Series P3TFMOL

Purged, Flouropolymer Chemical Heater

Please supply the model and serial numbers when ordering parts or requesting technical assistance.

PROCESS TECHNOLOGY

www.process-technology.com

7010 Lindsay Dr., Mentor, OH 44060 Phone: 440-974-1300 Fax: 440-974-9561 USA/CN: 800-621-1998

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Section 1: Introduction:

Process Technology Purged, Flouropolymer Chemical Heaters are designed to maintain the process fluid while also providing safe, energy-efficient heating. The low mass-to-wattage ratio of the patented heating elements yields optimum response; the unit heats quickly and the elements will not retain latent heat, a potential cause for overshoot. The wetted surfaces of the heater and chamber are constructed of high purity Flouropolymer fluorocarbon polymers. A nitrogen purge is used to remove any chemical permeation that may shorten the useful life of the heating element.

Process Technology Purged, Flouropolymer Chemical Heaters can withstand operation at a variety of temperatures. The maximum setpoint operating temperature for the Process Technology Purged, Flouropolymer Chemical heater is 180°C.

Warning: Safe operation of the equipment requires the use of over-temperature control sensors with an approved safety switching device. Operation in excess of the maximum operating temperature (180°C) can result in dangerous temperatures that may cause harm to operators and equipment.

Failure to use the supplied temperature sensors for their intended purposes may void all or part of the equipment warranty. Consult factory for technical assistance.

This heater is designed to be operated in an open, non-pressurized system. A minimum opening of 6mm is required to prevent pressure build-up in the chamber or vessel.

The standard Process Technology Purged, Flouropolymer Chemical Heater consists of:

* *Nitrogen purged, Flouropolymer heating element*
* *Flouropolymer sleeved "J" type process thermocouple*
* *10 foot length of 1/2" Flouropolymer BX conduit*
* *Type "E" over-temperature thermocouple*

Optional Equipment may include:

* *Purge flow and back pressure control*

The following equipment is required for safe operation, and must be customer-supplied if not purchased from Process Technology.

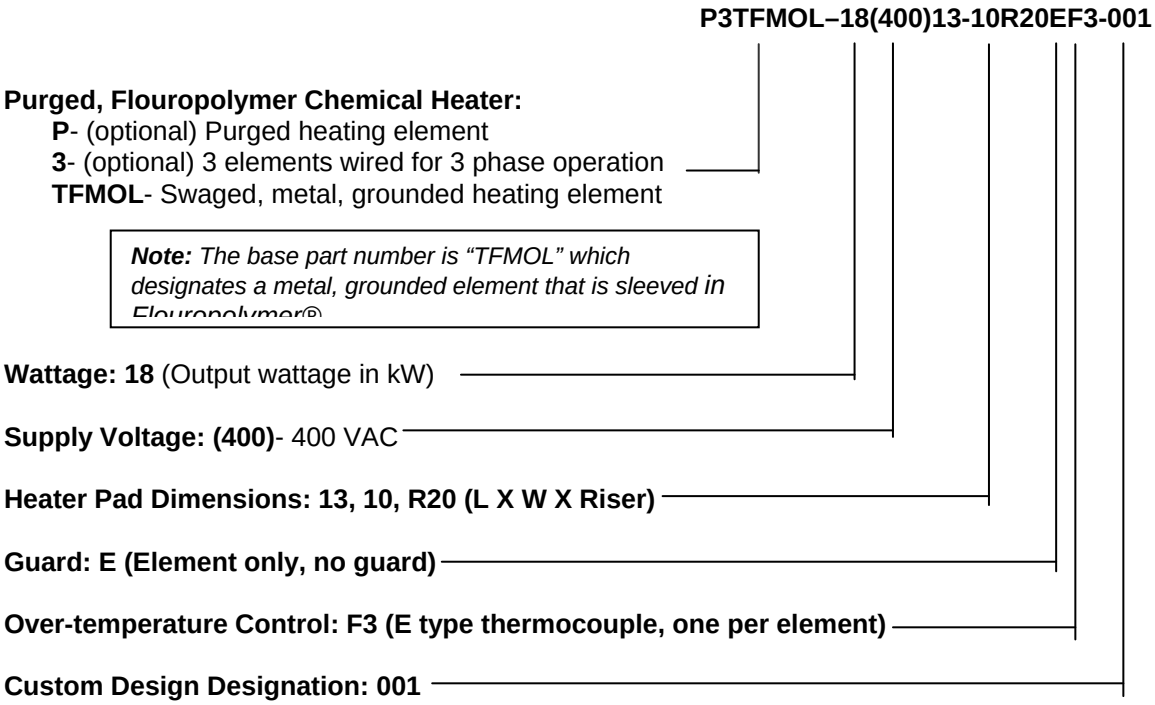
* *Process Controller*
* *Purge Flow pressure regulator and flowmeter*
* *Liquid Level Sensor*
* *Proper fusing and electrical disconnect provisions*
* *TCO (thermal cutoff device) eutectic fuse*

