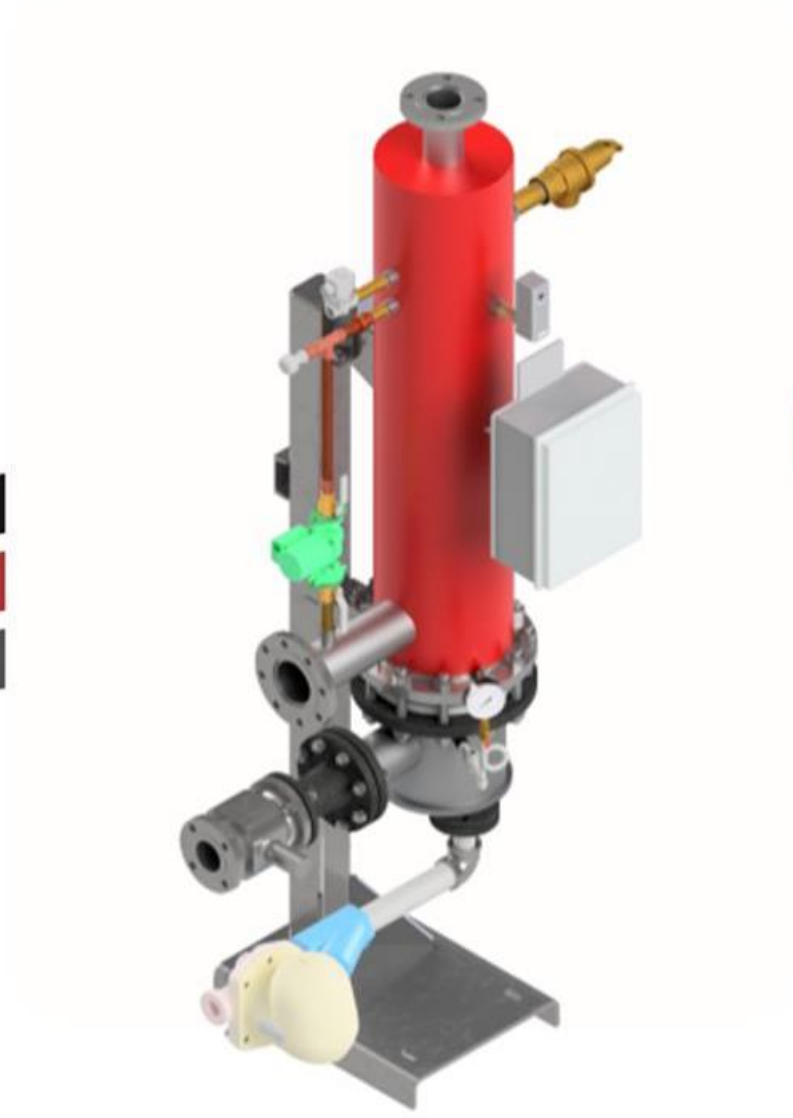
HX2 SERIES

Semi-Instantaneous Water Heaters



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

RECO USA

The Water Heater and Pressure Vessel Experts

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THE HX2 SERIES

SEMI-INSTANTANEOUS WATER HEATERS

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

INTRODUCTION

This Installation, Operation, and Maintenance (IOM) manual is current as of the date issued, and RECO USA reserves the right to update, modify, amend, or change the information contained herein at any time without prior notice and without obligation to notify owners of this product of such changes.

All installation, operation, and maintenance should only be attempted by authorized personnel trained to do so, and any personnel attempting these tasks should be completely familiar with the contents of this IOM manual before attempting to do so.

1.1 HX2 Overview

The **HX2** is RECO USA's next generation of compact, semi-instantaneous water heaters using available steam as the heating medium. Designed to the guidelines of TEMA, BOCA and IAPMO, these heaters can heat up to 150 GPM from 40 °F to 140 °F as standard, with higher capacities possible.

At the heart of the control system is the Control Master® panel with a digital PAC controller. The Control Master has an easy-to-navigate LCD panel for local monitoring and set point adjustment. It accepts remote set point changes and can re-transmit water temperature via standard Modbus® or BACnet® communications protocols.

An electrically operated, fast-acting V-ball control valve is used to modulate the flow of the heating fluid. It has a 100:1 rangeability which gives excellent control at all flow rates. Capacitors integrated into the actuator housing close the valve in the event of loss of main power. Soft valve seats provide tight valve shut-off and prevent temperature rises at low load due to valve seat leakage.

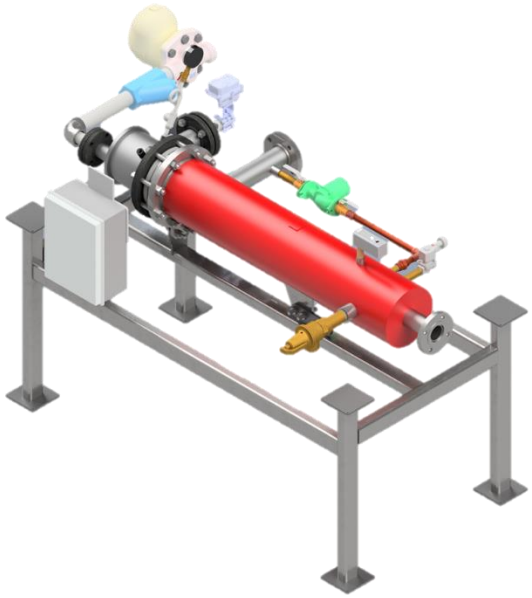


Fig. 1 – A horizontal HX2 unit (not all piping shown or insulation jacket shown)

1.2 Sales and Service Support

Key contacts at RECO USA for any quotation, sales, expediting, literature requests, shipping, or accounting issues can be reached at our main plant is located at 1839 Dunbar Road, Cayce, SC 29033.

Our main phone numbers are:

- Main office ..... (803) 794-3360
- Main fax ..... (803) 791-3304

To order replacement parts, contact RECO USA or your local authorized RECO USA representative.

1.3 Key Features and Benefits of the HX2

- The HX2 safety system includes a pressure/temperature (P/T) relief valve, solenoid-operated, fail-open dump valve, and an automatic fail-closed steam inlet control valve.
- Lightweight, compact design fits through standard doorways and freight elevators.
- High accuracy temperature control of ±4 °F achieved.
- Continuous forced re-circulation eliminates temperature stratification and ensures a uniform temperature distribution across all temperature sensors while also reducing scaling and sediment build-up on the tube bundles in the process.
- ASME constructed and stamped tank assures safe operation to 150 PSIG.
- All wetted parts on the heated side are lead-free and comply with NSF Standard 61 and the requirements of the U.S. Safe Drinking Water Act.
- Support stand can comply with International Building Code (IBC) guidelines for seismic requirements.

1.4 Materials of Construction

The standard HX2 tank and couplings are 316L stainless steel passivated to ASTM A380 and A967. Piping is carbon steel, welded or threaded as appropriate. All units come with a flexible insulation jacket conforming to ASHRAE Std. 90.1, and the support stand and heating bundle head are powder coated for added durability.

1.5 Flow, Pressure, and Temperature Ratings

- Heated water recovery rate ..... 5 to 150 GPM
- Steam supply pressure..... Up to 100 PSIG
- Cold water inlet pressure..... Up to150 PSIG
- Heated water outlet temperature..... Up to 210 °F
- Design rating ..... ASME Boiler and Pressure Vessel Code "U" stamped

1.6 Recommended Spare Parts

The table below shows the main spare parts available with the HX2, along with a recommendation for parts to be kept on hand to support the unit(s) in operation.

TABLE 1-1 RECOMMENDED SPARE PARTS PER UNIT

Operation	Gasket Kit	Pressure Gage Kit	P/T Relief Valve	RTD Assembly	High Limit Thermostat	Circulator Pump Kit	Steam Trap & Strainer Kit	Tube Bundle	Solenoid Valve	Control Valve Kit	Insulation Jacket	Control Panel
At Start Up	●	●										
5 Yr. Operation	●	●	●	●	●	●	●	●				
10 Yr. Operation	●	●	●	●	●	●	●	●	●	●	●	●

1.7 HX2 Rating Charts

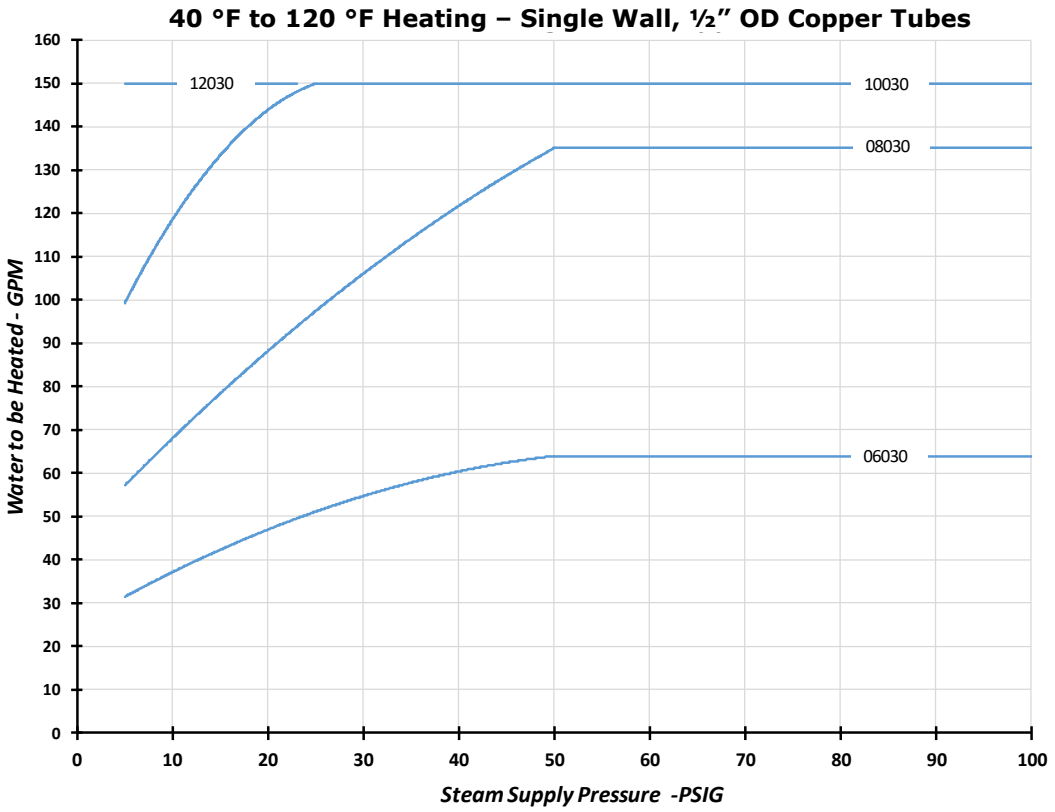
To select an HX2 the steam pressure (PSIG) available, amount of water (GPM) to be heated, and amount of heating (°F) to be done must be known. Heating is commonly specified in increments of 80 °F (40 °F to 120 °F) or 100 °F (40 °F to 140 °F).

