Series TC™

Oil, Gas & Gas/Oil Boilers

Installation, Operation & Maintenance Manual

PeerlessBoilers.com

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USING THIS MANUAL

A. MANUAL ORGANIZATION

The Series TC™ Installation, Operation & Maintenance Manual is divided into five basic sections:

1. Preinstallation (Sections A through I)
2. Boiler Assembly (Sections A through I)
3. Installation (Sections A through J)
4. Operation (Section A through B)
5. Maintenance

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 the 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 potentially cause severe personal injury, death or major property damage.

⚠ CAUTION

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

⚠ NOTICE

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

1. PREINSTALLATION

A. GENERAL

Series TC™ boilers are supplied completely knocked down for field assembly, completely assembled as packaged boilers or as assembled blocks of cast iron sections. All items should be inspected for damage upon receipt and any damage reported to wholesaler and trucking company. All components should be stored in a clean, dry area.

Carefully read these instructions, burner instructions, and control instructions before beginning work. This boiler must be installed by a qualified contractor. The boiler warranty may be voided if the boiler is not installed correctly.

B. CODES & REGULATIONS

1. All work is to be peformed in strict accordance with the requirements of state and local regulating agencies and codes dealing with boiler installations.
2. In the absence of such local requirements, the following codes should be followed:

   ASME B & PV Code, Section IV – "Heating Boilers"

   ASME B & PV Code, Section VI – "Care and Operation of Heating Boilers"

   ANSI/NFPA 31 – "Installation of Oil Burning Equipment"

   ANSI Z223.1 – "National Fuel Gas Code"

   ANSI/NFPA 70 – "National Electric Code"

   ASME CSD-1 – "Controls & Safety Devices for Automatically Fired Boilers"

   ANSI/NFPA 211 – "Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances"

3. In Canada, the following codes should be used in addition to those in Section 1.B.2.

   CAN1.3.1-77 (R1996) – "Industrial and Commercial Gas Fired Package Boilers"

   CSA B140.0-M87 – "General Requirements for Oil Burning Equipment"

   CSA B140.7.2-1967 – "Oil-Fired Steam and Hot Water Boilers for Commercial and Industrial Use"

   CAN/CSA C22.2 No.0-M91 – "General Requirements – Canadian Electrical Code Part II

   CSA C22/2 No.3-M1988 – "Electrical Features of Fuel Burning Equipment"

C. BOILER LOCATION

1. Locate the boiler close to the chimney to minimize the breeching length, but allow adequate clearance for piping, service, maintenance, and tankless coil replacement. A clearance of 36" [914 mm] on all sides of the boiler and 48" [1219 mm] in front of the boiler is recommended for serviceability.

⚠ WARNING

Do not install this boiler on carpeting. A significant fire hazard could result, with potential for property damage, personal injury or death.

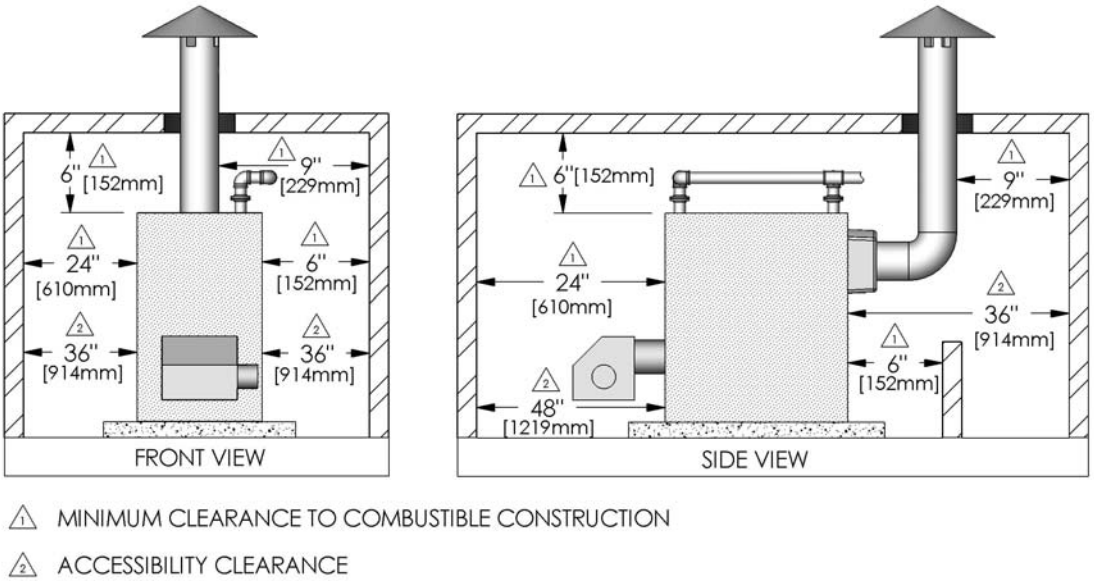

Figure 1.1: Clearance Requirments

2. The minimum clearances to combustible materials, based on ANSI/NFPA 31 are as follows. See Figure 1.1.

   Right Side: 6 inches [152 mm]

   Left Side: 24 inches [610 mm]

   Rear of Jacket: 6 inches [152 mm]

   Front of Boiler: 24 inches [610 mm]

   Top of Jacket: 6 inches [152 mm]

   Vent/Chimney/Flue Collector: 9" [229 mm]

⚠ WARNING

If this boiler is to be installed on combustible flooring, consult local building authorities for proper installation, or in the absence of regulations consult ANSI/NFPA 31 – "Installation of Oil Burning Equipment." Failure to comply with this warning may result in a fire, severe personal injury or death.

D. COMBUSTION & VENTILATION AIR

1. Provide adequate air for combustion and ventilation.

2. Unless the boiler room construction and natural air infiltration supply all necessary combustion air, provide an outside air opening or duct. The free cross-sectional area of the opening or duct shall meet or exceed 1 square inch [645 square millimeters] per 4000 Btu/hr [1.17 kW] input for all installed appliances. At altitudes greater than 2000 feet [610 meters] above sea level, this requirement is to be increased by 4% per each thousand feet [304 meters] above sea level.

   Example: at 5000 feet above sea level.

   Free Area = 1 + (0.04 x 5)

   $$\text{Free Area} = \frac{1.20 \text{ sq. in.}}{4000 \text{ Btu/hr}}$$

   Example: at 1500 meters above sea level.

   $$\text{Free Area} = 1 + \left(0.04 \times \frac{1500}{304}\right)$$

   $$\text{Free Area} = 1.2 \times 645 = \frac{772 \text{ sq. mm}}{1.17 \text{ kW}}$$

3. The boiler room must never be under negative pressure. If exhaust fans or other equipment that can potentially cause a negative pressure are used, the air openings must be engineered to assure a neutral or slightly positive pressure in the boiler room at all times of operation.
   a) If the equipment design and air openings cannot assure this, the boiler must be located in a room isolated from these appliances.
   b) If the vent system terminates in any area where wind-generated down drafts are likely, install a suitable vent cap which can control wind effects.

4. If motorized dampers are used on the combustion and ventilation air openings they must include an interlock device that prevents the boiler from operating if they do not open. See Figure 1.2 for this configuration.

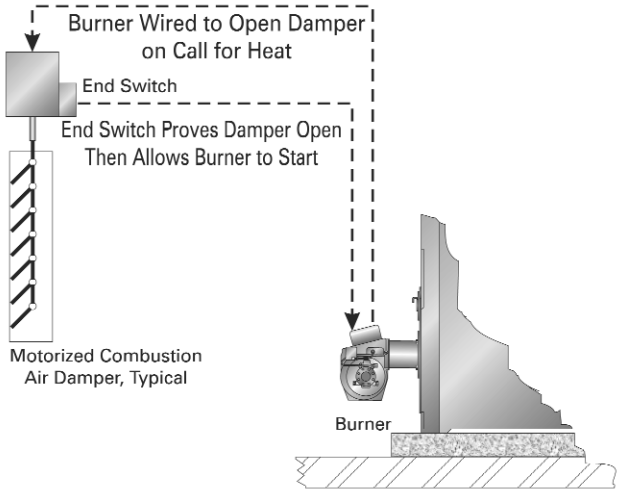

Figure 1.2: Motorized Vent Damper Interlock

E. CHIMNEY & BREECHING

1. Vent System Inspection:
   a) Inspect the existing chimney or vent system. Look for damage due to corrosion or other causes. Make sure the vent system is in good condition and all vent connectors and chimneys are properly supported.
   b) Inspect the chimney liner and repair or replace as necessary.

2. Vent System Sizing:
   a) The vent system must be sized and installed to remove all combustion products. If the vent system is not sized properly, the burner may not operate correctly. This may cause poor combustion or sooting.
   b) The breeching connection between the boiler and chimney should be as short as possible with a minimum number of elbows.
   c) Breeching Diameter:

      The breeching must be the same diameter as the boiler outlet for Model TC-04 through TC-16 and 18" [457 mm] diameter for Model TC-17 & TC-18 Boilers.

      The vent sizes for all Series TC™ Boilers are listed in the "Ratings and Dimensions" section of this manual.

   d) If extreme length, excessive elbows, or a reduction in diameter is necessary, consult your PB Heat representative for recommendations.

3. Vent System Installation:
   a) 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 local building codes.

⚠ WARNING

Configuration of the breeching and chimneys on some installations may result in a positive breeching pressure. In these cases, the breeching must be constructed of pressure tight materials. Consult local building authorities for proper installation. Failure to comply with this warning may result in carbon monoxide poisoning or fire, resulting in severe personal injury or death.

   b) Vent Terminations:
      1. Vent terminations must be extended to three feet above expected snow accumulation. See Figure 1.3.
      2. If the vent system terminates in any area where wind-generated down drafts are likely, install a suitable vent cap to help control wind effects.
   c) Vent Connection Support
      1. Support the vent system independently of the boiler flue connection.
      2. Provide support of the vent connector (breeching) at maximum 12 foot [3.66 meter] intervals to prevent sagging.
   d) Horizontal runs of vent are to be sloped back toward the boiler at approximately ¼" per foot [2 cm per meter].
   e) Breeching used with forced draft boilers must be sealed, of heavy gauge construction and must comply with all applicable codes of construction.
   f) Exterior Vents: Insulate vent pipes that pass through unheated spaces sufficiently to prevent excessive condensation and ensure adequate draft.
   g) Multiple Appliances: Do not vent multiple appliances with venting that operates under positive pressure into a common chimney or vent connector. This may cause products of combustion to circulate into the boiler room when one of the appliances is not operating.
   h) Draft Regulator: Install a barometric draft regulator when using a high chimney or any high draft vent.
      1. This is necessary to prevent negative draft conditions in the boiler.
      2. Excessive draft will cause flame lifting, poor combustion, or impingement.

4. Vent System Operation:
   a) This boiler is designed to fire only with a pressurized combustion chamber. The breeching and vent may be sized for negative, neutral, or positive pressure as desired.
   b) Maintain maximum of +0.1 inches [2.5 mm] of water at the boiler outlet.
   c) Avoid excessive negative pressure in the combustion chamber. This may cause the flame to lift off of the burner causing unstable combustion. In addition, this may cause impingement of the burner flame onto the crown sheet, which may lead to overheating.

F. BOILER FOUNDATION

1. If the boiler room floor is not level or if additional structural support is required, provide a level concrete foundation pad for the boiler. The flooring and structural support system must be suitable for the operating weight of the boiler and any connected piping.
   a) Figure 1.4 shows the Foundation Layout for Knocked-Down Boilers and Packaged Boilers.
   b) Dimensions for the foundation are given in Table 1.1a and 1.1b.

2. Do not operate the boiler until the foundation, if newly poured concrete, has thoroughly cured. Rapid heating may damage the concrete due to expanding moisture.

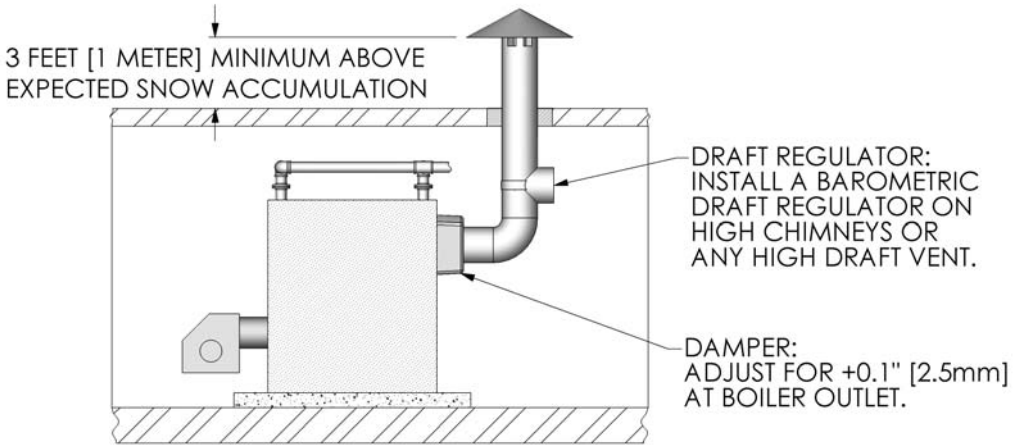

Figure 1.3: Typical Vent Termination

Table 1.1a: Foundation Dimensions (U.S. Customary Units)

Boiler Model	Knocked-Down Boilers			Packaged Boilers		
	Rail Length (inches)	Foundation		Base Length (inches)	Foundation	
		Width (inches)	Length (inches)		Width (inches)	Length (inches)
TC-04	34.19	48.5	46.25	66.19	48.5	78.25
TC-05	42.25	48.5	54.25	74.25	48.5	86.25
TC-06	50.31	48.5	62.50	82.31	48.5	94.50
TC-07	58.38	48.5	70.50	90.38	48.5	102.50
TC-08	66.44	48.5	78.50	98.44	48.5	110.50
TC-09	74.50	48.5	86.50	106.50	48.5	118.50
TC-10	82.56	48.5	95.00	114.56	48.5	127.00
TC-11	90.63	48.5	103.00	122.63	48.5	135.00
TC-12	98.69	48.5	111.00	130.69	48.5	143.00
TC-13	106.75	48.5	119.00	138.75	48.5	151.00
TC-14	114.81	48.5	127.00	146.81	48.5	159.00
TC-15	122.88	48.5	135.00	154.88	48.5	167.00
TC-16	130.94	48.5	143.00	162.94	48.5	175.00
TC-17	139.00	48.5	151.00	171.00	48.5	183.00
TC-18	147.06	48.5	159.00	179.06	48.5	191.00

Table 1.1b: Foundation Dimensions (SI Metric Units)

Boiler Model	Knocked-Down Boilers			Packaged Boilers		
	Rail Length (mm)	Foundation		Base Length (mm)	Foundation	
		Width (mm)	Length (mm)		Width (mm)	Length (mm)
TC-04	868	1232	1175	1681	1232	1988
TC-05	1073	1232	1378	1886	1232	2191
TC-06	1278	1232	1588	2091	1232	2400
TC-07	1483	1232	1791	2296	1232	2604
TC-08	1688	1232	1994	2500	1232	2807
TC-09	1892	1232	2197	2705	1232	3010
TC-10	2097	1232	2413	2910	1232	3226
TC-11	2302	1232	2616	3115	1232	3429
TC-12	2507	1232	2819	3320	1232	3632
TC-13	2711	1232	3023	3524	1232	3835
TC-14	2916	1232	3226	3729	1232	4039
TC-15	3121	1232	3429	3934	1232	4242
TC-16	3326	1232	3632	4139	1232	4445
TC-17	3531	1232	3835	4343	1232	4648
TC-18	3735	1232	4039	4548	1232	4851

3. If the boiler is installed in a penthouse or if wiring of any sort is run underneath the boiler foundation, construct the foundation with a provision for air flow between the main floor and the top of the boiler foundation.
   a) An acceptable foundation would be concrete blocks laid on their sides with the openings lined up.
   b) If the foundation must be a concrete slab, use an air cell high temperature insulating board, at least ½" [13 mm] thick, with aluminum backing. ½" [13 mm] thick, high temperature millboard with aluminum backing is also acceptable. Place the insulating board on the slab, with the aluminum side up, between the angle rails.

G. INSTALLATION SURVEY

For new and existing installations, a Steam or Water Installation Survey is available from PB Heat, LLC. The survey will provide information on how a steam or water boiler works with your specific system and will provide an overview of steam or water system operation.

You can also use this survey to locate system problems that will have to be corrected. To obtain copies of the Steam or Water Installation Survey, contact your PB Heat, LLC Representative or download it from PeerlessBoilers.com.

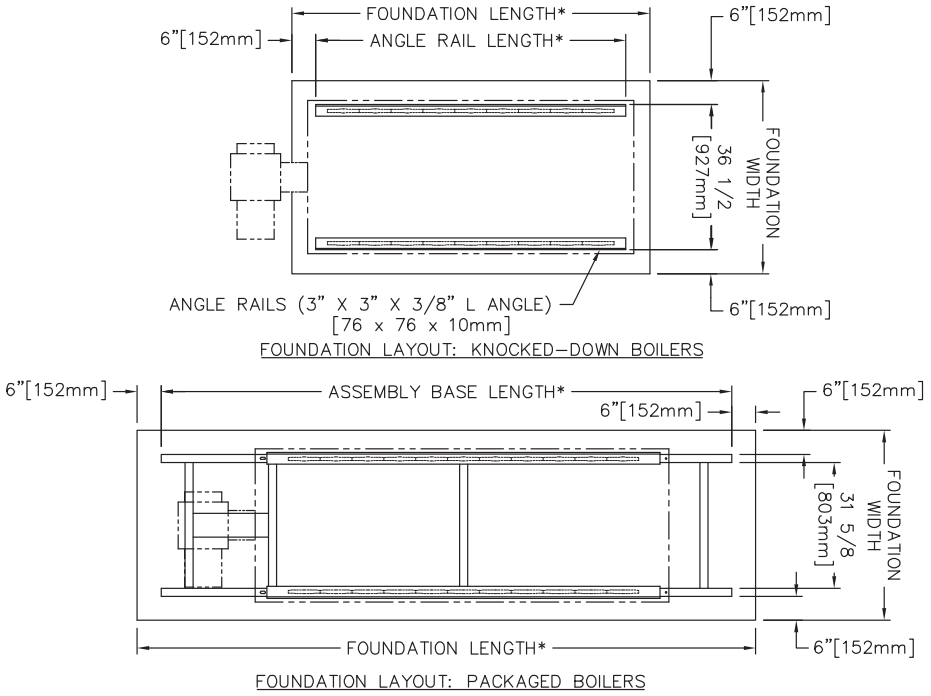

Figure 1.4: Foundation Layout

H. PLANNING THE LAYOUT

Prepare sketches and notes of the layout to minimize the possibility of interference with new or existing equipment, piping, venting, and wiring.

I. VERIFY COMPONENTS

1. Packaged Boilers: All standard components are located in the boiler package with the following exceptions:
   a) Relief Valves are assembled with piping and included in a separate carton to prevent damage in shipment.
   b) The Return Yoke is not mounted or assembled for shipment. This assembly is included in a separate carton.
   c) In some cases, the Burner and/or Gas Train may be shipped separately.
   d) The Optional Barometric Draft Damper is shipped in a separate carton.
2. Knocked-down Boilers: All components are shipped for field assembly. See Tables 1.2a and 1.2b for standard components. See Tables 1.3 through 1.8 for optional components.
3. Assembled Block Boilers: These are similar to knocked-down boilers except the angle rails, sections and section assembly kit cartons are pre-assembled into a single shipping level component.