Abbreviations: *Explanations for some abbreviations used in this manual.*

- *DI- De-ionized water*
- *OD- Outside Diameter*
- *CDA- Clean Dry Air*

1.1 Purged, Flouropolymer Chemical Heater Model Number Designation:

The P3TFMOL Purged Flouropolymer Chemical Heater can be supplied alone for use with customer-supplied control components, or as part of a system that includes control components.



1.2 **Chemical Compatibility:**

> **Warning:** The P3TFMOL Purged, Flouropolymer Chemical Heater heats process fluid to temperatures as high as 180°C. However, the standard over-temperature protection circuit will allow the heater core to reach temperatures as high as 300°C. Do not use this product with chemicals that will degrade or present fire hazard at this higher temperature without consulting the factory.

Although Flouropolymer is resistant to most chemicals, there are materials with which the P3TFMOL Purged, Flouropolymer Chemical Heater should not be used. These include chemicals that degrade, are flammable, are explosive, or produce dangerous or irritating vapors when heated. Halogenated solvents may attack the Flouropolymer material and should not be used with the unit.

1.3 **Performance Data:**

P3TFMOL Purged, Flouropolymer Chemical Heaters are designed to be used in either vessel or tank heating applications. Liquid level protection must be incorporated into the system design to ensure power is not supplied to the heater when the heating portion of the element (hot zone) is not fully submersed by the process fluid.

$$\text{Heat-up Time (min.)} = \frac{\text{Volume (Liters, l)} \times \text{Volumetric Mass kg/L} \times \text{Temp. Increase K (°C)} \times \text{Specific Heat J/(kgK)}}{\text{kW} \times 60{,}000}$$

Heater Power

Note that this formula does not take into account any heat losses from the system. Other factors that must be considered include heat losses through plumbing and exposed process tank surfaces, and the load placed on the heater by the introduction of cold products or chemicals into the process tank.

Section 2: Installation:

2.1 **System Requirements:**

Location: This heater is designed to be located in areas where exposure to process chemistry is likely. The upper/electrical portion of the heater is constructed of materials resistant to the process chemistry.

> **Warning:** The upper/electrical portion of the heater is not designed to be submerged.
>
> The heater must be located in an area where ambient temperature is maintained between –30 to 60°C.
>
> This heater is designed to be operated in an open, non-pressurized system. A minimum opening of 6mm is required to prevent pressure build-up in the chamber or vessel.
>
> Do not install or operate this heater in explosive or combustible atmospheres.

Space: The heater is designed to be vertically mounted using the integral mounting flange. Reference drawing 10-315-X, in the Appendix for mounting flange details.

Electrical Connections: Refer to the Identification Label, located on the heater, for power requirements.

Purge Gas: A source of nitrogen or CDA (clean, dry air) purge gas is needed to supply the heater's purge system. Reference the P3TFMOL Purged, Flouropolymer Chemical Heater Model Specification Table for the connection size and type supplied with this unit.

Purge gas supply must be regulated to 10psig (69kPa) and capable of supplying 1-2 SCFH (1.7-3.4m^3/min.)to the heater

2.2 **Electrical disconnect and over-current protection:** Electrical disconnect devices and over-current protection must be selected in accordance with IEC-60364-4.

Ensure protective measures used for isolation and switching comply with IEC 60364-4.

Over-current Protection: If using circuit breakers, ensure compliance with IEC 60947-2 for isolation suitability. If using fuses, select in accordance with IEC 60269-2 combined with a magnetic contactor in accordance with IEC 60947-4-1.

Ensure protective measures for over-current in electrical wiring is in accordance with IEC 60364-4-43 and IEC 60364-4-473.

