



INSTRUCTION  
No.

**HE-107**

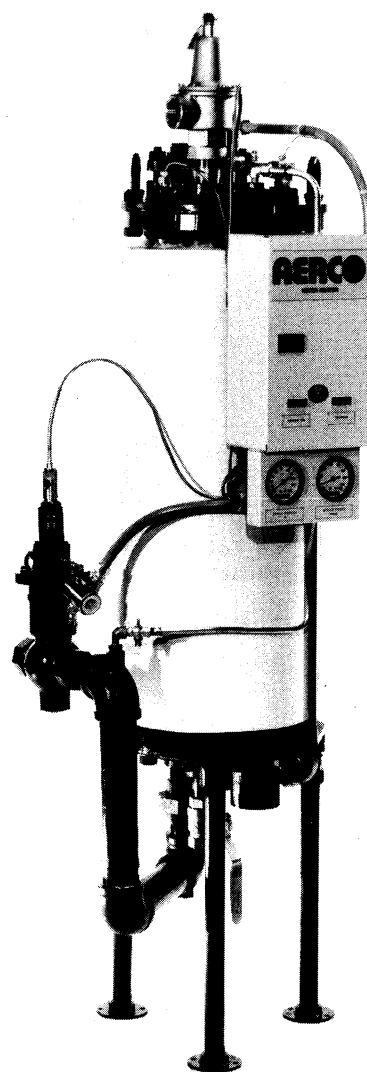
AERCO INTERNATIONAL, INC., NORTHVALE, NEW JERSEY 07647, U.S.A.

## **INSTALLATION, OPERATION, and MAINTENANCE INSTRUCTIONS**

# **HELITHERM HEAT EXCHANGERS**

## **PACKAGED WATER HEATERS**

### **MODEL SW1A-PLUS**



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**SAFETY PRECAUTIONS**

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

**WARNING!**

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

SHUT OFF ALL INCOMING AND OUTGOING STEAM AND WATER SHUTOFF VALVES AND CAREFULLY DECREASE ALL TRAPPED PRESSURES TO ZERO (see SHUTDOWN in OPERATING PROCEDURES) BEFORE PERFORMING ANY MAINTENANCE.

**WARNING!**

LIVE STEAM CAN CAUSE SEVERE BURNS.

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

## GENERAL INFORMATION

This instruction covers AERCO Helitherm Series A-PLUS Steam to Water Heat Exchangers. Steam is the primary or tube side fluid. The water being heated (service or domestic water or other fluid) is the secondary or shell side fluid.

The number of coils in a particular Heat Exchanger is denoted by the two digits following the "+" and preceding the first "/" in the Heat Exchanger Model Number. That is, 01 = 1 coil, 02 = 2 coils, 03 = 3 coils, etc.

The "Style" designation for a Heat Exchanger denotes materials of construction for the various components of the assembly. If this information is required for a specific Heat Exchanger, contact the nearest AERCO Sales Representative.

### ACCESSORIES

Accessories included in the AERCO A-PLUS Heat Exchanger Package Assembly are (see Figures HE-107-1, HE-107-12, and HE-107-13):

Steam Flow Control Valve -- either Air Operated or Self Contained as ordered, sized as required for the service.

Temperature Controller -- installed in the Control Box when an Air Operated Control Valve is furnished.

Over-Temperature Limit System, including the following:

Temperature Switch -- located in the Control Box

Solenoid Valves --

Water -- installed in the Heater Top Head

Air -- installed in the Control Box when an Air Operated Control Valve is furnished

Steam -- installed on the Self Contained Control Valve when such Valve is furnished

Indicator Lights -- "Power On" and "Tripped" -- installed in the Control Box

Steam Pressure Gage -- mounted below the Control Box

Shell Hot Water Outlet Temperature Gage -- mounted below the Control Box

Pressure and Temperature Relief Valve -- size furnished as required in accordance with the design Btu output of the Heater

Union Orifice -- located in Condensate Outlet (see HE-107-1 and HE-107-13) -- required in place of a steam trap to insure complete condensation of steam within the Heater

Check Valve -- located in Condensate Outlet

All other items -- shutoff valves, check valves, strainers, unions or flanges, and other piping and fittings as shown in Figures HE-107-2 through HE-107-5 -- are to be furnished by others.

### NOTE

The AERCO Helitherm Heat Exchanger carries the standard AERCO warranty against defective material and workmanship. HOWEVER, AERCO cannot honor its warranty if the installer or user deviates in any way from the instructions and precautions included herein or makes any alteration of the equipment from that as originally furnished without the written approval of AERCO.

### NOTE

THIS INSTRUCTION COVERS ONLY THE HEAT EXCHANGER PORTION OF THE MODEL A-PLUS PACKAGED HEATER ASSEMBLY. SEPARATE INSTRUCTIONS ARE INCLUDED IN THIS PACKAGE COVERING THE STEAM CONTROL VALVE, THE OVER-TEMPERATURE LIMIT SYSTEM AND ITS COMPONENTS, AND THE OTHER ACCESSORIES INCLUDED IN THE HEATER PACKAGE.

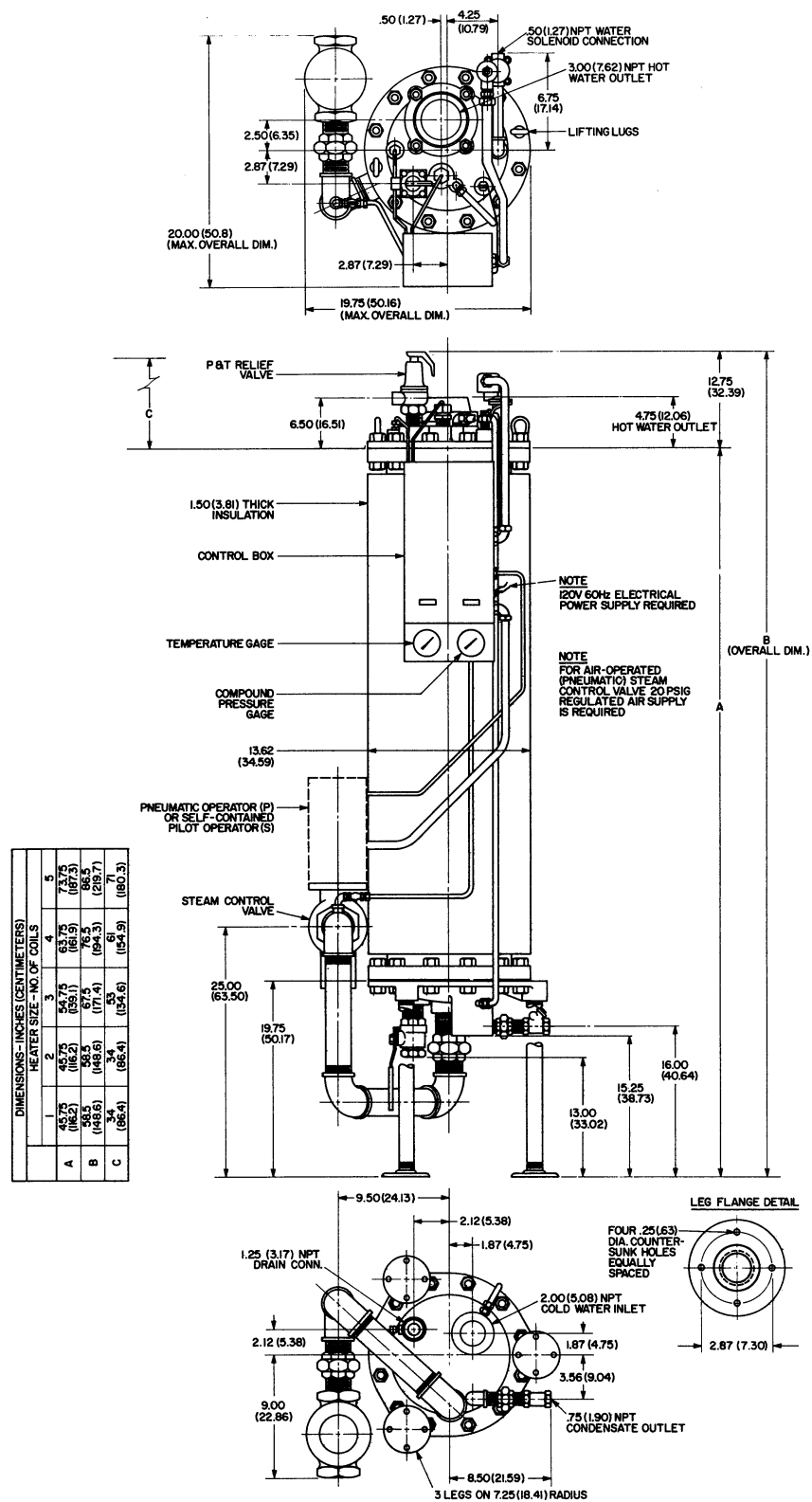


Figure HE-107-1 -- Dimensions for AERCO Helitherm Heat Exchanger  
Packaged Water Heater, Model SW1A-PLUS

