

Installation and service must be performed by a qualified service installer, service agency or the gas supplier.

**IMPORTANT:** THIS MANUAL CONTAINS INFORMATION REQUIRED FOR INSTALLATION, OPERATION AND MAINTENANCE OF THIS EQUIPMENT. READ AND FOLLOW THE INFORMATION IN THIS MANUAL AND ALL OTHER PROVIDED INSTRUCTIONS, LABELS AND MARKINGS BEFORE INSTALLING, OPERATING OR SERVICING THIS UNIT.



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**TO THE INSTALLER:** After installation, these instructions must be given to the equipment user or left near the appliance.

**SPECIAL INSTRUCTIONS TO THE OWNER:** Retain this manual for future reference. These instructions contain important information that will help you in maintaining and operating this appliance.

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## TABLE OF CONTENTS

- 1. Safety Considerations**
- 2. Product Description**
- 3. Standard Features and Equipment**
  - 3.1 Warranty
- 4. Boiler Installation**
  - 4.1 Checking Equipment Before You Install
  - 4.2 Codes
  - 4.3 Electrical Connections
  - 4.4 Location
  - 4.5 Installation
  - 4.6 Service Clearances
  - 4.7 Clearances to Combustible Surfaces
  - 4.8 Electronic Low Water Cutoff
- 5. Optional Equipment**
  - 5.1 Shunt Trip Circuit Interrupter
  - 5.2 Time Sequencer
  - 5.3 Proportional Sequencer
- 6. Start-up Procedures and Operation**
- 7. Element Continuity Checks**
- 8. Maintenance**
- 9. Troubleshooting Guide**

**Warranty forms ship separately with each product.**

## 1 SAFETY CONSIDERATIONS

**WARNING: If the information in the supplied manual(s) is not followed exactly, a fire, explosion or exposure to hazardous materials may result, causing property damage, personal injury or loss of life.**

### FOR YOUR SAFETY

- Do not store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.

### WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a location away from your building and the smell of gas. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

This product contains, or may come to contain materials that have been identified as carcinogenic, or possibly carcinogenic to humans. Before installing, servicing or removing this product, read and follow the supplied instructions

**WARNING: Installation and service must be performed by a qualified installer, service agency or the gas supplier, who must read and follow the supplied instructions before installing, servicing or removing this appliance. Refer to the information contained in this manual. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury, exposure to hazardous materials or loss of life.**

**WARNING: Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the unit and to replace any part of the control system, all gas controls and all other items affecting safe appliance operation and which has been under water.**

**WARNING: In an emergency shut the main gas supply valve to the appliance from a location safely away from the emergency. Failure to follow these instructions can cause property damage, personal injury, and exposure to hazardous materials or loss of life.**

### PRODUCT SAFETY INFORMATION REFRACTORY CERAMIC FIBER PRODUCT WITH CRYSTALLINE SILICA

**WARNING: This product contains or may come to contain crystalline silica, which has been identified by the International Agency for Research on Cancer (IARC) as carcinogenic to humans. This product also contains refractory ceramic fibers, which have been identified by the IARC as possibly carcinogenic to humans. Avoid breathing fiber particulates and dust.**

#### RISKS:

- Air borne fibrous insulation is a possible cancer hazard by inhalation.
- Airborne crystalline silica may cause silicosis (lung disease) by inhalation.
- May cause temporary irritation to eyes, skin, and respiratory tract.

#### PRECAUTIONARY MEASURES:

- Minimize airborne fibers with engineering controls.
- Use NIOSH/MSHA approved respirators as required (see MSDS).
- Wear long sleeved, loose-fitting clothing, eye protection and gloves.

#### FIRST AID MEASURES: (If any of the irritations listed persists, seek medical attention)

- Eyes: Flush with water.
- Skin: Wash with soap and warm water.
- Ingestion: Do not induce vomiting. Get medical attention if gastrointestinal symptoms develop.
- Inhalation: Remove to fresh clean air.

**WARNING: If you are unfamiliar with the safe handling of refractory ceramic fiber products, or if you wish additional information prior to beginning any disassembly of the water heater or boiler that might expose refractory ceramic fiber materials, contact: Unifrax Corporation, 2351 Whirlpool Street, Niagara Falls, NY 14305-2413, 1-800-322-2293.**

#### IDENTIFICATION OF REFRACTORY CERAMIC FIBER MATERIALS (RCF):

The burner, lower tank and upper and lower flue collector assemblies utilize RCF material. (The RCF materials are located within the product and not generally exposed except during service, disassembly or assembly.)

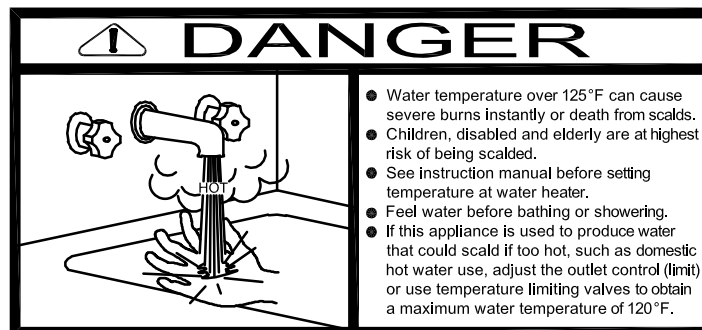
**IMPORTANT SAFETY NOTE**

*It takes only 5 seconds of skin contact with 140°F water to cause a second degree burn! You must protect against high water temperatures at all lavatories, tubs, showers and other points of hot water contact.*

**Accidental scalding from high water temperatures is a greater risk in some types of installations. Some examples are:**

**HOMES FOR THE MENTALLY HANDICAPPED  
HOMES FOR THE PHYSICALLY HANDICAPPED  
HOSPITALS AND NURSING HOMES  
ELDER CARE FACILITIES AND REST HOMES  
ORPHANAGES AND CHILD CARE FACILITIES**

