HEATERTEK
INDUSTRIAL HEATING SYSTEMS

Start Up Guide and Installation Instructions

Part I - Heater and Safety System Introduction

An immersion heater is one component in a heating system used to heat corrosive aqueous chemistry in an open tank process. **Review** these instructions prior to installation and/or operating the product. **Save** these instructions for future reference.

Minimum System Safety Devices Required for ALL Installations

and

IMPORTANT SAFETY NOTICES

WARNING

System Safety Devices stop electrical power to the heater if high temperature conditions or low liquid level conditions are detected. ALL IMMERSION HEATERS MUST BE INSTALLED WITH ALL THESE SAFETY DEVICES TO HELP INSURE SAFE OPERATION.

- **Low Liquid Level Device** shuts off the heater if the solution level falls too low. The Liquid Level must be maintained so that the Hot Zone of the heater is ALWAYS completely submersed in the solution. Heaters can cause fires. Special care must be taken, especially when used in proximity to plastic tanks (such as polypropylene, polyethylene, etc.). If the Hot Zone is exposed to air, it will overheat, cause an unsafe condition, and become a **fire hazard**. It is the customer's responsibility to purchase, install, and maintain low liquid level devices for every tank where Heater Tek heaters are installed. **NEVER** bypass a liquid level control device.
- **Over-temperature Heater Element Detection Device** turns off electrical power to the heater if the surface temperature of the heater exceeds a preset maximum value. All Heater Tek heaters come equipped with a thermal over-temperature device. This device must be installed and maintained properly throughout the life of the heater. **NEVER** bypass a heater's built-in thermal over-temperature device.

IGNITION SOURCE

- **Temperature Control** maintains the solution temperature at the proper operating temperature. Must be equipped with sensor detection for failed (open or shorted) temperature sensors to prevent an over-temperature hazardous condition. All Heater Tek heaters require a customer installed and properly designed temperature control system.
- **High Temperature Detection for Chemistry** shuts off the heater if the chemistry being heated exceeds a set high temperature value.
- **Properly installed earth ground.** Total ground resistance should be less than 5 ohms. Heaters are a potential shock hazard and must be installed correctly and well maintained. Earth ground both the heater and the tank.
- **Ground Fault Detection and Shut Off** is an electrical safety device that breaks an electrical circuit when there is leakage current to ground. It is designed to help protect equipment and to reduce the risk of serious harm from an ongoing electric shock.

SHOCK HAZARD

- If the heater sheath fails, assume there is full line voltage present in the tank and take appropriate precautions as a **SHOCK HAZARD** exists.

- **ALWAYS** turn off all power prior to handling any heater and take all appropriate safety measures to help prevent electrical shock.
- If a heater is improperly installed and maintained or installed without a properly engineered control system, a serious fire and personnel hazard is present.

IMPORTANT NOTE: Heater Tek heaters are NOT designed to be used with flammable chemistry. <u>DO NOT USE</u> Heater Tek electric immersion heaters to heat any flammable solutions. Keep all flammable solutions away from electric immersion heaters. Failure to do so may result in serious injury or death.

Part 2 – Heater Guidelines

When installing heaters, always follow NEC and local electrical codes as well as these heaters guidelines to ensure long, safe operation.

Mandatory Heater Cool Down Before Handling

NEVER remove an immersion heater from its installation while it is in service and operating. Immersion heaters have hot surfaces while in operation and are a burn hazard to personnel. In addition, removing a heater while in operation can cause physical damage to the heater. For instance, PTFE fluoropolymer heater sheaths may melt when operated in the air. ALWAYS cut power to the heater and keep heater off for 15 minutes before touching the heater or draining chemistry in the tank.

Cleaning of Heaters

- **Turn off Power** before initiating any maintenance. **Wear protective clothing** to avoid direct contact with any chemistry.
- Ensure you have long enough wire and conduit so that there is no stress on the electrical line or electrical connections. Sufficient conduit length also ensures easy maintenance and cleaning.
- Periodically inspect heaters for sludge and/or scale buildup. Buildup on heaters will result in excessive internal operating temperatures resulting in reduced heater service life. Scale and sludge buildup accelerates corrosion, resulting in reduced heater life.
- **DO NOT scrape PTFE** fluoropolymer heaters sheaths. Scraping PTFE heaters will damage the PTFE covering on the heater and void the warranty.
- Remove scale build up on metal heaters but **DO NOT hammer** any heater to remove built-up deposits. Doing so will result in internal damage and void the warranty.
- **Consult with your chemical supplier** for the proper sludge removal procedure for each chemistry.
- Use only Heater Tek Over-Temperature Thermal Protectors for replacement. Follow factory-supplied instructions for installation. Failure to properly install Thermal Protectors can result in unsafe operation and may pose a fire hazard.

