INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FOR

CARE-FREE
ELECTRIC BOILER
MODEL E4

For service or repairs to boiler, call your heating contractor. When seeking information on boiler, provide Boiler Model Number and Serial Number as shown on Rating Label.

Boiler Model Number	Boiler Serial Number	Installation Date
E4 _ _-_____	6_ _ _ _ _ _ _	
Heating Contractor		Phone Number
Address		

Burnham® Hydronics
U.S. Boiler Co., Inc.

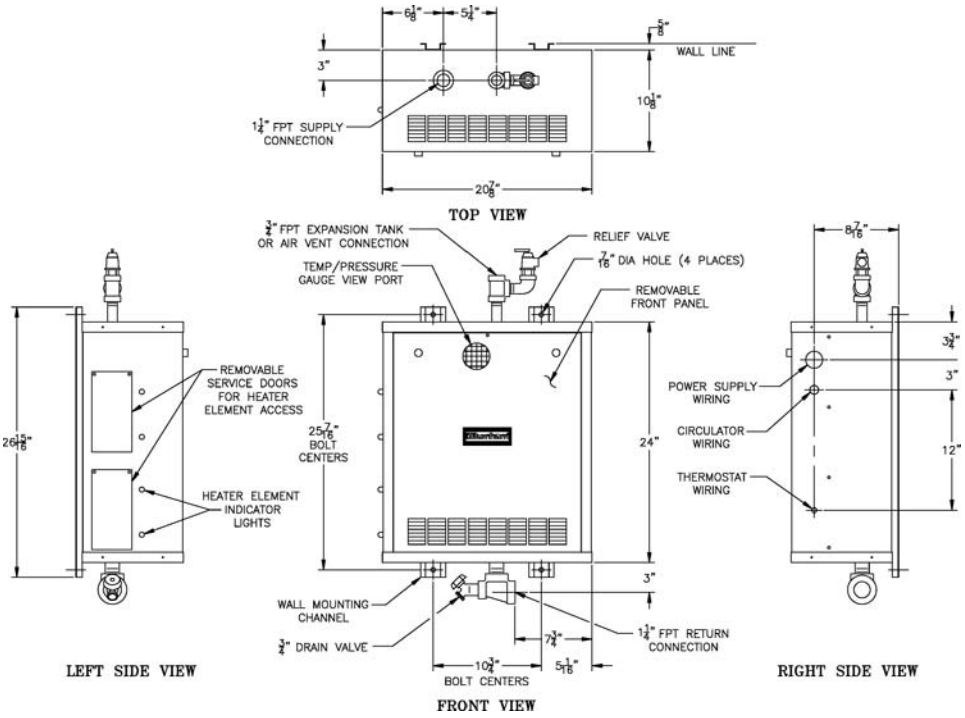
8143606R7-2/06

Price - $3.00

IMPORTANT: READ THESE INSTRUCTIONS CAREFULLY BEFORE PROCEEDING WITH THE INSTALLATION OF BOILER. POST INSTRUCTIONS NEAR BOILER FOR REFERENCE BY OWNER AND SERVICE TECHNICIAN. MAINTAIN INSTRUCTIONS IN LEGIBLE CONDITION.

NOTE: — The equipment shall be installed in accordance with those installation regulations in force in the area where the installation is to be made. These shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made.

All wiring shall be made in accordance with the National Electrical Code and/or local regulations.



CLEARANCE REQUIREMENTS

	For Service Accessibility	Approved for Closet & Alcove Installation with minimum clearance to combustible material*
LEFT SIDE	18"	18"
RIGHT SIDE	6"	0"
TOP	9"	9"
BOTTOM	9"	15"
REAR	0"	0"
FRONT	For Door Removal - 24"	2" Closet 18" Alcove

*Closet Installation Requires Two Ventilation Openings, one located at top and one at bottom, each opening to have 25 sq. in. net free area.

