

CROWN Boiler Co.

D E S I G N E D T O L E A D

Series 32

Gas-Fired Natural Draft Steam or Water Boilers

INSTALLATION AND OPERATING INSTRUCTIONS

These instructions must be affixed on or adjacent to the boiler.

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury, or loss of life. For assistance or additional information, consult a qualified installer, service agency or the gas supplier. Read these instructions carefully before installing.

CROWN
Boiler Co.

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I Product Description

The Series 32 boilers are low pressure cast iron gas fired steam or hot water boilers designed for use in commercial heating applications. These boilers are Category I draft diverter equipped appliances, which must be vented by natural draft using a lined masonry or listed metal chimney system. An adequate supply of air for combustion, ventilation and dilution of flue gases must be available in the boiler room. This boiler is intended for use with natural gas only.

The Series 32 may be used on low pressure steam heating systems or forced hot water heating systems and is intended for installation in “closed” systems only. Hot water Series 32 boilers are available with up to two optional tankless heaters for domestic hot water generation.

II Specifications

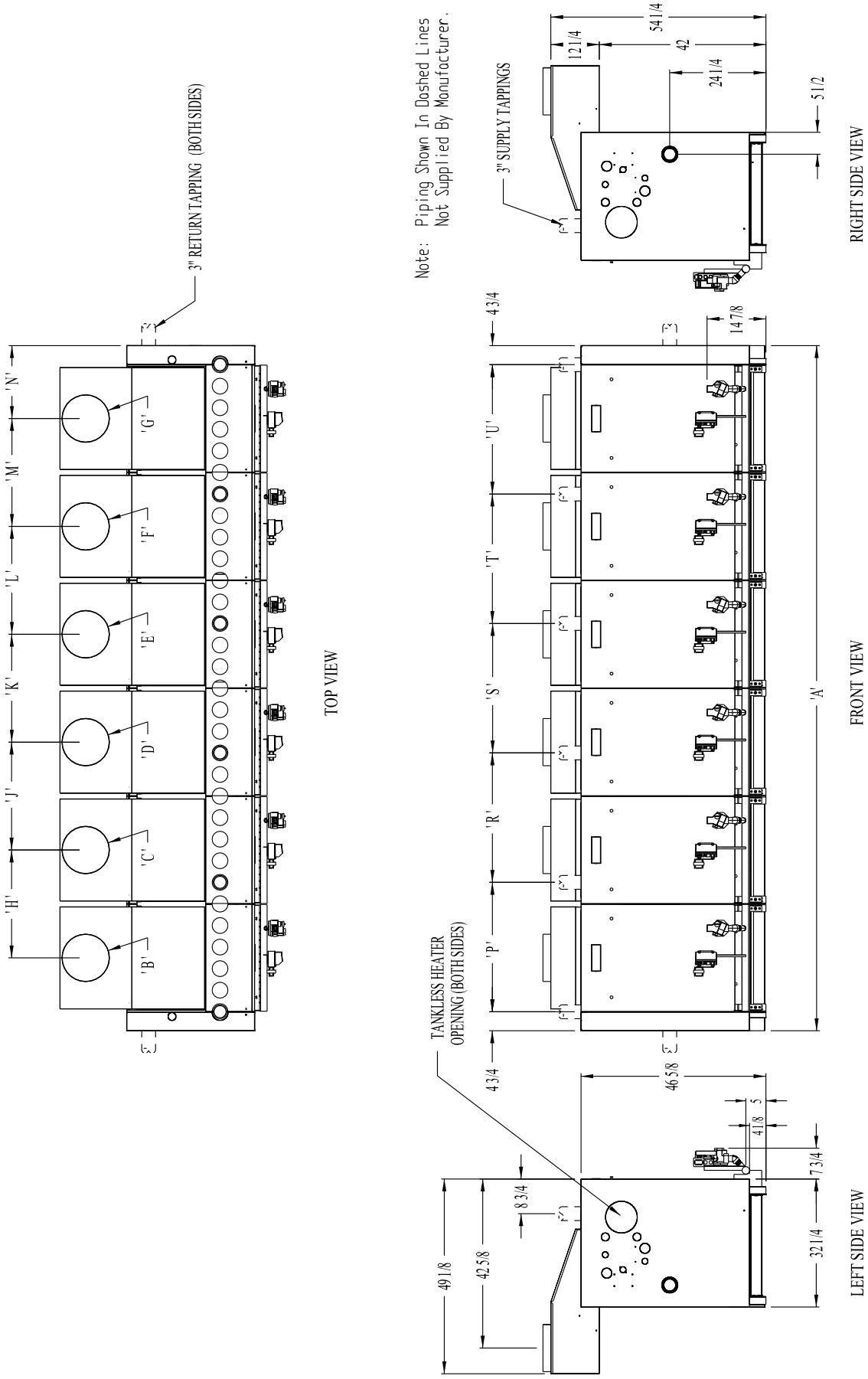


Figure 1: Base Model - General Configuration

Boiler Model Number	Jacket Overall Length		Draft Hood Size & Location														Top Supply Location					Flue Outlet No. & Size	
	'A'	'B' Dia.	'C' Dia.	'D' Dia.	'E' Dia.	'F' Dia.	'G' Dia.	'H'	'J'	'K'	'L'	'M'	'N'	'P'	'R'	'S'	'T'	'U'	10"	12"			
32-475W(S)N	36 3/4	12	-	-	-	-	-	-	-	-	-	-	18 3/8	27 3/16	-	-	-	-	-	-	1		
32-570W(S)N	42 1/4	10	10	-	-	-	-	16 5/16	-	-	-	-	12 15/16	32 5/8	-	-	-	-	-	-	2		
32-665W(S)N	47 5/8	10	12	-	-	-	-	19 1/16	-	-	-	-	15 11/16	38 1/16	-	-	-	-	-	-	1		
32-760W(S)N	53 1/8	12	12	-	-	-	-	21 3/4	-	-	-	-	15 11/16	43 1/2	-	-	-	-	-	-	2		
32-855W(S)N	58 1/2	12	12	-	-	-	-	24 7/16	-	-	-	-	18 3/8	48 15/16	-	-	-	-	-	-	2		
32-950W(S)N	64	12	12	-	-	-	-	27 3/16	-	-	-	-	18 3/8	54 3/8	-	-	-	-	-	-	2		
32-1045W(S)N	69 3/8	10	12	12	-	-	-	19 1/16	21 3/4	-	-	-	15 11/16	27 3/16	32 5/8	-	-	-	-	-	1		
32-1140W(S)N	74 7/8	12	12	12	-	-	-	21 3/4	21 3/4	-	-	-	15 11/16	32 5/8	32 5/8	-	-	-	-	-	3		
32-1235W(S)N	80 1/4	10	12	12	-	-	-	21 3/4	27 3/16	-	-	-	18 3/8	32 5/8	38 1/16	-	-	-	-	-	2		
32-1330W(S)N	85 3/4	12	12	12	-	-	-	24 7/16	27 3/16	-	-	-	18 3/8	38 1/16	38 1/16	-	-	-	-	-	3		
32-1425W(S)N	91 1/8	12	12	12	-	-	-	27 1/4	27 3/16	-	-	-	18 3/8	38 1/16	43 1/2	-	-	-	-	-	3		
32-1520W(S)N	96 5/8	12	12	12	12	-	-	21 3/4	21 3/4	21 3/4	-	-	15 11/16	43 1/2	43 1/2	-	-	-	-	-	4		
32-1615W(S)N	102	10	12	12	12	-	-	19 1/16	24 7/16	27 3/16	-	-	18 3/8	32 5/8	32 5/8	27 3/16	-	-	-	-	3		
32-1710W(S)N	107 1/2	12	12	12	12	-	-	21 3/4	24 7/16	27 3/16	-	-	18 3/8	32 5/8	38 1/16	27 3/16	-	-	-	-	4		
32-1805W(S)N	112 7/8	12	12	12	12	-	-	24 7/16	27 1/4	27 3/16	-	-	18 3/8	32 5/8	32 5/8	38 1/16	-	-	-	-	4		
32-1900W(S)N	118 3/8	12	12	12	12	-	-	27 1/4	27 1/4	27 3/16	-	-	18 3/8	32 5/8	38 1/16	38 1/16	-	-	-	-	4		
32-1995W(S)N	123 3/4	10	10	12	12	12	-	16 5/16	21 3/4	27 3/16	27 3/16	-	18 3/8	38 1/16	38 1/16	38 1/16	-	-	-	-	3		
32-2090W(S)N	129 1/4	12	12	12	12	12	-	21 3/4	21 3/4	24 7/16	27 3/16	-	18 3/8	32 5/8	32 5/8	27 3/16	27 3/16	-	-	-	5		
32-2185W(S)N	134 5/8	12	12	12	12	12	-	21 3/4	24 7/16	27 3/16	27 3/16	-	18 3/8	38 1/16	32 5/8	27 3/16	27 3/16	-	-	-	5		
32-2280W(S)N	140 1/8	12	12	12	12	12	-	24 7/16	27 3/16	27 3/16	27 3/16	-	18 3/8	32 5/8	32 5/8	32 5/8	32 5/8	-	-	-	5		
32-2375W(S)N	145 1/2	12	12	12	12	12	-	27 3/16	27 3/16	27 3/16	27 3/16	-	18 3/8	32 5/8	32 5/8	32 5/8	38 1/16	-	-	-	5		
32-2470W(S)N	151	10	10	12	12	12	12	16 5/16	21 3/4	27 3/16	27 3/16	27 3/16	18 3/8	32 5/8	32 5/8	38 1/16	38 1/16	-	-	-	4		
32-2565W(S)N	156 3/8	10	12	12	12	12	12	19 1/16	24 7/16	27 3/16	27 3/16	27 3/16	18 3/8	38 1/16	32 5/8	38 1/16	38 1/16	-	-	-	5		
32-2660W(S)N	161 7/8	12	12	12	12	12	12	21 3/4	24 7/16	27 3/16	27 3/16	27 3/16	18 3/8	32 5/8	32 5/8	32 5/8	27 3/16	27 3/16	-	-	6		
32-2755W(S)N	167 1/4	12	12	12	12	12	12	24 7/16	27 3/16	27 3/16	27 3/16	27 3/16	18 3/8	32 5/8	32 5/8	32 5/8	32 5/8	27 3/16	27 3/16	-	6		
32-2850W(S)N	172 3/4	12	12	12	12	12	12	27 3/16	27 3/16	27 3/16	27 3/16	27 3/16	18 3/8	32 5/8	32 5/8	32 5/8	32 5/8	32 5/8	32 5/8	-	6		

1. All Dimensions Are Approximate.

Table 1A: Dimensional Data

BASIC BOILER MODEL	NUMBER OF SECTIONS	NATURAL GAS ONLY					Combustion Effy. %	WATER VOL. ₁	WATER VOL. ₂	BHP OUTPUT ₃
		INPUT (MBH)	HEATING CAPACITY (MBH)	I=B=R NET RATING						
				Steam		Water				
				(Sq. ft)	(MBH)	(MBH)				
(Gal)	(Gal)									
32-475W(S)N	6	475	380	1188	285	330	80-1/2	28.58	39.80	11.4
32-570W(S)N	7	570	456	1425	342	397	80-1/2	32.65	45.47	13.6
32-665W(S)N	8	665	532	1663	399	463	80-1/2	36.72	51.14	15.9
32-760W(S)N	9	760	608	1900	456	529	80-1/2	40.79	56.81	18.2
32-855W(S)N	10	855	684	2138	513	595	80-1/2	44.86	62.48	20.4
32-950W(S)N	11	950	760	2376	570	661	80-1/2	48.93	68.15	22.7
32-1045W(S)N	12	1045	836	2613	627	727	80-1/2	53.00	73.82	25.0
32-1140W(S)N	13	1140	912	2851	684	793	80-1/2	57.07	79.49	27.2
32-1235W(S)N	14	1235	988	3088	741	859	80-1/2	61.14	85.16	29.5
32-1330W(S)N	15	1330	1064	3326	798	925	80-1/2	65.21	90.83	31.8
32-1425W(S)N	16	1425	1140	3563	855	991	80-1/2	69.28	96.50	34.1
32-1520W(S)N	17	1520	1216	3801	912	1057	80-1/2	73.35	102.17	36.3
32-1615W(S)N	18	1615	1292	4050	972	1123	80-1/2	77.42	107.84	38.6
32-1710W(S)N	19	1710	1368	4312	1035	1190	80-1/2	81.49	113.51	40.9
32-1805W(S)N	20	1805	1444	4575	1098	1256	80-1/2	85.56	119.18	43.1
32-1900W(S)N	21	1900	1520	4839	1161	1322	80-1/2	89.63	124.85	45.4
32-1995W(S)N	22	1995	1596	5102	1225	1388	80-1/2	93.70	130.52	47.7
32-2090W(S)N	23	2090	1672	5366	1288	1454	80-1/2	97.77	136.19	49.9
32-2185W(S)N	24	2185	1748	5628	1351	1520	80-1/2	101.84	141.86	52.2
32-2280W(S)N	25	2280	1824	5890	1414	1586	80-1/2	105.91	147.53	54.5
32-2375W(S)N	26	2375	1900	6143	1474	1652	80-1/2	109.98	153.20	56.8
32-2470W(S)N	27	2470	1976	6392	1534	1718	80-1/2	114.05	158.87	59.0
32-2565W(S)N	28	2565	2052	6638	1593	1784	80-1/2	118.12	164.54	61.3
32-2660W(S)N	29	2660	2128	6884	1652	1850	80-1/2	122.19	170.21	63.6
32-2755W(S)N	30	2755	2204	7130	1711	1917	80-1/2	126.26	175.88	65.8
32-2850W(S)N	31	2850	2280	7376	1770	1983	80-1/2	130.33	181.55	68.1