Table 1.2a: Series TC™ Shipping List (Steam Boilers)

Boiler Model Number		Angle Rail	Standard Sections				Flue Outlet		Controls Carton	Trim Carton	Section Assembly Cartons		Graphite Port Connector Carton		Miscellaneous Parts Carton	Jacket Panels					
			Front	Rear	Plain Intermediate	Supply Intermediate	Flue Collector	Outlet Adapter								Jacket Channel Carton	Jacket Front/Back Carton	Jacket Top/Side Carton			
TC-04	Qty.	2	1	1	1	1	1		1	1	1		1		1	1	1	1			
	SCN	74004	76000	76001	76002	76003	76060		88512	77000	76050		76053		76070	75004	76030	76031			
TC-05	Qty.	2	1	1	2	1	1		1	1	1		1		1	1	1	1			
	SCN	74005	76000	76001	76002	76003	76060		88512	77000	76051		76054		76070	75005	76030	76032			
TC-06	Qty.	2	1	1	2	2	1		1	1	1		1		1	1	1	1	1		
	SCN	74006	76000	76001	76002	76003	76060		88512	77001	76052		76055		76070	75006	76030	76033	76035		
TC-07	Qty.	2	1	1	3	2	1		1	1	2		2		1	1	1	1	1		
	SCN	74007	76000	76001	76002	76003	76061		88512	77001	76050		76053		76070	75007	76030	76031	76036		
TC-08	Qty.	2	1	1	4	2	1		1	1	1	1	1	1	1	1	1	1	1		
	SCN	74008	76000	76001	76002	76003	76061		88512	77002	76050	76051	76053	76054	76070	75008	76030	76031	76037		
TC-09	Qty.	2	1	1	5	2	1		1	1	2		2		1	1	1	1	1		
	SCN	74009	76000	76001	76002	76003	76062		88512	77002	76051		76054		76071	75009	76030	76031	76038		
TC-10	Qty.	2	1	1	6	2	1		1	1	1	1	1	1	1	1	1	1	1		
	SCN	74010	76000	76001	76002	76003	76062		88512	77002	76051	76052	76054	76055	76071	75010	76030	76032	76038		
TC-11	Qty.	2	1	1	6	3	1		1	1	2		2		1	1	1	1	2		
	SCN	74011	76000	76001	76002	76003	76062		88512	77003	76052		76055		76071	75011	76030	76032	76036		
TC-12	Qty.	2	1	1	7	3	1		1	1	1	2	1	2	1	1	1	1	1	1	
	SCN	74012	76000	76001	76002	76003	76062		88512	77003	76050	76051	76053	76054	76071	75012	76030	76032	76036	76037	
TC-13	Qty.	2	1	1	8	3	1		1	1	3		3		1	1	1	1	2		
	SCN	74013	76000	76001	76002	76003	76062		88512	77003	76051		76054		76071	75013	76030	76032	76037		
TC-14	Qty.	2	1	1	9	3	1		1	1	1	2	1	2	1	1	1	1	1	1	
	SCN	74014	76000	76001	76002	76003	76063		88512	77004	76050	76052	76053	76055	76071	75014	76030	76032	76037	76038	
TC-15	Qty.	2	1	1	10	3	1		1	1	1	2	1	2	1	1	1	1	2		
	SCN	74015	76000	76001	76002	76003	76063		88512	77004	76051	76052	76054	76055	76071	75015	76030	76032	76038		
TC-16	Qty.	2	1	1	11	3	1		1	1	3		3		1	1	1	1	1	1	1
	SCN	74016	76000	76001	76002	76003	76063		88512	77004	76052		76055		76071	75016	76030	76032	76035	76039	76038
TC-17	Qty.	2	1	1	12	3	1	1	1	1	4		4		1	1	1	1	2	2	
	SCN	74017	76000	76001	76002	76003	76063	76064	88512	77005	76051		76054		76071	75017	76030	76034	76040	76037	
TC-18	Qty.	2	1	1	13	3	1	1	1	1	3	1	3	1	1	1	1	1	2	1	1
	SCN	74018	76000	76001	76002	76003	76063	76064	88512	77005	76051	76052	76054	76055	76071	75018	76030	76034	76040	76037	76038

Table 1.2b: Series TC™ Shipping List (Water Boilers)

Boiler Model Number		Angle Rail	Standard Sections			Flue Outlet		Controls Carton	Trim Carton	Yoke	Section Assembly Cartons		Graphite Port Connector Carton		Miscellaneous Parts Carton	Jacket Panels					
			Front	Rear	Plain Intermediate	Flue Collector	Outlet Adapter									Jacket Channel Carton	Jacket Front/Back Carton	Jacket Top/Side Carton			
TC-04	Qty.	2	1	1	2	1		1	1	1	1		1		1	1	1	1			
	SCN	74004	76000	76001	76002	76060		78510	77030	76072	76050		76053		76070	75004	76030	76031			
TC-05	Qty.	2	1	1	3	1		1	1	1	1		1		1	1	1	1			
	SCN	74005	76000	76001	76002	76060		78510	77031	76072	76051		76054		76070	75005	76030	76032			
TC-06	Qty.	2	1	1	4	1		1	1	1	1		1		1	1	1	1	1		
	SCN	74006	76000	76001	76002	76060		78510	77031	76072	76052		76055		76070	75006	76030	76033	76035		
TC-07	Qty.	2	1	1	5	1		1	1	1	2		2		1	1	1	1	1		
	SCN	74007	76000	76001	76002	76061		78510	77032	76072	76050		76053		76070	75007	76030	76031	76036		
TC-08	Qty.	2	1	1	6	1		1	1	1	1	1	1	1	1	1	1	1	1		
	SCN	74008	76000	76001	76002	76061		78510	77032	76072	76050	76051	76053	76054	76070	75008	76030	76031	76037		
TC-09	Qty.	2	1	1	7	1		1	1	1	2		2		1	1	1	1	1		
	SCN	74009	76000	76001	76002	76062		78510	77032	76072	76051		76054		76071	75009	76030	76031	76038		
TC-10	Qty.	2	1	1	8	1		1	1	1	1	1	1	1	1	1	1	1	1		
	SCN	74010	76000	76001	76002	76062		78510	77032	76072	76051	76052	76054	76055	76071	75010	76030	76032	76038		
TC-11	Qty.	2	1	1	9	1		1	1	1	2		2		1	1	1	1	2		
	SCN	74011	76000	76001	76002	76062		78510	77033	76072	76052		76055		76071	75011	76030	76032	76036		
TC-12	Qty.	2	1	1	10	1		1	1	1	1	2	1	2	1	1	1	1	1	1	
	SCN	74012	76000	76001	76002	76062		78510	77033	76072	76050	76051	76053	76054	76071	75012	76030	76032	76036	76037	
TC-13	Qty.	2	1	1	11	1		1	1	1	3		3		1	1	1	1	2		
	SCN	74013	76000	76001	76002	76062		78510	77033	76072	76051		76054		76071	75013	76030	76032	76037		
TC-14	Qty.	2	1	1	12	1		1	1	1	1	2	1	2	1	1	1	1	1	1	
	SCN	74014	76000	76001	76002	76063		78510	77033	76072	76050	76052	76053	76055	76071	75014	76030	76032	76037	76038	
TC-15	Qty.	2	1	1	13	1		1	1	1	1	2	1	2	1	1	1	1	2		
	SCN	74015	76000	76001	76002	76063		78510	77034	76072	76051	76052	76054	76055	76071	75015	76030	76032	76038		
TC-16	Qty.	2	1	1	14	1		1	1	1	3		3		1	1	1	1	1	1	1
	SCN	74016	76000	76001	76002	76063		78510	77034	76072	76052		76055		76071	75016	76030	76032	76035	76039	76038
TC-17	Qty.	2	1	1	15	1	1	1	1	1	4		4		1	1	1	1	2	2	
	SCN	74017	76000	76001	76002	76063	76064	78510	77034	76072	76051		76054		76071	75017	76030	76034	76040	76037	
TC-18	Qty.	2	1	1	16	1	1	1	1	1	3	1	3	1	1	1	1	1	2	1	1
	SCN	74018	76000	76001	76002	76063	76064	78510	77034	76072	76051	76052	76054	76055	76071	75018	76030	76034	76040	76037	76038

Table 1.3: Burner Mounting Plates

Boiler Model	Beckett		Carlin		Gordon-Piatt		Power Flame (Gas)		Power Flame (Oil)		Power Flame (Gas/Oil)		Webster	
	Mounting Plate Stock Code	Burner Model	Mounting Plate Stock Code	Burner Model	Mounting Plate Stock Code	Burner Model	Mounting Plate Stock Code	Burner Model	Mounting Plate Stock Code	Burner Model	Mounting Plate Stock Code	Burner Model	Mounting Plate Stock Code	Burner Model
TC-04	76027	CF1400	76027	702CRD	76023	R8	76028	J30A	76028	C1	76028	C1	76028	JB1
TC-05						R8.2	76027	J50A						
TC-06		CF2300		801CRD					76027	C2	76027	C2		
TC-07														
TC-08						R8.4		C2						
TC-09				1050FFD									76025	JB2
TC-10		CF2500			76026	R10.1								
TC-11			76024	1150FFD			76024	C3	76024	C3	76024	C3		
TC-12	76024	CF3500												
TC-13														
TC-14						R10.2								
TC-15														
TC-16														
TC-17							76022	C4	76022	C4	76022	C4	76022	JB3
TC-18														

Table 1.4: Standard & Optional Sections

Section	Standard	With Inspection Tappings
	Stock Code	Stock Code
Front	76000	76010
Intermediate	76002	----
Intermediate with Boss	76005	76007
Intermediate with LWCO Tappings	76011	----
Intermediate Supply with Boss	76003	76008
Intermediate Supply w/ LWCO Taps	76012	----
Intermediate Heater	76004	76009
Intermediate Heater w/ LWCO Taps	76013	----
Back	76001	76006

Table 1.5: Tankless Coil & Cover Plate Options

Description	Stock Code
Heater Cover Plate Assembly	76075
Heater Cover Plate Gasket	74019
Tankless Coil -8 GPM	76073
Tankless Coil -12 GPM	76074
Return Yoke - Water Boiler	76072

Table 1.6: Controls Cartons

Description	Stock Code
Steam Controls Carton - L404A	88511
Steam Controls Carton - PA404A	88512
Water Controls Carton - L4006A	78510

Table 1.7: Steam Trim Cartons

Description	15 PSI [103 kPa] Steam
	Stock Code
Steam Trim Carton TC-04	77000
Steam Trim Carton TC-05	
Steam Trim Carton TC-06	77001
Steam Trim Carton TC-07	
Steam Trim Carton TC-08	77002
Steam Trim Carton TC-09	
Steam Trim Carton TC-10	
Steam Trim Carton TC-11	77003
Steam Trim Carton TC-12	
Steam Trim Carton TC-13	
Steam Trim Carton TC-14	77004
Steam Trim Carton TC-15	
Steam Trim Carton TC-16	
Steam Trim Carton TC-17	77005
Steam Trim Carton TC-18	

Table 1.8: Water Trim Cartons

Description	30 PSI [207 kPa]	50 PSI [345 kPa]	80 PSI [552 kPa]
	Stock Code	Stock Code	Stock Code
Water Trim Carton TC-04	77030	77050	77080
Water Trim Carton TC-05	77031		
Water Trim Carton TC-06		77051	77081
Water Trim Carton TC-07	77032		
Water Trim Carton TC-08			
Water Trim Carton TC-09			77082
Water Trim Carton TC-10		77052	
Water Trim Carton TC-11	77033		
Water Trim Carton TC-12			
Water Trim Carton TC-13			77083
Water Trim Carton TC-14			
Water Trim Carton TC-15	77034		
Water Trim Carton TC-16		77053	
Water Trim Carton TC-17			77084
Water Trim Carton TC-18			

2. ASSEMBLY

A. PACKAGED BOILERS

1. All assemblies should be carefully inspected for shipping damage on arrival. Any damage should be reported immediately to the shipping company and PB Heat.
2. Remove shrink-wrap and inspect the jacket, cast iron sections, and burner (if supplied) for damage. Remove the left side panels and inspect the clean out covers for damaged or missing silicone seals.
3. Continue to Section 3, Installation.

B. ASSEMBLED BLOCKS

1. All assemblies should be carefully inspected for shipping damage on arrival. Any damage should be reported immediately to the shipping company and PB Heat.
2. Check the component list in Tables 1.2a and 1.2b and packing slip to assure that all shipping level items are received. Inspect all packages for shipping damage.
3. Continue to Section 2.F, Burner Mounting Plate Installation.

C KNOCKDOWN BOILERS

1. Check the component list in Tables 1.2a and 1.2b and packing slip to assure that all shipping level items are received. Inspect all packages for shipping damage.
2. Report any damage to the shipping company and PB Heat immediately.
3. Lay the angle rails provided at the point of final installation. Set the angles in parallel position measuring 36-1/2" [927 mm] outside-to-outside of angles as shown in Figure 2.1. Shim the angles to level them and grout under angles after the sections are assembled.
4. Place the Front Section in position on the angles as shown in Figure 2.2. The end of the floor angle must either be flush with the boss for the wash out connection or extend beyond it by as much as 3/8" [10 mm].

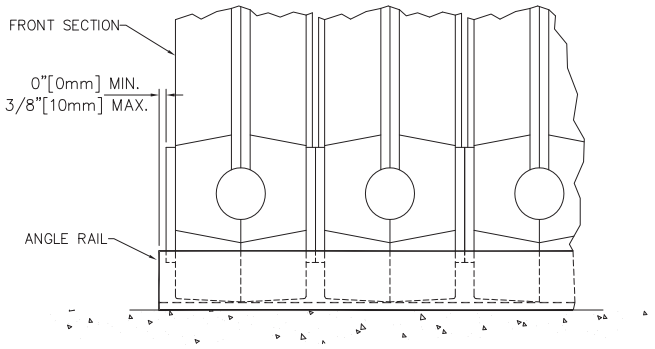

Figure 2.2: Front Section Placement

5. The Front Section should be supported vertically as shown in Figure 2.3. Install a 3" NPT x 30" [762 mm] long pipe in the wash out connection at the rear of the section and block with wood.

⚠ WARNING

The cast iron sections are top heavy. Handle with care to avoid tipping or falling.

6. Inspect the port connector recesses and rope groove on the cast iron rear section for dirt and obstructions.
7. Clean the port connector recesses with a stiff wire brush.

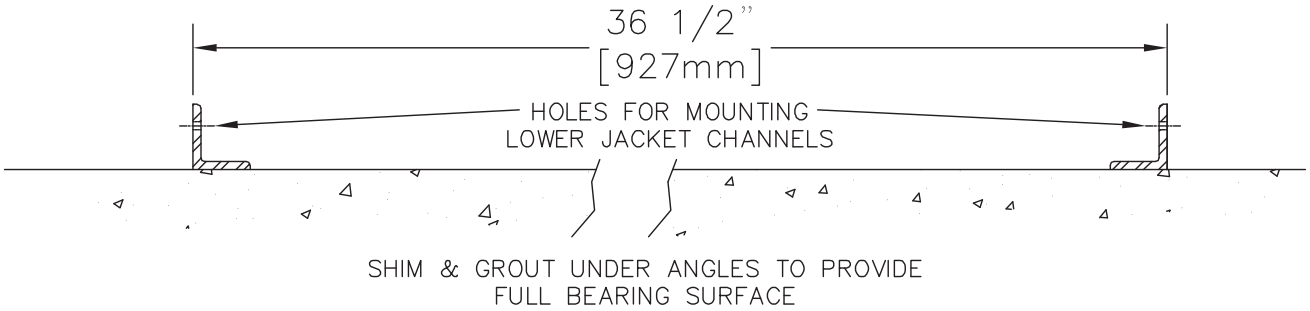

Figure 2.1: Angle Rail Placement

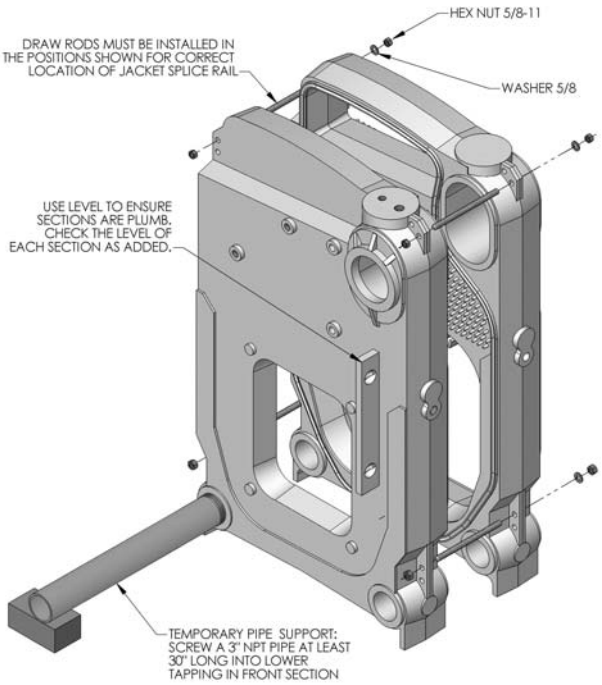

Figure 2.3: Front Section Support

8. Apply the spray-on adhesive supplied with the boiler to the rope groove. This will hold the rope gasket in place during assembly.

9. Apply a length of rope gasket (supplied in the section assembly cartons), avoiding bends and twists in the rope. Ensure that the ends of the rope gasket extend past the clean-out cover opening as shown in Figure 2.4.

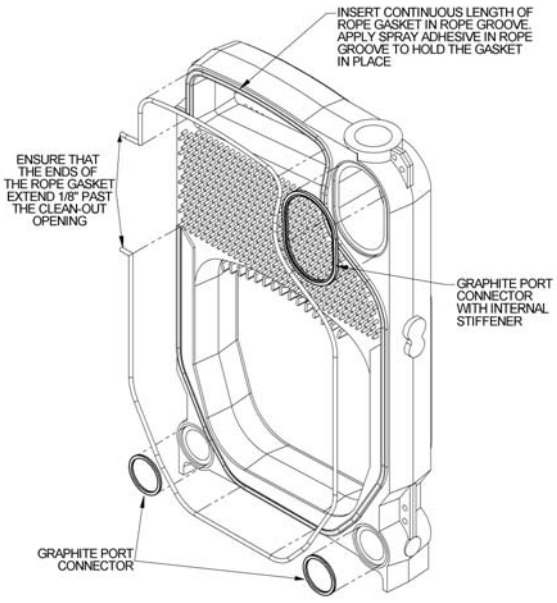

Figure 2.4: Rope Gasket and Port Connector Instalation

10. Install the large graphite port connector with steel inner ring into the upper port making sure that the inner ring stays inside the port connector.

⚠ NOTICE

Handle the graphite port connectors with care. Do not bend, twist, stretch or drop the port connectors. If the graphite port conector is damaged it must be replaced.

11. Install the two small, circular, graphite port connectors with steel inner rings in the lower recess ports. Make sure that the inner rings stay inside the port connectors. Spray adhesive used for attaching rope may be used to keep the port connectors in place during assembly.

12. Select the correct intermediate section (refer to Table 2.2), and slide it into place against the front section. Ensure that the sections are plumb and the port connectors are properly seated in the port recesses as indicated in Figure 2.5.