Boiler Model	DOE HEATING CAPACITY, BTU/HR			AFUE %	KW Rating (240V)	Amps (240V)	No. and Size of Elements	Recommended Power Supply to Boiler		Appx. Wt. Full (Lb.)	Water Contents (Gal.)	Water Flow Rate - (GPM) Based on 20°F Temp. Rise and Boiler Capacity At		
	240V	220V	208V					Min.* Wire Size	Max. Fuse Size-Amps.			240V	220V	208V
412	41,000	35,000	31,000	100	12	50	4-3KW	#6 AWG	60	155	3½	4.1	3.5	3.1
416	55,000	46,000	41,000	100	16	70	2-3KW (top) 2-5KW (bottom)	#4 AWG	80	155	3½	5.5	4.6	4.2
420	68,000	58,000	52,000	100	20	85	4-5KW	#2 AWG	90	155	3½	6.8	5.8	5.2

DOE Heating Capacities are shown. Where the boiler and piping are in the heated space, the boiler may be selected on the basis of the DOE Heating Capacity. Where a piping loss and/or a pickup loss will exist, add this loss to the building loss to determine the total heating requirements. Where a piping loss only will exist but cannot be calculated, multiply the calculated building loss by a 1.15 factor to determine the total heating requirement.

*For runs in excess of 50 ft. consult local or national electrical code.

Maximum Allowable Working Pressure: 30 PSI (Water Only)

Figure 1: Dimensions and Specifications

SECTION I: INSTALLATION INSTRUCTIONS

A. **Inspect Shipment** carefully for any signs of damage.

1. All equipment is carefully manufactured, inspected and packed. Our responsibility ceases upon delivery of Boiler to the carrier in good condition.
2. Any claims for damage or shortage in shipment must be filed immediately against the carrier by the consignee. No claims for variances from, or shortage in orders, will be allowed by Boiler Manufacturer, unless presented within sixty (60) days after receipt of goods.

B. **Read These Instructions Carefully** before proceeding with installation and operation of the "CARE-FREE" Electric Boiler.

1. The "CARE-FREE" is U.L. listed, constructed and tested in accordance with the requirements of the ASME Boiler and Pressure Vessel Code and designed for use in any conventional hydronic system except steam and gravity hot water.
2. The "CARE-FREE" Electric Boilers are shipped completely assembled less circulator. All electrical controls are mounted and wired in a compartment immediately behind the Front Door of the Boiler Jacket, see Figure 1.

C. **Locate Boiler** in or adjacent to the space to be heated with consideration given to the location of the electrical service. Although its compactness will allow the "CARE-FREE" Electric Boiler to be mounted almost anywhere – closet, alcove, or other small area, see CLEARANCE REQUIREMENTS on Page 2.

D. **Mount Boiler** to wall using four 3/8" lag screws or anchor bolts (depending upon wall construction) passing through the holes provided in the wall mounting channels. Figure 1 shows bolt center dimensions. It is recommended that 1/2" plywood be used as a base for mounting the boiler so that the structure is adequate to carry the weight imposed upon it – see Figure 1 for weight of boiler when full of water. Boiler should be level for proper operation of BUILT-IN AIR SEPARATOR.

E. **Connect Supply and Return Piping** to Heating System using standard recognized practices. See Figure 2. Install an appropriate size expansion tank in system as per Figure 2. Do not connect into the 3/4" tee on top of the boiler; instead install an automatic float type air vent at this point. Water content of the boiler is given in Figure 1.

The relief valve outlet should be piped full size to a drain or near the floor.

The heating elements are NOT compatible with ethylene glycol based antifreeze.

If a low water cut-off is required, it must be mounted in the system piping above the boiler.

The minimum safe water level of a hot water boiler is just above the highest water containing cavity of the boiler; that is, a hot water boiler must be full of water to operate safely.

If it is required to perform a long term pressure test of the hydronic system, the boiler should first e isolated to avoid a pressure test including the boiler, ALL trapped air must first be removed from the boiler.

A loss of pressure during such a test, with no visible water leakage, is an indication that the boiler contained trapped air.

