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IMTEC

ACCUHEAT®

PFA In-Line Heaters

Instruction Manual

Part Number 10-018-0045

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Instruction Manual Revision History

Date	Section	Description
9/24/2019	Entire Manual	a) Replaced with stainless steel housing inline heater picture. b) Table 1.4. updated with 1.5KW and 3KW model details. c) Caution added to Page 5-4 of Operating Instruction. d) Operating instruction updated with N2 shall not exceed 40°C. e) Addendum included with Certification, schedule of limitation, Equipment marking & NFPA 496 compliance requirements.
9/30/2019	7.1	a) IEC Safety standards added.
10/31/2019	Entire Manual	a) Inline heater picture replaced with new one to reflects all new labels, and KC logo added at the bottom left corner in the front page.
6/26/2020	2.3 & 5.1 4.2.1 4.3.2 7.1 & 7.2	a) Dual language labels added in section 2.3 & 5.1. b) N2 Gas purge flow requirement schematic added to 4.3.2. c) 0.018 SLPM corrected to 14.2 SLPM. d) IMTEC Acculine INC was IMTEC Acculine LLC. Flow rate and Warning were corrected to 14.2 SLPM from 0.018 SLMP.
11/30/2020	4.3.2	a) N2 pressure monitor exhaust outlet removed in schematic diagram.
01/08/2021	Entire Manual	a) 176°F / 80°C was 356°F / 180°C.
12/2/2022	Entire Manual	a) Updated addresses from Fremont to Kamas.
12/5/2022	7.1	a) Updated Certificate Number in label.
11/11/2024	7.1	a) Updated label with new ATEX Certification Number.
05/07/2025	Entire Manual	a) White Knight contact details replaced Imtec contact details. b) Copyright date updated to 2025 from 2017 c) Updated logo in headers and website added to footer. d) 392ºF / 200ºC was 550ºF / 260ºC, new unit standard setting. e) 232ºC was 288ºC in section 2.3.4, new unit standard setting. f) Hazardous Voltage label updated.

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PREFACE

This preface includes the following topics:

- Intended use and audience
- Basic safety considerations
- Customer support
- Conventions used in this manual
- How this manual is organized
- Standard WK IMTEC Accuheat warranty
- Table of contents

CAUTION	
	**USING IMPROPER CONFIGURATION VALUES CAN CAUSE PRODUCT OR EQUIPMENT DAMAGE** Do not enter set-up or configuration values outside the specified range for any given heater or optional device. To do so may seriously damage your product or equipment.

Intended Use of this Equipment

WK IMTEC's Accuheat PFA Inline Heaters are not to be used for any purpose other than for which they were designed. What product is to be produced and how the heater and any optional equipment are to be configured for the allowed processing chemicals and parameters are stated in this Instructions Manual.

Intended Audience

The level of detail in this manual assumes you have previously been trained to install, operate and maintain these systems.

This document supplements that training and addresses the comprehensive needs of Process Engineers and Maintenance personnel. After reading and understanding this information, Process Engineers are responsible for disseminating the appropriate level of information to their Equipment Operators.

Safety Considerations

Your company's policies and procedures for safely operating any of the Accuheat PFA Inline Heater supersede the safety considerations listed below. It is your responsibility to follow your company's safety procedures. If there are none, follow those established by OSHA, NEC, DEQ, and/or the DOT, as a minimum.

Environmental Information

The following laws and regulations are applicable to the operation and maintenance of WK IMTEC's Accuheat PFA Inline.

- Air Emissions are regulated under the US Clean Air Act and local regulations applicable to the emissions of acids, bases and organic compounds.
- Wastewater emissions are regulated under the US Clean Water Act and applicable local pretreatment regulations.
- Solids contaminated with acids and other chemicals are regulated as hazardous wastes.

General Safety

- Never open or disassemble the heater tube. There are no serviceable parts inside the tube.
- Do not attempt to work on or with hazardous chemicals or electrical equipment without proper safety training and certification, and personal protective equipment.
- Lockout and tag the electrical and/or chemical systems before any repair or replacement tasks. Refer to this Instructions Manual for this equipment and your company's safety policies and procedures for repair instructions.
- Before attempting any procedures, know how to perform emergency first aid response for electrical shock and spills of hazardous chemicals.
- Review & understand emergency escape routes to safe areas.

Electrical Safety

- During periods of lightning activity, do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration.
- Before attempting any procedures, locate the main electrical source and understand how to safely control it.
- Whenever possible, disengage the heater and optional devices from their electrical sources before attempting repairs.
- Notify nearby personnel that you are attempting to operate or service this equipment. Follow your company's lockout and tagout operating procedures.

Chemical Safety

- Never attempt operations or repairs involving hazardous chemicals alone. Always have another person within sight and voice range.
- Protect eyes, face, hands, and body with appropriate personal protective equipment.

Before Powering Up the Heater

- Understand the system's alarm indications and automatic system interlocks (refer to Section 2, *Safety Requirements*).
- Ensure that all safety devices in the work area are properly installed and functional.

Cleanroom Requirements

Specific cleanroom requirements can vary widely according to the class rating, i.e., Class 10, Class 100, etc.WK IMTEC's products qualify as Class 1. While performing maintenance or operating the system, follow your company's policies and procedures for this equipment.

Customer Support

In the case of emergency or equipment failure, refer to the **Emergency Contact Form** (under separate cover).

For assistance in operating, troubleshooting, or maintaining your heater, refer first to this and any other manuals supplied to you by WK IMTEC. If these manuals do not address your specific question, please contact WK IMTEC Customer Service:

IMTEC by WHITE KNIGHT 187 East 670 South Kamas, UT 84036	Telephone: (435) 783-6040 Fax: (435) 783 -6128
Email: support@wkfluidhandling.com	From 8:00 a.m. to 5:00 p.m., ET, Monday through Friday

When calling, please be at the system, if possible, and be prepared to give a detailed description of the problem.

Customer (EHS) Contact Information

In the event that WK IMTEC needs to contact the customer regarding EHS issues related to the heater, they will use the contact provided on the Purchase Order or that provided on a returned warranty registration card. In the event the equipment is moved to a different location you can send new contact information via mail to Imtec's address above. Please note company name, address, product serial number, and contact information.

NOTE
Review your contract warranty statements regarding specific instructions for receiving help.

Preventive Maintenance

Other than a weekly visual inspection for leaking connections, there are no preventive maintenance schedules or procedures.

Conventions Used In This Manual

1. The word “WARNING” when used in warning boxes is defined as: **IMPROPER USE OF THIS EQUIPMENT CAN CAUSE SEVERE INJURY OR PRODUCT DAMAGE!**
2. The word “CAUTION” when used in warning boxes is defined as, **POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!**
3. The following **WARNING** and **CAUTION** boxes are samples used to identify potential hazards that could occur if the heater is used improperly or if unsafe practices are followed.

WARNING		
	**IMPROPER USE OF THIS EQUIPMENT CAN CAUSE SEVERE INJURY OR PRODUCT DAMAGE!** To ensure operator, equipment, and product safety, follow the instructions and use care when operating this equipment.	

CAUTION	
	**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!** Equipment or product damage can occur if care is not taken.

A **NOTE** box highlights special information.

NOTE
Specific information is placed in a NOTE box when clear procedural understanding is essential.

The following conventions are used throughout the manual:

Data entries on pictured control screens or menus. Unless stated otherwise, all example values on pictured data entry screens are for display purposes only and were not intended to be considered as recommended values for your equipment.

Boldface text indicates the actual words used in a screen command or on an equipment label.

How To Use This Manual

The level of detail in this manual, and listed below, covers the necessary information to install, operate, maintain, and service Accuheat heaters.

Instruction Manual Revision History Page: details any changes made to the manual, the date the change took place, and what specific information was changed, added or deleted. If changes or updates are added to your individual manual, a new Revision History Page will be sent to you along with those changes.

Preface, includes the intended use and audience, basic safety considerations, customer support, conventions used in this manual, how this manual is organized, standard WK IMTEC Accuheat warranty, and a table of contents.

Section 1, ***Introduction***, is a description of the various models for the Accuheat heater including: a theory of operations, specifications, and facility requirements.

Section 2, ***Safety Requirements***, is a detailed description of all safety features and their functions and interactions.

Section 3, ***Unpacking Procedures***, lists the procedures for inspecting and unpacking the Accuheat heater and optional equipment.

Section 4, ***Installation Procedures***, included is a set of drawings indicating the connections to be made specific to your system.

Section 5, ***Operating Instructions***, gives instructions on how to operate the heater and optional equipment after installation.

Section 6, ***Troubleshooting and Maintenance Procedures***, covers typical troubleshooting techniques, maintenance schedule and procedures. If the heater needs to be returned for servicing this section give instructions for removing the heater for preparation for repair.

Updates. In the event new information is required, such as, corrections or updates after shipment of this documentation, WK IMTEC will send this new information to you. Upon initial shipment of this manual this section will be empty.

Accuheat In-Line Heater Limited Warranty – (Non-Warranty of Merchantability, Fitness and Limitation of Liability)

Terms and Conditions

1. WK IMTEC warrants the Accuheat In-Line Heater, whether new or remanufactured, to be free from manufacturing defects in materials and workmanship for a period of **one year** from the date of original shipment from our factory, with the following exceptions:
   - **Failures caused by chemical etching of the PFA wetted surfaces are not covered under warranty.**
   - **Failures due to not using the Imtec Power Modulator or system with same functionality are not covered under warranty**
   - **Failures due to not using N2 purge as detailed in this manual when so equipped.**

NOTE
"Remanufactured" applies to the complete rebuilding of a customer-owned Accuheat unit to new in-line heater specifications, including heaters, cable attachments, insulation and the like.

2. This Warranty, with the exception noted above, is limited as follows: In the event of a defect, WK IMTEC agrees, at its option, to repair or replace the defective unit or refund the purchase price and WK IMTEC's liability is limited thereto. Heaters repaired or replaced under warranty will bear the remainder of the original equipment warranty.
3. All repairs must be made at WK IMTEC's place of business. Buyer pays the cost of returning the product to WK IMTEC's factory. Any such return must be pre-authorized by IMTEC using issuance of an IMTEC Returned Materials Authorization (RMA) number. The RMA number must be displayed on the returned merchandise. It is the buyer's responsibility to retain the original packing materials or to obtain authorized replacement packing materials from WK IMTEC should the heater ever need to be returned to the factory. Refer to Section 6, *Maintenance Procedures*, for the Returned Goods Authorization procedures.
4. The period of warranty commences as of the date of shipment from WK IMTEC.