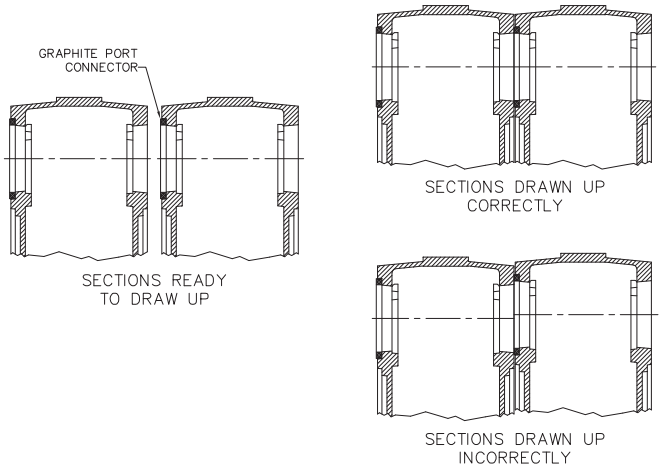

Figure 2.5: Drawing Up Sections

13. Install the draw rods as shown in Figure 2.3 and tighten them lightly. Note: Draw rods must be installed as shown to ensure correct installation of the Jacket Channel Splice Rail.

14. Inspect the rope gasket to ensure that it remains in the rope groove.

15. Check the section alignment and port connector position by looking through the ports. If necessary, reposition the port connector by loosening the draw rods and then retightening them.

16. Check the floor angles and sections for alignment.

17. Gently tighten the draw rods to the torque specification and sequence as described in Table 2.1. Make sure the port connectors stay inside the boiler ports. Do not completely tighten any draw rod out of sequence. Gradually work each side until the correct torque is reached.

Table 2.1: Torque Specifications for Series TC™ Boiler with Graphite Port Connectors

Seq. No.	Draw Rod Position	Torque (ft. lbs.)	Torque (Nm)
1	Upper Right	25	34
2	Lower Left	25	34
3	Lower Right	25	34
4	Upper Left	10	14
5	Upper Right	50	68
6	Lower Left	50	68
7	Lower Right	50	68
8	Upper Right	75	102
9	Lower Left	75	102
10	Lower Right	75	102
11	Upper Left	30	41
12	Upper Right	125	169
13	Lower Left	125	169
14	Lower Right	125	169
15	Upper Right	125	169
16	Upper Left	40	54

18. If any ports develop leaks during the hydrostatic test, the torque may be increased up to 200 ft. lbs. [270 Nm] on the upper right and 150 ft. lbs. [203 Nm] on both of the lower ports.

19. Prepare the rope groove and gasket recess on the intermediate section as described for the front section in paragraph 2.C.6 through 2.C.11.

20. Select the next appropriate section in accordance with Table 2.2.

21. For TC-08 through TC-18 refer to Figure 2.6, 2.7 and Table 2.3 for correct placement of nuts and washers for jacket channel splice piece.

Table 2.2a: Steam Section Arrangement

TC-04	F	T	H_L	B													
TC-05	F	H	T_L	H	B												
TC-06	F	T	H_L	T	H	B											
TC-07	F	T	H_L	P	T	H	B										
TC-08	F	T	H_L	P	H	T	H	B									
TC-09	F	T	H_L	P	H	P	T	H	B								
TC-10	F	H	T_L	H	P	H	P	T	H	B							
TC-11	F	H	T_L	H	P	T	H	P	T	H	B						
TC-12	F	H	T_L	H	P	T	H	P	H	T	H	B					
TC-13	F	H	T_L	H	P	H	T	H	P	H	T	H	B				
TC-14	F	H	T_L	H	P	H	T	H	P	H	P	T	H	B			
TC-15	F	H	T_L	H	P	H	P	T	H	P	H	P	T	H	B		
TC-16	F	H	T_L	H	P	H	P	H	T	H	P	P	H	T	H	B	
TC-17	F	H	T_L	H	P	H	P	H	T	H	P	H	P	H	T	H	B
TC-18	F	H	T_L	H	P	H	P	H	P	T	H	P	H	P	H	T	H	B

F	Front Section
T	Intermediate Section w/5" Steam Tapping (Steam Only)
T_L	Intermediate Section w/5" Steam & LWCO Tappings (Steam Only)
H	Optional Intermediate Section w/Heater Connections
H_L	Optional Intermediate Section w/Heater Connections & LWCO Tapping
P	Plain Intermediate Section
P_L	Plain Intermediate Section & LWCO Tappings
B	Back Section

Notes:

1) Tapped Intermediate Sections with LWCO Tappings (T_L) are optional and if not used are replaced with a Tapped Intermediate Section (T).
2) Intermediate Sections with Heater Connections (H) & (H_L) are optional. The locations shown indicate the possible placement of these sections if they are ordered. Unless Intermediate Heater Sections are specified, the sections provided will be Plain Intermediate Sections (P) or (P_L).
3) Sections with Low Water Cut-Off (LWCO) Tappings are optional. However, if used, they must be placed at the third position from the front in order to assure proper jacket fit.

Table 2.2b: Water Section Arrangement

TC-04	F	P	H_L	B													
TC-05	F	H	P_L	H	B												
TC-06	F	P	H_L	P	H	B											
TC-07	F	P	H_L	P	P	H	B										
TC-08	F	P	H_L	P	H	P	H	B									
TC-09	F	P	H_L	P	H	P	P	H	B								
TC-10	F	H	P_L	H	P	H	P	P	H	B							
TC-11	F	H	P_L	H	P	P	H	P	P	H	B						
TC-12	F	H	P_L	H	P	P	H	P	H	P	H	B					
TC-13	F	H	P_L	H	P	H	P	H	P	H	P	H	B				
TC-14	F	H	P_L	H	P	H	P	H	P	H	P	P	H	B			
TC-15	F	H	P_L	H	P	H	P	P	H	P	H	P	P	H	B		
TC-16	F	H	P_L	H	P	H	P	H	P	H	P	P	H	P	H	B	
TC-17	F	H	P_L	H	P	H	P	H	P	H	P	H	P	H	P	H	B
TC-18	F	H	P_L	H	P	H	P	H	P	P	H	P	H	P	H	P	H	B

Notes:

1) Intermediate Sections with Heater Connections (H) & (H_L) are optional. The locations shown indicate the possible placement of these sections if they are ordered. Unless Intermediate Heater Sections are specified, the sections provided will be Plain Intermediate Sections (P) or (P_L).

2) Sections with Low Water Cut-Off (LWCO) Tappings are optional. However, if used, they must be placed at the third position from the front in order to assure proper jacket fit.

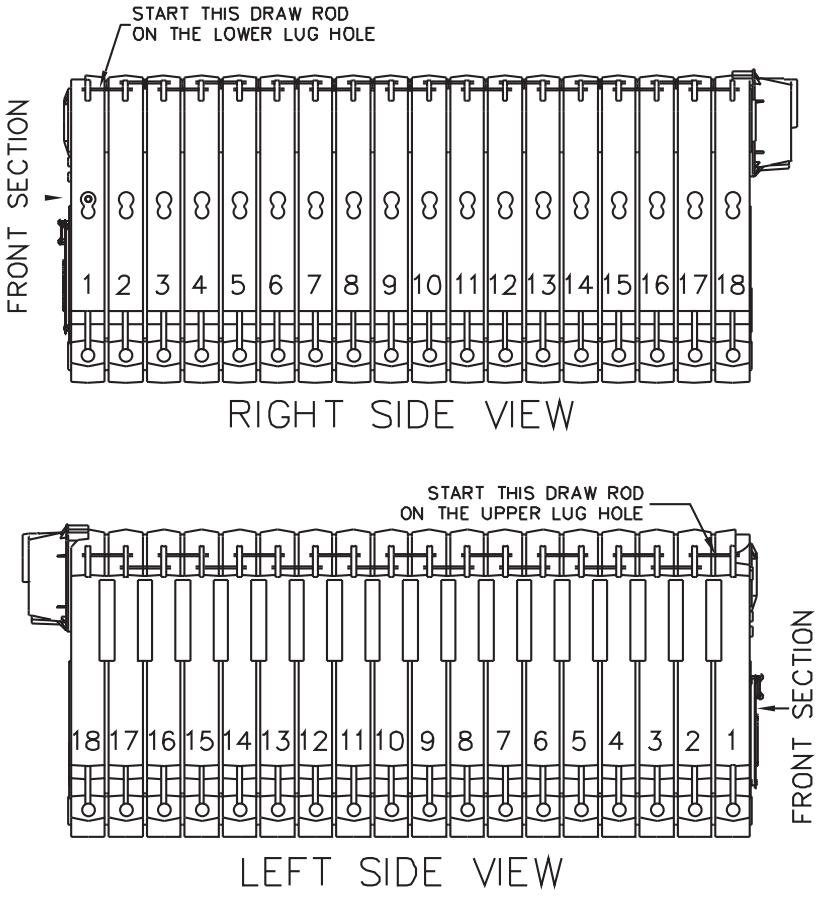

Figure 2.6: Numbered Section Illustration

Table 2.3: Splice Piece Nut & Washer Locations

Boiler Model	Splice Piece & Washer Locations	
TC-04	N/A	
TC-05	N/A	
TC-06	N/A	
TC-07	N/A	
TC-08	Between Sections 3-4 & Sections 5-6	
TC-09	3-4 & 5-6	
TC-10	5-6 & 7-8	
TC-11	5-6 & 7-8	
TC-12	5-6 & 7-8	
TC-13	5-6 & 7-8	
TC-14	7-8 & 9-10	
TC-15	5-6 & 7-8	9-10 & 11-12
TC-16	5-6 & 7-8	9-10 & 11-12
TC-17	5-6 & 7-8	9-10 & 11-12
TC-18	5-6 & 7-8	11-12 & 13-14

Note: Splice Piece nuts and washers are to be installed as shown in Figure 2.7 on the draw rods that connect the sections indicated. The sections are numbered from front to back as indicated in Figure 2.6. The Splice Pieces are shown in Section 3 in Figure 3.12.

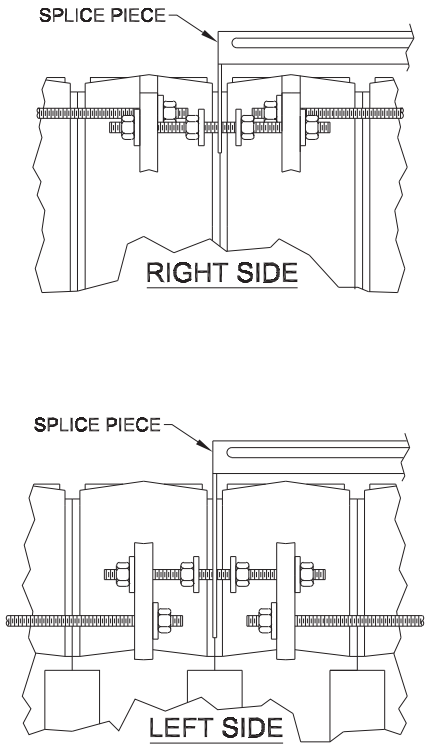

Figure 2.7

D. HYDROSTATIC TESTING

1. Plug all openings in the boiler waterways and fill the boiler with cold water. While filling the boiler, re-check the torque on all ports and tighten the draw rods if necessary.

⚠ NOTICE

Do not exceed the maximum torque specifications (upper Right – 200 ft. lbs. [270 Nm]; Lower Ports – 150 ft. lbs. [203 Nm]). Tighten the rods in the sequence shown in Table 2.2.

Do not continue to tighten the sections after metal-to-metal contact is made. Over-tightening the draw rods will not improve the seal and may cause damage to the castings.

2. Hydrostatically test the boiler for leaks in accordance with ASME Code, Section IV.
   a) Steam Boilers: The assembled boiler shall be subjected to a hydrostatic test pressure of not less than 45 psig [310 kPa].
   b) Water Boilers: The assembled boiler shall be subjected to a hydrostatic test pressure of not less than 1-1/2 times the maximum allowable working pressure.
   c) The test pressure shall not exceed the minimum requirements shown above by more than 10 psi [69 kPa].
3. If any port connector leaks, tighten the draw rods until either the joint achieves full metal-to-metal contact or until or the maximum torque is reached (Upper Right - 200 ft. lbs. [270 Nm]; Lower Ports - 150 ft. lbs.[203 Nm]). Check the torque on the other draw rods that may have been affected by the draw rod that was tightened.

⚠ NOTICE

When the boiler is put into operation for the first time, the temperature should be brought up slowly (low fire on burners with this capability).

E. CLEAN-OUT COVER INSTALLATION

1. Attach the clean-out cover plates and insulation to the clean-out openings on the left side of the boiler. Use the T-bolt assemblies and hex nuts provided in the Section Assembly Cartons. See Figure 2.8.
2. Press each clean-out cover plate with insulation over the protruding T-bolts until the bolts punch through the insulation. Install a 5/16" flat washer and 5/16" brass nut on each bolt and tighten until the insulation forms a good seal around the clean-out opening.
3. Seal tops and bottoms of insulation with silicone sealant.

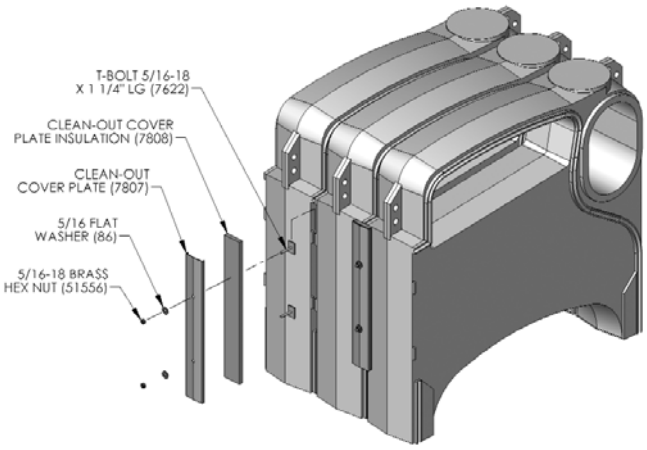

Figure 2.8: Clean-Out Cover Installation

F. BURNER MOUNTING PLATE INSTALLATION

1. Inspect the rope groove on the Burner Mounting Plate for dirt and obstructions. Use a wire brush if necessary to clean the groove.

2. Spray the rope groove with the spray adhesive provided in the Misc. Parts Carton and apply the 3/8" diameter rope gasket.

3. Install the 7/16" x 2-1/2" Studs provided into the four threaded holes around the perimeter of the burner opening in the Boiler Front Section as shown in Figure 2.9.

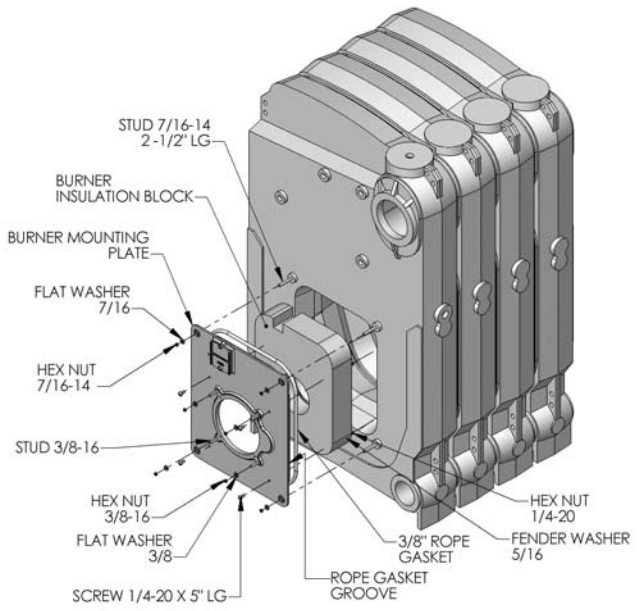

Figure 2.9: Burner Mounting Plate Installation

4. Insert the Burner Insulation Block into the burner opening with the notch for the Observation Port on the top left side.

5. Place the Burner Mounting Plate over the block and force the block inward until the Studs extend far enough through the holes to accept 7/16" Hex Nuts and Washers. Tighten the nuts.

6. Use a long drill, awl, or other such tool to create holes in the Insulation Block for four 1/4" machine screws.

7. Install the 1/4" x 5" machine screws through the holes in the Burner Mounting Plate, supporting the Insulation Block on the inside to prevent tearing.

8. Install the stainless steel washers and 1/4" hex nuts on the inside of the Insulation Block and tighten lightly. Be careful not to crush the insulation.

9. Install the four 3/8-16 x 1-1/4" studs provided into the screw seats provided on the Burner Mounting Plate.

10. When the burner is installed, the hole in the Insulation Block for the Burner may need to be enlarged and shaped. This can be cut with a hacksaw blade.

G. REAR OBSERVATION PORT INSTALLATION.

1. Assemble Rear Observation Port as shown in Figure 2.10:
   a) Lift up the flapper door on the inside of the Observation Port and insert the Hex Head Cap Screw provided in the Misc. Parts Carton.
   b) Slide the Spring over the hex head screw and thread the Hex Nut onto the screw.
   c) Thread the Knob onto the Hex Head Screw behind the nut and lock into position using the jam nut.

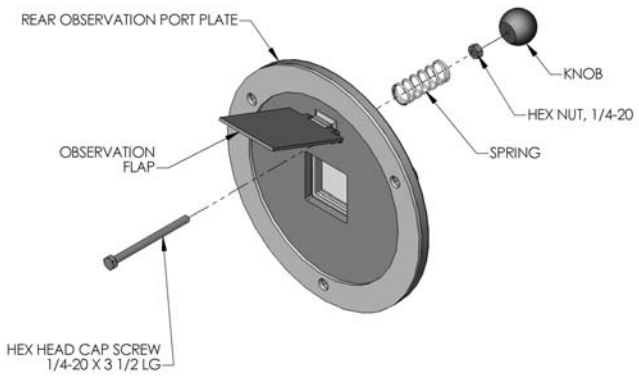

Figure 2.10: Rear Observation Port Assembly

2. Thread the 5/16" x 1-1/2" studs into the screw seats around the rear observation port opening in the Boiler Back Section.

3. Apply a thin layer of furnace cement over the mounting flap.

4. Install the Rear Observation Port Assembly on the Boiler Back Section using three 5/16" hex nuts and washers.

H. FLUE COLLECTOR INSTALLATION

1. Screw the eight 5/16-18 x 1-1/2" studs provided into the screw seats around the flue collector outlet on the Boiler Back Section.

2. Place the 1/8" [3 mm] thick x 3/4" [19 mm] wide Bolt Tape provided in the Misc. Parts Carton over the studs.

3. Place the flue collector in position and install the 5/16" washers and nuts. Tighten the nuts uniformly.

4. Open the Slide Damper to the full open position to prepare for adjustment during Burner commissioning.

5. Install 1/2" brass plug from Misc. Parts Carton.

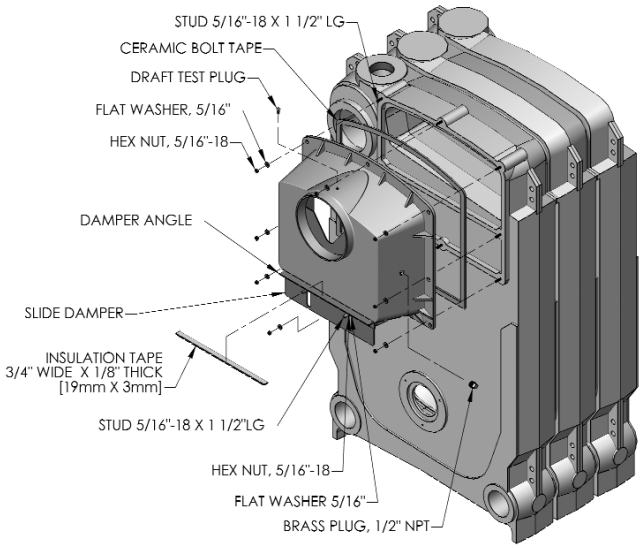

Figure 2.11: Rear Flue Collector Installation

I. BURNER MOUNTING

1. Read the Burner Instruction Manual before starting.

2. Remove the Burner from its crate. Verify that all components are included with the burner.

3. Place the high temperature gasket specified by the Burner Manufacturer on the Burner Mounting Plate and secure the Burner using 3/8" flat washers and hex nuts provided.

