Tubular and Process Assemblies

Elements and Assemblies

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
- Over-the-Side
- Vertical Loop
- Drum
- 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 2.2 megawatts
- Process assembly ratings up to 1000 psi (70 kg/cm^2)
- Watt densities up to 120 W/in^2 (18.6 W/cm^2)

Assemblies, left to right: WATROD duct, WATROD screw plug, circulation and FIREBAR flange heater. WATROD and FIREBAR elements are in front.

- Enhanced performance beyond these specifications available from Watlow Process Systems.①

Features and Benefits

- **36 standard bend formations** enable designing the heating element around available space to maximize heating efficiency.
- **FIREBAR flat surface geometry** enhances heat transfer in both immersion and air applications, and surface heating, too. Increased surface area per linear inch allows heaters to run cooler in viscous materials.
- **Wattages from 95 watts to 2.2 megawatts** (on individual elements and assemblies respectively) make tubular heaters one of the most versatile electric heating sources available.

Applications

- Liquids
- Air
- Gases
- Molten materials
- Contact surface heating
- Radiant surface heating

① Watlow Process Systems can design thermal systems to meet specific performance criteria. Contact your Watlow representative for details.

Elements and Assemblies

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 consult 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, Over-the-Side, Vertical Loop, and Pipe Insert
Caustic Soda 12% Concentrate 10% Concentrate 75% Concentrate	Direct immersion (circulating/non-circulating)	WATROD, Screw Plug, Square Flange, Flange, Over-the-Side, Vertical Loop, Circulation, and Pipe Insert
Degreasing Solutions	Direct immersion (circulating/non-circulating)	FIREBAR, WATROD, Screw Plug, Square Flange, Flange, Over-the-Side, and Pipe Insert
Electroplating	Direct immersion (circulating/non-circulating)	FIREBAR, WATROD, Screw Plug, Square Flange, Flange, Over-the-Side, Drum, Vertical Loop and Pipe Insert
Ethylene Glycol 50% Concentrate 100% Concentrate	Direct immersion (circulating/non-circulating)	FIREBAR, WATROD, Screw Plug, Flange, Over-the-Side, Circulation, Booster, and Engine Preheater
Oils Asphalt Fuel Oils Light Grades 1 & 2 Medium Grades 4 & 5 Heavy Grade 6 & 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, Over-the-Side, Drum, Vertical Loop, Circulation, Booster, and Pipe Insert
Paraffin or Wax	Direct immersion (circulating/non-circulating)	FIREBAR, WATROD, Screw Plug, Square Flange, Flange, Over-the-Side, Drum, and Pipe Insert

CONTINUED

Tubular and Process Assemblies

Elements and Assemblies

Element and Assembly Selection Guide

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, Over-the-Side, Drum, Vertical Loop, 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)	FIREBAR, WATROD, Screw Plug, Flange, and Circulation
Molten Materials:		
Aluminum	Indirect (radiant)	WATROD
Lead	Direct (non-circulating)	FIREBAR and WATROD
Salt	Direct (non-circulating)	FIREBAR and WATROD
Solder	Direct (non-circulating)	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're heating vegetable oil, either WATROD or FIREBAR elements at 30 and 40 watts per square inch respectively (4.6 and 6.2 W/cm^2) with 304 stainless steel sheath can be used.

Supplemental Applications Chart

Heated Material	Maximum Operating Temperature °F	(°C)	WATROD Element: Maximum Watt Density W/in^2	(W/cm^2)	WATROD Element: Sheath Material	FIREBAR Element: Maximum Watt Density W/in^2	(W/cm^2)	FIREBAR Element: Sheath Material
Acid Solutions (Mild)								
Acetic	180	(82)	40	(6.2)	316 Stainless Steel	40	(6.2)	Incoloy® 800
Boric (30% max.)	257	(125)	40	(6.2)	Titanium	40	(6.2)	304 Stainless Steel
Carbonic	180	(82)	40	(6.2)	Inconel® 600	40	(6.2)	304 Stainless Steel
Chromic	180	(82)	40	(6.2)	Titanium	N/A	N/A	N/A
Citric	180	(82)	23	(3.6)	Incoloy®	30	(4.6)	Incoloy® 800
Fatty Acids	150	(65)	20	(3.1)	316 Stainless Steel	30	(4.6)	Incoloy® 800
Lactic	122	(50)	10	(1.6)	316 Stainless Steel	N/A	N/A	N/A
Levulinic	180	(82)	40	(6.2)	Inconel® 600	40	(6.2)	304 Stainless Steel
Malic	122	(50)	10	(1.6)	316 Stainless Steel	16	(2.5)	Incoloy® 800
Nitric (30% max.)	167	(75)	20	(3.1)	316 Stainless Steel	30	(4.6)	Incoloy® 800
Phenol—2-4 Disulfonic	180	(82)	40	(6.2)	316 Stainless Steel	40	(6.2)	Incoloy® 800
Phosphoric	180	(82)	23	(3.6)	Incoloy®	30	(4.6)	Incoloy® 800
Phosphoric (Aerated)	180	(82)	23	(3.6)	304 Stainless Steel	30	(4.6)	304 Stainless Steel

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Elements and Assemblies

Supplemental Applications Chart

Heated Material	Maximum Operating Temperature °F	(°C)	WATROD Element: Maximum Watt Density W/in²	(W/cm²)	WATROD Element: Sheath Material	FIREBAR Element: Maximum Watt Density W/in²	(W/cm²)	FIREBAR Element: Sheath Material
Proponic (10% max.)	180	(82)	40	(6.2)	Copper	40	(6.2)	304 Stainless Steel
Tannic	167/180	(75/82)	23/40	(3.6/6.2)	Steel/304 S. Steel	40	(6.2)	304 Stainless Steel
Tartaric	180	(82)	40	(6.2)	316 Stainless Steel	40	(6.2)	Incoloy® 800
Acetaldehyde	180	(82)	10	(1.6)	Copper	16	(2.4)	Incoloy® 800
Acetone	130	(54)	10	(1.6)	304 Stainless Steel	16	(2.4)	304 Stainless Steel
Air	①	①	①	①	Incoloy®	①	①	Incoloy® 800
Alcyl Alcohol	200	(93)	10	(1.6)	Copper	16	(2.4)	Incoloy® 800
Alkaline Solutions	212	(100)	40	(6.2)	Steel	48	(7.4)	304 Stainless Steel
Aluminum Acetate	122	(50)	10	(1.6)	316 Stainless Steel	16	(2.5)	Incoloy® 800
Aluminum Potassium Sulfate	212	(100)	40	(6.2)	Copper	N/A	N/A	N/A
Ammonia Gas	①	①	①	①	Steel	①	①	304 Stainless Steel
Ammonium Acetate	167	(75)	23	(3.6)	Incoloy®	30	(4.6)	Incoloy® 800
Amyl Acetate	240	(115)	23	(3.6)	Incoloy®	30	(4.6)	Incoloy® 800
Amyl Alcohol	212	(100)	20	(3.1)	304 Stainless Steel	30	(4.6)	304 Stainless Steel
Aniline	350	(176)	23	(3.6)	304 Stainless Steel	30	(4.6)	304 Stainless Steel
Asphalt	200-500	(93-260)	4-10	(0.6 - 1.6)	Steel	6-12	(0.9 - 1.8)	304 Stainless Steel
Barium Hydroxide	212	(100)	40	(6.2)	316 Stainless Steel	40	(6.2)	Incoloy® 800
Benzene, liquid	150	(65)	10	(1.6)	Copper	16	(2.5)	304 Stainless Steel
Butyl Acetate	225	(107)	10	(1.6)	316 Stainless Steel	16	(2.5)	Incoloy® 800
Calcium Bisulfate	400	(204)	20	(3.1)	316 Stainless Steel	N/A	N/A	N/A
Calcium Chloride	200	(93)	5-8	(0.8 - 1.2)	Inconel® 600	N/A	N/A	N/A
Carbon Monoxide	—	—	①	①	Incoloy®	①	①	Incoloy®
Carbon Tetrachloride	160	(71)	23	(3.6)	Incoloy®	30	(4.6)	Incoloy®
Caustic Soda:								
2%	210	(98)	48	(7.4)	Incoloy®	—	—	Consult factory
10% Concentrate	210	(98)	23	(3.6)	Incoloy®	—	—	Consult factory
75%	180	(82)	23	(3.6)	Incoloy®	—	—	Consult factory
Citric Juices	185	(85)	23	(3.6)	Incoloy®	30	(4.6)	Incoloy®
Degreasing Solution	275	(135)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
Dextrose	212	(100)	20	(3.1)	304 Stainless Steel	30	(4.6)	304 Stainless Steel
Dyes & Pigments	212	(100)	23	(3.6)	304 Stainless Steel	30	(4.6)	304 Stainless Steel
Electroplating Baths:								
Cadmium	180	(82)	40	(6.2)	304 Stainless Steel	40	(6.2)	304 Stainless Steel
Copper	180	(82)	40	(6.2)	316 Stainless Steel	N/A	N/A	N/A
Dilute Cyanide	180	(82)	40	(6.2)	316 Stainless Steel	N/A	N/A	N/A
Rochelle Cyanide	180	(82)	40	(6.2)	316 Stainless Steel	N/A	N/A	N/A
Sodium Cyanide	180	(82)	40	(6.2)	316 Stainless Steel	N/A	N/A	N/A
Potassium Cyanide	180	(82)	40	(6.2)	316 Stainless Steel	40	(6.2)	304 Stainless Steel
Ethylene Glycol	300	(148)	30	(4.6)	Steel	40	(6.2)	304 Stainless Steel
Formaldehyde	180	(82)	10	(1.6)	304 Stainless Steel	16	(2.5)	304 Stainless Steel
Freon® Gas	300	(148)	2-5	(0.3 - 0.8)	Steel	①	①	304 Stainless Steel
Gasoline	300	(148)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel

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① Consult your Watlow representative.
Freon® is a registered trademark of
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Tubular and Process Assemblies

Elements and Assemblies

Supplemental Applications Chart

Heated Material	Maximum Operating Temperature °F	(°C)	WATROD Element: Maximum Watt Density W/in²	(W/cm²)	WATROD Element: Sheath Material	FIREBAR Element: Maximum Watt Density W/in²	(W/cm²)	FIREBAR Element: Sheath Material
Gelatin Liquid	150	(65)	23	(3.6)	304 Stainless Steel	30	(4.6)	304 Stainless Steel
Gelatin Solid	150	(65)	5	(0.8)	304 Stainless Steel	7	(1.0)	304 Stainless Steel
Glycerin	500	(260)	10	(1.6)	Incoloy®	12	(1.9)	304 Stainless Steel
Glycerol	212	(100)	23	(3.6)	Incoloy®	30	(4.6)	304 Stainless Steel
Grease:								
Liquid	—	—	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
Solid	—	—	5	(0.8)	Steel	7	(1.0)	304 Stainless Steel
Hydrazine	212	(100)	16	(2.5)	304 Stainless Steel	20	(3.1)	304 Stainless Steel
Hydrogen	①	①	—	—	Incoloy®	①	①	Incoloy® 800
Hydrogen Chloride	①	①	—	—	Inconel® 600	①	①	N/A
Hydrogen Sulfide	①	①	—	—	316 Stainless Steel (heavy wall)	①	①	N/A
Magnesium Chloride	212	(100)	40	(6.2)	Inconel® 600	40	(6.2)	Incoloy® 800
Magnesium Sulfate	212	(100)	40	(6.2)	304 Stainless Steel	40	(6.2)	304 Stainless Steel
Magnesium Sulfate	212	(100)	40	(6.2)	316 Stainless Steel	40	(6.2)	304 Stainless Steel
Methanol Gas	①	①	—	—	304 Stainless Steel	①	①	304 Stainless Steel
Methylamine	180	(82)	20	(3.1)	Inconel® 600	30	(4.6)	304 Stainless Steel
Methychloride	180	(82)	20	(3.1)	Copper	N/A	N/A	N/A
Molasses	100	(37)	4-5	(0.6 - 0.8)	304 Stainless Steel	5-8	(0.8 - 1.2)	304 Stainless Steel
Molten Salt Bath	800-900	(426-482)	25-30	(3.8 - 4.6)	Monel®	N/A	N/A	N/A
Naphtha	212	(100)	10	(1.6)	Steel	16	(2.5)	304 Stainless Steel
Oils								
Fuel Oils:								
Grades 1 & 2 (distillate)	200	(93)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
Grades 4 & 5 (residual)	200	(93)	13	(2.0)	Steel	16	(2.5)	304 Stainless Steel
Grades 6 & Bunker C (residual)	160	(71)	8	(1.2)	Steel	10	(1.6)	304 Stainless Steel
Heat Transfer Oils: ②								
Static	500	(260)	16	(2.5)	Steel	23	(3.6)	304 Stainless Steel
	600	(315)	10	(1.6)	Steel	16	(2.5)	304 Stainless Steel
Circulating	500	(260)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
	600	(315)	15	(2.3)	Steel	20	(3.1)	304 Stainless Steel
Lubrication Oils:								
SAE 10, 90-100 SSU @ 130°F	250	(121)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
SAE 20, 120-185 SSU @ 130°F	250	(121)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
SAE 30, 185-255 SSU @ 130°F	250	(121)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
SAE 40, -80 SSU @ 210°F	250	(121)	13	(2.0)	Steel	18	(2.7)	304 Stainless Steel
SAE 50, 80-105 SSU @ 210°F	250	(121)	13	(2.0)	Steel	18	(2.7)	304 Stainless Steel
Miscellaneous Oils:								
Draw Bath	600	(315)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
Hydraulic	—	—	15③	(2.3)	Steel	15③	(2.3)	304 Stainless Steel
Linseed	150	(65)	50	(7.7)	Steel	60	(9.3)	304 Stainless Steel
Mineral	200	(93)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
	400	(204)	16	(2.5)	Steel	23	(3.6)	304 Stainless Steel
Vegetable/Shortening	400	(204)	30	(4.6)	304 Stainless Steel	40	(6.2)	304 Stainless Steel

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② Maximum operating temperatures and watt densities are detailed in Heat Transfer Oil charts on page 265.
③ Per API standards.
Monel® is a registered trademark of Special Metals Corporation.

Elements and Assemblies

Supplemental Applications Chart

Heated Material	Maximum Operating Temperature °F	(°C)	WATROD Element: Maximum Watt Density W/in²	(W/cm²)	WATROD Element: Sheath Material	FIREBAR Element: Maximum Watt Density W/in²	(W/cm²)	FIREBAR Element: Sheath Material
Paraffin or Wax (liquid)	150	(65)	16	(2.4)	Steel	20	(3.1)	304 Stainless Steel
Perchloroethylene	200	(93)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
Potassium Chlorate	212	(100)	40	(6.2)	316 Stainless Steel	N/A	N/A	N/A
Potassium Chloride	212	(100)	40	(6.2)	316 Stainless Steel	N/A	N/A	N/A
Potassium Hydroxide	160	(71)	23	(3.6)	Monel®	N/A	N/A	N/A
Soap, liquid	212	(100)	20	(3.1)	304 Stainless Steel	30	(4.6)	304 Stainless Steel
Sodium Acetate	212	(100)	40	(6.2)	Steel	50	(7.7)	304 Stainless Steel
Sodium Cyanide	140	(60)	40	(6.2)	Incoloy®	50	(7.7)	Incoloy® 800
Sodium Hydride	720	(382)	28	(4.3)	Incoloy®	36	(5.5)	Incoloy® 800
Sodium Hydroxide	—	—	—	—	See Caustic Soda	—	—	—
Sodium Phosphate	212	(100)	40	(6.2)	Copper	50	(7.7)	304 Stainless Steel
Steam, flowing	300	(148)	10	(1.6)	Incoloy®	①	①	Incoloy® 800
	500	(260)	5-10	(0.8-1.6)	Incoloy®	①	①	Incoloy® 800
	700	(371)	5	(0.8)	Incoloy®	①	①	Incoloy® 800
Sulfur, Molten	600	(315)	10	(1.6)	Incoloy®	12	(1.8)	Incoloy® 800
Toluene	212	(100)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
Trichlorethylene	150	(65)	23	(3.6)	Steel	30	(4.6)	304 Stainless Steel
Turpentine	300	(148)	20	(3.1)	304 Stainless Steel	25	(3.8)	304 Stainless Steel
Water								
Clean	212	(100)	60	(9.3)	Incoloy®	45	(7)	Incoloy® 800
Deionized	212	(100)	60	(9.3)	316 SS (passivated)	90	(14)	Incoloy® 800
Demineralized	212	(100)	60	(9.3)	316 SS (passivated)	90	(14)	Incoloy® 800
Potable	212	(100)	60	(9.3)	Incoloy®	45	(7)	Incoloy® 800
Process	212	(100)	48	(9.3)	Incoloy®			Consult factory

① Consult your Watlow representative.

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 inch/9.5 mm)
- All WATROD heating elements are 0.475 inch diameter (12 mm)

Circulation Heater Size Inches	Free Cross Sectional Area in Square Feet (Number of Elements in Parenthesis)					
WATROD						
2½ NPT	0.044	(3)				
3 Flange	0.044	(3)	0.037	(6)		
4 Flange	0.074	(6)				
5 Flange	0.124	(6)	0.117	(9)		
6 Flange	0.172	(12)	0.164	(15)		
8 Flange	0.303	(18)	0.296	(21)	0.288	(24)
10 Flange	0.481	(27)	0.460	(36)		
12 Flange	0.697	(36)	0.652	(54)		
14 Flange	0.848	(45)	0.781	(72)		
16 Flange	1.091	(72)	1.054	(87)	1.017	(102)
18 Flange	1.372	(102)	1.357	(108)	1.342	(114)
20 Flange	1.748	(108)	1.733	(114)	1.704	(126)
FIREBAR						
2½ NPT	0.0417	(3)				
4 Flange	0.0692	(6)				
6 Flange	0.154	(15)				

Tubular and Process Assemblies

Elements and Assemblies

Heat Transfer Oil Chart

Heat Transfer Fluid	Recommended Maximum Temperature °F (°C)				Flammability Data °F (°C)						Minimum 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	(0.9)	5	(1.52)	7	(2.1)
Calflo AF	550	(288)	600	(316)	400	(204)	437	(225)	650	(343)	1.5	(0.5)	3	(0.9)	5	(1.52)	7	(2.1)
Caloria HT-43	600	(316)	680	(360)	400	(204)	no data	no data	670	(354)	1.5	(0.5)	2.5	(0.75)	3	(0.9)	4	(1.22)
Dow therm® A	750	(399)	835	(446)	255	(124)	275	(135)	1150	(621)	0.5	(0.15)	1	(0.3)	2	(0.61)	3	(0.9)
Dow therm® 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)
Dow therm® J	575	(302)	650	(343)	145	(63)	155	(68)	806	(430)	1	(0.3)	2	(0.61)	3	(0.9)	4.5	(1.37)
Dow therm® 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)
Dow therm® 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	(1.52)
Dow therm® 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	(0.9)	5	(1.52)	7	(2.1)
Mobiltherm 603	590	(310)	625	(329)	380	(193)	no data	no data	no data	no data	1.5	(0.5)	3	(0.9)	5	(1.52)	7	(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	(0.9)
Multitherm PG-1	600	(316)	640	(338)	340	(171)	385	(196)	690	(368)	1	(0.3)	2	(0.61)	3	(0.9)	4	(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	(0.9)	5	(1.52)	7	(2.1)
Syltherm XLT	500	(260)	550	(288)	116	(47)	130	(54)	662	(350)	1.5	(0.5)	2.5	(0.75)	4	(1.22)	5	(1.52)
Texatherm	600	(316)	640	(338)	430	(221)	no data	no data	no data	no data	2	(0.61)	4	(1.22)	6	(1.83)	8	(2.4)
Thermia 33	600	(316)	650	(343)	455	(235)	495	(257)	no data	no data	1.5	(0.5)	3	(0.9)	5	(1.52)	7	(2.1)
Therminol 44	400	(204)	475	(246)	405	(207)	438	(228)	705	(374)	1	(0.3)	2	(0.61)	3	(0.9)	4	(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	(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	(1.52)
Therminol 60	620	(327)	655	(346)	310	(154)	320	(160)	835	(448)	1.5	(0.5)	3	(0.9)	5	(1.52)	7	(2.1)
Therminol 68	650	(343)	705	(374)	350	(177)	380	(183)	705	(374)	1.5	(0.5)	2.5	(0.75)	3	(0.9)	4.5	(1.37)
Therminol 75	750	(399)	805	(429)	390	(199)	440	(227)	1000	(538)	1	(0.3)	2	(0.61)	3	(0.9)	4	(1.22)
Therminol LT	600	(316)	650	(343)	134	(57)	150	(66)	805	(429)	1.5	(0.5)	2.5	(0.75)	4	(1.22)	5	(1.52)
Therminol VP-1	750	(399)	800	(427)	255	(124)	280	(127)	1150	(621)	1	(0.3)	2	(0.61)	3	(0.9)	4	(1.22)
U-Con 500	500	(260)	550	(288)	540	(282)	600	(316)	750	(399)	1	(0.3)	2	(0.61)	3	(0.9)	4	(1.22)

Dow therm® is a registered trademark of Dow Chemical Corporation.

Elements 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 I, under “Heaters Miscellaneous” (Classification KSOT2).

Elements

WATROD Diameter inch	(mm)	Code Number Designation		Max. Volts	Max Amps	Max. Watt Density W/in²	W/cm²	Min. Bend Radius inch	(mm)	Allowable Sheath Materials	End Seal Types
0.210	(6.0)		**U0-xx**	250	15	N/A	N/A	1/16	(2)	Aluminum,	
0.260	(6.6)	**RA** series	**U1-xx**	250	15	N/A	N/A	1/16	(2)	Copper,	Epoxy resin,
0.315	(8.0)	**RB** series	**U3-xx**	480	30	N/A	N/A	1/16	(2)	Incoloy®,	Lavacone,
0.335	(8.5)		**UE-xx**	480	30	N/A	N/A	3/16	(5)	Inconel®,	Silicone resin,
0.375	(9.5)	**RD**, **RS** series	**U5-xx**	480	30	N/A	N/A	3/16	(5)	Stainless steel,	Silicone rubber,
0.430	(10.9)	**RC** series	**U6-xx**	600	40	N/A	N/A	5/32	(4)	Steel,	Glass,
0.475	(12.0)	**RG** series	**U7-xx**	600	40	N/A	N/A	3/16	(5)	Titanium,	ULTRAGARD,
0.490	(12.4)		**U8-xx**	600	40	N/A	N/A	3/16	(5)	Special Request	SF 99
0.625	(15.9)		**U9-xx**	600	40	N/A	N/A	7/16	(11)		

FIREBAR® Height inch	(mm)	Code Number Designation		Max. Volts	Max. Amps	Max. Watt Density W/in²	W/cm²	Min. Bend Radius Major Axis inch	(mm)	Minor Axis inch	(mm)	Allowable Sheath Materials	End Seal Types
Air or Immersion Heating													
5/8	(16)	**FA**, **FS** series	**A-xx**	250	N/A	33	(5.1)	1	(25)	1/2	(13)	Incoloy®	Epoxy resin
1	(25.4)	**FB**, **FS** series		250	N/A	33	(5.1)	1	(25)	1/2	(13)	Stainless steel	Lavacone
												Titanium	Silicone resin
													Silicone rubber
													ULTRAGARD
Liquid Immersion Heating Only													
5/8	(16)	**FA**, **FS** series	**U-xx**	480	N/A	160	(24.7)	1	(25)	1/16	(2)	Incoloy®	Epoxy resin
1	(25.4)	**FB**, **FS** series		480	N/A	160	(24.7)	1	(25)	1/16	(2)	Stainless steel	Lavacone
												Titanium	Silicone resin
													Silicone rubber
													ULTRAGARD

Note: UL® and CSA must be requested at the time the order is placed.

Tubular and Process Assemblies

Elements and Assemblies

Assemblies

Refer to applicable WATROD and FIREBAR elements for maximum voltage, watt density and sheath materials.

Heater Type	Code Number Designations	Electrical Enclosure Options
Screw Plug	All catalog "**B**" models Series **U1** to **U9**	General purpose 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 with or without thermostat
Circulation	All catalog models **CB**, **CF**, **CP** Series **U1** to **U9**	General purpose with or without thermostat
Over-the-Side	All catalog "**OL**," "**OR**" and "**VL**" models Series **U1** to **U9**, *except* **U2** and **U4**	Moisture resistant with or without thermostat
Duct	All catalog "**D6** to **D125**" models Series **U1** to **U9**, *except* **U2** and **U4**	General purpose enclosure only (Incoloy® sheath only)

File Number E56488 (UL 1030)—Water Immersion Only (Classification UBJY2). — Component Recognition

Elements

WATROD Diameter inch	(mm)	Code Number Designation	Max. Volts	Max Amps	Max. Watt Density W/in²	W/cm²	Min. Bend Radius inch	(mm)	Allowable Sheath Materials	End Seal Types
0.315	(8.0)		480	7	120	(18.5)	⅛	(3)		
0.375	(9.5)		480	7	120	(18.5)	⅛	(3)	Copper	Epoxy
0.430	(10.9)	**T** series	575	7	120	(18.5)	5⁄16	(8)	Incoloy®	RTV
0.475	(12.0)	Example: **T085CN3S**	575	7	120	(18.5)	5⁄16	(8)	Stainless steel	Silicone
0.490	(12.4)		575	7	120	(18.5)	5⁄16	(8)		
0.625	(15.9)		575	7	120	(18.5)	5⁄16	(8)		

FIREBAR® Height inch	(mm)	Code Number Designation	Max. Volts	Max. Amps	Max. Watt Density W/in²	W/cm²	Min. Bend Major Axis inch	(mm)	Min. Bend Minor Axis inch	(mm)	Allowable Sheath Materials	End Seal Types
1	(25.4)	**T** series Example: **T085HN3W**	250	N/A	80	(12.4)	1	(25)	5⁄32	(4)	Incoloy® Stainless steel	Epoxy RTV Silicone

Assemblies

Refer to applicable WATROD and FIREBAR elements for maximum voltage, watt density and sheath materials.

Heater Type	Code Number Designations	Electrical Enclosure Options
Screw Plug	Models **T3**, **T5**, **T6**, **T7**, **T8**, **T9** Example: **T336xxxx**	General purpose without thermostat
Flange	Models **T3**, **T5**, **T6**, **T7**, **T8**, **T9** Example: **T621xxxx**	General purpose without thermostat

Note: UL® and CSA must be requested at the time the order is placed.

Elements and Assemblies

File Number MH26554 (UL 574)—Electric Oil Heaters (Classification MDST2).
— Component Recognition or Listing (Consult factory if UL® Listed marking is desired)

Elements

For reference only, marking applies only to assemblies noted below.

WATROD Diameter inch	(mm)	Code Number Designation	Max. Volts	Max Amps	Max. Watt Density W/in²	W/cm²	Min. Bend Radius inch	(mm)	Allowable Sheath Materials	End Seal Types
0.260	(6.6)	series **1-xx**	250	15	23	(3.56)	1/16	(2)	Steel, Inconel®	Epoxy resin, silicone resin
0.315	(8.0)	series **3-xx**	480	30	23	(3.56)	1/16	(2)	Stainless steel	Silicone rubber
0.375	(9.5)	series **5-xx**	480	30	23	(3.56)	3/16	(5)	Incoloy®	Lavacone
0.430	(10.9)	series **6-xx**	600	40	23	(3.56)	5/32	(4)	Monel®	ULTRAGARD
0.475	(12.0)	series **7-xx**	600	40	23	(3.56)	3/16	(5)		
0.490	(12.4)	series **8-xx**	600	40	23	(3.56)	3/16	(5)	Hastelloy®	
0.625	(15.8)	series **9-xx**	600	40	23	(3.56)	7/16	(11)	Titanium	

Assemblies

Refer to applicable WATROD elements for maximum voltage, watt density and sheath materials.

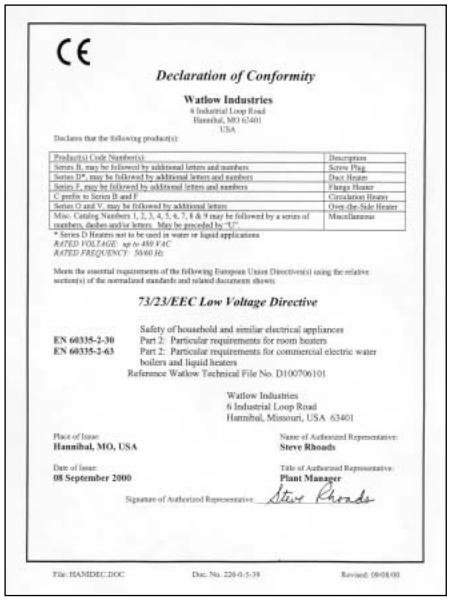
Heater Type	Code Number Designations	Electrical Enclosure Options
Screw Plug	Models **BCS and BGS** series **1-xx** thru **9-xx**, excluding series **2-xx** and **4-xx**	Enclosure Types 1 or 4, with or without thermostat. Thermostat shall be Watlow Type 4, 12 or 12A

Note: UL® and CSA must be requested at the time the order is placed.

Declaration of Conformity

The Low Voltage Directive (LVD) (73/23/EEC) states that electrical and electronic equipment placed on the market in the European Union (EU) must be safe. The CE Marketing Directive (93/68/EEC) for the LVD came into force on January 1, 1995, subject to a two-year transition period. All heaters operating on a supply voltage of between 50 and 1000V~(ac), and between 75 and 1500V⎓(dc) fall within the scope of the LVD.

The Self Declaration of Conformity shown on the right, backed by our risk assessment and technical file, assure that the product series shown on the Declaration meet the EU requirements. The Declaration is not applicable to any of our heaters intended for use in an explosive atmosphere, or for radiological and medical purposes.



CE

Declaration of Conformity

Watlow Industries
6 Industrial Loop Road
Hannibal, MO 63401
USA

Declares that the following product(s):

Product(s) Code Number(s)	Description
Series B, may be followed by additional letters and numbers	Screw Plug
Series D*, may be followed by additional letters and numbers	Duct Heater
Series F, may be followed by additional letters and numbers	Flange Heater
C prefix to Series B and F	Circulation Heater
Series O and V, may be followed by additional letters	Over-the-Side Heater
Misc. Catalog Numbers 1, 2, 3, 4, 5, 6, 7, 8 & 9 may be followed by a series of numbers, dashes and/or letters. May be preceded by "E".	Miscellaneous

* Series D Heaters not to be used in water or liquid applications
RATED VOLTAGE: up to 480 VAC
RATED FREQUENCY: 50/60 Hz

Meets the essential requirements of the following European Union Directive(s) using the relative section(s) of the normalized standards and related documents shown:

73/23/EEC Low Voltage Directive

EN 60335-2-30, EN 60335-2-63: Safety of household and similar electrical appliances Part 2: Particular requirements for room heaters Part 2: Particular requirements for commercial electric water boilers and liquid heaters

Reference Watlow Technical File No. D100706101

Watlow Industries
6 Industrial Loop Road
Hannibal, Missouri, USA 63401

Place of Issue: **Hannibal, MO, USA**
Name of Authorized Representative: **Steve Rhoads**
Date of Issue: **08 September 2000**
Title of Authorized Representative: **Plant Manager**
Signature of Authorized Representative: Steve Rhoads

File: HANDEC.DOC Doc. No. 220-0-5-39 Revised: 09/08/00

Hastelloy® is a registered trademark of Haynes International.

Tubular and Process Assemblies

Elements 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 inch	(mm)	Code Number Designation	Max. Volts	Max. Watt Density W/in²	(W/cm²)	Allowable Sheath Materials①	End Seal Type (All Diameters)
WATROD:							
0.260	(6.6)	All catalog models, **1-xx**	600	120	(18.5)	Copper	
0.315	(8.0)	All catalog models, **3-xx**	600	120	(18.5)	Incoloy®	Epoxy resin,
0.375	(9.5)	All catalog models, **5-xx**	600	120	(18.5)	Stainless steel	Lavacone,
0.430	(10.9)	All catalog models, **6-xx**	600	120	(18.5)	Steel	Silicone resin,
0.475	(12.0)	All catalog models, **7-xx**	600	120	(18.5)	Titanium	Silicone rubber
0.490	(12.4)	All catalog models, **8-xx**	600	120	(18.5)	Special request	ULTRAGARD
0.625	(15.9)	All catalog models, **9-xx**	600	120	(18.5)		
FIREBAR:							
⅝	(15.9)	**FA**, **FS** models, **4-xx**	480	120	(18.5)	Incoloy®	Epoxy resin,
1	(25.4)	**FB**, **FS** models, **2-xx**	480	120	(18.5)	Stainless steel	Lavacone,
						Titanium	Silicone resin,
							Silicone rubber

Note: Heating elements are certified only for use in equipment where the acceptability of the construction combination is determined by the Canadian Standards Association.
① Some sheath materials not available on all diameters. Consult factory.

Assemblies

Heater Type	Code Number Designations	Electrical Enclosure Options
Screw Plug	All catalog "**B**" models Series **1-xx** to **9-xx**	General purpose with or without thermostat Enclosure 4 with or without thermostat
Flange	All catalog models **FM**, **FN**, **FO**, **FP**, **FR**, **FS**, **FT**, **FW** Series **1-xx** to **9-xx**	General purpose with or without thermostat ***Enclosure 4 with or without thermostat
Circulation	All catalog models **CBD**, **CBE**, **CBL**, **CFM**, **CFN**, **CFO**, **CFP**, **CFR**, **CFS**, **CFT**, **CFW**—Series **1-10** to **9-10**	General purpose with or without thermostat ***Enclosure 4 with or without thermostat
Over-the-Side	All catalog "**OL**" and "**OR**" models Series **1-30** to **9-30**	Enclosure 4 with or without thermostat
Duct	All catalog "**D**" and "**MDH**" models Series **1-1** to **9-1**	General purpose enclosure only

* 4, 5, 6 and 8 inch flange size only.

File Number LR 61707—Heater Assemblies–Miscellaneous–For Hazardous Locations

Heater Type	Code Number Designations	Electrical Enclosure Options
Screw Plug	All catalog "**B**" models Series **1-xx** to **9-xx**	Class I, Groups B, C and D
Flange	All catalog models **FM**, **FN**, **FO**, **FP**, **FR**, **FS**, **FT**, **FW** Series **1-xx** to **9-xx**	Class I, Groups B, C and D, and Enclosure 4 with or without thermostat
Circulation	All catalog models **CFM**, **CFN**, **CFO**, **CFP**, **CFR**, **CFS**, **CFT**, **CFW** Series **1-10** to **9-10**	Class I, 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.

Tubular and Process Assemblies

Elements and Assemblies

WATROD Heating Elements

Single- and Double-Ended Elements

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

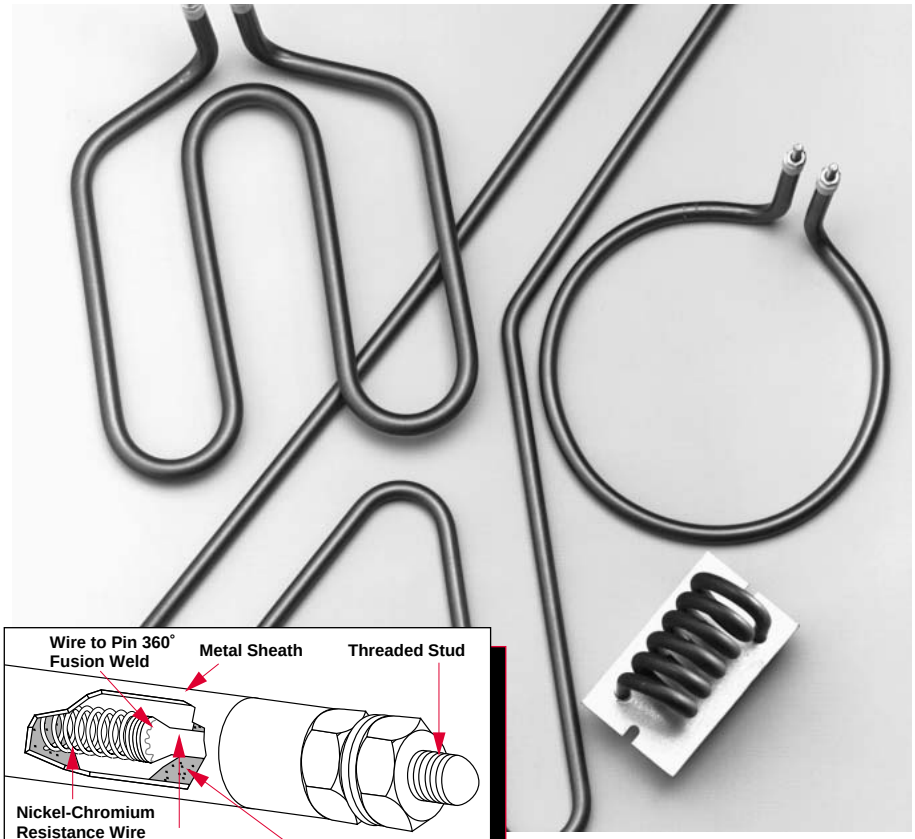
The single-ended WATROD tubular design has both terminals at one end. The opposite end is sealed. Standard 12-inch (305 mm) flexible lead wires are crimp connected to the terminal pin and have silicone-impregnated fiberglass oversleeves.

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 new double-sided 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 that deliver 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 that make them highly popular among industrial customers.



Single-Ended WATROD Performance Capabilities

- Watt densities to 45 W/in² (6.9 W/cm²)
- UL® and CSA component recognition to 240V~(ac)
- Incoloy® and stainless steel sheath temperatures to 1200°F (650°C)

Double-Ended WATROD Performance Capabilities

- Watt densities up to 120 W/in² (18.6 W/cm²)
- UL® and CSA component recognition to 480 and 600V~(ac) respectively
- Inconel® sheath temperatures to 1800°F (982°C)
- Incoloy® sheath temperatures to 1600°F (870°C)
- Stainless steel sheath temperatures to 1200°F (650°C)
- Steel sheath temperatures to 750°F (400°C)
- Copper sheath temperatures to 350°F (175°C)
- Inconel® 600 sheath temperatures 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** protect against moisture contamination and are rated to 390°F (200°C).
- **MgO insulation filled sheath** maximizes dielectric strength, heat transfer and life.
- **Standard sheath materials include**: copper, steel, 316 stainless steel and Incoloy®. Optional materials, available on made-to-order, include 304 stainless steel, Inconel® Monel® and titanium.
- **36 standard bend formations** allow forming the heating element to the application. Spirals, compound bends and multi-axis and multi-plane configurations.
- **Resistance wire fusion welded to the terminal pin** for a stronger, positive electrical connection.
- **Stainless steel studs** are fusion welded to terminal pins for mechanical strength with ceramic insulators.
- **Popular termination, mounting and moisture seal options available.**

WATROD Heating Elements

High Temperature Tubular Double-Ended Elements

Watlow manufactures high temperature tubular heaters to bridge the gap between standard tubular heaters and Watlow multicell heaters. This new 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 Inconel® 600 and a special internal construction. The outer sheath offers high temperature capabilities, reduced oxidation, as well as corrosion resistance.

The new 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

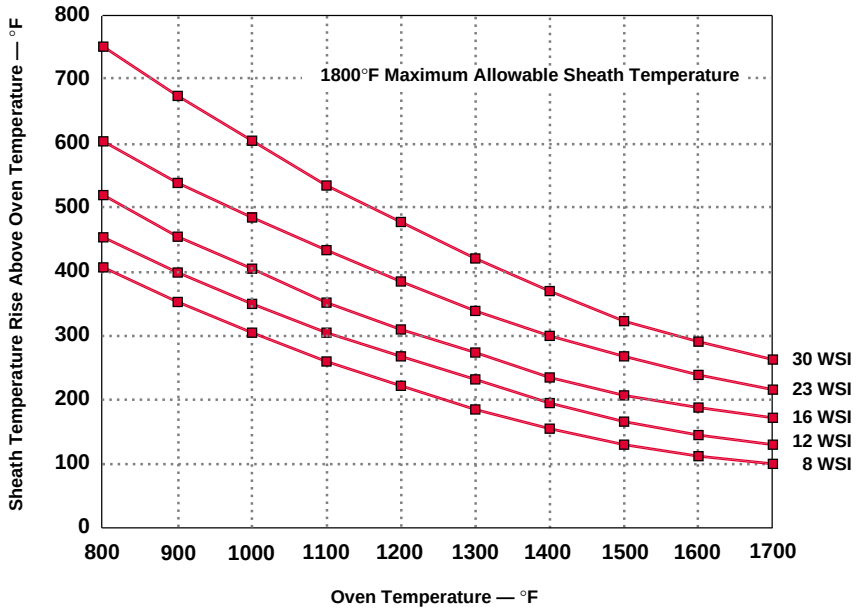
- **Inconel® 600 sheath material and a special internal construction** assures high temperature performance and corrosion protection in tough applications.
- **0.375 in and 0.430 in diameters** allow heater to be configured to existing tubular designs that may be experiencing short life.
- **Dual-ended termination** can be installed 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.

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

Sheath Temperature Versus Oven Temperature at Various Watt Density

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.



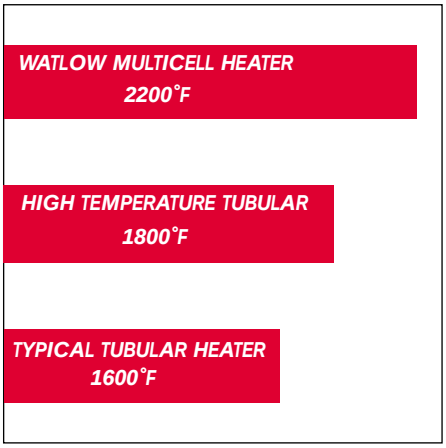
WATROD Heating Elements

High Temperature Tubular Double-Ended Elements

Continued

Heater Life Estimate Service

High Temperature Heater Comparisons



*Assuming normal design practices.

Watlow now provides an industry first service with the offering of the high temperature tubular. By providing operating parameters Watlow can provide 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 in or 0.375 in)
- Heated length
- Bend configuration and dimensions (# of bends and radius)
- Application including process temperature
- Power switching device and cycle time (SCR, etc.)

F.O.B.: Hannibal, Missouri

How to Order

To order please specify:

- Volts
- Watts
- Heater diameter (0.430 in or 0.375 in)
- Termination type or style (studs, lead wire)
- Heated length
- Cold end length
- Overall sheath length
- Formation
- Mounting option (bulkheads, brackets, etc.)

WATROD Heating Elements

Multicoil Single- or Double-Ended Elements

Watlow's new tubular element with multiple coils and/or thermocouples inside one sheath answers the need for a versatile, innovative tubular heater. Our new, patent-pending 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 lower amperage 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 new multicoil heater capabilities save money.

Watlow has the capability to put up to two coils in a 0.375 or 0.430 diameter heater and up to three coils in a 0.475 or 0.490 diameter heater. Any one or more of these coils can be a resistance wire or a thermocouple. The bending formations are virtually limitless; while mounting options are similar to other Watlow tubular heaters. The three-phase multicoil heaters can be single ended with three leads for three-phase wye hook up. Watlow recommends using an epoxy moisture seal or silicone-based seal.

Watlow's multicoil heaters are available in all standard materials such as Incoloy®, 304 and 316 stainless steel, and can be formed into almost any configuration. Our five thermocouple and/or coil options for multicoil tubular configurations will meet most requirements; however, we are always interested in discussing the use of different materials or changing the number of coils and thermocouples.

Features and Benefits

- **Three-phase capability** results in one element versus three, lower amperage, reduced installation time and lower overall cost.
- **Internal thermocouple** allows responsive and accurate, internal, high-limit sensing and reduced assembly costs.
- **Single ended** allows for mounting in a ½ inch NPT or ¾ inch NPT fitting with three-phase capability.
- **Multiple coil options** reduce inventory by allowing dual voltage capability.
- **Versatile forming capabilities** can be formed into virtually any configuration.
- **Internal construction** 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.

Applications

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

Tubular and Process Assemblies

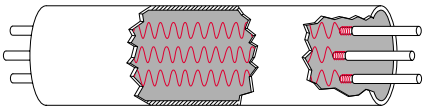
WATROD Heating Elements

Multicoil Single- or Double-Ended Elements

Continued

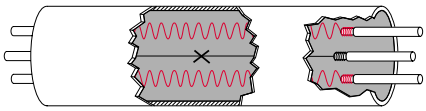
Options

Option A



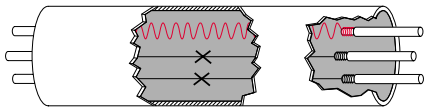
3-phase tubular, 0.475 and 0.490 inch diameter.

Option B



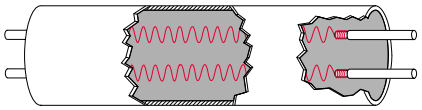
1-phase tubular with two resistance wires and one thermocouple, 0.475 and 0.490 inch diameter.

Option C



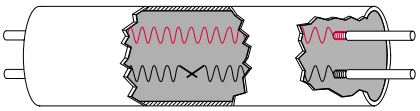
1-phase tubular with one resistance wire and two thermocouples, 0.475 and 0.490 inch diameter.

Option D



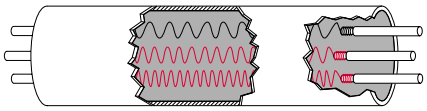
1-phase tubular with three different one phase circuits, 0.475 and 0.490 inch diameter.

Option E



1-phase tubular with two resistance coils, 0.375, 0.430, 0.475 and 0.490 inch diameter.

Option F



1-phase tubular with one resistance coil and one thermocouple, 0.375, 0.430, 0.475 and 0.490 inch diameter.

Specifications

Termination style is currently limited to lead wires 392°F (200˚C) Sil-A-Blend™ or 482°F (250˚C) GGS.

Moisture seals are required, options include:

- Standard epoxy with temperature rating to 266˚F (130°C). Typical applications include water/oil immersion.
- Lavacone with temperature rating to 300˚F (148.9°C). Typical application includes air heating.
- High-temp ceramic rated to 2800˚F (1537.8°C).
- Consult factory for other moisture seal options.
- ULTRAGARD with temperature rating to 700˚F (375˚C).

Mounting options include:

- Mounting brackets
- Locator washers
- Mounting collars
- Water-tight bulkheads

Maximum trim length is 237 inches (6020 mm). Heater designs with trim length greater than 120 inches (3048 mm) must be reviewed with factory.

Sheath materials: Incoloy®, 304 and 316 stainless steel, consult factory for other sheath material options.

Internal thermocouple options: Type K is used, consult factory for Type J thermocouple options.

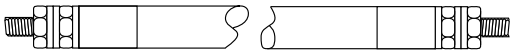
U.S. Patent Pending

Sil-A-Blend™ is a trademark of Radix Wire Company.

WATROD Heating Elements

Specifications

Double-Ended



Single-Ended

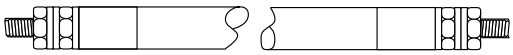
Applications	Direct immersion Hot runner mold (manifold) Forced air Ovens Radiant Clamp-on		Vacuums Semiconductor		Platens Forced air Deicing antennas Plastic wrap cutting Seal bars			
Watt Density	Stock:		up to 60	(9.3)	Stock:		up to 20	(3.1)
W/in² (W/cm²)	Made-to-Order (M-t-O):		up to 120	(18.6)	M-t-O:		up to 45	(6.9)
Element Diameters	**Dia.**	**in²**	**Dia. (mm)**	**cm²**	**Dia.**	**in²**	**Dia. (mm)**	**cm²**
inch (mm)	0.210	0.660	(5.3)	(4.26)	0.375	1.178	(9.5)	(7.600)
and Surface Area per Linear	0.260	0.817	(6.6)	(5.27)	0.430	1.351	(10.9)	(8.717)
inch (cm)	0.315	0.990	(8.0)	(6.38)	0.475	1.492	(12.0)	(9.626)
Diameter Tolerance	0.332	1.043	(8.4)	(6.73)	0.490	1.539	(12.4)	(9.930)
± 0.005 inch (0.13 mm)	0.375	1.178	(9.5)	(7.60)	0.625	1.963	(15.9)	(12.665)
	0.430	1.351	(10.9)	(8.72)				
	0.475	1.492	(12.0)	(9.63)				
	0.490	1.539	(12.4)	(9.93)				
	0.625	1.963	(15.9)	(12.66)				
Sheath Materials	Stock:	Incoloy®	1600°F	(870°C)	Stock:	Incoloy®	1200°F	(650°C)
Maximum Operating		316 stainless steel	1200°F	(650°C)				
Temperature		Steel	750°F	(400°C)				
		Copper	350°F	(175°C)				
	M-t-O:	Inconel® 600	1800°F	(980°C)	M-t-O:	Incoloy®	1600°F	(870°C)
		Incoloy®	1600°F	(870°C)		316 stainless steel	1200°F	(650°C)
		316 stainless steel	1200°F	(650°C)		304 stainless steel	1200°F	(650°C)
		304 stainless steel	1200°F	(650°C)		Steel	750°F	(400°C)
		Steel	750°F	(400°C)				
		Copper	350°F	(175°C)				
		Monel®		Consult Factory				
		Titanium		Consult Factory				
Sheath Length By Diameter		**Sheath**		**Sheath**		**Sheath**		**Sheath**
inch (mm)	**Dia.**	**Length**	**Dia.**	**Length**	**Dia.**	**Length**	**Dia.**	**Length**
	Stock:				Stock:			
	0.260	20 to 80	(6.6)	(510 to 2030)	0.375	15 to 40	(9.5)	(380 to 1015)
	0.315	12 to 100	(8.0)	(305 to 2540)				
	0.375	11 to 180	(9.5)	(275 to 4555)				
	0.430	15 to 120	(10.9)	(380 to 3050)				
	0.475	20 to 157	(12.0)	(510 to 3990)				
	M-t-O:				M-t-O:			
	0.210	9 to 130	(5.3)	(230 to 3300)	0.375	11 to 125	(9.5)	(280 to 3175)
	0.260	9 to 275	(6.6)	(230 to 6980)	0.430	11 to 106	(10.9)	(280 to 2690)
	0.315	9 to 270	(8.0)	(230 to 6850)	0.475	11 to 125	(12.0)	(280 to 3175)
	0.332	9 to 125	(8.5)	(230 to 3170)	0.490	11 to 125	(12.4)	(280 to 3175)
	0.375	11 to 325	(9.5)	(280 to 8255)	0.625	11 to 125	(15.9)	(280 to 3175)
	0.430	11 to 268	(10.9)	(280 to 6810)				
	0.475	11 to 275	(12.0)	(280 to 6985)				
	0.490	11 to 275	(12.4)	(280 to 6985)				
	0.625	11 to 275	(15.9)	(280 to 6985)				

Tubular and Process Assemblies

WATROD Heating Elements

Specifications

Double-Ended



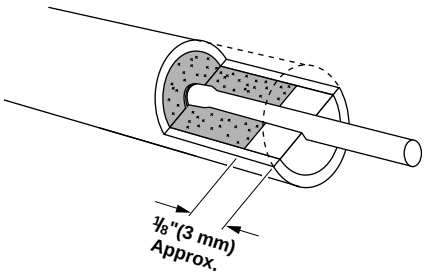
Single-Ended

Minimum No-Heat Length inch (mm)	**Sheath Length**	**No-Heat Length**	**Sheath Length**	**No-Heat Length**	**Sheath Length**	**No-Heat Length**	**Sheath Length**	**No-Heat Length**
	11 to 20	1	(280 to 510)	(25)	11 to 20	1½	(280 to 5100)	(38)
	21 to 50	1¼	(535 to 1270)	(32)	21 to 50	1¾	(533 to 1270)	(44)
	51 to 80	1½	(1295 to 2030)	(38)	51 to 80	2⅛	(1295 to 2030)	(54)
	81 to 110	1⅝	(2055 to 2795)	(42)	81 to 110	2⅜	(2055 to 2795)	(60)
	111 to 140	1¾	(2820 to 3555)	(44)	111 to 125	2⅝	(2820 to 3175)	(67)
	141 to 170	2	(3580 to 4320)	(51)				
	171 to 200	2¼	(4345 to 5080)	(57)				
	201 & up	2½	(5105 & up)	(64)	**½ inch (13 mm) No-heat length on all blunt ends**			
Maximum Voltage/Amperage By Dia. inch (mm)	**Dia.**	**Volts**	**Amps**		**Dia.**	**Volts**	**Amps**	
	0.260 (6.6)	250V~(ac)	15		0.375 (9.5)	480V~(ac)	30	
	0.315 (8.0)	480V~(ac)	30		0.430 (10.9)	480V~(ac)	30	
	0.332 (8.5)	480V~(ac)	30		0.475 (12.0)	480V~(ac)	30	
	0.375 (9.5)	480V~(ac)	30		0.490 (12.4)	480V~(ac)	30	
	0.430 (10.9)	600V~(ac)	40		0.625 (15.9)	480V~(ac)	30	
	0.475 (12.0)	600V~(ac)	40					
	0.490 (12.4)	600V~(ac)	40					
	0.625 (15.9)	600V~(ac)	40					
Ohms Per Heated Inch By Dia. inch	**Dia.**	**Minimum**	**Maximum**		**Dia.**	**Minimum**	**Maximum**	
	0.210	0.100Ω	16Ω					
	0.260	0.080Ω	25Ω		0.375	0.200Ω	34Ω	
	0.315	0.050Ω	25Ω		0.430	0.200Ω	34Ω	
	0.332	0.050Ω	23Ω		0.475	0.200Ω	34Ω	
	0.375	0.020Ω	18Ω		0.490	0.200Ω	34Ω	
	0.430	0.025Ω	30Ω		0.625	0.200Ω	34Ω	
	0.475	0.030Ω	30Ω					
	0.490	0.030Ω	30Ω					
	0.625	0.030Ω	25Ω					
Terminations	Stock:	Threaded stud			Stock:	Flexible lead wires		
	M-t-O:	Threaded stud Screw lug (plate) Quick connect (spade) Flexible lead wires Rubber overmolds			M-t-O:	Flexible lead wires Rubber overmolds		
Seals	Stock:	Silicone resin	390°F	(200°C)	Stock:	Silicone resin	390°F	(200°C)
	M-t-O:	Ceramic base	2800°F	(1535°C)	M-t-O:	Silicone rubber (RTV)	500˚F	(260°C)
		ULTRAGARD	700°F	(375°C)		ULTRAGARD	700°F	(375°C)
		Ceramic-to-metal	500°F	(260°C)		Silicone resin	392°F	(200°C)
		Silicone rubber (RTV)	500°F	(260°C)		Epoxy resin	266/350°F	(130/177°C)
		Silicone resin	392°F	(200°C)				
		Epoxy resin	266/350°F	(130/177°C)				
Mounting Options	Threaded bulkheads Mounting brackets Locator washers Mounting collars				Threaded bulkhead Locator washers Mounting collars			
Surface Finish Options	Belt polishing Passivation	Bright Anneal			Belt polishing Passivation	Bright Anneal		
Agency Recognition	UL® Component to 480V~(ac) (file # E52951/E56488) CSA Component to 600V~(ac) (file # 31388)				UL® Component to 240V~(ac) (file # E52951) CSA Component to 240V~(ac) (file # 31388) ①			

① Not applicable to 0.375 inch diameter single-ended WATROD

WATROD Heating Elements

Options



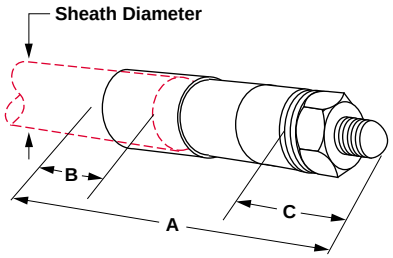
Moisture Resistant Seals

WATROD's MgO insulating material is hygroscopic. To prevent moisture contamination from entering the heater, an appropriate moisture seal must be used. Choosing the correct seal is important to the life and performance of the heater. 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.

End Seal Options

End Seal	Code Number	Color	Seal Depth	UL® Recognition	Max. Cont. Use Temperature	Typical or General Usage/Application
Standard Epoxy	**EC**	Cream	3/16"	Yes	266°F (130°C)	General purpose for moisture resistance
Intermediate Epoxy	**EB**	Blue	3/16"	Yes	350°F (177°C)	Intermediate temp. rating for moisture resistance
High-Temp. Epoxy	**HTE**	Amber	3/16"	No	450°F (232°C)	Higher temp. rating for moisture resistance
Silicone Resin	**SR**	Clear	1/16"	Yes	392°F (200°C)	General usage on tubular products
Silicone Fluid	**SF**	Clear	N/A	No	392°F (200°C)	Moisture resistance of the MgO, or High-Temp. ceramic seal (storage only)
Lavacone	**LC**	Dark Brown	3/16"	Yes	392°F (200°C)	Porous seal for the FIREBAR
Silicone Rubber RTV	**RTV**	Red-Orange	3/16"	Yes	500°F (260°C)	General usage on FIREBAR applications
ULTRAGARD	**UG**	Clear	3/16"	Yes	700°F (350°C)	High temp. around seal area and for vacuum applications
High-Temp. Ceramic	**HTC**	White	3/16"	No	2800°F (1538°C)	Very high temperature applications

Ceramic-to-Metal End Seal



Sheath Diameter inch	(mm)	A inch	(mm)	B inch	(mm)	C inch	(mm)	Thread Size
0.260	(6.6)	1 11/16	(40)	1/2	(13)	13/32	(10)	#8-32
0.315	(8)	1 7/8	(43)	1/2	(13)	13/32	(10)	#10-32
0.430	(10.9)	2 1/8	(54)	1/2	(13)	21/32	(10)	#¼-28

To order specify, **ceramic-to-metal end seal**.

Ceramic-to-metal end seals with threaded stud terminations provide an air-tight seal for continuous terminal temperatures up to 500°F (260°C). Watlow does not recommend this seal if terminations are exposed to temperatures exceeding 500°F (260°C).

External Finishes

Belt Polishing

Belt polishing sands the oxidized sheath to a bright finish. This finish is available only on alloy sheath materials.

To order, specify **belt polishing**.

Bright Annealing

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

To order, specify **bright annealing**.

Passivation

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

To order, specify **passivation**.

Tubular and Process Assemblies

WATROD Heating Elements

WATROD 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.

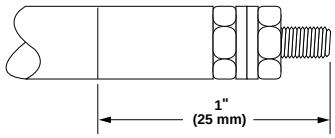
Standard flexible lead wires are 12 inches (305 mm), Sil-A-Blend™ 390°F (200°C) unless otherwise specified. Insulation options include TGGT (480°F/250°C) plus other temperature ratings. Consult factory for availability.

Overmolds are available for flexible lead wires only. Available in silicone rubber (390°F/200°C), neoprene (212°F/90°C) and other materials. Consult factory for details.

WATROD Element	Sheath Diameter inch	(mm)	Threaded Stud① A	Screw Lug (Plate) B	C	D	Quick Connect (Spade) E	F	G	Flexible Lead Wires H	Lead Wire Overmolds J
Double-Ended	0.260	(6.6)	#6-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	0.315	(8.0)	#10-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	0.335	(8.5)	#10-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
	0.375	(9.5)	#10-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
	0.430	(10.9)	#10-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	0.475	(12.0)	#10-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	0.490	(12.4)	#10-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
	0.625	(15.9)	#10-32	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Single-Ended	0.375	(9.5)	No	No	No	No	No	No	No	Yes	No
	0.430	(10.9)	No	No	No	No	No	No	No	Yes	Yes
	0.475	(12.0)	No	No	No	No	No	No	No	Yes	Yes
	0.490	(12.4)	No	No	No	No	No	No	No	Yes	No
	0.625	(15.9)	No	No	No	No	No	No	No	Yes	Yes

Threaded Stud

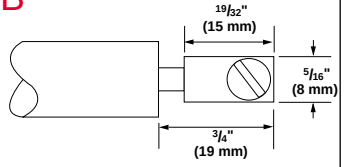
A



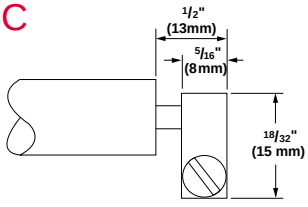
① Optional #8-32, ¼ inch and 4 or 5 mm studs available. Consult factory for details.

Screw Lug (Plate)

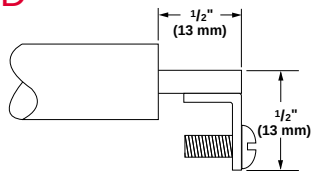
B



C

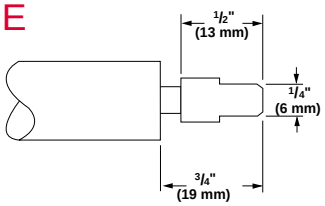


D

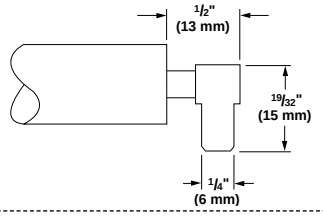


Quick Connect (Spade)

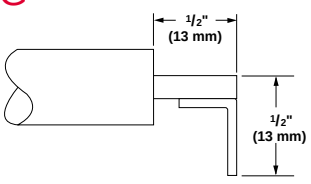
E



F

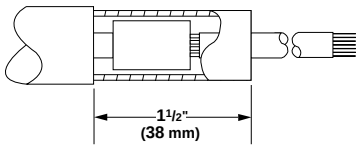


G



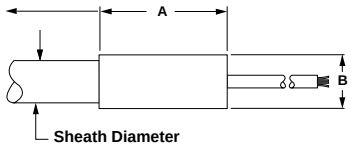
Flexible Lead Wires

H



Rubber Overmolds

J



Overmold Availability

Sheath Diameter inch	(mm)	A inch	(mm)	B inch	(mm)
0.260	(6.6)	2½	(63.5)	½	(13.0)
0.315	(8.0)	2½	(63.5)	½	(13.0)
0.375	(9.5)	2½	(63.5)	⅝	(15.9)
0.430	(10.9)	2½	(63.5)	⅝	(15.9)
0.475	(12.0)	2½	(63.5)	⅝	(15.9)
0.625	(15.9)	2½	(63.5)	⅞	(22.2)

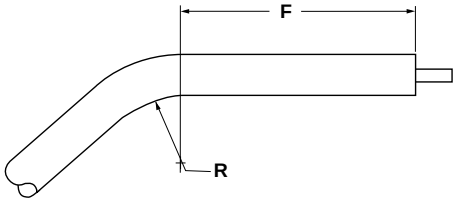
WATROD Heating Elements

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 three inches (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 282 to 286** are the 36 common bend configurations available on both stock and made-to-order WATROD heating elements.



Single-Ended WATROD Bend Formations

Watlow does not recommend field bending single-ended WATROD elements. Formation is limited by the minimum radius of a bend (R) and the straight length (F) beyond the bend. The radius must be three inches (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 Length Tolerance (T)

Sheath Length inch	Sheath Length (mm)	Length Tolerance inch	Length Tolerance (mm)
11-50	(280-1270)	±⅛	(±3)
51-110	(1295-2795)	±3⁄16	(±5)
111-170	(2820-4320)	±¼	(±6)
171-200	(4345-5080)	±⅜	(±10)
201 & up	(5105 & up)	±½	(±13)

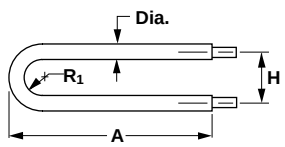
WATROD Minimum Radius

Sheath Diameter inch	Sheath Diameter (mm)	Field Bend R① inch	Field Bend R① (mm)	Factory R① inch	Factory R① (mm)	F② Dimension inch	F② Dimension (mm)
0.260	(6.6)	¾	(19)	⅜	(10)	½	(13)
0.315	(8.0)	¾	(19)	½	(13)	½	(13)
0.335	(8.5)	1	(25)	½	(13)	1	(25)
0.375	(9.5)	1	(25)	½	(13)	½	(13)
0.430	(10.9)	1	(25)	½	(13)	¾	(19)
0.475	(12.0)	1	(25)	⅝	(16)	1	(25)
0.490	(12.5)	1	(25)	⅝	(16)	1	(25)
0.625	(15.9)	1½	(38)	¾	(19)	1 ½	(38)

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.