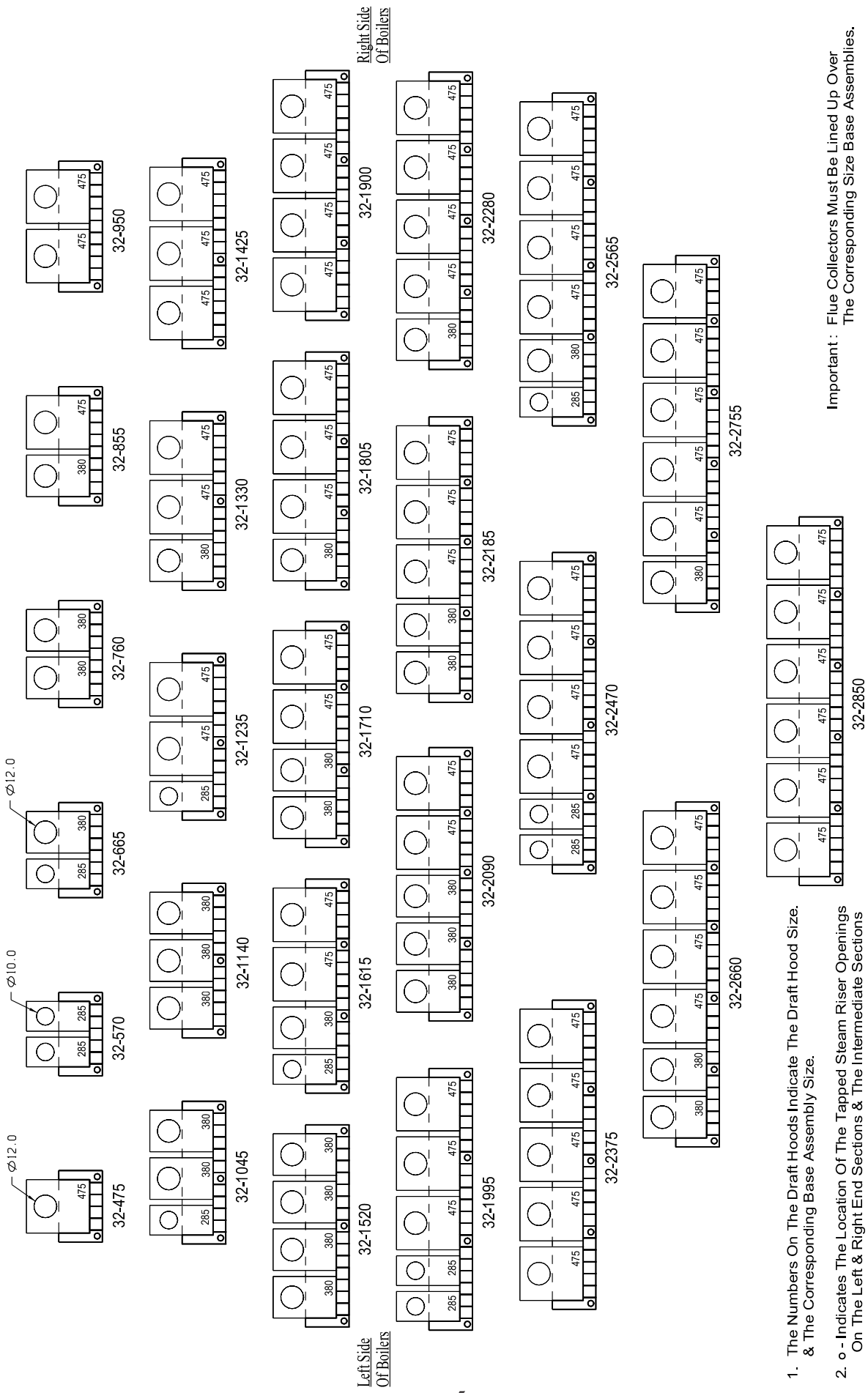
1. Water Volume Total To Normal Water Line (Steam Boiler).

2. Water Volume Total (Water Boiler).

3. Ratings Based on 33,475 Btuh Per Boiler Horsepower

Table 1B: Specifications

Rear Of Boilers



Left Side Of Boilers

Right Side Of Boilers

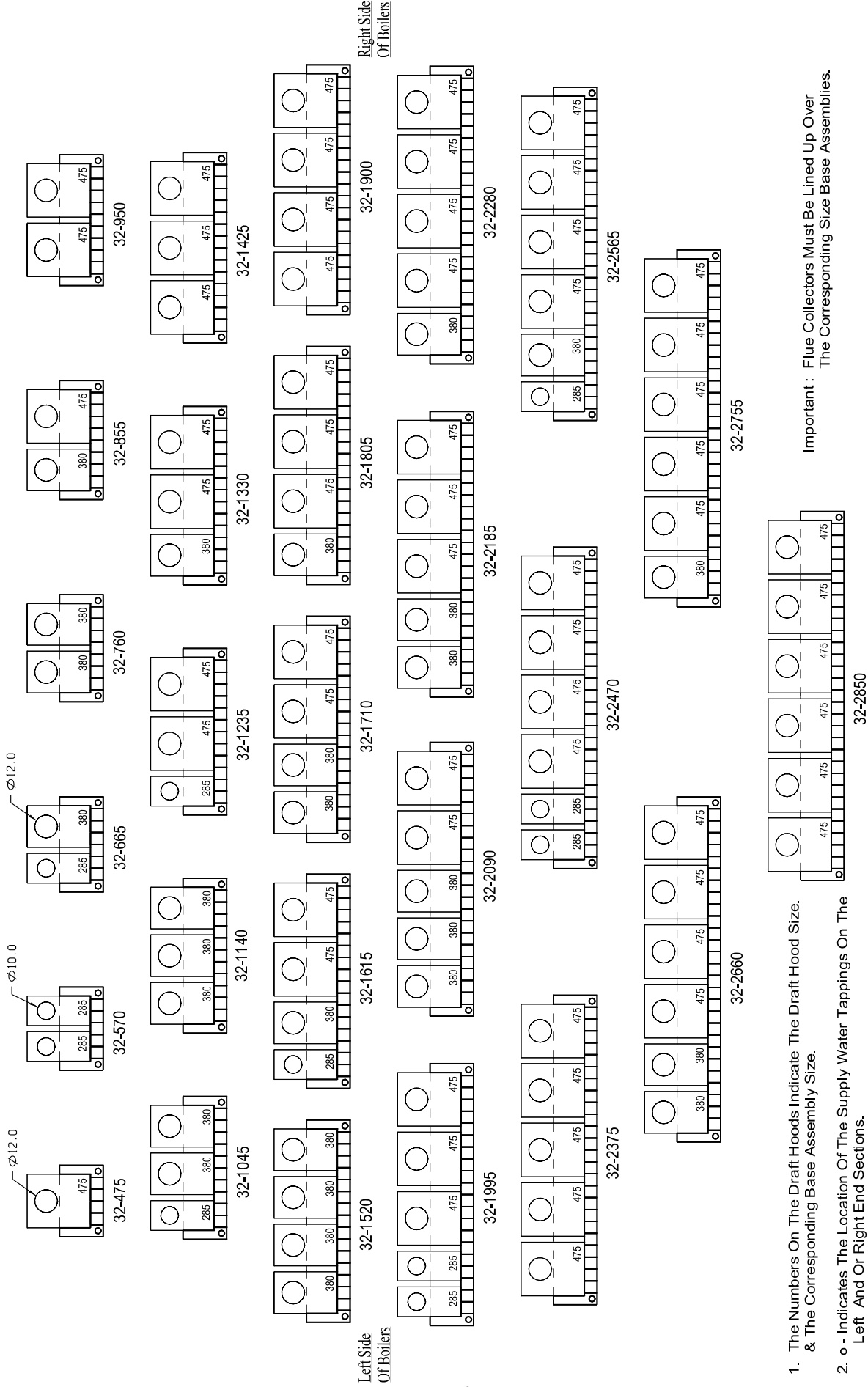
Front Of Boilers

1. The Numbers On The Draft Hoods Indicate The Draft Hood Size. & The Corresponding Base Assembly Size.
2. o - Indicates The Location Of The Tapped Steam Riser Openings On The Left & Right End Sections & The Intermediate Sections Where Required.
3. The 32-475 Boiler Requires Only One Riser, However It May Be Located On Either The Left Or Right End Section.

Important : Flue Collectors Must Be Lined Up Over The Corresponding Size Base Assemblies.

Figure 2a: Series 32 Steam Boilers - Arrangement Of Steam Riser Connections, Draft Hoods And Base Assemblies

Rear Of Boilers



Important : Flue Collectors Must Be Lined Up Over The Corresponding Size Base Assemblies.

1. The Numbers On The Draft Hoods Indicate The Draft Hood Size. & The Corresponding Base Assembly Size.
2. o - Indicates The Location Of The Supply Water Tappings On The Left And Or Right End Sections.
3. The Boiler Models 32-475 Through & Including The 32-1425 Model Boilers Require Only One Riser However It May Be Located On Either The Left Or Right End Section.

Figure 2b: Series 32 Water Boilers - Arrangement Of Water Supply Connections, Draft Hoods And Base Assemblies

III Before Installing

- 1) Safe, reliable operation of this boiler depends upon installation by a professional heating contractor in strict accordance with this manual and the requirements of the authority having jurisdiction.
 - In the absence of an authority having jurisdiction, installation must be in accordance with this manual and the latest edition of the *National Fuel Gas Code*, ANSI Z223.1.
 - Where required by the authority having jurisdiction, this installation must conform to the latest edition of the *Standard for Controls and Safety Devices for Automatically Fired Boilers* (ANSI/ASME CSD-1)
- 2) Make sure that a properly sized chimney is available and is in good condition. Consult the authority having jurisdiction, Part VII of this manual, and the *National Fuel Gas Code* for additional information on venting requirements.
- 3) Make sure that the boiler is correctly sized.
- 4) This boiler is designed and listed for use with natural gas only.
- 5) Boilers installed at altitudes above 2000 ft. require different main burner orifice than those at sea level. Make sure that the boiler is configured for use at the correct altitude.
- 6) If this boiler was received as a knockdown boiler, follow the instructions in Section V to assemble the boiler.

WARNING

This Product Must be Installed By A Licensed Plumber Or Gas Fitter when Installed Within The Commonwealth Of Massachusetts.

If This Boiler is Equipped With a Tankless Heater, Tankless Heater Piping Must be Installed by a Licensed Plumber When Boiler is Installed Within the Commonwealth of Massachusetts.

IV Locating the Boiler

WARNING

All Series 32 boilers must be installed in rooms that are large in comparison with the size of the equipment and must be installed with the clearances listed in Table 2. Such a room will have a volume equal to at least 16 times the total volume of the boiler.