Warranty Exclusions

1. While other Exclusions may apply, WK IMTEC specifically does not guarantee, and accepts no responsibility for the following:

- Failure caused by incorrect plumbing: for example, installing with flow opposite to the direction indicated in this manual and on the Accuheat housing, or with piping elevations that may result in vapor-lock to the outlet flow.
- Failure caused by incorrect mounting, such as upside down or any orientation that results in trapped air inside the heater.
- Corrosion or deterioration of the PFA components by non-compatible chemistries.
- Damage as a result of misuse of the WK IMTEC-supplied Power Modulator.
- Damage as a result of operating the Accuheat outside the specified limits.
- Damage as a result of not properly running and monitoring any PFA inline equipped with an N2 purge.
- Customer modifications to the housing, electrical circuitry, safety sensors and/or accessories;
- Improper transportation, handling, or installation damage, including, but not limited to, insufficient air gap around the perimeter of the Accuheat; insufficient support of plumbing lines, creating stress on the plumbing connections; use of plumbing nuts other than those supplied with the unit; placement of the Accuheat in a corrosive environment; immersion of the Accuheat in water or other fluids.
- Unauthorized customer modification to any portion of the system.

NOTE
Unauthorized customer modification(s) may void all warranties.

Damage Related to Shipment

It is the buyer's responsibility to carefully inspect each Accuheat Heater upon receiving it and to determine if any breakage has occurred during shipping. Claims for damage in shipment are not the responsibility of WK IMTEC and should be submitted to the freight carrier. WK IMTEC recommends such claims be submitted within 5 days of Receipt of Shipment.

Packaging

It is the buyer's responsibility to retain the original packing materials or to obtain authorized replacement packing materials from WK IMTEC should the equipment ever need to be returned to the factory.

In Conclusion:

NOTE
WK IMTEC does not warranty merchantability or fitness for any purpose and there are no warranties expressed or implied other than those expressly stated in this document. WK IMTEC is not responsible for any consequential, incidental or other damages whatsoever. WK IMTEC's liability is limited to the repair or replacement of such defective product OR refund of purchase price, at WK IMTEC's sole option, as stated above. All claims must be made in a timely manner and within the warranty period to be considered valid. Please contact WK IMTEC at:
IMTEC by White Knight Fluid Handling **187 East 670 South** **Kamas, UT 84036** **Telephone: (435) 783-6040** **Fax: (435) 783 -6128** **On the Web at: https://wkfluidhandling.com/** Email: support@wkfluidhandling.com

TABLE CONTENTS

4. Installation Procedures

5. Operating Instructions

6. Troubleshooting and Maintenance Procedures

7. Addendum to IMTEC instruction manual

Updates

NOTE
The Updates section will be empty if this is the Initial shipment of this manual. Updates will follow at the discretion of WK IMTEC.

1 INTRODUCTION

This section describes the WK IMTEC Accuheat PFA series of In-Line Heaters. This section includes the following information:

- Overview of the basic models
- Components Overview
- Specifications
- Facilities Requirements

1.1 Overview – Basic Model

The Accuheat PFA is an efficient in-line heater combining low cost-of-ownership with an extended service life. These models have all-PFA wetted surfaces with no o-rings or sliding seals for leak free operation and process purity. They can be applied to a number of uses, including filtered RCA cleans, DI water heating, photoresist-strip recirculation, nitride etch recirculation heating or pre-heating, and the heating of any chemical which is PFA compatible (see following warnings).

1.1.1 Overview – Solvent Inline Model

WK Imtec's line of Accuheat PFA solvent inlines are specifically designed to be Class 1 Division 2 compliant for hazardous environments. These models have the standard all-PFA wetted surfaces with no o-rings or sliding seals for process purity and leak free operation. These models can be used with a number of different solvents such as IPA, SC1, NMP, MEK, solvent-based photoresist strippers, and others which are PFA compatible (see following warnings). Custom modulation and snap switch configurations can be tailored to individual process solvent needs. The Accuheat PFA solvent inlines require an N2 purge and meet the following compliance standards:

IECEx Standards: IEC 60079-0:2017
IEC 60079-2:2014
IEC 61010-1, IEC 61010-2-10, UL 499 & CSA 22.2 No.88
ATEX Standards: EN 60079-0:2018
EN 60079-2:2014/AC:2015
USA/CAN Standards: NFPA 496:2016 Ed.2017
UL 60079-0:2019 Ed.7
UL 60079-2:2017 Ed.6
CSA C22.2 No. 60079-0:2019 Ed.4
CSA C22.2 No. 60079-2:2016 Ed.2

USA – Class 1, Division 2, Group A, B, C, AND D, Type Z; T2
Class 1, Zone 2, Aex pzc IIc T2 Gc
CAN – Ex pzc IIC T2 Gc

WARNING		
	**CHEMISTRY COMPATIBILITY WITH PFA TEFLON** The customer is responsible for verification that the chemicals they are using in this in-line heater are absolutely compatible. This will ensure that no deterioration or degradation of the PFA occurs at the highest possible temperatures incurred during operation.	

WARNING		
	**CHEMISTRY COMPATIBILITY WITH HOUSING** The customer is responsible for verification that the chemicals they are using in this in-line heater are absolutely compatible. This will ensure that no deterioration or degradation of the PTFE, CPVC, or stainless steel housing occurs at the highest possible temperatures incurred during operation.	

These heaters conductively transfer heat for better efficiency and their low-mass heater arrays minimize temperature overshoot. The fluid flow pattern is designed for optimal heat transfer, so the heater can be used for both high-flow and low-flow applications.

The heater module can be interconnected with other Accuheat modules to provide an optimum configuration for temperature rise, fluid flow and three-phase electrical load balancing. A special version of the WK IMTEC Model 951 Controller is also available for process control.

1.1.2 Power Modulators

The basic purpose of power modulators is to extend the life of the heater element. The standard power modulator is designed for all processing applications with an operating set point temperature of 200°C.

Additionally, the power modulator allows the heater to provide as much heat to the process fluid as it can absorb without overheating when properly installed, internal to an electrical enclosure.

Since process temperatures vary with the type of liquid and flow rate the WK IMTEC heater can provide the maximum amount of heat for any application. When heat is applied beyond where it can be absorbed, the element temperature rises. When the heat reaches the set point of the power modulator, the signal to, a correctly wired power relay, is interrupted until the element temperature drops down below the set point. Where it once again allows the power relay to energize.

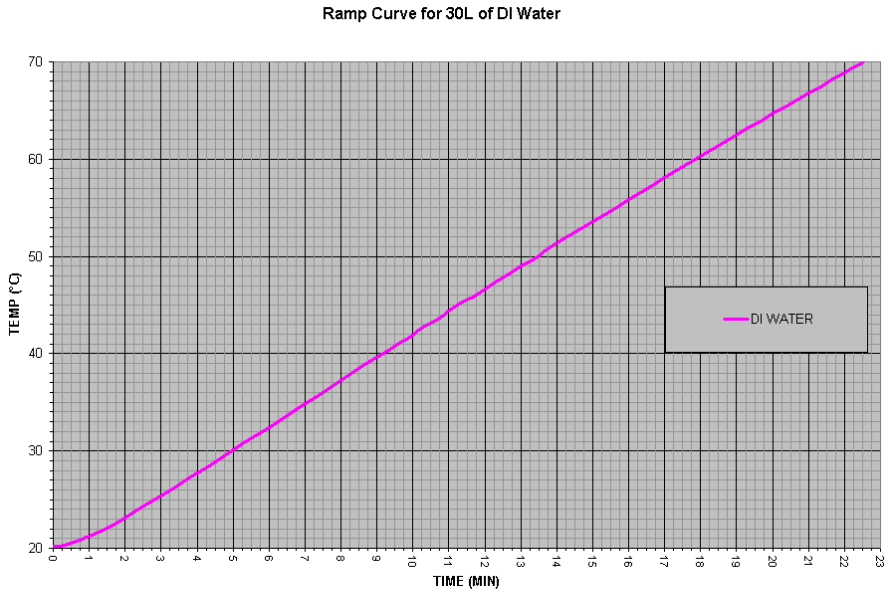
1.1.3 IMTEC FIT-ONE NUTS

The standard nuts supplied with Imtec inline heaters are standard FIT-ONE design. Other plumbing connections available upon request.

When installed correctly, the nuts provide a leak tight connection up to 200°C with no maintenance required. Installation instructions are included in the installation section.

1.2 Theory of Operation – Heat-Up Times

The heat-up time curves in the following figure, reflect the amount of time for 30 liters of DI water to raise to operating temperatures using an IMTEC PFA In-Line Heater. The results do not include heat loss from plumbing or other system components. A 6.0kw model was used to reflect these times. A line voltage of 208V was used for the chart below. Heat-up rates will vary with the voltage used.



Typical Heat-Up Times.

1.3 Specifications

The specifications included in this section are for general use only. A model specific drawing and schematic is included with each heater. Refer to these drawings when working with the heater.

1.3.1 Environmental Specifications

Environmental Temperature	Indoor use only at 5°C to 40°C
Environmental Humidity	Maximum relative humidity is 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C.
Altitude	Up to 2000 meters (6561.66 feet).
Supply Voltage	MAINS supply voltage fluctuations up to ±10% of the nominal voltage. Transient over voltages typically present on the MAINS supply.
Pollution	Applicable rated pollution degree 1

1.4 Facilities Requirements

The following facilities requirements are model dependent. While reading this section ensure you are referencing your model.

Facilities Requirements				
Model	**Model Voltage**	**Line Voltage**	**Minimum Recommended Circuit Breaker**	**Amperage (line current)**
AH1500SP	208V (AC 1Φ) 50/60 Hz	200V	10A	6.9A
		208V	10A	7.2A
	208V (AC 3Φ) 50/60 Hz.	200V	5A	4.0A
		208V	10A	4.2A
	240V (AC 1Φ) 50/60 Hz	220V	10A	5.7A
		230V	10A	6.0A
		240V	10A	6.3A
	400V (AC 3Φ) 50/60 Hz.	400V	5A	2.17A
AH3000SP	208V (AC 1Φ)	200V	20A	13.9A
		208V	20A	14.4A
	208V (AC 3Φ) 50/60 Hz.	200V	15A	8.0A
		208V	15A	8.4A
	240V (AC 1Φ) 50/60 Hz	220V	15A	11.5A
		230V	15A	12.0A
		240V	20A	12.5A
	400V (AC 3Φ) 50/60 Hz.	400V	5A	4.3A
AH4500SP	208V (AC 1Φ) 50/60 Hz.	208	30A	22A
	208V (AC 3ϕ) 50/60 Hz.	200V	20A	12.5A
		208V	15A	12A
	240V (AC 1ϕ) 50/60 Hz.	220V	25A	17.2A
		230V	25A	18A

		240V	25A	18.8A
	400V (AC 3Φ) 50/60 Hz.	400V	10A	6.5A
AH6000SP	**208V** (AC 1Φ) 50/60 Hz	208V	40A	28.8A
	208V (AC 3Φ) 50/60 Hz.	200V	25A	16A
		208V	25A	16.7A
	240V (AC 1Φ) 50/60 Hz.	240	35A	25A
	400V (AC 3ϕ) 50/60 Hz.	380V	15A	8.2A
		400V	15A	8.7A
AH7500SP*	**208V** (AC 3ϕ) 50/60 Hz.	200V	25A	20A
		208V	30A	20.8A
	400V (AC 3Φ) 50/60 Hz.	380V	15A	10.3A
		400V	15A	10.8A
AH9000SP*	**208V** (AC 3Φ) 50/60 Hz.	200V	30A	24A
		208V	35A	24.9A
	400V (AC 3Φ) 50/60 Hz.	380V	20A	12.4A
		400V	20A	13A
AH12000SP	**400V** (AC **3**ϕ) 50/60 Hz.	380V	25A	16.5A
		400V	25A	17.3A
	208V (AC **3**ϕ) 50/60 Hz.	208V	45A	33.3A

**208V models have 6 heater wires and can be wired in parallel for single phase or as a 3-phase delta.*

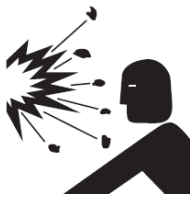
***If your model is not listed please consult the factory for facilities requirements.*

Modulator Power	**Input** is 24VAC ± 10%, 50-60 Hz ± 5%, 10 VA (watts) maximum power consumption. **Relay contact rating:** 8 amps at 240VAC or 30 VDC maximum resistive load or 250VA pilot duty, 120/240 VAC maximum inductive load. Use RC suppression for inductive loads.