4. If the Burner is supplied with a pedestal support, install it per the Burner Manufacturer's Instructions. The pedestal supports the burner and prevents undue stress on the Boiler Castings.

3. INSTALLATION

A. PREPARATION

1. The boiler must be hydrostatically pressure tested as indicated in Section 2, paragraph D.

2. The jacket panels are designed so that they may be installed after the boiler is piped. Use nipples long enough to extend through the jacket.

B. STEAM BOILER PIPING

1. Refer to the PB Heat Steam Installation Survey for guidance with steam boiler piping and components.

2. Piping for steam boilers is shown in Figure 3.1, 3.2, and 3.3. Table 3.1 contains a pipe size schedule for steam boilers.

3. Series TC™ Boilers are intended to be piped with one, two or three risers to the header depending on the boiler size.
   a) Table 3.1 shows a pipe schedule for steam boiler headers.
   b) See Figure 3.1 for a typical piping arrangement for boilers with one riser. (TC-04 & TC-05)

⚠ CAUTION

Do not reduce the size or number of risers shown in Table 3.1. If the risers are undersized or incorrectly placed, a sloped water line may occur in the boiler. This may lead to the overheating of boiler sections.

Table 3.1: Piping Schedule

Steam Boiler Piping			
Boiler Model	**Number of 5" NPT Risers**	**Header Size (NPT)**	**Equalizer Size (NPT**
TC-04 & TC-05	1	5"	2-1/2"
TC-06 & TC-07	2	5"	2-1/2"
TC-08 to TC-10	2	6"	4"
TC-11 to TC-18	3	8"	4"

   c) See Figure 3.2 for a typical piping arrangement for boilers with two risers. (TC-06 through TC-10)
   d) See Figure 3.3 for a typical piping arrangement for boilers with three risers. (TC-11 through TC-18)

4. A Hartford loop, as shown in Figures 3.1, 3.2 and 3.3 is recommended in all steam boiler installations. The loop prevents the boiler from being drained completely due to a leak in a return line.

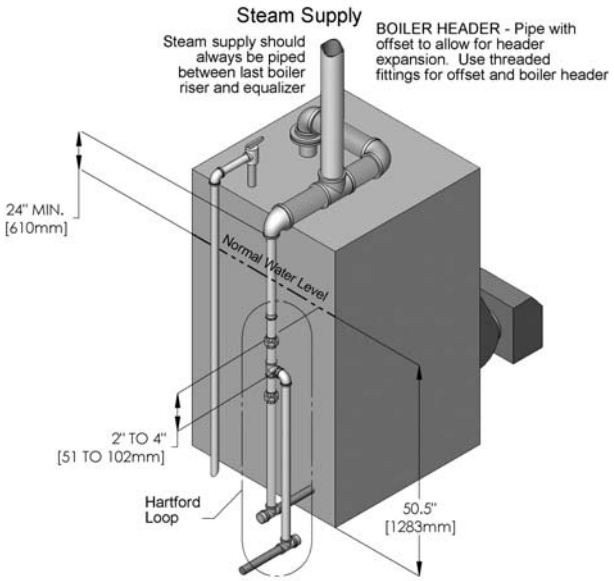

Figure 3.1: Typical piping arrangement for boilers with one riser.

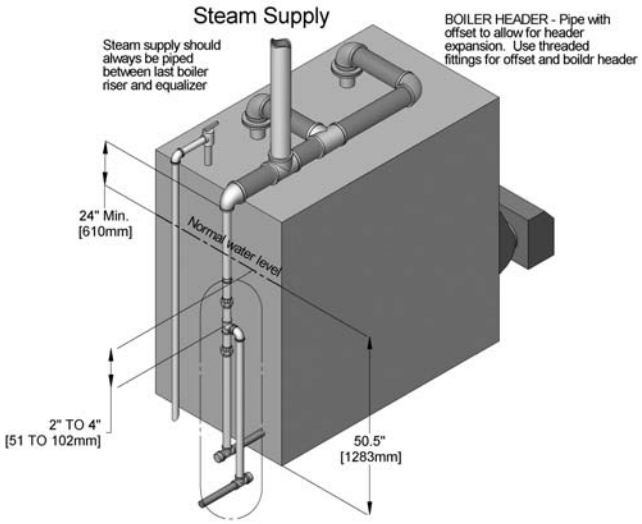

Figure 3.2: Typical piping arrangement for boilers with two risers.

5. Pumped Return Systems:
   a) For pumped return systems, install a spring-loaded check valve on the pump discharge. This will prevent boiler water from backing up into the condensate receiver.
   b) If the pump discharge is looped above the normal water level, install a spring-loaded check valve at the connection to the boiler return. This will ensure water under pressure in the vertical pipe preventing water hammer due to hot condensate flashing to steam.

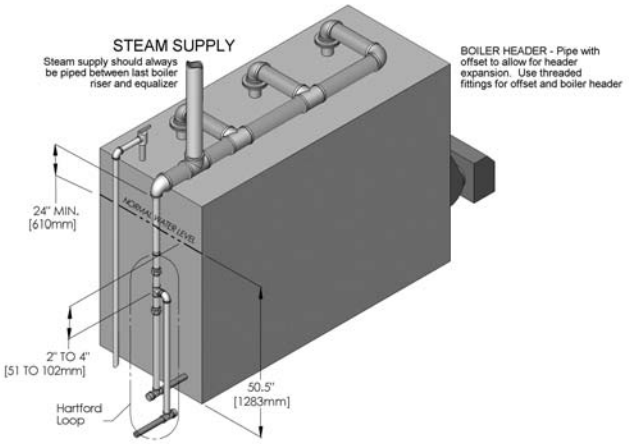

Figure 3.3: Typical piping arrangement for boilers with three risers.

c) Install a flow regulating valve on the pump discharge to allow throttling of the pump flow. Excess return flow may cause water hammer and water level fluctuations.

d) Use a Hartford Loop connection. Oversize the equalizer slightly to make sure water doesn't spray into the header and cause hammering.

6. Always locate the steam supply take-off between the equalizer and the last boiler riser. Failure to do this will cause water carryover into the system because the condensate will collect at the entrance to the steam main.
7. Pitch the steam header to allow condensate to flow toward the equalizer.
8. Feedwater requirements for steam boilers at full input are shown in Tables 3.2a and 3.2b. Addition of water to the boiler should be controlled by sensing the boiler water level.
9. 1" NPT water column tappings are provided on the front section for mounting low water cutoffs and level controllers.
10. The front section has 3" NPT tappings at the base for installation of 3" NPT close nipples and 3" NPT pipe caps. Removal of caps allows flushing of sediment from the boiler.

C. MULTIPLE STEAM BOILER PIPING

1. Figure 3.4 shows typical piping for multiple steam boiler gravity return systems.
2. Figure 3.5 shows typical piping for multiple steam boiler pumped return systems.
3. Provide separate feed lines for multiple steam boiler pumped return systems. Use either separate feed pumps or electrically actuated valves to isolate the boiler feed. This is necessary to provide reliable level control and avoid nuisance performance problems.
4. Condensate return units are not recommended for multiple boiler installations. Use a boiler feed system which is actuated by a boiler control that responds to the needs of the boiler.
5. Install a float & thermostatic (F&T) trap at the boiler normal water level on each of the boilers in a multiple boiler system with pumped returns. This will prevent flooding of idle boilers due to condensation of steam.

D. WATER BOILER PIPING

1. Refer to the Peerless® Water Installation Survey for guidance with water boiler piping and components.
2. Typical piping for a Series TC™ water boiler is shown in Figure 3.6.

Table 3.2a: Feedwater Requirements - US Customary Units

Boiler Model	I=B=R Gross Output MBH	Evap. Rate[1] GPM	Minimum Feedwater Pump Flow[2] GPM	Condensate Receiver Capacity[3] Gallon
TC-04	900	1.86	3.7	37
TC-05	1166	2.41	4.8	48
TC-06	1433	2.96	5.9	59
TC-07	1699	3.50	7.0	70
TC-08	1965	4.05	8.1	81
TC-09	2232	4.60	9.2	92
TC-10	2498	5.15	10.3	103
TC-11	2764	5.70	11.4	114
TC-12	3031	6.25	12.5	125
TC-13	3297	6.80	13.6	136
TC-14	3563	7.35	14.7	147
TC-15	3830	7.90	15.8	158
TC-16	4096	8.45	16.9	169
TC-17	4362	9.00	18.0	180
TC-18	4629	9.55	19.1	191

1. Evaporation rate is based on heat of vaporization at 212°F, 970 BTU/lbm.
2. Minimum feedwater pump flow is based on 2 times evaporation rate.
3. Condensate receiver capacities are based on 20 minute steam

Table 3.2b: Feedwater Requirements - SI Metric Units

Boiler Model	I=B=R Gross Output KW	Evap. Rate[1] ltr/min	Minimum Feedwater Pump Flow[2] tr/min	Condensate Receiver Capacity[3] Liter
TC-04	264	7.0	14.1	141
TC-05	342	9.1	18.2	182
TC-06	420	11.2	22.4	224
TC-07	498	13.2	26.5	265
TC-08	576	15.3	30.7	307
TC-09	654	17.4	34.8	348
TC-10	732	19.5	39.0	390
TC-11	810	21.6	43.2	432
TC-12	888	23.7	47.3	473
TC-13	966	25.7	51.5	515
TC-14	1044	27.8	55.6	556
TC-15	1122	29.9	59.8	598
TC-16	1200	32.0	64.0	640
TC-17	1278	34.1	68.1	681
TC-18	1357	36.2	72.3	723

1. Evaporation rate is based on heat of vaporization at 100°C, 2257 kJ/kb.
2. Minimum feedwater pump flow is based on 2 times evaporation rate.
3. Condensate receiver capacities are based on 20 minute steam cycle. Chart shows actual capacity, not gross receiver volume

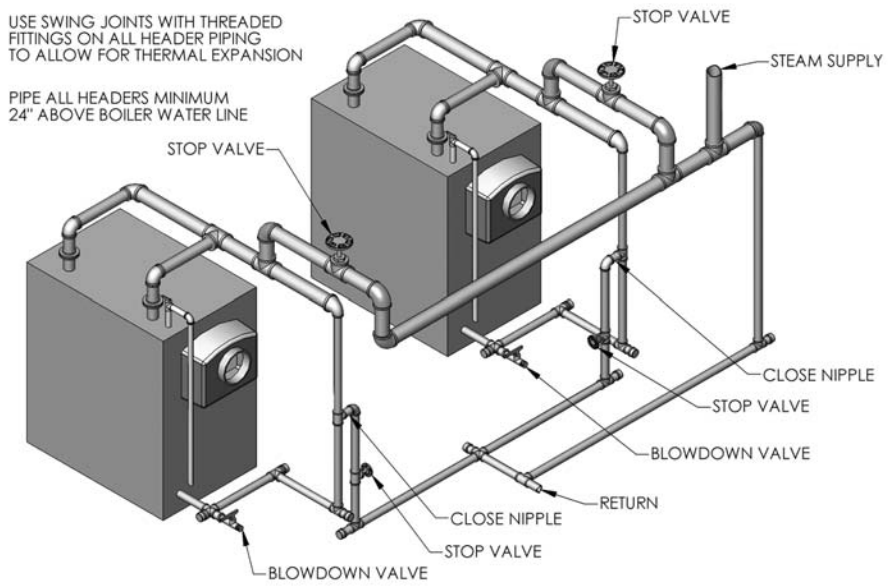

Figure 3.4: Multiple Steam Boiler Piping – Gravity Return

3. A return yoke as shown in Figure 3.7 is provided as standard equipment for each water boiler. Assemble each joint as follows:
   a) Cover edges and outer surface of the gasket with a thin layer of petroleum-free silicone lubricant (supplied).
   b) Install each gasket by placing it over the ends of the two pipes to be connected.
   c) Center the gasket between the grooves.
   d) Place the coupling housings over the gasket so that the keys fully engage into grooves.
   e) Insert the bolts into the coupling and tighten the nuts until finger tight.
   f) Alternately tighten the nuts evenly so they do not bind the gasket. The gasket should not be visible after fully tight.
4. The recommended supply and return pipe sizing in Tables 3.3a and 3.3b is based on a flow rate through the boiler that produces a 20°F [11°C] temperature rise (1 gpm [3.79 ltr/min] of flow for each 10,000 Btu/hr [2.93 kW] of boiler output).
5. Using higher flow rates is not recommended because it may cause poor distribution through the boiler.

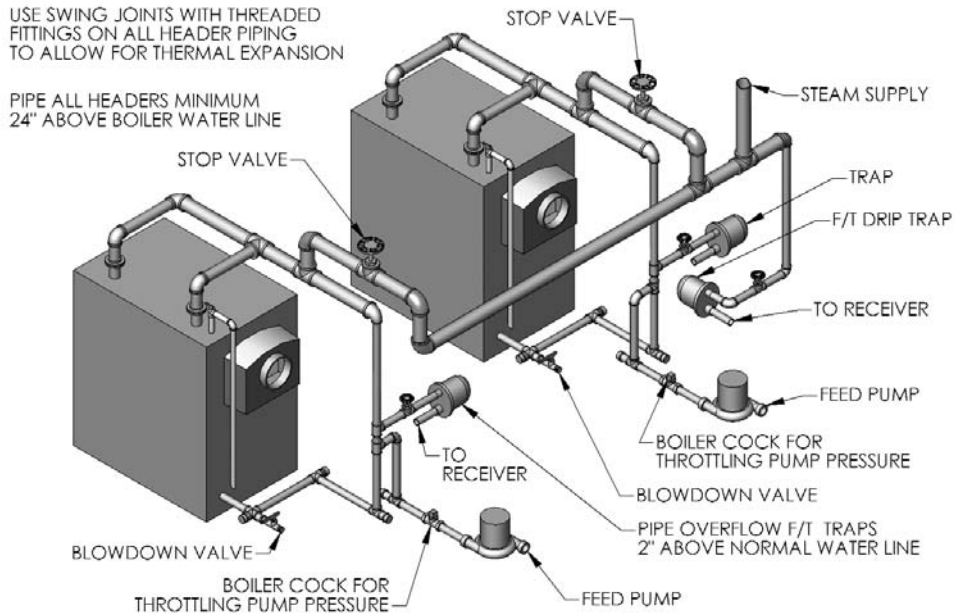

Figure 3.5: Multiple Steam Boiler Piping – Pumped Return

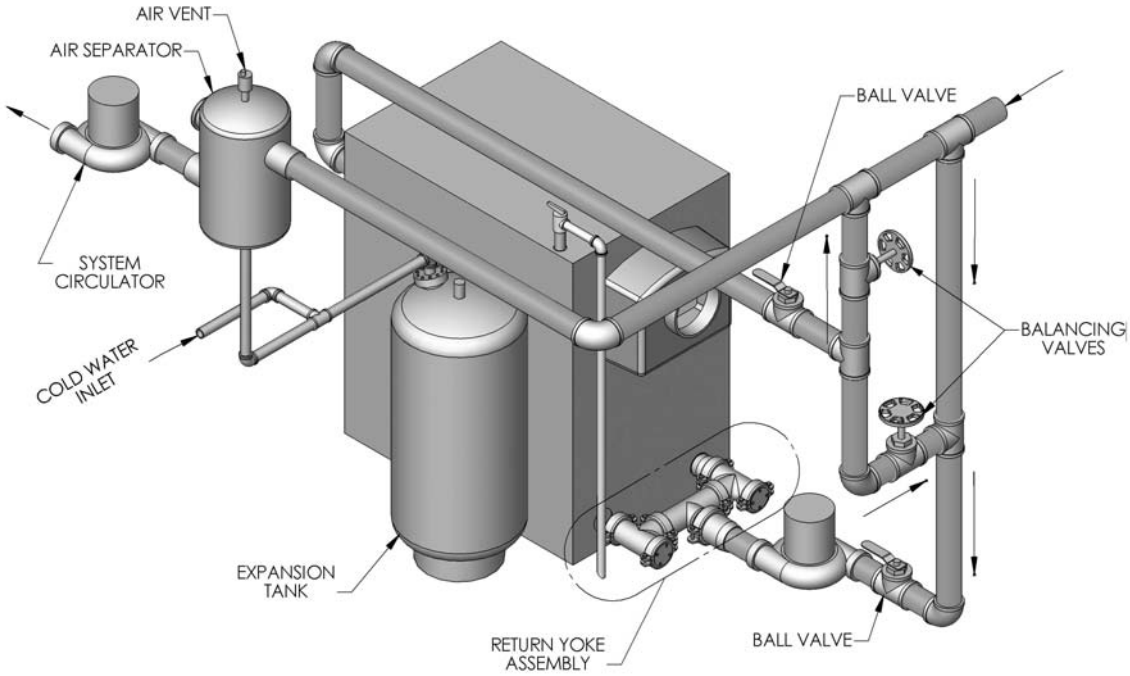

Figure 3.6: Water Boiler Piping

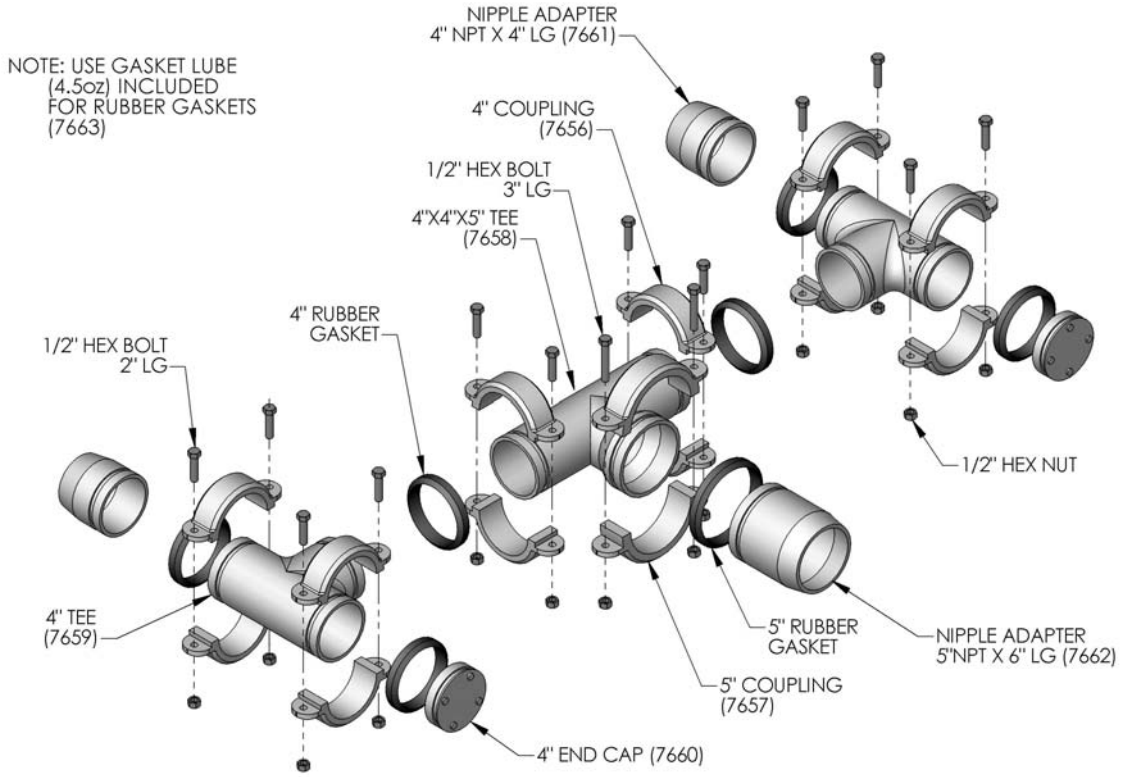

Figure 3.7: Return Yoke

Table 3.3a: Supply & Return Pipe Sizing – US Customary Units

Boiler Model	I=B=R Gross Output (MBH)	Flow Rate @20 F Rise (GPM)	Recommended	
			Supply Size (NPT)	Return Size (NPT)
TC-04	900	90	3	3
TC-05	1166	117	3	3
TC-06	1433	143	4	4
TC-07	1699	170	4	4
TC-08	1965	196	4	4
TC-09	2232	223	4	4
TC-10	2498	250	5	5
TC-11	2764	276	5	5
TC-12	3031	303	5	5
TC-13	3297	329	5	5
TC-14	3563	356	5	5
TC-15	3830	383	5	5
TC-16	4096	409	5	5
TC-17	4362	436	5	5
TC-18	4629	463	5	5

Table 3.3b: Supply & Return Pipe Sizing – SI Metric Units

Boiler Model	I=B=R Gross Output (kW)	Flow Rate @36 C Rise (ltr/min)	Recommended	
			Supply Size (NPT)	Return Size (NPT)
TC-04	264	341	3	3
TC-05	342	443	3	3
TC-06	420	541	4	4
TC-07	498	644	4	4
TC-08	576	742	4	4
TC-09	654	844	4	4
TC-10	732	946	5	5
TC-11	810	1045	5	5
TC-12	888	1147	5	5
TC-13	966	1245	5	5
TC-14	1044	1348	5	5
TC-15	1122	1450	5	5
TC-16	1200	1548	5	5
TC-17	1278	1650	5	5
TC-18	1357	1753	5	5

6. Lower flow rates are acceptable providing that the return temperature to the boiler is a minimum of 130°F [54°C] on gas boilers and 150°F [66°C] on oil boilers to prevent condensation of flue gases.