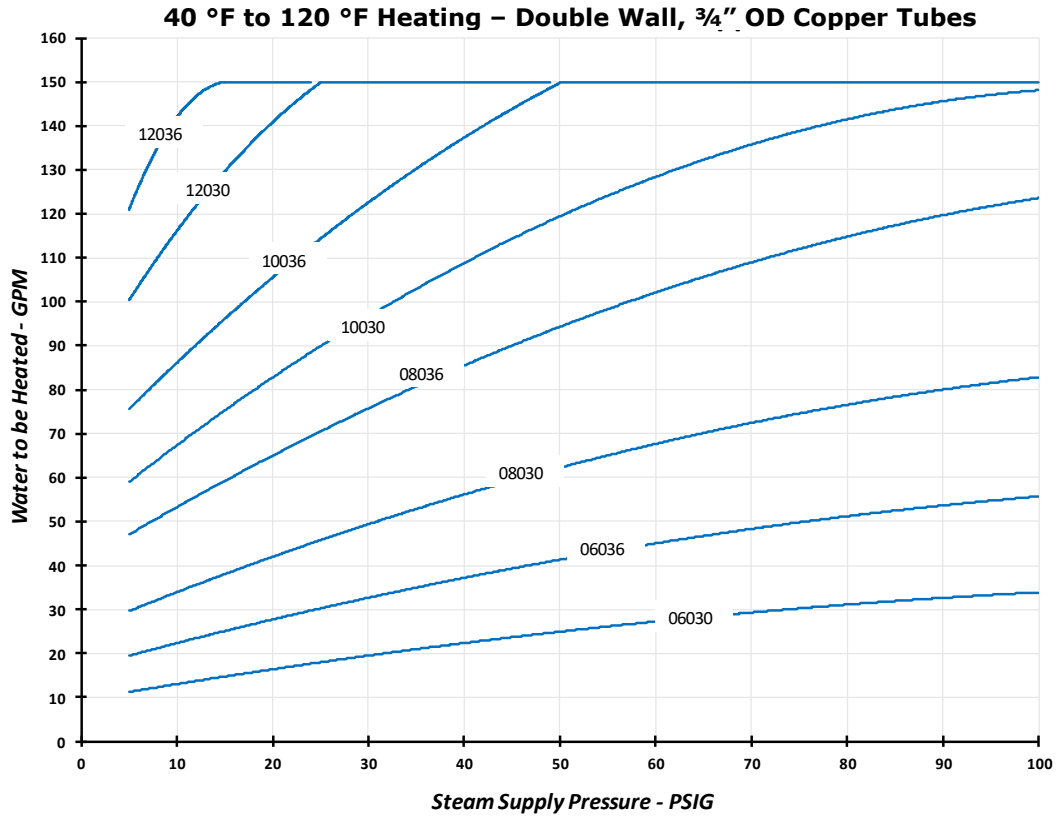
The first step is to locate the correct chart from the four that follow. Next locate the appropriate Steam Supply Pressure available (PSIG) along the X-axis, and the amount of water to be heated (GPM) along the Y-axis. Where the two intersect, find the rating curve corresponding to those conditions. If this intersection lies between two rating curves, choose the larger unit (higher curve).

Notes:

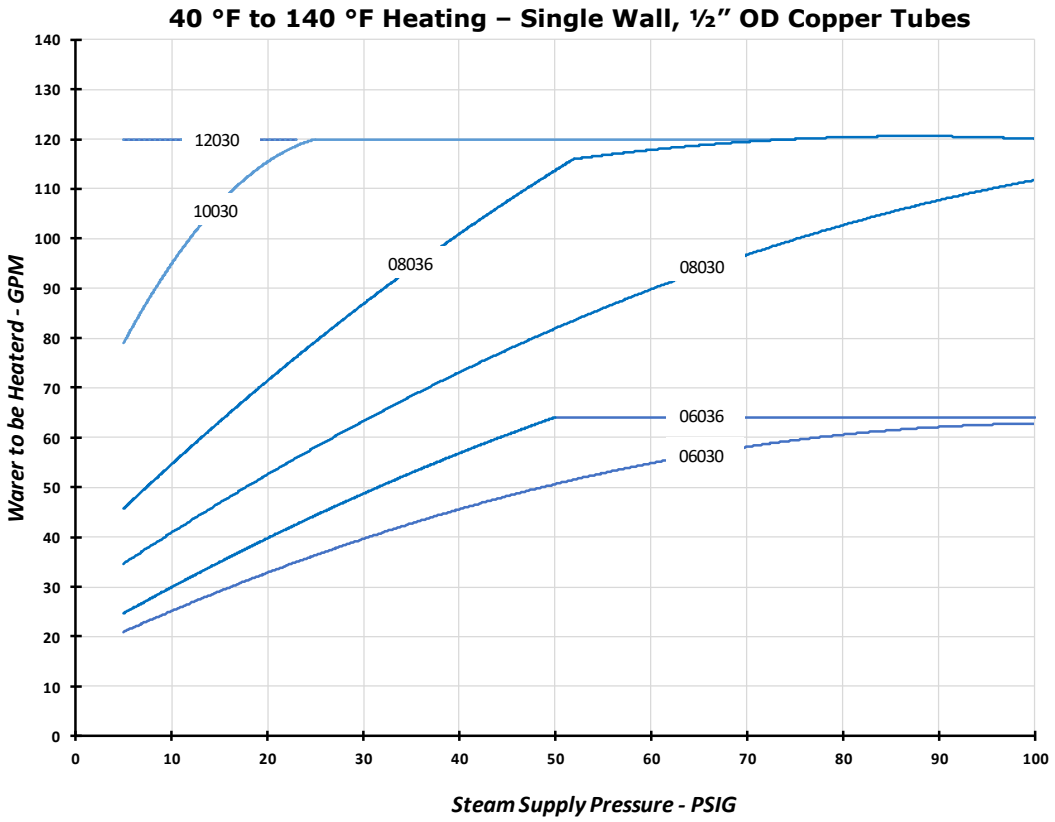
1. For copper-nickel tubes, de-rate the copper tube ratings shown by 20%.
2. The ratings curves shown assume a tube bundle fouling factor of 0.00025 (hr. x ft^2 x °F / BTU).
3. For applications with water as the heating source, contact RECO USA Sales Department.

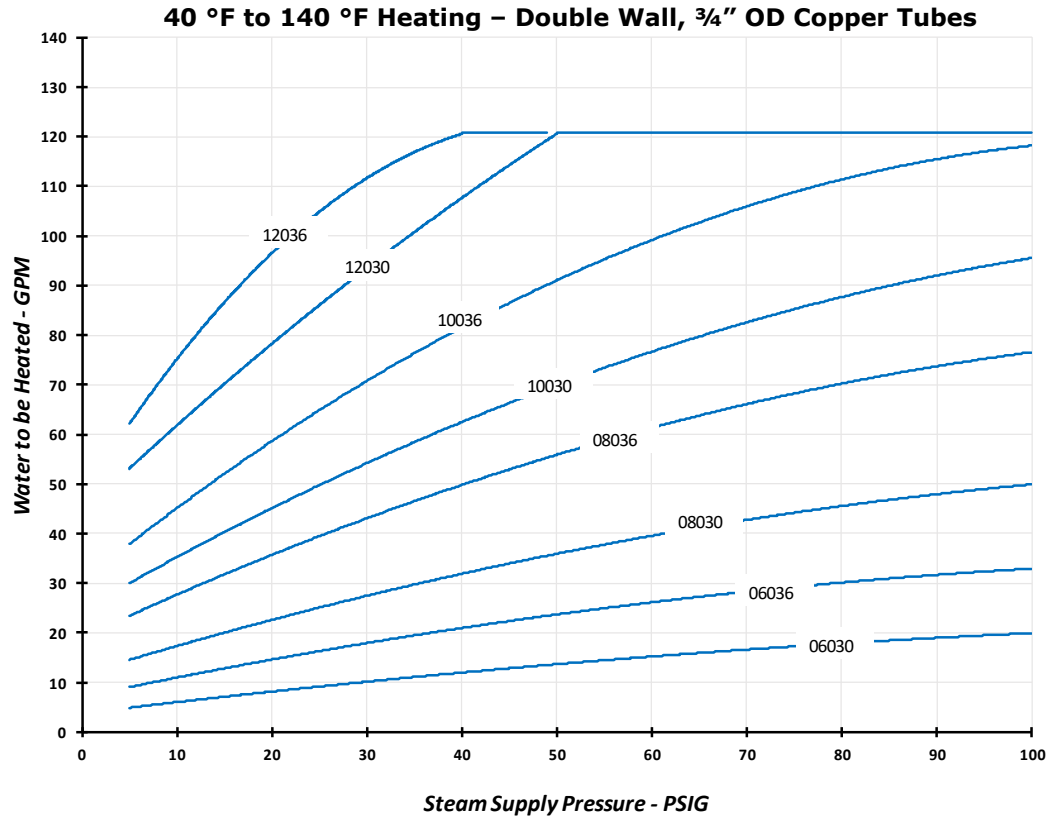
1.7a Rating Charts for 40 °F to 120 °F Heating





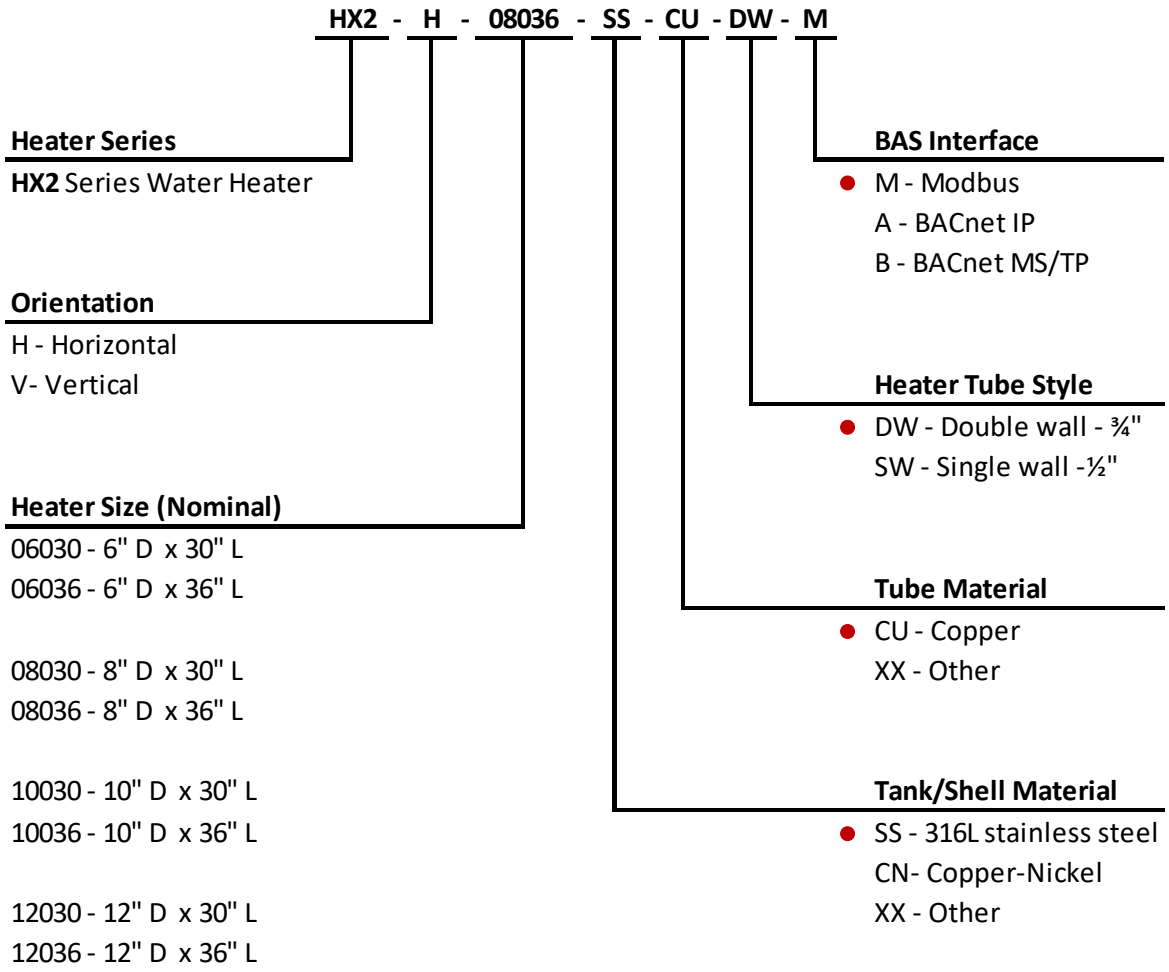
1.7 Rating Charts for 100 °F Heating





1.8 HX2 Configuration and Ordering Code

The following Configuration and Ordering Code defines the **HX2** and can be found on the unit nameplate. When inquiring about a HX2 this code must be used. Doing so enables us to handle requests quicker and assure the correct unit is being discussed.



