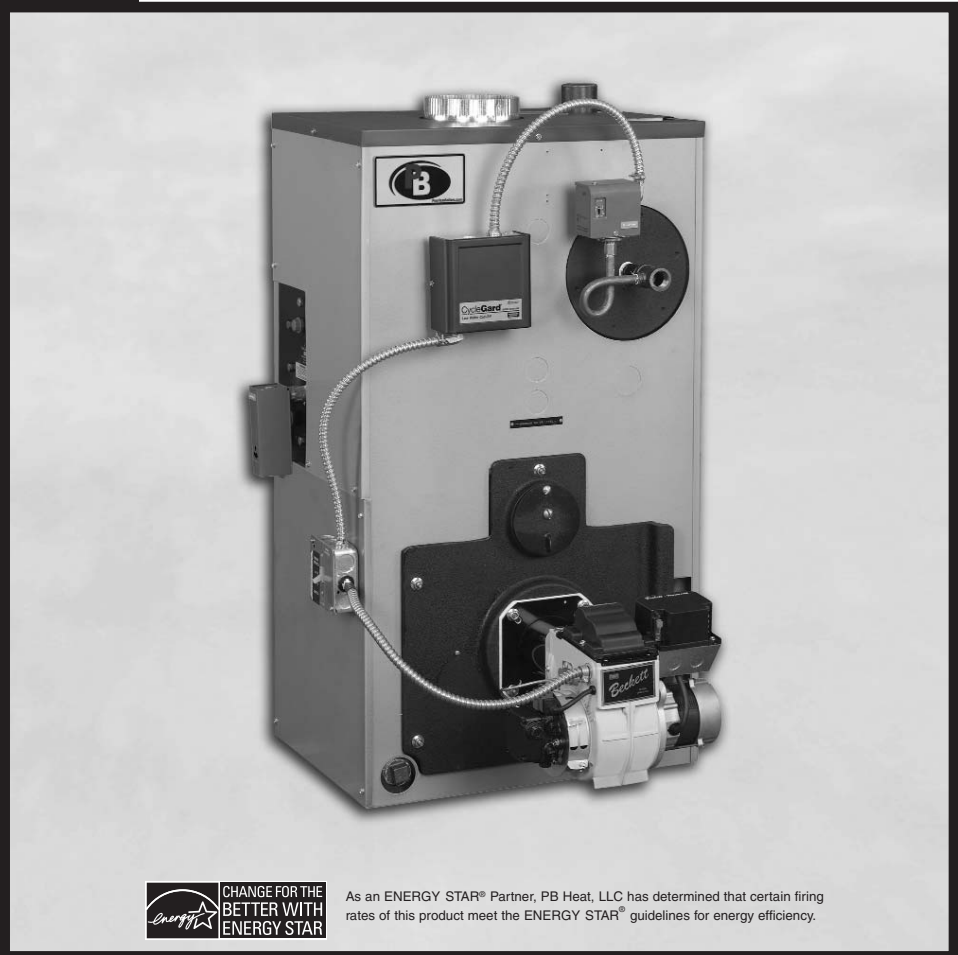


# Series **EC/ECT™**

## *Oil Boilers*



As an ENERGY STAR® Partner, PB Heat, LLC has determined that certain firing rates of this product meet the ENERGY STAR® guidelines for energy efficiency.

## **Installation, Operation & Maintenance Manual**



PeerlessBoilers.com

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# USING THIS MANUAL

## A. INSTALLATION CLEARANCE

Follow the installation instructions provided in this manual in the order shown. The order of these instructions has been set in order to provide the installer with a logical sequence of steps that will minimize potential interferences and maximize safety during boiler installation.

## B. SPECIAL ATTENTION BOXES

Throughout this manual you will see special attention boxes intended to supplement the instructions and make special notice of potential hazards. These categories mean, in the judgment of PB Heat, LLC.

### DANGER

Indicates a condition or hazard which will cause severe personal injury, death or major property damage.

### WARNING

Indicates a condition or hazard which may cause severe personal injury, death or major property damage.

### CAUTION

Indicates a condition or hazard which will cause minor personal injury or property damage.

### NOTICE

Indicates special attention is needed, but not directly related to potential injury or property damage.

# 1. PREINSTALLATION

Read carefully, study these instructions before beginning work. It will save time. Study the included drawings. Save these instructions for reference.

This boiler must be installed by a qualified contractor.

The boiler warranty can be voided if the boiler is not installed, maintained and serviced correctly.

**NOTICE** The equipment shall be installed in accordance with those installation regulations in force in the local area where the installation is to be made, including the current edition of *NFPA-31, Standard for the Installation of Oil-Burning Equipment*, and in *Canada, CSA B139, Installation Code for Oil Burner Equipment*. These shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made.

**CAUTION** Never burn garbage or paper in the unit, and never leave combustible material around it.

**CAUTION** Do not tamper with boiler controls.

## A. CLEARANCES

**Table 1.1: Clearances from Jacket and Vent System**

Required from Jacket to Combustible Construction		Recommended From Jacket for Accessibility and Mounting Controls
Top	5"*	24" if Left Side Clearance less than 24" (to clean flueways from top).
Front	16"*	16" from jacket due to burner.
Left	2"*	24" if Top Clearance less than 24" (to clean flueways from left side).
		24" on steam with tankless coil.
		9" in area of boiler service switch and junction box.
Right	2"*	12" due to burner swing radius*.
Rear	2"*	9" for mounting relief valve.
<b>Vent Pipe (Single Wall)</b> - 9" to Combustible Construction. Clearance may be reduced using methods in NFPA 31. <b>Vent Pipe (Double Wall)</b> - See Manufacturer's Instructions.		

\* Consider also vent pipe clearance, including distance from edge of flue outlet to combustible construction (as applicable).

Unit may be installed on combustible flooring, provided the boiler is not set on carpet and a metal drip pan is placed under the appliance.

Unit may be installed in a closet with the above clearances. See also Section B, Air for Combustion and Ventilation.

## B. AIR FOR COMBUSTION AND VENTILATION

1. Be certain adequate facilities are available to provide air for satisfactory combustion and ventilation.
2. Appliances Located in Unconfined Spaces.
  - a. For installation in unconfined spaces with conventional construction and larger areas such as basements, the supply of air for combustion and ventilation can usually be considered adequate.
3. Appliances Located in Confined Spaces.
  - a. All air from inside the building: Provide two permanent openings communicating directly with an additional room. If all air for combustion and ventilation is to come from within the building: two openings, one near the ceiling and one near the floor of the boiler room shall be provided with the minimum free area of each opening equal to 140 sq. in. per gallon of oil burned.
  - b. If all air for combustion and ventilation is to come from outside the building: two openings, one near the ceiling and one near the floor of the boiler room shall be provided with the minimum free area of each opening equal to 35 sq. in. per gallon of oil burned.

If ducts are used to convey the air, areas of 35 sq. in. per gallon of oil burned for vertical ducts or 70 sq. in. per gallon of oil burned for horizontal ducts are to be provided. Ducts shall have the same area as the free area of the openings to which they are connected.

**C. CHIMNEY / VENT AND DRAFT CONTROL**

**CAUTION** An oil-fired unit shall be connected to a flue having sufficient draft at all times, to assure safe proper operation of the unit.

1. Draft Requirement – Minimum draft required in the vent system is -.03" to -.05" W.C. depending on boiler model, see Table 7.1 (Section 7). This draft is necessary to provide the necessary draft over fire of -.01" to -.02" W.C. See discussion in paragraph 5 below regarding draft.
2. Use barometric provided to control draft. Follow manufacturer's instructions to locate and adjust the control.
3. Inspect the existing chimney or vent system. Make sure it is in good condition. Inspect chimney liner and repair or replace if necessary.
4. The vent system and installation must be in accordance with the current edition of the American National Standard ANSI/NFPA 211, "Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances," or applicable provisions of the local building codes. See Table 7.1 (Section 7) for typical chimney size. If the vent system is not sized properly, the burner may not operate properly. This can cause poor combustion, sooting and odors to occur.
5. Background Information Regarding Draft:

Modern boilers operate with higher efficiencies than older boilers. Smaller flueways, as well as bars, pins and fins are designed into modern boilers to transfer as much heat as possible from the hot gases to the water or steam and prevent heat loss up the chimney. However, these design features result in higher pressure, or draft loss, in the boiler.

This draft loss must be taken into account when installing an oil boiler into a new or old chimney. New chimneys are less likely to have poor draft. However, they must have sufficient draft to support combustion. A -.06" draft is desirable and preferred. Older chimneys may require a replacement liner to have them perform well enough to support combustion.

For Example:

	Old Installation	New Installation	Comments
Chimney Draft	-.04"	-.04"	No change, but older chimneys (especially unlined ones) have leaks which reduce draft.
Boiler Design Pressure Drop	+.01"	+.04"	Required for mandated efficiency increases.
Draft Over Fire	-.03"	0.00"	The old installation would have had a higher temperature in the chimney [as high as 800 degrees vs. 400 degrees F], which would increase the draft.

The above readings are "cold" readings (before the boiler and chimney are heated up).

Note also that the higher the firing rate on a unit which has multiple firing rates, the higher the draft required. For example, increasing the firing rate 1/4 gallon may increase the draft loss in a unit by approximately +.01".

**D. INSTALLATION SURVEY**

For new and existing installations, a Water Installation Survey or a Steam Installation Survey is available from P.B. Heat, LLC. The surveys will provide information on how the boiler works with your specific system and will provide an overview of boiler system operation in general.

You can also use this survey to locate system problems which will have to be corrected. To obtain copies of these Surveys, contact your PB Heat representative or download it from PeerlessBoilers.com.

**E. PLANNING THE LAYOUT**

Prepare sketches and notes of the layout of the installation. Include boiler location, venting system, existing piping and wiring. Show existing equipment that may interfere with installation of new equipment.

