

Checklist — Selecting the Proper Screw Plug Heater

☑ Determine a Safe and Efficient Element Watt Density

Element Watt Density is the wattage dissipated per square inch of the element sheath surface and is calculated with the following formula.

$$\text{Watt Density} = \frac{\text{element wattage}}{\pi \times \text{element dia.} \times \text{element heated length}}$$

For a particular application, element watt density will govern element sheath temperature.

Factors to consider when choosing a suitable watt density are:

1. Many materials are heat sensitive and can decompose or be damaged if the element is running too hot.
2. Air and other gases that are poor conductors of heat require watt densities matched to the velocity of the gas flow to prevent element overheating.
3. When heating hard water and cleaning solutions mineral deposits can build up on the element sheath, acting as a heat insulator and raising the internal element temperature. If these deposits cannot be periodically removed, use a lower watt density element to increase heater life expectancy.

☑ Select the Element Sheath Material

Sheath Material Selection

CORROSION. In addition to selecting a sheath material that is compatible with the heated medium, other factors that affect corrosion need to be considered.

1. The temperature of the corrodent. As temperature increases the degree of corrosion increases. Also remember that usually the element temperature is higher than the material it is heating.
2. The degree of aeration to which a corrodent is exposed. Stagnant conditions can deprive the stainless steels of oxygen, which is required to maintain their corrosion resistant surface.
3. Velocity of the corrodent. Increased velocity can increase the corrosion rate.



Note: See pages 16-12 through 16-20 for the recommended sheath materials for many immersion heating applications. If you are purchasing the material you are heating, check with the supplier for their recommendations.

Typical Applications

Copper Sheath—Process water, water with very weak chemical solutions, potable water, hot water storage for washrooms, showers, cleaning and rinsing parts, for freeze protection of cooling towers and sprinkler systems and other aqueous solutions not corrosive to copper sheath. Sheath temperatures to 350°F (177°C).

Incoloy® Sheath—Weak chemical solutions, oils, tar, caustic soda, detergent, alkaline solutions, molten salts, demineralized, deionized or pure water (sheath passivation is recommended), and other aqueous solutions not corrosive to Incoloy® sheath. Air, gas mixtures and superheated steam. Sheath temperatures to 1600°F (871°C).

Steel Sheath—Fluid heat transfer media, tar, high to low viscosity petroleum oils, asphalt, wax, paraffin, degreasing solvents, alcohol, molten salt, and other solutions not corrosive to steel sheath. Sheath temperatures to 750°F (399°C).

Surface Treatments for Stainless Steel and Incoloy® Elements and other Wetted Parts to Improve Corrosion Resistance

Screw Plug Immersion Heater surfaces in contact with the material being heated can be passivated or electro-polished to improve their resistance to corrosion.

Passivation removes surface contamination, usually iron, so that the optimum corrosion resistance of the stainless steel is maintained. Surface contamination would come from the small amount of steel that may be worn off a tool during the manufacturing process. Passivating is accomplished by dipping the heater in a warm solution of nitric acid.

Electro-Polishing is an electrochemical process that removes surface imperfections and contaminants, enhancing the corrosion resisting ability of the stainless steels. The resultant surface is clean, smooth and bright. Many medical and food applications require this finish.

CONTINUED

Screw Plug Immersion Heaters

Checklist — Selecting the Proper Screw Plug Heater, *continued*



Select the Terminal Housing Type

Standard catalog screw plug immersion heaters are supplied with the **Type 1N** general purpose (NEMA 1) terminal housing with a single Dual 1/2-3/4 conduit knockout as shown on page 11-2. Additional housings with and without a thermostat include:

Moisture Resistant (NEMA 4)

Explosion Resistant (NEMA 7)

Moisture/Explosion Resistant (NEMA 4/7)

If the housings on this page do not meet the size, construction or other criteria of your application, consult Tempco with your requirements.



