Installation and Operating Instructions

ELECTRIC HOT WATER

FOR YOUR SAFETY

This manual supplies information on the application, installation and operation of Rheem Electric Hot Water. Review all application and installation procedures completetly before proceeding with the installation. Consult the Rheem's factory or local Factory Representative with any problems or questions regarding this equipment. Experience has shown that improper installation causes most operation problems.

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. **Read this manual thoroughly and follow the instructions herein.** The RHEEM Boilers shall be installed according to the procedures detailed in this manual, or the Rheem Boilers Limited Warranty may be voided. The installation must conform to the requirements of the local jurisdiction having authority, and to the latest edition of the National Fuel Gas Code, ANSI Z223.1. Any modifications to the boiler or its gas / oil controls may void the warranty. If field installation requires modifications, consult either the local Rheem Boilers' Representative or the Factory

RETAIN THESE INSTRUCTIONS NEAR THE EQUIPMENT FOR READY REFERENCE

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1.0 GENERAL INFORMATION

Introduction 1.1

Rheem has made a commitment to product improvement and follows a continuing quest for the highest standards of product performance. In pursuing this policy of continuous development of products, the manufacturer reserves the right to vary any details in this manual without notice

This Electric Water Heater Operations and Maintenance manual presents information that will properly operate and care for the equipment. Study the contents carefully. The unit will provide good service and continued operation if proper operating and operation if proper operating and manitenance instructions are followed. The standard Limited Warranty is not applicable with equipment not installed or operated in accordance with these procedures.

Although the unit and its components afford a high degree of protection and safety, operation of the equipment is not be considered free from hazards inherent in the handling of electricity and pressurized hot water.

Pay close attention to WARNINGS and CAUTIONS as these present situations of potential hazard, and remember no amount of written instruction can replace intelligent thinking and reasoning.

1.2 Local Regulations

Consult local building and safety codes before proceeding with work. The operation of this equipment by the owner and his operating personnel must comply with all requirements or regulations of the authorities having jurisdiction.

In the absence of such authorities, the installation must conform to the safety codes set forth by both the American Society of Mechanical Engineers (ASME) and the National Electric Code (NEC).

1.3 Recommendations

1.3.1 Preventative Maintenance

A preventative Maintenance Schedule is provided as a recommendation for periodic equipment inspections. Recording of daily, weekly, monthly, and yearly maintenance activities, as well as the recording of any unusual operation, will serve as a valuable guide to any necessary investigation.

The standard Limited Warranty does not cover any damage caused by lack of required maintenance.

2.0 STORAGE & HANDLING

2.1 Receiving

Each boiler/water heater is completely inspected at the factory and carefully packaged for shipment. Upon receipt of the shipment, immediately inspect the packing for signs of exterior damage. Verify receipt of all packages listed on the packing slip. Advise the carrier of any shortage or damage. Any such claims should be filed with the carrier. The carrier, not the shipper, is responsible for shortages and damage to the shipment.

2.2 Storage

Electrical equipment can be damaged if exposed to adverse weather. The heater should be stored inside. The electrical panel and controls should be covered with plastic throughout construction to avoid accumulation of dust and moisture on the controls and load components. The contactors can be damaged by dust/dirt in the mechanism.

2.3 Uncrating

2.3.1 Care must be taken not to damage controls or deform the heater sheet metal during removal of the crate.

2.3.2 If using pry bars or fork lifts, be certain of support the boiler weight by the skids or channel base.

2.4 Placement

CAUTION: If the equipment is placed in a room with little or no ventilation, a supply of ducted filtered air may have to be brought to the lower portion of the control cabinet to limit the control cabinet interior temperature to 50˚C (122˚F) maximum.

2.4.1 Provide a firm, level foundation for the equipment.

NOTE: Standard electric water heaters are not suitable for placement on combustible flooring.

