LUFRAN™

Fluoropolymer Inline Water Heater

PROCESS TECHNOLOGY

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INTRODUCTION:

The Lufran™ fluoropolymer inline water heater is an ultrapure heater designed to heat DI water with very stringent cleanliness requirements. All wetted surfaces in this unit are fluoropolymer and PVDF material. There are no metallic wetted surfaces. The cleanliness of these units has been confirmed by independent third party testing. The cleanliness report is available upon request.

The Lufran fluoropolymer inline water heaters are available in wattages from 24kW to 288kW. These units consist of one or more heating columns combined with a control system and all necessary power distribution circuitry in a freestanding enclosure. The table on page 10 shows the various wattages with the corresponding number of heating columns. The photo on the cover shows a typical unit with two heating columns.

These units are CE, ETL and Semi S2/S3 compliant.

This system features the patented DAC™ control system operating from a PLC with a touch-screen operator interface. The DAC control system provides superior temperature control and faster response to changes in conditions versus a typical PID temperature control system.

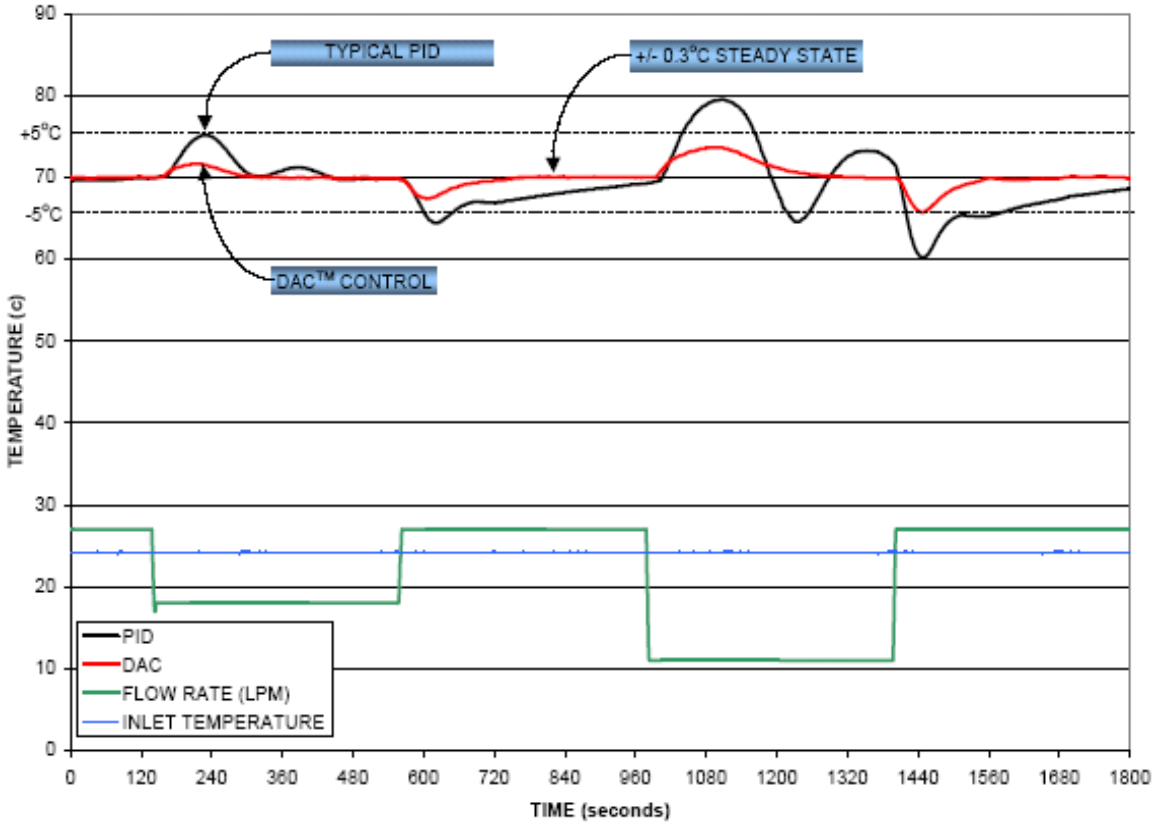


Figure 1: DAC Performance Graph

INTRODUCTION (Continued):

While the DAC control system is capable of providing an outlet temperature within 0.3°C of the desired PROCESS SETPOINT, the maximum possible temperature rise through the heater is dependant upon the wattage of the unit and the water flow rate through the unit. The following table illustrates the maximum temperature rise of various models based upon the water flow rate through the unit.

	Heater Power (Kilowatts)										
Flow Rate	24	36	52	65	72	105	130	144	210	260	288
L/min	Maximum Theoretical Temperature Rise (°C)										
5	68.6	-	-	-	-	-	-	-	-	-	-
10	34.3	51.4	74.3	-	-	-	-	-	-	-	-
15	22.9	34.3	49.5	61.9	68.6	-	-	-	-	-	-
20	17.1	25.7	37.1	46.4	51.4	75.0	-	-	-	-	-
25	13.7	20.6	29.7	37.1	41.1	60.0	74.3	82.3	-	-	-
30	11.4	17.1	24.8	31.0	34.3	50.0	61.9	68.6	-	-	-
35	9.8	14.7	21.2	26.5	29.4	42.9	53.1	58.8	85.7	-	-
40	8.6	12.9	18.6	23.2	25.7	37.5	46.4	51.4	75.0	-	-
45	7.6	11.4	16.5	20.6	22.9	33.3	41.3	45.7	66.7	82.5	-
50	6.9	10.3	14.9	18.6	20.6	30.0	37.1	41.1	60.0	74.3	82.3
55	6.2	9.4	13.5	16.9	18.7	27.3	33.8	37.4	54.5	67.5	74.8
60	5.7	8.6	12.4	15.5	17.1	25.0	31.0	34.3	50.0	61.9	68.6
65	5.3	7.9	11.4	14.3	15.8	23.1	28.6	31.6	46.2	57.1	63.3
70	4.9	7.3	10.6	13.3	14.7	21.4	26.5	29.4	42.9	53.1	58.8
75	4.6	6.9	9.9	12.4	13.7	20.0	24.8	27.4	40.0	49.5	54.9
80	4.3	6.4	9.3	11.6	12.9	18.8	23.2	25.7	37.5	46.4	51.4

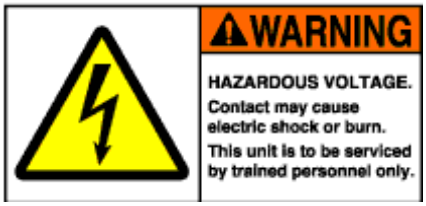
Figure 2: Maximum Temperature Rise Table

The Lufran fluoropolymer inline water heaters include a comprehensive system of safety controls and devices to insure safe and long-lasting operation. The list of safety devices includes but is not limited to the following:

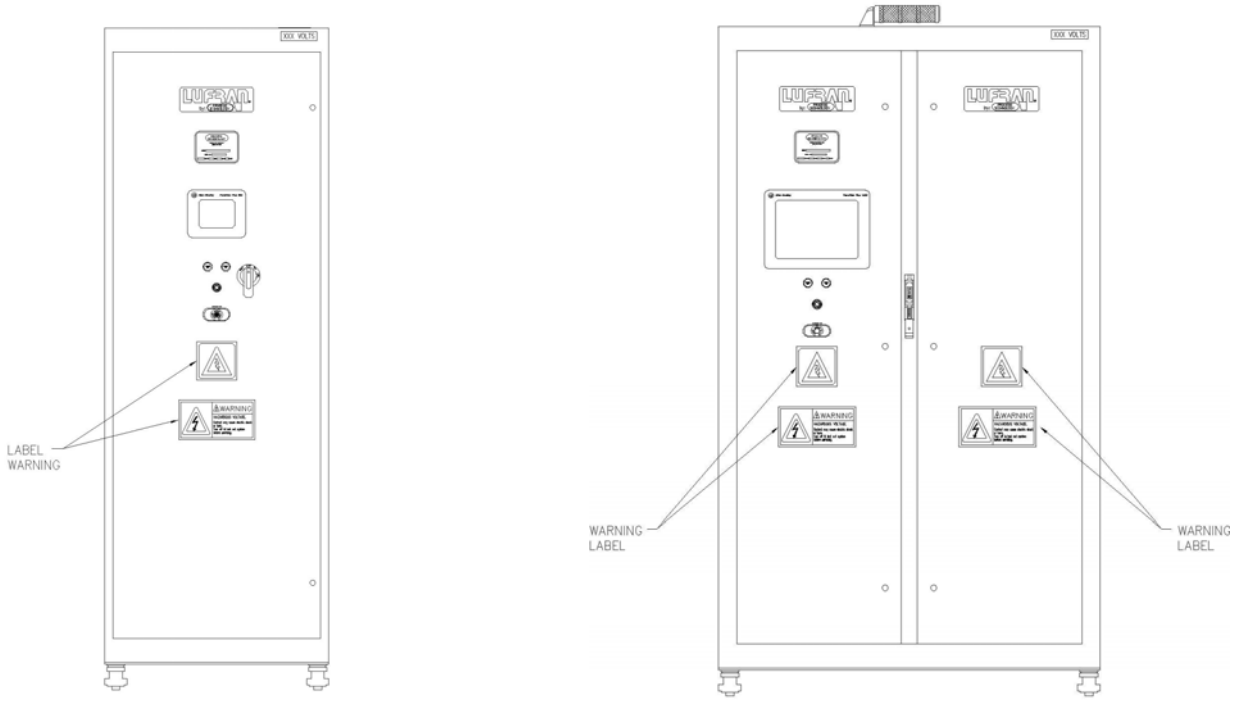
- EMO pushbutton
- Circuit breaker
- Ground fault (earth leakage) protection
- Pressure relief valve
- Liquid level sensors
- Leak detector
- High process temperature sensors
- High element temperature sensors
- Purge gas flow switch
- Moisture sensors in the purge gas exhaust line
- Solid state relay (SSR) fault and overheat detection
- Sensor failure (open sensor) detection

INTRODUCTION (Continued):

The following symbols and warning labels appear on the unit and in the instruction manual. The table below provides an explanation of each one.

DESCRIPTION	PICTORIAL DESCRIPTION
DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.	
WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.	
CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.	
DANGER: HAZARDOUS VOLTAGE ENCLOSED Voltage or current hazard sufficient to cause shock, burn or death. Disconnect and lock out power before servicing.	
WARNING: HAZARDOUS VOLTAGE Contact may cause electric shock or burn. This unit to be serviced by trained personnel only.	
CAUTION: HOT SURFACE. DO NOT TOUCH Heater column may be hot. Allow unit to cool before servicing.	
EIP: Electronic Information Product Pollution Control Logo.	
PROTECTIVE EARTH (GROUND)	

INTRODUCTION (Continued):



24 kW – 144 kW Units

157 kW – 288 kW Units

Figure 3: Warning Label Locations

SYSTEM SPECIFICATIONS:

Product		**Lufran fluoropolymer inline water heater**			
Standards		CE, ETL, Semi S2/S3			
Available Wattages		24kW – 288kW Refer to model number label for the wattage of any specific unit			
Available Voltages		380V – 600V, 50/60Hz, 3 phase only (Lower voltages available with special construction, consult factory for details)			
Cabinet dimensions and unit weight:		Width	Depth	Height	Weight
24kW – 72kW		508mm (20-in)	769mm (30.25-in)	2123mm (83.57-in)	270 kg (595 lbs)
105kW – 144kW (Including 72kW, 208V unit)		712mm (28-in)	769mm (30.25-in)	2123mm (83.57-in)	341 kg (750 lbs)
157kW – 288kW		1220mm (48-in)	769mm (30.25-in)	2123mm (83.57-in)	682 kg (1500 lbs)
Wetted surfaces:					
Heating elements		PTFE fluoropolymer			
Columns and plumbing		PVDF			
o-rings		Chemraz®			
Operating temperatures:					
Process inlet		50°C maximum			
Process outlet		Up to 95°C, depending upon operating conditions			
Temperature accuracy		+/- 0.3°C, depending upon operating conditions			
Ambient air temperature		30°C maximum			
Water flow rate range		1 l/min (0.25 gpm) to 200 l/min (50 gpm)			
Water pressure range		Minimum 69 kPa (0.69 bar, 10 psi) Maximum 690 kPa (6.9 bar, 100 psi)			
Purge gas flow rate required (minimum):					
24kW – 72kW		141 l/hr (5 scfh)			
105kW – 144kW (and 72kW, 208V unit)		282 l/hr (10 scfh)			
210kW – 288kW		564 l/hr (20 scfh)			
Purge gas pressure range		Minimum 175 kPa (1.75 bar, 25 psi) Maximum 690 kPa (6.9 bar, 100 psi)			

Chinese RoHS Compliance Table

	Lead (铅)	Mercury (汞)	Cadmium (镉)	Hexavalent (铬) Chromium	Polybrominated biphenyls (多溴化联(二)苯)	Polybrominated diphenyl ethers (二苯醚)
Assembly (组件)	O	O	O	O	O	O
Control circuit (控制电路)	O	O	O	O	O	O
Power circuit (电源电路)	O	O	O	O	O	O
Enclosure (包装)	O	O	O	O	O	O
Fasteners (固定件)	O	O	O	O	O	O
O indicates that this toxic or hazardous substance contained in the omogenous material for this part, according to EIP-A, EIP-B, EIP-C is below the limit requirement in SJ/T11363 2006						
X indicates that this toxic or hazardous substance contained in the omogenous material for this part, according to EIP-A, EIP-B, EIP-C is above the limit requirement in SJ/T11363 2006						

MODEL NUMBER:

Process Technology model numbers are designed to offer some description of the heater construction, including features and options. The model number can be found on the model/serial number label located directly above the operator interface screen. Refer to figure 17 (page 31) to see the location of this label.

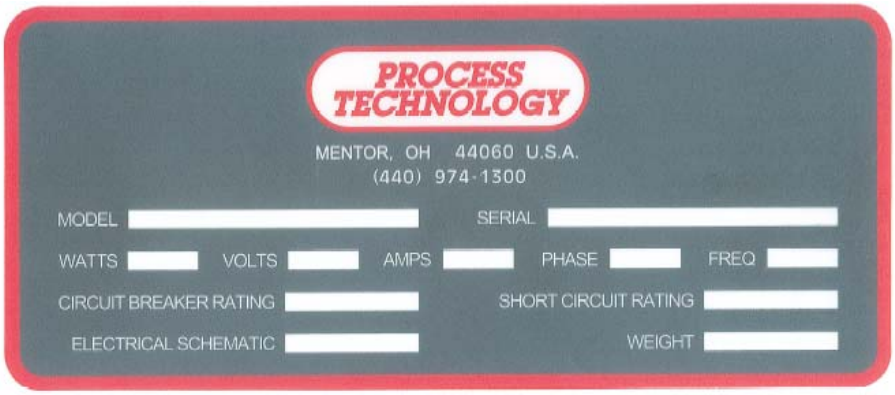
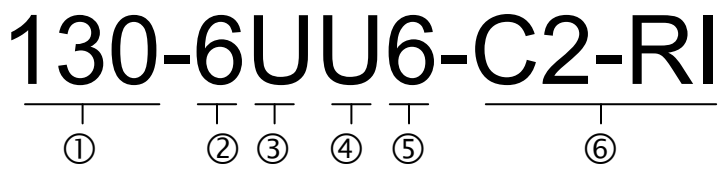


Figure 4: Model/Serial Number Label

Model Number Explanation:

Provided below is an example of a typical model number along with an explanation of each part. This key will help you understand your model number.

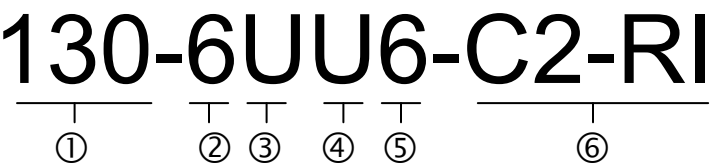
Model number example:



① **Heater Wattage.** The model number will always begin with the wattage of your heater. The table provided below identifies the standard available wattage ratings and the number of heater columns needed to provide that amount of Wattage.

Heater Model Number	Heater Wattage (W)	Number of Heater Columns	Wattage per Heater Column (W)	Heater Model Number	Heater Wattage (W)	Number of Heater Columns	Wattage per Heater Column (W)
024	24,000	1	24,000	**130**	130,000	2	65,000
036	36,000	1	36,000	**144**	144,000	2	72,000
052	52,500	1	52,500	**157**	157,500	3	52,500
065	65,000	1	65,000	**195**	195,000	3	65,000
072	72,000	1	72,000	**210**	210,000	4	52,500
072 (208V)	72,000	2	36,000	**260**	260,000	4	65,000
105	105,000	2	52,500	**288**	288,000	4	72,000

Model Number Explanation (continued):



② **Heater Voltage.** The first character following the heater Wattage will describe the rated Voltage of the heater. Please note that all heaters are rated for Three-Phase power.

Heater Model Number	Rated Voltage (V)	Heater Model Number	Rated Voltage (V)
1	208	6	480
2	240	7	440
3	380	8	575
4	400	9	220
5	415	10	200

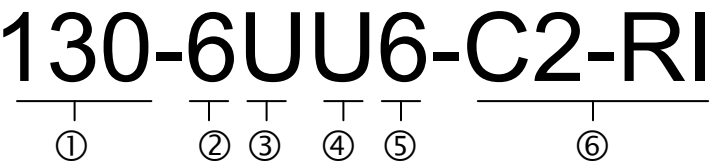
③ **Heater Inlet Plumbing Connection.**

④ **Heater Outlet Plumbing Connection.**

The heater inlet and outlet plumbing connections are usually the same. However, it is possible to have different plumbing connections for the inlet and outlet. The characters to describe the plumbing connections have the same designation for both the inlet and outlet connections. Please refer to the table below to see the specific plumbing connections provided with the heater:

Heater Model Number	Plumbing Connection Type	Plumbing Connection Size: mm (in)
A	Flared Tube Fitting	13mm (1/2-inch)
B	Flared Tube Fitting	19mm (3/4-inch)
C	Flared Tube Fitting	25mm (1-inch)
D	Union manifold Connector	32mm (1 ¼-inch)
E	Flange	19mm (3/4-inch)
F	NPT Pipe Threads, Female	13mm (1/2-inch)
G	NPT Pipe Threads, Female	19mm (3/4-inch)
H	NPT Pipe Threads, Female	25mm (1-inch)
I	NPT Pipe Threads, Male	13mm (1/2-inch)
J	NPT Pipe Threads, Male	19mm (3/4-inch)
K	NPT Pipe Threads, Male	25mm (1-inch)
L	Butt Fusion Union	25mm (1-inch)
M	BCF Union	32mm (1 ¼-inch)
N	Socket Fusion Union	32mm (1 ¼-inch)
P	Pillar Tube Fitting	13mm (1/2-inch)
Q	Pillar Tube Fitting	19mm (3/4-inch)
R	Pillar Tube Fitting	25mm (1-inch)
U	Socket Fusion Union (Standard)	25mm (1-inch)
X	Super 300 Pillar	25mm (1-inch)

Model Number Explanation (continued):



⑤ **Flow Meter Device.** The flow meter device is part of the DAC temperature control system. The flow meter is selected based upon total wattage of the heater and operating flow rate range. This device does not require routine maintenance or re-calibration.

Heater Model Number	Flow Monitor Device	Device Brand	Connection Size	Process Technology Part Number
0-4	Not Used			
5	Ultrasonic	Thornton	13mm (1/2-inch)	8136
6	Ultrasonic	Thornton	19mm (3/4-inch)	8137
7	Ultrasonic	Honda	13mm (1/2-inch)	9238
8	Ultrasonic	Honda	19mm (3/4-inch)	09-6820
9	Ultrasonic	Thronton	25mm (1-inch)	9964

⑥ **Options.** There are several options available with the Lufran fluoropolymer inline water heater. Some of these options are described in greater detail in the OPERATION section of this manual. More than one option may be included in an individual Lufran heater. Please refer to the table below for a brief listing of the available options.

Heater Model Number	Refer to Page # for a more detailed explanation	Description
C1		Ethernet communications
C2		Device net communications
C3		RS232 communications
C4		RS485 communications
C5		Modbus communications
C#	N/A	Additional communications option. Contact the Process Technology technical service department for assistance.
CS	N/A	Color touch-screen interface
RI		Expanded remote interface
ROI	N/A	Remote touch-screen interface.
R#	N/A	Additional remote interface option. Contact the Process Technology technical service department for assistance.
RM		Thornton resistivity monitor
S4	N/A	Stainless steel cabinet
##	N/A	Customer specific design/construction (Which may or may not include some of the above options)

FACILITY REQUIREMENTS:

Before installing the Lufran fluoropolymer inline water heater confirm the facility requirements listed below.

Space Requirements:

The Lufran fluoropolymer inline water heater is constructed in a freestanding enclosure. This cabinet includes the common framework for the heating column(s) as well as the electrical components. No additional support is required.

The dimensions of the specific model are based upon the unit wattage. The cabinet assembly requires ventilation. Locate equipment so that ventilation fans on the top and bottom of the enclosure and louvers on the sides are not obstructed. The ventilation fan exhausts through these openings, preventing overheating of the unit. Be sure to provide adequate clearance for normal operation and maintenance of this heater.

