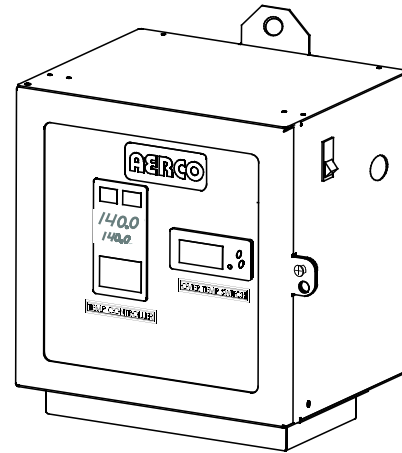




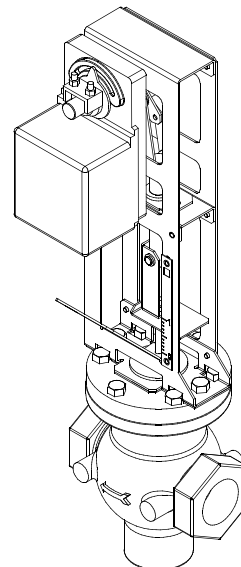
USER MANUAL

Installation, Operation, and Maintenance

Electronic Control System (ECS) and Type CXT-E Electronic Valve



Electronic Control System



Type CXT-E Electronic Valve

Latest Revision: 11/02/2016

Technical Support:
(Mon–Fri, 8am-5pm EST)
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SAFETY PRECAUTIONS

Installing or operating personnel must, at all times, observe all safety regulations. The following warnings are general and must be given the same attention as specific precautions included in the instructions.

 **WARNING** 

FLUIDS UNDER PRESSURE MAY CAUSE INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT WHEN RELEASED.

CLOSE ALL SHUTOFF VALVES AND CAREFULLY DECREASE ALL TRAPPED PRESSURES TO ZERO BEFORE PERFORMING ANY MAINTENANCE. TAG THE PRESSURE SOURCE “OUT OF SERVICE” WHILE PERFORMING MAINTENANCE TASKS.

 **WARNING** 

LIVE STEAM CAN CAUSE SEVERE BURNS.

NEVER SEARCH FOR LEAKAGE IN A LIVE STEAM LINE BY SIGHT ALONE OR BY “FEEL.” USE A MIRROR OR OTHER SUITABLE POLISHED OBJECT. ALSO, ALWAYS WEAR GLOVES AND LONG SLEEVES.

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1. GENERAL INFORMATION

1.1 INTRODUCTION

This Instruction Manual provides detailed coverage for both the AERCO Electronic Control System (ECS) and the Electronic Control Valve CXT-E. This Control System and Valve combination can be used with all models and sizes of AERCO Indirect Fired Water Heaters which include the following Models:

- SW1A PLUS
- SW1B PLUS, SW1B PLUS II
- WW3E PLUS

Double- Wall Heater Models DW-24, DW-45, DW-68 (Refer to HE-111 for SWDW-24, SWDW-45 & SWDW-68 Models)

Figure 1-1 shows a typical installation with a Water Wizard, Model SW1B-Plus II Packaged Water Heater. The remaining paragraphs in this section provide descriptions of the units, assemblies and sub-assemblies included with the Electronic Control System (ECS) and the Electronic Control Valve CXT-E.

NOTE:

This Instruction Manual provides detailed Installation, Operation, Maintenance and Parts information and procedures for the Electronic Control System and Electronic Control Valve. A separate Instruction Manual for the Heat Exchanger is included with the Packaged Water Heater. Also, refer to the paragraph titled REFERENCE DOCUMENTS at the end of this Section for additional documentation which may be required for accessories or options provided with your order.

1.2 ELECTRONIC CONTROL SYSTEM (ECS)

The Electronic Control System contains a Control Box Assembly which includes all of the electronic circuitry for the ECS. In addition, the ECS includes several sensors and safety devices which provide temperature and flow control information to the Control Box circuitry. The Control Box and the additional devices included in the ECS are shown in Figure 1-2. The additional devices included in the ECS include:

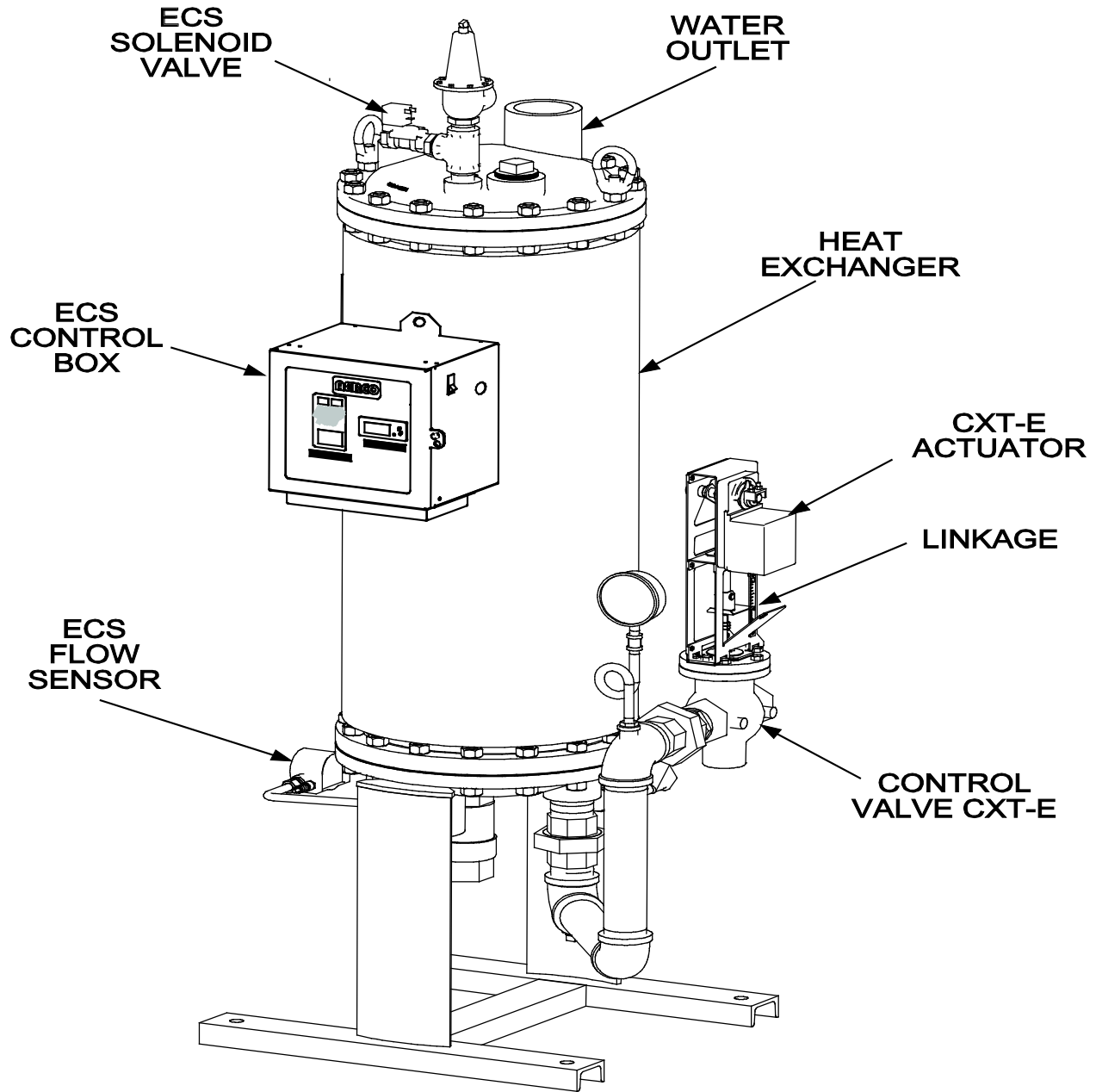
- Feed-Forward Flow Sensor (Flowmeter)
- Outlet Dual Temperature Sensors (Type J Thermocouples)
- Heating Fluid Inlet/Outlet Temperature Sensors (Type J Thermocouples) – For Water-to-Water Heat Exchangers Only
- Over-Temperature Solenoid Valve

If desired, the Electronic Control System (ECS) can be ordered with a Modbus Communication Option. This option permits the ECS to be externally controlled by an Energy Management System (EMS), Building Automation System (BAS), or Computer supplied by other manufacturers.

A Gateway option exists to link with other communication protocols. Check with your AERCO sales representative for more information.

The Electronic Control System assemblies and components are described in the following paragraphs.

Electronic Control System (ECS) and Type CXT-E Valve
1. GENERAL INFORMATION



**WATER WIZARD (SW1B-PLUS II) WITH
ELECTRONIC CONTROL SYSTEM (ECS) & CONTROL VALVE CXT-E**

Figure 1-1. Typical ECS & CXT-E Installation With a Packaged Water Heater

Electronic Control System (ECS) and Type CXT-E Valve

1. GENERAL INFORMATION

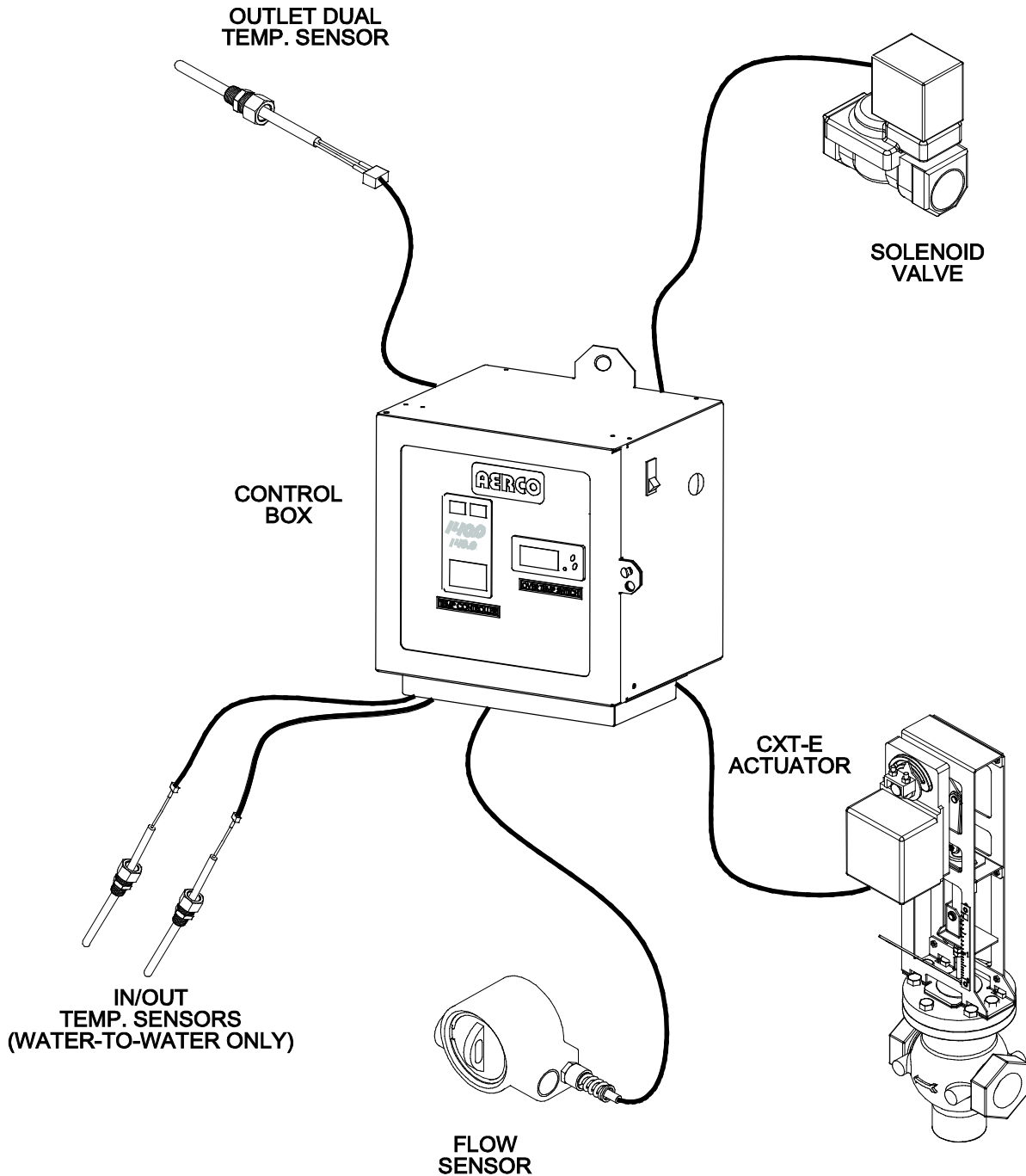


Figure 1-2. Electronic Control System (ECS)

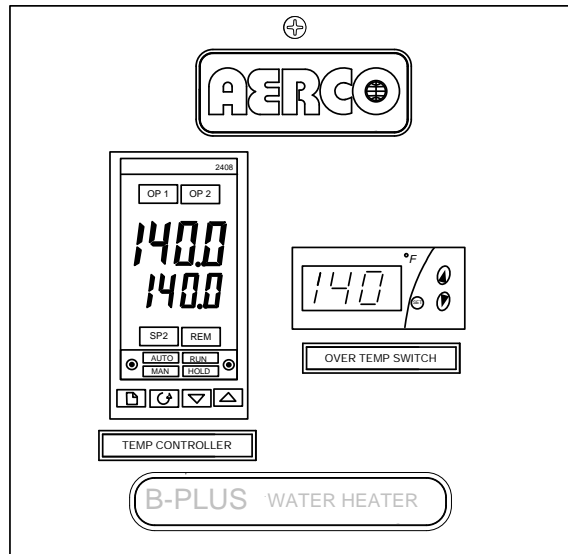
1.2.1 Control Box Assembly

The Control Box Assembly is available in two models; one for Steam-to-Water Heaters and one for Water-to-Water Heaters. The only difference between these two models are the Display devices provided on the front panels. The panel of the Control Box model for Water-to-Water applications contain two additional Display devices which display the heating fluid (hot boiler

Electronic Control System (ECS) and Type CXT-E Valve

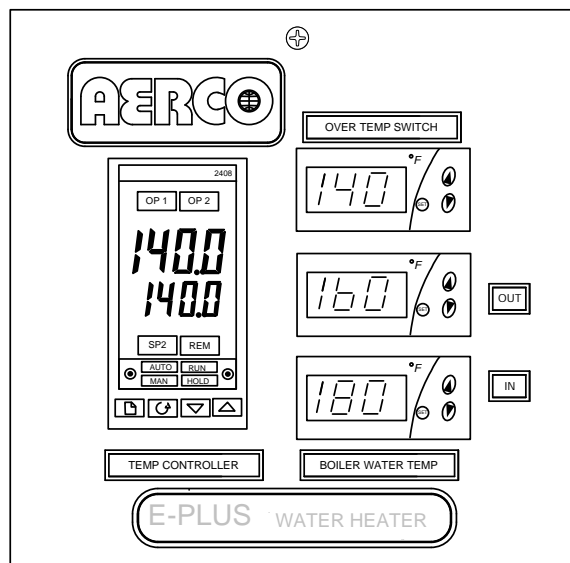
1. GENERAL INFORMATION

water) inlet and outlet temperatures. The Control Box front panels for both models are shown in Figure 1-3.



MODEL 69012-1

FRONT PANEL FOR STEAM-TO-WATER HEATERS



MODEL 69012-2

FRONT PANEL FOR WATER-TO-WATER HEATERS

Figure 1-3. ECS Control Box Models Showing Front Panel Differences

The Control Box is the heart of the ECS. It contains the Temperature Controller, an Over-Temperature Switch and, when required, Inlet/Outlet Temperature Indicators for Water-to-Water applications. The Temperature Controller is the “brain” of the ECS which processes data received from the temperature and flow sensors. Using PID (Proportional Integral Derivative) algorithms, the Temperature Controller provides a 4-to-20 mA control signal to the Control Valve Actuator which precisely modulates the Control Valve for optimum outlet temperature control.

Electronic Control System (ECS) and Type CXT-E Valve

1. GENERAL INFORMATION

An Over-Temperature Switch is also included in the Control Box to constantly monitor the Water Heater outlet temperature to ensure the Heater does not exceed the preset high temperature limit. Typically, the over-temperature limit is set 20°F above the desired Heater setpoint temperature. If an over-temperature condition occurs, this Switch sounds an audible alarm, activates the Over-Temperature Solenoid and cuts off power to the Control Valve Actuator. This closes the Control Valve and shuts off the heating fluid (steam or hot boiler water) to the Heater. In addition, activation of the Over-Temperature Solenoid allows over-temperature water to be dumped from the Heater shell.

The Control Box also contains a DC Power Supply and Voltage Regulator to provide the voltage levels required by the ECS Control Box circuitry, flow sensor and safety devices. It also provides 24 VDC power to the Control Valve CXT-E Actuator.

The Control Box components are housed in a steel enclosure with a hinged front door. This door contains a clear polycarbonate window which permits maintenance personnel to view the controls and displays of the Temperature Controller, and other display devices mounted on a recessed panel behind the door. All sensor and control signal connections are made via cable connections at the bottom of the Control Box. External AC power (120 to 240 VAC, 50/60 Hz) is supplied via a cutout on the right side of the Control Box.

1.2.2 Feed-Forward Flow Sensor

The Feed-Forward Flow Sensor is installed between the cold water inlet and the drain valve on the Water Heater as shown in Figure 1-1. The Flow Sensor monitors a portion of the inlet flow to the Heater and provides a feed-forward signal to the Temperature Controller which is proportional to the change in flow through the Heater.

1.2.3 Outlet Temperature Sensors

The Control System includes a Dual Temperature Sensor which is installed in the hot water outlet of the Water Heater. This sensor contains two identical Type J thermocouples. The first thermocouple connects directly to the Temperature Controller in the Control Box to provide the outlet water temperature. The second thermocouple connects to the Over-Temperature Switch in the Control Box.

1.2.4 Heating Fluid Inlet/Outlet Temperature Sensors

When the Heater utilizes hot (boiler) water as the heating fluid, two additional Temperature Sensors (Type J thermocouples) are provided with the Control System. One temperature Sensor is installed at the heating fluid inlet and the other is installed at the heating fluid outlet. These two Sensors are connected to two identical Temperature Display Indicators in the Control Box to provide real-time indications of the inlet and outlet heating fluid temperatures. These Temperature Indicators are physically identical to the Over-Temperature Switch, however they are "Indicator-Only" devices and do not provide any switching functions.

1.2.5 Over-Temperature Solenoid Valve

As previously mentioned, the Over-Temperature Solenoid Valve operates in conjunction with the Over-Temperature Switch in the Control Box. An over-temperature alarm is activated when the preset high temperature limit is exceeded, thereby energizing and opening the Solenoid Valve. This allows over-heated water and pressure build-up to be expelled from the Heater Shell and relieve pressure build-up.

1.3 ELECTRONIC CONTROL VALVE CXT-E

Each Control Valve is comprised of three major sections; the Valve Body, Linkage Assembly and the Valve Actuator. The Control Valves are available in sizes ranging from 1 inch to 4 inches. An identical Actuator Assembly is used with each size Valve Body. The Linkage Assembly used with each size Valve Body is identical, except for minor differences in the Shaft Adapter stroke of the mechanical linkage. Figure 1-4 shows the basic dimensions for each size AERCO Control Valve CXT-E.

It should be noted that the Control Valves used for steam flow are identical to those used for hot (boiler) water flow.

1.3.1 Control Valve Accessories

The accessories required for use with AERCO Electronic Control Valves, Type CXT-E will depend on the specific application. Detailed installation instructions, including typical installation drawings are provided in the INSTALLATION Section of this manual. However, please note the items listed below and ensure that ALL mandatory items are available:

<u>ACCESSORY</u>	<u>REQUIREMENT</u>
• Upstream Shutoff Valve	- Mandatory
• Downstream Shutoff Valve	Suggested for ease of maintenance. Required if a Bypass Line is used.
• Strainer and Blow-Off Valve	Mandatory
• High Side Pressure Gauge	Recommended for adjustment and maintenance
• Low Side Pressure Gauge, Compound Type for steam flow	Recommended for adjustment and maintenance.

If any of these items have been furnished by AERCO with the Control Valve, the necessary drawings and/or instructions should be included with the shipment.

Electronic Control System (ECS) and Type CXT-E Valve

1. GENERAL INFORMATION

VALVE SIZES (INCHES)							
DIM.	1.00"	1.25"	1.50"	2.00"	2.50"	3.00"	4.00"
A	21.12	21.12	21.12	24.25	24.25	24.25	24.25
B	7.75	7.75	7.75	7.75	10.87	10.87	10.87
C	3.56	3.56	3.56	3.56	6.38	6.38	6.38
D	6.00	6.00	6.00	6.00	10.87	10.87	10.87

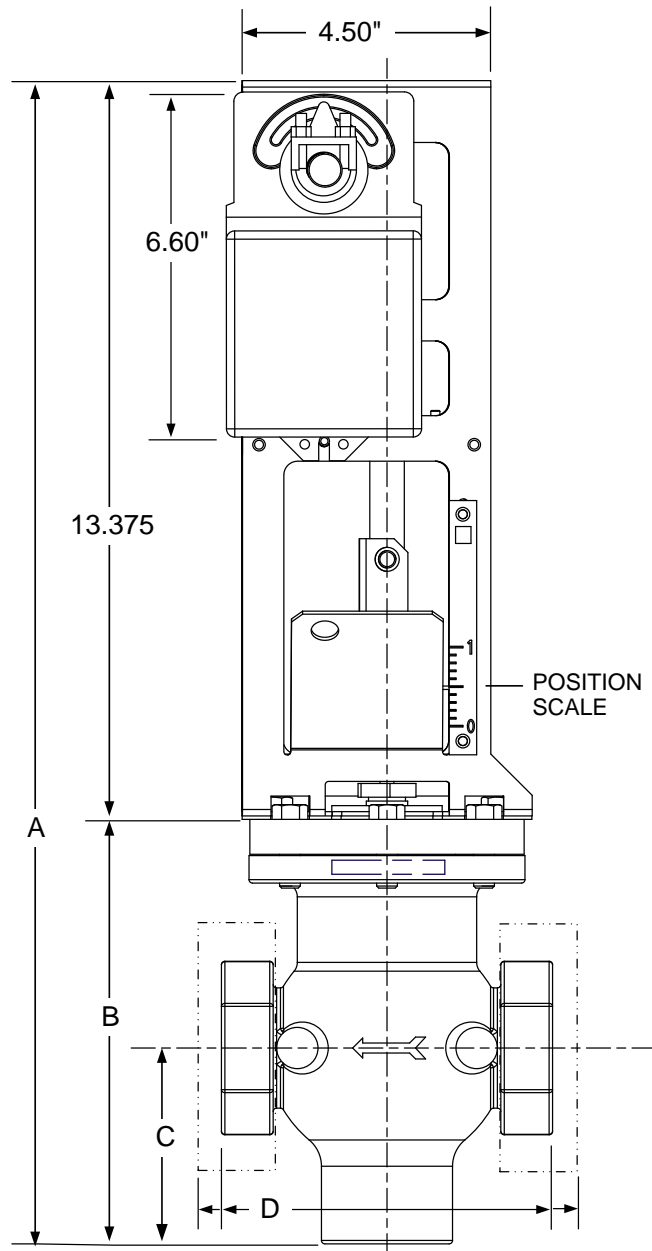


Figure 1-4. Reference Dimensions for AERCO Control Valves, Type CXT-E

1.4 REFERENCE DOCUMENTS

Refer to the following documents as necessary for additional information and procedures for the applicable AERCO Heat Exchanger provided with your Electronic Control System (ECS) and CXT-E Control Valve. In addition, if the ECS is provided with the Modbus Communication option, refer to the referenced Eurotherm documents listed.

