1/4	(4553.0)	171 1/4	(4350.0)	6500		**RDN179E10S**		3.4	(1.6)

CONTINUED

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WATROD Single/Double-Ended Heaters

Double-Ended WATROD *(Continued)*

Special 208VAC and 277VAC Voltages

WATROD Description	Sheath A Dimension in.	Sheath A Dimension (mm)	Heated B Dimension in.	Heated B Dimension (mm)	Watts	Part Number 208VAC	Part Number 277VAC	Est. Net Wt. lbs	Est. Net Wt. (kg)
Application: Radiant Heating									
40 W/in²	21 1/16	(535)	16 13/16	(427)	800	**RDN21B2S**	**RDN21B4S**	0.4	(0.2)
0.375 in. Dia.	27 1/8	(689)	22 7/8	(581)	1100	**RDN27C2S**	**RDN27C4S**	0.5	(0.3)
Alloy 800	42 7/8	(1089)	38 5/8	(981)	1800	**RDN42R2S**	**RDN42R4S**	0.8	(0.4)
(6.2 W/cm²)	57 1/2	(1461)	53 1/4	(1353)	2500	**RDN57J2S**	**RDN57J4S**	1.1	(0.5)
(9.5 mm)	69 1/4	(1759)	65	(1651)	3000	**RDN69E2S**	**RDN69E4S**	1.3	(0.6)
	81 1/4	(2064)	77	(1956)	3600	**RDN81E2S**	**RDN81E4S**	1.6	(0.8)

WATROD Description	Sheath A Dimension in.	Sheath A Dimension (mm)	Heated B Dimension in.	Heated B Dimension (mm)	Watts	Part Number 120VAC	Part Number 240VAC	Part Number 480VAC	Est. Net Wt. lbs	Est. Net Wt. (kg)
Application: Process Water										
48 W/in²	23	(584)	14	(356)	1000	**RGN231S**	**RGN2310S**	**RGN2311S**	0.7	(0.4)
0.475 in. Dia.	30	(762)	21	(533)	1500	**RGN301S**	**RGN3010S**	**RGN3011S**	0.9	(0.5)
Alloy 800	39	(991)	27	(686)	2000	**RGN391S**	**RGN3910S**	**RGN3911S**	1.2	(0.6)
(7.4 W/cm²)	44	(1118)	35	(889)	2500	**RGN441S**	**RGN4410S**	**RGN4411S**	1.3	(0.6)
(12 mm)	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/in²	35	(889)	25	(635)	1500		**RBR3510S**		0.2	(0.1)
0.315 in. Dia.	44	(1118)	34	(864)	2000		**RBR4410S**		0.3	(0.2)
316 SS	52	(1321)	42	(1067)	2500		**RBR5210S**		0.3	(0.2)
(9.3 W/cm²)	60	(1524)	50	(1270)	3000		**RBR6010S**		0.4	(0.2)
(8 mm)	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/in²	20	(508)	11	(279)	1000	**RGR201S**	**RGR2010S**	**RGR2011S**	0.6	(0.3)
0.475 in. Dia.	26	(660)	17	(432)	1500	**RGR261S**	**RGR2610S**	**RGR2611S**	0.8	(0.4)
316 SS	34	(864)	22	(559)	2000		**RGR3410S**	**RGR3411S**	1.0	(0.5)
(9.3 W/cm²)	40	(1016)	28	(711)	2500		**RGR4010S**	**RGR4011S**	1.2	(0.6)
(12 mm)	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)

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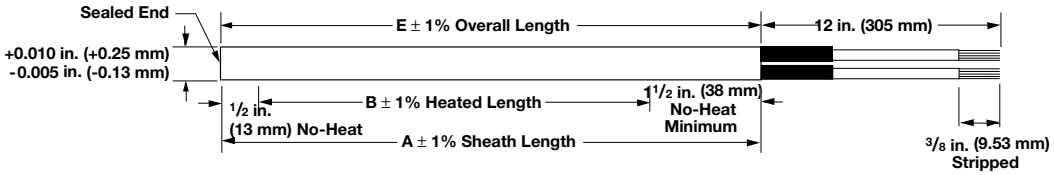
WATROD Single/Double-Ended Heaters

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.



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EXTENDED CAPABILITY

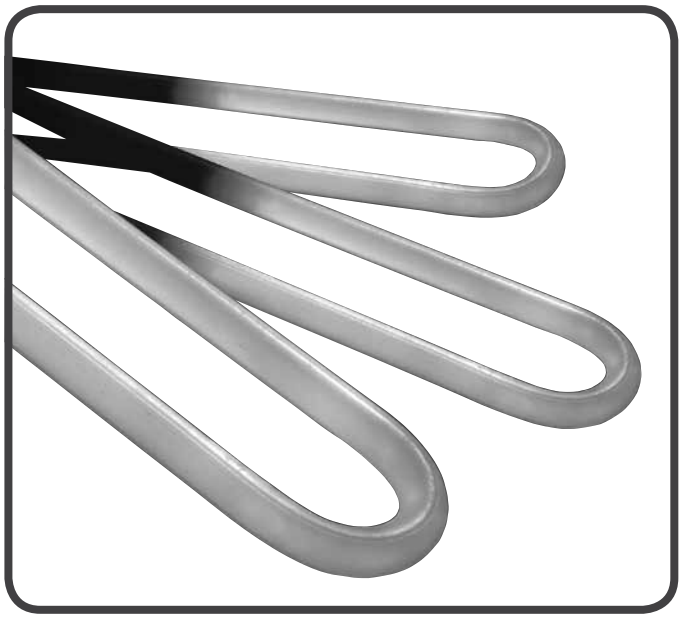
WATROD Double-Ended Heaters

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

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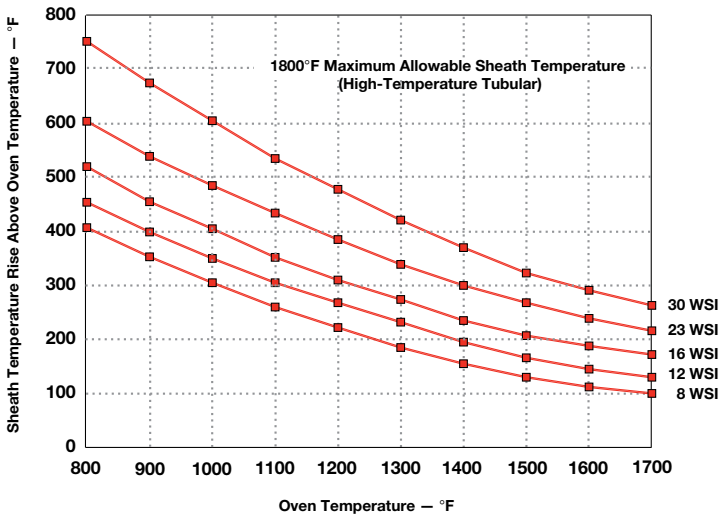
EXTENDED CAPABILITY

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.

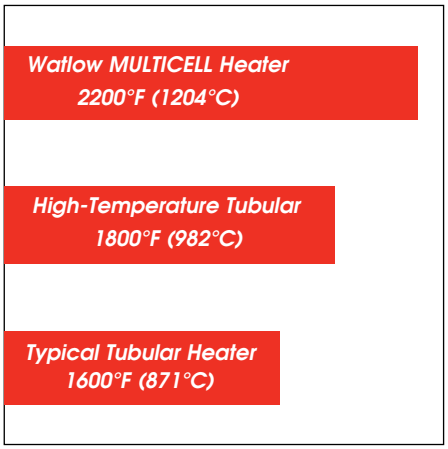


Heater Life Estimate Service

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.

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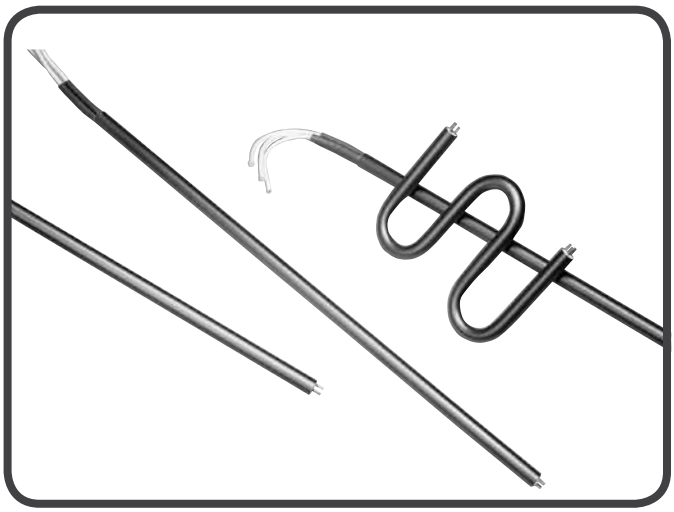
EXTENDED CAPABILITY

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^2 (9.3 W/cm^2)
- 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

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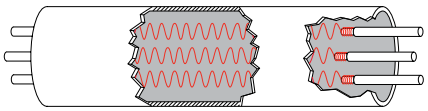
EXTENDED CAPABILITY

WATROD Single/Double-Ended Heaters

Extended Capabilities for MULTICOIL Tubular Heaters

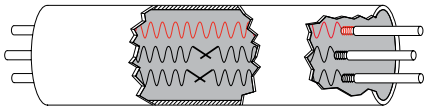
Options

Option A



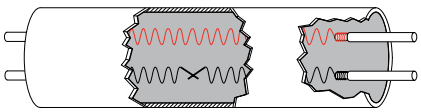
3-phase tubular, 0.475 inch diameter.

Option C



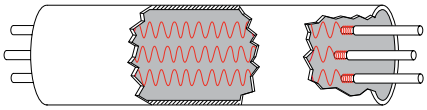
1-phase tubular with one resistance wire and two thermocouples, 0.475 inch diameter.

Option D



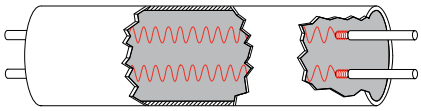
1-phase tubular with one resistance coil and one thermocouple, 0.375, 0.430 and 0.475 inch diameter.

Option E



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

Option F



1-phase tubular with two resistance coils, 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.

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FIREBAR® Single/Double-Ended Heaters

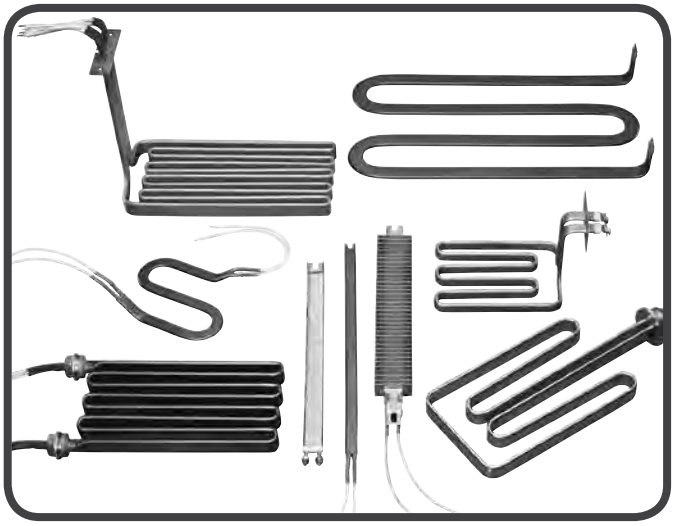
FIREBAR® heating elements provide added heating performance over standard round tubular heating elements—especially for immersion applications in petroleum based liquids requiring high kilowatts.

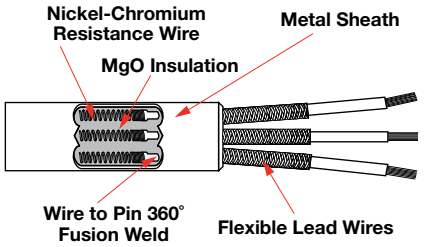
The FIREBAR's unique flat surface geometry packs more power in shorter elements and assemblies, along with a host of other performance improvements. These include:

- 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

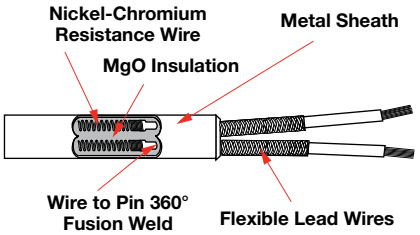
FIREBAR elements are available in single- and double-ended constructions with one inch or 5/8 inch heights. These two configuration variables make it possible to use FIREBAR elements instead of round tubular elements in virtually all applications.

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.





One Inch Double-Ended FIREBAR Element and Lead Configurations



⅝ Inch Double-Ended FIREBAR Element and Lead Configurations

Double-Ended Performance Capabilities

One Inch

- Watt densities up to 120 W/in^2 (18.6 W/cm^2)
- 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

5/8 Inch

- Watt densities up to 90 W/in^2 (13.9 W/cm^2)
- 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^2 (9.3 W/cm^2)
- 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

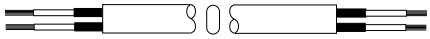
5/8 Inch

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

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FIREBAR Double-Ended Heaters

Specifications

	One Inch FIREBAR	⅝ Inch FIREBAR
		
Applications	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
Watt Density W/in² (W/cm²)	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)
Surface Area Per Linear In. (cm)	2.3 in² (14.8 cm²)	1.52 in² (9.80 cm²)
Cross Section 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)
Sheath Material—Max. 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)
Sheath Length 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)
Straightness Tolerance 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)
No-Heat Length	1 in. min., 12 in. max. (25/305 mm)	1 in. min., 12 in. max. (25/305 mm)
Max. Voltage—Amperage **Max. Hipotential** **Max. Current Leakage Per Coil (cold)** **Max. Amperage Per Coil** **Phase(s)** **Resistance Coils**	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
Ohms/In./Unit① **Ohms/In./Coil**①	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
Terminations	Flexible lead wires Quick connect (spade) Screw lug (plate) Threaded stud	Flexible lead wires Quick connect (spade) Screw lug (plate) Threaded stud
Seals	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)
Min. Axis Bending Radius in. (mm) (Do not field bend)	Major: 1 (25) Minor: ½ (13) 90° bend Minor: 5/32 (4) 180° bend	Major: ¾ (19) Minor: ½ (13) 90° bend Minor: 5/32 (4) 180° bend
Mounting Options	Brackets (Type 1, 2 and 3) Threaded bulkhead or fitting	Brackets (Type 1, 2 and 3) Threaded bulkhead or fitting
Surface Finish Options	Bright anneal, passivation	Bright anneal, passivation
Agency Recognition	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)

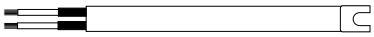
① Resistance values valid for three coil 1 in. (25 mm) FIREBAR only.

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FIREBAR Single-Ended Heaters

Specifications *(Continued)*





	One Inch Single-Ended FIREBAR	⅝ Inch Single-Ended FIREBAR
Applications	Clamp-on; hoppers, griddles Forced or convection air heating (Also see FINBAR, page 103)	Clamp-on; hoppers, griddles Forced or convection air heating
Watt Density W/in² (W/cm²)	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)
Surface Area Per Linear In. (cm)	2.3 in² (14.8 cm²)	1.52 in² (9.80 cm²)
Cross Section 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)
Sheath Material—Max. 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)
Sheath Length 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)
Straightness Tolerance 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)
No-Heat Length 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
Max. Voltage—Amperage **Max. Hipotential** **Max. Current Leakage (cold)** **Max. Amperage Per Coil** **Phase(s)** **Resistance Coils**	240VAC—48A 1480VAC 3mA 16A 1-ph, 3-ph wye 3 or 1	240VAC—16A 1480VAC 3mA 16A 1-ph 1
Ohms/In./Unit	0.200Ω min.—14.00Ω max. ①	0.200Ω min.—14.00Ω max. ①
Terminations	Flexible lead wires Threaded stud Quick connect (spade) Screw lug (plate)	Flexible lead wires Quick connect (spade) Screw lug (plate)
Seals	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)
Min. Axis Bending Radius in. (mm) (Do not field bend)	Major: 1 (25) Minor: ½ (13) 90° bend Minor: 5⁄32 (4) 180° bend	Major: ¾ (19) Minor: ½ (13) 90° bend Minor: 5⁄32 (4) 180° bend
Mounting Options	Bracket (Type 2) Threaded bulkhead	Bracket (Type 2) Threaded bulkhead
Surface Finish Options	Bright anneal	Bright anneal
Optional Internal Thermocouple	—	—
Single-end Configuration	Standard: Slotted M-t-O: Slotted, sealed or welded	Standard: Slotted M-t-O: Slotted, sealed or welded
Agency Recognition	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.

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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)

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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.



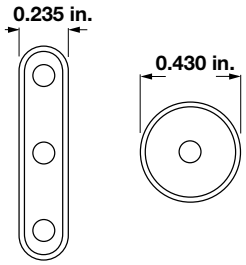
2. Normal to the Flow

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) in²	(cm²)
1 in. FIREBAR	2.30 in²	(5.84 cm²)
5/8 in. FIREBAR	1.52 in²	(3.86 cm²)
0.430 in. Round	1.35 in²	(3.43 cm²)

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.

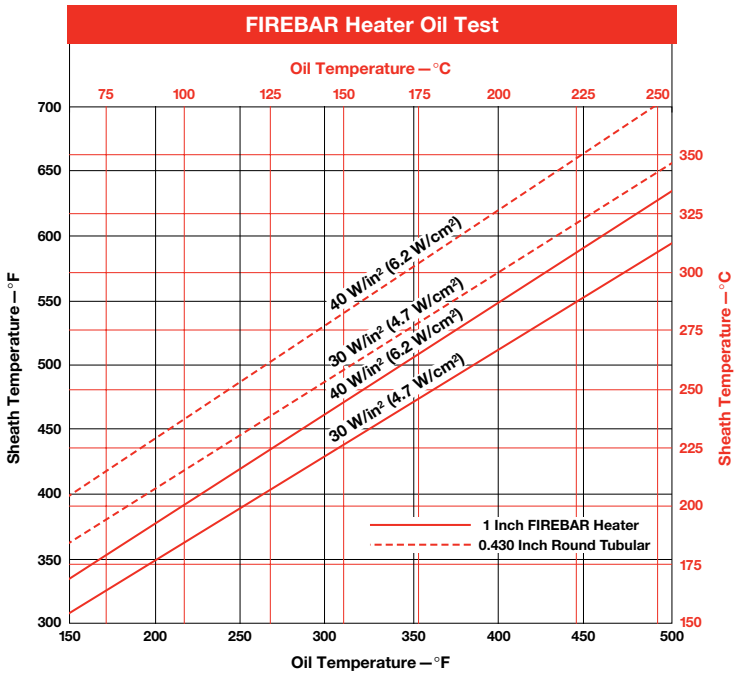
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FIREBAR Single/Double-Ended Heaters

Technical Data

The *FIREBAR Heater Oil Test* graph compares sheath temperatures of 40 W/in^2 (6.7 W/cm^2) 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^2 (6.7 W/cm^2) is lower than a 30 W/in^2 (4.6 W/cm^2) 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^2	(W/cm^2)
1 in. FIREBAR Element	19 7/8	(504.8)	1000	23	(3.6)
0.430 in. Round Tubular Element	32 1/4	(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^2	(W/cm^2)
1 in. FIREBAR Element	32 1/4	(819.0)	1700	23	(3.6)
0.430 in. Round Tubular Element	32 1/4	(819.0)	1000	23	(3.6)

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FIREBAR Single/Double-Ended Heaters

Technical Data *(Continued)*

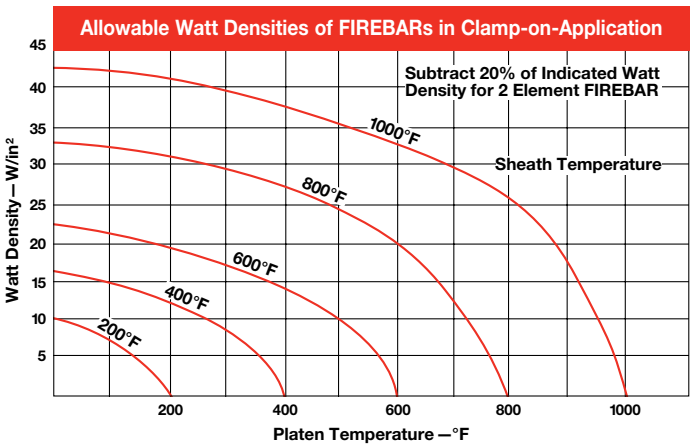
Clamp-On Applications

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.

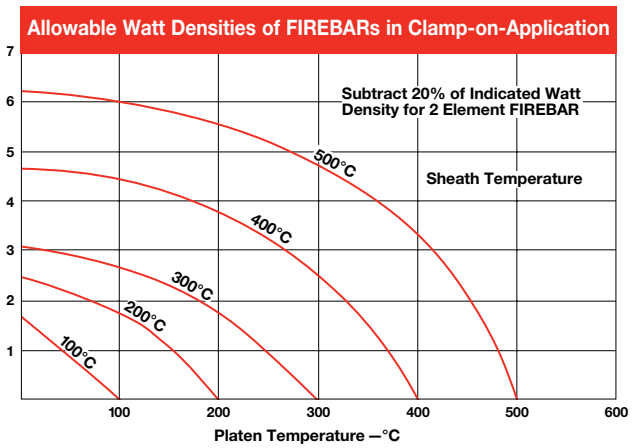
FIREBAR elements are also economical platen heaters. The *Platen Heating* graph shows FIREBAR's large, flat surface area allowing it to operate at twice the watt density of round tubular elements … without sacrificing heater life.

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

Platen Heating (˚F)

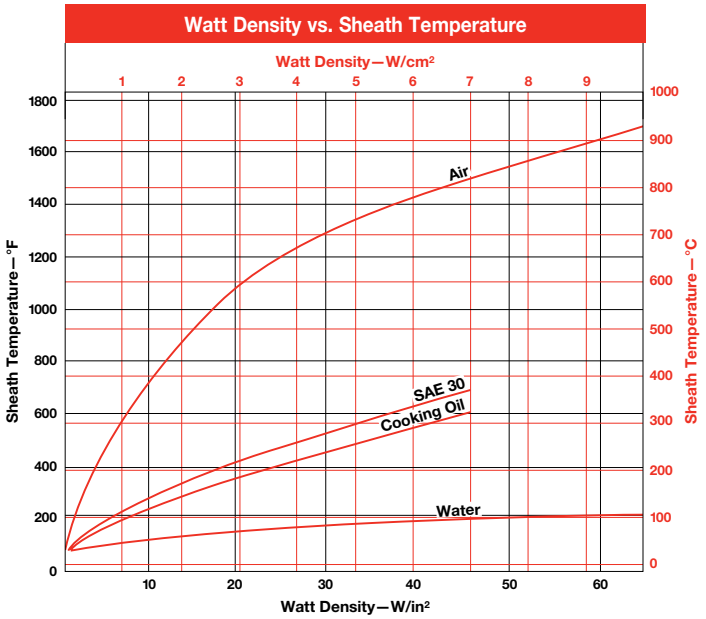


Platen Heating (˚C)



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.



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FIREBAR Single/Double-Ended Heaters

Technical Data *(Continued)*

Air Heating

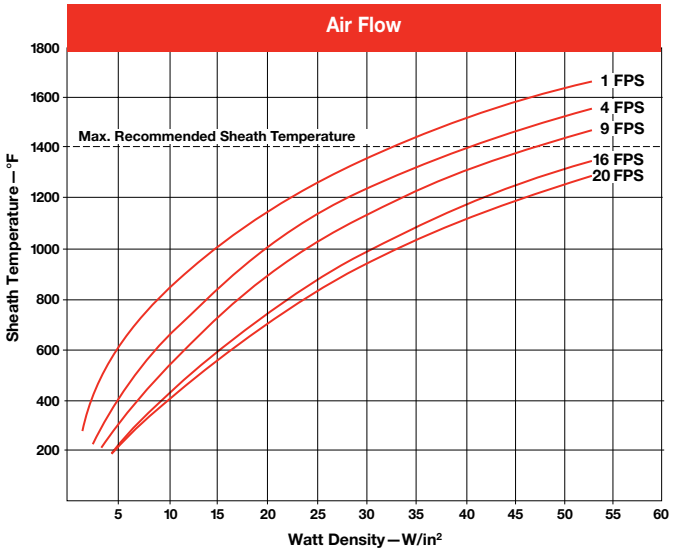
The Air *Flow/Watt Density/Sheath Temperature* graph shows the relationship between air flow, watt density and sheath temperature. Keep in mind that lower sheath temperature yields longer heater life.

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.

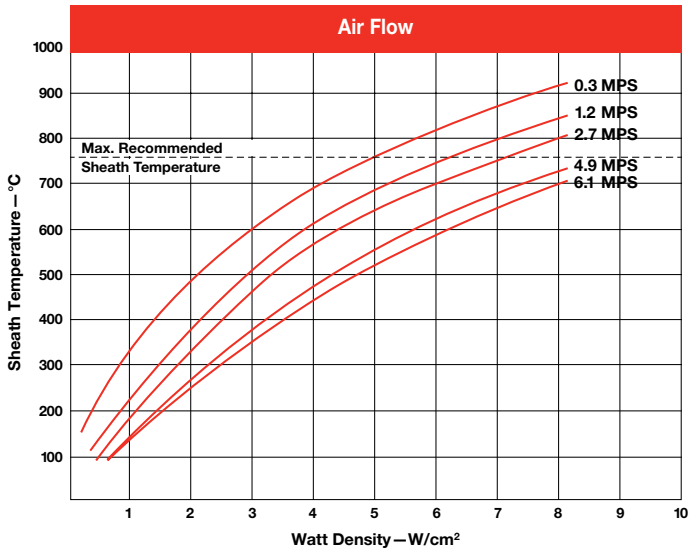


Air Flow Normal to Sheath Geometry

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.

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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
A1	Sil-A-Blend® 200°C lead wire	1	Parallel	Yes	Yes	Yes	Yes
A2	Sil-A-Blend® 200°C lead wire	1	Series	Yes	No	Yes	No
A3	Sil-A-Blend® 200°C lead wire	3	Delta	Yes	No	No	No
A4	Sil-A-Blend® 200°C lead wire	3	Wye	Yes	Yes	No	No
B1	TGGT 250°C lead wire	1	Parallel	Yes	Yes	Yes	Yes
B2	TGGT 250°C lead wire	1	Series	Yes	No	Yes	No
B3	TGGT 250°C lead wire	3	Delta	Yes	No	No	No
B4	TGGT 250°C lead wire	3	Wye	Yes	Yes	No	No
C1	¼ in. quick connect (spade)	1	Parallel	Yes	Yes	Yes	Yes
C2	¼ in. quick connect (spade)	1	Series	Yes	No	No	No
D1	Screw lug (plate) terminal	1	Parallel	Yes	Yes	Yes	Yes
D2	Screw lug (plate) terminal	1	Series	Yes	No	No	No
D3	Screw lug (plate) terminal	3	Delta	Yes	No	No	No
E1	#10-32 stud terminal	1	Parallel	Yes	Yes	Yes	Yes
E2	#10-32 stud terminal	1	Series	Yes	No	No	No
E3	#10-32 stud terminal	3	Delta	Yes	No	No	No

Termination Code Number Legend*

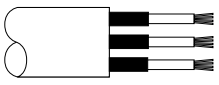
A = Silicone rubber insulation (Sil-A-Blend®) with fiberglass oversleeves Rated to 392°F (200°C)
B = High-temperature TGGT insulation with fiberglass oversleeves Rated to 480°F (250°C)
C = Nickel-plated steel quick connect
D = Nickel-plated steel screw lug with ceramic insulator and plated steel screw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

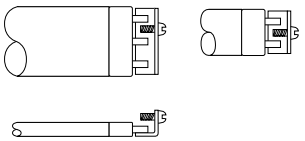
Double-End/Single-End 1 in. FIREBAR

Flexible Lead Wire①
A, B



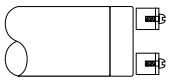
- Double-End 1 in. FIREBAR
- Single-End 1 in. FIREBAR
- FINBAR

Screw Lug (Plate)
D1



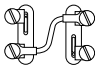
- Double-End 1 & 5/8 in. FIREBAR

Screw Lug (Plate)
D3

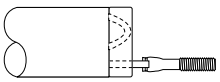


- Double-End 1 in. FIREBAR

3-phase delta wiring example

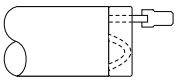


Threaded Stud
E2



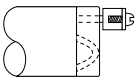
- Double-End 1 in. FIREBAR

Quick Connect (Spade)
C2



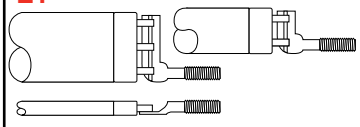
- Double-End 1 in. FIREBAR

Screw Lug (Plate)
D2



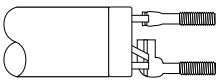
- Double-End 1 in. FIREBAR

Threaded Stud
E1



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

Threaded Stud
E3



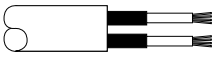
- Double-End 1 in. FIREBAR

3-phase delta wiring example



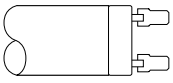
Single-End FIREBAR, Double-End/Single-End FINBAR

Flexible Lead Wire①
A, B



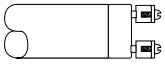
- Single-End 1 in. FIREBAR
- Double-End 5/8 in. FIREBAR
- Single-End 5/8 in. FIREBAR
- FINBAR

Quick Connect (Spade)
C1

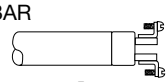


- Single-End 1 FIREBAR
- FINBAR
- Double-End 5/8 in. FIREBAR
- Single-End 5/8 in. FIREBAR

Screw Lug (Plate)
D1

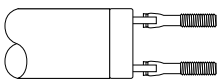


- Single-End 1 in. FIREBAR
- FINBAR



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

Threaded Stud
E1



- Single-End 1 in. FIREBAR
- FINBAR

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

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FIREBAR Single/Double-Ended Heaters

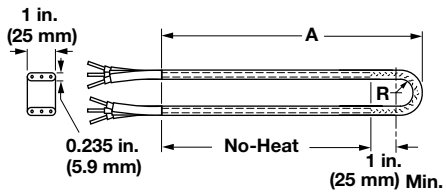
Bending

Major and Minor Axis Bending Parameters

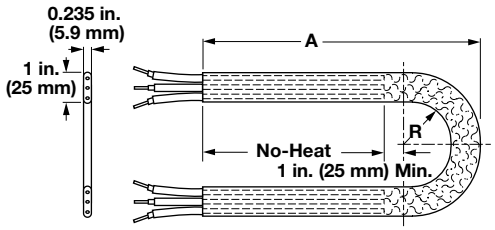
The following illustrations detail the recommended major and minor axis bend parameters for FIREBAR elements. These illustrations show the relationship between the type of bend and the location of heat and no-heat sections. See the next two pages for the 15 common bend formations.

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.

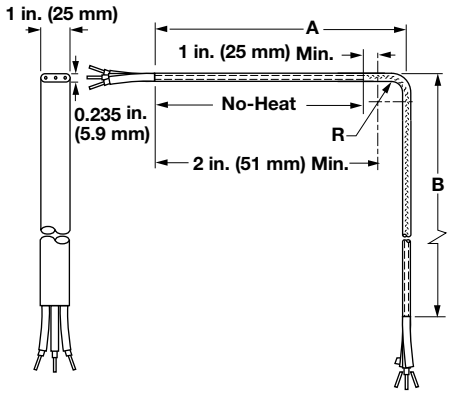
180° Minor Axis Heated Bend



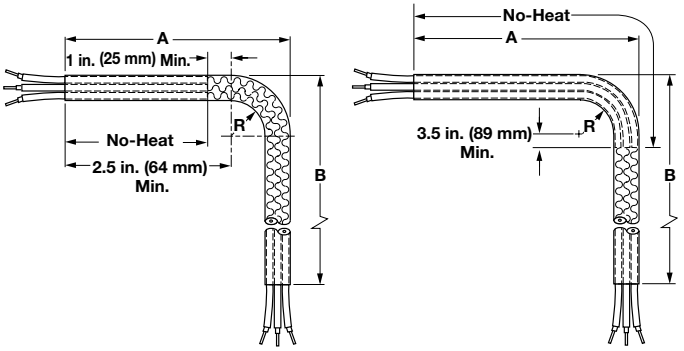
180° Major Axis Heated Bend



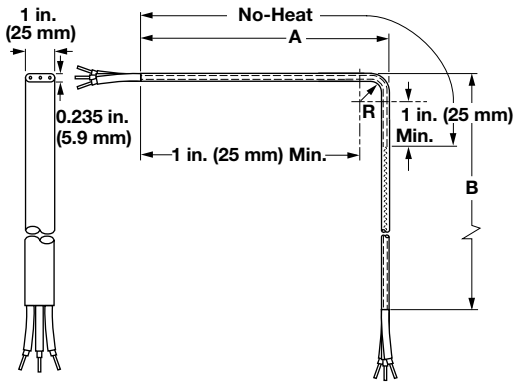
90° Minor Axis Heated Bend



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

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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.

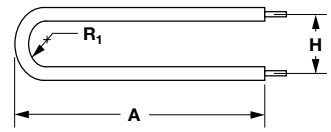
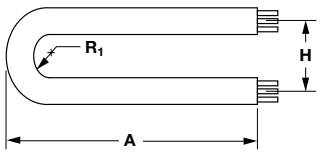
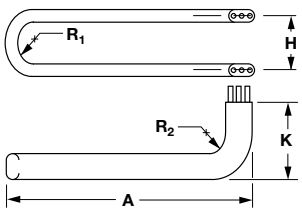
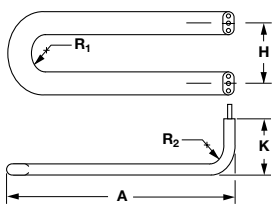
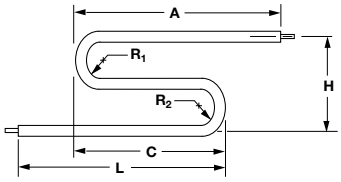
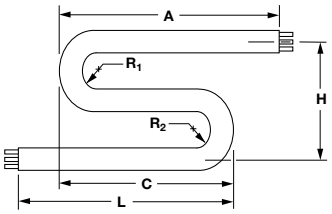
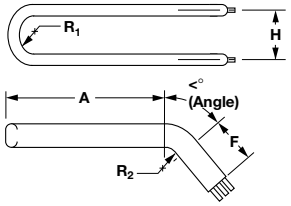
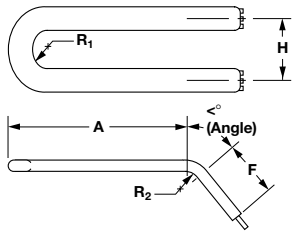
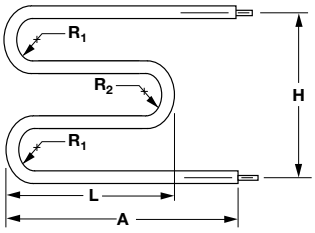
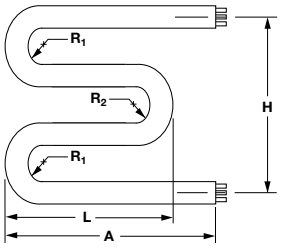
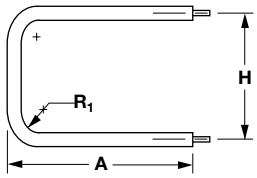
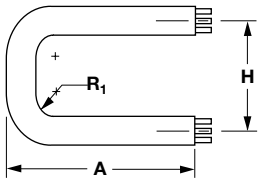
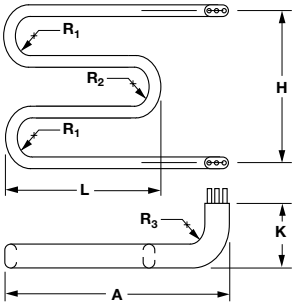
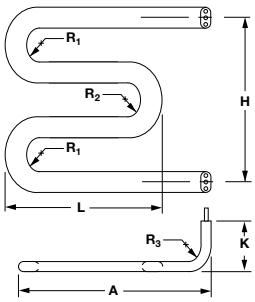
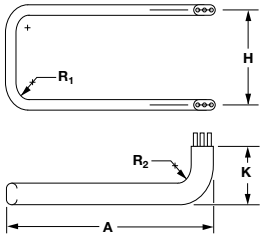
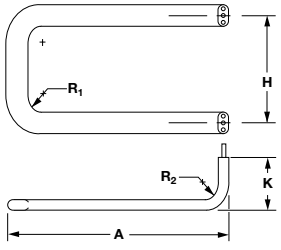
Formation is limited by bending parameters specified in the illustrations of major and minor axis bends on the previous page. On these illustrations, please note the no-heat end location.

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**.

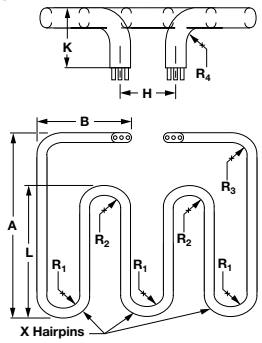
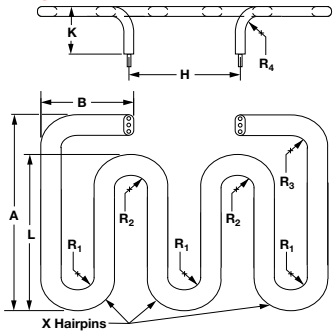
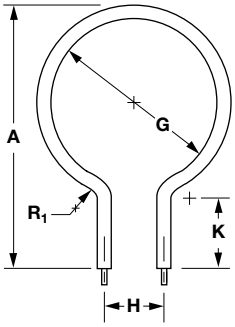
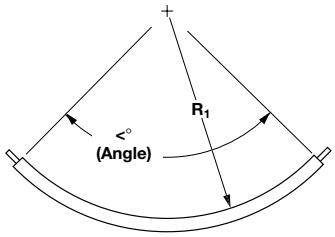
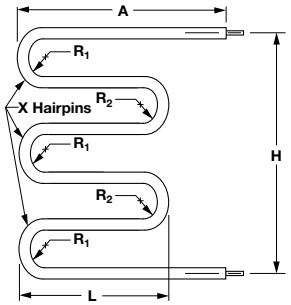
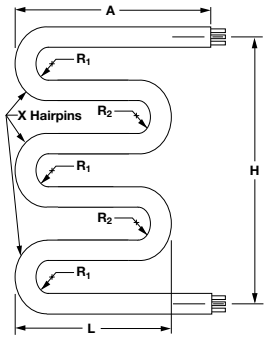
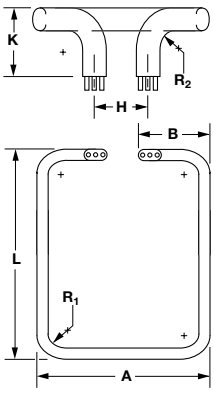
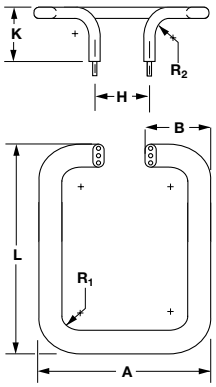
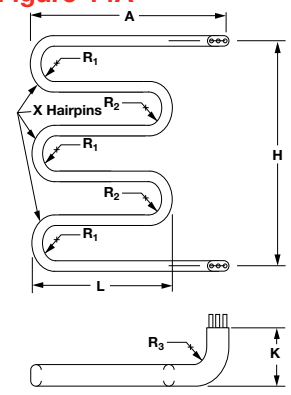
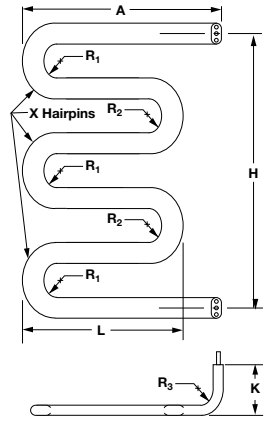
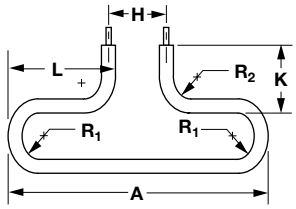
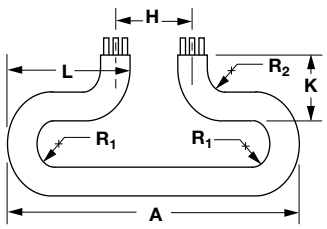
Note: The alpha characters and symbols are used to designate specific dimensions within each illustration.

Minor Axis	Major Axis	Minor Axis	Major Axis
Figure 1A 	**Figure 1B** 	**Figure 2A** 	**Figure 2B** 
Figure 3A 	**Figure 3B** 	**Figure 4A** 	**Figure 4B** 
Figure 5A 	**Figure 5B** 	**Figure 6A** 	**Figure 6B** 
Figure 7A 	**Figure 7B** 	**Figure 8A** 	**Figure 8B** 

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FIREBAR Single/Double-Ended Heaters

Bend Formation *(Continued)*

Minor Axis	Major Axis	Minor Axis	Major Axis
Figure 9A 	**Figure 9B** 	**Figure 10A** 	Bend Figure 10B Not Available On Major Axis
Figure 11A 	Bend Figure 11B Not Available On Major Axis	**Figure 12A** 	**Figure 12B** 
Figure 13A 	**Figure 13B** 	**Figure 14A** 	**Figure 14B** 
Figure 15A 	**Figure 15B** 		

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FIREBAR Single/Double-Ended Heaters

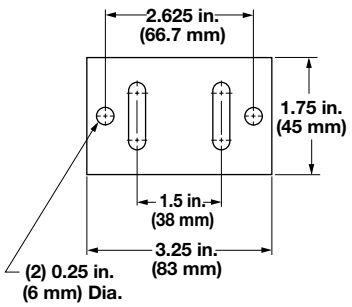
Mounting Brackets

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.

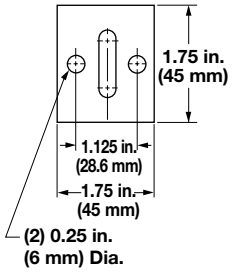
The bracket is located 1/2 in. (13 mm) from the sheath's end, 1/16 in. (1.6 mm) if welded. Available on 5/8 in. (15.9 mm) FIREBAR as **made-to-order** only.

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

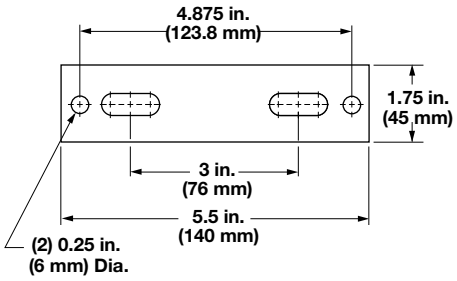
Type 1



Type 2



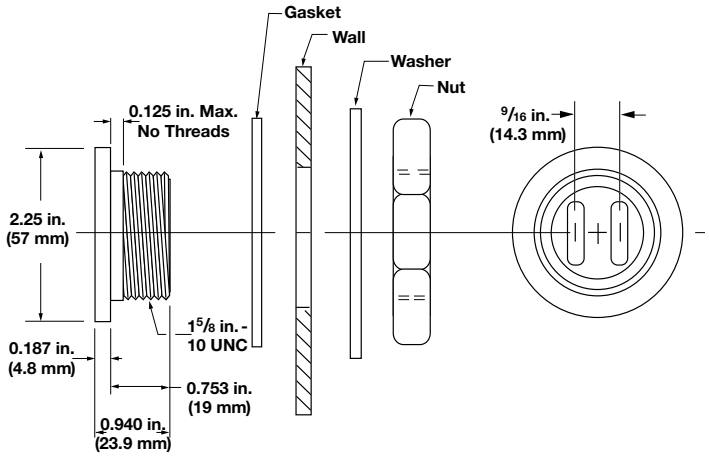
Type 3



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**.

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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**.

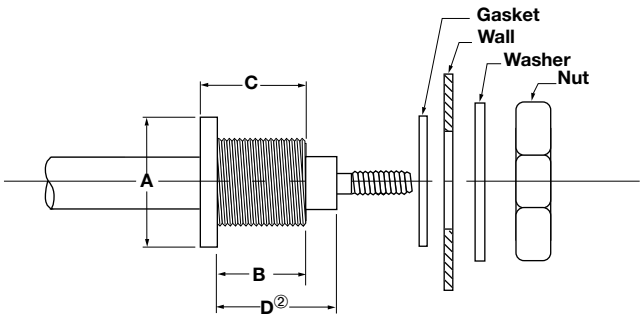


Illustration for 1-inch FIREBAR

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 ⅝-inch FIREBAR

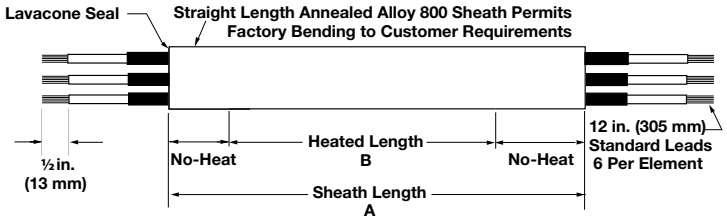
Options for One-Inch and 5/8-Inch FIREBAR

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

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FIREBAR Single/Double-Ended Heaters

One-Inch, Double-Ended FIREBAR



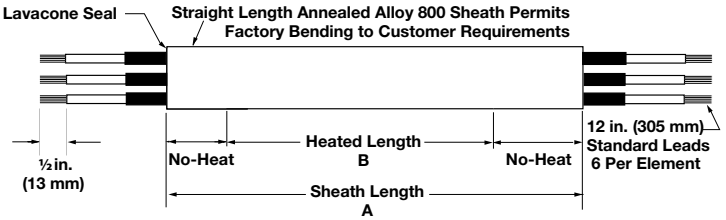
FIREBAR Description	Sheath A Dimension in.	(mm)	Heated B Dimension in.	(mm)	Watts	Part Number 120VAC	Part Number 240VAC	Est. Net Wt. lbs	(kg)
Applications: Asphalt, Paraffin (Solid), Bunker Oil, Clamp-On									
6 W/in²	35	(889)	25	(635)	310	**FBN351WD**		1.3	(0.6)
Alloy 800	41	(1041)	31	(787)	410	**FBN411WD**		1.5	(0.7)
(1 W/cm²)	51	(1295)	41	(1041)	530	**FBN511WD**	**FBN5110WD**	1.9	(0.9)
	62	(1574)	52	(1320)	650	**FBN621WD**	**FBN6210WD**	2.3	(1.1)
	72	(1828)	62	(1574)	800	**FBN721WD**	**FBN7210WD**	2.6	(1.2)
	93	(2362)	83	(2108)	1,060	**FBN931WD**	**FBN9310WD**	3.4	(1.6)
	114	(2895)	104	(2641)	1,350	**FBN1141WD**	**FBN11410WD**	4.2	(1.9)
Applications: Griddles, Fuel Oil, Clamp-On									
10 W/in²	25	(635)	22	(558)	500	**FBN251WL**		0.9	(0.4)
Alloy 800	35	(889)	32	(812)	750	**FBN351WL**	**FBN3510WL**	1.3	(0.6)
(1.6 W/cm²)	47	(1193)	43	(1092)	1,000	**FBN471WL**	**FBN4710WL**	1.7	(0.8)
	69	(1752)	65	(1651)	1,500	**FBN691WL**	**FBN6910WL**	2.5	(1.2)
	90	(2286)	86	(2184)	2,000	**FBN901WL**	**FBN9010WL**	3.3	(1.5)
Applications: Clamp-On, Medium Weight Oils, Liquid Paraffin, Low-Temperature Ovens 400°F (205°C)									
15 W/in² ①	29	(736)	19	(482)	670		**FBN2910WE**	1.1	(0.5)
Alloy 800	34	(863)	24	(609)	830		**FBN3410WE**	1.3	(0.6)
(2.3 W/cm²)	39	(990)	29	(736)	1,000		**FBN3910WE**	1.4	(0.7)
	48	(1219)	38	(965)	1,330		**FBN4810WE**	1.8	(0.9)
	58	(1473)	48	(1219)	1,670		**FBN5810WE**	2.1	(1.0)
	68	(1727)	58	(1473)	2,000		**FBN6810WE**	2.5	(1.2)
	87	(2209)	77	(1955)	2,670		**FBN8710WE**	3.2	(1.5)
	106	(2692)	96	(2438)	3,330		**FBN10610WE**	3.9	(1.8)
Applications: Radiant, Platens, Dies, Low-Temperature Ovens 300°F (150°C)									
20 W/in²	15	(381)	11	(279)	500	**FBN151WM**		0.6	(0.3)
Alloy 800	20	(508)	16	(406)	750	**FBN201WM**		0.8	(0.4)
(3.1 W/cm²)	26	(660)	22	(558)	1,000	**FBN261WM**	**FBN2610WM**	1.0	(0.5)
	36	(914)	32	(812)	1,500	**FBN361WM**	**FBN3610WM**	1.3	(0.6)
	48	(1219)	43	(1092)	2,000	**FBN481WM**	**FBN4810WM**	1.8	(0.9)
	70	(1778)	65	(1651)	3,000		**FBN7010WM**	2.6	(1.2)
	91	(2311)	85	(2159)	4,000		**FBN9110WM**	3.3	(1.5)
Applications: Degreasing Solutions, Heat Transfer Oils									
23 W/in²	35	(889)	25	(635)	1,250	**FBN351WT**	**FBN3510WT**	1.3	(0.6)
Alloy 800	41	(1041)	31	(787)	1,625	**FBN411WT**	**FBN4110WT**	1.5	(0.7)
(3.6 W/cm²)	51	(1295)	41	(1041)	2,125	**FBN511WT**	**FBN5110WT**	1.9	(0.9)
	62	(1574)	52	(1320)	2,625	**FBN621WT**	**FBN6210WT**	2.3	(1.1)
	72	(1828)	62	(1574)	3,200	**FBN721WT**	**FBN7210WT**	2.6	(1.2)
	93	(2362)	83	(2108)	4,250	**FBN931WT**	**FBN9310WT**	3.4	(1.6)
	114	(2895)	104	(2641)	5,400	**FBN1141WT**	**FBN11410WT**	4.2	(1.9)

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FIREBAR Single/Double-Ended Heaters

One-Inch, Double-Ended FIREBAR (Continued)

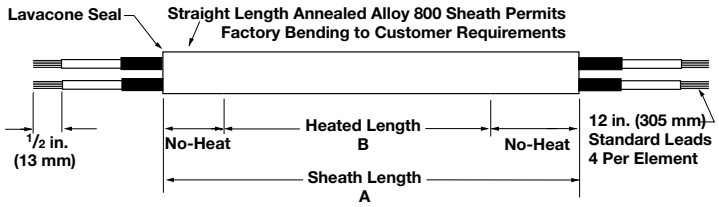


FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number		Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	lbs	(kg)
Applications: Cooking Oils, Mild Caustic Solution, Ethylene Glycol (100%)									
30 W/in²	16	(406)	10	(254)	750	**FBN161WH**		0.6	(0.3)
Alloy 800	20	(508)	14	(355)	1000	**FBN201WH**		0.8	(0.4)
(4.7 W/cm²)	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/in²	25	(635)	22	(558)	2000		**FBN2510WK**	0.9	(0.4)
Alloy 800	35	(889)	32	(812)	3000		**FBN3510WK**	1.3	(0.6)
(6.2 W/cm²)	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/in²	29	(736)	19	(482)	2000		**FBN2910WP**	1.1	(0.5)
Alloy 800	34	(863)	24	(609)	2500		**FBN3410WP**	1.3	(0.6)
(7 W/cm²)	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/in²	15	(381)	11	(279)	2000		**FBN1510WJ**	0.6	(0.3)
Alloy 800	20	(508)	16	(406)	3000		**FBN2010WJ**	0.8	(0.4)
(12.4 W/cm²)	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)
	91	(2311)	85	(2159)	16,000			3.3	(1.5)
90 W/in²	35	(889)	25	(635)	5000	**FBN351WG**	**FBN3510WG**	1.3	(0.6)
Alloy 800	41	(1041)	31	(787)	6500	**FBN411WG**	**FBN4110WG**	1.5	(0.7)
(14 W/cm²)	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)

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FIREBAR Single/Double-Ended Heaters

5/8-Inch Double-Ended FIREBAR

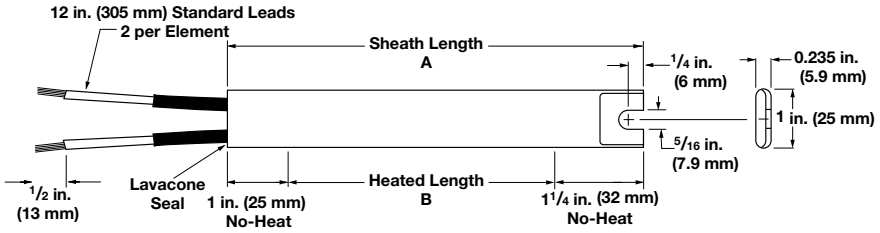


FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number		Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	lbs	(kg)
Applications: Degreasing Fluids, Heat Transfer Oils									
23 W/in² ①	19	(483)	11	(279)	375	**FAN191WT**		0.5	(0.3)
Alloy 840	22	(559)	14	(356)	500	**FAN221WT**	**FAN2210WT**	0.5	(0.3)
(3.6 W/cm²)	26	(660)	18	(457)	625	**FAN261WT**	**FAN2610WT**	0.6	(0.3)
	30	(762)	22	(559)	750	**FAN301WT**	**FAN3010WT**	0.7	(0.4)
	37	(940)	29	(737)	1000	**FAN371WT**	**FAN3710WT**	0.9	(0.5)
	44	(1118)	36	(914)	1250	**FAN441WT**	**FAN4410WT**	1.0	(0.5)
	51	(1295)	43	(1092)	1500	**FAN511WT**	**FAN5110WT**	1.2	(0.6)
Applications: Clean and Potable Water									
90 W/in²	15	(381)	7	(178)	1000	**FAN151WG**	**FAN1510WG**	0.4	(0.2)
Alloy 840	19	(483)	11	(279)	1500	**FAN191WG**	**FAN1910WG**	0.5	(0.3)
(14 W/cm²)	22	(559)	14	(356)	2000	**FAN221WG**	**FAN2210WG**	0.5	(0.3)
	26	(660)	18	(457)	2500	**FAN261WG**	**FAN2610WG**	0.6	(0.3)
	30	(762)	22	(559)	3000	**FAN301WG**	**FAN3010WG**	0.7	(0.4)
	37	(940)	29	(737)	4000		**FAN3710WG**	0.9	(0.5)
	44	(1118)	36	(914)	5000		**FAN4410WG**	1.0	(0.5)
	51	(1295)	43	(1092)	6000		**FAN5110WG**	1.2	(0.6)

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FIREBAR Single/Double-Ended Heaters

One-Inch, Single-Ended FIREBAR

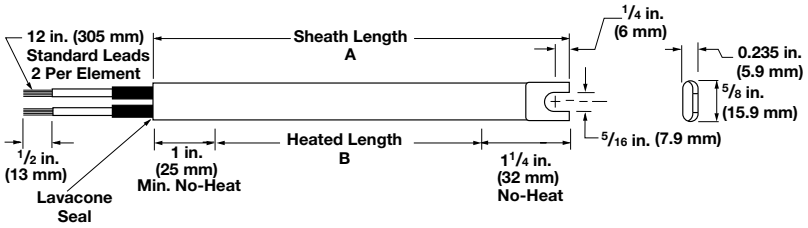


FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number		Est. Net Wt.	
	in.	(mm)	in.	(mm)		120VAC	240VAC	lbs	(kg)
Applications: Radiant, Platens, Dies, Low-Temperature Ovens 300°F (150°C)									
20 W/in²	8 3/4	(222.0)	6 1/2	(165.0)	300	**FSP91WM**		0.4	(0.2)
304 SS	10 1/4	(260.0)	7 1/2	(203.0)	375	**FSP101WM**		0.4	(0.2)
(3.1 W/cm²)	12 1/4	(311.0)	10	(254.0)	450	**FSP121WM**		0.5	(0.3)
	13 1/2	(343.0)	11 1/4	(286.0)	500	**FSP141WM**		0.5	(0.3)
	16 1/8	(408.6)	13 7/8	(352.4)	650	**FSP161WM**	**FSP1610WM**	0.6	(0.3)
	17 3/4	(451.0)	15 1/2	(393.0)	725	**FSP181WM**	**FSP1810WM**	0.7	(0.4)
	19 1/4	(489.0)	17	(431.0)	800	**FSP191WM**	**FSP1910WM**	0.7	(0.4)
	22	(558.0)	19 3/4	(502.0)	900	**FSP221WM**	**FSP2210WM**	0.8	(0.4)
	23 3/4	(603.0)	21 1/2	(546.0)	1,000	**FSP241WM**	**FSP2410WM**	0.9	(0.4)
	25	(635.0)	22 3/4	(578.0)	1,050	**FSP251WM**	**FSP2510WM**	0.9	(0.4)
	28 5/8	(727.1)	26 3/8	(670.0)	1,250	**FSP291WM**	**FSP2910WM**	1.1	(0.5)
	31 5/8	(803.3)	29 3/8	(746.1)	1,350	**FSP321WM**	**FSP3210WM**	1.2	(0.6)
	34 1/8	(866.8)	31 7/8	(809.6)	1,500		**FSP3410WM**	1.3	(0.6)
	36 7/8	(936.6)	34 5/8	(879.5)	1,600		**FSP3710WM**	1.4	(0.7)
	40 5/8	(1031.9)	38 3/8	(974.7)	1,800		**FSP4110WM**	1.5	(0.7)
	46 1/4	(1175.0)	44	(1117.0)	2,000		**FSP4610WM**	1.7	(0.8)
Applications: Air Heating									
40 W/in²	8 3/4	(222.0)	6 1/2	(165.0)	600	**FSP91WK**		0.4	(0.2)
304 SS	10 1/4	(260.0)	7 1/2	(203.0)	750	**FSP101WK**		0.4	(0.2)
(6.2 W/cm²)	12 1/4	(311.0)	10	(254.0)	900	**FSP121WK**	**FSP1210WK**	0.5	(0.3)
	13 1/2	(343.0)	11 1/4	(286.0)	1,000	**FSP131WK**	**FSP1310WK**	0.5	(0.3)
	16 1/4	(413.0)	13 7/8	(352.4)	1,300	**FSP161WK**	**FSP1610WK**	0.6	(0.3)
	17 3/4	(451.0)	15 1/2	(393.0)	1,450	**FSP181WK**	**FSP1810WK**	0.7	(0.4)
	19 1/4	(489.0)	17	(431.0)	1,600		**FSP1910WK**	0.7	(0.4)
	22	(558.0)	19 3/4	(502.0)	1,800		**FSP2210WK**	0.8	(0.4)
	23 3/4	(603.0)	21 1/2	(546.0)	2,000		**FSP2410WK**	0.9	(0.4)
	25	(635.0)	22 3/4	(578.0)	2,100		**FSP2510WK**	0.9	(0.4)
	28 5/8	(727.1)	26 3/8	(669.9)	2,500		**FSP2910WK**	1.1	(0.5)
	31 5/8	(803.2)	29 3/8	(746.1)	2,700		**FSP3210WK**	1.2	(0.6)
	34 1/8	(866.8)	31 7/8	(809.6)	3,000		**FSP3410WK**	1.3	(0.6)
	36 7/8	(936.6)	34 5/8	(879.5)	3,200		**FSP3710WK**	1.4	(0.7)
	40 5/8	(1031.9)	38 3/8	(974.7)	3,600		**FSP4110WK**	1.5	(0.7)
	46 1/4	(1175.0)	44	(1117.0)	4,000		**FSP4610WK**	1.7	(0.8)

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FIREBAR Single/Double-Ended Heaters

5/8-Inch Single-Ended FIREBAR



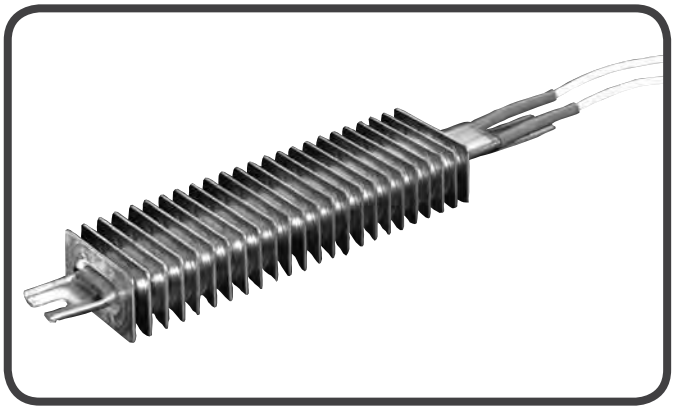
FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Part Number		Est. Net Weight	
	in.	(mm)	in.	(mm)		120VAC	240VAC	lbs	(kg)
Applications: Radiant, Platens, Dies, Low-Temperature Ovens 300°F (150°C)									
20 W/in²	11 1/2	(292)	8	(203)	250	**FSA121WM**		0.3	(0.2)
Alloy 840	15 1/2	(394)	12	(304)	375	**FSA161WM**	**FSA1610WM**	0.4	(0.2)
(3.1 W/cm²)	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)

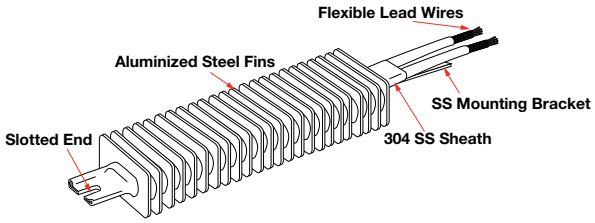
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FINBAR™ Single-Ended Heaters

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^2 (7.7 W/cm^2)
- 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^2 (6.2 W/cm^2)

Fin Surface Area: 16 in^2/linear in. (40.5 cm^2/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

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FINBAR Single-Ended Heaters

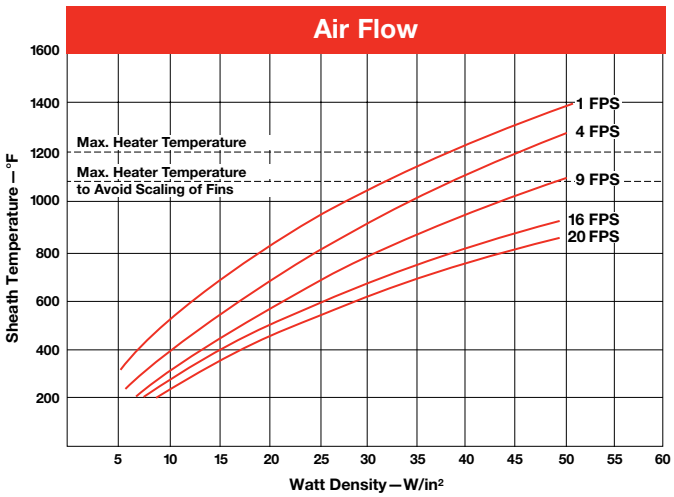
Air Heating

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**.

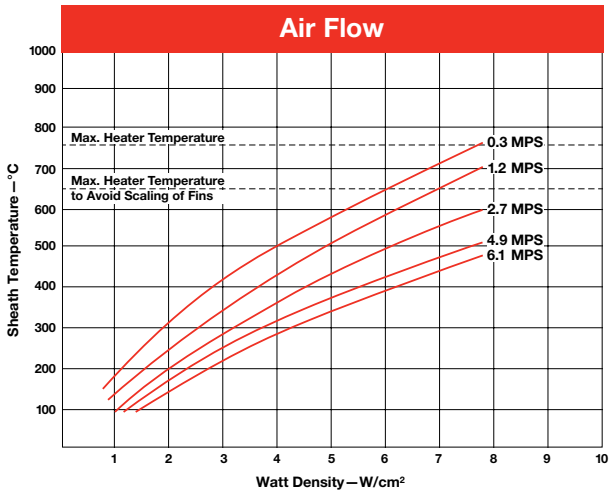
The graphic representation is based on a single-ended FINBAR, various air velocities (at 68°F/20°C inlet temperature) and different watt densities.

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

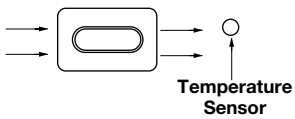
FINBAR elements are typically terminated at one end. Upon request, however, dual-ended FINBAR heaters can be ordered. To order, specify **dual-ended FINBAR** and lead length.

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:

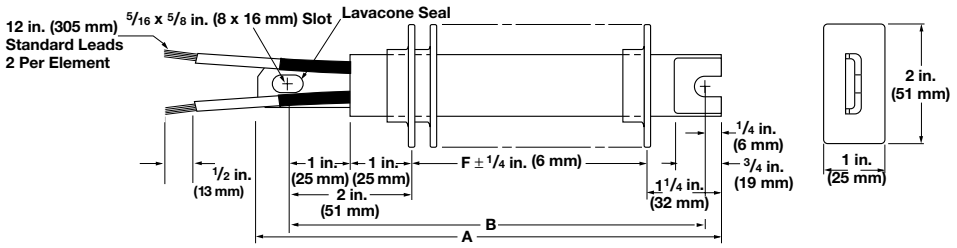
- Air flow over element must be parallel with the flat side.
- Element center line to element center line spacing must be a minimum of 1 1/2 in. (38 mm).



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

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FINBAR Single-Ended Heaters



FINBAR Description	Overall A Dimension in.	(mm)	Overall F Dimension in.	(mm)	Mounting B Dimension in.	(mm)	Watts	Part Number 120VAC	Part Number 240VAC	Est. Net Wt. lbs	(kg)
Application: Forced Air											
20 W/in²	10 1/4	(260.0)	6 1/2	(158.0)	9 1/2	(241.0)	300	**FSP91WMF**		1.4	(0.7)
304 SS	11 3/4	(298.0)	8	(203.0)	11	(279.0)	375	**FSP101WMF**		1.4	(0.7)
(3.1 W/cm²)	13 3/4	(349.0)	10	(254.0)	13	(330.0)	450	**FSP121WMF**		1.5	(0.7)
	15	(381.0)	11 1/4	(285.0)	14 1/4	(362.0)	500	**FSP141WMF**		1.5	(0.7)
	17 5/8	(447.7)	13 7/8	(352.4)	16 7/8	(428.6)	650	**FSP161WMF**	**FSP1610WMF**	1.6	(0.8)
	19 1/4	(489.0)	15 1/2	(393.0)	18 1/2	(469.0)	725	**FSP181WMF**	**FSP1810WMF**	1.7	(0.8)
	20 3/4	(527.0)	17	(431.0)	20	(508.0)	800	**FSP191WMF**	**FSP1910WMF**	1.7	(0.8)
	23 1/2	(597.0)	19 3/4	(501.0)	22 3/4	(577.0)	900	**FSP221WMF**	**FSP2210WMF**	1.8	(0.9)
	25 1/4	(641.0)	21 1/2	(546.0)	24 1/2	(622.0)	1000	**FSP241WMF**	**FSP2410WMF**	1.9	(0.9)
	26 1/2	(673.0)	22 3/4	(577.0)	25 3/4	(654.0)	1050	**FSP251WMF**	**FSP2510WMF**	1.9	(0.9)
	30 1/8	(765.2)	26 3/8	(669.9)	29 3/8	(746.1)	1250	**FSP291WMF**	**FSP2910WMF**	2.1	(1.0)
	33 1/8	(841.4)	29 3/8	(746.1)	32 3/8	(822.3)	1350	**FSP321WMF**	**FSP3210WMF**	2.2	(1.0)
	35 5/8	(904.9)	31 ⅛	(809.6)	34 7/8	(885.8)	1500		**FSP3410WMF**	2.3	(1.1)
	38 3/8	(974.7)	34 5/8	(879.5)	37 5/8	(955.7)	1600		**FSP3710WMF**	2.4	(1.1)
	42 1/8	(1070.0)	38 3/8	(974.7)	41 3/8	(1051.0)	1800		**FSP4110WMF**	2.5	(1.2)
	47 3/4	(1213.0)	44	(1117.0)	47	(1193.0)	2000		**FSP4610WMF**	2.7	(1.3)
40 W/in²	10 1/4	(260.0)	6 1/2	(158.0)	9 1/2	(241.0)	600	**FSP91WKF**		1.4	(0.7)
304 SS	11 3/4	(298.0)	8	(203.0)	11	(279.0)	750	**FSP101WKF**		1.4	(0.7)
(6.2 W/cm²)	13 3/4	(349.0)	10	(254.0)	13	(330.0)	900	**FSP121WKF**	**FSP1210WKF**	1.5	(0.7)
	15	(381.0)	11 1/4	(285.0)	14 1/4	(362.0)	1000	**FSP131WKF**	**FSP1310WKF**	1.5	(0.7)
	17 5/8	(447.7)	13 7/8	(352.4)	16⅞	(428.6)	1300	**FSP161WKF**	**FSP1610WKF**	1.6	(0.8)
	19 1/4	(489.0)	15 1/2	(393.0)	18 1/2	(469.0)	1450	**FSP181WKF**	**FSP1810WKF**	1.7	(0.8)
	20 3/4	(527.0)	17	(431.0)	20	(508.0)	1600		**FSP1910WKF**	1.7	(0.8)
	23 1/2	(597.0)	19 3/4	(501.0)	22 3/4	(577.0)	1800		**FSP2210WKF**	1.8	(0.9)
	25 1/4	(641.0)	21 1/2	(546.0)	24 1/2	(622.0)	2000		**FSP2410WKF**	1.9	(0.9)
	26 1/2	(673.0)	22 3/4	(577.0)	25 3/4	(654.0)	2100		**FSP2510WKF**	1.9	(0.9)
	30 1/8	(765.2)	26 3/8	(669.9)	29 3/8	(746.1)	2500		**FSP2910WKF**	2.1	(1.0)
	33 1/8	(841.4)	29 3/8	(746.1)	32 3/8	(822.3)	2700		**FSP3210WKF**	2.2	(1.0)
	35 5/8	(904.9)	31 7/8	(809.6)	34 7/8	(885.8)	3000		**FSP3410WKF**	2.3	(1.1)
	38 3/8	(974.7)	34 5/8	(879.4)	37 5/8	(955.7)	3200		**FSP3710WKF**	2.4	(1.1)
	42 1/8	(1070.0)	38 3/8	(974.7)	41 3/8	(1050.9)	3600		**FSP4110WKF**	2.5	(1.2)
	47 3/4	(1213.0)	44	(1117.0)	47	(1193.0)	4000		**FSP4610WKF**	2.7	(1.3)

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Flexible Heaters

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

* Ambient environment, not maximum controlling temperature.



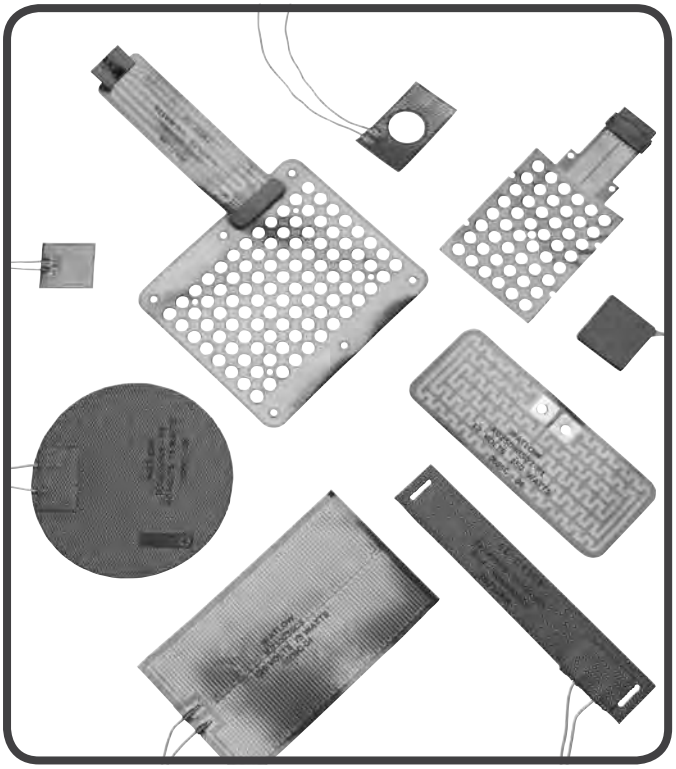
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Flexible Shapes and Geometries

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

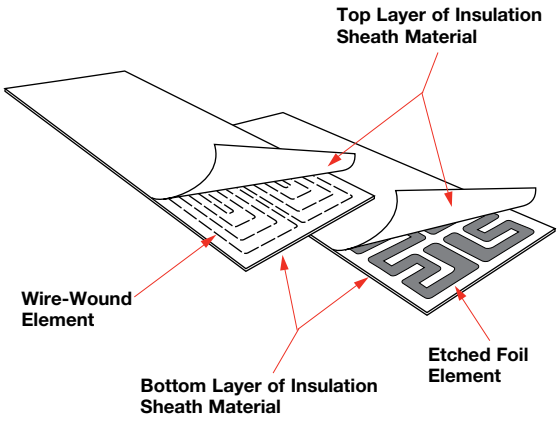
Lightweight construction and low thermal mass
- Permit use in applications with limited space or weight requirements

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



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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.

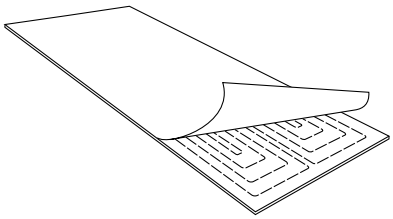
Polyimide

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

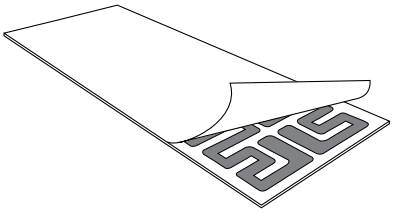


This element style is created by spiraling fine resistance wires around a fiberglass cord. The element is laid out in a pattern designed for a specific application. The benefits of wire-wound elements include:

- 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:

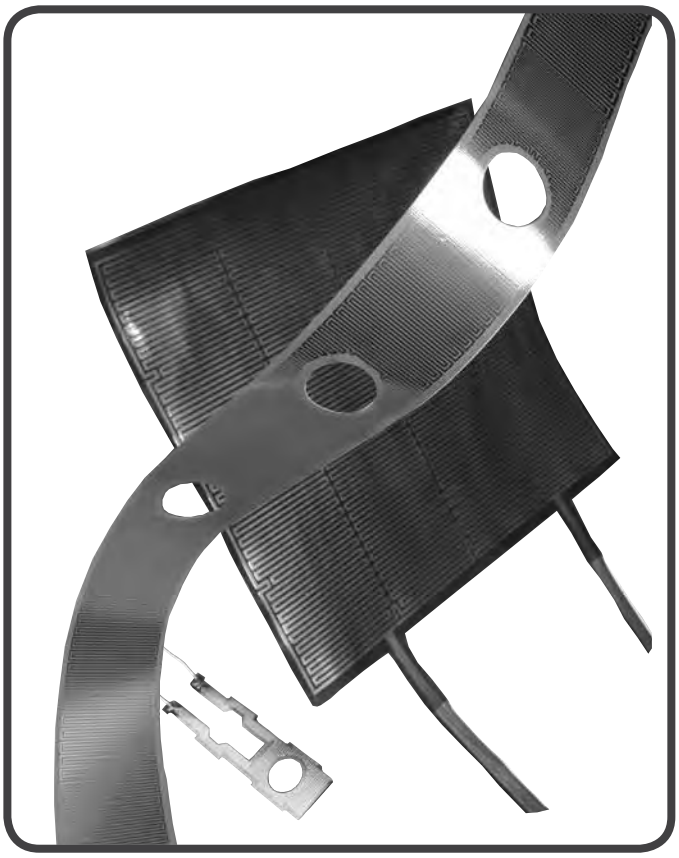
- Delivery of more heat and up to twice the watt density of a wire-wound element provides longer heater life
- Complex heat distribution patterns

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

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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/in² (7.75 W/cm²)①
- UR® and C-UR® 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

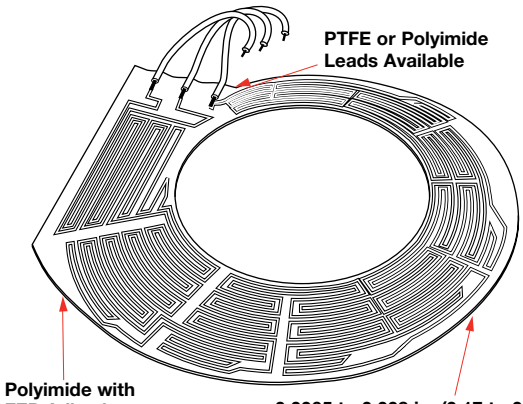
Resistance to radiation and fungus

- 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).



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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^2 (0.05 g/cm^2)

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

Watt density rating on stock units
- 5 W/in^2 (0.8 W/cm^2)

Dielectric strength
- Min. VAC: 1000

Flammability rating
- Self-extinguishing

Heater size limitations
- 18 x 26 in. (457 mm x 660 mm)

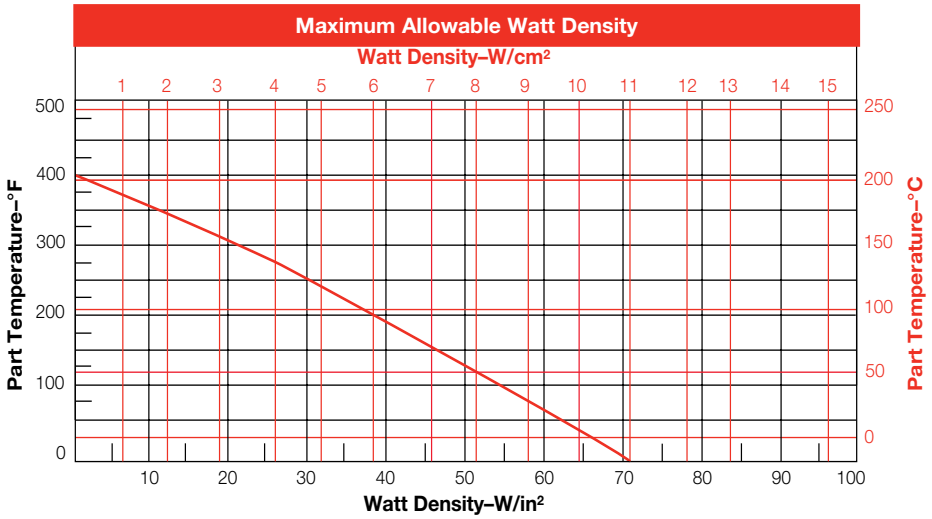
Weight loss (outgassing)
- 0.51%

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.



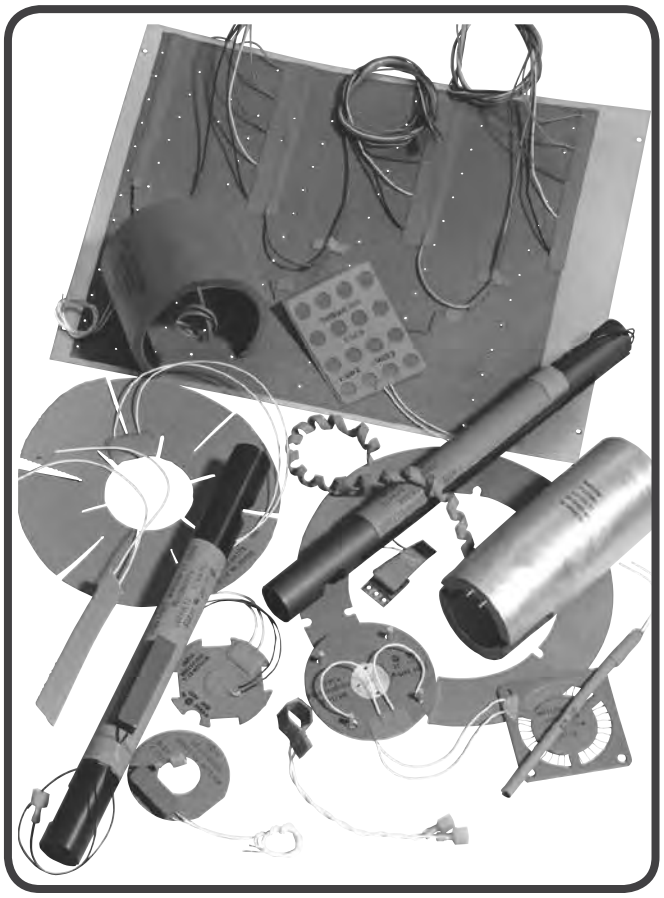
Note: The maximum watt density (W/in^2) in open air is 5 W/in^2. The chart above assumes bonding the polyimide heater to a part.

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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^2 (12.5 W/cm^2), 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

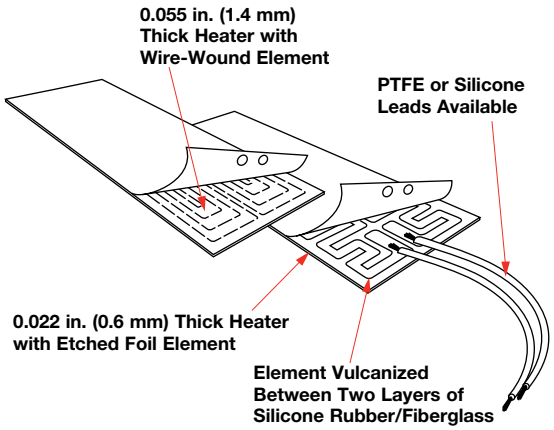
Designed to the exact shape and size needed
- Conforms to component and/or equipment

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

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Silicone Rubber Heaters

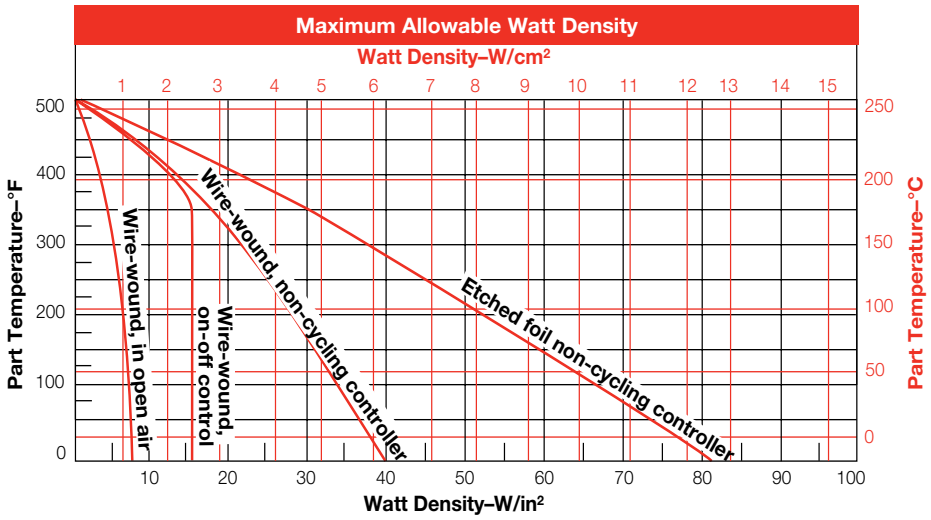
Applications and Technical Data

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^2 (3.7 W/cm^2) maximum. An etched foil heater operating under the same conditions can be rated at 45 W/in^2 (7 W/cm^2) 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^2 (0.24 g/cm^2)
- Etched foil: 3 oz/ft^2 (0.09 g/cm^2)

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 +1^1/$_2$ -^{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%

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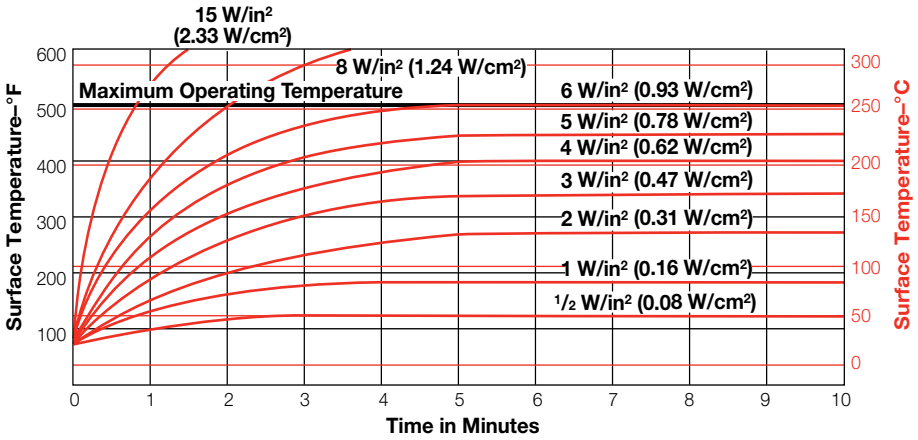
Silicone Rubber Heaters

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.

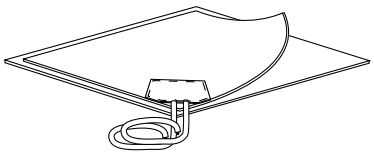
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Silicone Rubber Heaters

Mounting Methods

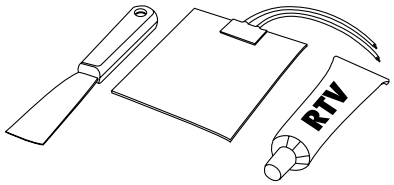
Watlow offers various attachment techniques designed for fast installation.

Pressure Sensitive Adhesive Surface (PSAS)



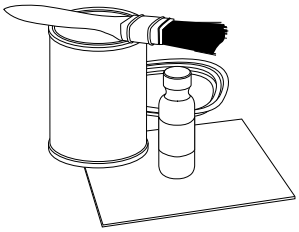
For speed, convenience and economy of installation, specify PSAS. Simply peel off the protective backing and roll the heater in place for an even bond to a clean, smooth surface. PSAS is not recommended for curved surfaces or for heaters rated above 10 W/in^2 (1.5 W/cm^2). It should not be used for applications 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



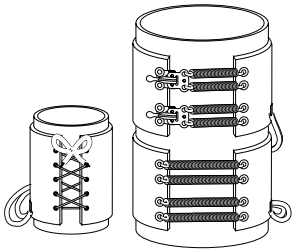
For a stronger bond or when long storage is probable, room temperature vulcanizing (RTV) silicone adhesive works well. Watlow offers red RTV for temperatures up to 500°F (260°C). White RTV is available from adhesive suppliers for temperatures up to 400°F (205°C). Watlow's one-part RTV is self-priming 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.

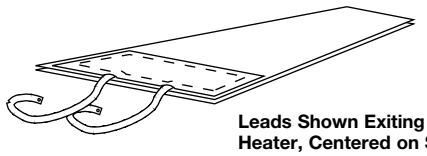
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Silicone Rubber Heaters

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.**

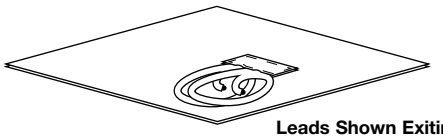
PTFE UL® 1180 CSA



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.

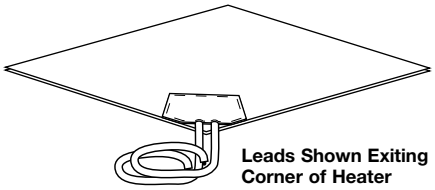
PTFE Leads



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

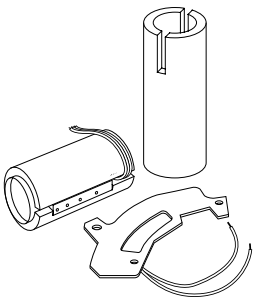


Leads Shown Exiting Corner of Heater

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 waporproof. 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.

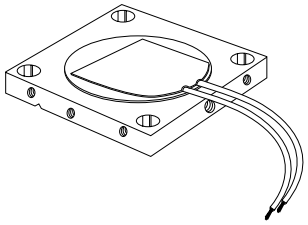
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EXTENDED CAPABILITY

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.

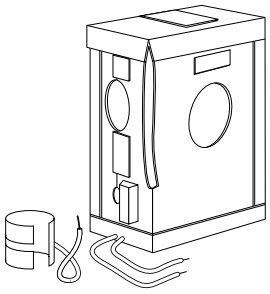
Integrated Control



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.

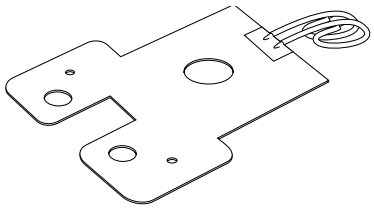
Construction

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.

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.

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Silicone Rubber Heaters

Wire-Wound Elements

Width in.	Width (mm)	Length in.	Length (mm)	Watts	120VAC Part Number	120/240VAC Part Number
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**	
		80	(2032)	400	**010800C1**	
		120	(3048)	600	**010F10C1**	
2	(51)	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® component recognition available
- Silicone rubber wire-wound elements rated at 5 W/in^2 (0.78 W/cm^2)

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Silicone Rubber Heaters

Wire-Wound Elements *(Continued)*

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

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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

Type	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.

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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
- ATS™ 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

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Line Heating

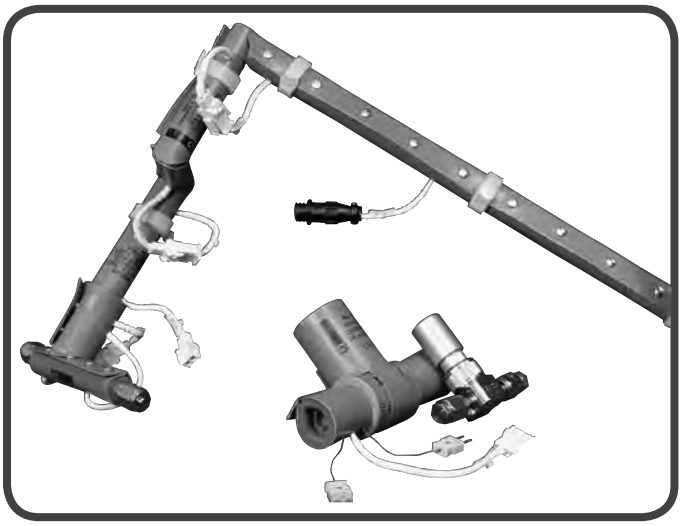
Silicone Gas Line Heaters

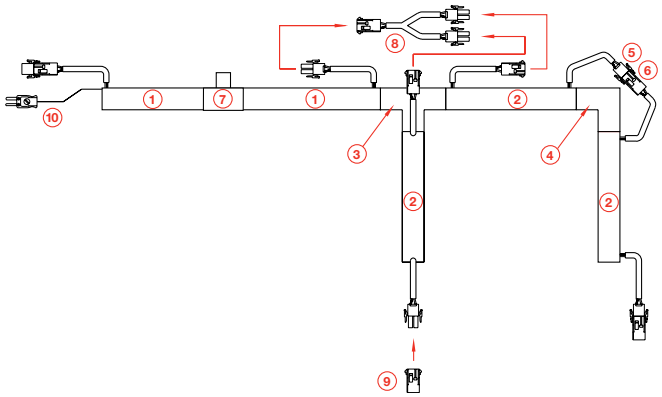
Gas Delivery

Tetraethyl orthosilicate (TEOS), boron trichloride (BCl^3), aluminum chloride ($AlCl^3$), chlorine trifluoride (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 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^2 (0.4 W/cm^2) on gas line O.D.
- UL® recognized for U.S. and Canadian safety standards
- Heaters and insulators meet UL® 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® 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™ connector part number 1-480698-0; with sockets AMP MATE-N-LOK™ connector part number 350689-1

⑥ Female cap, AMP MATE-N-LOK™ connector part number 1-480699-0; with pins AMP MATE-N-LOK™ 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)

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Line Heating

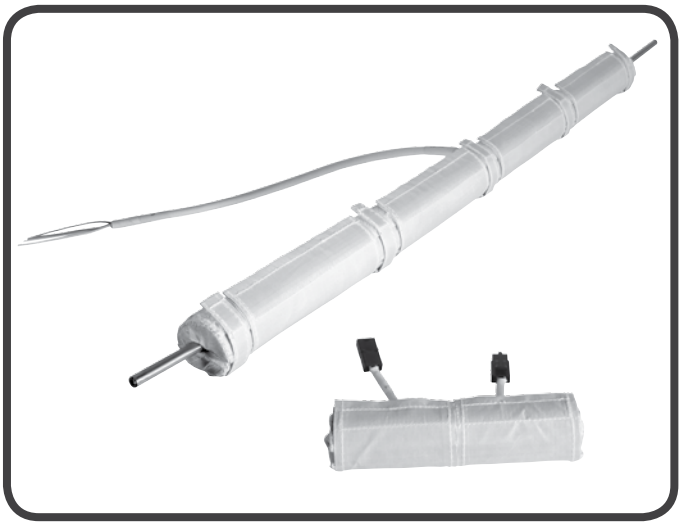
ASSURANT® SERIES TF Gas Line Heaters

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 upsteam 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_3
- Chlorine trifluoride, ClF_3
- Dichlorosilane, (DCS), SiH_2Cl_2
- Tetra ethyl orthosilicate, TEOS
- Tungsten hexafluoride, WF_3
- Process gas line qualification

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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.

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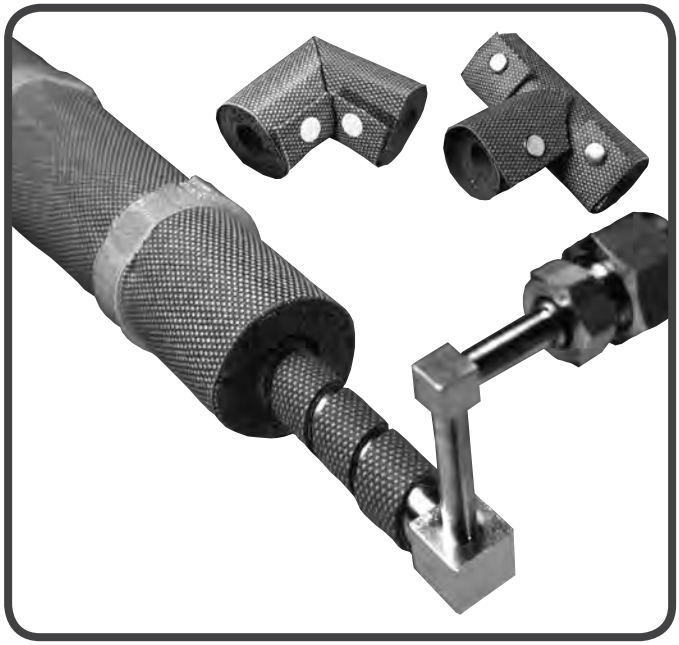
Line Heating

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^2 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_3
- Chlorine trifluoride, ClF_3
- Dichlorosilane, (DCS), SiH_2Cl_2
- Tetra ethyl orthosilicate, TEOS
- Tungsten hexafluoride, WF_3
- 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^2 (0.31 W/cm^2) – 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

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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/in², 80 percent coverage 1.6 W/in² or 60 percent coverage 1.2 W/in².

S-T-L Heater Ranges - 1/4 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 - 1/2 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

1/4 in. (6 mm) O.D. Tubing Insulators

1/4 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**

1/2 in. (13 mm) O.D. Tubing Insulators

1/2 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**

3/8 in. (9.5 mm) O.D. Tubing Insulators

3/8 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**

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Line Heating

STRETCH-TO-LENGTH Heaters *(Continued)*

Power Extensions

Description	Part Number
3 ft (914 mm)	**A000136**
6 ft (1829 mm)	**A000137**
10 ft (3048 mm)	**A000138**

Accessories

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

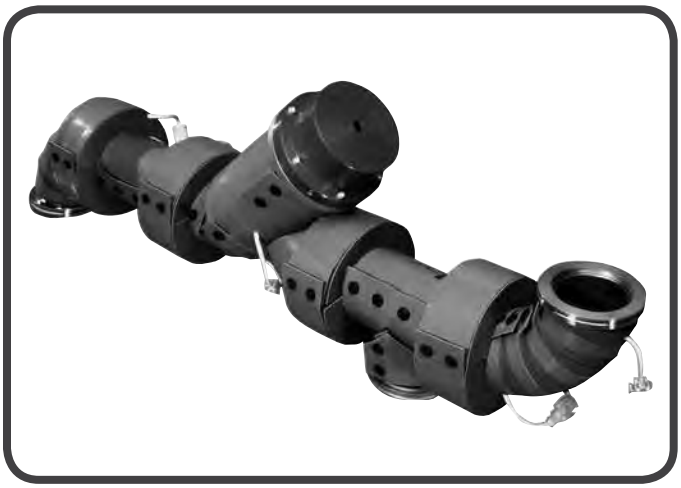
Note: All power connectors use AMP MATE-N-LOK™

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Line Heating

Silicone Pump Line Heaters

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



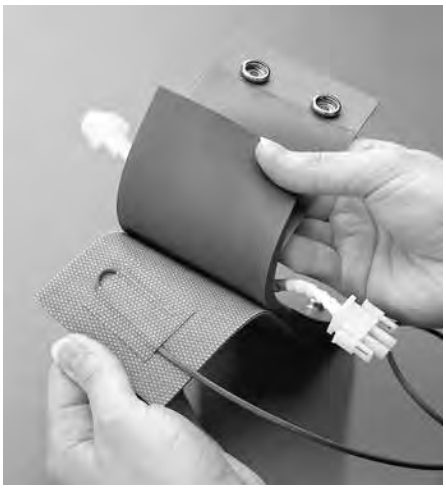
Agency Certification, Recognition Compliance and Approvals

- 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

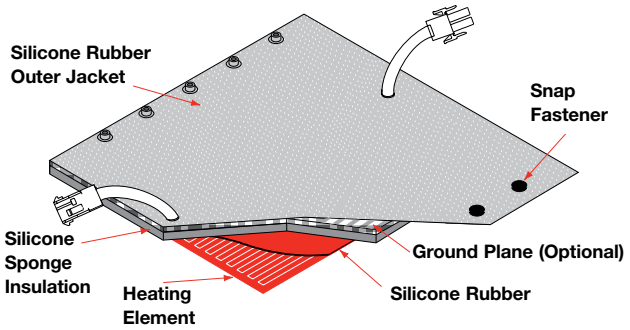
Contact your Watlow representative for specific applications and approvals.

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



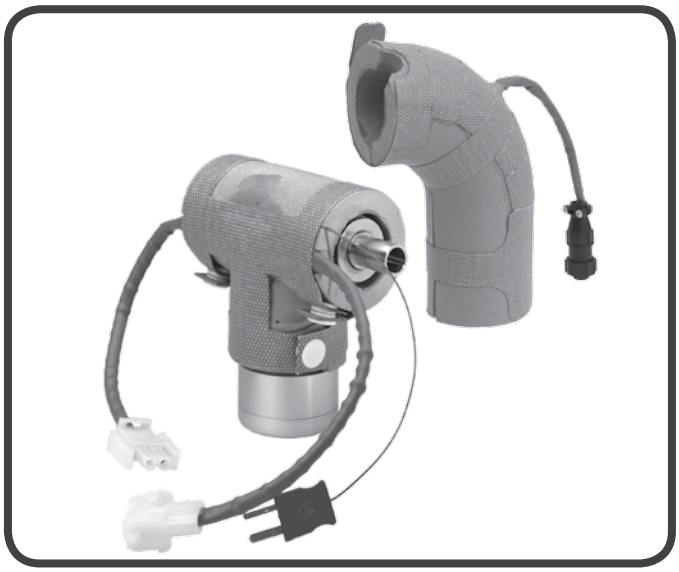
- Snap type fasteners are ½ in. (13 mm) with a nominal diameter metal construction and a nylon cover. The maximum operating temperature is 392°F (200°C).
- Hook and latch fasteners are available.
- 120 and 208VAC are standard. Contact your Watlow representative for other voltages.
- Power lead wires 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/in² (0.23 W/cm²)
  3-4 in. (76-102 mm) diameter, 1.25 W/in² (0.19 W/cm²)

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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

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Line Heating

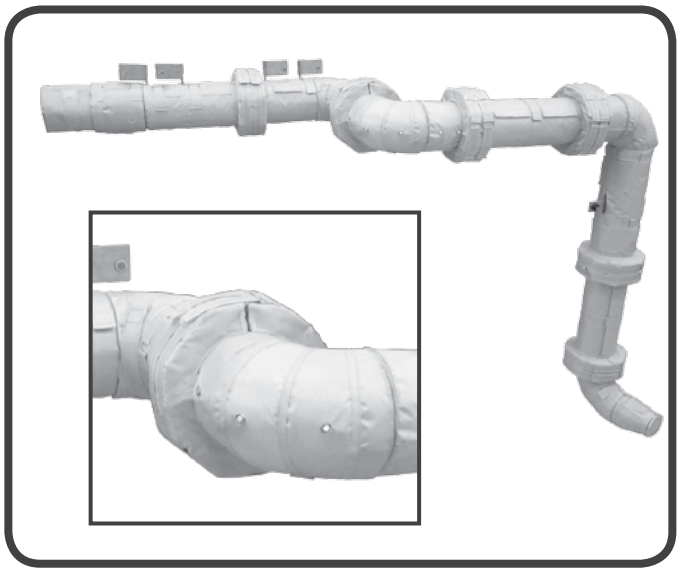
ASSURANT SERIES TC Pump Line Heaters

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

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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

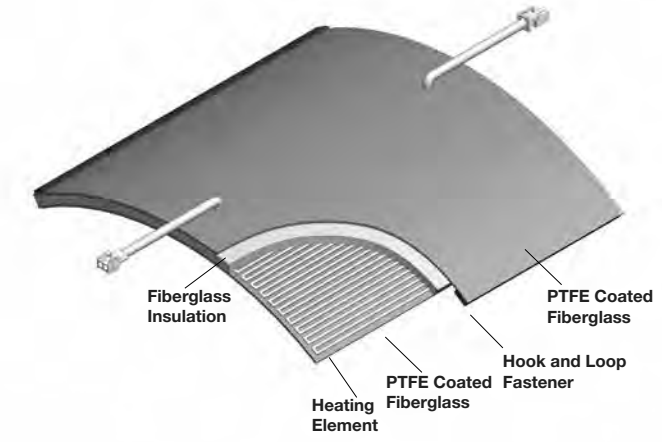
- PTFE coated fiberglass

Dimensions

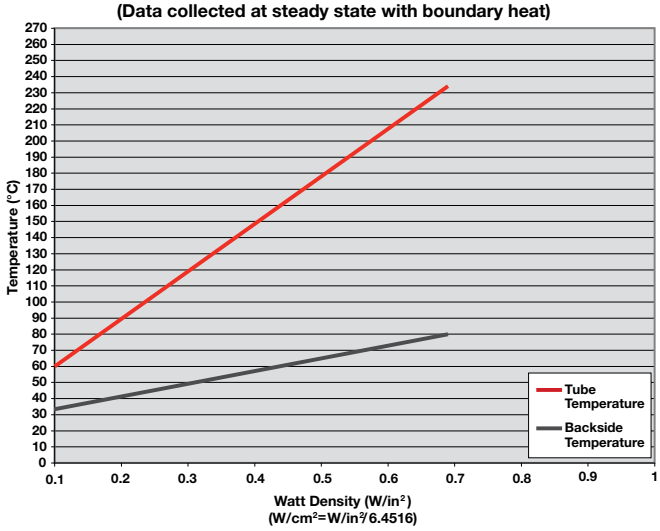
- Available for pipe sizes 1 to 6 in. (25 to 152 mm) diameter.

For other sizes contact your Watlow representative.

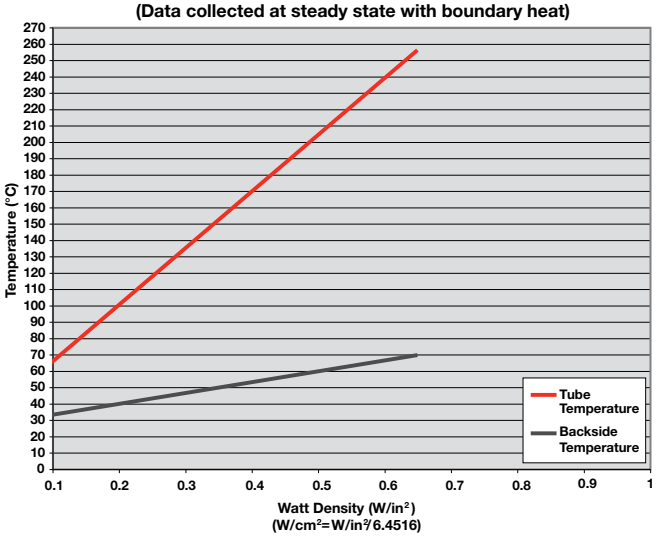
Heater Construction



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.

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Line Heating

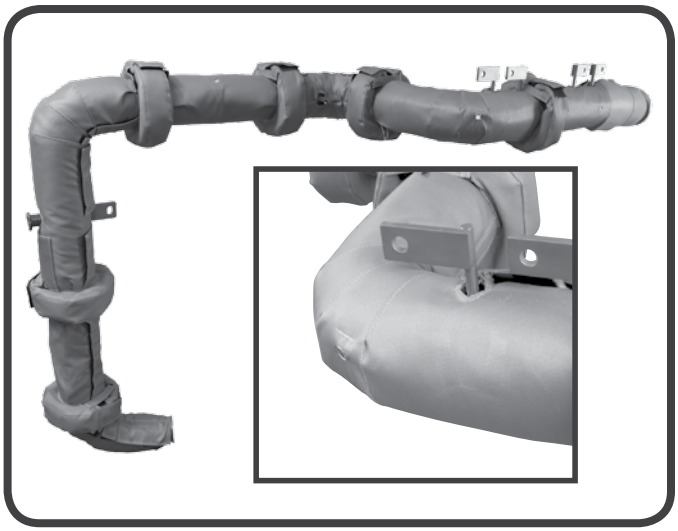
ASSURANT SERIES TA Pump Line Heaters

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

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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

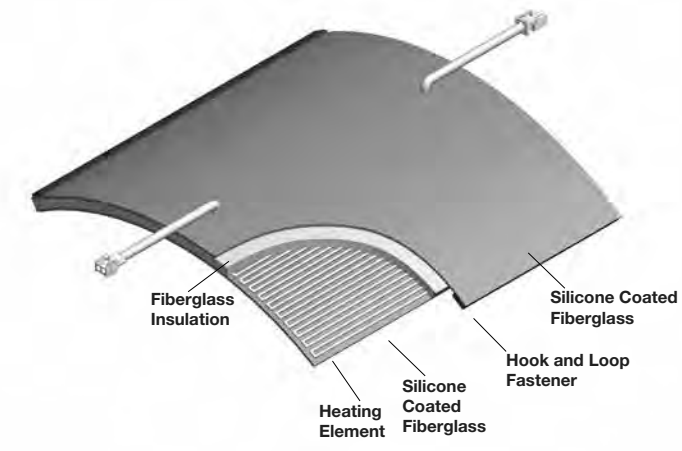
- Silicone rubber coated fiberglass

Dimensions

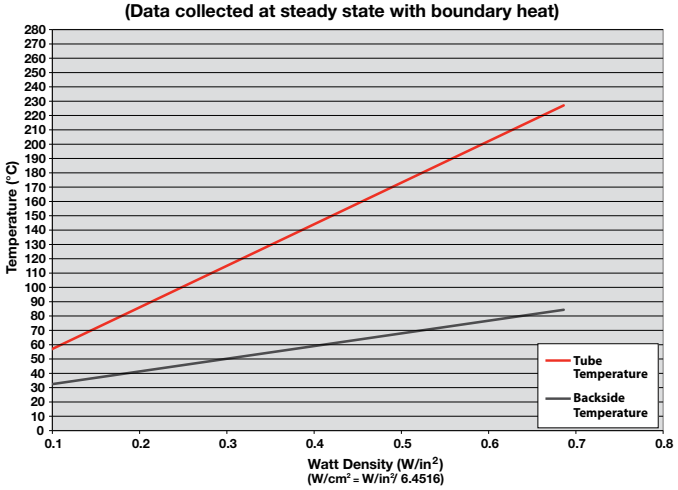
- Available for pipe sizes 1 to 6 in. (25 to 152 mm) diameter.

For other sizes contact your Watlow representative.

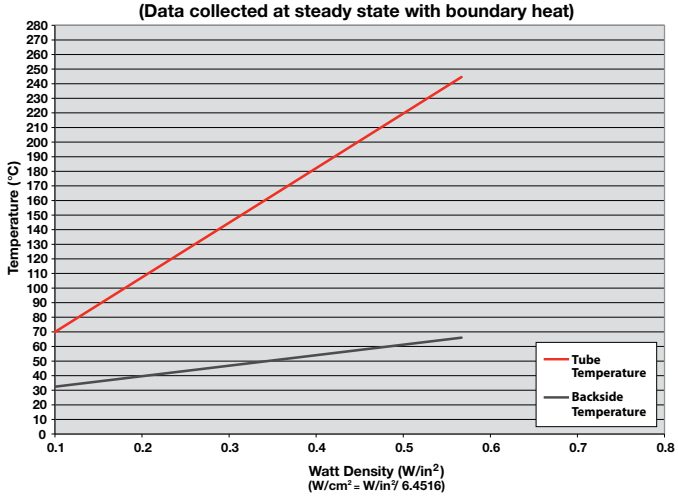
Heater Construction



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.

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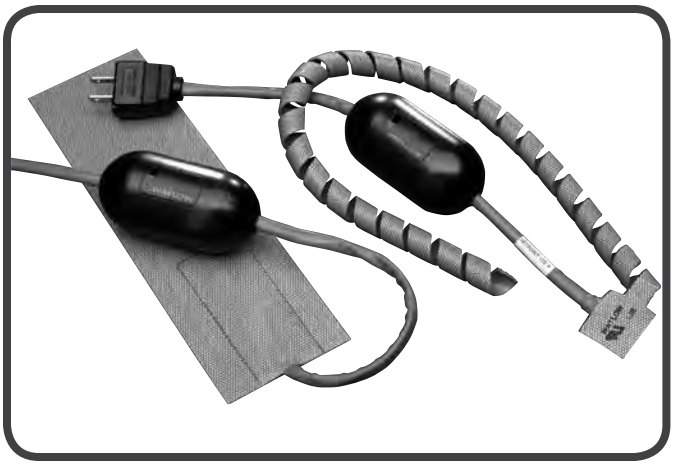
SERIES EHG®

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

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SERIES EHG

Technical Information

Specifications

Operational

- SERIES EHG silicone rubber heater UL® 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^2 (12.5 W/cm^2) dependent on application temperature
- SERIES EHG system UL® 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

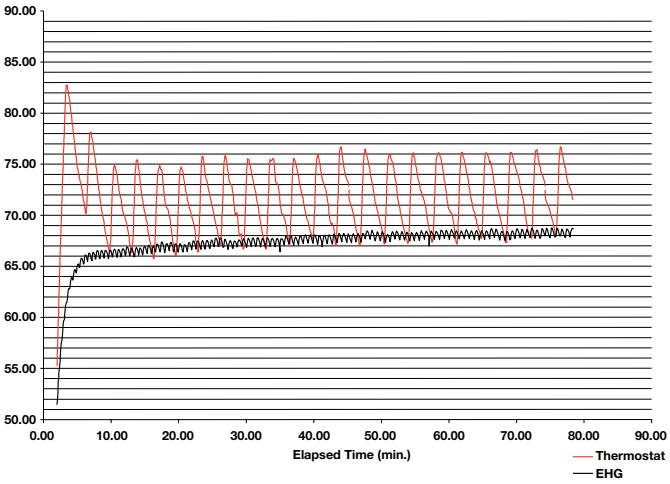
- Silicone rubber heater: UL® recognized File #E52951
- SERIES EHG control: TUV File DE 3-3068 to EN 61010-1:2001, UL® File E43684 to UL® 873 temperature indicating and regulating equipment

Environmental

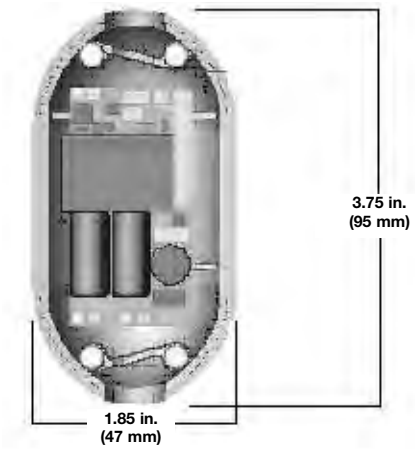
- Control operating temperature range 32 to 158°F (0 to 70°C)
- Control storage temperature range -40 to 158°F (–40 to 70°C)

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)

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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/VDC, 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

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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

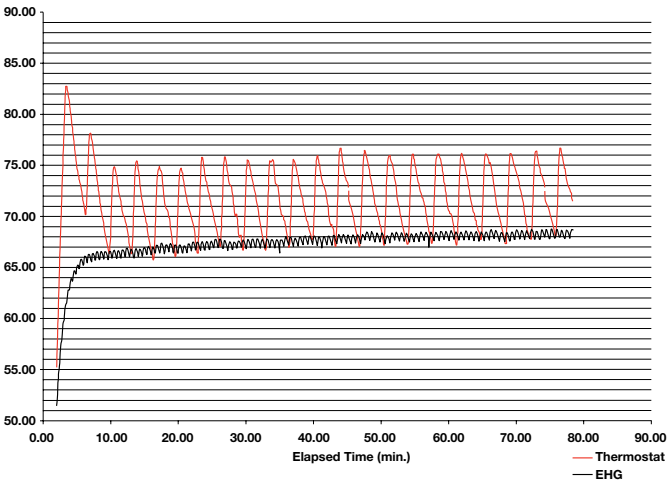
Environmental

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

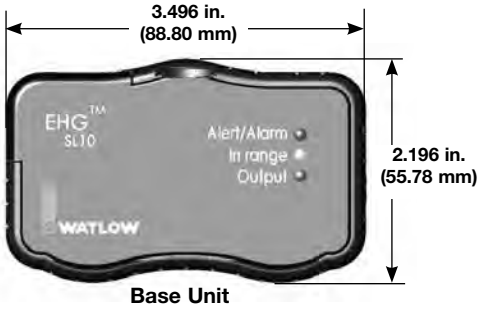
Agency Approvals

- 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)

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SERIES EHG SL10

Technical Information *(Continued)*

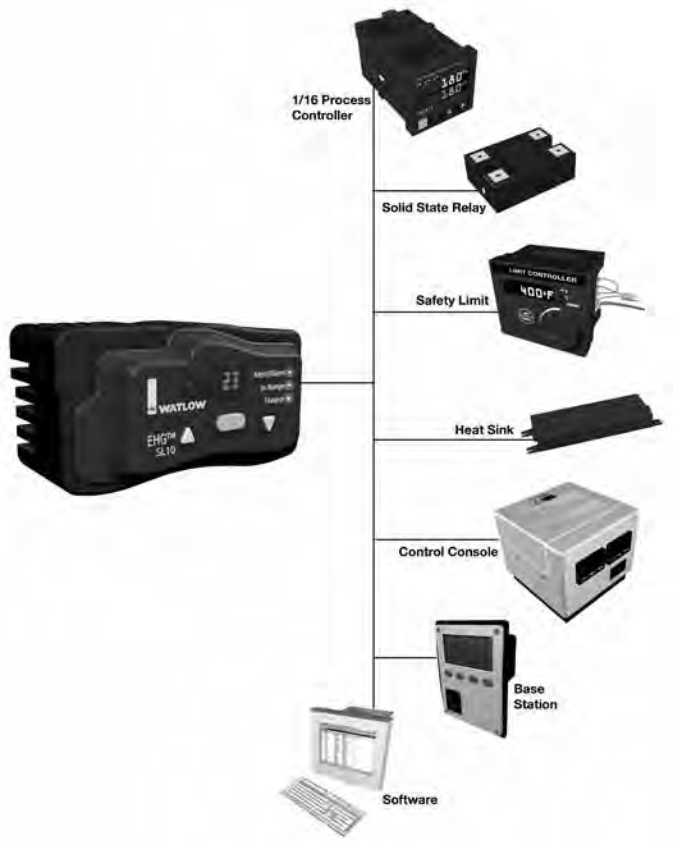
EHG SL10 Software

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.

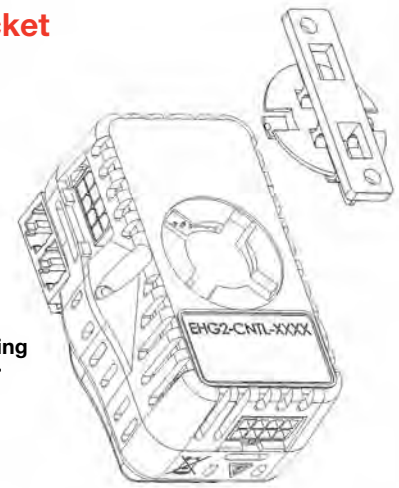




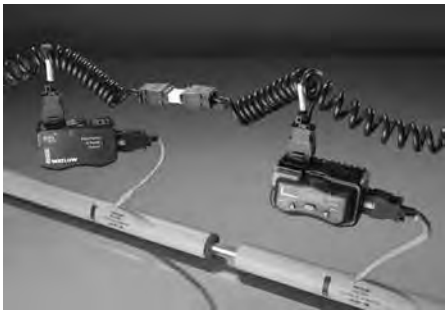
Reduces System Complexity and Cost



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.

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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 gasline applications were 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)



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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

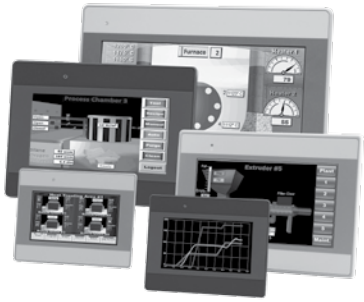
⑦ ⑧ ⑨	Modules
001 =	Base unit
007 =	Display module
008 =	Communications module
002 =	Display and communications module

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.

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Immersion Heaters

Immersion Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
WATROD and FIREBAR® Screw Plug	Alloy 800/840	1600	870	120	18.6	145
	Stainless steel	1200	650	120	18.6	
	Steel	750	400	120	18.6	
WATROD Screw Plug with Control Assembly	Alloy 800	1600	870	60	9.3	218
WATROD ANSI Flange	Alloy 800	1600	870	100	15.5	220
	Stainless steel	1200	650	100	15.5	
	Steel	750	400	100	15.5	
WATROD Plate Flange	Alloy 800/840	1600	870	60	9.3	282
	304 stainless steel	1200	650	100	15.5	
	Steel	750	400	30	4.7	
WATROD and FIREBAR Square Flange	Alloy 800	1600	870	100	15.5	288
WATROD and FIREBAR Bayonet/Pipe Insert	Alloy 800	1600	870	10	1.6	291
	Steel	750	400	10	1.6	
FIREROD®	Alloy 800	212	100	300	46.5	293



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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.

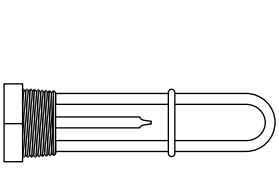
Available in a variety of sizes, Watlow® screw plug immersion heaters feature both WATROD™ round and FIREBAR® flat tubular elements.

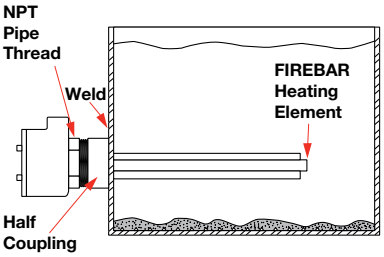
Heating elements are hairpin bent and either welded or brazed into the screw plug—depending on element sheath and plug material compatibility.

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^2 (18.6 W/cm^2)
- 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.

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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

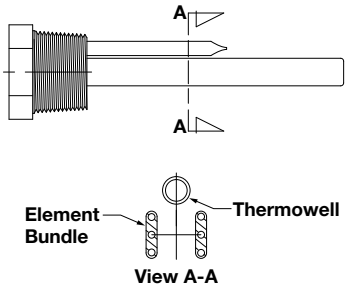
Screw Plug Orientation

Correct element/thermowell orientation assures proper process temperature sensing.

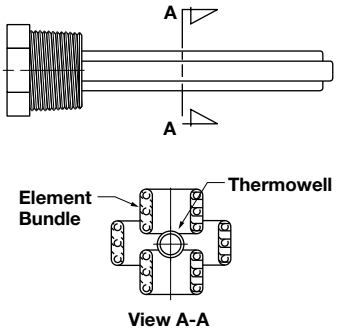
Correct horizontal mounting of WATROD and FIREBAR screw plugs is shown below. Correct orientation assures optimum performance and maximum heater life. Additional mounting information is provided in the *Installation and Maintenance Instructions*.

FIREBAR Heating Elements

1 1/4 in. NPT–One Element

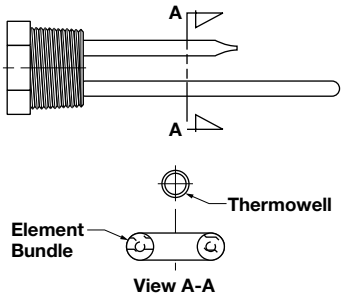


2 1/2 in. NPT–Three Elements

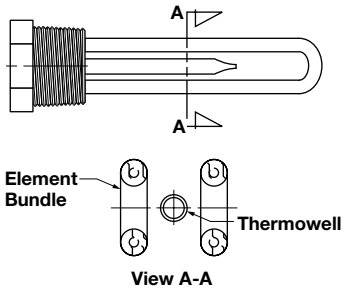


WATROD Heating Element

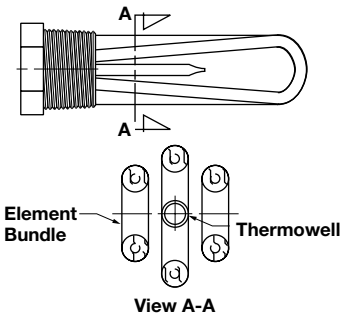
1 in. NPT–One Element



1 1/4 in. and 2 in. NPT–Two Elements



2 in. and 2 1/2 in. NPT–Three Elements



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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.

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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 Positive	Conductor Characteristics Negative	Recommended ① Temperature Range °F	Recommended ① Temperature Range (°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

WATROD	Alloy 800/840 316 SS Copper clad steel Steel
FIREBAR	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

WATROD	304 SS, Brass, 316 SS Steel
FIREBAR	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.

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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

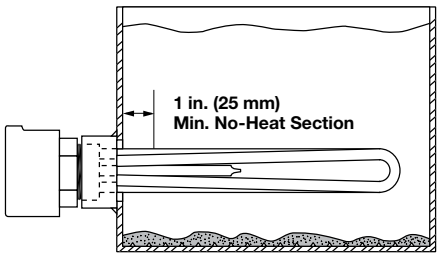
Screw plug to flange adapters permit replacing flange heaters with screw plug heaters. To order, specify the appropriate part number.

Screw Plug to Flange Adapters

Screw Plug to Flange Adapter Sizes	Material	Estimated Shipping Wt. lbs	(kg)	Part Number
1¼ to 3 in.-150#	Steel	13	(5.9)	**125X3SA**
2½ to 3 in.-150#	Steel	11	(5.0)	**250X3SA**
2½ to 4 in.-150#	Steel	16	(7.3)	**250X4SA**
2½ to 5 in.-150#	Steel	25	(11.3)	**250X5SA**
2½ to 6 in.-150#	Steel	33	(15.0)	**250X6SA**

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.

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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

WATROD	Hastelloy C276 Monel®

Screw Plug Materials

The following screw plug materials are available:

Extended Screw Plug Materials

WATROD	Brass Carbon steel 304 SS 316 SS

To order, specify **screw plug size** and **material**.

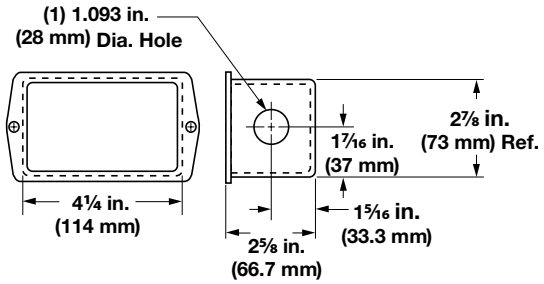
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WATROD and FIREBAR Screw Plug Immersion Heaters

Optional Moisture Resistant Enclosures

With Single-Pole Thermostat

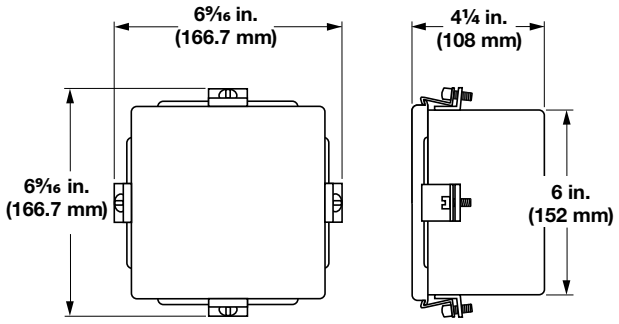
1 and 1 1/4 inch NPT–1 WATROD Element



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.

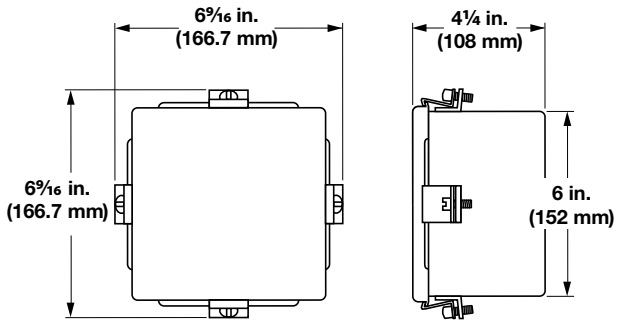
To order: Reference "W" in the *Ordering Information* section on page 217.

With Double-Pole Thermostat

1 1/4 inch NPT–2 WATROD Elements

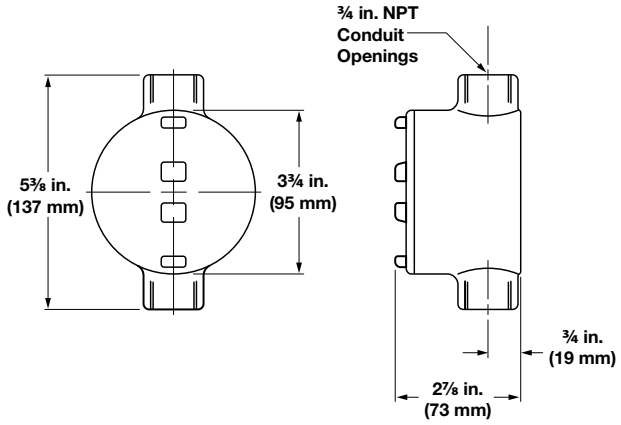
1 1/4 inch NPT–1 FIREBAR Element

All 2 and 2 1/2 inch NPT screw plugs



Note: The enclosure is not centered on the screw plug heater.

Without Thermostat

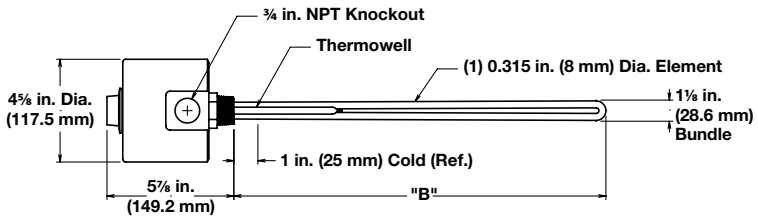


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WATROD and FIREBAR Screw Plug Immersion Heaters

Application: Clean Water

- 1 inch NPT screw plug
- WATROD elements
- With thermostat (SPST), Type 2 or 3
- General purpose enclosure



								Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	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/in² 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.

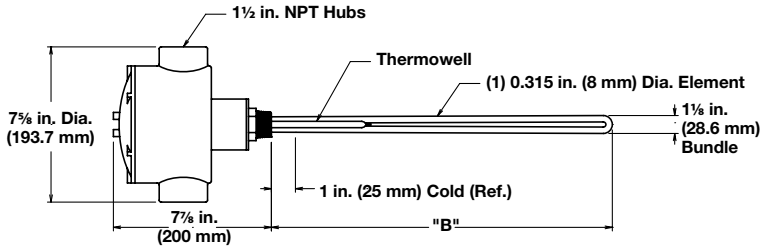
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WATROD and FIREBAR
Screw Plug Immersion Heaters

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)



							Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in.	(mm)	Ship Wt. lbs (kg)	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/in² Brass Plug 1-Alloy 800 Element (9.3 W/cm²)	120	0.50	1	4 1/2	(114.0)	3 (2)	BCN4J1C2	C/F	C/F	BCN4J1C3	C/F	C/F
	240	0.50	1	4 1/2	(114.0)	3 (2)	BCN4J10C2	C/F	C/F	BCN4J10C3	C/F	C/F
	120	0.75	1	6 1/2	(165.0)	3 (2)	BCN6J1C2	C/F	C/F	BCN6J1C3	C/F	C/F
	240	0.75	1	6 1/2	(165.0)	3 (2)	BCN6J10C2	C/F	C/F	BCN6J10C3	C/F	C/F
	120	1.00	1	6 5/8	(168.3)	3 (2)	BCN6L1C2	C/F	C/F	BCN6L1C3	C/F	C/F
	240	1.00	1	6 5/8	(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 5/8	(269.9)	4 (2)	BCN10L1C2	C/F	C/F	BCN10L1C3	C/F	C/F
	240	1.50	1	10 5/8	(269.9)	4 (2)	BCN10L10C2	C/F	C/F	BCN10L10C3	C/F	C/F
	120	2.00	1	12 1/2	(318.0)	5 (3)	BCN12J1C2	C/F	C/F	BCN12J1C3	C/F	C/F
	240	2.00	1	12 1/2	(318.0)	5 (3)	BCN12J10C2	C/F	C/F	BCN12J10C3	C/F	C/F
	120	2.50	1	14 3/4	(375.0)	5 (3)	BCN14N1C2	C/F	C/F	BCN14N1C3	C/F	C/F
	240	2.50	1	14 3/4	(375.0)	5 (3)	BCN14N10C2	C/F	C/F	BCN14N10C3	C/F	C/F
	120	3.00	1	16 3/4	(425.0)	6 (3)	BCN16N1C2	C/F	C/F	BCN16N1C3	C/F	C/F
	240	3.00	1	16 3/4	(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.

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⑤ No third party recognition

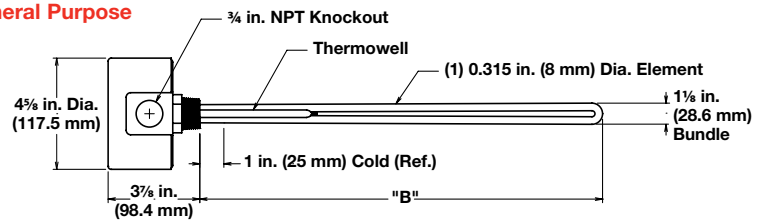
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WATROD and FIREBAR Screw Plug Immersion Heaters

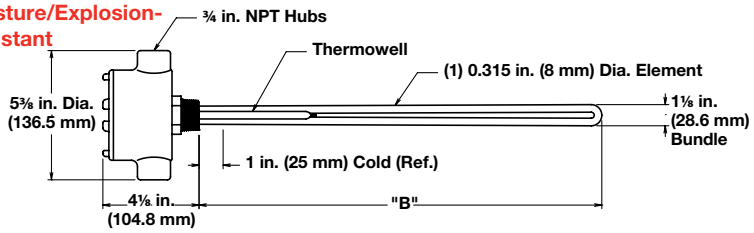
Application: Clean Water

- 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	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
60 W/in² Brass Plug 1-Alloy 800 Element (9.3 W/cm²)	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.

