TREBOR
An IDEX Corporation

MODEL 2472
DI WATER HEATER

Operation / Maintenance Manual

SERIAL NUMBER :

IDEX CORPORATION

CONTENTS

1 INTRODUCTION

2472 DI WATER HEATER

Proven advantages associated with using high purity DI water at elevated temperature include: faster rinse time to purity, elimination of substrate streaking, less water consumption for rinsing and increased product throughput.

This system employs a simple, compact design, which minimizes the use of cleanroom floor space. The heater systems temperature sensors, controls and heaters are constructed for tight control of the process temperature even in the extent of large process flow changes. DI water contacts only high purity fluoropolymer materials (PVDF, PFA, and PTFE). The modular system design facilitates the addition or replacement of system components as the need arises. Redundant, built-in safety features and heater diagnostics provide valuable user protection and performance feedback.

With proper care and maintenance, the Model 2472 DI Water Heater System has proven itself reliable with many years of installed heater run time, resulting in substantial cost saving through increased productivity.

This equipment complies with the semiconductor manufacturing industry requirements of SEMI S2-0200:

Figure 1-1: "SEMI S2-0200"

Conformity of the equipment with the above guidelines is attested by the TUV certification mark.

2 SAFETY

This section describes the safety-related information that is important for safe equipment operation. Included is a listing of message conventions used in this manual as well as equipment safety interlocks, pushbuttons, and labels.

The equipment described in this manual uses high-voltage electricity that can be dangerous. Only personnel trained in the procedures and safety messages outlined in this manual should install (if applicable), operate, or maintain this equipment. Read and understand this manual before installation or operation of the system. Follow all recommended practices and procedures that apply to your actions and conduct. All safety guard devices must be in place when equipment is in operation. Operators, set-up operators, helpers or installation personnel should not alter, remove or disable safety equipment. When using this equipment, be sure to follow the safety procedures outlined by your facility. These safety procedures should cover the two primary types of hazard training: (1) equipment hazards, and (2) facility-related hazards.

2.1 SAFETY MESSAGE CONVENTIONS

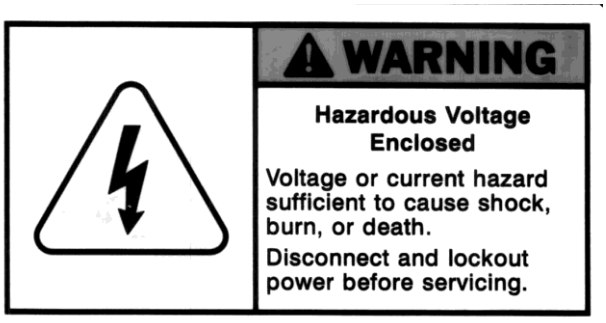
Safety messages contained in this manual, **Dangers, Warnings, and Cautions** are highlighted for quick identification.

2.1.a Danger

A Danger message indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. Messages identified by the word **Danger** are used sparingly and only for those situations presenting the most serious hazards.

2.1.b Warning

A Warning message indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury. Following is a typical example of a **Warning** message as it could appear:



2.1.c Caution

A Caution message indicates a potentially hazardous situation, which, if not avoided, could result in minor or moderate injury. It may also be used to alert against unsafe practices. Following is a typical example of a **Caution** message as it could appear:

2.2 EQUIPMENT SAFETY

The rest of this section describes equipment safety features:

- Equipment Safety Interlocks
- Emergency Off Pushbuttons
- Main Power Disconnect Switch
- Lockout/Tagout Information
- Equipment Safety Labels
- Hazard Lights

2.3 INTERLOCKS

> **!** **WARNING:** The high voltage interlock circuit does not remove high voltage from the circuit breaker, contactor, and the control transformer. Only authorized, qualified, trained personnel should service this equipment.

2.3.a Over Temperature Controller Interlock (OTC)

The OTC disengages power to the heater components when it detects a heater module temperature over 105°C (221°F). The over temperature fault LED will indicate a failure has occurred and the display of the OTC causing the fault will flash “ALR”. The OTC’s will disengage power and a manual reset will be required by pressing HEATER ON (see Section 8, Troubleshooting).

> **!** **CAUTION:** Do not change OTC temperature settings. These units are factory set and sealed at 105°C (221°F). Any change to the setpoint of these over temperature controller devices may damage the heater modules and will void the system warranty.

2.3.b Low Pressure Switch Interlock

The pressure switch will disengage power when heater module pressure drops below 22-25 psig. DI water pressure is required for efficient heat transfer. Operating the heater at lower pressure can damage heater elements. The system will require pressing HEATER ON to restart (see Section 8, Troubleshooting).

2.3.c Liquid Level Sensor Interlock

The Liquid Level Sensor will disengage power to the system if the heater modules are not full of water and prevents them from running dry. The system will require pressing HEATER ON to restart (see Section 8, Troubleshooting). If sensor calibration is required, follow directions in Section 7.4.

2.3.d Panel Interlock Switches(is this section ok?)

The “Positive-Break” panel interlock switches will disengage power to the system when the control panel on the system is opened (see Figure 2-1: Panel Interlock Locations). Replacing panels and pressing HEATER ON will be required to restart heater.

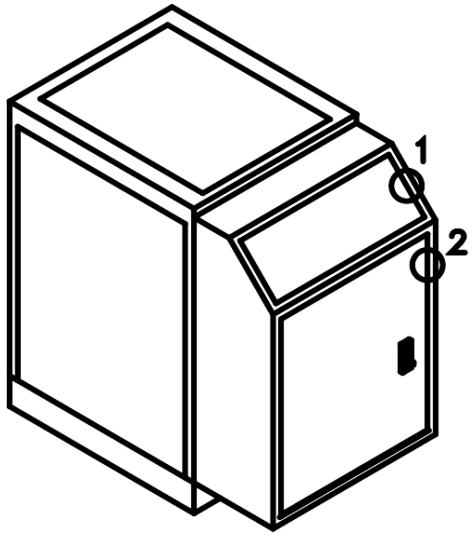


Figure 2-1: Panel Interlock Locations

Troubleshooting

Condition: System will not start if a panel is removed or interlock switches are not operating properly.

Solution: Check that heater panels are secure, review condition of panel interlock switches; replace if necessary.

2.3.e Leak Sensor

The Leak Sensor will disable heater power immediately when water is detected in the leak tray and the corresponding fault LED will illuminate. The fault condition is caused by a plumbing leak inside the heater. Fix any leaks and dry the leak tray prior to turning power on to the system. The heater can be reactivated by pressing the HEATER ON button and will not function until the fault condition clears.