1.4.1 AERCO Documents

- HE-104 SW1B-Plus Heat Exchanger Installation, Operation & Maintenance Manual
- HE-105 WW3E Heat Exchanger Installation, Operation & Maintenance Manual
- HE-106 DW-24, DW-45, DW-68 Double Wall Heat Exchanger Installation, Operation & Maintenance Manual
- HE-107 SW1A-Plus Heat Exchanger Installation, Operation & Maintenance Manual
- HE-110 B-Plus II Water Wizard Heat Exchanger Installation, Operation & Maintenance Manual

1.4.2 Eurotherm Documents – (Available at www.eurotherm.com)

- HA025132 2404/2408 Installation & Operation Handbook
- HA02630 Series 2000 Communications Handbook



DO NOT use the Actuator Linkage Frame at the top of the Control Valve Body for leverage when installing The Control Valve. Use pipe wrenches on the inlet and outlet hex of the Valve Body.

2. INSTALLATION

2.1 INTRODUCTION

Normally, the Electronic Control System (ECS) is shipped already installed on the Packaged Water Heater. However, the Control Valve, Type CXT-E is packed separately. For smaller size Valves (1" to 2"), the packaged Valve is attached to the base of the shipping crate. For larger size Valves (2 ½" to 4"), the packaged Valve may be shipped separately due to space limitations within the Heater shipping crate. Therefore, the installation procedures consist basically of:

- Installing the Electronic Control Valve, Type CXT-E and associated steam or hot (boiler) water piping and components.
- Connecting external power to the ECS Control Box
- Connecting and checking electrical connections to the CXT-E Actuator and other ECS components

IMPORTANT NOTE!

For Water-to-Water Double-Wall (WWDW) heaters equipped with the ECS, the following minimum recirculation flow must be provided to achieve $\pm 4^{\circ}\text{F}$ temperature control under normal diversified domestic load conditions:

Double-Wall Model	Minimum System Recirculation
WWDW24	10 gpm
WWDW45	15 gpm
WWDW68	20 gpm

2.2 ELECTRONIC CONTROL VALVE TYPE CXT-E INSTALLATION

The following procedures apply to all sizes of AERCO Electronic Control Valves Type CXT-E ranging from 1 inch to 4 inches. In addition, the following steps can be used for both steam and hot (boiler) water flow systems. Proceed as follows:

- 1) Refer to Figure 1-3 for dimensions of the Control Valve furnished with the Packaged Water Heater.
- 2) Next, refer to the recommended installation drawing in Figure 2-1 for steam flow, or Figure 2-2 for hot (boiler) water flow.
- 3) Install the Control Valve with the Actuator Linkage in the vertical, upright position as shown in Figure 2-1 or 2-2.
- 4) For maintenance purposes, unions are required with threaded ends to simplify removal from the steam or hot boiler water line.
- 5) Blow out all pipe lines to clear them of dirt chips, scale or other foreign matter which could adversely affect Valve operation when in service.
- 6) Install an in-line strainer upstream of the Valve, as shown in Figure 2-1 (steam) or Figure 2-2 (hot boiler water). This will protect against foreign matter reaching the Valve during service operation.

Electronic Control System (ECS) and Type CXT-E Valve

2. INSTALLATION

- 7) If the Valve is controlling steam, ensure that the steam line is properly trapped to prevent accumulation of condensate ahead of the Valve.
- 8) Install Shutoff Valves (metal-seated, gate-type) upstream and downstream of the Control Valve to permit removal from the line for maintenance.
- 9) Pressure gauges should be installed on both sides of the Control Valve as shown in Figure 2-1 (steam) or Figure 2-2 (hot water).
- 10) The gauge on the high pressure side of the Valve is for adjustment and maintenance purposes. The gauge on the low pressure side is to ensure that the correct pressure is being introduced to the Control Valve. For either steam or water flow, the low side gauge denotes the pressure of the fluid in the line which may create a hazardous condition.
- 11) A temperature gauge should be installed in the high pressure side of a hot (boiler) water line as shown in Figure 2-2.
- 12) Install the Control Valve with the arrow on the Valve Body pointing in the direction of flow.
- 13) After the Control Valve has been installed in the steam or hot water line, ensure that all piping connections are secure and leak tight.
- 14) This completes the installation procedures for the Control Valve. Proceed to the next section, 2.3 ELECTRONIC CONTROL SYSTEM (ECS) INSTALLATION.

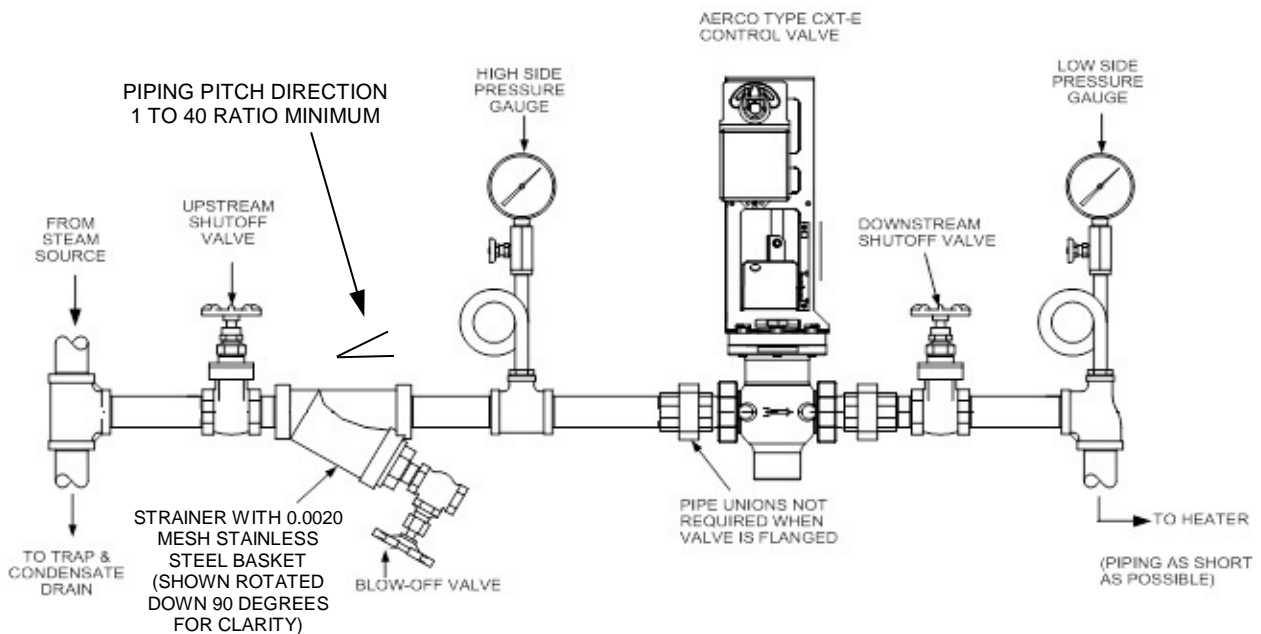


Figure 2-1. Recommended Control Valve, CXT-E Installation For Steam Flow

Electronic Control System (ECS) and Type CXT-E Valve 2. INSTALLATION

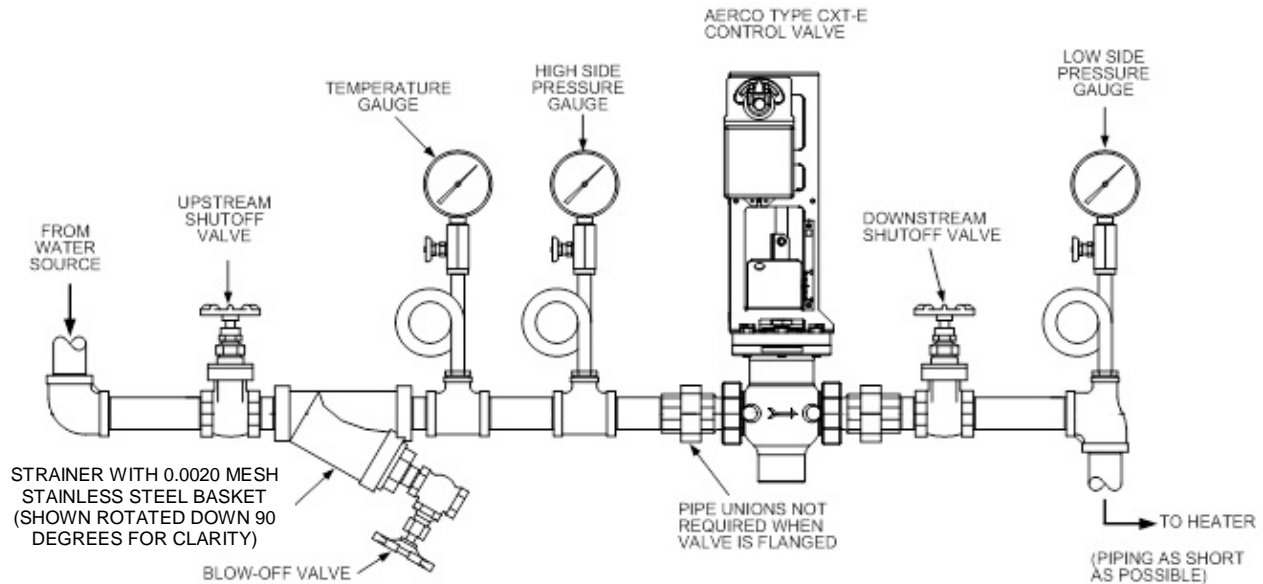


Figure 2-2. Recommended Control Valve, CXT-E Installation For Hot (Boiler) Water Flow

2.3 ELECTRONIC CONTROL SYSTEM (ECS) INSTALLATION

As previously mentioned, the Control Box and all other Electronic Control System (ECS) components are installed on the Packaged Water Heater prior to shipment from the factory. Therefore, ECS installation basically consists of connecting external AC power to the System and providing the necessary power and control signal connections to the Control Valve Type CXT-E. However, if your ECS was ordered with the Modbus Communication option, several additional signal lead connections will need to be made inside the Control Box. These signal leads will permit the ECS to be controlled by an external Energy Management System (EMS), Building Automation System (BAS), or Computer.

NOTE:

Following installation, a lock (Not Supplied) can be installed on the front door of the Control Box, if desired, to prevent unauthorized access to ECS settings.

Electronic Control System (ECS) and Type CXT-E Valve

2. INSTALLATION

- 1) Loosen the captive screw on the right-front portion of the Control Box (Figure 2-3) to open the hinged panel door.

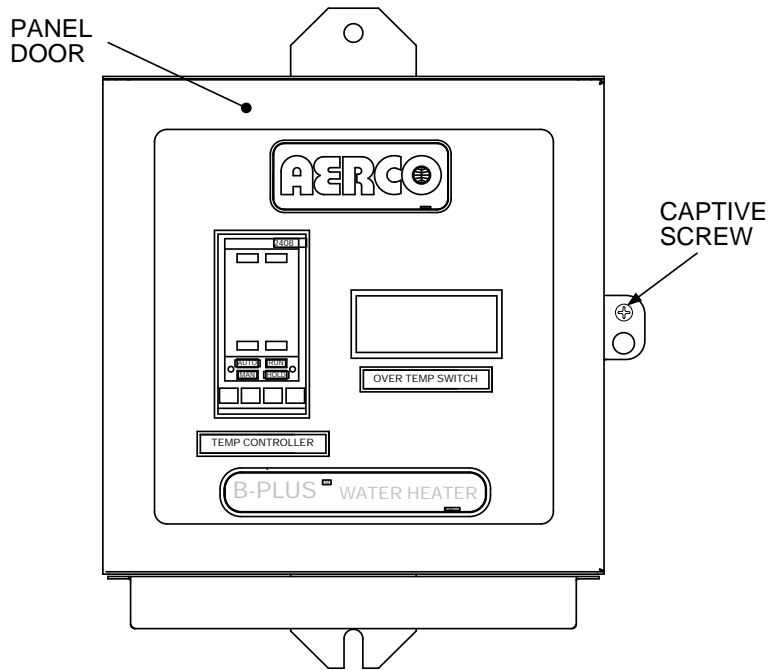


Figure 2-3. ECS Control Panel Front View

- 2) Next, open the door and loosen the captive screw at the top of the recessed panel (Figure 2-4). Swing down the recessed panel to access Terminal Block TB-2 on the bottom interior surface of the Control Box shown in Figure 2-5.

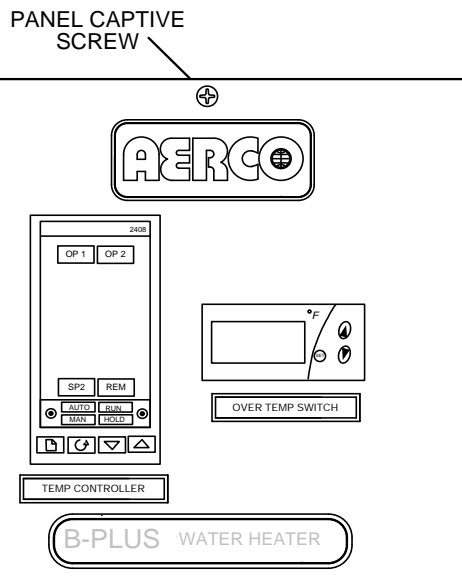
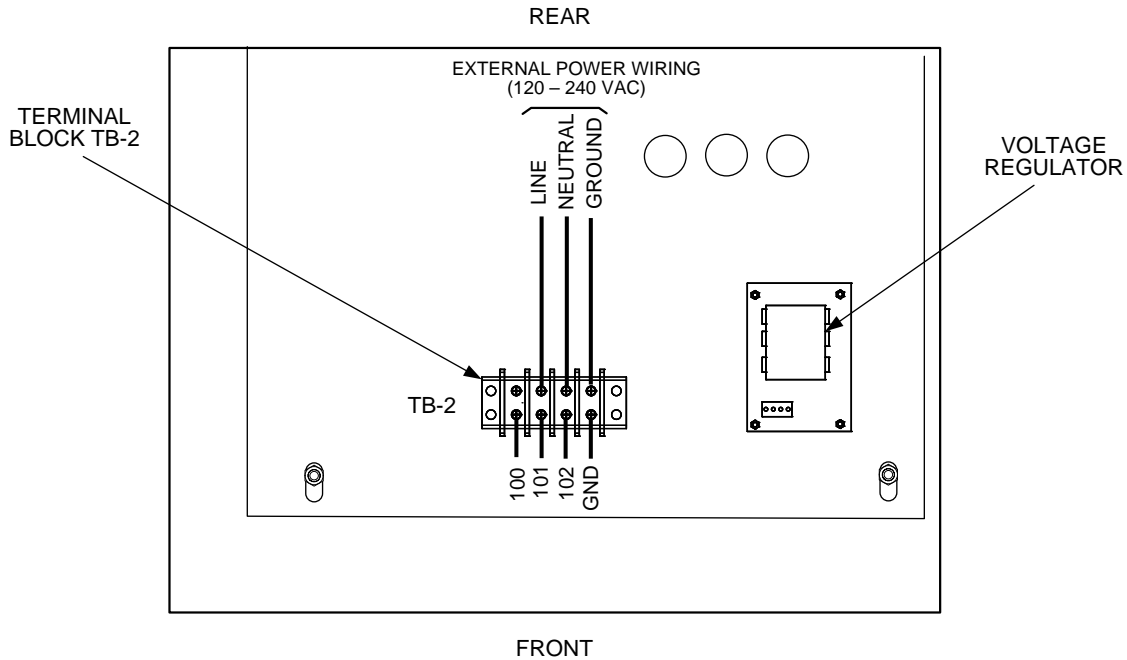


Figure 2-4. Recessed Panel Behind Control Box Door

Electronic Control System (ECS) and Type CXT-E Valve

2. INSTALLATION

- 3) Feed the external 120/240 VAC power leads through the cutout labeled "POWER IN" on the right side of the Control Box.
- 4) Connect the LINE, NEUTRAL and GROUND leads to the TB-2 terminals shown in Figure 2-5.



CONTROL BOX - INTERIOR BOTTOM VIEW

Figure 2-5. ECS Control Box AC Power Connections

- 5) Connect the Control Box cable labeled ACTUATOR to the 3-pin connector plug on the Control Valve Actuator.
- 6) Check to ensure that all cable harness connectors and wire leads between the Control Box and the following ECS components are secure:
 - a) Flow Sensor
 - b) Over-Temperature Solenoid
 - c) Outlet Dual Temperature Sensor
 - d) Heating Fluid Inlet/Outlet Temperature Sensors (Water-to-Water Heaters Only)
- 7) If the ECS was ordered with the Modbus Communication Option, proceed to step 8. However, if this option is not included, no further steps are required for ECS installation.

NOTE:

Step 8 applies **ONLY** to Electronic Control Systems which include a Temperature Controller (Eurotherm, Model 2408) equipped with a Communications Board which allows connection to Modbus Networks. The required signal connections will depend on the ports available on the Energy Management System (EMS), Building Automation System (BAS), or Computer being used with the ECS.

Electronic Control System (ECS) and Type CXT-E Valve
2. INSTALLATION

CAUTION!

DO NOT route Modbus communication wiring in the same conduit as power wiring. Attempting to do so may result in excessive noise on the signal lines. Also, ensure that the RS232 or RS485 signal cable connections do not exceed the following lengths:

RS232 Cable: 50 feet maximum
RS485 Cable: 4,000 feet maximum

- 8) To permit Modbus control of the ECS, refer to Table 2-1 and connect the appropriate wire leads to the Temperature Controller terminals listed. Refer to the Temperature Controller (Eurotherm 2408) pinouts shown in Figure 2-6 to locate the required terminals. Also, refer to Appendix A for a listing of active Modbus data addresses for the 2408 Controller. In addition, the Eurotherm documents referenced in this Appendix provide additional communication information related to Modbus.

NOTE:

The complete wiring diagram for the Electronic Control System is provided in Appendix B of this Instruction Manual. In addition, the wiring connections for Terminal Blocks TB-1 and TB-2 are provided for reference purposes.

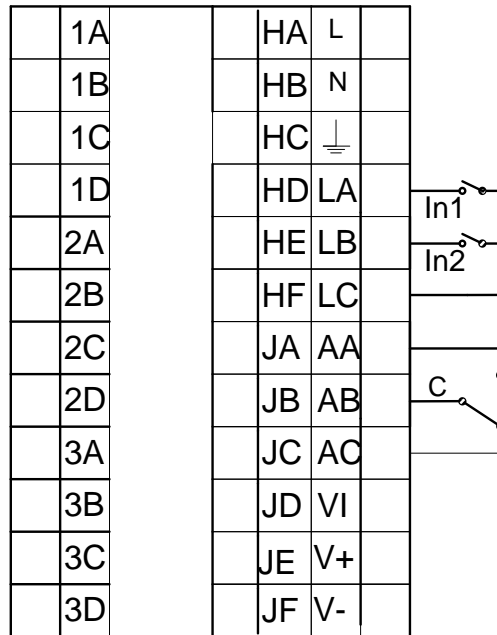
NOTE:

AERCO recommends that shielded, twisted-pair cable be used for communication wiring. Examples of suitable wiring are: Belden 9841, 8761, 3105A, or equivalent.

Table 2-1. Modbus Communication Signal Connections

2408 TEMP. CONTROLLER		COMPUTER CONTROL CABLE			
			RS232/9-PIN	RS232/25-PIN	RS485
SIGNAL NAME	PIN NO.	SIGNAL NAME	PIN NO.	PIN NO.	PIN NO.
GROUND	HD	GROUND	5	7	GROUND
RECEIVE	HE	TRANSMIT	3	2	A (-)
TRANSMIT	HF	RECEIVE	2	3	B (+)

2408 CONTROLLER



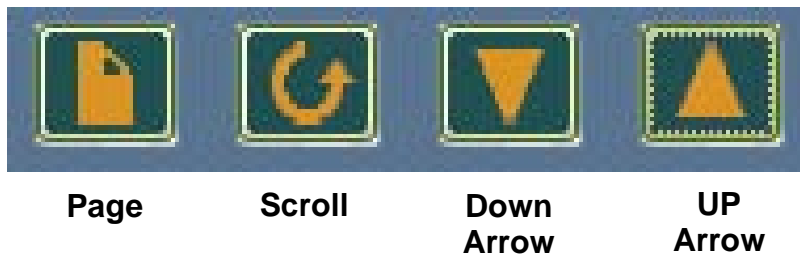
SEE TABLE 2-1 FOR COMM CONNECTIONS

Figure 2-6. Temperature Controller (Eurotherm 2408) Terminal Connection Diagram

2.4 CHANGING COMMUNICATION ADDRESSES ON AERCO EURO THERM TEMPERATURE CONTROLLER

The address is defaulted to 1 from the factory. Refer to the Button map below for all panel navigation instructions.

Button Map



Electronic Control System (ECS) and Type CXT-E Valve

2. INSTALLATION

To change the modbus address:

- 1) Page to the ACCS list and Scroll down the list to *codE*.



- 2) Enter 24 using the Up Arrow. The number will display and flash PASS.



- 3) Scroll to *Goto* (current value is OPER) and use the Down Arrow to enter a value of Full. The entry is confirmed by the flashing of the lower display momentarily off and then on.



Electronic Control System (ECS) and Type CXT-E Valve

2. INSTALLATION

- 4) Go to the home screen by pressing the Page and Scroll buttons at the same time.
- 5) Page to the cmS list.
- 6) Scroll to the Addr screen
- 7) Use the Up Arrow to select the desired address number.



- 8) Go to the home screen by pressing the Page and Scroll buttons at the same time.
- 9) Page to the ACCS List and change the code to anything other than 24. The code number you have entered will flash off and then on to 0 to confirm that access is now set to OPER level and it is safe to return to use.



- 10) Confirm that the Addr is set properly by pressing Page button until the cmS list is displayed and Scroll to Addr. If the value is correct, you are done. If not, then repeat the steps over again.



2.5 ENABLING REMOTE SETPOINT CONFIGURATION ON THE AERCO EUROTHERM TEMPERATURE CONTROLLER

The setpoint may be programmed to be remotely configured by executing the following steps. See the previous instructions for changing communication addresses in the AERCO Eurotherm Temperature Controller for more detailed directions for programming the controller.

- 1) Page to "ACCS".
- 2) Scroll and enter code of 1.
- 3) Scroll and at the "GOTO" menu choose "Conf".
- 4) At the "Conf" screen enter the code of 2
- 5) Press the Scroll button once and then the Page button until you find "SP".
- 6) Scroll until you find "rmt" and set the parameter value to "SP".
- 7) Press the Page and Scroll button together at the same time to go to "exit".
- 8) Press the Up arrow to select "yes" and then the instrument will reboot.
- 9) Once the instrument has returned to its normal state, press the Page button until you see "SP".
- 10) Scroll until you see "L-r" and using the Up arrow select "rmt".
- 11) Once you have selected "rmt" press the Page and Scroll buttons at the same time to return to the normal temp display.

You should now be able to control the set point remotely.

3. ADJUSTMENT

3.1 INTRODUCTION

This Section provides adjustment procedures for both the Control Valve, Type CXT-E and the Electronic Control System (ECS).

Prior to shipment, from AERCO, all CXT-E Control Valve Actuators are adjusted (auto-stroked) to ensure that they properly position the Control Valve from the fully-open to the fully-closed positions. In addition, the ECS is adjusted to the Setpoint Temperature specified on the Sales Order. If no setting was specified, the default is 140°F.

It is recommended that the following procedures be performed to the extent necessary, prior to placing the system into operation. Also, the applicable procedures **MUST** be performed following replacement of the CXT-E Control Valve or other ECS components. In addition, the following procedure must be performed following maintenance or adjustment of linkage, actuator or packing nut.



As a precaution, ensure that all heating fluid (steam or hot (boiler) water) shutoff valves are fully closed prior to performing any of the following adjustment procedures.

3.2 CONTROL VALVE TYPE CXT-E ADJUSTMENT

All CXT-E Actuators are powered by 24 VDC and are controlled by a linear 4-to-20 mA control signal. A 4 mA control signal input places the Control Valve in the fully-closed position (Valve shaft down); while a 20 mA signal strokes the Valve to the fully-open position (Valve shaft up).

The Control Valve Actuators are self-calibrating for all Valve sizes. Therefore, simply proceed as follows to automatically adjust the Actuator:

NOTE:

The following adjustment procedure must be performed any time that the CXT-E Actuator is replaced or a mechanical adjustment is made to the Linkage Assembly or Valve.

- 1) Refer to Figure 3-1 and loosen the Actuator cover set screw.
- 2) Remove the Actuator cover to access the PC Board containing the terminal connections, DIP switches, Auto-Stroke (Reset) button and LED shown in Figure 3-1.