● ***Denotes standard configuration***

1.8a Sample Selection:

The selected unit is a RECO USA HX2 series water heater model **HX2-H-0836-SS-CU-DW-M** horizontal water heater with 8" diameter x 36" long heating element, 316L stainless steel tank, ¾" copper double-wall tubes, and standard Modbus® communication interface with the building automation system.

THE HX2 SERIES

SEMI-INSTANTANEOUS WATER HEATERS

INSTALLATION

The following guidelines must be followed when installing a HX2 series water heater. Failure to do so can result in faulty performance, field service / support charges, and/or voiding of the warranty. Installation, operation, and/or maintenance should only be performed by trained personnel knowledgeable in proper plumbing and electrical practices, and in particular should be thoroughly trained in working with high pressure steam systems.

2.1 Shipment and Storage

All products are assumed to be installed and operated soon after receipt. RECO USA does not include any special preservation for long term storage, and assumes no responsibility for storage deterioration after shipment unless explicitly agreed to in writing beforehand. All units must only be lifted by the lifting lug(s) provided, as failure to do so could result in damage to the unit.

After the unit has been uncrated, it should be carefully examined for any damage that may have occurred in transit. If any damage is found and a shipping claim of damage is being made, immediately contact RECO USA or your local authorized sales, as well as the common carrier who delivered the unit(s).

2.2 General Installation Instructions and Guidelines

2.2.1 The HX2 is designed for indoor use only, unless specified otherwise. Install the unit so there is adequate room around the unit for servicing. Provide clear access (see Figures 1.7 and 1.8) to permit tube bundle removal.

2.2.2 The unit should be level to permit proper drainage and must be anchored securely to the floor. It should be on a level surface with no more than 0.5° slope and capable of supporting the total weight of the unit when filled to capacity.

2.3.3 All steam, water, and condensate lines should be installed in accordance with good engineering practices. Note that the ASME code requires that no reduction in pipe size, and no valves or other restrictions may be introduced in the piping from the relief valve.

2.2.4 After mounting the unit in place, connect the cold-water source to the unit's cold-water inlet, and then the hot water discharge from the unit to the building hot water feed line. The locations of these are indicated on the General Arrangement drawings in Figures 1.7 and 1.8.

2.2.5 Next connect the steam outlet trap and strainer (supplied loose) to the unit, and connect this line to the steam condensate return line.

2.2.6 Pipe the relief valve, tank drain, and solenoid dump valve separately to a suitable floor drain. Do not install a valve in relief valve or solenoid valve line, as that would defeat the purpose of these drain lines.

2.2.7 Complete the installation by making the appropriate electrical connections to the main control panel.

2.2.8 A manual shut off valve of the same size as the inlet water line should be installed upstream of the cold-water supply to the unit, and kept in the closed position until the installation is complete. A shut off valve of the same size as the hot water discharge line should also be installed at the unit's hot water discharge. Together, these two valves will isolate the heated water side of the unit.

2.2.9 A manual shut off valve of the same size as the steam inlet line should be installed upstream of the steam supply to the unit.

2.2.10 The condensate return line should have a shut off valve of the same size as the line installed downstream of the unit to isolate it from the system. This valve will also prevent backflow of steam if the line is disconnected at the unit's hot water discharge.

2.2.11 All piping is pressure tested at the factory for leaks prior to shipment. However, piping connections can loosen during transit, and installation, resulting in leaking connections, damaged threads, etc. Once installed and started, all piping should be inspected again, and any leaks or damage corrected at the time of installation.

2.2.12 An inlet steam strainer and steam trap immediately upstream of the inlet control valve (not provided by RECO USA) is necessary for optimal system performance. A condensate strainer and steam trap are provided loose as standard, with mounting and connection to be done in the field by others.

2.2.13 A suitable means, such as a gravity drain or condensate pump system, must be provided to remove condensate from the unit and otherwise prevent condensate from collecting and blocking its ability to freely flow away from the unit.

2.3 Major Components of the HX2

A general listing of the major, external components of an HX2, and their function, are as follows:

2.3.1 The solenoid valve is an electrically actuated, normally closed valve that opens to relieve tank pressure once a pre-set high temperature limit is exceeded. It should be independently piped to a suitable gravity drain using a line size of the same size as the solenoid valve discharge.

2.3.2 The resistance temperature detector (RTD) is a temperature probe immersed in the tank flow stream near the discharge nozzle. Under normal operation it is a self-contained device not requiring routine maintenance.

2.3.3 The high-limit thermostat is a primary safety feature that upon reaching a pre-set high temperature limit, interrupts power to the control valve, causing it to close, and energizes the solenoid valve to open.

2.3.4 The pressure/temperature (P/T) relief valve is a secondary mechanical safety device used to protect against over-pressure or over-temperature conditions within the unit tank. It should be independently piped to a suitable gravity drain using a line size of the same size as the relief valve discharge.

2.3.5 The circulator pump consists of a pump/motor assembly with companion flanges. It provides continuous circulation throughout the tank, which ensures a uniform temperature distribution across all temperature sensors.

2.3.6 An electrically operated, fast-acting V-ball control valve is used to modulate flow of heating medium to the unit. It has a 100:1 rangeability which gives excellent control at all flow rates. Capacitors integrated into the actuator housing close the valve in the event of loss of power.

2.3.7 The steam trap and strainer are a float and thermostatic (f & t) type steam trap and "Y" type strainer. These components are supplied loose for connection at the steam (condensate) outlet of the heating tube bundle.

2.3.8 The insulation jacket is a flexible, Velcro-attached design specific to the unit it insulates. All cut outs and openings for piping and instrumentation are provided for easy installation without the need for field modification.

2.3.9 The tube bundle is provided pre-assembled into the heating tank, with all piping and controls installed and tested, ready for start-up and operation.

2.3.10 The Control Master control panel is a complete, pre-assembled and pre-wired unit with a programmable automation controller (PAC) and easy to navigate LCD panel for local monitoring and set point adjustment.

2.4 Factory Pre-Sets

All temperature settings for the unit are factory set for the specified outlet temperature requirements. This is typically 120 °F or 140 °F.

2.4.1 The temperature pre-sets start with the RTD sensor and PID control loop tied to the control panel PAC. It is set to the specified outlet water temperature, and modulates the control valve position to maintain the inflow of steam corresponding to the demand for hot water. Upon reaching the desired water outlet temperature, the control valve will back off to the point it may fully close. Outlet water temperature is controlled to +/- 4 °F.

2.4.2 The high temperature alarm is set to 10 °F above the outlet temperature setting. Upon reaching this setting the control panel LCD display will blink and send an alarm signal to the BAS (if so wired). Upon returning below this high temperature setting, the system will automatically come out of alarm mode and reset itself without the need for a manual reset.

2.4.3 In addition to the RTD sensor and PID control loop, a separate high temperature limit switch is provided. This is pre-set to 10 °F above the high temperature alarm setting (which is 20 °F above the outlet water temperature setting). In the event the high temperature limit switch is tripped, it will cut power to the control panel. This will de-energize the steam inlet control valve, causing it to fail closed and cut off any further supply of steam to the unit, and energize the tank-mounted solenoid valve, causing it to open and relive any pressure in the tank.

2.4.4 As a third safety feature, a factory pre-set pressure / temperature relief valve mounted near the tank outlet will open upon reaching its high pressure or temperature setting, relieving the contents of the tank until the internal pressure in the tank falls below the valve settings. These settings are typically 150 PSIG and 210 °F, respectively.

2.5 General Arrangement Dimensions and Weights – Vertical Units

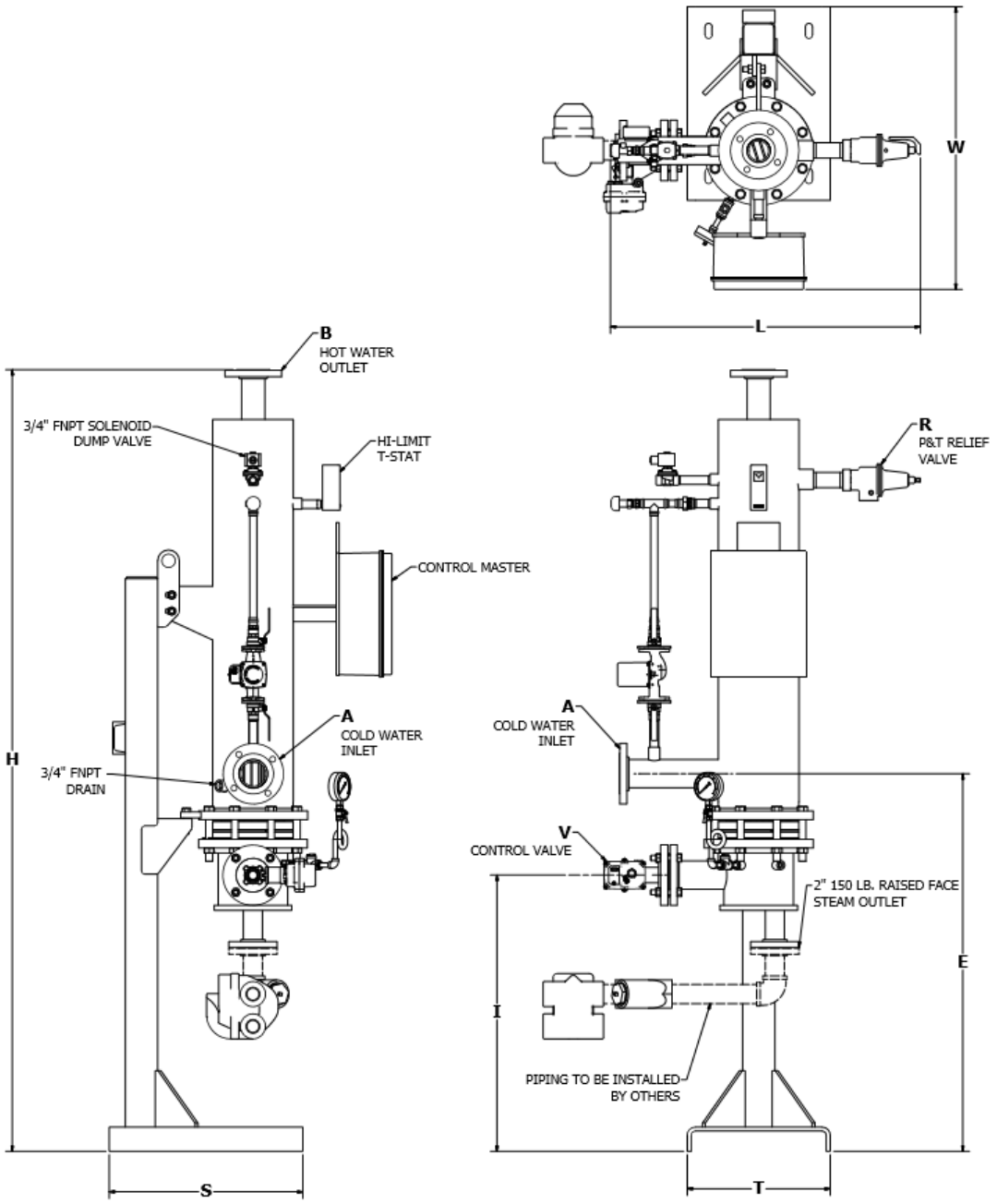


TABLE 2-1 VERTICAL UNIT DIMENSIONS

Basic Size	A	B	E	H	I	L	R	S	T	V	W	Wt. (lbs.)
06030 / 06036	2"	1 ½"	46.75	95.0	34.25	32	¾ FNPT	24.0	17.75	1" FNPT / 1.25" FNPT	33.0	930 / 950
08030 / 08036	3"	2 ½"	46.75	97.0	34.25	38	1.5 FNPT	24.0	17.75	1.5" FNPT / 2" FNPT	35.0	1,125 / 1,155
10030 / 10036	4"	3"	46.75	99.0	33.75	49	1.5 FNPT	24.0	17.75	2.5" 150 Lb. RFSO	37.0	1,380 / 1,420
12030 / 12036	4"	3"	46.75	100.0	33.75	51	1.5 FNPT	24.0	17.75	3" 150 Lb. RFSO	39.0	1,655 / 1,705

Notes:

1. Dimensions "A" and "B" are nominal sizes for ANSI 150 lb. raised face, slip on (RFSO) flange.
2. All dimensions in inches, unless noted otherwise.
3. Weights shown are net empty weight for a standard HX2 unit. Crating or shipping materials not included.