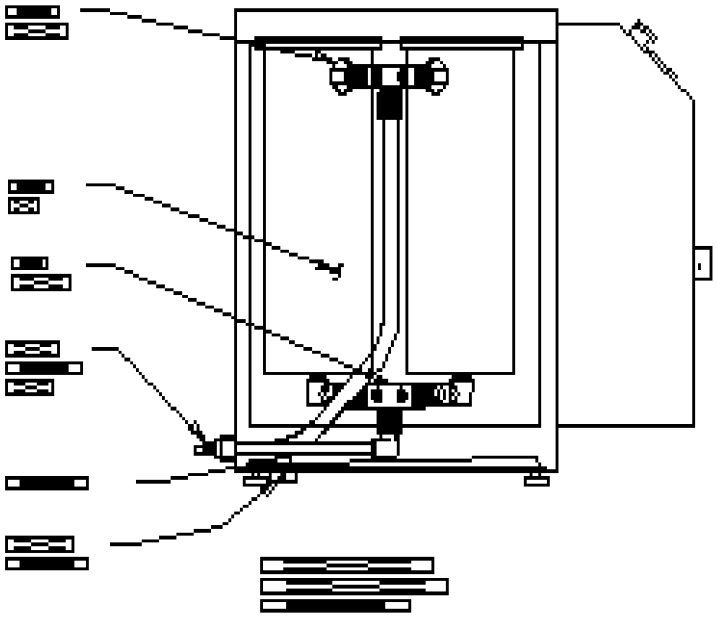


Figure 2-2

2.3.f Overpressure Burst Fitting

The overpressure burst fitting (“Relief Drain”) is connected in-line with the cold DI inlet port to provide a safeguard against possible overpressure damage. Do not operate the heater above 60-psig (4.1 bar).

If the overpressure relief device opens, the low pressure sensor can disable heater power when an alarm condition exists and the pressure fault LED will illuminate. Refer to Section 7.1.e on replacing burst fitting.

2.4 EMERGENCY OFF (EMO)

The EMERGENCY OFF button (EMO) is located on the front of the Control Panel. When the EMO circuit is activated by pushing button in, the equipment will be placed into a safe shutdown condition. The EMO circuit de-energizes all electrical control power to the equipment. Only the supply voltage and supply to EMO switch are energized when the EMO is in the OFF position.

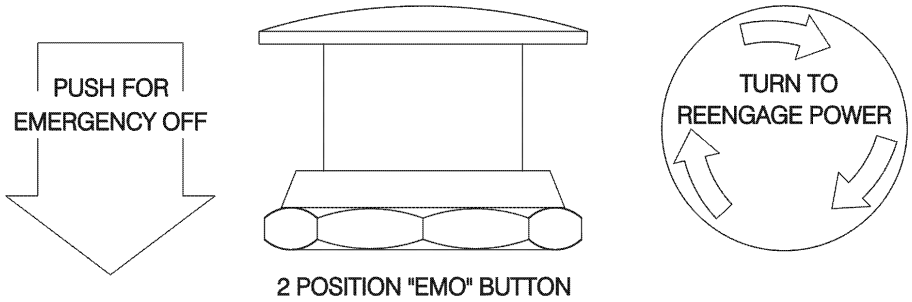


Figure 2-3

2.5 LOCKOUT / TAGOUT

2.5.a Preliminary

Before installation or servicing the DI water heater, the facility's circuit breaker or power source must be de-energized to prevent serious injury to personnel and equipment. An authorized employee representing the facility installing the DI water heater must follow approved company guidelines and lockout or use suitable means to prevent re-energizing the electrical system during installation or servicing.

2.5.b Definitions

Lockout: the placement of a lockout device on an energy isolating device, in accordance with established company procedures, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Tagout: a prominent warning device such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with established company procedure, to indicate that the energy isolated device and the equipment being controlled may not be re-energized or operated until the tagout device is removed.

A simple Lockout device is provided with each system. The Lockout is tethered to the main circuit breaker.

- Always perform an electrical de-energization test before and after installation of the Lockout device by verifying the circuit breaker properly isolates the line voltage from the system.

- Place the circuit breaker in the OFF position
- Place the Lockout device over the switch.
- Tighten the set screw securely with a 1/8” or smaller flathead screwdriver. Typically, two (2) complete revolutions of the setscrew are required after the screw first touches the switch. Do not over tighten the setscrew. The circuit breaker switch may fracture.
- Verify that the Lockout is adequately secured to the switch.
- Insert a padlock through both holes. This will prevent access to the setscrew. The Lockout device is designed for use with 9/32” diameter shackle padlocks. Smaller diameter padlocks may not adequately block access to the setscrew.
- Verify that the circuit breaker switch cannot be repositioned to ON.
- Attach a safety tag.

Use the following information to assist in writing Lockout/Tagout procedures for the system. For more specific instructions, refer to your site’s Lockout/Tagout requirements and procedures.

This table lists the Lockout/Tagout information for the system.

Energy Type	**Electrical**
Hazard:	Electrocution, electrical burns, and shock
Magnitude:	480 VAC
Control Method:	Main Power – Disconnect Switch
Shutdown Procedure	
• Press Emergency Off • Switch off circuit breaker on front of system.	

2.6 SEISMIC PROTECTION

It is the users responsibility to adequately secure and anchor the equipment to comply with local regulatory agency seismic requirements. Mechanical anchor locations are provided on the top and bottom of the cabinet enclosure.

3 INSTALLATION

3.1 UNPACKING

Remove heater system from crate and inspect heater cabinet for any signs of damage (dented panels, paint scratches, etc.). Shock indicators inside the heater cabinet should be checked for rough handling during shipment. Any damage to the system should be reported to the carrier immediately.

> **!** **CAUTION:** Heavy Object. When lifting or moving the system, follow safe heavy object handling methods to prevent injury.

Be careful when using a dolly or forklift to not damage the drain fitting located under the heater cabinet.

3.2 LOCATION

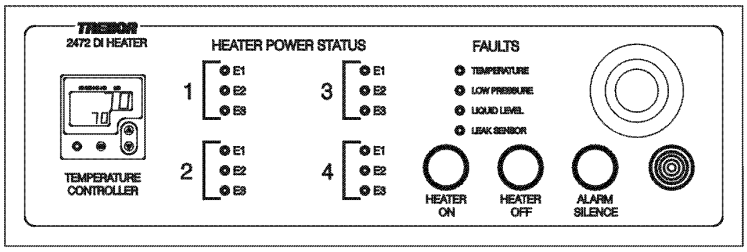
Locate the heater near the point-of-use to reduce plumbing heat loss. Access to the front and rear of the system will be necessary for maintenance and hook-up. For heater replacement, access to the top and sides of the enclosure are required. This access can be achieved by disconnecting the fluid and power hookups (see Section 2.6) and moving the heater to a serviceable area.

> **NOTE:** The DI water heater must be allowed to stabilize at installation location at ambient temperature and humidity for 24 hours before operation. Refer to Section 3.3 for system requirements.