# 2. BOILER PLACEMENT AND ASSEMBLY

## A. SETTING THE BOILER

1. Provide a level foundation, located as close as possible to the center of the heating system.
2. Refer to Figure 2.2 for exploded view of boiler while checking and/or assembling parts of the boiler.
3. See clearance information in Section 1, "Preinstallation."
4. On packaged boilers, open burner mounting plate (Item 3) at this time to make certain the target wall (Item 2) is seated in the back of the combustion chamber. Ceramic fiber blanket base liner (Item 28) should be lying flat on bottom of combustion chamber between target wall and burner.

## B. OBSERVATION COVER ASSEMBLY (KNOCKDOWN BOILERS)

1. Remove observation door (Item 4) from inside burner mounting plate. Attach the observation door to the outside of the mounting plate.

## C. INSTALLATION OF FLUE COLLECTOR & COVERPLATES (KNOCKDOWN BOILERS)

1. Open flue collector carton. Remove flue collector (Item 9) and high temperature rope. Lay rope (Item 8) on top of boiler against bead provided. Place flue collector on top of rope and attach to boiler with 1/4"-20 x 1-3/4" studs with nuts through flue collector brackets into the tapped lugs provided in the top of the boiler end sections. Draw nuts down snugly.
2. Remove clean-out cover plates and insulation (Item 25). Each clean-out cover plate is attached to the boiler by using two carriage bolts, nuts and washers (Item 24). Install the carriage bolts into the notch at the top and bottom of each clean-out opening, then secure them with a flat washer and steel nut as shown in Figure 2.1 locking them in place. Press the clean-out plate with insulation over the protruding carriage bolts until the bolts punch through the insulation so flat washer and brass nut can be installed. Tighten down nuts snugly compressing the insulation to form a good seal around the clean-out opening.

## D. TANKLESS HEATER OR COVERPLATE

If an ECT™ steam boiler is to be installed with a tankless heater coil, the coil must be installed before the left side jacket panels are attached. When a tankless heater is not employed, cover the heater opening with cover plate (Item 12 or 16).

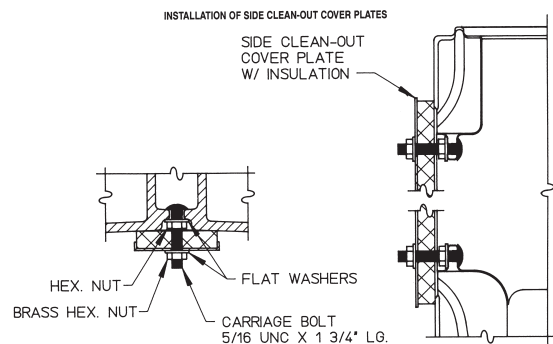
See Section 3, Piping and Controls, for piping information.

## NOTICE

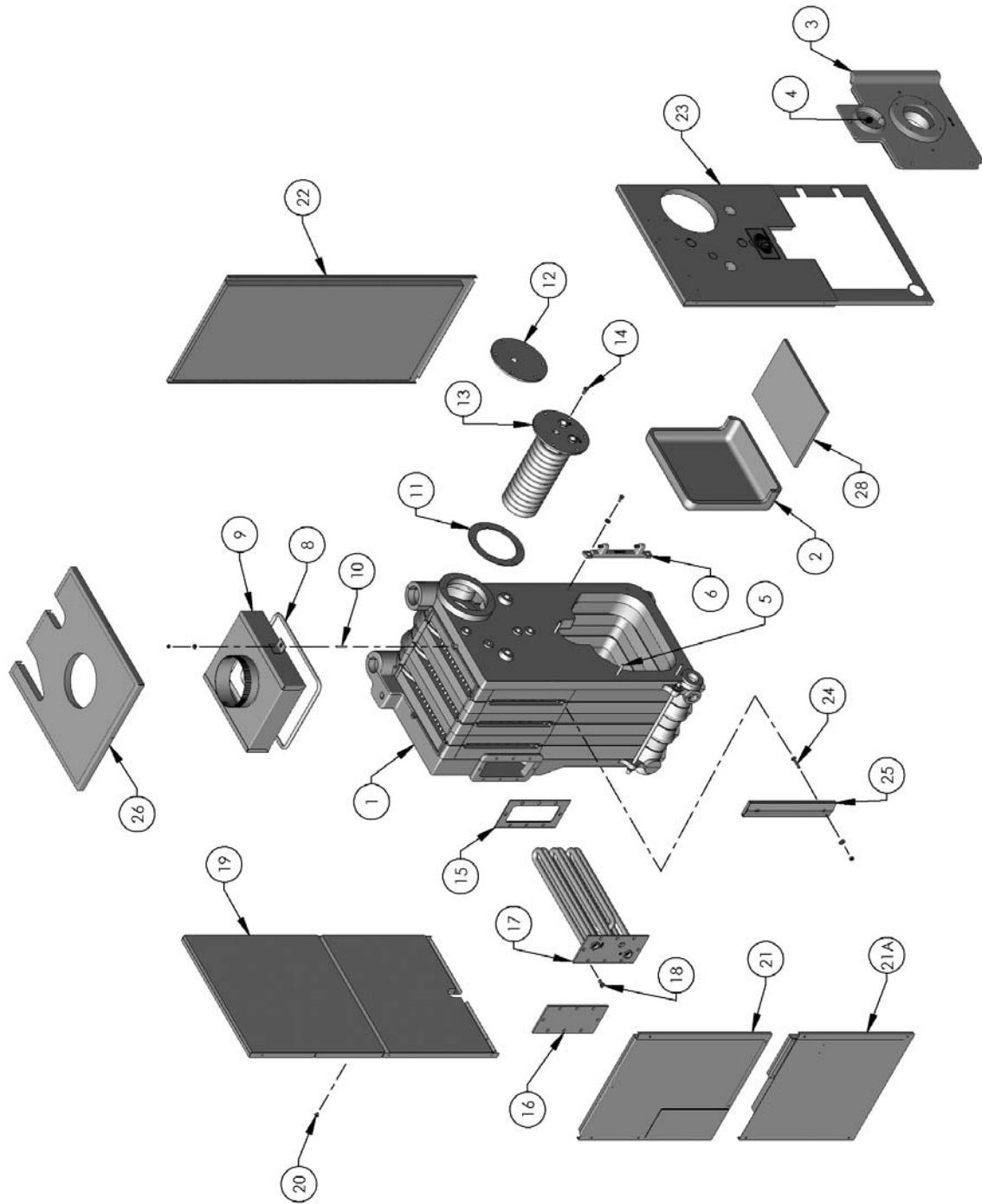
Be sure rubber gasket is in place between cover plate or water heater plate and boiler section.

## E. JACKET ASSEMBLY

1. Refer to Figure 2.2 for exploded view.
2. Attach the back panel (Item 19) to bosses on middle of back section with two 1/4" x 3/8" truss head machine screws (Item 20) provided. The back panel has two 5/16" diameter holes close to the center of the panel.
3. Lift off the burner mounting plate.
4. Remove the (2) knock-outs in the front jacket panel (Item 23) which allow clearance for the hinge. Place the front jacket panel on the block and replace the burner mounting plate.
5. Attach right side jacket panel (Item 22) to the front and back panels with sheet metal screws.
6. On steam boilers, if a tankless heater is used, remove the knock out in upper left side jacket panel (Item 21) and back jacket panel (Item 19) before installing. Attach left side jacket panels in the same manner as the right side panel.
7. Attach the top panel (Item 26). Secure top panel to front and back panel with sheet metal screws.



**Figure 2.1: Side Clean-out Cover Plates**



**Figure 2.2: Boiler Exploded View**  
 (See Table 8.1 in Section 8 for parts identification).



# 3. PIPING AND CONTROLS

**NOTICE** Do not pipe boiler before jacket is installed.

## A. PRESSURE TEST BLOCK ASSEMBLY

1. Make up cold water supply connection to the boiler.
2. Install pressure gauge or pressure-temperature gauge in tapping provided. See Boiler Dimensional drawing, Figure 7.1 (Section 7).
3. Plug all open tappings in the boiler and fill with water. Apply approximately thirty (30) psig pressure. Check to make certain that all joints and fittings are water tight.
4. After all joints and connections have been proven tight, remove cold water supply and plugs from all tappings that are to be used. See Figure 7.1 (Section 7) for tapping locations.

## B. BOILER RETURN CLEARANCE

Return piping must allow for opening and closing Burner Mounting Plate. PB Heat, LLC suggests installing a 1-1/4 NPT tee, a 90° elbow, and a 1-1/4 NPT x 5" long nipple in the return tapping before a vertical stand pipe is used.

## C. STEAM BOILER PIPING

1. Refer to the Steam Installation Survey and Hydronics Institute Residential Hydronic Heating Installation/Design Guide for guidance.
2. See Figures 3.1 and 3.2. The return from system should always enter equalizer through Hartford Loop, 2" to 4" below normal water line (see dimensional drawing for normal water line).
3. See Table 3.1 for pipe size information.
4. Use swing joints to attach header to avoid damage to the boiler due to thermal expansion and contraction of steam header pipe.
5. Pipe the steam header a minimum of 24" above the normal water line using swing joints to attach the risers into the steam header.