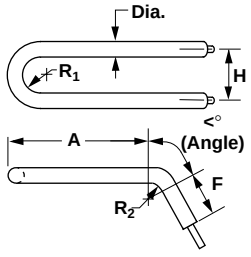
Bend Formations

Figure 1



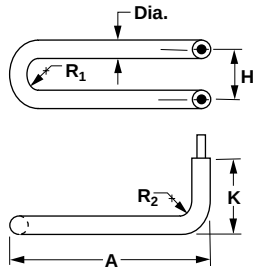
SL = 2A + 1.14R_1 - 0.43 Dia.
(For pricing, use 1 bend)

Figure 2



SL = 2A + 2F + 1.14R_1 + 0.0175 (<°)
(2R_2 + Dia.) - 0.43 Dia.
(For pricing, use 3 bends)

Figure 3

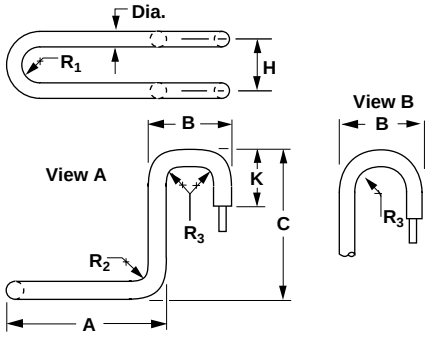


SL = 2K - 0.86R_2 - 2.86 Dia. + 2A + 1.14R_1
(For pricing, use 3 bends)

Tubular and Process Assemblies

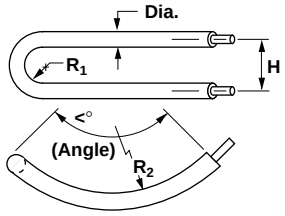
WATROD Heating Elements

Figure 4



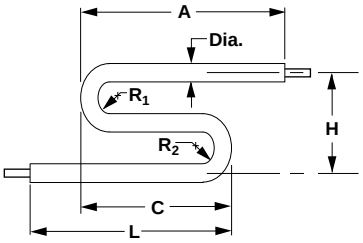
View A: SL = 2K- 1.72R_3 - 7.72 Dia. + 2C - 0.86R_2 + 2A + 1.14R_1
View B: SL = 2K- 2.28R_3 - 3.72 Dia. + 2C - 0.86R_2 + 2A + 1.14R_1
(For pricing, use 5 bends)

Figure 5



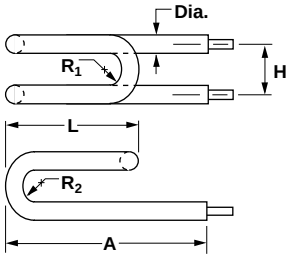
SL = 0.0175(<°) (2R_2 + Dia.) +1.14R_1 + 0.43 Dia.
(For pricing, use 3 bends)

Figure 6



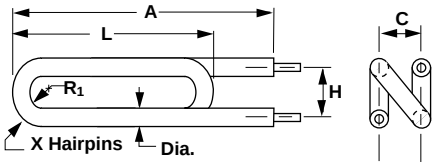
SL = L + 1.14R_2 - 0.86 Dia. + C + 1.14R_1 + A
(For pricing, use 2 bends)

Figure 7



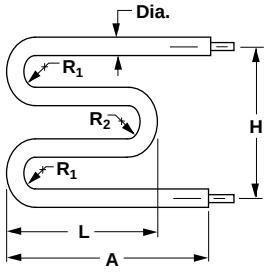
SL = 2A + 2.28R_2- 1.29 Dia. + 2L + 1.14R_1
(For pricing, use 3 bends)

Figure 8



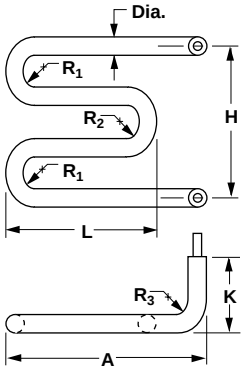
X = number of outside hairpins
SL = 2A + 3.42R_1 - 1.29 Dia. + 2L
(For pricing, use 5 bends)

Figure 9



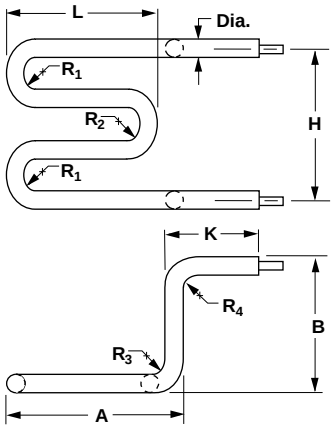
SL = 2A + 2.28R_1 - 1.29 Dia. + 2L + 1.14R_2
(For pricing, use 3 bends)

Figure 10



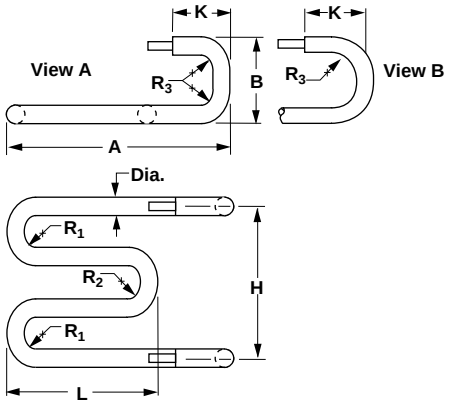
SL = 2K - 0.86R_3 - 3.72 Dia. + 2A + 2L + 2.28R_1 + 1.14R_2
(For pricing, use 5 bends)

Figure 11



SL = 2K - 086R_3 - 0.86R_4 - 6.15 Dia. + 2B + 2A + 2L + 2.28R_1 + 1.14R_2
(For pricing, use 7 bends)

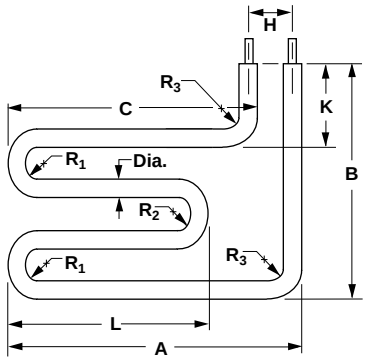
Figure 12



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.
(For pricing, use 5 bends)

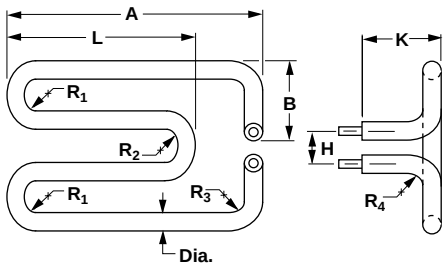
WATROD Heating Elements

Figure 13



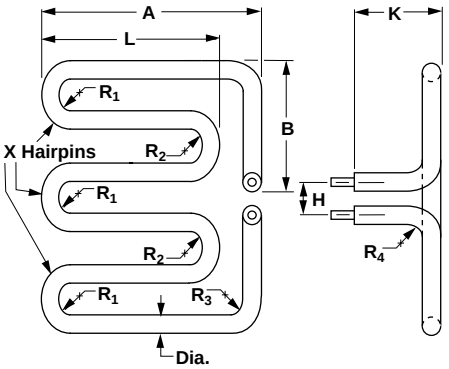
SL = 2B + 2A + 2L - 6.717 Dia. - 1.717R_1 - H - 0.858R_2 - 0.858R_3
(For pricing, use 5 bends)

Figure 14



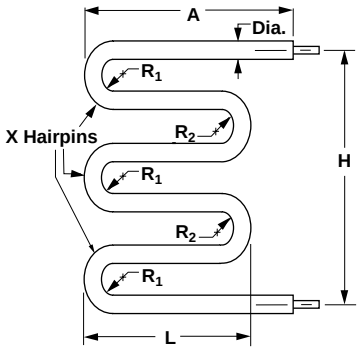
SL+2K+2A+2L+2.28R_1+1.14R_2+2B -6.15 Dia. -0.86R_3+0.86R_4
(For pricing use 7 bends)

Figure 15



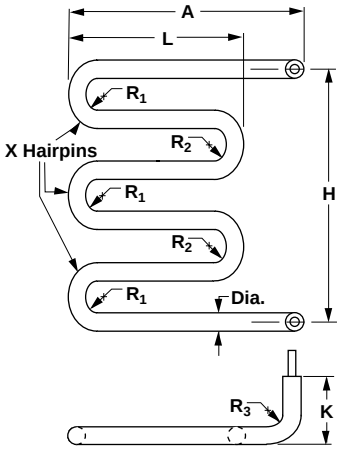
X = number of outside hairpins
SL = 2K + 2A + 2K(X - 1) + 2B - 0.86R_3 - 0.86R_4 + 1.14R_1 (X) + 1.14R_2 (X - 1) - 4.86 Dia. - (2X - 1) 0.43 Dia.
(For pricing, use 9 bends if X = 3 hairpins)

Figure 16



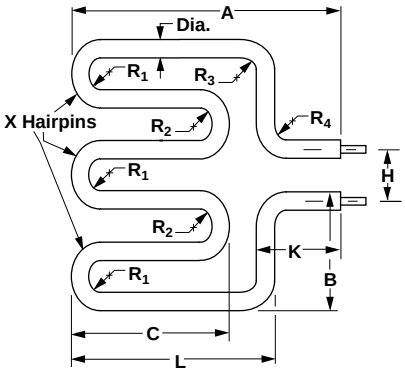
X = number of outside hairpins
SL = 2A + 0.43 Dia. (1 - 2X) + 2L (X - 1) + 1.14R_1 + 1.14R_2 (X - 1)
(For pricing, use 5 bends if X = 3 hairpins)

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
(For pricing, use 7 bends if X = 3 hairpins)

Figure 18

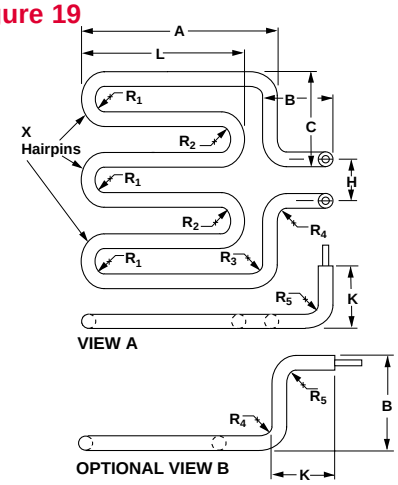


X = number of outside hairpins
SL = 2L + 2K + 2B + 2C (X - 1) - 0.86R_3 - 0.86R_4 - 4.86 Dia. + 1.14R_1 (X) + 1.14R_2 (X - 1) - (2X - 1) 0.43 Dia.
(For pricing, use 9 bends if X = 3 hairpins)

Tubular and Process Assemblies

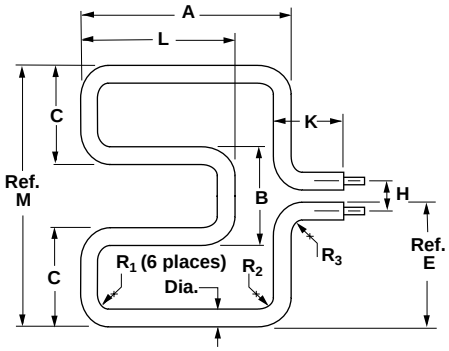
WATROD Heating Elements

Figure 19



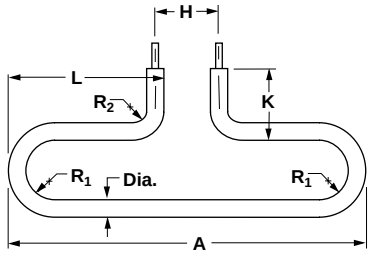
X = number of outside hairpins
View A and B: SL = 2K + 2A + 2B + 2C + 2L (X - 1) + 1.14R_1 (X) + 1.14R_2 (X - 1) - 0.86R_3 - 0.86R_4 - 0.86R_5 - 7.29 Dia. - (2X - 1) 0.43 Dia.
(For pricing, use 11 bends if X = 3 hairpins)

Figure 20



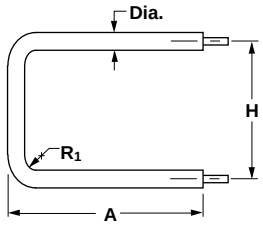
SL = 2K + 2C + B + 2A + 2L - 2.58R_1 - 0.86R_2 - 0.86R_3 - 12.15 Dia.
(For pricing, use 10 bends)

Figure 21



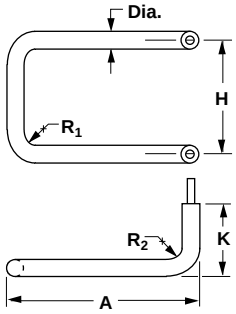
SL = 2A + 2K - H - 2.28R_1 - 0.86R_2 - 3.29 Dia.
(For pricing, use 4 bends)

Figure 22



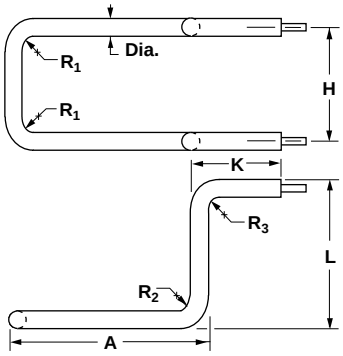
SL = 2A - 0.86R_1 - 1.43 Dia. + H
(For pricing, use 2 bends)

Figure 23



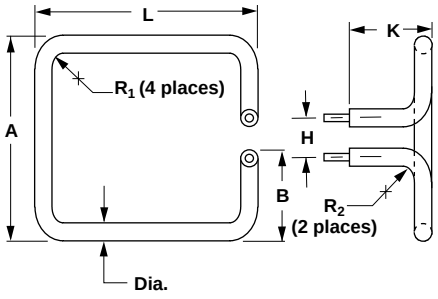
SL = 2K - 0.86R_2 - 3.86 Dia. + 2A - 0.86R_1 + H
(For pricing, use 4 bends)

Figure 24



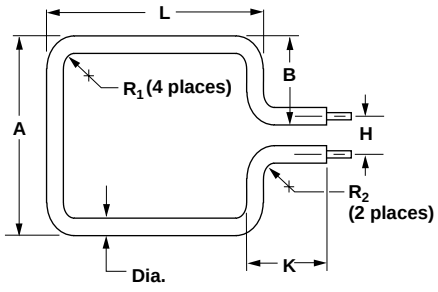
SL = 2K + 2L + H - 0.86R_1 - 0.86R_2 - 0.86R_3 - 7.29 Dia.
(For pricing, use 6 bends)

Figure 25



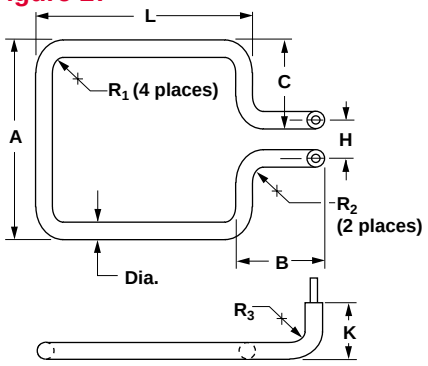
SL = 2K + 2A + 2L - H - 1.72R_1 - 0.86R_2 - 6.92 Dia.
(For pricing, use 6 bends)

Figure 26



SL = 2K + 2A + 2L - H - 1.72R_1 - 0.86R_2 - 6.29 Dia.
(For pricing, use 6 bends)

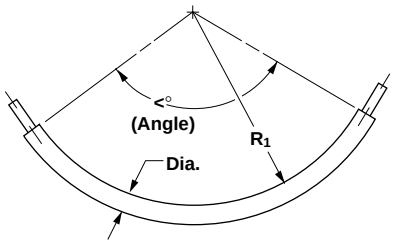
Figure 27



SL = 2K + 2A + 2L + 2B - H - 1.72R_1 - 1.72R_2 - 8.72 Dia.
(For pricing, use 8 bends)

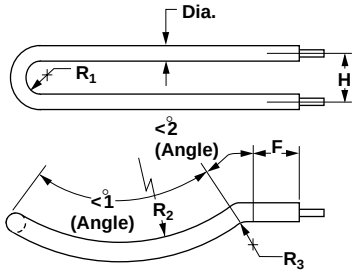
WATROD Heating Elements

Figure 28



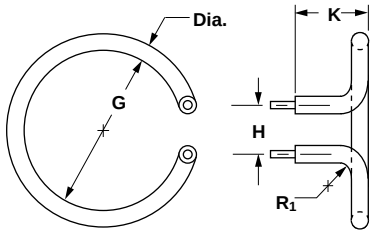
SL = 0.0175 <° (R_1 + 0.5 Dia.)
(For pricing, use 1 bend)

Figure 29



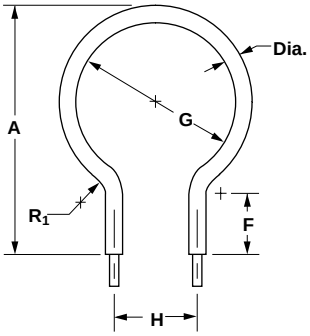
SL = 0.0175 <°1 (2R_2 + Dia.) + 2F + 1.14R_1 + 0.0175 <°2 (2R_3 + Dia.) - 0.43 Dia.
(For pricing, use 5 bends)

Figure 30



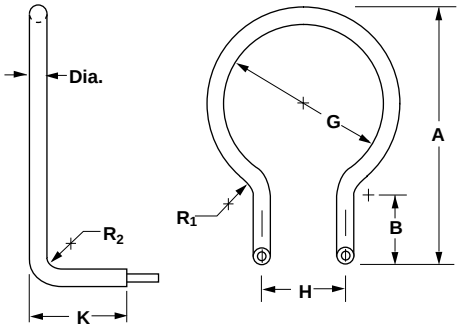
SL = (G + Dia.) 3.14 + 1.14R_1 + 2K + 3.28 Dia. - H
(For pricing, use 4 bends)

Figure 31



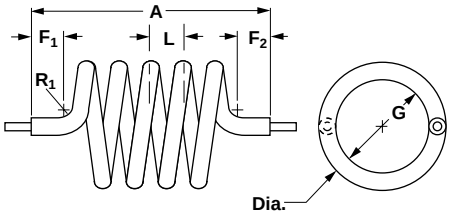
SL = (G + Dia.) 3.14 + 1.14R_1 + 2F + 3.71 Dia. - H
(For pricing, use 4 bends)

Figure 32



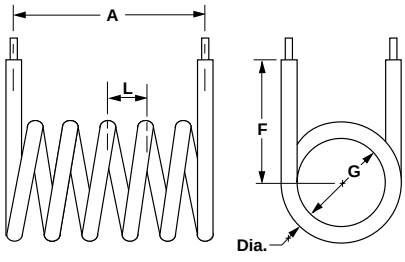
SL = (G + Dia.) 3.14 + 1.14R_1 + 2B + 1.14R_2 + 2K + 3.28 Dia. - H
(For pricing, use 6 bends)

Figure 33



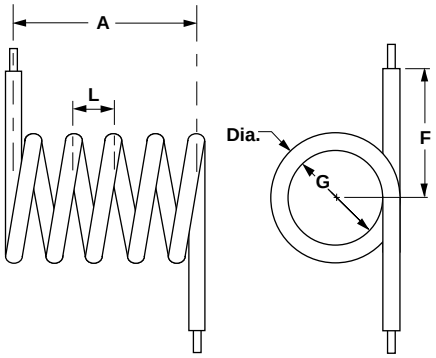
SL = [(G + Dia.) (3.14) (Number of 360°'s)] + F1 + F2
(For pricing, consult factory)

Figure 34



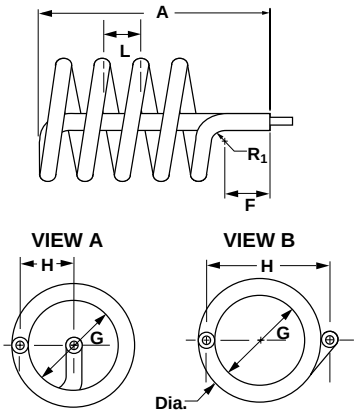
SL = [(G + Dia.) (3.14) (Number of 360°'s)] + 2F
(For pricing, consult factory)

Figure 35



SL = [(G + Dia.) (3.14) (Number of 360°'s)] + 2F
(For pricing, consult factory)

Figure 36



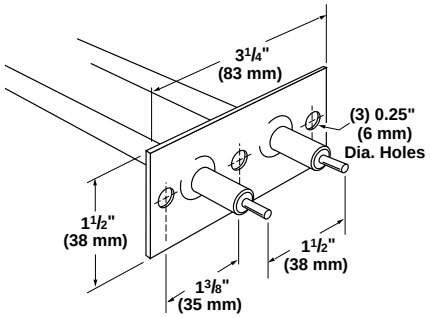
SL = [(G + Dia.) (3.14) (Number of 360°'s)] + (G ÷ 2) + A + F
(For pricing, consult factory)

Tubular and Process Assemblies

WATROD Heating Elements

Mounting Methods

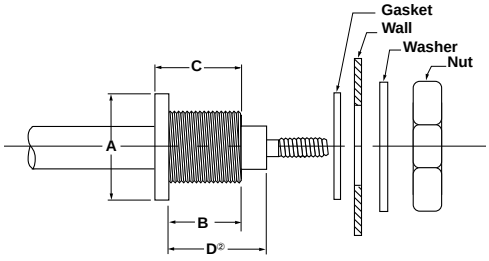
Brackets



A 0.065 inch (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 ½ inch (13 mm) from the sheath's end, unless otherwise specified.

To order, specify **mounting bracket**.

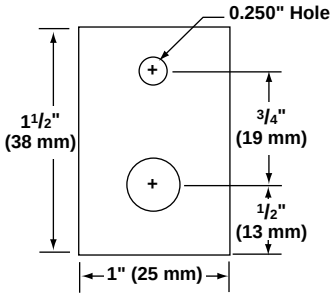
Threaded Bulkheads



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.

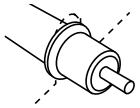
Single Leg Bracket



A 1 ½ inch (38 mm) x 1 inch (25 mm) wide x 16 gauge stainless steel bracket with one element hole and one mounting hole ½ inch from end.

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

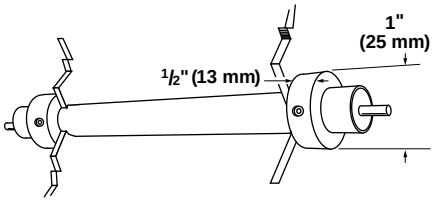
Locator Washers



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.

Mounting Collars



Plated steel mounting collars secure the heater sheath with set screws to serve as adjustable stops for through-the-wall mounting. Collars are shipped in bulk.

To order, specify **mounting collars**.

Threaded Bulkhead Specifications

Element Diameter inch	(mm)	Material	Thread Size	A① Flange Size/Style inch	(mm)	B Threaded Length inch	(mm)	C Overall Length inch	(mm)
0.260	(6.6)	Brass	½ - 20 UNF	¾ Round	(19)	⅝	(15.9)	¾	(19)
0.260	(6.6)	Steel	½ - 20 UNF	¾ Hex	(19)	⅝	(15.9)	¾	(19)
0.260	(6.6)	S. Steel	½ - 20 UNF	¾ Round	(19)	⅝	(15.9)	¾	(19)
0.315	(8.0)	Brass	½ - 20 UNF	¾ Round	(19)	⅝	(15.9)	¾	(19)
0.315	(8.0)	Steel	½ - 20 UNF	¾ Hex	(19)	¾	(19.0)	15⁄16	(24)
0.315	(8.0)	S. Steel	½ - 20 UNF	¾ Round	(19)	¾	(19.0)	27⁄32	(21)
0.375	(9.5)	Brass	½ - 20 UNF	¾ Round	(19)	⅝	(15.9)	¾	(19)
0.375	(9.5)	Steel	½ - 20 UNF	¾ Hex	(19)	¾	(19.0)	15⁄16	(24)
0.375	(9.5)	S. Steel	½ - 20 UNF	¾ Round	(19)	¾	(19.0)	27⁄32	(21)
0.430	(10.9)	Brass	⅝ - 18 UNF	⅞ Hex	(22)	¾	(19.0)	15⁄16	(24)
0.430	(10.9)	Steel	⅝ - 18 UNF	⅞ Round	(22)	¾	(19.0)	15⁄16	(24)
0.430	(10.9)	S. Steel	⅝ - 18 UNF	1 Round	(25)	¾	(19.0)	15⁄16	(24)
0.475	(12.1)	Brass	⅝ - 18 UNF	⅞ Round	(22)	¾	(19.0)	15⁄16	(24)
0.475	(12.1)	Steel	⅝ - 18 UNF	1 Round	(25)	1	(25.0)	1⅛	(29)
0.475	(12.1)	S. Steel	⅝ - 18 UNF	1 Round	(25)	¾	(19.0)	15⁄16	(24)
0.490	(12.4)	Brass	¾ - 16 UNF	1 Round	(25)	¾	(19.0)	1	(25)
0.490	(12.4)	Steel	¾ - 16 UNF	1 Hex	(25)	¾	(19.0)	1	(25)
0.490	(12.4)	S. Steel	¾ - 16 UNF	1 Round	(25)	¾	(19.0)	1	(25)
0.625	(15.9)	S. Steel	⅞ - 14 UNF	1 Round	(25)	¾	(19.0)	1	(25)

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.

WATROD Heating Elements

Tubular PLUS Program

Watlow's Tubular PLUS Program is an innovative stocking program that allows formed tubular heaters to be shipped in three to six days, instead of the four to six weeks it takes most manufacturers.

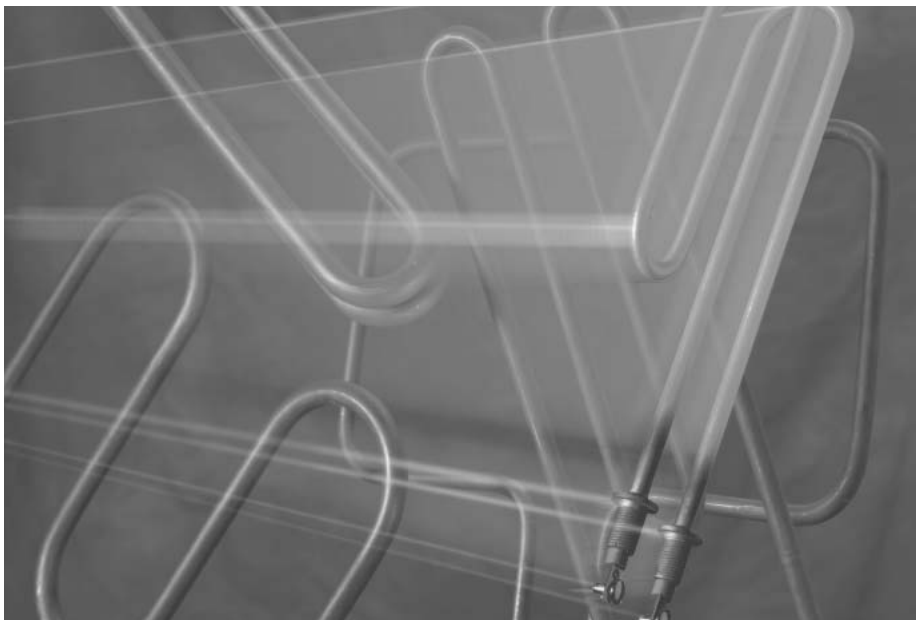
The Tubular PLUS Program allows customers to order the desired heated length, cold length, diameter, heater wattage, voltage, formation and termination option.

By utilizing stocked 0.315 inch or 0.430 inch diameter Incoloy® elements, an appropriate heater is selected from stock and modified to fit the physical description of the required heater. The heater is annealed to remove moisture and enable bending and then formed to the desired configuration. In most cases the only variation will be a slight difference in the heater wattage.

Because Watlow will now stock additional tubular elements, the Tubular PLUS Program reduces downtime, lowers inventories and increases overall customer value.

Features and Benefits

- **Availability of 0.315 inch and 0.430 inch diameters;** most commonly requested for formed tubular heaters.
- **Cold ends from one inch to 18 inches** provide increased capabilities for short and long cold ends.



- **Minimum heated lengths to four inches** provide shorter heated lengths than currently available using conventional tubulars.
- **Incoloy® 800 sheath material** provides the highest quality sheath material for immersion and air applications.

PLUS One

- **Quick delivery: three to six days vs. four to six weeks** results in reduced downtime, lower inventories and increased overall customer value.

PLUS Two

- **Precise location of cold ends and heated lengths** assists in applying heater and in proper bending, allows uniform heating in platens and puts the heat within the application.

PLUS Three

- **Longer element lengths** allows use of one element to replace multiple elements and reduces terminations.

Applications

- Plastics-Hot runner molds
- Packaging-Seal bars
- Semiconductor-CVD, PVD
- Cast-in heater platens

Options

- Maximum heated length: 118 inches, up to 18 inches cold length on each side.
- All standard WATROD options are available.
- Selection of formation numbers 1, 3, 6, 7, 8, 11, 15, 16, 17, 18, 21, 22, 23, 25, 26, 30 and 31 **(pages 282-286)** offer quick delivery. Special formations will increase delivery times. Please consult factory for details.
- To determine if program is applicable to your needs, please contact your local Watlow sales representative.

Incoloy® is a registered trademark of Special Metals Corporation.

Tubular PLUS Program Fax Back Order Form

Fax to 1-800-697-4329 or outside U.S. 1-573-221-3723

Customer Name
Customer Number
Ship to Address:
Street
City
State
ZIP

Ordered By
Order Date
Purchase Order #
Delivery Date
Ship VIA
List/Net Price/Unit
NSUC

Heater Description

General Description

Heater Voltage
Heater Wattage *(watts)* **desired**
Heater Wattage *(watts)* **actual**
Diameter: *(0.315" or 0.430")*
Material *(Incoloy®)*
Heated Length / inches *(4" min.)*
Cold End 1 Length / inches *(1" - 18")*
Cold End 2 Length / inches *(1" - 18")*
Belt Polishing: *(Yes, No)*
Moisture Seal: *(Epoxy, Ceramic, Ceramic to Metal, Silicone, None)*

Product Number
Quantity *(1-12 pieces)*
Termination Type: *(A, B, C, D, E, F, G)*
Leadwire: *(Sil-A-Blend™ - 200°C, TGGT - 250°C, Overmold)*
Leadwire length *(Inches in dec.)*
Bulkhead Type: *(Brass, Steel, St. Steel)*
Mounting: *(Brackets, Locator Washers, Mounting Collars)*
Bracket / washer location: *(From element end, ½" standard)*

Formation Details

Formation #: *(1,3,6,7,8,11,15,16,17,18,21,22,23,25,26,30,31)*

Dimensions:

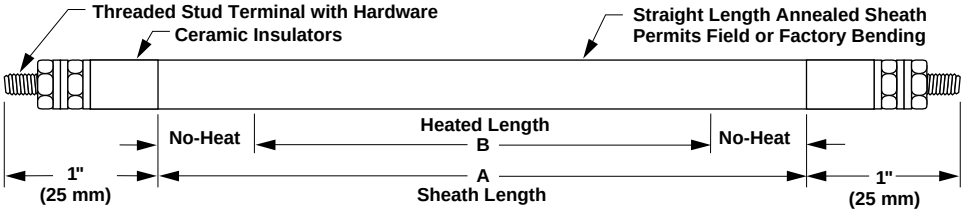
A Dimension in inches
B Dimension in inches
C Dimension in inches
G Dimension in inches
H Dimension in inches
L Dimension in inches
K Dimension in inches

X Number of outside hairpins
R *(In ⅛" increments)*
R1 *(In ⅛" increments)*
R2 *(In ⅛" increments)*
R3 *(In ⅛" increments)*
R4 *(In ⅛" increments)*

F.O.B.: Hannibal, Missouri

WATROD Heating Elements

Double-Ended WATROD



WATROD Description	Sheath A Dimension inch	(mm)	Heated B Dimension inch	(mm)	Watts	Code Number 120V~(ac)	240V~(ac)	480V~(ac)	Est. Net Weight lbs	(kg)
Applications: Medium-Weight, Non-Circulating Oil, Heat-Transfer Oil										
15 W/in²	29⅞	(759)	22⅝	(568)	500		**RGSS29R10S**		1.0	(0.5)
0.475" Dia.	38⅜	(975)	29⅞	(759)	667		**RGSS38G10S**	**RGSS38G11S**	1.3	(0.6)
Steel	44¾	(1137)	37¼	(946)	833		**RGSS44G10S**	**RGSS44G11S**	1.7	(0.8)
(2.3 W/cm²)	53⅜	(1356)	44¾	(1137)	1000		**RGSS53G10S**	**RGSS53G11S**	1.9	(0.9)
(12 mm)	68⅜	(1737)	59⅝	(1514)	1333		**RGSS68G10S**	**RGSS68G11S**	2.1	(1.0)
	83⅜	(2118)	74½	(1892)	1667		**RGSS83G10S**	**RGSS83G11S**	2.5	(1.1)
	98⅜	(2499)	89½	(2273)	2000		**RGSS98G10S**	**RGSS98G11S**	3.0	(1.4)
	120⅜	(3057)	111⅞	(2842)	2500		**RGSS120G10S**	**RGSS120G11S**	3.9	(1.8)
	142⅞	(3629)	134¼	(3410)	3000		**RGSS142R10S**	**RGSS142R11S**	4.1	(1.9)
Application: Air Heating										
20 W/in²	48¾	(1238)	38¾	(984)	1000		**RCN48N10S**	**RCN48N11S**	1.0	(0.5)
0.430" Dia.	58¾	(1492)	48¾	(1238)	1250		**RCN58N10S**	**RCN58N11S**	1.1	(0.5)
Incoloy®	73¾	(1873)	63¾	(1619)	1667			**RCN73N11S**	1.4	(0.7)
(3.1 W/cm²)	91¾	(2330)	81¾	(2076)	2083			**RCN91N11S**	1.7	(0.8)
(10.9 mm)										
Applications: Caustic Solutions, Air Heating										
23 W/in²	29	(737)	22	(559)	500	**RBN291S**			0.4	(0.2)
Incoloy®	40	(1016)	33	(839)	750	**RBN401S**			0.5	(0.3)
0.315" Dia.	51	(1296)	44	(1118)	1000	**RBN511S**			0.7	(0.4)
(3.6 W/cm²)										
(8 mm)										
23 W/in²	39	(991)	27	(686)	1000	**RGNA391S**	**RGNA3910S**	**RGNA3911S**	1.2	(0.6)
0.475" Dia.	54	(1372)	42	(1067)	1500		**RGNA5410S**	**RGNA5411S**	1.6	(0.8)
Incoloy®	69	(1753)	57	(1448)	2000		**RGNA6910S**	**RGNA6911S**	2.1	(1.0)
(3.6 W/cm²)	84	(2134)	72	(1829)	2500		**RGNA8410S**	**RGNA8411S**	2.5	(1.2)
(12 mm)	99	(2515)	87	(2210)	3000		**RGNA9910S**	**RGNA9911S**	3.0	(1.4)
	106	(2692)	94	(2388)	2778			**RGNA10611S**	3.2	(1.5)
	132	(3353)	120	(3048)	4167		**RGNA13210S**	**RGNA13211S**	4.0	(1.8)
	157	(3988)	145	(3683)	5000		**RGNA15710S**	**RGNA15711S**	4.7	(2.2)
Applications: Light Oils, Greases, Heat-Transfer Oils										
23 W/in²	16	(406)	12	(305)	250	**RBS161S**	**RBS1610S**		0.2	(0.1)
0.315" Dia.	18	(457)	14	(356)	250	**RBS181S**			0.3	(0.2)
Steel	21	(533)	17	(432)	350	**RBS211S**	**RBS2110S**		0.3	(0.2)
(3.6 W/cm²)	23⅜	(594)	19⅝	(492)	375	**RBS23G1S**			0.3	(0.2)
(8 mm)	28⅞	(733)	24⅞	(632)	500	**RBS28R1S**			0.4	(0.2)
	29	(737)	24	(610)	500	**RBS291S**	**RBS2910S**		0.4	(0.2)
	42	(1067)	37	(940)	750	**RBS421S**	**RBS4210S**		0.6	(0.3)
	54	(1372)	49	(1245)	1000	**RBS541S**	**RBS5410S**		0.7	(0.4)
	77	(1956)	72	(1829)	1500	**RBS771S**	**RBS7710S**		1.0	(0.5)

CONTINUED

All heating elements are Stock unless otherwise noted.

Truck Shipment only

Availability
Stock: Same day shipment
Standard: Straight length, three weeks; formed with options, four weeks

Tubular and Process Assemblies

WATROD Heating Elements

Double-Ended WATROD

WATROD Description	Sheath A Dimension inch	(mm)	Heated B Dimension inch	(mm)	Watts	Code Number 120V~(ac)	240V~(ac)	480V~(ac)	Est. Net Weight 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" 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" Dia.	25	(635)	20	(508)	500		**RAN2510S**		0.3	(0.2)
Incoloy®	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" Dia.	20	(508)	15	(381)	400		**RBN2010S**		0.3	(0.2)
Incoloy®	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)

CONTINUED

All heating elements are Stock unless otherwise noted.

Availability

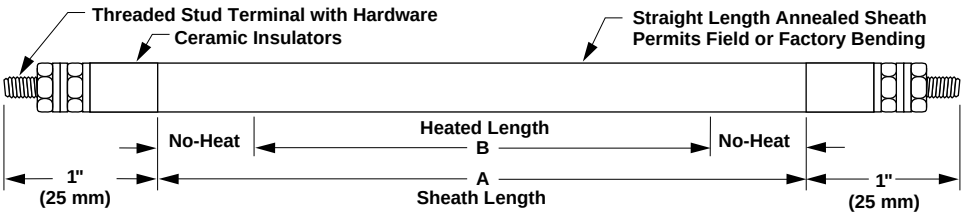
Stock: Same day shipment

Standard: Straight length, three weeks; formed with options, four weeks

Truck Shipment only

WATROD Heating Elements

Double-Ended WATROD



WATROD Description	Sheath A Dimension		Heated B Dimension		Watts	Code Number			Est. Net Weight	
	inch	(mm)	inch	(mm)		120V~(ac)	240V~(ac)	480V~(ac)	lbs	(kg)
Application: Air Heating										
30 W/in²	15	(381)	10	(254)	400		**RCN1510S**		0.3	(0.2)
0.430" Dia.	20	(508)	15	(381)	600		**RCN2010S**		0.4	(0.2)
Incoloy®	25	(635)	20	(508)	800		**RCN2510S**		0.5	(0.3)
(4.7 W/cm²)	30	(762)	25	(635)	1000		**RCN3010S**		0.6	(0.3)
(10.9 mm)	35	(889)	30	(762)	1200		**RCN3510S**		0.7	(0.4)
	40	(1016)	35	(889)	1400		**RCN4010S**		0.8	(0.4)
	48¾	(1238)	38¾	(984)	1500		**RCNX48N10S**	**RCNX48N11S**	1.0	(0.5)
	45	(1143)	40	(1016)	1600		**RCN4510S**		0.9	(0.5)
	50	(1270)	45	(1143)	1800		**RCN5010S**		1.0	(0.5)
	58¾	(1492)	48¾	(1238)	1917		**RCNX58N10S**	**RCNX58N11S**	1.1	(0.5)
	55	(1397)	50	(1270)	2000		**RCN5510S**		1.0	(0.5)
	60	(1524)	55	(1397)	2200		**RCN6010S**		1.1	(0.5)
	65	(1651)	60	(1524)	2400		**RCN6510S**		1.2	(0.6)
	73¾	(1873)	63¾	(1619)	2500			**RCNX73N11S**	1.4	(0.7)
	70	(1778)	65	(1651)	2600		**RCN7010S**		1.3	(0.6)
	75	(1905)	70	(1778)	2800		**RCN7510S**		1.4	(0.7)
	80	(2032)	75	(1905)	3000		**RCN8010S**		1.5	(0.7)
	91¾	(2330)	81¾	(2076)	3167			**RCNX91N11S**	1.7	(0.8)
	90	(2286)	85	(2159)	3500		**RCN9010S**		1.7	(0.8)
	100	(2540)	95	(2413)	4000		**RCN10010S**		1.9	(0.9)
	110	(2794)	105	(2667)	4500		**RCN11010S**		2.1	(1.0)
	120	(3048)	115	(2921)	5000		**RCN12010S**		2.3	(1.1)
Application: Radiant Heating										
40 W/in²	10¼	(260)	7¼	(184)	400	**RDN10E1S**			0.2	(0.1)
0.375" Dia.	16⅝	(422)	13⅜	(346)	650	**RDN16L1S**			0.3	(0.2)
Incoloy®	21 1/16	(535)	16 13/16	(427)	800	**RDN21B1S**	**RDN21B10S**		0.4	(0.2)
(6.2 W/cm²)	27⅛	(689)	22⅞	(581)	1100	**RDN27C1S**	**RDN27C10S**		0.5	(0.3)
(9.5 mm)	32⅛	(816)	27⅞	(708)	1300		**RDN32C10S**	**RDN32C11S**	0.6	(0.3)
	42⅞	(1089)	38⅜	(981)	1800		**RDN42R10S**	**RDN42R11S**	0.8	(0.4)
	57½	(1461)	53¼	(1353)	2500		**RDN57J10S**	**RDN57J11S**	1.1	(0.5)
	69¼	(1759)	65	(1651)	3000		**RDN69E10S**	**RDN69E11S**	1.3	(0.6)
	81¼	(2064)	77	(1956)	3600		**RDN81E10S**	**RDN81E11S**	1.6	(0.8)
	109¼	(2775)	105	(2667)	4000		**RDN109E10S①**		2.1	(1.0)
	134½	(3416)	127¾	(3245)	5000		**RDN134J10S①**		2.6	(1.2)
	153⅜	(3896)	145⅞	(3705)	5500		**RDN153R10S①**		2.9	(1.4)
	179¼	(4553)	171¼	(4350)	6500		**RDN179E10S①**		3.4	(1.6)

CONTINUED

All heating elements are Stock unless otherwise noted.

Availability

Stock: Same day shipment

Standard: Straight length, three weeks; formed with options, four weeks

① Standard

Truck Shipment only

Tubular and Process Assemblies

WATROD Heating Elements

Double-Ended WATROD

Special 208V~(ac) and 277V~(ac) Voltages

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

WATROD Description	Sheath A Dimension inch	(mm)	Heated B Dimension inch	(mm)	Watts	Code Number 120V~(ac)	Code Number 240V~(ac)	Code Number 480V~(ac)	Est. Net Weight lbs	(kg)
Application: Process Water										
48 W/in²	23	(584)	14	(356)	1000	**RGN231S**	**RGN2310S**	**RGN2311S**	0.7	(0.4)
0.475" Dia.	30	(762)	21	(533)	1500	**RGN301S**	**RGN3010S**	**RGN3011S**	0.9	(0.5)
Incoloy®	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" 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" 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)

CONTINUED

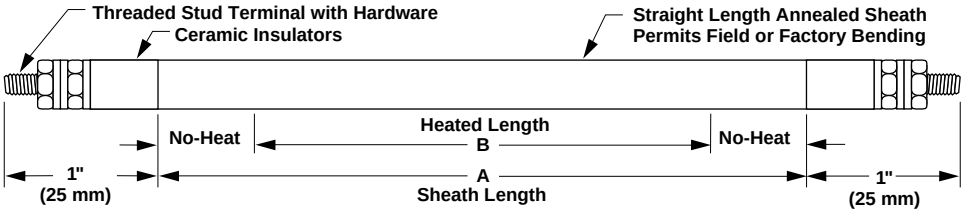
All heating elements are Stock unless otherwise noted.
Availability
Stock: Same day shipment
Standard: Straight length, three weeks; formed with options, four weeks

① Standard

Truck Shipment only.

WATROD Heating Elements

Double-Ended WATROD



WATROD Description	Sheath A Dimension		Heated B Dimension		Watts	Code Number			Est. Net Weight	
	inch	(mm)	inch	(mm)		120V~(ac)	240V~(ac)	480V~(ac)	lbs	(kg)
Application: Clean Water										
60 W/in²	12	(305)	8	(203)	500	**RBC121S**	**RBC1210S**		0.2	(0.1)
0.315" Dia.	16	(406)	12	(305)	750	**RBC161S**	**RBC1610S**		0.2	(0.1)
Copper	19⅞	(505)	12⅞	(327)	750	**RBC19R1S**			0.3	(0.2)
(9.3 W/cm²)	20	(508)	16	(406)	1000	**RBC201S**	**RBC2010S**		0.3	(0.2)
(8 mm)	23¾	(603)	16¾	(425)	1000	**RBC23N1S**			0.3	(0.2)
	24	(610)	20	(508)	1250	**RBC241S**	**RBC2410S**		0.3	(0.2)
	27¾	(705)	20¾	(527)	1250	**RBC27N1S**			0.4	(0.2)
	33	(838)	26	(660)	1500	**RBC331S**	**RBC3310S**		0.5	(0.3)
	41	(1041)	34	(864)	2000	**RBC411S**	**RBC4110S**		0.6	(0.3)
	50	(1270)	43	(1092)	2500	**RBC501S**②	**RBC5010S**②		0.7	(0.4)
	58	(1473)	51	(1295)	3000	**RBC581S**②	**RBC5810S**②		0.8	(0.4)
	74	(1880)	67	(1702)	4000		**RBC7410S**②		1.0	(0.5)
60 W/in²	20	(508)	11	(279)	1000	**RGC201S**	**RGC2010S**		0.6	(0.3)
0.475" Dia.	26	(660)	17	(432)	1500	**RGC261S**	**RGC2610S**	**RGC2611S**	0.8	(0.4)
Copper	34	(864)	22	(559)	2000	**RGC341S**	**RGC3410S**	**RGC3411S**	1.0	(0.5)
(9.3 W/cm²)	40	(1016)	28	(711)	2500	**RGC401S**	**RGC4010S**	**RGC4011S**	1.2	(0.6)
(12 mm)	46	(1169)	34	(864)	3000		**RGC4610S**②	**RGC4611S**②	1.4	(0.7)
	47	(1194)	31	(787)	2778			**RGC4711S**②	1.4	(0.7)
	57	(1448)	45	(1143)	4000		**RGC5710S**②	**RGC5711S**②	1.7	(0.8)
	68	(1727)	56	(1422)	5000		**RGC6810S**②	**RGC6811S**②	2.1	(1.0)
	78	(1981)	62	(1575)	5556			**RGC7811S**②	2.4	(1.1)
	79	(2007)	67	(1702)	6000		**RGC7910S**②	**RGC7911S**②	2.4	(1.1)
	105	(2661)	93	(2362)	8333			**RGC10511S**②	3.2	(1.5)

All heating elements are Stock unless otherwise noted.
Availability
Stock: Same day shipment
Standard: Straight length, three weeks; formed with options, four weeks

② Stocked unannealed. Allow one day for annealing. Specify **DO NOT ANNEAL** if annealed WATROD not required.

Truck Shipment only

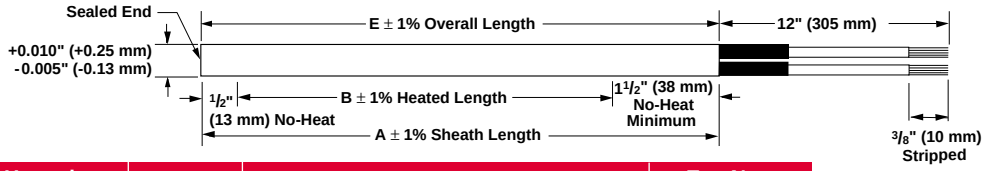
Tubular and Process Assemblies

WATROD Heating Elements

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.
- Your application requires lower wattage or a smaller package.
- Do not locate the end of the heated length within a bend, unless the radius is three inches (75 mm) or more. Field bending is not recommended.
- Bending is limited to bend Figures 1, 6, 22 and 28 (see **pages 282 to 286** for details).
- Ensure termination temperatures do not exceed 390°F (200°C) or the seal's maximum rating.
- Keep terminations clean, dry and tight.



Single-Ended WATROD

WATROD Description	Sheath A Dimension		Heated B Dimension		Watts	Code Number		Est. Net Weight	
	inch	(mm)	inch	(mm)		120V~(ac)	240V~(ac)	lbs	(kg)
Applications: Platen and Forced Air Heating, and Deicing									
20 W/in²	15	(381)	11½	(292)	270	**RSN151W**	**RSN1510W**	0.3	(0.2)
0.375" Dia.	20	(508)	16½	(419)	390	**RSN201W**	**RSN2010W**	0.4	(0.2)
Incoloy®	25	(635)	21½	(546)	500	**RSN251W**	**RSN2510W**	0.5	(0.3)
(3.1 W/cm²)	30	(762)	26½	(673)	625	**RSN301W**	**RSN3010W**	0.6	(0.3)
(9.5 mm)	35	(889)	31½	(800)	750	**RSN351W**	**RSN3510W**	0.7	(0.4)
	40	(1016)	36½	(927)	860	**RSN401W**	**RSN4010W**	0.8	(0.4)

All heating elements are Standard units.
Availability
Standard: Shipment within six weeks

F.O.B.: Hannibal, Missouri

How to Order

Single or Double-Ended WATROD

To order a stock, standard or assembly stock WATROD element, specify:

- Watlow code number
- Volts/watts
- Termination options
- Options
- Quantity

If stock WATROD heaters do not meet your application needs, Watlow can provide a made-to-order unit. Please specify:

- Description of application, including heated material, operating temperature and flow rate, etc.
- Volts/watts
- Sheath material/diameter
- Sheath length
- Single or double-ended
- Heated length
- No-heat length at each end
- Terminal pin length or termination options
- Moisture seal type
- Bend configuration, dimensions and critical tolerances (send drawing, if available)
- Options, including external finish and mounting method
- Quantity

Availability

Double-Ended WATROD

Straight Length Element

Stock: Same day shipment
Modified Stock①: Three to five working days
Standard: 10 working days
Made-to-Order: Three weeks

Formed Element

Modified Stock①: Five to seven working days
Standard: Three weeks
Made-to-Order: Four to five weeks

Single-Ended WATROD

Straight Length Element

Modified Stock①: Three weeks
Standard: Three weeks
Made-to-Order: Three weeks

Formed Element

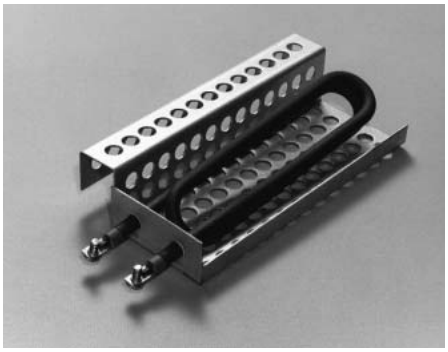
Modified Stock①: Three weeks
Standard: Three weeks
Made-to-Order: Four to five weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

① Stock units with catalog options.

WATROD Heating Elements

Enclosure Heaters



Designed to prevent freezing and condensation in electrical and mechanical housings, the WATROD element is enclosed in a perforated, aluminized-steel bracket.

Performance Capabilities

- Watt densities to 15 W/in² (2.3 W/cm²)
- Wattages to 1000 watts
- UL® and CSA component recognition to 250V~(ac)

Features and Benefits

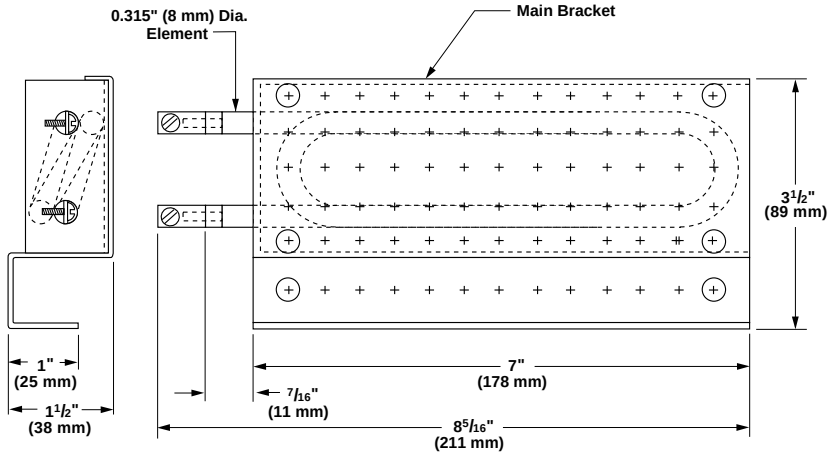
- **Stainless steel sheath wall** further resists corrosion and protects the heating coil from exposure.
- **Silicone resin seal** provides protection against humid storage conditions and is effective to 390°F (200°C).
- **Perforated aluminized-steel mounting bracket** eases installation and helps prevent direct contact with the heating element.
- **Stock straight projection Type B #10-32 screw lug terminals** provide easy electrical connection.
- **Made-to-Order threaded stud**, quick connect and flexible lead wire termination options. See **page 281** for details.

Applications

- Control panels
- Traffic signal boxes
- Automatic 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).



Watts	Watt Density		Code No.		Availability	Est. Net Weight	
	W/in²	(W/cm²)	125V~(ac)	250V~(ac)		lbs	(kg)
95	4	(0.6)	**EN951**		Stock	1.5	(0.7)
100	4	(0.6)		**EN10010**	Stock	1.5	(0.7)
250	10	(1.6)	**EN2501**	**EN25010**	Stock	1.5	(0.7)
375	15	(2.3)	**EN3751**	**EN37510**	Stock	1.5	(0.7)

F.O.B.: Hannibal, Missouri

How to Order

To order a stock WATROD enclosure heater, please specify:

- Watlow code number
- Volts/watts
- Termination options
- Options
- Quantity

If our stock units do not meet your application, Watlow can provide **made-to-order** enclosure heaters. Please specify:

- Volts/watts
- Sheath diameter/material
- No-heat section
- A, C, H, L and R dimensions per Figure 8 bend formation shown on catalog **page 283**.
- Termination options
- Options
- Quantity

Availability

Stock: Same day shipment

Modified Stock①: Three to five working days

Made-to-Order: Four to five weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

① Stock units with catalog options.

Tubular and Process Assemblies

F.O.B.: Hannibal, Missouri

WATROD Heating Elements

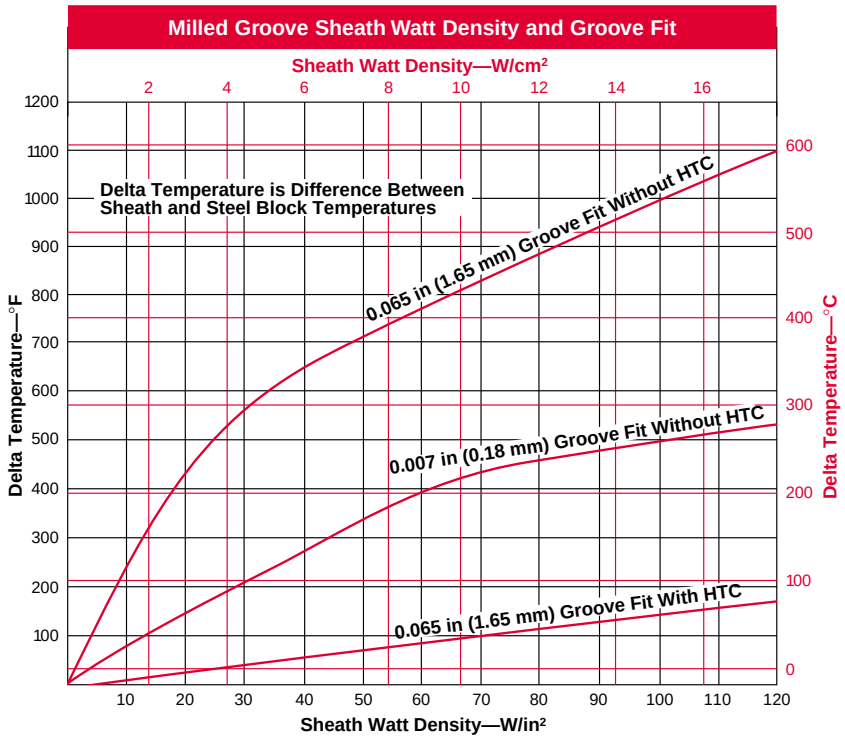
Plastics Application

Hot Runner Mold (Manifold)

Features and Benefits

- **Precise conformity to customer specifications** ensures easy installation—bending tolerances as low as ± 0.002 inch.
- **Common element diameters** include: 0.260, 0.315, 0.335, 0.375 and 0.430 inch (6.6, 8, 8.5, 9.5 and 10.9 mm).
- **Incoloy® sheath material** for high temperatures, 304 stainless steel for smaller radius bends.
- **Superior resistance coil design** produces even heating.
- **Threaded stud or leadwire termination** as required.

Use the *Milled Groove Sheath Watt Density and Groove Fit* chart to find the recommended watt density or tightest groove fit. Optimum groove fit, without heat transfer cement, can be determined by plotting the intersect point between the required sheath watt density and the Delta temperature (T). If the Delta T is not known, simply subtract the mold temperature from the maximum 1000°F (540°C) sheath temperature. Any combination of watt density and groove fit which results in a Delta T below the recommended maximum will maximize heater life. Conversely, if the Delta T is greater, less heater life can be expected.



- Recommended maximum watt density = 40 to 70 W/in² (6.2 to 10.9 W/cm²)
- Recommended groove = 0.065 inch (1.65 mm) larger in diameter than sheath diameter, and use heat transfer cement.
- Recommended heater sheath diameter = 0.315 inch (8 mm)
- Recommended maximum Delta T = 400°F (205°C)
- Maximum sheath temperature = 1000°F (540°C)
- Recommended sheath material = Incoloy®

How to Order

All milled groove heaters are made-to-order. Due to precision forming requirements, please provide a detailed drawing or CAD disk. Consult your Watlow representative for price and shipment details. To help the ordering process, provide the following information:

- Operating temperature
- Volts/watts
- Sheath diameter and material
- No-heat section
- Electrical terminations
- Bend configurations and dimensions
- Groove cross section dimensions
- Quantity

Replacement Heaters

To order a replacement for an existing milled groove heater, specify original Watlow code number, or provide dimensions of the competitive heater, or the groove dimensions from the manifold.

Heat Transfer Cement (HTC)

Heat transfer cement can maximize heater performance and life by increasing thermal conductivity between the sheath and manifold. The maximum exposure temperature is 1250°F (675°C). Available in one quart cans. To order, specify **code number 148-15-2-1.**

Caution

Heat transfer cement conducts electricity. Avoid contact with terminations, wiring and other sources of electric current.

WATROD Heating Elements

Semiconductor Application

Sheath temperatures can vary up to a maximum sheath temperature of 1832°F (1000°C), with maximum watt densities up to 60 W/in^2. Individual element and assembly speci cations vary depending on the application. Contact factory for E-beam welding, vacuum brazing and special plating.

Features and Benefits

- Operating temperatures to 1832°F (1000°C)
- Electrical isolation to a minimum of 10 teraohms, high isolation resistance heater only
- Vacuum compatibility to 10^{-9} Torr
- Nitrogen purge vacuum packaging
- Milled groove patterning to 0.25 inch (6.35 mm) radius
- Materials: stainless steel, Incoloy®, Inconel®, aluminum, nickel, copper
- Heated part assemblies: hot plates, vacuum ttings, special formed heaters
- Round elements from 0.210 to 0.475 inch (5.3 to 12.1 mm) diameter
- FIREBAR heating elements from 0.625 to 1.00 inch (15.9 to 25.4 mm) wide
- X-Ray capabilities and testing certi cation for ensured reliability.

Applications

- CVD
- PVD
- Etch
- Photolithography
- Annealing
- Wafer probers
- Flat panel display

External Finishes

- Black oxide
- Bright anneal
- Glass bead
- Belt polish
- Electropolish

ULTRAGARD Seal

A high temperature hermetic seal to 700°F (350°C).

For special plating, consult the factory.

Tubular and Process Assemblies

FIREBAR Heating Elements

FIREBAR® heating elements provide added heating performance over standard round tubular heating elements- especially for immersion applications in petroleum based liquids that require 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 that allows 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 318**.

Double-Ended Performance Capabilities

One Inch

- Watt densities to 120 W/in² (18.6 W/cm²)
- Incoloy® sheath temperatures to 1400°F (760°C)
- 304 stainless steel sheath temperatures to 1200°F (650°C)
- Voltages to 480V~(ac)
- Amperages to 48 amps per heater or 16 amps per coil

⅝ Inch

- Watt densities to 90 W/in² (13.9 W/cm²)
- Incoloy® sheath temperatures to 1400°F (760°C)
- Voltages to 480V~(ac)
- Amperages to 32 amps per heater or 16 amps per coil

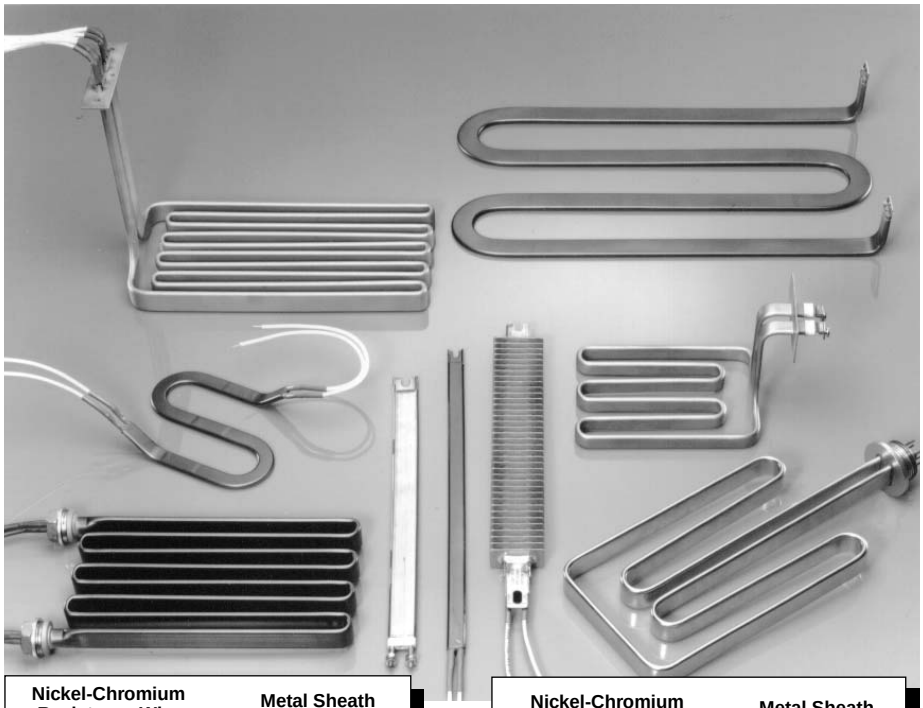
Single-Ended Performance Capabilities

One Inch

- Watt densities to 60 W/in² (9.3 W/cm²)
- Incoloy® sheath temperatures to 1400°F (760°C)
- 304 stainless steel sheath temperatures to 1200°F (650°C)
- Voltages to 480V~(ac)
- Amperages to 48 amps per heater or 16 amps per coil

⅝ Inch

- Watt densities to 80 W/in² (12.4 W/cm²)
- Incoloy® sheath temperatures to 1400°F (760°C)
- Voltages to 480V~(ac)
- Amperages to 25 amps per heater.



One Inch Double-Ended FIREBAR Element and Lead Configurations

⅝ Inch Double-Ended FIREBAR Element and Lead Configurations

Incoloy® is a registered trademark of Special Metals Corporation.

FIREBAR Heating Elements

Specifications

	One Inch FIREBAR	⅝ Inch FIREBAR
Applications	Direct immersion; water, oils, etc. Clamp-on; hoppers, griddles Forced air heating (Also see FINBAR, page 318) Radiant heating	Direct immersion; water, oils, etc. Clamp-on; hoppers, griddles Forced air heating Radiant heating
Watt Density W/in² (W/cm²)	Stock: up to 90 (13.9) Made-to-Order (M-t-O): up to 120 (18.6)	Stock: up to 90 (13.9) Made-to-Order (M-t-O) up to 90 (13.9)
Surface Area Per Linear Inch (cm)	2.3 in² (14.8 cm²)	1.52 in² (9.80 cm²)
Cross Section Height ± 0.015/0.010" (0.381/0.254 mm) Thickness ± 0.005/0.001" (0.127/0.025 mm)	 1.010 (25.7) 0.235 (5.9)	 0.650 (16.5) 0.235 (5.9)
Sheath Material—Maximum Operating Temperature	Stock: Incoloy® 1400°F (760°C) M-t-O: Incoloy® 1400°F (760°C) 304 S. Steel 1200°F (650°C)	Stock: Incoloy® 1400°F (760°C) M-t-O: Incoloy® 1400°F (760°C) 304 S. Steel 1200°F (650°C)
Sheath Length inch (mm)	Stock: 15 to 114 (381 to 2896) M-t-O: 11 to 180 (280 to 4572)	Stock: 15 to 51 (381 to 1295) M-t-O: 11 to 115 (280 to 2920)
Straightness Tolerance Major axis inch/foot (cm/m): Minor axis inch/foot (cm/m):	 0.062 (0.52) 0.062 (0.52)	 0.062 (0.52) 0.062 (0.52)
No-Heat Length (Refer to page 279)	1" minimum, 12" maximum (25/305 mm)	1" minimum, 12" maximum (25/305 mm)
Maximum Voltage—Amperage	480V~(ac)- 48 amps	480V~(ac)- 32 amps
Maximum Hipotential	1960V~(ac)	1960V~(ac)
Maximum Current Leakage (cold)	2 milliamps	2 milliamps
Maximum Amperage Per Coil	16 amps	16 amps
Phase(s)	1-phase parallel/series, 3-phase delta/wye	1-phase parallel/series
Resistance Coils	3 or 2	2
Ohms/Inch/Unit①	0.270Ω minimum- 2.833Ω maximum	0.040Ω minimum- 4.250Ω maximum
Ohms/Inch/Coil①	0.080Ω minimum- 8.500Ω maximum per coil	0.080Ω minimum- 8.500Ω maximum 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	Stock: Lavacone 390°F (200°C) M-t-O: Ceramic base 2800°F (1535°C) RTV 500°F (260°C) Lavacone 390°F (200°C) Epoxy resin 250°F (120°C)	Stock: Lavacone 390°F (200°C) M-t-O: Ceramic base 2800°F (1535°C) RTV 500°F (260°C) Lavacone 390°F (200°C) Epoxy resin 250°F (120°C)
Minimum Axis Bending Radius inch (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
Optional Internal Thermocouple	ASTM Type K	-
Agency Recognition	UL® Component recognition to 480V~(ac) (file # E52951) CSA Component recognition to 480V~(ac) (file # 31388)	UL® Component recognition to 480V~(ac) (file # E52951) CSA Component recognition to 480V~(ac) (file # 31388)

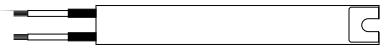
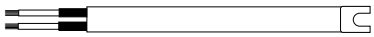
① Resistance values valid for three coil 1 inch FIREBAR only.

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

Tubular and Process Assemblies

FIREBAR Heating Elements

Specifications

	One Inch Single-Ended FIREBAR	⅝ Inch Single-Ended FIREBAR
		
Applications	Clamp-on; hoppers, griddles Forced or convection air heating (Also see FINBAR, page 318)	Clamp-on; hoppers, griddles Forced or convection air heating
Watt Density W/in² (W/cm²)	Stock: up to 40 (6.2) M-t-O: up to 60 (9.3)	Stock: up to 20 (3.1) M-t-O: up to 60 (12.4)
Surface Area Per Linear Inch (cm)	2.3 in² (14.8 cm²)	1.52 in² (9.80 cm²)
Cross Section Height ± 0.015/0.010" (0.381/0.254 mm) Thickness ± 0.005/0.001" (0.127/0.025 mm)	 1.010 (25.7) 0.235 (5.9)	 0.650 (16.5) 0.235 (5.9)
Sheath Material—Maximum Operating Temperature	Stock: 304 S. Steel 1200°F (650°C) M-t-O: Incoloy® 1400°F (760°C) 304 S. Steel 1200°F (650°C)	Stock: Incoloy® 1400°F (760°C) M-t-O: Incoloy® 1400°F (760°C) 304 S. Steel 1200°F (650°C)
Sheath Length inch (mm)	Stock: 11 to 46 ¼ (280 to 1175) M-t-O: 11 to 120 (280 to 3048)	Stock: 11 ½ to 52 (280 to 1321) M-t-O: 11 to 116 (280 to 2946)
Straightness Tolerance Major axis inch/foot (cm/m): Minor axis inch/foot (cm/m):	 0.062 (0.52) 0.062 (0.52)	 0.062 (0.52) 0.062 (0.52)
No-Heat Length (Refer to page 279) Top Cold End Bottom (blunt end) Cold End	 1" min., 12" max. (25/305 mm) 1 ph- 0.5 min., 2" max. (13/51 mm) 3 ph- 0.75 min., 2" max. (19/51 mm)	 1" min., 12" max. (25/305 mm) Only available at 1.25" N/A
Maximum Voltage—Amperage	480V~(ac)—48 amps	480V~(ac)—25 amps
Maximum Hipotential	1960V~(ac)	1960V~(ac)
Maximum Current Leakage (cold)	2 milliamps	2 milliamps
Maximum Amperage Per Coil	16 amps	16 amps
Phase(s)	1-phase, 3-phase wye	1-phase
Resistance Coils	3 or 1	1
Ohms/Inch/Unit	0.200Ω minimum—14.00Ω maximum①	0.200Ω minimum—14.00Ω maximum①
Terminations	Flexible lead wires Threaded stud Quick connect (spade) Screw lug (plate)	Flexible lead wires Quick connect (spade) Screw lug (plate)
Seals	Stock: Lavacone 392°F (200°C) M-t-O: Ceramic base 2800°F (1535°C) RTV 500°F (260°C) Lavacone 390°F (200°C) Epoxy resin 266/350°F (130/176°C)	Stock: Lavacone 392°F (200°C) M-t-O: Ceramic base 2800°F (1535°C) RTV 500°F (260°C) Lavacone 390°F (200°C) Epoxy resin 266/350°F (130/176°C)
Minimum Axis Bending Radius inch (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	Stock: Slotted M-t-O: Slotted, sealed or welded	Stock: Slotted M-t-O: Slotted, sealed or welded
Agency Recognition	UL® Component recognition to 480V~(ac) (file # E52951) CSA Component recognition to 480V~(ac) (file # 31388)	UL® Component recognition to 480V~(ac) (file # E52951) CSA Component recognition to 480V~(ac) (file # 31388)

① Based on 1-phase, single voltage heater.

FIREBAR Heating Elements

One inch Features and Benefits

Double-Ended

- **Streamline, 0.235 X 1.010 inch (5.9 X 25.6 mm) normal to flow dimension** reduces drag.
- **The 70 percent greater surface area per linear inch**, compared to a 0.430 inch (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** are precision wound.
- **The 0.040 inch (1 mm) thick MgO walls** more efficiently transfer heat away from the resistance wire to the sheath and media—conducts heat out of the element faster.
- **The 360° fusion welded wire-to-pin connection** ensures reliable electrical connection.
- **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** provide protection against humid storage conditions. Moisture retardant to 392°F (200°C).

Single-Ended

- **Single-ended termination** simplifies wiring and installation.
- **Streamline, 0.235 X 1.010 inch (5.9 X 25.6 mm) normal to flow dimension** reduces drag.
- **The 70 percent greater surface area per linear inch** reduces the watt density from that of the 0.430 inch (11 mm) diameter round tubular heater.
- **Slotted end** provides installation ease in clamp-on applications.
- **Lavacone seals** provide protection against humid storage conditions. Moisture retardant to 392°F (200°C).

⅝ inch Features and Benefits

Double-Ended

- **Special sheath dimensions, 0.235 X 0.650 inch (5.9 X 16.5 mm)**, result in a lower profile heater.
- **The 10 percent greater surface area per linear inch** reduce the watt density from that of the 0.430 inch (11 mm) diameter round tubular heater.
- **The 0.040 inch (1 mm) thick MgO walls** efficiently transfer heat away from the resistance wire to the heated media—conducts heat out of the element faster.
- **Lavacone seals** provide protection against humid storage conditions. Moisture retardant to 392°F (200°C).

Single-Ended

- **Single-ended termination** simplifies wiring and installation.
- **Special sheath dimensions**, **0.235 X 0.650 inch (5.9 X 16.5 mm)**, result in a lower profile heater for more wattage in a smaller package.
- **Slotted end** is supplied for installation ease in clamp-on applications.
- **Lavacone seals** provide protection against humid storage conditions. Moisture retardant to 392°F (200°C).

Tubular and Process Assemblies

FIREBAR Heating Elements

FIREBAR 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 you can:

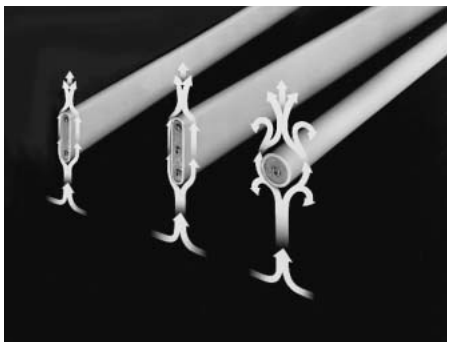
- Lower the element's watt density
- Reduce element size and keep the same watt density
- Increase element life by reducing sheath temperature

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

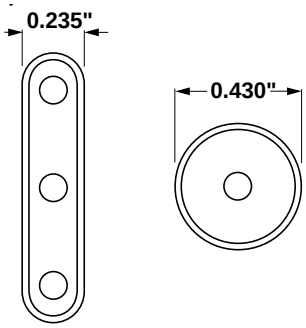
FIREBAR's flat, vertical geometry is streamline. The liquid's flow past the heating element's surface is not impaired by back eddies inherent in the round tubular shape. The FIREBAR's streamline shape results in fluids flowing more freely with more heat carried away from the sheath.



2) Normal to the Flow

The element's width (thickness) of both one inch and ⅝ inch FIREBAR elements is just 0.235 inch (5.9 mm). Compared to a 0.430 inch (11 mm) round tubular element, this relative thinness further reduces drag on liquids or gases flowing past the heater.

Comparative Widths

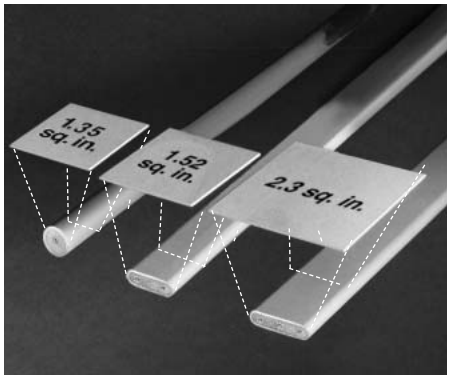


3) Buoyancy Force

The FIREBAR element's boundary layer, or vertical side, is greater than virtually all round tubular elements. This is 1.010 and 0.650 inches (25.6 and 16.5 mm) for the one inch and ⅝ inch FIREBARs respectively, compared to a 0.430 inch (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.

Watt Density and Surface Area Advantages

The surface area per linear inch of a one inch FIREBAR is 70 percent greater than the 0.430 inch (11 mm) diameter round tubular element. And for the ⅝ inch FIREBAR it's nearly 10 percent greater.