⑤ No third party recognition

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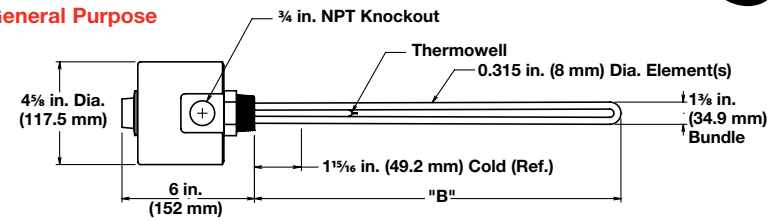
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WATROD and FIREBAR Screw Plug Immersion Heaters

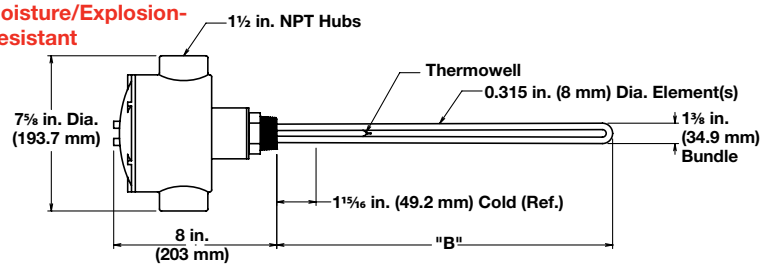
Application: Clean Water

- 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



						Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² Brass Plug 1-Alloy 800 Element (9.3 W/cm²)	120	0.50	1	4 3/8 (111.1)	3 (2)	**BDN4G1S2**	C/F	C/F	**BDN4G1S3**	C/F	C/F
	240	0.50	1	4 3/8 (111.1)	3 (2)	**BDN4G10S2**	C/F	C/F	**BDN4G10S3**	C/F	C/F
	120	0.75	1	6 3/8 (161.9)	3 (2)	**BDN6G1S2**	C/F	C/F	**BDN6G1S3**	C/F	C/F
	240	0.75	1	6 3/8 (161.9)	3 (2)	**BDN6G10S2**	C/F	C/F	**BDN6G10S3**	C/F	C/F
60 W/in² ④ Brass Plug 2-Alloy 800 Elements (9.3 W/cm²)	120/240	1.00	1	4 3/8 (111.1)	4 (2)	**BEN4G6S2**	C/F	C/F	**BEN4G6S3**	C/F	C/F
	120/240	1.50	1	6 3/8 (161.9)	4 (2)	**BEN6G6S2**	C/F	C/F	**BEN6G6S3**	C/F	C/F
	120/240	2.00	1	8 1/2 (216.0)	5 (3)	**BEN8J6S2**	C/F	C/F	**BEN8J6S3**	C/F	C/F
	120/240	2.50	1	10 3/4 (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 1/2 (597.0)	8 (4)	**BEN23J10S2**	C/F	C/F	**BEN23J10S3**	C/F	C/F
	240	6.00	1	27 1/2 (699.0)	9 (4)	**BEN27J10S2**	C/F	C/F	**BEN27J10S3**	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
60 W/in² Brass Plug 1-Alloy 800 Element (9.3 W/cm²)	120	0.50	1	4 3/8 (111.1)	7 (4)	**BDN4G1C2**	C/F	C/F	**BDN4G1C3**	C/F	C/F
	240	0.50	1	4 3/8 (111.1)	7 (4)	**BDN4G10C2**	C/F	C/F	**BDN4G10C3**	C/F	C/F
	120	0.75	1	6 3/8 (161.9)	7 (4)	**BDN6G1C2**	C/F	C/F	**BDN6G1C3**	C/F	C/F
	240	0.75	1	6 3/8 (161.9)	7 (4)	**BDN6G10C2**	C/F	C/F	**BDN6G10C3**	C/F	C/F
60 W/in² ④ Brass Plug 2-Alloy 800 Elements (9.3 W/cm²)	120/240	1.00	1	4 3/8 (111.1)	8 (4)	**BEN4G6C2**	C/F	C/F	**BEN4G6C3**	C/F	C/F
	120/240	1.50	1	6 3/8 (161.9)	8 (4)	**BEN6G6C2**	C/F	C/F	**BEN6G6C3**	C/F	C/F
	120/240	2.00	1	8 1/2 (216.0)	9 (4)	**BEN8J6C2**	C/F	C/F	**BEN8J6C3**	C/F	C/F
	120/240	2.50	1	10 3/4 (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 1/2 (597.0)	12 (6)	**BEN23J10C2**	C/F	C/F	**BEN23J10C3**	C/F	C/F
	240	6.00	1	27 1/2 (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
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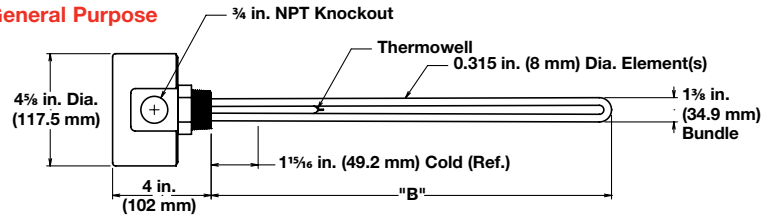
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WATROD and FIREBAR Screw Plug Immersion Heaters

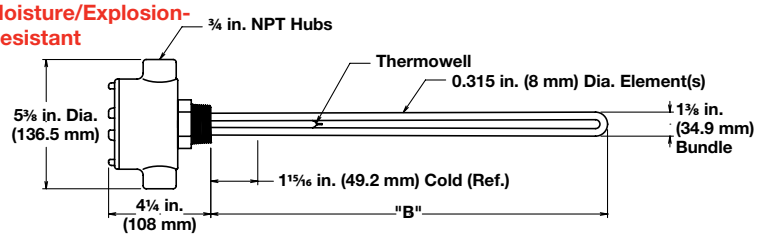
Application: Clean Water

- 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)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT Part Number		240V WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT 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/in² Brass Plug 1-Alloy 800 Element (9.3 W/cm²)	120	0.50	1	4 3/8 (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 3/8 (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 3/8 (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 3/8 (161.9)	**BDN6G10S**	3 (2)	**N/A**	**N/A**	**C1-17**	**C1-13**	**BDN6G10C**	6 (3)	**C/F**	**C/F**
60 W/in² ④ Brass Plug 2-Alloy 800 Elements (9.3 W/cm²)	120/240	1.00	1	4 3/8 (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 3/8 (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 1/2 (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 3/4 (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 1/2 (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 1/2 (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.

④ Wired for higher voltage

⑤ No third party recognition

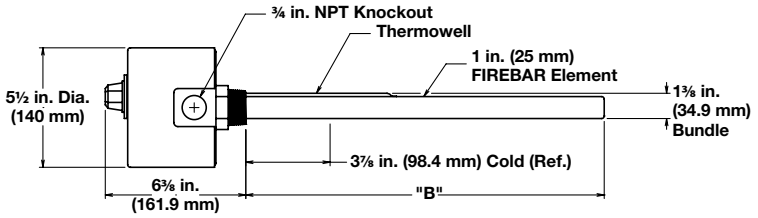
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N/A - Not available

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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



						Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
90 W/in² ⑧ 304 SS Plug 1-Alloy 800 Element (14 W/cm²)	240	1.5	1	7 5/8 (193.7)	6 (3)	**BDNF7R10S5A**	C/F	C/F	**BDNF7R10S7A**	C/F	C/F
	480	1.5	1	7 5/8 (193.7)	6 (3)	**BDNF7R11S5A**	C/F	C/F	**BDNF7R11S7A**	C/F	C/F
	240	3.0	1	11 1/8 (282.6)	7 (4)	**BDNF11G10S5A**	C/F	C/F	**BDNF11G10S7A**	C/F	C/F
	480	3.0	1	11 1/8 (282.6)	7 (4)	**BDNF11G11S5A**	C/F	C/F	**BDNF11G11S7A**	C/F	C/F
	240	5.0	3	16 1/8 (409.6)	8 (4)	**BDNF16G3S5A**	C/F	C/F	**BDNF16G3S7A**	C/F	C/F
	480	5.0	3	16 1/8 (409.6)	8 (4)	**BDNF16G5S5A**	C/F	C/F	**BDNF16G5S7A**	C/F	C/F
	240	6.5	3	19 1/8 (485.8)	9 (4)	**BDNF19G3S5A**	C/F	C/F	**BDNF19G3S7A**	C/F	C/F
	480	6.5	3	19 1/8 (485.8)	9 (4)	**BDNF19G5S5A**	C/F	C/F	**BDNF19G5S7A**	C/F	C/F
	240	8.5	3	24 3/8 (619.1)	10 (5)	**BDNF24L3S5A**	C/F	C/F	**BDNF24L3S7A**	C/F	C/F
	480	8.5	3	24 3/8 (619.1)	10 (5)	**BDNF24L5S5A**	C/F	C/F	**BDNF24L5S7A**	C/F	C/F
	240	10.5	3	29 5/8 (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.

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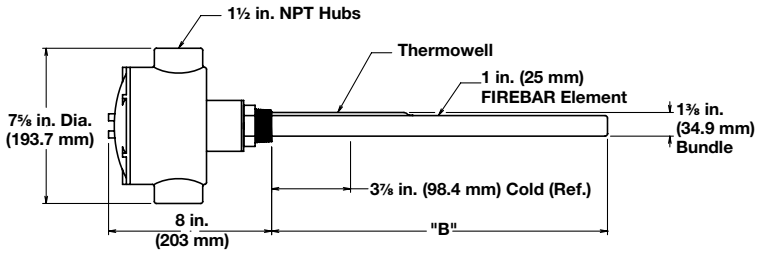
⑧ Can be wired for 1-phase operation

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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)



						Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² ⑧ 304 SS Plug 1-Alloy 800 Element (14 W/cm²)	240	1.5	1	7 5/8 (193.7)	9 (4)	BDNF7R10C5A	C/F	C/F	BDNF7R10C7A	C/F	C/F
	480	1.5	1	7 5/8 (193.7)	9 (4)	BDNF7R11C5A	C/F	C/F	BDNF7R11C7A	C/F	C/F
	240	3.0	1	11 1/8 (282.6)	10 (5)	BDNF11G10C5A	C/F	C/F	BDNF11G10C7A	C/F	C/F
	480	3.0	1	11 1/8 (282.6)	10 (5)	BDNF11G11C5A	C/F	C/F	BDNF11G11C7A	C/F	C/F
	240	5.0	3	16 1/8 (409.6)	11 (5)	BDNF16G3C5A	C/F	C/F	BDNF16G3C7A	C/F	C/F
	480	5.0	3	16 1/8 (409.6)	11 (5)	BDNF16G5C5A	C/F	C/F	BDNF16G5C7A	C/F	C/F
	240	6.5	3	19 1/8 (485.8)	12 (6)	BDNF19G3C5A	C/F	C/F	BDNF19G3C7A	C/F	C/F
	480	6.5	3	19 1/8 (485.8)	12 (6)	BDNF19G5C5A	C/F	C/F	BDNF19G5C7A	C/F	C/F
	240	8.5	3	24 3/8 (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.

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⑤ No third party recognition

⑧ Can be wired for 1-phase operation

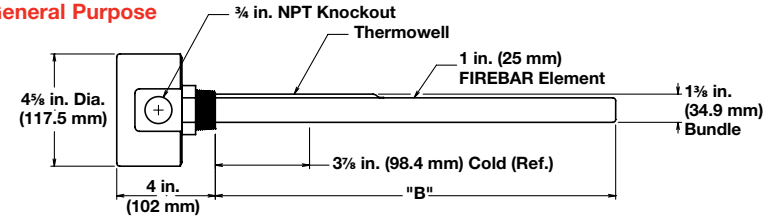
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WATROD and FIREBAR Screw Plug Immersion Heaters

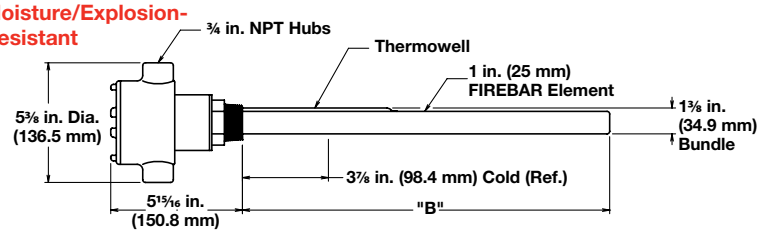
Application: Clean Water

- 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)

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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
90 W/in² ⑧ 304 SS Plug 1-Alloy 800 Element (9.3 W/cm²)	240	1.5	1	7 5/8 (193.7)	**BDNF7R10S**	5 (3)	**C1-17**	**C1-13**	**BDNF7R10C**	8 (4)	**C/F**	**C/F**
	480	1.5	1	7 5/8 (193.7)	**BDNF7R11S**	5 (3)	**C/F**	**C/F**	**BDNF7R11C**	8 (4)	**C/F**	**C/F**
	240	3.0	1	11 1/8 (282.6)	**BDNF11G10S**	6 (3)	**C1-17**	**C1-13**	**BDNF11G10C**	9 (4)	**C/F**	**C/F**
	480	3.0	1	11 1/8 (282.6)	**BDNF11G11S**	6 (3)	**C/F**	**C/F**	**BDNF11G11C**	9 (4)	**C/F**	**C/F**
	240	5.0	3	16 1/8 (409.6)	**BDNF16G3S**	7 (4)	**C2-50**	**C2-92**	**BDNF16G3C**	10 (5)	**C3-94**	**C3-93**
	480	5.0	3	16 1/8 (409.6)	**BDNF16G5S**	7 (4)	**C2-43**	**C2-35**	**BDNF16G5C**	10 (5)	**C3-116**	**C3-118**
	240	6.5	3	19 1/8 (485.8)	**BDNF19G3S**	8 (4)	**C2-50**	**C2-92**	**BDNF19G3C**	11 (5)	**C3-94**	**C3-93**
	480	6.5	3	19 1/8 (485.8)	**BDNF19G5S**	8 (4)	**C2-43**	**C2-35**	**BDNF19G5C**	11 (5)	**C3-116**	**C3-118**
	240	8.5	3	24 3/8 (619.1)	**BDNF24L3S**	9 (4)	**C2-50**	**C2-92**	**BDNF24L3C**	12 (6)	**C3-94**	**C3-93**
	480	8.5	3	24 3/8 (619.1)	**BDNF24L5S**	9 (4)	**C2-43**	**C2-35**	**BDNF24L5C**	12 (6)	**C3-116**	**C3-118**
	240	10.5	3	29 5/8 (752.5)	**BDNF29R3S**	10 (5)	**C2-236**	**C2-214**	**BDNF29R3C**	13 (6)	**C3-114**	**C3-115**
	480	10.5	3	29 5/8 (752.5)	**BDNF29R5S**	10 (5)	**C2-43**	**C2-35**	**BDNF29R5C**	13 (6)	**C3-116**	**C3-118**
	240	12.7	3	34 5/8 (879.5)	**BDNF34R3S**	11 (5)	**C2-236**	**C2-214**	**BDNF34R3C**	14 (7)	**C3-114**	**C3-115**
	480	12.7	3	34 5/8 (879.5)	**BDNF34R5S**	11 (5)	**C2-43**	**C2-35**	**BDNF34R5C**	14 (7)	**C3-116**	**C3-118**
	240	17.0	3	45 1/8 (1146.2)	**BDNF45G3S**	13 (6)	**C2-236**	**C2-214**	**BDNF45G3C**	16 (8)	**C3-114**	**C3-115**
	480	17.0	3	45 1/8 (1146.2)	**BDNF45G5S**	13 (6)	**C2-43**	**C2-35**	**BDNF45G5C**	16 (8)	**C3-116**	**C3-118**
	480	21.5	3	55 5/8 (1412.9)	**BDNF55R5S**	15 (7)	**C2-225**	**C2-226**	**BDNF55R5C**	18 (9)	**C3-117**	**C3-119**

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⑤ No third party recognition

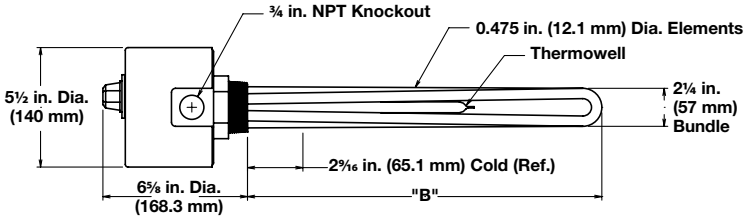
⑧ Can be wired for 1-phase operation

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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



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² ④ 304 SS Plug 2-Alloy 800 Elements (9.3 W/cm²)	120/240	2.0	1	8 1/8 (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 1/8 (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 1/8 (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 1/8 (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 1/8 (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 1/8 (460.4)	7 (4)	BGN718C6S4	C/F	C/F	BGN718C6S5A	C/F	C/F	BGN718C6S7A	C/F	C/F
60 W/in² 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm²)	240	3.0	3	8 1/8 (206.4)	6 (3)	BHN78C3S4	C/F	C/F	BHN78C3S5A	C/F	C/F	BHN78C3S7A	C/F	C/F
	480	3.0	3	8 1/8 (206.4)	6 (3)	BHN68C13S4	C/F	C/F	BHN68C13S5A	C/F	C/F	BHN68C13S7A	C/F	C/F
	240	4.5	3	11 1/8 (282.6)	7 (4)	BHN711C3S4	C/F	C/F	BHN711C3S5A	C/F	C/F	BHN711C3S7A	C/F	C/F
	480	4.5	3	11 1/8 (282.6)	7 (4)	BHN611C13S4	C/F	C/F	BHN611C13S5A	C/F	C/F	BHN611C13S7A	C/F	C/F
	240	6.0	3	15 1/8 (384.2)	8 (4)	BHN715C3S4	C/F	C/F	BHN715C3S5A	C/F	C/F	BHN715C3S7A	C/F	C/F
	480	6.0	3	15 1/8 (384.2)	8 (4)	BHN715C5S4	C/F	C/F	BHN715C5S5A	C/F	C/F	BHN715C5S7A	C/F	C/F
	240	7.5	3	18 1/8 (460.4)	8 (4)	BHN718C3S4	C/F	C/F	BHN718C3S5A	C/F	C/F	BHN718C3S7A	C/F	C/F
	240	9.0	3	21 1/8 (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.

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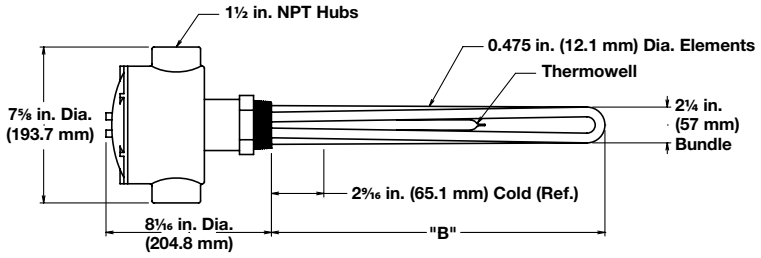
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WATROD and FIREBAR Screw Plug Immersion Heaters

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)



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
60 W/in² ④ 304 SS Plug 2-Alloy 800 Elements (9.3 W/cm²)	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/in² 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm²)	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.

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④ Wired for higher voltage

⑤ No third party recognition

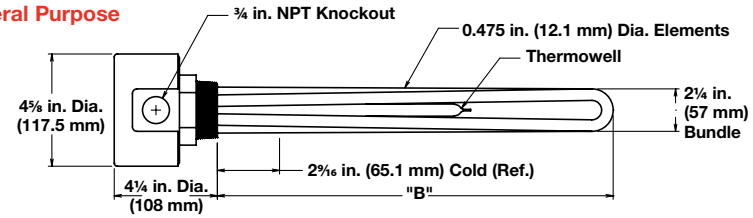
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WATROD and FIREBAR Screw Plug Immersion Heaters

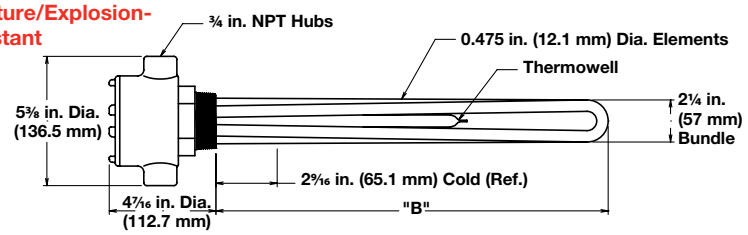
Application: Clean Water

- 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 Part Number		240V WATCONNECT Part Number		480V WATCONNECT Part Number	
					General Purpose 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
60 W/in² ④ 304 SS Plug 2-Alloy 800 Elements (9.3 W/cm²)	120/240	2.0	1	8 1/8 (206.4)	**BGN78C6S**	4 (2)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**N/A**	**N/A**
	240/480	2.0	1	8 1/8 (206.4)	**BGN78C7S**	4 (2)	**N/A**	**N/A**	**C1-17**	**C1-13**	**C/F**	**C/F**
	120/240	3.0	1	11 1/8 (282.6)	**BGN711C6S**	5 (3)	**C/F**	**C/F**	**C1-17**	**C1-13**	**N/A**	**N/A**
	240/480	3.0	1	11 1/8 (282.6)	**BGN711C7S**	5 (3)	**N/A**	**N/A**	**C1-17**	**C1-13**	**C/F**	**C/F**
	120/240	4.0	1	15 1/8 (384.2)	**BGN715C6S**	6 (3)	**C/F**	**C/F**	**C1-17**	**C1-13**	**N/A**	**N/A**
	240/480	4.0	1	15 1/8 (384.2)	**BGN715C7S**	6 (3)	**N/A**	**N/A**	**C1-17**	**C1-13**	**C/F**	**C/F**
	120/240	5.0	1	18 1/8 (460.4)	**BGN718C6S**	6 (3)	**C/F**	**C/F**	**C/F**	**C/F**	**N/A**	**N/A**
	240/480	5.0	1	18 1/8 (460.4)	**BGN718C7S**	6 (3)	**N/A**	**N/A**	**C/F**	**C/F**	**C/F**	**C/F**
	240/480	6.0	1	21 1/8 (536.6)	**BGN721C7S**	7 (4)	**N/A**	**N/A**	**C/F**	**C/F**	**C/F**	**C/F**
	240/480	8.0	1	26 5/8 (676.3)	**BGN726L7S**	7 (4)	**N/A**	**N/A**	**C/F**	**C/F**	**C/F**	**C/F**
	240/480	10.0	1	32 1/8 (816.0)	**BGN732C7S**	8 (4)	**N/A**	**N/A**	**C/F**	**C/F**	**C/F**	**C/F**
60 W/in² 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm²)	120	3.0	1	8 1/8 (206.4)	**BHN78C1S**	5 (3)	**C/F**	**C/F**	**N/A**	**N/A**	**N/A**	**N/A**
	240	3.0	3	8 1/8 (206.4)	**BHN78C3S**	5 (3)	**N/A**	**N/A**	**C2-50**	**C2-92**	**N/A**	**N/A**
	480	3.0	3	8 1/8 (206.4)	**BHN68C13S**	5 (3)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	120	4.5	1	11 1/8 (282.6)	**BHN711C1S**	6 (3)	**C/F**	**C/F**	**N/A**	**N/A**	**N/A**	**N/A**
	240	4.5	3	11 1/8 (282.6)	**BHN711C3S**	6 (3)	**N/A**	**N/A**	**C2-50**	**C2-92**	**N/A**	**N/A**
	480	4.5	3	11 1/8 (282.6)	**BHN611C13S**	6 (3)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	240	6.0	3	15 1/8 (384.2)	**BHN715C3S**	7 (4)	**N/A**	**N/A**	**C2-50**	**C2-92**	**N/A**	**N/A**
	480	6.0	3	15 1/8 (384.2)	**BHN715C5S**	7 (4)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	240	7.5	3	18 1/8 (460.4)	**BHN718C3S**	7 (4)	**N/A**	**N/A**	**C2-50**	**C2-92**	**N/A**	**N/A**
	480	7.5	3	18 1/8 (460.4)	**BHN718C5S**	7 (4)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	240	9.0	3	21 1/8 (536.6)	**BHN721C3S**	8 (4)	**N/A**	**N/A**	**C2-50**	**C2-92**	**N/A**	**N/A**
	480	9.0	3	21 1/8 (536.6)	**BHN721C5S**	8 (4)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	240	12.0	3	26 5/8 (676.3)	**BHN726L3S**	8 (4)	**N/A**	**N/A**	**C2-236**	**C2-214**	**N/A**	**N/A**
	480	12.0	3	26 5/8 (676.3)	**BHN726L5S**	8 (4)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	240	15.0	3	32 1/8 (816.0)	**BHN732C3S**	9 (4)	**N/A**	**N/A**	**C2-236**	**C2-214**	**N/A**	**N/A**
	480	15.0	3	32 1/8 (816.0)	**BHN732C5S**	9 (4)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**

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
N/A - Not available

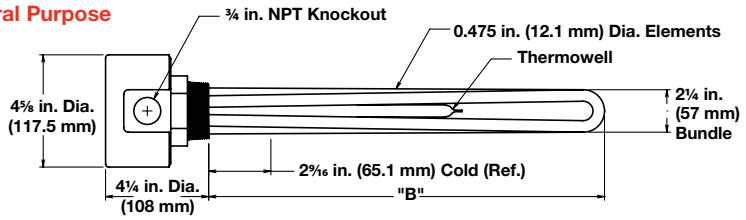
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WATROD and FIREBAR Screw Plug Immersion Heaters

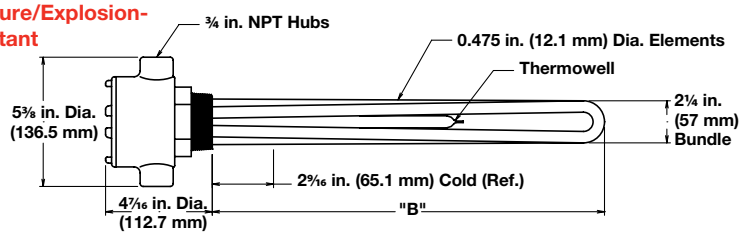
Application: Clean Water

- 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 Part Number		240V WATCONNECT Part Number		480V WATCONNECT 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
60 W/in² ④ 304 SS Plug 2-Alloy 800 Elements (9.3 W/cm²)	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/in² 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm²)	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.

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N/A - Not available

④ Wired for higher voltage

⑤ No third party recognition

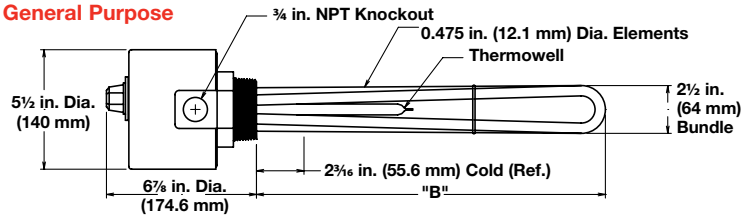
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WATROD and FIREBAR Screw Plug Immersion Heaters

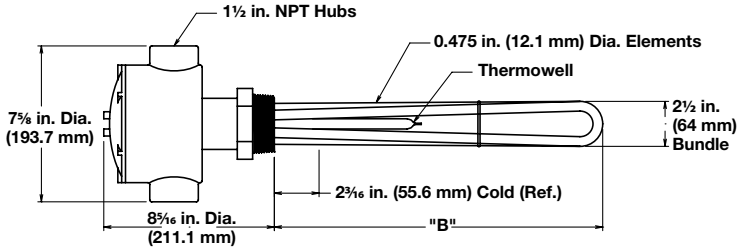
Application: Clean Water

- 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



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm²)	240	3.0	3	7 5/8 (193.7)	7 (4)	BLN77L3S4	C/F	C/F	BLN77L3S5A	C/F	C/F	BLN77L3S7A	C/F	C/F
	480	3.0	3	7 5/8 (193.7)	7 (4)	BLN77L13S4	C/F	C/F	BLN77L13S5A	C/F	C/F	BLN77L13S7A	C/F	C/F
	240	4.5	3	10 5/8 (269.9)	8 (4)	BLN710L3S4	C/F	C/F	BLN710L3S5A	C/F	C/F	BLN710L3S7A	C/F	C/F
	480	4.5	3	10 5/8 (269.9)	8 (4)	BLN610K13S4	C/F	C/F	BLN610K13S5A	C/F	C/F	BLN610K13S7A	C/F	C/F
	240	6.0	3	14 5/8 (371.5)	10 (5)	BLN714L3S4	C/F	C/F	BLN714L3S5A	C/F	C/F	BLN714L3S7A	C/F	C/F
	480	6.0	3	14 5/8 (371.5)	10 (5)	BLN714L5S4	C/F	C/F	BLN714L5S5A	C/F	C/F	BLN714L5S7A	C/F	C/F
	240	7.5	3	17 5/8 (447.7)	10 (5)	BLN717L3S4	C/F	C/F	BLN717L3S5A	C/F	C/F	BLN717L3S7A	C/F	C/F
	240	9.0	3	20 5/8 (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/in² 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm²)	240	3.0	3	7 5/8 (193.7)	10 (5)	BLN77L3C4	C/F	C/F	BLN77L3C5A	C/F	C/F	BLN77L3C7A	C/F	C/F
	480	3.0	3	7 5/8 (193.7)	10 (5)	BLN77L13C4	C/F	C/F	BLN77L13C5A	C/F	C/F	BLN77L13C7A	C/F	C/F
	240	4.5	3	10 5/8 (269.9)	11 (5)	BLN710L3C4	C/F	C/F	BLN710L3C5A	C/F	C/F	BLN710L3C7A	C/F	C/F
	480	4.5	3	10 5/8 (269.9)	11 (5)	BLN610K13C4	C/F	C/F	BLN610K13C5A	C/F	C/F	BLN610K13C7A	C/F	C/F
	240	6.0	3	14 5/8 (371.5)	13 (6)	BLN714L3C4	C/F	C/F	BLN714L3C5A	C/F	C/F	BLN714L3C7A	C/F	C/F
	480	6.0	3	14 5/8 (371.5)	13 (6)	BLN714L5C4	C/F	C/F	BLN714L5C5A	C/F	C/F	BLN714L5C7A	C/F	C/F
	240	7.5	3	17 5/8 (447.7)	13 (6)	BLN717L3C4	C/F	C/F	BLN717L3C5A	C/F	C/F	BLN717L3C7A	C/F	C/F
	240	9.0	3	20 5/8 (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.

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⑤ No third party recognition

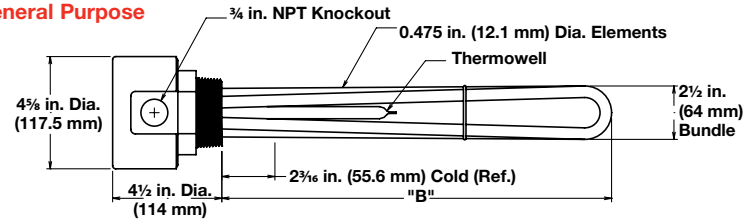
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WATROD and FIREBAR Screw Plug Immersion Heaters

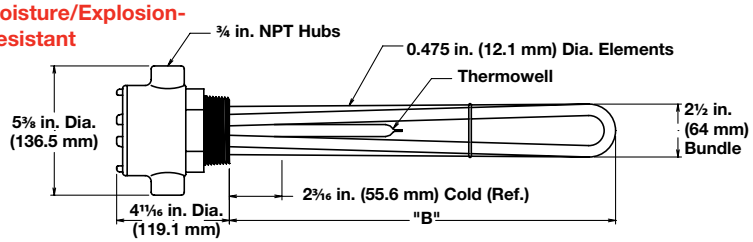
Application: Clean Water

- 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)

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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
60 W/in² 304 SS Plug 3-Alloy 800 Elements (9.3 W/cm²)	120	3.0	1	7⅝ (193.7)	**BLN77L1S**	6 (3)	**C/F**	**C/F**	**BLN77L1C**	9 (4)	**C/F**	**C/F**
	240	3.0	3	7⅝ (193.7)	**BLN77L3S**	6 (3)	**C2-50**	**C2-92**	**BLN77L3C**	9 (4)	**C3-94**	**C3-93**
	480	3.0	3	7⅝ (193.7)	**BLN77L13S**	6 (3)	**C2-43**	**C2-35**	**BLN77L13C**	9 (4)	**C3-116**	**C3-118**
	120	4.5	1	10⅝ (269.9)	**BLN710L1S**	7 (4)	**C/F**	**C/F**	**BLN710L1C**	10 (5)	**C/F**	**C/F**
	240	4.5	3	10⅝ (269.9)	**BLN710L3S**	7 (4)	**C2-50**	**C2-92**	**BLN710L3C**	10 (5)	**C3-94**	**C3-93**
	480	4.5	3	10⅝ (269.9)	**BLN610K13S**	7 (4)	**C2-43**	**C2-35**	**BLN610K13C**	10 (5)	**C3-116**	**C3-118**
	240	6.0	3	14⅝ (371.5)	**BLN714L3S**	9 (4)	**C2-50**	**C2-92**	**BLN714L3C**	12 (6)	**C3-94**	**C3-93**
	480	6.0	3	14⅝ (371.5)	**BLN714L5S**	9 (4)	**C2-43**	**C2-35**	**BLN714L5C**	12 (6)	**C3-116**	**C3-118**
	240	7.5	3	17⅝ (447.7)	**BLN717L3S**	9 (4)	**C2-50**	**C2-92**	**BLN717L3C**	12 (6)	**C3-94**	**C3-93**
	480	7.5	3	17⅝ (447.7)	**BLN717L5S**	9 (4)	**C2-43**	**C2-35**	**BLN717L5C**	12 (6)	**C3-116**	**C3-118**
	240	9.0	3	20⅝ (523.9)	**BLN720L3S**	11 (5)	**C2-50**	**C2-92**	**BLN720L3C**	14 (7)	**C3-94**	**C3-93**
	480	9.0	3	20⅝ (523.9)	**BLN720L5S**	11 (5)	**C2-43**	**C2-35**	**BLN720L5C**	14 (7)	**C3-116**	**C3-118**
	240	12.0	3	26⅛ (663.6)	**BLN726C3S**	12 (6)	**C2-50**	**C2-92**	**BLN726C3C**	15 (7)	**C3-114**	**C3-115**
	480	12.0	3	26⅛ (663.6)	**BLN726C5S**	12 (6)	**C2-43**	**C2-35**	**BLN726C5C**	15 (7)	**C3-116**	**C3-118**
	240	15.0	3	31⅝ (803.3)	**BLN731L3S**	14 (7)	**C2-50**	**C2-92**	**BLN731L3C**	17 (8)	**C3-114**	**C3-115**
	480	15.0	3	31⅝ (803.3)	**BLN731L5S**	14 (7)	**C2-43**	**C2-35**	**BLN731L5C**	17 (8)	**C3-116**	**C3-118**
	240	18.0	3	37⅛ (943.0)	**BLN737C3S**	15 (7)	**C2-50**	**C2-92**	**BLN737C3C**	18 (9)	**C3-114**	**C3-115**
	480	18.0	3	37⅛ (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.

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⑤ No third party recognition

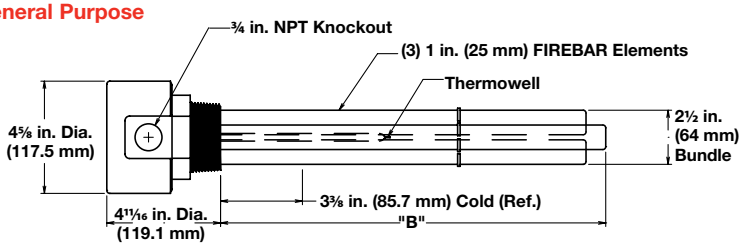
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WATROD and FIREBAR Screw Plug Immersion Heaters

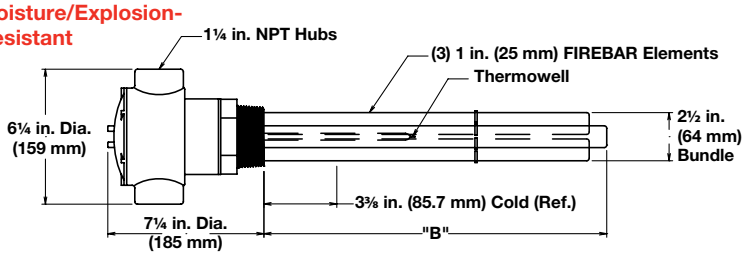
Application: Clean Water

- 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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
90 W/in² ⑧ 304 SS Plug 3-Alloy 800 Elements (14 W/cm²)	240	15.0	3	15 1/8 (384.2)	**BLNF15C3S**	11 (5)	**C2-50**	**C2-92**	**BLNF15C3C**	14 (7)	**C3-114**	**C3-115**
	480	15.0	3	15 1/8 (384.2)	**BLNF15C5S**	11 (5)	**C2-43**	**C2-35**	**BLNF15C5C**	14 (7)	**C3-116**	**C3-118**
	240	20.0	3	18 1/8 (460.4)	**BLNF18C3S**	12 (6)	**C2-50**	**C2-92**	**BLNF18C3C**	15 (7)	**C3-114**	**C3-115**
	480	20.0	3	18 1/8 (460.4)	**BLNF18C5S ③**	12 (6)	**C2-43**	**C2-35**	**BLNF18C5C ③**	15 (7)	**C3-116**	**C3-118**
	480	25.0	3	23 1/8 (587.4)	**BLNF23C5S**	14 (7)	**C2-225**	**C2-226**	**BLNF23C5C**	17 (8)	**C3-117**	**C3-119**
	480	32.0	3	28 5/8 (727.1)	**BLNF28L5S**	17 (8)	**C2-225**	**C2-226**	**BLNF28L5C**	20 (9)	**C3-117**	**C3-119**
	480	38.0	3	33 5/8 (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

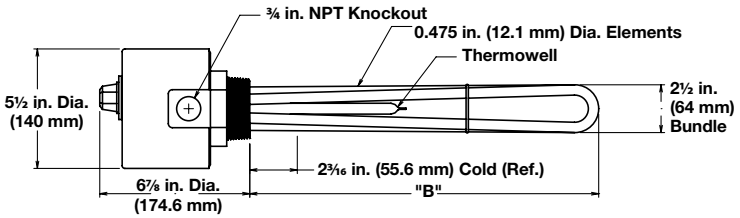
⑧ Can be wired for 1-phase operation

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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



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² 316 SS Plug 3-316 SS Elements (9.3 W/cm²) (Passivated)	240	3.0	3	7 5/8 (193.7)	7 (4)	BLR77L3S4	C/F	C/F	BLR77L3S5A	C/F	C/F	BLR77L3S7A	C/F	C/F
	480	3.0	3	7 5/8 (193.7)	7 (4)	BLR77L5S4	C/F	C/F	BLR77L5S5A	C/F	C/F	BLR77L5S7A	C/F	C/F
	240	4.5	3	10 5/8 (269.9)	8 (4)	BLR710L3S4	C/F	C/F	BLR710L3S5A	C/F	C/F	BLR710L3S7A	C/F	C/F
	480	4.5	3	10 5/8 (269.9)	8 (4)	BLR710L5S4	C/F	C/F	BLR710L5S5A	C/F	C/F	BLR710L5S7A	C/F	C/F
	240	6.0	3	14 5/8 (371.5)	10 (5)	BLR714L3S4	C/F	C/F	BLR714L3S5A	C/F	C/F	BLR714L3S7A	C/F	C/F
	480	6.0	3	14 5/8 (371.5)	10 (5)	BLR714L5S4	C/F	C/F	BLR714L5S5A	C/F	C/F	BLR714L5S7A	C/F	C/F
	240	7.5	3	17 5/8 (447.7)	10 (5)	BLR717L3S4	C/F	C/F	BLR717L3S5A	C/F	C/F	BLR717L3S7A	C/F	C/F
	240	9.0	3	20 5/8 (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.

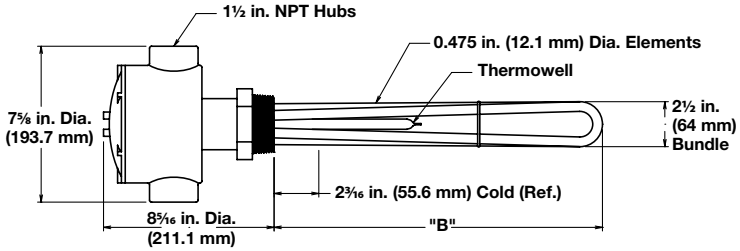
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WATROD and FIREBAR Screw Plug Immersion Heaters

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)



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
60 W/in² 316 SS Plug 3-316 SS Elements (9.3 W/cm²) (Passivated)	240	3.0	3	7⅝ (193.7)	10 (5)	**BLR77L3C4**	C/F	C/F	**BLR77L3C5A**	C/F	C/F	**BLR77L3C7A**	C/F	C/F
	480	3.0	3	7⅝ (193.7)	10 (5)	**BLR77L5C4**	C/F	C/F	**BLR77L5C5A**	C/F	C/F	**BLR77L5C7A**	C/F	C/F
	240	4.5	3	10⅝ (269.9)	11 (5)	**BLR710L3C4**	C/F	C/F	**BLR710L3C5A**	C/F	C/F	**BLR710L3C7A**	C/F	C/F
	480	4.5	3	10⅝ (269.9)	11 (5)	**BLR710L5C4**	C/F	C/F	**BLR710L5C5A**	C/F	C/F	**BLR710L5C7A**	C/F	C/F
	240	6.0	3	14⅝ (371.5)	13 (6)	**BLR714L3C4**	C/F	C/F	**BLR714L3C5A**	C/F	C/F	**BLR714L3C7A**	C/F	C/F
	480	6.0	3	14⅝ (371.5)	13 (6)	**BLR714L5C4**	C/F	C/F	**BLR714L5C5A**	C/F	C/F	**BLR714L5C7A**	C/F	C/F
	240	7.5	3	17⅝ (447.7)	13 (6)	**BLR717L3C4**	C/F	C/F	**BLR717L3C5A**	C/F	C/F	**BLR717L3C7A**	C/F	C/F
	240	9.0	3	20⅝ (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.

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⑤ No third party recognition

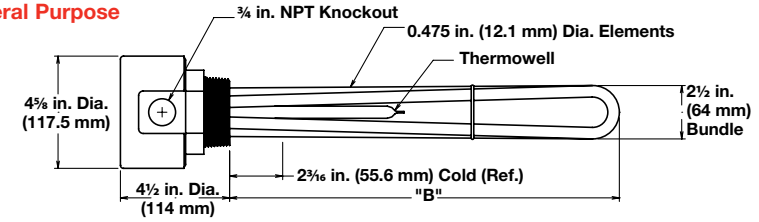
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WATROD and FIREBAR Screw Plug Immersion Heaters

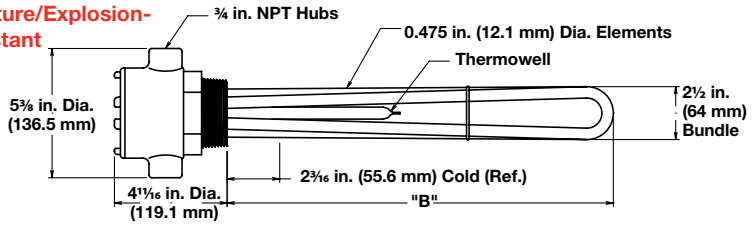
Application: Deionized/ Demineralized Water

- 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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
60 W/in² 316 SS Plug 3-316 SS Elements (9.3 W/cm²) (Passivated)	120	3.0	1	7 5/8 (193.7)	**BLR77L1S**	6 (3)	**C/F**	**C/F**	**BLR77L1C**	9 (4)	**C/F**	**C/F**
	240	3.0	3	7 5/8 (193.7)	**BLR77L3S**	6 (3)	**C2-50**	**C2-92**	**BLR77L3C**	9 (4)	**C3-94**	**C3-93**
	480	3.0	3	7 5/8 (193.7)	**BLR77L5S**	6 (3)	**C2-43**	**C2-35**	**BLR77L5C**	9 (4)	**C3-116**	**C3-118**
	120	4.5	1	10 5/8 (269.9)	**BLR710L1S**	7 (4)	**C/F**	**C/F**	**BLR710L1C**	10 (5)	**C/F**	**C/F**
	240	4.5	3	10 5/8 (269.9)	**BLR710L3S**	7 (4)	**C2-50**	**C2-92**	**BLR710L3C**	10 (5)	**C3-94**	**C3-93**
	480	4.5	3	10 5/8 (269.9)	**BLR710L5S**	7 (4)	**C2-43**	**C2-35**	**BLR710L5C**	10 (5)	**C3-116**	**C3-118**
	240	6.0	3	14 5/8 (371.5)	**BLR714L3S**	9 (4)	**C2-50**	**C2-92**	**BLR714L3C**	12 (6)	**C3-94**	**C3-93**
	480	6.0	3	14 5/8 (371.5)	**BLR714L5S**	9 (4)	**C2-43**	**C2-35**	**BLR714L5C**	12 (6)	**C3-116**	**C3-118**
	240	7.5	3	17 5/8 (447.7)	**BLR717L3S**	9 (4)	**C2-50**	**C2-92**	**BLR717L3C**	12 (6)	**C3-94**	**C3-93**
	480	7.5	3	17 5/8 (447.7)	**BLR717L5S**	9 (4)	**C2-43**	**C2-35**	**BLR717L5C**	12 (6)	**C3-116**	**C3-118**
	240	9.0	3	20 5/8 (523.9)	**BLR720L3S**	11 (5)	**C2-50**	**C2-92**	**BLR720L3C**	14 (7)	**C3-94**	**C3-93**
	480	9.0	3	20 5/8 (523.9)	**BLR720L5S**	11 (5)	**C2-43**	**C2-35**	**BLR720L5C**	14 (7)	**C3-116**	**C3-118**
	240	12.0	3	26 1/8 (663.6)	**BLR726C3S**	12 (6)	**C2-236**	**C2-214**	**BLR726C3C**	15 (7)	**C3-114**	**C3-115**
	480	12.0	3	26 1/8 (663.6)	**BLR726C5S**	12 (6)	**C2-43**	**C2-35**	**BLR726C5C**	15 (7)	**C3-116**	**C3-118**
	240	15.0	3	31 5/8 (803.3)	**BLR731L3S**	14 (7)	**C2-236**	**C2-214**	**BLR731L3C**	17 (8)	**C3-114**	**C3-115**
	480	15.0	3	31 5/8 (803.3)	**BLR731L5S**	14 (7)	**C2-43**	**C2-35**	**BLR731L5C**	17 (8)	**C3-116**	**C3-118**
	240	18.0	3	37 1/8 (943.0)	**BLR737C3S**	15 (7)	**C2-236**	**C2-214**	**BLR737C3C**	18 (9)	**C3-114**	**C3-115**
	480	18.0	3	37 1/8 (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.

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⑤ No third party recognition

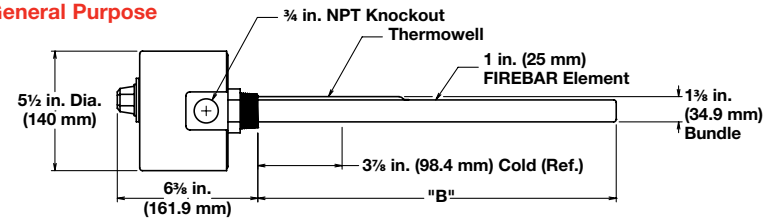
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WATROD and FIREBAR Screw Plug Immersion Heaters

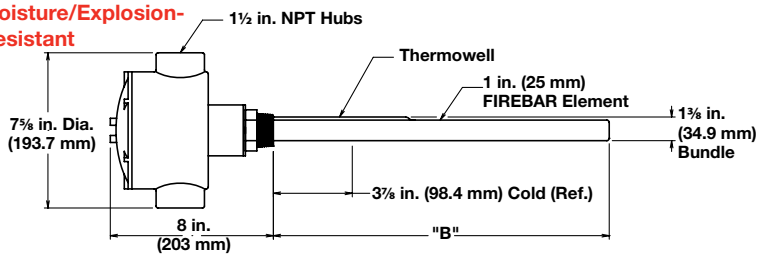
Application: Process Water

- 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



								Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in.	(mm)	Ship Wt. lbs	(kg)	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/in² ⑧ 304 SS Plug 1-Alloy 800 Element (7 W/cm²)	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/in² ⑧ 304 SS Plug 1-Alloy 800 Element (7 W/cm²)	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.

C/F - Contact factory, go to www.watlow.com/en/contact-us

⑤ No third party recognition

⑧ Can be wired for 1-phase operation

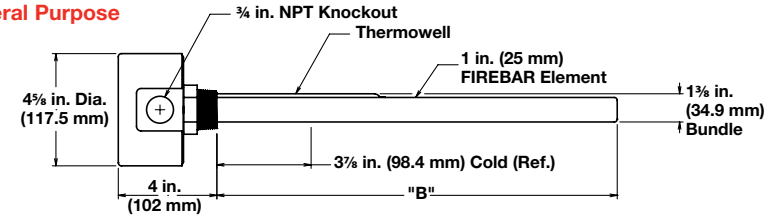
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WATROD and FIREBAR Screw Plug Immersion Heaters

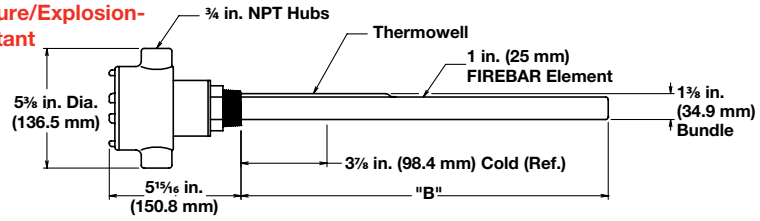
Application: Process Water

- 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.	"B" Dim. (mm)	Part Number	Ship Wt. lbs	Ship Wt. (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs	Ship Wt. (kg)	WATCONNECT Part Number	
						General Purpose Enclosure			Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure			Type J T/C	Type K T/C
45 W/in² ⑧ 304 SS Plug 1-Alloy 800 Element (7 W/cm²)	240	2.0	3	13	(330)	**BDNF13A27S**	6	(3)	**C2-50**	**C2-92**	**BDNF13A27C**	9	(4)	**C3-94**	**C3-93**
	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

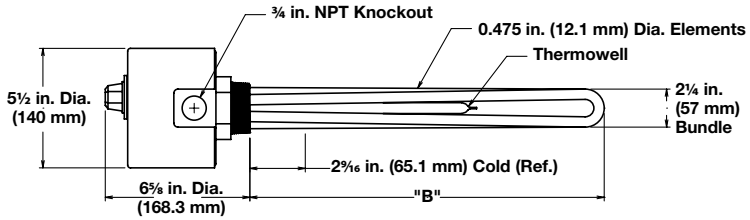
⑧ Can be wired for 1-phase operation

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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



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
48 W/in² ④ 304 SS Plug 2-Alloy 800 Elements (7.5 W/cm²)	120/240	2.0	1	9 3/4 (248)	5 (3)	BGN79N6S4	C/F	C/F	BGN79N6S5A	C/F	C/F	BGN79N6S7	C/F	C/F
	240/480	2.0	1	9 3/4 (248)	5 (3)	BGN79N7S4	C/F	C/F	BGN79N7S5A	C/F	C/F	BGN79N7S7A	C/F	C/F
	120/240	3.0	1	13 1/4 (337)	6 (3)	BGN713E6S4	C/F	C/F	BGN713E6S5A	C/F	C/F	BGN713E6S7A	C/F	C/F
	240/480	3.0	1	13 1/4 (337)	6 (3)	BGN713E7S4	C/F	C/F	BGN713E7S5A	C/F	C/F	BGN713E7S7A	C/F	C/F
	120/240	4.0	1	17 3/4 (451)	7 (4)	BGN717N6S4	C/F	C/F	BGN717N6S5A	C/F	C/F	BGN717N6S7A	C/F	C/F
	120/240	5.0	1	20 1/4 (514)	8 (4)	BGN720E6S4	C/F	C/F	BGN720E6S5A	C/F	C/F	BGN720E6S7A	C/F	C/F
48 W/in² 304 SS Plug 3-Alloy 800 Elements (7.5 W/cm²)	240	3.0	3	9 3/4 (248)	6 (3)	BHN79N3S4	C/F	C/F	BHN79N3S5A	C/F	C/F	BHN79N3S7A	C/F	C/F
	480	3.0	3	9 3/4 (248)	6 (3)	BHN79N5S4	C/F	C/F	BHN79N5S5A	C/F	C/F	BHN79N5S7A	C/F	C/F
	240	4.5	3	13 1/4 (337)	7 (4)	BHN713E3S4	C/F	C/F	BHN713E3S5A	C/F	C/F	BHN713E3S7A	C/F	C/F
	480	4.5	3	13 1/4 (337)	7 (4)	BHN713E5S4	C/F	C/F	BHN713E5S5A	C/F	C/F	BHN713E5S7A	C/F	C/F
	240	6.0	3	17 3/4 (451)	8 (4)	BHN717N3S4	C/F	C/F	BHN717N3S5A	C/F	C/F	BHN717N3S7A	C/F	C/F
	480	6.0	3	17 3/4 (451)	8 (4)	BHN717N5S4	C/F	C/F	BHN717N5S5A	C/F	C/F	BHN717N5S7A	C/F	C/F
	240	7.5	3	20 1/4 (514)	9 (4)	BHN720E3S4	C/F	C/F	BHN720E3S5A	C/F	C/F	BHN720E3S7A	C/F	C/F
	240	9.0	3	25 1/4 (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.

④ Wired for higher voltage

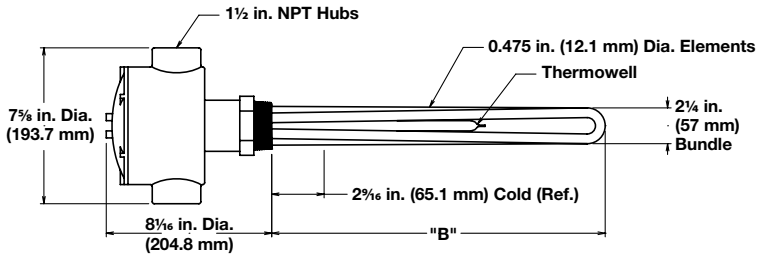
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WATROD and FIREBAR Screw Plug Immersion Heaters

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)



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
48 W/in² ④ 304 SS Plug 2-Alloy 800 Elements (7.5 W/cm²)	120/240	2.0	1	9 3/4 (248)	8 (4)	**BGN79N6C4**	C/F	C/F	**BGN79N6C5A**	C/F	C/F	**BGN79N6C7A**	C/F	C/F
	240/480	2.0	1	9 3/4 (248)	8 (4)	**BGN79N7C4**	C/F	C/F	**BGN79N7C5A**	C/F	C/F	**BGN79N7C7A**	C/F	C/F
	120/240	3.0	1	13 1/4 (337)	9 (4)	**BGN713E6C4**	C/F	C/F	**BGN713E6C5A**	C/F	C/F	**BGN713E6C7A**	C/F	C/F
	240/480	3.0	1	13 1/4 (337)	9 (4)	**BGN713E7C4**	C/F	C/F	**BGN713E7C5A**	C/F	C/F	**BGN713E7C7A**	C/F	C/F
	120/240	4.0	1	17 3/4 (451)	10 (5)	**BGN717N6C4**	C/F	C/F	**BGN717N6C5A**	C/F	C/F	**BGN717N6C7A**	C/F	C/F
	120/240	5.0	1	20 1/4 (514)	11 (5)	**BGN720E6C4**	C/F	C/F	**BGN720E6C5A**	C/F	C/F	**BGN720E6C7A**	C/F	C/F
48 W/in² 304 SS Plug 3-Alloy 800 Elements (7.5 W/cm²)	240	3.0	3	9 3/4 (248)	9 (4)	**BHN79N3C4**	C/F	C/F	**BHN79N3C5A**	C/F	C/F	**BHN79N3C7A**	C/F	C/F
	480	3.0	3	9 3/4 (248)	9 (4)	**BHN79N5C4**	C/F	C/F	**BHN79N5C5A**	C/F	C/F	**BHN79N5C7A**	C/F	C/F
	240	4.5	3	13 1/4 (337)	10 (5)	**BHN713E3C4**	C/F	C/F	**BHN713E3C5A**	C/F	C/F	**BHN713E3C7A**	C/F	C/F
	480	4.5	3	13 1/4 (337)	10 (5)	**BHN713E5C4**	C/F	C/F	**BHN713E5C5A**	C/F	C/F	**BHN713E5C7A**	C/F	C/F
	240	6.0	3	17 3/4 (451)	11 (5)	**BHN717N3C4**	C/F	C/F	**BHN717N3C5A**	C/F	C/F	**BHN717N3C7A**	C/F	C/F
	480	6.0	3	17 3/4 (451)	11 (5)	**BHN717N5C4**	C/F	C/F	**BHN717N5C5A**	C/F	C/F	**BHN717N5C7A**	C/F	C/F
	240	7.5	3	20 1/4 (514)	12 (6)	**BHN720E3C4**	C/F	C/F	**BHN720E3C5A**	C/F	C/F	**BHN720E3C7A**	C/F	C/F
	240	9.0	3	25 1/4 (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

④ Wired for higher voltage

⑤ No third party recognition

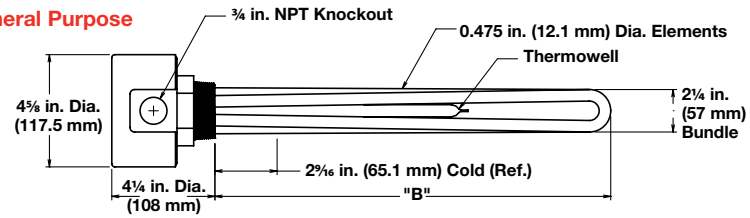
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WATROD and FIREBAR Screw Plug Immersion Heaters

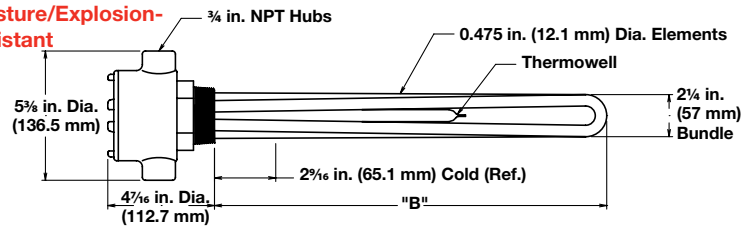
Application: Process Water

- 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 Part Number		240V WATCONNECT Part Number		480V WATCONNECT Part Number	
					General Purpose 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/in² ④ 304 SS Plug 2-Alloy 800 Elements (7.5 W/cm²)	120/240	2.0	1	9 3/4 (248)	BGN79N6S	4 (2)	C1-15	C1-12	C1-17	C1-13	N/A	N/A
	240/480	2.0	1	9 3/4 (248)	BGN79N7S	4 (2)	N/A	N/A	C1-17	C1-13	C/F	C/F
	120/240	3.0	1	13 1/4 (337)	BGN713E6S	5 (3)	C/F	C/F	C1-17	C1-13	N/A	N/A
	240/480	3.0	1	13 1/4 (337)	BGN713E7S	5 (3)	N/A	N/A	C1-17	C1-13	C/F	C/F
	120/240	4.0	1	17 3/4 (451)	BGN717N6S	6 (3)	C/F	C/F	C1-17	C1-13	N/A	N/A
	240/480	4.0	1	17 3/4 (451)	BGN717N7S	6 (3)	N/A	N/A	C1-17	C1-13	C/F	C/F
	120/240	5.0	1	20 1/4 (514)	BGN720E6S	7 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	5.0	1	20 1/4 (514)	BGN720E7S	7 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	6.0	1	25 1/4 (641)	BGN725E7S	7 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	8.0	1	32 3/4 (832)	BGN732N7S	8 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	10.0	1	40 1/4 (1022)	BGN740E7S	9 (4)	N/A	N/A	C/F	C/F	C/F	C/F
48 W/in² 304 SS Plug 3-Alloy 800 Element (7.5 W/cm²)	120	3.0	1	9 3/4 (248)	BHN79N1S	5 (3)	C/F	C/F	N/A	N/A	N/A	N/A
	240	3.0	3	9 3/4 (248)	BHN79N3S	5 (3)	N/A	N/A	C2-50	C2-92	N/A	N/A
	480	3.0	3	9 3/4 (248)	BHN79N5S	5 (3)	N/A	N/A	N/A	N/A	C2-43	C2-35
	120	4.5	1	13 1/4 (337)	BHN713E1S	6 (3)	C/F	C/F	N/A	N/A	N/A	N/A
	240	4.5	3	13 1/4 (337)	BHN713E3S	6 (3)	N/A	N/A	C2-50	C2-92	N/A	N/A
	480	4.5	3	13 1/4 (337)	BHN713E5S	6 (3)	N/A	N/A	N/A	N/A	C2-43	C2-35
	240	6.0	3	17 3/4 (451)	BHN717N3S	7 (4)	N/A	N/A	C2-50	C2-92	N/A	N/A
	480	6.0	3	17 3/4 (451)	BHN717N5S	7 (4)	N/A	N/A	N/A	N/A	C2-43	C2-35
	240	7.5	3	20 1/4 (514)	BHN720E3S	8 (4)	N/A	N/A	C2-50	C2-92	N/A	N/A
	480	7.5	3	20 1/4 (514)	BHN720E5S	8 (4)	N/A	N/A	N/A	N/A	C2-43	C2-35
	240	9.0	3	25 1/4 (641)	BHN725E3S	9 (4)	N/A	N/A	C2-50	C2-92	N/A	N/A
	480	9.0	3	25 1/4 (641)	BHN725E5S	9 (4)	N/A	N/A	N/A	N/A	C2-43	C2-35
	240	12.0	3	32 3/4 (832)	BHN732N3S	9 (4)	N/A	N/A	C2-236	C2-214	N/A	N/A
	480	12.0	3	32 3/4 (832)	BHN732N5S	9 (4)	N/A	N/A	N/A	N/A	C2-43	C2-35
	240	15.0	3	40 1/4 (1022)	BHN740E3S	10 (5)	N/A	N/A	C2-236	C2-214	N/A	N/A
	480	15.0	3	40 1/4 (1022)	BHN740E5S	10 (5)	N/A	N/A	N/A	N/A	C2-43	C2-35
	240	18.0	3	47 3/4 (1213)	BHN747N3S	11 (5)	N/A	N/A	C2-236	C2-214	N/A	N/A
	480	18.0	3	47 3/4 (1213)	BHN747N5S	11 (5)	N/A	N/A	N/A	N/A	C2-43	C2-35

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
N/A - Not available

④ Wired for higher voltage

⑤ No third party recognition

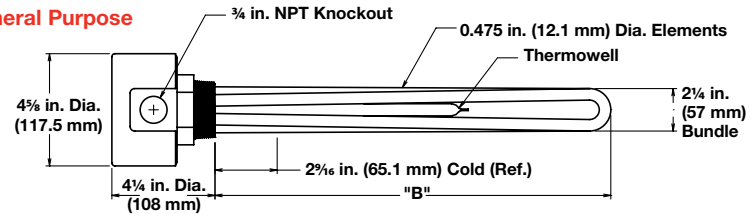
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WATROD and FIREBAR Screw Plug Immersion Heaters

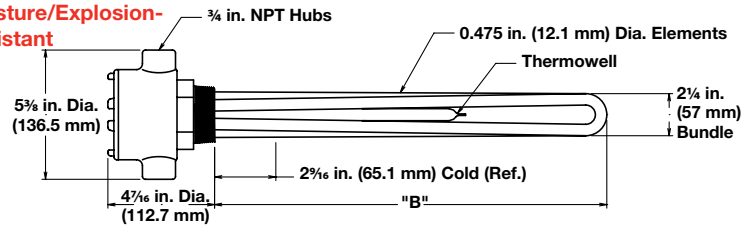
Application: Process Water

- 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 Part Number		240V WATCONNECT Part Number		480V WATCONNECT 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/in² ④ 304 SS Plug 2-Alloy 800 Elements (7.5 W/cm²)	120/240	2.0	1	9 3/4 (248)	BGN79N6C	7 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	2.0	1	9 3/4 (248)	BGN79N7C	7 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	3.0	1	13 1/4 (337)	BGN713E6C	8 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	3.0	1	13 1/4 (337)	BGN713E7C	8 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	4.0	1	17 3/4 (451)	BGN717N6C	9 (4)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	4.0	1	17 3/4 (451)	BGN717N7C	9 (4)	N/A	N/A	C/F	C/F	C/F	C/F
	120/240	5.0	1	20 1/4 (514)	BGN720E6C	10 (5)	C/F	C/F	C/F	C/F	N/A	N/A
	240/480	5.0	1	20 1/4 (514)	BGN720E7C	10 (5)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	6.0	1	25 1/4 (641)	BGN725E7C	10 (5)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	8.0	1	32 3/4 (832)	BGN732N7C	11 (5)	N/A	N/A	C/F	C/F	C/F	C/F
	240/480	10.0	1	40 1/4 (1022)	BGN740E7C	12 (6)	N/A	N/A	C/F	C/F	C/F	C/F
48 W/in² 304 SS Plug 3-Alloy 800 Element (7.5 W/cm²)	120	3.0	1	9 3/4 (248)	BHN79N1C	8 (4)	C/F	C/F	N/A	N/A	N/A	N/A
	240	3.0	3	9 3/4 (248)	BHN79N3C	8 (4)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	3.0	3	9 3/4 (248)	BHN79N5C	8 (4)	N/A	N/A	N/A	N/A	C3-116	C3-118
	120	4.5	1	13 1/4 (337)	BHN713E1C	9 (4)	C/F	C/F	N/A	N/A	N/A	N/A
	240	4.5	3	13 1/4 (337)	BHN713E3C	9 (4)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	4.5	3	13 1/4 (337)	BHN713E5C	9 (4)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	6.0	3	17 3/4 (451)	BHN717N3C	10 (5)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	6.0	3	17 3/4 (451)	BHN717N5C	10 (5)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	7.5	3	20 1/4 (514)	BHN720E3C	11 (5)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	7.5	3	20 1/4 (514)	BHN720E5C	11 (5)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	9.0	3	25 1/4 (641)	BHN725E3C	12 (6)	N/A	N/A	C3-94	C3-93	N/A	N/A
	480	9.0	3	25 1/4 (641)	BHN725E5C	12 (6)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	12.0	3	32 3/4 (832)	BHN732N3C	12 (6)	N/A	N/A	C3-114	C3-115	N/A	N/A
	480	12.0	3	32 3/4 (832)	BHN732N5C	12 (6)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	15.0	3	40 1/4 (1022)	BHN740E3C	13 (6)	N/A	N/A	C3-114	C3-115	N/A	N/A
	480	15.0	3	40 1/4 (1022)	BHN740E5C	13 (6)	N/A	N/A	N/A	N/A	C3-116	C3-118
	240	18.0	3	47 3/4 (1213)	BHN747N3C	14 (7)	N/A	N/A	C3-114	C3-115	N/A	N/A
	480	18.0	3	47 3/4 (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
N/A - Not available

④ Wired for higher voltage

⑤ No third party recognition

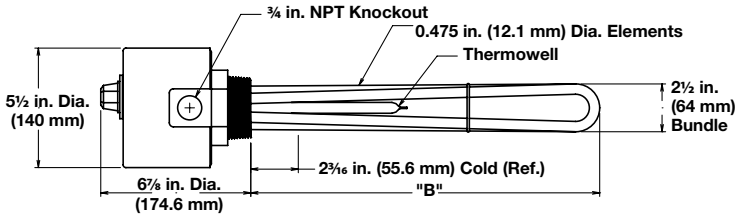
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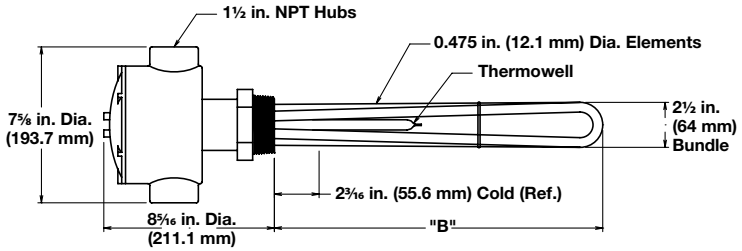
Application: Process Water

- 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



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
48 W/in² 304 SS Plug 3-Alloy 800 Elements (7.5 W/cm²)	240	3.0	3	9 3/8 (238.1)	7 (4)	BLN79G3S4	C/F	C/F	BLN79G3S5A	C/F	C/F	BLN79G3S7A	C/F	C/F
	480	3.0	3	9 3/8 (238.1)	7 (4)	BLN79G5S4	C/F	C/F	BLN79G5S5A	C/F	C/F	BLN79G5S7A	C/F	C/F
	240	4.5	3	12 7/8 (327.0)	8 (4)	BLN712R3S4	C/F	C/F	BLN712R3S5A	C/F	C/F	BLN712R3S7A	C/F	C/F
	480	4.5	3	12 7/8 (327.0)	8 (4)	BLN712R5S4	C/F	C/F	BLN712R5S5A	C/F	C/F	BLN712R5S7A	C/F	C/F
	240	6.0	3	17 3/8 (441.3)	10 (5)	BLN717G3S4	C/F	C/F	BLN717G3S5A	C/F	C/F	BLN717G3S7A	C/F	C/F
	480	6.0	3	17 3/8 (441.3)	10 (5)	BLN717G5S4	C/F	C/F	BLN717G5S5A	C/F	C/F	BLN717G5S7A	C/F	C/F
	240	7.5	3	19 7/8 (504.8)	12 (6)	BLN719R3S4	C/F	C/F	BLN719R3S5A	C/F	C/F	BLN719R3S7A	C/F	C/F
	240	9.0	3	24 7/8 (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/in² 304 SS Plug 3-Alloy 800 Elements (7.5 W/cm²)	240	3.0	3	9 3/8 (238.1)	10 (5)	BLN79G3C4	C/F	C/F	BLN79G3C5A	C/F	C/F	BLN79G3C7A	C/F	C/F
	480	3.0	3	9 3/8 (238.1)	10 (5)	BLN79G5C4	C/F	C/F	BLN79G5C5A	C/F	C/F	BLN79G5C7A	C/F	C/F
	240	4.5	3	12 7/8 (327.0)	11 (5)	BLN712R3C4	C/F	C/F	BLN712R3C5A	C/F	C/F	BLN712R3C7A	C/F	C/F
	480	4.5	3	12 7/8 (327.0)	11 (5)	BLN712R5C4	C/F	C/F	BLN712R5C5A	C/F	C/F	BLN712R5C7A	C/F	C/F
	240	6.0	3	17 3/8 (441.3)	13 (6)	BLN717G3C4	C/F	C/F	BLN717G3C5A	C/F	C/F	BLN717G3C7A	C/F	C/F
	480	6.0	3	17 3/8 (441.3)	13 (6)	BLN717G5C4	C/F	C/F	BLN717G5C5A	C/F	C/F	BLN717G5C7A	C/F	C/F
	240	7.5	3	19 7/8 (504.8)	15 (7)	BLN719R3C4	C/F	C/F	BLN719R3C5A	C/F	C/F	BLN719R3C7A	C/F	C/F
	240	9.0	3	24 7/8 (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

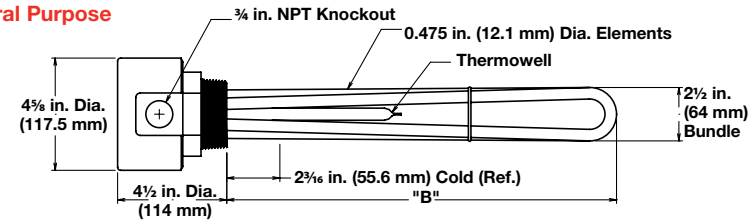
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WATROD and FIREBAR Screw Plug Immersion Heaters

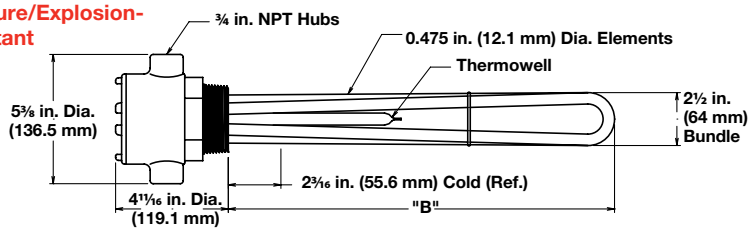
Application: Process Water

- 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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
48 W/in² 304 SS Plug 3-Alloy 800 Elements (7.5 W/cm²)	120	3.0	1	9 3/8 (238.1)	**BLN79G1S**	6 (3)	**C/F**	**C/F**	**BLN79G1C**	9 (4)	**C/F**	**C/F**
	240	3.0	3	9 3/8 (238.1)	**BLN79G3S**	6 (3)	**C2-50**	**C2-92**	**BLN79G3C**	9 (4)	**C3-94**	**C3-93**
	480	3.0	3	9 3/8 (238.1)	**BLN79G5S**	6 (3)	**C2-43**	**C2-35**	**BLN79G5C**	9 (4)	**C3-116**	**C3-118**
	120	4.5	1	12 7/8 (327.0)	**BLN712R1S**	7 (4)	**C/F**	**C/F**	**BLN712R1C**	10 (5)	**C/F**	**C/F**
	240	4.5	3	12 7/8 (327.0)	**BLN712R3S**	7 (4)	**C2-50**	**C2-92**	**BLN712R3C**	10 (5)	**C3-94**	**C3-93**
	480	4.5	3	12 7/8 (327.0)	**BLN712R5S**	7 (4)	**C2-43**	**C2-35**	**BLN712R5C**	10 (5)	**C3-116**	**C3-118**
	240	6.0	3	17 3/8 (441.3)	**BLN717G3S**	9 (4)	**C2-50**	**C2-92**	**BLN717G3C**	12 (6)	**C3-94**	**C3-93**
	480	6.0	3	17 3/8 (441.3)	**BLN717G5S**	9 (4)	**C2-43**	**C2-35**	**BLN717G5C**	12 (6)	**C3-116**	**C3-118**
	240	7.5	3	19 7/8 (504.8)	**BLN719R3S**	11 (5)	**C2-50**	**C2-92**	**BLN719R3C**	14 (7)	**C3-94**	**C3-93**
	480	7.5	3	19 7/8 (504.8)	**BLN719R5S**	11 (5)	**C2-43**	**C2-35**	**BLN719R5C**	14 (7)	**C3-116**	**C3-118**
	240	9.0	3	24 7/8 (631.8)	**BLN724R3S**	12 (6)	**C2-50**	**C2-92**	**BLN724R3C**	15 (7)	**C3-94**	**C3-93**
	480	9.0	3	24 7/8 (631.8)	**BLN724R5S**	12 (6)	**C2-43**	**C2-35**	**BLN724R5C**	15 (7)	**C3-116**	**C3-118**
	240	12.0	3	32 3/8 (822.3)	**BLN732G3S**	14 (7)	**C2-236**	**C2-214**	**BLN732G3C**	17 (8)	**C3-114**	**C3-115**
	480	12.0	3	32 3/8 (822.3)	**BLN732G5S**	14 (7)	**C2-43**	**C2-35**	**BLN732G5C**	17 (8)	**C3-116**	**C3-118**
	240	15.0	3	39 7/8 (1012.8)	**BLN739R3S**	15 (7)	**C2-236**	**C2-214**	**BLN739R3C**	18 (9)	**C3-114**	**C3-115**
	480	15.0	3	39 7/8 (1012.8)	**BLN739R5S**	15 (7)	**C2-43**	**C2-35**	**BLN739R5C**	18 (9)	**C3-116**	**C3-118**
	240	18.0	3	47 3/8 (1203.3)	**BLN747G3S**	17 (8)	**C2-236**	**C2-214**	**BLN747G3C**	20 (9)	**C3-114**	**C3-115**
	480	18.0	3	47 3/8 (1203.3)	**BLN747G5S**	17 (8)	**C2-43**	**C2-35**	**BLN747G5C**	20 (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.

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⑤ No third party recognition

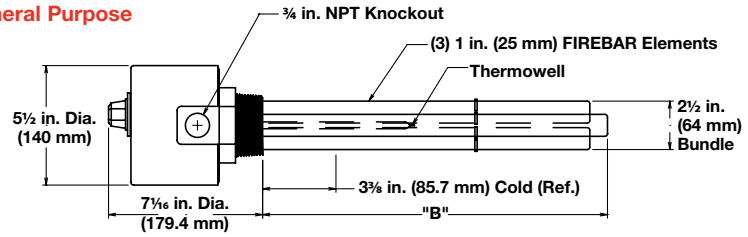
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WATROD and FIREBAR Screw Plug Immersion Heaters

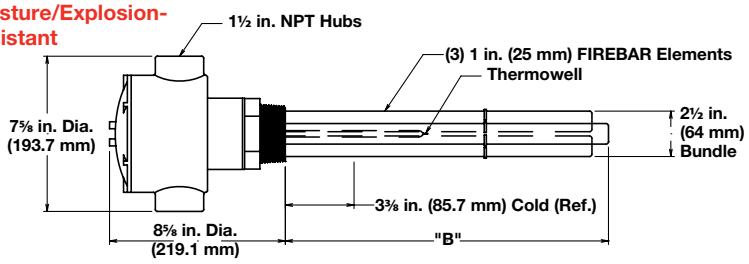
Application: Process Water

- 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



						Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² ⑧ 304 SS Plug 3-Alloy 800 Elements (7 W/cm²)	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
						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/in² ⑧ 304 SS Plug 3-Alloy 800 Elements (7 W/cm²)	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

⑤ No third party recognition

⑧ Can be wired for 1-phase operation

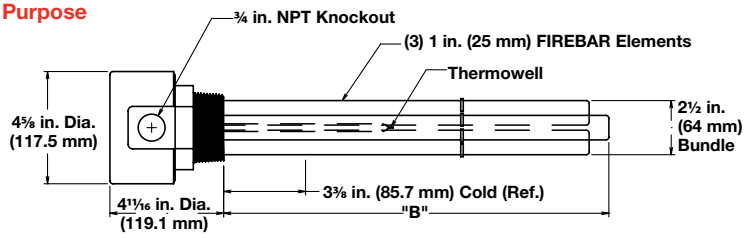
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WATROD and FIREBAR Screw Plug Immersion Heaters

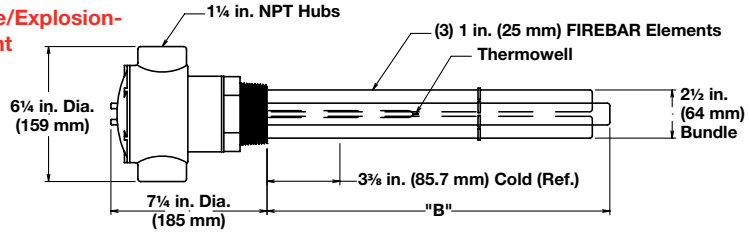
Application: Process Water

- 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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
45 W/in² ⑧ 304 SS Plug 3-Alloy 800 Elements (7 W/cm²)	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

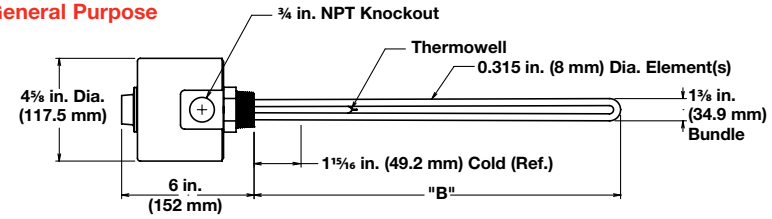
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WATROD and FIREBAR Screw Plug Immersion Heaters

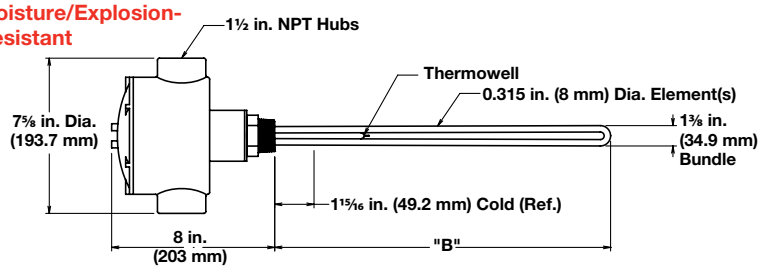
Application: Forced Air and Caustic Solutions

- 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)

General Purpose



Moisture/Explosion-Resistant



						Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² ④ 304 SS Plug 2-Alloy 800 Elements (3.6 W/cm²)	120/240	1.0	1	13 3/8 (339.7)	6 (3)	BEN13G6S2	C/F	C/F	BEN13G6S3	C/F	C/F
	120/240	1.5	1	19 (483.0)	7 (4)	BEN19A6S2	C/F	C/F	BEN19A6S3	C/F	C/F
	120/240	2.0	1	24 3/8 (619.1)	8 (4)	BEN24G6S2	C/F	C/F	BEN24G6S3	C/F	C/F
						Moisture/Explosion-Resistant Enclosure⑤	Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure⑤	Type J T/C	Type K T/C
23 W/in² ④ 304 SS Plug 2-Alloy 800 Elements (3.6 W/cm²)	120/240	1.0	1	13 3/8 (339.7)	10 (5)	BEN13G6C2	C/F	C/F	BEN13G6C3	C/F	C/F
	120/240	1.5	1	19 (483.0)	11 (5)	BEN19A6C2	C/F	C/F	BEN19A6C3	C/F	C/F
	120/240	2.0	1	24 3/8 (619.1)	12 (6)	BEN24G6C2	C/F	C/F	BEN24G6C3	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

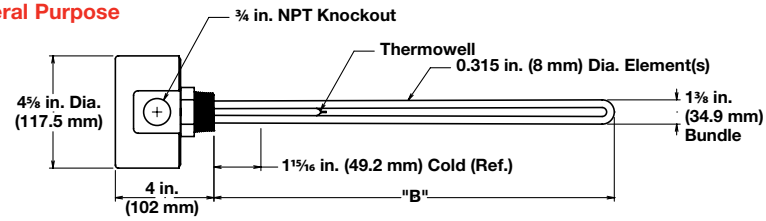
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WATROD and FIREBAR Screw Plug Immersion Heaters

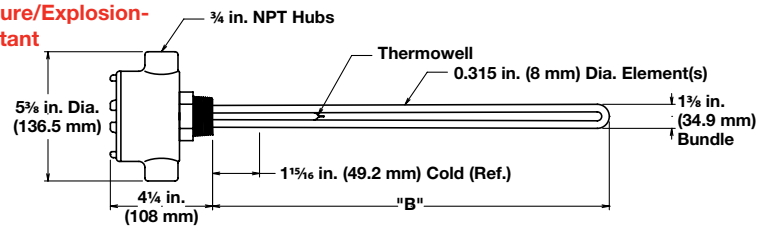
Application: Forced Air and Caustic Solutions

- 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 Part Number		240V WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT 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
23 W/in² ④ 304 SS Plug 2-Alloy 800 Elements (3.6 W/cm²)	120/240	1.0	1	13 3/8 (339.7)	**BEN13G6S**	6 (3)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**BEN13G6C**	9 (4)	**C/F**	**C/F**
	120/240	1.5	1	19 (483.0)	**BEN19A6S**	7 (4)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**BEN19A6C**	10 (5)	**C/F**	**C/F**
	120/240	2.0	1	24 3/8 (619.1)	**BEN24G6S**	8 (4)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**BEN24G6C**	11 (5)	**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

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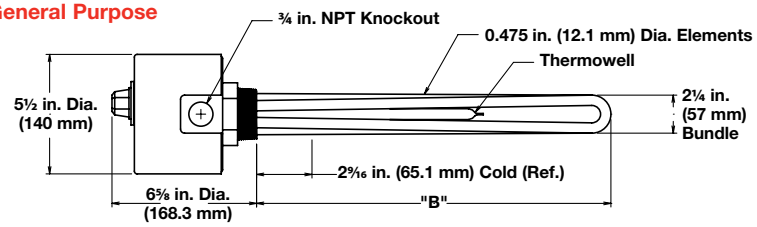
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WATROD and FIREBAR Screw Plug Immersion Heaters

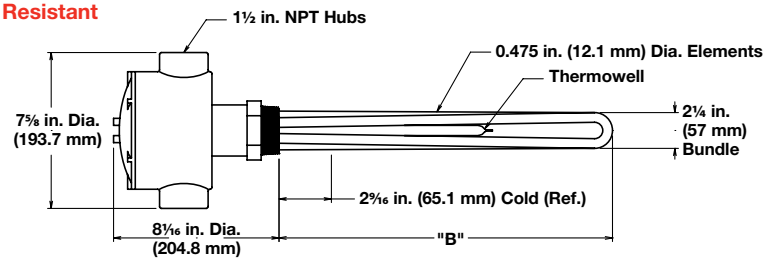
Application: Forced Air and Caustic Solutions

- 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



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm²)	240	3.0	3	17¾ (451)	8 (4)	**BHNA17N3S4**	C/F	C/F	**BHNA17N3S5A**	C/F	C/F	**BHNA17N3S7A**	C/F	C/F
	480	3.0	3	17¾ (451)	8 (4)	**BHNA17N5S4**	C/F	C/F	**BHNA17N5S5A**	C/F	C/F	**BHNA17N5S7A**	C/F	C/F
	240	4.5	3	25¼ (641)	10 (5)	**BHNA25E3S4**	C/F	C/F	**BHNA25E3S5A**	C/F	C/F	**BHNA25E3S7A**	C/F	C/F
	480	4.5	3	25¼ (641)	10 (5)	**BHNA25E5S4**	C/F	C/F	**BHNA25E5S5A**	C/F	C/F	**BHNA25E5S7A**	C/F	C/F
	240	6.0	3	32¾ (832)	10 (5)	**BHNA32N3S4**	C/F	C/F	**BHNA32N3S5A**	C/F	C/F	**BHNA32N3S7A**	C/F	C/F
	480	6.0	3	32¾ (832)	10 (5)	**BHNA32N5S4**	C/F	C/F	**BHNA32N5S5A**	C/F	C/F	**BHNA32N5S7A**	C/F	C/F
	240	7.5	3	40¼(1022)	11 (5)	**BHNA40E3S4**	C/F	C/F	**BHNA40E3S5A**	C/F	C/F	**BHNA40E3S7A**	C/F	C/F
	240	9.0	3	47¾(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/in² ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm²)	240	3.0	3	17¾ (451)	11 (5)	**BHNA17N3C4**	C/F	C/F	**BHNA17N3C5A**	C/F	C/F	**BHNA17N3C7A**	C/F	C/F
	480	3.0	3	17¾ (451)	11 (5)	**BHNA17N5C4**	C/F	C/F	**BHNA17N5C5A**	C/F	C/F	**BHNA17N5C7A**	C/F	C/F
	240	4.5	3	25¼ (641)	13 (6)	**BHNA25E3C4**	C/F	C/F	**BHNA25E3C5A**	C/F	C/F	**BHNA25E3C7A**	C/F	C/F
	480	4.5	3	25¼ (641)	13 (6)	**BHNA25E5C4**	C/F	C/F	**BHNA25E5C5A**	C/F	C/F	**BHNA25E5C7A**	C/F	C/F
	240	6.0	3	32¾ (832)	13 (6)	**BHNA32N3C4**	C/F	C/F	**BHNA32N3C5A**	C/F	C/F	**BHNA32N3C7A**	C/F	C/F
	480	6.0	3	32¾ (832)	13 (6)	**BHNA32N5C4**	C/F	C/F	**BHNA32N5C5A**	C/F	C/F	**BHNA32N5C7A**	C/F	C/F
	240	7.5	3	40¼(1022)	14 (7)	**BHNA40E3C4**	C/F	C/F	**BHNA40E3C5A**	C/F	C/F	**BHNA40E3C7A**	C/F	C/F
	240	9.0	3	47¾(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

⑤ No third party recognition

⑥ Can be rewired wye to produce ⅓ of the original kW and watt density (3-phase only)

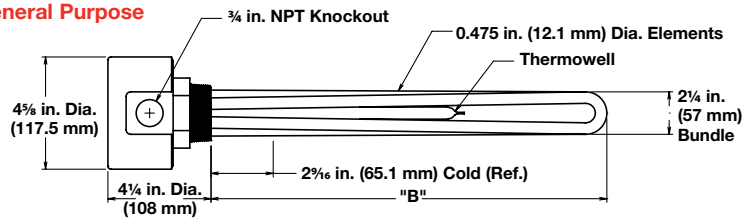
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WATROD and FIREBAR Screw Plug Immersion Heaters

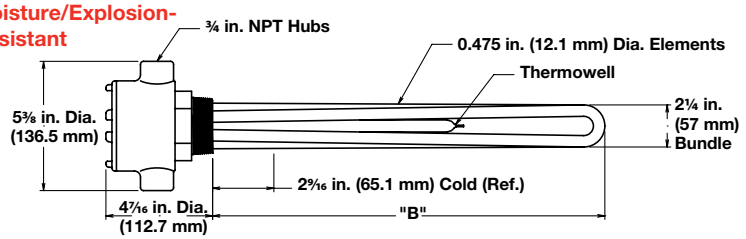
Application: Forced Air and Caustic Solutions

- 2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
23 W/in² ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm²)	120	3.0	1	17¾ (451)	**BHNA17N1S**	7 (4)	**C/F**	**C/F**	**BHNA17N1C**	10 (5)	**C/F**	**C/F**
	240	3.0	3	17¾ (451)	**BHNA17N3S**	7 (4)	**C2-50**	**C2-92**	**BHNA17N3C**	10 (5)	**C3-94**	**C3-93**
	480	3.0	3	17¾ (451)	**BHNA17N5S**	7 (4)	**C2-43**	**C2-35**	**BHNA17N5C**	10 (5)	**C3-116**	**C3-118**
	120	4.5	1	25¼ (641)	**BHNA25E1S**	8 (4)	**C/F**	**C/F**	**BHNA25E1C**	11 (5)	**C/F**	**C/F**
	240	4.5	3	25¼ (641)	**BHNA25E3S**	8 (4)	**C2-50**	**C2-92**	**BHNA25E3C**	11 (5)	**C3-94**	**C3-93**
	480	4.5	3	25¼ (641)	**BHNA25E5S**	8 (4)	**C2-43**	**C2-35**	**BHNA25E5C**	11 (5)	**C3-116**	**C3-118**
	240	6.0	3	32¾ (832)	**BHNA32N3S**	9 (4)	**C2-50**	**C2-92**	**BHNA32N3C**	12 (6)	**C3-94**	**C3-93**
	480	6.0	3	32¾ (832)	**BHNA32N5S**	9 (4)	**C2-43**	**C2-35**	**BHNA32N5C**	12 (6)	**C3-116**	**C3-118**
	240	7.5	3	40¼ (1022)	**BHNA40E3S**	10 (5)	**C2-50**	**C2-92**	**BHNA40E3C**	13 (6)	**C3-94**	**C3-93**
	480	7.5	3	40¼ (1022)	**BHNA40E5S**	10 (5)	**C2-43**	**C2-35**	**BHNA40E5C**	13 (6)	**C3-116**	**C3-118**
	240	9.0	3	47¾ (1213)	**BHNA47N3S**	11 (5)	**C2-50**	**C2-92**	**BHNA47N3C**	14 (7)	**C3-94**	**C3-93**
	480	9.0	3	47¾ (1213)	**BHNA47N5S**	11 (5)	**C2-43**	**C2-35**	**BHNA47N5C**	14 (7)	**C3-116**	**C3-118**
	240	12.5	3	64¼ (1632)	**BHNA64E3S**	15 (7)	**C2-236**	**C2-214**	**BHNA64E3C**	18 (9)	**C3-114**	**C3-115**
	480	12.5	3	64¼ (1632)	**BHNA64E5S**	15 (7)	**C2-43**	**C2-35**	**BHNA64E5C**	18 (9)	**C3-116**	**C3-118**
	240	15.0	3	76¾ (1950)	**BHNA76E3S**	18 (9)	**C2-236**	**C2-214**	**BHNA76E3C**	21 (10)	**C3-114**	**C3-115**
	480	15.0	3	76¾ (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

⑤ No third party recognition

⑥ Can be rewired wye to produce ⅓ of the original kW and watt density (3-phase only)

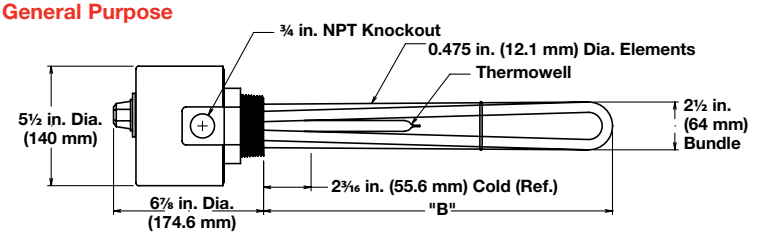
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WATROD and FIREBAR Screw Plug Immersion Heaters

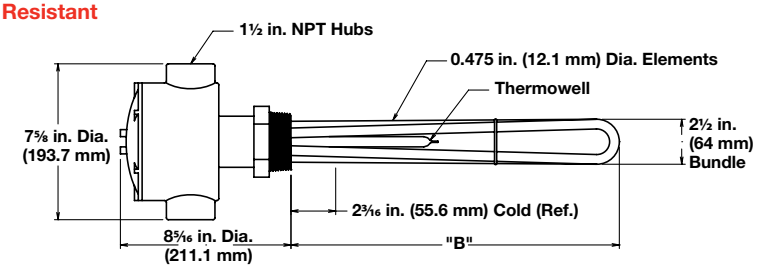
Application: Forced Air and Caustic Solutions

- 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



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm²)	240	3.0	3	17 3/8 (441.3)	10 (5)	BLNA17G3S4	C/F	C/F	BLNA17G3S5A	C/F	C/F	BLNA17G3S7A	C/F	C/F
	480	3.0	3	17 3/8 (441.3)	10 (5)	BLNA17G5S4	C/F	C/F	BLNA17G5S5A	C/F	C/F	BLNA17G5S7A	C/F	C/F
	240	4.5	3	24 7/8 (631.8)	13 (6)	BLNA24R3S4	C/F	C/F	BLNA24R3S5A	C/F	C/F	BLNA24R3S7A	C/F	C/F
	480	4.5	3	24 7/8 (631.8)	13 (6)	BLNA24R5S4	C/F	C/F	BLNA24R5S5A	C/F	C/F	BLNA24R5S7A	C/F	C/F
	240	6.0	3	32 3/8 (822.3)	15 (7)	BLNA32G3S4	C/F	C/F	BLNA32G3S5A	C/F	C/F	BLNA32G3S7A	C/F	C/F
	480	6.0	3	32 3/8 (822.3)	15 (7)	BLNA32G5S4	C/F	C/F	BLNA32G5S5A	C/F	C/F	BLNA32G5S7A	C/F	C/F
	240	7.5	3	39 7/8 (1012.8)	16 (8)	BLNA39R3S4	C/F	C/F	BLNA39R3S5A	C/F	C/F	BLNA39R3S7A	C/F	C/F
	240	9.0	3	47 3/8 (1203.3)	18 (9)	BLNA47G3S4	C/F	C/F	BLNA47G3S5A	C/F	C/F	BLNA47G3S7A	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/in² ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm²)	240	3.0	3	17 3/8 (441.3)	13 (6)	BLNA17G3C4	C/F	C/F	BLNA17G3C5A	C/F	C/F	BLNA17G3C7A	C/F	C/F
	480	3.0	3	17 3/8 (441.3)	13 (6)	BLNA17G5C4	C/F	C/F	BLNA17G5C5A	C/F	C/F	BLNA17G5C7A	C/F	C/F
	240	4.5	3	24 7/8 (631.8)	16 (8)	BLNA24R3C4	C/F	C/F	BLNA24R3C5A	C/F	C/F	BLNA24R3C7A	C/F	C/F
	480	4.5	3	24 7/8 (631.8)	16 (8)	BLNA24R5C4	C/F	C/F	BLNA24R5C5A	C/F	C/F	BLNA24R5C7A	C/F	C/F
	240	6.0	3	32 3/8 (822.3)	18 (9)	BLNA32G3C4	C/F	C/F	BLNA32G3C5A	C/F	C/F	BLNA32G3C7A	C/F	C/F
	480	6.0	3	32 3/8 (822.3)	18 (9)	BLNA32G5C4	C/F	C/F	BLNA32G5C5A	C/F	C/F	BLNA32G5C7A	C/F	C/F
	240	7.5	3	39 7/8 (1012.8)	19 (9)	BLNA39R3C4	C/F	C/F	BLNA39R3C5A	C/F	C/F	BLNA39R3C7A	C/F	C/F
	240	9.0	3	47 3/8 (1203.3)	21 (10)	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.

⑤ No third party recognition

⑥ Can be rewired wye to produce ⅓ of the original kW and watt density (3-phase only)

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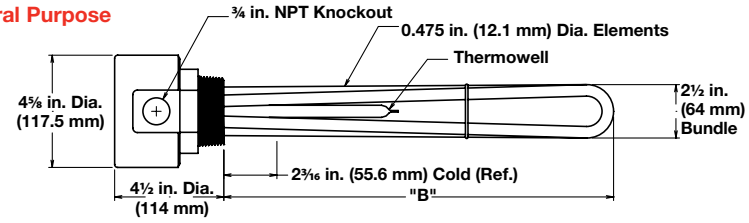
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WATROD and FIREBAR Screw Plug Immersion Heaters

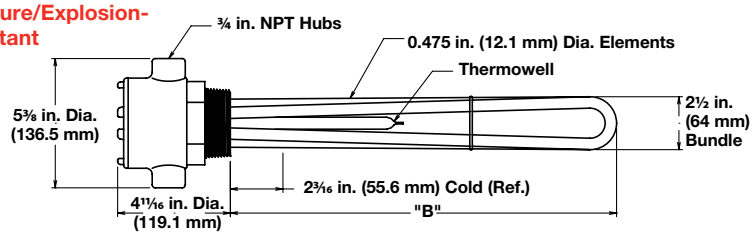
Application: Forced Air and Caustic Solutions

- 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)	Part Number	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
23 W/in² ⑥ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm²)	120	3.0	1	17 3/8 (441.3)	**BLNA17G1S**	9 (4)	**C/F**	**C/F**	**BLNA17G1C**	12 (6)	**C/F**	**C/F**
	240	3.0	3	17 3/8 (441.3)	**BLNA17G3S**	9 (4)	**C2-50**	**C2-92**	**BLNA17G3C**	12 (6)	**C3-94**	**C3-93**
	480	3.0	3	17 3/8 (441.3)	**BLNA17G5S**	9 (4)	**C2-43**	**C2-35**	**BLNA17G5C**	12 (6)	**C3-116**	**C3-118**
	120	4.5	1	24 7/8 (631.8)	**BLNA24R1S**	12 (6)	**C/F**	**C/F**	**BLNA24R1C**	15 (7)	**C/F**	**C/F**
	240	4.5	3	24 7/8 (631.8)	**BLNA24R3S**	12 (6)	**C2-50**	**C2-92**	**BLNA24R3C**	15 (7)	**C3-94**	**C3-93**
	480	4.5	3	24 7/8 (631.8)	**BLNA24R5S**	12 (6)	**C2-43**	**C2-35**	**BLNA24R5C**	15 (7)	**C3-116**	**C3-118**
	240	6.0	3	32 3/8 (822.3)	**BLNA32G3S**	14 (7)	**C2-50**	**C2-92**	**BLNA32G3C**	17 (8)	**C3-94**	**C3-93**
	480	6.0	3	32 3/8 (822.3)	**BLNA32G5S**	14 (7)	**C2-43**	**C2-35**	**BLNA32G5C**	17 (8)	**C3-116**	**C3-118**
	240	7.5	3	39 7/8 (1012.8)	**BLNA39R3S**	15 (7)	**C2-50**	**C2-92**	**BLNA39R3C**	18 (9)	**C3-94**	**C3-93**
	480	7.5	3	39 7/8 (1012.8)	**BLNA39R5S**	15 (7)	**C2-43**	**C2-35**	**BLNA39R5C**	18 (9)	**C3-116**	**C3-118**
	240	9.0	3	47 3/8 (1203.3)	**BLNA47G3S**	17 (8)	**C2-50**	**C2-92**	**BLNA47G3C**	20 (9)	**C3-94**	**C3-93**
	480	9.0	3	47 3/8 (1203.3)	**BLNA47G5S**	17 (8)	**C2-43**	**C2-35**	**BLNA47G5C**	20 (9)	**C3-116**	**C3-118**
	240	12.5	3	63 7/8 (1622.4)	**BLNA63R3S**	20 (9)	**C2-236**	**C2-214**	**BLNA63R3C**	23 (11)	**C3-114**	**C3-115**
	480	12.5	3	63 7/8 (1622.4)	**BLNA63R5S**	20 (9)	**C2-43**	**C2-35**	**BLNA63R5C**	23 (11)	**C3-116**	**C3-118**
	240	15.0	3	76 3/8 (1939.9)	**BLNA76G3S**	23 (11)	**C2-236**	**C2-214**	**BLNA76G3C**	26 (12)	**C3-114**	**C3-115**
	480	15.0	3	76 3/8 (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

⑤ No third party recognition

⑥ Can be rewired wye to produce ⅓ of the original kW and watt density (3-phase only)

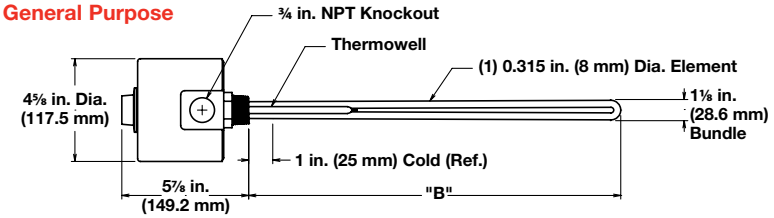
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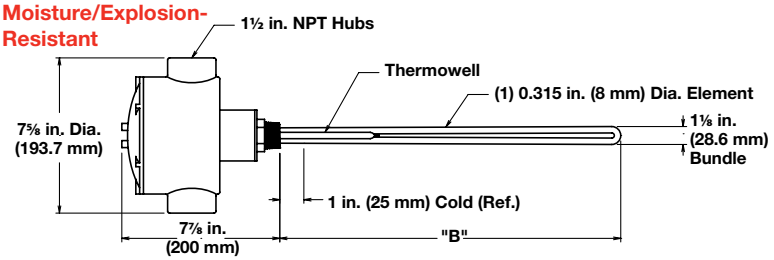
Application: Lightweight Oils and Heat Transfer Oils

- 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)

General Purpose



Moisture/Explosion-Resistant



						Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² Steel Plug 1-Steel Element (3.6 W/cm²)	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
						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/in² Steel Plug 1-Steel Element (3.6 W/cm²)	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

⑤ No third party recognition

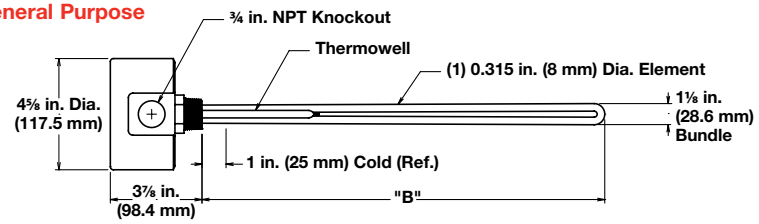
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WATROD and FIREBAR Screw Plug Immersion Heaters

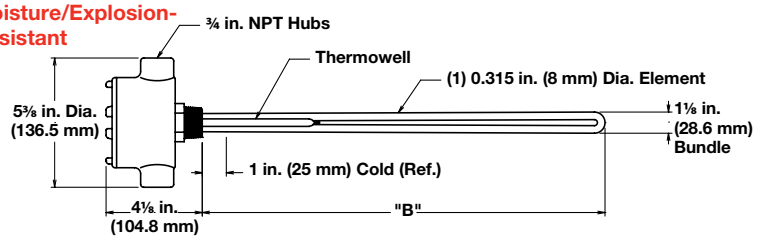
Application: Lightweight Oils and Heat Transfer Oils

- 1 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
23 W/in² Steel Plug 1-Steel Element (3.6 W/cm²)	120	0.25	1	6 1/2 (165)	**BCS6J1S**	3 (2)	**C1-15**	**C1-12**	**BCS6J1C**	6 (3)	**C/F**	**C/F**
	240	0.25	1	6 1/2 (165)	**BCS6J10S**	3 (2)	**C1-17**	**C1-13**	**BCS6J10C**	6 (3)	**C/F**	**C/F**
	120	0.35	1	9 1/4 (235)	**BCS9E1S**	4 (2)	**C1-15**	**C1-12**	**BCS9E1C**	7 (4)	**C/F**	**C/F**
	240	0.35	1	9 1/4 (235)	**BCS9E10S**	4 (2)	**C1-17**	**C1-13**	**BCS9E10C**	7 (4)	**C/F**	**C/F**
	120	0.50	1	9 3/8 (238)	**BCS9G1S**	4 (2)	**C1-15**	**C1-12**	**BCS9G1C**	7 (4)	**C/F**	**C/F**
	240	0.50	1	9 3/8 (238)	**BCS9G10S**	4 (2)	**C1-17**	**C1-13**	**BCS9G10C**	7 (4)	**C/F**	**C/F**
	120	0.75	1	13 1/2 (343)	**BCS13J1S**	5 (3)	**C1-15**	**C1-12**	**BCS13J1C**	8 (4)	**C/F**	**C/F**
	240	0.75	1	13 1/2 (343)	**BCS13J10S**	5 (3)	**C1-17**	**C1-13**	**BCS13J10C**	8 (4)	**C/F**	**C/F**
	120	1.00	1	16 3/4 (426)	**BCS16N1S**	6 (3)	**C1-15**	**C1-12**	**BCS16N1C**	9 (4)	**C/F**	**C/F**
	240	1.00	1	16 3/4 (426)	**BCS16N10S**	6 (3)	**C1-17**	**C1-13**	**BCS16N10C**	9 (4)	**C/F**	**C/F**
	120	1.50	1	23 3/4 (603)	**BCS23N1S**	7 (4)	**C1-15**	**C1-12**	**BCS23N1C**	10 (5)	**C/F**	**C/F**
	240	1.50	1	23 3/4 (603)	**BCS23N10S**	7 (4)	**C1-17**	**C1-13**	**BCS23N10C**	10 (5)	**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

⑤ No third party recognition

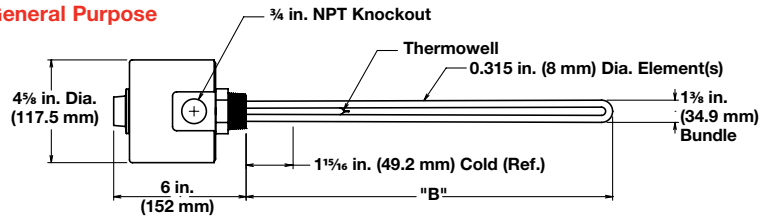
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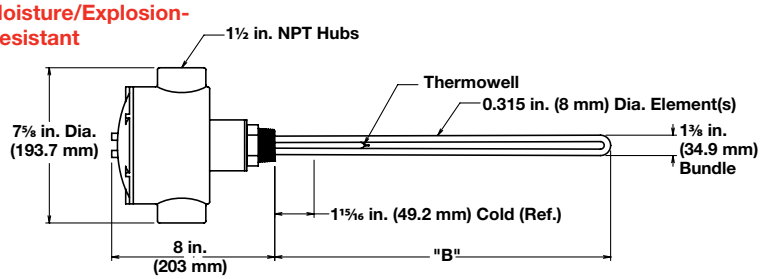
Application: Lightweight Oils and Heat Transfer Oils

- 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



						Type 2 (30 to 250°F)			Type 3 (175 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² ④ Steel Plug 2-Steel Elements (3.6 W/cm²)	120/240	0.50	1	6 3/8 (161.9)	4 (2)	**BES6G6S2**	C/F	C/F	**BES6G6S3**	C/F	C/F
	120/240	0.50	1	7 3/8 (187.3)	4 (2)	**BES7G6S2**	C/F	C/F	**BES7G6S3**	C/F	C/F
	120/240	0.70	1	8 7/8 (225.4)	5 (3)	**BES8R6S2**	C/F	C/F	**BES8R6S3**	C/F	C/F
	120/240	0.75	1	10 1/16 (255.6)	5 (3)	**BES10B6S2**	C/F	C/F	**BES10B6S3**	C/F	C/F
	120/240	1.00	1	12 3/4 (324.0)	6 (3)	**BES12N6S2**	C/F	C/F	**BES12N6S3**	C/F	C/F
	120/240	1.50	1	19 3/8 (492.1)	7 (4)	**BES19G6S2**	C/F	C/F	**BES19G6S3**	C/F	C/F
	120/240	2.00	1	25 3/8 (644.5)	8 (4)	**BES25G6S2**	C/F	C/F	**BES25G6S3**	C/F	C/F
	120/240	3.00	1	36 7/8 (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/in² ④ Steel Plug 2-Steel Elements (3.6 W/cm²)	120/240	0.50	1	6 3/8 (161.9)	8 (4)	**BES6G6C2**	C/F	C/F	**BES6G6C3**	C/F	C/F
	120/240	0.50	1	7 3/8 (187.3)	8 (4)	**BES7G6C2**	C/F	C/F	**BES7G6C3**	C/F	C/F
	120/240	0.70	1	8 7/8 (225.6)	9 (4)	**BES8R6C2**	C/F	C/F	**BES8R6C3**	C/F	C/F
	120/240	0.75	1	10 1/16 (256.0)	9 (4)	**BES10B6C2**	C/F	C/F	**BES10B6C3**	C/F	C/F
	120/240	1.00	1	12 3/4 (324.0)	10 (5)	**BES12N6C2**	C/F	C/F	**BES12N6C3**	C/F	C/F
	120/240	1.50	1	19 3/8 (492.1)	11 (5)	**BES19G6C2**	C/F	C/F	**BES19G6C3**	C/F	C/F
	120/240	2.00	1	25 3/8 (644.5)	12 (6)	**BES25G6C2**	C/F	C/F	**BES25G6C3**	C/F	C/F
	120/240	3.00	1	36 7/8 (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.

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④ Wired for higher voltage

⑤ No third party recognition

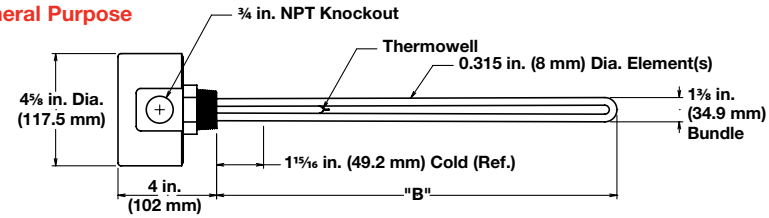
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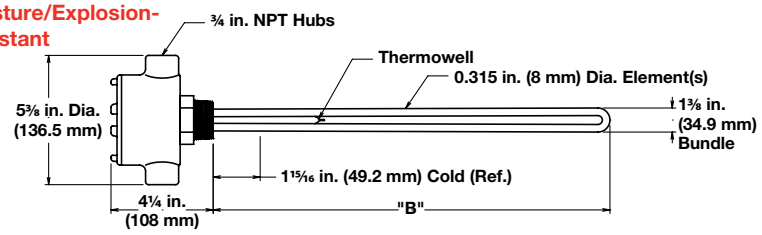
Application: Lightweight Oils and Heat Transfer Oils

- 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 Part Number		240V WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT 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
23 W/in² ④ Steel Plug 2-Steel Elements (3.6 W/cm²)	120/240	0.50	1	6 3/8 (161.9)	**BES6G6S**	4 (2)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**BES6G6C**	7 (4)	**C/F**	**C/F**
	120/240	0.50	1	7 3/8 (187.3)	**BES7G6S**	4 (2)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**BES7G6C**	7 (4)	**C/F**	**C/F**
	120/240	0.70	1	8 7/8 (225.4)	**BES8R6S**	5 (3)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**BES8R6C**	8 (4)	**C/F**	**C/F**
	120/240	0.75	1	10 1/16 (255.6)	**BES10B6S**	5 (3)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**BES10B6C**	8 (4)	**C/F**	**C/F**
	120/240	1.00	1	12 3/4 (324.0)	**BES12N6S**	6 (3)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**BES12N6C**	9 (4)	**C/F**	**C/F**
	120/240	1.50	1	19 3/8 (492.1)	**BES19G6S**	7 (4)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**BES19G6C**	10 (5)	**C/F**	**C/F**
	120/240	2.00	1	25 3/8 (644.5)	**BES25G6S**	8 (4)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**BES25G6C**	11 (5)	**C/F**	**C/F**
	120/240	3.00	1	36 7/8 (936.6)	**BES36R6S**	9 (4)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**BES36R6C**	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

④ Wired for higher voltage

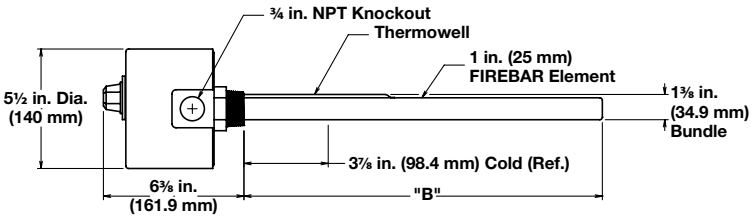
⑤ No third party recognition

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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



						Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
30 W/in² ③ 304 SS Plug 1-Alloy 800 Element (4.7 W/cm²)	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
23 W/in² ⑧ 304 SS Plug 1-Alloy 800 Element (3.6 W/cm²)	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

③ Wired for 3-phase operation only

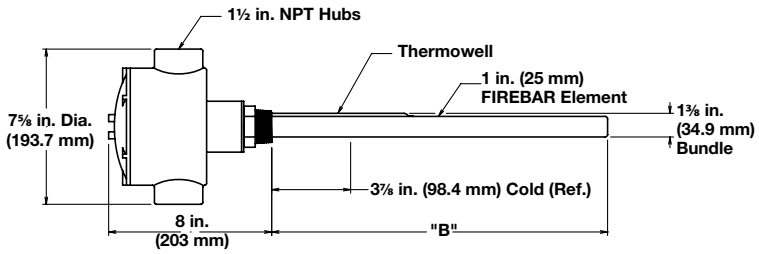
⑧ Can be wired for 1-phase operation

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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)



						Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
30 W/in² ③ 304 SS Plug 1-Alloy 800 Element (4.7 W/cm²)	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
23 W/in² ⑧ 304 SS Plug 1-Alloy 800 Element (3.6 W/cm²)	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

③ Wired for 3-phase operation only

⑤ No third party recognition

⑧ Can be wired for 1-phase operation

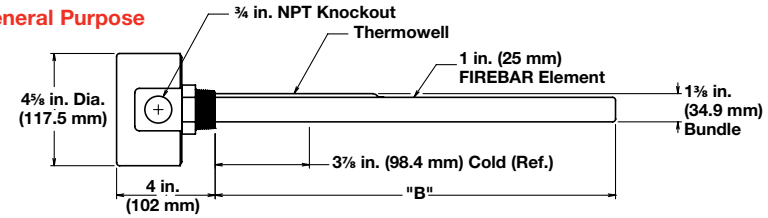
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WATROD and FIREBAR Screw Plug Immersion Heaters

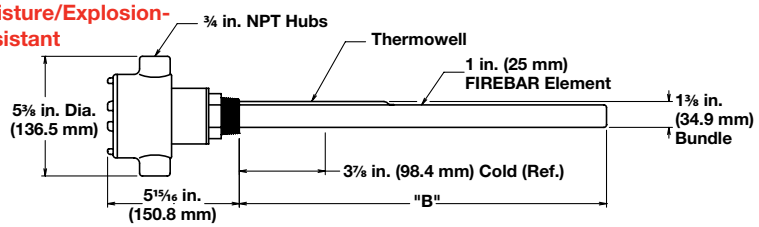
Application: Lightweight Oils and Heat Transfer Oils

- 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)

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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
30 W/in² ③ 304 SS Plug 1-Alloy 800 Element (4.7 W/cm²)	240	1.70	3	16 1/8 (409.6)	**BDNF16G12S**	7 (4)	**C2-50**	**C2-92**	**BDNF16G12C**	10 (5)	**C3-94**	**C3-93**
	480	1.70	3	16 1/8 (409.6)	**BDNF16G13S**	7 (4)	**C2-43**	**C2-35**	**BDNF16G13C**	10 (5)	**C3-116**	**C3-118**
	240	2.20	3	19 1/8 (485.8)	**BDNF19G12S**	8 (4)	**C2-50**	**C2-92**	**BDNF19G12C**	11 (5)	**C3-94**	**C3-93**
	480	2.20	3	19 1/8 (485.8)	**BDNF19G13S**	8 (4)	**C2-43**	**C2-35**	**BDNF19G13C**	11 (5)	**C3-116**	**C3-118**
	240	2.80	3	24 3/8 (619.1)	**BDNF24L12S**	9 (4)	**C2-50**	**C2-92**	**BDNF24L12C**	12 (6)	**C3-94**	**C3-93**
	480	2.80	3	24 3/8 (619.1)	**BDNF24L13S**	9 (4)	**C2-43**	**C2-35**	**BDNF24L13C**	12 (6)	**C3-116**	**C3-118**
	240	3.50	3	29 5/8 (752.5)	**BDNF29R12S**	10 (5)	**C2-50**	**C2-92**	**BDNF29R12C**	13 (6)	**C3-94**	**C3-93**
	480	3.50	3	29 5/8 (752.5)	**BDNF29R13S**	10 (5)	**C2-43**	**C2-35**	**BDNF29R13C**	13 (6)	**C3-116**	**C3-118**
	240	4.25	3	34 5/8 (879.5)	**BDNF34R12S**	11 (5)	**C2-50**	**C2-92**	**BDNF34R12C**	14 (7)	**C3-94**	**C3-93**
	480	4.25	3	34 5/8 (879.5)	**BDNF34R13S**	11 (5)	**C2-43**	**C2-35**	**BDNF34R13C**	14 (7)	**C3-116**	**C3-118**
	240	5.70	3	45 1/8 (1146.2)	**BDNF45G12S**	13 (6)	**C2-50**	**C2-92**	**BDNF45G12C**	16 (8)	**C3-94**	**C3-93**
	480	5.70	3	45 1/8 (1146.2)	**BDNF45G13S**	13 (6)	**C2-43**	**C2-35**	**BDNF45G13C**	16 (8)	**C3-116**	**C3-118**
	240	7.20	3	55 5/8 (1412.9)	**BDNF55R12S**	15 (7)	**C2-50**	**C2-92**	**BDNF55R12C**	18 (9)	**C3-94**	**C3-93**
	480	7.20	3	55 5/8 (1412.9)	**BDNF55R13S**	15 (7)	**C2-43**	**C2-35**	**BDNF55R13C**	18 (9)	**C3-116**	**C3-118**
23 W/in² ⑧ 304 SS Plug 1-Alloy 800 Element (3.6 W/cm²)	240	1.25	3	16 1/8 (409.6)	**BDNF16G20S**	7 (4)	**C2-50**	**C2-92**	**BDNF16G20C**	10 (5)	**C3-94**	**C3-93**
	240	1.65	3	19 1/8 (485.8)	**BDNF19G20S**	8 (4)	**C2-50**	**C2-92**	**BDNF19G20C**	11 (5)	**C3-94**	**C3-93**
	240	2.15	3	24 3/8 (619.1)	**BDNF24L20S**	9 (4)	**C2-50**	**C2-92**	**BDNF24L20C**	12 (6)	**C3-94**	**C3-93**
	480	2.15	3	24 3/8 (619.1)	**BDNF24L19S**	9 (4)	**C2-43**	**C2-35**	**BDNF24L19C**	12 (6)	**C3-116**	**C3-118**
	240	2.65	3	29 5/8 (752.5)	**BDNF29R20S**	10 (5)	**C2-50**	**C2-92**	**BDNF29R20C**	13 (6)	**C3-94**	**C3-93**
	480	2.65	3	29 5/8 (752.5)	**BDNF29R19S**	10 (5)	**C2-43**	**C2-35**	**BDNF29R19C**	13 (6)	**C3-116**	**C3-118**
	240	3.20	3	34 5/8 (879.5)	**BDNF34R20S**	11 (5)	**C2-50**	**C2-92**	**BDNF34R20C**	14 (7)	**C3-94**	**C3-93**
	480	3.20	3	34 5/8 (879.5)	**BDNF34R19S**	11 (5)	**C2-43**	**C2-35**	**BDNF34R19C**	14 (7)	**C3-116**	**C3-118**
	240	4.25	3	45 1/8 (1146.2)	**BDNF45G20S**	13 (6)	**C2-50**	**C2-92**	**BDNF45G20C**	16 (8)	**C3-94**	**C3-93**
	480	4.25	3	45 1/8 (1146.2)	**BDNF45G19S**	13 (6)	**C2-43**	**C2-35**	**BDNF45G19C**	16 (8)	**C3-116**	**C3-118**
	240	5.40	3	55 5/8 (1412.9)	**BDNF55R20S**	15 (7)	**C2-50**	**C2-92**	**BDNF55R20C**	18 (9)	**C3-94**	**C3-93**
	480	5.40	3	55 5/8 (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

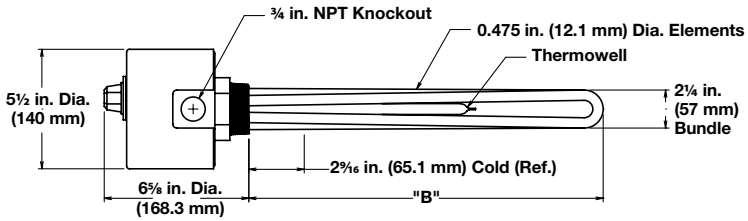
⑧ Can be wired for 1-phase operation

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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



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² ④ Steel Plug 2-Steel Elements (3.6 W/cm²)	120/240	1.0	1	9½ (241)	5 (3)	**BGS79J6S4**	C/F	C/F	**BGS79J6S5A**	C/F	C/F	**BGS79J6S7A**	C/F	C/F
	240/480	1.0	1	9½ (241)	5 (3)	**BGS79J7S4**	C/F	C/F	**BGS79J7S5A**	C/F	C/F	**BGS79J7S7A**	C/F	C/F
	120/240	1.5	1	13½ (343)	6 (3)	**BGS713J6S4**	C/F	C/F	**BGS713J6S5A**	C/F	C/F	**BGS713J6S7A**	C/F	C/F
	240/480	1.5	1	13½ (343)	6 (3)	**BGS713J7S4**	C/F	C/F	**BGS713J7S5A**	C/F	C/F	**BGS713J7S7A**	C/F	C/F
	120/240	2.0	1	17½ (445)	7 (4)	**BGS717J6S4**	C/F	C/F	**BGS717J6S5A**	C/F	C/F	**BGS717J6S7A**	C/F	C/F
	240/480	2.0	1	17½ (445)	7 (4)	**BGS717J7S4**	C/F	C/F	**BGS717J7S5A**	C/F	C/F	**BGS717J7S7A**	C/F	C/F
	120/240	2.5	1	20½ (521)	8 (4)	**BGS720J6S4**	C/F	C/F	**BGS720J6S5A**	C/F	C/F	**BGS720J6S7A**	C/F	C/F
	240/480	2.5	1	20½ (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	32½ (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/in² Steel Plug 3-Steel Elements (3.6 W/cm²)	120	1.5	1	9½ (241)	6 (3)	**BHS79J1S4**	C/F	C/F	**BHS79J1S5A**	C/F	C/F	**BHS79J1S7A**	C/F	C/F
	240	1.5	3	9½ (241)	6 (3)	**BHS79J3S4**	C/F	C/F	**BHS79J3S5A**	C/F	C/F	**BHS79J3S7A**	C/F	C/F
	480	1.5	3	9½ (241)	6 (3)	**BHS79J13S4**	C/F	C/F	**BHS79J13S5A**	C/F	C/F	**BHS79J13S7A**	C/F	C/F
	240	3.0	3	17½ (445)	8 (4)	**BHS717J3S4**	C/F	C/F	**BHS717J3S5A**	C/F	C/F	**BHS717J3S7A**	C/F	C/F
	480	3.0	3	17½ (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	32½ (826)	13 (6)	**BHS732J3S4**	C/F	C/F	**BHS732J3S5A**	C/F	C/F	**BHS732J3S7A**	C/F	C/F
	480	6.0	3	32½ (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	47½ (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.

④ Wired for higher voltage

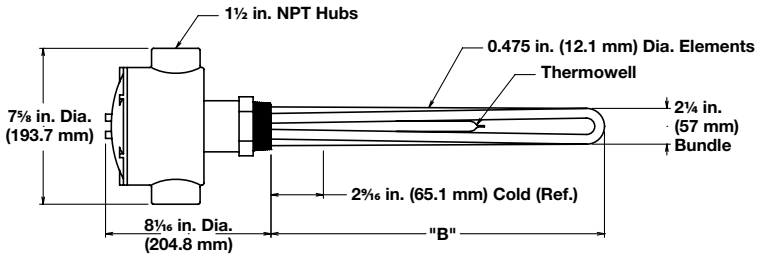
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WATROD and FIREBAR Screw Plug Immersion Heaters

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)



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
23 W/in² ④ Steel Plug 2-Steel Elements (3.6 W/cm²)	120/240	1.0	1	9½ (241)	8 (4)	**BGS79J6C4**	C/F	C/F	**BGS79J6C5A**	C/F	C/F	**BGS79J6C7A**	C/F	C/F
	240/480	1.0	1	9½ (241)	8 (4)	**BGS79J7C4**	C/F	C/F	**BGS79J7C5A**	C/F	C/F	**BGS79J7C7A**	C/F	C/F
	120/240	1.5	1	13½ (343)	9 (4)	**BGS713J6C4**	C/F	C/F	**BGS713J6C5A**	C/F	C/F	**BGS713J6C7A**	C/F	C/F
	240/480	1.5	1	13½ (343)	9 (4)	**BGS713J7C4**	C/F	C/F	**BGS713J7C5A**	C/F	C/F	**BGS713J7C7A**	C/F	C/F
	120/240	2.0	1	17½ (445)	10 (5)	**BGS717J6C4**	C/F	C/F	**BGS717J6C5A**	C/F	C/F	**BGS717J6C7A**	C/F	C/F
	240/480	2.0	1	17½ (445)	10 (5)	**BGS717J7C4**	C/F	C/F	**BGS717J7C5A**	C/F	C/F	**BGS717J7C7A**	C/F	C/F
	120/240	2.5	1	20½ (521)	11 (5)	**BGS720J6C4**	C/F	C/F	**BGS720J6C5A**	C/F	C/F	**BGS720J6C7A**	C/F	C/F
	240/480	2.5	1	20½ (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	32½ (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
23 W/in² Steel Plug 3-Steel Elements (3.6 W/cm²)	120	1.5	1	9½ (241)	9 (4)	**BHS79J1C4**	C/F	C/F	**BHS79J1C5A**	C/F	C/F	**BHS79J1C7A**	C/F	C/F
	240	1.5	3	9½ (241)	9 (4)	**BHS79J3C4**	C/F	C/F	**BHS79J3C5A**	C/F	C/F	**BHS79J3C7A**	C/F	C/F
	480	1.5	3	9½ (241)	9 (4)	**BHS79J13C4**	C/F	C/F	**BHS79J13C5A**	C/F	C/F	**BHS79J13C7A**	C/F	C/F
	240	3.0	3	17½ (445)	11 (5)	**BHS717J3C4**	C/F	C/F	**BHS717J3C5A**	C/F	C/F	**BHS717J3C7A**	C/F	C/F
	480	3.0	3	17½ (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	32½ (826)	16 (8)	**BHS732J3C4**	C/F	C/F	**BHS732J3C5A**	C/F	C/F	**BHS732J3C7A**	C/F	C/F
	480	6.0	3	32½ (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	47½(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

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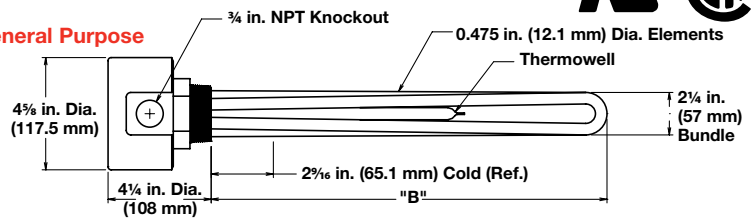
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WATROD and FIREBAR Screw Plug Immersion Heaters

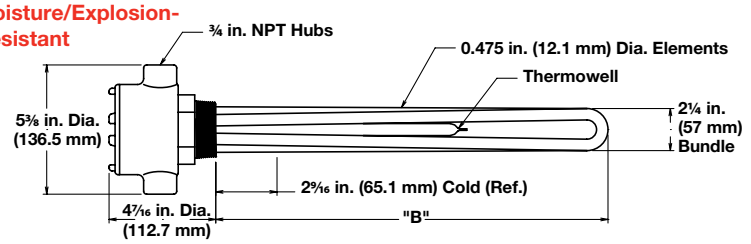
Application: Lightweight Oils and Heat Transfer Oils

- 2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT Part Number		240V WATCONNECT Part Number		480V WATCONNECT Part Number	
					General Purpose 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
23 W/in² ④ Steel Plug 2-Steel Elements (3.6 W/cm²)	120/240	1.0	1	9½ (241)	**BGS79J6S**	4 (2)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**N/A**	**N/A**
	240/480	1.0	1	9½ (241)	**BGS79J7S**	4 (2)	**N/A**	**N/A**	**C1-17**	**C1-13**	**C/F**	**C/F**
	120/240	1.5	1	13½ (343)	**BGS713J6S**	5 (3)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**N/A**	**N/A**
	240/480	1.5	1	13½ (343)	**BGS713J7S**	5 (3)	**N/A**	**N/A**	**C1-17**	**C1-13**	**C/F**	**C/F**
	120/240	2.0	1	17½ (445)	**BGS717J6S**	6 (3)	**C1-15**	**C1-12**	**C1-17**	**C1-13**	**N/A**	**N/A**
	240/480	2.0	1	17½ (445)	**BGS717J7S**	6 (3)	**N/A**	**N/A**	**C1-17**	**C1-13**	**C/F**	**C/F**
	120/240	2.5	1	20½ (521)	**BGS720J6S**	7 (4)	**C/F**	**C/F**	**C1-17**	**C1-13**	**N/A**	**N/A**
	240/480	2.5	1	20½ (521)	**BGS720J7S**	7 (4)	**N/A**	**N/A**	**C1-17**	**C1-13**	**C/F**	**C/F**
	120/240	3.0	1	25 (635)	**BGS725A6S**	7 (4)	**C/F**	**C/F**	**C1-17**	**C1-13**	**N/A**	**N/A**
	240/480	3.0	1	25 (635)	**BGS725A7S**	7 (4)	**N/A**	**N/A**	**C1-17**	**C1-13**	**C/F**	**C/F**
	120/240	4.0	1	32½ (826)	**BGS732J6S**	8 (4)	**C/F**	**C/F**	**C1-17**	**C1-13**	**N/A**	**N/A**
	240/480	4.0	1	32½ (826)	**BGS732J7S**	8 (4)	**N/A**	**N/A**	**C1-17**	**C1-13**	**C/F**	**C/F**
	120/240	5.0	1	40 (1016)	**BGS740A6S**	9 (4)	**C/F**	**C/F**	**C/F**	**C/F**	**N/A**	**N/A**
	240/480	5.0	1	40 (1016)	**BGS740A7S**	9 (4)	**N/A**	**N/A**	**C/F**	**C/F**	**C/F**	**C/F**
	240/480	6.0	1	47½ (1207)	**BGS747J7S**	10 (5)	**N/A**	**N/A**	**C/F**	**C/F**	**C/F**	**C/F**
23 W/in² Steel Plug 3-Steel Elements (3.6 W/cm²)	120	1.5	1	9½ (241)	**BHS79J1S**	5 (3)	**C1-15**	**C1-12**	**N/A**	**N/A**	**N/A**	**N/A**
	240	1.5	3	9½ (241)	**BHS79J3S**	5 (3)	**N/A**	**N/A**	**C2-50**	**C2-92**	**N/A**	**N/A**
	480	1.5	3	9½ (241)	**BHS79J13S**	5 (3)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	120	3.0	1	17½ (445)	**BHS717J1S**	7 (4)	**C/F**	**C/F**	**N/A**	**N/A**	**N/A**	**N/A**
	240	3.0	3	17½ (445)	**BHS717J3S**	7 (4)	**N/A**	**N/A**	**C2-50**	**C2-92**	**N/A**	**N/A**
	480	3.0	3	17½ (445)	**BHS717J5S**	7 (4)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	120	4.5	1	25 (635)	**BHS725A1S**	9 (4)	**C/F**	**C/F**	**N/A**	**N/A**	**N/A**	**N/A**
	240	4.5	3	25 (635)	**BHS725A3S**	9 (4)	**N/A**	**N/A**	**C2-50**	**C2-92**	**N/A**	**N/A**
	480	4.5	3	25 (635)	**BHS725A5S**	9 (4)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	240	6.0	3	32½ (826)	**BHS732J3S**	12 (6)	**N/A**	**N/A**	**C2-50**	**C2-92**	**N/A**	**N/A**
	480	6.0	3	32½ (826)	**BHS732J5S**	12 (6)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	240	7.5	3	40 (1016)	**BHS740A3S**	13 (6)	**N/A**	**N/A**	**C2-50**	**C2-92**	**N/A**	**N/A**
	480	7.5	3	40 (1016)	**BHS740A5S**	13 (6)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	240	9.0	3	47½ (1207)	**BHS747J3S**	13 (6)	**N/A**	**N/A**	**C2-50**	**C2-92**	**N/A**	**N/A**
	480	9.0	3	47½ (1207)	**BHS747J5S**	13 (6)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**
	240	12.5	3	64 (1626)	**BHS764A3S**	17 (8)	**N/A**	**N/A**	**C2-236**	**C2-214**	**N/A**	**N/A**
	480	12.5	3	64 (1626)	**BHS764A5S**	17 (8)	**N/A**	**N/A**	**N/A**	**N/A**	**C2-43**	**C2-35**

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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N/A - Not available

④ Wired for higher voltage

⑤ No third party recognition

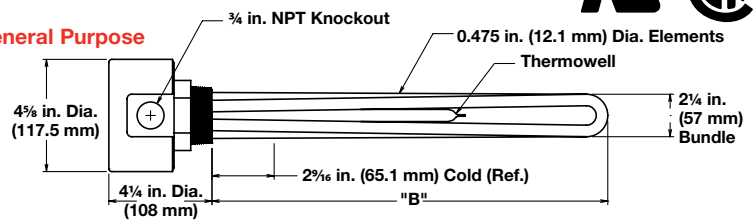
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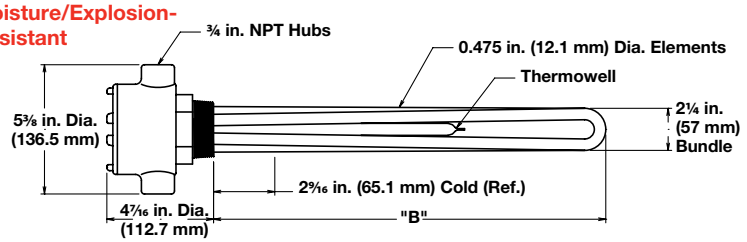
Application: Lightweight Oils and Heat Transfer Oils

- 2 inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

General Purpose



Moisture/Explosion-Resistant



Description	Volts	kW	Ph	"B" Dim. in. (mm)	Part Number	Ship Wt. lbs (kg)	120V WATCONNECT Part Number		240V WATCONNECT Part Number		480V WATCONNECT Part Number	
					Moisture/Explosion-Resistant Enclosures		Type J T/C	Type K T/C	Type J T/C	Type K T/C	Type J T/C	Type K T/C
23 W/in² ④ Steel Plug 2-Steel Elements (3.6 W/cm²)	120/240	1.0	1	9½ (241)	**BGS79J6C**	7 (4)	**C/F**	**C/F**	**C/F**	**C/F**	**N/A**	**N/A**
	240/480	1.0	1	9½ (241)	**BGS79J7C**	7 (4)	**N/A**	**N/A**	**C/F**	**C/F**	**C/F**	**C/F**
	120/240	1.5	1	13½ (343)	**BGS713J6C**	8 (4)	**C/F**	**C/F**	**C/F**	**C/F**	**N/A**	**N/A**
	240/480	1.5	1	13½ (343)	**BGS713J7C**	8 (4)	**N/A**	**N/A**	**C/F**	**C/F**	**C/F**	**C/F**
	120/240	2.0	1	17½ (445)	**BGS717J6C**	9 (4)	**C/F**	**C/F**	**C/F**	**C/F**	**N/A**	**N/A**
	240/480	2.0	1	17½ (445)	**BGS717J7C**	9 (4)	**N/A**	**N/A**	**C/F**	**C/F**	**C/F**	**C/F**
	120/240	2.5	1	20½ (521)	**BGS720J6C**	10 (5)	**C/F**	**C/F**	**C/F**	**C/F**	**N/A**	**N/A**
	240/480	2.5	1	20½ (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	32½ (826)	**BGS732J6C**	11 (5)	**C/F**	**C/F**	**C/F**	**C/F**	**N/A**	**N/A**
	240/480	4.0	1	32½ (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	47½ (1207)	**BGS747J7C**	13 (6)	**N/A**	**N/A**	**C/F**	**C/F**	**C/F**	**C/F**
23 W/in² Steel Plug 3-Steel Elements (3.6 W/cm²)	120	1.5	1	9½ (241)	**BHS79J1C**	8 (4)	**C/F**	**C/F**	**N/A**	**N/A**	**N/A**	**N/A**
	240	1.5	3	9½ (241)	**BHS79J3C**	8 (4)	**N/A**	**N/A**	**C3-94**	**C3-93**	**N/A**	**N/A**
	480	1.5	3	9½ (241)	**BHS79J13C**	8 (4)	**N/A**	**N/A**	**N/A**	**N/A**	**C3-116**	**C3-118**
	120	3.0	1	17½ (445)	**BHS717J1C**	10 (5)	**C/F**	**C/F**	**N/A**	**N/A**	**N/A**	**N/A**
	240	3.0	3	17½ (445)	**BHS717J3C**	10 (5)	**N/A**	**N/A**	**C3-94**	**C3-93**	**N/A**	**N/A**
	480	3.0	3	17½ (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	32½ (826)	**BHS732J3C**	15 (7)	**N/A**	**N/A**	**C3-94**	**C3-93**	**N/A**	**N/A**
	480	6.0	3	32½ (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	47½ (1207)	**BHS747J3C**	16 (8)	**N/A**	**N/A**	**C3-94**	**C3-93**	**N/A**	**N/A**
	480	9.0	3	47½ (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.