Part 3 –Wiring Instructions

Wiring Power Connections. Size and route power wires according to the latest edition of National Electric Code (NEC). Wire to temperature controller. For individual heaters that are labeled single phase, the three-

phase current value on the heater nameplates ONLY applies when field installing and assembling three (3) identical single-phase heaters in a three-phase delta wiring arrangement.

Wiring More than One Protector: For installations in which multiple Thermal Protectors are used, each Protector should operate independently, and each Protector must be wired so that any Protector which trips, shuts down (turns off) the heater installation.

Part 4 –Installing Heaters

PTFE fluoropolymer heaters are easily subject to damage and require extreme care when handling and installing. PTFE Fluoropolymer sheaths can be damaged by even a minor cut. **DO NOT** use any sharp object to open heater packaging.

1. Inspect each heater for any potential shipping damage. If shipping damage is found, notify the common carrier for instructions for filing a freight damage claim with the carrier. Do not install damaged heaters as unsafe operating conditions may occur.
2. Check the packing list, product label, and purchase order to confirm you have the correct heaters.
3. Please confirm all the following information:
   - Do the line voltage and heater voltage match?
   - Is the Over Temperature Thermal Protector the correct style and temperature setting?
   - Are the fusible disconnect (or circuit breaker) sized correctly (per latest edition of the National Electrical Code)?
   - Is the process tank equipped with a Low Solution Level Detection shut-off device?
   - Is the temperature controller (thermostat) sized correctly for heater being used? (The Heater Tek controller contains the required circuitry for the Over Temperature Protector and Low Solution Level Detector.)
   - Is the heater sheath material and solution to be heated correctly matched for maximum heater life?
4. Check that the cover for the molded heater junction box is screwed on tightly so that it maintains a liquid tight seal.
5. Carefully mount the heater (and guard if applicable) to the tank.
   - Hot Zone must **ALWAYS** be immersed. The cold portion of the heater must be long enough to prevent **EVER** exposing the top of the heater Hot Zone above the solution level.
   - Low Solution Level Detection wired so the heater power shuts off provides the ability to interrupt heater power if the solution level falls, exposing the heater Hot Zone. **Liquid Level controls must ALWAYS be used.**
   - Maintain a **minimum one-inch (1”) clearance** between heater sheath and tank at all points.
   - A minimum one-inch (1”) solution above the heater Hot Zone is required to safe operation. If the solution level drops below the Hot Zone, it will shorten the life of the heater and may pose a significant **fire hazard** in plastic or plastic lined tanks.

- Maintain a minimum two-inch (2”) clearance above any parts accumulation or sludge in the bottom of tank.
- Isolate heaters from any electrified source. Heaters should not contact anodes, cathodes, any electrified portions of tank, racks, saddles, or parts at any time.
- Connect the heater ground leads to the building or rectifier ground (proper earth ground) to prevent voltage potential difference.
- Heater heads should be protected from liquid splashing, dripping and excessive moisture. Do not operate heaters under covers. Always provide adequate ventilation. Do not install heaters near ventilation intakes.

6. Route heater power lead wires, ground wire, and Protector wires through conduit. Size and route power wiring according to the latest edition NEC. Standard wiring:
   - Black — power leads
   - Green — ground lead
   - Yellow, blue, white or red — Over Temperature Thermal Protector leads (may vary depending on Protector designation and temperature rating)
   - Other wiring colors are possible. Consult factory for details.
   - If installing flexible nonmetallic conduit, properly install connector ferrule to ensure liquid-tight operation.
7. Install the control.
   - Secure the sensor in the chemical solution or place in a suitable thermowell to prevent movement that could lead to erroneous readings or a dangerous overheat condition.
   - Install the top of the sensor bulb below the minimum liquid level and **ALWAYS** above the bottom of the heater. A mislocated or floating sensor can result in an overheat condition which could result in a significant fire hazard in plastic tanks.
8. Install a low level shut-off at least one-inch (1”) above the top of heater Hot Zone.
9. Install the heater junction box per latest edition of the NEC. Mount on a horizontal ambient surface.