2.6 General Arrangement Dimensions and Weights – Horizontal Units

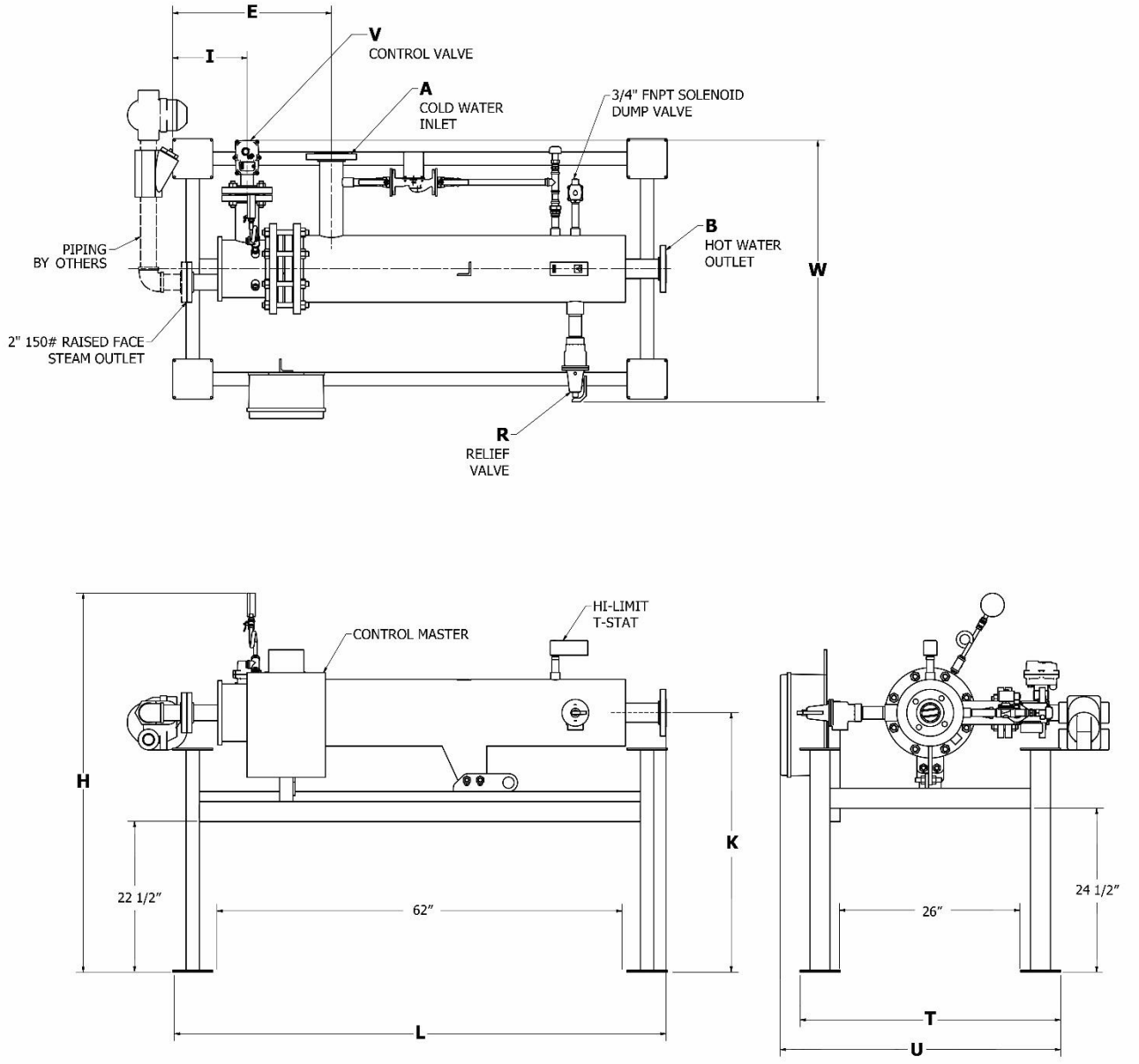


TABLE 2-1 HORIZONTAL UNIT DIMENSIONS

Basic Size	A	B	E	H	I	K	L	R	S	T	U	V	W	Wt. (lbs.)
06030 / 06036	2"	1 ½"	23.75	95.0	34.25	37.75	71.75	¾ FNPT	24	39	41	1" / 1.25" FNPT	33	985 / 1,005
08030 / 08036	3"	2 ½"	23.75	97.0	34.25	38.75	73.5	1.5 FNPT	24	39	41	1.5" / 2" FNPT	35	1,180 / 1,210
10030 / 10036	4"	3"	23.75	99.0	33.75	39.75	74	1.5 FNPT	24	39	41	2.5" 150 Lb. RFSO	37	1,435 / 1,475
12030 / 12036	4"	3"	23.75	100.0	33.75	40.75	77	1.5 FNPT	24	39	41	3" 150 Lb. RFSO	39	1,710 / 1,765

Notes:

1. Dimensions "A" and "B" are nominal sizes for ANSI 150 lb. raised face, slip on (RFSO) flanges.
2. All dimensions in inches, unless noted otherwise.
3. Weights shown are net weight for a standard HX2 unit. Crating or shipping materials not included.
4. Allow "L" dimension plus 6 inches for tube bundle removal clearance.

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OPERATION

3.1 Operating Instructions and Guidelines – Start Up

Before starting, read this HX2 Installation, Operation, and Maintenance Manual (IOM) in its entirety prior to proceeding. The separate section on the Control Master operation (Appendix A) contains important information on pump on/off, and control valve open/close instructions that should be understood before starting the unit up.

3.1.2 Begin with all assuring all steam, condensate, and water valves closed.

3.1.3 Slowly open the inlet and outlet isolation valves at the pump on the circulator line.

3.1.4 Open the cold-water inlet valve and fill unit with cold water. The tank can be vented by lifting the bypass lever on relief valve to allow trapped air to escape. Allow the relief valve lever to return to its original closed position once all traces of air have been vented from the unit. Leave the cold-water valve open.

3.1.5 Activate (Enable) the circulator pump at the control panel LCD display. Never operate the pump without the unit being filled with water and all isolation valves open, or damage to the pump will result from dry running.

3.1.6 Gradually open the control valve to allow steam to enter the tube bundle. Monitor the tank temperature until the desired temperature is reached. If the temperature regulator shuts off before the desired temperature is reached, or if significant over-shoot occurs, adjustment of the temperature settings may be required.

3.1.7 After any control valve adjustments have been made, and the desired water temperature has been reached, open the valves on the hot water discharge and building recirculation line.

3.1.8 Check for any leaks, as tightening of gasketed joints may be required after unit has been heated.

3.1.9 Never allow the unit to operate beyond its design conditions (see Section 1.5).

3.1.10 Never break any joint, gasketed surfaces, or threaded connections while the unit is in operation. Instead, the unit must be isolated and de-energized, with adequate time given for it to cool (see Shut Down instructions, Section 3.2).

3.2 Operating Instructions and Guidelines – Shut Down

Before shutting the unit down, assure that hot water demand for the unit is not needed. The operator should also re-read this HX2 Installation, Operation, and Maintenance Manual (IOM) in its entirety prior to proceeding.

To shut the unit down, follow the sequence as listed:

3.2.1 Close the inlet control valve to cut off incoming live steam to the unit.

3.2.2 Close the hot water discharge valve at the tank outlet.

3.2.3 Close the building recirculation valve, isolating the unit from the building steam line.

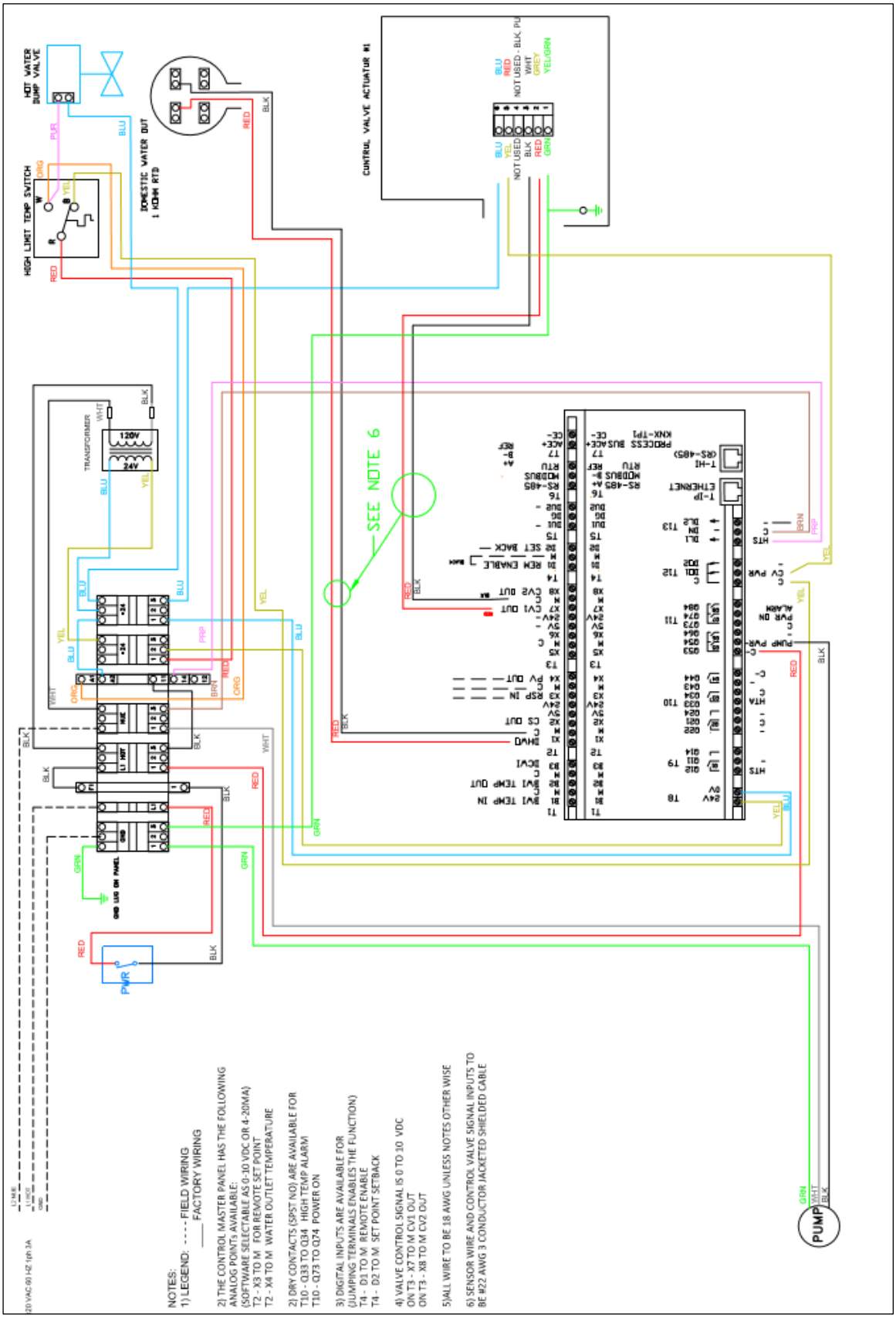
3.2.4 Close the water inlet valve to cut off incoming cold water to the unit.