Element Type	Surface Area Per Linear inch (cm) in²	(cm²)
One inch FIREBAR	2.30 in²	(5.84 cm²)
⅝ inch FIREBAR	1.52 in²	(3.86 cm²)
0.430 inch 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:

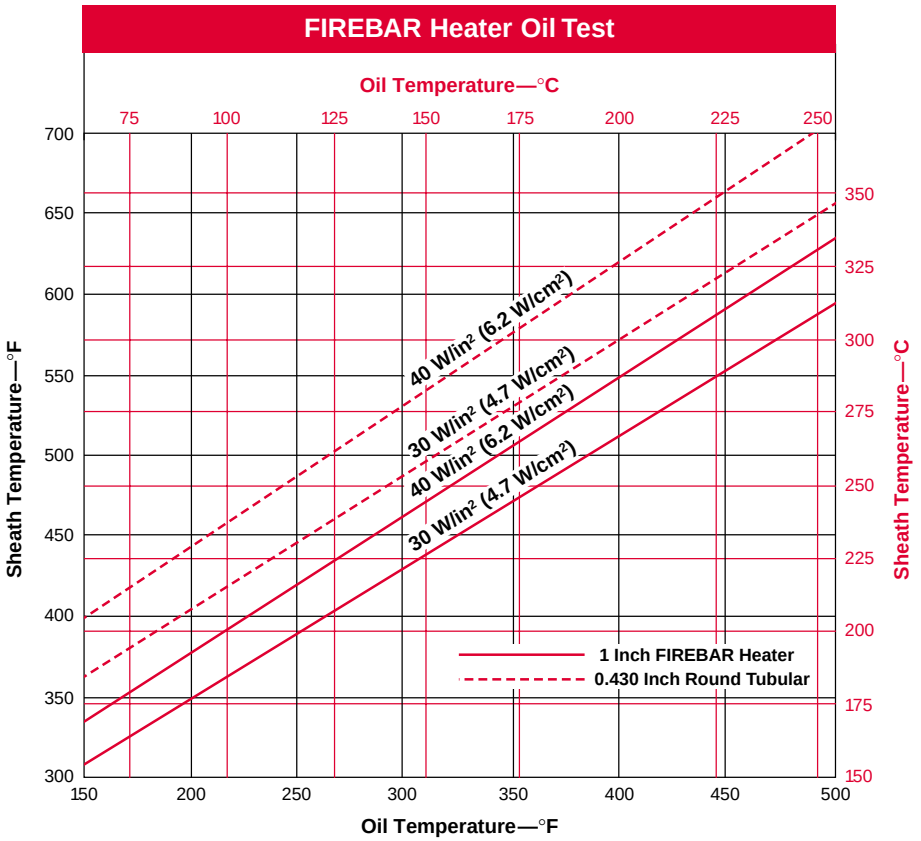
- Reduce coking and fluid degrading
- Increase heater power within application space parameters
- Provide superior heat transfer in clamp-on applications resulting from greater surface area contact
- Lower watt density

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.

FIREBAR Heating Elements

For example, the *FIREBAR Heater Oil Test* graph compares sheath temperatures of 40 W/in² (6.7 W/cm²) 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/in² (6.7 W/cm²) is lower than a 30 W/in² (4.6 W/cm²) 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 inch (11 mm) round tubular element. The FIREBAR element requires less space in application and equipment designs.

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 Size Comparison

Element	Heated Length inches	(mm)	Wattage	W/in²	(W/cm²)
One inch FIREBAR Element	19⅞	(505)	1000	23	(3.6)
0.430 inch Round Tubular Element	32¼	(820)	1000	23	(3.6)

Heater Power Comparison

Element	Heated Length inches	(mm)	Wattage	W/in²	(W/cm²)
One inch FIREBAR Element	32¼	(820)	1700	23	(3.6)
0.430 inch Round Tubular Element	32¼	(820)	1000	23	(3.6)

Tubular and Process Assemblies

FIREBAR Heating Elements

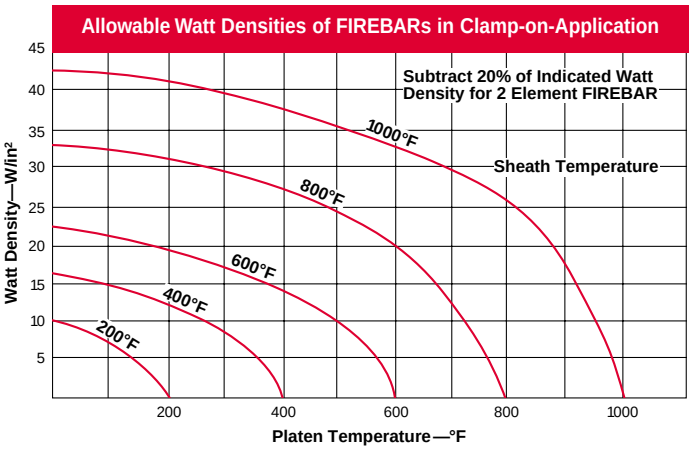
Clamp-On Applications

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.

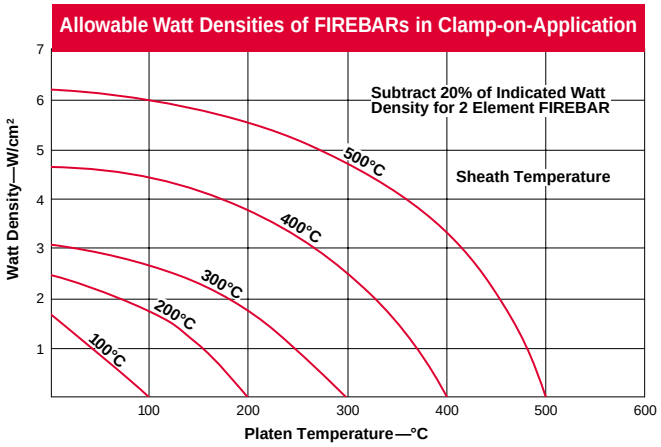
FIREBAR elements are also economical platen heaters. The *Platen Heating* graph shows FIREBAR's large, flat surface area allows it to operate at twice the watt density of round tubular elements … without sacrificing heater life.

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

Platen Heating (˚F)

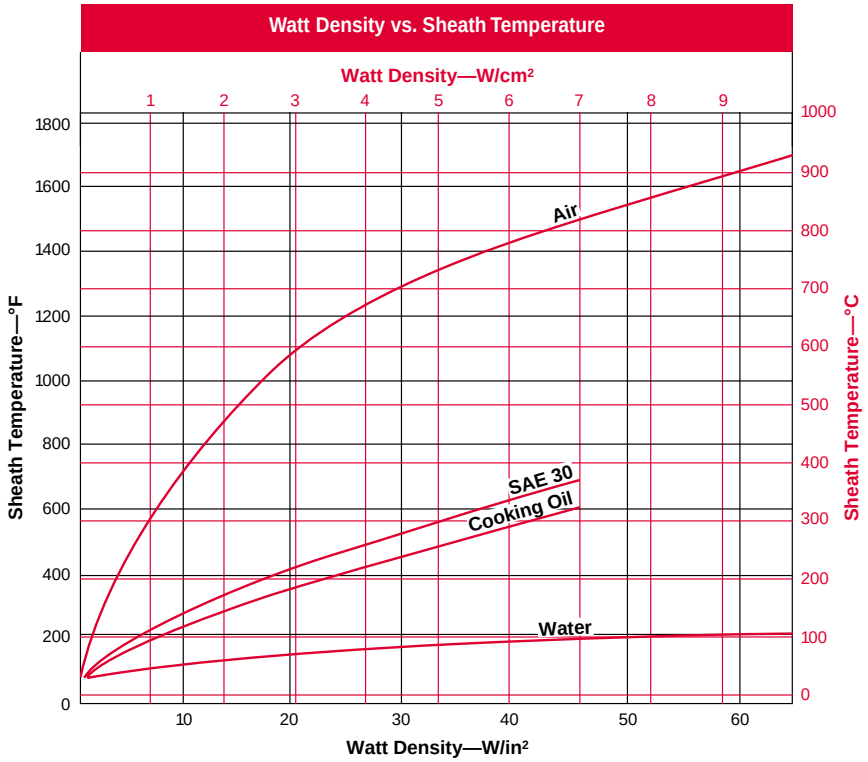


Platen Heating (˚C)



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.

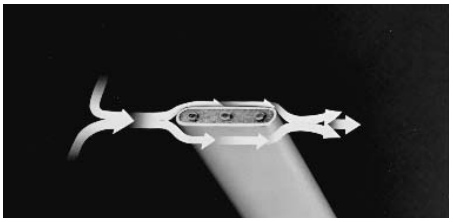


FIREBAR Heating Elements

Air Heating

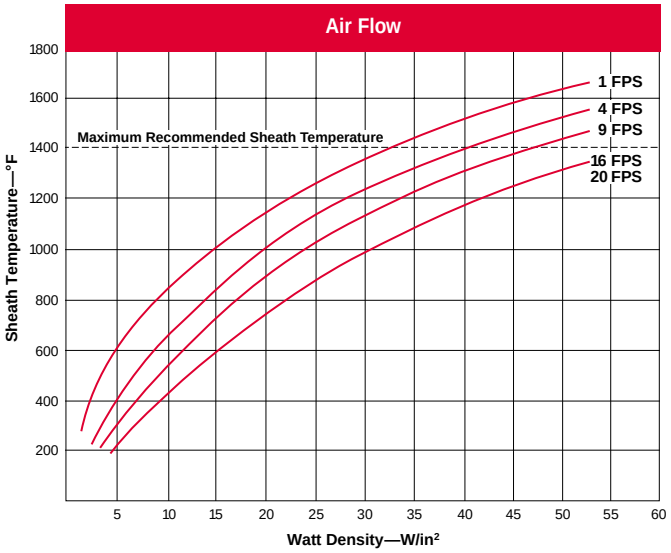
The Air *Flow/Watt Density/Sheath Temperature* graph shows the relationship between air flow, watt density and sheath temperature. Keep in mind that lower sheath temperature yields longer heater life.

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.

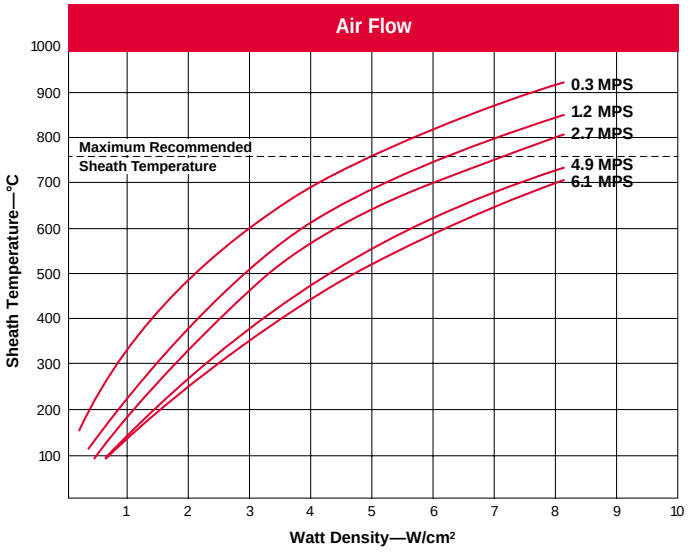


Air flow normal to sheath geometry

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



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



Moisture Resistant Seals

A standard 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 ⅛ inch (3.2 mm) moisture barriers surrounding the terminal pins at the end of the sheath. Silicone rubber is effective to 500°F (260°C).

Epoxy Resin Seal

Epoxy resin seals are ⅛ inch (3.2 mm) moisture barriers surrounding the terminal pins at the end of the sheath. Epoxy resin is effective to 266°F (130°C) or 350°F (176°C), and recommended for water heating applications.

Application Hints

- Choose a FIREBAR heating element instead of an assembly, when your 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 three inches (76 mm) or larger.
- Ensure termination temperatures do not exceed 392°F (200°C) or the maximum temperature rating of the end seal.

Tubular and Process Assemblies

FIREBAR Heating Elements

All FIREBAR heaters are available with a variety of termination options. Consult factory for availability.

Termination Code Legend

Termination Type

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.

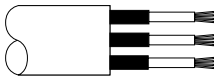
Electrical Configuration

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

Code No.	Termination	Phase	Wiring	1 Inch FIREBAR		5/8 inch 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	No	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	No	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	No	No
B3	TGGT 250°C Lead wire	3	Delta	Yes	No	No	No
B4	TGGT 250°C Lead wire	3	Wye	No	Yes	No	No
C1	¼" Quick Connect (Spade)	1	Parallel	Yes	Yes	Yes	Yes
C2	¼" 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	No
E2	#10-32 Stud Terminal	1	Series	Yes	No	No	No
E3	#10-32 Stud Terminal	3	Delta	Yes	No	No	No

Flexible Lead Wire①

A, B



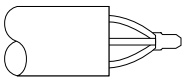
- Double End 1 inch FIREBAR
- Single End 1 inch FIREBAR
- FINBAR

A, B

- Single End 1 inch FIREBAR
- Double End ⅝ inch FIREBAR
- Single End ⅝ inch FIREBAR
- FINBAR

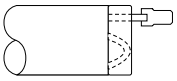
Quick Connect (Spade)

C1



- Double End 1 inch FIREBAR

C2



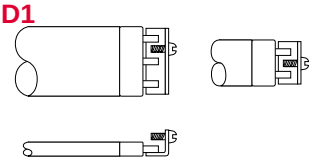
- Double End 1 inch FIREBAR

C3

- Single End 1 FIREBAR
- FINBAR
- Double End ⅝ inch FIREBAR
- Single End ⅝ inch FIREBAR

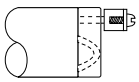
Screw Lug (Plate)

D1



- Double End 1 & ⅝ inch FIREBAR

D2



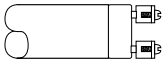
- Double End 1 inch FIREBAR

D3

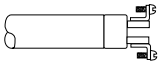
- Double End 1 inch FIREBAR

3 Phase delta wiring example

D4



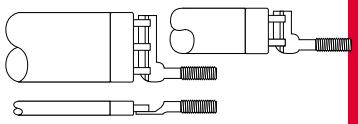
- Single End 1 inch FIREBAR
- FINBAR



- Double End ⅝ inch FIREBAR
- Single End ⅝ inch FIREBAR

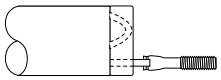
Threaded Stud

E1



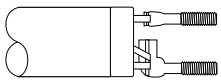
- Double End 1 & ⅝ inch FIREBAR

E2



- Double End 1 inch FIREBAR

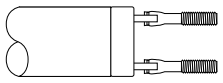
E3



- Double End 1 inch FIREBAR

3 Phase delta wiring example

E4



- Single End 1 inch FIREBAR
- FINBAR

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

Sil-A-Blend™ is a trademark of Radix Wire Company.

FIREBAR Heating Elements

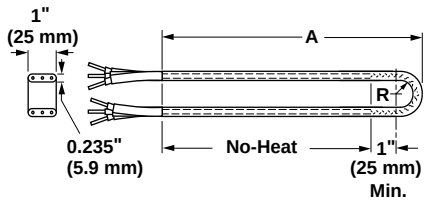
Bending

Major and Minor Axis Bending Parameters

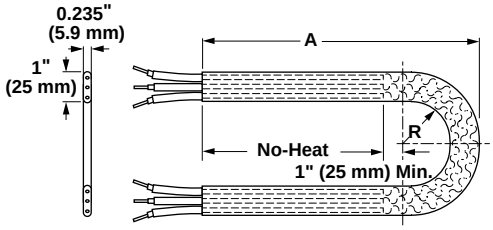
The following illustrations detail the recommended major and minor axis bend parameters for FIREBAR elements. These illustrations show the relationship between the type of bend and the location of heat and no-heat sections. See **pages 309 to 310** for the 15 common bend formations.

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

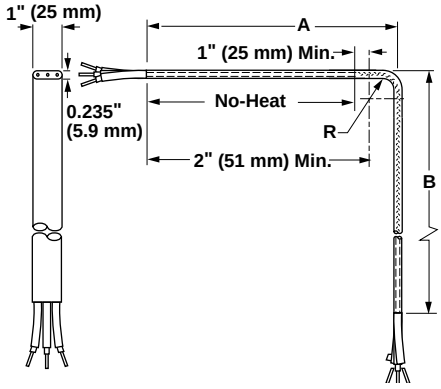
180 degree Minor Axis Heated Bend



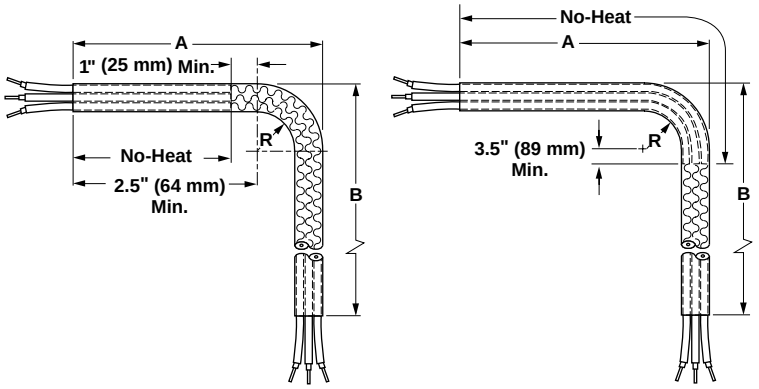
180 degree Major Axis Heated Bend



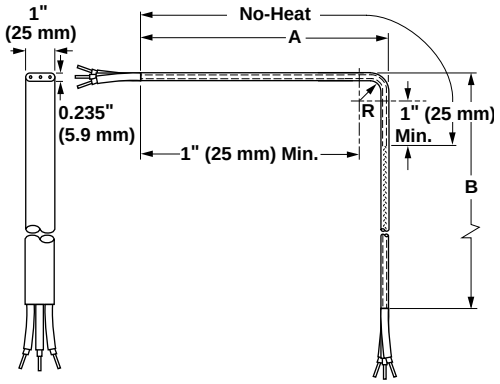
90 degree Minor Axis Heated Bend



90 degree Major Axis Heated Bend



90 degree Minor Axis Un-Heated Bend



180 degree Major Axis Bends

FIREBAR Size		Radius		
inch	(mm)	inch	(mm)	Arc Length
⅝"	(16)	¾"	(19)	3.125
⅝"	(16)	1"	(25)	3.900
⅝"	(16)	1 ¼"	(32)	4.620
⅝"	(16)	1 ½"	(38)	5.600
1"	(25)	1"	(25)	4.335
1"	(25)	1 ¼"	(32)	5.121
1"	(25)	1 ½"	(38)	5.906

Tubular and Process Assemblies

FIREBAR Heating Elements

Bend Formations

FIREBAR elements can be formed into spirals, 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 **page 308**. On these illustrations, please note the no-heat end location.

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

Illustrated on **pages 309 to 310** are the 15 common bends that can be ordered for all in-stock and **made-to-order** 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**

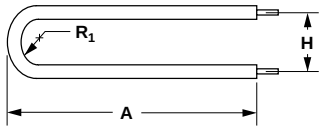
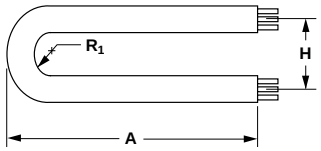
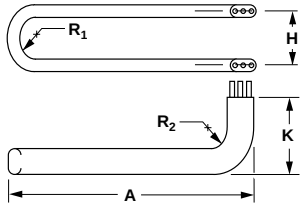
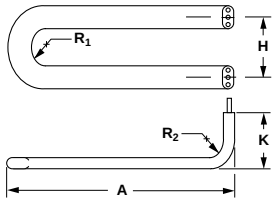

			

Figure 3A	**Figure 3B**	**Figure 4A**	**Figure 4B**

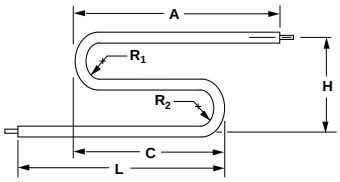
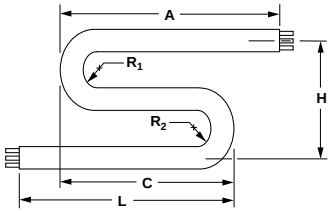
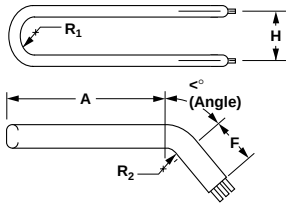
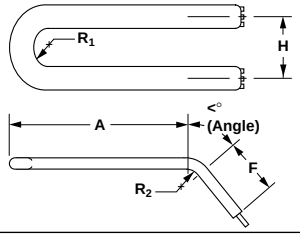

			

Figure 5A	**Figure 5B**	**Figure 6A**	**Figure 6B**

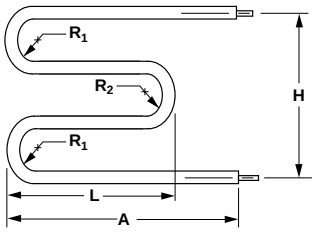
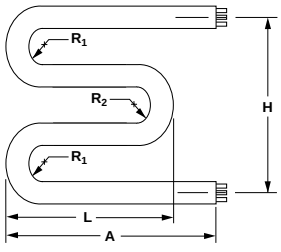
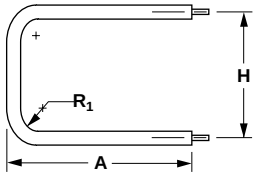
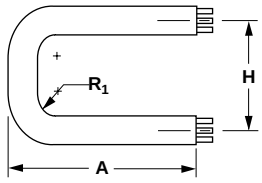
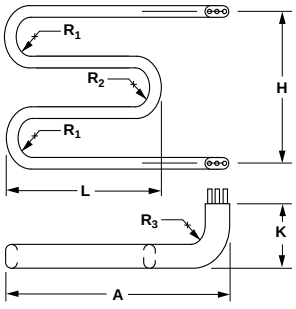
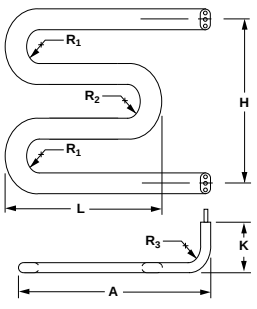
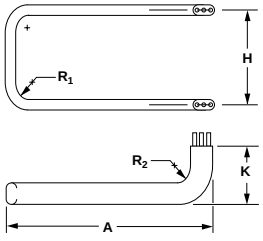
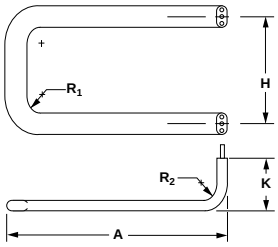

			

Figure 7A	**Figure 7B**	**Figure 8A**	**Figure 8B**
			

FIREBAR®

FIREBAR Heating Elements

Minor Axis	Major Axis	Minor Axis	Major Axis
Figure 9A	**Figure 9B**	**Figure 10A**	Bend Figure 10B Not Available On Major Axis

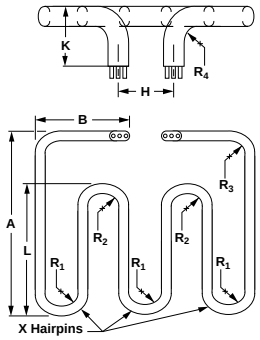
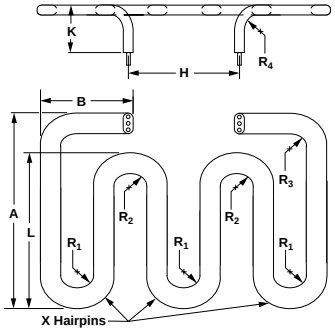
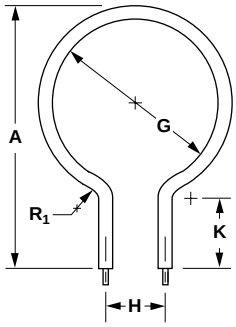
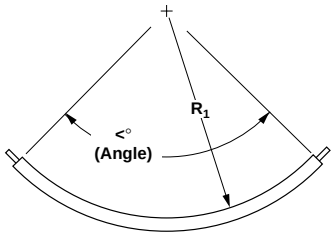
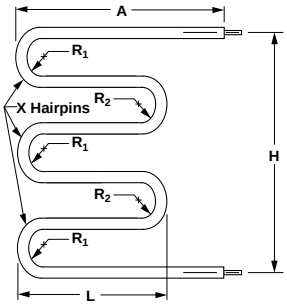
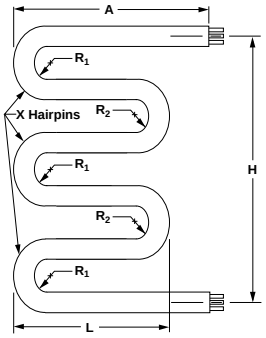

		

Figure 11A		**Figure 12A**	**Figure 12B**
	Bend Figure 11B Not Available On Major Axis		
Figure 13A	**Figure 13B**	**Figure 14A**	**Figure 14B**

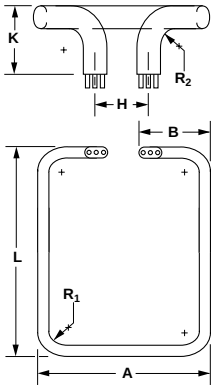
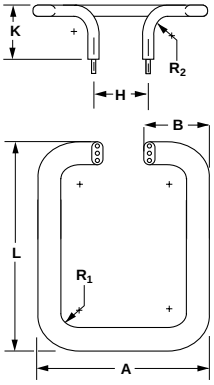
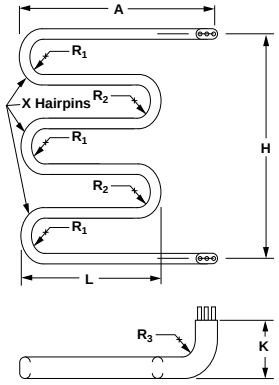
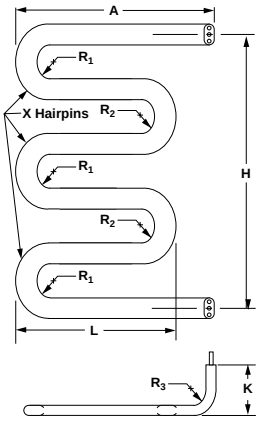
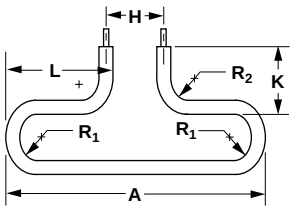
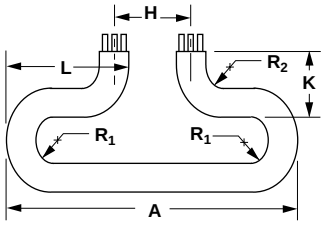

			

Figure 15A	**Figure 15B**		
			

Tubular and Process Assemblies

FIREBAR Heating Elements

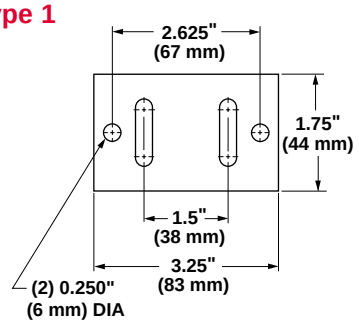
Mounting Brackets

Steel brackets provide element mounting in non-pressurized applications. In air heating applications, an 18 gauge aluminized steel bracket is press fitted to the element. A ¼ inch (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.

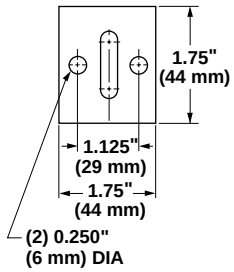
The bracket is located ½ inch (13 mm) from the sheath's end, unless otherwise specified. Available on ⅝ inch FIREBAR as **made-to-order** only.

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

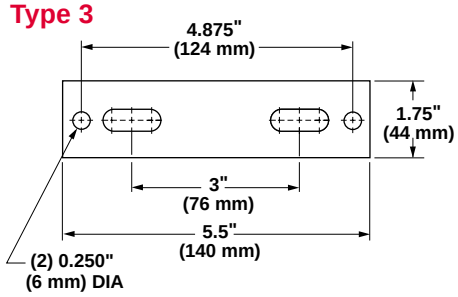
Type 1



Type 2



Type 3



Threaded Bulkheads

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.

To order, specify **threaded bulkheads**.

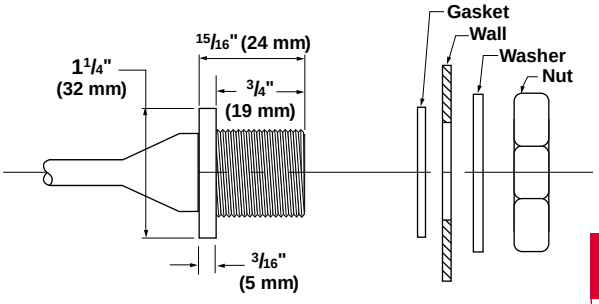


Illustration for 5/8 inch FIREBAR

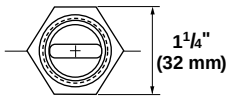


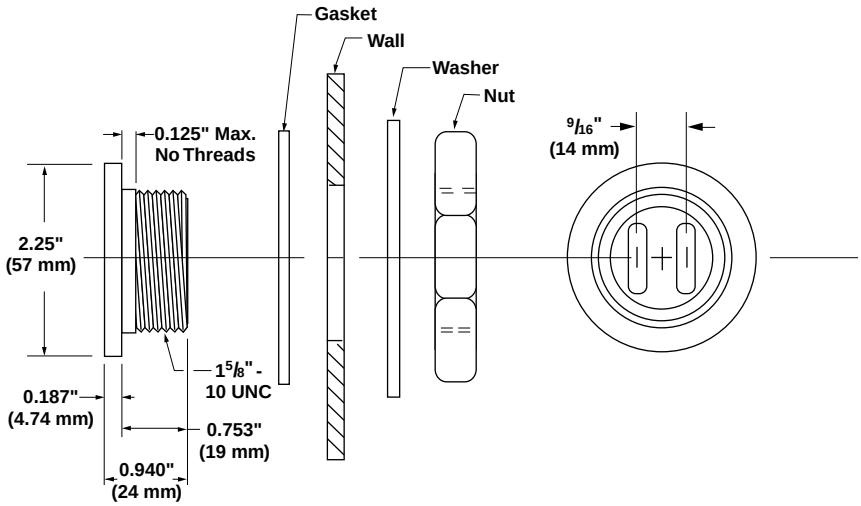
Illustration for one inch FIREBAR

Heater Size		Thread Size
inch	(mm)	
⅝"	(16)	⅞-14 UNF-2A
1"	(25)	1¼-16 UNF-2A

Water-Tight Double Leg Threaded Fitting

A threaded 1⅝ inch-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 **one inch FIREBAR only**.

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



FIREBAR Heating Elements

Options

Continued

Surface Finish

Bright Annealing

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**.

Internal Thermocouples

To provide protection against element over-temperature conditions, one inch single- and double-ended FIREBAR elements can be ordered with ASTM **Type K** thermocouples. This is accomplished by eliminating the center resistance coil and embedding the thermocouple junction inside the sheath. Thus thermocouples are available only on two resistance coil, one inch FIREBAR elements.

To order, specify:

- **Type K** thermocouple
- Distance the junction is to be located from the element's end
- Lead length

Thermocouple Types

ASTM Type	Conductor Positive	Characteristics Negative	Recommended① Temperature Range °F	(°C)
K	Chromel® (Non-magnetic)	Alumel® (Magnetic)	0 to 2000	(-20 to 1100)

① **Type K** thermocouples are rated 32 to 2282°F (0 to 1250°C). Watlow does not recommend exceeding the temperature range shown on this chart.

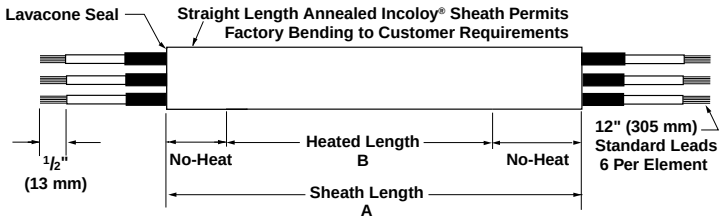
Alumel® and Chromel® are registered trademarks of the Hoskins Manufacturing Company.

Tubular and Process Assemblies

F.O.B.: Hannibal, Missouri

FIREBAR Heating Elements

One Inch, Double Ended FIREBAR



FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Code Number			Est. Net Weight	
	inch	(mm)	inch	(mm)		120V~(ac)	240V~(ac)	480V~(ac)	lbs	(kg)
Applications: Asphalt, Paraffin (Solid), Bunker Oil, Clamp-On										
6 W/in²	35	(889)	25	(635)	310	**FBN351WD**			1.3	(0.6)
Incoloy®	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)	1060	**FBN931WD**	**FBN9310WD**		3.4	(1.6)
	114	(2895)	104	(2641)	1350	**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)
Incoloy®	35	(889)	32	(812)	750	**FBN351WL**	**FBN3510WL**		1.3	(0.6)
(1.6 W/cm²)	47	(1193)	43	(1092)	1000	**FBN471WL**	**FBN4710WL**		1.7	(0.8)
	69	(1752)	65	(1651)	1500	**FBN691WL**	**FBN6910WL**		2.5	(1.2)
	90	(2286)	86	(2184)	2000	**FBN901WL**	**FBN9010WL**		3.3	(1.5)
Applications: Clamp-On, Medium Weight Oils, Liquid Paraffin, Low Temperature Ovens 400°F (205°C)										
15 W/in²②	29	(736)	19	(482)	670		**FBN2910WE**		1.1	(0.5)
Incoloy®	34	(863)	24	(609)	830		**FBN3410WE**		1.3	(0.6)
(2.3 W/cm²)	39	(990)	29	(736)	1000		**FBN3910WE**		1.4	(0.7)
	48	(1219)	38	(965)	1330		**FBN4810WE**	**FBN4811WE**	1.8	(0.9)
	58	(1473)	48	(1219)	1670		**FBN5810WE**	**FBN5811WE**	2.1	(1.0)
	68	(1727)	58	(1473)	2000		**FBN6810WE**	**FBN6811WE**	2.5	(1.2)
	87	(2209)	77	(1955)	2670		**FBN8710WE**	**FBN8711WE**	3.2	(1.5)
	106	(2692)	96	(2438)	3330		**FBN10610WE**	**FBN10611WE**	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)
Incoloy®	20	(508)	16	(406)	750	**FBN201WM**			0.8	(0.4)
(3.1 W/cm²)	26	(660)	22	(558)	1000	**FBN261WM**	**FBN2610WM**		1.0	(0.5)
	36	(914)	32	(812)	1500	**FBN361WM**	**FBN3610WM**		1.3	(0.6)
	48	(1219)	43	(1092)	2000	**FBN481WM**	**FBN4810WM**		1.8	(0.9)
	70	(1778)	65	(1651)	3000		**FBN7010WM**	**FBN7011WM**	2.6	(1.2)
	91	(2311)	85	(2159)	4000		**FBN9110WM**	**FBN9111WM**	3.3	(1.5)
Applications: Degreasing Solutions, Heat Transfer Oils										
23 W/in²	35	(889)	25	(635)	1250	**FBN351WT**	**FBN3510WT**		1.3	(0.6)
Incoloy®	41	(1041)	31	(787)	1625	**FBN411WT**	**FBN4110WT**		1.5	(0.7)
(3.6 W/cm²)	51	(1295)	41	(1041)	2125	**FBN511WT**	**FBN5110WT**	**FBN5111WT**	1.9	(0.9)
	62	(1574)	52	(1320)	2625	**FBN621WT**	**FBN6210WT**	**FBN6211WT**	2.3	(1.1)
	72	(1828)	62	(1574)	3200	**FBN721WT**	**FBN7210WT**	**FBN7211WT**	2.6	(1.2)
	93	(2362)	83	(2108)	4250	**FBN931WT**	**FBN9310WT**	**FBN9311WT**	3.4	(1.6)
	114	(2895)	104	(2641)	5400	**FBN1141WT**	**FBN11410WT**	**FBN11411WT**	4.2	(1.9)

CONTINUED

All heating elements are Stock units unless otherwise noted.

② Standard

Truck Shipment only

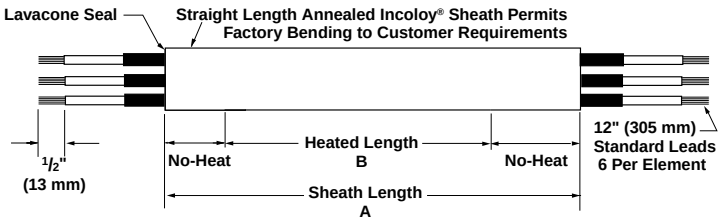
Availability

Stock: Same day shipment

Standard: 10 working days

FIREBAR Heating Elements

One Inch, Double Ended FIREBAR



FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Code Number			Est. Net Weight	
	inch	(mm)	inch	(mm)		120V~(ac)	240V~(ac)	480V~(ac)	lbs	(kg)
Applications: Cooking Oils, Mild Caustic Solution, Ethylene Glycol (100%)										
30 W/in²	16	(406)	10	(254)	750	**FBN161WH**			0.6	(0.3)
Incoloy®	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**	**FBN5011WH**	1.8	(0.9)
	64	(1625)	57	(1447)	4000		**FBN6410WH**	**FBN6411WH**	2.4	(1.1)
	80	(2032)	72	(1828)	5000		**FBN8010WH**	**FBN8011WH**	2.9	(1.4)
Applications: Process Water, Ethylene Glycol (50%)										
40 W/in²	25	(635)	22	(558)	2000		**FBN2510WK**		0.9	(0.4)
Incoloy®	35	(889)	32	(812)	3000		**FBN3510WK**	**FBN3511WK**	1.3	(0.6)
(6.2 W/cm²)	47	(1193)	43	(1092)	4000		**FBN4710WK**	**FBN4711WK**	1.7	(0.8)
	69	(1752)	65	(1651)	6000		**FBN6910WK**	**FBN6911WK**	2.5	(1.2)
	90	(2286)	86	(2184)	8000		**FBN9010WK**	**FBN9011WK**	3.3	(1.5)
45 W/in²	29	(736)	19	(482)	2000		**FBN2910WP**		1.1	(0.5)
Incoloy®	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**	**FBN4811WP**	1.8	(0.9)
	58	(1473)	48	(1219)	5000		**FBN5810WP**	**FBN5811WP**	2.1	(1.0)
	68	(1727)	58	(1473)	6000		**FBN6810WP**	**FBN6811WP**	2.5	(1.2)
	87	(2209)	77	(1955)	8000		**FBN8710WP**	**FBN8711WP**	3.2	(1.5)
	106	(2692)	96	(2438)	10,000		**FBN10610WP**	**FBN10611WP**	3.9	(1.8)
Applications: Clean and Potable Water										
80 W/in²	15	(381)	11	(279)	2000		**FBN1510WJ**		0.6	(0.3)
Incoloy®	20	(508)	16	(406)	3000		**FBN2010WJ**		0.8	(0.4)
(12.4 W/cm²)	26	(660)	22	(558)	4000		**FBN2610WJ**	**FBN2611WJ**	1.0	(0.5)
	36	(914)	32	(812)	6000		**FBN3610WJ**	**FBN3611WJ**	1.3	(0.6)
	48	(1219)	43	(1092)	8000		**FBN4810WJ**	**FBN4811WJ**	1.8	(0.9)
	70	(1778)	65	(1651)	12,000			**FBN7011WJ**	2.6	(1.2)
	91	(2311)	85	(2159)	16,000			**FBN9111WJ**	3.3	(1.5)
90 W/in²	35	(889)	25	(635)	5000	**FBN351WG**	**FBN3510WG**	**FBN3511WG**	1.3	(0.6)
Incoloy®	41	(1041)	31	(787)	6500	**FBN411WG**①	**FBN4110WG**	**FBN4111WG**	1.5	(0.7)
(14 W/cm²)	51	(1295)	41	(1041)	8500		**FBN5110WG**	**FBN5111WG**	1.9	(0.9)
	62	(1574)	52	(1320)	10,500		**FBN6210WG**	**FBN6211WG**	2.3	(1.1)
	72	(1828)	62	(1574)	12,750		**FBN7210WG**	**FBN7211WG**	2.6	(1.2)
	93	(2362)	83	(2108)	17,000			**FBN931WG**	3.4	(1.6)
	114	(2895)	104	(2641)	21,5000			**FBN11411WG**	3.4	(1.6)

All heating elements are Stock units unless otherwise noted.

Availability
Stock: Same day shipment
Standard: 10 working days

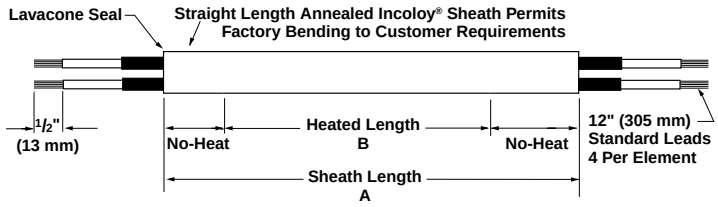
① Standard

Truck Shipment only

Tubular and Process Assemblies

FIREBAR Heating Elements

⅝ Inch, Double Ended FIREBAR



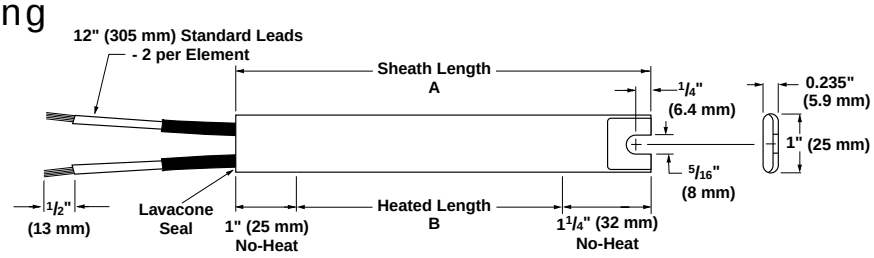
FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Code Number			Est. Net Weight	
	inch	(mm)	inch	(mm)		120V~(ac)	240V~(ac)	480V~(ac)	lbs	(kg)
Applications: Degreasing Fluids, Heat Transfer Oils										
23 W/in² ②	19	(483)	11	(279)	375	**FAN191WT**			0.5	(0.3)
Incoloy®	22	(559)	14	(356)	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**②	**FAN1510WG**		0.4	(0.2)
Incoloy®	19	(483)	11	(279)	1500	**FAN191WG**	**FAN1910WG**②	**FAN1911WG**	0.5	(0.3)
(14 W/cm²)	22	(559)	14	(356)	2000	**FAN221WG**	**FAN2210WG**②	**FAN2211WG**	0.5	(0.3)
	26	(660)	18	(457)	2500	**FAN261WG**	**FAN2610WG**②	**FAN2611WG**	0.6	(0.3)
	30	(762)	22	(559)	3000	**FAN301WG**②	**FAN3010WG**②	**FAN3011WG**	0.7	(0.4)
	37	(940)	29	(737)	4000		**FAN3710WG**②	**FAN3711WG**	0.9	(0.5)
	44	(1118)	36	(914)	5000		**FAN4410WG**②	**FAN4411WG**	1.0	(0.5)
	51	(1295)	43	(1092)	6000		**FAN5110WG**②	**FAN5111WG**	1.2	(0.6)

All heating elements are Stock units.

② Stock

Availability
Stock: Same day shipment
Standard: 10 working days

FIREBAR Heating Elements



One Inch, Single Ended FIREBAR

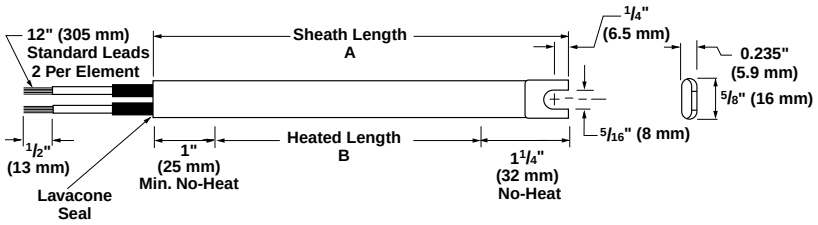
FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Code Number		Est. Net Weight	
	inch	(mm)	inch	(mm)		120V~(ac)	240V~(ac)	lbs	(kg)
Applications: Radiant, Platens, Dies, Low Temperature Ovens 300°F (150°C)									
20 W/in²	8 3/4	(222)	6 1/2	(165)	300	**FSP91WM**		0.4	(0.2)
304 SS	10 1/4	(260)	7 1/2	(203)	375	**FSP101WM**		0.4	(0.2)
(3.1 W/cm²)	12 1/4	(311)	10	(254)	450	**FSP121WM**		0.5	(0.3)
	13 1/2	(342)	11 1/4	(285)	500	**FSP141WM**		0.5	(0.3)
	16 1/8	(408)	13 7/8	(352)	650	**FSP161WM**	**FSP1610WM**	0.6	(0.3)
	17 3/4	(450)	15 1/2	(393)	725	**FSP181WM**	**FSP1810WM**	0.7	(0.4)
	19 1/4	(489)	17	(431)	800	**FSP191WM**	**FSP1910WM**	0.7	(0.4)
	22	(558)	19 3/4	(501)	900	**FSP221WM**	**FSP2210WM**	0.8	(0.4)
	23 3/4	(603)	21 1/2	(546)	1000	**FSP241WM**	**FSP2410WM**	0.9	(0.4)
	25	(635)	22 3/4	(577)	1050	**FSP251WM**	**FSP2510WM**	0.9	(0.4)
	28 5/8	(727)	26 3/8	(669)	1250	**FSP291WM**	**FSP2910WM**	1.1	(0.5)
	31 5/8	(803)	29 3/8	(746)	1350	**FSP321WM**	**FSP3210WM**	1.2	(0.6)
	34 1/8	(865)	31 7/8	(809)	1500		**FSP3410WM**	1.3	(0.6)
	36 7/8	(936)	34 5/8	(879)	1600		**FSP3710WM**	1.4	(0.7)
	40 5/8	(1031)	38 3/8	(974)	1800		**FSP4110WM**	1.5	(0.7)
	46 1/4	(1174)	44	(1117)	2000		**FSP4610WM**	1.7	(0.8)
Applications: Process Water, Ethylene Glycol (50%)									
40 W/in²	8 3/4	(222)	6 1/2	(165)	600	**FSP91WK**		0.4	(0.2)
304 SS	10 1/4	(260)	7 1/2	(203)	750	**FSP101WK**		0.4	(0.2)
(6.2 W/cm²)	12 1/4	(311)	10	(254)	900	**FSP121WK**	**FSP1210WK**	0.5	(0.3)
	13 1/2	(342)	11 1/4	(285)	1000	**FSP131WK**	**FSP1310WK**	0.5	(0.3)
	16 1/4	(408)	13 7/8	(352)	1300	**FSP161WK**	**FSP1610WK**	0.6	(0.3)
	17 3/4	(450)	15 1/2	(393)	1450	**FSP181WK**	**FSP1810WK**	0.7	(0.4)
	19 1/4	(489)	17	(431)	1600		**FSP1910WK**	0.7	(0.4)
	22	(558)	19 3/4	(501)	1800		**FSP2210WK**	0.8	(0.4)
	23 3/4	(603)	21 1/2	(546)	2000		**FSP2410WK**	0.9	(0.4)
	25	(635)	22 3/4	(577)	2100		**FSP2510WK**	0.9	(0.4)
	28 5/8	(727)	26 3/8	(669)	2500		**FSP2910WK**	1.1	(0.5)
	31 5/8	(803)	29 3/8	(746)	2700		**FSP3210WK**	1.2	(0.6)
	34 1/8	(865)	31 7/8	(809)	3000		**FSP3410WK**	1.3	(0.6)
	36 7/8	(936)	34 5/8	(879)	3200		**FSP3710WK**	1.4	(0.7)
	40 5/8	(1031)	38 3/8	(974)	3600		**FSP4110WK**	1.5	(0.7)
	46 1/4	(1174)	44	(1117)	4000		**FSP4610WK**	1.7	(0.8)

All heating elements are Stock units.
Availability
Stock: Same day shipment

Tubular and Process Assemblies

FIREBAR Heating Elements

⅝ Inch, Single Ended FIREBAR



FIREBAR Description	Sheath A Dimension		Heated B Dimension		Watts	Code Number		Est. Net Weight	
	inch	(mm)	inch	(mm)		120V~(ac)	240V~(ac)	lbs	(kg)
Applications: Radiant, Platens, Dies, Low Temperature Ovens 300°F (150°C)									
20 W/in²	11½	(292)	8	(203)	250	**FSA121WM①**		0.3	(0.2)
Incoloy®	15½	(394)	12	(304)	375	**FSA161WM**	**FSA1610WM**	0.4	(0.2)
(3.1 W/cm²)	19½	(495)	16	(406)	500	**FSA201WM**	**FSA2010WM①**	0.5	(0.3)
	28	(711)	24	(609)	750	**FSA281WM①**	**FSA2810WM①**	0.6	(0.3)
	36	(914)	32	(812)	1000	**FSA361WM**	**FSA3610WM**	0.8	(0.4)
	52	(1321)	48	(1219)	1500	**FSA521WM**	**FSA5210WM①**	1.2	(0.6)

Availability
Stock: Same day shipment
Standard: 10 working days
① Stock

F.O.B.: Hannibal, Missouri

How to Order

To order a stock FIREBAR heating element, specify:

- Watlow code number
- Size (one or ⅝ inch)
- Type (single- or double-ended)
- Volts/watts
- Termination options
- Options
- Quantity

If our stock units do not meet your application needs, Watlow can provide a **made-to-order** unit, please specify:

- Type of application, including heated material, operating temperature, etc.
- Size (one or ⅝ inch)
- Type (single- or double-ended)
- Volts/watts
- Sheath length and material
- Heated length
- No-heat length
- Terminal pin length or termination options
- Moisture seal
- Bend configuration- including dimensions, critical tolerances, major and minor axis bends (please send drawing, if available)
- Options, including external finish and mounting method
- Quantity

Availability

One and ⅝ Inch Double Ended

Straight Length Element

Stock: Same day shipment

Modified Stock①: Three to five working days

Standard: Three weeks

Made-to-Order: Four to five weeks

Formed Element

Modified Stock①: Five to seven working days

Standard: Three weeks

Made-to-Order: Four to five weeks

One and ⅝ Inch Single Ended

Straight Length Element

Stock: Same day shipment

Modified Stock①: Three working days

Made-to-Order: Four to five weeks

Formed Element

Modified Stock①: Three working days

Made-to-Order: Four to five weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

① Stock units with catalog options.

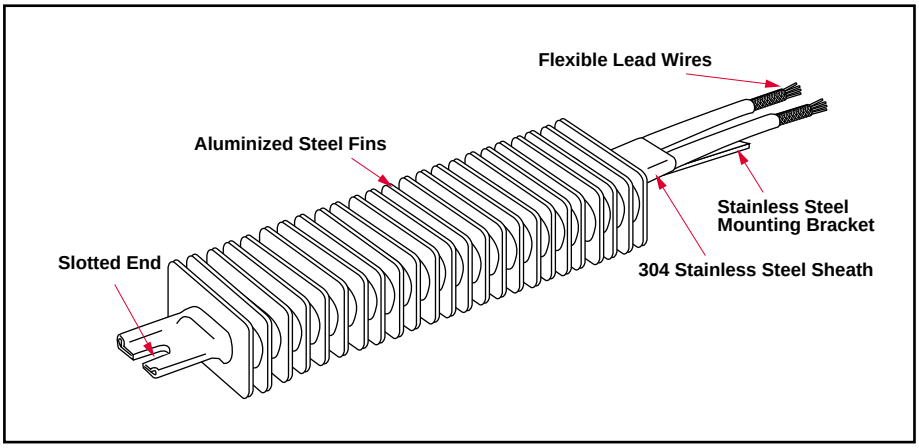
FIREBAR Heating Elements

FINBAR

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 to 50 W/in^2 (7.7 W/cm^2)
- 304 stainless steel sheath temperatures to 1200°F (650°C)
- Voltages to 480V~(ac)
- Amperages to 48 amps per heater or 16 amps per coil

Features and Benefits

- **Rugged aluminized steel fins** effectively increase 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, is supplied with a slotted end for ease of installation.
- **Lavacone seals** provide protection against humid storage conditions. Moisture retardant to 392°F (200°C).

Applications

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

Construction Features

Construction features are detailed for assembly stock products only. Optional materials, sizes, terminations and ratings may be available at additional cost. For availability and ordering information on options, see **pages 307 to 312**.

Watt Density: Stock; up to 40 W/in^2 (6.2 W/cm^2), made-to-order; up to 50 W/in^2 (7.7 W/cm^2)

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

Fin Cross Section: 2 X 1 inch (50 X 25 mm)

Maximum Operating Temperature: Sheath material: 304 Stainless Steel, 1200°F (650°C), Fin material; Aluminized Steel; 1100°F (600°C)

Heater Length: Stock; 10 to 48 inches (260 to 1210 mm), made-to-order; 6 to 120 inches (150 to 3050 mm)

No-Heat Length: 1 inch minimum, 12 inch maximum (25/305 mm)

Voltages: Up to 480V~(ac)

Phase: Stock; 1-phase parallel made-to-order; 1-phase parallel or 3-phase wye

Resistance Coils: Stock; 1 made-to-order 1 or 3

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

Seal Material: Lavacone, rated to 392°F (200°C)

Optional Internal Thermocouple: made-to-order only; ASTM **Type K**

Single-End Configuration: Stock: slotted, made-to-order; slotted, no-slot or sealed

Agency Recognition: refer to FIREBAR UL file # E52951 and CSA file # 31388 under ***Agency Recognition*** on **pages 268 to 271**.

Tubular and Process Assemblies

FIREBAR Heating Elements

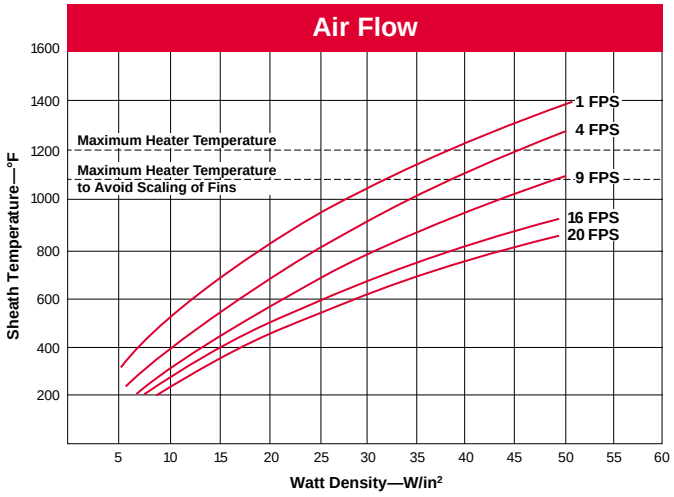
Air Heating

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**.

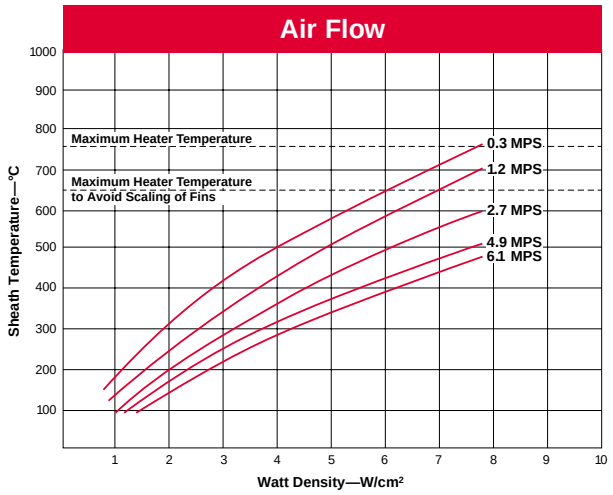
The graphic representation is based on a a single-ended FINBAR, various air velocities (at 68°F/20°C inlet temperature) and different watt densities.

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)

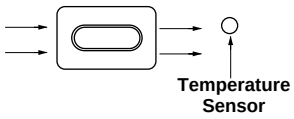


Application Hints

- 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} inches (38 mm).



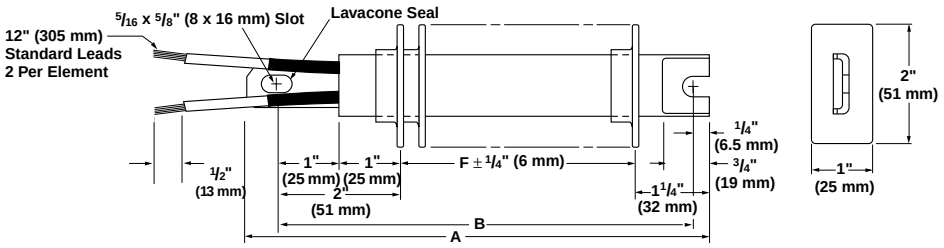
Proper air flow relative to the heater's sheath is parallel with the longer cross sectional axis.

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.

FIREBAR Heating Elements

FINBAR



FINBAR Description	Overall A Dimension Inch	(mm)	Overall F Dimension Inch	(mm)	Mounting B Dimension Inch	(mm)	Watts	Code Number 120V~(ac)	Code Number 240V~(ac)	Est.Net Weight lbs	(kg)
Application: Forced Air											
20 W/in²	10¼	(260)	6½	(158)	9½	(241)	300	**FSP91WMF**		1.4	(0.7)
304 SS	11¾	(298)	8	(203)	11	(279)	375	**FSP101WMF**		1.4	(0.7)
(3.1 W/cm²)	13¾	(349)	10	(254)	13	(330)	450	**FSP121WMF**		1.5	(0.7)
	15	(381)	11¼	(285)	14¼	(362)	500	**FSP141WMF**		1.5	(0.7)
	17⅝	(447)	13⅞	(352)	16⅞	(428)	650	**FSP161WMF**	**FSP1610WMF**	1.6	(0.8)
	19¼	(489)	15½	(393)	18½	(469)	725	**FSP181WMF**	**FSP1810WMF**	1.7	(0.8)
	20¾	(527)	17	(431)	20	(508)	800	**FSP191WMF**	**FSP1910WMF**	1.7	(0.8)
	23½	(597)	19¾	(501)	22¾	(577)	900	**FSP221WMF**	**FSP2210WMF**	1.8	(0.9)
	25¼	(641)	21½	(546)	24½	(622)	1000	**FSP241WMF**	**FSP2410WMF**	1.9	(0.9)
	26½	(673)	22¾	(577)	25¾	(654)	1050	**FSP251WMF**	**FSP2510WMF**	1.9	(0.9)
	30⅛	(765)	26⅜	(669)	29⅜	(746)	1250	**FSP291WMF**	**FSP2910WMF**	2.1	(1.0)
	33⅛	(841)	29⅜	(746)	32⅜	(822)	1350	**FSP321WMF**	**FSP3210WMF**	2.2	(1.0)
	35⅝	(905)	31⅞	(809)	34⅞	(885)	1500		**FSP3410WMF**	2.3	(1.1)
	38⅜	(975)	34⅝	(879)	37⅝	(955)	1600		**FSP3710WMF**	2.4	(1.1)
	42⅛	(1070)	38 ⅜	(974)	41⅜	(1050)	1800		**FSP4110WMF**	2.5	(1.2)
	47¾	(1213)	44	(1117)	47	(1193)	2000		**FSP4610WMF**	2.7	(1.3)
40 W/in²	10¼	(260)	6½	(158)	9½	(241)	600	**FSP91WKF**		1.4	(0.7)
304 SS	11¾	(298)	8	(203)	11	(279)	750	**FSP101WKF**		1.4	(0.7)
(6.2 W/cm²)	13¾	(349)	10	(254)	13	(330)	900	**FSP121WKF**	**FSP1210WKF**	1.5	(0.7)
	15	(381)	11¼	(285)	14¼	(362)	1000	**FSP131WKF**	**FSP1310WKF**	1.5	(0.7)
	17⅝	(447)	13⅞	(352)	16⅞	(428)	1300	**FSP161WKF**	**FSP1610WKF**	1.6	(0.8)
	19¼	(489)	15½	(393)	18½	(469)	1450	**FSP181WKF**	**FSP1810WKF**	1.7	(0.8)
	20¾	(527)	17	(431)	20	(508)	1600		**FSP1910WKF**	1.7	(0.8)
	23½	(597)	19¾	(501)	22¾	(577)	1800		**FSP2210WKF**	1.8	(0.9)
	25¼	(641)	21½	(546)	24½	(622)	2000		**FSP2410WKF**	1.9	(0.9)
	26½	(673)	22¾	(577)	25¾	(654)	2100		**FSP2510WKF**	1.9	(0.9)
	30⅛	(765)	26⅜	(669)	29⅜	(746)	2500		**FSP2910WKF**	2.1	(1.0)
	33⅛	(841)	29⅜	(746)	32⅜	(822)	2700		**FSP3210WKF**	2.2	(1.0)
	35⅝	(905)	31⅞	(809)	34⅞	(885)	3000		**FSP3410WKF**	2.3	(1.1)
	38⅜	(975)	34⅝	(879)	37⅝	(955)	3200		**FSP3710WKF**	2.4	(1.1)
	42⅛	(1070)	38⅜	(974)	41⅜	(1050)	3600		**FSP4110WKF**	2.5	(1.2)
	47¾	(1213)	44	(1117)	47	(1193)	4000		**FSP4610WKF**	2.7	(1.3)

All stock units are Assembly stock.
Availability
Assembly Stock: Three working days

F.O.B.: Hannibal, Missouri

How to Order

To order a stock FINBAR heating element, specify:

- Watlow Code number
- Volts/watts
- Termination options
- Options
- Quantity

For **made-to-order** FINBAR heating elements, specify:

- Type of application, including air flow velocity, volume, etc.
- Single- or double-ended element
- Volts/watts
- Heated length
- No-heat length
- Terminal pin length or termination options, including moisture seal type
- Quantity
- Options, including thermocouple, sealed end, no mounting bracket, etc.

Availability

Assembly Stock: Three working days

Modified Stock①: Five to seven working days

Made-to-Order: Four to five weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

① Assembly Stock units with catalog options.

Tubular and Process Assemblies

Quick Ship

On stock chart units:
- *Same day on most heaters*
- *10 working days on special voltages and/or wattages*
- *15 working days on special element lengths*

Screw Plug Immersion Heaters

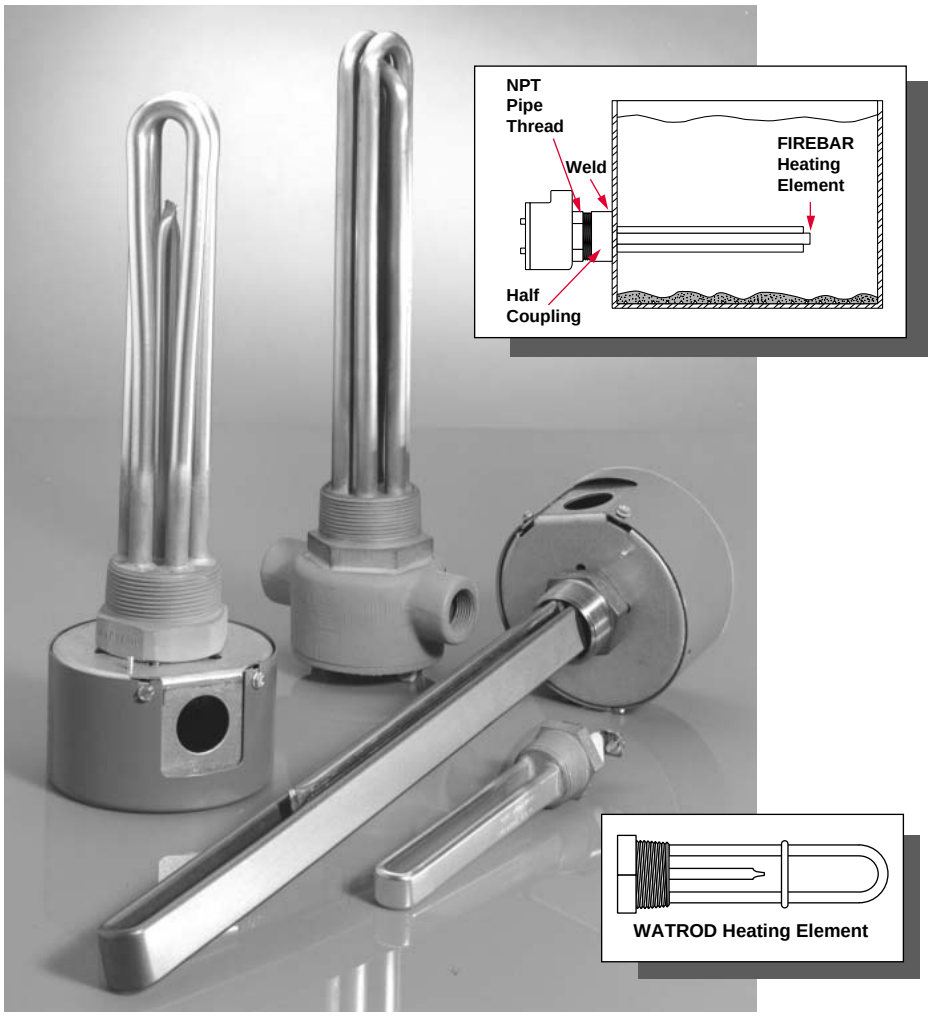
Screw plug immersion heaters are ideal for direct immersion heating of liquids, including all types of oils and heat transfer solutions.

Available in a variety of stock and made-to-order 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 (NEMA 1) terminal enclosures are standard; with optional moisture resistant (NEMA 4), explosion resistant (NEMA 7) and explosion/moisture resistant (NEMA 7/4) enclosures available to meet specific application needs.

Optional thermostats provide convenient process temperature regulation.



Performance Capabilities

- Watt densities to 120 W/in² (18.6 W/cm²)
- Wattages to 38kW
- UL® and CSA component recognition to 480V~(ac) and 600V~(ac) respectively
- Incoloy® sheath temperatures to 1600°F (870°C)
- Passivated 316 stainless steel sheath temperatures to 1200°F (650°C)
- 304 stainless steel sheath temperatures to 1200°F (650°C)
- Steel sheath temperatures to 750°F (400°C)
- Copper sheath temperatures to 350°F (175°C)

Features and Benefits

- **Screw plug and element sizes:**

1" NPT	0.315" WATROD
1¼" NPT	0.315" WATROD 1" FIREBAR
2" NPT	0.475" WATROD
2½" NPT	0.475" WATROD 1" FIREBAR

- **A variety of element sheath and screw plug materials** to meet application needs.
- **Integral thermowells** provide convenient temperature sensor insertion and replacement without draining the fluid being heated.
- **Terminal enclosures** can 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)** to maintain MgO density, dielectric strength, heat transfer and life.
- **2½" NPT screw plug assemblies feature element support(s)** to help ensure proper spacing for maximizing heater performance and life.
- **Phase capability**:

1" NPT	1-Phase
1¼", 2", 2½" NPT	1- or 3-Phase

- **UL® and CSA component recognition** under file numbers E52951 and 31388 respectively. See **pages 268-271** for details.

Incoloy® is a registered trademark of Special Metals Corporation.

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

Screw Plug Immersion Heaters

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

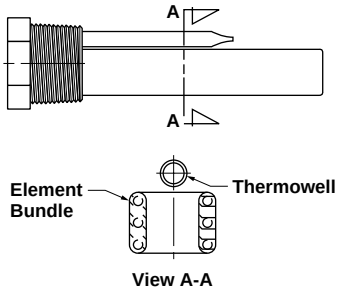
Screw Plug Orientation

Correct element/thermowell orientation assures proper process temperature sensing.

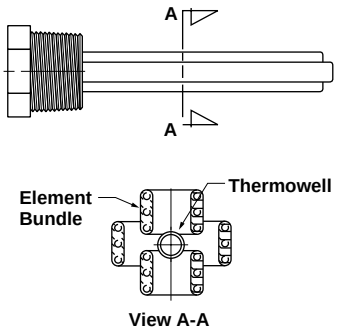
Correct horizontal mounting of WATROD and FIREBAR screw plugs is shown to the right. Correct orientation assures optimum performance and maximum heater life. Additional mounting information is provided in the *Installation and Maintenance Instructions*.

FIREBAR Heating Element

1¼" NPT–One Element

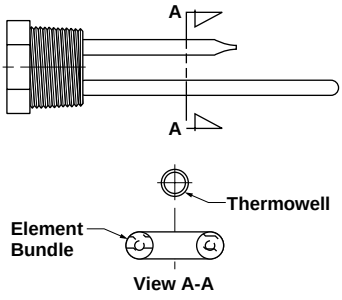


2½" NPT–Three Elements

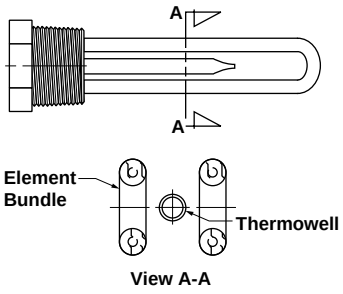


WATROD Heating Element

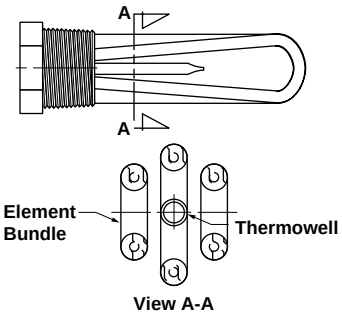
1" NPT–One Element



1¼" & 2" NPT–Two Elements



2" & 2½" NPT–Three Elements



Options

Terminal Enclosures

General purpose (NEMA 1) terminal enclosures, without thermostats, are standard on all screw plug immersion heaters. To meet specific application requirements, Watlow offers the following optional terminal enclosures:

- General purpose (NEMA 1) with single or double pole thermostat
- Moisture resistant (NEMA 4) or corrosion resistant (NEMA 4X) — available with optional single or double pole thermostat
- Explosion resistant (NEMA 7) class 1, groups C and D explosion resistant—available with optional single or double pole thermostat. For class 1, group B enclosures, consult your Watlow representative or refer to CSA specifications on **page 271**.
- Explosion/moisture resistant (NEMA 7/4) combination—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 code number. This is depicted on the *Stock* and *Options* ordering example on **page 336**. Also, specify class and group, if applicable.