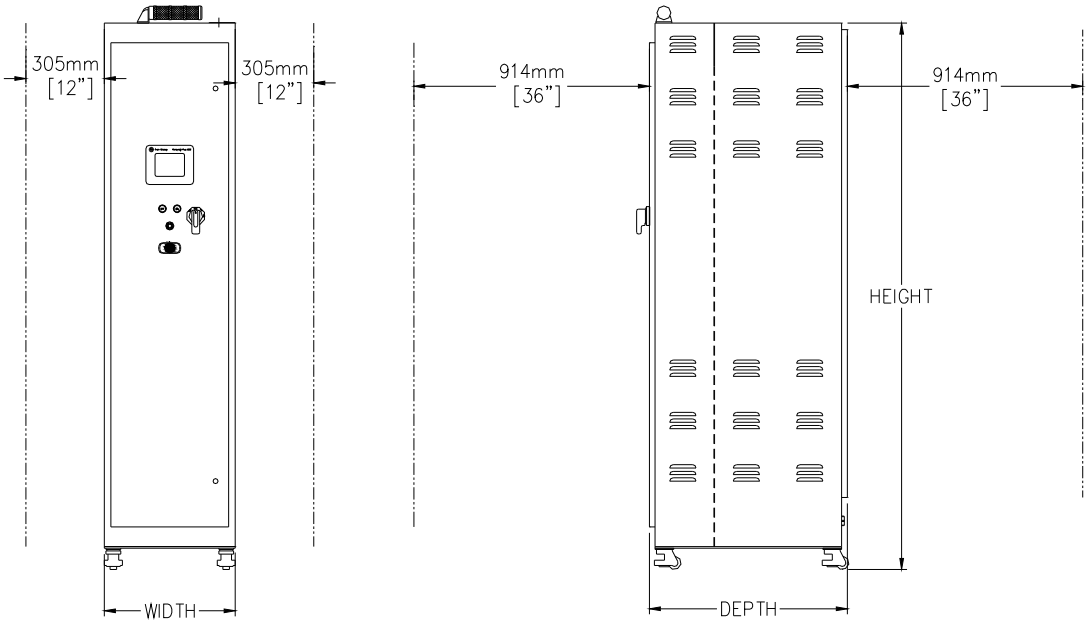


Figure 5: Clearance Dimensions (Single Column 24-72kW Model Shown)

Typical Cabinet Dimensions				
Heater Wattage (kW)	Number of Heating Columns	Width	Depth	Height
24-72	1	508mm (20-in)	769mm (30.25-in)	2123mm (83.57-in)
105-144 (including 72kW, 208V unit)	2	712mm (28-in)	769mm (30.25-in)	2123mm (83.57-in)
157-288	3-4	1220mm (48-in)	769mm (30.25-in)	2123mm (83.57-in)

FACILITY REQUIREMENTS (Continued):

Water Plumbing Requirements:

This unit is typically supplied with a single inlet and outlet water connection located just inside the rear of the cabinet. The connections are arranged vertically and do not offset from the horizontal center of the unit. The inlet plumbing should also include a means to drain the unit for service. There are also connections for the PRV valve and the leak pan drain. Reference the unit's model number and the model number key to identify the specific plumbing connections provided with your unit.

Electrical Requirements:

Reference the unit's model number and model number key or the Electrical Specifications Table inside the front door to identify the electrical power requirements of this unit. In addition, the model number tag on the front of the unit includes the unit's Wattage, Voltage, Amperage draw and Phase. Verify that the incoming electrical service is rated and fused for the required amperage draw.

⚠ CAUTION	**Do not exceed the rated voltage. Irreparable damage to the heating column or control circuitry may result.**

NOTE: Ensure electrical power fusing and disconnects meet local jurisdictional requirements. Fuse ratings noted in this document are for reference only. Ensure external electrical components comply with local requirements before operating this unit.

Purge Gas Requirements:

A source of purge gas, nitrogen (N_2) or clean dry air (CDA) is required for the heater element purge system. All Lufran fluoropolymer inline water heaters use 6.4-mm (0.25-inch) compression fittings as the purge gas inlet and outlet connections.

The purge gas supply must be regulated between 1.75 – 6.9 bar (25 – 100 psig) gas pressure. Each heating column inside the unit will use approximately 141 l/hr (5 SCFH) of purge gas.

If the gas pressure is supplied lower than 1.75 bar (25 psi), the control's safety circuitry will disable the heater and indicate a safety alarm. If the gas pressure exceeds 6.9 bar (100 psi) equipment damage will result.

⚠ CAUTION	**Do not exceed pure gas pressure of 6.9 bar (100 PSI). Irreparable damage to the heater column may result.**

INSTALLATION:

Note: Before installation, carefully read this entire section. The installation of this unit must be performed by qualified technicians.

⚠ CAUTION	**Due to the weight of the unit, DO NOT ATTEMPT to move or lift the unit without the appropriate material handling equipment.**

Inspection and Uncrating:

The Lufran fluoropolymer inline water heater is shipped in a horizontal position. The unit must be raised to a vertical orientation before it can be removed from the shipping crate.

1) Inspect the shipping crate for evidence of damage. If any damage is detected, contact the carrier immediately.

2) Inspect the shock sensors located on the outside of the crate. The shock sensors will indicate if the unit experienced rough handling. If the sensors indicate that the unit has experienced rough handling, contact the carrier immediately.

Figure 6: Shockwatch Sensor

3) Secure crate with adequate straps and carefully lift into a vertical position.

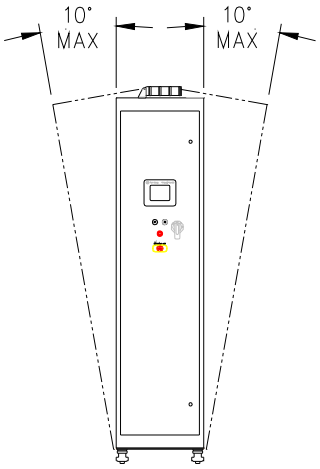
Inspection and Uncrating (Continued):

4) Remove one side of the crate.

5) Remove any protective packaging material and any other materials that may have been packed in the crate with the enclosure.

6) Remove any braces used to hold the unit in place during shipping.

7) Using a fork truck or other suitable lifting device, lift the unit from underneath and remove from the crate.

⚠ CAUTION	 **Do not tip the unit beyond 10° from vertical. Serious personal injury or equipment damage may result.**

8) Visually inspect the unit itself for damage. If there is evidence of damage, notify Process Technology and the freight carrier immediately.

Inspecting Heater Accessories:

The Lufran fluoropolymer inline water heater is shipped with the following standard heater accessories. These items are cleaned, double-bagged and packaged in a separate box that is inside the heater's shipping crate.

1) **Interface Cable** (1 each):
   The standard interface cable is a 15.2 m (50-foot) with a connector plug for the heater on one end and loose lead wires at the other end. Longer cables may be specified at the time of order or purchased separately. Please refer to the electrical prints for your heater (provided with this instruction manual) for an explanation of the wire numbers and functions.
   This cable may be used during installation to integrate this unit with a customer-supplied control system. If no remote control system is to be used with this unit, then the cable will not be necessary.

2) **Seismic Brackets, Bottom-half** (4 each):
   The top-half of the seismic brackets are already attached to the underside of the heater cabinet. The bottom half of each bracket is provided here in the event they are required for heater installation. Depending upon local standards or requirements they may or may not be necessary for the installation of this unit.

3) **Plumbing O-rings** (2 each, for 25mm Union connections only):
   These two Chemraz O-rings are needed for the plumbing connections for the 25mm union connections for the inlet and outlet plumbing connections. These o-rings are double-bagged for cleanliness. Please refer to the plumbing procedure on page 20.

4) **DeviceNet Communications Cable (-C2 option only)** (1 each):
   With the –C2 communications option, a 6 m (20 ft) DeviceNet cable is included to connect the Lufran heater to a DeviceNet network. The cable has the connector plug for the heater on one end and loose lead wires at the other end. Please refer to the electrical prints for your heater (provided with this instruction manual) for an explanation of the wire numbers and functions.
   This cable may be used during installation to integrate this unit with a customer-supplied DeviceNet communications network.

Positioning the Unit:

1) Once the Lufran fluoropolymer inline water heater has been removed from the crate and the unit passes the damage inspection, it can be moved to the service location. Move the unit using either the lifting hooks located on top of the enclosure or by lifting the unit from underneath using a fork truck or other suitable handling equipment.

⚠ CAUTION	**The castors should not be used to move the unit over long distances or on uneven surfaces. They are intended to facilitate small adjustments to the position of the unit at its place of operation. Move the unit slowly, as there is no means of slowing or stopping the unit. Ensure that there are sufficient personnel to move the unit safely. Failure to follow these instructions can result in serious personal injury and/or damage to the unit.**

2) The unit was shipped with the leveling feet extended. To utilize the castors the leveling feet must be retracted.

Figure 7: Leveling Foot Located on Castor

3) Place the unit on a hard, level surface.

4) Ensure the unit is secured so as not to roll as the casters are extended.

5) Leveling is accomplished by adjusting the stem and foot that is concentric with the caster spindle.

⚠ CAUTION	**Ensure the unit is on a smooth, level surface and there are sufficient personnel to hold the unit in place. As the leveling feet are retracted and the unit rests on the castors unexpected movement may result. Failure to properly secure the unit may result in serious personal injury and/or damage to equipment.**

Installing Seismic Brackets (optional):

This unit includes four seismic brackets in the event such brackets are a requirement for the installation of this unit. The top-half of these brackets have already been installed on the unit.

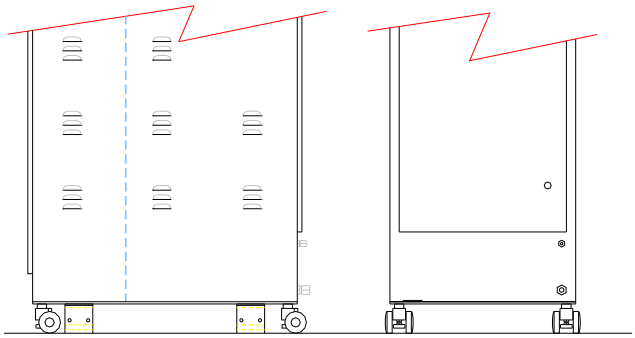
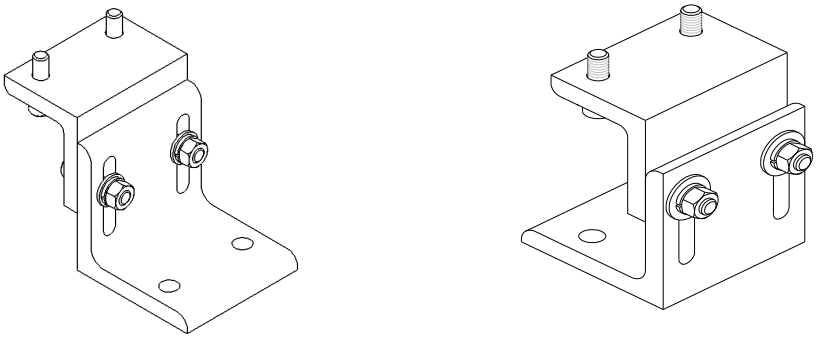


Figure 8: Seismic Brackets (top-half) Attached to Cabinet

If the heater installation requires that the seismic brackets be used, the bottom-half of these seismic brackets may be secured to the floor and then fastened to the bracket halves on the cabinet. The customer can decide whether to install the bottom half of the brackets to face inward or outward, as shown below.



Bottom facing outward **Bottom facing inward**

Figure 9: Seismic Bracket Assembled, two possible orientations

Plumbing:

The plumbing installation of this unit should only be performed by qualified technicians.

⚠ CAUTION	**Verify that the water supply and purge gas supply is shut off, and any necessary lockout/tagout devices are properly installed.**

Refer to the MODEL NUMBER EXPLANATION and the model number of this unit for the specific inlet/outlet plumbing connections. The various plumbing connections are located as follows:

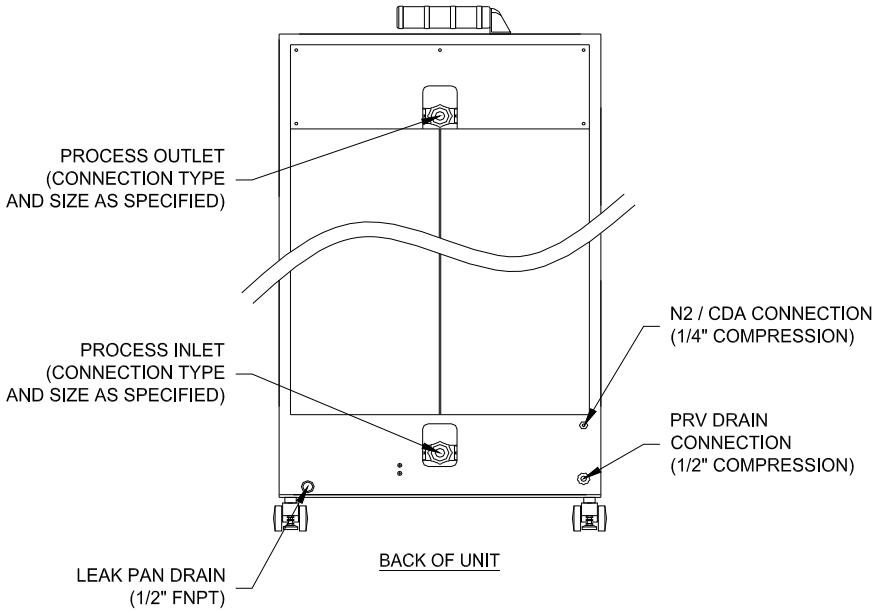


Figure 10: Water, Gas Plumbing Connections

Column Drain:

The customer must supply the means to drain the heating columns, which will be necessary in the case of replacing a heating column or some other items. The following describes a recommended means of column drain:

1) Install a service shutoff valve before the inlet and after the outlet of the heater.
2) After the inlet service shutoff valve, install a 3-way valve on the inlet side of the heater. This valve should be plumbed to direct water flow from the water supply to the heater, and then from the heater to a non-pressurized drain.
3) Before the outlet service shutoff valve, install a tee fitting to the outlet side of the heater. The tee portion of the fitting should be closed.

Plumbing (Continued):

Water Line Connections:

The following section details the installation procedure for the 25mm union connections (plumbing designation = **U**). For other types of plumbing connections follow the procedure appropriate for that specific type of connection.

When tightening all connections on this unit, be sure to support the internal plastic piping as close as possible to the plumbing connections, to prevent excessive torque or strain from being applied to the internal plumbing of the unit.

The various plastic piping connections available (Unions, Flared tube fittings, etc) do not require very much force to properly seal. Once the plumbing connections have been made, test the connections for possible leaks and repair any leaks as needed.

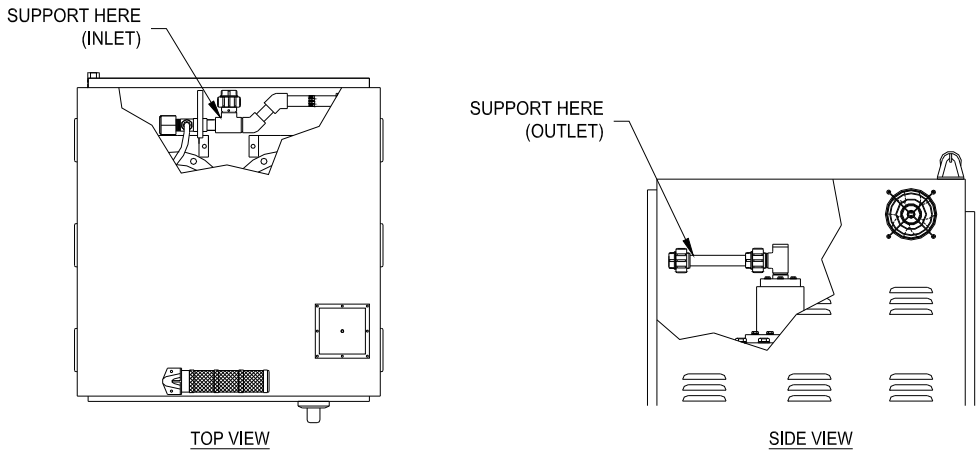


Figure 11: Support Internal Piping when Connecting Plumbing (2-column unit shown)

⚠ CAUTION	**Failure to properly secure the plastic piping when tightening the plumbing connections may result in internal damage to the plumbing of this unit. Such damage is not covered under our product warranty.**

Plumbing (Continued):

Inlet/Outlet Connections (25mm-32mm Unions standard)

1) Remove the access panel(s) from the rear of the unit, exposing the internal plumbing and heater column(s). The inlet plumbing will be located just below the bottom of the access panel, and the outlet plumbing will be located just above the access panel (See figure 11).
2) Remove the sealing cap from plumbing connection.
3) Test fit the piping to ensure proper length.
4) Support the internal piping to avoid any damage during plumbing.
5) Attach the o-ring (supplied with accessories) to the male side of the union.
6) Orient the male 25mm union half so the threads can be engaged into the female 25mm union half (nut) of the fitting.
7) Attach the male and female union halves to create the inlet connection and tighten the union halves securely, until the connections are fully tightened.

Plumbing (Continued):

Flared Compression Process Fluid Inlet and Outlet Connections:

The standard process fluid connections consist of inlet and outlet ports with two fittings on the same horizontal centerline. Please note that the procedure specified below should only be performed once, when the tubing is first connected to the fittings. Once properly tightened, the fittings will not need to be re-tightened in the future.

1) Remove the protective plastic caps from the flared fittings on the Inlet and Outlet piping of the heater assembly.
2) Connect properly flared tubing to the flared fitting on the heater chamber assembly.
3) Tighten the fitting nuts until fitting nut contacts the flared tubing. Tighten an additional ¼ turn. Then tighten fitting nut to the **maximum** required torque value. See the table below for proper values.
4) Repeat this procedure for each of the flared tube fittings on the filter chamber, including the bleed and drain fittings.
5) Check for leaks at the fittings.
6) Circulate hot fluid through the filter chamber at the operating temperature of the system, allowing the filter chamber to reach operating temperature.
7) Cool down the filter chamber to ambient. Re-tighten the fitting nut to the **minimum** torque value. See Table 6 for proper value.

Fitting Size	Torque Value	
	Minimum value (cold)	Maximum value (cold)
13mm (½-inch) flared	1.24 N-m (11in-lbs).	1.8 N-m (16 in-lbs).
19mm (¾-inch) flared	1.58 N-m (14in-lbs).	3.2 N-m (28 in-lbs).
25mm (1-inch) flared	3.39 N-m (30in-lbs).	5.1 N-m (45 in-lbs).

⚠ CAUTION	**Do NOT tighten fitting nuts at elevated temperatures. Irreparable damage to the plumbing connections will result.**

Plumbing (Continued):

Super 300 Type Pillar™ Process Fluid Inlet and Outlet Connections:

Super 300 Type Pillar ™ process fluid connections are available for the LTFH filter housings. Super 300 Type Pillar Fittings use a “gauge ring” which is used to determine the proper tightness of the fitting connections.

1) Remove the protective plastic caps from the fittings on the Inlet and Outlet piping of the heater assembly.
2) Install appropriately sized Super 300 Type Pillar “gauge ring”

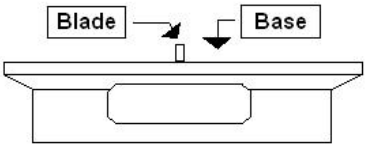


Figure 12: Gauge ring for Super 300 type Pillar fittings

3) Tighten the Pillar fitting nut until the bosses on the union nut makes contact with the gauge ring and pulls the blade. A clicking (crunching) sound will be heard at this point. Continue tightening the union nut until the bosses make full contact with the gauge ring.

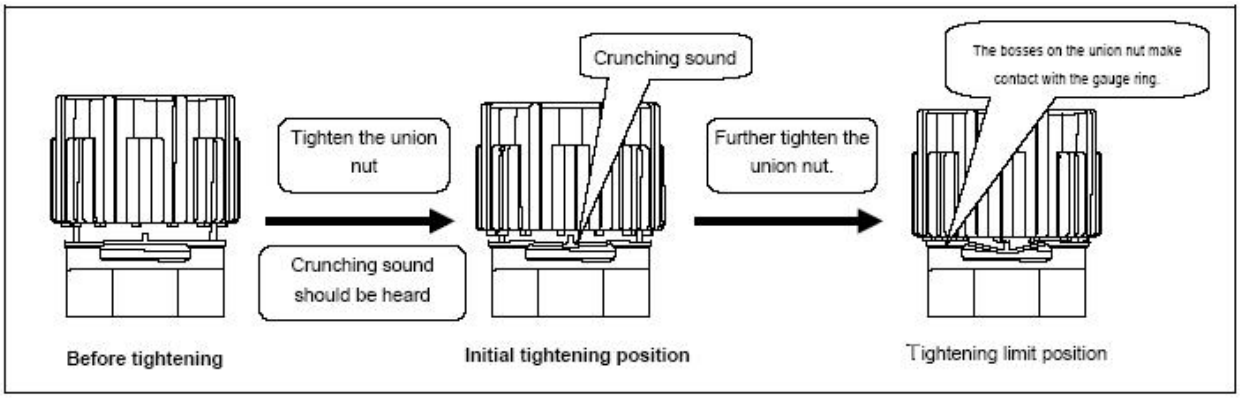


Figure 13: Super 300 type Pillar fittings tightening procedure

Plumbing (Continued):

PRV Connection (13mm (1/2-inch) compression fitting)

> **NOTE:** The 210 kW – 288 kW units have two PRV connections.

1) Loosen and remove the compression nut. Remove the sealing cap from plumbing connection and discard.
2) Test fit the tubing to ensure proper length. The tubing must be plumbed to a non-pressurized drain.
3) Slide the compression nut over the tubing.
4) Insert the tubing into the compression fitting. Tighten the compression nut securely.

Leak Pan Drain (1/2-inch FNPT (13mm) threaded connection)

1) Remove and discard the pipe plug.
2) Test fit the pipe or tubing to ensure proper length. The tubing must be plumbed to a non-pressurized drain.
3) Cover the male pipe threads with PTFE tape or some other approved pipe thread sealant.
4) Engage threads into drain connection. Tighten the threaded connection securely.