④ Wired for higher voltage

⑤ No third party recognition

C/F - Contact factory, go to www.watlow.com/en/contact-us

N/A - Not available

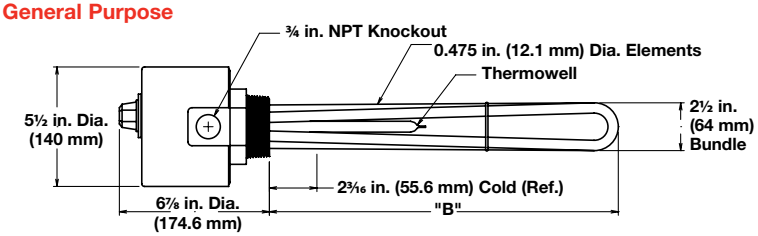
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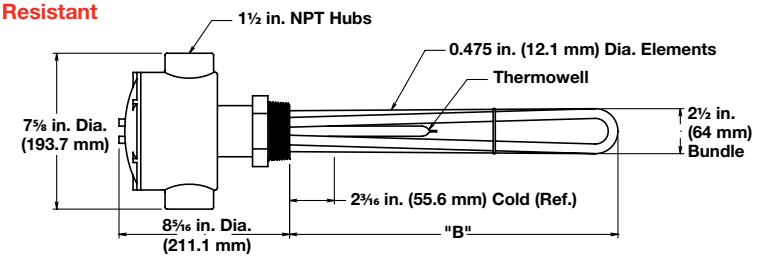
Application: Lightweight Oils and Heat Transfer Oils

- 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



						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² ⑥ Steel Plug 3-Steel Elements (3.6 Wcm²)	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/in² ⑥ Steel Plug 3-Steel Elements (3.6 Wcm²)	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 ⅓ of original kW and watt density (3-phase only)

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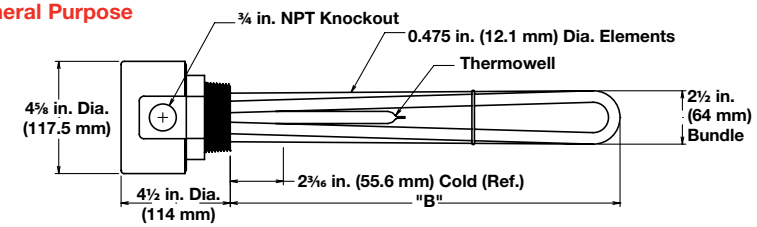
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WATROD and FIREBAR Screw Plug Immersion Heaters

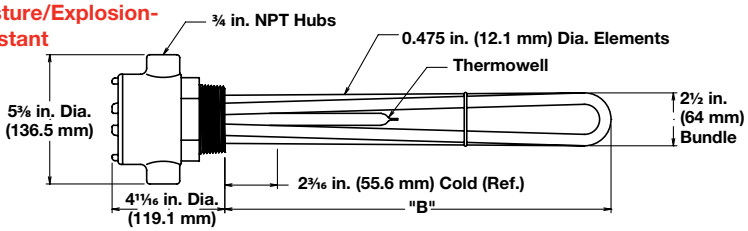
Application: Lightweight Oils and Heat Transfer Oils

- 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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture /Explosion-Resistant Enclosure		Type J T/C	Type K T/C
23 W/in² ⑥ Steel Plug 3-Steel Elements (3.6 Wcm²)	120	3.0	1	17 1/4 (438)	**BLS717E1S**	9 (4)	**C/F**	**C/F**	**BLS717E1C**	12 (6)	**C/F**	**C/F**
	240	3.0	3	17 1/4 (438)	**BLS717E3S**	9 (4)	**C2-50**	**C2-92**	**BLS717E3C**	12 (6)	**C3-94**	**C3-93**
	480	3.0	3	17 1/4 (438)	**BLS717E5S**	9 (4)	**C2-43**	**C2-35**	**BLS717E5C**	12 (6)	**C3-116**	**C3-118**
	120	4.5	1	24 3/4 (629)	**BLS724N1S**	12 (6)	**C/F**	**C/F**	**BLS724N1C**	15 (7)	**C/F**	**C/F**
	240	4.5	3	24 3/4 (629)	**BLS724N3S**	12 (6)	**C2-50**	**C2-92**	**BLS724N3C**	15 (7)	**C3-94**	**C3-93**
	480	4.5	3	24 3/4 (629)	**BLS724N5S**	12 (6)	**C2-43**	**C2-35**	**BLS724N5C**	15 (7)	**C3-116**	**C3-118**
	240	6.0	3	32 1/4 (819)	**BLS732E3S**	14 (7)	**C2-50**	**C2-92**	**BLS732E3C**	17 (8)	**C3-94**	**C3-93**
	480	6.0	3	32 1/4 (819)	**BLS732E5S**	14 (7)	**C2-43**	**C2-35**	**BLS732E5C**	17 (8)	**C3-116**	**C3-118**
	240	7.5	3	39 3/4 (1010)	**BLS739N3S**	15 (7)	**C2-50**	**C2-92**	**BLS739N3C**	18 (9)	**C3-94**	**C3-93**
	480	7.5	3	39 3/4 (1010)	**BLS739N5S**	15 (7)	**C2-43**	**C2-35**	**BLS739N5C**	18 (9)	**C3-116**	**C3-118**
	240	9.0	3	47 1/4 (1200)	**BLS747E3S**	17 (8)	**C2-50**	**C2-92**	**BLS747E3C**	20 (9)	**C3-94**	**C3-93**
	480	9.0	3	47 1/4 (1200)	**BLS747E5S**	17 (8)	**C2-43**	**C2-35**	**BLS747E5C**	20 (9)	**C3-116**	**C3-118**
	240	12.5	3	63 3/4 (1619)	**BLS763N3S**	20 (9)	**C2-236**	**C2-214**	**BLS763N3C**	23 (11)	**C3-114**	**C3-115**
	480	12.5	3	63 3/4 (1619)	**BLS763N5S**	20 (9)	**C2-43**	**C2-35**	**BLS763N5C**	23 (11)	**C3-116**	**C3-118**
	240	15.0	3	76 1/4 (1937)	**BLS776E3S**	23 (11)	**C2-236**	**C2-214**	**BLS776E3C**	26 (12)	**C3-114**	**C3-115**
	480	15.0	3	76 1/4 (1937)	**BLS776E5S**	23 (11)	**C2-43**	**C2-35**	**BLS776E5C**	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.

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⑤ No third party recognition

⑥ Can be rewired to produce ⅓ of original kW and watt density (3-phase only)

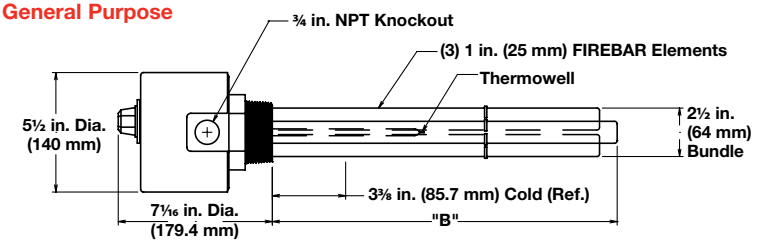
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WATROD and FIREBAR Screw Plug Immersion Heaters

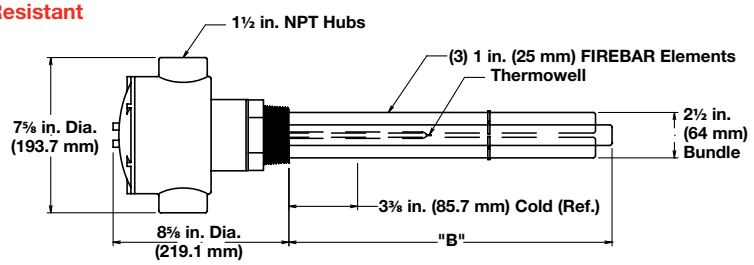
Application: Lightweight Oils and Heat Transfer Oils

- 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



						Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
30 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (4.7 W/cm²)	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/in² ⑧ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm²)	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/in² ③ 304 SS Plug 3-Alloy 800 Elements (4.7 W/cm²)	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/in² ⑧ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm²)	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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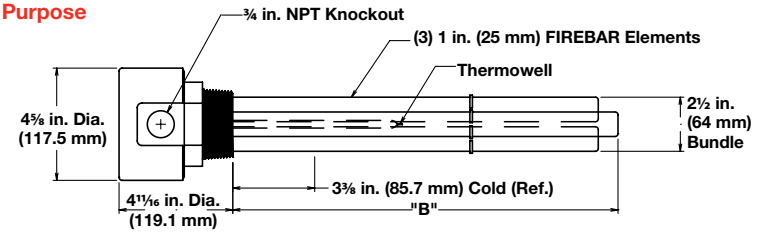
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WATROD and FIREBAR Screw Plug Immersion Heaters

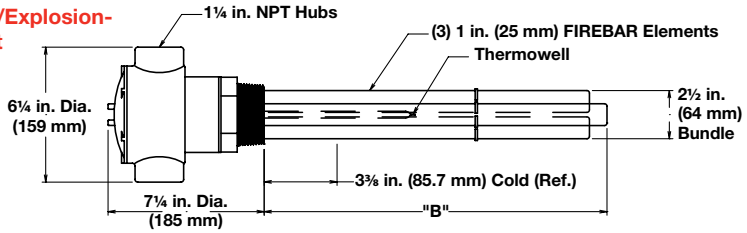
Application: Lightweight Oils and Heat Transfer Oils

- 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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
30 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (4.7 W/cm²)	240	5.0	3	15 1/8 (384.2)	**BLNF15C12S**	11 (5)	**C2-50**	**C2-92**	**BLNF15C12C**	14 (7)	**C3-94**	**C3-93**
	480	5.0	3	15 1/8 (384.2)	**BLNF15C13S**	11 (5)	**C2-43**	**C2-35**	**BLNF15C13C**	14 (7)	**C3-116**	**C3-118**
	240	6.5	3	18 1/8 (460.4)	**BLNF18C12S**	12 (6)	**C2-50**	**C2-92**	**BLNF18C12C**	15 (7)	**C3-94**	**C3-93**
	480	6.5	3	18 1/8 (460.4)	**BLNF18C13S**	12 (6)	**C2-43**	**C2-35**	**BLNF18C13C**	15 (7)	**C3-116**	**C3-118**
	240	8.5	3	23 1/8 (587.4)	**BLNF23C12S**	14 (7)	**C2-50**	**C2-92**	**BLNF23C12C**	17 (8)	**C3-94**	**C3-93**
	480	8.5	3	23 1/8 (587.4)	**BLNF23C13S**	14 (7)	**C2-43**	**C2-35**	**BLNF23C13C**	17 (8)	**C3-116**	**C3-118**
	240	10.5	3	28 5/8 (727.1)	**BLNF28L12S**	17 (8)	**C2-236**	**C2-214**	**BLNF28L12C**	20 (9)	**C3-114**	**C3-115**
	480	10.5	3	28 5/8 (727.1)	**BLNF28L13S**	17 (8)	**C2-43**	**C2-35**	**BLNF28L13C**	20 (9)	**C3-116**	**C3-118**
	240	12.8	3	33 5/8 (854.1)	**BLNF33L12S**	18 (9)	**C2-236**	**C2-214**	**BLNF33L12C**	21 (10)	**C3-114**	**C3-115**
	480	12.8	3	33 5/8 (854.1)	**BLNF33L13S**	18 (9)	**C2-43**	**C2-35**	**BLNF33L13C**	21 (10)	**C3-116**	**C3-118**
	240	17.0	3	44 1/8 (1120.8)	**BLNF44C12S**	20 (9)	**C2-236**	**C2-214**	**BLNF44C12C**	23 (11)	**C3-114**	**C3-115**
	480	17.0	3	44 1/8 (1120.8)	**BLNF44C13S**	20 (9)	**C2-43**	**C2-35**	**BLNF44C13C**	23 (11)	**C3-116**	**C3-118**
	480	21.5	3	54 5/8 (1387.5)	**BLNF54L13S**	22 (10)	**C2-225**	**C2-226**	**BLNF54L13C**	25 (12)	**C3-117**	**C3-119**
23 W/in² ⑧ 304 SS Plug 3-Alloy 800 Elements (3.6 W/cm²)	240	3.8	3	15 1/8 (384.2)	**BLNF15C20S**	11 (5)	**C2-50**	**C2-92**	**BLNF15C20C**	14 (7)	**C3-94**	**C3-93**
	240	4.9	3	18 1/8 (460.4)	**BLNF18C20S**	12 (6)	**C2-50**	**C2-92**	**BLNF18C20C**	15 (7)	**C3-94**	**C3-93**
	240	6.4	3	23 1/8 (587.4)	**BLNF23C20S**	14 (7)	**C2-50**	**C2-92**	**BLNF23C20C**	17 (8)	**C3-94**	**C3-93**
	480	6.4	3	23 1/8 (587.4)	**BLNF23C19S**	14 (7)	**C2-43**	**C2-35**	**BLNF23C19C**	17 (8)	**C3-116**	**C3-118**
	240	7.9	3	28 5/8 (727.1)	**BLNF28L20S**	17 (8)	**C2-50**	**C2-92**	**BLNF28L20C**	20 (9)	**C3-94**	**C3-93**
	480	7.9	3	28 5/8 (727.1)	**BLNF28L19S**	17 (8)	**C2-43**	**C2-35**	**BLNF28L19C**	20 (9)	**C3-116**	**C3-118**
	240	9.6	3	33 5/8 (854.1)	**BLNF33L20S**	18 (9)	**C2-50**	**C2-92**	**BLNF33L20C**	21 (10)	**C3-94**	**C3-93**
	480	9.6	3	33 5/8 (854.1)	**BLNF33L19S**	18 (9)	**C2-43**	**C2-35**	**BLNF33L19C**	21 (10)	**C3-116**	**C3-118**
	240	12.8	3	44 1/8 (1120.8)	**BLNF44C20S**	20 (9)	**C2-236**	**C2-214**	**BLNF44C20C**	23 (11)	**C3-114**	**C3-115**
	480	12.8	3	44 1/8 (1120.8)	**BLNF44C19S**	20 (9)	**C2-43**	**C2-35**	**BLNF44C19C**	23 (11)	**C3-116**	**C3-118**
	240	16.1	3	54 5/8 (1387.5)	**BLNF54L20S**	22 (10)	**C2-236**	**C2-214**	**BLNF54L20C**	25 (12)	**C3-114**	**C3-115**
	480	16.1	3	54 5/8 (1387.5)	**BLNF54L19S**	22 (10)	**C2-43**	**C2-35**	**BLNF54L19C**	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

⑧ Can be wired for 1-phase operation

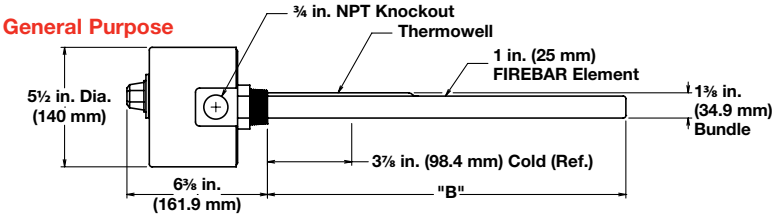
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WATROD and FIREBAR Screw Plug Immersion Heaters

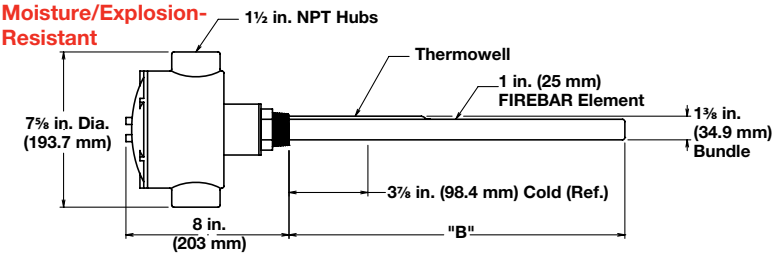
Application: Medium Weight Oils and Heat Transfer Oils

- 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)

General Purpose



Moisture/Explosion-Resistant



						Type 5A (60 to 250°F)			Type 7A (100 to 550F°)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² ③ 304 SS Plug 1-Alloy 800 Element (2.3 W/cm²)	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
						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/in² ③ 304 SS Plug 1-Alloy 800 Element (2.3 W/cm²)	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

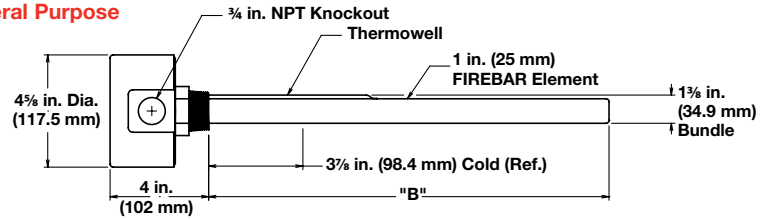
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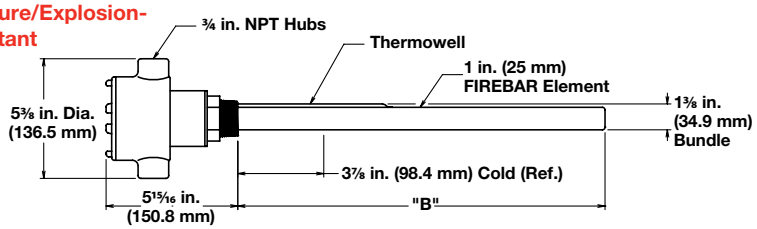
Application: Medium Weight Oils and Heat Transfer Oils

- 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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
15 W/in² ③ 304 SS Plug 1-Alloy 800 Element (2.3 W/cm²)	240	0.67	3	13 (330)	**BDNF13A29S**	6 (3)	**C2-50**	**C2-92**	**BDNF13A29C**	9 (4)	**C3-94**	**C3-93**
	240	0.83	3	15 1/2 (394)	**BDNF15J29S**	7 (4)	**C2-50**	**C2-92**	**BDNF15J29C**	10 (5)	**C3-94**	**C3-93**
	240	1.00	3	18 (457)	**BDNF18A29S**	8 (4)	**C2-50**	**C2-92**	**BDNF18A29C**	11 (5)	**C3-94**	**C3-93**
	240	1.33	3	22 1/2 (572)	**BDNF22J29S**	9 (4)	**C2-50**	**C2-92**	**BDNF22J29C**	12 (6)	**C3-94**	**C3-93**
	480	1.33	3	22 1/2 (572)	**BDNF22J30S**	9 (4)	**C2-43**	**C2-35**	**BDNF22J30C**	12 (6)	**C3-116**	**C3-118**
	240	1.67	3	27 1/2 (699)	**BDNF27J29S**	10 (5)	**C2-50**	**C2-92**	**BDNF27J29C**	13 (6)	**C3-94**	**C3-93**
	480	1.67	3	27 1/2 (699)	**BDNF27J30S**	10 (5)	**C2-43**	**C2-35**	**BDNF27J30C**	13 (6)	**C3-116**	**C3-118**
	240	2.00	3	32 1/2 (826)	**BDNF32J29S**	11 (5)	**C2-50**	**C2-92**	**BDNF32J29C**	14 (7)	**C3-94**	**C3-93**
	480	2.00	3	32 1/2 (826)	**BDNF32J30S**	11 (5)	**C2-43**	**C2-35**	**BDNF32J30C**	14 (7)	**C3-116**	**C3-118**
	240	2.67	3	42 (1067)	**BDNF42A29S**	13 (6)	**C2-50**	**C2-92**	**BDNF42A29C**	16 (8)	**C3-94**	**C3-93**
	480	2.67	3	42 (1067)	**BDNF42A30S**	13 (6)	**C2-43**	**C2-35**	**BDNF42A30C**	16 (8)	**C3-116**	**C3-118**
	240	3.33	3	51 1/2 (1308)	**BDNF51J29S**	15 (7)	**C2-50**	**C2-92**	**BDNF51J29C**	18 9)	**C3-94**	**C3-93**
	480	3.33	3	51 1/2 (1308)	**BDNF51J30S**	15 (7)	**C2-43**	**C2-35**	**BDNF51J30C**	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

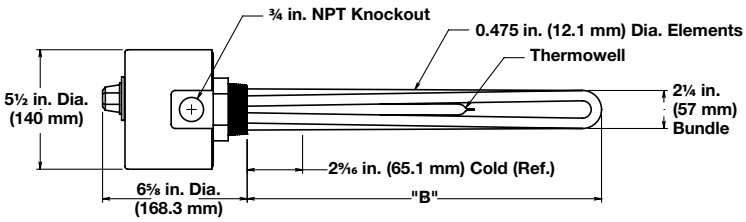
⑤ No third party recognition

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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



						Type 4 (30-110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
16 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm²)	240	1.0	3	9¾ (248)	6 (3)	**BHN79N12S4**	C/F	C/F	**BHN79N12S5A**	C/F	C/F	**BHN79N12S7A**	C/F	C/F
	480	1.0	3	9¾ (248)	6 (3)	**BHN79N13S4**	C/F	C/F	**BHN79N13S5A**	C/F	C/F	**BHN79N13S7A**	C/F	C/F
	240	1.5	3	13¼ (337)	7 (4)	**BHN713E12S4**	C/F	C/F	**BHN713E12S5A**	C/F	C/F	**BHN713E12S7A**	C/F	C/F
	480	1.5	3	13¼ (337)	7 (4)	**BHN713E13S4**	C/F	C/F	**BHN713E13S5A**	C/F	C/F	**BHN713E13S7A**	C/F	C/F
	240	2.0	3	17¾ (451)	8 (4)	**BHN717N12S4**	C/F	C/F	**BHN717N12S5A**	C/F	C/F	**BHN717N12S7A**	C/F	C/F
	480	2.0	3	17¾ (451)	8 (4)	**BHN717N13S4**	C/F	C/F	**BHN717N13S5A**	C/F	C/F	**BHN717N13S7A**	C/F	C/F
	240	2.5	3	20¼ (514)	9 (4)	**BHN720E12S4**	C/F	C/F	**BHN720E12S5A**	C/F	C/F	**BHN720E12S7A**	C/F	C/F
	480	2.5	3	20¼ (514)	9 (4)	**BHN720E13S4**	C/F	C/F	**BHN720E13S5A**	C/F	C/F	**BHN720E13S7A**	C/F	C/F
	240	3.0	3	25¼ (641)	10 (5)	**BHN725E12S4**	C/F	C/F	**BHN725E12S5A**	C/F	C/F	**BHN725E12S7A**	C/F	C/F
	480	3.0	3	25¼ (641)	10 (5)	**BHN725E13S4**	C/F	C/F	**BHN725E13S5A**	C/F	C/F	**BHN725E13S7A**	C/F	C/F
	240	4.0	3	32¾ (832)	10 (5)	**BHN732N12S4**	C/F	C/F	**BHN732N12S5A**	C/F	C/F	**BHN732N12S7A**	C/F	C/F
	480	4.0	3	32¾ (832)	10 (5)	**BHN732N13S4**	C/F	C/F	**BHN732N13S5A**	C/F	C/F	**BHN732N13S7A**	C/F	C/F
	240	5.0	3	40¼ (1022)	11 (5)	**BHN740E12S4**	C/F	C/F	**BHN740E12S5A**	C/F	C/F	**BHN740E12S7A**	C/F	C/F
	480	5.0	3	40¼ (1022)	11 (5)	**BHN740E13S4**	C/F	C/F	**BHN740E13S5A**	C/F	C/F	**BHN740E13S7A**	C/F	C/F
	240	6.0	3	47¾ (1213)	12 (6)	**BHN747N12S4**	C/F	C/F	**BHN747N12S5A**	C/F	C/F	**BHN747N12S7A**	C/F	C/F
	480	6.0	3	47¾ (1213)	12 (6)	**BHN747N13S4**	C/F	C/F	**BHN747N13S5A**	C/F	C/F	**BHN747N13S7A**	C/F	C/F
15 W/in² Steel Plug 3-Steel Elements (2.3 W/cm²)	240	1.5	3	13¼ (337)	7 (4)	**BHSS13E3S4**	C/F	C/F	**BHSS13E3S5A**	C/F	C/F	**BHSS13E3S7A**	C/F	C/F
	480	1.5	3	13¼ (337)	7 (4)	**BHSS13E13S4**	C/F	C/F	**BHSS13E13S5A**	C/F	C/F	**BHSS13E13S7A**	C/F	C/F
	240	2.0	3	17½ (445)	8 (4)	**BHSS17J3S4**	C/F	C/F	**BHSS17J3S5A**	C/F	C/F	**BHSS17J3S7A**	C/F	C/F
	480	2.0	3	17½ (445)	8 (4)	**BHSS17J5S4**	C/F	C/F	**BHSS17J5S5A**	C/F	C/F	**BHSS17J5S7A**	C/F	C/F
	240	2.5	3	20½ (521)	9 (4)	**BHSS20J3S4**	C/F	C/F	**BHSS20J3S5A**	C/F	C/F	**BHSS20J3S7A**	C/F	C/F
	480	2.5	3	20½ (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	32½ (826)	13 (6)	**BHSS32J3S4**	C/F	C/F	**BHSS32J3S5A**	C/F	C/F	**BHSS32J3S7A**	C/F	C/F
	480	4.0	3	32½ (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	47½ (1207)	14 (7)	**BHSS47J3S4**	C/F	C/F	**BHSS47J3S5A**	C/F	C/F	**BHSS47J3S7A**	C/F	C/F
	480	6.0	3	47½ (1207)	14 (7)	**BHSS47J5S4**	C/F	C/F	**BHSS47J5S5A**	C/F	C/F	**BHSS47J5S7A**	C/F	C/F
	240	7.5	3	58½ (1486)	17 (8)	**BHSS58J3S4**	C/F	C/F	**BHSS58J3S5A**	C/F	C/F	**BHSS58J3S7A**	C/F	C/F
	240	9.0	3	69¾ (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.

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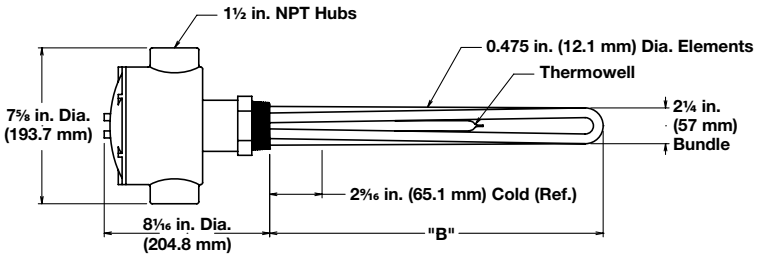
③ Wired for 3-phase operation only

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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)

						Type 4 (30 to 110°F)			Type 5A (60 to 250°F)			Type 7A (100 to 550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
16 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm²)	240	1.0	3	9¾ (248)	9 (4)	BHN79N12C4	C/F	C/F	BHN79N12C5A	C/F	C/F	BHN79N12C7A	C/F	C/F
	480	1.0	3	9¾ (248)	9 (4)	BHN79N13C4	C/F	C/F	BHN79N13C5A	C/F	C/F	BHN79N13C7A	C/F	C/F
	240	1.5	3	13¼ (337)	10 (5)	BHN713E12C4	C/F	C/F	BHN713E12C5A	C/F	C/F	BHN713E12C7A	C/F	C/F
	480	1.5	3	13¼ (337)	10 (5)	BHN713E13C4	C/F	C/F	BHN713E13C5A	C/F	C/F	BHN713E13C7A	C/F	C/F
	240	2.0	3	17¾ (451)	11 (5)	BHN717N12C4	C/F	C/F	BHN717N12C5A	C/F	C/F	BHN717N12C7A	C/F	C/F
	480	2.0	3	17¾ (451)	11 (5)	BHN717N13C4	C/F	C/F	BHN717N13C5A	C/F	C/F	BHN717N13C7A	C/F	C/F
	240	2.5	3	20¼ (514)	12 (6)	BHN720E12C4	C/F	C/F	BHN720E12C5A	C/F	C/F	BHN720E12C7A	C/F	C/F
	480	2.5	3	20¼ (514)	12 (6)	BHN720E13C4	C/F	C/F	BHN720E13C5A	C/F	C/F	BHN720E13C7A	C/F	C/F
	240	3.0	3	25¼ (641)	13 (6)	BHN725E12C4	C/F	C/F	BHN725E12C5A	C/F	C/F	BHN725E12C7A	C/F	C/F
	480	3.0	3	25¼ (641)	13 (6)	BHN725E13C4	C/F	C/F	BHN725E13C5A	C/F	C/F	BHN725E13C7A	C/F	C/F
	240	4.0	3	32¾ (832)	13 (6)	BHN732N12C4	C/F	C/F	BHN732N12C5A	C/F	C/F	BHN732N12C7A	C/F	C/F
	480	4.0	3	32¾ (832)	13 (6)	BHN732N13C4	C/F	C/F	BHN732N13C5A	C/F	C/F	BHN732N13C7A	C/F	C/F
	240	5.0	3	40¼ (1022)	14 (7)	BHN740E12C4	C/F	C/F	BHN740E12C5A	C/F	C/F	BHN740E12C7A	C/F	C/F
	480	5.0	3	40¼ (1022)	14 (7)	BHN740E13C4	C/F	C/F	BHN740E13C5A	C/F	C/F	BHN740E13C7A	C/F	C/F
	240	6.0	3	47¾ (1213)	15 (7)	BHN747N12C4	C/F	C/F	BHN747N12C5A	C/F	C/F	BHN747N12C7A	C/F	C/F
	480	6.0	3	47¾ (1213)	15 (7)	BHN747N13C4	C/F	C/F	BHN747N13C5A	C/F	C/F	BHN747N13C7A	C/F	C/F
15 W/in² Steel Plug 3-Steel Elements (2.3 W/cm²)	240	1.5	3	13¼ (337)	10 (5)	BHSS13E3C4	C/F	C/F	BHSS13E3C5A	C/F	C/F	BHSS13E3C7A	C/F	C/F
	480	1.5	3	13¼ (337)	10 (5)	BHSS13E13C4	C/F	C/F	BHSS13E13C5A	C/F	C/F	BHSS13E13C7A	C/F	C/F
	240	2.0	3	17½ (445)	11 (5)	BHSS17J3C4	C/F	C/F	BHSS17J3C5A	C/F	C/F	BHSS17J3C7A	C/F	C/F
	480	2.0	3	17½ (445)	11 (5)	BHSS17J5C4	C/F	C/F	BHSS17J5C5A	C/F	C/F	BHSS17J5C7A	C/F	C/F
	240	2.5	3	20½ (521)	12 (6)	BHSS20J3C4	C/F	C/F	BHSS20J3C5A	C/F	C/F	BHSS20J3C7A	C/F	C/F
	480	2.5	3	20½ (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	32½ (826)	16 (8)	BHSS32J3C4	C/F	C/F	BHSS32J3C5A	C/F	C/F	BHSS32J3C7A	C/F	C/F
	480	4.0	3	32½ (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	47½ (1207)	17 (8)	BHSS47J3C4	C/F	C/F	BHSS47J3C5A	C/F	C/F	BHSS47J3C7A	C/F	C/F
	480	6.0	3	47½ (1207)	17 (8)	BHSS47J5C4	C/F	C/F	BHSS47J5C5A	C/F	C/F	BHSS47J5C7A	C/F	C/F
	240	7.5	3	58½ (1486)	20 (9)	BHSS58J3C4	C/F	C/F	BHSS58J3C5A	C/F	C/F	BHSS58J3C7A	C/F	C/F
	240	9.0	3	69¾ (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
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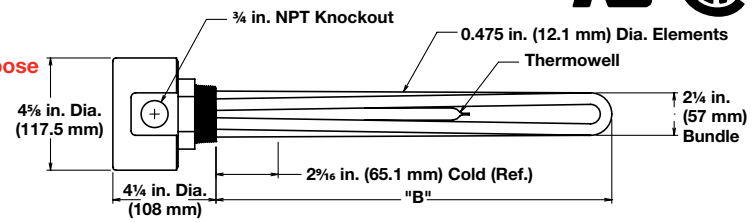
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WATROD and FIREBAR Screw Plug Immersion Heaters

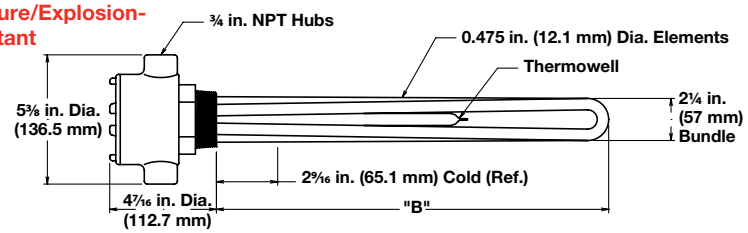
Application: Medium Weight Oils and Heat Transfer Oils

- 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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
16 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm²)	240	1.0	3	9 3/4 (248)	**BHN79N12S**	5 (3)	**C2-50**	**C2-92**	**BHN79N12C**	8 (4)	**C3-94**	**C3-93**
	480	1.0	3	9 3/4 (248)	**BHN79N13S**	5 (3)	**C2-43**	**C2-35**	**BHN79N13C**	8 (4)	**C3-116**	**C3-118**
	240	1.5	3	13 1/4 (337)	**BHN713E12S**	6 (3)	**C2-50**	**C2-92**	**BHN713E12C**	9 (4)	**C3-94**	**C3-93**
	480	1.5	3	13 1/4 (337)	**BHN713E13S**	6 (3)	**C2-43**	**C2-35**	**BHN713E13C**	9 (4)	**C3-116**	**C3-118**
	240	2.0	3	17 3/4 (451)	**BHN717N12S**	7 (4)	**C2-50**	**C2-92**	**BHN717N12C**	10 (5)	**C3-94**	**C3-93**
	480	2.0	3	17 3/4 (451)	**BHN717N13S**	7 (4)	**C2-43**	**C2-35**	**BHN717N13C**	10 (5)	**C3-116**	**C3-118**
	240	2.5	3	20 1/4 (514)	**BHN720E12S**	8 (4)	**C2-50**	**C2-92**	**BHN720E12C**	11 (5)	**C3-94**	**C3-93**
	480	2.5	3	20 1/4 (514)	**BHN720E13S**	8 (4)	**C2-43**	**C2-35**	**BHN720E13C**	11 (5)	**C3-116**	**C3-118**
	240	3.0	3	25 1/4 (641)	**BHN725E12S**	9 (4)	**C2-50**	**C2-92**	**BHN725E12C**	12 (6)	**C3-94**	**C3-93**
	480	3.0	3	25 1/4 (641)	**BHN725E13S**	9 (4)	**C2-43**	**C2-35**	**BHN725E13C**	12 (6)	**C3-116**	**C3-118**
	240	4.0	3	32 3/4 (832)	**BHN732N12S**	9 (4)	**C2-50**	**C2-92**	**BHN732N12C**	12 (6)	**C3-94**	**C3-93**
	480	4.0	3	32 3/4 (832)	**BHN732N13S**	9 (4)	**C2-43**	**C2-35**	**BHN732N13C**	12 (6)	**C3-116**	**C3-118**
	240	5.0	3	40 1/4 (1022)	**BHN740E12S**	10 (5)	**C2-50**	**C2-92**	**BHN740E12C**	13 (6)	**C3-94**	**C3-93**
	480	5.0	3	40 1/4 (1022)	**BHN740E13S**	10 (5)	**C2-43**	**C2-35**	**BHN740E13C**	13 (6)	**C3-116**	**C3-118**
	240	6.0	3	47 3/4 (1213)	**BHN747N12S**	11 (5)	**C2-50**	**C2-92**	**BHN747N12C**	14 (7)	**C3-94**	**C3-93**
	480	6.0	3	47 3/4 (1213)	**BHN747N13S**	11 (5)	**C2-43**	**C2-35**	**BHN747N13C**	14 (7)	**C3-116**	**C3-118**
15 W/in² Steel Plug 3-Steel Elements (2.3 W/cm²)	240	1.5	3	13 1/4 (337)	**BHSS13E3S**	6 (3)	**C2-50**	**C2-92**	**BHSS13E3C**	9 (4)	**C3-94**	**C3-93**
	480	1.5	3	13 1/4 (337)	**BHSS13E13S**	6 (3)	**C2-43**	**C2-35**	**BHSS13E13C**	9 (4)	**C3-116**	**C3-118**
	240	2.0	3	17 1/2 (445)	**BHSS17J3S**	7 (4)	**C2-50**	**C2-92**	**BHSS17J3C**	10 (5)	**C3-94**	**C3-93**
	480	2.0	3	17 1/2 (445)	**BHSS17J5S**	7 (4)	**C2-43**	**C2-35**	**BHSS17J5C**	10 (5)	**C3-116**	**C3-118**
	240	2.5	3	20 1/2 (521)	**BHSS20J3S**	8 (4)	**C2-50**	**C2-92**	**BHSS20J3C**	11 (5)	**C3-94**	**C3-93**
	480	2.5	3	20 1/2 (521)	**BHSS20J5S**	8 (4)	**C2-43**	**C2-35**	**BHSS20J5C**	11 (5)	**C3-116**	**C3-118**
	240	3.0	3	25 (635)	**BHSS25A3S**	9 (4)	**C2-50**	**C2-92**	**BHSS25A3C**	12 (6)	**C3-94**	**C3-93**
	480	3.0	3	25 (635)	**BHSS25A5S**	9 (4)	**C2-43**	**C2-35**	**BHSS25A5C**	12 (6)	**C3-116**	**C3-118**
	240	4.0	3	32 1/2 (826)	**BHSS32J3S**	9 (4)	**C2-50**	**C2-92**	**BHSS32J3C**	12 (6)	**C3-94**	**C3-93**
	480	4.0	3	32 1/2 (826)	**BHSS32J5S**	9 (4)	**C2-43**	**C2-35**	**BHSS32J5C**	12 (6)	**C3-116**	**C3-118**
	240	5.0	3	40 (1016)	**BHSS40A3S**	10 (5)	**C2-50**	**C2-92**	**BHSS40A3C**	13 (6)	**C3-94**	**C3-93**
	480	5.0	3	40 (1016)	**BHSS40A5S**	10 (5)	**C2-43**	**C2-35**	**BHSS40A5C**	13 (6)	**C3-116**	**C3-118**
	240	6.0	3	47 1/2 (1207)	**BHSS47J3S**	11 (5)	**C2-50**	**C2-92**	**BHSS47J3C**	14 (7)	**C3-94**	**C3-93**
	480	6.0	3	47 1/2 (1207)	**BHSS47J5S**	11 (5)	**C2-43**	**C2-35**	**BHSS47J5C**	14 (7)	**C3-116**	**C3-118**
	240	7.5	3	58 1/2 (1486)	**BHSS58J3S**	14 (7)	**C2-50**	**C2-92**	**BHSS58J3C**	17 (8)	**C3-94**	**C3-93**
	480	7.5	3	58 1/2 (1486)	**BHSS58J5S**	14 (7)	**C2-43**	**C2-35**	**BHSS58J5C**	17 (8)	**C3-116**	**C3-118**
	240	9.0	3	69 3/4 (1772)	**BHSS69N3S**	16 (8)	**C2-50**	**C2-92**	**BHSS69N3C**	19 (9)	**C3-94**	**C3-93**

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.

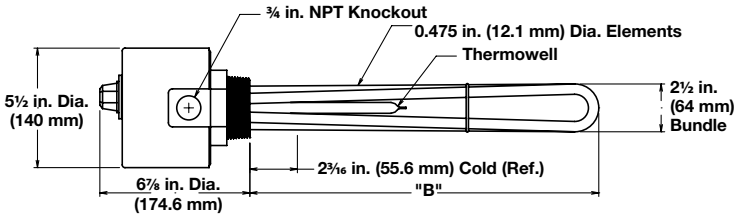
③ Wired for 3-phase operation only ⑤ No third party recognition

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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



						Type 4 (30-110°F)			Type 5A (60-250°F)			Type 7A (100-550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
16 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm²)	240	1.0	3	9 3/8 (238.1)	7 (4)	**BLN79G12S4**	C/F	C/F	**BLN79G12S5A**	C/F	C/F	**BLN79G12S7A**	C/F	C/F
	480	1.0	3	9 3/8 (238.1)	7 (4)	**BLN79G13S4**	C/F	C/F	**BLN79G13S5A**	C/F	C/F	**BLN79G13S7A**	C/F	C/F
	240	1.5	3	12 7/8 (327.0)	8 (4)	**BLN712R12S4**	C/F	C/F	**BLN712R12S5A**	C/F	C/F	**BLN712R12S7A**	C/F	C/F
	480	1.5	3	12 7/8 (327.0)	8 (4)	**BLN712R13S4**	C/F	C/F	**BLN712R13S5A**	C/F	C/F	**BLN712R13S7A**	C/F	C/F
	240	2.0	3	17 3/8 (441.3)	10 (5)	**BLN717G12S4**	C/F	C/F	**BLN717G12S5A**	C/F	C/F	**BLN717G12S7A**	C/F	C/F
	480	2.0	3	17 3/8 (441.3)	10 (5)	**BLN717G13S4**	C/F	C/F	**BLN717G13S5A**	C/F	C/F	**BLN717G13S7A**	C/F	C/F
	240	2.5	3	19 7/8 (504.8)	12 (6)	**BLN719R12S4**	C/F	C/F	**BLN719R12S5A**	C/F	C/F	**BLN719R12S7A**	C/F	C/F
	480	2.5	3	19 7/8 (504.8)	12 (6)	**BLN719R13S4**	C/F	C/F	**BLN719R13S5A**	C/F	C/F	**BLN719R13S7A**	C/F	C/F
	240	3.0	3	24 7/8 (631.8)	13 (6)	**BLN724R12S4**	C/F	C/F	**BLN724R12S5A**	C/F	C/F	**BLN724R12S7A**	C/F	C/F
	480	3.0	3	24 7/8 (631.8)	13 (6)	**BLN724R13S4**	C/F	C/F	**BLN724R13S5A**	C/F	C/F	**BLN724R13S7A**	C/F	C/F
	240	4.0	3	32 3/8 (822.3)	15 (7)	**BLN732G12S4**	C/F	C/F	**BLN732G12S5A**	C/F	C/F	**BLN732G12S7A**	C/F	C/F
	480	4.0	3	32 3/8 (822.3)	15 (7)	**BLN732G13S4**	C/F	C/F	**BLN732G13S5A**	C/F	C/F	**BLN732G13S7A**	C/F	C/F
	240	5.0	3	39 7/8(1012.8)	16 (8)	**BLN739R12S4**	C/F	C/F	**BLN739R12S5A**	C/F	C/F	**BLN739R12S7A**	C/F	C/F
	480	5.0	3	39 7/8(1012.8)	16 (8)	**BLN739R13S4**	C/F	C/F	**BLN739R13S5A**	C/F	C/F	**BLN739R13S7A**	C/F	C/F
	240	6.0	3	47 3/8(1203.3)	18 (9)	**BLN747G12S4**	C/F	C/F	**BLN747G12S5A**	C/F	C/F	**BLN747G12S7A**	C/F	C/F
	480	6.0	3	47 3/8(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.

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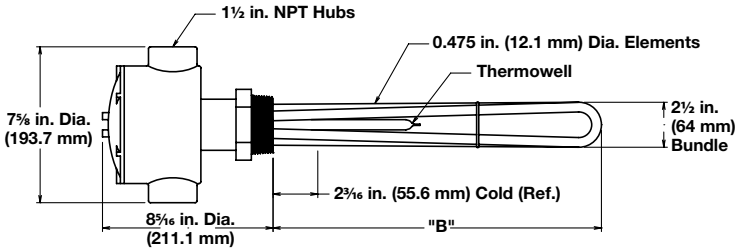
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WATROD and FIREBAR Screw Plug Immersion Heaters

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)



						Type 4 (30-110°F)			Type 5A (60-250°F)			Type 7A (100-550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
16 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm²)	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

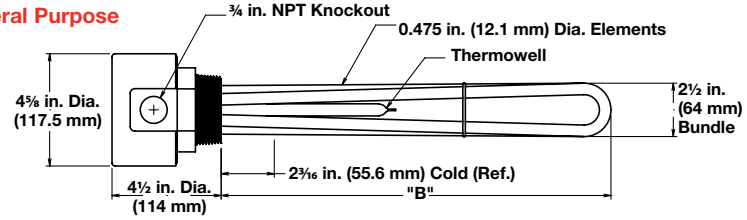
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WATROD and FIREBAR Screw Plug Immersion Heaters

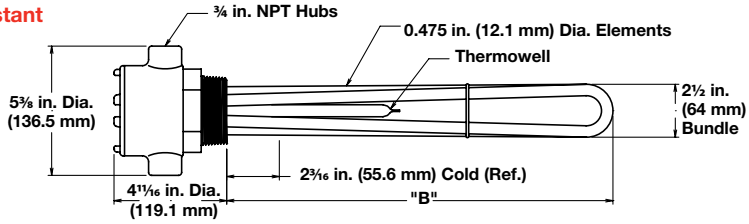
Application: Medium Weight Oils and Heat Transfer Oils

- 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)

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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
16 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (2.5 W/cm²)	240	1.0	3	9 3/8 (238.1)	**BLN79G12S**	6 (3)	**C2-50**	**C2-92**	**BLN79G12C**	9 (4)	**C3-94**	**C3-93**
	480	1.0	3	9 3/8 (238.1)	**BLN79G13S**	6 (3)	**C2-43**	**C2-35**	**BLN79G13C**	9 (4)	**C3-116**	**C3-118**
	240	1.5	3	12 7/8 (327.0)	**BLN712R12S**	7 (4)	**C2-50**	**C2-92**	**BLN712R12C**	10 (5)	**C3-94**	**C3-93**
	480	1.5	3	12 7/8 (327.0)	**BLN712R13S**	7 (4)	**C2-43**	**C2-35**	**BLN712R13C**	10 (5)	**C3-116**	**C3-118**
	240	2.0	3	17 3/8 (441.3)	**BLN717G12S**	9 (4)	**C2-50**	**C2-92**	**BLN717G12C**	12 (6)	**C3-94**	**C3-93**
	480	2.0	3	17 3/8 (441.3)	**BLN717G13S**	9 (4)	**C2-43**	**C2-35**	**BLN717G13C**	12 (6)	**C3-116**	**C3-118**
	240	2.5	3	19 7/8 (504.8)	**BLN719R12S**	11 (5)	**C2-50**	**C2-92**	**BLN719R12C**	14 (7)	**C3-94**	**C3-93**
	480	2.5	3	19 7/8 (504.8)	**BLN719R13S**	11 (5)	**C2-43**	**C2-35**	**BLN719R13C**	14 (7)	**C3-116**	**C3-118**
	240	3.0	3	24 7/8 (631.8)	**BLN724R12S**	12 (6)	**C2-50**	**C2-92**	**BLN724R12C**	15 (7)	**C3-94**	**C3-93**
	480	3.0	3	24 7/8 (631.8)	**BLN724R13S**	12 (6)	**C2-43**	**C2-35**	**BLN724R13C**	15 (7)	**C3-116**	**C3-118**
	240	4.0	3	32 3/8 (822.3)	**BLN732G12S**	14 (7)	**C2-50**	**C2-92**	**BLN732G12C**	17 (8)	**C3-94**	**C3-93**
	480	4.0	3	32 3/8 (822.3)	**BLN732G13S**	14 (7)	**C2-43**	**C2-35**	**BLN732G13C**	17 (8)	**C3-116**	**C3-118**
	240	5.0	3	39 7/8 (1012.8)	**BLN739R12S**	15 (7)	**C2-50**	**C2-92**	**BLN739R12C**	18 (9)	**C3-94**	**C3-93**
	480	5.0	3	39 7/8 (1012.8)	**BLN739R13S**	15 (7)	**C2-43**	**C2-35**	**BLN739R13C**	18 (9)	**C3-116**	**C3-118**
	240	6.0	3	47 3/8 (1203.3)	**BLN747G12S**	17 (8)	**C2-50**	**C2-92**	**BLN747G12C**	20 (9)	**C3-94**	**C3-93**
	480	6.0	3	47 3/8 (1203.3)	**BLN747G13S**	17 (8)	**C2-43**	**C2-35**	**BLN747G13C**	20 (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

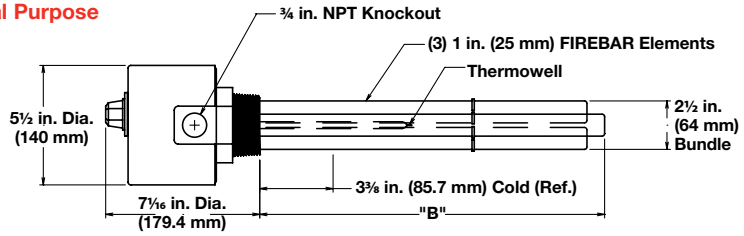
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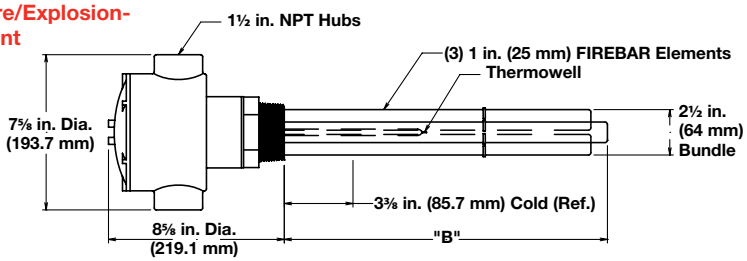
Application: Medium Weight Oils and Heat Transfer Oils

- 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) Part Number	Type 5A (60-250°F) WATCONNECT Part Number		Type 7A (100-550°F) Part Number	Type 7A (100-550°F) 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/in² ③ 304 SS Plug 3-Alloy 800 Elements (2.3 W/cm²)	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/in² ③ 304 SS Plug 3-Alloy 800 Elements (2.3 W/cm²)	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.

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③ Wired for 3-phase operation only

⑤ No third party recognition

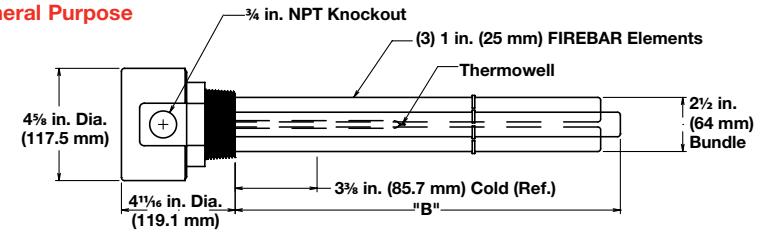
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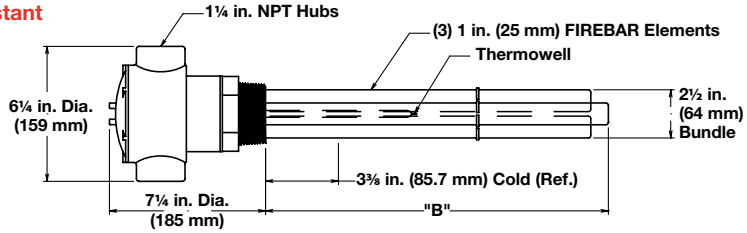
Application: Medium Weight Oils and Heat Transfer Oils

- 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	Ship Wt. lbs (kg)	WATCONNECT Part Number		Part Number ⑤	Ship Wt. lbs (kg)	WATCONNECT Part Number	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
15 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (2.3 W/cm²)	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.

③ Wired for 3-phase operation only

⑤ No third party recognition

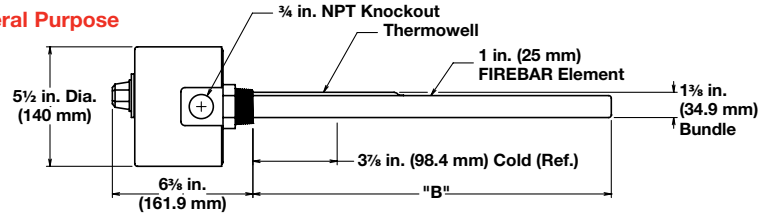
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WATROD and FIREBAR Screw Plug Immersion Heaters

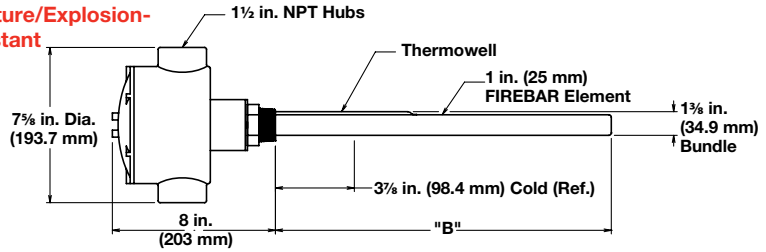
Application: Bunker C, Asphalt and #6 Fuel Oil

- 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)

General Purpose



Moisture/Explosion-Resistant



						Type 5A (60-250°F)			Type 7A (100-550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	Part Number	WATCONNECT Part Number		Part Number	WATCONNECT Part Number	
						General Purpose	Type J T/C	Type K T/C	General Purpose	Type J T/C	Type K T/C
8 W/in² ③ 304 SS Plug 1-Alloy 800 Element (1.3 W/cm²)	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
						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
8 W/in² ③ 304 SS Plug 1-Alloy 800 Element (1.3 W/cm²)	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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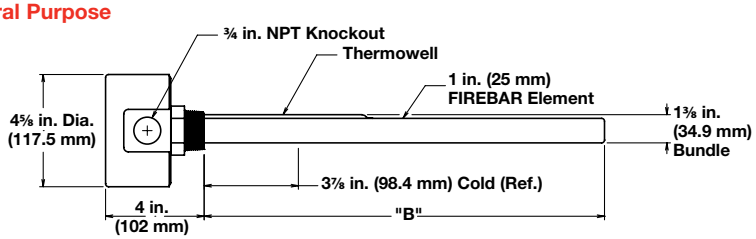
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WATROD and FIREBAR Screw Plug Immersion Heaters

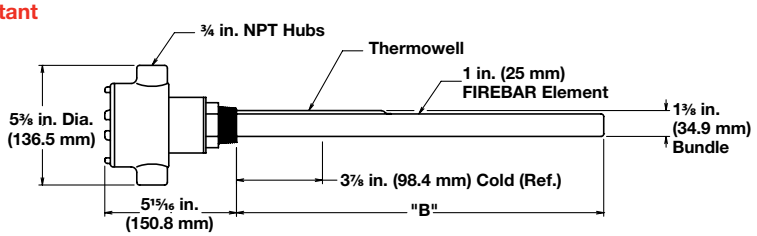
Application: Bunker C, Asphalt and #6 Fuel Oil

- 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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
8 W/in² ③ 304 SS Plug 1-Alloy 800 Element (1.3 W/cm²)	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

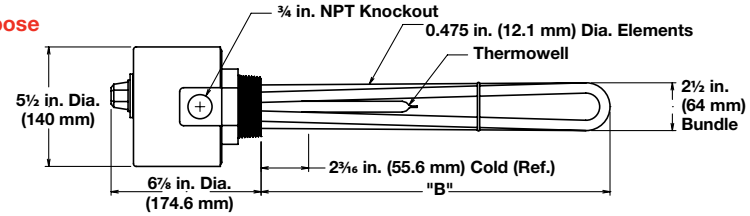
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WATROD and FIREBAR Screw Plug Immersion Heaters

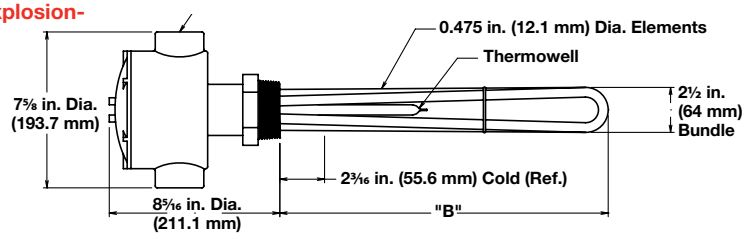
Application: Bunker C, Asphalt and #6 Fuel Oil

- 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



						Type 4 (30-110°F)			Type 5A (60-250°F)			Type 7A (100-550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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/in² ③ Steel Plug 3-Steel Elements (1.3 W/cm²)	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
						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
8 W/in² ③ Steel Plug 3-Steel Elements (1.3 W/cm²)	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

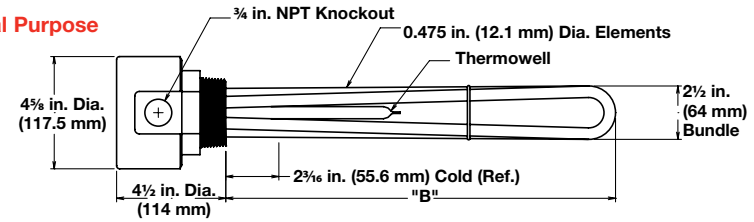
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WATROD and FIREBAR Screw Plug Immersion Heaters

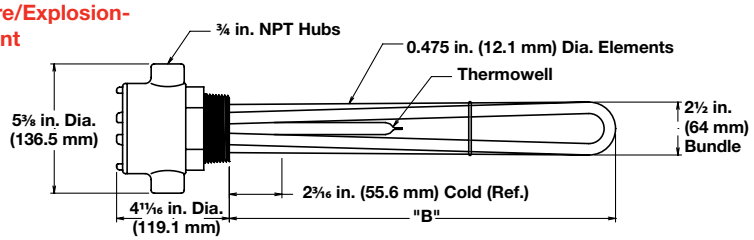
Application: Bunker C, Asphalt and #6 Fuel Oil

- $2^1/_2$ inch NPT screw plug
- WATROD elements
- Without thermostat
- General purpose enclosure
- Moisture/Explosion-Resistant enclosure (suitable for use in non-classified areas only)

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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
8 W/in² ③ Steel Plug 3-Steel Elements (1.3 W/cm²)	240	1.0	3	$17^1/_4$ (438)	**BLS717E12S**	9 (4)	**C2-50**	**C2-92**	**BLS717E12C**	12 (6)	**C3-94**	**C3-93**
	480	1.0	3	$17^1/_4$ (438)	**BLS717E13S**	9 (4)	**C2-43**	**C2-35**	**BLS717E13C**	12 (6)	**C3-116**	**C3-118**
	240	1.5	3	$24^3/_4$ (629)	**BLS724N12S**	12 (6)	**C2-50**	**C2-92**	**BLS724N12C**	15 (7)	**C3-94**	**C3-93**
	480	1.5	3	$24^3/_4$ (629)	**BLS724N13S**	12 (6)	**C2-43**	**C2-35**	**BLS724N13C**	15 (7)	**C3-116**	**C3-118**
	240	2.0	3	$32^1/_4$ (819)	**BLS732E12S**	14 (7)	**C2-50**	**C2-92**	**BLS732E12C**	17 (8)	**C3-94**	**C3-93**
	480	2.0	3	$32^1/_4$ (819)	**BLS732E13S**	14 (7)	**C2-43**	**C2-35**	**BLS732E13C**	17 (8)	**C3-116**	**C3-118**
	240	2.5	3	$39^3/_4$ (1010)	**BLS739N12S**	15 (7)	**C2-50**	**C2-92**	**BLS739N12C**	18 (9)	**C3-94**	**C3-93**
	480	2.5	3	$39^3/_4$ (1010)	**BLS739N13S**	15 (7)	**C2-43**	**C2-35**	**BLS739N13C**	18 (9)	**C3-116**	**C3-118**
	240	3.0	3	$47^1/_4$ (1200)	**BLS747E12S**	17 (8)	**C2-50**	**C2-92**	**BLS747E12C**	20 (9)	**C3-94**	**C3-93**
	480	3.0	3	$47^1/_4$ (1200)	**BLS747E13S**	17 (8)	**C2-43**	**C2-35**	**BLS747E13C**	20 (9)	**C3-116**	**C3-118**
	240	4.0	3	$63^3/_4$ (1619)	**BLS763N12S**	20 (9)	**C2-50**	**C2-92**	**BLS763N12C**	23 (11)	**C3-94**	**C3-93**
	480	4.0	3	$63^3/_4$ (1619)	**BLS763N13S**	20 (9)	**C2-43**	**C2-35**	**BLS763N13C**	23 (11)	**C3-116**	**C3-118**
	240	5.0	3	$76^1/_4$ (1937)	**BLS776E12S**	23 (11)	**C2-50**	**C2-92**	**BLS776E12C**	26 (12)	**C3-94**	**C3-93**
	480	5.0	3	$76^1/_4$ (1937)	**BLS776E13S**	23 (11)	**C2-43**	**C2-35**	**BLS776E13C**	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.

③ Wired for 3-phase operation only

⑤ No third party recognition

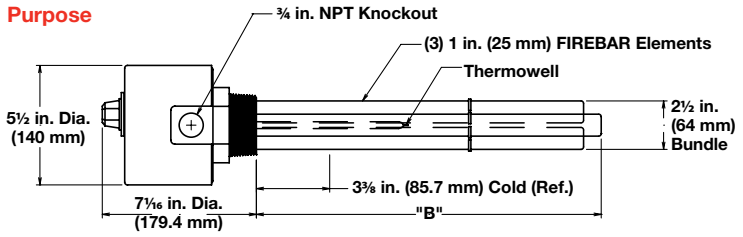
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WATROD and FIREBAR Screw Plug Immersion Heaters

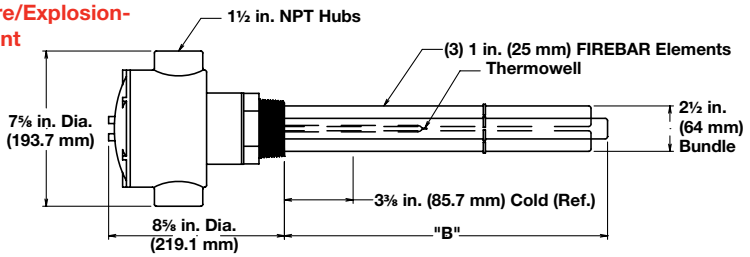
Application: Bunker C, Asphalt and #6 Fuel Oil

- 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



						Type 5A (60-250°F)			Type 7A (100-550°F)		
Description	Volts	kW	Ph	"B" Dim. in. (mm)	Ship Wt. lbs (kg)	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
8 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (1.3 W/cm²)	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
						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
8 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (1.3 W/cm²)	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

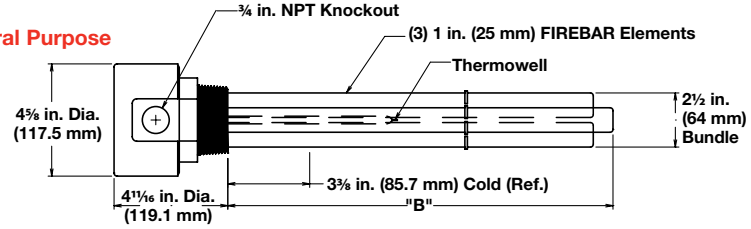
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WATROD and FIREBAR Screw Plug Immersion Heaters

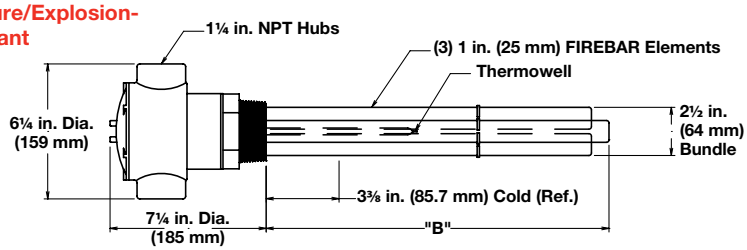
Application: Bunker C, Asphalt and #6 Fuel Oil

- 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)

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	
					General Purpose Enclosure		Type J T/C	Type K T/C	Moisture/Explosion-Resistant Enclosure		Type J T/C	Type K T/C
8 W/in² ③ 304 SS Plug 3-Alloy 800 Elements (1.3 W/cm²)	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

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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.	

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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^2 (9.3 W/cm^2)
- 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

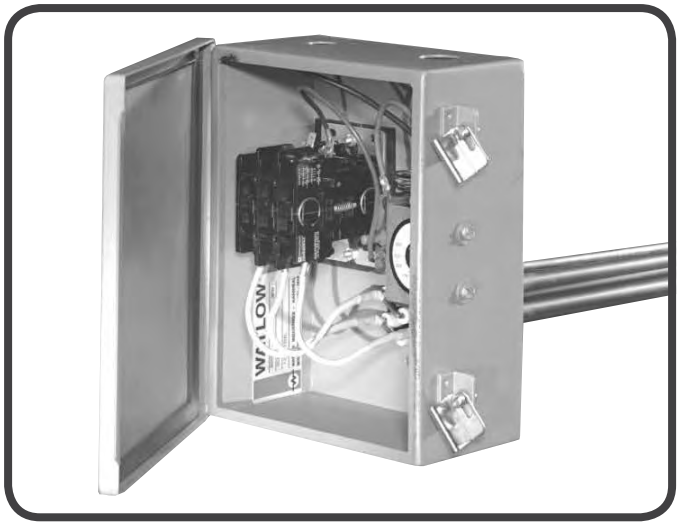
- Accommodates 3/4 in. (19 mm) NPT conduit fittings

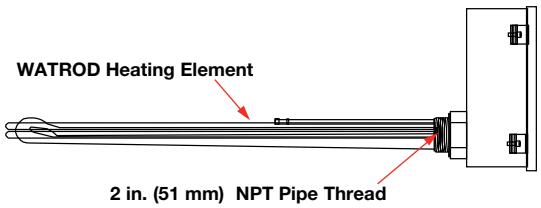
Terminal enclosures can be rotated to mate with existing conduits

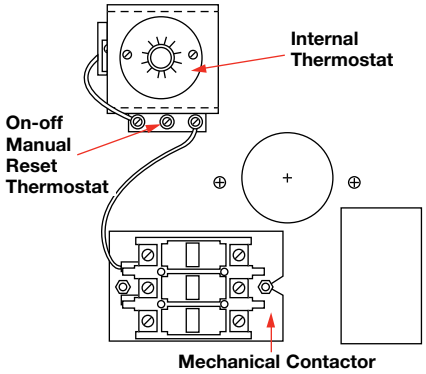
- Minimal fastener adjustment required

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.

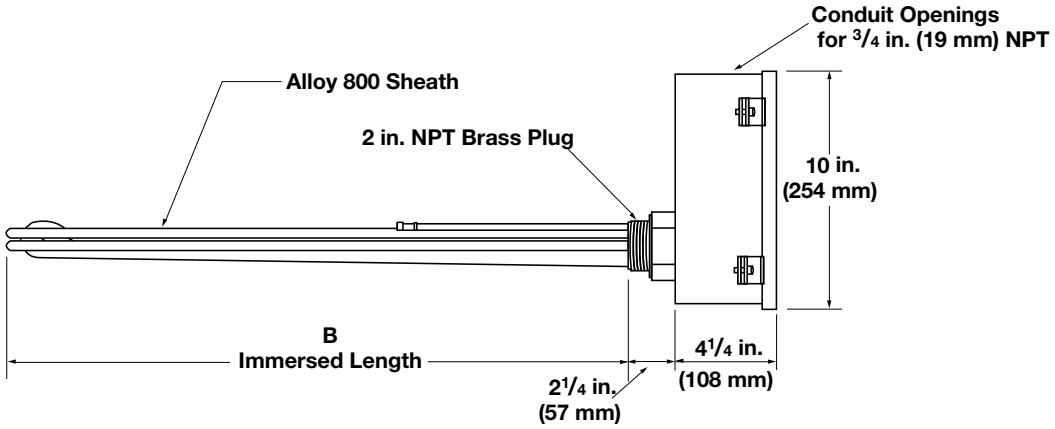
Accessories

Clamping Nut, Gasket and Washers–for mounting to thin-wall tanks, use optional clamping nut, gasket and washers. To order, specify **NGW**.

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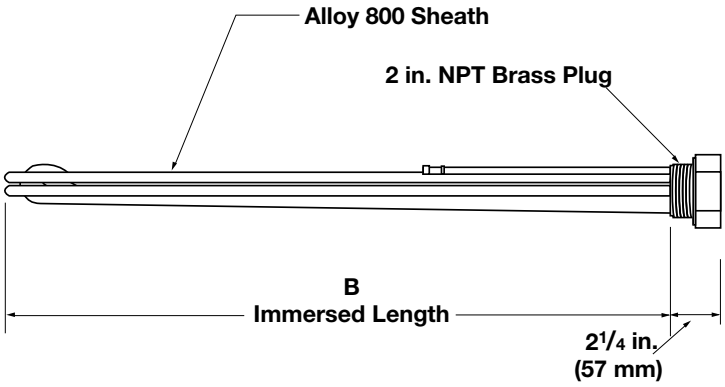
WATROD and FIREBAR
Screw Plug Immersion Heaters

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 208VAC 3-Phase	240VAC 3-Phase	380VAC 3-Phase	480VAC 3-Phase	575VAC 3-Phase	Est. Net Wt. lbs (kg)
50 W/in²	9	24¾ (629.0)		BHNB24N3W2C11		BHNB24N5W2C11	BHNB24N16W2C11	23 (10)
Brass Plug	12	30 (762.0)	BHNB30A2W2C11	BHNB30A3W2C11	BHNB30A8W2C11	BHNB30A5W2C11	BHNB30A16W2C11	24 (11)
3-Alloy 800	16	35⅝ (904.8)	BHNB35L2W2C11	BHNB35L3W2C11	BHNB35L8W2C11	BHNB35L5W2C11	BHNB35L16W2C11	25 (11)
(7.8 W/cm²)	20	45⅝ (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 208VAC 3-Phase	240VAC 3-Phase	380VAC 3-Phase	480VAC 3-Phase	575VAC 3-Phase	Est. Net Wt. lbs (kg)
50 W/in²	9	24¾ (628.7)		BHNB24N3		BHNB24N5	BHNB24N16	21 (9)
Brass Plug	12	30 (762.0)	BHNB30A2	BHNB30A3	BHNB30A8	BHNB30A5	BHNB30A16	22 (10)
Alloy 800	16	35⅝ (904.8)	BHNB35L2	BHNB35L3	BHNB35L8	BHNB35L5	BHNB35L16	23 (10)
(7.8 W/cm²)	20	45⅝ (1158.8)		BHNB45L3	BHNB45L8	BHNB45L5	BHNB45L16	25 (11)

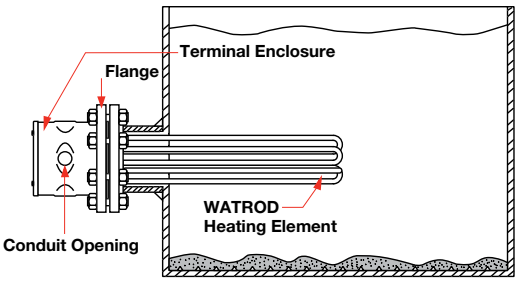
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WATROD™ ANSI Flange Immersion Heaters

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^2 (15.5 W/cm^2)
- 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, 2 1/2, 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

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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

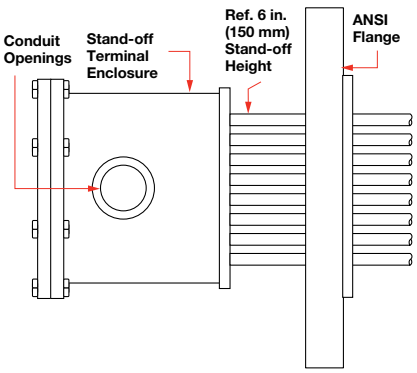
Options *(Continued)*

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. 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**.

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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

WATROD	Alloy 800, 840 316 SS Copper clad steel Steel

Exotic Sheath Materials

Contact your Watlow representative for details and availability.

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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 Positive	Conductor Characteristics Negative	Recommended① Temperature Range °F	Recommended① Temperature Range (°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)

①Type 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: 2①, 2 1/2①, 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

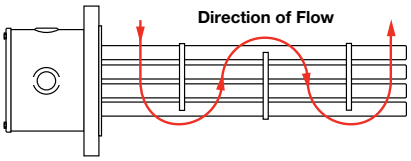
③ Depends on metal gasket material.

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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

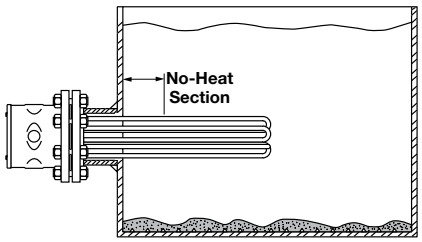
Bright annealing available to meet cosmetic demands.

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.

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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

WATROD	Titanium 304 and 321 SS Hastelloy C276 Alloy 600 Inconel®/Steel Monel®

Flanges

Flange Materials

Extended	Exotic materials to meet specific application needs ①

Pressure Classes

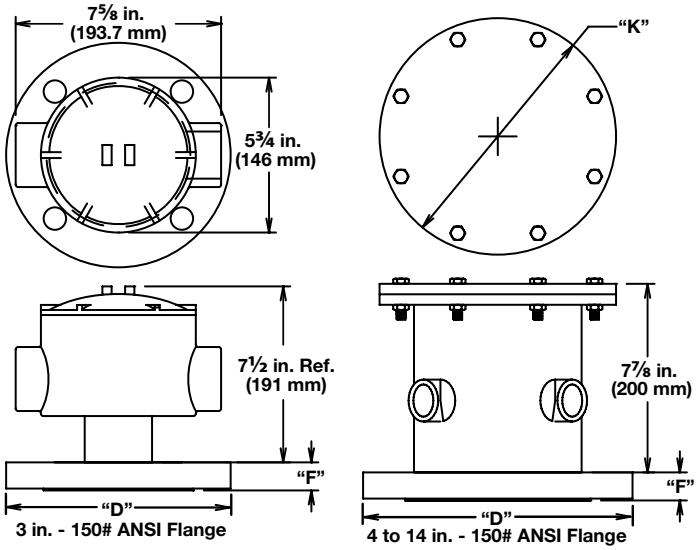
Extended	Over 300 lb ①

① Contact your Watlow representative

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WATROD ANSI Flange Immersion Heaters

Optional CSA Type 4/Explosion Proof Enclosure Without Thermostat



Terminal Enclosure Dimensions

General Purpose or NEMA 4 Enclosure

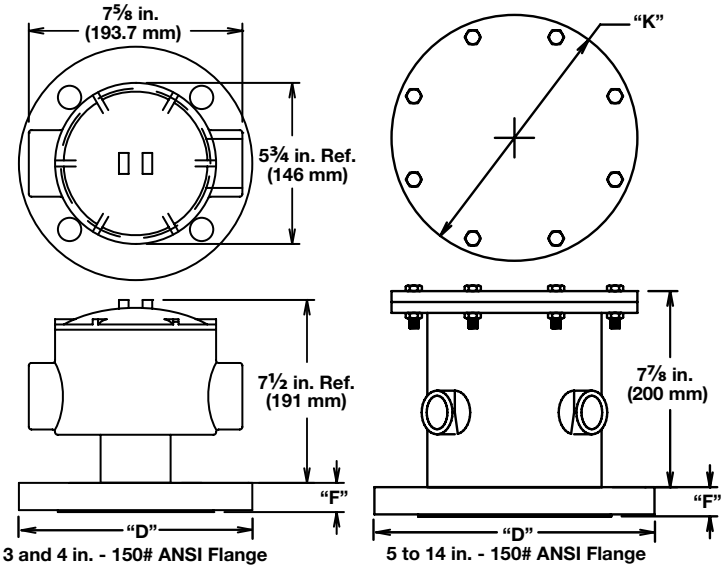
ANSI Flange Size in.	"F" Thickness in. (mm)	"K" With Thermostat	"K" Without Thermostat	"D" in. (mm)
3	15/16 (23.8)	5 3/4 (146)	See heater dwg.	7 1/2 (191)
4	15/16 (23.8)	5 3/4 (146)	See heater dwg.	9 (229)

Note: 5 thru 12 in. (127 thru 305 mm) flange dimensions are on catalog heater drawings.

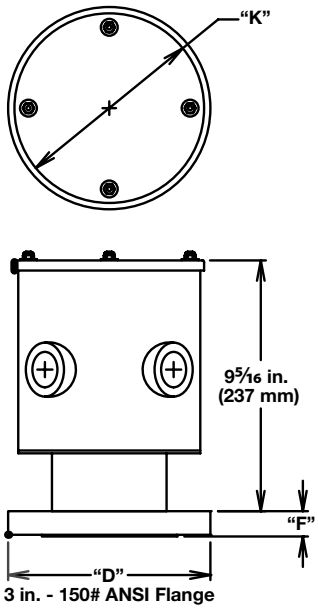
CSA Type 4/Explosion Proof Enclosures

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)

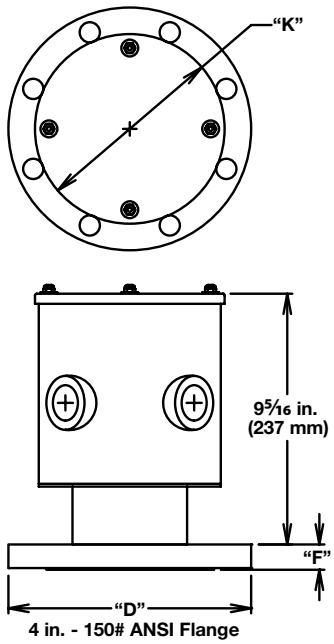
Optional CSA Type 4/Explosion Proof Enclosure With Thermostat



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.

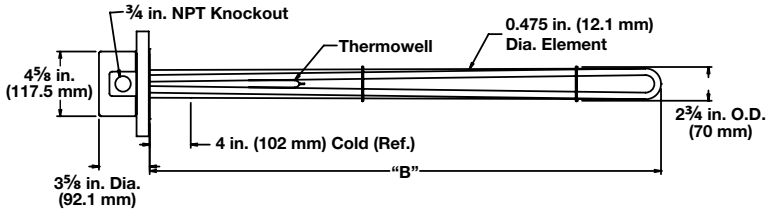
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WATROD ANSI Flange Immersion Heaters

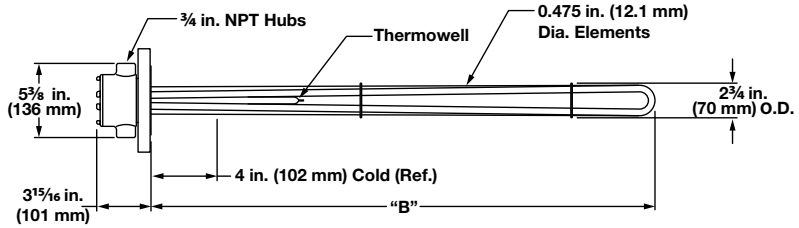
Application: Clean Water

- 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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
60 W/in² Steel Flange 3-Alloy 800 Elements (9.3 W/cm²)	120	6.0	1	15½	(394)	22	(10)	FMN715J10S	FMN715J10W	C/F	C/F
	240	6.0	3	15½	(394)	22	(10)	FMN715J3S	FMN715J3W	C2-50	C2-92
	480	6.0	1	15½	(394)	22	(10)	FMN715J11S	FMN715J11W	C/F	C/F
	480	6.0	3	15½	(394)	22	(10)	FMN715J5S	FMN715J5W	C2-43	C2-35
	120	9.0	1	21½	(546)	25	(12)	FMN721J10S	FMN721J10W	C/F	C/F
	240	9.0	3	21½	(546)	25	(12)	FMN721J3S	FMN721J3W	C2-50	C2-92
	480	9.0	1	21½	(546)	25	(12)	FMN721J11S	FMN721J11W	C/F	C/F
	480	9.0	3	21½	(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	32½	(826)	28	(13)	FMN732J3S	FMN732J3W	C2-236	C2-214
	480	15.0	1	32½	(826)	28	(13)	FMN732J11S	FMN732J11W	C/F	C/F
	480	15.0	3	32½	(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	60½	(1537)	36	(17)	FMN760J11S	FMN760J11W	C/F	C/F
	480	30.0	3	60½	(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

C/F - Contact factory, go to www.watlow.com/en/contact-us

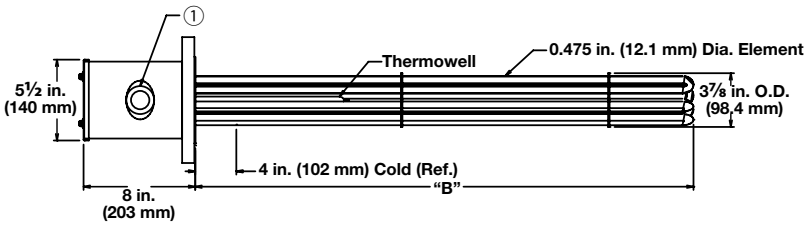
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
60 W/in² Steel Flange 6-Alloy 800 Elements (9.3 W/cm²)	240	12.0	1	2	15½	(394)	31	(14)	**FON715J10S**	**FON715J10W**	**C/F**	**C/F**
	240	12.0	3	1	15½	(394)	31	(14)	**FON715J3S**	**FON715J3W**	**C2-236**	**C2-214**
	480	12.0	1	1	15½	(394)	31	(14)	**FON715J11S**	**FON715J11W**	**C/F**	**C/F**
	480	12.0	3	1	15½	(394)	31	(14)	**FON715J5S**	**FON715J5W**	**C2-43**	**C2-35**
	240	18.0	1	2	21½	(546)	34	(16)	**FON721J10S**	**FON721J10W**	**C/F**	**C/F**
	240	18.0	3	1	21½	(546)	34	(16)	**FON721J3S**	**FON721J3W**	**C2-236**	**C2-214**
	480	18.0	1	1	21½	(546)	34	(16)	**FON721J11S**	**FON721J11W**	**C/F**	**C/F**
	480	18.0	3	1	21½	(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	32½	(826)	39	(18)	**FON732J3S**	**FON732J3W**	**C2-218**	**C2-224**
	480	30.0	1	2	32½	(826)	39	(18)	**FON732J11S**	**FON732J11W**	**C/F**	**C/F**
	480	30.0	3	1	32½	(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	60½	(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

C/F - Contact factory, go to www.watlow.com/en/contact-us

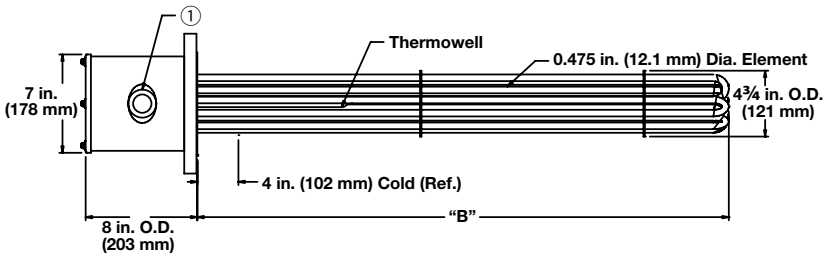
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
60 W/in² Steel Flange 6-Alloy 800 Elements (9.3 W/cm²)	240	12.0	1	2	15½	(394)	35	(16)	**FNN715J10S**	**FNN715J10W**	**C/F**	**C/F**
	240	12.0	3	1	15½	(394)	35	(16)	**FNN715J3S**	**FNN715J3W**	**C2-236**	**C2-214**
	480	12.0	1	1	15½	(394)	35	(16)	**FNN715J11S**	**FNN715J11W**	**C/F**	**C/F**
	480	12.0	3	1	15½	(394)	35	(16)	**FNN715J5S**	**FNN715J5W**	**C2-43**	**C2-35**
	240	18.0	1	2	21½	(546)	38	(18)	**FNN721J10S**	**FNN721J10W**	**C/F**	**C/F**
	240	18.0	3	1	21½	(546)	38	(18)	**FNN721J3S**	**FNN721J3W**	**C2-236**	**C2-214**
	480	18.0	1	1	21½	(546)	38	(18)	**FNN721J11S**	**FNN721J11W**	**C/F**	**C/F**
	480	18.0	3	1	21½	(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	32½	(826)	43	(20)	**FNN732J3S**	**FNN732J3W**	**C2-218**	**C2-224**
	480	30.0	1	2	32½	(826)	43	(20)	**FNN732J11S**	**FNN732J11W**	**C/F**	**C/F**
	480	30.0	3	1	32½	(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	60½	(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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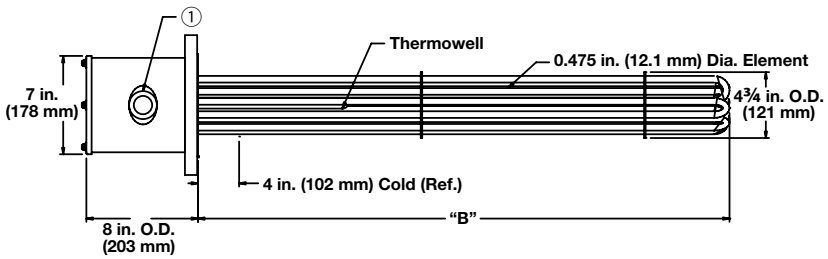
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WATROD ANSI Flange Immersion Heaters

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/in² Steel Flange 9-Alloy 800 Elements (9.3 W/cm²)	240	18.0	1	3	15½ (394)	38 (18)	**FNN715J10XS**	**FNN715J10XW**	**C/F**	**C/F**
	240	18.0	3	1	15½ (394)	38 (18)	**FNN715J3XS**	**FNN715J3XW**	**C2-236**	**C2-214**
	480	18.0	1	1	15½ (394)	38 (18)	**FNN715J11XS**	**FNN715J11XW**	**C/F**	**C/F**
	480	18.0	3	1	15½ (394)	38 (18)	**FNN715J5XS**	**FNN715J5XW**	**C2-43**	**C2-35**
	240	27.0	1	3	21½ (546)	42 (19)	**FNN721J10XS**	**FNN721J10XW**	**C/F**	**C/F**
	240	27.0	3	3	21½ (546)	42 (19)	**FNN721J3XS**	**FNN721J3XW**	**C4-143**	**C4-142**
	480	27.0	1	3	21½ (546)	42 (19)	**FNN721J11XS**	**FNN721J11XW**	**C/F**	**C/F**
	480	27.0	3	1	21½ (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	32½ (826)	48 (22)	**FNN732J3XS**	**FNN732J3XW**	**C4-144**	**C4-145**
	480	45.0	1	3	32½ (826)	48 (22)	**FNN732J11XS**	**FNN732J11XW**	**C/F**	**C/F**
	480	45.0	3	3	32½ (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	60½ (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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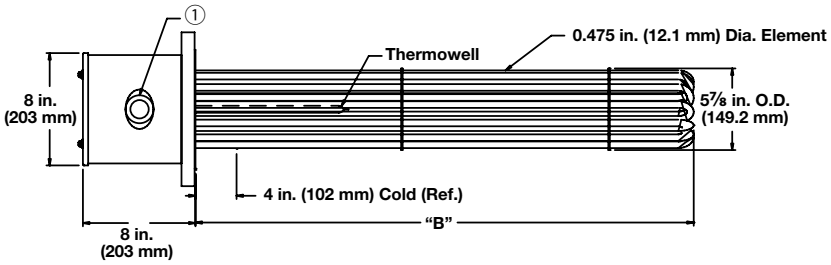
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WATROD ANSI Flange Immersion Heaters

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	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
60 W/in² Steel Flange 12-Alloy 800 Elements (9.3 W/cm²)	240	24.0	1	3	15 3/8 (390.5)	73 (33)	**FPN715G10S**	**FPN715G10W**	**C/F**	**C/F**
	240	24.0	3	2	15 3/8 (390.5)	73 (33)	**FPN715G3S**	**FPN715G3W**	**C2-218**	**C2-224**
	480	24.0	1	2	15 3/8 (390.5)	73 (33)	**FPN715G11S**	**FPN715G11W**	**C/F**	**C/F**
	480	24.0	3	1	15 3/8 (390.5)	73 (33)	**FPN715G5S**	**FPN715G5W**	**C2-225**	**C2-226**
	240	36.0	1	4	21 3/8 (542.9)	78 (36)	**FPN721G10S**	**FPN721G10W**	**C/F**	**C/F**
	240	36.0	3	2	21 3/8 (542.9)	78 (36)	**FPN721G3S**	**FPN721G3W**	**C2-218**	**C2-224**
	480	36.0	1	2	21 3/8 (542.9)	78 (36)	**FPN721G11S**	**FPN721G11W**	**C/F**	**C/F**
	480	36.0	3	1	21 3/8 (542.9)	78 (36)	**FPN721G5S**	**FPN721G5W**	**C2-225**	**C2-226**
	240	48.0	3	4	26 7/8 (682.6)	81 (37)	**FPN726R3S**	**FPN726R3W**	**C4-148**	**C4-149**
	480	48.0	1	3	26 7/8 (682.6)	81 (37)	**FPN726R11S**	**FPN726R11W**	**C/F**	**C/F**
	480	48.0	3	2	26 7/8 (682.6)	81 (37)	**FPN726R5S**	**FPN726R5W**	**C2-229**	**C2-230**
	240	60.0	3	4	32 3/8 (822.3)	85 (39)	**FPN732G3S**	**FPN732G3W**	**C4-148**	**C4-149**
	480	60.0	1	3	32 3/8 (822.3)	85 (39)	**FPN732G11S**	**FPN732G11W**	**C/F**	**C/F**
	480	60.0	3	2	32 3/8 (822.3)	85 (39)	**FPN732G5S**	**FPN732G5W**	**C2-229**	**C2-230**
	240	72.0	3	4	37 7/8 (962.0)	92 (42)	**FPN737R3S**	**FPN737R3W**	**C4-148**	**C4-149**
	480	72.0	3	2	37 7/8 (962.0)	92 (42)	**FPN737R5S**	**FPN737R5W**	**C2-229**	**C2-230**
	480	100.0	3	4	50 7/8 (1292.2)	100 (45)	**FPN750R5S**	**FPN750R5W**	**C4-156**	**C4-157**
	480	120.0	3	4	60 3/8 (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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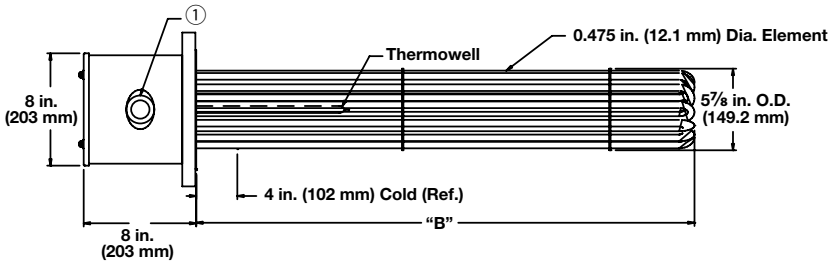
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WATROD ANSI Flange Immersion Heaters

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/in² Steel Flange 15-Alloy 800 Elements (9.3 W/cm²)	240	30.0	1	3	15 3/8 (390.5)	76 (35)	FPN715G10XS	FPN715G10XW	C/F	C/F
	240	30.0	3	5	15 3/8 (390.5)	76 (35)	FPN715G3XS	FPN715G3XW	C4-144	C4-145
	480	30.0	1	3	15 3/8 (390.5)	76 (35)	FPN715G11XS	FPN715G11XW	C/F	C/F
	480	30.0	3	1	15 3/8 (390.5)	76 (35)	FPN715G5XS	FPN715G5XW	C2-225	C2-226
	240	45.0	1	5	21 3/8 (542.9)	82 (38)	FPN721G10XS	FPN721G10XW	C/F	C/F
	240	45.0	3	5	21 3/8 (542.9)	82 (38)	FPN721G3XS	FPN721G3XW	C4-144	C4-145
	480	45.0	1	3	21 3/8 (542.9)	82 (38)	FPN721G11XS	FPN721G11XW	C/F	C/F
	480	45.0	3	5	21 3/8 (542.9)	82 (38)	FPN721G5XS	FPN721G5XW	C4-150	C4-151
	240	60.0	3	5	26 7/8 (682.6)	85 (39)	FPN726R3XS	FPN726R3XW	C/F	C/F
	480	60.0	1	3	26 7/8 (682.6)	85 (39)	FPN726R11XS	FPN726R11XW	C/F	C/F
	480	60.0	3	5	26 7/8 (682.6)	85 (39)	FPN726R5XS	FPN726R5XW	C4-152	C4-153
	240	75.0	3	5	32 3/8 (822.3)	90 (41)	FPN732G3XS	FPN732G3XW	C/F	C/F
	480	75.0	1	5	32 3/8 (822.3)	90 (41)	FPN732G11XS	FPN732G11XW	C/F	C/F
	480	75.0	3	5	32 3/8 (822.3)	90 (41)	FPN732G5XS	FPN732G5XW	C4-152	C4-153
	240	90.0	3	5	37 7/8 (962.0)	98 (45)	FPN737R3XS	FPN737R3XW	C/F	C/F
	480	90.0	3	5	37 7/8 (962.0)	98 (45)	FPN737R5XS	FPN737R5XW	C4-152	C4-153
	480	125.0	3	5	50 7/8 (1292.2)	108 (49)	FPN750R5XS	FPN750R5XW	C/F	C/F
	480	150.0	3	5	60 3/8 (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

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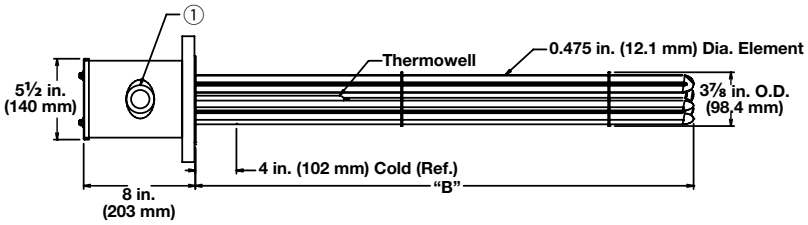
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
60 W/in² 316 SS Flange 6-316 SS Elements (9.3 W/cm²) 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	27½	(699)	36	(17)	**FOR727J10S**	**FOR727J10W**	**C/F**	**C/F**
	240	24.0	3	2	27½	(699)	36	(17)	**FOR727J3S**	**FOR727J3W**	**C2-218**	**C2-224**
	480	24.0	1	1	27½	(699)	36	(17)	**FOR727J11S**	**FOR727J11W**	**C/F**	**C/F**
	480	24.0	3	1	27½	(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	38½	(978)	43	(20)	**FOR738J3S**	**FOR738J3W**	**C2-218**	**C2-226**
	480	36.0	1	2	38½	(978)	43	(20)	**FOR738J11S**	**FOR738J11W**	**C/F**	**C/F**
	480	36.0	3	1	38½	(978)	43	(20)	**FOR738J5S**	**FOR738J5W**	**C2-225**	**C2-226**
	480	50.0	3	2	51½	(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

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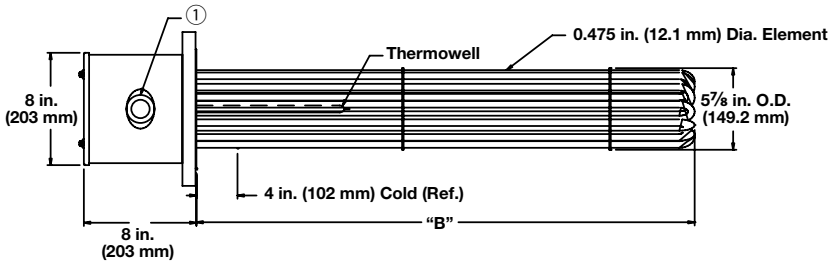
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WATROD ANSI Flange Immersion Heaters

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/in² 316 SS Flange 12-316 SS Elements (9.3 W/cm²) (Passivated)	240	24.0	1	3	15 3/4 (400)	73 (33)	**FPR715N10S**	**FPR715N10W**	**C/F**	**C/F**
	240	24.0	3	2	15 3/4 (400)	73 (33)	**FPR715N3S**	**FPR715N3W**	**C2-218**	**C2-224**
	480	24.0	1	2	15 3/4 (400)	73 (33)	**FPR715N11S**	**FPR715N11W**	**C/F**	**C/F**
	480	24.0	3	1	15 3/4 (400)	73 (33)	**FPR715N5S**	**FPR715N5W**	**C2-225**	**C2-226**
	240	36.0	1	4	21 3/4 (552)	78 (36)	**FPR721N10S**	**FPR721N10W**	**C/F**	**C/F**
	240	36.0	3	2	21 3/4 (552)	78 (36)	**FPR721N3S**	**FPR721N3W**	**C2-218**	**C2-224**
	480	36.0	1	2	21 3/4 (552)	78 (36)	**FPR721N11S**	**FPR721N11W**	**C/F**	**C/F**
	480	36.0	3	1	21 3/4 (552)	78 (36)	**FPR721N5S**	**FPR721N5W**	**C2-225**	**C2-226**
	240	48.0	3	4	27 1/4 (692)	81 (37)	**FPR727E3S**	**FPR727E3W**	**C4-148**	**C4-149**
	480	48.0	1	3	27 1/4 (692)	81 (37)	**FPR727E11S**	**FPR727E11W**	**C/F**	**C/F**
	480	48.0	3	2	27 1/4 (692)	81 (37)	**FPR727E5S**	**FPR727E5W**	**C2-229**	**C2-230**
	240	60.0	3	4	32 3/4 (832)	85 (39)	**FPR732N3S**	**FPR732N3W**	**C4-148**	**C4-149**
	480	60.0	1	3	32 3/4 (832)	85 (39)	**FPR732N11S**	**FPR732N11W**	**C/F**	**C/F**
	480	60.0	3	2	32 3/4 (832)	85 (39)	**FPR732N5S**	**FPR732N5W**	**C2-229**	**C2-230**
	240	72.0	3	4	38 1/4 (972)	92 (42)	**FPR738E3S**	**FPR738E3W**	**C4-148**	**C4-149**
	480	72.0	3	2	38 1/4 (972)	92 (42)	**FPR738E5S**	**FPR738E5W**	**C2-229**	**C2-230**
	480	100.0	3	4	51 1/4 (1302)	100 (45)	**FPR751E5S**	**FPR751E5W**	**C4-156**	**C4-157**
	480	120.0	3	4	60 3/4 (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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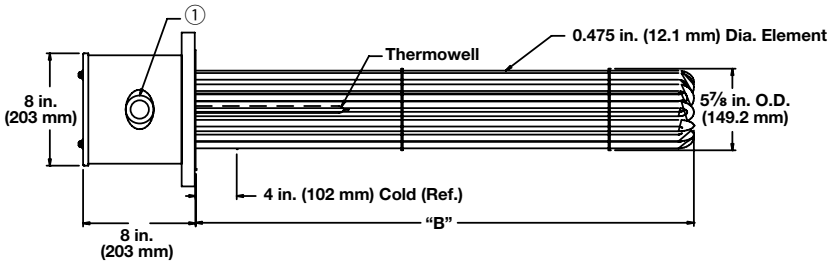
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WATROD ANSI Flange Immersion Heaters

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/in² 316 SS Flange 15-316 SS Elements (9.3 W/cm²) (Passivated)	240	30.0	1	3	15 3/4 (400)	76 (35)	**FPR715N10XS**	**FPR715N10XW**	**C/F**	**C/F**
	240	30.0	3	5	15 3/4 (400)	76 (35)	**FPR715N3XS**	**FPR715N3XW**	**C4-144**	**C4-145**
	480	30.0	1	3	15 3/4 (400)	76 (35)	**FPR715N11XS**	**FPR715N11XW**	**C/F**	**C/F**
	480	30.0	3	1	15 3/4 (400)	76 (35)	**FPR715N5XS**	**FPR715N5XW**	**C2-225**	**C2-226**
	240	45.0	1	5	21 3/4 (552)	82 (38)	**FPR721N10XS**	**FPR721N10XW**	**C/F**	**C/F**
	240	45.0	3	5	21 3/4 (552)	82 (38)	**FPR721N3XS**	**FPR721N3XW**	**C4-144**	**C4-145**
	480	45.0	1	3	21 3/4 (552)	82 (38)	**FPR721N11XS**	**FPR721N11XW**	**C/F**	**C/F**
	480	45.0	3	5	21 3/4 (552)	82 (38)	**FPR721N5XS**	**FPR721N5XW**	**C4-150**	**C4-151**
	240	60.0	3	5	27 1/4 (692)	85 (39)	**FPR727E3XS**	**FPR727E3XW**	**C/F**	**C/F**
	480	60.0	1	3	27 1/4 (692)	85 (39)	**FPR727E11XS**	**FPR727E11XW**	**C/F**	**C/F**
	480	60.0	3	5	27 1/4 (692)	85 (39)	**FPR727E5XS**	**FPR727E5XW**	**C4-152**	**C4-153**
	240	75.0	3	5	32 3/4 (832)	90 (41)	**FPR732N3XS**	**FPR732N3XW**	**C/F**	**C/F**
	480	75.0	1	5	32 3/4 (832)	90 (41)	**FPR732N11XS**	**FPR732N11XW**	**C/F**	**C/F**
	480	75.0	3	5	32 3/4 (832)	90 (41)	**FPR732N5XS**	**FPR732N5XW**	**C4-152**	**C4-153**
	240	90.0	3	5	38 1/4 (972)	98 (45)	**FPR738E3XS**	**FPR738E3XW**	**C/F**	**C/F**
	480	90.0	3	5	38 1/4 (972)	98 (45)	**FPR738E5XS**	**FPR738E5XW**	**C4-152**	**C4-153**
	480	125.0	3	5	51 1/4 (1302)	108 (49)	**FPR751E5XS**	**FPR751E5XW**	**C/F**	**C/F**
	480	150.0	3	5	60 3/4 (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

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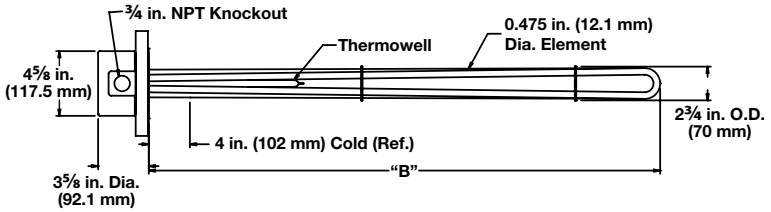
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WATROD ANSI Flange Immersion Heaters

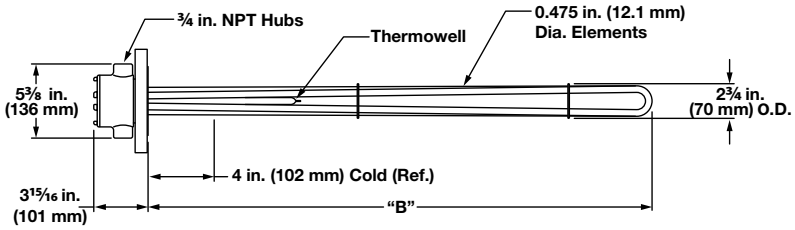
Application: Process Water

- 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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
48 W/in² ⑥ Steel Flange 3-Alloy 800 Elements (7.5 W/cm²)	240	4.5	1	13½	(343)	22	(10)	**FMN713J10S**	**FMN713J10W**	**C/F**	**C/F**
	240	4.5	3	13½	(343)	22	(10)	**FMN713J3S**	**FMN713J3W**	**C2-50**	**C2-92**
	480	4.5	1	13½	(343)	22	(10)	**FMN713J11S**	**FMN713J11W**	**C/F**	**C/F**
	480	4.5	3	13½	(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	20½	(521)	25	(12)	**FMN720J10S**	**FMN720J10W**	**C/F**	**C/F**
	240	7.5	3	20½	(521)	25	(12)	**FMN720J3S**	**FMN720J3W**	**C2-50**	**C2-92**
	480	7.5	1	20½	(521)	25	(12)	**FMN720J11S**	**FMN720J11W**	**C/F**	**C/F**
	480	7.5	3	20½	(521)	25	(12)	**FMN720J5S**	**FMN720J5W**	**C2-43**	**C2-35**
	240	9.0	1	25½	(648)	27	(13)	**FMN725J10S**	**FMN725J10W**	**C/F**	**C/F**
	240	9.0	3	25½	(648)	27	(13)	**FMN725J3S**	**FMN725J3W**	**C2-50**	**C2-92**
	480	9.0	1	25½	(648)	27	(13)	**FMN725J11S**	**FMN725J11W**	**C/F**	**C/F**
	480	9.0	3	25½	(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	40½	(1029)	30	(14)	**FMN740J3S**	**FMN740J3W**	**C2-236**	**C2-214**
	480	15.0	1	40½	(1029)	30	(14)	**FMN740J11S**	**FMN740J11W**	**C/F**	**C/F**
	480	15.0	3	40½	(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

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

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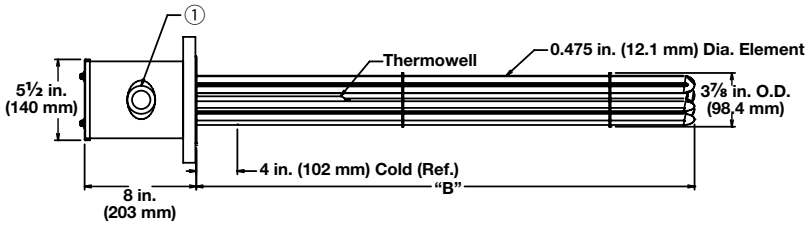
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
48 W/in² ⑥ Steel Flange 6-Alloy 800 Elements (7.5 W/cm²)	240	9.0	1	1	13½	(343)	29	(14)	**FON713J10S**	**FON713J10W**	**C/F**	**C/F**
	240	9.0	3	1	13½	(343)	29	(14)	**FON713J3S**	**FON713J3W**	**C2-50**	**C2-92**
	480	9.0	1	1	13½	(343)	29	(14)	**FON713J11S**	**FON713J11W**	**C/F**	**C/F**
	480	9.0	3	1	13½	(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	20½	(521)	34	(16)	**FON720J10S**	**FON720J10W**	**C/F**	**C/F**
	240	15.0	3	1	20½	(521)	34	(16)	**FON720J3S**	**FON720J3W**	**C2-236**	**C2-214**
	480	15.0	1	1	20½	(521)	34	(16)	**FON720J11S**	**FON720J11W**	**C/F**	**C/F**
	480	15.0	3	1	20½	(521)	34	(16)	**FON720J5S**	**FON720J5W**	**C2-225**	**C2-226**
	240	18.0	1	2	25½	(648)	36	(17)	**FON725J10S**	**FON725J10W**	**C/F**	**C/F**
	240	18.0	3	1	25½	(648)	36	(17)	**FON725J3S**	**FON725J3W**	**C2-236**	**C2-214**
	480	18.0	1	1	25½	(648)	36	(17)	**FON725J11S**	**FON725J11W**	**C/F**	**C/F**
	480	18.0	3	1	25½	(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	40½	(1029)	43	(20)	**FON740J3S**	**FON740J3W**	**C2-218**	**C2-224**
	480	30.0	1	2	40½	(1029)	43	(20)	**FON740J11S**	**FON740J11W**	**C/F**	**C/F**
	480	30.0	3	1	40½	(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

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

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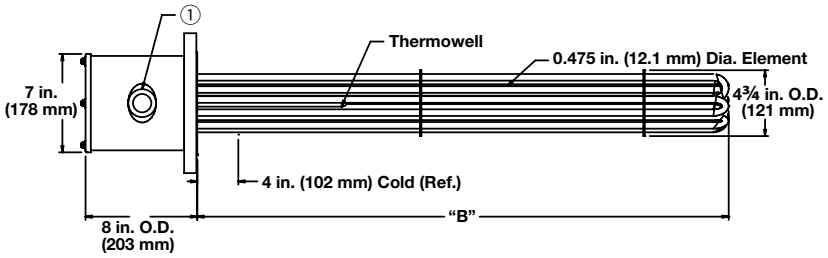
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WATROD ANSI Flange Immersion Heaters

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 General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
48 W/in² Steel Flange 6-Alloy 800 Elements (7.5 W/cm²)	240	9.0	1	1	13 1/2	(343)	33	(15)	FNN713J10S	FNN713J10W	C/F	C/F
	240	9.0	3	1	13 1/2	(343)	33	(15)	FNN713J3S	FNN713J3W	C2-50	C2-92
	480	9.0	1	1	13 1/2	(343)	33	(15)	FNN713J11S	FNN713J11W	C/F	C/F
	480	9.0	3	1	13 1/2	(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 1/2	(521)	38	(18)	FNN720J10S	FNN720J10W	C/F	C/F
	240	15.0	3	1	20 1/2	(521)	38	(18)	FNN720J3S	FNN720J3W	C2-236	C2-214
	480	15.0	1	1	20 1/2	(521)	38	(18)	FNN720J11S	FNN720J11W	C/F	C/F
	480	15.0	3	1	20 1/2	(521)	38	(18)	FNN720J5S	FNN720J5W	C2-43	C2-35
	240	18.0	1	2	25 1/2	(648)	40	(19)	FNN725J10S	FNN725J10W	C/F	C/F
	240	18.0	3	1	25 1/2	(648)	40	(19)	FNN725J3S	FNN725J3W	C2-236	C2-214
	480	18.0	1	1	25 1/2	(648)	40	(19)	FNN725J11S	FNN725J11W	C/F	C/F
	480	18.0	3	1	25 1/2	(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 1/2	(1029)	47	(22)	FNN740J3S	FNN740J3W	C2-218	C2-224
	480	30.0	1	2	40 1/2	(1029)	47	(22)	FNN740J11S	FNN740J11W	C/F	C/F
	480	30.0	3	1	40 1/2	(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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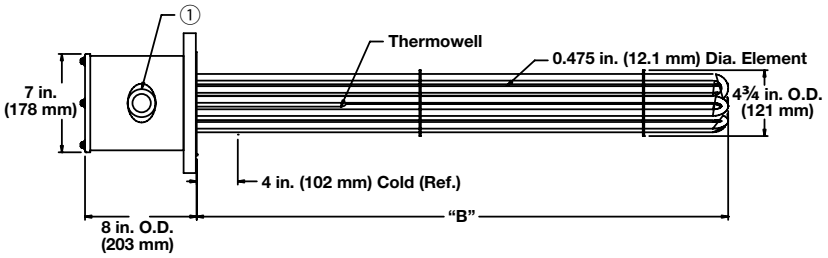
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
48 W/in² Steel Flange 9-Alloy 800 Elements (7.5 W/cm²)	240	14.0	1	3	13½	(343)	35	(16)	**FNN713J10XS**	**FNN713J10XW**	**C/F**	**C/F**
	240	14.0	3	1	13½	(343)	35	(16)	**FNN713J3XS**	**FNN713J3XW**	**C2-236**	**C2-214**
	480	14.0	1	1	13½	(343)	35	(16)	**FNN713J11XS**	**FNN713J11XW**	**C/F**	**C/F**
	480	14.0	3	1	13½	(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	20½	(521)	42	(19)	**FNN720J10XS**	**FNN720J10XW**	**C/F**	**C/F**
	240	23.0	3	3	20½	(521)	42	(19)	**FNN720J3XS**	**FNN720J3XW**	**C4-143**	**C4-142**
	480	23.0	1	1	20½	(521)	42	(19)	**FNN720J11XS**	**FNN720J11XW**	**C/F**	**C/F**
	480	23.0	3	1	20½	(521)	42	(19)	**FNN720J5XS**	**FNN720J5XW**	**C2-225**	**C2-226**
	240	27.0	1	3	25½	(648)	45	(21)	**FNN725J10XS**	**FNN725J10XW**	**C/F**	**C/F**
	240	27.0	3	3	25½	(648)	45	(21)	**FNN725J3XS**	**FNN725J3XW**	**C4-143**	**C4-142**
	480	27.0	1	3	25½	(648)	45	(21)	**FNN725J11XS**	**FNN725J11XW**	**C/F**	**C/F**
	480	27.0	3	1	25½	(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	40½	(1029)	53	(24)	**FNN740J3XS**	**FNN740J3XW**	**C4-144**	**C4-145**
	480	45.0	1	3	40½	(1029)	53	(24)	**FNN740J11XS**	**FNN740J11XW**	**C/F**	**C/F**
	480	45.0	3	3	40½	(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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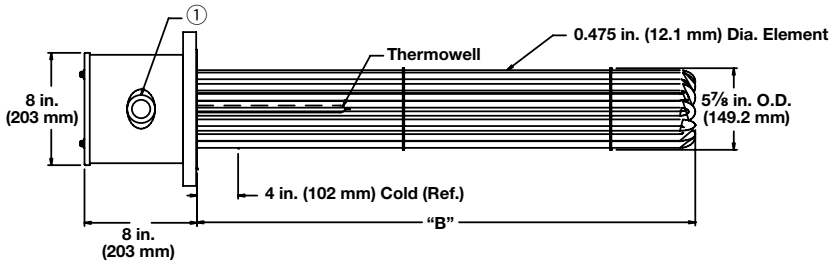
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WATROD ANSI Flange Immersion Heaters

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/in² Steel Flange 12-Alloy 800 Elements (7.5 W/cm²)	240	18.0	1	2	13 3/8 (339.7)	73 (33)	FPN713G10S	FPN713G10W	C/F	C/F
	240	18.0	3	1	13 3/8 (339.7)	73 (33)	FPN713G3S	FPN713G3W	C2-236	C2-214
	480	18.0	1	1	13 3/8 (339.7)	73 (33)	FPN713G11S	FPN713G11W	C/F	C/F
	480	18.0	3	1	13 3/8 (339.7)	73 (33)	FPN713G5S	FPN713G5W	C2-43	C2-35
	240	24.0	1	3	17 7/8 (454.0)	75 (34)	FPN717R10S	FPN717R10W	C/F	C/F
	240	24.0	3	2	17 7/8 (454.0)	75 (34)	FPN717R3S	FPN717R3W	C2-218	C2-224
	480	24.0	1	2	17 7/8 (454.0)	75 (34)	FPN717R11S	FPN717R11W	C/F	C/F
	480	24.0	3	1	17 7/8 (454.0)	75 (34)	FPN717R5S	FPN717R5W	C2-225	C2-226
	240	30.0	1	3	20 3/8 (517.5)	78 (36)	FPN720G10S	FPN720G10W	C/F	C/F
	240	30.0	3	2	20 3/8 (517.5)	78 (36)	FPN720G3S	FPN720G3W	C2-218	C2-224
	480	30.0	1	2	20 3/8 (517.5)	78 (36)	FPN720G11S	FPN720G11W	C/F	C/F
	480	30.0	3	1	20 3/8 (517.5)	78 (36)	FPN720G5S	FPN720G5W	C2-225	C2-226
	240	36.0	1	4	25 3/8 (644.5)	81 (37)	FPN725G10S	FPN725G10W	C/F	C/F
	240	36.0	3	2	25 3/8 (644.5)	81 (37)	FPN725G3S	FPN725G3W	C2-218	C2-224
	480	36.0	1	2	25 3/8 (644.5)	81 (37)	FPN725G11S	FPN725G11W	C/F	C/F
	480	36.0	3	1	25 3/8 (644.5)	81 (37)	FPN725G5S	FPN725G5W	C2-225	C2-226
	240	48.0	3	4	32 7/8 (835.0)	85 (39)	FPN732R3S	FPN732R3W	C4-148	C4-149
	480	48.0	1	3	32 7/8 (835.0)	85 (39)	FPN732R11S	FPN732R11W	C/F	C/F
	480	48.0	3	2	32 7/8 (835.0)	85 (39)	FPN732R5S	FPN732R5W	C2-229	C2-230
	240	60.0	3	4	40 3/8 (1025.5)	92 (42)	FPN740G3S	FPN740G3W	C4-148	C4-149
	480	60.0	1	3	40 3/8 (1025.5)	92 (42)	FPN740G11S	FPN740G11W	C/F	C/F
	480	60.0	3	2	40 3/8 (1025.5)	92 (42)	FPN740G5S	FPN740G5W	C2-229	C2-230
	240	72.0	3	4	47 7/8 (1216.0)	100 (46)	FPN747R3S	FPN747R3W	C4-148	C4-149
	480	72.0	3	2	47 7/8 (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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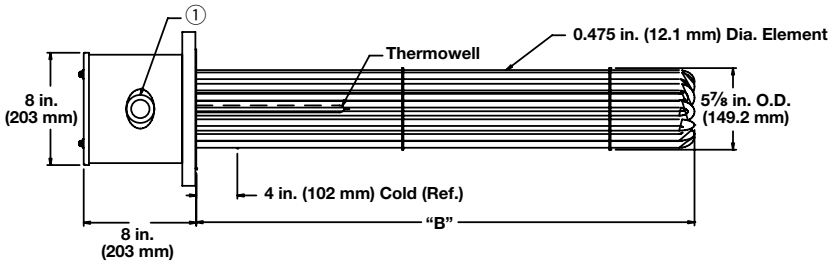
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WATROD ANSI Flange Immersion Heaters

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/in² Steel Flange 15-Alloy 800 Elements (7.5 W/cm²)	240	23.0	1	3	13 3/8 (339.7)	76 (35)	**FPN713G10XS**	**FPN713G10XW**	**C/F**	**C/F**
	240	23.0	3	5	13 3/8 (339.7)	76 (35)	**FPN713G3XS**	**FPN713G3XW**	**C4-143**	**C4-142**
	480	23.0	1	1	13 3/8 (339.7)	76 (35)	**FPN713G11XS**	**FPN713G11XW**	**C/F**	**C/F**
	480	23.0	3	1	13 3/8 (339.7)	76 (35)	**FPN713G5XS**	**FPN713G5XW**	**C2-225**	**C2-226**
	240	30.0	1	3	17 7/8 (441.3)	78 (36)	**FPN717R10XS**	**FPN717R10XW**	**C/F**	**C/F**
	240	30.0	3	5	17 7/8 (441.3)	78 (36)	**FPN717R3XS**	**FPN717R3XW**	**C4-144**	**C4-145**
	480	30.0	1	3	17 7/8 (441.3)	78 (36)	**FPN717R11XS**	**FPN717R11XW**	**C/F**	**C/F**
	480	30.0	3	1	17 7/8 (441.3)	78 (36)	**FPN717R5XS**	**FPN717R5XW**	**C2-225**	**C2-226**
	240	38.0	1	5	20 3/8 (517.5)	82 (38)	**FPN720G10XS**	**FPN720G10XW**	**C/F**	**C/F**
	240	38.0	3	5	20 3/8 (517.5)	82 (38)	**FPN720G3XS**	**FPN720G3XW**	**C4-144**	**C4-145**
	480	38.0	1	3	20 3/8 (517.5)	82 (38)	**FPN720G11XS**	**FPN720G11XW**	**C/F**	**C/F**
	480	38.0	3	1	20 3/8 (517.5)	82 (38)	**FPN720G5XS**	**FPN720G5XW**	**C2-225**	**C2-226**
	240	45.0	1	5	25 3/8 (644.5)	85 (39)	**FPN725G10XS**	**FPN725G10XW**	**C/F**	**C/F**
	240	45.0	3	5	25 3/8 (644.5)	85 (39)	**FPN725G3XS**	**FPN725G3XW**	**C4-144**	**C4-145**
	480	45.0	1	3	25 3/8 (644.5)	85 (39)	**FPN725G11XS**	**FPN725G11XW**	**C/F**	**C/F**
	480	45.0	3	5	25 3/8 (644.5)	85 (39)	**FPN725G5XS**	**FPN725G5XW**	**C4-150**	**C4-151**
	240	60.0	3	5	32 7/8 (835.0)	90 (41)	**FPN732R3XS**	**FPN732R3XW**	**C/F**	**C/F**
	480	60.0	1	3	32 7/8 (835.0)	90 (41)	**FPN732R11XS**	**FPN732R11XW**	**C/F**	**C/F**
	480	60.0	3	5	32 7/8 (835.0)	90 (41)	**FPN732R5XS**	**FPN732R5XW**	**C4-152**	**C4-153**
	240	75.0	3	5	40 3/8 (1025.5)	98 (45)	**FPN740G3XS**	**FPN740G3XW**	**C/F**	**C/F**
	480	75.0	1	5	40 3/8 (1025.5)	98 (45)	**FPN740G11XS**	**FPN740G11XW**	**C/F**	**C/F**
	480	75.0	3	5	40 3/8 (1025.5)	98 (45)	**FPN740G5XS**	**FPN740G5XW**	**C4-152**	**C4-153**
	240	90.0	3	5	47 7/8 (1216.0)	108 (49)	**FPN747R3XS**	**FPN747R3XW**	**C/F**	**C/F**
	480	90.0	3	5	47 7/8 (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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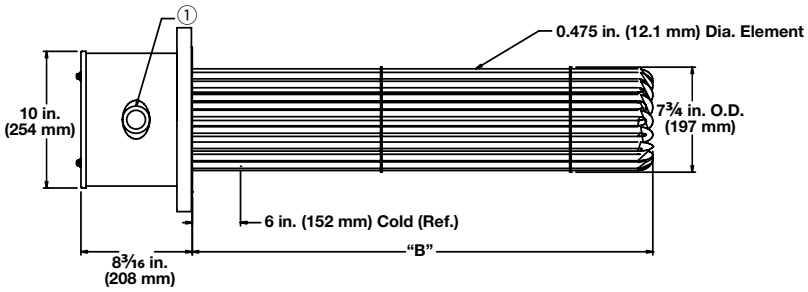
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WATROD ANSI Flange Immersion Heaters

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/in² Steel Flange 18-Alloy 800 Elements (7.5 W/cm²)	240	50.0	3	3	25 3/4 (654.0)	121 (55)	FRN725N3S	FRN725N3W	C4-144	C4-145
	480	50.0	1	3	25 3/4 (654.0)	121 (55)	FRN725N11S	FRN725N11W	C/F	C/F
	480	50.0	3	2	25 3/4 (654.0)	121 (55)	FRN725N5S	FRN725N5W	C2-229	C2-230
	240	75.0	3	6	35 3/4 (908.0)	130 (59)	FRN735N3S	FRN735N3W	C/F	C/F
	480	75.0	3	2	35 3/4 (908.0)	130 (59)	FRN735N5S	FRN735N5W	C2-229	C2-230
	240	100.0	3	6	44 1/4 (1124.0)	132 (60)	FRN744E3S	FRN744E3W	C/F	C/F
	480	100.0	3	3	44 1/4 (1124.0)	132 (60)	FRN744E5S	FRN744E5W	C2-229	C2-230
	240	125.0	3	6	54 11/16 (1389.1)	140 (64)	FRN754M3S	FRN754M3W	C/F	C/F
	480	125.0	3	6	54 11/16 (1389.1)	140 (64)	FRN754M5S	FRN754M5W	C/F	C/F
	480	150.0	3	6	63 11/16 (1617.6)	145 (66)	FRN763M5S	FRN763M5W	C/F	C/F
	480	175.0	3	6	73 3/16 (1859.0)	151 (69)	FRN773D5S	FRN773D5W	C/F	C/F
	480	200.0	3	6	82 11/16 (2100.3)	157 (72)	FRN782M5S	FRN782M5W	C/F	C/F
48 W/in² Steel Flange 24-Alloy 800 Elements (7.5 W/cm²)	240	67.0	3	4	26 3/16 (665.2)	129 (59)	FRN726D3XS	FRN726D3XW	C4-148	C4-149
	480	67.0	1	3	26 3/16 (665.2)	129 (59)	FRN726D11XS	FRN726D11XW	C/F	C/F
	480	67.0	3	2	26 3/16 (665.2)	129 (59)	FRN726D5XS	FRN726D5XW	C2-229	C2-230
	240	100.0	3	8	36 3/16 (919.2)	142 (65)	FRN736D3XS	FRN736D3XW	C/F	C/F
	480	100.0	3	4	36 3/16 (919.2)	142 (65)	FRN736D5XS	FRN736D5XW	C4-156	C4-157
	240	133.0	3	8	44 11/16 (1135.1)	147 (67)	FRN744M3XS	FRN744M3XW	C/F	C/F
	480	133.0	3	4	44 11/16 (1135.1)	147 (67)	FRN744M5XS	FRN744M5XW	C4-156	C4-157
	240	167.0	3	8	54 11/16 (1389.1)	158 (72)	FRN754M3XS	FRN754M3XW	C/F	C/F
	480	167.0	3	8	54 11/16 (1389.1)	158 (72)	FRN754M5XS	FRN754M5XW	C/F	C/F
	480	200.0	3	8	63 11/16 (1617.6)	166 (76)	FRN763M5XS	FRN763M5XW	C/F	C/F
	480	233.0	3	8	73 3/16 (1859.0)	175 (80)	FRN773D5XS	FRN773D5XW	C/F	C/F
	480	267.0	3	8	82 11/16 (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

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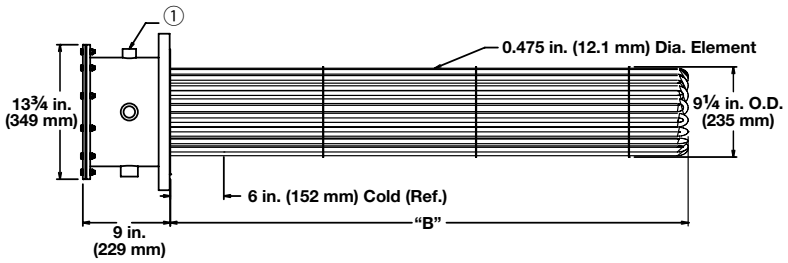
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WATROD ANSI Flange Immersion Heaters

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



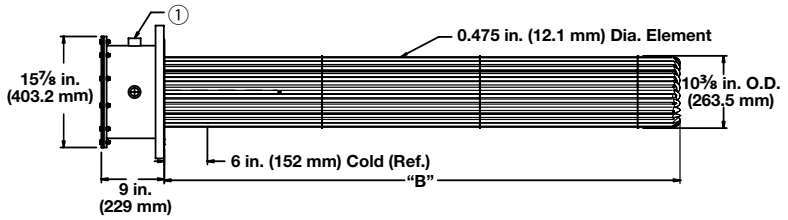
① The number and size of the conduit opening will comply with the National Electrical Code® standards.

