Installation, Operation & Maintenance Instructions

Double-Wall Heat Exchanger

Model DW
Telephone Support

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SAFETY PRECAUTIONS

Personnel involved in the installation, operation and maintenance of the SmartPlate Water Heater must, at all times, observe all safety regulations. The following Warnings are general and must be given the same attention as specific Warnings and Cautions appearing throughout this Instruction Manual.

**WARNING**

FLUIDS UNDER PRESSURE MAY CAUSE INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT WHEN RELEASED. BE SURE TO SHUT OFF ALL INCOMING AND OUTGOING WATER SHUTOFF VALVES. CAREFULLY DECREASE ALL TRAPPED PRESSURES TO ZERO BEFORE PERFORMING MAINTENANCE.

**WARNING**

ELECTRICAL VOLTAGES UP TO 240 VAC MAY BE USED IN THIS EQUIPMENT. DEATH ON CONTACT OR SERIOUS PERSONAL INJURY MAY RESULT IF EXPOSED CONNECTIONS ARE TOUCHED.

**WARNING**

CLOSE ALL SHUT-OFF VALVES AND CAREFULLY DECREASE TRAPPED PRESSURES TO ZERO BEFORE PERFORMING ANY MAINTENANCE TASKS. TAG THE UNIT “OUT OF SERVICE” WHILE PERFORMING MAINTENANCE TASKS.
CHAPTER 1  GENERAL INFORMATION

1.1 INTRODUCTION

AERCO’s DW-series heat exchangers provide potable hot water for commercial and institutional applications. These heat exchangers are available in steam-to-water configurations and are equipped with electronic controls. This manual addresses the steam-to-water double-wall heat exchanger with electronic controls.

The three steam-to-water DW heat exchangers available from AERCO include the:

- DW-24 with 24 square feet of heating surface
- DW-45 with 45 square feet of heating surface
- DW-68 with 68 square feet of heating surface

Figure 1-1 illustrates a typical AERCO DW-series heat exchanger.

Figure 1-1.  DW-24 Heat Exchanger

This chapter provides a top-level mechanical overview of the DW-series heat exchanger (1.2), its electronic control system (1.3) and the options and accessories available from AERCO (1.4) for units in this series.

1.2 MECHANICAL OVERVIEW

The AERCO double-wall steam-to-water heat exchanger is illustrated in Figure 1-2:
Figure 1-2. Mechanical Overview of the AERCO Double-Wall Steam-to-Water Heat Exchanger

The DW steam-to-water heat exchanger includes the following principal mechanical parts and assemblies:

- Shell and upper/lower head assemblies
- Enclosed double-wall tube bundle and tubesheets
- Input/output connections for steam, condensate and hot/cold water
- Control Valve
- Recirculation piping and pump

1.3 ELECTRONIC CONTROL SYSTEM

The Electronic Control System (ECS; illustrated in Figure 1-3) includes the Control Box components and associated temperature sensors and actuators. The ECS:

- Controls the temperature of the hot water output to within ±4°F of the Control Box setting under normal, diversified load conditions (load fluctuations of up to 25% of water heater capacity)
- Shuts down the heat exchanger when the maximum safe water temperature is exceeded
- Relays commands and alarms from/to the MODBUS Communication Option

The ECS and its components are described in Chapter 3.
1.4 OPTIONS AND ACCESSORIES

1.4.1 MODBUS Communication Option

The ECS can be ordered with the MODBUS Communication Option to enable the ECS to be externally controlled by an Energy Management System, Building Automation System or computer (supplied by others).

1.4.2 Accessories

Accessories available for the DW-series steam-to-water heat exchangers equipped with the CXT-E Electronic Control Valve are listed in Table 1. Required accessories may be supplied separately by AERCO if they are not factory-installed on the heater.

The accessories required will depend on the specific application. Detailed installation instructions, including typical installation drawings are provided in Chapter 2 Installation. Please ensure that ALL mandatory items are available for installation.

If any of these items have been furnished by AERCO, the necessary drawings and/or instructions are included with the shipment.
### Table 1. DW-Series Heat Exchanger and CXT-E Actuator/Valve Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>AERCO Supplied</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. DW-Series Heat Exchanger</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Controller</td>
<td>Yes</td>
<td>Required</td>
</tr>
<tr>
<td>Pressure and Temperature Relief Valve</td>
<td>Yes</td>
<td>Required</td>
</tr>
<tr>
<td>Over-temperature Limit System, including:</td>
<td>Yes</td>
<td>Required</td>
</tr>
<tr>
<td>• Solenoid valve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Water temperature sensor in heat exchanger upper head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Over-temperature indicating switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam Flow Control Valve, sized as required for the application</td>
<td>Yes</td>
<td>Required</td>
</tr>
<tr>
<td>Compound Steam Pressure Gauge, mounted on steam inlet connection</td>
<td>Yes</td>
<td>Required</td>
</tr>
<tr>
<td>Traps</td>
<td>No</td>
<td>Required</td>
</tr>
<tr>
<td>• Drip trap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Valve trap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Condensate trap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vacuum Breaker</td>
<td>Yes</td>
<td>Required</td>
</tr>
<tr>
<td><strong>II. CXT-E Actuator and Valve</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upstream Shutoff Valve</td>
<td>No</td>
<td>Required</td>
</tr>
<tr>
<td>Downstream Shutoff Valve</td>
<td>No</td>
<td>• Suggested for ease of maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Required if a bypass line is used</td>
</tr>
<tr>
<td>Strainer and Blow-Off Valve</td>
<td>No</td>
<td>Required</td>
</tr>
<tr>
<td>High Side Pressure Gauge</td>
<td>No</td>
<td>Recommended for adjustment and maintenance</td>
</tr>
<tr>
<td>Low Side Pressure Gauge, compound-type for steam flow</td>
<td>No</td>
<td>Recommended for adjustment and maintenance</td>
</tr>
</tbody>
</table>
CHAPTER 2 INSTALLATION

2.1 INTRODUCTION
This chapter provides instructions for:

- Receiving the heat exchanger and installing it in a suitable location (2.2)
- Piping into the steam and water systems (2.3)
- Installing and connecting the Electronic Control System (2.4)

2.2 RECEIVING, UNPACKING AND INSTALLING
To prepare the heat exchanger for installation:

1. Carefully uncrate the heat exchanger.
2. Set the heat exchanger upright using a block and tackle or hoist attached to the lifting lugs (eye-bolts) on the top head.

CAUTION
ALWAYS USE THE LIFTING LUGS to lift and/or move the heat exchanger.

3. To simplify in-place maintenance, install the heat exchanger in a location having the following clearances:
   a. Horizontal clearance: At least two (2) feet all-around
   b. Headroom: At least six (6) feet measured upward from the top of the upper shell flange.

   The dimensions of the AERCO Model DW-heat exchangers are presented in Figures 2-1 through 2-3.

4. Secure the heat exchanger in place, preferably, by attaching it to the floor. If you use piping to secure the heat exchanger in position, be sure to include ample provision for pipe expansion.
Figure 2-1. AERCO Model DW-24 Heat Exchanger Dimensions (Reference AP-A-928 rev C)
Figure 2-2. AERCO Model DW-45 Heat Exchanger Dimensions
(reference AP-A-930 rev C)
**Figure 2-3. AERCO Model DW-68 Heat Exchanger Dimensions**
(Reference AP-A-959 rev B)
2.3 MAKING THE PIPING CONNECTIONS

Figure 2-4 illustrates the recommended CXT-E Control Valve installation for steam flow.

1. Install the CXT-E Control Valve with the Actuator linkage in the vertical, upright position, as shown.

2. For maintenance purposes, install pipe unions with threaded ends to simplify removal from the steam line. Blow out all pipe lines to remove dirt chips, scale or other foreign matter which could adversely affect Control Valve (“Valve”) operation when in service.

3. Blow out all pipe lines to remove dirt chips, scale or other foreign matter which could adversely affect Control Valve (“Valve”) operation when in service.

4. Install an in-line strainer upstream of the Valve (as illustrated on the left side of Figure 2-4) to protect against foreign matter entering the Valve during service operation.

5. Ensure that the steam line is properly trapped to prevent accumulation of condensate ahead of the Valve.

6. Install metal-seated, gate-type shutoff valves upstream and downstream of the Valve so that it can be readily removed from the line for maintenance.

7. Install pressure gauges on both sides of the Control Valve, as shown in Figure 2-4.

8. The high-side pressure gauge is provided for adjustment and maintenance purposes. The low-side pressure gauge is intended to ensure that the correct pressure is available to monitor the operation of the temperature regulator valve. The low-side pressure gauge measures the pressure of the steam.

**CAUTION**

When installing the Valve, DO NOT use the Actuator linkage frame at the top of the Valve body for leverage. Use pipe wrenches on the inlet and outlet hex of the Valve body.

9. Install the Valve so that the arrow on the Valve body points in the direction of steam flow.

10. After the Valve has been installed in the steam or hot water line, ensure that all piping connections are secure and leak-tight.
The AERCO recommended heat exchanger and Control Valve piping arrangements for single and parallel heat exchanger installations are presented in Appendix C.

11. For best heat exchanger performance, OBSERVE THE FOLLOWING VERY CAREFULLY when installing the heat exchanger piping:

   a. Do not use cement or red lead when assembling pipe joints.
   
   b. For heat exchanger connection types, sizes, and exact locations, see Figure 2-1, Figure 2-2 or Figure 2-3.
   
   c. All piping to the heat exchanger top head should be provided with unions or flanges LOCATED BEYOND THE OUTSIDE DIAMETER OF THE HEAT EXCHANGER HEAD to permit removal of the head and shell for in-place maintenance.
   
   d. Include all of the stop valves, check valves, steam traps, strainers and other elements shown in Appendix C, or as specified separately by AERCO.
   
   e. If the heat exchanger is furnished with the Control Valve not connected as shown in Figure 2-1, Figure 2-2, or Figure 2-3, make the piping between the Control Valve and the heat exchanger as short as possible, with sufficient unions or flanges included to allow easy Valve removal.
   
   f. Reductions from a pipe to a smaller size connection at the heat exchanger or Control Valve should be made directly at the heat exchanger or Valve connection. Expansions from a pipe to a larger size connection at the heat exchanger or Control Valve should be made as far as practical from the heat exchanger or Valve connection.
   
   g. The condensate return piping must be arranged to permit condensate to drain freely by gravity from the heat exchanger connection. If condensate drain by gravity is not feasible, you may substitute a pumping steam trap. Refer to the trap manufacturer’s instructions for sizing and installation procedures.

   **CAUTION**

   Failure to provide proper condensate drainage can result in improper operation of the heat exchanger and/or damage to the heat exchanger condensate drainage system.

   h. All drain discharges — relief valve, over-temperature solenoid valve and heat exchanger shell drain — should be piped directly to a convenient floor drain.

   **IMPORTANT**

   Before making final piping connections to and from the heat exchanger and Control Valve, blow out all piping thoroughly.

### 2.4 INSTALLING THE CXT-E ELECTRONIC CONTROL SYSTEM

The Control Box and all other Electronic Control System (ECS) components are installed on the heat exchanger assembly before it is shipped from the factory, so that the ECS installation consists of connecting AC power to the Control Box and making the internal power and control connections to the CXT-E Control Valve. However, if your ECS was ordered with the MODBUS Communication option, you are required to make several additional connections (starting with step 8, below) to enable the ECS to be controlled by an external Energy Management System (EMS), Building Automation System (BAS) or computer.
2.4.1 Accessing the Control Box Interior

NOTE
After installing the Control Box, you can install a lock (not supplied) on its front door to prevent unauthorized access to ECS settings.

1. Loosen the captive screw on the Control Box (Figure 2-5) front cover and open the hinged panel door.

2. Loosen the captive screw at the top of the recessed panel (Figure 2-6). Swing down the recessed panel to access Terminal Block TB-2 on the bottom interior surface of the Control Box (see Figure 2-7).
HE-111 – INSTALLATION

2.4.2 Connecting AC Power to the Control Box

3. Feed the external 120 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 2-7.

2.4.3 Wiring the CXT-E Actuator

5. Connect the Control Box cable labeled ACTUATOR to the 3-pin connector plug on the CXT-E Actuator.
2.4.4 Verifying Pre-wired Connections

6. Check to ensure that all pre-wired cable harness connectors and wire leads between the Control Box and the following ECS components are secure:
   • Recirculation Pump
   • Over-Temperature Solenoid
   • Outlet Dual Temperature Sensor
   • Mixed Temperature Sensor

7. If the ECS was ordered with the MODBUS Communication Option, proceed to step 8. Otherwise, the ECS installation is complete.

2.4.5 Wiring the Temperature Controller to the MODBUS Control System

Step 8, below, applies to the Eurotherm, Mode 2408 Temperature Controller equipped with a MODBUS communication board and connected to an Energy Management System (EMS), Building Automation System (BAS) or computer. The type of communication port (RS232-9, RS232-25, or RS485) mounted on the EMS, BAS or computer determines the relevant signal leads (Ground, Receive and Transmit) in the control cable that you connect to the MODBUS device and the Temperature Controller, as described in Table 2-1.

NOTE
If required, the procedure for adding a communication board to the Temperature Controller is provided in Appendix A

| TABLE 2-1. MODBUS Communication Signal Connections |
|---------------------------------|------------------|------------------|------------------|
| **SIGNAL NAME** | **TERMINAL** | **SIGNAL NAME** | **RS232 9-PIN** | **RS232 25-PIN** | **RS485** |
| GROUND          | HD              | GROUND          | 5               | 7               | GROUND   |
| RECEIVE         | HE              | TRANSMIT        | 3               | 2               | A(-)     |
| TRANSMIT        | HF              | RECEIVE         | 2               | 3               | B(+)     |

8. Refer to Table 2-1, Figure 2-8 and/or the ECS wiring diagram in Appendix B to wire the Ground (HD), Receive (HE) and Transmit (HF) terminals of the Temperature Controller to the RS232-9, RS232-25 or RS485 connector on the EMS, BAS or computer.

Examples of cable types suitable for this purpose are: Belden 9841, 8761, 3105A, or equivalent. Ensure that the RS232 or RS485 cable connections do not exceed the following lengths:
   • RS232 Cable: 50 feet, maximum
   • RS485 Cable: 4,000 feet, maximum

NOTE
For best results, DO NOT run MODBUS communication wiring in the same conduit as power wiring which can couple excessive noise and/or hum into the MODBUS lines.
### 2.4.6 Control System Programming Information

 Appendix A lists the MODBUS data addresses for the 2408 Controller. The procedures for changing the Controller address is also provided in Appendix A. Also included are references to the manufacturer's handbooks covering the Temperature Controller communication option.
CHAPTER 3  FUNCTIONAL DESCRIPTION

3.1 INTRODUCTION
The AERCO DW-series steam-to-water heat exchangers incorporate double-wall heat tubes, in which steam circulating in a bundle of immersed double-wall primary tubes heats the service water in the heat exchanger’s shell. The following Mechanical Description (3.2) briefly discusses how double-wall heat tubes work and describes each of the principal steam-to-water heat exchanger components. The Mechanical Description is followed by a discussion of the Electronic Control System (3.3), which regulates the heat exchanger water temperature and activates alarms and shutdown processes in the event safety limits are exceeded.

3.2 MECHANICAL DESCRIPTION

3.2.1 Overview
Referring to Figure 3-1, cold service water entering the heat exchanger through the Cold Water Input is dispersed evenly throughout the heat exchanger shell. As the cold water flows upward, it is heated by steam circulating through the immersed tube bundle. The heated service water exits through the Hot Water Output connection in the upper head assembly.

