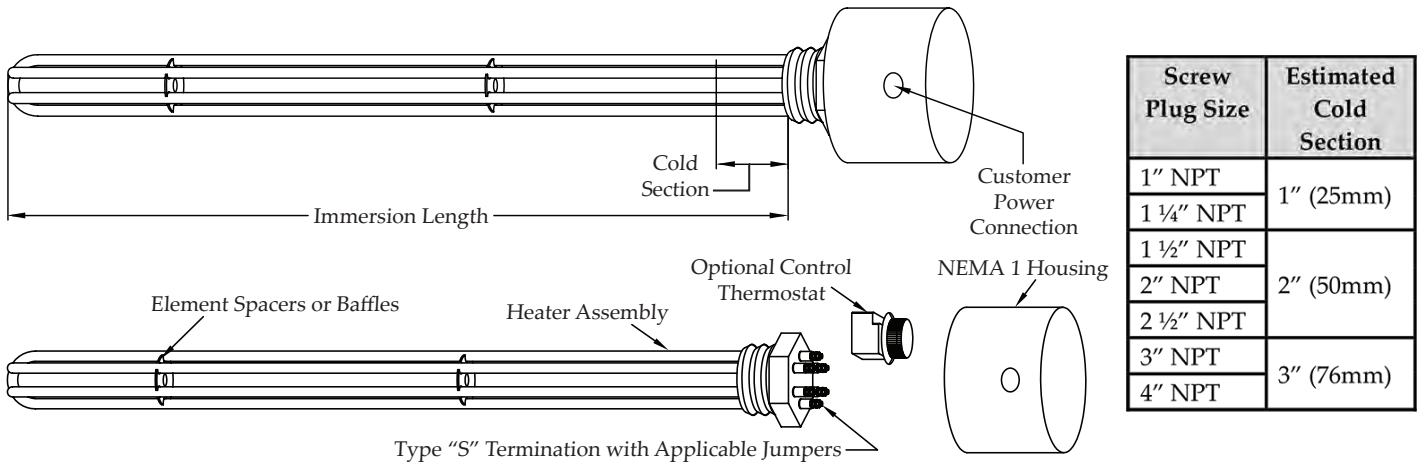




closing the loop on thermal solutions

SCREW PLUG IMMERSION HEATER INSTALLATION & OPERATIONS MANUAL



BEFORE INSTALLATION

NOTICE!

Read this entire document before installing, operating or servicing this product. Failure to do so may cause personal injury and/or equipment damage.

Read all WARNING messages. They call out important safety information to prevent personal injury and/or equipment damage.

1. Unpack the heater and ensure all parts are included. Consult Durex Industries for instructions if parts appear to be missing or if the product appears to be damaged. **DO NOT OPERATE DAMAGED EQUIPMENT.**
2. Check nameplate information to ensure the product complies with the required specifications. Contact Durex Industries if there appears to be an error prior to proceeding with the installation.

INSTALLATION

WARNING!

EXPLOSION & FIRE HAZARD. Avoid installation of heater near combustible vapors or flammable gas-laden atmospheres as hot heater surfaces can possibly ignite the flammable mixtures and cause personal injury and equipment damage.

EXPLOSION & FIRE HAZARD. The user of this product is entirely responsible for determining and complying with ALL hazardous location classification requirements for the application of this product.

1. The heater must be installed so that the heated section is immersed at all times. Premature failure of element will occur if this is not done. Provisions must be provided to monitor and ensure fluid levels are above the heating elements.
2. Horizontal mounting of the heater is recommended.
3. The heater should be located as close to the bottom of the tank as possible for maximum heating efficiency.
4. Locate the heater at least 2" (50mm) below the minimum liquid level and 1" to 2" (25mm-50mm) above the maximum expected sediment or sludge level at tank bottom.
5. Cover the threads of screw plug immersion heaters with high quality pipe sealing compound before installing.
6. Use a wrench on the hex portion of screw plug to tighten the heater in the threaded tank opening. Do not turn the heater by the terminal enclosure.
7. Do not over torque screw plug for risk of damaging threads and creating a leaking point.
8. When heating closed tanks and vessels, controls and safety limits must be used to regulate temperature and/or pressure build-up.