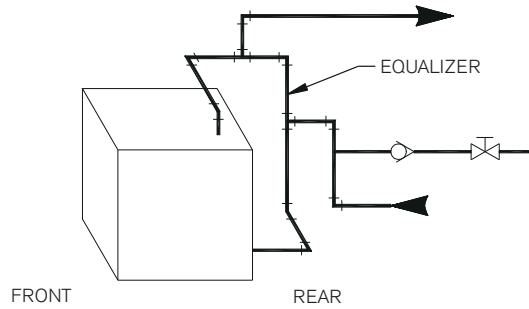


Figure 3.1: Steam Boiler Piping, EC-03

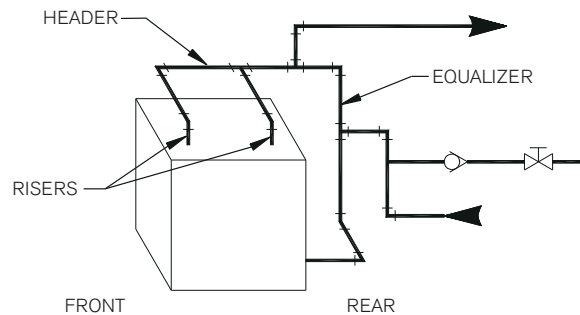


Figure 3.2: Steam Piping, EC-04 to EC-06

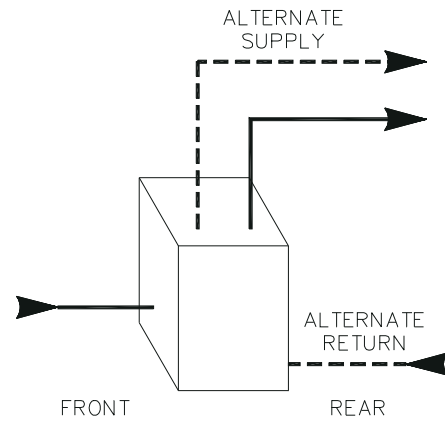
Table 3.1: Steam Pipe Sizing

Boiler Model No.	Risers	Header	Equalizer
EC/ECT-03-075	1-2"	2"	1-1/4"
EC/ECT-03-100	1-2"	2"	1-1/4"
EC/ECT-03-120	1-2"	2"	1-1/4"
EC/ECT-04-125	2-2"	2-1/2"	1-1/2"
EC/ECT-04-175	2-2"	2-1/2"	1-1/2"
EC/ECT-04-175	2-2"	2-1/2"	1-1/2"
EC/ECT-05-200	2-2"	3"	1-1/2"
EC/ECT-05-250	2-2"	3"	1-1/2"
EC/ECT-06-275	2-2"	3"	1-1/2"
EC/ECT-06-300	2-2"	3"	1-1/2"

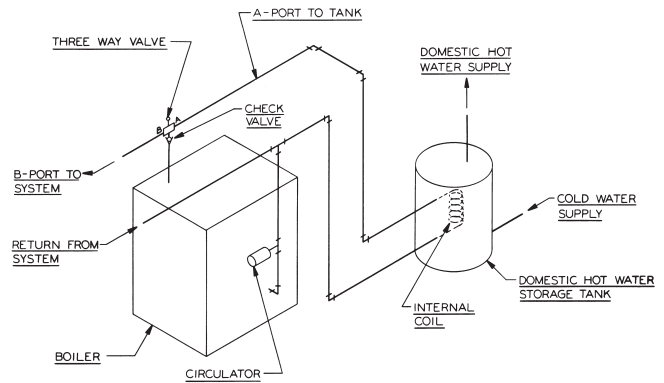


**D. WATER BOILER PIPING**

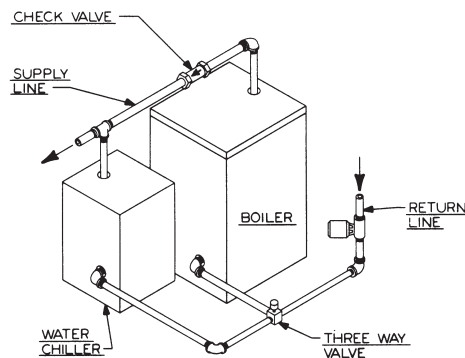
1. Refer to the Water Installation Survey and Hydronics Institute Residential Hydronic Heating Installation/Design Guide for Guidance.
2. The supply and return connections should be sized to suit the system.
3. Pipe the supply and return in one of two ways as shown in Figure 3.3:
  - a. Pipe the supply from the top of the rear section and return to the bottom of the front section. Use the 3/4" tapping in the top of the back section for air elimination.
  - b. As an alternative, pipe the supply from the top of the front section and return to the bottom of the rear section. Provide air elimination means within the supply piping.
4. When the return temperature from the system will be below 150°F on oil boilers for extended periods (heat pump systems, outdoor reset, snow melt, etc.), provide piping and controls to protect the boiler from condensation. Condensation will damage the boiler and will lead to shortened boiler life and maintenance problems.
5. If using a Partner® indirect fired water heater or other, see Figure 3.4 for typical piping. Also refer to additional instructions supplied with the Partner®.
6. If the boiler is to be used in conjunction with a refrigeration system, the chilled medium shall be piped in parallel with boiler and proper valves applied to prevent the chilled medium from entering the boiler. Refer to Figure 3.5.
7. If the boiler is connected to heating coils located in air handling units, the boiler piping system must be equipped with flow control valves or other automatic devices to prevent gravity circulation of the boiler water during the cooling cycle.



**Figure 3.3: Water Boiler Piping**



**Figure 3.4: Piping with Peerless® Indirect Water Tank**



**Figure 3.5: Isolating Boiler from Chilled Medium on Chiller Systems**

**E. TANKLESS HEATER OR COVERPLATE**

1. If a tankless coil is used (item 13 or 17), install as pictured. On water boilers, install in opening in front section. On steam boilers, install in opening in rear section. For suggested piping of tankless water heaters refer to Figures 3.6 and 3.7.

**DANGER** Install anti-scald device in hot water supply piping. Water temperature above 125°F can cause severe burns instantly or death from scalds.

**NOTICE** X1020R and X1082R coils installed in EC/ECT-03 & 04 packaged boilers have internal flow controls installed. Do not use external flow controls with these coils.

2. If not using a tankless coil, cover the heater opening with cover plate (item 12 or 16).

**NOTICE** Be sure rubber gasket is in place between cover plate or water heater plate and boiler section.

3. See Table 3.2 for tankless coil ratings.

**Table 3.2: Maximum Tankless Water Heater Ratings**

Heater No.	Capacity* GPM	Boiler Series
X1020 X1020R	5	Series EC™
X1082 X1082R	4	Series ECT™

\* Water Heater ratings are based on intermittent demand -40°F to 140°F with 200°F Boiler Water.

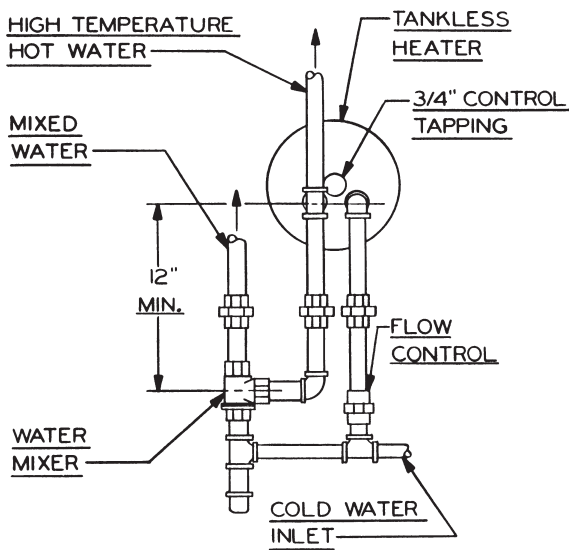


Figure 3.6: Tankless Coil Piping, Water Boiler

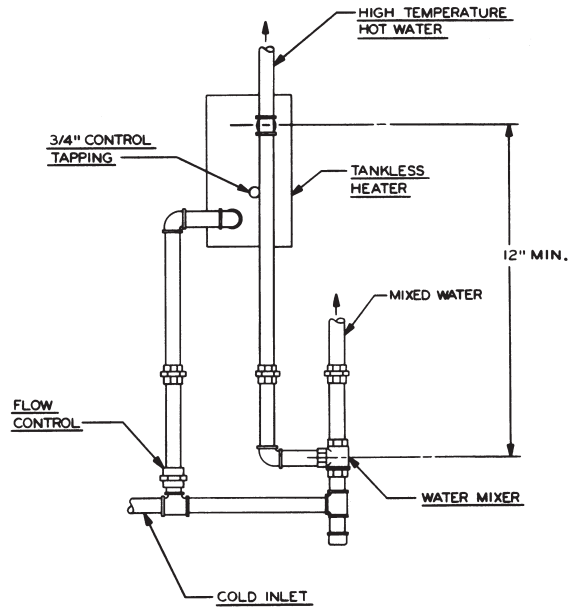


Figure 3.7: Tankless Coil Piping, Steam Boiler

**F. CONTROLS**

**CAUTION** Pipe the discharge of the safety valve or relief valve to prevent injury in the event of pressure relief. Pipe the discharge to a drain. Provide piping that is the same size as the relief valve.

1. Water Boiler Controls:  
Install the limit / operating control, pressure-temperature gauge and safety relief valve. See Figure 7.1 (Section 7) for proper location. For installations subject to UL726, a second operating control that senses water temperature is also required (not provided). Use an L4080B or equivalent. Install in the supply piping near the boiler.
2. Steam Boiler with Float Low Water Cut-Off:  
Install pressure limit control, pressure gauge, gauge glass trim and safety valve. See Figure 3.8, Figure 3.9, and Figure 7.1 (Section 7). See also control manufacturer's instruction sheet shipped with the control.
3. Steam boilers with Probe Low Water Cut-Off:

**CAUTION** Use only the Hydrolevel CG450 as a primary probe low water. The CG450 includes a cycle timer to sense water level under foaming or surging conditions. Failure to use this model could result in a failed heat exchanger.