Notes:

- Reference the sample wiring diagram, located in the Appendix for a sample wiring method. Details may vary dependent on specific components used. Reference the manufacturer's information for instructions on proper terminal connection methods, torque requirements, etc.
- Ensure compliance with local requirements for installation of SCPD (short circuit protection device), methods for earthing/grounding control circuits.
- Devices for disconnecting the load should be capable of switching all line voltages simultaneously.
- Heater wiring to protective earth/ground is rated for 25A maximum.

2.3 **Uncrating and Inspection:**

2.3.1 Caution: Handle the heater with extreme care! Ensure the Flouropolymer elements are not damaged during uncrating, installation and during operation.

2.3.2 The P3TFMOL Purged, Flouropolymer Chemical Heater may have been shipped in a horizontal or vertical position.

2.3.3 Remove the Heater assembly from its shipping container.

2.3.4 Remove box(es) containing support equipment (i.e. optional remote control module, interconnect cables and tubing, etc.

2.3.5 Remove any protective packaging material and discard.

2.3.6 Inspect unit for any apparent physical damage.

2.4 **Component Identification:**

Reference the assembly drawing, 10-315-X, located in the Appendix.

Heater Assembly: Consists of patented, purged, PTFE Flouropolymer resistive heating element(s) with Flouropolymer electrical junction box, purge chamber and integral mounting flange.

Nitrogen Purge Connections: The standard nitrogen purge connections are 1/4" compression fittings. Check the P3TFMOL Purged, Flouropolymer Chemical Heater's Model Specification Table for the connection size and type supplied with this unit.

2.5 **Mounting the Heater:**

Caution: Handle the heater with extreme care! Ensure the Flouropolymer elements are not damaged during uncrating, installation and during operation.

2.5.1 The P3TFMOL Purged, Flouropolymer Chemical Heater is designed to be top mounted into a tank or vessel.

2.5.2 Expected Sources of Danger: The heater should be installed in an area free from excessive chemical or liquid exposure. The electrical junction area must not be submerged or exposed to excessive splashing or high pressure spray. Refer to the *Model Specifications* table for temperature limitations.

2.5.3 Mounting the heater assembly: The heater is designed to be vertically mounted using the integral mounting flange and mounting holes. An o-ring groove is incorporated to allow for sealing to prevent leakage and process contamination. The o-ring seal is not designed for pressurized systems.

2.5.4 Fasten the heater to the tank/vessel using the integral mounting flange and mounting holes provided. The heater must be mounted to prevent inadvertent removal during operation.

Warning: This heater is designed to be operated in an open, non-pressurized system. A minimum opening of 6mm is required to prevent pressure build-up in the chamber or vessel.

Note: If the unit is to be used for process fluid other that DI Water, install the chemical warning label provided (or equivalent warning) on the outside of the heater chamber.

2.6 Nitrogen Purge Connections:

The P3TFMOL Purged, Flouropolymer Chemical Heater requires a source of Nitrogen (N_2) or Clean Dry Air (CDA) for operation. The supply gas must be regulated to 60 psi (414kPa) and be capable of supplying 1-2 SCFH (1.7-3.4m^3/min.)

Reference the assembly drawing, in the Appendix, for the specific location of the purge inlet and outlet connection.

Caution: Connect the purge exhaust to a chemically compatible exhaust or plenum. Even during normal operation, the purge exhaust may contain trace amounts of the process chemistry that has permeated the heater's Flouropolymer sheath. In the event of a breach in the Flouropolymer sheath, significant quantities of the process chemistry may be present in the purge exhaust.

Using ¼" OD tubing, connect the purge INLET to Nitrogen or CDA (compressed, dry air) supply.

Using ¼" OD tubing, connect the Heater Purge Exhaust (labeled OUTLET) to an approved exhaust area.

Note: Perform a service check to ensure proper purge gas flow rate before operation.

2.7 Main Electrical Connections:

2.7.1 System Power Requirements are listed in the Model Specification Table, in this manual. An identification label, which lists the voltage specification for the unit, is located on the heater assembly.

2.7.2 Fuse the incoming power supply lines for the rated amperage using an approved electrical disconnect. Process Technology recommends that the electrical disconnect have the following minimum specifications:

- Appropriate voltage and amperage ratings for the specific heating system. Verify that all fused electrical disconnects meet jurisdictional requirements.
- Locate the electrical disconnect within sight of the heater to help ensure the safety of maintenance and operating personnel.