NOTE:

When properly connected to the ECS, +24 VDC power is supplied to the Control Valve Actuator when the Control Box POWER switch is set to the ON position. This switch is located on the right side of the Control Box.

- 3) Set the ECS Control Box POWER switch to the ON position to apply 24 VDC power to the Actuator (pin 2 = +24 VDC, pin 1 = Common). The LED will light indicating that power is applied.
- 4) Wait approximately 10 seconds while the unit performs a self-test. The LED will blink from one (1) to seven (7) times depending on the size of the valve as follows:

Electronic Control System (ECS) and Type CXT-E Valve

3. ADJUSTMENT

NOTE:

DO NOT PRESS THE RESET BUTTON before the 10 second period has ended.

Blinks	Valve Size
1	1"
2	1.25"
3	1.5"
4	2"
5	2.5"
6	3"
7	4"

- 5) For Full-Stroke automatic adjustment, press the Reset button. The LED will light.
- 6) The Actuator will then rotate in both directions to find its open and closed Valve position stops.
- 7) Upon successful completion of the automatic adjustment, the LED will blink 1 to 7 times (depending on the valve size shown above) and then go off.
- 8) Replace and secure the Actuator cover by tightening the set screw.

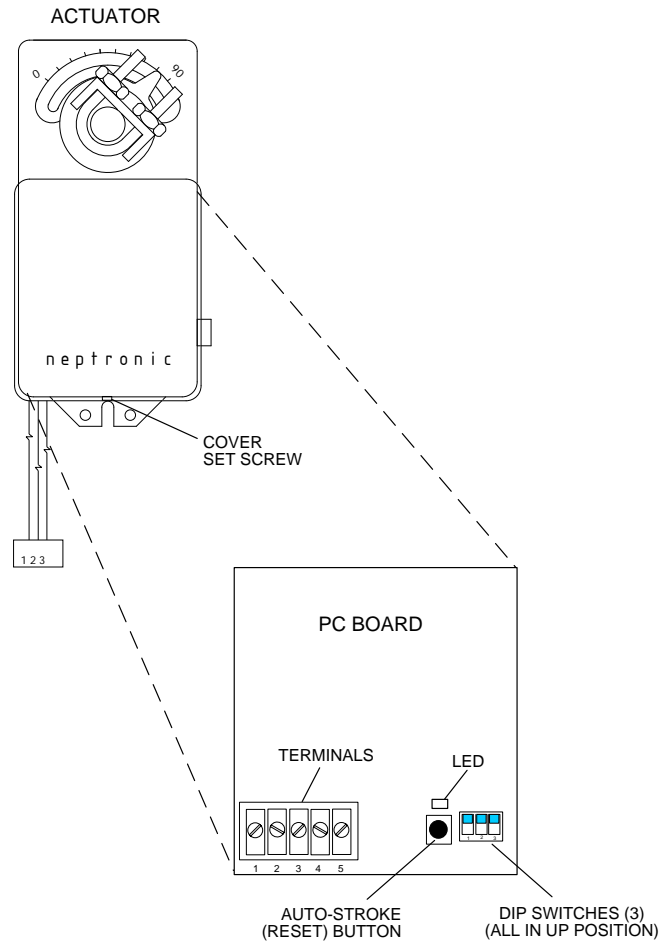


Figure 3-1. Actuator Adjustment

3.3 ELECTRONIC CONTROL SYSTEM (ECS) ADJUSTMENT

The Electronic Control System (ECS) is preset at the setpoint temperature specified on the Sales Order. The over-temperature alarm limit is normally set 20°F above the specified setpoint. If no setpoint or over-temperature alarm limit is specified, the ECS will be set to the Factory Default values of 140°F (setpoint) and 160°F (over-temperature alarm limit). If changes are required, the setpoint and over-temperature alarm limits can be easily changed. This is accomplished using the controls provided on the Temperature Controller and the Over-Temperature Switch contained in the Control Box shown in Figure 3-2. These items can be viewed through the window on the front door of the Control Box. To access these controls and adjust the setpoint or over-temperature alarm limit, open the hinged Control Box door. Proceed as follows to adjust the required parameters:

NOTE:

For “Water-to-Water” Heater applications, two additional Temperature Display Indicators are mounted below the Over Temp Switch. Although these Indicators are identical to the Over Temp Switch, they are “Indicator-Only” devices which cannot be adjusted.

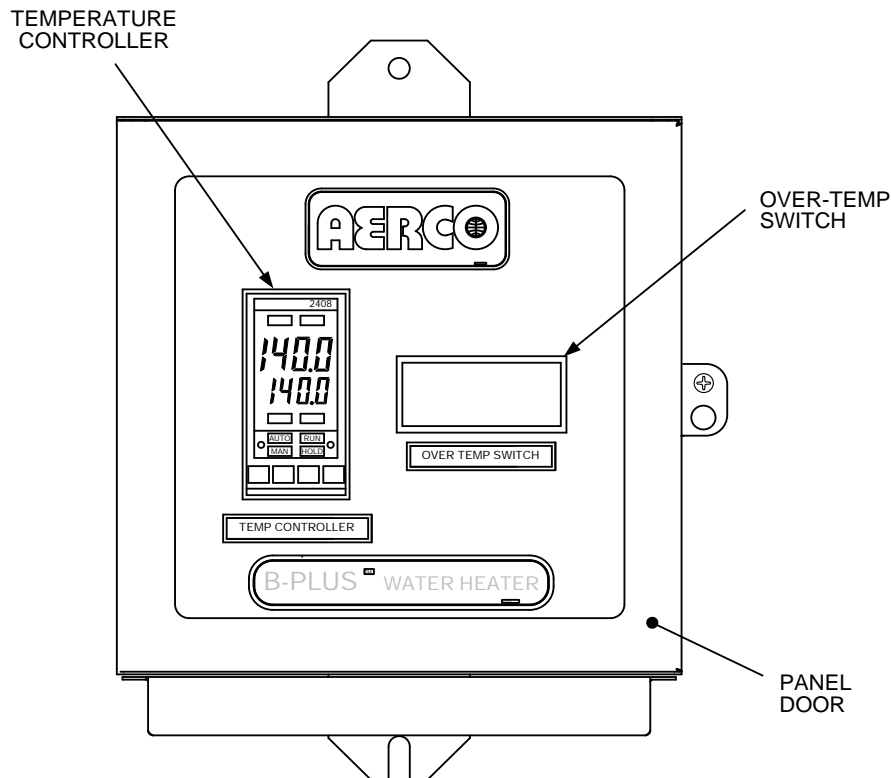


Figure 3-2. Control Box – Front View

NOTE:

When the Power Switch on the Control Box is set to the ON position, it also energizes the internal DC Power Supply in the Control Box. This in turn provides 24 VDC power to the Control Valve Actuator, provided that the water temperature at the heater outlet is below the high temperature limit setting.

3.3.1 Setpoint Temperature Adjustment

The setpoint temperature is adjusted using the controls and displays provided on the Temperature Controller. These controls and displays are illustrated and described in Figure 3-3 and Table 3-1. If necessary, setpoint temperature adjustment is accomplished as follows:

- 1) With the Control Box door open, set the ON/OFF POWER switch on the right side to the ON position. The Temperature Controller will initiate a self-test for approximately 3 seconds. Following the self-test, the top display will show the current outlet water temperature of the Heater and the lower display will show the current setpoint temperature stored in memory (default = 140°F).
- 2) Ensure that the Temperature Controller is set to the AUTO (automatic) mode and the AUTO indicator is lit. If the MAN indicator is lit, press the AUTO/MAN button to toggle the mode setting. Indicator OP1 will be lit if the process is calling for heat.
- 3) If the lower display does not show the desired setpoint temperature, press the ▲ or ▼ arrow button to change the display to the desired value.
- 4) Two seconds after the ▲ or ▼ arrow button is released, the display will blink to indicate that the Temperature Controller has accepted and stored the displayed value.

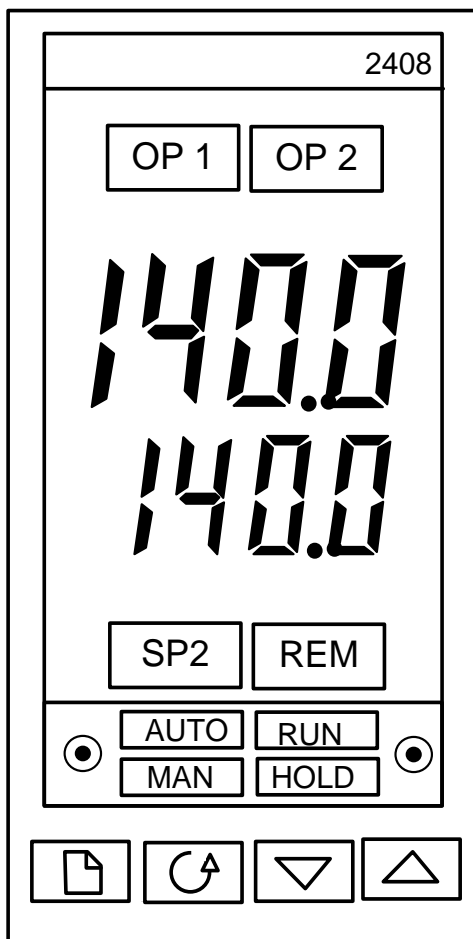
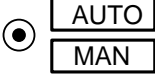







Figure 3-3. Temperature Controller

Electronic Control System (ECS) and Type CXT-E Valve
3. ADJUSTMENT

Table 3-1. Temperature Controller Operating Controls, Indicators & Displays

CONTROL or INDICATOR	MEANING	FUNCTION
OP1	Output 1 Indicator	OP1 lights when a 4 to 20 mA signal is being supplied to the ECS Valve Actuator
OP2	Output 2 Indicator	Not used for the ECS application
SP2	Setpoint 2 Indicator	Not used for the ECS application
REM	Remote Setpoint Indicator	REM lights when the ECS is set up to be controlled by a Remote (Modbus) signal. REM will also flash when Modbus communication is active.
	Auto/Manual Button and Indicators	When button is pressed, the Controller is toggled between the automatic (AUTO) and manual (MAN) modes. AUTO lights when in the automatic mode. MAN lights when in the manual mode.
	Run/Hold Button and Indicators	Not used for ECS application
	Page Button	Press Page button to select a new list of parameters
	Scroll Button	Press Scroll button to select a new parameter in a list
	Down Button	Press to decrease the value shown in the lower display
	Up Button	Press to increase the value shown in the lower display

3.3.2 Over-Temperature Alarm Limit Adjustment

The over-temperature alarm limit setting is adjusted using the controls and display on the Over-Temperature Switch. The controls and display are illustrated and described in Figure 3-4 and Table 3-2. If necessary, over-temperature alarm limit adjustment is accomplished as follows:

- 1) With the Control Box door open, set the ON/OFF POWER switch to the ON position.
- 2) Press the SET button on the Over-Temperature Switch. SP will appear in the display.
- 3) Press the SET button again. The current over-temperature limit value stored in memory will be displayed (default = 160°F).

Electronic Control System (ECS) and Type CXT-E Valve

3. ADJUSTMENT

- 4) If the display does not show the desired over-temperature alarm setting, press the ▲ or ▼ arrow button to change the display to the desired temperature setting.
- 5) Once the desired over-temperature alarm setting is displayed, press the SET button to store the setting in memory.
- 6) To exit the programming mode, press the SET and ▼ buttons simultaneously, or simply wait one minute.
- 7) Once the programming mode has been exited, the display will show the current outlet water temperature of the Heater.



Figure 3-4. Over-Temperature Switch

Table 3-2. Over-Temperature Switch Controls and Indicators

CONTROL or INDICATOR	MEANING	FUNCTION
LED Display	TEMP status	Displays current water temperature or setpoint.
RST	RESET Button	Resets the unit after an alarm condition.
▲	UP Button	Increases the displayed temperature.
▼	DOWN Button	Decreases the displayed temperature.
SET	SET Button	Used to access and store parameters in the unit.

3.3.3 Over-Temperature Switch Sensor Adjustment

The Over-Temperature Switch can be adjusted to allow a $\pm 10^{\circ}\text{F}$ offset, in order to match the value from a Eurotherm Temperature Controller. To use this function, complete the following steps:

- 1) Press and hold the SET button for 8 to 12 seconds. The display will show 00. DO NOT change these values.
- 2) Momentarily press the SET button. The SP parameter will be displayed.
- 3) Using the Up and Down arrow keys, scroll to parameter P1.
- 4) Press the SET button. The display will show the current offset (default = 0).
- 5) Press the Up and Down arrows to enter the desired offset value (-10 to +10°).
- 6) Press the SET button to store the selected offset value.
- 7) Press the SET and Down arrow buttons at the same time to quit the programming mode, or wait one minute and the display will automatically exit the programming mode.

4. OPERATION

4.1 INTRODUCTION

This Section provides the pre-operational checks, initial start-up procedures for the AERCO Water Heater, Electronic Control System (ECS) and CXT-E Control Valve. In addition, procedures are included to check the hot water outlet flow through the heater.

4.2 PRE-OPERATIONAL CHECKS

- 1) Verify that the ECS Temperature Controller setpoint and Over-Temperature Switch alarm limit have been properly set using the procedures in Section 3 – ADJUSTMENTS.
- 2) Refer to Figure 2-1 (Steam Flow) or Figure 2-2 (Hot Water Flow). To place the Control Valve and Heater System into operation, proceed as follows:
 - a) Ensure that the AERCO Heater is ready for operation in accordance with the instructions provided in the Heater Operation & Maintenance Manual included with the equipment.
 - b) First, slowly open the upstream and the downstream shutoff valves until they are fully open. Check to insure that the CXT Valve is not allowing the flow of steam or hot water.
 - c) Ensure that electrical power is properly connected to the ECS Control System and the Electronic Control Valve, Type CXT-E.

4.3 INITIAL START-UP

In order to prevent a possible over-temperature condition during initial start-up, AERCO recommends that the following steps be performed in the order specified:

- 1) With the ECS Control Box door open, set the POWER switch on the right side of the box to the ON position. This will provide power to the complete ECS and CXT-E Control Valve. When power is initially applied, the ECS Temperature Controller automatically performs a self-test sequence for approximately three seconds. Proceed immediately to the next step.
- 2) Upon completion of the self-test, the Temperature Controller will show the present water heater outlet temperature in the upper display and the setpoint temperature in the lower display.
- 3) Press the AUTO/MAN button on the front panel of the Controller (Figure 3-3) and toggle the display to the MAN (Manual) mode. The MAN indicator will light when the Manual mode is selected.
- 4) When in the Manual mode, the upper display will continue to show the current outlet water temperature of the heater. The lower display will show the position of the CXT-E Control Valve Actuator in %. When the Manual mode is initially selected, the lower display will show 0%, indicating that the Control Valve is fully closed.
- 5) Using the ▲ arrow button, set the CXT-E Control Valve to the 10% position and monitor the outlet water temperature of the heater.
- 6) Next, continue to increase the valve “open” position in 5% increments until the water temperature starts to increase at a moderate rate.
- 7) When the outlet water temperature has increased to within 20°F of the desired setpoint, press the AUTO/MAN button and toggle the Temperature Controller to the AUTO mode. The AUTO indicator will light and the MAN indicator will go off. When in the AUTO mode the upper display will continue to show the outlet water temperature of the heater. The lower display will show the selected setpoint temperature.


- 8) When in the AUTO mode, the ECS will stabilize at the selected setpoint temperature (see Section 3). Once stabilized, the ECS is set for unattended operation with no further operator intervention.

IMPORTANT NOTE:


In order to accurately measure the outlet flow rate of the AERCO Water Heater, it is imperative that the properly sized inlet orifice be installed in the cold water inlet. Failure to do so will result in erroneous flow rate readings.

4.4 CHECKING WATER HEATER FLOW RATE

If desired, the water heater outlet flow rate in gallons per minute (GPM) can be monitored using the controls and displays on the Temperature Controller. This is accomplished as follows:

- 1) Press the **Scroll** () button and scroll to **Li.2**.
- 2) When **Li.2** is shown in the upper display, the lower display will show the water heater outlet flow rate in gallons per minute (GPM). The flow rate will be displayed for several seconds and then the Controller will revert to the default displays (outlet water temperature and setpoint).

4.5 CHECKING THE VALVE POSITION OUTPUT IN AUTO MODE

- 1) Press the **Scroll** () button and scroll to **OP**.
- 2) The display will indicate the percent open from 0 to 100. This should be checked with the indicator scale on the CXT valve linkage. See Figure 1-4 for scale location.

5. FUNCTIONAL DESCRIPTION

5.1 INTRODUCTION

The AERCO Electronic Control System (ECS) and Electronic Control Valve Type CXT-E provide a highly responsive control system which provides virtually constant hot water flow at the selected setpoint temperature. A simplified functional block diagram for the ECS and CXT-E is shown in Figure 5-1. The following paragraphs provide a top-level functional overview of system operation.

5.2 FUNCTIONAL OVERVIEW

The primary control mechanism for the ECS is an Electronic Process Controller which is installed in the Control Box. The Controller utilizes PID (Proportional Integral Derivative) algorithms to provide precise control of the Water Heater outlet temperature. Outlet temperature control is accomplished by modulating the open/closed position of the CXT-E Control Valve Actuator.

The Controller continuously monitors the Water Heater outlet temperature via a thermocouple located in the outlet port. The Controller also receives a feed-forward signal from the flow sensor mounted in the cold water inlet as shown in Figure 5-1. The flow sensor monitors flow changes through the Water Heater and provides a feed-forward signal (0 to 5 VDC) to the Controller proportional to the change in flow.

Using PID algorithms, the Controller provides a 4-to-20 mA output signal to the CXT-E Control Valve Actuator. This 4-to-20 mA signal proportionally modulates the Control Valve position from fully closed (4 mA) to fully open (20 mA). The control signal varies as necessary to maintain the setpoint temperature programmed into the Controller. Under normal conditions, the Water Heater outlet temperature is maintained within $\pm 4^{\circ}\text{F}$ of the desired setpoint based on a load change of 50% or less.

5.3 OVER-TEMPERATURE CONTROL AND SAFETY FEATURES

The Control Box also contains an Over-Temperature Switch which continuously monitors and displays the outlet water temperature of the Heater via the input received from the thermocouple installed in the hot water outlet port. Normally, the Over-Temperature Switch is set 20°F above the setpoint temperature for the Water Heater. If the configurable over-temperature limit is exceeded, the Over-Temperature Switch alarm is triggered, which sounds an audible alarm, disconnects power from the Control Valve Actuator and energizes the Solenoid Valve located in the Water Heater top head, expelling over-heated water from the Heater.

The Solenoid Valve in the top head remains open until the water temperature drops below the over-temperature limit setting. Once the water temperature drops below the limit, the Over-Temperature Switch resets automatically, silencing the audible alarm, de-energizing and closing the Solenoid Valve, and reapplying power to the Control Valve Actuator.

It should be noted that the Over-Temperature Switch has a slightly slower response to temperature changes than the Temperature Controller. Therefore, slightly different temperature readings may appear momentarily in their respective displays, particularly during system start-up.

The Control Valve Actuator also incorporates a "Fail-Safe" feature which automatically closes the Valve if there is a loss of the 4-to-20 mA control signal or loss of input power.

Electronic Control System (ECS) and Type CXT-E Valve
5. FUNCTIONAL DESCRIPTION

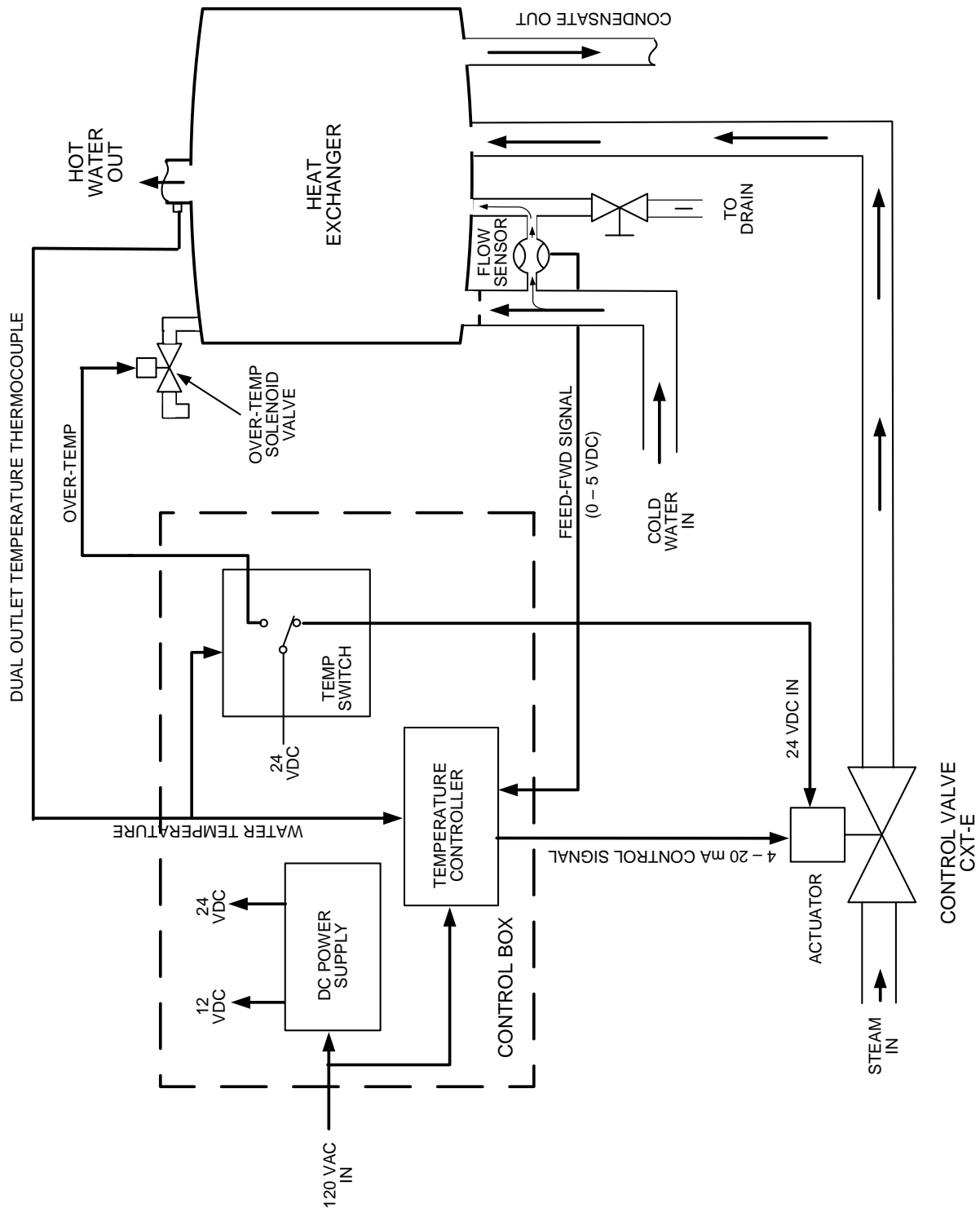


Figure 5-1. ECS Simplified Block Diagram

6. ROUTINE MAINTENANCE

6.1 INTRODUCTION

The following paragraphs provide the AERCO recommended routine maintenance procedures for the Electronic Control Valve Type CXT-E and the Electronic Control System (ECS).

6.2 CXT-E CONTROL VALVE ROUTINE MAINTENANCE

6.2.1 Monthly Maintenance

Once each month, check the Control Valve for leakage as follows:

- 1) Refer to Figure 6-1 and check the Packing Nut and Valve Top for evidence of leakage.



CAUTION

Over-tightening the Packing Nut may trap the Valve Stem and slow or stop Valve motion.

- a) If there is leakage between the Packing Nut and Valve Top, tighten the Packing Nut until the leakage stops. **DO NOT FORCE** the Packing Nut.
- b) If tightening the Packing Nut does not stop the leak, the Packing Nut and Packing Assembly must be replaced in accordance with the procedures specified in the Control Valve **CORRECTIVE MAINTENANCE** Section.