# INSTALLATION

1. Dimensions for an AERCO Heat Exchanger (Heater) Model SW1A-Plus are shown in Figure HE-107-1.
2. Uncrate the Heater carefully. Set the Heater upright by using a block and tackle or hoist attached to the lifting lugs on the top head of the Heater (the eye-bolts shown in Figures HE-107-1 and HE-107-14). Always use the lifting lugs to lift and/or move the Heater.
3. If possible, for easy in-place maintenance, locate the Heater where there is at least 2 feet clearance all around the Heater and where the head room clearance from the top of dimension B in Figure HE-107-1 is at least equal to dimension A for the Heater Model less 12 inches.
4. It is suggested that the Heater legs be secured to the floor. However, any other means for securing the Heater may be used. If piping is used to secure the Heater, the piping must include ample provision for expansion.
5. Make all piping connections as instructed in step 6 below and in accordance with the appropriate Figure showing:
  - Single Heater -- Figure HE-107-2
  - Parallel Heaters -- Figure HE-107-3
  - Single Heater used with an Accumulator -- Figure HE-107-4
  - Single Heater used with a Stratified Storage Tank -- Figure HE-107-5or with any specific piping diagram which may have been furnished by AERCO for this installation.
6. For best Heater performance, observe the following very carefully in making the piping installation:
  - a. Do not use cement or red lead in making up pipe joints.
  - b. For Heater connection types, sizes, and exact locations, see Figure HE-107-1.
  - c. All piping to the Heater top head should be provided with unions or flanges which are located beyond the outside diameter of the Heater head to permit removal of the head and shell for in-place maintenance.
  - d. include all of the shutoff (stop) valves, check valves, steam traps and other elements in the piping as shown in Figure HE-107-2, HE-107-3, HE-107-5, or HE-107-5, or as separately specified by AERCO. Note that the check valve shown at the Heater in the Condensate return line is furnished in the piping package assembly by AERCO.
  - e. The condensate return piping should be arranged to permit condensate to drain freely by gravity from the Heater bottom head. Failure to do so may result in Heater improper operation and/or in damage to the Heater Steam/Condensate system.
  - f. All drain discharges -- relief valve in the top head of the Heater, outlet of the water solenoid valve in the top head of the Heater, and drain valve in the bottom head of the Heater -- should be piped directly to a convenient floor drain.
7. Before making final piping connections to and from the Heater and Control Valve, blow out all piping thoroughly.
8. If an air-operated Control Valve is furnished in the Heater package, make the necessary supply air connection to the connector through the side of the Control Box (see Figure HE-107-12). The supply air pressure must be maintained at 20 psig.
9. Connect 110 v 60 Hz power supply wiring through the side of the Control Box to the electrical junction box (see Figure HE-107-12).

## LEGEND

	STOP VALVE		STRAINER
	CHECK VALVE		RELIEF VALVE
	CONTROL VALVE		THERMO-METER
	ORIFICE UNION		STEAM TRAP
	CONTROL THERMAL ELEMENT		CIRCULATOR
	PRESSURE GAGE		BALANCING COCK
	PIPE UNION OR FLANGES		PETCOCK
	COMPOUND PRESS. GAGE		FLOW INDICATOR