3.3 UTILITY REQUIREMENTS

Utility	2472 Heater
System Power:	480 volts, 3 phase, 50/60 Hz, 86 Amp Full Load
	100A over-current protection provided at machine hook-up terminals
	Machine Interrupting Rating 14kA
	Schematic #P0169
Remote Signals:	See schematic
Cold DI Inlet:	3/4" Flare PFA Tube
	4.08 bars Maximum (60 psig)
	2.04 bars Minimum (30 psig)
Hot DI Outlet:	3/4" Flare PFA Tube
	Discharge line must be restricted to create adequate backpressure (>30 psig). A flow restriction may be required at the point of use to limit discharge rate.
Overpressure Relief	3/4" Flare PFA Tube
Drain:	3/4 tube or equivalent <20m (60 ft.) length to open drain
System Weight:	Dry Kg. (lbs.): 134 Kg. (295 lbs.)
Min. Dimensions:	76cm x 78cm x 48.3cm (30"H x 31"L x 19"W)

> **!** **CAUTION:** Use a facility power disconnect switch equipped with Lockout/Tagout capabilities, per OSHA 29 CFR, should be installed and adjusted to the heater. Refer to Section 2.5 in this manual.



CONTROL PANEL

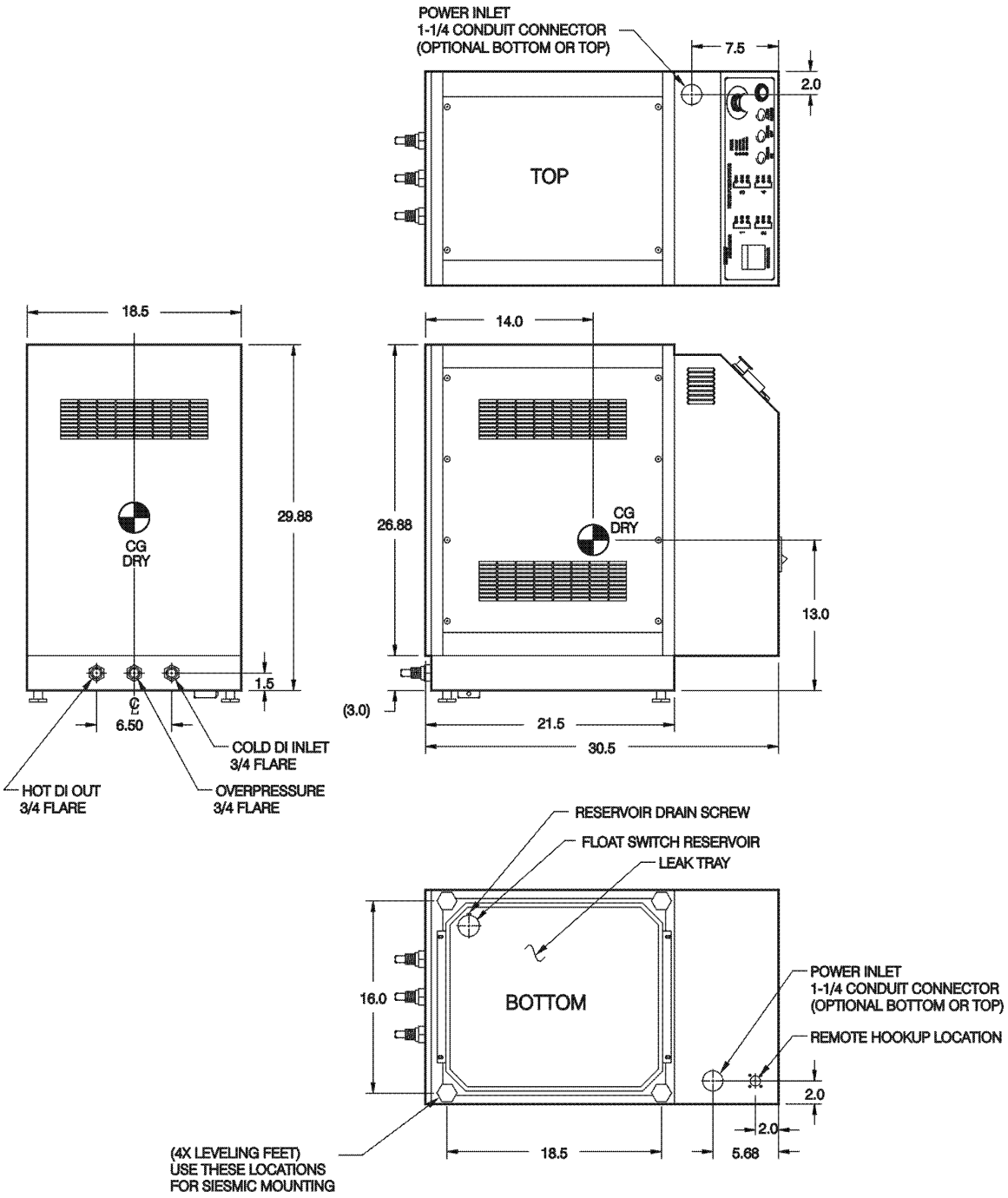


Figure 3-1: Facility Installation Layout

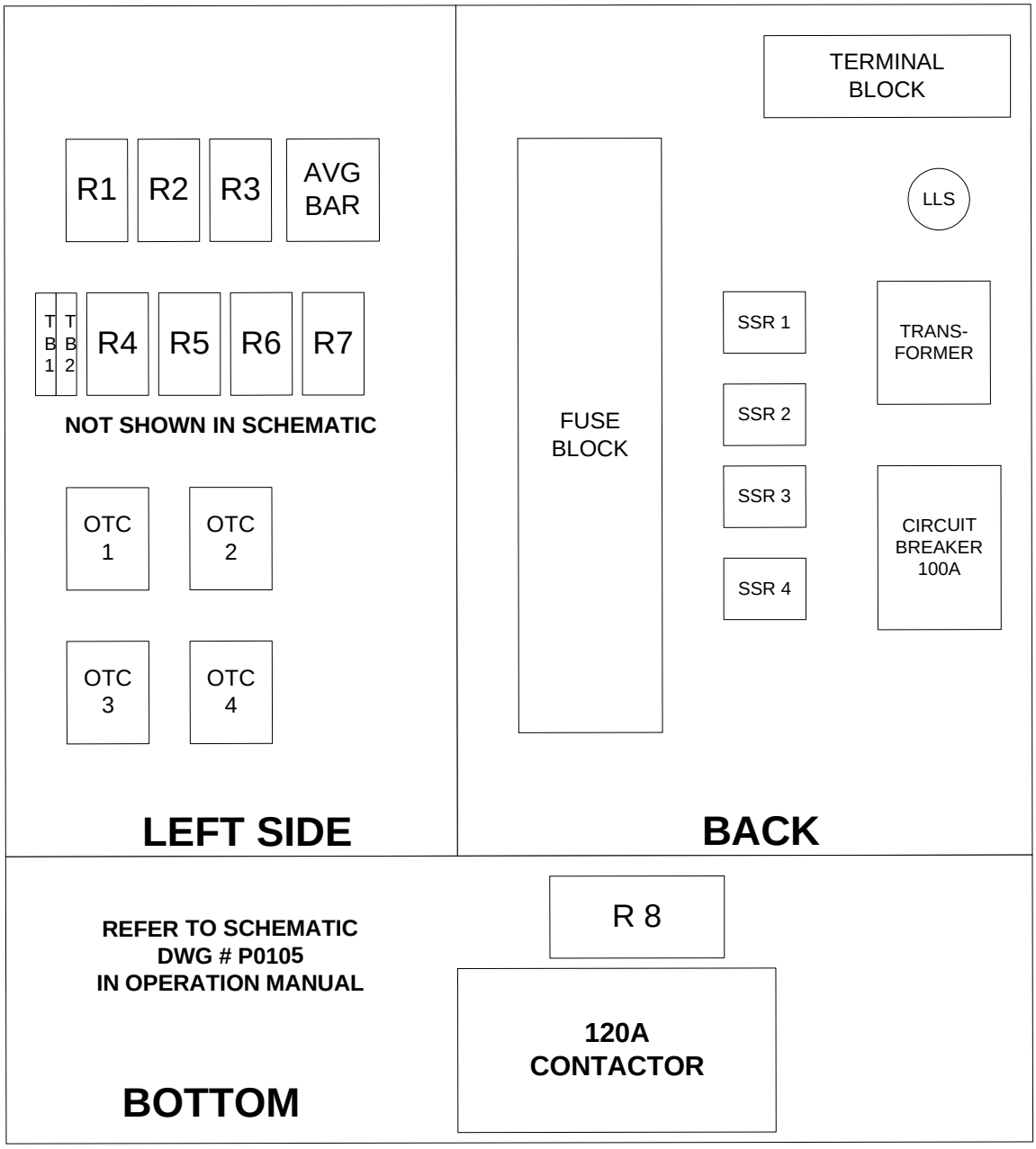


Figure 3-2: Electrical Component Layout

3.4 HOOK-UP

All utility hook-ups associated with the DI Water Heater are easily accessible and are referenced in Figure 3-1: Facility Installation Layout.

After positioning heater at operating location, raise the four leveling feet until the heater is level and stable. Adequate clearance of leak tray must be provided.

- If a large leak occurs, the heater is not capable of containing the volume of liquid from a continuous flow. An adequate sized spill tray and drain line may be required to allow time to shut off the heater in the event of a leak.
- Connect the cold DI supply line to the “Cold DI Inlet” connection.

NOTE: The cold DI water supply line should have a readily accessible inlet control valve capable of shutting off supply flow in case of any down-stream plumbing leaks or system leaks.

- Connect the hot DI process line to the “Hot DI Outlet” connection. Use only hot DI compatible plumbing components. They must be rated at a minimum of 110°C (230°F) and 60 psig (4.1 bar). The outlet line should have a flow control valve to control DI water flow rate.
- The discharge line must be restricted to create adequate backpressure (>30 psig) (running the system at low pressures will trip the system pressure interlock).

NOTE: It is recommended that the hot water supply line have a bleed, or purge, at the point-of-use to reduce the possibility of stagnating the DI water in the heaters when not in use. The amount of this bleed is best evaluated on a case-by-case basis, taking into account each user’s criteria and production standards.