Purge Gas Supply Connection (6mm (1/4-inch) compression fitting)

1) Loosen and remove the compression nut. Remove the sealing cap from plumbing connection and discard.
2) Test fit the tubing to ensure proper length.
3) Slide the compression nut over the tubing.
4) Insert the tubing into the compression fitting. Tighten securely.

> **NOTE:** There is no exhaust connection for the purge gas. The purge gas is exhausted inside the cabinet and released into the air.

Wiring:

The wiring of this unit should only be performed by qualified technicians.

⚠ CAUTION	**Verify that the electrical supply is shut off, and any necessary lockout/tagout devices are properly installed.**

Before the plumbing is connected to this unit, verify that the electrical supply is shut off. Apply any plumbing lockout/tagout devices as required by factory guidelines.

Incoming power should be routed through the electrical access panel on the top of the unit. The power wires and ground wire must be connected to the main circuit breaker, per the electrical prints, which are provided with this manual.

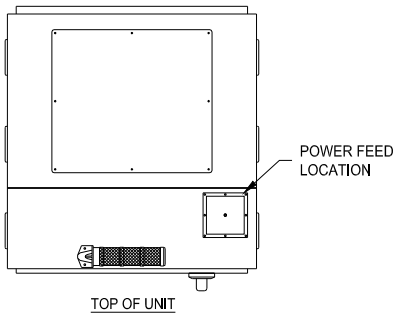


Figure 14: Electrical Access Panel

Wiring (Continued):

In addition to providing incoming power, all high-voltage wiring connections must be inspected for connections that may have loosened during shipment. Refer to the TORQUE SPECIFICATIONS table for proper connection torque values. The torque table is located on the inside of the front door.

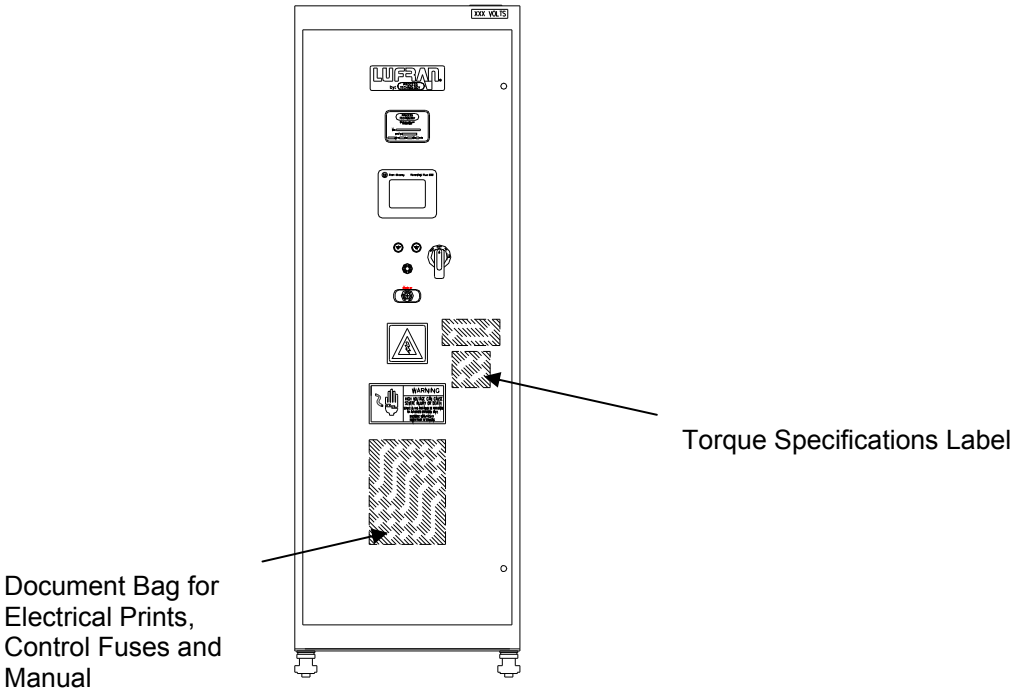


Figure 15: Location of Torque Specifications Label

Opening the front cabinet doors:

1-2 column (24kW – 144 kW) units:

1) Turn the two quarter-turn latches. They are located on the right side of the door, near the top and bottom.
2) Rotate the disconnect switch handle past the OFF position to the RESET position and pull the door open.

3-4 column (157 kW – 288 kW) units:

1) Turn the three quarter turn latches on each door. They are located near the center of the two doors, near the top, middle and bottom.
2) Push the disconnect switch down, past the OFF position to the RESET position.
3) Hold the switch in the RESET position and open the two doors.

Wiring (Continued):

TORQUE SPECIFICATIONS

CIRCUIT BREAKER (1CB)

DISTRIBUTION BLOCK (1PD)
PRIMARY: SECONDARY: SECONDARY:

POWER FUSES (7FU-9FU)

SAFETY CONTACTOR (1CON)

SOLID STATE RELAYS (1SSR-2SSR)
INPUT: OUTPUT:

Figure 16: Torque Specifications Table

OPERATION:

The Lufran fluoropolymer inline water heater can be operated from the front of the unit, remotely through the interface cable provided with the unit, or through an optional remote operator interface panel (ROI). This section deals with controlling the heater locally from the front of the unit. For an explanation of controlling the unit remotely refer to the REMOTE INTERFACE (RI) or (ROI) section of this manual.

Front Panel Layout:

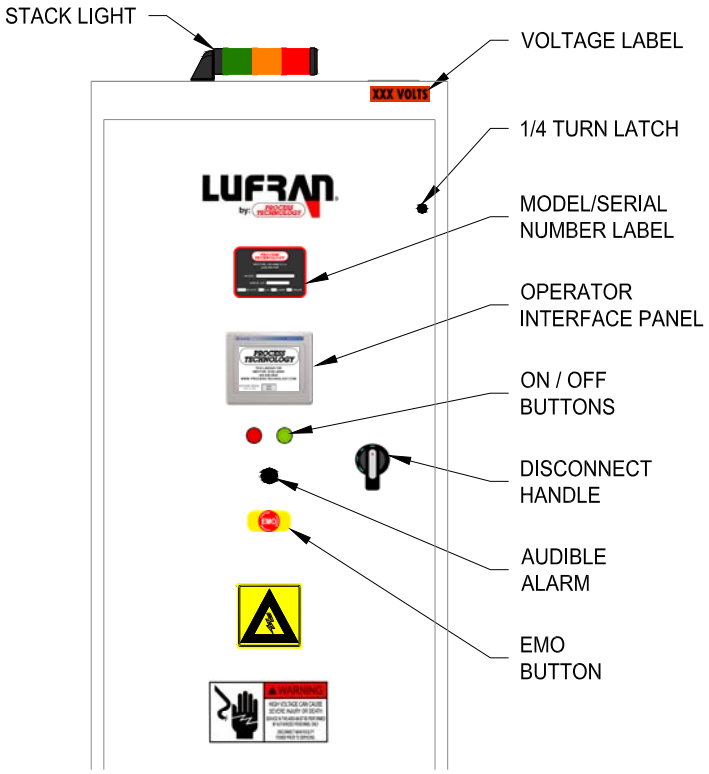


Figure 17: Front Panel Layout

Stack Light:

The status lights on the top of the unit indicates the operating status of the unit.

Figure 18: Status Lights

Color	Description
RED	Indicates an alarm condition exists with the system and operation halted. Correct the alarm condition and press the FAULT RESET button to resume operation.
AMBER	Indicates that the system is in a standby mode, or is operating with a warning condition. A message will appear on the information panel notifying the user of the warning condition as it occurs.
GREEN	Indicates the system is operating with all conditions in a normal operating state.

Operator Interface Buttons:

There are two push buttons are located on the front panel of the unit.

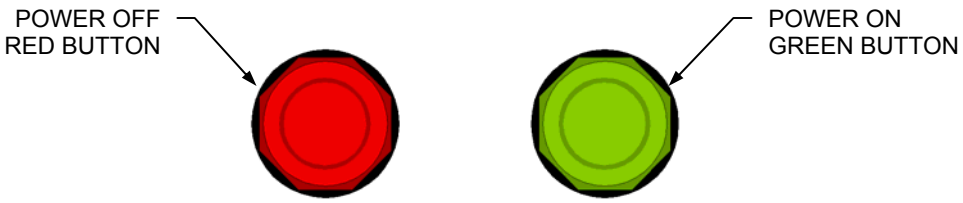


Figure 19: Operator Interface Buttons

Power On Button: When depressed, this button enables the main power contactor and readies the system for operation. It illuminates to indicate the system is in an operational mode.

Power Off Button: When depressed this button disables heater operation by disengaging the main power safety contactor. It illuminates to indicate the main power is off.

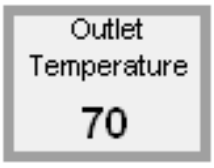
Operator Interface Touchscreen/Display:

The operator interface panel is an intelligent flat panel display. It is designed to interchange and display graphical data from a PLC by merely viewing or touching the screen. To ensure the effectiveness of the panel, it is important to take the following precautions:

- Do not press sharp objects against the screen.
- Do not strike the panel with hard objects.
- Do not press the screen with excessive force.

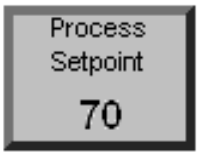
Indicators:

The different screens and menus available in the PLC touch screen interface have different types of push buttons and display fields. The following are examples of these different items.



The simple rectangular fields with the light borders are information fields only.

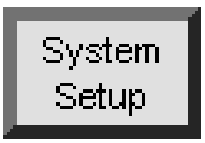
The oval fields with the dark borders are function buttons. The specific function is indicated in the center of the button.



The rectangular fields with the dark borders are also function buttons. These buttons require that numeric values be entered to change these settings.

When you press these buttons, a keypad will appear to allow you to change the value of the specific setting. After you key-in a new value, you must press the ENTER (◄┘) key in order to complete the change.

If you fail to press the ENTER key, or if the control system is locked, you will not be able to make changes to these settings.



The rectangular fields with dark borders that are located in the navigation area (at the bottom of the screen) are used to navigate between different screens and menus.

Operator Interface Touchscreen/Display (Continued):

Typical Touch Screen Display: General information

All of the touch screen displays have a similar format, as illustrated below. Navigating from screen to screen will change the information in the center of the screen, but the information at the top, right side and bottom of the screen will usually remain unchanged.

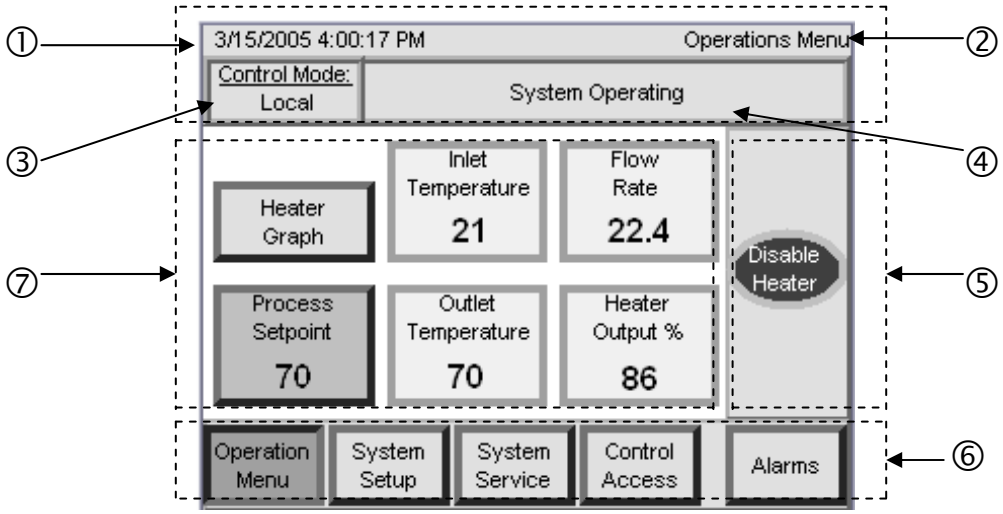


Figure 20: Typical Touch Screen Display

Explanation of Display Features:

①-④ **Title Panel.** This top section of the display provides general information about the unit and the display.

① **Time, Date.** This is factory set prior to shipment. However, if the customer wants to change the date or time (to match their local time zone), the run-time file application would first need to be shut down in order to change the time and date in the operating system menu of the panel display itself.

The run-time application can be terminated in the SYSTEM SERVICE menu by selecting the SHUTDOWN APPLICATION pushbutton.

② **Menu Name.** The name of the current menu is always provided at the very top of the display.

Operator Interface Touchscreen/Display (Continued):

Explanation of Display Features:

③ **Control Mode.** This box indicates whether the unit is in LOCAL, MANUAL or REMOTE control mode.

When in LOCAL mode the heater control settings may be adjusted from the touch screen interface only.

When in REMOTE mode the heater control settings may be adjusted through the interface cable connection only.

When in ROI mode (**optional**) the ENABLE HEATER and PROCESS SETPOINT heater control settings may be adjusted through the remote touch-screen interface only.

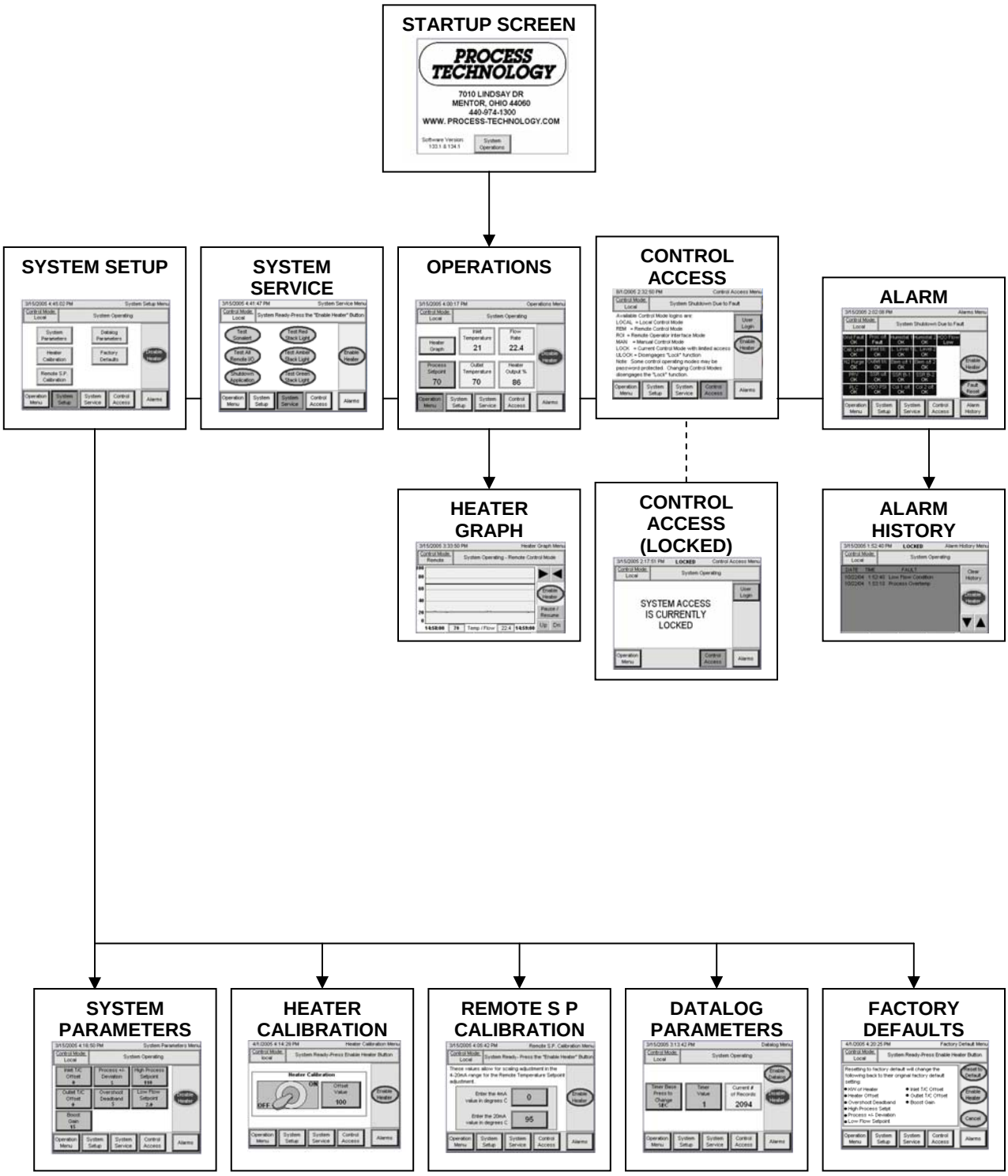
④ **Message Box.** This box indicates the status of the water heater. It will detail current system messages such as heater operation or any potential alarms.

⑤ **Command Panel.** In most menus the command panel will provide the function buttons to start and stop the operation of the heater. On one menu screen the command panel will also have the function buttons needed to enable or disable the datalog function of the controller.

⑥ **Navigation Panel.** These buttons will allow the user access to other available system menus. The current menu will be highlighted.

⑦ **Information Panel.** This area of the screen will feature different information fields and function buttons for the different menu screens. This section of the display is explained for each of the menu screens in the following pages of this section.

Touchscreen Menu Overview:



Operations Menu:

The operations menu provides current performance statistics of the Lufran fluoropolymer inline water heater. It is the default menu that appears following the startup screen. The navigation keys at the bottom of the screen provide access to the other menus available.

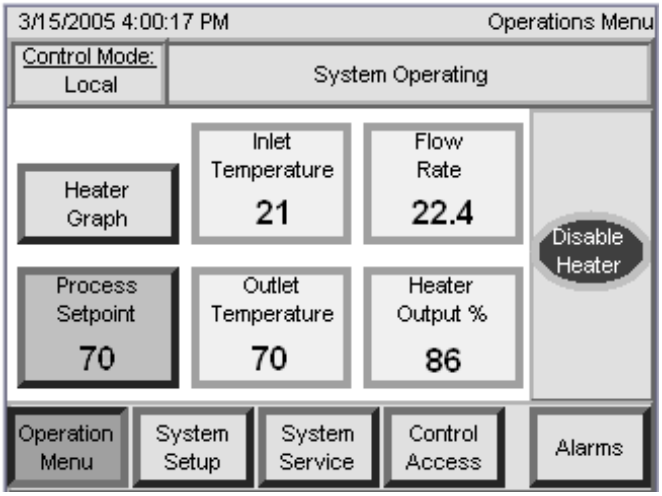


Figure 21: Operations Menu

Operations Menu Information Panel	Description
HEATER GRAPH	This button will go directly to a display that charts the current temperature performance of the heater.
INLET TEMPERATURE	This value is the temperature measured from the process sensor located at the inlet of the heater.
FLOW RATE	This value Is the water flow rate measurement taken from the internal flow meter.
PROCESS SETPOINT	This button will display the current temperature outlet setting. The operator can change this value by pressing the button. A numeric keypad will appear to allow the operator to enter a new setpoint value. The operator must press ENTER (◄┘) on the keypad in order to save the new value.
OUTLET TEMPERATURE	This value is the temperature measured from the process sensor located at the outlet of the heater.
HEATER OUTPUT %	This value shows the output load of the heating elements needed at that specific time in order to provide the desired outlet temperature.

System Setup Menu:

This menu will provide navigation to five different setup menus. The information in these various menus are factory set during performance testing and should only be modified if necessary. The different setup menus are described in more detail in the following pages.

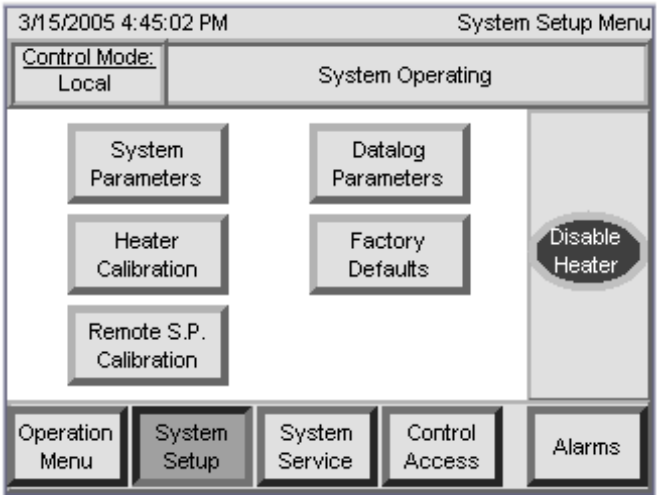


Figure 22: System Setup Menu Screen

System Setup Menu Information Panel	Description
SYSTEM PARAMETERS	This button will forward the operator to the SYSTEM PARAMETERS menu.
DATALOG PARAMETERS	This button will forward the operator to the DATALOG PARAMETERS menu.
HEATER CALIBRATION	This button will forward the operator to the HEATER CALIBRATION PARAMETERS menu.
FACTORY DEFAULTS	This button will forward the operator to the FACTORY DEFAULTS menu.
REMOTE S. P. CALIBRATION	This button will forward the operator to the REMOTE SET POINT (S. P.) menu.

System Parameters Menu:

This menu will provide information pertaining to the different offset values entered for the temperature sensors as well as some adjustable control parameters. When one of these buttons is selected, a keypad will appear to allow the operator to change the value. The operator must press enter after making a change in order to save the new value.