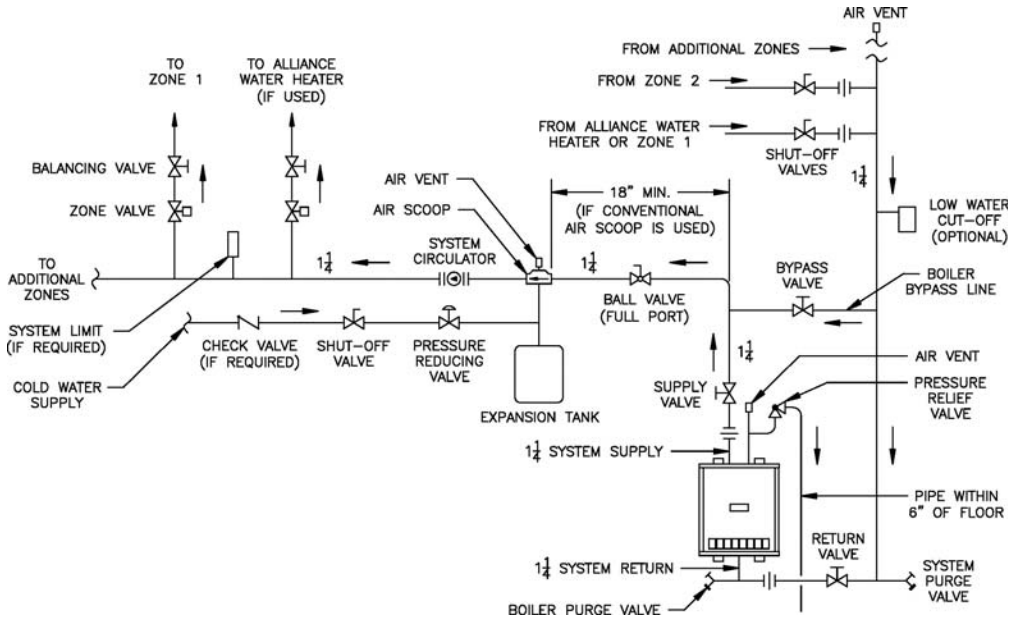


Figure 2: Recommended Boiler Piping

F. **Install Electric Wiring** in accordance with NATIONAL ELECTRICAL CODE and Local Regulations. The Burnham "CARE-FREE" Electric Boilers may be used with 208 and 240 volt, 60 cycle, single phase power and one 3 wire power supply. Since the heaters are rated at 240 volts, however, any input voltage less than this affects boiler capacity, see Figure 3.

To remove Front Door for access to terminal blocks and controls:

1. CAUTION – make sure Electrical Service to Boiler is disconnected.
2. Remove retaining screw at top of door.
3. Lower Door as far as possible, then push forward until Hinge Pins in lower corners slide out of the slots.
4. Raise one side of Door until Door will clear opening – pull forward for removal.

Repeat above in reverse for replacing Door.

Provisions are provided in the right side of the boiler jacket for power input, circulator, and thermostat wiring, see Figure 1.

The power input legs are connected to the L1 and L2 terminals on the terminal board on the control compartment of the boiler. The neutral leg is connected to the terminal marked N. Minimum recommended wire sizes are shown in Figure 1. A separate grounding conductor of at least #6AWG copper must be run to the field grounding lug on the control panel.

The Circulator is to be connected from its housing to the terminals marked N and M on the Main Terminal Block using Flexible Conduit, see Figures 2 and 4. If the "QUICK CONNECT CIRCULATOR-PAK" is ordered as Optional Equipment from the Boiler Manufacturer, the Flexible Conduit for connecting the circulator will be furnished.

G. **A Prewired Low Voltage Control System** is furnished with every "CARE-FREE" boiler.

1. All controls are furnished in a compartment at the front of the boiler for easy accessibility. In addition to the Transformer used to power the system, are the following: Circulator Relay, Heating Element Sequencers (one per Heating Element), Dual High Limit Control, Circulator Operation Selector Switch, Circulator Fuse and Heating Element Relays.
2. If the Circulator Fuse is blown, power is interrupted to the Transformer and hence, the control system de-energized. This action prevents the Heating Elements from coming on while the Circulator is inoperative.

A Circulator Operation Selector Switch provides for either Continuous or Intermittent Circulator operation. With the switch in the "CONT." position the Circulator Delay Control will be bypassed and the Circulator will operate continuously. The room Thermostat regulates only the operation of the Heating Elements in the boiler.