7. The size of supply and return connections given in Tables 3.3a and 3.3b are the minimum size for a 20°F [36°C] temperature differential. Do not reduce these sizes unless the flow is low enough to keep the velocity from developing noise and erosion problems.

8. When the boiler is connected to heating coils located in air handling units, the boiler piping must be equipped with flow control devices to prevent gravity circulation of the boiler water during the cooling cycle.

9. Low Temperature Return Systems:
   a) When the system return temperature will be below 130°F [54°C] on gas or 150°F [66°C] on oil for extended periods (heat pump systems, radiant panels, snow melt, outdoor reset, etc.) provide piping and controls to protect the boiler from condensation. Excessive condensation will lead to corrosion in the boiler and breeching, which will shorten the life of the boiler.
   b) Low return water temperatures are likely to occur whenever the boiler is allowed to cool below design temperatures (cold start). This is acceptable as long as the frequency of these shut-downs is very low.

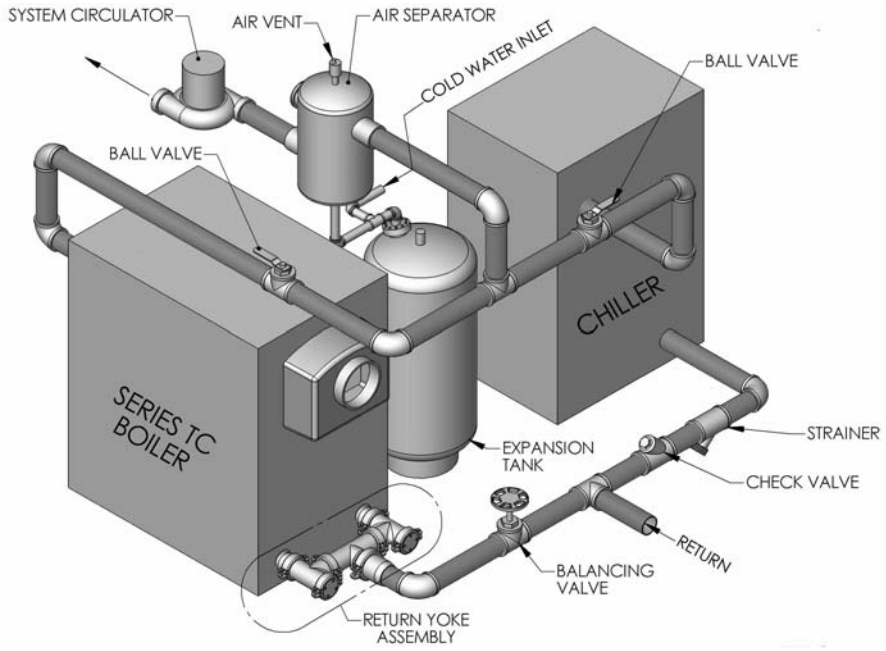

Figure 3.8: Chilled Water Systems

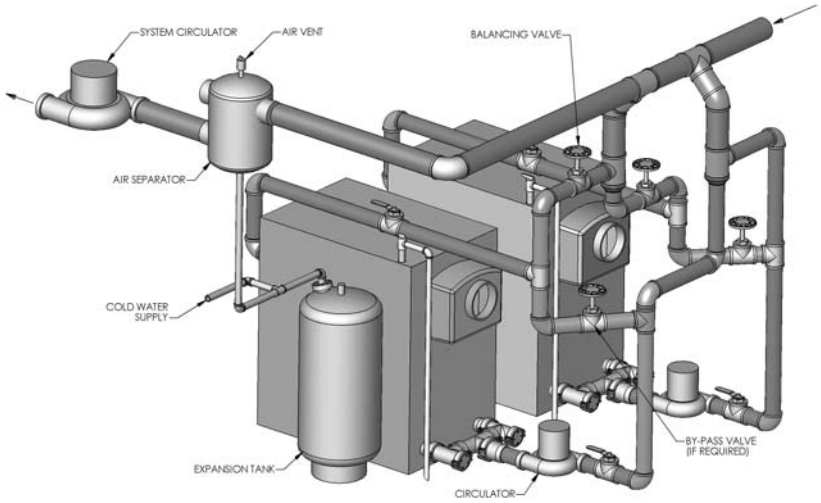

Figure 3.9: Multiple Water Boiler Piping

c) For systems with variable low temperature returns or constant low temperature returns please refer to the Peerless® Water Survey for system information.

10. Chilled Water Systems:
    a) If the boiler will be used in conjuction with a chilled medium system, the chiller must be piped in parallel with the boiler to prevent the chilled medium from entering the boiler and causing damage. See Figure 3.8.

E. MULTIPLE WATER BOILER PIPING

1. Figure 3.9 shows a typical piping arrangement for multiple water boilers. The optional bypass valve is used when the system return water temperature is consistently below 130°F [54°C] for gas boilers or 150°F [66°C] for oil boilers.

2. For systems with variable low temperature return temperature, a three-way valve may be used (see Peerless® Water Installation Survey for details).

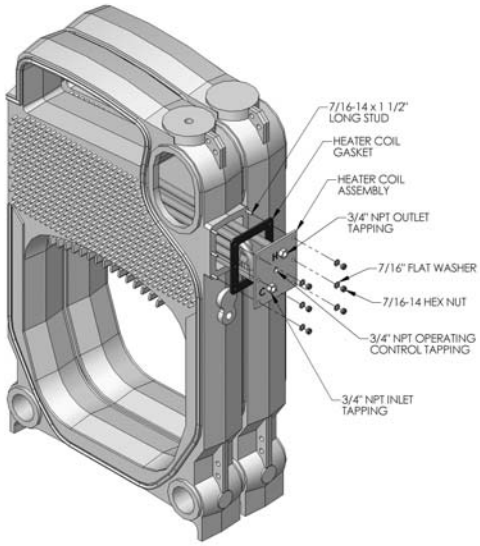

Figure 3.10: Tankless Heater Coil Installation

F. TANKLESS HEATER INSTALLATION

1 Heater sections must be installed as shown in Table 2.2 in the Assembly section of this manual.

2. Inspect heater section for dirt or rust on the mating surface. Clean with a wire brush if necessary.

3. Install 7/16" x 1-1/2" studs in the screw seats around the heater opening as shown in Figure 3.10.

4. Place the heater gasket over the studs. Be sure the gasket is not twisted.

5. Carefully install the heater coil. Install the nuts and tighten them evenly to ensure uniform compression of the gasket.

6. Install the operating control in the center tapping on the heater mounting plate. Figure 3.11 shows an acceptable piping arrangement for multiple heater coils.

⚠ WARNING

Provide anti-scald devices in the system where needed. Failure to control water temperature to showers or other usage areas where scald risk exists may result in severe personal injury.

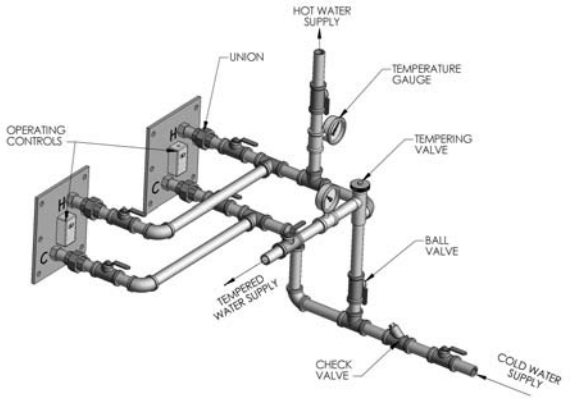

Figure 3.11: Typical Piping for Multiple Tankless Heater Coils

G. JACKET PREPARATION

1. Collect all jacket cartons as listed in Table 1.2 in the Pre-installation section of this manual. One Jacket Channel Carton, one Jacket Front/Back Carton, and one to five Jacket Top/Side Cartons are included.
2. The cartons contain pre-insulated panels and screws for attaching them to the unit.
3. Remove all required knock-outs (Heater Coils, Steam Supply, LWCO, etc.) from jacket panels before assembly.
4. The boiler block must be completely assembled on the Angle Rails supplied by PB Heat before installing the jacket. The Angle Rails are drilled and tapped to accept the Lower Jacket Channels.
5. Any limit controls, steam gauge glass, low water cutoffs or gauges to be mounted on the front of the boiler must be installed after the Front Jacket Panel, F2, as shown in Figure 3.12.
6. All other piping, burner, and control connections may be made before jacket installation.

H. JACKET ASSEMBLY

1. Figure 3.12 shows a typical jacket assembly.
   a) Lower Channels: Locate Lower Channels on the Angle Rails. TC-04 through TC-07 boilers require only one Lower Channel per side. TC-08 through TC-14 boilers require two Lower Channels per side and the TC-15 through TC-18 boilers require three Lower Channels per side. On TC-08 through TC-18 be sure that the 5/16" diameter holes in the outer flange of the Lower Channels are at the front and rear of the boiler.
   b) Front Panel: Locate Front Panel, F2, over the front of the boiler with the bottom corners supported by the Lower Channels. Align holes in the Front Panel with those in the Lower Channels and fasten with #10 washer head sheet metal screws. Install panels F1 and F2A with #10 washer head sheet metal screws.
   c) Back Panel: Assemble Right Rear Post to Back Panel (B1) with #10 washer head sheet metal screw. Install Panel/Post assembly on rear of boiler. Assemble Left Rear Post to Back Panel. Align lower holes of right and left posts with Lower Channel holes and attach with #10 washer head sheet metal screws. Install panel B2 with sheet metal screws.

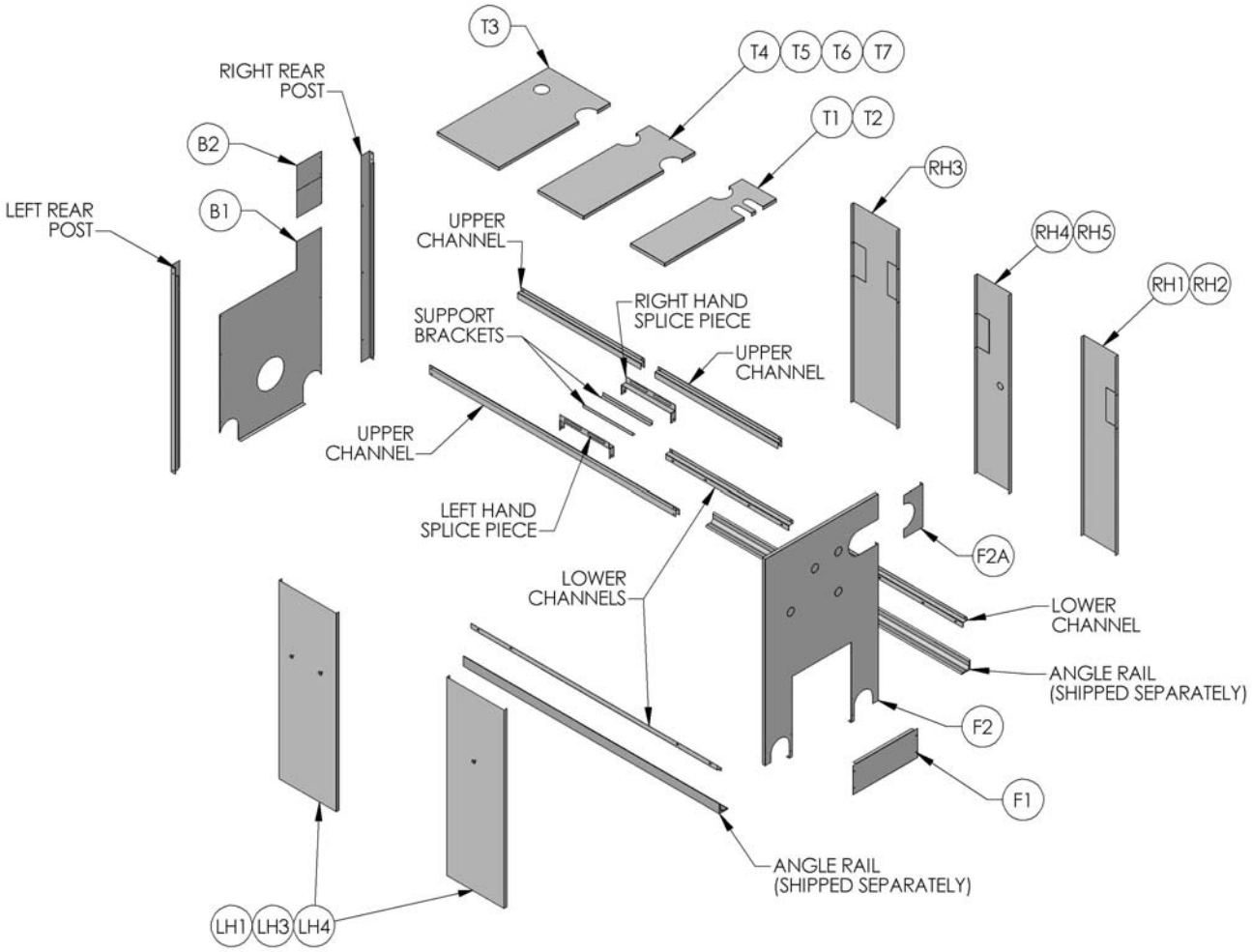

Figure 3.12: Jacket Assembly

d) Upper Channels:
   1. TC-04 through TC-07 Boilers have one piece Upper Channels. These are to be attached to the top of the Front and Back Panels with 1/4"-20 round head machine screws, washers and nuts.
   2 TC-08 through TC-18 Boilers have two or three piece Upper Channels. Install splice pieces with the splice piece mounting hardware as shown in Section 2, Assembly, Figures 2.6 & 2.7. Attach the Upper Channels to the Splice Pieces and to the Front and Back Panels with 1/4"-20 round head machine screws, washers, and nuts.

e) Side and Top Panels
   1 Left Side Panels: Attach knobs to Left Side Panels and install by inserting the top into the Upper Channel and then dropping the Panel into the space between the Lower Channel and the Angle Rail.
   2 Top Panels: Lay out the Top Panels so that the knock-outs and openings correspond to the piping and components on the assembled boiler. After checking the layout, remove the necessary knock-outs and install Top Panels.

f) Right Side Panels: Lay out the Right Side Panels so that the knock-outs and openings correspond to the piping and components on the assembled boiler. After checking the layout, remove the necessary knock-outs and install the Right Side Panels by inserting them into the Upper Channels then dropping them into the space between the Lower Channels and Angle Rails.

I. FUEL PIPING

1. General:
   a) Read the Burner Instruction Manual, supplied with the boiler, or if the burner was purchased separately, with the burner.
   b) Review applicable code requirements for the burner and fuel piping installations.
   c) Install piping to allow for removal of burner and access to combustion chamber for cleaning or service.

2. Install Fuel Oil Piping:
   a) Place the fuel oil tank and install the piping in accordance with local codes or in the absence of such codes with the codes listed in paragraph 1.B.
   b) Follow guidelines in the Burner Instruction Manual for sizing oil lines. Never use smaller than 1/2" [12.7 mm] OD copper tubing.
   c) Install manual shut-off valves on the suction line at the burner and at the oil line entrance to the building.
   d) If installing a shut-off valve on the return line, you must provide an oil pressure relief valve piped ahead of the shut-off valve and discharged to the tank to prevent over-pressure conditions.
   e) Install a two pipe oil distribution system when possible. It will improve the reliability of the oil delivery to the burner.
   f) Use flare fittings when using copper tubing.
   g) If the burner is above the top of the fuel oil tank, install a check valve on the oil suction line at the burner to prevent oil from evacuating the line.
   h) If the burner is below the top of the tank, install an anti-siphon device to prevent oil flow in the event of an oil line break.

3. Install Gas Supply Piping
   a) Size gas piping as required by Local codes or in the absence of such authority, the codes listed in paragraph 1.B.
   b) Use Table 3.6 & 3.7 for sizing of piping for natural gas with a system pressure drop of 0.3 inches of water [0.075 kPa].