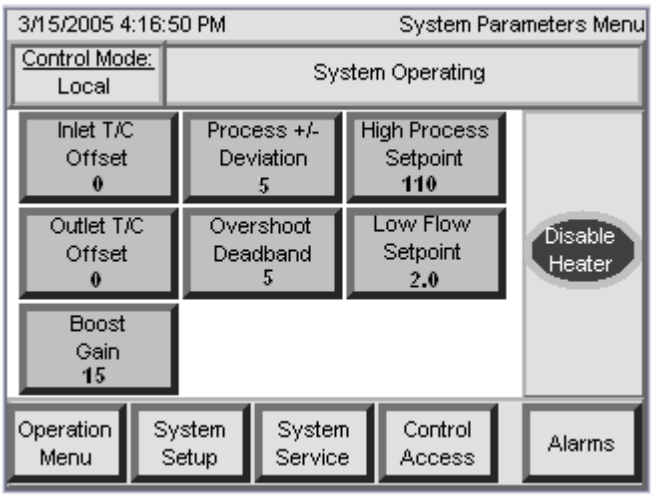


Figure 23: System Parameters Menu Screen

System Parameters Menu Information Panel	Description
INLET T/C OFFSET	This button allows adjustment of the offset value for the inlet water thermocouple sensor. The adjustment range is -10°C to +10°C.
PROCESS +/- DEVIATION	This button allows adjustment of the process deviation value. The maximum value for this setting is 20°C. The process deviation provides indication to the operator whenever the heater outlet water temperature is above or below the process setpoint by a value greater than the value of this setting. This setting does not trigger an alarm and will not shut down the heater.
HIGH PROCESS SETPOINT	This button allows adjustment of the HIGH PROCESS SETPOINT. This setting may be adjusted as high as 120°C. The factory default value for this setting is 110°C. If the heater outlet temperature exceeds the value of this setting, the heater will enter an alarm state. This alarm state will shut down the heater and will require a manual reset once the alarm event has ended.
OUTLET T/C OFFSET	This button allows adjustment of the offset value for the outlet water thermocouple sensor. The adjustment range is -10°C to +10°C.
OVERSHOOT DEADBAND	This button allows adjustment of the outlet temperature OVERSHOOT DEADBAND. When the heater outlet temperature rises above the process setpoint by this value (°C), the heater power output will be reduced to 0%. This will not trip an alarm. The DAC control system will detect the peak of the temperature overshoot and re-establish power to the heater once the peak has occurred in order to provide a more gradual and precise return to the process setpoint.

System Parameters Menu (Continued):

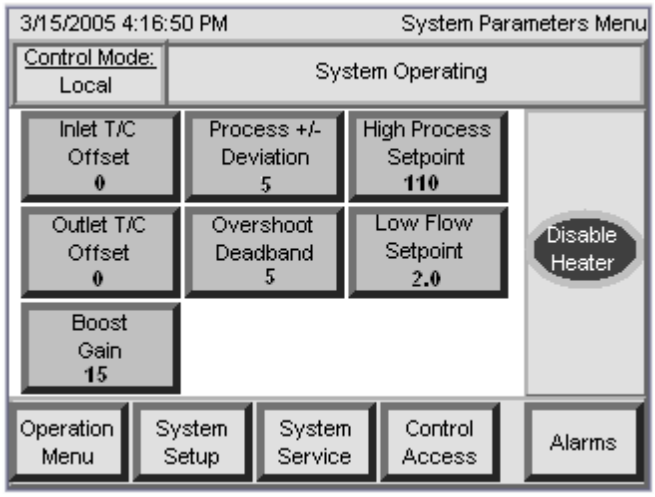


Figure 24: System Parameters Menu Screen

System Parameters Menu Information Panel	Description		
LOW FLOW SETPOINT	This button allows adjustment of the LOW FLOW SETPOINT. This setting will disable the heaters when the flow rate through the heater falls below this setting (liters per minute). The controller will provide a warning message when the flow rate has dropped below this setting, but it will not enter an alarm state. When the flow rate through the heater has risen above the value of this setting heater operation will continue. This setting is factory set to the valued listed below:		
	Heater Wattage	Number of Heating Columns	LOW FLOW SETPOINT
	24Kw – 72Kw	1	1.0
	105Kw – 144Kw	2	2.0
	210Kw – 288Kw	4	4.0
BOOST GAIN	This button allows adjustment of the BOOST GAIN. This setting improves heater performance during initial temp rise from a low temperature. This setting has a range of 0-100 (no units). It is factory set during testing. The factory set value is saved in the FACTORY DEFAULT menu. By increasing the value of this setting (by increments of 1), the heater will increase the rate of temperature rise from a low temperature. Note however that increasing the value of this setting will result in a temperature overshoot as the heater outlet temperature reaches the process setpoint. The default value will provide the quickest rate of temperature rise with no temperature overshoot above the process setpoint.		

Heater Calibration Menu:

This menu is used during initial startup only. The value listed in the information panel is used, if needed, to make adjustments to the heater's power output rating. Depending upon operating conditions and the supply voltage these values may help improve the precision of the DAC control system.

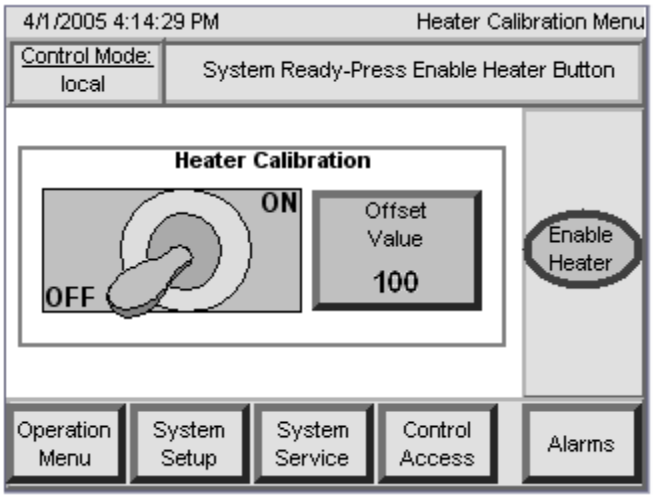


Figure 25: Heater Calibration Menu Screen

Heater Calibration Menu Information Panel	Description
ON / OFF	This animated toggle switch will enable the system calibration mode. In this mode, the error correction is disabled, and the DAC control system will operate as an open loop control. The HEATER CALIBRATION STARTUP PROCEDURE details the proper calibration procedure for this unit. The procedure may be found in the STARTUP section of this manual. This calibration was performed at the factory prior to shipment.
OFFSET VALUE	This button allows adjustment of the heater power output rating. This setting will be adjusted at the factory, so the initial value may not be 100(%). If, during initial startup, the heater is having difficulty in reaching the process setpoint, this value may be adjusted (in 1% increments) up or down in order to improve the precision of the unit.

Remote S. P. Calibration Menu:

This menu provides adjustment to the scale of the 4-20 mA input responsible for making changes to the primary setpoint. The values of these settings must match the values used by the customer control. Otherwise the primary setpoint will be incorrect.

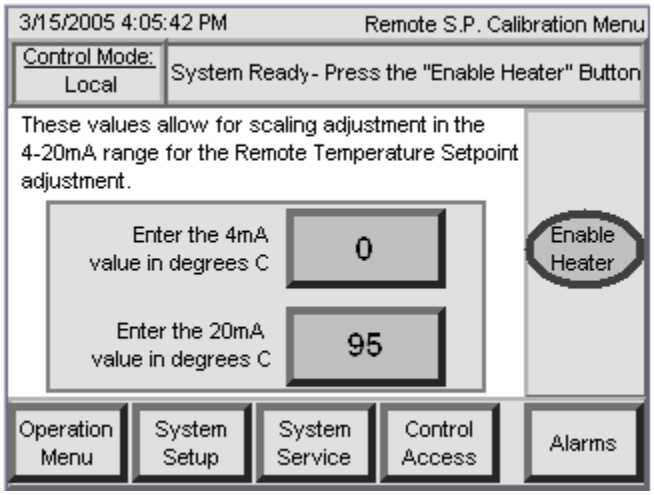


Figure 26: Remote Setpoint Calibration Menu

Remote S. P. Calibration Menu Information Panel	Description
ENTER THE 4mA VALUE IN DEGREES C	This button allows adjustment to the lowest setpoint value provided remotely by the customer control.
ENTER THE 20mA VALUE IN DEGREES C	This button allows adjustment to the highest setpoint value provided remotely by the customer control.

Datalog Menu:

This menu allows adjustment of the frequency of datalog sampling. The DAC control systems will record the following information:

Flow rate (liters per minute)

Outlet Temperature (°C)

Alarm Events

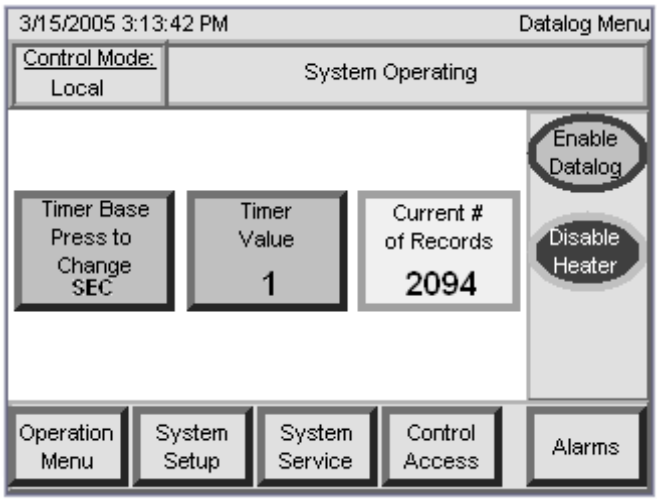


Figure 27: Datalog Menu Screen

Datalog Menu Information Panel	Description
TIMER BASE PRESS TO CHANGE	This button allows adjustment of the time interval for the data sampling. Pressing this button will change the time units from SEC (seconds) to MIN (minutes). Pressing the button again will change the time units from MIN to HR (hours). Pressing the button a third time will change the time units from HR back to SEC.
TIMER VALUE	This button allows adjustment of the time period between datalog events.
CURRENT # OF RECORDS	This display indicates the number of datalog records that have been collected. The controller can collect a maximum of 4096 datalogs. Beyond this, the controller will begin to replace the oldest datalogs with the new datalogs as they are taken.
ENABLE DATALOG	This button in the command panel will enable the datalog feature of the controller. Once enabled, this function button will change to DISABLE DATALOG.

Factory Default Menu:

This menu holds the record of all the factory-set control parameters of the DAC™ control system.

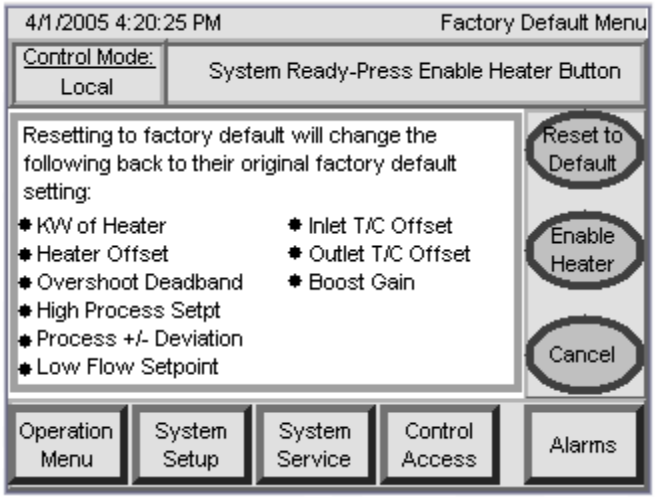


Figure 28: Factory Default Menu Screen

Factory Default Menu Command Panel	Description
RESET TO DEFAULT	This button will reset all controller settings to the factory default settings listed in the information panel.
CANCEL	This button will return the display to the SYSTEM SETUP menu.

System Service Menu:

This menu provides buttons that can test the various output signals and indicator lights on the unit, as well as shut down the OIP application software.

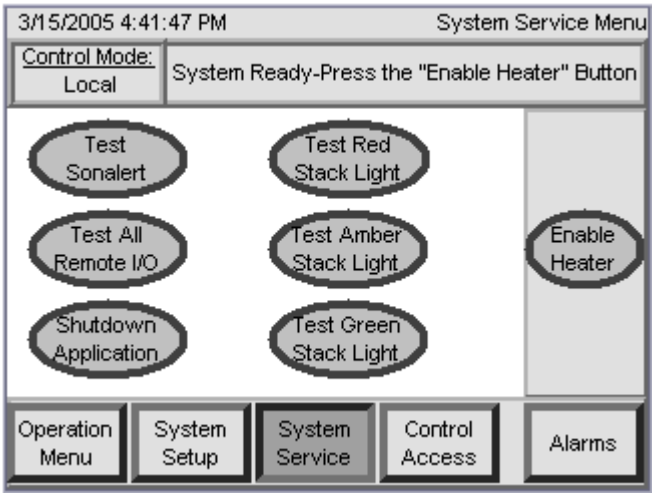


Figure 29: System Service Menu

System Service Menu Information Panel	Description
TEST SONALERT	Depress this button to energize the Sonalert audible alarm. This function will not send the unit into an alarm condition.
TEST RED STACK LIGHT	Depress this button to illuminate the red light on the stack light.
TEST ALL REMOTE I/O	This button allows testing of all output signals through the interface cable. When this button is depressed, all interface outputs toggle from normal operating states.
TEST AMBER STACK LIGHT	Depress this button to illuminate the amber light on the stack light.
SHUTDOWN APPLICATION	When the heater is disabled, this button will shut down the OIP application software. The PLC and the touch screen display will remain turned on. When this button is depressed, a verification message and two buttons in the command panel called APPLY and CANCEL will appear.
TEST GREEN STACK LIGHT	Depress this button to illuminate the green light on the stack light.

System Service Menu Command Panel	Description
APPLY	This button will appear if the SHUTDOWN APPLICATION button is depressed. Depress the APPLY button to shut down the DAC™ control system.
CANCEL	This button will appear if the SHUTDOWN APPLICATION button is depressed. Depress the CANCEL button return to the SYSTEM SERVICE menu.

Control Access Menu:

This menu provides access to adjust the DAC control system from LOCAL control mode to remote (REM) control mode or manual (MAN) control mode. This menu also provides the ability to LOCK or UNLOCK the control system. The different login modes are described on the following page.

When the system is UNLOCKED the CONTROL ACCESS MENU will appear as follows:

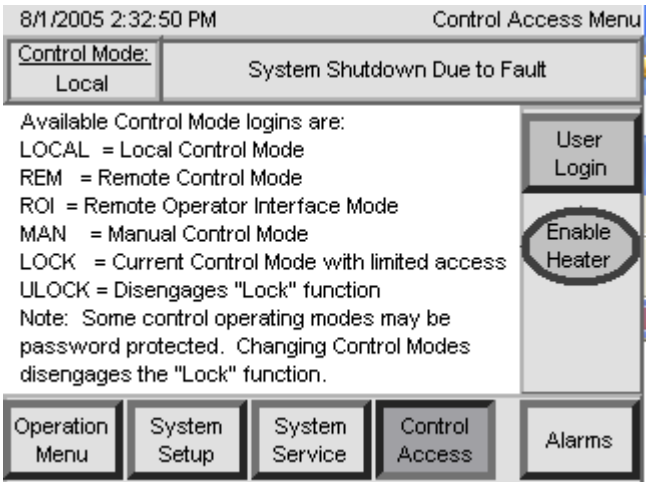


Figure 30: Control Access Menu Screen

Control Access Menu Command Panel	Description
USER LOGIN	This button will bring up the LOGIN display on the information panel. Pressing User (F2) on the LOGIN display will bring up a small keyboard. From the keyboard you can enter one of the available control mode login codes, to change the control mode. When finished entering the code, press the enter (◄┘) key to input the change. Then press the password (F3) on the login display and enter the same login code as the password. When finished entering the password, press the enter (◄┘) key to input the password. Press the enter (◄┘) key on the LOGIN display to enter the login code, which will then change the control mode.
CANCEL	This button will return the display to the CONTROL ACCESS menu.

Control Access Menu (Continued):

When the system is LOCKED the CONTROL ACCESS MENU will appear as follows:

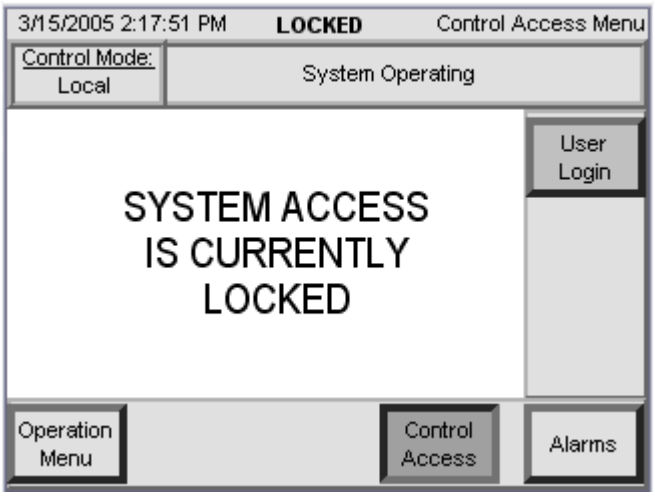


Figure 31: Control Access Menu Screen (locked)

Control Mode Login Code	Description
LOCAL	**LOCAL MODE.** This control mode allows heater control from the touch screen display of the PLC. All menus and settings can be accessed and changed from the touch screens.
REM	**REMOTE MODE.** This control mode allows heater control through the interface cable connection only. The customer provided remote control system can access and change settings remotely.
ROI	**REMOTE OPERATOR INTERFACE MODE. This selection will only appear if the Lufran heater includes the ROI option.** This control mode allows ENABLE HEATER and PROCESS SETPOINT heater control settings to be adjusted through the remote operator interface heater control only. The customer can also access and change all other user settings either locally or remotely.
ENET	**ETHERNET MODE. This selection will only appear if the Lufran heater includes the C1 communications option.** This control mode allows heater control through the Ethernet cable connection only. The Ethernet network can access and change settings remotely.
DNET	**DEVICENET MODE. This selection will only appear if the Lufran heater includes the C2 communications option.** This control mode allows heater control through the DeviceNet cable connection only. The DeviceNet network can access and change settings remotely.
MBUS	**MODBUS MODE. This selection will only appear if the Lufran heater includes the C5 communications option.** This control mode allows heater control through the Modbus cable connection only. The Modbus network can access and change settings remotely.

Control Access Menu (Continued):

<table>
<tr><th>Control Mode Login Code</th><th colspan="2">Description</th></tr>
<tr><td rowspan="2">MAN</td><td colspan="2">MANUAL MODE. This control mode allows an operator to control the % output of the heater, regardless of flow rate or desired outlet temperature. When this mode is selected, the HEATER CALIBRATION menu will disappear, and the PROCESS SETPOINT button in the OPERATION MENU will be replaced by MANUAL OUTPUT %.</td></tr>
<tr><td>⚠ CAUTION</td><td>Once in manual control mode the automated control is no longer active and may result in erratic behavior or over-temperature conditions. For this reason, manual control should only be used by qualified personnel as a maintenance tool.</td></tr>
<tr><td>LOCK</td><td colspan="2">This control mode limits operator access to most operator functions. When the control system is LOCKED (see above figure), the SYSTEM SETUP and SYSTEM SERVICE menus will disappear. In addition, the settings in the OPERATION MENU will be locked, so no changes can be made to the system.
In order to unlock the control system the operator must access the USER LOGIN function, and enter the login code ULOCK.
The system can be locked while in any of the operating modes. Changing control modes will automatically unlock the control system.</td></tr>
<tr><td>ULOCK</td><td colspan="2">This control mode will disable the lock function.</td></tr>
</table>

Alarms Menu:

This menu provides a display status of all alarm conditions in the Lufran fluoropolymer inline water heater. When one of the alarms trip, the Alarms menu will automatically appear. The alarm setting(s) that has tripped will flash.

Note: To silence the audible alarm during an alarm event, press the POWER OFF button on the front of the unit. When the alarm condition has been cleared, press the POWER ON button before the unit is restarted.

When the alarm condition(s) has been corrected, the alarm setting will continue to flash until the control system has been reset. To reset the safety, press the FAULT RESET button located on the command panel.

Please note that the high-wattage Lufran heaters that use 3 or 4 heating columns (157kW – 288kW) will have a slightly different alarm screen. Some of the alarms will be multiplied due to the number of heating columns. These alarms will be labeled with the column number.

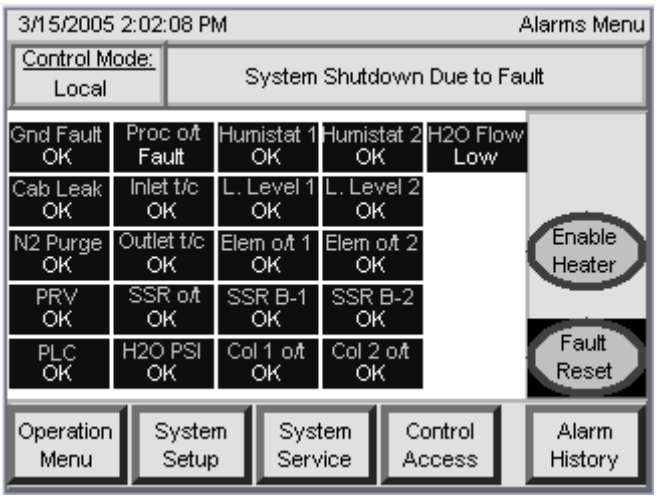


Figure 32: Alarms Menu Screen

Alarm Menu Command Panel	Description
FAULT RESET	This button will reset all of the safety settings. If a particular safety has tripped and the conditions causing the safety trip has not been corrected, then the safety indicator will not reset and will continue to flash.

Alarm Menu Navigation Panel	Description
ALARM HISTORY	This button will forward the operator to the ALARM HISTORY display.

Alarm History Menu:

This display will list the alarm history of the unit. The information panel provides the date and time of the event, as well as the type of fault that occurred.