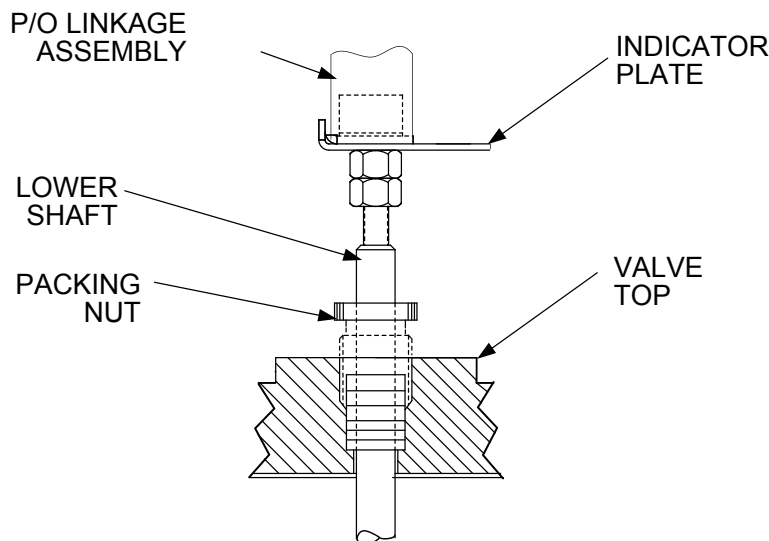


Figure 6-1. Valve Shaft Seals

6.2.2 Semi-Annual Maintenance:

Every six months, check the following items:

- 1) Refer to Section 3 - ADJUSTMENT and perform the Actuator adjustment procedure specified. Verify that the Actuator strokes the Control Valve from the fully closed to the fully open position.
- 2) Clean the Strainer in the heating fluid line (Figure 2-1 or Figure 2-2) in accordance with the instructions furnished with the Strainer.

6.3 ELECTRONIC CONTROL SYSTEM (ECS) ROUTINE MAINTENANCE

6.3.1 Quarterly Maintenance:

Every three months, check the operation of the Over-Temperature Switch as follows:



THIS PROCEDURE WILL RELEASE HOT WATER. TAKE APPROPRIATE PRECAUTIONS TO AVOID BURNS.

- 1) Refer to Section 3 (ADJUSTMENTS) and lower the Over Temperature setting to approximately 5°F below the present Setpoint shown in the lower display of the Temperature Controller.
- 2) Verify that an Over-Temperature Alarm is generated and the following events occur:
 - The CXT-E Control Valve closes.
 - The Over-Temperature Solenoid (located at top of Heater) opens and expels water from the system.
 - The Over-Temperature Switch generates an audible alarm.
- 3) Following successful completion of the Over-Temperature Alarm check, return the Over-Temperature Switch setting to its original Over-Temperature setting.

6.3.2 Annually:

Once each year, AERCO recommends that the Temperature Sensor(s) and Flow Sensor be checked to ensure there is no scale build-up or clogging that may degrade system operation. Proceed as follows:

- 1) Close the upstream and downstream water supply valves to the Heater.
- 2) For Water-to-Water Heaters (E-Plus or Double-Wall) where hot boiler water is the heating fluid, turn off the inlet and outlet valves in the fluid lines.
- 3) Check the Temperature Sensors and Flow Sensor as described in the following paragraphs and steps. Upon completion of the Annual checks, restore the Heater to operation by opening all valves which were closed in steps 1 and 2 above.

6.3.3 Temperature Sensors:

The Heater contains a Dual Temperature Sensor in the Heater outlet port. In addition, Water to Water Heaters (E-Plus or Double-Wall) using hot (boiler) water as the heating fluid also contain single-Element Sensors in the heating fluid inlet and outlet lines. Check and, if necessary, clean these items by performing the following step:

- 1) Disconnect and remove the Dual Temperature Sensor (Thermocouple) at the Heater outlet and inspect for evidence of scale buildup on the stainless steel sleeve. If necessary, clean the sensor using a wire brush.
- 2) For Water-to-Water Systems, repeat step 1 for the Single-Element Sensors in the heating fluid inlet and outlet lines.
- 3) After cleaning, reinstall the sensor(s) and ensure they are securely tightened.

Electronic Control System (ECS) and Type CXT-E Valve

6. ROUTINE MAINTENANCE

6.3.4 Flow Sensor:

The Flow Sensor is installed between the Heater water inlet line and the Heater drain (refer to Figures 1-1 & 5-1). Check this sensor for evidence of blockage or scale build-up as follows:

- 1) Disconnect the electrical connector from the Flow Sensor.
- 2) Loosen the fittings at the Sensor inlet and outlet connections and completely remove the Sensor. To ease removal, loosen the strain relief on the flow sensor cable. This creates clearance for the removal of the fitting on the meter body.
- 3) Inspect the Sensor inlet and outlet for blockage and clean as necessary.
- 4) Refer to Figure 6-2 and disassemble the Flow Sensor as follows:
 - a) Remove the internal snap-ring.
 - b) Remove the clear polycarbonate window and O-ring.
 - c) Remove the turbine paddle wheel.
 - d) Clean all foreign matter from the Flow Sensor. If replacement parts are needed, order the appropriate Flow Sensor Rebuild Kit (see Table 9-2) from your local AERCO Sales Representative.

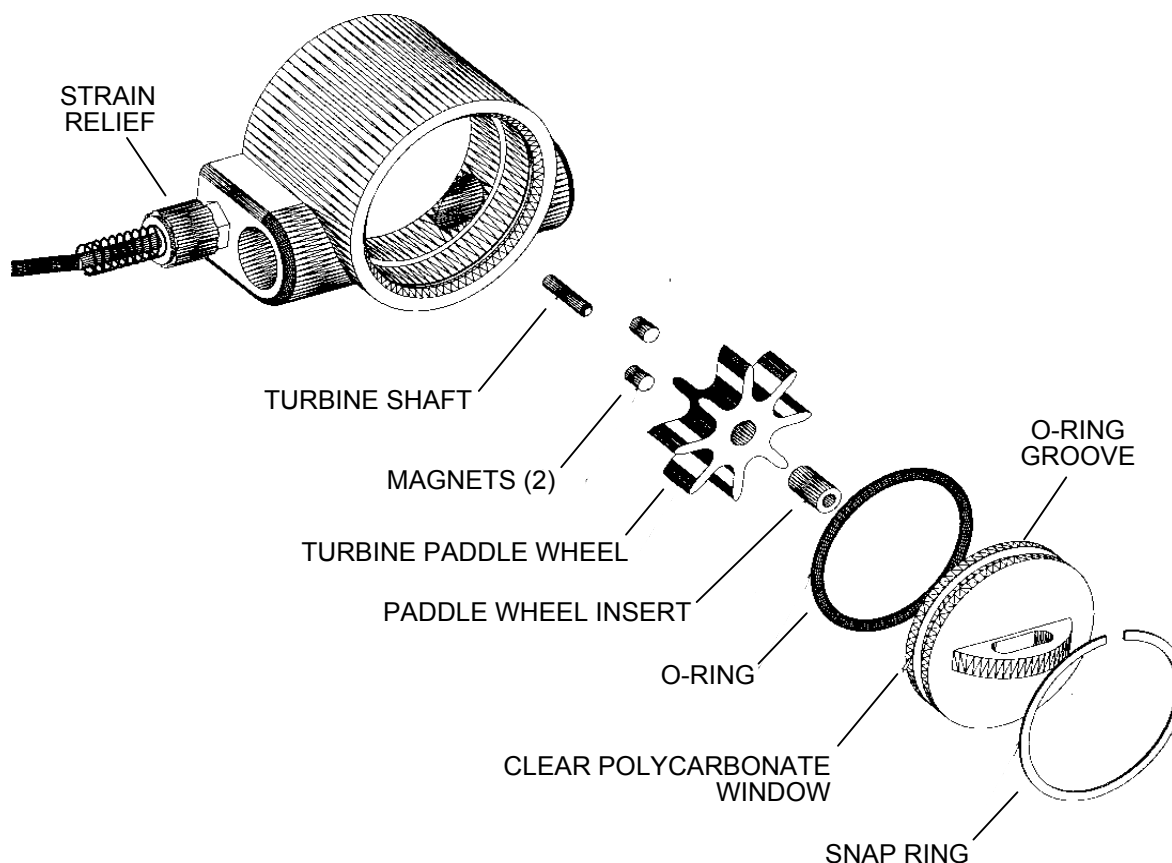


Figure 6-2. Flow Sensor, Part No. 64006 – Exploded View

Electronic Control System (ECS) and Type CXT-E Valve

6. ROUTINE MAINTENANCE

5) After cleaning, reassemble the Flow Sensor as follows:

IMPORTANT NOTE!

Ensure that the paddle wheel magnets are installed facing the internal wall of the Flow Sensor. If not correctly installed, the Sensor will not function properly.

- a) Reinstall the paddle wheel.
 - b) Apply a thin film of silicone grease on the O-ring in the groove of the clear polycarbonate window.
 - c) Reinstall the polycarbonate window.
 - d) Reinstall the snap-ring.
- 6) After the Flow Sensor has been reassembled, reinstall the Sensor. Tighten the strain relief and connect the electrical connector.

6.4 HEAT EXCHANGER ROUTINE MAINTENANCE CLEANING

AERCO recommends that the heat exchanger of the unit be cleaned annually using a solution of Hydroskrub and water. Hydroskrub is distributed by AERCO International, Inc. and is designed to dissolve the toughest water scale, lime, mud and rust deposits from virtually any type of water-based equipment.

NOTE:

The following cleaning procedure applies to all sizes WWDW and SWDW Heaters. For Helical Coil Type Water Heaters, refer to the applicable manuals listed in Section 1, page 1-8 of this document for cleaning/descaling procedures.



Please review MSDS, specifications, and our website www.aerco.com for additional information, or call technical service at (800) 526-0288.



Do not drain the unit without venting the shell! A vacuum in the unit may displace the liner causing serious damage not covered by warranty.

6.4.1 Pumping System Set-Up Instructions:

Refer to the sample pumping set-up diagram shown in Figure 6-3 for a Double-Wall Heat Exchanger. For Helical Coil Heaters, refer to the applicable manuals listed in Section 1, paragraph 1.4.

- 1) Turn off the water heater and close the inlet and outlet isolation valves.
- 2) Drain at least half of the water-side volume from the heat exchanger. The amount of water drained will depend on the size of the heater.
- 3) Prepare a 50% solution of Hydroskrub and clean water. The amount of the solution should be approximately equal to the full volume of water that the heat exchanger holds.
- 4) Close the drain valve and connect a suitable size bucket and pump to the unit drain as shown in Figure 6-3.

Electronic Control System (ECS) and Type CXT-E Valve
6. ROUTINE MAINTENANCE

- 5) Install a valve and hose connection in the outlet piping of the heater (Figure 6-3) and route the hose back to the top of the circulation bucket.

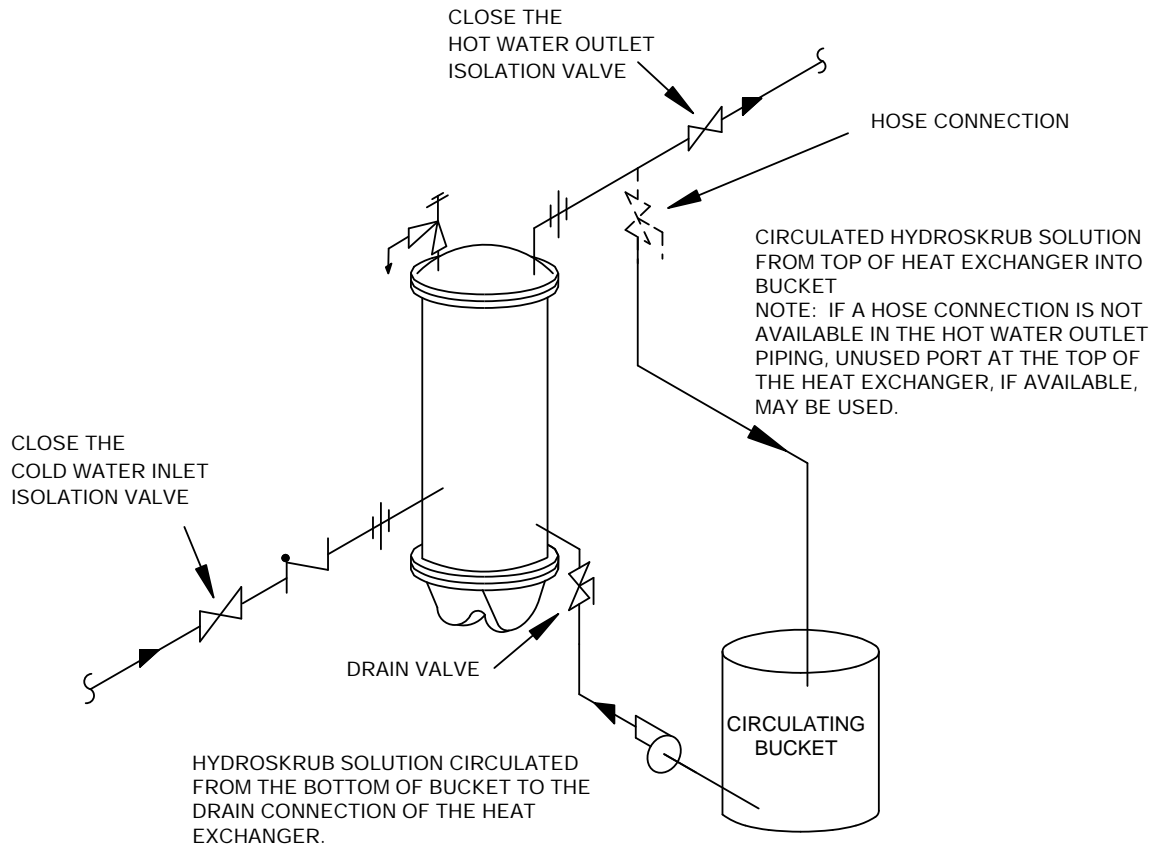


Figure 6-3. Sample HydroSkруб Pumping System Set-Up for Double-Wall Heater

6.4.2 Cleaning Procedure:

- 1) Slowly add the prescribe amount of the HydroSkруб solution to the circulating bucket.
- 2) Open the drain and outlet hose connection valves and turn on the pump. Periodically check for leaks and maintain the liquid level in the bucket. A lowering volume level is an indication that there is an open drain in the system.
- 3) Check the cleaning circuit to ensure that the HydroSkруб solution is flowing from the circulation bucket, through the pump and the heater and back to the top of the top of the bucket.
- 4) Return discharge foaming indicates an active HydroSkруб solution and the presence of mineral deposits in the equipment.
- 5) Additional HydroSkруб and/or water may be required to maintain circulation and to prevent the pump from cavitating.
- 6) Circulate through the Heat Exchanger and piping for 1 to 3 hours. Estimate the circulation period based on the time in service and water hardness. If the heating equipment is more than 40 gallons, the circulation time may need to be extended to complete cleaning. When foaming action stops, HydroSkруб strength is depleted (two pounds of deposits removed per gallon used) or the equipment is free from calcium and other water-formed mineral deposits.

Electronic Control System (ECS) and Type CXT-E Valve

6. ROUTINE MAINTENANCE

- 7) Periodically test the solution for effectiveness to determine if more HydroSkруб is needed. Refer to "Testing hydroSkруб Effectiveness" in the next paragraph for details. If the cleaning solution is expended before circulation time is up, additional HydroSkруб will be needed and circulation time may be extended to complete the cleaning.
- 8) Upon completion of the cleaning process, begin flushing the solution by adding clean water to the circulation bucket, then disconnect the return valve and hose connection from the top of the circulating bucket and thoroughly flush. Continue water flushing the equipment for a minimum of 10 minutes or until discharge runs clear.
- 9) HydroSkруб is biodegradable, and in most instances may be purged down sewers. Check with local authorities before disposing of any complex compositions
- 10) Turn off water, shut off the pump and immediately close discharge valves to prevent backflow.
- 11) Completely drain pump bucket. Disconnect hoses from equipment and thoroughly rinse the bucket, pump, and associated hoses used.

6.4.3 Testing HydroSkруб Effectiveness

There are two methods of testing the effectiveness of HydroSkруб during cleaning: the calcium carbonate spot test of the circulating solution and the charting of a trend in the pH of the cleaning solution.

6.4.4 Calcium Carbonate Spot Test:

A calcium carbonate spot test is performed by exposing a form of calcium carbonate to the HydroSkруб solution. Samples of the deposit, a Tums or Roloids tablet, or bare concrete can be used. Observe the reaction of the HydroSkруб solution on the calcium carbonate. Foaming and bubbling indicates the solution is still active. Little or no reaction indicates that the solution is expended. This test should be performed near the end of the circulating time. If the solution has been expended, more HydroSkруб will be required to complete the job. If the solution is still active at the end of the time, all the scale has been dissolved.

6.4.5 pH Trend Charting:

The initial pH of the cleaning solution will measure between 1-3 (See pH sheet on HydroSkруб packaging). To test the effectiveness of the circulating solution as a function of pH, take readings at regular intervals and chart as a trend. Note that the deposits can cause a premature jump in the pH. After circulating for approximately 75% of the cycle time, begin testing the pH at 10-15 minute intervals. Once the solution's pH reads 6.0-7.0 on three or more consecutive readings, the solution is expended. If the pH reads below 6.0 after the circulating time, the application is clean.

7. TROUBLESHOOTING

7.1 INTRODUCTION

This Section provides the troubleshooting procedures necessary to isolate faults to the most probable cause(s) for a malfunction of the Electronic Control System (ECS) or Electronic Control Valve Type CXT-E. Prior to performing the troubleshooting steps and procedures specified in this Section, perform the following preliminary checks:

NOTE:

In addition to the procedures contained in this Section, also check the Troubleshooting Sections of the AERCO Heat Exchanger Manual and any other ancillary equipment manuals included with the installation.

7.1.1 Electronic Control System (ECS) Preliminary Check:

- a) Check to ensure that all ECS electrical cable connections are secure.
- b) Ensure that the CXT-E Control Valve actuator is connected to the Control Box cable plug.

7.1.2 Electronic Control Valve, CXT-E Preliminary Check:

- a) Verify that all connections have been made in accordance with Figure 2-1 (Steam Flow) or Figure 2-2 (Hot (Boiler) Water Flow).
- b) Ensure that the Control Valve is installed with the flow arrow on the Valve Body pointing in the direction of flow.
- c) Ensure that both the upstream and downstream shutoff valves are fully open.

7.2 TROUBLESHOOTING PROCEDURES

The troubleshooting procedures are provided in Table 7-1 (Control Valve CXT-E) and Table 7-2 (ECS) which follow. Also, when troubleshooting ECS faults related to the Temperature Controller (Eurotherm, Model 2408), additional information concerning process fault and diagnostic alarms is included in Appendix A. When a fault occurs, proceed as follows:

- 1) Refer to the **FAULT INDICATION** column in the following tables and locate the fault that best describes the existing conditions.
- 2) Proceed to the **PROBABLE CAUSE** column and, if more than one item is listed, start with the first item shown for the fault condition.
- 3) Perform the corresponding checks and procedures listed in the **CORRECTIVE ACTION** column for the first **PROBABLE CAUSE**.
- 4) Continue checking each additional **PROBABLE CAUSE** for the existing fault until the fault has been corrected.
- 5) Refer to the applicable procedures in Section 8 – **CORRECTIVE MAINTENANCE** if component removal and/or replacement is required.

Electronic Control System (ECS) and Type CXT-E Valve
7. TROUBLESHOOTING

Table 7-1. Troubleshooting – Control Valve CXT-E

NO.	FAULT INDICATION	PROBABLE CAUSE	CORRECTIVE ACTION
T1	System not operating. Control Valve is closed and outlet water temp. is far below setpoint.	<ol style="list-style-type: none"> No power supplied to Control Valve Control signal not being supplied from Temp. Controller. 	<ol style="list-style-type: none"> Disconnect Valve Actuator plug and verify that 24 VDC power is present at pin 2 of Actuator cable. Restore power if necessary. If System includes ECS, proceed to Table 7-2 and check Over-Temp Switch to ensure it has not tripped. Verify presence of 4 - 20 mA control signal at pin 3 of Actuator cable. If control signal is not present, troubleshoot ECS per Table 7-2.
T2	System overheats by more than 10°F above the desired setpoint. Outlet temp is below Over-Temp limit setting CAUTION! Over-tightening the Pack-ing nut may trap the Valve Stem and slow or stop Valve motion.	<ol style="list-style-type: none"> Control Valve not fully closed. Temp. Controller not set properly or defective. Valve Actuator not properly secured to Linkage Assembly. Foreign matter in Valve Seat 	<ol style="list-style-type: none"> Check the 4 – 20 mA control signal being supplied to Actuator. If signal is greater than 4 mA when heater outlet temperature is 10°F (or more) above the desired setpoint, proceed to next item in list. Refer to Section 3 – ADJUSTMENTS and check current setting of Temp. Controller. Readjust if necessary. If adjustment does not clear fault, proceed to Table 7-2 and continue. Check Actuator U-bolt securing it to Linkage Assembly. Tighten if needed and readjust the CXT-E Control Valve per Section 3. If Valve still does not close after checking the above items, disassemble the Valve and clean the Seat per steps CM18 – CM28 in Section 8.
T3	System outlet water temperature is below desired setpoint CAUTION! Over-tightening the Packing nut may trap the Valve Stem and slow or stop Valve motion.	<ol style="list-style-type: none"> Temp. Controller not properly set Control Valve not opening properly. 	<ol style="list-style-type: none"> Refer to Section 3 –ADJUSTMENTS. Check the current ECS Temp. Controller setting. If the setting is below the desired setpoint, readjust as necessary. Check as follows: <ul style="list-style-type: none"> Ensure Actuator is secured to Linkage Assembly. Tighten if needed. Verify that 24 VDC power and 4 – 20 mA control signal are present at Actuator pins 2 and 3 respectively. To ensure Valve is not binding, check Seal Retainer per steps CM1-CM10 of Section 8 Corrective Maintenance. Replace items as necessary.

Electronic Control System (ECS) and Type CXT-E Valve
7. TROUBLESHOOTING

Table 7-1. Troubleshooting – Control Valve CXT-E (Continued)

NO.	FAULT INDICATION	PROBABLE CAUSE	CORRECTIVE ACTION
T3	(Continued) System outlet water temperature is below desired setpoint	3. Steam pressure, or heating fluid temperature too low. 4. For Steam Heating System, Trap or Orifice in Heater Condensate Line is malfunctioning.	3. Check the high side steam pressure to the Control Valve to ensure it is correct. For high temperature (HT) water, ensure there is good circulation. a. If steam pressure or HT water temperature is lower than the system design spec., correct as necessary. b. If high side steam pressure drops, or there is no HT water circulation as the Control Valve opens, there may be a partially closed valve in the upstream line. Also, the strainer may be clogged. Correct as needed. 4. Check for improper operation of Trap or clogged Orifice in Condensate Line as follows: a. If low side pressure gauge shows pressure but steam does not heat properly, CAREFULLY break Condensate Line connection AHEAD of Trap or Orifice. b. Allow condensate to run out into floor drain. c. If Heater outlet temperature rises to desired setpoint with condensate connection open, repair or replace Trap or unplug Orifice.
T4	Wide variations in Heater outlet temperature during wide variations in flow.	ECS Flow Sensor not functioning properly	Refer to Table 7-2 and check operation of Flow Sensor.
T5	Rapid fluctuations in heater outlet temperature which <u>do not</u> follow load changes	1. Temp. Controller not functioning properly. 2. Steam System Trap or Orifice fault	1. Refer to Table 7-2 and troubleshoot Temperature Controller. 2. Refer to T3, Corrective Action 4 above and proceed as indicated.