2.7.3 Ensure that all services are off before making connections (electrical, gases and liquids). Lockout and Tagout as appropriate and in accordance with local requirements and facility procedures. Use only approved and properly rated wire, conduit and connectors.

2.7.4 Connect heater leads to an electrical disconnect device in the customer supplied controller. This electrical disconnect must have the proper electrical rating necessary for the equipment.

2.7.5 Check all connections before establishing power to the heater and control systems.

Note: Components are installed, internally to protect against pull-out.

2.7.6 Temperature Sensors and Over-temperature Control:

This Purged Chemical Heater is supplied with independent temperature control and over-temperature protection devices.

- Process Temperature Control Device
- Heater Over-temperature Control Device
- Thermal Cutoff Device

Note: Failure to use the supplied over-temperature control devices for their intended purposes may void all or part of the equipment warranty. Consult factory for technical assistance.

2.7.7 Process Control Temperature Sensor: For additional information, reference the Safety Circuit Flowchart, located in the Appendix.

The Process Control Temperature Sensor measures the temperature of the process fluid near the heater. This sensor is intended to be used as the primary control input for the process temperature controller.

The Heater can be supplied with a "J" Type thermocouple, a 100 ohm RTD or a 1000 ohm for process control. Refer to the Model Specification Table, included in this manual, for the specific process control device supplied with this unit.

Caution: It is recommended that this sensor be used as the primary input for process control. However, in the event an external sensor is used to control the heater, the internal Process Control Temperature Sensor must be used to prevent over-heating of the process fluid.

If the Process Control Temperature Sensor is used to prevent over-heating of the process fluid, ensure that the corresponding controller is set to disable power to the heater at a maximum of 10°C above the process control setpoint.

1) Locate the Process Temperature Control Device labeled "CONTROL" .

2) Wire this temperature sensor to the primary input of the systems process temperature controller.

2.7.8 Heater Over-Temperature Control Device: For additional information, reference Section 4, Safety Features and drawing 03-761-0, Safety Circuit Flowchart, located in the Appendix.

The Heater Over-temperature Control Device measures the operating temperature of the heating element. Refer to the Model Specification Table, included in this manual, for the specific over-temperature control sensor supplied with this unit.

Locate the Heater Over-temperature Safety Device labeled "HEATER OVERTEMPERATURE".

Note:

- This sensor must be connected to an ELV circuit(s) for protection against over-temperature.
- This sensor MUST be connected to an approved safety switching device.
- Activation of the over-temperature protection should require manual reset to enable heating.

- This sensor is in direct contact with the metallic heating element sheath and consequently in contact with protective earth/ground.

Refer to "OTCD Setting vs. Process Setpoint" in the appendix for the proper setting of the OTCD, not to exceed 300°C.

2.7.9 Heater Element TCO (Thermal Cutoff): For additional information, reference *Safety Features* and the *Safety Circuit Flowchart*, located in the Appendix. Reference IEC 60947-5-1.

Refer to *Model Specifications* in the Appendix for specifications of the TCO.

The Heater Element TCO is a eutectic fuse that will open when it reaches a preset temperature. This is a single use device intended to protect adjacent equipment in the event of a heater failure. Activation of the TCO requires removal of the heater and return to the manufacturer for TCO replacement. Inspection of the heating element will determine if element replacement is required. Contact the Technical Service Department for assistance.

The TCO should be connected to interrupt the operation of the control circuit if it is activated by element over-temperature. Reference the sample wiring diagram, located in the Appendix for a sample wiring method. Details may vary dependent on specific components used. Reference the manufacturer's information for instructions on proper terminal connection methods, torque requirements, etc.

Caution: Do not connect the TCO in series with the heating element/main load. The TCO is designed to be wired into the heater's control circuit, connected in series with the coil of the magnetic contactor for the main load.

Protection of the circuit shall be done with a fuse, according to IEC or EN 60691 or a circuit breaker according to IEC 60947-2.

Refer to *Model Specifications* in the Appendix for specifications of the TCO.

A re-settable, bi-metallic TCO is also available. Contact the Technical Service Department for more information.

2.7.10 Liquid Level Sensor Connections: For additional information, reference Section 4, Safety Features and drawing 03-761-0, Safety Circuit Flowchart, located in the Appendix.