- 1) Minimum required boiler room volumes are shown in Table 2. To find the volume of the boiler room calculate:

Boiler Room Volume (ft³) = Length (ft) x Width (ft) x Height (ft)

If the height is greater than 8 ft for the room height, use 8 ft for the height in the above equation.
- 2) Observe the minimum clearances as shown in Table 3. These clearances apply to all combustible construction, as well as noncombustible walls, ceilings and doors. Also see Figure 3.
- 3) This boiler must be installed on a non-combustible floor. A concrete pad is not sufficient to protect combustible flooring.
- 4) The boiler must be installed on a hard level surface.
- 5) Do not install this boiler in a location where gasoline or other flammable vapors or liquids will be stored or used. Do not install this boiler in an area where large amounts of airborne dust will be present, such as a workshop.

Boiler Model	Over All Length Jacket	Over All Depth Jacket	Over All Height Floor To Top Of Jacket	Boiler Volume (Ft3)	Minimum Room Volume (Ft3)
32-475	36 3/4	32 1/4	46 5/8	32.0	511.7
32-570	42 1/4	32 1/4	46 5/8	36.7	587.4
32-665	47 5/8	32 1/4	46 5/8	41.4	663.1
32-760	53 1/8	32 1/4	46 5/8	46.2	738.8
32-855	58 1/2	32 1/4	46 5/8	50.9	814.5
32-950	64	32 1/4	46 5/8	55.6	890.2
32-1045	69 3/8	32 1/4	46 5/8	60.4	965.9
32-1140	74 7/8	32 1/4	46 5/8	65.1	1041.6
32-1235	80 1/4	32 1/4	46 5/8	69.8	1117.3
32-1330	85 3/4	32 1/4	46 5/8	74.6	1193.0
32-1425	91 1/8	32 1/4	46 5/8	79.3	1268.7
32-1520	96 5/8	32 1/4	46 5/8	84.0	1344.4
32-1615	102	32 1/4	46 5/8	88.8	1420.1
32-1710	107 1/2	32 1/4	46 5/8	93.5	1495.8
32-1805	112 7/8	32 1/4	46 5/8	98.2	1571.5
32-1900	118 3/8	32 1/4	46 5/8	103.0	1647.2
32-1995	123 3/4	32 1/4	46 5/8	107.7	1722.9
32-2090	129 1/4	32 1/4	46 5/8	112.4	1798.6
32-2185	134 5/8	32 1/4	46 5/8	117.1	1874.3
32-2280	140 1/8	32 1/4	46 5/8	121.9	1950.1
32-2375	145 1/2	32 1/4	46 5/8	126.6	2025.8
32-2470	151	32 1/4	46 5/8	131.3	2101.5
32-2565	156 3/8	32 1/4	46 5/8	136.1	2177.2
32-2660	161 7/8	32 1/4	46 5/8	140.8	2252.9
32-2755	167 1/4	32 1/4	46 5/8	145.5	2328.6
32-2850	172 3/4	32 1/4	46 5/8	150.3	2404.3

Table 2: Minimum Room Volumes Based On Sixteen Times Boiler Volume By Model Size

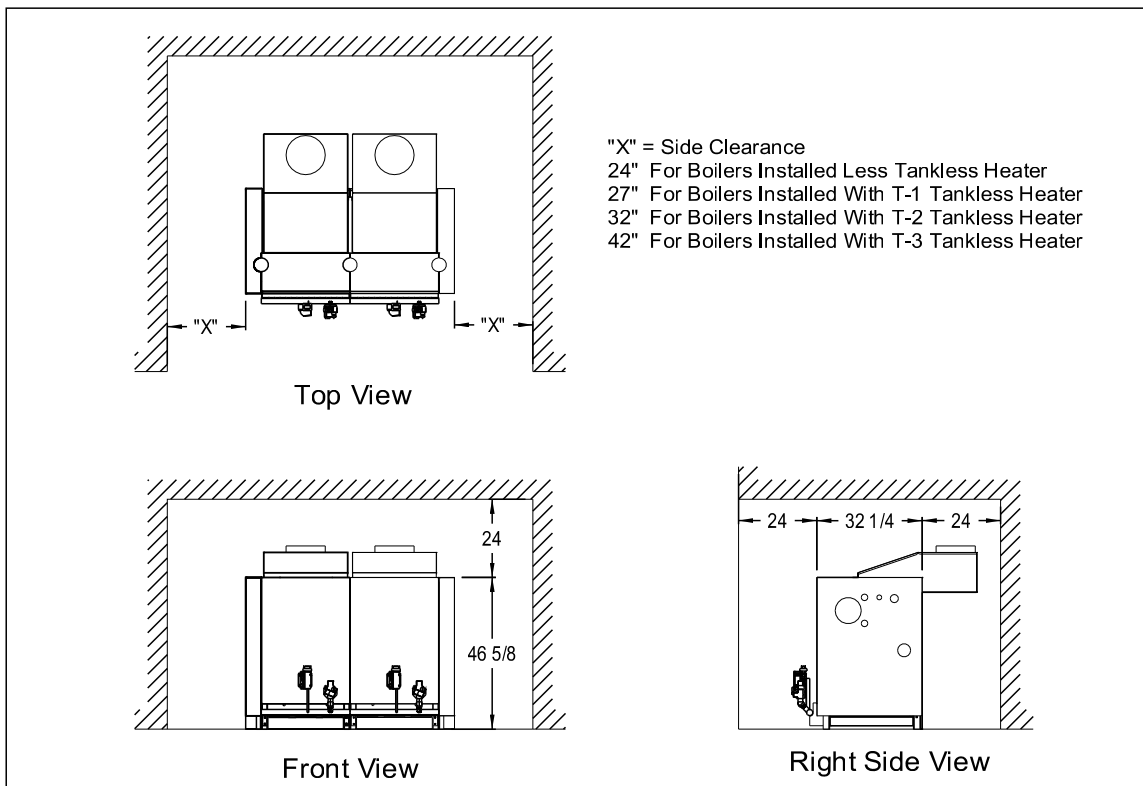


Figure 3: Clearances To Combustible Construction

	Minimum Clearance - Jacket To Combustible Or Non-Combustible Construction	Service Clearance To Non-Combustible Construction	Clearances Required For Removal Of Tankless Heater		
			T-1	T-2	T-3
Left Side	24"	18" (Controls)	27"	32"	42"
Right Side	24"	18" (Controls)	27"	32"	42"
Front	24"	36" (Cleaning-Burner Removal)	-----	-----	-----
Rear	24"	36" (Cleaning)	-----	-----	-----
Top	24"	-----	-----	-----	-----

Table 3: Minimum Clearances to Combustibles

- 6) The boiler should be located as close to the chimney as possible.
- 7) Do not install this boiler directly on a surface that may get wet. Raise the boiler on a pad.

V Knockdown Boiler Assembly Instructions

A. Prior To Assembly

- 1) Thoroughly inspect the cast iron heat exchanger sections for any shipping damage, i.e. cracks in the castings, broken lugs or punctures due to mishandling.
- 2) Do not use a damaged heat exchanger section. Replace it with an undamaged heat exchanger section.
- 3) Keep the base in the shipping carton until it is time to perform the assembly. This keeps foreign material from contaminating the burners or creating other hazards. Do not use the base assembly if there are any signs of visible damage.
- 4) Review all of the installation requirements in this installation manual.
- 5) Verify that all needed components are on hand. A complete list of all sections and cartons that should be on hand, along with their contents, can be found in the Parts Section. A summary of the cartons and their contents is shown below. All boilers except the 32-475 use multiple base modules and therefore require multiple Base Cartons and Intermediate Cartons. All boilers larger than the 32-855 require multiple Section Joiner Cartons. Some parts, such as jacket screws and jacket mounting brackets are packed in both the Base Carton and the Base Side Panel Carton.

PACKAGE	SUMMARY OF CONTENTS
BASE CARTON	BASE MODULE BRACKETS AND HARDWARE FOR ATTACHING JACKET AND FLUE COLLECTOR
INTERMEDIATE CARTON	FRONT, TOP, REAR JACKET PANELS FLUE COLLECTOR
SECTION JOINER CARTON	PUSHNIPPLES TIE ROD HARDWARE PUSHNIPPLE LUBRICANT SECTION SEALING COMPOUND
BASE SIDE PANEL CARTON	BASE SIDE PANELS BRACKETS AND HARDWARE FOR ATTACHING JACKET AND FLUE COLLECTOR TO SIDES OF BOILER
JACKET SIDE PANEL CARTON	LEFT AND RIGHT SIDE JACKET PANELS
WATER TRIM CARTON	LIMIT CONTROLS GAUGE LOW WATER CUT-OFF (CSD-1 BOILERS ONLY) TANKLESS COIL OPENING COVER PLATES AND HARDWARE ASSORTED FITTINGS
STEAM TRIM CARTON	LIMIT CONTROLS GAUGE LOW WATER CUT-OFFS TANKLESS COIL OPENING COVER PLATES AND HARDWARE ASSORTED FITTINGS
BOILER CARTON	INSTALLATION MANUAL USER'S MANUAL WARRANTY PUSHNIPPLE GAUGE RATING PLATE SEALANT FOR SEALING HEAT EXCHANGER TO BASE POP SAFETY OR RELIEF VALVE FITTINGS FOR MOUNTING POP SAFETY OR RELIEF VALVE
TANKLESS HEATER CARTON	TANKLESS HEATER (IF USED)

B. Base Assembly

- 1) Each base module is tested and shipped assembled.
 - a. All boilers are assembled using base modules with inputs of 285, 380 and 475 MBH
 - b. The model 475 boiler requires only a single base module. All other boiler combinations require multiple base module subassemblies. See Figure 2 for the proper order of assembly.
 - c. Join Base Sub-assemblies together. Use (4) 3/8"-16 x 3/4" screws, nuts and washers to attach subassemblies. (See Figure 4)
 - d. Assemble the base in the location where the boiler is to be installed. Refer to Sections III and IV in this manual for additional information on placement.
 - e. Once the base modules are assembled, install the base end panels. These base end panels must be installed prior to assembling the sections.
 - f. The base must be level in both directions and supported under all feet. Shim and grout under base if necessary.
 - g. Verify that the front and sides of the base are square.
 - h. Place cardboard covering over the top of the burners to protect them during the assembly of the boiler sections.