The heating steam enters through the CXT-E Control Valve at the bottom of the heat exchanger assembly and flows through the inner tubes of the double-wall tube bundle. The flowing steam transfers its heat to the service water contained within the shell, condenses and exits through the Condensate Output connection.

The flow rate of the heated water varies according to the demand for hot water. The flow rate of the steam is regulated by the Temperature Controller in the Control Box so as to maintain the temperature of
the delivered hot water to within ±4°F of the Control Box setting, under normal, diversified load conditions (load fluctuations of up to 25% of water heater capacity).

3.2.2 Double-Wall Heat Transfer and Water Leakage

As illustrated in Figure 3-2, the heat exchanger’s primary tubes incorporate double-wall construction in which the inner and outer tube walls are separated by air space. The steam flows within the double-wall primary tubes’ inner walls. Any condensate leaking outward through the inner walls is trapped within vented air space between the inner and outer tube walls. Any service water that leaks inward through the outer tube walls is similarly contained within the air space. The accumulated leakage water is conducted along these air spaces, collected in the bottom head (see 3.2.3.2) and discharged through an atmospherically vented leak detection port. This construction effectively provides double protection against primary steam or condensate leaking into the service water, or vice versa. However, it is not unusual for moisture to appear at the leak detection port at initial heat exchanger start-up, even when there are no tube leaks. This moisture results from water condensing during the manufacturing process and being expelled when the system is initially operated.

![Figure 3-2. Segment of a Double-Wall Primary Tube](image)

3.2.3 Principal Mechanical Components

The AERCO DW-series heat exchanger consists of the following principal mechanical components (see Figure 3-3):

- Shell and heads (3.2.3.1)
- Double-wall U-bend tube bundle and tubesheet (3.2.3.2)
- Recirculation pipe and pump (3.2.3.3)
- Electronic CXT-E Control Valve (3.2.3.4)
3.2.3.1 Shell and Heads

The heat exchanger body incorporates a stainless steel shell, bronze upper head and navy brass tubesheets, forming a pressure vessel that conforms to ASME standards. The heat exchanger body encloses the tube bundle and tubesheets.

3.2.3.2 Double-Wall U-Tube Bundle and Tubesheets

The double-wall U-bend copper tubes that conduct steam through the heater shell conform to BOCA (National Plumbing Code), IAPMO (Uniform Plumbing Code) and NAPHCC (National Standard Plumbing Code), the three national standards that address double-wall construction. The outer wall of each double-wall tube is brazed to the upper tubesheet, and the inner wall is brazed to the navy brass lower tubesheet. Any tube leakage from the air spaces between the inner and outer walls of the double-wall tubes accumulates in the space between the bottom shell flanges which make up the bottom head. The accumulated leakage water is discharged through the leak detection port.

3.2.3.3 Recirculation Pipe and Pump

Referring to Figure 3-3, the recirculation pipe and constant-rate recirculation pump deliver a continuous sample of the heated output water to a 1½-inch pipe junction with the Cold Water Input pipe to regulate steam flow at the Steam Input (see 3.3.2).

3.2.3.4 CXT-E Control Valve

The CXT-E Control Valve regulates the flow rate of steam into the heat exchanger in response to positioning control signaling from the Temperature Controller (see 3.3.2). The CXT-E Control Valve consists of a valve body and linkage to the CXT-E Actuator. The CXT-E Actuator is discussed in 3.3.4.5.
3.3 ELECTRONIC CONTROL SYSTEM

The Electronic Control System consists of the internal Control Box components and a number of sensor and safety devices distributed throughout the heat exchanger assembly (see Figure 3-4).

![Figure 3-4. Electronic Control System Components](image)

3.3.1 ECS Block Diagram

A simplified block diagram of the ECS is presented in Figure 3-5.
3.3.2 ECS Operational Summary

The ECS adjusts the flow rate of steam into the heat exchanger in response to:

- The water temperature at the Hot Water Output (at A)
- The water temperature of the sampled Hot Water Output mixed with the Cold Water Input (at B)

Changes in hot water demand vary the flow rate of service water through the heat exchanger, requiring compensating adjustments of the steam flow rate to maintain the service water temperature. To determine what steam flow rate adjustments are required, the Temperature Controller monitors (via the feed-forward signal) the temperature of a continuous sample of output hot water mixed (at B) with the cold water input. The mixture temperature changes according to the flow rate of the incoming cold water, which in turn depends on the hot water demand.

The Temperature Controller calculation of the optimum steam flow rate into the heat exchanger is based on a mathematical process known as the Proportional Integral Derivative (PID) algorithm, which accepts as inputs the measured outlet and inlet temperatures of the system.

3.3.3 Over-temperature Condition

At startup, the operator programs the maximum safe water temperature into the Control Box. During operation, the Temperature Controller monitors the Hot Water Output temperature to ensure that the programmed maximum safe temperature is not exceeded. If it is, the Temperature Controller operates the Over-temperature Solenoid Valve (see 3.3.4.4) to relieve excessive temperature buildup in the heat exchanger.
3.3.4 Principal ECS Components

3.3.4.1 Control Box Assembly

The Control Box Assembly houses the components that monitor heat exchanger temperatures and operate system controls. The Control Box is illustrated in Figure 3-6. The Control Box components include the Temperature Controller, Over-temperature Switch and dc Power Supply/Voltage Regulator (not shown).

![Figure 3-6. Control Box Front View](image)

**Temperature Controller.** The Temperature Controller processes data received from the temperature and flow sensors. Using the PID algorithm, the Temperature Controller calculates the optimum steam flow rate to maintain the Hot Water Output temperature within the programmed range. The Temperature Controller translates the optimum flow rate into a 4-to-20 mA control signal to the CXT-E Control Valve Actuator to adjust the Control Valve opening.

**Over-temperature Switch.** The Over-temperature Switch compares the output hot water temperature to the programmed high temperature limit, typically 20°F above the heater setpoint. If the measured Hot Water Output temperature exceeds the maximum setting, the Over-temperature Switch sounds an audible alarm and activates the Over-temperature Solenoid Valve, causing the overheated water to be dumped from the heater shell. Simultaneously, the Over-temperature Switch cuts off dc power to the CXT-E Control Valve Actuator, shutting off the flow of steam into the heat exchanger.

**DC Power Supply/Voltage Regulator.** The dc power supply within the Control Box converts the 120 VAC primary power to 12 VDC and 24 VDC to operate the Control Box components, Over-temperature Switch, Over-temperature Solenoid Valve and the CXT-E Actuator.

3.3.4.2 DHW Outlet Dual Temperature Sensor

The DHW outlet dual temperature sensor consists of dual thermocouple sensing elements mounted in the top head. The DHW outlet dual temperature sensor continuously monitors the service water temperature at the Hot Water Output and transmits it simultaneously to both the Temperature Controller and the Over-temperature Switch in the Control Box.

3.3.4.3 Feed-Forward Mixture Temperature Sensor

The feed-forward mixture temperature sensor is installed in the Cold Water Inlet nozzle to measure the mixture temperature of the combined input cold water and the recirculated sample of the Hot Water Output.
3.3.4.4 Over-temperature Solenoid Valve

The Over-temperature Solenoid Valve is operated by the Over-temperature Switch in the Control Box. When the preset high temperature limit is exceeded at the Hot Water Output, The DHW Outlet Dual Temperature Sensor signals the Over-temperature Switch, energizing the Solenoid Valve and relieving the temperature build-up in the heat exchanger.

3.3.4.5 Electronic CXT-E Control Valve Actuator

The Electronic CXT-E Actuator operates the CXT-E Control Valve, as discussed in 3.2.3.4. Control Valves are available in pipe sizes ranging from 1 inch to 4 inches. Figure 3-7 identifies the basic dimensions for each size Electronic CXT-E Control Valve. The CXT-E Actuator is identical for each size valve. The linkage assemblies used with each size valve body are nearly identical, except for minor differences in the shaft adapter stroke of the mechanical linkage.
## HE–111– FUNCTIONAL DESCRIPTION

### VALVE SIZES (INCHES)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>1.00</th>
<th>1.25</th>
<th>1.50</th>
<th>2.00</th>
<th>2.50</th>
<th>3.00</th>
<th>4.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>7.75</td>
<td>7.75</td>
<td>7.75</td>
<td>7.75</td>
<td>10.87</td>
<td>10.87</td>
<td>10.87</td>
</tr>
<tr>
<td>C</td>
<td>3.56</td>
<td>3.56</td>
<td>3.56</td>
<td>3.56</td>
<td>6.38</td>
<td>6.38</td>
<td>6.38</td>
</tr>
<tr>
<td>D</td>
<td>6.00</td>
<td>6.00</td>
<td>6.00</td>
<td>6.00</td>
<td>10.87</td>
<td>10.87</td>
<td>10.87</td>
</tr>
</tbody>
</table>

*Figure 3-7. CXT-E Control Valve and Actuator*
CHAPTER 4  ADJUSTMENT

4.1 INTRODUCTION

This chapter explains the procedures you use to adjust the CXT-E Control Valve ("Valve"), Electronic CXT-E Actuator ("Actuator") and Electronic Control System (ECS). The ECS is factory adjusted to the setpoint temperature specified on the sales order, and the Actuator is factory adjusted (auto-stroked) to ensure that it correctly operates the Valve from the fully-open to the fully-closed positions.

To the extent necessary, perform all the procedures listed in 4.2 and 4.3 before placing the system into operation and after replacing the Valve or any ECS components.

CAUTION

BE SURE that all steam shutoff valves are fully closed before performing any of the following adjustment procedures.

4.2 ADJUSTING THE ELECTRONIC CXT-E ACTUATOR

The Actuator is self-calibrating for all size Valves. The Actuator is powered by 24 VDC and controlled by a linear 4-to-20 mA control signal, as follows:

- A 4 mA control signal input operates the Valve to the fully-closed position (Valve shaft down)
- A 20 mA signal strokes the Valve to the fully-open position (Valve shaft up).

When properly connected to the ECS, applying power to the Control Box applies +24 VDC power to the Actuator. The power switch is located on the right side of the Control Box, as illustrated in Figure 4-2.

Figure 4-1. Control Box – Front View

IMPORTANT

Perform this adjustment after three months of use and annually thereafter. Also, this adjustment is mandatory each time the Actuator is replaced or when mechanical adjustments are made to the Valve or its linkage.
Automatically adjust the Actuator as follows:

1. Referring to Figure 4-2, loosen the set screw on the Actuator cover.
2. Remove the Actuator cover to access the PC board containing the terminal connections, DIP switches, Auto-Stroke (Reset) Button and LED.
3. Referring to Figure 4-1, use the power switch to turn on the Control Box and apply 24 VDC power to the Actuator. (On the terminal strip: pin 2 = +24 VDC, pin 1 = Common). The LED will light indicating that power is applied to the Control Box.
4. Wait approximately 10 seconds for the unit to perform its self-test. The LED will blink from one to four times, depending on the size of the Valve, as follows:

<table>
<thead>
<tr>
<th>Blinks</th>
<th>Valve Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1”</td>
</tr>
<tr>
<td>2</td>
<td>1.25” and 2.5”</td>
</tr>
<tr>
<td>3</td>
<td>1.5” and 3”</td>
</tr>
<tr>
<td>4</td>
<td>2” and 4”</td>
</tr>
</tbody>
</table>

5. For full-stroke automatic adjustment, press the Reset button. The LED will light and the Actuator will rotate in both directions to find its open and closed Valve position stops.
6. When the automatic adjustment is complete, the LED will blink from one to four times, depending on the size of the valves, as described in step 4, above.
7. Turn the Control Box power off to disconnect power to the Actuator.
8. Replace the Actuator cover and tighten the set screw.

Figure 4-2. Actuator Adjustment
4.3 ADJUSTING THE ELECTRONIC CONTROL SYSTEM

The ECS is factory set by AERCO to the setpoint temperature specified on the sales order. Normally, the over-temperature alarm limit is set 20°F above the specified setpoint. If no setpoint or over-temperature alarm limit is specified, the ECS is set to the factory default values of 140°F (setpoint) and 160°F (over-temperature alarm limit).

To change the setpoint and over-temperature alarm limits, use the controls provided on the Temperature Controller and the Over-temperature Switch. These controls are visible through the Control Box front door window and can be accessed by opening the panel door (Figure 4-1).

4.3.1 Adjusting the Setpoint Temperature

Figure 4-3 illustrates and Table 4-1 describes the Temperature Controller controls and indicators. Use these controls/indicators to adjust the setpoint temperature as follows:

1. Turn the Control Box power switch on and open the Control Box door.
2. Wait approximately 3 seconds while the Temperature Controller performs its self-test. When the test is completed, the upper display will indicate the current heat exchanger Hot Water Output temperature, and the lower display will indicate the setpoint temperature stored in memory (default = 140°F), as illustrated in Figure 4-3.
3. Ensure that the Temperature Controller is set to the AUTO(matic) mode and the AUTO indicator is lit. If the MAN(ual) indicator is lit, press the AUTO/MAN pushbutton to toggle the mode setting. Indicator OP1 should also be lit.
4. Press the ▲ or ▼ arrow buttons, as necessary, to change the display to the desired value.
5. 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 4-3. Temperature Controller
Table 4-1. Temperature Controller Operating Controls, Indicators and Displays

<table>
<thead>
<tr>
<th>CONTROL / INDICATOR</th>
<th>MEANING</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP1</td>
<td>Output 1 Indicator</td>
<td>OP1 lights when a 4-to-20 mA signal is supplied to the Actuator, or when the valve position is above 0%.</td>
</tr>
<tr>
<td>OP2</td>
<td>Output 2 Indicator</td>
<td>Not used for the ECS application</td>
</tr>
<tr>
<td>SP2</td>
<td>Setpoint 2 Indicator</td>
<td>Not used for the ECS application</td>
</tr>
<tr>
<td>REM</td>
<td>Remote Setpoint Indicator</td>
<td>REM lights when the ECS is set up to be controlled by a Remote (MODBUS) signal. REM will flash when MODBUS communication is active.</td>
</tr>
</tbody>
</table>
| | Auto/Manual Button and Indicators | Pressing the button toggles the Controller between the automatic (AUTO) and manual (MAN) modes.  
- AUTO lights when in the automatic mode.  
- MAN lights when in the manual mode.  
When entering the MAN mode, the Valve position is reset to 0%. |
| | Run/Hold Button and Indicators | Not used for ECS application |
| | Page Button | Press the Page button to select a new list of parameters |
| | Scroll Button | Press the Scroll button to select a new parameter in a list |
| | Down Button | Press the Down button to decrease the value shown in the lower display |
| | Up Button | Press the UP button to increase the value shown in the lower display |

4.3.2 Adjusting the Over-Temperature Alarm Limit

Adjust the over-temperature alarm limit setting using the controls and displays illustrated in Figure 4-4 and described in Table 4-2. Adjust the over-temperature alarm limit as follows:

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 4-4 and Table 4-2. If necessary, over-temperature alarm limit adjustment is accomplished as follows:

1. With the Control Box door open, set the ON/OFF POWER switch on the right side 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).
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 4-4. Over-Temperature Switch

Table 4-2. Over-Temperature Switch Controls and Indicators

<table>
<thead>
<tr>
<th>CONTROL or INDICATOR</th>
<th>MEANING</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Display</td>
<td>TEMP status</td>
<td>Displays current water temperature or setpoint.</td>
</tr>
<tr>
<td>RST</td>
<td>RESET Button</td>
<td>Resets the unit after an alarm condition.</td>
</tr>
<tr>
<td>▲</td>
<td>UP Button</td>
<td>Increases the displayed temperature.</td>
</tr>
<tr>
<td>▼</td>
<td>DOWN Button</td>
<td>Decreases the displayed temperature.</td>
</tr>
<tr>
<td>SET</td>
<td>SET Button</td>
<td>Used to access and store parameters in the unit.</td>
</tr>
</tbody>
</table>
CHAPTER 5  OPERATION

5.1 INTRODUCTION
This chapter provides instructions for:

• Preparing your heat exchanger and Electronic Control System (ECS) for operation (5.2)
• Turning on the heat exchanger and setting it to run automatically (5.3)
• Shutting down and draining the heat exchanger (5.4)

5.2 PRE-OPERATIONAL
1. Refer to Chapter 2 Installation and verify that:
   a. Electrical power is properly connected to the ECS and the CXT-E Control Valve.
   b. All piping connections have been made according to recommended configurations.
   c. All connecting piping has been cleaned (blown) out.
2. Refer to Chapter 4 Adjustments and verify that the Temperature Controller setpoint (4.3.1) and Over-temperature Switch alarm limit (4.3.2) have been set properly.