Table 3.6: Capacity of Gas Supply Pipe in Cubic Feet Per Hour of Natural Gas for a Pressure Drop of 0.30 inches of water

Pipe Length (Feet)	1-1/4" Pipe	1-1/2" Pipe	2" Pipe	2-1/2" Pipe	3" Pipe	4" Pipe	6" Pipe
10	1,050	1,600	3,050	4,800	8,500	17,500	44,000
20	730	1,100	2,100	3,300	5,900	12,000	31,000
30	590	890	1,650	2,700	4,700	9,700	25,000
40	500	760	1,450	2,300	4,100	8,300	22,000
50	440	670	1,270	2,000	3,600	7,400	20,000
60	400	610	1,150	1,850	3,250	6,800	18,000
70	350	560	1,050	1,700	3,000	6,200	17,000
90	320	490	930	1,500	2,600	5,400	15,000
100	305	460	870	1,400	2,500	5,100	14,000
150	250	380	710	1,130	2,000	4,100	11,500

Table 3.7: Capacity of Gas Supply Pipe in Cubic Meters Per Hour of Natural Gas for a Pressure Drop of 0.075 kPa

Pipe Length (meter)	1-1/4" Pipe	1-1/2" Pipe	2" Pipe	2-1/2" Pipe	3" Pipe	4" Pipe	6" Pipe
3.05	30	45	86	136	241	496	1,246
6.10	21	31	59	93	167	340	878
9.14	17	25	47	76	133	275	708
12.19	14	22	41	65	116	235	623
15.24	12	19	36	57	102	210	566
18.29	11	17	33	52	92	193	510
21.34	10	16	30	48	85	176	481
27.43	9	14	26	42	74	153	425
30.48	9	13	25	40	71	144	396
45.72	7	11	20	32	57	116	326

Above ratings are based on natural gas with a specific gravity of 0.60 allowing pressure drop of 0.3 inces of water (0.075 kPa). No allowance is needed for pipe fittings. Apply the following factors to the above capacities for specific gravity other than 0.60.

Specific Gravity	0.50	0.55	0.60	0.65	0.70	0.75
Multiplier	1.10	1.04	1.00	0.96	0.93	0.90
Specific Gravity	0.80	0.85	0.90	1.00	1.10	1.20
Multiplier	0.87	0.84	0.82	0.78	0.74	0.71
Specific Gravity	1.30	1.40	1.50	1.60	1.70	1.80
Multiplier	0.68	0.66	0.63	0.61	0.59	0.58

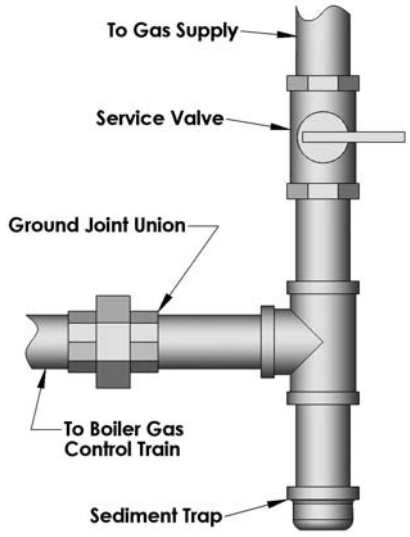

Figure 3.13: Gas Supply Connection to Boiler

c) Check the maximum inlet gas pressure in the Burner Instruction Manual and make sure that the system regulator will not allow the gas pressure to exceed this value.

d) The minimum gas supply pressure is listed on the Burner Rating Plate. Make sure the system regulator and piping are sized and adjusted properly to provide this pressure under all conditions.

e) Install a Service Valve, Sediment Trap and Ground Joint Union at the supply connection to the Gas Control Train as shown in Figure 3.13. These components are to be supplied by the installing contractor and are not part of the boiler or burner. Install them in accordance with local codes or in the absence of such authority with the codes listed in paragraph 1.B.

f) Use only pipe joint compounds rated for use with Liquefied Petroleum Gases.

4. Test Gas Supply Piping
   a) Isolate the Boiler Gas Control Train from the system during testing.
   b) For test pressures 1/2 psig [3.4 kPa] or less, close the Manual Shut-Off Valve on the Boiler Gas Control Train.

⚠ WARNING

Do not expose the Gas Control Train to excessive pressure. The gas valves can be damaged. This may result in explosion hazard and severe personal injury or death.

Do not test gas supply piping with an open flame. Use a soap suds mixture brushed onto the pipe joints to test for leaks.

   c) For test pressures above 1/2 psig [3.4 kPa], disconnect the gas supply piping upstream of the Boiler Manual Shut-Off Valve.

J. INSTALL CONTROLS AND TRIM

1. Install Safety Relief Valve:
   a) Install a Safety Relief Valve on the 3" NPT tapping at the top of the rear section for both steam and water boilers as shown in Figure 3.14.

⚠ CAUTION

Pipe the discharge of the Safety Relief Valve away from any traffic area, preferably to a floor drain. This is necessary to prevent injury should the valve discharge. Pipe the discharge in the same size pipe or larger than the valve discharge size. Do not put any valves or restrictions in the Safety Relief Valve discharge piping.

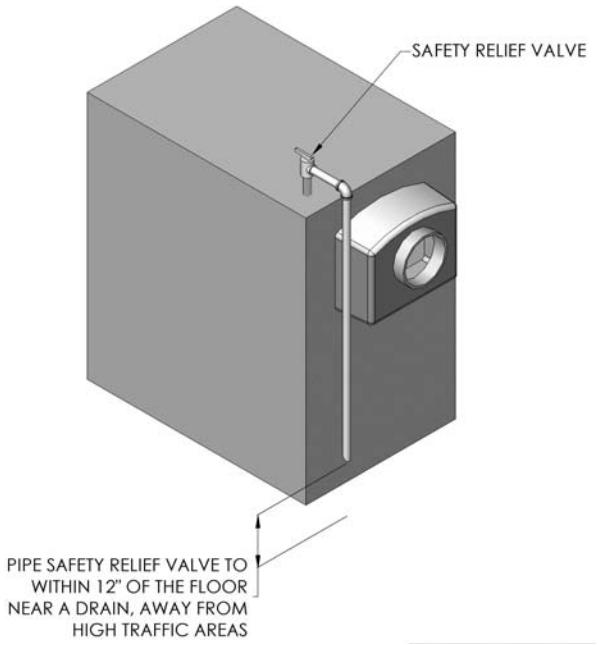

Figure 3.14: Safety Relief Valve Installation

   b) Water and Steam Trim Cartons contain safety relief valves and fittings.
   c) Be sure that the relief valve sizing meets local code requirements.

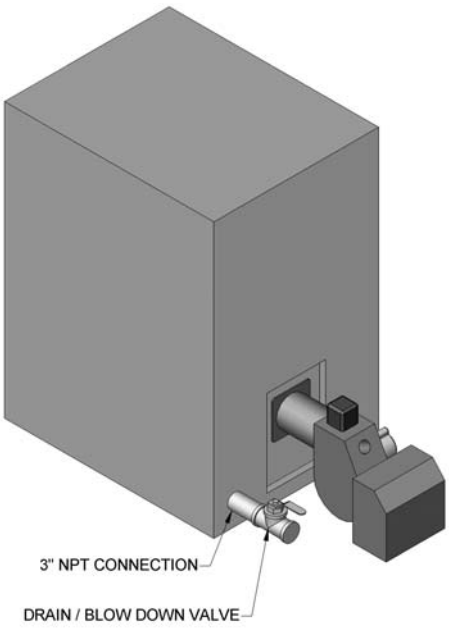

Figure 3.15: Boiler Drain/Blowdown Valve Installation

2. Install Drain/Blowdown Valves
   a) Water Boilers: Install a drain valve either in the return piping or in one of the 3" NPT lower tappings in the Front Section of the boiler. See Figure 3.15.
   b) Steam Boilers: Install a 1-1/4" NPT Full Port Blowdown Valve either in the return piping or in one of the 3" NPT connections in the Front Section of the boiler. See Figure 3.15.
   c) Pipe the valve discharge to a floor drain if available or install a nipple and a pipe cap to close off the discharge when not in use.

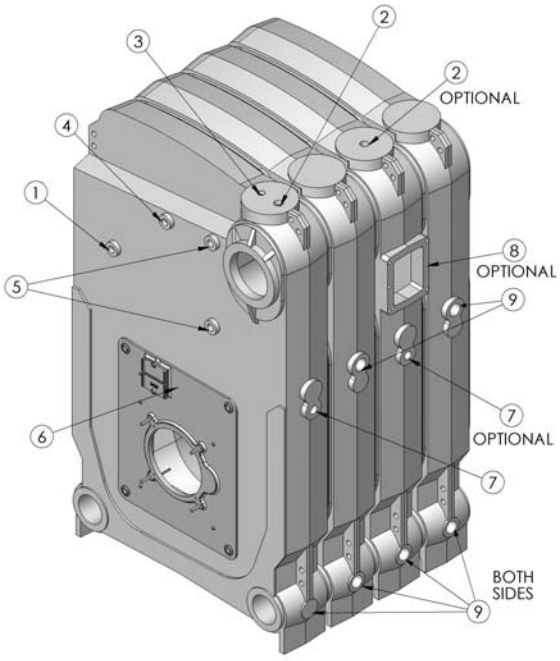

Figure 3.16: Control Connection Locations

3. Install Low Water Cut-off
   a) Mount an optional Float-type Low Water Cutoff (LWCO) in the tappings provided in the top and side of the Front Section or the Intermediate LWCO Section (this optional section is located at the third section from the front when supplied). See Figure 3.16 for the location of control connection tappings.
   b) Figure 3.17 shows a typical control configuration for a steam boiler and Figure 3.18 shows a typical control configuration for a water boiler.
   c) Provide piping for the Float-type LWCO such that the vertical position of the device is as recommended by the manufacturer.
      1. LWCOs that are piped too high will result in water carryover into the steam distribution system and will cause erratic operation of the boiler.
      2. LWCOs that are piped too low will expose the boiler crown sheet and cause damage to the boiler.
   d) For correct positions of common Float-type LWCO devices see Figures 3.19 through 3.22.
   e) Provide a blowdown valve for each Float-type LWCO. Pipe the valve discharge away from high traffic areas to a floor drain if possible. The blowdown valve is required for proper maintenance of the control.
   f) Maintain a height of 50 1/2" [1283 mm] from the bottom of the Angle Rails to the Normal Water Level.
   g) When using multiple Float-type Low Water Cutoffs, always pipe them as shown in Figure 3.17. Do not mount these devices on opposite ends of the boiler. This will cause erratic operation and nuisance shut downs of the boiler.

Table 3.4: Control Connections Sizes (See Figure 3.16)

Tap. No.	Tapping Size	Connection Description	
		Steam Boiler	Water Boiler
1	3/4" NPT	Optional Probe LWCO	–
2	1" NPT	Optional Water Column - (top)	Air Removal, Water Column (top)
3	1" NPT	Manual Reset High Limit, Operating Control & Steam Pressure Gauge	Optional Auxiliary Firing Rate, Limit Controls
4	3/4" NPT	–	Operating Control
5	3/4" NPT	Water Gauge Glass	Manual Reset High Limit (top) Temp/Press Gauge (bottom)
6	1/4" NPT	Overfire Pressure Tapping	Overfire Pressure Tapping
7	1" NPT	Water Column - (bottom)	Water Column - (bottom)
8	7⅛" x 5¼"	Tankless Heater	Tankless Heater
9	1½" NPT	Optional Inspection Tappings	Optional Inspection Tappings

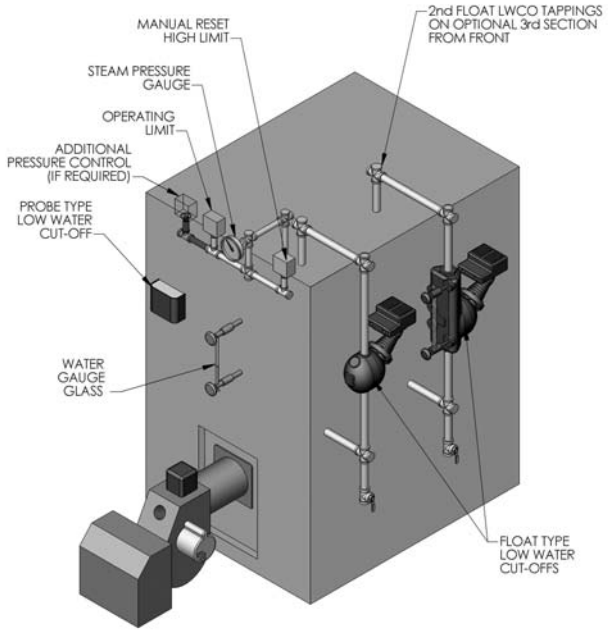

Figure 3.17: Steam Boiler Control Locations

4. Install Limit Controls:
   a) Steam Boilers: See Figure 3.17 for typical control locations for steam boilers. Additional limit and firing rate controls can be added to the 3/4" NPT piped header.
   b) Water Boilers: See Figure 3.18 for typical control locations for water boilers. Additional limit and firing rate controls can be added to the boiler supply piping.

5. Connect Control Wiring:
   a) Install all wiring in accordance with local codes, the National Electrical Code and other controlling agencies or governing bodies.

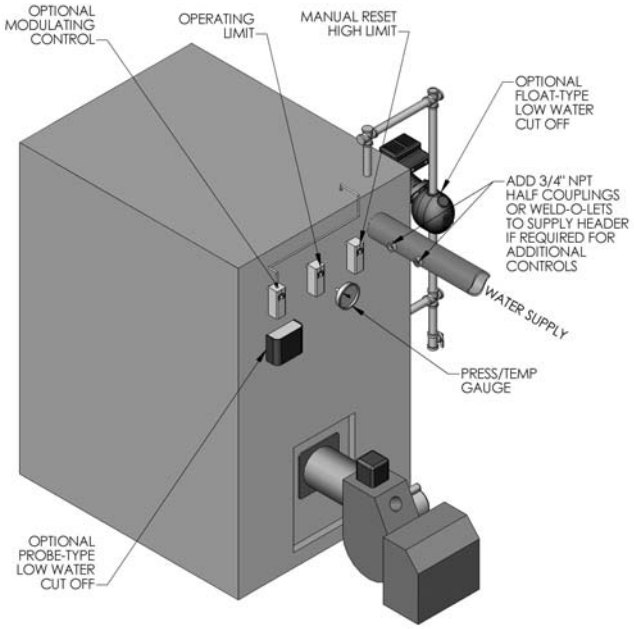

Figure 3.18: Water Boiler Control Locations

b) Use #14 gauge or heavier wire for supply wiring. Protect the circuit with a fused disconnect switch (supplied by others) and a grounded neutral.

c) Mount an electrical junction box on the boiler Front Panel for connection of boiler controls to the burner control panel.

⚠ NOTICE

The boiler/burner must be electrically grounded in accordance with the requirements of the local authority having jurisdiction, or in the absence of such requirements, with the current edition of the National Electric Code, ANSI/NFPA 70.

d) Follow the instructions in the Burner Manual and the wiring diagram supplied with the burner.

e) Install all line voltage (120 VAC) wiring in conduit.

f) Do not install single pole switches including safety controls in the neutral leg of a motor control circuit.

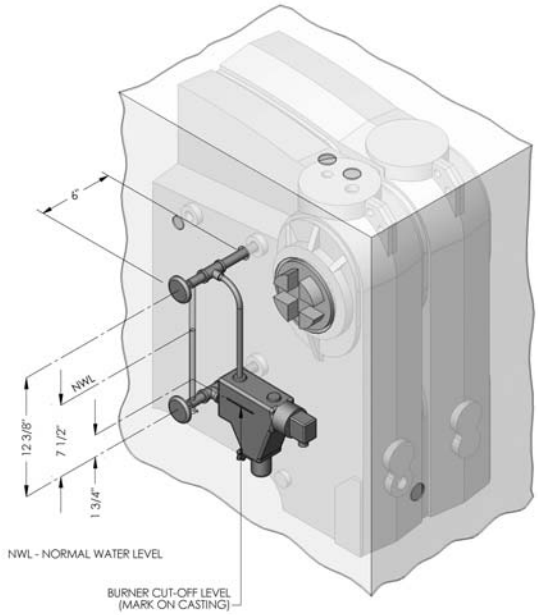

Figure 3.19: Optional Model 67PE2 Low Water Cutoff

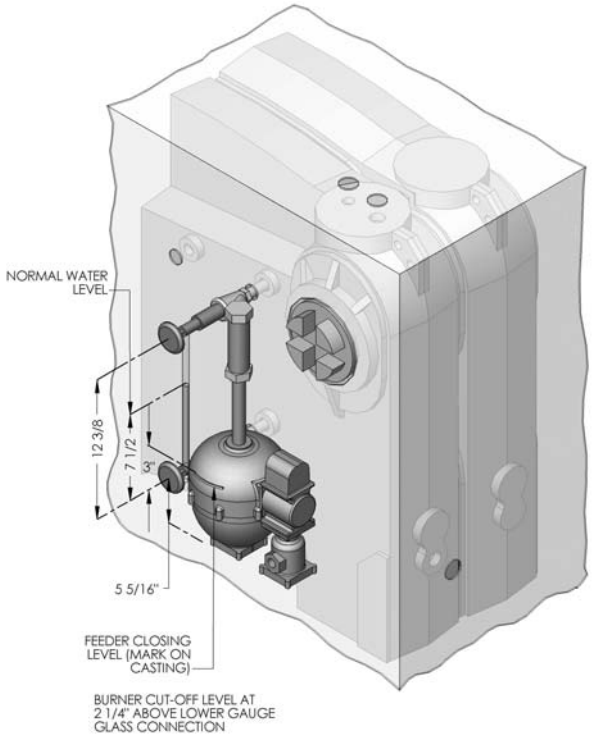

Figure 3.20: Optional Model 47-2 Low Water Cutoff/Feeder

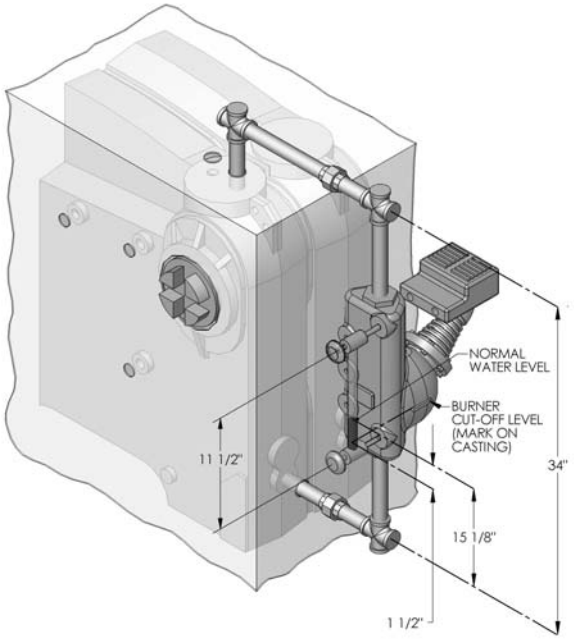

Figure 3.21: Optional Model 157 Low Water Cutoff/Pump Control

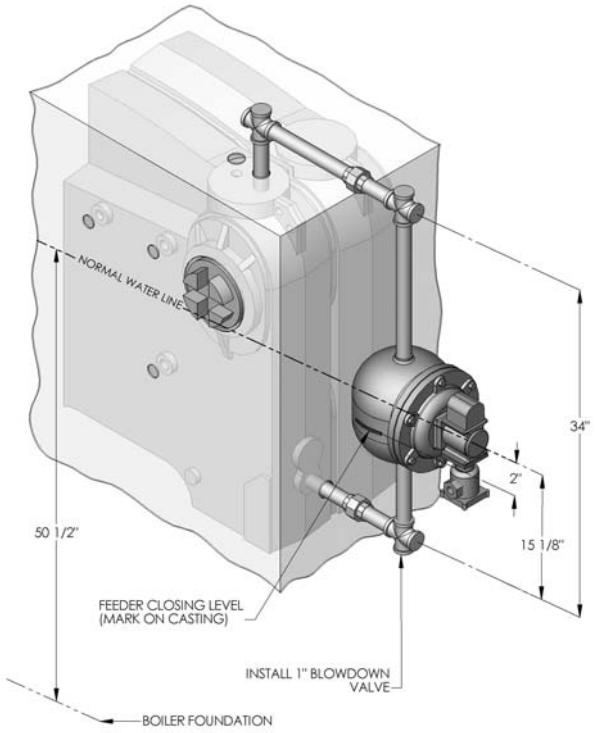

Figure 3.22: Optional Model 51-2 Low Water Cutoff/Feeder

4. OPERATION

A. STARTING THE BOILER

1. Check the piping.
   a) Water/Steam Piping
      1. The Boiler must have been hydrostatically tested.
      2. Check the attached piping for joint tightness.
      3. Continue monitoring as you proceed through start up.
   b) Gas Piping
      1. Make sure the gas system piping and the connections to the boiler Gas Control Train(s) have been leak tested.
      2. After the boiler is in operation, check the tightness of all joints in the boiler gas piping with a soap suds solution.
      3. Purge the gas piping of all air up to the boiler Gas Control Train.
   c) Oil Piping
      1. Check the oil piping visually. Make sure all joints are tight.
      2. When the burner is firing, check the suction line and return line pressures.
      3. If the pressure exceeds the allowable pressure in the Burner Manual or if the suction line vacuum is higher than allowable, correct the piping as needed to bring the suction line and return line pressures within acceptable range.
      4. Excess pressure can cause pump seal failures. Excess vacuum will cause fuel flow problems with the burner oil pump.