WARNING

BURST HAZARD

Do not exceed 40 PSI / 275 kPa operating pressure and 176° F/ 80° C operating temperature. Do not exceed 392° F / 200° C Power Modulation temperature under any circumstances.



This concludes Section 1, *Introduction*.

2 SAFETY REQUIREMENTS

The following recommendations and requirements are included for personal and equipment safety. Please read them completely before installing and operating your Accuheat heater.

NOTE

These recommendations are advisory in scope. ***WK IMTEC assumes no responsibility for the correct or incorrect installation or use of this equipment in any user's facility.*** IMTEC recommends that installation of this equipment be confined to licensed contractors, OEM-provided personnel and/or trained Facility Maintenance personnel.

Ensure you are familiar with your company's Equipment Safety Regulations and Specifications, the local fire marshal codes and applicable electrical code requirements for compliance.

CAUTION

USING IMPROPER CONFIGURATION VALUES CAN CAUSE PRODUCT OR EQUIPMENT DAMAGE

Do not enter set-up or configuration values outside the specified range for any given heater or optional device. To do so may seriously damage your product or equipment.

CAUTION

SAFE OPERATION IS DEPENDENT ON CONTROL SYSTEM

Ensuring that a heater operates safely is dependent on proper controls with backup protection to ensure that the heater is shut down when there are certain fault conditions. It is recommended that users familiarize themselves with Semi S3 guidelines covering the operation of heated chemical systems.

WK IMTEC's Accuheat heaters are not to be used for any purpose other than for which they were designed. What product is to be produced and how the heater and any optional equipment are to be configured for the allowed processing chemicals and parameters are stated in this Instruction Manual.

2.1 Emergency Contact

In the case of emergency or equipment failure, refer to the **Emergency Contact Form** (under separate cover). For assistance in operating, troubleshooting, or maintaining your heater refer first to this and any other manuals supplied to you by WK IMTEC. If these manuals do not address your specific needs and questions, please contact WK IMTEC Customer Service:

IMTEC by WHITE KNIGHT 187 East 670 South Kamas, UT 84036	Telephone: (435) 783-6040 Fax: (435) 783 -6128
Email: support@wkfluidhandling.com	From 8:00 a.m. to 5:00 p.m., ET, Monday through Friday

2.2 Electrical Safeguard Recommendations

Refer to this section and the attached schematics for electrical safety information. If you are using a non-WK IMTEC controller, refer to the controller manufacturer's documentation for electrical safety information and recommendations.

The Equipment that this heater will be installed in must have a Semi S2-approved EMO circuit, where "*the EMO actuator (button), when activated, must place the equipment into a safe shutdown condition, without generating any additional hazard to personnel or the facility*". The EMO actuator is required to be installed in close proximity to the equipment and within easy reach of the operator and is required to be marked as a disconnect device according to S2-approved regulations.

Some heater models have multiple heater elements. If you are using one circuit breaker and/or control relays for multiple elements, the rating of the breaker may exceed the current capacity of the heater wiring. Where this occurs, the elements should be individually protected by a fuse or other appropriate protection device. It is the responsibility of the customer to ensure that all wiring in the circuit is properly rated and protected.

WARNING

DANGEROUS VOLTAGE IS PRESENT!

Hazardous voltages exist. To minimize risk of electrical shock, do not open the heater housing. Use caution around exposed circuits. Check area for exposed contacts prior to contacting this equipment.

To ensure operator, equipment, and product safety, use care when operating this equipment. The following warnings must be adhered to.

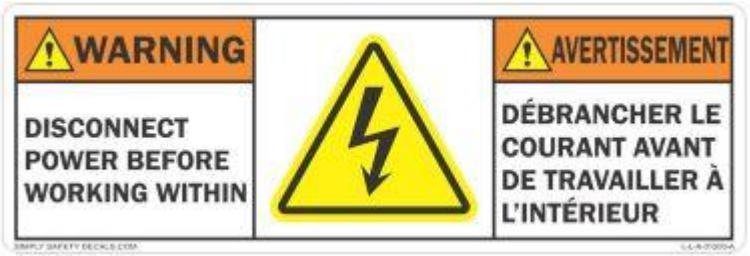
- The Accuheat comes with safety devices. For your safety and to ensure the Accuheat works as designed, do not disconnect or modify them. Report any malfunctions to IMTEC Customer Service.
- The heater's housing is made of PTFE, CPVC, or stainless steel. Avoid any chemicals that could attack these materials.
- The use of a GFCI protection device is required for safe operation of the In-Line Heater.
- Some heater models use multiple heater elements that may be powered from a common electrical supply. In this case the current rating of the supply circuit breaker may exceed the current rating of the individual heater wires. Where this is the case, each heater element must have its own circuit protection. Verify need for multiple breakers from the Marketing Drawing.

2.3 In-Use Safety Precautions

CAUTION	
	**HOT SURFACES!** Surfaces may be as hot as 200°C. Do not move the heater or touch the hot surfaces of the heater.

The following warning labels are placed on the equipment. Adhere to these safety labels. Do not exceed the label's recommend operating pressures or temperatures.

Do not exceed 40 PSI / 275 kPa operating pressure and 176° F/ 80° C operating temperature. Do not exceed 392° F / 200°C Power Modulation temperature.



The In-Line Heater must be enclosed in a secondary containment area that will hold 110% of the fluid in the entire recirculation system including the process vessel. It is strongly advised that this enclosure be protected with interlocks to prevent operation if the enclosure is not properly sealed.

Read, understand, follow and implement the following general warnings and cautions during the use of this system.

GENERAL WARNINGS	GENERAL CAUTIONS
	• Ensure that all protective sensors and automatic shutdowns are attached and functional. • Take extra care when using volatile flammables: fumes are more dangerous than liquids. • The heater's housing is made of CPVC, PTFE, or stainless steel. Avoid any chemicals that could attack or degrade these materials. • **DO NOT** apply power to the heater without fluid circulating through it. • An over-temperature safety controller is required for installation. Please contact IMTEC Customer Service for specification. • There are no specific procedures for shutting-down the heater, except for maintaining pump flow. Ensure heater power is shut down while the fluid is still recirculating. Then maintain recirculation for at least three minutes to ensure withdrawal of stored heat from the heater. • The minimum flow rate is determined by Imtec given the particular parameters submitted by customer at time of order. Do not operate below this flow rate.

WARNING

NITROGEN PURGE REQUIRED FOR FLAMMABLE SOLVENTS!

Non-conductive solvents/solutions such as IPA will not be detected by the internal CFI and can potentially generate flammable vapors. For safety, any inline equipped with a nitrogen purge must **always** have the nitrogen purge running as per the operating instructions any time the host tool is powered up to reduce the oxygen level in the housing below the limit oxygen concentration.

WARNING

HAZARDOUS CHEMICALS CAN CAUSE SEVERE INJURY OR DEATH!

Process chemicals may remain in the heater while attempting removal procedures if flushing and purging procedures are not followed. Before attempting removal procedures apply your company's personal protective equipment (PPE).

PPE equipment must be applied in accordance with the instructions supplied by manufacturer of the PPE equipment. These procedures must be performed while wearing the appropriate personal protective equipment, such as, but not limited to:

Goggles

Gloves

Respirator

Apron

Boots

2.3.1 Chemical Safety Requirements

WARNING

DANGEROUS CHEMICALS MAY BE PRESENT!

The In-Line Heater must be enclosed in a secondary containment area that will hold 110% of the fluid in the entire recirculation system including the process vessel. It is strongly advised that this enclosure be protected with interlocks to prevent operation if the enclosure is not properly sealed. It is also strongly advised that this enclosure be exhausted to remove potentially hazardous and/or flammable vapors if fitting or line leaks occur.

WARNING

FLAMMABLE GASSES MAY BE PRESENT!

The N2 nitrogen purge protects against the buildup and possible ignition of flammable solvents in the event of a leak by displacing oxygen in the housing and removing any potentially flammable vapors. If the inline heater is equipped with an N2 purge it must be exhausted to remove any hazardous and/or flammable vapors potentially present.

2.3.2 Environmental Specifications

Environmental Temperature	Indoor use only at 5°C to 40°C
Environmental Humidity	Maximum relative humidity is 80% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C.
Altitude	Up to 2000 meters (6561.66 feet).
Supply Voltage	MAINS supply voltage fluctuations up to ±10% of the nominal voltage. Transient over voltages typically present on the MAINS supply.
Pollution	Applicable rated pollution degree 1

2.3.3 Power Modulator

This power modulator must be installed internal to an electrical enclosure.

2.3.4 Thermal Snap Switch Information

The snap switch is a self resetting thermostatic snap switch that is adhered to the PFA heater assembly on the outlet side and will interrupt the control signal. It is a critical safety device and must be utilized to prevent equipment damage in certain fault conditions.

The snap switch trips at 232°C. Typically if there is liquid flowing through the heater, the switch will not trip. If for some reason, the heater is not full of liquid, or partially full, the internal components may continue to increase in temperature without being sensed by other devices. If the heater reaches 232°C, then the snap switch will open. It is the integrators responsibility to use this switch as part of their control circuit. This switch typically is hard wired so that it will remove all power to the heater and require acknowledgement/reset before power can be re-applied.

