Series TC II™

Oil, Gas & Gas/Oil Boilers

Installation, Operation & Maintenance Manual

PeerlessBoilers.com

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USING THIS MANUAL

A. MANUAL ORGANIZATION

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

1. Preinstallation (Sections A through I)
2. Boiler Assembly (Sections A through J)
3. Installation (Sections A through K)
4. Operation (Sections A & 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 hazardous situation, which, if not avoided, will result in death or serious injury and major property damage.

⚠ WARNING

Indicates a hazardous situation, which, if not avoided, could result in death or serious injury and major property damage.

⚠ CAUTION

Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury, and minor property damage.

NOTICE

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

1. PREINSTALLATION

A. GENERAL

Series TCII™ 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 performed 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:
   a. ASME B & PV Code, Section IV – "Heating Boilers"
   b. ASME B & PV Code, Section VI – "Care and Operation of Heating Boilers"
   c. ANSI/NFPA 31 – "Installation of Oil Burning Equipment"
   d. ANSI Z223.1 – "National Fuel Gas Code"
   e. ANSI/NFPA 70 – "National Electric Code"
   f. ASME CSD-1 – "Controls & Safety Devices for Automatically Fired Boilers"
   g. 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.
   a. CAN1.3.1-77 (R1996) – "Industrial and Commercial Gas Fired Package Boilers"
   b. CSA B140.0-M87 – "General Requirements for Oil Burning Equipment"
   c. CSA B140.7.2-1967 – "Oil-Fired Steam and Hot Water Boilers for Commercial and Industrial Use"
   d. CAN/CSA C22.2 No.0-M91 – "General Requirements – Canadian Electrical Code Part II"
   e. 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 left side, front and flue box; and 24" (610 mm) on right side and rear of 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.

NOTICE

For water boilers a clearance of 36" is required from rear of boiler to allow installation of Balanced Temperature Return.

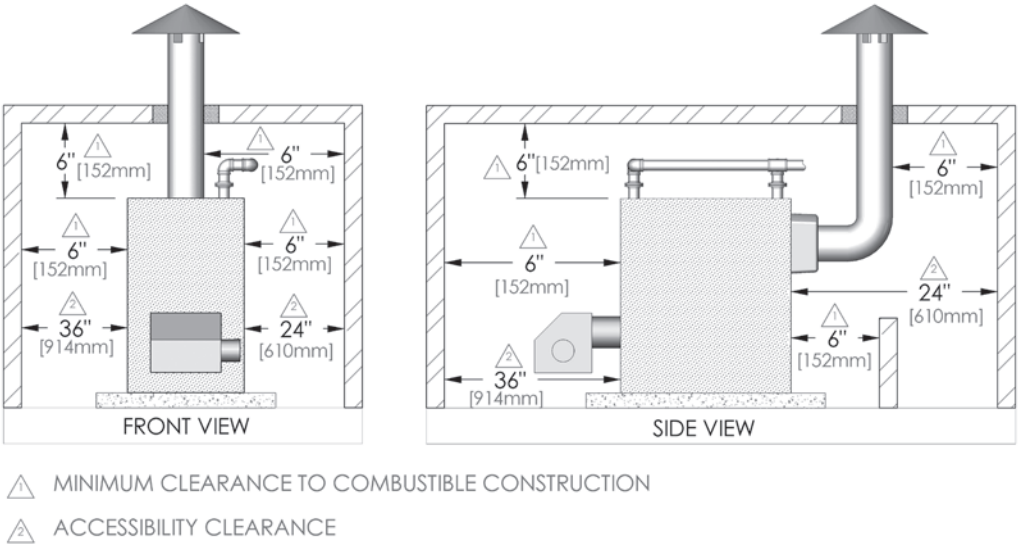


Figure 1.1: Clearance Requirements

2. The minimum clearances to combustible materials are as follows. See Figure 1.1.

   Right Side: 6 inches (152 mm)

   Left Side: 6 inches (152 mm)

   Rear of Jacket: 6 inches (152 mm)

   Front of Boiler: 6 inches (152 mm)

   Top of Jacket: 6 inches (152 mm)

   Vent/Chimney/Flue Collector: 6 inches (152 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

⚠ WARNING

This boiler must be supplied with combustion and ventilation air in accordance with the latest revision of Section 5.3, Air for Combustion & Ventilation, of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 for gas boilers or ANSI/NFPA 31 Installation of Oil Burning Equipment for oil boilers. Canadian installations must comply with CAN/CSA B149.1 Natural Gas and Propane Installation Code for gas boilers or CSA B140.7 Oil Burning Equipment for oil boilers. All applicable local building codes must be adhered to. Failure to provide adequate combustion air for this boiler can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

1. To operate properly and safely this boiler requires a continuous supply of air for combustion. An adequate supply of air must be available to replace the air used by the combustion process. NEVER store objects on or around the boiler.

⚠ CAUTION

Never use an exhaust fan in the boiler room. The boiler room must never be under a negative pressure or improper burner operation will occur!

NOTICE

Forced make-up air supplied to the boiler room must be approved by the local authorities. A minimum of 30 ft³/GAL (0.22 m³/L) for oil or 25 ft³/100 MBH (Therm) (0.024 m³/kW) for gas must be provided.

2. **All Air From Inside The Building:**
   If the boiler is to be located in a confined space minimum clearances of 24" (610 mm) must be maintained between the boiler and any adjacent construction. When installed in a confined space, two permanent openings communicating with an additional room(s) are required. The combined volume of these spaces must have sufficient volume to meet the criteria for an unconfined space. The total air requirements of all fuel burning equipment or any type of exhaust fan must be considered when making this determination.

   Each opening must have a minimum free area of 1 in²/1000 Btu/hr, 140 in²/GPH (2200 mm²/kW) based on the total input rating of ALL fuel burning equipment in the confined area. Each opening must be no less than 100 in² (64,516 mm²) in size. The upper opening must be within 12" (305 mm) of, but not less than 3" (76 mm) from, the top of the enclosure. The bottom opening must be within 12", (305 mm) of, but not less than 3" (76 mm) from the bottom of the enclosure.

3. **All Air From Outside The Building:**
   When installed in a confined space two permanent openings communicating directly with, or by ducts to, the outdoors or spaces that freely communicate with the outdoors must be present. The upper opening must be within 12" (305 mm) of, but not less than 3" (76 mm) from, the top of the enclosure. The bottom opening must be within 12" (305 mm) of, but not less than 3" (76 mm) from, the bottom of the enclosure.

   Where directly communicating with the outdoors or communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of 1 in²/4000 Btu/hr, 35 in²/GPH (550 mm²/kW) of the total input rating of all of the equipment in the enclosure.

   Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 in²/2000 Btu/hr, 70 in²/GPH (1100 mm²/kW) of the total input rating of all of the equipment in the enclosure. When ducts are used, they must have the same cross-sectional area as the free area of the opening to which they connect. When calculating the free area necessary to meet the make-up air requirements of the enclosure, consideration must be given to the blockage effects of louvers, grills and screens. Screens must have a minimum mesh size of 1/4 in (6.4mm). If the free area through a louver or grill is not known the louver or grille should be sized per Table 1.1.

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.

Table 1.1: Make-up Air Louver Sizing

Required Cross Sectional Louver Area (in²)						
Input (MBH)	1/4" (6.4 mm) Wire Screen		Metal Louvers 75% Free Area		Wooden Louvers 25% Free Area	
	in²	cm²	in²	cm²	in²	cm²
1000	250	1613	333	2148	1000	6452
1200	300	1936	400	2578	1200	7742
1400	350	2258	467	3007	1400	9033
1600	400	2581	533	3437	1600	10,323
1800	450	2903	600	3866	1800	11,614
2000	500	3226	666	4296	2000	12,904
2200	550	3549	733	4726	2200	14,194
2400	600	3871	800	5155	2400	15,485
2600	650	4194	867	5585	2600	16,775
2800	700	4516	934	6014	2800	18,066
3000	750	4838	1000	6452	3000	19,354
3200	800	5162	1066	6874	3200	20,646
3400	850	5484	1134	7303	3400	21,937
3600	900	5807	1200	7733	3600	23,227
3800	950	6129	1267	8162	3800	24,518
4000	1000	6452	1334	8592	4000	25,808
4200	1050	6775	1400	9022	4200	27,098
4400	1100	7097	1467	9451	4400	28,389
4600	1150	7420	1533	9881	4600	29,679
4800	1200	7742	1600	10,310	4800	30,970

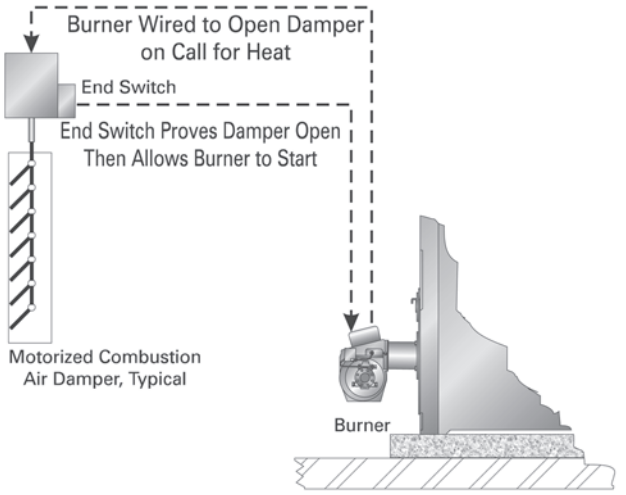


Figure 1.2: Motorized Vent Damper Interlock

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 TCII-04 through TCII-16 and 18" (457 mm) diameter for Model TCII-17 & TCII-18 Boilers.
      The vent sizes for all Series TC II™ 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:
      i. Vent terminations must be extended to three feet above expected snow accumulation. See Figure 1.3.
      ii. 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:
      i. Support the vent system independently of the boiler flue connection.
      ii. 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 1/4" 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.

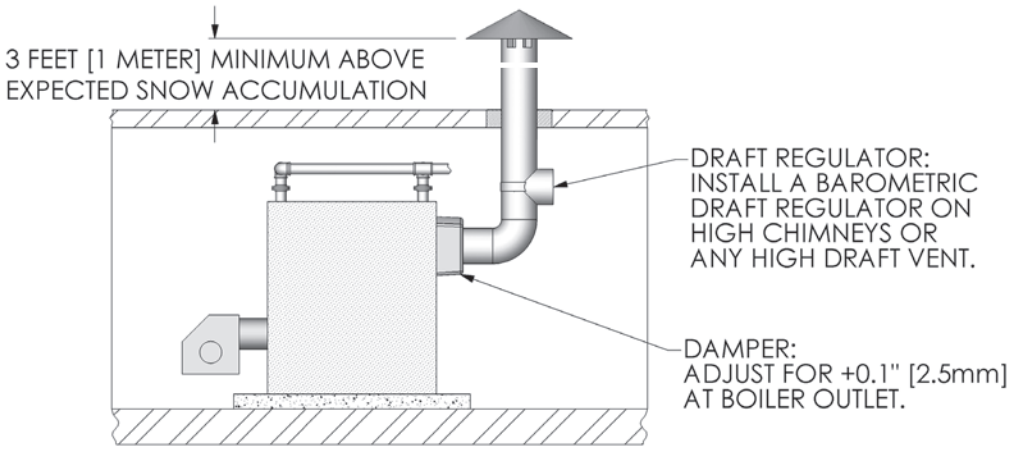


Figure 1.3: Typical Vent Termination

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.
   i. This is necessary to prevent negative draft conditions in the boiler.
   ii. 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 1.2a and 1.2b.

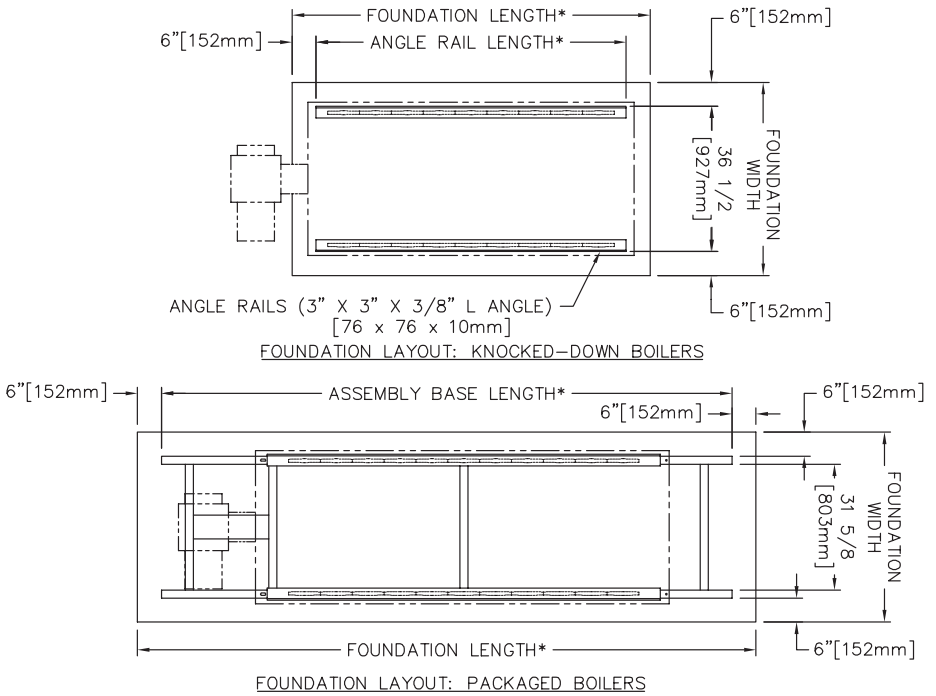


Figure 1.4: Foundation Layout

Table 1.2a: 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)
TCII-04	34.19	48.5	46.25	66.19	48.5	78.25
TCII-05	42.25	48.5	54.25	74.25	48.5	86.25
TCII-06	50.31	48.5	62.50	82.31	48.5	94.50
TCII-07	58.38	48.5	70.50	90.38	48.5	102.50
TCII-08	66.44	48.5	78.50	98.44	48.5	110.50
TCII-09	74.50	48.5	86.50	106.50	48.5	118.50
TCII-10	82.56	48.5	95.00	114.56	48.5	127.00
TCII-11	90.63	48.5	103.00	122.63	48.5	135.00
TCII-12	98.69	48.5	111.00	130.69	48.5	143.00
TCII-13	106.75	48.5	119.00	138.75	48.5	151.00
TCII-14	114.81	48.5	127.00	146.81	48.5	159.00
TCII-15	122.88	48.5	135.00	154.88	48.5	167.00
TCII-16	130.94	48.5	143.00	162.94	48.5	175.00
TCII-17	139.00	48.5	151.00	171.00	48.5	183.00
TCII-18	147.06	48.5	159.00	179.06	48.5	191.00

Table 1.2b: 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)
TCII-04	868	1232	1175	1681	1232	1988
TCII-05	1073	1232	1378	1886	1232	2191
TCII-06	1278	1232	1588	2091	1232	2400
TCII-07	1483	1232	1791	2296	1232	2604
TCII-08	1688	1232	1994	2500	1232	2807
TCII-09	1892	1232	2197	2705	1232	3010
TCII-10	2097	1232	2413	2910	1232	3226
TCII-11	2302	1232	2616	3115	1232	3429
TCII-12	2507	1232	2819	3320	1232	3632
TCII-13	2711	1232	3023	3524	1232	3835
TCII-14	2916	1232	3226	3729	1232	4039
TCII-15	3121	1232	3429	3934	1232	4242
TCII-16	3326	1232	3632	4139	1232	4445
TCII-17	3531	1232	3835	4343	1232	4648
TCII-18	3735	1232	4039	4548	1232	4851

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.

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 1/2" (13 mm) thick, with aluminum backing. 1/2" (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.

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. In some cases, the Burner and/or Gas Train may be shipped separately.
   c. The Optional Barometric Draft Damper is shipped in a separate carton.