Probe models use a longer gauge glass than float models. The following components are packed in the Probe Carton (90759):

- Hydrolevel CG450 LWCO
- Gauge glass 22-162-10
- 3/4"x 3" nipple
- 3/4" x 3/4" x 1/4" tee
- (2) 1/2" couplings

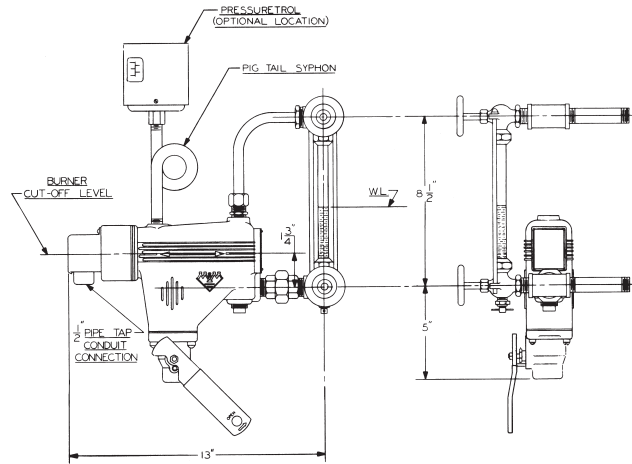


**Figure 3.8: Steam Boiler with Float Low Water Cut-Off**

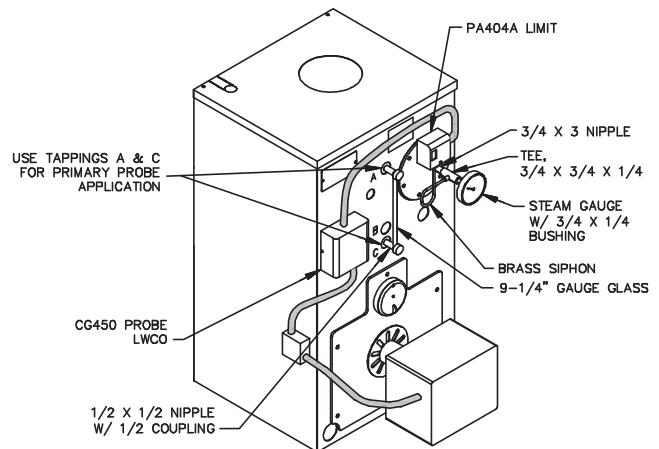
Use these components along with the gauge glass handles and other components from the Steam Trim Carton and install fittings and controls per Figure 3.10.

The shorter gauge glass located in the Steam Trim Carton is not necessary for the probe application.

4. Steam boilers subject to UL726:  
For installations subject to UL726, a second operating control that senses steam pressure is required (not provided). Use a PA404A or equivalent. On probe boilers, install the additional pressure control opposite the standard PA404A using a cross instead of a tee along with a second brass siphon (not provided). On float boilers, install the additional pressure control in the location normally used for the standard PA404A on steam-probe boilers (fittings not provided).
5. For complete information on servicing and adjustment of controls, refer to the attached control specification sheets.



**Figure 3.9: Assembling Float Low Water Cut-Off**



**Figure 3.10: Steam Boiler with Probe Low Water Cut-Off**

## 4. ELECTRICAL

### A. GENERAL

All electrical wiring shall be done in accordance with the National Electrical Code and Local Requirements. Single pole switches including those of safety controls or protective devices shall not be wired in a grounded line.

### B. BURNER WIRING

1. See Section 5 for mounting burner.
2. Install junction box, limit harness, and Heyco bushing, each located in the trim carton. See Figure 4.1. Mount junction box to the holes in the left side of jacket with (2) #10 x 1/2" sheet metal screws. Attach Heyco bushing to 7/8" knockout in front side of junction box. Connect limit harness to 7/8" knockout on top of junction box and insert limit harness Molex connector into Heyco bushing until it snaps firmly in place.

3. Install burner harness located in the burner carton.

Beckett or Carlin – EC7022 Harness  
(21" conduit)

Riello – EC7023 Harness (28" conduit)

4. For complete information on servicing and adjustment of controls, refer to the attached control specification sheets.

5. See the following Wiring Diagrams:

Figure 4.2 - Steam Boilers with Float LWCO

Figure 4.3 - Steam Boilers with Probe LWCO

Figure 4.4 - Water Boilers

Figure 4.5 - Zoning with Circulators

Figure 4.6 - Zoning with Zone Valves

**WARNING** Improper installation of burner harness can allow burner to energize with burner mounting plate open, creating a severe burn hazard to boiler maintenance personnel.