Electronic Control System (ECS) and Type CXT-E Valve
7. TROUBLESHOOTING

Table 7-2. Troubleshooting – Electronic Control System (ECS)

NO.	FAULT INDICATION	PROBABLE CAUSE	CORRECTIVE ACTION
T6	System not operating. All displays are blank.	<ol style="list-style-type: none"> 1. External 120 VAC power disconnected. 2. Defective ON/OFF switch on Control Box. 3. Defective DC Power Supply. 	<ol style="list-style-type: none"> 1. Ensure external circuit breaker is ON. Check for 120 VAC power across TB-2 terminal leads 101 (Line) and 102 (Neutral). 2. Set ON/OFF POWER switch to the ON (Up) position and verify that the switch indicator lights. Also: <ol style="list-style-type: none"> a. Verify that 120 VAC is present across TB-2 terminal leads 100 (Line) and 102 (Neutral). b. If voltage not present, replace ON/OFF POWER switch. 3. Disconnect the DC output connector on the left internal wall of the Control Box (Figure 8-9, sh. 2). Verify that 24 VDC is present across the V+ and V- terminals. If 24 VDC not present, replace the DC Power Supply.
T7	Water Heater outlet temp. consistently above Setpoint by 10°F or more. However, temperature is below Over-Temp. limit setting.	<ol style="list-style-type: none"> 1. Temp. Controller is not properly set. 2. Faulty Temp. Sensor (thermocouple) is connected to Temp. Controller. 3. Valve Actuator not properly secured to Linkage Assembly. 	<ol style="list-style-type: none"> 1. Refer to Section 3 – ADJUSTMENTS and check current setting of Temp. Controller. Readjust if necessary. 2. Verify Outlet Temp Sensor is securely connected to cable plug. Replace the Dual Sensor if necessary. 3. Check to ensure that the Actuator is securely fastened to the Linkage Assembly. Tighten if needed and readjust the CXT-E Control Valve per Section 3.
T8	Over-Temp Alarm occurs repeatedly. NOTE Audible alarms will be generated if Outlet Temp Sensor is open. Erroneous temperature readings will be displayed if Sensor is shorted.	<ol style="list-style-type: none"> 1. Over-Temp Switch not properly set. 2. Open or shorted Outlet Temp. Sensor (thermocouple) connected to Over-Temp. Switch. 3. Over-Temp Switch is defective. 	<ol style="list-style-type: none"> 1. Refer to Section 3 and check the current setting of the ECS Over-Temp. Switch. Readjust if necessary. 2. Check thermocouple connections between Sensor connector plug and TB-1 terminal leads 111 (+) and 112 (-). If connections are secure, replace Dual Temp Sensor. 3. Replace Over-Temp Switch.

Electronic Control System (ECS) and Type CXT-E Valve
7. TROUBLESHOOTING

Table 7-2. Troubleshooting – Electronic Control System (ECS) - Continued

NO.	FAULT INDICATION	PROBABLE CAUSE	CORRECTIVE ACTION
T9	Over-Temp. Alarm condition cannot be cleared. Over-Temp Switch displays erroneous temperature readings	<ol style="list-style-type: none"> 1. Shorted Outlet Temp. Sensor. 2. Defective Over-Temp. Switch 3. A “No-Flow” condition caused a gradual buildup of heat to the water in vessel. 4. External recirculation pump shut off or failed. 	<ol style="list-style-type: none"> 1. Replace Outlet Temp, Sensor. 2. Replace Over-Temp Switch. 3. Open heater outlet to see if fault clears. If there is no flow through heater, go to Probable Cause 4. 4. Check pump to ensure it is turned on and functioning properly. Also, check for blockage in the incoming flow.
T10	Over-Temp. Alarm condition occurs when doing an initial startup.	Starting system after being shut down without following proper initial start-up procedure.	Refer to Section 4 (Operation) for starting system after being shut down. See Pre-Operational Checks and Initial Start-Up on page 4-1 and follow instructions (OP1–OP10).
T11	Outlet water temp. far below Setpoint	<ol style="list-style-type: none"> 1. Incorrect Temp Controller setting 2. Defective Temp. Controller. 3. Linkage not properly connected. 4. Defective Actuator. 5. Control Valve shaft may be binding 	<ol style="list-style-type: none"> 1. Refer to Section 3 and check the current setting of Over-Temp. Switch. Readjust if necessary. 2. Disconnect cable plug from Valve Actuator and verify that the Temp. Controller is generating a control signal greater than 4 mA. If not replace Temp. Controller. 3. Check Control Valve Linkage and verify it is properly connected and the pin in the Linkage is in the correct position for the Valve size being used. 4. Replace Valve Actuator. 5. Refer to Table 7-1, Fault T3, Corrective Action 2c and perform the steps indicated.
T12	Wide fluctuations in outlet water temperature during large flow changes.	Flow Sensor output signal too low for flow changes. Defective or clogged Flow Sensor.	Under large changes in flow, the Flow Sensor output should vary from 0 to 5 VDC. Check the signal level at TB-1 lead 113 to ensure it varies with flow changes. If not, clean or replace Flow Sensor.

Electronic Control System (ECS) and Type CXT-E Valve
7. TROUBLESHOOTING

Table 7-2. Troubleshooting – Electronic Control System (ECS) - Continued

NO.	FAULT INDICATION	PROBABLE CAUSE	CORRECTIVE ACTION
T13	Wide fluctuations in outlet water temperature under low flow conditions.	<ol style="list-style-type: none"> 1. Outlet Temp Sensor connected to Temp Controller is intermittent 2. Obstruction in Flow Sensor. 3. Inlet Orifice worn or not properly seated. 4. Recirculation Pump failure. 	<ol style="list-style-type: none"> 1. Replace Outlet Temp Dual Sensor at Heater outlet port. 2. Clean or refurbish Flow Sensor per Section 6. 3. Replace Orifice or reseal in required nozzle position. 4. Replace Recirculation Pump.
T14	Temp Controller displays Loop break (Lbr) error message	<ol style="list-style-type: none"> 1. Outlet Temp Sensor not connected. 2. Outlet Temp Sensor defective. 	<ol style="list-style-type: none"> 1. Ensure Temp Sensor connector plug is securely connected. 2. Replace Outlet Temp Dual Sensor installed at Heater outlet port.
T15	Outlet water temperature above Over-Temp Limit, but Solenoid (Dump) Valve does not open.	<ol style="list-style-type: none"> 1. Disconnected or defective Solenoid 2. Defective Over-Temp Switch 	<ol style="list-style-type: none"> 1. Verify that 24 VDC is present at Solenoid plug between leads 103(+) and 104 (-). If voltage is present and Solenoid is connected, it is defective and must be replaced. If 24 VDC is not present, go to item 2. 2. Replace Over-Temp Switch.
T16	Inconsistent temperature reading	<ol style="list-style-type: none"> 1. Sensor wire polarity reversed. 2. Faulty Sensor. 	<ol style="list-style-type: none"> 1. Check polarity of TC wiring; J Thermocouple Standard Wiring: -- Red wire is negative. -- White wire is positive. (Refer to Wiring Diagram B-2) 2. Replace TC Sensor.
OPEn	Secondary Input is missing.	<ol style="list-style-type: none"> 1. Flow meter not powered.^g 2. Failed feedforward sensor. 3. Unplugged connection to feedforward sensor. 	<ol style="list-style-type: none"> 1. Check power LED of Flow meter. Apply power or replace. 2. Replace feedforward sensor. 3. Ensure proper sensor connections.

8. CORRECTIVE MAINTENANCE

8.1 INTRODUCTION

The Corrective Maintenance procedures are divided into two Parts. Part 1 provides corrective maintenance for all sizes of Electronic Control Valves Type CXT-E. Part 2 provides corrective maintenance for the Electronic Control System (ECS).

8.2 PART 1 - CXT-E CONTROL VALVE CORRECTIVE MAINTENANCE

The corrective maintenance procedures for the Electronic Control Valve are divided into the following major areas:

- Valve Shaft Seal Retainer Replacement
- Valve Disassembly
- Valve Reassembly
- Actuator Replacement
- Linkage Replacement

Refer to the applicable paragraphs which follow and perform the Corrective Maintenance steps indicated.

8.2.1 Valve Shaft Seal Retainer Replacement:

Refer to Figure 8-1 or Figure 8-2 and proceed as follows:



Ensure that the Control Valve has been isolated from the steam or hot (boiler) water supply. Live steam or hot water can cause serious burns to personnel.



Ensure that all electrical power to the Control System and Actuator have been disconnected. Serious personal injury may result if this Warning is not observed.

- 1) Loosen the Hex Nuts (17) under the Indicator Plate (Figure 8-1 or 8-2) approximately a half turn clockwise.
- 2) Disconnect the Linkage Adapter from the Valve Shaft (16) by turning the Shaft clockwise (as viewed from above). If the Valve Shaft cannot be turned by hand, use an open-end wrench to turn the "double-nuts" on the Shaft until it disengages the Linkage Adapter threads.
- 3) Remove the Indicator Plate from the Valve Shaft (16).
- 4) Remove the two Cap Screws (19) securing the Linkage Assembly (26) to the Valve Top (21).
- 5) Remove the complete Linkage Assembly (26), with the Actuator Assembly (27) still attached, from the Valve Top. Also, remove the Gasket (29).
- 6) If the Packing Nut (18) is faulty (leaking or binding the Valve Shaft), it must be replaced.

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- 7) Measure and record the current position of the Hex Nuts (17) from the end of the Valve Shaft (16). This will simplify adjustment of the Actuator Linkage during reassembly.
- 8) Next, completely remove the Hex Nuts (17) from the Valve Shaft (16).
- 9) Remove the Packing Nut (18) and the Packing Assembly (20) from the Valve Body.



Over-tightening the Packing Nut (18) may trap the Valve Stem and slow or stop Valve motion.

- 10) Replace BOTH the Packing Nut (18) and the Packing Assembly (20) with a NEW Packing Nut and Packing Assembly.
- 11) Replace the Hex Nuts (17) onto the Valve Shaft (25) and position them in the same location noted in step CM7.
- 12) Attach the Actuator (27), Linkage (26) and Gasket (29) to the Valve Top using the two Cap Screws (19) provided.
- 13) Install the Indicator Plate on the Valve Lower Shaft (16) and secure it in place with the Linkage Adapter.
- 14) Reconnect the Linkage Adapter to the Linkage Shaft by replacing the Shaft Pin.

8.2.2 Valve Disassembly

Refer to Figure 8-1, or Figure 8-2 and proceed as follows:

- 1) Close the upstream and downstream shutoff valves before and after the Control Valve.
- 2) If the Control Valve is easily accessible for disassembly and reassembly, leave it installed in the fluid line. If it is not easily accessible, remove the Valve from the line and clamp it in a bench vise for easy accessibility.
- 3) Completely remove the Actuator (27) and Linkage Assembly (26) from the Valve Body as described in steps CM1 through CM5.
- 4) Refer to Figure 8-1 or Figure 8-2. It is strongly recommended that disassembly of the Valve be limited to only the steps necessary to restore the Valve to proper operation. However, the following steps cover complete disassembly, if necessary. When performing Valve disassembly, USE EXTREME CARE not to mar or scratch any surfaces. The following steps assume that the Actuator and Linkage Assemblies have already been removed from the Valve Body.
- 5) Remove the following parts in the order specified:



CAREFULLY remove the Packing Nut (18) and Cap Screws (14) indicated below to relieve any trapped pressure.

- Hex Nuts (17)
- Packing Nut (18)
- Packing Assembly (20)
- Cap Screws (14)

- 6) Grasp the Lower Shaft (16) and carefully lift out the ENTIRE Shaft/Seat/Piston Assembly.

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- 7) For Control Valves, 1-inch through 2-inch (Figure 8-1), disassemble the Shaft/Seat/Piston assembly in the following order:
 - a) Lock Washer (23)
 - b) Retaining Ring (11)
 - c) Pilot Spring (10)
 - d) Valve Stem Retaining Nut (35)
 - e) Lower Shaft (16) and Valve Stem (12)
 - f) Retaining Disc (8)
 - g) Disc Seat (7)
 - h) Seat Retainer (34)
 - i) Valve Plug Shaft (5)
- 8) For Control Valves, 2.5-inch, 3-inch and 4-inch, (refer to Figure 8-2), disassemble the Shaft/Seat/Piston Assembly in the following order:
 - a) Lock Washer (23)
 - b) Pilot Spring Retainer (11)
 - c) Pilot Spring Back-Up Washer (31), 4-inch Valve only
 - d) Pilot Spring (10)
 - e) Cap Screws (9)
 - f) Valve Seat Retaining Disc (8)
 - g) Lower Shaft (16) and Valve Stem (12)
 - h) Valve Seat (7)
 - i) Top Piston (6) and Bottom Piston (3) assembly
- 9) It is recommended that the Seat Cage (2) NOT BE DISASSEMBLED unless it must be replaced. See Step CM29.

NOTE:

In any cleaning operation called for in these instructions, ALWAYS clean all denoted parts thoroughly of all dirt and scale. Always use a clean cloth and, if necessary, a solvent. NEVER use emery cloth or sandpaper unless instructed otherwise herein.

- 10) CLEAN ALL PARTS THOROUGHLY. ALL DIRT AND/OR SCALE MUST BE REMOVED from the outer surfaces of the Valve Plug Shaft (5) (Figure 8-1) or the Top Piston (6) and Bottom Piston (3) (Figure 8-2) and from the surface of the Valve Stem (12).
- 11) Inspect the Valve Stem (12). If it is damaged or it does not seat properly on the Valve Seat (7), or does not move freely in the Valve Seat Retaining Disc (8), the Valve Stem (12), Pilot Spring Retainer (11) and Pilot Spring (10) must be replaced.
- 12) Inspect the outer surfaces of the Valve Plug (5) or the Top Piston (6) and Bottom Piston (3). If they are scored or damaged so that they will not move freely up and down in the Seat Cage (2), the Valve Plug or Pistons must be replaced. Also see Step CM32.
- 13) Inspect the Valve Seat (7). If it is worn and does not seat properly with the Seat Cage (2), (or Valve Stem (12) for 2.5 to 4 inch Valves), it must be replaced.
- 14) THOROUGHLY clean and inspect the seating and inner surfaces of the Seat Cage (2). If the seat properly, or if the inner surfaces of the Cage are scored or damaged so that the Valve Plug (5) or Pistons (3) and (6) will not move up and down freely, the Cage (2) must be replaced.

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- 15) If the Cage (2) must be removed from the Valve Body (1), it will be necessary to fabricate a tool, such as shown in Figure 8-3 for Cage removal. Insert the tool into the slots on top of the Cage (2) and turn the Cage out of the Valve Body. To obtain a Cage Removal tool, contact AERCO or your nearest Sales Representative.

8.2.3 Valve Reassembly

Refer to Figure 8-1 or Figure 8-2 when performing the following procedures.

- 1) If the Seat Cage has been removed, place a NEW Seat Cage Gasket (24) on the seating surface of the Valve Body. Next, replace the Seat Cage (2) into the Valve Body (1), using the tool described in Step CM29. Make the Seat Cage tight.
- 2) If disassembled or being replaced, reassemble the Top Piston (6) and Bottom Piston (3) onto the Valve Plug Shaft (5), using the Top Piston Retaining Nut (46) (1-inch through 2-inch Valves), and Bottom Piston Retaining Nut (50) or Bottom Piston Retaining Ring (4).
- 3) For Control Valves, 1-inch through 2-inch, (Figure 8-1), reassemble the Valve Plug/Seat/Shaft assembly in the following order:
 - a) Valve Plug (5)
 - b) Seat Retainer (34)
 - c) Valve Seat (7)
 - d) Retaining Disc (8)
 - e) Valve Stem (12) and Lower Shaft (16)
 - f) Valve Stem Retaining Nut (35)
 - g) Pilot Spring (10)
 - h) Pilot Spring Retaining Clip (3)
 - i) Lock Washer (23)
- 4) For Control Valves, 2.5-inch, 3-inch and 4-inch, (Figure 8-2), reassemble the Piston/Seat/Shaft assembly in the following order:
 - a) Top Piston (6) and Bottom Piston (3) assembly
 - b) Valve Seat (7)
 - c) Valve Stem (12) and Lower Shaft (16)
 - d) Valve Seat Retaining Disc (8)
 - e) Cap Screws (9)
 - f) Pilot Spring (10)
 - g) Pilot Spring Back-Up Washer (31), 4-inch Valve only
 - h) Pilot Spring Retainer (11)
 - i) Lock Washer (23)
- 5) Holding the Lower Shaft (16), carefully replace the entire Shaft/Seat/Piston assembly into the Valve Body (1) and Seat Cage (2).
- 6) Thoroughly clean the gasket surfaces of the Valve Body (1) and Valve Top (21) of all dirt and scale. If necessary, use a wire brush, emery or both.
- 7) See Figure 8-1 or 8-2. Reassemble these parts in the following order:
 - a) NEW Valve Top Gasket (13)
 - b) Valve Top (21)
 - c) Cap Screws or Hex Hd. Bolts (14) – Valve sizes 2-1/2" to 4" use 1/2-13 Cap Screws; Valve sizes 1" to 2" use 3/8-16 hex hd. Bolts. Tighten using an alternating pattern to

Electronic Control System (ECS) and Type CXT-E Valve
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- provide a uniform seal and prevent Valve leakage.
- d) NEW Packing Assembly (20)
 - e) Packing Nut (18)
 - f) Hex Nuts (17)
 - g) Indicator Plate (See Figure 8-1 or 8-2)
- 8) Replace the Actuator (27), Linkage (26) and Gasket (29) onto the Valve Top (21) and secure with Cap Screws (19).
 - 9) Position the Hex Nuts (17) at the original location noted during the removal process (CM7).
 - 10) Install the Indicator Plate on the Valve Shaft (16) with the curved end facing upward (Figure 8-4).
 - 11) Attach the Valve Shaft (16) to the Linkage Adapter by rotating the Shaft counterclockwise (as viewed from above). If the Valve Shaft cannot be turned by hand, use an open-end wrench to turn the "double-nuts" on the Shaft until it engages the Linkage adapter threads. Insert the Shaft into the Linkage Adapter until the Hex Nuts (17) are snug against the Indicator Plate.
 - 12) Press down on the Valve Shaft (16) to compress the Pilot Spring (10) in the Valve Body.
 - 13) With the Pilot Spring compressed, verify that the Indicator Plate is aligned with the "0" (zero) marking on the Scale (28). If necessary, rotate the Valve Shaft until the Plate is aligned with the "0" Scale marking.
 - 14) If the Valve had been removed from the heating fluid line, replace it in. the line. Reconnect the electrical connector plug to the Actuator.
 - 15) Prior to placing the Valve back into service, perform the Control Valve Adjustment procedure in Section 3.

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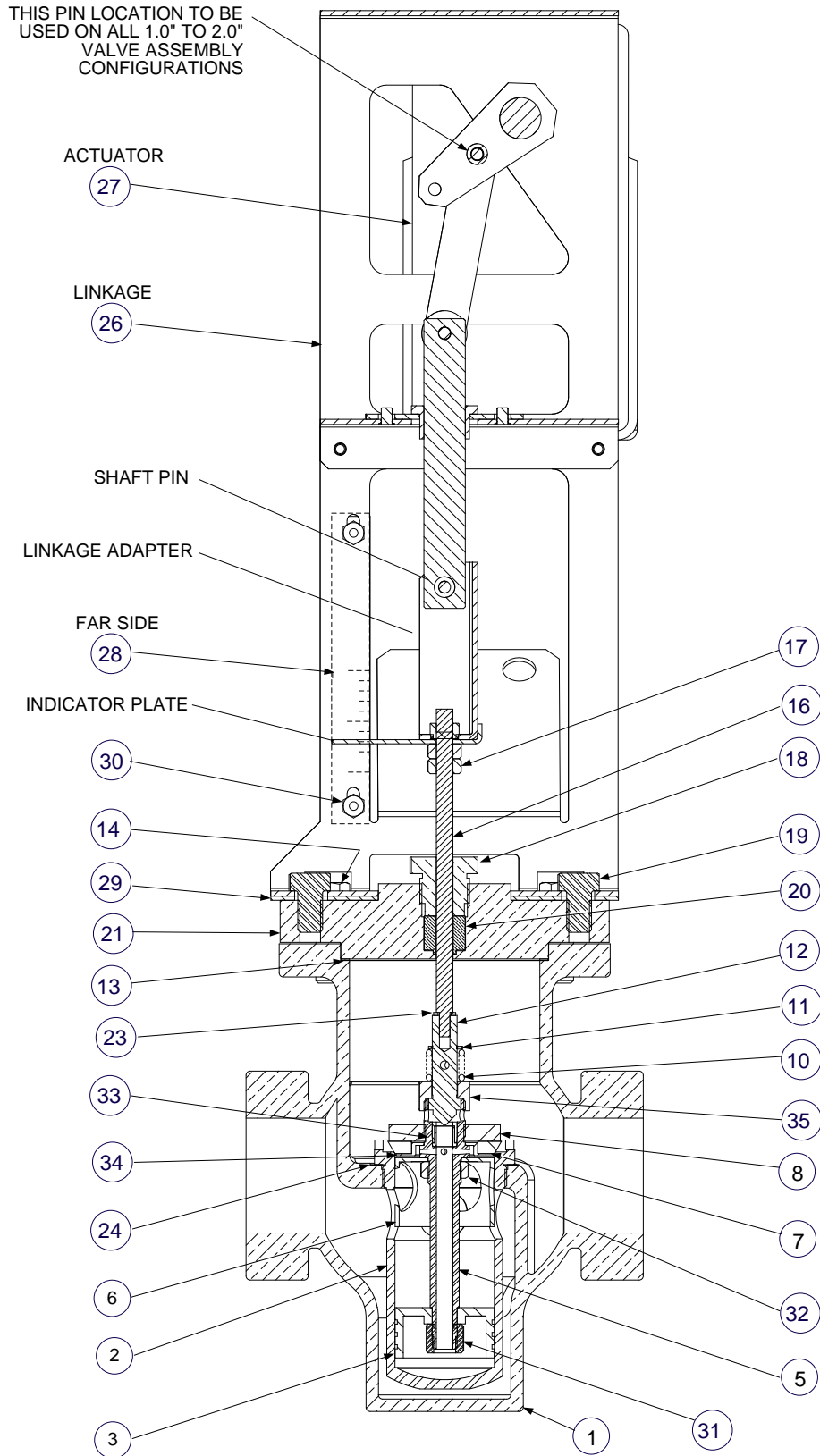


Figure 8-1. Valve Assemblies, Type CXT-E (Sizes 1.00" To 2.00")

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Parts List Table For Valve Assemblies, Type CXT-E (Sizes 1.00" To 2.00")

ITEM	QTY	PART NAME	VALVE SIZE AND PART NUMBERS			
			1.00 INCH	1.25 INCH	1.50 INCH	2.00 INCH
1	1	VALVE BODY	20762	20759	20758	20761
2	1	SEAT CAGE	16844	16845	16837	16843
3	1	BOTTOM PISTON	121540	121525	121502	121529
4		NOT USED				
5	1	VALVE PLUG SHAFT	16849	16839	16838	16848
6	1	TOP PISTON	121539	12154	121501	121530
7	1	DISC SEAT	121541	121527	121510	121531
8	1	RETAINING DISC	121542	121513	121504	121532
9		NOT USED				
10		PILOT SPRING	121528	121528	121528	121528
11	1	RETAINING RING	121545	121545	121545	121545
12	1	VALVE STEM	122655	122654	122651	122650
13	1	VALVE TOP GASKET	122136	122136	122136	122136
14	6	BOLT, HEX, 3/8-16	122405	122405	122405	122405
16	1	LOWER SHAFT	121979	121980	121980	121982
17	2	HEX NUT, 1/4-20	6-226	6-226	6-226	6-226
18	1	PACKING NUT	122664	122664	122664	122664
19	2	BOLT, HEX 3/8-16 x 5/8 LG	54014	54014	54014	54014
20	1	PACKING ASSY	121567	121567	121567	121567
21	1	VALVE TOP	16943	16943	16943	16943
22		NOT USED				
23	1	LOCKWASHER	122666	122666	122666	122666
24	1	SEAT CAGE GASKET	123080	123081	123082	123083
26	1	LINKAGE	24038-1	24038-1	24038-1	24038-1
27	1	ACTUATOR	69170	69170	69170	69170
28	1	SCALE	59028-1	59028-1.25	59028-1.5	59028-2
29	1	GASKET	81046	81046	81046	81046
30	2	HEX NUT, #8-32	123322	123322	123322	123322
31	1	BOTTOM PISTON RETAINING NUT	122982	122982	122982	122982
32	1	TOP PISTON RETAINING NUT	121543	121543	121543	121543
33	1	LOWER PILOT SEAT ASSY	121505	121505	121505	121505
34	1	SEAT RETAINER	N/A	121559	121506	121506
35	1	VALVE STEM RETAINING NUT	121503	121503	121503	121503