2. Knocked-down Boilers: All components are shipped for field assembly. See Tables 1.3a and 1.3b for standard components. See Tables 1.4 through 1.9 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 1.3a: Series TCII™ 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	Clean Out Cover Carton		Steam Cover Plate Carton	Flue Rod Baffle Carton	Burner Plate Insulation Carton	Jacket Panels						
			Front	Rear	Plain Intermediate	Supply Intermediate	Flue Collector	Outlet Adapter											Jacket Channel Carton	Jacket Front/Back Carton	Jacket Top Carton	Jacket Left/Right Carton	Jacket Left Carton	Jacket Right Carton
TCII-04	Qty.	2	1	1	1	1	1		1	1	1	1	1	1		1	3	1	1	1	1	1		
	SCN	74004	76014	76015	76002	76003	76060		88512	77010	76156	76053	76070	76144		76091	76143	76029	76164	76100	76104	76119		
TCII-05	Qty.	2	1	1	2	1	1		1	1	1	1	1	1		1	4	1	1	1	1	1		
	SCN	74005	76014	76015	76002	76003	76060		88512	77010	76157	76054	76070	76145		76091	76143	76029	76165	76100	76105	76120		
TCII-06	Qty.	2	1	1	2	2	1		1	1	1	1	1	1		1	5	1	1	1	1	1		
	SCN	74006	76014	76015	76002	76003	76060		88512	77011	76158	76055	76070	76146		76091	76143	76029	76166	76100	76106	76121		
TCII-07	Qty.	2	1	1	3	2	1		1	1	2	2	1	2		1	6	1	1	1	1	1		
	SCN	74007	76014	76015	76002	76003	76061		88512	77011	76156	76053	76070	76144		76091	76143	76029	76167	76100	76107	76122		
TCII-08	Qty.	2	1	1	4	2	1		1	1	1	1	1	1	1	1	7	1	1	1	1	1		
	SCN	74008	76014	76015	76002	76003	76061		88512	77012	76156	76053	76070	76144	76145	76091	76143	76029	76168	76100	76108	76123		
TCII-09	Qty.	2	1	1	5	2	1		1	1	2	2	1	2		1	8	1	1	1	1	1		
	SCN	74009	76014	76015	76002	76003	76062		88512	77012	76157	76054	76071	76145		76091	76143	76029	76169	76100	76109	76124		
TCII-10	Qty.	2	1	1	6	2	1		1	1	1	1	1	1	1	1	9	1	1	1	1	1		
	SCN	74010	76014	76015	76002	76003	76062		88512	77012	76157	76054	76071	76145	76146	76091	76143	76029	76170	76100	76110	76125		
TCII-11	Qty.	2	1	1	6	3	1		1	1	2	2	1	2		1	10	1	1	1	1	1		
	SCN	74011	76014	76015	76002	76003	76062		88512	77013	76158	76055	76071	76146		76091	76143	76029	76171	76100	76111	76126		
TCII-12	Qty.	2	1	1	7	3	1		1	1	1	1	1	2	1	1	11	1	1	1	1	1		
	SCN	74012	76014	76015	76002	76003	76062		88512	77013	76156	76053	76071	76144	76146	76091	76143	76029	76172	76100	76112	76127		
TCII-13	Qty.	2	1	1	8	3	1		1	1	3	3	1		3	1	12	1	1	1	1		1	1
	SCN	74013	76014	76015	76002	76003	76062		88512	77013	76157	76054	76071	76145		76091	76143	76029	76173	76100	76113		76128	76134
TCII-14	Qty.	2	1	1	9	3	1		1	1	1	1	1	2	1	1	13	1	1	1	1		1	1
	SCN	74014	76014	76015	76002	76003	76063		88512	77014	76156	76053	76071	76144	76146	76091	76143	76029	76174	76100	76114		76129	76135
TCII-15	Qty.	2	1	1	10	3	1		1	1	1	2	1	2	1	1	14	1	1	1	1		1	1
	SCN	74015	76014	76015	76002	76003	76063		88512	77014	76157	76054	76071	76146	76145	76091	76143	76029	76175	76100	76115		76130	76136
TCII-16	Qty.	2	1	1	11	3	1		1	1	3	3	1	3		1	15	1	1	1	1		1	1
	SCN	74016	76014	76015	76002	76003	76063		88512	77014	76158	76055	76071	76146		76091	76143	76029	76176	76100	76116		76131	76137
TCII-17	Qty.	2	1	1	12	3	1	1	1	1	4	4	1		4	1	16	1	1	1	1		1	1
	SCN	74017	76014	76015	76002	76003	76063	76064	88512	77015	76157	76054	76071	76145		76091	76143	76029	76177	76100	76117		76132	73168
TCII-18	Qty.	2	1	1	13	3	1	1	1	1	3	3	1	3	1	1	17	1	1	1	1		1	1
	SCN	74018	76014	76015	76002	76003	76063	76064	88512	77015	76157	76158	76054	76055	76071	76145	76146	76091	76178	76100	76118		76133	76139

Table 1.3b: Series TCII™ Shipping List (Water Boilers)

Boiler Model Number		Angle Rail	Standard Sections			Flue Outlet		Controls Carton	Trim Carton	Balanced Temperature Return Carton	Section Assembly Cartons	Graphite Port Connector Carton	Miscellaneous Parts Carton	Clean Out Cover Carton	Flue Rod Baffle Carton	Burner Plate Insulation Carton	Jacket Panels					
			Front	Rear	Plain Intermediate	Flue Collector	Outlet Adapter										Jacket Channel Carton	Jacket Front/Back Carton	Jacket Top Carton	Jacket Left/Right Carton	Jacket Left Carton	Jacket Right Carton
TCII-04	Qty.	2	1	1	2	1		1	1	1	1	1	1	1	3	1	1	1	1	1		
	SCN	74004	76014	76015	76002	76060		78510	77016	76076	76156	76053	76070	76144	76143	76029	76164	76100	76104	76119		
TCII-05	Qty.	2	1	1	3	1		1	1	1	1	1	1	1	4	1	1	1	1	1		
	SCN	74005	76014	76015	76002	76060		78510	77017	76077	76157	76054	76070	76145	76143	76029	76165	76100	76105	76120		
TCII-06	Qty.	2	1	1	4	1		1	1	1	1	1	1	1	5	1	1	1	1	1		
	SCN	74006	76014	76015	76002	76060		78510	77017	76078	76158	76055	76070	76146	76143	76029	76166	76100	76106	76121		
TCII-07	Qty.	2	1	1	5	1		1	1	1	2	2	1	2	6	1	1	1	1	1		
	SCN	74007	76014	76015	76002	76061		78510	77018	76079	76156	76053	76070	76144	76143	76029	76167	76100	76107	76122		
TCII-08	Qty.	2	1	1	6	1		1	1	1	1	1	1	1	7	1	1	1	1	1		
	SCN	74008	76014	76015	76002	76061		78510	77018	76080	76156	76053	76070	76144	76143	76029	76168	76100	76108	76123		
TCII-09	Qty.	2	1	1	7	1		1	1	1	2	2	1	2	8	1	1	1	1	1		
	SCN	74009	76014	76015	76002	76062		78510	77018	76081	76157	76054	76071	76145	76143	76029	76169	76100	76109	76124		
TCII-10	Qty.	2	1	1	8	1		1	1	1	1	1	1	1	9	1	1	1	1	1		
	SCN	74010	76014	76015	76002	76062		78510	77018	76082	76157	76054	76071	76145	76143	76029	76170	76100	76110	76125		
TCII-11	Qty.	2	1	1	9	1		1	1	1	2	2	1	2	10	1	1	1	1	1		
	SCN	74011	76014	76015	76002	76062		78510	77019	76083	76158	76055	76071	76146	76143	76029	76171	76100	76111	76126		
TCII-12	Qty.	2	1	1	10	1		1	1	1	1	1	1	2	11	1	1	1	1	1		
	SCN	74012	76014	76015	76002	76062		78510	77019	76084	76156	76053	76071	76144	76143	76029	76172	76100	76112	76127		
TCII-13	Qty.	2	1	1	11	1		1	1	1	3	3	1		12	1	1	1	1		1	1
	SCN	74013	76014	76015	76002	76062		78510	77019	76085	76157	76054	76071	76145	76143	76029	76173	76100	76113		76128	76134
TCII-14	Qty.	2	1	1	12	1		1	1	1	1	1	1	1	13	1	1	1	1		1	1
	SCN	74014	76014	76015	76002	76063		78510	77019	76086	76156	76053	76071	76144	76143	76029	76174	76100	76114		76129	76135
TCII-15	Qty.	2	1	1	13	1		1	1	1	1	1	1	1	14	1	1	1	1		1	1
	SCN	74015	76014	76015	76002	76063		78510	77020	76087	76157	76054	76071	76146	76143	76029	76175	76100	76115		76130	76136
TCII-16	Qty.	2	1	1	14	1		1	1	1	3	3	1	3	15	1	1	1	1		1	1
	SCN	74016	76014	76015	76002	76063		78510	77020	76088	76158	76055	76071	76146	76143	76029	76176	76100	76116		76131	76137
TCII-17	Qty.	2	1	1	15	1	1	1	1	1	4	4	1	4	16	1	1	1	1		1	1
	SCN	74017	76014	76015	76002	76063	76064	78510	77020	76089	76157	76054	76071	76145	76143	76029	76177	76100	76117		76132	76138
TCII-18	Qty.	2	1	1	16	1	1	1	1	1	3	3	1	3	17	1	1	1	1		1	1
	SCN	74018	76014	76015	76002	76063	76064	78510	77020	76090	76157	76054	76071	76145	76143	76029	76178	76100	76118		76133	76139

Table 1.4a: Burner Mounting Plates

Boiler Model	Beckett		Carlin		Power Flame (Gas)		Power Flame (Oil)		Power Flame (Gas/Oil)	
	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
TCII-04	76027	CF1400	76027	702CRD	76027	J50A	76028	C1	76028	C1
TCII-05		CF2300								
TCII-06				801CRD			76027	C2	76027	C2
TCII-07										
TCII-08		CF2500				C2				
TCII-09				1050FFD						
TCII-10										
TCII-11	76025	CF3500	76025	1150FFD	76025	C3	76025	C3	76025	C3
TCII-12										
TCII-13										
TCII-14										
TCII-15										
TCII-16										
TCII-17					76022	C4	76022	C4	76022	C4
TCII-18										

Table 1.4b: Burner Mounting Plate

Boiler Model	Beckett (Gas)		Riello (Oil)			Riello (Gas)			Riello (Gas/Oil)		
	Mounting Plate Stock Code	Burner Model	Mounting Plate Stock Code	Burner Model	*Riello Adapter Plate	Mounting Plate Stock Code	Burner Model	*Riello Adapter Plate	Mounting Plate Stock Code	Burner Model	*Riello Adapter Plate
TCII-04	76027	CG15	76027	RL 28/2	C7000411	76027	RS28	C7000411	76027	RLS28	C7000418
TCII-05		CG25		RL 38/2			RS38			RLS38	
TCII-06				RL 50/2			RS50			RLS50	C7000411
TCII-07											
TCII-08				RL 70/2	C7000413		RS70	C7000413		RLS70	C7000413
TCII-09		CG50									
TCII-10				RL 100/M	C7000415		RS100/M			RLS100	
TCII-11											
TCII-12											
TCII-13											
TCII-14											
TCII-15				RL 130/M			RS130/M	C7000415		RLS130	
TCII-16											
TCII-17											
TCII-18				RL 190/M	C7000416		RS190/M	C7000416			

*Riello adapter plates must be ordered separately from Riello.

Table 1.5: Standard & Optional Sections

Section	Standard	With Inspection Tappings
	Stock Code	Stock Code
Front	76014	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	76015	76006

Table 1.6: 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

Table 1.7: Controls Cartons

Description	Stock Code
Steam Controls Carton – L404F/L4079B	88511
Steam Controls Carton – PA404A/L4079B	88512
Water Controls Carton – L4006A/L4006E	78510

Table 1.8: Steam Trim Cartons

Description	15 PSI (103 kPa) Steam
	Stock Code
Steam Trim Carton TCII-04	77010
Steam Trim Carton TCII-05	
Steam Trim Carton TCII-06	77011
Steam Trim Carton TCII-07	
Steam Trim Carton TCII-08	77012
Steam Trim Carton TCII-09	
Steam Trim Carton TCII-10	
Steam Trim Carton TCII-11	77013
Steam Trim Carton TCII-12	
Steam Trim Carton TCII-13	
Steam Trim Carton TCII-14	77014
Steam Trim Carton TCII-15	
Steam Trim Carton TCII-16	
Steam Trim Carton TCII-17	77015
Steam Trim Carton TCII-18	

Table 1.9: 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 TCII-04	77016	77054	77085
Water Trim Carton TCII-05	77017		
Water Trim Carton TCII-06		77055	77086
Water Trim Carton TCII-07	77018		
Water Trim Carton TCII-08			
Water Trim Carton TCII-09			77087
Water Trim Carton TCII-10		77056	
Water Trim Carton TCII-11	77019		
Water Trim Carton TCII-12			
Water Trim Carton TCII-13			77088
Water Trim Carton TCII-14			
Water Trim Carton TCII-15	77020		
Water Trim Carton TCII-16		77057	
Water Trim Carton TCII-17			77089
Water Trim Carton TCII-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 1.3a and 1.3b and packing slip to assure that all shipping level items are received. Inspect all packages for shipping damage.
3. Continue to Section 2.G, Burner Mounting Plate Installation.

C KNOCKDOWN BOILERS

1. Check the component list in Tables 1.3a and 1.3b 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. Grease floor angle rails for ease of assembly.
5. 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).

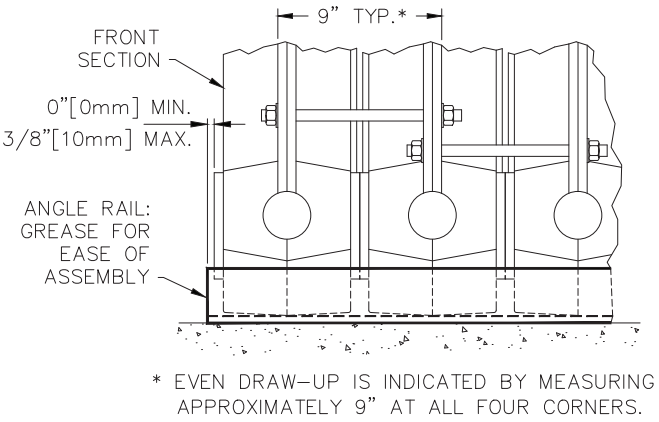


Figure 2.2: Front Section Placement

6. The Front Section should be supported vertically as shown in Figure 2.3.

⚠ WARNING

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

7. Inspect the port connector recesses and rope groove on the cast iron rear section for dirt and obstructions.
8. Clean the port connector recesses with a stiff wire brush.
9. Apply the spray-on adhesive supplied with the boiler to the rope groove. This will hold the rope gasket in place during assembly.

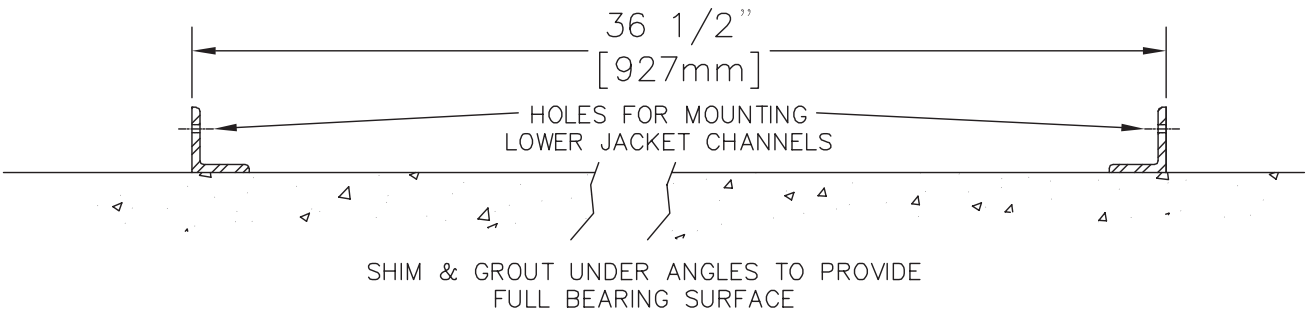


Figure 2.1: Angle Rail Placement

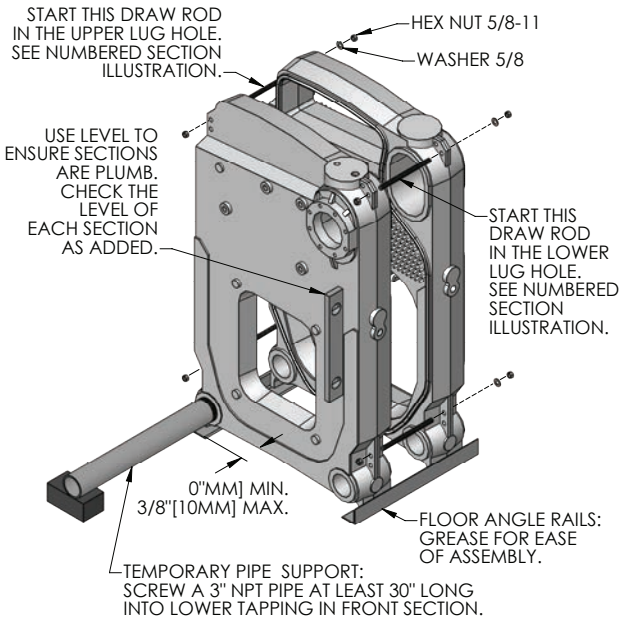


Figure 2.3: Front Section Support

10. 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.