3.2.5 Turn off all electrical power to the unit control panel.

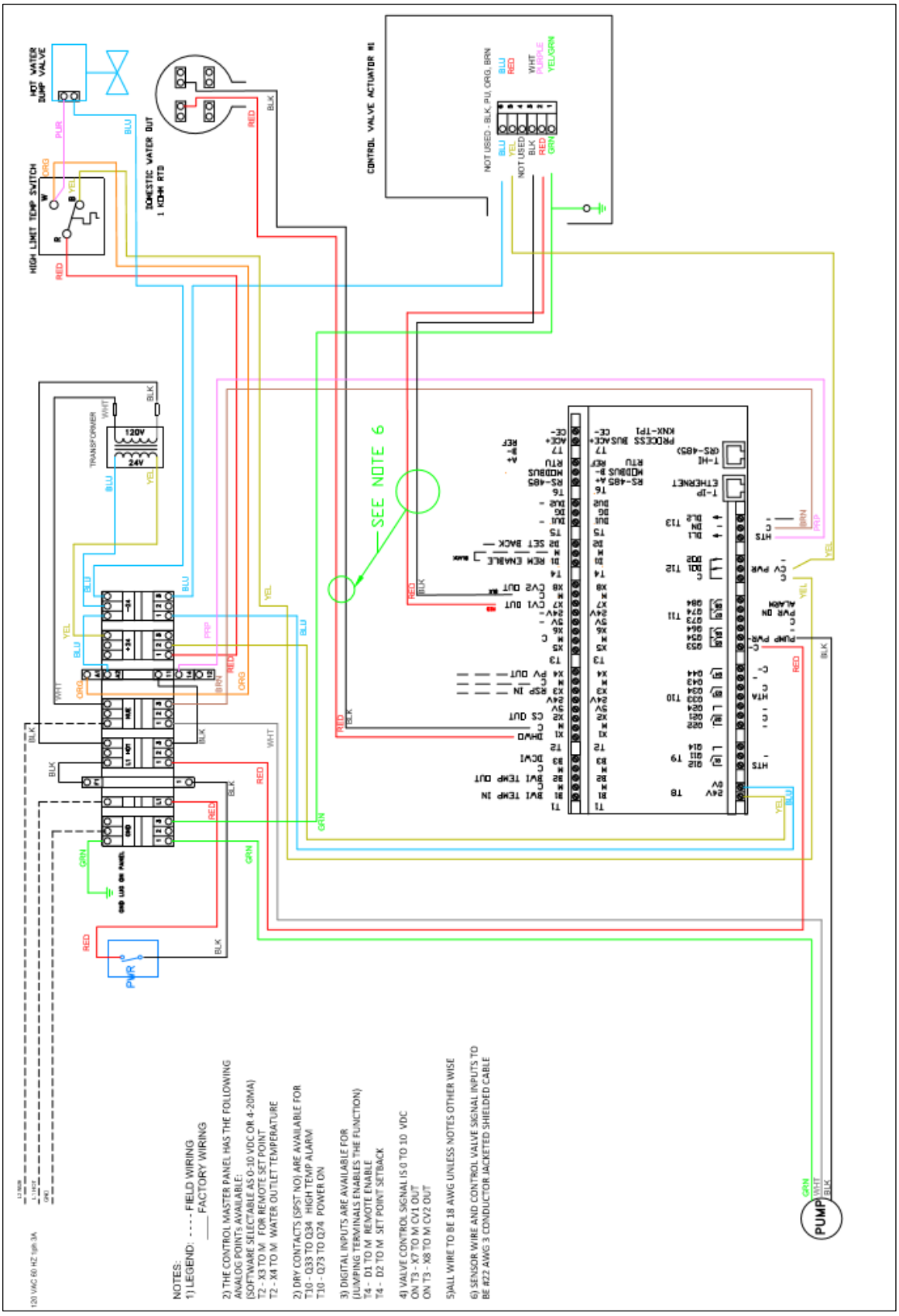
3.2.7 With the unit now isolated by the valving, and de-energized electrically, lift the release lever on the tank relief valve to evacuate hot water in the tank until the tank interior is brought to atmospheric pressure.

3.2.8 Open the tank drain valve to drain the remaining water from the tank.

3.3 System Wiring Diagram - Sizes 0630 and 0636



3.4 System Wiring Diagram - Sizes 0830 Through 1236



MAINTENANCE

4.1 HX2 Series Maintenance Schedule

Even under the best of conditions, some regular maintenance on the HX2 is needed. The table below is a general guide as to how often this should be done.

TABLE 4-1 RECOMMENDED INSPECTION INTERVALS

Item	At Start Up	Weekly	Monthly	Quarterly	Annually	Bi-annually
Circulator Pump	●				●	
Control Panel	●				●	
Control Valve	●		●			
Drain Valve	●				●	
Pressure Gauge	●			●		
Heat Exchanger Gaskets	●	●				
Heat Exchanger Tube Bundle	●					●
Manual Shut Off Valves	●	●				
Piping Connections	●		●			
Pressure / Temperature Relief Valve	●			●		
Solenoid Valve	●			●		
Steam Trap	●			●		
Support Stand	●					
Strainer	●		●			
Vacuum Breaker	●		●			

4.2 Troubleshooting

The table below is a quick summary of common problems encountered, and their most likely causes, along with a recommendation for how to correct them. These are by not intended to be an all-inclusive, definitive answer to every field issue that can occur, but rather a reasonable approach to common problems considering the highest likelihood of root cause, and how we would suggest addressing those problems based on our own experience.

TABLE 4-2 TROUBLESHOOTING FIELD GUIDE

Problem	Likely Cause and Suggested Remedy									
	1	2	3	4	5	6	7	8	9	10
Unit fails to reach required outlet water temperature	●	●	●					●	●	●
Outlet water temperature too high	●				●		●		●	
Outlet water temperature unsteady	●	●	●					●	●	●
Tube bundle leaking							●			
Outlet water temperature decreasing over time	●	●	●		●			●		●
Relief valve popping					●	●			●	
Control valve cycling, non-steady operation	●	●	●		●			●	●	●
Steam discharging into condensate line							●			

4.2a Troubleshooting Issues and Remedies

1 – The RTD sensor is not reading the temperature correctly.

Remedy - Check the water temperature with a temperature gauge known to be accurate. Replace the RTD if it is found to be faulty.

2 – The inlet steam is not at the specified temperature, pressure, or flow rate.

Remedy - Check the inlet steam pressure with a suitable pressure gauge with the control valve fully open. If the reading is low, adjust the inlet pressure to the required inlet pressure. If this initial reading is correct, the pressure gauge reading should reach the design pressure for the steam in the heating coil as the water temperature in the tank approaches shut off.

3 – The Condensate return piping has not been installed properly, and the condensate is not able to freely drain.

Remedy - Re-route the condensate return line and assure there are no restrictions in that line and that the condensate is either being pumped away or free to gravity drain.

4 – The outlet steam trap or strainer basket are clogged.

Remedy - Check both for fouling and clean as necessary. Follow the procedures given in Section 4.6 for further details on how to do this.

5 – The steam control valve or not opening or closing properly.

Remedy - Follow the procedures given in Section 4.7 for further details on how to do this.

6 – The high temperature sensor is not set correctly or is not functioning properly.

Remedy - Check the setting on the unit and re-set as necessary. If this does not work the sensor will need to be replaced.

7 – There is a leak with one or more tubes in the tube bundle, either directly in a tube or at the tube-to-tubesheet interface, causing tank water or steam condensate to leak out the tube bundle weep hole area.

Remedy – A tube has worn through, either through erosive or corrosive wear, or

its connection at the tube sheet has been compromised. The heating tube bundle will have to be removed, and cleaned or replaced. Follow the procedures given in Section 4.3 for this.

8 – The heating tube bundle is heavily scaled or otherwise damaged.

Remedy – The heating tube bundle will have to be removed, and cleaned or replaced. Follow the procedures given in Section 4.3 for this.

9 - The circulator pump is not moving sufficient water through the external tank circulation line.

Remedy - Check that the isolation valves immediately before and after the pump are fully open. If these appear to be positioned correctly, check for any restrictions in the circulation line and at the connections to the tank. If these are clear, then check that the pump motor is operating. If all of these conditions are satisfied, then the pump is likely worn or otherwise defective and needs to be replaced. See Section 4.5 for further details on how to do this.

10 - Sediment or debris is covering the tube bundle surface, impeding its ability to transfer heat.

Remedy – Shut down the unit as described in Section 3.2. Allow the unit to sufficient time to cool, and then open the tank drain line to let the tank drain. Once empty, close the drain line and re-start the unit as described in Section 3.1.

4.3 HX2 Tube Bundle Maintenance

All HX2 units feature a U-tube heat exchanger coil that should be removed and inspected at least once every two years. One of the common situations with the tube bundle involves the water composition, which make them susceptible to fouling and/or scaling.

This is most commonly found in the tank on the exterior of the heating tubes, and units experiencing fouling or scaling need to be cleaned periodically. A marked increase in pressure drop and/or a noticeable reduction in heating performance over time are good indicators that cleaning is necessary. To inspect and/or clean the inside of the tubes the tube bundle must be removed.

4.2.1 Follow the steps outlined in Section 3.2 to shut down the unit. Ensure that the steam inlet, condensate return, cold water inlet, and hot water outlet lines have been shut off, the tank has been completely drained, and all pressure has been bled from the steam and the water lines.

Also ensure that sufficient times has passed that all components and surfaces have safely cooled. To help speed up this process, the removable insulation jacket on the HX2 tank can be removed

4.2.2 Carefully break the connections between the element head and the steam and condensate lines. It may be necessary to break those lines in a second location to provide clearance for the removal of the tube bundle. Take care to ensure that components in that line are not damaged.

4.2.3 Loosen the bolts that secure the element head to the shell flange.

4.2.4 Remove the tube bundle from the unit.

4.3a HX2 Tube Bundle Inspection and Cleaning

Examine the heat exchanger coil for signs of leaking or scale buildup on the tube surface. If there is no leaking detected, carefully clean any scale from the coil and prepare the coil for installation. If leaking is detected, either repair or replace the coil.

Whenever cleaning a tube bundle, do not be use a hammer or chisel on the tubes. If it is necessary to use scrapers, extreme care should be taken to ensure the tubes are not score or damaged.