With the Circulator Switch in the "INT." position, the Thermostat will operate both the Circulator and the Heating Elements. Timing and wiring of the bimetal heaters in the Circulator Relay and Sequencers assures Circulator operation before and after Heating Elements are energized and de-energized, respectively. The Sequencers permit only one Heating Element at a time (from bottom to top) to be energized thus preventing a sudden inrush of electrical current. More detailed operation is described in subsequent pages.

Wiring of a one zone system is shown in Figure 4. Figures 5 and 6 show wiring for zoned systems, the former when Zone Valves are used and the latter when multiple Circulators are used.

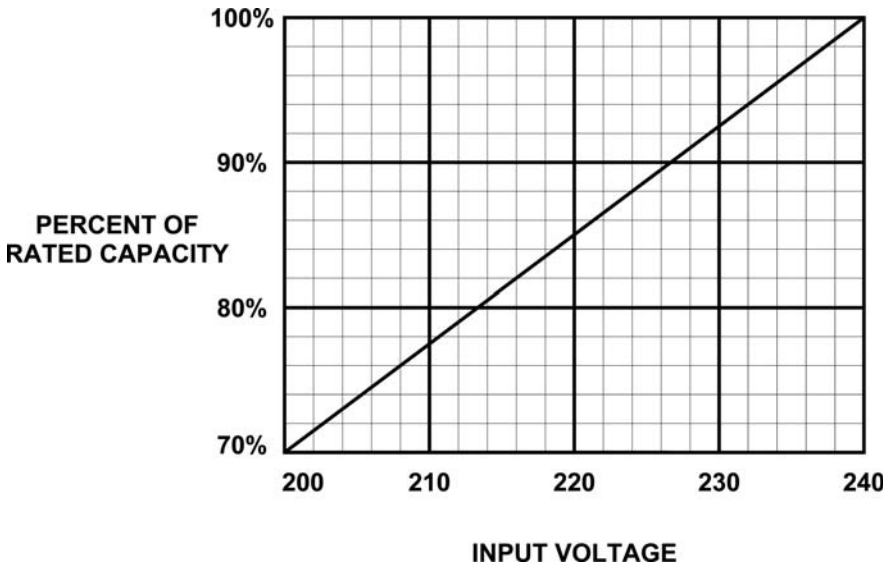


Figure 3: Boiler Capacity at Various Voltages

SECTION II: OPERATING AND SERVICE INSTRUCTIONS

A. Intermittent Circulator Operation

1. ROOM THERMOSTAT CLOSES
2. CIRCULATOR MOTOR ENERGIZED
   a. As the thermostat closes its contacts, a low voltage circuit (24V.) is completed to the bimetal heater in the circulator relay (24A51). After a time delay of 15 seconds, the main contacts (120V.) of the circulator relay close to start the circulator.
3. HEATING ELEMENT #1 ENERGIZED
   a. Simultaneous with the completing of the circuit for the circulator relay, two additional circuits are completed.
   b. The first circuit is for the Heating Element Relays which pull in immediately and the second is for the bimetal heater in the #1 Heating Element Sequencer (24A54).
   c. These two circuits will be energized only if the boiler is not "OFF" on limit.
   d. After a time delay of 45 seconds (30 seconds after the circulator has started) the main and auxiliary contacts of the #1 Sequencer close; the main contacts (240V.) energizing heating element #1 and its pilot light (located at the bottom of the side panel), the auxiliary contacts (24V.) energizing the bimetal heater in the #2 Heating Element Sequencer.
4. HEATING ELEMENT #2 ENERGIZED
   a. 45 seconds after bimetal heater in #2 Heating Element Sequencer is energized, its main contacts (240V.) and auxiliary contacts close; the main contacts energizing heating element #2 and its pilot light (3rd lowest in the boiler), the auxiliary contacts (24V.) energizing the bimetal heater in the #3 Heating Element Sequencer.
5. HEATING ELEMENT #3 ENERGIZED
   a. 45 seconds after bimetal heater in the #3 Heating Element Sequencer is energized, its main contacts and auxiliary contacts close; the main contacts (240V.) energizing heating element #3 and its pilot light (2nd lowest in the boiler), the auxiliary contacts (24V.) energizing the bimetal heater in the #4 Heating Element Sequencer.
6. HEATING ELEMENT #4 ENERGIZED
   a. 45 seconds after bimetal heater in #4 Heating Element Sequencer is energized, its main contacts and auxiliary contacts close, the main contacts (240V.) energizing heating element #4 and its pilot light (highest in the boiler) – nothing is connected to the auxiliary contacts.
7. ROOM THERMOSTAT OPENS
8. HEATING ELEMENTS DE-ENERGIZED