**OTHER INSTALLATIONS - WHERE RESPONSE TO CONTACT WITH HOT WATER MAY BE SLOWER OR WHERE THE DANGER OF HOT WATER CONTACT IS GREATER**



**Thermostatically controlled mixing valves must be used in the design of the potable hot water system.**

**Potable hot water should be tempered to no more than 110°F when used for bathing or other personal uses.**

**Good engineering practice mandates the use of thermostatically controlled mixing valves set at 120°F or less to keep the delivered water temperature below scalding temperatures.**

## 2 PRODUCT DESCRIPTION

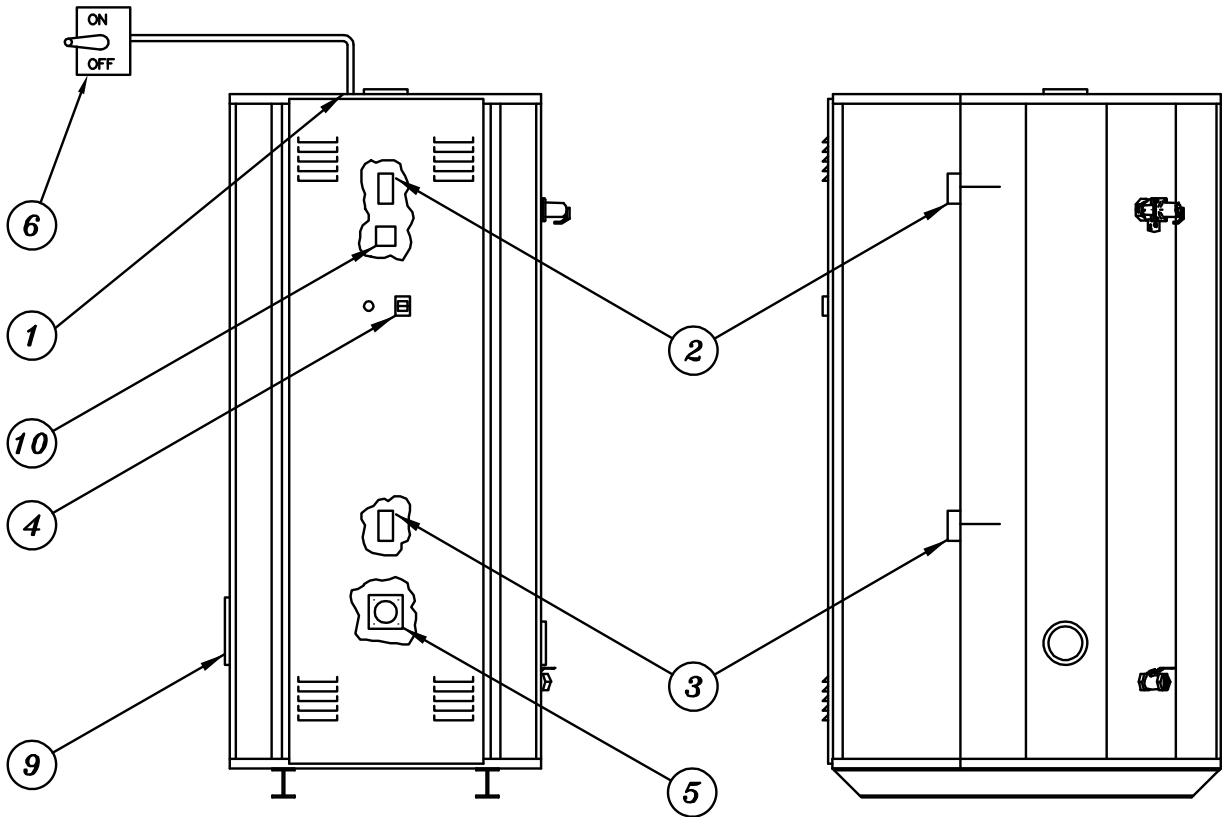


FIGURE 1

- |                                |  |
|--------------------------------|--|
| 1. Electrical Entry            | 6. Manual Fused Disconnect                 |
| 2. Temperature Limiting Device | 7. Water Level Control (LWCO/Pump Control) |
| 3. Operating Control           | 8. Pressure Controls                       |
| 4. Control Switch and Fuse     | 9. Inspection Fitting - Handhole           |
| 5. Heating Element             | 10. Electronic LWCO                        |

### 3 STANDARD FEATURES AND EQUIPMENT

#### 3.1 Warranty

Factory warranty does not cover improper installation or operation. (See warranty for complete details.)  
Warranty exclusions include but are not limited to failure or malfunctions resulting from:

1. Failures to properly apply, install, operate, or maintain the appliance in accordance to printed instructions.
2. Abuse, alteration, accident, fire, flood and the like.
3. Sediment or lime buildup, freezing or any other conditions causing inadequate circulation.
4. Corrosive or contaminated atmosphere.

### 4 BOILER INSTALLATION

#### 4.1 Checking Equipment Before You Install

Inspect the unit completely upon receipt from the freight carrier before signing the bill of lading. Inspect the appliance and all accompanying parts for signs of impact or mishandling. Verify the total number of pieces shown on packing slips with those actually received. Contact the freight carrier immediately if any damage or shortage is detected.

#### 4.2 Codes

The equipment shall be installed in accordance with those installation regulations in force in the local area where the installation is to be made. These shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installation is made. In the absence of such requirements, the installation shall conform to the latest edition of the National Fuel Gas Code, ANSI Z223.1 and with the National Electrical Code, NFPA 70. Where required by the authority having jurisdiction, the installation must conform to American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, No. (CSD-1). All appliances conform to the latest edition of the ASME Boiler and Pressure Vessel Code, Section IV. Where required by the authority having jurisdiction, the installation must comply with the Canadian Association Code, CAN/CSA-B149.1 and/or B149.2 and/or local codes.