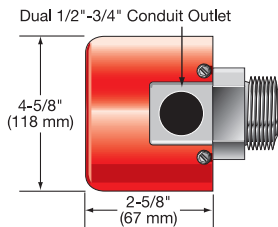
Explosion resistant terminal housings are intended to provide containment of an explosion in the enclosure only. No portion of the heater assembly outside the enclosure is covered under this NEMA rating. Abnormal use of a heater which results in excessive temperature can create hazardous conditions such as a fire. Never perform any type of service nor remove the housing cover prior to disconnecting all electrical power to the heater.

Standard NEMA 1 Housing Dimensions

TYPE 1N

(for no thermostat)

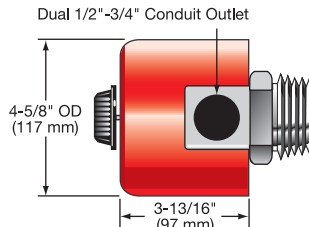
for 1", 1-1/4", 2" and 2-1/2"
Screw Plug Heaters



TYPE 1T

(for a single pole thermostat)

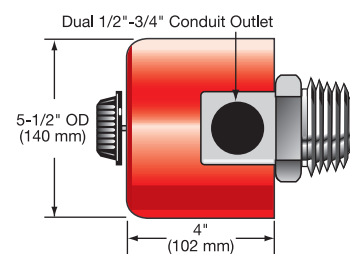
for 1", 1-1/4", 2" and 2-1/2"
Screw Plug Heaters



TYPE 6T

(for a double pole thermostat)

for 1", 1-1/4", 2" and 2-1/2"
Screw Plug Heaters



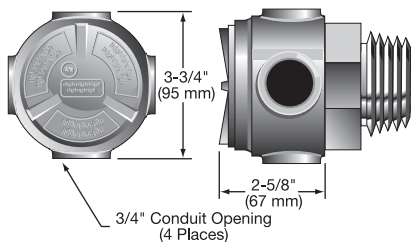
Standard NEMA 4 and/or 7 Housing Dimensions

NEMA 4 rating requires the use of the cover gasket.

TYPE 2N

(for no thermostat)

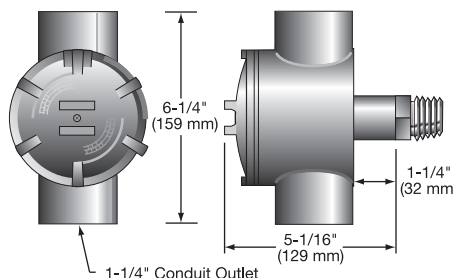
for 1", 1-1/4", 2" and 2-1/2"
Screw Plug Heaters



TYPE 2T

(for use with a single pole thermostat)

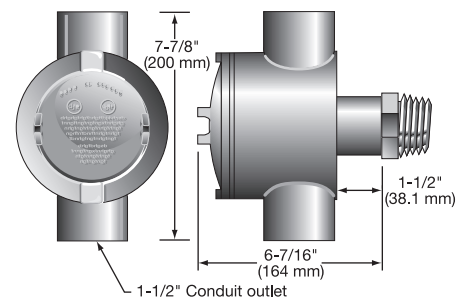
for 1" and 1-1/4" Screw Plug Heaters



TYPE 3T

(for use with a double pole thermostat)

for 2" and 2-1/2" Screw Plug Heaters



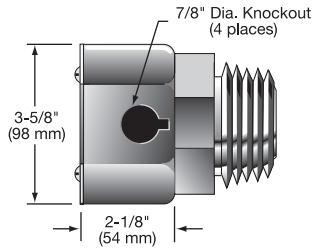
Screw Plug Immersion Heaters

Alternate NEMA 1 Housing

Type 3N

(for no thermostat)

for 1", 1-1/4", 2" and 2-1/2" Screw Plug Heaters

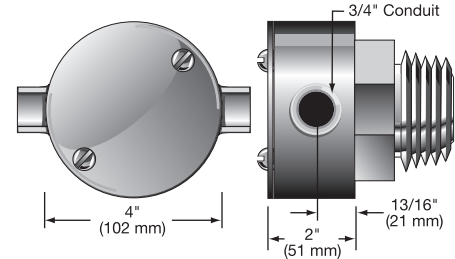


Alternate NEMA 4 Housing

TYPE 4N

(for no thermostat)