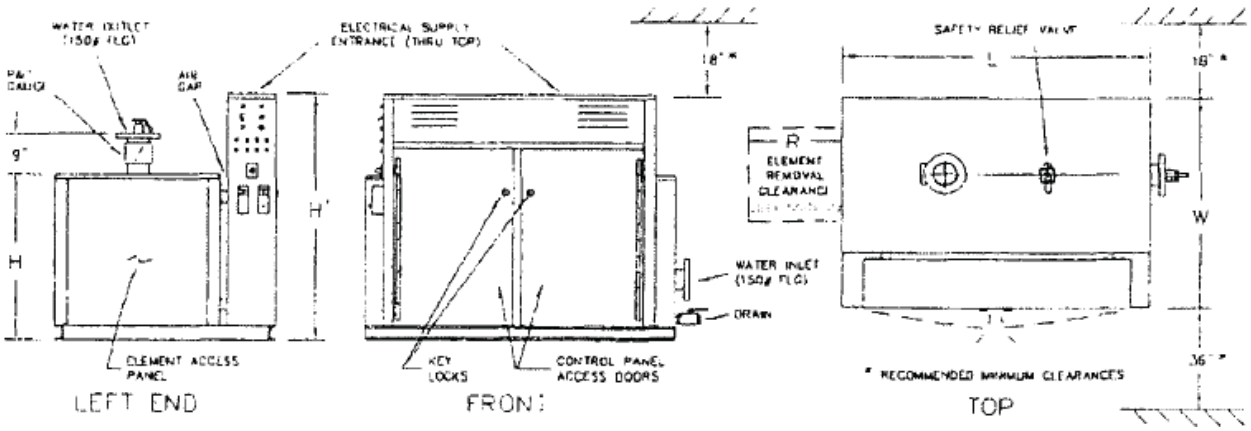
2.4.2 Leave a permanent space for element removal opposite element access panels as shown on the Dimensional Drawing (DD), and 36 inches opposite electrical panels.

NOTE: Electrical panels require 42” opposite any opposing conductive surface.

2.4.3 Be sure to keep electrical panels and controls covered at all times while construction work is in process.

CAUTION: Do not use the equipment housing top for scaffolding.

Figure 1 –
Minimum Clearance Recommendations and General Dimensional Data for Boiler Placement



RHEEM Electric Hot Water (HW)

NOTE: Consult Local codes for specific requirements and refer to the Dimensional Drawing and Wiring Diagram provided with unit.

NOTE: Removal clearance required on both ends for HW_D.

3.0 INSTALLATION

3.1 Piping Connections

NOTE: Some of the following piping may have been completed at the Factory.

3.1.1 Heater piping connections and values MUST comply with state and local codes, in addition to compliance with ANSI piping requirements.

CAUTION: The pipe extensions outside the unit are usually the extensions of pipes which are permanently welded into the unit's vessel. Normally the only removable (threaded) connection is the drain pipe. DO NOT ATTEMPT TO REMOVE ANY OTHER PIPING!

3.1.2 Install the safety relief valve(s) on the pipes provided. Plumb the relief valve outlet connections full size to the floor drain.

3.1.4 The direction of flow through water heaters must be from the inlet to the outlet (IE: bottom to top). Do not reverse these connections.

3.2 Electrical Connections

3.2.1 Power Feed Wiring

The recommended wire size is listed on both the unit's Bill of Material (BOM) and the Wiring Diagram (WD). Also, the full load amperage and maximum voltage are stamped on the unit's nameplate. The feeder must be sized for 125% of the full load amperage in accordance with Article 424-3 of the NEC. The wiring must have insulation rated 75°C or greater. Copper wiring is recommended for all power connections. The recommended size is noted in the 'Notes" on the wiring diagram.

CAUTION: Do not exceed the maximum voltage as listed on the nameplate. For resistance loads, amperage increases proportionally with voltage.

3.2.2 Equipment Grounding Conductors

The unit is equipped with grounding lug(s) inside the power panel(s). The grounding conductors must be installed and sized in accordance with NEC Article 424-14. The recommended size is noted in the 'Notes" on the diagram.

3.2.3 Control Wiring

Alteration of, or additions to, control wiring may void both the Underwriters Laboratories listing and the Manufacturer's Limited Warranty. Field-installed controls, control connections, and modifications must be approved in writing by the Factory.

NOTE: All power connections are 3-Phase, 3-wire. (Exception: If unit is single phase.) There is no provision for a neutral connection ;(IE: the unit should not be wired ‘wye’ or ‘star’).

3.3 Filling the System

3.3.1 The system and the water heater must be thoroughly flushed before the final fill.

4.0 PRE-STARTUP INSPECTION

4.1 Minimum Equipment Required For Startup And Troubleshooting

- Volt OHN Meter
- Clamp-On Ammeter
- Megohm Meter
- Torque Wrench-inch lbs
- Toque Wrench-foot lbs

4.2 Mechanical System Checks

4.2.1 Plumbing Connections Completed

- Inlet/makeup Water?
- Discharge/Outlet?
- Drain
- Relief/Safety Valve Discharge?