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/in² Steel Flange 27-Alloy 800 Elements (7.5 W/cm²)	480	190.0	3	9	54 3/4 (1391)	240 (109)	FSN754N5S	FSN754N5W	C/F	C/F
	480	262.0	3	9	73 1/4 (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/in² Steel Flange 36-Alloy 800 Elements (7.5 W/cm²)	480	250.0	3	6	54 5/8 (1387.5)	280 (127)	FTN754L5S	FTN754L5W	C/F	C/F
	480	350.0	3	12	73 1/8 (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

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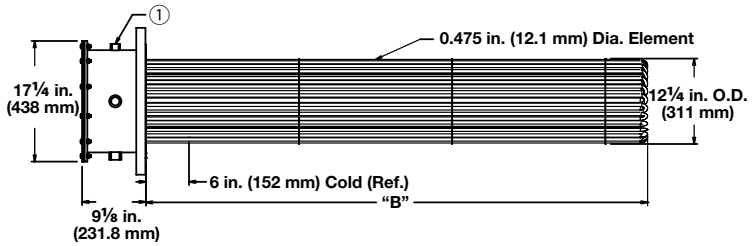
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WATROD ANSI Flange Immersion Heaters

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/in² Steel Flange 45-Alloy 800 Elements (7.5 W/cm²)	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

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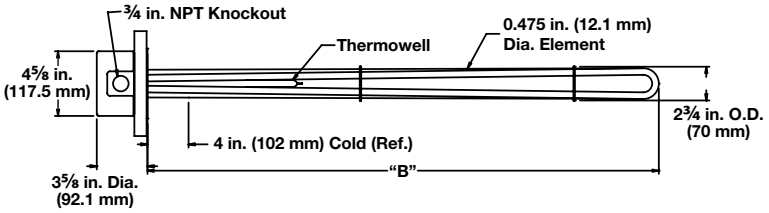
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WATROD ANSI Flange Immersion Heaters

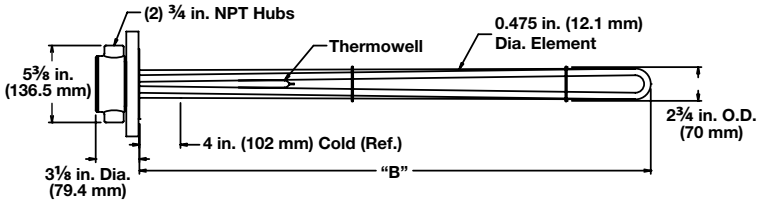
Application: Forced Air and Caustic Solutions

- 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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
23 W/in² ⑥ Steel Flange 3-Alloy 800 Elements (3.6 W/cm²)	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

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

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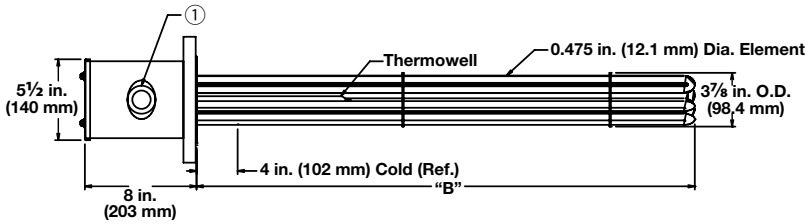
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
23 W/in² ⑥ Steel Flange 6-Alloy 800 Elements (3.6 W/cm²)	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	25½	(648)	36	(17)	**FONA25J10S**	**FONA25J10W**	**C/F**	**C/F**
	240	9.0	3	1	25½	(648)	36	(17)	**FONA25J3S**	**FONA25J3W**	**C2-50**	**C2-92**
	480	9.0	1	1	25½	(648)	36	(17)	**FONA25J11S**	**FONA25J11W**	**C/F**	**C/F**
	480	9.0	3	1	25½	(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	40½	(1029)	43	(20)	**FONA40J10S**	**FONA40J10W**	**C/F**	**C/F**
	240	15.0	3	1	40½	(1029)	43	(20)	**FONA40J3S**	**FONA40J3W**	**C2-236**	**C2-214**
	480	15.0	1	1	40½	(1029)	43	(20)	**FONA40J11S**	**FONA40J11W**	**C/F**	**C/F**
	480	15.0	3	1	40½	(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	64½	(1638)	53	(24)	**FONA64J3S**	**FONA64J3W**	**C2-236**	**C2-214**
	480	25.0	1	2	64½	(1638)	53	(24)	**FONA64J11S**	**FONA64J11W**	**C/F**	**C/F**
	480	25.0	3	1	64½	(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

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⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

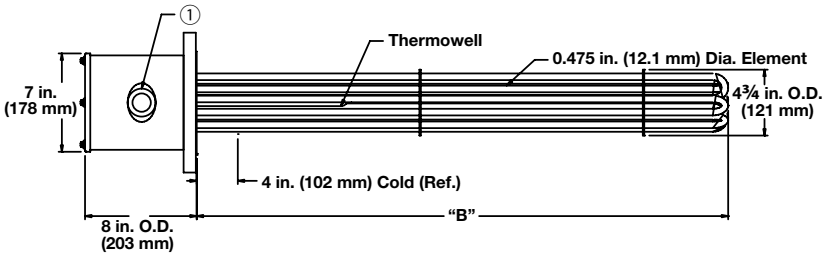
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WATROD ANSI Flange Immersion Heaters

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/in² ⑥ Steel Flange 6-Alloy 800 Elements (3.6 W/cm²)	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	25½	(648)	40	(19)	**FNNA25J10S**	**FNNA25J10W**	**C/F**	**C/F**
	240	9.0	3	1	25½	(648)	40	(19)	**FNNA25J3S**	**FNNA25J3W**	**C2-50**	**C2-92**
	480	9.0	1	1	25½	(648)	40	(19)	**FNNA25J11S**	**FNNA25J11W**	**C/F**	**C/F**
	480	9.0	3	1	25½	(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	40½	(1029)	47	(22)	**FNNA40J10S**	**FNNA40J10W**	**C/F**	**C/F**
	240	15.0	3	1	40½	(1029)	47	(22)	**FNNA40J3S**	**FNNA40J3W**	**C2-236**	**C2-214**
	480	15.0	1	1	40½	(1029)	47	(22)	**FNNA40J11S**	**FNNA40J11W**	**C/F**	**C/F**
	480	15.0	3	1	40½	(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	64½	(1638)	57	(26)	**FNNA64J3S**	**FNNA64J3W**	**C2-218**	**C2-224**
	480	25.0	1	2	64½	(1638)	57	(26)	**FNNA64J11S**	**FNNA64J11W**	**C/F**	**C/F**
	480	25.0	3	1	64½	(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

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⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

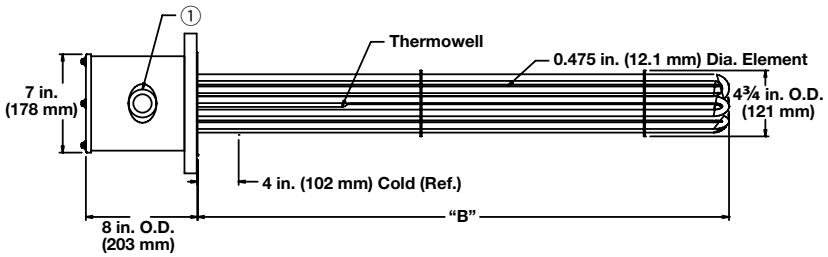
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
23 W/in² ⑥ Steel Flange 9-Alloy 800 Elements (3.6 W/cm²)	240	9.0	1	1	18	(457)	39	(18)	**FNNA18A10XS**	**FNNA18A10XW**	**C/F**	**C/F**
	240	9.0	3	1	18	(457)	39	(18)	**FNNA18A3XS**	**FNNA18A3XW**	**C2-50**	**C2-92**
	480	9.0	1	1	18	(457)	39	(18)	**FNNA18A11XS**	**FNNA18A11XW**	**C/F**	**C/F**
	480	9.0	3	1	18	(457)	39	(18)	**FNNA18A5XS**	**FNNA18A5XW**	**C2-43**	**C2-35**
	240	14.0	1	3	25½	(648)	45	(21)	**FNNA25J10XS**	**FNNA25J10XW**	**C/F**	**C/F**
	240	14.0	3	1	25½	(648)	45	(21)	**FNNA25J3XS**	**FNNA25J3XW**	**C2-236**	**C2-214**
	480	14.0	1	1	25½	(648)	45	(21)	**FNNA25J11XS**	**FNNA25J11XW**	**C/F**	**C/F**
	480	14.0	3	1	25½	(648)	45	(21)	**FNNA25J5XS**	**FNNA25J5XW**	**C2-43**	**C2-35**
	240	18.0	1	3	33	(838)	48	(22)	**FNNA33A10XS**	**FNNA33A10XW**	**C/F**	**C/F**
	240	18.0	3	1	33	(838)	48	(22)	**FNNA33A3XS**	**FNNA33A3XW**	**C2-236**	**C2-214**
	480	18.0	1	1	33	(838)	48	(22)	**FNNA33A11XS**	**FNNA33A11XW**	**C/F**	**C/F**
	480	18.0	3	1	33	(838)	48	(22)	**FNNA33A5XS**	**FNNA33A5XW**	**C2-43**	**C2-35**
	240	23.0	1	3	40½	(1029)	53	(24)	**FNNA40J10XS**	**FNNA40J10XW**	**C/F**	**C/F**
	240	23.0	3	3	40½	(1029)	53	(24)	**FNNA40J3XS**	**FNNA40J3XW**	**C4-143**	**C4-142**
	480	23.0	1	1	40½	(1029)	53	(24)	**FNNA40J11XS**	**FNNA40J11XW**	**C/F**	**C/F**
	480	23.0	3	1	40½	(1029)	53	(24)	**FNNA40J5XS**	**FNNA40J5XW**	**C2-225**	**C2-226**
	240	27.0	1	3	48	(1219)	60	(28)	**FNNA48A10XS**	**FNNA48A10XW**	**C/F**	**C/F**
	240	27.0	3	3	48	(1219)	60	(28)	**FNNA48A3XS**	**FNNA48A3XW**	**C4-143**	**C4-142**
	480	27.0	1	3	48	(1219)	60	(28)	**FNNA48A11XS**	**FNNA48A11XW**	**C/F**	**C/F**
	480	27.0	3	1	48	(1219)	60	(28)	**FNNA48A5XS**	**FNNA48A5XW**	**C2-225**	**C2-226**
	240	38.0	3	3	64½	(1638)	68	(31)	**FNNA64J3XS**	**FNNA64J3XW**	**C4-144**	**C4-145**
	480	38.0	1	3	64½	(1638)	68	(31)	**FNNA64J11XS**	**FNNA64J11XW**	**C/F**	**C/F**
	480	38.0	3	1	64½	(1638)	68	(31)	**FNNA64J5XS**	**FNNA64J5XW**	**C2-225**	**C2-226**
	240	45.0	3	3	77	(1956)	78	(36)	**FNNA77A3XS**	**FNNA77A3XW**	**C4-144**	**C4-145**
	480	45.0	1	3	77	(1956)	78	(36)	**FNNA77A11XS**	**FNNA77A11XW**	**C/F**	**C/F**
	480	45.0	3	3	77	(1956)	78	(36)	**FNNA77A5XS**	**FNNA77A5XW**	**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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⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

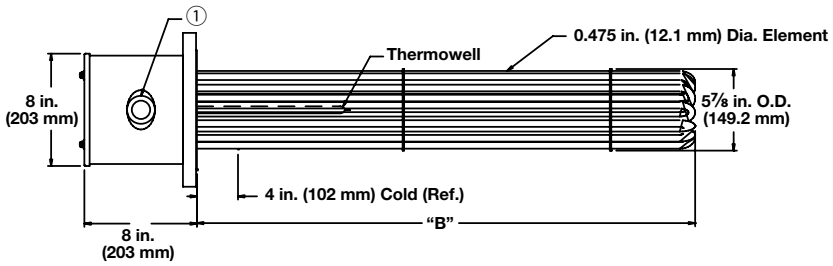
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
23 W/in² ⑥ Steel Flange 12-Alloy 800 Elements (3.6 W/cm²)	240	12.0	1	2	17 7/8	(454.0)	75	(34)	**FPNA17R10S**	**FPNA17R10W**	**C/F**	**C/F**
	240	12.0	3	1	17 7/8	(454.0)	75	(34)	**FPNA17R3S**	**FPNA17R3W**	**C2-236**	**C2-214**
	480	12.0	1	1	17 7/8	(454.0)	75	(34)	**FPNA17R11S**	**FPNA17R11W**	**C/F**	**C/F**
	480	12.0	3	1	17 7/8	(454.0)	75	(34)	**FPNA17R5S**	**FPNA17R5W**	**C2-43**	**C2-35**
	240	18.0	1	2	25 3/8	(644.5)	81	(37)	**FPNA25G10S**	**FPNA25G10W**	**C/F**	**C/F**
	240	18.0	3	1	25 3/8	(644.5)	81	(37)	**FPNA25G3S**	**FPNA25G3W**	**C2-236**	**C2-214**
	480	18.0	1	1	25 3/8	(644.5)	81	(37)	**FPNA25G11S**	**FPNA25G11W**	**C/F**	**C/F**
	480	18.0	3	1	25 3/8	(644.5)	81	(37)	**FPNA25G5S**	**FPNA25G5W**	**C2-43**	**C2-35**
	240	24.0	1	3	32 7/8	(835.0)	85	(39)	**FPNA32R10S**	**FPNA32R10W**	**C/F**	**C/F**
	240	24.0	3	2	32 7/8	(835.0)	85	(39)	**FPNA32R3S**	**FPNA32R3W**	**C2-218**	**C2-224**
	480	24.0	1	2	32 7/8	(835.0)	85	(39)	**FPNA32R11S**	**FPNA32R11W**	**C/F**	**C/F**
	480	24.0	3	1	32 7/8	(835.0)	85	(39)	**FPNA32R5S**	**FPNA32R5W**	**C2-225**	**C2-226**
	240	30.0	1	3	40 3/8	(1025.5)	92	(42)	**FPNA40G10S**	**FPNA40G10W**	**C/F**	**C/F**
	240	30.0	3	2	40 3/8	(1025.5)	92	(42)	**FPNA40G3S**	**FPNA40G3W**	**C2-218**	**C2-224**
	480	30.0	1	2	40 3/8	(1025.5)	92	(42)	**FPNA40G11S**	**FPNA40G11W**	**C/F**	**C/F**
	480	30.0	3	1	40 3/8	(1025.5)	92	(42)	**FPNA40G5S**	**FPNA40G5W**	**C2-225**	**C2-226**
	240	36.0	1	4	47 7/8	(1216.0)	100	(46)	**FPNA47R10S**	**FPNA47R10W**	**C/F**	**C/F**
	240	36.0	3	2	47 7/8	(1216.0)	100	(46)	**FPNA47R3S**	**FPNA47R3W**	**C2-218**	**C2-224**
	480	36.0	1	2	47 7/8	(1216.0)	100	(46)	**FPNA47R11S**	**FPNA47R11W**	**C/F**	**C/F**
	480	36.0	3	1	47 7/8	(1216.0)	100	(46)	**FPNA47R5S**	**FPNA47R5W**	**C2-225**	**C2-226**
	240	50.0	3	4	64 3/8	(1635.1)	110	(50)	**FPNA64G3S**	**FPNA64G3W**	**C4-148**	**C4-149**
	480	50.0	1	3	64 3/8	(1635.1)	110	(50)	**FPNA64G11S**	**FPNA64G11W**	**C/F**	**C/F**
	480	50.0	3	2	64 3/8	(1635.1)	110	(50)	**FPNA64G5S**	**FPNA64G5W**	**C2-229**	**C2-230**
	240	60.0	3	4	76 7/8	(1952.4)	118	(54)	**FPNA76R3S**	**FPNA76R3W**	**C4-148**	**C4-149**
	480	60.0	1	3	76 7/8	(1952.4)	118	(54)	**FPNA76R11S**	**FPNA76R11W**	**C/F**	**C/F**
	480	60.0	3	2	76 7/8	(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

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

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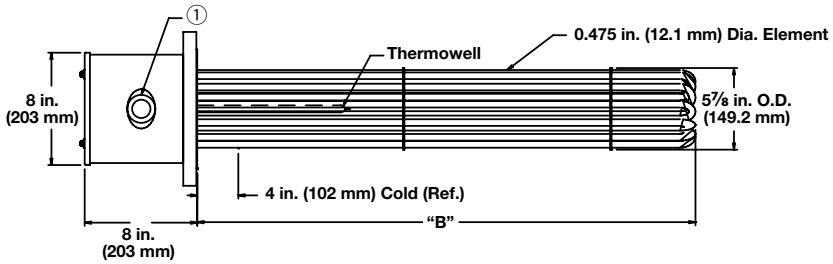
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WATROD ANSI Flange Immersion Heaters

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/in² ⑥ Steel Flange 15-Alloy 800 Elements (3.6 W/cm²)	240	15.0	1	3	17⅞ (454.0)	78 (36)	**FPNA17R10XS**	**FPNA17R10XW**	**C/F**	**C/F**
	240	15.0	3	1	17⅞ (454.0)	78 (36)	**FPNA17R3XS**	**FPNA17R3XW**	**C2-236**	**C2-214**
	480	15.0	1	1	17⅞ (454.0)	78 (36)	**FPNA17R11XS**	**FPNA17R11XW**	**C/F**	**C/F**
	480	15.0	3	1	17⅞ (454.0)	78 (36)	**FPNA17R5XS**	**FPNA17R5XW**	**C2-43**	**C2-35**
	240	23.0	1	3	25⅜ (644.5)	85 (39)	**FPNA25G10XS**	**FPNA25G10XW**	**C/F**	**C/F**
	240	23.0	3	5	25⅜ (644.5)	85 (39)	**FPNA25G3XS**	**FPNA25G3XW**	**C4-143**	**C4-142**
	480	23.0	1	1	25⅜ (644.5)	85 (39)	**FPNA25G11XS**	**FPNA25G11XW**	**C/F**	**C/F**
	480	23.0	3	1	25⅜ (644.5)	85 (39)	**FPNA25G5XS**	**FPNA25G5XW**	**C2-225**	**C2-226**
	240	30.0	1	3	32⅞ (835.0)	90 (41)	**FPNA32R10XS**	**FPNA32R10XW**	**C/F**	**C/F**
	240	30.0	3	5	32⅞ (835.0)	90 (41)	**FPNA32R3XS**	**FPNA32R3XW**	**C4-144**	**C4-145**
	480	30.0	1	3	32⅞ (835.0)	90 (41)	**FPNA32R11XS**	**FPNA32R11XW**	**C/F**	**C/F**
	480	30.0	3	1	32⅞ (835.0)	90 (41)	**FPNA32R5XS**	**FPNA32R5XW**	**C2-224**	**C2-226**
	240	38.0	1	5	40⅜ (1025.5)	98 (45)	**FPNA40G10XS**	**FPNA40G10XW**	**C/F**	**C/F**
	240	38.0	3	5	40⅜ (1025.5)	98 (45)	**FPNA40G3XS**	**FPNA40G3XW**	**C4-144**	**C4-145**
	480	38.0	1	3	40⅜ (1025.5)	98 (45)	**FPNA40G11XS**	**FPNA40G11XW**	**C/F**	**C/F**
	480	38.0	3	1	40⅜ (1025.5)	98 (45)	**FPNA40G5XS**	**FPNA40G5XW**	**C2-225**	**C2-226**
	240	45.0	1	5	47⅞ (1216.0)	108 (49)	**FPNA47R10XS**	**FPNA47R10XW**	**C/F**	**C/F**
	240	45.0	3	5	47⅞ (1216.0)	108 (49)	**FPNA47R3XS**	**FPNA47R3XW**	**C4-144**	**C4-145**
	480	45.0	1	3	47⅞ (1216.0)	108 (49)	**FPNA47R11XS**	**FPNA47R11XW**	**C/F**	**C/F**
	480	45.0	3	5	47⅞ (1216.0)	108 (49)	**FPNA47R5XS**	**FPNA47R5XW**	**C4-152**	**C4-153**
	240	63.0	3	5	64⅜ (1635.1)	120 (55)	**FPNA64G3XS**	**FPNA64G3XW**	**C/F**	**C/F**
	480	63.0	1	3	64⅜ (1635.1)	120 (55)	**FPNA64G11XS**	**FPNA64G11XW**	**C/F**	**C/F**
	480	63.0	3	5	64⅜ (1635.1)	120 (55)	**FPNA64G5XS**	**FPNA64G5XW**	**C4-152**	**C4-153**
	240	75.0	3	5	76⅞ (1952.4)	131 (60)	**FPNA76R3XS**	**FPNA76R3XW**	**C/F**	**C/F**
	480	75.0	1	5	76⅞ (1952.4)	131 (60)	**FPNA76R11XS**	**FPNA76R11XW**	**C/F**	**C/F**
	480	75.0	3	5	76⅞ (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

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⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

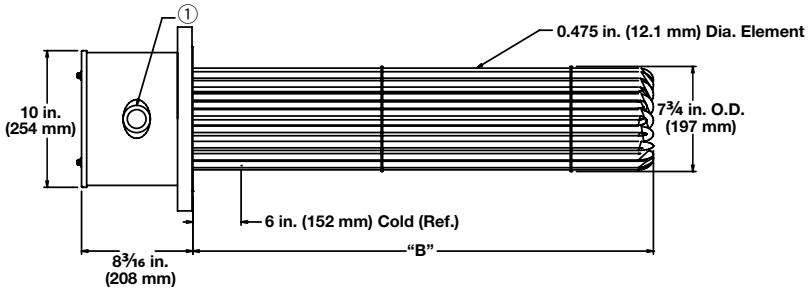
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WATROD ANSI Flange Immersion Heaters

Application: Forced Air and Caustic Solutions

- 8 inch - 150 lb ANSI flange
- WATROD elements
- Without thermostat
- General purpose or NEMA 4 enclosure

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
23 W/in² ⑥ Steel Flange 18-Alloy 800 Elements (3.6 W/cm²)	240	30.0	1	3	32 3/4	(832.0)	130	(59)	**FRNA32N10S**	**FRNA32N10W**	**C/F**	**C/F**
	240	30.0	3	2	32 3/4	(832.0)	130	(59)	**FRNA32N3S**	**FRNA32N3W**	**C2-218**	**C2-224**
	480	30.0	1	2	32 3/4	(832.0)	130	(59)	**FRNA32N11S**	**FRNA32N11W**	**C/F**	**C/F**
	480	30.0	3	1	32 3/4	(832.0)	130	(59)	**FRNA32N5S**	**FRNA32N5W**	**C2-225**	**C2-226**
	240	40.0	3	3	43 1/4	(1099.0)	132	(60)	**FRNA43E3S**	**FRNA43E3W**	**C4-144**	**C4-145**
	480	40.0	1	2	43 1/4	(1099.0)	132	(60)	**FRNA43E11S**	**FRNA43E11W**	**C/F**	**C/F**
	480	40.0	3	3	43 1/4	(1099.0)	132	(60)	**FRNA43E5S**	**FRNA43E5W**	**C4-150**	**C4-151**
	240	50.0	3	3	51 11/16	(1312.9)	137	(63)	**FRNA51M3S**	**FRNA51M3W**	**C4-144**	**C4-145**
	480	50.0	1	3	51 11/16	(1312.9)	137	(63)	**FRNA51M11S**	**FRNA51M11W**	**C/F**	**C/F**
	480	50.0	3	2	51 11/16	(1312.9)	137	(63)	**FRNA51M5S**	**FRNA51M5W**	**C2-229**	**C2-230**
23 W/in² ⑥ Steel Flange 24-Alloy 800 Elements (3.6 W/cm²)	240	40.0	1	4	33 3/16	(843.0)	142	(65)	**FRNA33D10XS**	**FRNA33D10XW**	**C/F**	**C/F**
	240	40.0	3	4	33 3/16	(843.0)	142	(65)	**FRNA33D3XS**	**FRNA33D3XW**	**C4-146**	**C4-147**
	480	40.0	1	2	33 3/16	(843.0)	142	(65)	**FRNA33D11XS**	**FRNA33D11XW**	**C/F**	**C/F**
	480	40.0	3	2	33 3/16	(843.0)	142	(65)	**FRNA33D5XS**	**FRNA33D5XW**	**C2-227**	**C2-228**
	240	53.0	3	4	43 11/16	(1109.7)	147	(67)	**FRNA43M3XS**	**FRNA43M3XW**	**C4-148**	**C4-149**
	480	53.0	1	3	43 11/16	(1109.7)	147	(67)	**FRNA43M11XS**	**FRNA43M11XW**	**C/F**	**C/F**
	480	53.0	3	2	43 11/16	(1109.7)	147	(67)	**FRNA43M5XS**	**FRNA43M5XW**	**C2-229**	**C2-230**
	240	67.0	3	4	51 11/16	(1312.9)	154	(70)	**FRNA51M3XS**	**FRNA51M3XW**	**C4-148**	**C4-149**
	480	67.0	1	3	51 11/16	(1312.9)	154	(70)	**FRNA51M11XS**	**FRNA51M11XW**	**C/F**	**C/F**
	480	67.0	3	2	51 11/16	(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

⑥ Can be rewired wye to produce 1/3 of the original kW and watt density (3-phase only)

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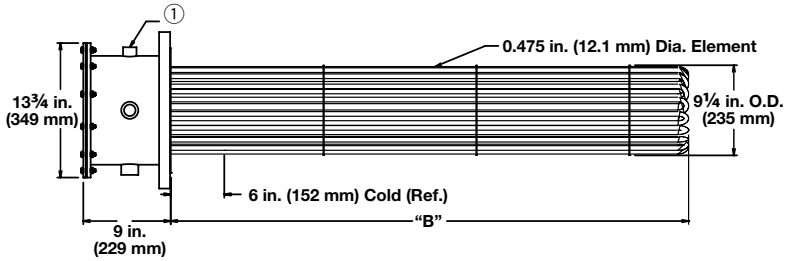
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
23 W/in² Steel Flange 27-Alloy 800 Elements (3.6 W/cm²)	240	45.0	3	3	33 1/4	(845)	165	(75)	**FSNA33E3S**	**FSNA33E3W**	**C4-144**	**C4-145**
	480	45.0	3	3	33 1/4	(845)	165	(75)	**FSNA33E5S**	**FSNA33E5W**	**C4-150**	**C4-151**
	240	60.0	3	3	43 3/4	(1111)	195	(89)	**FSNA43N3S**	**FSNA43N3W**	**C4-144**	**C4-145**
	480	60.0	3	3	43 3/4	(1111)	195	(89)	**FSNA43N5S**	**FSNA43N5W**	**C4-150**	**C4-151**
	240	75.0	3	9	51 3/4	(1314)	230	(105)	**FSNA51N3S**	**FSNA51N3W**	**C/F**	**C/F**
	480	75.0	3	3	51 3/4	(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

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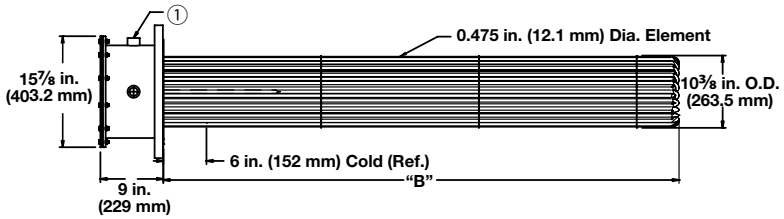
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WATROD ANSI Flange Immersion Heaters

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	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in² Steel Flange 36-Alloy 800 Elements (3.6 W/cm²)	480	60.0	3	3	33⅛ (841.4)	205 (93)	**FTNA33C5S**	**FTNA33C5W**	**C4-150**	**C4-151**
	480	80.0	3	3	43⅝ (1108.1)	240 (109)	**FTNA43L5S**	**FTNA43L5W**	**C4-152**	**C4-153**
	480	100.0	3	3	51⅝ (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

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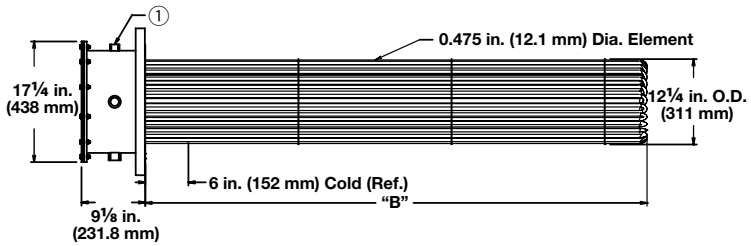
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WATROD ANSI Flange Immersion Heaters

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/in² Steel Flange 45-Alloy 800 Elements (3.6 W/cm²)	480	75.0	3	3	33 (838)	225 (102)	**FWNA33A5S**	**FWNA33A5W**	**C4-152**	**C4-153**
	480	100.0	3	3	43½ (1105)	255 (116)	**FWNA43J5S**	**FWNA43J5W**	**C4-152**	**C4-153**
	480	125.0	3	5	51½ (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

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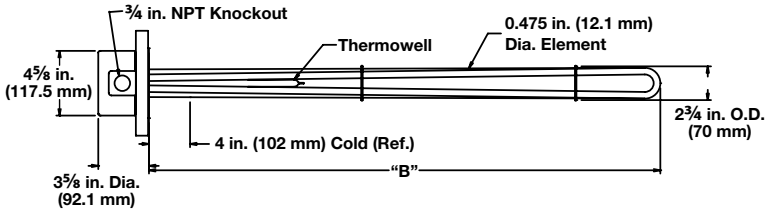
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WATROD ANSI Flange Immersion Heaters

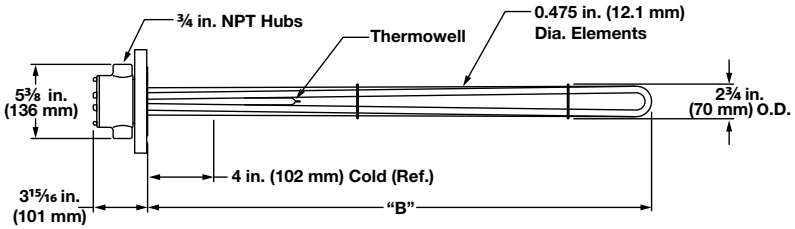
Application: Lightweight Oils and Heat Transfer Oils

- 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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
23 W/in² Steel Flange 3-Steel Elements (3.6 W/cm²)	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	25½	(648)	27	(13)	**FMS725J10S**	**FMS725J10W**	**C/F**	**C/F**
	240	4.5	3	25½	(648)	27	(13)	**FMS725J3S**	**FMS725J3W**	**C2-50**	**C2-92**
	480	4.5	1	25½	(648)	27	(13)	**FMS725J11S**	**FMS725J11W**	**C/F**	**C/F**
	480	4.5	3	25½	(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	40½	(1029)	30	(14)	**FMS740J10S**	**FMS740J10W**	**C/F**	**C/F**
	240	7.5	3	40½	(1029)	30	(14)	**FMS740J3S**	**FMS740J3W**	**C2-50**	**C2-92**
	480	7.5	1	40½	(1029)	30	(14)	**FMS740J11S**	**FMS740J11W**	**C/F**	**C/F**
	480	7.5	3	40½	(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	64½	(1638)	37	(17)	**FMS764J3S**	**FMS764J3W**	**C2-236**	**C2-214**
	480	12.5	1	64½	(1638)	37	(17)	**FMS764J11S**	**FMS764J11W**	**C/F**	**C/F**
	480	12.5	3	64½	(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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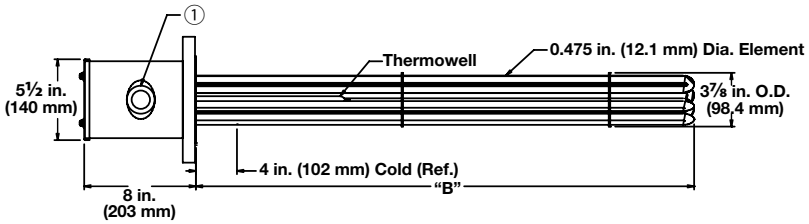
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WATROD ANSI Flange Immersion Heaters

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/in² Steel Flange 6-Steel Elements (3.6 W/cm²)	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	25½	(648)	36	(17)	**FOS725J10S**	**FOS725J10W**	**C/F**	**C/F**
	240	9.0	3	1	25½	(648)	36	(17)	**FOS725J3S**	**FOS725J3W**	**C2-50**	**C2-92**
	480	9.0	1	1	25½	(648)	36	(17)	**FOS725J11S**	**FOS725J11W**	**C/F**	**C/F**
	480	9.0	3	1	25½	(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	40½	(1029)	43	(20)	**FOS740J10S**	**FOS740J10W**	**C/F**	**C/F**
	240	15.0	3	1	40½	(1029)	43	(20)	**FOS740J3S**	**FOS740J3W**	**C2-236**	**C2-214**
	480	15.0	1	1	40½	(1029)	43	(20)	**FOS740J11S**	**FOS740J11W**	**C/F**	**C/F**
	480	15.0	3	1	40½	(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	64½	(1638)	53	(24)	**FOS764J3S**	**FOS764J3W**	**C2-218**	**C2-224**
	480	25.0	1	2	64½	(1638)	53	(24)	**FOS764J11S**	**FOS764J11W**	**C/F**	**C/F**
	480	25.0	3	1	64½	(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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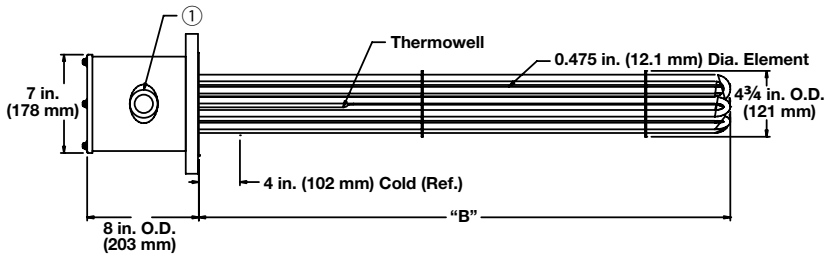
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WATROD ANSI Flange Immersion Heaters

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	Part Number	WATCONNECT Part Number	
									General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in² Steel Flange 6-Steel Elements (3.6 W/cm²)	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	25½	(648)	40	(19)	**FNS725J10S**	**FNS725J10W**	**C/F**	**C/F**
	240	9.0	3	1	25½	(648)	40	(19)	**FNS725J3S**	**FNS725J3W**	**C2-50**	**C2-92**
	480	9.0	1	1	25½	(648)	40	(19)	**FNS725J11S**	**FNS725J11W**	**C/F**	**C/F**
	480	9.0	3	1	25½	(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	40½	(1029)	47	(22)	**FNS740J10S**	**FNS740J10W**	**C/F**	**C/F**
	240	15.0	3	1	40½	(1029)	47	(22)	**FNS740J3S**	**FNS740J3W**	**C2-236**	**C2-214**
	480	15.0	1	1	40½	(1029)	47	(22)	**FNS740J11S**	**FNS740J11W**	**C/F**	**C/F**
	480	15.0	3	1	40½	(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	64½	(1638)	57	(26)	**FNS764J3S**	**FNS764J3W**	**C2-218**	**C2-224**
	480	25.0	1	2	64½	(1638)	57	(26)	**FNS764J11S**	**FNS764J11W**	**C/F**	**C/F**
	480	25.0	3	1	64½	(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

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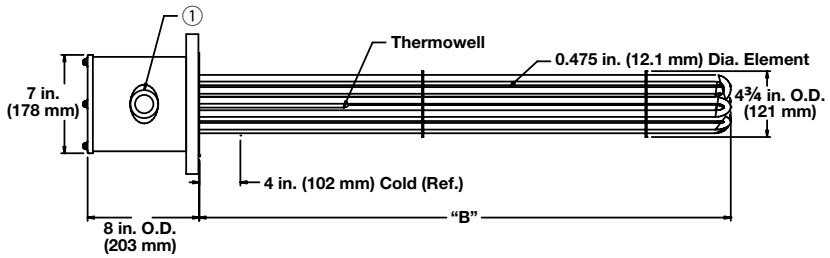
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lb	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
23 W/in² Steel Flange 9-Steel Elements (3.6 W/cm²)	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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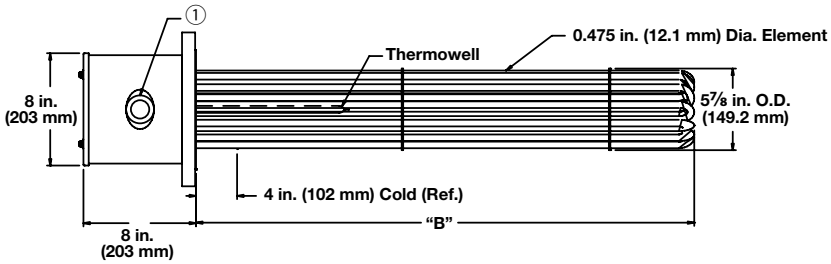
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
23 W/in² Steel Flange 12-Steel Elements (3.6 W/cm²)	240	12.0	1	2	17 7/8	(454.0)	75	(34)	**FPS717R10S**	**FPS717R10W**	**C/F**	**C/F**
	240	12.0	3	1	17 7/8	(454.0)	75	(34)	**FPS717R3S**	**FPS717R3W**	**C2-236**	**C2-214**
	480	12.0	1	1	17 7/8	(454.0)	75	(34)	**FPS717R11S**	**FPS717R11W**	**C/F**	**C/F**
	480	12.0	3	1	17 7/8	(454.0)	75	(34)	**FPS717R5S**	**FPS717R5W**	**C2-43**	**C2-35**
	240	18.0	1	2	25 3/8	(644.5)	81	(37)	**FPS725G10S**	**FPS725G10W**	**C/F**	**C/F**
	240	18.0	3	1	25 3/8	(644.5)	81	(37)	**FPS725G3S**	**FPS725G3W**	**C2-236**	**C2-214**
	480	18.0	1	1	25 3/8	(644.5)	81	(37)	**FPS725G11S**	**FPS725G11W**	**C/F**	**C/F**
	480	18.0	3	1	25 3/8	(644.5)	81	(37)	**FPS725G5S**	**FPS725G5W**	**C2-43**	**C2-35**
	240	24.0	1	3	32 7/8	(835.0)	85	(39)	**FPS732R10S**	**FPS732R10W**	**C/F**	**C/F**
	240	24.0	3	2	32 7/8	(835.0)	85	(39)	**FPS732R3S**	**FPS732R3W**	**C2-218**	**C2-224**
	480	24.0	1	2	32 7/8	(835.0)	85	(39)	**FPS732R11S**	**FPS732R11W**	**C/F**	**C/F**
	480	24.0	3	1	32 7/8	(835.0)	85	(39)	**FPS732R5S**	**FPS732R5W**	**C2-225**	**C2-226**
	240	30.0	1	3	40 3/8	(1025.5)	92	(42)	**FPS740G10S**	**FPS740G10W**	**C/F**	**C/F**
	240	30.0	3	2	40 3/8	(1025.5)	92	(42)	**FPS740G3S**	**FPS740G3W**	**C2-218**	**C2-224**
	480	30.0	1	2	40 3/8	(1025.5)	92	(42)	**FPS740G11S**	**FPS740G11W**	**C/F**	**C/F**
	480	30.0	3	1	40 3/8	(1025.5)	92	(42)	**FPS740G5S**	**FPS740G5W**	**C2-225**	**C2-226**
	240	36.0	1	4	47 7/8	(1216.0)	100	(46)	**FPS747R10S**	**FPS747R10W**	**C/F**	**C/F**
	240	36.0	3	2	47 7/8	(1216.0)	100	(46)	**FPS747R3S**	**FPS747R3W**	**C2-218**	**C2-224**
	480	36.0	1	2	47 7/8	(1216.0)	100	(46)	**FPS747R11S**	**FPS747R11W**	**C/F**	**C/F**
	480	36.0	3	1	47 7/8	(1216.0)	100	(46)	**FPS747R5S**	**FPS747R5W**	**C2-225**	**C2-226**
	240	50.0	3	4	64 3/8	(1635.1)	110	(50)	**FPS764G3S**	**FPS764G3W**	**C4-148**	**C40149**
	480	50.0	1	3	64 3/8	(1635.1)	110	(50)	**FPS764G11S**	**FPS764G11W**	**C/F**	**C/F**
	480	50.0	3	2	64 3/8	(1635.1)	110	(50)	**FPS764G5S**	**FPS764G5W**	**C2-229**	**C2-230**
	240	60.0	3	4	76 7/8	(1952.4)	118	(54)	**FPS776R3S**	**FPS776R3W**	**C4-148**	**C4-149**
	480	60.0	1	3	76 7/8	(1952.4)	118	(54)	**FPS776R11S**	**FPS776R11W**	**C/F**	**C/F**
	480	60.0	3	2	76 7/8	(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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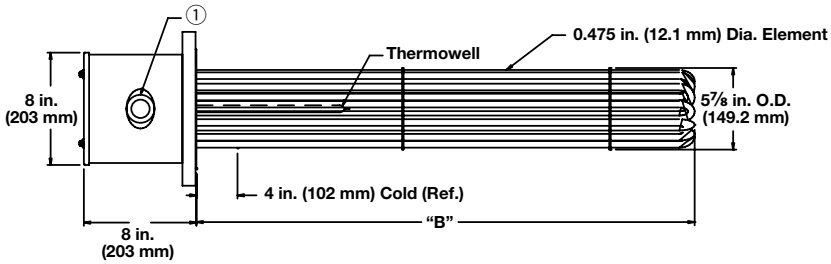
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number	Part Number	WATCONNECT Part Number	
									General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
23 W/in² Steel Flange 15-Steel Elements (3.6 W/cm²)	240	15.0	1	3	17 7/8	(454.0)	78	(36)	FPS717R10XS	FPS717R10XW	C/F	C/F
	240	15.0	3	1	17 7/8	(454.0)	78	(36)	FPS717R3XS	FPS717R3XW	C2-236	C2-214
	480	15.0	1	1	17 7/8	(454.0)	78	(36)	FPS717R11XS	FPS717R11XW	C/F	C/F
	480	15.0	3	1	17 7/8	(454.0)	78	(36)	FPS717R5XS	FPS717R5XW	C2-43	C2-35
	240	23.0	1	3	25 3/8	(644.5)	85	(39)	FPS725G10XS	FPS725G10XW	C/F	C/F
	240	23.0	3	5	25 3/8	(644.5)	85	(39)	FPS725G3XS	FPS725G3XW	C4-143	C4-142
	480	23.0	1	1	25 3/8	(644.5)	85	(39)	FPS725G11XS	FPS725G11XW	C/F	C/F
	480	23.0	3	1	25 3/8	(644.5)	85	(39)	FPS725G5XS	FPS725G5XW	C2-225	C2-226
	240	30.0	1	3	32 7/8	(835.0)	90	(41)	FPS732R10XS	FPS732R10XW	C/F	C/F
	240	30.0	3	5	32 7/8	(835.0)	90	(41)	FPS732R3XS	FPS732R3XW	C4-144	C4-145
	480	30.0	1	3	32 7/8	(835.0)	90	(41)	FPS732R11XS	FPS732R11XW	C/F	C/F
	480	30.0	3	1	32 7/8	(835.0)	90	(41)	FPS732R5XS	FPS732R5XW	C2-225	C2-226
	240	38.0	1	5	40 3/8	(1025.5)	98	(45)	FPS740G10XS	FPS740G10XW	C/F	C/F
	240	38.0	3	5	40 3/8	(1025.5)	98	(45)	FPS740G3XS	FPS740G3XW	C4-144	C4-145
	480	38.0	1	3	40 3/8	(1025.5)	98	(45)	FPS740G11XS	FPS740G11XW	C/F	C/F
	480	38.0	3	1	40 3/8	(1025.5)	98	(45)	FPS740G5XS	FPS740G5XW	C2-225	C2-226
	240	45.0	1	5	47 7/8	(1216.0)	108	(49)	FPS747R10XS	FPS747R10XW	C/F	C/F
	240	45.0	3	5	47 7/8	(1216.0)	108	(49)	FPS747R3XS	FPS747R3XW	C4-144	C4-145
	480	45.0	1	3	47 7/8	(1216.0)	108	(49)	FPS747R11XS	FPS747R11XW	C/F	C/F
	480	45.0	3	5	47 7/8	(1216.0)	108	(49)	FPS747R5XS	FPS747R5XW	C4-150	C4-151
	240	63.0	3	5	64 3/8	(1635.1)	120	(55)	FPS764G3XS	FPS764G3XW	C/F	C/F
	480	63.0	1	3	64 3/8	(1635.1)	120	(55)	FPS764G11XS	FPS764G11XW	C/F	C/F
	480	63.0	3	5	64 3/8	(1635.1)	120	(55)	FPS764G5XS	FPS764G5XW	C4-152	C4-153
	240	75.0	3	5	76 7/8	(1952.4)	131	(60)	FPS776R3XS	FPS776R3XW	C/F	C/F
	480	75.0	1	5	76 7/8	(1952.4)	131	(60)	FPS776R11XS	FPS776R11XW	C/F	C/F
	480	75.0	3	5	76 7/8	(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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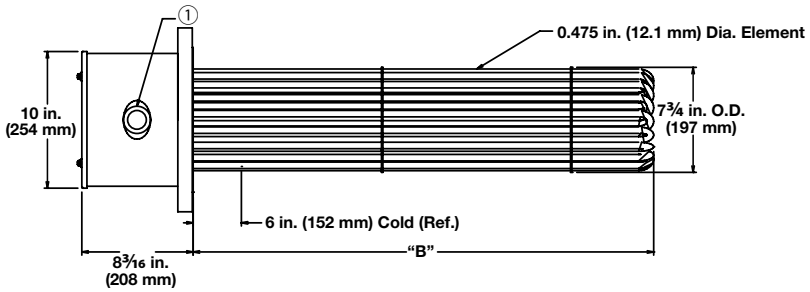
WATROD ANSI Flange Immersion Heaters

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.**

General Purpose or NEMA 4 Enclosure



Description	Volts	kW	Ph	# Circ.	"B" Dim. in.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
23 W/in² Steel Flange 18-Steel Elements (3.6 W/cm²)	240	30.0	1	3	32 3/4	(832.0)	130	(59)	FRS732N10S	FRS732N10W	C/F	C/F
	240	30.0	3	2	32 3/4	(832.0)	130	(59)	FRS732N3S	FRS732N3W	C2-218	C2-224
	480	30.0	1	2	32 3/4	(832.0)	130	(59)	FRS732N11S	FRS732N11W	C/F	C/F
	480	30.0	3	1	32 3/4	(832.0)	130	(59)	FRS732N5S	FRS732N5W	C2-225	C2-226
	240	40.0	3	3	43 1/4	(1099.0)	132	(60)	FRS743E3S	FRS743E3W	C4-144	C4-145
	480	40.0	1	2	43 1/4	(1099.0)	132	(60)	FRS743E11S	FRS743E11W	C/F	C/F
	480	40.0	3	2	43 1/4	(1099.0)	132	(60)	FRS743E5S	FRS743E5W	C2-227	C2-228
	240	50.0	3	3	51 11/16	(1312.9)	137	(63)	FRS751M3S	FRS751M3W	C4-144	C4-145
	480	50.0	1	3	51 11/16	(1312.9)	137	(63)	FRS751M11S	FRS751M11W	C/F	C/F
	480	50.0	3	2	51 11/16	(1312.9)	137	(63)	FRS751M5S	FRS751M5W	C2-229	C2-230
	240	60.0	3	6	62 3/16	(1579.6)	154	(70)	FRS762D3S	FRS762D3W	C4-144	C4-145
	480	60.0	1	3	62 3/16	(1579.6)	154	(70)	FRS762D11S	FRS762D11W	C/F	C/F
	480	60.0	3	2	62 3/16	(1579.6)	154	(70)	FRS762D5S	FRS762D5W	C2-229	C2-230
	240	70.0	3	6	70 11/16	(1795.5)	160	(73)	FRS770M3S	FRS770M3W	C/F	C/F
	480	70.0	1	6	70 11/16	(1795.5)	160	(73)	FRS770M11S	FRS770M11W	C/F	C/F
	480	70.0	3	2	70 11/16	(1795.5)	160	(73)	FRS770M5S	FRS770M5W	C2-229	C2-230
	240	80.0	3	6	79 11/16	(2024.1)	172	(78)	FRS779M3S	FRS779M3W	C/F	C/F
	480	80.0	3	3	79 11/16	(2024.1)	172	(78)	FRS779M5S	FRS779M5W	C4-152	C4-153
23 W/in² Steel Flange 24-Steel Elements (3.6 W/cm²)	240	40.0	1	4	33 3/16	(843.0)	142	(65)	FRS733D10XS	FRS733D10XW	C/F	C/F
	240	40.0	3	4	33 3/16	(843.0)	142	(65)	FRS733D3XS	FRS733D3XW	C4-146	C4-147
	480	40.0	1	2	33 3/16	(843.0)	142	(65)	FRS733D11XS	FRS733D11XW	C/F	C/F
	480	40.0	3	2	33 3/16	(843.0)	142	(65)	FRS733D5XS	FRS733D5XW	C2-227	C2-228
	240	53.0	3	4	43 11/16	(1109.7)	147	(67)	FRS743M3XS	FRS743M3XW	C4-148	C4-149
	480	53.0	1	3	43 11/16	(1109.7)	147	(67)	FRS743M11XS	FRS743M11XW	C/F	C/F
	480	53.0	3	2	43 11/16	(1109.7)	147	(67)	FRS743M5XS	FRS743M5XW	C2-229	C2-230
	240	67.0	3	4	51 11/16	(1312.9)	154	(70)	FRS751M3XS	FRS751M3XW	C4-148	C4-149
	480	67.0	1	3	51 11/16	(1312.9)	154	(70)	FRS751M11XS	FRS751M11XW	C/F	C/F
	480	67.0	3	2	51 11/16	(1312.9)	154	(70)	FRS751M5XS	FRS751M5XW	C2-229	C2-230
	240	80.0	3	8	62 3/16	(1579.6)	166	(76)	FRS762D3XS	FRS762D3XW	C4-148	C4-149
	480	80.0	1	4	62 3/16	(1579.6)	166	(76)	FRS762D11XS	FRS762D11XW	C/F	C/F
	480	80.0	3	4	62 3/16	(1579.6)	166	(76)	FRS762D5XS	FRS762D5XW	C4-154	C4-155
	240	93.0	3	8	70 11/16	(1795.5)	175	(80)	FRS770M3XS	FRS770M3XW	C/F	C/F
	480	93.0	1	6	70 11/16	(1795.5)	175	(80)	FRS770M11XS	FRS770M11XW	C/F	C/F
	480	93.0	3	4	70 11/16	(1795.5)	175	(80)	FRS770M5XS	FRS770M5XW	C4-156	C4-157
	240	107.0	3	8	79 11/16	(2024.1)	181	(82)	FRS779M3XS	FRS779M3XW	C/F	C/F
	480	107.0	3	4	79 11/16	(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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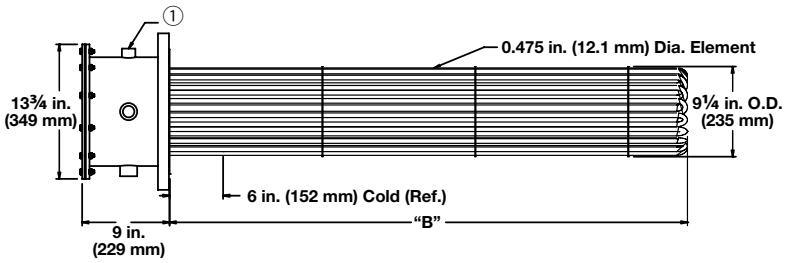
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
23 W/in² Steel Flange 27-Steel Elements (3.6 W/cm²)	240	45.0	3	3	33 1/4	(845)	165	(75)	**FSS733E3S**	**FSS733E3W**	**C4-144**	**C4-145**
	480	45.0	3	3	33 1/4	(845)	165	(75)	**FSS733E5S**	**FSS733E5W**	**C4-150**	**C4-151**
	240	60.0	3	3	43 3/4	(1111)	195	(89)	**FSS743N3S**	**FSS743N3W**	**C4-144**	**C4-145**
	480	60.0	3	3	43 3/4	(1111)	195	(89)	**FSS743N5S**	**FSS743N5W**	**C4-150**	**C4-151**
	240	75.0	3	9	51 3/4	(1314)	230	(105)	**FSS751N3S**	**FSS751N3W**	**C/F**	**C/F**
	480	75.0	3	3	51 3/4	(1314)	230	(105)	**FSS751N5S**	**FSS751N5W**	**C4-152**	**C4-153**
	480	90.0	3	3	62 1/4	(1581)	250	(114)	**FSS762E5S**	**FSS762E5W**	**C4-152**	**C4-153**
	480	105.0	3	3	70 3/4	(1797)	258	(117)	**FSS770N5S**	**FSS770N5W**	**C4-152**	**C4-153**
	480	120.0	3	3	78 3/4	(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

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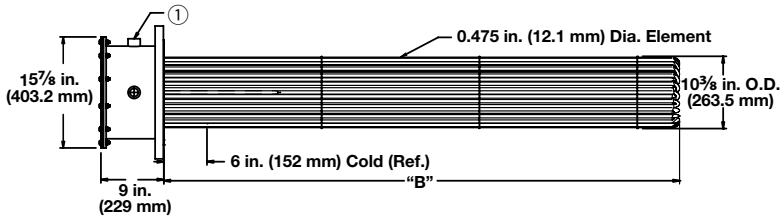
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WATROD ANSI Flange Immersion Heaters

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/in² Steel Flange 36-Steel Elements (3.6 W/cm²)	480	60.0	3	3	33⅛ (841.4)	205 (93)	**FTS733C5S**	**FTS733C5W**	**C4-150**	**C4-151**
	480	80.0	3	3	43⅝ (1108.1)	240 (109)	**FTS743L5S**	**FTS743L5W**	**C4-152**	**C4-153**
	480	100.0	3	3	51⅝ (1311.3)	280 (127)	**FTS751L5S**	**FTS751L5W**	**C4-152**	**C4-153**
	480	120.0	3	3	62⅛ (1578.0)	285 (130)	**FTS762C5S**	**FTS762C5W**	**C4-152**	**C4-153**
	480	140.0	3	4	70⅝ (1793.9)	290 (132)	**FTS770L5S**	**FTS770L5W**	**C4-156**	**C4-157**
	480	160.0	3	4	78⅝ (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

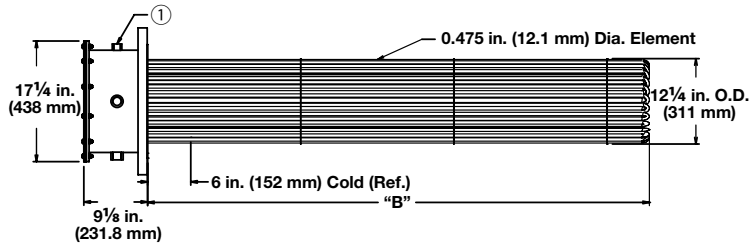
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WATROD ANSI Flange Immersion Heaters

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/in² Steel Flange 45-Steel Elements (3.6 W/cm²)	480	75.0	3	3	33	(838)	225	(102)	**FWS733A5S**	**FWS733A5W**	**C4-152**	**C4-153**
	480	100.0	3	3	43½	(1105)	255	(116)	**FWS743J5S**	**FWS743J5W**	**C4-152**	**C4-153**
	480	125.0	3	5	51½	(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	70½	(1791)	318	(145)	**FWS770J5S**	**FWS770J5W**	**C/F**	**C/F**
	480	200.0	3	5	78½	(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

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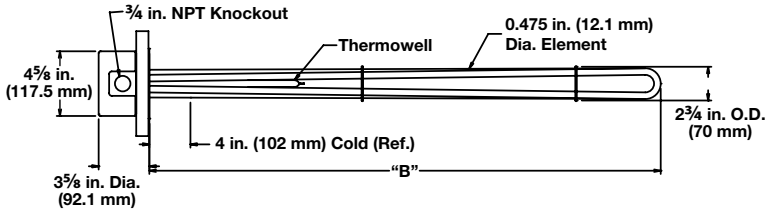
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WATROD ANSI Flange Immersion Heaters

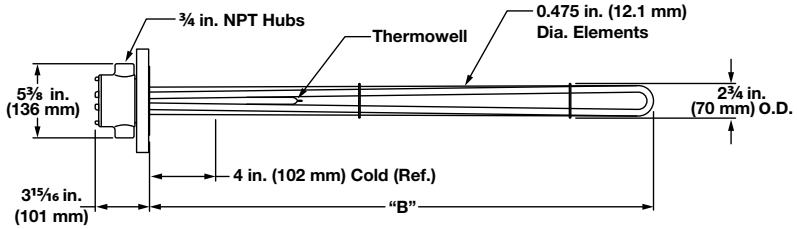
Application: Medium Weight Oils and Heat Transfer Oils

- 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	Part Number	WATCONNECT Part Number	
						General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 W/in² ③ Steel Flange 3-Alloy 800 Elements (2.5 W/cm²)	240	1.5	3	13½ (343)	22 (10)	**FMN713J12S**	**FMN713J12W**	**C2-50**	**C2-92**
	480	1.5	3	13½ (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	20½ (521)	25 (12)	**FMN720J12S**	**FMN720J12W**	**C2-50**	**C2-92**
	480	2.5	3	20½ (521)	25 (12)	**FMN720J13S**	**FMN720J13W**	**C2-43**	**C2-35**
	240	3.0	3	25½ (648)	27 (13)	**FMN725J12S**	**FMN725J12W**	**C2-50**	**C2-92**
	480	3.0	3	25½ (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	40½ (1029)	30 (14)	**FMN740J12S**	**FMN740J12W**	**C2-50**	**C2-92**
	480	5.0	3	40½ (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

③ Wired for 3-phase operation only

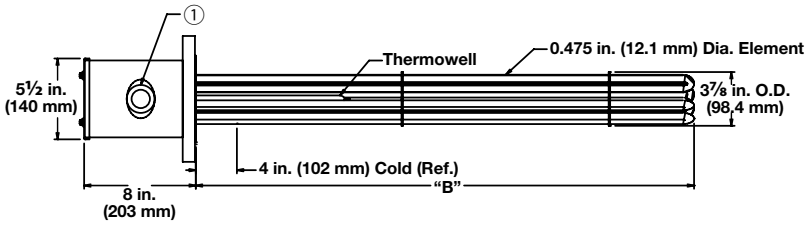
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WATROD ANSI Flange Immersion Heaters

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	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 W/in² ③ Steel Flange 6-Alloy 800 Elements (2.5 W/cm²)	240	3.0	3	1	13½ (343)	29 (14)	**FON713J12S**	**FON713J12W**	**C2-50**	**C2-92**
	480	3.0	3	1	13½ (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	20½ (521)	34 (16)	**FON720J12S**	**FON720J12W**	**C2-50**	**C2-92**
	480	5.0	3	1	20½ (521)	34 (16)	**FON720J13S**	**FON720J13W**	**C2-43**	**C2-35**
	240	6.0	3	1	25½ (648)	36 (17)	**FON725J12S**	**FON725J12W**	**C2-50**	**C2-92**
	480	6.0	3	1	25½ (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	40½ (1029)	43 (20)	**FON740J12S**	**FON740J12W**	**C2-50**	**C2-92**
	480	10.0	3	1	40½ (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

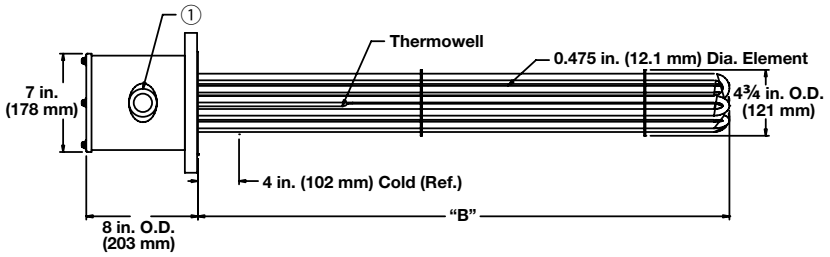
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WATROD ANSI Flange Immersion Heaters

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	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 W/in² ③ Steel Flange 6-Alloy 800 Elements (2.5 W/cm²)	240	3.0	3	1	13½ (343)	36 (17)	FNN713J12S	FNN713J12W	C2-50	C2-92
	480	3.0	3	1	13½ (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	20½ (521)	43 (20)	FNN720J12S	FNN720J12W	C2-50	C2-92
	480	5.0	3	1	20½ (521)	43 (20)	FNN720J13S	FNN720J13W	C2-43	C2-35
	240	6.0	3	1	25½ (648)	47 (22)	FNN725J12S	FNN725J12W	C2-50	C2-92
	480	6.0	3	1	25½ (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	40½ (1029)	57 (26)	FNN740J12S	FNN740J12W	C2-50	C2-92
	480	10.0	3	1	40½ (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/in² ③ Steel Flange 9-Alloy 800 Elements (2.5 W/cm²)	240	4.5	3	1	13½ (343)	39 (18)	FNN713J12XS	FNN713J12XW	C2-50	C2-92
	480	4.5	3	1	13½ (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	20½ (521)	48 (22)	FNN720J12XS	FNN720J12XW	C2-50	C2-92
	480	7.5	3	1	20½ (521)	48 (22)	FNN720J13XS	FNN720J13XW	C2-43	C2-35
	240	9.0	3	1	25½ (648)	53 (24)	FNN725J12XS	FNN725J12XW	C2-50	C2-92
	480	9.0	3	1	25½ (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	40½ (1029)	68 (31)	FNN740J12XS	FNN740J12XW	C2-236	C2-214
	480	15.0	3	1	40½ (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

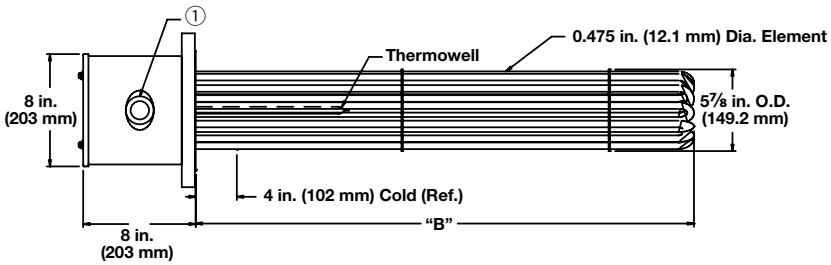
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WATROD ANSI Flange Immersion Heaters

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/in² ③ Steel Flange 12-Alloy 800 Elements (2.5 W/cm²)	240	6.0	3	1	13 3/8 (339.7)	73 (33)	**FPN713G12S**	**FPN713G12W**	**C2-50**	**C2-92**
	480	6.0	3	1	13 3/8 (339.7)	73 (33)	**FPN713G13S**	**FPN713G13W**	**C2-43**	**C2-35**
	240	8.0	3	1	17 7/8 (454.0)	75 (34)	**FPN717R12S**	**FPN717R12W**	**C2-50**	**C2-92**
	480	8.0	3	1	17 7/8 (454.0)	75 (34)	**FPN717R13S**	**FPN717R13W**	**C2-43**	**C2-35**
	240	10.0	3	1	20 3/8 (517.5)	78 (36)	**FPN720G12S**	**FPN720G12W**	**C2-50**	**C2-92**
	480	10.0	3	1	20 3/8 (517.5)	78 (36)	**FPN720G13S**	**FPN720G13W**	**C2-43**	**C2-35**
	240	12.0	3	1	25 3/8 (644.5)	81 (37)	**FPN725G12S**	**FPN725G12W**	**C2-236**	**C2-214**
	480	12.0	3	1	25 3/8 (644.5)	81 (37)	**FPN725G13S**	**FPN725G13W**	**C2-43**	**C2-35**
	240	16.0	3	1	32 7/8 (835.0)	85 (39)	**FPN732R12S**	**FPN732R12W**	**C2-236**	**C2-214**
	480	16.0	3	1	32 7/8 (835.0)	85 (39)	**FPN732R13S**	**FPN732R13W**	**C2-43**	**C2-35**
	240	20.0	3	2	40 3/8 (1025.5)	92 (42)	**FPN740G12S**	**FPN740G12W**	**C2-219**	**C2-220**
	480	20.0	3	1	40 3/8 (1025.5)	92 (42)	**FPN740G13S**	**FPN740G13W**	**C2-43**	**C2-35**
	240	24.0	3	2	47 7/8 (1216.0)	100 (46)	**FPN747R12S**	**FPN747R12W**	**C2-219**	**C2-220**
	480	24.0	3	1	47 7/8 (1216.0)	100 (46)	**FPN747R13S**	**FPN747R13W**	**C2-225**	**C2-226**
16 W/in² ③ Steel Flange 15-Alloy 800 Elements (2.5 W/cm²)	240	7.5	3	1	13 3/8 (339.7)	76 (35)	**FPN713G12XS**	**FPN713G12XW**	**C2-50**	**C2-92**
	480	7.5	3	1	13 3/8 (339.7)	76 (35)	**FPN713G13XS**	**FPN713G13XW**	**C2-43**	**C2-35**
	240	10.0	3	1	17 7/8 (454.0)	78 (36)	**FPN717R12XS**	**FPN717R12XW**	**C2-50**	**C2-92**
	480	10.0	3	1	17 7/8 (454.0)	78 (36)	**FPN717R13XS**	**FPN717R13XW**	**C2-43**	**C2-35**
	240	12.5	3	1	20 3/8 (517.5)	82 (38)	**FPN720G12XS**	**FPN720G12XW**	**C2-236**	**C2-214**
	480	12.5	3	1	20 3/8 (517.5)	82 (38)	**FPN720G13XS**	**FPN720G13XW**	**C2-43**	**C2-35**
	240	15.0	3	1	25 3/8 (644.5)	85 (39)	**FPN725G12XS**	**FPN725G12XW**	**C2-236**	**C2-214**
	480	15.0	3	1	25 3/8 (644.5)	85 (39)	**FPN725G13XS**	**FPN725G13XW**	**C2-43**	**C2-35**
	240	20.0	3	5	32 7/8 (835.0)	90 (41)	**FPN732R12XS**	**FPN732R12XW**	**C4-143**	**C4-142**
	480	20.0	3	1	32 7/8 (835.0)	90 (41)	**FPN732R13XS**	**FPN732R13XW**	**C2-43**	**C2-35**
	240	25.0	3	5	40 3/8 (1025.5)	98 (45)	**FPN740G12XS**	**FPN740G12XW**	**C4-143**	**C4-142**
	480	25.0	3	1	40 3/8 (1025.5)	98 (45)	**FPN740G13XS**	**FPN740G13XW**	**C2-225**	**C2-226**
	240	30.0	3	5	47 7/8 (1216.0)	108 (49)	**FPN747R12XS**	**FPN747R12XW**	**C4-144**	**C4-145**
	480	30.0	3	1	47 7/8 (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

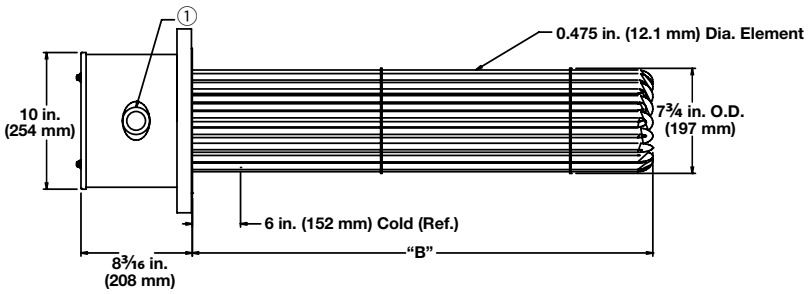
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
16 W/in² ③ Steel Flange 18-Alloy 800 Elements (2.5 W/cm²)	240	17.0	3	1	25¾	(654.0)	121	(55)	FRN725N12S	FRN725N12W	C2-236	C2-214
	480	17.0	3	1	25¾	(654.0)	121	(55)	FRN725N13S	FRN725N13W	C2-43	C2-35
	240	25.0	3	2	35¾	(908.0)	130	(59)	FRN735N12S	FRN735N12W	C2-219	C2-220
	480	25.0	3	1	35¾	(908.0)	130	(59)	FRN735N13S	FRN735N13W	C2-225	C2-226
	240	33.0	3	2	44¼	(1124.0)	132	(60)	FRN744E12S	FRN744E12W	C2-218	C2-224
	480	33.0	3	1	44¼	(1124.0)	132	(60)	FRN744E13S	FRN744E13W	C2-225	C2-226
	240	42.0	3	3	54¹⁄₁₆	(1389.1)	140	(64)	FRN754M12S	FRN754M12W	C4-144	C4-145
	480	42.0	3	2	54¹⁄₁₆	(1389.1)	140	(64)	FRN754M13S	FRN754M13W	C2-229	C2-230
	480	50.0	3	2	63¹⁄₁₆	(1617.6)	145	(66)	FRN763M13S	FRN763M13W	C2-229	C2-230
	480	58.0	3	2	73⅜	(1859.0)	151	(69)	FRN773D13S	FRN773D13W	C2-229	C2-230
	480	67.0	3	2	82¹⁄₁₆	(2100.3)	157	(72)	FRN782M13S	FRN782M13W	C2-229	C2-230
16 W/in² ③ Steel Flange 24-Alloy 800 Elements (2.5 W/cm²)	240	23.0	3	2	26⅜	(665.2)	129	(59)	FRN726D12XS	FRN726D12XW	C2-218	C2-224
	480	23.0	3	1	26⅜	(665.2)	129	(59)	FRN726D13XS	FRN726D13XW	C2-225	C2-226
	240	33.0	3	2	36⅜	(919.2)	142	(65)	FRN736D12XS	FRN736D12XW	C2-218	C2-224
	480	33.0	3	1	36⅜	(919.2)	142	(65)	FRN736D13XS	FRN736D13XW	C2-225	C2-226
	240	44.0	3	4	44¹⁄₁₆	(1135.1)	147	(67)	FRN744M12XS	FRN744M12XW	C4-148	C4-149
	480	44.0	3	2	44¹⁄₁₆	(1135.1)	147	(67)	FRN744M13XS	FRN744M13XW	C2-229	C2-230
	240	56.0	3	4	54¹⁄₁₆	(1389.1)	158	(72)	FRN754M12XS	FRN754M12XW	C4-148	C4-149
	480	56.0	3	2	54¹⁄₁₆	(1389.1)	158	(72)	FRN754M13XS	FRN754M13XW	C2-229	C2-230
	480	67.0	3	2	63¹⁄₁₆	(1617.6)	166	(76)	FRN763M13XS	FRN763M13XW	C2-229	C2-230
	480	77.0	3	2	73⅜	(1859.0)	175	(80)	FRN773D13XS	FRN773D13XW	C2-229	C2-230
	480	89.0	3	4	82¹⁄₁₆	(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

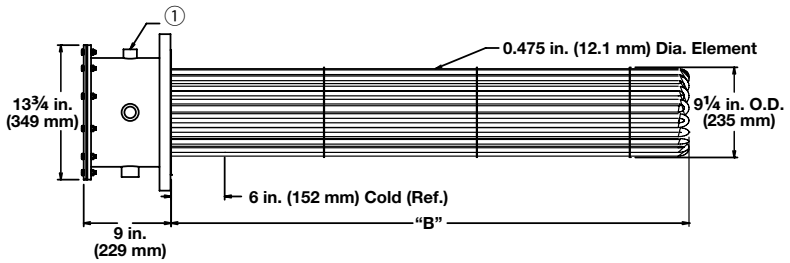
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WATROD ANSI Flange Immersion Heaters

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/in² ③ Steel Flange 27-Alloy 800 Elements (2.5 W/cm²)	480	63.0	3	3	54 3/4 (1391)	240 (109)	**FSN754N13S**	**FSN754N13W**	**C4-152**	**C4-153**
	480	75.0	3	3	63 3/4 (1619)	250 (114)	**FSN763N13S**	**FSN763N13W**	**C4-152**	**C4-153**
	480	87.0	3	3	73 1/4 (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

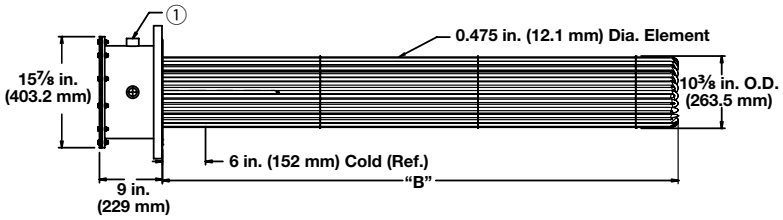
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WATROD ANSI Flange Immersion Heaters

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	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 W/in² ③ Steel Flange 36-Alloy 800 Elements (2.5 W/cm²)	480	83.0	3	3	54⅝ (1387.5)	280 (127)	**FTN754L13S**	**FTN754L13W**	**C4-152**	**C4-153**
	480	117.0	3	3	73⅛ (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

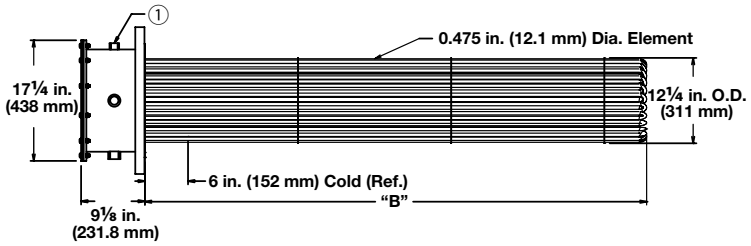
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WATROD ANSI Flange Immersion Heaters

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	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
16 Win² ③ Steel Flange 45-Alloy 800 Elements (2.5 W/cm²)	480	105.0	3	3	54½ (1384)	300 (136)	**FWN754J13S**	**FWN754J13W**	**C4-152**	**C4-153**
	480	125.0	3	5	63½ (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

③ Wired for 3-phase operation only

C/F - Contact factory, go to www.watlow.com/en/contact-us

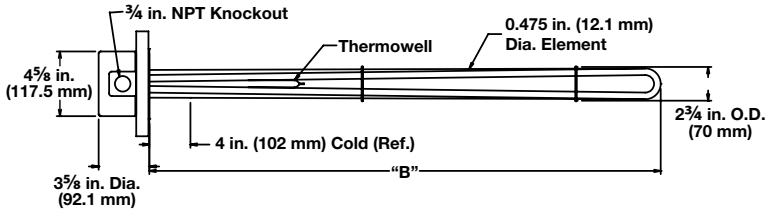
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WATROD ANSI Flange Immersion Heaters

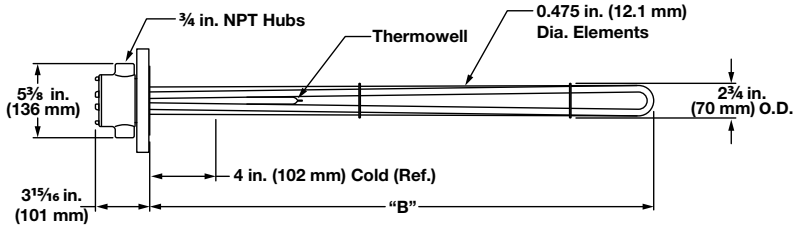
Application: Bunker C, Asphalt and #6 Fuel Oil

- 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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
8 W/in² ③ Steel Flange 3-Steel Elements (1.3 W/cm²)	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	64½	(1638)	37	(17)	FMS764J12S	FMS764J12W	C2-50	C2-92
	480	4.0	3	64½	(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

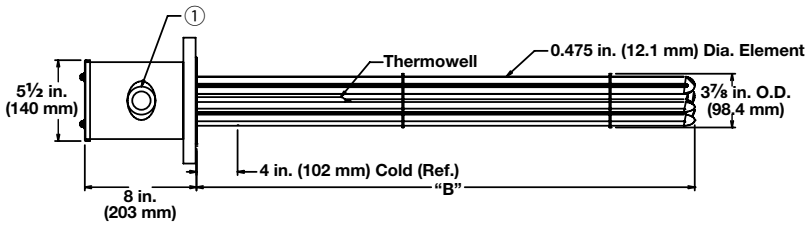
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WATROD ANSI Flange Immersion Heaters

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/in² ③ Steel Flange 6-Steel Elements (1.3 W/cm²)	240	5.0	3	1	40½ (1029)	43 (20)	**FOS740J12S**	**FOS740J12W**	**C2-50**	**C2-92**
	480	5.0	3	1	40½ (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	64½ (1638)	53 (24)	**FOS764J12S**	**FOS764J12W**	**C2-50**	**C2-92**
	480	8.0	3	1	64½ (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

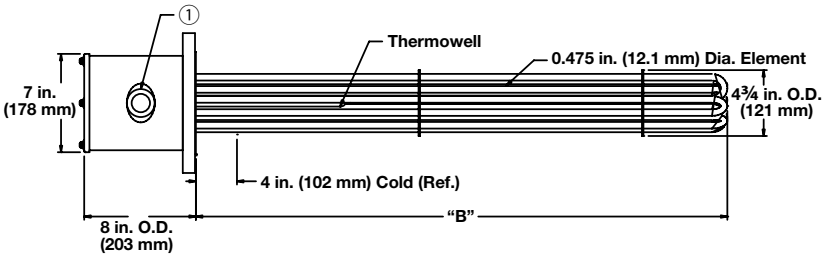
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
8 W/in² ③ Steel Flange 6-Steel Elements (1.3 W/cm²)	240	5.0	3	1	40½	(1029)	47	(22)	**FNS740J12S**	**FNS740J12W**	**C2-50**	**C2-92**
	480	5.0	3	1	40½	(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	64½	(1638)	57	(26)	**FNS764J12S**	**FNS764J12W**	**C2-50**	**C2-92**
	480	8.0	3	1	64½	(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/in² ③ Steel Flange 9-Steel Elements (1.3 W/cm²)	240	7.5	3	1	40½	(1029)	53	(24)	**FNS740J12XS**	**FNS740J12XW**	**C2-50**	**C2-92**
	480	7.5	3	1	40½	(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	64½	(1638)	68	(31)	**FNS764J12XS**	**FNS764J12XW**	**C2-236**	**C2-214**
	480	12.0	3	1	64½	(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

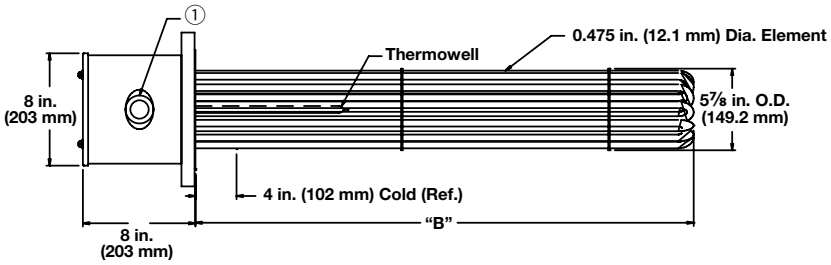
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WATROD ANSI Flange Immersion Heaters

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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
8 W/in² ③ Steel Flange 12-Steel Elements (1.3 W/cm²)	240	8.0	3	1	32 7/8	(835.0)	85	(39)	FPS732R12S	FPS732R12W	C2-50	C2-92
	480	8.0	3	1	32 7/8	(835.0)	85	(39)	FPS732R13S	FPS732R13W	C2-43	C2-35
	240	10.0	3	1	40 3/8	(1025.5)	92	(42)	FPS740G12S	FPS740G12W	C2-50	C2-92
	480	10.0	3	1	40 3/8	(1025.5)	92	(42)	FPS740G13S	FPS740G13W	C2-43	C2-35
	240	12.0	3	1	47 7/8	(1216.0)	100	(46)	FPS747R12S	FPS747R12W	C2-236	C2-214
	480	12.0	3	1	47 7/8	(1216.0)	100	(46)	FPS747R13S	FPS747R13W	C2-43	C2-35
	240	16.5	3	1	64 3/8	(1635.1)	110	(50)	FPS764G12S	FPS764G12W	C2-236	C2-214
	480	16.5	3	1	64 3/8	(1635.1)	110	(50)	FPS764G13S	FPS764G13W	C2-43	C2-35
	240	20.0	3	2	76 7/8	(1952.4)	118	(54)	FPS776R12S	FPS776R12W	C2-236	C2-214
	480	20.0	3	1	76 7/8	(1952.4)	118	(54)	FPS776R13S	FPS776R13W	C2-43	C2-35
8 W/in² ③ Steel Flange 15-Steel Elements (1.3 W/cm²)	240	10.0	3	1	32 7/8	(835.0)	90	(41)	FPS732R12XS	FPS732R12XW	C2-50	C2-92
	480	10.0	3	1	32 7/8	(835.0)	90	(41)	FPS732R13XS	FPS732R13XW	C2-43	C2-35
	240	12.5	3	1	40 3/8	(1025.5)	98	(45)	FPS740G12XS	FPS740G12XW	C2-236	C2-214
	480	12.5	3	1	40 3/8	(1025.5)	98	(45)	FPS740G13XS	FPS740G13XW	C2-43	C2-35
	240	15.0	3	1	47 7/8	(1216.0)	108	(49)	FPS747R12XS	FPS747R12XW	C2-236	C2-214
	480	15.0	3	1	47 7/8	(1216.0)	108	(49)	FPS747R13XS	FPS747R13XW	C2-43	C2-35
	240	21.0	3	5	64 3/8	(1635.1)	120	(55)	FPS764G12XS	FPS764G12XW	C4-143	C4-142
	480	21.0	3	1	64 3/8	(1635.1)	120	(55)	FPS764G13XS	FPS764G13XW	C2-225	C2-226
	240	25.0	3	5	76 7/8	(1952.4)	131	(60)	FPS776R12XS	FPS776R12XW	C4-143	C4-142
	480	25.0	3	1	76 7/8	(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

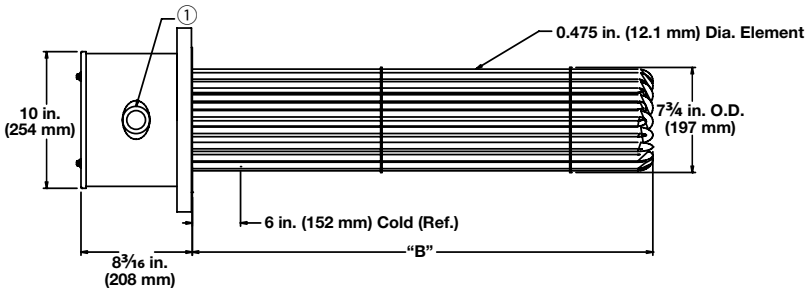
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WATROD ANSI Flange Immersion Heaters

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/in² ③ Steel Flange 18-Steel Elements (1.3 W/cm²)	240	12.5	3	1	43¼ (1099.0)	132 (60)	FRS743E12S	FRS743E12W	C2-236	C2-214
	480	12.5	3	1	43¼ (1099.0)	132 (60)	FRS743E13S	FRS743E13W	C2-43	C2-35
	240	16.5	3	1	51¹¹⁄₁₆ (1312.9)	137 (63)	FRS751M12S	FRS751M12W	C2-236	C2-214
	480	16.5	3	1	51¹¹⁄₁₆ (1312.9)	137 (63)	FRS751M13S	FRS751M13W	C2-43	C2-35
	240	20.0	3	2	62³⁄₁₆ (1579.6)	154 (70)	FRS762D12S	FRS762D12W	C2-219	C2-220
	480	20.0	3	1	62³⁄₁₆ (1579.6)	154 (70)	FRS762D13S	FRS762D13W	C2-43	C2-50
	240	24.0	3	2	70¹¹⁄₁₆ (1795.5)	160 (73)	FRS770M12S	FRS770M12W	C2-218	C2-224
	480	24.0	3	1	70¹¹⁄₁₆ (1795.5)	160 (73)	FRS770M13S	FRS770M13W	C2-225	C2-226
	240	27.0	3	2	79¹¹⁄₁₆ (2024.1)	172 (78)	FRS779M12S	FRS779M12W	C2-218	C2-224
	480	27.0	3	1	79¹¹⁄₁₆ (2024.1)	172 (78)	FRS779M13S	FRS779M13W	C2-225	C2-226
8 W/in² ③ Steel Flange 24-Steel Elements (1.3 W/cm²)	240	17.0	3	1	43¹¹⁄₁₆ (1109.7)	147 (67)	FRS743M12XS	FRS743M12XW	C2-236	C2-214
	480	17.0	3	1	43¹¹⁄₁₆ (1109.7)	147 (67)	FRS743M13XS	FRS743M13XW	C2-43	C2-35
	240	22.0	3	2	51¹¹⁄₁₆ (1312.9)	154 (70)	FRS751M12XS	FRS751M12XW	C2-218	C2-224
	480	22.0	3	1	51¹¹⁄₁₆ (1312.9)	154 (70)	FRS751M13XS	FRS751M13XW	C2-225	C2-226
	240	27.0	3	2	62³⁄₁₆ (1579.6)	166 (76)	FRS762D12XS	FRS762D12XW	C2-218	C2-224
	480	27.0	3	1	62³⁄₁₆ (1579.6)	166 (76)	FRS762D13XS	FRS762D13XW	C2-225	C2-226
	240	32.0	3	2	70¹¹⁄₁₆ (1795.5)	175 (80)	FRS770M12XS	FRS770M12XW	C2-218	C2-224
	480	32.0	3	1	70¹¹⁄₁₆ (1795.5)	175 (80)	FRS770M13XS	FRS770M13XW	C2-225	C2-226
	240	36.0	3	2	79¹¹⁄₁₆ (2024.1)	181 (82)	FRS779M12XS	FRS779M12XW	C2-218	C2-224
	480	36.0	3	1	79¹¹⁄₁₆ (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

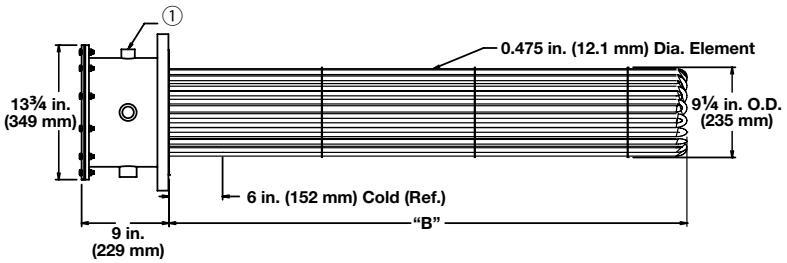
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WATROD ANSI Flange Immersion Heaters

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 General Purpose Enclosure	Part Number NEMA 4 Enclosure	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C
8 W/in² ③ Steel Flange 27-Steel Elements (1.3 W/cm²)	240	25.0	3	3	51 3/4	(1314)	230	(105)	FSS751N12S	FSS751N12W	C4-143	C4-142
	480	25.0	3	1	51 3/4	(1314)	230	(105)	FSS751N13S	FSS751N13W	C2-225	C2-226
	240	30.0	3	3	62 1/4	(1581)	250	(114)	FSS762E12S	FSS762E12W	C4-143	C4-142
	480	30.0	3	1	62 1/4	(1581)	250	(114)	FSS762E13S	FSS762E13W	C2-225	C2-226
	240	35.0	3	3	70 3/4	(1797)	258	(117)	FSS770N12S	FSS770N12W	C4-144	C4-145
	480	35.0	3	1	70 3/4	(1797)	258	(117)	FSS770N13S	FSS770N13W	C2-225	C2-226
	240	40.0	3	3	78 3/4	(2000)	265	(121)	FSS778N12S	FSS778N12W	C4-144	C4-145
	480	40.0	3	1	78 3/4	(2000)	265	(121)	FSS778N13S	FSS778N13W	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

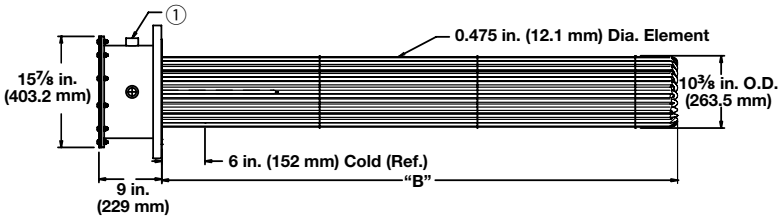
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WATROD ANSI Flange Immersion Heaters

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	Part Number	WATCONNECT Part Number	
							General Purpose Enclosure	NEMA 4 Enclosure	Type J T/C	Type K T/C
8 W/in² ③ Steel Flange 27-Steel Elements (1.3 W/cm²)	240	34.0	3	2	51⅝ (1311.3)	280 (127)	**FTS751L12S**	**FTS751L12W**	**C2-218**	**C2-224**
	480	34.0	3	1	51⅝ (1311.3)	280 (127)	**FTS751L13S**	**FTS751L13W**	**C2-225**	**C2-226**
	240	40.0	3	2	62⅛ (1578.0)	285 (130)	**FTS762C12S**	**FTS762C12W**	**C2-218**	**C2-224**
	480	40.0	3	1	62⅛ (1578.0)	285 (130)	**FTS762C13S**	**FTS762C13W**	**C2-225**	**C2-226**
	240	47.0	3	3	70⅝ (1793.9)	290 (132)	**FTS770L12S**	**FTS770L12W**	**C4-144**	**C4-145**
	480	47.0	3	2	70⅝ (1793.9)	290 (132)	**FTS770L13S**	**FTS770L13W**	**C2-229**	**C2-230**
	240	54.0	3	3	78⅝ (1997.1)	300 (136)	**FTS778L12S**	**FTS778L12W**	**C4-144**	**C4-145**
	480	54.0	3	2	78⅝ (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

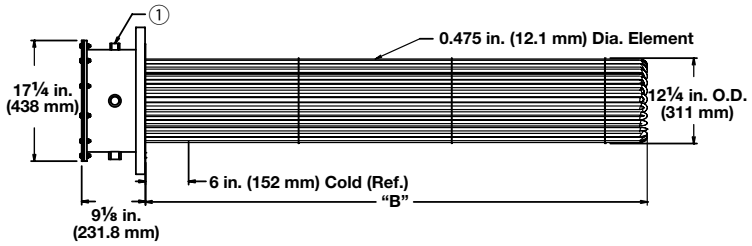
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WATROD ANSI Flange Immersion Heaters

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/in² ③ Steel Flange 27-Steel Elements (1.3 W/cm²)	240	42.0	3	3	51½ (1308)	300 (136)	**FWS751J12S**	**FWS751J12W**	**C4-144**	**C4-145**
	480	42.0	3	3	51½ (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	70½ (1791)	318 (145)	**FWS770J12S**	**FWS770J12W**	**C4-144**	**C4-145**
	480	60.0	3	3	70½ (1791)	318 (145)	**FWS770J13S**	**FWS770J13W**	**C4-150**	**C4-151**
	240	67.0	3	5	78½ (1994)	330 (150)	**FWS778J12S**	**FWS778J12W**	**C/F**	**C/F**
	480	67.0	3	3	78½ (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

③ Wired for 3-phase operation only

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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.	

Example Part Number: FPS732R12 S 2 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.	

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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^2 (15.5 W/cm^2)
- 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 2 1/2 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

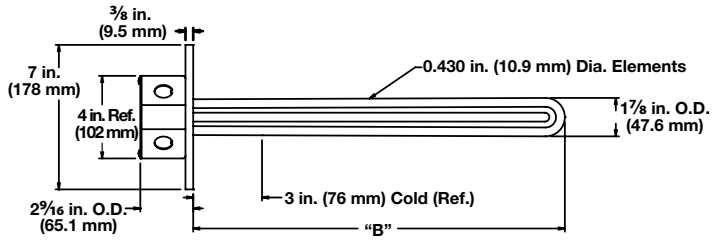
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WATROD Plate Flange Immersion Heaters

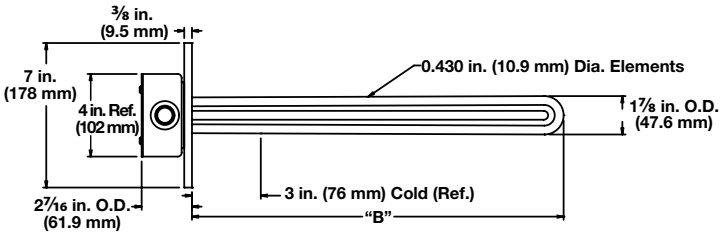
Application: Clean Water

- 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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number Moisture-Resistant Enclosure
100 W/in² Steel Flange 3-304 SS Elements (15.5 W/cm²)	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/in² Steel Flange 3-304 SS Elements (12.4 W/cm²)	240	9.0	1	1	17 3/4	(451)	22	(10)	**FLN17N10S**	**FLN17N10W**
	240	9.0	3	1	17 3/4	(451)	22	(10)	**FLN17N3S**	**FLN17N3W**
	480	9.0	1	1	17 3/4	(451)	22	(10)	**FLN17N11S**	**FLN17N11W**
	480	9.0	3	1	17 3/4	(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/in² Steel Flange 3-Alloy 800 Elements (9.3 W/cm²)	240	4.5	1	1	12 1/2	(318)	21	(10)	**FLN12J10S**	**FLN12J10W**
	240	4.5	3	1	12 1/2	(318)	21	(10)	**FLN12J3S**	**FLN12J3W**
	480	4.5	1	1	12 1/2	(318)	21	(10)	**FLN12J11S**	**FLN12J11W**
	480	4.5	3	1	12 1/2	(318)	21	(10)	**FLN12J5S**	**FLN12J5W**

Note: All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe

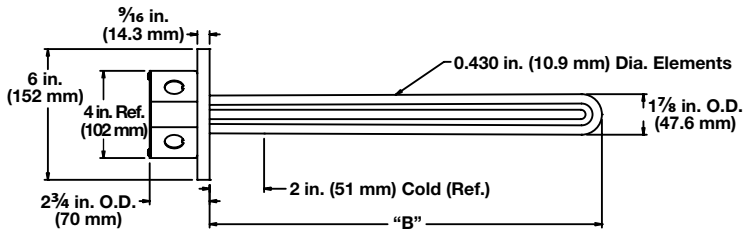
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WATROD Plate Flange Immersion Heaters

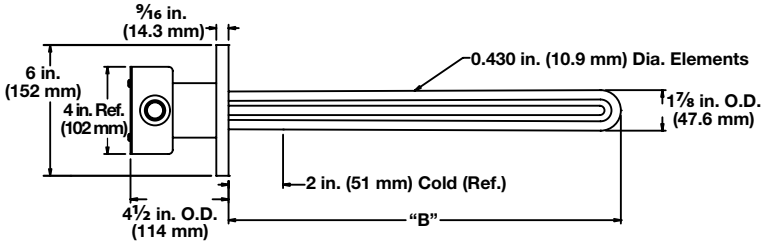
Application: Process Water

- 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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number Moisture-Resistant Enclosure
45 W/in² Steel Flange 3-Alloy 800 Elements (7 W/cm²)	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/in² Steel Flange 3-Alloy 800 Elements (7 W/cm²)	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

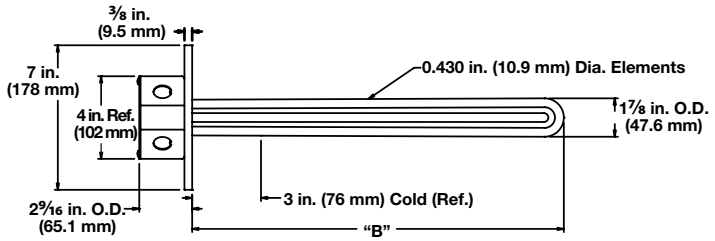
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WATROD Plate Flange Immersion Heaters

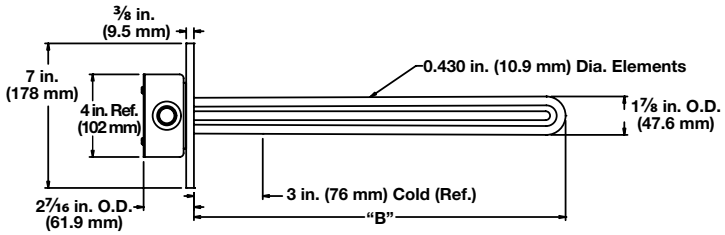
Application: Forced Air and Caustic Solutions

- 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. in.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number Moisture-Resistant Enclosure
30 W/in² Steel Flange 3-Alloy 800 Elements (4.7 W/cm²)	240	3.0	3	1	17 3/4	(451)	22	(10)	**FLN17N12S**	**FLN17N12W**
	480	3.0	3	1	17 3/4	(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

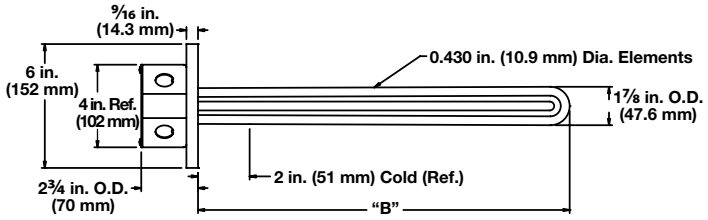
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WATROD Plate Flange Immersion Heaters

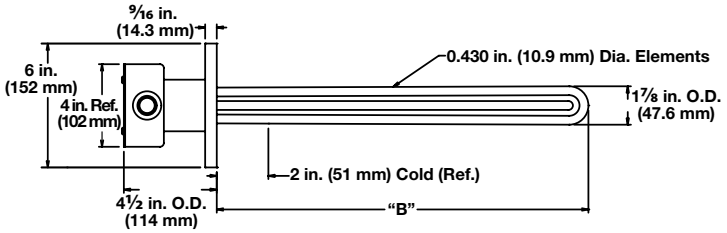
Application: Lightweight Oils and Ethylene Glycol (100%)

- 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. in.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number General Purpose Enclosure	Part Number Moisture-Resistant Enclosure
30 W/in² Steel Flange 3-Steel Elements (4.7 W/cm²)	240	6.0	1	1	29	(737)	27	(13)	**FKS29A10S**	**FKS29A10W**
	240	6.0	3	1	29	(737)	27	(13)	**FKS29A3S**	**FKS29A3W**
	480	6.0	1	1	29	(737)	27	(13)	**FKS29A11S**	**FKS29A11W**
	480	6.0	3	1	29	(737)	27	(13)	**FKS29A5S**	**FKS29A5W**

Note: All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe

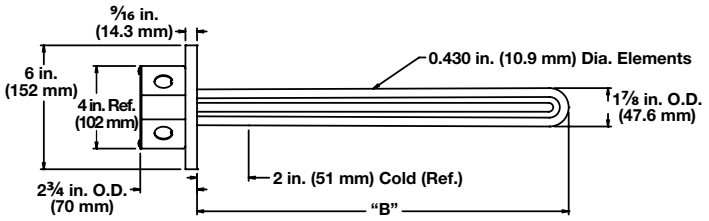
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WATROD Plate Flange Immersion Heaters

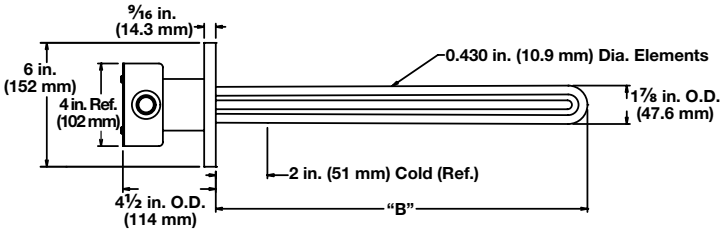
Application: Medium Weight Oils and Heat Transfer Oils

- 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.	"B" Dim. (mm)	Ship Wt. lbs	Ship Wt. (kg)	Part Number	Part Number
									General Purpose Enclosure	Moisture-Resistant Enclosure
15 W/in² Steel Flange 3-Alloy 800 Elements (2.3 W/cm²)	240	3.0	3	1	28	(711)	27	(13)	**FKN28A12S**	**FKN28A12W**
	480	3.0	3	1	28	(711)	27	(13)	**FKN28A13S**	**FKN28A13W**
10 W/in² Steel Flange 3-Steel Elements (1.6 W/cm²)	240	2.0	3	1	29	(737)	27	(13)	**FKS29A12S**	**FKS29A12W**
	480	2.0	3	1	29	(737)	27	(13)	**FKS29A13S**	**FKS29A13W**

Note: All flange bundles are designed to fit the inside diameter of the equivalent standard schedule pipe

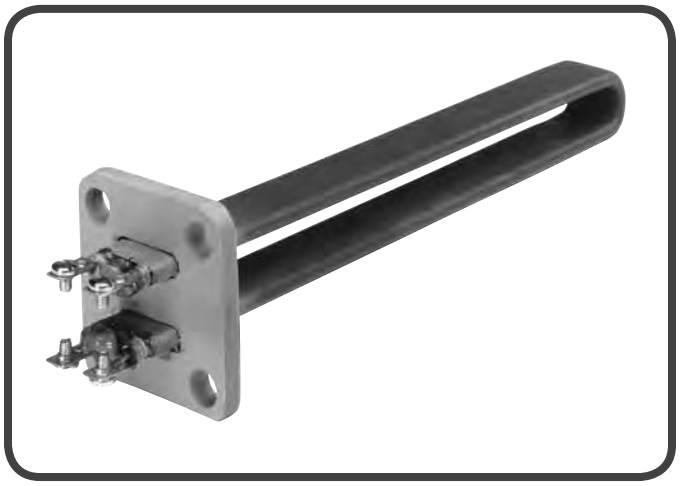
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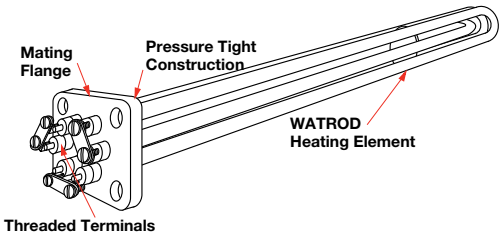
WATROD™ and FIREBAR® Square Flange Immersion Heaters

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^2 (15.5 W/cm^2)
- 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

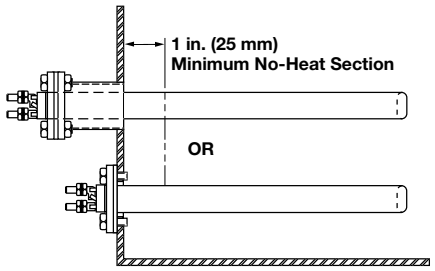
- **Sheath materials** in steel, 304 and 316 stainless steel and titanium
- **Flange materials** in titanium and 316 stainless steel
- **Flange sizes** to meet specific application needs
- **External finishes** such as passivation, belt polishing and glass beading
- **Other voltage and wattage ratings**
  Contact your Watlow representative for details

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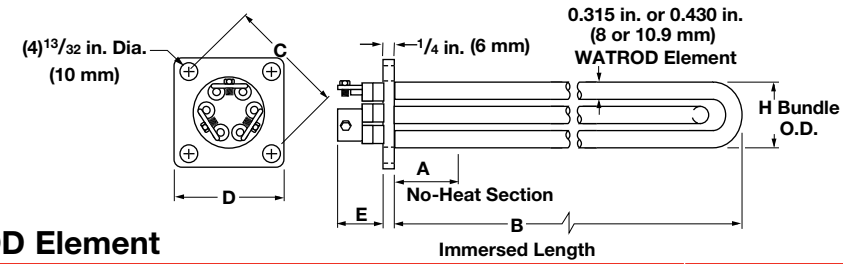
WATROD and FIREBAR Square Flange Immersion Heaters

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)



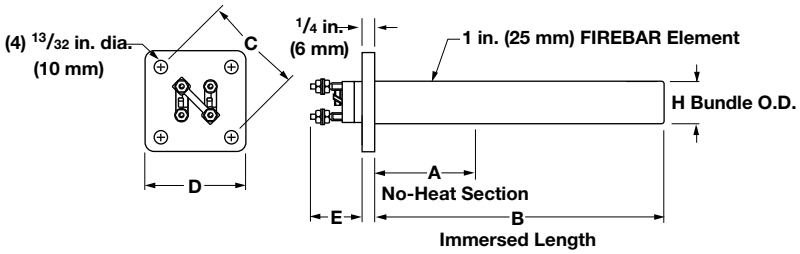
2 1/2 inch Square Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension in.	(mm)	Part Number 240VAC 1-Phase	240VAC 3-Phase	480VAC 1-Phase	480VAC 3-Phase	Est. Ship. Wt. lbs	(kg)
Applications: Clean and Potable Water									
100 W/in² Steel Flange 3-Alloy 800 (15.5 W/cm²)	8.0	11 3/4	(298.0)	**FHN11N10**	**FHN11N3**	**FHN11N11**	**FHN11N5**	18	(9)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions									
30 W/in² 304 SS Flange 3-Alloy 800 (4.7 W/cm²)	3.0	18 1/2	(470.0)	**FHN18J10**	**FHN18J3**	**FHN18J11**	**FHN18J5**	19	(9)
	3.75	23 1/16	(585.8)	**FHN23B10**	**FHN23B3**	**FHN23B11**	**FHN23B5**	20	(9)
25 W/in² 304 SS Flange 3-Alloy 800 (3.9 W/cm²)	1.5	12	(305.0)	**FHN12A10**	**FHN12A3**	**FHN12A11**	**FHN12A5**	18	(8)
Applications: Bunker C and #6 Fuel Oils									
10 W/in² 304 SS Flange 3-Alloy 800 (1.6 W/cm²)	1.0	18 1/2	(470.0)		**FHN18J12**		**FHN18J13**	19	(9)
	1.25	23 1/16	(585.8)		**FHN23B12**		**FHN23B13**	20	(9)
8 W/in² 304 SS Flange 3-Alloy 800 (1.3 W/cm²)	0.5	12	(305.0)		**FHN12A12**		**FHN12A13**	18	(8)

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WATROD and FIREBAR
Square Flange Immersion Heaters

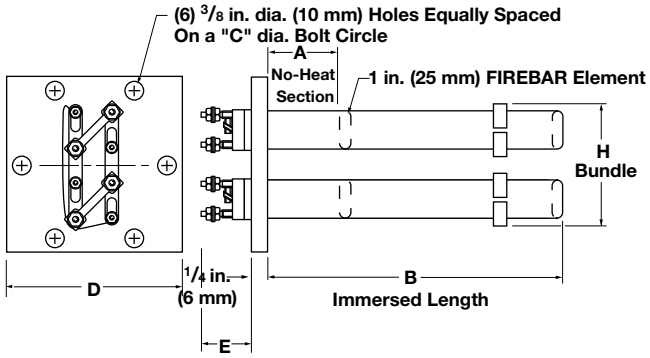
Heater Dimension	in.	(mm)
A	1 1/2	(38)
C	2 1/2	(64)
D	2 1/2	(64)
E	1 3/4	(44)
H	1 5/16	(33)



2 1/2 inch Square Flange—FIREBAR Element

FIREBAR Description	kW	Immersed B Dimension in. (mm)	Part Number 208VAC 3-Phase	240VAC 1-Phase	240VAC 3-Phase	480VAC 1-Phase	480VAC 3-Phase	Est. Ship. Wt. lbs (kg)
Applications: Clean and Potable Water								
100 W/in² Steel Flange 1-Alloy 800 (15.5 W/cm²)	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/in² Steel Flange 1-Alloy 800 (12.4 W/cm²)	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

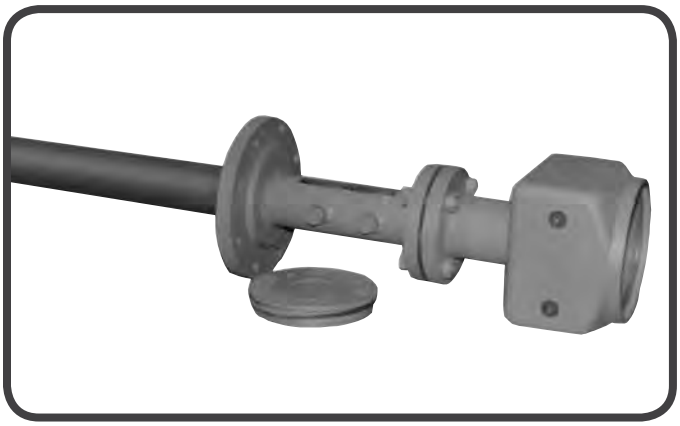
FIREBAR Description	kW	Immersed B Dimension in. (mm)	Part Number 208VAC 3-Phase	240VAC 3-Phase	480VAC 3-Phase	Est. Ship. Wt. lbs (kg)
Applications: Clean and Potable Water						
100 W/in² Steel Flange 2-Alloy 800 (15.5 W/cm²)	18	10 1/2 (267)	**FGNFB10J26N**	**FGNFB10J3N**	**FGNFB10J5N**	16 (8)
70 W/in² Steel Flange 2-Alloy 800 (10.9 W/cm²)	12	10 1/2 (267)	**FGNFB10J26P**	**FGNFB10J3P**	**FGNFB10J5P**	16 (8)

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EXTENDED CAPABILITY

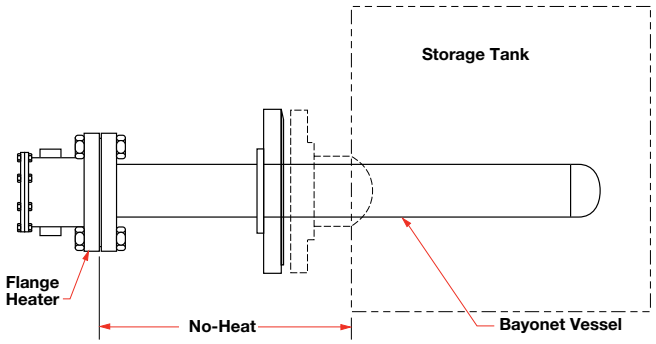
WATROD™ and FIREBAR® Flange Immersion Heaters

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

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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.

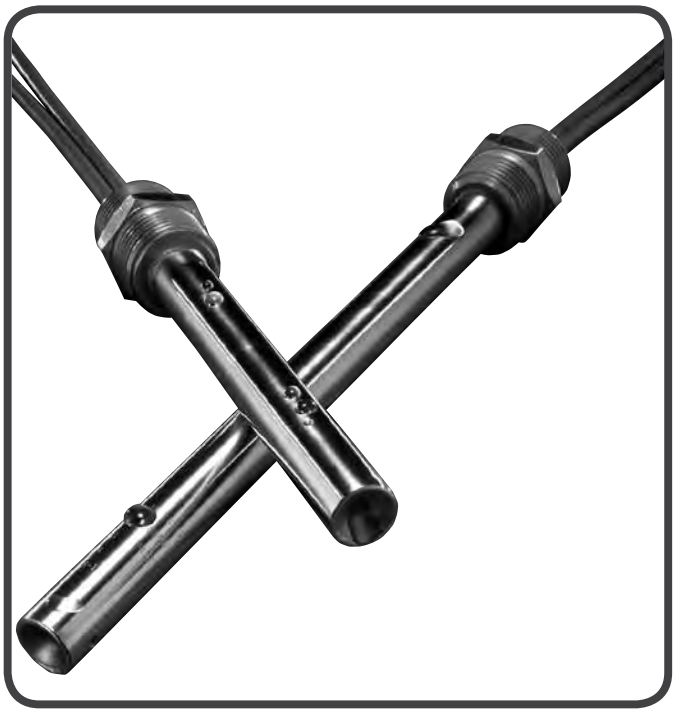
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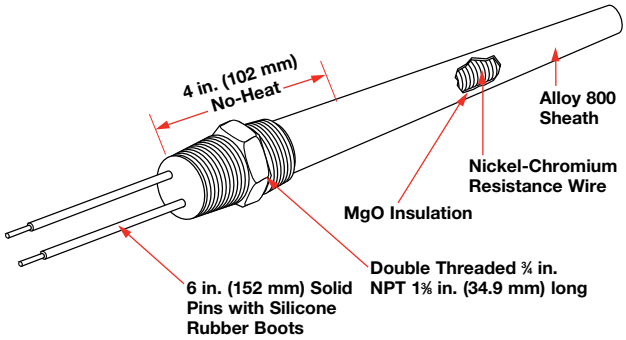
FIREROD® Immersion Heaters

FIREROD® immersion heaters are ideal to replace large screw-plug immersion heaters. Packaging up to 300 W/in^2 (46.5 W/cm^2) in a compact unit, these heaters are versatile when designed into a heating system.

FIREROD immersion heaters are complete with a stainless steel 3/4 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^2 (46.5 W/cm^2)
- 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

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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^2 is recommended. Laboratory tests show that under certain conditions, ratings as high as 700 W/in^2 are safe. For longer life at high watt densities, the FIREROD 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
Nickel Alloys																
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		
Stainless Steels																
304		0.08 ①		18-20		Bal	2 ①		8-12			1 ①				
316		0.08 ①		16-18		Bal	2 ①	2-3	10-14			1 ①				

① Maximum

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FIREROD Immersion Heaters

Heater Part Numbers With Stainless Steel Fittings

Diameter in.	Overall Length in.	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Part Number
5/8	6 1/4	(159)	120	500	127	(19.7)	0.58	(0.26)	**L6EX12B**
	6 1/4	(159)	240	500	127	(19.7)	0.58	(0.26)	**L6EX13B**
	6 1/4	(159)	120	750	191	(29.6)	0.58	(0.26)	**L6EX14B**
	6 1/4	(159)	240	750	191	(29.6)	0.58	(0.26)	**L6EX15B**
	6 1/4	(159)	120	1,000	254	(39.4)	0.58	(0.26)	**L6EX16B**
	6 1/4	(159)	240	1,000	254	(39.4)	0.58	(0.26)	**L6EX17B**
	6 3/4	(172)	240	1,500	300	(46.5)	0.60	(0.27)	**L6NX7B**
	6 3/4	(172)	480	1,500	300	(46.5)	0.60	(0.27)	**L6NX8B**
	7 3/4	(197)	240	2,000	291	(45.1)	0.66	(0.30)	**L7NX5B**
	7 3/4	(197)	480	2,000	291	(45.1)	0.66	(0.30)	**L7NX6B**
	8 1/2	(216)	240	2,500	300	(46.5)	0.68	(0.31)	**L8JX16B**
	8 1/2	(216)	480	2,500	300	(46.5)	0.68	(0.31)	**L8JX17B**
	9 1/4	(235)	240	3,000	300	(46.5)	0.72	(0.33)	**L9EX11B**
	9 1/4	(235)	480	3,000	300	(46.5)	0.72	(0.33)	**L9EX12B**
	11	(279)	240	4,000	300	(46.5)	0.80	(0.36)	**L11AX59B**
	11	(279)	480	4,000	300	(46.5)	0.80	(0.36)	**L11AX60B**
	12 3/4	(324)	240	5,000	300	(46.5)	0.89	(0.41)	**L12NX4B**
	12 3/4	(324)	480	5,000	300	(46.5)	0.89	(0.41)	**L12NX5B**
	14 1/2	(368)	240	6,000	300	(46.5)	0.95	(0.43)	**L14JX8B**
	14 1/2	(368)	480	6,000	300	(46.5)	0.95	(0.43)	**L14JX9B**
	18	(457)	240	8,000	295	(45.7)	1.14	(0.52)	**L18AX43B**
	18	(457)	480	8,000	295	(45.7)	1.14	(0.52)	**L18AX44B**
	21 1/4	(540)	240	10,000	300	(46.5)	1.30	(0.59)	**L21EX1B**
	21 1/4	(540)	480	10,000	300	(46.5)	1.30	(0.59)	**L21EX2B**
	24 3/4	(629)	480	12,000	300	(46.5)	1.50	(0.68)	**L24NX1B**
	29 3/4	(756)	480	15,000	300	(46.5)	1.80	(0.82)	**L29NX5B**
	35	(889)	480	18,000	300	(46.5)	2.00	(0.91)	**L35AX5B**

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Circulation Heaters

Circulation Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
HYDROSAFE® Heat Exchanger	316/316L stainless steel, Inconel® 625, super duplex 2507 stainless steel	572	300	N/A	N/A	299
STARFLOW™	316L stainless steel	1000	537	30	4.6	303
WATROD™ and FIREBAR®	Alloy 800/840	1600	870	120	18.6	305
	Stainless steel	1200	650	120	18.6	
	Steel	750	400	120	18.6	
	Alloy 800	350	175	120	18.6	
Booster Heaters	Alloy 800	350	175	60	9.3	360
	Steel	750	400	23	3.6	
Engine Preheaters	Alloy 800	1600	870	90	13.9	362
FLUENT® In-line	444 stainless steel (substrate tube), 316L stainless steel (baffle and fitings)	212 (in water)	100	450	70	365



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HYDROSAFE® Heat Exchanger

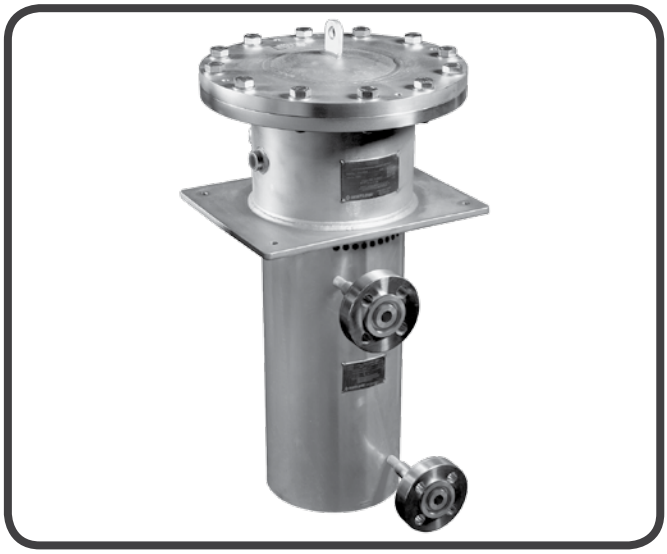
HYDROSAFE®, Watlow's indirect electric heat exchanger for dry gas seal applications, has been designed as a standardized thermal solution that minimizes custom engineering requirements because it can be adapted to a variety of conditions. The HYDROSAFE provides very flexible heating capabilities (12 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

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HYDROSAFE Heat Exchanger

Heater Assembly Specifications

HYDROSAFE Assembly	Standard Offering	Standard Options	Other Available Options
Base Construction	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
Electrical			
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)		
Flow Coil			
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		
Inlet/Outlet			
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	—
Enclosure			
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		

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HYDROSAFE Heat Exchanger

Heater Assembly Specifications *(Continued)*

HYDROSAFE Assembly	Standard Offering	Standard Options	Other Available Options
Sensors			
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)
Testing			
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
Other Options			
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

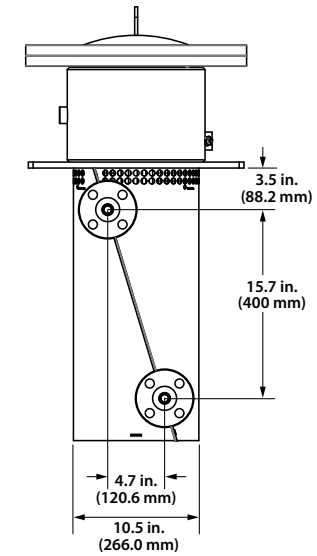
Media type
- Liquid or gas

Media
- Methane, natural gas (methane, butane, propane, ethane and water vapor) and nitrogen

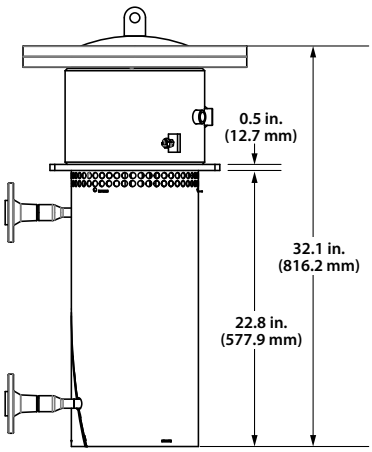
Environment T code rating
- None, T2, T3 or T4

Dimensional Drawings

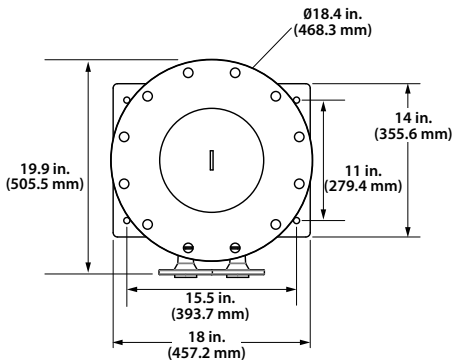
Front View



Side View



Top View



Note: Dimensions shown are approximate. Configuration GA drawing available with order or quote.

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HYDROSAFE Heat Exchanger

Ordering Information

Part Number

①	② Gen. Size & Power	③ Input Voltage/ Phase	④ In/ Out & Gasket	⑤ Connect & Coil Material	⑥ Temperature Sensors	⑦ Assembly Cert. & Encl. Matl.	⑧ Design & Fab.	⑨ Power & Sensor Connections	⑩ Elec. Encl. Htr.	⑪ Testing Options	⑫ Material C.O.O.	⑬ ⑭ ⑮ 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. Cl 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. Cl 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 =	Cl 1, Div. 1 & 2, Groups B, C & D; 304 SS, Type 4X
2 =	Cl 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

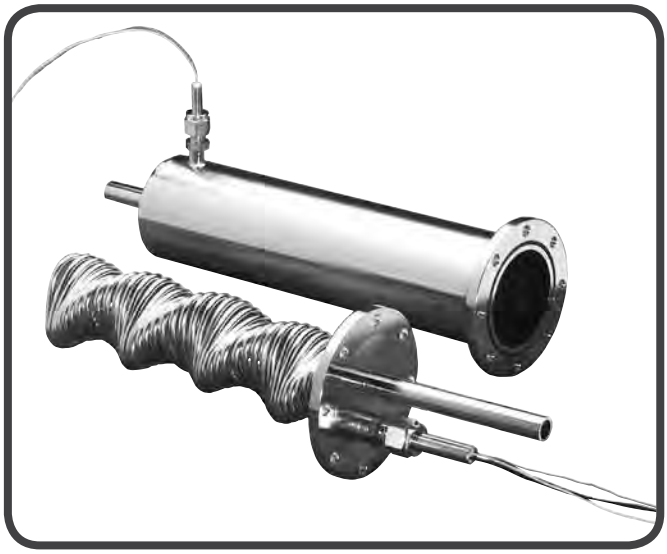
⑬ ⑭ ⑮	Custom Options
AAA =	Standard

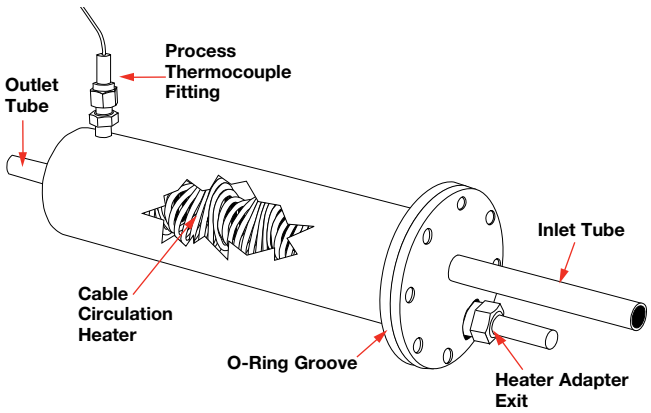
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STARFLOW™ Heaters

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^2 (4.7 W/cm^2)
- 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

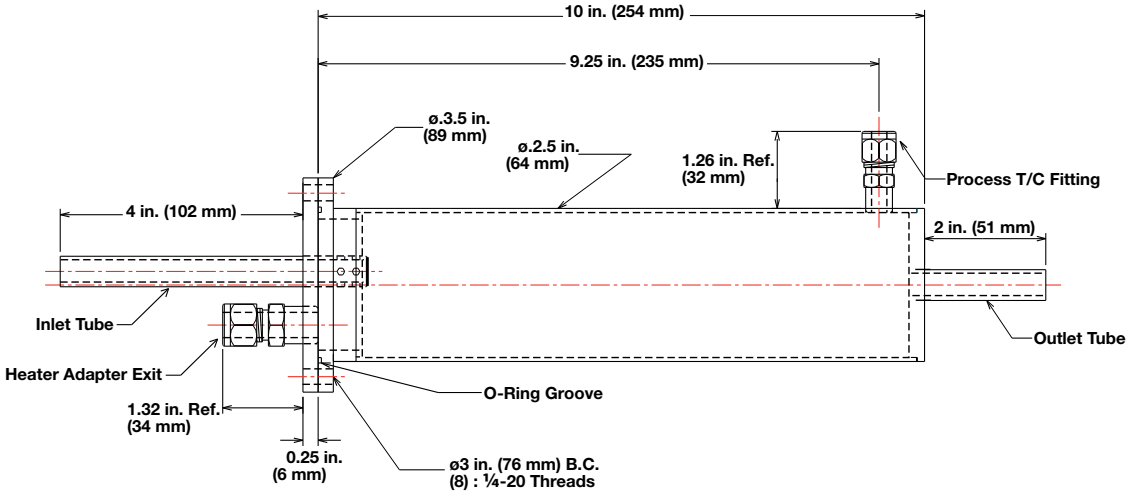
Shipment from stock
- Reduces downtime

Typical Applications

- Semiconductor processing
- Curing and drying
- Electronics
- Heat shrinking
- Thermoforming/sealing

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STARFLOW Heaters



Ordering Information

Part Number

①	②	③ ④ Type of Inlet	⑤ ⑥ Type of Outlet	⑦ ⑧ ⑨ ⑩ Heater Wattage	⑪ Internal T/C Calibration (Heater)	⑫ Surface Finish of Assembly and Heater	⑬ Process T/C Calibration (Assembly)	⑭ O-Ring Material
C	H							

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)

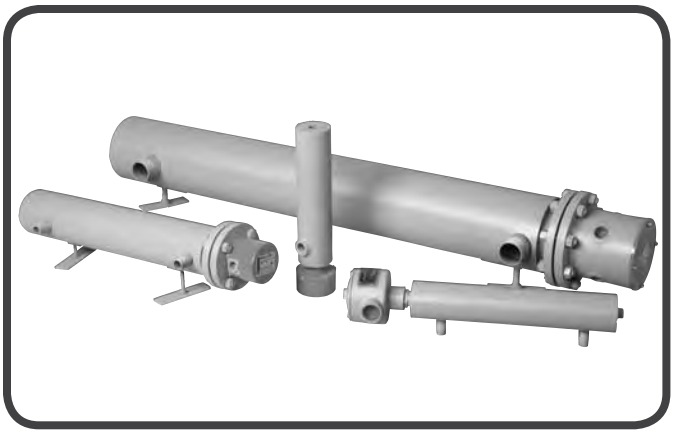
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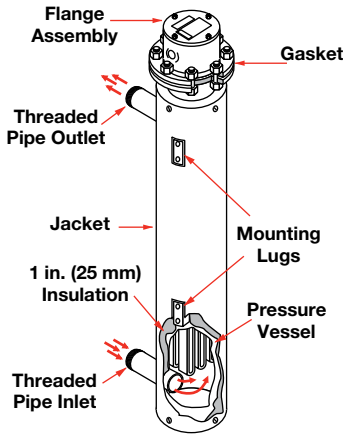
WATROD™ and FIREBAR® Circulation Heaters

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^2 (18.6 W/cm^2)
- 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

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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. 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.

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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.

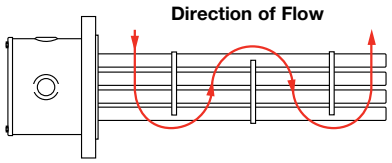
See *Screw Plug Immersion Heaters,* page 148 and *Flange Immersion Heaters*, on page 223 for details.

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.

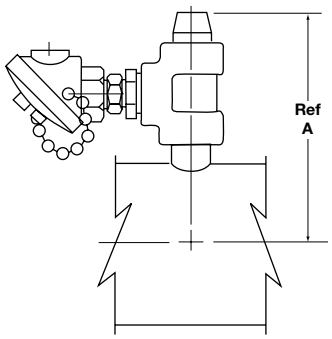
For critical sheath temperature and low flow conditions, baffles may be required.

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 1/4	3/4 NPT	8 3/16
2 1/2	1 NPT	8 3/16
3	1 NPT	8 3/16
4	1 1/2 NPT	10 3/8
5	2 NPT	11 1/16
6	2 1/2 NPT	13 3/8
8	2 1/2 NPT	14 3/8

For 10 in. (254 mm) and larger tanks contact your Watlow representative for dimension.

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WATROD and FIREBAR Circulation Heaters

Options *(Continued)*

Sheath Materials

The following sheath materials are available on WATROD and FIREBAR heating elements:

Standard Sheath Materials

WATROD	Alloy 800/840 316 SS Copper clad steel
FIREBAR	Steel Alloy 800, 304 SS

Made-to-Order Sheath Materials

WATROD	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 $2^1/_2$ 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 $1^1/_4$ 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.

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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.

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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.