Tubular and Process Assemblies

Screw Plug Immersion Heaters

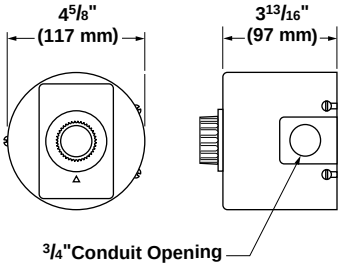
Options

Continued

General Pupose (NEMA 1)

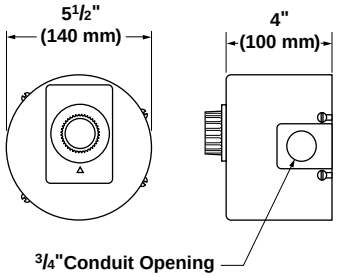
Single Pole Thermostat

All screw plug sizes



Double Pole Thermostat

All screw plug sizes



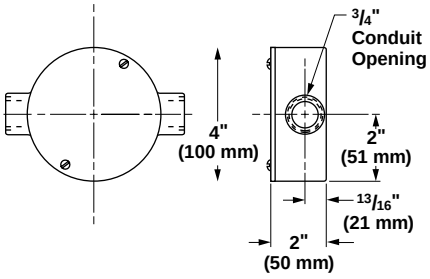
Caution:

Explosion-resistant 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 NEMA rating. NEMA rating effectiveness may be compromised by abuse or misapplication.

Moisture Resistant NEMA 4

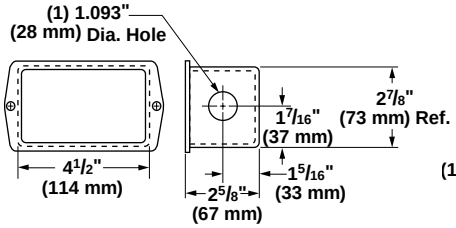
Without Thermostat

All screw plug sizes



Single Pole Thermostat

1" & 1¼" NPT–1 WATROD Element



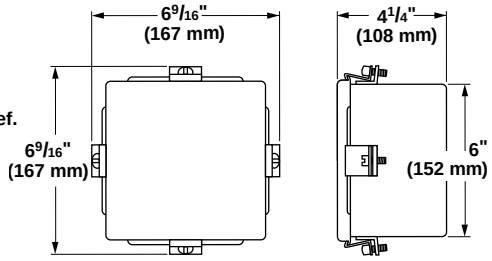
Note: The thermostat is not centered on the WATROD screw plug immersion heater.

Single or Double Pole Thermostat

1¼" NPT–2 WATROD Elements

1¼" NPT–1 FIREBAR Element

All 2" & 2 ½" NPT screw plugs

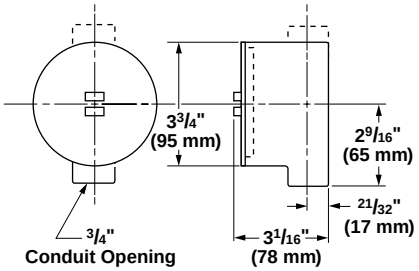


Note: The thermostat is not centered on the screw plug immersion heater.

Explosion/Moisture Resistant (NEMA 7 or 7/4) ①

Without Thermostat

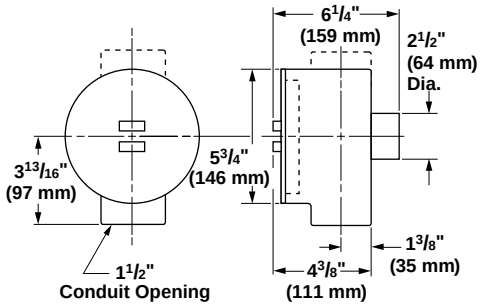
All WATROD screw plugs



Single or Double Pole Thermostat

1¼" NPT–1 FIREBAR Element

All WATROD screw plugs



① All NEMA 7/4 rated terminal enclosures supplied with a gasket for the cover.

Screw Plug Immersion Heaters

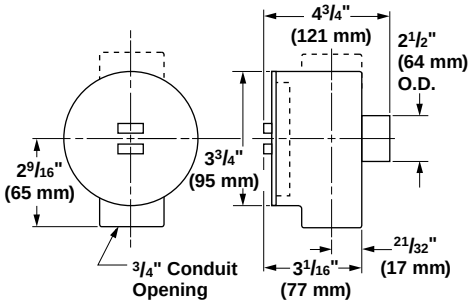
Options

Continued

Explosion/Moisture Resistant (NEMA 7 or 7/4) ①

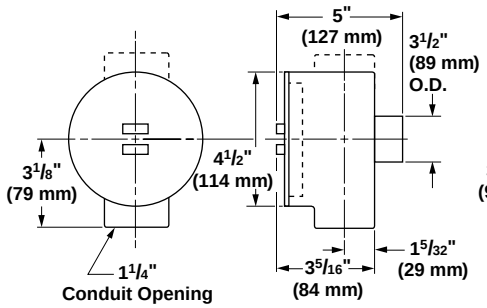
Without Thermostat

1¼ " NPT—1 FIREBAR element



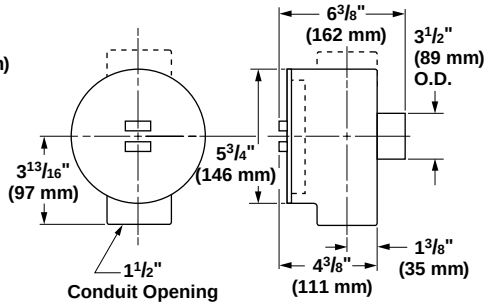
Without Thermostat

2½ " NPT–3 FIREBAR elements



Single or Double Pole Thermostat

2½ " NPT–3 FIREBAR elements



① All NEMA 7/4 rated terminal enclosures supplied with a gasket for the cover.

CSA Certified Enclosures

CSA certified moisture and/or explosion resistant 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, consult 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 250V~(ac), and supplied with six inch (150 mm) leads.

The PL11 pilot light is rated for 480V~(ac), and supplied with four inch (100 mm) leads.

Pilot lights may be attached to either single or double pole thermostats with general purpose (NEMA 1) enclosure only. For moisture or explosion resistant terminal enclosures (NEMA 4 or NEMA 7), consult factory.

To order, refer to the *Build-a-Code* chart on **page 336**.

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 423 to 425**.

Please verify that the thermostat's sensing bulb O.D. is compatible with the screw plug's thermowell I.D.

Tubular and Process Assemblies

Screw Plug Immersion Heaters

Options

Continued

Thermocouples

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 supplied with 120 inch (305 mm) leads (longer lead lengths available). Unless otherwise specified, thermocouples are supplied with temperature ranges detailed on the *Thermocouple Types* chart.

Using a thermocouple requires an appropriate temperature and power control. These must be purchased separately. Watlow offers a wide variety of temperature and power controls to meet virtually all applications. Temperature controls can be configured to accept process variable inputs, too. Consult your Watlow representative for details.

To order, specify **Type J** or **K** thermocouple and lead length.

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 480V~(ac) as well as wattages from 250 watts to 38kW. If required, Watlow will configure heaters with voltages and wattages outside these parameters. For more information on special voltage and wattage configurations, consult your Watlow representative.

Sheath Materials

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

Standard Sheath Materials

WATROD	Incoloy® 316 stainless steel Steel Copper
FIREBAR	Incoloy®

Made-to-Order Sheath Materials

WATROD	304 stainless steel Monel®
FIREBAR	304 stainless steel

Exotic Sheath Materials

Consult 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

Simple belt polishing and glass beading are available to meet cosmetic demands. Consult factory for details.

Screw Plug Immersion Heaters

Options

Continued

Screw Plug Materials

The following screw plug materials are available:

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

Standard Screw Plug Materials

WATROD	304 stainless steel 316 stainless steel Steel Brass
FIREBAR	304 stainless steel

Made-to-Order Plug Materials

For both WATROD and FIREBAR, consult factory about details and availability.

Screw Plug Sizes

Including European

- **NPT**–1, 1¼, 2, 2½ inch
- **Gas**–G1¼, G1½, G 2 inch (brass only)
- **BSP**–1½ inch (stainless steel only)

Consult factory for sizes and materials not listed.

To order, specify **size**, **style** (NPT, Gas or BSP) and material.

BSP = British Standard Pipe
Gas = Gas pipe standard

Screw Plug to Flange Adaptors

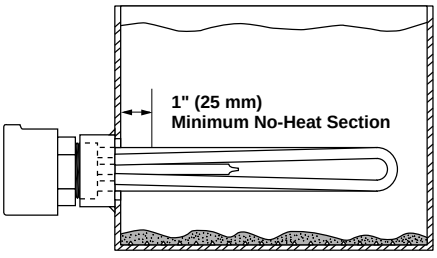
Screw plug to flange adaptors permit replacing flange heaters with screw plug heaters. To order, specify the appropriate code number.

Screw Plug to Flange Adaptors

Screw Plug to Flange Adaptor Sizes	Material	Estimated Shipping Wt. lbs	(kg)	Availability	Code Number
1 ¼ to 3”-150#	Steel	13	(5.9)	Stock	**125X3SA**
2 ½ to 3”-150#	Steel	11	(5.0)	Stock	**250X3SA**
2 ½ to 4”-150#	Steel	16	(7.3)	Stock	**250X4SA**
2 ½ to 5”-150#	Steel	25	(11.3)	Stock	**250X5SA**
2 ½ to 6”-150#	Steel	33	(15.0)	Stock	**250X6SA**

Application Hints

- Select the recommended sheath material and watt density for the substance being heated. Use the ***Supplemental Applications Chart*** on **pages 263 to 266**. If unable to determine the correct heater material and type, consult your Watlow representative.
- Extend the element’s 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 screw plug heater low in the tank, but above the sludge level.

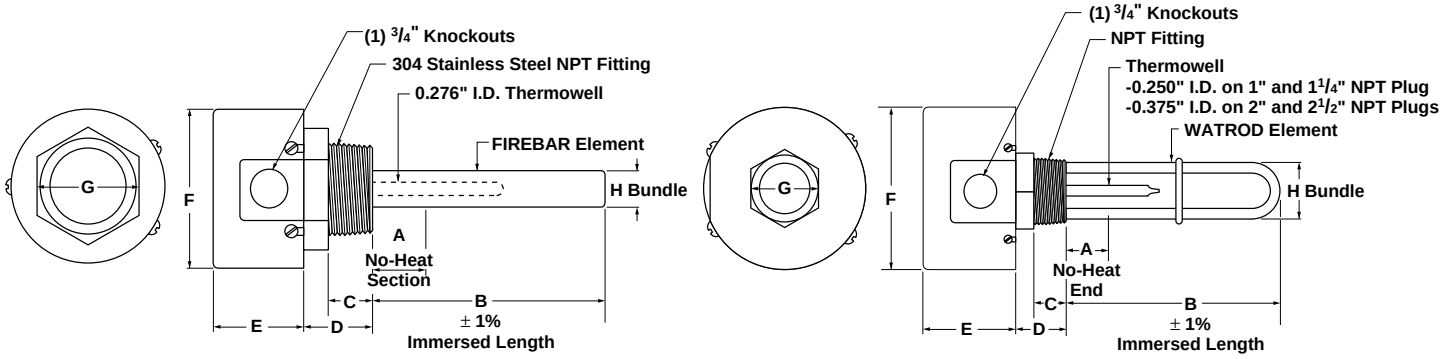


- Choose a FIREBAR element when your application requires a smaller system package or lower watt density.
- Ensure wiring integrity by making sure terminal enclosure temperature does not exceed 400°F (205°C).
- Keep electrical connections clean, dry and tight.
- Minimize problems associated with low 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.

Tubular and Process Assemblies

Screw Plug Immersion Heaters

Screw Plug Heater Dimensions



WATROD and FIREBAR Screw Plug Immersion Heater Dimensions

Heater Type	NPT Size in	A Dimension in	A Dimension (mm)	C Dimension in	C Dimension (mm)	D Dimension in	D Dimension (mm)	E Dimension in	E Dimension (mm)	F Dimension in	F Dimension (mm)	G Dimension in	G Dimension (mm)	H Dimension* in	H Dimension* (mm)
WATROD	1	1	(25)	7/8	(22)	1 1/4	(32)	2 5/8	(67)	4 5/8	(117)	1 3/8	(35)	1 1/8	(29)
WATROD	1 1/4	1 15/16	(24)	15/16	(24)	1 5/16	(33)	2 5/8	(67)	4 5/8	(117)	1 3/4	(44)	1 3/8	(35)
WATROD	2 Steel	2 9/16	(65)	1	(25)	1 11/16	(43)	2 5/8	(67)	4 5/8	(117)	2 1/2	(64)	2 1/4	(57)
WATROD	2 Brass	2 11/16	(68)	1 1/16	(27)	1 9/16	(40)	2 5/8	(67)	4 5/8	(117)	2 1/2	(64)	2 1/4	(57)
WATROD	2 S. Steel	2 13/16	(71)	1	(25)	1 5/8	(41)	2 5/8	(67)	4 5/8	(117)	2 1/2	(64)	2 1/4	(49)
WATROD	2 1/2	2 7/16	(56)	1 9/16	(33)	2 1/16	(52)	2 5/8	(67)	4 5/8	(117)	3 1/2	(76)	2 1/2	(64)
FIREBAR	1 1/4	3 7/8	(98)	13/16	(21)	1 1/16	(27)	2 5/8	(67)	4 5/8	(117)	1 3/4	(44)	1 3/8	(35)
FIREBAR	2 1/2	3 3/8	(86)	1 1/4	(32)	1 1/2	(38)	2 5/8	(67)	4 5/8	(117)	3 1/2	(76)	2 1/2	(64)

* **Note**: All plug bundles fit into equivalent NPT coupling. They do not fit in equivalent pipe sizes.

1" NPT Screw Plug – WATROD Element

WATROD Description	kW	Immersed B Dimension inch	Immersed B Dimension (mm)	Code No. 120V~(ac) 1-Phase	Code No. 240V~(ac) 1-Phase	Est. Ship. Weight lbs	Est. Ship. Weight (kg)
Application: Clean Water							
60 W/in²	0.5	4 1/2	(114)	**BCC4J1**	**BCC4J10**	3	(2)
Brass Plug	0.75	6 1/2	(165)	**BCC6J1**	**BCC6J10**	3	(2)
1-Copper	1.0	6 5/8	(168)	**BCC6L1**	**BCC6L10**	3	(2)
(9.3 W/cm²)	1.25	8	(203)	**BCC8A1**	**BCC8A10**	4	(2)
	1.5	10 5/8	(270)	**BCC10L1**	**BCC10L10**	4	(2)
	2.0	12 1/2	(318)	**BCC12J1**	**BCC12J10**	5	(3)
	2.5	14 3/4	(375)	**BCC14N1**	**BCC14N10**	5	(3)
	3.0	16 3/4	(426)	**BCC16N1**	**BCC16N10**	6	(3)
	4.0	21	(533)		**BCC21A10**	6	(3)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils							
23 W/in²	0.25	6 1/2	(165)	**BCS6J1**	**BCS6J10**	3	(2)
Steel Plug	0.35	9 1/4	(235)	**BCS9E1**	**BCS9E10**	4	(2)
1-Steel	0.5	9 3/8	(238)	**BCS9G1**	**BCS9G10**	4	(2)
(3.6 W/cm²)	0.75	13 1/2	(343)	**BCS13J1**	**BCS13J10**	5	(3)
	1.0	16 3/4	(425)	**BCS16N1**	**BCS16N10**	6	(3)
	1.5	23 3/4	(603)	**BCS23N1**	**BCS23N10**	7	(4)

All heating elements are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Three to five working days

Screw Plug Immersion Heaters

1¼" NPT Screw Plug – WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 120V~(ac) 1-Phase	Code No. 120/240V~(ac) 1-Phase	Code No. 240V~(ac) 1-Phase	Est. Ship. Weight lbs (kg)
Application: Clean Water						
60 W/in²	0.5	4⅜ (111)	**BDC4G1**		**BDC4G10**	3 (2)
Brass Plug	0.75	6⅜ (162)	**BDC6G1**		**BDC6G10**	3 (2)
1-Copper						
(9.3 W/cm²)						
60 W/in² ④	1.0	4⅜ (111)		**BEC4G6**		4 (2)
Brass Plug	1.5	6⅜ (162)		**BEC6G6**		4 (2)
2-Copper	2.0	8½ (216)		**BEC8J6**		5 (3)
(9.3 W/cm²)	2.5	10¾ (273)		**BEC10N6**		5 (3)
	3.0	15 (381)		**BEC15A6**		6 (3)
	4.0	19 (483)			**BEC19A10**	7 (4)
	5.0	23½ (597)			**BEC23J10**	8 (4)
	6.0	27½ (699)			**BEC27J10**	9 (4)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils						
23 W/in² ④	0.5	6⅜ (162)		**BES6G6**		4 (2)
Steel Plug	0.5	7⅜ (187)		**BES7G6**		4 (2)
2-Steel	0.7	8⅞ (225)		**BES8R6**		5 (3)
(3.6 W/cm²)	0.75	10 1⁄16 (256)		**BES10B6**		5 (3)
	1.0	12¾ (324)		**BES12N6**		6 (3)
	1.5	19⅜ (492)		**BES19G6**		7 (4)
	2.0	25⅜ (645)		**BES25G6**		8 (4)
	3.0	36⅞ (937)		**BES36R6**		9 (4)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions						
23 W/in² ④	1.0	13⅜ (340)		**BEN13G6**		6 (3)
304 SS Plug	1.5	19 (483)		**BEN19A6**		7 (4)
2-Incoloy®	2.0	24⅜ (619)		**BEN24G6**		8 (4)
(3.6 W/cm²)						

1¼" NPT Screw Plug– FIREBAR Element

FIREBAR Description	kW	Immersed B-Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Clean and Potable Water						
90 W/in² ⑧	1.5	7⅝ (194)	**BDNF7R10** ② ⑦		**BDNF7R11** ② ⑦	5 (3)
304 SS Plug	3.0	11⅛ (283)	**BDNF11G10** ② ⑦		**BDNF11G11** ② ⑦	6 (3)
1-Incoloy®	5.0	16⅛ (410)		**BDNF16G3**	**BDNF16G5**	7 (4)
(14 W/cm²)	6.5	19⅛ (486)		**BDNF19G3**	**BDNF19G5**	8 (4)
	8.5	24⅜ (619)		**BDNF24L3**	**BDNF24L5**	9 (4)
	10.5	29⅝ (753)		**BDNF29R3**	**BDNF29R5**	10 (5)
	12.7	34⅝ (879)		**BDNF34R3**	**BDNF34R5**	11 (5)
	17.0	45⅛ (1146)		**BDNF45G3**	**BDNF45G5**	13 (6)
	21.5	55⅝ (1413)			**BDNF55R5**	15 (7)

CONTINUED

All heating elements are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Three to five working days
Standard: 10 working days

② Standard
④ Wired for higher voltage.
⑦ Not available as 3-phase – 1-phase only.
⑧ Can be wired 1-phase.

Tubular and Process Assemblies

Screw Plug Immersion Heaters

1¼" NPT Screw Plug – FIREBAR Element

FIREBAR Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Process Water, Ethylene Glycol (50%)						
45 W/in² ⑧	2.0	13 (330)		**BDNF13A27**		6 (3)
304 SS Plug	2.5	15½ (394)		**BDNF15J27**		7 (4)
1-Incoloy®	3.0	18 (457)		**BDNF18A27**		8 (4)
(7 W/cm²)	4.0	22½ (572)		**BDNF22J27**	**BDNF22J28**	9 (4)
	5.0	27½ (699)		**BDNF27J27**	**BDNF27J28**	10 (5)
	6.0	32½ (826)		**BDNF32J27**	**BDNF32J28**	11 (5)
	8.0	42 (1067)		**BDNF42A27**	**BDNF42A28**	13 (6)
	10.0	51½ (1308)		**BDNF51J27**	**BDNF51J28**	15 (7)
Applications: Cooking Oils, Ethylene Glycol (100%)						
30 W/in² ③	1.7	16⅛ (410)		**BDNF16G12**	**BDNF16G13**	7 (4)
304 SS Plug	2.2	19⅛ (486)		**BDNF19G12**	**BDNF19G13**	8 (4)
1-Incoloy®	2.8	24⅜ (619)		**BDNF24L12**	**BDNF24L13**	9 (4)
(4.7 W/cm²)	3.5	29⅝ (752)		**BDNF29R12**	**BDNF29R13**	10 (5)
	4.25	34⅝ (880)		**BDNF34R12**	**BDNF34R13**	11 (5)
	5.7	45⅛ (1146)		**BDNF45G12**	**BDNF45G13**	13 (6)
	7.2	55⅝ (1413)		**BDNF55R12**	**BDNF55R13**	15 (7)
Applications: Heat Transfer Oils, Mineral Oils, Degreasing Solutions						
23 W/in² ⑧	1.25	16⅛ (410)		**BDNF16G20**		7 (4)
304 SS Plug	1.65	19⅛ (486)		**BDNF19G20**		8 (4)
1-Incoloy®	2.15	24⅜ (619)		**BDNF24L20**	**BDNF24L19**	9 (4)
(3.6 W/cm²)	2.65	29⅝ (752)		**BDNF29R20**	**BDNF29R19**	10 (5)
	3.2	34⅝ (879)		**BDNF34R20**	**BDNF34R19**	11 (5)
	4.25	45⅛ (1146)		**BDNF45G20**	**BDNF45G19**	13 (6)
	5.4	55⅝ (1413)		**BDNF55R20**	**BDNF55R19**	15 (6)
Applications: Medium Weight Oils, Heat Transfer Oils, Lubrication Oils, Liquid Paraffin						
15 W/in² ③	0.67	13 (330)		**BDNF13A29**		6 (3)
304 SS Plug	0.83	15½ (394)		**BDNF15J29**		7 (4)
1-Incoloy®	1.0	18 (457)		**BDNF18A29**		8 (4)
(2.3 W/cm²)	1.33	22½ (572)		**BDNF22J29**	**BDNF22J30**	9 (4)
	1.67	27½ (699)		**BDNF27J29**	**BDNF27J30**	10 (5)
	2.0	32½ (826)		**BDNF32J29**	**BDNF32J30**	11 (5)
	2.67	42 (1067)		**BDNF42A29**	**BDNF42A30**	13 (6)
	3.33	51½ (1308)		**BDNF51J29**	**BDNF51J30**	15 (7)
Applications: Bunker C and #6 Fuel Oils, Asphalt						
8 W/in² ③	0.43	16⅛ (410)		**BDNF16G22**		7 (4)
304 SS Plug	0.55	19⅛ (486)		**BDNF19G22**		8 (4)
1-Incoloy®	0.7	24⅜ (619)		**BDNF24L22**	**BDNF24L21**	9 (4)
(1.3 W/cm²)	0.88	29⅝ (753)		**BDNF29R22**	**BDNF29R21**	10 (5)
	1.08	34⅝ (880)		**BDNF34R22**	**BDNF34R21**	11 (5)
	1.4	45⅛ (1146)		**BDNF45G22**	**BDNF45G21**	13 (6)
	1.8	55⅝ (1413)		**BDNF55R22**	**BDNF55R21**	15 (7)

③ Must be operated 3-phase only.
⑧ Can be wired 1-phase.

All heating elements are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Three to five working days

Screw Plug Immersion Heaters

2" NPT Screw Plug – WATROD Element (Note: Will not fit into a two inch pipe)

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 120V~(ac) 1-Phase	120/240V~(ac) 1-Phase	240/480V~(ac) 1-Phase	240V~(ac) 3-Phase	480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Application: Clean Water								
60 W/in² ④	2.0	8⅛ (206)		**BGC78C6**	**BGC78C7**			4 (2)
Brass Plug	3.0	11⅛ (283)		**BGC711C6**	**BGC711C7**			5 (3)
2-Copper	4.0	15⅛ (384)		**BGC715C6**	**BGC715C7**			6 (3)
(9.3 W/cm²)	5.0	18⅛ (460)		**BGC718C6**	**BGC718C7** ②			6 (3)
	6.0	21⅛ (537)			**BGC721C7**			7 (4)
	8.0	26⅝ (676)			**BGC726L7**			7 (4)
	10.0	32⅛ (816)			**BGC732C7**			8 (4)
60 W/in²	3.0	8⅛ (206)	**BHC78C1**			**BHC78C3**	**BHC78C13** ②③	5 (3)
Brass Plug	4.5	11⅛ (283)	**BHC711C1**			**BHC711C3**	**BHC711C5**	6 (3)
3-Copper	6.0	15⅛ (384)				**BHC715C3**	**BHC715C5**	7 (4)
(9.3 W/cm²)	7.5	18⅛ (460)				**BHC718C3**	**BHC718C5**	7 (4)
	9.0	21⅛ (537)				**BHC721C3**	**BHC721C5**	8 (4)
	12.0	26⅝ (676)				**BHC726L3**	**BHC726L5**	8 (4)
	15.0	32⅛ (816)				**BHC732C3**	**BHC732C5**	9 (4)
Application: Process Water								
48 W/in² ④	2.0	9¾ (248)		**BGN79N6**	**BGN79N7**			4 (2)
304 SS Plug	3.0	13¼ (337)		**BGN713E6**	**BGN713E7**			5 (3)
2-Incoloy®	4.0	17¾ (451)		**BGN717N6**	**BGN717N7**			6 (3)
(7.5 W/cm²)	5.0	20¼ (514)		**BGN720E6**	**BGN720E7**			7 (4)
	6.0	25¼ (641)			**BGN725E7**			7 (4)
	8.0	32¾ (832)			**BGN732N7**			8 (4)
	10.0	40¼ (1022)			**BGN740E7**			9 (4)
48 W/in² ⑤	3.0	9¾ (248)	**BHN79N1**			**BHN79N3** ②	**BHN79N5**	5 (3)
304 SS Plug	4.5	13¼ (337)	**BHN713E1**			**BHN713E3** ②	**BHN713E5** ②	6 (3)
3-Incoloy®	6.0	17¾ (451)				**BHN717N3** ②	**BHN717N5** ②	7 (4)
(7.5 W/cm²)	7.5	20¼ (514)				**BHN720E3** ②	**BHN720E5** ②	8 (4)
	9.0	25¼ (641)				**BHN725E3** ②	**BHN725E5** ②	9 (4)
	12.0	32¾ (832)				**BHN732N3** ②	**BHN732N5** ②	9 (4)
	15.0	40¼ (1022)				**BHN740E3**	**BHN740E5** ②	10 (5)
	18.0	47¾ (1213)				**BHN747N3** ②	**BHN747N5** ②	11 (5)

CONTINUED

All heating elements are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Three to five working days

② Stock
③ Must be operated 3-phase only.
④ Wired for higher voltage.
⑤ 240V~(ac) can be wired wye and operated at 480V~(ac) 3-phase to produce ⅓ more kW

Tubular and Process Assemblies

Screw Plug Immersion Heaters

2" NPT Screw Plug – WATROD Element (**Note:** Will not fit into a two inch pipe)

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 120V~(ac) 1-Phase	120/240V~(ac) 1-Phase	240/480V~(ac) 1-Phase	240V~(ac) 3-Phase	480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions								
23 W/in² ⑤⑥	3.0	17¾ (451)	**BHNA17N1**			**BHNA17N3** ①	**BHNA17N5** ①	7 (4)
304 SS Plug	4.5	25¼ (641)	**BHNA25E1**			**BHNA25E3**	**BHNA25E5**	9 (4)
3-Incoloy®	6.0	32¾ (832)				**BHNA32N3**	**BHNA32N5** ①	9 (4)
(3.6 W/cm²)	7.5	40¼ (1022)				**BHNA40E3**	**BHNA40E5**	10 (5)
	9.0	47¾ (1213)				**BHNA47N3**	**BHNA47N5**	11 (5)
	12.5	64¼ (1632)				**BHNA64E3**	**BHNA64E5**	15 (7)
	15.0	76¾ (1950)				**BHNA76E3**	**BHNA76E5**	18 (9)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils								
23 W/in² ④	1.0	9½ (241)		**BGS79J6**	**BGS79J7**			4 (2)
Steel Plug	1.5	13½ (343)		**BGS713J6** ①	**BGS713J7** ①			5 (3)
2-Steel	2.0	17½ (445)		**BGS717J6** ①	**BGS717J7**			6 (3)
(3.6 W/cm²)	2.5	20½ (521)		**BGS720J6**	**BGS720J7**			7 (4)
	3.0	25 (635)		**BGS725A6**	**BGS725A7**			7 (4)
	4.0	32½ (826)		**BGS732J6**	**BGS732J7**			8 (4)
	5.0	40 (1016)		**BGS740A6**	**BGS740A7**			9 (4)
	6.0	47½ (1207)			**BGS747J7**			10 (5)
23 W/in²	1.5	9½ (241)	**BHS79J1**			**BHS79J3**	**BHS79J13** ③	5 (3)
Steel Plug	3.0	17½ (445)	**BHS717J1**			**BHS717J3**	**BHS717J5** ①	7 (4)
3-Steel	4.5	25 (635)	**BHS725A1**			**BHS725A3**	**BHS725A5**	9 (4)
(3.6 W/cm²)	6.0	32½ (826)				**BHS732J3**	**BHS732J5**	12 (6)
	7.5	40 (1016)				**BHS740A3**	**BHS740A5**	13 (6)
	9.0	47½ (1207)				**BHS747J3**	**BHS747J5**	13 (6)
	12.5	64 (1626)				**BHS764A3**	**BHS764A5**	17 (8)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin								
16 W/in² ③	1.0	9¾ (248)				**BHN79N12**	**BHN79N13**	5 (3)
304 SS Plug	1.5	13¼ (337)				**BHN713E12**	**BHN713E13**	6 (3)
3-Incoloy®	2.0	17¾ (451)				**BHN717N12**	**BHN717N13**	7 (4)
(2.5 W/cm²)	2.5	20¼ (514)				**BHN720E12**	**BHN720E13**	8 (4)
	3.0	25¼ (641)				**BHN725E12**	**BHN725E13**	9 (4)
	4.0	32¾ (832)				**BHN732N12**	**BHN732N13**	9 (4)
	5.0	40¼ (1022)				**BHN740E12**	**BHN740E13**	10 (5)
	6.0	47¾ (1213)				**BHN747N12**	**BHN747N13**	11 (5)
15 W/in²	1.5	13¼ (337)				**BHSS13E3**	**BHSS13E13** ③	6 (4)
Steel Plug	2.0	17½ (445)				**BHSS17J3**	**BHSS17J5**	7 (4)
3-Steel	2.5	20½ (521)				**BHSS20J3**	**BHSS20J5**	8 (4)
(2.3 W/cm²)	3.0	25 (635)				**BHSS25A3**	**BHSS25A5**	9 (4)
	4.0	32½ (826)				**BHSS32J3**	**BHSS32J5**	12 (6)
	5.0	40 (1016)				**BHSS40A3**	**BHSS40A5**	13 (6)
	6.0	47½ (1207)				**BHSS47J3**	**BHSS47J5**	13 (6)
	7.5	58½ (1486)				**BHSS58J3**	**BHSS58J5**	16 (8)
	9.0	69¾ (1772)				**BHSS69N3**	**BHSS69N5**	20 (9)

All heating elements are Assembly Stock unless otherwise noted.

Availability

Assembly Stock: Three to five working days
Stock: Same day shipment

① Stock
③ 3-phase wye only.
④ Wired for higher voltage.
⑤ 240V~(ac) can be wired wye and operated at 480V~(ac) 3-phase to produce ⅓ more kW and watt density.
⑥ Can be rewired wye to produce ⅓ of original kW and watt density (3-phase only).

Screw Plug Immersion Heaters

2½" NPT Screw Plug – WATROD Element

WATROD Description	kW	Immersed B Dimension inch	(mm)	Code No. 120V~(ac) 1-Phase	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs	(kg)
Applications: Deionized Water, Demineralized Water								
60 W/in²	3.0	7⅝	(194)	**BLR77L1**	**BLR77L3**	**BLR77L5**	6	(3)
316 SS Plug	4.5	10⅝	(270)	**BLR710L1**	**BLR710L3**	**BLR710L5**	7	(4)
3-316 SS	6.0	14⅝	(372)		**BLR714L3**	**BLR714L5**	9	(4)
Passivated	7.5	17⅝	(448)		**BLR717L3**	**BLR717L5**	9	(4)
(9.3 W/cm²)	9.0	20⅝	(524)		**BLR720L3**	**BLR720L5**	11	(5)
	12.0	26⅛	(664)		**BLR726C3**	**BLR726C5**	12	(6)
	15.0	31⅝	(803)		**BLR731L3**	**BLR731L5**	14	(7)
	18.0	37⅛	(943)		**BLR737C3**	**BLR737C5**	15	(7)
Application: Clean Water								
60 W/in²	3.0	7⅝	(194)	**BLC77L1**	**BLC77L3**	**BLC77L13**	6	(3)
Brass Plug	4.5	10⅝	(270)	**BLC710L1**	**BLC710L3**	**BLC710L5**	7	(4)
3-Copper	6.0	14⅝	(371)		**BLC714L3**	**BLC714L5**	9	(4)
(9.3 W/cm²)	7.5	17⅝	(448)		**BLC717L3**	**BLC717L5**	9	(4)
	9.0	20⅝	(524)		**BLC720L3**	**BLC720L5** ①	11	(5)
	12.0	26⅛	(664)		**BLC726C3**	**BLC726C5** ①	12	(6)
	15.0	31⅝	(803)		**BLC731L3**	**BLC731L5**	14	(7)
	18.0	37⅛	(943)		**BLC737C3**	**BLC737C5**	15	(7)
Application: Process Water								
48 W/in²	3.0	9⅜	(238)	**BLN79G1**	**BLN79G3**	**BLN79G5**	6	(3)
304 SS Plug	4.5	12⅞	(327)	**BLN712R1**	**BLN712R3**	**BLN712R5**	7	(4)
3-Incoloy®	6.0	17⅜	(441)		**BLN717G3**	**BLN717G5** ①	9	(4)
(7.5 W/cm²)	7.5	19⅞	(505)		**BLN719R3**	**BLN719R5**	11	(5)
	9.0	24⅞	(632)		**BLN724R3**	**BLN724R5** ①	12	(6)
	12.0	32⅜	(822)		**BLN732G3**	**BLN732G5** ①	14	(7)
	15.0	39⅞	(1013)		**BLN739R3**	**BLN739R5**	15	(7)
	18.0	47⅜	(1203)		**BLN747G3**	**BLN747G5** ①	17	(8)

CONTINUED

All heating elements are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Three to five working days
Stock: Same day shipment

① Stock

Tubular and Process Assemblies

Screw Plug Immersion Heaters

2½" NPT Screw Plug – WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 120V~(ac) 1-Phase	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions						
23 W/in² ⑤⑥	3.0	17⅜ (441)	**BLNA17G1**	**BLNA17G3**	**BLNA17G5**	9 (4)
304 SS Plug	4.5	24⅛ (632)	**BLNA24R1**	**BLNA24R3**	**BLNA24R5**	12 (5)
3-Incoloy®	6.0	32⅜ (822)		**BLNA32G3**	**BLNA32G5** ①	14 (7)
(3.6 W/cm²)	7.5	39⅞ (1013)		**BLNA39R3**	**BLNA39R5**	15 (7)
	9.0	47⅜ (1203)		**BLNA47G3**	**BLNA47G5**	17 (8)
	12.5	63⅞ (1622)		**BLNA63R3**	**BLNA63R5**	20 (9)
	15.0	76⅜ (1940)		**BLNA76G3**	**BLNA76G5**	23 (11)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils						
23 W/in² ⑥	3.0	17¼ (438)	**BLS717E1**	**BLS717E3**	**BLS717E5** ①	9 (4)
Steel Plug	4.5	24¾ (629)	**BLS724N1**	**BLS724N3**	**BLS724N5**	12 (6)
3-Steel	6.0	32¼ (819)		**BLS732E3**	**BLS732E5** ①	14 (7)
(3.6 W/cm²)	7.5	39¾ (1010)		**BLS739N3**	**BLS739N5**	15 (7)
	9.0	47¼ (1200)		**BLS747E3**	**BLS747E5**	17 (8)
	12.5	63¾ (1619)		**BLS763N3**	**BLS763N5**	20 (9)
	15.0	76¼ (1937)		**BLS776E3**	**BLS776E5**	27 (13)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin						
16 W/in² ③	1.0	9⅜ (238)		**BLN79G12**	**BLN79G13**	6 (3)
304 SS Plug	1.5	12⅛ (327)		**BLN712R12**	**BLN712R13**	7 (4)
3-Incoloy®	2.0	17⅜ (441)		**BLN717G12**	**BLN717G13**	9 (4)
(2.5 W/cm²)	2.5	19⅞ (505)		**BLN719R12**	**BLN719R13**	11 (5)
	3.0	24⅛ (632)		**BLN724R12**	**BLN724R13**	12 (6)
	4.0	32⅜ (822)		**BLN732G12**	**BLN732G13**	14 (7)
	5.0	39⅞ (1013)		**BLN739R12**	**BLN739R13**	15 (7)
	6.0	47⅜ (1203)		**BLN747G12**	**BLN747G13**	17 (8)
Applications: Bunker C and #6 Fuel Oils						
8 W/in² ③	1.0	17¼ (438)		**BLS717E12**	**BLS717E13**	9 (4)
Steel Plug	1.5	24¾ (629)		**BLS724N12**	**BLS724N13**	12 (6)
3-Steel	2.0	32¼ (819)		**BLS732E12**	**BLS732E13**	14 (7)
(1.3 W/cm²)	2.5	39¾ (1010)		**BLS739N12**	**BLS739N13**	15 (7)
	3.0	47¼ (1200)		**BLS747E12**	**BLS747E13**	17 (8)
	4.0	63¾ (1619)		**BLS763N12**	**BLS763N13**	20 (9)
	5.0	76¼ (1937)		**BLS776E12**	**BLS776E13**	23 (11)

All heating elements are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Three to five working days
Stock: Same day shipment

① Stock
③ Must be operated 3-phase only.
⑤ 240V~(ac) can be wired wye and operated at 480V~(ac) 3-phase to produce ⅓ more kW and watt density.
⑥ Can be rewired wye to produce ⅓ of original kW and watt density (3-phase only).

Tubular and Process Assemblies

Screw Plug Immersion Heaters

2½" NPT Screw Plug – FIREBAR Element

FIREBAR Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Clean and Potable Water					
90 W/in² ⑧	15	15⅛ (384)	**BLNF15C3**	**BLNF15C5**	10 (5)
304 SS Plug	20	18⅛ (460)	**BLNF18C3**	**BLNF18C5 ③**	12 (6)
3-Incoloy®	25	23⅛ (587)		**BLNF23C5**	14 (7)
(14 W/cm²)	32	28⅝ (727)		**BLNF28L5**	17 (8)
	38	33⅝ (854)		**BLNF33L5**	18 (9)
Applications: Process Water, Ethylene Glycol (50%)					
45 W/in² ⑧	6	12 (305)	**BLNF12A27**		10 (5)
304 SS Plug	7.5	14½ (368)	**BLNF14J27**		11 (5)
3-Incoloy®	9	17 (432)	**BLNF17A27**		12 (6)
(7 W/cm²)	12	21½ (546)	**BLNF21J27**	**BLNF21J28**	14 (7)
	15	26½ (673)	**BLNF26J27**	**BLNF26J28**	17 (8)
	18	31½ (800)	**BLNF31J27**	**BLNF31J28**	18 (9)
	24	41 (1041)		**BLNF41A28**	20 (9)
	30	50½ (1283)		**BLNF50J28**	22 (10)
Applications: Cooking Oils, Ethylene Glycol (100%)					
30 W/in² ③	5	15⅛ (384)	**BLNF15C12**	**BLNF15C13**	10 (5)
304 SS Plug	6.5	18⅛ (460)	**BLNF18C12**	**BLNF18C13**	12 (6)
3-Incoloy®	8.5	23⅛ (587)	**BLNF23C12**	**BLNF23C13**	14 (7)
(4.7 W/cm²)	10.5	28⅝ (727)	**BLNF28L12**	**BLNF28L13**	17 (8)
	12.8	33⅝ (854)	**BLNF33L12**	**BLNF33L13**	18 (9)
	17	44⅛ (1121)	**BLNF44C12**	**BLNF44C13**	20 (9)
	21.5	54⅝ (1388)		**BLNF54L13**	22 (10)
Applications: Heat Transfer Oils, Mineral Oils, Degreasing Solutions					
23 W/in² ⑧	3.8	15⅛ (384)	**BLNF15C20**		10 (5)
304 SS Plug	4.9	18⅛ (460)	**BLNF18C20**		12 (6)
3-Incoloy®	6.4	23⅛ (587)	**BLNF23C20**	**BLNF23C19**	14 (7)
(3.6 W/cm²)	7.9	28⅝ (727)	**BLNF28L20**	**BLNF28L19**	17 (8)
	9.6	33⅝ (854)	**BLNF33L20**	**BLNF33L19**	18 (9)
	12.8	44⅛ (1121)	**BLNF44C20**	**BLNF44C19**	20 (9)
	16.1	54⅝ (1387)	**BLNF54L20**	**BLNF54L19**	22 (10)

CONTINUED

All heating elements are Assembly Stock unless otherwise noted.

Availability

Assembly Stock: Three to five working days

Stock: Same day shipment

③ Must be operated 3-phase only.

⑧ Can be wired 1-phase.

Tubular and Process Assemblies

Screw Plug Immersion Heaters

2½" NPT Screw Plug – FIREBAR Element

FIREBAR Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Medium Weight Oils, Heat Transfer Oils, Lubrication Oils, Liquid Paraffin					
15 W/in² ③	2	12 (305)	**BLNF12A29**		10 (5)
304 SS Plug	2.5	14½ (368)	**BLNF14J29**		11 (5)
3-Incoloy®	3	17 (432)	**BLNF17A29**		12 (6)
(2.3 W/cm²)	4	21½ (546)	**BLNF21J29**	**BLNF21J30**	14 (7)
	5	26½ (673)	**BLNF26J29**	**BLNF26J30**	17 (8)
	6	31½ (800)	**BLNF31J29**	**BLNF31J30**	18 (9)
	8	41 (1041)	**BLNF41A29**	**BLNF41A30**	20 (9)
	10	50½ (1283)	**BLNF50J29**	**BLNF50J30**	22 (10)
Applications: Bunker C and #6 Fuel Oils, Asphalt					
8 W/in² ③	1.25	15⅛ (384)	**BLNF15C22**		10 (5)
304 SS Plug	1.63	18⅛ (460)	**BLNF18C22**		12 (6)
3-Incoloy®	2.13	23⅛ (587)	**BLNF23C22**	**BLNF23C21**	14 (7)
(1.3 W/cm²)	2.63	28⅝ (727)	**BLNF28L22**	**BLNF28L21**	17 (8)
	3.19	33⅝ (854)	**BLNF33L22**	**BLNF33L21**	18 (9)
	4.25	44⅛ (1121)	**BLNF44C22**	**BLNF44C21**	20 (9)
	5.38	54⅝ (1388)	**BLNF54L22**	**BLNF54L21**	22 (10)

All heating elements are Assembly Stock unless otherwise noted.

Availability

Assembly Stock: Three to five working days

Stock: Same day shipment

③ Must be operated 3-phase only.

F.O.B.: Hannibal, Missouri

Screw Plug Immersion Heaters

Build-a-Code

– – –

Stock Screw Plug Code Number ①
(Includes general purpose terminal enclosure (NEMA 1)

Optional Terminal Enclosure

S = General purpose with thermostat (NEMA 1)
W = Moisture resistant (NEMA 4)
E = Explosion resistant (NEMA 7)
E/W = Explosion/moisture resistant (NEMA 7/4)

Optional Thermostat ② **or Thermocouple** ④

Optional Pilot Light ③

PL10 = 250V~(ac) Max.
PL11 = 480V~(ac) Max.

① Screw plug immersion heaters are supplied with a general purpose terminal enclosure (NEMA 1). A thermostat will not fit inside the standard 2⅝ inch (67 mm) tall general purpose terminal enclosure. If a thermostat is required, a taller terminal enclosure will be supplied.
② Thermostat code numbers are shown in the *Thermostat Stock* chart on **page 425**.
③ Pilot lights are configured for general purpose enclosure (NEMA 1) applications. For pilot light availability with other terminal enclosure ratings, consult factory.
④ Specify Type J or K thermocouple. If overtemp thermocouple specify orientation horizontal, vertical up or vertical down.

How to Order

To order a stock screw plug heater, please specify:

- Watlow code number
- NPT screw plug size and material
- Volts/watts
- Phase
- Options
- Quantity

If our stock units do not meet your application needs, Watlow can provide made-to-order heaters. For a **made-to-order** unit, please specify:

- Application, including heated material, process temperature and flow rate, etc.
- Volts/watts
- Watt density
- Phase
- Screw plug size, style and material
- Element diameter
- Number of heating element(s)
- Sheath material
- Immersed ('B' dimension) length
- No-heat section below the plug
- Terminal enclosure type
- Options
- Quantity

Availability

Stock: Same day shipment

Assembly Stock: Three to five working days

Modified Stock ④: Five to seven working days

Standard: 10 working days

Made-to-Order: Four to six weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

④ Stock and assembly stock units with catalog options.

Tubular and Process Assemblies

Quick Ship

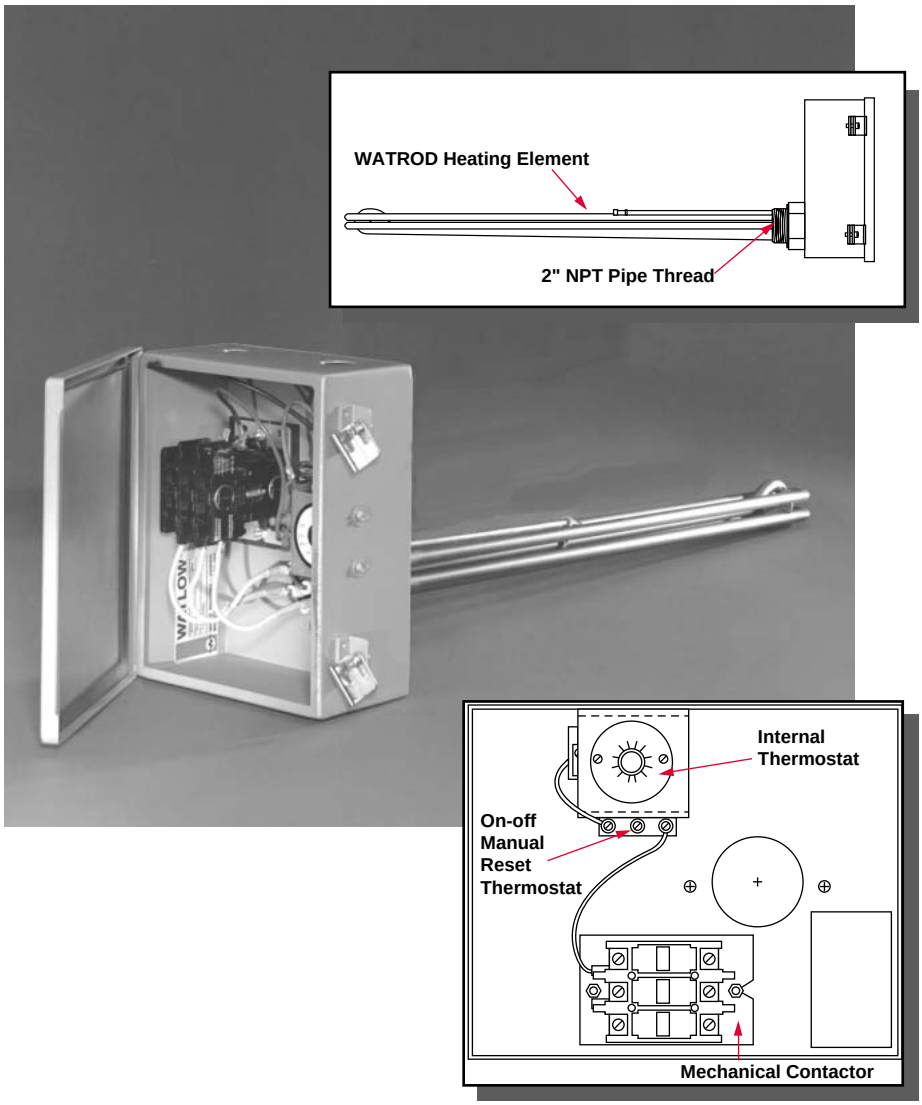
On stock chart units:
- *Five working days on all heaters*
- *10 working days on special voltages and/or wattages*
- *15 working days on special element lengths*

Screw Plug Immersion Heaters

with Control Assembly

Constructed from a WATROD screw plug heater, a moisture resistant (NEMA 4) terminal enclosure and built-in temperature sensor and power control, this assembly comes pre-wired and ready for hook-up to any 120V~(ac) control circuit.

Optional sheath materials, NPT screw plug sizes and materials, wattages, voltages and terminal enclosures extend application versatility.



Performance Capabilities

- Watt densities to 60 W/in² (9.3 W/cm²)
- Wattages to 20kW
- Voltages to 600V~(ac)
- Incoloy® sheath temperatures to 1400°F (760°C)

Features and Benefits

- **Three 0.475 inch (12 mm) diameter WATROD elements** are brazed to a two inch NPT brass screw plug to produce a pressure-tight seal.
- **WATROD hairpins are repressed (recompacted)** after bending to maintain MgO density, dielectric strength, heat transfer and life.
- **Two built-in thermostats**, one on-off with manual reset, help 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 120V~(ac) control circuit to switch higher volts/amps to the heating elements.
- **Hinged, moisture resistant (NEMA 4) terminal enclosure** has two conduit openings to accommodate ¾ inch NPT conduit fittings.
- **Terminal enclosures can be rotated** to mate with existing conduits.
- **Thermowells** allow replacing the thermostat sensing element without draining the fluid being heated.

Applications

- Water heating
- Commercial dishwashers and glass washers
- Sterilizing equipment

Construction Features

Same as ***Screw Plug Immersion Heaters.*** See **pages 321 to 322** for details.

Application Hints

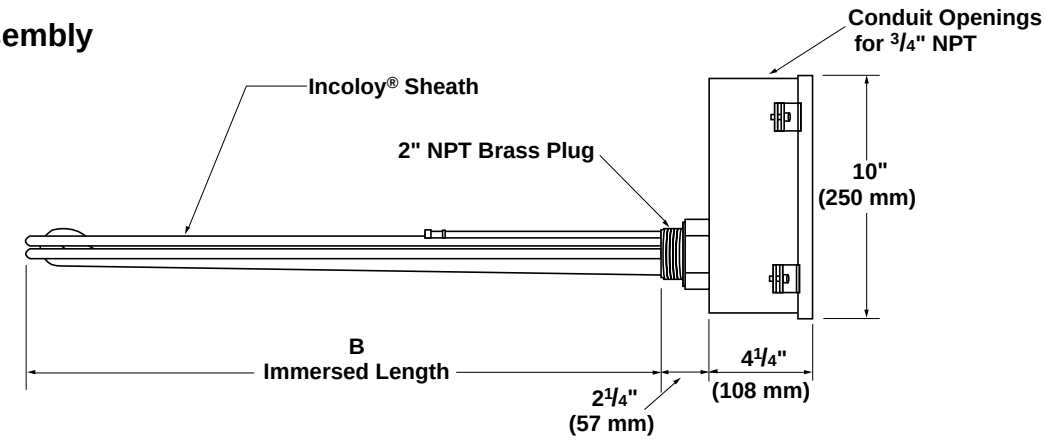
Same as ***Screw Plug Immersion Heaters***. See **page 326** for details.

Accessories

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

Screw Plug Immersion Heaters

with Control Assembly



2" NPT Brass Screw Plug With Control Box (Assembly Stock)

WATROD Descript.	kW	Immersed Length Inch (mm)	Code Number 208V~(ac) 3-Phase	240V~(ac) 3-Phase	380V~(ac) 3-Phase	480V~(ac) 3-Phase	575V~(ac) 3-Phase	Est.Net Weight lbs (kg)
50 W/in²	9	24¾ (629)		**BHNB24N3W2C11**		**BHNB24N5W2C11**	**BHNB24N16W2C11**	23 (10)
Brass Plug	12	30 (762)	**BHNB30A2W2C11**	**BHNB30A3W2C11**	**BHNB30A8W2C11**	**BHNB30A5W2C11**	**BHNB30A16W2C11**	24 (11)
3-Incoloy®	16	35⅝ (905)	**BHNB35L2W2C11**	**BHNB35L3W2C11**	**BHNB35L8W2C11**	**BHNB35L5W2C11**	**BHNB35L16W2C11**	25 (11)
(7.8 W/cm²)	20	45⅝ (1159)		**BHNB45L3W2C11**	**BHNB45L8W2C11**	**BHNB45L5W2C11**	**BHNB45L16W2C11**	27 (12)

How to Order

To order an Assembly Stock unit, please specify:

- Watlow code number
- Volts/watts
- Options, if applicable
- Quantity

If our assembly stock units do not meet your application needs, Watlow can provide **made-to-order** assemblies. For made-to order units, please specify:

- Volts/watts
- Phase
- Screw plug size and materials
- Number of elements
- Sheath material
- Immersed ('B' dimension) length
- No-heat section below the plug
- Options
- Quantity

Availability

Assembly Stock: Five working days

Modified Stock ①: Five to seven working days

Made-to-Order: Four to six weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

Replacement Heater Only

To order a replacement screw plug heater, simply delete the last five characters from the original *Screw Plug Immersion with Control Assembly* base code number.

① Assembly Stock units with catalog options.

Tubular and Process Assemblies

Quick Ship

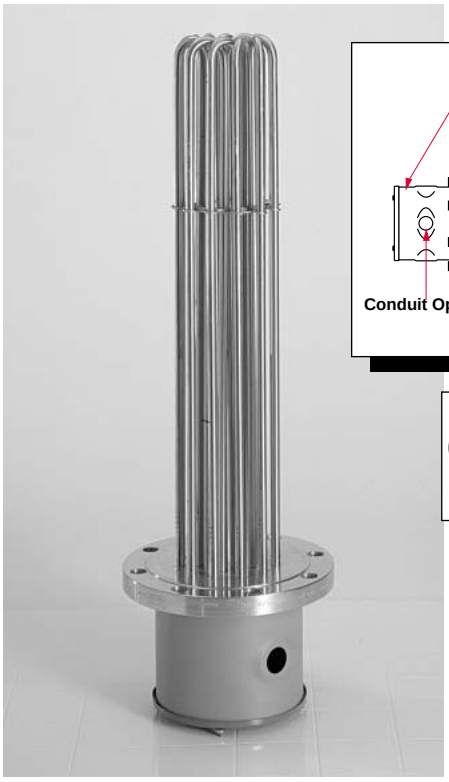
On stock chart units:
- *Three to five working days on most heaters*
- *10 working days on special voltages and/or wattages*
- *15 working days on special element lengths*

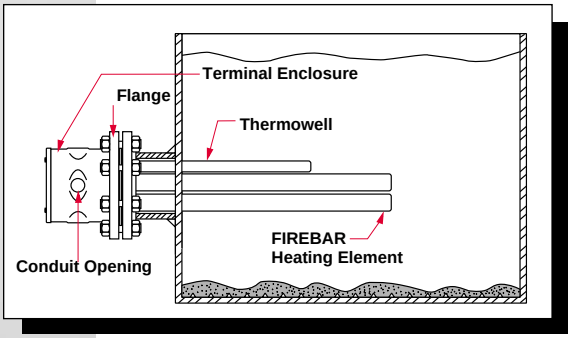
Flange Immersion Heaters

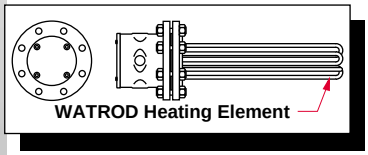
Watlow flange heaters are easy to install and maintain. Designed for heating liquids and gases in tanks and pressure vessels, flange immersion heaters are ideal for applications requiring higher kilowatts.

Watlow flange heaters are made with WATROD or FIREBAR® tubular elements brazed or welded to a flange. Stock flange heaters are equipped with a general purpose (NEMA 1) terminal enclosure.

Flange heaters, with FIREBAR elements, also answer the need for liquid immersion applications requiring high kilowatts in small tanks. The FIREBAR element's unique flat surface geometry packs more power in a smaller bundle, with lower watt density, making it especially well suited for petroleum-based liquid heating applications.







Performance Capabilities

- Watt densities to 100 W/in² (15.5 W/cm²)
- Wattages to one megawatt
- UL® and CSA component recognition to 480V~(ac) and 600V~(ac) respectively
- Incoloy® sheath temperatures to 1600°F (870°C)
- Passivated 316 stainless steel sheath temperatures to 1200°F (650°C)
- 304 stainless steel sheath temperatures to 1200°F (650°C)
- Steel sheath temperatures to 750°F (400°C)
- Copper sheath temperatures to 350°F (175°C)

Features and Benefits

- **ANSI and ANSI compatible 2, 2½, 3, 4, 5, 6, 8, 10, 12 and 14 inch flanges** provide appropriate heater size-to-application and fit.
- **Flange sizes up to 24 inches** available on made-to-order units.
- **Element sheath and flange materials** to meet application needs.
- **Integral thermowells** provide convenient temperature sensor insertion and replacement without draining the fluid being heated.
- **A standard, general purpose (NEMA 1) terminal enclosure** offers easy access to wiring.
- **Element support(s)** provide proper element spacing to maximizing heater performance and life.
- **To facilitate lifting**, drilled and tapped holes come supplied for eye bolts on 10 inch and larger flange heaters.
- **All units are inspected and/or tested** to ensure element-to-flange pressure seals do not leak.
- **Four or six inch FIREBAR flange heaters** pack more kilowatts in smaller bundles—in liquid immersion applications, a conventional 10 inch round tubular element flange can be replaced with a six inch FIREBAR flange.
- **WATROD hairpins are repressed (recompacted)** to maintain MgO density, dielectric strength, heat transfer and life.
- **Branch circuits meet NEC** with 48 amps per circuit maximum.
- **UL® and CSA component recognition** under file numbers E52951 and 31388 respectively. See **pages 268-271** for details.

Flange Immersion Heaters

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

Terminal Enclosures

General purpose terminal enclosures, without thermostats, are standard on all flange immersion heaters. Optional terminal enclosures include:

- General purpose (NEMA 1) with a single or double pole thermostat.
- Moisture resistant (NEMA 4–steel). Available with or without a single or double pole thermostat.
- Corrosion resistant (NEMA 4X). Available with or without a single or double pole thermostat.
- Explosion resistant (NEMA 7) class 1 groups C and D. Available with or without a single or double pole thermostat.
- Explosion/moisture resistant (NEMA 7/4) combinations. Available with or without a single or double pole thermostat.
- For class 1, group B enclosures, consult your Watlow representative.

Enclosure Enhancements

- Enclosure heater to solve condensation and freeze problems.
- Power distribution blocks to facilitate power feed line wiring.

Prior to ordering, refer to the terminal enclosure dimensions on **page 341**. Order by adding the appropriate suffix letter(s) to the base flange heater code number, as shown on the Build-a-Code chart. Heater code numbers and suffix letters are depicted on the *Stock* and *Options* charts, **pages 345 to 362**. Specify class and group, if applicable.

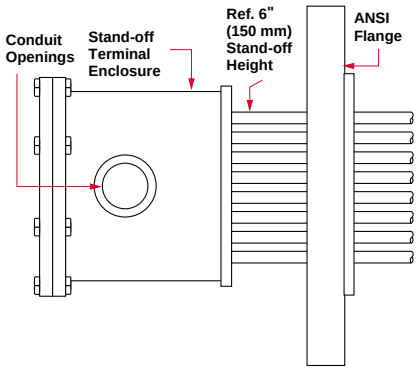
Caution

Explosion-resistant 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 NEMA rating. NEMA rating effectiveness may be compromised by abuse or misapplication.

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 400°F (205°C). This helps minimize terminal enclosure temperatures.

To order, specify **stand-off terminal enclosure**.



CSA Certified Enclosures

CSA certified moisture and/or explosion resistant terminal enclosures protect wiring in hazardous gas environments. These terminal enclosures, covered under CSA file number 61707, are available on all WATROD and FIREBAR flange heaters. For additional information, consult your Watlow representative.

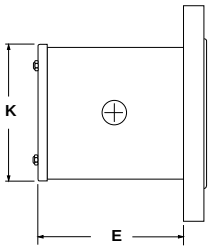
To order, specify **CSA certified enclosure**, **process temperature** (°F), maximum **working pressure** of application (psig), **media** being heated and heater **mounting orientation** (horizontal or vertical) and **flange size**.

Tubular and Process Assemblies

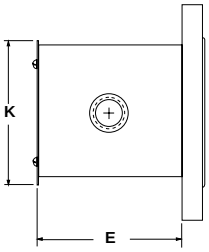
Flange Immersion Heaters

Options

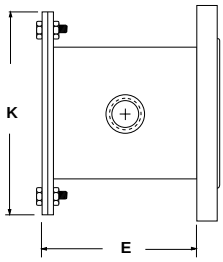
4-8 inches NEMA 1 and NEMA 4



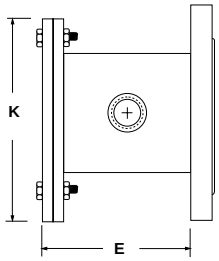
10-14 inches NEMA 1



10-14 inches NEMA 4



4-14 inches NEMA 7



Terminal Enclosure Dimensions

Enclosure Type	Flange Size inch	Without Thermostat				With Thermostat							
						Single Pole				Double Pole			
		E Dimension inch	(mm)	K Dimension inch	(mm)	E Dimension inch	(mm)	K Dimension inch	(mm)	E Dimension inch	(mm)	K Dimension inch	(mm)
General Purpose (NEMA 1)	2①	1 ½	(38)	3 ⅜	(86)	—	—	—	—	—	—	—	—
	2½①	2 ⅛	(54)	4	(102)	—	—	—	—	—	—	—	—
	3	3 $^{13}/_{16}$	(97)	4 ⅝	(117)	9 ⅜	(238)	7	(178)	9 ⅜	(238)	7	(178)
	4	9 ⅜	(238)	7	(178)	9 ⅜	(238)	7	(178)	9 ⅜	(238)	7	(178)
	5	7 $^{1}/_{16}$	(179)	7	(178)	7 $^{1}/_{16}$	(179)	7	(178)	7 $^{1}/_{16}$	(179)	7	(178)
	6	7 $^{1}/_{16}$	(179)	8	(203)	7 $^{1}/_{16}$	(179)	8	(203)	7 $^{1}/_{16}$	(179)	8	(203)
	8	7 $^{1}/_{16}$	(179)	10 $^{1}/_{32}$	(255)	7 $^{1}/_{16}$	(179)	10 $^{1}/_{32}$	(255)	7 $^{1}/_{16}$	(179)	10 $^{1}/_{32}$	(255)
	10	7 $^{1}/_{16}$	(179)	11 ⅝	(295)	7 $^{1}/_{16}$	(179)	11 ⅝	(295)	7 $^{1}/_{16}$	(179)	11 ⅝	(295)
	12	7 $^{1}/_{16}$	(179)	13 ½	(343)	7 $^{1}/_{16}$	(179)	13 ½	(343)	7 $^{1}/_{16}$	(179)	13 ½	(343)
	14	7 $^{1}/_{16}$	(179)	15 ⅛	(384)	7 $^{1}/_{16}$	(179)	15 ⅛	(384)	7 $^{1}/_{16}$	(179)	15 ⅛	(384)
Moisture Resistant (NEMA 4)	2	2 ⅝	(67)	3 ½	(89)	—	—	—	—	—	—	—	—
	2 ½	2 ⅝	(67)	3 ½	(89)	—	—	—	—	—	—	—	—
	3	2 ⅛	(54)	4	(102)	9 ⅜	(238)	7	(178)	9 ⅜	(238)	7	(178)
	4	9 ⅜	(238)	7	(178)	9 ⅜	(238)	7	(178)	9 ⅜	(238)	7	(178)
	5	7 $^{1}/_{16}$	(179)	7	(178)	7 $^{1}/_{16}$	(179)	7	(178)	7 $^{1}/_{16}$	(179)	7	(178)
	6	7 $^{1}/_{16}$	(179)	8	(203)	7 $^{1}/_{16}$	(179)	8	(203)	7 $^{1}/_{16}$	(179)	8	(203)
	8	7 $^{1}/_{16}$	(179)	10 $^{1}/_{32}$	(255)	7 $^{1}/_{16}$	(179)	10 $^{1}/_{32}$	(255)	7 $^{1}/_{16}$	(179)	10 $^{1}/_{32}$	(255)
	10	7 ¾	(197)	13 ¾	(349)	7 ¾	(197)	13 ¾	(349)	7 ¾	(197)	13 ¾	(349)
	12	7 ¾	(197)	15 ⅞	(403)	7 ¾	(197)	15 ⅞	(403)	7 ¾	(197)	15 ⅞	(403)
	14	7 ¾	(197)	17 ¼	(438)	7 ¾	(197)	17 ¼	(438)	7 ¾	(197)	17 ¼	(438)
Explosion Resistant (NEMA 7) Class 1, Groups C and D Consult Factory for Group B)	2	3 $^{1}/_{16}$	(78)	3 ¾	(95)	—	—	—	—	—	—	—	—
	2 ½	3 $^{1}/_{16}$	(78)	3 ¾	(95)	—	—	—	—	—	—	—	—
	3	7 ⅛	(181)	5 ¾	(146)	7 ⅛	(181)	5 ¾	(146)	7 ⅛	(181)	5 ¾	(146)
	4	7 ⅛	(181)	5 ¾	(146)	7 ⅛	(181)	5 ¾	(146)	7 ⅛	(181)	5 ¾	(146)
	5	7 ⅞	(200)	8 ⅞	(225)	7 ⅞	(200)	8 ⅞	(225)	7 ⅞	(200)	8 ⅞	(225)
	6	7 ⅞	(200)	9 ⅞	(251)	7 ⅞	(200)	9 ⅞	(251)	7 ⅞	(200)	9 ⅞	(251)
	8	7 ⅞	(200)	12 ⅛	(308)	7 ⅞	(200)	12 ⅛	(308)	7 ⅞	(200)	12 ⅛	(308)
	10	7 ⅞	(200)	14 ⅝	(371)	7 ⅞	(200)	14 ⅝	(371)	7 ⅞	(200)	14 ⅝	(371)
	12	7 ⅞	(200)	15 ⅞	(403)	7 ⅞	(200)	15 ⅞	(403)	7 ⅞	(200)	15 ⅞	(403)
	14	7 ⅞	(200)	19 ⅜	(492)	7 ⅞	(200)	19 ⅜	(492)	7 ⅞	(200)	19 ⅜	(492)

① Terminal enclosure is octagonal, not round.

Flange Immersion Heaters
Options

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 423 to 425**. Please verify that the thermostat's sensing bulb O.D. is compatible with the flange heater's thermowell I.D.

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 supplied with 120 inch (3050 mm) leads (longer lead lengths available). Unless otherwise specified, thermocouples are supplied with temperature ranges detailed on the *Thermocouple Types* chart.

Using a thermocouple requires an appropriate temperature and power control. These must be purchased separately. Watlow offers a wide variety of temperature and power controls to meet virtually all applications. Temperature controls can be configured to accept process variable inputs, too.

Consult your Watlow representative for details.

To order, specify **Type J** or **K** thermocouple and lead length. 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.

RTDs

If your process requires greater temperature sensing accuracy than is possible with thermocouples, Watlow can also supply RTDs in DIN or JIS calibrations. Consult Watlow for details.

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.

Wattages and Voltages

Watlow routinely supplies flange immersion heaters with 240 to 480V~(ac) as well as wattages from 150 watts to one megawatt. If required, Watlow will make heaters with voltage up to 600V~(ac) and wattage beyond one megawatt. For more information on special voltage and wattage configurations, consult your Watlow representative.

Branch Circuits

Branch circuits are subdivided by National Electrical Code (NEC) requirements to a maximum of 48 amps per circuit. Consult factory for circuit requirements other than those listed in the stock charts.

Tubular and Process Assemblies

Flange Immersion Heaters

Options

Sheath Materials

The following sheath materials are available on WATROD and FIREBAR flange heaters:

Standard Sheath Materials

WATROD	Incoloy® 316 stainless steel Steel Copper
FIREBAR	Incoloy®

Made-to-Order Sheath Materials

WATROD	304 stainless steel Monel®
FIREBAR	304 stainless steel

Exotic Sheath Materials

Consult 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 sheath applications, passivation will remove free iron from the sheath. To order, specify **passivation**.

Other Finishes

Simple belt polishing and glass beading are available to meet cosmetic demands. Consult factory for details.

Flanges

Flange Sizes and Styles

Standard: 2①, 2½①, 3, 4, 5, 6, 8, 10, 12 and 14 inch ANSI raised face/blind flanges.

Made-to-Order: 16, 18, 20 and 24 inch in any recognized configuration, as well as customer specified. Over 24 inch, consult Watlow Process Systems.

Flange Materials

Standard	Carbon steel 316 stainless steel 304 stainless steel
Made-to-Order	Exotic materials to meet specific application needs②

Pressure Classes

Standard	150 lb
Made-to-Order	300 lb 600 lb Over 600 lb②

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

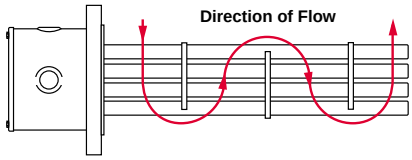
③ Depends on metal gasket material.

Baffles

For forced circulation applications, 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**.



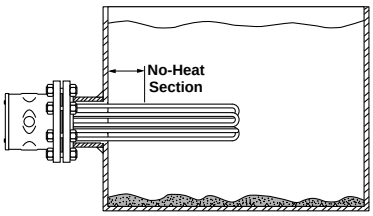
① ANSI compatible only.
② Consult Watlow Process Systems in Troy, Missouri.

Monel® is a registered trademark of Special Metals Corporation.

Flange Immersion Heaters

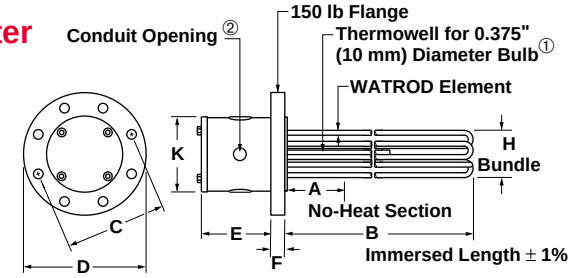
Application Hints

- Select the recommended heating element sheath material and watt density for the substance being heated. Use the ***Supplemental Applications Chart*** on **pages 263 to 266**. If unable to determine the correct heating element sheath material and type, consult 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.