4.2.2 Feedpumps/Circulating Pumps

- Pumps wired, connected and checked for proper rotation?
- Is the heater filled to the proper level with water?

4.2.3 System Flush

- Has the System been flushed?
- Has the unit been cleaned of all construction debris?

4.2.4 Valves

- Are all valves in the proper open or closed positions?

4.3 Electrical System Checks

WARNING:
ALL POWER supplying boiler should be off and locked out! With the unit(s) main power switch (es) OFF and locked out.

Inspect all components, external and internal, to assure that there has been no damage during shipment or installation.

- Remove one of the unit's control circuit transformer primary fuses. Then check the resistance phase-to-phase for all three phases. Make sure that there are no short circuits phase-to-phase ground.

With a megger (500VDC minimum) check contactor load side terminals to ground. If a reading of < 1 megohm is obtained, consult the Factory.

- Remove element access panel(s) and open doors to the electrical control panel(s). Run an inspection the tightness of all electrical connections (IE: at fuse lugs, power entrance lugs, contactors, heating elements).

All branch circuit connections should be tightened to 40-50 inch lbs. (actual value listed on components).Torque to avoid component damage from heat build-up.

This tightness inspection is vital, because the vibration during shipment can often loosen electrical connections. If this is not done, damage may occur to component parts when power is switched on, and those damaged parts will not be covered under the manufacturer's Limited warranty.
NOTE: See Maintenance Section on rechecking the torque on these components after an initial break-in period, then typically one to two weeks after start-up and then at least annually.

- With an ohm meter, check the resistance between the phases on the load side of the contactors. Each should read the same and approximately what is shown on the wiring diagram.
- Check the electrical panels for loose material, dust and/or moisture. Thoroughly vacuum the panels if dust or foreign materials have accumulated there.

If there has been severe exposure to dust, the contactors should be disassembled and cleaned. Dust in the contactors will cause contractor chattering and eventual destruction of the contacts.

All components should be clean and free of dust, moisture and foreign matter.

- Verify that field-installed control and load connections have been properly completed.
- Check the tightness of all control circuit connections.

CAUTON: Moisture in the elements may result in damage to the elements.

NOTE: There is a possibility that during shipment prior to operation, the elements may accumulate moisture. The moisture will turn to steam when the elements are turned on and may rupture the element casing.

4.4 Heating Elements

4.4.1 How to check Elements for Moisture

Take a reading with a megger between the contactor terminals (load side) to ground for each contactor. Moisture is present if the reading is less than1 megohm for standard 3 phase connection.

4.4.2 Removal of Moisture in Element (Method#1)

Remove the fuses going to that contactor. The fuses should be removed so that, during the first day of operation, the affected element will not be energized allowing the hot water to drive the moisture out at a controlled rate.

4.4.3 Removal of Moisture in Element (Method #2)

An alternate heating method is to direct a heat lamp at the suspect element, or remove the element, bake it in a 200˚F oven for 8 hours, then reinstall and rewire.

4.4.4 After completion of either of the above methods for moisture removal, re-check the element with a megger. When the reading indicates an acceptable level, the element may be put in operation by replacing the fuses.

4.4.5 Replace all Element Access Panel(s) and close electrical / control panel doors.

4.5 Inspection Power/ Voltage

4.5.1 Verify the boiler ON / OFF control switch is in the “OFF” position. Close the heater main power switch, turn the control switch to “ON” and then:

4.5.1.1 Check the phase-to-phase voltage at the main terminals in the heater electrical panel. The phase-to-phase voltage between any two of the phases **must not exceed** the heater nameplate voltage.

4.5.1.2 Check the voltage at the heater control circuit fuse. It should be between 105 volts and 125 volts.

4.5.1.3 Open the heater main power switch.

4.5.2 If all of the above prove satisfactory, proceed with “Startup Instructions” (Section 5.0). Replace all covers and close all doors.

5.0 STARTUP INSTRUCTIONS

5.1 Control Settings

5.1.1 Controller

(See parts List for Part No. and Type)

5.1.1.1 The controller is the pressure or temperature sensing device which controls the operation of the contactors directly or indirectly via the step control.