- Recommendation: Either insulate the hot DI water process line or place a Hot Surface hazard warning (like shown below) on the tubing every 20 feet.

- Connect the “Over Pressure Relief Drain” to an open drain line (do not connect restrictive fittings or valves in line with the drain). If an overpressure condition occurs in the heater, a burst fitting will rupture to relieve pressure in the heater. The fitting must be replaced.
- Attach cabinet drain line to bottom of cabinet. If a cabinet drain line is not installed, the system will be difficult to drain for maintenance or repair and can cause water damage if a large leak occurs.

! **CAUTION:** Depending on installation and routing of water supply lines, a trip hazard may be created. It is the responsibility of the facility installation personnel to eliminate or minimize any and all trip hazards or identify such hazards with visual warning signs.

- **Lockout** and **Tagout** facility circuit breaker before servicing system.
- Remove the power box front panel to allow access to the electrical connections.
- Route the wires from the electrical source (480 VAC 3-phase) into and through the conduit opening and into the electrical box. Top or bottom conduit connections are provided (see Figure 3-1: Facility Installation Layout).
- Add supplementary insulation (heat shrink) to exposed conductors between the conduit opening and terminations on the circuit breaker.
- Connect the 480 VAC supply grounding connector to the grounding lug and the other three lines into the top of the circuit breaker connections (L1, L2, and L3) as shown in Figure 3-3: Main Breaker Hook-Up (torque wire terminal connections to 120 in/lb.).

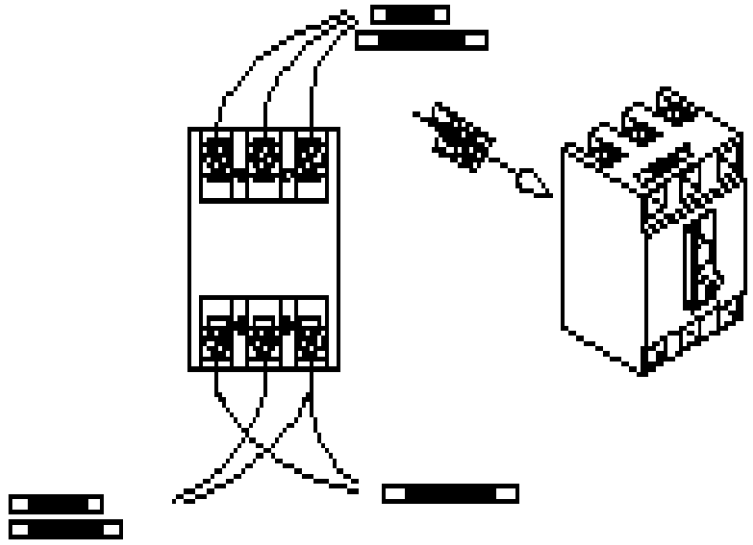


Figure 3-3: Main Breaker Hook-Up(insert new pic like figure 3-4 in t-series manual, needs to be created)

- Unlock and turn on facility circuit breaker.
- Follow heater Pre-Start Inspection (see Section 5.1).

NOTE: Before starting the system, it is important to become familiar with Section 4, Operation. Only trained, qualified, authorized, personnel should operate this system.

3.5 REMOTE HOOK-UP

If a remote control hook-up is desired, refer to schematic for pin-outs and Amp connector part number (see Figure 3-1: Facility Installation Layout).

4 OPERATION

4.1 GENERAL

The following charts show the maximum flow capacity versus available temperature output for the heater system. Applications below the saturation curve can be controlled to within 1°C of setpoint at steady state flow. Applications above the saturation curve will not allow the process value to reach setpoint temperature.