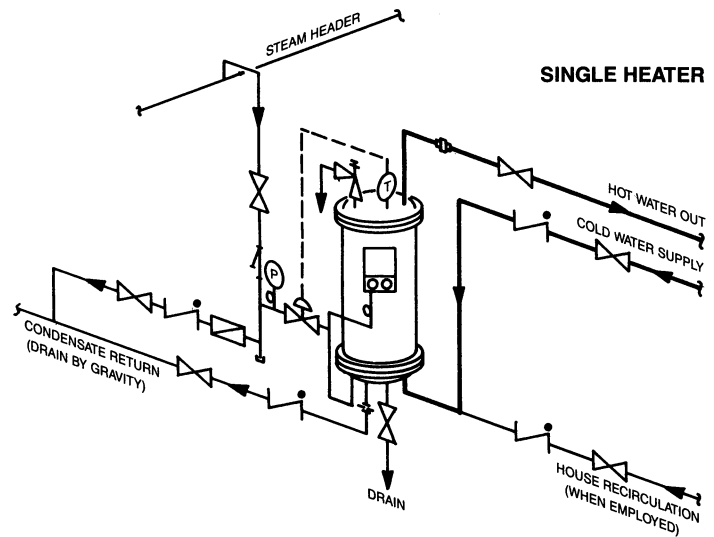


Figure HE-107-2 -- Piping Connections for a Single Heater

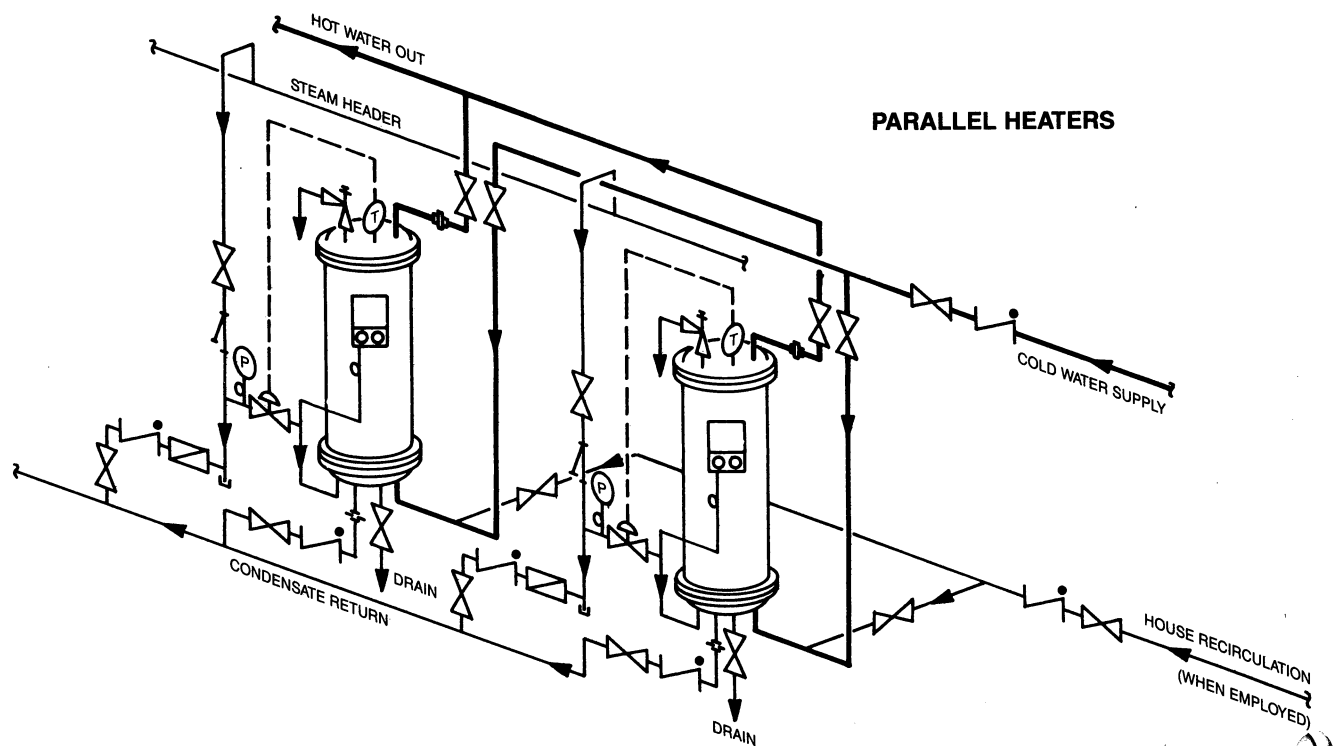


Figure HE-107-3 -- Piping Connections for Parallel Heaters

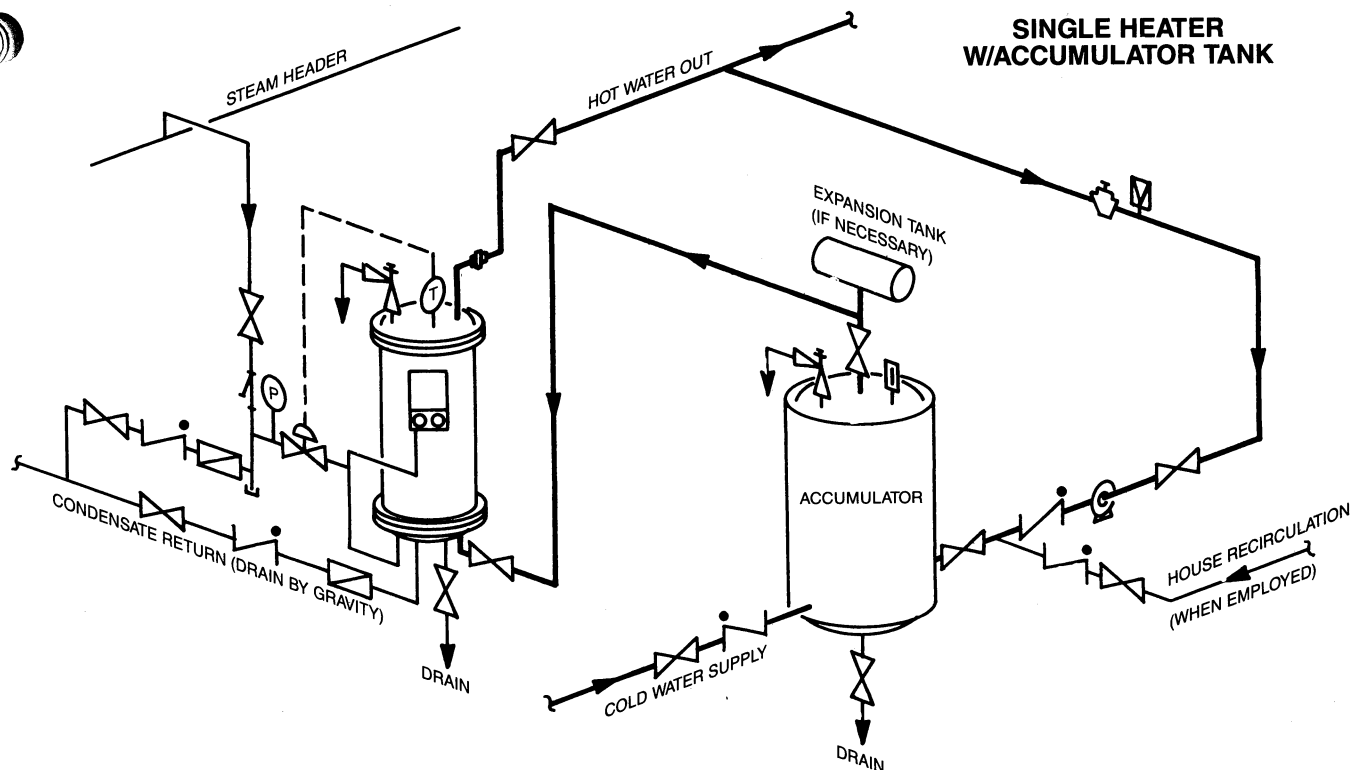


Figure HE-107-4 -- Piping Connections for a Single Heater used with an Accumulator

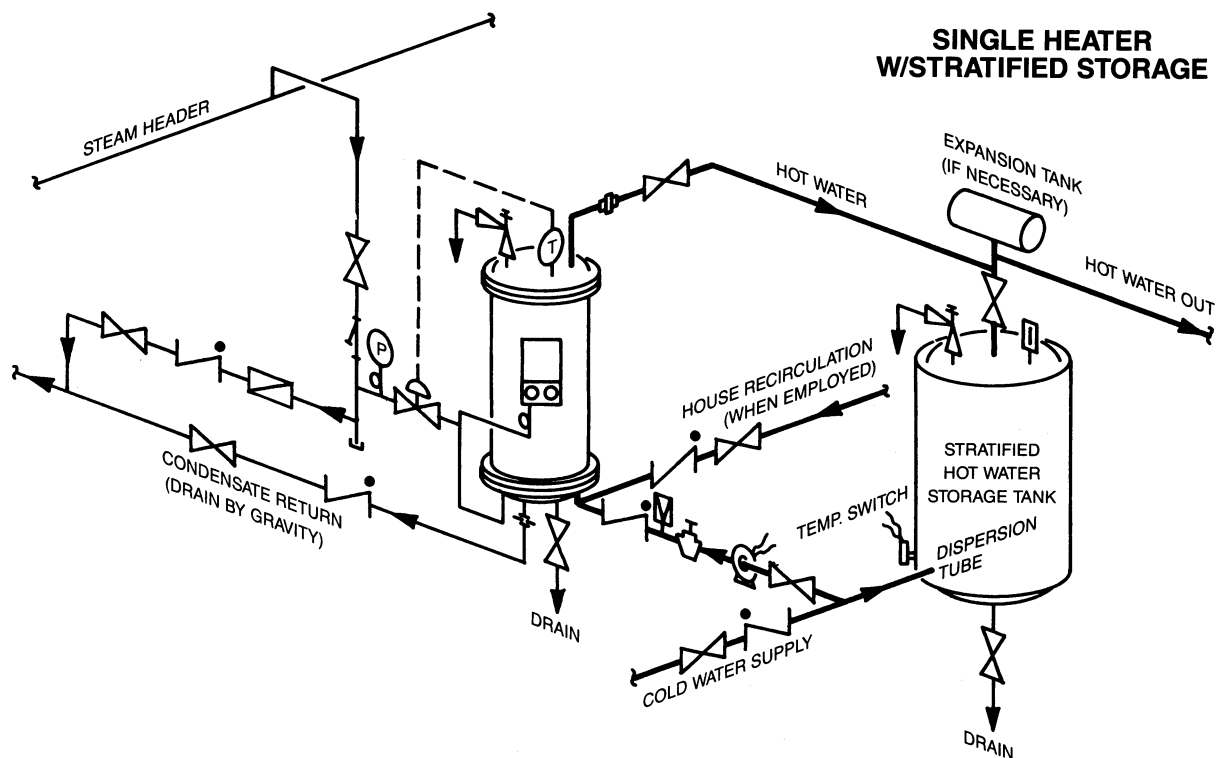


Figure HE-107-5 -- Piping Connections for a Single Heater used with a Stratified Storage Tank

# PRINCIPLE OF OPERATION

The AERCO Helitherm Heat Exchanger (Heater) consists of three principal parts (see Figure HE-107-6):

- 1 -- Shell with Top and Bottom Heads
- 2 -- Coils assembled to Steam Riser and Condensate Return
- 3 -- Integral Demand Anticipator Temperature Control Unit

Cold Water (or other liquid) enters the Heater through the inlet connection and orifice in the bottom head and strikes the deflector. The orifice serves to divert some Cold Water into the shunt tube, whereas the deflector disperses the incoming Cold Water evenly into the bottom of the shell. The Cold Water in the shell, then, flows upward among the coils (heating surfaces) and, heated, is discharged through the check valve and Hot Water outlet connection in the Heater top head.

Steam enters through the control valve and its inlet connection in the bottom head and is fed through the Steam riser to the inlet of each coil unit. The Steam then flows through each coil unit simultaneously in parallel, leaves through each coil outlet as Condensate, enters the condensate return, and leaves the Heater through the condensate outlet connection in the bottom head of the Heater.

As noted above, the Cold Water being heated flows through the Heater from bottom to top. In addition, Heated Water, being of less density than Cold Water, migrates to the top of the shell by convection. These actions result in the hottest Water always being at the top of the Heater -- at the Heater outlet and at the Hot Water inlet to the Anticipator sensing tube (see Figure HE-107-6).

Hot Water from the top of the Heater shell enters the open end of the sensing tube and Cold Water enters the sensing tube from the shunt tube at a rate proportional to the load (call for Hot Water) on the Heater. The mixture of Hot and Cold Water in the sensing tube, plus the Hot Water around the lower exposed portion of the temperature sensing element, creates an average temperature which necessarily will be cooler than the temperature of the Hot Water in the top of the Heater shell itself.

The temperature sensing element "reads" the average temperature of the Water in the sensing tube and Heater at any given moment and signals the Steam control valve to modulate between full open and closed as necessary to maintain the required Heater Hot Water outlet temperature. With no demand or load on the Heater, the temperature sensing element reads only the temperature of the Water in the top of the Heater and at the Heater outlet. If the Water is at the required temperature or above, the sensing element signals the Steam control valve to close.

However, the moment that there is a demand for Hot Water, Cold Water flows from the shunt tube to mix with the Hot Water in the sensing tube, cooling the sensing element so that it signals the Steam control valve to open. The need for Steam (heat) to the coils is satisfied at once, incoming Cold Water passing through the coils is heated, and the Heater Hot Water outlet temperature does not fall below that required.

The Anticipator Unit, therefore, as its name implies, is constantly alert to load conditions and changes, as well as to changes in the temperature of the incoming Cold Water, and provides FEED-FORWARD temperature control at all times.