Caution: The use of a process fluid level sensor is required. Heater operation must be interrupted when the process solution level is ½" or less above the heated portion of the element. The heater must not be operated unless the heating element is completely immersed in liquid.

Position the liquid level sensor to operate or switch when the process solution level drops to within 1" (minimum of ½") above the heating element.

Connect the liquid level sensor to the safety circuit for the heater in such a way that it interrupts power to the contactor/relay that switches power for the heater.

Section 3: **Safety Features:**

Caution:

1) Do not “jumper out” or defeat the safety interlocks. The safety interlocks are intended to provide user and/or system protection.
2) Do not exceed the recommended temperature limits.
3) Turn power off at main disconnect before performing any service. Lockout/Tagout all energy sources according to facility procedures and local regulations.
4) Read all instructions carefully and understand the system before operating. Consult the factory for assistance.

3.1 **Safety System Network:**

The Heater can be supplied with or without a Process Technology Temperature Control package. In both cases, certain safety interlocks must be incorporated into the control package to prevent damage to the heater and ensure the safety of the operator. Each interlock circuit monitors a critical operating parameter of the Heater. The P3TFMOL control system is designed so that if a "fault condition" is detected by one of the sensors, the power to the heating element is disengaged. The shutdown mechanism may be momentary or latching; refer to table below.

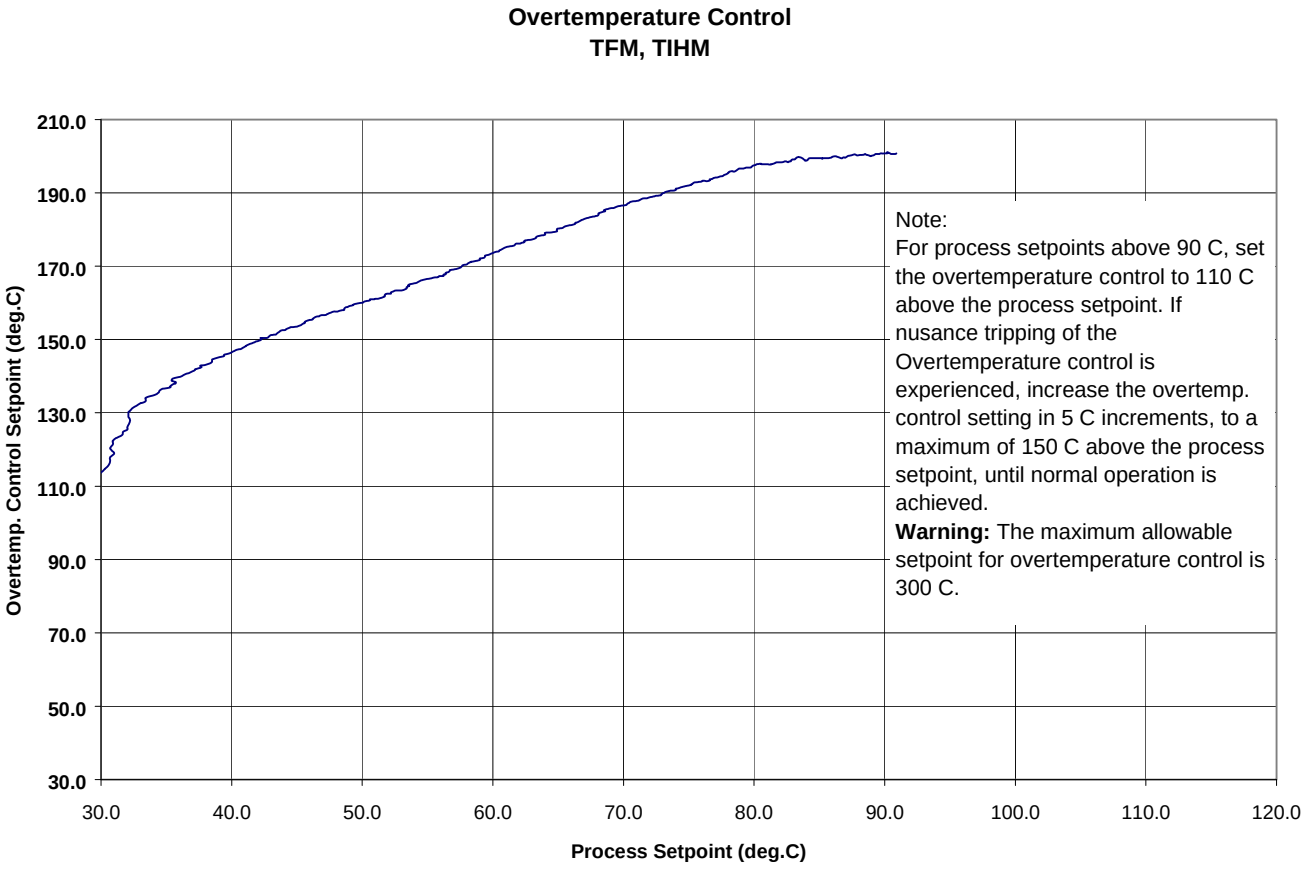
Refer to drawing 03-761-X, Safety Circuit Flowchart, located in the Appendix.