For solvent inlines, the snap switch trip temperature may be lower depending on the solvent used. Reference the supplied marketing drawing for the snap switch trip temperature specific to your solvent inline.

CAUTION	
	**AUTOIGNITION DANGER!** If the chemistry has an autoignition temperature lower than 232°C then a different thermostatic switch will be required and specified to prevent dangerous overheating of the process chemistry.

The snap switch UL rating for 100,000 cycles is 10A at 120VAC or 10 amps at 240VAC. The CSA rating of 100,000 cycles allows 5A (120VA) for 120 and 240VAC.

This concludes Section 2, *Safety Requirements*.

3 PRODUCT INSPECTION

This chapter describes guidelines to follow when unpacking and inspecting the WK IMTEC Accuheat In-Line Heater and standard optional equipment.

NOTE
These guidelines have also been included with the shipping manifest attached to the outside of the shipping container.

3.1 Unpacking Considerations

CAUTION	
	**HANDLE WITH CARE!** Protect the inlet and outlet tubes from impact at all times. Do not lift the heater by the plumbing connections as these are mounted directly on to the heater core. Mishandling may result in non-warranty covered breakage (see below). **Do not lift the heater by these connections.** 

3.2 Inspecting the Packaging

Before opening the shipping container, please look for evidence of transportation damage. It is your responsibility to notify the shipper promptly of any claims of freight damage. Please contact WK IMTEC also, so that we may be of assistance with an expeditious repair or replacement of the damaged parts.

CAUTION

POTENTIAL EQUIPMENT DAMAGE!

Keep the WK IMTEC packaging and box in which the system and any options were shipped. If the system should ever need to be returned to WK IMTEC, it **must** be returned in an appropriate container to minimize risk of shipping damage. If the original container is not available, purchase a packing kit from WK IMTEC for a nominal fee.

3.3 Checking the Contents

The Accuheat In-Line heater's shipping carton will contain the heater itself and any accessory components ordered with it. This may include the following items.

Quantity	Equipment
1	Accuheat In-Line heater (model specific)
1	This Instruction Manual
1	Warranty Registration Card (in an envelope)
1	*Optional* Standard Power Modulator
2	*Optional* Fit-One Nuts (Typically threaded onto the stems)
1	Accuheat In-Line heater Marketing Drawing (model specific) with facility, electrical and system requirements

NOTE

If any of the items you ordered are missing, contact IMTEC immediately.

If the system is shipped consolidated with other components, check your receiving documents and / or additional manuals for a checklist of the pertinent items.

This concludes Section 3, *Product Inspection*.

4 INSTALLATION PROCEDURES

NOTE

Unless otherwise noted, the information provided in this section pertains to standard Accuheat models. Certain OEM specific models may have different plumbing and electrical connections in addition to other unique attributes. Where there are discrepancies between this document and your heater refer to the drawings and schematics that came with the heater.

This section includes the following topics:

- Controller Recommendations
- Plumbing Recommendations
- Installation Procedures
- System Schematics

4.1 Emergency Off (EMO) Recommendations

The heater is installed as an internal device within the host equipment. The heater receives its electrical power from the host equipment. The host equipment must provide EMO devices to remove all power including removing power from the heater. This EMO device must be installed close to the equipment and within easy reach of the operator.

The host equipment must connect the J type thermocouple over temperature sensor and thermal snap switch to a Semi–compliant safety interlock circuit that will remove the power to the heaters if the Overtemp Control maximum temperature listed on the marketing drawing is exceeded for the thermocouple or if the thermal snap switch opens. Refer to Section 4.4, *Installation Procedures*, for power modulator wiring information.

4.2 Controller Recommendations

CAUTION

SAFE OPERATION IS DEPENDENT ON CONTROL SYSTEM

Ensuring that a heater operates safely is dependent on proper controls with backup protection to ensure that the heater is shut down when there are certain fault conditions. It is recommended that users familiarize themselves with Semi S3 guidelines covering the operation of heated chemical systems. When applicable, users should further familiarize themselves with applicable Class 1 Division 2 hazardous environment guidelines covering the operation of heated solvent systems.

A controller is necessary for process temperature control and over-temperature protection. If you use a non-WK IMTEC controller, that controller must drive a separate relay circuit for heater power. The relay circuit should have a primary and secondary relay in series for the line supply to the heaters, with a SSR or other sufficient, high-

cycle rated switching relay used as the primary, and a simple electromagnetic-closed secondary safety relay.

The over-temperature controller should be capable of reaching and maintaining the Overtemp Control temperature set point listed on the marketing drawing.

4.2.1 N2 Gas Purge Controller Requirements

(please see section 7.3 for schedule of limitation)

When equipped with N2 gas purge ports (solvent inline applications), housing N2 purge pressure monitoring is required for Class 1 Division 2 OR Zone 2 compliance. A minimum of 0.06 PSIG (1.7 inches of water) of pressure must be maintained in the housing during operation and measured at N2 pressure monitor port.

Similarly a minimum purge flow of rate 14.2 SLPM (0 .5 SCFM) measured at N2 outlet by a flowmeter/switch. There is no Maximum flow rate requirement as long the N2 housing pressure is within Min (0.06 PSI) and Max (3.8 PSI) limit.

Any time there are flammable solvents present in the inline, an audible and visual alarm must sound if the housing pressure ever drops below 0.06 PSIG (1.7 inches of water) indicating a loss of N2 purge flow. In the event of an alarm due to lower purge pressure OR lower flow rate an immediate system shutdown is essential followed by an operator manual reset.

4.3 Plumbing Recommendations

The plumbing connections are “FIT-ONE” and accommodate 3/4” OD Teflon tubes flared by means of a FIT-ONE flaring tool, or equivalent. All plumbing connections and fittings must be supported to eliminate any strain on the heater’s plumbing connections. Recommended continuous operating pressure is no more than 40psi (275 kPa, 2.81 kg/cm^2, 2.76 bar).

The heater is drained through the INLET tube, refer to Section 6, *Troubleshooting and Maintenance Procedures*. To facilitate draining and heater removal, install a manual or automatic drain valve on the INLET tube side.

Never allow the heater to become over pressurized. Read and understand the warning below.

WARNING

DANGEROUS CHEMICALS MAY BE PRESENT!

The In-Line Heater must be enclosed in a secondary containment area that will hold 110% of the fluid contained in the recirculation loop including the process vessel. It is strongly advised that this enclosure be protected with interlocks to prevent operation if the enclosure is not properly sealed.

WARNING

BURST HAZARD

Never configure the recirculation loop with valves that could close on either side of the heater and prevent a release of pressure. If a reactive chemistry is allowed to be sealed inside an inline heater with no pressure relief, a burst of the PFA Teflon can occur.

Do not exceed 40 PSI / 275 kPa operating pressure and 176° F/ 80°C operating temperature. Do not exceed 392° F / 200° C Power Modulation temperature under any circumstances.

WARNING

INCORRECT MOUNTING MAY BRING OVERHEATING DANGER

The In-Line Heater must be mounted as specified on the particular unit. Faithfully follow the label showing “THIS SIDE UP FOR VERTICAL INSTALLATION” or “THIS SIDE UP FOR HORIZONTAL INSTALLATION”. Failure to obey could result in internal air pockets in the fluid path which will likely damage the in-line heater!

The tubing between the heater and pump should have a “looped” run rather than a lateral run. Looped runs decrease pump vibrations from stressing the plumbing connections (Figure 4-1).