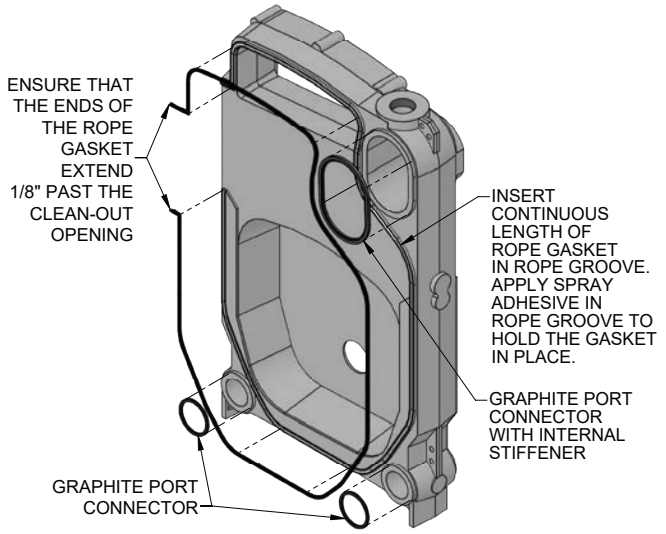


Figure 2.4: Rope Gasket and Port Connector Installation

11. 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 connector is damaged it must be replaced.

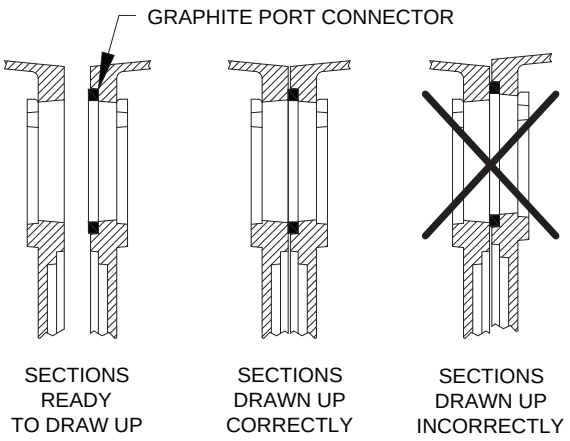


Figure 2.5: Section Alignment

12. 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.

13. 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.

14. 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.

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

16. 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.

17. Check the floor angles and sections for alignment.

18. Gently tighten the draw rods in the sequence described in Figure 2.6 and Table 2.1. Make sure the port connectors stay inside the boiler ports. Do not completely tighten any draw rod out of sequence.

    Verify the sections are drawing up evenly by periodically measuring the span between draw rod nuts/lugs at each corner. The distances should not vary by more than 1/4" and should measure approximately 9" when draw-up is complete as shown in Figure 2.2.

    Torques shown are approximate - drawing evenly is more important than actual torques. Once the sections are metal to metal additional torque will not improve the seal. If the torques shown in Table 2.1 are not sufficient to draw-up the sections evenly, there is an alignment issue that must be corrected. Do not exceed 125 ft. lb. on any draw rod.

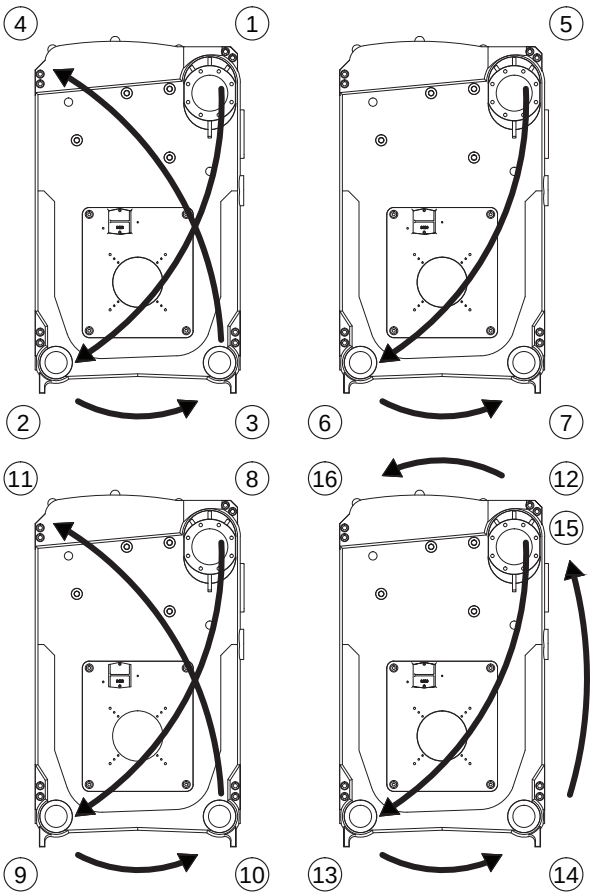


Figure 2.6: Draw-up Torque Sequence

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

Sequence No.	Draw Rod Position	Approximate Torque *	
		(ft. lbs.)	(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

* Approximate torque required to draw-up evenly. Drawing sections evenly and in sequence is more important than actual torque.
** Do not exceed 125 ft. lb. on any draw rod.

Table 2.2a: Steam Section Arrangement

TCII-04	F	T	H_L	B													
TCII-05	F	H	T_L	H	B												
TCII-06	F	T	H_L	T	H	B											
TCII-07	F	T	H_L	P	T	H	B										
TCII-08	F	T	H_L	P	H	T	H	B									
TCII-09	F	T	H_L	P	H	P	T	H	B								
TCII-10	F	H	T_L	H	P	H	P	T	H	B							
TCII-11	F	H	T_L	H	P	T	P	P	T	H	B						
TCII-12	F	H	T_L	H	P	T	H	P	H	T	H	B					
TCII-13	F	H	T_L	H	P	H	T	H	P	H	T	H	B				
TCII-14	F	H	T_L	H	P	H	T	H	P	H	P	T	H	B			
TCII-15	F	H	T_L	H	P	H	P	T	H	P	H	P	T	H	B		
TCII-16	F	H	T_L	H	P	H	P	H	T	H	P	P	H	T	H	B	
TCII-17	F	H	T_L	H	P	H	P	H	T	H	P	H	P	H	T	H	B
TCII-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 & Balanced Temperature Return Support Bracket Locations

	Section Location Numbered From Front to Back																	
TCII-04	F	SB	H	B														
TCII-05	F	H	SB	H	B													
TCII-06	F	SB	H	P	H	B												
TCII-07	F	SB	H	P	P	H	B											
TCII-08	F	P	H	SB	H	P	H	B										
TCII-09	F	P	H	SB	H	P	P	H	B									
TCII-10	F	H	P	H	SB	H	P	P	H	B								
TCII-11	F	H	P	H	SB	P	P	P	P	H	B							
TCII-12	F	H	SB	H	P	P	H	SB	H	P	H	B						
TCII-13	F	H	SB	H	P	H	P	P	SB	H	P	H	B					
TCII-14	F	H	SB	H	P	H	P	H	SB	H	P	P	H	B				
TCII-15	F	H	SB	H	P	H	P	T	H	SB	H	P	P	H	B			
TCII-16	F	H	P	H	SB	H	P	H	P	H	SB	H	P	P	H	B		
TCII-17	F	H	P	H	SB	H	P	H	P	H	SB	H	P	H	P	H	B	
TCII-18	F	H	P	H	SB	H	P	H	P	P	H	SB	H	P	H	P	H	B

F Front Section
SB Intermediate Section w/ Support Bracket
H Intermediate Section w/ Heater Opening
P Intermediate Section, Plain
B Back Section

Notes: 1. Intermediate Sections with Heater Connections (H) 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).

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.

Table 2.3: Jacket Channel Support Bracket Nut & Washer Locations

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

Note: Support bracket nuts and washers are to be installed as shown in Figure 2.11 on the draw rods that connect the sections indicated. The sections are numbered from front to back as indicated in Figure 2.9. The support brackets are shown in Section 3 in Figure 3.18.

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 2.2a or 2.2b.

21. For TCII-08 through TCII-18 refer to Figure 2.9, 2.11 and Table 2.3 for correct placement of nuts and washers for jacket channel support brackets.

NOTICE

For water boilers the Balanced Temperature Return support brackets must be installed during section assembly.

22. Balanced Temperature Return Support Bracket Location:
    a. Refer to Table 2.2b for the section location of the Balanced Temperature Return support brackets. The brackets are to be installed during section assembly.
    b. Insert the support bracket through the upper port opening, rotate it sideways and hook one ear over the center of the stay, then the other. See Figure 2.7.

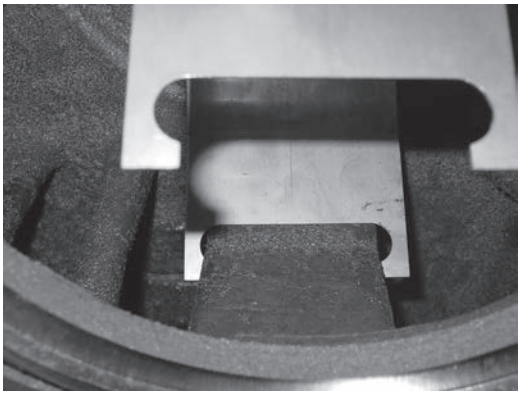


Figure 2.7: Balanced Temperature Return Support Bracket Installation

c. Push the bracket towards the back of the section compressing the bracket until the front ears are in the middle of the stay. Twist the bracket sideways hooking one ear then the other. Release the bracket and let it spring into position. See Figure 2.8.

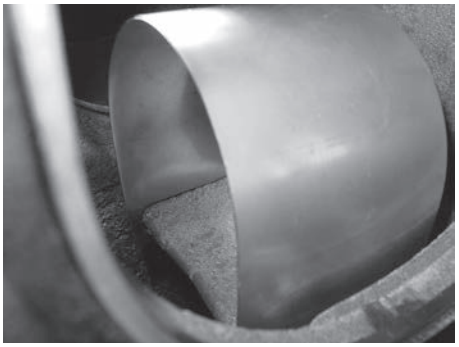


Figure 2.8: Balanced Temperature Return Support Bracket Installation

D. HYDROSTATIC TESTING

Note: Steam boilers are provided with a steam cover plate kit 76091 for use on front and rear flanged sections. The cover plate for the front section has a 1-1/2" NPT tapping for use as a skim tapping.

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 shown in Table 2.1. Tighten the rods in the sequence shown.

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).

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).

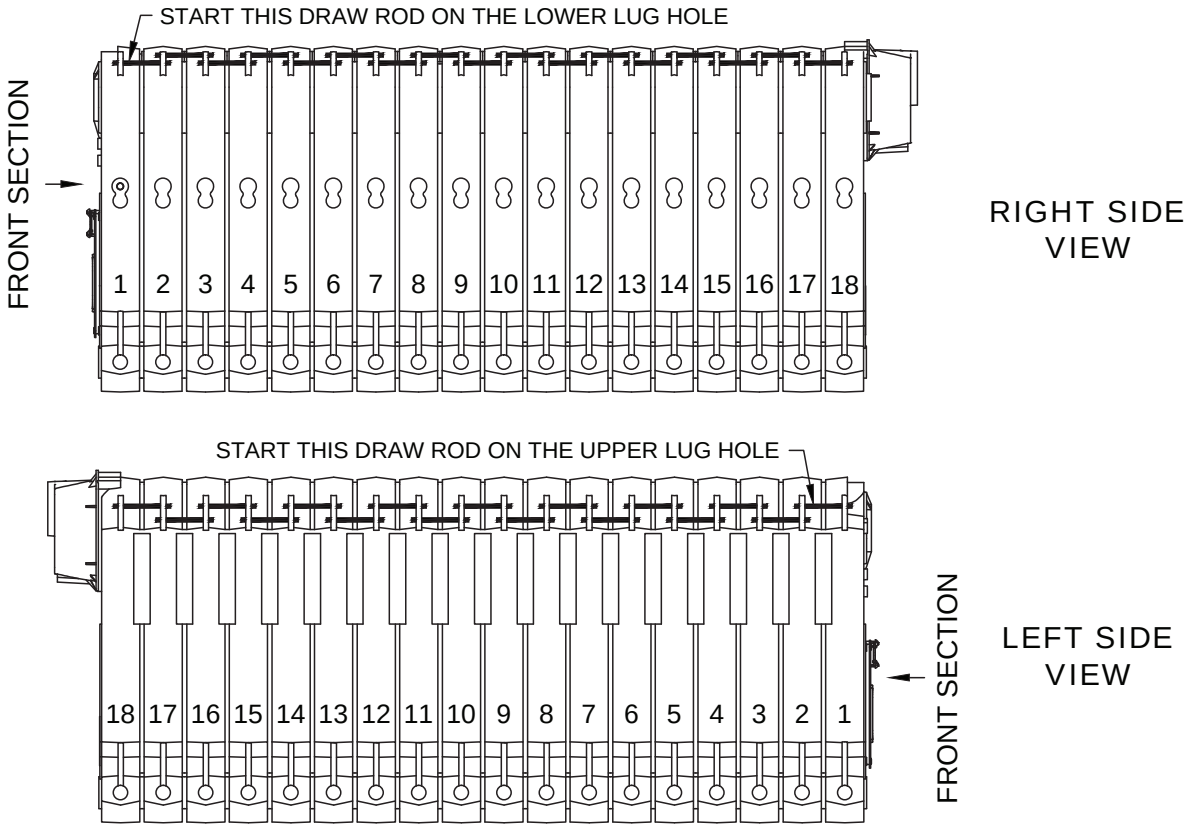


Figure 2.9: Numbered Section Illustration

E. FLUE ROD BAFFLE

The high efficiency Series TC II™ comes with design certified flue rod baffle sets. Each tube of 15 heat transfer rods will baffle one flue. In order to obtain the high efficiency for which the boiler was designed, the flue rod baffles must be properly installed.

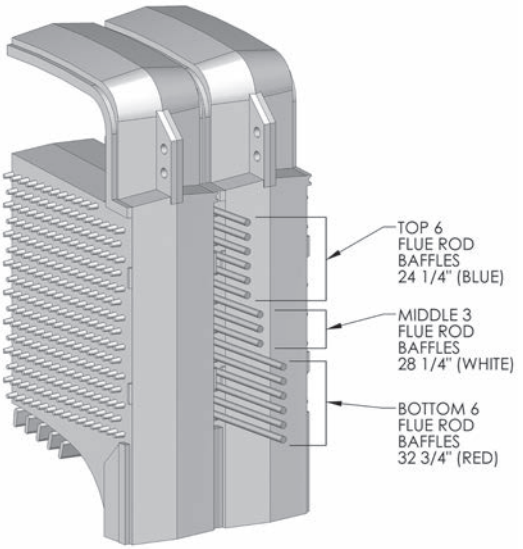


Figure 2.10: Flue Rod Baffle Installation

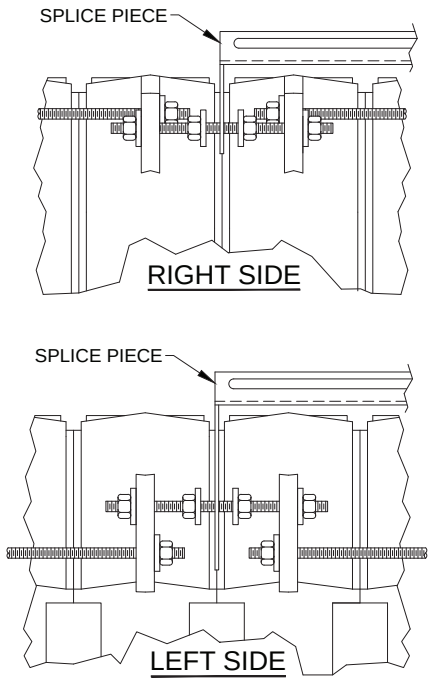


Figure 2.11

F. CLEANOUT COVER INSTALLATION

⚠ CAUTION

Inspect the covers to ensure that the insulation is not damaged or missing. If it is call PB Heat customer service.