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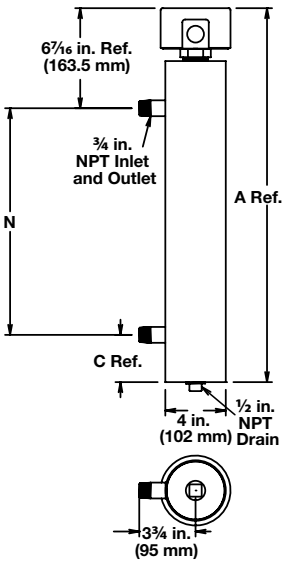
WATROD and FIREBAR Circulation Heaters

Application: Clean Water⑤

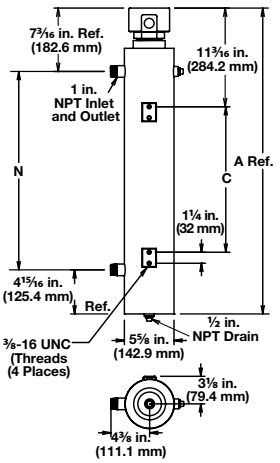
- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
1 1/4 inch NPT Screw Plug (WATROD)											
60 W/in² ④ Steel Tank 2-Alloy 800 Elements (9.3 W/cm²)	120	3.0	1	1	**CBEN15A6S**	**C1-15**	**C1-12**	23 (11)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	3.0	1	1	**CBEN15A6S**	**C1-17**	**C1-13**	23 (11)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	4.0	1	1	**CBEN19A10S**	**C1-17**	**C1-13**	29 (14)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	5.0	1	1	**CBEN23J10S**	**C/F**	**C/F**	29 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	6.0	1	1	**CBEN27J10S**	**C/F**	**C/F**	31 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
1 1/4 inch NPT Screw Plug (FIREBAR)											
90 W/in² Steel Tank 1-Alloy 800 Element (14 W/cm²)	240	1.5	1	1	**CBDNF7R10S**	**C1-17**	**C1-13**	26 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	480	1.5	1	1	**CBDNF7R11S**	**C/F**	**C/F**	26 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	3.0	1	1	**CBDNF11G10S**	**C1-17**	**C1-13**	26 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	480	3.0	1	1	**CBDNF11G11S**	**C/F**	**C/F**	26 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	5.0	3	1	**CBDNF16G3S**	**C2-50**	**C2-92**	26 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	480	5.0	3	1	**CBDNF16G5S**	**C2-43**	**C2-35**	26 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	6.5	3	1	**CBDNF19G3S**	**C2-50**	**C2-92**	30 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	480	6.5	3	1	**CBDNF19G5S**	**C2-43**	**C2-35**	30 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	8.5	3	1	**CBDNF24L3S**	**C2-50**	**C2-92**	31 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	480	8.5	3	1	**CBDNF24L5S**	**C2-43**	**C2-35**	31 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	10.5	3	1	**CBDNF29R3S**	**C2-236**	**C2-214**	43 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	480	10.5	3	1	**CBDNF29R5S**	**C2-43**	**C2-35**	43 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	240	12.7	3	1	**CBDNF34R3S**	**C2-236**	**C2-214**	44 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	480	12.7	3	1	**CBDNF34R5S**	**C2-43**	**C2-35**	44 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	240	17.0	3	1	**CBDNF45G3S**	**C2-236**	**C2-214**	69 (32)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	480	17.0	3	1	**CBDNF45G5S**	**C2-43**	**C2-35**	69 (32)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	480	21.5	3	1	**CBDNF55R5S**	**C2-225**	**C2-226**	71 (33)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
2 1/2 inch NPT Screw Plug (WATROD)											
60 W/in² Steel Tank 3-Alloy 800 Elements (9.3 W/cm²)	240	6.0	3	1	**CBLN714L3S**	**C2-50**	**C2-92**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	6.0	3	1	**CBLN714L5S**	**C2-43**	**C2-35**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	7.5	3	1	**CBLN717L3S**	**C2-50**	**C2-92**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	7.5	3	1	**CBLN717L5S**	**C2-43**	**C2-35**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	9.0	3	1	**CBLN720L3S**	**C2-50**	**C2-92**	26 (12)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	9.0	3	1	**CBLN720L5S**	**C2-43**	**C2-35**	26 (12)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	12.0	3	1	**CBLN726C3S**	**C2-236**	**C2-214**	27 (13)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	12.0	3	1	**CBLN726C5S**	**C2-43**	**C2-35**	27 (13)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	15.0	3	1	**CBLN731L3S**	**C2-236**	**C2-214**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	15.0	3	1	**CBLN731L5S**	**C2-43**	**C2-35**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	18.0	3	1	**CBLN737C3S**	**C2-236**	**C2-214**	30 (14)	57 1/4 (1453)	45 (1143)	39 (991)
	480	18.0	3	1	**CBLN737C5S**	**C2-43**	**C2-35**	30 (14)	57 1/4 (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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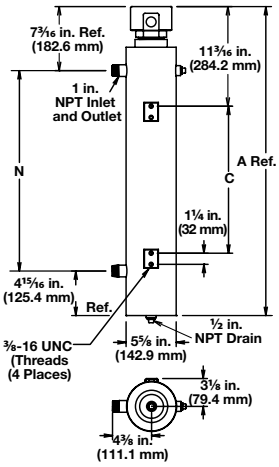
WATROD and FIREBAR Circulation Heaters

Application: Clean Water⑤

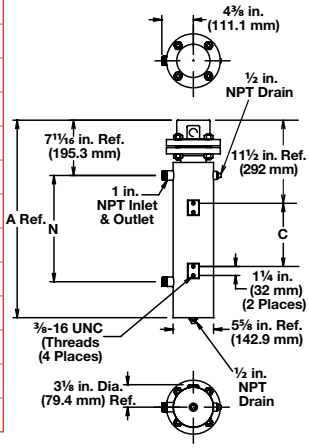
- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
2 1/2 inch NPT Screw Plug (FIREBAR)											
90 W/in² ⑧ Steel Tank 3-Alloy 800 Elements (14 W/cm²)	240	15.0	3	1	**CBLNF15C3S**	**C2-236**	**C2-214**	22 (10)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	15.0	3	1	**CBLNF15C5S**	**C2-43**	**C2-35**	22 (10)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	20.0	3	1	**CBLNF18C3S**	**C2-236**	**C2-214**	23 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	20.0	3	1	**CBLNF18C5S③**	**C2-43**	**C2-35**	23 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	25.0	3	1	**CBLNF23C5S**	**C2-225**	**C2-226**	31 (14)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	32.0	3	1	**CBLNF28L5S**	**C2-225**	**C2-226**	34 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	38.0	3	1	**CBLNF33L5S**	**C2-225**	**C2-226**	35 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
3 inch - 150 lb ANSI Flange (WATROD)											
60 W/in² Steel Tank 3-Alloy 800 Elements (9.3 W/cm²)	120	6.0	1	1	**CFMN715J10S**	**C/F**	**C/F**	66 (30)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	6.0	3	1	**CFMN715J3S**	**C2-50**	**C2-92**	66 (30)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	6.0	1	1	**CFMN715J11S**	**C/F**	**C/F**	66 (30)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	6.0	3	1	**CFMN715J5S**	**C2-43**	**C2-35**	66 (30)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	120	9.0	1	1	**CFMN721J10S**	**C/F**	**C/F**	70 (32)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	9.0	3	1	**CFMN721J3S**	**C2-50**	**C2-92**	70 (32)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	9.0	1	1	**CFMN721J11S**	**C/F**	**C/F**	70 (32)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	9.0	3	1	**CFMN721J5S**	**C2-43**	**C2-35**	70 (32)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	12.0	3	1	**CFMN727A3S**	**C2-236**	**C2-214**	80 (37)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	12.0	1	1	**CFMN727A11S**	**C/F**	**C/F**	80 (37)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	12.0	3	1	**CFMN727A5S**	**C2-43**	**C2-35**	80 (37)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	15.0	3	1	**CFMN732J3S**	**C2-236**	**C2-214**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	15.0	1	1	**CFMN732J11S**	**C/F**	**C/F**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	15.0	3	1	**CFMN732J5S**	**C2-43**	**C2-35**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	18.0	3	1	**CFMN738A3S**	**C2-236**	**C2-236**	98 (45)	57 3/4 (1465)	45 (1143)	39 (991)
	480	18.0	1	1	**CFMN738A11S**	**C/F**	**C/F**	98 (45)	57 3/4 (1465)	45 (1143)	39 (991)
	480	18.0	3	1	**CFMN738A5S**	**C2-43**	**C2-35**	98 (45)	57 3/4 (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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WATROD and FIREBAR Circulation Heaters

Application: Clean Water⑤

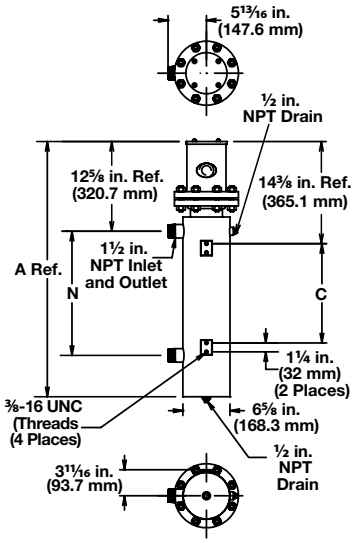
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
4 inch - 150 lb ANSI Flange (WATROD)											
60 W/in² Steel Tank 6-Alloy 800 Elements (9.3 W/cm²)	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



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WATROD and FIREBAR Circulation Heaters

Application: Clean Water⑤

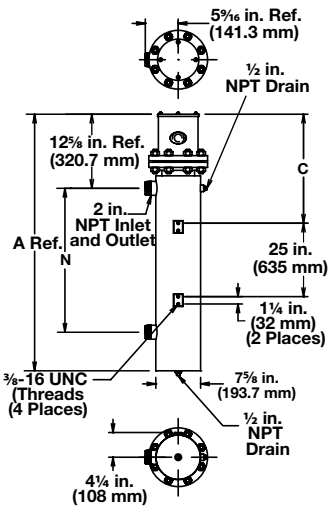
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
5 inch - 150 lb ANSI Flange (WATROD)											
60 W/in² Steel Tank 6-Alloy 800 Elements (9.3 W/cm²)	240	24.0	1	3	**CFNN727A10S**	**C/F**	**C/F**	140 (64)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	240	24.0	3	2	**CFNN727A3S**	**C2-218**	**C2-224**	140 (64)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	480	24.0	1	3	**CFNN727A11S**	**C/F**	**C/F**	140 (64)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	480	24.0	3	1	**CFNN727A5S**	**C2-225**	**C2-226**	140 (64)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	240	30.0	3	2	**CFNN732J3S**	**C2-218**	**C2-224**	142 (65)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	480	30.0	1	2	**CFNN732J11S**	**C/F**	**C/F**	142 (65)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	480	30.0	3	1	**CFNN732J5S**	**C2-225**	**C2-226**	142 (65)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	240	36.0	3	2	**CFNN738A3S**	**C2-218**	**C2-224**	160 (73)	56 1/4 (1427.0)	37 (940)	18 5/8 (473.1)
	480	36.0	1	2	**CFNN738A11S**	**C/F**	**C/F**	160 (73)	56 1/4 (1427.0)	37 (940)	18 5/8 (473.1)
	480	36.0	3	1	**CFNN738A5S**	**C2-224**	**C2-226**	160 (73)	56 1/4 (1427.0)	37 (940)	18 5/8 (473.1)
	480	50.0	3	2	**CFNN751A5S**	**C2-229**	**C2-230**	180 (82)	67 3/4 (1719.0)	48 1/2 (1232)	25 (633.0)
	480	60.0	3	2	**CFNN760J5S**	**C2-229**	**C2-230**	190 (87)	81 1/8 (2060.6)	61 7/8 (1572)	30 7/8 (784.2)
5 inch - 150 lb ANSI Flange (WATROD)											
60 W/in² Steel Tank 9-Alloy 800 Elements (9.3 W/cm²)	240	36.0	3	3	**CFNN727A3XS**	**C4-144**	**C4-145**	145 (66)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	480	36.0	1	3	**CFNN727A11XS**	**C/F**	**C/F**	145 (66)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	480	36.0	3	1	**CFNN727A5XS**	**C2-225**	**C2-226**	145 (66)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	240	45.0	3	3	**CFNN732J3XS**	**C4-144**	**C4-145**	147 (67)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	480	45.0	1	3	**CFNN732J11XS**	**C/F**	**C/F**	147 (67)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	480	45.0	3	3	**CFNN732J5XS**	**C4-150**	**C4-151**	147 (67)	49 1/4 (1249.0)	30 (762)	14 7/8 (378.8)
	240	54.0	3	3	**CFNN738A3XS**	**C4-144**	**C4-145**	166 (76)	56 1/4 (1427.0)	37 (940)	18 5/8 (473.1)
	480	54.0	1	3	**CFNN738A11XS**	**C/F**	**C/F**	166 (76)	56 1/4 (1427.0)	37 (940)	18 5/8 (473.1)
	480	54.0	3	3	**CFNN738A5XS**	**C4-150**	**C4-151**	166 (76)	56 1/4 (1427.0)	37 (940)	18 5/8 (473.1)
	480	75.0	3	3	**CFNN751A5XS**	**C4-152**	**C4-153**	188 (86)	67 3/4 (1719.0)	48 1/2 (1232)	25 (633.0)
	480	90.0	3	3	**CFNN760J5XS**	**C4-152**	**C4-153**	200 (91)	81 1/8 (2060.6)	61 7/8 (1572)	30 7/8 (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



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WATROD and FIREBAR Circulation Heaters

Application: Clean Water⑤

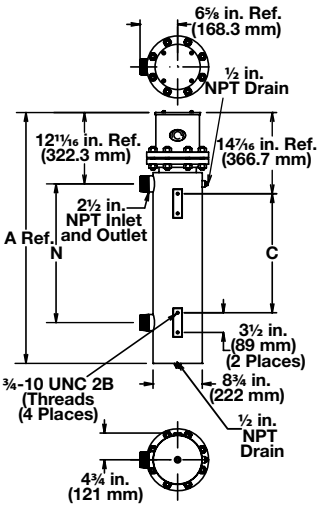
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
6 inch - 150 lb ANSI Flange (WATROD)											
60 W/in² Steel Tank 12-Alloy 800 Elements (9.3 W/cm²)	240	24.0	1	3	**CFPN715G10S**	**C/F**	**C/F**	212 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	24.0	3	2	**CFPN715G3S**	**C2-218**	**C2-224**	212 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	24.0	1	2	**CFPN715G11S**	**C/F**	**C/F**	212 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	24.0	3	1	**CFPN715G5S**	**C2-225**	**C2-226**	212 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	36.0	1	4	**CFPN721G10S**	**C/F**	**C/F**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	36.0	3	2	**CFPN721G3S**	**C2-218**	**C2-224**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	36.0	1	2	**CFPN721G11S**	**C/F**	**C/F**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	36.0	3	1	**CFPN721G5S**	**C2-225**	**C2-226**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	48.0	3	4	**CFPN726R3S**	**C4-148**	**C4-149**	222 (101)	51 (1294)	31 (787)	27 1/2 (699)
	480	48.0	1	3	**CFPN726R11S**	**C/F**	**C/F**	222 (101)	51 (1294)	31 (787)	27 1/2 (699)
	480	48.0	3	2	**CFPN726R5S**	**C2-229**	**C2-230**	222 (101)	51 (1294)	31 (787)	27 1/2 (699)
	240	60.0	3	4	**CFPN732G3S**	**C4-148**	**C4-149**	288 (131)	51 (1294)	31 (787)	27 1/2 (699)
	480	60.0	1	3	**CFPN732G11S**	**C/F**	**C/F**	288 (131)	51 (1294)	31 (787)	27 1/2 (699)
	480	60.0	3	2	**CFPN732G5S**	**C2-229**	**C2-230**	288 (131)	51 (1294)	31 (787)	27 1/2 (699)
	240	72.0	3	4	**CFPN737R3S**	**C4-148**	**C4-149**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	72.0	3	2	**CFPN737R5S**	**C2-229**	**C2-230**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	100.0	3	4	**CFPN750R5S**	**C4-156**	**C4-157**	298 (136)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	120.0	3	4	**CFPN760G5S**	**C4-156**	**C4-157**	360 (164)	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



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WATROD and FIREBAR Circulation Heaters

Application: Clean Water⑤

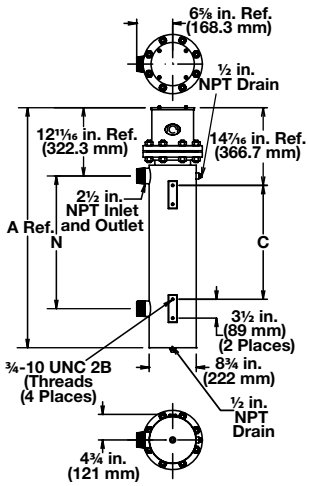
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
6 inch - 150 lb ANSI Flange (WATROD)											
60 W/in² Steel Tank 15-Alloy 800 Elements (9.3 W/cm²)	240	30.0	1	3	**CFPN715G10XS**	**C/F**	**C/F**	215 (98)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	30.0	3	5	**CFPN715G3XS**	**C4-144**	**C4-145**	215 (98)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	30.0	1	3	**CFPN715G11XS**	**C/F**	**C/F**	215 (98)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	30.0	3	1	**CFPN715G5XS**	**C2-225**	**C2-226**	215 (98)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	45.0	1	5	**CFPN721G10XS**	**C/F**	**C/F**	223 (102)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	45.0	3	5	**CFPN721G3XS**	**C4-144**	**C4-145**	223 (102)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	45.0	1	3	**CFPN721G11XS**	**C/F**	**C/F**	223 (102)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	45.0	3	5	**CFPN721G5XS**	**C4-150**	**C4-151**	223 (102)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	60.0	3	5	**CFPN726R3XS**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	480	60.0	1	3	**CFPN726R11XS**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	480	60.0	3	5	**CFPN726R5XS**	**C4-152**	**C4-153**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	240	75.0	3	5	**CFPN732G3XS**	**C/F**	**C/F**	288 (131)	51 (1294)	31 (787)	27 1/2 (699)
	480	75.0	1	5	**CFPN732G11XS**	**C/F**	**C/F**	288 (131)	51 (1294)	31 (787)	27 1/2 (699)
	480	75.0	3	5	**CFPN732G5XS**	**C4-152**	**C4-153**	288 (131)	51 (1294)	31 (787)	27 1/2 (699)
	240	90.0	3	5	**CFPN737R3XS**	**C/F**	**C/F**	296 (134)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	90.0	3	5	**CFPN737R5XS**	**C4-152**	**C4-153**	296 (134)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	125.0	3	5	**CFPN750R5XS**	**C/F**	**C/F**	306 (139)	72 (1827)	52 (1321)	48 1/2 (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



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WATROD and FIREBAR Circulation Heaters

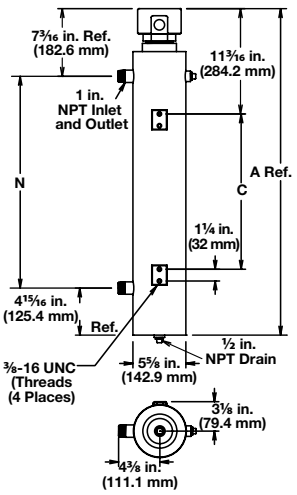
Application: Deionized or Demineralized Water

- WATROD elements
- Without thermostat
- General purpose enclosure

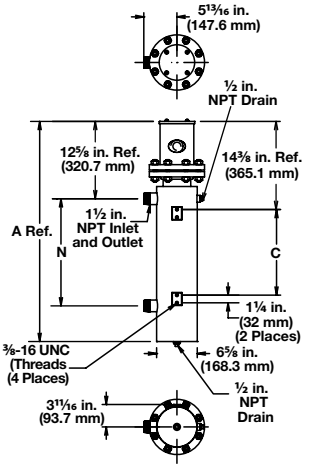
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
2 1/2 inch NPT Screw Plug (WATROD)											
60 W/in² 316 SS Tank 3-316 SS Elements (9.3 W/cm²) Passivated	240	6.0	3	1	**CBLR714L3S**	**C2-50**	**C2-92**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	6.0	3	1	**CBLR714L5S**	**C2-43**	**C2-35**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	7.5	3	1	**CBLR717L3S**	**C2-50**	**C2-92**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	7.5	3	1	**CBLR717L5S**	**C2-43**	**C2-35**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	9.0	3	1	**CBLR720L3S**	**C2-50**	**C2-92**	26 (12)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	9.0	3	1	**CBLR720L5S**	**C2-43**	**C2-35**	26 (12)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	12.0	3	1	**CBLR726C3S**	**C2-236**	**C2-214**	27 (13)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	12.0	3	1	**CBLR726C5S**	**C2-43**	**C2-35**	27 (13)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	15.0	3	1	**CBLR731L3S**	**C2-236**	**C2-214**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	15.0	3	1	**CBLR731L5S**	**C2-43**	**C2-35**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	18.0	3	1	**CBLR737C3S**	**C2-236**	**C2-214**	30 (14)	57 1/4 (1453)	45 (1143)	39 (991)
	480	18.0	3	1	**CBLR737C5S**	**C2-43**	**C2-35**	30 (14)	57 1/4 (1453)	45 (1143)	39 (991)
4 inch - 150 lb ANSI Flange (WATROD)											
60 W/in² 316 SS Tank 6-316 SS Elements (9.3 W/cm²) Passivated	240	12.0	1	2	**CFOR716A10S**	**C/F**	**C/F**	124 (57)	39 (989)	20 1/2 (521)	17 (432)
	240	12.0	3	1	**CFOR716A3S**	**C2-236**	**C2-214**	124 (57)	39 (989)	20 1/2 (521)	17 (432)
	480	12.0	1	1	**CFOR716A11S**	**C/F**	**C/F**	124 (57)	39 (989)	20 1/2 (521)	17 (432)
	480	12.0	3	1	**CFOR716A5S**	**C2-43**	**C2-35**	124 (57)	39 (989)	20 1/2 (521)	17 (432)
	240	18.0	1	2	**CFOR722A10S**	**C/F**	**C/F**	127 (58)	39 (989)	20 1/2 (521)	17 (432)
	240	18.0	3	1	**CFOR722A3S**	**C2-236**	**C2-214**	127 (58)	39 (989)	20 1/2 (521)	17 (432)
	480	18.0	1	1	**CFOR722A11S**	**C/F**	**C/F**	127 (58)	39 (989)	20 1/2 (521)	17 (432)
	480	18.0	3	1	**CFOR722A5S**	**C2-43**	**C2-35**	127 (58)	39 (989)	20 1/2 (521)	17 (432)
	240	24.0	1	2	**CFOR727J10S**	**C/F**	**C/F**	160 (73)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	240	24.0	3	2	**CFOR727J3S**	**C2-218**	**C2-224**	160 (73)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	480	24.0	1	1	**CFOR727J11S**	**C/F**	**C/F**	160 (73)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	480	24.0	3	1	**CFOR727J5S**	**C2-225**	**C2-226**	160 (73)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	240	30.0	3	2	**CFOR733A3S**	**C2-218**	**C2-224**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	480	30.0	1	2	**CFOR733A11S**	**C/F**	**C/F**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	480	30.0	3	1	**CFOR733A5S**	**C2-225**	**C2-226**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	240	36.0	3	2	**CFOR738J3S**	**C2-218**	**C2-226**	229(104)	70 1/2 (1789)	52 (1321)	48 1/2(1232)
	480	36.0	1	2	**CFOR738J11S**	**C/F**	**C/F**	229(104)	70 1/2 (1789)	52 (1321)	48 1/2(1232)
	480	36.0	3	1	**CFOR738J5S**	**C2-225**	**C2-226**	229(104)	70 1/2 (1789)	52 (1321)	48 1/2(1232)
	480	50.0	3	2	**CFOR751J5S**	**C2-229**	**C2-230**	234(107)	70 1/2 (1789)	52 (1321)	48 1/2(1232)
	480	60.0	3	2	**CFOR761A5S**	**C2-229**	**C2-230**	297(135)	91 1/2 (2326)	73 (1854)	66 (1676)

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2 1/2 inch NPT Screw Plug



4 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

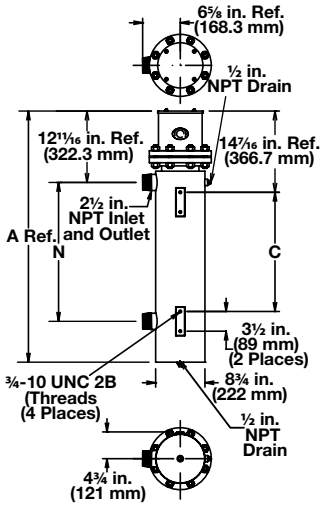
Application: Deionized or Demineralized Water

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
6 inch - 150 lb ANSI Flange (WATROD)											
60 W/in² 316 SS Tank 12-316 SS Elements (9.3 W/cm²) Passivated	240	24.0	1	3	**CFPR715N10S**	**C/F**	**C/F**	212 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	24.0	3	2	**CFPR715N3S**	**C2-218**	**C2-224**	212 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	24.0	1	2	**CFPR715N11S**	**C/F**	**C/F**	212 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	24.0	3	1	**CFPR715N5S**	**C2-225**	**C2-226**	212 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	36.0	1	4	**CFPR721N10S**	**C/F**	**C/F**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	36.0	3	2	**CFPR721N3S**	**C2-218**	**C2-224**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	36.0	1	2	**CFPR721N11S**	**C/F**	**C/F**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	36.0	3	1	**CFPR721N5S**	**C2-225**	**C2-226**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	48.0	3	4	**CFPR727E3S**	**C4-148**	**C4-149**	222 (101)	51 (1294)	31 (787)	27 1/2 (699)
	480	48.0	1	3	**CFPR727E11S**	**C/F**	**C/F**	222 (101)	51 (1294)	31 (787)	27 1/2 (699)
	480	48.0	3	2	**CFPR727E5S**	**C2-229**	**C2-230**	222 (101)	51 (1294)	31 (787)	27 1/2 (699)
	240	60.0	3	4	**CFPR732N3S**	**C4-148**	**C4-149**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	480	60.0	1	3	**CFPR732N11S**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	480	60.0	3	2	**CFPR732N5S**	**C2-229**	**C2-230**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	240	72.0	3	4	**CFPR738E3S**	**C4-148**	**C4-149**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	72.0	3	2	**CFPR738E5S**	**C2-229**	**C2-230**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	100.0	3	4	**CFPR751E5S**	**C4-156**	**C4-157**	298 (136)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	120.0	3	4	**CFPR760N5S**	**C4-156**	**C4-157**	360 (164)	93 (2361)	73 (1854)	66 (1676)

C/F - Contact factory, go to www.watlow.com/en/contact-us

6 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

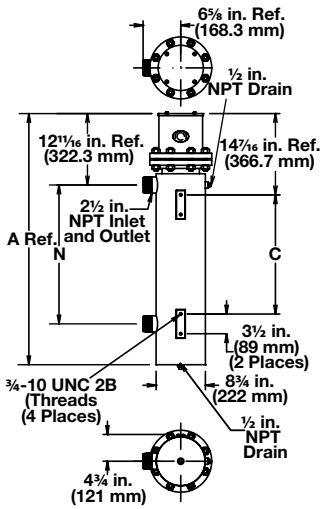
Application: Deionized or Demineralized Water

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
6 inch - 150 lb ANSI Flange (WATROD)											
60 W/in² 316 SS Tank 15-316 SS Elements (9.3 W/cm²) Passivated	240	30.0	1	3	**CFPR715N10XS**	**C/F**	**C/F**	215 (98)	40½ (1027)	20½ (521)	17 (432)
	240	30.0	3	5	**CFPR715N3XS**	**C4-144**	**C4-145**	215 (98)	40½ (1027)	20½ (521)	17 (432)
	480	30.0	1	3	**CFPR715N11XS**	**C/F**	**C/F**	215 (98)	40½ (1027)	20½ (521)	17 (432)
	480	30.0	3	1	**CFPR715N5XS**	**C2-225**	**C2-226**	215 (98)	40½ (1027)	20½ (521)	17 (432)
	240	45.0	1	5	**CFPR721N10XS**	**C/F**	**C/F**	223 (102)	40½ (1027)	20½ (521)	17 (432)
	240	45.0	3	5	**CFPR721N3XS**	**C4-144**	**C4-145**	223 (102)	40½ (1027)	20½ (521)	17 (432)
	480	45.0	1	3	**CFPR721N11XS**	**C/F**	**C/F**	223 (102)	40½ (1027)	20½ (521)	17 (432)
	480	45.0	3	5	**CFPR721N5XS**	**C4-150**	**C4-151**	223 (102)	40½ (1027)	20½ (521)	17 (432)
	240	60.0	3	5	**CFPR727E3XS**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27½ (699)
	480	60.0	1	3	**CFPR727E11XS**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27½ (699)
	480	60.0	3	5	**CFPR727E5XS**	**C4-152**	**C4-153**	226 (103)	51 (1294)	31 (787)	27½ (699)
	240	75.0	3	5	**CFPR732N3XS**	**C/F**	**C/F**	288 (131)	51 (1294)	31 (787)	27½ (699)
	480	75.0	1	5	**CFPR732N11XS**	**C/F**	**C/F**	288 (131)	51 (1294)	31 (787)	27½ (699)
	480	75.0	3	5	**CFPR732N5XS**	**C4-152**	**C4-153**	288 (131)	51 (1294)	31 (787)	27½ (699)
	240	90.0	3	5	**CFPR738E3XS**	**C/F**	**C/F**	296 (135)	72 (1827)	52 (1321)	48½ (1232)
	480	90.0	3	5	**CFPR738E5XS**	**C4-152**	**C4-153**	296 (135)	72 (1827)	52 (1321)	48½ (1232)
	480	125.0	3	5	**CFPR751E5XS**	**C/F**	**C/F**	306 (139)	72 (1827)	52 (1321)	48½ (1232)
	480	150.0	3	5	**CFPR760N5XS**	**C/F**	**C/F**	370 (168)	93 (2361)	73 (1854)	66 (1676)

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6 inch - 150 lb ANSI Flange



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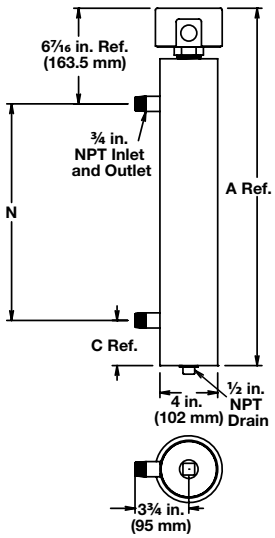
WATROD and FIREBAR Circulation Heaters

Application: Process Water⑤

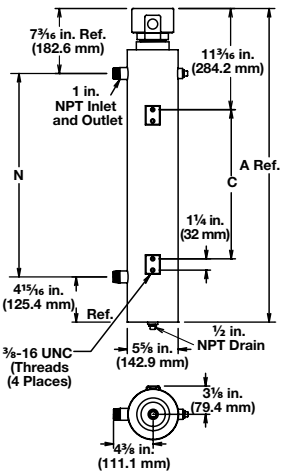
- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
1¼ inch NPT Screw Plug (FIREBAR)											
45 W/in² ⑧ Steel Tank 1-Alloy 800 Element (7 W/cm²)	240	2.0	3	1	**CBDNF13A27S**	**C2-50**	**C2-92**	25 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	2.5	3	1	**CBDNF15J27S**	**C2-50**	**C2-92**	26 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	3.0	3	1	**CBDNF18A27S**	**C2-50**	**C2-92**	30 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	4.0	3	1	**CBDNF22J27S**	**C2-50**	**C2-92**	31 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	480	4.0	3	1	**CBDNF22J28S**	**C2-43**	**C2-35**	31 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	5.0	3	1	**CBDNF27J27S**	**C2-50**	**C2-92**	43 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	480	5.0	3	1	**CBDNF27J28S**	**C2-43**	**C2-35**	43 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	240	6.0	3	1	**CBDNF32J27S**	**C2-50**	**C2-92**	44 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	480	6.0	3	1	**CBDNF32J28S**	**C2-43**	**C2-35**	44 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	240	8.0	3	1	**CBDNF42A27S**	**C2-50**	**C2-92**	69 (32)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	480	8.0	3	1	**CBDNF42A28S**	**C2-43**	**C2-35**	69 (32)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	240	10.0	3	1	**CBDNF51J27S**	**C2-50**	**C2-92**	71 (33)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	480	10.0	3	1	**CBDNF51J28S**	**C2-43**	**C2-35**	71 (33)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
2½ inch NPT Screw Plug (WATROD)											
48 W/in² ⑧ Steel Tank 3-Alloy 800 Elements (7.5 W/cm²)	240	6.0	3	1	**CBLN717G3S**	**C2-50**	**C2-92**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	6.0	3	1	**CBLN717G5S**	**C2-43**	**C2-35**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	7.5	3	1	**CBLN719R3S**	**C2-50**	**C2-92**	26 (12)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	7.5	3	1	**CBLN719R5S**	**C2-43**	**C2-35**	26 (12)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	9.0	3	1	**CBLN724R3S**	**C2-50**	**C2-92**	27 (13)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	9.0	3	1	**CBLN724R5S**	**C2-43**	**C2-35**	27 (13)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	12.0	3	1	**CBLN732G3S**	**C2-236**	**C2-214**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	12.0	3	1	**CBLN732G5S**	**C2-43**	**C2-35**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	15.0	3	1	**CBLN739R3S**	**C2-236**	**C2-214**	31 (14)	57 1/4 (1453)	45 (1143)	39 (991)
	480	15.0	3	1	**CBLN739R5S**	**C2-43**	**C2-35**	31 (14)	57 1/4 (1453)	45 (1143)	39 (991)
	240	18.0	3	1	**CBLN747G3S**	**C2-236**	**C2-214**	32 (15)	57 1/4 (1453)	45 (1143)	39 (991)
	480	18.0	3	1	**CBLN747G5S**	**C2-43**	**C2-35**	32 (15)	57 1/4 (1453)	45 (1143)	39 (991)
2½ inch NPT Screw Plug (FIREBAR)											
45 W/in² ⑧ Steel Tank 3-Alloy 800 Elements (7 W/cm²)	240	6.0	3	1	**CBLNF12A27S**	**C2-50**	**C2-92**	21 (10)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	7.5	3	1	**CBLNF14J27S**	**C2-50**	**C2-92**	22 (10)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	9.0	3	1	**CBLNF17A27S**	**C2-50**	**C2-92**	23 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	12.0	3	1	**CBLNF21J27S**	**C2-236**	**C2-214**	31 (14)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	12.0	3	1	**CBLNF21J28S**	**C2-43**	**C2-35**	31 (14)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	15.0	3	1	**CBLNF26J27S**	**C2-236**	**C2-214**	34 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	15.0	3	1	**CBLNF26J28S**	**C2-43**	**C2-35**	34 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	18.0	3	1	**CBLNF31J27S**	**C2-236**	**C2-214**	35 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	18.0	3	1	**CBLNF31J28S**	**C2-43**	**C2-35**	35 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	24.0	3	1	**CBLNF41A28S**	**C2-225**	**C2-226**	44 (20)	57 1/4 (1453)	45 (1143)	39 (991)
	480	30.0	3	1	**CBLNF50J28S**	**C2-225**	**C2-226**	52 (24)	63 3/4 (1618)	51 1/2 (1308)	46 1/2 (1181)

1¼ inch NPT Screw Plug



2½ inch NPT Screw Plug



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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WATROD and FIREBAR Circulation Heaters

Application: Process Water⑤

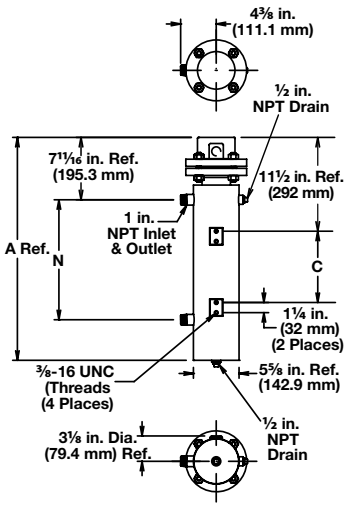
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
3 inch - 150 lb ANSI Flange (WATROD)											
48 W/in² Steel Tank 3-Alloy 800 Elements (7.5 W/cm²)	240	6.0	1	1	**CFMN718A10S**	**C/F**	**C/F**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	6.0	3	1	**CFMN718A3S**	**C2-50**	**C2-92**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	6.0	1	1	**CFMN718A11S**	**C/F**	**C/F**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	6.0	3	1	**CFMN718A5S**	**C2-43**	**C2-35**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	7.5	1	1	**CFMN720J10S**	**C/F**	**C/F**	70 (32)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	7.5	3	1	**CFMN720J3S**	**C2-50**	**C2-92**	70 (32)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	7.5	1	1	**CFMN720J11S**	**C/F**	**C/F**	70 (32)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	7.5	3	1	**CFMN720J5S**	**C2-43**	**C2-35**	70 (32)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	9.0	1	1	**CFMN725J10S**	**C/F**	**C/F**	78 (36)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	9.0	3	1	**CFMN725J3S**	**C2-50**	**C2-92**	78 (36)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	9.0	1	1	**CFMN725J11S**	**C/F**	**C/F**	78 (36)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	9.0	3	1	**CFMN725J5S**	**C2-43**	**C2-35**	78 (36)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	12.0	3	1	**CFMN733A3S**	**C2-236**	**C2-214**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	12.0	1	1	**CFMN733A11S**	**C/F**	**C/F**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	12.0	3	1	**CFMN733A5S**	**C2-43**	**C2-35**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	15.0	3	1	**CFMN740J3S**	**C2-236**	**C2-214**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	480	15.0	1	1	**CFMN740J11S**	**C/F**	**C/F**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	480	15.0	3	1	**CFMN740J5S**	**C2-43**	**C2-35**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	240	18.0	3	1	**CFMN748A3S**	**C2-236**	**C2-214**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
	480	18.0	1	1	**CFMN748A11S**	**C/F**	**C/F**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
	480	18.0	3	1	**CFMN748A5S**	**C2-43**	**C2-35**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)

⑤ 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



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WATROD and FIREBAR Circulation Heaters

Application: Process Water⑤

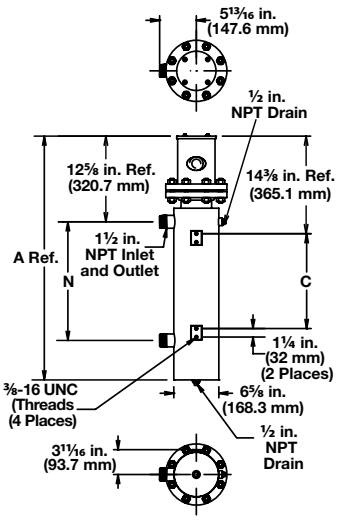
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
4 inch - 150 lb ANSI Flange (WATROD)											
48 W/in² Steel Tank 6-Alloy 800 Elements (7.5 W/cm²)	240	9.0	1	1	**CFON713J10S**	**C/F**	**C/F**	122 (56)	39 (989)	20 1/2 (521)	17 (432)
	240	9.0	3	1	**CFON713J3S**	**C2-50**	**C2-92**	122 (56)	39 (989)	20 1/2 (521)	17 (432)
	480	9.0	1	1	**CFON713J11S**	**C/F**	**C/F**	122 (56)	39 (989)	20 1/2 (521)	17 (432)
	480	9.0	3	1	**CFON713J5S**	**C2-43**	**C2-35**	122 (56)	39 (989)	20 1/2 (521)	17 (432)
	240	12.0	1	2	**CFON718A10S**	**C/F**	**C/F**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	240	12.0	3	1	**CFON718A3S**	**C2-236**	**C2-214**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	480	12.0	1	1	**CFON718A11S**	**C/F**	**C/F**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	480	12.0	3	1	**CFON718A5S**	**C2-43**	**C2-35**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	240	15.0	1	2	**CFON720J10S**	**C/F**	**C/F**	127 (58)	39 (989)	20 1/2 (521)	17 (432)
	240	15.0	3	1	**CFON720J3S**	**C2-236**	**C2-214**	127 (58)	39 (989)	20 1/2 (521)	17 (432)
	480	15.0	1	1	**CFON720J11S**	**C/F**	**C/F**	127 (58)	39 (989)	20 1/2 (521)	17 (432)
	480	15.0	3	1	**CFON720J5S**	**C2-225**	**C2-226**	127 (58)	39 (989)	20 1/2 (521)	17 (432)
	240	18.0	1	2	**CFON725J10S**	**C/F**	**C/F**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	240	18.0	3	1	**CFON725J3S**	**C2-236**	**C2-214**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	480	18.0	1	1	**CFON725J11S**	**C/F**	**C/F**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	480	18.0	3	1	**CFON725J5S**	**C2-43**	**C2-35**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	240	24.0	1	2	**CFON733A10S**	**C/F**	**C/F**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	240	24.0	3	2	**CFON733A3S**	**C2-218**	**C2-224**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	480	24.0	1	1	**CFON733A11S**	**C/F**	**C/F**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	480	24.0	3	1	**CFON733A5S**	**C2-225**	**C2-226**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	240	30.0	3	2	**CFON740J3S**	**C2-218**	**C2-224**	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	30.0	1	2	**CFON740J11S**	**C/F**	**C/F**	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	30.0	3	1	**CFON740J5S**	**C2-225**	**C2-226**	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	36.0	3	2	**CFON748A3S**	**C2-218**	**C2-224**	234 (107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	36.0	1	2	**CFON748A11S**	**C/F**	**C/F**	234 (107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	36.0	3	1	**CFON748A5S**	**C2-225**	**C2-226**	234 (107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)

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



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WATROD and FIREBAR Circulation Heaters

Application: Process Water⑤

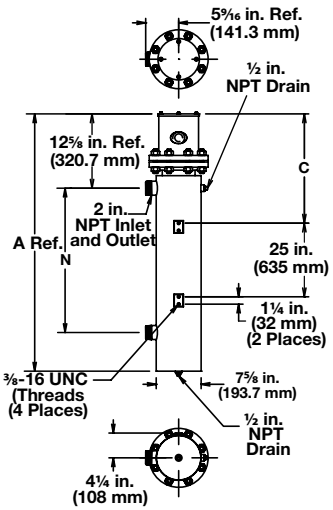
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
5 inch - 150 lb ANSI Flange (WATROD)											
48 W/in² Steel Tank 6-Alloy 800 Elements (7.5 W/cm²)	240	24.0	1	3	**CFNN733A10S**	**C/F**	**C/F**	145 (66)	49 1/4 (1249)	30 (762)	14 7/8 (377.8)
	240	24.0	3	2	**CFNN733A3S**	**C2-218**	**C2-224**	145 (66)	49 1/4 (1249)	30 (762)	14 7/8 (377.8)
	480	24.0	1	2	**CFNN733A11S**	**C/F**	**C/F**	145 (66)	49 1/4 (1249)	30 (762)	14 7/8 (377.8)
	480	24.0	3	1	**CFNN733A5S**	**C2-225**	**C2-226**	145 (66)	49 1/4 (1249)	30 (762)	14 7/8 (377.8)
	240	30.0	3	2	**CFNN740J3S**	**C2-218**	**C2-224**	167 (76)	56 1/4 (1427)	37 (940)	18 5/8 (473.1)
	480	30.0	1	2	**CFNN740J11S**	**C/F**	**C/F**	167 (76)	56 1/4 (1427)	37 (940)	18 5/8 (473.1)
	480	30.0	3	1	**CFNN740J5S**	**C2-225**	**C2-226**	167 (76)	56 1/4 (1427)	37 (940)	18 5/8 (473.1)
	240	36.0	3	2	**CFNN748A3S**	**C2-218**	**C2-224**	180 (82)	67 3/4 (1719)	48 1/2 (1232)	25 (633.0)
	480	36.0	1	2	**CFNN748A11S**	**C/F**	**C/F**	180 (82)	67 3/4 (1719)	48 1/2 (1232)	25 (633.0)
	480	36.0	3	1	**CFNN748A5S**	**C2-225**	**C2-226**	180 (82)	67 3/4 (1719)	48 1/2 (1232)	25 (633.0)
5 inch - 150 lb ANSI Flange (WATROD)											
48 W/in² Steel Tank 9-Alloy 800 Elements (7.5 W/cm²)	240	36.0	3	3	**CFNN733A3XS**	**C4-144**	**C4-145**	150 (68)	49 1/4 (1249)	30 (762)	14 7/8 (377.8)
	480	36.0	1	3	**CFNN733A11XS**	**C/F**	**C/F**	150 (68)	49 1/4 (1249)	30 (762)	14 7/8 (377.8)
	480	36.0	3	1	**CFNN733A5XS**	**C2-225**	**C2-226**	150 (68)	49 1/4 (1249)	30 (762)	14 7/8 (377.8)
	240	45.0	3	3	**CFNN740J3XS**	**C4-144**	**C4-145**	173 (79)	56 1/4 (1427)	37 (940)	18 5/8 (473.1)
	480	45.0	1	3	**CFNN740J11XS**	**C/F**	**C/F**	173 (79)	56 1/4 (1427)	37 (940)	18 5/8 (473.1)
	480	45.0	3	3	**CFNN740J5XS**	**C4-150**	**C4-151**	173 (79)	56 1/4 (1427)	37 (940)	18 5/8 (473.1)
	240	54.0	3	3	**CFNN748A3XS**	**C4-144**	**C4-145**	188 (86)	67 3/4 (1719)	48 1/2 (1232)	25 (633.0)
	480	54.0	1	3	**CFNN748A11XS**	**C/F**	**C/F**	188 (86)	67 3/4 (1719)	48 1/2 (1232)	25 (633.0)
	480	54.0	3	3	**CFNN748A5XS**	**C4-150**	**C4-151**	188 (86)	67 3/4 (1719)	48 1/2 (1232)	25 (633.0)

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



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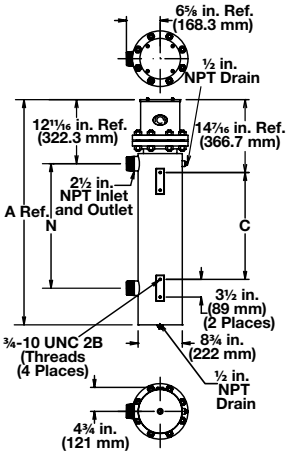
WATROD and FIREBAR Circulation Heaters

Application: Process Water⑤

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
6 inch - 150 lb ANSI Flange (WATROD)											
48 W/in² Steel Tank 12-Alloy 800 Elements (7.5 W/cm²)	240	18.0	1	2	**CFPN713G10S**	**C/F**	**C/F**	212 (97)	40½ (1027)	20½ (521)	17 (432)
	240	18.0	3	1	**CFPN713G3S**	**C2-236**	**C2-214**	212 (97)	40½ (1027)	20½ (521)	17 (432)
	480	18.0	1	1	**CFPN713G11S**	**C/F**	**C/F**	212 (97)	40½ (1027)	20½ (521)	17 (432)
	480	18.0	3	1	**CFPN713G5S**	**C2-43**	**C2-35**	212 (97)	40½ (1027)	20½ (521)	17 (432)
	240	24.0	1	3	**CFPN717R10S**	**C/F**	**C/F**	214 (97)	40½ (1027)	20½ (521)	17 (432)
	240	24.0	3	2	**CFPN717R3S**	**C2-218**	**C2-224**	214 (97)	40½ (1027)	20½ (521)	17 (432)
	480	24.0	1	2	**CFPN717R11S**	**C/F**	**C/F**	214 (97)	40½ (1027)	20½ (521)	17 (432)
	480	24.0	3	1	**CFPN717R5S**	**C2-225**	**C2-226**	214 (97)	40½ (1027)	20½ (521)	17 (432)
	240	30.0	1	3	**CFPN720G10S**	**C/F**	**C/F**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	240	30.0	3	2	**CFPN720G3S**	**C2-218**	**C2-224**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	480	30.0	1	2	**CFPN720G11S**	**C/F**	**C/F**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	480	30.0	3	1	**CFPN720G5S**	**C2-225**	**C2-226**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	240	36.0	1	4	**CFPN725G10S**	**C/F**	**C/F**	222 (101)	40½ (1027)	20½ (521)	17 (432)
	240	36.0	3	2	**CFPN725G3S**	**C2-218**	**C2-224**	222 (101)	40½ (1027)	20½ (521)	17 (432)
	480	36.0	1	2	**CFPN725G11S**	**C/F**	**C/F**	222 (101)	40½ (1027)	20½ (521)	17 (432)
	480	36.0	3	1	**CFPN725G5S**	**C2-225**	**C2-226**	222 (101)	40½ (1027)	20½ (521)	17 (432)
	240	48.0	3	4	**CFPN732R3S**	**C4-148**	**C4-149**	226 (103)	51 (1294)	31 (787)	27½ (699)
	480	48.0	1	3	**CFPN732R11S**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27½ (699)
	480	48.0	3	2	**CFPN732R5S**	**C2-229**	**C2-230**	226 (103)	51 (1294)	31 (787)	27½ (699)
	240	60.0	3	4	**CFPN740G3S**	**C4-148**	**C4-149**	290 (132)	72 (1827)	52 (1321)	48½ (1232)
	480	60.0	1	3	**CFPN740G11S**	**C/F**	**C/F**	290 (132)	72 (1827)	52 (1321)	48½ (1232)
	480	60.0	3	2	**CFPN740G5S**	**C2-229**	**C2-230**	290 (132)	72 (1827)	52 (1321)	48½ (1232)
	240	72.0	3	4	**CFPN747R3S**	**C4-148**	**C4-149**	298 (136)	72 (1827)	52 (1321)	48½ (1232)
	480	72.0	3	2	**CFPN747R5S**	**C2-229**	**C2-230**	298 (136)	72 (1827)	52 (1321)	48½ (1232)
6 inch - 150 lb ANSI Flange (WATROD)											
48 W/in² Steel Tank 15-Alloy 800 Elements (7.5 W/cm²)	240	23.0	1	3	**CFPN713G10XS**	**C/F**	**C/F**	215 (98)	40½ (1027)	20½ (521)	17 (432)
	240	23.0	3	5	**CFPN713G3XS**	**C4-143**	**C4-142**	215 (98)	40½ (1027)	20½ (521)	17 (432)
	480	23.0	1	1	**CFPN713G11XS**	**C/F**	**C/F**	215 (98)	40½ (1027)	20½ (521)	17 (432)
	480	23.0	3	1	**CFPN713G5XS**	**C2-225**	**C2-226**	215 (98)	40½ (1027)	20½ (521)	17 (432)
	240	30.0	1	3	**CFPN717R10XS**	**C/F**	**C/F**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	240	30.0	3	5	**CFPN717R3XS**	**C4-144**	**C4-145**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	480	30.0	1	3	**CFPN717R11XS**	**C/F**	**C/F**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	480	30.0	3	1	**CFPN717R5XS**	**C2-225**	**C2-226**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	240	38.0	1	5	**CFPN720G10XS**	**C/F**	**C/F**	223 (102)	40½ (1027)	20½ (521)	17 (432)
	240	38.0	3	5	**CFPN720G3XS**	**C4-144**	**C4-145**	223 (102)	40½ (1027)	20½ (521)	17 (432)
	480	38.0	1	3	**CFPN720G11XS**	**C/F**	**C/F**	223 (102)	40½ (1027)	20½ (521)	17 (432)
	480	38.0	3	1	**CFPN720G5XS**	**C2-225**	**C2-226**	223 (102)	40½ (1027)	20½ (521)	17 (432)
	240	45.0	1	5	**CFPN725G10XS**	**C/F**	**C/F**	226 (103)	40½ (1027)	20½ (521)	17 (432)
	240	45.0	3	5	**CFPN725G3XS**	**C4-144**	**C4-145**	226 (103)	40½ (1027)	20½ (521)	17 (432)
	480	45.0	1	3	**CFPN725G11XS**	**C/F**	**C/F**	226 (103)	40½ (1027)	20½ (521)	17 (432)
	480	45.0	3	5	**CFPN725G5XS**	**C4-150**	**C4-151**	226 (103)	40½ (1027)	20½ (521)	17 (432)
	240	60.0	3	5	**CFPN732R3XS**	**C/F**	**C/F**	288 (131)	51 (1294)	31 (787)	27½ (699)
	480	60.0	1	3	**CFPN732R11XS**	**C/F**	**C/F**	288 (131)	51 (1294)	31 (787)	27½ (699)
	480	60.0	3	5	**CFPN732R5XS**	**C4-152**	**C4-153**	288 (131)	51 (1294)	31 (787)	27½ (699)
	240	75.0	3	5	**CFPN740G3XS**	**C/F**	**C/F**	296 (135)	72 (1827)	52 (1321)	48½ (1232)
	480	75.0	1	5	**CFPN740G11XS**	**C/F**	**C/F**	296 (135)	72 (1827)	52 (1321)	48½ (1232)
	480	75.0	3	5	**CFPN740G5XS**	**C4-152**	**C4-153**	296 (135)	72 (1827)	52 (1321)	48½ (1232)
	240	90.0	3	5	**CFPN747R3XS**	**C/F**	**C/F**	306 (139)	72 (1827)	52 (1321)	48½ (1232)
	480	90.0	3	5	**CFPN747R5XS**	**C4-152**	**C4-153**	306 (139)	72 (1827)	52 (1321)	48½ (1232)

6 inch - 150 lb ANSI Flange



⑤ When steel vessel materials are used in this application, some rust may be present in the process media

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WATROD and FIREBAR Circulation Heaters

Application: Process Water[5]

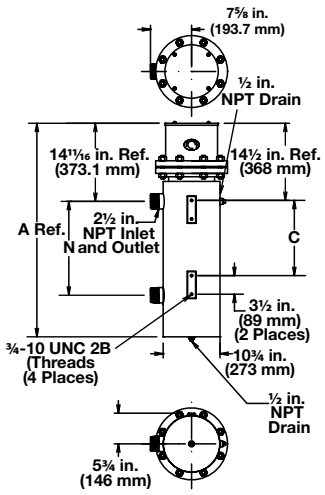
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
8 inch - 150 lb ANSI Flange (WATROD)											
48 W/in² Steel Tank 18-Alloy 800 Elements (7.5 W/cm²)	240	50.0	3	3	**CFRN725N3S**	**C4-144**	**C4-145**	350 (159)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	50.0	1	3	**CFRN725N11S**	**C/F**	**C/F**	350 (159)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	50.0	3	2	**CFRN725N5S**	**C2-229**	**C2-230**	350 (159)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	75.0	3	6	**CFRN735N3S**	**C/F**	**C/F**	380 (173)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	75.0	3	2	**CFRN735N5S**	**C2-229**	**C2-230**	380 (173)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	240	100.0	3	6	**CFRN744E3S**	**C/F**	**C/F**	410 (186)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	100.0	3	3	**CFRN744E5S**	**C2-229**	**C2-230**	410 (186)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	240	125.0	3	6	**CFRN754M3S**	**C/F**	**C/F**	445 (202)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	125.0	3	6	**CFRN754M5S**	**C/F**	**C/F**	445 (202)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	150.0	3	6	**CFRN763M5S**	**C/F**	**C/F**	490 (223)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	480	175.0	3	6	**CFRN773D5S**	**C/F**	**C/F**	530 (241)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)
	480	200.0	3	6	**CFRN782M5S**	**C/F**	**C/F**	560 (254)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)
8 inch - 150 lb ANSI Flange (WATROD)											
48 W/in² Steel Tank 24-Alloy 800 Elements (7.5 W/cm²)	240	67.0	3	4	**CFRN726D3XS**	**C4-148**	**C4-149**	358 (163)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	67.0	1	3	**CFRN726D11XS**	**C/F**	**C/F**	358 (163)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	67.0	3	2	**CFRN726D5XS**	**C2-229**	**C2-230**	358 (163)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	100.0	3	8	**CFRN736D3XS**	**C/F**	**C/F**	392 (178)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	100.0	3	4	**CFRN736D5XS**	**C4-156**	**C4-157**	392 (178)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	240	133.0	3	8	**CFRN744M3XS**	**C/F**	**C/F**	425 (193)	69 7/8 (1774.8)	47⅝ (1203.3)	43 7/8 (1114.4)
	480	133.0	3	4	**CFRN744M5XS**	**C4-156**	**C4-157**	425 (193)	69 7/8 (1774.8)	47⅝ (1203.3)	43 7/8 (1114.4)
	240	167.0	3	8	**CFRN754M3XS**	**C/F**	**C/F**	463 (210)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	167.0	3	8	**CFRN754M5XS**	**C/F**	**C/F**	463 (210)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	200.0	3	8	**CFRN763M5XS**	**C/F**	**C/F**	511 (232)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	480	233.0	3	8	**CFRN773D5XS**	**C/F**	**C/F**	554 (252)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)
	480	267.0	3	8	**CFRN782M5XS**	**C/F**	**C/F**	587 (267)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (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



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WATROD and FIREBAR Circulation Heaters

Application: Process Water⑤

- WATROD elements
- Without thermostat
- General purpose enclosure

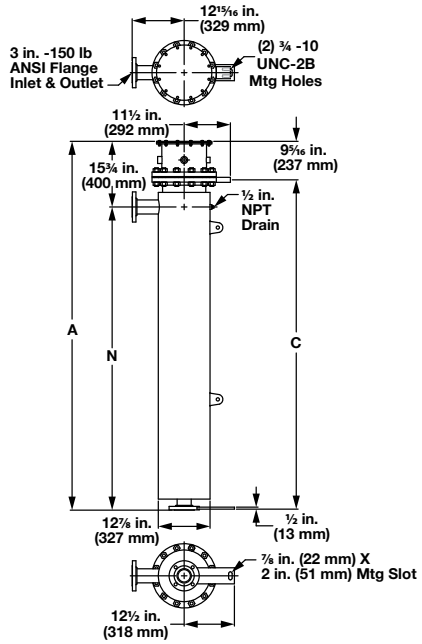
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
10 inch - 150 lb ANSI Flange (WATROD)											
48 W/in² ⑧ Steel Tank 27-Alloy 800 Elements (7.5 W/cm²)	480	262.0	3	9	**CFSN773E5S**	**C/F**	**C/F**	600 (273)	106 5/8 (2708.3)	90 7/8 (2308.2)	97 5/16 (2471.7)
12 inch, 150 lb ANSI Flange (WATROD)											
48 W/in² Steel Tank 36-Alloy 800 Elements (7.5 W/cm²)	480	350.0	3	12	**CFTN773C5S**	**C/F**	**C/F**	650 (295)	106 1/2 (2705)	90 3/8 (2295.5)	97 1/8 (2467.0)
14 inch - 150 lb ANSI Flange (WATROD)											
48 W/in² Steel Tank 45-Alloy 800 Elements (7.5 W/cm²)	480	315.0	3	15	**CFWN754J5S**	**C/F**	**C/F**	600 (273)	83 1/4 (2115)	67 (1700)	73 11/16 (1871.7)
	480	375.0	3	15	**CFWN763J5S**	**C/F**	**C/F**	650 (295)	90 3/4 (2305)	74 1/2 (1891)	81 3/16 (2062.2)

⑤ When steel vessel materials are used in this application, some rust may be present in the process media

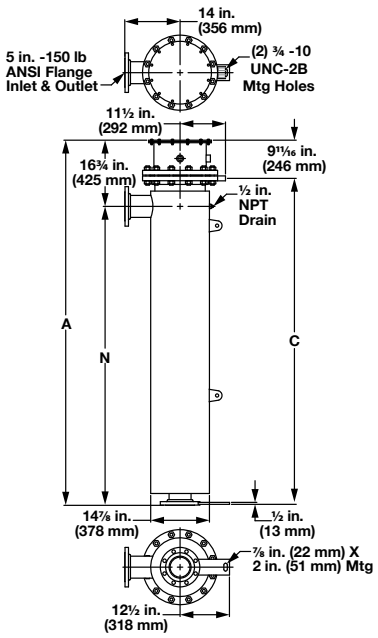
⑧ Can be wired for 1-phase operation

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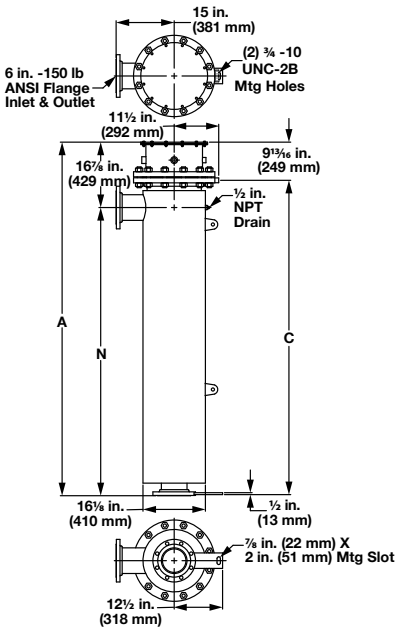
10 inch - 150 lb ANSI Flange



12 inch - 150 lb ANSI Flange



14 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

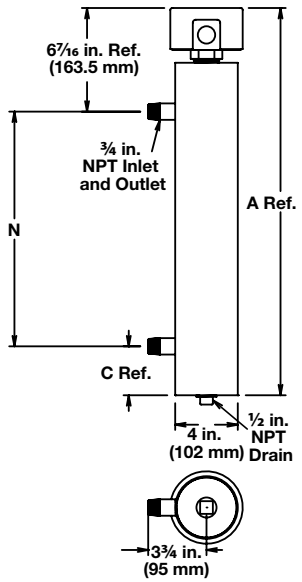
Application: Forced Air and Caustic Solutions

- WATROD elements
- Without thermostat
- General purpose enclosure

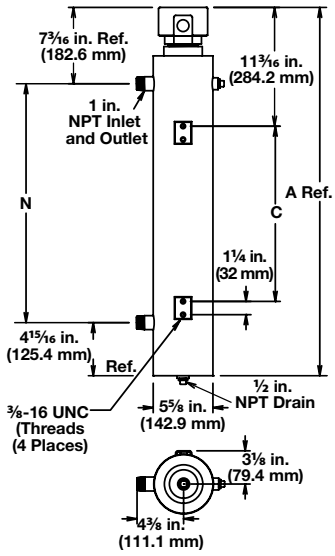
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
1 1/4 inch NPT Screw Plug (WATROD)											
23 W/in² ④ Steel Tank 2-Alloy 800 Elements (3.6 W/cm²)	120	1.0	1	1	**CBEN13G6S**	**C1-15**	**C1-12**	21 (10)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	1.0	1	1	**CBEN13G6S**	**C1-17**	**C1-13**	21 (10)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	120	1.5	1	1	**CBEN19A6S**	**C1-15**	**C1-12**	29 (14)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	1.5	1	1	**CBEN19A6S**	**C1-17**	**C1-13**	29 (14)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	120	2.0	1	1	**CBEN24G6S**	**C1-15**	**C1-12**	29 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	2.0	1	1	**CBEN24G6S**	**C1-17**	**C1-13**	29 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
2 1/2 inch NPT Screw Plug (WATROD)											
23 W/in² Steel Tank 3-Alloy 800 Elements (3.6 W/cm²)	240	3.0	3	1	**CBLNA17G3S**	**C2-50**	**C2-92**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	3.0	3	1	**CBLNA17G5S**	**C2-43**	**C2-35**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	4.5	3	1	**CBLNA24R3S**	**C2-50**	**C2-92**	27 (13)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	4.5	3	1	**CBLNA24R5S**	**C2-43**	**C2-35**	27 (13)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	6.0	3	1	**CBLNA32G3S**	**C2-50**	**C2-92**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	6.0	3	1	**CBLNA32G5S**	**C2-43**	**C2-35**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	7.5	3	1	**CBLNA39R3S**	**C2-50**	**C2-92**	31 (14)	57 1/4 (1453)	45 (1143)	39 (991)
	480	7.5	3	1	**CBLNA39R5S**	**C2-43**	**C2-35**	31 (14)	57 1/4 (1453)	45 (1143)	39 (991)
	240	9.0	3	1	**CBLNA47G3S**	**C2-50**	**C2-92**	32 (15)	57 1/4 (1453)	45 (1143)	39 (991)
	480	9.0	3	1	**CBLNA47G5S**	**C2-43**	**C2-35**	32 (15)	57 1/4 (1453)	45 (1143)	39 (991)

④ Wired for higher voltage

1 1/4 inch NPT Screw Plug



2 1/2 inch NPT Screw Plug



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WATROD and FIREBAR Circulation Heaters

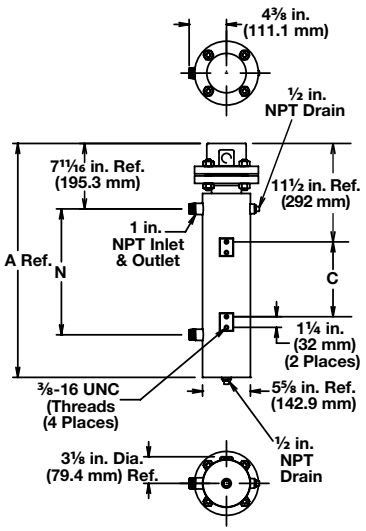
Application: Forced Air and Caustic Solutions

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
3 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 3-Alloy 800 Elements (3.6 W/cm²)	240	3.0	1	1	**CFMNA18A10S**	**C1-17**	**C1-13**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	3.0	3	1	**CFMNA18A3S**	**C2-50**	**C2-92**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	3.0	1	1	**CFMNA18A11S**	**C/F**	**C/F**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	3.0	3	1	**CFMNA18A5S**	**C2-43**	**C2-35**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	4.5	1	1	**CFMNA25J10S**	**C/F**	**C/F**	78 (36)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	4.5	3	1	**CFMNA25J3S**	**C2-50**	**C2-92**	78 (36)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	4.5	1	1	**CFMNA25J11S**	**C/F**	**C/F**	78 (36)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	4.5	3	1	**CFMNA25J5S**	**C2-43**	**C2-35**	78 (36)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	6.0	1	1	**CFMNA33A10S**	**C/F**	**C/F**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	6.0	3	1	**CFMNA33A3S**	**C2-50**	**C2-92**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	6.0	1	1	**CFMNA33A11S**	**C/F**	**C/F**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	6.0	3	1	**CFMNA33A5S**	**C2-43**	**C2-35**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	7.5	1	1	**CFMNA40J10S**	**C/F**	**C/F**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	240	7.5	3	1	**CFMNA40J3S**	**C2-50**	**C2-92**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	480	7.5	1	1	**CFMNA40J11S**	**C/F**	**C/F**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	480	7.5	3	1	**CFMNA40J5S**	**C2-43**	**C2-35**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	240	9.0	1	1	**CFMNA48A10S**	**C/F**	**C/F**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
	240	9.0	3	1	**CFMNA48A3S**	**C2-50**	**C2-92**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
	480	9.0	1	1	**CFMNA48A11S**	**C/F**	**C/F**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
	480	9.0	3	1	**CFMNA48A5S**	**C2-43**	**C2-35**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)

C/F - Contact factory, go to www.watlow.com/en/contact-us

3 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

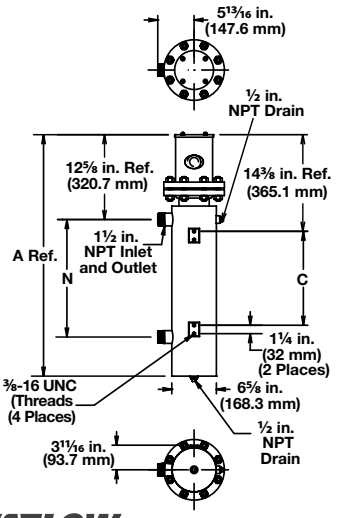
Application: Forced Air and Caustic Solutions

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
4 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² ⑥ Steel Tank 6-Alloy 800 Elements (3.6 W/cm²)	240	6.0	1	1	**CFONA18A10S**	**C/F**	**C/F**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	240	6.0	3	1	**CFONA18A3S**	**C2-50**	**C2-92**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	480	6.0	1	1	**CFONA18A11S**	**C/F**	**C/F**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	480	6.0	3	1	**CFONA18A5S**	**C2-43**	**C2-35**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	240	9.0	1	1	**CFONA25J10S**	**C/F**	**C/F**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	240	9.0	3	1	**CFONA25J3S**	**C2-50**	**C2-92**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	480	9.0	1	1	**CFONA25J11S**	**C/F**	**C/F**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	480	9.0	3	1	**CFONA25J5S**	**C2-43**	**C2-35**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	240	12.0	1	2	**CFONA33A10S**	**C/F**	**C/F**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	240	12.0	3	1	**CFONA33A3S**	**C2-236**	**C2-214**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	480	12.0	1	1	**CFONA33A11S**	**C/F**	**C/F**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	480	12.0	3	1	**CFONA33A5S**	**C2-43**	**C2-35**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	240	15.0	1	2	**CFONA40J10S**	**C/F**	**C/F**	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	15.0	3	1	**CFONA40J3S**	**C2-236**	**C2-214**	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	15.0	1	1	**CFONA40J11S**	**C/F**	**C/F**	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	15.0	3	1	**CFONA40J5S**	**C2-43**	**C2-35**	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	18.0	1	2	**CFONA48A10S**	**C/F**	**C/F**	234 (107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	18.0	3	1	**CFONA48A3S**	**C2-236**	**C2-214**	234 (107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	18.0	1	1	**CFONA48A11S**	**C/F**	**C/F**	234 (107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	18.0	3	1	**CFONA48A5S**	**C2-43**	**C2-35**	234 (107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	25.0	3	2	**CFONA64J3S**	**C2-236**	**C2-214**	298 (136)	91 1/2 (2326)	73 (1854)	66 (1676)
	480	25.0	1	2	**CFONA64J11S**	**C/F**	**C/F**	298 (136)	91 1/2 (2326)	73 (1854)	66 (1676)
	480	25.0	3	1	**CFONA64J5S**	**C2-225**	**C2-226**	298 (136)	91 1/2 (2326)	73 (1854)	66 (1676)
	240	30.0	3	2	**CFONA77A3S**	**C2-236**	**C2-214**	306 (139)	91 1/2 (2326)	73 (1854)	66 (1676)
	480	30.0	1	2	**CFONA77A11S**	**C/F**	**C/F**	306 (139)	91 1/2 (2326)	73 (1854)	66 (1676)
	480	30.0	3	1	**CFONA77A5S**	**C2-225**	**C2-226**	306 (139)	91 1/2 (2326)	73 (1854)	66 (1676)

⑥ Can be wired 3-phase wye to produce 1/3 of the rated kW and watt density C/F - Contact factory, go to www.watlow.com/en/contact-us

4 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

Application: Forced Air and Caustic Solutions

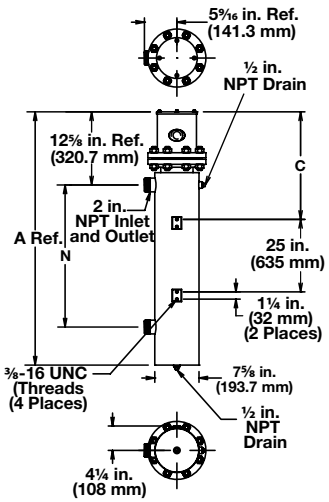
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
5 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² ⑥ Steel Tank 6-Alloy 800 Elements (3.6 W/cm²)	240	9.0	1	1	**CFNNA25J10S**	**C/F**	**C/F**	140 (64)	49 1/4 (1249.0)	30 (762.0)	14 7/8 (377.8)
	240	9.0	3	1	**CFNNA25J3S**	**C2-50**	**C2-92**	140 (64)	49 1/4 (1249.0)	30 (762.0)	14 7/8 (377.8)
	480	9.0	1	1	**CFNNA25J11S**	**C/F**	**C/F**	140 (64)	49 1/4 (1249.0)	30 (762.0)	14 7/8 (377.8)
	480	9.0	3	1	**CFNNA25J5S**	**C2-43**	**C2-35**	140 (64)	49 1/4 (1249.0)	30 (762.0)	14 7/8 (377.8)
	240	12.0	1	2	**CFNNA33A10S**	**C/F**	**C/F**	145 (66)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	12.0	3	1	**CFNNA33A3S**	**C2-236**	**C2-214**	145 (66)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	12.0	1	1	**CFNNA33A11S**	**C/F**	**C/F**	145 (66)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	12.0	3	1	**CFNNA33A5S**	**C2-43**	**C2-35**	145 (66)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	15.0	1	2	**CFNNA40J10S**	**C/F**	**C/F**	167 (76)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	15.0	3	1	**CFNNA40J3S**	**C2-236**	**C2-214**	167 (76)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	15.0	1	1	**CFNNA40J11S**	**C/F**	**C/F**	167 (76)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	15.0	3	1	**CFNNA40J5S**	**C2-43**	**C2-35**	167 (76)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	18.0	1	2	**CFNNA48A10S**	**C/F**	**C/F**	180 (82)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	240	18.0	3	1	**CFNNA48A3S**	**C2-236**	**C2-214**	180 (82)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	480	18.0	1	1	**CFNNA48A11S**	**C/F**	**C/F**	180 (82)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	480	18.0	3	1	**CFNNA48A5S**	**C2-43**	**C2-35**	180 (82)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	240	25.0	3	2	**CFNNA64J3S**	**C2-218**	**C2-224**	195 (89)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	480	25.0	1	2	**CFNNA64J11S**	**C/F**	**C/F**	195 (89)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	480	25.0	3	1	**CFNNA64J5S**	**C2-225**	**C2-226**	195 (89)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	240	30.0	3	2	**CFNNA77A3S**	**C2-218**	**C2-224**	220 (100)	94 1/8 (2390.8)	75 (1902.0)	25 (633.0)
	480	30.0	1	2	**CFNNA77A11S**	**C/F**	**C/F**	220 (100)	94 1/8 (2390.8)	75 (1902.0)	25 (633.0)
	480	30.0	3	1	**CFNNA77A5S**	**C2-225**	**C2-226**	220 (100)	94 1/8 (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



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WATROD and FIREBAR Circulation Heaters

Application: Forced Air and Caustic Solutions

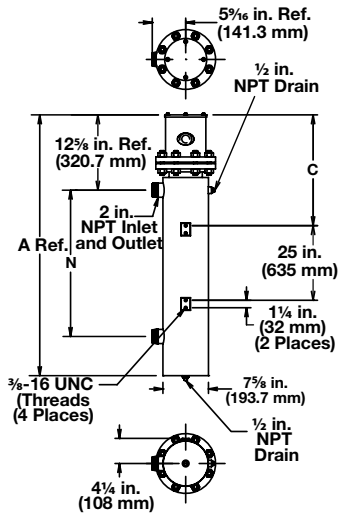
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
5 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² ⑥ Steel Tank 9-Alloy 800 Elements (3.6 W/cm²)	240	14.0	1	3	**CFNNA25J10XS**	**C/F**	**C/F**	145 (66)	49 1/4 (1249.0)	30 (762.0)	14 7/8 (377.8)
	240	14.0	3	1	**CFNNA25J3XS**	**C2-236**	**C2-214**	145 (66)	49 1/4 (1249.0)	30 (762.0)	14 7/8 (377.8)
	480	14.0	1	1	**CFNNA25J11XS**	**C/F**	**C/F**	145 (66)	49 1/4 (1249.0)	30 (762.0)	14 7/8 (377.8)
	480	14.0	3	1	**CFNNA25J5XS**	**C2-43**	**C2-35**	145 (66)	49 1/4 (1249.0)	30 (762.0)	14 7/8 (377.8)
	240	18.0	1	3	**CFNNA33A10XS**	**C/F**	**C/F**	150 (68)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	18.0	3	1	**CFNNA33A3XS**	**C2-236**	**C2-214**	150 (68)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	18.0	1	1	**CFNNA33A11XS**	**C/F**	**C/F**	150 (68)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	18.0	3	1	**CFNNA33A5XS**	**C2-43**	**C2-35**	150 (68)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	23.0	1	3	**CFNNA40J10XS**	**C/F**	**C/F**	174 (79)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	23.0	3	3	**CFNNA40J3XS**	**C4-143**	**C4-142**	174 (79)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	23.0	1	1	**CFNNA40J11XS**	**C/F**	**C/F**	174 (79)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	23.0	3	1	**CFNNA40J5XS**	**C2-225**	**C2-226**	174 (79)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	27.0	1	3	**CFNNA48A10XS**	**C/F**	**C/F**	189 (86)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	240	27.0	3	3	**CFNNA48A3XS**	**C4-143**	**C4-142**	189 (86)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	480	27.0	1	3	**CFNNA48A11XS**	**C/F**	**C/F**	189 (86)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	480	27.0	3	1	**CFNNA48A5XS**	**C2-225**	**C2-226**	189 (86)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	240	38.0	3	3	**CFNNA64J3XS**	**C4-144**	**C4-145**	207 (94)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	480	38.0	1	3	**CFNNA64J11XS**	**C/F**	**C/F**	207 (94)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	480	38.0	3	1	**CFNNA64J5XS**	**C2-225**	**C2-226**	207 (94)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	240	45.0	3	3	**CFNNA77A3XS**	**C4-144**	**C4-145**	233 (106)	94 1/8 (2389.0)	75 (1902.0)	25 (633.0)
	480	45.0	1	3	**CFNNA77A11XS**	**C/F**	**C/F**	233 (106)	94 1/8 (2389.0)	75 (1902.0)	25 (633.0)
	480	45.0	3	3	**CFNNA77A5XS**	**C4-150**	**C4-151**	233 (106)	94 1/8 (2389.0)	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



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WATROD and FIREBAR Circulation Heaters

Application: Forced Air and Caustic Solutions

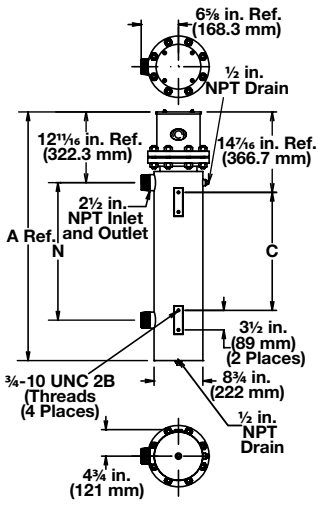
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
6 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² ⑥ Steel Tank 12-Alloy 800 Elements (3.6 W/cm²)	240	12.0	1	2	**CFPNA17R10S**	**C/F**	**C/F**	214 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	12.0	3	1	**CFPNA17R3S**	**C2-236**	**C2-214**	214 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	12.0	1	1	**CFPNA17R11S**	**C/F**	**C/F**	214 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	12.0	3	1	**CFPNA17R5S**	**C2-43**	**C2-35**	214 (97)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	18.0	1	2	**CFPNA25G10S**	**C/F**	**C/F**	222 (101)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	18.0	3	1	**CFPNA25G3S**	**C2-236**	**C2-214**	222 (101)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	18.0	1	1	**CFPNA25G11S**	**C/F**	**C/F**	222 (101)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	18.0	3	1	**CFPNA25G5S**	**C2-43**	**C2-35**	222 (101)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	24.0	1	3	**CFPNA32R10S**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	240	24.0	3	2	**CFPNA32R3S**	**C2-218**	**C2-224**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	480	24.0	1	2	**CFPNA32R11S**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	480	24.0	3	1	**CFPNA32R5S**	**C2-225**	**C2-226**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	240	30.0	1	3	**CFPNA40G10S**	**C/F**	**C/F**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	240	30.0	3	2	**CFPNA40G3S**	**C2-218**	**C2-224**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	30.0	1	2	**CFPNA40G11S**	**C/F**	**C/F**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	30.0	3	1	**CFPNA40G5S**	**C2-225**	**C2-226**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	240	36.0	1	4	**CFPNA47R10S**	**C/F**	**C/F**	298 (136)	72 (1827)	52 (1321)	48 1/2 (1232)
	240	36.0	3	2	**CFPNA47R3S**	**C2-218**	**C2-224**	298 (136)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	36.0	1	2	**CFPNA47R11S**	**C/F**	**C/F**	298 (136)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	36.0	3	1	**CFPNA47R5S**	**C2-225**	**C2-226**	298 (136)	72 (1827)	52 (1321)	48 1/2 (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)

⑥ Can be wired 3-phase wye to produce 1/3 of the rated kW and watt density

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6 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

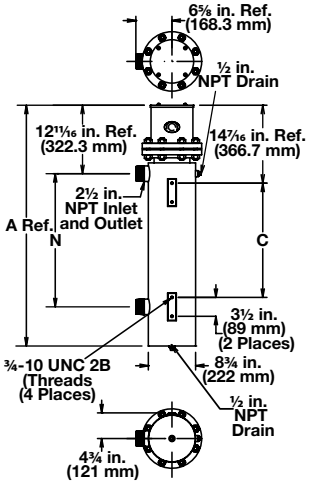
Application: Forced Air and Caustic Solutions

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs	Ship Wt. (kg)	"A" Dim. in.	"A" Dim. (mm)	"N" Dim. in.	"N" Dim. (mm)	"C" Dim. in.	"C" Dim. (mm)
6 inch - 150 lb ANSI Flange (WATROD)															
23 W/in² Steel Tank 15-Alloy 800 Elements (3.6 W/cm²)	240	15.0	1	3	**CFPNA17R10XS**	**C/F**	**C/F**	217	(99)	40 1/2	(1027)	20 1/2	(521)	17	(432)
	240	15.0	3	1	**CFPNA17R3XS**	**C2-236**	**C2-214**	217	(99)	40 1/2	(1027)	20 1/2	(521)	17	(432)
	480	15.0	1	1	**CFPNA17R11XS**	**C/F**	**C/F**	217	(99)	40 1/2	(1027)	20 1/2	(521)	17	(432)
	480	15.0	3	1	**CFPNA17R5XS**	**C2-43**	**C2-35**	217	(99)	40 1/2	(1027)	20 1/2	(521)	17	(432)
	240	23.0	1	3	**CFPNA25G10XS**	**C/F**	**C/F**	226	(103)	40 1/2	(1027)	20 1/2	(521)	17	(432)
	240	23.0	3	5	**CFPNA25G3XS**	**C4-143**	**C4-142**	226	(103)	40 1/2	(1027)	20 1/2	(521)	17	(432)
	480	23.0	1	1	**CFPNA25G11XS**	**C/F**	**C/F**	226	(103)	40 1/2	(1027)	20 1/2	(521)	17	(432)
	480	23.0	3	1	**CFPNA25G5XS**	**C2-225**	**C2-226**	226	(103)	40 1/2	(1027)	20 1/2	(521)	17	(432)
	240	30.0	1	3	**CFPNA32R10XS**	**C/F**	**C/F**	288	(131)	51	(1294)	31	(787)	27 1/2	(699)
	240	30.0	3	5	**CFPNA32R3XS**	**C4-144**	**C4-145**	288	(131)	51	(1294)	31	(787)	27 1/2	(699)
	480	30.0	1	3	**CFPNA32R11XS**	**C/F**	**C/F**	288	(131)	51	(1294)	31	(787)	27 1/2	(699)
	480	30.0	3	1	**CFPNA32R5XS**	**C2-224**	**C2-226**	288	(131)	51	(1294)	31	(787)	27 1/2	(699)
	240	38.0	1	5	**CFPNA40G10XS**	**C/F**	**C/F**	296	(135)	72	(1827)	52	(1321)	48 1/2	(1232)
	240	38.0	3	5	**CFPNA40G3XS**	**C4-144**	**C4-145**	296	(135)	72	(1827)	52	(1321)	48 1/2	(1232)
	480	38.0	1	3	**CFPNA40G11XS**	**C/F**	**C/F**	296	(135)	72	(1827)	52	(1321)	48 1/2	(1232)
	480	38.0	3	1	**CFPNA40G5XS**	**C2-225**	**C2-226**	296	(135)	72	(1827)	52	(1321)	48 1/2	(1232)
	240	45.0	1	5	**CFPNA47R10XS**	**C/F**	**C/F**	306	(139)	72	(1827)	52	(1321)	48 1/2	(1232)
	240	45.0	3	5	**CFPNA47R3XS**	**C4-144**	**C4-145**	306	(139)	72	(1827)	52	(1321)	48 1/2	(1232)
	480	45.0	1	3	**CFPNA47R11XS**	**C/F**	**C/F**	306	(139)	72	(1827)	52	(1321)	48 1/2	(1232)
	480	45.0	3	5	**CFPNA47R5XS**	**C4-152**	**C4-153**	306	(139)	72	(1827)	52	(1321)	48 1/2	(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



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WATROD and FIREBAR Circulation Heaters

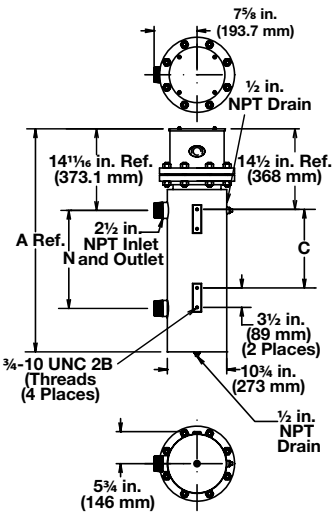
Application: Forced Air and Caustic Solutions

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
8 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 18-Alloy 800 Elements (3.6 W/cm²)	240	30.0	1	3	**CFRNA32N10S**	**C/F**	**C/F**	370 (168)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	30.0	3	2	**CFRNA32N3S**	**C2-218**	**C2-224**	370 (168)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	30.0	1	2	**CFRNA32N11S**	**C/F**	**C/F**	370 (168)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	30.0	3	1	**CFRNA32N5S**	**C2-225**	**C2-226**	370 (168)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	40.0	3	3	**CFRNA43E3S**	**C4-144**	**C4-145**	410 (186)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	40.0	1	2	**CFRNA43E11S**	**C/F**	**C/F**	410 (186)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	40.0	3	3	**CFRNA43E5S**	**C4-150**	**C4-151**	410 (186)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	240	50.0	3	3	**CFRNA51M3S**	**C4-144**	**C4-145**	440 (200)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	50.0	1	3	**CFRNA51M11S**	**C/F**	**C/F**	440 (200)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	50.0	3	2	**CFRNA51M5S**	**C2-229**	**C2-230**	440 (200)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
8 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 24-Alloy 800 Elements (3.6 W/cm²)	240	40.0	1	4	**CFRNA33D10XS**	**C/F**	**C/F**	382 (174)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	40.0	3	4	**CFRNA33D3XS**	**C4-146**	**C4-147**	382 (174)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	40.0	1	2	**CFRNA33D11XS**	**C/F**	**C/F**	382 (174)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	40.0	3	2	**CFRNA33D5XS**	**C2-227**	**C2-228**	382 (174)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	53.0	3	4	**CFRNA43M3XS**	**C4-148**	**C4-149**	425 (193)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	53.0	1	3	**CFRNA43M11XS**	**C/F**	**C/F**	425 (193)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	53.0	3	2	**CFRNA43M5XS**	**C2-229**	**C2-230**	425 (193)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	240	67.0	3	4	**CFRNA51M3XS**	**C4-148**	**C4-149**	457 (207)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	67.0	1	3	**CFRNA51M11XS**	**C/F**	**C/F**	457 (207)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	67.0	3	2	**CFRNA51M5XS**	**C2-229**	**C2-230**	457 (207)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)

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8 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

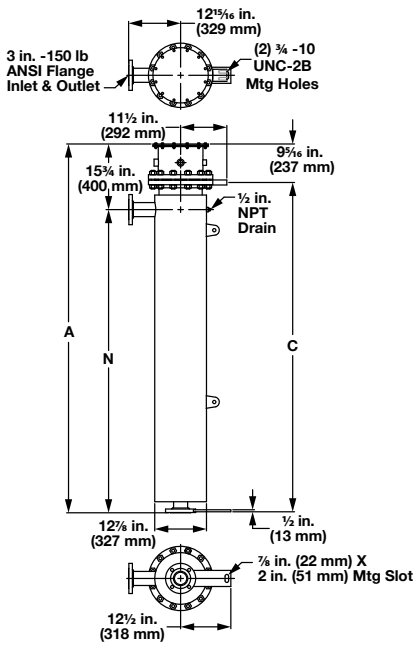
Application: Forced Air and Caustic Solutions

- WATROD elements
- Without thermostat
- General purpose enclosure

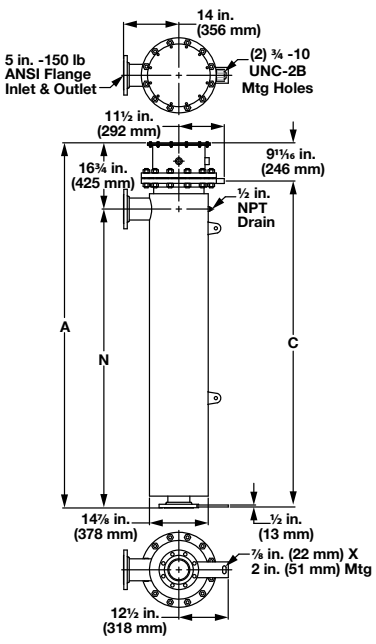
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
10 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 27-Alloy 800 Elements (3.6 W/cm²)	240	60.0	3	3	**CFSNA43N3S**	**C4-144**	**C4-145**	515 (234)	76 5/8 (1946.3)	60 7/8 (1546.2)	67 5/16 (1709.7)
	480	60.0	3	3	**CFSNA43N5S**	**C4-150**	**C4-151**	515 (234)	76 5/8 (1946.3)	60 7/8 (1546.2)	67 5/16 (1709.7)
	240	75.0	3	9	**CFSNA51N3S**	**C/F**	**C/F**	530 (241)	84 1/8 (2136.8)	68 3/8 (1736.2)	74 13/16 (1900.2)
	480	75.0	3	3	**CFSNA51N5S**	**C4-152**	**C4-153**	530 (241)	84 1/8 (2136.8)	68 3/8 (1736.2)	74 13/16 (1900.2)
12 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 36-Alloy 800 Elements (3.6 W/cm²)	480	80.0	3	3	**CFTNA43L5S**	**C4-152**	**C4-153**	565 (257)	76 7/8 (1952.6)	60 3/4 (1541)	67 1/2 (1714.0)
	480	100.0	3	3	**CFTNA51L5S**	**C4-152**	**C4-153**	585 (266)	84 3/8 (2143.1)	68 1/4 (1732)	75 (1905.0)
14 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 45-Alloy 800 Elements (3.6 W/cm²)	480	100.0	3	3	**CFWNA43J5S**	**C4-152**	**C4-153**	570 (259)	75 3/4 (1924)	59 1/2 (1510)	66 3/16 (1681.2)
	480	125.0	3	5	**CFWNA51J5S**	**C/F**	**C/F**	590 (268)	83 1/4 (2115)	67 (1700)	73 11/16 (1871.7)

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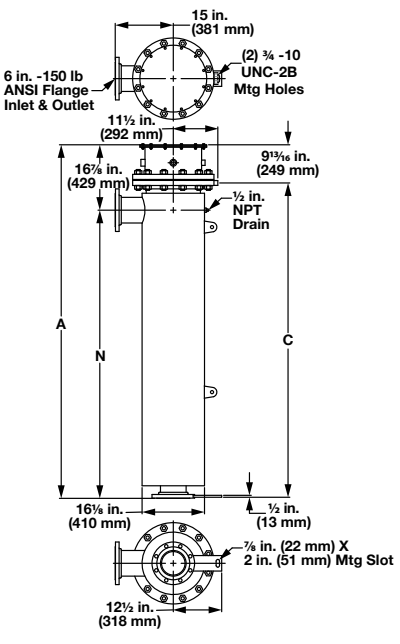
10 inch - 150 lb ANSI Flange



12 inch - 150 lb ANSI Flange



14 inch - 150 lb ANSI Flange



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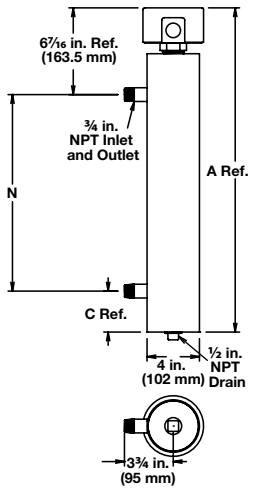
WATROD and FIREBAR Circulation Heaters

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 Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
1 1/4 inch NPT Screw Plug (WATROD)											
23 W/in² ④ Steel Tank 2-Steel Element (3.6 W/cm²)	120	1.5	1	1	**CBES19G6S**	**C1-15**	**C1-12**	29 (14)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	1.5	1	1	**CBES19G6S**	**C1-17**	**C1-13**	29 (14)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	120	2.0	1	1	**CBES25G6S**	**C1-15**	**C1-12**	29 (14)	32 5/8 (828.7)	23 (584)	3 (76.0)
	240	2.0	1	1	**CBES25G6S**	**C1-17**	**C1-13**	29 (14)	32 5/8 (828.7)	23 (584)	3 (76.0)
1 1/4 inch NPT Screw Plug (FIREBAR)											
30 W/in² Steel Tank 1-Alloy 800 Element (4.7 W/cm²)	240	1.7	3	1	**CBDNF16G12S**	**C2-50**	**C2-92**	26 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	480	1.7	3	1	**CBDNF16G13S**	**C2-43**	**C2-35**	26 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	2.2	3	1	**CBDNF19G12S**	**C2-50**	**C2-92**	30 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	480	2.2	3	1	**CBDNF19G13S**	**C2-43**	**C2-35**	30 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	2.8	3	1	**CBDNF24L12S**	**C2-50**	**C2-92**	31 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	480	2.8	3	1	**CBDNF24L13S**	**C2-43**	**C2-35**	31 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	3.5	3	1	**CBDNF29R12S**	**C2-50**	**C2-92**	43 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	480	3.5	3	1	**CBDNF29R13S**	**C2-43**	**C2-35**	43 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	240	4.3	3	1	**CBDNF34R12S**	**C2-50**	**C2-92**	44 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	480	4.3	3	1	**CBDNF34R13S**	**C2-43**	**C2-35**	44 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	240	5.7	3	1	**CBDNF45G12S**	**C2-50**	**C2-92**	69 (32)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	480	5.7	3	1	**CBDNF45G13S**	**C2-43**	**C2-35**	69 (32)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	240	7.2	3	1	**CBDNF55R12S**	**C2-50**	**C2-92**	71 (33)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	480	7.2	3	1	**CBDNF55R13S**	**C2-43**	**C2-35**	71 (33)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
1 1/4 inch NPT Screw Plug (FIREBAR)											
23 W/in² Steel Tank 1-Alloy 800 Element (3.6 W/cm²)	240	1.25	3	1	**CBDNF16G20S**	**C2-50**	**C2-92**	26 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	1.65	3	1	**CBDNF19G20S**	**C2-50**	**C2-92**	30 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	2.15	3	1	**CBDNF24L20S**	**C2-50**	**C2-92**	31 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	480	2.15	3	1	**CBDNF24L19S**	**C2-43**	**C2-35**	31 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	2.65	3	1	**CBDNF29R20S**	**C2-50**	**C2-92**	43 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	480	2.65	3	1	**CBDNF29R19S**	**C2-43**	**C2-35**	43 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	240	3.20	3	1	**CBDNF34R20S**	**C2-50**	**C2-92**	44 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	480	3.20	3	1	**CBDNF34R19S**	**C2-43**	**C2-35**	44 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	240	4.25	3	1	**CBDNF45G20S**	**C2-50**	**C2-92**	69 (32)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	480	4.25	3	1	**CBDNF45G19S**	**C2-43**	**C2-35**	69 (32)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	240	5.40	3	1	**CBDNF55R20S**	**C2-50**	**C2-92**	71 (33)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	480	5.40	3	1	**CBDNF55R19S**	**C2-43**	**C2-35**	71 (33)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)

1 1/4 inch NPT Screw Plug



④ Wired for higher voltage

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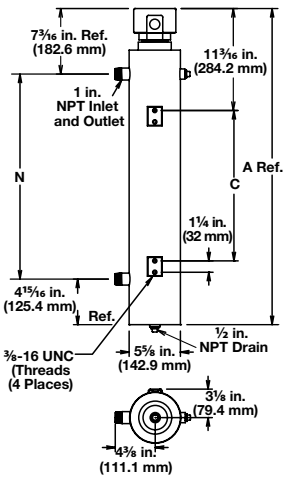
WATROD and FIREBAR Circulation Heaters

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 Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
2 1/2 inch NPT Screw Plug (WATROD)											
23 W/in² Steel Tank 3-Steel (3.6 W/cm²)	240	3.0	3	1	**CBLS717E3S**	**C2-50**	**C2-92**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	3.0	3	1	**CBLS717E5S**	**C2-43**	**C2-35**	24 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	4.5	3	1	**CBLS724N3S**	**C2-50**	**C2-92**	27 (13)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	4.5	3	1	**CBLS724N5S**	**C2-43**	**C2-35**	27 (13)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	6.0	3	1	**CBLS732E3S**	**C2-50**	**C2-92**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	6.0	3	1	**CBLS732E5S**	**C2-43**	**C2-35**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	7.5	3	1	**CBLS739N3S**	**C2-50**	**C2-92**	31 (14)	57 1/4 (1453)	45 (1143)	39 (991)
	480	7.5	3	1	**CBLS739N5S**	**C2-43**	**C2-35**	31 (14)	57 1/4 (1453)	45 (1143)	39 (991)
	240	9.0	3	1	**CBLS747E3S**	**C2-50**	**C2-92**	32 (15)	57 1/4 (1453)	45 (1143)	39 (991)
	480	9.0	3	1	**CBLS747E5S**	**C2-43**	**C2-35**	32 (15)	57 1/4 (1453)	45 (1143)	39 (991)
2 1/2 inch NPT Screw Plug (FIREBAR)											
30 W/in² ③ Steel Tank 3-Alloy 800 Elements (4.7 W/cm²)	240	5.0	3	1	**CBLNF15C12S**	**C2-50**	**C2-92**	22 (10)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	5.0	3	1	**CBLNF15C13S**	**C2-43**	**C2-35**	22 (10)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	6.5	3	1	**CBLNF18C12S**	**C2-50**	**C2-92**	23 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	6.5	3	1	**CBLNF18C13S**	**C2-43**	**C2-35**	23 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	8.5	3	1	**CBLNF23C12S**	**C2-50**	**C2-92**	31 (14)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	8.5	3	1	**CBLNF23C13S**	**C2-43**	**C2-35**	31 (14)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	10.5	3	1	**CBLNF28L12S**	**C2-236**	**C2-214**	34 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	10.5	3	1	**CBLNF28L13S**	**C2-43**	**C2-35**	34 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	12.8	3	1	**CBLNF33L12S**	**C2-236**	**C2-214**	35 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	12.8	3	1	**CBLNF33L13S**	**C2-43**	**C2-35**	35 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	17.0	3	1	**CBLNF44C12S**	**C2-236**	**C2-214**	44 (20)	57 1/4 (1453)	45 (1143)	39 (991)
	480	17.0	3	1	**CBLNF44C13S**	**C2-43**	**C2-35**	44 (20)	57 1/4 (1453)	45 (1143)	39 (991)
	480	21.5	3	1	**CBLNF54L13S**	**C2-225**	**C2-226**	52 (24)	63 3/4 (1618)	51 1/2 (1308)	46 1/2 (1181)
2 1/2 inch NPT Screw Plug (FIREBAR)											
23 W/in² ⑧ Steel Tank 3-Alloy 800 Elements (3.6 W/cm²)	240	3.80	3	1	**CBLNF15C20S**	**C2-50**	**C2-92**	22 (10)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	4.90	3	1	**CBLNF18C20S**	**C2-50**	**C2-92**	23 (11)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	6.40	3	1	**CBLNF23C20S**	**C2-50**	**C2-92**	31 (14)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	6.40	3	1	**CBLNF23C19S**	**C2-43**	**C2-35**	31 (14)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	7.90	3	1	**CBLNF28L20S**	**C2-50**	**C2-92**	34 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	7.90	3	1	**CBLNF28L19S**	**C2-43**	**C2-35**	34 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	9.60	3	1	**CBLNF33L20S**	**C2-50**	**C2-92**	35 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	9.60	3	1	**CBLNF33L19S**	**C2-43**	**C2-35**	35 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	12.80	3	1	**CBLNF44C20S**	**C2-236**	**C2-214**	44 (20)	57 1/4 (1453)	45 (1143)	39 (991)
	480	12.80	3	1	**CBLNF44C19S**	**C2-43**	**C2-35**	44 (20)	57 1/4 (1453)	45 (1143)	39 (991)
	240	16.10	3	1	**CBLNF54L20S**	**C2-236**	**C2-214**	52 (24)	63 3/4 (1618)	51 1/2 (1308)	46 1/2 (1181)
	480	16.10	3	1	**CBLNF54L19S**	**C2-43**	**C2-35**	52 (24)	63 3/4 (1618)	51 1/2 (1308)	46 1/2 (1181)

2 1/2 inch NPT Screw Plug



③ Wired for 3-phase operation only

⑧ Can be wired for 1-phase operation

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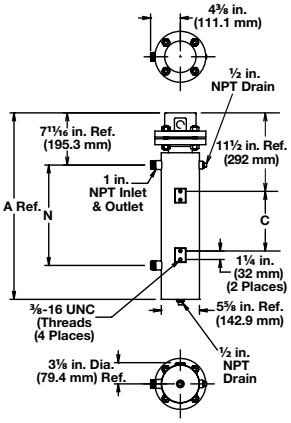
WATROD and FIREBAR Circulation Heaters

Application: Lightweight Oils and Heat Transfer Oils

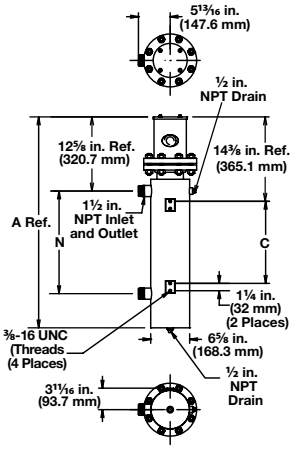
- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
3 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 3-Steel Elements (3.6 W/cm²)	240	3.0	1	1	**CFMS718A10S**	**C1-17**	**C1-13**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	3.0	3	1	**CFMS718A3S**	**C2-50**	**C2-92**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	3.0	1	1	**CFMS718A11S**	**C/F**	**C/F**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	3.0	3	1	**CFMS718A5S**	**C2-43**	**C2-35**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	4.5	1	1	**CFMS725J10S**	**C/F**	**C/F**	78 (36)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	4.5	3	1	**CFMS725J3S**	**C2-50**	**C2-92**	78 (36)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	4.5	1	1	**CFMS725J11S**	**C/F**	**C/F**	78 (36)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	4.5	3	1	**CFMS725J5S**	**C2-43**	**C2-35**	78 (36)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	6.0	1	2	**CFMS733A10S**	**C/F**	**C/F**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	6.0	3	1	**CFMS733A3S**	**C2-50**	**C2-92**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	6.0	1	1	**CFMS733A11S**	**C/F**	**C/F**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	6.0	3	1	**CFMS733A5S**	**C2-43**	**C2-35**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	7.5	1	2	**CFMS740J10S**	**C/F**	**C/F**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	240	7.5	3	1	**CFMS740J3S**	**C2-50**	**C2-92**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	480	7.5	1	1	**CFMS740J11S**	**C/F**	**C/F**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	480	7.5	3	1	**CFMS740J5S**	**C2-43**	**C2-35**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	240	9.0	1	2	**CFMS748A10S**	**C/F**	**C/F**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
	240	9.0	3	1	**CFMS748A3S**	**C2-50**	**C2-92**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
	480	9.0	1	1	**CFMS748A11S**	**C/F**	**C/F**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
	480	9.0	3	1	**CFMS748A5S**	**C2-43**	**C2-35**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
4 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 6-Steel Elements (3.6 W/cm²)	240	6.0	1	1	**CFOS718A10S**	**C/F**	**C/F**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	240	6.0	3	1	**CFOS718A3S**	**C2-50**	**C2-92**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	480	6.0	1	1	**CFOS718A11S**	**C/F**	**C/F**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	480	6.0	3	1	**CFOS718A5S**	**C2-43**	**C2-35**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	240	9.0	1	1	**CFOS725J10S**	**C/F**	**C/F**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	240	9.0	3	1	**CFOS725J3S**	**C2-50**	**C2-92**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	480	9.0	1	1	**CFOS725J11S**	**C/F**	**C/F**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	480	9.0	3	1	**CFOS725J5S**	**C2-43**	**C2-35**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	240	12.0	1	2	**CFOS733A10S**	**C/F**	**C/F**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	240	12.0	3	1	**CFOS733A3S**	**C2-236**	**C2-214**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	480	12.0	1	1	**CFOS733A11S**	**C/F**	**C/F**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	480	12.0	3	1	**CFOS733A5S**	**C2-43**	**C2-35**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	240	15.0	1	2	**CFOS740J10S**	**C/F**	**C/F**	229(104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	15.0	3	1	**CFOS740J3S**	**C2-236**	**C2-214**	229(104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	15.0	1	1	**CFOS740J11S**	**C/F**	**C/F**	229(104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	15.0	3	1	**CFOS740J5S**	**C2-43**	**C2-35**	229(104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	18.0	1	2	**CFOS748A10S**	**C/F**	**C/F**	234(107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	18.0	3	1	**CFOS748A3S**	**C2-236**	**C2-214**	234(107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	18.0	1	1	**CFOS748A11S**	**C/F**	**C/F**	234(107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	18.0	3	1	**CFOS748A5S**	**C2-43**	**C2-35**	234(107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	25.0	3	2	**CFOS764J3S**	**C2-218**	**C2-224**	298(136)	91 1/2 (2326)	73 (1854)	66 (1676)
	480	25.0	1	2	**CFOS764J11S**	**C/F**	**C/F**	298(136)	91 1/2 (2326)	73 (1854)	66 (1676)
	480	25.0	3	1	**CFOS764J5S**	**C2-225**	**C2-226**	298(136)	91 1/2 (2326)	73 (1854)	66 (1676)
	240	30.0	3	2	**CFOS777A3S**	**C2-218**	**C2-224**	306(139)	91 1/2 (2326)	73 (1854)	66 (1676)
	480	30.0	1	2	**CFOS777A11S**	**C/F**	**C/F**	306(139)	91 1/2 (2326)	73 (1854)	66 (1676)
	480	30.0	3	1	**CFOS777A5S**	**C2-225**	**C2-226**	306(139)	91 1/2 (2326)	73 (1854)	66 (1676)

3 inch - 150 lb ANSI Flange



4 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

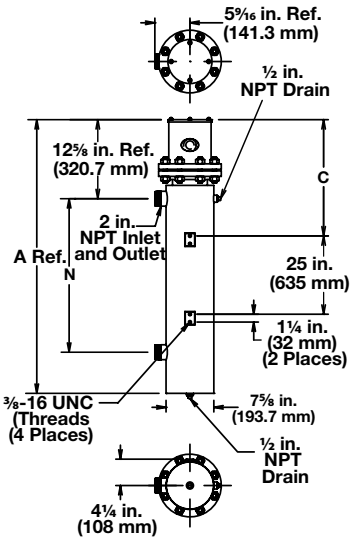
Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
5 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 6-Steel Elements (3.6 W/cm²)	240	12.0	1	2	**CFNS733A10S**	**C/F**	**C/F**	145 (66)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	12.0	3	1	**CFNS733A3S**	**C2-236**	**C2-214**	145 (66)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	12.0	1	1	**CFNS733A11S**	**C/F**	**C/F**	145 (66)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	12.0	3	1	**CFNS733A5S**	**C2-43**	**C2-35**	145 (66)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	15.0	1	2	**CFNS740J10S**	**C/F**	**C/F**	167 (76)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	15.0	3	1	**CFNS740J3S**	**C2-236**	**C2-214**	167 (76)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	15.0	1	1	**CFNS740J11S**	**C/F**	**C/F**	167 (76)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	480	15.0	3	1	**CFNS740J5S**	**C2-43**	**C2-35**	167 (76)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (473.1)
	240	18.0	1	2	**CFNS748A10S**	**C/F**	**C/F**	180 (82)	67 3/4 (1719.0)	48 1/2 (1232.0)	18 5/8 (473.1)
	240	18.0	3	1	**CFNS748A3S**	**C2-236**	**C2-214**	180 (82)	67 3/4 (1719.0)	48 1/2 (1232.0)	18 5/8 (473.1)
	480	18.0	1	1	**CFNS748A11S**	**C/F**	**C/F**	180 (82)	67 3/4 (1719.0)	48 1/2 (1232.0)	18 5/8 (473.1)
	480	18.0	3	1	**CFNS748A5S**	**C2-43**	**C2-35**	180 (82)	67 3/4 (1719.0)	48 1/2 (1232.0)	18 5/8 (473.1)
	240	25.0	3	2	**CFNS764J3S**	**C2-218**	**C2-224**	195 (89)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	480	25.0	1	2	**CFNS764J11S**	**C/F**	**C/F**	195 (89)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	480	25.0	3	1	**CFNS764J5S**	**C2-225**	**C2-226**	195 (89)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	240	30.0	3	2	**CFNS777A3S**	**C2-218**	**C2-224**	220 (100)	94 1/8 (2390.8)	75 (1902.0)	25 (633.0)
	480	30.0	1	2	**CFNS777A11S**	**C/F**	**C/F**	220 (100)	94 1/8 (2390.8)	75 (1902.0)	25 (633.0)
	480	30.0	3	1	**CFNS777A5S**	**C2-225**	**C2-226**	220 (100)	94 1/8 (2390.8)	75 (1902.0)	25 (633.0)

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5 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

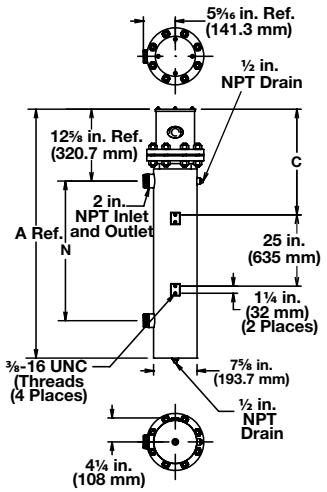
Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
5 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 9-Steel Elements (3.6 W/cm²)	240	18.0	1	3	**CFNS733A10XS**	**C/F**	**C/F**	150 (68)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (471.1)
	240	18.0	3	1	**CFNS733A3XS**	**C2-236**	**C2-214**	150 (68)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (471.1)
	480	18.0	1	1	**CFNS733A11XS**	**C/F**	**C/F**	150 (68)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (471.1)
	480	18.0	3	1	**CFNS733A5XS**	**C2-43**	**C2-35**	150 (68)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (471.1)
	240	23.0	1	3	**CFNS740J10XS**	**C/F**	**C/F**	173 (79)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (471.1)
	240	23.0	3	3	**CFNS740J3XS**	**C4-143**	**C4-142**	173 (79)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (471.1)
	480	23.0	1	1	**CFNS740J11XS**	**C/F**	**C/F**	173 (79)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (471.1)
	480	23.0	3	1	**CFNS740J5XS**	**C2-225**	**C2-226**	173 (79)	56 1/4 (1427.0)	37 (940.0)	18 5/8 (471.1)
	240	27.0	1	3	**CFNS748A10XS**	**C/F**	**C/F**	188 (86)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	240	27.0	3	3	**CFNS748A3XS**	**C4-143**	**C4-142**	188 (86)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	480	27.0	1	3	**CFNS748A11XS**	**C/F**	**C/F**	188 (86)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	480	27.0	3	1	**CFNS748A5XS**	**C2-225**	**C2-226**	188 (86)	67¾ (1719.0)	48 1/2 (1232.0)	25 (633.0)
	240	38.0	3	3	**CFNS764J3XS**	**C4-144**	**C4-145**	206 (94)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	480	38.0	1	3	**CFNS764J11XS**	**C/F**	**C/F**	206 (94)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	480	38.0	3	1	**CFNS764J5XS**	**C2-225**	**C2-226**	206 (94)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	240	45.0	3	3	**CFNS777A3XS**	**C4-144**	**C4-145**	233 (106)	94 1/8 (2390.8)	75 (1902.0)	25 (633.0)
	480	45.0	1	3	**CFNS777A11XS**	**C/F**	**C/F**	233 (106)	94 1/8 (2390.8)	75 (1902.0)	25 (633.0)
	480	45.0	3	3	**CFNS777A5XS**	**C4-150**	**C4-151**	233 (106)	94 1/8 (2390.8)	75 (1902.0)	25 (633.0)

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5 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

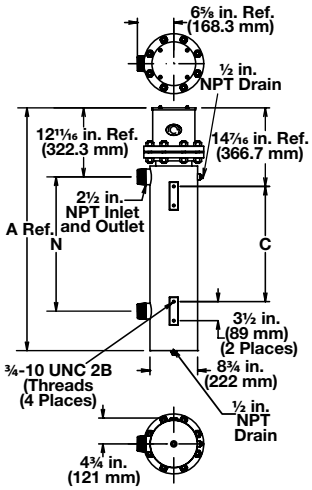
Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
6 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 12-Steel Elements (3.6 W/cm²)	240	12.0	1	2	**CFPS717R10S**	**C/F**	**C/F**	214 (97)	40½ (1027)	20½ (521)	17 (432)
	240	12.0	3	1	**CFPS717R3S**	**C2-236**	**C2-214**	214 (97)	40½ (1027)	20½ (521)	17 (432)
	480	12.0	1	1	**CFPS717R11S**	**C/F**	**C/F**	214 (97)	40½ (1027)	20½ (521)	17 (432)
	480	12.0	3	1	**CFPS717R5S**	**C2-43**	**C2-35**	214 (97)	40½ (1027)	20½ (521)	17 (432)
	240	18.0	1	2	**CFPS725G10S**	**C/F**	**C/F**	222 (101)	40½ (1027)	20½ (521)	17 (432)
	240	18.0	3	1	**CFPS725G3S**	**C2-236**	**C2-214**	222 (101)	40½ (1027)	20½ (521)	17 (432)
	480	18.0	1	1	**CFPS725G11S**	**C/F**	**C/F**	222 (101)	40½ (1027)	20½ (521)	17 (432)
	480	18.0	3	1	**CFPS725G5S**	**C2-43**	**C2-35**	222 (101)	40½ (1027)	20½ (521)	17 (432)
	240	24.0	1	3	**CFPS732R10S**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27½ (699)
	240	24.0	3	2	**CFPS732R3S**	**C2-218**	**C2-224**	226 (103)	51 (1294)	31 (787)	27½ (699)
	480	24.0	1	2	**CFPS732R11S**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27½ (699)
	480	24.0	3	1	**CFPS732R5S**	**C2-225**	**C2-226**	226 (103)	51 (1294)	31 (787)	27½ (699)
	240	30.0	1	3	**CFPS740G10S**	**C/F**	**C/F**	290 (132)	72 (1827)	52 (1321)	48½ (1232)
	240	30.0	3	2	**CFPS740G3S**	**C2-218**	**C2-224**	290 (132)	72 (1827)	52 (1321)	48½ (1232)
	480	30.0	1	2	**CFPS740G11S**	**C/F**	**C/F**	290 (132)	72 (1827)	52 (1321)	48½ (1232)
	480	30.0	3	1	**CFPS740G5S**	**C2-225**	**C2-226**	290 (132)	72 (1827)	52 (1321)	48½ (1232)
	240	36.0	1	4	**CFPS747R10S**	**C/F**	**C/F**	298 (136)	72 (1827)	52 (1321)	48½ (1232)
	240	36.0	3	2	**CFPS747R3S**	**C2-218**	**C2-224**	298 (136)	72 (1827)	52 (1321)	48½ (1232)
	480	36.0	1	2	**CFPS747R11S**	**C/F**	**C/F**	298 (136)	72 (1827)	52 (1321)	48½ (1232)
	480	36.0	3	1	**CFPS747R5S**	**C2-225**	**C2-226**	298 (136)	72 (1827)	52 (1321)	48½ (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



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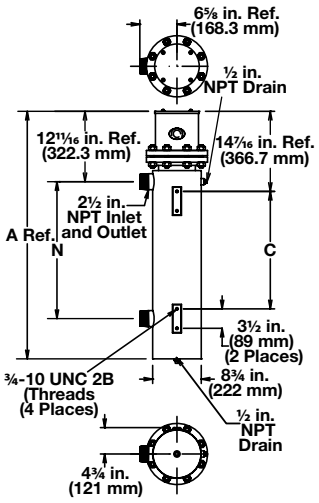
Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
6 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 15-Steel Elements (3.6 W/cm²)	240	15.0	1	3	**CFPS717R10XS**	**C/F**	**C/F**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	15.0	3	1	**CFPS717R3XS**	**C2-236**	**C2-214**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	15.0	1	1	**CFPS717R11XS**	**C/F**	**C/F**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	15.0	3	1	**CFPS717R5XS**	**C2-43**	**C2-35**	217 (99)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	23.0	1	3	**CFPS725G10XS**	**C/F**	**C/F**	222 (101)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	23.0	3	5	**CFPS725G3XS**	**C4-143**	**C4-142**	222 (101)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	23.0	1	1	**CFPS725G11XS**	**C/F**	**C/F**	222 (101)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	480	23.0	3	1	**CFPS725G5XS**	**C2-225**	**C2-226**	222 (101)	40 1/2 (1027)	20 1/2 (521)	17 (432)
	240	30.0	1	3	**CFPS732R10XS**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	240	30.0	3	5	**CFPS732R3XS**	**C4-144**	**C4-145**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	480	30.0	1	3	**CFPS732R11XS**	**C/F**	**C/F**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	480	30.0	3	1	**CFPS732R5XS**	**C2-225**	**C2-226**	226 (103)	51 (1294)	31 (787)	27 1/2 (699)
	240	38.0	1	5	**CFPS740G10XS**	**C/F**	**C/F**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	240	38.0	3	5	**CFPS740G3XS**	**C4-144**	**C4-145**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	38.0	1	3	**CFPS740G11XS**	**C/F**	**C/F**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	38.0	3	1	**CFPS740G5XS**	**C2-225**	**C2-226**	290 (132)	72 (1827)	52 (1321)	48 1/2 (1232)
	240	45.0	1	5	**CFPS747R10XS**	**C/F**	**C/F**	298 (136)	72 (1827)	52 (1321)	48 1/2 (1232)
	240	45.0	3	5	**CFPS747R3XS**	**C4-144**	**C4-145**	298 (136)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	45.0	1	3	**CFPS747R11XS**	**C/F**	**C/F**	298 (136)	72 (1827)	52 (1321)	48 1/2 (1232)
	480	45.0	3	5	**CFPS747R5XS**	**C4-150**	**C4-151**	298 (136)	72 (1827)	52 (1321)	48 1/2 (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



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WATROD and FIREBAR Circulation Heaters

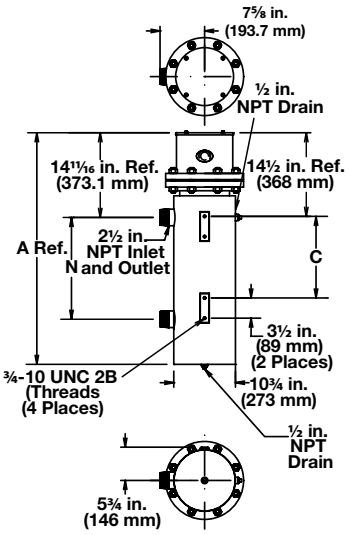
Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
8 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 18-Steel Elements (3.6 W/cm²)	240	30.0	1	3	**CFRS732N10S**	**C/F**	**C/F**	370 (168)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	30.0	3	2	**CFRS732N3S**	**C2-218**	**C2-224**	370 (168)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	30.0	1	2	**CFRS732N11S**	**C/F**	**C/F**	370 (168)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	30.0	3	1	**CFRS732N5S**	**C2-225**	**C2-226**	370 (168)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	40.0	3	3	**CFRS743E3S**	**C4-144**	**C4-145**	410 (186)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	40.0	1	2	**CFRS743E11S**	**C/F**	**C/F**	410 (186)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	40.0	3	2	**CFRS743E5S**	**C2-227**	**C2-228**	410 (186)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	240	50.0	3	3	**CFRS751M3S**	**C4-144**	**C4-145**	440 (200)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	50.0	1	3	**CFRS751M11S**	**C/F**	**C/F**	440 (200)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	50.0	3	2	**CFRS751M5S**	**C2-229**	**C2-230**	440 (200)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	240	60.0	3	6	**CFRS762D3S**	**C4-144**	**C4-145**	480 (218)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	60.0	1	3	**CFRS762D11S**	**C/F**	**C/F**	480 (218)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	60.0	3	2	**CFRS762D5S**	**C2-229**	**C2-230**	480 (218)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	240	70.0	3	6	**CFRS770M3S**	**C/F**	**C/F**	530 (241)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	480	70.0	1	6	**CFRS770M11S**	**C/F**	**C/F**	530 (241)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	480	70.0	3	2	**CFRS770M5S**	**C2-229**	**C2-230**	530 (241)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	240	80.0	3	6	**CFRS779M3S**	**C/F**	**C/F**	610 (277)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)
	480	80.0	3	3	**CFRS779M5S**	**C4-152**	**C4-153**	610 (277)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)

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8 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

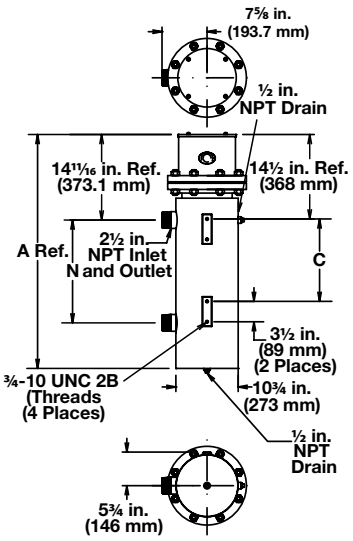
Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
8 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 24-Steel (3.6 W/cm²)	240	40.0	1	4	**CFRS733D10XS**	**C/F**	**C/F**	382 (174)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	40.0	3	4	**CFRS733D3XS**	**C4-146**	**C4-147**	382 (174)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	40.0	1	2	**CFRS733D11XS**	**C/F**	**C/F**	382 (174)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	40.0	3	2	**CFRS733D5XS**	**C2-227**	**C2-228**	382 (174)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	53.0	3	4	**CFRS743M3XS**	**C4-148**	**C4-149**	425 (193)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	53.0	1	3	**CFRS743M11XS**	**C/F**	**C/F**	425 (193)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	53.0	3	2	**CFRS743M5XS**	**C2-229**	**C2-230**	425 (193)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	240	67.0	3	4	**CFRS751M3XS**	**C4-148**	**C4-149**	457 (208)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	67.0	1	3	**CFRS751M11XS**	**C/F**	**C/F**	457 (208)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	67.0	3	2	**CFRS751M5XS**	**C2-229**	**C2-230**	457 (208)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	240	80.0	3	8	**CFRS762D3XS**	**C4-148**	**C4-149**	461 (209)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	80.0	1	4	**CFRS762D11XS**	**C/F**	**C/F**	461 (209)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	80.0	3	4	**CFRS762D5XS**	**C4-154**	**C4-155**	461 (209)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	240	93.0	3	8	**CFRS770M3XS**	**C/F**	**C/F**	554 (252)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	480	93.0	1	6	**CFRS770M11XS**	**C/F**	**C/F**	554 (252)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	480	93.0	3	4	**CFRS770M5XS**	**C4-156**	**C4-157**	554 (252)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	240	107.0	3	8	**CFRS779M3XS**	**C/F**	**C/F**	636 (289)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)
	480	107.0	3	4	**CFRS779M5XS**	**C4-156**	**C4-157**	636 (289)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)

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8 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

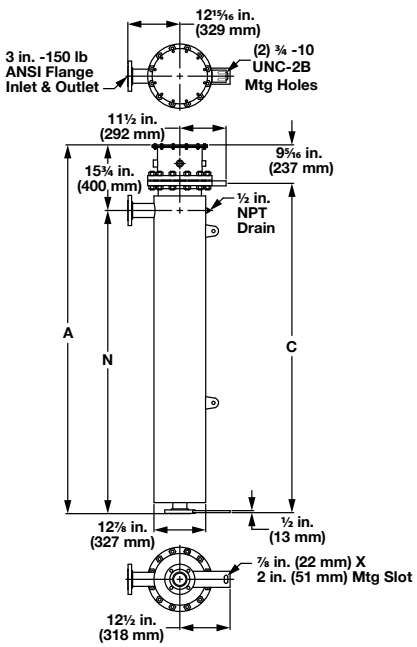
Application: Lightweight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

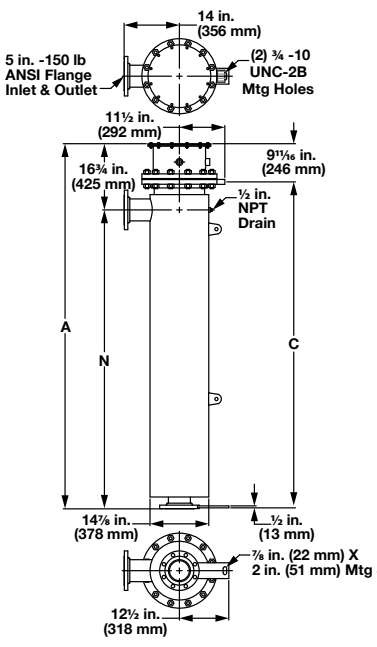
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
10 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 27-Steel Elements (3.6 W/cm²)	480	90.0	3	3	**CFSS762E5S**	**C4-152**	**C4-153**	540 (245)	91 1/4 (2316.0)	75 1/2 (1916.0)	81 15/16 (2081.2)
	480	105.0	3	3	**CFSS770N5S**	**C4-152**	**C4-153**	600 (645)	99 1/8 (2517.8)	83 3/8 (2117.7)	89 13/16 (2281.2)
	480	120.0	3	3	**CFSS778N5S**	**C4-152**	**C4-153**	645 (293)	106 5/8 (2708.3)	90 7/8 (2308.2)	97 5/16 (2471.7)
12 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 36-Steel Elements (3.6 W/cm²)	480	140.0	3	4	**CFTS770L5S**	**C4-156**	**C4-157**	650 (295)	99 (2515)	82 7/8 (2105.0)	89 5/8 (2276.5)
	480	160.0	3	4	**CFTS778L5S**	**C4-156**	**C4-157**	700 (318)	106 1/2 (2705)	90 3/8 (2295.5)	97 1/8 (2467.0)
14 inch - 150 lb ANSI Flange (WATROD)											
23 W/in² Steel Tank 45-Steel Elements (3.6 W/cm²)	480	150.0	3	5	**CFWS762A5S**	**C/F**	**C/F**	650 (295)	90 3/4 (2305)	74 1/2 (1891)	81 3/16 (2062.2)
	480	175.0	3	5	**CFWS770J5S**	**C/F**	**C/F**	700 (318)	98 1/4 (2496)	82 (2081)	88 11/16 (2252.7)
	480	200.0	3	5	**CFWS778J5S**	**C/F**	**C/F**	780 (354)	105 3/4 (2686)	89 1/2 (2272)	96 3/16 (2443.2)

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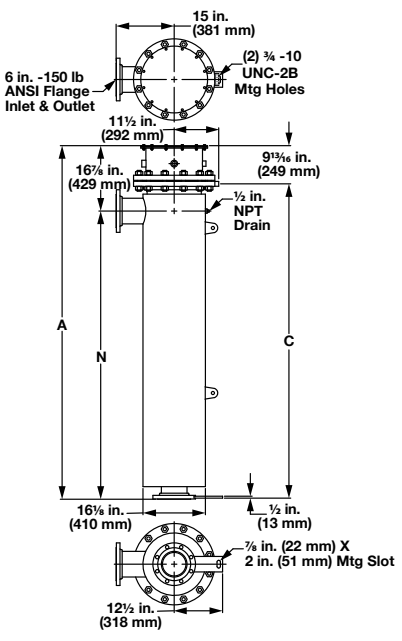
10 inch - 150 lb ANSI Flange



12 inch - 150 lb ANSI Flange



14 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

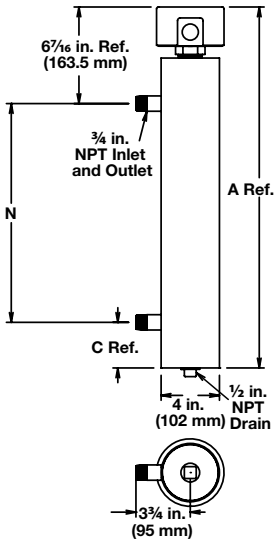
Application: Medium Weight Oils and Heat Transfer Oils

- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

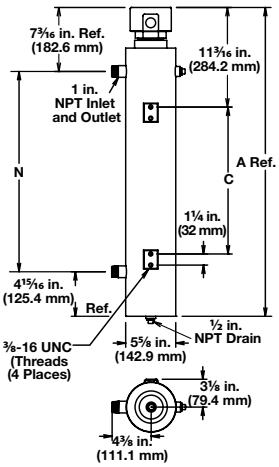
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
1¼ inch NPT Screw Plug (FIREBAR)											
15 W/in² ③ Steel Tank 1-Alloy 800 Elements (2.3 W/cm²)	240	0.67	3	1	**CBDNF13A29S**	**C2-50**	**C2-92**	25 (12)	24⅝ (625.5)	15 (381)	3⅛ (79.4)
	240	0.83	3	1	**CBDNF15J29S**	**C2-50**	**C2-92**	26 (12)	24⅝ (625.5)	15 (381)	3⅛ (79.4)
	240	1.00	3	1	**CBDNF18A29S**	**C2-50**	**C2-92**	30 (14)	32⅝ (828.7)	23 (584)	3⅛ (79.4)
	240	1.33	3	1	**CBDNF22J29S**	**C2-50**	**C2-92**	31 (14)	32⅝ (828.7)	23 (584)	3⅛ (79.4)
	480	1.33	3	1	**CBDNF22J30S**	**C2-43**	**C2-35**	31 (14)	32⅝ (828.7)	23 (584)	3⅛ (79.4)
	240	1.67	3	1	**CBDNF27J29S**	**C2-50**	**C2-92**	43 (20)	42⅝ (1082.7)	32 (813)	4⅜ (111.1)
	480	1.67	3	1	**CBDNF27J30S**	**C2-43**	**C2-35**	43 (20)	42⅝ (1082.7)	32 (813)	4⅜ (111.1)
	240	2.00	3	1	**CBDNF32J29S**	**C2-50**	**C2-92**	44 (20)	42⅝ (1082.7)	32 (813)	4⅜ (111.1)
	480	2.00	3	1	**CBDNF32J30S**	**C2-43**	**C2-35**	44 (20)	42⅝ (1082.7)	32 (813)	4⅜ (111.1)
	240	2.67	3	1	**CBDNF42A29S**	**C2-50**	**C2-92**	69 (32)	63⅝ (1616.1)	53 (1346)	4⅜ (111.1)
	480	2.67	3	1	**CBDNF42A30S**	**C2-43**	**C2-35**	69 (32)	63⅝ (1616.1)	53 (1346)	4⅜ (111.1)
	240	3.33	3	1	**CBDNF51J29S**	**C2-50**	**C2-92**	71 (33)	63⅝ (1616.1)	53 (1346)	4⅜ (111.1)
	480	3.33	3	1	**CBDNF51J30S**	**C2-43**	**C2-35**	71 (33)	63⅝ (1616.1)	53 (1346)	4⅜ (111.1)
2½ inch NPT Screw Plug (WATROD)											
16 W/in² ③ Steel Tank 3-Alloy 800 Elements (2.5 W/cm²)	240	2.0	3	1	**CBLN717G12S**	**C2-50**	**C2-92**	24 (11)	34¾ (881)	22½ (572)	16½ (419)
	480	2.0	3	1	**CBLN717G13S**	**C2-43**	**C2-35**	24 (11)	34¾ (881)	22½ (572)	16½ (419)
	240	2.5	3	1	**CBLN719R12S**	**C2-50**	**C2-92**	26 (12)	34¾ (881)	22½ (572)	16½ (419)
	480	2.5	3	1	**CBLN719R13S**	**C2-43**	**C2-35**	26 (12)	34¾ (881)	22½ (572)	16½ (419)
	240	3.0	3	1	**CBLN724R12S**	**C2-50**	**C2-92**	27 (13)	34¾ (881)	22½ (572)	16½ (419)
	480	3.0	3	1	**CBLN724R13S**	**C2-43**	**C2-35**	27 (13)	34¾ (881)	22½ (572)	16½ (419)
	240	4.0	3	1	**CBLN732G12S**	**C2-50**	**C2-92**	29 (14)	44¾ (1135)	32½ (826)	26½ (673)
	480	4.0	3	1	**CBLN732G13S**	**C2-43**	**C2-35**	29 (14)	44¾ (1135)	32½ (826)	26½ (673)
	240	5.0	3	1	**CBLN739R12S**	**C2-50**	**C2-92**	31 (14)	57¼ (1453)	45 (1143)	39 (991)
	480	5.0	3	1	**CBLN739R13S**	**C2-43**	**C2-35**	31 (14)	57¼ (1453)	45 (1143)	39 (991)
	240	6.0	3	1	**CBLN747G12S**	**C2-50**	**C2-92**	32 (15)	57¼ (1453)	45 (1143)	39 (991)
	480	6.0	3	1	**CBLN747G13S**	**C2-43**	**C2-35**	32 (15)	57¼ (1453)	45 (1143)	39 (991)
2½ inch NPT Screw Plug (FIREBAR)											
15 W/in² ③ Steel Tank 3-Alloy 800 Elements (2.3 W/cm²)	240	2.00	3	1	**CBLNF12A29S**	**C2-50**	**C2-92**	21 (10)	34¾ (881)	22½ (572)	16½ (419)
	240	2.50	3	1	**CBLNF14J29S**	**C2-50**	**C2-92**	22 (10)	34¾ (881)	22½ (572)	16½ (419)
	240	3.00	3	1	**CBLNF17A29S**	**C2-50**	**C2-92**	23 (11)	34¾ (881)	22½ (572)	16½ (419)
	240	4.00	3	1	**CBLNF21J29S**	**C2-50**	**C2-92**	31 (14)	34¾ (881)	22½ (572)	16½ (419)
	480	4.00	3	1	**CBLNF21J30S**	**C2-43**	**C2-35**	31 (14)	34¾ (881)	22½ (572)	16½ (419)
	240	5.00	3	1	**CBLNF26J29S**	**C2-50**	**C2-92**	34 (16)	44¾ (1135)	32½ (826)	26½ (673)
	480	5.00	3	1	**CBLNF26J30S**	**C2-43**	**C2-35**	34 (16)	44¾ (1135)	32½ (826)	26½ (673)
	240	6.00	3	1	**CBLNF31J29S**	**C2-50**	**C2-92**	35 (16)	44¾ (1135)	32½ (826)	26½ (673)
	480	6.00	3	1	**CBLNF31J30S**	**C2-43**	**C2-35**	35 (16)	44¾ (1135)	32½ (826)	26½ (673)
	240	8.00	3	1	**CBLNF41A29S**	**C2-50**	**C2-92**	44 (20)	57¼ (1453)	45 (1143)	39 (991)
	480	8.00	3	1	**CBLNF41A30S**	**C2-43**	**C2-35**	44 (20)	57¼ (1453)	45 (1143)	39 (991)
	240	10.00	3	1	**CBLNF50J29S**	**C2-50**	**C2-92**	52 (24)	63¾ (1618)	51½(1308)	46½(1181)
	480	10.00	3		**CBLNF50J30S**	**C2-43**	**C2-35**	52 (24)	63¾ (1618)	51½(1308)	46½(1181)

③ Wired for 3-phase operation only

1¼ inch NPT Screw Plug



2½ inch NPT Screw Plug



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WATROD and FIREBAR Circulation Heaters

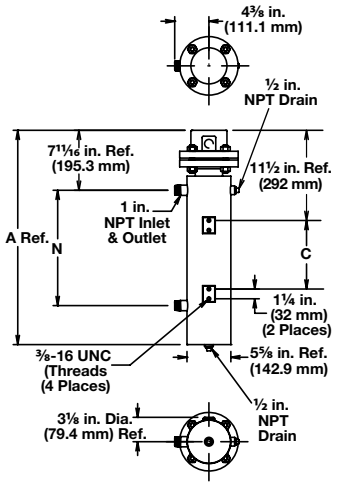
Application: Medium Weight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