5.1.1.2 Set the Controller for the desired Outlet Water Temperature

NOTE: The Maximum water temperature for lined vessels is 160°F except for cement lined vessels which can operate at 180°F

5.1.1.3 Throttling Range

The throttling range is the number of degrees the outlet water temperature must change to drive the step controller from full-off to full-on.

For instance, if the controller is set at 160°F, and the throttling range is set for 10°F, the step controller will befull on at 165°F (2/1 of throttling range above setpoint). The more stable the load on the unit (from system demands), the smaller the throttling range may be set.

5.1.2 High limit (Temperature)

Set the automatic reset high limit to 10˚F, or twice the throttling range, whichever is greater, above the setting of the controller.

Manual reset limits should be set slightly higher than the automatic reset limits.

5.1.3 Low water Cutoffs

These cutoffs are always factory-set. If additional cutoffs are field-installed, the cut-offs should be at least three inches above the highest heating element. Manual reset cutoffs should be set below automatic reset cutoffs.

5.1.4 Low Limit Sensors (Temperature)

Low limits should be set below the controller setting by at least the same margin as specified for high limits to be above the controller setting.

5.2 Operating Instructions

5.2.1 With the unit(s) control power ON/OFF or ON/OFF/PREHEAT switch to “OFF”, close the main power switch (es).

NOTE: Units with shunt trip disconnects and rmoet120-volt control power may require turning the control power switch “ON” and activating the 120-volt control power, before closing the main power switch (es).

5.2.2 Electric Door Interlocks

For units equipped with electric door interlocks, do not attempt to open electrical panel doors after the main switch is closed. The lock tabs are mechanically restrained by the electric interlocks.

5.2.3 Switch all the ‘enable/disable’ pilot switches the ‘OFF’ position (toggle down).

5.2.4 120 Volt Power Source

If a separate 120-volt power source is provided, close it’s disconnect switch.

5.2.5 Turn the control power ON/OFF or ON/OFF/PREHEAT switch to ‘ON’.

5.2.6 Alarm and Reset Circuits

5.2.6.1 If the alarm sounds when the control switch is turned ‘ON’, depress the alarm silence button. Check the unit to make certain that no limit condition exists by noting if the alarm pilot is illuminated.

5.2.6.2 Units with Manual Rest Button(s) may require resetting of the manual reset switch upon initial application of power, and after the interruption of power or the trip-out of a limit control.

5.2.7 Sequencing of Elements Circuits

5.2.7.1 On units with step controls, the unit will always start with no steps energized.

5.2.7.2 As the steps begin cycling on, the LED’s on the step control (circuit board inside cabinet) will light up one at a time, indicating that step control is operating properly.

NOTE: The enable pilot lights or contractors will not be activated at this time since the ‘enable/disable’ switches are in the off position).

5.2.7.3 With the step control board full on, individually enable each step. The respective pilot light should light and the contractor(s) applying power to the respective elements.

5.2.7.4 For units with ON/OFF/Preheat switches, only part (approximately 25% may be activated when the switch is down in the ‘PREHEAT’ position. This PREHEAT option is now rarely used.

6.0 SEQUENCE OF OPERATION

6.1 Activation of Heating Element Circuits

6.1.1 Contactors

The heating elements are energized by pilot operation. That is, the power to an element circuit is supplied through the contacts of a contactor. The contactor is activated (on a call for heat) by the closure of a temperature (or pressure) switch or by a contact in the step control circuit.

6.1.2 Fuses

All power leads to the elements are fused. The fusing is on the line side of the contactors.

6.2 Sequencing Controls

6.2.1 Staged Control Circuit

6.2.1.1 In this type circuit, the contractor coils are energized directly by the contracts of immersion thermostats. There is usually on thermostat for each stage: or a multi-stage thermostat may be provided in some cases.

6.2.1.2 The safety limit devices (high temperature, low water, etc.) interrupt the power to the contactor coil circuits.

6.2.2 Proportional Step Controls

6.2.2.1 Step Control Sequence

The controller senses the unit's water temperature (either via 135-ohm device or thermistor) or steam pressure (either via 135-ohm device or 4-20 ma transducer). The output signal or the controller causes the step control to sequence the steps on, or off, depending on whether the unit's output is below or above setpoint.

When one of the switches closed on the step control, a contractor coil (or coils) is energized in a step-wise fashion. This type of step control will mid-position (bring on half of the steps) when the unit's water temperature is at setpoint.