1. The Series TCII™ uses special cast iron cover plates with flue side fins. The insulation and rope seal are installed at the factory.
2. Trim the 1/2" rope that is sticking out around the cleanout opening flush with the castings to insure an air-tight seal.
3. Install the cleanout cover bolts from the baffled side of the cleanout cover and start the nuts.
4. Rotate the bolts so the cam heads fit between the cleanout cover bosses on the castings.
5. Insert the cleanout cover and tighten the nuts to 15 ft lbs (21 Nm).
6. Apply a bead of high temperature silicone caulk around the perimeter of the cleanout cover to ensure an air tight seal.

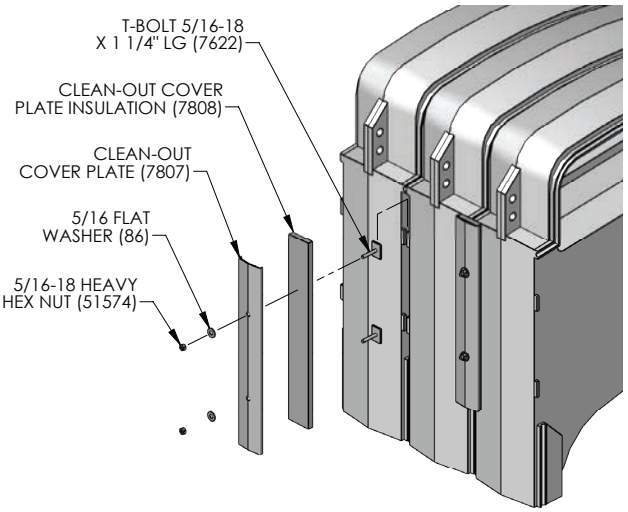


Figure 2.12: Cleanout Cover Installation

G. 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 2.13.
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.

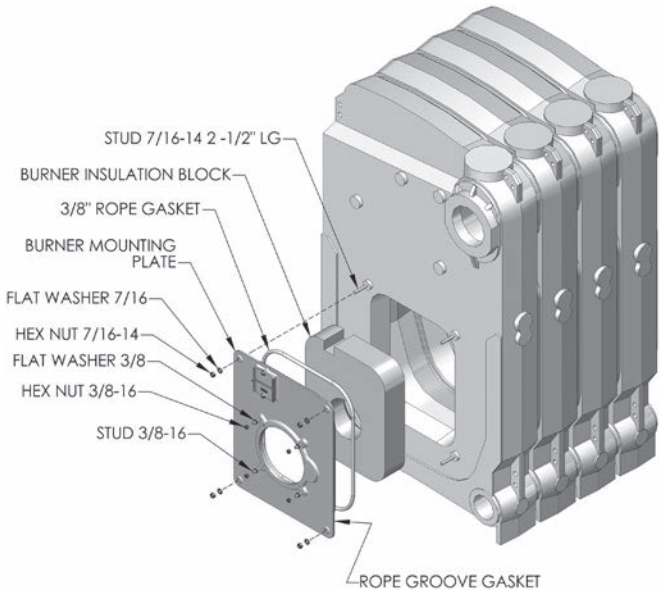


Figure 2.13: Burner Mounting Plate Installation

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

7. 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.

H. REAR OBSERVATION PORT INSTALLATION

1. Assemble Rear Observation Port as shown in Figure 2.14:
   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.

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.

I. 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.

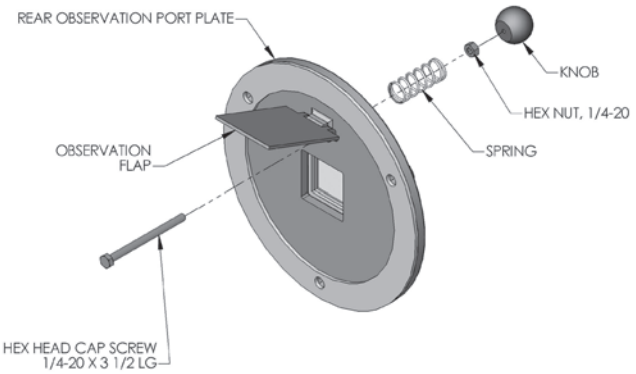


Figure 2.14: Rear Observation Port Assembly

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.

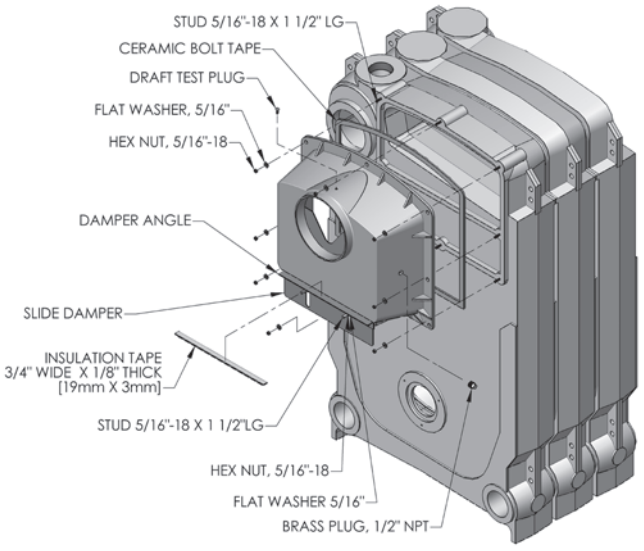


Figure 2.15: Rear Flue Collector Installation

J. 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 TCII™ 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 (TCII-04 & TCII-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
TCII-04 & TCII-05	1	5"	2-1/2"
TCII-06 & TCII-07	2	5"	2-1/2"
TCII-08 to TCII-10	2	6"	4"
TCII-11 to TCII-18	3	8"	4"

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

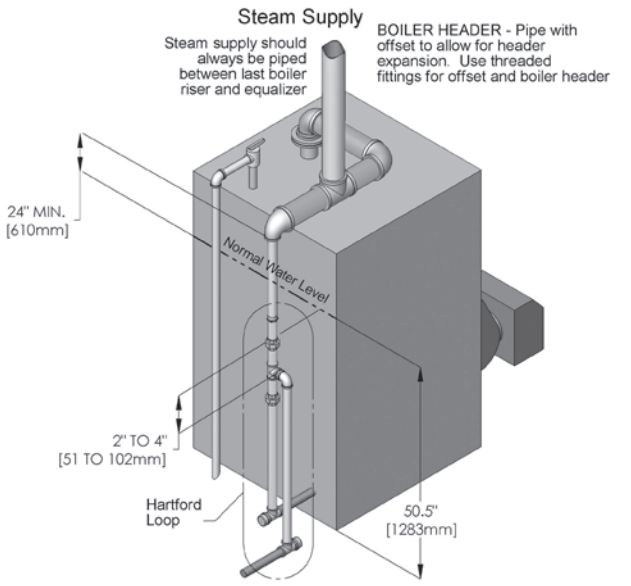


Figure 3.1: Typical piping arrangement for boilers with one riser.

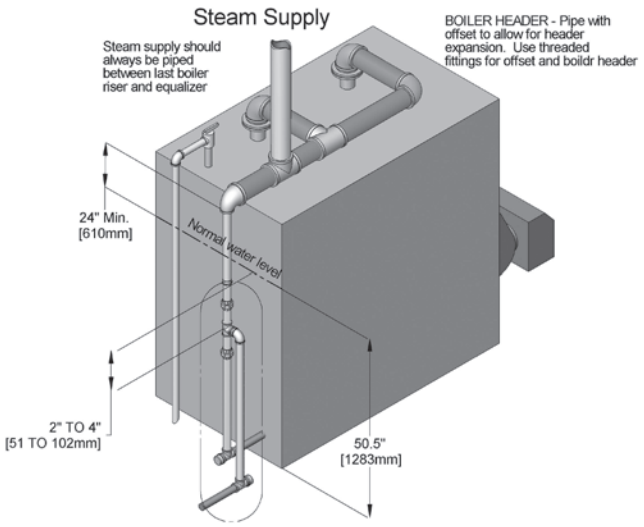


Figure 3.2: Typical piping arrangement for boilers with two risers.

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.

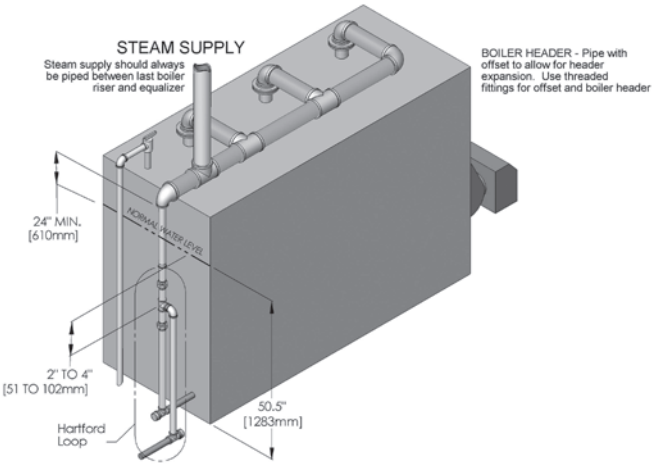


Figure 3.3: Typical piping arrangement for boilers with three risers.

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.

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
TCII-04	931	1.92	3.8	38
TCII-05	1194	2.46	4.9	49
TCII-06	1458	3.01	6.0	60
TCII-07	1722	3.55	7.1	71
TCII-08	1985	4.09	8.2	82
TCII-09	2249	4.64	9.3	93
TCII-10	2513	5.18	10.4	104
TCII-11	2776	5.73	11.5	115
TCII-12	3040	6.27	12.5	125
TCII-13	3304	6.82	13.6	136
TCII-14	3567	7.36	14.7	147
TCII-15	3831	7.90	15.8	158
TCII-16	4095	8.45	16.9	169
TCII-17	4358	8.99	18.0	180
TCII-18	4622	9.53	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] ltr/min	Condensate Receiver Capacity[3] Liter
TCII-04	273	7.3	14.5	145
TCII-05	350	9.3	18.6	186
TCII-06	427	11.4	22.8	228
TCII-07	505	13.4	26.9	269
TCII-08	582	15.5	31.0	310
TCII-09	659	17.6	35.1	351
TCII-10	736	19.6	39.2	392
TCII-11	813	21.7	43.4	434
TCII-12	891	23.7	47.5	475
TCII-13	968	25.8	51.6	516
TCII-14	1045	27.9	55.7	557
TCII-15	1122	29.9	59.8	598
TCII-16	1200	32.0	63.9	639
TCII-17	1277	34.0	68.1	681
TCII-18	1354	36.1	72.2	722

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

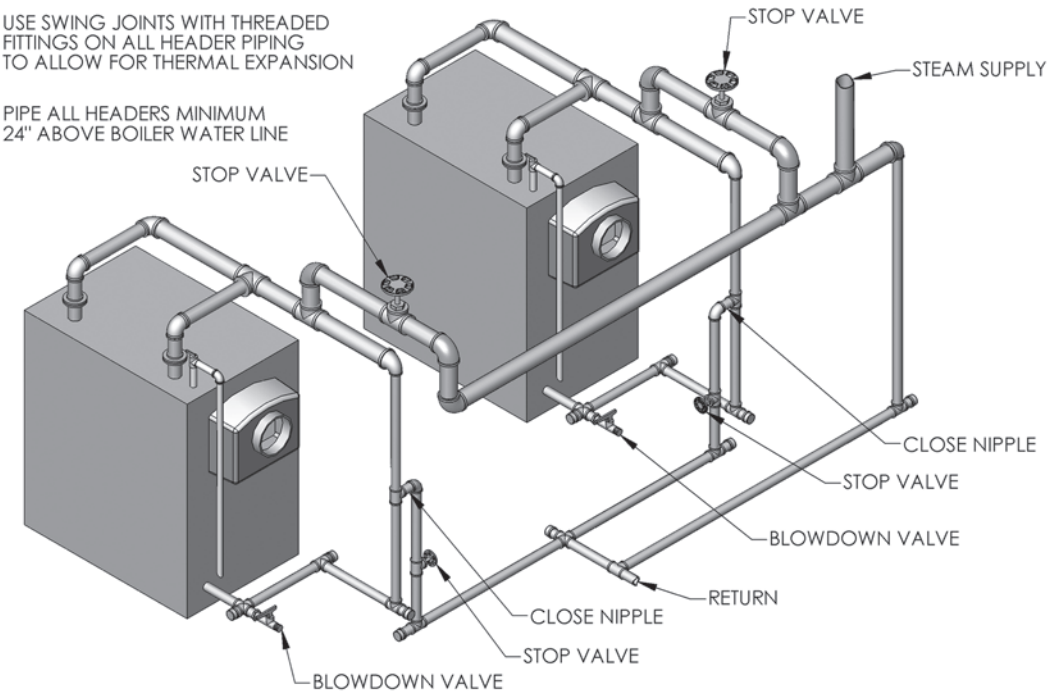


Figure 3.4: Multiple Steam Boiler Piping – Gravity Return

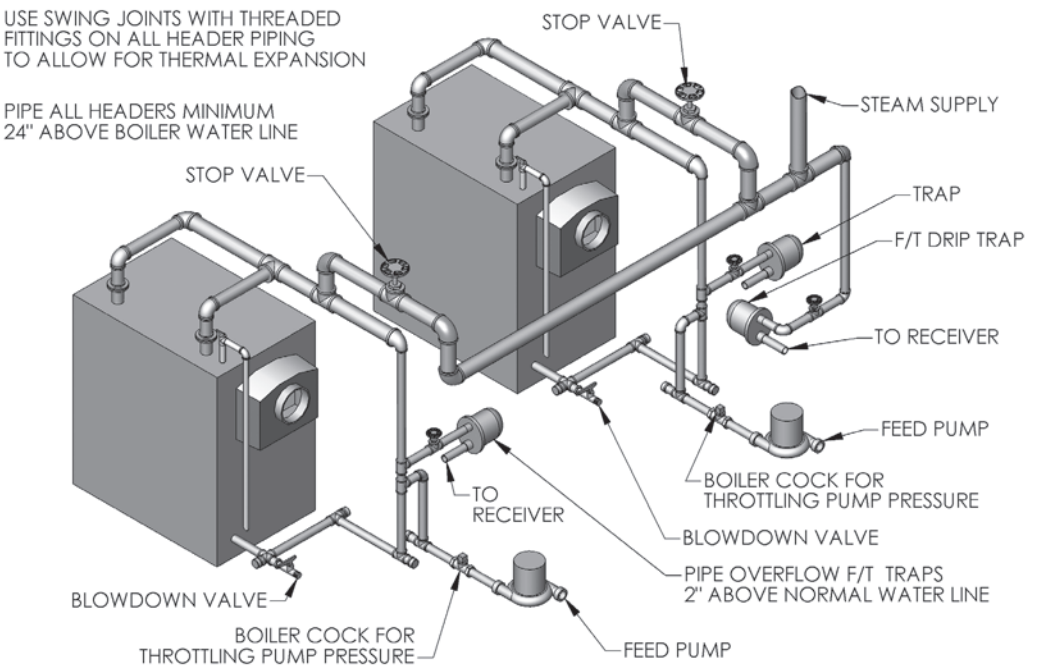


Figure 3.5: Multiple Steam Boiler Piping – Pumped Return

D. BALANCED TEMPERATURE RETURN

1. The Balanced Temperature Return must be installed in the rear flanged opening for water boilers only.

2. Install the eight 3/4 x 3" long mounting studs in the Back Section using a thread sealant on studs. See Figure 3.6.

NOTICE

A minimum distance of 3 feet must be maintained between the Back Section and adjacent construction behind the boiler to allow for the Balanced Temperature Return installation and removal.