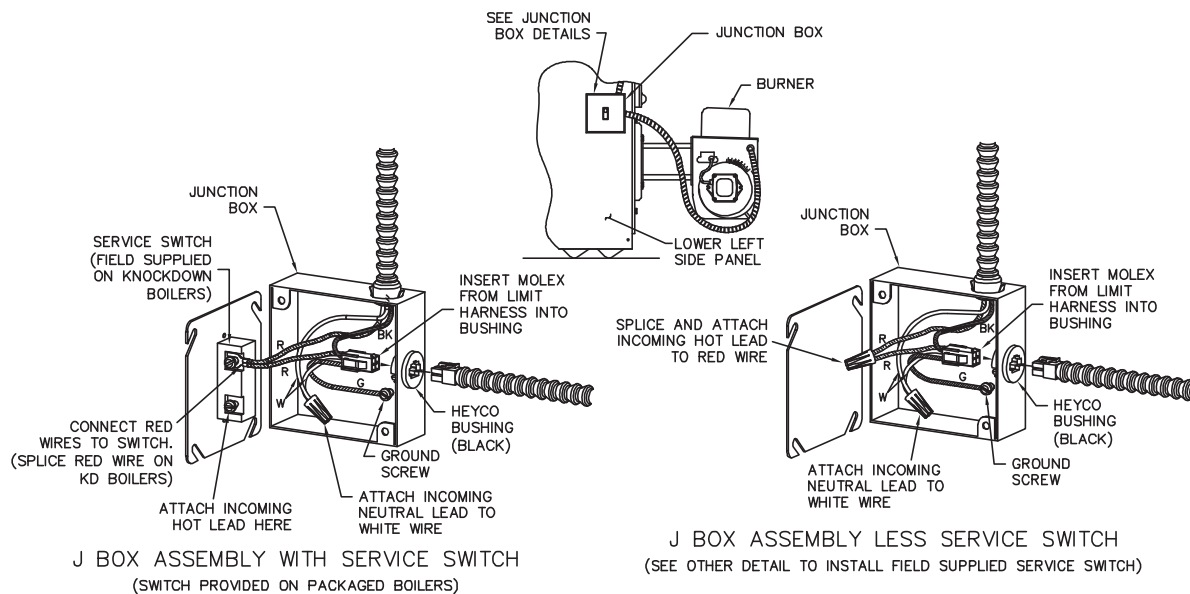


Figure 4.1: Junction Box Wiring

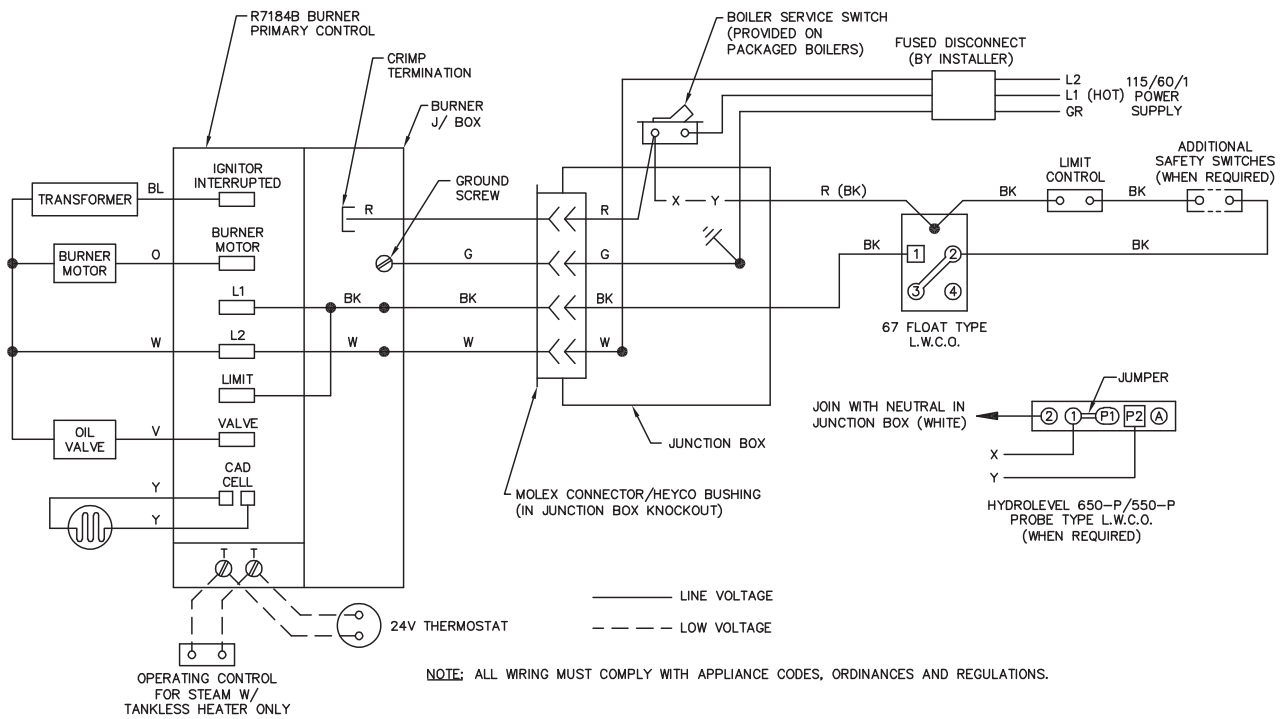


Figure 4.2: Steam Boiler with Float Low Water Cut-Off

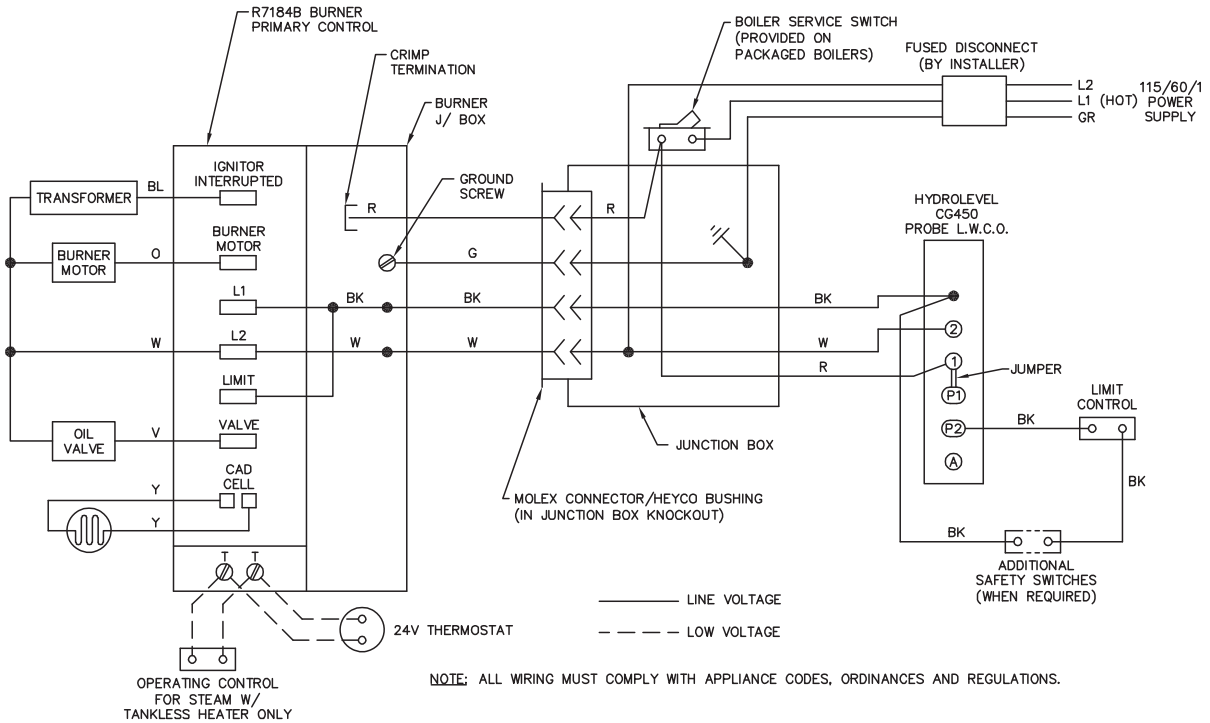
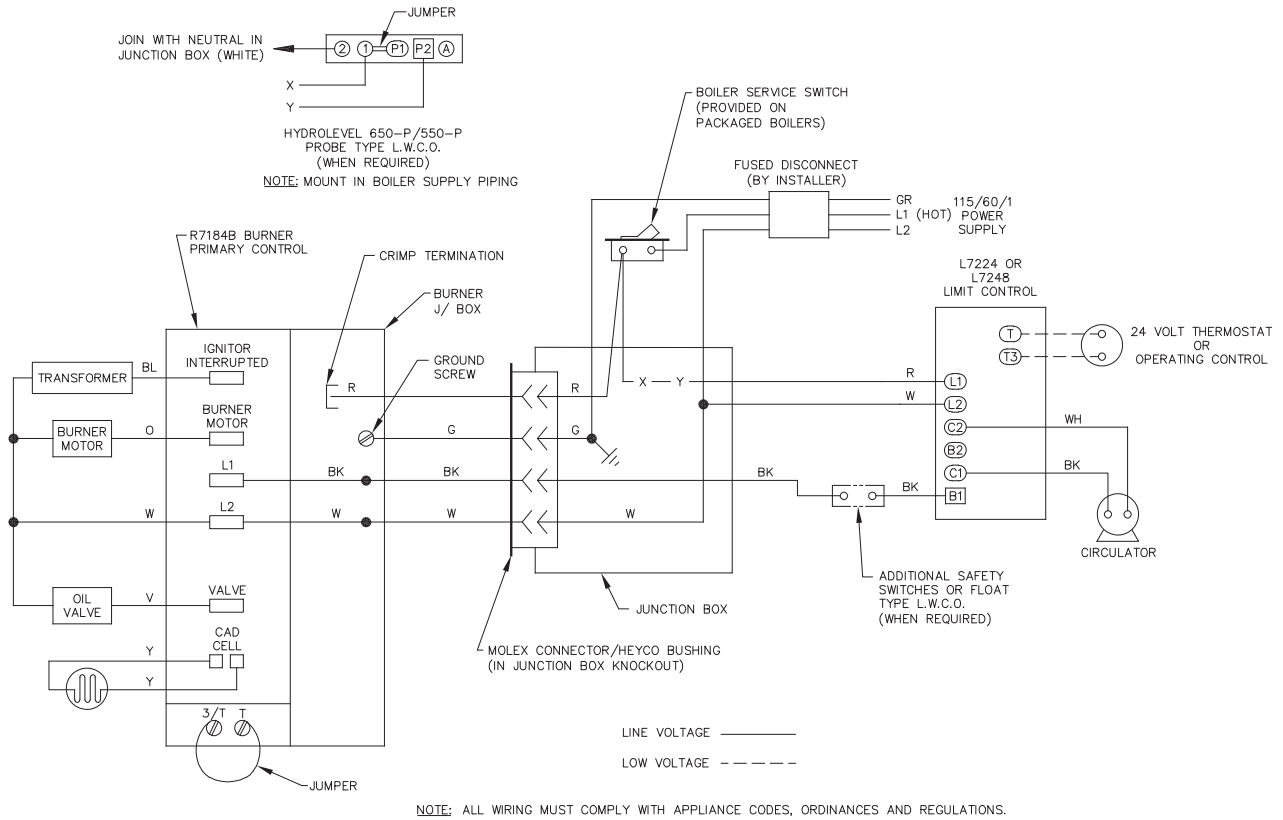
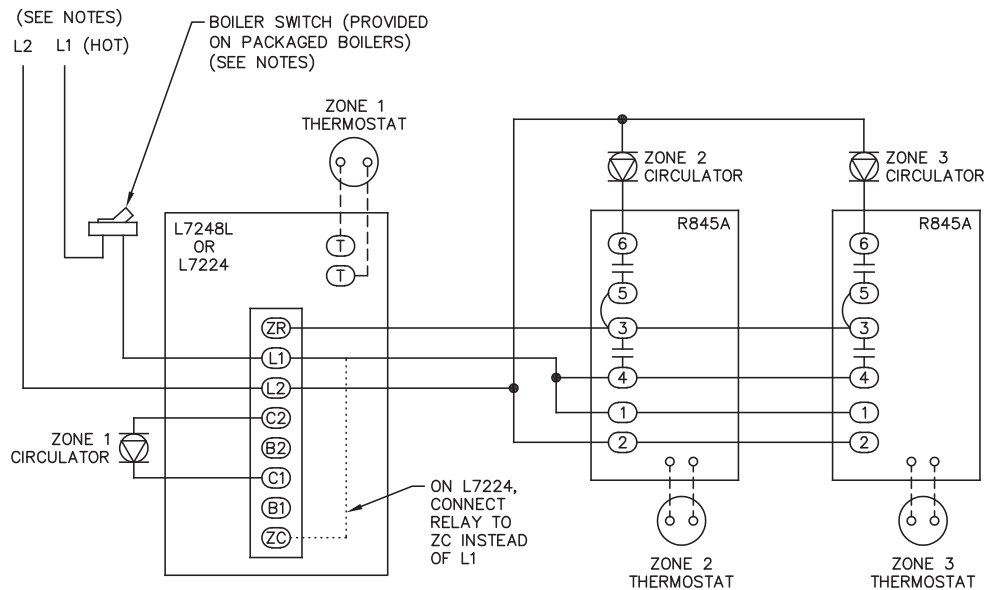


Figure 4.3: Steam Boiler with Probe Low Water Cut-Off



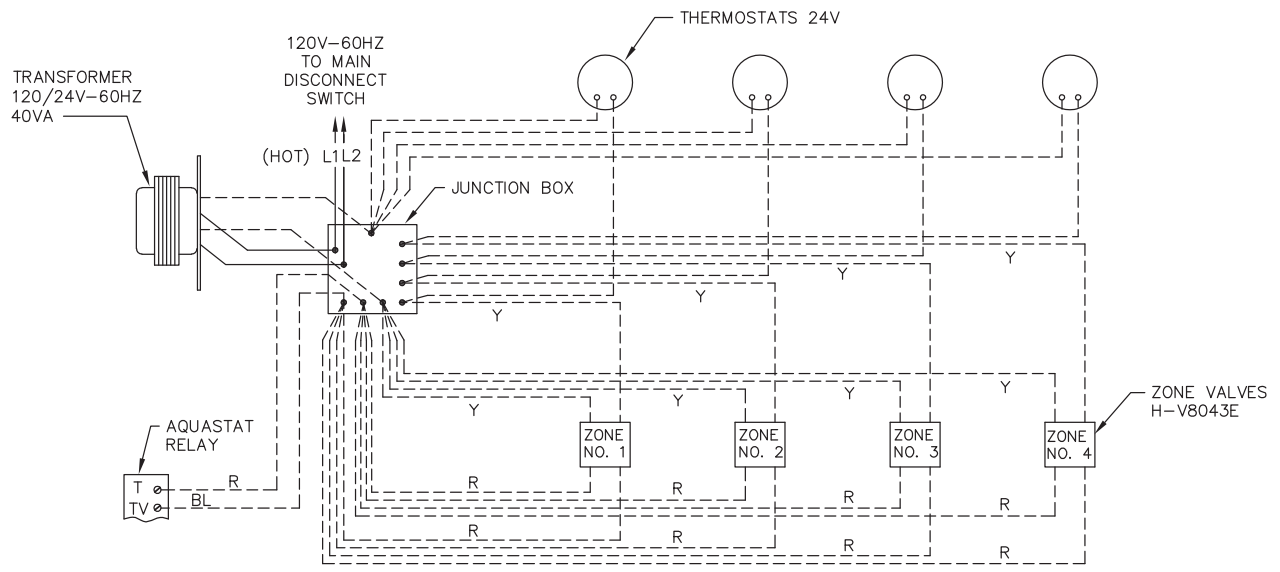
**Figure 4.4: Water Boilers**



**NOTES:**

1. WIRE AS SHOWN FOR PROPER OPERATION OF BOILER SWITCH. VERIFY AT START-UP THAT BOILER SWITCH SHUTS DOWN BOILER.
2. MAXIMUM TOTAL LOAD OF ZONE RELAYS AND ADDITIONAL CIRCULATORS IS 7.4 AMPS (TYPICALLY 4 ZONES).
3. ALL WIRING MUST COMPLY WITH APPLICABLE CODES, ORDINANCES AND REGULATIONS.