Before it is necessary to apply mechanical means for cleaning, try to clean the unit using the following methods.

a. Circulate hot water at a reasonably high velocity over the tubes.

b. Spray the exterior of the tubes with a high velocity water jet.

c. Consult with manufacturers of cleaning compounds and chemicals. They will check the nature of the deposit, recommend the right cleaning compound, and in many cases can provide equipment and personnel for a complete cleaning job.

d. Do not attempt to clean tubes by blowing steam through individual tubes.

To tighten a loose tube joint, use a suitable roller type tube expander. Do not roll tubes that are not leaking. Note that double wall tubes are not field repairable.

4.3b HX2 Tube Bundle Installation

If the tube bundle is dismantled for any reason, it should be reassembled using new gaskets.

a. Remove the old element gaskets and clean gasket surfaces. Install two new gaskets: one ring gasket between the tubesheet and the shell flange, and one rib gasket between the tubesheet and the element head.

b. Carefully reinstall the heat exchanger coil and element head in the same orientation that it was removed. Precede with re-torqueing the bolts that secure the coil to the shell flange. Pay special attention to the divider on the element head and rib gasket to make sure they line up with the tubesheet on the heat exchanger coil.

c. Refer to the drawing in Section 4.4 for the proper flange tightening sequence and torque values. Do not tighten bolts until all gaskets are properly seated.

d. Reconnect the steam lines and condensate return lines to the element head. For threaded connections, follow the recommendations in this IOM, along with all local codes and accepted practices regarding the use and type of joint compound or pipe thread sealer at the joint connections.

e. Follow the startup procedure outlined in Section 3.1 to return the unit to service.

f. Carefully check all connections to verify leak-free operation.

4.4 Flange Bolt Tightening Sequence and Torque Values

The following bolt tightening pattern and torque values should be used whenever tightening a flange. A recommended practice is to do this in (3) steps leading up to the final torque values, rather than attempting to complete this in one sequence.

	FT/LBS		
BOLT SIZE	STEP 1	STEP 2	FINAL
5/8"	60	96	120
3/4"	100	160	200
7/8"	160	256	320
1"	245	392	490
1 1/8"	355	568	710
1 1/4"	500	800	1000
1 3/8"	680	1088	1360

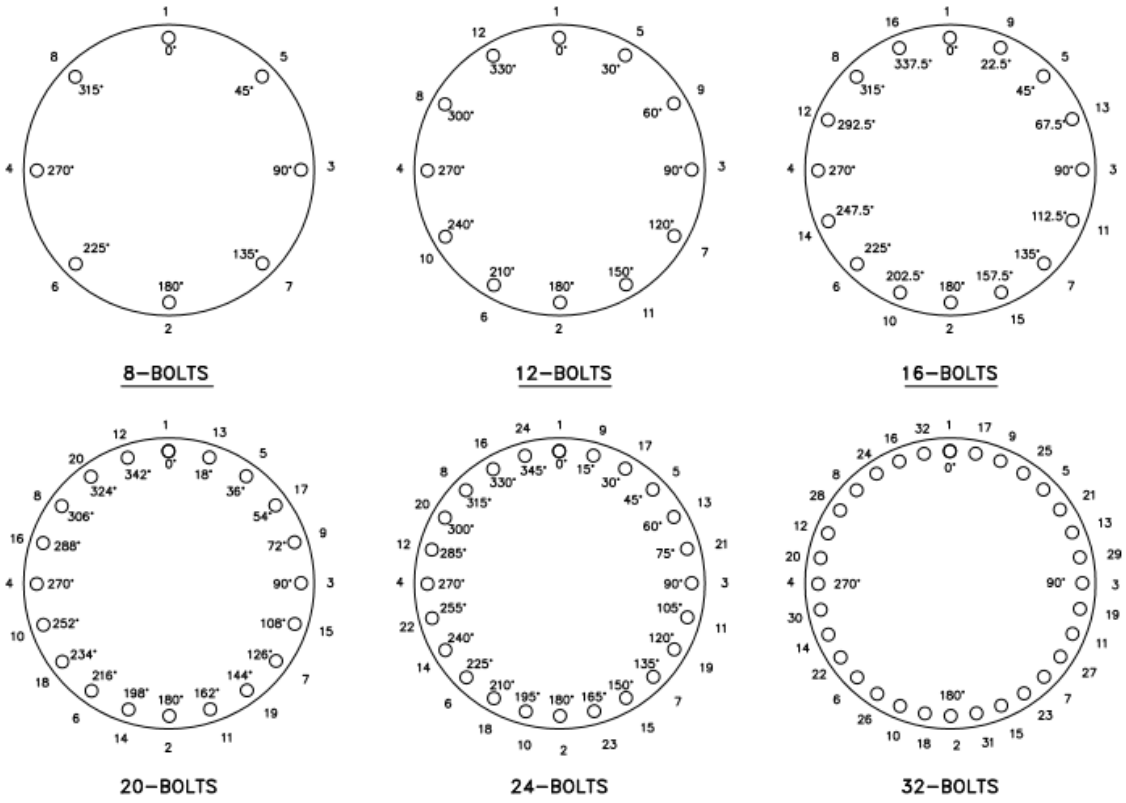


Fig 4.1 – Bolt Tightening Sequence and Torque Values

4.5 Circulator Pump Maintenance

The HX2 is equipped with a circulator pump. This circulator should be inspected periodically per the following guideline.

4.5.1 Observe all applicable codes when connecting to power supply. The motor is impedance protected and does not require overload protection. Either colored wire from the capacitor box can be attached to either colored wire from the power supply. There is no "hot" or "common" wire leading from the capacitor box. Typical installation would be to attach the white wire to the white (common) power supply wire and either the yellow or blue wire to the black (hot) power supply wire.

4.5.2 The system must be filled before operating the circulator to avoid having the pump run dry. The bearings are water lubricated and should not be operated dry. Filling and venting the tank will result in immediate lubrication of the bearings.

4.5.3 It is always good practice to flush a new system of foreign matter before starting the pump. Operate the pump for 5 minutes immediately after flushing the system to purge any remaining air from the bearing chamber. This is especially important when starting the pump after long idle periods.

4.5.4 Several cautions and warnings should be observed when maintaining the circulator pump:

a. The addition of petroleum-based fluids or certain chemical additives to this equipment will void the warranty.

b. To avoid electrical shock, disconnect the power supply to the pump at the control panel before attempting any work on it.

c. In the event the retaining screws have been pulled out of the housing, do not replace them. Use of any other screw may short out the stator windings, creating a risk of electrical shock.

d. When installing electrical connections, do not apply mechanical loads to the capacitor box; otherwise, the retaining screws may be pulled out of the housing, making the pump unusable.

4.5.5 To remove the pump:

a. Disconnect power to the pump and related equipment.

b. Shut off water supply using the isolation valves before and after the pump, and loosen the flange bolts to remove entire circulator from the piping.

4.5.6 Reassemble the pump using a new gasket and bolts following the reverse of the sequence previously described.

4.6 Strainer Maintenance

4.6.1 The strainer requires little maintenance once installed. Over time, however, it will become clogged with foreign matter, causing the differential pressure across it to increase. Once the differential pressure reaches an unacceptable value, it is time to clean or replace the screen.

4.6.2 Before removing the strainer screen cover, ensure that the media flowing in the pipeline is known and any special handling precautions are understood. Review the available Material Safety Data Sheet (MSDS) for that specific fluid.

4.6.3 To remove the screen first follow instructions in Section 3.2 of this IOM manual to shut the unit down and relieve any pressure and fluid in the strainer line. Once pressure is relieved, remove the strainer cap or cover.

4.6.4 Remove the screen and clean it. Do not let the screen dry out, as it will be difficult to remove debris after it has hardened. Avoid banging or hitting the screen. Note that before removing the cover of the strainer, the pressure inside the tank must be released to bring it to atmospheric. Failure to do so may result in serious bodily injury.

4.6.5 Follow the start-up procedure outlined in Section 3.1 of this IOM Manual.

4.7 Control Valve Maintenance

The HX2 control valves are designed to be disassembled and reassembled in the field. However, before completing any maintenance on a controls valve, the safety precautions in this IOM must be reviewed.

Ball valves normally do not require an internal lubricant or routine maintenance once installed. Packing can be adjusted if the valve has stem leakage, or if the stem seems loose. See the Troubleshooting section of this IOM below for more information.

4.7.1 Troubleshooting - Stem Leakage - Examine the disk springs for damage. If they are in good condition, then tighten the gland nut until disk springs are firmly compressed, then back the nut off 1/16th of a turn. If damaged, take the stem apart down to the gland, fit new disk springs with their outer edges touching, and replace and retighten with the stem nut. Any further maintenance will require dismantling the valve.

TABLE 4-3 CONTROL VALVE TORQUE VALUES

HX2 Size	Control Valve Nominal Size	Bolt Torque (ft. / lbs.)	Stem Nut Torque (ft. / lbs.)
06 030	1″	204	90
06 036	1 ¼″	221	90
08 030	1 ½″	230	106
08 036	2″	248	106
10 030	2 ½″	292	133
10 036	2 ½″	292	133
12 030	3″	336	133
12 036	3″	336	133

4.7.2 Troubleshooting - Leakage at the Body Joint

Check to see if the body connector bolts have been tightened. If loose, tighten the body bolts according to the torque requirements given in the table below. If the valve still leaks, the valve has to be disassembled and the body seals will need replaced.

Position the valve in the closed position. If leakage occurs while the valve is closed, ball sealant surface or seat could be damaged and the valve will have to be disassembled. Before beginning any maintenance, be sure to read the safety precautions in this IOM.

a. To inspect and/or replace body seals, seats, packing, and/or ball, the valve must be in the open position with no flow through the valve and removed from pipeline.

b. With the valve in the open position, undo the body bolts from the body nuts to remove the end caps from the body.

c. Remove the seats and gaskets.

d. Turn the valve in the closed position so the ball can be taken out from the body.

e. Remove the handle nut to remove the handle, spacer, and nut stop.

f. Remove the stem nut so the disk washers, gland, and stem packing can be removed.

g. Push the stem down into the body cavity to remove. Once removed, take off the O-ring and thrust washer.

4.7.3 Valve Re-assembly - When disassembled, be sure to clean all valve parts.

a. The ball surface should be free from defects, and if any are found, the ball should be replaced. Using a defective ball will severely impair the valve performance.

b. The replacement of the valve seats is recommended.

c. The used stem seals and body seals, including the thrust washer, should be discarded and replaced.

d. After cleaning the rest of the valve parts, examine them for wear, corrosion, or mechanical damage. Replace any defective parts.

e. Apply an adequate amount of lubricant that is compatible with the media being handled, around the ball, seats, stem, and thrust washer.

f. For stem re-assembly, the disassembly procedure should be followed in reverse order.

g. When the stem assembly is complete, tighten the Stem Nut according to the values in the table above.

h. With the Stem in the closed position, insert the Ball into the Body so the stem slot engages with the slot at the base of the stem.

i. Insert the seats and gaskets into the body.

j. Place end caps on either side of the Body.

k. Insert and finger tighten the body bolts diagonally, in accordance to the cross-pattern procedure to body nuts.

l. In the final assembly step ensure that body bolts are tightened accordingly to the torques values in the table above.

m. Replace the nut stop, spacer, handle, and handle nut and then tighten.

n. After re-assembling the valve, check that it operates smoothly by cycling the valve open and closed several times.

