

# 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.

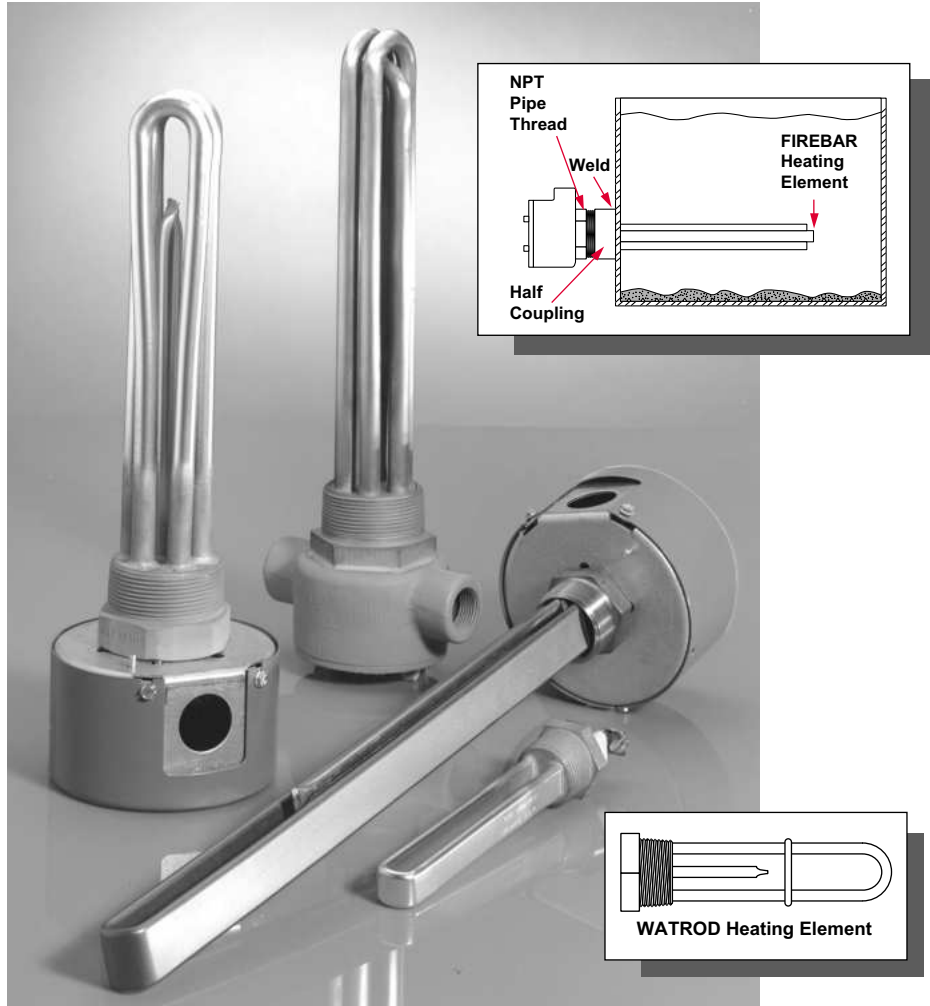
Heating elements are hairpin bent and either welded or brazed into the screw plug—depending on element sheath and plug material compatibility.

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/in<sup>2</sup> (18.6 W/cm<sup>2</sup>)
- 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.

# Tubular and Process Assemblies

## 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

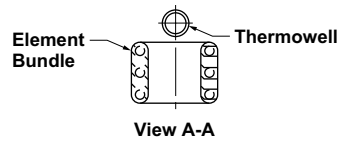
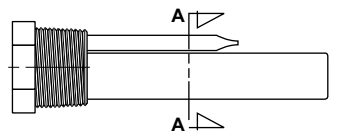
### Screw Plug Orientation

Correct element/thermowell orientation assures proper process temperature sensing.