#### 4.3 Electrical Connections

Check rating plate on front for correct voltage, phase and amperage. Refer to wiring diagram for control components mounted on boiler.

Use proper wire size and branch circuit protection as required by National Electrical Code and state and local codes. RIVERSIDE HYDRONICS electric water boiler specification sheets show number and size of power connectors furnished with the boiler for minimum 90°C copper connecting wire.

Use correct size ground wire, attach to bottom ground terminal connection on the terminal block assembly marked with decal "GR".

Connect supply feeders to distribution block (or circuit interrupter if furnished) inside electrical enclosure on the boiler.

**IMPORTANT:** Check all wiring connections in boiler and element enclosure to assure tightness prior to energizing.

**NOTE:** Use only copper wire of proper sizing for incoming service. Damage resulting from use of aluminum wiring is excluded from coverage under the warranty of this unit.

#### 4.4 Location

1. Locate the unit in a clean and dry area as close as possible to the greatest hot water usage and as near to gas, oil, steam, boiler water and/or electrical power as practical.
2. Install the unit on a firm, level foundation.
3. Locate the foundation on a pitched floor near a suitable drain, or make other provisions to prevent contact to areas of the building subject to water damage should the boiler or a water connection leak. The drain must be sufficient to contain water in excess of 210°F.

## 4.5 Installation

**WARNING: Use industry standard safe rigging methods when attempting to lift or move this product. Failure to follow these instructions could result in property damage, serious injury or death. One common method includes the use of straps and spreader bars, lifting from the water boiler base skid assembly.**

1. Check the data decal on the boiler. Be sure the electrical, water, oil, or gas supply is adequate for the installation.
2. Carefully remove all shipping supports and bracing. (Float type devices have shipping plugs blocking the float).
3. Install shut-off valves and unions on the inlet and outlet water piping for servicing. Use caution when threading pipe nipples into tank connections to prevent cross threading, or over-tightening. Always use a back-up wrench on tank nipples when tightening unions, valves, etc.
4. Insulate hot water and return circulation lines. Insulate cold water supply lines if subject to freezing during shutdown periods.

**IMPORTANT:** Do not use the plumbing connected to the appliance as a ground for welding or any other purpose.

5. The boiler is equipped with a temperature and pressure relief valve(s) rated for the input. Pipe the relief valve discharge to a suitable open drain. The drain pipe may not be smaller than the relief valve opening and must be secured to prevent it from lifting out of the drain under discharge pressure. Do not install valves or restrictions in the discharge line.
6. Pipe the drain valve to a suitable open drain.

## 4.6 Service Clearances

Allow sufficient space to provide adequate clearances on all sides for service and inspection. Recommended clearance is 24" at the top and front, 18" at left and right sides of the appliance. Optional equipment may increase the clearance requirements. Allow sufficient space for installing and servicing connections such as water, gas, vent, combustion air, electrical, pump and other auxiliary equipment.

## 4.7 Clearances to Combustible Surfaces

The appliance must not be installed on a combustible floor, or on a non-combustible floor covering combustible material. Clearance to unprotected combustible material must be 6" minimum at top, sides and rear, and 24" minimum in front.

## 4.8 Electronic Low Water Cutoff

The device consists of a probe in the tank that acts as a switch, open when submerged in water and closed when the water level is below the probe, preventing heating elements from energizing. The probe should be kept free of scale buildup to insure operation.

## 5 OPTIONAL EQUIPMENT

**5.1 Shunt Trip Circuit Interrupter** (optional on all models): The shunt trip, wired in the non-automatic circuit interrupter, is a safety device designed to open the circuit interrupter and prevent the elements from energizing if water level in the tank is low or if water temperature or pressure exceeds the high limit. A delay relay switch is used to delay action of the shunt trip to allow time for cover installation.

**5.2 Time Sequencer** (optional on all models): Time sequencing is optional and used in lieu of the proportional sequencer. It is a series of time delay relays wired to the contactors which allows approximately a 40 second delay in energizing each succeeding heating element when the controls call for heat. This prevents all heating elements from energizing at the same time.

**5.3 Proportional Sequencer** (optional on all models): Progressive sequencing (orbital) equalizes the on time for each contactor and heating element. The heating elements are staged on based on the demand on the boiler. The control gives visual, indication of stages that are on. In the event of power interruption, all contactors are turned off. When power is resumed, the control will re-stage the elements beginning with number one.

## 6 START-UP PROCEDURES AND OPERATION

**WARNING:** Turn off all electrical service to the appliance when accessing the controls located inside the control cabinet. The cabinet contains high voltage wiring and terminals. If the electrical service is not turned off and these wires or terminals are touched, a dangerous shock causing personal injury or loss of life could occur. Close the control cabinet before restoring electrical service to the appliance.