Safety device	**Operation**	**type of shutdown**
Liquid Level control	Monitors presence of adequate fluid in heater vessel, disrupts power to heater if fluid is not present in the outlet piping	latching
Process Temperature Control Device	Monitors temperature of fluid in heater chamber, disrupts power to heater when temperature rises above setpoint. Refer to chart.	momentary
Heater Over-temperature safety device	Monitors temperature of heating element, disrupts power to heater when temperature rises above setpoint. Refer to chart.	latching
Purge back-pressure switch	Monitors purge flow, disrupts power to heater when purge pressure is inadequate.	latching

3.2 **Over-temperature Control Device (OTCD):**

The Flouropolymer element operates at a higher temperature than the process solution. The Element over-temperature control device measures the temperature of the heating element and will interrupt the power to the heater if excessive element temperature is detected.

Set the element over-temperature control using the graph below. The graph shows the maximum normal element temperature with respect to the process temperature (setpoint). Set the over-temperature control to the temperature that corresponds to the process setpoint temperature.



Section 4: **Operation:**

4.1 Start Up Procedure:

1) Start purge gas flow to the heater chamber. Set purge flow meter and allow Nitrogen to flow for several minutes to ensure proper purge.

   Set the nitrogen inlet pressure at 10 psi (69kPa) and 1- 2 SCFH (1.7-3.4m^3/min.)

2) Ensure the process fluid level is sufficient to fully submerge the hot zone of the heater.

3) Turn on the main power to the system. Turn on the control module.

4) Verify proper temperature setting of the temperature controller.

5) Engage the control system's Safety Relay, if applicable.

6) Turn on the heater.

4.2 Shut-Down Procedure:

> **Caution:** The heater contains residual process solution. Handle the heater with the same care and precautions as any process solution.

4.2.1 Turn off electrical power to the heater.

4.2.2 Allow heater to cool. The P3TFMOL Chemical Heater may be damaged if allowed to operate in air or if residual heat is not allowed to dissipate before removing from solution. Before the chamber is removed from solution, turn off power to the heater and allow it to cool for at least 10 minutes.

> **Caution:** If the process solution is still at elevated temperature, the heating elements will be at the same temperature as the solution when removed from the tank.

4.2.3 Turn OFF the temperature controller.

4.2.4 Turn OFF Main Electrical Power.

4.2.5 For extended shut down periods, drain the system, and purge the heating chamber with a low pressure (10 PSI, 69kPa maximum) inert gas, such as Nitrogen, until dry. See section 5.4 for draining procedure.

4.2.6 Turn off the nitrogen or CDA purge gas supply.

4.3 Removing the Heater:

> **Caution:** Lock out and tag out all sources of energy using appropriate devices according to facility procedures.

4.4 Remove the mounting flange fasteners. Support the heater during this operation to prevent damage to the Flouropolymer heating elements.

4.4.1 Remove the heater from the tank or vessel. Reference the model specification table for information on storage temperature limitations.

> **Caution:** Handle the heater with extreme care! Ensure the Flouropolymer elements are not damaged during removal or storage.

Section 5: Warranty:

All products and components not manufactured by Process Technology, will carry the original manufacturer's warranty, copies of which are available upon request. Process Technology, makes no warranty or representation, expressed or implied, with respect to the products not manufactured by Process Technology.