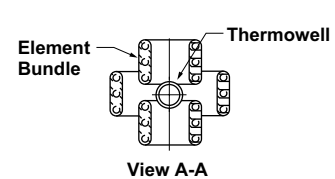
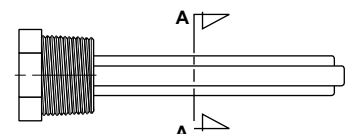
Correct horizontal mounting of WATROD and FIREBAR screw plugs is shown to the right. Correct orientation assures optimum performance and maximum heater life. Additional mounting information is provided in the *Installation and Maintenance Instructions*.

### FIREBAR Heating Element

#### 1½" NPT—One Element

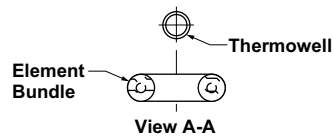
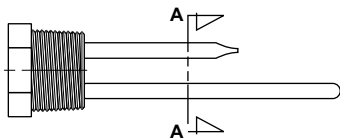


#### 2½" NPT—Three Elements

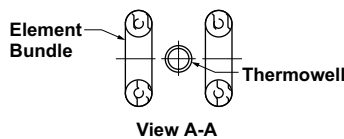
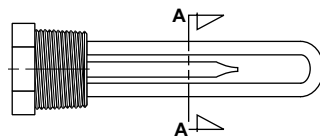


### WATROD Heating Element

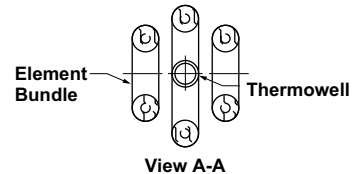
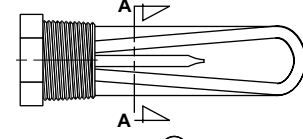
#### 1" NPT—One Element



#### 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

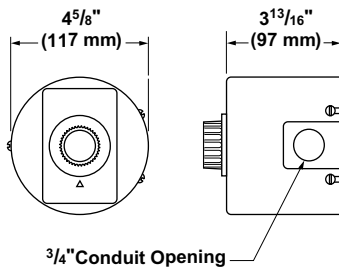
### Options

Continued

#### General Purpose (NEMA 1)

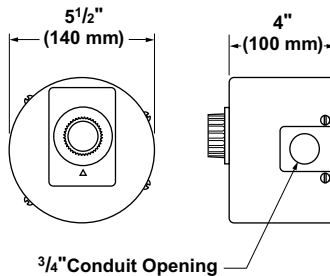
##### Single Pole Thermostat

All screw plug sizes



##### Double Pole Thermostat

All screw plug sizes



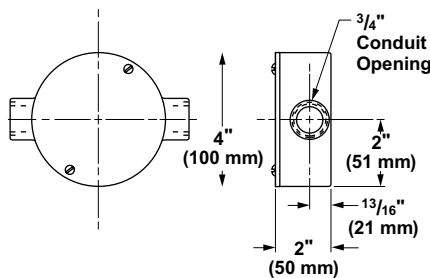
#### Caution:

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

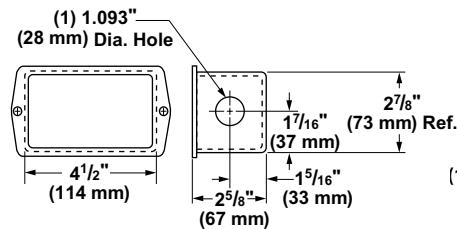
##### Without Thermostat

All screw plug sizes



##### Single Pole Thermostat

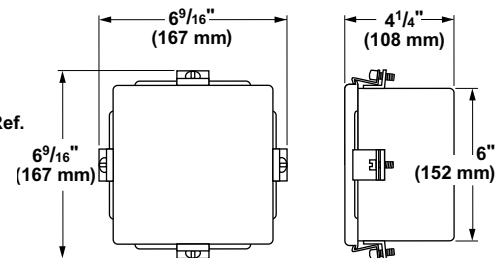
1" & 1 1/4" NPT-1 WATROD Element



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

##### Single or Double Pole Thermostat

1 1/4" NPT-2 WATROD Elements  
1 1/4" NPT-1 FIREBAR Element  
All 2" & 2 1/2" NPT screw plugs

