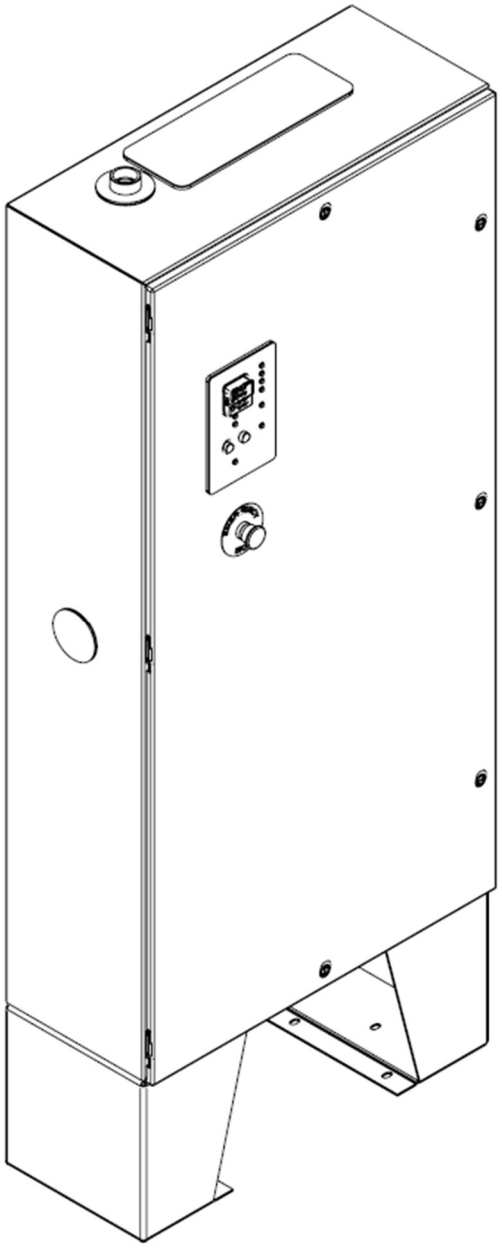
LAARS®
Heating Systems Company



Installation

Laars N Series
Tankless Heater Models

LCTEN036	**Voltage options for**
LCTEN054	**models:**
LCTEN063	**600V Three-Phase**
LCTEN072	**480V Three-Phase**
LCTEN108	**415V Three-Phase**
LCTEN126	**400V Three-Phase**
LCTEN144	**380V Three-Phase**

238-54231-00 REV 4/21
Doc# 11102

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DANGER

Tip over hazard. System can crush you resulting in serious injury or death. Read and follow precautions in this installation manual that accompanied the heater for instructions on how to safely transport and mount. DO NOT transport with the heater in the vertical position. This heater is top heavy and should not be placed in the vertical position until the site is prepared to anchor the heater to the wall or the legs to the floor.

WARNING

Read this manual BEFORE using this equipment. Failure to read and follow all safety and user information could result in death, serious personal injury, minor burns, property damage, or damage to the equipment. Keep this manual for future reference. Failure to comply with proper installation and maintenance instructions could contribute to the heater's failure.

A qualified plumber or electrician should install and service this system. Install system according to these instructions and in compliance with national and local codes.

ASSE standard 1016, 1069, or 1070 listed devices should be used at fixtures to prevent possible injury. Severe bodily injury including scalding, chilling, and/or death may result depending upon system water pressure changes and/or supply water temperature changes.

For safe operation of the heater, observe all warning labels as indicated.

Water heater system under pressure. DO NOT open enclosure while in operation.

These heaters should never be used to provide "anti-scald" or "anti-chill" service.

Hazardous voltage inside enclosure may result in serious burns or death. Disconnect power supply before performing any work in the enclosure.

Failure to ground this system may result in death or serious injury.

Make sure that all water supply lines have been flushed and then completely turned off before beginning installation. Debris in supply lines can cause valves to malfunction.

CAUTION

Hot pipes! DO NOT touch. May cause minor burns.

NOTICE

These heaters DO NOT provide protection from supply or outlet pipe freezing.

Consult local building and plumbing codes prior to installation. Should these codes differ from the information in the manual, follow the local codes. Inquire with governing authorities for additional local requirements.

Regular checking and cleaning of the heater's internal components and check stops is necessary for maximum life and proper product function. Periodic inspection and yearly maintenance by a licensed contractor is required. Corrosive water conditions, and/or unauthorized adjustments or repairs could render the heater ineffective for its intended service. Frequency of cleaning and inspection depends upon local water conditions. For heaters with adjustable output temperatures, check and adjust as needed at initial installation and on a quarterly basis.

IMPORTANT

Read this entire installation manual to ensure proper installation. When finished with the installation, file this manual with the owner or maintenance department. Compliance and conformity to local codes and ordinances is the responsibility of the installer. Product warranties may be found under "Resources" on our website at www.laars.com.

Separate parts from packaging and make sure all parts are accounted for before discarding any packaging material. If any parts are missing, do not begin installation until you obtain the missing parts.

Pre-Installation Information

General Information

The N Series Tankless Water Heater provides instant and precise temperature-controlled hot water. To ensure proper performance, install the heater according to the following installation instructions and in compliance with applicable national and local codes.

N Series can supply heaters for most commercial and industrial hot water applications. Flow rates and temperature figures are important for proper sizing. If needed to meet certain temperature demands, flow control devices are readily available. See Maximum Temperature Rise Specifications chart. Contact a Laars representative for further information on available flow devices.

Operation and Setup

N Series heaters supply an unlimited amount of hot water with specific flow and temperature rise capabilities. These heaters are energy efficient, reliable, and provide optimum performance in the most demanding applications.

Application Specific Requirements

The N Series can be used in many different applications that require custom tuning for specific applications to maximize performance of the heater.

For use in a re-circulation loop, the incoming loop temperature should not exceed 140°F (60°C).

For applications utilizing quick close valves or solenoid valves, it is important to install a hammer arrestor or surge tank close to the point of use to absorb pressure spikes.

ASME CERTIFICATION: Please verify if your State Boiler Code requires ASME Certification and that you have the proper heater to meet your code requirements prior to installation.

Installation Considerations

Maximum operating pressure: 150 psi (10 bar)

ASME maximum operating pressure: 160psi (11 bar)

Standard flow activation: 1.5 gpm (5.7 lpm)

Certifications

Certified by ETL to UL499, UL50E, CSA22 2 No 88 and NFPA 496 (for hazardous locations) and third party certified to NSF/ANSI 372. Heaters are compliant with NEC/NFPA 70 and Canadian Electrical Code C22.1.

⚠ **WARNING For safe operation of the heater, observe all the warning labels as indicated.**

Storage Instructions

NOTICE! Keep Electric Tankless Water Heaters stored in original packaging until installation.

Recommended storage criteria:

Store N Series Electric Tankless Water Heaters where temperatures exceed 35°F (2°C) at all times.

Indoor storage is recommended.

Minimize excessive on-site transport to reduce risk of shock and impact damage.

Alternate storage:

If in the original crate, Electric Tankless Water Heaters will withstand outside storage for approximately 1 month in most climates. The crate may not be capable of protecting the heater if left outside longer than this time frame.

If the Electric Tankless Water Heater is stored in an outdoor environment, care should be taken to protect the heaters from:

- Rain or other falling precipitation via tarp or other waterproof media
- Runoff and accumulation of groundwater from any source that may exceed 1 inch (25mm).