5.3 STARTUP PROCEDURES
1. Referring to Figure 5-1, press the power switch on the right side of the Control Box to apply power to both the Electronic Control System (ECS) and the CXT-E Control Valve. When power is initially applied, the Temperature Controller automatically performs a self-test sequence for approximately three seconds.
2. When the self-test is complete, the Temperature Controller will show the present hot water outlet temperature in the upper display and the setpoint temperature in the lower display.
3. Set the temperatures to the desired setpoints on the Over-temperature switch and the Eurotherm.
4. Set the Eurotherm into the Man mode and set the Valve position to 0%. If the temperature in the heater increases, see Chapter 7 Troubleshooting.
5. Open the stop valve in the Cold Water Input line and hold the relief valve in the heat exchanger upper head assembly open to enable air to escape (to avoid an air pocket build-up which could prevent the heat exchanger from filling with water). When water flows out of the relief valve, the heat exchanger is full.
6. Open any stop valves in the building or process recirculation system, if such a system is included in the Heater installation.
7. Open the stop valve in the Hot Water Output line. Open hot water faucets or valves in the building or process to ensure a flow of water through the heat exchanger.
8. Slowly open all stop valves in the Steam Input and Condensate Output lines. If double block and bleed valving is used, make sure that the drain (bleed) valve is closed tight.

IMPORTANT
To prevent a possible over-temperature condition during initial start-up, be sure to perform the following steps in the order specified:
9. Referring to Figure 5-2, press the AUTO/MAN pushbutton to toggle the AUTO/MAN display to the MAN (Manual) mode. The MAN indicator will light.

10. The upper display will continue to show the current heat exchanger outlet water temperature, and 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.

11. Using the ▲ arrow button, set the CXT-E Control Valve to the 10% position and monitor the heat exchanger Hot Water Output water temperature.

12. Continue to open the valve further in 5% increments until the Hot Water Output temperature begins to increase at a moderate rate.

13. When the Hot Water Output water temperature has increased to within 20°F of the desired setpoint, press the AUTO/MAN button to set the Temperature Controller to the AUTO mode. The AUTO indicator will light and the MAN indicator will go off. When the Temperature Controller is in the AUTO...
mode, the upper display will continue to show the heat exchanger Hot Water Output water temperature, and the lower display will show the selected setpoint temperature.

14. In the AUTO mode, the ECS will stabilize at the selected setpoint temperature. When stabilized, the ECS is set for unattended operation and no further operator intervention is required.

15. Close the Hot Water faucets or valves that were opened in step 7.

5.4 SHUTTING DOWN AND DRAINING THE HEAT EXCHANGER

To shut down the heat exchanger:

1. Set the Eurotherm to the MAN(ual) in the 0% Valve position.
2. Close all stop valves in the Steam Input and Condensate Output lines.
3. IN THIS ORDER, close the stop valves in the:
   a. Hot Water Output line
   b. Recirculation line
   c. Cold Water Input line

When the heat exchange has been shut down according to steps 1 and 2, drain the heat exchanger as follows:

4. CAREFULLY open the relief valve in the heat exchanger upper head assembly to relieve pressure in the heat exchanger shell. If water continues to flow from the relief valve, one of the cold water stop valves is either leaking or is not shut tightly. Stop the flow from the relief valve and proceed.

5. Holding the relief valve open (to prevent creating a vacuum in the shell), open the plugged drain at the bottom of the heater exchanger shell and drain the heat exchanger completely.
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CHAPTER 6 SCHEDULED MAINTENANCE

6.1 INTRODUCTION

This chapter lists the preventive maintenance procedures recommended for the heat exchanger and Electronic Control System (ECS). These recommendations include procedures to be performed each week (6.2), month (6.3), quarter (6.4), six-month interval (6.5) and year (6.6).

The recommended preventive maintenance schedule is summarized in Table 6-1 at the end of this chapter.

6.2 WEEKLY MAINTENANCE

☐ Tube Leaks

Check the leak detection tube once each week for evidence of leaks in the heat exchanger tubes. MAKE CERTAIN THAT THE DETECTION TUBE NEVER GETS PLUGGED. If any fluid is escaping from the detection tube, shut down the heat exchanger as outlined in Section 5.4 and see Section 9.2 to investigate the leak.

6.3 MONTHLY MAINTENANCE

☐ Steam Strainer

After the first month of operation, clean the strainer in the Steam Input line in accordance with the instructions furnished with the strainer.

☐ CXT-E Control Valve

Check the CXT-E Control Valve ("Valve") for leaks, as follows:

1. Referring to Figure 6-1, check the packing nut and Valve top for evidence of leakage.

2. 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.

   CAUTION
   Take care not to over-tighten the packing nut to avoid trapping the valve stem and slowing or stopping Valve motion.

3. 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 Sections 8.2.2 and 8.2.3.
6.4 QUARTERLY MAINTENANCE

6.4.1 First Three Months

☐ Accumulated Shell Solids

After the first three months of initial operation, drain the heat exchanger as follows:

1. Close all stop valves in the Steam Input and Condensate Output lines.

2. IN THIS ORDER, close the stop valves in the:
   a. Hot Water Output line
   b. Recirculation line
   c. Cold Water Input line

3. CAREFULLY open the relief valve in the upper head assembly to relieve pressure in the shell. If fluid continues to flow from the relief valve, one of the Cold Water Input stop valves is either leaking or is not completely shut off. Securely close all Cold Water Input stop valves until there is no more flow from the relief valve.

4. WITH THE RELIEF VALVE HELD OPEN (to prevent creating a vacuum in the shell), open the plugged drain at the bottom of the shell (see Figure 3-3), and drain the heat exchanger completely.

5. Examine the water being drained.
   a. If the amount of solids in the water being drained appears to be heavy, set a schedule to drain the heat exchanger every 3 months.
   b. If the amount of solids appears to be light, set a schedule to drain the heat exchanger every 6 months.
   c. Even if the amount of solids appears to be very light or not at all, set a schedule to drain the heat exchanger at least once each year.

6. To refill the heat exchanger and place it back into operation, replace the drain plug and perform the Pre-Operational and Operational steps listed in Chapter 5.

6.4.2 Each Quarter

☐ Valve Calibration

Refer to 4.2 and perform the CXT-E Actuator adjustment procedure as instructed.

☐ Over-temperature Switch

Check the operation of the Over-temperature Switch as follows:

1. Refer to 4.3.2 and lower the over-temperature setting to approximately 5°F below the present setpoint, as shown in the lower display of the Temperature Controller.

2. Verify that an over-temperature alarm is generated and the following events occur:
   a. The CXT-E Control Valve closes.
   b. The Over-temperature Solenoid (located at top of heat exchanger) opens and expels water from the system.
   c. The Over-temperature Switch generates an audible alarm.

3. When you have successfully completed the over-temperature alarm check, return the Over-temperature Switch to its original setting.
6.5 SEMI-ANNUAL MAINTENANCE

☐ Actuator

Refer to Section 4.2 and perform the Actuator adjustment procedure presented there. Verify that the Actuator strokes the Control Valve from the fully closed to the fully open position.

☐ Temperature Controller

Check the Temperature Controller operation at least every 6 months. Make any necessary adjustments per Section 5.3, steps 7 through 11.

☐ Steam Strainer

Clean the strainer in the Steam Input line in accordance with the instructions furnished with the strainer.

6.6 ANNUAL MAINTENANCE

☐ Temperature Sensors

AERCO recommends that you check the temperature sensors once a year to ensure that there is no scale build-up or clogging that may degrade system operation. To check the temperature sensors, proceed as follows:

1. Close the upstream and downstream water supply valves to the heat exchanger.

2. Check the DHW Outlet Temperature Sensor at the Hot Water Output port. If necessary, clean it using the following procedure:
   a. Disconnect and remove the DHW Outlet Temperature Sensor (dual thermocouples).
   b. Inspect for evidence of scale buildup on the stainless steel sleeve.
   c. If necessary, clean the thermocouples using a wire brush.

3. After cleaning, reinstall both thermocouples and ensure they are tightened securely.

4. Open all valves that were closed in Step 1 and restore the heat exchanger to operation.

☐ Recirculation Pump

The recirculation pump is located in the recirculation line, just above the Cold Water Input.

1. Turn the power switch on the Control Box to OFF.

2. Ensure that the water has been drained from the unit (see 6.4.1, steps 1-4).

   **WARNING**

3. Locate the recirculation pump and disconnect the flanges from the recirculation piping.

4. Without pulling on the electrical conduit attached to the recirculation pump, carefully slide it out and inspect it.
5. If there is evidence of scale build-up, disconnect the conduit and electrical power lines from the pump and service or replace it, as necessary.

6. If there is no evidence of scale build-up on the recirculation pump, reinstall it and reconnect the wiring and flanges.

**Table 6-1. Recommended Maintenance Schedule**

<table>
<thead>
<tr>
<th>Maintenance Check</th>
<th>Week (6.3)</th>
<th>Month (6.4)</th>
<th>Quarter (6.5)</th>
<th>Six Months (6.6)</th>
<th>Year (6.7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Tube Leak</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Control Valve Leak</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Vacuum Breaker(s)</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Shell Solids*</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>□ Over-temperature Switch Alarm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>□ Temperature Controller</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Actuator Adjustment</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Steam Strainer</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Over-temperature Switch</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>□ Temperature Sensor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>□ Recirculation Pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

* Perform the first test for shell solids upon completion of the first three months of heat exchanger operation. Depending upon the results (see 6.4.1, Step 5), repeat this test quarterly, semi-annually or annually.
CHAPTER 7 TROUBLESHOOTING

7.1 INTRODUCTION

This section provides you with troubleshooting procedures for isolating faults to the most probable cause whenever malfunctions occur in the heat exchanger (Table 7-1), CXT-E Electronic Control Valve (Table 7-2), or Electronic Control System (ECS; Table 7-3). Table 7-4 provides troubleshooting tips for correcting control system faults, and Table 7-5 provides the dynamic temperature control settings for the three models of the DW-Series water heater product line.

Before performing the troubleshooting steps and procedures provided in Tables 7-1 through 7-4, complete the following preliminary checks:

1. ELECTRONIC CONTROL VALVE, CXT-E
   a. Verify that all piping connections have been made in accordance with Figure 2-4 and that all electrical connections have been made in accordance with Figure 2-7.
   b. Ensure that the Electronic Control Valve (“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.

2. ELECTRONIC CONTROL SYSTEM
   a. 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.

**NOTE**

When system malfunctions occur, check the troubleshooting sections of the manuals for any other equipment included in this installation, as necessary, in addition to the procedures provided in this section. Appendix A of this manual contains process fault and diagnostic alarm information for the Eurotherm, Model 2408 Temperature Controller.

7.2 TROUBLESHOOTING PROCEDURES

When a heat exchanger 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. 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. If component removal and/or replacement is required, refer to the applicable procedures in Chapter 8 Corrective Maintenance.
<table>
<thead>
<tr>
<th>NO.</th>
<th>FAULT INDICATION</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>The heat exchanger does not maintain the required temperature at rated capacity.</td>
<td>1. The Control Valve does not open.</td>
<td>1. Check the instructions in Table 7-2.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. There is a leak in either the inside or outside wall of one or more of the heat exchanger tubes, as indicated by a flow from the leak detection port.</td>
<td>2. Refer to Chapter 9, section 9.2, and proceed as instructed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Recirculating pump failure.</td>
<td>3. Proceed as follows:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. The heat exchanger tubes are scaled up.</td>
<td>a. Check input power to the recirculation pump.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. The heat exchanger is being used at a rate higher than its design capacity.</td>
<td>b. Check the temperature of the copper tube above the pump.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Steam pressure is too low.</td>
<td>It should be the same as the outlet DHW temperature. If cold, repair or replace the pump, as needed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Condensate is backing up into the heat exchanger because of a restriction in the condensate drain line.</td>
<td>4. Contact AERCO or your nearest AERCO representative.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. The condensate return piping has not been installed so as to enable the condensate to drain freely by gravity, and/or the condensate check valve leaks or has failed.</td>
<td>5. Contact AERCO or your nearest AERCO representative.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9. Thermocouple is not installed in the water flow.</td>
<td>6. Check the supply pressure gauge ahead of the Control Valve. If the reading is low, adjust the steam supply pressure to the required value. If the steam supply line is restricted, the gauge reading will drop excessively when the heat exchanger calls for full steam, even though the pressure seems to be normal when the load is light. If the steam supply pressure is correct, the steam pressure compound gauge reading should reach design pressure for steam in the heat exchanger tubes as the Hot Water Output temperature starts to drop. If it does not, check the operation of the Control Valve.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10. The Temperature Controller reads wrong.</td>
<td>7. Contact AERCO or the nearest AERCO representative for the trap size required and make the necessary correction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8. If necessary, rearrange the condensate return piping to permit condensate to drain freely from the heat exchanger connection. Inspect the condensate check valve and replace it if it is leaking or has failed. Also, ensure that there is no restriction in the condensate drain line.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9. Check to ensure that the thermocouple sheath does not protrude more than ½” from the compression fitting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10. Check by replacing the Temperature Controller with one known to be correct.</td>
</tr>
</tbody>
</table>
### Table 7-1. TROUBLESHOOTING – HEAT EXCHANGER, continued

<table>
<thead>
<tr>
<th>NO.</th>
<th>FAULT INDICATION</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2</td>
<td>Heat exchanger overheats</td>
<td>1. Temperature Controller is indicating the wrong value.</td>
<td>1. Check by replacing the Temperature Controller with one known to be correct.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Water is preheated too hot.</td>
<td>2. Reduce the preheating to a temperature at least 10°F below the desired Hot Water Output temperature.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Termocouple is not installed in the water flow.</td>
<td>3. Check to ensure that the thermocouple sheath does not protrude more than ½&quot; from the compression fitting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Leaking valve in by-pass line, if any, around the Control Valve.</td>
<td>4. Maintain the valve to shut tight.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. The Steam Input does not close.</td>
<td>5. Check the instructions in Table 7-2, Item T11.</td>
</tr>
<tr>
<td>T3</td>
<td>Hot water outlet temperature fluctuates widely</td>
<td>1. The Control Valve does not close.</td>
<td>1. Determine if the packing is too tight. See the instructions in Table 7-2.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. The Control Valve does not open.</td>
<td>2. Determine if the packing is too tight. See the instructions in Table 7-2.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. There is a leak in either the inside or outside wall of one or more of the heat exchanger tubes, as indicated by a flow from the leak detection port.</td>
<td>3. Refer to Chapter 9, Section 9.2, and proceed as instructed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. The heat exchanger is being used at a rate higher than its design capacity.</td>
<td>4. Contact AERCO or your nearest AERCO Representative for advice in remedying this problem.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Steam pressure is too low.</td>
<td>5. Check the supply pressure gauge ahead of the Control Valve. If the reading is low, adjust the steam supply pressure to the required value. If there is a restriction in the steam supply line, the gauge reading will drop excessively when the heat exchanger calls for full steam, even though the pressure seems to be normal when the load is light. If the steam supply pressure is correct, the steam pressure compound gauge reading should reach design pressure for steam in the heat exchanger tubes as the Hot Water Output temperature starts to drop. If it does not, check the operation of the Control Valve.</td>
</tr>
</tbody>
</table>
### Table 7-1. TROUBLESHOOTING – HEAT EXCHANGER, continued