THE HX2 SERIES

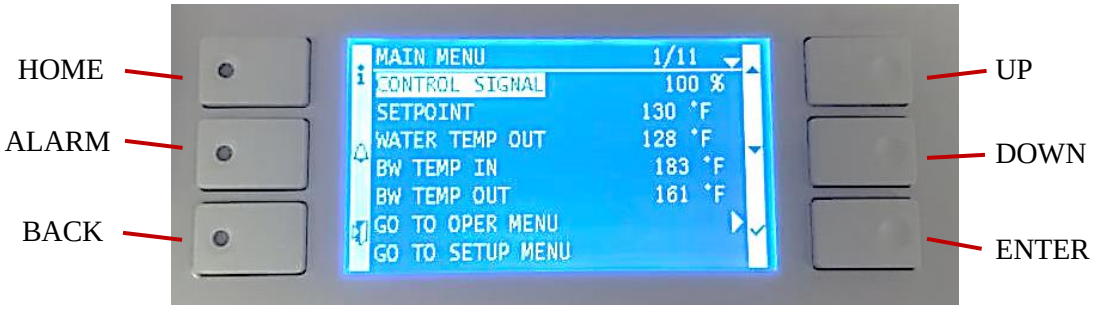
SEMI-INSTANTANEOUS WATER HEATERS

APPENDIX 1 – THE CONTROL MASTER CONTROL PANEL

A.1 General Operation

The function of the controller is to maintain the water outlet temperature of the water heater and monitor its status. This is done with a PID control loop that sends a signal to the steam control valve. Valve signaling is 0-10 VDC as standard.

Symbols shown in the border on the LCD display's left and right borders indicate the button functions. In the upper right corner, the "1/11" notation indicates the cursor is at line 1 of the 11 items on this screen menu.



There are four menu levels: **MAIN**, **OPER**, **SETUP**, and **CONFIG**. The main menu lists the primary values and access to other menus.

- The Main menu [**MAIN**] displays the primary controller information and provides access to the other menus.
- The Operator menu [**OPER**] is used to select local or remote set points, adjust the local set point, or to manually test the control valves.
- The Setup menu [**SETUP**] is password protected and used for adjusting alarm points or tuning the controller's PID loop.
- The Configuration menu [**CONFIG**] is also password protected and is used to set up input or output signal types, ranges for variables and control valve operation.

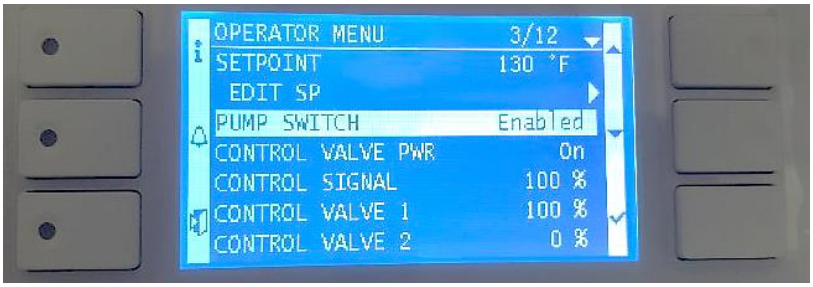
A.2 Start Up Procedures

The control panel is preprogrammed with set points configured to the job conditions. By default, the circulating pump and control valve are disabled to prevent their immediate operation upon application of AC power to the panel. Some components, such as the control valve, may also have been disconnected for shipping purposes. A wiring diagram is located in the panel box for reference.

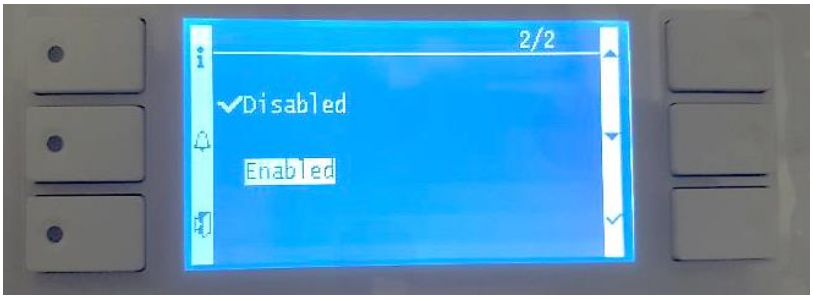
A.2.1 Pump Control- The circulating pump is intended to run continuously. It is disabled at the time of shipment to prevent dry running if power is applied to the panel at the time of installation but before filling the unit with water. To turn the pump on or off, follow the instructions below.

Step 1 - From the **MAIN MENU**, scroll down to **GO TO OPER MENU** and press the **ENTER** key

Step 2 - From the **OPERATOR MENU**, scroll down to **PUMP SWITCH** and press the **ENTER** key



Step 3 - Use the **UP** or **DOWN** key to select (highlight) **ENABLED** or **DISABLED** and press **ENTER** to turn the pump on or off, respectively.



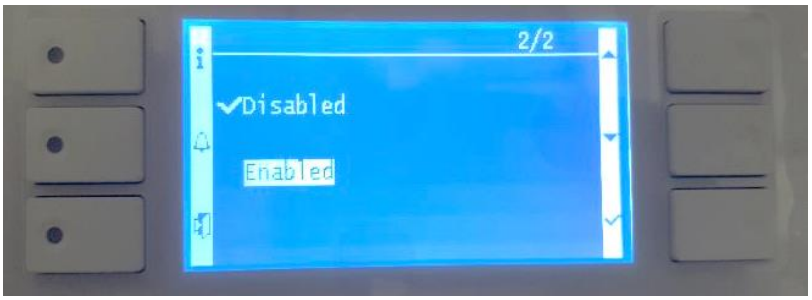
A.2.2 Control Valve - The controller has the ability to stroke the control valves manually. After factory testing, the **MANUAL OVERRIDE** is **ENABLED** and control valves are set to 0% to keeps the control valve closed. To open or close the control valve, follow the instructions below.

Step 1 - From the **MAIN MENU**, scroll down to **GO TO OPER MENU** and press the **ENTER** key.

Step 2 - Scroll down to **EDIT CONTROL VALVES** and press the **ENTER** key.

Step 3 - Scroll down to **MANUAL OVERRIDE** and press the **ENTER** key.

Step 4 - Using the **UP** / **DOWN** keys, select **ENABLED** or **DISABLED** and press the **ENTER key**.

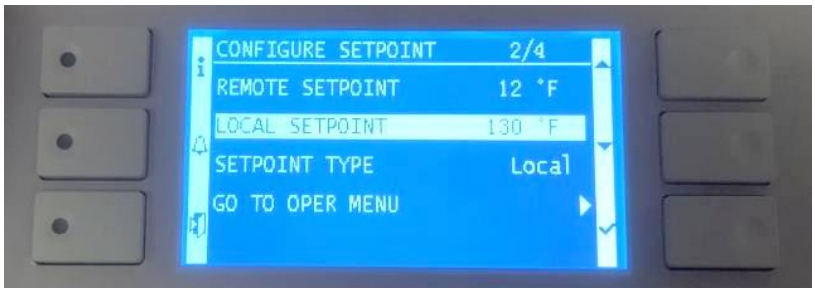


A.3 Adjusting the Set Points

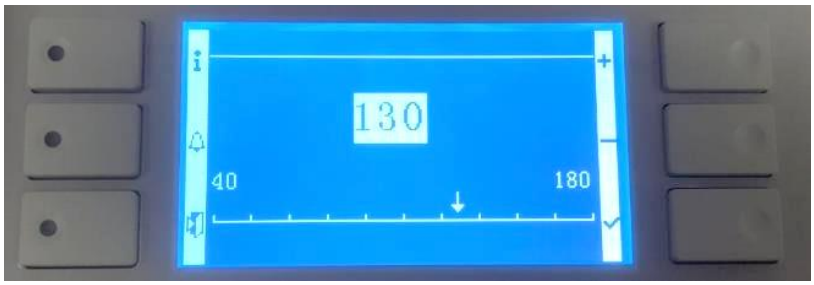
Step 1 - Access the **OPER** menu by using the down button to move the cursor to **GO TO OPER MENU** and press **ENTER**.

Step 2 - To edit the set point move to **EDIT SP** and press **ENTER**.

Step 3 - Use the **SETPOINT TYPE** to toggle between **LOCAL** or **REMOTE**. LOCAL is set at the panel and REMOTE is selected when the set point is supplied by a building automation system.



Step 4 - Use the **UP** or **DOWN** buttons to adjust and then press the **ENTER** key. Note that if the set point is changed, the high and low temperature alarm settings should be verified and adjusted as required.



A.4 Adjusting the Alarm Settings

Step 1 - Access the **SET UP** menu by scrolling to the bottom of the main menu top **PASSWORD HANDLING** and press the **ENTER** key.

Step 2 - Use the **UP / DOWN** buttons to enter the password **1709**, pressing the **ENTER** key after each digit is entered, to access the Setup Menu.

Step 3 - Scroll down to **GO TO SETUP MENU** and press the **ENTER key**.

Step 4 - In the **SETUP MENU**, scroll down to **EDIT HIGHTEMPALARM** and press **ENTER**.

Step 5 – Press **ENTER** to bring up the **HIGHTEMPALARM** setpoint and dead band options. Press **ENTER** on the highlighted item to bring up the adjustment screen.

Step 6 - Adjust **UP** or **DOWN** and press **ENTER**. Use the **HOME**, **BACK**, or **GO TO** menu buttons to return to the Main Menu.

Note that the **HIGH TEMP ALARM** setting is a secondary temperature control switch. When reached it will log the event, and will automatically reset when the temperature reaches **HIGHTEMPALARM SP – HIGHTEMPALARM DB.**

These same conventions are used throughout the controller for navigating menus and adjusting settings. Use the **HOME**, **BACK**, or **GOTO** menu buttons to return to the Main Menu.

A.5 Alarm Menu

If there is an active alarm condition the red LED in the ALARM button will flash.

Step 1 - Scroll to the **ALARM HISTORY** and press **ENTER** to display the fault history.

Select one of the entries and press **ENTER** for more details. For example, the screen shot below shows the time and date that the high temp limit switch had tripped.

The Control Master panel keeps a history log of these events. If there are no active alarms on critical items, pressing the alarm key will show this screen.