NOTICE! For heaters with ENHT freeze protection option: If the heater is stored where the temperature could fall below 45°F (7°C), the heater must be powered immediately after hydro testing to ensure internal freeze protection components are activated. Once the heater is installed and the on-site plumbing has been hydro tested, the power supply must remain constant until the risk of freeze is eliminated. If this is not possible, the heater must be drained. Freezing of the heater can cause serious damage. Follow notes in Start Up Check List section following an electrical lockout/tagout procedure.

Packaging

Crates are constructed from 7/16" (11mm) OSB.

Crate dimensions approx: 82" x 48" x 25" (2083mm x 1219mm x 635mm)

Crates should not be stacked more than 2 high.

All crates must be stacked evenly and horizontally.

Safety issues related to packaging:

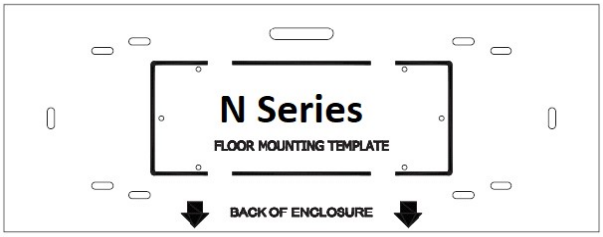
- Product should be transported with the care associated to packages labeled “FRAGILE” even if packaging is not marked accordingly marked accordingly.
- Standard safety procedures for forklift transport and large items less than 1000lbs (454 kgs) should be followed at all times.
- When stored, crate must be supported in entirety of its length and width.

1 Mounting Heater

⚠ **WARNING HIGH VOLTAGE SHOCK. Disconnect power supply before performing any work inside the heater enclosure.**

- ☑ *If heater is installed where freezing can occur, specify ENHT Freeze Protection option. ENHT option must be purchased at the time of order. Do not install in areas where freezing can occur without the ENHT option listed in the model number.*
- ☑ *Installation should be performed by a qualified plumber or electrician.*
- ☑ *For best results, install heater as close as possible to the point of use.*
- ☑ *Long pipe runs are not recommended. A heat loss of 1°F for every 10ft (3 meters) of uninsulated pipe can occur.*
- ☑ *When determining a mounting location, give consideration to the location of the main electrical panel and ensure accessibility of the cabinet enclosure door and other plumbing for service/maintenance. 36" (914mm) minimum in front of cabinet enclosure and 48" (1219mm) minimum above the cabinet enclosure is required.*

A Set heater in a vertical, upright position with the water outlet located at top. Use the floor mounting template from the inside of the crate to help with alignment of the leg mounting.



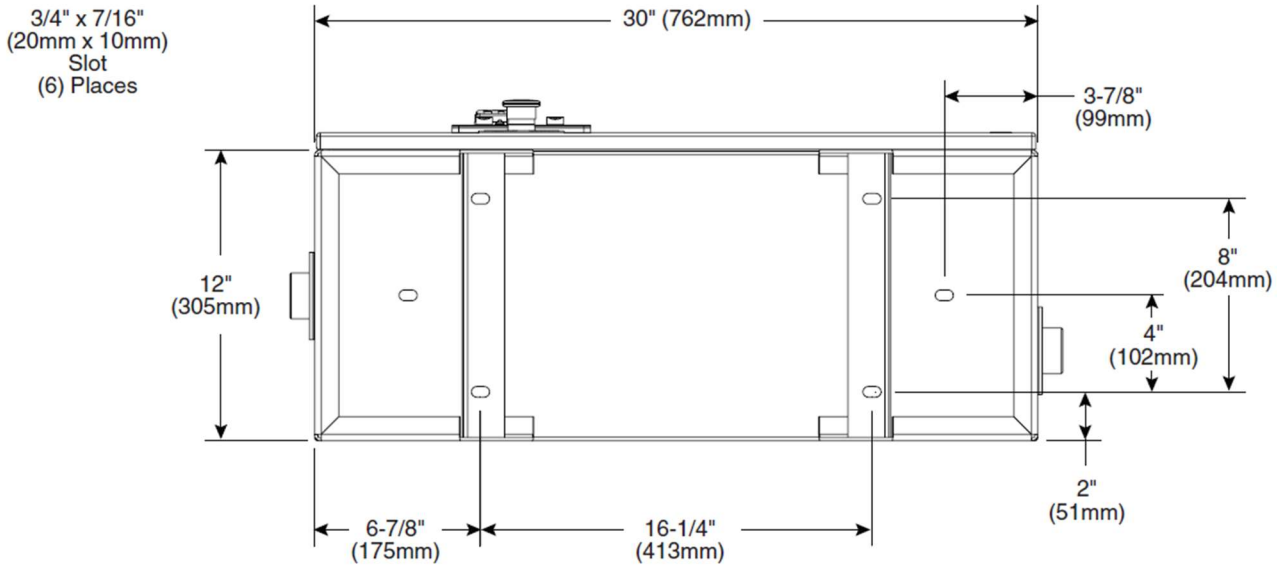
B Secure heater by bolting each leg to the floor using 3/8" (10mm) anchor bolts.

C Install the pressure and temperature relief valve on hot water outlet immediately following the union.

NOTICE! Valve must empty into a drain.

- ☑ *Rectangle outlines on template are not actual size of heater.*
- ☑ *Template may require cutting to fit into tight areas.*
- ☑ *Holes are for alignment purposes and may not represent actual drill size for mounting hardware.*

Bottom View - Leg Mounting Holes



2 Plumbing Installation

Components Needed:

- (4) Union 1-1/4"
- Shutoff Valve
- Pressure and Temperature Relief Valve (150 psi/10 bar)
- Y-Strainer (100 mesh) or Inline Filter (150 microns)
- (2) Gate or Ball Type Valves
- Drain pipe
- Water hammer arrestor (recommended)
- Elbows, nipples and fittings as needed

⚠ **CAUTION To avoid damage to the electronics or internal wiring, do not perform any brazing or sweat soldering inside the enclosure.**

NOTICE! Failure to install proper filtration may result in a flow switch malfunction.

NOTICE! To avoid water damage, install a drain pipe from the pressure relief valve to an unrestricted drain.

☑ *If end use fixture is not at the highest point in the plumbing loop, then an automatic air vent valve must be added at the highest point in the system or at any drop to eliminate trapped air.*

Dimensions, Plumbing and Electrical Configurations

A Install shutoff valve above (upstream of) the heater inlet.

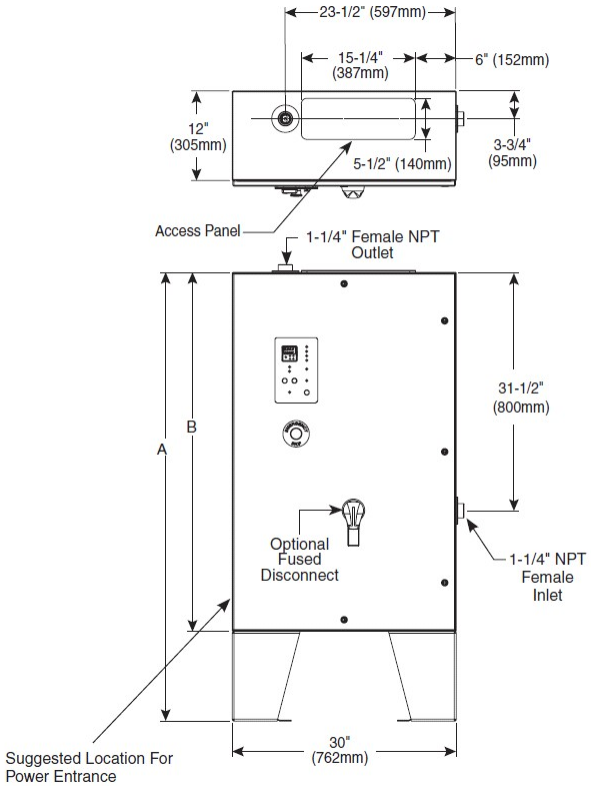
B Install one union on the water inlet side of the heater and another union upstream of the 100 Mesh (150 micron) y-strainer.