Electronic Control System (ECS) and Type CXT-E Valve
8. CORRECTIVE MAINTENANCE

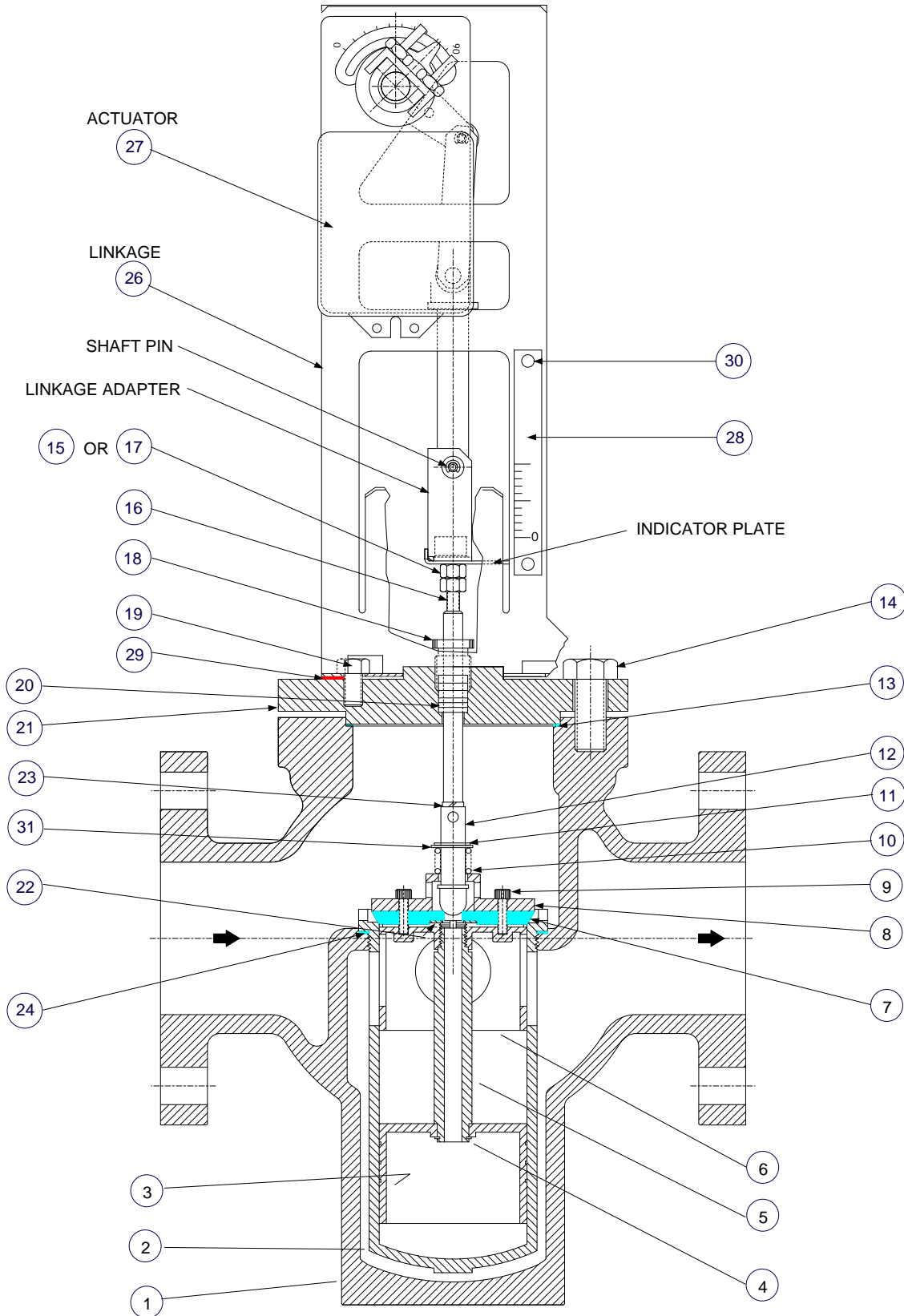


Figure 8-2. Valve Assemblies, Type CXT-E (Sizes 2.50" To 4.00")

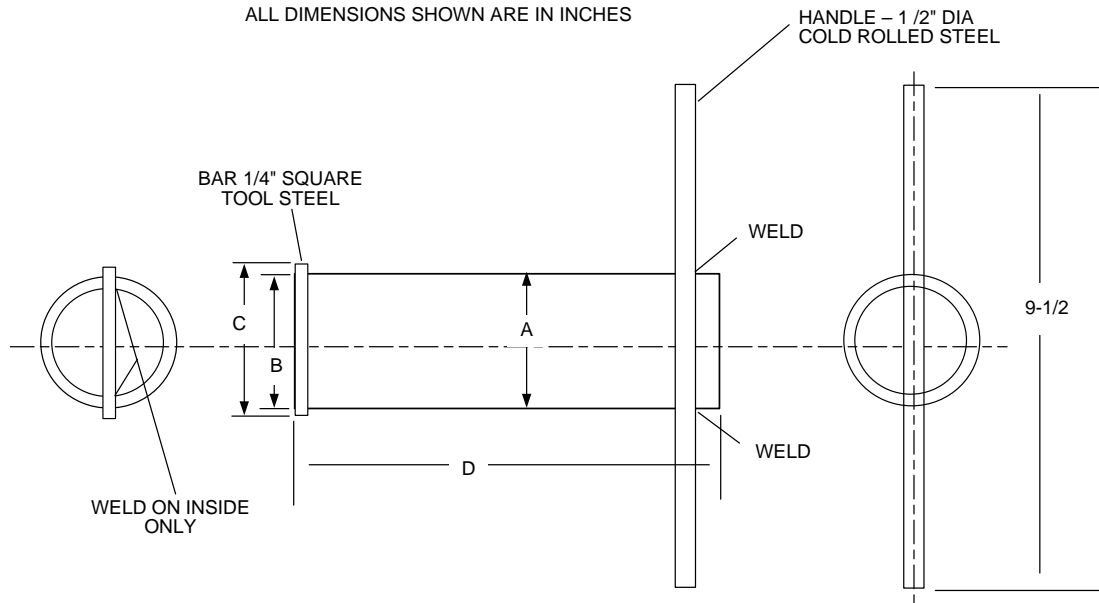
Electronic Control System (ECS) and Type CXT-E Valve
8. CORRECTIVE MAINTENANCE

Parts List Table For Valve Assemblies, Type Cxt-E (Sizes 2.50" To 4.00")

ITEM	QTY	PART NAME	VALVE SIZE AND PART NUMBERS		
			2.50 INCH	3.00 INCH	4.00 INCH
1	1	VALVE BODY	20765-1	20766-1	20775
2	1	SEAT CAGE	16961	161004	161046
3	1	BOTTOM PISTON	16962	161007	161048
4	1	PISTON RETAINING RING	122173	122173	122234
5	1	VALVE PLUG SHAFT	16972	161006	161047
6	1	TOP PISTON	16970	161005	161050
7	1	VALVE SEAT	121935	122032	122178
8	1	VALVE SEAT RETAINING DISC	121934	122031	122177
9	4	10-32 x 3/4" LG. SOCKET HD. CAP SCREW	122174	122174	122238
10	1	PILOT SPRING	122081	122232	121823
11	1	PILOT SPRING RETAINER	122082	122082	122173
12	1	VALVE STEM	122648	122658	122659
13	1	VALVE TOP GASKET	122083	122204	122203
14	4	CAP SCREW 5/8-11 x 1-1/2" LG.	N/A	6-310	6-310
15	2	3/8-16 NUT (4" VALVE ONLY)	N/A	N/A	6-264
16	1	LOWER SHAFT	122223	122230	122224
17	2	HEX NUT, 1/4-20	6-226	6-226	N/A
18	1	PACKING NUT	122664	122665	122665
19	2	3/8-16 x 5/8" LG. CAP SREWS	54014	54014	54014
20	1	PACKING ASSY	121567	121568	121568
21	1	VALVE TOP	18781	18823	18824
22	1	SEAT BACK-UP RING	122326	122327	122328
23	1	LOCKWASHER	122666	122667	122667
24	1	SEAT CAGE GASKET	123084	123085	123086
25	2	1/4" HEX HD. NPT PLUG	9-22	9-22	9-22
26	1	LINKAGE	24038-1	24038-1	24038-2
27	1	ACTUATOR	69170	69170	69170
28	1	SCALE	59028-2.50	59028-3	59028-4
29	1	GASKET	81046	81046	81046
30	2	HEX NUT, 8-32	123332	123322	123322
31	1	PILOT SPRING BACKUP WASHER	N/A	N/A	122246

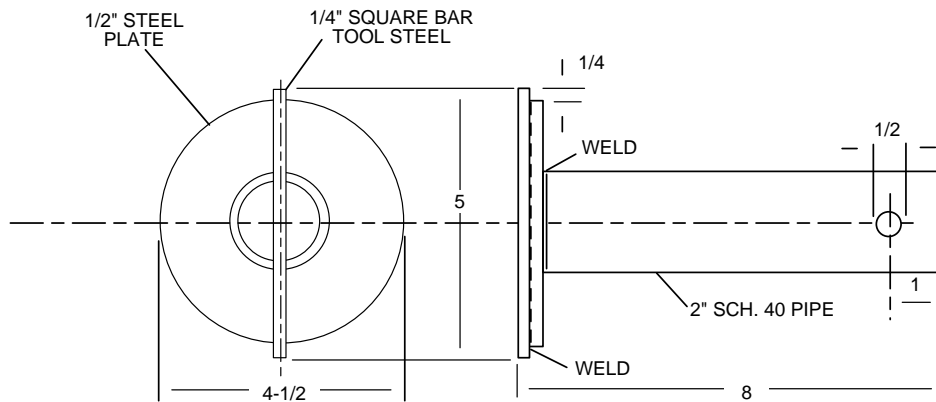
Electronic Control System (ECS) and Type CXT-E Valve

8. CORRECTIVE MAINTENANCE



VALVE SIZE	PIPE OR TUBING - A	B	C	D
1-INCH	1" SCH. 40 PIPE	1.11	1-5/8	7-1/2
1-1/4 INCH	1-1/4" SCH. 40 PIPE	1.42	2	7-1/2
1-1/2-INCH	1-1/2" SCH. 40 PIPE	1.67	2-3/8	8
2-INCH	2-1/2" OD x .120" WALL SEAMLESS STEEL TUBING	2.40	2-5/8	8
2-1/2-INCH	2-1/2" OD x .120" WALL SEAMLESS STEEL TUBING	2.895	3-3/8	8-1/4
3-INCH	3" OD x .120" WALL SEAMLESS STEEL TUBING	3.476	3-15/16	8-1/4

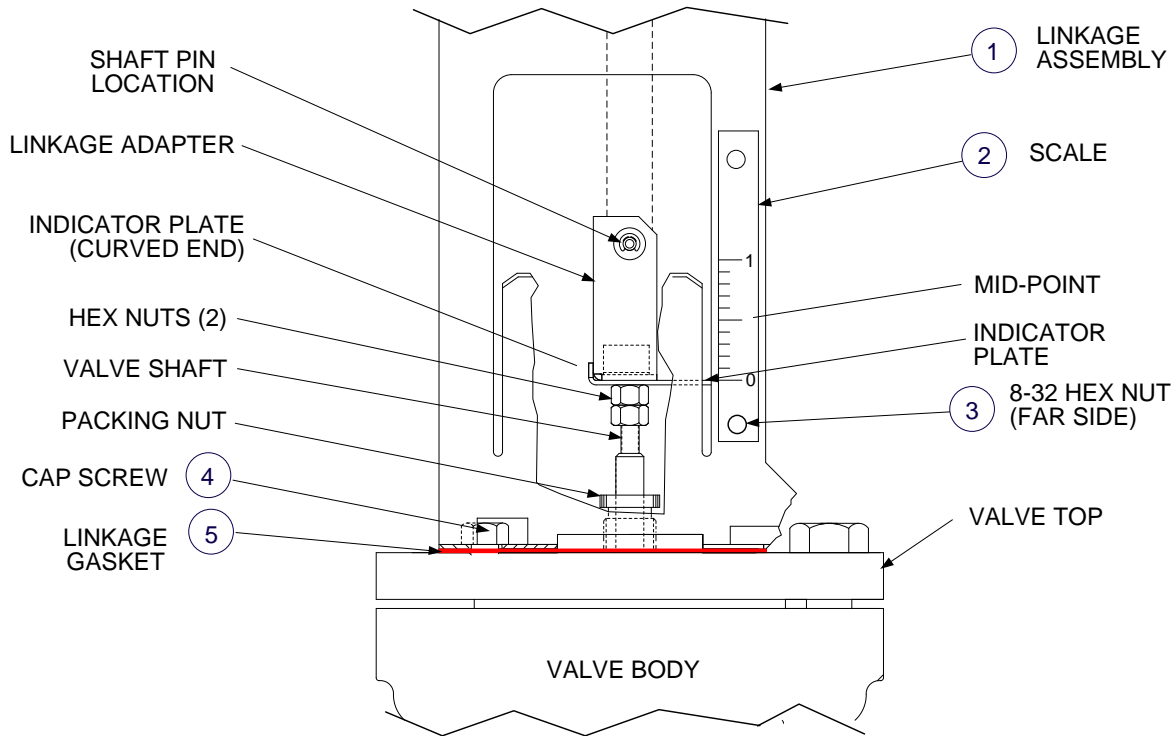
TOOLS FOR 1-INCH TO 3-INCH VALVES



TOOL FOR 4-INCH VALVE ONLY

Figure 8-3. Cage Removal Tool

Electronic Control System (ECS) and Type CXT-E Valve
8. CORRECTIVE MAINTENANCE



ITEM	QTY	PART DESCRIPTION	PART NUMBER
1	1	LINKAGE ASSEMBLY	24038-1 (1" TO 3" VALVES) 24038-2 (4" Valve)
2	1	SCALE	59028-1 (1" VALVE) 59028-1.25 (1.25" VALVE) 59028-1.5 (1.5" VALVE) 59028-2 (2" VALVE) 59028-2.5 (2.5" VALVE) 59028-3 (3" VALVE) 59028-4 (4" VALVE)
3	2	HEX NUT, 8-32	123322
4	2	CAP SCREW, 3/8-16 x 5/8 LONG	54014
5	1	LINKAGE GASKET	81046

Figure 8-4. Linkage Assembly Installation Details

8.2.4 Actuator Replacement

There are no repairable parts contained in the Actuator. Therefore, if the Troubleshooting procedures in this Instruction Manual isolate the cause of the fault to the Actuator, it must be replaced as described in the following steps:

- 1) Disconnect and lock-out/tag-out AC power going to the Control Box. Use a voltmeter to ensure that all voltages are zero before continuing.
- 2) Disconnect the Control Box cable connected to the Actuator.
- 3) Using an 8 mm wrench, loosen the hex nuts securing the Actuator to the Linkage Shaft.
- 4) Completely remove the defective Actuator from the shaft.
- 5) To install the replacement Actuator, depress and hold the Clutch button (Figure 8-5) and rotate the pointer to approximately 80° on the dial. Release the Clutch.



The clutch must NEVER be engaged with power applied or damage will result.

- 6) Next, slide the Actuator onto the Linkage Shaft.
- 7) Ensure that the pin on the Linkage Assembly is inserted in the center slot on the bottom of the Actuator (Figure 8-5).
- 8) Verify that the indicator plate on the Linkage Assembly is aligned with the 0 (zero) marking on the Linkage scale. Also, ensure that the Actuator Dial is approximately at the 80° position.
- 9) Ensure that the Pin on the Linkage is inserted in the center slot on the Actuator.
- 10) Using an 8 mm wrench, tighten the hex nuts on the U-bolt to secure the Actuator to the shaft. Torque nuts to 60 in-lbs.
- 11) Reconnect the Control Box cable to the Actuator.
- 12) Following Actuator replacement, perform the Control Valve Adjustment procedure in Section 3.

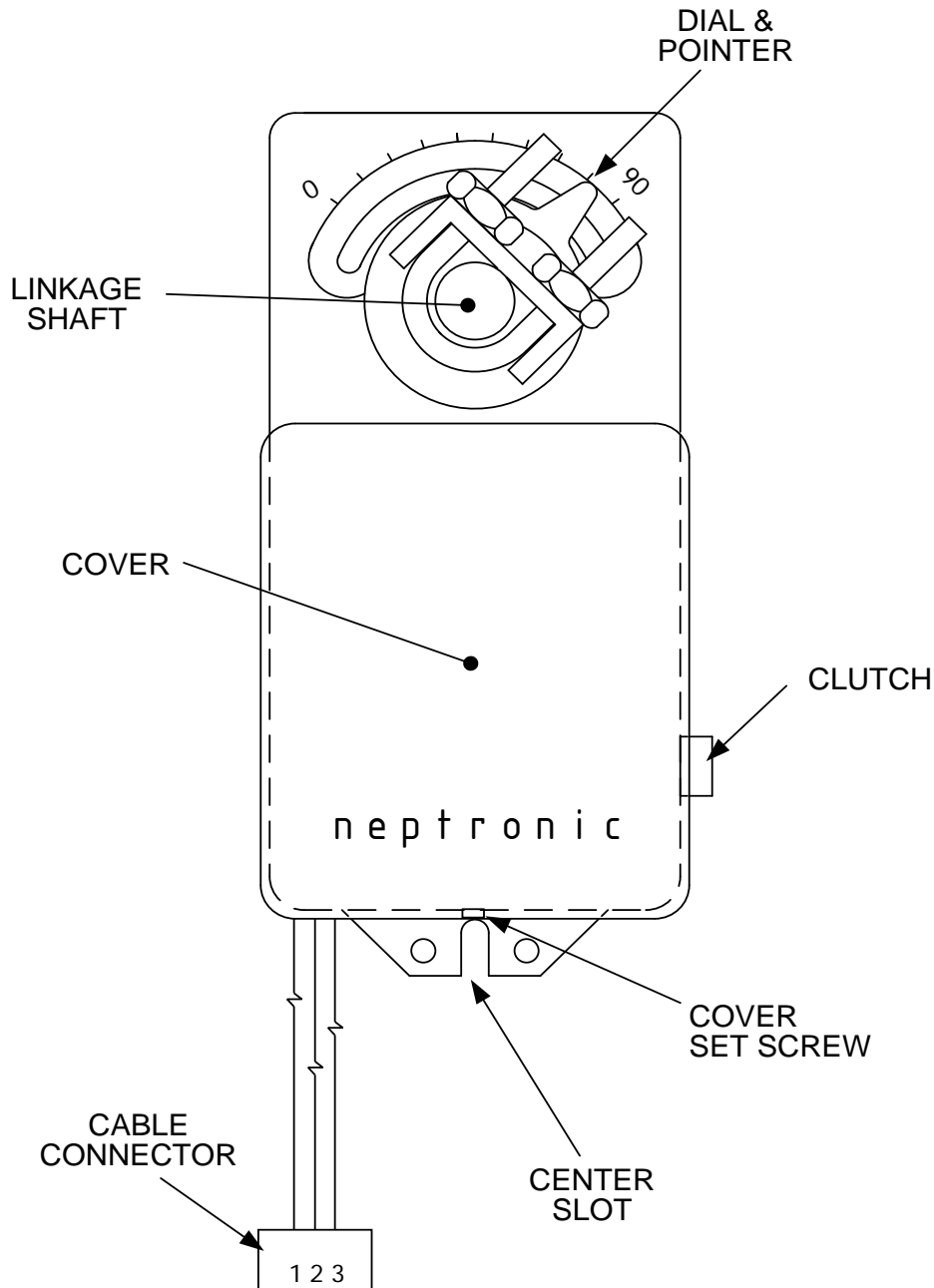


Figure 8-5. Actuator Replacement

8.2.5 Linkage Assembly Replacement

As Figure 8-6 shows, the Linkage Assembly Part No. will vary, depending on valve size. CXT-E valve sizes from 1.00 to 3.00 inches utilize Linkage Assembly Part No. 24038-1. However, 4.00 inch CXT-E Valves utilize Linkage Assembly Part No. 24038-2. The primary difference between the 24038-1 and 24038-2 Linkage Assemblies is the Adapter shown in Figure 8-6. In addition, the Linkage Pin location for the 24038-1 assembly will vary for 1.00 to 2.00 inch valves and for 2.50 to 3.00 inch valves. IT IS IMPERATIVE THAT THE CORRECT ADAPTER AND PIN LOCATION BE USED FOR THE VALVE SIZE BEING REPAIRED. The Linkage Assembly is attached to the Control Valve Top with two Cap Screws. The Linkage Gasket (Part No. 81046) should also be replaced when installing a new Linkage Assembly.

Electronic Control System (ECS) and Type CXT-E Valve
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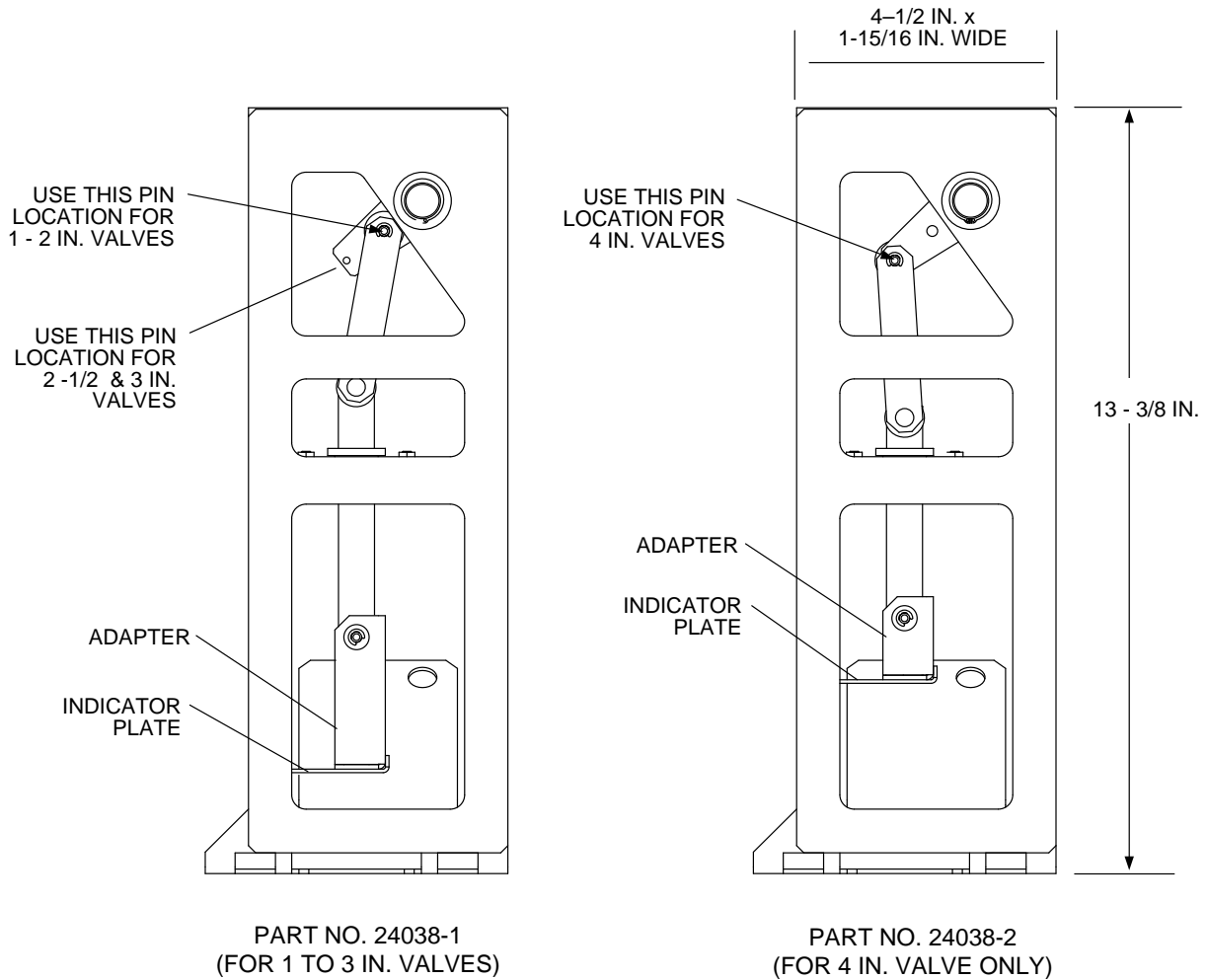


Figure 8-6. Linkage Assemblies

If necessary, the Linkage Assembly is removed and replaced as follows:

- 1) Remove the Actuator using steps CM45 through CM48 in the previous paragraph titled ACTUATOR REPLACEMENT.
- 2) Next, refer to Figure 8-1 (1" to 2" Valves or 8-2 (2 ½" to 4" Valves) to locate item numbers shown in parentheses in the following steps.
- 3) Loosen the Hex Nuts (17) under the Indicator Plate (Figure 8-1 or 8-2) approximately a half turn clockwise.
- 4) Disconnect the Linkage Adapter from the Valve Shaft (16) by turning the Shaft clockwise (as viewed from above). If the Valve Shaft cannot be turned by hand, use an open-end wrench to turn the "double-nuts" on the Shaft until it disengages the Linkage Adapter threads.
- 5) Remove the Indicator Plate from the Valve Shaft (16).
- 6) Remove the two Cap Screws (19) securing the Linkage Assembly (26) to the Valve Top (21).
- 7) Remove the Linkage Assembly (26) from the Valve Top. Also, remove the Gasket (29) which will be replaced.

