

Quality

Differences Among Screw Plug Immersion Heaters

Screw Plug Immersion Heaters include one, two or three hair-pin bent tubular element(s) joined to a threaded hex plug. Screwed into tank walls, this UL Listed / CSA Certified direct contact heat source heats liquids, viscous fluids, forced air and gases with maximum energy efficiency. In addition, elements can be bent into many configurations to suit a variety of applications. Most screw plug heaters come with a thermowell (for temperature control sensor) and a completely wired terminal enclosure for electrical connection. Certain models available with a patented 360° rotatable screw plug housing to facilitate easy conduit connections. Select from a variety of sheath materials, element lengths, plug sizes and ratings from 0.5 kW and up, for 120 to 600 volts.

On first impression, various manufacturers of screw plug immersion heaters appear to be all alike; but when you take a closer look at screw plug immersion heaters, it becomes evident that considerable differences exist. The following information will help to explain the differences in construction of Chromalox screw plug immersion heaters compared to other manufacturers. It will also describe Chromalox's third party listing program, quality testing, and delivery capabilities.

Before buying a screw plug heater, you should ask the manufacturer questions to insure you are getting a quality heater that will last in your application. Below, you will find a list of some of these important questions.



- 1 How is your resistance wire sized?
- 2 What grade of magnesium oxide is being used?
- 3 How is your cold pin attached to your resistance wire?
- 4 What is your standard element diameter?
- 5 Do you passivate stainless steel heaters?
- 6 Do you repress U-bends when required?
- 7 Do you use terminal sealant as a standard?
- 8 How are your elements fixed to the screw plug?
- 9 Are screw plug hex and threads to industry standards?
- 10 Do you provide a standard thermowell?
- 11 Is the terminal housing rotatable?
- 12 Do you have a standard grounding lug?
- 13 Are your heaters UL listed and CSA certified?
- 14 What quality assurance testing is done on your finished products?
- 15 Can you ship out of stock in 24 hours and provide assembly stock products in 5 days?
- 16 Can you provide me expert technical assistance when needed?

Chromalox®

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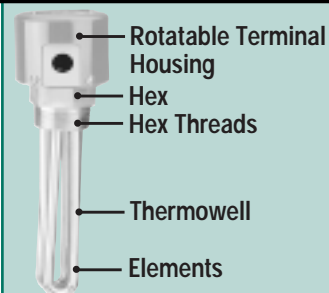
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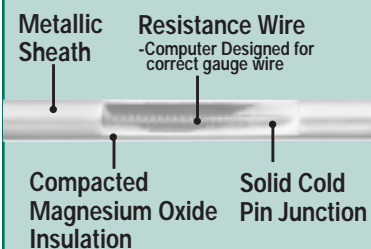
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Basic Construction



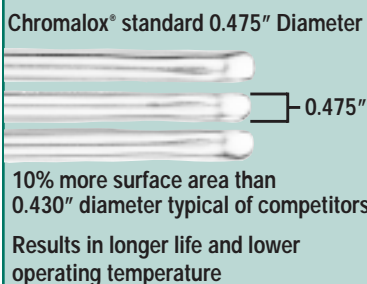
The basic construction of an immersion heater includes the terminal housing, standard NPT screw plug, thermowell and heating elements. If you take a closer look at the construction of a heating element, you will find the heart of the heater is the resistance wire. Chromalox's resistance wire is computer designed in order to select the correct gauge wire for the required heating element wattage and voltage. Many manufacturers use limited sizes of wire, and may not choose the optimal wire for the application. **Ask the heater manufacturer how they determine resistance wire dimensions.**

Elements Internal Construction



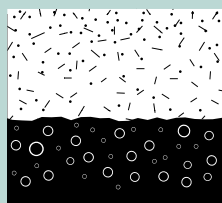
Chromalox connects the resistance wire to the cold pin with a weld. This provides a solid electrical connection that better withstands thermal cycling. Some manufacturers press or braze the cold pin onto the resistance wire, making failure due to thermal cycling more common. **Ask the heater manufacturer how they make their cold pin connections.** Chromalox uses only high purity magnesium oxide insulation to insure good dielectric resistance between the resistance wire and the metal sheath. In addition, Chromalox uses a rolling method to reduce the diameter and compact the MgO refractory. Other manufacturers often use lower grades of MgO, and swage versus rolling down the element diameters, causing inferior dielectric properties which can lead to a less reliable heater. By utilizing high grade materials and having controlled manufacturing processes, good thermal conductivity is achieved and a longer life heating element is produced. **Ask the heater manufacturer how they compact element refractory.**

Element Diameter



Although Chromalox makes elements that range from 0.315" to 0.475" in diameter, our standard 2" and 2-1/2" NPT screw plug immersion heater elements are 0.475" in diameter. Other manufacturers have standardized on 0.430" diameter elements to reduce costs. For an equivalent immersion length, the 0.475" diameter heating element provides 10% more surface area versus a 0.430" diameter element. The greater the surface area, the lower the heater watt density and lower its operating temperature. Lower operating temperatures result in longer heater life. **Ask the heater manufacturer what diameter elements they supply as standard.**