<table>
<thead>
<tr>
<th>NO.</th>
<th>FAULT INDICATION</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Continued)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>No check valve in the condensate drain line.</td>
<td>6. Lack of this check valve can allow condensate — and live Steam, if present — to be drawn back into the heat exchanger from the condensate line. This can result in a high back pressure, water hammer, and, if live steam is present, over-heating. Install a check valve in the condensate drain line as indicated in Appendix C, Figure C1 through Figure C5.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Condensate is backing up into the heat exchanger because of a restriction in the condensate drain line such as an undersized or faulty trap.</td>
<td>7. Check AERCO or the nearest AERCO Representative for the trap size required and make the necessary correction.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>The condensate return piping has not been installed so that the condensate drains freely by gravity and/or the condensate check valve leaks or has failed.</td>
<td>8. If necessary, rearrange the condensate return piping to permit condensate to drain freely from the heat exchanger connection. Inspect the check valve and replace it if it is leaking or has failed. Also, check to make sure that there is no restriction in the condensate drain line.</td>
<td></td>
</tr>
</tbody>
</table>
| 9.  | Recirculation pump is malfunctioning. | 9. Proceed as follows: 
  a. Check input power to the recirculation pump.  
  b. Check the temperature of the copper tube above the pump. It should be the same as the outlet DHW temperature. If cold, repair or replace the pump, as required. |
| T4  | Insufficient water flow rate through the heat exchanger | 1. Cold Water Input pressure is low.  
  2. There is a leak in either the inside or outside wall of one or more of the heat exchanger tubes, as indicated by a flow from the leak detection port.  
  3. Check valves may not be fully open. |
|     |                                   | 1. Check the pressure to the heater and correct, if necessary.  
  2. Refer to Section 9.2 and proceed as instructed.  
  3. Verify that the check valves on the CW and DHW sides are fully open. |
<table>
<thead>
<tr>
<th>NO.</th>
<th>FAULT INDICATION</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
</table>
| T5  | Excess or insufficient condensate being returned from the heat exchanger | 1. There is a leak in either the inside or outside wall of one or more of the heat exchanger tubes, as indicated by a flow from the leak detection port.  
2. Condensate is backing up into the heat exchanger because of a restriction in the condensate drain line, such as an undersized or faulty trap.  
3. The condensate return piping has not been installed so as to enable the condensate to drain freely by gravity, and/or the condensate check valve leaks or has failed. | 1. Refer to Section 9.2 and proceed as instructed.  
2. Check AERCO or the nearest AERCO Representative for the trap size required and make the necessary correction.  
3. If necessary, rearrange the condensate return piping to permit condensate to drain freely from the heat exchanger connection. Inspect the check valve and replace it if it is leaking or has failed. Also, check to make sure that there is no restriction in the condensate drain line. |
| T6  | Steam being discharged from heat exchanger at too high a temperature | The heat exchanger tubes are scaled up.                                                                                                        | Contact AERCO or your nearest AERCO Representative for advice concerning the required remedy.                                                     |
| T7  | Pressure/temperature relief valve pops               | 1. Static pressure of the Cold Water is too high.  
2. Fluid to be heated is preheated too hot.  
3. Leaking valve in by-pass line, if any, around the Control Valve.  
4. Lack of expansion capability in the hot water system.  
5. Insufficient shock absorbers.  
6. The Control Valve does not close.  
7. The Over-temperature Limit Switch is out of adjustment, or some component of the system has failed. | 1. Make corrections necessary to bring the pressure below the relief valve setting.  
2. Reduce the preheating to a temperature at least 10°F below the desired Hot Water Output temperature.  
3. Maintain the valve to shut tight.  
4. Insert an expansion tank in the Hot Water Output line near the heat exchanger.  
5. Insert shock absorbers (water hammer arrestors) in both the cold and hot water systems, as needed to eliminate shock waves.  
6. Check the instructions in Table 7-2.  
7. Check the Over-temperature Limit Switch setting and adjust to the specified setting (usually 20°F higher than the desired Hot Water Output temperature) (See 4.3.2). Inspect and repair or replace each component as necessary. |
Table 7-1. TROUBLESHOOTING – HEAT EXCHANGER, continued

<table>
<thead>
<tr>
<th>NO.</th>
<th>FAULT INDICATION</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Continued)</td>
<td>8. The condensate return piping has not been installed so as to enable the condensate to drain freely by gravity, and/or the condensate check valve leaks or has failed.</td>
<td>8. If necessary, rearrange the condensate return piping to permit condensate to drain freely from the heat exchanger connection. Inspect the Check Valve and replace it if it is leaking or has failed. Also, check to make sure that there is no restriction in the condensate drain line.</td>
<td></td>
</tr>
<tr>
<td>T8</td>
<td>Heat exchanger shuts down below Hot Water Output temperature.</td>
<td>The Over-temperature Limit Switch is out of adjustment or some component of the system has failed.</td>
<td>Check the over-temperature Limit Switch setting per 4.3.2. Inspect and repair or replace each component as necessary.</td>
</tr>
<tr>
<td>T9</td>
<td>Loud banging in heat exchanger or in steam piping - not to be confused with the normal clicking noise</td>
<td>1. Faulty vacuum breaker. 2. Lack of expansion capability in the hot water system. 3. Insufficient shock absorbers. 4. No check valve in the condensate drain line. 5. Supply steam line is not properly trapped. 6. The condensate return piping has not been installed so as to enable the condensate to drain freely by gravity, and/or the condensate check valve leaks or has failed.</td>
<td>1. Check the vacuum breaker for faulty operation. If faulty, replace vacuum breaker. 2. Insert an expansion tank in the Hot Water Output line near the heat exchanger. 3. Insert shock absorbers (water hammer arresters) in both the cold and hot water systems, as needed to eliminate shock waves. 4. Lack of this check valve can enable condensate — and live steam, if present — to be drawn back into the heat exchanger from the condensate line. This can result in a high back pressure, water hammer, and if live steam is present, over-heating. Install a check valve in the condensate drain line as indicated in Appendix C, Figure C1 through Figure C5. 5. Install a trap as indicated in Appendix C, Figure C1 through Figure C5. 6. If necessary, rearrange the condensate return piping to permit condensate to drain freely from the heat exchanger connection. Inspect the check valve and replace it if it is leaking or has failed. Also, check to make sure that there is no restriction in the condensate drain line.</td>
</tr>
</tbody>
</table>
## Troubleshooting - Electronic Control Valve CXT-E

<table>
<thead>
<tr>
<th>NO.</th>
<th>Fault Indication</th>
<th>Probable Cause</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>T10</td>
<td>System not operating. Control Valve is closed and Hot Water Output water temperature is far below setpoint.</td>
<td>1. Power is not being supplied to the Control Valve.</td>
<td>1. Disconnect Actuator plug and verify that 24 VDC power is present at pin 2 of the Actuator cable. Restore power as necessary. Proceed to Table 7-3, Item T17, and verify that the Over-temperature Switch is not tripped.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. The Actuator has failed.</td>
<td>2. Replace Actuator.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Control signal is not being supplied from the Temperature Controller.</td>
<td>3. Verify presence of 4 – 20 mA control signal at pin 3 of the Actuator cable. If the control signal is not present, troubleshoot ECS per Table 7-3.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. The Actuator linkage has failed.</td>
<td>4. Check Actuator linkage and verify that it is properly connected and that the pin in the linkage is in the correct position for the installed Valve size.</td>
</tr>
<tr>
<td>T11</td>
<td>System overheats by more than 10°F above the desired setpoint. Outlet temperature is below the over-temperature limit setting.</td>
<td>1. Control Valve is not fully closed.</td>
<td>1. Check the 4 – 20 mA control signal being supplied to the Actuator. If the signal is greater than 4 mA when the heater outlet temperature is 10°F (or more) above the desired setpoint, proceed to next item on the list.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Actuator U-bolt loose.</td>
<td>2. Check Actuator U-bolt securing it to the linkage assembly. Tighten as needed (per 8.2.4, Step 55) and readjust the CXT-E Control Valve per 4.2.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. The Actuator has failed.</td>
<td>3. Replace Actuator.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Temperature Controller is not set properly or is defective.</td>
<td>4. Refer to Chapter 4 Adjustments. Check the current setting of the Temperature Controller. Readjust if necessary. If adjustment does not clear the fault, proceed to Table 7-3, Item T16, and proceed as instructed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Actuator is not properly secured to the linkage assembly.</td>
<td>5. Check the Actuator U-bolt that secures the linkage assembly. Tighten if needed and readjust the Control Valve per section 4.2.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Foreign matter in the Control Valve seat</td>
<td>6. If the Valve still does not close after checking the above items, disassemble the Valve and clean the seat per 8.2.2, steps 18 – 28.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Recirculation pump failure.</td>
<td>7. Proceed as follows:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>a. Check input power to the recirculation pump.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b. Check the temperature of the copper tube above the pump. It should be the same as the outlet DHW temperature. If cold, repair or replace the pump, as required.</td>
</tr>
</tbody>
</table>
### Table 7-2. TROUBLESHOOTING – ELECTRONIC CONTROL VALVE CXT-E, continued

<table>
<thead>
<tr>
<th>NO.</th>
<th>FAULT INDICATION</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T12</td>
<td>System outlet water temperature is below desired setpoint.</td>
<td>1. Temperature Controller is not set properly.</td>
<td>1. Refer to 4.3.1 and check the current Temperature Controller setting. If the setting is below the desired setpoint, readjust as necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Control Valve is not opening properly.</td>
<td>2. Proceed as follows:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Steam pressure is too low</td>
<td>a. Ensure that the Actuator is correctly secured to the Control Valve linkage assembly. Tighten mounting bolts, as needed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Trap in Condensate Output line is malfunctioning.</td>
<td>b. Verify that 24 VDC power and 4 - 20 mA control signal are present at Actuator pins 2 and 3, respectively.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>c. To ensure that the Valve is not binding, check the Valve shaft seal retainer per 8.2.1, steps 1 through 10. Replace items as necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Check the high-side steam pressure to the Control Valve to ensure it is correct.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>a. If steam pressure is lower than the system design specification, correct as necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b. If the high-side steam pressure drops as the Control Valve opens, the strainer may be clogged, or there may be a partially closed valve in the upstream line. Correct as required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. Check for improper operation of the trap in the Condensate Output line, as follows:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>a. If the low-side pressure gauge shows pressure, but steam does not heat properly, CAREFULLY break the Condensate Output line connection AHEAD of the trap.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b. Allow condensate to run out into the floor drain.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>c. If the heat exchanger outlet temperature rises to the desired setpoint with the condensate connection open, repair or replace the trap.</td>
</tr>
</tbody>
</table>

**CAUTION**

Do not over-tighten the packing nut, as it may trap the Valve stem and slow or stop Valve motion.
### Table 7-2. TROUBLESHOOTING – ELECTRONIC CONTROL VALVE CXT-E, continued

<table>
<thead>
<tr>
<th>NO.</th>
<th>FAULT INDICATION</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
</table>
| T13 | Wide variations in heat exchanger outlet temperature during wide flow variations. | 1. Mixed water temperature sensor is malfunctioning.                            | 1. Refer to Table 7-3 Item T21, and check the operation of the mixed water temperature sensor.  
  2. Recirculation pump is malfunctioning.                                                                 1. Proceed as follows:  
  a. Check input power to the recirculation pump.  
  b. Check the temperature of the copper tube above the pump. It should be the same as the outlet DHW temperature. If cold, repair or replace the pump, as required. |
|     |                                                                                  | 2. Recirculation pump is malfunctioning.                                       |                                                                                                                                                                                                                                                                                                     |
| T14 | Rapid fluctuations in heater outlet temperature which do not follow load changes   | 1. Temperature Controller is malfunctioning.                                   | 1. Refer to Table 7-3, Items T16 and T19 to troubleshoot the Temperature Controller.  
  2. Steam Trap or orifice fault                                                                                                                                  2. Refer to T12, Corrective Action 4 above and proceed as directed. |
|     |                                                                                  | 2. Steam Trap or orifice fault                                                |                                                                                                                                                                                                                                                                                                     |
| T15 | System not operating. All displays are blank.                                    | 1. External 120 VAC power is disconnected.                                     | 1. Ensure that the external circuit breaker is ON. Check for 120 VAC power across TB-2 terminal leads 101 (Line) and 102 (Neutral).  
  2. Defective ON/OFF power switch on Control Box.                                                                                                               2. Set ON/OFF power switch to the ON (Up) position and verify that the switch indicator lights. Also:  
  a. Verify that 120 VAC is present across TB-2 terminal leads 100 (Line) and 102 (Neutral).  
  b. If voltage is not present, replace the ON/OFF power switch.                                                                                                     |
| T16 | Love Over-temperature Switch display is blank.                                    | Defective DC Power Supply                                                     | Disconnect the DC output connector on the left internal wall of the Control Box (Figure 8-12b). Verify that 24 VDC is present across the V+ and V-terminals. If 24 VDC is not present, replace the DC Power Supply.                                                         |
| T17 | Hot Water Output temperature consistently above setpoint by 10°F, or more. However, | 1. Temperature Controller is not set properly.                                 | 1. Refer to Chapter 4 Adjustments and check current setting of Temperature Controller. Readjust as necessary.  
  temperature is below over-temperature limit setting.                                                                                                           2. Verify that Hot Water Outlet Temperature Sensor is securely connected to the cable plug. Replace the DHW Outlet Temperature Sensor, if necessary.  
  2. Faulty Temperature Sensor (thermocouple) is connected to Temperature Controller.  
  3. Valve Actuator is not properly secured to the linkage assembly.                                                                                           3. Verify that the Actuator is securely fastened to the linkage assembly. Tighten as needed and readjust the CXT-E Control Valve per Chapter 4.  
  4. Polarity of J-Thermocouple connection is reversed. [Should be Red (-) White (+)]  
|     |                                                                                  | 2. Faulty Temperature Sensor (thermocouple) is connected to Temperature Controller. |                                                                                                                                                                                                                                                                                                     |
|     |                                                                                  | 3. Valve Actuator is not properly secured to the linkage assembly.             |                                                                                                                                                                                                                                                                                                     |
|     |                                                                                  | 4. Polarity of J-Thermocouple connection is reversed. [Should be Red (-) White (+)] |                                                                                                                                                                                                                                                                                                     |
### Table 7-3 TROUBLESHOOTING – ELECTRONIC CONTROL SYSTEM