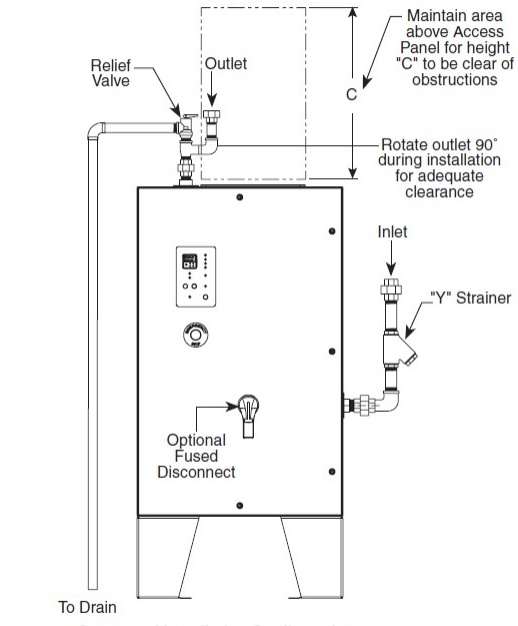
Install one union on the water outlet side of the heater and another after the T & P Relief Valve.

Install the pressure relief valve (150 psi/10 bar) and outlet plumbing of heater per code requirements and route relief valve discharge to drain. Make sure no shutoff valve is between the water heater outlet and the relief valve, as well as no shutoff valve between the relief valve discharge and drain. Ensure plumbing is secure and not subject to vibrations.

C Use 3/4" hard copper tubing or pipe as needed.

	Dim. "A"	Dim. "B"	Dim. "C"
36kW	60” (1524mm)	48” (1219mm)	36” (914mm)
54kW	60” (1524mm)	48” (1219mm)	36” (914mm)
63kW	72” (1524mm)	60” (1524mm)	48” (1219mm)
72kW	60” (1524mm)	48” (1219mm)	36” (914mm)
108kW	60” (1524mm)	48” (1219mm)	36” (914mm)
126kW	72” (1524mm)	60” (1524mm)	48” (1219mm)
144kW	72” (1524mm)	60” (1524mm)	48” (1219mm)





Suggested Installation Configuration
Components provided by installer unless otherwise specified.
Reference the product options sections or contact your local Laars representative for product options.

3 Electric Installation

⚠ **WARNING All heaters must be fused in accordance with National Electric Code (NEC) for the full load amperage listed on the nameplate rating for each heater.**

⚠ **WARNING Failure to properly ground the unit(s) per the National Electric Code could result in injury or death.**

A Open enclosure door.

NOTICE! Any option that requires field wiring must be done with 600V cable per the schematic that was shipped with the heater.

NOTICE! Use a 4-core cable or multi-stranded machine tool wire from an approved isolating 3-pole switch or circuit breaker.

NOTICE! Make sure the electrical cable is the correct size to carry 100% of the full load current. See table for proper wire sizes.

B Using a hole punch, cut a hole the proper size for conduit connection large enough for the wire size for each heater. The connectors need to be rated NEMA4/4X to ensure proper sealing of the enclosure.

C Run wires through the appropriate size conduit.

D Connect wires to the system terminal block or fused disconnect inside the enclosure.

E Connect the ground wire to the stud provided with the "Ground" label beneath it.

F If unit is ordered with a D1 or DC controller, option, the DB9 connector for hookup on a standard unit is located on the upper left/hinge side of the cabinet. Please review the appropriate Special Instruction & Operation Instructions section for information regarding controller programming and wiring. Proceed to the Start Up Checklist once the steps in the Special Installation & Operation Instructions section have been completed or if you do not have this option.

☑ Not all available (optional) voltages are listed in the table.

N SERIES ELECTRICAL SPECIFICATIONS FOR HEATER**

Model	Voltage	Amps	kWatts	Min Wire Size
LCTEN036T	600	35	36	8 AWG*
LCTEN054T	600	52	54	6 AWG*
LCTEN063T	600	61	63	4 AWG*
LCTEN072T	600	69	72	4 AWG*
LCTEN108T	600	104	108	2 AWG*
LCTEN126T	600	121	126	1 AWG*
LCTEN144T	600	139	144	1/0 AWG*
LCTEN036S	480	43	36	6 AWG*
LCTEN054S	480	65	54	4 AWG*
LCTEN063S	480	76	63	4 AWG*
LCTEN072S	480	87	72	3 AWG*
LCTEN108S	480	130	108	1 AWG*
LCTEN126S	480	152	126	1/0 AWG*
LCTEN144S	480	174	144	2/0 AWG*
LCTEN036P	415	38	27	8 AWG*
LCTEN054P	415	56	40	6 AWG*
LCTEN063P	415	65	47	4 AWG*
LCTEN072P	415	75	54	4 AWG*
LCTEN108P	415	113	81	2 AWG*
LCTEN126P	415	131	94	1 AWG*
LCTEN144P	415	150	108	1/0 AWG*
LCTEN036N	400	36	25	8 AWG*
LCTEN054N	400	53	37	6 AWG*
LCTEN063N	400	64	44	4 AWG*
LCTEN072N	400	72	50	4 AWG*
LCTEN108N	400	108	75	2 AWG*
LCTEN126N	400	126	87	1 AWG*
LCTEN144N	400	144	100	1/0 AWG*
LCTEN036M	380	35	23	8 AWG*
LCTEN054M	380	50	33	6 AWG*
LCTEN063M	380	59	39	4 AWG*
LCTEN072M	380	68	45	4 AWG*
LCTEN108M	380	103	68	2 AWG*
LCTEN126M	380	120	79	1 AWG*
LCTEN144M	380	137	90	1/0 AWG*

*Based on the NEC Table 310.15 for 75°C insulated copper wire @ 30°C Ambient. Aluminum wire requires larger gauges.

4 Start Up Check List

Plumbing

- ☐ System is set in a vertical, level, and upright position with the outlet located at the top. System is mounted to the wall using the (4) mounting brackets on the back of the enclosure or bolted to the floor with the optional leg kit.

- ☐ Confirm installation of shutoff valve above (upstream of) the union on the inlet connection Confirm installation of a Y-strainer (100 mesh screen) or inline filter (150 micron) between the inlet shutoff valve and the heater.

- ☐ Pressure and temperature relief valve is installed on tepid water outlet immediately following the union No valve or restriction is between the relief valve and the system or the relief valve and drain Shutoff valve is installed after pressure and temperature relief valve on outlet if required by local or national plumbing codes.

- ☐ If the hot water process is not at the highest point in the plumbing loop, then an automatic air vent valve must be added at the highest point in the system plumbing loop to eliminate trapped air.

Electrical

- ☐ Verify supply voltage matches the indicated voltage on the Serial Tag. Serial Tag is located within the heater enclosure on the upper left corner of the back plate (mounting plate).

- ☐ Appropriate conduit is installed properly, secured and sealed to unit enclosure per NEC and hazard location requirements.

- ☐ Appropriate conductors for unit routed through conduit and secured to power block inside the enclosure All electrical is installed in accordance with national and local electrical codes, including fuse size and rating.

- ☐ Appropriate earth ground is installed to the lug provided on enclosure backplate.

5 Start Up

WARNING Make sure the circuit breaker for the heater is OFF.

