



INSTALLATION, OPERATING & MAINTENANCE INSTRUCTIONS FOR FLANGE-MOUNTED & PIPE THREAD IMMERSION HEATERS

GENERAL

HEATREX Flange-Mounted & Pipe Thread 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.

Immersion Heaters are built with tubular electric resistance elements soldered or welded to an ANSI flange, custom fabricated rectangular flange, or NPT pipe thread fitting. The heater can be installed in holding/storage tanks or in the piping of circulating fluid systems. Instructions for Industrial Control Panels are provided in HX87-2000-83. For additional product information and offerings, refer to HEATREX catalog literature on Circulation Heaters, Immersion Heaters, or Tubular Heating Elements.

ASME certified and stamped ANSI flanged immersion heaters can be supplied by HEATREX when specified.

A variety of designs and sizes are available with process temperatures up to 1200°F. Due to these high temperatures, 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. Outlet temperature, watt density and flow velocities 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, low liquid level, or low flow controls are recommended for use with Immersion 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 Immersion 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.

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 Immersion Heater installation or removal from the vessel should be at least equal to the overall length of the heater plus two feet.

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.

Handling and Storage

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

Large heaters (6" ANSI and larger) are normally provided with lifting lugs to assist with movement. For smaller heaters, flange bolt holes may be used.

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.

Heater Orientation

This heater has been constructed for a specific mounting orientation. It must be mounted in this manner, to prevent improper operation or damage.

Pipethread heaters with a Type 3R, 4, 4X or 12 terminal box are factory torqued to maintain environmental rating. Any movement of the box relative to the fitting may compromise the seal.

Horizontal mounted heaters must have the monitoring device(s) located above the element bundle. This orientation is most common.

Vertical mounted heaters can be top or bottom mounted.

- a. For top mounted heaters, the monitoring device(s) must be located near the flange end of the heater.
- b. For bottom mounted heaters the monitoring device(s) must be located near the U-bend of the element bundle.

CAUTION

Immersion Heaters with cross-baffles or over-temperature thermocouples may require specific orientation to match the vessel. Consult the factory for specific mounting requirements.

WARNING

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

Thermal expansion of the heating elements must be considered when locating the heater. Thermal expansion of the heating elements can be approximated as:

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

If the heater is installed in a pressurized system, a relief valve must be installed. As a minimum, the valve must be sized to relieve at a rate equal to the rate that the heater can thermally expand fluid trapped between the heater and a downstream blockage.

Do NOT place a shutoff of any type between the pressure relief valve and the heater, or on discharge pipes between the relief valve and the atmosphere.

Flanged immersion heaters are supplied from the factory with a non-asbestos nitrile bonded fiber flange gasket unless otherwise specified. The user must confirm that the gasket is suitable for the application.

Exercise care so as not to scratch or nick the mating surfaces between the mounting flanges or threads on pipe fitting.

For flange mounted heaters, the user must supply high strength studs or bolts and nuts, such as A-193 GR. B7 and A194 GR. 2H, rated for the design conditions. Bolts must be properly installed and tightened to prevent leaks.

Pipe thread heaters are installed by applying teflon tape or pipe dope to the threads and tightening into an appropriate threaded nozzle. Avoid over-tightening. Retighten as required if a leak develops.

Horizontal element bundles must be adequately supported. HEATREX recommends supports be provided every 24", starting at 36" from the heater flange.

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

Insulation

WARNING

The surface of the Immersion Heater flange or pipe thread fitting may be extremely hot. Avoid contact to prevent personnel injury or fire.

The customer may prefer to add insulation to the Immersion Heater flange or pipe thread fitting for personnel safety and energy conservation.

WARNING

On heaters with extended terminal boxes and exposed element tubes, do not insulate more than 2" above the Immersion Heater flange. Dangerous over-heating of the terminal box wiring could result.

Electrical Instructions

The potentially high operating and ambient temperatures of Immersion 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 at the heater flange. For liquid systems, the terminal box temperature can be estimated to be equal to the fluid temperature minus 50°F. For gases, use the temperature of the gas. Extended terminal boxes are provided on high temperature heaters to allow moisture seals on the heating elements, and to avoid costly high temperature wire. Contact HEATREX if required for estimated terminal box temperatures with extended terminal boxes.

Field supplied conductors must be sized for at least 125% of the circuit current. Field supply wiring must be rated for 600Vac. Use copper conductors.

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.

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 is provided to HEATREX.

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.

If the heater has a thermal cutoff, wire the cutoff back to the terminal block in the panel per the wiring diagram. This is a Class 1 circuit and can be in the same conduit as the power wiring. If there are two or more heaters connect the cutoffs in series as shown in the wiring diagram.

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.

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.

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.

OPERATION

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.

WARNING
This heater is designed to operate only up to the maximum pressure and temperature rating of the flange or plug. Where an ANSI flange is provided, the rating will match ANSI B16.5. Consult the factory if in doubt.

To operate this heater, start circulating 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

DO NOT operate heaters at flow rates below the design flow rate if for use in circulating systems. Reduced flow can shorten heater life or cause nuisance tripping of thermal safeties.

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.

Re-tighten heater flange bolts after the heater has completed one or two heating cycles. Tighten pipe thread fitting if required on pipe thread heaters.

MAINTENANCE

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.

Periodically inspect for leakage and retighten Immersion Heater flange bolts when required.

Inspect the terminal enclosure and conduit connections for evidence of water leaks or moisture collection. Tighten connections as required. Clean up any corrosion. Do not continue using a heater with signs of damage.

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.

CAUTION

Immersion Heaters with cross-baffles or over-temperature thermocouples may require specific mounting orientation. Do not rotate the Immersion Heater without consulting with the factory.

Where buildup of solids on the heating elements, or significant corrosion is expected, periodically remove the Immersion Heater to inspect the heating elements. If the heater is removed, it is recommended to replace the flange gasket. Do not continue using a heater with signs of damage. Before removing, note the orientation of the flange or pipe plug relative to the vessel. Place a reference mark on the vessel and Immersion Heater or use other methods, such as drawing a sketch showing the conduit hub orientation, to ensure proper orientation when re-installing.

TROUBLESHOOTING

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.

If the heater has a thermal cutoff, check for continuity and replace if open.

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.

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 Immersion Heaters designed for Division 2 locations are provided with Nema Type 4 enclosures unless otherwise specified, since the terminal box is free of arcing or sparking devices. Heaters designed for Division 1 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 flame path, 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 cause 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.



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