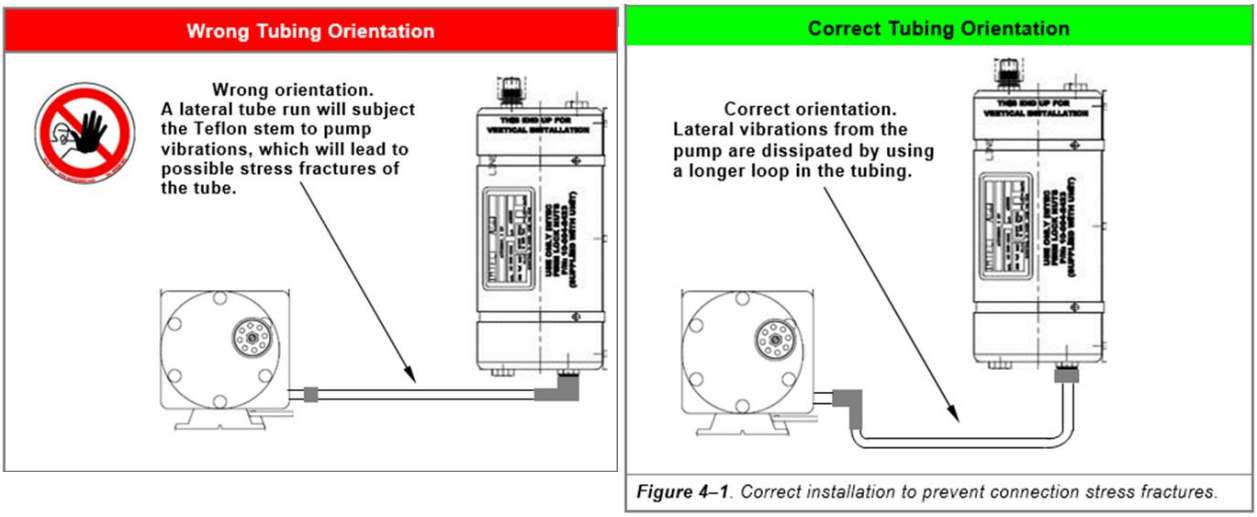


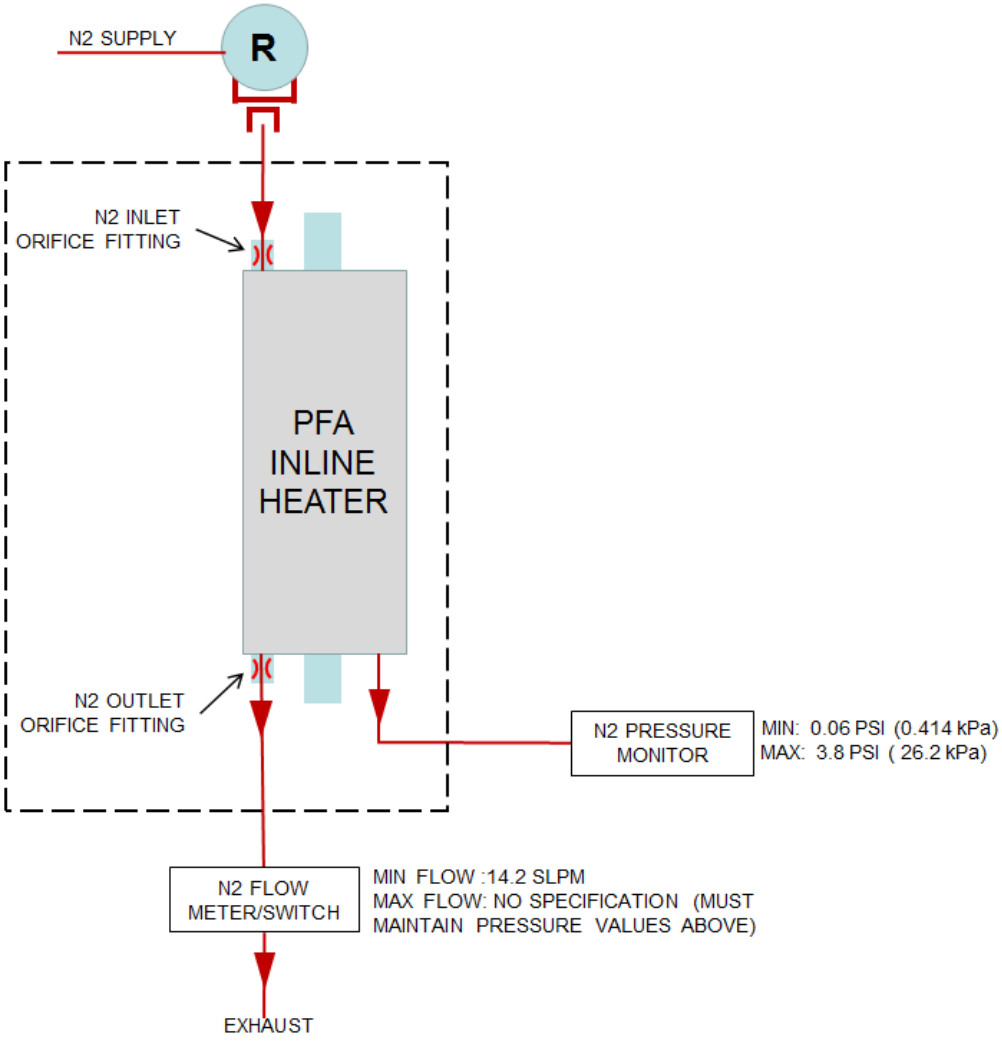
***Figure 4–1**. Correct installation to prevent connection stress fractures.*

4.3.1 N2 Gas Purge Plumbing

For Accuheat solvent inline models equipped with an N2 purge system, the N2 purge inlet and outlet plumbing connections are compression fittings and accommodate 1/4” OD Teflon tubes which do not require any flaring tools. The compression fittings necessary for securing the 1/4" OD tubing are located inside the nut of the fitting. The N2 purge pressure monitoring port is also a 1/4" compression fitting which accommodates a 1/4" OD Teflon tube and does not require any flaring tools to install. There should be no pressure relief valves installed between the housing pressure sensor and the inline housing which may cause an incorrect housing pressure reading. Tubes from both N2 flowmeter /switch and N2 pressure monitor goes to exhaust.

4.3.2 N2 Gas Purge Requirements

The below schematic drawing shows recommended installation and monitoring of the N2 supply, flow & housing pressure.



For Accuheat solvent inline models equipped with an N2 purge system, need adequate N2 supply pressure to the housing N2 Inlet port to maintain a minimum flow of 14.2 SLPM monitored at out let port at all times.

The N2 purge outlet should be connected to flow monitor /switch.

Due to the possibility of the presence of flammable vapors, the outlet of "flow monitor /switch" must be exhausted to remove any hazardous and/or flammable vapors which may potentially be present.

The pressure switch/monitor should be connected to N2 pressure monitor port using ¼" tubing. Minimum of 0.06 PSI must be maintained at all times.

WARNING

FLAMMABLE GASSES MAY BE PRESENT!

The N2 nitrogen purge protects against the buildup and possible ignition of flammable solvents in the event of a leak by displacing oxygen in the housing and removing any potentially flammable vapors. If the inline heater is equipped with an N2 purge it must be exhausted to remove any hazardous and/or flammable vapors potentially present.

WARNING

NITROGEN PURGE REQUIRED FOR FLAMMABLE SOLVENTS!

Non-conductive solvents/solutions such as IPA will not be detected by the internal CFI and can potentially generate flammable vapors. Inline equipped with a nitrogen purge may also be used in environments where combustible gasses or materials may be present. For safety, any inline equipped with a nitrogen purge must **always** have the nitrogen purge running as per the operating instructions whenever the host tool is powered up to reduce the oxygen level in the housing below the limit oxygen concentration.

Below are examples of housing pressure and N2 flow at various supply pressures:

Supply Pressure		Housing Pressure		N2 Flow
kPa	PSI	kPa	PSI	LPM
80	11.6	15.9	2.3	14.5
100	14.5	17.9	2.6	16.5
120	17.4	20.0	2.9	18.6
140	20.3	21.4	3.1	20.3

NOTE: Maintain sufficient supply pressure to avoid nuisance alarms.

4.4 Installation Procedures

Installation of any of the Accuheat models are divided into these parts:

- Installing the Power Modulator
- Installing the Heater
- Connecting the Power Modulator
- Connecting the Heater Power and Sensors
- Connecting the Heater Plumbing
- Making the plumbing connections

4.4.1 Installing the Power Modulator

CAUTION

POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

The power modulator is an optional component but its function is critical to assuring reliable operation. Customers choosing not to use Imtec's power modulator must perform the same function as part of their control system. Failure to do so will void the warranty.

For customers using an Imtec supplied power modulator, please follow the following steps. If another method is being used, skip to Paragraph 4.4.5

CAUTION

AVOID FLAMMABLE ENVIRONMENTS

The power modulator shall be installed only in non-flammable environments as the device is not certified for installation in anything contrary.

Install the Power Modulator in a chemical-free environment such as an enclosed electronics compartment of the wet-station or a well-ventilated head case. This modulator can also be DIN Rail mounted using DIN 50022, 35 mm X 7.5 (1.38-inch X 0.30-inch).

1. Drill and tap two 2.7 mm (0.106) diameter holes in the desired panel location. Mount the Power Modulator using two (2) #6 (M3.5) screws. IMTEC recommends mounting the modulator as close to the heater control relay as possible (Figure 4-2).

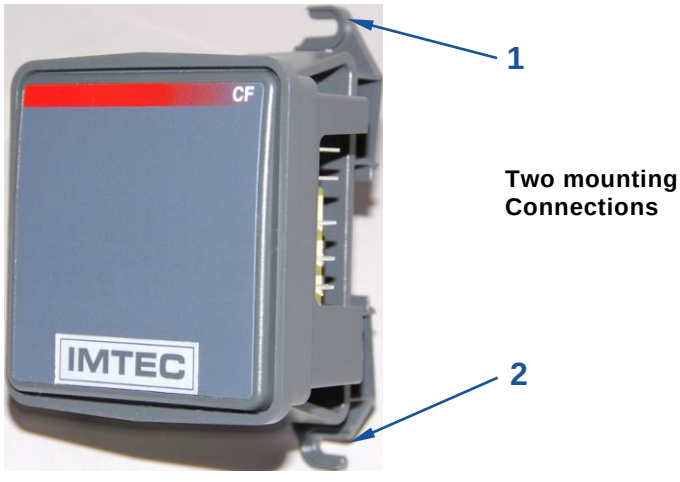


***Figure 4–2**. Power Modulator mounting connections.*

4.4.2 Installing the Accuheat In-Line Heater

There is no specified minimum or maximum distance from the point-of-use (POU), but the closer the heater's OUTLET is positioned to the POU INLET, the more stable the circulating system will be. Minimize the overall length of the plumbing loop and insulate the plumbing lines where possible to minimize heat loss.

Select a suitable location with a sturdy platform for mounting the heater (WK IMTEC recommends the heater be installed within the wet-bench rear access chase). Heaters may be mounted vertically or horizontally. Make sure to check your specific model and follow the mounting instructions. Ensure all operating environment requirements are adhered to as stated in Section 1.4, *Facilities Requirements*.

WARNING		
	**DANGEROUS CHEMICALS MAY BE PRESENT!** The In-Line Heater must be enclosed in a secondary containment area that will hold 110% of the fluid contained in the entire recirculation loop including the process vessel. It is strongly advised that this enclosure be protected with interlocks to prevent operation if the enclosure is not properly sealed.	
WARNING		
	**NO SUBMERSION OR DIRECTED SPRAY/ STREAMS** Mount the in-line heater where there will be no possibility of becoming submerged or hit with a high-pressure spray or stream during operation.	
CAUTION		
	**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!** A typical heater may be installed horizontally or vertically. If installing the heater in a vertical orientation, the "To Bath Exit" end must be oriented upwards. Please follow the instruction on the heater when installing vertically or warranty may be voided.	

4.4.2.1 Horizontal Installation

1. Using four (4) ¼-inch diameter (6mm) screws (not provided), pre-drill (tapping as necessary) the mounting platform. Make sure that the horizontal installation label is facing up and the outlet fitting is in the 12-o'clock position (Figure 4-3). Mount the heater to the platform in a level position (±1° at both "x" and "y" axes).

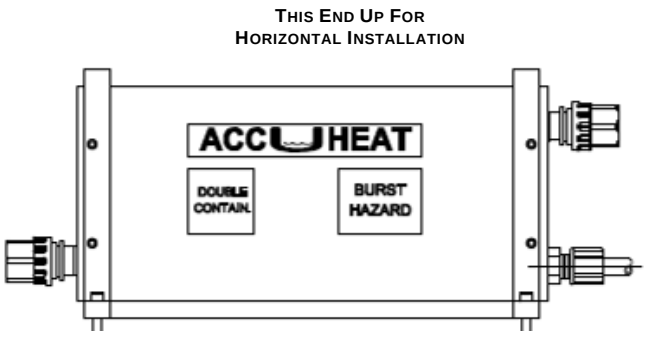


***Figure 4–3**. Side view of the Heater Horizontal Orientation Installation.*

CAUTION

POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

Do not install the heater without a minimum of a 0.5-inch air gap clearance on all sides — heat buildup and / or heater failure will result.

2. Ensure that the heater has at least a 0.5-inch (12mm) air gap clearance on all sides.
3. Connect power and plumbing as described in Sections 4.4.3 and 4.4.5.

4.4.2.2 Vertical Installation

1. Using eight (4) ¼-inch diameter (6mm) screws (not provided), pre-drill (tapping as necessary) the mounting platform. Make sure that the Vertical installation label is facing up (Figure 4-4). Mount an Accuheat (Model 6000) to the platform in a level position (±1° at both “x” and “y” axes).