   When the thermostat is satisfied and opens its contacts, the low voltage circuits to the Heating Element Relay and the Heating Element Sequencers are broken. The Heating Element Relays "drop-out" immediately and totally de-energize the Heating Elements and pilot lights. After a time delay of 45 seconds, the main contacts of all the Sequencers "break" thus resetting the Heating Element Relays.

9. CIRCULATOR MOTOR DE-ENERGIZED

   Simultaneous with the breaking of the low voltage circuit to the Heating Element Sequencers is the breaking of the low voltage circuit to the Circulator Relay by the opening of the thermostat contact. After a time delay of 90 seconds after all Heating Elements are "off" the bimetal heater opens the main contacts in the Circulator Relay thus stopping the circulator. When the boiler is zoned with circulator and switching relays as illustrated in Figure 6 on Page 8 the circulator switch must be in the "constant" position; therefore the circulator will not have any delay when the thermostat(s) closes or opens its contacts.

B. Continuous Circulator Operation

If the Circulator Switch (located in the control portion of the Boiler Jacket) is placed in the "CONT." position, the Circulator will run continuously and the Heating Elements will sequence as in steps 3-6 and 8 above.

C. Dual Limit Operation

The Dual Limit Control consists of two independently adjustable temperature limits. The left hand adjustment is for the safety limit and should be set initially for 220°F. The lower right hand adjustment is for the operating limit and should be set for 210°F with a differential setting (upper right hand adjustment) of 10º. These adjustments may be varied to suit the individual installation, with minimum of 10° difference between the limit settings. If the setting of the operating Limit or the safety limit is reached, the Heating Elements only will be de-energized; the Circulator will continue to run. If the Circulator Switch is in the "INT." position, the Circulator runs until the thermostat is satisfied and the main contacts on the Circulator Relay open.

WARNING

Before installation of the boiler is considered complete, the operation of the boiler controls should be checked, particularly the Operating & Safety Limit Controls.