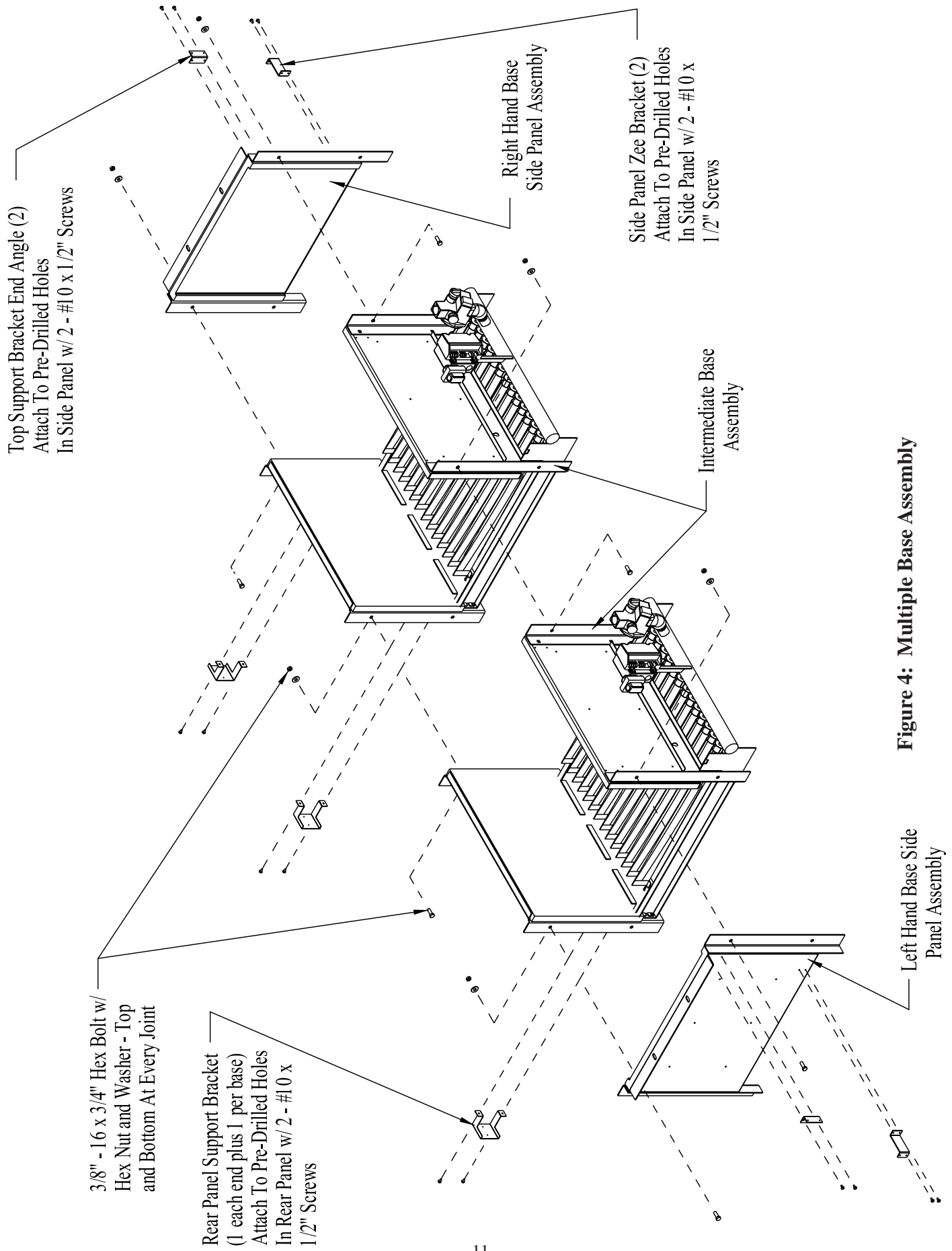


Figure 4: Multiple Base Assembly

C. Section Assembly

- 1) Clean the boiler sections inside and out to remove dirt due to shipping and handling.
- 2) Clean all nipples and nipple ports with kerosene immediately prior to section assembly.
- 3) Set the left end section on the base so that the locating lugs on the bottom of the section go inside the front and rear base panels. Left end sections are identified by "LEH" cast on the section. Right end sections are identified by "REH" cast on the section.
- 4) Apply the Loctite 592 lubricant/sealant furnished to two nipples and the nipple ports in the left section.
- 5) Start each nipple by hand in the nipple port and bump carefully with a wooden block to set. As this is done, check the nipple frequently with the nipple gauge to verify that the nipple is square in the port and not cocked (see Figure 5). Continue to bump the nipple until the nipple gauge just touches the ground surface as measured in two directions 90 degrees apart.

CAUTION

Seating the nipples in accordance with the above instructions will make drawing the sections together easier and assure water tight joints.

- 6) Apply the "joint sealer" to all ground surfaces on the left end section.
- 7) Carefully join the first intermediate section with the left end section. Bump lightly to secure.
- 8) Install 5/8" nuts and washers on one end of each of three 9 3/4" tie rods. Install one of these tie rods in each of the three bosses in the left and intermediate section. Lubricate the other end of each of these tie rods with heavy oil or grease. Install 5/8" nuts and washers on the lubricated ends. Finger tighten.
- 9) Draw the two sections together slowly and evenly, tightening each tie rod a little at a time so that the sections are evenly spaced. **KEEP THE NIPPLES ALIGNED WITH THE NIPPLE PORTS – DO NOT DRAW UP THE SECTIONS IF THE NIPPLES ARE COCKED.** Continue drawing up the sections in this manner until the ground surfaces on each section are touching.
- 10) Repeat Steps (4-9) to assemble the remaining sections. After approximately five sections have been drawn together, use a pinch bar to insert the wood wedges supplied under the last intermediate section to raise it above the base. This will make it easier to assemble subsequent sections, particularly the right end section. As each section is drawn up, move the wedges under that section.

CAUTION

Some boilers use intermediate sections with supply tappings. When these sections are used, it is critical that they are located in the correct position. When assembling the sections refer to Figure 2 to verify that they are assembled in the correct order.

- 11) After all sections have been drawn up, verify that the bottom lugs on the left end section are still against the left end base panel. Using a pinch bar, remove the wood wedges and carefully lower the right end of the assembled block onto the base.
- 12) Install four block anchors using 3/8 x 2" cap screws, nuts and washers (Figure 6).
- 13) Loosen all tie rod nuts so that they are finger tight.

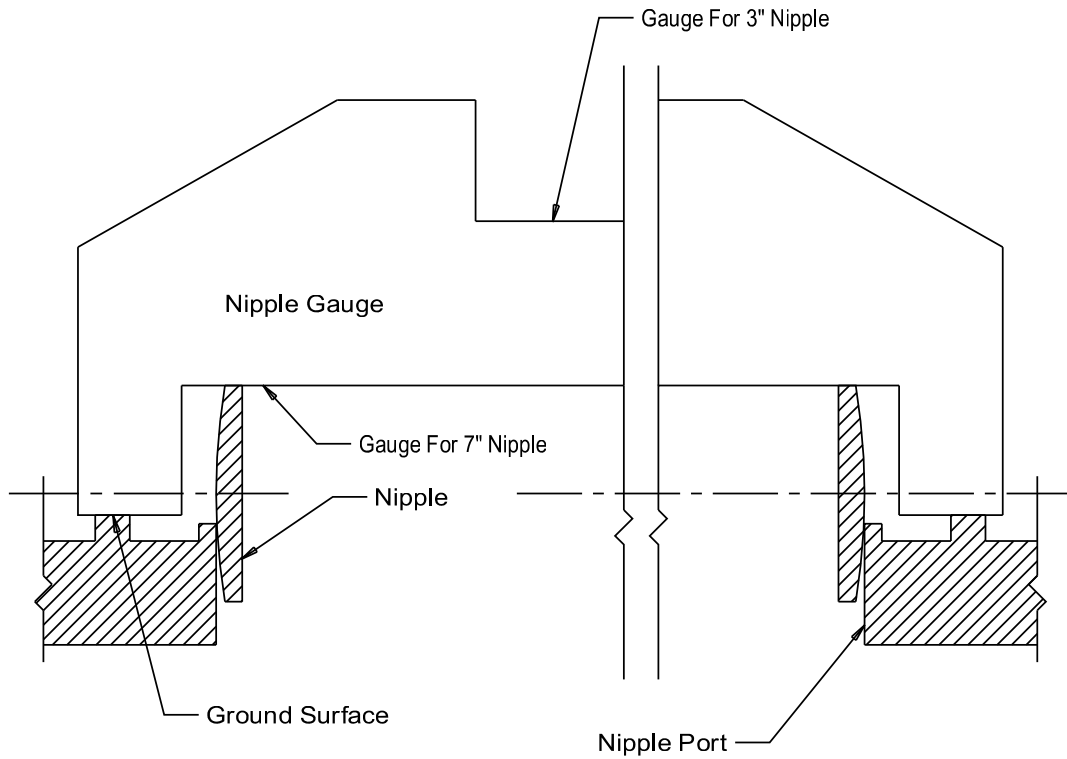


Figure 5: Use Of Nipple Gauge

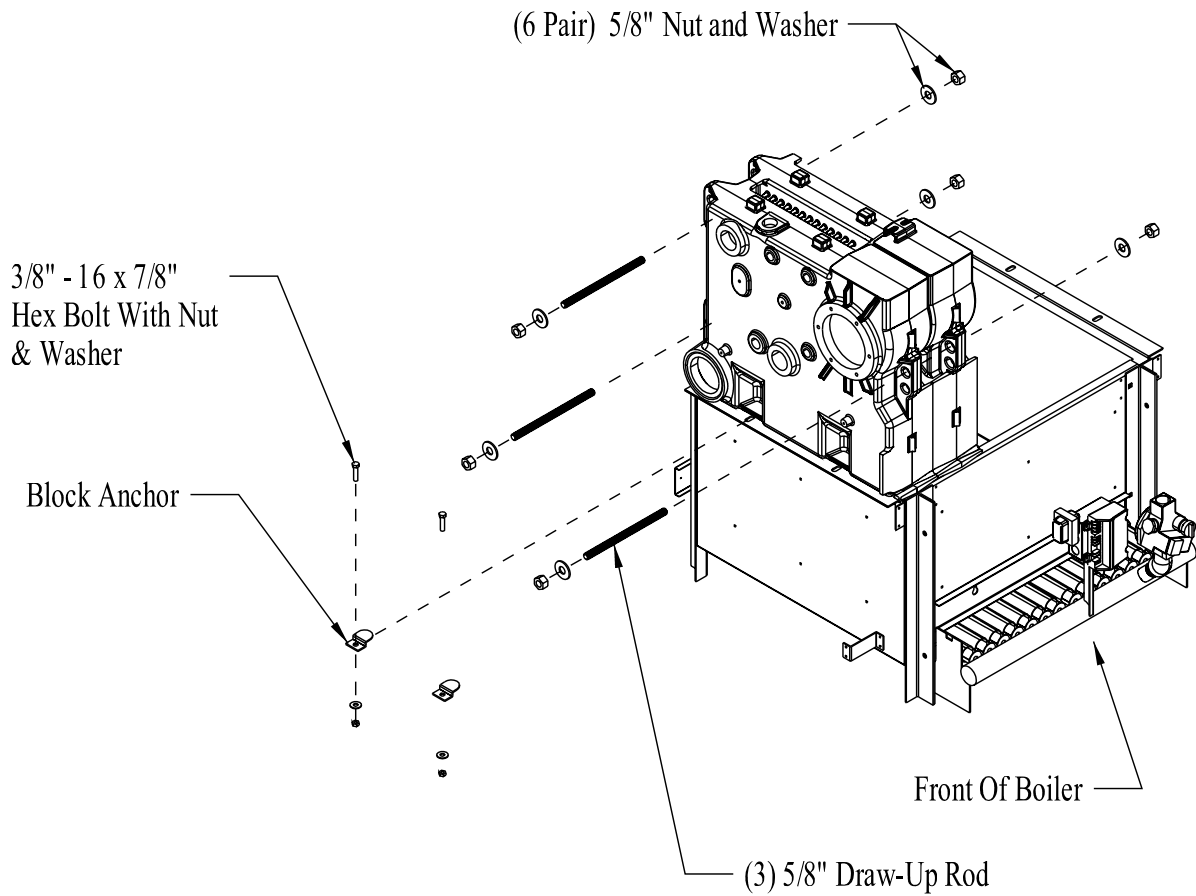


Figure 6: Assembly Of Sections

- 14) Install the tankless coil/s and/or cover plates using the gaskets and 3/8 x 7/8 bolts and washers provided (see Figure 7).
- 15) Test assembled block for leaks. Unless local codes have other requirements, use the following procedure:
 - a) Run a hose from the water service to one of the lower tapings. Install a ball or gate valve in one of the tapings on the top of the block and connect the other end of this valve to a drain. Install a gauge in any other convenient tapping. Plug all remaining unused tapings (See Figure 8).
 - b) Fill the boiler until a steady stream of water is observed going down the drain.
 - c) Slowly close the valve until the pressure in the boiler reads between 10 and 50 psi. **DO NOT EXCEED.**
 - d) Carefully examine all parts of the boiler block assembly for leaks.
 - e) Drain the boiler and remove all plugs from tapings that will be used for connections and trim (see Piping Sections in this manual).
- 16) Use the supplied Resbond sealant to seal the joint between the assembled block and the base.
- 17) Inspect the joints between the sections for any areas that are not flue gas tight. Seal any areas found with the remaining Resbond sealant.