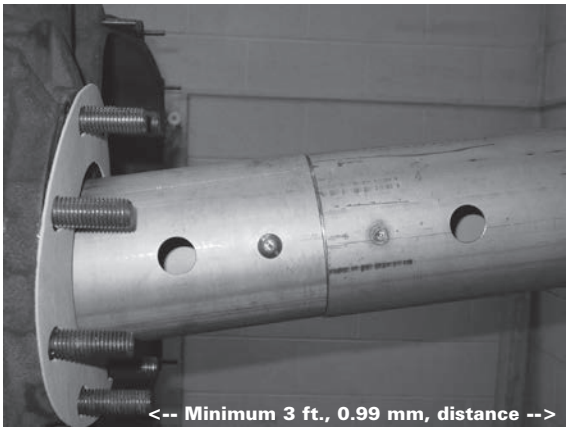


Figure 3.6: Balanced Temperature Return Installation

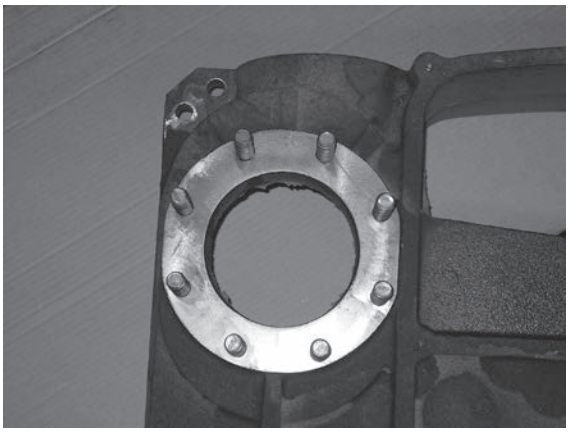


Figure 3.7: Balanced Temperature Return Stud Installation

3. Lay the flange gasket on the machined surface. The gasket will fit just inside the mounting studs.

4. Insert the Balanced Temperature Return End Tube into the port opening as shown in Figure 3.6 and connect the next sections, either an Intermediate Tube or Flanged End Tube depending on boiler size, using brass screws provided. Be sure to guide the tube over the support bracket(s). Refer to Table 3.3 for quantity and type of tubes required.

   See Figure 3.8 for illustration of the three types of End Tubes that are available.

⚠ IMPORTANT

The holes in the connecting tubes must all be aligned in the same direction for the Balanced Temperature Return to function properly.

Table 3.3: Balanced Temperature Return Component Table

Model Number	Stock Code	Flanged End	3 Hole Int.	2 Hole End	3 Hole End	4 Hole End	Support Bracket
TCII-04	76076	1		1			1
TCII-05	76077	1			1		1
TCII-06	76078	1				1	1
TCII-07	76079	1	1	1			1
TCII-08	76080	1	1		1		1
TCII-09	76081	1	1			1	1
TCII-10	76082	1	2	1			1
TCII-11	76083	1	2		1		1
TCII-12	76084	1	2			1	2
TCII-13	76085	1	3	1			2
TCII-14	76086	1	3		1		2
TCII-15	76087	1	3			1	2
TCII-16	76088	1	4	1			2
TCII-17	76089	1	4		1		2
TCII-18	76090	1	4			1	2

Figure 3.8: End Tubes

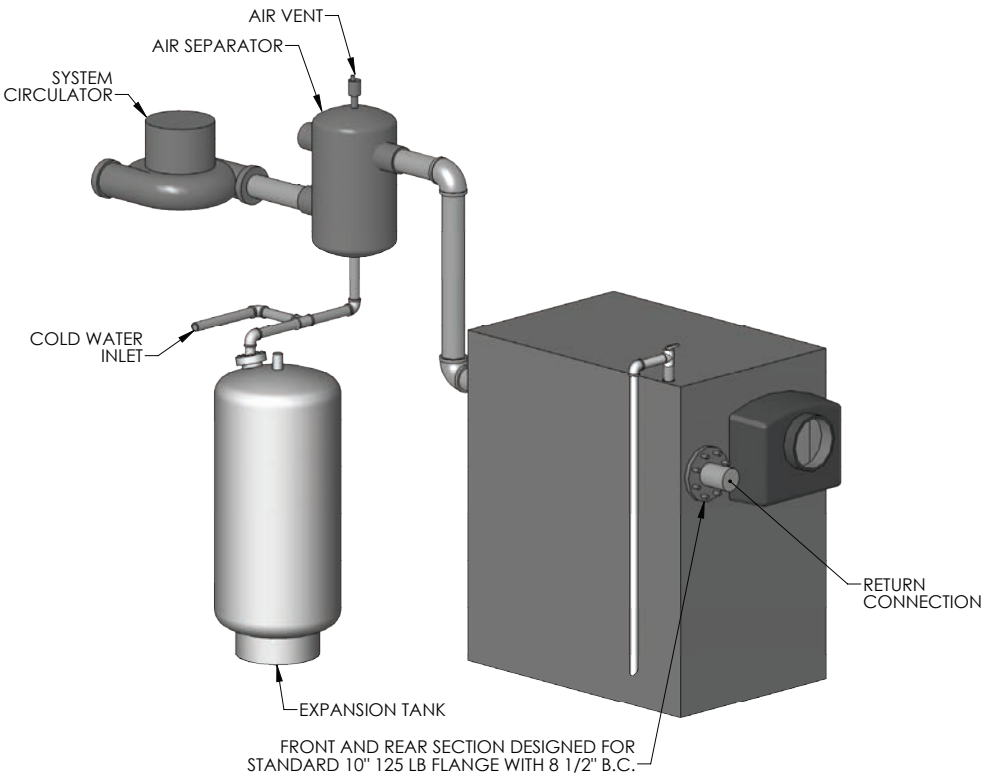


Figure 3.9: Typical Water Boiler Piping

5. The Flanged End Tube incorporates a tab that must be in the 9 O'Clock position when installed over the mounting studs. See Figure 3.10.

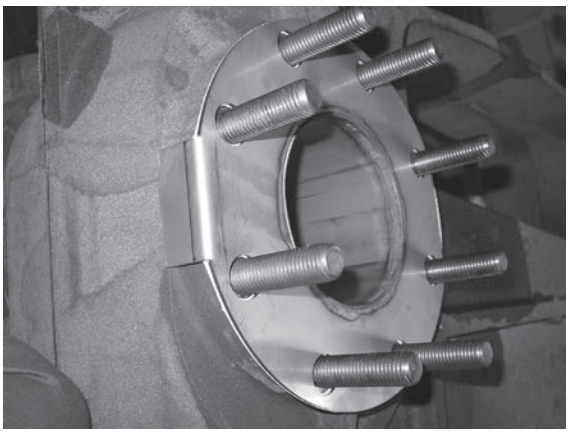


Figure 3.10: Balanced Temperature Return Flange Orientation

⚠ IMPORTANT

A removable elbow or section of pipe must be used at the flanged connection of the Rear Section to allow for service removal of the Balanced Temperature Return tube.

6. Return piping can be connected to the Rear Section flange with a standard 10" 125# flange with a 8-1/2" bolt hole circle.

7. Place purchased flange gasket against Balanced Temperature Return flange and attached pipe flange using the eight nuts provided with the Balanced Temperature Return Kit. See Figure 3.11.

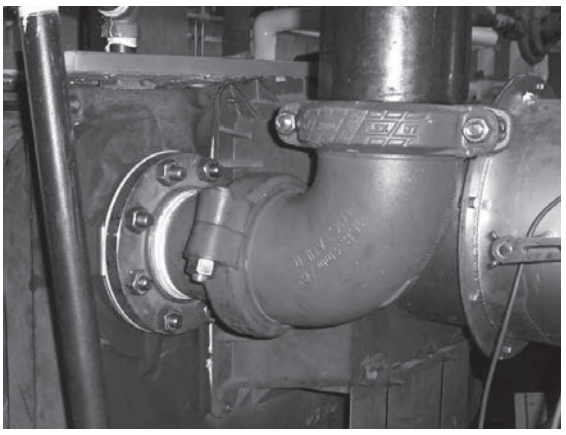


Figure 3.11: Removable Elbow

E. 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 TCII™ water boiler is shown in Figure 3.9. and alternate pipings shown in Figure 3.12.

3. The recommended supply and return pipe sizing in Tables 3.4 and 3.5 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).

4. Using higher flow rates is not recommended because it may cause poor distribution through the boiler.

5. 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.

6. The size of supply and return connections given in Tables 3.4 and 3.5 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.

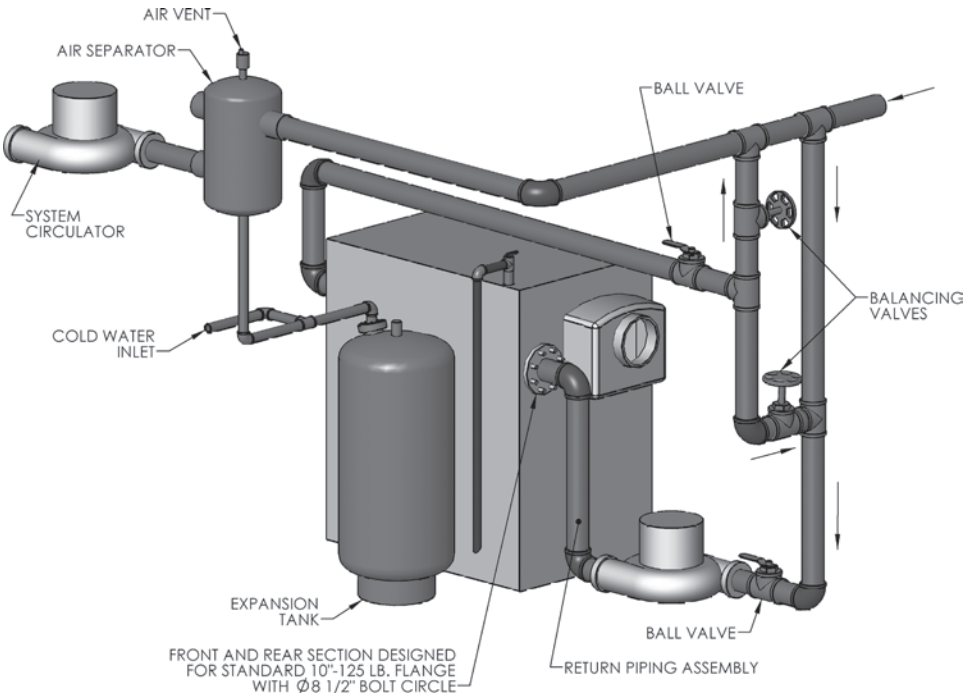


Figure 3.12: Alternate Water Boiler Piping

Table 3.4: Supply & Return Pipe Sizing – US Customary Units

Boiler Model	Gross Output (MBH)	Flow Rate @20 F Rise (GPM)	Recommended	
			Supply Size (NPT)	Return Size (NPT)
TCII-04	931	93	3	3
TCII-05	1194	119	3	3
TCII-06	1458	146	4	4
TCII-07	1722	172	4	4
TCII-08	1985	199	4	4
TCII-09	2249	225	4	4
TCII-10	2513	251	5	5
TCII-11	2776	278	5	5
TCII-12	3040	304	5	5
TCII-13	3304	330	5	5
TCII-14	3567	357	5	5
TCII-15	3831	383	5	5
TCII-16	4095	410	5	5
TCII-17	4358	436	5	5
TCII-18	4622	462	5	5

Table 3.5: Supply & Return Pipe Sizing – SI Metric Units

Boiler Model	Gross Output (kW)	Flow Rate @36 C Rise (ltr/min)	Recommended	
			Supply Size (NPT)	Return Size (NPT)
TCII-04	273	352	3	3
TCII-05	350	452	3	3
TCII-06	427	552	4	4
TCII-07	505	652	4	4
TCII-08	582	751	4	4
TCII-09	659	851	4	4
TCII-10	736	951	5	5
TCII-11	813	1051	5	5
TCII-12	891	1151	5	5
TCII-13	968	1251	5	5
TCII-14	1045	1350	5	5
TCII-15	1122	1450	5	5
TCII-16	1200	1550	5	5
TCII-17	1277	1650	5	5
TCII-18	1354	1750	5	5

7. 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.

8. 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.
   c) For systems with variable low temperature returns or constant low temperature returns please refer to the Peerless® Water Survey for system information.

9. Chilled Water Systems:
   If the boiler will be used in conjunction 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 3.13.

F. MULTIPLE WATER BOILER PIPING

1. Figure 3.14 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.

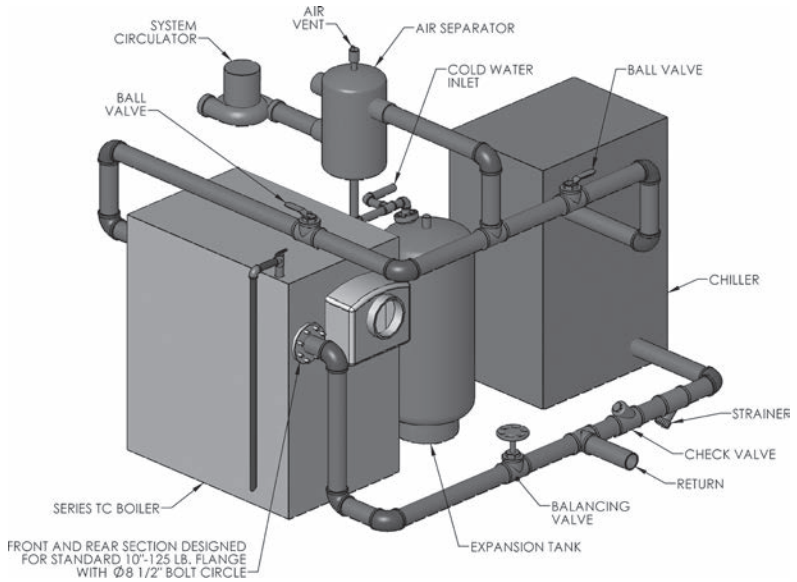


Figure 3.13: Chilled Water Systems

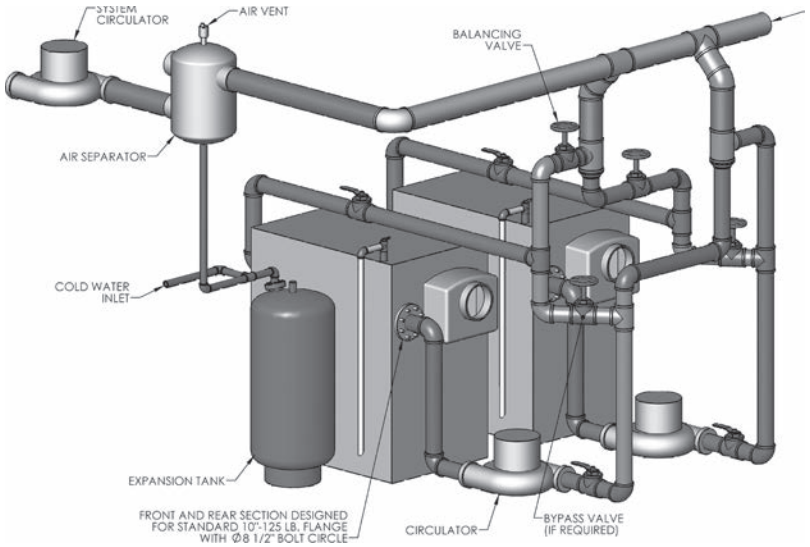


Figure 3.14: Multiple Water Boiler Piping

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

G. TANKLESS HEATER INSTALLATION

1 Heater sections must be installed as shown in Table 2.2a & 2.2b 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 3.15.

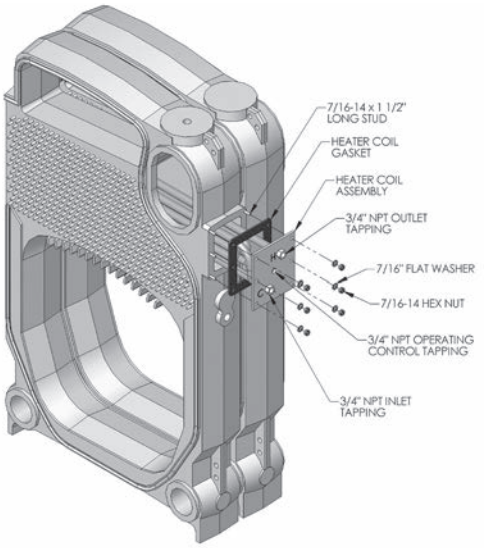


Figure 3.15: Tankless Heater Coil Installation

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 3.16 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.