The pressure loss through the heater is shown. Lower pressure drop configurations are available, consult factory for further information.

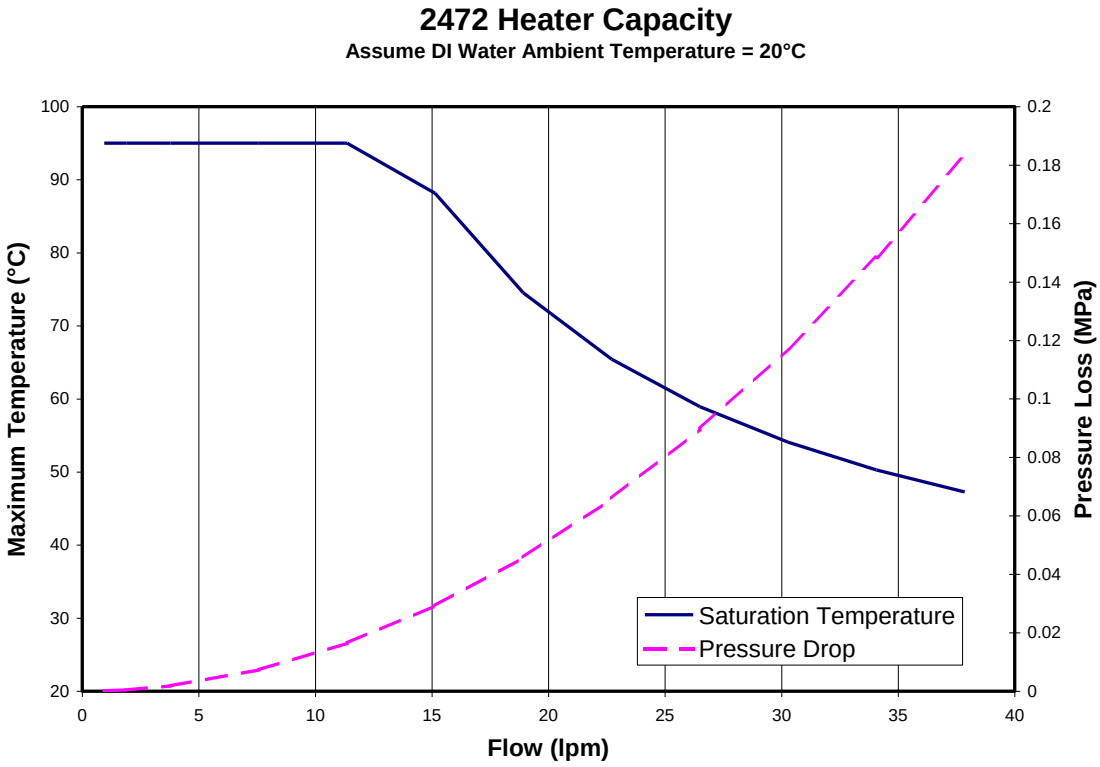


Figure 4-1

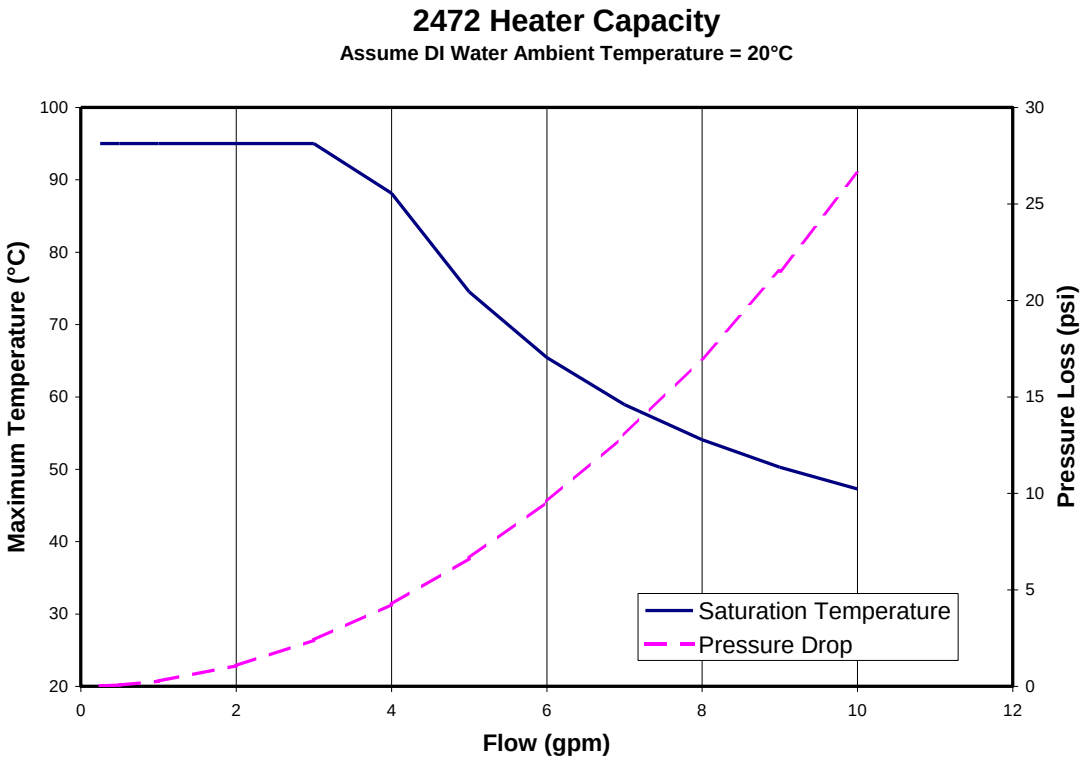


Figure 4-2

5 START-UP

5.1 PRE-START INSPECTION

This Trebor DI Water Heater has been thoroughly tested and inspected for proper performance and operation prior to leaving the factory. Additional pre-start inspection can identify any damage or condition change that may have occurred during shipment of the heater and reduce nuisance problems during start-up.

5.1.a Verify Shipping Condition

Refer to Section 3.1, Unpacking.

5.1.b High Power Terminals

Refer to PM Schedule, Section 7.3. Tighten high power connections at the main circuit breaker, main contactor, SSR's, distribution blocks, and fuseblocks. Slightly loose connections at these high power terminals can cause arcing. This arcing can introduce higher than normal operating temperatures, resulting in damage of electrical components. Tighten terminal in a clockwise direction only. Do not loosen terminals before tightening as this may affect the contact area.

5.1.c Electrical Inspection

Refer to system schematic. Visually inspect all electrical components for anything that seems unusual, such as damaged wire insulation, disconnected wires, etc.