2. Fill the boiler.
   a) Steam: Fill the boiler to the normal water line.
      1. Gravity Systems and Pumped Return with Condensate Units – Fill to the normal water level mark on front jacket panel.
      2. Pumped Return with Boiler Feed Unit – Fill the boiler using the boiler feed unit. Fill level will depend on the control being used, but should be at the normal water level mark on front jacket panel.

3. Fill the boiler.
   a) Water: Fill the boiler and system.
      1. Fill the system with fresh water only. If the water hardness is high, use water treatment to reduce the deposition of minerals in the boiler.

⚠ CAUTION

Check the system for leaks and make sure the automatic fill valve (if used) and the expansion tank are operating correctly. Leakage or weeping of the relief valve will cause make-up water to be added to the system. Excessive make-up water will damage the boiler and system components due to liming and oxygen corrosion.

      2. If the system requires antifreeze, use only antifreeze designed for hydronic systems. These contain inhibitors to prevent corrosion of the boiler and system components. Do not use ethylene glycol or automotive antifreezes.
         - Make sure the antifreeze supplier can provide periodic inhibitor check service.
         - If automatic fill is used, the system will have to be checked periodically to make sure the antifreeze concentration has not been diluted below design level.
         - Local codes may require the use of a backflow preventer or manual fill only with separation from the city supply.
         - Consider the minimum temperature of potential exposure for the system when deciding on the antifreeze concentration. A concentration of 50% generally provides protection from freezing down to -30°F.
      3. Purge the air from the system.

4. Run burner check-out.
   a) Before firing the burner, slide the Slide Gate Damper on the rear flue box all the way down (full open).
   b) Follow the instructions in the Burner Manual for starting the burner, adjusting air openings and fuel rates. Perform ignition system and flame supervisory control test and checkout as described in the manual.
   c) After burner is set at rate, close the damper until the pressure reading at the test opening in the rear flue box is between 0.0" wc and 0.1" wc positive.
   d) When a barometric draft regulator is installed in the venting system, adjust the boiler damper for 0.0” wc pressure reading at the damper. Adjust the draft regulator for -0.05" wc draft between the boiler damper and the draft regulator.
   e) Adjust the burner as needed for a CO_2 reading of:

⚠ CAUTION

On installations with high draft, do not leave the boiler with a negative draft reading at the rear flue box or draft damper. High negative draft can pull the flame up into the boiler crown sheet and overheat the iron. This can result in cracked sections or shortened boiler life.

      1. Oil burners: 12% to 12.5% or 1% less than the level at which the smoke reading goes above a trace on the Bacharach scale.
      2. Natural gas burners: 9% to 10% with CO less than 50 ppm.

5. Check boiler controls.
   a) Limit and Operating Controls
      1. Lower the setting of each control until the burner shuts down.
   b) Low Water Cutoffs

1. Test probe type controls by using the Push-to-Test Button.
2. Test float type controls. ASME CSD-1 requires the control to be piped with Test-n-Check valves in order to allow isolation for test.

c) Follow additional instructions in the Burner Manual for proving the burner component operation.

d) Check all controls to make sure they function correctly.

e) After all controls have been proven, set the Operating and High Limit Controls to the set point desired.

B. CLEANING BOILER WATERWAYS

Steam Boilers

1. The boiler must be completely assembled before cleaning. The burner must be installed and made operational with the operating, limit and safety controls functional. Combustion should be adjusted to prevent sooting of the boiler flues.

2. Final burner adjustment is to be made after cleaning. Plug any unused boiler tappings and install gauge glass and safety valve.

3. Install a 2" skim valve and fittings in the 6" N.P.T. tapping of the front section. See Figure 4.1.

4. Clean the boiler as described below no later than one week after the initial start-up. Cleaning will be more effective if the boiler operates a day or two to loosen sediment and impurities in the system.

⚠ WARNING

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

5. The boiler must be cleaned to remove any accumulation of oil, grease, sludge, etc. that may be in the system. These substances can cause foaming and surging of the boiler water, producing unstable water line and water carryover to the system.

6. Connect a 2 inch drain line off of the skim valve, run to a point of safe discharge.

7. Close all valves to the system. Provide a means of continuous fresh water to the boiler for the cleaning process.

8. Use common washing soda (such as Arm and Hammer Super Washing Soda). Mix the soda with water in a 10 quart pail and pour into the boiler through the safety valve tapping. Use a proportion of one (1) pound of washing soda for each 800 square feet EDR net boiler rating.

9. Open the skim valve. Fill the boiler until water begins to flow out of the valve.

10. Turn burner on and allow the boiler water to heat up to just below steaming (180° to 200°F). Cycle the burner to maintain temperature during skimming. Do not allow the boiler to steam. Steaming mixes up the contaminants in the water instead of floating them at the surface.

11. Open the make-up water valve to continuously feed water to the boiler. Allow water to flow out the skim tapping.

12. Continue skimming the boiler until the water flowing from the skim tapping flows clear. This will take some time, possibly several hours for a dirty system.

13. After skimming is complete, close the skim valve and turn off the boiler.

14. Close the make-up water valve and open the boiler blowdown valves.

15. Drain the boiler completely then refill and drain again one or two times to make sure all of the soda has been washed out.

16. Restore piping to normal. Pipe a nipple and cap in the skim valve.

17. Note: If the gauge glass becomes dirty again, this indicates more contaminants have worked loose in the system. Repeat the cleaning and skimming process as needed to clean the system.

⚠ CAUTION

Do not leave the boiler unattended while firing during the cleaning cycle.

Take great care not to allow the water level to drop below the bottom of the gauge glass or to allow fresh water make-up to flow in too fast. This will avoid the possibility of causing the boiler sections to fracture.

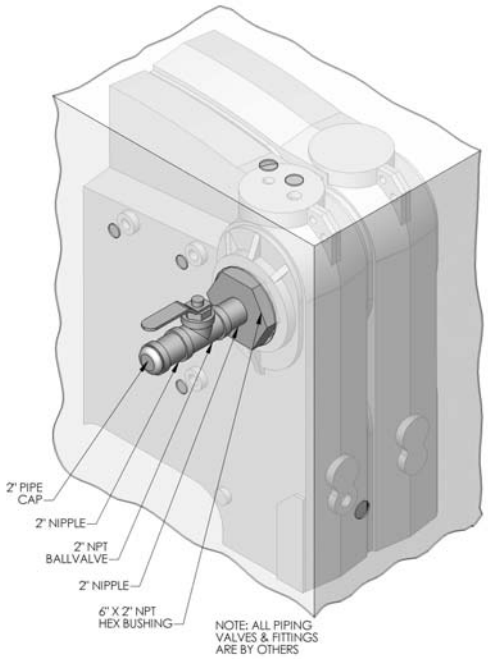

Figure 4.1: Skim Valve Piping

5. MAINTENANCE

⚠ WARNING

Do not store or allow combustible or flammable materials near the boiler. Substantial fire or explosion hazard could result, causing risk of personal injury, death or property damage.

Do not use this boiler if any part of it has been under water. Immediately call a qualified service technician to inspect the boiler. Any part of the control system, any gas control or any burner or gas component which has been under water must be replaced.

Should overheating occur or the fuel supply fail to shut off: Shut off the fuel supply at a location external to the boiler. Do not turn off or disconnect the electrical supply to the pump. Immediately call a qualified service technician to inspect the boiler for damage and defective components.

1. Placing boiler in operation.
   a) Start up the Burner/Boiler per the Burner Manual and the instructions in this manual on starting the boiler.
   b) Prove the correct operation of all controls on the boiler and burner as outlined below.
   c) Check the operation of the ignition and flame proving controls as described in the Burner Manual.
   d) Test the limit and operating controls to assure they are operating correctly.
   e) Inspect and test all low water cutoffs.
   f) Test the safety relief valve(s) using the procedure given by the valve manufacturer on the valve tag.
   g) Visually inspect the burner and pilot flames (if applicable).

2. To shut down the boiler.
   a) Turn off Burner.
   b) Open main line power disconnect switch to boiler/burner.
   c) Close fuel shut-off valves.
   d) To take boiler out of service if the boiler and system are not to be used when temperatures are below freezing:
      1. Shut off make-up water supply and drain the boiler and system completely.
      2. Open main line power disconnect switch to boiler/burner. Remove the fuses or secure the switch so that the power cannot be turned on accidentally.
      3. Do not use ethylene glycol antifreeze in a boiler system.
      4. Be certain that the boiler and system are refilled before returning to service. Follow the instructions in this manual and the burner instructions to operate.

⚠ CAUTION

Before servicing the boiler:

- **Turn off all electrical power to the boiler.**
- **Close the Gas Service Valve and Oil Shut-Off Valve.**
- **Allow the boiler to cool if it has been operating.**
- **Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.**

3. Maintenance – Annual
   a) **Before the start of each heating season**, inspect and make all necessary adjustments to insure proper boiler and burner operation. Use the maintenance and inspection procedures following.
   b) Inspect the Venting System
      1. Check the chimney or vent to make sure it is clean and free from cracks or potential leaks.
      2. All joints must be tight and sealed.
      3. The vent connector must extend into, but not beyond the inside edge of the chimney or vent.
   c) Inspect the Boiler Area
      1. The boiler area must be clean and free from combustible materials, gasoline or any other flammable liquids or vapors.
      2. The combustion air openings and the area around the boiler must be unobstructed.
   d) Inspect boiler flueways and burner for cleanliness. If cleaning is required, use the following procedure.
      1. Turn off all electrical power to the boiler.
      2. Remove left jacket panels. Remove cleanout cover plates on each flueway.
      3. Brush the boiler flue areas through cleanout openings.
      4. Remove the burner and burner mounting plate. Remove any scale or soot from the combustion chamber by means of vacuum cleaning or other available means.
      5. Reinstall the burner mounting plate, burner and all cleanout cover plates. Make sure all sealing rope and seals are in good condition. Replace sealing rope if necessary.
      6. Reinstall all jacket panels.
   e) Inspect the boiler and piping for signs of leaks. Check to see if there are signs of heavy make-up water addition to the system.

f) When placing boiler into operation, follow burner manual, all instructions supplied with the boiler and the instructions in this chapter.

g) Test the operation of all limit controls, float controls and ignition components.

4. Monthly Maintenance
   a) Inspect the burner and pilot flames.
   b) Inspect the boiler and system for any signs of leakage or excessive make-up water usage.
   c) Inspect and check the operation of the venting system.

5. Daily Maintenance
   a) Inspect the boiler area to make sure the area is free from combustible or flammable materials and that there are not obstructions to the flow of air to the boiler or combustion air openings to the room.
   b) Make sure there are no signs of abnormal operation, such as overfilling or leakage.

⚠ CAUTION

Be vary careful when adding water to a hot boiler. Add very slowly or, if possible, allow the boiler to cool naturally before adding water.

⚠ NOTICE

If an excessive loss of water occurs, check for a leak in the piping and correct the problem. Excessive make-up water will cause corrosion and damage to the boiler.

⚠ NOTICE

STEAM BOILERS: Do not place cold boilers in service on a hot steam line or severe damage may occur to boiler and piping. Keep cold boilers valved off line, fire until boiler reaches line pressure and then open steam main isolation valve. Steam entering a cold boiler cools quickly causing severe steam hammer. Boilers not valved off the system should have an overflow installed to prevent idle boilers from flooding. If this is not done, cold boilers must be heated to near steaming conditions (210°F) before the water level is dropped to normal.

WATER BOILERS: Avoid thermal shock of water boilers. Establish water circulation through the boiler before starting burner. Where hot standby is required, special piping and operation procedures are required. Consult your PB Heat, LLC representative.

6. REPAIR PARTS

Repair parts are available from your installer or by contacting PB Heat, LLC, 131 S. Church, Bally, PA 19503. Use the Figures and Tables on pages 32-33 to assist in ordering parts.

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

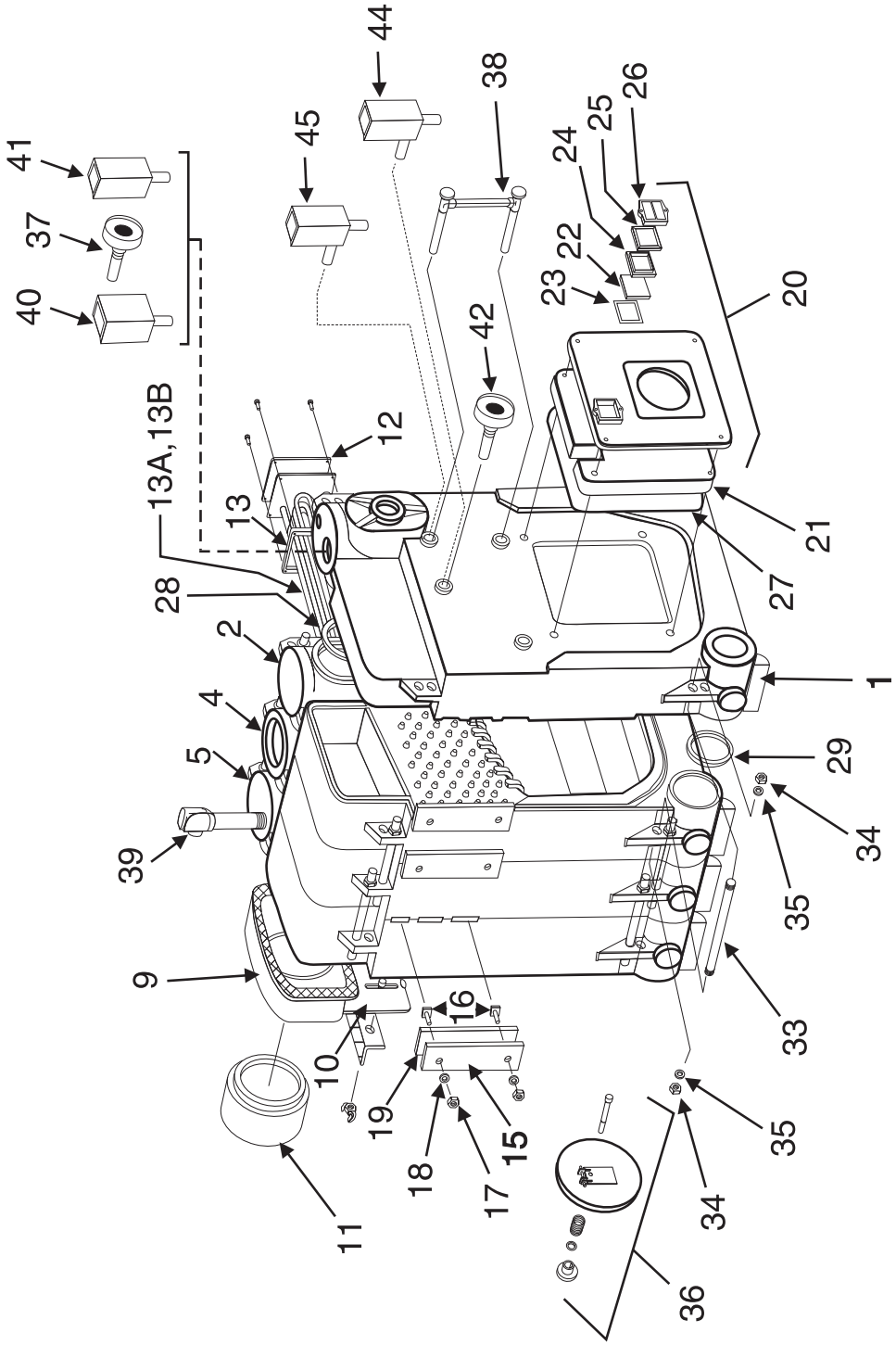

Figure 6.1: Boiler Assembly

Table 6.1: Series TC™ Repair Parts

Item No.	Description	Stock Code
1	Front Section	76000
	Intermediate Section	76002
2	Intermediate Section w/Heater Connection	76004
4	Intermediate Section w/Supply Connection	76003
5	Back Section	76001
Flue Collector Assembly includes: Flue Collector, Slide Damper and Angle Bracket		
9	Flue Collector Assembly (4-6 Section)	76060
	Flue Collector Assembly (7-8 Section)	76061
	Flue Collector Assembly (9-13 Section)	76062
	Flue Collector Assembly (14-18 Section)	76063
10	Slide Damper Only (4-8 Section)	7664
	Slide Damper Only (9-13 Section)	7679
	Slide Damper Only (14-18 Section)	7680
11	16" to 18" Increaser (17-18 Section)	76064
12	Tankless Coil Cover Plate Assembly	76075
13	Tankless Coil Cover Plate Gasket	74019
13A	Tankless Coil (8 GPM)	76073
13B	Tankless Coil (12 GPM)	76074
Cleanout Cover Plate Assembly Includes: Cleanout Plate, Insulation, Rope and Hardware		
15	Cleanout Cover Plate	7807
16	Cleanout Cover Plate Bolts	7622
17	Cleanout Cover Plate Nut	51556
18	Cleanout Cover Plate Washer	86
19	Cleanout Cover Plate Insulation	7808
Burner Mounting Plate Assembly Includes: Burner Mounting Plate Observation Port Glass, and Cover		
20	Burner Mounting Plate Assembly - 7-3/4"	76028
	Burner Mounting Plate Assembly - 8-1/2"	76023
	Burner Mounting Plate Assembly - 9"	76027
	Burner Mounting Plate Assembly - 10-1/4" (Web-JB2)	76026
	Burner Mounting Plate Assembly - 10-1/4" (GP-R10.1)	76025
	Burner Mounting Plate Assembly - 10-1/4" (STD)	76024
	Burner Mounting Plate Assembly - 12-1/2"	76022
–	Burner Mounting Plate Hardware	7653
21	Burner Insulating Block	76029