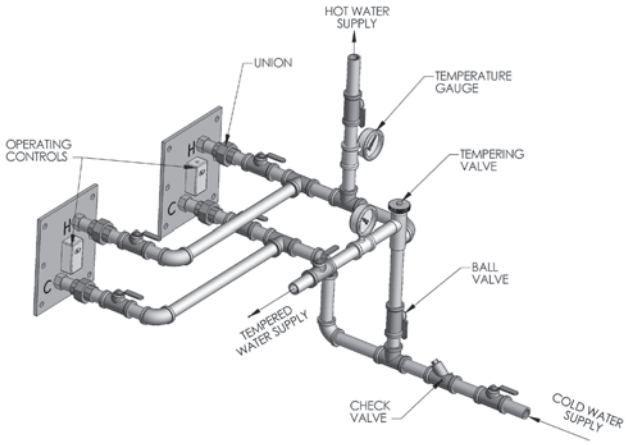


Figure 3.16: Typical Piping for Multiple Tankless Heater Coils

H. JACKET PREPARATION

1. Collect all jacket cartons as listed in Table 1.3 in the Pre-installation section of this manual.

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.

6. All other piping, burner, and control connections may be made before jacket installation.

I. JACKET ASSEMBLY

1. Lower Channels:
   a. 4 through 7 section boilers have one-piece lower channels 8 through 14 section boilers have two-piece lower channels and 15 through 18 section boilers have a three-piece lower channel per side. The center lower channels for the 15 through 18 section boilers have slots for mounting to the base angle only.
   b. Locate the lower channels and layout along the outside of base angles so that the 5/16" hole(s) on the ends of the channels are to the front and back of the base angles.

c. Mount the lower channels through the slots to the tapped holes in the base angle with 1/4-20 x 1/2" round head machine screws and washers found in Front/Back CTN for 4 to 7 section boilers and additional hardware in Channel CTN when shipped with 8 to 18 section boilers.

2. Front Panel:
   a. Position the front panel F1 over the front section and in front of panel F2 and place over the lower channels so that the edges of the lower channels are inside the side edges of the F1 panel and in front of the retaining clip.
   b. Align holes in the F1 panel to the holes in the lower channels (see Figure 3.17) and F2 and fasten with (15) hex head sheet metal screws (hardware front/back CTN). If the burner mounting plate is not installed at this time you can fasten F2 to F1 before mounting to the lower channels. **REMEMBER TO INSTALL ALL CONTROLS AND GAUGES TO FRONT FACE OF BOILER AT THIS TIME**.
   c. Temporarily support the front panel while installing upper channels between the front and rear panels.

3. Rear Panel:
   a. Locate the rear panel B1 and place over the rear of lower channels so that the edges of the lower channels are inside the side edges of the rear panel and in front of the retaining clip (See Figure 3.17).
   b. Align holes in lower channels and the rear panel and fasten with (2) hex head sheet metal screws.
   c. Temporarily support the rear panel while installing the upper channels between the front and rear panels.

4. Upper Channels:
   a. 4 Through 7 Section Boilers:
      i. Boilers from 4 through 7 sections have one piece upper channels. The upper channels are to be mounted between the top of the inside of the front jacket panel and the top of the inside of the rear jacket panel.
      ii. Align the holes on the topside of Jacket panels with the weld nuts on the upper channels and fasten with (8) 1/4-20 x 3/4" slotted round head machine screws and washers.
   b. 8 Through 18 Section Boilers:
      i. Boilers from 8 through 18 sections have two to three piece upper channels. The channels are supported at their joints by splice angles and support brackets (see Figure 3.18).
      ii. Install support brackets as shown in Section 2, Assembly, Figures 2.9 & 2.11.
      iii. Align the upper channels on the floor with the 5/16" holes on the flat side of channels to face the front and back of boiler.
      iv. Align the holes in the splice angle to the hole on the inside of the upper channels.
      v. Assemble the upper channels on the floor with splice angles using (8) 1/4-20 x 1/2" round head machine screws, per joint, with nuts and washers (hand tighten only).
      vi. Mount the upper channel assemblies between the front jacket panel and the rear panel.
      vii. Align the holes on the topside of front and rear jacket panels with the weld nuts on upper channels and fasten with (8) 1/4-20 x 3/4" slotted round head machine screws and washers.

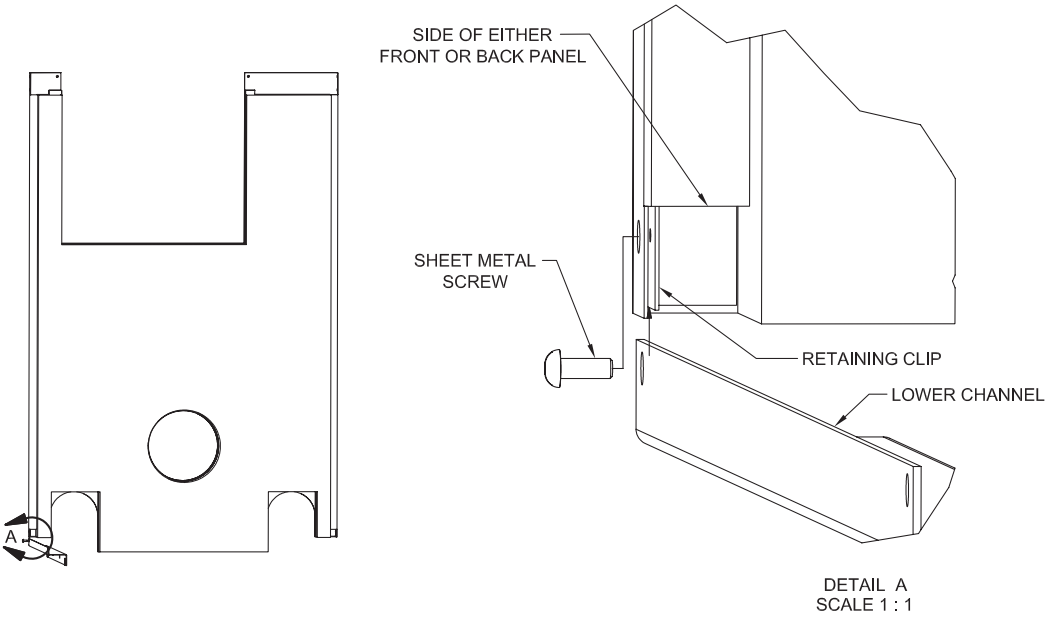


Figure 3.17

viii. Line up the support brackets with splice angles and closest corresponding draw rods that will allow overlapping of the support bracket and the splice angle.

ix. Remove as many of the 1/4-20 machine screw as necessary from the inside edges of splice angle to fasten the support bracket.

⚠ IMPORTANT

On some size boilers the slots in the support bracket used for mounting to the upper channels and splice angles might not line up with all the holes in the upper channels and splice angles.

5. Side Panels:
   a. Install side panels by inserting the tops into the grooves in the top channels first and then sliding the panels down into the groove made by the lower channel.
   b. The solid LH panels go on the left-hand side.
   c. The RH panels with the knockouts go on the right-hand side in their corresponding locations (See Figure 3.19).

6. Top Panels:
   a. Lay out T top panels, such that the knockouts and openings agree with the assembled boiler.
   b. After lay out has been checked remove the necessary knockouts and install panels.

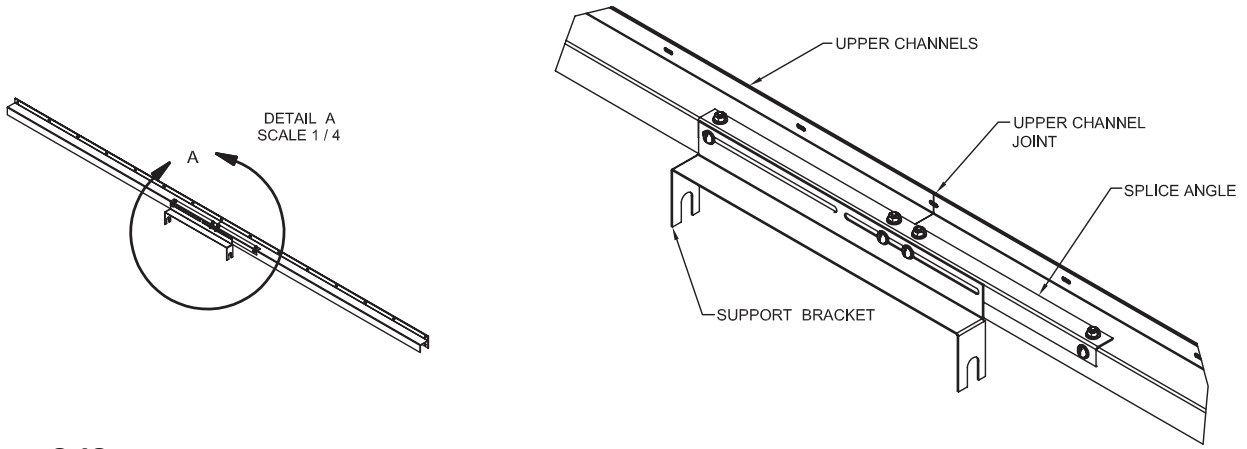


Figure 3.18

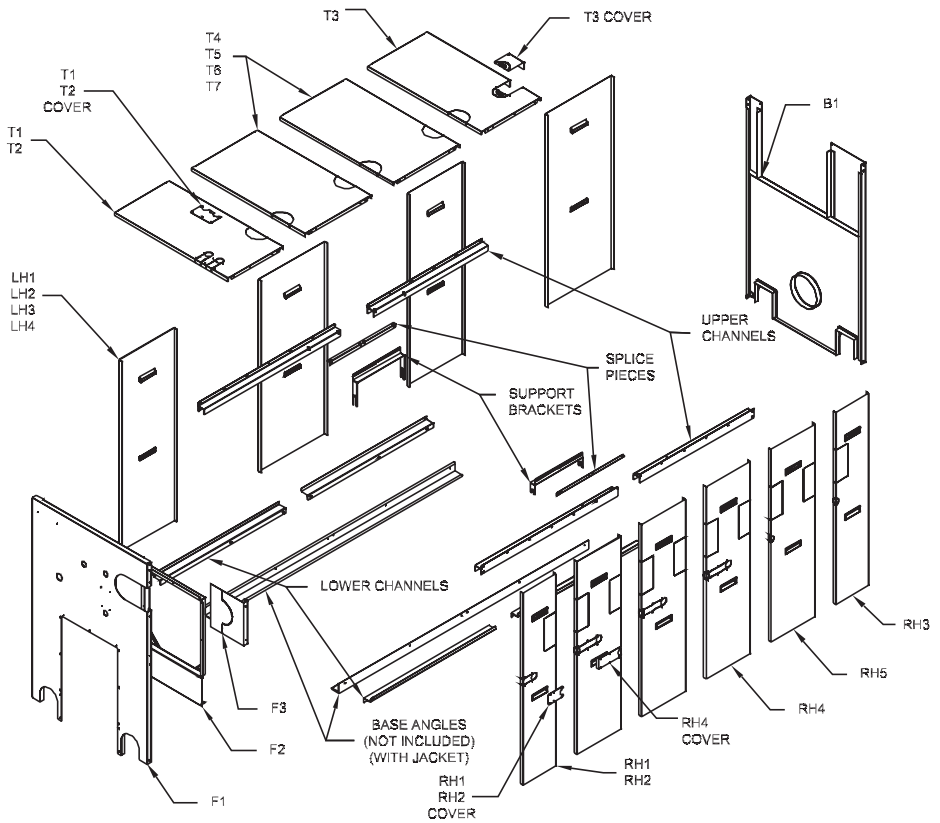


Figure 3.19

c. Fasten top panels to side rails using sheet metal screws (2 to 4 per panel). The top panel T3 gets fastened to the inside top of rear panel near large opening (See Figure 3.19).

7. Knockout Covers:
   a. Place necessary knockout cover plates over exposed areas; fasten with sheet metal screws that are supplied. Cover plates go to F1, RH1, RH2, RH4, T1, T2, and T3.
   b. The knockout cover plate, F3, for the front panel must be installed inside of the panel.
   c. Knockout cover plate for the RH1 and the RH2 panels also fastens to the side of the F1 panel.

J. 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 inches 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

   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 3.20. 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.

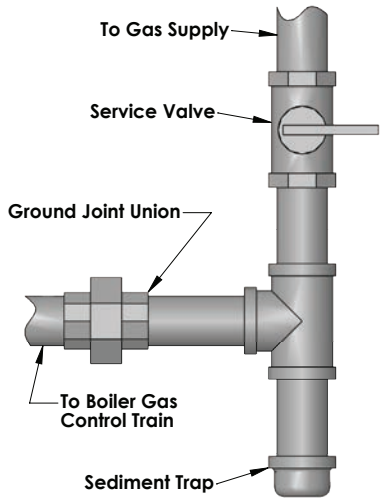


Figure 3.20: Gas Supply Connection to Boiler

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.

K. INSTALL CONTROLS & 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 3.21.

⚠ 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.

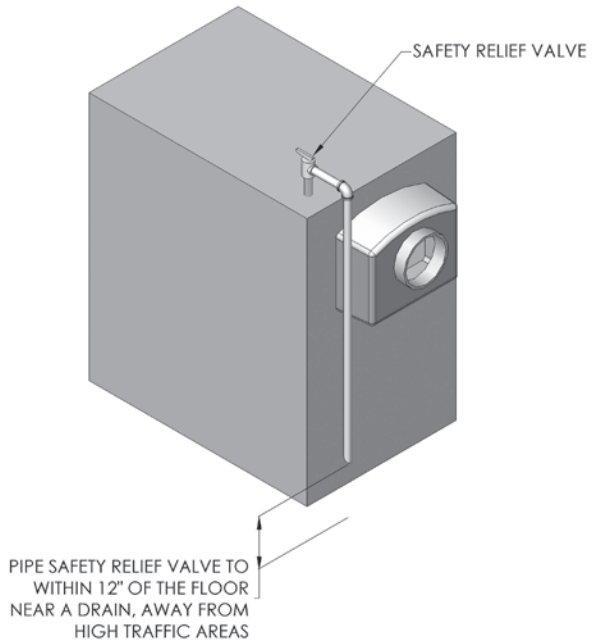


Figure 3.21: Safety Relief Valve Installation

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

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 3.22.
   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 3.22.

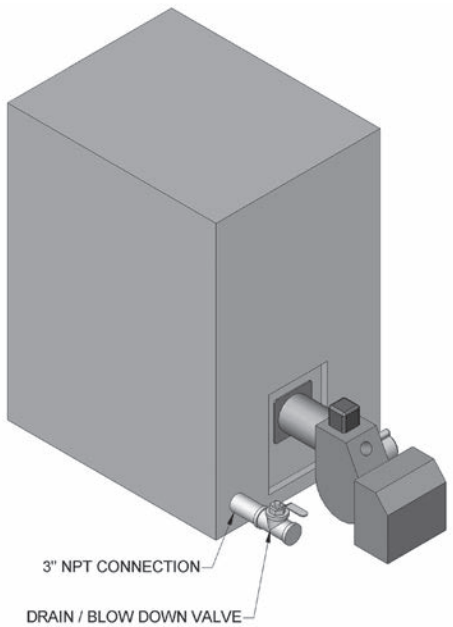


Figure 3.22: Boiler Drain/Blowdown Valve Installation

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.

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 3.23 for the location of control connection tappings.