Be sure that plumbing and electrical are complete per Start Up Check List.

A Slowly turn on water supply to the unit with the enclosure door open and the circuit breaker in the off position.

B Slowly turn on the water outlet valve, activate the connected process requiring heated water (faucet, shower, etc.), then flush the system for 5 minutes to ensure all air is purged from the system.

NOTICE! Failure to bleed air properly will damage elements and cause heater malfunction.

C Turn off the connected process and check the entire system to verify leak-free installation.

D Close enclosure door and secure. Depress the Emergency Stop Button.

E **If your heater has the EXP2CFPM option and is located in a Class I Division 2 area, please review Special Instructions & Operation Instructions section for all proper electrical connections and sealing to ensure the installation will provide the proper protection.** Proceed to Step F once you have completed the steps in the Special Instructions & Operation Instructions or if you do not have this option.

F Energize the electrical service to the unit by switching on the circuit breaker.

G Pull out Emergency Stop Button. Unit is now in the ready state.

H Turn on the connected process; observe output temperature rise to setpoint.

Top portion of temperature controller displays output temperature, bottom displays setpoint temperature.

If unit is ordered with the D1 option, the controller is shipped with this option deactivated. Contact a Bradford White representative to get the unlock code to activate the option.

I When startup is complete, leave circuit breaker in the ON position and the Emergency Stop Button on the door pulled out. The green power light should be illuminated.

NOTICE! If your heater is mounted in an area where freezing temperatures are possible, an ENHT Freeze Protection Option is strongly recommended and the heater must be powered at all times to be Freeze Protected. If continuous power is not possible, do not allow the heater to remain full of water. Freezing of the heater can cause serious damage.

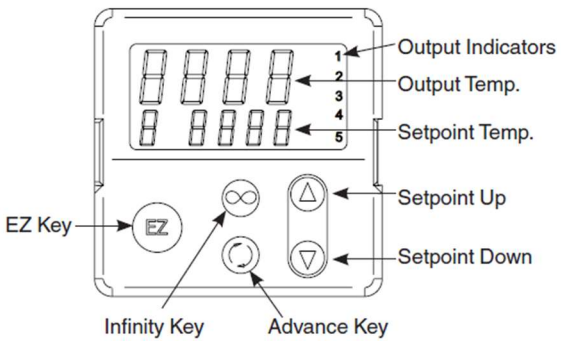
6 Digital Controller Operation

The preprogrammed digital controller is mounted through the bezel on the enclosure door. The digital controller will be powered but the bottom display will read OFF until water is flowing through the heater. The bottom display will then display the setpoint temperature (see Digital Controller Operation section for more information).

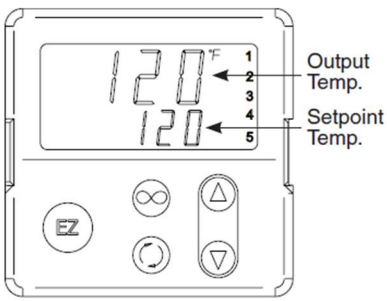
Refer to table and drawings below for instructions on changing the desired set point temperature of the controller.

Description	Upper Display	Lower Display	Function
EZ Key			Toggles output on/off
Setpoint Up Button			Increases output temperature
Setpoint Down Button			Decreases output temperature
Infinity Key			Back to Home page
Advance Key			Advances through parameter prompts
	Auto, Man, Off	C.r71	Turns Control Loop On/Manual/Off
	XX.X%	h.PR1	Heater Power%
	No	AUt1	Autotune (Contact Bradford White representative)
	C or F	C_F1	Change Temperature Units from F to C
Output Indicators (1-5)			Output 1, 2, 3, 4 or 5 are active and operating if these LEDs are illuminated.
Setpoint Temperature (Lower Display)			Displays: • Setpoint • Percent Power • Temperature units F or C • Menu prompt name • Alarm code
Output Temperature (Upper Display)			Displays: • Actual process temp. of outgoing water • Prompt parameter value • Error code (feature disabled)

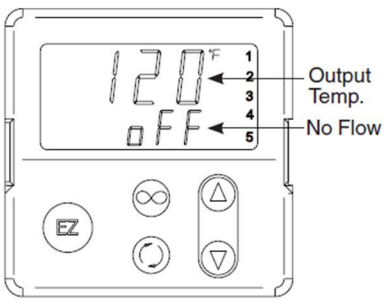
Layout Diagram



ON - Heating



OFF - No Flow



7 Perform Operational Test No. 1

☑ Ensure the enclosure door is closed prior to performing operation test.

A Set the 3-pole switch or circuit breaker to the ON position.

B Start the water flow through the heater by starting the process or fixture this heater is connected to in order to activate heater.

C When flow rate reaches approximately 1.5gpm (5.7lpm), the flow sensor recognizes this condition and begins the heating process.

When the flow sensor activates:

- Green bank energized lights illuminate on the front bezel verifying power supply connection to the heating elements via the solid-state relays.
- Element load lights may be solid or flash in unison as heating elements modulate depending on the hot water demand.
- Digital temperature controller sows water temperature. Additional programming is not necessary.

D Press the up or down arrow keys to adjust the set temperature. The controller displays the temperature of water measured at the outlet.

☑ Located on the panel is one (36kW-63kW) or two (72kW-144kW) green ready lights. When illuminated, the safety circuit is engaged and ready for use.

E Test water temperature and stability at outlet by viewing the display (in red) the temperature of water exiting the heater.

☑ *Heater will not energize heating elements if the inlet water temperature is equal to or greater than the temperature set on the digital controller.*

8 Perform Operational Test No. 2

Each model has precise specifications for temperature rise capabilities.

A Turn on hot water faucet/fixture/process.
The heater should activate immediately.

B Turn off hot water faucet/fixture/process.
The flow switch will deactivate and shut off power to the heater.

If the water flow exceeds maximum heating capacity of the heater, the temperature of water at the outlet may be lower than the temperature selected on the controller. See table below to determine maximum temperature rise capabilities.

N Series

Temperature Rise (GPM & F°)												
480/600V	**kW**	2 gpm ΔT °F	4 gpm ΔT °F	6 gpm ΔT °F	8 gpm ΔT °F	10 gpm ΔT °F	12 gpm ΔT °F	15 gpm ΔT °F	20 gpm ΔT °F	25 gpm ΔT °F	30 gpm ΔT °F	35 gpm ΔT °F
LCTEN036	36	122	62	40	30	24	20	16	12			
LCTEN054	54		93	60	45	37	31	24	18	14		
LCTEN063	63		107	71	53	43	35	29	21	17	14	
LCTEN072	72		124	80	80	49	40	33	24	20	16	14
LCTEN0108	108			120	90	74	61	49	36	29	24	21
LCTEN0126	126			143	107	86	71	57	43	34	28	25
LCTEN0144	144				120	96	82	66	49	39	33	28

Temperature Rise (LPM & C°)												
480/600V	**kW**	7.6 lpm ΔT °C	15.1 lpm ΔT °C	22.7 lpm ΔT °C	30.2 lpm ΔT °C	37.8 lpm ΔT °C	45.4 lpm ΔT °C	56.7 lpm ΔT °C	75.6 lpm ΔT °C	94.5 lpm ΔT °C	113.4 lpm ΔT °C	132.5 lpm ΔT °C
LCTEN036	36	68	34	22	17	13	11	9	7			
LCTEN054	54		52	33	25	21	17	13	10	8		
LCTEN063	63		59	39	29	24	19	16	12	9	8	
LCTEN072	72		69	44	44	27	22	18	13	11	16	8
LCTEN0108	108			67	50	41	34	27	20	16	13	12
LCTEN0126	126			79	59	48	39	32	24	19	16	14
LCTEN0144	144				67	53	46	37	27	22	18	16