Stainless Steel Heating Element Surface Finish

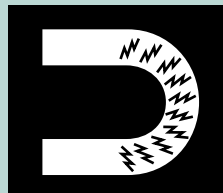


Pickling & Passivation
Removes most carbon particles

Corrosion is often accelerated by a poor surface finish. Proper surface finish of stainless steel heating elements is very important to prevent corrosion. During typical heater manufacturing processes, steel dies and rollers come into contact with the element sheath, and as a result, carbon steel particles are embedded into the surface of the element. If not removed, pitting and corrosion will occur, eventually leading to premature heater failure. As standard practice, Chromalox pickles and passivates stainless steel heaters by soaking the elements in an acid bath. This process removes the carbon steel particles from the surface of the heating element and prolongs heater life. Other manufacturers will only passivate for an extra charge. **Ask the heater manufacturer if passivation is a standard practice.**

Quality - Differences Among Screw Plug Immersion Heaters

Elements U-Bends



Air gaps in Mgo
Electrical short to sheath

Elements U-Bends - Repressed



Recompacts Mgo
Removes any air gaps

Most screw plug immersion heater elements are bent in a U-bend configuration. When bending a heating element on a tight radius, air gaps can occur in the magnesium oxide insulation within the element bend. Air gaps can permit a dielectric (insulation) breakdown to occur, and cause an electrical short to the metal sheath of the heater.

Chromalox represses U-bends to recompact the MgO and remove any air gaps, which ensures dielectric integrity. Many manufacturers do not repress bends to save time and money. **Ask the heater manufacturer if they repress U-bends when necessary.**

Terminal Seal Types

Silicone - Fluid, Resin, RTV
200°F to 300°F continuous exposure
Moderate moisture barrier

Epoxy
200°F continuous exposure
Good moisture barrier

Hermetic
Up to 1000°F sheath temperature
The only true seal

Heating element refractory can absorb moisture from the air, and if enough moisture is absorbed, high leakage current could occur during start-up. Chromalox screw plug immersion heaters contain heating element terminal sealant as a standard feature. A terminal sealant inhibits moisture from being absorbed by the heating element refractory.

There are several optional types of terminal sealants to suit the particular application. **Ask the heater manufacturer about terminal sealants before making a purchase decision.**

Welded Stainless/Steel Elements



Minimizes corrosion at element attachment

Solder not a good corrosion resistant material

Prevents leakage into terminal enclosure

Chromalox stainless steel, INCOLOY® and carbon steel elements are welded to stainless and carbon steel screw plugs. A welded element provides superior corrosion protection and element attachment. Some manufacturers braze elements to the screw plug without concern for the heaters intended application. In heating a corrosive fluid, braze material is susceptible to being chemically attacked by the fluid. A welded-in element prevents corrosive fluid leakage into the terminal housing which can lead to heater failure. **Ask the heater manufacturer how they secure their elements to the screw plug.**

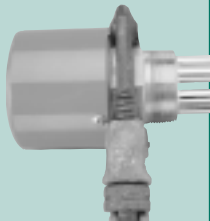
Differences Among Screw Plug Immersion Heaters - Quality

Hex and Threads

Wide hex fits standard tools

Long threads for tighter fit

Easy to install



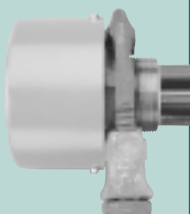
Hex and Threads - Other Supplier Alternatives

Short hex requires special tools

Short threads susceptible to damage

Short threads cause loose fit into tank

Difficult to install



Chromalox heater design provides a screw plug hex and threads that are user friendly. Wide hex and generous threaded lengths allow standard tools to be used and allows a secure fit.

Other manufacturers often provide a narrow hex, making the hex difficult to grip, potentially damaging the screw plug threads, or short thread lengths that may not provide a tight seal. Chromalox screw plug immersion heaters are easy to install – no special tools are required. **Ask the heater manufacturer if their Hex and Threads meet industry standards.**

Chromalox stainless steel and steel screw plugs come with a standard solid hex and threads. Others use stamped, cast or hollow plugs and threads that can fail under higher pressures.

Thermowells



Standard to accept sensing bulbs

Integral and remote thermostat options

Chromalox screw plug immersion heaters can be provided with or without an integral thermostat. Regardless, a thermowell is standard on most heaters to accept the sensing bulb of a thermostat. This allows an easy retrofit if later you learn that a thermostat is necessary. Most manufacturers charge extra for thermowells. **Ask the heater manufacturer if a thermowell is standard.**

Rotatable Terminal Housing



IT DOES THE TWIST

Unique with 360 Degree Rotation Feature

The NEMA 1 terminal enclosure of the Chromalox screw plug heater is fully rotatable. This patented feature allows 360° rotation of the terminal enclosure (270° rotation for heaters with thermostat). Thus, you are able to rotate the enclosure (housing) to face the electrical conduit connection after the heater has been properly installed.