<table>
<thead>
<tr>
<th>NO.</th>
<th>FAULT INDICATION</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
</table>
| T18 | Over-temperature alarm occurs repeatedly.  
     | 1. Over-temperature Switch is not set properly.  
     | 2. Open or shorted Hot Water Outlet temperature sensor (thermocouple) is connected to the Over-temperature Switch.  
     | 3. Over-temperature Switch is defective. | 1. Refer to Chapter 4 and check the current setting of the Over-temperature Switch. Readjust as necessary.  
     | 2. Check thermocouple connections between Hot Water Outlet sensor connector plug and TB-1 terminal leads 111 (+) and 112 (-). If connections are secure, replace the Dual-temperature Sensor.  
     | 3. Replace the Over-temperature Switch. |
| T19 | Over-temperature alarm condition cannot be cleared.  
     | 1. Shorted Hot Water Output temperature sensor.  
     | 2. Defective Over-temperature Switch  
     | 3. A “No-Flow” condition is causing a gradual buildup of heat in the vessel water.  
     | 4. External recirculation pump has shut off or has failed.  
     | 5. Over-temperature Switch setting is too low.  
     | 6. Packing nut is too tight.  
     | 7. Over-temperature Solenoid Valve is leaking or open. | 1. Replace Hot Water Output Temperature Sensor.  
     | 2. Replace Over-temperature Switch.  
     | 3. Open heat exchanger Hot Water Outlet to see if fault clears. If there is no flow through the heat exchanger, see Probable Cause 4.  
     | 4. Check pump to ensure that it is turned on and functioning properly. Also, check for blockage in the incoming flow.  
     | 5. Refer to Chapter 4 and check the current setting of the Over-temperature Switch. Readjust as necessary.  
     | 6. Loosen the packing nut and re-tighten it avoiding the use of excessive force.  
<pre><code> | 7. Inspect the solenoid valve for evidence of leaks. If leaks are detected, replace the solenoid valve. |
</code></pre>
<table>
<thead>
<tr>
<th>NO.</th>
<th>FAULT INDICATION</th>
<th>PROBABLE CAUSE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T20</td>
<td>Outlet water temperature is far below setpoint</td>
<td>1. Incorrect Temperature Controller setting</td>
<td>1. Refer to Chapter 4 and check the current setting of the Over-temperature Switch. Readjust as necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Defective Temperature Controller.</td>
<td>2. Disconnect the cable plug from the Valve Actuator and verify that the Temperature Controller is generating a control signal greater than 4 mA. If not, replace the Temperature. Controller.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Linkage not properly connected.</td>
<td>3. Check the Control Valve linkage to verify that it is properly connected and that the pin in the linkage is in the correct position for the selected Valve size.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Defective Actuator.</td>
<td>4. Replace the Valve Actuator.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Control Valve shaft may be binding</td>
<td>5. Refer to Table 7-2, Fault T12, Corrective Action 2c and perform the indicated action.</td>
</tr>
<tr>
<td>T21</td>
<td>Wide fluctuations occur in Hot Water Output water temperature during large flow</td>
<td>1. Heat exchanger recirculation pump is not operating.</td>
<td>1. Check the power to the recirculation pump.</td>
</tr>
<tr>
<td></td>
<td>changes.</td>
<td>2. Over-temperature Switch setting is too low.</td>
<td>2. Refer to Chapter 4 and check the current setting of the Over-temperature Switch. Readjust as necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Over-temperature Solenoid Valve is leaking or open.</td>
<td>3. Inspect the solenoid valve for evidence of leaks. If leaks are detected, replace the solenoid valve.</td>
</tr>
<tr>
<td>T22</td>
<td>Wide fluctuations occur in Hot Water Output water temperature under low flow</td>
<td>1. DHW Outlet Temperature Sensor connected to the Temperature Controller is intermittent.</td>
<td>1. Replace DHW Outlet Temperature Sensor at the heat exchanger Hot Water Output port.</td>
</tr>
<tr>
<td></td>
<td>conditions.</td>
<td>2. Mixed water temperature sensor is open, shorted or gives inconsistent readings.</td>
<td>2. Replace mixed water temperature sensor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Recirculation pump has failed</td>
<td>3. Replace recirculation pump.</td>
</tr>
<tr>
<td>T23</td>
<td>Hot Water Output temperature above over-temperature limit, but solenoid (Dump)</td>
<td>1. Disconnected or defective solenoid</td>
<td>1. Verify that 24 VDC is present at the solenoid plug between leads 103(+) and 104 (-). If voltage is present and the solenoid is connected, replace the solenoid. If 24 VDC is not present, proceed to Item 2, below.</td>
</tr>
<tr>
<td></td>
<td>valve does not open.</td>
<td>2. Defective Over-temperature Switch</td>
<td>2. Replace Over-Temperature Switch.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Solenoid valve wiring is loose or reversed.</td>
<td>3. Verify that solenoid valve wiring is secure and connected per Figure B-1.</td>
</tr>
</tbody>
</table>
CHAPTER 8  CORRECTIVE MAINTENANCE

8.1  INTRODUCTION

This chapter documents AERCO’s recommended corrective maintenance procedures for the packaged assembly of the DW-series heat exchanger, the CXT-E Control Valve and the Electronic Control System (ECS). This chapter is organized as follows:

- CXT-E Control Valve (8.2)
- Electronic Control System (8.3)

8.2 CXT-E ELECTRONIC CONTROL VALVE

The corrective maintenance procedures for the CXT-E Control Valve are organized as follows:

- Valve Shaft Seal Retainer Replacement (8.2.1)
- Valve Disassembly (8.2.2)
- Valve Reassembly (8.2.3)
- Actuator Replacement (8.2.4)
- Linkage Assembly Replacement (8.2.5)

Refer to the following drawings and parts list tables to perform the indicated operations on the AERCO Type CXT-E Actuator and Valve Assembly:

<table>
<thead>
<tr>
<th>Size</th>
<th>Figure</th>
<th>Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00&quot; to 2.00&quot;</td>
<td>Figure 8-1</td>
<td>Table 8-1</td>
</tr>
<tr>
<td>2.50&quot; to 4.00&quot;</td>
<td>Figure 8-2</td>
<td>Table 8-2</td>
</tr>
</tbody>
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Figure 8-1. CXT-E Actuator and Control Valve Assemblies, (Sizes 1.00” To 2.00”)

THIS PIN LOCATION TO BE USED ON ALL 1.0” TO 2.0” VALVE ASSEMBLY CONFIGURATIONS

ACTUATOR 27

LINKAGE 26

SHAFT PIN

LINKAGE ADAPTER

FAR SIDE 28

INDICATOR PLATE

17 16 18
14 29 21 13 23
30 11 10 12
33 34
24 6 2
3 31
5
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<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NAME</th>
<th>VALVE SIZE AND PART NUMBERS</th>
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<tr>
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<td>SEAT CAGE</td>
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<tr>
<td>3</td>
<td>1</td>
<td>BOTTOM PISTON</td>
<td>121540</td>
</tr>
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<td>4</td>
<td></td>
<td>NOT USED</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>VALVE PLUG SHAFT</td>
<td>16849</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>TOP PISTON</td>
<td>121539</td>
</tr>
<tr>
<td>7</td>
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<td>DISC SEAT</td>
<td>121541</td>
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<td>8</td>
<td>1</td>
<td>RETAINING DISC</td>
<td>121542</td>
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<td>9</td>
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<tr>
<td>10</td>
<td></td>
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<td>121528</td>
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<tr>
<td>11</td>
<td>1</td>
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<td>23</td>
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### Table 8-1. PARTS LIST FOR VALVE ASSEMBLIES, TYPE CXT-E (SIZES 1.00” TO 2.00”), continued

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<td>35</td>
<td>1</td>
<td>VALVE STEM RETAINING NUT</td>
<td>121503</td>
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Figure 8-2. CXT-E Actuator and Control Valve Assemblies (Sizes 2.50” To 4.00”)

Rev C Aug 2, 2017
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<td>VALVE SEAT RETAINING DISC</td>
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<td>9</td>
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<td>10-32 x 3/4&quot; LG. SOCKET HD.</td>
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<td></td>
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<td>CAP SCREW</td>
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<td>CAP SCREW 5/8-11 x 1-1/2&quot; LG.</td>
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<td>3/8-16 NUT (4&quot; VALVE ONLY)</td>
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<td>LOCK WASHER</td>
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<td>25</td>
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<td>1/4&quot; HEX HD. NPT PLUG</td>
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Table 8-2. PARTS LIST FOR VALVE ASSEMBLIES, TYPE CXT-E (SIZES 2.50" TO 4.00"), continued

<table>
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<td>59028-2.50</td>
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<tr>
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<td>GASKET</td>
<td>81046</td>
</tr>
<tr>
<td>30</td>
<td>2</td>
<td>HEX NUT, 8-32</td>
<td>123332</td>
</tr>
<tr>
<td>31</td>
<td>1</td>
<td>PILOT SPRING BACKUP WASHER</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**8.2.1 Valve Shaft Seal Retainer Replacement**

**WARNING**

BEFORE PROCEEDING WITH THIS OPERATION, ENSURE THAT THE CONTROL VALVE HAS BEEN ISOLATED FROM THE STEAM SUPPLY. LIVE STEAM CAN CAUSE SERIOUS BURNS TO PERSONNEL.

**WARNING**

ENSURE THAT ELECTRICAL POWER TO THE ELECTRONIC CONTROL SYSTEM AND ACTUATOR HAS BEEN DISCONNECTED. SERIOUS INJURY TO PERSONNEL CAN RESULT IF THIS WARNING IS NOT OBSERVED.

To replace the valve shaft seal retainer proceed as follows:

1. Referring to Figure 8-1 or Figure 8-2, loosen the hex nuts (17) under the indicator plate approximately one-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. With the Actuator assembly (27) still attached, remove the complete linkage assembly (26) from the valve top. Also, remove the gasket (29).
6. If the packing nut (18) is leaking or binding the Valve shaft, replace it.
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. 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.
CAUTION
In the following steps, avoid over-tightening the packing nut (18), which can 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 7.

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.

15. **Critical Step:** Autostroke the Valve and check for leaks.

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

16. Close the upstream and downstream shutoff valves before and after the CXT-E Control Valve.

17. If the CXT-E Control Valve is easily accessible for disassembly and reassembly, leave it installed in the Steam Input line. If it is not easily accessible, remove the Valve from the line and clamp it in a bench vise for easy accessibility.

18. Completely remove the Actuator (27) and linkage assembly (26) from the Valve body, as described in steps 1 through 5, above.

19. The following steps cover complete Valve disassembly, in the event it should ever be required. IT IS STRONGLY RECOMMENDED, however, that the Valve be disassembled only to the extent necessary to restore it to proper operation. When disassembling the Valve, USE EXTREME CARE not to mar or scratch any surfaces.

   The following steps assume that the Actuator and linkage assemblies have been removed from the Valve body.

20. Remove the following Valve parts in the order specified:

   CAUTION
   CAREFULLY remove the packing nut (18) and cap screws (14) (listed below) to relieve any trapped pressure.
   a. Hex nuts (17)
   b. Packing nut (18)
   c. Packing assembly (20)
   d. Cap screws (14)
   e. Valve top (21)
   f. Valve top gasket (13)

21. Grasp the lower shaft (16) and carefully remove the ENTIRE shaft/seat/piston assembly.

22. For 1-inch through 2-inch Control Valves (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)

23. For 2.5-inch, 3-inch and 4-inch Control Valves, (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 backup 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 stern (12)
   h. Valve seat (7)
   i. Top piston (6) and bottom piston (3) assembly

24. DO NOT DISASSEMBLE the seat cage (2) unless you need to replace it. If seat cage replacement is required, see Step 30.

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

25. 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).

26. Inspect the Valve stem (12). If the Valve stem (12) is damaged or does not seat properly on the Valve seat (7), or if it does not move freely in the Valve seat retaining disc (8), replace the Valve stem (12), pilot spring retainer (11) and pilot spring (10).

27. Inspect the outer surfaces of the Valve plug (5) or the top piston (6) and bottom piston (3). If they are scored or damaged such that they will not move freely up and down in the Seat Cage (2), the Valve plug or pistons must be replaced. Reassembly instructions are provided below beginning with step 33.

28. Inspect the Valve seat (7). Replace the Valve seat if it is worn and does not seat properly with the seat cage (2) (or with the Valve stem (12), in the case of 2.5 to 4 inch Valves).

29. THOROUGHLY clean and inspect the seating and inner surfaces of the seat cage (2). Replace the cage (2) if the seating surface around the top of the cage is worn or so damaged that the Valve seat (7) will not seat properly, or if the inner surfaces of the cage are scored or are so damaged that the Valve plug (5) or pistons (3) and (6) do not move up and down freely.

30. If it is necessary to remove the cage (2) from the Valve body (1), first fabricate a tool similar to the one illustrated in Figure 8-3. Insert the tool into the slots on top of the cage (2) and turn the cage out of the Valve body. You may also obtain a cage removal tool from AERCO by contacting AERCO directly or through your nearest sales representative.
Figure 8-3. Cage Removal Tool
8.2.3 Valve Reassembly

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

31. If the seat cage has been removed, place a NEW seat cage gasket (24) on the seating surface of the Valve body. When this has been accomplished, use the tool described in Step 29 to replace the seat cage (2) in the Valve body (1). Ensure that the seat cage fits tightly.

32. If they have been disassembled or are being replaced, reassemble the top piston (6) and bottom piston (3) onto the Valve plug shaft (5) using the top piston retaining nut (46) (for 1-inch through 2-inch Valves), and the bottom piston retaining nut (50) or bottom piston retaining ring (4).

33. For 1-inch through 2-inch Control Valves, (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)

34. For 2.5-inch, 3-inch and 4-inch Control Valves (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 backup washer (31), 4-inch Valve only
   h. Pilot spring retainer (11)
   i. Lock washer (23)

35. Holding the lower shaft (16), carefully replace the entire shaft/seat/piston assembly into the Valve body (1) and seat cage (2).

36. 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 cloth or both.
37. Referring to Figure 8-1 or Figure 8-2, reassemble the following parts in the order indicated:
   a. NEW Valve top gasket (13)
   b. Valve top (21)
   c. Cap screws or hex-head bolts (14):
      • For valve sizes 2-1/2" to 4" use 1/2-13 cap screws
      • For valve sizes 1" to 2" use 3/8-16 hex-head bolts
      Tighten the cap screws using an alternating pattern to 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 Figure 8-2)

38. Replace the Actuator (27), linkage (26) and gasket (29) onto the Valve top (21) and secure with cap screws (19).

39. Position the hex nuts (17) in the original location noted during the removal process (Step 7).

40. Install the indicator plate on the Valve shaft (16) with the curved end facing upward (Figure 8-6).

41. 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.

42. Press down on the Valve shaft (16) to compress the pilot spring (10) in the Valve body.

43. 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.

44. If the Valve had been removed from the steam line, replace it and reconnect the electrical connector plug to the Actuator.

45. Before placing the Valve back into service, adjust the CXT-E Actuator according to Section 4.2.
### 8.2.4 Actuator Replacement

The Actuator includes no repairable parts. Therefore, if the troubleshooting procedures point to the Actuator as the cause of the fault, replace it as described in the following steps:

46. Disconnect and lock-out/tag-out the AC power supplied to the Control Box. Use a voltmeter to ensure that all voltages are zero before continuing.

47. Disconnect the Control Box cable connected to the Actuator.

48. Use an 8-mm wrench to loosen the hex nuts securing the Actuator to the linkage shaft.

49. Completely remove the defective Actuator from the shaft.

50. To install a replacement Actuator, depress and hold the clutch button (see Figure 8-5) and rotate the pointer to approximately 80° on the dial. Release the clutch.
51. Slide the Actuator onto the linkage shaft.