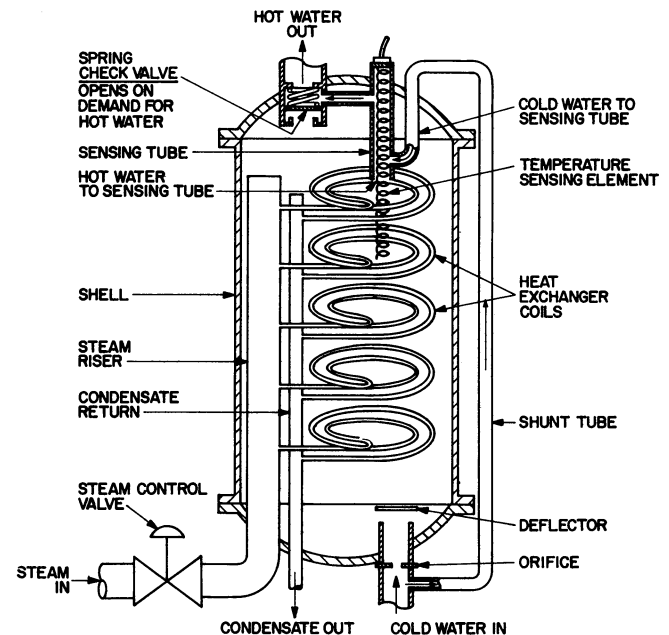


Figure HE-107-6 -- Schematic of AERCO Model A-PLUS Water Heater showing Anticipator Temperature Control



# OPERATING PROCEDURES

- OP1. With the installation entirely completed, including
- .....all piping and connections have been made,
  - .....all connecting piping has been cleaned (blown) out,
  - .....all connections per steps 7 and 8 under INSTALLATION have been made,
- open the shutoff valve in the Cold Water inlet line and hold the relief valve in the Heater top head open to allow air to come out (otherwise an air pocket will be built up and the Heater will not fill). When water flows out of the relief valve, the Heater is full.
- OP2. Temporarily set the Over-Temperature Limit System Temperature Switch in the Control Box (see Figure HE-107-12) to its high temperature limit.
- OP3. If the Steam Control Valve furnished is air-operated and there is a Temperature Controller in the Control Box (see Figure HE-107-12), set the Controller at the temperature desired to be held at the Heater hot water outlet.
- OP4. Open the shutoff valve in the Hot Water outlet line. Open a hot water faucet or faucets in the building or process to insure a flow of water through the Heater. For best results in adjusting the temperature control, a water flow of 10% to 25% of Heater rating is desirable.
- OP5. Slowly open all shutoff valves in the Steam inlet and Condensate outlet lines.
- OP6. Follow the instructions furnished with the air-operated Temperature Controller and Control Valve or with the self-contained Temperature Regulator Valve, and:
- a. Introduce Steam to the Heater.
  - b. Adjust the air-operated Temperature Controller or self-contained Temperature Regulator Valve until the Heater hot water outlet temperature is being held steady at the desired temperature. If the hot water outlet temperature is erratic, see step OP7 below.
  - c. Close the hot water faucet or faucets opened in step OP4. Open any shutoff valves in the building recirculation system if such is included in the Heater installation.
- OP7. If the hot water outlet temperature is erratic, especially during load changes:
- a. Put a load on the Heater as quickly as possible by opening a hot water faucet or faucets in the building or process.
  - b. Adjust the Temperature Controller or Temperature Regulator to provide best response on load changes. See the instruction furnished with the Controller or Regulator.
- OP8. Adjust the Over-Temperature Limit System Temperature Switch in the Control Box to its proper setting in accordance with the instructions furnished which cover the Over-Temperature Limit System -- usually 150°F to 200°F higher than the desired hot water outlet temperature.
- OP9. The Heater installation is now set for operation. No further operation procedure is necessary unless or until further temperature control adjustments may be required. If so, repeat steps OP4, OP5, OP6, and, if necessary, step OP7.
- OP10. To SHUT DOWN the system:
- a. Close all shutoff valves in the Steam inlet and Condensate outlet lines.
  - b. In this order, close the shutoff valves in
    - (1) the hot water outlet line,
    - (2) the recirculation line, if any, and
    - (3) the cold water inlet line.
  - c. If the system includes an accumulator or stratified storage tank, do not shut off the cold water until the Heater has cooled down. If the system is allowed to cool while the cold water is shut off, the Heater liner may collapse because of formation of a vacuum.
- OP11. For DRAINING THE HEATER, see the instructions included below under ROUTINE MAINTENANCE.
- OP12. To START UP again, with Heater shell filled per step OP1 above, open the shutoff valves in the following order:
- (1) shutoff valve in the Cold Water inlet line,
  - (2) any shutoff valve in the recirculation line, if any,
  - (3) shutoff valve in the Hot Water outlet line, and
  - (4) shutoff valves in the Steam inlet and Condensate outlet lines.
- OP13. After each startup, check the temperature control. If necessary, make adjustments per steps OP4 through OP8 above.

## ROUTINE MAINTENANCE

The constant flexure of the Heater coils under varying load conditions automatically provides a descaling action and prevents a buildup of brittle scale. A periodic blowdown (draining) is required to remove accumulated solids.

After the first 3 months of initial operation, drain the Heater as outlined below. Examine the water being drained.

- (a) If the amount of solids appears to be heavy, set schedule to drain the Heater every 3 months.
- (b) If the amount of solids appears to be light, set a schedule to drain the Heater every 6 months.
- (c) Even if the amount of solids appears to be very light, drain the Heater at least once each year.
- (d) Also see TROUBLESHOOTING and CORRECTIVE MAINTENANCE below. If descaling by thermal shock is required, schedule that procedure in your Routine Maintenance program.

Check the temperature control at least once every 3 months. Make any necessary adjustments per steps OP4 through OP8 under OPERATING PROCEDURES above.

DRAIN THE HEATER as follows:

- RM1. Close all shutoff valves in the Steam inlet and Condensate outlet lines.
- RM2. In this order, close the shutoff valves in
  - (1) the hot water outlet line,
  - (2) the recirculation line, if any, and
  - (3) the cold water inlet line.
- RM3. Carefully open the relief valve in the Heater top head to relieve pressure in the Heater shell. If water continues to flow from the relief valve, one of the water shutoff valves either leaks or is not shut off tight. This must be remedied until there is no more flow through the relief valve.
- RM4. With the relief valve being held open (to prevent creating a vacuum in the Heater shell), open the drain valve and drain the Heater completely.
- RM5. To refill the Heater and place it back into operation, close the drain valve and proceed through steps OP1, OP12, and OP13 under OPERATING PROCEDURES above.

## TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE & REMEDY CORRECTIVE MAINTENANCE (CM) ITEM NO.
A. Heater does not maintain required temperature at rated capacity	CM1, CM2, CM6, CM12, CM14, CM17, CM18, CM19
B. Heater overheats	CM1, CM5, CM6, CM8, CM11, CM13, CM14
C. Hot Water outlet temperature fluctuates widely	CM2, CM6, CM11, CM12, CM13, CM14, CM17, CM19
D. Insufficient Water through or from Heater	CM3, CM15
E. Excess or insufficient Condensate being returned from Heater	CM6, CM17
F. Steam being discharged into Condensate drain	CM18, CM19
G. Pressure/Temperature Relief Valve pops	CM4, CM5, CM6, CM8, CM9, CM10, CM11, CM13, CM14, CM16
H. Heater shuts down below, at, or too near above required hot water temperature	CM16
I. Loud banging in Heater or in Steam or Condensate piping (not to be confused with a normal clicking noise)	CM6, CM7, CM9, CM10

## CORRECTIVE MAINTENANCE

The following are probable causes and remedies for improper action of the Heater. See TROUBLESHOOTING for the symptoms and references to the corrective maintenance actions to be taken.

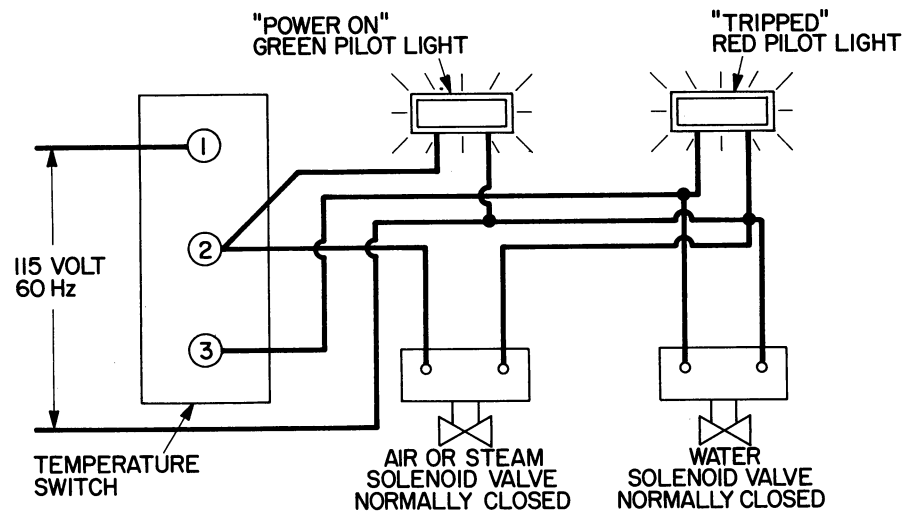
- CM1. The temperature gage or steam pressure gage, or the steam supply pressure gage ahead of the Control Valve, may read wrong. Check each with a gage which is known to be correct.
- CM2. Steam pressure is too low. Check the steam supply pressure gage ahead of the Control Valve. If the reading is low, adjust the steam supply pressure to that which is required. If there is a restriction in the steam supply line, the gage reading will drop excessively when the Heater calls for full steam even though the pressure appears to be normal when the load is light. If the steam supply pressure is correct, the steam pressure gage (below the Control Box) reading should reach design pressure for steam in the coils as the Heater hot water outlet temperature drops. If it does not, check the operation of the Control Valve.
- CM3. Cold Water pressure is low. Check and correct, if necessary, the Water pressure to the Heater.
- CM4. Static pressure of the Cold Water is too high. Make the necessary corrections to bring the Water pressure below that for which the Relief Valve is set.
- CM5. Water to be heated is preheated too hot. Reduce the preheating to a temperature at least 10°F under the desired Heater hot water outlet temperature.
- CM6. 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. If necessary, rearrange the Condensate return piping per step 6e under INSTALLATION above. 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.
- CM7. Steam supply line is not properly trapped. Install a trap as indicated in the Figures HE-107-2 through HE-107-5.
- CM8. Leaking shutoff valve in the by-pass line, if any, around the Control Valve. Maintain the shutoff valve to shut tight.
- CM9. Lack of expansion capability in the hot water system. Insert an expansion tank in the outlet hot water line close to the Heater.
- CM10. Insufficient shock absorbers. Insert shock absorbers (water hammer arresters) in both the cold and hot water systems as needed to eliminate shock waves.
- CM11. The Steam Control Valve does not close. Check the instructions covering the Valve.
- CM12. The Steam Control Valve does not open. Check the instructions covering the Valve.
- CM13. The temperature control thermal element (connected to the air-operated Temperature Controller or the self-operated Control Valve and located in the Heater top head) has failed. Refer to the instructions covering the Temperature Controller or Control Valve.
- CM14. The Anticipator Unit system is not operating properly. Check to make sure that the temperature sensing element has not failed (see CM13 above), that the shunt tube (Item 18 in Figure HE-107-13) has not become clogged, and that the check valve at the hot water outlet is working properly (see CM15 below). Make any necessary corrections.
- CM15. The Anticipator check valve at the Heater hot water outlet is not working properly. Disassemble and inspect the check valve, clean the valve, and repair or replace any parts as necessary per steps D1 through D5 under DISASSEMBLY below.
- CM16. The Over-Temperature Limit System is out of adjustment or some component of the system has failed. Check out the system setting per step OP8 under OPERATING PROCEDURES above. Inspect and repair or replace each component as necessary.
- CM17. There is a leak in the Heater coil(s), steam riser, or condensate return, causing water from the shell to leak into the heating coil system, or steam or condensate from the coil system into the shell. To verify such a leak, shut off the Steam supply and break a connection in the Condensate line -- CAREFULLY to avoid being burned. Condensate will drain from the coil system initially, but the flow should stop after a minute or two. If the flow continues, water is leaking from the pressurized shell side to the tube side of the Heater. Disassemble, inspect, repair (if possible), replace, and reassemble the Heater as outlined below under DISASSEMBLY and REASSEMBLY.
- CM18. The Heater coils are scaled up. Descale the Heater by thermal shock in the manner outlined below under DESCALING BY THERMAL SHOCK METHOD.
- CM19. The Heater is being utilized at a rate higher than its design capacity. Contact the nearest AERCO Representative for advice in remedying this problem.