5.1.d Plumbing Leak Check

- Refer to PM Schedule, Section 7.3. Inspect heater for leaks during start-up. Remove access panels to the heater modules and open the heater module top caps during start-up. Inspect heater module fittings and heater system plumbing for leaks.
- If leaks are found at the flare fittings, hand tighten fittings while they are at ambient temperature. Do not use a wrench to tighten flare fittings, excessive tightening can cause damage to the fittings.
- If leaks are found at the heater element fittings, cinch the fittings up using an end wrench. If the leak does not cease, remove element fittings and inspect the ferrule inside for damage.

If any problems are encountered during start-up of this heater, contact Trebor International for technical support.

5.2 SYSTEM ON

Activate the power to the system by switching the “Main Breaker” to ON. If the display on the control panel does not illuminate, ensure that the EMERGENCY OFF button is in the operate position.

5.3 TEMPERATURE CONTROLLER

The Temperature Controller, located on the Control Box, should read as follows for initial start-up:

PV - Incoming water temperature in Degrees Celsius
SV - 10°C (factory preset)

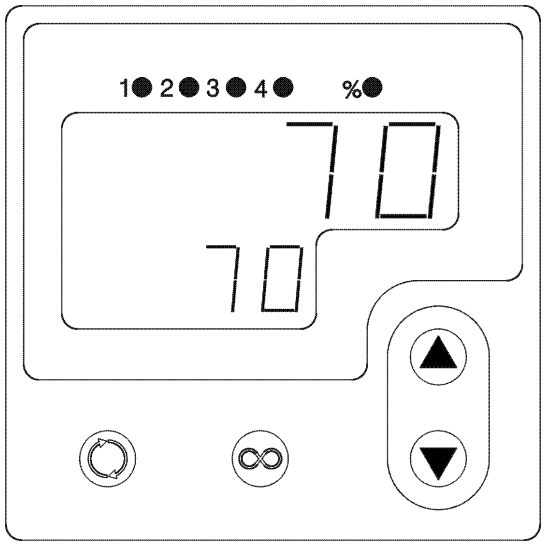


Figure 5-1

∧ Increases heater temperature setpoint

∨ Decreases heater temperature setpoint

If the Temperature Controller display does not illuminate refer to Section 8, Troubleshooting.

If an alarm sounds, check control panel for fault condition then press ALARM SILENCE and refer to Section 8, Troubleshooting.

! **CAUTION:** Do not attempt to change Temperature Controller parameter settings. The only user alterable setting in the controller is the temperature setpoint. Changing any other controller values may cause damage to the heater modules and will void the system warranty. Consult factory for settings.

5.4 HEATER MODULE POWER

Press HEATER ON button and adjust the setpoint to the desired temperature. To do this, press the "^" button on the face of the Controller unit. Scroll to the desired setpoint temperature. Temperature controller setpoint will remain at last setting during a restart. (See Figure 5-1.)

NOTE: Maximum setpoint is 90°C.

5.5 POWER DISTRIBUTION INDICATORS

Each 18 kW Heater Module contains three (3) 6 kW resistive heating elements that are electrically fused at either end. The LED indicators on the control panel will indicate the functioning of each element (see Figure 3-1: Facility Installation Layout). An indicator that does not illuminate in conjunction with others indicates a blown fuse on one side of the element or possibly a failed heater (see Section 8, Troubleshooting).

6 SHUT DOWN

The DI Water Heater may be shut down by the following methods:

- Switch “Main Breaker” off.
- Push HEATER OFF button to disengage heater element power only.
- Press the EMERGENCY OFF button to deactivate the system. The system will not turn on after a power shutdown until the EMO is returned to the enabled position and the HEATER ON button is pressed.
- Turn off the main system circuit breaker or the facility circuit breaker.
- Lockout and tagout heater for maintenance or repair. Refer to Section 2.5.

6.1 HEATER CLEANOUT

The system has been tested with high purity DI water. After installation a 48-hour purge “burn-in” period >1 gpm is recommended to clean out the system and plumbing before use in high purity process applications.

7 MAINTENANCE

7.1 REPAIR INSTRUCTIONS

7.1.a Heater Element Check

- Follow Lockout/Tagout procedures as referenced in the Safety section of this manual.
- The resistance of each 6 kW heater element winding is 36 ohms. Remove the 20 Amp fuses and check across the right hand element terminals at the fuse block. Refer to schematic.
- Another reference (with 20 Amp fuses removed) is from the right hand element terminal to ground, in which case a value of at least one mega-ohm resistance should be measured.
- Resistance through the element or to ground at values less than indicated probably indicates a faulty element, in which case a heater module replacement is necessary.

7.1.b Fuse Replacement

- A power distribution indicator (LED) that does not illuminate along with the others on the control panel indicates a blown 20 Amp fuse of a failed heater. Each heater module contains three (3) 6 kW elements with a 20 Amp fuse at either end of the element wiring. The labeling of the power distribution LED's should correspond with the fuse block labeling. The LED indicates which element is inoperative but not which fuse.

> **!** **CAUTION:** Fuses must be replaced with the same type of fuses and rating. Failure to do so could result in a safety hazard and cause injury to personnel and equipment. Consult factory for further information.

- Follow Lockout/Tagout procedures as referenced in the Safety section of this manual.

Example: "Power Distribution" LED E1 of Heater 1 fails to illuminate; check these two fuses ("Main Breaker" off).

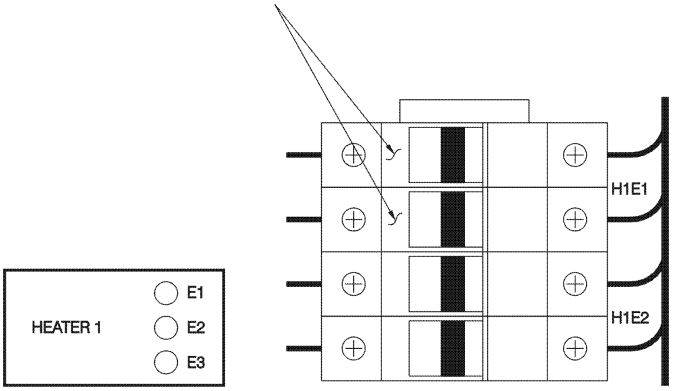


Figure 7-1

- Lockout/Tagout power to the heater.
- Remove electrical access panel and replace fuse with proper type.

NOTE: Chronic replacement of the same fuse(s) indicates possible heater element damage or fuse block contact damage (see Section 8, Troubleshooting).

7.1.c Draining the System

- Close heater DI water inlet isolation valve.
- Connect fluid inlet to an open drain line.
- Loosen a fitting in the upper manifold to release internal vacuum in the line.
- The system will drain through the cold DI inlet; a small amount of water will drain through fluid exit port.
- Perform required maintenance.
- Reconnect fluid inlet and outlet to process lines and refill the system.

7.1.d Leaks

When a leak has been detected it is recommended that the supply water be shut off along with the facility circuit breaker. Allow sufficient time for the DI heater and plumbing to cool down before inspection.