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INSTALLATION CONTINUED - HAZARDOUS LOCATIONS

WARNING!

EXPLOSION & FIRE HAZARD: For classified hazardous locations, the user must verify that the properly rated enclosure is being employed for the designated hazardous area. Also the user is responsible for proper field wirings and connections as required by NEC, NFPA 70 and other local electrical codes.

EXPLOSION HAZARD: It is imperative in hazardous locations, that power is disconnected and open circuit is verified prior to opening the heater's electrical enclosure or performing ANY installation or service.

Heaters installed in classified hazardous locations have the following requirements.

1. It is the user's responsibility to provide provisions to monitor fluid level above heating elements.
2. Safe operation in a hazardous location requires the maximum operating temperature of all exposed fittings and electrical terminal enclosure surfaces be limited to the Temperature Code (T-Code) specified in the hazardous location. It is the user's responsibility to determine the proper classification and T-Code ratings for a particular installation and for providing Durex Industries with hazardous area specifications and requirements for proper equipment design. (NEC Articles 500 and 501 provide guidelines for evaluating and classifying hazardous locations.)

3. It is the user's responsibility to monitor and/or verify that screw plug fitting and enclosure temperatures are kept below the marked Temperature Code (T-Code).
4. A conduit seal is required within 18" (46cm) of the enclosure for conduit entries $\leq 1"$ NPT size. However, a conduit seal is required AT THE ENCLOSURE for conduit entries from 1-1/8" NPT to 1-1/2" NPT sizes. Note: Gas Group B and Group B+H2 locations require additional conduit seals and thread engagement.
5. It is the user's responsibility to size the proper minimum wire gauge for feed wiring (and protective conduit) to the heater, including appropriate temperature de-rating factor. Feed wire should be rated for 150°C (300°F) minimum. The current carrying capacity of the power feed wires should be at least 25% above the rated heater amperage.
6. Installation locations should have ambient temperatures of -20°C to +40°C (-5°F to +104°F).
7. Approved pressure and/or temperature limiting controls must be used on electric heaters and heating elements to ensure safe conditions and operation in the event of system malfunctions.

WIRING

WARNING!

ELECTRIC SHOCK HAZARD: Disconnect power prior to making (or servicing) wire, cable and conduit connections. Failure to do so may cause personal injury or equipment damage. Only qualified electricians should install wiring, and ensure proper grounding, in accordance with the NEC, NFPA 70 and other local codes.

EXPLOSION & FIRE HAZARD: For classified hazardous locations, user must verify that the properly rated enclosure is being employed and is responsible for proper field connections as required by NEC, NFPA70 and other local codes.

FIRE & SHOCK HAZARD: Install Ground Fault Circuit Interrupter (GFCI) to prevent personal injury or Equipment Ground Fault Protection to prevent property damage.

1. It is the user's responsibility to properly size and install feed wire and protective conduit.

2. The current carrying capacity of the power supply leads should exceed the heater amperage by at least 25%. Be sure to consider the ambient operating temperature and apply the appropriate de-rate factor to the ampacity rating of the wire. Lead wire used must be rated for 150°C (300°F) minimum.
3. Consult wiring diagrams for wiring connection guidance. Consult factory if anything is unclear.
4. After heater is wired, check tightness on each terminal by supporting lower hex nut and tightening upper hex nut to a maximum torque of 20 in-lb (2.25 N-m). Over tightening will lead to termination breakage and render heater inoperable!
5. Ensure that process temperature controllers, high limit controllers and temperature sensors are properly wired and connected. Ensure that the power switching device (relay or SSR) is properly rated for voltage and current requirements.
6. If using a thermostat, ensure that it is properly wired and connected. If the thermostat is used as pilot duty, verify proper wiring to user supplied contactors and field wiring.
7. Thermostats and temperature controllers should not be used to "power off" or disconnect power to the heater. Use of a disconnect switch or circuit breaker is required to interrupt power supply to the heater and electrical connections.

THERMOSTATS

1. Integrally mounted thermostats are designated as "SPST" for single pole, single throw models and as "DPST" for double pole, single throw models.
2. Thermostats may be connected directly to heaters that are rated within the electrical capacities specified to the right. When the heater amperage exceeds the contact rating of the thermostat, the heater should be controlled by a magnetic contactor with the thermostat wired for pilot duty.