# DESCALING BY THERMAL SHOCK METHOD

Where, under certain conditions of continuous steady usage, the Cold Water is so hard or alkaline that normal flexure of the Heater coils (see ROUTINE MAINTENANCE) and routine blowdown (draining the Heater shell) will not remove scale build-up on the coils, the heating surfaces (coils) may be thermally shocked, without damage to any part of the Heater, to dislodge scale solids.

Proceed as follows:

- TS1. Drain the Heater per steps RM1 through RM4 under ROUTINE MAINTENANCE above. However, instead of holding the relief valve open in step RM4, remove the relief valve shown as Item 5 in Figure HE-107-13 from the Heater top head.
- TS2. Open the Heater drain valve. Leave the drain valve open until step TS8 below.
- TS3. Connect a source of cold water (for example, a hose from a cold water faucet) to the open relief valve connection.
- TS4. Open all shutoff valves in the Steam inlet line and the Condensate outlet line to allow Steam to the Heater. After about 30 seconds, or until Steam is blowing out of the Condensate drain line, close the shutoff valve in
- the Condensate outlet line. Leave the Steam inlet line open for about 2 minutes longer, and then close all Steam inlet shutoff valves.
- TS5. Inject a flow of cold water through the relief valve connection for about 2 minutes. Then shut off the cold water flow and open the Condensate line shutoff valve to drain off all Condensate.
- TS6. Repeat steps TS4 and TS5 several times until the water coming from the Heater drain appears to be relatively free of solids.
- TS7. Remove the cold water source from the relief valve connection. Open the shutoff valve in the main Cold Water inlet line and allow a complete flushing of the Heater shell.
- TS8. After the Heater shell has been completely drained, close the Heater drain valve, replace the relief valve, and place the Heater back into operation per steps OP1, OP12, and OP13 under OPERATING PROCEDURES above.
- TS9. If Cold Water conditions are so severe that thermal shocking does not remove scale deposits, consult the nearest AERCO Representative for advice.



## TEMPERATURE SWITCH TERMINAL DESIGNATION

- 1 - COMMON
- 2 - NORMALLY CLOSED (BREAKS ON TEMPERATURE RISE)
- 3 - NORMALLY OPEN (MAKES ON TEMPERATURE RISE)

NOTE: UPON LOSS OF ELECTRICAL POWER, HEATER SHUTS DOWN

A REV.-REDRAWN

Figure HE-107-7 -- Over-Temperature Limit System  
Wiring Diagram

# DISASSEMBLY

## Reference illustrations:

HE-107-7	Over-Temperature Limit System Wiring Diagram
HE-107-8	Anticipator Check Valve Assembly
HE-107-12	Heater Control Box Assembly
HE-107-13	Heater Package Assembly
HE-107-14	Heater Assembly

**Special Tools Required:** (1) Torque wrench for 5/8" nuts.  
(2) Block and tackle or ratchet or winch hoist is recommended for lifting and moving the Heater, or for lifting off the Heater top head and shell.

## To Remove Check Valve Assembly

See Figure HE-107-8.

- D1. Shut down the Heater in accordance with step OP10 under OPERATING PROCEDURES above. Manually (and carefully) open the relief valve in the Heater top head to relieve any pressure in the Heater shell.
- D2. Disconnect the union in the Hot water outlet piping (the one located beyond the outside diameter of the Heater top head). Then remove the Nuts (51) and the Outlet Flange (56) and outlet piping connected to the Flange.
- D3. Separately, lift out the Spring Plate Assembly (58), the Gasket (57), the Spring (59), the Washer (61) and the Valve Plug (64).
- D4. Clean all parts and gasket surfaces thoroughly, and repair or replace any part necessary to make the Check Valve operate properly (open on water flow through the Heater).
- D5. See REASSEMBLY below for reassembly of the Check Valve into the Heater top head.

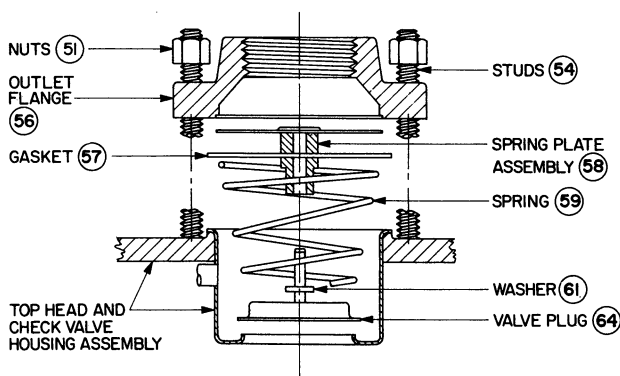


Figure HE-107-8 -- Exploded Anticipator Check Valve Assembly

## To Remove Heater Shell

**NOTE** that all part item numbers given in parentheses ( ) in the instructions below refer to those shown in Figure HE-107-12, HE-107-13, or HE-107-14.

**ALSO, NOTE** that it is not necessary to disassemble or remove the Check Valve assembly (see above) in order to remove the Heater Shell.

- D6. Shut down and drain the Heater in accordance with steps RM 1 through RM4 under ROUTINE MAINTENANCE above.
- D7. Remove the Temperature Control Thermal Element from the Thermal Well Bushing (7) in the Heater top head. Be careful not to damage the Element or its capillary.
- D8. Disconnect ALL external piping from the Heater top head, including that to the Relief Valve (5) and the Water Solenoid Valve (1). Disconnect the Hot Water outlet piping at the union located beyond the outside edge of the Heater top head.
- D9. Disconnect the power supply wiring to the Control Box and all wiring between the Control Box and the Solenoid Valve(s).
- D10. If an air-operated Steam Control Valve has been furnished with the Heater, disconnect the air supply and control air piping from the Control Box.
- D11. Close the Shutoff Cock (20) in the Pressure Gage line and disconnect the Compression Fitting (19).
- D12. Disconnect the Compression Fitting (26), located at the bottom of the Shunt Tubing (18), from the Heater bottom head.
- D13. Mark the edges of the Heater lower head flanges in order to indicate their correct relative positions upon reassembly.
- D14. Remove the Nuts (51) and Studs (52) from the Heater lower head flanges.
- D15. Using a hoist or block and tackle attached to the Lifting Lugs (53) on the Heater upper head, CAREFULLY lift the top head and shell assembly STRAIGHT UP off the Heater riser and coil assembly. **DO NOT SCRAPE** the Shell lining against the coil tubing or risers.
- D16. Clean and inspect the inside of the Shell and the Steam Riser/Condensate Return/Coils assembly for obvious damage.
- D17. With the Condensate return shutoff valves closed, open the shutoff valves in the Steam inlet line to allow Steam to the Heater. Any leak in the Coils, Steam Riser, or Condensate

Return will become visible quickly. Note where the leaks are and shut off the Steam.