Part 5 – Installing the Conduit

1. Make sure the end of the conduit is cut straight so that the fitting will fit securely on the conduit and make a good seal.
2. Put the compression nut on end of conduit, followed by the ferrule, and then the threaded fitting.
3. Put this subassembly into the connector body. It should fit snuggly inside of the bottom of the connector.
4. Seat the connector ferrule firmly against the connector.
5. Tighten the compression nut firmly by hand into the connector threads.
6. Put the seal ring on the connector.
7. Insert the completed conduit assembly in an appropriately sized hole cutout in your electrical panel.
8. Using the locknut that comes with the conduit assembly, tighten the assembled conduit with its connector into your electrical panel. The locknut goes on the side opposite the conduit fitting assembly.

Part 6 – Protector "1" Series Over Temperature Thermal Protectors

Heater Tek P1 Over Temperature Thermal Protectors melt at a preset temperature. They are a single use device and must be replaced after they have activated ONCE. NEVER wire around (bypass) a Thermal Protection Device. Always keep spare Thermal Protectors in stock in case one needs to be replaced. All Heater Tek heaters come with built it Thermal Protection. They must be incorporated into the installation and temperature control to operate properly.

You must purchase replacement Heater Tek Thermal Protectors from Heater Tek. Do not use thermal protectors from other manufacturers in Heater Tek heaters. Do not use Heater Tek Thermal Protectors in any heaters other than those from Heater Tek.

Part Number	Heater Type	Maximum Solution Temperature
P1	Metal	up to 180°F
P4	Metal	up to 230°F
P5	Metal	up to 300°F
P1	PTFE Fluoropolymer	up to 190°F

Closely follow this Thermal Protector replacement procedure. Improperly replacing the Thermal Protector can result in unsafe operating conditions and result in a potential fire hazard.

A. Turn off power to heater and lock out according to National Electrical Code safety protocol.
B. Remove heater junction box cover.
C. Locate the Thermal Protector lead wires where they exit the Thermal Protector well and take off the wire nuts.
D. Remove the Thermal Protector device from the Protector well. Use it to determine where to cut the wires on the replacement device. Cut the wires exactly the same as the device being replaced and strip back the insulation from the wire leads.
E. Make sure the Thermal Protector well is completely dry. If moisture in the well persists, do NOT replace the Thermal Protector. The heater must be replaced instead.
F. Put the new Thermal Protector into the Thermal Protector well. Make sure that the device is extended completely to the bottom of the well. If the wires on the new device are cut the same as the device being replaced, they should be the same length as they extend out of the Protector well as the old device was before it was removed. Failure to install the new Thermal Protector completely down to the bottom of the Protector well can result in unsafe operating conditions and a **FIRE HAZARD**.
G. Rewire the wire nuts to the lead wires going to the temperature control.
H. Screw the heater junction head back on, ensuring the seal is moisture tight.
I. Mount the heater back on the tank.
J. Inspect the conduit connection and retighten if needed. Make sure it is moisture tight.
K. Reconnect heater power.

Part 7 – Protector "2" Over Temperature Thermal Protectors

Over Temperature Thermal Protectors are required for all heater installations regardless of tank material. The Protector 2 Thermal Protector is a bimetallic switch. It opens at a preset temperature and resets back to the "on", or closed, position once it cools down. Since it resets automatically, it must be used with a temperature control with a latching safety relay that must be manually reset by the operator once the unsafe tank condition has been corrected.

You must only use Thermal Protectors from Heater Tek in Heater Tek heaters.

Part Number	Heater Type	Maximum Solution Temperature
P2	Metal	up to 180°F
P6	Metal	up to 230°F
P7	Metal	up to 300°F
P2	PTFE Fluoropolymer	up to 190°F
P8	PFTE Fluoropolymer	up to 210°F

Protector 2 Series Installation

NOTE: NEVER use any Thermal Protection Device directly in line with the heater power lines. Instead, always use the Thermal Protector in series with the holding coil on the contactor which is handling the current load of the heater. Otherwise, an unsafe operating condition may occur.

Part 8 – P3 or P8 Over Temperature Thermal Protectors

P3/P8 Thermal Protectors are J-type thermocouples. These devices are only recommended for applications requiring PTFE fluoropolymer heaters operating at solution temperatures in excess of 190 degrees F. These safety devices require a thermostat control that is separate and distinct from the thermostat controlling the solution temperature. This safety thermostat is located inside the temperature control enclosure. THE SETTING ON THIS SAFETY DEVICE MUST NOT BE MODIFIED UNDER ANY CONDITIONS. Doing so voids the warranty and may cause an unsafe operating condition. The P3/P8 J thermocouple is designed to read the temperature of the heater element in order to sense an over-temperature condition and shut the heater off.

Consult Heater Tek for additional information regarding the safe operation of these devices.