1. Use multimeter to check resistance to ground between all element terminals and the element mounting flange. (See Table 1)

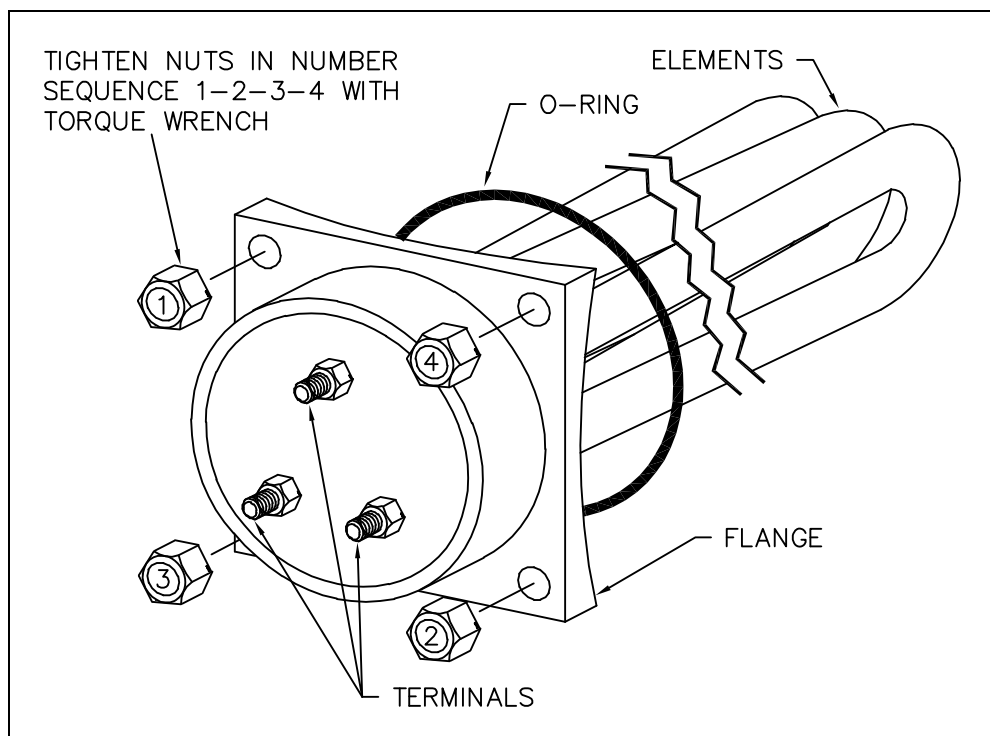
Fill the boiler with water. For steam boilers, allow the water level controller to establish the correct water level. Open the relief valve to allow air in the tank to escape. Be sure all connections into the tank are tight as leaks at tank fittings or heating elements can cause damage.

Check inside of electrical enclosure for leaks with tank full of water at water line pressure. Heating element gaskets are pressure tested at factory but may leak if unit has been in dry storage for a long period of time.

If leaks are present, tighten all four nuts uniformly on the element mounting flange in a crisscross pattern. Tighten one nut, then the nut on the diagonal from the first nut. Next, tighten the nut adjacent to the second nut, and then the nut diagonal from the third nut. Repeat this sequence until all nuts are tight. Each nut should be tightened to 15 foot pounds of torque. To avoid warping the flange, do not over tighten.

**IMPORTANT:** All leaks must be corrected prior to turning on electricity to avoid damage to electrical components within the enclosure.

**Electric element (design may vary): 3 phase elements have 3 terminals; 1 phase elements have 6 terminals**



**FIGURE 2**

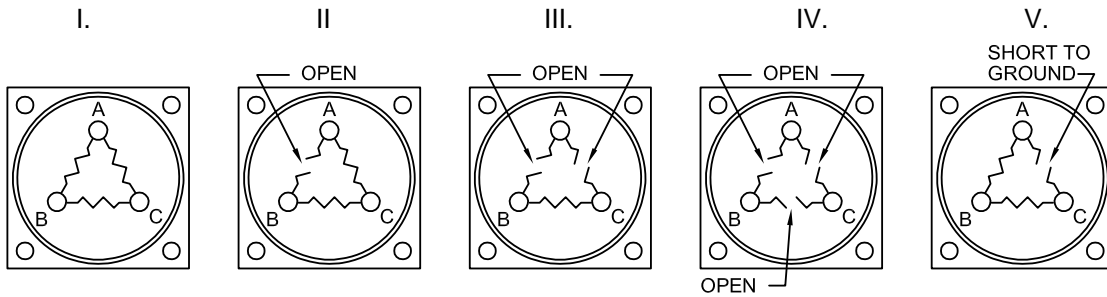
2. The tank must be full of water before turning on electricity. If elements are energized without water in the tank, they will burn out immediately. Warranty is void on dry starts.
3. Check all electrical connections for tightness before turning the unit on.
4. Energize manual disconnect switch. Check for proper voltage (with voltmeter) on power circuit. Voltage should not vary more than 5% from voltage shown on data plate. If voltage exceeds these limits, immediately turn off main disconnect and contact utility company.
5. Energize control circuit switch. Check for proper voltage.



6. Check for proper amperage with ammeter on power circuit. Amperage should not vary more than 5%, when under full load, from amperage shown on data plate. (See Table 2). If amperage exceeds these limits, immediately turn off main manual disconnect and refer to Electric Boiler Trouble Shooting Guide).
7. Check magnetic contactors for noise. If noisy, i.e., buzzing or chattering, turnoff main power disconnect, disassemble contactor and blow out foreign particles. Drill filings, dirt or other particles can cause pitting of points which will in turn burn out contactor and/or wire. Extra care has been taken during fabrication and inspection for cleanliness; however, field installation is often responsible for debris collecting on the contactor points.
8. On water boilers, the manual reset thermostat is a temperature limiting safety device set at 240°F. The operating thermostat is set at the factory at 140°F. Adjustment may be made by turning the thermostat dial to the desired temperature.
9. The pressure controls on a steam boiler are factory set for the desired operating pressure. Adjustments may be made as required. The manual reset control is the pressure limit and should be set just below the design pressure of the boiler or setting of the safety relief valve.
10. If an optional proportional sequencer is furnished, adjust set point to desired water temperature or pressure. (All other temperature or pressure controls must be set above the sequencer's set point.) Refer to manufacturer's product literature for servicing, operation and maintenance of proportional sequencer.

**IMPORTANT:** After approximately 30 minutes of operation, turn off all power to the unit. With main disconnect off, feel each wire connection and fuse clip with the hand for elevated temperature. If an elevated temperature is noted, there is a loose connection at the point of greatest heat. All connections must be tight for proper performance.