6.2.2.2 Progressive Controls Sequence Step

These controls are provided as standard and include Selectronix SLC series and Viconics' model R851B. They provide first-on, first-off staging of the element circuits.

As the unit's temperature drops below setpoint, the control brings on more steps.

As the temperature increases and approaches setpoint, the step control drops out stages. The first step to drop off is the one that has been on the longest.

This provides even usage of the system's components.

6.2.2.3 Linear Sequence Step Controls

This type of step control is limited to the some Selectronix models and Viconics' model R851B. In this sequence progression, the control applies power by progressing from Step 1 to the maximum number required to satisfy the load, and then decreases power by retracing this sequence down toward the first step.

NOTE: Refer to the applicable vendor literature provided on the step control installed in your unit.

6.2.3 Recycle Feature

All step controls now incorporate the recycle feature which returns the step control to the no-load condition upon loss of control power.

6.2.4 Manual Step 'ENABLE / DISABLE' Toggle Switches

All units with >1 step now include manual 'ENABLE / DISABLE' toggle switches to provide a positive 'OFF' override of each step. These are used to disable a faulty step, limit total output or allow for a slow preheat.

7.0 OPERATIONAL TESTING

7.1 Standard Controls

7.1.1 135-ohm Controllers (T991, T915, L91,etc.)

With the water temperature at setpoint, the step controller should bring on nominally one half of the steps. An adjustable proportional band is provided on the controller (sensor) to enable tuning the unit to system demand.

7.1.2 Solid State Controls

With the water temperature at setpoint, the step controller should bring on nominally on half of the steps. Adjustable time delays between steps and adjustable proportional bands are normally provided on the step control to enable tuning the unit to system demand. Most solid state controls also include band width adjustment at the control itself, and normally include PID control action.

IMPORTANT: The timing between stages adjustable (with step control).

The slower the step sequencing, the less wear on both the contractors and heating elements (yet still able to control the process as needed) the less heat is generated in the cabinet which results in longer component life.

7.2 Outdoor Reset Controls

7.2.1 Solid State Dual Input Reset Controls (Honeywell T775J controls)

These are dual sensor reset controllers with adjustable reset ration and outdoor reference temperature. The 'reset ratio' is the ratio of the change in the temperature at the secondary sensor to the opposing change in the control point. If the reset ratio is 2:1, every 2°F change at the outdoor sensor will cause an automatic inverse change of 1°F at the control point.

EXAMPLE: Assume a reset ratio of 2:1, a primary set point of 100°F, and a secondary setpoint at 70°F. The first number of the reset ratio indicates change in outdoor temperature; the second, the change in the control point. If the outdoor temperature drops from 70°F to 20°F, a change of 50°F, the control point will increase from 100°F to 125°F, a change of 25°F.

NOTE: Refer to the applicable vendor literature provided on both the setpoint controls and step controls installed in your boiler.

8.0 PREVENTATIVE MAINTENANCE

8.1 General

Electrical immersion heating element water heaters are automatic, quiet and safe. Consequently, they are all too often neglected. Like any piece of electrical / mechanical equipment, they require care and maintenance to keep them in top working condition.

If electrical connections are allowed to become loose or dirty, there is danger of an electrical fault. If the elements are not inspected periodically for leaks, the water from leaking elements can leak onto adjacent elements, causing external element damage and resulting in blowing of load fuses in the heater electrical panels. If the heater water is not properly treated, element failure could occur due to the formation of scale.

Treat the heater with respect.

CAUTION: Always work on the heater with all electrical power sources disconnected.

8.2 Electrical System Maintenance

8.2.1 Clean the control cabinets periodically (as often as needed) to keep both the interior and the exterior free of dust, moisture and foreign matter. The interior cleaning of the electrical panels must be done with the **POWER OFF!**

NOTE: For units supplied with control cabinet cooling fans, the condition of the fan filter must be periodically checked and the filters cleaned or replaced as necessary.

8.2.2 With the POWER OFF, periodically check the tightness of electrical connections; particularly at power entrance lugs, fuses (line side) and contractors (load side). This should be done at time of commissioning, at 7 – 14 days thereafter and at least annually. Replace any components that show signs of heat damage (IE: discoloration, charring, melted insulation, etc.).

8.2.3 Inspect the condition of the contactors. Look for burned or corroded contacts or overheated coils and wires. If the contactors chatter or hum during operation, they should be either disassembled and cleaned to remove dust or other foreign material in the mechanism or replaced.