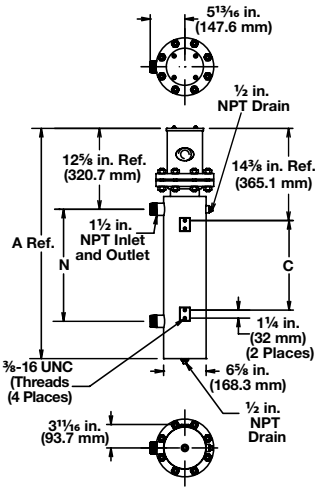
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
3 inch - 150 lb ANSI Flange (WATROD)											
16 W/in² ③ Steel Tank 3-Alloy 800 Elements (2.6 W/cm²)	240	2.00	3	1	**CFMN718A12S**	**C2-50**	**C2-92**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	2.00	3	1	**CFMN718A13S**	**C2-43**	**C2-35**	68 (31)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	2.50	3	1	**CFMN720J12S**	**C2-50**	**C2-92**	70 (32)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	480	2.50	3	1	**CFMN720J13S**	**C2-43**	**C2-35**	70 (32)	35 1/4 (894)	22 1/2 (573)	16 1/2 (419)
	240	3.00	3	1	**CFMN725J12S**	**C2-50**	**C2-92**	78 (36)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	3.00	3	1	**CFMN725J13S**	**C2-43**	**C2-35**	78 (36)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	4.00	3	1	**CFMN733A12S**	**C2-50**	**C2-92**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	4.00	3	1	**CFMN733A13S**	**C2-43**	**C2-35**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	5.00	3	1	**CFMN740J12S**	**C2-50**	**C2-92**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	480	5.00	3	1	**CFMN740J13S**	**C2-43**	**C2-35**	100 (46)	57 3/4 (1465)	45 (1143)	39 (991)
	240	6.00	3	1	**CFMN748A12S**	**C2-50**	**C2-92**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
	480	6.00	3	1	**CFMN748A13S**	**C2-43**	**C2-35**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
4 inch - 150 lb ANSI Flange (WATROD)											
16 W/in² ③ Steel Tank 6-Alloy 800 Elements (2.5 W/cm²)	240	3.0	3	1	**CFON713J12S**	**C2-50**	**C2-92**	122 (56)	39 (989)	20 1/2 (521)	17 (432)
	480	3.0	3	1	**CFON713J13S**	**C2-43**	**C2-35**	122 (56)	39 (989)	20 1/2 (521)	17 (432)
	240	4.0	3	1	**CFON718A12S**	**C2-50**	**C2-92**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	480	4.0	3	1	**CFON718A13S**	**C2-43**	**C2-35**	125 (57)	39 (989)	20 1/2 (521)	17 (432)
	240	5.0	3	1	**CFON720J12S**	**C2-50**	**C2-92**	127 (58)	39 (989)	20 1/2 (521)	17 (432)
	480	5.0	3	1	**CFON720J13S**	**C2-43**	**C2-35**	127 (58)	39 (989)	20 1/2 (521)	17 (432)
	240	6.0	3	1	**CFON725J12S**	**C2-50**	**C2-92**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	480	6.0	3	1	**CFON725J13S**	**C2-43**	**C2-35**	160 (73)	39 (989)	20 1/2 (521)	17 (432)
	240	8.0	3	1	**CFON733A12S**	**C2-50**	**C2-92**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	480	8.0	3	1	**CFON733A13S**	**C2-43**	**C2-35**	163 (74)	49 1/2 (1256)	31 (787)	27 1/2 (699)
	240	10.0	3	1	**CFON740J12S**	**C2-50**	**C2-92**	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	10.0	3	1	**CFON740J13S**	**C2-43**	**C2-35**	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	12.0	3	1	**CFON748A12S**	**C2-236**	**C2-214**	234 (107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	12.0	3	1	**CFON748A13S**	**C2-43**	**C2-35**	234 (107)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)

③ Wired for 3-phase operation only

3 inch - 150 lb ANSI Flange



4 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

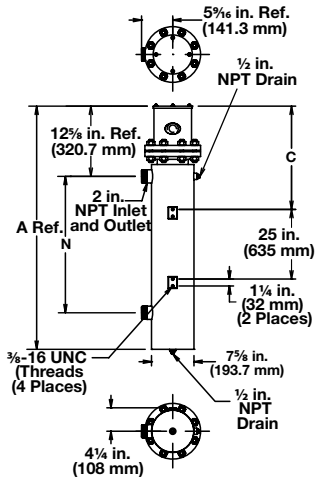
Application: Medium Weight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs	Ship Wt. (kg)	"A" Dim. in.	"A" Dim. (mm)	"N" Dim. in.	"N" Dim. (mm)	"C" Dim. in.	"C" Dim. (mm)
5 inch - 150 lb ANSI Flange (WATROD)															
16 W/in² ③ Steel Tank 6-Alloy 800 Elements (2.6 W/cm²)	240	8.0	3	1	**CFNN733A12S**	**C2-50**	**C2-92**	145	(66)	49 1/4	(1249)	30	(762)	25	(633.0)
	480	8.0	3	1	**CFNN733A13S**	**C2-43**	**C2-35**	145	(66)	49 1/4	(1249)	30	(762)	25	(633.0)
	240	10.0	3	1	**CFNN740J12S**	**C2-50**	**C2-92**	167	(76)	56 1/4	(1427)	37	(940)	25	(633.0)
	480	10.0	3	1	**CFNN740J13S**	**C2-43**	**C2-35**	167	(76)	56 1/4	(1427)	37	(940)	25	(633.0)
	240	12.0	3	1	**CFNN748A12S**	**C2-236**	**C2-214**	180	(82)	67 3/4	(1719)	48 1/2	(1232)	25	(633.0)
	480	12.0	3	1	**CFNN748A13S**	**C2-43**	**C2-35**	180	(82)	67 3/4	(1719)	48 1/2	(1232)	25	(633.0)
5 inch - 150 lb ANSI Flange (WATROD)															
16 W/in² ③ Steel Tank 9-Alloy 800 Elements (2.6 W/cm²)	240	12.0	3	1	**CFNN733A12XS**	**C2-236**	**C2-214**	150	(68)	49 1/4	(1249)	30	(762)	25	(633.0)
	480	12.0	3	1	**CFNN733A13XS**	**C2-43**	**C2-35**	150	(68)	49 1/4	(1249)	30	(762)	25	(633.0)
	240	15.0	3	1	**CFNN740J12XS**	**C2-236**	**C2-214**	173	(79)	56 1/4	(1427)	37	(940)	25	(633.0)
	480	15.0	3	1	**CFNN740J13XS**	**C2-43**	**C2-35**	173	(79)	56 1/4	(1427)	37	(940)	25	(633.0)
	240	18.0	3	1	**CFNN748A12XS**	**C2-236**	**C2-214**	188	(86)	67 3/4	(1719)	48 1/2	(1232)	25	(633.0)
	480	18.0	3	1	**CFNN748A13XS**	**C2-43**	**C2-35**	188	(86)	67 3/4	(1719)	48 1/2	(1232)	25	(633.0)

③ Wired for 3-phase operation only

5 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

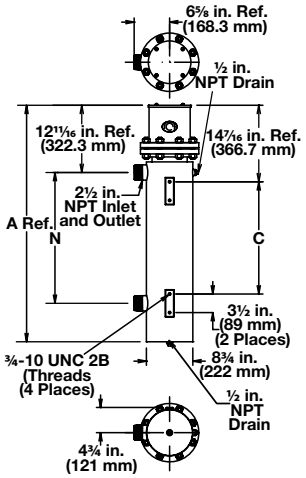
Application: Medium Weight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
6 inch - 150 lb ANSI Flange (WATROD)											
16 W/in² ③ Steel Tank 12-Alloy 800 Elements (2.6 W/cm²)	240	6.0	3	1	**CFPN713G12S**	**C2-50**	**C2-92**	212 (97)	40½ (1027)	20½ (521)	17 (432)
	480	6.0	3	1	**CFPN713G13S**	**C2-43**	**C2-35**	212 (97)	40½ (1027)	20½ (521)	17 (432)
	240	8.0	3	1	**CFPN717R12S**	**C2-50**	**C2-92**	214 (97)	40½ (1027)	20½ (521)	17 (432)
	480	8.0	3	1	**CFPN717R13S**	**C2-43**	**C2-35**	214 (97)	40½ (1027)	20½ (521)	17 (432)
	240	10.0	3	1	**CFPN720G12S**	**C2-50**	**C2-92**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	480	10.0	3	1	**CFPN720G13S**	**C2-43**	**C2-35**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	240	12.0	3	1	**CFPN725G12S**	**C2-236**	**C2-214**	222 (101)	40½ (1027)	20½ (521)	17 (432)
	480	12.0	3	1	**CFPN725G13S**	**C2-43**	**C2-35**	222 (101)	40½ (1027)	20½ (521)	17 (432)
	240	16.0	3	1	**CFPN732R12S**	**C2-236**	**C2-214**	226 (103)	51 (1294)	31 (787)	27½ (699)
	480	16.0	3	1	**CFPN732R13S**	**C2-43**	**C2-35**	226 (103)	51 (1294)	31 (787)	27½ (699)
	240	20.0	3	2	**CFPN740G12S**	**C2-219**	**C2-220**	290 (132)	72 (1827)	52 (1321)	48½ (1232)
	480	20.0	3	1	**CFPN740G13S**	**C2-43**	**C2-35**	290 (132)	72 (1827)	52 (1321)	48½ (1232)
	240	24.0	3	2	**CFPN747R12S**	**C2-219**	**C2-220**	298 (136)	72 (1827)	52 (1321)	48½ (1232)
	480	24.0	3	1	**CFPN747R13S**	**C2-225**	**C2-226**	298 (136)	72 (1827)	52 (1321)	48½ (1232)
6 inch - 150 lb ANSI Flange (WATROD)											
16 W/in² ③ Steel Tank 15-Alloy 800 Elements (2.6 W/cm²)	240	7.50	3	1	**CFPN713G12XS**	**C2-50**	**C2-92**	215 (98)	40½ (1027)	20½ (521)	17 (432)
	480	7.50	3	1	**CFPN713G13XS**	**C2-43**	**C2-35**	215 (98)	40½ (1027)	20½ (521)	17 (432)
	240	10.0	3	1	**CFPN717R12XS**	**C2-50**	**C2-92**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	480	10.0	3	1	**CFPN717R13XS**	**C2-43**	**C2-35**	217 (99)	40½ (1027)	20½ (521)	17 (432)
	240	12.5	3	1	**CFPN720G12XS**	**C2-236**	**C2-214**	223 (102)	40½ (1027)	20½ (521)	17 (432)
	480	12.5	3	1	**CFPN720G13XS**	**C2-43**	**C2-35**	223 (102)	40½ (1027)	20½ (521)	17 (432)
	240	15.0	3	1	**CFPN725G12XS**	**C2-236**	**C2-214**	226 (103)	40½ (1027)	20½ (521)	17 (432)
	480	15.0	3	1	**CFPN725G13XS**	**C2-43**	**C2-35**	226 (103)	40½ (1027)	20½ (521)	17 (432)
	240	20.0	3	5	**CFPN732R12XS**	**C4-143**	**C4-142**	288 (131)	51 (1294)	31 (787)	27½ (699)
	480	20.0	3	1	**CFPN732R13XS**	**C2-43**	**C2-35**	288 (131)	51 (1294)	31 (787)	27½ (699)
	240	25.0	3	5	**CFPN740G12XS**	**C4-143**	**C4-142**	296 (135)	72 (1827)	52 (1321)	48½ (1232)
	480	25.0	3	1	**CFPN740G13XS**	**C2-225**	**C2-226**	296 (135)	72 (1827)	52 (1321)	48½ (1232)
	240	30.0	3	5	**CFPN747R12XS**	**C4-144**	**C4-145**	306 (139)	72 (1827)	52 (1321)	48½ (1232)
	480	30.0	3	1	**CFPN747R13XS**	**C2-225**	**C2-226**	306 (139)	72 (1827)	52 (1321)	48½ (1232)

③ Wired for 3-phase operation only

6 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

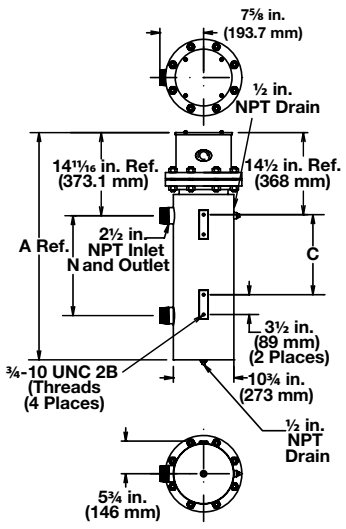
Application: Medium Weight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
8 inch - 150 lb ANSI Flange (WATROD)											
16 W/in² ③ Steel Tank 18-Alloy 800 Elements (2.6 W/cm²)	240	17.00	3	1	**CFRN725N12S**	**C2-236**	**C2-214**	350 (159)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	17.00	3	1	**CFRN725N13S**	**C2-43**	**C2-35**	350 (159)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	25.00	3	2	**CFRN735N12S**	**C2-219**	**C2-220**	380 (173)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	25.00	3	1	**CFRN735N13S**	**C2-225**	**C2-226**	380 (173)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	240	33.00	3	2	**CFRN744E12S**	**C2-218**	**C2-224**	410 (186)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	33.00	3	1	**CFRN744E13S**	**C2-225**	**C2-226**	410 (186)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	240	42.00	3	3	**CFRN754M12S**	**C4-144**	**C4-145**	445 (202)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	42.00	3	2	**CFRN754M13S**	**C2-229**	**C2-230**	445 (202)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	50.00	3	2	**CFRN763M13S**	**C2-229**	**C2-230**	490 (223)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	480	58.00	3	2	**CFRN773D13S**	**C2-229**	**C2-230**	530 (241)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)
	480	67.00	3	2	**CFRN782M13S**	**C2-229**	**C2-230**	560 (254)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)
8 inch - 150 lb ANSI Flange (WATROD)											
16 W/in² ③ Steel Tank 24-Alloy 800 Elements (2.6 W/cm²)	240	23.0	3	2	**CFRN726D12XS**	**C2-218**	**C2-224**	358 (163)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	480	23.0	3	1	**CFRN726D13XS**	**C2-225**	**C2-226**	358 (163)	55 1/4 (1402.0)	32 3/4 (830.0)	29 1/4 (741.0)
	240	33.0	3	2	**CFRN736D12XS**	**C2-218**	**C2-224**	392 (178)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	33.0	3	1	**CFRN736D13XS**	**C2-225**	**C2-226**	392 (178)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	240	44.0	3	4	**CFRN744M12XS**	**C4-148**	**C4-149**	425 (193)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	44.0	3	2	**CFRN744M13XS**	**C2-229**	**C2-230**	425 (193)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	240	56.0	3	4	**CFRN754M12XS**	**C4-148**	**C4-149**	463 (210)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	56.0	3	2	**CFRN754M13XS**	**C2-229**	**C2-230**	463 (210)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	67.0	3	2	**CFRN763M13XS**	**C2-229**	**C2-230**	511 (232)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	480	77.0	3	2	**CFRN773D13XS**	**C2-229**	**C2-230**	554 (252)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)
	480	89.0	3	4	**CFRN782M13XS**	**C4-156**	**C4-157**	587 (267)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)

③ Wired for 3-phase operation only

8 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

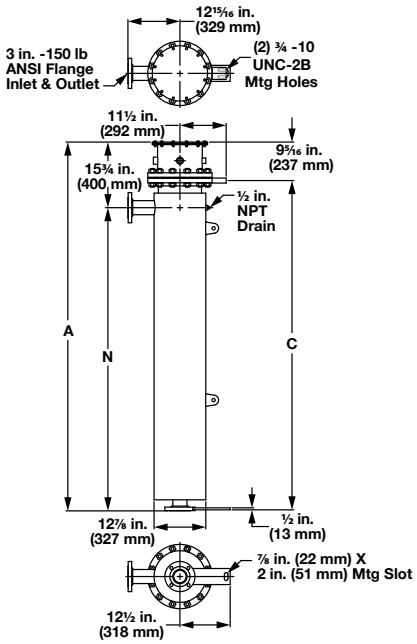
Application: Medium Weight Oils and Heat Transfer Oils

- WATROD elements
- Without thermostat
- General purpose enclosure

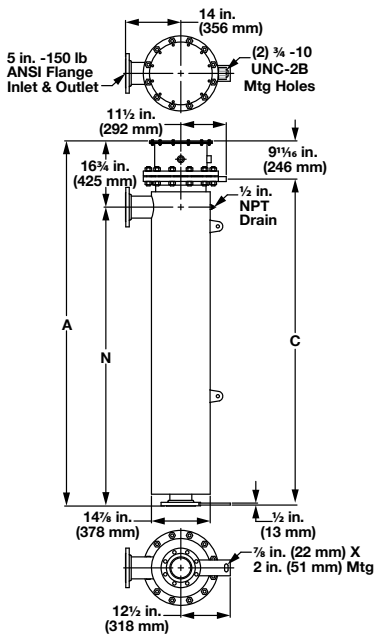
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
10 inch - 150 lb ANSI Flange (WATROD)											
16 W/in² ③ Steel Tank 27-Alloy 800 Elements (2.6 W/cm²)	480	75.0	3	3	**CFSN763N13S**	**C4-152**	**C4-153**	540 (245)	91 3/16 (2316)	75 7/16 (1916)	81 15/16 (2081)
	480	87.0	3	3	**CFSN773E13S**	**C4-152**	**C4-153**	600 (273)	106 9/16 (2707)	90 13/16 (1037)	97 5/16 (2471)
12 inch - 150 lb ANSI Flange (WATROD)											
16 W/in² ③ Steel Tank 36-Alloy 800 Elements (2.6 W/cm²)	480	117.0	3	3	**CFTN773C13S**	**C4-152**	**C4-153**	650 (295)	106 1/2 (2705)	90 3/8 (2295.5)	97 3/16 (2468.6)
14 inch - 150 lb ANSI Flange (WATROD)											
16 W/in² ③ Steel Tank 45-Alloy 800 Elements (2.6 W/cm²)	480	105.0	3	3	**CFWN754J13S**	**C4-152**	**C4-153**	600 (273)	83 1/4 (2115)	67 (1700)	73 11/16 (1872)
	480	125.0	3	5	**CFWN763J13S**	**C/F**	**C/F**	650 (295)	90 3/4 (2305)	74 1/2 (1891)	81 3/16 (2062)

③ Wired for 3-phase operation only
C/F - Contact factory, go to www.watlow.com/en/contact-us

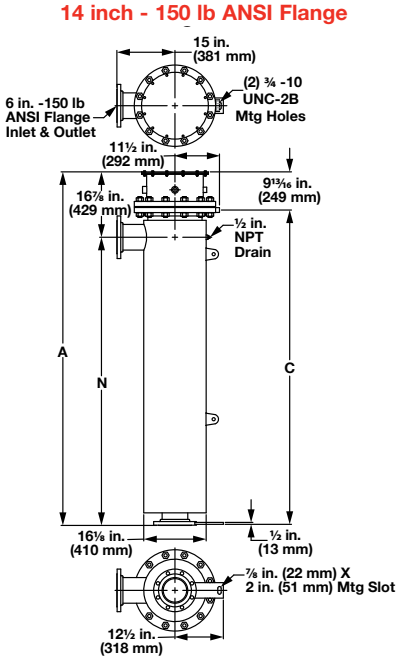
10 inch - 150 lb ANSI Flange



12 inch - 150 lb ANSI Flange



14 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

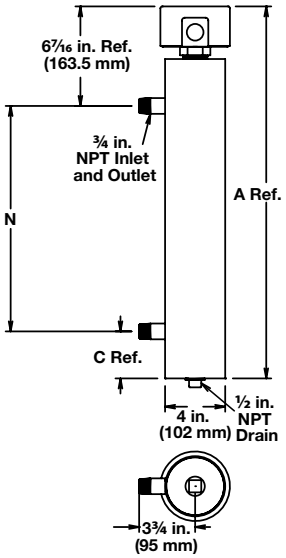
Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

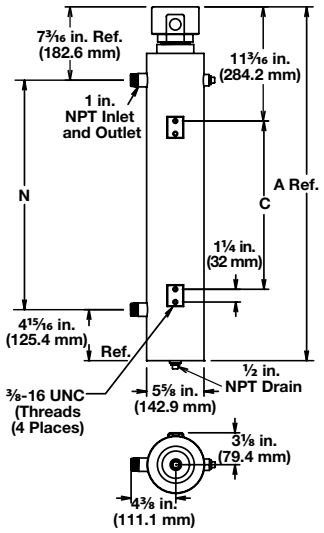
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
1 1/4 inch NPT Screw Plug (FIREBAR)											
8 W/in² ③ Steel Tank 1-Alloy 800 Element (1.3 W/cm²)	240	0.43	3	1	**CBDNF16G22S**	**C2-50**	**C2-92**	26 (12)	24 5/8 (625.5)	15 (381)	3 1/8 (79.4)
	240	0.55	3	1	**CBDNF19G22S**	**C2-50**	**C2-92**	30 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	0.70	3	1	**CBDNF24L22S**	**C2-50**	**C2-92**	31 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	480	0.70	3	1	**CBDNF24L21S**	**C2-43**	**C2-35**	31 (14)	32 5/8 (828.7)	23 (584)	3 1/8 (79.4)
	240	0.88	3	1	**CBDNF29R22S**	**C2-50**	**C2-92**	43 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	480	0.88	3	1	**CBDNF29R21S**	**C2-43**	**C2-35**	43 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	240	1.08	3	1	**CBDNF34R22S**	**C2-50**	**C2-92**	44 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	480	1.08	3	1	**CBDNF34R21S**	**C2-43**	**C2-35**	44 (20)	42 5/8 (1082.7)	32 (813)	4 3/8 (111.1)
	240	1.40	3	1	**CBDNF45G22S**	**C2-50**	**C2-92**	69 (31)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	480	1.40	3	1	**CBDNF45G21S**	**C2-43**	**C2-35**	69 (31)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	240	1.80	3	1	**CBDNF55R22S**	**C2-50**	**C2-92**	71 (32)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
	480	1.80	3	1	**CBDNF55R21S**	**C2-43**	**C2-35**	71 (32)	63 5/8 (1616.1)	53 (1346)	4 3/8 (111.1)
2 1/2 inch NPT Screw Plug (WATROD)											
8 W/in² ③ Steel Tank 3-Steel Elements (1.3 W/cm²)	240	2.0	3	1	**CBLS732E12S**	**C2-50**	**C2-92**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	2.0	3	1	**CBLS732E13S**	**C2-43**	**C2-35**	29 (14)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	3.0	3	1	**CBLS747E12S**	**C2-50**	**C2-92**	32 (15)	57 1/4 (1453)	45 (1143)	39 (991)
	480	3.0	3	1	**CBLS747E13S**	**C2-43**	**C2-35**	32 (15)	57 1/4 (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



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WATROD and FIREBAR Circulation Heaters

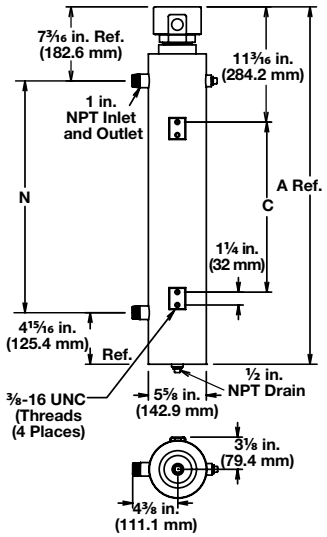
Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD or FIREBAR elements
- Without thermostat
- General purpose enclosure

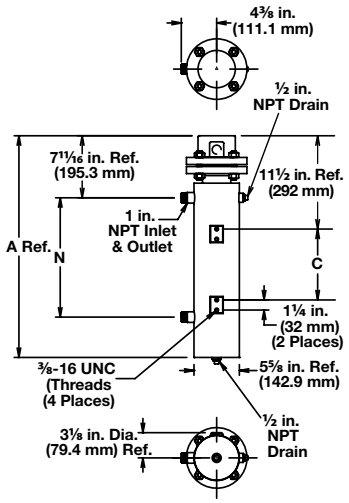
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
2 1/2 inch NPT Screw Plug (FIREBAR)											
8 W/in² ③ Steel Tank 3-Alloy 800 Elements (1.3 W/cm²)	240	1.25	3	1	**CBLNF15C22S**	**C2-50**	**C2-92**	22 (10)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	1.63	3	1	**CBLNF18C22S**	**C2-50**	**C2-92**	23 (10)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	2.13	3	1	**CBLNF23C22S**	**C2-50**	**C2-92**	31 (14)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	480	2.13	3	1	**CBLNF23C21S**	**C2-43**	**C2-35**	31 (14)	34 3/4 (881)	22 1/2 (572)	16 1/2 (419)
	240	2.63	3	1	**CBLNF28L22S**	**C2-50**	**C2-92**	34 (15)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	2.63	3	1	**CBLNF28L21S**	**C2-43**	**C2-35**	34 (15)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	3.19	3	1	**CBLNF33L22S**	**C2-50**	**C2-92**	35 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	480	3.19	3	1	**CBLNF33L21S**	**C2-43**	**C2-35**	35 (16)	44 3/4 (1135)	32 1/2 (826)	26 1/2 (673)
	240	4.25	3	1	**CBLNF44C22S**	**C2-50**	**C2-92**	44 (20)	57 1/4 (1453)	45 (1143)	39 (991)
	480	4.25	3	1	**CBLNF44C21S**	**C2-43**	**C2-35**	44 (20)	57 1/4 (1453)	45 (1143)	39 (991)
	240	5.38	3	1	**CBLNF54L22S**	**C2-50**	**C2-92**	52 (24)	63 3/4 (1453)	51 1/2 (1308)	46 1/2 (1181)
	480	5.38	3	1	**CBLNF54L21S**	**C2-43**	**C2-35**	52 (24)	63 3/4 (1453)	51 1/2 (1308)	46 1/2 (1181)
3 inch - 150 lb ANSI Flange (WATROD)											
8 W/in² ③ Steel Tank 3-Steel Elements (1.3 W/cm²)	240	2.0	3	1	**CFMS733A12S**	**C2-50**	**C2-92**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	480	2.0	3	1	**CFMS733A13S**	**C2-43**	**C2-35**	96 (44)	45 1/4 (1148)	32 1/2 (826)	26 1/2 (673)
	240	3.0	3	1	**CFMS748A12S**	**C2-50**	**C2-92**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)
	480	3.0	3	1	**CFMS748A13S**	**C2-43**	**C2-35**	107 (49)	57 3/4 (1465)	45 (1143)	39 (991)

③ Wired for 3-phase operation only

2½ inch NPT Screw Plug



3 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

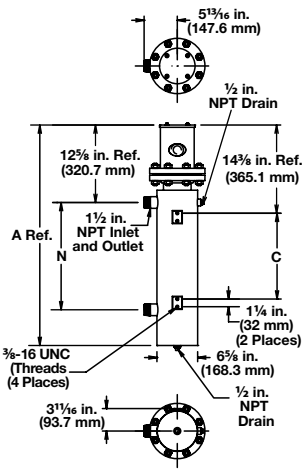
Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD elements
- Without thermostat
- General purpose enclosure

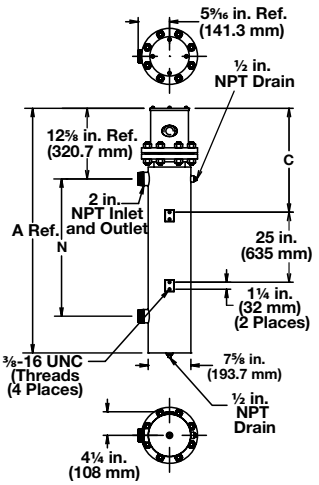
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in (mm)	"C" Dim. in. (mm)
4 inch - 150 lb ANSI Flange (WATROD)											
8 W/in² ③ Steel Tank 6-Steel Elements (1.3 W/cm²)	240	5.00	3	1	**CFOS740J12S**	**C2-50**	**C2-92**	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	5.00	3	1	**CFOS740J13S**	**C2-43**	**C2-35**	229 (104)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	6.00	3	1	**CFOS748A12S**	**C2-50**	**C2-92**	234 (106)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	480	6.00	3	1	**CFOS748A13S**	**C2-43**	**C2-35**	234 (106)	70 1/2 (1789)	52 (1321)	48 1/2 (1232)
	240	8.00	3	1	**CFOS764J12S**	**C2-50**	**C2-92**	298 (135)	91 1/2 (2326)	73 (1854)	66 (1676)
	480	8.00	3	1	**CFOS764J13S**	**C2-43**	**C2-35**	298 (135)	91 1/2 (2326)	73 (1854)	66 (1676)
	240	10.00	3	1	**CFOS777A12S**	**C2-50**	**C2-92**	306 (139)	91 1/2 (2326)	73 (1854)	66 (1676)
	480	10.00	3	1	**CFOS777A13S**	**C2-43**	**C2-35**	306 (139)	91 1/2 (2326)	73 (1854)	66 (1676)
5 inch - 150 lb ANSI Flange (WATROD)											
8 W/in² ③ Steel Tank 6-Steel Elements (1.3 W/cm²)	240	5.00	3	1	**CFNS740J12S**	**C2-50**	**C2-92**	167 (76)	56 1/4 (1427.0)	37 (940.0)	25 (633.0)
	480	5.00	3	1	**CFNS740J13S**	**C2-43**	**C2-35**	167 (76)	56 1/4 (1427.0)	37 (940.0)	25 (633.0)
	240	6.00	3	1	**CFNS748A12S**	**C2-50**	**C2-92**	180 (82)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	480	6.00	3	1	**CFNS748A13S**	**C2-43**	**C2-35**	180 (82)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	240	8.00	3	1	**CFNS764J12S**	**C2-50**	**C2-92**	195 (89)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	480	8.00	3	1	**CFNS764J13S**	**C2-43**	**C2-35**	195 (89)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	240	10.00	3	1	**CFNS777A12S**	**C2-50**	**C2-92**	220 (100)	94 1/8 (2390.8)	75 (1902.0)	25 (633.0)
	480	10.00	3	1	**CFNS777A13S**	**C2-43**	**C2-35**	220 (100)	94 1/8 (2390.8)	75 (1902.0)	25 (633.0)
5 inch - 150 lb ANSI Flange (WATROD)											
8 W/in² ③ Steel Tank 9-Steel Elements (1.3 W/cm²)	240	7.5	3	1	**CFNS740J12XS**	**C2-50**	**C2-92**	173 (79)	56 1/4 (1427.0)	37 (940.0)	25 (633.0)
	480	7.5	3	1	**CFNS740J13XS**	**C2-43**	**C2-35**	173 (79)	56 1/4 (1427.0)	37 (940.0)	25 (633.0)
	240	9.0	3	1	**CFNS748A12XS**	**C2-50**	**C2-92**	188 (86)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	480	9.0	3	1	**CFNS748A13XS**	**C2-43**	**C2-35**	188 (86)	67 3/4 (1719.0)	48 1/2 (1232.0)	25 (633.0)
	240	12.0	3	1	**CFNS764J12XS**	**C2-236**	**C2-214**	206 (94)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	480	12.0	3	1	**CFNS764J13XS**	**C2-43**	**C2-35**	206 (94)	81 1/8 (2060.6)	61 7/8 (1571.6)	25 (633.0)
	240	15.0	3	1	**CFNS777A12XS**	**C2-236**	**C2-214**	233 (106)	94 1/8 (2390.8)	75 (1902.0)	25 (633.0)
	480	15.0	3	1	**CFNS777A13XS**	**C2-225**	**C2-226**	233 (106)	94 1/8 (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



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WATROD and FIREBAR Circulation Heaters

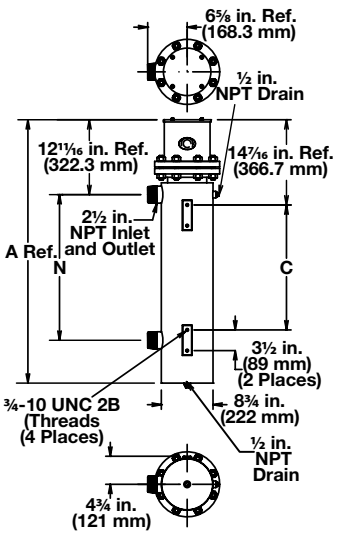
Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
6 inch - 150 lb ANSI Flange (WATROD)											
8 W/in² ③ Steel Tank 12-Steel Elements (1.3 W/cm²)	240	8.0	3	1	**CFPS732R12S**	**C2-50**	**C2-92**	226 (103)	51 (1294)	31 (787)	27½ (699)
	480	8.0	3	1	**CFPS732R13S**	**C2-43**	**C2-35**	226 (103)	51 (1294)	31 (787)	27½ (699)
	240	10.0	3	1	**CFPS740G12S**	**C2-50**	**C2-92**	290 (132)	72 (1827)	52 (1321)	48½ (1232)
	480	10.0	3	1	**CFPS740G13S**	**C2-43**	**C2-35**	290 (132)	72 (1827)	52 (1321)	48½ (1232)
	240	12.0	3	1	**CFPS747R12S**	**C2-236**	**C2-214**	298 (136)	72 (1827)	52 (1321)	48½ (1232)
	480	12.0	3	1	**CFPS747R13S**	**C2-43**	**C2-35**	298 (136)	72 (1827)	52 (1321)	48½ (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)
6 inch - 150 lb ANSI Flange (WATROD)											
8 W/in² ③ Steel Tank 15-Steel Elements (1.3 W/cm²)	240	10.0	3	1	**CFPS732R12XS**	**C2-50**	**C2-92**	288 (131)	51 (1294)	31 (787)	27½ (699)
	480	10.0	3	1	**CFPS732R13XS**	**C2-43**	**C2-35**	288 (131)	51 (1294)	31 (787)	27½ (699)
	240	12.5	3	1	**CFPS740G12XS**	**C2-236**	**C2-214**	296 (135)	72 (1827)	52 (1321)	48½ (1232)
	480	12.5	3	1	**CFPS740G13XS**	**C2-43**	**C2-35**	296 (135)	72 (1827)	52 (1321)	48½ (1232)
	240	15.0	3	1	**CFPS747R12XS**	**C2-236**	**C2-214**	306 (139)	72 (1827)	52 (1321)	48½ (1232)
	480	15.0	3	1	**CFPS747R13XS**	**C2-43**	**C2-35**	306 (139)	72 (1827)	52 (1321)	48½ (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



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WATROD and FIREBAR Circulation Heaters

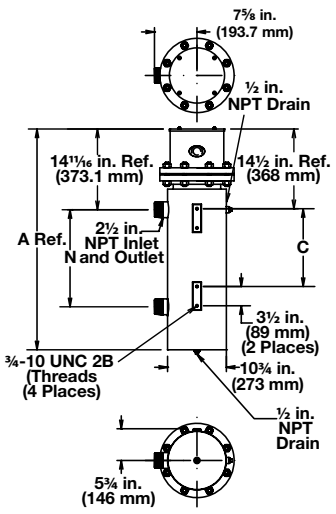
Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
8 inch - 150 lb ANSI Flange (WATROD)											
8 W/in² ③ Steel Tank 18-Steel Elements (1.3 W/cm²)	240	12.5	3	1	**CFRS743E12S**	**C2-236**	**C2-214**	410 (186)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	12.5	3	1	**CFRS743E13S**	**C2-43**	**C2-35**	410 (186)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	240	16.5	3	1	**CFRS751M12S**	**C2-236**	**C2-214**	440 (200)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	16.5	3	1	**CFRS751M13S**	**C2-43**	**C2-35**	440 (200)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	240	20.0	3	2	**CFRS762D12S**	**C2-219**	**C2-220**	480 (218)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	20.0	3	1	**CFRS762D13S**	**C2-43**	**C2-50**	480 (218)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	240	24.0	3	2	**CFRS770M12S**	**C2-218**	**C2-224**	530 (241)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	480	24.0	3	1	**CFRS770M13S**	**C2-225**	**C2-226**	530 (241)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	240	27.0	3	2	**CFRS779M12S**	**C2-218**	**C2-224**	610 (277)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)
	480	27.0	3	1	**CFRS779M13S**	**C2-225**	**C2-226**	610 (277)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)
8 inch - 150 lb ANSI Flange (WATROD)											
8 W/in² ③ Steel Tank 24-Steel Elements (1.3 W/cm²)	240	17.0	3	1	**CFRS743M12XS**	**C2-236**	**C2-214**	425 (193)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	480	17.0	3	1	**CFRS743M13XS**	**C2-43**	**C2-35**	425 (193)	62 1/4 (1580.0)	39 3/4 (1008.0)	36 1/4 (919.0)
	240	22.0	3	2	**CFRS751M12XS**	**C2-218**	**C2-224**	457 (208)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	480	22.0	3	1	**CFRS751M13XS**	**C2-225**	**C2-226**	457 (208)	69 7/8 (1774.8)	47 3/8 (1203.3)	43 7/8 (1114.4)
	240	27.0	3	2	**CFRS762D12XS**	**C2-218**	**C2-224**	461 (209)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	480	27.0	3	1	**CFRS762D13XS**	**C2-225**	**C2-226**	461 (209)	79 3/8 (2016.1)	56 7/8 (1444.6)	53 3/8 (1355.7)
	240	32.0	3	2	**CFRS770M12XS**	**C2-218**	**C2-224**	554 (252)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	480	32.0	3	1	**CFRS770M13XS**	**C2-225**	**C2-226**	554 (252)	88 3/8 (2244.7)	65 7/8 (1673.2)	62 3/8 (1584.3)
	240	36.0	3	2	**CFRS779M12XS**	**C2-218**	**C2-224**	636 (289)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)
	480	36.0	3	1	**CFRS779M13XS**	**C2-224**	**C2-226**	636 (289)	98 3/8 (2498.7)	75 7/8 (1927.2)	72 3/8 (1838.3)

③ Wired for 3-phase operation only

8 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

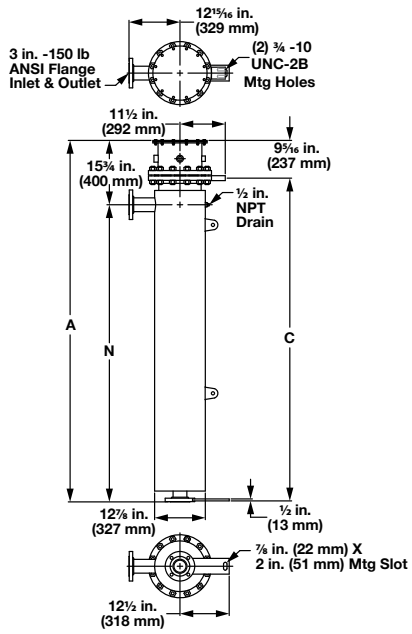
Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD elements
- Without thermostat
- General purpose enclosure

Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
10 inch - 150 lb ANSI Flange (WATROD)											
8 W/in² ③ Steel Tank 27-Steel Elements (1.3 W/cm²)	240	30.0	3	3	**CFSS762E12S**	**C4-143**	**C4-142**	540 (245)	91 1/4 (2316.0)	75 1/2 (1916.0)	82 1/4 (2088.0)
	480	30.0	3	1	**CFSS762E13S**	**C2-225**	**C2-226**	540 (245)	91 1/4 (2316.0)	75 1/2 (1916.0)	82 1/4 (2088.0)
	240	35.0	3	3	**CFSS770N12S**	**C4-144**	**C4-145**	600 (273)	99 1/8 (2517.8)	83 3/8 (2117.7)	89 13/16 (2281.2)
	480	35.0	3	1	**CFSS770N13S**	**C2-225**	**C2-226**	600 (273)	99 1/8 (2517.8)	83 3/8 (2117.7)	89 13/16 (2281.2)
	240	40.0	3	3	**CFSS778N12S**	**C4-144**	**C4-145**	645 (293)	106 5/8 (2708.3)	90 7/8 (2308.2)	97 5/16 (2471.7)
	480	40.0	3	1	**CFSS778N13S**	**C2-225**	**C2-226**	645 (293)	106 5/8 (2708.3)	90 7/8 (2308.2)	97 5/16 (2471.7)

③ Wired for 3-phase operation only

10 inch - 150 lb ANSI Flange



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WATROD and FIREBAR Circulation Heaters

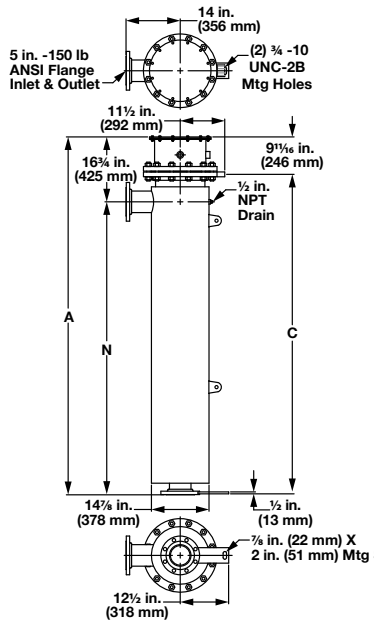
Application: Bunker C, Asphalt and #6 Fuel Oil

- WATROD elements
- Without thermostat
- General purpose enclosure

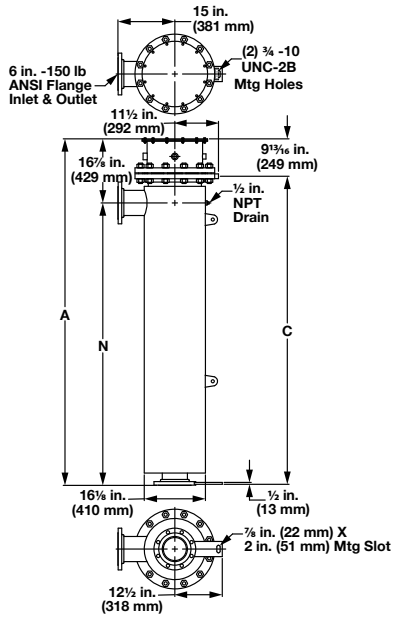
Description	Volts	kW	Ph	# Circ.	Part Number	WATCONNECT Part Number Type J T/C	WATCONNECT Part Number Type K T/C	Ship Wt. lbs (kg)	"A" Dim. in. (mm)	"N" Dim. in. (mm)	"C" Dim. in. (mm)
12 inch - 150 lb ANSI Flange (WATROD)											
8 W/in² ③ Steel Tank 36-Steel Elements (1.3 W/cm²)	240	47.0	3	3	**CFTS770L12S**	**C4-144**	**C4-145**	700 (318)	99 (2515)	82 7/8 (2105.0)	89 5/8 (2277)
	480	47.0	3	2	**CFTS770L13S**	**C2-229**	**C2-230**	700 (318)	99 (2515)	82 7/8 (2105.0)	89 5/8 (2277)
	240	54.0	3	3	**CFTS778L12S**	**C4-144**	**C4-145**	750 (341)	106 1/2 (2705)	90 3/8 (2295.5)	97 1/8 (2467)
	480	54.0	3	2	**CFTS778L13S**	**C2-229**	**C2-230**	750 (341)	106 1/2 (2705)	90 3/8 (2295.5)	97 1/8 (2467)
14 inch - 150 lb ANSI Flange (WATROD)											
8 W/in² ③ Steel Tank 45-Steel Elements (1.3 W/cm²)	240	60.0	3	3	**CFWS770J12S**	**C4-144**	**C4-145**	700 (318)	98 1/4 (2496)	82 (2081)	88 11/16 (2253)
	480	60.0	3	3	**CFWS770J13S**	**C4-150**	**C4-151**	700 (318)	98 1/4 (2496)	82 (2081)	88 11/16 (2253)
	240	67.0	3	5	**CFWS778J12S**	**C/F**	**C/F**	780 (354)	105 3/4 (2686)	89 1/2 (2272)	96 3/16 (2443)
	480	67.0	3	3	**CFWS778J13S**	**C4-152**	**C4-153**	780 (354)	105 3/4 (2686)	89 1/2 (2272)	96 3/16 (2443)

C/F - Contact factory, go to www.watlow.com/en/contact-us

12 inch - 150 lb ANSI Flange



14 inch - 150 lb ANSI Flange



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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
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 =	Moisture/explosion resistant enclosure
Note: Catalog listings include either a general purpose enclosure or NEMA 4 enclosure. Substitute enclosure options are noted.	

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
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: CFONA18A10 S 5 HJ

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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^2 (9.3 W/cm^2)
- 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

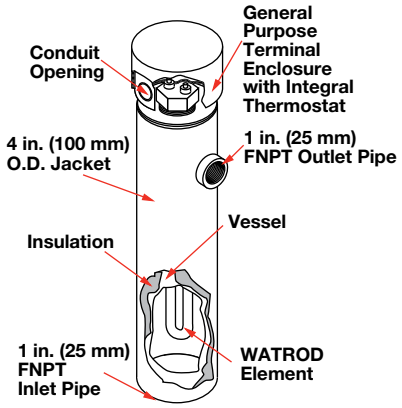
One inch thick (25 mm) fiberglass thermal insulation rated to 750°F (400°C)
- Reduces heat loss

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

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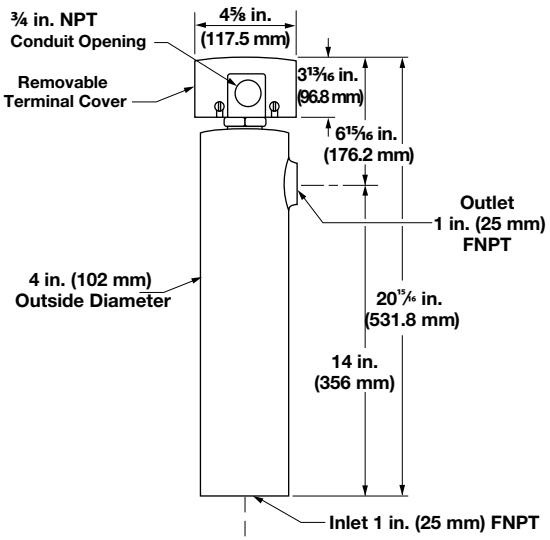
WATROD and FIREBAR Heaters

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/in²	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/cm²)	3.00	1	**CBEN15A6X**	18	(8.2)
Application: Lightweight Oils					
23 W/in²	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/cm²)					

For optional housing adders, use circulation heater adders.

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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^2 (7 to 14 W/cm^2)
- 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

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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:

English
Cubic inches X 3 = estimated wattage
Metric
Liters X 183 = estimated wattage

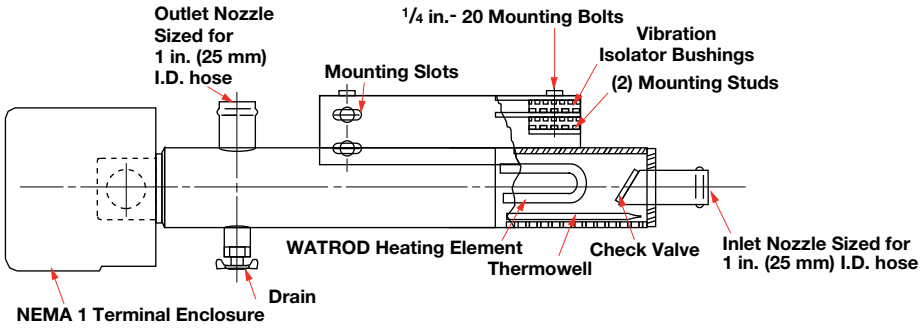
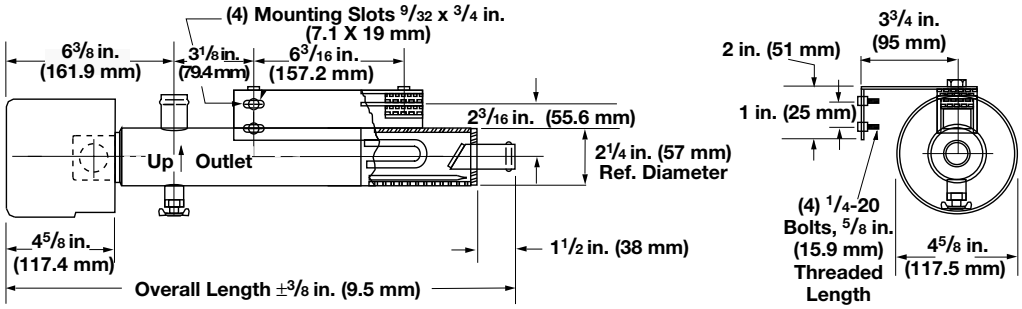


Figure 1



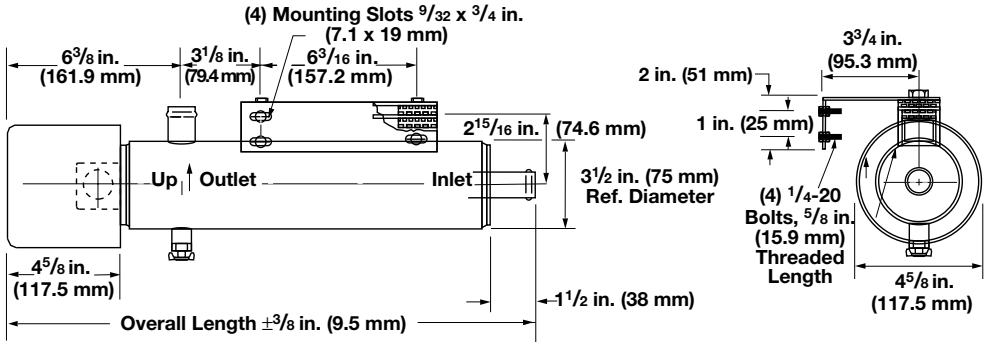
kW	Overall Length in.	Overall Length (mm)	Part Number 120/240VAC 1-Phase	Part Number 208VAC 1-Phase	Part Number 240/480VAC 1-Phase	Est. Ship. Wt. lbs	Est. Ship. Wt. (kg)
Application: Ethylene Glycol/Engine Coolant							
1.13	20 7/8	(530.2)		**CPBPL2S12**		12	(6)
1.50	20 7/8	(530.2)	**CPBPB6S12**	**CPBPB2S12**		12	(6)
1.69	20 7/8	(530.2)		**CPBPM2S12**		12	(6)
1.88	20 7/8	(530.2)		**CPBPN2S12**		12	(6)
2.00	20 7/8	(530.2)	**CPBPC6S12**			12	(6)
2.25	20 7/8	(530.2)	**CPBPD6S12**			12	(6)
2.25	26 11/16	(677.9)		**CPBPD2S12**		15	(7)
2.50	20 7/8	(530.2)	**CPBPE6S12**			12	(6)
3.00	26 11/16	(677.9)		**CPBPF2S12**	**CPBPF7S12**	15	(7)
3.75	26 11/16	(677.9)		**CPBPG2S12**		15	(7)
4.00	26 11/16	(677.9)			**CPBPH7S12**	15	(7)
5.00	26 11/16	(677.9)			**CPBPJ7S12**	15	(7)

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WATROD and FIREBAR Heaters

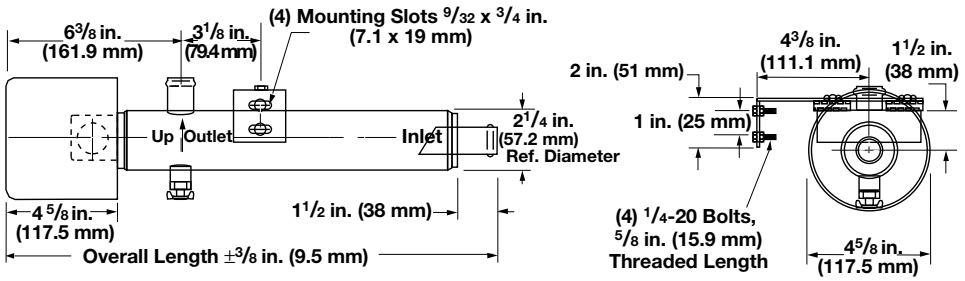
Engine Preheaters

Figure 2



kW	Overall Length in. (mm)	Part Number 277VAC 1-Phase	Part Number 480VAC 3-Phase	Est. Ship. Wt. lbs (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 120/240VAC 1-Phase	Part Number 208VAC 1-Phase	Est. Ship. Wt. lbs (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)

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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

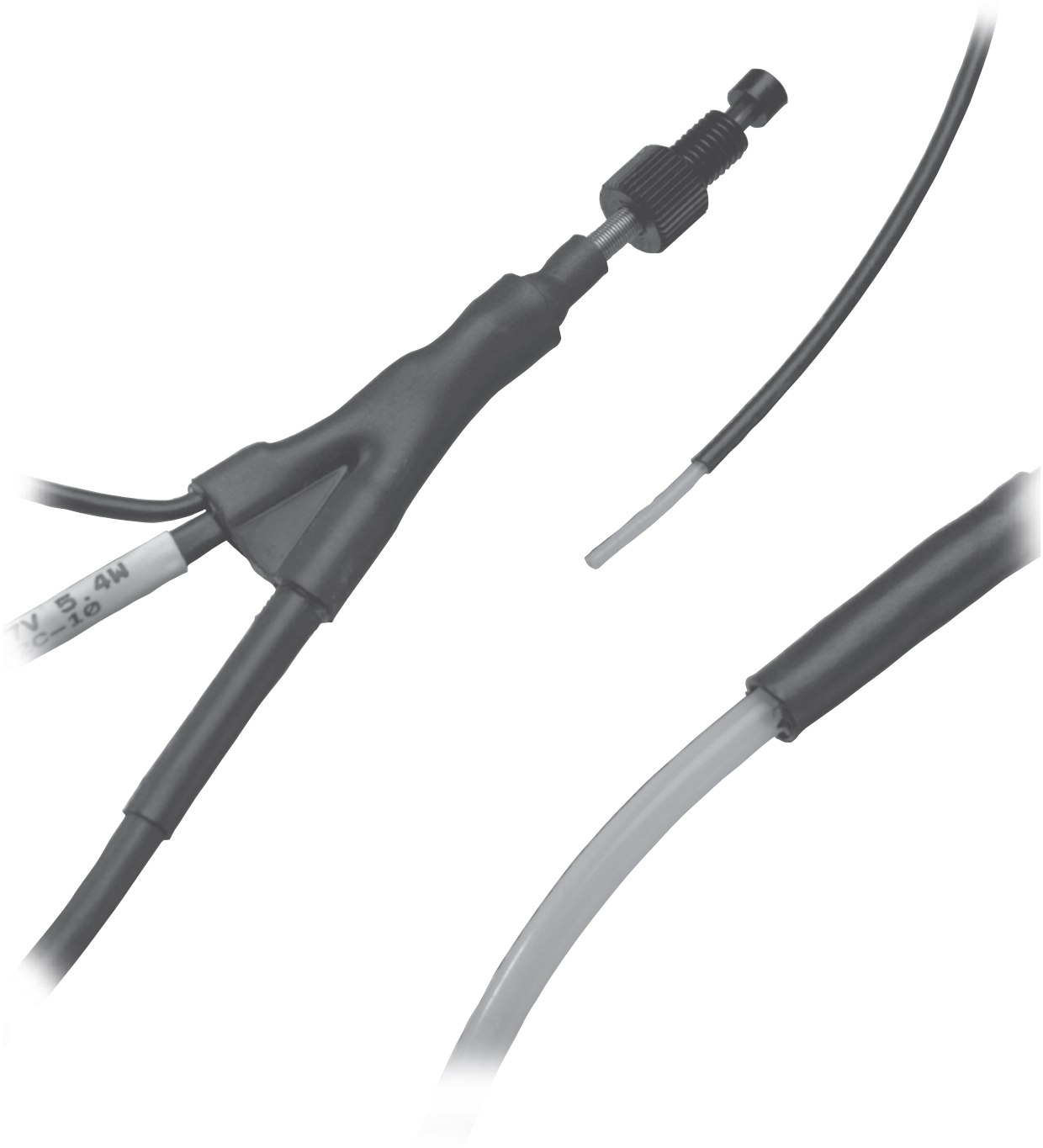
For detailed product and technical data, see the full FLUENT In-line product section located on pages 445 through 448.

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Fluid Delivery Heaters

Fluid Delivery Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
FREEFLEX®	Polymeric	212	100	10	1.5	369
Syringe	Polycarbonate laminate	185	85	2	0.3	372
FLUENT® In-line	444 stainless steel (substrate tube), 316L stainless steel (baffle and fittings)	212 (in water)	100	450	70	373



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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.

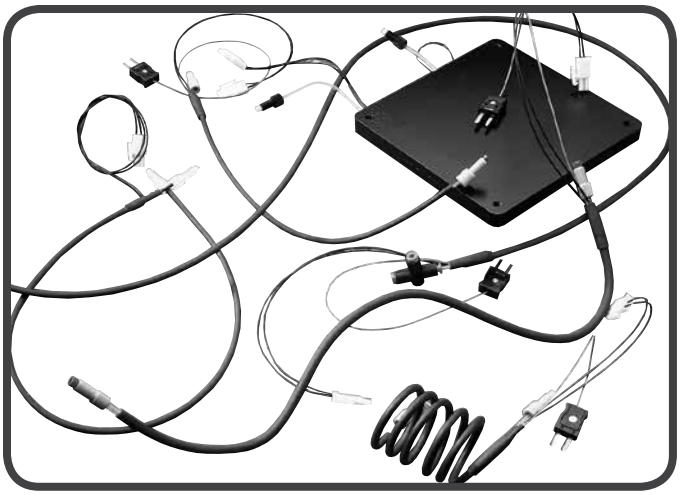
The FREEFLEX heater's efficient heating element design can incorporate an optional thermocouple, thermistor or resistance temperature detector (RTD) temperature sensor into the thermal package. Users can select leads to exit from one or both ends of the assembly. Typical standard PTFE tubing is available 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**

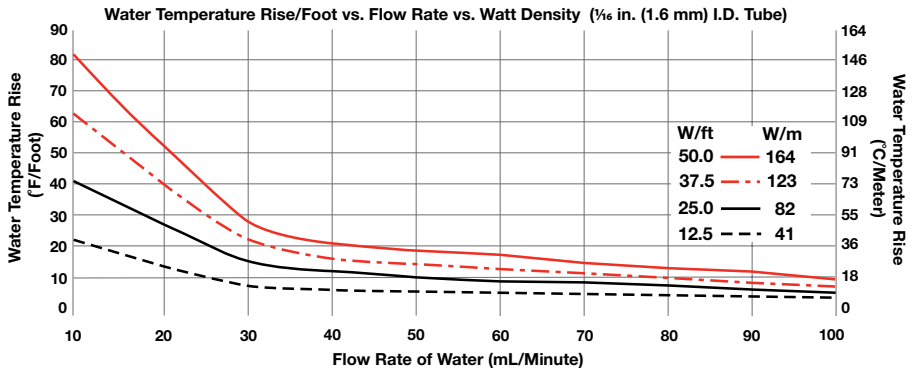
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EXTENDED CAPABILITY

Extended Capabilities for FREEFLEX Heaters

Technical Data

Water Temperature Rise/Length Versus Flow Rate Versus Watt Density



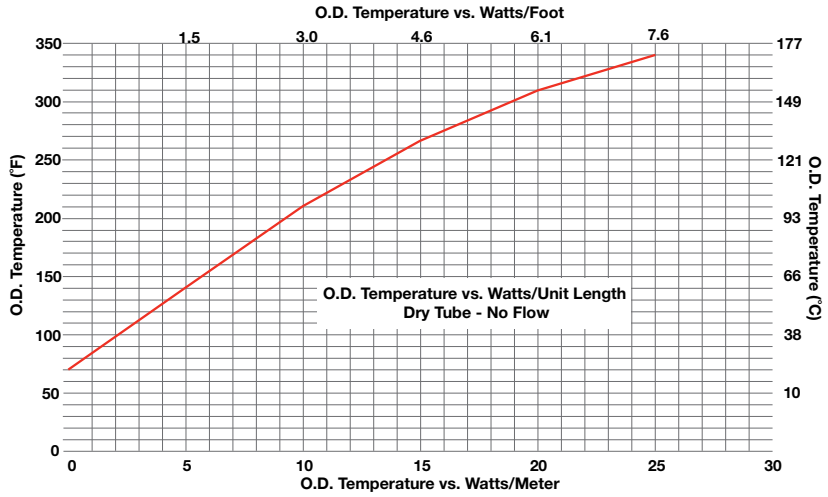
Water Temperature Rise °F/Foot

	Flow Rate (mL/minute)			
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

	Flow Rate (mL/minute)			
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	(°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)

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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

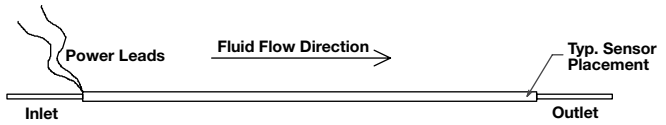
Sensor lead exit direction

- Inboard/outboard

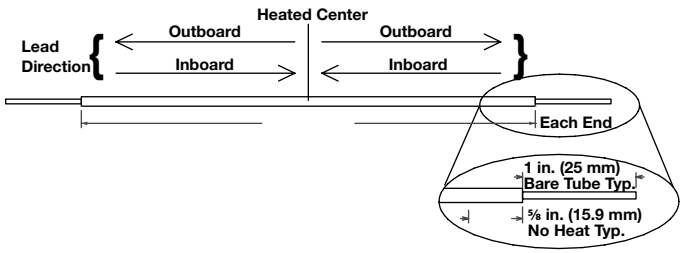
Temperature sensor lead length

- 12 in. (305 mm)
- Other (specify)

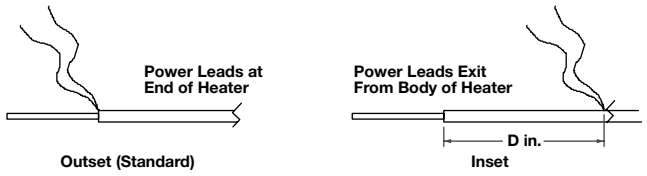
Typical FREEFLEX Layout



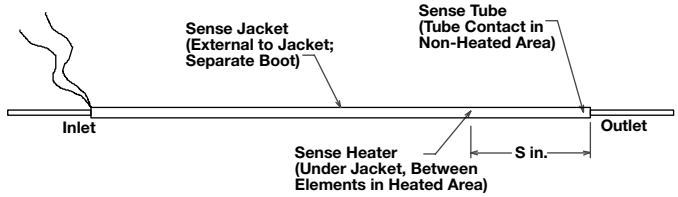
Lead Orientation



Lead Location



Sensor Location/Mounting Description



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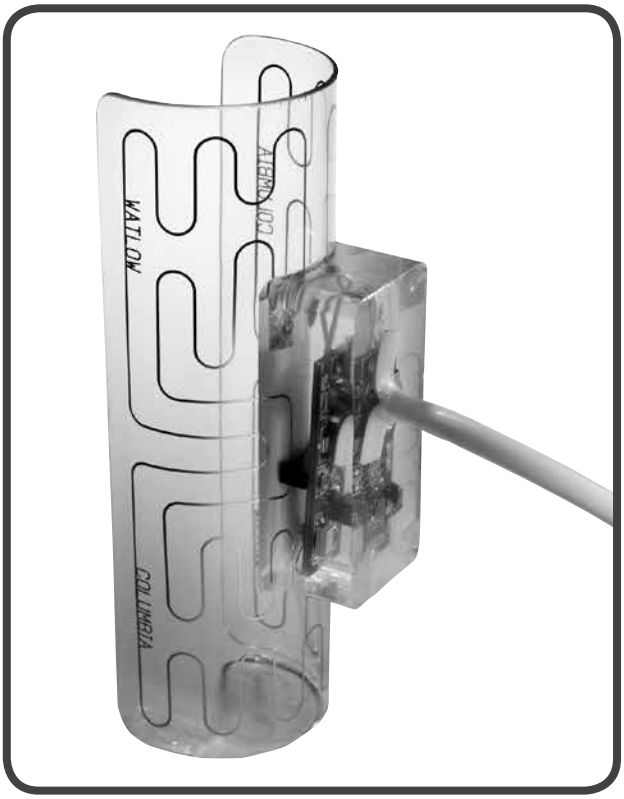
EXTENDED CAPABILITY

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_F)*

* Dependent on design requirements.

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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.

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Air Heaters

Air Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
Duct Heaters						
LDH SERIES and D SERIES	Alloy 840	1200	650	30	4.7	**377**
MDH SERIES	Alloy 840	1200	650	26	4.0	**391**
Finned						
375 Finned Strip	Aluminized steel	1100	595	33	5.1	**395**
FINBAR™ Single-Ended	304 stainless steel	1200	650	50	7.7	**401**
FIREROD® Cartridge	Alloy 800	Application Specific		100	15.5	**402**
Enclosure Heaters						
WATROD™	Alloy 840	390	200	15	2.3	**403**
Silicone Rubber	Fiberglass reinforced silicone rubber	500	260	5	0.8	**405**
FLUENT® In-line	444 stainless steel (substrate tube), 316L stainless steel (baffle and fittings)	482 (internal)	250	150	23	**408**



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Duct Heaters

LDH SERIES and D SERIES

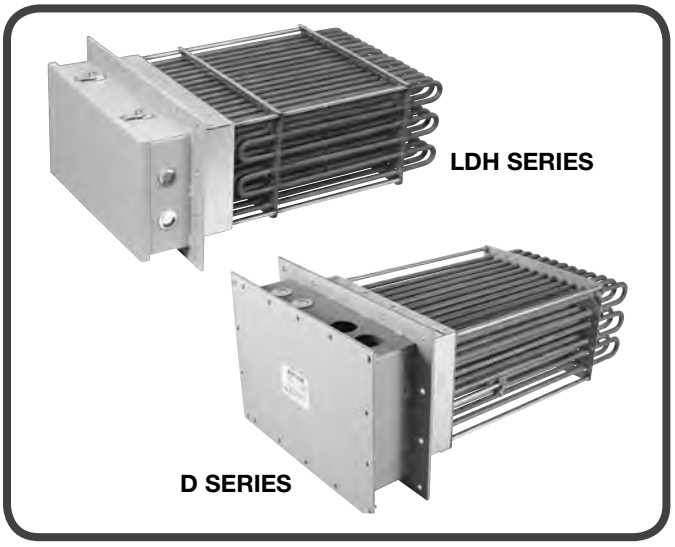
Constructed of sturdy 0.430 in. (11 mm) diameter WATROD™ heating elements mounted to a 1/4 in. (6 mm) thick steel flange, duct heaters are easily adapted to many non-pressurized air-heating systems.

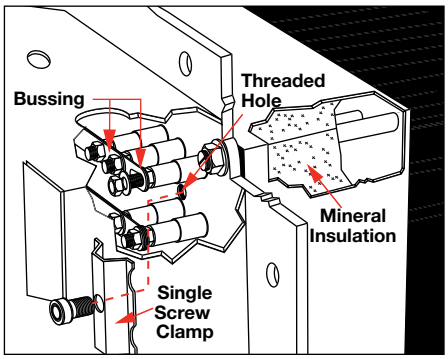
They are easily installed in applications requiring a wide range of temperature versus air flow combinations.

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^2 (6.2 W/cm^2)
- 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

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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:

English

$$FPM = \frac{\text{CFM measured at standard conditions}}{\text{Duct cross section area at heater in ft}^2}$$

Metric

$$MPM = \frac{\text{CMM measured at normal conditions}}{\text{Duct cross section area at heater in m}^2}$$

- Minimum duct heater wattage (kW). This can be determined by:

English

$$kW = \frac{\text{CFM x Delta T (°F) x 1.1 (safety factor)}}{3000}$$

Metric

$$kW = \frac{\text{CMM x Delta T (°C) x 1.1 (safety factor)}}{48}$$

Note: The duct heater, or combination of duct heaters, used for the process should be equal to or exceed the minimum wattage calculation.

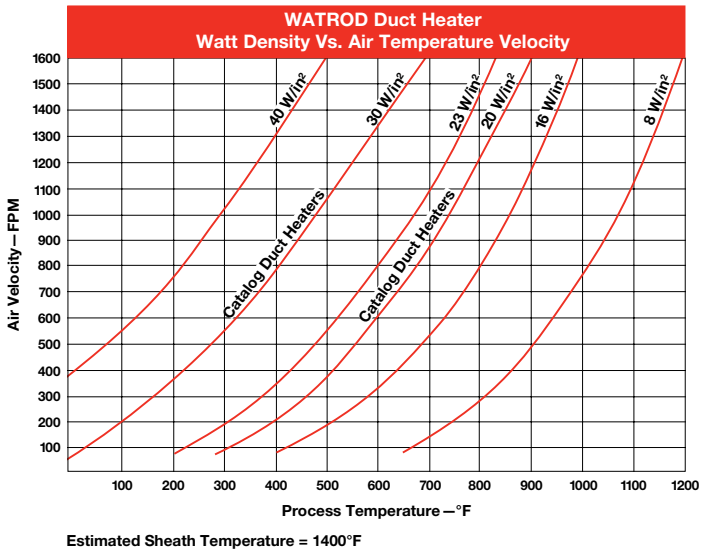
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Duct Heaters

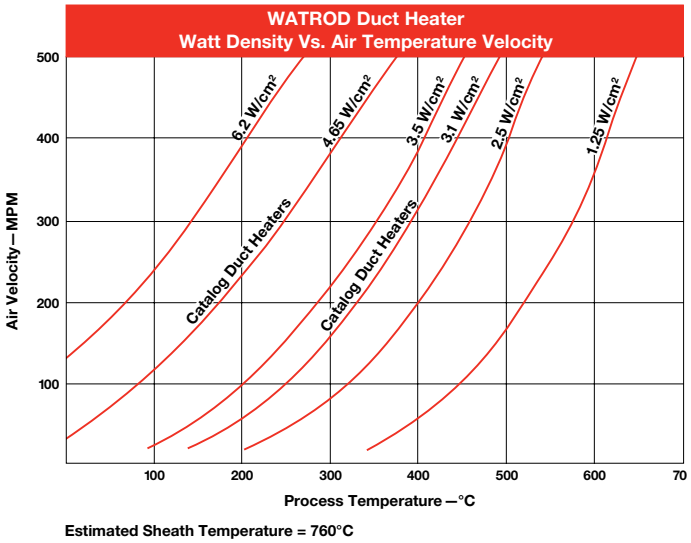
LDH SERIES and D SERIES

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.**



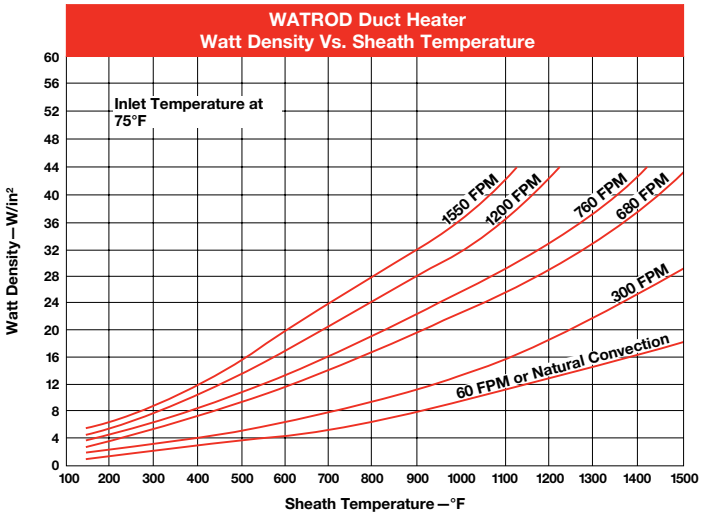
Estimated Sheath Temperature = 1400°F

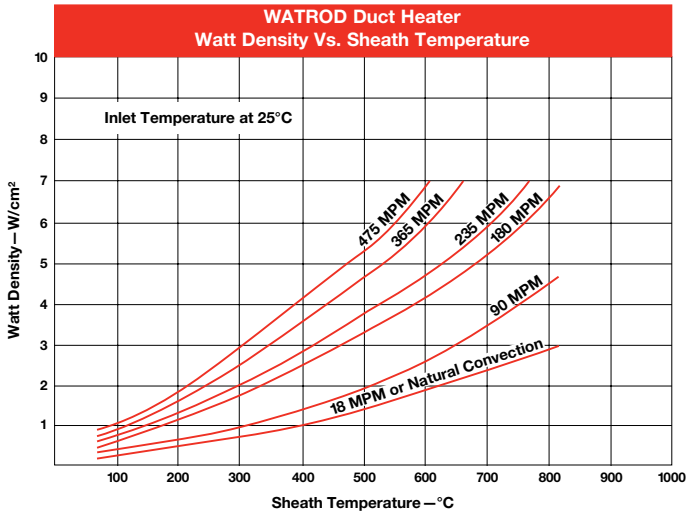


Estimated Sheath Temperature = 760°C

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.





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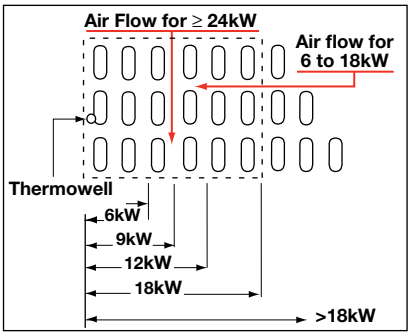
Duct Heaters

LDH SERIES and D SERIES

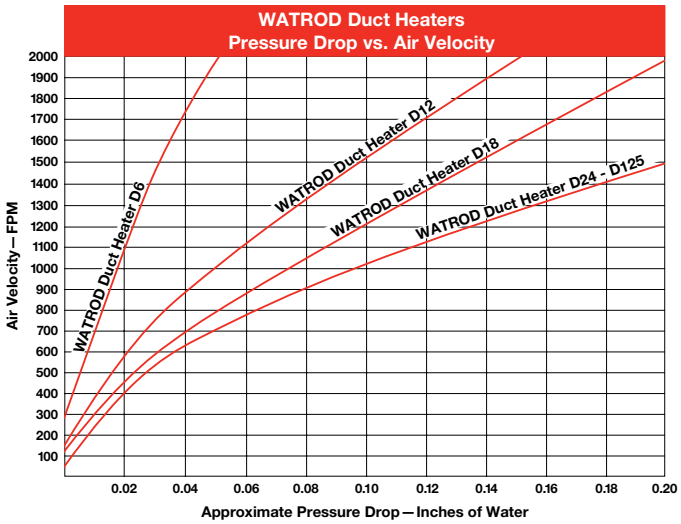
Pressure Drop vs. Air Velocity

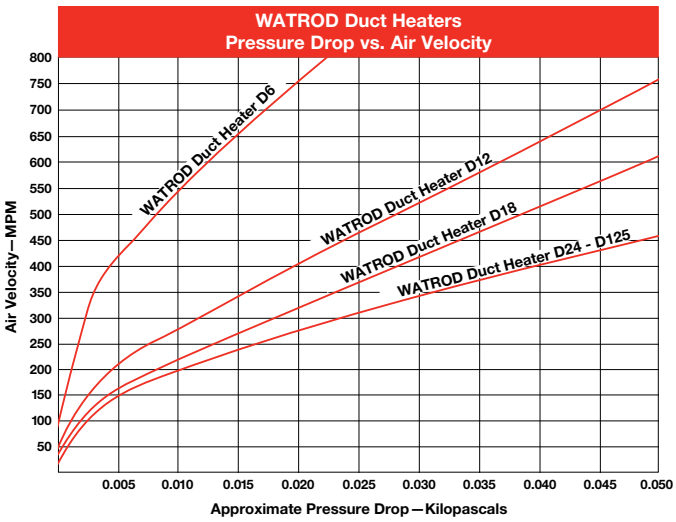
The rate at which pressure drops through the duct heater is critical for properly sizing blowers and pumps. *The Pressure Drop vs. Air Velocity* graph gives recommended maximum velocities in feet per minute and meters per minute according to the air velocity and duct heater size.

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

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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. 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

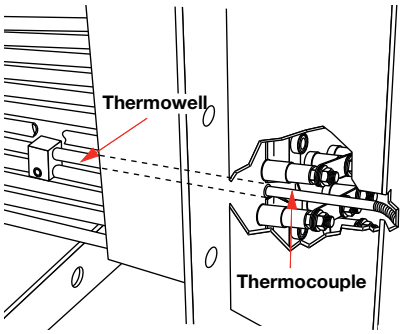
Type J or **K** thermocouples, inserted in the thermowell, accurately sense element sheath temperature for over-temperature conditions.

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 Positive	Conductor Characteristics Negative	Recommended① Temperature Range °F	Recommended① Temperature Range (°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.

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.

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EXTENDED CAPABILITY

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

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Duct Heaters

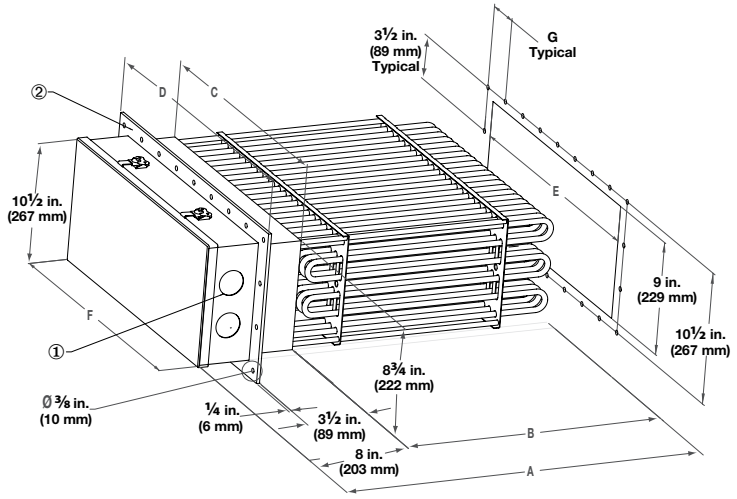
LDH SERIES

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 J T/C	WATCONNECT P/N K T/C	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)
20 W/in² (3.1 W/cm²)															
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 (648)	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 (648)	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 (648)	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 (648)	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 (648)	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 (648)	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 (648)	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 (648)	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 (648)	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 (648)	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.

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Duct Heaters

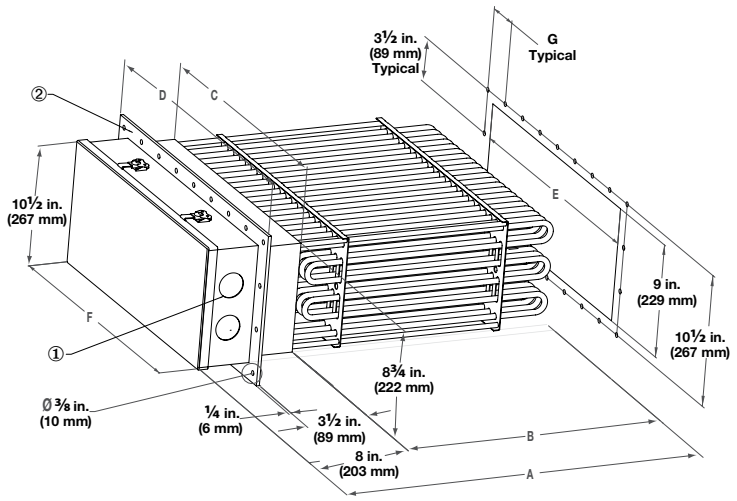
LDH SERIES

Application: Medium Temperature Air 750°F (399°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 J T/C	WATCONNECT P/N K T/C	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)
30 W/in² (4.7 W/cm²)															
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)	18¾(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.

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Duct Heaters

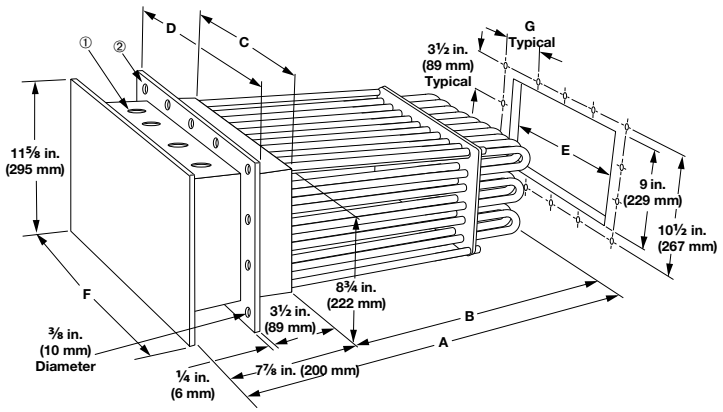
D SERIES

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 J T/C	WATCONNECT P/N K T/C	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)
20 W/in² (3.1 W/cm²)															
6	240	6.0	1	1	**D6S10S**	**C/F**	**C/F**	50 (23)	27 7/8 (708)	20 (508)	2 3/4 (70)	6 1/2 (165)	3 (76)	5 3/4 (146)	2 1/2 (64)
6	240	6.0	3	1	**D6S3S**	**C2-50**	**C2-92**	50 (23)	27 7/8 (708)	20 (508)	2 3/4 (70)	6 1/2 (165)	3 (76)	5 3/4 (146)	2 1/2 (64)
6	480	6.0	1	1	**D6S11S**	**C/F**	**C/F**	50 (23)	27 7/8 (708)	20 (508)	2 3/4 (70)	6 1/2 (165)	3 (76)	5 3/4 (146)	2 1/2 (64)
6	480	6.0	3	1	**D6S5S**	**C2-43**	**C2-35**	50 (23)	27 7/8 (708)	20 (508)	2 3/4 (70)	6 1/2 (165)	3 (76)	5 3/4 (146)	2 1/2 (64)
12	240	12.0	1	1	**D12S10S**	**C/F**	**C/F**	55 (25)	27 7/8 (708)	20 (508)	4 3/4 (121)	8 1/2 (215)	5 (127)	7 3/4 (197)	3 1/2 (89)
12	240	12.0	3	1	**D12S3S**	**C2-236**	**C2-214**	55 (25)	27 7/8 (708)	20 (508)	4 3/4 (121)	8 1/2 (215)	5 (127)	7 3/4 (197)	3 1/2 (89)
12	480	12.0	1	1	**D12S11S**	**C/F**	**C/F**	55 (25)	27 7/8 (708)	20 (508)	4 3/4 (121)	8 1/2 (215)	5 (127)	7 3/4 (197)	3 1/2 (89)
12	480	12.0	3	1	**D12S5S**	**C2-43**	**C2-35**	55 (25)	27 7/8 (708)	20 (508)	4 3/4 (121)	8 1/2 (215)	5 (127)	7 3/4 (197)	3 1/2 (89)
18	240	18.0	1	2	**D18S10S**	**C/F**	**C/F**	65 (30)	27 7/8 (708)	20 (508)	6 3/4 (171)	10 1/2 (267)	7 (178)	9 3/4 (248)	3 (76)
18	240	18.0	3	1	**D18S3S**	**C2-236**	**C2-214**	65 (30)	27 7/8 (708)	20 (508)	6 3/4 (171)	10 1/2 (267)	7 (178)	9 3/4 (248)	3 (76)
18	480	18.0	1	1	**D18S11S**	**C/F**	**C/F**	65 (30)	27 7/8 (708)	20 (508)	6 3/4 (171)	10 1/2 (267)	7 (178)	9 3/4 (248)	3 (76)
18	480	18.0	3	1	**D18S5S**	**C2-43**	**C2-35**	65 (30)	27 7/8 (708)	20 (508)	6 3/4 (171)	10 1/2 (267)	7 (178)	9 3/4 (248)	3 (76)
24	240	24.0	1	2	**D24S10S**	**C/F**	**C/F**	95 (43)	27 7/8 (708)	20 (508)	8 3/4 (222)	12 1/2 (318)	9 (229)	11 3/4 (298)	2 3/4 (70)
24	240	24.0	3	2	**D24S3S**	**C2-218**	**C2-224**	95 (43)	27 7/8 (708)	20 (508)	8 3/4 (222)	12 1/2 (318)	9 (229)	11 3/4 (298)	2 3/4 (70)
24	480	24.0	1	1	**D24S11S**	**C/F**	**C/F**	95 (43)	27 7/8 (708)	20 (508)	8 3/4 (222)	12 1/2 (318)	9 (229)	11 3/4 (298)	2 3/4 (70)
24	480	24.0	3	1	**D24S5S**	**C2-225**	**C2-226**	95 (43)	27 7/8 (708)	20 (508)	8 3/4 (222)	12 1/2 (318)	9 (229)	11 3/4 (298)	2 3/4 (70)
30	240	30.0	3	2	**D30S3S**	**C2-218**	**C2-224**	120 (55)	27 7/8 (708)	20 (508)	10 3/4 (273)	14 1/2 (368)	11 (279)	13 3/4 (349)	3 1/4 (83)
30	480	30.0	1	2	**D30S11S**	**C/F**	**C/F**	120 (55)	27 7/8 (708)	20 (508)	10 3/4 (273)	14 1/2 (368)	11 (279)	13 3/4 (349)	3 1/4 (83)
30	480	30.0	3	1	**D30S5S**	**C2-225**	**C2-226**	120 (55)	27 7/8 (708)	20 (508)	10 3/4 (273)	14 1/2 (368)	11 (279)	13 3/4 (349)	3 1/4 (83)

CONTINUED

Notes:

- See *Watt Density vs. Air Temperature/Velocity* charts on page 379 to confirm suitability in the application.

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Duct Heaters

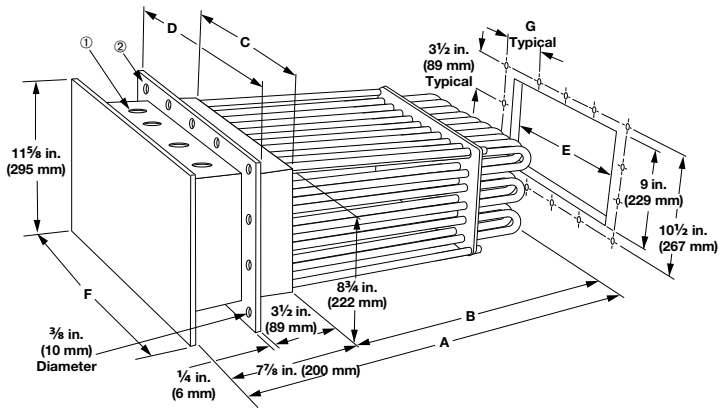
D SERIES

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 J T/C	WATCONNECT P/N K T/C	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)
20 W/in² (3.1 W/cm²)															
36	240	36.0	3	2	**D36S3S**	**C2-218**	**C2-219**	135 (62)	27 7/8 (708.0)	20 (508)	12 3/4 (324)	16 1/2 (419)	13 (330)	15 3/4 (400)	3 3/4 (95)
36	480	36.0	1	2	**D36S11S**	**C/F**	**C/F**	135 (62)	27 7/8 (708.0)	20 (508)	12 3/4 (324)	16 1/2 (419)	13 (330)	15 3/4 (400)	3 3/4 (95)
36	480	36.0	3	1	**D36S5S**	**C2-225**	**C2-226**	135 (62)	27 7/8 (708.0)	20 (508)	12 3/4 (324)	16 1/2 (419)	13 (330)	15 3/4 (400)	3 3/4 (95)
42	240	42.0	3	2	**D42S3S**	**C/F**	**C/F**	155 (71)	27 7/8 (708.0)	20 (508)	14 3/4 (375)	18 1/2 (470)	15 (381)	17 3/4 (451)	4 1/4(108)
42	480	42.0	1	2	**D42S11S**	**C/F**	**C/F**	155 (71)	27 7/8 (708.0)	20 (508)	14 3/4 (375)	18 1/2 (470)	15 (381)	17 3/4 (451)	4 1/4(108)
42	480	42.0	3	2	**D42S5S**	**C2-229**	**C2-230**	155 (71)	27 7/8 (708.0)	20 (508)	14 3/4 (375)	18 1/2 (470)	15 (381)	17 3/4 (451)	4 1/4(108)
48	240	48.0	3	4	**D48S3S**	**C4-148**	**C4-149**	195 (89)	27 7/8 (708.0)	20 (508)	16 3/4 (425)	20 1/2 (521)	17 (432)	19 3/4 (502)	4 3/4(121)
48	480	48.0	1	2	**D48S11S**	**C/F**	**C/F**	195 (89)	27 7/8 (708.0)	20 (508)	16 3/4 (425)	20 1/2 (521)	17 (432)	19 3/4 (502)	4 3/4(121)
48	480	48.0	3	2	**D48S5S**	**C2-229**	**C2-230**	195 (89)	27 7/8 (708.0)	20 (508)	16 3/4 (425)	20 1/2 (521)	17 (432)	19 3/4 (502)	4 3/4(121)
54	240	54.0	3	3	**D54S3S**	**C4-144**	**C4-145**	205 (93)	27 7/8 (708.0)	20 (508)	18 3/4 (476)	22 1/2 (572)	19 (483)	21 3/4 (552)	5 1/4(133)
54	480	54.0	1	3	**D54S11S**	**C/F**	**C/F**	205 (93)	27 7/8 (708.0)	20 (508)	18 3/4 (476)	22 1/2 (572)	19 (483)	21 3/4 (552)	5 1/4(133)
54	480	54.0	3	2	**D54S5S**	**C2-229**	**C2-230**	205 (93)	27 7/8 (708.0)	20 (508)	18 3/4 (476)	22 1/2 (572)	19 (483)	21 3/4 (552)	5 1/4(133)
60	240	60.0	3	4	**D60S3S**	**C4-148**	**C4-149**	235 (107)	27 7/8 (708.0)	20 (508)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	60.0	1	4	**D60S11S**	**C/F**	**C/F**	235 (107)	27 7/8 (708.0)	20 (508)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	60.0	3	2	**D60S5S**	**C2-229**	**C2-230**	235 (107)	27 7/8 (708.0)	20 (508)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	240	75.0	3	4	**D75S3S**	**C4-148**	**C4-149**	260 (118)	32 7/8 (835.0)	25 (635)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	75.0	1	4	**D75S11S**	**C/F**	**C/F**	260 (118)	32 7/8 (835.0)	25 (635)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	75.0	3	2	**D75S5S**	**C2-229**	**C2-230**	260 (118)	32 7/8 (835.0)	25 (635)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	100.0	3	4	**D100S5S**	**C4-156**	**C4-157**	290 (132)	40 3/8(1025.5)	32 1/2 (826)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	125.0	3	4	**D125S5S**	**C4-156**	**C4-157**	310 (141)	49 3/8(1254.1)	41 1/2(1054)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)

Notes:

- See *Watt Density vs. Air Temperature/Velocity* charts on page 379 to confirm suitability in the application.

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Duct Heaters

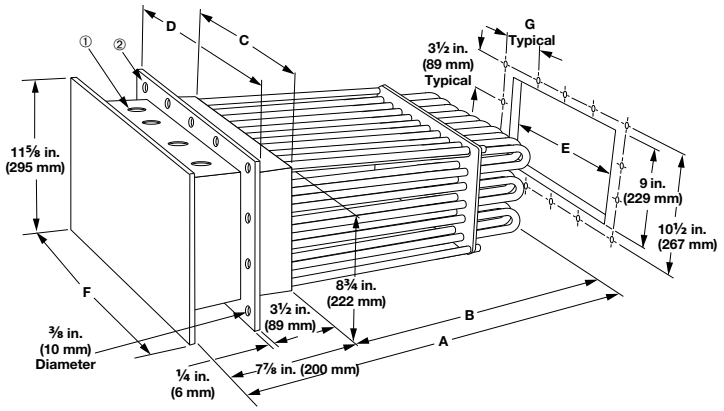
D SERIES

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 J T/C	WATCONNECT P/N K T/C	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)
30 W/in² (4.7 W/cm²)															
6	240	9.0	1	1	**D6SX10S**	**C/F**	**C/F**	50 (23)	27 7/8 (708)	20 (508)	2 3/4 (70)	6 1/2 (165)	3 (76)	5 3/4 (146)	2 1/2 (64)
6	240	9.0	3	1	**D6SX3S**	**C2-50**	**C2-92**	50 (23)	27 7/8 (708)	20 (508)	2 3/4 (70)	6 1/2 (165)	3 (76)	5 3/4 (146)	2 1/2 (64)
6	480	9.0	1	1	**D6SX11S**	**C/F**	**C/F**	50 (23)	27 7/8 (708)	20 (508)	2 3/4 (70)	6 1/2 (165)	3 (76)	5 3/4 (146)	2 1/2 (64)
6	480	9.0	3	1	**D6SX5S**	**C2-43**	**C2-35**	50 (23)	27 7/8 (708)	20 (508)	2 3/4 (70)	6 1/2 (165)	3 (76)	5 3/4 (146)	2 1/2 (64)
12	240	18.0	1	2	**D12SX10S**	**C/F**	**C/F**	55 (25)	27 7/8 (708)	20 (508)	4 3/4 (121)	8 1/2 (215)	5 (127)	7 3/4 (197)	3 1/2 (89)
12	240	18.0	3	1	**D12SX3S**	**C2-236**	**C2-214**	55 (25)	27 7/8 (708)	20 (508)	4 3/4 (121)	8 1/2 (215)	5 (127)	7 3/4 (197)	3 1/2 (89)
12	480	18.0	1	1	**D12SX11S**	**C/F**	**C/F**	55 (25)	27 7/8 (708)	20 (508)	4 3/4 (121)	8 1/2 (215)	5 (127)	7 3/4 (197)	3 1/2 (89)
12	480	18.0	3	1	**D12SX5S**	**C2-43**	**C2-35**	55 (25)	27 7/8 (708)	20 (508)	4 3/4 (121)	8 1/2 (215)	5 (127)	7 3/4 (197)	3 1/2 (89)
18	240	27.0	1	3	**D18SX10S**	**C/F**	**C/F**	65 (30)	27 7/8 (708)	20 (508)	6 3/4 (171)	10 1/2 (267)	7 (178)	9 3/4 (248)	3 (76)
18	240	27.0	3	2	**D18SX3S**	**C2-218**	**C2-224**	65 (30)	27 7/8 (708)	20 (508)	6 3/4 (171)	10 1/2 (267)	7 (178)	9 3/4 (248)	3 (76)
18	480	27.0	1	2	**D18SX11S**	**C/F**	**C/F**	65 (30)	27 7/8 (708)	20 (508)	6 3/4 (171)	10 1/2 (267)	7 (178)	9 3/4 (248)	3 (76)
18	480	27.0	3	1	**D18SX5S**	**C2-225**	**C2-226**	65 (30)	27 7/8 (708)	20 (508)	6 3/4 (171)	10 1/2 (267)	7 (178)	9 3/4 (248)	3 (76)
24	240	36.0	1	4	**D24SX10S**	**C/F**	**C/F**	95 (43)	27 7/8 (708)	20 (508)	8 3/4 (222)	12 1/2 (318)	9 (229)	11 3/4 (298)	2 3/4 (70)
24	240	36.0	3	2	**D24SX3S**	**C2-218**	**C2-219**	95 (43)	27 7/8 (708)	20 (508)	8 3/4 (222)	12 1/2 (318)	9 (229)	11 3/4 (298)	2 3/4 (70)
24	480	36.0	1	2	**D24SX11S**	**C/F**	**C/F**	95 (43)	27 7/8 (708)	20 (508)	8 3/4 (222)	12 1/2 (318)	9 (229)	11 3/4 (298)	2 3/4 (70)
24	480	36.0	3	1	**D24SX5S**	**C2-225**	**C2-226**	95 (43)	27 7/8 (708)	20 (508)	8 3/4 (222)	12 1/2 (318)	9 (229)	11 3/4 (298)	2 3/4 (70)
30	240	45.0	3	5	**D30SX3S**	**C4-144**	**C4-145**	120 (55)	27 7/8 (708)	20 (508)	10 3/4 (273)	14 1/2 (368)	11 (279)	13 3/4 (349)	3 1/4 (83)
30	480	45.0	1	2	**D30SX11S**	**C/F**	**C/F**	120 (55)	27 7/8 (708)	20 (508)	10 3/4 (273)	14 1/2 (368)	11 (279)	13 3/4 (349)	3 1/4 (83)
30	480	45.0	3	2	**D30SX5S**	**C2-229**	**C2-230**	120 (55)	27 7/8 (708)	20 (508)	10 3/4 (273)	14 1/2 (368)	11 (279)	13 3/4 (349)	3 1/4 (83)

CONTINUED

Notes:

- See *Watt Density vs. Air Temperature/Velocity* charts on page 379 to confirm suitability in the application.

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Duct Heaters

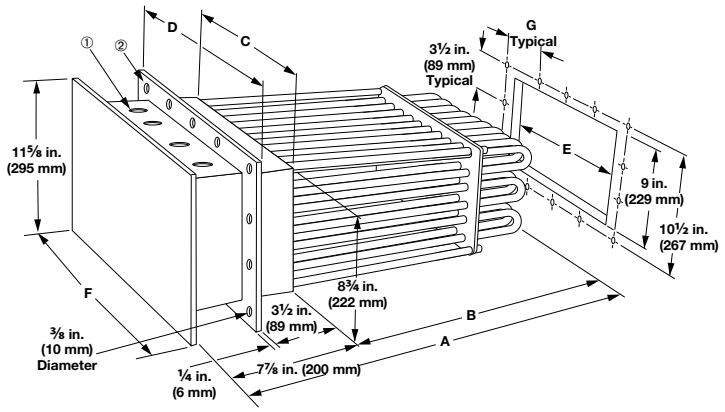
D SERIES

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 J T/C	WATCONNECT P/N K T/C	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)
30 W/in² (4.7 W/cm²)															
36	240	54.0	3	3	**D36SX3S**	**C4-144**	**C4-145**	135 (62)	27 7/8 (708.0)	20 (508)	12 3/4 (324)	16 1/2 (419)	13 (330)	15 3/4 (400)	3 3/4 (95)
36	480	54.0	1	3	**D36SX11S**	**C/F**	**C/F**	135 (62)	27 7/8 (708.0)	20 (508)	12 3/4 (324)	16 1/2 (419)	13 (330)	15 3/4 (400)	3 3/4 (95)
36	480	54.0	3	2	**D36SX5S**	**C2-229**	**C2-230**	135 (62)	27 7/8 (708.0)	20 (508)	12 3/4 (324)	16 1/2 (419)	13 (330)	15 3/4 (400)	3 3/4 (95)
42	240	63.0	3	7	**D42SX3S**	**C4-148**	**C4-149**	155 (71)	27 7/8 (708.0)	20 (508)	14 3/4 (375)	18 1/2 (470)	15 (381)	17 3/4 (451)	4 1/4(108)
42	480	63.0	1	3	**D42SX11S**	**C/F**	**C/F**	155 (71)	27 7/8 (708.0)	20 (508)	14 3/4 (375)	18 1/2 (470)	15 (381)	17 3/4 (451)	4 1/4(108)
42	480	63.0	3	2	**D42SX5S**	**C2-229**	**C2-230**	155 (71)	27 7/8 (708.0)	20 (508)	14 3/4 (375)	18 1/2 (470)	15 (381)	17 3/4 (451)	4 1/4(108)
48	240	72.0	3	4	**D48SX3S**	**C4-148**	**C4-149**	195 (89)	27 7/8 (708.0)	20 (508)	16 3/4 (425)	20 1/2 (521)	17 (432)	19 3/4 (502)	4 3/4(121)
48	480	72.0	1	4	**D48SX11S**	**C/F**	**C/F**	195 (89)	27 7/8 (708.0)	20 (508)	16 3/4 (425)	20 1/2 (521)	17 (432)	19 3/4 (502)	4 3/4(121)
48	480	72.0	3	2	**D48SX5S**	**C2-229**	**C2-230**	195 (89)	27 7/8 (708.0)	20 (508)	16 3/4 (425)	20 1/2 (521)	17 (432)	19 3/4 (502)	4 3/4(121)
54	240	81.0	3	6	**D54SX3S**	**C/F**	**C/F**	205 (93)	27 7/8 (708.0)	20 (508)	18 3/4 (476)	22 1/2 (572)	19 (483)	21 3/4 (552)	5 1/4(133)
54	480	81.0	1	6	**D54SX11S**	**C/F**	**C/F**	205 (93)	27 7/8 (708.0)	20 (508)	18 3/4 (476)	22 1/2 (572)	19 (483)	21 3/4 (552)	5 1/4(133)
54	480	81.0	3	3	**D54SX5S**	**C4-152**	**C4-153**	205 (93)	27 7/8 (708.0)	20 (508)	18 3/4 (476)	22 1/2 (572)	19 (483)	21 3/4 (552)	5 1/4(133)
60	240	90.0	3	5	**D60SX3S**	**C/F**	**C/F**	235 (107)	27 7/8 (708.0)	20 (508)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	90.0	1	4	**D60SX11S**	**C/F**	**C/F**	235 (107)	27 7/8 (708.0)	20 (508)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	90.0	3	4	**D60SX5S**	**C4-156**	**C4-157**	235 (107)	27 7/8 (708.0)	20 (508)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	240	115.0	3	10	**D75SX3S**	**C/F**	**C/F**	260 (118)	32 7/8 (835.0)	25 (635)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	115.0	1	5	**D75SX11S**	**C/F**	**C/F**	260 (118)	32 7/8 (835.0)	25 (635)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	115.0	3	4	**D75SX5S**	**C4-156**	**C4-157**	260 (118)	32 7/8 (835.0)	25 (635)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	150.0	3	4	**D100SX5S**	**C4-156**	**C4-157**	290 (132)	40 3/8 (1025.5)	32 1/2 (826)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)
60	480	190.0	3	5	**D125SX5S**	**C/F**	**C/F**	310 (141)	49 3/8 (1254.1)	41 1/2 (1054)	20 3/4 (527)	24 1/2 (622)	21 (533)	23 3/4 (603)	5 3/4(146)

Notes:

- See *Watt Density vs. Air Temperature/Velocity* charts on page 379 to confirm suitability in the application.

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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 Volts	Watts	A Dimension in.	(mm)	Replacement Element Part Number	Est. Net Wt. lbs	(kg)
20 W/in² (3.1 W/cm²)							
D6S3 to D60S3	240	1000	27 7/8	(708.0)	**D6240**	1.0	(0.5)
D6S5 to D60S5	480	1000	27 7/8	(708.0)	**D6480**	1.0	(0.5)
D75S3	240	1250	32 7/8	(835.0)	**D75240**	1.0	(0.5)
D75S5	480	1250	32 7/8	(835.0)	**D75480**	1.0	(0.5)
D100S5	480	1667	40 3/8	(1025.5)	**D100480**	1.4	(0.7)
D125S5	480	2083	49 3/8	(1254.1)	**D125480**	1.7	(0.8)
30 W/in² (4.7 W/cm²)							
D6SX3 to D60SX3	240	1500	27 7/8	(708.0)	**D6X240**	1.0	(0.5)
D6SX5 to D60SX5	480	1500	27 7/8	(708.0)	**D6X480**	1.0	(0.5)
D75SX3	240	1917	32 7/8	(835.0)	**D75X240**	1.0	(0.5)
D75SX5	480	1917	32 7/8	(835.0)	**D75X480**	1.0	(0.5)
D100SX5	480	2500	40 3/8	(1025.5)	**D100X480**	1.4	(0.7)
D125SX5	480	3167	49 3/8	(1254.1)	**D125X480**	1.7	(0.8)

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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

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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

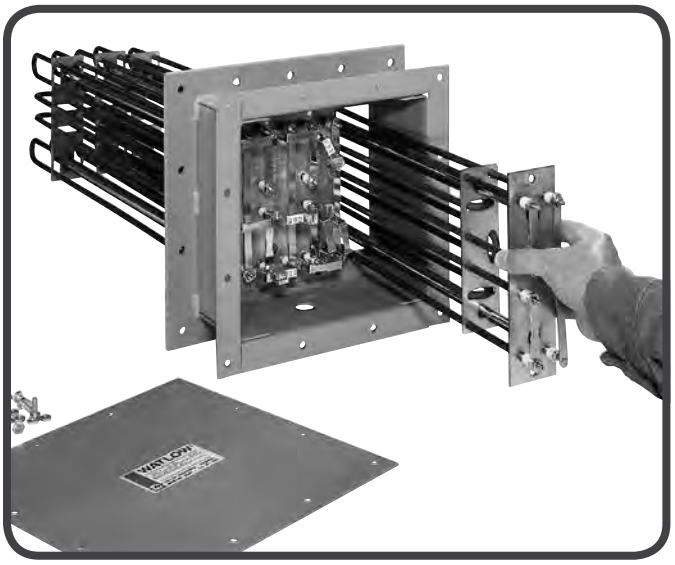
27 percent reduction in heat-up time as compared to traditional 0.430 inch diameter duct heater elements
- Results in faster response time

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

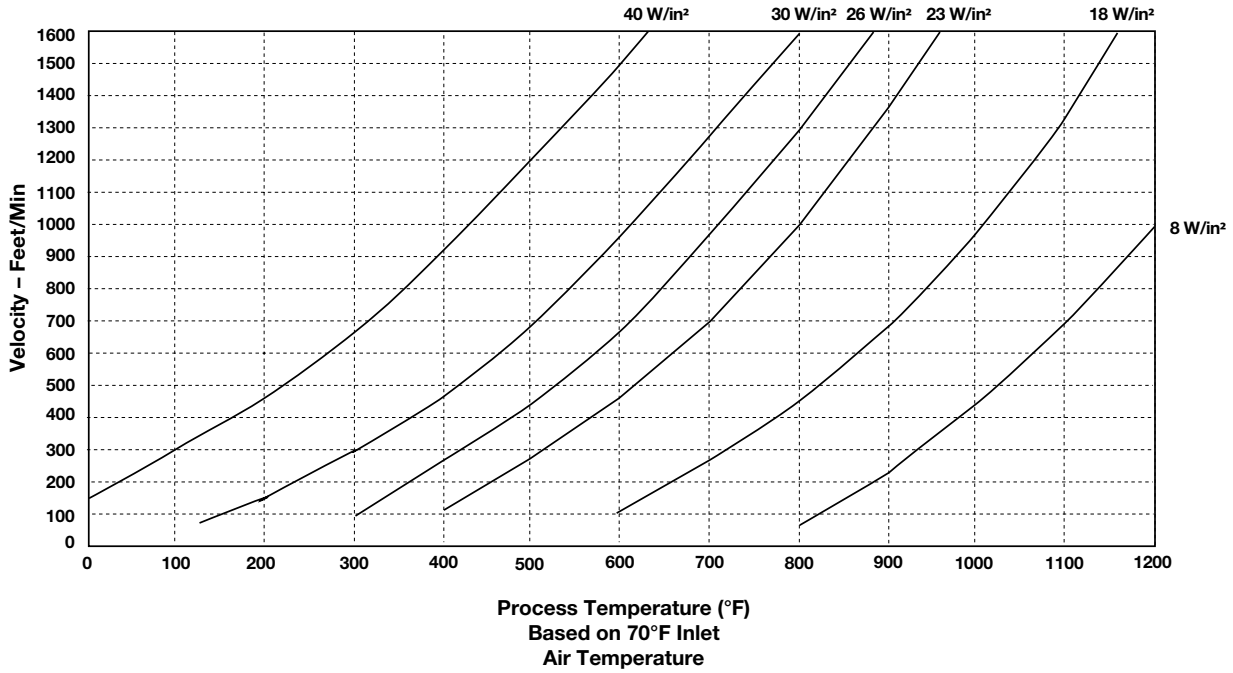
- Low temperature ovens
- Parts drying
- Semiconductor cleanroom environmental heating
- Plastic curing
- Load banks
- Heated air knives
- Food dehydration
- Heat shrink tunnels

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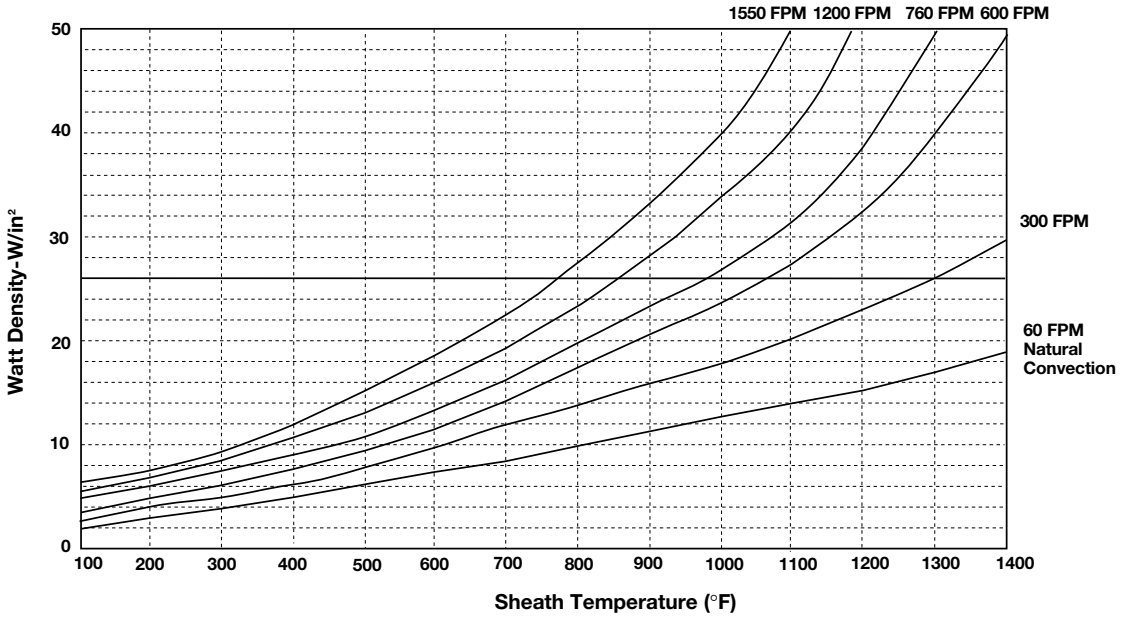
Duct Heaters

MDH SERIES

Velocity vs. Process Temperature



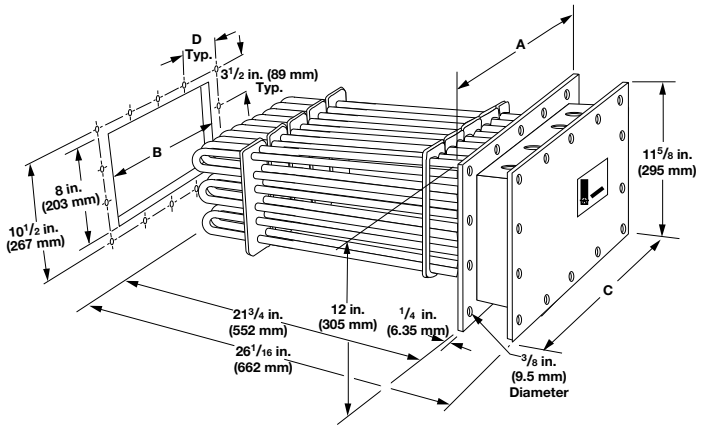
Watt Density vs. Sheath Temperature



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Duct Heaters

MDH SERIES



Application: Air Heating – Maximum Outlet Temperature – 750°F (399°C)

								WATCONNECT P/N		Dimensions in.			
Watt Density W/in²	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	**MDH24S10**	**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	**MDH6OS11**	**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
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.

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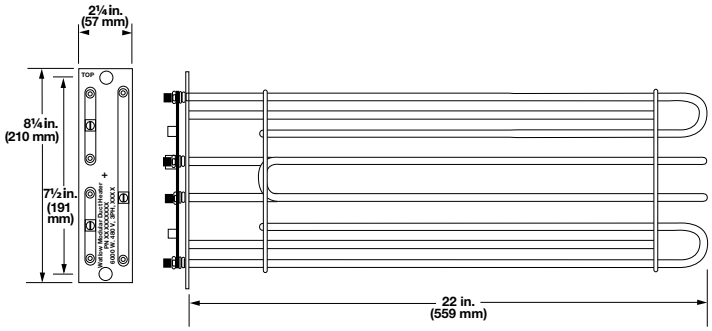
Duct Heaters

MDH SERIES

Individual Module Dimensions

Specifications

- Module rating - 240 or 480VAC, 6kW, three-phase or one-phase
- Watt density - 26 W/in^2
- 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
Replacement Modules	
M63	6kW, 240V, 3 phase
M610	6kW, 240V, 1 phase
M65	6kW, 480V, 3 phase
M611	6kW, 480V, 1 phase
High Limit Thermocouple Kits	
MTCJ	Type J (0-1000°F)
MTCK	Type K (0-2000°F)
Blank Module Covers	
MBLK	Cover slots in main flange

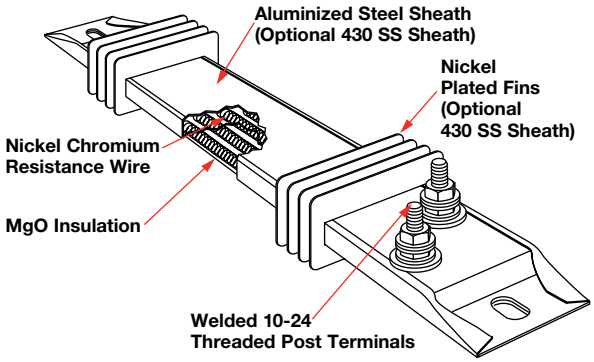
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Finned Heaters

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^2 (5.1 W/cm^2)
- 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

- 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 5^1/$_2$ 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

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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.

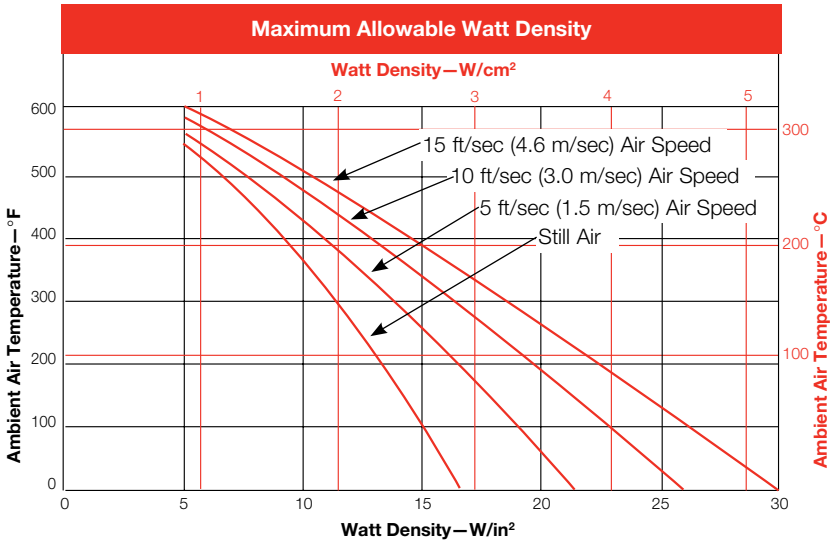
Formulas

$$\text{Watt Density} = \frac{\text{Wattage}}{\text{Heated Area}}$$

Heated Area
(Offset Terminals) = [Overall Length (A) - 4 in.]
x 3.75 in.
= [Overall Length (A) - 102 mm]
x 95.3 mm

Heated Area
(Parallel Terminals) = [Overall Length (A) - 3.12 in.]
x 3.75 in.
= [Overall Length (A) - 79.3 mm]
x 95.3 mm

Heated Area
(One-on-One Terminals) = [Overall Length (A) - 4.25 in.]
x 3.75 in.
= [Overall Length (A) - 108 mm]
x 95.3 mm



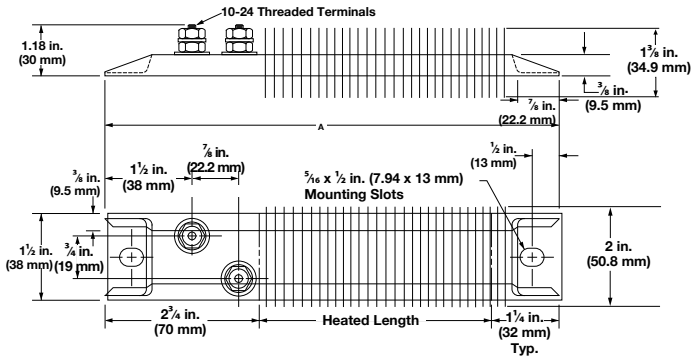
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Finned Heaters

375 Finned Strip Heaters

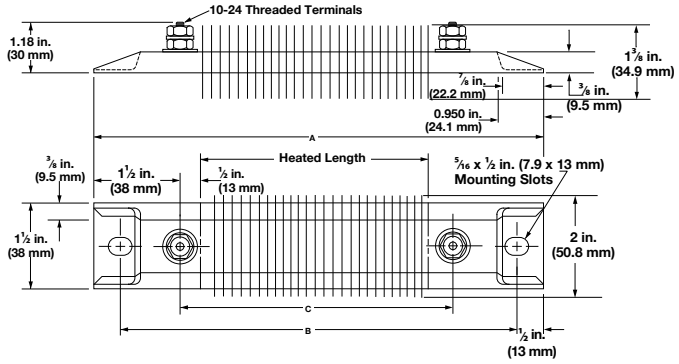
Termination Options

Offset Terminals



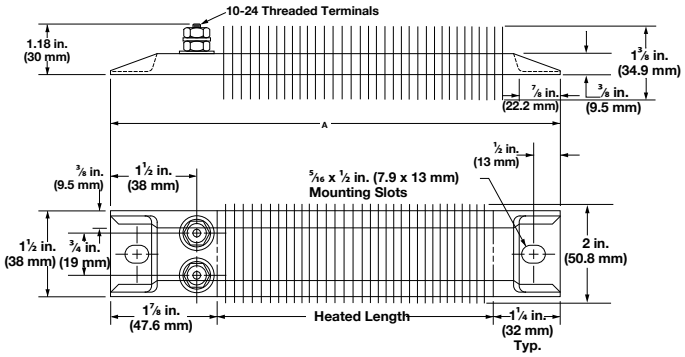
Two 10-24 threaded post terminals are offset from each other on the same end.

One-on-One Terminals



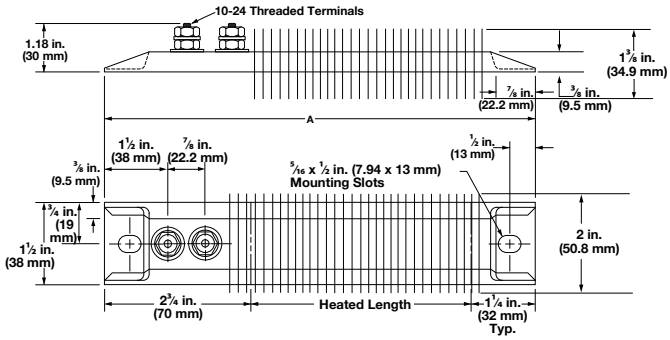
Two 10-24 threaded post terminals are placed one on each end.

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.

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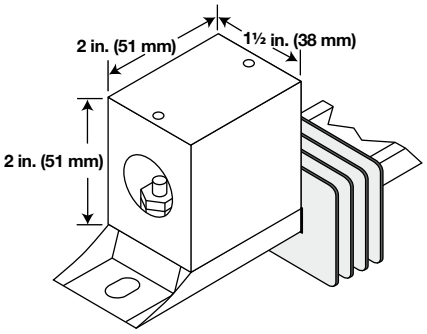
Finned Heaters

375 Finned Strip Heaters

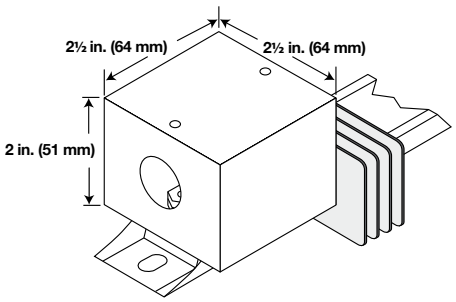
Termination Options *(Continued)*

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 7/8 in. (22.2 mm) diameter holes in the ends of the box. To order, specify **terminal box**.



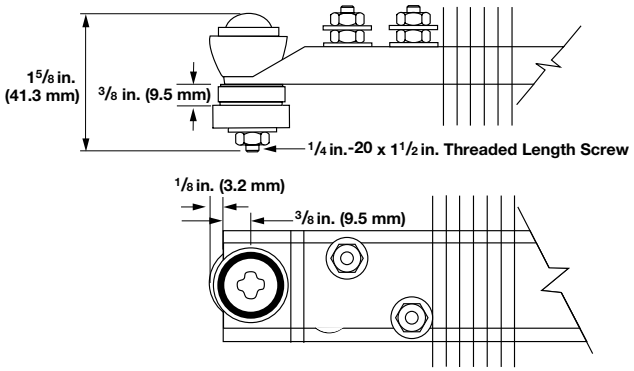
Available on in-line terminals only.



Available on offset terminals from stock and manufactured.

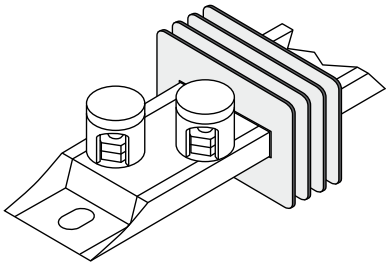
Accessories

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, 17/32 x 11/16 inch diameter mounting holes **must** be specified when ordering.

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.

Note: Number of fins are dependent on length of heater.

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Finned Heaters

375 Finned Strip Heaters

Heater Part Numbers

Width in. (mm)	Termination	Length in. (mm)	Volts	Power (Watts)	W/in² (W/cm²)	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)	**SGA1J5JY2**
	Parallel	5 1/2 (140)	120	250	28 (4.3)	0.5 (0.23)	**SGA1J5JY3**
	Parallel	6 (152)	120	150	14 (2.1)	0.5 (0.23)	**SGA1J6AY1**
	Parallel	6 (152)	240	150	14 (2.1)	0.5 (0.23)	**SGA1J6AY2**
	Parallel	6 (152)	120	300	28 (4.3)	0.5 (0.23)	**SGA1J6AY3**
	Parallel	6 (152)	240	300	28 (4.3)	0.5 (0.23)	**SGA1J6AY4**
	Offset	7 1/2 (191)	120	150	12 (1.8)	0.7 (0.32)	**SGA1J7JW1**
	Offset	7 1/2 (191)	240	150	12 (1.8)	0.7 (0.32)	**SGA1J7JW2**
	Offset	7 1/2 (191)	240	200	15 (2.3)	0.7 (0.32)	**SGA1J7JW3**
	Offset	8 (203)	120	150	10 (1.5)	0.7 (0.32)	**SGA1J8AW2**
	Offset	8 (203)	240	150	10 (1.5)	0.7 (0.32)	**SGA1J8AW3**
	Offset	8 (203)	120	175	12 (1.8)	0.7 (0.32)	**SGA1J8AW4**
	Offset	8 (203)	240	175	12 (1.8)	0.7 (0.32)	**SGA1J8AW5**
	Offset	8 (203)	120	250	17 (2.6)	0.7 (0.32)	**SGA1J8AW6**
	Offset	8 (203)	240	250	17 (2.6)	0.7 (0.32)	**SGA1J8AW7**
	Offset	8 (203)	120	400	27 (4.2)	0.7 (0.32)	**SGA1J8AW8**
	Offset	8 (203)	240	400	27 (4.2)	0.7 (0.32)	**SGA1J8AW9**
	Offset	8 (203)	120	500	33 (5.1)	0.7 (0.32)	**SGA1J8AW10**
	Offset	8 (203)	240	500	33 (5.1)	0.7 (0.32)	**SGA1J8AW11**
	Offset	10 1/2 (267)	120	250	10 (1.5)	0.9 (0.40)	**SGA1J10JW1**
	Offset	10 1/2 (267)	240	250	10 (1.5)	0.9 (0.40)	**SGA1J10JW2**
	Offset	10 1/2 (267)	120	350	14 (2.1)	0.9 (0.40)	**SGA1J10JW3**
	Offset	10 1/2 (267)	240	350	14 (2.1)	0.9 (0.40)	**SGA1J10JW4**
	Offset	10 1/2 (267)	120	400	16 (2.5)	0.9 (0.40)	**SGA1J10JW5**
	Offset	10 1/2 (267)	240	400	16 (2.5)	0.9 (0.40)	**SGA1J10JW6**
	Offset	12 (305)	120	250	8 (1.2)	1.0 (0.45)	**SGA1J12AW1**
	Offset	12 (305)	240	250	8 (1.2)	1.0 (0.45)	**SGA1J12AW2**
	Offset	12 (305)	120	350	12 (1.8)	1.0 (0.45)	**SGA1J12AW3**
	Offset	12 (305)	240	350	12 (1.8)	1.0 (0.45)	**SGA1J12AW4**
	Offset	12 (305)	120	500	17 (2.6)	1.0 (0.45)	**SGA1J12AW5**
	Offset	12 (305)	240	500	17 (2.6)	1.0 (0.45)	**SGA1J12AW6**
	Offset	14 (356)	120	300	8 (1.2)	1.2 (0.54)	**SGA1J14AW1**
	Offset	14 (356)	240	300	8 (1.2)	1.2 (0.54)	**SGA1J14AW2**
	Offset	14 (356)	120	500	13 (2.0)	1.2 (0.54)	**SGA1J14AW3**
	Offset	14 (356)	240	500	13 (2.0)	1.2 (0.54)	**SGA1J14AW4**
	Offset	15 1/4 (387)	120	325	8 (1.2)	1.4 (0.64)	**SGA1J15EW1**
	Offset	15 1/4 (387)	240	325	8 (1.2)	1.4 (0.64)	**SGA1J15EW2**
	Offset	15 1/4 (387)	240	500	12 (1.8)	1.4 (0.64)	**SGA1J15EW3**

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.

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Finned Heaters

375 Finned Strip Heaters

Heater Part Numbers *(Continued)*

Width in. (mm)	Termination	Length in. (mm)	Volts	Power (Watts)	W/in² (W/cm²)	Approx. Net Wt. lbs (kg)	Part Number
1 1/2 (38)	Offset	17 7/8 (454)	120	350	8 (1.2)	1.6 (0.73)	**SGA1J17RW1**
	Offset	17 7/8 (454)	240	350	8 (1.2)	1.6 (0.73)	**SGA1J17RW2**
	Offset	17 7/8 (454)	120	375	9 (1.4)	1.6 (0.73)	**SGA1J17RW3**
	Offset	17 7/8 (454)	240	375	9 (1.4)	1.6 (0.73)	**SGA1J17RW4**
	Offset	17 7/8 (454)	120	500	12 (1.8)	1.6 (0.73)	**SGA1J17RW5**
	Offset	17 7/8 (454)	240	500	12 (1.8)	1.6 (0.73)	**SGA1J17RW6**
	Offset	17 7/8 (454)	120	750	18 (2.8)	1.6 (0.73)	**SGA1J17RW7**
	Offset	17 7/8 (454)	240	750	18 (2.8)	1.6 (0.73)	**SGA1J17RW8**
	Offset	17 7/8 (454)	120	1000	24 (3.7)	1.6 (0.73)	**SGA1J17RW9**
	Offset	17 7/8 (454)	240	1000	24 (3.7)	1.6 (0.73)	**SGA1J17RW10**
	Offset	19 1/2 (495)	240	350	6 (.9)	1.7 (0.77)	**SGA1J19JW2**
	Offset	19 1/2 (495)	120	500	9 (1.4)	1.7 (0.77)	**SGA1J19JW3**
	Offset	19 1/2 (495)	240	500	9 (1.4)	1.7 (0.77)	**SGA1J19JW4**
	Offset	19 1/2 (495)	240	750	13 (2.0)	1.7 (0.77)	**SGA1J19JW5**
	Offset	19 1/2 (495)	240	1000	17 (2.6)	1.7 (0.77)	**SGA1J19JW6**
	Offset	21 (533)	120	500	8 (1.2)	1.9 (0.86)	**SGA1J21AW3**
	Offset	21 (533)	240	500	8 (1.2)	1.9 (0.86)	**SGA1J21AW4**
	Offset	21 (533)	120	750	12 (1.8)	1.9 (0.86)	**SGA1J21AW5**
	Offset	21 (533)	240	750	12 (1.8)	1.9 (0.86)	**SGA1J21AW6**
	Offset	23 3/4 (603)	240	500	7 (1.0)	2.1 (0.95)	**SGA1J23NW3**
	Offset	23 3/4 (603)	240	750	10 (1.5)	2.1 (0.95)	**SGA1J23NW5**
	Offset	23 3/4 (603)	120	1000	14 (2.1)	2.1 (0.95)	**SGA1J23NW6**
	Offset	23 3/4 (603)	240	1000	14 (2.1)	2.1 (0.95)	**SGA1J23NW7**
	Offset	23 3/4 (603)	240	1500	20 (3.1)	2.1 (0.95)	**SGA1J23NW8**
	Offset	25 1/2 (648)	120	500	6 (0.9)	2.3 (1.00)	**SGA1J25JW2**
	Offset	25 1/2 (648)	240	500	6 (0.9)	2.3 (1.00)	**SGA1J25JW3**
	Offset	25 1/2 (648)	120	750	9 (1.4)	2.3 (1.00)	**SGA1J25JW4**
	Offset	25 1/2 (648)	240	750	9 (1.4)	2.3 (1.00)	**SGA1J25JW5**
	Offset	25 1/2 (648)	240	1000	12 (1.8)	2.3 (1.00)	**SGA1J25JW6**
	Offset	26 3/4 (680)	240	700	8 (1.2)	2.4 (1.10)	**SGA1J26NW2**
	Offset	26 3/4 (680)	240	1000	12 (1.8)	2.4 (1.10)	**SGA1J26NW3**
	Offset	30 1/2 (775)	120	750	8 (1.2)	2.7 (1.20)	**SGA1J30JW1**
	Offset	30 1/2 (775)	240	750	8 (1.2)	2.7 (1.20)	**SGA1J30JW2**
	Offset	33 1/2 (851)	240	750	7 (1.0)	3.0 (1.40)	**SGA1J33JW1**
	Offset	35 7/8 (911)	120	1000	8 (1.2)	3.2 (1.50)	**SGA1J35RW1**
	Offset	35 7/8 (911)	240	1000	8 (1.2)	3.2 (1.50)	**SGA1J35RW2**
	Offset	35 7/8 (911)	240	1500	13 (2.0)	3.2 (1.50)	**SGA1J35RW3**
	Offset	38 1/2 (978)	120	1000	8 (1.2)	3.4 (1.50)	**SGA1J38JW2**
	Offset	38 1/2 (978)	240	1500	11 (1.7)	3.4 (1.50)	**SGA1J38JW3**
	Offset	42 1/2 (1080)	240	1500	10 (1.5)	3.8 (1.70)	**SGA1J42JW1**
	Offset	47 7/8 (1216)	240	2250	16 (2.4)	4.3 (2.00)	**SGA1J47RW2**

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).

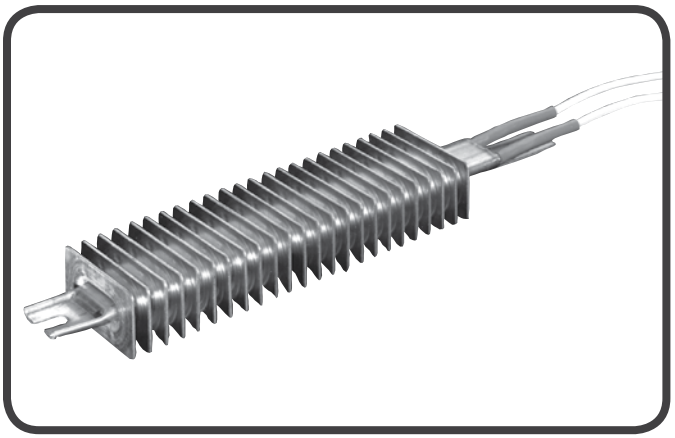
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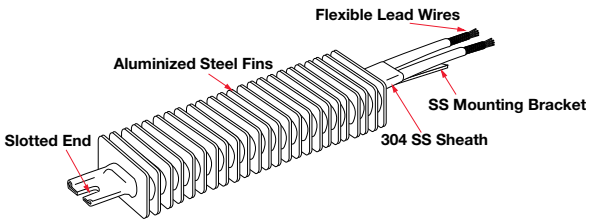
Finned Heaters

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^2 (7.7 W/cm^2)
- 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.

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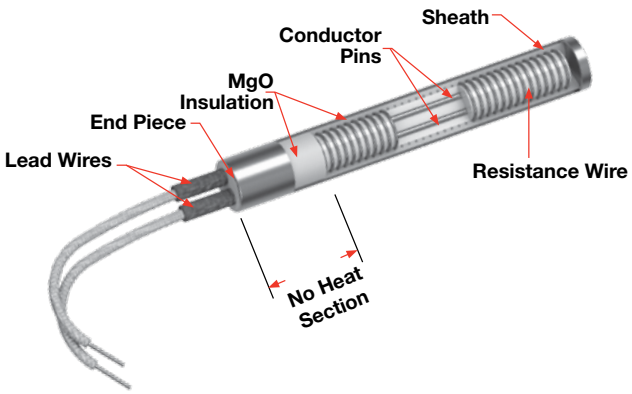
FIREROD® CARTRIDGE Heaters

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^2 (62 W/cm^2)
- 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

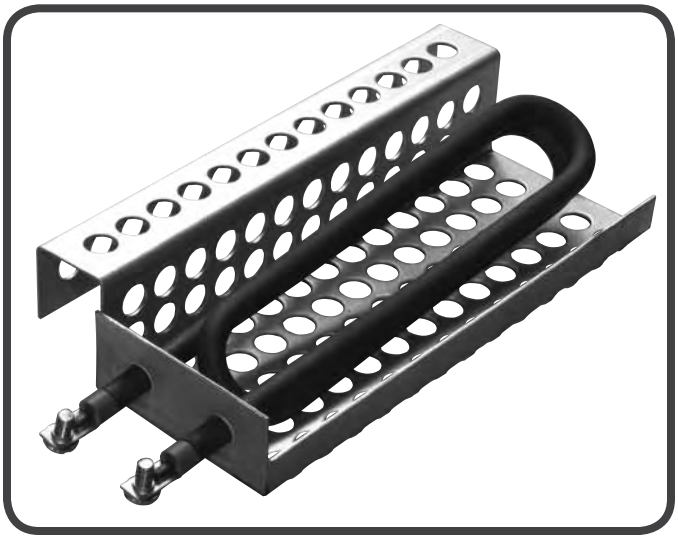
For detailed product and technical data, see the full FIREROD product section located on pages 9 through 44.