52. Ensure that the pin on the linkage assembly is inserted in the center slot on the bottom of the Actuator (Figure 8-5).

53. Verify that the indicator plate on the linkage assembly is aligned with "0" (zero) on the linkage scale. Also, ensure that the Actuator dial is approximately at the 80° position.

54. Ensure that the pin on the linkage is inserted in the center slot on the Actuator.

55. Use an 8-mm wrench to tighten the hex nuts on the U-bolt to secure the Actuator to the shaft. Torque the hex nuts to 60 inch-pounds.

56. Reconnect the Control Box cable to the Actuator.

57. When you have completed the Actuator replacement, perform the Control Valve adjustment procedure in Section 4.2.

8.2.5 Linkage Assembly Replacement

As illustrated in Figure 8-6, the linkage assembly part number will vary according to the valve size. The CXT-E valve sizes ranging from 1.00 to 3.00 inches use linkage assembly Part No. 24038-1. The 4.00-inch CXT-E Valves use 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 is different for 1.00 to 2.00-inch valves and 2.50 to 3.00-inch valves.
IMPORTANT

FOR PROPER OPERATION OF THE CONTROL VALVE, IT IS IMPERATIVE THAT YOU USE THE CORRECT ADAPTER AND PIN LOCATION FOR THE VALVE SIZE BEING REPAIRED.

The linkage assembly is attached to the Control Valve top with two cap screws. Be sure to replace the linkage gasket (Part No. 81046) each time you install a new linkage assembly.

Use the following procedure when you need to remove and replace the linkage assembly:

58. Remove the Actuator per steps 46 through 49.
59. Refer to Figure 8-1 (for 1 to 2-inch Valves) or Figure 8-2 (for 2 ½ to 4-inch Valves) to locate the items identified in parentheses in the following steps.
60. Rotate (loosen) the hex nuts (17) under the indicator plate approximately one half-turn clockwise.
61. 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.
62. Remove the indicator plate from the Valve shaft (16).
63. Remove the two cap screws (19) securing the linkage assembly (26) to the Valve top (21).
64. Remove the linkage assembly (26) from the Valve top. Also, remove the gasket (29) (which will not be retained).
65. 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).

66. Install the indicator plate on the Valve shaft (16) with the curved end facing upward (Figure 8-4).

67. 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.

68. Press down on the Valve shaft (16) to compress the pilot spring (10) in the Valve body.

69. With the pilot spring compressed, verify that the indicator plate is aligned with the “0” (zero) on the scale (28). If necessary, rotate the Valve shaft until the plate is aligned with “0”.

70. Replace the Actuator using steps 50 through 57, above.

8.2.6 Recirculation Pump Replacement

The recirculation pump is required to assure proper heat exchanger operation and has an expected service life of five years. The pump is installed in the recirculation piping (see Figure 8-7) to continuously circulate domestic water through the heat exchanger, even when there is no DHW demand.

Use the following procedure to replace the recirculation pump:

1. Turn OFF both the external power circuit breaker to the DW-series heat exchanger and the power switch on the side of the Control Box.

2. Close all stop valves in the Steam Input and Condensate Output lines.
3. IN THE FOLLOWING ORDER, close the stop valves in the:
   a. Hot Water Output line
   b. Recirculation line
   c. Cold Water Input line

When the heat exchange has been shut down according to steps 1 and 2, drain the heat exchanger as follows:

4. CAREFULLY open the relief valve in the heat exchanger upper head assembly to relieve pressure in the heat exchanger shell. If fluid continues to flow from the relief valve, one of the cold water stop valves is either leaking or is not shut tightly. Stop the flow from the relief valve and proceed.

5. Holding the relief valve open (to prevent creating a vacuum in the shell), open the plugged drain at the bottom of the Heater Shell and drain the heat exchanger completely.

6. Disconnect the power leads from the recirculation pump.

7. Remove the bolts on the recirculation pump flanges and slide the pump out from between the flanges.

8. When installing the replacement recirculation pump, ensure that the seals are in place and not pinched.

9. Reinstall the flange bolts and reconnect the power leads to the pump.

10. Refill the heat exchanger and put it back into operation in accordance with section 5.3, steps 1 through 14.

8.3 ELECTRONIC CONTROL SYSTEM

The corrective maintenance procedures for the ECS consist of replacing the Control Box components and subassemblies that were identified as being faulty following the procedures listed in Chapter 7 Troubleshooting. The ECS replaceable items include the:

- Control Box Assembly (8.3.1)
- Temperature Controller (8.3.2)
- Over-temperature Switch (8.3.3)
- DC Power Supply (8.3.4)
- DC Voltage Regulator (8.3.5)

**WARNING**

BE SURE TO TURN OFF THE CONTROL BOX POWER SWITCH (see Figure 8-7) AND DISCONNECT AC POWER BEFORE PERFORMING ANY CORRECTIVE MAINTENANCE PROCEDURES LISTED IN THIS SECTION. FAILURE TO OBSERVE THIS WARNING CAN RESULT IN SERIOUS PERSONAL INJURY.

8.3.1 Replacing the Control Box Assembly

If necessary, replace the complete Control Box assembly as follows:

1. Referring to Figure 8-8, loosen the captive screws on the Control Box door and the recessed panel.
2. Swing down the recessed panel and locate Terminal Block TB-2 (Figure 8-9).

3. Disconnect the Line, Neutral and Ground leads connected to Terminal Block TB-2.

4. Referring to figures in previous chapters (identified below), disconnect the Control Box cables from the following devices:
   a. Figure 1-3: Disconnect the Actuator cable (terminated in a 3-pin Molex connector) from the Control Valve Actuator.
   b. Figure 2-1: Disconnect the outlet temperature dual sensor cables (terminated in 4-pin Molex connectors) from the DHW outlet dual temperature sensor installed in the upper head.
assembly of the heat exchanger.

c. Figure 2-1. Disconnect the solenoid cable (terminated in a 3-pin DIN connector) from the Over-temperature Solenoid Valve on the upper head assembly of the heat exchanger.

d. Disconnect the mixed temperature cable (terminated in a 2-pin Molex connector) from the mixed temperature sensor mounted at the Cold Water Input to the heat exchanger.

5. After the Control Box cables have been disconnected, remove the two hex nuts securing the Control Box top and bottom mounting attachments to the heat exchanger. Completely remove the Control Box from the heat exchanger.

6. To replace the Control Box, reverse Steps 1 through 5.

8.3.2 Replacing the Temperature Controller

The Temperature Controller is located on the recessed panel behind the Control Box door, as shown in Figure 8-8. Remove and replace the Temperature Controller 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 8-10. To unplug and remove the Temperature Controller from its sleeve, pry the latching ears outward and pull the Temperature Controller out of the panel.

3. To install a replacement Temperature Controller, slide it into the front panel sleeve until the latching ears click into place. When the new Temperature Controller is in place, adjust the setpoint to the required temperature using the adjustment procedures in 4.3.1.

4. Close and secure Control Box front door.

8.3.3 Replacing the Over-temperature Switch

The Over-temperature Switch performs a switching function and generates an alarm when the preset temperature limit is exceeded. Remove and replace the Over-temperature Switch as follows:

1. Open the Control Box door and locate the Over-temperature Switch (Figure 8-11a).

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 Over-temperature Switch assembly.

Figure 8-10. Temperature Controller Installation
3. Loosen the terminal wiring connection screws on the rear of the Over-temperature Switch assembly and disconnect the wires.

4. To remove the Over-temperature Switch assembly, push in tab of each of two side retaining clips (Figure 8-11b), slide toward rear and remove.

![Figure 8-11a. Over-Temperature Switch & Temperature Indicator](image)

5. If the replaced unit is an Over-temperature Switch, set the desired over-temperature alarm limit using the adjustment procedures in Chapter 4, Section 4.3.2.

6. Following adjustment (if necessary), raise and secure the swing-down panel. Close and secure the Control Box door.

8.3.4 Replacing the DC Power Supply

To replace the DC Power Supply, please refer to Figure 8-11a through 8-12d and proceed as follows:

1. Open the Control Box door and loosen the captive screw on the recessed panel inside the door.
2. Open the swing-down panel and locate the DC Power Supply on the left interior wall of the Control Box (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. Replace the DC Power Supply by reversing the previous steps.

8.3.5 Replacing the DC Voltage Regulator

To replace the DC Voltage Regulator, please refer to Figure 8-11a through 8-12d and proceed 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 (View D – D).
3. Disconnect the wiring connector plug shown in 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. Replace the DC Voltage Regulator by reversing the previous steps.

Figure 8-11a. ECS Control Box Assembly Component Locations
Figure 8-12b. ECS Control Box Assembly Component Locations
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NOTE:
SEE APPENDIX C FOR
WIRING CONNECTIONS

Figure 8-12c. ECS Control Box Assembly Component Locations
**HE-111 – CORRECTIVE MAINTENANCE**

**Figure 8-12d. ECS Control Box Assembly Component Locations**

**Table 8-3. ECS Control Box Assembly Parts List**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>69011-1</td>
<td>CONTROL BOX (STEAM/WATER)</td>
</tr>
<tr>
<td>2</td>
<td>NOT USED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>64028-12</td>
<td>TEMPERATURE CONTROLLER</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>64007</td>
<td>OVER-TEMP SWITCH/TEMP INDICATOR</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>60003</td>
<td>ON/OFF SWITCH</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>63009-4</td>
<td>CONTROL BOX, COMPLETE EXTERNAL HARNESS (S/W)</td>
</tr>
<tr>
<td>7</td>
<td>NOT USED</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>65006</td>
<td>POWER SUPPLY</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>65007</td>
<td>TERMINAL BLOCK, 4-POSITION (TB-2)</td>
</tr>
<tr>
<td>10</td>
<td>1</td>
<td>64011</td>
<td>VOLTAGE REGULATOR</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>65008</td>
<td>TERMINAL BLOCK, 20-POSITION (TB-1)</td>
</tr>
</tbody>
</table>
HE-111 – CORRECTIVE MAINTENANCE

Table 8-3. ECS Control Box Assembly Parts List, continued

<table>
<thead>
<tr>
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<th>QTY</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
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<tr>
<td>12</td>
<td>AS REQ'D</td>
<td>SEE TABLE 8-5</td>
<td>COMMUNICATION BOARD</td>
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<tr>
<td>13</td>
<td>1</td>
<td>62004</td>
<td>PLUG</td>
</tr>
<tr>
<td>14</td>
<td>8</td>
<td>53011</td>
<td>LOCK WASHER, #4</td>
</tr>
<tr>
<td>15</td>
<td>12</td>
<td>65010</td>
<td>STANDOFF</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>53010</td>
<td>LOCK WASHER, #8</td>
</tr>
<tr>
<td>17</td>
<td>4</td>
<td>56012</td>
<td>HEX NUT, #8-32</td>
</tr>
<tr>
<td>18</td>
<td>2</td>
<td>56011</td>
<td>HEX NUT, #6-32</td>
</tr>
<tr>
<td>19</td>
<td>2</td>
<td>53012</td>
<td>LOCK WASHER, #6</td>
</tr>
<tr>
<td>20</td>
<td>4</td>
<td>56010</td>
<td>HEX NUT, #4-40</td>
</tr>
<tr>
<td>21</td>
<td>2</td>
<td>62002</td>
<td>STRAIN RELIEF</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>62003</td>
<td>PLUG</td>
</tr>
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THE FOLLOWING ITEMS ARE NOT ILLUSTRATED IN FIGURE 8-12

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>23</td>
<td>1</td>
<td>63007</td>
<td>AC WIRE HARNESS</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>63008-1</td>
<td>CONTROL BOX CONN. WIRE HARNESS</td>
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Table 8-4. Individual Component Wiring Harnesses

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
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<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>All Heat Exchangers</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>63009-51</td>
<td>SOLENOID VALVE WIRING HARNESS</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>63009-52</td>
<td>HOT WATER OUT –TO-TEMPERATURE CONTROLLER WIRING HARNESS</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>63009-53</td>
<td>HOT WATER OUT –TO-OVER-TEMPERATURE SWITCH WIRING HARNESS</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>63009-59</td>
<td>ACTUATOR WIRING HARNESS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>All Steam-to-Water Double-Wall Heat Exchangers with Serial Number H-09-430 and Above</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>63009-58</td>
<td>MIXED INLET TEMPERATURE WIRING HARNESS</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>63009-61</td>
<td>RECIRCULATION PUMP WIRING HARNESS</td>
</tr>
</tbody>
</table>

Table 8-5. Communication Board Options

<table>
<thead>
<tr>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>64009-1</td>
<td>RS232 COMMUNICATIONS BOARD</td>
</tr>
<tr>
<td>64009-2</td>
<td>RS485 COMMUNICATIONS BOARD</td>
</tr>
</tbody>
</table>

8.4 RECOMMENDED SPARE PARTS
AERCO recommends the DW-Series Spare Parts listed in Table 8-6.
**HE-111 – CORRECTIVE MAINTENANCE**

**Table 8-6. Recommended Spare Parts**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Recommended Emergency Spare Parts</strong></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>123196-24</td>
<td>DW24 GASKET KIT</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>123196-45</td>
<td>DW45 GASKET KIT</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>123196-68</td>
<td>DW68 GASKET KIT</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>69101</td>
<td>CIRCULATOR PUMP</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>69009</td>
<td>VALVE ACTUATOR</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>122770</td>
<td>VACUUM BREAKER</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>64028-12</td>
<td>TEMPERATURE CONTROLLER</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>99042-1</td>
<td>DOMESTIC WATER INLET THERMOCOUPLE</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>99042-2</td>
<td>DOMESTIC WATER OUTLET THERMOCOUPLE</td>
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<table>
<thead>
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<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>12</td>
<td>1</td>
<td>89011-1</td>
<td>PUMP FLANGE GASKET SET</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>89011-2</td>
<td>PUMP CASING O-RING</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>89011-3</td>
<td>PUMP CAPACITOR</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>89011-5</td>
<td>PUMP CARTRIDGE ASSEMBLY</td>
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<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>PART NUMBER (Valve Size)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1”</td>
</tr>
<tr>
<td>16</td>
<td>DISC/VALVE SEAT</td>
<td>121541</td>
</tr>
<tr>
<td>17</td>
<td>VALVE TOP GASKET</td>
<td>122136</td>
</tr>
<tr>
<td>18</td>
<td>PACKING ASSEMBLY</td>
<td>121567</td>
</tr>
<tr>
<td>19</td>
<td>ACTUATOR/LINKAGE ASSEMBLY GASKET</td>
<td>81046</td>
</tr>
<tr>
<td>20</td>
<td>LOWER PILOT SEAT ASSEMBLY</td>
<td>121505</td>
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</table>

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>1</td>
<td>64007</td>
<td>Over-temperature Switch</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>65006</td>
<td>Power Supply 24VDC Output</td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>64011</td>
<td>Voltage Regulator 12VDC Output</td>
</tr>
</tbody>
</table>
CHAPTER 9 DISASSEMBLY AND REASSEMBLY

9.1 INTRODUCTION
This chapter tells you how to disassemble your DW-Series heat exchanger, check it for tubing leaks, reassemble it and put it back into service.