for 1", 1-1/4", 2" and 2-1/2" Screw Plug Heaters

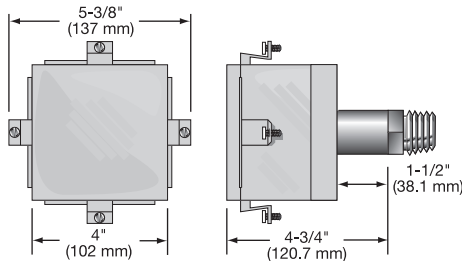


Alternate NEMA 4 Housing

TYPE 4T

(for a single pole thermostat)

for 1" and 1-1/4" Screw Plug Heaters

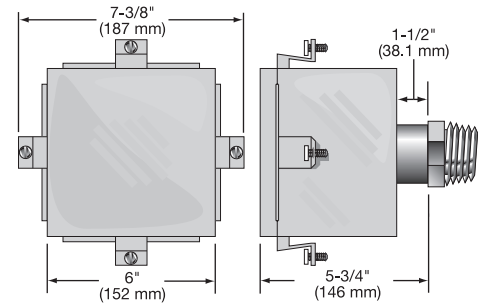


Alternate NEMA 4 Housing

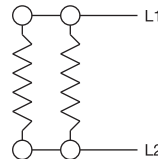
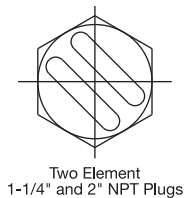
TYPE 5T

(for a single or double pole thermostat)

for 2" and 2-1/2" Screw Plug Heaters



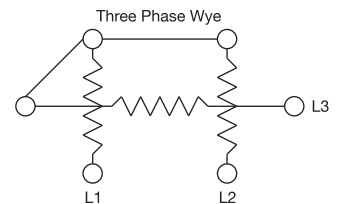
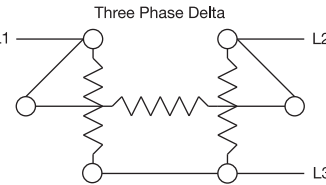
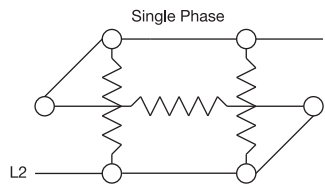
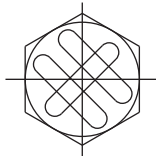
Wiring Diagrams — Screw Plug Heaters with Two Elements



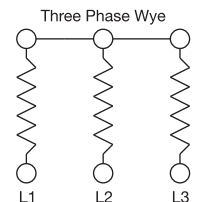
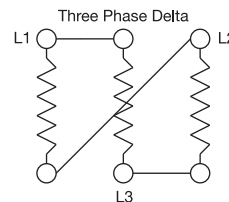
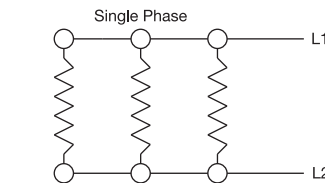
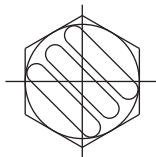
Note: Dual-Voltage heaters are factory wired for the higher voltage (series connection) unless otherwise specified. Easily rewired for lower voltage operation (parallel connection).

Wiring Diagrams — Screw Plug Heaters with Three Elements

Three Element
Crisscross Pattern
2" NPT Plugs
(Optional on 2-1/2" NPT Plugs)



Three Element
Parallel Pattern
2-1/2" NPT Plugs



NOTE: Standard screw plug immersion heaters with three elements, factory wired for three-phase delta, can be rewired for single-phase operation with no wattage change. Wattage can be reduced to one-third of the designed wattage by switching from three-phase delta to wye connection.



Heaters wired for three-phase wye should not be changed to single-phase or three-phase delta connection, since this will increase wattage and watt density on the elements by three times the original designed wattage, causing premature heater failure.