3. Thermostats should not be used as an "off" switch. Use of a disconnect switch or circuit breaker is recommended to provide electric power disconnect to the heater and thermostat. Maintenance should only be performed after power is fully disconnected.

Voltage	Thermostat Type	
	SPST	DPST
120	20 AMPS	30 AMPS
240	20 AMPS	30 AMPS
480	N/A	21 AMPS

Electrical rating of thermostats:



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TEMPERATURE SENSORS

WARNING!

Install high temperature control protection in systems where an over temperature fault condition could present a fire hazard or other hazard. High limit sensors and controllers provide over temperature protection.

1. If the heater is equipped with process and/or high limit temperature sensors ensure that the controller input matches the sensor type (thermocouple, RTD, etc.) and calibration (Type J, Type K, PT100, etc.) exactly to ensure proper temperature readings and control. Also ensure that thermocouples are connected with the proper polarity and RTD wiring is connected to the proper wiring inputs.

2. Process Sensor. If a process sensor is used to control liquid temperatures, ensure that it is properly connected to the process temperature controller.

3. High Limit Sensor. If equipped with a high limit sensor, the sensor is attached to one of the heater elements to sense heater temperatures. The sensor must be connected to a FM Approved high limit controller (which in turn is connected to safety shut down contactors) to protect the heater elements from a dangerous over temperature situation. This may be used to protect the liquid from getting too hot, or ensuring the heater element does not over temp if the liquid level drops and exposes the heater elements to air. When a high limit condition exists, the controller interrupts power to the heater circuit, requiring manual intervention to clear the fault condition prior to restarting operation. **It is the user's responsibility to ensure safety of the installation!**

OPERATION

WARNING!

Sheath corrosion can result in a ground fault which, depending upon solution being heated, can cause an explosion or fire. Therefore, verify heater sheath compatibility with the medium being heated.

1. Provisions should be made to prevent damage due to leaking of tank contents during operation.
2. Do not operate heaters at voltages in excess of rated nameplate voltage.
3. Do not operate the heater unless the liquid level is at least 2" above the heater element.
4. Do not bend the elements. Consult DUREX if bending is necessary.
5. The heater can be protected from possible mechanical damage by placing a screen or grill around the elements.
6. Protect the terminal end of the heater from spray, condensation, dripping and vapors. A protective terminal enclosure should be used if the heater is to be subjected to these conditions.
7. If the heater is to be operated in the presence of explosive vapors or dust, an explosion resistant terminal enclosure must be provided.
8. Do not set the thermostats above the boiling point of the liquid. The boiling liquid could create a steam pocket which could cause the element(s) to overheat and burn out.

9. Be sure the sheath material is compatible with the material being heated. Copper sheathed elements are used to heat water. Steel sheathed elements are used to heat oils. Stainless steel and incoloy sheathed elements are used to heat alkaline, wax, corrosive liquids and other similar materials.

10. **Low Megohm Conditions** - The refractory material used in electric heaters may absorb moisture during transit, storage or when subject to humid environments that will reduce the cold insulation resistance (low megohm). Low megohm may result in high leakage current to ground and nuisance trips of ground fault protection equipment. Normally, the megohm value increases after heat-up. Typical insulation values are 5 megohm or greater on complete assemblies of unsealed elements or 20 megohm on individual unsealed elements. It is recommended that heaters with 1 megohm or less be dried out before applying full power. If dried properly low megohm will not effect heater life efficiency. To correct a low megohm condition, remove terminal enclosure cover, gaskets, and terminal hardware. Bake heaters in an oven at 300 to 350°F for several hours or preferably overnight. An alternate procedure is to cycle the heater in 10 to 15 minute periods at low voltage until megohm values are normal. Sheath temperatures should not exceed 350°F.

NOTE: Low megohm on heating elements with epoxy or hermetic seals cannot be serviced in the field. Typical resistance values when sealed are 200 megohm or greater.

MAINTENANCE

WARNING!

ELECTRIC SHOCK HAZARD: Disconnect power and ensure circuit is open prior to removing the enclosure and/or attempting to service the heater or the wiring and cable connections. Failure to do so may cause personal injury and/or equipment damage.