D18. If a Coil must be replaced, use a 1-5/16" open end wrench to disconnect the unions holding the Coil to the Steam Riser and Condensate Return. Be careful not to damage the spud threads.

D19. If either the Steam Riser or Condensate Return must be replaced, it is recommended that the Heater be reassembled and returned to the AERCO factory for the replacement. (AERCO has the proper factory setup, pressure testing equipment, ready access to any additional parts needed, and the expertise necessary to provide a guaranteed replacement.) Contact the nearest AERCO Representative for instruction for making the return.

If, however, returning the Heater to the AERCO factory is impractical, field replacement may be made but cannot be guaranteed by AERCO. If this decision is made, proceed as follows:

- a. Remove all Coils per step D18 above. Examine each Coil carefully to make sure that replacement at this time is not an advisable action.
- b. Remove the damaged Steam Riser or Condensate Return.

D20. If the Shell copper liner has been damaged, reassemble the Heater and return it to the AERCO factory for replacement of the liner -- field replacement cannot be made. Contact the nearest AERCO Representative for instruction for making the return.

D21. If it is necessary for any reason to remove the Heater Upper Head (55) from the Shell (68):

- a. Remove the Temperature Gage and Temperature Switch Thermal Elements from their locations in the Heater Upper Head.
- b. Remove the Nuts (51), Studs (52) and (77), and Lifting Lugs (Eye Bolts) (53), and lift the Head off the Shell.
- c. Inspect, repair, or replace any of the Anticipator assembly (see Section A-A in Figure HE-107-14) which may have been damaged.

## REASSEMBLY

Reference illustrations:

HE-107-8	Anticipator Check Valve Assembly
HE-107-9	Alignment of Steam Riser and Condensate Return
HE-107-10	Assembly of Coil to Steam Riser or Condensate Return
HE-107-11	Coil Spacing Tool
HE-107-13	Heater Package Assembly
HE-107-14	Heater Assembly

Special Tools Required: Same as for DISASSEMBLY above plus a coil spacing tool as shown in Figure HE-107-11.

### To Reassemble Check Valve

See Figure HE-107-8.

- R1. Insert the Valve Plug (64), the Washer (61), the Spring (59), and the Gasket (57) -- AERCO recommends that a new Gasket (57) be used whenever the Check Valve is reassembled.
- R2. Insert the Spring Plate Assembly (58), taking care to center it as closely as possible.
- R3. Line up the Outlet Flange (56) on the Studs

(54) in the Heater Upper Head, making sure that the Spring Plate Assembly (58) is centered in its groove in the bottom of the Outlet Flange (56).

- R4. Replace the Nuts (51) and tighten the Outlet Flange (56) leak-tight to the Heater top head.
- R5. If this is the only reassembly operation required, reconnect the Heater hot water outlet piping union and place the Heater back into operation in accordance with steps OP1, OP12, and OP13 under OPERATING PROCEDURES above.

### To Reassemble Heater Shell

NOTE that all part item numbers given in parentheses ( ) in the instructions below refer to those shown in Figures HE-107-12, HE-107-13, and HE-107-14.

- R6. If either the Steam Riser (65) or Condensate Return (66) must be replaced:
  - a. Use pipe joint compound or Teflon tape on threads and screw the replacement Steam Riser and/or Condensate Return into the Heater Lower Head (71).

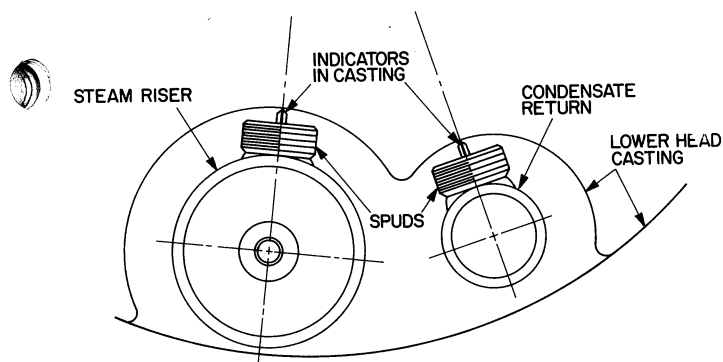


Figure HE-107-9 -- Alignment of Steam Riser and Condensate Return

- b. Turn the Riser and/or Return in leak tight, but carefully line up the spud centers with the raised indicators on the bosses in the Lower Head casting as shown in Figure HE-107-9.

R7. If a coil must be replaced:

- See Figure HE-107-10. Before the coils to the Riser or Return spuds, wrap each spud with Teflon tape and apply a lubricant (grease) to the back of the union nuts and shoulders on the coil tail pieces (see Figure HE-107-10). Rotate the nuts to spread the grease.
- Assemble the coil union to the Condensate Return first. Do not tighten. Assemble the other coil union to the Steam Riser.
- Using a torque wrench, tighten both unions to approximately 40 ft-lb while holding the coil so that the turns of the coil remain as horizontal as possible, where they are brazed to the tail pieces, after tightening.  
NOTE: Never use a hammer on a wrench to tighten a union nut. Deformation and subsequent leaking may result.
- Space the coil tubes evenly throughout the Heater, with each tube space about 1/8" wide. It is especially important that no tubes rest on any coil unions. A spacing tool may be made up similar to that shown in Figure HE-107-11 (available from AERCO, Part No. 12523). Insert the tool flat between the coil tubes and twist the tool until the desired spacing is obtained.
- Test for leaks in accordance with step D17 above under DISASSEMBLY. Make any corrections necessary.

- R8. Clean all gaskets and gasket surfaces thoroughly. AERCO recommends that new Gaskets (74) be used whenever reassembling either the Upper or Lower Head to the Shell.

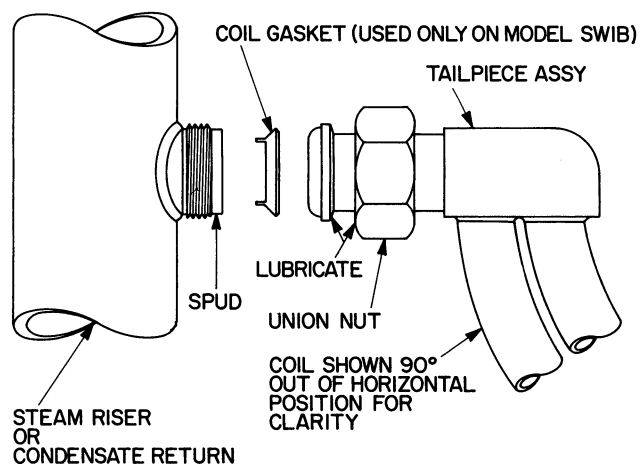


Figure HE-107-10 -- Assembly of Coil to Steam Riser or Condensate Return

- R9. If the Heater Upper Head (55) has been removed from the Shell (68):

- Clean the gasket surfaces thoroughly and place a Gasket (74) (a new gasket is recommended) on the Shell top flange.
- Replace the Heater Upper Head and Anticipator Assembly into the top of the Shell, lining up the stud holes.
- Reassemble the Studs (52) and (77), the Lifting Lugs (eye bolts) (53), and Nuts (51) into the Head and Shell flanges. Cross-tighten the Nuts to approximately 75 ft-lb torque to obtain uniform seating. Then progressively tighten the Nuts to approximately 150 ft-lb torque for a tight seal.
- Replace the Temperature Gage and Temperature Switch Thermal Elements into their locations in the Heater Upper Head.

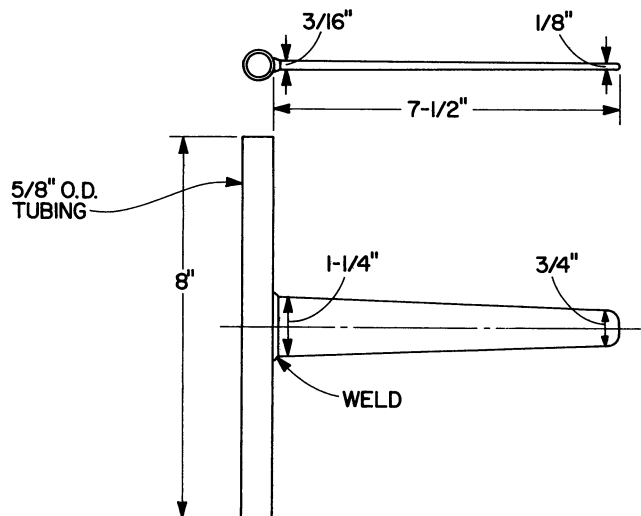


Figure HE-107-11 -- Coil Spacing Tool

- R10. Place the Gasket (74) (new is recommended) on the Heater Lower Head flange.
- R11. Using a hoist or block and tackle attached to the Lifting Lugs (53) on the Heater Upper Head (55), CAREFULLY lower the Upper Head and Shell STRAIGHT DOWN over the Coil and Riser assembly. DO NOT SCRAPE the Shell lining against the Coil tubing or Risers.
- R12. Before resting the Shell flange onto the Lower Head flange, make sure that the Shell is positioned properly by lining up the marking put on the edges of the flanges in step D13 under DISASSEMBLY above. For further assurance, see that the raised indicators on the outside edges of each of the Upper and Lower Head flanges line up with each other. THIS IS VERY IMPORTANT.
- R13. Assemble the Studs (52) and Nuts (51) into the Shell and Lower Head flanges. Tighten the Nuts in the same manner as in step R9c above.
- R14. Reconnect the Compression Fitting (26), located at the bottom of the Shunt tubing (18), to the Lower Heater Head.
- R15. Reconnect the Compression Fitting (19) at the end of the Pressure Gage line and open the Shutoff Cock (20).
- R16. If an air-operated Control Valve has been furnished with the Heater, reconnect the air supply and control air piping to the Control Box.
- R17. Reconnect the power supply wiring to the Control Box and all wiring between the Control Box and Solenoid Valve(s).
- R18. Reconnect all external piping to the Heater Upper Head, including that to the Relief Valve (5) and the Water Solenoid Valve (1).
- R19. Replace the Temperature Thermal Element into the Thermal Well Bushing (7) in the Heater Upper Head. Be careful not to damage the Element or its capillary.
- R20. Refill and place the Heater back into operation in accordance with steps OP1, OP12, and OP13 under OPERATING PROCEDURES above.