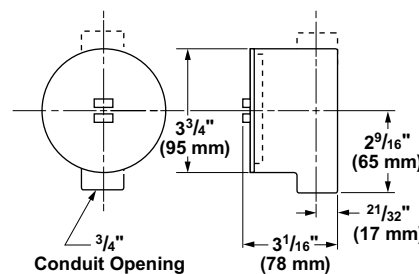


**Note:** The thermostat is not centered on the screw plug immersion heater.

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

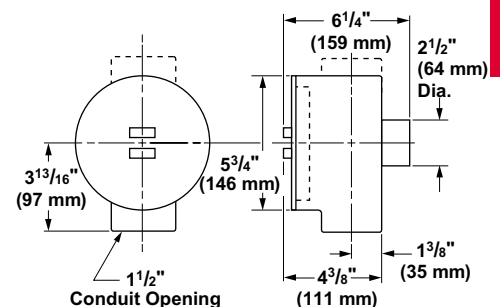
##### Without Thermostat

All WATROD screw plugs



##### Single or Double Pole Thermostat

1 1/4" NPT-1 FIREBAR Element  
All WATROD screw plugs



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

# Tubular and Process Assemblies

## Screw Plug Immersion Heaters

### Options

Continued

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

##### Without Thermostat

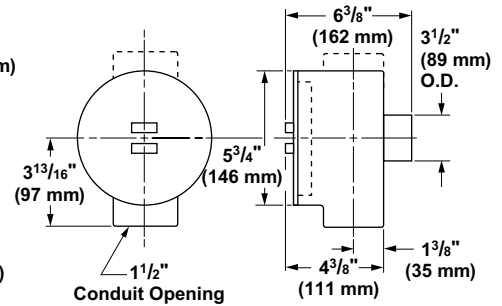
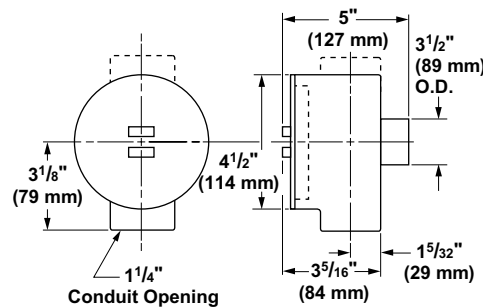
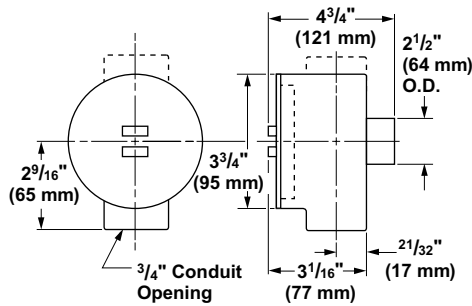
1/4" NPT--1 FIREBAR element

##### Without Thermostat

2 1/2" NPT-3 FIREBAR elements

##### Single or Double Pole Thermostat

2 1/2" 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		Recommended <sup>①</sup> 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)

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

#### 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.

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

Monel® is a registered trademark of Special Metals Corporation.

# Tubular and Process Assemblies

## 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

<b>WATROD</b>	304 stainless steel 316 stainless steel Steel Brass
<b>FIREBAR</b>	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, 1½, 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

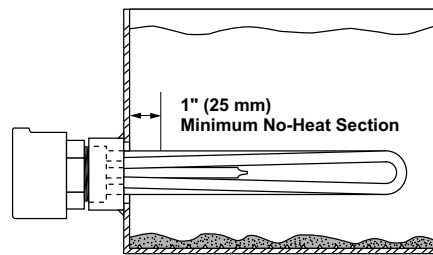
Screw plug to flange adaptors permit replacing flange heaters with screw plug heaters. To order, specify the appropriate code number.

#### Screw Plug to Flange Adaptors

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

#### Application Hints

- Select the recommended sheath material and watt density for the substance being heated. Use the **Supplemental Applications Chart** on **pages 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.