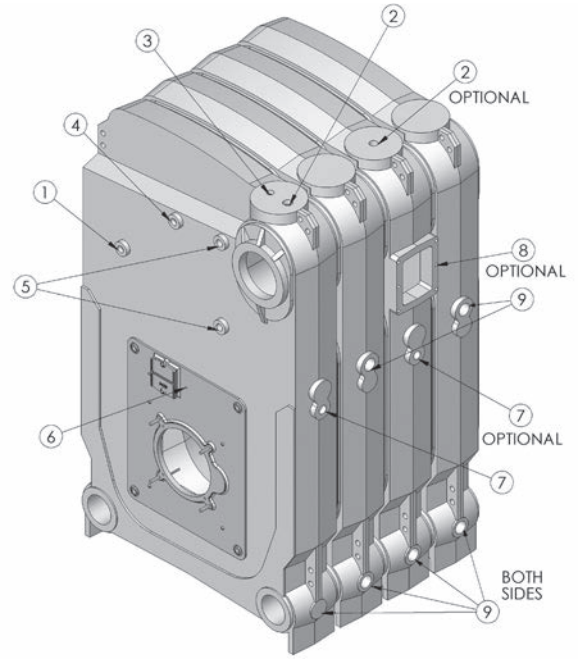


Figure 3.23: Control Connection Locations

   b) Figure 3.24 shows a typical control configuration for a steam boiler and Figure 3.25 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.
      i. LWCOs that are piped too high will result in water carryover into the steam distribution system and will cause erratic operation of the boiler.
      ii. 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 3.26 through 3.27.
   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 3.24. Do not mount these devices on opposite ends of the boiler. This will cause erratic operation and nuisance shut downs of the boiler.

4. Install Limit Controls:
   a) Steam Boilers: See Figure 3.24 for typical control locations for steam boilers. Additional limit and firing rate controls can be added to the 3/4" NPT piped header.

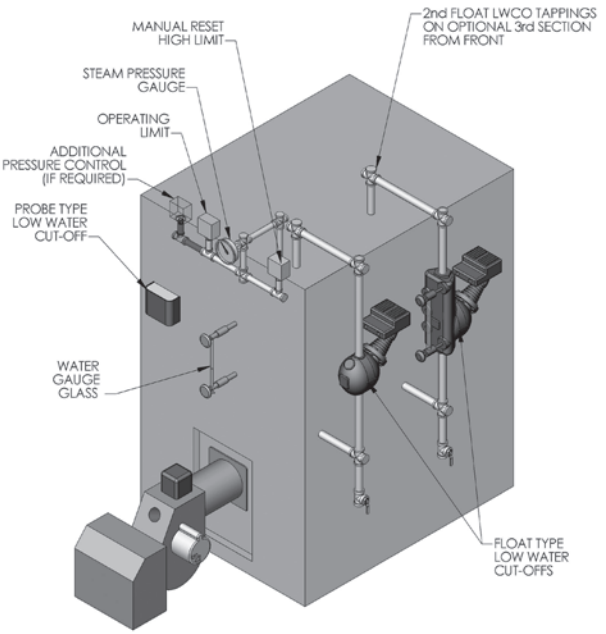


Figure 3.24: Steam Boiler Control Locations

Table 3.8: Control Connections Sizes (See Figure 3.23)

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	7-1/8" x 5-1/4"	Tankless Heater	Tankless Heater
9	1-1/2" NPT	Optional Inspection Tappings	Optional Inspection Tappings

b) Water Boilers: See Figure 3.25 for typical control locations for water boilers. Additional limit and firing rate controls can be added to the boiler supply piping.

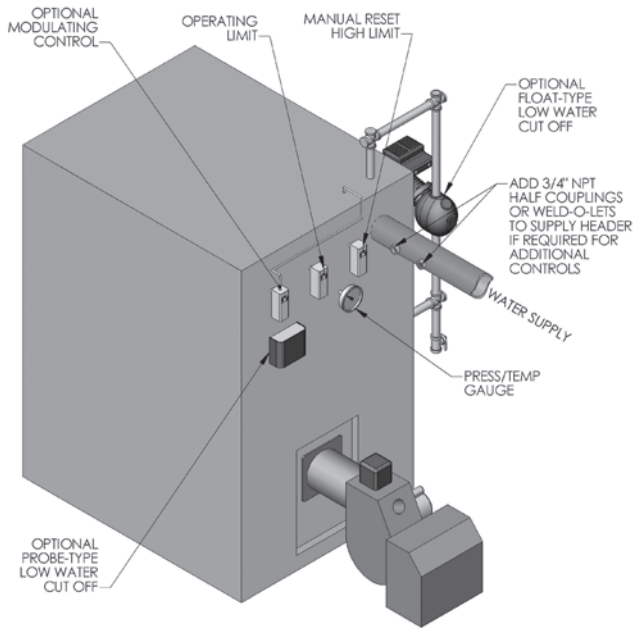


Figure 3.25: Water Boiler Control Locations

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

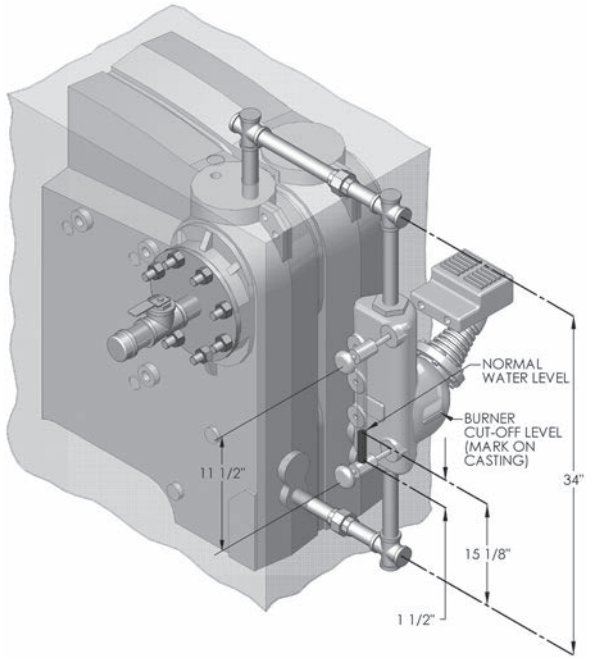


Figure 3.26: Optional Model 157 Low Water Cutoff/Pump Control

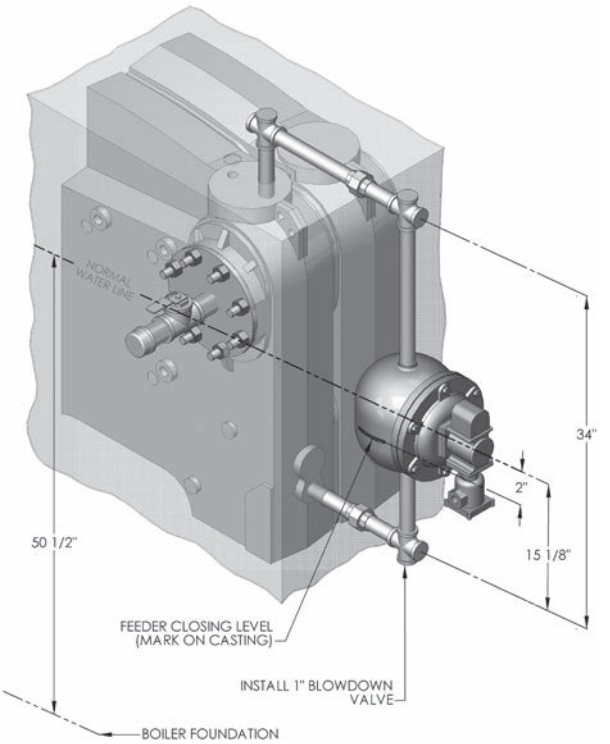


Figure 3.27: Optional Model 51-2 Low Water Cutoff/Feeder

4. OPERATION

A. STARTING THE BOILER

1. Check the Piping:
   a) Water/Steam Piping:
      i. The Boiler must have been hydrostatically tested.
      ii. Check the attached piping for joint tightness.
      iii. Continue monitoring as you proceed through start up.
   b) Gas Piping:
      i. Make sure the gas system piping and the connections to the boiler Gas Control Train(s) have been leak tested.
      ii. After the boiler is in operation, check the tightness of all joints in the boiler gas piping with a soap suds solution.
      iii. Purge the gas piping of all air up to the boiler Gas Control Train.
   c) Oil Piping:
      i. Check the oil piping visually. Make sure all joints are tight.
      ii. When the burner is firing, check the suction line and return line pressures.
      iii. 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.
      iv. 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.
      i. Gravity Systems and Pumped Return with Condensate Units – Fill to the normal water level mark on front jacket panel.
      ii. 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.
      i. 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.

      ii. 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.

⚠ 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.

   e) Adjust the burner as needed for a CO_2 reading of:
      i. 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.
      ii. Natural gas burners: 9% to 10% with CO less than 50 ppm.

5. Check Boiler Controls:
   a) Limit and Operating Controls
      i. Lower the setting of each control until the burner shuts down.

b) Low Water Cutoffs:
   i. Test probe type controls by using the Push-to-Test Button.
   ii. 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.

⚠ CAUTION

If the flue gas temperature exiting the smoke hood is less than 320°F (160°C) at full rated input, the number of heat transfer rods in the boiler must be reduced. Failure to protect the boiler from low flue gas temperatures will shorten the life of the boiler and breaching and void the warranty!

6. Flue Temperature Adjustment:
   a. Shut the boiler off and remove the left side jacket panels and cleanout covers.
   b. Remove the bottom red flue rod from each flue.
   c. Replace the cleanout covers and fire the boiler for at least 15 minutes.
   d. Check the flue temperature. If it is greater than 320°F (160°C) reseal the cleanout covers and install the left side jacket panels.
   e. If the flue temperature is still less than 320°F (160°C) repeat steps a through e by removing another bottom red flue rod.

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 1-1/2" skim valve and fittings in the 1-1/2" NPT tapping of the front cover plate section. See Figure 4.1.

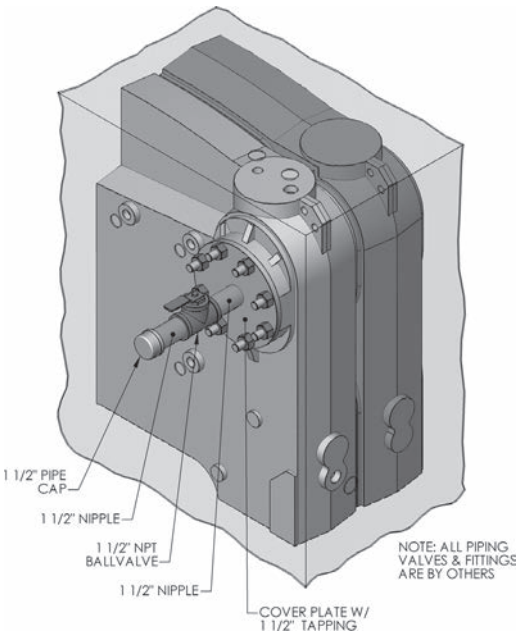


Figure 4.1: Skim Valve Piping

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 1-1/2" 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.

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:
      i. Shut off make-up water supply and drain the boiler and system completely.
      ii. 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.
      iii. Do not use ethylene glycol antifreeze in a boiler system.
      iv. 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:
      i. Check the chimney or vent to make sure it is clean and free from cracks or potential leaks.
      ii. All joints must be tight and sealed.
      iii. The vent connector must extend into, but not beyond the inside edge of the chimney or vent.
   c) Inspect the Boiler Area:
      i. The boiler area must be clean and free from combustible materials, gasoline or any other flammable liquids or vapors.
      ii. 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.
      i. Turn off all electrical power to the boiler.
      ii. Remove left jacket panels. Remove cleanout cover plates on each flueway. Remove flue rods.
      iii. Brush the boiler flue areas through cleanout openings.
      iv. 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.
      v. Reinstall the burner mounting plate, burner, flue rods (refer to Figure 2.10 for correct order) and all cleanout cover plates. Make sure all sealing rope and seals are in good condition. Replace sealing rope if necessary.
      vi. 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

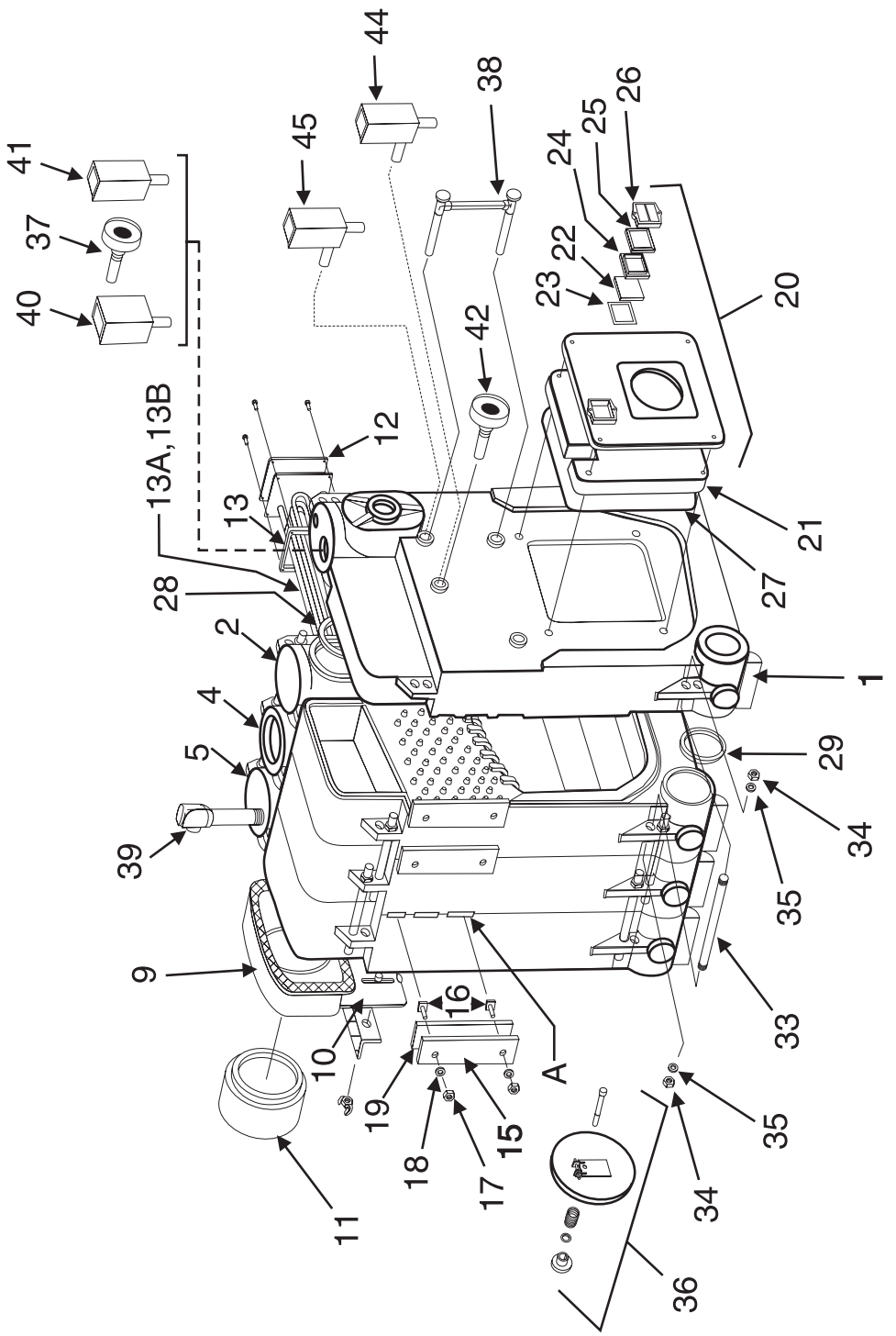
STEAM BOILERS: Do not place cold boilers in service on a hot steam line or severe damage may occur to boiler and piping. Keep cold boilers valved off line, fire until boiler reaches line pressure and then open steam main isolation valve. Steam entering a cold boiler cools quickly causing severe steam 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 local PB Heat, LLC distributor or from Parts To Your Door at 1 (610) 916-5380 (www.partstoyourdoor.com).

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



A: Heat Transfer Rod Set – One set required per flueway. Stock Code 76143.