**Figure 4.5: Zoning with Circulators**



(WIRE REMAINDER OF AQUASTAT RELAY IN ACCORDANCE WITH SYSTEM WIRING DIAGRAM SUPPLIED)

**NOTE:**

ALL WIRING MUST COMPLY WITH APPLICABLE CODES, ORDINANCES, AND REGULATIONS.

LINE VOLTAGE ————  
LOW VOLTAGE - - - - -

**Figure 4.6: Zoning with Zone Valves**



# 5. BURNER SETUP & BOILER OPERATION

**CAUTION** Burn only #2 Fuel Oil in this appliance. Do not use gasoline, crankcase drainings or any oil containing gasoline.

## A. BURNER INSTALLATION

1. The oil burner is supplied with a mounting flange fixed in position.
2. Mount the burner to the Burner Mounting Plate (item 3) with four (4) 5/16" studs and nuts provided.

**NOTICE** Be sure hi temp gasket is between the burner mounting flange and the Burner Mounting Plate.

3. Care must be taken when routing the oil lines so not to interfere with the opening and closing of the burner mounting plate. Flexible oil lines or flared copper disconnects with valves (when copper lines are used) may be installed to assure full opening of the burner mounting plate when servicing.

**NOTICE** Two-pipe oil supply for Riello burner requires a separate kit. Order part #C7001026 from Riello dealer.

4. Oil burner specifications:  
For information pertinent to the oil burner such as nozzle sizing, fuel supply piping, adjusting or servicing, refer to the charts in this section and the burner installation manual.

## B. BURNER START-UP AND ADJUSTMENT

**CAUTION** Do not start the burner unless all cleanout doors are in place.

1. Burner should start automatically when thermostat is turned up and main boiler service switch is turned on. If burner does not start, check to be sure there is oil in the tank and push reset button on burner control:  
Beckett: Square red button.  
Carlin: Round red button.  
Riello: Round red button inside clear flexible cover on back of burner cover.

If burner still does not start, contact serviceman.

**CAUTION** Do not attempt to start the burner when excess oil has accumulated, when the unit is full of vapor, or when the combustion chamber is very hot.

2. Adjust burner and barometric draft control for highest CO<sub>2</sub> (Maximum 13% [EC-03 - EC-05] or 12-1/2% [EC-06]) while maintaining a 0 Smoke and -.01 to -.02" W.C. draft overfire.

All adjustments must be made using suitable instruments such as found in a Bacharach Combustion Test Kit.

3. Burner and boiler can be shut down by turning down the thermostat and moving the main boiler service switch to the "off" position.
4. See burner manufacturer's manual for further information regarding the burner.

## C. CHECK BOILER CONTROLS

1. Limit and Operating Controls:
  - a. Lower the set point of each control until the burner shuts down. Note that the system pressure (or temperature) corresponds to the desired set point.
  - b. Return the controls to the desired set point.
2. Low Water Cut-off (if used) - consult the manufacturer's instructions for the low water cut-off operational check procedure.

## D. PURGE AIR FROM THE SYSTEM (WATER BOILERS ONLY)

1. Purge the system using purge valves, isolating zones in the process or use system vents. Do not operate the pump(s) while purging. Pumps will hold air in the eye of the impeller.
2. Allow the system to reach 180°F and use manual vents, if installed, to remove any remaining air. Watch the pressure gauge as the system approaches 180°F. If the pressure exceeds the design operating pressure, check:
  - a. Fill valve pressure.
  - b. Expansion or compression tank operation and sizing.

**E. CLEAN THE BOILER  
(STEAM BOILERS ONLY)**

1. Clean the boiler within one week after initial start-up. Cleaning will be more effective if boiler operates a day or two to loosen sediment and impurities in system.
2. Boiler must be cleaned to remove any accumulation of oil, grease, sludge, etc. in the system. These substances can cause foaming and surging of boiler water, producing an unstable water line and water carryover to system.

**WARNING** Cleaning the boiler requires the use of very hot water and corrosive chemicals. Use care when handling to prevent injury.

3. Connect a skim valve off the 1-1/2 NPT skim tapping on rear of boiler. See Figure 7.1 (Section 7) for skim tapping location. Run a 1-1/2 NPT drain line off skim valve to a point of safe discharge.
4. Provide a means of supplying continuous fresh water to the boiler for the cleaning process.
5. Use common washing soda, such as Arm and Hammer Super Washing Soda. Mix 1/2 pound of soda with water in a 10 quart pail. Pour the mixture into the boiler through the safety relief valve tapping.
6. Open the skim valve. Fill boiler until water begins to flow out of the valve.

**CAUTION** Do not leave boiler unattended while firing burner. Operating boiler with water below minimum permissible water level may fracture sections.

7. Turn on burner. Allow boiler water to heat up to just below steaming (180 - 200°F). Do not allow boiler to steam; steaming mixes up contaminants instead of floating them at surface.
8. Open make-up water valve to continually feed water to boiler. Adjust flow to maintain water temperature at 180 - 200°F.

**CAUTION** Do not allow make-up water to flow too fast. Excessive quantities of cold water may fracture sections.

9. Continue skimming boiler until water flowing from skim tapping flows clear. This will take some time, possibly several hours for a dirty system.
10. Turn off burner, close make-up water valve.
11. Drain boiler completely. Refill and drain one or two times to wash out all washing soda.
12. Remove skim valve and piping. Pipe a nipple and cap in the skim valve.

**NOTICE** If gauge glass becomes dirty more contaminants have worked loose in system. Repeat cleaning and skimming process as needed to clean system.

## BURNER SETUP & BOILER OPERATION

**Table 5.1: Carlin Burner Specifications**

CARLIN BURNER SPECIFICATIONS							
Boiler Model No.	Firing Rate	Burner Model No.	Air Shutter	Nozzle Size	Pump Pressure	Start-up Settings Air Band	Head Bar
EC/ECT-03-075	.75	EZ-1HP	Blank	0.60 70° B DEL <sup>3</sup>	150 psig	0.55	0.60 - 0.65
EC/ECT-03-100	1.00	EZ-1HP	Blank	<b>0.85 70° A DEL</b>	150 psig	0.65	0.85 - 1.00
EC/ECT-03-120	1.20	EZ-1HP	Blank	1.00 70° A DEL <sup>3</sup>	150 psig	0.80	0.85 - 1.00
Boiler Model No.	Burner Model No.	Air Shutter	Nozzle Size	Pump Pressure	Start-up Settings		
					Head Dim. A	Air Band	
EC/ECT-04-125	99FRD	Blank	1.00 x 70° B DEL <sup>3</sup>	150 psig	2	40% open	
EC/ECT-04-150	99FRD	Blank	1.25 x 60° B DEL <sup>3</sup>	150 psig	3	60% open	
EC/ECT-04-175	99FRD	Blank	<b>1.50 x 60° B DEL</b>	150 psig	4	100% open	
EC/ECT-05-175	99FRD	Open	1.50 x 60° B HAGO <sup>3</sup>	150 psig	5	10% open	
EC/ECT-05-200	99FRD	Open	<b>1.65 x 60° B HAGO</b>	150 psig	5	45% open	
EC/ECT-05-250	99FRD	Open	2.00 x 60° B HAGO <sup>3</sup>	150 psig	8	100% open	
EC/ECT-06-275	102CRD	Open	2.25 x 60° B DEL <sup>3</sup>	150 psig	6	100% open	
EC/ECT-06-300	102CRD	Open	<b>2.50 x 60° B DEL</b>	150 psig	8	100% open	

**Table 5.2: Beckett Burner Specifications**

BECKETT BURNER SPECIFICATIONS (140 psig Pump Pressure)							
Boiler Model No.	Burner Model No.	Burner Head	Static Plate	Nozzle Size	Start-up Settings		Head Setting
					Air Shutter	Air Band	
EC/ECT-03-075	AFG-L1 <sup>1</sup>	L1 <sup>1</sup>	3-3/8"	0.65 60° B HAGO <sup>3</sup>	9.0	2	N/A
EC/ECT-03-100	AFG-L1	L1	3-3/8"	<b>0.85 60° B HAGO</b>	10.0	1	N/A
EC/ECT-03-120	AFG-L1	L1	— <sup>2</sup>	1.00 60° B HAGO <sup>3</sup>	9.0	2	N/A
EC/ECT-04-125	AFG-F6	F6	2-3/4"	1.10 80° A DEL <sup>3</sup>	5.0	1	N/A
EC/ECT-04-150	AFG-F6	F6	2-3/4"	<b>1.25 80° B HAGO</b>	8.0	1	N/A
EC/ECT-04-175	AFG-F6	F6	2-3/4"	1.50 80° B HAGO <sup>3</sup>	10.0	3	N/A
EC/ECT-05-175	AFG-MV1	M-V1-3	—	1.50 60° B HAGO <sup>3</sup>	10.0	3	3
EC/ECT-05-200	AFG-MV1	M-V1-3	—	<b>1.75 60° B HAGO</b>	10.0	9	3
EC/ECT-05-250	AFG-MV1	M-V1-5	—	2.00 45° B HAGO <sup>3</sup>	10.0	5	5
EC/ECT-06-275	CF-375	L1-S	—	2.25 45° P HAGO <sup>3</sup>	10.0	6	2
EC/ECT-06-300	CF-375	L1-S	—	<b>2.50 45° P HAGO</b>	10.0	6	3