- Choose a FIREBAR element when your application requires a smaller system package or lower watt density.
- Ensure wiring integrity by keeping terminal enclosure temperature below 400°F (205°C).
- 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.
- Refer to the *Installation and Maintenance Instructions* for correct orientation of FIREBAR elements. This is important in air applications with customer supplied circulation tanks. Correct element orientation to flow minimizes pressure drop, increases buoyancy force and heater performance.

Flange Immersion Heater



For terminal enclosure dimensions (K and E) see page 341.

Flange Immersion Heater Dimensions

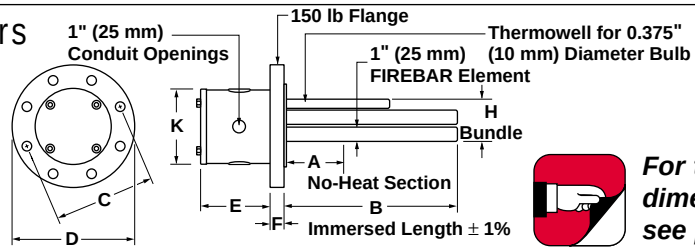
Element Type	Flange Size in	Flange Mounting Hole Size in	Flange Mounting Hole Size (mm)	Flange Mounting Hole Number	Thermowell Length in	Thermowell Length (mm)	A Dimension in	A Dimension (mm)	C Dimension in	C Dimension (mm)	D Dimension in	D Dimension (mm)	F Dimension in	F Dimension (mm)	H Dimension in	H Dimension (mm)	Number of Elements Std	Number of Elements Max
WATROD	2①	¾	(19)	4	—	—	2	(51)	4¾	(121)	6	(152)	9/16	(14)	2	(51)	3	3
WATROD	2½①	¾	(19)	4	—	—	3	(76)	5½	(140)	7	(178)	⅜	(10)	2¼	(57)	3	3
WATROD	3	¾	(19)	4	12	(305)	4	(102)	6	(152)	7½	(191)	15/16	(24)	2¾	(70)	3	6
WATROD	4	¾	(19)	8	12	(305)	4	(102)	7½	(191)	9	(229)	15/16	(24)	3⅜	(98)	6	6
WATROD	5	⅞	(22)	8	12	(305)	4	(102)	8½	(216)	10	(254)	15/16	(24)	5	(127)	6	9
WATROD	6	⅞	(22)	8	12	(305)	4	(102)	9½	(241)	11	(279)	1	(25)	6	(152)	12	15
WATROD	8	⅞	(22)	8	18	(457)	6	(152)	11¾	(298)	13½	(343)	1⅛	(29)	7 13/16	(198)	18	24
WATROD	10	1	(25)	12	18	(457)	6	(152)	14¼	(362)	16	(406)	1 3/16	(30)	9¾	(248)	27	36
WATROD	12	1	(25)	12	18	(457)	6	(152)	17	(432)	19	(483)	1¼	(32)	11¾	(298)	36	54
WATROD	14	1⅛	(29)	12	18	(457)	6	(152)	18¾	(476)	21	(533)	1⅜	(35)	12¾	(324)	45	72

① Thermowells are not provided on two and 2½ inch units. 150 lb rating is not available on two and 2½ inch stock units.

Note: The number and size of conduit openings will comply with the National Electrical Code standards.

Tubular and Process Assemblies

Flange Immersion Heaters



For terminal enclosure dimensions (K and E) see page 341.

Flange Immersion Heater Dimensions

Element Type	Flange Size in	Flange Mounting Hole Size in (mm)	Flange Mounting Hole Number	Thermowell Length in (mm)	A Dimension in (mm)	C Dimension in (mm)	D Dimension in (mm)	F Dimension in (mm)	H Dimension in (mm)	Elements Standard
FIREBAR	4	¾ (19)	8	12 (305)	4 (102)	7½ (191)	9 (229)	15⁄16 (24)	3⅞ (98)	6
FIREBAR	6	⅞ (22)	8	12 (305)	4 (102)	9½ (241)	11 (279)	1 (25)	6 (152)	15

6" O.D. Plate Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 1-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Process Water, Ethylene Glycol (50%)							
45 W/in² Steel Flange 3-Copper (7 W/cm²)	4.5 9	16 (406) 29 (737)	**FKC16A10**② **FKC29A10**②	**FKC16A3**② **FKC29A3**	**FKC16A11**② **FKC29A11**②	**FKC16A5** **FKC29A5**	22 (10) 27 (13)
Application: Process Water							
45 W/in² Steel Flange 3-Incoloy® (7 W/cm²)	9	28 (711)	**FKN28A10**②	**FKN28A3**②	**FKN28A11**②	**FKN28A5**	27 (13)
Applications: Cooking Oils, Ethylene Glycol (100%)							
30 W/in² Steel Flange 3-Steel (4.7 W/cm²)	6	29 (737)	**FKS29A10**②	**FKS29A3**②	**FKS29A11**②	**FKS29A5**	27 (13)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin							
15 W/in² ③ **Steel Flange 3-Incoloy®** (2.3 W/cm²)	3	28 (711)		**FKN28A12**②		**FKN28A13**②	27 (13)
Applications: Medium Weight Oils, Heat Transfer Oils, Lube Oils, Liquid Paraffin							
10 W/in² ③ **Steel Flange 3-Steel** (1.6 W/cm²)	2	29 (737)		**FKS29A12**②		**FKS29A13**②	27 (13)

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

② Standard

③ Must be operated 3-phase wye

Flange Immersion Heaters

7" O.D. Plate Flange— WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Clean and Potable Water											
100 W/in² **Steel Flange** **3-304 SS** (15.5 W/cm²)	12	18 (457)	**FLN18A10**②	2	**FLN18A3**②	1	**FLN18A11**②	1	**FLN18A5**	1	22 (10)
Applications: Clean and Potable Water											
80 W/in² **Steel Flange** **3-304 SS** (12.4 W/cm²)	9	17¾ (451)	**FLN17N10**②	1	**FLN17N3**	1	**FLN17N11**②	1	**FLN17N5**②	1	22 (10)
	18	30 (762)	**FLN30A10**②	2	**FLN30A3**	1	**FLN30A11**②	1	**FLN30A5**②	1	27 (13)
Application: Process Water											
60 W/in² **Steel Flange** **3-Incoloy®** (9.3 W/cm²)	4.5	12½ (318)	**FLN12J10**②	1	**FLN12J3**	1	**FLN12J11**②	1	**FLN12J5**②	1	21 (10)
Applications: Cooking Oils, Ethylene Glycol (100%)											
30 W/in²③ **Steel Flange** **3-Incoloy®** (4.7 W/cm²)	3	17¾ (451)			**FLN17N12**②	1			**FLN17N13**②	1	22 (10)
	4	18 (457)			**FLN18A12**②	1			**FLN18A13**	1	22 (10)
	6	30 (762)			**FLN30A12**	1			**FLN30A13**	1	27 (13)

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

② Standard

③ Must be operated 3-phase wye

Tubular and Process Assemblies

Flange Immersion Heaters

3" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Clean Water											
60 W/in²	6	15½ (394)	**FMC715J10**	1	**FMC715J3**	1	**FMC715J11**	1	**FMC715J5**	1	22 (10)
Steel Flange	9	21½ (546)	**FMC721J10**	1	**FMC721J3**	1	**FMC721J11**	1	**FMC721J5**	1	25 (12)
3-Copper	12	27 (686)			**FMC727A3**	1	**FMC727A11**	1	**FMC727A5**	1	27 (13)
(9.3 W/cm²)	15	32½ (826)			**FMC732J3**	1	**FMC732J11**	1	**FMC732J5**	1	28 (13)
	18	38 (965)			**FMC738A3**	1	**FMC738A11**	1	**FMC738A5**	1	30 (14)
	25	51 (1295)					**FMC751A11**	1	**FMC751A5**	1	34 (16)
	30	60½ (1537)					**FMC760J11**②	1	**FMC760J5**②	1	36 (17)
Application: Process Water											
48 W/in² ⑤⑥	4.5	13½ (343)	**FMN713J10**	1	**FMN713J3**	1	**FMN713J11**	1	**FMN713J5**	1	22 (10)
Steel Flange	6	18 (457)	**FMN718A10**	1	**FMN718A3**	1	**FMN718A11**	1	**FMN718A5**	1	23 (11)
3-Incoloy®	7.5	20½ (521)	**FMN720J10**	1	**FMN720J3**	1	**FMN720J11**	1	**FMN720J5**	1	25 (12)
(7.5 W/cm²)	9	25½ (648)	**FMN725J10**	1	**FMN725J3**	1	**FMN725J11**	1	**FMN725J5**	1	27 (13)
	12	33 (838)			**FMN733A3**	1	**FMN733A11**	1	**FMN733A5**	1	28 (13)
	15	40½ (1029)			**FMN740J3**	1	**FMN740J11**	1	**FMN740J5**	1	30 (14)
	18	48 (1219)			**FMN748A3**	1	**FMN748A11**	1	**FMN748A5**	1	32 (15)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions											
23 W/in² ⑤⑥	3	18 (457)	**FMNA18A10**	1	**FMNA18A3**	1	**FMNA18A11**	1	**FMNA18A5**	1	23 (11)
Steel Flange	4.5	25½ (648)	**FMNA25J10**	1	**FMNA25J3**	1	**FMNA25J11**	1	**FMNA25J5**	1	27 (13)
3-Incoloy®	6	33 (838)	**FMNA33A10**	1	**FMNA33A3**	1	**FMNA33A11**	1	**FMNA33A5**	1	28 (13)
(3.6 W/cm²)	7.5	40½ (1029)	**FMNA40J10**	1	**FMNA40J3**	1	**FMNA40J11**	1	**FMNA40J5**	1	30 (14)
	9	48 (1219)	**FMNA48A10**	1	**FMNA48A3**	1	**FMNA48A11**	1	**FMNA48A5**	1	32 (15)
	12.5	64½ (1638)			**FMNA64J3**	1	**FMNA64J11**	1	**FMNA64J5**	1	37 (17)
	15	77 (1956)			**FMNA77A3**	1	**FMNA77A11**	1	**FMNA77A5**	1	42 (19)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils											
23 W/in²	3	18 (457)	**FMS718A10**	1	**FMS718A3**	1	**FMS718A11**	1	**FMS718A5**	1	23 (11)
Steel Flange	4.5	25½ (648)	**FMS725J10**	1	**FMS725J3**	1	**FMS725J11**	1	**FMS725J5**	1	27 (13)
3-Steel	6	33 (838)	**FMS733A10**	1	**FMS733A3**	1	**FMS733A11**	1	**FMS733A5**	1	28 (13)
(3.6 W/cm²)	7.5	40½ (1029)	**FMS740J10**	1	**FMS740J3**	1	**FMS740J11**	1	**FMS740J5**	1	30 (14)
	9	48 (1219)	**FMS748A10**	1	**FMS748A3**	1	**FMS748A11**	1	**FMS748A5**	1	32 (15)
	12.5	64½ (1638)			**FMS764J3**	1	**FMS764J11**	1	**FMS764J5**	1	37 (17)
	15	77 (1956)			**FMS777A3**	1	**FMS777A11**	1	**FMS777A5**	1	42 (19)

CONTINUED

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

② Standard

⑤ 240V~(ac) 3-phase can be rewired wye to produce ⅓ more kW and watt density when operated at 480V~(ac) 3-phase.

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

Flange Immersion Heaters

3" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin											
16 W/in²③	1.5	13½ (343)			**FMN713J12**	1			**FMN713J13**	1	22 (10)
Steel Flange	2	18 (457)			**FMN718A12**	1			**FMN718A13**	1	23 (11)
3-Incoloy®	2.5	20½ (521)			**FMN720J12**	1			**FMN720J13**	1	25 (12)
(2.5 W/cm²)	3	25½ (648)			**FMN725J12**	1			**FMN725J13**	1	27 (13)
	4	33 (838)			**FMN733A12**	1			**FMN733A13**	1	30 (14)
	5	40½ (1029)			**FMN740J12**	1			**FMN740J13**	1	30 (14)
	6	48 (1219)			**FMN748A12**	1			**FMN748A13**	1	33 (15)
Applications: Bunker C and #6 Fuel Oils											
8 W/in²③	2	33 (838)			**FMS733A12**	1			**FMS733A13**	1	28 (13)
Steel Flange	3	48 (1219)			**FMS748A12**	1			**FMS748A13**	1	32 (15)
3-Steel	4	64½ (1638)			**FMS764J12**	1			**FMS764J13**	1	37 (17)
(1.3 W/cm²)	5	77 (1956)			**FMS777A12**	1			**FMS777A13**	1	42 (19)

4" 150 Lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Clean Water											
60 W/in²	12	15½ (394)	**FOC715J10**	2	**FOC715J3**	1	**FOC715J11**	1	**FOC715J5**	1	31 (14)
Steel Flange	18	21½ (546)	**FOC721J10**	2	**FOC721J3**	1	**FOC721J11**	1	**FOC721J5**	1	34 (16)
6-Copper	24	27 (686)	**FOC727A10**	2	**FOC727A3**	2	**FOC727A11**	1	**FOC727A5**	1	36 (17)
(9.3 W/cm²)	30	32½ (826)			**FOC732J3**	2	**FOC732J11**	2	**FOC732J5**	1	39 (18)
	36	38 (965)			**FOC738A3**	2	**FOC738A11**	2	**FOC738A5**	1	43 (20)
	50	51 (1295)							**FOC751A5**	2	48 (22)
	60	60½ (1537)							**FOC760J5**②	2	52 (24)
Application: Deionized Water, Demineralized Water											
60 W/in²	12	16 (406)	**FOR716A10**	1	**FOR716A3**	1	**FOR716A11**	1	**FOR716A5**	1	31 (14)
316 SS Flange	18	22 (559)	**FOR722A10**	2	**FOR722A3**	1	**FOR722A11**	1	**FOR722A5**	1	34 (16)
6-316 SS	24	27½ (699)	**FOR727J10**	2	**FOR727J3**	2	**FOR727J11**	1	**FOR727J5**	1	36 (17)
(9.3 W/cm²)	30	33 (838)			**FOR733A3**	2	**FOR733A11**	2	**FOR733A5**	1	39 (18)
Passivated	36	38½ (978)			**FOR738J3**	2	**FOR738J11**	2	**FOR738J5**	1	43 (20)
	50	51½ (1308)							**FOR751J5**	2	53 (25)
	60	61 (1549)							**FOR761A5**	2	56 (26)

CONTINUED

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

② Standard

③ Must be operated 3-phase wye

Tubular and Process Assemblies

Flange Immersion Heaters

4" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Process Water											
48 W/in²⑤ Steel Flange 6-Incoloy® (7.5 W/cm²)	9	13½ (343)	FON713J10	1	FON713J3	1	FON713J11	1	FON713J5	1	29 (14)
	12	18 (457)	FON718A10	2	FON718A3	1	FON718A11	1	FON718A5	1	32 (15)
	15	20½ (521)	FON720J10	2	FON720J3	1	FON720J11	1	FON720J5	1	34 (16)
	18	25½ (648)	FON725J10	2	FON725J3	1	FON725J11	1	FON725J5	1	36 (17)
	24	33 (838)	FON733A10	2	FON733A3	2	FON733A11	1	FON733A5	1	39 (18)
	30	40½ (1029)			FON740J3	2	FON740J11	2	FON740J5	1	43 (20)
	36	48 (1219)			FON748A3	2	FON748A11	2	FON748A5	1	48 (22)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions											
23 W/in²⑤⑥ Steel Flange 6-Incoloy® (3.6 W/cm²)	6	18 (457)	FONA18A10	1	FONA18A3	1	FONA18A11	1	FONA18A5	1	32 (15)
	9	25½ (648)	FONA25J10	1	FONA25J3	1	FONA25J11	1	FONA25J5	1	36 (17)
	12	33 (838)	FONA33A10	2	FONA33A3	1	FONA33A11	1	FONA33A5	1	39 (18)
	15	40½ (1029)	FONA40J10	2	FONA40J3	1	FONA40J11	1	FONA40J5	1	43 (20)
	18	48 (1219)	FONA48A10	2	FONA48A3	1	FONA48A11	1	FONA48A5	1	48 (22)
	25	64½ (1638)			FONA64J3	2	FONA64J11	2	FONA64J5	1	53 (24)
	30	77 (1956)			FONA77A3	2	FONA77A11	2	FONA77A5	1	61 (28)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils											
23 W/in² Steel Flange 6-Steel (3.6 W/cm²)	6	18 (457)	FOS718A10	1	FOS718A3	1	FOS718A11	1	FOS718A5	1	32 (15)
	9	25½ (648)	FOS725J10	1	FOS725J3	1	FOS725J11	1	FOS725J5	1	36 (17)
	12	33 (838)	FOS733A10	2	FOS733A3	1	FOS733A11	1	FOS733A5	1	39 (18)
	15	40½ (1029)	FOS740J10	2	FOS740J3	1	FOS740J11	1	FOS740J5	1	43 (20)
	18	48 (1219)	FOS748A10	2	FOS748A3	1	FOS748A11	1	FOS748A5	1	48 (22)
	25	64½ (1638)			FOS764J3	2	FOS764J11	2	FOS764J5	1	53 (24)
	30	77 (1956)			FOS777A3	2	FOS777A11	2	FOS777A5	1	61 (28)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin											
16 W/in²③ Steel Flange 6-Incoloy® (2.5 W/cm²)	3	13½ (343)			FON713J12	1			FON713J13	1	29 (14)
	4	18 (457)			FON718A12	1			FON718A13	1	32 (15)
	5	20½ (521)			FON720J12	1			FON720J13	1	34 (16)
	6	25½ (648)			FON725J12	1			FON725J13	1	36 (17)
	8	33 (838)			FON733A12	1			FON733A13	1	39 (18)
	10	40½ (1029)			FON740J12	1			FON740J13	1	43 (20)
	12	48 (1219)			FON748A12	1			FON748A13	1	48 (22)
Applications: Bunker C and #6 Fuel Oils											
8 W/in²③ Steel Flange 6-Steel (1.3 W/cm²)	5	40½ (1029)			FOS740J12	1			FOS740J13	1	43 (20)
	6	48 (1219)			FOS748A12	1			FOS748A13	1	48 (22)
	8	64½ (1638)			FOS764J12	1			FOS764J13	1	53 (24)
	10	77 (1956)			FOS777A12	1			FOS777A13	1	61 (28)

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

③ Must be operated 3-phase wye

⑤ 240V~(ac) 3-phase can be rewired wye to produce ⅓ more kW and watt density when operated at 480V~(ac) 3-phase.

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

Tubular and Process Assemblies

Flange Immersion Heaters

4" 150 lb ANSI Flange—FIREBAR Element

FIREBAR Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Process Water, Ethylene Glycol (50%)							
45 W/in²	12	13⅜ (340)	**FONF13G27**	1			32 (20)
304 SS Flange	15	16 (406)	**FONF16A27**	1			35 (20)
6-Incoloy®	18	18⅜ (467)	**FONF18G27**	1			38 (21)
(7 W/cm²)	24	22⅞ (581)	**FONF22R27**	2	**FONF22R28**	1	41 (21)
	30	27⅞ (708)	**FONF27R27**	2	**FONF27R28**	1	44 (20)
	36	32⅞ (835)	**FONF32R27**	2	**FONF32R28**	1	46 (21)
	48	42⅜ (1076)			**FONF42G28**	2	50 (23)
	60	51⅞ (1318)			**FONF51R28**	2	54 (25)
Applications: Cooking Oils, Ethylene Glycol (100%)							
30 W/in²③	10	16½ (420)	**FONF16J12**	1	**FONF16J13**	1	35 (16)
304 SS Flange	13	19½ (495)	**FONF19J12**	1	**FONF19J13**	1	38 (17)
6-Incoloy®	17	24½ (622)	**FONF24J12**	1	**FONF24J13**	1	41 (19)
(4.7 W/cm²)	21	30 (762)	**FONF30A12**	2	**FONF30A13**	1	44 (20)
	25.5	35 (889)	**FONF35A12**	2	**FONF35A13**	1	46 (21)
	34	45½ (1156)	**FONF45J12**	2	**FONF45J13**	1	50 (23)
	43	56 (1422)			**FONF56A13**	2	54 (25)
Applications: Heat Transfer Oils, Mineral Oils, Degreasing Solutions							
23 W/in²⑧	7.5	16½ (419)	**FONF16J20**	1			35 (16)
304 SS Flange	10	19½ (495)	**FONF19J20**	1			38 (18)
6-Incoloy®	12.8	24½ (622)	**FONF24J20**	1	**FONF24J19**	1	41 (19)
(3.6 W/cm²)	15.8	30 (762)	**FONF30A20**	1	**FONF30A19**	1	44 (20)
	19	35 (889)	**FONF35A20**	1	**FONF35A19**	1	46 (21)
	25	45½ (1156)	**FONF45J20**	2	**FONF45J19**	1	50 (23)
	32.3	56 (1422)	**FONF56A20**	2	**FONF56A19**	1	54 (25)
Applications: Medium Weight Oils, Heat Transfer Oils, Lube Oils, Liquid Paraffin							
15 W/in²③	4	13⅜ (340)	**FONF13G29**	1			32 (15)
304 SS Flange	5	16 (406)	**FONF16A29**	1			35 (16)
6-Incoloy®	6	18⅜ (467)	**FONF18G29**	1			38 (18)
(2.3 W/cm²)	8	22⅞ (581)	**FONF22R29**	1	**FONF22R30**	1	41 (19)
	10	27⅞ (708)	**FONF27R29**	1	**FONF27R30**	1	44 (20)
	12	32⅞ (835)	**FONF32R29**	1	**FONF32R30**	1	46 (21)
	16	42⅜ (1076)	**FONF42G29**	1	**FONF42G30**	1	50 (23)
	20	51⅞ (1318)	**FONF51R29**	1	**FONF51R30**	1	54 (25)
Applications: Bunker C and #6 Fuel Oils, Asphalt							
8 W/in²③	2.5	16½ (419)	**FONF16J22**	1			35 (16)
304 SS Flange	3.25	19½ (495)	**FONF19J22**	1			38 (17)
6-Incoloy®	4.25	24½ (622)	**FONF24J22**	1	**FONF24J21**	1	41 (19)
(1.3 W/cm²)	5.25	30 (762)	**FONF30A22**	1	**FONF30A21**	1	44 (20)
	6.38	35 (889)	**FONF35A22**	1	**FONF35A21**	1	46 (21)
	8.5	45½ (1156)	**FONF45J22**	1	**FONF45J21**	1	50 (23)
	10.75	56 (1422)	**FONF56A22**	1	**FONF56A21**	1	54 (25)

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

③ Must be operated 3-phase wye

⑧ Can be rewired for 1-phase

Tubular and Process Assemblies

Flange Immersion Heaters

5" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Clean Water											
60 W/in²	12	15½ (394)	**FNC715J10**	2	**FNC715J3**	1	**FNC715J11**	1	**FNC715J5**	1	35 (16)
Steel Flange	18	21½ (546)	**FNC721J10**	2	**FNC721J3**	1	**FNC721J11**	1	**FNC721J5**	1	38 (18)
6-Copper	24	27 (686)	**FNC727A10**	3	**FNC727A3**	2	**FNC727A11**	3	**FNC727A5**	1	40 (19)
(9.3 W/cm²)	30	32½ (826)			**FNC732J3**	2	**FNC732J11**	2	**FNC732J5**	1	43 (20)
	36	38 (965)			**FNC738A3**	2	**FNC738A11**	2	**FNC738A5**	1	47 (22)
	50	51 (1295)							**FNC751A5**	2	52 (24)
	60	60½ (1537)							**FNC760J5**②	2	56 (26)
60 W/in²	18	15½ (394)	**FNC715J10X**	3	**FNC715J3X**	1	**FNC715J11X**	1	**FNC715J5X**	1	38 (18)
Steel Flange	27	21½ (546)	**FNC721J10X**	3	**FNC721J3X**	3	**FNC721J11X**	3	**FNC721J5X**	1	42 (19)
9-Copper	36	27 (686)			**FNC727A3X**	3	**FNC727A11X**	3	**FNC727A5X**	1	45 (21)
(9.3 W/cm²)	45	32½ (826)			**FNC732J3X**	3	**FNC732J11X**	3	**FNC732J5X**	3	48 (22)
	54	38 (965)			**FNC738A3X**	3	**FNC738A11X**	3	**FNC738A5X**	3	53 (24)
	75	51 (1295)							**FNC751A5X**	3	60 (28)
	90	60½ (1537)							**FNC760J5X**②	3	66 (30)
Application: Process Water											
48 W/in²⑤	9	13½ (343)	**FNN713J10**	1	**FNN713J3**	1	**FNN713J11**	1	**FNN713J5**	1	33 (15)
Steel Flange	12	18 (457)	**FNN718A10**	2	**FNN718A3**	1	**FNN718A11**	1	**FNN718A5**	1	36 (17)
6-Incoloy®	15	20½ (521)	**FNN720J10**	2	**FNN720J3**	1	**FNN720J11**	1	**FNN720J5**	1	38 (18)
(7.5 W/cm²)	18	25½ (648)	**FNN725J10**	2	**FNN725J3**	1	**FNN725J11**	1	**FNN725J5**	1	40 (19)
	24	33 (838)	**FNN733A10**	3	**FNN733A3**	2	**FNN733A11**	3	**FNN733A5**	1	43 (20)
	30	40½ (1029)			**FNN740J3**	2	**FNN740J11**	2	**FNN740J5**	1	47 (22)
	36	48 (1219)			**FNN748A3**	2	**FNN748A11**	2	**FNN748A5**	1	52 (24)
48 W/in²	14	13½ (343)	**FNN713J10X**	3	**FNN713J3X**	1	**FNN713J11X**	1	**FNN713J5X**	1	35 (16)
Steel Flange	18	18 (457)	**FNN718A10X**	3	**FNN718A3X**	1	**FNN718A11X**	1	**FNN718A5X**	1	39 (18)
9-Incoloy®	23	20½ (521)	**FNN720J10X**	3	**FNN720J3X**	3	**FNN720J11X**	1	**FNN720J5X**	1	42 (19)
(7.5 W/cm²)	27	25½ (648)	**FNN725J10X**	3	**FNN725J3X**	3	**FNN725J11X**	3	**FNN725J5X**	1	45 (21)
	36	33 (838)			**FNN733A3X**	3	**FNN733A11X**	3	**FNN733A5X**	1	48 (22)
	45	40½ (1029)			**FNN740J3X**	3	**FNN740J11X**	3	**FNN740J5X**	3	53 (24)
	54	48 (1219)			**FNN748A3X**	3	**FNN748A11X**	3	**FNN748A5X**	3	60 (28)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions											
23 W/in²⑤⑥	6	18 (457)	**FNNA18A10**	1	**FNNA18A3**	1	**FNNA18A11**	1	**FNNA18A5**	1	36 (17)
Steel Flange	9	25½ (648)	**FNNA25J10**	1	**FNNA25J3**	1	**FNNA25J11**	1	**FNNA25J5**	1	40 (19)
6-Incoloy®	12	33 (838)	**FNNA33A10**	2	**FNNA33A3**	1	**FNNA33A11**	1	**FNNA33A5**	1	43 (20)
(3.6 W/cm²)	15	40½ (1029)	**FNNA40J10**	2	**FNNA40J3**	1	**FNNA40J11**	1	**FNNA40J5**	1	47 (22)
	18	48 (1219)	**FNNA48A10**	2	**FNNA48A3**	1	**FNNA48A11**	1	**FNNA48A5**	1	52 (24)
	25	64½ (1638)			**FNNA64J3**	2	**FNNA64J11**	2	**FNNA64J5**	1	57 (26)
	30	77 (1956)			**FNNA77A3**	2	**FNNA77A11**	2	**FNNA77A5**	1	65 (28)

CONTINUED

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

② Standard

⑤ 240V~(ac) 3-phase can be rewired wye to produce ⅓ more kW and watt density when operated at 480V~(ac) 3-phase.

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

Flange Immersion Heaters

5" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions											
23 W/in²	9	18 (457)	**FNNA18A10X**	1	**FNNA18A3X**	1	**FNNA18A11X**	1	**FNNA18A5X**	1	39 (18)
Steel Flange	14	25½ (648)	**FNNA25J10X**	3	**FNNA25J3X**	1	**FNNA25J11X**	1	**FNNA25J5X**	1	45 (21)
9-Incoloy®	18	33 (838)	**FNNA33A10X**	3	**FNNA33A3X**	1	**FNNA33A11X**	1	**FNNA33A5X**	1	48 (22)
(3.6 W/cm²)	23	40½ (1029)	**FNNA40J10X**	3	**FNNA40J3X**	3	**FNNA40J11X**	1	**FNNA40J5X**	1	53 (24)
	27	48 (1219)	**FNNA48A10X**	3	**FNNA48A3X**	3	**FNNA48A11X**	3	**FNNA48A5X**	1	60 (28)
	38	64½ (1638)			**FNNA64J3X**	3	**FNNA64J11X**	3	**FNNA64J5X**	1	68 (31)
	45	77 (1956)			**FNNA77A3X**	3	**FNNA77A11X**	3	**FNNA77A5X**	3	78 (36)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils											
23 W/in²	6	18 (457)	**FNS718A10**	1	**FNS718A3**	1	**FNS718A11**	1	**FNS718A5**	1	36 (17)
Steel Flange	9	25½ (648)	**FNS725J10**	1	**FNS725J3**	1	**FNS725J11**	1	**FNS725J5**	1	40 (18)
6-Steel	12	33 (838)	**FNS733A10**	2	**FNS733A3**	1	**FNS733A11**	1	**FNS733A5**	1	43 (20)
(3.6 W/cm²)	15	40½ (1029)	**FNS740J10**	2	**FNS740J3**	1	**FNS740J11**	1	**FNS740J5**	1	47 (22)
	18	48 (1219)	**FNS748A10**	2	**FNS748A3**	3	**FNS748A11**	1	**FNS748A5**①	1	52 (24)
	25	64½ (1638)			**FNS764J3**	2	**FNS764J11**	2	**FNS764J5**	1	57 (26)
	30	77 (1956)			**FNS777A3**	2	**FNS777A11**	2	**FNS777A5**	1	65 (30)
23 W/in²	9	18 (457)	**FNS718A10X**	1	**FNS718A3X**	1	**FNS718A11X**	1	**FNS718A5X**	1	39 (18)
Steel Flange	14	25½ (648)	**FNS725J10X**	3	**FNS725J3X**	1	**FNS725J11X**	1	**FNS725J5X**	1	45 (21)
9-Steel	18	33 (838)	**FNS733A10X**	3	**FNS733A3X**	1	**FNS733A11X**	1	**FNS733A5X**	1	48 (22)
(3.6 W/cm²)	23	40½ (1029)	**FNS740J10X**	3	**FNS740J3X**	3	**FNS740J11X**	1	**FNS740J5X**	1	53 (24)
	27	48 (1219)	**FNS748A10X**	3	**FNS748A3X**	1	**FNS748A11X**	3	**FNS748A5X**	1	60 (28)
	38	64½ (1638)			**FNS764J3X**	3	**FNS764J11X**	3	**FNS764J5X**	1	68 (31)
	45	77 (1956)			**FNS777A3X**	3	**FNS777A11X**	3	**FNS777A5X**	3	78 (36)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin											
16 W/in²③	3	13½ (343)			**FNN713J12**	1			**FNN713J13**	1	36 (17)
Steel Flange	4	18 (457)			**FNN718A12**	1			**FNN718A13**	1	40 (18)
6-Incoloy®	5	20½ (521)			**FNN720J12**	1			**FNN720J13**	1	43 (20)
(2.5 W/cm²)	6	25½ (648)			**FNN725J12**	1			**FNN725J13**	1	47 (22)
	8	33 (838)			**FNN733A12**	1			**FNN733A13**	1	52 (24)
	10	40½ (1029)			**FNN740J12**	1			**FNN740J13**	1	57 (26)
	12	48 (1219)			**FNN748A12**	1			**FNN748A13**	1	65 (30)
16 W/in²③	4.5	13½ (343)			**FNN713J12X**	1			**FNN713J13X**	1	39 (18)
Steel Flange	6	18 (457)			**FNN718A12X**	1			**FNN718A13X**	1	45 (21)
9-Incoloy®	7.5	20½ (521)			**FNN720J12X**	1			**FNN720J13X**	1	48 (22)
(2.5 W/cm²)	9	25½ (648)			**FNN725J12X**	1			**FNN725J13X**	1	53 (24)
	12	33 (838)			**FNN733A12X**	1			**FNN733A13X**	1	60 (28)
	15	40½ (1029)			**FNN740J12X**	1			**FNN740J13X**	1	68 (31)
	18	48 (1219)			**FNN748A12X**	1			**FNN748A13X**	1	78 (36)

CONTINUED

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

① Stock

③ Must be operated 3-phase wye

Tubular and Process Assemblies

Flange Immersion Heaters

5" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Bunker C and #6 Fuel Oils											
8 W/in²③	5	40½ (1029)			**FNS740J12**	1			**FNS740J13**	1	47 (22)
Steel Flange	6	48 (1219)			**FNS748A12**	1			**FNS748A13**	1	52 (24)
6-Steel	8	64½ (1638)			**FNS764J12**	1			**FNS764J13**	1	57 (26)
(1.3 W/cm²)	10	77 (1956)			**FNS777A12**	1			**FNS777A13**	1	65 (30)
8 W/in²③	7.5	40½ (1029)			**FNS740J12X**	1			**FNS740J13X**	1	53 (24)
Steel Flange	9	48 (1219)			**FNS748A12X**	1			**FNS748A13X**	1	60 (28)
9-Steel	12	64½ (1638)			**FNS764J12X**	1			**FNS764J13X**	1	68 (31)
(1.3 W/cm²)	15	77 (1956)			**FNS777A12X**	1			**FNS777A13X**	1	78 (36)

6" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Clean Water											
60 W/in²	24	15⅜ (391)	**FPC715G10**	3	**FPC715G3**	2	**FPC715G11**	2	**FPC715G5**	1	73 (33)
Steel Flange	36	21⅜ (543)	**FPC721G10**	4	**FPC721G3**	2	**FPC721G11**	2	**FPC721G5**	1	78 (36)
12-Copper	48	26⅜ (683)			**FPC726R3**	4	**FPC726R11**	3	**FPC726R5**	2	81 (37)
(9.3 W/cm²)	60	32⅜ (822)			**FPC732G3**	4	**FPC732G11**	3	**FPC732G5**	2	85 (39)
	72	37⅜ (962)			**FPC737R3**	4			**FPC737R5**	2	92 (42)
	100	50⅞ (1292)							**FPC750R5**	4	100 (45)
	120	60⅜ (1534)							**FPC760G5**②	4	110 (50)
60 W/in²	30	15⅜ (391)	**FPC715G10X**	3	**FPC715G3X**	5	**FPC715G11X**	3	**FPC715G5X**	1	76 (35)
Steel Flange	45	21⅜ (543)	**FPC721G10X**	5	**FPC721G3X**	5	**FPC721G11X**	3	**FPC721G5X**	5	82 (38)
15-Copper	60	26⅜ (683)			**FPC726R3X**	5	**FPC726R11X**	3	**FPC726R5X**	5	85 (39)
(9.3 W/cm²)	75	32⅜ (822)			**FPC732G3X**	5	**FPC732G11X**	5	**FPC732G5X**	5	90 (41)
	90	37⅜ (962)			**FPC737R3X**	5			**FPC737R5X**	5	98 (45)
	125	50⅞ (1292)							**FPC750R5X**	5	108 (49)
	150	60⅜ (1534)							**FPC760G5X**②	5	120 (55)
Application: Deionized Water, Demineralized Water											
60 W/in²	24	15¾ (400)	**FPR715N10**	3	**FPR715N3**	2	**FPR715N11**	2	**FPR715N5**	1	73 (33)
316 SS Flange	36	21¾ (552)	**FPR721N10**	4	**FPR721N3**	2	**FPR721N11**	3	**FPR721N5**	1	78 (36)
12-316 SS	48	27¼ (692)			**FPR727E3**	4	**FPR727E11**	3	**FPR727E5**	2	81 (37)
(9.3 W/cm²)	60	32¾ (832)			**FPR732N3**	4	**FPR732N11**	3	**FPR732N5**	2	85 (39)
Passivated	72	38¼ (972)			**FPR738E3**	4			**FPR738E5**	2	92 (42)
	100	51¼ (1302)							**FPR751E5**	4	100 (46)
	120	60¾ (1543)							**FPR760N5**	4	110 (50)

CONTINUED

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

② Standard

③ Must be operated 3-phase wye

Flange Immersion Heaters

6" 150 Lbs ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Deionized Water, Demineralized Water											
60 W/in²	30	15¾ (400)	**FPR715N10X**	3	**FPR715N3X**	5	**FPR715N11X**	3	**FPR715N5X**	1	76 (35)
316 SS Flange	45	21¾ (552)	**FPR721N10X**	5	**FPR721N3X**	5	**FPR721N11X**	3	**FPR721N5X**	5	82 (38)
15-316 SS	60	27¼ (692)			**FPR727E3X**	5	**FPR727E11X**	3	**FPR727E5X**	5	85 (39)
(9.3 W/cm²)	75	32¾ (832)			**FPR732N3X**	5	**FPR732N11X**	5	**FPR732N5X**	5	90 (41)
Passivated	90	38¼ (972)			**FPR738E3X**	5			**FPR738E5X**	5	98 (45)
	125	51¼ (1302)							**FPR751E5X**	5	108 (49)
	150	60¾ (1543)							**FPR760N5X**	5	120 (55)
Application: Process Water											
48 W/in²⑤	18	13⅜ (340)	**FPN713G10**	2	**FPN713G3**	1	**FPN713G11**	1	**FPN713G5**	1	73 (33)
Steel Flange	24	17⅞ (454)	**FPN717R10**	3	**FPN717R3**	2	**FPN717R11**	2	**FPN717R5**	1	75 (34)
12-Incoloy®	30	20⅜ (518)	**FPN720G10**	3	**FPN720G3**	2	**FPN720G11**	2	**FPN720G5**	1	78 (36)
(7.5 W/cm²)	36	25⅜ (645)	**FPN725G10**	4	**FPN725G3**	2	**FPN725G11**	2	**FPN725G5**	1	81 (37)
	48	32⅞ (835)			**FPN732R3**	4	**FPN732R11**	3	**FPN732R5**	2	85 (39)
	60	40⅜ (1026)			**FPN740G3**	4	**FPN740G11**	3	**FPN740G5**	2	92 (42)
	72	47⅞ (1216)			**FPN747R3**	4			**FPN747R5**	2	100 (46)
48 W/in²	23	13⅜ (340)	**FPN713G10X**	3	**FPN713G3X**	5	**FPN713G11X**	1	**FPN713G5X**	1	76 (35)
Steel Flange	30	17⅞ (454)	**FPN717R10X**	3	**FPN717R3X**	5	**FPN717R11X**	3	**FPN717R5X**	1	78 (36)
15-Incoloy®	38	20⅜ (518)	**FPN720G10X**	5	**FPN720G3X**	5	**FPN720G11X**	3	**FPN720G5X**	1	82 (38)
(7.5 W/cm²)	45	25⅜ (645)	**FPN725G10X**	5	**FPN725G3X**	5	**FPN725G11X**	3	**FPN725G5X**	5	85 (39)
	60	32⅞ (835)			**FPN732R3X**	5	**FPN732R11X**	3	**FPN732R5X**	5	90 (41)
	75	40⅜ (1026)			**FPN740G3X**	5	**FPN740G11X**	5	**FPN740G5X**	5	98 (45)
	90	47⅞ (1216)			**FPN747R3X**	5			**FPN747R5X**	5	108 (49)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions											
23 W/in²⑤⑥	12	17⅞ (454)	**FPNA17R10**	2	**FPNA17R3**	1	**FPNA17R11**	1	**FPNA17R5**	1	75 (34)
Steel Flange	18	25⅜ (645)	**FPNA25G10**	2	**FPNA25G3**	1	**FPNA25G11**	1	**FPNA25G5**	1	81 (37)
12-Incoloy®	24	32⅞ (835)	**FPNA32R10**	3	**FPNA32R3**	2	**FPNA32R11**	2	**FPNA32R5**	1	85 (39)
(3.6 W/cm²)	30	40⅜ (1026)	**FPNA40G10**	3	**FPNA40G3**	2	**FPNA40G11**	1	**FPNA40G5**	1	92 (42)
	36	47⅞ (1216)	**FPNA47R10**	4	**FPNA47R3**	2	**FPNA47R11**	2	**FPNA47R5**	1	100 (46)
	50	64⅜ (1635)			**FPNA64G3**	4	**FPNA64G11**	3	**FPNA64G5**	2	110 (50)
	60	76⅞ (1953)			**FPNA76R3**	4	**FPNA76R11**	3	**FPNA76R5**	2	118 (54)
23 W/in²	15	17⅞ (454)	**FPNA17R10X**	3	**FPNA17R3X**	1	**FPNA17R11X**	1	**FPNA17R5X**	1	78 (36)
Steel Flange	23	25⅜ (645)	**FPNA25G10X**	3	**FPNA25G3X**	5	**FPNA25G11X**	1	**FPNA25G5X**	1	85 (39)
15-Incoloy®	30	32⅞ (835)	**FPNA32R10X**	3	**FPNA32R3X**	5	**FPNA32R11X**	3	**FPNA32R5X**	1	90 (41)
(3.6 W/cm²)	38	40⅜ (1026)	**FPNA40G10X**	5	**FPNA40G3X**	5	**FPNA40G11X**	3	**FPNA40G5X**	1	98 (45)
	45	47⅞ (1216)	**FPNA47R10X**	5	**FPNA47R3X**	5	**FPNA47R11X**	3	**FPNA47R5X**	5	108 (49)
	63	64⅜ (1635)			**FPNA64G3X**	5	**FPNA64G11X**	3	**FPNA64G5X**	5	120 (55)
	75	76⅞ (1953)			**FPNA76R3X**	5	**FPNA76R11X**	5	**FPNA76R5X**	5	131 (60)

CONTINUED

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

⑤ 240V~(ac) 3-phase can be rewired wye to produce ⅓ more kW and watt density when operated at 480V~(ac) 3-phase.

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

Tubular and Process Assemblies

Flange Immersion Heaters

6" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils											
23 W/in²	12	17⅞ (454)	**FPS717R10**	2	**FPS717R3**	1	**FPS717R11**	1	**FPS717R5**	1	75 (34)
Steel Flange	18	25⅝ (645)	**FPS725G10**	2	**FPS725G3**	1	**FPS725G11**	1	**FPS725G5**	1	81 (37)
12-Steel	24	32⅞ (835)	**FPS732R10**	3	**FPS732R3**	2	**FPS732R11**	2	**FPS732R5**	1	85 (39)
(3.6 W/cm²)	30	40⅜ (1026)	**FPS740G10**	3	**FPS740G3**	2	**FPS740G11**	2	**FPS740G5**	1	92 (42)
	36	47⅞ (1216)	**FPS747R10**	4	**FPS747R3**	2	**FPS747R11**	2	**FPS747R5**	1	100 (46)
	50	64⅜ (1635)			**FPS764G3**	4	**FPS764G11**	3	**FPS764G5**	2	110 (50)
	60	76⅞ (1953)			**FPS776R3**	4	**FPS776R11**	3	**FPS776R5**	2	118 (54)
23 W/in²	15	17⅞ (454)	**FPS717R10X**	3	**FPS717R3X**	1	**FPS717R11X**	1	**FPS717R5X**	1	78 (36)
Steel Flange	23	25⅝ (645)	**FPS725G10X**	3	**FPS725G3X**	5	**FPS725G11X**	1	**FPS725G5X**	1	85 (39)
15-Steel	30	32⅞ (835)	**FPS732R10X**	3	**FPS732R3X**	5	**FPS732R11X**	3	**FPS732R5X**	1	90 (41)
(3.6 W/cm²)	38	40⅜ (1026)	**FPS740G10X**	5	**FPS740G3X**	5	**FPS740G11X**	3	**FPS740G5X**	1	98 (45)
	45	47⅞ (1216)	**FPS747R10X**	5	**FPS747R3X**	5	**FPS747R11X**	3	**FPS747R5X**	5	108 (49)
	63	64⅜ (1635)			**FPS764G3X**	5	**FPS764G11X**	3	**FPS764G5X**	5	120 (55)
	75	76⅞ (1953)			**FPS776R3X**	5	**FPS776R11X**	5	**FPS776R5X**	5	131 (60)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin											
16 W/in²③	6	13⅜ (340)			**FPN713G12**	1			**FPN713G13**	1	73 (33)
Steel Flange	8	17⅞ (454)			**FPN717R12**	1			**FPN717R13**	1	75 (34)
12-Incoloy®	10	20⅜ (518)			**FPN720G12**	1			**FPN720G13**	1	78 (36)
(2.5 W/cm²)	12	25⅜ (645)			**FPN725G12**	1			**FPN725G13**	1	81 (37)
	16	32⅞ (835)			**FPN732R12**	1			**FPN732R13**	1	85 (39)
	20	40⅜ (1026)			**FPN740G12**	2			**FPN740G13**	1	92 (42)
	24	47⅞ (1216)			**FPN747R12**	2			**FPN747R13**	1	100 (46)
16 W/in²③	7.5	13⅜ (340)			**FPN713G12X**	1			**FPN713G13X**	1	76 (35)
Steel Flange	10	17⅞ (454)			**FPN717R12X**	1			**FPN717R13X**	1	78 (36)
15-Incoloy®	12.5	20⅜ (518)			**FPN720G12X**	1			**FPN720G13X**	1	82 (38)
(2.5 W/cm²)	15	25⅜ (645)			**FPN725G12X**	1			**FPN725G13X**	1	85 (39)
	20	32⅞ (835)			**FPN732R12X**	5			**FPN732R13X**	1	90 (41)
	25	40⅜ (1026)			**FPN740G12X**	5			**FPN740G13X**	1	98 (45)
	30	47⅞ (1216)			**FPN747R12X**	5			**FPN747R13X**	1	108 (49)
Applications: Bunker C and #6 Fuel Oils											
8 W/in²③	8	32⅞ (835)			**FPS732R12**	1			**FPS732R13**	1	85 (39)
Steel Flange	10	40⅜ (1026)			**FPS740G12**	1			**FPS740G13**	1	92 (42)
12-Steel	12	47⅞ (1216)			**FPS747R12**	1			**FPS747R13**	1	100 (46)
(1.3 W/cm²)	16.5	64⅜ (1635)			**FPS764G12**	1			**FPS764G13**	1	110 (50)
	20	76⅞ (1953)			**FPS776R12**	2			**FPS776R13**	1	118 (54)
8 W/in²③	10	32⅞ (835)			**FPS732R12X**	1			**FPS732R13X**	1	90 (41)
Steel Flange	12.5	40⅜ (1026)			**FPS740G12X**	1			**FPS740G13X**	1	98 (45)
15-Steel	15	47⅞ (1216)			**FPS747R12X**	1			**FPS747R13X**	1	108 (49)
(1.3 W/cm²)	21	64⅜ (1635)			**FPS764G12X**	5			**FPS764G13X**	1	120 (55)
	25	76⅞ (1953)			**FPS776R12X**	5			**FPS776R13X**	1	131 (60)

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

③ Must be operated 3-phase wye

Flange Immersion Heaters

6" 150 lb ANSI Flange—FIREBAR Element

FIREBAR Description	kW	Immersed B Dimension inch	(mm)	Code No. 240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs	(kg)
Applications: Process Water, Ethylene Glycol (50%)									
45 W/in²	30	13⅜	(340)	**FPNF13G27**				78	(36)
304 SS Flange	37.5	16	(406)	**FPNF16A27**	5			81	(37)
15-Incoloy®	45	18⅜	(467)	**FPNF18G27**	5			84	(38)
(7 W/cm²)	60	22⅞	(581)	**FPNF22R27**	5	**FPNF22R28**	5	87	(40)
	75	27⅞	(708)	**FPNF27R27**	5	**FPNF27R28**	5	91	(42)
	90	32⅞	(835)	**FPNF32R27**	5	**FPNF32R28**	5	95	(43)
	120	42⅜	(1076)			**FPNF42G28**	5	106	(48)
	150	51⅞	(1318)			**FPNF51R28**	5	116	(53)
Applications: Cooking Oils, Ethylene Glycol (100%)									
30 W/in²③	25	16½	(419)	**FPNF16J12**	5	**FPNF16J13**	5	81	(37)
304 SS Flange	32	19½	(495)	**FPNF19J12**	5	**FPNF19J13**	5	84	(38)
15-Incoloy®	42	24½	(622)	**FPNF24J12**	5	**FPNF24J13**	5	87	(40)
(4.7 W/cm²)	52	30	(762)	**FPNF30A12**	5	**FPNF30A13**	5	91	(42)
	64	35	(889)	**FPNF35A12**	5	**FPNF35A13**	5	95	(43)
	85	45½	(1156)	**FPNF45J12**	5	**FPNF45J13**	5	106	(48)
	110	56	(1422)		5	**FPNF56A13**	5	116	(53)
Applications: Heat Transfer Oils, Mineral Oils, Degreasing Solutions									
23 W/in²④	19	16½	(419)	**FPNF16J20**	5			81	(37)
304 SS Flange	24	19½	(495)	**FPNF19J20**	5			84	(38)
15-Incoloy®	32	24½	(622)	**FPNF24J20**	5	**FPNF24J19**	5	87	(40)
(3.6 W/cm²)	40	30	(762)	**FPNF30A20**	5	**FPNF30A19**	5	91	(42)
	48	35	(889)	**FPNF35A20**	5	**FPNF35A19**	5	95	(43)
	64	45½	(1156)	**FPNF45J20**	5	**FPNF45J19**	5	106	(48)
	80	56	(1422)	**FPNF56A20**	5	**FPNF56A19**	5	116	(53)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin									
15 W/in²③	10	13⅜	(340)	**FPNF13G29**	5			78	(36)
304 SS Flange	12.5	16	(406)	**FPNF16A29**	5			81	(37)
15-Incoloy®	15	18⅜	(467)	**FPNF18G29**	5			84	(38)
(2.3 W/cm²)	20	22⅞	(581)	**FPNF22R29**	5	**FPNF22R30**	5	87	(40)
	25	27⅞	(708)	**FPNF27R29**	5	**FPNF27R30**	5	91	(42)
	30	32⅞	(835)	**FPNF32R29**	5	**FPNF32R30**	5	95	(43)
	40	42⅜	(1076)	**FPNF42G29**	5	**FPNF42G30**	5	106	(48)
	50	51⅞	(1318)	**FPNF51R29**	5	**FPNF51R30**	5	116	(53)
Applications: Bunker C and #6 Fuel Oils, Asphalt									
8 W/in²③	6.3	16½	(419)	**FPNF16J22**	5			81	(37)
304 SS Flange	8.1	19½	(495)	**FPNF19J22**	5			84	(38)
15-Incoloy®	10.6	24½	(622)	**FPNF24J22**	5	**FPNF24J21**	5	87	(40)
(1.3 W/cm²)	13.1	30	(762)	**FPNF30A22**	5	**FPNF30A21**	5	91	(42)
	16	35	(889)	**FPNF35A22**	5	**FPNF35A21**	5	95	(43)
	21.3	45½	(1156)	**FPNF45J22**	5	**FPNF45J21**	5	106	(48)
	26	56	(1422)	**FPNF56A22**	5	**FPNF56A21**	5	116	(53)

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

③ Must be operated 3-phase wye.
④ Can be rewired for 1-phase.

Tubular and Process Assemblies

Flange Immersion Heaters

8" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Clean Water											
60 W/in²	50	21¾ (553)			**FRC721N3②**	3	**FRC721N11**	3	**FRC721N5**	2	118 (54)
Steel Flange	75	29¾ (756)			**FRC729N3②**	6			**FRC729N5②**	2	126 (58)
18-Copper	100	37¼ (946)			**FRC737E3②**	6			**FRC737E5**	3	130 (59)
(9.3 W/cm²)	125	45¼ (1149)			**FRC745E3②**	6			**FRC745E5②**	6	132 (60)
	150	52¾ (1340)							**FRC752N5②**	6	137 (63)
	175	60¾ (1543)							**FRC760N5②**	6	144 (66)
	200	68¼ (1734)							**FRC768E5②**	6	149 (68)
Application: Process Water											
48 W/in²⑤	50	25¾ (654)			**FRN725N3②**	3	**FRN725N11②**	3	**FRN725N5②**	2	121 (55)
Steel Flange	75	35¾ (908)			**FRN735N3②**	6			**FRN735N5②**	2	130 (59)
18-Incoloy®	100	44¼ (1124)			**FRN744E3**	6			**FRN744E5**	3	132 (60)
(7.5 W/cm²)	125	54 1/16 (1389)			**FRN754M3②**	6			**FRN754M5②**	6	140 (64)
	150	63 1/16 (1617)							**FRN763M5②**	6	145 (66)
	175	73 1/16 (1859)							**FRN773D5**	6	151 (69)
	200	82 1/16 (2100)							**FRN782M5②**	6	157 (72)
48 W/in²	67	26 3/16 (665)			**FRN726D3X②**	4	**FRN726D11X②**	3	**FRN726D5X②**	2	129 (59)
Steel Flange	100	36 3/16 (919)			**FRN736D3X②**	8			**FRN736D5X②**	4	142 (65)
24-Incoloy®	133	44 1/16 (1135)			**FRN744M3X②**	8			**FRN744M5X②**	4	147 (67)
(7.5 W/cm²)	167	54 1/16 (1389)			**FRN754M3X②**	8			**FRN754M5X②**	8	158 (72)
	200	63 1/16 (1618)							**FRN763M5X②**	8	166 (76)
	233	73 3/16 (1859)							**FRN773D5X**	8	175 (80)
	267	82 1/16 (2100)							**FRN782M5X②**	8	184 (84)
Application: Forced Air and Gases, Caustic Solutions, Degreasing Solutions											
23 W/in²⑤⑥	30	32¾ (832)	**FRNA32N10②**	3	**FRNA32N3②**	2	**FRNA32N11②**	2	**FRNA32N5②**	1	130 (59)
Steel Flange	40	43¼ (1099)			**FRNA43E3②**	3	**FRNA43E11②**	2	**FRNA43E5②**	2	132 (60)
18-Incoloy®	50	51 1/16 (1313)			**FRNA51M3**	3	**FRNA51M11**	3	**FRNA51M5**	2	137 (63)
(3.6 W/cm²)											
23 W/in²	40	33 3/16 (843)	**FRNA33D10X②**	4	**FRNA33D3X②**	4	**FRNA33D11X②**	2	**FRNA33D5X②**	2	142 (65)
Steel Flange	53	43 1/16 (1110)			**FRNA43M3X②**	4	**FRNA43M11X②**	3	**FRNA43M5X②**	2	147 (67)
24-Incoloy®	67	51 1/16 (1313)			**FRNA51M3X②**	4	**FRNA51M11X②**	3	**FRNA51M5X②**	2	154 (70)
(3.6 W/cm²)											

CONTINUED

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

Truck Shipment only

② Standard

⑤ 240V~(ac) 3-phase can be rewired wye to produce ⅓ more kW and watt density when operated at 480V~(ac) 3-phase.

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

Flange Immersion Heaters

8" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils											
23 W/in²	30	32¾ (832)	**FRS732N10②**	3	**FRS732N3②**	2	**FRS732N11②**	2	**FRS732N5②**	1	130 (59)
Steel Flange	40	43¾ (1099)			**FRS743E3②**	3	**FRS743E11②**	2	**FRS743E5**	2	132 (60)
18-Steel	50	51 1/16 (1313)			**FRS751M3**	3	**FRS751M11**	3	**FRS751M5**	2	137 (63)
(3.6 W/cm²)	60	62 3/16 (1580)			**FRS762D3②**	6	**FRS762D11②**	3	**FRS762D5②**	2	154 (70)
	70	70 1/16 (1795)			**FRS770M3②**	6	**FRS770M11**	6	**FRS770M5**	2	160 (73)
	80	79 1/16 (2024)			**FRS779M3②**	6			**FRS779M5②**	3	172 (78)
23 W/in²	40	33 3/16 (843)	**FRS733D10X②**	4	**FRS733D3X②**	4	**FRS733D11X②**	2	**FRS733D5X②**	2	142 (65)
Steel Flange	53	43 1/16 (1110)			**FRS743M3X②**	4	**FRS743M11X②**	3	**FRS743M5X②**	2	147 (67)
24-Steel	67	51 1/16 (1313)			**FRS751M3X②**	4	**FRS751M11X②**	3	**FRS751M5X②**	2	154 (70)
(3.6 W/cm²)	80	62 3/16 (1580)			**FRS762D3X②**	8	**FRS762D11X②**	4	**FRS762D5X②**	4	166 (76)
	93	70 1/16 (1796)			**FRS770M3X②**	8	**FRS770M11X②**	6	**FRS770M5X②**	4	175 (80)
	107	79 1/16 (2024)			**FRS779M3X②**	8			**FRS779M5X②**	4	181 (82)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin											
16 W/in²③	17	25¾ (654)			**FRN725N12②**	1			**FRN725N13②**	1	121 (55)
Steel Flange	25	35¾ (908)			**FRN735N12②**	2			**FRN735N13②**	1	130 (59)
18-Incoloy®	33	44¼ (1124)			**FRN744E12②**	2			**FRN744E13**	1	132 (60)
(2.5 W/cm²)	42	54 1/16 (1389)			**FRN754M12②**	3			**FRN754M13②**	2	140 (64)
	50	63 1/16 (1618)							**FRN763M13②**	2	145 (66)
	58	73 3/16 (1859)							**FRN773D13**	2	151 (69)
	67	82 1/16 (2100)							**FRN782M13②**	2	157 (72)
16 W/in²③	23	26 3/16 (665)			**FRN726D12X②**	2			**FRN726D13X②**	1	129 (59)
Steel Flange	33	36 3/16 (919)			**FRN736D12X②**	2			**FRN736D13X②**	1	142 (65)
24-Incoloy®	44	44 1/16 (1135)			**FRN744M12X②**	4			**FRN744M13X②**	2	147 (67)
(2.5 W/cm²)	56	54 1/16 (1389)			**FRN754M12X②**	4			**FRN754M13X②**	2	158 (72)
	67	63 1/16 (1618)							**FRN763M13X②**	2	166 (76)
	77	73 3/16 (1859)							**FRN773D13X②**	2	175 (80)
	89	82 1/16 (2100)							**FRN782M13X②**	4	184 (84)
Applications: Bunker C and #6 Fuel Oils											
8 W/in²③	12.5	43¾ (1099)			**FRS743E12②**	1			**FRS743E13②**	1	132 (60)
Steel Flange	16.5	51 1/16 (1313)			**FRS751M12**	1			**FRS751M13**	1	137 (62)
18-Steel	20	62 3/16 (1580)			**FRS762D12②**	2			**FRS762D13②**	1	145 (66)
(1.3 W/cm²)	24	70 1/16 (1795)			**FRS770M12**	2			**FRS770M13**	1	151 (69)
	27	79 1/16 (2024)			**FRS779M12②**	2			**FRS779M13②**	1	155 (71)
8 W/in²③	17	43 1/16 (1110)			**FRS743M12X②**	1			**FRS743M13X②**	1	147 (67)
Steel Flange	22	51 1/16 (1313)			**FRS751M12X②**	2			**FRS751M13X②**	1	154 (70)
24-Steel	27	62 3/16 (1580)			**FRS762D12X②**	2			**FRS762D13X②**	1	166 (76)
(1.3 W/cm²)	32	70 1/16 (1796)			**FRS770M12X②**	2			**FRS770M13X②**	1	175 (80)
	36	79 1/16 (2024)			**FRS779M12X②**	2			**FRS779M13X②**	1	181 (82)

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

Truck Shipment only

② Standard

③ Must be operated 3-phase wye

Tubular and Process Assemblies

Flange Immersion Heaters

10" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 3-Phase	No. of Circuits	Code No. 480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Process Water							
48 W/in²⑤	190	54¾ (1391)			**FSN754N5**②	9	240 (109)
Steel Flange	262	73¼ (1861)			**FSN773E5**	9	260 (118)
27-Incoloy®							
(7.5 W/cm²)							
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions							
23 W/in²⑤⑥	45	33¼ (845)	**FSNA33E3**②	3	**FSNA33E5**②	3	165 (75)
Steel Flange	60	43¾ (1111)	**FSNA43N3**②	3	**FSNA43N5**②	3	195 (89)
27-Incoloy®	75	51¾ (1314)	**FSNA51N3**	9	**FSNA51N5**	3	230 (105)
(3.6 W/cm²)							
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils							
23 W/in²	45	33¼ (845)	**FSS733E3**②	3	**FSS733E5**②	3	165 (75)
Steel Flange	60	43¾ (1111)	**FSS743N3**②	3	**FSS743N5**②	3	195 (89)
27-Steel	75	51¾ (1314)	**FSS751N3**	9	**FSS751N5**	3	230 (105)
(3.6 W/cm²)	90	62¼ (1581)			**FSS762E5**②	3	250 (114)
	105	70¾ (1797)			**FSS770N5**	3	258 (117)
	120	78¾ (2000)			**FSS778N5**②	3	265 (121)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin							
16 W/in²③	63	54¾ (1391)			**FSN754N13**②	3	240 (109)
Steel Flange	75	63¾ (1619)			**FSN763N13**②	3	250 (114)
27-Incoloy®	87	73¼ (1861)			**FSN773E13**	3	258 (117)
(2.5 W/cm²)							
Applications: Bunker C and #6 Fuel Oils							
8 W/in²③	25	51¾ (1314)	**FSS751N12**	3	**FSS751N13**	1	230 (105)
Steel Flange	30	62¼ (1581)	**FSS762E12**②	3	**FSS762E13**②	1	250 (114)
27-Steel	35	70¾ (1797)	**FSS770N12**	3	**FSS770N13**	1	258 (117)
(1.3 W/cm²)	40	78¾ (2000)	**FSS778N12**②	3	**FSS778N13**②	1	265 (121)

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

Truck Shipment only

② Standard

③ Must be operated 3-phase wye.

⑤ 240V~(ac) 3-phase can be rewired wye to produce ⅓ more kW and watt density when operated at 480V~(ac) 3-phase.

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

Flange Immersion Heaters

12" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 3-Phase	No. of Circuits	Code No. 480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Process Water							
48 W/in²	250	54⅝ (1387)			**FTN754L5②**	6	280 (127)
Steel Flange	350	73⅛ (1857)			**FTN773C5**	12	291 (132)
36-Incoloy®							
(7.5 W/cm²)							
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions							
23 W/in²	60	33⅛ (841)			**FTNA33C5②**	3	205 (93)
Steel Flange	80	43⅝ (1108)			**FTNA43L5②**	3	240 (109)
36-Incoloy®	100	51⅝ (1311)			**FTNA51L5**	3	280 (127)
(3.6 W/cm²)							
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils							
23 W/in²	60	33⅛ (841)			**FTS733C5②**	3	205 (93)
Steel Flange	80	43⅝ (1108)			**FTS743L5②**	3	240 (109)
36-Steel	100	51⅝ (1311)			**FTS751L5**	3	280 (127)
(3.6 W/cm²)	120	62⅛ (1578)			**FTS762C5②**	3	285 (130)
	140	70⅝ (1794)			**FTS770L5**	4	290 (132)
	160	78⅝ (1997)			**FTS778L5②**	4	300 (136)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin							
16 W/in²③	83	54⅝ (1387)			**FTN754L13②**	3	280 (127)
Steel Flange	117	73⅛ (1857)			**FTN773C13②**	3	291 (132)
36-Incoloy®							
(2.5 W/cm²)							
Applications: Bunker C and #6 Fuel Oils							
8 W/in²③	34	51⅛ (1311)	**FTS751L12②**	2	**FTS751L13**	1	280 (127)
Steel Flange	40	62⅛ (1578)	**FTS762C12②**	2	**FTS762C13②**	1	285 (130)
36-Steel	47	70⅝ (1794)	**FTS770L12②**	3	**FTS770L13**	2	290 (132)
(1.3 W/cm²)	54	78⅝ (1997)	**FTS778L12②**	3	**FTS778L13②**	2	300 (136)

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

Truck Shipment only

② Standard

③ Must be operated 3-phase wye.

Tubular and Process Assemblies

Flange Immersion Heaters

14" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 3-Phase	No. of Circuits	Code No. 480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Process Water							
48 W/in²	315	54½ (1384)			**FWN754J5**②	15	300 (136)
Steel Flange	375	63½ (1613)			**FWN763J5**②	15	310 (141)
45-Incoloy®							
(7.5 W/cm²)							
Application: Forced Air and Gases, Caustic Solutions, Degreasing Solutions							
23 W/in²	75	33 (838)			**FWNA33A5**②	3	225 (102)
Steel Flange	100	43½ (1105)			**FWNA43J5**②	3	255 (116)
45-Incoloy®	125	51½ (1308)			**FWNA51J5**	5	300 (136)
(3.6 W/cm²)							
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils							
23 W/in²	75	33 (838)			**FWS733A5**②	3	225 (102)
Steel Flange	100	43½ (1105)			**FWS743J5**②	3	255 (116)
45-Steel	125	51½ (1308)			**FWS751J5**	5	300 (136)
(3.6 W/cm²)	150	62 (1575)			**FWS762A5**②	5	310 (141)
	175	70½ (1791)			**FWS770J5**	5	318 (145)
	200	78½ (1994)			**FWS778J5**②	5	330 (150)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin							
16 W/in²③	105	54½ (1384)			**FWN754J13**②	3	300 (136)
Steel Flange	125	63½ (1613)			**FWN763J13**②	5	310 (141)
45-Incoloy®							
(2.5 W/cm²)							
Applications: Bunker C and #6 Fuel Oils							
8 W/in²③	42	51½ (1308)	**FWS751J12**	3	**FWS751J13**	3	300 (136)
Steel Flange	50	62 (1575)	**FWS762A12**②	3	**FWS762A13**②	3	310 (141)
45-Steel	60	70½ (1791)	**FWS770J12**	3	**FWS770J13**	3	318 (144)
(1.3 W/cm²)	67	78½ (1994)	**FWS778J12**②	5	**FWS778J13**②	3	330 (150)

All flange immersion heaters are Assembly Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Standard: 10 working days, depending on size

Truck Shipment only

② Standard

③ Must be operated 3-phase wye.

F.O.B.: Hannibal, Missouri

Flange Immersion Heaters

Build-a-Code

- - -

Flange Immersion Heater Base Code Number①

(Includes general purpose enclosure without thermostat)

Terminal Enclosure Type

S = General purpose (NEMA 1)
W = Moisture resistant (NEMA 4)
E = Explosion resistant (NEMA 7)
E/W = Explosion/moisture resistant (NEMA 7/4)

Thermostat②

Thermocouple③

J = Type J

K = Type K

① Flange immersion heaters are supplied with a standard, general purpose (NEMA 1) terminal enclosure. A thermostat will not fit the standard general purpose terminal enclosure on 2, 2½ and 3 inch flange sizes.

② Code numbers are shown on the Thermostat stock chart on page 425. Check the temperature sensing bulb O.D. to be certain it will fit into the thermowell's I.D.

③ Specify Type J or K thermocouple. If overtemp thermocouple specify orientation horizontal, vertical up or vertical down.

How to Order

To order a stock flange heater, please specify:

- Watlow code number
- Flange size and material
- Volts/watts
- Phase
- Options
- Quantity

If the flange immersion heater is to be configured with options, add the suffix letter(s) to the base flange heater code number, as indicated on the Build-a-Code chart.

If our stock units do not meet your application needs, Watlow will make-to-order.

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

- Application, including media heated, flow rate, pressure, and process operating temperatures
- Volts/watts
- Watt density
- Phase
- Number of circuits
- Number of heating elements
- Element diameter (WATROD only)
- Immersed ('B' dimension) length
- Flange size, rating and material
- No-heat section below the flange
- Terminal enclosure type
- Options
- Quantity

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Modified Stock③: Five to seven working days

Standard: 10 working days

Made-to-Order: Five to seven weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

③ Stock or Assembly Stock units with catalog options.

Tubular and Process Assemblies

Quick Ship

On stock chart units:
- *Same day on most heaters*
- *10 working days on special voltages and/or wattages*
- *15 working days on special element lengths*

Square Flange Immersion Heaters

Designed for use in boilers and industrial storage tanks, square flange immersion heaters offer 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 to 100 W/in² (15.5 W/cm²)
- Wattages to 24kW
- Voltages to 480V~(ac)
- Incoloy® sheath temperatures to 1600°F (870°C)

Features and Benefits

- **2½, 3⅛ and 4½ inch square flanges** easily adapt to application needs.

Flange materials:

WATROD	Steel 304 stainless steel
FIREBAR	Steel Brass

- **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) respectively, protect elements against moisture and other contaminants.
- **WATROD hairpins are repressed (recompacted)** to maintain MgO density, dielectric strength, heat transfer and life.
- **UL® and CSA component recognition** under file numbers E52951 and 31388 respectively. See **pages 268 to 271** for details.

Applications

- Water
- Boiler equipment
- Vapor degreasers
- Fuel oils
- Heat transfer fluids
- Caustic solutions

Available on request:

- **Sheath materials** in copper, 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**

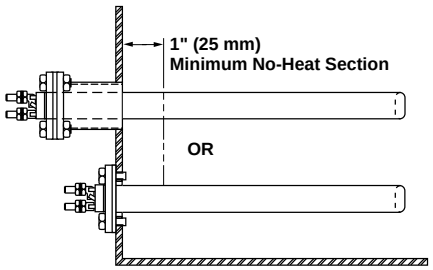
  Consult your Watlow representative for details.