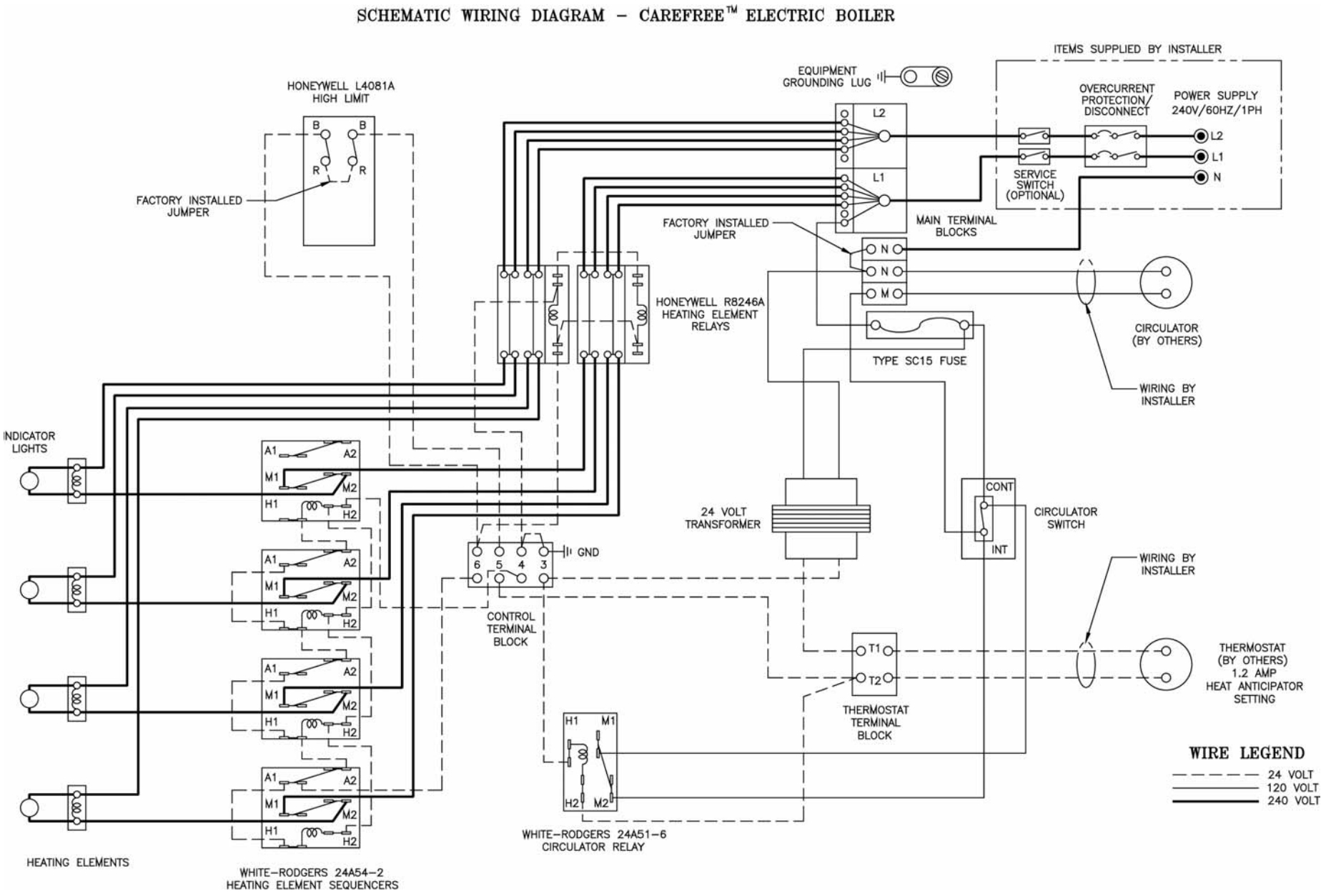


Figure 4: Wiring Diagram - Model E-4 Boilers

D. Indicator Lights

There is an indicator light for each heating element. If an indicator light is “on” it indicates its respective heating element is energized. If the light is “off” it indicates:

1. The heating element has not been energized.
2. The heating element sequencer is malfunctioning.

E. Built-In Air Eliminator

An air eliminator has been built into the top of the electric boiler and a 3/4" tapping is provided with nipple and tee for connection of Relief Valve and a float type Air Vent. See Figure 1.