A.6 Fault Detection

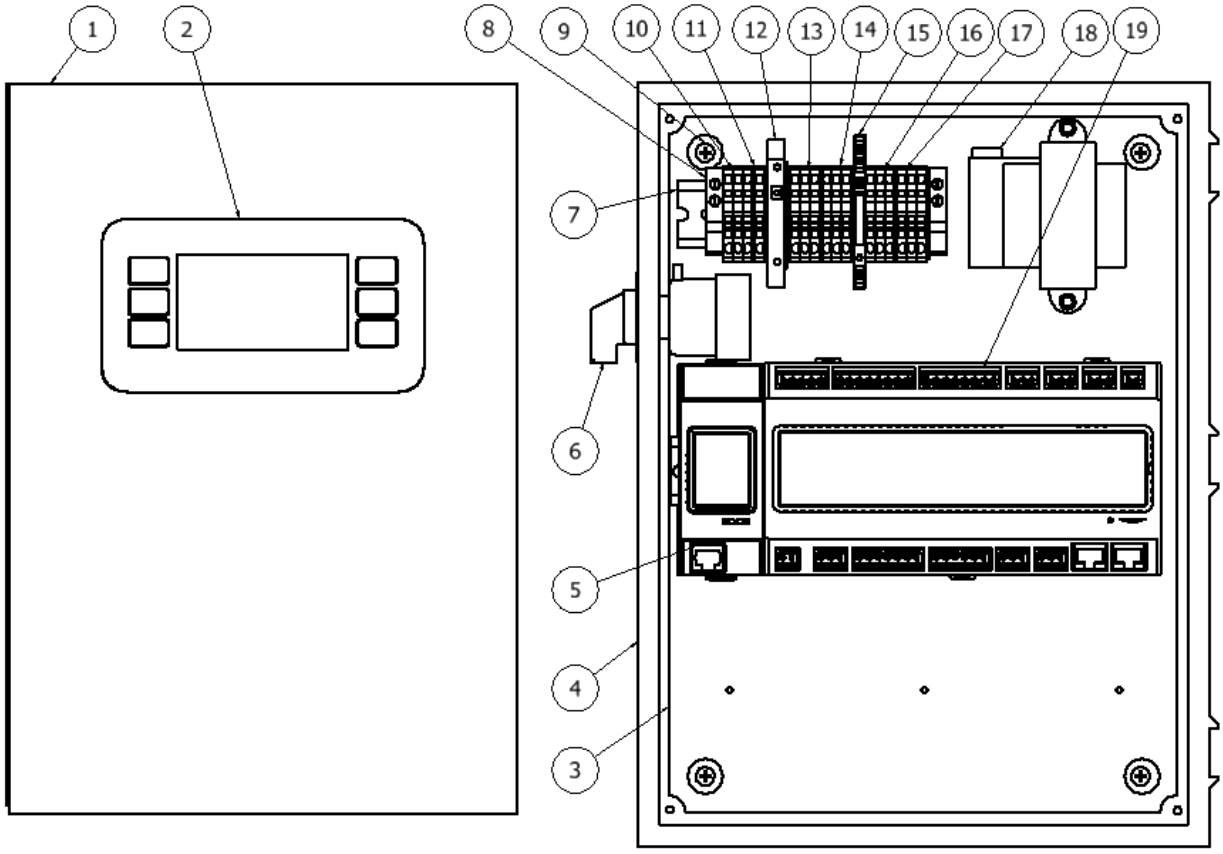
As in the alarm messaging, the controller's Fault Detection provides detailed information to simplify troubleshooting. In the case of a faulty water outlet temperature sensor, the controller can distinguish between and a shorted and open sensor.

For example, in the screen shot below a short in the sensor circuit is sensed. The screen shows an open circuit (no sensor) has been detected.

A.7 Panel Box Layout and Component Listing

TABLE A-1 PANEL BOX COMPONENT LAYOUT

Item	Description	Item	Description
1	Front panel	11	120 vac l1 (hot) connection
2	HMI display	12	Fuse block
3	Internal panel	13	120 vac terminals
4	12” x 16” x 6” NEMA 4 enclosure	14	120 vac neutral terminals
5	Optional BACnet COMM MODULE	15	Hi-limit relay
6	On/off switch	16	+ 24 VAC terminals
7	DIN mounting rail	17	- 24 VAC terminals
8	Terminal block clamp	18	120 / 24 VAC transformer
9	Ground screw	19	Siemens POL687 controller
10	Ground terminals		



A.8 Panel Box Controller Connections

TABLE A-2 CONTROLLER CONNECTIONS AND FUNCTIONS

Block	Position	Terminal	Type	Signal	Description
T1	1	B1	AI	100K Ohm	Boiler Water Inlet Temp (n/a for Steam Fired)
T1	2	M	C	-	Common
T1	3	B2	AI	100K Ohm	Boiler Water Outlet Temp (n/a for Steam Fired)
T1	4	M	C	-	
T1	5	B3	AI	T1	
T2	1	X1	UIO	1K Ohm	Domestic Water Outlet Temp
T2	2	M	C		
T2	3	X2	UIO	O-mA	Control Signal Re-Transmit
T2	4	5V	5VDC	-	
T2	5	24V	24VDC	-	
T2	6	X3	UIO	1 mA	Remote Setpoint Input
T2	7	M	C	-	Common
T2	8	X4	UIO	O mA	Dom. Water Outlet Temp Re-Transmit
T3	1	X5	UIO	-	
T3	2	M	C	-	
T3	3	X6	UIO	-	
T3	4	5V	5VDC	-	
T3	5	24V	24VDC	-	
T3	6	X7	UIO	O-10 VDC	Control Valve 1 Signal
T3	7	M	C	C	
T3	8	X8	UIO	O-10 VDC	Control Valve 2 Signal
T4	1	D1	DI		Remote Enable
T4	2	M	C	C	Common
T4	3	D2	DI	J	Setback Setpoint
T5	1	DU1	DI	-	
T5	2	DG	C	-	
T5	3	DU2	DI	-	
T6	1	A+			
T5	2	B-	RS-485		Modbus Connection
T6	3	REF			
T7	1	CE+	KNX	-	
T7	2	CE-		-	
T8	1	0	AC	-24 VAC	
T8	2	24	AC	+24 VAC	
T9	1	Q12	NC		
T9	2	Q11	C		High Temp Limit Alarm
T9	3	Q14	NO		
T10	1	Q22	NC	-	
T10	2	Q21	C	-	
T10	3	Q24	NO	T10	High Temp Alarm
T10	4	Q33	C	T10	
T10	5	Q34	NO	T10	
T10	6	Q43	C	T10	
T10	7	Q44	NO	T10	
T11	1	Q53	C	120 VAC	Pump Relay
T11	2	Q54	NO	To Pump	
T11	3	Q64	NO		
T11	4	Q73	C	Common	
T11	5	Q74	NO		Power On Indication
T11	6	Q84	NO		Alarm Relay
T12	1	C	C		
T12	2	DO1	NO	24 VAC	Control Valve Power
T12	3	DO2	NO	-	
T13	1	DL1		120 VAC	High Limit Switch
T13	2	DN	C	Neutral	
T13	2	DN	C	Neutral	

A.9 Control Panel Display Menu Listings – Main Menu

TABLE A-3 MAIN MENU DISPLAY LISTINGS		
MAIN Menu Listing	**Description**	**Limits / Values**
Control Signal	Temperature Controller Output	%
Setpoint	Displays Current Set Point	Deg F
Water Temp Out	Displays Current Water Outlet Temperature	Deg F
BW Temp In	Displays Current Boiler Water Inlet Temperature	Not for Steam heated units
BW Temp Out	Displays Current Boiler Water Outlet Temperature	
Go to OPER Menu	For Navigation to Other Menus	n/a
Go to SET UP Menu		n/a
Go to Config Menu		n/a
Go to Sys Overview		n/a
Go to Alarms		n/a
Password Handling		n/a

A.9a Control Panel Display Menu Listings – Operator Menu

TABLE A-4 OPERATOR MENU DISPLAY LISTINGS		
OPER Menu	**Description**	**Limits / Values**
Setpoint		
Edit Set Point	Use for Set Point Selection and Adjustment	
Remote Setpoint	Analog Input Signal Mapped to 0-10 VDC or 4-20 Ma	
Local Setpoint	Set Point Entered at Panel	
Setpoint Type	Default = **LOCAL**, **REMOTE** Uses Input Signal	
Go to OPER Menu	Return to Previous Menu	
Pump Switch	Set to **ENABLE** for ON	**DISABLED** at Shipment
Control Valve Power	Status Display - Normal Status = **ON**	**OFF** / **ON** Alarm Status
Control Signal	Displays Current Controller PID Output	%
Control Valve 1	Displays Valve 1 Signal (%)	%
Control Valve 2	Displays Valve 2 Signal (%)	Valve 2 Is Optional
Edit Control Valves	To Set Up Valves and Manually Operate	
Control Valve 1	To Manually Operate Valve 1	If Override is **ENABLED**
Control Valve 2	N/a For HX2 Units	
Manual Override	Default is **DISABLED** for Automatic Operation	
CV 2 Enabled	Use to **ENABLE** VALVE 2, Default Is DISABLED	
Go Back	Return to Previous Menu	
Go to Main Menu	Navigation to Other Menus	
Edit Control Valves	Use to Set Up Valves and Manually Operate	
Control Valve 1	Use to Manually Operate Valve 1	
Control Valve 2	N/a For HX2 Units	
Manual Override	Default Setting Is **DISABLED**	
CV 2 Enabled	Use to **ENABLE** VALVE 2, Default Is **DISABLED**	
Go Back	Return to Previous Menu	
Go to Main Menu	Navigation to Other Menus	

A.9b Control Panel Display Menu Listings – Configuration Menu

TABLE A-5 SET UP MENU DISPLAY LISTINGS

CONFIG Menu	Description	Limits / Values
Water Temp Out	Displays Water Outlet Temp	Deg F
Water Temp Out Min	Set Maximum Water Temp Range	Deg F
Water Temp Out Max	Set Minimum Water Temp Range	Deg F
Edit WTO	Edit WTO Min & WTO Max	
Edit SP	Same Functions as OPER MENU	
Edit Signal Types	Setup of Configurable I/O	
(X1) WATERTEMPOUT	PT 1000 RTD Water Temp Sensor	I-PT1
(X2) CONTROLSIGNAL	Analog out of Control Signal	0 mA, 0 Volts
(X3) SET POINT	Analog in of Remote Set Point	I-V
(X4) WATER TEMP OUT	Analog out of Water Outlet Temp	0 mA, 0 Volts
(X7) CONTROL VALVE1	Analog out to Control Valve 1	0 Volts
Min Set Point	Set Max Water Temp Set Point	Deg F
Max Set Point	Set Min Water Temp Set Point	Deg F
GO TO MAIN MENU…	Navigation to Other Menus	
GO TO SYS OVERVIEW		
Communications		
Communication Type	Select MODBUS, BACnet IP, or BACnet MS/TP	
MODBUS Module		Sample Data only, Configure Settings Per Your Connection
Address	0	
Baud Rate	9600	
Parity	Even	
2 Stop Bits	No	
BACnet IP MODULE MENU		Sample Data only, Configure Settings Per Your Connection
State	OK	
DHCP	YES	
Actual IP	10.0.0.134	
Actual Mask	255.255.255.0	
Actual Gate	10.0.0.1	
BACnet MS/TP MODULE MENU >		Sample Data only, Configure Settings Per Your Connection
State	OK	
Device Name	POL904_FF9D4A	
Device Id	9600	
Address	0	
Baud Rate	9600	
Max Info Frames	0	
Max Master	0	
Term. Resistor	NO	
Password Handling	Enter 4 Digit Password for Menu Access	
	SETUP: 1709, CONFIG = 1979	

A.9c Control Panel Display Menu Listings – Set Up Menu

TABLE A-6 SET UP MENU DISPLAY LISTINGS

SET UP Menu	Description	Limits / Values
Configure Setpoint	Access for Set Point Functions	
Remote Enable	Jumper Enables Heater Operation	
Proportional Factor	Display of Proportional Gain	%
Integral Factor	Display of Integral Time	Seconds
Derivative Factor	Display of Derivative Time	Seconds
Edit PID		
Proportional Factor	Adjust Proportional Gain	%
Integral Factor	Adjust Integral Time	Seconds
Derivative Factor	Adjust Derivative Time	Seconds
Setback Enable	Status of Setback Enable	Deg F
Setback Set Point	Amount of Change in Set Point if Enabled	Deg F
Edit Set Back Set Pt.	Adjust of Setback Enable	Deg F
High Temp Alarm SP	View High Temp Alarm Set Point	Deg F
High Temp Alarm DB	View High Temp Alarm Dead Band	Deg F
Edit High Temp Alarm	Edit High Temp Alarm Set Point and Dead Band	Deg F
Low Temp Alarm SP	View Low Temp Alarm Set Point	Deg F
Low Temp Alarm Db	View Low Temp Alarm Dead Band	Deg F
Edit Low Temp Alarm	Edit Low Temp Alarm Set Point and Dead Band	Deg F
Min Control Signal	Set Minimum Control Output	%
Max Control Signal	Set Maximum Control Output	%
Go Back	Return to Previous Menu	
Go to Main Menu	Navigation to Other Menus	

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