During installation, it is preferred that the conduit for the wiring be in a down position. This prevents any moisture that may accumulate on the conduit from running down into the terminal enclosure of the heater and cause potential heater failure. **No other heater manufacturer offers this feature.**

Differences Among Screw Plug Immersion Heaters - Quality

Electrical Grounding



National
Electrical Code
Requirement

Chromalox
Standard

Ground lugs
not provided
by all suppliers

Proper electrical grounding is extremely important and is required by the National Electrical Code. Some manufacturers do not provide a standard grounding lug with their heaters. Grounding lugs are a standard feature with Chromalox heaters. **Ask the heater manufacturer if a grounding lug is standard.**

Third Party Listing



Most Extensive
in the Industry

Underwriters
Listing (UL)

Canadian Standards
Association (CSA)

Chromalox has the most extensive third party listing in the industry. We provide more heaters with Underwriters Laboratory listing and/or Canadian Standards Association Certification than ***all other heater manufacturers combined.*** This assures the heater is built to stringent standards and allows you to receive quick electrical inspector approval. **Ask the heater manufacturer about UL Listing and CSA Certification.**

Quality Testing



100% Hydrostatic
Pressure Test for
Weld Leaks

100% Resistance Check
for Element Wattage

Insulation Resistance
Check for Moisture
20 Megohms or greater

Dielectric Hi-pot Check

Chromalox heaters undergo extensive quality inspection prior to shipment. All screw plug heaters are 100 percent hydrostatically pressure tested to insure a tight leak-proof fit of the elements to the screw plug. We also perform a 100 percent resistance check on all our heater elements to ensure proper heating element wattage. A two-step insulation resistance check is also performed. First, elements must have a test measurement of insulation resistance to insure minimal moisture content of the element refractory. Then, a dielectric high potential check insures that no electrical short exists from the resistance wire to the metal sheath. Many manufacturers do not perform all of this quality assurance testing. **Ask the heater manufacturer about their testing program.**

Delivery and Service

Stock heaters shipped in 24 Hours
Over 1000 Screw Plug heaters in stock



Toll free service number
1-800-368-2493

Chromalox's stocking program is unequalled in the industry. Our distribution warehouse can ship stock heaters within 24 hours of receipt of an order. Chromalox has over 1,000 different screw plug heaters in stock. In addition, most of our assembly stock products can ship within 5 days. And, we offer 10 day shipment for many of our other thousands of pre-engineered designs. We also provide a toll free service number for replacement part orders and installation assistance. **1-800-368-2493. Ask the heater manufacturer about their delivery times and stock offering.**

Quality - Differences Among Screw Plug Immersion Heaters

In Summary



Over 80 years of experience
Highest quality heater construction
Extensive UL/CSA Listings/Certifications
Comprehensive testing prior to delivery
Fast delivery and customer service

Chromalox has over 80 years of experience, the highest quality construction, extensive UL Listings and CSA Certifications, a comprehensive quality program and the largest stock and pre-engineered designs of any manufacturer. Chromalox also has the largest and most technically competent field sales force in the industry. This means you get the best products and application support when you need it!

To Chromalox, an educated customer is our best customer. We are proud to build the world's highest quality and longest lasting screw plug heaters. We ask you to ask these questions to whomever you buy your screw plug heaters from. Remember, not all screw plug heaters are created equal.

Feature / Benefit Analysis

Feature

- ◆ High Quality Components
- ◆ Strict Manufacturing Processes
- ◆ Element Diameter as required
- ◆ Repressed Bends where necessary
- ◆ Standard Terminal Sealant
- ◆ Welded Elements
- ◆ Standard Hex Width and Thread Length
- ◆ Standard Grounding Lug
- ◆ Rotatable Enclosure
- ◆ Third Party Listing (for a list, ask your Representative for bulletin PD314)
- ◆ Comprehensive Quality Assurance Testing
- ◆ Product Availability
- ◆ Responsive Production Facility
- ◆ Highly Technical and Experienced Sales Force

Benefit

- ◆ Longer Lasting, More Reliable Heater
- ◆ Higher Consistency and Quality
- ◆ Longer Lasting Heaters
- ◆ Higher Dielectric Integrity
- ◆ Insulation Moisture Inhibitor
- ◆ Resists Chemical Attack
- ◆ Easier Installation, Better Fit
- ◆ Insures NEC Compliance for Ground
- ◆ Proper Enclosure Orientation Makes for Easy Installation
- ◆ Insures Highest Quality and Strict Manufacturing Procedures
- ◆ Greater Reliability
- ◆ Large Stock & Assembly Stock Offering
- ◆ Lower Lead Times for Assembly Stock and Special Order Products
- ◆ Support and Assistance When You Need It Most