F.O.B.: Hannibal, Missouri

Square Flange Immersion Heaters

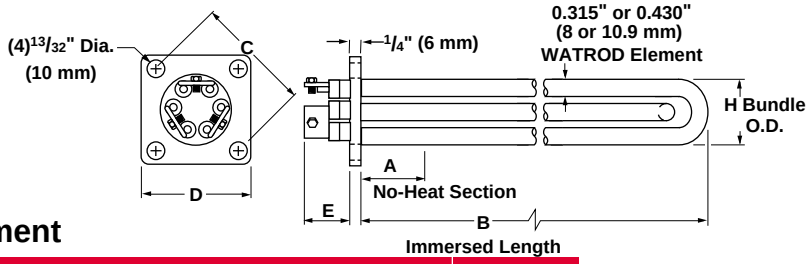
Application Hints

- Determine recommended sheath materials and watt densities by using the ***Element and Assembly Selection Guide*** on **pages 262 to 263**. If wattage is not known, consult 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	Inch	(mm)
A	1½	(38)
C	2½	(64)
D	2 ½	(64)
E	1	(25)
H	1½	(38)



2½" Square Flange—WATROD Element

WATROD Description	kW	Immersed B Dimension inch (mm)	Code No. 240V~(ac) 1-Phase	240V~(ac) 3-Phase	480V~(ac) 1-Phase	480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Clean and Potable Water							
100 W/in² **Steel Flange** **3-Incoloy®** (15.5 W/cm²)	8.0	11¾ (298)	**FHN11N10②**	**FHN11N3②**	**FHN11N11②**	**FHN11N5**	18 (9)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions							
30 W/in² **304 SS Flange** **3-Incoloy®** (4.7 W/cm²)	3.0 3.75	18½ (470) 23 1/16 (586)	**FHN18J10①** **FHN23B10①**	**FHN18J3** **FHN23B3①**	**FHN18J11②** **FHN23B11②**	**FHN18J5②** **FHN23B5②**	19 (9) 20 (9)
25 W/in² **304 SS Flange** **3-Incoloy®** (3.9 W/cm²)	1.5	12 (305)	**FHN12A10①**	**FHN12A3**	**FHN12A11②**	**FHN12A5②**	18 (8)
Applications: Bunker C and #6 Fuel Oils							
10 W/in² **304 SS Flange** **3-Incoloy®** (1.6 W/cm²)	1.0 1.25	18½ (470) 23 1/16 (586)		**FHN18J12①** **FHN23B12①**		**FHN18J13②** **FHN23B13②**	19 (9) 20 (9)
8 W/in² **304 SS Flange** **3-Incoloy®** (1.3 W/cm²)	0.5	12 (305)		**FHN12A12①**		**FHN12A13②**	18 (8)

All square flange heaters are Stock unless otherwise noted.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

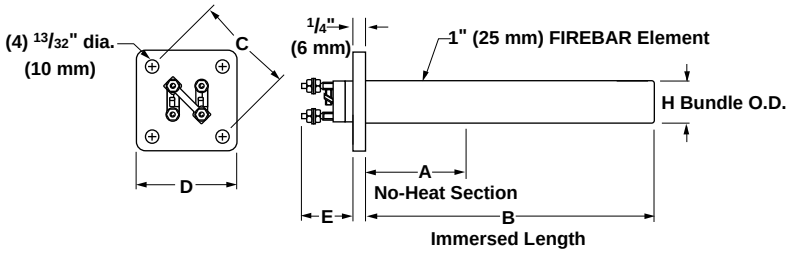
Standard: Six weeks

① Assembly Stock
② Standard

Tubular and Process Assemblies

Square Flange Immersion Heaters

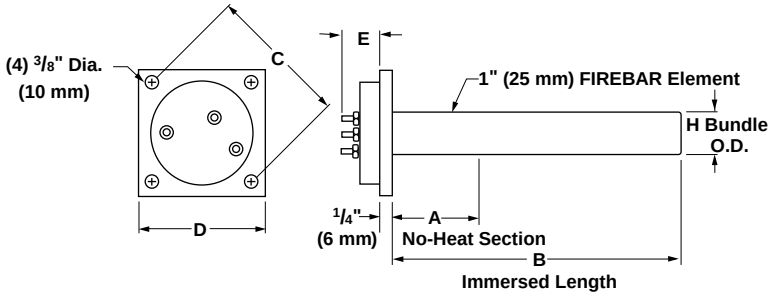
Heater Dimension	Inch	(mm)
A	1½	(38)
C	2½	(64)
D	2½	(64)
E	1¾	(44)
H	1 5/16	(33)



2½" Square Flange—FIREBAR Element

FIREBAR Description	kW	Immersed B Dimension inch (mm)	Code No. 208V~(ac) 3-Phase	240V~(ac) 1-Phase	240V~(ac) 3-Phase	480V~(ac) 1-Phase	480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Clean and Potable Water								
100 W/in²	5	11½ (292)	FHNFA11J26N②	FHNFA11J10N①	FHNFA11J3N①	FHNFA11J11N②	FHNFA11J5N②	5 (3)
Steel Flange	8	20¾ (527)	FHNFA20N26N②	FHNFA20N10N①	FHNFA20N3N①	FHNFA20N11N②	FHNFA20N5N①	7 (4)
1-Incoloy®	10	24⅜ (619)	FHNFA24G26N②	FHNFA24G10N①	FHNFA24G3N②	FHNFA24G11N②	FHNFA24G5N①	8 (4)
(15.5 W/cm²)	15	33 15/16 (862)	FHNFA33S26N②		FHNFA33S3N②	FHNFA33S11N②	FHNFA33S5N①	9 (5)
80 W/in² **Steel Flange** **1-Incoloy®** (12.4 W/cm²)	16	22⅝ (575)	FHNFB22L26J②	FHNFB22L10J②	FHNFB22L3J②	FHNFB22L11J②	FHNFB22L5J②	10 (5)

Heater Dimension	Inch	(mm)
A	1 9/16	(40)
C	3 17/32	(90)
D	3⅛	(74)
E	1 9/16	(40)
H	2⅛	(54)



3⅛" Square Flange—FIREBAR Element

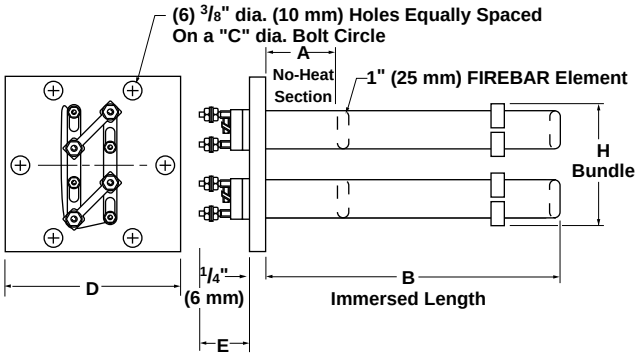
FIREBAR Description	kW	Immersed B Dimension Inch (mm)	Code No. 208V~(ac) 3-Phase	240V~(ac) 3-Phase	480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Clean and Potable Water						
80 W/in² **Brass Flange** **1-Incoloy®** (12.4 W/cm²)	18	24½ (622)	FENFB24J26J①	FENFB24J3J②	FENFB24J5J①	12 (6)
Applications: Process Water, Ethylene Glycol (50%)						
40 W/in² **Brass Flange** **1-Incoloy®** (6.2 W/cm²)	9	24½ (622)	FENFB24J26K②	FENFB24J3K②	FENFB24J5K②	12 (6)

Availability
Stock: Same day shipment
Assembly Stock: Five to seven working days
Standard: Six weeks

① Stock
② Standard

Square Flange Immersion Heaters

Heater Dimension	Inch	(mm)
A	1	(25)
C	3 13/16	(97)
D	4½	(114)
E	2¼	(57)
H	3 7/32	(82)



4½" Square Flange—FIREBAR Element

FIREBAR Description	kW	Immersed B Dimension Inch (mm)	Code No. 208V~(ac) 3-Phase	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Clean and Potable Water						
100 W/in² Steel Flange 2-Incoloy® (15.5 W/cm²)	18	10½ (267)	**FGNFB10J26N②**	**FGNFB10J3N②**	**FGNFB10J5N①**	16 (8)
70 W/in² Steel Flange 2-Incoloy® (10.9 W/cm²)	12	10½ (267)	**FGNFB10J26P①**	**FGNFB10J3P②**	**FGNFB10J5P①**	16 (8)

Availability
Stock: Same day shipment
Assembly Stock: Five to seven working days
Standard: Six weeks

① Stock
② Standard

How to Order

To order a stock unit, please specify:

- Watlow code number
- Flange size and material
- Volts/watts
- Phase
- Quantity

If our stock units do not meet your application needs, Watlow can provide a made-to-order unit. For **made-to-order** units, please specify:

- Application
- Volts/watts
- Phase
- Flange size, dimensions and material
- Sheath material and diameter
- Number of elements
- No-heat section below the flange
- Immersed ('B' dimension) length
- Maximum bundle diameter (H) or clearance hole size
- Bolt pattern, if not standard
- Options
- Quantity

③ Stock or Assembly Stock units with catalog options.

Availability

Stock: Same day shipment

Assembly Stock: Five to seven working days

Modified Stock③: Five to seven working days

Standard: Three weeks

Made-to-Order: Four to six weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

Tubular and Process Assemblies

Circulation Heaters

Quick Ship

On stock chart units:
- *Five to seven working days on all Assembly Stock heaters*
- *10 working days on special voltages and/or wattages*
- *15 working days on special element lengths*

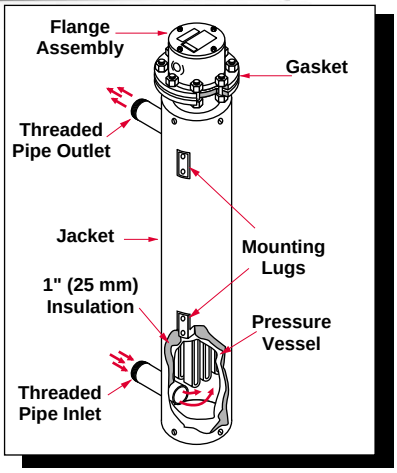
Circulation heaters provide a ready-made means to install electric heating with a minimal amount of time and labor. This is accomplished by combining heating elements, vessel, insulation, terminal enclosure, mounting brackets and inlet and outlet connections into a complete assembly.

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 can meet virtually all your circulation heater assembly needs with made-to-order units. Made-to-order 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 to 120 W/in² (18.6 W/cm²)
- Wattages to one megawatt
- UL® and CSA component recognition to 480V~(ac) and 600V~(ac) respectively
- Ratings to 600 lb pressure class
- Incoloy® sheath temperatures to 1600°F (870°C)
- Passivated 316 stainless steel sheath temperatures to 1200°F (650°C)
- Steel sheath temperatures to 750°F (400°C)
- Copper sheath temperatures to 350°F (175°C)



Features and Benefits

- **Standard screw plugs and flanges** feature a wide selection of WATROD and FIREBAR elements to meet specific application requirements.

Type	Sizes (inch)
NPT Screw Plugs	1¼, 2½
ANSI flanges	3, 4, 5, 6, 8, 10, 12, 14

- **Flange ratings meet recognized agency standards**. ANSI B16.5 Class 150 on:

  Four or six inch FIREBAR element flanges

  Three to 14 inch WATROD element flanges
- **FIREBAR assemblies** pack more wattage in a smaller heater bundle—replaces larger flanges with round tubular elements, with a smaller package.
- **Compacted MgO insulation filled elements** maximize dielectric strength, heat transfer and life.
- **One 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. Comes with protective primer coating.
- **All catalog units rated to ANSI pressure Class 150**. Pressure vessels (tanks) are either carbon or 316 stainless steel.
- **NPT or ANSI Class 150 nozzle connections** make installation easy. Inlet and outlet nozzle connections are:

  Threaded MNPT on eight inch and smaller tanks

  Class 150 flanged connections on 10 inch and larger tanks

Circulation Heaters

Features and Benefits

- **Mounting lugs** are welded onto the tank wall of all 2½ inch NPT and larger units. Lugs are flush with outer insulation jacket and provide mounting support.
- **Flange mounting holes** straddle centerline to comply with industry standards.
- **Standard, general purpose (NEMA 1) terminal enclosures** offer easy access to terminal wiring.
- **UL® and CSA component recognition** under file numbers E52951 and 31388 respectively. See **pages 268 to 271** for details.
- **Branch circuits** are subdivided by National Electric Code (NEC) requirements to a maximum of 48 amps per circuit.

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

Terminal Enclosures

General purpose (NEMA 1) 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 **pages 322 to 324**. For flange terminal enclosures, refer to **pages 340 to 341**.

Stand-off Terminal Enclosures

Stand-off terminal enclosures help protect terminal enclosures against excessive temperatures. For details, refer to **page 340**.

CSA Certified Enclosures

To meet agency recognition requirements, CSA certified moisture and/or explosion resistant terminal enclosures are available. Consult your Watlow representative for details.

Thermostats

To provide process temperature control, Watlow offers optional single and double pole thermostats.

Thermostats are typically mounted in the terminal enclosure. Optional side mounting on vessel also available.

See ***Screw Plug Immersion Heaters***, **page 324**, and ***Flange Immersion Heaters***, on **page 342** for details.

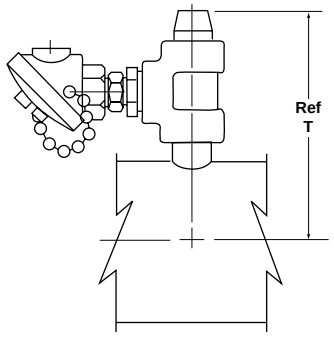
Thermocouples

To sense process or element sheath temperature, ASTM Type J or K thermocouples are available.

See ***Screw Plug Immersion Heaters***, **page 325** and ***Flange Immersion Heaters***, on **page 342** for details.

Process Thermocouple in Nozzle

(Must specify which nozzle)



Ref. Tank Size	Ref. Nozzle Size	Dimension "A"
1 ¼	¾ NPT	8 3/16
2 ½	1 NPT	8 3/16
3	1 NPT	8 3/16
4	1 ½ NPT	10 3/8
5	2 NPT	11 1/16
6	2 ½ NPT	13 3/8
8	2 ½ NPT	14 3/8

For 10 inch and larger tanks consult factory for dimension.

Tubular and Process Assemblies

Circulation Heaters

Options
Continued

Branch Circuits

Branch circuits are subdivided by National Electrical Code (NEC) requirements to a maximum of 48 amps per circuit. Consult factory for circuit requirements other than those listed in the stock charts.

Wattages and Voltages

Watlow routinely supplies circulation heaters with 120 to 480V~(ac) 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, consult your Watlow representative.

Sheath Materials

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

Standard Sheath Materials

WATROD	Incoloy® 316 stainless steel Steel Copper
FIREBAR	Incoloy®

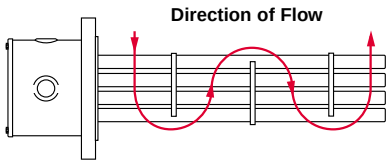
Made-to-Order Sheath Materials

WATROD	304 stainless steel Monel®
FIREBAR	304 stainless steel

Exotic Sheath Materials

Consult your Watlow representative for details and availability.

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.

Consult your Watlow representative for details.

Pressure Vessels

All standard pressure vessel (tank) materials are rated to 150 lb and made from:

- 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 from Assembly Stock on 2½ inch NPT and four or six inch ANSI flange circulation heaters.

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**.

ANSI ratings to 600 lb are available for high-pressure applications. For pressure class ratings above 600 lb, as well as other vessel materials, consult Watlow Process Systems in Troy, Missouri.

Passivated Finish

For critical applications, passivation will remove free iron from all wetted surfaces.

Consult factory for details.

Monel® is a registered trademark of Special Metals Corporation.

Circulation Heaters

Options

Continued

Gaskets

Rubber, asbestos-free and spiral wound gaskets are available for all heater flange, 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 343**.

Inlet and Outlet Nozzle Connections

All inlet and outlet materials are compatible with the pressure vessel material and pressure class rating.

Vessel sizes from 1¼ to eight inches are typically configured with MNPT (Male National 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.

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, consult 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**.

Protective Steel Jacket (Shroud)

To protect circulation heaters from weather or wash-down conditions, fully welded (weatherproof) or partially welded (standard) outer protective steel jackets are available. Standard steel, or made-to-order 304 or 316 stainless steel can be supplied. Jacket diameter is dependent upon thermal insulation thickness.

To order, specify **protective steel jacket, material type** and **weatherproof**, if desired.

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.

Tubular and Process Assemblies

Circulation Heaters

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 inch	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, consult 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 263 to 266**. If unable to determine the correct heating element type and material, consult 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, consult 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).
- 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.

F.O.B.: Hannibal, Missouri

Circulation Heaters

Replacement Heater Assemblies

To help assure minimum process downtime, it's advisable to order and keep on hand a replacement flange or screw plug heater assembly.

Spare and/or replacement screw plug or flange heaters can be ordered by simply providing the complete circulation heater code number and specifying "*replacement heater only.*"

1¼" NPT

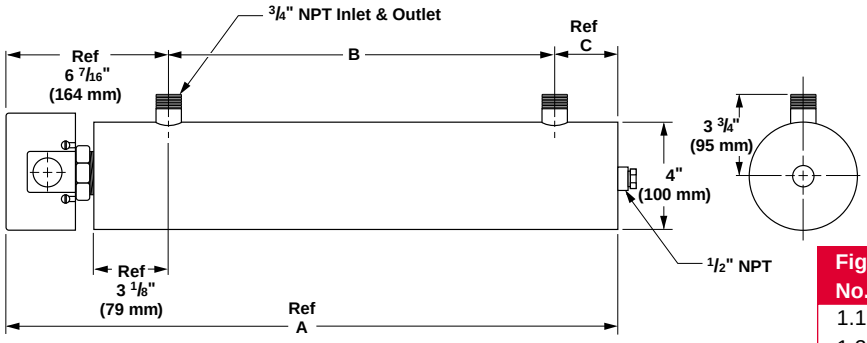


Fig. No.	A Dimension in	A Dimension (mm)	B Dimension in	B Dimension (mm)	C Dimension in	C Dimension (mm)
1.1	24⅝	(625)	15	(381)	3⅛	(79)
1.2	32⅝	(829)	23	(584)	3	(76)
1.3	42⅝	(1083)	32	(813)	4	(102)
1.4	63⅝	(1616)	53	(1346)	4	(102)

1¼" NPT Screw Plug—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 120/240V~(ac) 1-Phase	Code No. 240V~(ac) 1-Phase	Est. Ship. Weight lbs	(kg)
Application: Clean Water						
60 W/in²④	3.0	1.1	**CBEC15A6**		23	(11)
Steel Tank	4.0	1.1		**CBEC19A10**	29	(14)
2-Copper	5.0	1.2		**CBEC23J10**	29	(14)
(9.3 W/cm²)	6.0	1.2		**CBEC27J10**	31	(14)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions						
23 W/in²④	1.0	1.1	**CBEN13G6**		21	(10)
Steel Tank	1.5	1.1	**CBEN19A6**		29	(14)
2-Incoloy®	2.0	1.2	**CBEN24G6**		29	(14)
(3.6 W/cm²)						
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils						
23 W/in²④	1.5	1.1	**CBES19G6**		29	(14)
Steel Tank	2.0	1.2	**CBES25G6**		29	(14)
2-Steel						
(3.6 W/cm²)						

All circulation heaters are Assembly Stock unless otherwise noted.

④ Wired for higher voltage.

Availability

Assembly Stock: Five to seven working days

Standard: 10 working days

Tubular and Process Assemblies

Circulation Heaters

1¼" NPT Screw Plug—FIREBAR Element

FIREBAR Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 1-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs (kg)
Applications: Clean and Potable Water							
90 W/in²⑧	1.5	1.1	**CBDNF7R10②⑦**		**CBDNF7R11②⑦**		26 (12)
Steel Tank	3.0	1.1	**CBDNF11G10②⑦**		**CBDNF11G11②**		26 (12)
1-Incoloy®	5.0	1.1		**CBDNF16G3**		**CBDNF16G5**	26 (12)
(14 W/cm²)	6.5	1.2		**CBDNF19G3**		**CBDNF19G5**	30 (14)
	8.5	1.2		**CBDNF24L3**		**CBDNF24L5**	31 (14)
	10.5	1.3		**CBDNF29R3**		**CBDNF29R5**	43 (20)
	12.75	1.3		**CBDNF34R3**		**CBDNF34R5**	44 (20)
	17.0	1.4		**CBDNF45G3**		**CBDNF45G5**	69 (32)
	21.5	1.4				**CBDNF55R5**	71 (33)
Applications: Process Water, Ethylene Glycol (50%)							
45 W/in²⑧	2.0	1.1		**CBDNF13A27**			25 (12)
Steel Tank	2.5	1.1		**CBDNF15J27**			26 (12)
1-Incoloy®	3.0	1.2		**CBDNF18A27**			30 (14)
(7 W/cm²)	4.0	1.2		**CBDNF22J27**		**CBDNF22J28**	31 (14)
	5.0	1.3		**CBDNF27J27**		**CBDNF27J28**	43 (20)
	6.0	1.3		**CBDNF32J27**		**CBDNF32J28**	44 (20)
	8.0	1.4		**CBDNF42A27**		**CBDNF42A28**	69 (32)
	10.0	1.4		**CBDNF51J27**		**CBDNF51J28**	71 (33)
Applications: Cooking Oils, Ethylene Glycol (100%)							
30 W/in²③	1.7	1.1		**CBDNF16G12**		**CBDNF16G13**	26 (12)
Steel Tank	2.2	1.2		**CBDNF19G12**		**CBDNF19G13**	30 (14)
1-Incoloy®	2.8	1.2		**CBDNF24L12**		**CBDNF24L13**	31 (14)
(4.7 W/cm²)	3.5	1.3		**CBDNF29R12**		**CBDNF29R13**	43 (20)
	4.25	1.3		**CBDNF34R12**		**CBDNF34R13**	44 (20)
	5.7	1.4		**CBDNF45G12**		**CBDNF45G13**	69 (32)
	7.2	1.4		**CBDNF55R12**		**CBDNF55R13**	71 (33)
Applications: Heat Transfer Oils, Lubrication Oils, Mineral Oil, Degreasing Solutions							
23 W/in²⑧	1.25	1.1		**CBDNF16G20**			26 (12)
Steel Tank	1.65	1.2		**CBDNF19G20**			30 (14)
1-Incoloy®	2.15	1.2		**CBDNF24L20**		**CBDNF24L19**	31 (14)
(3.6 W/cm²)	2.65	1.3		**CBDNF29R20**		**CBDNF29R19**	43 (20)
	3.20	1.3		**CBDNF34R20**		**CBDNF34R19**	44 (20)
	4.25	1.4		**CBDNF45G20**		**CBDNF45G19**	69 (32)
	5.40	1.4		**CBDNF55R20**		**CBDNF55R19**	71 (33)

CONTINUED

All circulation heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Five to seven working days
Standard: 10 working days
Truck Shipment only

② Standard
③ Must be operated 3-phase wye.
⑦ Available in 1-phase only.
⑧ Can be wired 1-phase.

Circulation Heaters

1¼" NPT Screw Plug—FIREBAR Element

FIREBAR Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 1-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs	(kg)
Applications: Medium Weight Oils, Heat Transfer Oils, Lube Oils, Liquid Paraffin								
15 W/in²③	0.67	1.1		**CBDNF13A29**			25	(12)
Steel Tank	0.83	1.1		**CBDNF15J29**			26	(12)
1-Incoloy®	1.00	1.2		**CBDNF18A29**			30	(14)
(2.3 W/cm²)	1.33	1.2		**CBDNF22J29**		**CBDNF22J30**	31	(14)
	1.67	1.3		**CBDNF27J29**		**CBDNF27J30**	43	(20)
	2.00	1.3		**CBDNF32J29**		**CBDNF32J30**	44	(20)
	2.67	1.4		**CBDNF42A29**		**CBDNF42A30**	69	(32)
	3.30	1.4		**CBDNF51J29**		**CBDNF51J30**	71	(33)
Applications: Bunker C and #6 Fuel Oils, Asphalt								
8 W/in²③	0.43	1.1		**CBDNF16G22**			26	(12)
Steel Tank	0.55	1.2		**CBDNF19G22**			30	(14)
1-Incoloy®	0.70	1.2		**CBDNF24L22**		**CBDNF24L21**	31	(14)
(1.3 W/cm²)	0.88	1.3		**CBDNF29R22**		**CBDNF29R21**	43	(20)
	1.08	1.3		**CBDNF34R22**		**CBDNF34R21**	44	(20)
	1.40	1.4		**CBDNF45G22**		**CBDNF45G21**	69	(31)
	1.80	1.4		**CBDNF55R22**		**CBDNF55R21**	71	(32)

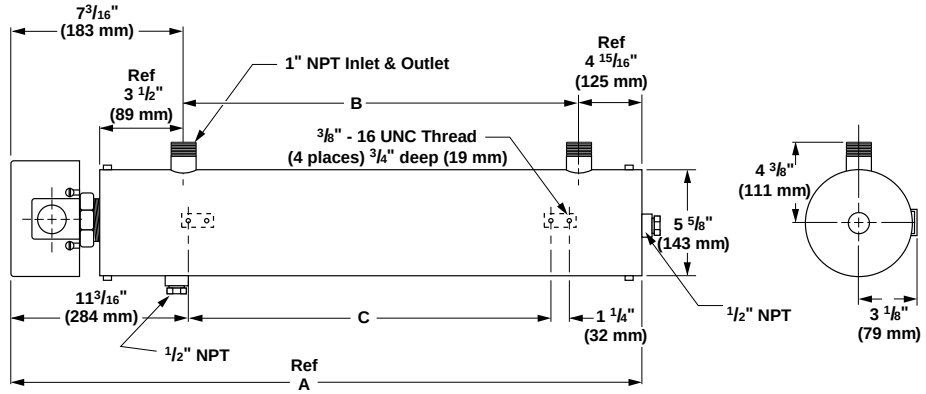
All circulation heaters are Assembly Stock unless otherwise noted.

Availability
Assembly Stock: Five to seven working days
Standard: 10 working days

Truck Shipment only

③ Must be operated 3-phase wye only.

2½" NPT



2½" NPT Screw Plug

Fig. No.	A Dimension in	(mm)	B Dimension in	(mm)	C Dimension in	(mm)
2.1	34 11/16	(881)	22½	(572)	16½	(419)
2.2	44 11/16	(1135)	32½	(1129)	26½	(673)
2.3	57 3/16	(1453)	45	(1143)	39	(991)
2.4	63 11/16	(1618)	51½	(1308)	46½	(1181)
2.5	34 11/16	(881)	22½	(572)	16½	(419)
2.6	44 11/16	(1135)	32½	(1129)	26½	(673)
2.7	57 3/16	(1453)	45	(1143)	39	(991)

Tubular and Process Assemblies

Circulation Heaters

2½" NPT Screw Plug—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs	(kg)
Application: Clean Water						
60 W/in²	6.0	2.5	**CBLC714L3**	**CBLC714L5**	24	(11)
Steel Tank	7.5	2.5	**CBLC717L3**	**CBLC717L5**	24	(11)
3-Copper	9.0	2.5	**CBLC720L3**	**CBLC720L5**	26	(12)
(9.3 W/cm²)	12.0	2.6	**CBLC726C3**	**CBLC726C5**	27	(13)
	15.0	2.6	**CBLC731L3**	**CBLC731L5**	29	(14)
	18.0	2.7	**CBLC737C3**	**CBLC737C5**	30	(14)
Application: Deionized Water, Demineralized Water						
60 W/in²	6.0	2.5	**CBLR714L3**	**CBLR714L5**	24	(11)
316 SS Tank	7.5	2.5	**CBLR717L3**	**CBLR717L5**	24	(11)
3-316 SS	9.0	2.5	**CBLR720L3**	**CBLR720L5**	26	(12)
(9.3 W/cm²)	12.0	2.6	**CBLR726C3**	**CBLR726C5**	27	(13)
Passivated	15.0	2.6	**CBLR731L3**	**CBLR731L5**	29	(14)
	18.0	2.7	**CBLR737C3**	**CBLR737C5**	30	(14)
Application: Process Water						
48 W/in²	6.0	2.5	**CBLN717G3**	**CBLN717G5**	24	(11)
Steel Tank	7.5	2.5	**CBLN719R3**	**CBLN719R5**	26	(12)
3-Incoloy®	9.0	2.5	**CBLN724R3**	**CBLN724R5**	27	(13)
(7.5 W/cm²)	12.0	2.6	**CBLN732G3**	**CBLN732G5**	29	(14)
	15.0	2.7	**CBLN739R3**	**CBLN739R5**	31	(14)
	18.0	2.7	**CBLN747G3**	**CBLN747G5**	32	(15)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions						
23 W/in²⑤⑥	3.0	2.5	**CBLNA17G3**	**CBLNA17G5**	24	(11)
Steel Tank	4.5	2.6	**CBLNA24R3**	**CBLNA24R5**	27	(13)
3-Incoloy®	6.0	2.6	**CBLNA32G3**	**CBLNA32G5**	29	(14)
(3.6 W/cm²)	7.5	2.7	**CBLNA39R3**	**CBLNA39R5**	31	(14)
	9.0	2.7	**CBLNA47G3**	**CBLNA47G5**	32	(15)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils						
23 W/in²⑥	3.0	2.5	**CBLS717E3**	**CBLS717E5**	24	(11)
Steel Tank	4.5	2.5	**CBLS724N3**	**CBLS724N5**	27	(13)
3-Steel	6.0	2.6	**CBLS732E3**	**CBLS732E5**	29	(14)
(3.6 W/cm²)	7.5	2.7	**CBLS739N3**	**CBLS739N5**	31	(14)
	9.0	2.7	**CBLS747E3**	**CBLS747E5**	32	(15)
Applications: Medium Weight Oils, Heat Transfer Oils, Lube Oils, Liquid Paraffin						
16 W/in²③	2.0	2.5	**CBLN717G12**	**CBLN717G13**	24	(11)
Steel Tank	2.5	2.5	**CBLN719R12**	**CBLN719R13**	26	(12)
3-Incoloy®	3.0	2.5	**CBLN724R12**	**CBLN724R13**	27	(13)
(2.5 W/cm²)	4.0	2.6	**CBLN732G12**	**CBLN732G13**	29	(14)
	5.0	2.7	**CBLN739R12**	**CBLN739R13**	31	(14)
	6.0	2.7	**CBLN747G12**	**CBLN747G13**	32	(15)
Applications: Bunker C and #6 Fuel Oils						
8 W/in²③	2.0	2.6	**CBLS732E12**	**CBLS732E13**	29	(14)
Steel Tank	3.0	2.7	**CBLS747E12**	**CBLS747E13**	32	(15)
3-Steel						
(1.3 W/cm²)						

All circulation heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Five to seven working days
Standard: 10 working days

③ Must be operated 3-phase wye only.
⑤ 240V~(ac) can be wired wye and operated at 480V~(ac) 3-phase to produce ⅓ more kW and watt density.
⑥ Can be wired wye to produce ⅓ of the original kW and watt density (3-phase only).

Circulation Heaters

2½" NPT Screw Plug—FIREBAR Element

FIREBAR Description	kW	Fig. No.	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs	(kg)
Applications: Clean and Potable Water						
90 W/in²⑧ Steel Tank 3-Incoloy® (14 W/cm²)	15.0	2.1	**CBLNF15C3**	**CBLNF15C5**	22	(10)
	20.0	2.1	**CBLNF18C3**	**CBLNF18C5③**	23	(11)
	25.0	2.1		**CBLNF23C5**	31	(14)
	32.0	2.2		**CBLNF28L5**	34	(16)
	38.0	2.2		**CBLNF33L5**	35	(16)
Applications: Process Water, Ethylene Glycol (50%)						
45 W/in²⑧ Steel Tank 3-Incoloy® (7 W/cm²)	6.0	2.1	**CBLNF12A27**		21	(10)
	7.5	2.1	**CBLNF14J27**		22	(10)
	9.0	2.1	**CBLNF17A27**		23	(11)
	12.0	2.1	**CBLNF21J27**	**CBLNF21J28**	31	(14)
	15.0	2.2	**CBLNF26J27**	**CBLNF26J28**	34	(16)
	18.0	2.2	**CBLNF31J27**	**CBLNF31J28**	35	(16)
	24.0	2.3		**CBLNF41A28**	44	(20)
	30.0	2.4		**CBLNF50J28**	52	(24)
Applications: Cooking Oils, Ethylene Glycol (100%)						
30 W/in²③ Steel Tank 3-Incoloy® (4.7 W/cm²)	5.0	2.1	**CBLNF15C12**	**CBLNF15C13**	22	(10)
	6.5	2.1	**CBLNF18C12**	**CBLNF18C13**	23	(11)
	8.5	2.1	**CBLNF23C12**	**CBLNF23C13**	31	(14)
	10.5	2.2	**CBLNF28L12**	**CBLNF28L13**	34	(16)
	12.8	2.2	**CBLNF33L12**	**CBLNF33L13**	35	(16)
	17.0	2.3	**CBLNF44C12**	**CBLNF44C13**	44	(20)
	21.5	2.4		**CBLNF54L13**	52	(24)
Applications: Heat Transfer Oils, Mineral Oil, Degreasing Solutions						
23 W/in²⑧ Steel Tank 3-Incoloy® (3.6 W/cm²)	3.8	2.1	**CBLNF15C20**		22	(10)
	4.9	2.1	**CBLNF18C20**		23	(11)
	6.4	2.1	**CBLNF23C20**	**CBLNF23C19**	31	(14)
	7.9	2.2	**CBLNF28L20**	**CBLNF28L19**	34	(16)
	9.6	2.2	**CBLNF33L20**	**CBLNF33L19**	35	(16)
	12.8	2.3	**CBLNF44C20**	**CBLNF44C19**	44	(20)
	16.1	2.4	**CBLNF54L20**	**CBLNF54L19**	52	(24)
Applications: Medium Weight Oils, Heat Transfer Oils, Lube Oils, Liquid Paraffin						
15 W/in²③ Steel Tank 3-Incoloy® (2.3 W/cm²)	2.0	2.1	**CBLNF12A29**		21	(10)
	2.5	2.1	**CBLNF14J29**		22	(10)
	3.0	2.1	**CBLNF17A29**		23	(11)
	4.0	2.1	**CBLNF21J29**	**CBLNF21J30**	31	(14)
	5.0	2.2	**CBLNF26J29**	**CBLNF26J30**	34	(16)
	6.0	2.2	**CBLNF31J29**	**CBLNF31J30**	35	(16)
	8.0	2.3	**CBLNF41A29**	**CBLNF41A30**	44	(20)
	10.0	2.4	**CBLNF50J29**	**CBLNF50J30**	52	(24)
Applications: Bunker C and #6 Fuel Oils, Asphalt						
8 W/in²③ Steel Tank 3-Incoloy® (1.3 W/cm²)	1.25	2.1	**CBLNF15C22**		22	(10)
	1.63	2.1	**CBLNF18C22**		23	(10)
	2.13	2.1	**CBLNF23C22**	**CBLNF23C21**	31	(14)
	2.63	2.2	**CBLNF28L22**	**CBLNF28L21**	34	(15)
	3.19	2.2	**CBLNF33L22**	**CBLNF33L21**	35	(16)
	4.25	2.3	**CBLNF44C22**	**CBLNF44C21**	44	(20)
	5.38	2.4	**CBLNF54L22**	**CBLNF54L21**	52	(24)

All circulation heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Five to seven working days
Standard: 10 working days
Note: Assembly Stock may be shipped same day if ordered before 11:00 am CST.

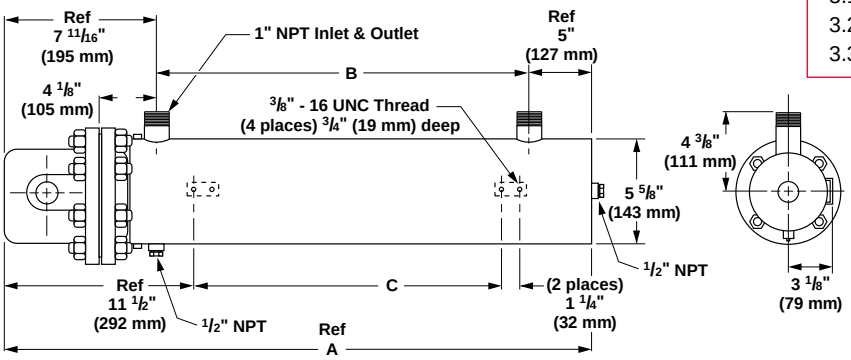
③ Must be operated 3-phase wye only.
⑧ Can be wired 1-phase.

Tubular and Process Assemblies

Circulation Heaters

3" Flange

Fig. No.	A Dimension in	A Dimension (mm)	B Dimension in	B Dimension (mm)	C Dimension in	C Dimension (mm)
3.1	35 3/16	(894)	22 1/2	(573)	16 1/2	(419)
3.2	45 3/16	(1148)	32 1/2	(826)	26 1/2	(673)
3.3	57 11/16	(1465)	45	(1143)	39	(991)



3" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 1-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs	Est. Ship. Weight (kg)
Application: Clean Water								
60 W/in²	6.0	3.1	**CFMC715J10**	**CFMC715J3**	**CFMC715J11**	**CFMC715J5**	66	(30)
Steel Tank	9.0	3.1	**CFMC721J10**	**CFMC721J3**	**CFMC721J11**	**CFMC721J5**	70	(32)
3-Copper	12.0	3.2		**CFMC727A3**	**CFMC727A11**	**CFMC727A5**	80	(37)
(9.3 W/cm²)	15.0	3.2		**CFMC732J3**	**CFMC732J11**	**CFMC732J5**	96	(44)
	18.0	3.3		**CFMC738A3**	**CFMC738A11**	**CFMC738A5**	98	(45)
Application: Process Water								
48 W/in²⑤	6.0	3.1	**CFMN718A10**	**CFMN718A3**	**CFMN718A11**	**CFMN718A5**	68	(31)
Steel Tank	7.5	3.1	**CFMN720J10**	**CFMN720J3**	**CFMN720J11**	**CFMN720J5**	70	(32)
3-Incoloy®	9.0	3.2	**CFMN725J10**	**CFMN725J3**	**CFMN725J11**	**CFMN725J5**	78	(36)
(7.5 W/cm²)	12.0	3.2		**CFMN733A3**	**CFMN733A11**	**CFMN733A5**	96	(44)
	15.0	3.3		**CFMN740J3**	**CFMN740J11**	**CFMN740J5**	100	(46)
	18.0	3.3		**CFMN748A3**	**CFMN748A11**	**CFMN748A5**	107	(49)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions								
23 W/in²⑤⑥	3.0	3.1	**CFMNA18A10**	**CFMNA18A3**	**CFMNA18A11**	**CFMNA18A5**	68	(31)
Steel Tank	4.5	3.2	**CFMNA25J10**	**CFMNA25J3**	**CFMNA25J11**	**CFMNA25J5**	78	(36)
3-Incoloy®	6.0	3.2	**CFMNA33A10**	**CFMNA33A3**	**CFMNA33A11**	**CFMNA33A5**	96	(44)
(3.6 W/cm²)	7.5	3.3	**CFMNA40J10**	**CFMNA40J3**	**CFMNA40J11**	**CFMNA40J5**	100	(46)
	9.0	3.3	**CFMNA48A10**	**CFMNA48A3**	**CFMNA48A11**	**CFMNA48A5**	107	(49)

CONTINUED

All circulation heaters are Assembly Stock unless otherwise noted.

Availability

Assembly Stock: Five to seven working days

Standard: 10 working days

Truck Shipment only

⑤ 240V~(ac) can be wired wye and operated at 480V~(ac) 3-phase to produce ⅓ more kW and watt density.

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

Circulation Heaters

3" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 1-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs	Est. Ship. Weight (kg)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils								
23 W/in²	3.0	3.1	**CFMS718A10**	**CFMS718A3**	**CFMS718A11**	**CFMS718A5**	68	(31)
Steel Tank	4.5	3.1	**CFMS725J10**	**CFMS725J3**	**CFMS725J11**	**CFMS725J5**	78	(36)
3-Steel	6.0	3.2	**CFMS733A10**	**CFMS733A3**	**CFMS733A11**	**CFMS733A5**	96	(44)
(3.6 W/cm²)	7.5	3.3	**CFMS740J10**	**CFMS740J3**	**CFMS740J11**	**CFMS740J5**	100	(46)
	9.0	3.3	**CFMS748A10**	**CFMS748A3**	**CFMS748A11**	**CFMS748A5**	107	(49)
Applications: Medium Weight Oils, Heat Transfer Oils, Lube Oils, Liquid Paraffin								
16 W/in²③	2.0	3.1		**CFMN718A12**		**CFMN718A13**	68	(31)
Steel Tank	2.5	3.1		**CFMN720J12**		**CFMN720J13**	70	(32)
3-Incoloy®	3.0	3.2		**CFMN725J12**		**CFMN725J13**	78	(36)
(2.6 W/cm²)	4.0	3.2		**CFMN733A12**		**CFMN733A13**	96	(44)
	5.0	3.3		**CFMN740J12**		**CFMN740J13**	100	(46)
	6.0	3.3		**CFMN748A12**		**CFMN748A13**	107	(49)
Applications: Bunker C and #6 Fuel Oils								
8 W/in²③	2.0	3.2		**CFMS733A12**		**CFMS733A13**	96	(44)
Steel Tank	3.0	3.3		**CFMS748A12**		**CFMS748A13**	107	(49)
3-Steel								
(1.3 W/cm²)								

All circulation heaters are Assembly Stock unless otherwise noted.

Availability

Assembly Stock: Five to seven working days

Standard: 10 working days

Truck Shipment only

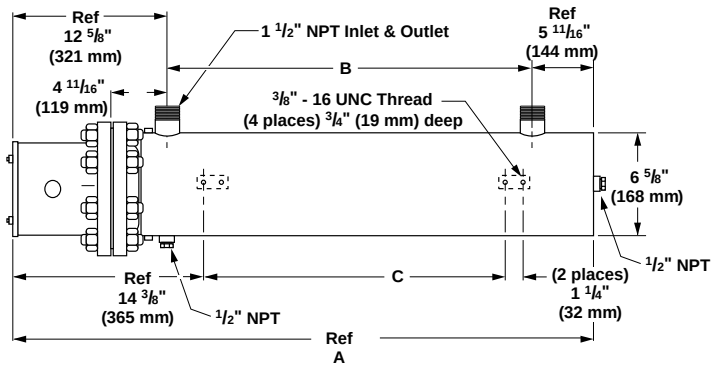
③ Must be operated 3-phase wye only.

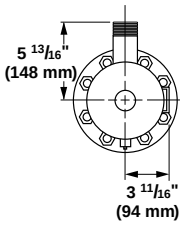
Tubular and Process Assemblies

Circulation Heaters

4" Flange

Fig. No.	A Dimension in	A Dimension (mm)	B Dimension in	B Dimension (mm)	C Dimension in	C Dimension (mm)
4.1	38 15/16	(989)	20 1/2	(521)	17	(432)
4.2	49 7/16	(1256)	31	(787)	27 1/2	(699)
4.3	70 7/16	(1789)	52	(1321)	48 1/2	(1232)
4.4	91 7/16	(2326)	73	(1854)	66	(1676)





4" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Clean Water											
60 W/in²	12	4.1	**CFOC715J10**	2	**CFOC715J3**	1	**CFOC715J11**	1	**CFOC715J5**	1	124 (57)
Steel Tank	18	4.1	**CFOC721J10**	2	**CFOC721J3**	1	**CFOC721J11**	1	**CFOC721J5**	1	127 (58)
6-Copper	24	4.2	**CFOC727A10**	2	**CFOC727A3**	2	**CFOC727A11**	1	**CFOC727A5**	1	160 (73)
(9.3 W/cm²)	30	4.2			**CFOC732J3**	2	**CFOC732J11**	2	**CFOC732J5**	1	163 (74)
	36	4.3			**CFOC738A3**	2	**CFOC738A11**	2	**CFOC738A5**	1	229 (104)
	50	4.3							**CFOC751A5**②	2	234 (107)
	60	4.4							**CFOC760J5**②	2	297 (135)
Application: Deionized Water, Demineralized Water											
60 W/in²	12	4.1	**CFOR716A10**	1	**CFOR716A3**	1	**CFOR716A11**	1	**CFOR716A5**	1	124 (57)
316 SS Tank	18	4.1	**CFOR722A10**	2	**CFOR722A3**	1	**CFOR722A11**	1	**CFOR722A5**	1	127 (58)
6-316 SS	24	4.2	**CFOR727J10**	2	**CFOR727J3**	2	**CFOR727J11**	1	**CFOR727J5**	1	160 (73)
(9.3 W/cm²)	30	4.2			**CFOR733A3**	2	**CFOR733A11**	2	**CFOR733A5**	1	163 (74)
Passivated	36	4.3			**CFOR738J3**	2	**CFOR738J11**	2	**CFOR738J5**	1	229 (104)
	50	4.3							**CFOR751J5**	2	234 (106)
	60	4.4							**CFOR761A5**	2	297 (135)
Application: Process Water											
48 W/in²	9	4.1	**CFON713J10**	1	**CFON713J3**	1	**CFON713J11**	1	**CFON713J5**	1	122 (56)
Steel Tank	12	4.1	**CFON718A10**	2	**CFON718A3**	1	**CFON718A11**	1	**CFON718A5**	1	125 (57)
6-Incoloy®	15	4.1	**CFON720J10**	2	**CFON720J3**	1	**CFON720J11**	2	**CFON720J5**	1	127 (58)
(7.5 W/cm²)	18	4.1	**CFON725J10**	2	**CFON725J3**	1	**CFON725J11**	1	**CFON725J5**	1	160 (73)
	24	4.2	**CFON733A10**	2	**CFON733A3**	2	**CFON733A11**	1	**CFON733A5**	1	163 (74)
	30	4.3			**CFON740J3**	2	**CFON740J11**	2	**CFON740J5**	1	229 (104)
	36	4.3			**CFON748A3**	2	**CFON748A11**	2	**CFON748A5**	1	234 (107)

CONTINUED

All circulation heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Five to seven working days
Standard:10 working days
Truck Shipment only

② Standard

Circulation Heaters

4" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions											
23 W/in²⑤⑥	6	4.1	**CFONA18A10**	1	**CFONA18A3**	1	**CFONA18A11**	1	**CFONA18A5**	1	125 (57)
Steel Tank	9	4.1	**CFONA25J10**	1	**CFONA25J3**	1	**CFONA25J11**	1	**CFONA25J5**	1	160 (73)
6-Incoloy®	12	4.2	**CFONA33A10**	2	**CFONA33A3**	1	**CFONA33A11**	1	**CFONA33A5**	1	163 (74)
(3.6 W/cm²)	15	4.3	**CFONA40J10**	2	**CFONA40J3**	1	**CFONA40J11**	1	**CFONA40J5**	1	229 (104)
	18	4.3	**CFONA48A10**	2	**CFONA48A3**	1	**CFONA48A11**	1	**CFONA48A5**	1	234 (107)
	25	4.4			**CFONA64J3**	2	**CFONA64J11**	2	**CFONA64J5**	1	298 (136)
	30	4.4			**CFONA77A3**	2	**CFONA77A11**	2	**CFONA77A5**	1	306 (139)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils											
23 W/in²	6	4.1	**CFOS718A10**	1	**CFOS718A3**	1	**CFOS718A11**	1	**CFOS718A5**	1	125 (57)
Steel Tank	9	4.1	**CFOS725J10**	1	**CFOS725J3**	1	**CFOS725J11**	1	**CFOS725J5**	1	160 (73)
6-Steel	12	4.2	**CFOS733A10**	2	**CFOS733A3**	1	**CFOS733A11**	1	**CFOS733A5**	1	163 (74)
(3.6 W/cm²)	15	4.3	**CFOS740J10**	2	**CFOS740J3**	1	**CFOS740J11**	1	**CFOS740J5**	1	229 (104)
	18	4.3	**CFOS748A10**	2	**CFOS748A3**	1	**CFOS748A11**	1	**CFOS748A5**	1	234 (107)
	25	4.4			**CFOS764J3**	2	**CFOS764J11**	2	**CFOS764J5**	1	298 (136)
	30	4.4			**CFOS777A3**	2	**CFOS777A11**	2	**CFOS777A5**	1	306 (139)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin											
16 W/in²③	3	4.1			**CFON713J12**	1			**CFON713J13**	1	122 (56)
Steel Tank	4	4.1			**CFON718A12**	1			**CFON718A13**	1	125 (57)
6-Incoloy®	5	4.1			**CFON720J12**	1			**CFON720J13**	1	127 (58)
(2.6 W/cm²)	6	4.1			**CFON725J12**	1			**CFON725J13**	1	160 (73)
	8	4.2			**CFON733A12**	1			**CFON733A13**	1	163 (74)
	10	4.3			**CFON740J12**	2			**CFON740J13**	1	229 (104)
	12	4.3			**CFON748A12**	1			**CFON748A13**	1	234 (107)
Applications: Bunker C and #6 Fuel Oils											
8 W/in²③	5	4.3			**CFOS740J12**	1			**CFOS740J13**	1	229 (104)
Steel Tank	6	4.3			**CFOS748A12**	1			**CFOS748A13**	1	234 (106)
6-Steel	8	4.4			**CFOS764J12**	1			**CFOS764J13**	1	298 (135)
(1.3 W/cm²)	10	4.4			**CFOS777A12**	1			**CFOS777A13**	1	306 (139)

All circulation heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Five to seven working days
Standard: 10 working days
Truck Shipment only

③ Must be operated 3-phase wye only.
⑤ 240V~(ac) can be wired wye and operated at 480V~(ac) 3-phase to produce ⅓ more kW and watt density.
⑥ Can be wired wye to produce ⅓ of the original kW and watt density (3-phase only).

Tubular and Process Assemblies

Circulation Heaters

4" 150 lb ANSI Flange—FIREBAR Element

FIREBAR Description	kW	Fig. No.	Code No. 240V~(ac) 3-Phase	No. of Circuits	Code No. 480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Process Water, Ethylene Glycol (50%)							
45 W/in²	12.0	4.1	**CFONF13G27**	1			125 (57)
Steel Tank	15.0	4.1	**CFONF16A27**	1			128 (58)
6-Incoloy®	18.0	4.1	**CFONF18G27**	1			130 (59)
(7 W/cm²)	24.0	4.1	**CFONF22R27**	2	**CFONF22R28**	1	133 (61)
	30.0	4.2	**CFONF27R27**	2	**CFONF27R28**	1	168 (77)
	36.0	4.2	**CFONF32R27**	2	**CFONF32R28**	1	170 (78)
	48.0	4.3			**CFONF42G28**	2	236 (107)
	60.0	4.3			**CFONF51R28**	2	240 (109)
Applications: Cooking Oils, Ethylene Glycol (100%)							
30 W/in²	10.0	4.1	**CFONF16J12**	1	**CFONF16J13**	1	128 (58)
Steel Tank	13.0	4.1	**CFONF19J12**	1	**CFONF19J13**	1	130 (59)
6-Incoloy®	17.0	4.1	**CFONF24J12**	1	**CFONF24J13**	1	133 (61)
(4.7 W/cm²)	21.0	4.2	**CFONF30A12**	2	**CFONF30A13**	1	168 (77)
	25.5	4.2	**CFONF35A12**	2	**CFONF35A13**	1	170 (78)
	34.0	4.3	**CFONF45J12**	2	**CFONF45J13**	1	236 (107)
	43.0	4.3			**CFONF56A13**	2	240 (109)
Applications: Heat Transfer Oils, Mineral Oils, Degreasing Solutions							
23 W/in²④	7.5	4.1	**CFONF16J20**	1			128 (58)
Steel Tank	10.0	4.1	**CFONF19J20**	1			130 (59)
6-Incoloy®	12.8	4.1	**CFONF24J20**	1	**CFONF24J19**	1	133 (61)
(3.6 W/cm²)	15.8	4.2	**CFONF30A20**	1	**CFONF30A19**	1	168 (77)
	19.0	4.2	**CFONF35A20**	1	**CFONF35A19**	1	170 (78)
	25.0	4.3	**CFONF45J20**	2	**CFONF45J19**	1	236 (107)
	32.3	4.3	**CFONF56A20**	2	**CFONF56A19**	1	240 (109)
Applications: Medium Weight Oils, Heat Transfer Oils, Lube Oils, Liquid Paraffin							
15 W/in²③	4.0	4.1	**CFONF13G29**	1			125 (57)
Steel Tank	5.0	4.1	**CFONF16A29**	1			128 (58)
6-Incoloy®	6.0	4.1	**CFONF18G29**	1			130 (59)
(2.3 W/cm²)	8.0	4.1	**CFONF22R29**	1	**CFONF22R30**	1	133 (61)
	10.0	4.2	**CFONF27R29**	1	**CFONF27R30**	1	168 (77)
	12.0	4.2	**CFONF32R29**	1	**CFONF32R30**	1	170 (78)
	16.0	4.3	**CFONF42G29**	1	**CFONF42G30**	1	236 (107)
	20.0	4.3	**CFONF51R29**	1	**CFONF51R30**	1	240 (109)
Applications: Bunker C and #6 Fuel Oils, Asphalt							
8 W/in²③	2.5	4.1	**CFONF16J22**	1			128 (58)
Steel Tank	3.25	4.1	**CFONF19J22**	1			130 (59)
6-Incoloy®	4.25	4.1	**CFONF24J22**	1	**CFONF24J21**	1	133 (61)
(1.3 W/cm²)	5.25	4.2	**CFONF30A22**	1	**CFONF30A21**	1	168 (77)
	6.38	4.2	**CFONF35A22**	1	**CFONF35A21**	1	170 (77)
	8.5	4.3	**CFONF45J22**	1	**CFONF45J21**	1	236 (107)
	10.75	4.3	**CFONF56A22**	1	**CFONF56A21**	1	240 (109)

All circulation heaters are Assembly Stock unless otherwise noted.

Availability

Assembly Stock: Five to seven working days

Standard: 10 working days

Truck Shipment only

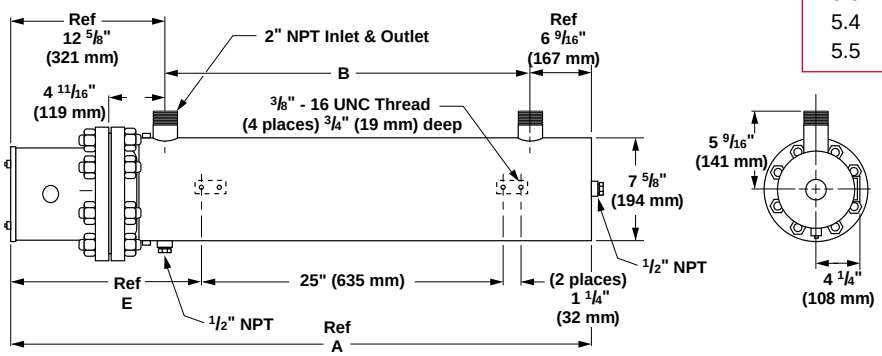
③ Must be operated 3-phase wye only.

④ Wired for higher voltage.

Circulation Heaters

5"Flange

Fig. No.	A Dimension in	A Dimension (mm)	B Dimension in	B Dimension (mm)	E Dimension in	E Dimension (mm)
5.1	49 3/16	(1249)	30	(762)	14 7/8	(378)
5.2	56 3/16	(1427)	37	(940)	18 9/16	(471)
5.3	67 11/16	(1719)	48 1/2	(1232)	24 15/16	(633)
5.4	81 1/16	(2059)	61 7/8	(1572)	30 7/8	(784)
5.5	94 1/16	(2389)	74 7/8	(1902)	37 15/16	(964)



5" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs	(kg)
Application: Clean Water												
60 W/in²	24	5.1	**CFNC727A10**	3	**CFNC727A3**	2	**CFNC727A11**	3	**CFNC727A5**	1	140	(64)
Steel Tank	30	5.1			**CFNC732J3**	2	**CFNC732J11**	2	**CFNC732J5**	1	142	(65)
6-Copper	36	5.2			**CFNC738A3**	2	**CFNC738A11**	2	**CFNC738A5**	1	160	(73)
(9.3 W/cm²)	50	5.3							**CFNC751A5**	2	180	(82)
	60	5.4							**CFNC760J5**②	2	190	(87)
60 W/in²	36	5.1			**CFNC727A3X**	3	**CFNC727A11X**	3	**CFNC727A5X**	1	145	(66)
Steel Tank	45	5.1			**CFNC732J3X**	3	**CFNC732J11X**	3	**CFNC732J5X**	3	147	(67)
9-Copper	54	5.2			**CFNC738A3X**	3	**CFNC738A11X**	3	**CFNC738A5X**	3	166	(76)
(9.3 W/cm²)	75	5.3							**CFNC751A5X**	3	188	(86)
	90	5.4							**CFNC760J5X**②	3	200	(91)
Application: Process Water												
48 W/in²⑤	24	5.1	**CFNN733A10**	3	**CFNN733A3**	2	**CFNN733A11**	3	**CFNN733A5**	1	145	(66)
Steel Tank	30	5.2			**CFNN740J3**	2	**CFNN740J11**	2	**CFNN740J5**	1	167	(76)
6-Incoloy®	36	5.3			**CFNN748A3**	2	**CFNN748A11**	2	**CFNN748A5**	1	180	(82)
(7.5 W/cm²)												
48 W/in²	36	5.1			**CFNN733A3X**	3	**CFNN733A11X**	3	**CFNN733A5X**	1	150	(68)
Steel Tank	45	5.2			**CFNN740J3X**	3	**CFNN740J11X**	3	**CFNN740J5X**	3	173	(79)
9-Incoloy®	54	5.3			**CFNN748A3X**	3	**CFNN748A11X**	3	**CFNN748A5X**	3	188	(86)
(7.5 W/cm²)												

CONTINUED

All circulation heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Five to seven working days
Standard: 10 working days
Truck Shipment only

② Standard
⑤ 240V~(ac) can be wired wye and operated at 480V~(ac) 3-phase to produce ⅓ more kW and watt density.

Tubular and Process Assemblies

Circulation Heaters

5" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions											
23 W/in²⑤⑥	9	5.1	**CFNNA25J10**	1	**CFNNA25J3**	1	**CFNNA25J11**	1	**CFNNA25J5**	1	140 (64)
Steel Tank	12	5.2	**CFNNA33A10**	2	**CFNNA33A3**	1	**CFNNA33A11**	1	**CFNNA33A5**	1	145 (66)
6-Incoloy®	15	5.2	**CFNNA40J10**	2	**CFNNA40J3**	1	**CFNNA40J11**	1	**CFNNA40J5**	1	167 (76)
(3.6 W/cm²)	18	5.3	**CFNNA48A10**	2	**CFNNA48A3**	1	**CFNNA48A11**	1	**CFNNA48A5**	1	180 (82)
	25	5.4			**CFNNA64J3**	2	**CFNNA64J11**	2	**CFNNA64J5**	1	195 (89)
	30	5.5			**CFNNA77A3**	2	**CFNNA77A11**	2	**CFNNA77A5**	1	220 (100)
23 W/in²	14	5.1	**CFNNA25J10X**	3	**CFNNA25J3X**	1	**CFNNA25J11X**	1	**CFNNA25J5X**	1	140 (66)
Steel Tank	18	5.2	**CFNNA33A10X**	3	**CFNNA33A3X**	1	**CFNNA33A11X**	1	**CFNNA33A5X**	1	145 (68)
9-Incoloy®	23	5.2	**CFNNA40J10X**	3	**CFNNA40J3X**	3	**CFNNA40J11X**	1	**CFNNA40J5X**	1	167 (79)
(3.6 W/cm²)	27	5.3	**CFNNA48A10X**	3	**CFNNA48A3X**	3	**CFNNA48A11X**	3	**CFNNA48A5X**	1	180 (86)
	38	5.4			**CFNNA64J3X**	3	**CFNNA64J11X**	3	**CFNNA64J5X**	1	195 (94)
	45	5.5			**CFNNA77A3X**	3	**CFNNA77A11X**	3	**CFNNA77A5X**	3	220 (106)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils											
23 W/in²	12	5.2	**CFNS733A10**	2	**CFNS733A3**	1	**CFNS733A11**	1	**CFNS733A5**	1	145 (66)
Steel Tank	15	5.2	**CFNS740J10**	2	**CFNS740J3**	1	**CFNS740J11**	1	**CFNS740J5**	1	167 (76)
6-Steel	18	5.3	**CFNS748A10**	2	**CFNS748A3**	3	**CFNS748A11**	1	**CFNS748A5**	1	180 (82)
(3.6 W/cm²)	25	5.4			**CFNS764J3**	2	**CFNS764J11**	2	**CFNS764J5**	1	195 (89)
	30	5.5			**CFNS777A3**	2	**CFNS777A11**	2	**CFNS777A5**	1	220 (100)
23 W/in²	18	5.2	**CFNS733A10X**	3	**CFNS733A3X**	1	**CFNS733A11X**	1	**CFNS733A5X**	1	150 (68)
Steel Tank	23	5.2	**CFNS740J10X**	3	**CFNS740J3X**	3	**CFNS740J11X**	1	**CFNS740J5X**	1	173 (79)
9-Steel	27	5.3	**CFNS748A10X**	3	**CFNS748A3X**	1	**CFNS748A11X**	3	**CFNS748A5X**	1	188 (86)
(3.6 W/cm²)	38	5.4			**CFNS764J3X**	3	**CFNS764J11X**	3	**CFNS764J5X**	1	206 (94)
	45	5.5			**CFNS777A3X**	3	**CFNS777A11X**	3	**CFNS777A5X**	3	233 (106)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin											
16 W/in²③	8	5.1			**CFNN733A12**	1			**CFNN733A13**	1	145 (66)
Steel Tank	10	5.2			**CFNN740J12**	1			**CFNN740J13**	1	167 (76)
6-Incoloy®	12	5.3			**CFNN748A12**	1			**CFNN748A13**	1	180 (82)
(2.6 W/cm²)											
16 W/in²③	12	5.1			**CFNN733A12X**	1			**CFNN733A13X**	1	150 (68)
Steel Tank	15	5.2			**CFNN740J12X**	1			**CFNN740J13X**	1	173 (79)
9-Incoloy®	18	5.3			**CFNN748A12X**	1			**CFNN748A13X**	1	188 (86)
(2.6 W/cm²)											
Applications: Bunker C and #6 Fuel Oils											
8 W/in²③	5	5.2			**CFNS740J12**	1			**CFNS740J13**	1	167 (76)
Steel Tank	6	5.3			**CFNS748A12**	1			**CFNS748A13**	1	180 (82)
6-Steel	8	5.4			**CFNS764J12**	1			**CFNS764J13**	1	195 (89)
(1.3 W/cm²)	10	5.5			**CFNS777A12**	1			**CFNS777A13**	1	220 (100)
8 W/in²③	7.5	5.2			**CFNS740J12X**	1			**CFNS740J13X**	1	173 (79)
Steel Tank	9	5.3			**CFNS748A12X**	1			**CFNS748A13X**	1	188 (86)
9-Steel	12	5.4			**CFNS764J12X**	1			**CFNS764J13X**	1	206 (94)
(1.3 W/cm²)	15	5.5			**CFNS777A12X**	1			**CFNS777A13X**	1	233 (106)

All circulation heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Five to seven working days
Standard: 10 working days
Truck Shipment only

③ Must be operated 3-phase wye only.
⑤ 240V~(ac) can be wired wye and operated at 480V~(ac) 3-phase to produce ⅓ more kW and watt density.
⑥ Can be wired wye to produce ⅓ of the original kW and watt density (3-phase only).

Circulation Heaters

6" Flange

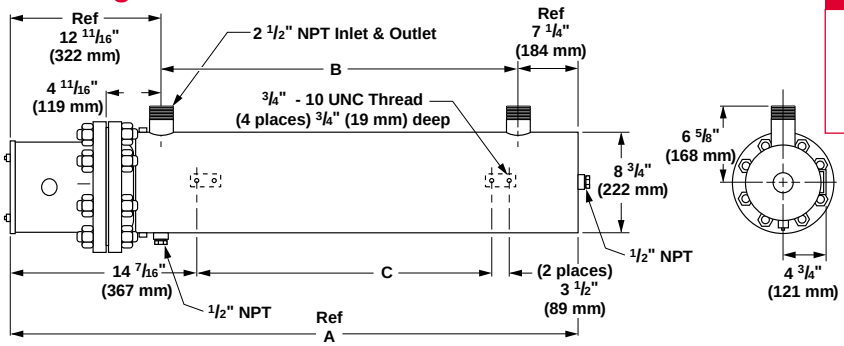


Fig. No.	A Dimension in	(mm)	B Dimension in	(mm)	C Dimension in	(mm)
6.1	40 7/16	(1027)	20½	(521)	17	(432)
6.2	50 15/16	(1294)	31	(787)	27½	(699)
6.3	71 15/16	(1827)	52	(1321)	48½	(1232)
6.4	92 15/16	(2361)	73	(1854)	66	(1676)

6" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs	(kg)
Application: Clean Water												
60 W/in²	24	6.1	**CFPC715G10**	3	**CFPC715G3**	2	**CFPC715G11**	2	**CFPC715G5**	1	212	(97)
Steel Tank	36	6.1	**CFPC721G10**	4	**CFPC721G3**	2	**CFPC721G11**	2	**CFPC721G5**	1	217	(99)
12-Copper	48	6.2			**CFPC726R3**	4	**CFPC726R11**	3	**CFPC726R5**	2	222	(101)
(9.3 W/cm²)	60	6.2			**CFPC732G3**	4	**CFPC732G11**	3	**CFPC732G5**	2	226	(103)
	72	6.3			**CFPC737R3**	4			**CFPC737R5**	2	290	(132)
	100	6.3							**CFPC750R5**	4	298	(136)
	120	6.4							**CFPC760G5**	4	360	(164)
60 W/in²	30	6.1	**CFPC715G10X**	3	**CFPC715G3X**	5	**CFPC715G11X**	3	**CFPC715G5X**	1	215	(98)
Steel Tank	45	6.1	**CFPC721G10X**	5	**CFPC721G3X**	5	**CFPC721G11X**	3	**CFPC721G5X**	5	223	(102)
15-Copper	60	6.2			**CFPC726R3X**	5	**CFPC726R11X**	3	**CFPC726R5X**	5	226	(103)
(9.3 W/cm²)	75	6.2			**CFPC732G3X**	5	**CFPC732G11X**	5	**CFPC732G5X**	5	288	(131)
	90	6.3			**CFPC737R3X**	5			**CFPC737R5X**	5	296	(134)
	125	6.3							**CFPC750R5X**	5	306	(139)
	150	6.4							**CFPC760G5X**②	5	370	(168)
Application: Deionized Water, Demineralized Water												
60 W/in²	24	6.1	**CFPR715N10**	3	**CFPR715N3**	2	**CFPR715N11**	2	**CFPR715N5**	1	212	(97)
316 SS Tank	36	6.1	**CFPR721N10**	4	**CFPR721N3**	2	**CFPR721N11**	3	**CFPR721N5**	1	217	(99)
12-316 SS	48	6.2			**CFPR727E3**	4	**CFPR727E11**	3	**CFPR727E5**	2	222	(101)
(9.3 W/cm²)	60	6.2			**CFPR732N3**	4	**CFPR732N11**	3	**CFPR732N5**	2	226	(103)
Passivated	72	6.3			**CFPR738E3**	4			**CFPR738E5**	2	290	(132)
	100	6.3							**CFPR751E5**	4	298	(136)
	120	6.4							**CFPR760N5**	4	360	(164)
60 W/in²	30	6.1	**CFPR715N10X**	3	**CFPR715N3X**	5	**CFPR715N11X**	3	**CFPR715N5X**	1	215	(98)
316 SS Tank	45	6.1	**CFPR721N10X**	5	**CFPR721N3X**	5	**CFPR721N11X**	3	**CFPR721N5X**	5	223	(102)
15-316 SS	60	6.2			**CFPR727E3X**	5	**CFPR727E11X**	3	**CFPR727E5X**	5	226	(103)
(9.3 W/cm²)	75	6.2			**CFPR732N3X**	5	**CFPR732N11X**	5	**CFPR732N5X**	5	288	(131)
Passivated	90	6.3			**CFPR738E3X**	5			**CFPR738E5X**	5	296	(135)
	125	6.3							**CFPR751E5X**	5	306	(139)
	150	6.4							**CFPR760N5X**	5	370	(168)

CONTINUED

All circulation heaters are Assembly Stock unless otherwise noted.