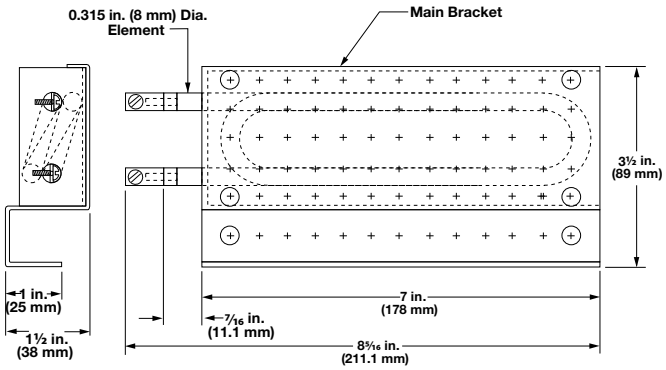
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Enclosure Heaters

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^2 (2.3 W/cm^2)
- 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)

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Enclosure Heaters

WATROD Heaters

Technical Heaters

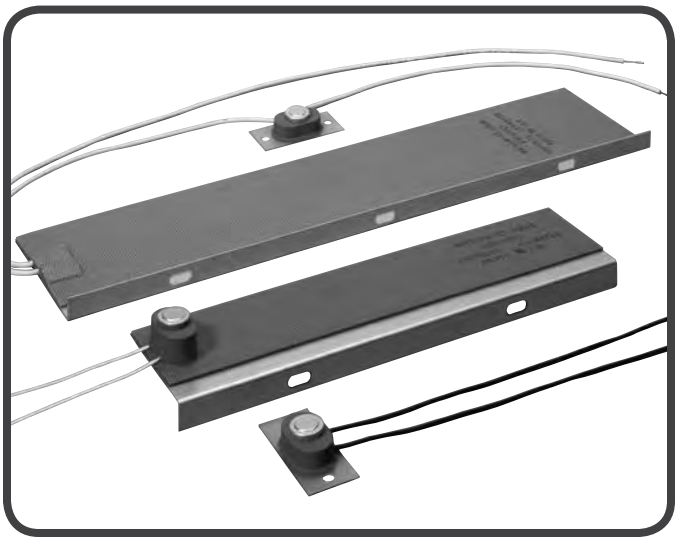
Watts	Watt Density W/in²	Watt Density (W/cm²)	Part Number 125VAC	Part Number 250VAC	Est. Net Wt. lbs	Est. Net Wt. (kg)
95	4	(0.6)	**EN951**		1.5	(0.7)
100	4	(0.6)		**EN10010**	1.5	(0.7)
250	10	(1.6)	**EN2501**	**EN25010**	1.5	(0.7)
375	15	(2.3)	**EN3751**	**EN37510**	1.5	(0.7)

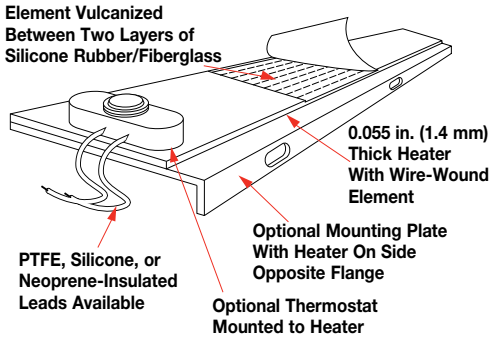
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Enclosure Heaters

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^2 (0.8 W/cm^2)
- 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

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Enclosure Heaters

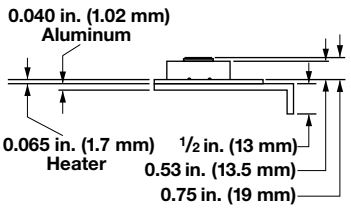
Silicone Rubber Heaters

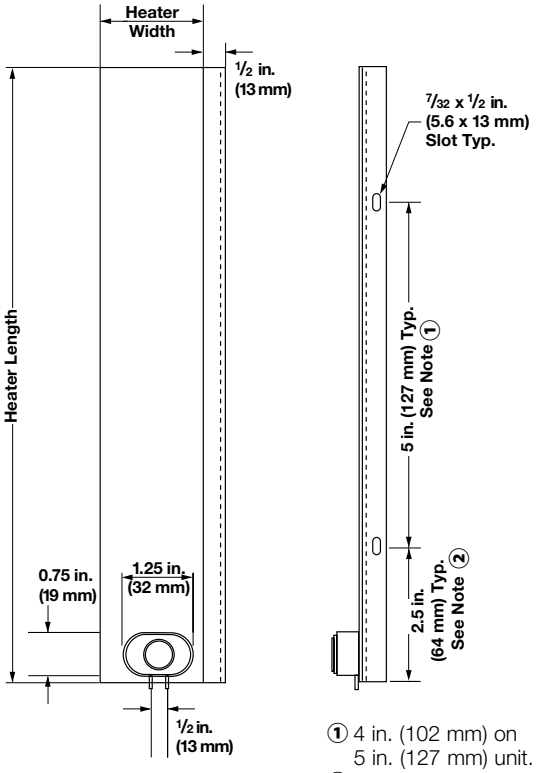
Options

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.

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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.

Temperature Rise from Ambient °F (°C)	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)
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.

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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

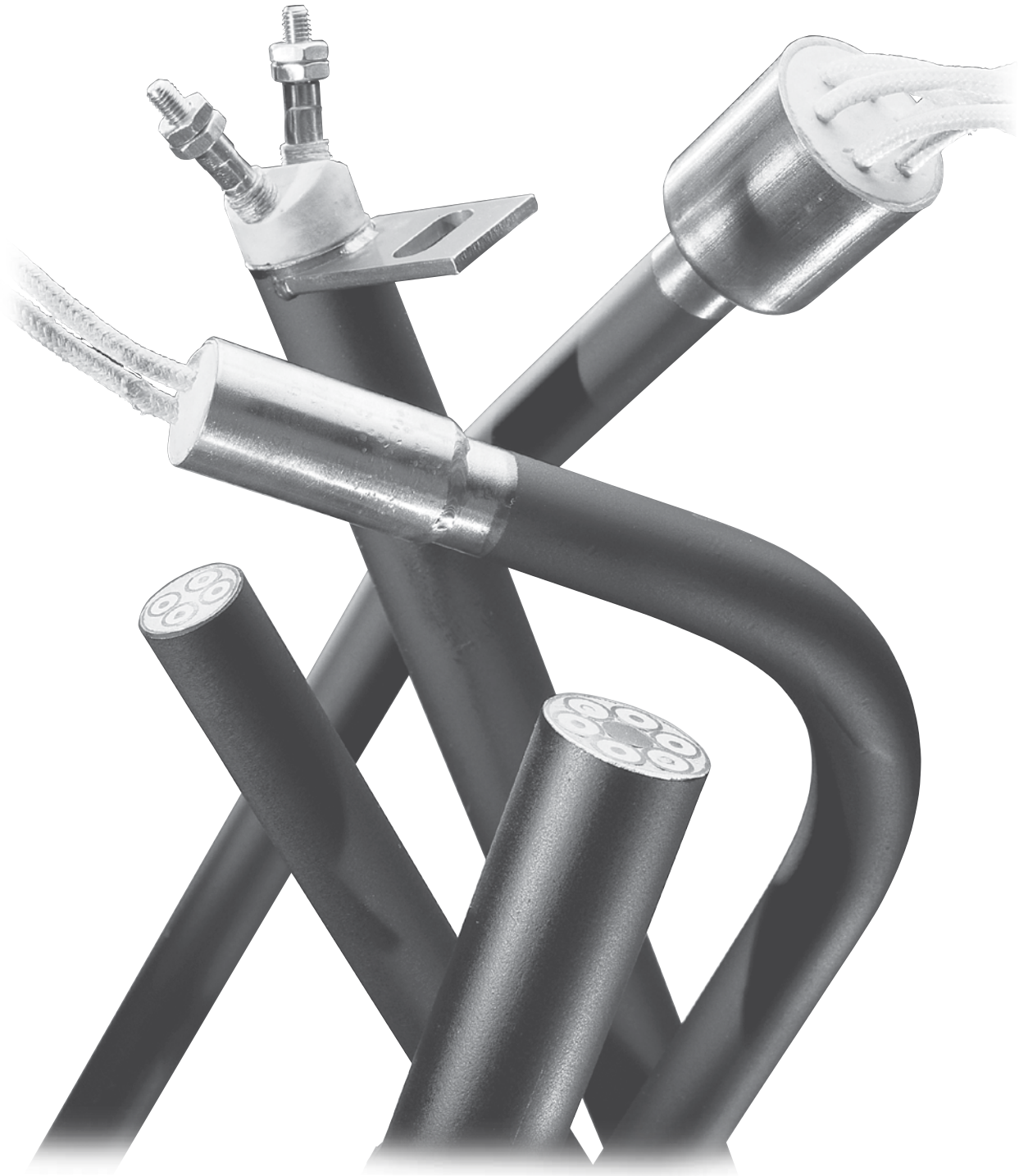
- Hemodialysis fluid heating
- Food cooking equipment
- Semiconductor purge and carrier gas heating
- Ink preheating systems
- On-demand fluid heating

For detailed product and technical data, see the full FLUENT in-line product section located on pages 445 through 448.

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High-Temperature Heaters

High-Temperature Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
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



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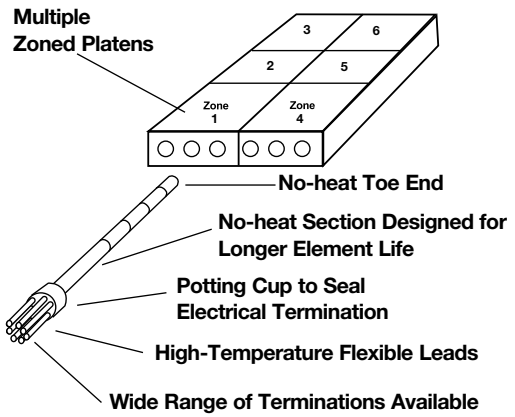
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Extended Capabilities for MULTICELL™ Heaters

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

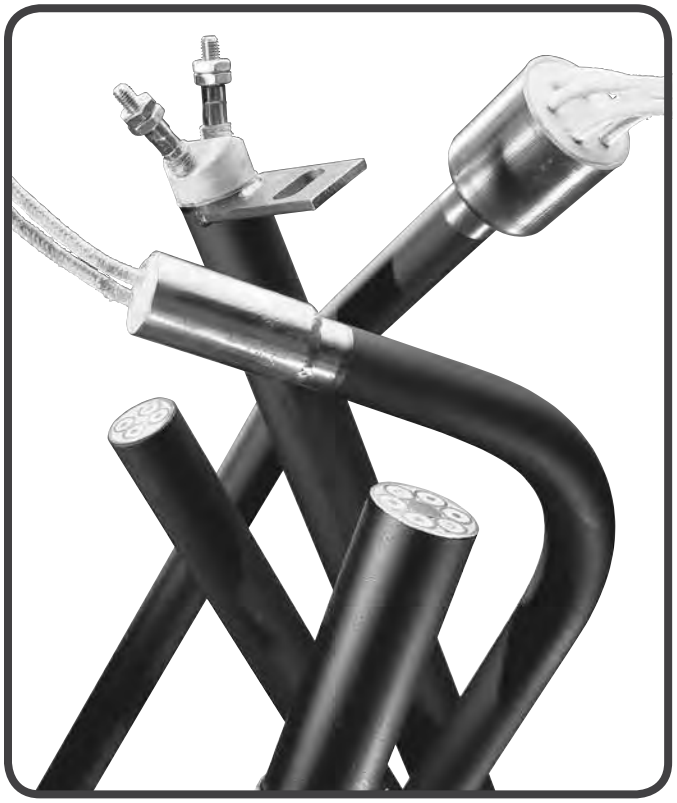
- Permits fast replacement of individual elements while the press stays at operating temperature

Special bending capabilities

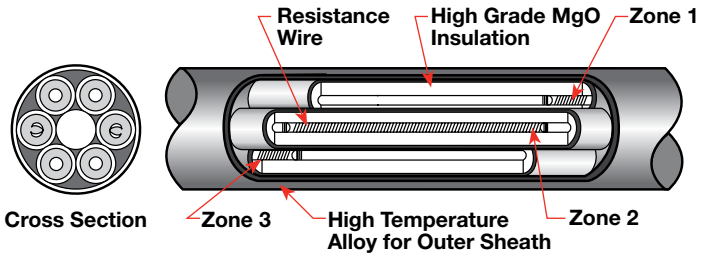
- Solves unusual machinery needs and keeps leads away from heated zones

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

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EXTENDED CAPABILITY

Extended Capabilities for MULTICELL™ Heaters

Applications and Technical Data

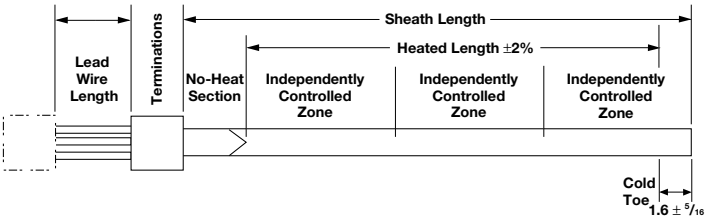
Definition of Terms

Cold Toe: A physical minimum requirement of $1\frac{5}{8} \pm \frac{5}{16}$ inch

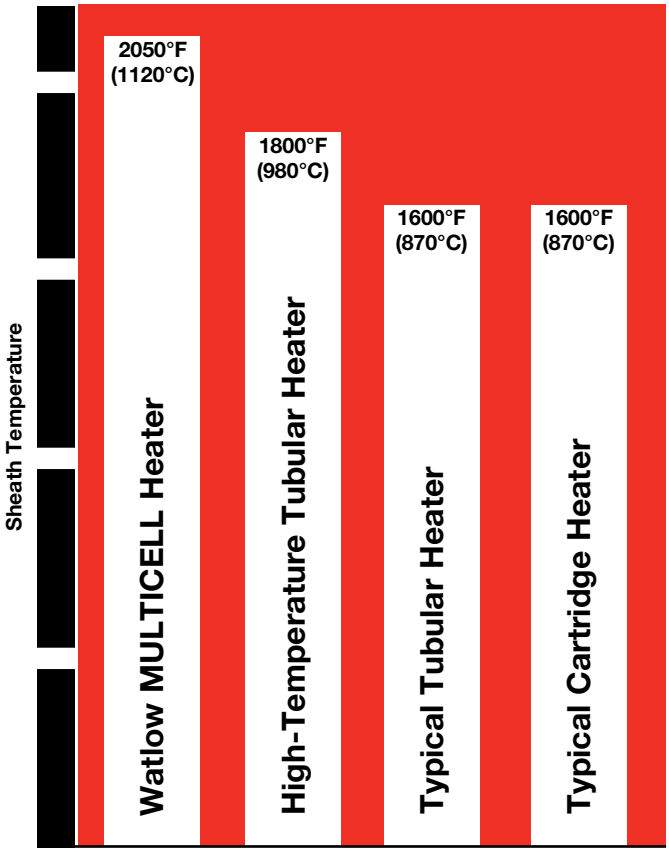
Independent Zone: Up to three, separately controlled zones, which can be of varying lengths and wattages

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



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EXTENDED CAPABILITY

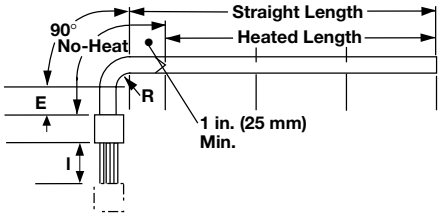
Extended Capabilities for MULTICELL™ Heaters

Applications and Technical Data (Continued)

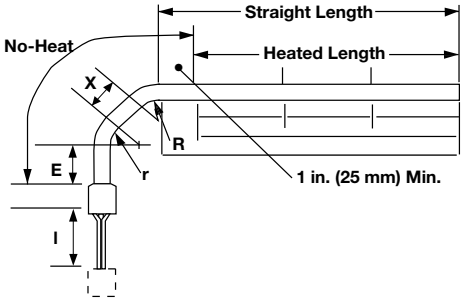
Physical Design Parameters

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.

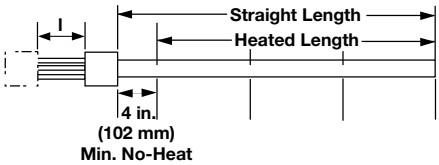
"L"



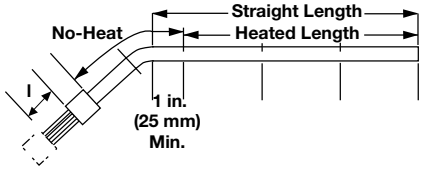
Droop



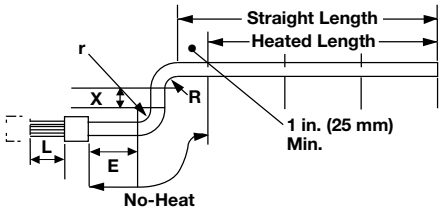
Straight



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) 225 (5715)	Contact Watlow Contact Watlow	6 (152) 160 (4064)
0.935	Angle	17 (432) 225 (5715)	Contact Watlow Contact Watlow	6 (152) 172 1/2 (4382)
0.935	L	18 (457) 225 (5715)	Contact Watlow Contact Watlow	6 (152) 170 1/4 (4324)
0.935	Crank	23 (584) 225 (5715)	Contact Watlow Contact Watlow	6 (152) 163 (4140)
0.935	Droop	18 (457) 225 (5715)	Contact Watlow Contact Watlow	6 (152) 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) 225 (5715)	Contact Watlow Contact Watlow	6 (152) 178 (4521)
0.685	Angle	17 (432) 225 (5715)	Contact Watlow Contact Watlow	6 (152) 173 1/2 (4407)
0.685	L	18 (457) 225 (5715)	Contact Watlow Contact Watlow	6 (152) 172 (4369)
0.685	Crank	18 (457) 225 (5715)	Contact Watlow Contact Watlow	6 (152) 163 (4267)
0.685	Droop	15½ (394) 225 (5715)	Contact Watlow Contact Watlow	6 (152) 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)

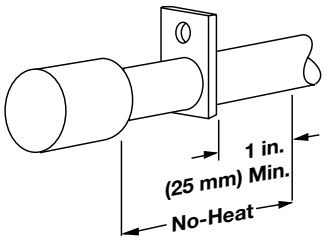
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EXTENDED CAPABILITY

Extended Capabilities for MULTICELL™ Heaters

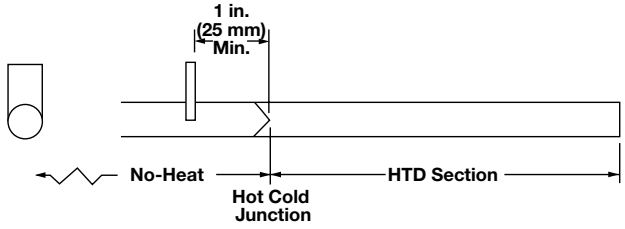
Applications and Technical Data *(Continued)*

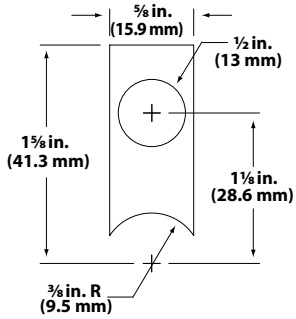
Tab Styles



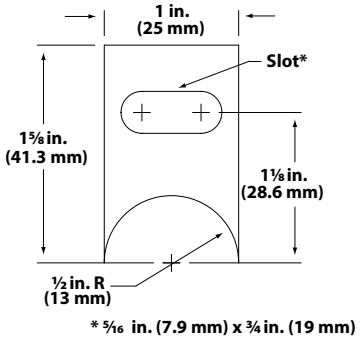
Full View

Weldments to the MULTICELL Heater Element

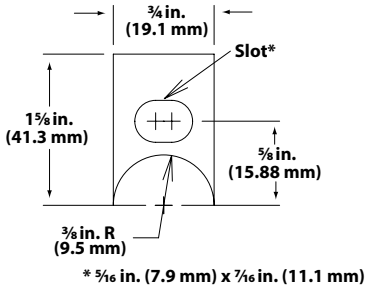




Style S1



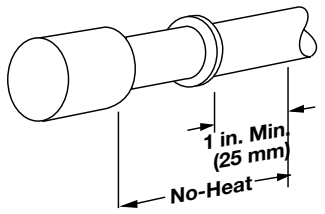
Style S2



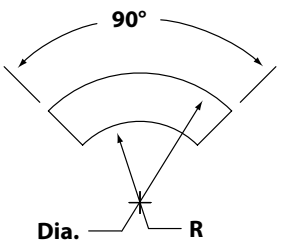
Style S3

Tabs and rings are used to hold the heater in place and keep it from creeping. Available in carbon steel, 304 and 316 SS.

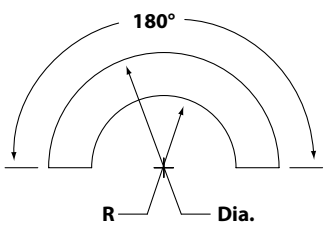
Ring Styles



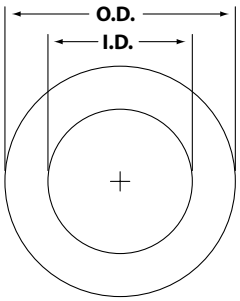
Full View



Style S4



Style S5



Style H1

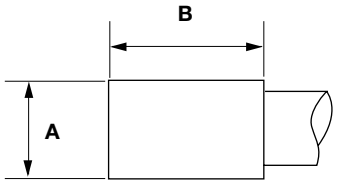
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EXTENDED CAPABILITY

Extended Capabilities for MULTICELL™ Heaters

Termination Standards

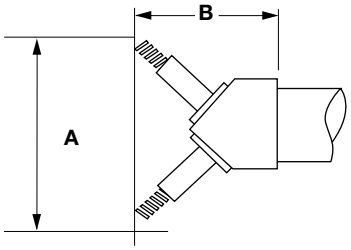
Potting Sleeves



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	3①	91L

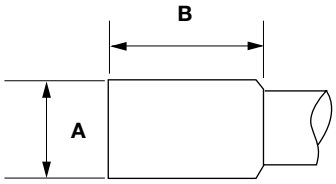
① 3 wire only

Ceramic Wedge with 10-32 Threaded Terminals



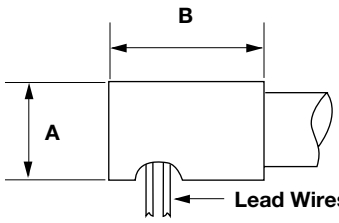
Heater O.D. in.	Dimension A in. (mm)	Dimension B in. (mm)	Zone	Phase	Type No.
0.685	1 1/4 (32)	1 1/4 (32)	1	1	61T
0.935	1 5/8 (41)	1 5/8 (41)	1	1	91T

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

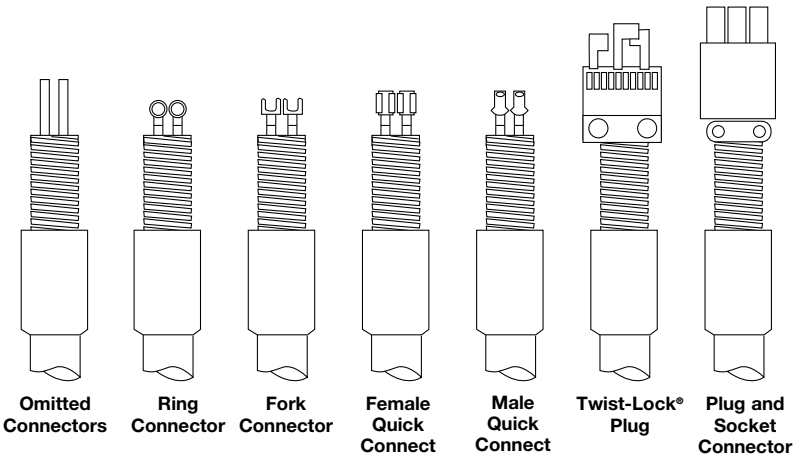
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EXTENDED CAPABILITY

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.

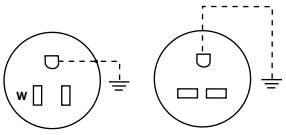
Male Plug	Zones	Type	Voltage	Amperage	Blade Type
P406-CCT	3	6 wire	600	15	Straight
4570C	1	3 wire	250	15	Twist-Lock®
4720C	1	3 wire	125	15	Twist-Lock®
5266C	1	3 wire	125	15	Straight
5666C	1	3 wire	250	15	Straight
7102C	1	2 wire	250	20	Twist-Lock®
7545C	1	2 wire	250	15	Twist-Lock®
7567C	1	3 wire	125	10	Twist-Lock®

Twist-Lock®



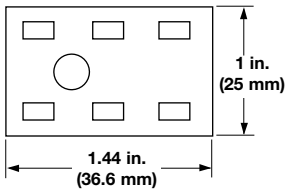
4720C 4570C 7567C 7102C 7545C

Straight



5266C 5666C

Plug and Socket



6 Contacts

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EXTENDED CAPABILITY

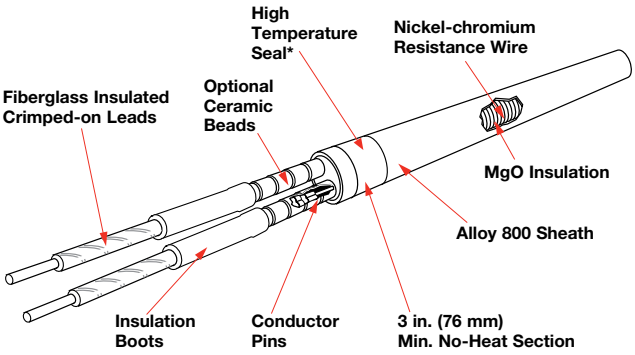
Extended Capabilities for High-Temperature (HT) FIREROD® Heaters

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





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

Performance Capabilities

- Platen temperatures up to 1600°F (871°C)
- Maximum watt density up to 100 W/in² (15.5 W/cm²)
- 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).

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.

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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

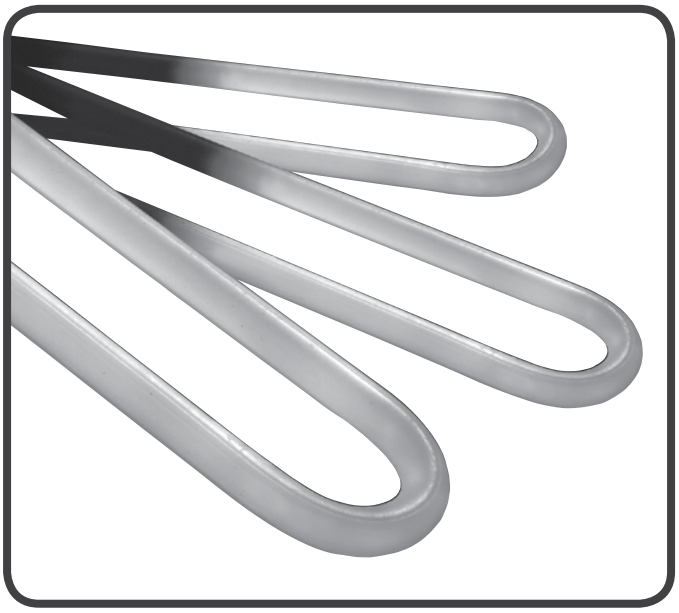
***Note: 0.375 diameters are available in Watlow's extended capabilities, contact your Watlow representative for details.**

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.

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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^2 (0.8 to 4.6 W/cm^2)
- 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)

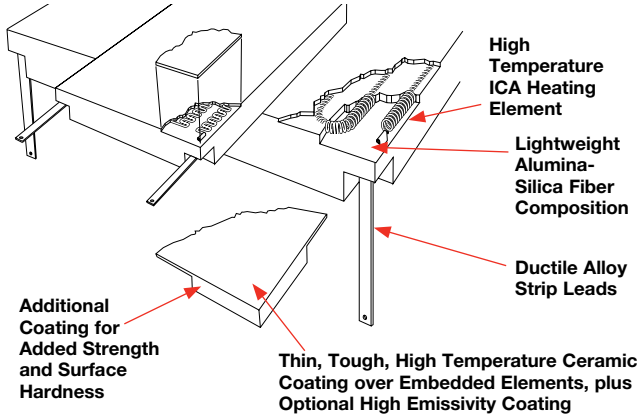
- Provides high temperature performance that is not possible with many other heater types (See page 423 for detailed limits)

Low mass ceramic fiber insulation of 10 to 15 lb/ft^3 (160 to 240 kg/m^3)

- 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

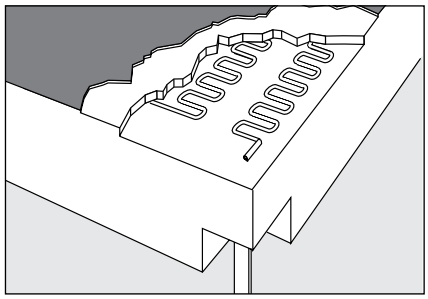
- High temperature furnaces
- Metal melting, holding and transfer
- Semiconductor processing
- Glass, ceramic and wire processing
- Analytical instrumentation

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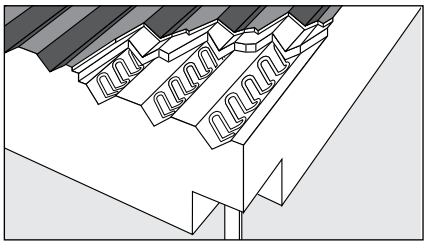
Ceramic Fiber Heaters

Options

Embedded Sinuated Elements



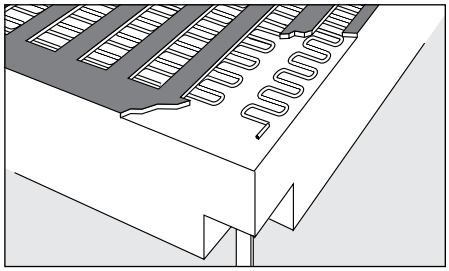
Flat Sinuated



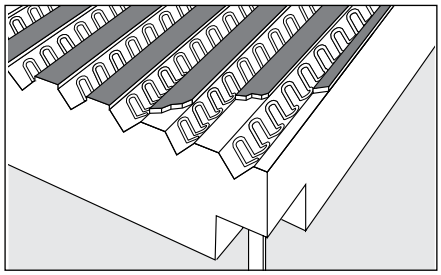
V-Sinuated

- 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.

Exposed Sinuated Elements



Flat Sinuated



V-Sinuated

- 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.

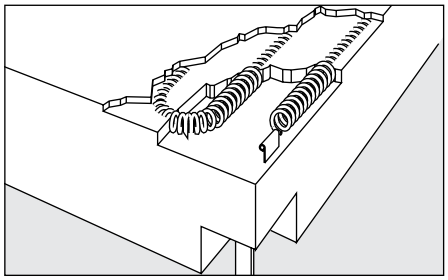
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Ceramic Fiber Heaters

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



Embedded Coil Elements

- 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.



- 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.
- 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 $^{1}/_{16}$ 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.

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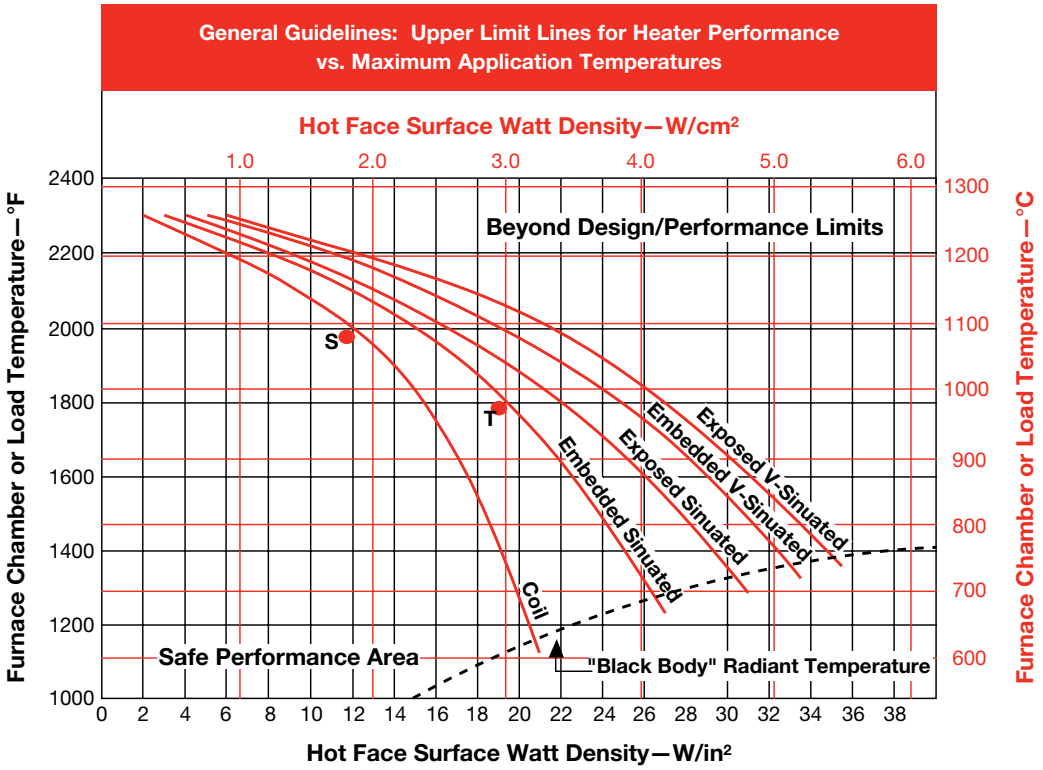
Ceramic Fiber Heaters

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.



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Ceramic Fiber Heaters

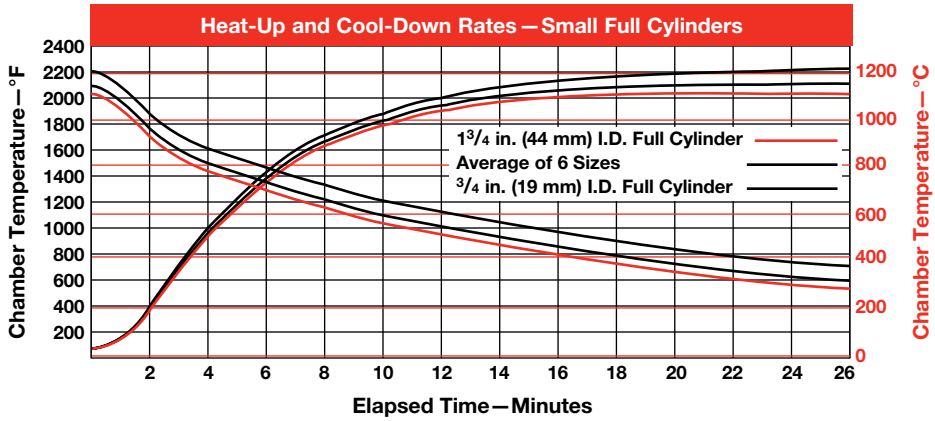
Performance Data *(Continued)*

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.

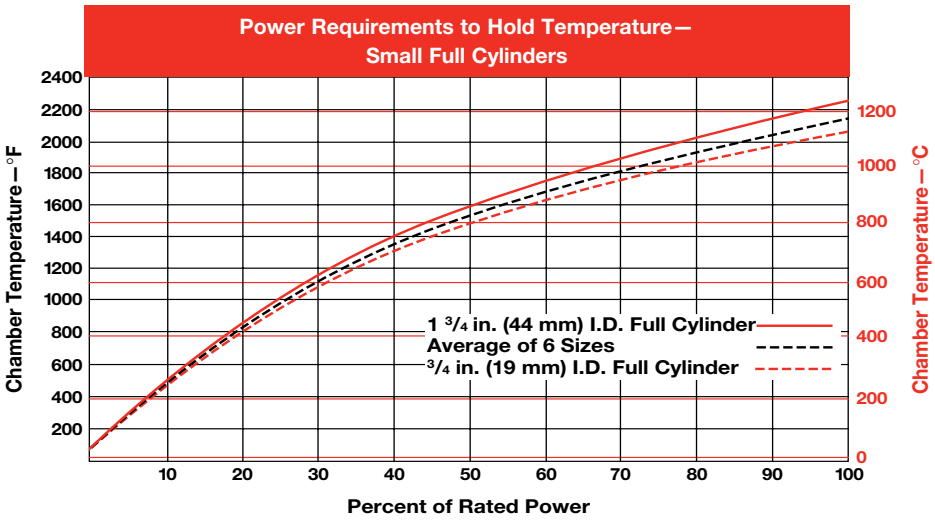
Small, Full Cylinder, Heated Chambers

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.



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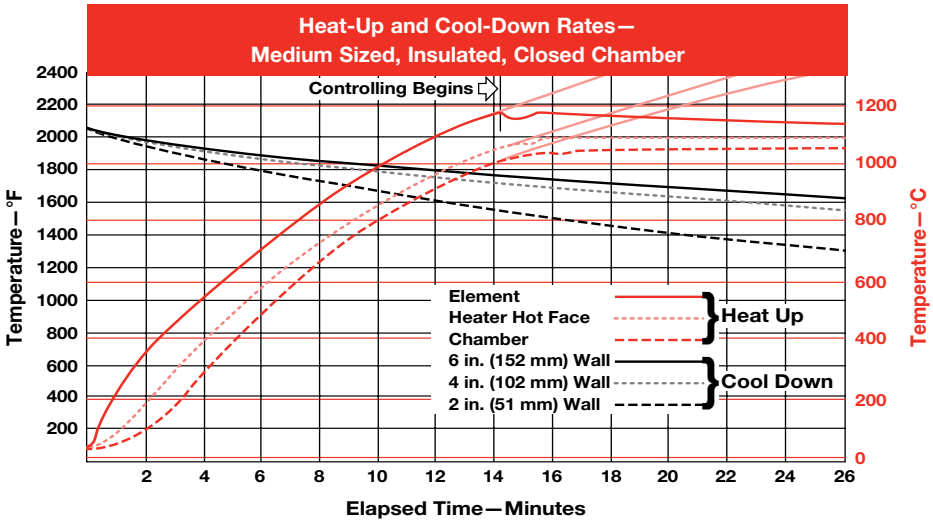
Ceramic Fiber Heaters

Performance Data *(Continued)*

Medium Sized, Insulated Closed Chambers

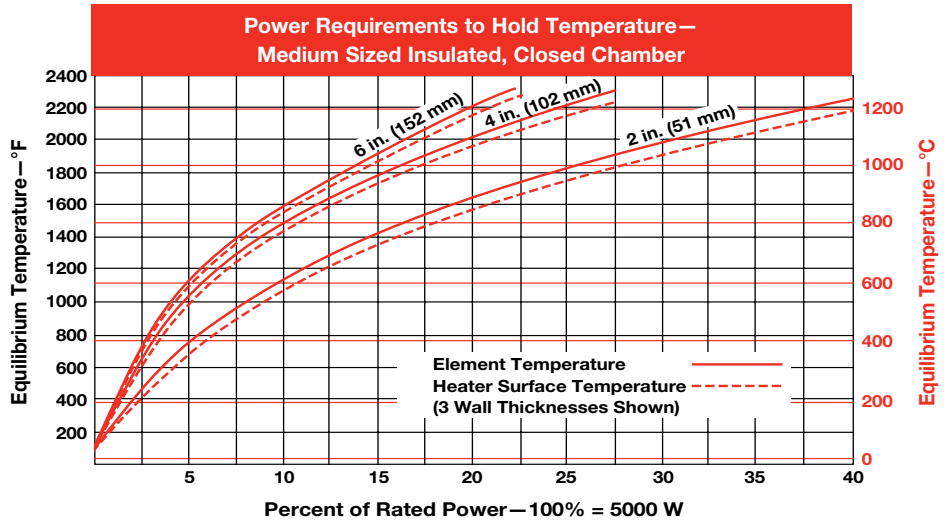
Test conditions for medium-sized, insulated chambers are typical of pit and box furnaces, large tube furnaces and pipe and reactor heating. Standard embedded coil units (Watlow part number **VS412A12S**) were used and rated for 2000°F (1093°C). The test chamber size was 12 in. long and 12 in. I.D. (305 X 305 mm). The volume was approximately 0.75 ft^3 (0.02 m^3).

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.



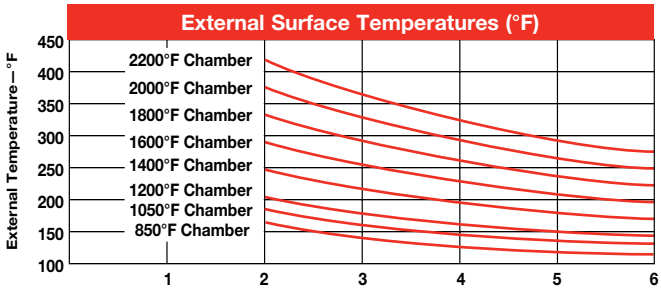
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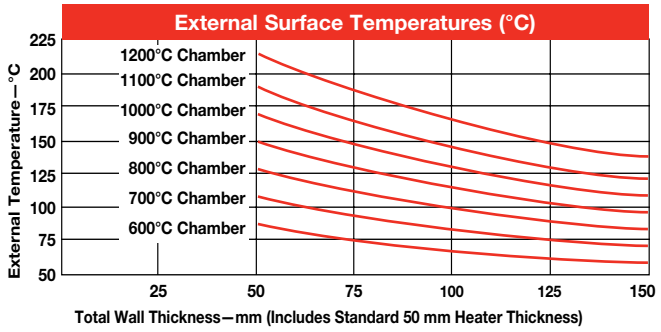
Ceramic Fiber Heaters

Performance Data *(Continued)*

Insulation Effectiveness

The graphs below illustrate the effectiveness of adding 6 lb/ft^3 (96 kg/m^3) 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.

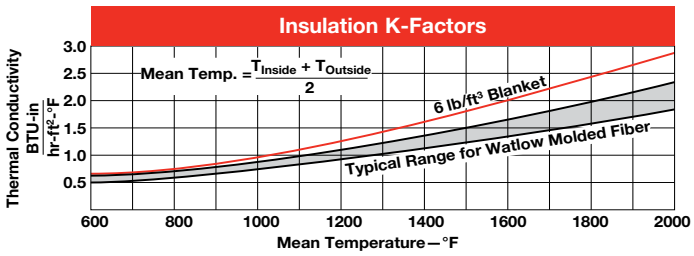


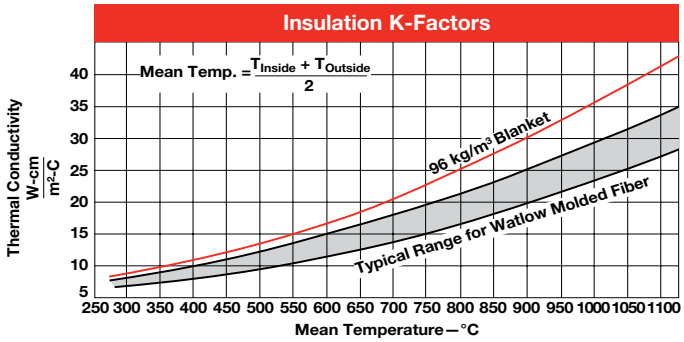


Heat Loss and Energy Transfer

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

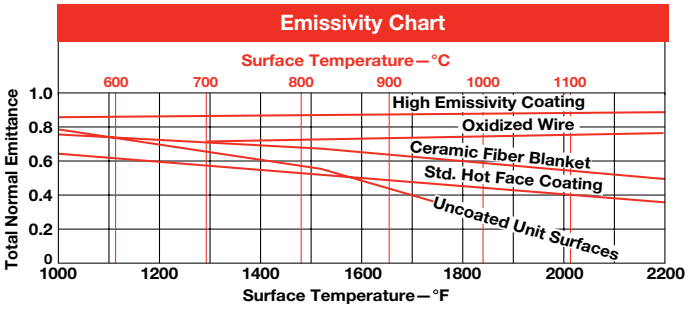
For wall thicknesses (T) in cylindrical situations use the "equivalent thickness" conversion.

$$T_{cyl.} = r_{out} \log_e \left(\frac{r_{out}}{r_{in}}\right)$$

Where r_{out} is outer radius
r_{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.



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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

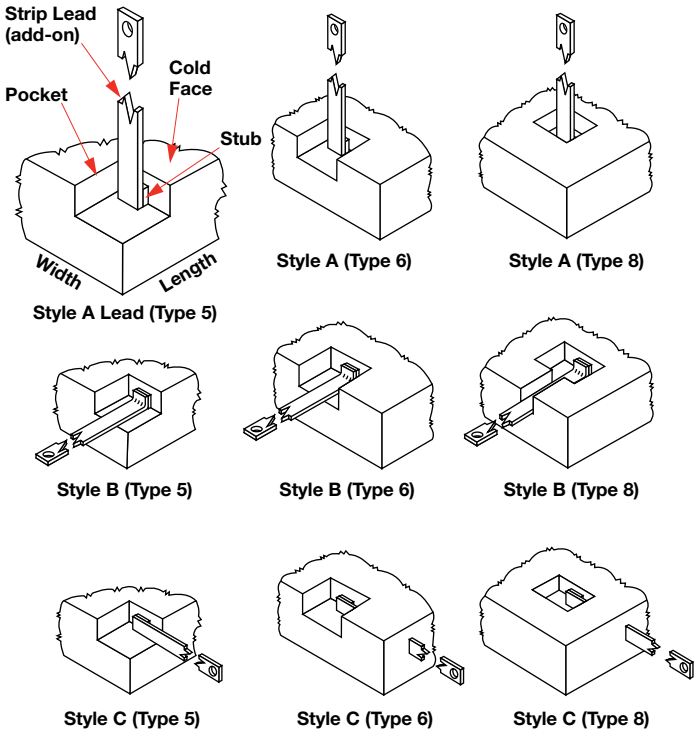
Flat and semi-cylindrical ceramic fiber heaters are available with the termination options shown here. When ordering termination options for catalog units, the specific strip lead **Style** must be specified. To determine the desired style, refer to the following illustrations. If a style is not specified, **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 $^{13}/_{64}$ 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.

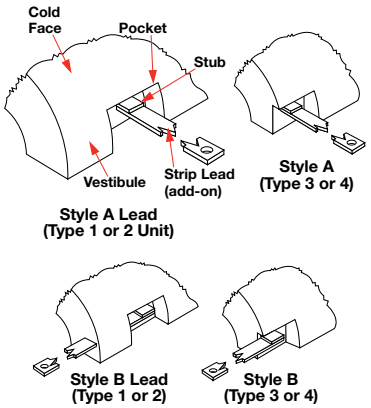
Important

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



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Ceramic Fiber Heaters

Termination Options *(Continued)*

Special Lead Orientation

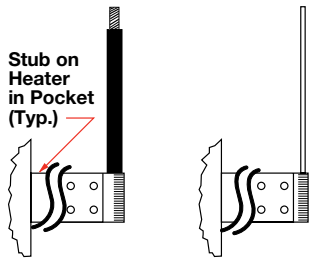
If the various standard strip lead orientations and pocket configurations are not suitable, special designs are available. When ordering, please include drawings that show proposed locations.

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.



Flexible Stranded MGT Insulated Nickel Lead Wire (450°C Rated)

Solid NiCr Wire

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 **CFRGDGAL**.

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)	**CC405-1**
0.265	(6.7)	0.90	(22)	**CC405-2**
0.390	(9.9)	0.74	(19)	**CC405-3**
0.515	(13.1)	0.90	(22)	**CC405-9**
0.140	(3.6)	1.90	(48)	**CC405-4**
0.265	(6.7)	1.90	(48)	**CC405-5**
0.390	(9.9)	1.60	(41)	**CC405-6**
0.515	(13.1)	1.90	(48)	**CC405-8**

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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^3 (96 kg/m^3) 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	**CFBLKT1/4**①
24 in. X 25 ft X 1/2 in.	610 mm X 7.6 m X 13 mm	**CFBLKT1/2**①
24 in. X 25 ft X 1 in.	610 mm X 7.6 m X 25 mm	**CFBLKT-1**①

① Add ...R to end of part number for full roll.

Powdered Ceramic Fiber

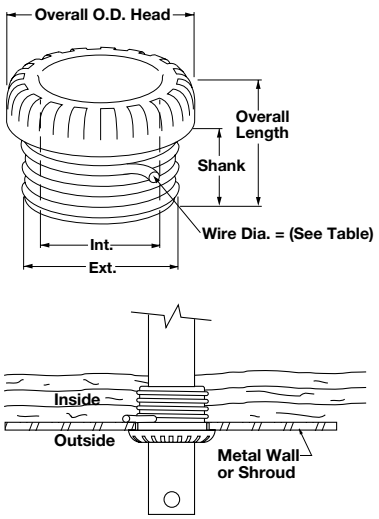
Powdered ceramic fiber is used primarily to improve surface finish in critical areas. It can also be used to fill voids, cracks and broken corners in damaged units. Use powdered ceramic fiber with rigidizer to make an easy to apply paste. A standard container size is one pint (0.47 L). Order part number **CFPDRFPT**.

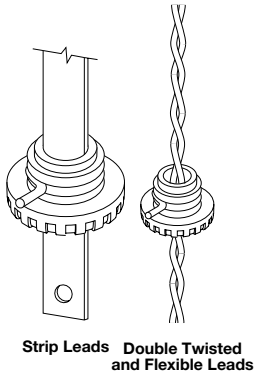
High Temperature Coating and Electrical Potting Cement

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 Int. in.	(mm)	Ext. in.	(mm)	Wire Nut Dia. in.	(mm)	Shank Length in.	(mm)	Overall Length in.	(mm)	Overall Head O.D. (Ref.) in.	(mm)	Use With:	Part Number
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	**CS45-11**
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	**CS45-20**
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	**CS45-30**

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Ceramic Fiber Heaters

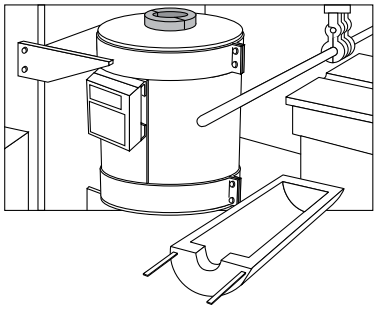
Mounting Methods

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.

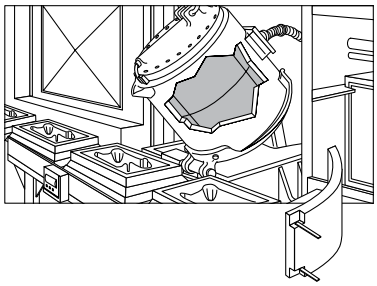
1. Full Cylinder Heaters



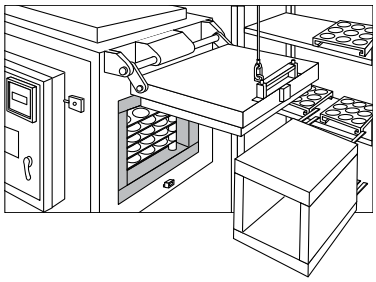
2. Semi-Cylindrical (180° section) Heaters



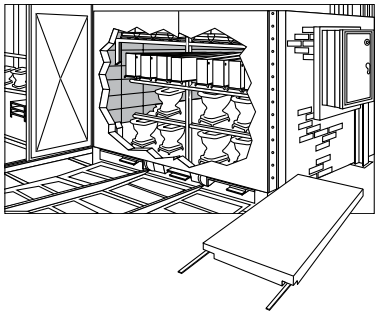
3. Arc-Section Arrays of Heaters (3 or more units of 120° or less each)



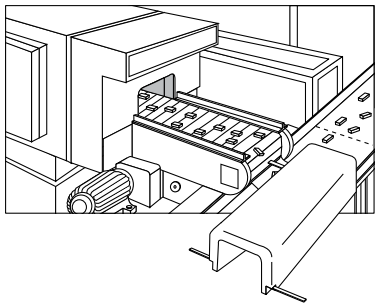
4. Flat Panels, with One Panel on Each Side



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



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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 alkalies, 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^3 (160 to 240 kg/m^3), 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.

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Ceramic Fiber Heaters

Molded Ceramic Fiber Insulation Modules

Ordering Information

VN - No-Heat Panels

Part Number

① Base Code Nbr.	② Base Code Nbr.	③ Base Code Nbr.	④ Base Code Nbr.	⑤ Base Code Nbr.	⑥ Base Code Nbr.	⑦ Base Code Nbr.	⑧ Base Code Nbr.	⑨ Base Code Nbr.	⑩ Modification Options	⑪	⑫	⑬	⑭
V	N	5	1	2	A	1	2	A		0	0	0	0

①②③④⑤⑥⑦⑧⑨ 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

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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.

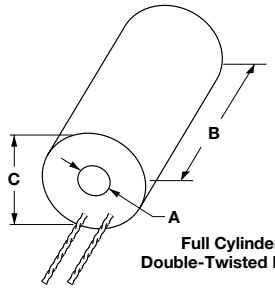


Warning

This product contains refractory ceramic fibers (RCF) which have been identified by the International Agency for Research on Cancer (IRAC) 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.

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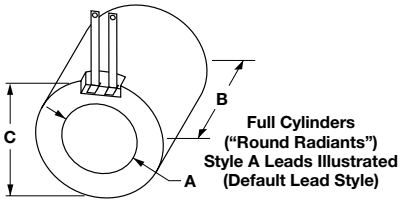
Ceramic Fiber Heaters



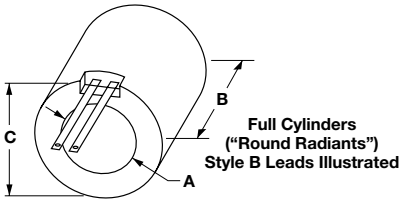
Full Cylinder
Double-Twisted Leads

Full Cylinder Units

Dimensions, in. (mm)						Electrical Ratings									
Heated Area				Overall											
I.D. (A) in. (mm) ±1/16 (±1.6)		Length (B) in. (mm) ±1/16 (±1.6)		O.D. (C) in. (mm) ±1/8 (±3.2)		Volts	Power (Watts) ±5%	Surface Loading ① W/in² (W/cm²)		Lead Width	Approx. Net Wt. oz	(kg)	Part Number ②
1/2	(13)	6	(152)	2	(51)	60	175	18.6	(2.9)		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)	Double	11	(0.31)	VC401E06A
1 1/4	(32)	12	(305)	3 1/2	(89)	120	550	11.7	(1.8)	Twisted	18	(0.51)	VC401E12A
1 1/2	(38)	6	(152)	3 1/2	(89)	60	300	10.6	(1.6)	Leads	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 Cylinders
("Round Radiants")
Style A Leads Illustrated
(Default Lead Style)



Full Cylinders
("Round Radiants")
Style B Leads Illustrated

Full Cylinder Units

Dimensions, in. (mm)						Electrical Ratings									
Heated Area				Overall											
I.D. (A) in. (mm) ±1/16 (±1.6)		Length (B) in. (mm) ±1/16 (±1.6)		O.D. (C) in. (mm) ±1/8 (±3.2)		Volts	Power (Watts) ±5%	Surface Loading ① W/in² (W/cm²)		Lead Width in. (mm)		Approx. Net Wt. lbs	(kg)	Part Number 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 ...**0A**, watt densities between 10.6 to 14.2 W/in² (1.6 to 2.2 W/cm²), 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/in² (2.3 to 2.7 W/cm²) 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.

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Ceramic Fiber Heaters

Ordering Information

VC - Full Cylindrical

Part Number

① Base Code Nbr.	② Base Code Nbr.	③ Base Code Nbr.	④ Base Code Nbr.	⑤ Base Code Nbr.	⑥ Base Code Nbr.	⑦ Base Code Nbr.	⑧ Base Code Nbr.	⑨ Base Code Nbr.	⑩ Modification Options	⑪	⑫	⑬ Lead Options	⑭ Lead Length
V	C	4	0	5	A	0	6	A		0	0		

①②③④⑤⑥⑦⑧⑨ 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.

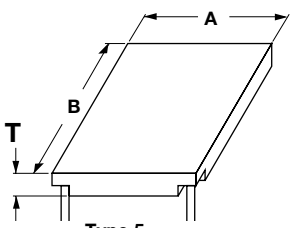
Notes:

- If the order is placed before 11:00 AM CST, heaters with standard leads (...0R) 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.

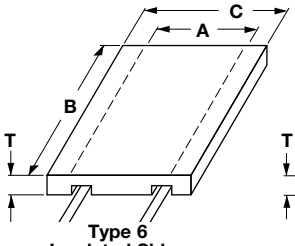
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Ceramic Fiber Heaters

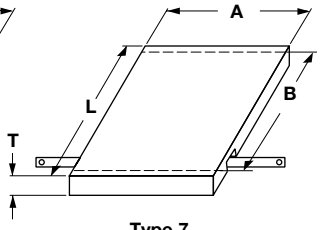
All units: **T** = 2 ±¼ inches (51 ±6 mm)



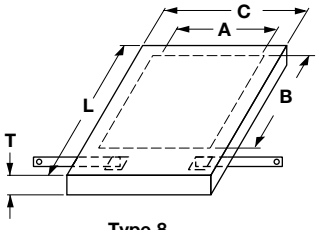
Type 5
Fully Heated
(Style A Leads Illustrated)
(Default Lead Style)



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 — Embedded Coiled Elements (see page 421)

Dimensions, in. (mm)															
Heated Size				Type 6 & 8		Type 7 & 8		Electrical Rating			Strip	Approximate Net Wt.			
Width (A) in. (mm) +1/16 -1/8 (1.6-3.2)		Length (B) in. (mm) +1/16 -1/8 (1.6-3.2)		Width (C) in. (mm) +1/16 -1/8 (1.6-3.2)		Length (L) in. (mm) +1/16 -1/8 (1.6-3.2)		Volts	Power (Watts) ±5%	Surface Loading W/in² (W/cm²)	Lead Width in. (mm)	Type 5 lbs (kg)	Type 6 & 7 lbs (kg)	Type 8 lbs (kg)	Part Number
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)	**VF①04A06S**
		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)	**VF①04A12S**
		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)	**VF①04A18S**
		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)	**VF①04A24S**
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)	**VF①06A06S**
		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)	**VF①06A12S**
		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)	**VF①06A18S**
		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)	**VF①06A24S**
		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)	**VF①06A30S**
		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)	**VF①06A36S**
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)	**VF①08A12S**
		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)	**VF①08A18S**
		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)	**VF①08A24S**
		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)	**VF①08A30S**
		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)	**VF①08A36S**
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)	**VF①10A12S**
		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)	**VF①10A18S**
		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)	**VF①10A24S**
		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)	**VF①10A30S**
		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)	**VF①10A36S**
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)	**VF①12A12S**
		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)	**VF①12A18S**
		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)	**VF①12A24S**
		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)	**VF①12A30S**
		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)	**VF①12A36S**
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)	**VF①14A12S**
		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)	**VF①14A18S**
		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)	**VF①14A24S**
		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)	**VF①14A30S**
		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)	**VF①14A36S②**
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)	**VF①16A12S**
		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)	**VF①16A18S**
		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)	**VF①16A24S**
		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)	**VF①16A30S②**
		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)	**VF①16A36S②**

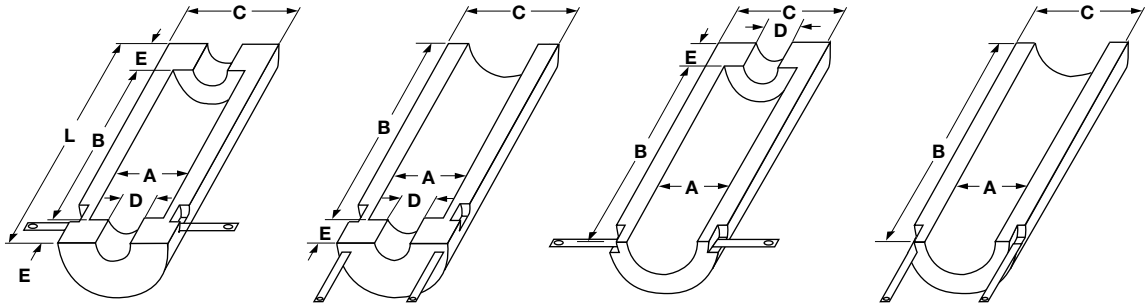
All units in this table are suitable for use up to 2000°F (1093°C) maximum surface temperature.

① Add Type number (Type 5 - 8) in the blank position in the part number. Example: **VS7̲04A06S**.
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.

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Ceramic Fiber Heaters



Type 1
Full Vestibule
(Style A Leads Illustrated)
(Default Lead Style)

Type 2
Left Vestibule
(Style B Leads Illustrated)

Type 3
Right Vestibule
(Style A Leads Illustrated)

Type 4
No Vestibule
(Style B Leads Illustrated)

(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.		
Heated Size			Type 1, 2, & 3 Sizes										
			Vestibule Sizes										
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)	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	Power (Watts) ±5%	Surface Loading W/in² (W/cm²)	Strip Lead Width in. (mm)	Type 1 Full Vest. lbs (kg)	Type 4 No Vest. lbs (kg)	Part Number
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)	VS①02A06S
	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)	VS①02A12S
	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)	VS①02A18S
	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)	VS①02A24S
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)	VS①03J06S
	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)	VS①03J12S
	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)	VS①03J18S
	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)	VS①03J24S
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)	VS①05A06S
	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)	VS①05A12S
	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)	VS①05A18S
	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)	VS①05A24S
	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)	VS①05A30S
	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)	VS①05A36S
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)	VS①06J06S
	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)	VS①06J12S
	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)	VS①06J18S
	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)	VS①06J24S
	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)	VS①06J30S
	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)	VS①06J36S
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)	VS①08A06S
	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)	VS①08A12S
	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)	VS①08A18S
	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)	VS①08A24S
	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)	VS①08A30S
	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)	VS①08A36S②

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.

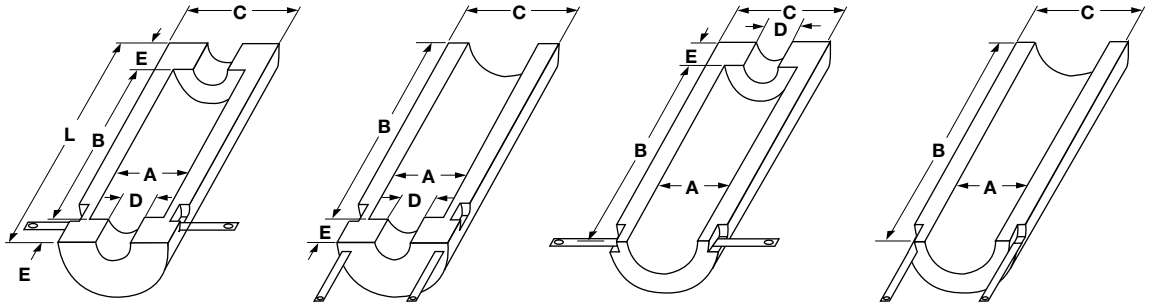
① Add Type number (Type 1 - 4) in the blank position in the part number. Example: **VS1 02A06S**.
For unheated units, see catalog page 430.

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.

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Ceramic Fiber Heaters



Type 1
Full Vestibule
(Style A Leads Illustrated)
(Default Lead Style)

Type 2
Left Vestibule
(Style B Leads Illustrated)

Type 3
Right Vestibule
(Style A Leads Illustrated)

Type 4
No Vestibule
(Style B Leads Illustrated)

(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.		
Heated Size			Type 1, 2, & 3 Sizes										
			Vestibule Sizes										
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)	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	Power (Watts) ±5%	Surface Loading W/in² (W/cm²)	Strip Lead Width in. (mm)	Type 1 Full Vest. lbs (kg)	Type 4 No Vest. lbs (kg)	Part Number
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)	VS①10A12S
	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)	VS①10A18S
	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)	VS①10A24S
	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)	VS①10A30S②
	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)	VS①10A36S②
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)	VS①12A12S
	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)	VS①12A18S
	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)	VS①12A24S
	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)	VS①12A30S②
	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)	VS①12A36S②
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)	VS①14A12S
	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)	VS①14A18S
	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)	VS①14A24S②
	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)	VS①14A30S②
	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)	VS①14A36S②
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)	VS①16A12S
	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)	VS①16A18S
	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)	VS①16A24S②
	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)	VS①16A30S②
	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)	VS①16A36S②

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: **VS1<u>0</u>2A06S**. 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)**.

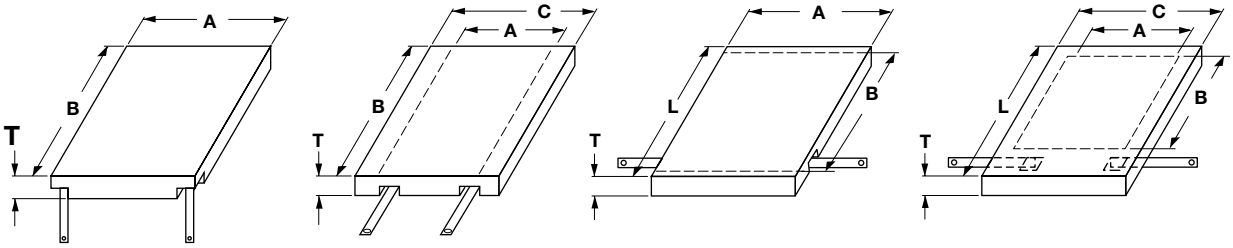
Type 2 (left vestibule) and Type 3 (right vestibule) style units are not stocked. They are, however, still standard units and designs are kept on file.

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.

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Ceramic Fiber Heaters

All units: **T** = 2 ±¼ 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	Approximate Net Wt.			
Heated Size				Type 6 & 8		Type 7 & 8									
Width (A) in. (mm) +1/16 -1/8 (1.6-3.2)		Length (B) in. (mm) +1/16 -1/8 (1.6-3.2)		Width (C) in. (mm) +1/16 -1/8 (1.6-3.2)		Length (L) in. (mm) +1/16 -1/8 (1.6-3.2)		Volts	Power (Watts) ±5%	Surface Loading W/in² (W/cm²)	Lead Width in. (mm)	Type 5 lbs (kg)	Type 6 & 7 lbs (kg)	Type 8 lbs (kg)	Part Number
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)	VF①06A12T
		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)	VF①06A18T
		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)	VF①06A24T
		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)	VF①06A24U
		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)	VF①06A30T
		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)	VF①06A36T
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)	VF①08A12T
		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)	VF①08A18T
		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)	VF①08A24T
		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)	VF①08A30T
		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)	VF①08A36T
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)	VF①10A12T
		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)	VF①10A18T
		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)	VF①10A24T
		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)	VF①10A30T
		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)	VF①10A36T
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)	VF①12A12T
		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)	VF①12A12U
		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)	VF①12A18T
		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)	VF①12A24T
		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)	VF①12A30T
		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)	VF①12A36T②
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)	VF①14A12T
		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)	VF①14A18T
		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)	VF①14A24T
		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)	VF①14A30T②
		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)	VF①14A36T②
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)	VF①16A12T
		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)	VF①16A18T
		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)	VF①16A24T
		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)	VF①16A30T②
		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)	VF①16A36T②

All units in this table are suitable for use up to 1800°F (982°C) maximum surface temperature.

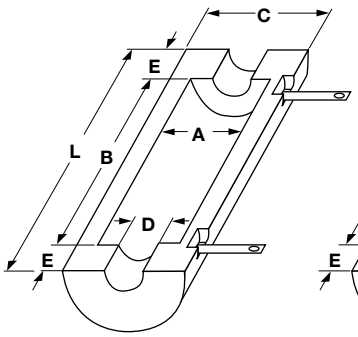
① Add Type number (Type 5 - 8) in the blank position in the part number. Example: **VF806A12T**. For unheated units, see catalog page 430.

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.

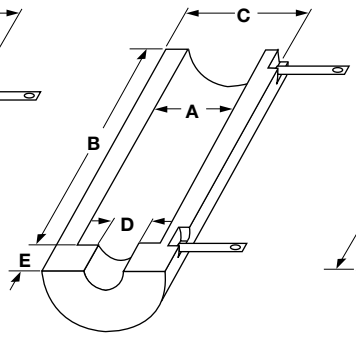
② These units have dual elements to use in "parallel" for 240V usage. Alternate designs are available for 480V, 277V and three-phase (internally wired). Contact your Watlow representative.

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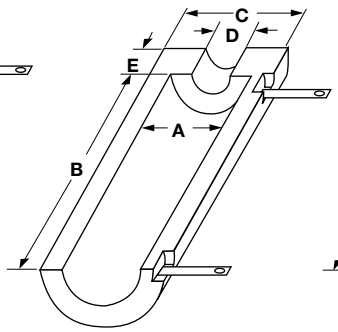
Ceramic Fiber Heaters



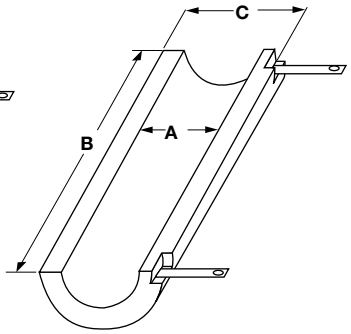
Type 1
Full Vestibule
(Style A Leads Illustrated)
(Default Lead Style)



Type 2
Left Vestibule
(Style A Leads Illustrated)



Type 3
Right Vestibule
(Style A Leads Illustrated)



Type 4
No Vestibule
(Style A Leads Illustrated)

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										
			Vestibule Sizes										
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)	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	Power (Watts) ±5%	Surface Loading W/in² (W/cm²)		Type 1 Full Vest. lbs (kg)	Type 4 No Vest. lbs (kg)	
5 (127)	6 (152)	9 (229)	11 (279)	3 1/2 (89)	2 1/2 (64)	60	750	15.9 (2.5)	3/8 (10)	3.1 (1.4)	2.3 (1.0)	VS①05A06T
	12 (305)	9 (229)	17 (432)	3 1/2 (89)	2 1/2 (64)	60	1400	14.9 (2.3)	3/4 (19)	4.5 (2.0)	3.6 (1.6)	VS①05A12T
	18 (457)	9 (229)	23 (584)	3 1/2 (89)	2 1/2 (64)	120	2100	14.9 (2.3)	1/2 (13)	5.2 (2.4)	4.3 (2.0)	VS①05A18T
	24 (610)	9 (229)	29 (737)	3 1/2 (89)	2 1/2 (64)	120	2800	14.9 (2.3)	3/4 (19)	6.9 (3.1)	6.0 (2.7)	VS①05A24T
	30 (762)	9 (229)	35 (889)	3 1/2 (89)	2 1/2 (64)	240	3500	14.9 (2.3)	1/2 (13)	8.3 (3.8)	7.4 (3.4)	VS①05A30T
	36 (914)	9 (229)	41 (102)	3 1/2 (89)	2 1/2 (64)	240	4200	14.9 (2.3)	1/2 (13)	9.6 (4.4)	8.7 (3.9)	VS①05A36T
6 1/2 (165)	6 (152)	10 1/2 (267)	12 (305)	5 (127)	3 (76)	60	1000	16.3 (2.5)	1/2 (13)	3.6 (1.6)	2.4 (1.1)	VS①06J06T
	12 (305)	10 1/2 (267)	18 (457)	5 (127)	3 (76)	120	2000	16.3 (2.5)	1/2 (13)	5.1 (2.3)	3.9 (1.8)	VS①06J12T
	18 (457)	10 1/2 (267)	24 (610)	5 (127)	3 (76)	120	3000	16.3 (2.5)	3/4 (19)	6.8 (3.1)	5.6 (2.5)	VS①06J18T
	24 (610)	10 1/2 (267)	30 (762)	5 (127)	3 (76)	240	4000	16.3 (2.5)	1/2 (13)	9.5 (4.3)	7.4 (3.4)	VS①06J24T
	30 (762)	10 1/2 (267)	36 (914)	5 (127)	3 (76)	240	5000	16.3 (2.5)	3/4 (19)	11.0 (5.0)	9.3 (4.2)	VS①06J30T
	36 (914)	10 1/2 (267)	42 (1067)	5 (127)	3 (76)	240	6000	16.3 (2.5)	3/4 (19)	12.4 (5.6)	11.2 (5.1)	VS①06J36T
8 (203)	6 (152)	12 (305)	12 (305)	6 1/2 (165)	3 (76)	60	1300	17.2 (2.7)	1/2 (13)	4.1 (1.9)	2.6 (1.2)	VS①08A06T
	12 (305)	12 (305)	18 (457)	6 1/2 (165)	3 (76)	120	2600	17.2 (2.7)	3/4 (19)	6.9 (3.1)	5.4 (2.4)	VS①08A12T
	18 (457)	12 (305)	24 (610)	6 1/2 (165)	3 (76)	240	3900	17.2 (2.7)	1/2 (13)	8.5 (3.9)	7.0 (3.2)	VS①08A18T
	24 (610)	12 (305)	30 (762)	6 1/2 (165)	3 (76)	240	5200	17.2 (2.7)	1/2 (13)	12.0 (5.4)	10.5 (4.8)	VS①08A24T
	30 (762)	12 (305)	36 (914)	6 1/2 (165)	3 (76)	240	6250	16.7 (2.6)	3/4 (19)	13.8 (6.3)	12.3 (5.6)	VS①08A30T
	36 (914)	12 (305)	42 (1067)	6 1/2 (165)	3 (76)	240/240	7800	17.2 (2.7)	1/2 (13)	15.6 (7.1)	14.1 (6.4)	VS①08A36T②

CONTINUED

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 - 4) in the blank position in the part number. Example: **VS1<u>0</u>6J06T**. 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.

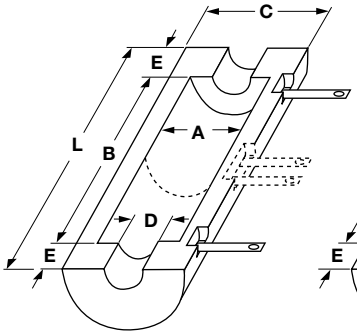
Overall length applies only to the full vestibule (Type 1) units. Types 2 and 3 are shorter by one vestibule length. Type 4 length equals **(B)**.

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.

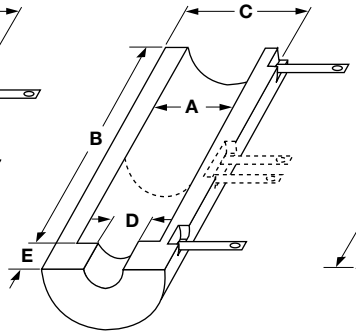
② These units have dual elements to use in "parallel" for 240V usage. Alternate designs are available for 480V, 277V and three-phase (internally wired). Contact your Watlow representative.

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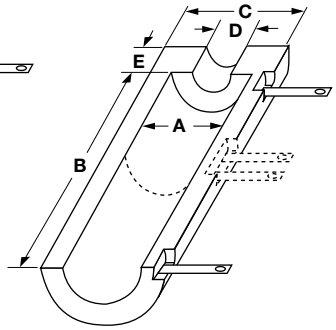
Ceramic Fiber Heaters



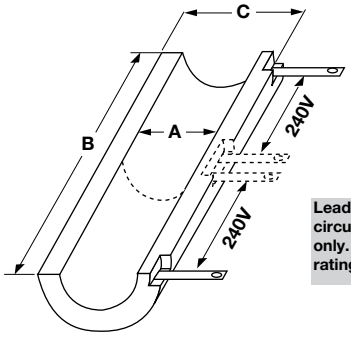
Type 1
Full Vestibule
(Style A Leads Illustrated)
(Default Lead Style)



Type 2
Left Vestibule
(Style A Leads Illustrated)



Type 3
Right Vestibule
(Style A Leads Illustrated)



Type 4
No Vestibule
(Style A Leads Illustrated)

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				Approx. Net Wt.		
Heated Size			Type 1, 2, & 3 Sizes									
			Vestibule Sizes									
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)	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	Power (Watts) ±5%	Surface Loading W/in² (W/cm²)	Strip Lead Width in. (mm)	Type 1 Full Vest. lbs (kg)	Type 4 No Vest. lbs (kg)	Part Number
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)	VS①10A12T
	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)	VS①10A18T
	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)	VS①10A24T
	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)	VS①10A30T②
	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)	VS①10A36T②
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)	VS①12A12T
	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)	VS①12A18T
	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)	VS①12A24T
	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)	VS①12A30T②
	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)	VS①12A36T②
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)	VS①14A12T
	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)	VS①14A18T
	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)	VS①14A24T②
	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)	VS①14A30T②
	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)	VS①14A36T②
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)	VS①16A12T
	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)	VS①16A18T
	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)	VS①16A24T②
	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)	VS①16A30T②
	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)	VS①16A36T②

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.

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Ceramic Fiber Heaters

Ordering Information

VF - Flat

VS - Semi-Cylindrical

Part Number

① Base Code Nbr.	② Base Code Nbr.	③ Base Code Nbr.	④ Base Code Nbr.	⑤ Base Code Nbr.	⑥ Base Code Nbr.	⑦ Base Code Nbr.	⑧ Base Code Nbr.	⑨ Base Code Nbr.	⑩ Modification Options	⑪	⑫	⑬ Lead Options	⑭ Lead Length
V	F	5	1	2	A	1	2	S		0	0		

①②③④⑤⑥⑦⑧⑨ 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.

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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^2 (1.0 - 3.9 W/cm^2) 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.

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Specialty Heaters

Specialty Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
FLUENT® In-line	444 stainless steel (substrate tube), 316L stainless steel (baffle and fittings	482	250	450	70	445
ULTRAMIC® Advanced Ceramic	Aluminum nitride	1112	600	1000	155	449
Thick Film Conduction	430 stainless steel	1022	550	75	11.6	453
Coil/Cable	304 stainless steel or alloy 600	1200	650	30	4.6	457



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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

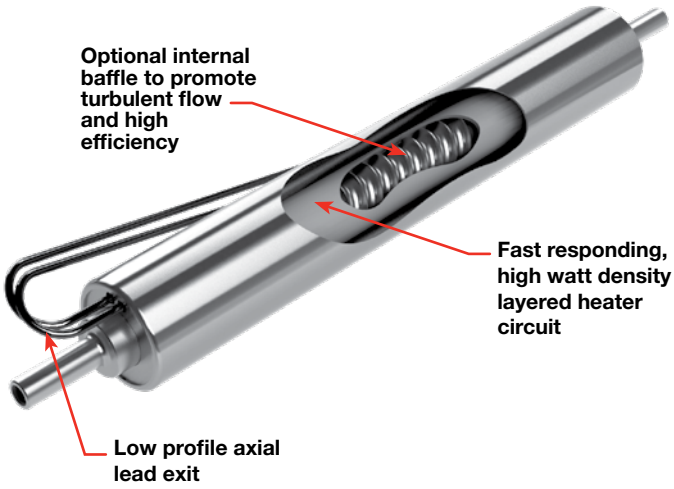
Buy: www.ValinOnline.com | Phone: 844-385-3099 | Email: CustomerService@valin.com

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^2 (23 W/cm^2)
  - Water 450 W/in^2 (70 W/cm^2)
- Maximum pressure: 150psi (10.2 bar)
- Maximum temperature: 662°F (350°C) as measured by internal T/C
- UL®/cUL® and CE



Application Orientation

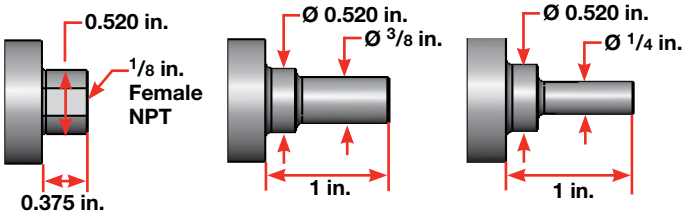
Gas Heating—
(Any orientation)



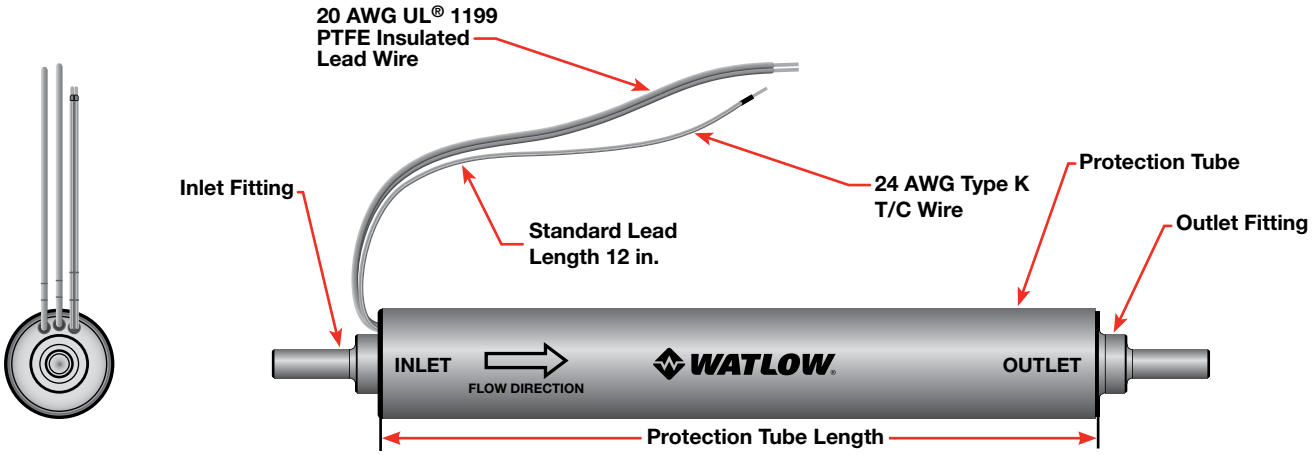
Liquid Heating—
(Heater must be vertical with inlet at the bottom)



Inlet/Outlet Fitting Options



Standard Construction



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FLUENT In-line Heaters

Technical Information

Standard Product Offering: Base Heaters

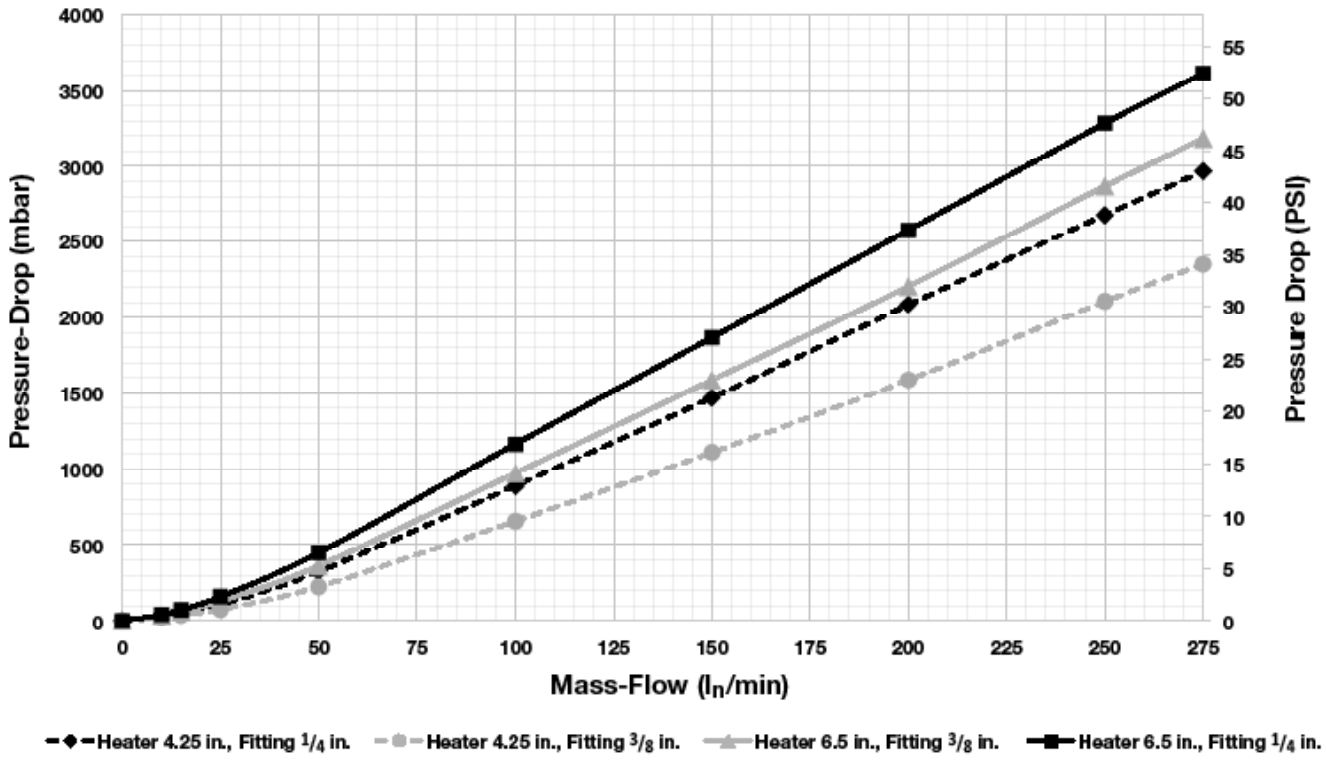
Volts	Watts	Protection Tube Length in.	(mm)	Number of Heating Circuits	Watt Density (W/in²)
240	500	3.00	(76)	1	210
120	250	4.25	(108)	1	57
240	1,000	4.25	(108)	1	228
120	375	5.25	(133)	1	62
240	1,500	5.25	(133)	1	247
120	500	6.50	(165)	1	63
240	2,000	6.50	(165)	1	250
120	750	6.50	(165)	2	94
240	3,000	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 for the latest list of standard designs and product information.

Pressure Drop - Air - With Internal Baffle @ 250°C



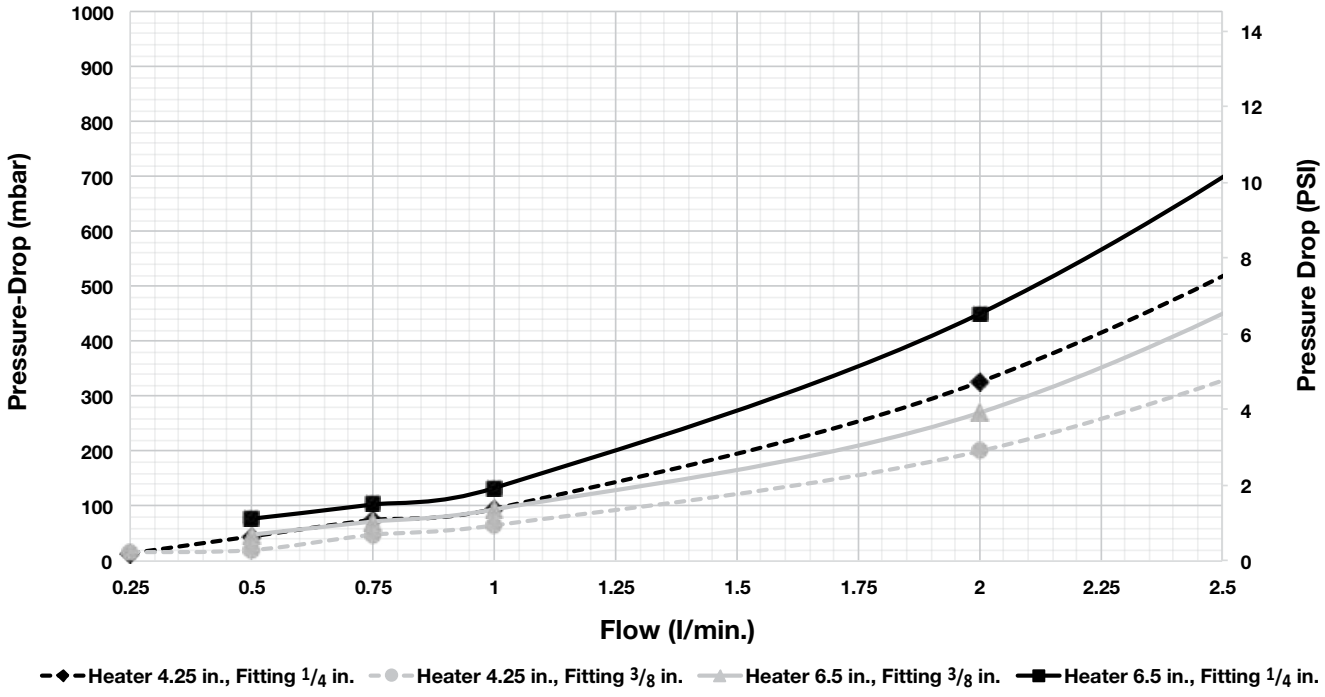
Note: Internal baffle is required for all gas heating applications.

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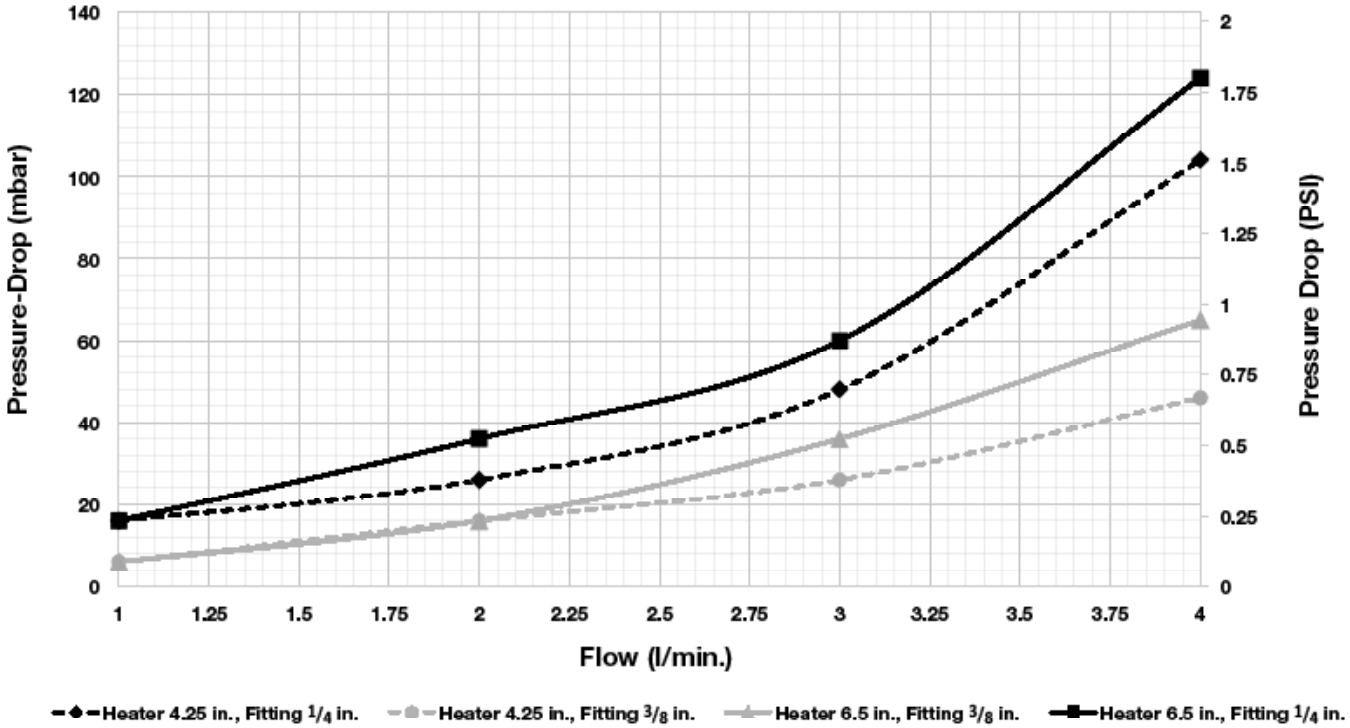
FLUENT In-line Heaters

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.

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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 (AIN), ULTRAMIC heaters' thermally matched proprietary heating element provides maximum performance in challenging applications. AIN 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 AIN heaters operate up to 400°C (752°F)① 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)①
- Watt densities up to 155 W/cm^2 (1000 W/in^2)
- Temperature ramp rate up to 150°C (270°F) per second (depending on application parameters)

Features and Benefits

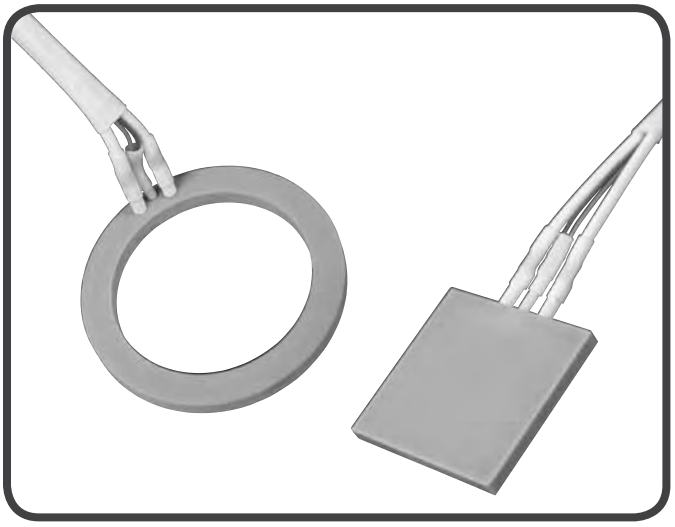
Robust AIN ceramic

- 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

① 400°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

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ULTRAMIC Advanced Ceramic Heaters

Technical Data

Mounting Guidelines

- Temperature <200°C (392°F): bond with high-temperature epoxy adhesive
- Clamp using single or multiple-point fasteners

Optional Thermocouple

- Bonded Type K thermocouple for <400°C (752°F)

Specifications and Tolerances

Surface Finish

- Flatness: <0.05 mm (0.002 in.)
- Parallelism: <0.05 mm (0.002 in.)
- Surface roughness (Ra): <1.5 µm

Dimensional Tolerance (length/width/diameter)

- ± 1% of dimension (± 0.13 mm minimum)

Electrical Properties

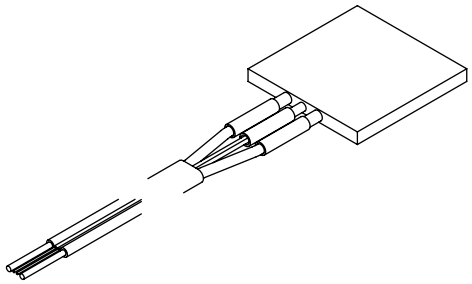
- TCR: 0.0015/°C
- Resistance tolerance: ±25%

Intellectual Property

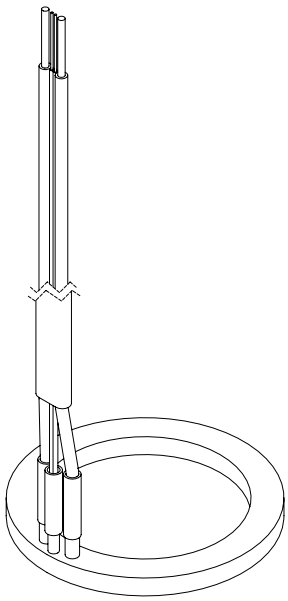
- U.S. Patents 7,696,455, 7,832,616 and 8,242,416

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

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EXTENDED CAPABILITY

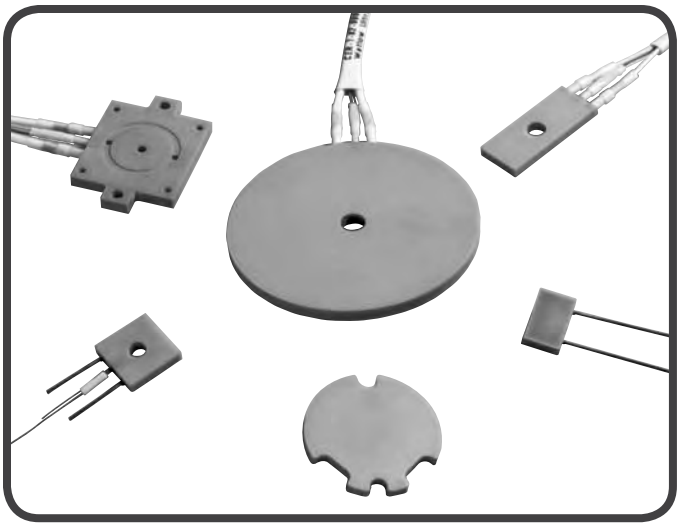
Extended Capabilities for ULTRAMIC Advanced Ceramic Heaters

Mounting Guidelines①

- 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**
Flat Square	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
Rectangular	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**
Ring	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

① See www.watlow.com/ultramic for detailed mounting guide.

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ULTRAMIC Advanced Ceramic Heaters

Technical Data

Product Ordering Information

Part Number	Dimensions mm (in.)	Thickness mm (in.)	Watt Density	Watts	Volts	Lead Exit
Square						
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
Heaters With Holes						
CER-1-01-00540	12 mm x 12 mm ① (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 ② (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 ② (1.97 in. x 1.97 in.)	3.0 mm (0.12 in.)	Medium	1500	240	Side
Rectangular						
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
Ring						
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

① 3 mm (0.12 in.) hole in center of heater
② 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)

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.

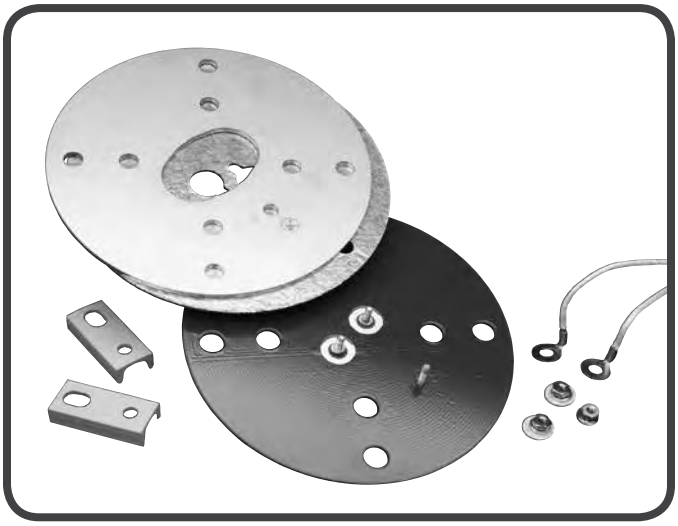
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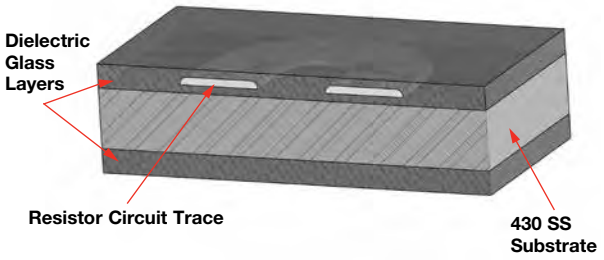
Thick Film Conduction Heaters

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^2 (11.6 W/cm^2)
- Voltages up to 240V

Features and Benefits

Watt densities up to 75 W/in^2 (11.6 W/cm^2) 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® component recognition available upon request

Typical Applications

- Food warming cabinets
- Load dump resistors
- Seal bars
- Deposition chamber lids

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Thick Film Conduction Heaters

Technical Information

Specifications

Min. length
- 2.25 in. (57 mm)

Max. length
- 24 in. (610 mm)

Max. voltage
- 240VAC

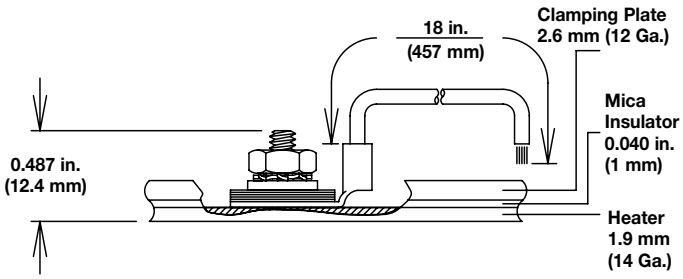
Max. amperage
- 25A

Terminations
- Stud terminals

Substrate
- 14 ga. typical

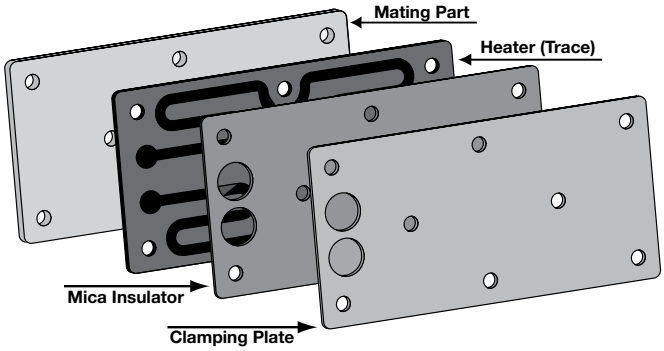
Features
- Holes/slots up to 15% of area

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.

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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



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Thick Film Conduction Heaters

Technical Information

Heater Part Numbers

Heater Size in. (mm)	Voltage	Wattage[1]	W/in² (W/cm²)	Approximate Assembly Weight lbs (kg)	Watlow Part Number[2]
Round					
4.5 dia. (114)	120	325	20.4 (3.2)	1.10 (0.50)	**TFA004JA03EL18B**
6.0 dia. (152)	120	850	30.1 (4.7)	2.74 (1.24)	**TFA006AA08KL18C**
6.0 dia. (152)	240	1125	39.8 (6.2)	2.74 (1.24)	**TFA006AE11EL18C**
8.0 dia. (203)	240	2000	39.8 (6.2)	4.91 (2.23)	**TFA008AE200L18C**
10.0 dia. (254)	240	3000	38.2 (5.9)	7.24 (3.28)	**TFA010AE300L18C**
Square					
2.25 x 2.25 (57 x 57)	120	100	19.8 (3.1)	0.27 (0.12)	**TFA2E2EA010L18B**
3.00 x 3.00 (76 x 76)	120	225	25.0 (3.8)	0.50 (0.23)	**TFA3A3AA02EL18B**
4.00 x 4.00 (102 x 102)	120	400	25.0 (3.8)	1.61 (0.73)	**TFA4A4AA040L18C**
6.00 x 6.00 (152 x 152)	120	1250	34.7 (5.4)	3.74 (1.70)	**TFA6A6AA12KL18C**
6.00 x 6.00 (152 x 152)	240	1450	40.3 (6.3)	3.74 (1.70)	**TFA6A6AE14KL18C**
8.00 x 8.00 (203 x 203)	240	2500	39.1 (6.1)	6.36 (2.88)	**TFA8A8AE250L18C**
Rectangle					
2.0 X 4.0 (51 x 102)	120	240	30.0 (4.6)	0.47 (0.21)	**TFA2A4AA02HL18B**
4.0 X 6.0 (102 x 152)	120	725	30.2 (4.7)	2.46 (1.12)	**TFA4A6AA07EL18C**
6.0 X 8.0 (152 x 203)	240	1920	40.0 (6.2)	5.01 (2.27)	**TFA6A8AE19DL18C**

[1]Wattage output at 77°F (25°C).

[2]Includes clamping plate, mica insulator and mounting hardware. Replace the last letter of the part number with “O” for heater only.

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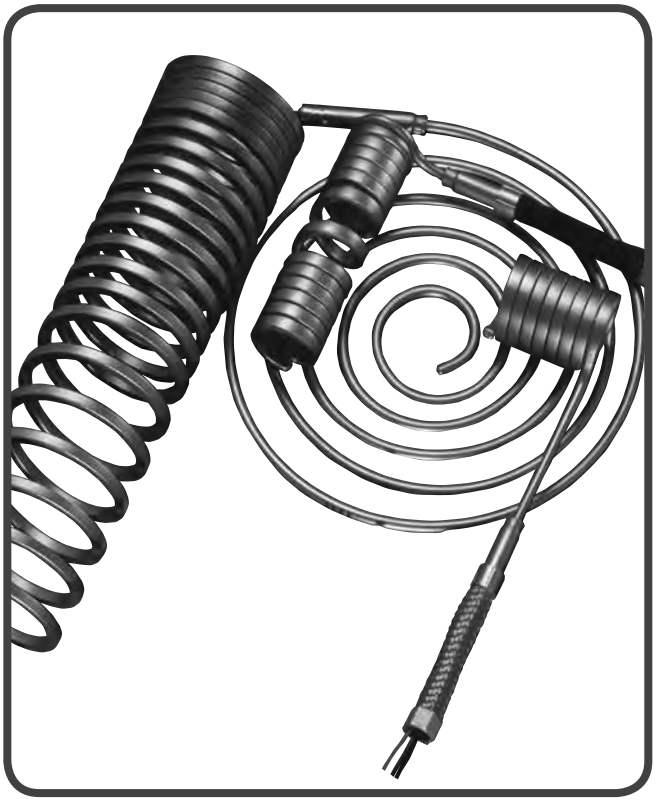
Coil/Cable Heaters

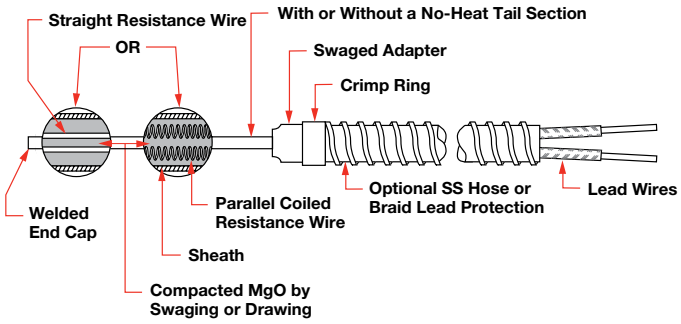
The versatile Watlow coil/cable heater can be formed into a variety of shapes. Small diameter, high performing cable heaters are fully annealed and readily bent to a multitude of configurations.

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

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

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





Performance Capabilities

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

Features and Benefits

High ductility

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

Low mass

- Allows quick response in both heating and cooling

Constructed with no open seams

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

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

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

Heater sheath can be brazed

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

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

- Delivers a high volume of heat into a tiny space

Internal construction options

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

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Coil/Cable Heaters

Typical Applications

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

Electrical Data and Coiling Limits

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

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

Coiling Tolerances

Cable Diameters	Coiled Width Tolerances: Coiled Width in. (mm)	Coiled Width Tolerances: Tolerances in. (mm)	Coiled I.D. Tolerances: Coil I.D. Range in. (mm)	Coiled I.D. Tolerances: 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%

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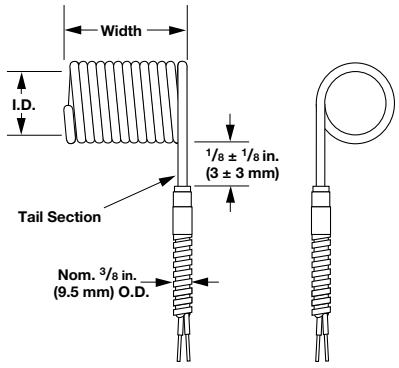
Coil/Cable Heaters

Formation Options

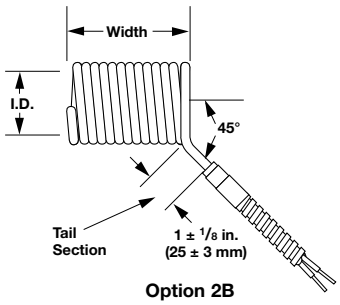
Coil Heaters

The coil heater can be tight wound or open pitch.

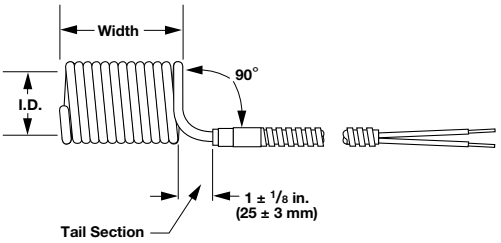
Lead Orientation Options for Coiled Cable Heaters



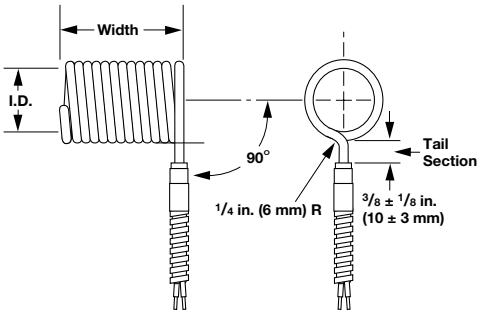
Option 2A



Option 2B



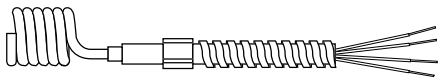
Option 2C



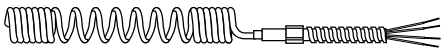
Option 2F

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

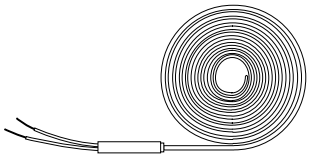
Closed Coil without Distributed Wattage



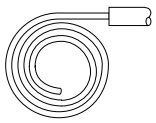
Closed Coil with Distributed Wattage



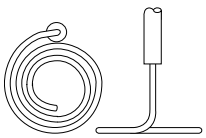
Flat Spiral



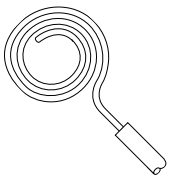
Flat, spiral formations are used to heat flat circular surfaces. This formation is often used in semiconductor and medical applications.



Flat Spiral with 2A Type Lead Orientation



Flat Spiral with 2C Type Lead Orientation



Flat Spiral with 2F Type Lead Orientation

Flat Spiral Inside Diameter Standards

Spiral Inside Diameter—in.		Cable Diameter—in. 1/16 (0.062)	3/32 (0.094)	1/8 (0.125)	5/32 (0.156)	3/16 (0.188)
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.

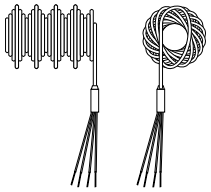
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Coil/Cable Heaters

Formation Options *(Continued)*

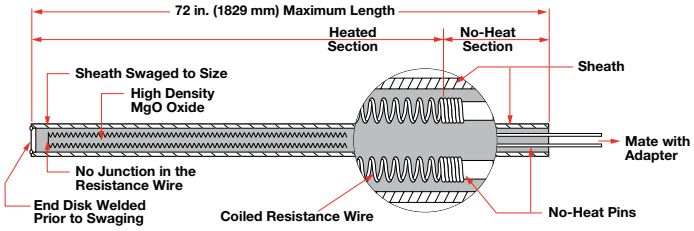
Star Wound

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

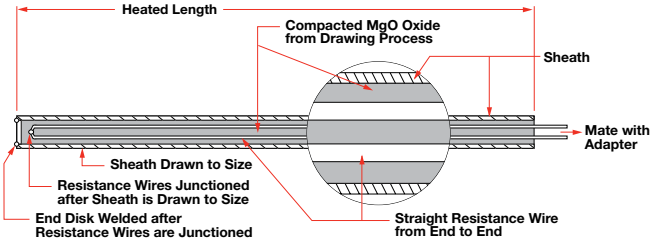
  0.125 in. (3.2 mm) round (minimum diameter with internal thermocouple)

  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

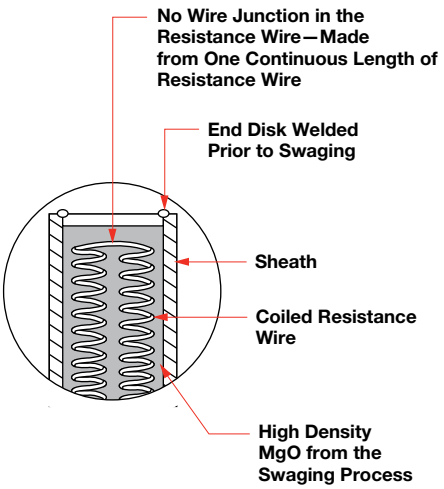
* Maximum length is 140 in. (3556 mm)

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Coil/Cable Heaters

Internal Construction *(Continued)*

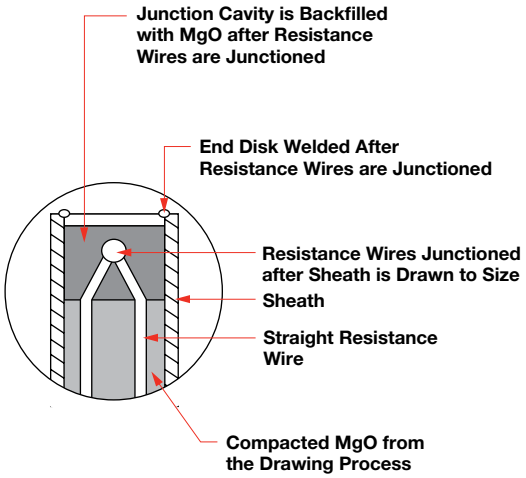
Disk End of Sheath



Coiled Internal Resistance Wire

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

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



Straight (Uncoiled) Resistance Wire

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

Thermocouples

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

Coil:

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

Straight:

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

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Coil/Cable Heaters

Options—Internal Construction

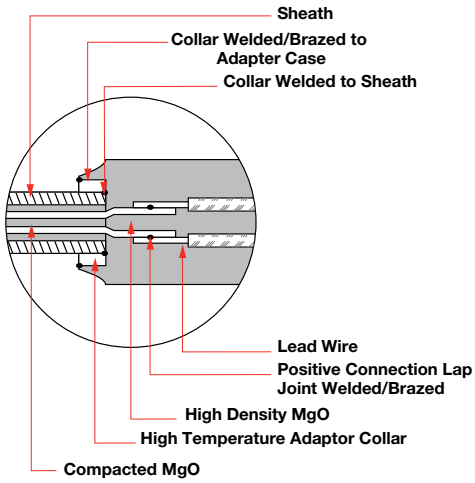
Adapters

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.

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Coil/Cable Heaters

Cable Heater Units (Internal thermocouple is not available)

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

Note: Lead protection is available upon request.

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Coil/Cable Heaters

Cable Heater Units (Type J internal thermocouple)

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

Note: Lead protection is available upon request.

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Strip/Clamp-On Heaters

Strip/Clamp-On Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
Mineral Insulated (MI)	304 stainless steel	1400	760	140	21.7	467
375 High-Temperature	Aluminized steel	1100	595	100	15.5	471
FIREBAR® Clamp-On	Alloy 800	1400	760	120	18.6	478
	304 stainless steel	1200	650	120	18.6	
Thick Film Conduction	430 stainless steel	1025	550	75	11.6	479

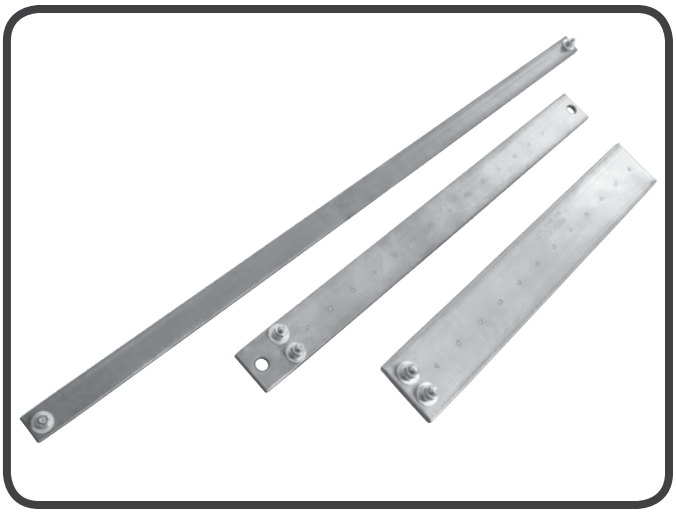


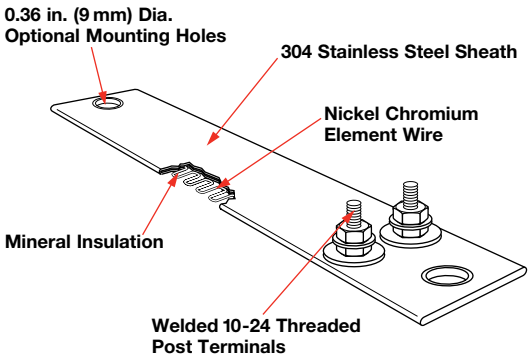
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Mineral Insulated (MI) Strip Heaters

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^2 (21.7 W/cm^2)
- 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

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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:

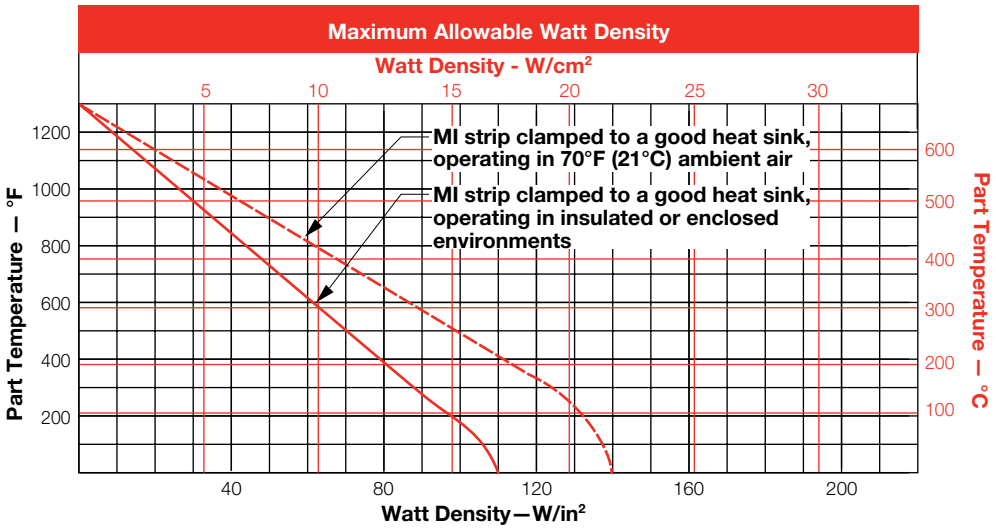
1. Using the chart below, locate the **no-heat factor** corresponding to the type of heater being considered.
2. To use the formula below, insert the no-heat factors, length and width (in inches).

Heated Area = (Overall Length - No-Heat Factor) x Width

Type	No-Heat Factor (in.)
1 in. wide 1 in. wide post terminal 1 on 1	1.75
1 in. wide post terminal 1 on 1 with mounting holes	3.00
For all other widths 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.

$$\text{Watt Density} = \frac{\text{Wattage}}{\text{Heated Area}}$$



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Mineral Insulated (MI) Strip Heaters

Applications and Technical Data *(Continued)*

Specifications

Width

- 1, 1 1/2 and 2 in. (25, 38, 51 mm), tolerance ±1/32

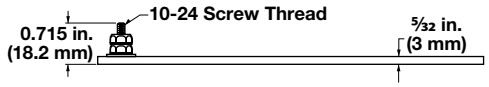
Length

- 8 to 30 in. (203 to 762 mm), tolerance ±1/8

Terminations

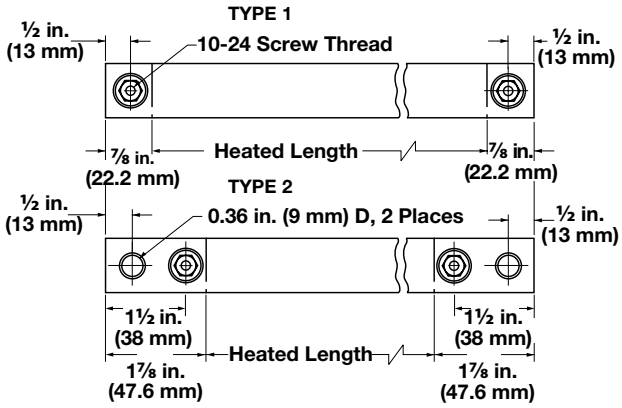
- 1 in. (25 mm) wide—post terminals one-on-one
  1 1/2 to 2 in. (38 to 51 mm)—post terminals two-on-one

All Widths

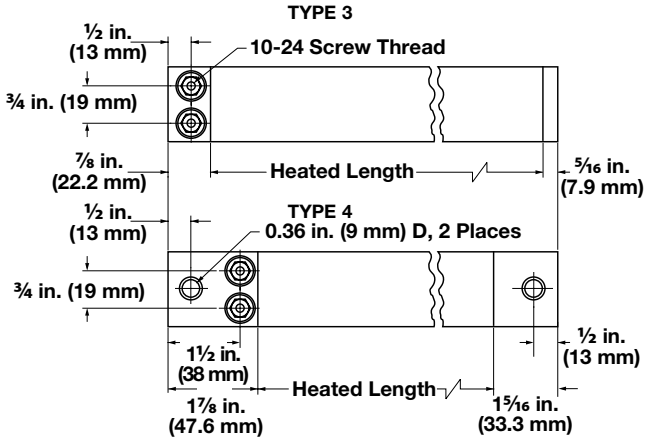


Note: In most applications, mounting holes alone do not provide adequate clamping. A clamp bar should be used for each 4 in. (102 mm) of heater length.

1 in. (25 mm) Wide



1 1/2 in. – 2 in. (38 – 51 mm) Wide



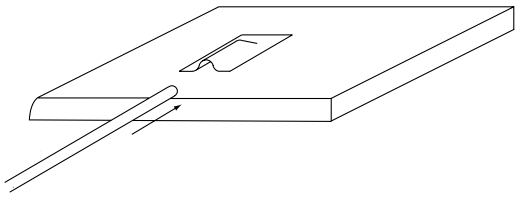
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Mineral Insulated (MI) Strip Heaters

Applications and Technical Data *(Continued)*

Options

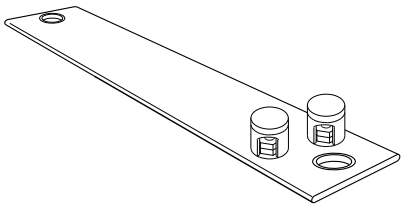
Thermocouple Pocket



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/in² (W/cm²)	Approx. Net Wt. lbs (kg)	Type	Part Number
1 1/2 (38)	8 (203)	240	500	50 (7.8)	0.3 (0.15)	3	**MS1J8AS3**
1 1/2 (38)	12 (305)	120	350	26 (4.0)	0.5 (0.2)	4	**MS1J12AV2**①
1 1/2 (38)	12 (305)	240	350	26 (4.0)	0.5 (0.2)	4	**MS1J12AV3**①
1 1/2 (38)	12 (305)	240	800	49 (7.6)	0.5 (0.2)	3	**MS1J12AS2**
1 1/2 (38)	18 (457)	120	1000	40 (6.2)	0.8 (0.3)	3	**MS1J18AS1**
1 1/2 (38)	18 (457)	240	1000	40 (6.2)	0.8 (0.3)	3	**MS1J18AS2**

① 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.

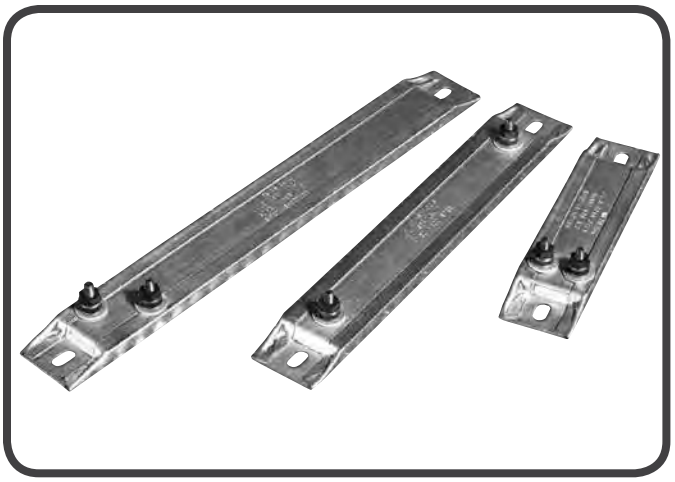
Centers of mounting holes are located 1/2 in. (13 mm) from the ends of the heater.

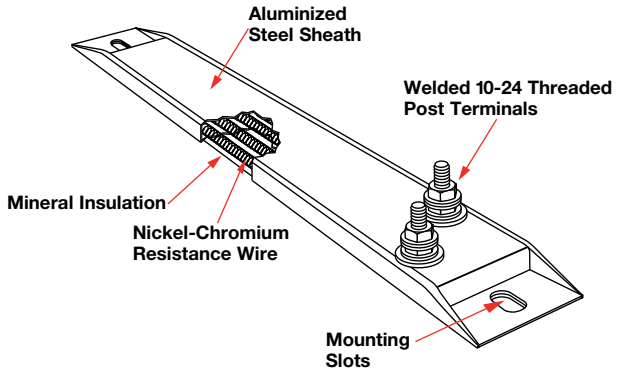
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375 High-Temperature Strip Heaters

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^2 (15.5 W/cm^2)
- 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

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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.**

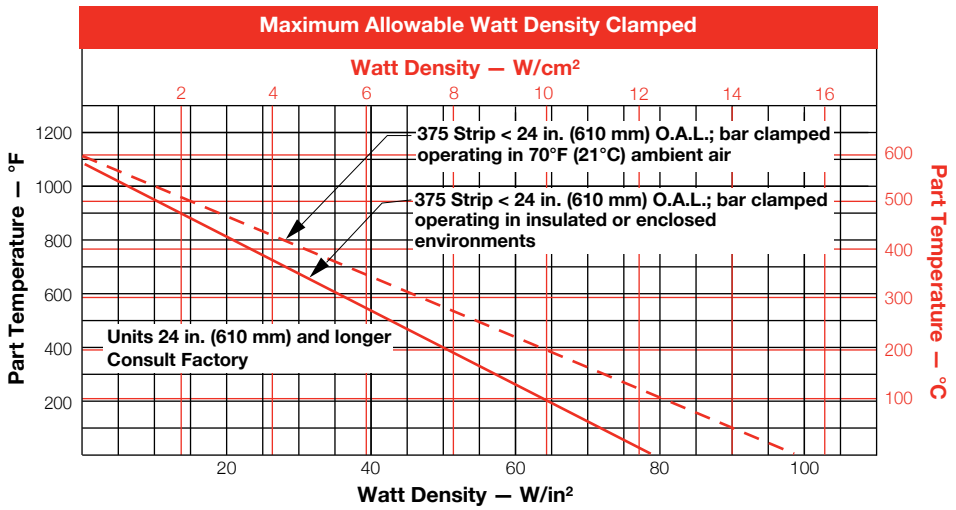
Formulas

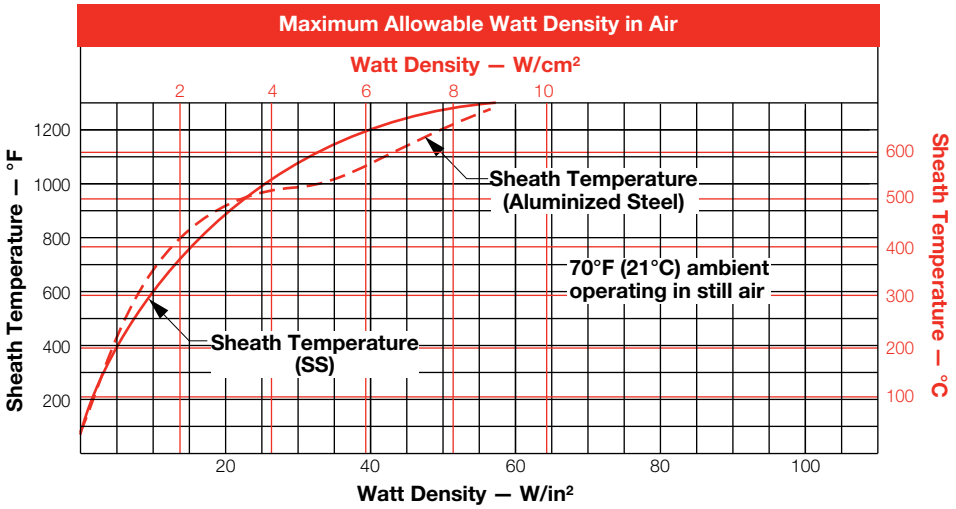
$$\text{Watt Density} = \frac{\text{Wattage}}{\text{Heated Area}}$$

Heated Area
(Offset Terminals) = [Overall Length (A) x 1.5 in.] - 6 in^2
= [Overall Length (A) x 38 mm] - 38.7 cm^2

Heated Area
(Parallel Terminals) = [Overall Length (A) x 1.5 in.] - 4.7 in^2
= [Overall Length (A) x 38 mm] - 30.3 cm^2

Heated Area
(One-on-One Terminals) = [Overall Length (A) x 1.5 in.] - 6 in^2
= [Overall Length (A) x 38 mm] - 38.7 cm^2



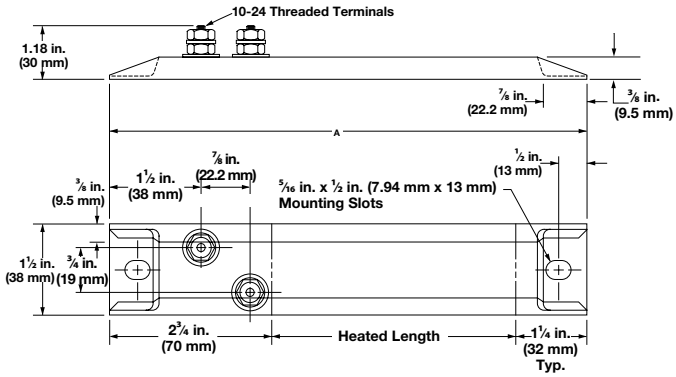


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375 High-Temperature Strip Heaters

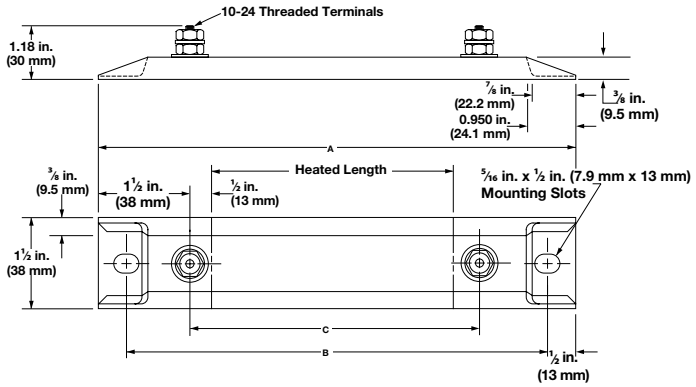
Termination Options

Offset Terminals



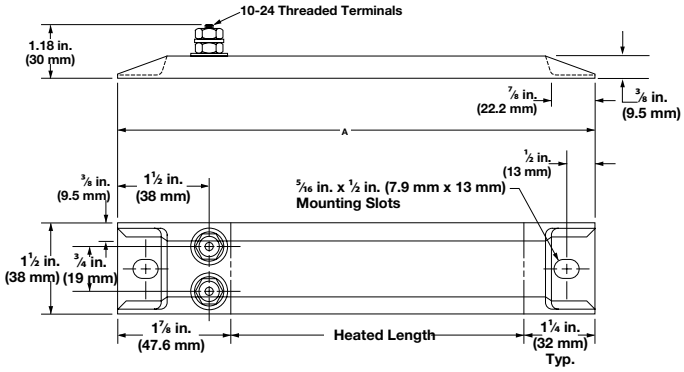
Two 10-24 threaded post terminals are offset from each other on the same end.

One-on-One Terminals



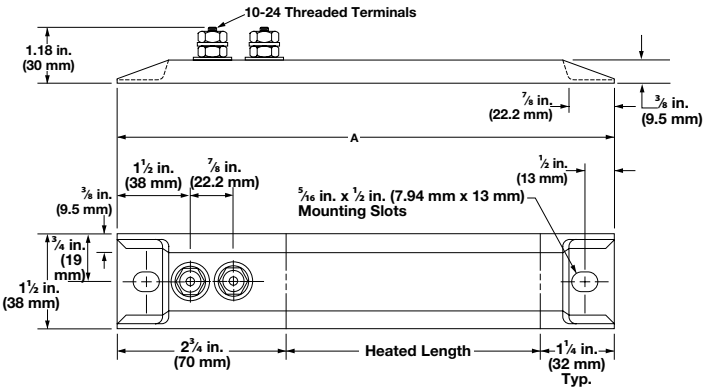
Two 10-24 threaded post terminals are placed one on each end.

