



# INSTALLATION, OPERATING & MAINTENANCE INSTRUCTIONS FOR OVER-THE-SIDE IMMERSION HEATERS

## GENERAL

HEATREX Over-the-Side Immersion Heaters are designed to provide years of trouble free operation if properly installed and maintained. Please read and follow these instructions for installing and maintaining the heater.

Over-the-Side Heaters are built with tubular electric resistance elements soldered or welded to a fabricated box. The heater can be installed in holding or storage tanks to heat a fluid. Standard designs utilize a riser tube to route the electrical wiring up above the fluid level of the tank.

Instructions for Industrial Control Panels, if provided, are per IOM ENM - 2183. For additional product information and offerings, refer to HEATREX catalog literature on Circulation Heaters, Immersion Heaters, or Tubular Heating Elements.

Standard construction is rated for 250° F. High temperature designs are also available. For high temperature heaters, the heater design features must be closely matched to the application. For end use applications, it is the responsibility of the installer to verify suitability through testing and installation of temperature regulating and temperature limiting controls.

The heating elements are available in various watt density ratings. Operating temperature, watt density and flow velocities (agitated tanks) determine the element surface temperature. Life expectancy of the heating element is directly related to its surface temperature.

### CAUTION

Failure to follow HEATREX recommendations could result in premature failure and/or serious equipment damage.

Temperature regulating devices, temperature limiting controls, or low liquid level are recommended for use with Over-the-Side Heaters, to control the heating process and safeguard the heater from excessive temperatures that can cause damage. Also on liquid systems, damage to fluid could occur if the heater is allowed to exceed the maximum film temperature recommended by the manufacturer.

HEATREX Over-the-Side Heaters can be specially designed for use in hazardous areas as specified in Article 500 through 516 of the National Electrical Code. Refer to the heater nameplate for classification of the heater provided. See section below labeled Hazardous Areas for specific requirements.

**It is the ultimate responsibility of the user to verify that the construction materials provided in the HEATREX Immersion Heater are suitable for use with the process fluid. Specifically, corrosion issues must be reviewed. Heater watt density and operating temperature must also be properly matched to the application. HEATREX can provide assistance if operating conditions are provided, but cannot be responsible for heater failure due to corrosion or excessive temperature.**

## INSTALLATION

### CAUTION

HEATREX recommends installation be performed by qualified personnel familiar with the National Electrical Code and all local codes and standards. It is the responsibility of the installer to verify the safety and suitability of the installation

### WARNING

DO NOT mount heaters in an atmosphere containing combustible gases, vapors, dusts, or fibers unless properly marked as suitable for the condition. Refer to section below for special instructions for Hazardous Areas.

### WARNING

Hazardous voltages are present in this equipment. Lock out and tag the branch circuit disconnect switch before working on this heater.

### Handling and Storage

Care must be taken to avoid damage to the heater and tubular elements during storage and handling.

Protect the heater from weather damage during storage if shipping packaging is not sealed. It is recommended to store the heater in a cool dry area to help prevent the heating elements from drawing moisture.

### Mechanical Instructions

#### Site Selection

Review the NEMA Type rating of the heater. Contact the factory if unsure of the rating. Do not install a heater in an area not consistent with its rating.

Allow sufficient free space around heater installation site. Work space for heater maintenance should be at least three feet in front of the heater. The minimum pull space for the Over-the-Side Heater installation or removal from the tank should be considered.

Electric heaters are capable of developing high temperatures. Therefore, extreme care should be taken to avoid mounting heaters in an atmosphere containing combustible gases, vapors, dusts, or fibers unless properly marked as suitable for the condition.

Heater Orientation

This heater has been constructed for either horizontal or vertical mounting. It must be mounted in this manner, to prevent improper operation or damage.

In either case, the riser tube must be oriented vertically with the electrical outlet box located above the highest fluid level.

Liquid level switches and thermal protection must be positioned above the highest point of the heating elements to properly protect the heater.

When securing the heater to the tank is required, thermal expansion of the heating elements must be considered. Anchor at only one end, or provide slotted or sliding mounts at the other end of the heater. Thermal expansion of the heating elements can be approximated as:

$$\text{Heater Length (Inches)} \times .00001 \times \left[ \begin{array}{l} \text{Element Sheath Temp } (^\circ\text{F}) \\ - 70^\circ\text{F} \end{array} \right]$$

**WARNING**

The heater bundle must always be completely immersed in the fluid, regardless of orientation, to prevent damage or failure of the heater.