## RECOMMENDED SPARE PARTS

<u>Quantity Per Heater</u>	<u>Item No.</u>	<u>Part Name</u>	<u>Shown in Figure No.</u>
<u>For any MODEL SW1A-PLUS Heater</u>			
1	103	Temperature Switch	HE-107-12
1	110	Dial Thermometer	HE-107-12
1	112	Compound Pressure Gage	HE-107-12
1	120	Green Indicator Light	HE-107-12
1	121	Red Indicator Light	HE-107-12
2	57	Outlet Flange Gasket	HE-107-14
4	74	Head Gasket	HE-107-14
*	67	Coil Assembly	HE-107-14

\* Minimum of 2 to a maximum of the number in your largest Heater

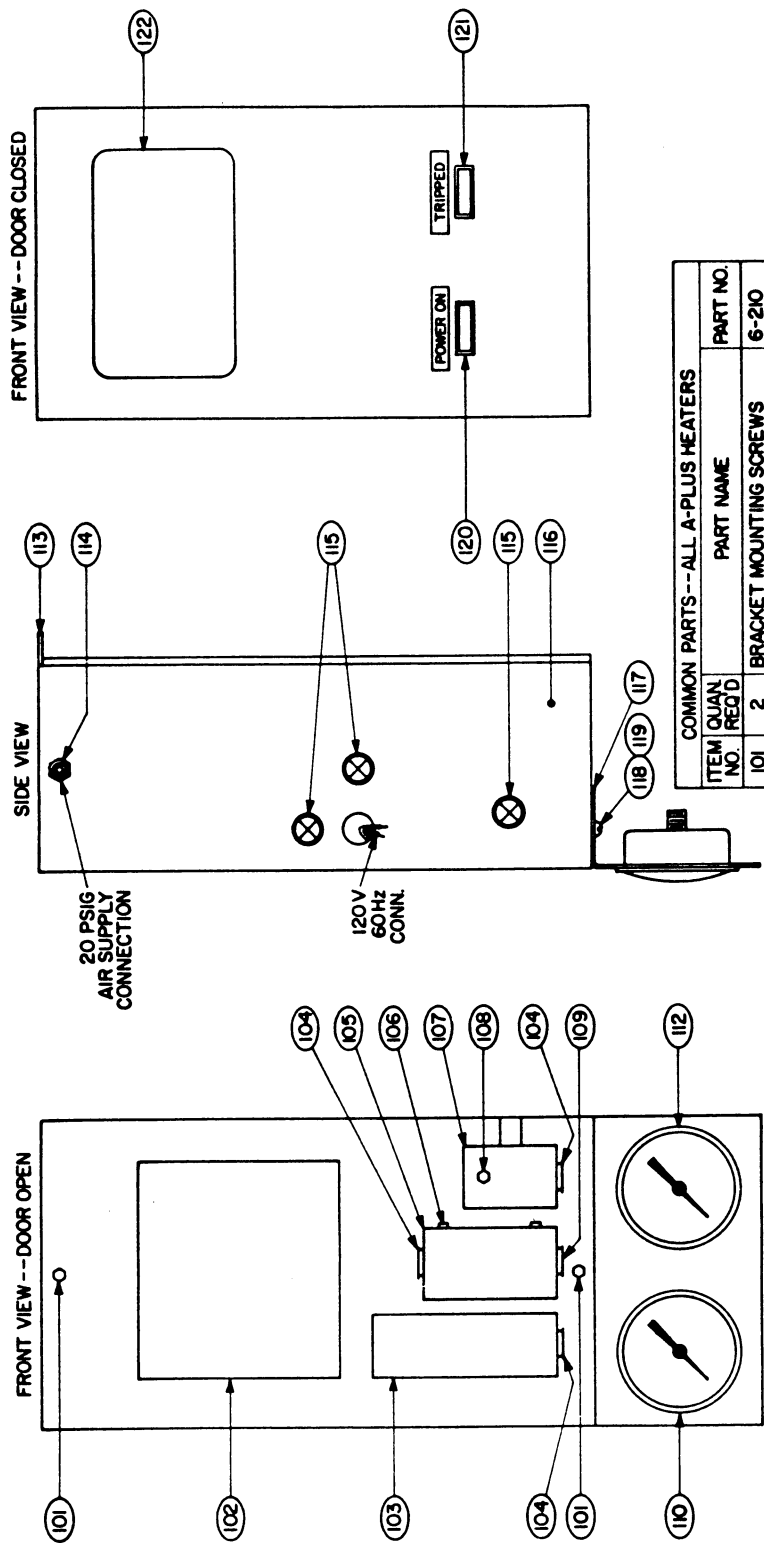
### For MODEL SW1A-PLUS Heater with Air-Operated Steam Control Valve

1	102	Temperature Controller	HE-107-12
1	107	Air Solenoid Valve	HE-107-12
1	5	P&T Relief Valve**	HE-107-13
1	1	Water Solenoid Valve	HE-107-13

### For MODEL SW1A-PLUS Heater with Self-Contained Steam Control Valve

1	1	Water Solenoid Valve	HE-107-13
1	5	P&T Relief Valve**	HE-107-13
1	16	Steam Solenoid Valve	HE-107-13
1	--	Control Valve Thermal Element, AERCO Part No. 5144-1	HE-107-13

\*\* See Table B in Figure HE-107-13 for correct size and Part No. of P&T Relief Valve required



CONTROL BOX PARTS FOR A-PLUS HEATERS WITH AIR-OPERATED CONTROL VALVE				
ITEM NO.	QUAN. REQ'D	PART NAME	PART NO.	
102	1	TEMPERATURE CONTROLLER BARBER COLMAN PK-8124-103	18557	
104	1	HEYCO BUSHING UB-875	12951	
107	1	AIR SOLENOID VALVE ASCO CAT. NO. 8320-B3	9537	
108	2	1/4" TUBE x 1/8" NPT 90° COMP FITTING	8-40	
114	1	1/4" BULKHEAD UNION CONN.	8-37	
115	1	HEYCO BUSHING UB-750	12952	

COMMON PARTS--ALL A-PLUS HEATERS				
ITEM NO.	QUAN. REQ'D	PART NAME	PART NO.	
101	2	BRACKET MOUNTING SCREWS	6-210	
103	1	TEMPERATURE SWITCH AQUASTAT MODEL L6008A	5131-1	
104	2	HEYCO BUSHING UB-875	12951	
105	1	ELECTRICAL JUNCTION BOX	121299	
106	4	PLUG	122183	
109	1	HEYCO BUSHING UB-625	122184	
110	1	2-1/2" DIAL THERMOMETER	12953-1	
112	1	2-1/2" DIAL COMPOUND PRESS. GAGE	121602-1	
113	1	BOX MOUNTING BRACKET	161100	
115	2	HEYCO BUSHING UB-750	12952	
116	1	CONTROL BOX	20789	
117	1	GAGE MOUNTING BRACKET	161016	
118	2	10-32x3/8" LG. MACH. SCREWS	6-288	
119	2	10-32 NUTS	6-223	
120	1	GREEN INDICATOR LIGHT	121949	
121	1	RED INDICATOR LIGHT	121948	
122	1	AERCO LOGO LABEL	12869	