Figure 6.1: Boiler Assembly

Table 6.1: Series TCII™ Repair Parts

Item No.	Description	Stock Code
1	Front Section	76014
	Intermediate Section	76002
2	Intermediate Section w/Heater Connection	76004
4	Intermediate Section w/Supply Connection	76003
5	Back Section	76015
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
15	Cleanout Cover Plate Assembly	90777
16	Cleanout Cover Plate Bolts	7622
17	Cleanout Cover Plate Nut	51556
18	Cleanout Cover Plate Washer	86
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
–	Burner Insulating Block Hardware	7720

Item No.	Description	Stock Code
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 (5-6 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

7. BOILER RATINGS & DIMENSIONS

Table 7.1: Series TCII™ Boiler Ratings

SERIES TCII™ BOILER RATINGS

Series TCII™ (AHRI CERTIFIED® www.ahridirectory.org)																	
	Oil Input		Gas	Gross	NET			Oil		Gas			Water Content		Furnace	Boiler	Heating
					Steam							Boiler			Volume	Working	Surface
Boiler Model	GPH	MBH	Input MBH	Output MBH	sqft	MBH	Water MBH	Comb Effy	Thermal Effy	Comb Effy	Thermal Effy	H.P.	Steam (Gallons)	Water (Gallons)	(Cu. Ft.)	Weight (lbs)	(sqft)
TCII-04	7.9	1106	1143	931	2908	698	810	86.2	83.9	83.6	81.4	28	103.8	123.4	12.04	4215	81.2
TCII-05	10.2	1428	1458	1194	3733	896	1038	86.2	84.4	83.6	81.9	36	125.8	150.3	16.14	5038	105.3
TCII-06	12.2	1708	1773	1458	4625	1110	1268	86.1	84.8	83.5	82.2	44	147.8	177.2	20.24	5861	129.4
TCII-07	14.4	2016	2088	1722	5542	1330	1497	86.1	85.0	83.5	82.5	51	169.8	204.1	24.34	6684	153.5
TCII-08	16.6	2324	2403	1985	6421	1541	1726	86.1	85.2	83.5	82.6	59	191.8	231.0	28.44	7507	177.6
TCII-09	18.8	2632	2718	2249	7275	1745	1956	86.1	85.3	83.5	82.7	67	213.8	257.9	32.54	8331	201.7
TCII-10	21.0	2940	3033	2513	8129	1951	2185	86.1	85.4	83.5	82.8	75	235.8	284.8	36.64	9169	225.8
TCII-11	23.0	3220	3348	2776	8979	2155	2414	86.0	85.5	83.5	82.9	83	257.8	311.7	40.74	9992	249.9
TCII-12	25.5	3570	3663	3040	9833	2360	2643	86.0	85.6	83.5	83.0	91	279.8	338.6	44.84	10,815	274.0
TCII-13	27.5	3850	3978	3304	10688	2565	2873	86.0	85.6	83.5	83.0	99	301.8	365.5	48.94	11,649	289.1
TCII-14	29.5	4130	4293	3567	11538	2769	3102	86.0	85.7	83.5	83.1	107	323.8	392.4	53.04	12,467	322.2
TCII-15	32.0	4480	4608	3831	12392	2974	3331	86.0	85.7	83.4	83.1	114	345.8	419.3	57.14	13,511	346.3
TCII-16	34.0	4760	4923	4095	13246	3179	3561	86.0	85.7	83.4	83.2	122	367.8	446.2	61.24	14,375	370.4
TCII-17	36.5	5110	5238	4358	14100	3384	3790	86.0	85.8	83.4	83.2	130	389.8	473.1	65.34	15,239	394.5
TCII-18	38.5	5390	5553	4622	14954	3589	4019	86.0	85.8	83.4	83.2	138	411.8	500.0	69.44	16,103	418.6

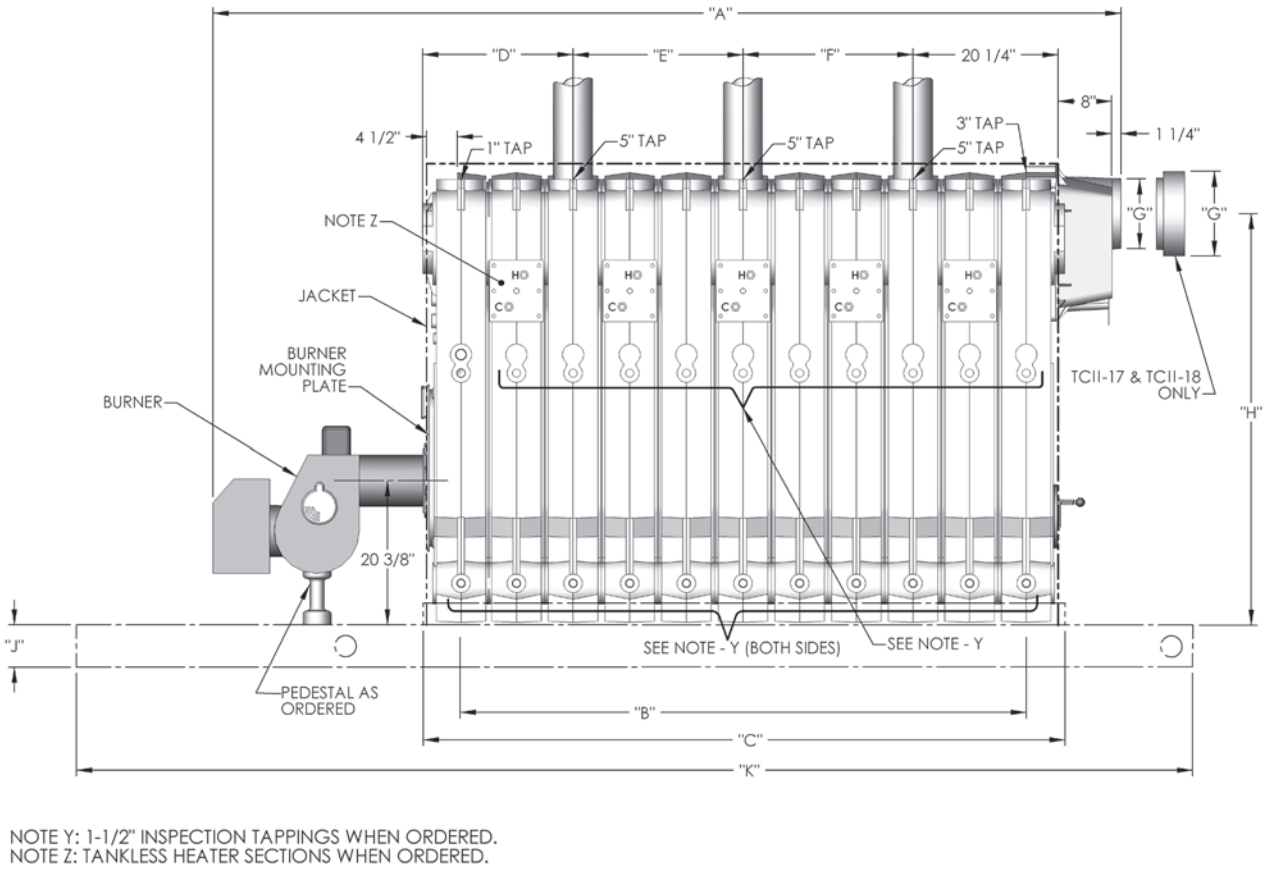
Notes:
1. Net Ratings are based on an allowance of 1.15 for Water Boilers. Net Ratings for steam boilers are based on a pick-up factors as follows: TCII-04 & TCII-05, 1.333; TCII-06 & TCII-07, 1.305; TCII-08 through TCII-18, 1.288.
2. Burner oil input based on Commercial Standard #2 fuel oil with a heating 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 7.1a: Series TCII™ Boiler Ratings (SI Metric Units)

SERIES TCII™ BOILER RATINGS (SI METRIC UNITS)

Series TCII™ (AHRI CERTIFIED® www.ahridirectory.org)																
	Oil Input		Gas	Gross	NET			Oil		Gas		Water Content		Furnace	Boiler	Heating
					Steam									Volume	Working	Surface
Boiler Model	l/hr	kW	Input kW	Output kW	m^2	kW	Water kW	Comb Effy	Thermal Effy	Comb Effy	Thermal Effy	Steam (Liters)	Water (Liters)	(m^3)	Weight (kg)	(m^3)
TCII-04	29.9	324.1	334.9	272.8	270.2	205	237.3	86.2	83.9	83.6	81.4	393	467	0.3409	1916	7.54
TCII-05	38.6	418.4	427.2	349.8	346.8	263	304.1	86.2	84.4	83.6	81.9	476	569	0.4570	2290	9.78
TCII-06	46.2	500.4	519.5	427.2	429.7	325	371.5	86.1	84.8	83.5	82.2	559	671	0.5731	2664	12.02
TCII-07	54.5	590.7	611.8	504.5	514.9	390	438.6	86.1	85.0	83.5	82.5	643	773	0.6892	3038	14.26
TCII-08	62.8	680.9	704.1	581.6	596.5	452	505.7	86.1	85.2	83.5	82.6	726	874	0.8053	3412	16.50
TCII-09	71.2	771.2	796.4	659.0	675.8	512	573.1	86.1	85.3	83.5	82.7	809	976	0.9214	3787	18.74
TCII-10	79.5	861.4	888.7	736.3	755.2	572	640.2	86.1	85.4	83.5	82.8	893	1078	1.0375	4168	20.98
TCII-11	87.1	943.5	981.0	813.4	834.1	631	707.3	86.0	85.5	83.5	82.9	976	1180	1.1536	4542	23.22
TCII-12	96.5	1046.0	1073.3	890.7	913.5	691	774.4	86.0	85.6	83.5	83.0	1059	1282	1.2697	4916	25.46
TCII-13	104.1	1128.1	1165.6	968.1	992.9	752	841.8	86.0	85.6	83.5	83.0	1142	1383	1.3858	5295	26.86
TCII-14	111.7	1210.1	1257.8	1045.1	1071.9	811	908.9	86.0	85.7	83.5	83.1	1226	1485	1.5019	5667	29.93
TCII-15	121.1	1312.6	1350.1	1122.5	1151.2	871	976	86.0	85.7	83.4	83.1	1309	1587	1.6180	6141	32.17
TCII-16	128.7	1394.7	1442.4	1199.8	1230.6	931	1043	86.0	85.7	83.4	83.2	1392	1689	1.7341	6534	34.41
TCII-17	138.2	1497.2	1534.7	1276.9	1309.9	992	1110	86.0	85.8	83.4	83.2	1457	1791	1.8502	6927	36.65
TCII-18	145.7	1579.3	1627.0	1354.2	1389.2	1052	1178	86.0	85.8	83.4	83.2	1559	1893	1.9663	7320	38.89

Notes:
1. Net Ratings are based on an allowance of 1.15 for Water Boilers. Net Ratings for steam boilers are based on a pick-up factors as follows: TCII-04 & TCII-05, 1.333; TCII-06 & TCII-07, 1.305; TCII-08 through TCII-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.



NOTE Y: 1-1/2" INSPECTION TAPPINGS WHEN ORDERED.
NOTE Z: TANKLESS HEATER SECTIONS WHEN ORDERED.

Figure 7.1: Boiler Dimensions – Side View

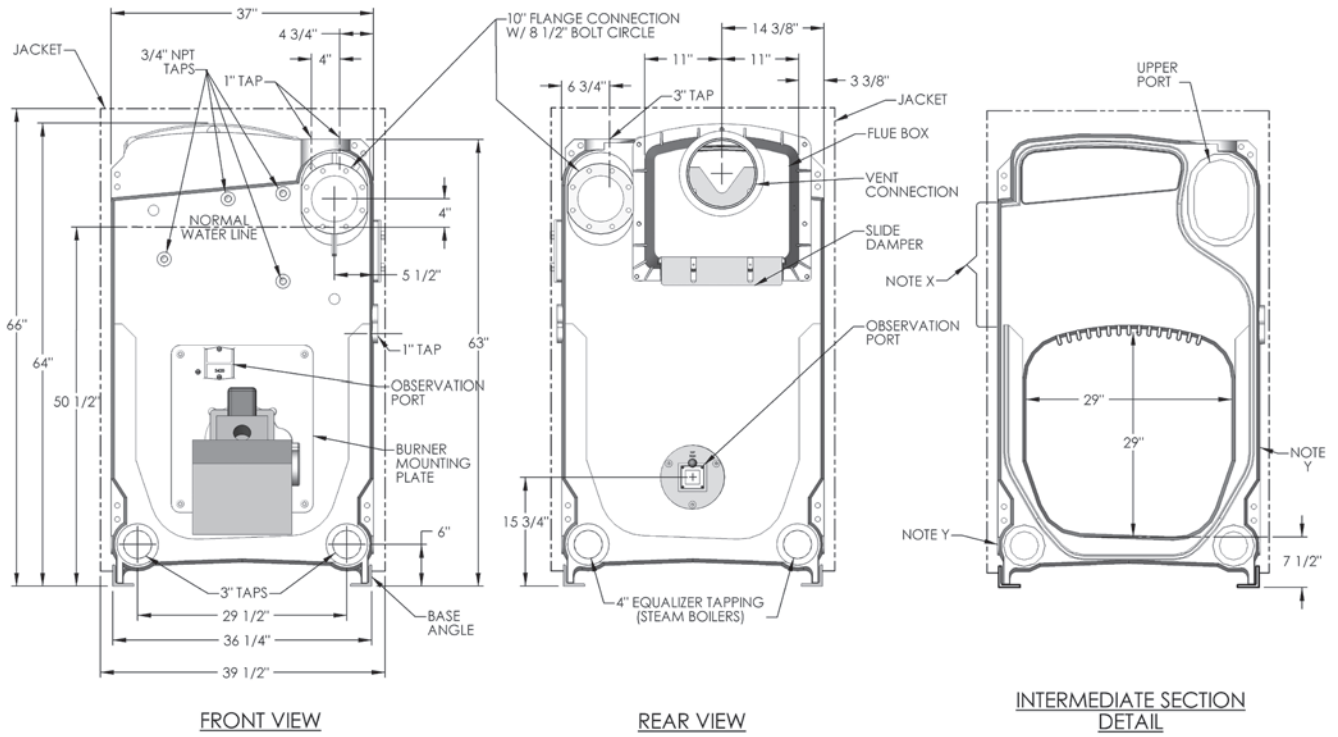


Figure 7.2: Boiler Dimensions – Auxiliary Views

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

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

Table 7.2b: Series TCII™ Boiler Dimensions (SI Metric Units)

SERIES TCII™ BOILER DIMENSIONS (SI METRIC UNITS)												
	Overall Length - "A"[2] (mm)						Riser Tapping Locations[3]					
Boiler Model	Beckett	Carlin	Power Flame	Optional Packaged Base Dimension "K" (mm)	Firebox Length "B" (mm)	Boiler Length "C" (mm)	"D" (mm)	"E" (mm)	"F" (mm)	Dia. Vent Conn. "G" (mm)	Height Vent Conn. "H" (mm)	Base Height "J" (mm)
TCII-04	1632	1581	1822	2318	592	838	318	–	–	254	1464	152
TCII-05	1835	1784	2115	2648	795	1041	521	–	–	254	1464	152
TCII-06	2038	2038	2318	2851	999	1245	318	406	–	254	1464	152
TCII-07	2254	2242	2521	3061	1202	1448	318	610	–	305	1438	152
TCII-08	2457	2445	2724	3264	1405	1651	318	813	–	305	1438	152
TCII-09	2661	2762	2927	3467	1608	1854	318	1016	–	356	1413	152
TCII-10	2959	2965	3181	3677	1811	2057	521	1016	–	356	1413	152
TCII-11	3162	3181	3486	4007	2015	2261	521	610	610	356	1413	152
TCII-12	3366	3385	3689	4223	2218	2464	521	610	813	356	1413	152
TCII-13	3366	3588	3893	4413	2421	2667	521	813	813	356	1413	152
TCII-14	N/A	3791	4096	4616	2624	2870	521	813	1016	406	1387	152
TCII-15	N/A	N/A	4299	4823	2827	3073	521	1016	1016	406	1387	203
TCII-16	N/A	N/A	4502	5036	3031	3277	521	1219	1016	406	1387	203
TCII-17	N/A	N/A	4858	5366	3234	3480	521	1219	1219	457	1387	203
TCII-18	N/A	N/A	5061	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 TCII-17 & TCII-18 for flue outlet adapter.
3. These dimensions are approximate.

Series TC II™

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.

PeerlessBoilers.com

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TC8058 R2 (3/21-2.5C
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