Horizontal heaters are provided with sludge leg spacers to hold the heater above any solids buildup. Premature failure will occur if the heating elements are below the sludge level.

Be sure that heating elements are completely immersed in the fluid before energizing the heater.

**Electrical Instructions**

Heaters require field wiring to the heater to be carefully matched to the application to avoid serious injury or damage to the equipment. The wiring must be de-rated for the expected terminal box temperature.

The size and type of incoming field wiring will depend upon the heater terminal box temperature, heater current draw per conductor, number of conductors per conduit, and wire insulation rating. Refer to the National Electrical Code.

The terminal box temperature is a function of the process fluid temperature and the length of the riser extension above the fluid level. For most operating conditions, 90°C wiring is suitable.

Field supplied conductors must be sized for at least 125% of the circuit current.

To calculate the circuit (in amps):

$$\text{Single phase Line current} = \frac{\text{KW} \times 1000}{\text{Line Voltage}}$$

$$\text{Three phase Line current} = \frac{\text{KW} \times 1000}{1.732 \times \text{Line Voltage}}$$

Wiring to the heater should be permanently installed in metallic or non-metallic electrical grade conduit in accordance with all applicable electrical codes, and should include a grounding conductor if non-metallic conduit is used.

Field supply wiring must be rated for 600Vac. Use copper conductors.

The electrical installation should include a service disconnect switch in sight of the heater, as well as branch circuit over-current protection and over-temperature protection (if not provided with the heater).

Wiring recommendations noted on the wiring diagram when application data provided to HEATREX. An additional copy is provided on the wiring diagram inside the heater terminal box.

Where thermocouple extension wire is required between the heater and control panel, verify it is connected with proper polarity as shown on the wiring diagram. Failure to do so may result in an uncontrolled heater. Refer to the wiring diagram for the required wire type. Shielded wire is recommended to reduce signal interference.

**WARNING**

Retighten all electrical connections that may have loosened during shipment. Failure to do so may result in damage to the heater or risk of fire.

Confirm all unused conduit holes in the terminal box are sealed with plugs suitable for the heater environment. Replace any plastic shipping plugs if an opening is not used.

Attach a ground conductor to the stud located in the heater terminal box or by other appropriate means per NEC Article 250.

Be sure the terminal box cover is properly installed at all times to ensure personnel protection. Also, contaminants can create leakage, (shock) hazards, permanent heater damage or failure and should be avoided.

It is recommended to perform an insulation resistance test prior to energizing the equipment. If the value is less than 1 Meg Ohm using a 500Vdc or similar tester, refer to Maintenance and Troubleshooting sections.

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## OPERATION

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**WARNING**  
**DO NOT TURN ON HEATER UNTIL TANK IS COMPLETELY FULL OF FLUID.** Permanent damage may result to heating elements if the heater is energized without fluid.

To operate this heater, ensure the tank is completely filled with fluid, start agitating pump (if applicable), and energize the main supply disconnect. Set the controlling device to the desired temperature.

During initial heating, it is recommended to slowly ramp up the process set point and inspect the heating system for problems.

**DO NOT** operate heaters at voltages in excess of that marked on the heater. Excessive voltage can shorten heater life or overload the branch circuit wiring.

**DO NOT** operate heaters at sheath temperatures higher than the recommended maximum. Excessive temperatures can cause premature failure. Generally, sheath materials are limited to the following maximum temperatures.

Sheath Material	Maximum Sheath Temperature
Copper	350° F
Steel	750° F
Stainless Steel 304	1400° F
Incoloy 800	1600° F
Monel	1000° F

HEATREX recommends that all safety interlocks be tested during initial startup to ensure they properly disable the heater.

After 10 days of operation, retighten all electrical connections.

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## MAINTENANCE

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**CAUTION**  
Troubleshooting and repairs should only be attempted by qualified maintenance personnel.

Periodically check all electrical connections, including field and factory-made connections for tightness, and all wiring for deterioration at least once a year.

Inspect tank for sludge level. Clean tank as required to keep heating elements above the sludge.

Where the heater is installed in cold climates, consider safety precautions to prevent damage due to freezing fluid when the heater is not in service.