 CAUTION 

Ensure that the replacement Linkage Assembly, Adapter and Scale are identical to those removed in the previous steps. Also, ensure that the Linkage Pin (Figure 8-6) is set to the proper position for the Control Valve size. Failure to observe this precaution may result in improper Control Valve operation.

- 8) Using a new Gasket (29), position the replacement Linkage Assembly on the Valve Top (21). Secure the Linkage Assembly to the Valve Top using the previously removed Cap Screws (29).
- 9) Install the Indicator Plate on the Valve Shaft (16) with the curved end facing upward (Figure 8-4)
- 10) Attach the Valve Shaft (16) to the Linkage Adapter by rotating the Shaft counterclockwise (as viewed from above). If the Valve Shaft cannot be turned by hand, use an open-end wrench to turn the “double-nuts” on the Shaft until it engages the Linkage adapter threads. Insert the Shaft into the Linkage Adapter until the Hex Nuts (17) are snug against the Indicator Plate.
- 11) Press down on the Valve Shaft (16) to compress the Pilot Spring (10) in the Valve Body.
- 12) Replace the Actuator using steps CM49 through CM56 in the previous paragraph titled ACTUATOR REPLACEMENT.
- 13) After performing the Auto Stroke procedure and before applying heat to the system, adjust the Indicator Scale to the plate. Set the Temperature Controller to the manual mode. Align the plate while the valve position is at 50% open on the Eurotherm Temperature Controller. The plate should be at the mid-point of the indicator scale (see Figure 8-4). Tighten the scale and check the 100% and zero % positions. Readjust as necessary.
- 14) Go to Section 4, paragraph 4.3 and perform the Initial Start-Up procedure.

8.3 PART 2 - ECS CORRECTIVE MAINTENANCE

The corrective maintenance procedures for the Electronic Control System (ECS) consist of replacing Control System components and assemblies determined to be faulty in the TROUBLESHOOTING Section 7 of this manual. These procedures consist of replacing the complete Control Box, components installed in the Control Box or Control System Sensors and Safety Devices installed on the Heat Exchanger.

 WARNING 

TURN OFF THE CONTROL BOX POWER SWITCH AND DISCONNECT AC POWER PRIOR TO PERFORMING ANY CORRECTIVE MAINTENANCE PROCEDURES IN THE FOLLOWING PARAGRAPHS. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN SERIOUS PERSONAL INJURY.

8.3.1 Control Box Assembly and Components

Corrective maintenance for the Control Box and internally-mounted components consist of removing and replacing the following items:

- Control Box Assembly
- Temperature Controller
- Over-Temperature Switch

Electronic Control System (ECS) and Type CXT-E Valve

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- Temperature Indicators (Water-to-Water Heat Exchangers Only)
- DC Power Supply
- DC Voltage Regulator

The following paragraphs reference Figures in previous Sections as well as Figures in this Section. Refer to the applicable Figures as necessary when performing the replacement procedures which follow.

8.3.2 Control Box Assembly Replacement

If necessary, the complete ECS Control Box Assembly can be removed and replaced as follows:

- 1) Loosen the captive screws on the Control Box door and the recessed panel (Figures 2-3, 2-4).
- 2) Open the swing-down recessed panel. Locate and disconnect the Line, Neutral and Ground leads connected to Terminal Block TB-2 on the bottom interior surface of the Control Box chassis (Figure 2-5).
- 3) Refer to Figures 1-1 and 1-2 and disconnect the Control Box cables from the following devices:
 - a) *Disconnect the ACTUATOR cable (3-pin Molex connector) from the Control Valve Actuator.*
 - b) *Disconnect the FLOW SENSOR cable (5-pin Molex connector) from the Flow Sensor mounted at the cold water inlet of the Heat Exchanger.*
 - c) *Disconnect the OUTLET TEMP cable (4-pin Molex connector) from the Outlet Temperature Dual Sensor installed in the Water Heater outlet port.*
 - d) *Disconnect the SOLENOID cable (3-pin DIN connector) from the Over-Temperature Solenoid on the top of the Heat Exchanger.*
 - e) *For Water-to-Water Heat Exchangers ONLY, disconnect BOILER TC IN and TC OUT leads (2-pin Molex connectors) connected to the heating fluid (boiler water) inlet and outlet Temperature Sensors.*
- 4) After all Control Box cables have been disconnected, remove the two hex nuts securing the top and bottom mounting attachments of the Control Box to the Heat Exchanger. Completely remove the Control Box from the Heat Exchanger.
- 5) Control Box replacement is accomplished by simply reversing the previous steps.

8.3.3 Temperature Controller Replacement

The Temperature Controller is located on the recessed panel behind the Control Box door as shown in Figure 3-2. Removal and replacement is accomplished as follows:

- 1) Open the Control Box door to access the Temperature Controller.
- 2) The Temperature Controller is installed in a sleeve as shown in Figure 8-7. To unplug and remove the Controller from its sleeve, simply pry the latching ears outward and pull the Controller out of the panel.
- 3) To install a replacement Temperature Controller, simply slide it into the front panel sleeve until the latching ears click into place. Following replacement, adjust the setpoint temperature to the required value using the Adjustment procedures in Section 3.

Electronic Control System (ECS) and Type CXT-E Valve

8. CORRECTIVE MAINTENANCE

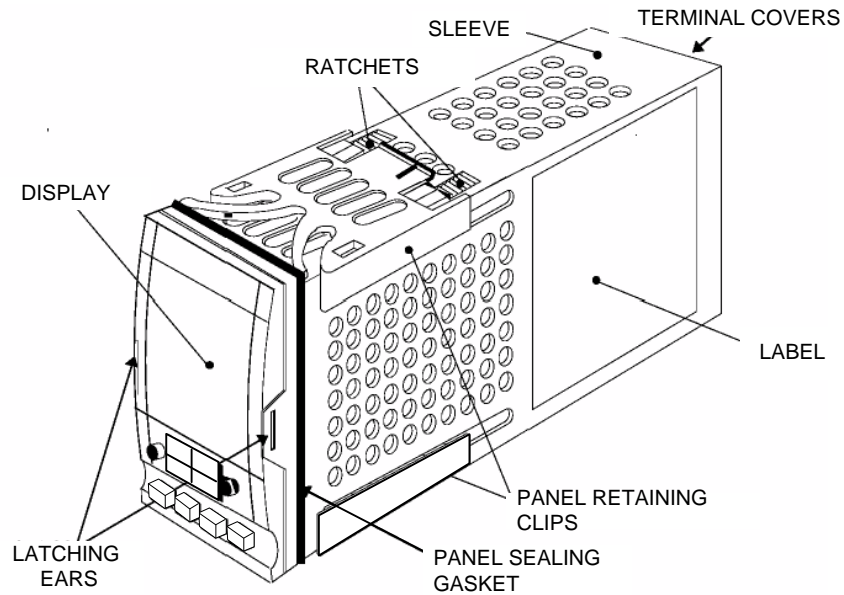


Figure 8-7. Temperature Controller Installation

- 4) Close and secure Control Box front door.

8.3.4 Over-Temperature Switch and Temperature Indicator Replacement

The Over-Temperature Switch and Temperature Indicators are actually identical devices, however they perform different functions. One Over-Temperature Switch is provided in each Control Box for both Steam-to-Water and Water-to-Water applications. As the name implies, the Over-Temperature Switch, performs a switching function and generates an alarm when the preset temperature limit is exceeded. However, the Temperature Indicators, used only with Water-to-Water Heat Exchangers, are Indicator-Only devices and are not wired to perform any switching functions. The locations of the Over-Temperature Switch and Temperature Indicators for Steam-to-Water and Water-to-Water applications are shown in Figure 1-3. Removal and replacement for each device are performed using the following identical steps:

- 1) Open the Control Box door to locate the Temperature Switch/Indicator assembly.
- 2) Loosen the captive screw on upper part of recessed panel behind the door and open the swing-down panel to access the terminal wiring connections and retaining clips of the Temperature Switch/Indicator assembly (Figure 8-8a).
- 3) Loosen the terminal wiring connection screws on the rear of the Temperature Switch/Indicator assembly and disconnect the wires.

NOTE:

The Type J Thermocouples are wired with the Red lead Negative (-) and the White lead Positive (+).

- 4) To remove the Temperature Switch/Indicator assembly, push in tab of each of two side retaining clips (Figure 8-8b), slide toward rear and remove.



Figure 8-8a. Over-Temperature Switch & Temperature Indicator



Figure 8-8b. Over-Temperature Switch & Temperature Indicator Installation

- 5) If the replaced unit is an Over-Temperature Switch, set the desired over-temperature alarm limit using the Adjustment procedures in Section 3. No adjustments are required following replacement of the Boiler Water IN or Boiler Water OUT Temperature Indicator on water-to-water heaters.
- 6) Following adjustment (if necessary), raise and secure the swing-down panel. Close and secure the Control Box door. If adjustments or replacements have been made, refer to the Adjustment procedures in Section 3 and repeat as necessary.

8.3.5 DC Power Supply Replacement

The DC Power Supply is mounted on the left interior wall of the Control Box (see Figure 8-9, View A - A). Replacement is accomplished as follows:

- 1) Open the Control Box door and loosen the captive screw on the recessed panel behind the door.
- 2) Open the swing-down panel and locate the DC Power Supply on the left interior wall of the Control Box (Figure 8-9, View A - A).
- 3) Disconnect the AC input power connector near the bottom of the Power Supply and the DC output connector near the top.
- 4) Remove the four hex standoffs and lock washers securing the DC Power Supply to the studs on the interior side wall of the Control Box. Completely remove the DC Power Supply from the Control Box.
- 5) Replacement is accomplished by simply reversing the previous steps.

8.3.6 DC Voltage Regulator Replacement

The DC Voltage Regulator is mounted on the bottom interior surface of the Control Box chassis. Replacement is accomplished as follows:

- 1) Open the Control Box door and loosen the captive screw on the recessed panel behind the door.
- 2) Open the swing-down panel and locate the DC Voltage Regulator on the bottom of the chassis interior (Figure 8-9, View D – D).
- 3) Disconnect the wiring connector plug shown in Figure 8-9, View D – D.
- 4) Remove the four hex nuts and lock washers securing the Regulator to the studs on the bottom of the chassis. Completely remove the DC Voltage Regulator from the Control Box.
- 5) DC Voltage Regulator replacement is accomplished by reversing the previous steps.

Electronic Control System (ECS) and Type CXT-E Valve
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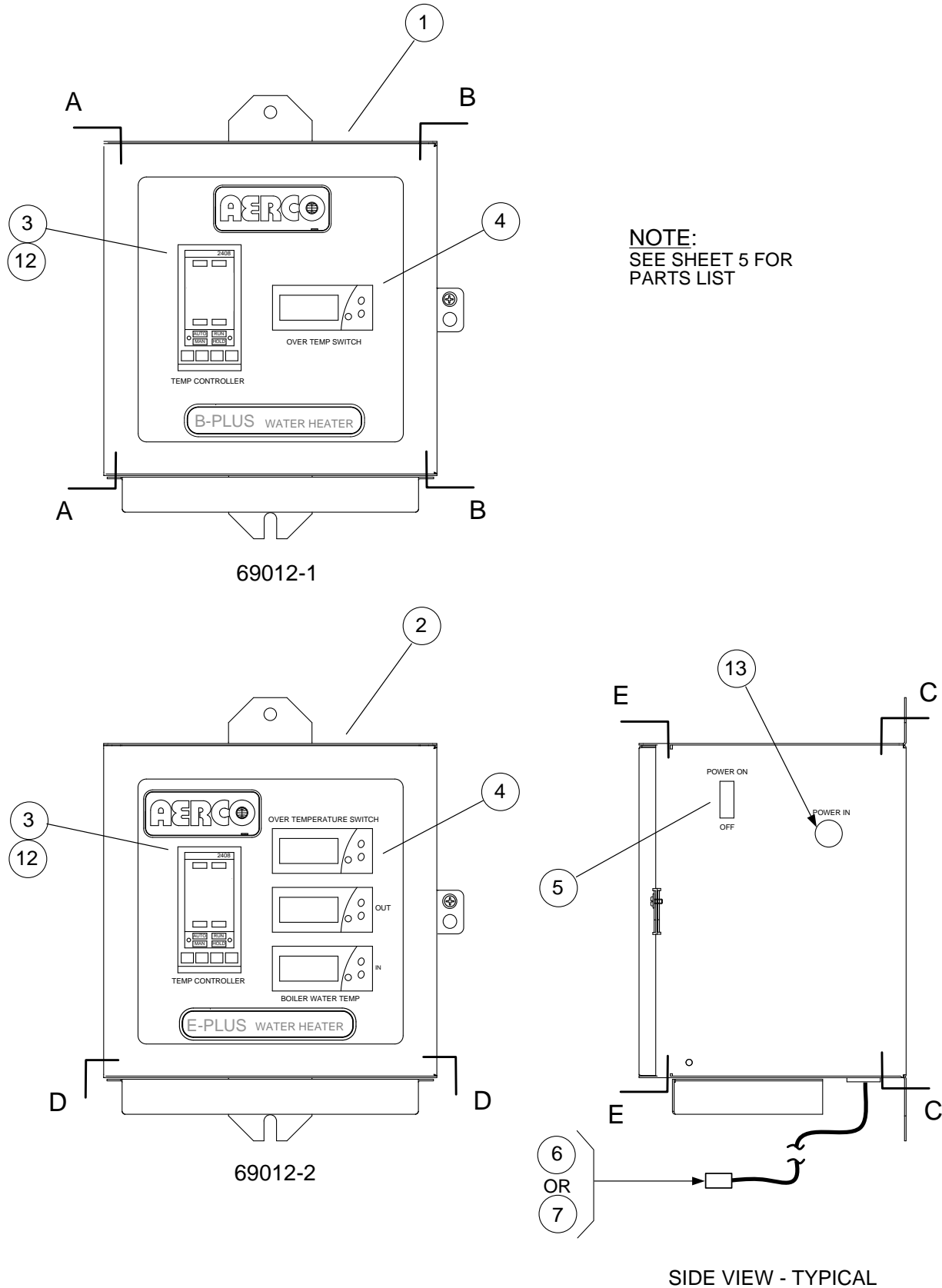


Figure 8-9. ECS Control Box Assembly Component Locations (Sheet 1 of 5)

Electronic Control System (ECS) and Type CXT-E Valve
8. CORRECTIVE MAINTENANCE

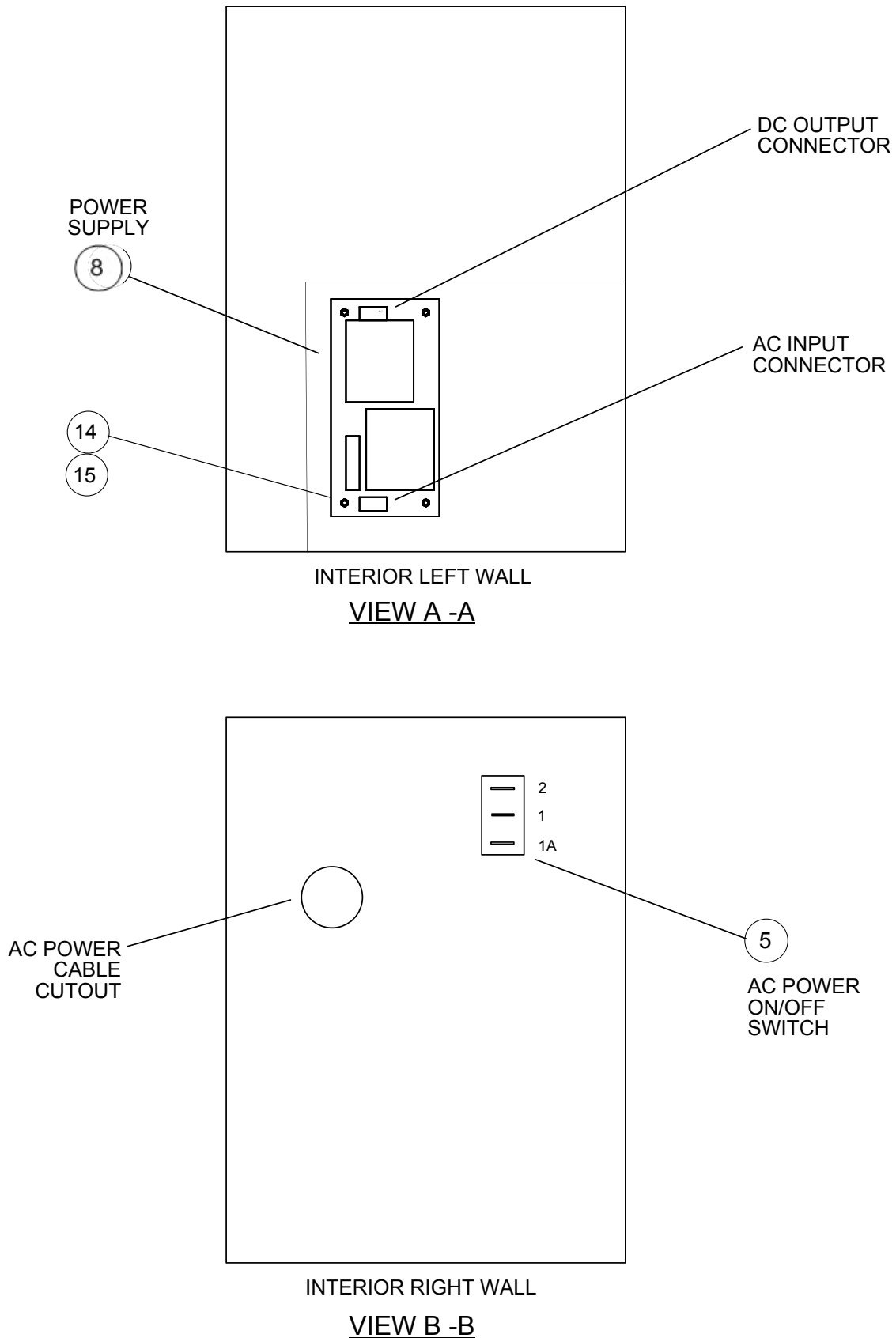


Figure 8-9. ECS Control Box Assembly Component Locations (Sheet 2 of 5)

Electronic Control System (ECS) and Type CXT-E Valve
8. CORRECTIVE MAINTENANCE

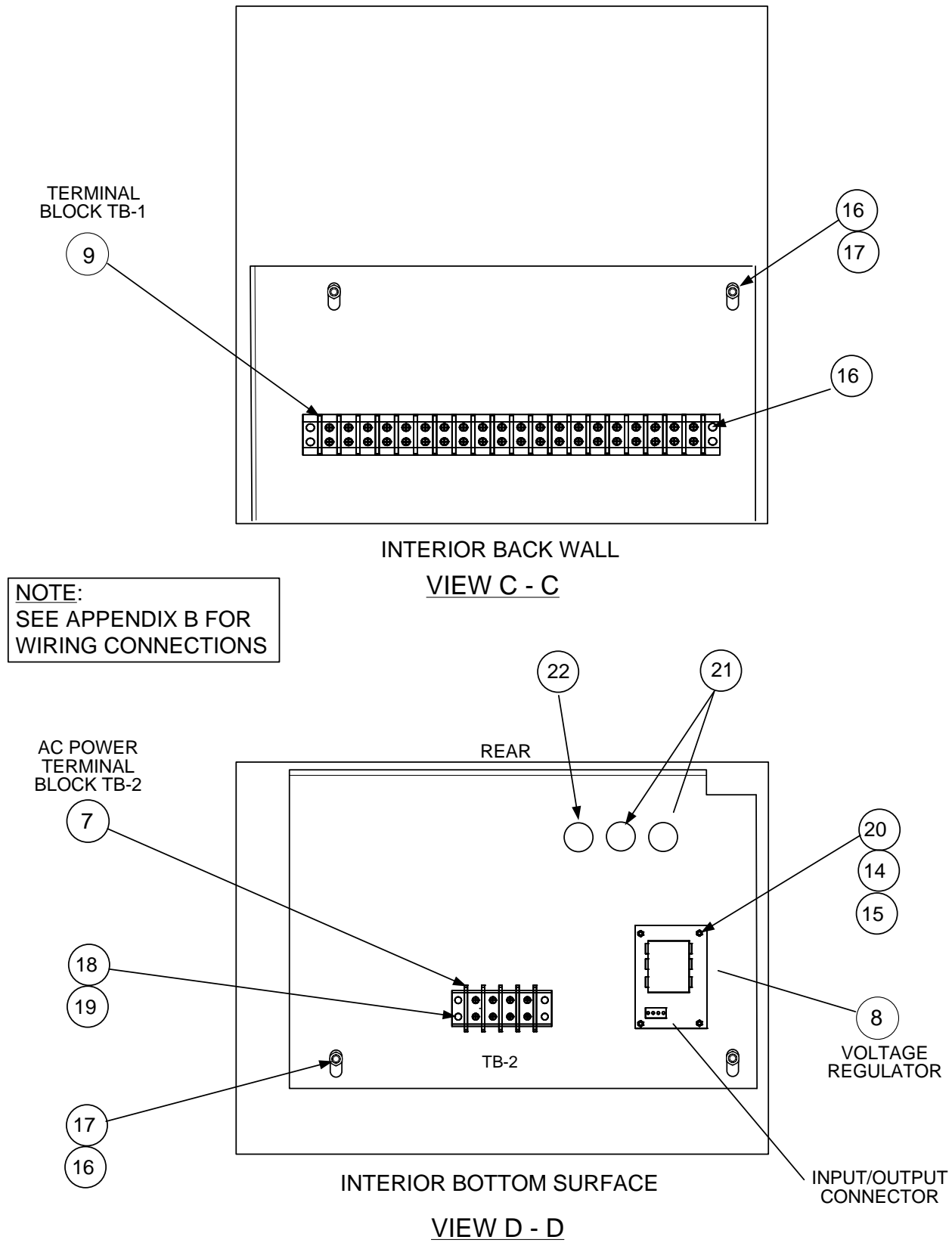
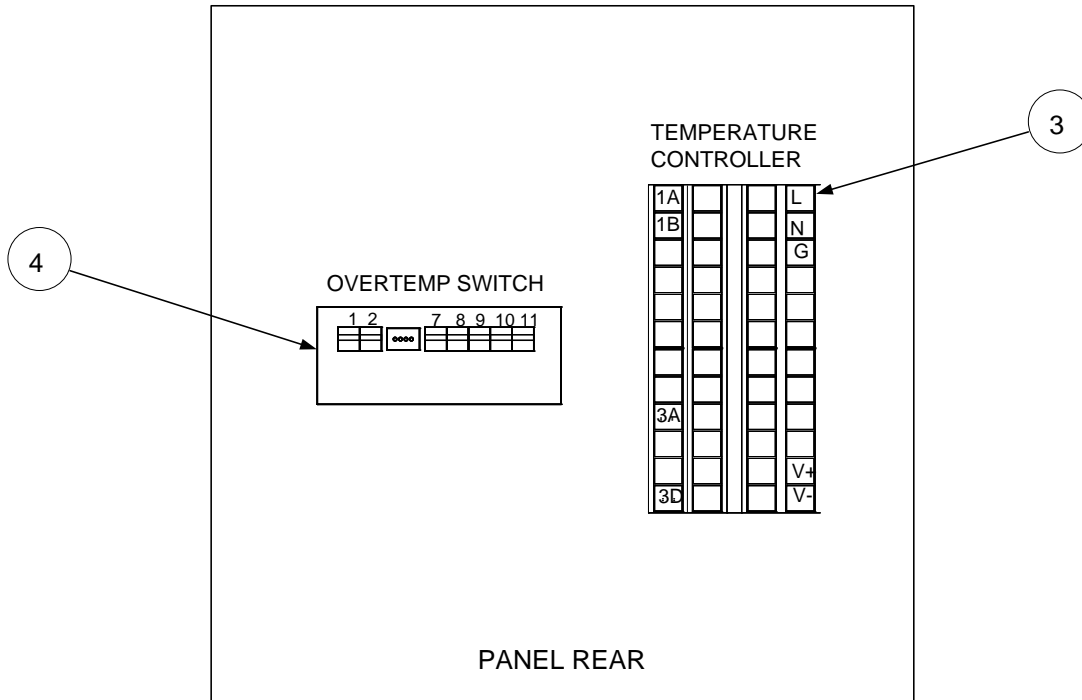