N Series Skid System (Two back-to-back-N Series Heaters)

Temperature Rise (GPM & F°)												
480/600V	**kW**	4 gpm ΔT °F	8 gpm ΔT °F	12 gpm ΔT °F	16 gpm ΔT °F	20 gpm ΔT °F	24 gpm ΔT °F	30 gpm ΔT °F	40 gpm ΔT °F	50 gpm ΔT °F	60 gpm ΔT °F	70 gpm ΔT °F
LCTEN108 & reverse (108kW ea)	216			120	90	74	61	49	36	29	24	21
LCTEN126 & reverse (126kW ea)	262			143	107	86	71	57	43	34	28	25
CTEN144 & reverse (144kW ea)	288				120	96	82	66	49	39	33	28

Temperature Rise (LPM & C°)												
480/600V	**kW**	15.1 lpm ΔT °F	30.3 lpm ΔT °F	45.4 lpm ΔT °F	60.6 lpm ΔT °F	75.7 lpm ΔT °F	90.8 lpm ΔT °F	113.6 lpm ΔT °F	151.4 lpm ΔT °F	189.3 lpm ΔT °F	227.1 lpm ΔT °F	265.lpm ΔT °F
LCTEN108 & reverse (108kW ea)	216			67	50	41	34	27	20	16	13	12
LCTEN126 & reverse (126kW ea)	262			79	59	48	39	32	24	19	16	14
LCTEN144 & reverse (144kW ea)	288				67	67	46	37	27	22	18	16

Output heating capacity is reduced if these heaters are installed on 415V, 400V, or 380V 3-ph.

Contact a Laars representative to supply this information.

Satisfactory performance of the heater is dependent upon a specific flow rate vs temperature rise capability. If the desired temperature is not achieved, please verify the following:

1. Circuit breaker is on and rated for the maximum power draw.
2. Heater is drawing the proper current for the supply voltage on all three phases.
3. All element load indicator lights are lit (not flashing) indicating maximum power draw and maximum amperage is being drawn.
4. Flow rate and temperature rise in the water heating process are compatible with the heater specifications.
5. Verify there is no additional supply of cold water entering the line downstream of the heater.

Product Options

AL High-Low Temperature Alarm: Alerts user to an over or under temperature situation.

GF (Ground Fault): Detects electrical leakage from external sources to protect equipment, electronics, and the heat exchanger from being damaged in the event of a power fault. After turning on water, then power, test ground fault:

1. Press GF Test button.
2. Watch for ground fault light to illuminate and Bank Ready light(s) to shut off. The Ground Fault system is active and in working order.
3. Press the GF Reset button, hold for 2 seconds and release to reset ground fault.

☑ *If a trip occurs under normal operation DO NOT RESET Ground Fault without evaluation and service.*

☑ *Normal state is Ground Fault light OFF, Bank Ready lights ON.*

ENHT Freeze Protection (ENHT & ENHT30): ENHT offers protection to -20°F (-28°C). The ENHT30 offers protection to -30°F (-34°C) Each level of protection utilizes the normal heater supply voltage. No additional dedicated circuit to the unit is required during field installation. Freeze protection (ENHT option) includes an internally insulated NEMA 4/4X enclosure and thermostatically controlled forced air heater to maintain internal temperatures above freezing. ENHT options also include a connection point for DCS monitoring. In the event of a power interruption or ENHT system failure when internal enclosure temperatures reach 40°F (4°C) or lower, the unit will notify a facilities control/monitoring system that the unit is unable to maintain freeze protection. Regardless of state of power to the unit, this warning notifies maintenance personnel and provides an opportunity to correct the condition before any damage occurs to the unit.

NOTICE! With this option, three-phase power must be continuously applied to the heater for the internal freeze protection heater to operate properly and provide protection. If three-phase power cannot be continuously applied, the heat exchanger must be completely drained of water and electrically locked out or damage from freezing may occur. Use Start Up procedure to restart this equipment. This option does not require a separate electrical circuit.

NOTICE! Failure to install these options properly, to maintain power at all times or to connect the contacts provided on ENHT heaters correctly to the BMS may result in damage to the heater and void the warranty. Please utilize the temperature sensor contacts (N.O.) that can provide a signal to a remote device when temperature inside the cabinet drops below 40°F (4°C) and be aware of freezing conditions in your area (Reference Schematic). The contacts will open and notify you that the operations of the system should be verified.

FDS Fused Disconnect: Internal fused disconnect interlocks with enclosure door when energized, prohibiting access to a live cabinet. Select the FDS option for an additional level of safety and convenience at the heater location.

LS (Level Sensor): Prevents accidental dry fire.

T170, T180, T190 & T200 High Temperature Option: High temperatures as indicated (maximum of 170°F/76.7°C, 180°F/82.2°C, 190°F/87.8°C, 200°F/93.3°C).

D1 Control Interface: Provides 4–20ma communication interface with temperature controller.

DC Control Interface: Is an RS-485 Modbus RTU and allows Building Management Systems to view heater outlet.

TE & TE2 Corrosive Fluid Protection: The TE option is a PFA Teflon® coated heat exchanger with bright annealed stainless steel elements, FDA Approved (use for deionized water or mild corrosive fluid applications). Similar to TE, the TE2 option is a single layer of Xylan Fluoropolymeric coated heat exchanger with bright annealed stainless steel elements, FDA Approved for Food Contact (use in deionized water applications).

EXP2CFPM (Continuous Flow Explosion Proof Purge System): EXP2 option makes heaters compliant for classified areas; Class L Division 2, Groups A, B, C, D, Temp Code: T5. The Purge System requires a supply of clean instrument air or inert gas (provided by installer). This supply maintains a positive internal pressure and prevents the enclosure from filling with flammable gases, dusts, or vapors from the ambient environment. Complete installation provided in this manual.

HLW (ASME Certified Heat Exchanger): Available on CTEN063 and larger. The heat exchanger is made of special brass and certified by ASME inspector for quality of workmanship.

N4X & N4X316 Cabinet Enclosure: NEMA 4X corrosion resistant enclosure made of stainless steel (316 stainless steel for N4X316 option) and ideal for harsh environments.

Maintenance

Preventative maintenance is important for optimal performance of the heater. To ensure the heater works properly, always keep the inside of the enclosure dry. Moisture inside an enclosure increases the humidity, which condenses on cooler surfaces. This can cause electrical problems and reduce the efficiency of enclosure insulation. To prevent problems, perform the following:

- Verify the interior of the enclosure is dry.
- Verify there are no leaks in seals of enclosure and that in high humidity environments all enclosure egresses are properly sealed.
- Ensure plugs are in place on back side of enclosure.
- Check seals monthly during temperatures above 32°F (0°C) and weekly during temperatures below 32°F (0°C).
- Bimetal manual reset safeties are set to trip at 175°F (79°C). If this temperature is reached, the bimetal manual safeties will trip and need to be reset.
- All heaters require filtration of 150 microns or smaller to ensure proper operation. Y-strainers or additional filtration should be verified and cleaned at least every 6 months or more often in areas where hard water sediment is present in the water.