Where buildup of solids on the heating elements, or significant corrosion is expected, periodically remove the Immersion Heater to inspect the heating elements. Do not continue using a heater with signs of damage.

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## TROUBLESHOOTING

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**CAUTION**  
Troubleshooting and repair should only be attempted by qualified maintenance personnel.

The nature of the magnesium oxide used to electrically isolate the nickel chromium resistance wire in the heating elements is such that over a long period of storage, they will absorb considerable moisture from the atmosphere unless hermetically sealed. It is recommended to perform an insulation resistance test prior to energizing the equipment. If the value is less than 1 Meg ohm using a 500Vdc or similar tester, care must be taken to dry out the heater to prevent failure. It is recommended that the elements be turned on at a reduced voltage at first to boil off the moisture. Meg Ohm readings may drop initially after a few minutes of operation, indicating moisture being forced out of the elements. The terminal enclosure lid should be left open during this period to allow the moisture to escape.

If the heater has a manual-reset high limit thermostat, be sure that the reset button is pressed in.

The heating elements are not field-repairable. The only recommended field repairs are to remove and replace the faulty Immersion Heater, or to return the heater to the factory for repair.

If reduced heat output is suspected, verify the condition of the heating elements by using an ammeter to check the current draw of each input line. All input lines should draw approximately equal current, which should agree with nameplate rating. If they do not, one or more of the heating elements could be damaged.

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## HAZARDOUS AREAS

(where applicable)

### **WARNING – Explosion Hazard**

HEATREX strongly recommends installation be performed by qualified personnel familiar with the National Electrical Code and all local codes and standards regarding explosion-proof equipment. It is the responsibility of the installer to verify the safety and suitability of the installation.

Per Article 500-516 of the National Electrical Code, a hazardous area is defined by a “Class”, “Division”, “Group”, and “Temperature Code”. The Class can be I or II, where Class I indicates that the hazard classification is due to the presence of an explosive vapor. Class II indicates an explosive dust. The division can be either 1 or 2. Division 1 indicates a hazard is ALWAYS considered to be present. Division 2 means the hazard is only present under abnormal conditions. The Group defines the explosiveness of the hazard. The Temperature Code specifies the temperature at which a hazard will ignite.

HEATREX can provide designs suitable for all of the above conditions, but a heater should never be placed in an environment not noted on the heater nameplate.

NEVER operate the heater in an atmosphere with an ignition code temperature LOWER THAN the nameplate rating. The user must determine the actual area classification.

Special design considerations for electric heaters used in hazardous locations:

1. Locate all electrical connections in an appropriate enclosure.
2. Prevent surface temperatures of the heater from exceeding the design ignition temperature.

HEATREX Over-the-Side Heaters designed for Division 1 or 2 atmospheres are provided with an enclosure designed to contain an explosion.

When the design temperature of the process exceeds the rated ignition temperature, it is critical that the heater and all customer piping is properly insulated.

A hazardous area heater must be powered and controlled by a heater control panel designed to provide necessary over-temperature safety interlocks. Contact HEATREX if assistance is required to properly control and protect the heater.

Never apply power to a heater in a hazardous atmosphere unless all terminal box covers are properly installed with all cover bolts.

All conduits entering the heater terminal box must be sealed within 18” of the heater using an explosion-proof conduit seal. Any unused openings must be properly sealed with a steel pipe plug. Follow the NEC for specific conduit requirements such as the requirement for Rigid Conduit.

To ensure proper flamepath, all threaded conduits must use rated fittings and be tight, with a minimum of 5 good threads engaged for Groups C&D, and 7 threads for Group B hazards. Any machined metal-to-metal surfaces on terminal boxes must be handled carefully, to prevent scratches, which may void the explosion-proof rating.

### **WARNING - Risk of Explosion**

Operating the heater at a voltage higher than the nameplate value may result in elevated temperatures and amperage above the design ratings.

Heaters used to heat explosive products such as methane at a temperature above their ignition temperature must remain free of oxygen.

Proper grounding of equipment in hazardous areas is critical to eliminate potential sources of sparking.

Replacement of electrical components should only be done by authorized personnel familiar with the requirements of maintaining electrical equipment in an explosion-hazard area.



Phone: 814-724-1800  
www.heatrex.com