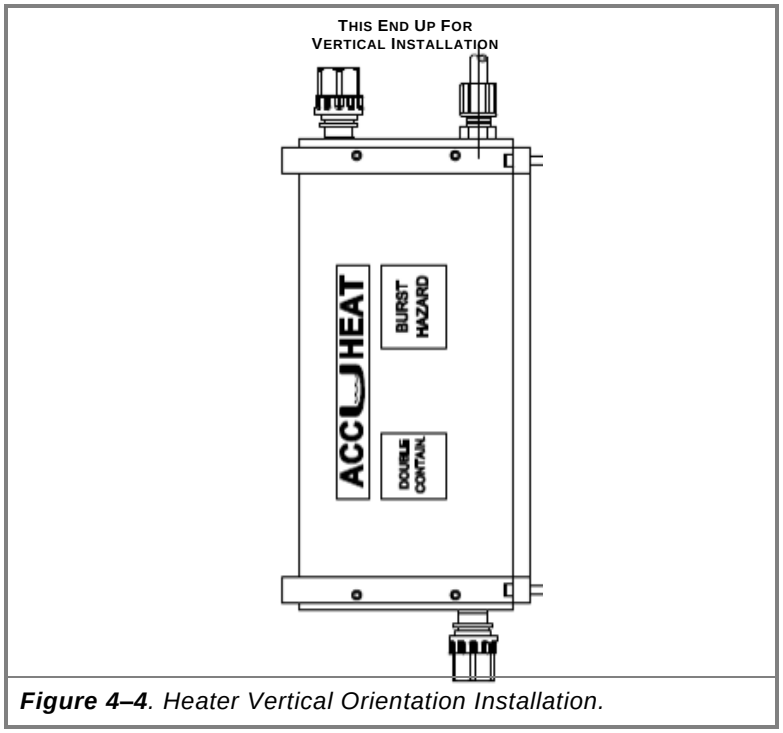


***Figure 4–4**. Heater Vertical Orientation Installation.*

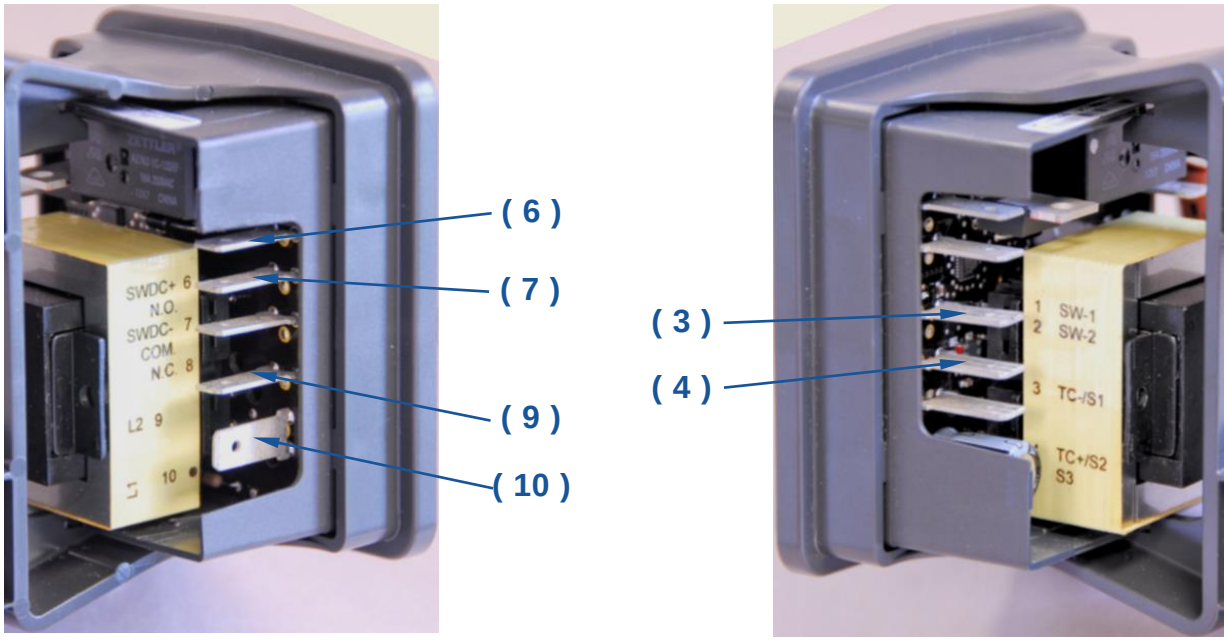
CAUTION	
	**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!** Do not install the heater without a minimum of a 0.5-inch air gap clearance on all sides — heat buildup and / or heater failure will result.

2. Ensure that the heater has at least a 0.5-inch (12mm) air gap clearance on all sides.
3. Connect power and plumbing as described in Sections 4.4.3 and 4.4.5

4.4.3 Connecting the Power Modulator

The Power Modulator is provided with 6.4 mm (0.25-inch) quick connect, push-on terminals. Refer to Table 4-1 below for power and connection descriptions.

***Table 4-1**. Power Modulator Output Specifications and Connections Descriptions.*

Modulator Power Input and Output Power Specifications	**Input** is 24VAC ± 10%, 50-60 Hz ± 5%, 10 VA (watts) maximum power consumption. **Output** is 8 amps at 240VAC or 30 VDC maximum resistive load or 250VA pilot duty, 120/240 VAC maximum inductive load. IMTEC part number 10-000-2812 for DIN Rail Mount – Limit Set Point 260°C
	
(3)	Position 3 – Thermocouple Negative (TC–)
(4)	Position 4 – Thermocouple Positive (TC+)

(6)	Position 6 – Relay Labeled NORMALLY OPEN. Note, NORMALLY CLOSED when power is on and less than 260°C. Wire in series with heater control signal so that when Power Modulator relay opens above 260°C, power to heater is interrupted until temp reduces.
(7)	Position 7 –Relay common pole for the (6) connection discussed above
(9)	Position 9 – Primary Power (VAC Voltage In)
(10)	Position 10 – Primary Power (VAC Voltage In)

4.4.4 Connecting the Heater Power and Sensors

CAUTION	
	**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!** An over temperature safety controller is required for installation. If your heater controller has a separate overtemperature input compatible with a J-type thermocouple, a second safety controller is not necessary. A J-Type thermocouple is provided, and the required Overtemp Control set point is listed on the marketing drawing.

Electrical schematics have been provided with this manual to serve as the most common standards for electrical and control connection recommendations. Select the appropriate standard for your configuration and wire the system as indicated in the schematics. If your configuration does not match one of these standards, please contact IMTEC Customer Service for assistance.

Thermal Snap Switch Information:

The snap switch is a self resetting thermostatic snap switch that is adhered to the heater core and if utilized properly will interrupt the control signal. It is a critical safety device and must be utilized to prevent equipment damage in certain fault conditions.

The snap switch trips at 232°C. Typically if there is liquid flowing through the heater, the switch will not trip. If for some reason, the heater is not full of liquid, or partially full, the internal components may continue to increase in temperature without being sensed by other devices. If the heater reaches 232°C, then the snap switch will open. It is the integrators responsibility to use this switch as part of their control circuit. This switch typically is hard wired so that it will remove all power to the heater and require acknowledgement/reset before power can be re-applied.

The snap switch UL rating for 100,000 cycles is 10A at 120VAC or 10 amps at 240VAC. The CSA rating of 100,000 cycles allows 5A (120VA) for 120 and 240VAC.

4.4.5 Use of the Accuheat without Imtec's Power Modulator

As noted earlier the function of the power moduator is critical to assuring a safe and reliable installation. The function of the power modulator is to limit the heater core temperature to prevent overheating. This is done by monitoring the designated **power modulator thermocouple** on the heater and interrupting the signal to the heater control relay when the temperature exceeds the setpoint. The standard setpoint is 200°C.

To perform the power modulator function, the customer may choose to use a discrete device or incorporate the function into the temperature control logic of a PLC or other controller. In all cases, it should function as shown in Figure 4-5

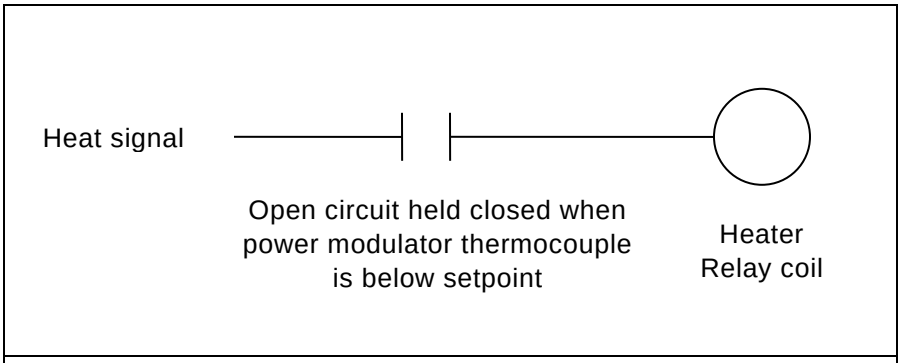


***Figure 4–5**. Power Modulator function.*

The contacts in the circuit should be self-resetting so that once the heater temp drops below the setpoint, the heater is operable.

4.4.6 Connecting the Heater Plumbing

CAUTION

POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

When planning the plumbing route, it is important that the flow from the pump through the succeeding circuit components be in a continuing upward angle so that no downward element can serve as a vapor trap. This is most critical in the plumbing circuit from the heater OUTLET port to the point of use. Failure to correctly plumb the heater will void the warranty!

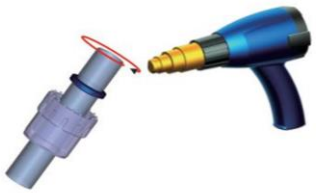
The Imtec Fit-One nuts should be tightened with a Fit-One wrench for maximum security. Please read and follow the guidelines below.

4.4.6.1 Installing the Fit-One plumbing nuts.

WK Imtec FIT-ONE Nut Installation Steps

1. Select either the inlet or outlet tube to the heater. Slide the nut onto the tube with the threads facing the end and then the impact ring as shown.

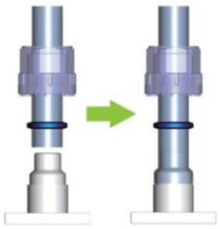
CAUTION	
	**HOT AIR GUN CAN CAUSE INJURY!** The hot air gun used in the next step can cause serious burns. Appropriate Personnel Protection Equipment should be worn while using this equipment. Please refer to the hot air gun manual for additional precautionary statements.



2. Using a Hot-air gun or heat flaring tool, heat up the tube end while rotating it to ensure even heating. Heat until the tube softens and becomes pliable.

3. Insert the flaring tool into the tube and hold it there till the tubing cools.

4. Remove the flaring tool and install the tube onto the flared stem of the heater. Tighten the nut till a click is heard, indicating the fitting has been installed with optimal torque. (If additional torque is required, a FIT-ONE wrench is available. Please contact your IMTEC representative.)



5. Repeat for the second connection ensuring that the flow direction corresponds to the “INLET” and

“OUTLET” fittings as necessary.

Failure to correctly plumb the heater will void the warranty.