## 7 ELEMENT CONTINUITY CHECKS



NOTE: ELEMENT WIRE LEADS MUST BE DISCONNECTED TO PREVENT FALSE OHM READINGS.

ELEMENT RATING		CHECK OPEN COILS	I.	II.	III.	IV.	V.
kW	VOLT		OHM READING NORMAL	OHM READING 1 LEG OPEN	OHM READING 2 LEGS OPEN	OHM READING 3 LEGS OPEN	OHM READING TERMINAL TO FLANGE
18	600	A-B	40	120	∞	∞	Depending on the severity of the short, the OHM reading may vary from zero, (direct short) to several hundred ohms (partial short). In any case zero, (direct short) to several hundred ohms (partial short). In any case where the OHM reading is not infinity, the element should be replaced.
		B-C	40	60	60	∞	
		C-A	40	60	∞	∞	
18	480	A-B	26	78	∞	∞	
		B-C	26	39	39	∞	
		C-A	26	39	∞	∞	
18	380	A-B	17	50	∞	∞	
		B-C	17	25	25	∞	
		C-A	17	25	∞	∞	
18	240	A-B	7	20	∞	∞	
		B-C	7	10	10	∞	
		C-A	7	10	∞	∞	
18	208	A-B	6	16	∞	∞	
		B-C	6	8	8	∞	
		C-A	6	8	∞	∞	
9	600	A-B	80	240	∞	∞	
		B-C	80	120	120	∞	
		C-A	80	120	∞	∞	
9	480	A-B	52	154	∞	∞	
		B-C	52	77	77	∞	
		C-A	52	77	∞	∞	
9	380	A-B	33	98	∞	∞	
		B-C	33	49	49	∞	
		C-A	33	49	∞	∞	
9	240	A-B	14	40	∞	∞	
		B-C	14	20	20	∞	
		C-A	14	20	∞	∞	
9	208	A-B	10	30	∞	∞	
		B-C	10	15	15	∞	
		C-A	10	15	∞	∞	
4.5	600	A-B	160	480	∞	∞	
		B-C	160	240	240	∞	
		C-A	160	240	∞	∞	
4.5	480	A-B	103	308	∞	∞	
		B-C	103	154	154	∞	
		C-A	103	154	∞	∞	
4.5	380	A-B	65	194	∞	∞	
		B-C	65	97	97	∞	
		C-A	65	97	∞	∞	
4.5	240	A-B	26	78	∞	∞	
		B-C	26	39	39	∞	
		C-A	26	39	∞	∞	
4.5	208	A-B	20	58	∞	∞	
		B-C	20	29	29	∞	
		C-A	20	29	∞	∞	