  To clean the Y-Strainer:

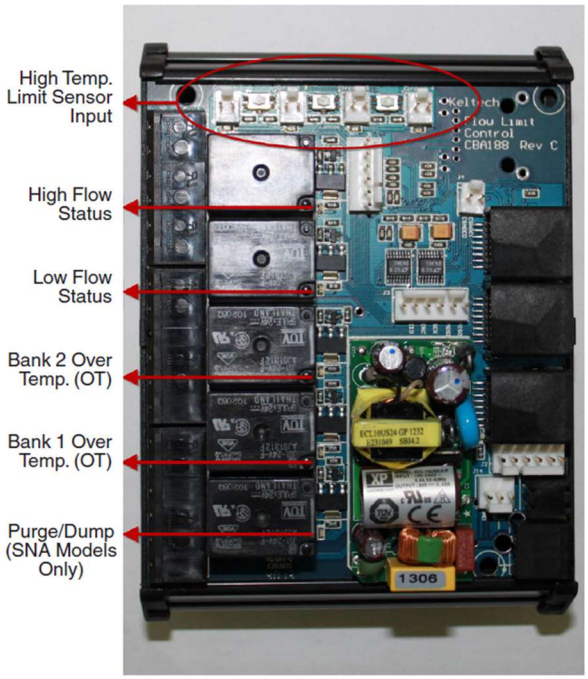
  1. Turn the power off at the circuit breaker panel.
  2. Shut off the installer supplied cold water isolation valve to the heater.
  3. Relieve pressure in the plumbing lines.
  4. Position a bucket under the cold water inlet to catch any water that may still be in the pipe.
  5. Loosen the plumbing connection on the Y-strainer to get to the screen.
  6. Remove screen and clean out debris. Use a wire brush to clean smaller particles from the screen.
  7. Once the screen is clean, put it back into the Y-strainer housing and secure the plumbing connection.
  8. Before switching the power back on, bleed the air out of the lines by turning heater water supply back on and the plumbing fixture or process farthest from the heater.
  9. With the air purged, turn on all circuit breakers supplying the water heater.

- At the same time the Y-strainer or additional filtration is cleaned, it is a good practice to also check all valves connected to the system. With no water flow through the heater, work both the inlet ball valves and the outlet gate valves open and shut to break up any calcium deposits that may have formed from the valve being open for an extended period of time. Power to the heater does not need to be turned off to do this.

Troubleshooting for Controller

Problem	Solution
No Power	Verify power is on.
	Check incoming service connection. Voltage must match name plate rated voltage. Labels are located on upper left of back plate (serial number label).
	Turn power off. Check continuity of all internal fuses in control transformer, heating elements or optional fused disconnect circuits.
	Check all field service circuit breakers or fuses.
	Check the safety interlock door switch to make sure that lack of power is not due to mis-adjustment or open enclosure door.
	Check system temperature limit control to make sure it has not activated due to excessive heat exchanger temperature or faulty sensor.
	Turn power off. Check for loose or disconnected wires.

Troubleshooting using the Flow Limit Control Board (FLCB)

Problem	Solution
The heater does not work or works intermittently.  	Check that the flow sensor located at the inlet is spinning with water running. Check if in Low flow (>1.5 gpm/5.7 lpm) that the FLCB light is on. If in High flow (>15 gpm/56.8 lpm) both the flow light and high flow lights will be illuminated.
	Check that water flow through the heater is adequate to activate the flow sensor at 1 5gpm (5 7 lpm).
	Check that the heater is wired with the proper breaker and wire size. Refer to Electrical Specifications table for proper requirements.
	Check that the unit is receiving voltage from all three phases of the power source. A load voltage reading is also helpful.
Element Load Bank 1–2 or 3–4 is not energized	Check FLCB with corresponding light indicated: Bank 1–2 on the front bezel = Bank 1 on the FLCB. Bank 3–4 on the front bezel = Bank 2 on the FLCB. If the light is off and there is power on. Check if water temperature is greater than 175˚F (79°C). Decrease water temperatures and restart.

If the above steps do not solve the problem, some additional checks may be performed. Follow the schematic to perform the following continuity checks:

- ☐ Emergency stop switch.
- ☐ Door guard.
- ☐ High temperature bimetals (Manual Reset Safeties).
- ☐ Optional ground fault breaker must be in the closed position for the unit to work.
- ☐ All internal breakers must be in the ON position for the unit to work.

For additional information on Troubleshooting or other information, contact Laars Technical Support. Please have Model No. and Serial No. available when seeking technical assistance. Serial No. tag is located in the enclosure on the upper left hand corner of the back plate.

Please record and maintain this information at all times:

N Series Model No. _____

Serial No. _____

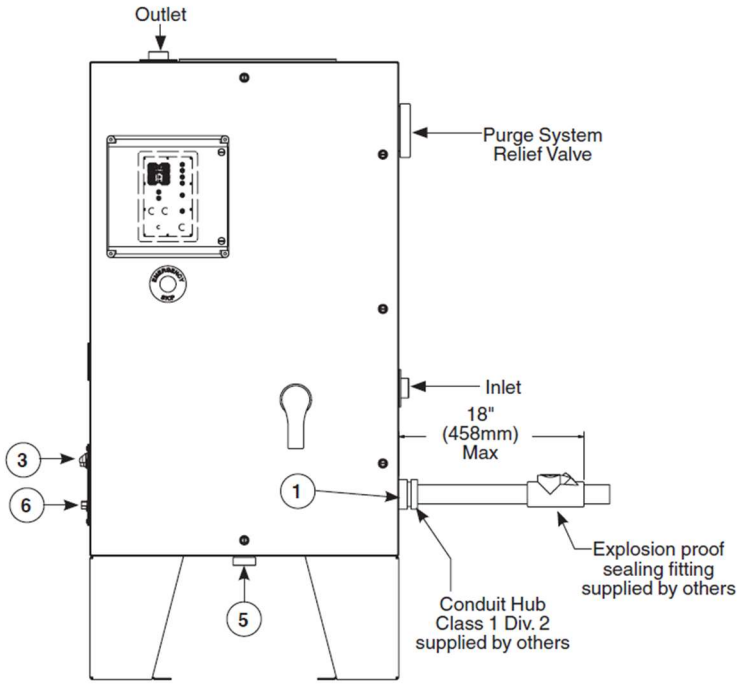
Special Installation and Operating Instructions

Tankless Water Heaters With Optional Class I Division 2 Purge EXP2CFPM Option

General Information

Tankless Water Heaters with model number suffix of - EXP2CFPM have been fitted with a Z purge system to pressurize the enclosure suitable for use in Class I Division 2 Hazardous Locations.

A Continuous Flow (Model CF) Mini-Z Pressurizing System has been fitted to the inside of the enclosure.



1. Suggested region for power entrance at right/bottom of enclosure.
   Entrance hole to be provided by installer.
2. All plumbing fittings are 1-1/4" NPT female threaded
3. Purge Control Panel Class 1 Division 2
4. All installation egress from panel must be sealed (electrical conduit) for proper explosion proof installation.
5. Spark arrestor with calibration orifice is located in the bottom of the enclosure.
6. Purge gas/compressed air inlet fitting here.

EXP2CFPM Installation Notes

1. Any tubing, conduit, or fittings connected to the Pressurized Enclosure (PE) must conform to local codes for flammability ratings.
2. All egress into PE must be plugged and properly sealed to minimize leakage of purge air. Use hazardous location sealing fittings suitable for Class I locations within 18" (458mm) of enclosure.
3. The EXP2CFPM purge system option is a continuous flow purge system mounted inside the cabinet enclosure and calibrated to flow at 0 9 SCFM (1 5291 CMH). To minimize waste, plug and seal all openings and conduit.
4. The system is designed for use primarily with compressed air. The source of the compressed air must be from a non-classified area (see Purge Gas Supply Notes). Purge air must be clean, dry, and free of flammable gases. When inert compressed gases are used (nitrogen, for example) the installer and facility manager must take suitable precautions on-site so that buildup of the inert gas does not present a health hazard. Where risk of asphyxiation exists, a warning label must be fitted to the Pressurized Enclosure (PE).
5. Adjustment of Purge System is not necessary. System is fully calibrated.
6. Connect to Purge System where indicated in the figure above. Connection port is 1/4" NPT female. Supply pressure must be regulated to 60–115 PSI (4-8 bar).