NOTE
If it is necessary to install an elbow onto the heater, a special elbow adapter is available from Imtec.

6. Install brackets or other such support as necessary to eliminate any strain on the heater's plumbing connections.

This concludes Section 4, *Installation Procedures*.

5 OPERATING INSTRUCTIONS

This section describes the operation of a typical Accuheat In-Line Heater. The information includes:

- Safety Precautions
- Controls and Indicators
- Ramp-Up
- Shut-down

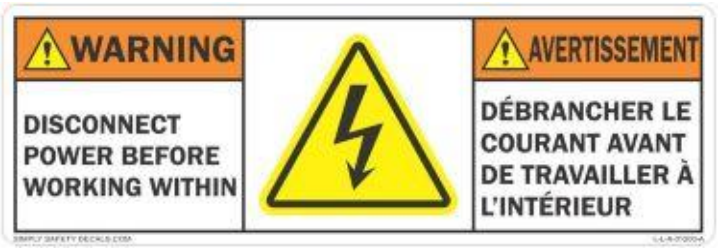
5.1 Safety Precautions

As stated in Section 2, *Safety*, and re-stated here for your safety:

CAUTION	
	**HOT SURFACES!** Surfaces may be as hot as 200°C. Do not move the heater or touch the hot surfaces of the heater.

The following warning labels are placed on the equipment. Adhere to these safety labels. Do not exceed the label's recommend operating pressures or temperatures.

Do not exceed 40 PSI / 275 kPa operating pressure and 176° F/ 80° C operating temperature. Do not exceed 392° F / 200° C Power Modulation temperature under any circumstances.



WARNING

DANGEROUS CHEMICALS MAY BE PRESENT!

The In-Line Heater must be enclosed in a secondary containment area that will hold 110% of the fluid the heater in the entire recirculation loop including the process vessel. It is strongly advised that this enclosure be protected with interlocks to prevent operation if the enclosure is not properly sealed.

WARNING

FLAMMABLE GASSES MAY BE PRESENT!

The N2 nitrogen purge protects against the buildup and possible ignition of flammable solvents in the event of a leak by displacing oxygen in the housing and removing any potentially flammable vapors. If the inline heater is equipped with an N2 purge it must be exhausted to remove any hazardous and/or flammable vapors potentially present.

Read, understand, follow and implement the following general warnings and cautions during the use of this heater.

GENERAL WARNINGS	GENERAL CAUTIONS
	• Ensure that all protective sensors and automatic shutdowns are attached and functional. • Take extra care when using volatile flammables: fumes are more dangerous than liquids. • The heater's housing is made of PTFE, CPVC, or stainless steel. Avoid any chemicals that could attack these materials. • **DO NOT** apply power to the heater without fluid circulating through it. • If equipped with an N2 purge, the N2 purge must be started and flowing per the requirements stated in the Installation section of this manual before and during the presence of any flammable fluids in the heater. • An over-temperature safety controller is required for installation. Please contact IMTEC Customer Service for specification. • There are no specific procedures for shutting-down the heater, except for maintaining pump flow. Ensure that the heater power is shut down while the fluid is still recirculating. Then maintain recirculation for at least three minutes to ensure withdrawal of stored heat from the heater. • The minimum flow rate is determined by Imtec given the parameters submitted by customer at time of order. Do not operate below this flow rate.

5.2 Controls and Indicators

The standard heater has no indicators or user controls. External controllers must be used with this equipment. Refer to the operating instructions of the external controller used with this application.

5.3 Ramp-Up

If the inline heater is equipped with an N2 purge, ensure that the N2 purge is started and flowing continuously before and during any time the host tool is powered and in use. The N2 purge protects against the potential buildup of any flammable gasses. Pressure and flow of the N2 purge **must** be ensured as stated in the Installation section of this manual.

Ensure that the fluid pump is turned on before powering up the heater. The INLET pressure at the heater should not exceed 40 PSI (275 kPa, 2.81 kg/cm^2, 2.76 bar).

Do not exceed 40 PSI / 275 kPa operating pressure and 176° F/ 80° C operating temperature. Do not exceed 392° F / 200° C Power Modulation temperature under any circumstances.

CAUTION	
	**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!** Do not power-up the heater unless there is fluid circulating through it.

CAUTION	
	**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!** If the heater is equipped with an N2 purge, do not circulate fluid through the heater unless the N2 purge is providing the minimum pressure required. The N2 purge must be running before and during the presence of any flammable fluids in the heater.

5.4 Shut-Down

There are no specific procedures for shutting-down the heater, except for maintaining pump flow.

Ensure that the heater power is shut down while the fluid is still recirculating, then maintain recirculation for at least three minutes to ensure withdrawal of stored heat from the heater.

If the heater is equipped with an N2 purge, the N2 purge (*N2 gas temperature shall not exceed 40°C*) must remain flowing per the minimum requirements stated in the Installation section of this manual while there is fluid present in the heater.

CAUTION	
	**POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!** If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

This concludes Section 5, *Operating Instructions*.

6 TROUBLESHOOTING and MAINTENANCE PROCEDURES

6.1 Troubleshooting Procedures

Most problems related to heating involve the “non”-WK IMTEC supplied control system and interlock systems that are used in conjunction with the heater. Most troubleshooting is performed to determine if the heater has failed or whether the symptoms are related to an external system. The heater has no user serviceable parts inside and should never be opened for any reason.

The following table lists common symptoms, probable causes, and corrective actions.

Symptom	Possible Cause	Check	Corrective Action
Heater does not heat	No Power to the heater	When the control system is calling for heat, check for voltage to all heater elements. This should be checked at the end of the heaters power cable to eliminate all other connections and interlocks.	If no voltage is present, refer to the control system schematic provided by the tool maker for troubleshooting information. If there is voltage at the heater wires, measure heater resistance as noted below.
	Heater Element Failure	Disconnect the heater power wires from the control system and measure the resistance of the heater element(s) to see that they are within +/-10% of the specification. Refer to model specific information for specs.	If the resistance is in spec, the heater elements are good. If they are out of spec, the unit should be returned to Imtec for repair.
Heater Snap Switch is open	Air trapped in heater	Ensure that heater is mounted per the requirements stated on the “THIS END UP” labels on heater so that air cannot be trapped inside. Refer to Section 4, *Installation Procedures*.	Correct the mounting per the installation section and measure resistance of the heater elements to ensure they were not damaged. Once the heater has cooled the snap switch should reset.
	Defective Snap Switch	When the heater has been deenergized for at least 15 minutes, measure for continuity across the snap switch leads.	If the tube is not being heated and the snap switch reads open, it is defective. The heater should be returned to Imtec for repair.
LD-1 Leak Detect Alarm	Internal Leak	Refer to your model schematic and measure the resistance of the 100kΩ terminating resistor on the leak detect wiring.	If the resistance is greater than 60kΩ and less than 120kΩ it should not trigger the leak detect module. Refer to the LD-1 Manual for troubleshooting.

Symptom	Possible Cause	Check	Corrective Action
Visible liquid coming from heater housing	Internal Leak	Certain situations over time could cause a pinhole leak that may not cause an immediate fault.	Immediately shut down the heater and return to Imtec for evaluation.
Overtemp circuit has tripped	Defective Overtemp controller	This item is not supplied by Imtec. Refer to the documentation supplied with your tool for troubleshooting.	Repair or replace as necessary.
	One J-type thermocouple is defective	Connect both thermocouple leads to a thermocouple meter. With a cool heater both thermocouple should read within a few degrees of each other.	If either thermocouple is defective, the heater must be returned to Imtec.
	Power modulator is faulty	If both thermocouples check ok, the power modulator may be defective. Connect a J-type thermocouple simulator up to the power modulator and set for 10°C above it's setpoint. This should cause the interlock relay contacts to open.	If the contacts do not open the power modulator is defective and should be replaced. Contact Imtec for a replacement.

This ends the Troubleshooting Procedures. If the heater needs to be returned to WK IMTEC for servicing go to Section 6.3, *Removing the Heater.*

6.2 Maintenance Procedures

Monthly: Check to ensure that the plumbing connections at the INLET and OUTLET are not leaking. If they are re-install the plumbing connection per the instructions in the installation section.

NOTE

There are no other maintenance procedures nor are there any periodic maintenance (PM) procedures necessary.

6.3 Removing the Heater

WARNING

DANGEROUS VOLTAGE IS PRESENT!

Hazardous voltages exist**. Lock out and tag out of electrical absolutely required** before working with this equipment!

Check area for exposed contacts prior to touching this equipment.

To ensure operator, equipment, and product safety, use care when operating this equipment. The following warnings must be adhered to.

- The Accuheat comes with safety devices. For your safety and to ensure the Accuheat works as designed, do not disconnect or modify them. Report any malfunctions to IMTEC Customer Service.
- The heater's housing is made of PTFE or CPVC: avoid any chemicals that could attack this material.

WARNING

HAZARDOUS CHEMICALS CAN CAUSE SEVERE INJURY OR DEATH!

Process chemicals may remain in the heater while attempting removal procedures if flushing procedures are not followed. **Flush thoroughly with DI water at inlet before removing heater.** Before attempting removal procedures apply your company's personal protective equipment. These procedures must be performed while wearing personal protective equipment, such as, but not limited to:

Goggles

Gloves

Respirator

Apron **Boots**

CAUTION

POTENTIAL PRODUCT OR EQUIPMENT DAMAGE!

A heater that has suffered an electrical failure may be returned to IMTEC for economical repair. However, damage associated with the heater core will significantly increase repair costs and may result in the heater not being able to be repaired.

1. Ensure all electrical power has been turned off to the heater
2. Purge, flush, and drain the entire recirculation loop and refill with DI H2O. Recirculate for 10 minutes and then drain the system. Repeat until chemical is satisfactorily diluted.
3. The heater will drain from the INLET tube. Open the manual or automatic drain valve installed on the INLET side, making sure that adequate drainage is available to receive the fluid.
4. **Lock out and Tag out the electrical supply** and then disconnect the heater wiring from any control systems.
5. Disconnect the OUTLET line and allow the fluid to siphon until empty (typically 20-30 ml of water will remain after siphoning).
6. Carefully re-mount the plumbing connection nuts to protect the INLETS and OUTLETS.
7. Rinse the housing externally with DI water.
8. Remove any hold-down hardware.
9. Remove the heater.

NOTE

When returning the heater for repair, drain, dry, and repackage it as described in Section 6.4, *Return Authorization Procedures*.

6.4 Return Authorization Procedures

The following policies and procedures are for returning a heater for repair to the WK IMTEC factory

- Return Policies
- Obtaining a Return Authorization (RMA#)
- Packing the heater for return

6.4.1 Return Policies

1. All heaters should be returned in WK IMTEC shipping containers. If the original container is no longer available, a shipping container can be purchased for a nominal fee from WK IMTEC Customer Service.
2. All returned heaters must be authorized by an IMTEC representative. If a heater is shipped to WK IMTEC without a Returned Materials Authorization (RMA) number, the heater will be refused by the WK IMTEC Receiving Department and returned to the sender.
3. All freight charges are the responsibility of the shipper. Insure for full or repaired value.