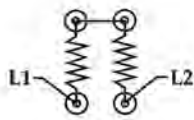
EXPLOSION HAZARD: It is imperative in hazardous locations, that power is disconnected and open circuit is verified prior to opening or removing the heater's electrical enclosure. Failure to do so may cause an explosion.

Periodically, remove the heater from the tank to inspect the elements for signs of corrosion and remove any deposits from the sheath. Be sure power is disconnected before removing elements.

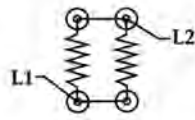
Check loose terminal connections and tighten if necessary. Tighten terminal connections by supporting lower hex nut and tightening upper hex nut to a maximum torque of 20 in-lb (2.25 N-m). Be careful as over tightening can break off the electrical termination and render the heater inoperable.

SCREW PLUG IMMERSION HEATER INSTALLATION & OPERATIONS MANUAL

Typical Screw Plug Wiring Diagrams

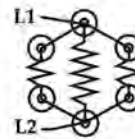


1 Phase Series

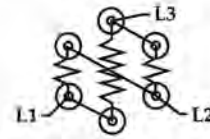


1 Phase Parallel

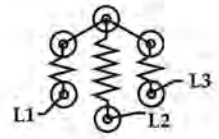
1 1/4" & 2" Screw Plugs, 2 Element



1 Phase Series



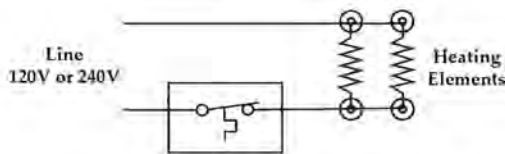
3 Phase Delta



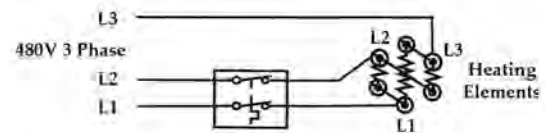
3 Phase Y

2" & 2 1/2" Screw Plugs, 3 Elements

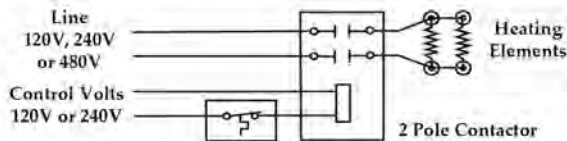
Typical Thermostat Wiring Diagrams



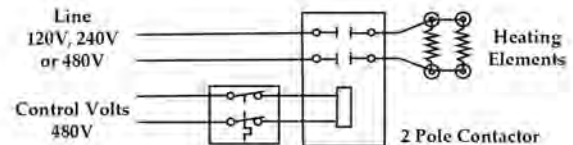
Single Phase Power with SPST Thermostat



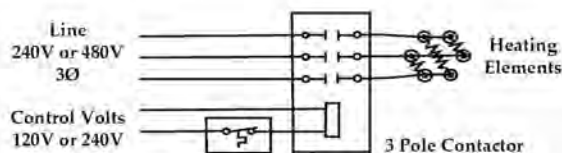
Three Phase Power with DPST Thermostat



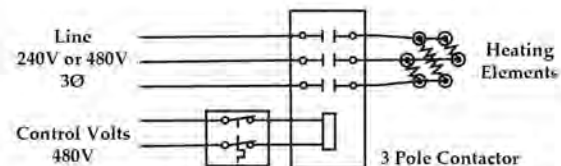
Single Phase Power Pilot Duty SPST Thermostat
For 120V, 240V or 480V heaters when current
exceeds thermostat rating



Single Phase Power Pilot Duty DPST Thermostat
For 120V, 240V or 480V heaters when current
exceeds thermostat rating



Three Phase Power Pilot Duty SPST Thermostat
For 240V and 480V 3 Phase heaters when current
exceeds thermostat rating



Three Phase Power Pilot Duty DPST Thermostat
For 240V and 480V 3 Phase heaters when current
exceeds thermostat rating

NOTE: A 2 pole (instead of 3 pole) contactor can be used for 3 Phase – 2 Leg control where one leg is wired direct to power.
Contact Durex for more information.