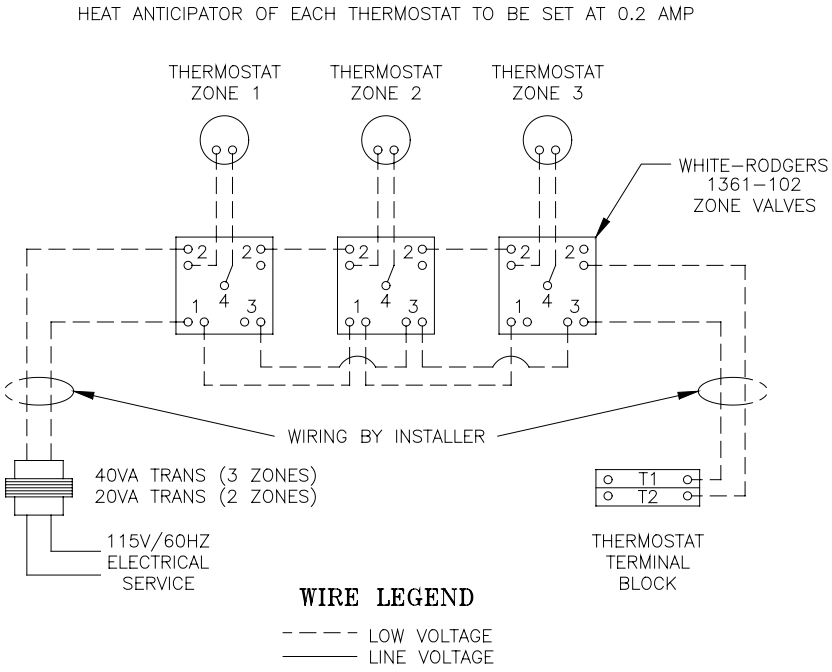


Figure 5: Wiring Diagram - 3 Zone System
White-Rodgers 2 Wire Zone Valves

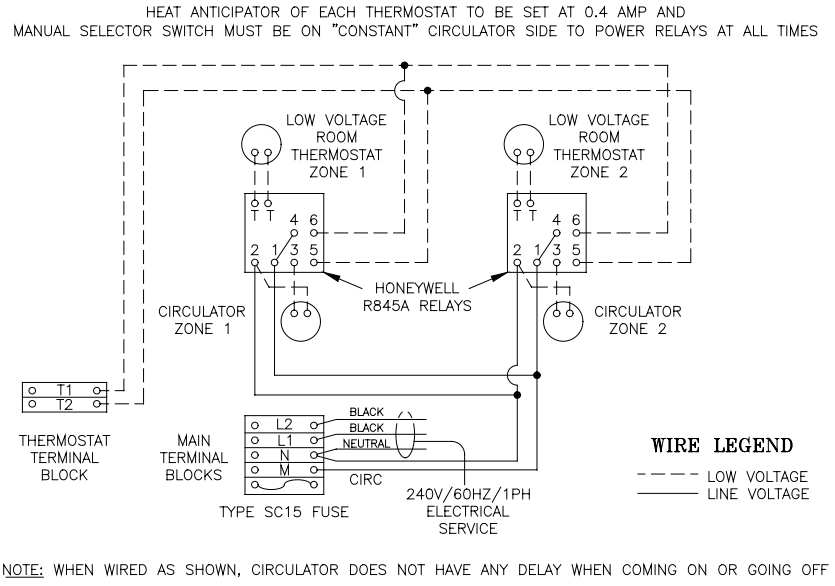


Figure 6: Wiring Diagram - 2 Zone System
Multiple Circulators

Limited Warranty

FOR RESIDENTIAL CAST IRON WATER BOILERS

Subject to the terms and conditions set forth below, U.S. Boiler™ Co., Inc. Lancaster, Pennsylvania hereby extends the following limited warranties to the original owner of a residential grade water boiler manufactured and shipped on or after July 1,1991:

ONE YEAR LIMITED WARRANTY ON RESIDENTIAL GRADE WATER BOILERS

U.S. Boiler Co., Inc. warrants to the original owner that its residential grade water boilers comply at the time of manufacture with recognized hydronic industry standards and requirements then in effect and will be free of defects in material and workmanship under normal usage for a period of one year from the date of original installation. If any part of a water boiler is found to be defective in material or workmanship during this one year period, U.S. Boiler Co., Inc. will, at its option, repair or replace the defective part.

LIFETIME LIMITED WARRANTY ON HEAT EXCHANGER

U.S. Boiler Co., Inc. warrants to the original owner that the heat exchanger of its residential grade water boilers will remain free from defects in material and workmanship under normal usage for the lifetime of the original owner at the original place of installation. If a claim is made under this warranty during the first ten years from the date of original installation, U.S. Boiler Co., Inc. will, at its option, repair or replace the heat exchanger. If a claim is made under this warranty after the expiration of ten years from the date of original installation, U.S. Boiler Co., Inc. will, at its option and upon payment of the pro-rated service charge set forth below, repair or replace the heat exchanger. The service charge applicable to a heat exchanger warranty claim is based upon the number of years the heat exchanger has been in service and will be determined as a percentage of the retail price of the heat exchanger model involved at the time the warranty claim is made as follows:

Years In Service	1-10	11	12	13	14	15	16	17
Service Charge as % of Retail Price	No Charge	5	10	15	20	25	30	35

Years In Service	18	19	20	21	22	23	24	25 and above
Service Charge as % of Retail Price	40	45	50	55	60	65	70	75

NOTE: If the heat exchanger model involved is no longer available due to product obsolescence or redesign, the value used to establish the retail price will be the published price as shown in the Burnham Hydronics Repair Parts Price Sheet where the heat exchanger last appeared or the current retail price of the then nearest equivalent heat exchanger.