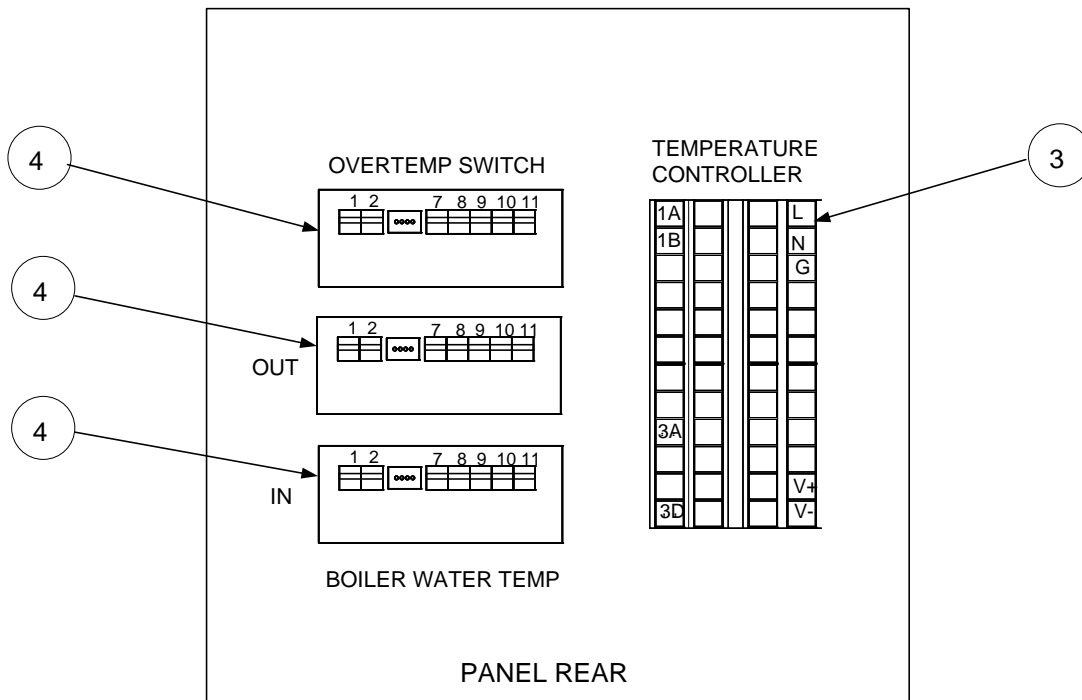
Figure 8-9. ECS Control Box Assembly Component Locations (Sheet 3 of 5)

Electronic Control System (ECS) and Type CXT-E Valve
8. CORRECTIVE MAINTENANCE



VIEW E – E (CONTROL BOX 69011-1)

NOTE:
 SEE APPENDIX B FOR WIRING CONNECTIONS



VIEW E – E (CONTROL BOX 69011-2)

Figure 8-9. ECS Control Box Assembly Component Locations (Sheet 4 of 5)

Electronic Control System (ECS) and Type CXT-E Valve
8. CORRECTIVE MAINTENANCE

ECS Control Box Assembly Parts List

ITEM	CONTROL BOX ASSY.		PART NO.	DESCRIPTION
	69012-1 (STEAM/ WATER)	69012-2 (WATER/ WATER)		
QTY	QTY			
1	1		69011-1	CONTROL BOX (STEAM/WATER)
2		1	69011-2	CONTROL BOX (WATER/WATER)
3	1	1	SEE TABLE A	TEMPERATURE CONTROLLER
4	1	3	64007	OVER-TEMP SWITCH/TEMP INDICATOR
5	1	1	60003	ON/OFF SWITCH
6	1		63009-1	CONTROL BOX, EXTERNAL HARNESS (S/W)
7		1	63009-2	CONTROL BOX, EXTERNAL HARNESS (W/W)
8	1	1	65006	POWER SUPPLY
9	1	1	65007	TERMINAL BLOCK, 4-POSITION (TB-2)
10	1	1	64011	VOLTAGE REGULATOR
11	1	1	65008	TERMINAL BLOCK, 20-POSITION (TB-1)
12	AS REQ'D	AS REQ'D	SEE TABLE B	COMMUNICATIONS BOARD
13	1	1	62004	PLUG
14	8	8	53011	LOCK WASHER, #4
15	12	12	65010	STANDOFF
16	4	4	53010	LOCK WASHER, #8
17	4	4	56012	HEX NUT, #8-32
18	2	2	56011	HEX NUT, #6-32
19	2	2	53012	LOCK WASHER, #6
20	4	4	56010	HEX NUT, #4-40
21	2	2	62002	STRAIN RELIEF
22	1	1	62003	PLUG
THE FOLLOWING ITEMS ARE NOT ILLUSTRATED IN FIGURE 8-9:				
23	1		69014-1	CONTROL BOX CONNECTORS
24		1	69014-2	CONTROL BOX CONNECTORS
25	1	1	63007	AC WIRE HARNESS
26	1		63008-1	CONTROL BOX CONN. WIRE HARNESS
27		1	63008-2	CONTROL BOX CONN. WIRE HARNESS

Figure 8-9. ECS Control Box Assembly Component Locations (Sheet 5 of 5)

Electronic Control System (ECS) and Type CXT-E Valve
8. CORRECTIVE MAINTENANCE

Table A – Programmed Temperature Controllers

PART NUMBER	PROGRAMMED TEMPERATURE CONTROLLER USED ON:
64028-1	HELITHERM HEATER MODELS: A+, B+, B+ II, E+
*64028-2	DOUBLE-WALL HEATER MODELS: SWDW24, SWDW45
64028-3	DOUBLE-WALL HEATER MODEL: WWDW24
64028-4	DOUBLE-WALL HEATER MODEL: WWDW45
*64028-5	DOUBLE-WALL HEATER MODEL: SWDW68
65028-6	DOUBLE-WALL HEATER MODEL: WWDW68

*Refer to HE-111 for SWDW Systems built after Nov. 1, 2009. These systems use a thermocouple for feed-forward instead of a flowmeter.

Table B – Communications Board Options

PART NUMBER	DESCRIPTION
64009-1	RS232 COMMUNICATIONS BOARD
64009-2	RS485 COMMUNICATIONS BOARD

Figure 8-9. ECS Control Box Assembly Component Locations (Sheet 6 of 6)

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9. RECOMMENDED SPARE PARTS

9.1 CXT-E CONTROL VALVE RECOMMENDED SPARE PARTS

AERCO recommends that the CXT-E Spare Parts listed in Table 9-1 be kept on hand for maintenance replacement purposes. The Recommended Quantity for the parts shown apply to each 1 to 5 Control Valves of the same size.

NOTE:

For Part Numbers of the items listed below, refer to Figure 8-1 for Control Valve sizes ranging from 1.00" to 2.00". Refer to Figure 8-2 for 2.50" to 4.00" Control Valve sizes.

Table 9-1. Recommended Spare Parts For CXT-E Control Valves (1.00" – 4.00")

RECOMMENDED QUANTITY	PART NAME	FIGURE 8-1 OR 8-2 ITEM NUMBER
2	Valve Seat	7
2	Valve Top Gasket	13
2	Packing Assembly	20
2	Seat Cage Gasket	24
2	Gasket (Linkage)	29
2	Lower Pilot Seat*	33*

* Used on Control Valve sizes ranging from 1.00" to 2.00" ONLY

9.2 ELECTRONIC CONTROL SYSTEM RECOMMENDED SPARE PARTS

AERCO recommends that the ECS Spare Parts listed in Table 9-2 be kept on hand for maintenance replacement purposes.

Table 9-2. Recommended Spare Parts For Electronic Control System (ECS)

RECOMMENDED QUANTITY	PART NAME	PART NUMBER
1	Dual Thermocouple (Tc) - Type J with compression fitting	99042-2
1	Single Thermocouple (Tc) – Type J with compression fitting (Water-to-Water ONLY)	99042-1
1	Flow Sensor Impeller Replacement Kit	24051-1
1	Flow Sensor Cover Replacement Kit (Clear Polycarbonate Cover)	24051-2
*	Flow Sensor Cover Replacement Kit (Stainless Steel Cover)	24051-3

* Part No. 24051-3 is only used for applications where the water pressure is greater than 200 psig.

APPENDIX A

TEMPERATURE CONTROLLER INFORMATION MODBUS Communication information (Eurotherm 2408)

NOTE:

The Eurotherm 2400 Controller supports the MODBUS RTU mode of transmission. The default settings are as follows: 9600 Baud Rate, one start bit, eight data bits, one stop bit, & no parity bit.

IMPORTANT NOTE:

All Modbus addresses specified in this manual are written generically in decimal format. However, many Building Automation Systems utilize another form of addressing where: 40001 is added to the generic address for a Holding Register address **And** 30001 is added to the generic address for an Input Register address.

Check the addressing scheme being used by the BAS interfaced to the XPC Gateway.

EUROTHERM SERIES 2400 CONTROLLER MODBUS POINTS

MODBUS Data Addr (BAS)	MODBUS Data Addr (Hex.)	MODBUS Data Addr (Dec.)	Menu Item	Menu Item Description	Units & Range	Default/Comments	Register Type	Ref. 1 Comm. Guide
30006	0x0005	5	w.SP	Setpoint	40-205°F	140°F, Address to read value	Read Only	5-4
40025	0x0018	24	SP 1	Setpoint (local or internal)	40-205°F	140°F, Address to change value	Write	5-11
30002	0x0001	1	Top Value	Outlet Temp	40-205°F	Same value as front display	Read Only	5-3
30134	0x0085	133	LoGH	Peak Temp	40-205°F	Resets on Power Loss	Read Only	5-15
30136	0x0087	135	LoGA	Average Temp	40-205°F	Resets on Power Loss	Read Only	5-15
30135	0x0086	134	LoGL	Low Temp	40-205°F	Resets on Power Loss	Read Only	5-15
30075 (status) 30014 (set)	0x004A 0x000D	13 (set) 74 (status, 0 = safe 1 = alarm)	AL 1	Over Temp Alarm	40-205°F	20°F above setpoint; Alarm Type 17: Deviation High	Read Only	5-7 5-20
30075 (status) 30015 (set)	0x000E 0x004A	14 (set) 74 (status, 0 = safe 1 = alarm)	AL 2 (FSH)	Full Scale High Alarm	205°F	205 ° F Alarm Type 2: Full Scale High	Read Only	5-7 5-20
30259	0x0102	258	Sbr	Feedback Sensor Break	Status: 0: Good 1: Failed	Denotes Feedback Sensor Failure/Open Circuit	Read Only	5-18
30290	0x0121	289	Li 1	Feedback Sensor Temp	40-180°F	Sensor input to controller, same as display temp.	Read Only	5-14
30291	0x0122	290	Li 2	Flow	GPM		Read Only	5-14
30004	0x0003	3	OP	Control Output Signal	%	Correlates to valve position	Read Only	5-4
40027	0x001A	26	RI	Remote Input Comms Access Parameter	40-205°F	MODBUS Remote Setpoint Address	Write	5-17

Electronic Control System (ECS) and Type CXT-E Valve
APPENDIX A

REFERENCE DOCUMENTS for MODBUS Points information: (www.eurotherm.com)

- Eurotherm 2000 Series Communications Handbook, # HA026230
- Eurotherm 2404/2408 Control Setpoint Programmer Installation and Operation Handbook, # HA025132

A.1 PROCESS ALARMS:

Eurotherm 2408 Process Alarms

DISPLAY	MEANING
_FSL*	PV Full Scale Low Alarm.
_FSH*	PV Full Scale High Alarm.
_dEu*	PV Deviation Band Alarm
_dHi*	PV Deviation High Alarm
_dLo*	PV Deviation Low Alarm

A.2 DIAGNOSTIC ALARMS

Eurotherm 2408 Diagnostic Alarms









DISPLAY	MEANING	WHAT TO DO`
EE.Er	<i>Electrically Erasable Memory Error:</i> The value of an operator, or configuration, parameter has been corrupted.	This fault will automatically take you into Configuration level. Check all of the configuration parameters before returning to Operator level. Once in Operator level, check all of the operator parameters before resuming normal operation. If the fault persists, or occurs frequently, contact your supplier
S.br	Sensor Break: Input sensor is unreliable or the input signal is out of range.	Check that the sensor is correctly connected
L.br	Loop Break The feedback loop is open circuit	Check that the heating and cooling circuits are working properly
Hw.Er	Hardware Error Indication that a module is of the wrong type, missing, or faulty.	Check to ensure that the correct items are installed. See page A-4 for procedure to clear the Hardware Error.
no.io	No I/O None of the expected I/O items are installed	This error message normally occurs when pre-configuring a controller without installing any of the required I/O modules.
rmt.F	Remote input failure. The remote DC input is open or shorted	Check for open or short circuit wiring on the remote DC input.
LLLL	Out of range low reading	Check the value of the input
HHHH	Out of range high reading	Check the value of the input

Eurotherm 2408 Diagnostic Alarms (*Continued*)

DISPLAY	MEANING	WHAT TO DO`
Err1	Error 1: ROM self-test fail	Return Controller for repair
Err2	Error 2: RAM self-test fail	Return Controller for repair
Err3	Error 3: Watchdog fail	Return Controller for repair
Err4	Error 4: Keyboard failure. Stuck button or button was pressed during power-up	Switch power off and then on, without touching any of the controller buttons
Err5	Error 5: Faulty internal communication	Check printed circuit board interconnections. If the fault cannot be cleared, return the controller for repair.
Err6	Digital filter chip faulty or loose board inside controller	Return Controller for repair
Err7	PV ID failure	Return Controller for repair
Err8	Module 1 ID failure	Faulty or loose module, or isolation problem
Err9	Module 2 ID failure	Faulty or loose module, or isolation problem
ErrA	Module 3 ID failure	Faulty or loose module, or isolation problem
dCF	DC output failure	Return Controller for repair
OPEn	Secondary Input Missing or Disconnected	This error may result from no power to the flow meter (check for green power light on rear of meter or 0-5V flowmeter signal connections), or a disconnection of the Molex connector between feedforward sensor and the Eurotherm controller.

A.2.1 Clearing Hardware Error (Hw.Er) Display

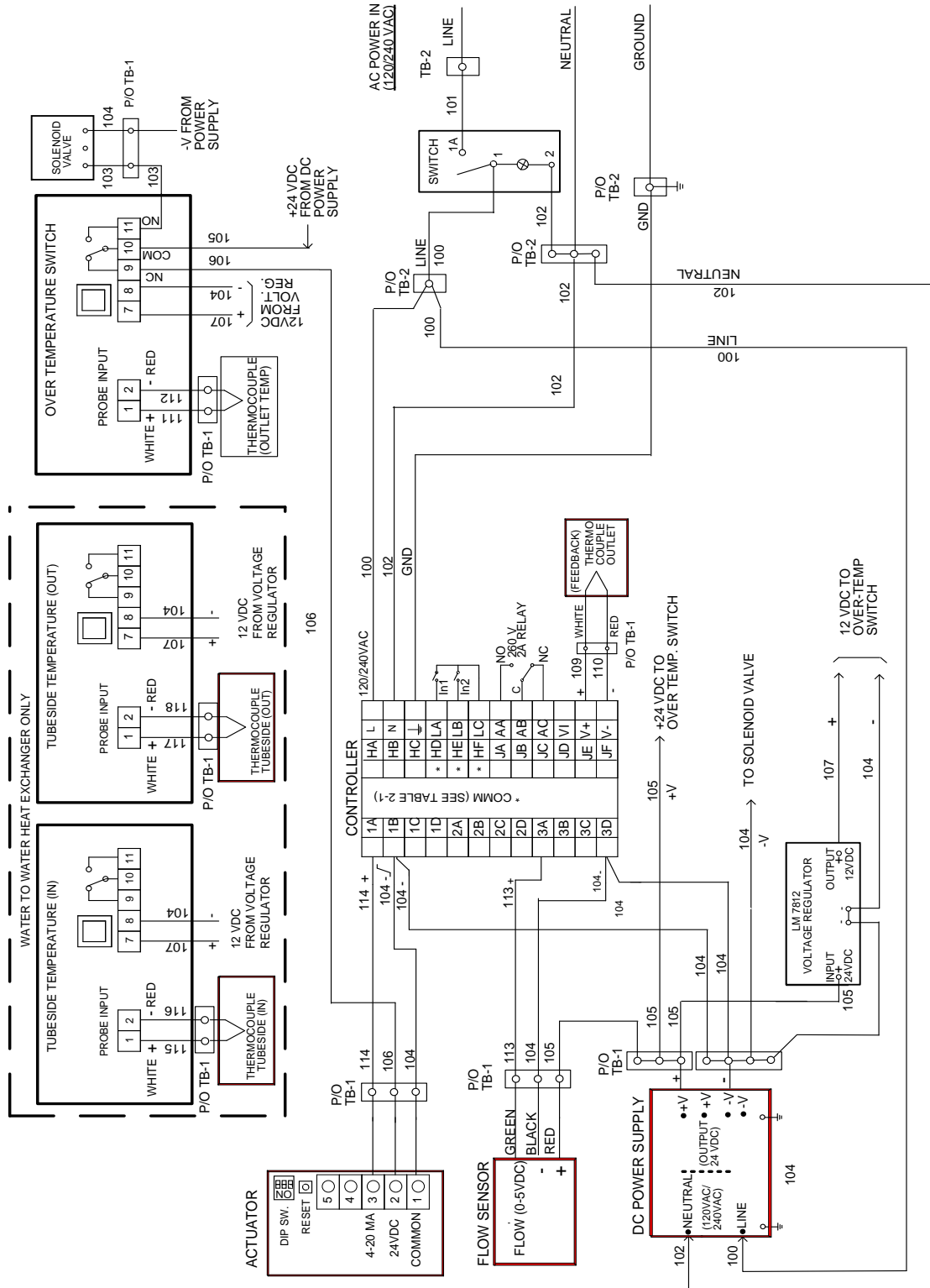
To clear a Hardware Error and reset the Temperature Controller, proceed as follows:

- 1) Simultaneously press the **Page** () and **Scroll** () buttons on the Temperature Controller.
- 2) Using the **Up** () arrow button, change the password to “8”.
- 3) Simultaneously press the **Page** () and **Scroll** () buttons again and observe the Temperature Controller display. The top line will display “8” and the bottom line will display “NO”.
- 4) Press the **Up** () arrow button to toggle the display from “NO” to “YES”.
- 5) Simultaneously press the **Page** () and **Scroll** () buttons to “Reset” the Temperature Controller and clear the Hardware Error.

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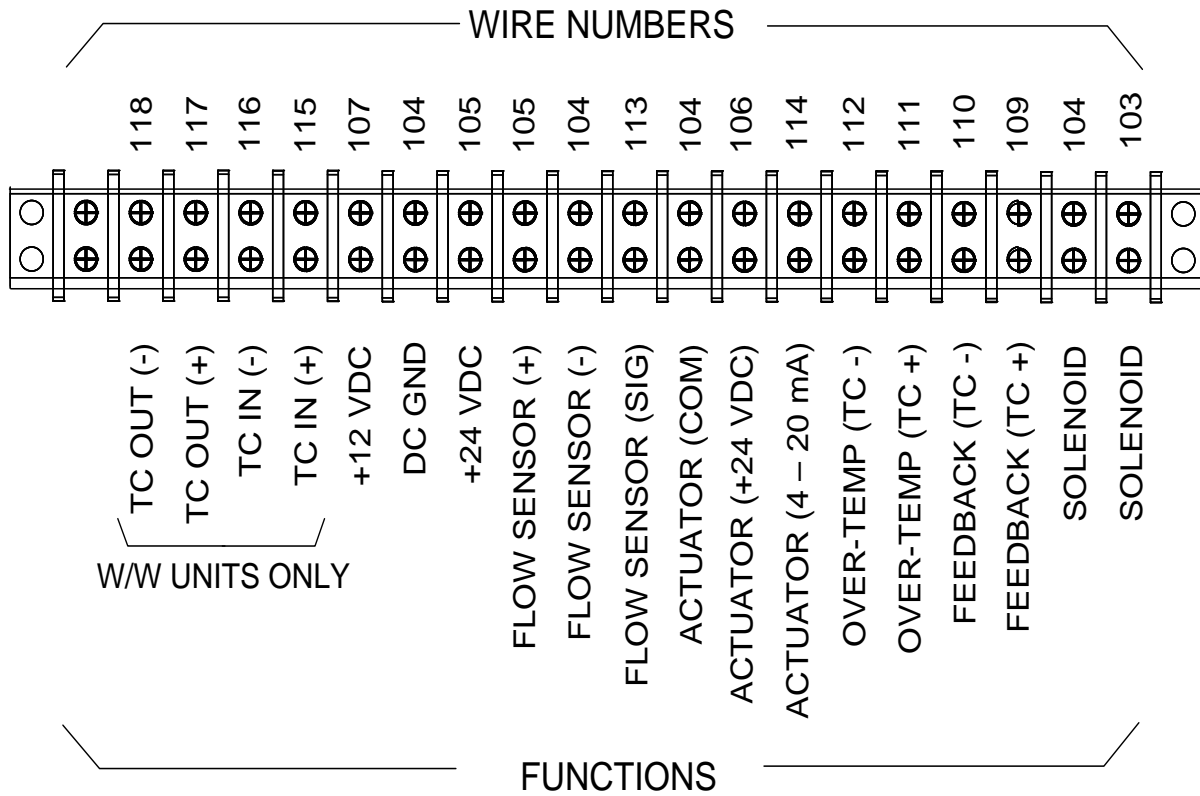
Appendix B

ECS WIRING & TERMINAL BLOCK CONNECTIONS

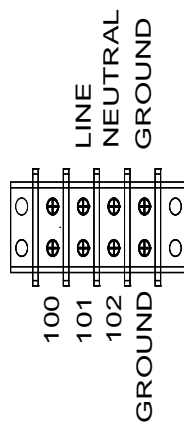


ECS Wiring Diagram

TERMINAL BLOCK TB-1 (REAR WALL)



TERMINAL BLOCK TB-2
(BOTTOM SURFACE)



Change Log

Date	Description	Changed By
12/16/2014	Rev E: PIR 987: Replace 69009 with 69170, sections 3.2 & 8.2.3	Chris Blair
11/02/2016	Rev F: DIR 371: Added mesh size 0.002 to strainer upstream of ECS valve in Figures 2-1 and 2-2 (p. 16 & 17) DIR 392: Change callout 6 to 8 in Fig 8-9 Sheet 3 (p. 67)	Chris Blair



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