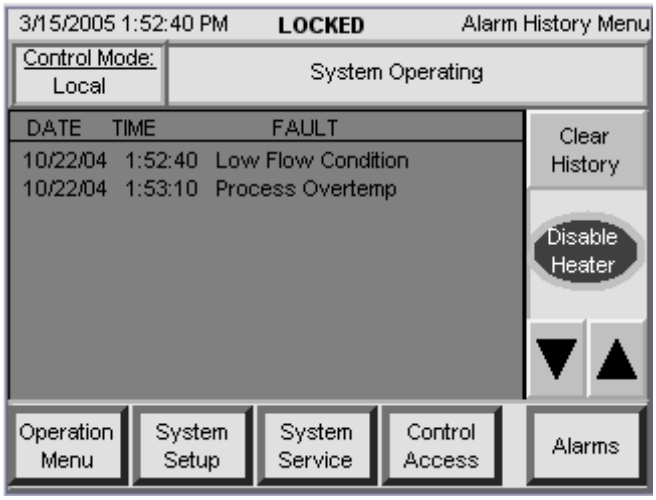


Figure 33: Alarm History Menu Screen

Alarm History Command Menu	Description
CLEAR HISTORY	This button will clear all of the entries in this menu.
▲ ▼	These two buttons will allow the operator to scroll up and down through the alarm history.

Startup Procedure:

1) Enable the power at the MAIN SERVICE DISCONNECT.
2) Ensure the disconnect handle on the front panel is in the ON Position and that the EMO button on the front panel is not depressed.
3) Establish purge gas flow.
4) Establish water flow. Allow water to flow for several minutes to ensure all entrapped air has been purged from the heating column(s).
5) Press the POWER ON switch on the front panel.
6) If all safety components are within allowable ranges, the main load/safety contactor will engage. The YELLOW indicator light will be illuminated.
7) Verify that the system parameters are correct.
8) Adjust the PROCESS SETPOINT in the OPERATIONS MENU to the desired temperature.
9) If the unit is being operated for the first time, complete the HEATER CALIBRATION STARTUP PROCEDURE. This procedure is provided on the following page.

   If the unit is not being started for the first time, proceed to step 10.

10) Press the ENABLE HEATERS button on the command panel. The unit will now start to heat the water.

Note: Steps 8 and 10 can also be accomplished through the remote control interface or on the ROI. Refer to the REMOTE INTERFACE section of this manual for more information.

Heater Calibration Startup Procedure:

This calibration procedure should be performed the first time the unit is operated. While this unit was tested and calibrated prior to shipment, this procedure will help correct for some offsets caused by variations in nominal supply voltages. While the DAC control system will compensate for these differences, performing this procedure will improve heater response.

This calibration startup procedure will disable the correction routines for the DAC control system and allow the unit to operate with an open loop control. By observing the performance of this unit without any error correction, the operator may adjust the heater to improve heater response. This procedure may not be performed while the unit is in MANUAL or REMOTE control mode.

This procedure must be performed following the STARTUP PROCEDURE provided on the previous page.

10) Once the startup procedure is complete, insure that there is an adequate and steady flow of water through the unit. Fluctuations in water flow will affect the results of calibration.

11) Access the HEATER CALIBRATION menu on the touch screen interface. Use the buttons on the navigation panel to first access the SYSTEM SETUP menu, and then press the HEATER CALIBRATION button in the information panel to access this display screen.

12) Turn the HEATER CALIBRATION setting ON. The image of the toggle switch will change to indicate that the calibration mode has been turned ON.

13) Press the ENABLE HEATER button on the command panel of the display.

14) Allow enough time for the heater to ramp up to the process setpoint and to stabilize. Depending upon the flow rate and the wattage of the unit, this may take several minutes.

Heater Calibration Startup Procedure (Continued):

15) Compare the outlet temperature of the unit to the process setpoint.

    If the outlet temperature is higher than the PROCESS SETPOINT, then decrease the OFFSET VALUE by 1%.

    If the outlet temperature is lower than the PROCESS SETPOINT, increase the OFFSET VALUE by 1%.

16) Repeat steps 14-15 until the outlet temperature matches the PROCESS SETPOINT. Once the unit outlet temperature matches the PROCESS SETPOINT the unit is calibrated. Proceed to step 17.

17) Turn the HEATER CALIBRATION setting OFF. The image of the toggle switch will change to indicate the calibration mode has been turned OFF.

	**The HEATER CALIBRATION setting must not be turned on during normal heater operation.** **The HEATER CALIBRATION mode will disable the following control performance features:** • **Overshoot compensation** • **Boost deadband** • **Error compensation** **Failure to turn the HEATER CALIBRATION setting off will result in poor temperature control and may result in over-temperature conditions.**

Shutdown:

	**The heater must be disabled and allowed to cool before the water flow is turned off. Dangerous temperatures and pressure conditions may result from improper shutdown procedures.**

1) Press the DISABLE HEATER button on the command panel of the controller. Continue water flow through the heater to allow the heating columns to cool down.
2) Maintain water flow until the outlet temperature reaches ambient as referenced from the Main screen.
3) Press the POWER OFF button located on the front panel of the heater.

Note: Steps 1 and 3 can also be accomplished through the remote control interface or on the ROI. Refer to the REMOTE INTERFACE section of this manual for more information.

4) Turn off the disconnect switch to complete the shutdown.

	**The purge gas supply MUST be maintained whenever there is liquid in the heating columns.** **Failure to maintain the purge will result in shortened heating element life.**

Note: For extended shut down periods, drain the heating columns and dry the columns internally with nitrogen or another inert gas.

Shutdown (Continued):

Draining the unit:

5) Close the customer installed service shutoff valves on the inlet and outlet of the unit. Apply any necessary lockout/tagout device.
6) Position the customer supplied 3-way valve on the inlet of the unit to open the heating columns to a non-pressurized drain.
7) Open the capped fitting of the customer supplied TEE fitting on the outlet of the unit. The heating columns will start draining.
8) Optional: the customer may apply pressurized N_2 or CDA gas to expedite the draining of the heating columns. Gas pressure must not exceed 1 Bar (14 PSI).
9) When the unit is finished draining, shut off the optional pressurized gas and close the fitting on the TEE fitting.
10) Shut off the purge gas supply. Apply lockout/tagout devices as necessary.

Alarm Conditions:

The following section describes each of the alarm conditions that may occur on the Lufran fluoropolymer inline water heater.

Alarms Menu	Alarm History Menu	Description
Gnd Fault	Ground Fault	A ground fault has occurred somewhere in the unit. This may be caused by a failed component. The cause of the ground fault must be identified and corrected before the heater is reset.
Proc o/t	Process Overtemp	The outlet water temperature has risen above the HIGH PROCESS SETPOINT value. This setting is located in the SYSTEM PARAMETERS MENU. This may be caused by a sudden and drastic decrease in flow rate or a failed SSR. When the outlet temperature falls below the value of this setting, the unit can be reset.
Humistat # (1 thru 4)	Humidistat Fault – Htr 1 thru Htr 4	There is moisture detected in the humidistat connected to the purge gas outlet of this particular heating column. This may be caused by a ruptured tube or a leaking seal in the heating column, or a normal heater response following an extended shutdown period. In most cases this leak can not be repaired and the heating column must be replaced. If restarting the heater following an extended shutdown period, exhaust the purge gas for 8-hours before attempting to reset the unit.
H2O Flow (Low Flow)	Low Flow Condition	The flow rate through the unit has dropped below the LOW FLOW SETPOINT. This setting is located in the SYSTEM PARAMETERS menu. This may be caused by shutting off the water supply to the unit. This is not an alarm event that requires a manual reset. Once the flow rate through the heater increases to a level higher than the LOW FLOW SETPOINT, the heater will automatically return to normal operation.
Cab Leak	Leak Detect	The cabinet leak detector has detected a leak inside the cabinet. This may be caused by a leaking plumbing connection or one of the heating columns. Any leaking plumbing fitting should be repaired and the leak pan must be drained before the fault can be reset. A leaking heating column must be replaced.
Inlet t/c	Inlet T/C Open	The inlet process temperature sensor has failed (open). The process temperature sensor must be replaced. This may also be caused by a disconnected sensor connection.
L. Level # (1 thru 4)	Liquid Level fault – Htr 1 thru Htr 4	The liquid level sensor at the top of heating column does not detect liquid in the outlet tube of that column. The system is disabled until the liquid level sensor detects liquid in the outlet tube of the heating column. This may be caused by a lack of water to the unit. This safety will prevent catastrophic overheat damage to the heating column. The cause of the liquid level fault must be identified and corrected before the unit can be reset.

Alarm Conditions (Continued):

Alarms Menu	Alarm History Menu	Description
N2 Purge	N2 Purge Fault	The purge gas pressure switch does not detect adequate purge gas pressure. The unit has been disabled to prevent heater failure. This may be caused by shutting off the purge gas supply to the unit. When the purge gas pressure is at an acceptable pressure, the unit can be reset.
Outlet t/c	Outlet T/C Open	The outlet process temperature sensor has failed (open). The process temperature sensor must be replaced. This may also be caused by a disconnected sensor connection.
Elem o/t # (1 thru 4)	Element OT (slc) – Htr 1 thru Htr 4	The element temperature has risen above the setting of the safety limit control (slc) module. This may be caused by lack of water flow to the unit, a failed SSR or a failed t/c sensor. This slc is redundant to the PLC control system. When the element temperature falls below the setting of the slc, the unit can be reset. **NOTE: this alarm can not be reset through the PLC. Rather, this alarm must be reset by shutting down the unit and then powering up the unit. Refer to the SHUTDOWN section on page 54 of this manual for the appropriate procedure.**
Elem o/t # (1 thru 4)	Element OT (soft) – Htr 1 thru Htr 4	This safety signal is redundant to the Element OT (slc) alarm signal. The element temperature has risen above the internal setting of the DAC™ control system, which is factory set a few degrees higher than the setting of the slc safety limit controller. This may be caused by a lack of water flow to the unit, a failed SSR or a failed t./c. The operator does not have access to view or adjust this setting. Contact PROCESS TECHNOLOGY for further details. When the element temperature falls below this setting the unit can be reset.
PRV	PRV Fault	The liquid sensor mounted in the pressure relief valve (PRV) discharge tube has detected liquid in the discharge tube. This is caused by high water pressure applied to the unit. This may be caused by inlet water pressure exceeding 6.9 bar (100 psi). When the water pressure drops to an acceptable level and the PRV closes, the unit can be reset.
SSR tco	SSR Heat Sink OT	The temperature of the heat sink for one or all of the solid state relays (SSR) has risen above the setting of the thermostat located directly on the heat sink. This may be caused by a malfunctioning fan, high ambient air temperature or inadequate air circulation through the cabinet. The SSR assembly should be replaced. The cause of this overtemp alarm must be identified and corrected before the unit can be reset.

Alarm Conditions (Continued):

Alarms Menu	Alarm History Menu	Description
Col # MB (1 thru 4)	SSR Board Fault – Htr 1 thru Htr 4	One of the SSR monitor boards has detected an open or shorted SSR. This may be caused by a failed SSR or a tripped power fuse in the unit. The tripped fuse or the failed SSR must be replaced before the unit can be reset.
PLC	PLC Fault	A problem has occurred with the PLC itself, and the system is unable to operate normally. Inspect the PLC unit itself and correct any open or broken connections. Try cycling main power to clear this fault. If the PLC Fault alarm will not clear, contact PROCESS TECHNOLOGY for assistance.
H2O PSI (Pres SW)	Low Water Pressure	The water supply pressure has dropped below the setting for the pressure switch. This may be caused by shutting off the water supply to the unit. The water pressure must increase to a level above the pressure switch setting in order for the unit to return automatically to normal operation.
Col # o/t (1 thru 4)	Column OT – Htr 1 thru Htr 4 (slc)	The water temperature inside the heating column has risen above the setting of the control system. This may be caused by lack of water flow, a failed SSR or a failed t/c sensor. The values of these temperature settings are an internal adjustment that is not accessible by the operator. It may only be adjusted by qualified personnel. When the element temperature falls below the setting of the slc, the unit can be reset. **NOTE: this alarm can not be reset through the PLC. Rather, this alarm must be reset by shutting down the unit and then powering up the unit. Refer to the SHUTDOWN section on page 53 of this manual for the appropriate procedure.**

REMOTE INTERFACE:

The remote interface is used for communication between the Lufran fluoropolymer inline water heater and a customer-supplied control device. The remote interface will allow remote operation of heater start/stop, adjustment of the process setpoint and remote monitoring of the alarm system. Some of the remote interface inputs have been jumpered at the factory, to allow for heater operation with the remote interface cable disconnected. These jumpers are located in the electrical side of the heater cabinet, and are marked by a red tag. If the customer wants to use the remote interface, these red tag jumpers must be removed.

The unit must be in REMOTE control mode in order to operate the unit through the remote interface. However, the various status signal outputs are active when in any mode of operation. Refer to the CONTROL ACCESS menu listed in the OPERATIONS section of this manual to change the PLC control system to REMOTE control mode.

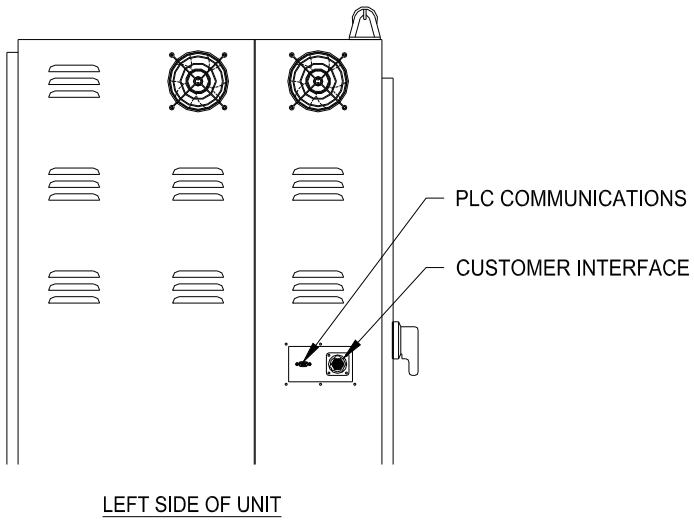


Figure 34: Customer Interface Panel

If the unit was provided with the optional expanded remote interface (**-RI**) or a custom remote interface (**-R#** at the end of the model number), then refer to the electrical prints (provided with this manual) for your specific signals and pin-out assignments.

An explanation of the pin assignments of the standard remote interface is described in the following pages:

Remote Interface (Continued):

Pin Number	Signal	Signal type	Description
1,2	EMO	Input, Dry contacts	The customer supplied remote controller can trip an EMO condition on the unit by opening contacts across these two pins. This is one of the signals that has been bypassed at the factory. In order to use this remote EMO feature, the red tag jumper must be removed. The EMO condition must be reset at the unit.
3,4	Start/Stop	Input, Dry contacts	The customer supplied remote controller can start heater operation by closing the contacts across these pins, when the controller is in REMOTE mode only. This is one of the signals that has been bypassed at the factory. In order to use this remote EMO feature, the red tag jumper must be removed. Open contacts will stop heater operation.
5,6	Process Setpoint Adjustment	Input, 4-20 mA current	This signal will change the process setpoint when the controller is in REMOTE mode only. The factory default range is as follows: 4mA = 0°C 20mA = 95°C The scale of this setting may be adjusted through the SYSTEM SETUP menu screen.
7,8	System Enabled	Output, Dry contacts	This output will apply closed contacts across these pins when power is applied to the unit and there is not EMO condition. Open contacts indicate the EMO has been tripped or the unit has been shut down.

Remote Interface (Continued):

Pin Number	Signal	Signal type	Description
7,9	System Operating	Output, Dry Contacts	This output will apply closed contacts across these pins when the SSRs are firing, and heat is generated. Open contacts indicate the heater operation has stopped due to any one of the following reasons: Reduction in flow rate Reduction in water pressure The HEATER DIABLE button on the command panel has been pressed The HEATER OFF pushbutton on the front of the unit has been pressed. The EMO button has been pressed. One of the alarms has been tripped.
10,11	System @ Setpoint	Output, Dry Contacts	This output will apply closed contacts across these pins when the outlet temperature is within the PROCESS +/- DEVIATION from the PROCESS SETPOINT. Open contacts indicate the outlet temperature is not within the PROCESS +/- DEVIATION setting.
10,12	System Fault	Output, Dry Contacts	This output will apply open contacts across these pins when any alarm condition has been tripped. Once the alarm condition has been corrected, the unit will require a manual reset at the unit. The unit can not be reset remotely. Closed contacts indicate all of the safety devices are in normal operating mode.

REMOTE TOUCH-SCREEN INTERFACE (-ROI Option):

The remote touch-screen interface (ROI) is used for communication between the Lufran fluoropolymer inline water heater and a remote touch-screen device. The remote touch-screen will allow remote operation of heater in the same manner as the touch-screen device mounted within the heater cabinet.

The unit must be in ROI control mode in order to operate the unit through the remote touch-screen interface. However, the screen displays are shown when in any mode of operation. Refer to the CONTROL ACCESS menu listed in the OPERATIONS section of this manual to change the PLC control system to ROI control mode.

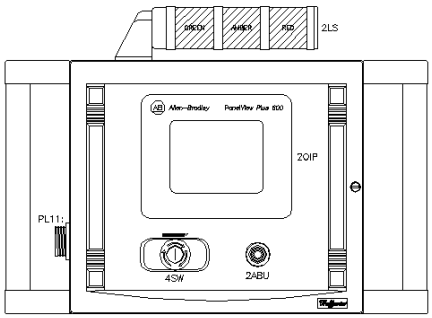
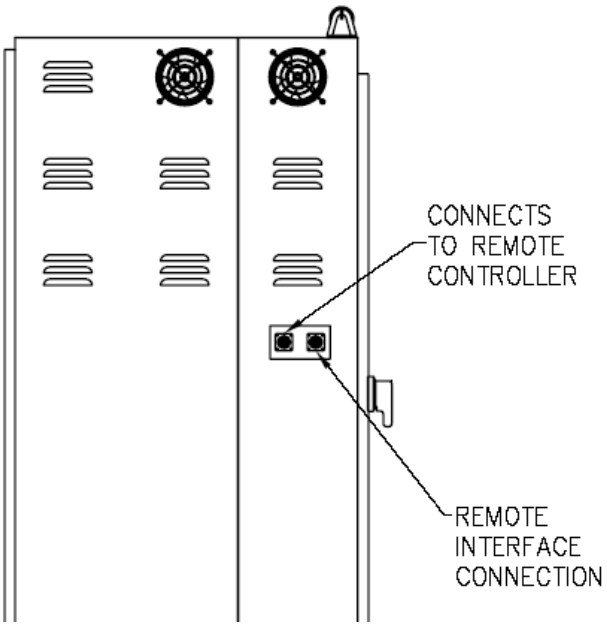


Figure 35: ROI Panel "REMOTE TOUCH_SCREEN INTERFACE"



Left Side of Unit

Figure 36: Customer Interface Panel

Remote Touch-Screen Interface (ROI Option) (Continued):

If the unit was provided with the optional remote touch-screen interface (**-ROI**) then refer to the electrical prints (provided with this manual) for your specific signals and pin-out assignments.

The displays on the remote touch-screen interface are the same as the cabinet mounted touch-screen, with the exception of the following: the CONTROL ACCESS button is not on the ROI screen. Also, the FAULT RESET button does not appear on the ROI screen when the heater is not in ROI mode.

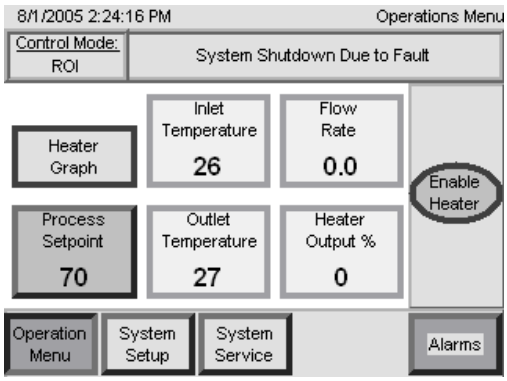


Figure 37: ROI Screen "OPERATIONS MENU"

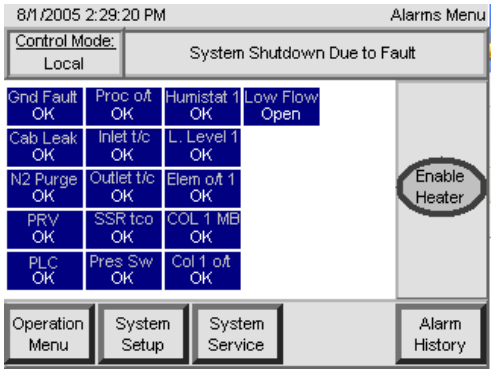


Figure 38: ROI Screen "ALARMS MENU" LOCAL MODE

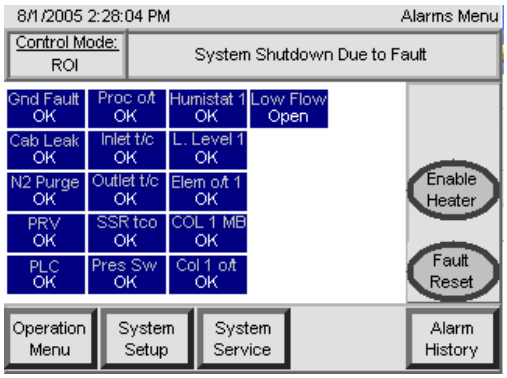


Figure 39: ROI Screen "ALARMS MENU" ROI MODE

OPTIONAL COMMUNICATIONS:

Ethernet (-C1 option):

The **–C1** communications option adds Ethernet communications to the PLC controller. The network can interface with the Lufran heater through the RJ45 connector included with the unit.