9.1.1 Tools required
- Torque wrench for 5/8” nuts
- Block and tackle or ratchet or winch hoist (for lifting the heat exchanger upper head assembly and shell, or for lifting and moving the heat exchanger)

9.2 CHECKING FOR A TUBING LEAK
To check for a tube leak:
1. Shut down and drain the heat exchanger in accordance with 6.4.1, Steps 1 through 5.
2. Open the stop valves in the Steam Input line to introduce steam into the heat exchanger tubes.
3. If there is no flow from the leak detection tube — whereas there had been a flow when the heat exchanger was in operation — the leak or leaks are in the outer wall (or walls) of the tubing. Similarly, if there is a flow from the leak detection tube, the leak or leaks are in the inside wall (or walls) of the tubing. When either type of leak occurs, it will be necessary to return the U-bend tube assembly or the entire heat exchanger to AERCO for repair.

Step 12 explains how to disassemble the U-bend tube assembly from the heat exchanger, and step 14 explains how to obtain instructions for returning equipment to AERCO for repair.

9.3 REMOVING THE HEAT EXCHANGER SHELL
Normally, there is no reason for the heat exchanger shell to be removed. However, if a leak has been detected in the heat exchanger tubing, and it has been determined to be in the outer tubing walls (per section 9.3, step 3), or if there is other valid justification for doing so, the heat exchanger shell may be removed as follows:
1. If the heat exchanger has not already been shut down and drained, shut down and drain the heat exchanger in accordance with 6.4.1, Steps 1 through 5.

Please refer to Figure 9-1.
2. Disconnect ALL EXTERNAL PIPING from the heat exchanger upper head assembly, including the piping to the relief valve (1) and the water solenoid valve (2). Disconnect the Hot Water Output piping (not shown) at the union or flange located beyond the outside diameter of the heat exchanger upper head assembly.
3. Disconnect the Cold Water Input piping from the heat exchanger inlet pipe.
4. Disconnect any power supply wiring to the heat exchanger Control Box (4).
5. Disconnect the pressure gauge (5) from the Steam Input flanges (6).
6. Disconnect recirculation piping (7) at unions 26 and 27.
Figure 9-1. Typical DW-Series Heat Exchanger
7. Mark the edge of the heat exchanger lower head assembly flanges (8) in order to indicate their correct relative positions for reassembly.

8. Remove nuts (9) and studs (10) from the heat exchanger lower head assembly flanges.

9. Using a hoist or block and tackle attached to the lifting lugs (11) on the heat exchanger upper head assembly, CAREFULLY lift the upper head assembly (12) and shell (13) STRAIGHT UP off the heat exchanger U-bend tubing assembly. AVOID SCRAPING THE SHELL AGAINST THE TUBING (14).

10. Clean and inspect the inside of the shell and the U-bend tubing assembly for obvious damage.

11. If a leak in the tubing has been detected (see steps 1 through 4) and it has been determined that the leak is in the outside wall of one or more of the double-wall tubes, the leak may be found either by a thorough inspection or as follows:
   a. Connect a source of cold water to the leak detection port (15).
   b. Turn the water on and locate the source of the leak or leaks.
   c. You may either reassemble the heat exchanger and return it in its entirety to AERCO for repair, or remove the U-bend tubing assembly and return only that assembly to AERCO for repair. See step 14 for equipment return information.

12. To disassemble the U-bend tubing assembly (14) from the heat exchanger, remove nuts (9) and studs (10) and lift the assembly off the manifold and skid assembly (16).

13. If for any reason it is necessary to remove the heat exchanger upper head assembly (12) from the shell (13):
   a. Remove the thermocouple (17) from its location in the heat exchanger upper head assembly.
   b. Remove all connecting wiring, if any, from the heat exchanger upper head assembly.
   c. Remove all piping and wiring to the relief valve (1) and water Solenoid Valve (2).
   d. Remove the nuts (18), studs (19), and lifting lugs (11).
   e. Lift the upper head assembly off the shell.

14. If the heat exchanger or any of its assemblies are to be returned to the AERCO factory for repair, consult AERCO or your nearest AERCO sales representative for instructions.

   **CAUTION**
   Inspect and replace any lugs, nuts and studs that show signs of corrosion with new properly rated hardware.

9.4 REASSEMBLING THE HEAT EXCHANGER

1. BEFORE REASSEMBLING, CLEAN ALL GASKET SURFACES THOROUGHLY, using a wire brush or emery cloth, if necessary. ALWAYS USE NEW GASKETS in a reassembly.

2. If the heat exchanger U-bend tubing assembly (14) must be reassembled onto the manifold and skid assembly (16), then proceed as follows:
   a. Place a lower tubesheet release gasket (20), a lower tubesheet gasket (21), and a second lower tubesheet release gasket (ALL NEW) onto the manifold flange (22).
   b. Lower the U-bend tubing assembly over the four studs in the manifold flange and onto the manifold gaskets, making sure the bottom flange of the U-bend assembly seats onto the locating pin in the top surface of the manifold flange, and that the U-bend assembly is lined up for insertion of the studs through the flanges.
3. To replace the heat exchanger shell (13) on a DW-45 heat exchanger, skip the rest of this step and all of step 4 and proceed to step 5. For DW-24 and DW-68 heat exchangers, proceed as follows:
   a. Place a Teflon upper tubesheet release gasket (24), the shell gasket (23) and another upper tubesheet release gasket (ALL NEW) onto the U-bend assembly flange.
   b. Using a hoist or block and tackle attached to the lifting lugs (11) on the heat exchanger upper head assembly (or to bolt holes in the shell top flange, if the upper head assembly has been removed), CAREFULLY lower the upper head assembly and shell STRAIGHT DOWN over the U-bend tubing assembly (14). DO NOT SCRAPE THE SHELL AGAINST THE TUBING.
   c. Make sure that the shell is positioned properly by lining up the marking you put on the edges of the flanges in 9.3, step 7.
   d. Assemble the studs (10) and nuts (9) into the manifold, U-bend assembly flange and shell flange. Cross-tighten the nuts to approximately 75 foot-pounds of torque to obtain uniform seating. Then progressively tighten the nuts to approximately 150 foot-pounds of torque for a tight seat.

4. If the heat exchanger upper head assembly (12) has been removed from the shell (13):
   a. Place a NEW shell gasket (23) onto the gasket surface of the shell top flange.
   b. Replace the heat exchanger upper head assembly onto the shell top flange making sure that the stud holes line up.
   c. Reassemble the studs, lifting lugs (11), and nuts (18) into the head and shell flanges. Tighten the nuts in the same manner as outlined in step 3d above.
   d. Replace the water solenoid valve (2), the relief valve (1), and all piping. Reconnect all connecting wiring, if any, required for accessories on the upper head assembly. Replace the thermocouple into their proper locations in the upper head assembly.

Continue assembling the heat exchanger at step 7.

5. If you are replacing the heat exchanger shell (13) on a DW-45 heat exchanger, proceed as follows:
   a. Place an upper tubesheet release gasket, the lower shell gasket (23) and another upper tubesheet release gasket (24) (ALL NEW) onto the U-bend assembly flange.
   b. Using a hoist or block and tackle attached to the lifting lugs (11) on the heat exchanger upper head assembly (or to bolt holes in the shell top flange, if the upper head assembly has been removed), CAREFULLY lower the upper head assembly and shell STRAIGHT DOWN over the U-bend tubing assembly (14). DO NOT SCRAPE THE SHELL AGAINST THE TUBING.
   c. Make sure that the shell is positioned properly by lining up the marking you put on the edges of the flanges in 9.3, step 7.
   d. Assemble the studs (10) and nuts (9) into the manifold, U-bend assembly flange and shell flange. Cross-tighten the nuts to approximately 75 foot-pounds of torque to obtain uniform seating. Then progressively tighten the nuts to approximately 150 foot-pounds of torque for a tight seat.

6. If the heat exchanger upper head assembly (12) has been removed from the shell (13):
   a. Place a NEW upper shell gasket (25) onto the gasket surface of the shell top flange.
   b. Replace the heat exchanger upper head assembly onto the shell top flange making sure that the stud holes line up.
c. Reassemble the studs, lifting lugs (11), and nuts (18) into the head and shell flanges. Tighten the nuts in the same manner as outlined in step 3d above.

d. Replace the water solenoid valve (2), if any, the relief valve (1), and all piping. Reconnect all connecting wiring, if any, required for accessories on the upper head assembly. Replace the thermocouple into its proper locations in the upper head assembly.

7. Reinstall the circulation piping.

8. Reconnect the pressure gauge to the Steam Input flange.

9. Reconnect any power supply wiring to the heat exchanger Control Box, and reconnect any wiring between the Control Box and any solenoid valves included in the system.

10. Reconnect all external piping to the heat exchanger upper head assembly, including the piping to the relief valve (1) and the water solenoid valve (2).

11. Refill and put the heat exchanger back into service in accordance with 5.3, steps 1 through 15.
APPENDIX A

CONTROL AND COMMUNICATION

A.1 TEMPERATURE CONTROLLER PROCEDURES

A.2 MODBUS COMMUNICATION INFORMATION

A.3 PROCESS / DIAGNOSTIC ALARM MESSAGES
A.1 TEMPERATURE CONTROLLER PROCEDURES
A.1.1 Adding a Communication Board to the Temperature Controller
A.1.1.1 Parts Needed
1. Control Box Assembly ECS, P/N: 69012-
2. Temperature Indicating Controller, P/N: 64008
3. Communications Board, P/N: 64009-

A.1.1.2 Procedure for Adding the Communication Board
1. Turn off power to Control Box Assembly ECS (P/N 69012-)
2. Slide out Temperature Indicating Controller (P/N: 64008) from Control Box Assembly by gently pushing the indicated latching ears to the side (See Figure 1).

3. Slide Communications Board (P/N 64009-) into Temperature Indicating Controller slot (COMMS 1). See Figure 2. Make sure to push Communications Board all the way in to ensure it is firmly seated in its slot.
4. Place Temperature Indicating Controller back into Control Box Assembly and power up unit. The following screen will appear. (See Figure 3)

5. The Controller will report a hardware error as indicated on Figure 3. Press the ▲ (up) arrow key located on the right side of the Temperature Controller until “8” appears on the lower half of the screen.

6. Press the page button located on the left side of the Temperature Indicating Controller until “Exit” appears on the top half of the screen.

7. Press the ▲ / ▼ (up/down) arrow key to choose “yes”.

8. Wait a moment as the screen updates. The hardware error will no longer be displayed.

9. This completes installation of the Communications Board.
A.1.2 Changing the Temperature Controller Communication Addresses

**NOTE**
Refer to the button map at the bottom of the display for all panel navigation instructions.

The Temperature Controller address is defaulted to 1 from the factory. To change the MODBUS address, proceed as follows:

1. **Page** to the **ACCS** list and **Scroll** down to **codE**.
2. Enter 24 using the **Up Arrow**. The number will flash and display **PASS**.

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

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 enter will flash off and then on to 0 to confirm that access is now set to the OPER level and it is safe to return to use.

10. Confirm that the **Addr** is set properly by pressing the **Page** button until the cmS list is displayed. **Scroll** to **Addr**. If the value is correct you are done; if not, repeat the steps in this procedure.
### A.2 MODBUS COMMUNICATION INFORMATION

**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 and no parity bit.

**Table A-1. Eurotherm Series 2400 Controller MODBUS Points**

<table>
<thead>
<tr>
<th>MODBUS Data Address</th>
<th>Menu Item</th>
<th>Menu Item Description</th>
<th>Units &amp; Range</th>
<th>Default/Comments</th>
<th>Register Type</th>
<th>Ref. 1 Comm. Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>w.SP</td>
<td>Setpoint</td>
<td>40-205°F</td>
<td>140°F, Address to read value</td>
<td>Read Only</td>
<td>5-4</td>
</tr>
<tr>
<td>24</td>
<td>SP 1</td>
<td>Setpoint</td>
<td>40-180°F</td>
<td>140°F, Address to change value</td>
<td>Write</td>
<td>5-11</td>
</tr>
<tr>
<td>1</td>
<td>Top Value</td>
<td>Outlet Temp</td>
<td>40-205°F</td>
<td>Same value as front display</td>
<td>Read Only</td>
<td>5-3</td>
</tr>
<tr>
<td>133</td>
<td>LoGH</td>
<td>Peak Temp</td>
<td>40-205°F</td>
<td>Resets on Power Loss</td>
<td>Read Only</td>
<td>5-15</td>
</tr>
<tr>
<td>135</td>
<td>LoGA</td>
<td>Average Temp</td>
<td>40-205°F</td>
<td>Resets on Power Loss</td>
<td>Read Only</td>
<td>5-15</td>
</tr>
<tr>
<td>134</td>
<td>LoGL</td>
<td>Low Temp</td>
<td>40-205°F</td>
<td>Resets on Power Loss</td>
<td>Read Only</td>
<td>5-15</td>
</tr>
<tr>
<td>13 (set) 74 (status, 0 = safe 1 = alarm)</td>
<td>AL 1</td>
<td>Over Temp Alarm</td>
<td>40-205°F</td>
<td>20°F above setpoint; Alarm Type 17: Deviation High</td>
<td>Read Only</td>
<td>5-7 5-20</td>
</tr>
<tr>
<td>14 (set) 74 (status, 0 = safe 1 = alarm)</td>
<td>AL 2 (FSH)</td>
<td>Full Scale High Alarm</td>
<td>205°F</td>
<td>205 °F Alarm Type 2: Full Scale High</td>
<td>Read Only</td>
<td>5-7 5-20</td>
</tr>
<tr>
<td>258</td>
<td>Sbr</td>
<td>Feedback Sensor Break</td>
<td>Status: 0: Good 1: Failed</td>
<td>Denotes Feedback Sensor Failure/Open Circuit</td>
<td>Read Only</td>
<td>5-18</td>
</tr>
<tr>
<td>289</td>
<td>Li 1</td>
<td>Feedback Sensor Temp</td>
<td>40-180°F</td>
<td>Sensor input to controller, same as display temp.</td>
<td>Read Only</td>
<td>5-14</td>
</tr>
<tr>
<td>290</td>
<td>Li 2</td>
<td>Flow</td>
<td>GPM</td>
<td></td>
<td>Read Only</td>
<td>5-14</td>
</tr>
<tr>
<td>3</td>
<td>OP</td>
<td>Control Output Signal</td>
<td>%</td>
<td>Correlates to valve position</td>
<td>Read Only</td>
<td>5-4</td>
</tr>
<tr>
<td>131</td>
<td>Addr</td>
<td>Communication Address</td>
<td>Integer (0-63)</td>
<td>Default – 1. Temperature Controller communication address</td>
<td>Read Only</td>
<td>5-14</td>
</tr>
</tbody>
</table>

**REFERENCE DOCUMENTS**

1. Eurotherm 2000 Series Communications Handbook, # HA026230
2. Eurotherm 2404/2408 Control Setpoint Programmer Installation and Operation Handbook, # HA025132
A.3 PROCESS AND DIAGNOSTIC ALARMS

A.3.1 Process Alarms

The following are the process alarms that can appear on the Temperature Controller display.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>_FSL*</td>
<td>PV Full Scale Low Alarm.</td>
</tr>
<tr>
<td>_FSH*</td>
<td>PV Full Scale High Alarm.</td>
</tr>
<tr>
<td>_dEu*</td>
<td>PV Deviation Band Alarm</td>
</tr>
<tr>
<td>_dHi*</td>
<td>PV Deviation High Alarm</td>
</tr>
<tr>
<td>_dLo*</td>
<td>PV Deviation Low Alarm</td>
</tr>
</tbody>
</table>

A.3.2 Diagnostic Alarms

The following are the diagnostic alarms that can appear on the Temperature Controller display.