Figure 7: Tankless Heater Installation

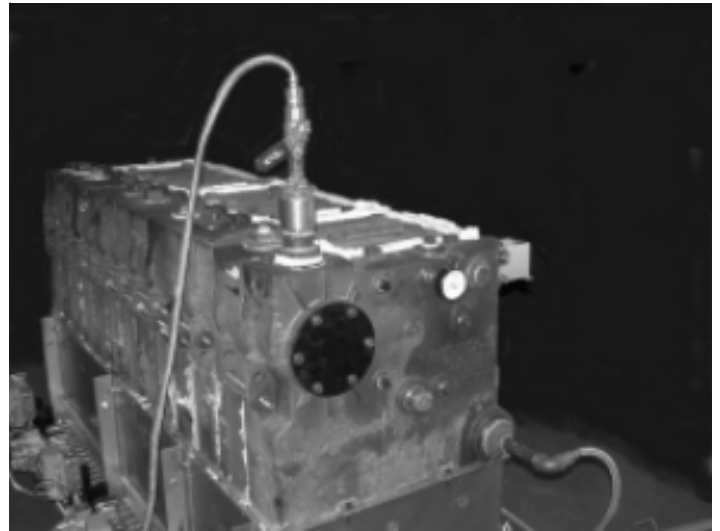


Figure 8: Testing Boiler Assembly For Leaks

D. Draft Hood Installation

- 1) The model 32-475 requires only one draft hood. All other boilers require multiple draft hoods. **WHEN MULTIPLE HOODS ARE USED THEY MUST BE ARRANGED SO THAT EACH HOOD IS OVER A CORRESPONDING SIZED BASE MODULE.**
- 2) Use the 1" x 1/2" Cerablanket strips provided to seal the draft hoods to the block assembly. To do this, lay the strips along the top of the block in the locations that will be under the edges of the draft hood (see Figure 9). Overlap the Cerablanket strips at the corners.
- 3) Install the rear panel support brackets using #10 x 1/2 sheet metal screws (Figure 3).
- 4) On the left end section, insert a 5/8 x 4 threaded stud through the available hole in the top rear tie rod lug. Use a 5/8 nut and washer on each side of the lug to attach this stud, making sure that the stud is approximately centered on the lug (See Figure 10). In the same manner, install 5/8 x 4" studs on the right end section and on all intermediate sections that span the joint between base modules.
- 5) Place the left-most draft hood on the boiler. Insert two 5/16 x 3 carriage bolts through the holes in the lip on the front of the hood with the head of the bolts on the underside of this lip. Thread a 5/16 washer and brass wing nuts on each of these bolts. Slip the bolt heads into the pockets on the top of the intermediate sections (Figure 11). Tighten just sufficiently enough to hold the hood in place.

NOTE

Installation of the draft hoods will be easier if one person supports the rear of the hood while another installs the carriage bolts, nuts and washers.

- 6) Hang a rear tie rod channel bracket on the 4" stud installed in the left end section (Figure 12a).
- 7) Facing the rear of the boiler, find the square mounting holes underneath the draft hood. Drop a 5/16 x 5" carriage bolt through this hole and through the hole in the rear tie rod channel bracket. Loosely secure with a wing nut and washer (Figure 12b). Install a second rear tie rod channel bracket on the other side of the draft hood.
- 8) Using a plumb bob, adjust the rear tie rod channel brackets so the jacket mounting holes in the rear tie rod channel brackets line up with the holes in the jacket rear panel support brackets on the base modules.
- 9) Tighten the 5/16 wing nuts on the front and back of the draft hood.

CAUTION

Before tightening the draft hood hold-down nuts, make sure the gasketing is properly located under the draft hood. Recheck the positioning of the gaskets after tightening the nuts and make adjustments as necessary.

- 10) Repeat Steps 5-9 to install the remaining draft hoods.

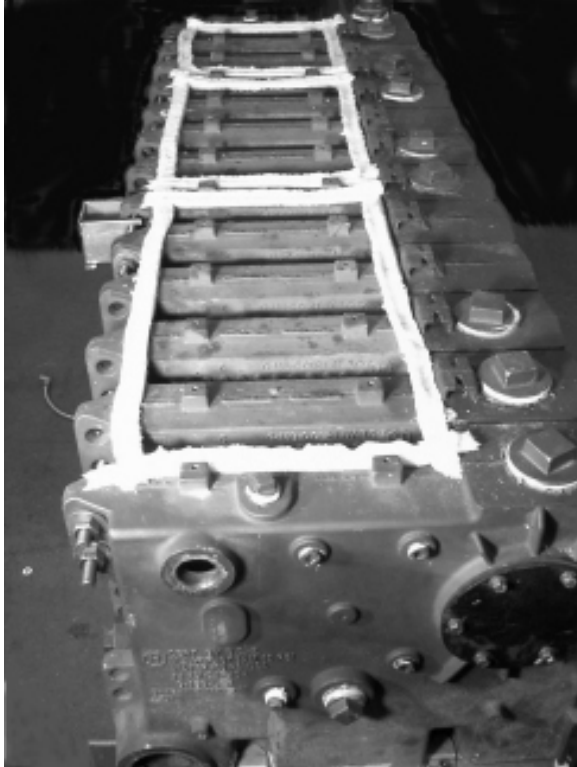


Figure 9: Draft Hood Gasket Installation

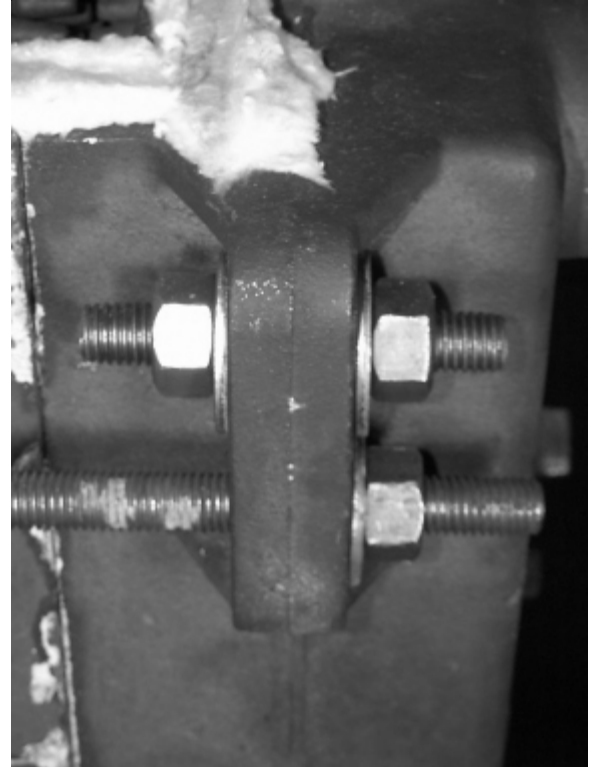


Figure 10: Hardware Arrangement for Rear Tie Rod Mounting Bracket Installation



Figure 11: Front Attachment Of Draft Hood



Figure 12a: Mounting Rear Tie Rod Channel Bracket

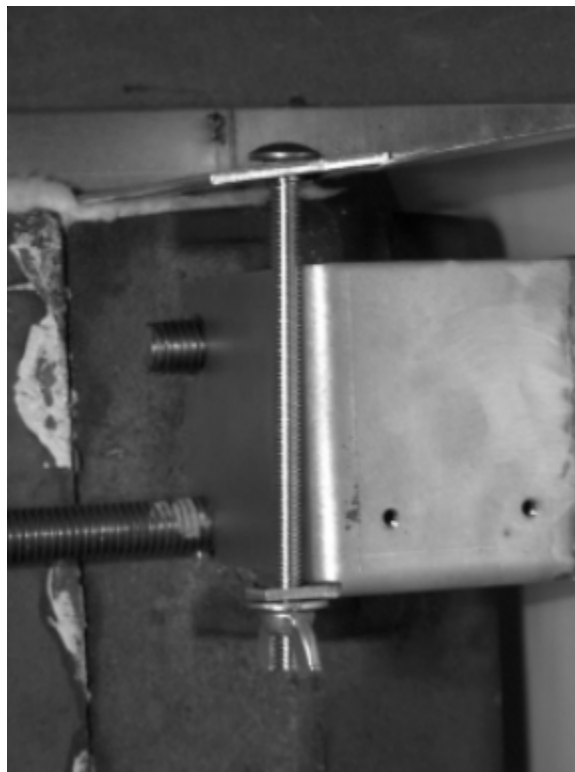


Figure 12b: Rear Attachment Of Draft Hood

D. Jacket Assembly Instructions

NOTE

Before installing the jacket, make sure to plug any tappings which are not going to be used. Also make sure that no tappings are plugged which will be needed later for piping the boiler. See Sections VIII and IX for piping and trim installation.

- 1) On the left and right side base panels attach the jacket side panel zee bracket and the jacket top support bracket end angle with #10 x 1/2" sheet metal screws as shown in Figure 13.
- 2) Jacket top support brackets are required at the joints between base modules and at each end of the base assembly. Attach the jacket top support brackets to the base front panel(s) with #10 x 1/2" sheet metal screws as shown in Figure 13. Also fasten the jacket top support brackets located on each end of the assembly to the jacket top support bracket end angles using #10 x 1/2" sheet metal screws.
- 3) Remove the appropriate knockouts from the side jacket panels.
- 4) Hang the left hand jacket side panel assembly in the slot of the jacket top support bracket and over the rear brackets of the boiler assembly. Fasten the jacket side panel to the jacket side panel zee bracket, the jacket rear panel support bracket, the rear tie rod channel bracket and the jacket top support bracket using #10 x 1/2" sheet metal screws.
- 5) Repeat the instructions in step 3 to install the right side panel.
- 6) Attach the jacket rear panel assembly(s) to the jacket rear panel support brackets and the tie rod channel brackets using #10 x 1/2" sheet metal screws.
- 7) Before installing the jacket top panel(s) locate the position of any intermediate supply risers and remove the appropriate knockouts.
- 8) Install the jacket top panel(s) by placing the left and right flanges of the jacket top panel(s) in the slots of the jacket top support brackets and attach using #10 x 1/2" sheet metal screws.
- 9) Attach the door knobs to the removable jacket front panel(s) with 8-32 x 1/2" machine screws.
- 10) Hang the jacket front panel(s) over the front flange of the jacket top panel while making sure the bottom of the door drops into the slots in the gas manifold bracket.