Process Technology industrial products are warranted against defects in materials and workmanship for a period of one year from date of shipment and is applied on a pro-rated basis. At its option, Process Technology will repair or replace defective equipment.

Users are responsible for the suitability of the products to their application.

Process Technology, disclaims responsibility for failure arising from misuse, negligence, improper installation, tampering or other operating conditions beyond its control (such as low solution level.)

Products must be installed and maintained in accordance with Process Technology instructions.

Process Technology is not liable for labor costs incurred in removal, reinstallation, or unauthorized repair of the product or for damage of any type including incidental or consequential damage.

Process Technology, neither assumes nor authorizes any representative of Process Technology or any other person to assume for it any other liabilities in connection with the sale of the products. This warranty may not be verbally changed or modified by any representative of Process Technology.

Damages:

Claims against freight carriers for damage in transit must be filed by the buyer at the time of delivery if possible.

Returns:

No product shall be returned to Process Technology without first obtaining return authorization from a Process Technology representative. All returns must be freight prepaid. Freight collect or shipments without authorization will be refused.

Information:

Process Technology will endeavor to furnish such advice as it may be able to supply with reference to the use by buyer of any material purchased, but Process Technology, Inc., makes no guarantees and assumes no obligation or liability for advice given verbally or in print or the results obtained. Buyer assumes all risk and liability which may result from the use of any material, whether used by itself or in combination with other products. No suggestion for product use shall be construed as a recommendation for its use in infringement on any existing patent.

Cancellation:

Process Technology will not accept cancellation or changes to orders that are in production or scheduled for production. At Process Technology's option, changes or cancellations may be made upon payment of reasonable cancellation charges that take into account expenses already incurred and commitments made by Process Technology.

Conflict Between Documents:

Acceptance of this offer is expressly conditioned upon agreement to all terms and conditions contained herein. In the event of a conflict between the terms and conditions of purchaser's purchase order, and Process Technology's terms and conditions, proposal or offer, the latter shall govern.

Addendum to the Standard Warranty:

If a PROCESS TECHNOLOGY Temperature Control Module is not included as a component of the supplied Heater Chamber assembly, Process Technology requires each of the supplied temperature sensors to be wired properly into the customer supplied control system. Refer to Sections 3.6 through 3.7 and controller instructions for additional information. Failure to use supplied temperature sensors for their intended purposes may void all or part of the equipment warranty. Consult factory for technical assistance.

Section 6: **Service:**

Process Technology supports its product line with a strong technical support and field service program. If your Heater fails to perform properly, follow the outlined steps for resolution.

1) Verify connections and program parameters.

2) Contact the Process Technology Technical Service Group. When placing this call, please have available the model number and serial number of the unit (located on the system tag), information about the application of the equipment, and information regarding the chemical constituents of the process fluid. The Service Technician will evaluate the situation and determine a course of action for troubleshooting and repair.

3) If the Technician determines that the unit should be returned to the factory for evaluation, a Returned Goods Authorization (RGA) Number will be issued. A return will not be accepted without prior authorization.

To protect the safety of Process Technology's workers and any others that may come in contact with the TIH in the course of transport, evaluation, and repair, Process Technology requires that these practices be followed in returning the equipment to the factory:

1) Rinse the equipment until it is free of any chemical residuals. This is required for safe transport and handling of the equipment.

2) Wrap the unit in plastic and secure. Make sure that it does not leak. (Process Technology is not responsible for damage caused by leakage during shipping.)

3) Carefully package the unit for shipment.

4) Indicate the type of chemical that was in use at the time of failure. Include this information on the packing slip or place the information on the outside of the box. Process Technology will not risk exposure of its personnel to unknown chemicals. A return will not be evaluated until chemical information is received.

> **Note:** Because of the configuration of the heating coils within the unit, it is possible that process fluid residues may remain even after thorough rinsing. Chemical information must be included even when a unit is believed to be clean so that Process Technology may protect its workers from exposure to these residues.

5) Clearly mark the outside of the box with the RGA number.

6) Ship the component prepaid to Process Technology Incorporated.

On receipt of a returned unit, Process Technology will follow these steps:

1) The equipment will be carefully unpacked, inspected and cleaned, and an evaluation will be done.

2) A Process Technology technician will contact you with information regarding the scope of work to be performed, the cost, and the amount of time needed.

3) After a purchase order and authorization to perform the repair are received, the repairs will be completed and the unit returned.