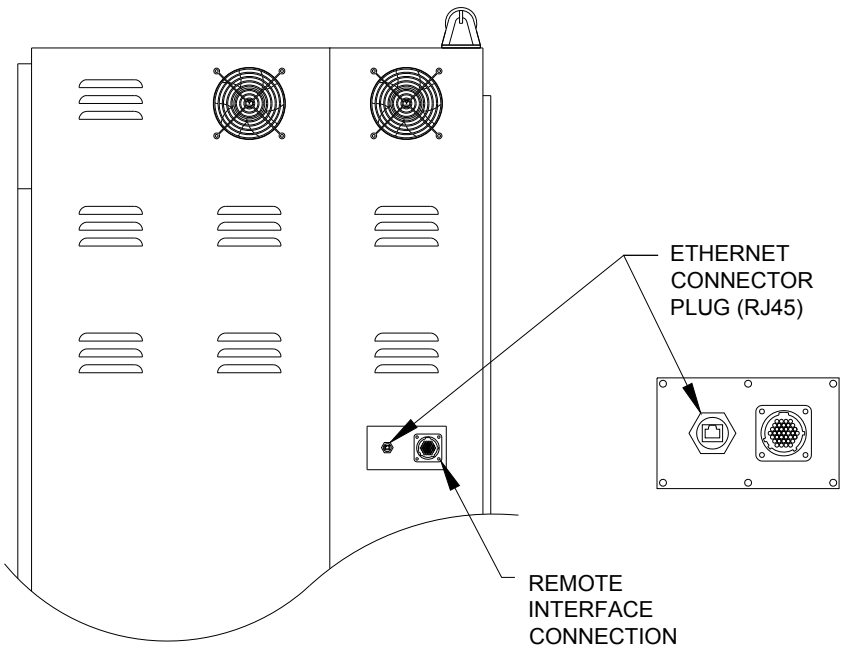


Figure 40: Ethernet RJ45 connector plug

The Lufran heater is provided with the following **default IP Address: 128.1.105.100**. Once connected to the network, the customer may wish to change the IP address. Adjusting the IP Address or performing other networking tasks with the Lufran heater will require the use of ***ENI Utilities*** software, available from Allen-Bradley. This software along with their instruction manual is available as a free download through their website:

http://www.ab.com/plclogic/micrologix/networkinterfaces

OPTIONAL COMMUNICATIONS (Continued):

DeviceNet (-C2 option):

The **–C2** communications option adds DeviceNet communications to the PLC controller. The network can interface with the Lufran heater through the DeviceNet male mini connector included with the unit.

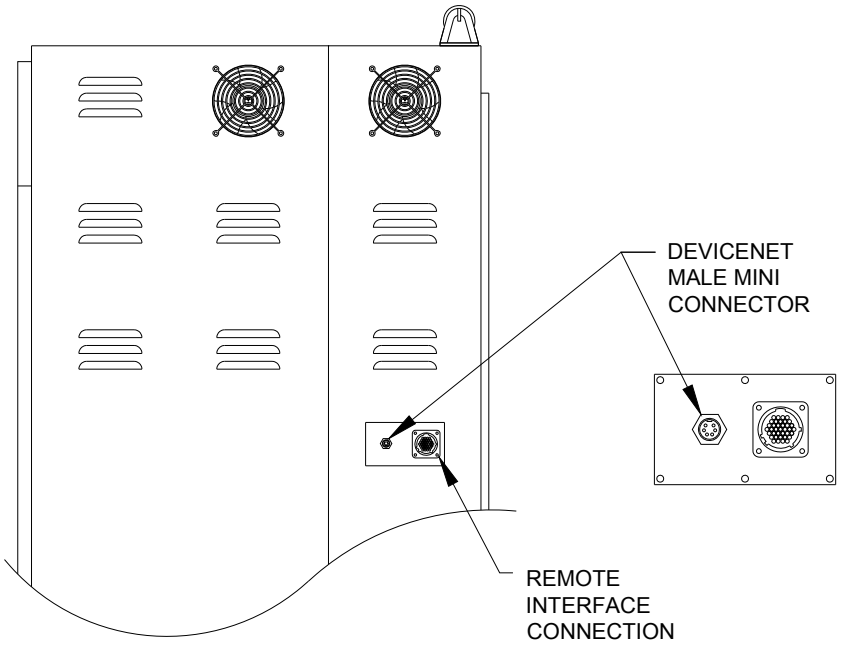


Figure 41: DeviceNet male mini connector plug

The Lufran heater is provided with the following **default node assignment: 63**. Once connected to the network, the customer must assign a new node to the Lufran heater. Assigning the node or performing other networking tasks with the Lufran heater will require the use of ***DNI Utilities*** software, available from Allen-Bradley. This software along with their instruction manual is available as a free download through their website:

http://www.ab.com/plclogic/micrologix/networkinterfaces

OPTIONAL COMMUNICATIONS (Continued):

Integer Points:

The following table describes the standard integer points of the Lufran water heater. These integer points are the same for both Ethernet (**-C1**) and DeviceNet (**-C2**) communications

Integer Point	Data	Signal type	Description
N48:01	Inlet water temperature (°C)	Heater output	The value provided is the measured inlet water temperature.
N48:02	Outlet water temperature (°C)	Heater output	The value provided is the measured outlet water temperature. This integer point may be used to monitor the outlet temperature of the heater through the network.
N48:03	Flow rate (liters/min)	Heater output	The value provided is the measured water flow rate through the heater.
N48:04	Heater output (%)	Heater output	The value provided is the current percentage (%) output of the heating column(s).
N48:05	Set point (°C)	Heater output	The value provided is the outlet set point of the heater. When the system is in REMOTE control mode, this value should match integer point N50:11.
N48:07	Remote control	Heater output	0 = System is in LOCAL control mode 1 = System is in REMOTE control mode This setting is adjusted in the control access menu, through the operator interface touch screen.
N48:15	System enabled	Heater output	0 = System disabled 1 = System enabled
N48:16	System operating	Heater output	0 = Not operating 1 = Operating
N48:17	System at temperature	Heater output	0 = Outlet temperature is not within the process deviation setting 1 = Outlet temperature is within the process deviation setting
N48:18	System fault	Heater output	0 = No system fault detected 1 = System fault detected
N48:19	Error code	Heater output	The value provided will indicate which safety device has tripped the system fault. For an explanation of a specific error code, please consult the factory.

Integer Points (Continued):

Integer Point	Data	Signal type	Description
N50:10	Remote start/stop	Heater input	0 = Stop heater operation 1 = Start heater operation
N50:11	Heater set point (°C)	Heater input	The value provided from the network to the heater will be the desired outlet set point of the heater. When the system is in REMOTE control mode, this value should be matched by integer point N48:05.

MAINTENANCE:

The Lufran fluoropolymer inline water heater requires only a routine inspection every 6 months to check the operation of the various operation and safety devices. The maintenance procedures listed here should only be performed by qualified technicians. Many of these devices require the control system to remain operational during inspection, while others may be checked while the unit is completely powered down.

Note: Several maintenance tasks can be completed simultaneously while the cabinet access covers are open and lockout/tagout procedures are in place.

Appendix I at the end of this manual is a copy of a maintenance checklist that can be used for the routine inspection of this heater. Have loose copies of this checklist available for your maintenance technicians.

Maintenance Procedures (Continued):

Maintenance Schedule:

Categories of Electrical Hazards

Type	Description
1	Equipment is energized, but live circuits are covered or insulated to prevent accidental shock.
2	Equipment is energized and energized circuits of less than 24 VDC, 240 VA and 20 joules are exposed to accidental contact.

Maintenance To Be Performed Every 6 Months:

Item to Inspect	Lockout / Tagout Required (Y/N)	Electrical Hazard Category (1-2)	Procedure Number
Outlet plumbing liquid level sensor(s), top-half plumbing	N	1	M1
Outlet process sensor, column TC sensor(s)	N	1	M2
Leak detector	N	1	M3
Purge gas flow switch	N	2	M4
Humidistat purge exhaust, humidistat switch	N	2	M5
Pressure relief valve (PRV), bottom-half plumbing	N	1	M6
PRV sensor	N	1	M7
Cabinet cooling fans	N	1	M8
SSR heat sink cooling fans	N	1	M9
Circuit breaker	N	2	M10
Audible alarm	N	1	M11
Indicator lights	N	1	M12
Remote Interface	N	1	M13
Safety Contactor	Y	2	M14

Maintenance Procedures (Continued):

M1: Liquid Level Sensor, Top Half Plumbing

There is one liquid level sensor located at the top of each heating column. This liquid level sensor is a capacitive sensor that must be inspected for proper adjustment every 6 months. If the sensor is out of adjustment, it may be re-calibrated.

Procedure M1-1: Liquid Level Sensor Inspection Procedure:

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the OIP. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller. This will also prevent the heaters from energizing.
2) Continue water flow through the unit for this procedure. Allow the unit to cool to ambient inlet temperature.
3) Open the rear cabinet door.
4) Inspect all of the plumbing connections on the top half of the unit for possible leaks. Any leaks found must be repaired.
5) Locate the capacitance-type sensor on the (top) outlet manifold of the column assembly. Notice the LED is red when operating properly. The liquid level sensor should be about 3.5mm (0.125-inch) away from the outlet manifold.

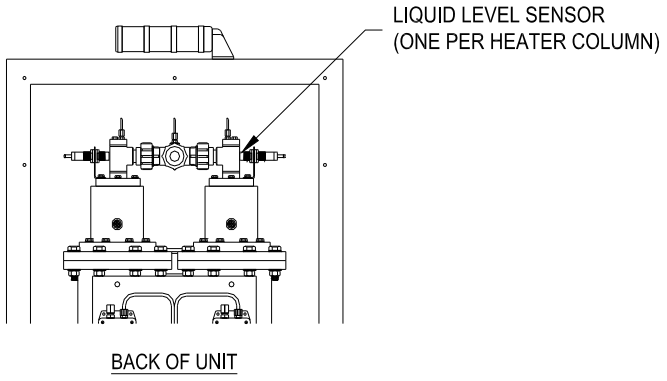


Figure 42: Liquid Level Sensor

Maintenance Procedures (Continued):

Procedure M1-1 (Continued):

6) Gently push downward on the back of the sensor. The slightest deflection from horizontal should cause the sensor to alarm. The red LED on the sensor will turn off to signify an alarm condition.

⚠ CAUTION	**Do not move the liquid level sensor position in the mounting bracket, or the sensor will lose its calibration. If the liquid level sensor has shifted in the mounting bracket, then the sensor MUST be re-calibrated.**

When the red LED illuminates, the unit will enter alarm mode. The red light on the top of the unit will illuminate and the ALARMS MENU on the touchscreen display will appear. The L Level 1 or L Level 2 alarm will flash on the display.

7) Press the FAULT RESET button on the command panel of the touch screen display to clear the fault condition.

8) If the red LED fails to illuminate and the unit fails to enter alarm mode, then the level sensor must be re-calibrated.

Procedure M1-2: Liquid Level Sensor Calibration Procedure:

1) Insure the liquid level sensor is properly positioned in facing the outlet tube of the heating column. The sensor should be about 3.5mm (0.125-inch) away from the outlet manifold.

2) Using a small flat blade screwdriver, turn the sensor adjustment potentiometer on the back of the sensor clockwise until the red LED on the sensor illuminates.

3) Once the red LED illuminates, turn the adjustment potentiometer an additional ¼ turn clockwise.

4) Repeat the inspection procedure above. If the sensor again fails to trip and/or reset from alarm mode, repeat the calibration procedure or replace the liquid level sensor.

Maintenance Procedures (Continued):

Procedure M1-3: Liquid Level Sensor Replacement Procedure:

1) Press the DISABLE HEATER button on the OIP to allow the unit to cool to ambient inlet temperature. This will also prevent the heaters from engaging.
2) Turn OFF Power to the unit.

⚠ CAUTION	**Verify that the electrical supply is shut off, and any necessary lockout/tagout devices are properly installed.**

3) Open the rear cabinet door. Locate the liquid level sensor to be replaced.
4) Disconnect the connector plug for the liquid level sensor.
5) Loosen and remove the two nuts that are holding the liquid level sensor in the bracket.
6) Slide the liquid level sensor out of the bracket.
7) Insert the new liquid level sensor into the bracket. Attach and tighten the two nuts on the liquid level sensor to fix its position.
8) Make sure that the position of the liquid level sensor is 3.5mm (0.125-inches) away from the outlet plumbing manifold. If necessary, adjust and re-tighten the two nuts to adjust the sensor position.
9) Restore power to the unit.
10) Perform procedure *M1-2: liquid level sensor calibration procedure* and then *M1-1: liquid level sensor inspection procedure*, provided on the previous two pages.
11) If the sensor passes the inspection, the unit may be restarted and returned to service.

Maintenance Procedures (Continued):

M2: Inlet/Outlet Process Sensor, Column TC Sensor(s)

The inlet process temperature sensor is located in the TEE fitting directly after the inlet plumbing connection. The outlet process temperature sensor is located in the TEE fitting directly before the outlet plumbing connection. The column temperature sensor(s) are located in the top manifold of each heating column, labeled COLUMN TC. These sensors should be checked for proper operation every 6 months.

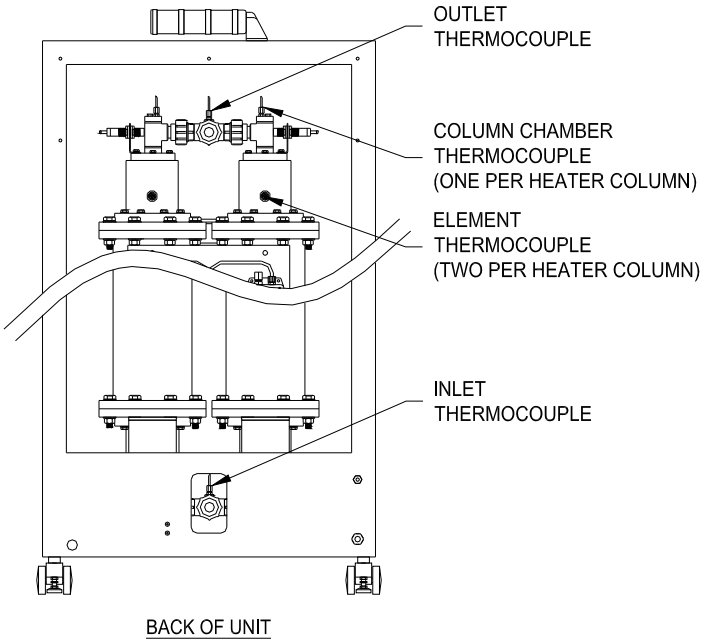


Figure 43: Thermocouple Locations

Procedure M2-1: Outlet Process Temperature Sensor, Column TC Sensor Inspection Procedure:

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the OIP. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller. This will also prevent the heaters from energizing.
2) Continue water flow through the unit for this procedure. Allow the unit to cool to ambient inlet temperature.
3) Open the rear cabinet door. Locate the outlet process temperature sensor located in the TEE fitting directly in front of the outlet plumbing connection.

Maintenance Procedures (Continued):

Procedure M2-1 (Continued):

4) Disconnect the connector plug for the outlet process temperature sensor. The unit will enter alarm mode. The red light on the top of the unit will illuminate and the ALARMS MENU on the touchscreen display will appear. The OUTLET T/C alarm will flash on the display.

5) Reconnect the connector plug for the outlet process temperature sensor. Press the FAULT RESET button on the command panel of the touch screen display to clear the fault condition.

6) Disconnect the connector plug for the inlet process temperature sensor. The unit will enter alarm mode. The red light on the top of the unit will illuminate and the ALARMS MENU on the touchscreen display will appear. The INLET T/C alarm will flash on the display.

7) Reconnect the connector plug for the inlet process temperature sensor. Press the FAULT RESET button on the command panel of the touch screen display to clear the fault condition.

8) Locate the column TC sensor(s), located in the top of each heating column.

9) Disconnect the connector plug for the each of the column TC sensor. The unit will enter alarm mode. The red light on the top of the unit will illuminate and the ALARMS MENU on the touchscreen display will appear. The COL 1 O/T and COL 2 O/T alarm will flash on the display.

10) Reconnect the connector plugs for these sensors. Press the FAULT RESET button on the command panel of the touch screen display to clear the fault condition.

Maintenance Procedures (Continued):

Procedure M2-2: Inlet Process, Outlet Process or Column TC Sensor Replacement Procedure:

1) Press the DISABLE HEATER button on the OIP to allow the unit to cool to ambient inlet temperature. This will also prevent the heaters from engaging.
2) Turn OFF Power to the unit.

	**Verify that the electrical supply is shut off, and any necessary lockout/tagout devices are properly installed.**

3) STOP flow of water to the unit and drain column assembly. A provision for draining the unit must be installed on the inlet plumbing when the unit is installed. If not method of draining the unit was provided, the inlet water connection must be removed. Apply lockout-tagout as required by your facility.
4) Open the rear cabinet door. Locate the sensor to be replaced.
5) Disconnect the 4-pin connector plug for the sensor.
6) Loosen the 1/8-inch fitting and remove the sensor from the fitting.
7) Insert the new sensor until the black label reaches the top of the 1/8-inch compression nut. Tighten the fitting.
8) Attach the 4-pin connector plug.
9) Close the drain and allow water to flow through the unit. Check for leaks. If the fitting is not leaking, the unit may be restarted.

Maintenance Procedures (Continued):

M3: Leak Detector

There is one leak detector sensor located at the bottom of the plumbing side of the cabinet. This device is a float switch that detects the presence of liquid in the bottom of the cabinet.

Procedure M3-1: Leak Detector Inspection Procedure:

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the OIP. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller. This will also prevent the heaters from energizing.
2) Open the rear cabinet door.
3) Locate the leak detector near the bottom of the cabinet. Verify that there is no liquid in the bottom of the cabinet.

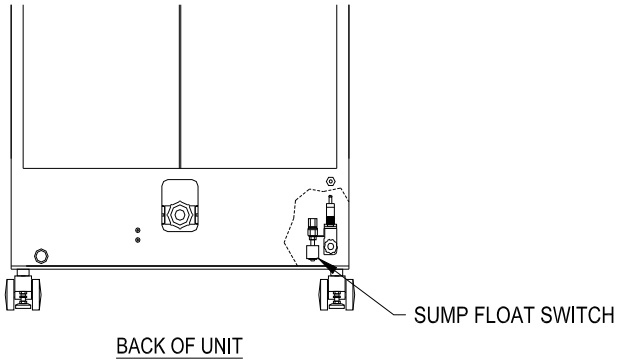


Figure 44: Leak Detector

4) Raise the float with your hand. The unit will enter alarm mode. The red light on the top of the unit will illuminate and the ALARMS MENU on the touchscreen display will appear. The CAB LEAK alarm will flash on the display.
5) Press the FAULT RESET button on the command panel of the touch screen display to clear the fault condition.

Maintenance Procedures (Continued):

Procedure M3-2: Leak Detector Replacement Procedure:

1) Press the DISABLE HEATER button on the OIP to allow the unit to cool to ambient inlet temperature. This will also prevent the heaters from engaging.
2) Turn OFF Power to the unit.

⚠ CAUTION	**Verify that the electrical supply is shut off, and any necessary lockout/tagout devices are properly installed.**

3) Open the rear cabinet door.
4) Disconnect the electrical connector for the leak detector from the multi-port sensor/actuator box located on the back panel. This connector us usually connected to port 3, but refer to your electrical prints to confirm the correct port number.
5) If needed, remove the electrical connector from the leak detector to ease in the wiring removal from the cabinet. If necessary, cut and remove any cable ties that hold the leak detector wiring.
6) Loosen and remove the fitting that holds the leak detector to the mounting bracket.
7) Slide the leak detector from the fitting on the bracket.
8) Install the new leak detector into the fitting.
9) Route the new wiring in the same pattern as the previous leak detector wiring.
10) Connect the leak detector plug to multi-port sensor/actuator box.
12) Restore power to the unit.
13) Perform procedure *M3-1: leak detector inspection procedure*.
14) If the sensor passes the inspection, the unit may be restarted and returned to service.

Maintenance Procedures (Continued):

M4: Purge Gas Flow Switch

There is one purge gas flow switch for the entire unit. It must be inspected every 6 months.

Procedure M4-1: Purge Gas Flow Switch Inspection Procedure:

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the OIP. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller. This will also prevent the heaters from energizing.
2) Shut off purge gas flow. The unit will enter an alarm condition. The red light on the top of the unit will illuminate and the ALARMS MENU on the touchscreen display will appear. The N2 Purge alarm will flash on the display.
3) Restart purge gas flow. Verify that the purge gas supply pressure is regulated between 1.75 – 6.9 bar (25 – 100 psig).
4) Press the FAULT RESET button on the command panel of the touch screen display to clear the fault condition.

   If the unit fails to generate an alarm or fails to reset, the switch must be replaced. There is no calibration procedure for this part.

Procedure M4-2: Purge Gas Flow Switch Replacement Procedure:

1) Press the DISABLE HEATER button on the OIP to allow the unit to cool to ambient inlet temperature. This will also prevent the heaters from engaging.
2) Turn OFF Power to the unit.

⚠ CAUTION	**Verify that the electrical supply is shut off, and any necessary lockout/tagout devices are properly installed.**

3) Turn off the purge gas supply to the unit.

⚠ CAUTION	**Verify that the purge gas supply is shut off, and any necessary lockout/tagout devices are properly installed.**

Maintenance Procedures (Continued):

4) Open the rear cabinet door.

5) Cut the lead wires coming out of the purge gas flow switch.

6) Loosen and remove the compression fitting nuts for the purge gas tubing connected to the inlet and the outlet of the purge gas flow switch. Retain the compression nuts and ferrules for use in step 13.

7) Remove the tubing from the inlet and outlet connections of the purge gas flow switch. Note the inlet and outlet tubing so the replacement switch will be connected properly.

8) Loosen the set-screw in the mounting bracket that keeps the flow switch in place. Remove the old switch.