6.4.2 Obtaining a Return Authorization Number

1. Please have the following information ready:
   - Serial number of the heater
   - Reason for the repair
   - Type of chemistry used with the heater
   - Process temperature used
   - Repair Purchase Order Number (used for tracking; there can be no charge amount until the heater has been evaluated by WK IMTEC).
2. Call IMTEC Customer Service at (435) 783-6040 and request an RMA number.
3. If needed, order a shipping container kit and / or approved plastic bags. If the heater is contaminated with process chemistry (***not*** DI water), ask for a contamination shipping kit.

NOTE
Always follow your company's procedures for handling and shipping of chemically contaminated material. Follow any applicable local, state, and Federal laws in regards to shipping chemically contaminated materials.

4. For contaminated heaters, cut the power cable leaving two (2) inches from the housing nut.

6.4.3 Packing Heater for Return or Decommissioning

1. Have the heater shipping container ready.
2. Ensure that heater housing has been neutralized of all chemicals. Test with pH paper.
3. Provide a description of the chemistry and process temperature used with the heater.
4. Disconnect the electrical connections and plumbing and tape the power cable to the outside.
5. Flush the heater internally and externally with DI water. Drain the heater until no free moisture is present.
6. Repeat step 5 until chemistries are neutralized. Test with pH paper.
7. Insert the heater into an approved plastic bag. Three (3) are supplied with the shipping kit. Additional bags may be obtained from WK IMTEC Customer Service.
8. If it was necessary to remove any of the PFA manifolds from the heater, make sure they are also bagged and packed in such a way as to not damage the heater.
9. Carefully and completely squeeze out all of the trapped air. Seal

the bag with a tie-wrap.

10. Repeat steps 8 and 9 twice more, using the remaining two bags.
11. Carefully place the bagged heater into the lower molded foam section in the shipping container.
12. Place upper molded foam section in place over the heater.
13. Pull up the bag liner, twist its top once and squeeze out all trapped air. It is important that all trapped air be removed. Twist the liner excess to seal out the air and use a tie-wrap to secure the liner top. This ends the decommissioning steps.
14. Insert photos, diagrams and documentation of chemicals and process temperature into a sealable plastic bag and place on top of box liner. Additionally, **decontamination verification and certification shall be included in the sealable bag.**
15. Seal the bath's shipping container with packing tape. Do not staple the container closed.
16. Remove the backing and secure a shock watch and companion label to the side of the container.
17. Write or apply the following label on all sides of container (except bottom). "***FRAGILE***".
18. Mark the RMA number legibly on the sides of the container.
19. Ship the container to WK IMTEC.

If you have any questions about WK IMTEC's return authorization policies or procedures, please contact IMTEC at:

IMTEC by WHITE KNIGHT 187 East 670 South Kamas, UT 84036	Telephone: (435) 783-6040 Fax: (435) 783 -6128
Email: support@wkfluidhandling.com	From 8:00 a.m. to 5:00 p.m., ET, Monday through Friday

7 ADDENDUM TO IMTEC INLINE HEATERS INSTRUCTION MANUAL

7.1 Disclosure

This document defines the product certifications and special conditions of use for Zone 2 Hazardous Areas. For additional information regarding installation, use, adjustment, putting into service, setup, maintenance and repair refer to the applicable chapter of this manual.

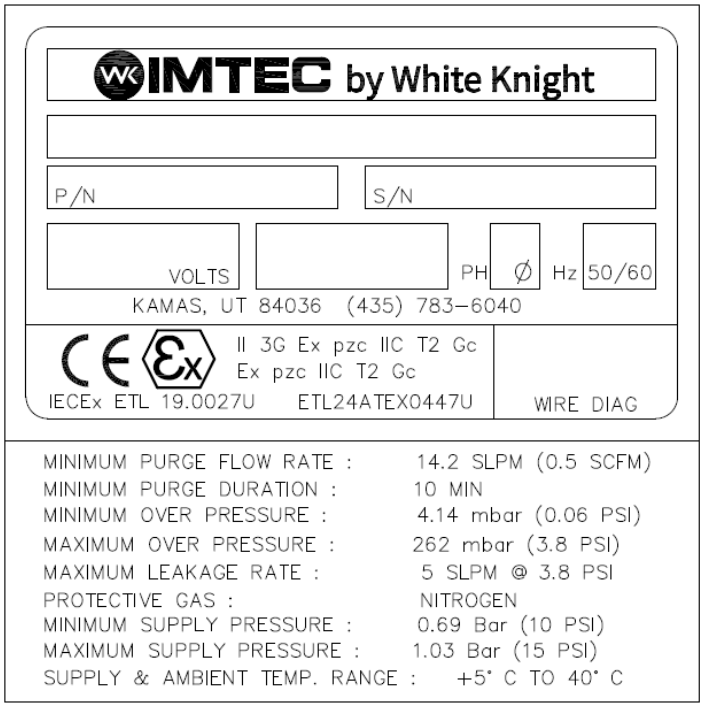
1. **Equipment Certified to:**

IECEx Standards: IEC 60079-0:2017
IEC 60079-2:2014
IEC 61010-1, IEC 61010-2-10, UL 499 & CSA 22.2 No.88

ATEX Standards: EN 60079-0:2018
EN 60079-2:2014/AC:2015

USA/CAN Standards: NFPA 496:2016 Ed.2017
UL 60079-0:2019 Ed.7
UL 60079-2:2017 Ed.6
CSA C22.2 No. 60079-0:2019 Ed.4
CSA C22.2 No. 60079-2:2016 Ed.2

2. **Equipment Marking:**



USA – Class 1, Division 2, Group A, B, C, AND D, Type Z; T2
Class 1, Zone 2, AEx pzc IIc T2 Gc
CAN – Ex pzc IIC T2 Gc

7.2 Warning

WARNING! Do not install in areas where flammable liquids can be splashed or spilled on the electrical equipment/enclosure.

WARNING! Power must not be turned on during initial installation or restored after enclosure has been opened until enclosure has been purged for 10 minutes at a minimum flow rate of 14.2 SLPM (0.5 SCFM) and achieved a minimum pressure of 4.14mbar (0.06 PSI)

WARNING! Protective Gas Release Poses Potential for Asphyxiation.

WARNING! PRESSURIZED ENCLOSURE! This enclosure must not be opened unless the area atmosphere is known to be below the ignitable concentration of combustible materials or unless all devices within have been de-energized.

WARNING! Inert gas must be used to purge this system.

7.3 Schedule of Limitation / Conditions of Acceptability

1. It is the end user's responsibility to provide a purge controller suitable for ATEX/IECEx Zone 2 hazardous area and indicates through a visual and audible alarms whenever the pressure condition is lost. Equipment was tested with a minimum overpressure of 4.14 mbar (0.06 PSI). Overall equipment incorporating the heater should be evaluated to the relevant requirements of equipment protected by pressurization.
2. Equipment was individually tested for maximum surface temperature per the requirements of IEC 60079-0 and attained a temperature code of T2.
3. Containment System tested for infallibility to a maximum process pressure of 40PSI. This pressure shall not be exceeded.
4. Non-metallic materials present in the exterior of the enclosure possess an electrostatic charging hazard. Clean only with a damp cloth.
5. Impact test was waived as equipment is intended to be installed inside a control room, protected from to impact risks.

7.4 Compliance with NFPA 496 installation the following requirements need to be met

Where an alarm is used, the following shall apply:

1. The alarm shall be located at a constantly attended location.
2. The alarm actuator shall take its signal from the protected enclosure and shall not be installed between the enclosure and the protective gas supply.
3. The alarm actuator shall be mechanical, pneumatic, or electrical.
4. Electrical alarm actuators shall be identified for a Division 2 or Zone 2 location as applicable.
5. No valves shall be permitted between the alarm actuator and the enclosure.
6. The alarm shall be permitted to satisfy the requirement to provide an alarm on the protected gas supply.

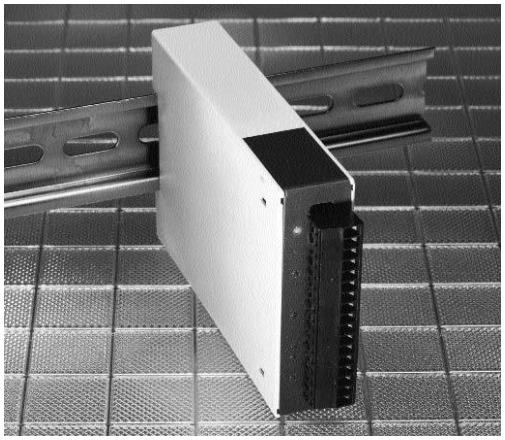
Where an indicator is used, the following shall apply:

1. The indicator shall be located for convenient viewing.
2. The indicator shall not be installed between the enclosure and the protective gas supply.
3. The indicator shall indicate either pressure or flow.
4. No valves shall be permitted between the indicator and the enclosure.
5. The protective gas supply shall have an alarm that is located at a constantly attended location

8 ADDENDUM FOR USE WITH SUPPLIED IQ POWER MODULATOR

8.1 IQ Power Modulator

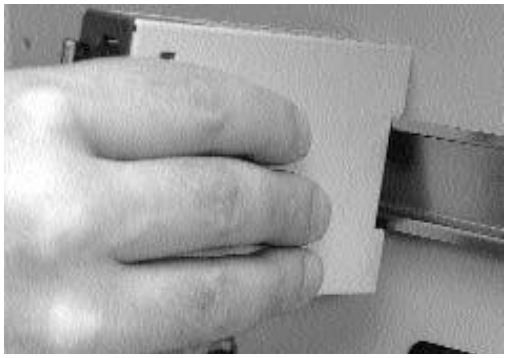
This version of the power modulator has been programmed with an operating set point temperature of 200°C. The heater also contains an overtemp switch with a trip temperature of 232.2°C ± 6.7°C.



8.2 Mounting and Installation

Install the Power Modulator in a chemical-free environment such as an enclosed electronics compartment of the wet-station or a well-ventilated head case. This modulator can also be DIN Rail mounted using DIN 50022, 35 mm X 7.5 (1.38-inch X 0.30-inch).

Step 1: Orient the controller so that the wiring label is visible after the unit is attached to the DIN rail.



Step 2: Place fixed catch onto DIN rail, rotate unit downward. The 1ZC will snap onto the rail.

8.3 Connecting the Power Modulator

Wiring of the power modulator should be made as per Sheet 2 in Document 10-002-0720.

Safety interlocks should be connected as per Document 10-007-0118.