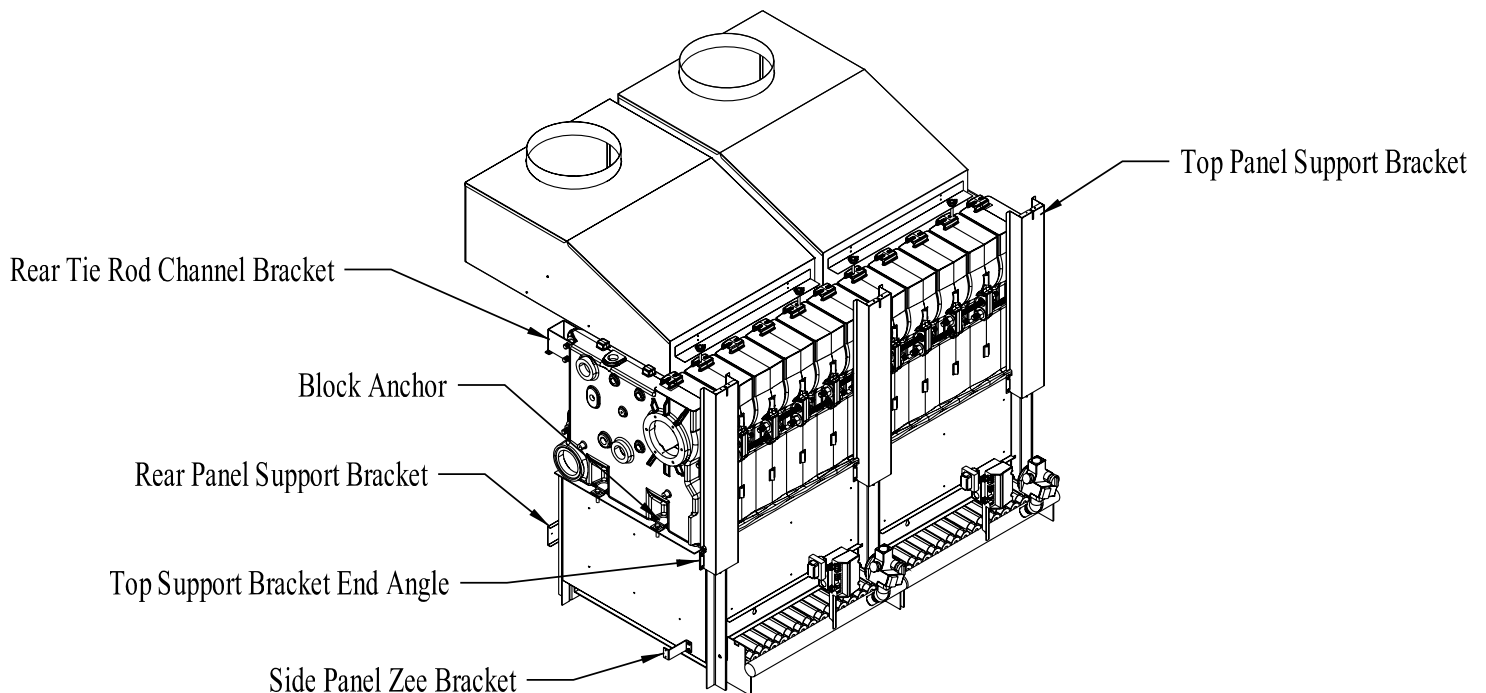


Figure 13: Jacket Mounting Bracket Arrangement

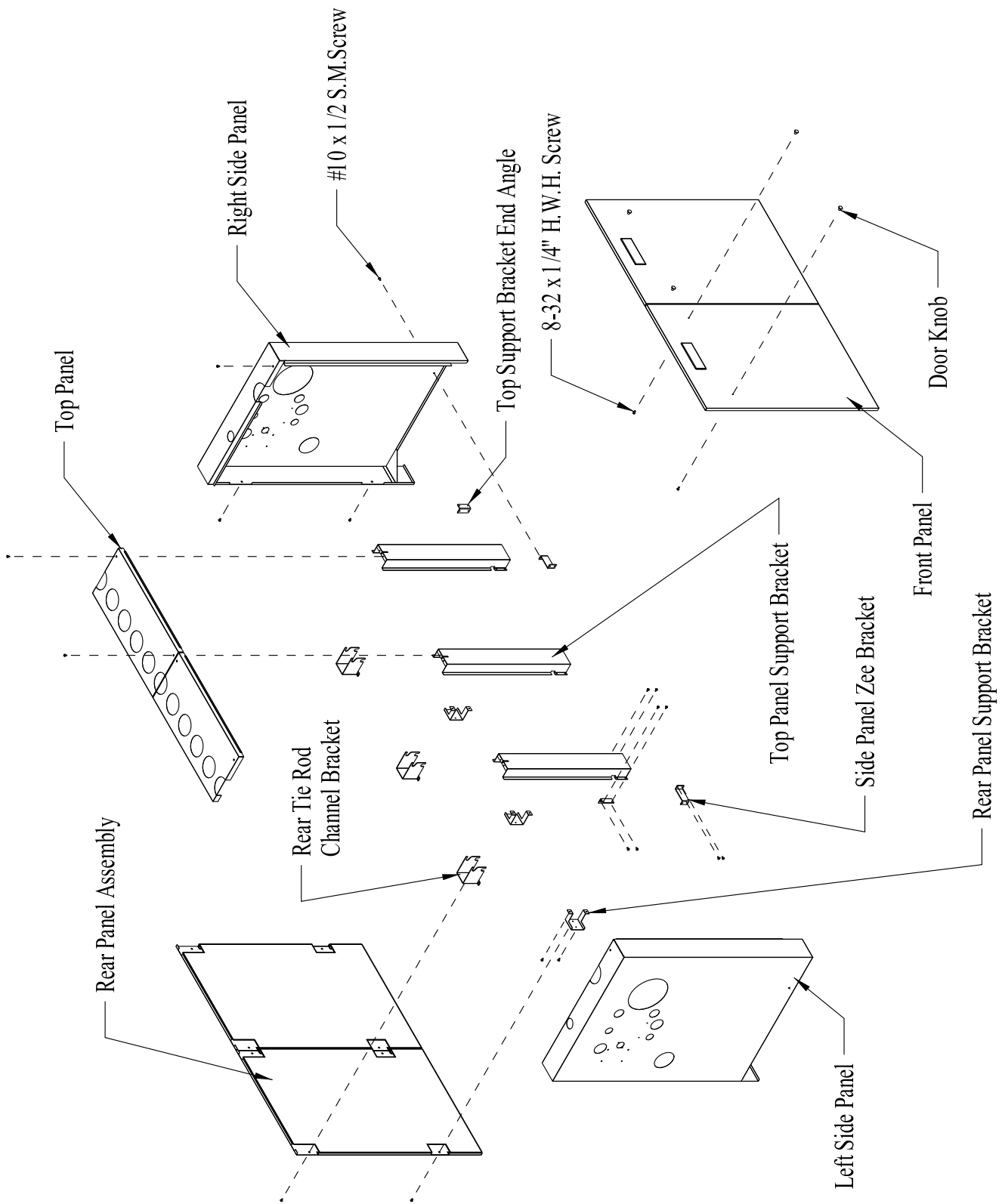


Figure 14: Exploded View Of Jacket Assembly

VI Air For Combustion and Ventilation

Sufficient fresh air must be supplied for combustion, ventilation and flue gas dilution. Provisions for combustion, ventilation and flue gas dilution air for gas utilization equipment vented by natural draft must be made in accordance with local building codes or, in absence of such codes, in accordance with the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1.

Warning

An adequate supply of combustion and ventilation air must be provided to assure proper combustion.

- 1) Start by determining whether the boiler is to be installed in a building of conventional construction or of unusually tight construction. A good definition of a building of unusually tight construction is one which has all of the following features:
 - Walls and ceilings exposed to outside atmosphere have a continuous water vapor retarder with a rating of 1 perm or less with openings gasketed and sealed.
 - Weather stripping has been added on openable windows and doors.
 - Caulking and sealants are applied to areas such as joints around window and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical, and gas lines, and at other openings.

- 2) Determine the volume of the boiler room space. Rooms communicating directly with the boiler room space, in which the fuel burning appliances are installed, through openings not furnished with doors, are considered a part of the boiler room space.

$$\text{Volume (ft}^3\text{)} = \text{Length (ft)} \times \text{Width (ft)} \times \text{Height (ft)}$$

In calculating the volume of the boiler room, consider the volume of adjoining spaces only if no doors are installed between them. If doors are installed between the boiler room and an adjoining space, do not consider the volume of the adjoining space, even if the door is normally left open.

- 3) Determine total input of all fuel burning appliances in the boiler room space. Add inputs of all fuel burning appliances in the boiler room space and round the result to the next highest 1000 Btu per hour.
- 4) Determine type of boiler room space to be used. Divide Volume by Total Input (in MBH) of all fuel burning appliances in the boiler room space. If the result is greater than or equal to 50 ft³/MBH, then it is considered a **unconfined space**. If the result is less than 50 ft³/MBH, then the boiler room space is considered a **confined space**.

A. For Buildings Not Of Unusually Tight Construction

- 1) **Unconfined space** - Fresh air infiltration through cracks and around windows and doors normally provides adequate air for combustion and ventilation without additional louvers or openings into the boiler room.
- 2) **Confined space** - Provide two openings into the boiler room, one near the floor and one near the ceiling. The top edge of the upper opening must be within 12" of the ceiling and the bottom edge of the lower opening must be within 12" of the floor. See Figure 15.
 - Each opening must have a free area of 1 square inch per 1000 BTU/hr input of all gas burning appliances in the boiler room. The minimum opening dimension is 3 inches. Minimum opening free area is 100 square inches per opening.
 - If the total volume of both the boiler room and the room to which the openings connect is less than 50 cubic feet per 1000 BTU/hr of total appliance input, install a pair of identical openings into a third room. Connect additional rooms with openings until the total volume of all rooms is at least 50 cubic feet per 1000 BTU/hr of input.
 - The "free area" of an opening takes into account the blocking effect of mesh, grills, and louvers. Where screens are used, they must be no finer than 1/4" (4 x 4) mesh.

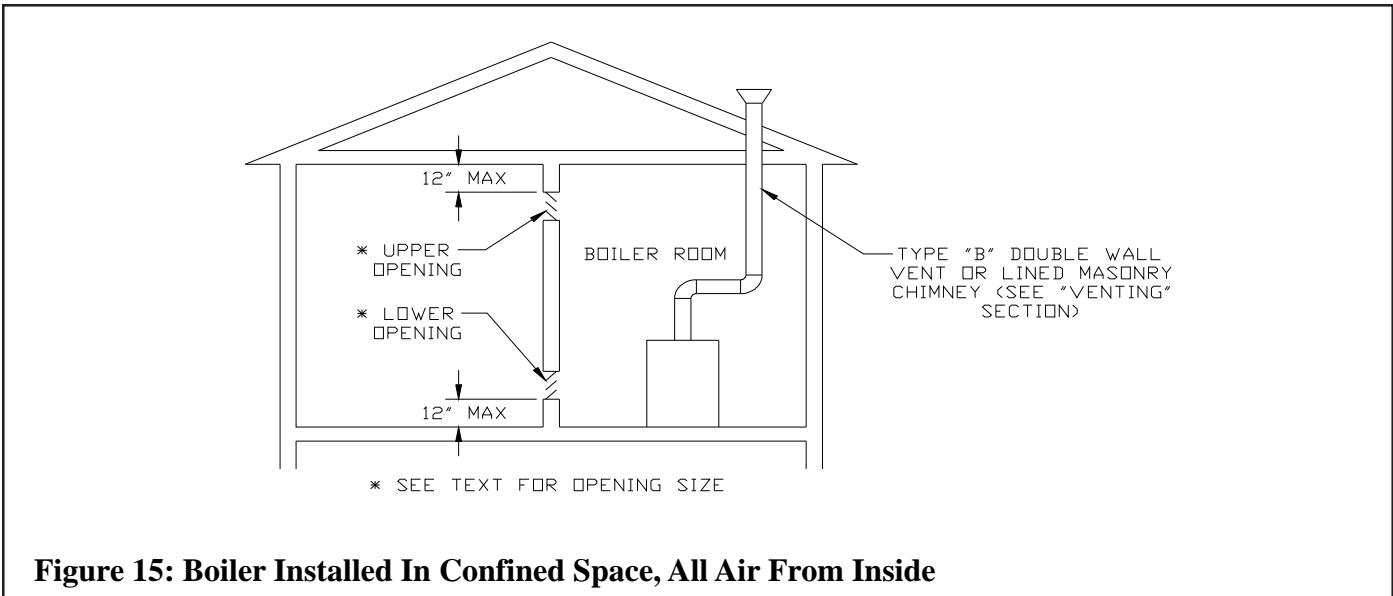


Figure 15: Boiler Installed In Confined Space, All Air From Inside

- If providing openings into adjacent rooms is undesirable, combustion and ventilation air can be brought into the boiler room from outdoors. See the instructions under **“For Buildings of Unusually Tight Construction”**.

B. For Buildings Of Unusually Tight Construction

- 1) Provide outdoor air through two permanent openings which communicate directly or by duct with the outdoors or spaces (crawl or attic) freely exchanging air with the outdoors. The top edge of the upper opening must be within 12” of the ceiling and the bottom edge of the lower opening must be within 12” of the floor. The minimum dimension of each air opening is 3 inches. Size each opening per the following instructions:
 - a. **Direct communication with outdoors** (Figure 18) require a minimum free area of 1 square inch per 4,000 Btu per hour input based on all fuel burning appliances in the boiler room space but not less than 100 square inches. The minimum opening size is 3 inches.
 - b. **Vertical ducts or Openings** (Figure 16 and Figure 17) require a minimum free area of 1 square inch per 4,000 Btu per hour input of all fuel burning appliances in the boiler room space but not less than 100 square inches. The cross-sectional area of the duct shall be the same as the required free area opening. The minimum opening size is 3 inches.
 - c. **Horizontal ducts** to the outdoors (Figure 19) require a minimum free area of 1 square inch per 2,000 Btu per hour input of all fuel burning appliances in the boiler room space but not less than 100 square inches. The cross-sectional area of the duct shall be the same as the required free area opening. The minimum opening size is 3 inches.
 - d. **Louvers and Grilles of Ventilation Ducts** - All outside openings should be screened or louvered. Louvers will prevent the entrance of rain and snow. Louvers and grilles must be fixed in the open position. If motorized louvers are used, they must be interlocked to prevent boiler operation in the event the louvers do not fully open.