9) Loosen and remove the compression fittings connected to the inlet and outlet connections of the purge gas flow switch. Retain these fittings for use in step 10. Discard the old flow switch.

10) Re-tape and install these two compression fittings into the new purge gas flow switch.

11) Install the new flow switch into the mounting bracket. Tighten the set-screw to hold the switch in position.

12) Splice the lead wires from the purge gas flow switch to the two wires that were cut in step 5. The polarity of these wires is not important.

13) Reconnect the purge gas tubing to the inlet and the outlet of the purge gas flow switch. Use the compression nuts and ferrules retained in step 6 and the tubing disconnected in step 7. Be sure to observe the correct polarity or the switch will not function.

14) Turn on the purge gas supply to the unit. Check the flow switch for gas leaks.

15) Restore power to the unit.

16) Perform procedure *M4-1: Purge Gas Flow Switch Inspection Procedure*.

17) If the purge gas flow switch passes the inspection, the unit may be restarted and returned to service.

Maintenance Procedures (Continued):

M5: Humidistat Purge Exhaust, Humidistat Switch

There is one humidistat device mounted on each heating column. These items are responsible for monitoring the purge gas exhaust for the presence of moisture. These humidistat devices must be inspected every 6 months.

Procedure M5-1: Humidistat Inspection Procedure:

The inspection part of this procedure must be repeated for each heating column.

Inspect the purge gas exhaust tubing:

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the OIP. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller. This will also prevent the heaters from energizing.
2) Open the rear cabinet door.
3) Locate the humidistat device(s) mounted on each heating column.

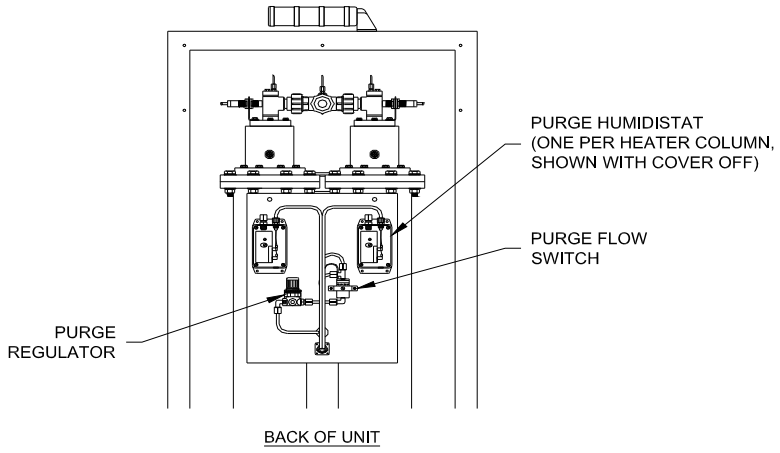


Figure 45: Purge Gas Control

4) Locate the ¼-inch tubing connected between the top of the heating column and the humidistat. The outlet of the purge column is labeled EXHAUST.

Maintenance Procedures (Continued):

Procedure M5-1 (Continued):

5) Inspect the tubing for the presence of moisture.

   If no moisture is present, then proceed to step 6.

   If moisture is present it may be caused by the following:

   - Startup following extended shutdown: If the heater was shut down for an extended period but was not drained properly, moisture will enter the purge tubing. This heater should be purged with gas for 12 hours before startup is attempted.
   - Failed heating column: A hole in the heating element or a leaking purge gas fitting will allow water into the exhaust tube. Contact PROCESS TECHNOLOGY for possible replacement heating column.

Inspect the adjustment of the humidistat:

6) Using a screwdriver remove the four cover screws and remove the cover from each humidistat device.

7) Turn the adjustment knob on the humidistat clockwise. The unit will enter an alarm condition. The red light on the top of the unit will illuminate and the ALARMS MENU on the touchscreen display will appear. Depending upon which humidistat is being tested, the Humistat 1 or Humistat 2 alarm will flash on the display.

8) To re-adjust the humidistat, turn knob fully counter-clockwise, then 1/8 turn clockwise.

9) Press the FAULT RESET button on the command panel of the touch screen display to clear the fault condition.

10) Repeat steps 7-9 for the humidistat on each heating column.

    If the unit fails to fault when the adjustment knob is turned fully clockwise, or the unit fails to reset the alarm condition then the humidistat should be replaced. Proceed to the humidistat replacement procedure on the next page.

11) Replace the black plastic enclosure cover of the humidistat.

12) Close the rear cabinet door.

Maintenance Procedures (Continued):

Procedure M5-2: Humidistat Replacement Procedure:

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the OIP. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller.
2) Allow the unit to cool to ambient temperature. Press the POWER OFF button on the front of the unit.
3) Shut down the unit. Turn off main power. Shut off the purge gas supply

⚠ CAUTION	**Verify that the electrical supply and the purge gas supply is shut off, and any necessary lockout/tagout devices are properly installed.**

4) Open the rear cabinet door.
5) Remove the black plastic enclosure cover on the humidistat.
6) Remove female disconnect terminal connectors.
7) Remove screw from the center of the humidistat switch and remove the humidistat from the unit. Install new humidistat and replace center screw to mount the switch to the unit.

Caution: Do not over tighten. The humidistat device needs to be fairly loose in the black box so that the switch setting is not impeded.

8) Replace female disconnect terminal connectors.
9) Remove electrical lockout/tag out devices as required by facility guidelines. Turn ON POWER to the unit.
10) Perform procedure *M5-1: Humidistat Inspection Procedure* and verify that humidistat is operating properly by performing the humidistat inspection procedure listed in this section of the manual.
11) Replace the black plastic enclosure cover on the humidistat.
12) Replace the rear cabinet panel.

Maintenance Procedures (Continued):

M6: Pressure Relief Valve (PRV), Bottom Half Plumbing

The PRV is located near the inlet water plumbing connection at the bottom of the heater side of the cabinet. The PRV and the inlet plumbing should be inspected every 6 months to insure that there are no leaks.

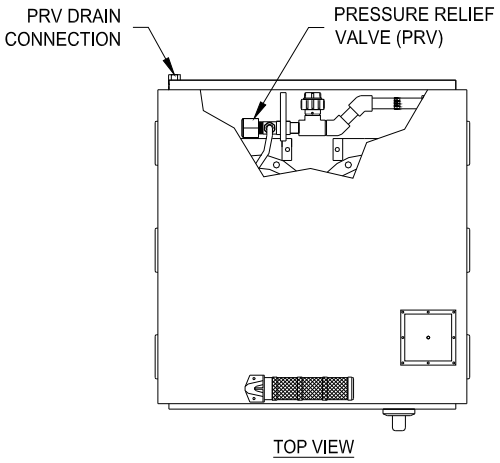


Figure 46: PRV location

Procedure M6-1: PRV Inspection Procedure:

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the touchscreen. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller. This will also prevent the heaters from energizing.
2) Continue water flow through the unit for this procedure. Allow the unit to cool to ambient inlet temperature.
3) Open the rear cabinet door.
4) Inspect all of the plumbing connections on the bottom half of the unit for leaks. Any leaks found must be repaired.
5) Locate the PRV which is connected to the TEE fitting that is adjacent to the inlet plumbing connection (see figure).
6) Inspect the discharge tubing of the PRV. Confirm that there is no liquid in the discharge tube. If the PRV is leaking it must be replaced.
7) Confirm that the weep hole of the PRV is not leaking.

Maintenance Procedures (Continued):

Procedure M6-2: PRV Replacement Procedure:

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the OIP. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller. Press the POWER OFF button on the front of the unit.
2) Continue water flow through the unit and allow it to cool to ambient temperature. Shut off power to the unit.
3) STOP flow of water to the unit. Drain the unit. A provision for draining the unit must be installed on the inlet plumbing when the unit is installed.

⚠ CAUTION	**Verify that the electrical supply and water supply is shut off, and any necessary lockout/tagout devices are properly installed.**

4) Once the system is drained, open the rear cabinet door. The PRV is attached to the TEE on the inlet plumbing.
5) Disconnect the ½-inch fluoropolymer discharge tube by loosening and removing the compression fitting on the PRV.
6) Unscrew and remove the PRV by turning the PRV body counter-clockwise.
7) Replace the O-Ring located in the inlet manifold for any damage.
8) Screw the new PRV into the inlet manifold connector.

Caution: Do not disturb the setting of the gray pvc adjustment cap. Do not over-tighten the compression fitting.

9) Re-connect the ½-inch discharge tubing to the PRV.
10) Start flow of water to the unit and check for leaks.
11) Close the rear cabinet door.

Maintenance Procedures (Continued):

M7: PRV Sensor

There is one liquid sensor located at the outlet fitting for the PRV discharge. This is a capacitive sensor. This sensor must be inspected for proper adjustment every 6 months. If the sensor is out of adjustment, it may be re-calibrated. If it fails to re-calibrate then it should be replaced.

Procedure M7-1: PRV Sensor Inspection Procedure:

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the OIP. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller. This will also prevent the heaters from energizing.
2) Continue water flow through the unit for this procedure. Allow the unit to cool to ambient inlet temperature.
3) Open the rear cabinet door. The PRV sensor is located next to the cabinet leak detector, just inside of the PRV outlet plumbing connection. The sensor is mounted on a metal plate, above the PRV discharge tubing.
4) Place your finger between the sensor and the PRV discharge tubing. The red LED on the back of the sensor will illuminate. When the red LED illuminates, the unit will enter alarm mode. The red light on the top of the unit will illuminate and the ALARMS MENU on the touchscreen display will appear. The PRV alarm will flash on the display.
5) Remove your finger from in between the sensor and the PRV discharge tubing. The red LED on the back of the sensor should turn off.
6) Press the FAULT RESET button on the command panel of the touch screen display to clear the fault condition.
7) If the red LED fails to illuminate and the unit fails to enter alarm mode, then the level sensor must be recalibrated.

Maintenance Procedures (Continued):

Procedure M7-2: PRV Sensor Calibration Procedure:

1) Insure the liquid sensor is properly positioned in facing the PRV discharge tube of the heating unit. The sensor face should be about 3.5mm (0.125-inch) away from the tube.

2) Using a small flat blade screwdriver, turn the sensor adjustment potentiometer on the back of the sensor clockwise until the red LED on the sensor illuminates.

3) Once the red LED illuminates, turn the adjustment potentiometer counterclockwise until the LED on the sensor turns off. Then turn the adjustment potentiometer an additional ¼ turn counterclockwise, verifying the LED does not illuminate.

4) Repeat the inspection procedure above. If the sensor again fails to trip and/or reset from alarm mode, repeat the calibration procedure or replace the sensor.

Maintenance Procedures (Continued):

Procedure M7-3: PRV Sensor Replacement Procedure:

1) Press the DISABLE HEATER button on the OIP to allow the unit to cool to ambient inlet temperature. This will also prevent the heaters from engaging.
2) Turn OFF Power to the unit.

	**Verify that the electrical supply is shut off, and any necessary lockout/tagout devices are properly installed.**

3) Open the rear cabinet door. Locate the PRV sensor.
4) Disconnect the connector plug for the PRV sensor from the multi-port sensor/actuator box. This connector us usually connected to port 3, but refer to your electrical prints to confirm the correct port number.
5) Loosen and remove the two nuts that are holding the liquid level sensor in the bracket.
6) Slide the PRV sensor out of the bracket.
7) Insert the new PRV sensor into the bracket. Attach and tighten the two nuts on the sensor to fix its position.
8) Make sure that the position of the PRV sensor is 3.5mm (0.125-inches) away from the PRV discharge tubing. If necessary, adjust and re-tighten the two nuts to adjust the sensor position.
9) Connect the connector plug for the new PRV sensor to the multi-port sensor/actuator box.
10) Restore power to the unit.
11) Perform procedure *M7-2: PRV sensor calibration procedure* followed by procedure *M7-1: PRV sensor inspection procedure*.
12) If the sensor passes the inspection, the unit may be restarted and returned to service.

Maintenance Procedures (Continued):

M8: Cabinet Cooling Fans

There are two cooling fans located in the heater cabinet. Both fans are located on the left side of the unit, near the top. One cooling fan is mounted in the electrical side, and one cooling fan is located in the plumbing side of the cabinet. These cooling fans should be operating continuously while power is applied.

The cooling fans should be replaced every 24-months.

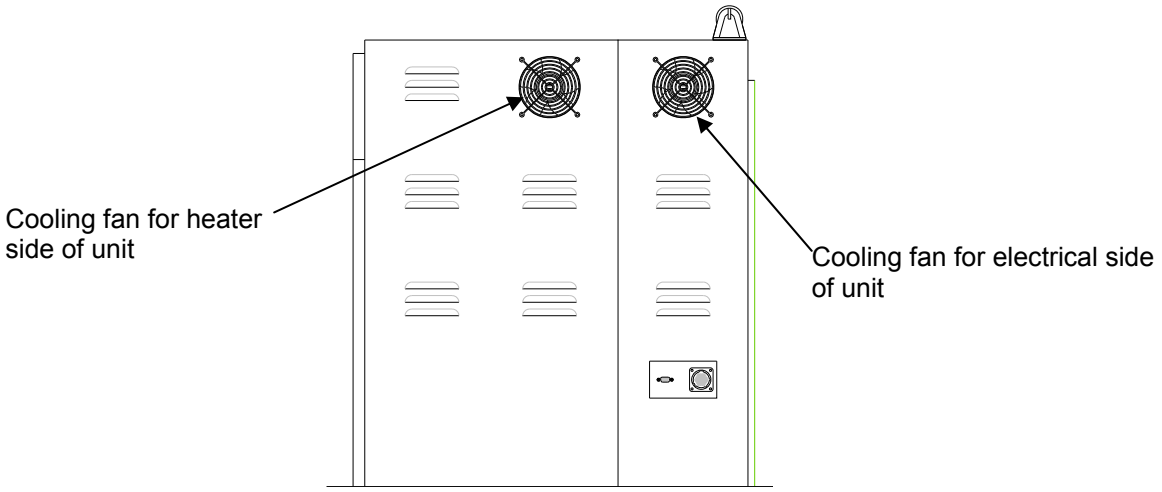


Figure 47: Cabinet Cooling Fans

Procedure M8-1: Cooling Fan Inspection Procedure:

Verify that the cooling fans are operating. If a cooling fan has stopped, it must be replaced.

Maintenance Procedures (Continued):

Procedure M8-2: Cooling Fan Replacement Procedure:

Cooling fan located in heater side of the cabinet:

1) Press the DISABLE HEATER button on the OIP to allow the unit to cool to ambient inlet temperature. This will also prevent the heaters from engaging.
2) Turn OFF Power to the unit.

⚠ CAUTION	**Verify that the electrical supply is shut off, and any necessary lockout/tagout devices are properly installed.**

3) Open the rear cabinet door.
4) Disconnect the connector plug for the cooling fan from the multi-port sensor/actuator box. This connector us usually connected to port 2, but refer to your electrical prints to confirm the correct port number.
5) Disconnect the fan wires from the connector plug.
6) Remove the cooling fan and fan guard from the sidewall of the cabinet.
7) If the replacement fan is not wired to a connector plug, then wire the replacement fan to the existing connector plug.
8) Attach the replacement fan and fan guard to the side of the cabinet.
9) Connect the connector plug for the cooling fan to the multi-port sensor/actuator box.
10) Remove lockout-tagout items. Power up the unit. Confirm that the replacement fan is operating.

Maintenance Procedures (Continued):

Procedure M8-2: Cooling Fan Replacement Procedure:

Cooling fan located in the electrical side of the cabinet:

1) Press the DISABLE HEATER button on the OIP to allow the unit to cool to ambient inlet temperature. This will also prevent the heaters from engaging.
2) Turn OFF Power to the unit.

⚠ CAUTION	**Verify that the electrical supply is shut off, and any necessary lockout/tagout devices are properly installed.**

3) Open the front cabinet door.
4) Locate the power wires going from the cooling fan to the terminal blocks on the ground plate. Refer to the electrical prints of the unit for the correct terminal block numbers. Disconnect the fan wires from the terminal blocks.
5) Remove the cooling fan and fan guard from the sidewall of the cabinet.
6) Attach the replacement fan and fan guard to the side of the cabinet.
7) Re-connect the cooling fan wires to the terminal blocks.
8) Remove lockout-tagout items. Power up the unit. Confirm that the replacement fan is operating.

Maintenance Procedures (Continued):

M9: SSR Cooling Fans

Each solid state relay (SSR) module has an aluminum heat sink with a cooling fan mounted on the underside. This fan draws cool air into the unit through the underside of the cabinet. These SSR modules are located at the bottom of the electrical side of the cabinet. The cooling fan should be operating continuously while power is applied.

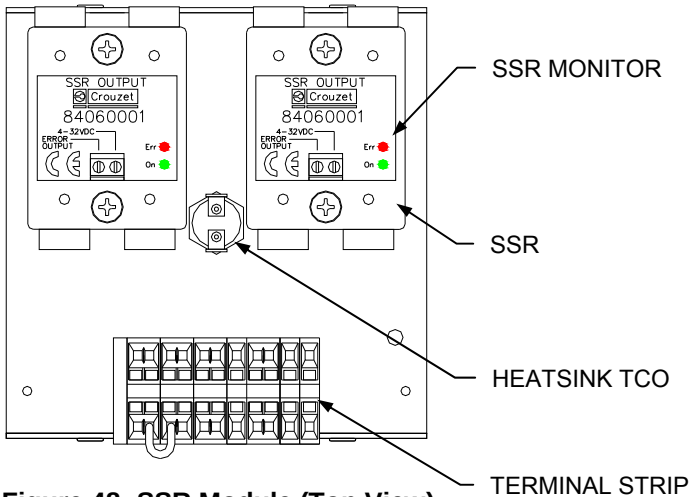


Figure 48: SSR Module (Top View)

Procedure M9-1: SSR Cooling Fan Inspection Procedure:

Open the front cabinet door. Verify that the cooling fans are operating. If a cooling fan has stopped, it must be replaced. Since a failed SSR fan will cause thermal stress to those SSRs mounted on the heat sink, it is recommended to replace the entire SSR module rather than just the fan.

Procedure M9-2: SSR Cooling Fan Replacement Procedure:

Refer to the instructions provided with the replacement SSR module for the replacement procedure.

Maintenance Procedures (Continued):

M10: Circuit Breaker

The main circuit breaker includes a test button located on its face. The circuit breaker should be inspected for proper operation every 6 months.

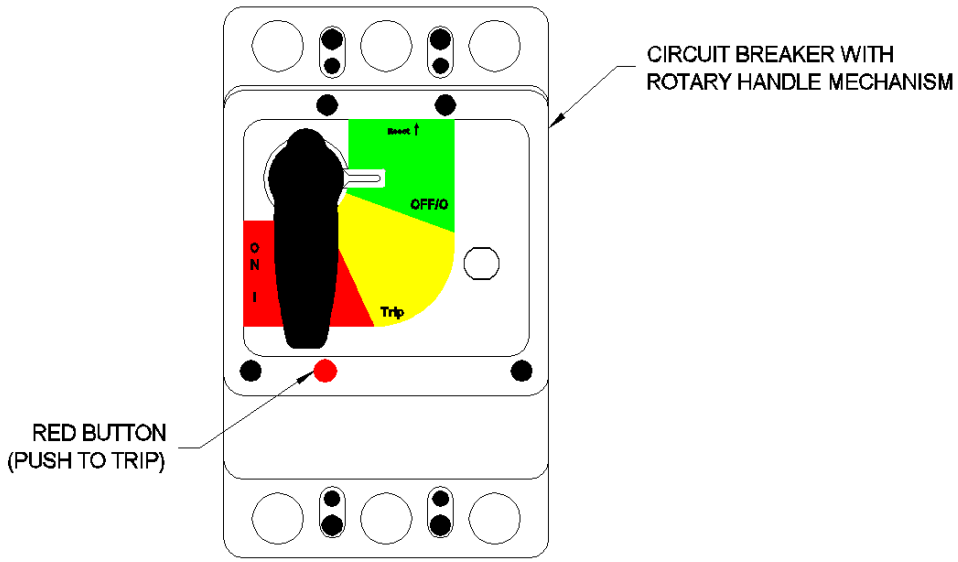


Figure 49: Circuit Breaker

Procedure M10-1: Circuit Breaker Inspection Procedure:

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the OIP. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller. This will also prevent the heaters from energizing.
2) Press the red POWER OFF button on the front of the unit.
3) Continue water flow through the unit for this procedure. Allow the unit to cool to ambient inlet temperature.
4) Open the front cabinet door.
5) Press the TEST button on the front of the circuit breaker. When this button is pressed, the entire unit will shut off.
6) Reset the circuit breaker and turn on the unit.

Maintenance Procedures (Continued):

M11: Audible Alarm

The audible alarm is mounted on the front of the unit. It should be checked for proper operation every 6 months.

Procedure M11-1: Audible Alarm Inspection Procedure:

The audible alarm may be inspected during heater operation. Testing the alarm will not trip an alarm event in the unit or suspend operation.

1) Access the SYSTEM SERVICE MENU though the navigation panel on the touch screen interface.

2) Press the TEST SONALERT button on the information panel. The alarm should sound. This will not trip an alarm event.

3) If the alarm does not sound when the TEST SONALERT button is pressed, the audible alarm must be replaced.

Procedure M11-2: Audible Alarm Replacement Procedure:

1) Shut down the unit. Turn off main power.

⚠ CAUTION	**Verify that the electrical supply is shut off, and any necessary lockout/tagout devices are properly installed.**

2) Open the front door of the unit.

3) Disconnect the lead wires from the back of the audible alarm.

4) Twist and remove the retaining ring on the front of the audible alarm. Discard the audible alarm.

5) Install the replacement audible alarm in the mounting hole in the front door of the unit. Twist and tighten the retaining ring to fix the alarm in place.

6) Attach the lead wires to the back of the audible alarm.