Purge Gas Supply Notes

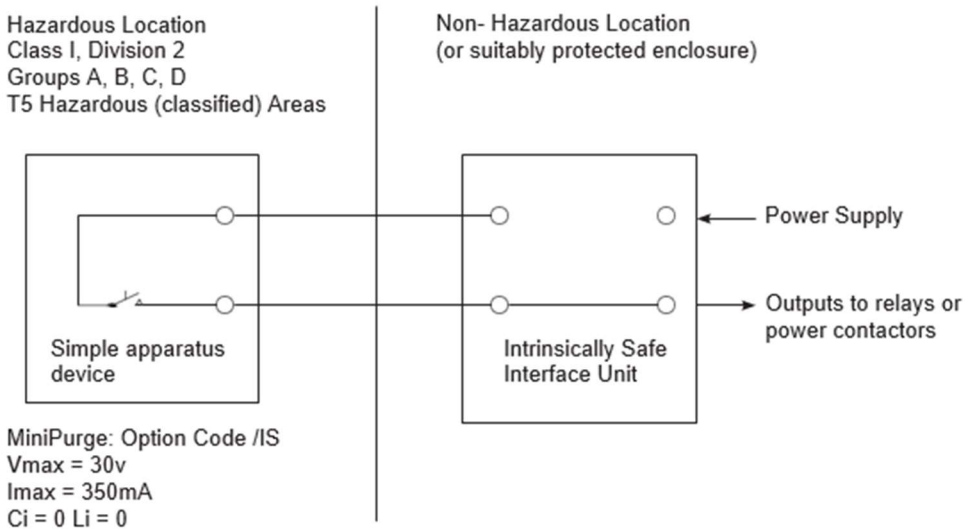
An alarm shall be provided to indicate failure of the protective gas supply to maintain the required pressure. Piping for the protective gas shall be protected against mechanical damage.

Where the compressor intake line passes through a classified location, it shall be constructed of noncombustible material, designed to prevent leakage of flammable gases, vapors, or dusts into the protective gas, and protected against mechanical damage and corrosion.

The electrical power for the protective gas supply (blower, compressor, etc.) shall be supplied either from a separate power source or from the protected enclosure power supply prior to any service disconnects of the protected enclosure. Any protected enclosure that can be isolated from the protective gas supply shall be equipped with an alarm. Where an alarm is used to indicate the loss of pressure in the cabinet:

- The alarm shall be located at a constantly attended location.
- The alarm actuator shall take its signal from the protected enclosure and shall not be installed between the enclosure and the protective gas supply.
- The alarm actuator shall be mechanical, pneumatic, or electrical.
- Electrical alarms and electrical alarm actuators shall be approved for the location in which they are installed.
- No valves shall be permitted between the alarm actuator and the enclosure.

Intrinsically Safe (IS) Installation



1. Electrical equipment connected to associated apparatus should not use or generate more than 250 volts.
2. Installation shall be in accordance with the manufacturer's instructions and the National Electrical Code (NFPA 70).
3. For guidance on Installation see ANSI/ISA RP12 .6 (Installation of IS Instrument System in Class I Hazardous Locations).
4. Voc or Vt of associated apparatus is less than Vmax.
   Isc or IT of associated apparatus is less than Imax.
   Ci plus capacitance of interconnecting cabling is less than Ca of the associated apparatus.
   Li plus inductance of interconnecting cabling is less than La of the associated apparatus.
5. "Simple Apparatus" is a device that will not generate or store more than 1 .2V, 0,1A, 25mW or 20uJ.

IS Installation continued…

All quarter turn latches in the door of the PE must be fully latched for proper operation. Power to the PE must be turned off before opening the enclosure.

⚠ **WARNING This pressurized enclosure shall not be opened unless the area is known to be free of flammable materials or unless all devices within have been de-energized.**

Power shall not be restored after the enclosure has been opened until the enclosure has been purged for allotted time (see table below). Time begins when pressure indicator turns green after the door of the enclosure has been closed and fully latched.

⚠ **WARNING Ignition of potentially explosive gas/air mixtures may result if power is turned on before the allotted purge time!**

Expo Technologies CF systems have a Minimum Pressure Sensor set to a pressure of at least 0.1" WC (0.25 bar). When the PE pressure is above this set point the sensor produces a positive Pressurized signal. This is displayed on the Red/ Green indicator located on the Purge System. This signal can be used to operate an electrical contact for a remote alarm. This signal may be supplied to the pressure operated switch suitable for Intrinsically Safe circuit. When the enclosure pressure falls below the set point of the sensor, the Pressurized signal is removed, and the Alarm conditions occurs. This alarm must be located where it can be readily observed according to NFPA496 requirements. **No valves may be fitted between the Expo Technologies system and the alarm switch.**

⚠ **WARNING Never turn on the power without purging first, unless you have proved the interior of the PE is gas free and checked that the "Pressurized" indicator is green!**

Commissioning Test

Commissioning Continuous Flow Option EXP2CFPM System:

1. Open the air or gas supply shutoff valve.
2. Adjust the Flow Control Valve (FCV) so that the enclosure pressure rises to the point where the "Pressurized" indicator turns green.
3. Lower the PE pressure until the Pressurized indicator turns Red.
4. Open the FCV again and set the PE pressure to a level somewhere between the Minimum Pressure Sensor set point and the RLV opening pressures. This working pressure is not critical. Enough pressure to keep the "Pressurized" indicator Green is sufficient.
5. On EXP2CFPM Purge System the timing function is performed by the user. The user must ensure that the time delay between the indicator turning Yellow and the application of power to the PE is not less than the minimum time required to purge the PE as shown in the table below.

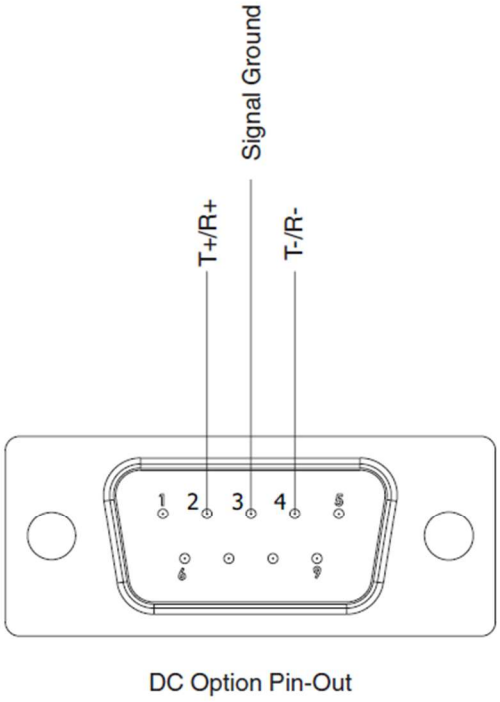
Normal Operation: Turn the air supply valve ON to start or OFF to stop the system. The user must close the Power Switch only after the enclosure has been pressurized and purged sufficiently to ensure that the interior of the enclosure is gas free. It is the operator's responsibility to shut off the power as soon as possible after a pressure failure.