② Standard

Availability

Assembly Stock: Five to seven working days

Standard: 10 working days

Truck Shipment only

Tubular and Process Assemblies

Circulation Heaters

6" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Process Water											
48 W/in²⑤	18	6.1	**CFPN713G10**	2	**CFPN713G3**	1	**CFPN713G11**	1	**CFPN713G5**	1	212 (97)
Steel Tank	24	6.1	**CFPN717R10**	3	**CFPN717R3**	2	**CFPN717R11**	2	**CFPN717R5**	1	214 (97)
12-Incoloy®	30	6.1	**CFPN720G10**	3	**CFPN720G3**	2	**CFPN720G11**	2	**CFPN720G5**	1	217 (99)
(7.5 W/cm²)	36	6.1	**CFPN725G10**	4	**CFPN725G3**	2	**CFPN725G11**	2	**CFPN725G5**	1	222 (101)
	48	6.2			**CFPN732R3**	4	**CFPN732R11**	3	**CFPN732R5**	2	226 (103)
	60	6.3			**CFPN740G3**	4	**CFPN740G11**	3	**CFPN740G5**	2	290 (132)
	72	6.3			**CFPN747R3**	4			**CFPN747R5**	2	298 (136)
48 W/in²	23	6.1	**CFPN713G10X**	3	**CFPN713G3X**	5	**CFPN713G11X**	1	**CFPN713G5X**	1	215 (98)
Steel Tank	30	6.1	**CFPN717R10X**	3	**CFPN717R3X**	5	**CFPN717R11X**	3	**CFPN717R5X**	1	217 (99)
15-Incoloy®	38	6.1	**CFPN720G10X**	5	**CFPN720G3X**	5	**CFPN720G11X**	3	**CFPN720G5X**	1	223 (102)
(7.5 W/cm²)	45	6.1	**CFPN725G10X**	5	**CFPN725G3X**	5	**CFPN725G11X**	3	**CFPN725G5X**	5	226 (103)
	60	6.2			**CFPN732R3X**	5	**CFPN732R11X**	3	**CFPN732R5X**	5	288 (131)
	75	6.3			**CFPN740G3X**	5	**CFPN740G11X**	5	**CFPN740G5X**	5	296 (135)
	90	6.3			**CFPN747R3X**	5			**CFPN747R5X**	5	306 (139)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions											
23 W/in²⑤⑥	12	6.1	**CFPNA17R10**	2	**CFPNA17R3**	1	**CFPNA17R11**	1	**CFPNA17R5**	1	214 (97)
Steel Tank	18	6.1	**CFPNA25G10**	2	**CFPNA25G3**	1	**CFPNA25G11**	1	**CFPNA25G5**	1	222 (101)
12-Incoloy®	24	6.2	**CFPNA32R10**	3	**CFPNA32R3**	2	**CFPNA32R11**	2	**CFPNA32R5**	1	226 (103)
(3.6 W/cm²)	30	6.3	**CFPNA40G10**	3	**CFPNA40G3**	2	**CFPNA40G11**	2	**CFPNA40G5**	1	290 (132)
	36	6.3	**CFPNA47R10**	4	**CFPNA47R3**	2	**CFPNA47R11**	2	**CFPNA47R5**	1	298 (136)
	50	6.4			**CFPNA64G3**	4	**CFPNA64G11**	3	**CFPNA64G5**	2	360 (164)
	60	6.4			**CFPNA76R3**	4	**CFPNA76R11**	3	**CFPNA76R5**	2	368 (167)
23 W/in²	15	6.1	**CFPNA17R10X**	3	**CFPNA17R3X**	1	**CFPNA17R11X**	1	**CFPNA17R5X**	1	217 (99)
Steel Tank	23	6.1	**CFPNA25G10X**	3	**CFPNA25G3X**	5	**CFPNA25G11X**	1	**CFPNA25G5X**	1	226 (103)
15-Incoloy®	30	6.2	**CFPNA32R10X**	3	**CFPNA32R3X**	5	**CFPNA32R11X**	3	**CFPNA32R5X**	1	288 (131)
(3.6 W/cm²)	38	6.3	**CFPNA40G10X**	5	**CFPNA40G3X**	5	**CFPNA40G11X**	3	**CFPNA40G5X**	1	296 (135)
	45	6.3	**CFPNA47R10X**	5	**CFPNA47R3X**	5	**CFPNA47R11X**	3	**CFPNA47R5X**	5	306 (139)
	63	6.4			**CFPNA64G3X**	5	**CFPNA64G11X**	3	**CFPNA64G5X**	5	370 (168)
	75	6.4			**CFPNA76R3X**	5	**CFPNA76R11X**	5	**CFPNA76R5X**	5	381 (173)

CONTINUED

All circulation heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Five to seven working days
Standard: 10 working days
Truck Shipment only

⑤ 240V~(ac) can be wired wye and operated at 480V~(ac) 3-phase to produce ⅓ more kW and watt density.
⑥ Can be wired wye to produce ⅓ of the original kW and watt density (3-phase only).

Circulation Heaters

6" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils											
23 W/in²	12	6.1	**CFPS717R10**	2	**CFPS717R3**	1	**CFPS717R11**	1	**CFPS717R5**	1	214 (97)
Steel Tank	18	6.1	**CFPS725G10**	2	**CFPS725G3**	1	**CFPS725G11**	1	**CFPS725G5**	1	222 (101)
12-Steel	24	6.2	**CFPS732R10**	3	**CFPS732R3**	2	**CFPS732R11**	2	**CFPS732R5**	1	226 (103)
(3.6 W/cm²)	30	6.3	**CFPS740G10**	3	**CFPS740G3**	2	**CFPS740G11**	2	**CFPS740G5**	1	290 (132)
	36	6.3	**CFPS747R10**	4	**CFPS747R3**	2	**CFPS747R11**	2	**CFPS747R5**	1	298 (136)
	50	6.4			**CFPS764G3**	4	**CFPS764G11**	3	**CFPS764G5**	2	360 (164)
	60	6.4			**CFPS776R3**	4	**CFPS776R11**	3	**CFPS776R5**	2	368 (167)
23 W/in²	15	6.1	**CFPS717R10X**	3	**CFPS717R3X**	1	**CFPS717R11X**	1	**CFPS717R5X**	1	217 (99)
Steel Tank	23	6.1	**CFPS725G10X**	3	**CFPS725G3X**	5	**CFPS725G11X**	1	**CFPS725G5X**	1	226 (103)
15-Steel	30	6.2	**CFPS732R10X**	3	**CFPS732R3X**	5	**CFPS732R11X**	3	**CFPS732R5X**	1	288 (131)
(3.6 W/cm²)	38	6.3	**CFPS740G10X**	5	**CFPS740G3X**	5	**CFPS740G11X**	3	**CFPS740G5X**	1	296 (135)
	45	6.3	**CFPS747R10X**	5	**CFPS747R3X**	5	**CFPS747R11X**	3	**CFPS747R5X**	5	306 (139)
	63	6.4			**CFPS764G3X**	5	**CFPS764G11X**	3	**CFPS764G5X**	5	370 (168)
	75	6.4			**CFPS776R3X**	5	**CFPS776R11X**	5	**CFPS776R5X**	5	381 (173)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin											
16 W/in²③	6	6.1			**CFPN713G12**	1			**CFPN713G13**	1	212 (97)
Steel Tank	8	6.1			**CFPN717R12**	1			**CFPN717R13**	1	214 (97)
12-Incoloy®	10	6.1			**CFPN720G12**	1			**CFPN720G13**	1	217 (99)
(2.6 W/cm²)	12	6.1			**CFPN725G12**	1			**CFPN725G13**	1	222 (101)
	16	6.2			**CFPN732R12**	1			**CFPN732R13**	1	226 (103)
	20	6.3			**CFPN740G12**	2			**CFPN740G13**	1	290 (132)
	24	6.3			**CFPN747R12**	2			**CFPN747R13**	1	298 (136)
16 W/in²③	7.5	6.1			**CFPN713G12X**	1			**CFPN713G13X**	1	215 (98)
Steel Tank	10	6.1			**CFPN717R12X**	1			**CFPN717R13X**	1	217 (99)
15-Incoloy®	12.5	6.1			**CFPN720G12X**	1			**CFPN720G13X**	1	223 (102)
(2.6 W/cm²)	15	6.1			**CFPN725G12X**	1			**CFPN725G13X**	1	226 (103)
	20	6.2			**CFPN732R12X**	5			**CFPN732R13X**	1	288 (131)
	25	6.3			**CFPN740G12X**	5			**CFPN740G13X**	1	296 (135)
	30	6.3			**CFPN747R12X**	5			**CFPN747R13X**	1	306 (139)
Applications: Bunker C and #6 Fuel Oils											
8 W/in²③	8	6.2			**CFPS732R12**	1			**CFPS732R13**	1	226 (103)
Steel Tank	10	6.3			**CFPS740G12**	1			**CFPS740G13**	1	290 (132)
12-Steel	12	6.3			**CFPS747R12**	1			**CFPS747R13**	1	298 (136)
(1.3 W/cm²)	16.5	6.4			**CFPS764G12**	1			**CFPS764G13**	1	360 (164)
	20	6.4							**CFPS776R13**	1	368 (167)
8 W/in²③	10	6.2			**CFPS732R12X**	1			**CFPS732R13X**		288 (131)
Steel Tank	12.5	6.3			**CFPS740G12X**	1			**CFPS740G13X**	1	296 (135)
15-Steel	15	6.3			**CFPS747R12X**	1			**CFPS747R13X**	1	306 (139)
(1.3 W/cm²)	21	6.4			**CFPS764G12X**	5			**CFPS764G13X**	1	370 (168)
	25	6.4			**CFPS776R12X**	5			**CFPS776R13X**	1	381 (173)

All circulation heaters are Assembly Stock unless otherwise noted.

Availability

Assembly Stock: Five to seven working days

Standard: 10 working days

Truck Shipment only

③ Must be operated 3-phase wye only.

Tubular and Process Assemblies

Circulation Heaters

6" 150 lb ANSI Flange—FIREBAR Element

FIREBAR Description	kW	Fig. No.	Code No. 240V~(ac) 3-Phase	No. of Circuits	Code No. 480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Process Water, Ethylene Glycol (50%)							
45 W/in²	30	6.1	**CFPNF13G27**	5			217 (99)
Steel Tank	37.5	6.1	**CFPNF16A27**	5			220 (100)
15-Incoloy®	45	6.1	**CFPNF18G27**	5			223 (102)
(7 W/cm²)	60	6.1	**CFPNF22R27**	5	**CFPNF22R28**	5	226 (103)
	75	6.2	**CFPNF27R27**	5	**CFPNF27R28**	5	232 (106)
	90	6.2	**CFPNF32R27**	5	**CFPNF32R28**	5	236 (107)
	120	6.3			**CFPNF42G28**	5	304 (138)
	150	6.3			**CFPNF51R28**	5	314 (143)
Applications: Cooking Oils, Ethylene Glycol (100%)							
30 W/in²③	25	6.1	**CFPNF16J12**	5	**CFPNF16J13**	5	220 (100)
Steel Tank	32	6.1	**CFPNF19J12**	5	**CFPNF19J13**	5	223 (102)
15-Incoloy®	42	6.1	**CFPNF24J12**	5	**CFPNF24J13**	5	226 (103)
(4.7 W/cm²)	52	6.2	**CFPNF30A12**	5	**CFPNF30A13**	5	232 (106)
	64	6.2	**CFPNF35A12**	5	**CFPNF35A13**	5	236 (107)
	85	6.3	**CFPNF45J12**	5	**CFPNF45J13**	5	304 (138)
	110	6.3			**CFPNF56A13**	5	314 (143)
Applications: Heat Transfer Oils, Mineral Oil, Degreasing Solutions							
23 W/in²④	19	6.1	**CFPNF16J20**	5			220 (100)
Steel Tank	24	6.1	**CFPNF19J20**	5			223 (102)
15-Incoloy®	32	6.1	**CFPNF24J20**	5	**CFPNF24J19**	5	226 (103)
(3.6 W/cm²)	40	6.2	**CFPNF30A20**	5	**CFPNF30A19**	5	232 (106)
	48	6.2	**CFPNF35A20**	5	**CFPNF35A19**	5	236 (107)
	64	6.3	**CFPNF45J20**	5	**CFPNF45J19**	5	304 (138)
	80	6.3	**CFPNF56A20**	5	**CFPNF56A19**	5	314 (143)
Applications: Medium Weight Oils, Heat Transfer Oils, Lube Oils, Liquid Paraffin							
15 W/in²③	10	6.1	**CFPNF13G29**	5			217 (99)
Steel Tank	12.5	6.1	**CFPNF16A29**	5			220 (100)
15-Incoloy®	15	6.1	**CFPNF18G29**	5			223 (102)
(2.3 W/cm²)	20	6.1	**CFPNF22R29**	5	**CFPNF22R30**	5	226 (103)
	25	6.2	**CFPNF27R29**	5	**CFPNF27R30**	5	232 (106)
	30	6.2	**CFPNF32R29**	5	**CFPNF32R30**	5	236 (107)
	40	6.3	**CFPNF42G29**	5	**CFPNF42G30**	5	304 (138)
	50	6.3	**CFPNF51R29**	5	**CFPNF51R30**	5	314 (143)
Applications: Bunker C and #6 Fuel Oils, Asphalt							
8 W/in²③	6.3	6.1	**CFPNF16J22**	5			220 (100)
Steel Tank	8.1	6.1	**CFPNF19J22**	5			223 (102)
15-Incoloy®	10.6	6.1	**CFPNF24J22**	5	**CFPNF24J21**	5	226 (103)
(1.3 W/cm²)	13.1	6.2	**CFPNF30A22**	5	**CFPNF30A21**	5	232 (106)
	16	6.2	**CFPNF35A22**	5	**CFPNF35A21**	5	236 (107)
	21.3	6.3	**CFPNF45J22**	5	**CFPNF45J21**	5	304 (138)
	26	6.3	**CFPNF56A22**	5	**CFPNF56A21**	5	314 (143)

All circulation heaters are Assembly Stock unless otherwise noted.

Availability

Assembly Stock: Five to seven working days

Truck Shipment only

③ Must be operated 3-phase wye only.

④ Wired for higher voltage.

Circulation Heaters

8" Flange

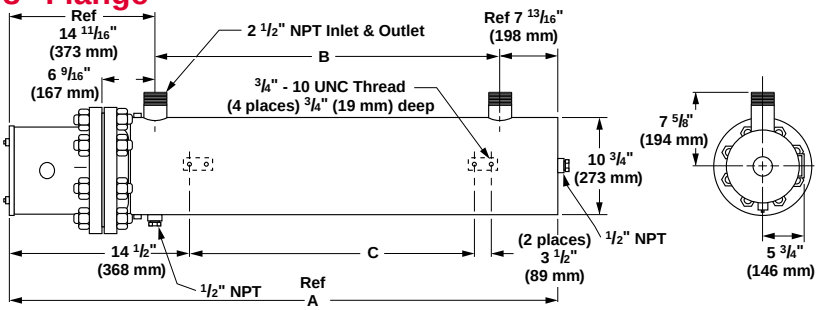


Fig. No.	A Dimension in	A Dimension (mm)	B Dimension in	B Dimension (mm)	C Dimension in	C Dimension (mm)
7.1	47 3/16	(1199)	24 11/16	(627)	21 3/16	(538)
7.2	55 3/16	(1402)	32 11/16	(830)	29 3/16	(741)
7.3	62 3/16	(1580)	39 11/16	(1008)	36 3/16	(919)
7.4	69 13/16	(1773)	47 5/16	(1202)	43 13/16	(1113)
7.5	79 5/16	(2014)	56 13/16	(1443)	53 5/16	(1354)
7.6	88 5/16	(2243)	65 13/16	(1672)	62 5/16	(1583)
7.7	98 5/16	(2497)	75 13/16	(1926)	72 5/16	(1837)

8" 150 lb ANSI Flange— WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs	(kg)
Application: Clean Water												
60 W/in²	50	7.1			**CFRC721N3②**	3	**CFRC721N11**	3	**CFRC721N5**	2	340	(155)
Steel Tank	75	7.2			**CFRC729N3②**	6			**CFRC729N5②**	2	360	(164)
18-Copper	100	7.3			**CFRC737E3②**	6			**CFRC737E5**	3	385	(175)
(9.3 W/cm²)	125	7.4			**CFRC745E3②**	6			**CFRC745E5②**	3	410	(186)
	150	7.5							**CFRC752N5②**	6	440	(200)
	175	7.6							**CFRC760N5②**	6	465	(211)
	200	7.7							**CFRC768E5②**	6	510	(232)
Application: Process Water												
48 W/in²⑤	50	7.2			**CFRN725N3②**	3	**CFRN725N11②**	3	**CFRN725N5②**	2	350	(159)
Steel Tank	75	7.3			**CFRN735N3②**	6			**CFRN735N5②**	2	380	(173)
18-Incoloy®	100	7.4			**CFRN744E3**	6			**CFRN744E5**	3	410	(186)
(7.5 W/cm²)	125	7.5			**CFRN754M3②**	6			**CFRN754M5②**	6	445	(202)
	150	7.6							**CFRN763M5②**	6	490	(223)
	175	7.7							**CFRN773D5**	6	530	(241)
	200	7.7							**CFRN782M5②**	6	560	(254)
48 W/in²	67	7.2			**CFRN726D3X②**	4	**CFRN726D11X②**	3	**CFRN726D5X②**	2	358	(163)
Steel Tank	100	7.3			**CFRN736D3X②**	8			**CFRN736D5X②**	4	392	(178)
24-Incoloy®	133	7.4			**CFRN744M3X②**	8			**CFRN744M5X②**	4	425	(193)
(7.5 W/cm²)	167	7.5			**CFRN754M3X②**	8			**CFRN754M5X②**	8	463	(210)
	200	7.6							**CFRN763M5X②**	8	511	(232)
	233	7.7							**CFRN773D5X**	8	554	(252)
	267	7.7							**CFRN782M5X②**	8	587	(267)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions												
23 W/in²⑤⑥	30	7.2	**CFRNA32N10②**	3	**CFRNA32N3②**	2	**CFRNA32N11②**	2	**CFRNA32N5②**	1	370	(168)
Steel Tank	40	7.3			**CFRNA43E3②**	3	**CFRNA43E11②**	2	**CFRNA43E5②**	2	410	(186)
18-Incoloy®	50	7.4			**CFRNA51M3②**	3	**CFRNA51M11**	3	**CFRNA51M5**	2	440	(200)
(3.6 W/cm²)												
23 W/in²	40	7.2	**CFRNA33D10X②**	4	**CFRNA33D3X②**	4	**CFRNA33D11X②**	2	**CFRNA33D5X②**	2	382	(174)
Steel Tank	53	7.3			**CFRNA43M3X②**	4	**CFRNA43M11X②**	3	**CFRNA43M5X②**	2	425	(193)
24-Incoloy®	67	7.4			**CFRNA51M3X②**	4	**CFRNA51M11X②**	3	**CFRNA51M5X②**	2	457	(207)
(3.6 W/cm²)												

CONTINUED

All circulation heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Five to seven working days
Standard: 10 working days
Truck Shipment only

② Standard
⑤ 240V~(ac) can be wired wye and operated at 480V~(ac) 3-phase to produce ⅓ more kW and watt density.
⑥ Can be wired wye to produce ⅓ of the original kW and watt density (3-phase only).

Tubular and Process Assemblies

Circulation Heaters

8" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 1-Phase	No. of Circuits	240V~(ac) 3-Phase	No. of Circuits	480V~(ac) 1-Phase	No. of Circuits	480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils											
23 W/in²	30.0	7.2	**CFRS732N10②**	3	**CFRS732N3②**	2	**CFRS732N11②**	2	**CFRS732N5②**	1	370 (168)
Steel Tank	40.0	7.3			**CFRS743E3②**	3	**CFRS743E11②**	2	**CFRS743E5**	2	410 (186)
18-Steel	50.0	7.4			**CFRS751M3**	3	**CFRS751M11**	3	**CFRS751M5**	2	440 (200)
(3.6 W/cm²)	60.0	7.5			**CFRS762D3②**	6	**CFRS762D11②**	3	**CFRS762D5②**	2	480 (218)
	70.0	7.6			**CFRS770M3②**	6	**CFRS770M11**	6	**CFRS770M5**	2	530 (241)
	80.0	7.7			**CFRS779M3②**	6			**CFRS779M5②**	3	610 (277)
23 W/in²	40.0	7.2	**CFRS733D10X②**	4	**CFRS733D3X②**	4	**CFRS733D11X②**	2	**CFRS733D5X②**	2	382 (174)
Steel Tank	53.0	7.3			**CFRS743M3X②**	4	**CFRS743M11X②**	3	**CFRS743M5X②**	2	425 (193)
24-Steel	67.0	7.4			**CFRS751M3X②**	4	**CFRS751M11X②**	3	**CFRS751M5X②**	2	457 (208)
(3.6 W/cm²)	80.0	7.5			**CFRS762D3X②**	8	**CFRS762D11X②**	4	**CFRS762D5X②**	4	461 (209)
	93.0	7.6			**CFRS770M3X②**	8	**CFRS770M11X②**	6	**CFRS770M5X②**	4	554 (252)
	107.0	7.7			**CFRS779M3X②**	8			**CFRS779M5X②**	4	636 (289)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin											
16 W/in²③	17.0	7.2			**CFRN725N12②**	1			**CFRN725N13②**	1	350 (159)
Steel Tank	25.0	7.3			**CFRN735N12②**	2			**CFRN735N13②**	1	380 (173)
18-Incoloy®	33.0	7.4			**CFRN744E12②**	2			**CFRN744E13**	1	410 (186)
(2.6 W/cm²)	42.0	7.5			**CFRN754M12②**	3			**CFRN754M13②**	2	445 (202)
	50.0	7.6							**CFRN763M13②**	2	490 (223)
	58.0	7.7							**CFRN773D13**	2	530 (241)
	67.0	7.7							**CFRN782M13②**	2	560 (254)
16 W/in²	23.0	7.2			**CFRN726D12X②**	2			**CFRN726D13X②**	1	358 (163)
Steel Tank	33.0	7.3			**CFRN736D12X②**	2			**CFRN736D13X②**	1	392 (178)
24-Incoloy®	44.0	7.4			**CFRN744M12X②**	4			**CFRN744M13X②**	2	425 (193)
(2.6 W/cm²)	56.0	7.5			**CFRN754M12X②**	4			**CFRN754M13X②**	2	463 (210)
	67.0	7.6							**CFRN763M13X②**	2	511 (232)
	77.0	7.7							**CFRN773D13X②**	2	554 (252)
	89.0	7.7							**CFRN782M13X②**	4	587 (267)
Applications: Bunker C and #6 Fuel Oils											
8 W/in²③	12.5	7.3			**CFRS743E12②**	1			**CFRS743E13②**	1	410 (186)
Steel Tank	16.5	7.4			**CFRS751M12**	1			**CFRS751M13**	1	440 (200)
18-Steel	20.0	7.5			**CFRS762D12②**	2			**CFRS762D13②**	1	480 (218)
(1.3 W/cm²)	24.0	7.6			**CFRS770M12**	2			**CFRS770M13**	1	530 (241)
	27.0	7.7			**CFRS779M12②**	2			**CFRS779M13②**	1	610 (277)
8 W/in²③	17.0	7.3			**CFRS743M12X②**	1			**CFRS743M13X②**	1	425 (193)
Steel Tank	22.0	7.4			**CFRS751M12X②**	2			**CFRS751M13X②**	1	457 (208)
24-Steel	27.0	7.5			**CFRS762D12X②**	2			**CFRS762D13X②**	1	461 (209)
(1.3 W/cm²)	32.0	7.6			**CFRS770M12X②**	2			**CFRS770M13X②**	1	554 (252)
	36.0	7.7			**CFRS779M12X②**	2			**CFRS779M13X②**	1	636 (289)

All circulation heaters are Assembly Stock unless otherwise noted.

Availability

Assembly Stock: Five to seven working days

Standard: 10 working days

Truck Shipment only

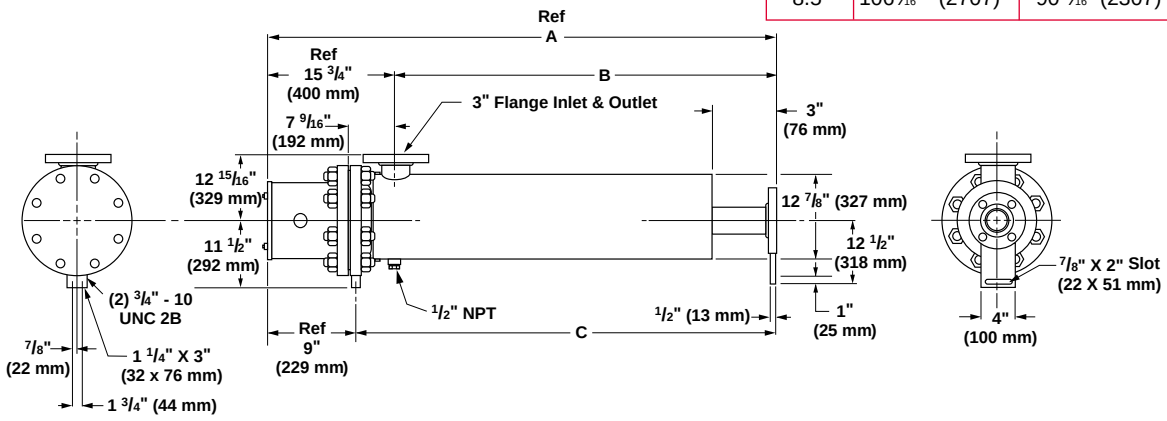
② Standard

③ Must be operated 3-phase wye only.

Circulation Heaters

10" Flange

Fig. No.	A Dimension in	A Dimension (mm)	B Dimension in	B Dimension (mm)	C Dimension in	C Dimension (mm)
8.1	76 9/16	(1945)	60 13/16	(1545)	67 9/16	(1716)
8.2	84 1/16	(2135)	68 5/16	(1735)	75 1/16	(1907)
8.3	91 3/16	(2316)	75 7/16	(1916)	82 3/16	(2088)
8.4	99 1/16	(2516)	83 5/16	(2116)	90 1/16	(2288)
8.5	106 9/16	(2707)	90 13/16	(2307)	97 9/16	(2478)



10" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 3-Phase	No. of Circuits	Code No. 480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs	(kg)
Application: Process Water								
48 W/in²⑤	262	8.5			**CFSN773E5**	9	600	(273)
Steel Tank								
27-Incoloy®								
(7.5 W/cm²)								
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions								
23 W/in²⑤⑥	60	8.1	**CFSNA43N3②**	3	**CFSNA43N5②**	3	515	(234)
Steel Tank	75	8.2	**CFSNA51N3②**	9	**CFSNA51N5**	3	530	(241)
27-Incoloy®								
(3.6 W/cm²)								
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils								
23 W/in²	90	8.3			**CFSS762E5②**	3	540	(245)
Steel Tank	105	8.4			**CFSS770N5**	3	600	(272)
27-Steel	120	8.5			**CFSS778N5②**	3	645	(293)
(3.6 W/cm²)								
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin								
16 W/in²③	75	8.3			**CFSN763N13②**	3	540	(245)
Steel Tank	87	8.5			**CFSN773E13②**	3	600	(273)
27-Incoloy®								
(2.6 W/cm²)								
Applications: Bunker C and #6 Fuel Oils								
8 W/in²③	30	8.3	**CFSS762E12②**	3	**CFSS762E13②**	1	540	(245)
Steel Tank	35	8.4	**CFSS770N12**	3	**CFSS770N13**	1	600	(273)
27-Steel	40	8.5	**CFSS778N12②**	3	**CFSS778N13②**	1	645	(293)
(1.3 W/cm²)								

All circulation heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Five to seven working days
Standard: 10 working days
Truck Shipment only

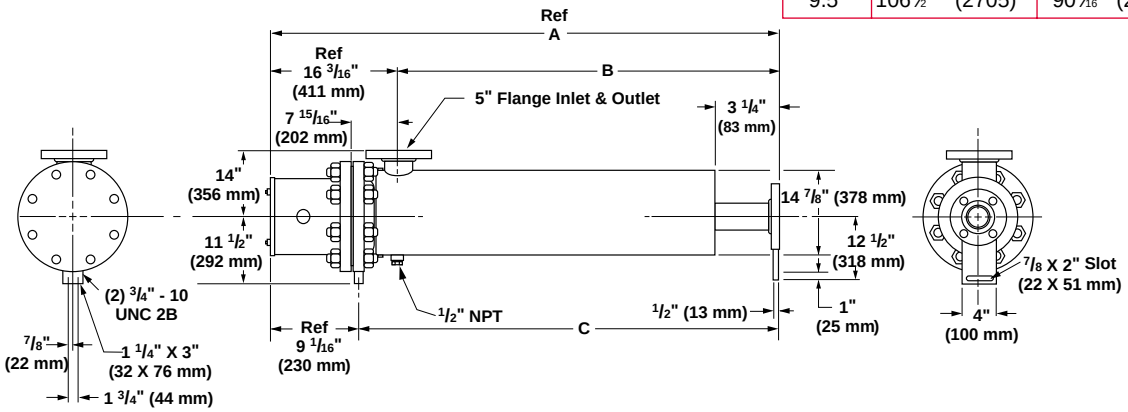
② Standard
③ Must be operated 3-phase wye only.
⑤ 240V~(ac) can be wired wye and operated at 480V~(ac) 3-phase to produce ⅓ more kW and watt density.
⑥ Can be wired wye to produce ⅓ of the original kW and watt density (3-phase only).

Tubular and Process Assemblies

Circulation Heaters

12" Flange

Fig. No.	A Dimension in	A Dimension (mm)	B Dimension in	B Dimension (mm)	C Dimension in	C Dimension (mm)
9.1	76 7/8	(1953)	60 11/16	(1541)	67 13/16	(1722)
9.2	84 3/8	(2143)	68 3/16	(1732)	75 5/16	(1913)
9.3	91 7/8	(2334)	75 11/16	(1922)	82 13/16	(2103)
9.4	99	(2515)	82 13/16	(2103)	89 15/16	(2284)
9.5	106 1/2	(2705)	90 5/16	(2294)	97 7/16	(2475)



12" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 3-Phase	No. of Circuits	Code No. 480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs (kg)
Application: Process Water							
48 W/in² **Steel Tank** **36-Incoloy®** (7.5 W/in²)	350	9.5			**CFTN773C5**	12	650 (295)
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions							
23 W/in² **Steel Tank** **36-Incoloy®** (3.6 W/cm²)	80 100	9.1 9.2			**CFTNA43L5②** **CFTNA51L5**	3 3	565 (257) 585 (266)
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils							
23 W/in² **Steel Tank** **36-Steel** (3.6 W/cm²)	140 160	9.4 9.5			**CFTS770L5** **CFTS778L5②**	4 4	650 (295) 700 (318)
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin							
16 W/in²③ **Steel Tank** **36-Incoloy®** (2.6 W/cm²)	117	9.5			**CFTN773C13②**	3	650 (295)
Applications: Bunker C and #6 Fuel Oils							
8 W/in²③ **Steel Tank** **36-Steel** (1.3 W/cm²)	47 54	9.4 9.5	**CFTS770L12②** **CFTS778L12②**	3 3	**CFTS770L13** **CFTS778L13②**	2 2	700 (318) 750 (341)

All circulation heaters are Assembly Stock unless otherwise noted.

Availability

Assembly Stock: Five to seven working days

Standard: 10 working days

Truck Shipment only

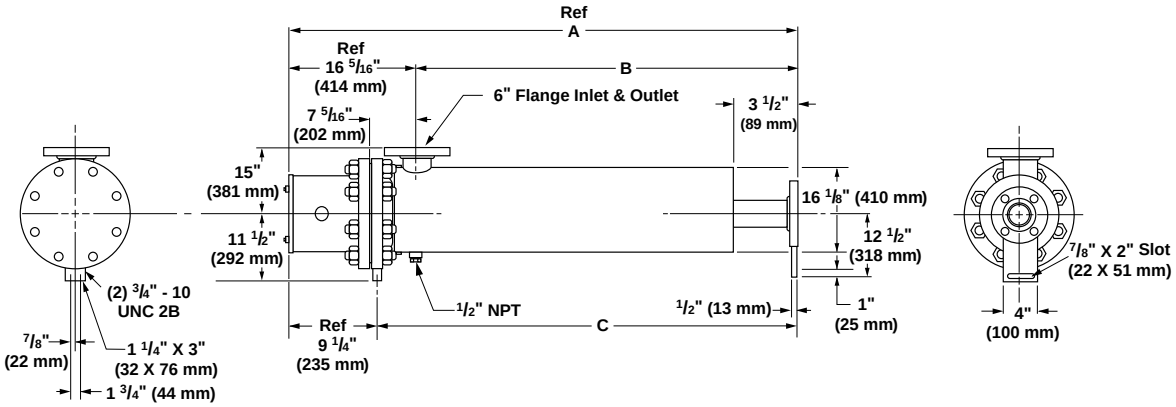
② Standard

③ Must be operated 3-phase wye only.

Circulation Heaters

14" Flange

Fig. No.	A Dimension in	(mm)	B Dimension in	(mm)	C Dimension in	(mm)
10.1	75¾	(1924)	59 7/16	(1510)	66½	(1689)
10.2	83¼	(2115)	66 15/16	(1700)	74	(1880)
10.3	90¾	(2305)	74 7/16	(1891)	81½	(2070)
10.4	98¼	(2496)	81 15/16	(2081)	89	(2261)
10.5	105¾	(2686)	89 7/16	(2272)	96½	(2451)



14" 150 lb ANSI Flange—WATROD Element

WATROD Description	kW	Fig. No.	Code No. 240V~(ac) 3-Phase	No. of Circuits	Code No. 480V~(ac) 3-Phase	No. of Circuits	Est. Ship. Weight lbs	(kg)
Application: Process Water								
48 W/in²	315	10.2			**CFWN754J5②**	15	600	(273)
Steel Tank	375	10.3			**CFWN763J5②**	15	650	(295)
45-Incoloy®								
(7.5 W/cm²)								
Applications: Forced Air and Gases, Caustic Solutions, Degreasing Solutions								
23 W/in²	100	10.1			**CFWNA43J5②**	3	570	(259)
Steel Tank	125	10.2			**CFWNA51J5**	5	590	(268)
45-Incoloy®								
(3.6 W/cm²)								
Applications: Lightweight Oils, Degreasing Solutions, Heat Transfer Oils								
23 W/in²	150	10.3			**CFWS762A5②**	5	650	(295)
Steel Tank	175	10.4			**CFWS770J5**	5	700	(318)
45-Steel	200	10.5			**CFWS778J5②**	5	780	(354)
(3.6 W/cm²)								
Applications: Medium Weight Oils, Heat Transfer Oils, Liquid Paraffin								
16 W/in²③	105	10.2			**CFWN754J13②**	3	600	(273)
Steel Tank	125	10.3			**CFWN763J13②**	5	650	(295)
45-Incoloy®								
(2.6 W/cm²)								
Applications: Bunker C and #6 Fuel Oils								
8 W/in²③	60	10.4	**CFWS770J12②**	3	**CFWS770J13**	3	700	(318)
Steel Tank	67	10.5	**CFWS778J12②**	5	**CFWS778J13②**	3	780	(354)
45-Steel								
(1.3 W/cm²)								

All circulation heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Five to seven working days
Standard: 10 working days
Truck Shipment only

② Standard
③ Must be operated 3-phase wye only.

Tubular and Process Assemblies

F.O.B.: Hannibal, Missouri

Circulation Heaters

Build-a-Code

_____ - _____ - _____

Circulation Heater Base Code Number

General purpose (NEMA 1) terminal enclosure standard

Optional Terminal Enclosure Type

S = General purpose with thermostat (NEMA 1)
W = Moisture resistant (NEMA 4)
E = Explosion resistant (NEMA 7)
E/W = Explosion/moisture resistant (NEMA 7/4)

Optional Thermostat① or Thermocouple②

① Thermostat code numbers shown on page 425. Check sensing bulb O.D. against thermowell I.D. to assure proper fit. For side-mount thermostats, also assure adequate capillary tube length.

② Specify Type J or K thermocouple. If overtemp thermocouple specify orientation horizontal, vertical up or vertical down.

How to Order

To order a stock circulation heater, please specify:

- Watlow code number
- Volts/watts
- Phase
- Flange or screw plug size
- Tank material
- Options
- Quantity

If the circulation heater is to be configured with options, add the suffix letter(s) to the circulation heater base code number, as indicated on the Build-a-Code chart.

If stock units do not meet your application needs, Watlow can provide **made-to-order** heaters. Please provide:

- Application (including vessel orientation)
- Volts/watts
- Phase
- Number of circuits
- Watt density
- Sheath material and number of heating elements
- Flange or screw plug size
- Tank material
- Inlet and outlet mating type and size
- Centerline of inlet and outlet
- Terminal enclosure type
- Options
- Quantity

Availability

Assembly Stock: Five to seven working days

Modified Stock②: Five-10 working days

Standard: 10 working days

Made-to-Order: Six to eight weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

Replacement Heater Assemblies Only

Replacement heater assemblies available by ordering circulation heater code number and specifying "*replacement heater only*."

② Assembly Stock units with catalog options.

Circulation Heaters

Booster Heaters

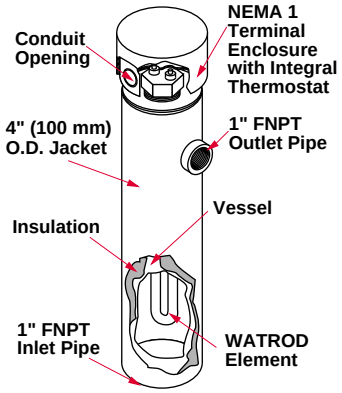
Booster Heaters

Booster heaters are ideal for circulating applications requiring less kilowatts, including engine preheating.

Booster heaters are made from a steel or brass 1¼" NPT screw plug heater and insulated pressure vessel with 1" FNPT inlet and outlet. This assembly also contains an integral thermostat.

Performance Capabilities

- Watt densities to 60 W/in^2 (9.3 W/cm^2)
- Wattages to 3kW
- Voltages to 480V~(ac)
- Steel sheath temperatures to 750°F (400°C)
- Copper sheath temperatures to 350°F (175°C)



Features and Benefits

- **Dual voltages** simplify stocking and wiring.
- **Carbon steel**, **standard pipe wall vessel** is compatible with many applications.
- **One inch thick (25 mm) fiber-glass thermal insulation**, rated to 750°F (400°C), reduces heat loss.
- **Steel jacket (shroud)** is fully welded and painted to protect thermal insulation.
- **Inlet and outlet nozzle connections** are one inch FNPT fittings welded to the vessel.
- **General purpose (NEMA 1) terminal enclosure** protects terminals and thermostat.
- **Integral thermostat controls** process temperatures from:

  60° to 160°F (15° to 70°C) on copper sheath elements

  175° to 550°F (80° to 290°C) on steel sheath elements

Applications

- Stand by generators
- Peak power trimming generators
- Mobile generator sets
- Earth-moving equipment
- Water heaters
- Lightweight oils

Options

Terminal Enclosure

General purpose (NEMA 1) terminal enclosures with integral thermostats are supplied on all Watlow booster heaters. Optional moisture resistant (NEMA 4) terminal enclosures protect wiring and thermostat from liquid contaminants. To order, add the suffix letter **W** to the booster heater base code number.

For explosion resistant (NEMA 7) and explosion/moisture resistant (NEMA 7/4) terminal enclosures, see ***Screw Plug Immersion Heaters,*** **pages 322 to 324**.

Tubular and Process Assemblies

F.O.B.: Hannibal, Missouri

Circulation Heaters

Booster Heaters

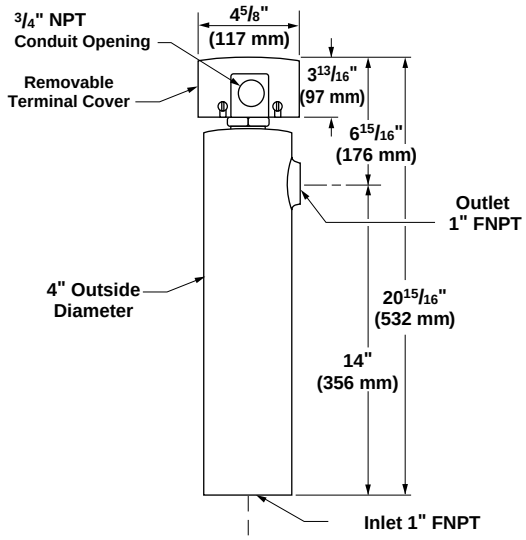
Description	kW	Phase	Code No. 120/240V~(ac)	Est. Ship. Weight lbs	(kg)
Application: Aqueous Solutions					
60 W/in²	1.5	1	**CBEC8G6**	18	(8.2)
Brass Plug	2.0	1	**CBEC10F6**	18	(8.2)
2-Copper	2.5	1	**CBEC12F6**	18	(8.2)
(9.3 W/cm²)	3.0	1	**CBEC15A6X**	18	(8.2)
Application: Lightweight Oils					
23 W/in²	0.5	1	**CBES7G6**	18	(8.2)
Steel Plug	0.75	1	**CBES10B6**	18	(8.2)
2- Steel	1.0	1	**CBES12P6**	18	(8.2)
(3.6 W/cm²)					

All units are Assembly Stock

For optional housing adders use circulation heater adders.

Availability

Assembly Stock: Five to seven days



How to Order

To order a booster heater, please specify:

- Watlow code number
- Volts/watts
- Options
- Quantity

If the booster heater requires an optional NEMA 4 terminal enclosure, add the suffix letter **W** to the base code number.

If our Assembly Stock units do not meet your application needs, Watlow can provide a made-to-order unit. For **made-to-order** units, consult your Watlow representative and provide the following information:

- Application
- Volts/watts
- Watt density
- Phase
- Terminal enclosure type
- Options
- Quantity

Availability

Assembly Stock: Five to seven working days

Modified Stock①: Five to seven working days

Made-to-Order: Six to eight weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

① Assembly Stock units with catalog options.

Circulation Heaters

Engine Preheaters

Watlow engine preheaters help maintain a desired minimum engine temperature to make starting fast and easy. Also reduces 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)
- Up to 6 kW
- UL® and CSA component recognition to 480V~(ac) and 600V~(ac) respectively.
- Thermostatically controlled from 60 to 160°F (15 to 70°C)
- Incoloy® sheath temperatures to 1600°F (870°C)

Features and Benefits

- **Incoloy® sheath** minimizes the risk of premature failure in the event of a dry-fire condition.
- **Integral, prewired adjustable thermostat**, mounted in a general purpose (NEMA 1) terminal enclosure provides a ready-to-install unit.
- **Easy installation with standard, one inch (25 mm) diameter beaded inlet and outlet nozzles**. Rubber hose connections eliminate the need for threaded fittings and adapters.
- **120/240V~(ac) or 240/480V~(ac) dual voltages** make field wiring flexible. Minimizes stocking multiple voltages.
- **Mounting bracket** isolates harmful engine vibration.
- **Heavy-duty welded carbon steel tank** resists corrosion and extends life.
- **Optional oil pressure interconnect switch** disrupts power during engine operation.

- **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. See **pages 268 to 271** for details.

Applications

- Standby generators
- Primary power generators
- Firepump engines

Options

Terminal Enclosures

The following terminal enclosures are available:

- Standard, general purpose (NEMA 1)
- Moisture resistant (NEMA 4)
- Explosion resistant (NEMA 7) class 1, groups C and D. For class 1, group B enclosures, consult your Watlow representative.

Order by adding the suffix letter **W** (NEMA 4) or **E** (NEMA 7) to the engine preheater base code number.

Threaded Nozzles

Carbon steel threaded inlets and outlets are available for installations using rigid piping or threaded adapters. Threaded nozzles are typically supplied for firepump applications. To order, specify **threaded nozzles** and **NPT size**.

Tubular and Process Assemblies

F.O.B.: Hannibal, Missouri

Circulation Heaters

Engine Preheaters

Application Hints

- Mount engine preheaters in horizontal position only (as shown in Figures #1, #2 and #3). Consult 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

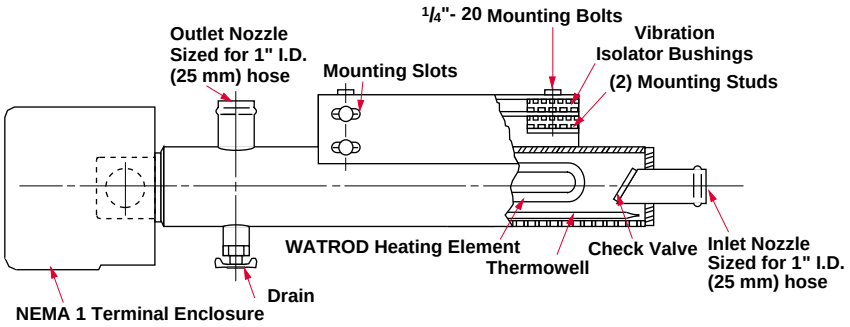
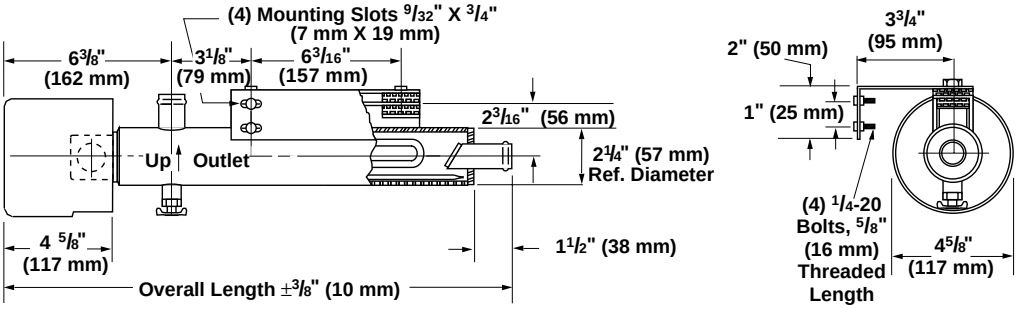


Figure 1



kW	Overall Length Inch	(mm)	Code No. 120/240V~(ac) 1-Phase	208V~(ac) 1-Phase	240/480V~(ac) 1-Phase	Est. Ship. Weight lbs	(kg)
Application: Ethylene Glycol/Engine Coolant							
1.13	20⅞	(530)		CPBPL2S12①		12	(6)
1.50	20⅞	(530)	CPBPB6S12	CPBPB2S12①		12	(6)
1.69	20⅞	(530)		CPBPM2S12①		12	(6)
1.88	20⅞	(530)		CPBPN2S12①		12	(6)
2.00	20⅞	(530)	CPBPC6S12			12	(6)
2.25	20⅞	(530)	CPBPD6S12			12	(6)
2.25	26 11/16	(678)		CPBPD2S12①		15	(7)
2.50	20⅞	(530)	CPBPE6S12			12	(6)
3.00	26 11/16	(678)		CPBPF2S12①	CPBPF7S12	15	(7)
3.75	26 11/16	(678)		CPBPG2S12①		15	(7)
4.00	26 11/16	(678)			CPBPH7S12	15	(7)
5.00	26 11/16	(678)			CPBPJ7S12①	15	(7)

All preheaters are Stock unless otherwise noted.

① Standard

Availability

Stock: Same day shipment

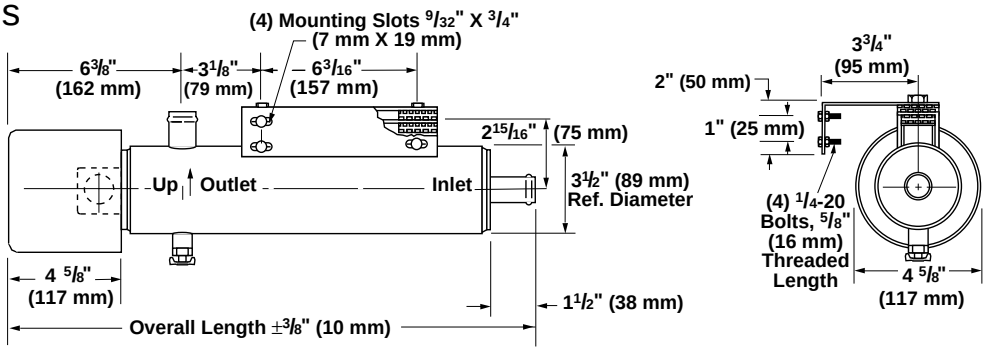
Standard: Four weeks

F.O.B.: Hannibal, Missouri

Circulation Heaters

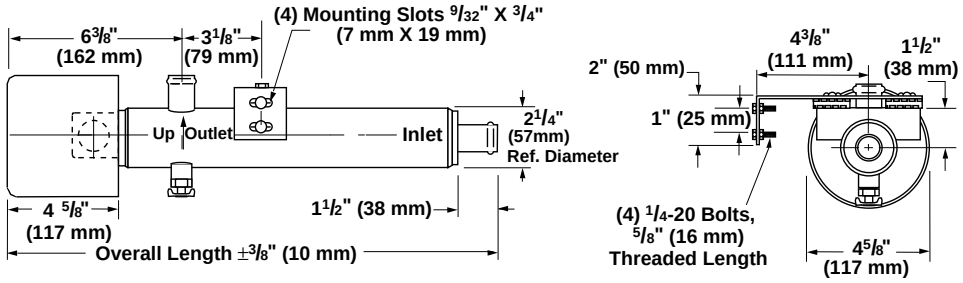
Engine Preheaters

Figure 2



kW	Overall Length Inch	(mm)	Code No. 277V~(ac) 1-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs	(kg)
Application: Ethylene Glycol/Engine Coolant						
1.5	20⅞	(530)	**CPCPB4S12①**	**CPCPB13S12①**	12	(6)
2.0	20⅞	(530)	**CPCPC4S12①**	**CPCPC13S12①**	12	(6)
2.5	20⅞	(530)	**CPCPE4S12①**	**CPCPE13S12①**	12	(6)
3.75	20⅞	(530)	**CPCPG4S12①**	**CPCPG13S12①**	12	(6)
4.0	20⅞	(530)	**CPCPH4S12①**	**CPCPH13S12**	12	(6)
5.0	20⅞	(530)	**CPCPJ4S12①**	**CPCPJ13S12**	12	(6)

Figure 3



kW	Overall Length Inch	(mm)	Code No. 120/240V~(ac) 1-Phase	Code No. 208V~(ac) 1-Phase	Est. Ship. Weight lbs	(kg)
Application: Ethylene Glycol/Engine Coolant						
0.75	15⅝	(397)		**CPBPK2S12①**	9	(4)
1.0	15⅝	(397)	**CPBPA6S12①**		9	(4)

All preheaters are stock unless otherwise noted.

Availability

Stock: Same day shipment

Standard: Four weeks

① Standard

How to Order

To order a Stock, or Standard engine preheater, please specify:

- Code number
- Volts/watts
- Phase
- Options
- Quantity

If our Stock units do not meet your application needs, Watlow will provide a made-to-order unit. For **made-to-order** units, provide the following information:

- Volts/watts
- Phase
- Inlet and outlet type and size
- Terminal enclosure type
- Mounting orientation
- Options
- Quantity

Availability

Stock: Same day shipment

Modified Stock②: Five to seven working days

Standard: Four weeks

Made-to-Order: Six to eight weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

② Stock units with catalog options.

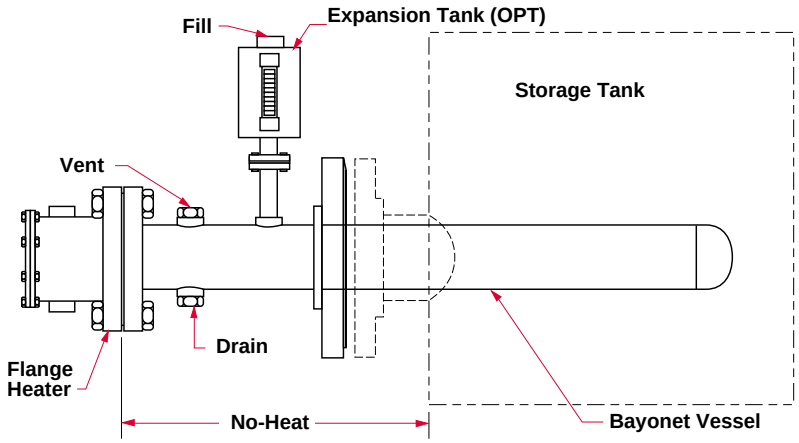
Tubular and Process Assemblies

Circulation Heaters

Pipe Insert Heaters

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 to 100kW
- Voltages to 600V~(ac)
- Ratings to 600 lb pressure class
- Incoloy® sheath temperatures to 1400°F (760°C)
- Stainless steel sheath temperatures to 1200°F (650°C)
- Steel sheath temperatures to 750°F (400°C)

Features and Benefits

- **Low watt density screw plug or flange heaters**, mounted in the bayonet vessel, provide long life.
- **Carbon steel, 304 and 316 stainless steel bayonet vessels** offer compatibility with a wide range of liquids.
- **Welded flange on pipe vessel** ensures pressure seal.
- **Heating element support(s)** ensure proper element spacing and maximum heater performance.
- **Heat transfer fluid fill/drain and vent couplings** ease installation and maintenance.

Applications

- Indirect heating of viscous fluids:
  - Asphalt
  - Tar
  - Molasses
  - Syrup
  - Glue
- Corrosive liquids
- Degreasing fluids

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 340 to 343**, or ***Screw Plug Immersion Heaters***, **pages 322 to 326**.

Flanges

Flanges to 24 inches nominal pipe size are available in materials compatible with specific application needs. For information on flange materials and ratings, consult your Watlow representative.

F.O.B.: Hannibal, Missouri

Circulation Heaters

Pipe Insert Heaters

Bayonet Vessels

Bayonet vessels are available up to 14 inches nominal pipe size and 20 feet long. Vessel size is dependent upon the kW requirement and element watt density. For more information, please consult 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 the proper heat transfer media (air or fluid) to adequately conduct heat from the elements to the bayonet vessel. Consult your Watlow representative for recommendations.
- Select a watt density that's compatible with the heat transfer media being used.
- Use a sheath high-limit sensing device inside the bayonet vessel to protect against element over-heating.
- For pipe insert heater assemblies employing heat transfer fluid, use an expansion tank. This will allow for fluid expansion and contraction during heater cycling.
- Insulate the pipe insert heater's exterior to minimize heat loss.

Caution:
Do not insulate the terminal enclosure.

How to Order

All pipe insert heaters are **made-to-order**. To order, please specify:

- Application
- Volts/watts
- Phase
- Number of circuits
- Bayonet vessel material
- Storage tank mating flange size
- Maximum bayonet length beyond the storage tank mating flange
- Dimension from heater flange to inside of storage tank wall
- Terminal enclosure type
- Options
- Quantity

Availability

Made-to-Order: Six to eight weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

Tubular and Process Assemblies

Quick Ship

On stock chart units:
- *Five to seven days on all heaters*
- *10 working days on special voltages and/or wattages*
- *15 working days on special element lengths*

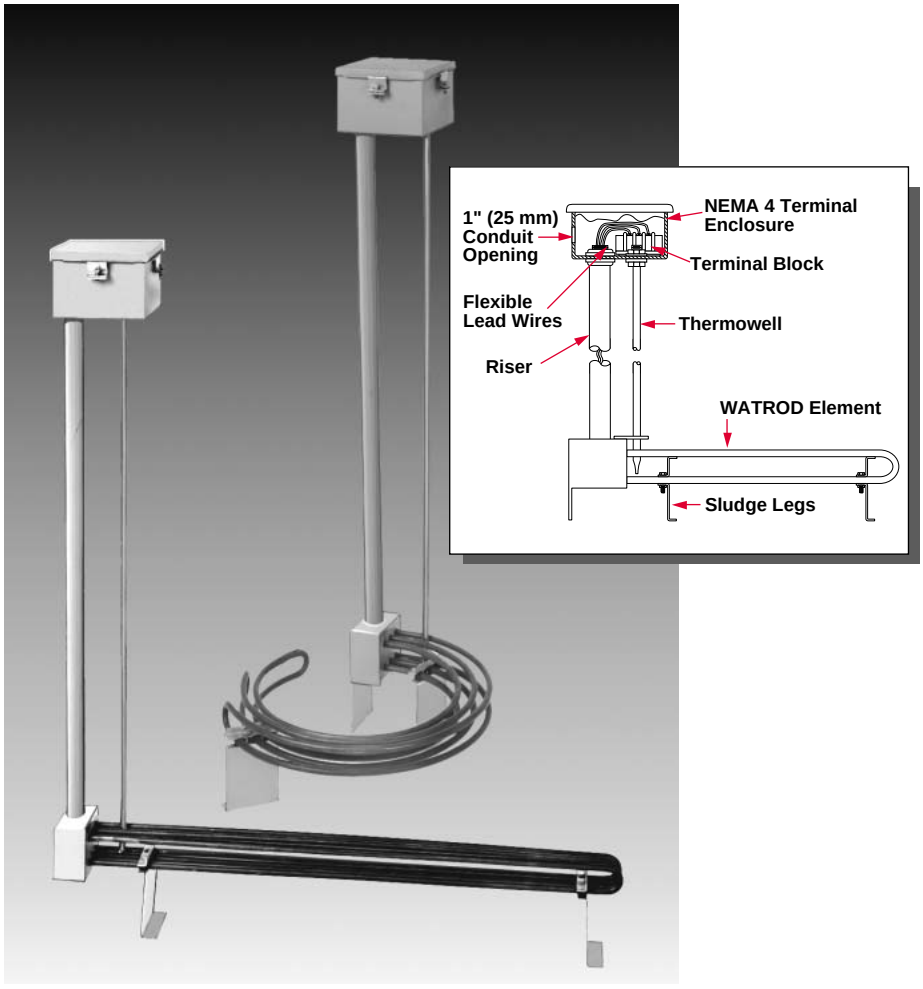
Over-the-Side Heaters

To provide portability, easy installation and removal, Watlow makes Over-the-Side heaters in three versions:

- "L" and "O" shaped
- Vertical loop
- Drum

These "installed-from-the-top" heaters slide easily into tanks, with the heated portion immersed along the side or at the bottom.

Over-the-Side heaters are ideal for heating water, oils, solvents, salts and acids. Application versatility is enhanced with optional sheath materials, kilowatt ratings, terminal enclosures and mounting methods.



"L" and "O" Shaped Performance Capabilities

- Incoloy® sheath element watt densities to 60 W/in² (9.3 W/cm²)
- Steel sheath element watt densities to 23 W/in² (3.6 W/cm²)
- Wattages to 50kW
- Voltages to 600V~(ac)

Features and Benefits

- **Rugged, light-weight construction** resists damage during installation or removal.
- **Three 0.475 inch (12 mm) diameter WATROD heating elements** offer one- or three-phase operation.
- **WATROD hairpins are repressed (recompacted)** after bending to assure MgO density, dielectric strength, heat transfer and life.
- **Four inch (100 mm) sludge legs** keep heating elements off the tank's bottom to help avoid being covered with sediment.
- **RTV riser seal** prevents moisture from infiltrating electrical areas.
- **Standard size one inch conduit openings** facilitate wiring.
- **SRG insulated flexible lead wires**, rated to 390°F (200°C), allow factory or field wiring for three or one phase operation.
- **Riser materials are compatible with element sheath materials:**
  Stainless steel with Incoloy® sheath
  Steel with steel sheath
  All other wetted parts are stainless steel.
- **Integral thermowells** provide convenient temperature sensor insertion and replacement without draining the fluid being heated.
- **Moisture resistant (NEMA 4)** enclosures standard.
- **UL® and CSA component recognition** to 480V~(ac) and 600V~(ac) under file numbers E52951 and 31388 respectively.

Applications

- Water heating
- Freeze protection
- Viscous oils
- Storage tanks
- Degreasing tanks
- Solvents
- Salts
- Caustic solutions
- Paraffin

Over-the-Side Heaters

L and O Shaped

Options

Caution

Explosion-resistant 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.

Terminal Enclosures

Moisture resistant (NEMA 4) terminal enclosures, without thermostats, are standard on all Watlow “L” and “O” shaped Over-the-Side heaters. Optional terminal enclosures meet application requirements with:

- Corrosion resistant (NEMA 4X). Available with or without a single or double pole thermostat.
- Explosion resistant (NEMA 7) class 1 groups C and D. Available with or without a single or double pole thermostat. For class 1, group B enclosures, consult your Watlow representative.
- Explosion/moisture resistant (NEMA 7/4) combinations. Available with or without a single or double pole thermostat.

Terminal enclosures without thermostats may be ordered by specifying the appropriate suffix code:

E for explosion resistant (NEMA 7)
E/W for explosion/moisture resistant (NEMA 7/4).

No suffix code is needed for corrosion resistant (NEMA 4X); simply specify terminal enclosure and rating.

To order a thermostat with a terminal enclosure, add the code number to the Over-the-Side heater base code number.

Thermostats

Optional single and double pole thermostats are also available separately.

For details on thermostats, see *Thermostats*, **pages 423 to 425**.

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 supplied with 120 inch (3050 mm) leads (longer lead lengths available). Unless otherwise specified, thermocouples are supplied with temperature ranges detailed on the *Thermocouple Types* chart.

Thermocouples require an appropriate temperature and power control. These must be purchased separately. Watlow offers a wide variety of temperature and power controls to meet virtually all applications. Temperature controls can be configured to accept process variable inputs, too. Consult your Watlow representative for details.

To order, specify **Type J** or **K** thermocouple, **lead length**, and indicate if it is for measuring **process** temperature or as a **high-limit** sensing device.

Thermocouple Types

ASTM Type	Conductor Characteristics		Recommended ① Temperature Range	
	Positive	Negative	°F	(°C)
J	Iron (Magnetic)	Constantan (Non-magnetic)	0 to 1000	(-20 to 540)
K	Chromel® (Non-magnetic)	Alumel® (Magnetic)	0 to 2000	(-20 to 1100)

① Type J and Type K thermocouples are rated 32 to 1382°F and 32 to 2282°F (0-750°C and 0-1250°C), respectively. Watlow does not recommend exceeding temperature ranges shown on this chart for the tubular product line.

Alumel® and Chromel® are registered trademarks of the Hoskins Manufacturing Company.

Tubular and Process Assemblies

Over-the-Side Heaters

L and O Shaped

Options

Continued

Wattages and Voltages

Watlow routinely supplies Over-the-Side heaters with 240 to 480V~(ac) as well as wattages from three to 18 kilowatts. If required, Watlow can configure heaters with voltages and wattages outside these parameters.

For more information about this option, consult your Watlow representative.

Multiple Elements

Over-the-Side immersion heaters are configured with three WATROD heating elements.

To achieve a specific kilowatt rating, Watlow can configure units with up to 18 heating elements.

To order, specify **multiple elements**, the **number of elements**, **volts**, **watts**, **phase** and **maximum bundle height** and **width**.

Sheath Material

Stock “O” and “L” shaped Over-the-Side heaters come with Incoloy® or steel sheaths. 304 or 316 stainless steel and titanium sheaths are available upon request.

To order, specify the **sheath material**.

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 and other wetted surfaces.

To order, specify **passivation**.

Riser

A stainless steel or steel riser is supplied to keep terminal enclosures out of the heated solution. Stock heights are 39⁵⁄₁₆ or 51⁵⁄₁₆ inches (1000 or 1320 mm). Upon request, riser height up to 60 feet (18.3 m) can be provided.

To order, specify **riser material** and and **height**.

Right Angle Riser

Riser may be right angle formed to move the terminal enclosure away from over the tank.

To order, specify **right angle riser** and **dimensions**.

Sludge Legs

Four inch (100 mm) sludge legs are supplied on all stock units to keep elements above sediments. Shorter or longer sludge legs are available upon request.

To order, specify **sludge legs** and **height**.

Man Hole Cover

A man hole cover seals the tank and provides heater mounting.

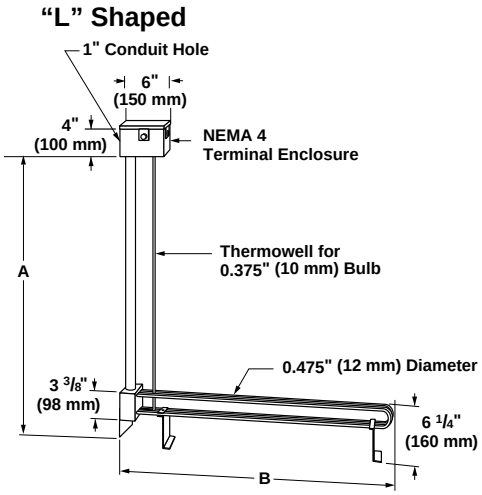
Man hole covers are pre-assembled to the riser. Standard man hole covers are made from steel with other materials available upon request.

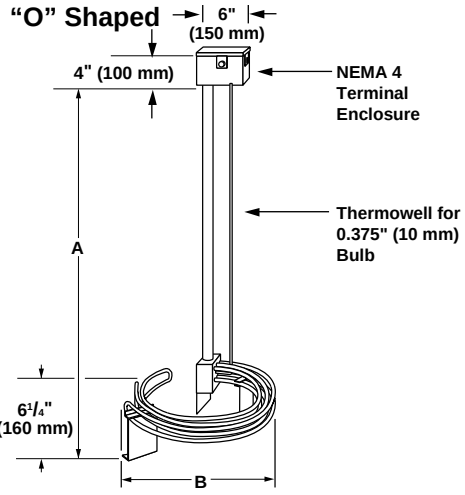
To order, specify **man hole construction**, **diameter** and **material**.

F.O.B.: Hannibal, Missouri

Over-the-Side Heaters

L and O Shaped





"L" Shaped

WATROD Description	kW	A Dimension inch	A Dimension (mm)	B Dimension inch	B Dimension (mm)	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs	Est. Ship. Weight (kg)
Applications: Process Water, Mild Caustic Solutions (2% Max), Clean Water									
48 W/in²	3	39 5/16	(1000)	14 5/8	(370)	**OLN714L3W**	**OLN714L13W①**	30	(14)
Incoloy®	6	39 5/16	(1000)	22 5/8	(575)	**OLN722L3W**	**OLN722L5W**	40	(19)
(7.5 W/cm²)	9	39 5/16	(1000)	30 1/8	(765)	**OLN730C3W**	**OLN730C5W**	45	(21)
	12	51 5/16	(1300)	37 5/8	(955)	**OLN737L3W**	**OLN737L5W**	50	(23)
	15	51 5/16	(1300)	45 1/8	(1145)	**OLN745C3W**	**OLN745C5W**	65	(30)
	18	51 5/16	(1300)	52 5/8	(1335)	**OLN752L3W**	**OLN752L5W**	75	(34)
Applications: Citric and Phosphoric Acid Solutions, Caustic Solutions, Water Based Solutions									
23 W/in²	3	39 5/16	(1000)	22 5/8	(575)	**OLNA22L3W**	**OLNA22L5W**	40	(19)
Incoloy®	6	51 5/16	(1300)	37 5/8	(955)	**OLNA37L3W**	**OLNA37L5W**	50	(23)
(3.6 W/cm²)	9	51 5/16	(1300)	52 5/8	(1335)	**OLNA52L3W**	**OLNA52L5W**	75	(34)
Applications: Lightweight Oils, Degreasing Solutions, Mineral Oil									
23 W/in²	3	39 5/16	(1000)	22 5/8	(575)	**OLS722L3W**	**OLS722L5W**	40	(19)
Steel	6	51 5/16	(1300)	37 5/8	(955)	**OLS737L3W**	**OLS737L5W**	50	(23)
(3.6 W/cm2)	9	51 5/16	(1300)	52 5/8	(1335)	**OLS752L3W**	**OLS752L5W**	75	(34)

"O" Shaped

WATROD Description	kW	A Dimension inch	A Dimension (mm)	B Dimension inch	B Dimension (mm)	Code No. 240V~(ac) 3-Phase	Code No. 480V~(ac) 3-Phase	Est. Ship. Weight lbs	Est. Ship. Weight (kg)
Applications: Process Water, Mild Caustic Solutions (2% Max), Clean Water									
48 W/in²	3	39 5/16	(1000)	10 3/4	(270)	**ORN710N3W**	**ORN710N13W①**	30	(14)
Incoloy®	6	39 5/16	(1000)	13 1/2	(345)	**ORN713J3W**	**ORN713J5W**	40	(19)
(7.5 W/cm²)	9	39 5/16	(1000)	16	(405)	**ORN716A3W**	**ORN716A5W**	45	(21)
	12	51 5/16	(1300)	18 1/2	(470)	**ORN718J3W**	**ORN718J5W**	50	(23)
	15	51 5/16	(1300)	21 1/2	(540)	**ORN721E3W**	**ORN721E5W**	65	(30)
	18	51 5/16	(1300)	23 1/2	(595)	**ORN723J3W**	**ORN723J5W**	75	(34)
Applications: Citric and Phosphoric Acid Solutions, Caustic Solutions, Water Based Solutions									
23 W/in²	3	39 5/16	(1000)	13 1/2	(345)	**ORNA13J3W**	**ORNA13J5W**	40	(19)
Incoloy®	6	51 5/16	(1300)	18 1/2	(470)	**ORNA18J3W**	**ORNA18J5W**	50	(23)
(3.6 W/cm²)	9	51 5/16	(1300)	23 1/2	(595)	**ORNA23J3W**	**ORNA23J5W**	75	(34)
Applications: Lightweight Oils, Degreasing Solutions, Mineral Oil									
23 W/in²	3	39 5/16	(1000)	13 1/2	(345)	**ORS713J3W**	**ORS713J5W**	40	(19)
Steel	6	51 5/16	(1300)	18 1/2	(470)	**ORS718J3W**	**ORS718J5W**	50	(23)
(3.6 W/cm²)	9	51 5/16	(1300)	23 1/2	(595)	**ORS723J3W**	**ORS723J5W**	75	(34)

All units are Assembly Stock.
Availability
Assembly Stock: Five to seven working days

Truck Shipment only
① Must be operated 3-phase only.

Tubular and Process Assemblies

F.O.B.: Hannibal, Missouri

Over-the-Side Heaters

L and O Shaped

Base Code Number

Includes moisture resistant (NEMA 4) terminal enclosure without thermostat

Enclosure with Thermostat

See chart below for order code suffix

Thermostat	Temperature °F	Temperature (°C)	Max. A Dimension inch	Max. A Dimension (mm)	Code No. Suffix: Moisture Resistant	Code No. Suffix: Explosion Resistant	Code No. Suffix: Exp./Moist. Resistant
Single Pole Single Throw (SPST) ①	30-250	(0-120)	84	(2135)	**2A**	**E2A**	**E/W2A**
	175-550	(80-290)	84	(2135)	**3A**	**E3A**	**E/W3A**
	300-700	(150-350)	60	(1525)	**10**	**E10**	**E/W10**
Double Pole Single Throw (DPST) ②	60-250	(15-120)	52	(1320)	**5**	**E5**	**E/W5**
	60-250	(15-120)	52	(1320)	**5A**	**E5A**	**E/W5A**
	100-550	(40-290)	60	(1525)	**6**	**E6**	**E/W6**
	100-550	(40-290)	52	(1320)	**7**	**E7**	**E/W7**
	100-550	(40-290)	52	(1320)	**7A**	**E7A**	**E/W7A**
On-Off Manual Reset (DPST)	60-250	(15-120)	55	(1395)	**8**	**E8**	**E/W8**
	100-550	(40-290)	60	(1525)	**9**	**E9**	**E/W9**

① SPST thermostats require an electrical contactor if operated at 480V~(ac); at 240V~(ac) over 22 amps; or wired three phase.

② DPST thermostats require an electrical contactor if operated at 480V~(ac) over 21 amps; at 240V~(ac) over 30 amps; or wired three phase wye.