To locate source of leak remove panels to expose heater modules and plumbing. The origin of the leak may be at one of the union flanges; retightening the flange by hand may be all that is required. If there is water leaking from the module outlet hole, remove top cap from heater module to identify source of leak. In the case of a ferrule leak, tighten fitting. Care needs to be taken when reinstalling the heater outlet manifold so that the top surface of the heater module and the outlet manifold are flush, to ensure that the top cap can be properly replaced. If the leak is elsewhere, identify the location and contact Trebor International.

- Remove Heater Cap.
- Inspect ferrule fittings (leads and thermocouple). Hand tighten, snug with 5/8" wrench. Inspect tube fittings and hand tighten.
- Inspect the joints after the module has thermo-cycled to ensure that the leak has been stopped.
- If the leak persists, contact Trebor International.

NOTE: If water is leaking out of the heater leads, meaning from inside the tubing that surrounds the grounding braid and Teflon® insulated wire, the tubing integrity has been compromised and requires replacement of the heater module. If water is leaking from the top and bottom cap welds, replacement of the heater module is required.

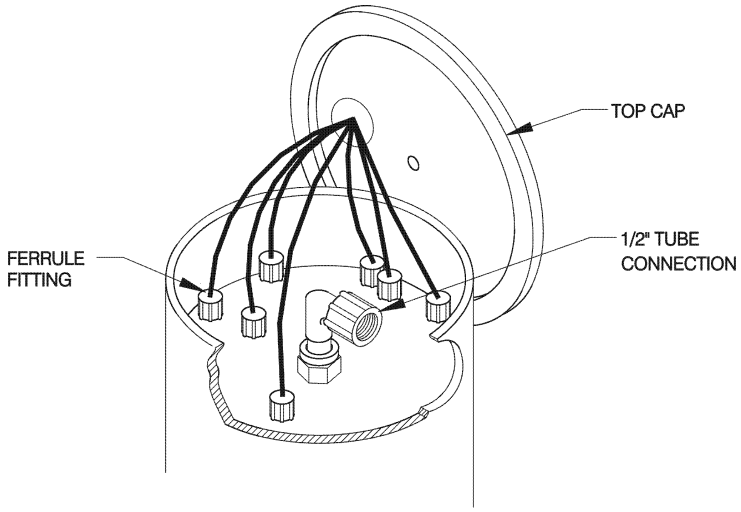


Figure 7-2

7.1.e Overpressure Relief Replacement

- Turn power off (see Section 2.5).
- Drain system (see Section 2.1.c).
- Remove and replace overpressure relief fitting (note orientation of fitting.
- Refill system.

- Inspect for leaks.
- Turn power on (see Section 2.5).

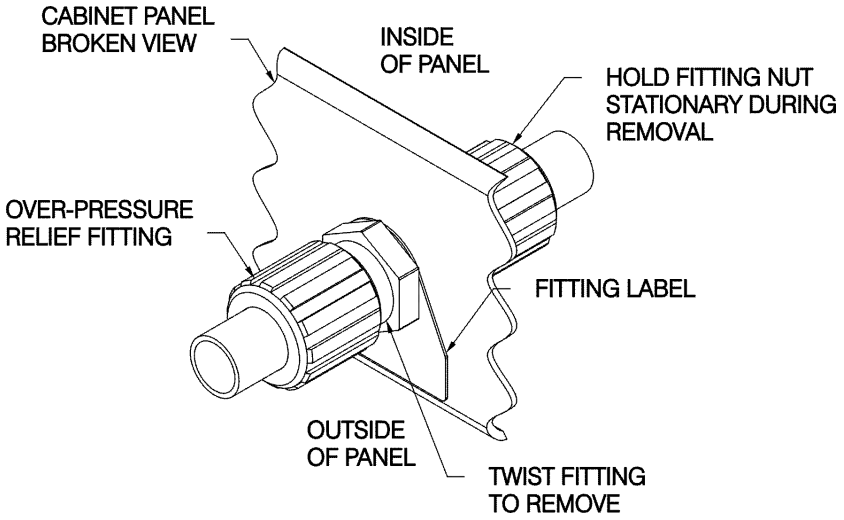


Figure 7-3

7.1.f Heater Replacement

The heater modules have been designed for quick replacement to minimize downtime and field service requirements. To replace a heater module, follow these procedures:

- Turn power off to system (see Section 2.5 for Lockout/Tagout procedures).
- Drain system (refer to Section 7.1.c for draining procedure).
- Remove necessary panels to access heater modules.
- Disconnect thermocouple wires from termination point.
- Disconnect the heater module electrical connector from the electrical enclosure.
- Disconnect the inlet and outlet heater tube fittings from the common manifolds.
- Loosen heater-mounting clamps.
- Remove heater module from cabinet.
- Remove necessary plumbing fittings from failed heater module and install on replacement heater module.
- Install replacement heater module into cabinet in reverse order from above.
- Return failed heater to manufacturer.

7.2 SPARE PARTS

The most common replacement parts are listed below. For items not listed please contact Trebor.

PART NO.	DESCRIPTION	RECOMMENDED SPARE QTY.
98003058	20 Amp Fuse, CCMR	6
AE128	Assembly, Solid State Relay w/Thermobond	2
KD2400T-CA	Diaphragm Overpressure Kit	1
M0192	Heater Module, 18kW	1

It is recommended that a spare heater module be on site when five (5) or more systems are in one location.

Please specify system Model Number and Serial Number when ordering spare parts. Consult factory for other parts not shown above.

7.3 PREVENTIVE MAINTENANCE SCHEDULE

Model 2472

Initial Start	Weekly	6 Months	Items
X	X		Temperature Controller / Element Status
X		X	Plumbing Leaks
X	X		Overpressure Relief Drain & Diaphragm
X		X	General Electronics
X		X	Fuse Blocks
X		X	Solid State Relays (SSR's)
X		X	Main Circuit Breaker
X		X	Main Contactor
X		X	Distribution Block / Terminal Block

See following table for details on each item.