**Table 5.3: Riello Burner Specifications**

RIELLO BURNER SPECIFICATIONS						
Boiler Model No.	Firing Rate	Burner Model No.	Nozzle Size	Pump Pressure	Start-Up Settings	
					Turbulator	Air Damper
EC/ECT-03-075	.75	F5	0.60 60° B DEL <sup>3</sup>	155 psig	0.5	2.1
EC/ECT-03-100	1.00	F5	0.85 60° W DEL <sup>3</sup>	145 psig	2.0	2.6
EC/ECT-03-120	1.20	F5	<b>1.00 60° W DEL</b>	145 psig	3.0	2.9
EC/ECT-04-125	1.25	F5	<b>1.00 60° W DEL</b>	155 psig	2.5	3.4
EC/ECT-04-150	1.50	F10	1.25 60° B DEL <sup>3</sup>	145 psig	1.5	3.1
EC/ECT-04-175	1.75	F10	<b>1.35 60° B DEL</b>	165 psig	2.0	2.5
EC/ECT-05-175	1.75	F10	1.35 60° B DEL <sup>3</sup>	165 psig	2.0	2.5
EC/ECT-05-200	2.00	F10	<b>1.50 60° B DEL</b>	170 psig	2.5	2.8
EC/ECT-05-250	2.50	F10	2.00 60° B DEL <sup>3</sup>	155 psig	3.5	4.2
EC/ECT-06-275	2.75	F10	2.25 60° B DEL <sup>3</sup>	150 psig	4.0	4.2
EC/ECT-06-300	3.00	F10	<b>2.50 60° B DEL</b>	145 psig	4.5	4.2

Factory Installed Nozzles (Packaged Boilers or Burner Cartons) are indicated in **Boldface**.

1 Requires Low Firing Rate Baffle

2 Remove Static Plate for 1.20 GPH Rate

3 Shipped Loose with Packaged Boiler or Burner Carton

## 6. MAINTENANCE

### WARNING

#### Product Safety Information Refractory Ceramic Fiber Product

This appliance contains materials made from refractory ceramic fibers (RCF). Airborne RCF, when inhaled, have been classified by the International Agency for Research on Cancer (IARC), as a possible carcinogen to humans. After the RCF materials have been exposed to temperatures above 1800°F, they can change into crystalline silica, which has been classified by the IARC as carcinogenic to humans. If particles become airborne during service or repair, inhalation of these particles may be hazardous to your health.

#### Avoid Breathing Fiber Particulates and Dust

Suppliers of RCF recommend the following precautions be taken when handling these materials:

#### Precautionary Measures:

Provide adequate ventilation.

Wear a NIOSH/MSHA approved respirator.

Wear long sleeved, loose fitting clothing and gloves to prevent skin contact.

Wear eye goggles.

Minimize airborne dust prior to handling and removal by water misting the material and avoiding unnecessary disturbance of materials.

Wash work clothes separately from others. Rinse washer thoroughly after use.

Discard RCF materials by sealing in an airtight plastic bag.

#### First Aid Procedures:

**Inhalation:** If breathing difficulty or irritation occurs, move to a location with fresh clean air. Seek immediate medical attention if symptoms persist.

**Skin Contact:** Wash affected area gently with a mild soap and warm water. Seek immediate medical attention if irritation persists.

**Eye Contact:** Flush eyes with water for 15 minutes while holding eyelids apart. Do not rub eyes. Seek immediate medical attention if irritation persists.

**Ingestion:** Drink 1 to 2 glasses of water. Do not induce vomiting. Seek immediate medical attention.

## A. GENERAL

1. Check pipes adjacent to cold walls or in unheated spaces. Insulate and tape them if necessary to be sure they can't freeze up. Keeping the water moving at all times will reduce the likelihood of freezing.
2. If there is considerable foreign matter in the boiler water, the boiler should be shut down and allowed to cool, then drained and thoroughly flushed out. Drain the boiler at the drain cock. Pipe the drain cock to a suitable drain or containment device (if antifreeze is used). Flush the system to remove remaining matter. If there is evidence that hard scale has formed on the internal surfaces, the boiler should be cleaned by chemical means as prescribed by a qualified water treatment specialist.
3. There must be no signs of continuous wetness at the chimney. If signs of continuous wetness are observed, a qualified service agency must be consulted to modify the vent configuration to prevent the formation of condensate, which may damage the vent pipe.

**WARNING** Do not use this appliance if any part has been under water. Improper or dangerous operation may result. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any control which has been under water.

## B. DAILY MAINTENANCE (WITH BOILER OPERATING)

Daily boiler observation can be performed by the owner. If any potential problems are found, a qualified installer or service technician/agency must be notified.

1. Remove any combustible materials, gasoline and other flammable liquids and substances that generate flammable vapors from the area where the boiler is contained. Make certain that the boiler area has ample air for combustion and ventilation and that there are no obstructions to the free flow of air to and from the boiler.
2. Observe general boiler conditions (unusual noises, vibrations, etc.).
3. Observe operating temperature and/or pressure gauge on the boiler. Boiler pressure should never be higher than 5 psi below the rating shown on the safety relief valve. The valve rating can be found on the top of the safety relief valve. Boiler temperature should never be higher than 250°F.
4. Check for water leaks in boiler and system piping.

## C. WEEKLY MAINTENANCE (WITH BOILER OPERATING)

1. Flush float-type low-water cut-off (if used) to remove sediment from the float bowl as stated in the manufacturer's instructions.

## D. MAINTENANCE OF SAFETY RELIEF VALVE

1. Check function and maintain safety relief valve as specified by manufacturer, typically every other month or every month, per the instructions on the tag on the safety relief valve.

## E. MONTHLY MAINTENANCE (WITH BOILER OPERATING)

1. Check boiler room floor drains for proper functioning.
2. Test probe type low-water cut-off (if used) by using the Push-to-Test Button.

**CAUTION** Turn off power to boiler before adjusting limit control.

3. Test limit by lowering the limit set point until the burner shuts down. When proper operation is confirmed, return the set point to original setting.
4. Follow additional instructions in the Burner Manual for proving the burner component operation.

## F. MAINTENANCE – ANNUAL

**NOTICE** Entire heating system, including boiler, burner and venting system, must be inspected at least once a year by a qualified heating professional. Boiler is to be cleaned at least once a year.

**WARNING** Disconnect all power to the burner before accessing combustion chamber.

TO CLEAN:

1. Remove top jacket panel and flue collector, Item 9.
2. To thoroughly clean the boiler it must be brushed down from the top and/or left side. Alternatively, for limited space or minimum clearance to combustible installations, cleaning the heat exchanger from the combustion chamber side is acceptable. If unit is extremely dirty, it may be necessary to brush from all directions. The target wall is made of a soft ceramic fiber. Care must be taken not to damage this material during cleaning.

3. Remove any scale or soot from the combustion chamber area by vacuum cleaning or any other available means.

**NOTICE** Burner mounting plate must be opened to facilitate this operation.

4. Replace flue collector and close burner mounting plate, making sure all gaskets are in place.
5. Replace jacket top panel.

**NOTICE** All cover plates, enclosures, and guards must be maintained in place at all times, except during maintenance and servicing.

6. Inspect venting system.

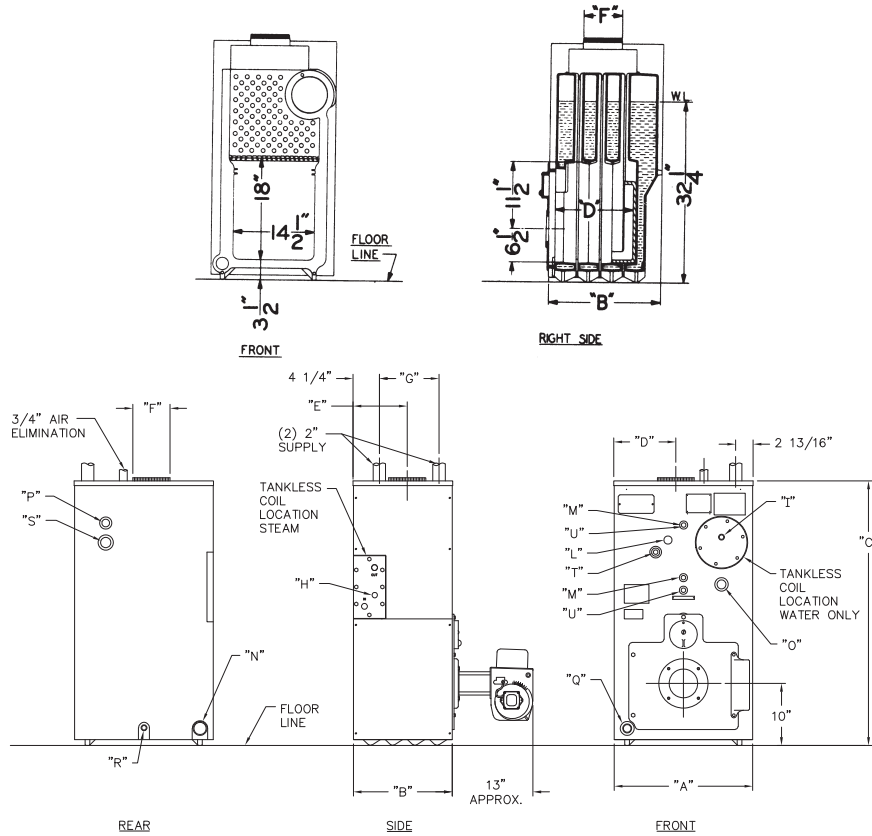
#### **G. IF A LONG SHUTDOWN IS REQUIRED**

1. To take boiler out of service if the boiler and system are not to be used when temperatures are below freezing:
  - a. Drain the boiler and system completely and shut off make-up water supply.
  - b. Open main line power disconnect switch to boiler. Remove the fuses or secure the switch so that the power cannot be turned on accidentally.