ADDITIONAL TERMS AND CONDITIONS

1. Applicability: The limited warranties set forth above are extended only to the original owner at the original place of installation within the United States and Canada. These warranties are applicable only to water boilers designated as residential grade by U.S. Boiler Co., Inc. and installed in a single or two-family residence and do not apply to steam boilers of any kind or to commercial grade boilers.

2. Components Manufactured by Others: Upon expiration of the one year limited warranty on residential grade water boilers, all boiler components manufactured by others but furnished by U.S. Boiler Co., Inc. (such as oil burner, circulator and controls) will be subject only to the manufacturer's warranty, if any.

3. Proper Installation: The warranties extended by U.S. Boiler Co., Inc. are conditioned upon the installation of the residential grade water boiler in strict compliance with U.S. Boiler Co., Inc. installation instructions. U. S. Boiler Co., Inc. specifically disclaims liability of any kind caused by or relating to improper installation.

4. Proper Use and Maintenance: The warranties extended by U.S. Boiler Co., Inc. conditioned upon the use of the residential grade water boiler for its intended purposes and its maintenance accordance with U. S. Boiler Co., Inc. recommendations and hydronics industry standards. These warranties will be inapplicable if the residential grade water boiler is used or operated over its rated capacity, is subjected to unauthorized modification, or is damaged as a result of being otherwise improperly operated or serviced including, but not limited to, damage from any of the following: operation with insufficient water, allowing the boiler to freeze, subjecting the boiler to flood conditions, and operation with unapproved water or fuel additives which cause deposits or corrosion.

5. Removal and Installation: These warranties do not cover expenses of removal or reinstallation. The owner is responsible for the cost of removing and reinstalling any defective part and its replacements and all labor and material connected therewith.

6. Exclusive Remedy: U.S. Boiler Co., Inc. obligation for any breach of these warranties is limited to the repair or replacement of its parts in accordance with the terms and conditions of these warranties.

7. Limitation of Damages: Under no circumstances shall U.S. Boiler Co., Inc. be liable for incidental, indirect, special or consequential damages of any kind whatsoever under these warranties, including, but not limited to, injury or damage to persons or property and damages for loss of use, inconvenience or loss of time. U.S. Boiler Co., Inc. liability under these warranties shall under no circumstances exceed the purchase price paid by the owner for the residential grade water boiler involved. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

8. Limitation of Warranties: These warranties set forth the entire obligation of U.S. Boiler Co., Inc. with respect to any defect in a residential grade water boiler and U.S. Boiler Co., Inc. shall have no express obligations, responsibilities or liabilities of any kind whatsoever other than those set forth herein. These warranties are given in lieu of all other express warranties.

ALL APPLICABLE IMPLIED WARRANTIES, IF ANY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY LIMITED IN DURATION TO A PERIOD OF ONE YEAR EXCEPT THAT IMPLIED WARRANTIES, IF ANY, APPLICABLE TO THE HEAT EXCHANGER IN A RESIDENTIAL GRADE WATER BOILER SHALL EXTEND TO THE ORIGINAL OWNER FOR THE LIFETIME OF THE ORIGINAL OWNER AT THE ORIGINAL PLACE OF INSTALLATION. SOME STATES DO NO ALLOW LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

PROCEDURE FOR OBTAINING WARRANTY SERVICE

In order to assure prompt warranty service, the owner is requested to complete and mail the attached Warranty Card within ten days after the installation of the boiler, although failure to comply with this request will not void the owner's rights under these warranties.

Upon discovery of a condition believed to be related to a defect in material or workmanship covered by these warranties, the owner should notify the installer, who will in turn notify the distributor. If this action is not possible or does not produce a prompt response, the owner should write to U.S. Boiler Co., Inc., Burnham Hydronics, at P.O. Box 3079, Lancaster, PA 17604, giving full particulars in support of the claim.

The owner is required to make available for inspection by U.S. Boiler Co., Inc. or its representative the parts claimed to be defective and, if requested by U.S. Boiler Co., Inc. to ship these parts prepaid to U.S. Boiler Co., Inc. at the above address for inspection or repair. In addition, the owner agrees to make all reasonable efforts to settle any disagreement arising in connection with a claim before resorting to legal remedies in the courts.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

Burnham® Hydronics

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