How to Order

To order a stock unit, please specify:

- Watlow code number
- Volts/watts
- Phase
- Options
- Quantity

If our stock units do not meet your application needs, Watlow will provide **made-to-order** units. Consult your Watlow representative and provide the following information:

- Application
- Volts/watts
- Phase
- Number of circuits
- Watt density
- Number of heating elements and sheath material
- ‘A’ dimension
- ‘B’ dimension
- Options, including terminal enclosure type
- Quantity

Availability

Assembly Stock: Five to seven working days

Modified Stock ③: Five to seven working days

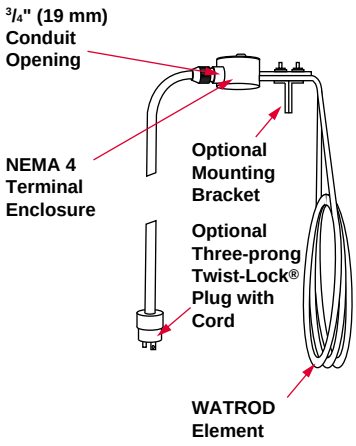
Made-to-Order: Five to seven weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

③ Assembly Stock units with catalog options.

Over-the-Side Heaters

Vertical Loop Heater



These light-weight, thin-profile vertical loop heaters are well suited for open tank applications.

A WATROD tubular element, formed into spiral loops, hugs the tank wall to maximize tank work space.

Available with four different sheath materials, vertical loop heaters come with options to meet application requirements.

Versatility is further enhanced with optional three-prong, Twist-Lock® plug and adjustable mounting brackets.

Performance Capabilities

- Incoloy® sheath watt densities to 60 W/in² (9.3 W/cm²)
- Titanium sheath watt densities to 45 W/in² (7 W/cm²)
- Steel sheath watt densities to 23 W/in² (3.5 W/cm²)
- Wattages to 9kW
- Voltages to 600V~(ac)

Features and Benefits

- **WATROD element** is filled with compacted MgO insulation to maximize dielectric strength, heat transfer and life.
- **Long no-heat ends** form the heater's riser. No-heat ends leave only the element's looped portion submerged and heated. These are also formed into a right angle to move the terminal enclosure away from over the tank.
- **Moisture resistant (NEMA 4) terminal enclosure** offers easy access to terminal wiring.
- **Terminal enclosure materials** depend on element sheath material. These include:

Cast iron	Incoloy® Steel 316 stainless steel
PVC	Titanium

- **Conduit openings** accept ¾ inch conduit fittings to facilitate wiring.
- **Screw lug terminals** accept customer supplied ring-type wire terminals.
- **Ground terminals** are supplied to facilitate equipment grounding.

Applications

- Water heating
- Lightweight oils
- Salt baths
- Mild acid baths
- Cleaning solutions
- Plating solutions

Options

Three-prong, Twist-Lock® Plug

An optional flexible cord, with three-prong, Twist-lock® plug, provides easy connection to standard 220V~(ac) outlets. The 70 inch (1780 mm) cord is rubber insulated to resist oil, ozone, grease, chemicals, acids, solvents, weather and temperature extremes to 195°F (90°C).

To order, add the suffix letter **C** to the heater's base code number.

Wattages and Voltages

Watlow supplies stock vertical loop heaters as 240V~(ac), with wattages from five to eight kilowatts. To meet specific application needs, Watlow can configure heaters with voltages and wattages outside these parameters.

For more information about this option, consult your Watlow representative.

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**.

Tubular and Process Assemblies

F.O.B.: Hannibal, Missouri

Over-the-Side Heaters

Vertical Loop Heater

Options

Continued

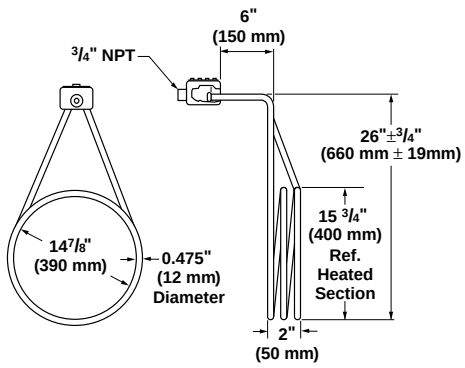
Adjustable Mounting Brackets

To accommodate varying tank wall thicknesses, optional stainless steel mounting brackets adjust from 0 to 4¾ inches (0 to 120 mm).

To order, add suffix letter **B** to the vertical loop heater base code number.

Application Hints

- Determine recommended sheath material and watt density by using the ***Supplemental Applications Chart*** on **pages 263 to 266**. If unable to determine the appropriate sheath material and watt density for the fluid being heated, consult your Watlow representative.
- Ensure conduit openings and fittings are compatible with the environment around the heater enclosure.
- Use optional mounting brackets to position the heating element so there is ample space between the tank wall and the heating element.
- Ensure the liquid level stays above the heater's looped section. If not submerged, it will overheat or create a hazardous situation.
- Remove the heater periodically to inspect and clean the element. This maintenance procedure will prolong the heater's life.



All units are Stock unless otherwise noted.
Availability
Stock: Same day shipment
Standard: Five weeks
Made-to-Order: Eight weeks

Vertical Loop Heaters

Applications	WATROD Description	kW	Code No. 240V~(ac) 1-Phase	Est.Ship. Weight lbs	(kg)
Conventional Plating Baths Such as Copper Plating, Cyanide Type; Tin Plating, Alkaline Stannate Type; Brass and Bronze; Nickel, Chrome, Gold and Silver Plating and Iron Chromide. Nitrites, Permanganates, Persulfates and Dichromates.	**43 W/in²** **Titanium** (6.7 W/cm²)	8	**VLT10W8** ①	28	(13)
Water Heating and Mild Acids	**40 W/in²** **Incoloy®** (6.2 W/cm²)	8	**VLN10W8**	28	(13)
Mild Acid Baths	**40 W/in²** **316 SS** (6.2 W/cm²)	8	**VLR10W8**	28	(13)
Alkaline Solutions Which Do Not Contain Fluorides, Fluoroborates or Fluorosilicates, Pyrophosphate Copper, Ferric Chloride, Iron Chloride; Bright Dips and Pickles Containing Nitric, Phosphoric, and Chromic Acids	**27 W/in²** **Titanium** (4.2 W/cm²)	5	**VLT10W5** ①	28	(13)
Water Heating, Corrosive Liquids and Salt Baths	**23 W/in²** **Incoloy®** (3.6 W/cm²)	5	**VLN10W5**	26	(12)
Citrus Juices, Mild Acid Baths and Other Fluids Normally Corrosive to Steel	**23 W/in²** **316 SS** (3.6 W/cm²)	5	**VLR10W5**	26	(12)
Oil Tempering Baths, Salt Baths, Alkaline Cleaning Solutions, Cyanide Cleaning Solutions	**23 W/in²** **Steel** (3.6 W/cm²)	5 8	**VLS10W5** **VLS10W8**	26 26	(12) (12)

① Standard

F.O.B.: Hannibal, Missouri

Over-the-Side Heaters

Vertical Loop Heater

How to Order

To order a stock vertical loop heater, please specify:

- Watlow code number
- Volts/watts
- Options
- Quantity

If our stock units do not meet your application needs, Watlow will provide **made-to-order** units.

Consult your Watlow representative and provide the following information:

- Application
- Volts/watts
- Watt density
- Dimensions
- No-heat section
- Heating element diameter and sheath material
- Options
- Quantity

Availability

Stock: Same day shipment

Modified Stock ①: Five to seven working days

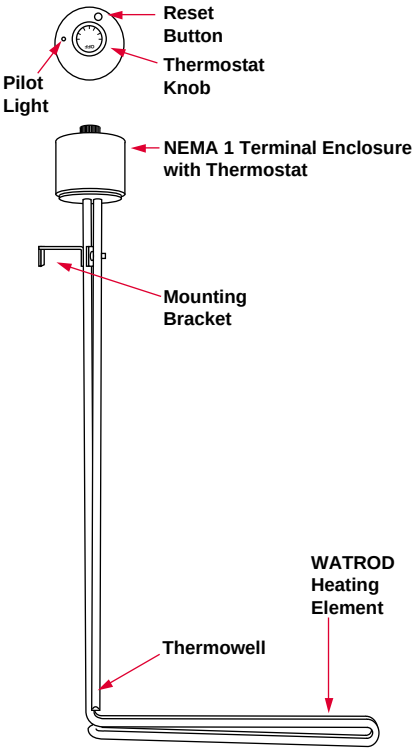
Standard: Three weeks

Made-to-Order: Five to seven weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

① Stock units with catalog options.

Drum



Designed for direct immersion in a standard 55 gallon steel drum, these heaters install easily through the two inch (50 mm) bung hole.

These one to four kilowatt WATROD heaters come prewired with a thermostat, manual reset button and pilot light in a general purpose (NEMA 1) terminal enclosure. This internal tank temperature sensing feature protects against overheating.

Performance Capabilities

- Incoloy® sheath watt densities to 60 W/in² (9.3 W/cm²)
- Wattages to 9kW
- Voltages to 600V~(ac)

Features and Benefits

- **Light-weight, rugged construction** resists damage during installation or removal.
- **Stainless steel mounting bracket** adjusts to varying immersion depths to keep the heating element above settled sludge.
- **A 0.475 inch (12 mm) diameter Incoloy® WATROD element** has its hairpins repressed (recompacted) after bending to assure MgO density, dielectric strength, heat transfer and life.
- **Integral, on-off, manual reset, Type 8 thermostat**, rated from 60 to 250°F (15 to 120°C), senses process temperature and helps protect against overheating.
- **Pilot light** indicates if heater is cycled on or off.
- **30 inch (760 mm) long no-heat ends** form the heater's riser. No-heat ends leave only the element's heated portion submerged.
- **General purpose (NEMA 1) terminal enclosure** has one inch (25 mm) conduit openings to facilitate wiring.
- **UL® and CSA component recognition** to 480 and 600V~(ac) maximum under file numbers E52951 and 31388 respectively.

Tubular and Process Assemblies

Over-the-Side Heaters

Drum

Applications

- Melting heat sensitive materials such as wax, lard, grease and coconut oil
- Water and water-based solution heating
- Freeze protection

Options

Terminal Enclosures

A general purpose (NEMA 1) terminal enclosure, with integral thermostat, is supplied on all Watlow drum heaters. As an option, moisture resistant (NEMA 4) and explosion resistant (NEMA 7) terminal enclosures are available to protect both wiring and the thermostat.

To order, add the suffix letter **W** for moisture resistant (NEMA 4) or **E** for explosion resistant (NEMA 7) to the drum heater's base code number.

Wattages and Voltages

Watlow routinely supplies drum heaters in 120, 240 and 480V~(ac) in one or four kilowatt versions. Watlow will configure heaters with voltages and wattages outside these parameters.

For more information about this option, consult your Watlow representative.

Three-prong, Twist-Lock® Plug

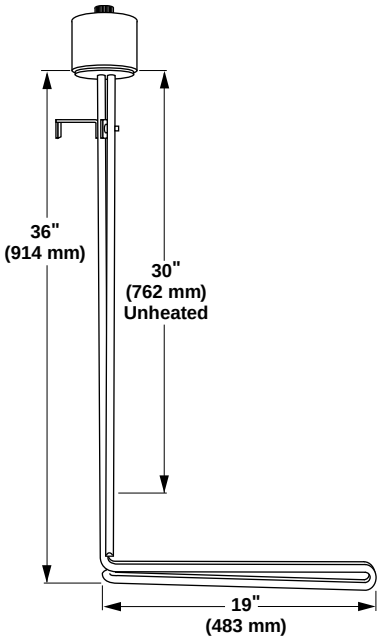
An optional flexible cord, with three-prong, Twist-lock® plug, provides easy connection to standard 220V~(ac) outlets. The 70 inch (1780 mm) cord is rubber insulated to resist oil, ozone, grease, chemicals, acids, solvents, weather and temperature extremes to 195°F (90°C).

To order, add the suffix letter **CP** to the drum heater base code number.

Application Hints

- Determine recommended sheath material and watt density by using the ***Supplemental Applications Chart*** on **pages 263 to 266**. If unable to determine the correct sheath material and watt density, consult your Watlow representative.
- Ensure that the element's heated portion is fully immersed at all times. If the element is not sufficiently submerged, it will overheat and become damaged.
- Use drum heaters only in metal drums.
- Do not use the thermostat as an on-off switch. Use a disconnect switch or circuit breaker to cut power prior to servicing.
- Ensure that conduit openings and fittings are compatible with the environment around the heater enclosure.
- Use the adjustable mounting bracket to raise the heating element above the drum's sludge level.
- Periodically remove the heater to inspect and clean the element. This maintenance procedure will prolong the heater's life.

Over-the-Side Heaters



Drum Heater

WATROD Description	kW	Code No. 120V~(ac) 1-Phase	Code No. 240V~(ac) 1-Phase	Code No. 480V~(ac) 1-Phase	Est. Ship. Weight lbs (kg)
Applications: Solvents, Water and Water Based Solutions					
32 W/in² Incoloy® (5 W/cm²)	4		**OLDN10S4**	**OLDN10S11**	35 (16)
Applications: Melting Oils, Lard, Fats, Tar					
8 W/in² Incoloy® (1.3 W/cm²)	1	**OLDN1S1**	**OLDN10S1**		35 (16)

All units are stock.

Availability

Stock: Same day shipment

How to Order

To order a stock drum heater, please specify:

- Watlow code number
- Volts/watts
- Options
- Quantity

If stock units do not meet your application needs, Watlow will provide **made-to-order** units.

Consult your Watlow representative and provide the following:

- Application
- Volts/watts
- Watt density
- Dimensions
- No-heat section
- Heating element diameter and sheath material
- Options
- Quantity

Availability

Stock: Same day shipment

Modified Stock ①: Five to seven working days

Standard: Three weeks

Made-to-Order: Five to seven weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

① Stock units with catalog options.

Tubular and Process Assemblies

Quick Ship

On stock chart units:
- *Three to five working days on most heaters*
- *10 working days on special voltages and/or wattages*
- *15 working days on special element lengths*

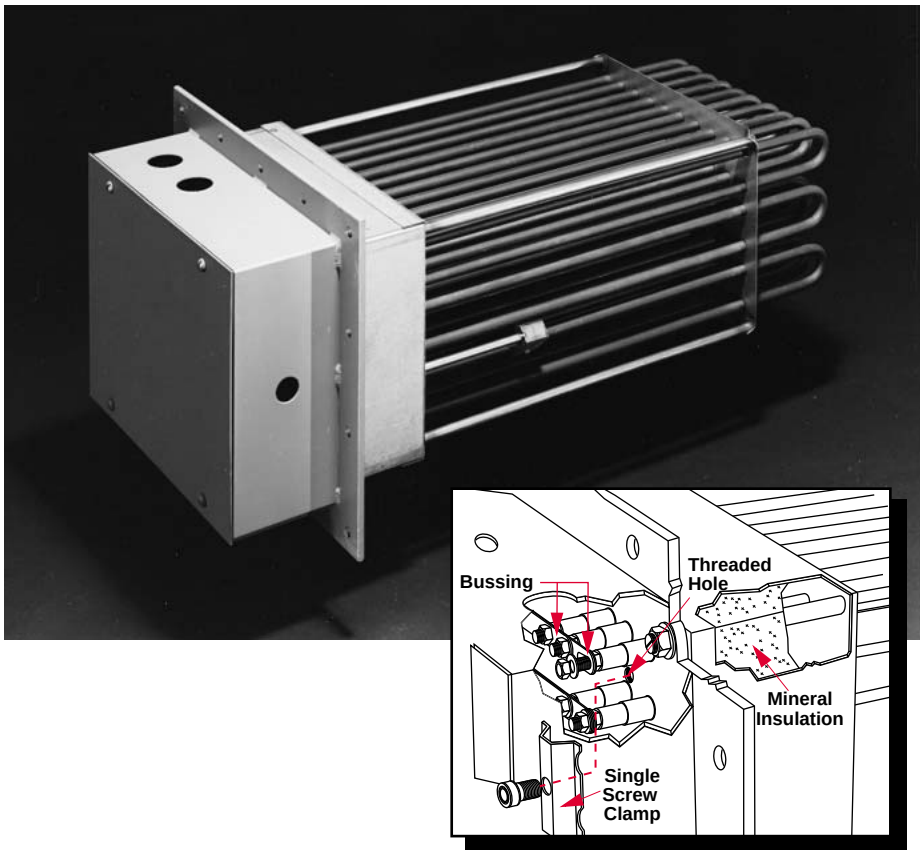
Duct Heaters

Constructed of sturdy 0.430 inch (11 mm) diameter WATROD heating elements mounted to a ¼ inch (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 vs. air flow combinations.

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 Incoloy® sheath is protected from corrosive environments.



Performance Capabilities

- Watt densities to 40 W/in² (6.2 W/cm²)
- Recommended process temperatures from -20 to 1200°F (-7 to 650°C)
- Wattages to 2.2 megawatts
- Voltages to 600V~(ac)

Features and Benefits

- **Long life Incoloy® sheath** resists corrosion/oxidation while protecting resistance coils against contamination.
- **MgO insulation filled elements**, compacted to rock hard density maximize dielectric strength, heat transfer and life.
- **Field replaceable heating elements** permit easy service and reduce downtime. Element change-out is made simple by a single screw clamp.
- **3½ inches (90 mm) thick mineral insulation** keeps wiring cooler and reduces heat loss.
- **Vented general purpose (NEMA 1) terminal enclosure** ensures cooler terminations.
- **A ¼ inch (6 mm) inside diameter thermowell** accepts an optional Type J or K thermocouple for accurate sheath temperature sensing.
- **Rigid stainless steel supports** prevent element sagging or deformation in various mounting positions.
- **A ¼ inch (6 mm) thick steel flange**, with ⅜ inch (10 mm) diameter mounting holes, easily bolts to the duct wall.
- **WATROD hairpins are repressed (recompacted)** after bending to assure MgO density that eliminates hot spots and electrical insulation voids.
- **Stock heaters feature 6, 12, 18, 24, 30, 36, 42, 48, 54, and 60 elements** to meet a wide variety of kW demands.
- **One or three phase voltages** to meet local power supplies.
- **Maximum 48 amps per circuit** complies with National Electrical Code (NEC).
- **Duct heaters with general purpose enclosures meet UL® and CSA component recognition** to 480 and 600V~(ac) maximum respectively—UL® and CSA file numbers are E52951 and 31388.

Incoloy® is a registered trademark of Special Metals Corporation.

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

Duct Heaters

Applications

- Drying ovens
- Autoclaves
- Furnaces
- Load banks
- Heat treating
- Reheating
- HVAC
- Paint drying

Choosing a Duct Heater

The following English and metric graphs, shown on **pages 413 to 414**, 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

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

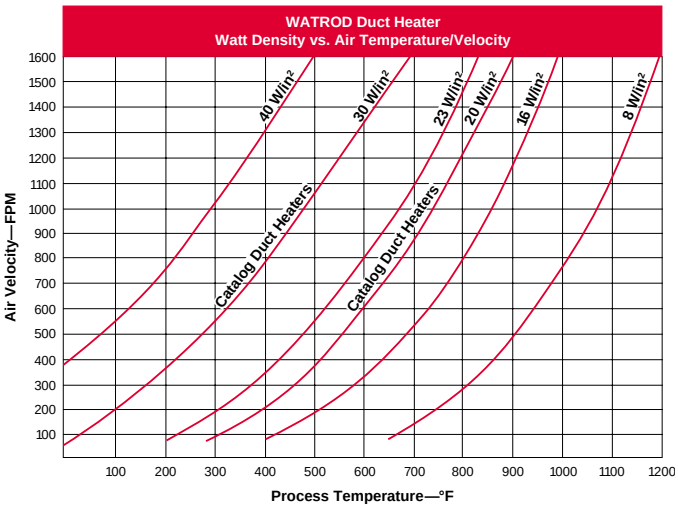
Note: The duct heater, or combination of duct heaters, used for the process should be equal to or exceed the minimum wattage calculation.

Tubular and Process Assemblies

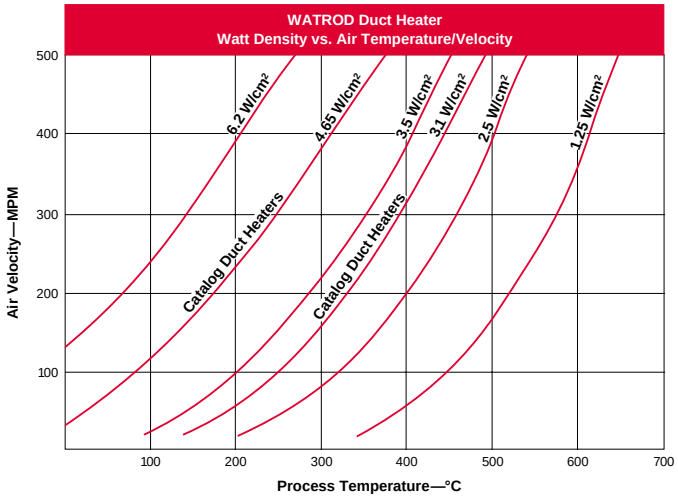
Duct Heaters

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.**



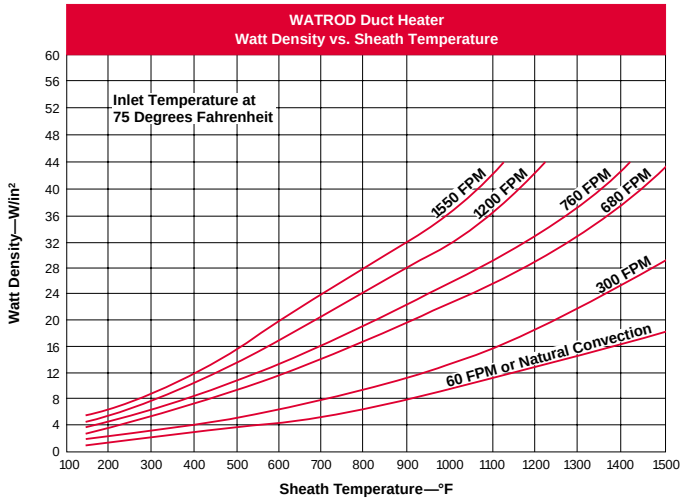
Estimated Sheath Temperature = 1400°F

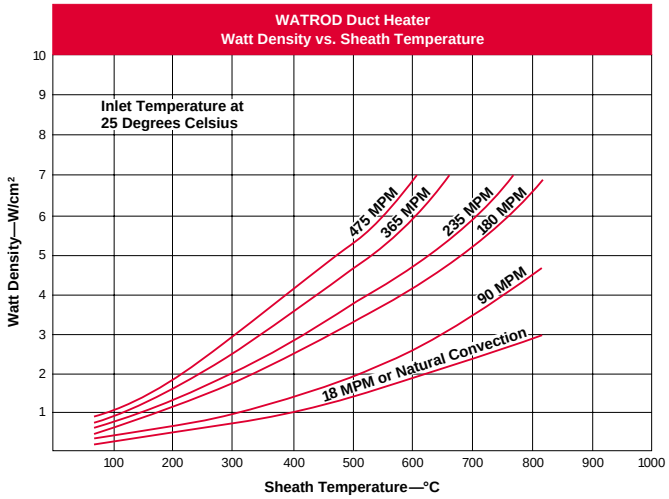


Estimated Sheath Temperature = 760°C

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.



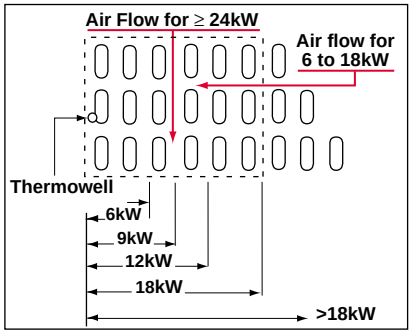


Duct Heaters

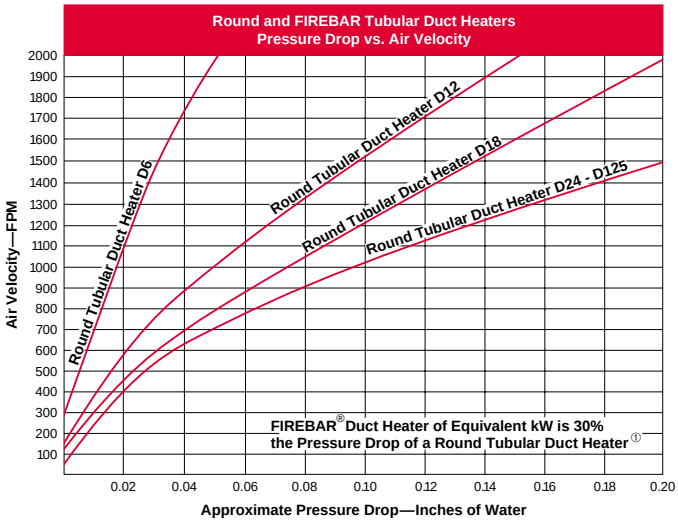
Pressure Drop vs. Air Velocity

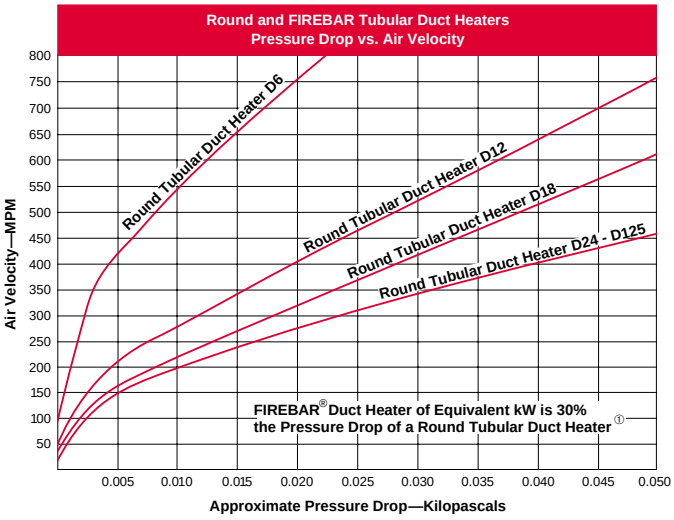
The rate at which pressure drops through the duct heater is critical for properly sizing blowers and pumps. *The Pressure Drop vs. Air Velocity* graph gives recommended maximum velocities in feet per minute and meters per minute according to the air velocity and duct heater size.

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.





① FIREBAR® flat tubular element duct heaters can be custom designed and built when they enhance your application output or performance. Although duct heaters are not normally constructed with FIREBAR elements, we show the pressure drop reduction using FIREBAR as a distinct advantage.

Options

Sheath Material

Watlow duct heaters can be made with element sheath materials other than Incoloy®.

Consult your Watlow representative for details and availability.

Wattages/Voltages

To meet specific application needs, voltage and wattage combinations outside stock product parameters are available.

For more information about this option, consult your Watlow representative.

Tubular and Process Assemblies

Duct Heaters

Options

Continued

Terminal Enclosures

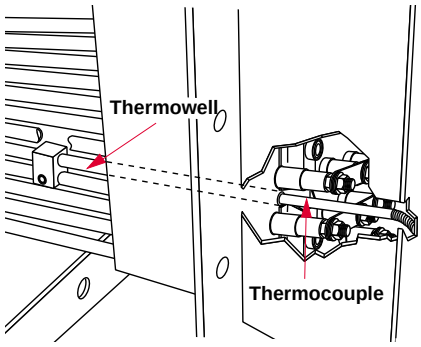
In addition to the standard, general purpose (NEMA 1) terminal enclosure, Watlow offers the following optional terminal enclosures to meet specific application requirements:

- Moisture resistant (NEMA 4)
- Stainless steel corrosion resistant (NEMA 4X—consult factory)
- Explosion resistant (NEMA 7—consult factory)
- Dust resistant (NEMA 12)

Thermocouples

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

To sense process temperature, sensing element should be located down stream from the duct heater. This will eliminate incorrect sensing caused by radiant heat.



Duct heater thermowell holds thermocouple for sensing sheath temperature.

Thermocouples are supplied with 120 inch (3050 mm) leads (longer lead lengths available). Unless otherwise specified, thermocouples are supplied with temperature ranges detailed on the *Thermocouple Types* chart.

Using a thermocouple requires an appropriate temperature and power control. These must be purchased separately. Watlow offers a wide variety of temperature and power controls to meet virtually all applications. Temperature controls can be configured to accept process variable inputs, too. Consult your Watlow representative for details.

To order a thermocouple, add the appropriate suffix letter to the duct heater's base code number, as indicated on the Build-a-Code chart on **page 418**.

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)

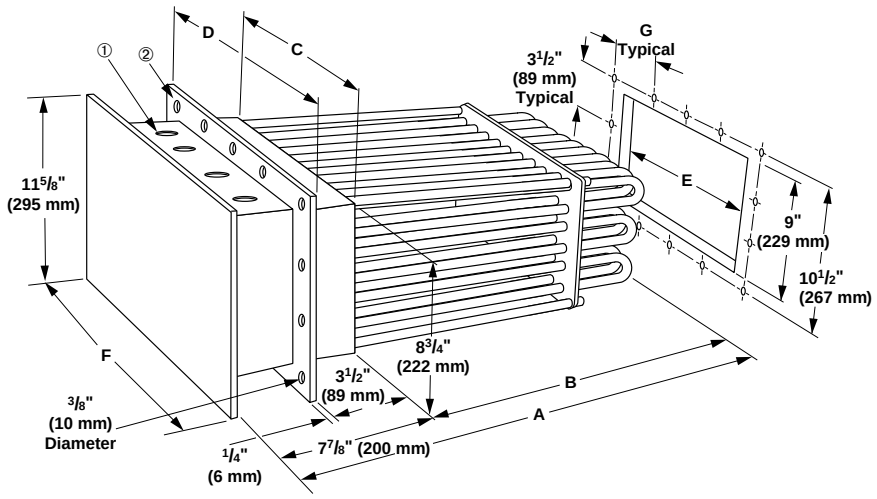
① **Type J** and **Type K** thermocouples are rated 32 to 1382°F and 32 to 2282°F (0-750°C and 0-1250°C), respectively. Watlow does not recommend exceeding temperature ranges shown on this chart for the tubular product line.

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 414**.
- 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.

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

Duct Heaters



① Stock heaters with six and 12 elements have one 1 inch NPT conduit opening.

Stock heaters with 18, 24, 30 and 42 elements have two 1 inch NPT conduit openings.

Stock heaters with 36, 48, 54 and 60 elements have two 1 inch NPT and two 1¼ inch NPT conduit openings.

② All flanges are 12 inches wide.

Duct Heater Dimensions

Dimension Reference No.	Number of Elements	A Dimension in	A (mm)	B Dimension in	B (mm)	C Dimension in	C (mm)	D Dimension in	D mm	E Dimension in	E (mm)	F Dimension in	F (mm)	G Dimension in	G (mm)
1	6	27⅞	(708)	20	(508)	2¾	(70)	6½	(165)	3	(76)	5 ¾	(146)	2½	(64)
2	12	27⅞	(708)	20	(508)	4¾	(121)	8 ½	(215)	5	(127)	7 ¾	(197)	3½	(89)
3	18	27⅞	(708)	20	(508)	6¾	(171)	10½	(267)	7	(178)	9 ¾	(248)	3½	(76)
4	24	27⅞	(708)	20	(508)	8¾	(222)	12½	(318)	9	(229)	11 ¾	(298)	2¾	(70)
5	30	27⅞	(708)	20	(508)	10¾	(273)	14½	(368)	11	(279)	13 ¾	(349)	3¼	(83)
6	36	27⅞	(708)	20	(508)	12¾	(324)	16½	(419)	13	(330)	15 ¾	(400)	3¾	(95)
7	42	27⅞	(708)	20	(508)	14¾	(375)	18½	(470)	15	(381)	17 ¾	(451)	4¼	(108)
8	48	27⅞	(708)	20	(508)	16¾	(425)	20½	(521)	17	(432)	19 ¾	(502)	4¾	(121)
9	54	27⅞	(708)	20	(508)	18¾	(476)	22½	(572)	19	(483)	21 ¾	(552)	5¼	(133)
10	60	27⅞	(708)	20	(508)	20¾	(527)	24½	(622)	21	(533)	23 ¾	(603)	5¾	(146)
11	60	32⅞	(835)	25	(635)	20¾	(527)	24½	(622)	21	(533)	23 ¾	(603)	5¾	(146)
12	60	40⅜	(1026)	32½	(826)	20¾	(527)	24½	(622)	21	(533)	23 ¾	(603)	5¾	(146)
13	60	49⅜	(1254)	41½	(1054)	20¾	(527)	24½	(622)	21	(533)	23 ¾	(603)	5¾	(146)

20 W/in² (3.1 W/cm²)

kW	Dimension Reference No.	Number of Elements	Code No. 240V~(ac) 1-Phase	# of Circ.	240V~(ac) 3-Phase	# of Circ.	480V~(ac) 1-Phase	# of Circ.	480V~(ac) 3-Phase	# of Circ.	Est. Ship. Weight lbs	(kg)
6	1	6	**D6S10**	1	**D6S3**	1	**D6S11**	1	**D6S5**	1	50	(23)
12	2	12	**D12S10**	1	**D12S3**	1	**D12S11**	1	**D12S5**	1	55	(25)
18	3	18	**D18S10**	2	**D18S3**	1	**D18S11**	1	**D18S5**	1	65	(30)
24	4	24	**D24S10**	2	**D24S3**	2	**D24S11**	1	**D24S5**	1	95	(43)
30	5	30			**D30S3**	2	**D30S11**	2	**D30S5**	1	120	(55)
36	6	36			**D36S3**	2	**D36S11**	2	**D36S5**	1	135	(62)
42	7	42			**D42S3**	2	**D42S11**	2	**D42S5**	2	155	(71)
48	8	48			**D48S3**	4	**D48S11**	2	**D48S5**	2	195	(89)
54	9	54			**D54S3**	3	**D54S11**	3	**D54S5**	2	205	(93)
60	10	60			**D60S3**	4	**D60S11**	4	**D60S5**	2	235	(107)
75	11	60			**D75S3**②	4	**D75S11**	4	**D75S5**	2	260	(118)
100	12	60							**D100S5**②	4	290	(132)
125	13	60							**D125S5**②	4	310	(141)

All duct heaters are Assembly Stock unless otherwise noted. ② Standard

Availability

Assembly Stock: Three to five working days

Standard: 10 working days

Truck Shipment only

Tubular and Process Assemblies

Duct Heaters

30 W/in² (4.7 W/cm²)

kW	Dimension Reference No.	Number of Elements	Code No.								Est. Ship. Weight	
			240V~(ac) 1-Phase	# of Circ.	240V~(ac) 3-Phase	# of Circ.	480V~(ac) 1-Phase	# of Circ.	480V~(ac) 3-Phase	# of Circ.	lbs	(kg)
9	1	6	**D6SX10**	1	**D6SX3**	1	**D6SX11**	1	**D6SX5**	1	50	(23)
18	2	12	**D12SX10**	2	**D12SX3**	1	**D12SX11**	1	**D12SX5**	1	55	(25)
27	3	18	**D18SX10**	3	**D18SX3**	2	**D18SX11**	2	**D18SX5**	1	65	(30)
36	4	24	**D24SX10**	4	**D24SX3**	2	**D24SX11**	2	**D24SX5**	1	95	(43)
45	5	30			**D30SX3**	5	**D30SX11**	2	**D30SX5**	2	120	(55)
54	6	36			**D36SX3**	3	**D36SX11**	3	**D36SX5**	2	135	(62)
63	7	42			**D42SX3**	7	**D42SX11**	3	**D42SX5**	2	155	(71)
72	8	48			**D48SX3**	4	**D48SX11**	4	**D48SX5**	2	195	(89)
81	9	54			**D54SX3**	6	**D54SX11**	6	**D54SX5**	3	205	(93)
90	10	60			**D60SX3**	5	**D60SX11**	4	**D60SX5**	4	235	(107)
115	11	60			**D75SX3**②	10	**D75SX11**	5	**D75SX5**	4	260	(118)
150	12	60							**D100SX5**②	4	290	(132)
190	13	60							**D125SX5**②	5	310	(141)

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 code number** (from the table) that corresponds to the original Watlow duct heater code number. Then specify **quantity.**

All duct heaters are Assembly Stock unless otherwise noted.
Availability
Assembly Stock: Three to five working days
Standard: 10 working days
Truck Shipment only

Replacement Elements

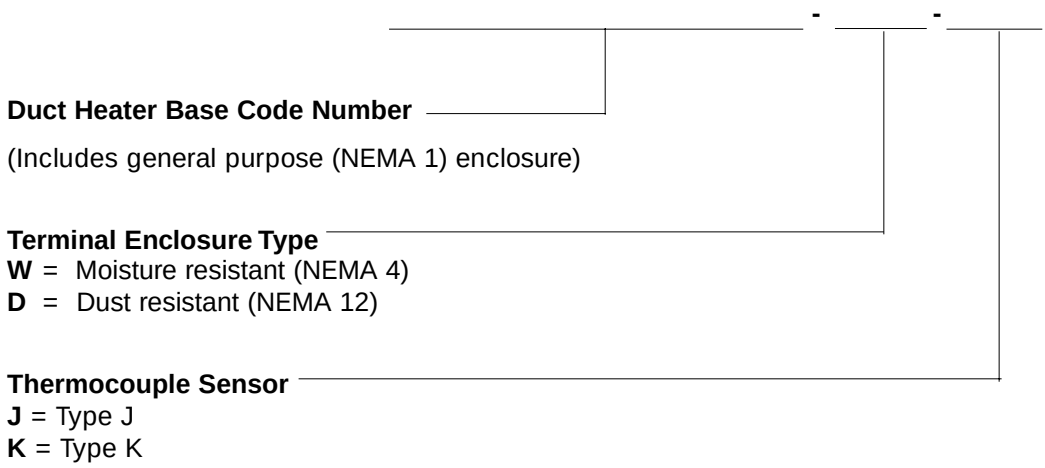
Original Duct Heater Code Numbers	Replacement Element Volts	Watts	A Dimension in	(mm)	Replacement Element Code No.	Availability	Est. Net Weight lbs	(kg)
20 W/in² (3.1 W/cm²)								
D6S3 to D60S3	240	1000	27⅞	(708)	**D6240**	Stock	1.0	(0.5)
D6S5 to D60S5	480	1000	27⅞	(708)	**D6480**	Stock	1.0	(0.5)
D75S3	240	1250	32⅞	(835)	**D75240**	Standard	1.0	(0.5)
D75S5	480	1250	32⅞	(835)	**D75480**	Stock	1.0	(0.5)
D100S5	480	1667	40⅜	(1026)	**D100480**	Stock	1.4	(0.7)
D125S5	480	2083	49⅜	(1254)	**D125480**	Stock	1.7	(0.8)
30 W/in² (4.7 W/cm²)								
D6SX3 to D60SX3	240	1500	27⅞	(708)	**D6X240**	Stock	1.0	(0.5)
D6SX5 to D60SX5	480	1500	27⅞	(708)	**D6X480**	Stock	1.0	(0.5)
D75SX3	240	1917	32⅞	(835)	**D75X240**	Standard	1.0	(0.5)
D75SX5	480	1917	32⅞	(835)	**D75X480**	Stock	1.0	(0.5)
D100SX5	480	2500	40⅜	(1026)	**D100X480**	Stock	1.4	(0.7)
D125SX5	480	3167	49⅜	(1254)	**D125X480**	Stock	1.7	(0.8)

② Standard

F.O.B.: Hannibal, Missouri

Duct Heaters

Build-a-Code



How to Order

To order stock duct heaters, please specify:

- Watlow code number
- Volts/watts
- Phase
- Options
- Quantity

If our stock units do not meet your application needs, Watlow can provide a made-to-order unit. For **made-to-order** units please consult your Watlow representative and provide the following information:

- Application (inlet and outlet air temperature, CFM/CMM, duct size and mounting orientation)
- Volts/watts
- Phase
- Number of circuits
- Watt density
- Number of heating elements
- Sheath material
- Element ('B' dimension) length
- Mounting flange material and mounting hole layout
- Insulation thickness and material
- Terminal enclosure type
- Options
- Quantity

Availability

Assembly Stock: Three to five working days

Modified Stock①: Five to seven working days

Standard: 10 working days

Made-to-Order: Five to seven weeks

Replacement Elements Only

Stock: Same day shipment

Standard: 10 working days

Made-to-Order: Four weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

① Stock or Assembly Stock units with catalog options.

Tubular and Process Assemblies

Modular Duct Heater

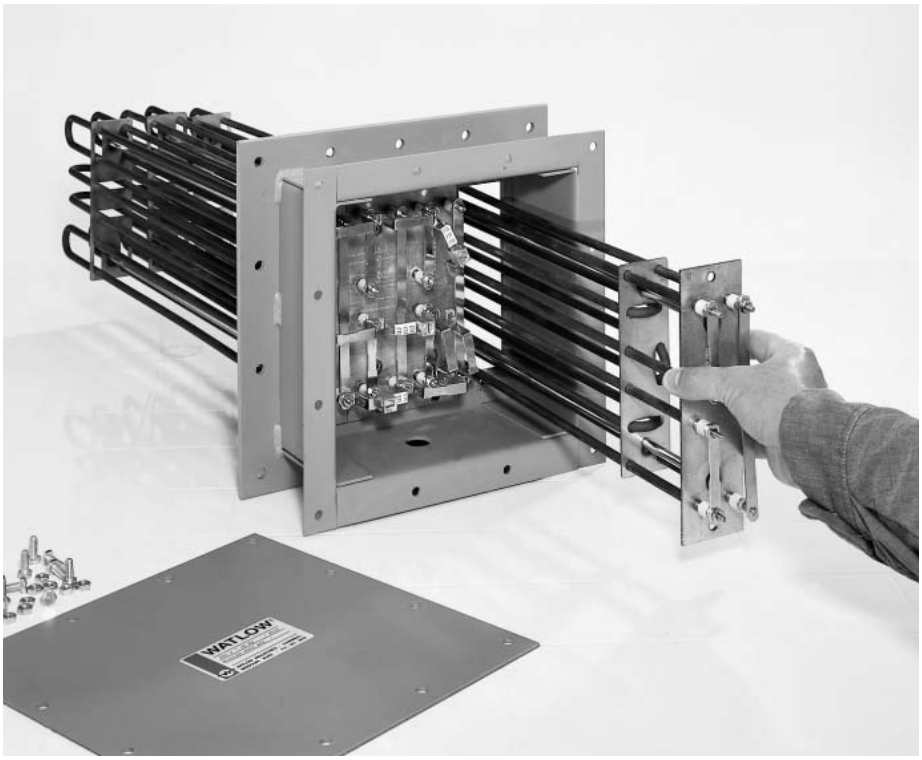
Watlow has developed a new line of process air heaters that offer improved performance and increased versatility in medium to low temperature applications.

The new duct heaters are modular and consist of two parts. The first is a 6kW heater available in either 240 or 480 volts, single or three phase.

The second part of the heater consists of the electrical housing that protects 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 1-10 modules. A range of 6-60kW, in 6kW increments is achieved.

The new design of 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 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

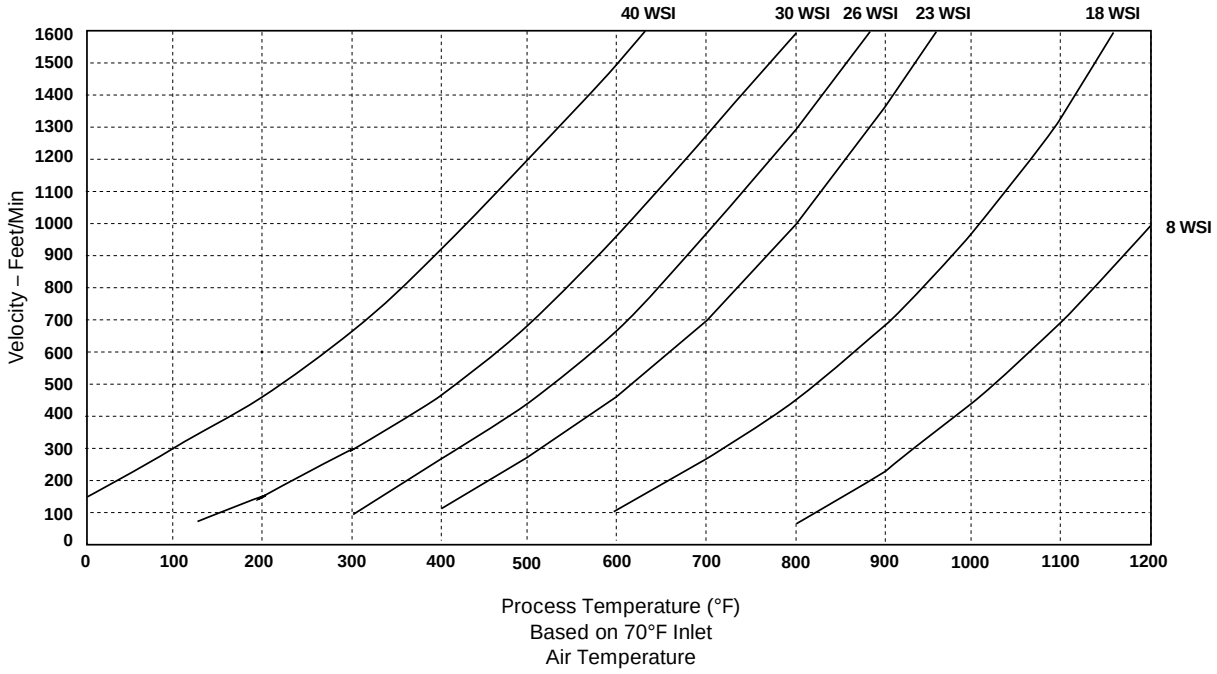
- **Individual modules removable through housing** reduces downtime for replacement of module.
- **27 percent reduction in heat-up time as compared to traditional 0.430 inch diameter duct heater elements** result in a faster response time.
- **Smaller diameter elements (0.315 inch)** result in a 25 percent lower energy usage on initial heat-up.
- **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 housing** results in lower electrical housing temperature.
- **Flexible module wiring** allows user to sequentially stage modules.

Applications

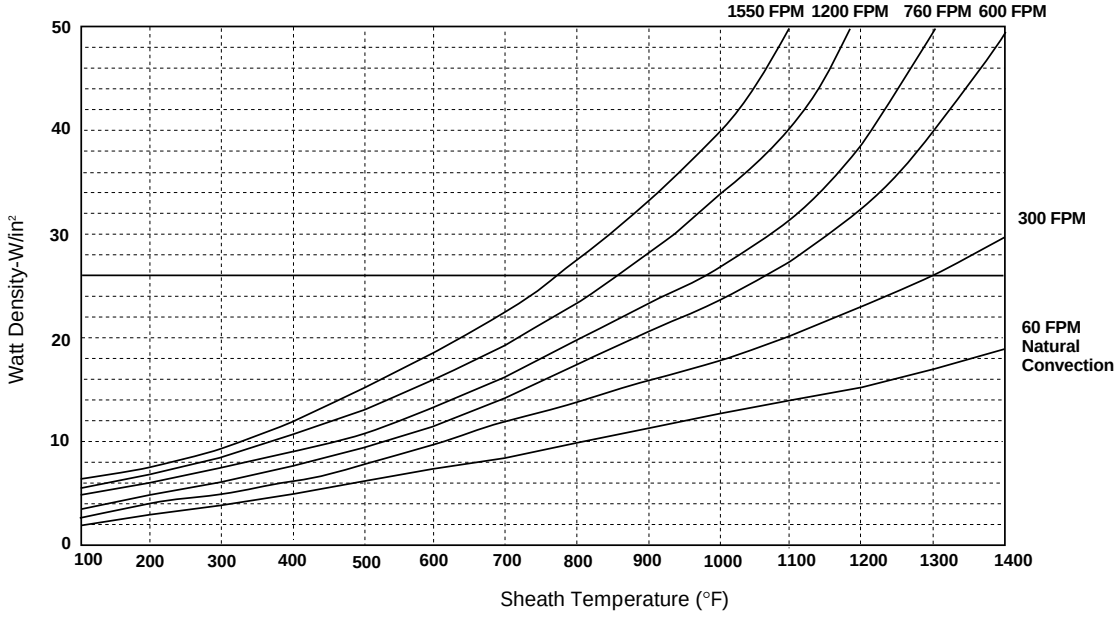
- Low temperature ovens
- Parts drying
- Semiconductor clean room environmental heating
- Plastic curing
- Load banks
- Heated air knives
- Food dehydration
- Heat shrink tunnels

Modular Duct Heater

Velocity vs. Process Temperature

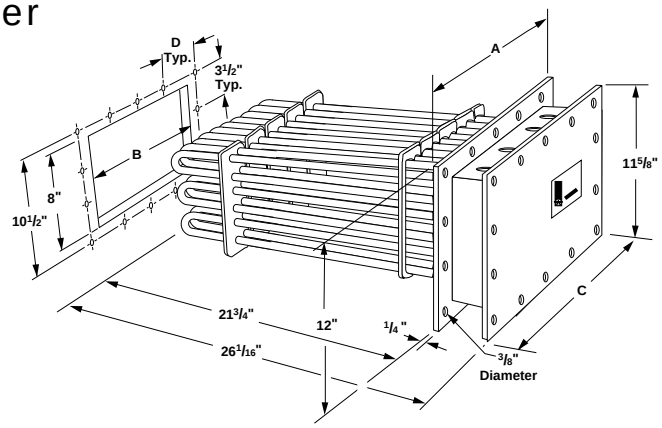


Watt Density vs. Sheath Temperature



Tubular and Process Assemblies

Modular Duct Heater



Application: Air Heating – Maximum outlet temperature – 750°F

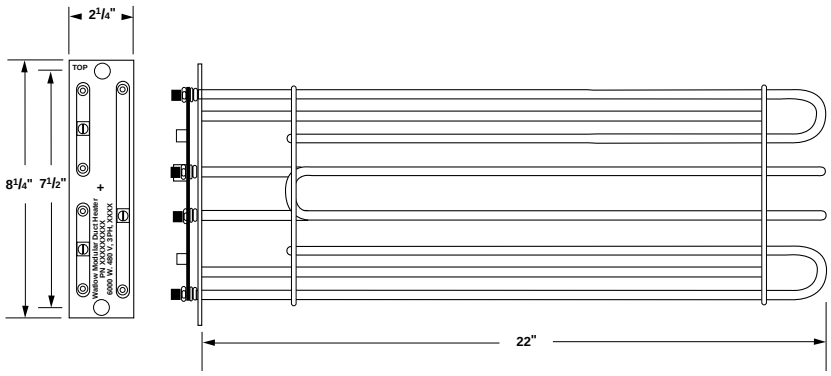
Watt Density W/in²	kW	Volts	Phase	No. of Circuits	No. of Modules	Est. Shipping Wt. lbs	Availability	Code No.	Dimensions in. A	B	C	D
26	6	240	1	1	1	35	Assy. Stk	**MDH6SI0**	6.50	2.50	5.75	2.50
26	6	240	3	1	1	35	Assy. Stk	**MDH6S3**	6.50	2.50	5.75	2.50
26	6	480	1	1	1	35	Assy. Stk.	**MDH6S11**	6.50	2.50	5.75	2.50
26	6	480	3	1	1	35	Assy. Stk.	**MDH6S5**	6.50	2.50	5.75	2.50
26	12	240	1	2	2	39	Assy. Stk.	**MDH12SI0**	8.50	4.75	7.75	3.50
26	12	240	3	1	2	39	Assy. Stk.	**MDH12S3**	8.50	4.75	7.75	3.50
26	12	480	1	1	2	39	Assy. Stk.	**MDH12S11**	8.50	4.75	7.75	3.50
26	12	480	3	1	2	39	Assy. Stk.	**MDH12S5**	8.50	4.75	7.75	3.50
26	18	240	1	3	3	46	Assy. Stk.	**MDH18SI0**	10.50	7.00	9.75	3.00
26	18	240	3	1	3	46	Assy. Stk.	**MDH18S3**	10.50	7.00	9.75	3.00
26	18	480	1	1	3	46	Assy. Stk.	**MDH18S11**	10.50	7.00	9.75	3.00
26	18	480	3	1	3	46	Assy. Stk.	**MDH18S5**	10.50	7.00	9.75	3.00
26	24	240	1	4	4	67	Assy. Stk.	**MDH24S10**	12.50	9.25	11.75	2.75
26	24	240	3	2	4	67	Assy. Stk.	**MDH24S3**	12.50	9.25	11.75	2.75
26	24	480	1	2	4	67	Assy. Stk.	**MDH24S11**	12.50	9.25	11.75	2.75
26	24	480	3	1	4	67	Assy. Stk.	**MDH24S5**	12.50	9.25	11.75	2.75
26	30	240	3	2	5	84	Assy. Stk.	**MDH30S3**	15.75	11.50	15.00	3.56
26	30	480	1	2	5	84	Assy. Stk.	**MDH30S11**	15.75	11.50	15.00	3.56
26	30	480	3	1	5	84	Assy. Stk.	**MDH30S5**	15.75	11.50	15.00	3.56
26	36	240	3	2	6	95	Assy. Stk.	**MDH36S3**	18.00	13.75	17.25	4.13
26	36	480	1	2	6	95	Assy. Stk.	**MDH36S11**	18.00	13.75	17.25	4.13
26	36	480	3	1	6	95	Assy. Stk.	**MDH36S5**	18.00	13.75	17.25	4.13
26	42	240	3	3	7	109	Assy. Stk.	**MDH42S3**	20.25	16.00	19.50	4.69
26	42	480	1	3	7	109	Assy. Stk.	**MDH42S11**	20.25	16.00	19.50	4.69
26	42	480	3	2	7	109	Assy. Stk	**MDH42S5**	20.25	16.00	19.50	4.69
26	48	240	3	4	8	137	Assy. Stk.	**MDH48S3**	22.50	18.25	21.75	5.25
26	48	480	1	3	8	137	Assy. Stk.	**MDH48S11**	22.50	18.25	21.75	5.25
26	48	480	3	2	8	137	Assy. Stk.	**MDH48S5**	22.50	18.25	21.75	5.25
26	54	240	3	3	9	144	Assy. Stk.	**MDH54S3**	24.75	20.50	24.00	5.81
26	54	480	1	3	9	144	Assy. Stk.	**MDH54S11**	24.75	20.50	24.00	5.81
26	54	480	3	2	9	144	Assy. Stk.	**MDH54S5**	24.75	20.50	24.00	5.81
26	60	240	3	4	10	165	Assy. Stk.	**MDH60S3**	27.00	22.75	26.25	6.38
26	60	480	1	4	10	165	Assy. Stk.	**MDH6OS11**	27.00	22.75	26.25	6.38
26	60	480	3	2	10	165	Assy. Stk.	**MDH60S5**	27.00	22.75	26.25	6.38

Options include individual modules with optional NEMA1 housing, high temperature thermocouple kit and blank flange modules.

Modular duct heaters with **1** and **2** modules have conduit openings for **1**-1 inch NPT fitting.
Modular duct heaters with **3,4,5,** and **7** modules have conduit openings for **2**-1 inch NPT fittings.
Modular duct heaters with **6,8,9,** and **10** modules have conduit openings for **2**-1 ¼ inch NPT and **2**-1 inch NPT fittings.

Modular Duct Heater

Individual Module Dimensions



Specifications

- Module rating - 240 or 480V~(ac), 6kW, three phase or one phase
- Watt Density - 26 W/in²
- Elements - 0.315 inch dia. Incoloy® 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
- Maximum outlet temperature = 750˚F

Options

Terminal Enclosures

Terminal enclosures are available in NEMA 1 and 4 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 module at a later time to allow higher wattage outputs.

Watlow Code Number	Description
Replacement Modules	
M63	6kW, 240 volts, 3 phase
M610	6kW, 240 volts, 1 phase
M65	6kW, 480 volts, 3 phase
M611	6kW, 480 volts, 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

Availability

- **Assembly Stock**: Three to five working days
- **Made-to-Order**: Eight weeks

Consult factory for more details.

Thermostats and Accessories

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 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 (NEMA 1)
- Moisture resistant (NEMA 4)
- Explosion resistant (NEMA 7)
- Explosion/moisture resistant (NEMA 7/4)
- Dust resistant (NEMA 12)

Pilot Light

An optional pilot light gives visual indication whether the power supplied to the heating element(s) is on or off.

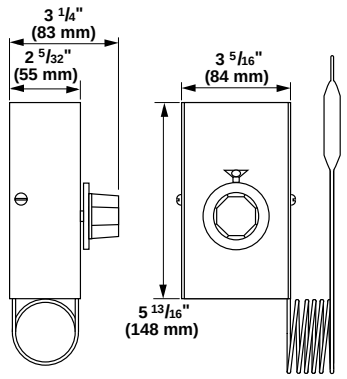
To order, please specify suffix code **PL11**.

Thermostat Conversion Kits

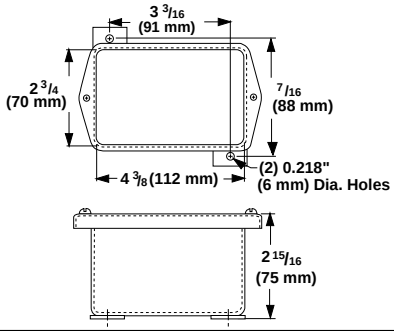
Kits are available to convert a heater's general purpose (NEMA 1) terminal enclosure to accept either a single or double pole thermostat.

Thermostats with Enclosures

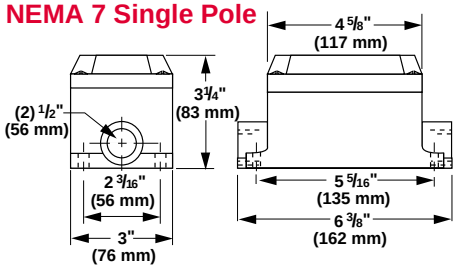
NEMA 1 Single and Double Pole



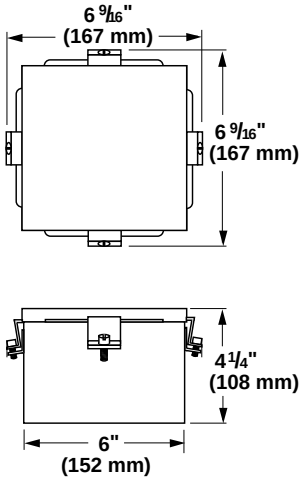
NEMA 4 and 12 Single Pole



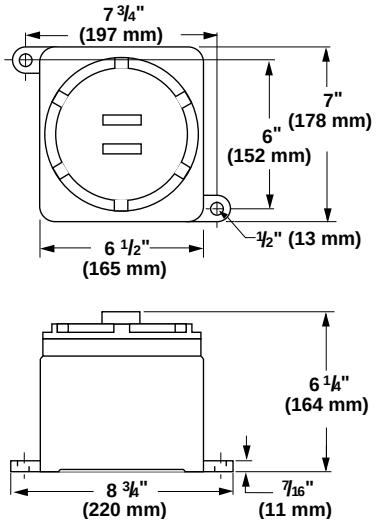
NEMA 7 Single Pole



NEMA 4 and 12 Double Pole



NEMA 7 Double Pole



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 kit covers 1, 1¼ , 2 and 2½ inch NPT screw plugs. To order, specify code **K492-000-35-(thermostat type)**.

Double pole conversion kit covers 2 and 2½ inch NPT screw plugs. To order, specify code **K492-000-34-(thermostat type)**.

Celsius Dial Scale

Thermostats are shipped with Fahrenheit (°F) dial scales. If your application requires a Celsius (°C) scale, order the optional dial face.

To order, specify code **CD**. Scale will match thermostat temperature range.

Incoloy® is a registered trademark of Special Metals Corporation.

Thermostats and Accessories

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 277V~(ac) for SPST or 480V~(ac) 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.

Warning

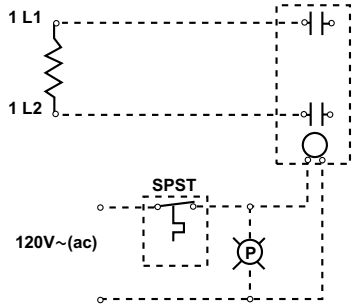
Do not use thermostats for high-limit sheath protection. Thermostats fail in a closed circuit mode and will not cut power to the heaters. Limit control should be provided by an isolated, redundant sensor and control system of the appropriate type, design and installation.

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.

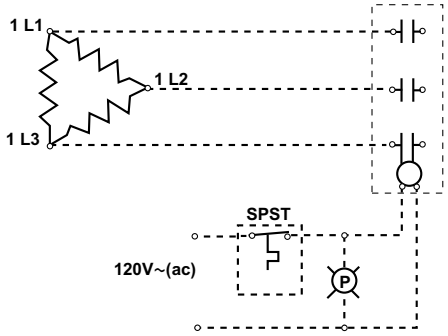
To help assure you select the correct thermostat, as well as install and wire it properly, we have put together a few helpful hints. Schematics are provided for interconnecting thermostats to single- and three-phase heaters.

Pilot Duty Wiring

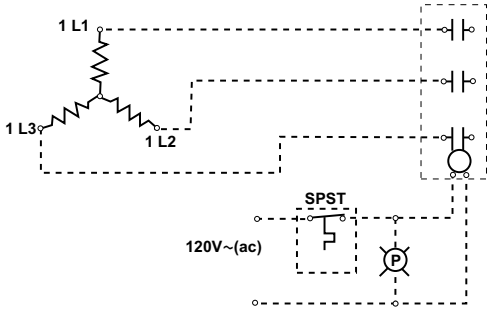
SPST,1-phase



SPST, 3-phase delta

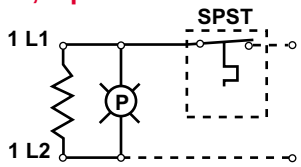


SPST, 3-phase wye

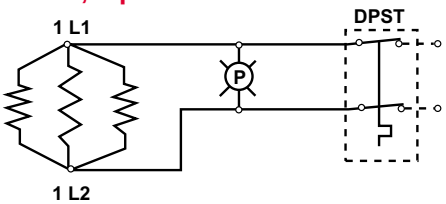


Interconnected Wiring

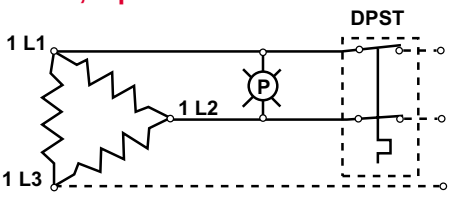
SPST, 1-phase



DPST, 1-phase



DPST, 3-phase delta



Tubular and Process Assemblies

F.O.B.: Hannibal, Missouri

Thermostats and Accessories

Thermostat

Control Mode	Type	Temperature Range °F	(°C)	Differential °F	(°C)	Ampacity @ Line Voltage 120	240	277	480	Bulb Diameter inch	(mm)	Bulb Length inch	(mm)	Capillary Length inch	(mm)	Terminal Type	Code No.	Est. Net Weight lbs	(kg)
On-off Temp Control	Single Pole Single Throw (SPST)	30-110	(0-40)	8	(0)	25	25	22	—	0.250	(6)	4 ¾	(121)	18	(455)		**1**	1	(0.4)
		30-250	(0-120)	15	(8)	25	25	22	—	0.250	(6)	3 ¼	(85)	18	(455)	#12 AWG	**2**	1	(0.4)
		30-250	(0-120)	15	(8)	25	25	22	—	0.250	(6)	3 ¼	(85)	84	(2135)	Stranded	**2A**	1	(0.4)
		175-550	(80-290)	26	(14)	25	25	22	—	0.250	(6)	3 ⅜	(85)	18	(455)	Leads	**3**	1	(0.4)
		175-550	(80-290)	26	(14)	25	25	22	—	0.250	(6)	2 ¾	(70)	84	(2135)		**3A**	1	(0.4)
		300-700	(150-350)	12	(7)	25	25	—	—	0.375	(10)	3 ¾	(95)	60	(1525)		**10**	1	(0.4)
		60-160	(15-70)	19	(10)	30	30	30	20	0.250	(6)	4 ⅜	(110)	14	(355)	#8-32	**12A**	1	(0.4)
	Double Pole Single Throw (DPST)	30-110	(0-40)	12	(7)	30	30	30	21	0.375	(10)	6 ¼	(160)	36	(915)		**4**	2	(0.9)
		60-250	(15-120)	12	(7)	30	30	30	21	0.375	(10)	4 ½	(115)	48	(1220)	#10-32	**5**	2	(0.9)
		60-250	(15-120)	12	(7)	30	30	30	21	0.250	(6)	6 ½	(165)	48	(1220)	Screw Lug	**5A**	2	(0.9)
		100-550	(40-290)	22	(12)	30	30	30	21	0.375	(10)	3 ⅞	(100)	48	(1220)		**7**	2	(0.9)
		100-550	(40-290)	22	(12)	30	30	30	21	0.250	(6)	7 $^{1}/_{16}$	(179)	48	(1220)		**7A**	2	(0.9)
On-off with Manual Reset	(DPST)	60-250	(15-120)	12	(7)	30	30	30	—	0.250	(6)	6 ½	(165)	48	(1220)	#10-32	**8**	2	(0.9)
		100-550	(40-290)	22	(12)	30	30	30	—	0.188	(8)	12	(305)	48	(1220)	Screw Lug	**9**	2	(0.9)
	(SPST)	350①	(180)	—		30	30	20	—	0.250	(6)	3 ½	(90)	36	(915)	#10-32 Screw Lug	**11**	1	(0.4)

① Fixed temperature setting

Availability

Stock: Same day shipment

How to Order

Thermostat Code Number

(See stock chart above)

Enclosure (Remote Mount Only)

- **S** = General purpose (NEMA 1)
- **W** = Moisture resistant (NEMA 4)
- **E** = Explosion resistant (NEMA 7)
- **E/W** = Explosion/moisture resistant (NEMA 7/4)
- **D** = Dust resistant (NEMA 12)

Options

- **CD** = Celsius dial scale
- **CB** = Chrome bezel
- **LTB** = Liquid-tight brass fitting (⅜"-18 NPT)
- **PL11** = Pilot Light

Cross-Reference For Replacement Thermostat	Order With This Number
202-0-21-1 (small knob)	1
202-0-21-2 (small knob)	202-0-21-2MB
202-0-21-4	2
202-0-21-5	2A
202-0-21-3	3
202-0-21-8 (small knob)	202-0-21-8M
202-0-21-6	3A
202-0-4-2	4
202-0-4-6	5
202-0-4-17	5A
202-0-4-5	7
202-0-4-16	7A
202-0-3-1	8
202-0-3-3	9
202-0-1-13	10
202-0-29-2	11
202-0-41-2 (small knob)	12A

If you only have the thermostat code number use this cross-reference chart.

Availability

Thermostats

Stock: Same day shipment

Remote Mount Thermostats

Stock: Same day shipment

Assembly Stock: Three to five working days

Modified Stock②: Three to five working days

Standard: Eight to 10 working days

Options, complexity and quantity may affect availability and lead times. Consult factory.

② Stock or Assembly Stock units with catalog options.

F.O.B.: Hannibal, Missouri

Thermostats and Accessories

Low Liquid Level Sensor

The Watlow low liquid level sensor can protect a heating system by sensing when a liquid drops below a predetermined level. This is accomplished by locating the sensor at the minimum desired liquid level in the tank or vessel. The sensor's ASTM Type J thermocouple output can be connected to a variety of controls, alarms and limit protection devices.

To provide an additional margin of protection, the Type J thermocouple makes this low liquid level sensor respond considerably faster than conventional capillary bulb thermostats.

To order, specify code number **BCN5J1SJ**.

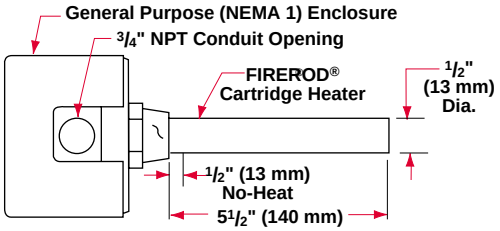
Application Hints

- Only use sensor in **non-flammable** liquids that are compatible with the Incoloy® sheath and 304 stainless steel screw plug.
- Application should tolerate sheath temperature at limit set point.
- The time delay between the low liquid level condition on-set, and the sensor's ability to signal the control device should be adequate to protect the heater(s). See *Installation and Maintenance Instructions* for details.

Controller Recommendation

- Use Watlow Safety Limit Temperature Control Series 142 (Code number **142A-3605-1300**). This controller features compact sub-panel mounting and is sealed against ambient environment. UL® recognized for limit protection (UL 991, "Tests For Safety-Related Controls Employing Solid State Devices").

  Controller supplied by Watlow's Winona, Minnesota facility.



Specifications

Screw plug: 1" NPT

Plug material: 304 stainless steel

Sheath material: Incoloy®

Watt density: 13 W/in² (2 W/cm²)

Watts: 100

Volts: 120V~(ac)

Immersed length: 5½ inch (140 mm)

Thermocouple: ASTM Type J

Est. ship. wt.: 2 lbs (1 kg)

Availability

Stock: Same day shipment

Modified Stock①: Five to seven working days

Made-to-Order: Four to six weeks

Options, complexity and quantity may affect availability and lead times. Consult factory.

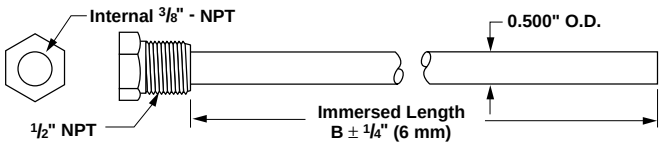
① Stock units with catalog options.

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 ½inch NPT mounting and ⅜inch-18 NPT internal thread for mating to a liquid-tight bushing (LTB).

All units are stock. To order, specify the appropriate code number from the stock table.



Protective Wells

Plug and Thermowell Material	Immersed B Dimension inch	(mm)	Code No.	Est. Ship. Weight 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)

Availability

Stock: Same day shipment

Modified Stock②: Five to seven working days

Made-to-Order: Three weeks

Options, complexity and quantity may affect availability and lead-times. Consult factory.

② Stock units with catalog options.