**CAUTION** Always keep the manual fuel supply valve shut off if the burner is shut down for an extended period of time.

2. Be certain that the boiler and system are refilled before returning to service.

# 7. BOILER DIMENSIONS & RATINGS



**Figure 7.1: Boiler Dimensions / Purpose of Tappings**


Boiler Model	Jacket			Length of Fire Box "D"	Rear of Jacket to Flue "E"	Flue Outlet Diameter "F"	Distance Between Tappings "G"
	Width "A"	Depth "B"	Height "C"				
EC/ECT-03	22-1/2"	15-3/4"	42"	10"	8-3/4"	6"	9-1/16"
EC/ECT-04	22-1/2"	19-15/16"	42"	14-3/16"	10-7/8"	7"	13-1/4"
EC/ECT-05	22-1/2"	24-1/8"	42"	18-3/8"	13"	8"	17-7/16"
EC/ECT-06	22-1/2"	28-5/16"	42"	22-9/16"	15-1/16"	9"	21-5/8"

\* Dimensions are approximate.

TAPPING LOCATIONS			
Location	Size NPT	Water	Steam
H	3/4"	N/A	Low Limit Control
I	3/4"	Limit Control	Pressure Gauge
L	1/4"	Temperature-Pressure Gauge	Limit Control
M	1/2"	N/A	Gauge Glass and Low Water Cut-Off
N	2"	Optional Return	Return
O	3/4"	Secondary Probe Low Water Cut-Off	Secondary Probe Low Water Cut-Off
P	3/4"	Safety Relief Valve	Safety Valve
Q	1-1/4"	Return	N/A
R	3/4"	Drain Valve	Drain Valve
S	1-1/2"	Optional High Limit	Skim
T	3/4"	N/A	Primary Probe Low Water Cut-Off
U	1/2"	N/A	Gauge Glass w/ Probe LWCO



**Table 7.1: Boiler Ratings**

 <b>Series EC/ECT™</b>												Water Content, gal		Minimum Stack Draft Required, in. W.C.
Model Number	Input		Output <sup>5</sup> , MBH		Net I=B=R Ratings <sup>4</sup>			AFUE, %		Thermal Efficiency <sup>6</sup> , %	Combustion Efficiency, %			
	GPH <sup>1</sup>	MBH	Water	Steam	Steam, sqft	Steam, MBH <sup>3</sup>	Water, MBH <sup>2</sup>	Water	Steam					
EC/ECT-03*	0.75	105	92	91	283	68	80	86.6*	85.4*	-	-	17.40	14.16	-.03
EC/ECT-03*	1.00	140	121	120	375	90	105	85.3*	84.4	-	-	17.40	14.16	-.04
EC/ECT-03	1.20	168	144	142	446	107	125	83.9	82.9	-	-	17.40	14.16	-.05
EC/ECT-04*	1.25	175	152	151	471	113	132	86.1*	85.1*	-	-	21.72	17.28	-.03
EC/ECT-04*	1.50	210	181	180	563	135	157	85.2*	84.5	-	-	21.72	17.28	-.04
EC/ECT-04	1.75	245	209	208	650	156	182	84.5	83.8	-	-	21.72	17.28	-.05
EC/ECT-05*	1.75	245	214	212	663	159	186	86.2*	85.6*	-	-	26.04	20.40	-.03
EC/ECT-05*	2.00	280	241	240	750	180	210	85.2*	84.6	-	-	26.04	20.40	-.04
EC/ECT-05†	2.50	350	286	286	896	215	249	-	-	81.9	84.1	26.04	20.40	-.05
EC/ECT-06†	2.75	385	321	321	1004	241	279	-	-	83.3	84.4	30.36	23.52	-.04
EC/ECT-06†	3.00	420	347	347	1083	261	302	-	-	82.5	83.7	30.36	23.52	-.05

\* As an ENERGY STAR® Partner, PB Heat has determined that these firing rates meet the ENERGY STAR guidelines for energy efficiency.

† All chimneys are 8" x 8" x 20' except those models denoted with (†), which are 8" x 12" x 20'.

1 Burner input based on No. 2 fuel oil with a heating value of 140,000 Btu per gallon.

2 Net I=B=R water ratings based on an allowance of 1.15.

3 Net I=B=R steam ratings based on an allowance of 1.333.

4 Consult factory before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc.

5 Output is Heating Capacity for models with inputs <300 MBH and Gross Output for models with inputs ≥300 MBH. Heating Capacity and Annual Fuel Utilization Efficiency (AFUE) ratings are based on U.S. Government tests, with 13% CO<sub>2</sub> and -0.02" w.c. draft over fire. Before purchasing this appliance, read important information about its estimated annual energy consumption or energy efficiency rating that is available from your retailer.

6 Combustion efficiency and gross output are determined in accordance with The Hydronics Institute's Testing and rating standard for Heating Boilers; @ 12.5% CO<sub>2</sub> and -0.02" w.c. draft over fire.

# 8. REPAIR PARTS

Repair parts are available from your installer or by contacting PB Heat, LLC, 131 S. Church, Bally, PA 19503.

Note: Remember to include boiler model number and serial number when ordering parts.

**Table 8.1**

	Description	Quantity Required	Stock Code
1	Block Assembly – EC-03	–	90662
	Block Assembly – EC-04	–	90663
	Block Assembly – EC-05	–	90657
	Block Assembly – EC-06	–	90661
	Block Assembly – ECT-03	–	90664
	Block Assembly – ECT-04	–	90665
	Block Assembly – ECT-05	–	90658
	Block Assembly – ECT-06	–	90660
–	Front Section	–	90006
–	Standard Intermediate Section	–	90000
–	Tapped Intermediate Section w/ 1" LWCO Tap	–	90002
–	Standard Back Section	–	90015
–	Tankless Back Section	–	90038
–	Large Push Nipple 1/Section #64 MCC-64	–	51546
–	Small Push Nipple 1/Section #12 MCC	–	51543
–	Draw Up Washer (large)	2	51163
–	Draw Up Washer (small)	2	51165
–	Draw Up Clamp Body	2	51146
–	Draw Up Clamp Jaws	4	51148
2	Target Wall	–	50768
3	Burner Mounting Plate Assembly for Standard Door	–	93530
–	Combustion Chamber Kit	–	50661
4	Observation Door Round Cover Plate	–	51677
–	Observation Door	–	51677
8	EC/ECT-03 4' 1/2" – MD-500	–	51211
	EC/ECT-04 5' 1/2" – MD-500	–	51211
	EC/ECT-05 6' 1/2" – MD-500	–	51211
	EC/ECT-06 6' 1/2" – MD-500	–	51211
9	Flue Collector w/ Side Clean Outs EC/ECT-03 EC5000	–	99536
	Flue Collector w/ Side Clean Outs EC/ECT-04 EC5000-1	–	99537
	Flue Collector w/ Side Clean Outs EC/ECT-05 EC5000-2	–	99538
	Flue Collector w/ Side Clean Outs EC/ECT-05 EC5000-3	–	99539

	Description	Quantity Required	Stock Code
–	Flue Collector Collar 6" – Water	–	90568
–	Flue Collector Rope Seal 1/2"	–	51209
11	Round Cover Plate Gasket	–	51800
12	Round Cover Plate w/ Gasket & Screws	–	99812
13	Tankless Coil – EC WPCT – X-1020-C w/ Gasket & Screws	–	90534
15	Rectangular Gasket (ECT Models)	–	90547
16	Rectangular Cover Plate w/ Gasket & Screws	–	90140
17	Tankless Coil ECT SPT – X-1082-C w/ Gasket & Screws	–	90546
25	Side Clean Out Plates (EC/SC) – 3 Sect. Kit – X-1087	–	50721
	Side Clean Out Plates (EC/SC) – 4 Sect. Kit – X-1087-1	–	50722
	Side Clean Out Plates (EC/SC) – 5 Sect. Kit – X-1087	2	
	Side Clean Out Plates (EC/SC) – 6 Sect. Kit – X-1087 & X-1087-1	1	
–	Insulation Board Only for Side Clean Out Plates	–	50800
–	Insulation Hardware	–	95016
28	Base Liner, 1/2" x 14"	–	50846
<b>***JACKETS SOLD ONLY AS ASSEMBLY***</b>			
19	Back Jacket Panel – EC/ECT-03 (Jacket Assembly)	–	90278
20	(2) 1/4"-20 x 3/8" Truss Hd. Mach. Screw Zinc – EC/ECT-04 (Jacket Assembly)	–	90279
21	Upper Left Side Jacket Panel – EC/ECT-05 (Jacket Assembly)	–	90280
21A	Lower Left Side Jacket Panel – EC/ECT-06 (Jacket Assembly)	–	90281
22	Right Side Jacket Panel	–	
23	Front Jacket Panel	–	
26	Right Top Jacket Panel	–	
27	Left Top Jacket Panel	–	

\*See Figure 2.2 on page 5 for boiler exploded view.





# Series EC/ECT™

## Oil Boilers

### Installation, Operation & Maintenance Manual

**TO THE INSTALLER:**

*This manual is the property of the owner and must be affixed near the boiler for future reference.*

**TO THE OWNER:**

*This boiler should be inspected annually by a Qualified Service Agency.*



PeerlessBoilers.com

**PB HEAT, LLC**

131 S. CHURCH ST • BALLY, PA 19503

#### Service Information

Name: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

Phone: \_\_\_\_\_



ASME