ITEM	DETAILS
Temperature Control	After the system has stabilized, the temperature reading indicated by the controller process temperature should track very closely with the temperature reading indicated by the controller setpoint temperature. This visual check should be made weekly.
Heater Element	Visually check the ELEMENT STATUS LED. The LED should not be illuminated.
Plumbing Leaks	Visually check DI water lines outside of heater cabinet for signs of leaks at the connections. (A leak sensor will detect leaks, but this periodic visual check is recommended.) Also visually check leak tray (if applicable) or bottom of cabinet inside heater module enclosure for DI water leaks. Tighten fitting(s) if necessary. If heater module is leaking, contact Trebor for instructions.
Overpressure Relief Drain & Diaphragm	Visually check the drain line for water running from the heater. The overpressure burst fitting can start leaking if the system has seen pressures above 60 psig. The burst fitting can be checked by inspecting the relief port at the back of the cabinet. No water should be present in the relief drain since it is required to be plumbed to an open drain. If water is present in the drain plumbing, the fitting should be removed.
General Electronics	Visually check electronics inside control enclosure for any signs of overheating, deformation, or corrosion.
Fuse Blocks	The fuse holders should be free of corrosion and should not have signs of overheating or deformation. All wire terminations on fuse blocks should be tight. Any blown fuses should be replaced.
Solid State Relays	The SSR's should be free of corrosion at the terminals and should not have signs of overheating or deformation. The wires attached to the SSR's should be clean and in good condition. Check and tighten mounting screws for optimum heat transfer to heatsink.
Main Circuit Breaker	The main circuit breaker should be checked for signs of loose connections at the termination lugs. Damaged lugs should be replaced. The terminals should be checked for tightness.
Main Contactor	The main contactor should be checked for signs of loose connections at termination lugs. Damaged lugs should be replaced. The terminals should be checked for tightness.
Distribution Block / Terminal Block	The distribution block / terminal block should be checked for signs of loose connections at the termination lugs. The terminals should be checked for tightness.

7.4 HEATER CALIBRATION

Due to heat loss and other external factors that effect the DI Water temperature after it leaves the heater, it is not critical to precisely calibrate the DI heater process temperature to closer than 1°C. For highly critical process application, the heater temperature calibration should be checked annually for possible degradation of sensors and or temperature controllers over time. If a significant error occurs (> 5°C), consult the factory for replacement parts.

The calibration method compares the output DI Water temperature to the DI heater temperature controller process value. Perform the following procedure:

- Turn heater power off and isolate plumbing connections to allow insertion of a temperature sensor.

- Install a reference temperature sensor (i.e. NIST traceable) into a fitting within a meter of the heater outlet.
- Allow flow through the plumbing connections to the heater.
- Control the DI water flow through the heater at 15 lpm.
- Turn heater on and engage the heaters.
- Set the heater temperature controller to 70°C and allow 15 minutes to fully reach a steady state temperature.
- Compare the DI water temperature at the reference sensor to the temperature controller process value.

If the temperatures are within 1°C then no recalibration is required. If a deviation exists between the temperatures, carefully follow the procedures below to change the thermocouple calibration in the temperature controller. The input sensor calibration parameter should be adjusted to match the process value on the temperature controller to the reference sensor temperature.

1. Method to changing input sensor calibration (Watlow Controller)
    a. Unlocking the Watlow
        - Press both the Advance key (⟲) and Home key (∞) for at least 6 seconds until the “Fcty” prompt appears in the lower display and “LOC” prompt appears in the upper display.
        - If “LOC” prompt does not appear in the upper display, press either the “up” or “down” arrow key to reach the “LOC” Menu.
        - Under the “LOC” Menu, press the Advance key 3 times to reach “Oper” setting.
        - Change the “Oper” setting to “Change” by using either the “up” or “down” arrow key.
        - Exit the Factory Menus by pressing the Home key (∞).
    b. Changing the Watlow Offset Calibration
        - Press both the “up” and “down” arrow keys for 3 seconds.
        - The prompt “Oper” will appear in the lower display and the prompt “User” will appear in the upper display.
        - If the upper display prompt does not read “User”, use the “up” or “down” arrow key to reach the “User” menu.
        - Press the Advance key 4 times to advance through the “User” menu to “CAL1”.
        - Change the “CAL1” offset value by using either the “up” or “down” arrow key to match the system output reading with the Watlow temperature reading.
        - Exit the “Oper” Menu by pressing the Home key.
        - To lock the Watlow Controller, access the “Fcty” menu again in the Factory Menus and change the “Oper” setting to “read”.
        - Press the Home key to exit.
2. Change the heater setpoint to 30°C and run for 10 minutes.

3. Verify the calibration offset is within 2°C.
4. Return heater to original configuration.

8 TROUBLESHOOTING

The following is an outline of routine troubleshooting techniques. Consult Trebor for further conditions not covered in this section.

8.1 TEMPERATURE CONTROLLER DOES NOT DISPLAY

CAUSES	SOLUTIONS
• EMO button engaged	• Twist EMO in direction of arrows (refer to Section 2.4).
• No power at main circuit breaker	• Review wiring procedure (see Section 3, Installation). • Main Breaker to ON.
• Panel Interlock Switch	• Refer to Section 2.3.d, Panel Interlock Switches.

8.2 ALARM SOUNDS

CAUSES	SOLUTIONS
• Over temperature	• Check that temperature process value doesn't exceed 90°C (review setpoint procedure). • Check Temperature Controller for proper operation.
• Low pressure	• Increase supply pressure. • Reduce flow downstream. • Check overpressure relief diaphragm.
• Liquid level	• Check water supply at source. • Check overpressure relief diaphragm. • Verify flow is on. • Recalibrate sensor (see Section 7.4).

8.3 HEATER ELEMENT STATUS LED IS ON

CAUSES	SOLUTIONS
• Fuse is out	• See Section 7.1.a, Heater Element Check. • Replace failed fuse(s) associated with unit indicator (see Section 7.1.b, Fuse Replacement). • Consult Trebor if fuse repeatedly fails.
• Some power distribution LED indicators stay on when output 01 LED of the temperature controller goes off	• An SSR has failed in the closed mode. Shut system off immediately and replace the failed SSR. SSR's should be replaced in pairs.
• Solid state relay may have "frozen" open	• An SSR has failed in the open mode. Shut system off immediately and replace the failed SSR. SSR's should be replaced in pairs.

9 WIRING SCHEMATIC

(See attached fold out sheet.)

10 WARRANTY

2472 DI WATER HEATER

TREBOR International, Inc. warrants to the purchaser of new equipment manufactured by TREBOR to be free from defects in material and workmanship when used for its intended purpose under normal operating conditions, and maintained according to the Operation/Maintenance Manual.

TREBOR's obligation under this warranty is limited to repairing or replacing, at TREBOR's option and at the TREBOR factory, any part or parts thereof which shall, within 1 year after delivery thereof to the original purchaser, be demonstrated to TREBOR's satisfaction to have been defective. This warranty may be transferred to subsequent owners. The warranty period is based on the original ship date from the factory. All warranty related freight costs shall be borne by the customer.

This warranty shall not apply to any equipment which, in the judgment of TREBOR, shall have been repaired or altered outside TREBOR's factory in any way, so as to affect its performance or reliability; subjected to misuse, negligence or accident; or used other than in accordance with TREBOR's printed instructions.

There are no terms, conditions or warranties, expressed, implied or statutory, of merchantability, fitness, capacity, or otherwise, of the goods ordered, other than, or different from, the warranty set forth above. This warranty takes precedence over any other warranty, expressed or implied.

TREBOR neither assumes, nor authorizes any other party to assume for it, any liability in connection with said equipment except as set forth above.