FOR CONTROL BOX WIRING DIAGRAM, SEE FIGURE HE-107-7

Figure HE-107-12 -- AERCO Model SW1A-PLUS Control Box -- Assembly and Parts List

ITEM NO.	QUAN. REQ'D	PART NAME	PART NO.
1	1	1/2" WATER SOLENOID VALVE	5134
2	1	3/8" x 1/2" STRAIGHT LT COND. CONN.	8-38
3	1	1/2" x 4" LONG NIPPLE	9-459
4	1	1/2" NPT STREET ELBOW	9-336
5	1	P&T RELIEF VALVE	SEE TABLE B
6	A/R	3/8" TYPE LT CONDUIT	RM2000
7	1	THERMAL WELL BUSHING	5143
8	1	1/2" OD TUBE x 1/4" NPT 90° COMPRESSION FITTING	12867
9	A/R	14 GAGE BLK STRANDED WIRE	RM4524
10	A/R	14 GAGE WHT STRANDED WIRE	RM4525
11	A/R	3/8" x 1/2" 90° LT CONDUIT CONN.	122104
12	1	CONTROL BOX ASSEMBLY	18940
13	A/R	1/4" IMPOLENE TUBING	RM3041
14	1	INSULATION	18864-□
15	1	1/4" x 1/8" NPT 90° IMPOLENE COMPRESSION FITTING	8-40
16	1	1/4" STEAM SOLENOID VALVE	11352
17	A/R	3/8" OD TYPE L COPPER TUBING	RM6041
18	A/R	1/2" OD TYPE K COPPER TUBING	RM6031
19	1	3/8" OD TUBE x 1/4" NPT MALE COMPRESSION FITTING	8-6
20	1	1/4" NPT FEMALE TO MALE SHUTOFF COCK	121975
21	1	1/4" NPT STREET ELBOW	12823
22	1	CONTROL VALVE	SEE TABLE A
23	1	A-PLUS HEATER	20870-□
24	1	1-1/4" NPT NIPPLE	9-295
25	1	1-1/4" DRAIN VALVE	12820-9
26	1	1/2" OD TUBE x 1/4" NPT STRAIGHT COMPRESSION FITTING	8-65
27	1	VALVE SPOOL PIECE	SEE TABLE A
28	1	3/4" NPT CHECK VALVE	12757-75
29	1	3/4" NPT CLOSE NIPPLE	9-397
30	1	3/4" NPT ORIFICE UNION	5000
31	1	3/4" NPT STREET ELBOW	9-320

A/R=AS REQUIRED

TABLE A CONTROL VALVE-ITEM 22			
SIZE	AIR-OPERATED	SELF-CONTAINED	SPOOL PIECE ITEM 27 *
1-INCH	CXT-P	CXT-S	18874
1-1/4-INCH	CXT-P	CXT-S	18874
1-1/2-INCH	CXT-P	CXT-S	18874
2-INCH	CXT-P	CXT-S	18874
2-1/2-INCH	CXT-P	CXT-S	18983

\*PLUS NECESSARY ACCESSORY FITTINGS AND ADAPTORS

TABLE B P&T RELIEF VALVE ITEM 5	
SIZE	PART NO
1-INCH	6461*
1-1/2-INCH	6462*

\*PLUS FITTINGS

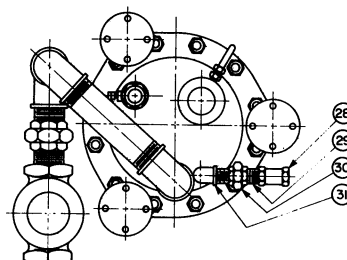
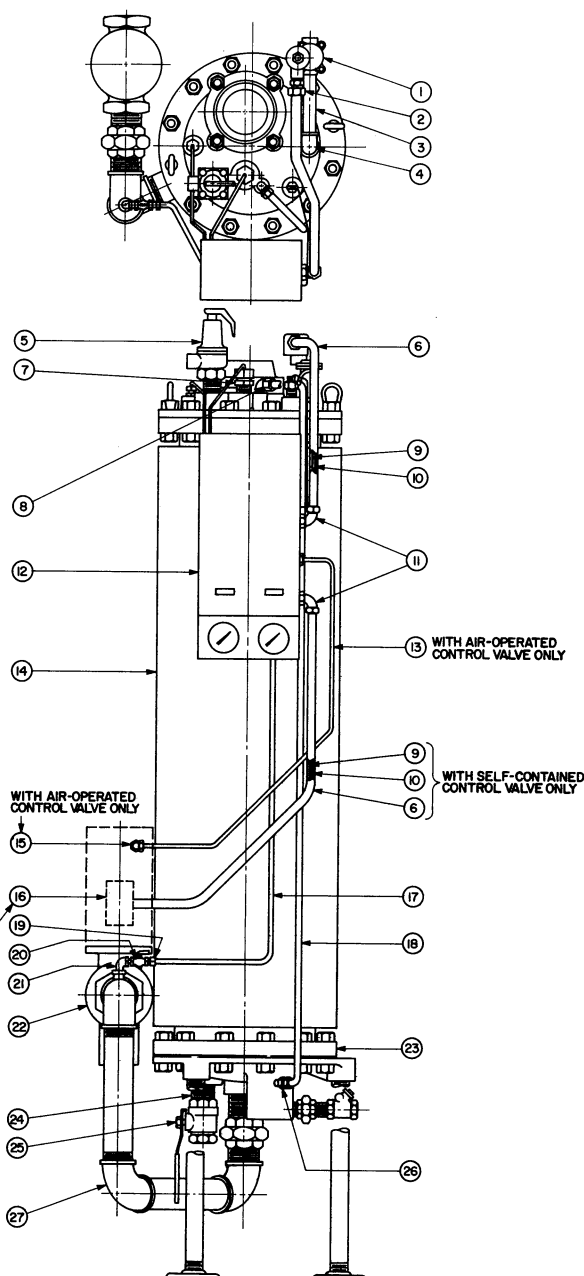


Figure HE-107-13 -- AERCO Model SW1A-PLUS Packaged Water Heater -- Assembly and Parts List

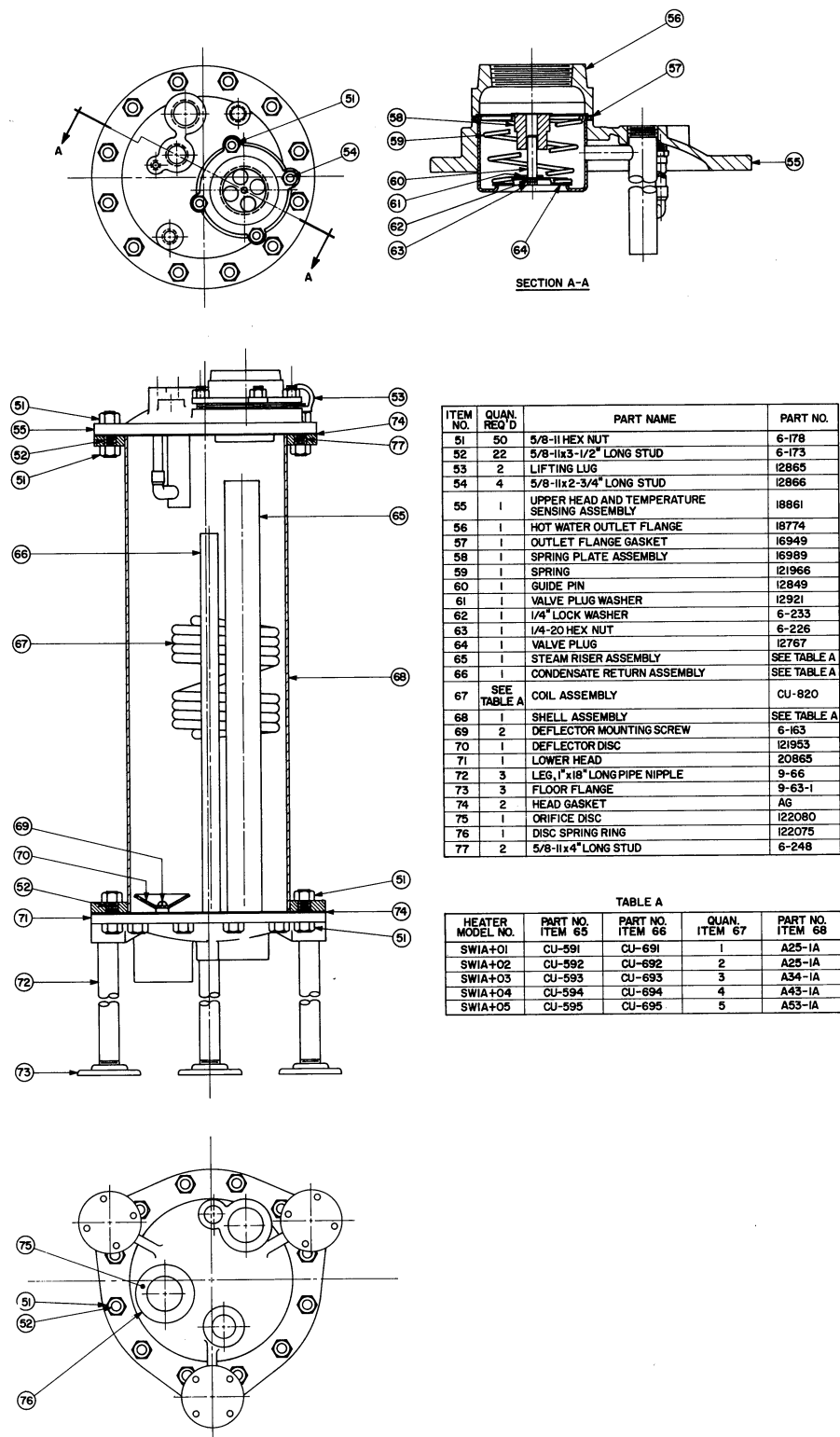


Figure HE-107-14 -- AERCO Model SW1A-PLUS Heat Exchanger -- Assembly and Parts List