Item No.	Description	Stock Code
–	Burner Insulating Block Hardware	7720
22	Observation Glass Only	7648
23	Observation Glass Gasket	7650
24	Observation Glass Gasket	7649
25	Observation Glass Retainer	7651
26	Observation Cover Plate	7677
27	Rope Seal (3/8" x 7 ft. Long)	55521
28	Upper Graphite Port Connector	7655
29	Lower Graphite Port Connector	
–	Rope Seal (1/2" x 12-1/2 ft. Long) Between Sections	7964
33	5/8" x 11" Draw Rod	7621
34	5/8" Hex Nuts	51567
35	5/8" Washer	7289
–	Spray Adhesive	55485
36	Rear Observation Port Assembly	7632
–	Rear Observation Port Hardware	7722
Steam Trim and Controls		
37	3-1/2" Steam Gauge w/Internal Syphon	51769
38	Gauge Glass Set	50521
39	1-1/4" Safety Relief Valve 15 PSI (4-5 Section)	50508
	1-1/2" Safety Relief Valve 15 PSI (6-7 Section)	50509
	2" Safety Relief Valve 15 PSI (8-10 Section)	50503
	2-1/2" Safety Relief Valve 15 PSI (11-13 Section)	50504
	3" Safety Relief Valve 15 PSI (14-16 Section)	50505
	2-1/2" Safety Relief Valve 15 PSI (17-18 Section)	50511
40	PA404A Operating Control	50549
41	L4079B Limit Control	50681
Water Trim and Controls		
42	Pressure/Temperature Gauge	55737
	3/4" - 30 PSI Water Relief Valve (4 Section)	51300
39	1" - 30 PSI Water Relief Valve (4-6 Section)	51301
	1-1/4" - 30 PSI Water Relief Valve (7-10 Section)	51302
	1-1/2" - 30 PSI Water Relief Valve (11-14 Section)	51303
	2" - 30 PSI Water Relief Valve (15-18 Section)	51304
44	L4006A Operating Control	51702
45	L4006E Limit Control	50570
46	Water Return Yoke (Not Shown)	76072

7. BOILER RATINGS & DIMENSIONS

Table 7.1a: Series TC™ Boiler Ratings (U.S. Customary Units)

TC™ Series																
			Net I=B=R Ratings[1]			Gas		Oil				Water Content				
Model Number	Input[3] MBH	Gross Output MBH	Steam sqft	Steam MBH	Water MBH	Combustion Efficiency %	Thermal Efficiency %	Combustion Efficiency %	Thermal Efficiency %	Boiler HP	Oil Input[2] GPH	Steam (Gallons)	Water (Gallons)	Furnace Volume (Cu. Ft.)	Boiler Working Weight (Lbs)	Heating Surface (sqft)
TC-04	1154	900	2813	675	783	81.0	78.0	83.5	80.4	27	8.0	103.8	123.4	12.04	4215	81.2
TC-05	1491	1166	3645	875	1014	81.0	78.2	83.5	80.7	35	10.4	125.8	150.3	16.14	5038	105.3
TC-06	1827	1433	4537	1089	1246	81.0	78.4	83.5	80.8	43	12.6	147.8	177.2	20.24	5861	129.4
TC-07	2163	1699	5458	1310	1477	81.0	78.5	83.5	81.0	51	15.0	169.8	204.1	24.34	6684	153.5
TC-08	2499	1965	6357	1526	1709	81.0	78.6	83.5	81.1	59	17.4	191.8	231.0	28.44	7507	177.6
TC-09	2836	2232	7220	1733	1941	81.0	78.7	83.5	81.1	67	19.6	213.8	257.9	32.54	8331	201.7
TC-10	3172	2498	8081	1939	2172	81.0	78.8	83.5	81.2	75	22.0	235.8	284.8	36.64	9169	225.8
TC-11	3508	2764	8942	2146	2403	81.0	78.8	83.5	81.2	83	24.5	257.8	311.7	40.74	9992	249.9
TC-12	3844	3031	9805	2353	2636	81.0	78.8	83.5	81.3	91	26.5	279.8	338.6	44.84	10,815	274.0
TC-13	4180	3297	10,666	2560	2867	81.0	78.9	83.5	81.3	98	29.0	301.8	365.5	48.94	11,649	289.1
TC-14	4517	3563	11,526	2766	3098	81.0	78.9	83.5	81.3	106	31.5	323.8	392.4	53.04	12,467	322.2
TC-15	4853	3830	12,390	2974	3330	81.0	78.9	83.5	81.4	114	33.5	345.8	419.3	57.14	13,511	346.3
TC-16	5189	4096	13,251	3180	3562	81.0	78.9	83.5	81.4	122	36.0	367.8	446.2	61.24	14,375	370.4
TC-17	5525	4362	14,111	3387	3793	81.0	79.0	83.5	81.4	130	38.5	389.8	473.1	65.34	15,239	394.5
TC-18	5862	4629	14,975	3594	4025	81.0	79.0	83.5	81.4	138	40.5	411.8	500.0	69.44	16,103	418.6

Notes:
1. Net I=B=R Ratings are based on an allowance of 1.15 for Water Boilers. Net I=B=R Ratings for steam boilers are based on a pick-up factors as follows: TC-04 & TC-05, 1.333; TC-06, 1.316; TC-07, 1.297; TC-08 through TC-18, 1.288.
2. Burner oil input based on Commercial Standard #2 fuel oil with a heating value of 140,000 BTU/Gal.
3. Burner natural gas input based on natural gas with a heating value of 1,000 BTU/Cu. Ft. and a specific gravity of 0.60.

Table 7.1b: Series TC™ Boiler Ratings (SI Metric Units)

TC™ Series																
			Net I=B=R Ratings[1]			Gas		Oil				Water Content				
Model Number	Input[3], kW	Gross Output kW	Steam m^2	Steam kW	Water kW	Combustion Efficiency %	Thermal Efficiency %	Combustion Efficiency %	Thermal Efficiency %	Oil Input[2] l/hr	Steam Liters	Water Liters	Furnace Volume m^3	Boiler Working Weight kg	Heating Surface m^3	
TC-04	338.2	263.8	261	198	229	81.0	78.0	83.5	80.4	30.3	393	467	0.3409	1916	7.54	
TC-05	437.0	341.7	339	256	297	81.0	78.2	83.5	80.7	39.4	476	569	0.4570	2290	9.78	
TC-06	535.4	420.0	422	319	365	81.0	78.4	83.5	80.8	47.7	559	671	0.5731	2664	12.02	
TC-07	633.9	497.9	507	384	433	81.0	78.5	83.5	81.0	56.8	643	773	0.6892	3038	14.26	
TC-08	732.4	575.9	591	447	501	81.0	78.6	83.5	81.1	65.9	726	874	0.8053	3412	16.50	
TC-09	831.1	654.1	671	508	569	81.0	78.7	83.5	81.1	74.2	809	976	0.9214	3787	18.74	
TC-10	929.6	732.1	751	568	637	81.0	78.8	83.5	81.2	83.3	893	1078	1.0375	4168	20.98	
TC-11	1028.1	810.0	831	629	704	81.0	78.8	83.5	81.2	92.7	976	1180	1.1536	4542	23.22	
TC-12	1126.5	888.3	911	690	772	81.0	78.8	83.5	81.3	100.3	1059	1282	1.2697	4916	25.46	
TC-13	1225.0	966.2	991	750	840	81.0	78.9	83.5	81.3	109.8	1142	1383	1.3858	5295	26.86	
TC-14	1323.8	1044.2	1071	811	908	81.0	78.9	83.5	81.3	119.2	1226	1485	1.5019	5667	29.93	
TC-15	1422.2	1122.4	1151	871	976	81.0	78.9	83.5	81.4	126.8	1309	1587	1.6180	6141	32.17	
TC-16	1520.7	1200.4	1231	932	1044	81.0	78.9	83.5	81.4	136.3	1392	1689	1.7341	6534	34.41	
TC-17	1619.2	1278.4	1311	993	1112	81.0	79.0	83.5	81.4	145.7	1457	1791	1.8502	6927	36.65	
TC-18	1718.0	1356.6	1391	1053	1180	81.0	79.0	83.5	81.4	153.3	1559	1893	1.9663	7320	38.89	

Notes:
1. Net I=B=R Ratings are based on an allowance of 1.15 for Water Boilers. Net I=B=R Ratings for steam boilers are based on a pick-up factors as follows: TC-04 & TC-05, 1.333; TC-06, 1.316; TC-07, 1.297; TC-08 through TC-18, 1.288.
2. Burner oil input based on Commercial Standard #2 fuel oil with a heating value of 39,000 kJ/liter.
3. Burner natural gas input based on natural gas with a heating value of 37,234 KJ/m^3 and a specific gravity of 0.60.

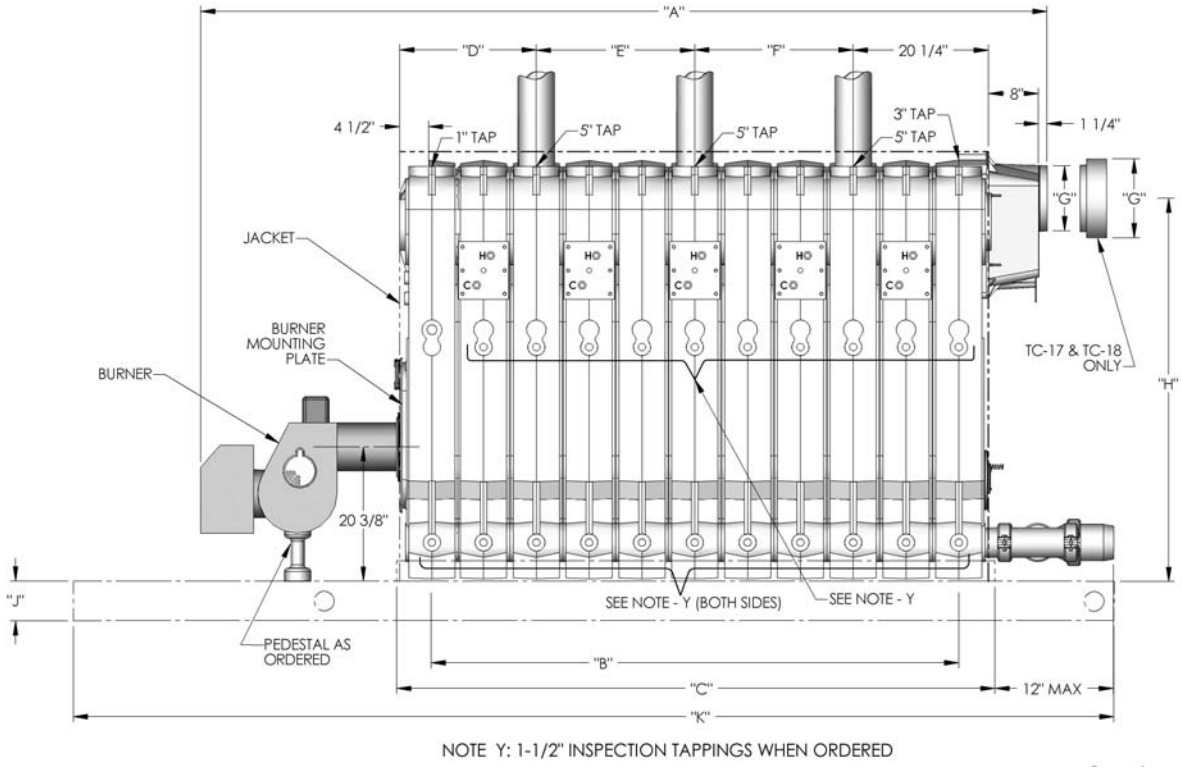

Figure 7.1: Boiler Dimensions – Side View

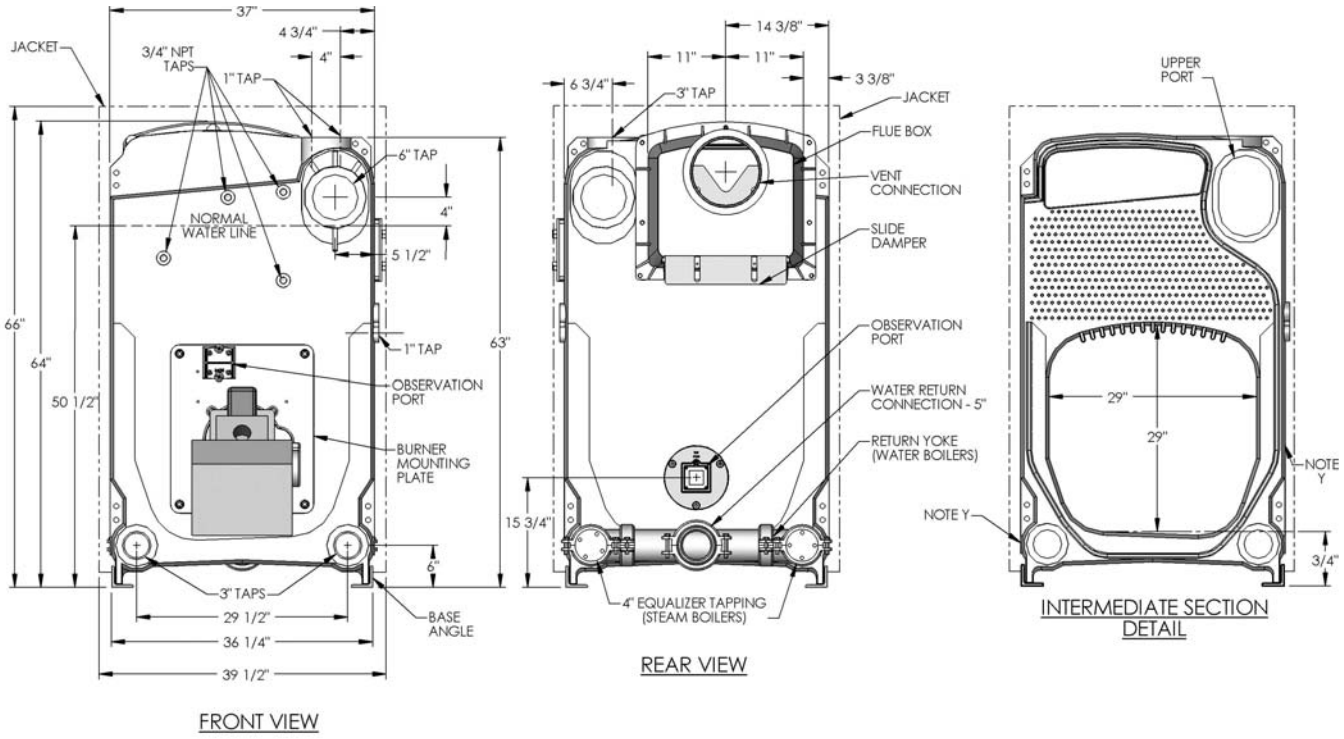

Figure 7.2: Boiler Dimensions – Auxiliary Views

Table 7.2a: Boiler Dimensions (U.S. Customary Units)

Boiler Model	Overall Length - "A"[2] (inch)				Optional Packaged Base Dimension "K" (inch)	Firebox Length "B" (inch)	Boiler Length "C" (inch)	Riser Tapping Locations			Dia. Vent Conn. "G" (inch)	Height Vent Conn. "H" (inch)	Base Height "J" (inch)
	Beckett	Carlin	Power Flame	Webster				"D" (inch)	"E" (inch)	"F" (inch)			
TC-04	64-1/4	62-1/4	71-3/4	66-1/2	91-1/4	23-5/16	33	12.5	-	-	10	57.625	6
TC-05	72-1/4	70-1/4	83-1/4	74-1/2	104-1/4	31-5/16	41	20.5	-	-	10	57.625	6
TC-06	80-1/4	80-1/4	91-1/4	82-1/2	112-1/4	39-5/16	49	12.5	16	-	10	57.625	6
TC-07	88-3/4	88-1/4	99-1/4	90-1/2	120-1/2	47-5/16	57	12.5	24	-	12	56.625	6
TC-08	96-3/4	96-1/4	107-1/4	98-1/2	128-1/2	55-5/16	65	12.5	32	-	12	56.625	6
TC-09	104-3/4	108-3/4	115-1/4	110-1/2	136-1/2	63-5/16	73	12.5	40	-	14	55.625	6
TC-10	116-1/2	116-3/4	128-1/4	118-1/2	144-3/4	71-5/16	81	20.5	40	-	14	55.625	6
TC-11	124-1/2	125-1/4	137-1/4	126-1/2	157-3/4	79-5/16	89	20.5	24	24	14	55.625	6
TC-12	132-1/2	133-1/4	145-1/4	134-1/2	166-1/4	87-5/16	97	20.5	24	32	14	55.625	6
TC-13	N/A	141-1/4	153-1/4	142-1/2	173-3/4	95-5/16	105	20.5	32	32	14	55.625	6
TC-14	N/A	149-1/4	161-1/4	150-1/2	181-3/4	103-5/16	113	20.5	32	40	16	54.625	6
TC-15	N/A	N/A	169-1/4	158-1/2	189-7/8	111-5/16	121	20.5	40	40	16	54.625	8
TC-16	N/A	N/A	177-1/4	166-1/2	198-1/4	119-5/16	129	20.5	48	40	16	54.625	8
TC-17	N/A	N/A	191-1/4	183-3/4	211-1/4	127-5/16	137	20.5	48	48	18	54.625	8
TC-18	N/A	N/A	199-1/4	191-3/4	219-1/4	135-5/16	145	20.5	56	48	18	54.625	8

Table 7.2b: Boiler Dimensions (SI Metric Units)

Boiler Model	Overall Length - "A"[2] (mm)				Optional Packaged Base Dimension "K" (mm)	Firebox Length "B" (mm)	Boiler Length "C" (mm)	Riser Tapping Locations			Dia. Vent Conn. "G" (mm)	Height Vent Conn. "H" (mm)	Base Height "J" (mm)
	Beckett	Carlin	Power Flame	Webster				"D" (mm)	"E" (mm)	"F" (mm)			
TC-04	1632	1581	1822	1689	2318	592	838	318	-	-	254	1464	152
TC-05	1835	1784	2115	1892	2648	795	1041	521	-	-	254	1464	152
TC-06	2038	2038	2318	2096	2851	999	1245	318	406	-	254	1464	152
TC-07	2254	2242	2521	2299	3061	1202	1448	318	610	-	305	1438	152
TC-08	2457	2445	2724	2502	3264	1405	1651	318	813	-	305	1438	152
TC-09	2661	2762	2927	2807	3467	1608	1854	318	1016	-	356	1413	152
TC-10	2959	2965	3181	3010	3677	1811	2057	521	1016	-	356	1413	152
TC-11	3162	3181	3486	3213	4007	2015	2261	521	610	610	356	1413	152
TC-12	3366	3385	3689	3416	4223	2218	2464	521	610	813	356	1413	152
TC-13	N/A	3588	3893	3620	4413	2421	2667	521	813	813	356	1413	152
TC-14	N/A	3791	4096	3823	4616	2624	2870	521	813	1016	406	1387	152
TC-15	N/A	N/A	4299	4026	4823	2827	3073	521	1016	1016	406	1387	203
TC-16	N/A	N/A	4502	4229	5036	3031	3277	521	1219	1016	406	1387	203
TC-17	N/A	N/A	4858	4667	5366	3234	3480	521	1219	1219	457	1387	203
TC-18	N/A	N/A	5061	4870	5569	3437	3683	521	1422	1219	457	1387	203

Notes:

1. When unit is assembled or packaged, add dimension “J” to all height dimensions.
2. Add 2-3/4" (70 mm) to TC-17 & TC-18 for flue outlet adapter.

Series TC™

Oil, Gas & Gas/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.

ASME

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