8.2.4 Inspect the heating elements. Make sure that the terminal contacts are tight, clean, and corrosion-free.

8.2.5 Check all the wiring throughout the unit for frayed or brittle insulation. Replace any wiring showing insulation degradation.

8.3 Boiler Mechanical System Maintenance

8.3.1 With the POWER OFF, remove the element access covers. Inspect all internal vessel connections, particularly at the heating elements. Spot check torque on element flange bolts. The acceptable torque range is 10 – 15 ft. lbs.

CAUTION: Do not over tighten elements!

8.3.2 Remove and replace any leaking elements or element gaskets. Inspect handhole and manhole gaskets. If these gaskets are brittle, they should be replaced.

WARNING: Over-torquing of the elements nuts will damage the element gasket.

8.3.3 Repair any leak at any place on the unit or adjacent piping. Re-torque flange bolts on system piping.

8.3.4 For all boilers, the interior of the pressure vessel must be inspected at least once a year. If there is any presence of scale, refer to 'Preventative Maintenance Water Treatment' above a consult a local water treatment firm immediately. Scale formation on the elements will cause heating element failures. Scale formation elsewhere in the boiler can cause erratic control operation / failure, particularly on water level controls.

8.3.5 Remove and clean the low water cutoff probe.

8.4 Element Replacement Procedure (4-Bolt Style Element)

CAUTION: Before element replacement, make certain main power to the unit is turned off, that there is no pressure in the unit, and that the unit is drained below the element opening.

NOTE: To prevent hazardous conditions of leaking water at the element terminal ends, defective elements or element gaskets should be replaced immediately upon leak detection.

8.4.1 Adequately tag wire and then remove wires from defective elements.
8.4.2 Remove element by removing the four (4) attachment nuts.
8.4.3 Install replacement element with the new gasket and torque nuts to 10 -15 ft. lbs.

WARNING: Do not exceed 15 ft. lbs.

8.4.4 Connect phase wires to new element.
8.4.5 When the unit is filled and pressurized, check for leaks.

Table 2	Recommended Feedwater and Heater Water Properties			
FEEDWATER				
Type of Boiler	**Hardness (ppm)**	**pH**	**Oxygen (cc/l)**	**TDS (ppm)** Total Dissolved Solids
Hot Water	0 – 10	7.5 – 9.5	4.0	0 – 500

HEATER WATER				
Type of Boiler	**Hardness (ppm)**	**pH**	**Oxygen (cc/l)**	**TDS (ppm)** Total Dissolved Solids
Hot Water	0 – 10	7.5 – 9.5#	0	0 – 5000
# - The limit of 9.5 pertains to copper elements; a pH of 10.5 is allowable for incoloy elements.				

8.5 Typical Preventative Maintenance List

NOTE: This list may not be all inclusive! Read and understand entire 'Operation and Maintenance Manual' and take into consideration any modifications and / or optional equipment for this unit:

WARNING: MAIN POWER MUST BE TURNED OFF TO DO ELECTRICAL CHECKS!

Daily	Bottom Blow-down to keep sludge from building up and help with water TDS
	Surface Blow-off to remove floating solids and maintain proper TDS
	Ensure valves, connections, piping, gaskets, etc. are not leaking
Weekly	Verify that heater water properties are within desired parameters
	Blow-down water column and (sight-glass) to prevent sludge from building up in piping.
7 – 14 days After STARTUP ***(Fax form)***	Re-torque screws on distribution, fuse blocks and contactors to their specified torque (typically 45 – 50 in – lbs.)
	Re-torque any bolts on copper distribution from disconnects or circuit breakers to typical torque valves for the size of bolt used.
Monthly	Check for any heating element gasket or manway gasket leaks
to	Clean filters on cooling fans to maintain proper air flow

every **Six Months**	Check fuses and heating elements with an ohm meter for proper values.
	Look for signs of overheating on fuses, fuse blocks, contractors and wires. Any discolored, charred or melted components should be replaced. Ensure all screws are torqued to their proper values for any replaced components.
Annually	Inspect interior of tank for sludge or scale. Clean tank and modify water treatment chemistry as necessary.
	Replace brittle element gaskets, valve gaskets and manway gaskets as necessary.
	Re-torque ALL distribution, fuse block and contactor screws to the proper value.
	Re-torque any bolts on copper distribution from disconnects or circuit breakers to typical torque values for the size of bolt used.