Important

When determining the “free area” of an opening the blocking effects of mesh screens, grills, louvers and the like should be taken into account. Where screens are used, they must be no finer than 1/4” (4 x 4) mesh.

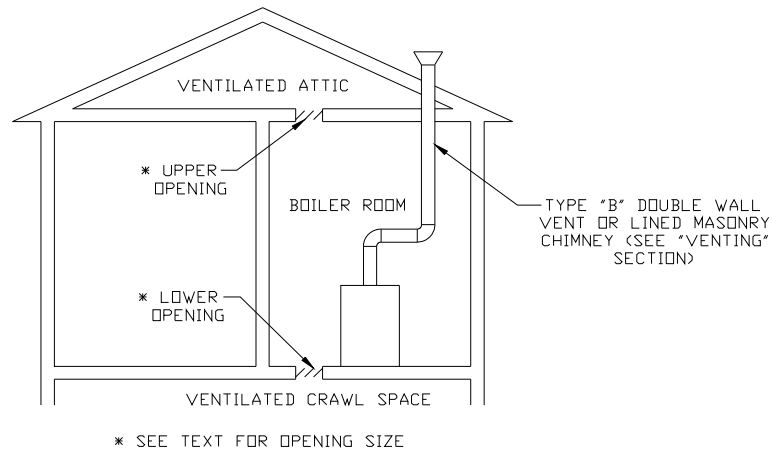


Figure 16: All Air From Outdoors, Ventiladed Crawl Space & Attic

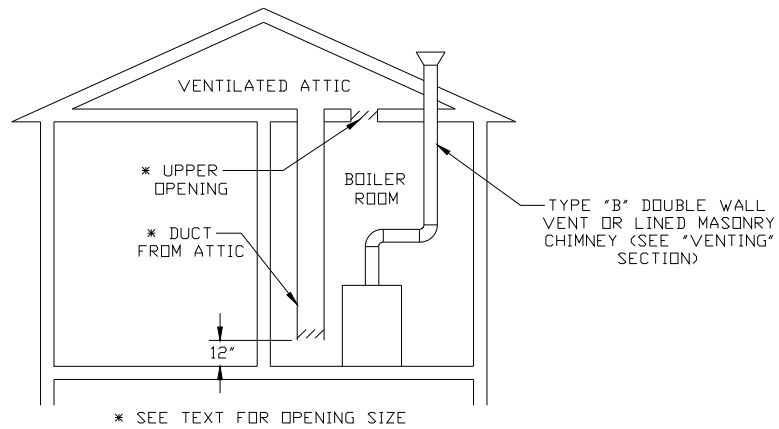


Figure 17: All Air From Outdoors, Via Ventiladed Attic

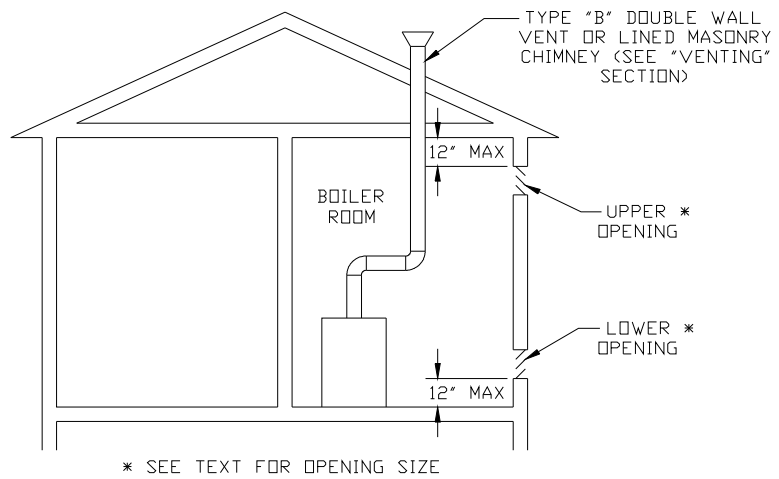


Figure 18: All Air From Outdoors, Using Openings Into Boiler Room

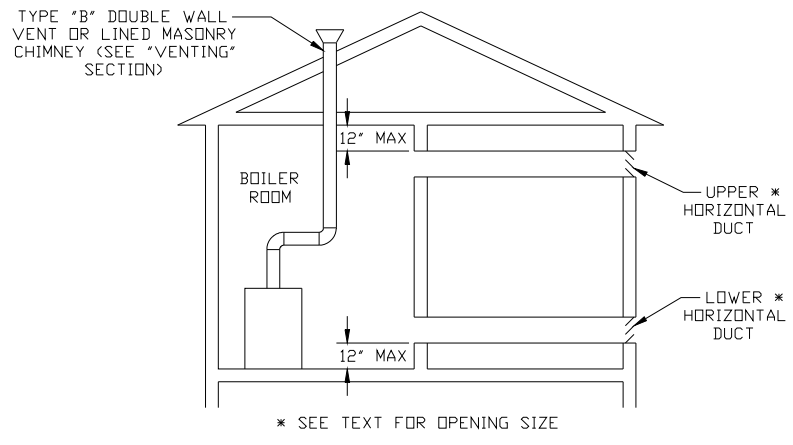


Figure 19: All Air From Outdoors, Using Horizontal Ducts Into The Boiler Room

VII Venting

Vent installation must be in accordance with local building codes, or the authority having jurisdiction, or the *National Fuel Gas Code, NFPA 54/ANSI Z223.1*.

Typical vent installations are shown in Figures 20 and 21. The vent system shown in Figure 20 uses a common vent for all boiler modules. In Figure 21, each boiler module is equipped with its own vent. The vent system in Figure 21 is ideal on large boilers with many individually controlled base modules as the vent system will not be effectively oversized when only a single module is firing.

- 1) Acceptable Chimneys - The following chimneys may be used to vent Series 32 boilers:
 - Listed Type B or L gas vent - Install in accordance with the manufacturer's instructions, the terms of its listing, and applicable codes.
 - Masonry Chimney - The masonry chimney must be constructed in accordance with the *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances* (NFPA 211) and lined with a clay liner or other listed lining system. Do not vent a Series 32 boiler into an unlined chimney.
- 2) Acceptable Vent Connectors - The following may be used for vent connectors:
 - Listed type B or L Gas Vent
 - Single Wall Galvanized Pipe - Use 0.018" (26 gauge or heavier). The size and location of the chimney may not permit the use of a single wall connector in some cases. See the National Fuel Gas Code. Do not use single wall pipe for vent connectors in attics.
 - Other Vent Connectors Permitted by the National Fuel Gas Code.
- 3) Chimney and Vent Connector sizing – If the entire vent system (chimney and vent connector) are constructed from Type "B" vent, size the vent system using the *National Fuel Gas Code*. Where possible, also use the *National Fuel Gas Code* to size vents employing single wall connectors and/or masonry chimneys. The minimum chimney size of the 32-475 is 12", even if the *National Fuel Gas Code* permits a smaller size. For boilers with more than one module, use the Multiple Appliance vent section of the code and treat each base module as though it were a separate boiler. For boilers with more than one module, the vent connector is always the same size as the module's flue collar.

Many Series 32 boiler vent systems with single wall connectors and/or masonry chimneys are too large to be sized using the *National Fuel Gas Code*. In these cases Table 4 may be used to size the vent system. The vent sizes shown in Table 4 are based on the following assumptions:

- Chimney Height (Dimension "H") at least 20 ft high
- Total length of lateral ("Lm") less than or equal to that shown in Table 4
- No more than one 90 elbow is permitted in lateral common venting
- Vent connectors and common vent lateral constructed of single wall pipe or "B" vent
- Chimney is constructed of B vent or is a lined masonry chimney in good condition
- No other appliances are connected into the vent system
- Listed Chimney Cap is used

If any of these assumptions are not valid, and where the National Fuel Gas Code cannot be used, use other accepted chimney design methods such as those shown in Chapter 30 of the *ASHRAE HVAC Systems and Equipment Handbook*.

- 4) Do not connect the boiler into a chimney flue serving an open fireplace or other solid fuel appliance.
- 5) Prior to boiler installation, inspect chimney for obstructions or other defects and correct as required. Clean chimney as necessary.