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>MEANING</th>
<th>WHAT TO DO</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE.Er</td>
<td>Electrically Erasable Memory Error: The value of an operator, or configuration, parameter has been corrupted.</td>
<td>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.</td>
</tr>
<tr>
<td>S.br</td>
<td>Sensor Break: Input sensor is unreliable or the input signal is out of range.</td>
<td>Check that the sensor is correctly connected</td>
</tr>
<tr>
<td>Hw.Er</td>
<td>Hardware Error Indication that a module is of the wrong type, missing, or faulty.</td>
<td>Check to ensure that the correct items are installed. See A.3.3 for procedure to clear the hardware error.</td>
</tr>
<tr>
<td>no.io</td>
<td>No I/O None of the expected I/O items are installed.</td>
<td>This error message normally occurs when pre-configuring a controller without installing any of the required I/O modules.</td>
</tr>
<tr>
<td>rmt.F</td>
<td>Remote input failure. The remote DC input is open or shorted.</td>
<td>Check for open or short circuit wiring on the remote DC input.</td>
</tr>
<tr>
<td>LLLL</td>
<td>Out of range low reading</td>
<td>Check the value of the input</td>
</tr>
<tr>
<td>HHHH</td>
<td>Out of range high reading</td>
<td>Check the value of the input</td>
</tr>
<tr>
<td>Err1</td>
<td>Error 1: ROM self-test fail</td>
<td>Return Controller for repair</td>
</tr>
</tbody>
</table>
### Table A-3. Diagnostic Alarms - continued

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>MEANING</th>
<th>WHAT TO DO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Err2</td>
<td>Error 2: RAM self-test fail</td>
<td>Return Controller for repair</td>
</tr>
<tr>
<td>Err4</td>
<td>Error 4: Keyboard failure. Stuck button or button was pressed during power-up</td>
<td>Switch power off and then on, without touching any of the controller buttons</td>
</tr>
<tr>
<td>Err5</td>
<td>Error 5: Faulty internal communication</td>
<td>Check printed circuit board interconnections. If the fault cannot be cleared, return the controller for repair.</td>
</tr>
<tr>
<td>Err6</td>
<td>Digital filter chip faulty or loose board inside controller</td>
<td>Return Controller for repair</td>
</tr>
<tr>
<td>Err7</td>
<td>PV ID failure</td>
<td>Return Controller for repair</td>
</tr>
<tr>
<td>Err8</td>
<td>Module 1 ID failure</td>
<td>Faulty or loose module, or isolation problem</td>
</tr>
<tr>
<td>Err9</td>
<td>Module 2 ID failure</td>
<td>Faulty or loose module, or isolation problem</td>
</tr>
<tr>
<td>ErrA</td>
<td>Module 3 ID failure</td>
<td>Faulty or loose module, or isolation problem</td>
</tr>
<tr>
<td>dCF</td>
<td>DC output failure</td>
<td>Return Controller for repair.</td>
</tr>
<tr>
<td>OPEN</td>
<td>Secondary Input Missing or Disconnected</td>
<td>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.</td>
</tr>
</tbody>
</table>

### A.3.3 Clearing the Hardware Error Display

To clear a hardware error (HW.ER) and reset the Temperature Controller, proceed as follows:

1. Simultaneously press the **Page** (asion) and **Scroll** (asion) buttons on the Temperature Controller.
2. Using the **Up** (asion) arrow button, change the password to “8”.
3. Simultaneously press the **Page** (asion) and **Scroll** (asion) 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** (asion) arrow button to toggle the display from “NO” to “YES”.
5. Simultaneously press the **Page** (asion) and **Scroll** (asion) buttons to “Reset” the Temperature Controller and clear the hardware error.
APPENDIX B

B.1 WIRING DIAGRAMS

B.2 TERMINAL BLOCK CONNECTIONS
NOTE: This drawing is only applicable for older units built WITH the voltage regulator, which are those units with a serial number BEFORE H-10-324.

**Figure B-1a. DW-Series Heat Exchanger Wiring Diagram (S/N H-10-323 and Below)**
Figure B-1b. DW-Series Heat Exchanger Wiring Diagram (S/N H-10-325 and Above)
**TERMINAL BLOCK TB-1 (REAR WALL)**

- WIRE NUMBERS
  - 107
  - 104
  - 105
  - 103
  - 102
  - 101

- FUNCTIONS
  - OVER-TEMP (+12 VDC)
  - OVER-TEMP (+24 VDC)
  - ACTUATOR (COM)
  - ACTUATOR (+24 VDC)
  - ACTUATOR (4 – 20 mA)
  - ACTUATOR (-24 VDC)
  - OVER-TEMP (TC +)
  - OVER-TEMP (TC -)
  - FEEDBACK (TC +)
  - FEEDBACK (TC -)
  - SOLENOID

*Figure B-2. Terminal Block TB-1 Connections*

**TERMINAL BLOCK TB-2 (BOTTOM SURFACE)**

- WIRE NUMBERS
  - 100
  - 101
  - 102

- FUNCTIONS
  - LINE
  - NEUTRAL
  - GROUND

*Figure B-3. Terminal Block TB-2 Connections*
This page intentionally left blank.
APPENDIX C

PIPING CONNECTIONS
NOTES:
1) FOR ACTUAL SIZES AND LOCATIONS OF PIPING AND OTHER CONNECTIONS TO THE HEATER, SEE DIMENSIONAL DRAWING.
2) PIPING TO THE UPPER HEATER HEAD SHOULD BE PROVIDED WITH UNIONS OR FLANGES WHICH ARE LOCATED BEYOND THE OUTSIDE DIAMETER OF THE HEAD TO PERMIT REMOVAL OF THE HEAD AND SHELL.
3) REDUCERS, ON THE WATER INLET SIDE, SHOULD BE LOCATED ADJACENT TO THE HEATER. EXPANSION FITTINGS, ON THE WATER INLET SIDE, SHOULD BE LOCATED AS FAR AS POSSIBLE FROM THE HEATER.
4) CONDENSATE RETURN PIPING SHOULD BE ARRANGED TO PERMIT THE CONDENSATE TO DRAIN FREELY, BY GRAVITY, FROM THE LOWER HEATER HEAD.
5) DRAIN VALVE SHOULD BE PIPED DIRECTLY TO A FLOOR DRAIN. RELIEF VALVE & OVER-TEMP SOLENOID VALVE SHOULD BE PIPED VERTICALLY TO A HEIGHT 19" ABOVE THE FLOOR.

Figure C-1. Piping Connection for Single Heat Exchanger
NOTES:
1) FOR ACTUAL SIZES AND LOCATIONS OF PIPING AND OTHER CONNECTIONS TO THE HEATER, SEE DIMENSIONAL DRAWING.
2) PIPING TO THE UPPER HEATER HEAD SHOULD BE PROVIDED WITH UNIONS OR FLANGES WHICH ARE LOCATED BEYOND THE OUTSIDE DIAMETER OF THE HEAD TO PERMIT REMOVAL OF THE HEAD AND SHELL.
3) HEATERS SHOULD BE PIPED REVERSE RETURN OR BALANCING DEVICES ON THE OUTLETS SHOULD BE EMPLOYED.
4) REDUCERS, ON THE WATER INLET SIDE, SHOULD BE LOCATED ADJACENT TO THE HEATER. EXPANSION FITTINGS, ON THE WATER INLET SIDE, SHOULD BE LOCATED AS FAR AS POSSIBLE FROM THE HEATER.
5) CONDENSATE RETURN PIPING SHOULD BE ARRANGED TO PERMIT THE CONDENSATE TO DRAIN FREELY, BY GRAVITY, FROM THE LOWER HEATER HEAD.
6) DRAIN VALVE SHOULD BE PIPED DIRECTLY TO A FLOOR DRAIN. RELIEF VALVE & OVER-TEMP SOLENOID VALVE SHOULD BE PIPED VERTICALLY TO A HEIGHT 19" ABOVE THE FLOOR.

Figure C-2. Piping Connection for Parallel Heat Exchanger
NOTES:
1) FOR ACTUAL SIZES AND LOCATIONS OF PIPING AND OTHER CONNECTIONS TO THE HEATER, SEE DIMENSIONAL DRAWING.
2) PIPING TO THE UPPER HEATER HEAD SHOULD BE PROVIDED WITH UNIONS OR FLANGES WHICH ARE LOCATED BEYOND THE OUTSIDE DIAMETER OF THE HEAD TO PERMIT REMOVAL OF THE HEAD AND SHELL.
3) REDUCERS, ON THE WATER INLET SIDE, SHOULD BE LOCATED ADJACENT TO THE HEATER. EXPANSION FITTINGS, ON THE WATER INLET SIDE, SHOULD BE LOCATED AS FAR AS POSSIBLE FROM THE HEATER.
4) CONDENSATE RETURN PIPING SHOULD BE ARRANGED TO PERMIT THE CONDENSATE TO DRAIN FREELY, BY GRAVITY, FROM THE LOWER HEATER HEAD.
5) DRAIN VALVE SHOULD BE PIPED DIRECTLY TO A FLOOR DRAIN. RELIEF VALVE & OVER-TEMP SOLENOID VALVE SHOULD BE PIPED VERTICALLY TO A HEIGHT 19" ABOVE THE FLOOR.

Figure C-3. Piping Connection for Single Heat Exchanger with an Accumulator
Figure C-4. Piping Connection for Single Heat Exchanger with a Stratified Storage Tank

NOTES:
1) FOR ACTUAL SIZES AND LOCATIONS OF PIPING AND OTHER CONNECTIONS TO THE HEATER, SEE DIMENSIONAL DRAWING.
2) PIPING TO THE UPPER HEATER HEAD SHOULD BE PROVIDED WITH UNIONS OR FLANGES WHICH ARE LOCATED BEYOND THE OUTSIDE DIAMETER OF THE HEAD TO PERMIT REMOVAL OF THE HEAD AND SHELL.
3) REDUCERS, ON THE WATER INLET SIDE, SHOULD BE LOCATED ADJACENT TO THE HEATER. EXPANSION FITTINGS, ON THE WATER INLET SIDE, SHOULD BE LOCATED AS FAR AS POSSIBLE FROM THE HEATER.
4) CONDENSATE RETURN PIPING SHOULD BE ARRANGED TO PERMIT THE CONDENSATE TO DRAIN FREELY, BY GRAVITY, FROM THE LOWER HEATER HEAD.
5) DRAIN VALVE SHOULD BE PIPED DIRECTLY TO A FLOOR DRAIN. RELIEF VALVE & OVER-TEMP SOLENOID VALVE SHOULD BE PIPED VERTICALLY TO A HEIGHT 19" ABOVE THE FLOOR.
6) MOUNT TEMPERATURE SWITCH 1/3 UP FROM THE BOTTOM OF THE TANK, SWITCH WILL TURN PUMP ON AND OFF.

AERCO INTERNATIONAL, INC.
NORTHVALE, NJ 07647

SWDW (DOUBLE WALL DESIGN) STEAM TO WATER HEAT EXCHANGER SINGLE UNIT WITH STRATIFIED TANK

TANK HEIGHT TO DIA. RATIO: 2:1 MIN., 3:1 PREFERRED
**HE-111 – PIPING CONNECTIONS**

**LEGEND**
- STRAINER
- STOP VALVE
- CHECK VALVE
- CONTROL VALVE
- RELIEF VALVE
- DRAIN VALVE
- UNION
- UNION ORIFICE
- THERMAL ELEMENT
- PRESSURE GAUGE
- TEMPERATURE GAUGE
- COMPOUND
- PRESSURE GAUGE
- "OVERTEMP"
- SOLENOID
- STEAM TRAP

### NOTES:
1) FOR ACTUAL SIZES AND LOCATIONS OF PIPING AND OTHER CONNECTIONS TO THE HEATER, SEE DIMENSIONAL DRAWING
2) PIPING TO THE UPPER HEATER HEAD SHOULD BE PROVIDED WITH UNIONS OR FLANGES WHICH ARE LOCATED BEYOND THE OUTSIDE DIAMETER OF THE HEAD TO PERMIT REMOVAL OF THE HEAD AND SHELL.
3) HEATERS SHOULD BE PIPED REVERSE RETURN OR BALANCING DEVICES ON THE OUTLETS SHOULD BE EMPLOYED.
4) REDUCERS, ON THE WATER INLET SIDE, SHOULD BE LOCATED ADJACENT TO THE HEATER. EXPANSION FITTINGS, ON THE WATER INLET SIDE, SHOULD BE LOCATED AS FAR AS POSSIBLE FROM THE HEATER.
5) CONDENSATE RETURN PIPING SHOULD BE ARRANGED TO PERMIT THE CONDENSATE TO DRAIN FREELY, BY GRAVITY, FROM THE LOWER HEATER HEAD.
6) DRAIN VALVE SHOULD BE PIPED DIRECTLY TO A FLOOR DRAIN. RELIEF VALVE & "OVERTEMP" SOLENOID VALVE SHOULD BE PIPED VERTICALLY TO A HEIGHT 19" ABOVE THE FLOOR.
7) PUMP SHOULD BE CAPABLE OF HEATERS' TOTAL RATED FLOW AT DESIGN TEMPERATURE RISE.
8) MOUNT TEMPERATURE SWITCH 1/3 UP FROM THE BOTTOM OF THE TANK, SWITCH WILL TURN PUMP ON AND OFF.

---

**Figure C-5. Piping Connection for Multiple Heat Exchangers with a Stratified Storage Tank**

Rev C: Aug 2, 2017
AERCO’S EXTENDED WARRANTY

AERCO’s Extended Warranty from shipment covers any SWDW and WWDW heater that is applied in a commercial potable water heating application. These consist of any domestic service: i.e. showers, tubs, lavs, kitchens, etc. Please contact your local representative for complete details regarding application.

Seller makes no warranty of merchantability, fitness for particular purpose, or any other express or implied warranties which extend beyond the description contained in Seller's Quotation. If any item manufactured by the Seller shall not comply with the applicable specifications, or shall prove defective in material and/or workmanship, within eighteen (18) months from the date of delivery. Buyer shall notify Seller, in writing, of such defect or non-compliance within thirty (30) days of discovery of such defect or non-compliance.

The following components of the AERCO Heater are covered by the Extended Warranty:

Pressure Vessel: The pressure vessel (shell and heads) shall carry a non-prorated 20-year guarantee against leakage due to internal corrosion.

Anticipator: The integral demand anticipator unit shall carry a non-prorated 20-year guarantee against any failure.

AERCO’S STANDARD WARRANTY: 18 MONTHS FROM SHIPMENT

All other components of the heater assembly including control valve and all other external accessories are guaranteed against failure from defect in material and/or workmanship for a period of 18 months from shipment.

Seller shall, at its option, modify, repair, exchange the product, or refund the purchase price of said item. Seller shall have the option of having the item returned, FOB its factory, or to make sure adjustment at the point of installation. In no event shall Seller be held responsible for replacement labor charges or for freight or handling charges. Total liability to the seller shall not exceed the purchase price of the item. Seller shall accept no responsibility if such item has been improperly installed, operated, or maintained or if Buyer has permitted any unauthorized modifications, adjustments, and/or repairs to the item. The use of replacement parts not manufactured or sold by AERCO will void any warranty, express or implied. Items not manufactured by the Seller shall be covered by the warranty of the manufacturer or supplier thereof. The foregoing shall be Sellers sole and exclusive obligation and Buyer's sole and exclusive remedy for any action, whether in breach of contract or for negligence.

This warranty coverage is only applicable within the United States and Canada. All other geographical areas carry a standard warranty of 18 months from date of shipment or 12 months from startup, whichever comes first.
Double-Wall Heat Exchanger Warranty