TABLE 1

# TYPICAL CURRENT MEASUREMENTS

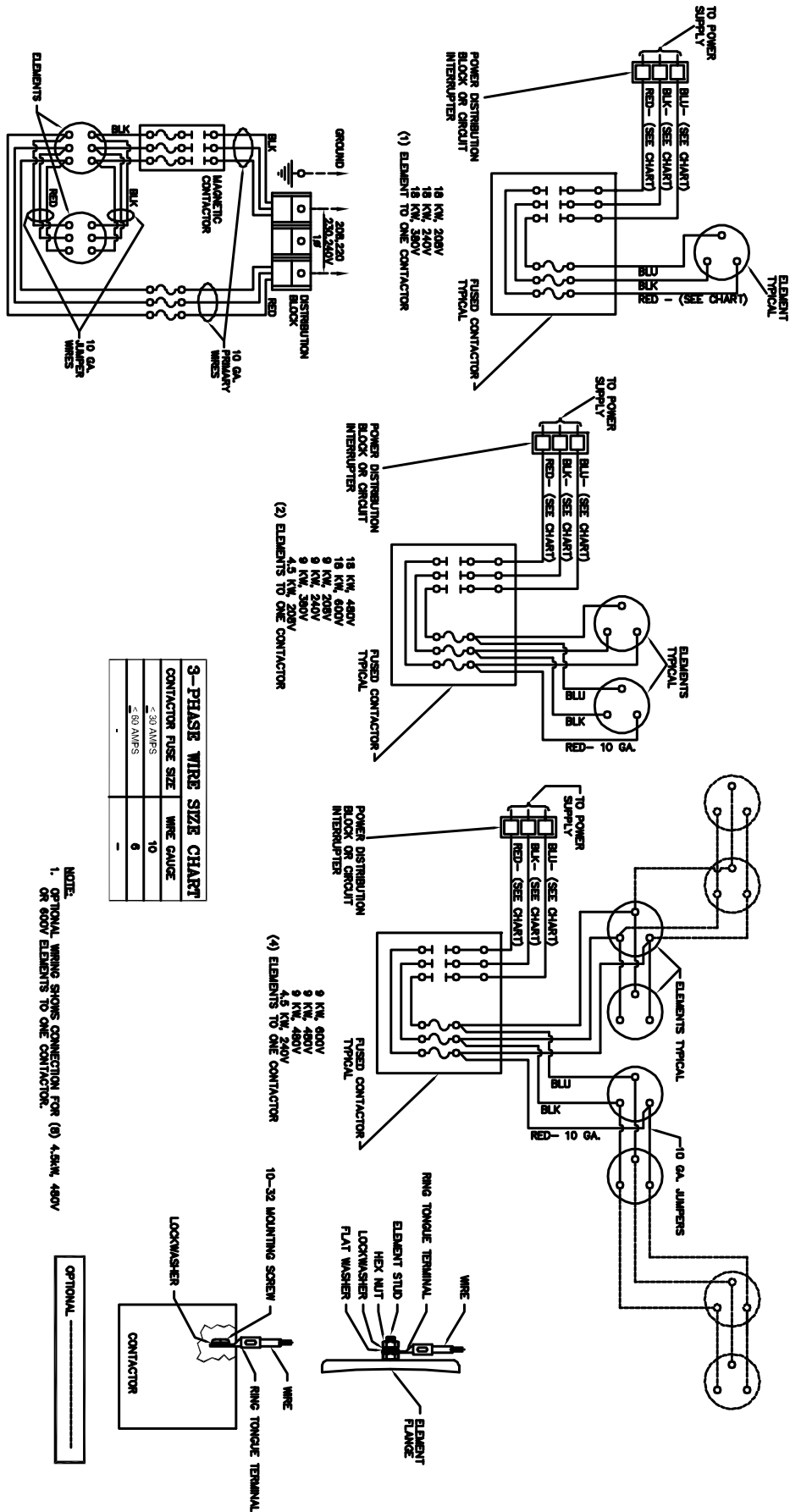
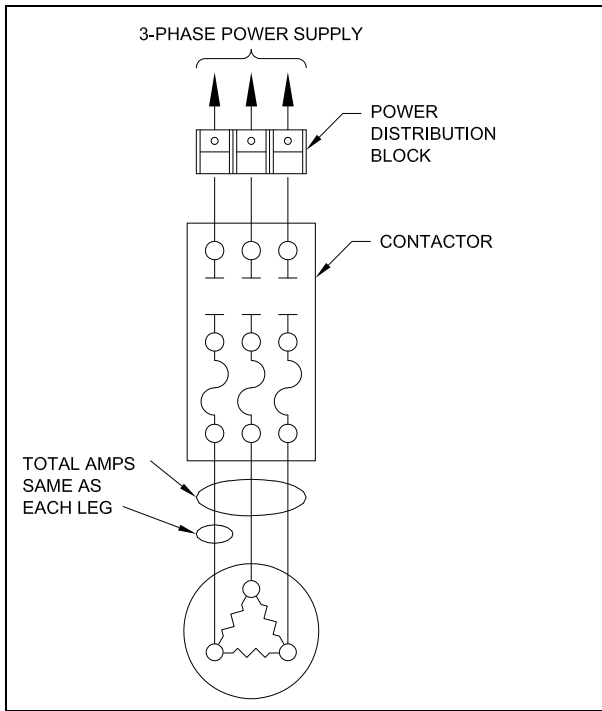
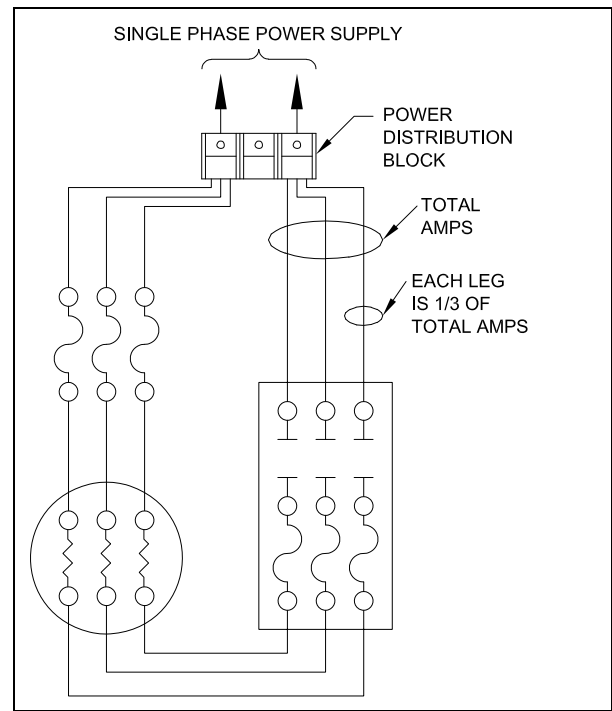


FIGURE 3



**FIGURE 4**



**FIGURE 5**

KW-VOLTAGE	3 Ø AMPS PER ELEMENT		1 Ø AMPS PER ELEMENT	
	AMPS PER LEG	AMPS TOTAL	AMPS PER LEG	AMPS TOTAL
*14 kW-600V	13 1/2	13 1/2	—	—
*7 kW-600V	7	7	—	—
18 kW-600V	18	18	—	—
9 kW-600V	9	9	—	—
4.5 kW-600V	4 1/2	4 1/2	—	—
18 kW-480V	22	22	—	—
9 kW-480V	11	11	—	—
4.5 kW-480V	5 1/2	5 1/2	—	—
18 kW-380V	28	28	—	—
9 kW-380V	14	14	—	—
4.5 kW-380V	7	7	—	—
18 kW-240V	44	44	25	75
9 kW-240V	22	22	13	38
4.5 kW-240V	11	11	6	18
18 kW-208V	50	50	29	87
9 kW-208V	25	25	15	44
4.5 kW-208V	12 1/2	12 1/2	7	22

**TABLE 2**

**NOTE:** Elements are usually wired to contactors in groups, in order to maintain an amperage draw of close to, but not more than, 50 amps per contactor.

\*Applications for 600V may be a re-rated 480V element. Therefore, the 40W/in.<sup>2</sup> may be rated for 14 kW instead of 9 kW.

## 8 MAINTENANCE

1. A preventative maintenance program should be established to assure a long, trouble-free life of the boiler. Refer to ASME Section VII for a comprehensive boiler operation, maintenance, and lay-up plan.
2. Boiler water blowdown is the periodic or continuous process of removing boiler water under pressure to remove sediment and excess concentration of dissolved solids.

Solids are present in the feedwater even though this water is treated prior to use with external processes that are designed to remove unwanted substances that contribute to scale and deposit formations. However, none of these processes are in themselves capable of removing all substances and regardless of their high efficiency, a small amount of encrusting solids will be present in the boiler water.