7) Close the front door. Once this procedure is complete, the unit may be restarted.

Maintenance Procedures (Continued):

M12: Indicator Lights

The three indicator lights are mounted on the top of the unit. They should be checked for proper operation every 6 months.

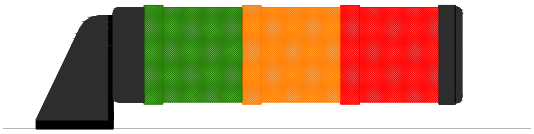


Figure 50: Status Light

Procedure M12-1: Indicator Light Inspection Procedure:

The indicator lights may be inspected during heater operation. Testing these lights will not trip an alarm event in the unit or suspend operation.

1) Access the SYSTEM SERVICE MENU though the navigation panel on the touch screen interface.

2) Press the TEST RED STACK LIGHT button on the information panel. The red indicator light will illuminate. The light will go out when the button is released. This will not trip an alarm event.

3) Press the TEST AMBER STACK LIGHT button on the information panel. The amber indicator light will illuminate. The light will go out when the button is released. This will not trip an alarm event.

4) Press the TEST GREEN STACK LIGHT button on the information panel. The green indicator light will illuminate. The light will go out when the button is released. This will not trip an alarm event.

5) If one of the indicator lights fails to illuminate when tested, the light should be replaced.

Maintenance Procedures (Continued):

Procedure M12-2: Indicator Light Replacement Procedure:
Each section of the light assembly is locked into the next piece with plastic tabs and o-rings. In order to remove them, each section must be twisted counter-clockwise approximately 15°, until the rotation is stopped. The pieces may then be separated by pulling them apart.

1) Shut down the unit. Turn off main power.

⚠ CAUTION	**Verify that the electrical supply is shut off, and any necessary lockout/tagout devices are properly installed.**

2) Twist and remove the black end piece from the end of the red light.

3) Twist and remove the red light from the amber light.

4) Twist and remove the amber light from the green light.

5) Twist and remove the green light from the base.

6) Replace the failed lamp color, and reassemble the unit.

7) Once the indicator light assembly is re-assembled, the unit may be restarted.

Maintenance Procedures (Continued):

M13: Remote Interface

The remote interface is connected through a cable connection on the left side of the unit. The interface connections should be checked for proper connections following installation.

Procedure M13-1: Remote Interface Inspection Procedure:
The audible alarm may be inspected during heater operation. Testing the alarm will not trip an alarm event in the unit or suspend operation.

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the OIP. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller. This will also prevent the heaters from energizing.

2) Access the SYSTEM SERVICE MENU though the navigation panel on the touch screen interface.

3) Press the TEST ALL REMOTE I/O button on the information panel. All of the output signals will toggle from normal operating states. This will not trip an alarm event.

4) If the remote interface signals fail to toggle, there may be a problem with the PLC or the software. Contact the Process Technology Technical Service Department for further assistance.

Maintenance Procedures (Continued):

M14: Safety Contactors

The safety contactors are mounted on the high-voltage section of the electrical panel. Each safety contactor should be inspected for proper operation every 6 months.

Procedure M14-1: Safety Contactor Inspection Procedure:

1) If the unit is in LOCAL mode, press the DISABLE HEATER button on the command panel of the OIP. If the unit is in REMOTE mode disable the heater from the customer supplied remote controller. This will also prevent the heaters from energizing.
2) Turn OFF power to the unit.

⚠ CAUTION	**Verify that the electrical supply is shut off, and any necessary lockout/tagout devices are properly installed.**

3) Continue water flow through the unit for this procedure. Allow the unit to cool to ambient inlet temperature.
4) Open the front cabinet door.
5) Using an ohm meter, measure the continuity across each of the poles of each safety contactor (ie. L1 to T1, etc). With power turned off, you should measure no continuity (infinite ohms).
6) If continuity is detected across any of the poles of the safety contactor at this time, when power is turned off, the contactor must be replaced.
7) Press and hold the test button on the each safety contactor. With the button depressed, measure the continuity across each of the poles again. This time you should measure continuity (low ohms).

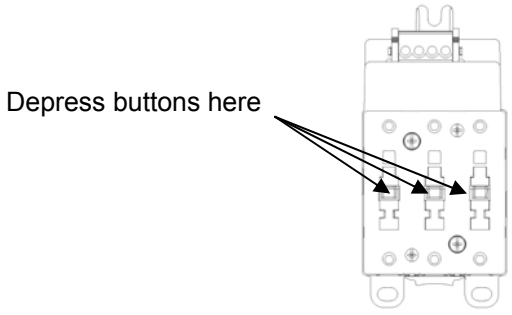


Figure 51: Safety Contactor

8) If no continuity is detected while the button is depressed, the contactor must be replaced.

SPARE PARTS:

Listed below is the spare parts list for the Lufran fluoropolymer inline water heater. These are items that may need replacement after some time in service. This is not the complete parts list, so there are some heater components that are not listed below. Please contact PROCESS TECHNOLOGY if a more complete parts list is needed.

Spare Parts List Common to all Units:

Process Technology Part #	Description	Qty
9978	POWER SUPPLY, 24VDC, 240W	1
9750	OPERATOR INTERFACE PANEL, MONOCHROME 6" TOUCH-SCREEN	1
9004	BULB, REPLACEMENT	1
9826	POWER OFF SWITCH ASSEMBLY (pushbutton, light, base, contact block)	1
9827	POWER ON SWITCH ASSEMBLY (pushbutton, light, base, contact block)	1
4851	Alarm, Sonalert audible buzzer	1
9289	FAN: Cabinet Cooling Fan, 24 VDC	2
9822	RELAY: SSR Module, 125Amps, 600VAC (One per heating column 24-52kW (heat sink, two SSRs, overtemp thermostat, cooling fan, guard)	1
9961	HUMIDISTAT: HUMIDITY CONTROL	1
TC-L-KT-2.25	SENSOR: Inlet/outlet water temperature, J-type thermocouple	2
4519	FUSE: 5A, 600V	1
4538	FUSE: 1.5A, 600V	2
8640	FUSE: 6.25A, 600V	3

Spare Parts (Continued):

Additional Spare Parts for Specific Units:

Process Technology Part #	Part for the Following Wattage Units:	Description	Qty
**		FUSE: high voltage power distribution (Refer to page 1 of the electrical prints for the specific part number of these fuses.)	3
**		HEATER: replacement heating column (Refer to label on heating column for the specific model number of this part)	1
TC-L-KT-15	65, 72, 130, 144	SENSOR: heating column water temperature, J-type thermocouple, one sensor per column	2
TC-L-KT	52, 105, (72kW, 208V)	SENSOR: heating column water temperature, J-type thermocouple, one sensor per column	1

Recommendations:

1) One complete spare parts kit is sufficient for every 4 to 6 Lufran fluoropolymer inline water heaters installed in a single location. Be sure to immediately reorder any parts that are used.

2) Sensors for the inlet/outlet process water (Part # TC-DI-L-2.25) are a required spare part for each DI Heating Column.

Note: Quantities may vary depending on the number of heating columns in a particular unit.

CLEANING:

The Lufran fluoropolymer inline water heater was thoroughly cleaned prior to shipment. The inlet/outlet plumbing connections were sealed and the heating columns were charged with nitrogen gas prior to shipment. PROCESS TECHNOLOGY recommends that, at a minimum, the following steps be taken to remove any contamination that may have been added to the system during installation. Additional steps may be required for certain applications. For sanitization procedures, contact your DI Water system suppler for their recommendations. The bypass to the DI recirculation loop should be installed as close as possible to the process tank. Confirm that the bypass plumbing will be able to withstand the maximum temperature and pressure that will be generated by the system.

This procedure should only be performed by qualified technicians.

1) Allow DI water to flow through the unit unheated with the maximum possible flow rate for one (1) hour. The effluent should be directed to the drain.

Note: In order to prevent damage to the heater coils, the purge system must be operated any time there is fluid inside the heater column.

2) If the DI Water Heating System includes the resistivity monitor (**-RM** on the model number), remove the resistivity cell after one (1) hour of flushing and rinse independently with a liberal flow of DI Water. Replace cell after rinsing.

3) Turn ON the heater and set the operating temperature at 70°C

4) Allow the unit to run at the maximum attainable flow rate for at least three (3) hours at elevated temperature.

5) Sanitize the system. Refer to the material compatibility chart to verify that the o-ring material will not be damaged by the sanitizing chemicals.

6) Proceed with normal operation after sanitizing and rinse procedures are completed.

Notes: The time required for absolute clean up of the system will be dependent on DI Water quality, flow rates, and installation techniques.

System Sanitizing:

Consult your DI Water equipment supplier to determine a method of sanitizing that will be compatible with *all* of the materials used throughout the system.

TROUBLESHOOTING:

Alarm	Description	Action Required
Gnd Fault	Ground Fault	1. Using an ohmmeter, measure each heater's power leads to earth ground and look for a short circuit. If a short to ground is identified within a column, it must be replaced. Consult the factory for the appropriate replacement. 2. Check the flashing sequence of the LED light on the GFCI module. The flashing sequence will indicate whether there is an actual Ground Fault problem. The LED sequence can be verified against a label on the GFCI component. Replace as needed. Consult the factory for the appropriate replacement.
Proc o/t	Process Thermocouple Overtemp	The outlet water temperature has risen above the HIGH PROCESS SETPOINT value. This setting is located in the SYSTEM PARAMETERS MENU. This may be caused by two possible problems. 1. A sudden and drastic decrease in flow rate 2. A failed forward SSR. When the outlet temperature falls below the value of this setting, the unit can be reset.
Humidistat (1 thru 4)	Humidistat Alarm	There is moisture detected in the humidistat connected to the purge gas outlet of this particular heating column indicated by the alarm button located on the Alarm screen of the OIP. This may be caused by a ruptured tube or a leaking seal in the heating column, or a normal heater response following an extended shutdown period. A visual inspection should be done on the column when indiacted by the alarm for any external water that may be leaking. In most cases this leak can not be repaired and the heating column must be replaced. Consult the factory for the appropriate replacement. If restarting the heater following an extended shutdown period, exhaust the purge gas for 8-hours before attempting to reset the unit..
Low Flow	Low Flow Deviation Alarm	The flow rate through the unit has dropped below the LOW FLOW SETPOINT. This setting is located in the SYSTEM PARAMETERS menu. This may be caused by shutting off the water supply to the unit. This is not an alarm event that requires a manual reset. Once the flow rate through the heater increases to a level higher than the LOW FLOW SETPOINT, the heater will automatically return to normal operation.
Cab Leak	Cabinet Leak Alarm	The cabinet leak detector has detected a leak inside the cabinet. This may be caused by a leaking plumbing connection or one of the heating columns. Any leaking plumbing fitting should be repaired and the leak pan must be drained before the fault can be reset. A leaking heating column must be replaced. Consult the factory for the appropriate replacement.
Inlet t/c	Inlet Thermocouple Alarm	The inlet process temperature sensor has failed (open). The process temperature sensor must be replaced. This may also be caused by a disconnected sensor connection. Verify that the sensor is operating properly by using an ohm meter to verify that the Thermocouple is ion good working condition. If the The thermocouple is working properly it is possible that the PLC input card may be damaged and need replaced. Consult the factory for the appropriate replacement component.

Troubleshooting (Continued):

Alarm	Description	Action Required
L. Level (1 thru 4)	Liquid Level Alarm Column	The liquid level sensor at the top of heating column does not detect liquid in the outlet tube of that column. The system is disabled until the liquid level sensor detects liquid in the outlet tube of the heating column. This may be caused by a lack of water to the unit. This safety will prevent catastrophic overheat damage to the heating column. The cause of the liquid level fault must be identified and corrected before the unit can be reset. The sensor can be recalibrated. Please reference the Lufran manual for the proper procedure to calibrate the liquid level sensor. This will be located in the Maintenance section of the manual.
N2 Purge	N2 Purge Alarm	The purge gas flow switch does not detect adequate purge gas flow. The unit has been disabled to prevent heater failure. This may be caused by shutting off the purge gas supply to the unit. When the purge gas pressure is at an acceptable pressure, the unit can be reset.
Outlet t/c	Outlet Thermocouple Alarm	The outlet process temperature sensor has failed (open). The process temperature sensor must be replaced. This may also be caused by a disconnected sensor connection. Verify that the sensor is operating properly by using an ohm meter to verify that the Thermocouple is in good working condition. If the The thermocouple is working properly it is possible that the PLC input card may be damaged and need replaced. Consult the factory for the appropriate replacement component.
Elem o/t # (1 thru 4)	Element Thermocouple Alarm	The element temperature has risen above the setting of the safety limit control (slc) module. This may be caused by lack of water flow to the unit, a failed SSR or a failed t/c sensor. This Future Design SLC is redundant to the PLC control system. When the element temperature falls below the setting of the slc, the unit can be reset. **NOTE:** This alarm can not be reset through the PLC. Rather, this alarm must be reset by cycling the main circuit breaker off and then on powering up the unit. Refer to the SHUTDOWN section of this manual for the procedure. If the element thermocouple is found to be damaged or open then the heater column will need to be replaced. Consult the factory for the appropriate replacement.
PRV	Pressure Relief Valve Alarm	The liquid sensor mounted above the pressure relief valve (PRV) discharge tube has detected liquid in the tube. This is caused by high water pressure applied to the unit. This may be caused by inlet water pressure exceeding 6.9 bar (100 psi). When the water pressure drops to an acceptable level and the PRV closes, the unit can be reset.
SSR tco	SSR TCO Alarm	The temperature of the heat sink for one or all of the solid state relays (SSR) has risen above the setting of the thermostat directly located on the heat sink. This may be caused by a malfunctioning fan, high ambient air temperature or inadequate air circulation through the cabinet. The SSR assembly should be replaced. The cause of this overtemp alarm must be identified and corrected before the unit can be reset.

Troubleshooting (Continued):

Alarm	Description	Action Required
Col # MB (1 thru 4)	Column Monitor Board Alarm	One of the SSR monitor boards has detected an open or shorted SSR. This may be caused by a failed SSR or a failed power fuse in the unit. The failed fuse or the failed SSR must be replaced before the unit can be reset. Consult the factory for the appropriate replacement.
PLC	PLC Alarm	A problem has occurred with the PLC itself, and the system is unable to operate normally. Inspect the PLC unit itself and correct any open or broken connections. Try cycling main power to clear this fault. If the PLC Fault alarm will not clear, contact PROCESS TECHNOLOGY for assistance.
Pres SW	Pressure Switch	The water supply pressure has dropped below the setting of 10PSI on the pressure switch. The water pressure must increase to a level above 15 PSI in order for the unit to return automatically to normal operation. If proper water is pressure is present it may be a problem with the PLC input card and or the actual pressure switch that is located the inlet plumbing. You will need to verify the proper operation of both. Consult the factory for the appropriate replacement.
Col # o/t (1 thru 4)	Column Overtemp	The water temperature inside the heating column has risen above the setting of the control system. This may be caused by lack of water flow, a failed SSR or a failed thermocouple sensor. The values of these temperature settings are an internal adjustment that is not accessible by the operator. It may only be adjusted by qualified personnel. When the water temperature falls below the setting of the SLC, the unit can be reset. **NOTE:** This alarm can not be reset through the PLC. Rather, this alarm must be reset by shutting down cycling the main circuit breaker off and then on powering up the unit. Refer to the SHUTDOWN of the Lufran manual for the procedure.

WARRANTY:

All PROCESS TECHNOLOGY equipment, heaters and controls have been carefully inspected before shipping and are warranted to be free from defects in workmanship and materials for a period of one year from date of purchase on a pro-rated basis. At its option, PROCESS TECHNOLOGY will repair or replace any defects that are exhibited under proper and normal use. PROCESS TECHNOLOGY disclaims any responsibility for misuse, misapplication, negligence or improper installation of equipment, tampering or other operating conditions that are beyond its control (such as excessively high or low purge gas supply pressure). PROCESS TECHNOLOGY makes no warranty or representation regarding the fitness for use or the application of its products by the customer.

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.

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.

Shipping Damages:

Claims against freight carriers for damage in transit must be filed by the customer at the time of delivery or as soon as possible.

Returns:

No product shall be returned to PROCESS TECHNOLOGY without first obtaining a return material authorization (RMA) number 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 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 that 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.

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.

Appendix I

LUFRAN MAINTENANCE CHECKLIST

Technician:_____ Date:_____

Heater Model Number:_____ Heater Serial Number:_____

Heater Location:_____

M1: Liquid Level Sensor, Top Half Plumbing		
Procedure **M1-1**: Column #1 Liquid Level Sensor Inspection ❑ Pass If sensor fails inspection —▶	Procedure **M1-2**: Recalibrated Sensor ❑ Done If sensor fails recalibration —▶	Procedure **M1-3**: Replaced sensor ❑ Done
Procedure **M1-1**: Column #2 Liquid Level Sensor Inspection ❑ Pass If sensor fails inspection —▶	Procedure **M1-2**: Recalibrated Sensor ❑ Done If sensor fails recalibration —▶	Procedure **M1-3**: Replaced sensor ❑ Done
M2: Inlet/Outlet Process Sensors, Column TC Sensors		
Procedure **M2-1**: Inlet Process Sensor Inspection ❑ Pass If sensor fails inspection ——▶		Procedure **M2-2**: Replaced sensor ❑ Done
Procedure **M2-1**: Outlet Process Sensor Inspection ❑ Pass If sensor fails inspection ——▶		Procedure **M2-2**: Replaced sensor ❑ Done
Procedure **M2-1**: Column #1 Sensor Inspection ❑ Pass If sensor fails inspection ——▶		Procedure **M2-2**: Replaced sensor ❑ Done
Procedure **M2-1**: Column #2 Sensor Inspection ❑ Pass If sensor fails inspection ——▶		Procedure **M2-2**: Replaced sensor ❑ Done
M3: Leak Detector		
Procedure **M3-1**: Leak Detector Inspection ❑ Pass If sensor fails inspection ——▶		Procedure **M3-2**: Replaced sensor ❑ Done
M4: Purge Gas Flow Switch		
Procedure **M4-1**: Purge Gas Flow Switch Inspection ❑ Pass If switch fails inspection ——▶		Procedure **M4-2**: Replaced switch ❑ Done
M5: Humidistat		
Procedure **M5-1**: Column #1 Humidistat Inspection ❑ Pass If humidistat fails inspection ——▶		Procedure **M5-2**: Replaced humidistat ❑ Done
Procedure **M5-1**: Column #2 Humidistat Inspection ❑ Pass If humidistat fails inspection ——▶		Procedure **M5-2**: Replaced humidistat ❑ Done
M6: PRV, Bottom Half Plumbing		
Procedure **M6-1**: PRV Inspection ❑ Pass If PRV fails inspection ——▶		Procedure **M6-2**: Replaced PRV ❑ Done
M7: PRV Sensor		
Procedure **M7-1**: PRV Sensor Inspection ❑ Pass If sensor fails inspection —▶	Procedure **M7-2**: Recalibrated PRV Sensor ❑ Done If sensor fails recalibration —▶	Procedure **M7-3**: Replaced PRV sensor ❑ Done
M8: Cabinet Cooling Fans		
Procedure **M8-1**: Electrical Cabinet Cooling Fan Inspection ❑ Pass If fan is not moving ——▶		Procedure **M8-2**: Replaced Fan ❑ Done
Procedure **M8-1**: Heater Cabinet Cooling Fan Inspection ❑ Pass If fan is not moving ——▶		Procedure **M8-2**: Replaced Fan ❑ Done

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LUFRAN MAINTENANCE CHECKLIST

M9: SSR Cooling Fans	
Procedure **M9-1**: SSR Module #1 Cooling Fan Inspection ☐ Pass If fan is not moving ⟶	Procedure **M9-2**: Replaced SSR module #1 ☐ Done
Procedure **M9-1**: SSR Module #2 Cooling Fan Inspection ☐ Pass If fan is not moving ⟶	Procedure **M9-2**: Replaced SSR module #2 ☐ Done
M10: Circuit Breaker	
Procedure **M10-1**: Circuit Breaker Inspection ☐ Pass If circuit breaker fails to trip ⟶	Procedure **M10-2**: Replaced circuit breaker ☐ Done
M11: Audible Alarm	
Procedure **M11-1**: Caudible Alarm Inspection ☐ Pass If audible alarm fails inspection ⟶	Procedure **M11-2**: Replaced audible alarm ☐ Done
M12: Indicator Lights	
Procedure **M12-1**: Red Indicator Light Inspection ☐ Pass If red light fails inspection ⟶	Procedure **M12-2**: Replaced red light ☐ Done
Procedure **M12-1**: Amber Indicator Light Inspection ☐ Pass If amber light fails inspection ⟶	Procedure **M12-2**: Replaced amber light ☐ Done
Procedure **M12-1**: Green Indicator Light Inspection ☐ Pass If green light fails inspection ⟶	Procedure **M12-2**: Replaced green light ☐ Done
M13: Remote Interface	
Procedure **M13-1**: Remote interface Inspection ☐ Pass If remote interface fails inspection ⟶	Contact Factory for Technical Assistance
M14: Safety Contactors	
Procedure **M14-1**: Safety Contactor #1 Inspection ☐ Pass If circuit breaker measures continuity when shut off ⟶	Replace safety contactor ☐ Done
Procedure **M14-1**: Safety Contactor #2 Inspection ☐ Pass If circuit breaker measures continuity when shut off ⟶	Replace safety contactor ☐ Done
Procedure **M14-1**: Safety Contactor #3 Inspection ☐ Pass If circuit breaker measures continuity when shut off ⟶	Replace safety contactor ☐ Done
Procedure **M14-1**: Safety Contactor #4 Inspection ☐ Pass If circuit breaker measures continuity when shut off ⟶	Replace safety contactor ☐ Done

Comments:

Confirmed By:

Inspector/Supervisor:_____ Date:_____

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