Parallel Terminals



Two 10-24 threaded post terminals are used; both terminals on one end.

In-Line Terminals



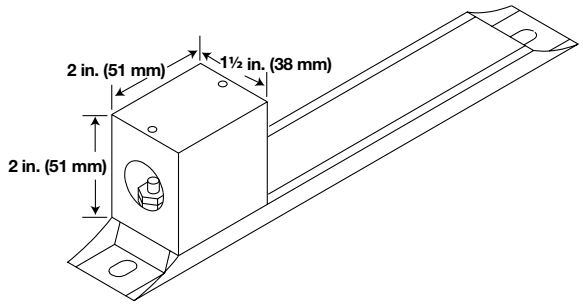
Two 10-24 threaded post terminals are in-line with each other on the same end.

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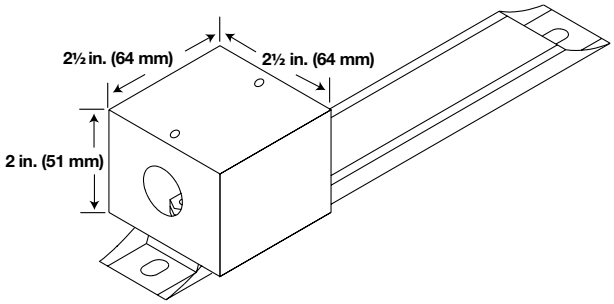
375 High-Temperature Strip Heaters

Termination Options *(Continued)*

Metallic Terminal Boxes - Variations



Available on in-line terminals only.

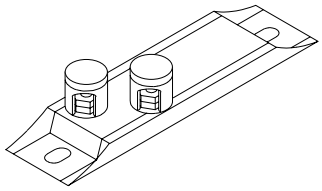


Available on offset terminals from stock and manufactured.

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 7/8 in. (22.2 mm) diameter holes in the ends of the box. To order, specify **terminal box**.

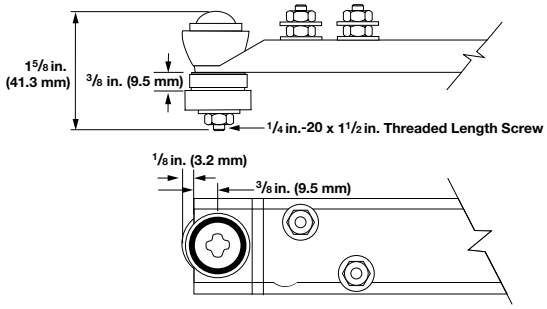
Accessories

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, 17/32 x 11/16 inch diameter mounting holes **must** be specified when ordering the heater.

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375 High-Temperature Strip Heaters

Heater Part Numbers

Width in. (mm)	Length in. (mm)	Term.	Volts	Power (Watts)	Watt Density W/in² (W/cm²)	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.

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375 High-Temperature Strip Heaters

Heater Part Numbers *(Continued)*

Width in. (mm)	Length in. (mm)	Term.	Volts	Power (Watts)	Watt Density W/in² (W/cm²)	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)	**SGA1J17R01**	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.

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375 High-Temperature Strip Heaters

Heater Part Numbers *(Continued)*

Width in. (mm)	Length in. (mm)	Term.	Volts	Power (Watts)	Watt Density W/in² (W/cm²)	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)	26 3/4 (680)	Offset	240	700	21 (3.3)	1.7 (0.77)	**SGA1J26NO1**	OT-2670	—	SS1472	—
	26 3/4 (680)	Offset	240	1000	29 (4.5)	1.7 (0.77)	**SGA1J26NO2**	—	OT-2601	—	SS2472
	30 1/2 (775)	Offset	120	750	19 (2.9)	2.0 (0.91)	**SGA1J30JO2**	OT-3075	OT-3007	SS1481	—
	30 1/2 (775)	Offset	240	750	19 (2.9)	2.0 (0.91)	**SGA1J30JO3**	OT-3075	OT-3007	SS1492	SS2482
	30 1/2 (775)	1-on-1	240	750	19 (2.9)	2.0 (0.91)	**SGA1J30JT1**	S-3075	S-3007	SD1452	—
	33 1/2 (851)	Offset	240	750	17 (2.6)	2.2 (1.0)	**SGA1J33JO1**	OT-3375	OT-3307	SS1522	SS2522
	33 1/2 (851)	1-on-1	240	1000	22 (3.4)	2.2 (1.0)	**SGA1J33JT1**	—	S-3301	—	SD2472
	35 7/8 (911)	Offset	120	1000	21 (3.3)	2.3 (1.0)	**SGA1J35RO4**	OT-3610	—	SS1531	—
	35 7/8 (911)	Offset	240	1000	21 (3.3)	2.3 (1.0)	**SGA1J35RO3**	OT-3610	—	SS1542	SS2532
	35 7/8 (911)	Offset	240	1500	31 (4.8)	2.3 (1.0)	**SGA1J35RO1**	—	OT-3601	SS2552	—
	35 7/8 (911)	1-on-1	240	1000	21 (3.3)	2.3 (1.0)	**SGA1J35RT1**	S-3610	S-3601	SD1492	SD2492
	38 1/2 (978)	Offset	120	1000	19 (2.9)	2.5 (1.1)	**SGA1J38JO2**	OT-3810	OT-3801	SS1581	SS2561
	38 1/2 (978)	Offset	240	1500	29 (4.5)	2.5 (1.1)	**SGA1J38JO3**	—	OT-3815	—	—
	42 1/2 (1080)	Offset	240	1500	26 (4.0)	2.8 (1.3)	**SGA1J42JO1**	—	OT-4315	SS1632	SS2632
	47 7/8 (1216)	Offset	240	2250	34 (5.3)	3.1 (1.4)	**SGA1J47RO1**	—	OT-4822	—	—

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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.

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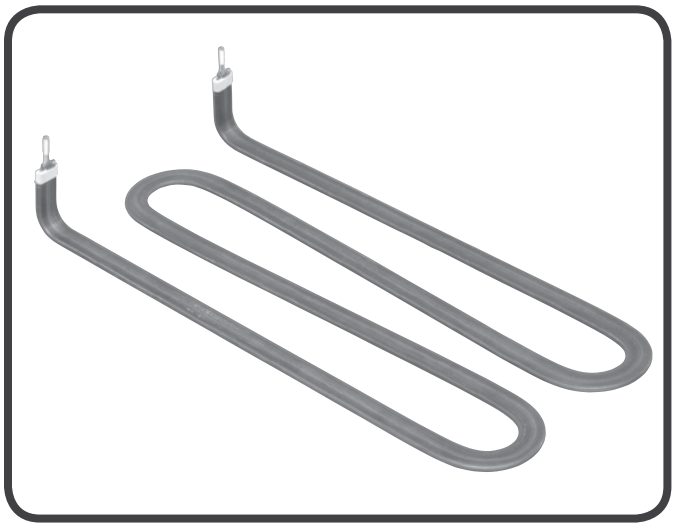
FIREBAR® Clamp-On Heaters

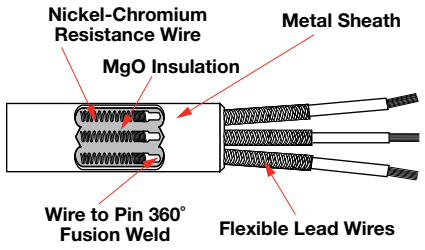
FIREBAR® heating elements provide added heating performance over standard round tubular heating elements—especially for immersion applications in petroleum based liquids requiring high kilowatts.

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:

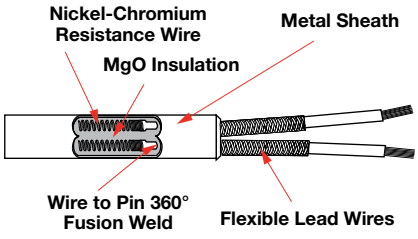
- Minimizing coking and fluid degrading
- Enhancing the flow of fluid past the element's surface to carry heat from the sheath
- Improving heat transfer with a significantly larger boundary layer allowing much more liquid to flow up and across the sheath's surface

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





One Inch Double-Ended FIREBAR Element and Lead Configurations



⅝ Inch Double-Ended FIREBAR Element and Lead Configurations

For detailed product and technical data, see the full FIREBAR product section located on pages 84 through 102.

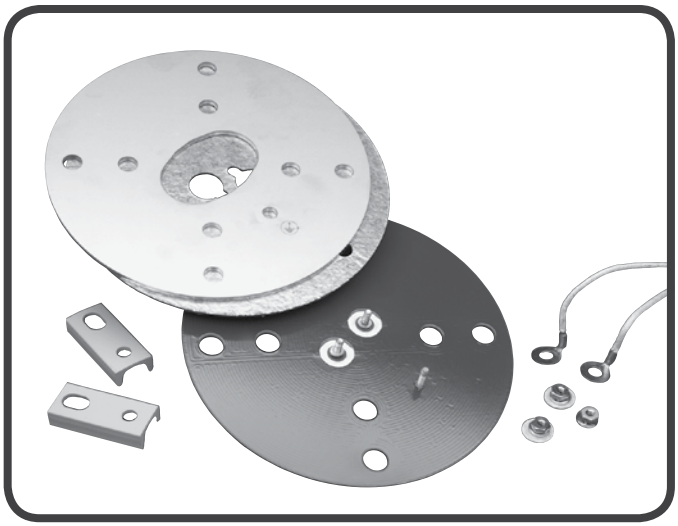
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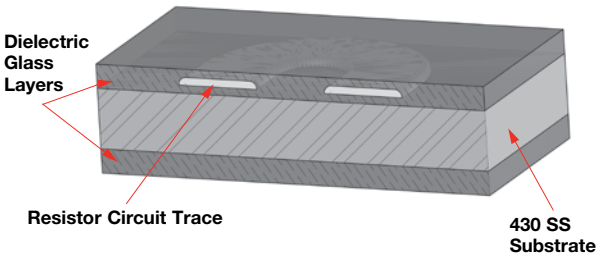
Thick Film Conduction Heaters

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^2 (11.6 W/cm^2)
- Voltages up to 240V

Features and Benefits

Watt densities up to 75 W/in^2 (11.6 W/cm^2) 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® 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.

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Band/Barrel Heaters

Band/Barrel Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
Mineral Insulated (MI)	Stainless steel	1400	760	100	15.5	483



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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^2 (15.5 W/cm^2) 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

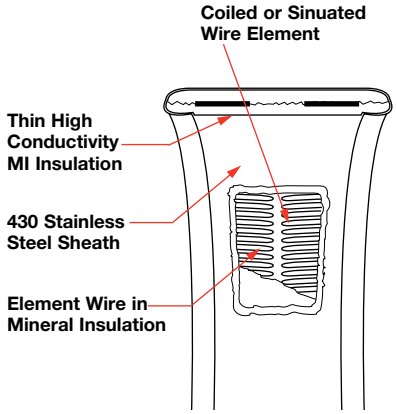
- Contributes to faster heat-up and throughput for increased productivity

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

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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		I.D. Available — in. (mm)												Available Terminations
		1 pc. Construction				Expandable				2 pc. Construction				
		Min.		Max.		Min.		Max.		Min.		Max.		
in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	
1	(25)	1	(25)	6	(152)	3	(76)	12	(305)	3	(76)	12	(305)	All
1 3/8	(35)	1	(25)	3	(76)	3	(76)	6	(152)	3	(76)	6	(152)	All - Except SLE
1 1/2	(38)	1	(25)	14	(356)	3	(76)	14	(356)	3	(76)	28	(711)	All
2	(51)	1 1/4	(32)	14	(356)	3	(76)	14	(356)	3	(76)	28	(711)	All
2 1/2	(64)	1 1/4	(32)	14	(356)	3	(76)	14	(356)	3	(76)	28	(711)	All
3	(76)	1 1/2	(38)	14	(356)	3	(76)	14	(356)	3	(76)	28	(711)	All
3 1/2	(89)	1 3/4	(45)	14	(356)	3	(76)	14	(356)	3	(76)	28	(711)	All
4	(102)	2	(51)	14	(356)	3	(76)	14	(356)	3	(76)	28	(711)	All
4 1/2	(114)	2 1/4	(57)	14	(356)	3	(76)	14	(356)	3	(76)	28	(711)	All
5	(127)	2 1/2	(64)	14	(356)	3	(76)	14	(356)	4	(102)	28	(711)	All
5 1/2	(140)	2 3/4	(70)	14	(356)	3	(76)	14	(356)	4	(102)	28	(711)	All - Except 90° "B" Leads
6	(152)	3	(76)	14	(356)	3	(76)	14	(356)	4	(102)	28	(711)	All

General Limitations

- Maximum width of 1 in. (25 mm) diameter heater: 1 1/2 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 1/8 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 1/2 in. (102 mm x 38 mm) width
- 90° leads not available over 250VAC
- Minimum I.D. for post terminals: 1 1/4 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.

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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.

Heated Area = Total Contact Area - 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).

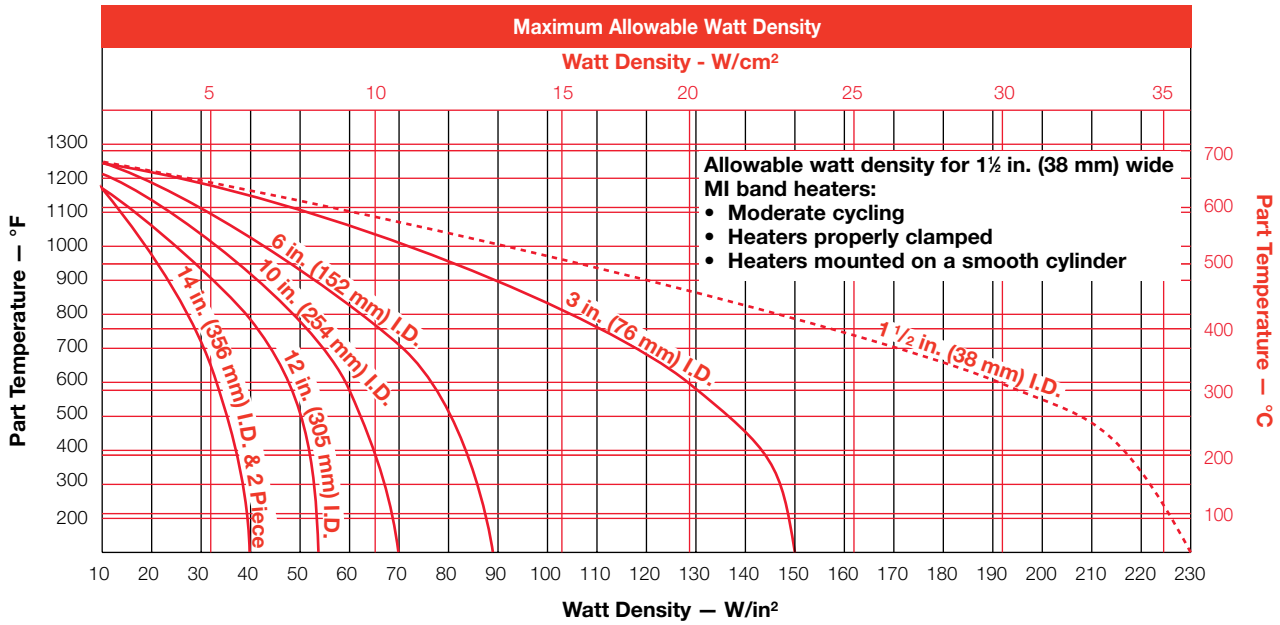
   Heated Area =
   (3.14 x Diameter - No-Heat Factor) x Width

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.



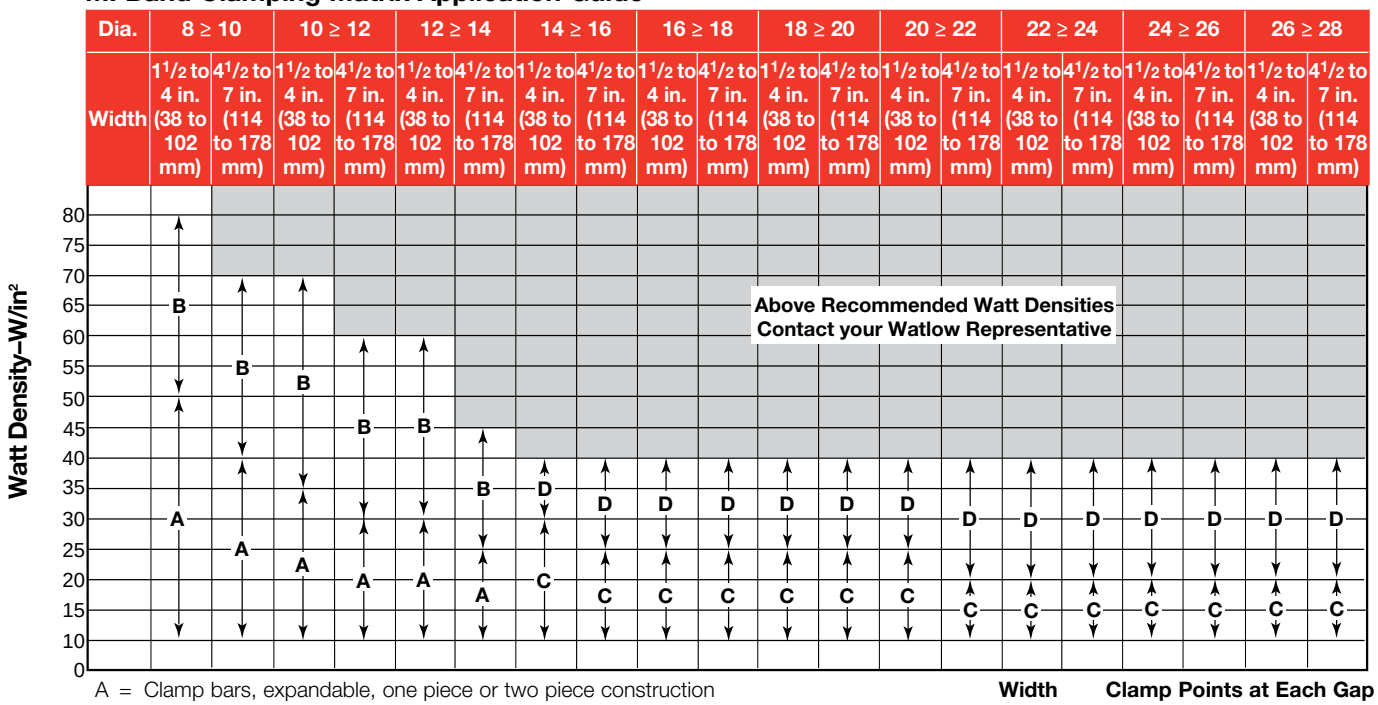
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Mineral Insulated (MI) Band Heaters

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.

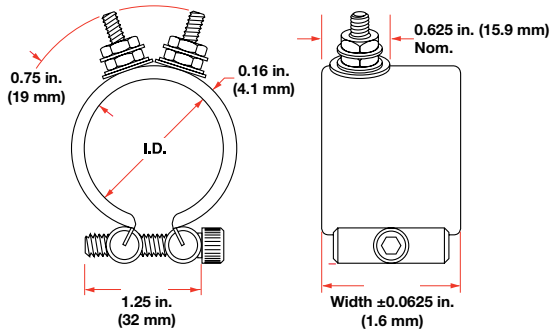
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Mineral Insulated (MI) Band Heaters

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

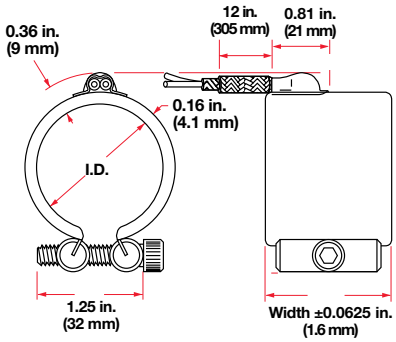
Heaters rated at less than 250VAC use UL® approved lead insulation for operations to 480°F (250°C) as standard. Lead insulation UL® rated for operation to 840°F (450°C) is available for high-temperature applications where the leads are shrouded or enclosed with the heater. These leads are available in 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.**

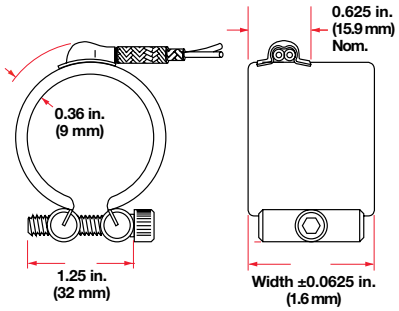
Type B

Stock



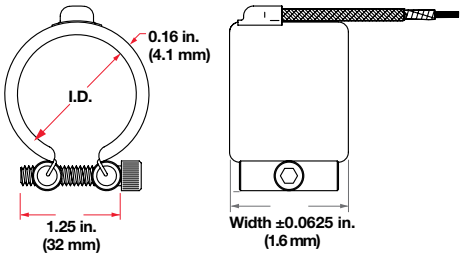
Type B - 90° Rotation

Non-Stock



Type B - 180° Rotation

Stock



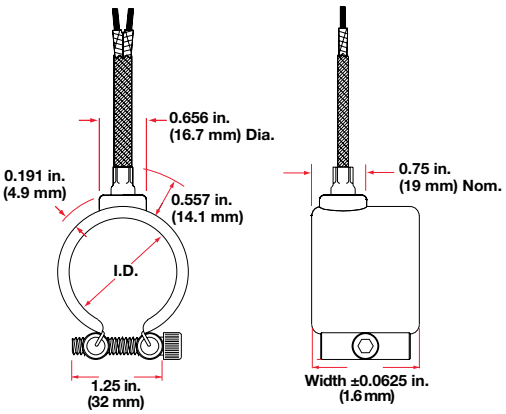
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Mineral Insulated (MI) Band Heaters

Termination Variations *(Continued)*

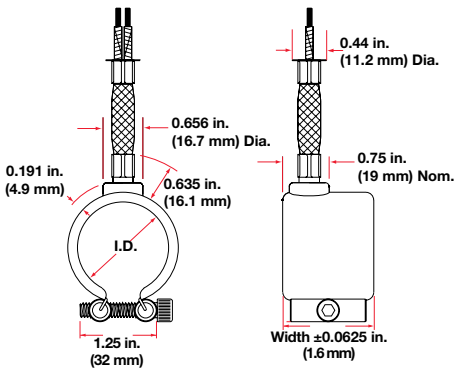
Lead Wire *(Continued)*

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.

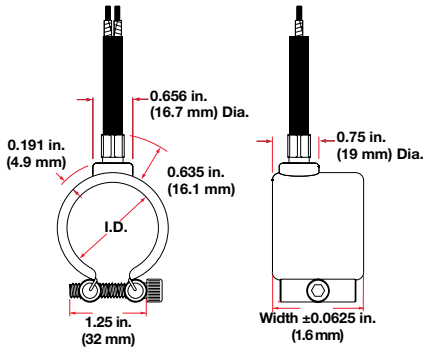
Type E
Stock



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.

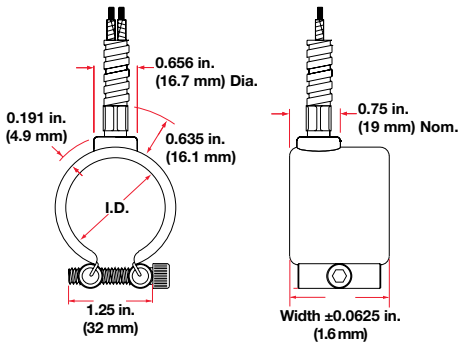
Type F
Stock



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.

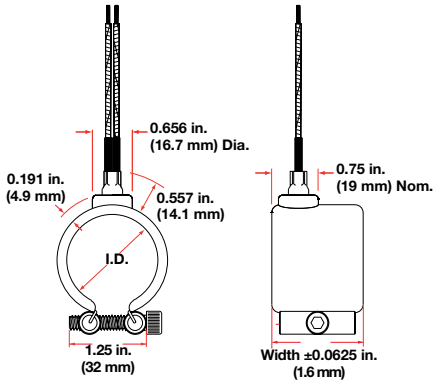
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Mineral Insulated (MI) Band Heaters

Termination Variations *(Continued)*

Lead Wire *(Continued)*

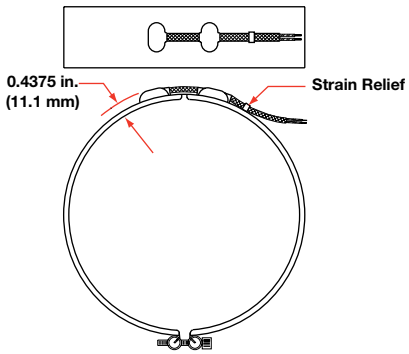
Type K
Stock



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.

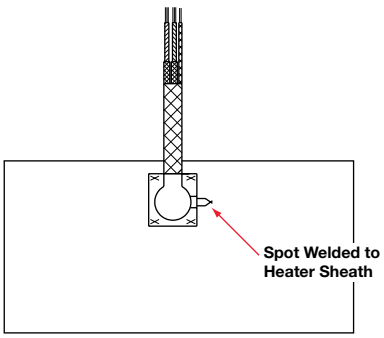
Type SLE



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.**

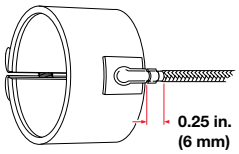
Variations

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



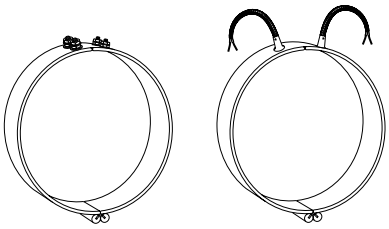
Heavy duty strain relief is recommended for applications where there is great stress or continued flexing of the leads. The strain relief is available on Type B, Type B - 90° and Type B - 180° leads only. To order, specify **heavy-duty strain relief. Note:** not available with loose braid or fiberglass sleeving.

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Mineral Insulated (MI) Band Heaters

Variations *(Continued)*

Expandable Heaters With Post Terminals or Leads

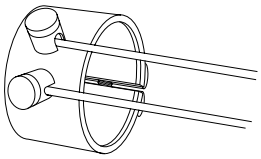


Expandable heaters are two-piece units with a common top metal allowing the heater to expand open to the full diameter of the barrel. On expandable bands, each half will be one half of the total wattage. Plus, on both expandable and two-piece bands, each half will be rated at full operating voltage, 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.

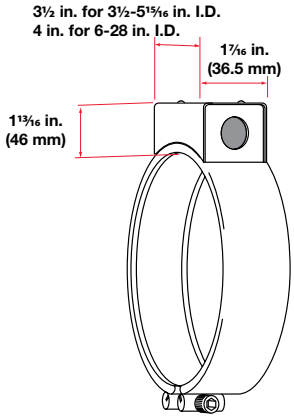
On 1 in. (25 mm) wide MI band heaters, post terminals will be located 90° from the expansion joint.

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



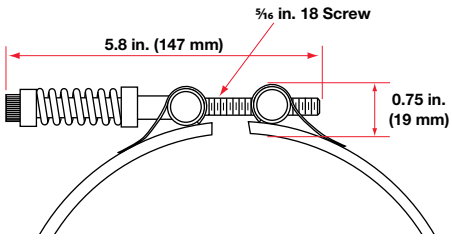
Metallic terminal boxes are available from stock on 3 1/2 in. inside diameter x 1 1/2 in. wide (89 mm x 38 mm) or larger heaters. Terminal boxes, which attach directly to the heater, act as a safety feature by covering the terminals. Conduit may be attached to the box through 7/8 in. (22 mm) diameter holes in the ends of the box. Two-piece heaters require two boxes. To order, specify **terminal box.**

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Mineral Insulated (MI) Band Heaters

Clamping Variations

Tig-Welded Barrel Nuts with Spring Loaded Clamping

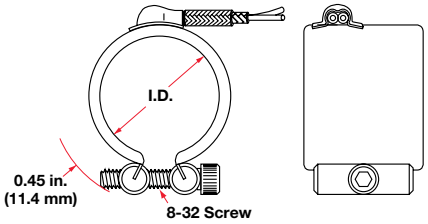


Welded barrel nuts with spring loaded clamping are used to maintain a tight heater fit on large barrels during start-up. This clamping variation is recommended for all MI band heaters greater than 14 in. (356 mm) in diameter and 1 1/2 in. (38 mm) or greater in width. Refer to *MI Band Clamping Matrix 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

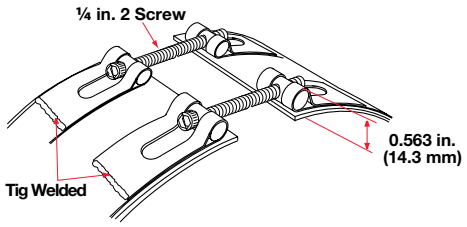
Low-profile barrel nuts are available on all widths and provide a clearance of 0.470 in. (12 mm). However, this value can be higher depending on how far the clamp screw extends past the barrel nut. To order, specify **low-profile tig-welded barrel nuts**.

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.**

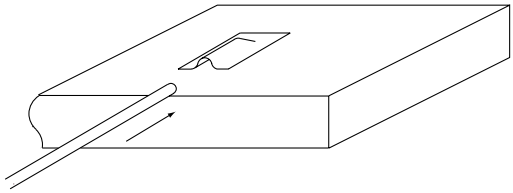
Tig-Welded Barrel Nuts



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.

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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.	I.D. (mm)	Width in.	Width (mm)	Construction	Volts	Watts	Watt Density W/in²	Watt Density (W/cm²)	Termination	Approx. Net Wt. lbs	Approx. Net Wt. (kg)	Part Number
1	(25)	1	(25)	1 pc	120	150	92	(14.2)	Type B,C,E, F or H	0.1	(0.05)	**MB1A1AN1**
		1	(25)	1 pc	120	100	61	(9.4)	Type B,C,E, F or H	0.1	(0.05)	**MB1A1AN2**
		1	(25)	1 pc	120	200	122	(18.9)	Type B,C,E, F or H	0.1	(0.05)	**MB1A1AN3**
		1	(25)	1 pc	240	200	122	(18.9)	Type B,C,E, F or H	0.1	(0.05)	**MB1A1AN4**
		1 1/2	(38)	1 pc	240	300	106	(16.4)	Type B,C,E, F or H	0.1	(0.05)	**MB1A1JN1**
		1 1/2	(38)	1 pc	120	300	106	(16.4)	Type B,C,E, F or H	0.1	(0.05)	**MB1A1JN2**
		1 1/2	(38)	1 pc	240	200	70	(10.8)	Type B,C,E, F or H	0.1	(0.05)	**MB1A1JN3**
		1 1/2	(38)	1 pc	120	200	70	(10.8)	Type B,C,E, F or H	0.1	(0.05)	**MB1A1JN4**
		1 1/2	(38)	1 pc	240	400	141	(21.8)	Type B,C,E, F or H	0.1	(0.05)	**MB1A1JN5**
1 1/4	(32)	1	(25)	1 pc	240	250	104	(16.1)	Type B,C,E, F or H	0.1	(0.05)	**MB1E1AN1**
		1	(25)	1 pc	120	250	104	(16.1)	Type B,C,E, F or H	0.1	(0.05)	**MB1E1AN2**
		1	(25)	1 pc	240	300	124	(19.2)	Type B,C,E, F or H	0.1	(0.05)	**MB1E1AN3**
		1 1/2	(38)	1 pc	240	350	87	(13.5)	Type B,C,E, F or H	0.2	(0.09)	**MB1E1JN1**
		1 1/2	(38)	1 pc	120	350	87	(13.5)	Type B,C,E, F or H	0.2	(0.09)	**MB1E1JN2**
		1 1/2	(38)	1 pc	240	450	112	(17.3)	Type B,C,E, F or H	0.2	(0.09)	**MB1E1JN3**
1 1/2	(38)	1	(25)	1 pc	240	300	93	(14.4)	Type B,C,E, F or H	0.1	(0.05)	**MB1J1AN1**
		1	(25)	1 pc	120	300	93	(14.4)	Type B,C,E, F or H	0.1	(0.05)	**MB1J1AN2**
		1	(25)	1 pc	240	200	62	(9.6)	Type B,C,E, F or H	0.1	(0.05)	**MB1J1AN3**
		1	(25)	1 pc	120	200	62	(9.6)	Type B,C,E, F or H	0.1	(0.05)	**MB1J1AN4**
		1	(25)	1 pc	240	400	125	(19.3)	Type B,C,E, F or H	0.1	(0.05)	**MB1J1AN5**
		1 1/2	(38)	1 pc	120	300	62	(9.6)	Type B,C,E, F or H	0.2	(0.09)	**MB1J1JN1**
		1 1/2	(38)	1 pc	240	450	87	(13.5)	Type B,C,E, F or H	0.2	(0.09)	**MB1J1JN2**
		1 1/2	(38)	1 pc	240	300	62	(9.6)	Type B,C,E, F or H	0.2	(0.09)	**MB1J1JN3**
		1 1/2	(38)	1 pc	240	600	116	(17.9)	Type B,C,E, F or H	0.2	(0.09)	**MB1J1JN4**
		1 1/2	(38)	1 pc	240	300	62	(9.6)	Post	0.2	(0.09)	**MB1J1JP4**
		1 1/2	(38)	1 pc	240	450	96	(14.8)	Post	0.2	(0.09)	**MB1J1JP6**
		2	(51)	1 pc	240	450	57	(8.8)	Type B,C,E, F or H	0.3	(0.14)	**MB1J2AN1**
		2	(51)	1 pc	240	300	42	(6.5)	Type B,C,E, F or H	0.3	(0.14)	**MB1J2AN2**
		2	(51)	1 pc	240	900	125	(19.3)	Type B,C,E, F or H	0.3	(0.14)	**MB1J2AN3**
		3	(76)	1 pc	240	500	45	(7.0)	Type B,C,E, F or H	0.4	(0.18)	**MB1J3AN1**
		3	(76)	1 pc	240	350	31	(4.8)	Type B,C,E, F or H	0.4	(0.18)	**MB1J3AN2**
		3	(76)	1 pc	240	1000	104	(16.1)	Type B,C,E, F or H	0.4	(0.18)	**MB1J3AN3**
1 3/4	(45)	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)	**MB1N1GX3A**
		1 1/2	(38)	1 pc	240	300	47	(7.3)	Type B,C,E, F or H	0.2	(0.09)	**MB1N1JN1**
		1 1/2	(38)	1 pc	120	300	50	(7.7)	Type B,C,E, F or H	0.2	(0.09)	**MB1N1JN2**
		1 1/2	(38)	1 pc	240	700	110	(17.0)	Type B,C,E, F or H	0.2	(0.09)	**MB1N1JN3**
		2	(51)	1 pc	240	750	86	(13.3)	Type B,C,E, F or H	0.3	(0.14)	**MB1N2AN1**
2	(51)	1	(25)	1 pc	240	350	73	(11.3)	Type B,C,E, F or H	0.2	(0.09)	**MB2A1AN1**
		1	(25)	1 pc	120	350	73	(11.3)	Type B,C,E, F or H	0.2	(0.09)	**MB2A1AN2**
		1	(25)	1 pc	240	450	94	(14.5)	Type B,C,E, F or H	0.2	(0.09)	**MB2A1AN3**
		1	(25)	1 pc	240	350	73	(10.3)	36 in. 90° Type B braid w/HD strain relief	0.2	(0.09)	**MB2A1AX6B**

CONTINUED

Notes:
All lead units are available with any length Type B, C, E, F or Type H leads.

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Mineral Insulated (MI) Band Heaters

Heater Part Numbers *(Continued)*

I.D. in.	I.D. (mm)	Width in.	Width (mm)	Construction	Volts	Watts	Watt Density W/in²	Watt Density (W/cm²)	Termination	Approx. Net Wt. lbs	Approx. Net Wt. (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)	**MB2A1JN1**
		1 1/2	(38)	1pc	240	1000	132	(20.4)	Type B,C,E, F or H	0.3	(0.14)	**MB2A1JN2**
		2	(51)	1pc	240	750	75	(11.6)	Type B,C,E, F or H	0.4	(0.18)	**MB2A2AN1**
		2	(51)	1pc	240	1200	125	(19.3)	Type B,C,E, F or H	0.4	(0.18)	**MB2A2AN2**
		2	(51)	1pc	240	750	75	(11.6)	36 in. 90° Type B braid w/HD strain relief	0.2	(0.09)	**MB2A2AX2A**
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)	**MB2E2AX7**
		2 1/2	(64)	1 pc	240	1000	72	(11.2)	Type B,C,E, F or H	0.5	(0.23)	**MB2E2JN1**
2 1/2	(64)	1	(25)	1 pc	240	400	63	(9.7)	Type B,C,E, F or H	0.2	(0.09)	**MB2J1AN1**
		1 1/2	(38)	1 pc	240	500	50	(7.7)	Type B,C,E, F or H	0.4	(0.18)	**MB2J1JN1**
3	(76)	1	(25)	1 pc	240	400	54	(8.4)	Post	0.3	(0.14)	**MB3A1AP1**
		1 1/2	(38)	1 pc	240	500	40	(6.2)	Post	0.4	(0.18)	**MB3A1JP1**
		1 1/2	(38)	2 pc exp	230/460	525	53	(8.2)	Post	0.4	(0.18)	**ME3A1JP10**
3 1/2	(89)	2	(51)	1 pc	240	800	42	(6.5)	Post	0.7	(0.32)	**MB3J2AP2**
3 5/8	(92)	1 1/2	(38)	2 pc exp	230/460	650	51	(7.9)	Post	0.5	(0.23)	**ME3L1JP5**
4	(102)	1	(25)	1 pc	240	700	62	(9.6)	Post	0.4	(0.18)	**MB4A1AP1**
		1 1/2	(38)	1 pc	240	800	48	(7.4)	Post	0.6	(0.27)	**MB4A1JP2**
		1 1/2	(38)	2 pc exp	230/460	625	43	(6.7)	Post	0.6	(0.27)	**ME4A1JP11**
		1 1/2	(38)	2 pc exp	230/460	725	50	(7.8)	Post	0.6	(0.27)	**ME4A1JP12**
4 1/2	(114)	2 1/2	(64)	1pc	240	1250	40	(6.2)	Post	1.0	(0.45)	**MB4J2JP1**
5	(127)	1 1/2	(38)	2 pc exp	240/480	1000	52	(8.1)	Post	0.8	(0.36)	**ME5A1JP8**
5 1/4	(133)	1 1/2	(38)	2 pc exp	240/480	1000	48	(7.4)	Post	0.8	(0.36)	**ME5E1JP1**
		1 1/2	(38)	2 pc exp	230/460	600	29	(4.5)	Post	0.7	(0.32)	**ME5E1JP9**
		3	(76)	2 pc exp	230/460	1700	40	(6.2)	Post	1.5	(0.68)	**ME5E3AP5**
		4 1/2	(114)	2 pc exp	230/460	2400	38	(5.9)	Post	2.2	(1.00)	**ME5E4JP2**
		4 1/2	(114)	2 pc exp	230/460	2700	43	(6.6)	Post	2.2	(1.00)	**ME5E4JP3**
5 1/2	(140)	1 1/2	(38)	2 pc exp	240/480	1000	46	(7.1)	Post	0.9	(0.40)	**ME5J1JP1**
6	(152)	1 1/2	(38)	2 pc exp	240/480	1000	41	(6.4)	Post	0.9	(0.40)	**ME6A1JP2**
6 1/2	(165)	1 1/2	(38)	2 pc exp	240/480	1250	47	(7.3)	Post	1.0	(0.45)	**ME6J1JP5**
6 3/4	(171)	1 1/2	(38)	2 pc exp	230/460	815	29	(4.5)	Post	0.9	(0.40)	**ME6N1JP6**
		1 1/2	(38)	2 pc exp	230/460	1000	36	(5.6)	Post	0.9	(0.40)	**ME6N1JP7**
		4	(102)	2 pc exp	230/460	2600	35	(5.4)	Post	2.5	(1.10)	**ME6N4AP2**
		5	(127)	2 pc exp	230/460	3700	40	(6.2)	Post	3.2	(1.50)	**ME6N5AP3**
		6	(152)	2 pc exp	230/460	3750	33	(5.1)	Post	3.8	(1.70)	**ME6N6AP5**
7	(178)	1 1/2	(38)	2 pc exp	240/480	1250	43	(6.6)	Post	1.1	(0.50)	**ME7A1JP4**
7 1/2	(191)	1 1/2	(38)	2 pc exp	240/480	1500	47	(7.3)	Post	1.1	(0.50)	**ME7J1JP4**
7 5/8	(194)	3	(76)	2 pc exp	230/460	1800	28	(4.3)	Post	2.2	(1.00)	**ME7L3AP1**
8	(203)	1 1/2	(38)	2 pc exp	240/480	1250	37	(5.7)	Post	1.2	(0.54)	**ME8A1JP4**
9	(229)	1 1/2	(38)	2 pc exp	240/480	1500	39	(6.0)	Post	1.4	(0.64)	**ME9A1JP1**
9 1/2	(241)	3	(76)	2 pc exp	230/460	3000	37	(5.7)	Post	2.6	(1.20)	**ME9J3AP2**
11 1/4	(286)	3	(76)	2 pc exp	230/460	2400	24	(3.7)	Post	3.2	(1.50)	**ME11E3AP2**
		5	(127)	2 pc exp	230/460	5100	31	(4.8)	Post	5.2	(2.40)	**ME11E5AP1**

Notes:
All lead units are available with any length Type B, C, E, F or Type H leads.

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Nozzle Heaters

Nozzle Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
Mineral Insulated (MI)	Stainless steel	1400	760	230	35.6	497



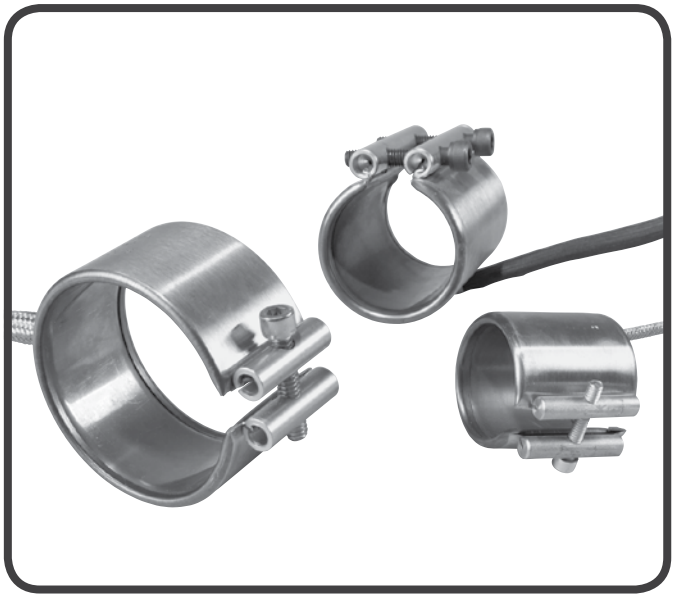
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Mineral Insulated (MI) Nozzle Heaters

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^2 (35.6 W/cm^2) 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.

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Mineral Insulated (MI) Nozzle Heaters

Heater Part Numbers

I.D. in.	I.D. (mm)	Width in.	Width (mm)	Construction	Volts	Watts	Watt Density W/in²	Watt Density (W/cm²)	Termination	Approx. Net Wt. lbs.	Approx. Net Wt. (kg)	Part Number
1	(25)	1	(25)	1 pc	120	150	92	(14)	Type B, C, E, F or H	0.1	(0.05)	**MB1A1AN1**
		1	(25)	1 pc	120	100	61	(9)	Type B, C, E, F or H	0.1	(0.05)	**MB1A1AN2**
		1	(25)	1 pc	120	200	122	(19)	Type B, C, E, F or H	0.1	(0.05)	**MB1A1AN3**
		1	(25)	1 pc	240	200	122	(19)	Type B, C, E, F or H	0.1	(0.05)	**MB1A1AN4**
		1 1/2	(38)	1 pc	240	300	106	(16)	Type B, C, E, F or H	0.1	(0.05)	**MB1A1JN1**
		1 1/2	(38)	1 pc	120	300	106	(16)	Type B, C, E, F or H	0.1	(0.05)	**MB1A1JN2**
		1 1/2	(38)	1 pc	240	200	70	(11)	Type B, C, E, F or H	0.1	(0.05)	**MB1A1JN3**
		1 1/2	(38)	1 pc	120	200	70	(11)	Type B, C, E, F or H	0.1	(0.05)	**MB1A1JN4**
		1 1/2	(38)	1 pc	240	400	141	(22)	Type B, C, E, F or H	0.1	(0.05)	**MB1A1JN5**
1 1/4	(32)	1	(25)	1 pc	240	250	104	(16)	Type B, C, E, F or H	0.1	(0.05)	**MB1E1AN1**
		1	(25)	1 pc	120	250	104	(16)	Type B, C, E, F or H	0.1	(0.05)	**MB1E1AN2**
		1	(25)	1 pc	240	300	124	(19)	Type B, C, E, F or H	0.1	(0.05)	**MB1E1AN3**
		1 1/2	(38)	1 pc	240	350	87	(13)	Type B, C, E, F or H	0.2	(0.09)	**MB1E1JN1**
		1 1/2	(38)	1 pc	120	350	87	(13)	Type B, C, E, F or H	0.2	(0.09)	**MB1E1JN2**
		1 1/2	(38)	1 pc	240	450	112	(17)	Type B, C, E, F or H	0.2	(0.09)	**MB1E1JN3**
1 1/2	(38)	1	(25)	1 pc	240	300	93	(14)	Type B, C, E, F or H	0.1	(0.05)	**MB1J1AN1**
		1	(25)	1 pc	120	300	93	(14)	Type B, C, E, F or H	0.1	(0.05)	**MB1J1AN2**
		1	(25)	1 pc	240	200	62	(10)	Type B, C, E, F or H	0.1	(0.05)	**MB1J1AN3**
		1	(25)	1 pc	120	200	62	(10)	Type B, C, E, F or H	0.1	(0.05)	**MB1J1AN4**
		1	(25)	1 pc	240	400	125	(19)	Type B, C, E, F or H	0.1	(0.05)	**MB1J1AN5**
		1 1/2	(38)	1 pc	120	300	58	(9)	Type B, C, E, F or H	0.2	(0.09)	**MB1J1JN1**
		1 1/2	(38)	1 pc	240	450	87	(14)	Type B, C, E, F or H	0.2	(0.09)	**MB1J1JN2**
		1 1/2	(38)	1 pc	240	300	58	(9.0)	Type B, C, E, F or H	0.2	(0.09)	**MB1J1JN3**
		1 1/2	(38)	1 pc	240	600	116	(18)	Type B, C, E, F or H	0.2	(0.09)	**MB1J1JN4**
		1 1/2	(38)	1 pc	240	300	64	(10)	Post	0.2	(0.09)	**MB1J1JP4**
		1 1/2	(38)	1 pc	240	450	96	(15)	Post	0.2	(0.09)	**MB1J1JP6**
		2	(51)	1 pc	240	450	57	(9)	Type B, C, E, F or H	0.3	(0.14)	**MB1J2AN1**
		2	(51)	1 pc	240	300	42	(7)	Type B, C, E, F or H	0.3	(0.14)	**MB1J2AN2**
		2	(51)	1 pc	240	900	125	(19)	Type B, C, E, F or H	0.3	(0.14)	**MB1J2AN3**
		3	(76)	1 pc	240	500	45	(7)	Type B, C, E, F or H	0.4	(0.18)	**MB1J3AN1**
		3	(76)	1 pc	240	350	31	(5)	Type B, C, E, F or H	0.4	(0.18)	**MB1J3AN2**
		3	(76)	1 pc	240	1000	104	(16)	Type B, C, E, F or H	0.4	(0.18)	**MB1J3AN3**
1 3/4	(45)	1 3/8	(35)	1 pc	240	450	83	(13)	36 in. 90° Type B braid w/HD strain relief	0.2	(0.09)	**MB1N1GX3A**
		1 1/2	(38)	1 pc	240	300	47	(7)	Type B, C, E, F or H	0.2	(0.09)	**MB1N1JN1**
		1 1/2	(38)	1 pc	120	300	50	(8)	Type B, C, E, F or H	0.2	(0.09)	**MB1N1JN2**
		1 1/2	(38)	1 pc	240	700	110	(17)	Type B, C, E, F or H	0.2	(0.09)	**MB1N1JN3**
		2	(51)	1 pc	240	750	86	(13)	Type B, C, E, F or H	0.3	(0.14)	**MB1N2AN1**
2	(51)	1	(25)	1 pc	240	350	73	(11)	Type B, C, E, F or H	0.2	(0.09)	**MB2A1AN1**
		1	(25)	1 pc	120	350	73	(11)	Type B, C, E, F or H	0.2	(0.09)	**MB2A1AN2**
		1	(25)	1 pc	240	450	94	(15)	Type B, C, E, F or H	0.2	(0.09)	**MB2A1AN3**
		1	(25)	1 pc	240	350	79	(12)	36 in. 90° Type B braid w/HD strain relief	0.2	(0.09)	**MB2A1AX6B**
		1 1/2	(38)	1 pc	240	400	53	(8)	Type B, C, E, F or H	0.3	(0.14)	**MB2A1JN1**
		1 1/2	(38)	1 pc	240	1000	132	(21)	Type B, C, E, F or H	0.3	(0.14)	**MB2A1JN2**
		2	(51)	1 pc	240	750	73	(11)	Type B, C, E, F or H	0.4	(0.18)	**MB2A2AN1**
		2	(51)	1 pc	240	1200	125	(19)	Type B, C, E, F or H	0.4	(0.18)	**MB2A2AN2**
		2	(51)	1 pc	240	750	75	(12)	36 in. 90° Type B braid w/HD strain relief	0.2	(0.09)	**MB2A2AX2A**
2 1/4	(57)	2	(51)	1 pc	240	750	63	(10)	120 in. 180° Type B braid w/HD strain relief	0.2	(0.09)	**MB2E2AX7**
		2 1/2	(64)	1 pc	240	1000	72	(11)	Type B, C, E, F or H	0.5	(0.23)	**MB2E2JN1**
2 1/2	(64)	1	(25)	1 pc	240	400	63	(10)	Type B, C, E, F or H	0.2	(0.09)	**MB2J1AN1**
		1 1/2	(38)	1 pc	240	500	50	(8)	Type B, C, E, F or H	0.4	(0.18)	**MB2J1JN1**

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Radiant Heaters

Radiant Heaters	Sheath Materials	Max. Operating Temperatures °F	°C	Typical Max. Watt Densities W/in²	W/cm²	Page
RAYMAX® Panel	Stainless steel/ Alumized steel	2000	1095	30	4.7	501



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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^2 (4.7 W/cm^2)

Features and Benefits

Variety of styles

- Match the ideal temperature and watt density requirements of the application

Watlow engineering and application support

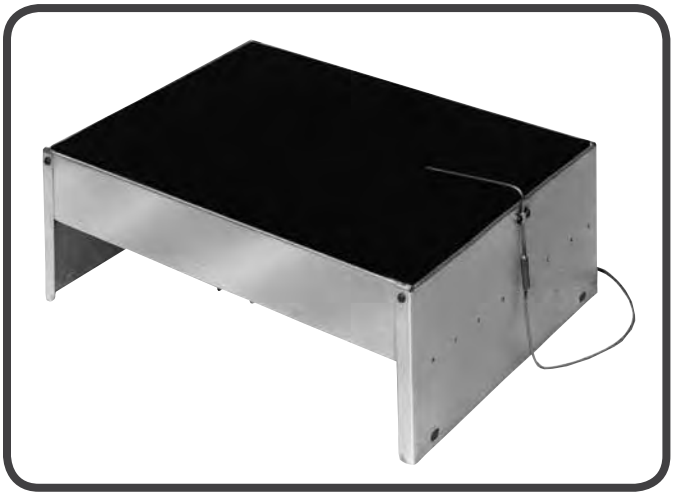
- Assures projects run smoothly

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.

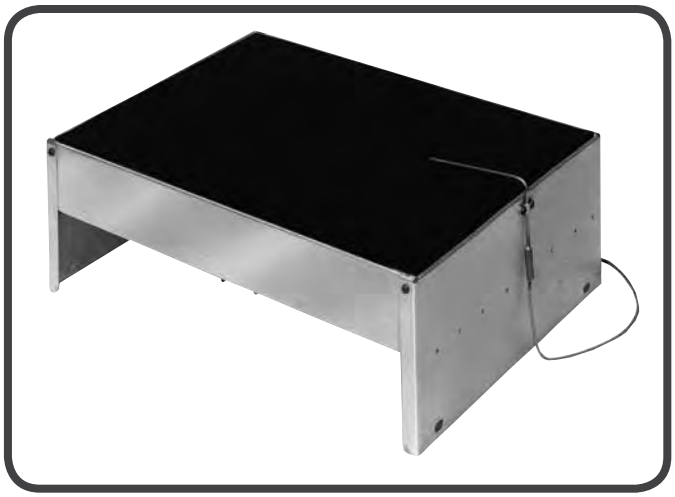
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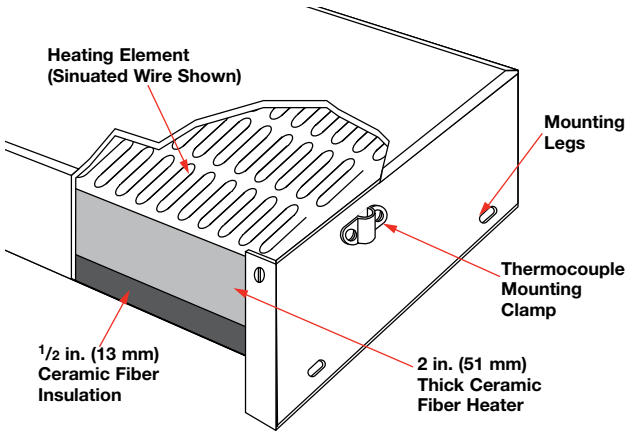
RAYMAX Panel Heaters

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 2 1/2 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^2 (4.7 W/cm^2)
- RAYMAX 1220 (uses an etched foil element): temperatures up to 1200°F (650°C); watt densities up to 20 W/in^2 (3 W/cm^2)
- Maximum voltage up to 600V

Features and Benefits

Lightweight, low mass design
- Allows fast response to controllers

Self insulation with 2 1/2 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

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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 1/8 in. (3.2 mm) outside diameter sheath thermocouples. The clamp is 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.

* 13/16 in. (4.8 mm) and 1/4 in. (6 mm) are available upon request.

Specifications

Weight: Under 6.5 lbs/ft^2 (31.75 kg/m^2)

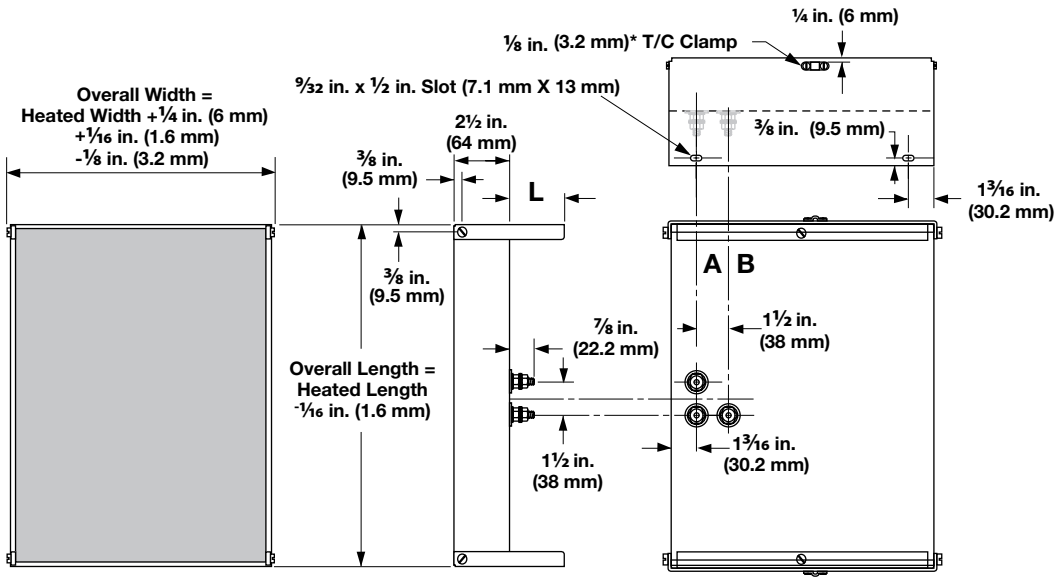
Voltage and Wattage: Ratings are based on the ceramic fiber heater module mounted inside of the case. Up to 600VAC is possible.

Terminals: Terminals are 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 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 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

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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/in²	(W/cm²)	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**①
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.

① Thermocouple clasp is not included in the length.

RAYMAX 2030

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/in²	(W/cm²)	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** ①
		18	(457)	120	1400	19.4	(3.0)	4.1	(1.9)	**VP504A18T** ①
		24	(610)	240	1850	19.5	(3.0)	5.2	(2.4)	**VP504A24T** ①
		30	(762)	240	2250	19.6	(3.1)	6.3	(2.9)	**VP504A30T** ①
		36	(914)	240	3200	22.2	(3.4)	7.4	(3.3)	**VP504A36T** ①
6	(152)	6	(152)	60	650	18.1	(2.8)	2.4	(1.1)	**VP506A06T** ①
		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**
		36	(914)	240	4000	18.5	(2.9)	10.6	(4.8)	**VP506A36T**
8	(203)	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** ①
		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**
		36	(914)	240	6000	20.8	(3.2)	13.9	(6.3)	**VP508A36T**
10	(254)	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.

①Vee sinuated

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RAYMAX Panel Heaters

RAYMAX 2030 *(Continued)*

Ceramic Fiber with Sinuated Element

Nominal Heated Width in.	(mm)	Nominal Heated Length in.	(mm)	Volts	Watts	Watt Density W/in²	(W/cm²)	Approx. Net Wt. lbs	(kg)	Part Number
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**①
		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**①
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**①
		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	(4.3)	**VP516A12T**
		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.

①Vee sinuated

Part Number

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩ Modification Options	⑪	⑫	⑬	⑭
V	P	5	0	8	A	1	2	T		0	0	0	0

①②③④⑤⑥⑦⑧⑨ 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

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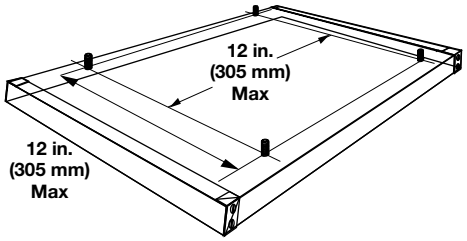
RAYMAX Panel Heaters

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.

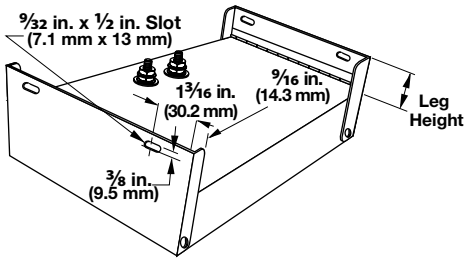


Mounting Legs

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.

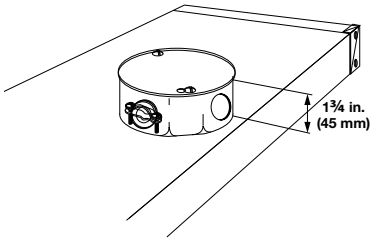
Available with RAYMAX 1220 and 2030



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

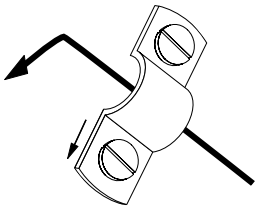


To protect electrical connections, a standard NEMA octagon terminal box is available. The standard size is 3 9/16 x 3 9/16 x 1 1/2 in. (90.5 x 90.5 x 38 mm) with knockouts for 1/2 in. (13 mm) conduit. Other NEMA sizes are available as an extended capability.

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.

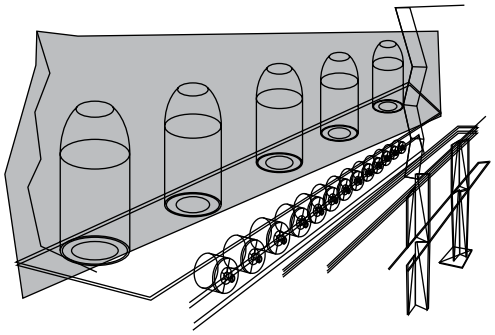
Available with RAYMAX 1220 and 2030.

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EXTENDED CAPABILITY

Extended Capabilities for RAYMAX Panel Heaters

Zoning

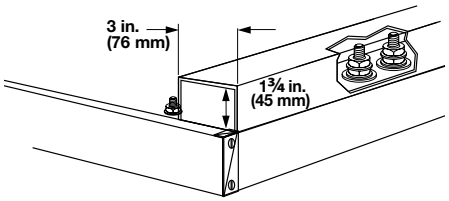


Watt densities can be varied across the entire width of RAYMAX heaters. If desired, each zone can have an individually controlled power supply.

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.

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Thermostats and Accessories

Thermostats and Accessories	Description	Page
ST10 and ST207	Pre-set thermostats used with flexible heaters are available mounted to the heater or as a separate device used to control process.	511
Bulb and Capillary	Regulates temperature in non-critical applications within a preset range and cycles heaters on and off.	514
Protective Wells	Provides protection for thermostat bulbs and other sensors while directly immersed in process fluids.	519

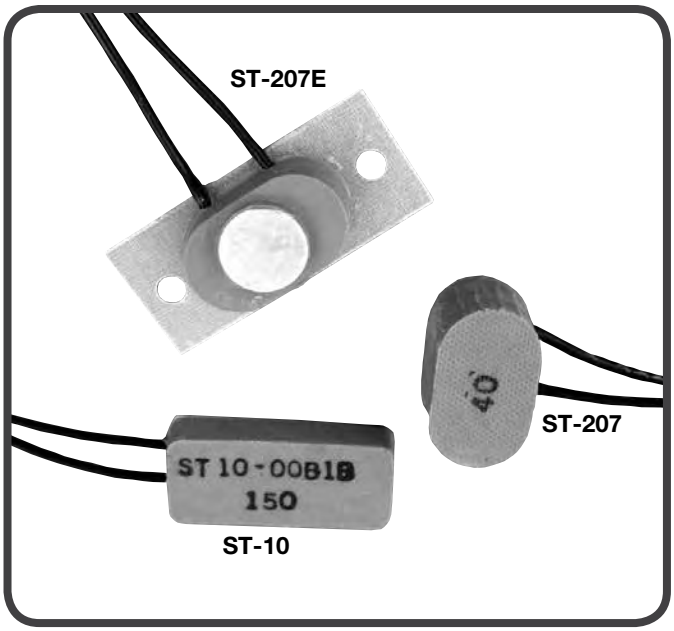


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ST10 and ST207

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.

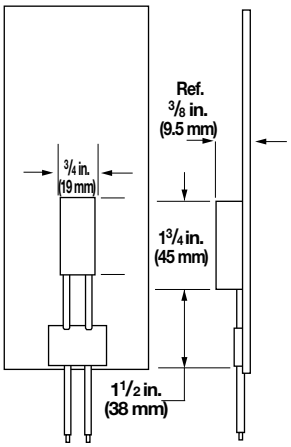


Pre-Set Thermostats

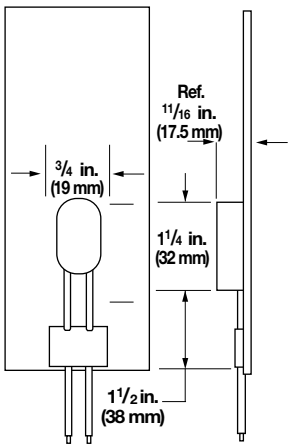
Several styles of non-adjustable, pre-set thermostats are available from Watlow. Thermostats separate from the heater are encapsulated in silicone rubber, and are available with standard 12 in. (305 mm) leads unless otherwise specified.

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.

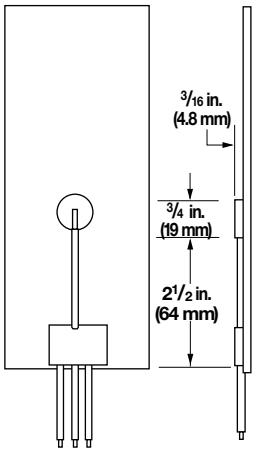
Note: Precise part temperature control with preset thermostats requires prototyping and field testing.



T-10



T-207



Thermocouple

Pre-Set Thermostats (Non-Adjustable)

Thermostat Model	Maximum Watts	Volts AC	Temperature Settings Available °F (°C)	Agency Approvals		
				UR	cUR	VDE
T-10	600/960	120/240	125-300±10 (50-149±5)	yes	yes	yes
T-207	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.

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ST10 and ST207

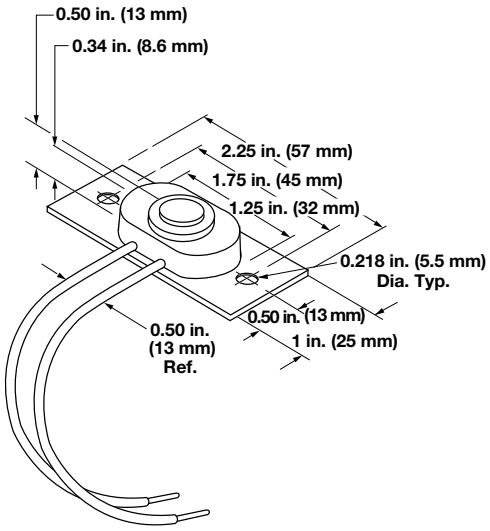
Temperature Sensors (Continued)

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 1/32 inch thick G-10 circuit board with the thermostat’s metal cap exposed to sense air temperature.

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ST10 and ST207

Thermostat Ordering Information

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

Tstat Part #- 0 0

Tstat Part #
ST10
ST207
ST207E (sense air)

Options
0 = None

Sensors
0 = None

T10 Set °F
A = 125
B = 150
E = 175
F = 200
G = 225
H = 250
J = 275
K = 300

T207 Set °F
1 = 40/55
2 = 60/75
3 = 95/110
4 = 145/160

Lead Insulation
1 = 1180 UL® R/C
2 = 1180 C-UL® R/C
4 = 3134 18 Ga.
6 = 1199 CSA
9 = Type E PTFE
A = 1180 VDE
B = 1199 VDE

Standard lead for T207 is 16 Ga. black.
Standard lead for T10 is 22 Ga. black.

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.

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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

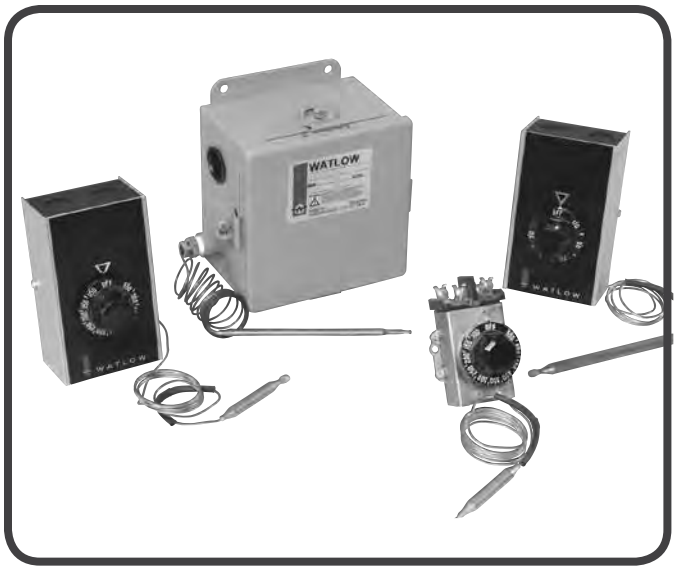
Kits are available to convert a heater's general purpose terminal enclosure to accept either a single- or double-pole thermostat. The kit contains all the necessary parts to change out the existing terminal enclosure cover and mount the thermostat inside. These are **hardware and wiring kits** only.

Single-pole conversion kits are for 1, 1 1/4 , 2 and 2 1/2 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 1/2 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
K492-000-35-2	K492-000-34-4
K492-000-35-2A	K492-000-34-5A
K492-000-35-3	K492-000-34-7A
K492-000-35-3A	
K492-000-35-12A	

① Double-pole conversion kits not available for 2 1/2 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.

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Bulb and Capillary

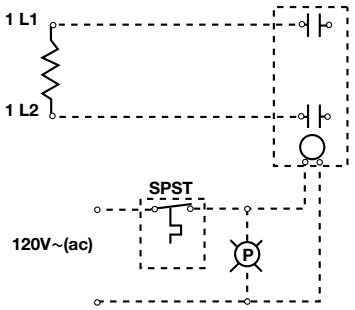
Technical Information

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.

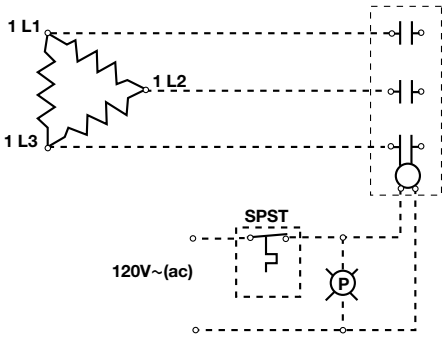
Pilot Duty Wiring

SPST, 1-phase

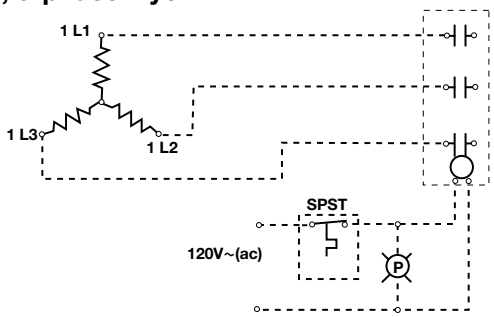


Pilot Duty Wiring *(Continued)*

SPST, 3-phase delta

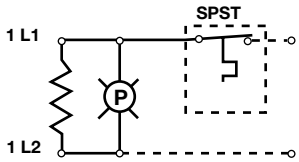


SPST, 3-phase wye

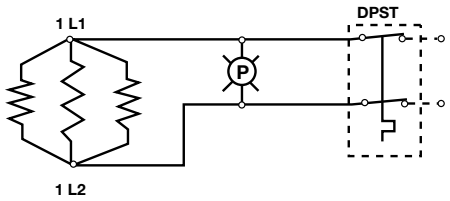


Interconnected Wiring

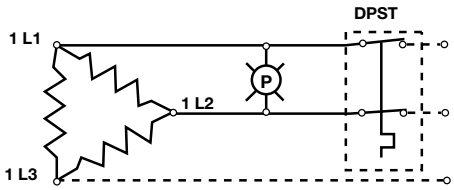
SPST, 1-phase



DPST, 1-phase



DPST, 3-phase delta



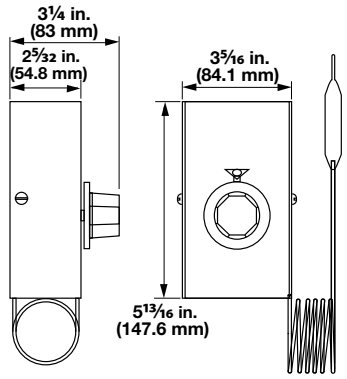
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Bulb and Capillary

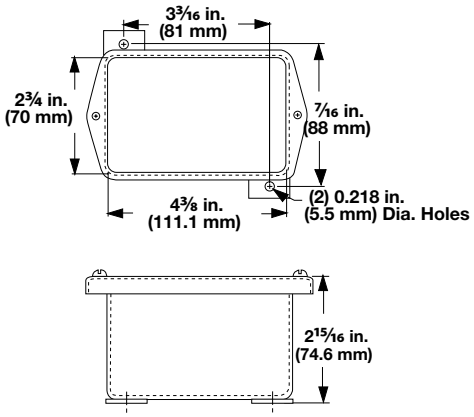
Technical Information *(Continued)*

Thermostats with Enclosures

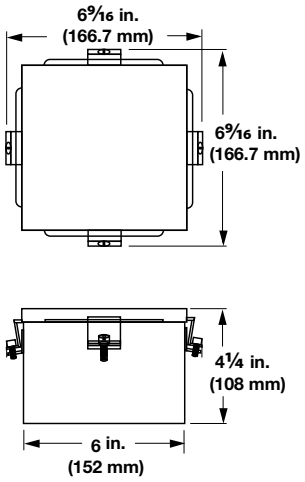
General Purpose Single- and Double-Pole



Moisture Resistant Single-Pole



Moisture Resistant Double-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		

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Bulb and Capillary

Technical Information *(Continued)*

Thermostats

Control Mode	Type	Temperature Range °F	(°C)	Differential °F	(°C)	Ampacity @ Line Voltage 120	240	277	480	Bulb Diameter in.	(mm)	Bulb Length in.	(mm)	Capillary Length in.	(mm)	Terminal Type	Part No.	Est. Net Wt. lbs	(kg)
On-off Temp Control	Single-Pole Single-Throw (SPST)	30-250	(0-120)	13	(7)	25	25	22	—	0.250	(6)	3 1/2	(89)	18	(455)	#12 AWG Stranded Leads or #8-32 screw lug	**2**	1	(0.4)
		30-250	(0-120)	13	(7)	25	25	22	—	0.250	(6)	3 1/4	(85)	84	(2135)		**2A**	1	(0.4)
		175-550	(80-290)	23	(13)	25	25	22	—	0.250	(6)	2 3/4	(70)	18	(455)		**3**	1	(0.4)
		175-550	(80-290)	23	(13)	25	25	22	—	0.250	(6)	2 3/4	(70)	84	(2135)		**3A**	1	(0.4)
		60-160	(15-70)	19	(10)	30	30	30	20	0.250	(6)	4 3/8	(110)	14	(355)	#8-32	**12A**	1	(0.4)
On-off Temp Control	Double-Pole Single-Throw (DPST)	30-110	(0-40)	12	(7)	30	30	30	10	0.375	(10)	6 9/16	(167)	36	(915)	Screw Lug	**4**	2	(0.9)
		60-250	(15-120)	12	(7)	30	30	30	10	0.250	(6)	6 1/2	(165)	48	(1220)		**5A**	2	(0.9)
		100-550	(40-290)	22	(12)	30	30	30	10	0.250	(6)	7 1/16	(179)	48	(1220)		**7A**	2	(0.9)
On-off with Manual Reset	(SPST)	350 ⑨	(180)	—		30	30	20	—	0.250	(6)	3 1/2	(90)	36	(915)	#10-32 Screw Lug	**11**	1	(0.4)

⑨ Fixed temperature rating

Note: All thermostats certified by UL® and/or CSA for use in the United States and Canada.

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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 (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

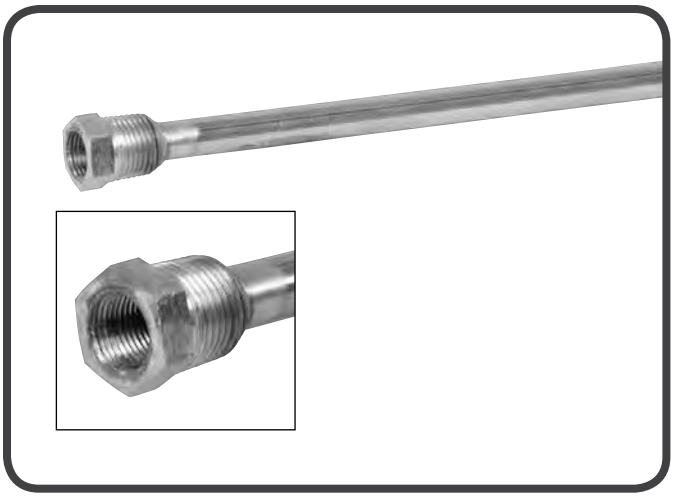
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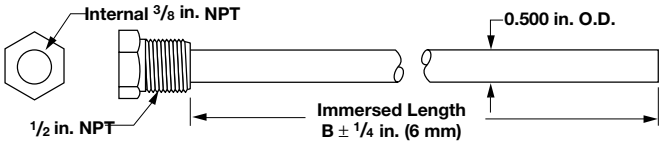
Protective Wells

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 in.	(mm)	Part Number	Est. Ship. Wt. lb	(kg)
Steel	12	(305)	**PWS12**	1	(0.5)
	24	(610)	**PWS24**	2	(1.0)
	36	(915)	**PWS36**	2	(1.0)
Stainless Steel	12	(305)	**PWSS12**	1	(0.5)
	24	(610)	**PWSS24**	2	(1.0)
	36	(915)	**PWSS36**	2	(1.0)

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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

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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 = $(P_A + P_C + {}^2/_3\ P_L)\times(1+S.F.)$

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))
- ΔT = temperature rise of material (T_{Final} - $T_{Initial}$) (°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./(ft²•°F •hr))
- A = surface area (ft²)
- ΔT = temperature differential to ambient (°F)
- d = thickness of material (in.)

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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 $\mathbf{C_p}$, 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))

ΔT = 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?

$$Q = \frac{w \times C_p \times \Delta T}{3.412}$$

$$= \frac{(50 \text{ lb}) \times (0.10 \text{ BTU/[lb•°F]}) \times (60°F)}{3.412} = 88 \text{ (Wh)}$$

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 $\mathbf{H_f}$. Another state change is involved in vaporization and condensation. The latent heat of vaporization $\mathbf{H_v}$ 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?

$$Q = \frac{w \times H_f}{3.412}$$

$$= \frac{(50 \text{ lbs}) \times (9.8 \text{ BTU/lb})}{3.412 \text{ BTU/(Wh)}} = 144 \text{ (Wh)}$$

Changing state (melting and vaporizing) is a constant temperature process. The $\mathbf{C_p}$ 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.

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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./[ft² x °F x hour])

A = heat transfer surface area (ft²)

L = thickness of material (in.)

ΔT = 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 (in²)

F_{SL} = vertical surface convection loss factor (W/in²) 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 (in²)

F_{SL} = blackbody radiation loss factor at surface temperature (W/in²) (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/in². Polished aluminum, in contrast, (e = 0.09) only has heat losses of 0.27 W/in² at the same temperature (2.95 W/in² · 0.09 = 0.27 W/in²).

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 (in²)

F_{SL} = combined surface loss factor at surface temperature (W/in²) (see pages 529 and 531, Reference 1, 2, 5, 6 and 7).

This equation assumes a constant surface temperature.

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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)

$$P_s = \frac{Q_A + Q_C + {}^2/_3 Q_L}{t_S} (1 + S.F.)$$

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 ${}^2/_3$.

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)

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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

$$\frac{P_R}{A} = \frac{\sigma\ (T_1^4 - T_2^4)\left(\frac{1}{e_f}\right) F}{(144\ in^2/ft^2)\quad (3.412\ BTU/Wh)}$$

P_R = power absorbed by the load (w) - from equation 4 or 5

A = area of heater (in^2) - known or assumed

σ = Stephan Boltzman constant

= $0.1714 \cdot 10^{-8}$ (BTU/hr. sq. ft. $°R^4$)

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)

$$e_f = \frac{1}{e_S} + \frac{1}{e_L} - 1$$ plane surfaces

$$e_f = \frac{1}{e_S} + \frac{D_S}{D_L}\left(\frac{1}{e_L} - 1\right)$$ concentric cylinders inner radiating outward

$$e_f = \frac{1}{e_S} + \left(\frac{D_S}{D_L} \times \frac{1}{e_L}\right) - 1$$ concentric cylinders outer radiating inward

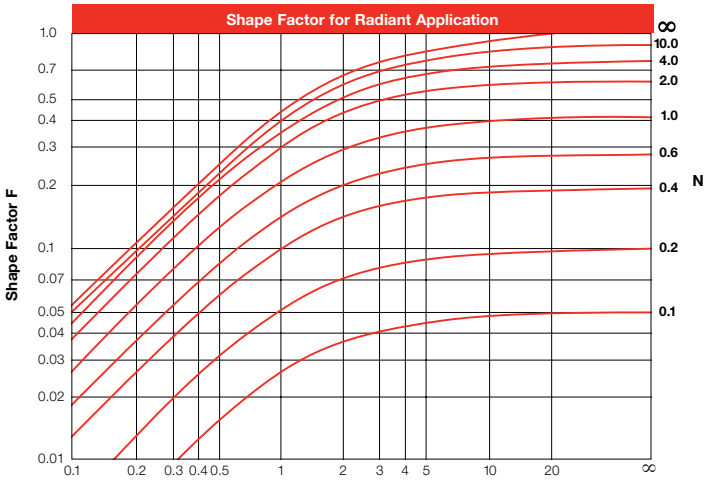
e_S = heater emissivity (from material emissivity tables)

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:

$$\mathbf{N} = \left(\frac{\text{Heated Length}}{\text{Distance to Material}}\right)$$

$$\mathbf{M} = \left(\frac{\text{Heated Width}}{\text{Distance to Material}}\right)$$

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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.

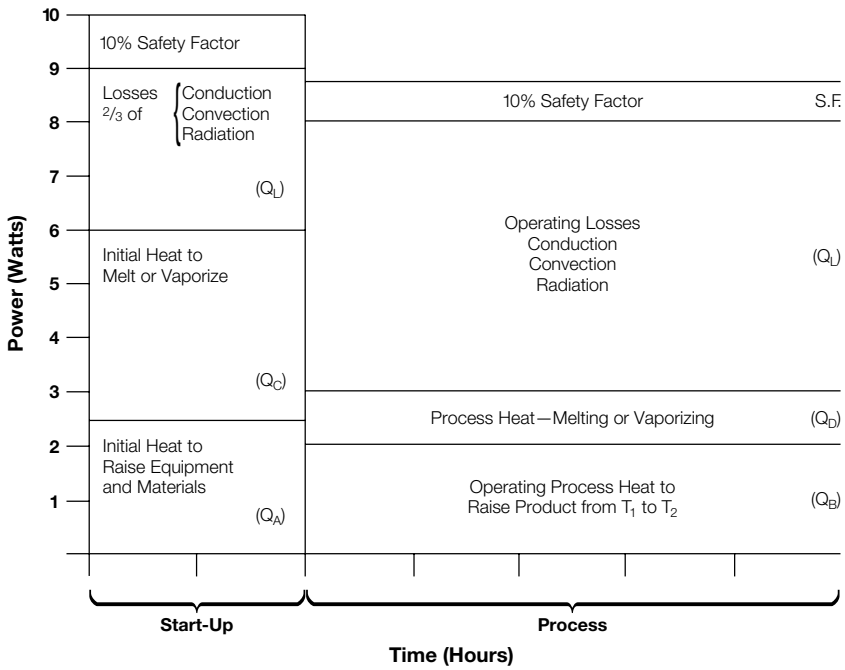
Shown in the graph below are the start up and operating watts displayed in a graphic format to help you see how power requirements add up.

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



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Power Calculations

Heat Loss Curves

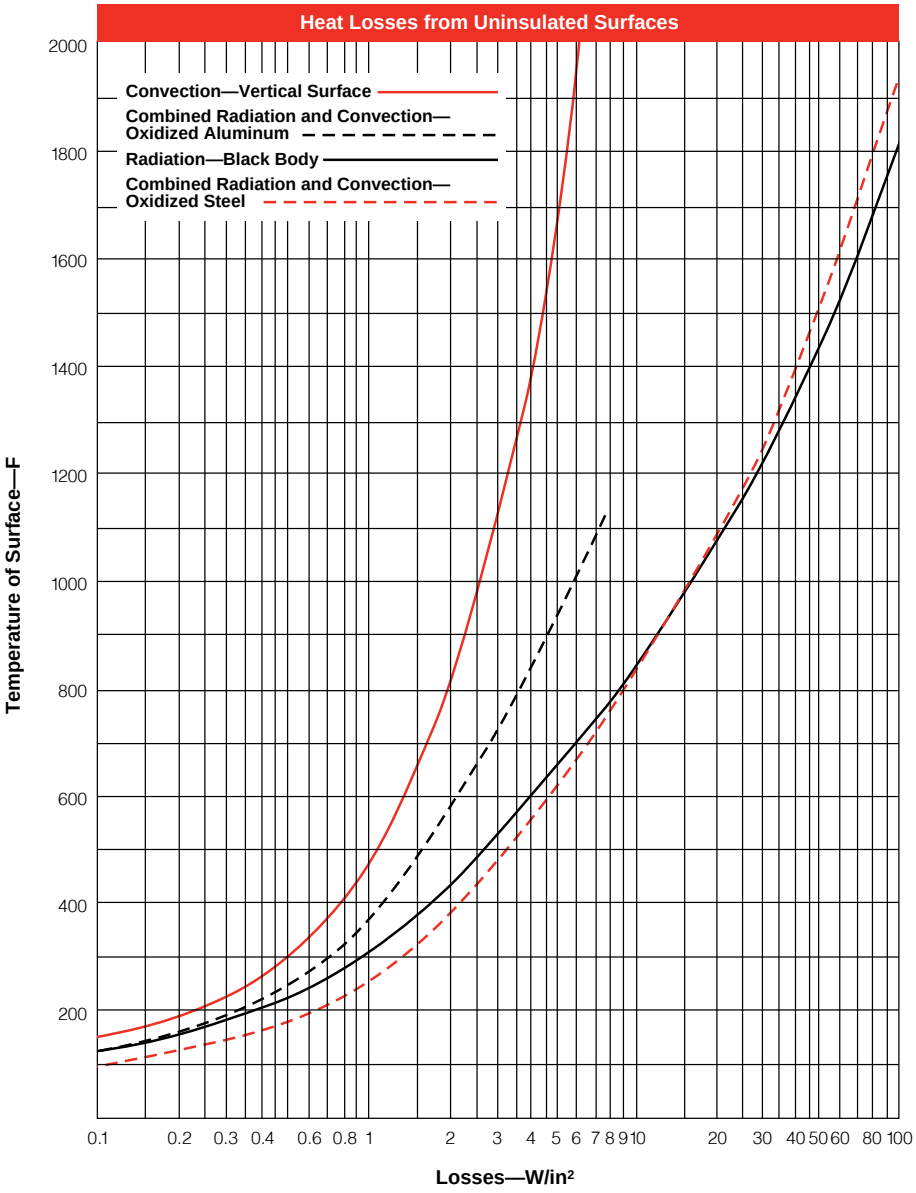
Ref. 1—Convection curve correction factors:

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

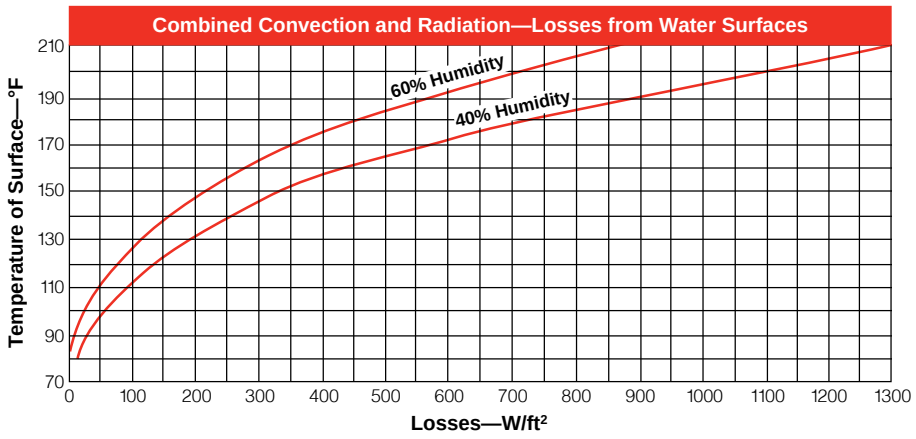
Radiation Curve Correction Factors

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 (e) values listed on page 530.

Ref. 1



Ref. 2



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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	

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Power Calculations

Heat Loss Curves

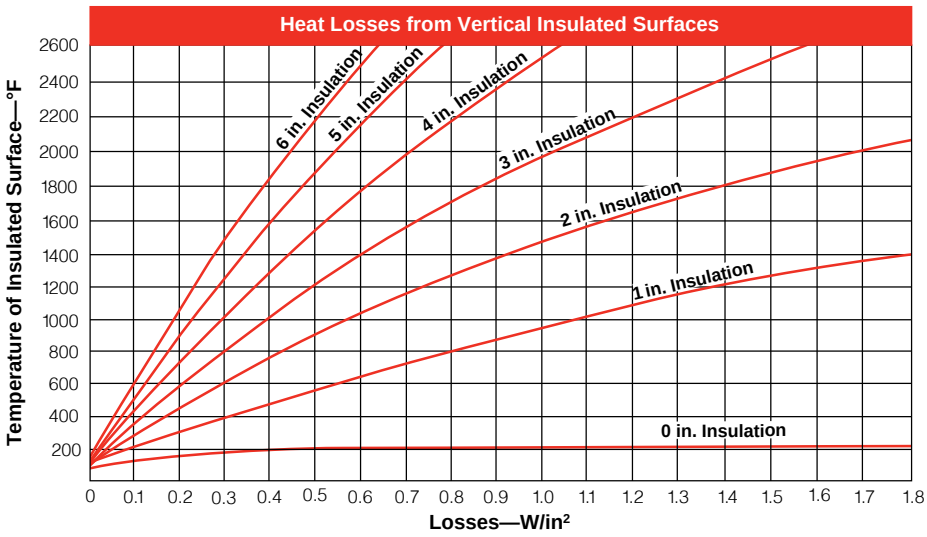
1. Based upon combined natural convection and radiation losses into 70°F environment.
2. Insulation characteristics
   k = 0.67 @ 200°F
   k = 0.83 @ 1000°F
3. For molded ceramic fiber products and packed or tightly packed insulation, losses will be lower than values shown.

   For 2 or 3 inches insulation multiply by 0.84.

   For 4 or 5 inches insulation multiply by 0.81.

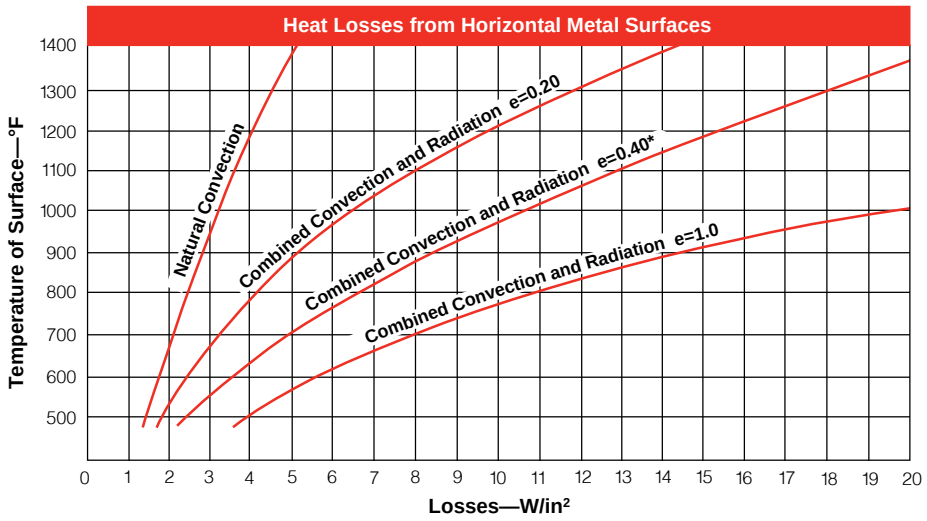
   For 6 inches insulation multiply by 0.79.

Ref. 5

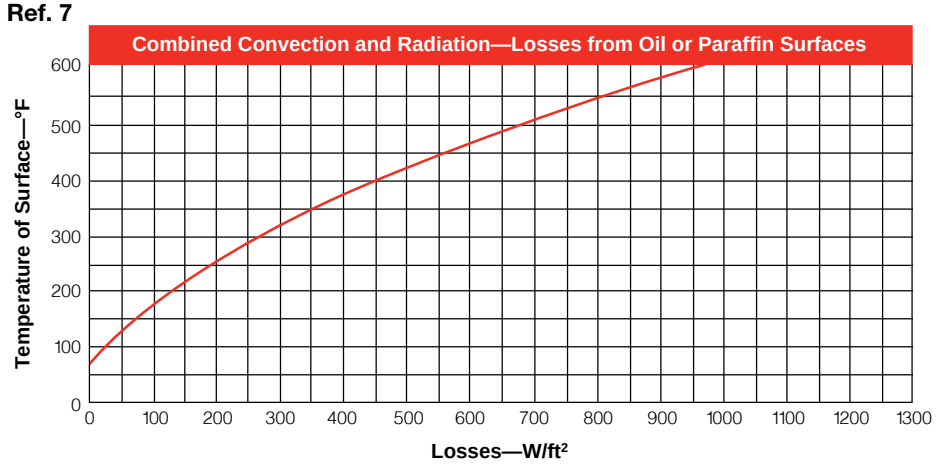


Ref. 6

*For losses of molten metal surfaces, use the curve e=0.40.



Ref. 7



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Equations

Ohms Law

Volts

Volts = $\sqrt{\text{Watts} \times \text{Ohms}}$

Volts = $\frac{\text{Watts}}{\text{Amperes}}$

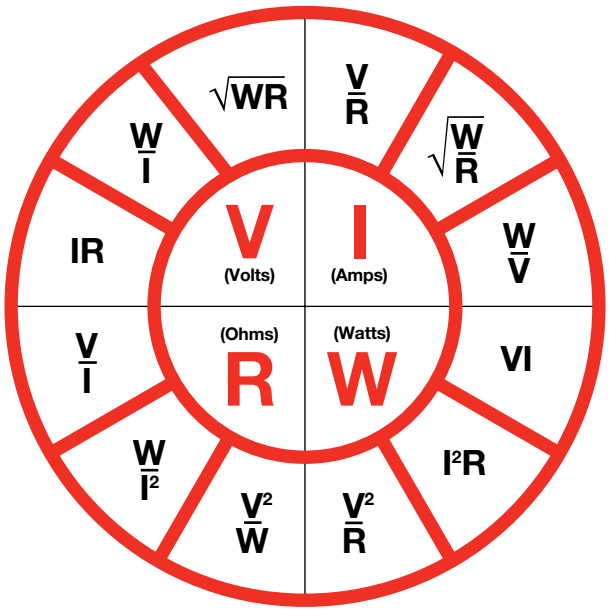
Volts = Amperes x Ohms

Ohms

Ohms = $\frac{\text{Volts}}{\text{Amperes}}$

Ohms = $\frac{\text{Volts}^2}{\text{Watts}}$

Ohms = $\frac{\text{Watts}}{\text{Amperes}^2}$



Amperes

Amperes = $\frac{\text{Volts}}{\text{Ohms}}$

Amperes = $\frac{\text{Watts}}{\text{Volts}}$

Amperes = $\sqrt{\frac{\text{Watts}}{\text{Ohms}}}$

Watts

Watts = $\frac{\text{Volts}^2}{\text{Ohms}}$

Watts = Amperes^2 x Ohms

Watts = Volts x Amperes

Wattage varies directly as ratio of voltages squared

$$W_2 = W_1 \times \left(\frac{V_2}{V_1}\right)^2$$

3 Phase Amperes = $\frac{\text{Total Watts}}{\text{Volts x 1.732}}$

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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

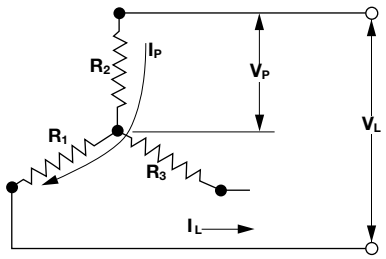
Wye and Delta Equivalents

$W_{DELTA} = 3\ W_{WYE}$

$W_{ODELTA} = {}^{2}/_{3}\ W_{DELTA}$

$W_{OWYE} = {}^{1}/_{2}\ W_{WYE}$

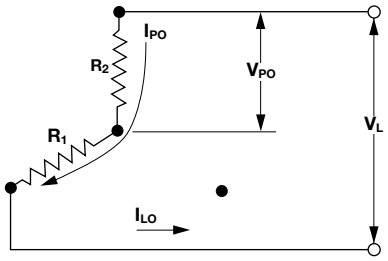
3-Phase Wye (Balanced Load)



Equations For Wye Only

$I_P = I_L$
$V_P = V_L/1.73$
$W_{WYE} = V_L^2/R = 3(V_P^2)/R$
$W_{WYE} = 1.73\ V_L I_L$

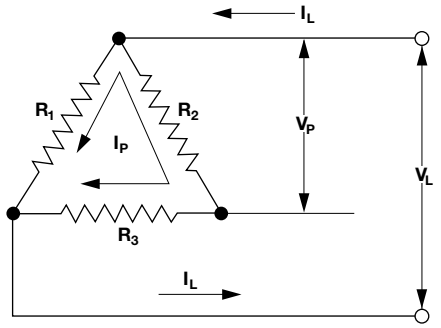
3-Phase Open Wye (No Neutral)



Equations For Open Wye Only

$I_{PO} = I_{LO}$
$V_{PO} = V_L/2$
$W_{0WYE} = {}^{1}/_{2}\ (V_L^2/R)$
$W_{0WYE} = 2\ (V_{PO}^2/R)$
$W_{0WYE} = V_L I_{LO}$

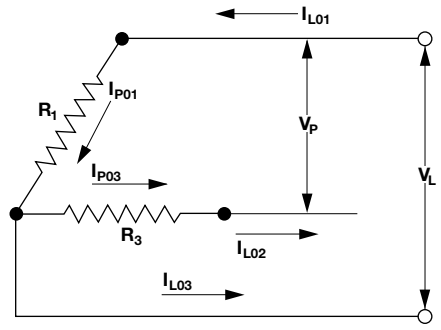
3-Phase Delta (Balanced Load)



Equations For Delta Only

$I_P = I_L/1.73$
$V_P = V_L$
$W_{DELTA} = 3(V_L^2)/R$
$W_{DELTA} = 1.73\ V_L I_L$

3-Phase Open Delta



Equations For Open Delta Only

$V_P = V_L$
$I_{PO1} = I_{PO3} = I_{LO2}$
$I_{LO3} = 1.73\ I_{PO1}$
$W_{0DELTA} = 2\ (V_L^2/R)$

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Wattage Requirements

The following equations can be used to make quick estimates of wattage requirements.

For Steel

Use equation:

$$kW = \frac{\text{pounds} \times \text{temperature rise (°F)}}{20{,}000 \times \text{heat-up time (hrs.)}}$$

1 cu. ft. = 7.49 gallons

For Heating Water in Tanks

Use equation:

$$kW = \frac{\text{gallons} \times \text{temperature rise (°F)}}{375 \times \text{heat-up time (hrs)}}$$

1 cu. ft. = 7.49 gallons

For Air

Use equation:

$$kW = \frac{\text{CFM}^{**①} \times \text{temperature rise (°F)}}{3000}$$

* Gallons per minute
** Cubic feet per minute
① Measured at normal temperature and pressure
② Measured at heater system inlet temperature and pressure

For Oil

Use equation:

$$kW = \frac{\text{gallons} \times \text{temperature rise (°F)}}{800 \times \text{heat-up time (hrs.)}}$$

For Heating Flowing Water

Use equation:

$kW = GPM^{*} \times \text{temperature rise (°F)} \times 0.16$

For Compressed Air

Use equation:

$$kW = \frac{\text{CFM}^{**②} \times \text{density}^{②} \times \text{temperature rise (°F)}}{228}$$

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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 $\mathbf{W_1}$.
3. Draw a straight line from **P** through **S** to **W**. Read $\mathbf{W_2}$.
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.

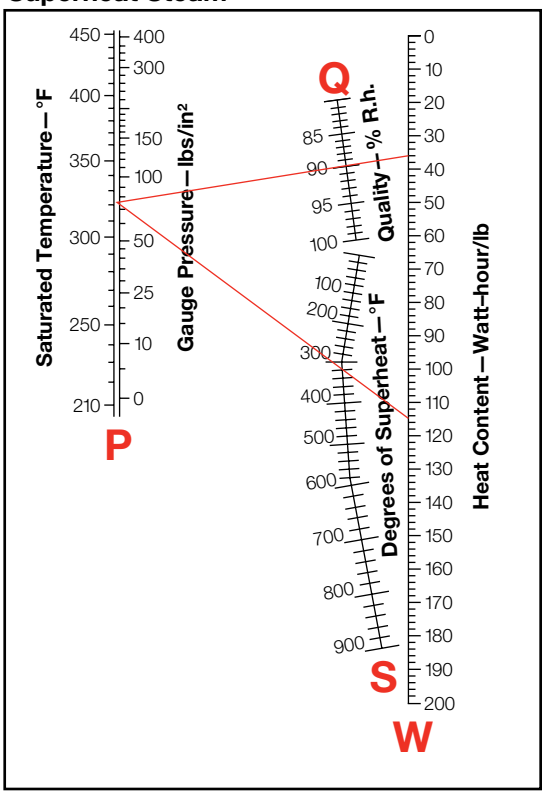
Example Shown:

Q = 90% quality (% R.H.)

P = 75 psig

S = 320°F

Superheat Steam



Note: Reference is based on >80% steam quality at >20 psig.

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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 = $(P_A + P_C + {}^2/_3\, P_L)\times(1+S.F.)$

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 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))
- ΔT = temperature rise of material (T_{Final} - $T_{Initial}$) (°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^2)
- ΔT = temperature differential to ambient (°C)
- d = thickness of material (m)

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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 $\mathbf{C_p}$, 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))

ΔT = temperature rise of material (T_{Final} - $T_{Initial}$)(°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?

$$Q = \frac{w \times C_p \times \Delta T}{3600}$$

$$= \frac{(25 \text{ kg}) \times (385 \text{ J/[kg•°C]}) \times (35°C)}{3600} = 94 \text{ (Wh)}$$

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 $\mathbf{H_f}$. Another state change is involved in vaporization and condensation. The latent heat of vaporization $\mathbf{H_v}$ 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?

$$Q = \frac{w \times H_f}{3600}$$

$$= \frac{(25 \text{ kg}) \times (22800 \text{ J/kg})}{3600} = 158 \text{ (Wh)}$$

Changing state (melting and vaporizing) is a constant temperature process. The $\mathbf{C_p}$ 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.

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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^2)

L = thickness of material (m)

ΔT = temperature difference across material (T_2-T_1) (°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^2)

F_{SL} = vertical surface convection loss factor (W/m^2) 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^2)

F_{SL} = blackbody radiation loss factor at surface temperature (W/m^2) (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^2. Polished aluminum, in contrast, (e = 0.09) only has heat losses of 412 W/m^2 at the same temperature (4851 W/m^2 · 0.09 = 412 W/m^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 (m^2)

F_{SL} = combined surface loss factor at surface temperature (W/m^2) (see pages 542 and 543, Reference 1, 2, 5, 6 and 7.)

This equation assumes a constant surface temperature.

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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)

$$P_s = \frac{Q_A + Q_C + {}^2/_3 Q_L}{t_S} \quad (1 + S.F.)$$

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 ${}^2/_3$.

Equation 5—Operating Power (Watts)

$$P_C = \frac{Q_B + Q_D + Q_L}{t_C} \quad (1 + S.F.)$$

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)

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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^2) - known or assumed

σ = Stephan Boltzman constant

= $5.67 \cdot 10^{-8}$ ($W/m^2 \bullet K^4$)

$T_1(K)$ = 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)

$$e_f = \frac{1}{e_S} + \frac{1}{e_L} - 1$$ plane surfaces

$$e_f = \frac{1}{e_S} + \frac{D_S}{D_L}\left(\frac{1}{e_L} - 1\right)$$ concentric cylinders inner radiating outward

$$e_f = \frac{1}{e_S} + \left(\frac{D_S}{D_L} \times \frac{1}{e_L}\right) - 1$$ concentric cylinders outer radiating inward

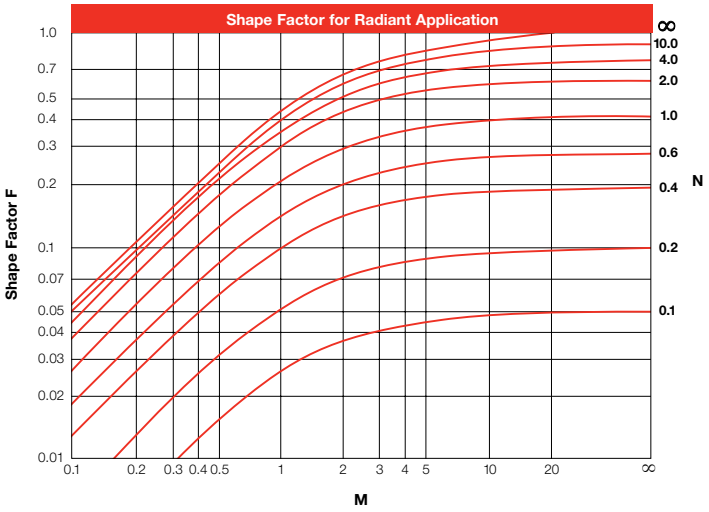
e_S = heater emissivity (from material emissivity tables)

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:

$$\mathbf{N} = \frac{\text{Heated Length}}{\left(\text{Distance to Material}\right)}$$

$$\mathbf{M} = \frac{\text{Heated Width}}{\left(\text{Distance to Material}\right)}$$

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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.

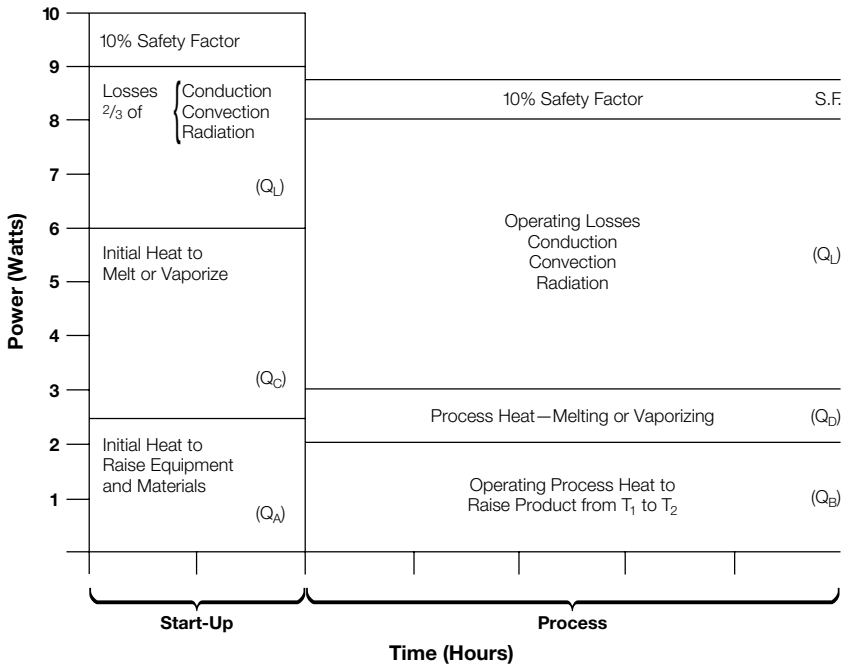
Shown in the graph below are the start up and operating watts displayed in a graphic format to help you see how power requirements add up.

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



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Power Calculations

Heat Loss Curves

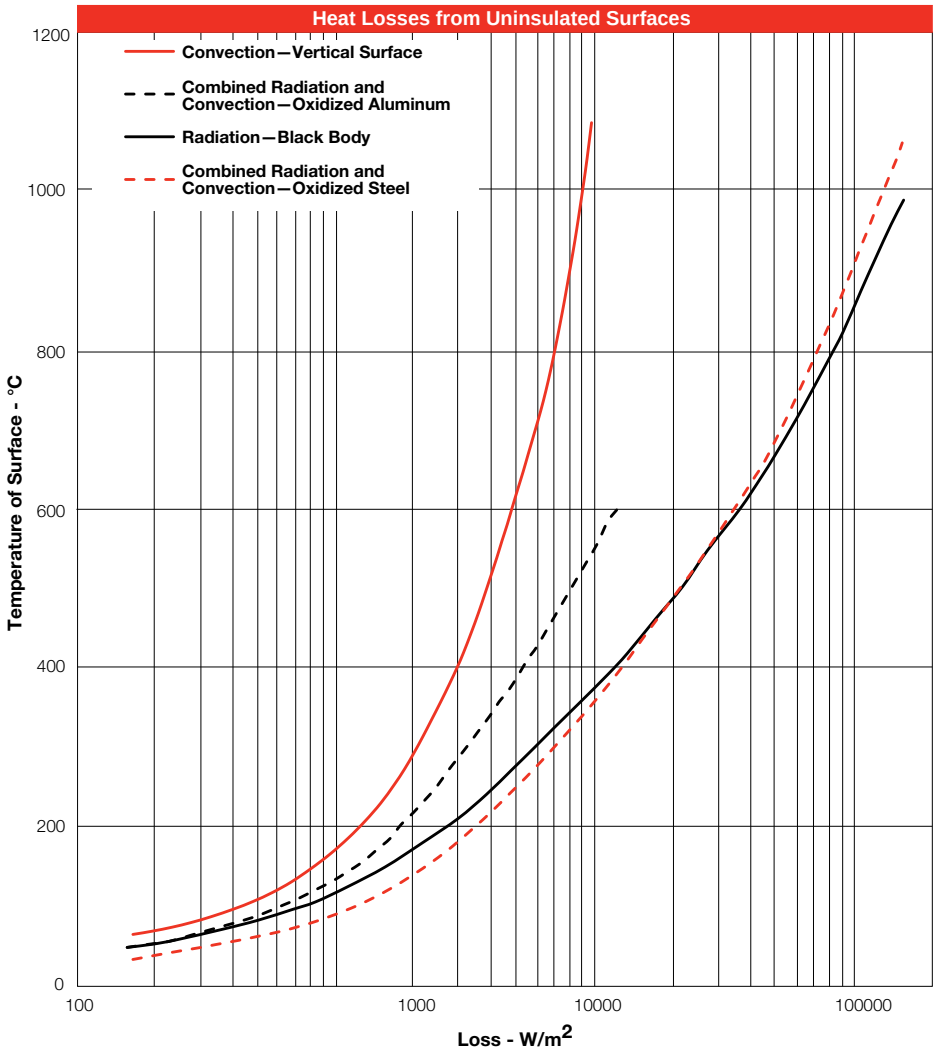
Ref. 1—Convection curve correction factors:

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

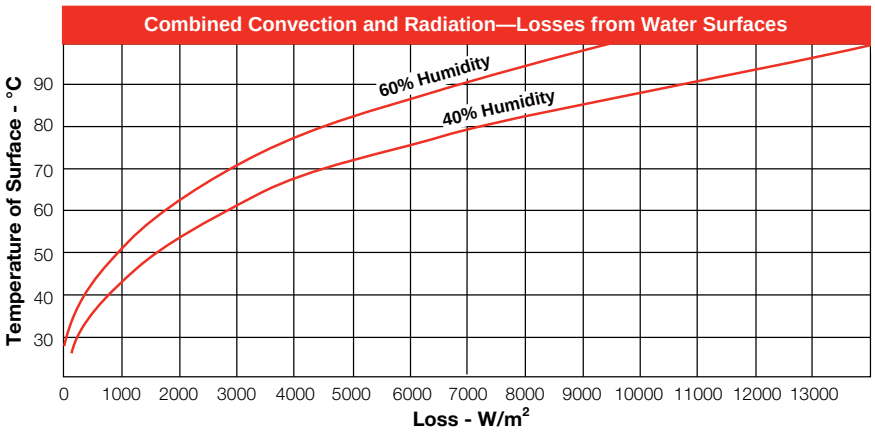
Radiation Curve Correction Factors

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 (e) values listed in the reference data section on page 530.

Ref. 1



Ref. 2



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Power Calculations

Heat Loss Curves

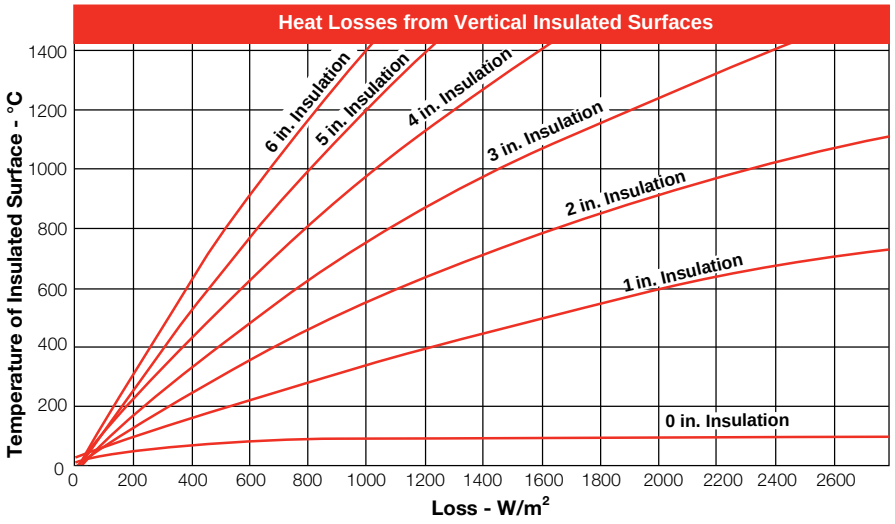
1. Based upon combined natural convection and radiation losses into 21°C environment.
2. Insulation characteristics
   k = 0.097 W/m K @ 93°C
   k = 0.120 W/m K @ 538°C
3. For molded ceramic fiber products and packed or tightly packed insulation, losses will be lower than values shown.

   For 50.8 or 76.2 mm insulation multiply by 0.84.

   For 102 or 127 mm insulation multiply by 0.81.

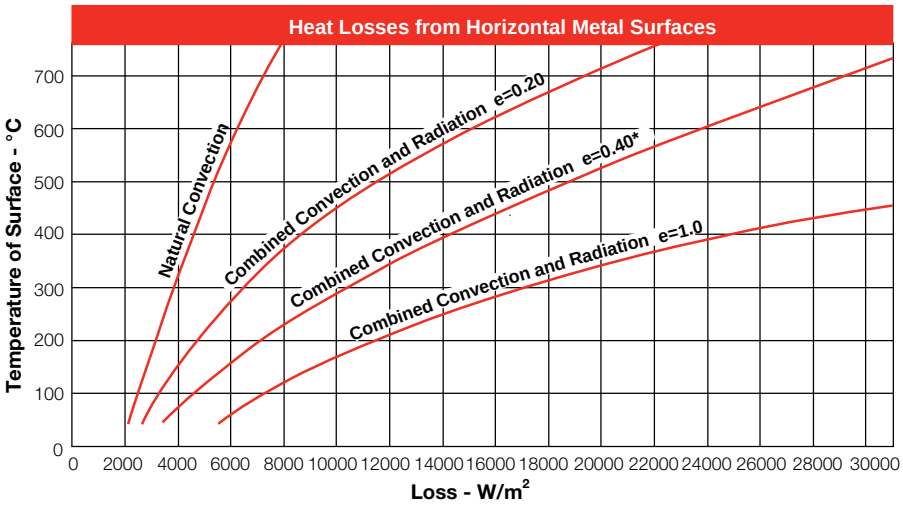
   For 152 inches insulation multiply by 0.79.

Ref. 5

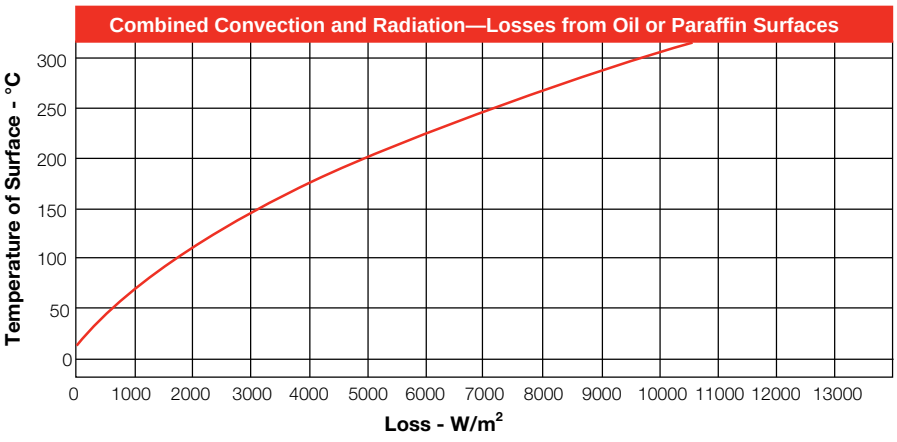


Ref. 6

*For losses of molten metal surfaces, use the curve e=0.40.



Ref. 7



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Equations

Ohm's Law

Volts

Volts = $\sqrt{\text{Watts} \times \text{Ohms}}$

Volts = $\frac{\text{Watts}}{\text{Amperes}}$

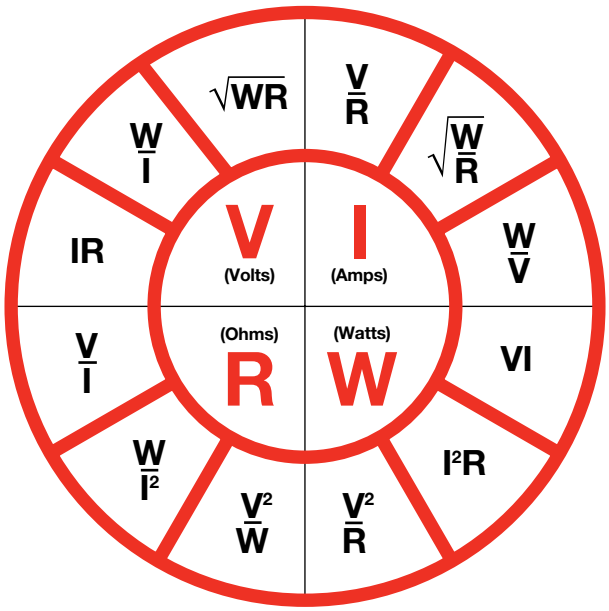
Volts = Amperes x Ohms

Ohms

Ohms = $\frac{\text{Volts}}{\text{Amperes}}$

Ohms = $\frac{\text{Volts}^2}{\text{Watts}}$

Ohms = $\frac{\text{Watts}}{\text{Amperes}^2}$



Amperes

Amperes = $\frac{\text{Volts}}{\text{Ohms}}$

Amperes = $\frac{\text{Watts}}{\text{Volts}}$

Amperes = $\sqrt{\frac{\text{Watts}}{\text{Ohms}}}$

Watts

Watts = $\frac{\text{Volts}^2}{\text{Ohms}}$

Watts = Amperes^2 x Ohms

Watts = Volts x Amperes

Wattage varies directly as ratio of voltages squared

$$W_2 = W_1 \times \left(\frac{V_2}{V_1}\right)^2$$

3 Phase Amperes = $\frac{\text{Total Watts}}{\text{Volts x 1.732}}$

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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

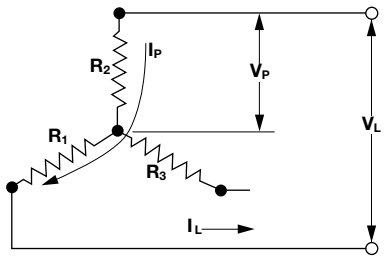
Wye and Delta Equivalents

$W_{DELTA} = 3\ W_{WYE}$

$W_{ODELTA} = {}^{2}/_{3}\ W_{DELTA}$

$W_{OWYE} = {}^{1}/_{2}\ W_{WYE}$

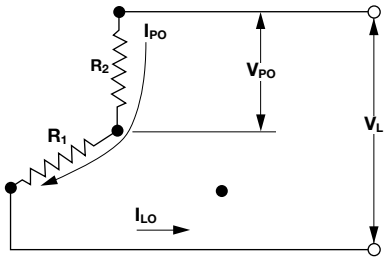
3-Phase Wye (Balanced Load)



Equations For Wye Only

$I_P = I_L$
$V_P = V_L/1.73$
$W_{WYE} = V_L^2/R = 3(V_P^2)/R$
$W_{WYE} = 1.73\ V_L I_L$

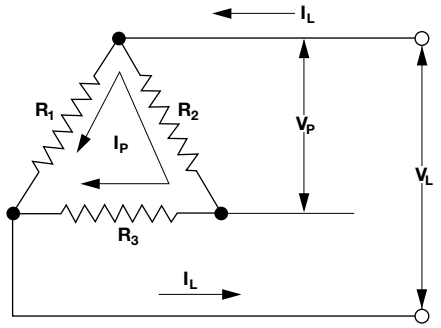
3-Phase Open Wye (No Neutral)



Equations For Open Wye Only

$I_{PO} = I_{LO}$
$V_{PO} = V_L/2$
$W_{0WYE} = {}^{1}/_{2}\ (V_L^2/R)$
$W_{0WYE} = 2\ (V_{PO}^2/R)$
$W_{0WYE} = V_L I_{LO}$

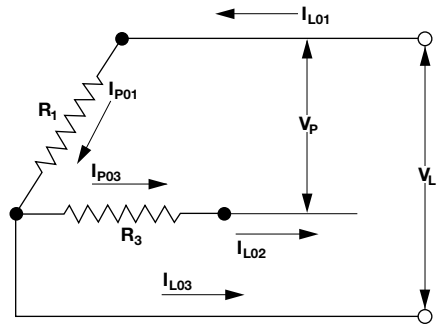
3-Phase Delta (Balanced Load)



Equations For Delta Only

$I_P = I_L/1.73$
$V_P = V_L$
$W_{DELTA} = 3(V_L^2)/R$
$W_{DELTA} = 1.73\ V_L I_L$

3-Phase Open Delta



Equations For Open Delta Only

$V_P = V_L$
$I_{PO1} = I_{PO3} = I_{LO2}$
$I_{LO3} = 1.73\ I_{PO1}$
$W_{0DELTA} = 2\ (V_L^2/R)$

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Wattage Requirements

The following equations can be used to make quick estimates of wattage requirements.

For Steel

Use equation:

$$kW = \frac{\text{kilograms} \times \text{temperature rise (°C)}}{5040 \times \text{heat-up time (hrs.)}}$$

For Oil

Use equation:

$$kW = \frac{\text{liters} \times \text{temperature rise (°C)}}{1680 \times \text{heat-up time (hrs.)}}$$

For Heating Water in Tanks

Use equation:

$$kW = \frac{\text{liters} \times \text{temperature rise (°C)}}{790 \times \text{heat-up time (hrs)}}$$

For Heating Flowing Water

Use equation:

$kW = \text{liters/min.} \times \text{temperature rise (°C)} \times 0.076$

For Air

Use equation:

$$kW = \frac{\text{cubic meters/min}^{①} \times \text{temperature rise (°C)}}{47}$$

For Compressed Air

Use equation:

$$kW = \frac{\text{cubic meters/min.}^{②} \times \text{temperature rise (°C)} \times \text{density (kg/m}^3)^{②}}{57}$$

① Measured at normal temperature and pressure
② Measured at heater system inlet temperature and pressure

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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 $\mathbf{W_1}$.
3. Draw a straight line from **P** through **S** to **W**. Read $\mathbf{W_2}$.
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.

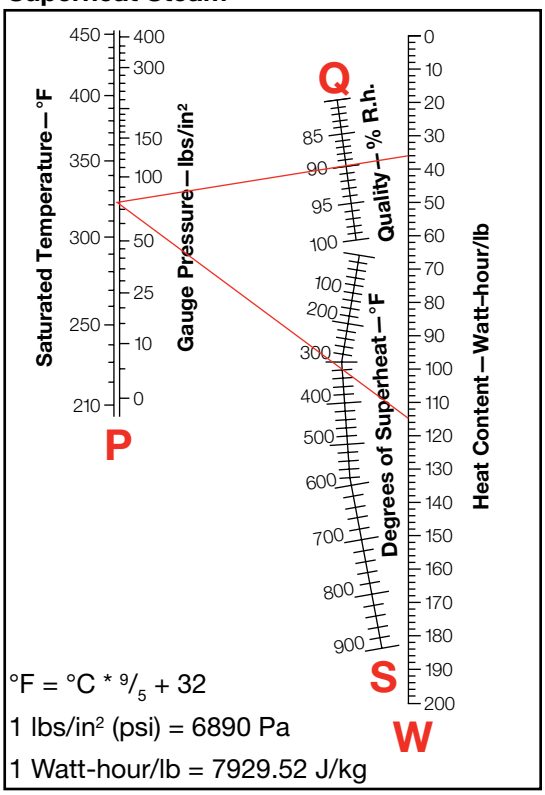
Example Shown:

Q = 90% quality (% R.H.)

P = 75 psig

S = 320°F

Superheat Steam



Note: Reference is based on >80% steam quality at >20 psig.

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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^2 (18.6 W/cm^2)
- 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

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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
Liquids:		
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

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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
Air:	Direct (forced or natural convection)	FIREBAR, WATROD, FINBAR, WATROD enclosure heater, screw plug, flange, circulation and duct
Gas: Hydrocarbons, Nitrogen, Oxygen Ozone, Steam	Direct (forced convection)	FIREBAR, WATROD, screw plug, flange and circulation
Molten Materials: 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
Surface Heating: 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/in² respectively (4.6 and 6.2 W/cm²) with 304 stainless steel, sheath can be used.

Supplemental Applications Chart

Heated Material	Max. Operating Temperature °F	(°C)	WATROD Element: Max. Watt Density W/in²	(W/cm²)	WATROD Element: Sheath Material	FIREBAR Element: Max. Watt Density W/in²	(W/cm²)	FIREBAR Element: Sheath Material
Acid Solutions (Mild)								
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

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Tubular Elements and Assembly Selection Guide

Supplemental Applications Chart *(Continued)*

Heated Material	Max. Operating Temperature °F	(°C)	WATROD Element Max. Watt Density W/in²	(W/cm²)	WATROD Element Sheath Material	FIREBAR Element Max. Watt Density W/in²	(W/cm²)	FIREBAR Element 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.

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Tubular Elements and Assembly Selection Guide

Supplemental Applications Chart *(Continued)*

Heated Material	Max. Operating Temperature °F	(°C)	WATROD Element Max. Watt Density W/in²	(W/cm²)	Sheath Material	FIREBAR Element Max. Watt Density W/in²	(W/cm²)	Sheath Material
Gelatin liquid	150	(65)	23	(3.6)	304 SS	30	(4.6)	304 SS
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
Methychloride	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.

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Tubular Elements and Assembly Selection Guide

Supplemental Applications Chart *(Continued)*

Heated Material	Max. Operating Temperature °F	(°C)	WATROD Element: Max. Watt Density W/in²	(W/cm²)	WATROD Element: Sheath Material	FIREBAR Element: Max. Watt Density W/in²	(W/cm²)	FIREBAR Element: 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.

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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)					
WATROD						
2 1/2 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)
FIREBAR						
2 1/2 NPT	0.0417	(3)				

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Tubular Elements and Assembly Selection Guide

Heat Transfer Oil Chart

Heat Transfer Fluid	Recommended Max. Temperature °F (°C)				Flammability Data °F (°C)						Min. Velocity Thru Heater in Feet/second at W/in² (M/second at W/cm²)							
	Process		Sheath		Flash Point		Fire Point		Autoignition		8	(1.2)	16	(2.8)	23	(3.6)	30	(4.7)
	F	(°C)	°F	(°C)	°F	(°C)	°F	(°C)	°F	(°C)	W/in²	(W/cm²)	W/in²	(W/cm²)	W/in²	(W/cm²)	W/in²	(W/cm²)
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)

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Agency Certifications, Recognition and Approvals

WATROD™ and FIREBAR® Element and Assemblies 559

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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 in.	(mm)	Allowable Part Numbers		Max. Volts	Max. Watt Density W/in²	W/cm²	Min. Bend Radius in.	(mm)	Allowable Sheath Materials	End Seal Types
0.210	(6.0)	**RK** series	**U0-xx**	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)	**RA** series	**U1-xx**	250						
0.315	(8.0)	**RB** series	**U3-xx**	480						
0.375	(9.5)	**RD**, **RS** series	**U5-xx**	480						
0.430	(10.9)	**RC** series	**U6-xx**	600						
0.475	(12.0)	**RG** series	**U7-xx**	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 in.	(mm)	Allowable Part Numbers	Max. Volts	Max. Watt Density W/in²	W/cm²	Min. Bend Radius in.	(mm)	Allowable Sheath Materials	End Seal Types
0.375	(9.5)	**U5M** 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)	**U6M** series							
0.475	(12.0)	**U7M** 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.

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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/in² W/cm²	Min. Bend Radius Major Axis in. (mm)	Min. Bend Radius Minor Axis in. (mm)	Allowable Sheath Materials	End Seal Types
Air or Immersion Heating							
5/8 (16)	**FA, FS** series **Axxx**	480	①	1 (25)	①	Nickel alloy 800, 840, 304 SS	Epoxy resin, Lavacone, Silicone resin, Silicone rubber, Silicone fluid, Ceramic potting
1 (25)	**FS** series	480		1 (25)			
Liquid Immersion Heating Only							
5/8 (16)	**FA, FS** series **Uxxx**	480	①	1 (25)	①	Nickel alloy 800, 840, 304 SS	Epoxy resin, Lavacone, Silicone resin, Silicone rubber, Silicone fluid, Ceramic potting
1 (25)	**FS** series	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** Series **U1** to **U7**	General purpose or moisture resistant with or without thermostat
Flange	All catalog models **FE**, **FG**, **FH**, **FK**, **FL**, **FM**, **FN**, **FO**, **FP** **FR**, **FS**, **FT**, **FW**—Series **U1** to **U9**	General purpose or moisture resistant with or without thermostat
Circulation	All catalog models **CB**, **CF**, **CP** Series **U1** to **U7**	General purpose or moisture resistant with or without thermostat
Over-the-Side	All catalog models **OL** and **OR** Series **U1** to **U7**, except **U2** and **U4**	Moisture resistant with or without thermostat
Duct	All catalog models **D6** to **D125**, **MDH6** to **MDH60**, **LDH9** to **LDH225** Series **U0 to U7**	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.

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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/in² (W/cm²)	Allowable Sheath Materials[4]	End Seal Type (All Diameters)
WATROD:					
0.260 (6.6) 0.315 (8.0) 0.375 (9.5) 0.430 (10.9) 0.475 (12.0)	**All catalog models, 1-xx** **All catalog models, 3-xx** **All catalog models, 5-xx** **All catalog models, 6-xx** **All catalog models, 7-xx**	250 480 600 600 600	120 (18.5) 120 (18.5) 120 (18.5) 120 (18.5) 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
FIREBAR:					
5/8 (15.9) 1 (25.0)	**FA**, **FS** models, **4-xx** **FB**, **FS** models, **2-xx**	480 480	120 (18.5) 120 (18.5)	Nickel alloy 800, 840 304 SS	Epoxy resin, Lavacone, Silicone resin, Silicone rubber Ceramic, Silicone fluid
MULTICELL:	**Contact Watlow**				

[4] 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**" Series **1-xx** to **7-xx**	General purpose with or without thermostat Enclosure 4 with or without thermostat
Flange	Catalog series "**F**" Series **1-xx** to **7-xx**	General purpose with or without thermostat Enclosure 4 with or without thermostat[5]
Circulation	Catalog series "**C**" Series **1-10** to **7-10**	General purpose with or without thermostat Enclosure 4 with or without thermostat[5]
Over-the-Side	Catalog series "**OL**" and "**OR**" Series **1-30** to **7-30**	Enclosure 4 with or without thermostat
Duct	Catalog series "**D**", "**LDH**" and "**MDH**" Series **1-1** to **7-1**	General purpose enclosure only

[5] 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**" Series **1-xx** to **7-xx**	Class 1, Div. 1 and 2, Groups B, C and D and enclosure 4 with or without thermostat
Flange	Catalog series "**F**" Series **1-xx** to **7-xx, 700, 701, 702, 703, 704, 713, 714**	Class 1, Div. 1 and 2, Groups B, C and D and enclosure 4 with or without thermostat
Circulation	Catalog series "**C**" Series **1-10** to **7-10**	Class 1, Div. 1 and 2, Groups B, C and D and enclosure 4 with or without thermostat

Note: UL® and CSA must be requested at the time the order is placed.

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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.

SERIES F Flange Heaters:
IECEx Certification IECEx CSA 09.0010X
ATEX Certification SIRA10ATEX1155X

SERIES FE Flange Heaters:
IECEx Certification IECEx SIR 12.0056X
ATEX Certification SIRA12ATEX3082X

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How To Use This Index

This easy cross reference contains the alpha or numeric prefixes for all Watlow product part numbers contained in this catalog. The spaces (_) shown in some of the following prefixes indicate additional characters. Some part numbers include a suffix alpha character. This is the last alpha character that appears in the product part number.

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.

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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.

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