PURGE TIME CHART - EXP2 Option for use with EXPO Mini Z Purge 1ZCF/bp/IS					
Model/Enclosure Group Size	Cubic Feet (Cubic Meters)	Volume Exchanges X 4	Orifice Size	Orifice No.	Purge Time (Minutes)
36-54kW	10 (0.28)	40	0.9	#2	44
63kW	12.5 (0.35)	50	0.9	#2	55
72-108kW	10 (0.28)	40	0.9	#2	44
126-144kW	12.5 (0.28)	50	0.9	#2	55

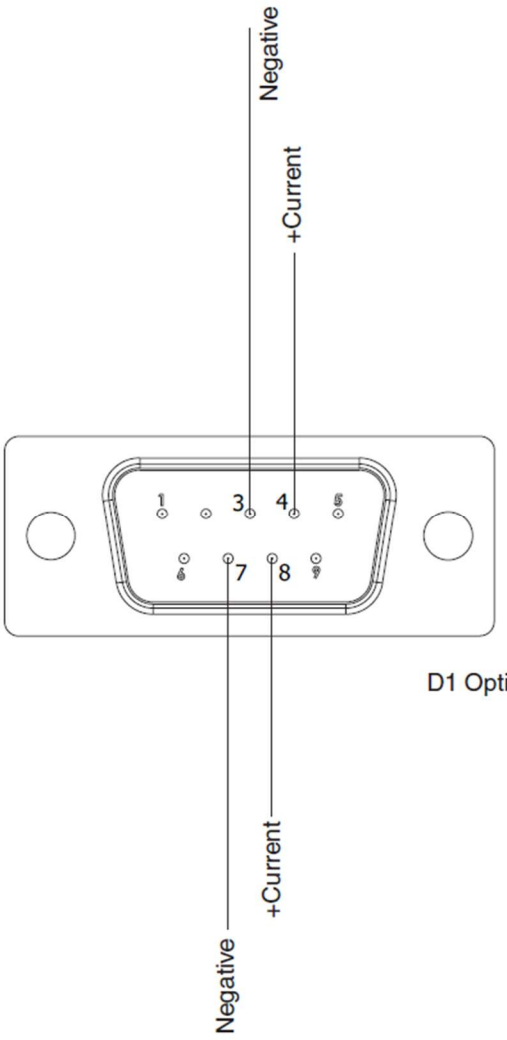
Tankless Water Heaters with Optional D1 or DC Controller Options

Pin-Out Diagram for Electrical Wiring

The controller is shipped with the D1 option deactivated. Contact Bradford White to get the unlock code to activate the option.



DC Option Pin-Out



D1 Option Pin Out

DC Option Pin-Out		
Pin	Name	Description
2	T+/R+	RS-485 Transmit/Receive Non-Inverting Input/Output
3	Signal Ground	Signal Ground
4	T-/R-	RS-485 Transmit/Receive Inverting Input/Output
1, 5, 6-9	--	No Connection

D1 Option Pin-Out		
Pin	Name	Description
3	Negative	Return Current Path for +Current, Pin 4
4	+Current	Supply 4-20mA Current to Set Heater Temperature
7	Negative	Return Current Path for +Current, Pin 8
8	+Current	Supply 40-20mA Current to Monitor Heater Temperature
1, 2, 5, 6, 9		No Connection

Table of Parameters for DC Option: RS-485 Modbus

Parameter Name	Range	Map 1	Map 2	Default	Data Type	Read/ Write	N-Series Meaning
Analog Input	-1999.000 to 9999.000 °F -1128.000 to 5537.000 °C	360	360	--	Float	R	Process Value
Analog Input Error	None (61) Open (65) Fail (32) Shorted (127) Measurement Error (140) Bad Calibration Data (139) Ambient Error (9) RTD Error (141) Not Sourced (246)	362	362	None	UINT	R	Process Value Sensor Error
Calibration Offset	-1999.000 to 9999.000 °F -1128.000 to 5537.000 °C	382	382	Factory Set	Float	RWES	Process Value Calibration
Digital in 5	Inactive (41) Active (5)	1328	1568	--	UINT	R	Flow Activation
Digital out 6	Off (62) On (63)	1042	1162	--	UINT	R	AL Only Alarm Status
EZ-KEY	Inactive (41) Active (5)	1328	1608	--	UINT	R	EZ-Key
Control Mode Active	Off (62) Auto (10) Manual (54)	1882	2362	Auto	UINT	R	Control Loop Mode
Heat Power	0.0 to 100.0%	1904	2384	--	Float	R	Duty Cycle Output %
Set Point	-1999.000 to 9999.000 °F -1128.000 to 5537.000 °C	2172	2652	--	Float	R	Heater Set Point
Remote Set Point	No (59) Yes (106)	220	2680	No	UINT	RWES	Remote Set Point Enable
Remote Set Point Type	Auto (10) Manual (54)	2202	2682	No	UINT	RWES	Remote Set Point Control Mode
Process Value	-1999.000 to 9999.000 °F -1128.000 to 5537.000 °C	402	402		Float	R	Process Value
Control Mode	OFF (62) Auto (10) Manual (54)	1880	2360	Auto	UINT	RWES	Control Loop Mode
Close Loop Set Point	40-160 std 40-170 T170 Option 40-180 T180 Option 40-190 T190 Option 40-200 T200 Option SPCL	2160	2640	Factory Set	Float	RWES	Heater Set Point
Open Loop Set Point	0 to 100.0%	2162	2642	--	UINT	RWES	Manual Mode Set Point
Display Units	Fahrenheit (30) Celsius (15)	1838	2308	°F	UINT	RWES	Controller Display Units
Address Modbus	1-247	2482	2962	1	UINT	RWE	Modbus Address
Baud Rate	9600 (188) 19200 (189) 38400 (190)	2484	2964	9600	UINT	RWE	Modbus Baud Rate
Parity Modbus	None (61) Even (191) Odd (192)	2486	2966	None	UINT	RWE	Modbus Parity
Modbus Units	Fahrenheit (30) Celsius (15)	2490	2970	°F	UINT	RWE	Communication Units
Modbus Word Order	Low-High (1331) High-Low (1330)	2488	2968	Low-High	UINT	RWE	Modbus Word Order
Non-Volatile Save	Yes (106) No (59)	2494	2974	Yes	UINT	RWE	If set to yes, all values to the control will be saved from EEPROM

NOTICE! ***For adjusting Modbus address, baud rate and parity, customer needs to set on Controller per manufacturer's (Watlow) manual.***

Legend	
Uint=Unsigned 16 bit int	string=ACSII (8 bit per character)
Dint=Long 32 bit	float=IEEE 754 32 bit
RWES=Readable, Writeable, EEPROM (saved), User Set (saved)	

Special Installation Maintenance

Routine Maintenance of the System (Every 6 months)

Recommended maintenance of the systems is as follows:

Repeat Commissioning test at least every six months. The test includes checking the opening pressure of the Relief Valve, setting of the Minimum Pressure Sensor, the "Normal Working Pressure" of the enclosure. Test that the interlock and alarms function correctly.

Check the Relief Valve and any other Spark Arrestors. Remove any debris or corrosion or replace the Spark Arrestor. Check the condition of the air supply filter element. Clean or replace it as necessary.

Periodic Maintenance (Every 18-24 months)

At least every two years, the following additional checks are recommended:

Apparatus (Heater, Purge Systems, Alarms etc.) is suitable for the Hazardous Location.

There are not unauthorized modifications.

The source of air is uncontaminated.
The interlock and alarms function correctly.

Approval labels are legible and undamaged.

Adequate spare parts are carried.

The action of pressure failure is correct.