Solids become less soluble in the high temperature of the boiler water and tend to crystallize and concentrate on heating surfaces. Therefore, internal chemical treatment is required to prevent the solids from forming harmful scale and sludge.

Scale has a low heat transfer value and acts as an insulation barrier. This retards heat transfer, which not only results in lower operating efficiency and consequently higher energy consumption, but, more frequently, can cause failure of heating elements.

Scale is caused primarily by calcium and magnesium salts and silica. Any calcium and magnesium salts in the boiler water are generally precipitated by the use of sodium phosphate along with organic materials to maintain these precipitates or "sludge" in a fluid form. The solids, such as sodium salts and suspended dirt, do not readily form scale, but as the boiler water boils off as relatively pure steam, the remaining water is thicker with the solids. If this concentration is permitted to accumulate, foaming and priming will occur and the sludge can cause harmful deposits that bring about overheating of the metal.

**SINCE RIVERSIDE HYDRONICS CANNOT CONTROL THE USE OF THE BOILER, WATER CONDITIONS OR MAINTENANCE, THE WARRANTY ON THE BOILER DOES NOT COVER POOR PERFORMANCE, STRUCTURAL FAILURE OR LEAKING DUE TO AN EXCESSIVE ACCUMULATION OF SCALE.**

**WARNING: Turn off all electrical service to the appliance when accessing the controls located inside the control cabinet. The cabinet contains high voltage wiring and terminals. If the electrical service is not turned off and these wires or terminals are touched, a dangerous shock causing personal injury or loss of life could occur. Close the control cabinet before restoring electrical service to the appliance.**

3. Inspect operating controls to ensure they are level, especially those containing mercury switches. Make sure that connecting tubing is not kinked or damaged on remote bulb thermostats.
4. The pressure relief valve should be checked at regular intervals by manually opening the valve. The openings inside the valve may become restricted by a buildup of scale and become inoperative. If the valve does not open and close properly and does not blow off internal pressure when tested, it must be replaced. Shut down boiler, relieve internal pressure and replace relief valve with a like kind or one meeting the requirements stated on the rating decal located adjacent to the relief valve mounting location.

**CAUTION: The relief valve is a primary safety device**

5. The need to periodically check water level controls and the waterside of the pressure vessel cannot be over emphasized. Most instances of major boiler damage are the result of operating with low water or the use of untreated (or incorrectly treated) water.

Always be sure of the boiler water level. The water column should be blown down regularly on steam boilers. Check samples of boiler water and condensate in accordance with procedures recommended by your water consultant.

A typical water level control is mounted in the water column on steam boilers and has float-actuated mercury switches. One switch is connected to the control circuit and will shut down if a low water condition occurs. On a steam boiler, the other switch is connected to the feedwater circuit to energize a water pump or feed valve to maintain the water at the proper operating level. Usually, the control is of the automatic reset type and will remake the limit circuit when the water level is restored. Some applications require that a control be equipped with a manual reset mechanism that must be manually reset before the boiler can be restarted. This is usually accomplished with the use of a second or auxiliary control that has this feature.

Since low water cut-off devices are generally set by the original manufacturer, no attempt should be made to adjust these controls to alter the point of low water cut-off or point of pump cut-in or cut-out. If a low water device should become erratic in operation, or if its setting changes from previous established levels, check for reasons and correct, repair, or replace as required.

The operation of the control may be checked by stopping the water supply to the boiler while the boiler is operating. While under constant attendance, allow the water to lower at a normal rate. If a control does not break the circuit to the heating elements at the proper point, **SHUT DOWN THE BOILER IMMEDIATELY.**

Do not restart until all cross connecting piping is checked for obstruction. Also check the float bowl. If these are clean, repair or replace the control. Repeat the above test to insure proper operation prior to returning the boiler to service.

Remove the pipe plugs from the tees or crosses and make certain the cross connecting pipe is clean and free of obstructions. Controls must be mounted in a plumb position for proper performance. Determine that piping is vertically aligned after shipment and installation and through life of equipment.

A schedule blowdown of the water controls on a steam boiler should be maintained.

A broken or discolored glass must be replaced at once. Periodic replacement should be part of the maintenance program. Always use new gaskets when replacing a glass. Use a proper size rubber packing. Do not use "loose packing," which could be forced below the glass and possibly plug the valve opening.

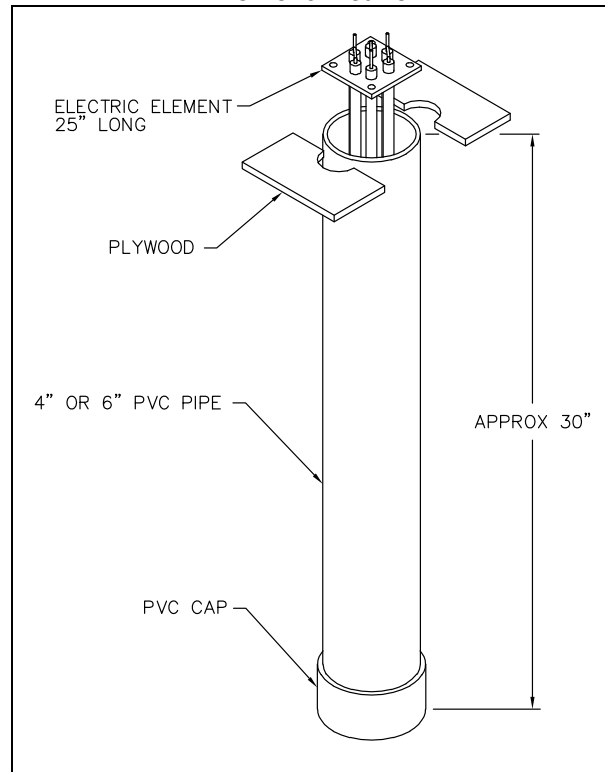
6. It is impractical to blowdown the low water cut-off devices, when supplied, on a hot water boiler since the entire water content of the system would become involved. Many hot water systems are fully closed and any loss of water will require make-up and additional feedwater treatment that might not otherwise be necessary. Since the boiler and system arrangement usually makes it impractical to perform daily and monthly maintenance of the low water cut-off devices, it is essential to shut down the boiler and remove the operating mechanism from the bowl housing at periodic intervals. Also, check the cross connecting piping to make certain that it is clean and free of obstruction.
7. The standard low water control on hot water boilers is electronic. Inspection should be made of the electrode on steam and hot water boilers equipped with electronic low water devices.

**WARNING: Turn off all electrical service to the appliance when accessing the controls located inside the control cabinet. The cabinet contains high voltage wiring and terminals. If the electrical service is not turned off and these wires or terminals are touched, a dangerous shock causing personal injury or loss of life could occur. Close the control cabinet before restoring electrical service to the appliance.**

8. Check all electrical connections approximately one to two weeks after initial start-up to assure tightness. Heating and cooling from operation can loosen connections. Visually inspect wire terminal points for any discoloration on a monthly basis. Discoloration is likely due to a loose connection at the point nearest discoloration. Check contactors periodically and clean if necessary and repair or replace pitted points caused by foreign particles. Check fuses periodically for continuity and replace if necessary with the same type and rating.
9. Electric immersion INCOLOY® sheath elements are wound at high wattage ratings and must be completely covered by water while in operation. Otherwise, they overheat and burn out. Scale from the water will collect on the sheathing of the element over a period of time and must be removed periodically to extend the life of the element. Water in some areas will produce the scale buildup more rapidly than other areas. The rapidity of the scale buildup is also determined by the watt density of the element.

It is good maintenance practice to remove and clean 80 W/in<sup>2</sup> (18kW) density elements on a monthly basis. The interval between removal and cleaning can usually be extended to six months when 40 W/in<sup>2</sup> (9kW) density elements are installed. Most installations where 20 W/in<sup>2</sup> (4 1/2kW) density elements are used, require only annual cleaning. Elements are cleaned by soaking in a scale dissolving solution. A 30" piece of four or six inch PVC pipe with a cap on one end makes an ideal container for element cleaning. (See figure 6.) Contact a chemical supply house for advice on the proper cleaning solution for your area.

### Element Cleaner



**FIGURE 6**

10. A boiler used for heating or seasonal loads or for stand-by service may have an extended period of non-use. Special attention must be given so that neither waterside surfaces are allowed to deteriorate from corrosion.
11. There are two methods of storage - wet or dry. Your water consultant or feedwater treating company can recommend the better method, depending upon circumstances in a particular installation. Section VII of the ASME Code also contains information relating to laying up a boiler. Extended shutdown of the boiler and restarting are as follows:
  - a. Turn off all power.
  - b. Enter boiler into dry storage.
  - c. Tag power switch(es) that energy is off and tank is in storage condition.
  - d. Remove tank from storage and turn power switch(es) on to start. Reset all controls and conduct start-up of the boiler as discussed previously.

## 9 TROUBLESHOOTING GUIDE

TROUBLE	PROBABLE CAUSE	REMEDY
<b>No hot water; or steam</b>	Thermostat(s) or pressure controls not closed	Check to assure proper thermostat or pressure controls setting.
	Contractors will not pull in	Check continuity between all three thermostats or pressure controls. Complete circuit. If one is open, it must be replaced.
	Control circuit switch is in OFF position	Close switch. (Turn to ON position)
	Control circuit fuse blown	Isolate cause for failure and replace fuse.
	Contractor(s) coil open	Check continuity. Replace coil if not a complete circuit.
	Time delay sequencer not operating	Check for 120 volts to coil on first sequencer step. Allow ample time for additional steps to energize. If steps do not energize in reasonable time, replace only the defective relay step. See wiring diagram.
	Proportional sequencer not operating	Check for 120 volts to line connection (L) on sequencer. Check fuse for continuity. See wiring diagram. Consult factory.
	Low water cutoff closed	Check for open circuit. Check water level in tank. Replace low water cutoff if defective.
	Heating elements	Check for open legs. (See table 2)
<b>Insufficient hot water</b>	Boiler not large enough to satisfy peak demands	Add booster or additional kw input. Consult local Riverside Hydronics representative.
	Hot water or steam lines not insulated	Add insulation; it will protect against heat loss and save on cost of operation.
	Power fuse(s) blown	Check fuses for continuity. Replace if blown. If blown, determine cause of break before replacing with same type fuse.
	Contractor(s) not closing	Check coil for continuity. If defective, replace.
	Thermostat(s) or pressure controls not correctly set	Check to assure proper thermostat or pressure control setting.
	Element(s) not heating	Check for proper amperage draw. Check for proper ohm resistance. Replace if defective. Consult factory. (See table 1)
<b>Burned or discolored wires</b>	Loose connections	Tighten all connections. If charred, replace wire with wire of same type and size.
	Dirty or pitted contactor points	Remove contactor points and inspect. If dirty, clean with emery paper. <b>CAUTION: Point must remain flat. If pitted or burned, contractor points must be replaced.</b>
<b>Blown fuses</b>	Loose connection. Defective element	Check all connections for tightness. Check ohm resistance in electric elements. Replace.
<b>High or low voltage</b>	Local utility	Check with local utility.
<b>High or low amperage</b>	High or low voltage. Defective element	Check with local utility. Low amperage, check fuses, tighten connections. Check ohm resistance on elements.
<b>Wire burned or melted at element</b>	Loose connections. Water leaking on elements	Tighten connection and replace wire. Isolate leaking water and repair. Replace wire with same type and size.