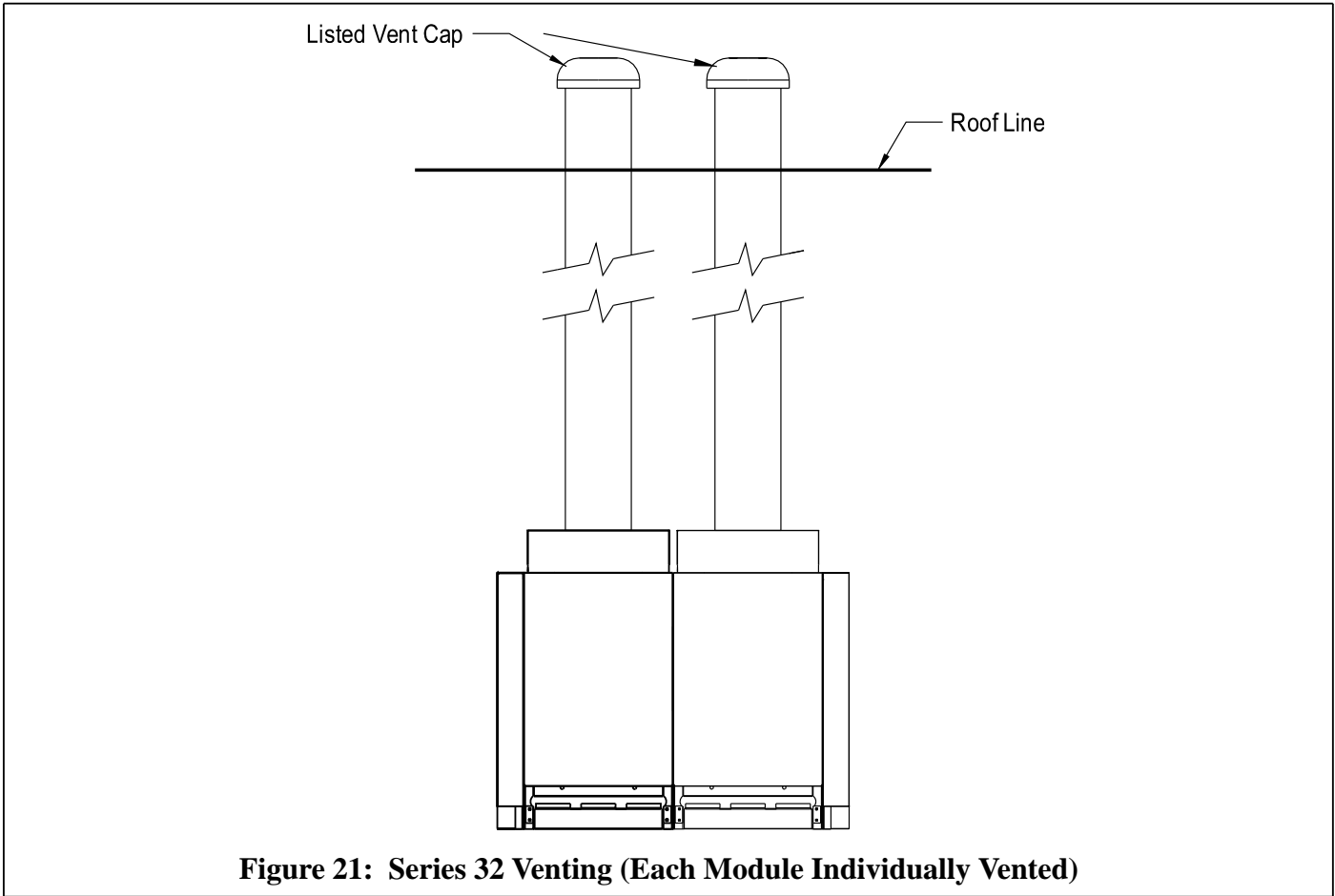
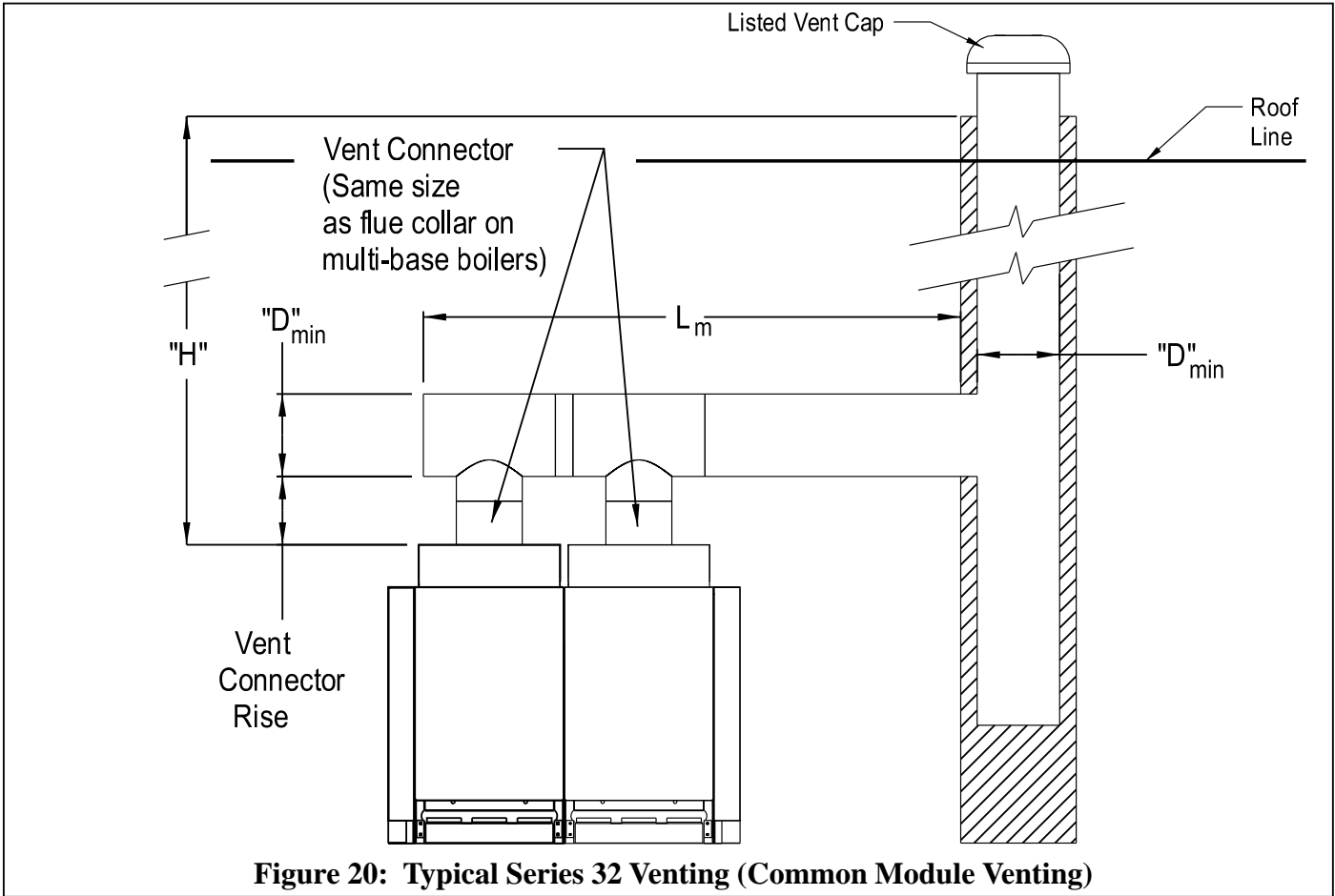
- 6) Lateral venting should slope upwards towards the chimney not less than one inch in four feet. No portion of vent pipe should run downward or have sags. Vent pipe must be securely supported.
- 7) The connector rise coming off the boiler should be as tall as possible, while still maintaining the proper clearance from the horizontal vent connector to combustibles and the proper pitch called for in (6) above.
- 8) Lateral vent pipe should be installed above the bottom of the chimney to prevent blockage.
- 9) Lateral vent pipe must be inserted flush with inside face of the chimney liner and the space between vent pipe and chimney sealed tight.

**IMPORTANT: READ THE ENTIRE VENT SECTION
AND REFER TO FIGURE 20 BEFORE
ATTEMPTING TO USE THIS CHART**

MODEL	MIN. CHIMNEY HEIGHT (H), ft	MAX. LATERAL COMMON VENT (Lm), ft	MIN. COMMON VENT INSIDE DIA. (D), in
32-475*			
32-570	20	9 1/2	12
32-665	20	9 1/2	12
32-760	20	10	12
32-855	20	10 1/2	12
32-950	20	11	14
32-1045	20	11 1/2	14
32-1140	20	12	14
32-1235	20	12 1/2	14
32-1330	20	13	16
32-1425	20	13 1/2	16
32-1520	20	14	16
32-1615	20	14 1/2	16
32-1710	20	14 1/2	18
32-1805	20	15	18
32-1900	20	15 1/2	18
32-1995	20	16	18
32-2090	20	16 1/2	18
32-2185	20	17	20
32-2280	20	17 1/2	20
32-2375	20	18	20
32-2470	20	18 1/2	20
32-2565	20	19	20
32-2660	20	19 1/2	22
32-2755	20	19 1/2	22
32-2850	20	20	22

* USE NATIONAL FUEL GAS CODE TO SIZE 32-475 VENTING

Table 4: Sizing For Vent Systems Outside The Scope Of The National Fuel Gas Code Venting Tables



Removing An Existing Boiler From A Common Chimney

In some cases, when an existing boiler is removed from a common chimney, the common venting system may be too large for the remaining appliances. At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

- a) Seal any unused opening in the common venting system.
- b) Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- c) Insofar as practical, close all building doors and windows and all doors between the space in which all the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- d) Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so the appliance will operate continuously.
- e) Test for spillage at the draft hood relief opening after five (5) minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.
- f) After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliances to their previous condition of use.
- g) Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1.

VIII Steam Boiler Piping & Trim Installation

CAUTION

- INSTALL BOILER SO THAT THE GAS IGNITION SYSTEM COMPONENTS ARE PROTECTED FROM WATER (DRIPPING, SPRAYING, RAIN, ETC.) DURING APPLIANCE OPERATION AND SERVICE (CIRCULATOR REPLACEMENT, ETC.).
- OPERATION OF THIS BOILER IN A SYSTEM HAVING SIGNIFICANT AMOUNTS OF DISSOLVED OXYGEN CAN CAUSE SEVERE HEAT EXCHANGER CORROSION DAMAGE.

A. Heating System Piping (Steam Boilers)

- 1) Figures 27 shows the recommended near boiler piping for most common types of gravity return steam systems. Use Table 6 to determine the riser, header and equalizer piping sizes for the appropriate boiler model.
- 2) One of the primary purposes of the near boiler piping is to separate tiny water droplets from the steam exiting the boiler so that “dry” steam is sent to the system. If the near boiler piping is not correct, wet steam will enter the system and the following problems may occur:
 - Short cycling on low water
 - Boiler or system Flooding
 - Hammering
 - Failure to heat one or more radiators
- 3) Avoid the three common piping mistakes shown in Figure 25. This applies even if the existing boiler has one of the piping mistakes shown in Figure 25 and appears to be working. If two or more steam mains must be connected to the boiler, connect a separate take-off for each main into the header between the riser(s) and equalizer. Also note the following points:
 - a. A size reduction must be made to connect the header to the equalizer. This reduction must be made in the equalizer line. Do not make this size reduction in the horizontal header.
 - b. For installations with condensate or boiler feed pumps, follow the pump manufacturer’s piping instructions. Such systems generally do not require Hartford loops. Figure 26 shows typical near-boiler piping when a boiler feed pump is used.
 - c. Do not use a check valve in place of, or in addition to, a Hartford loop on a gravity return system.
 - d. Steam pipes shall have a clearance of at least 1/2” from all combustible construction.
 - e. Pipe the fill connection from a clean source of cold water. When the water supply is from a well, make sure that a strainer is installed in the well system.
- 4) Boiler trim may be installed on either the left or right side of the boiler. Table 4B shows the uses of all steam boiler tappings. The tapping letter designations referenced below are shown in Figure 22:
 - a. Pressure Gauge – Install in tapping “D” using the 1/2” nipple, tee and bushing provided. See Figure 23. **DO NOT TIGHTEN THE GAUGE BY ITS’ CASE.**
 - b. Low Water Cut-off – Depending upon local codes, and how the boiler is ordered, one or more of the following low water cut-offs may be used:
 - McDonnell & Miller #67 – Install in tappings “E”. If redundant low water cut-offs are used, the #67 must be the back-up low water cut-off. The #67M (manual reset type) is standard on the CSD-1 control package and should also be used when other codes require a back-up low water cut-off with manual reset.

Hydrolevel CG450 – This is a probe type LWCO and is installed in tapping “G”. On the CSD-1 control package, and other boilers with redundant low water cut-offs, the CG450 is the operating low water cut-off and should be used to control a feeder (if used).

The CG450 supplied with the Series 32 uses a special probe which does not have a mounting flange. Install this probe in tapping “G”. **DO NOT INSTALL WITH TEFLON TAPE.** With the jacket already installed, installation of the probe is most easily done using a 1-1/16" deep throated socket. After the probe is installed, mount the case of the CG450 to the jacket using two #10 x ½ sheet metal screws through the keyhole slots in the case (Figure 24). Connect the white probe wire to the wing nut on the probe. Note: A direct ground connection between the case and the body of the probe is not required.

Other Low Water Cut-offs – Other float type low water cut-offs, such as the McDonnell & Miller #150 pump controller, are installed in an equalizing pipe connected between tappings “B” and “J”.

c. Gauge Glass – Install gauge glass in tappings “E” or in the #67 LWCO Tees (if used).

d. Pressure Limit Controls – All Series 32 steam boilers are supplied with a PA404A or L404A operating pressure limit control. In addition, a manual reset L404C is supplied on boilers with the CSD-1 control package.

Install the PA404A using the straight pigtail siphon and bushing in the tee installed in Tapping “D”. See Figure 23.

When an L404C is used, install it using the straight pigtail siphon in the 1/4" tapping on top of the #67 LWCO.

e. Safety Valve – Before installing the safety valve, examine the tag on the valve and confirm that it has a capacity greater than or equal to the of the boiler’s gross output. Also confirm that its’ pressure setting is less than or equal to that marked on the boiler sections (15 psi for steam). The location of the safety valve depends upon its’ size:

- Safety Valves of 1-1/2" and smaller are installed in one of the “C” tappings using the 1-1/2" nipple, tee and bushing provided. See Figures 26 or 27. To do this, install a 1-1/2" nipple and 1-½" Tee in the “C” tapping with the run of the Tee horizontal and the “bull” (side outlet) of the Tee pointing up. Install the Safety Valve in the “bull” of the Tee and plug the remaining opening in the Tee. The use of a Tee to mount the relief valve will permit Tapping “C” to also be used for skimming the boiler.
- Safety Valves greater than 1-1/2" must be installed in the steam riser with their spindle vertical (Figure 27c). No valves are permitted between the boiler and the steam header.

Pipe the discharge of the safety valve to a location where hot water and steam will not create a hazard or cause property damage if the valve opens. The discharge pipe must be the same size as the outlet connection on the safety valve and must terminate in unthreaded pipe. The safety valve discharge piping must be in an area where it is not likely to become plugged by debris or subjected to freezing.

DANGER

- CONFIRM SAFETY VALVE HAS THE CORRECT PRESSURE SETTING AND CAPACITY FOR THE BOILER.
- PIPE SAFETY VALVE DISCHARGE TO A SAFE LOCATION.
- PIPING BETWEEN SAFETY VALVE CONNECTION AND BOILER MUST BE AT LEAST AS LARGE AS SAFETY VALVE INLET CONNECTION.
- DO NOT INSTALL A VALVE IN THE SAFETY VALVE DISCHARGE LINE.
- DO NOT MOVE SAFETY VALVE FROM FACTORY LOCATION.
- DO NOT PLUG SAFETY VALVE DISCHARGE.
- DO NOT INSTALL A POP SAFETY VALVE WITH A SETTING GREATER THAN 15 PSI.

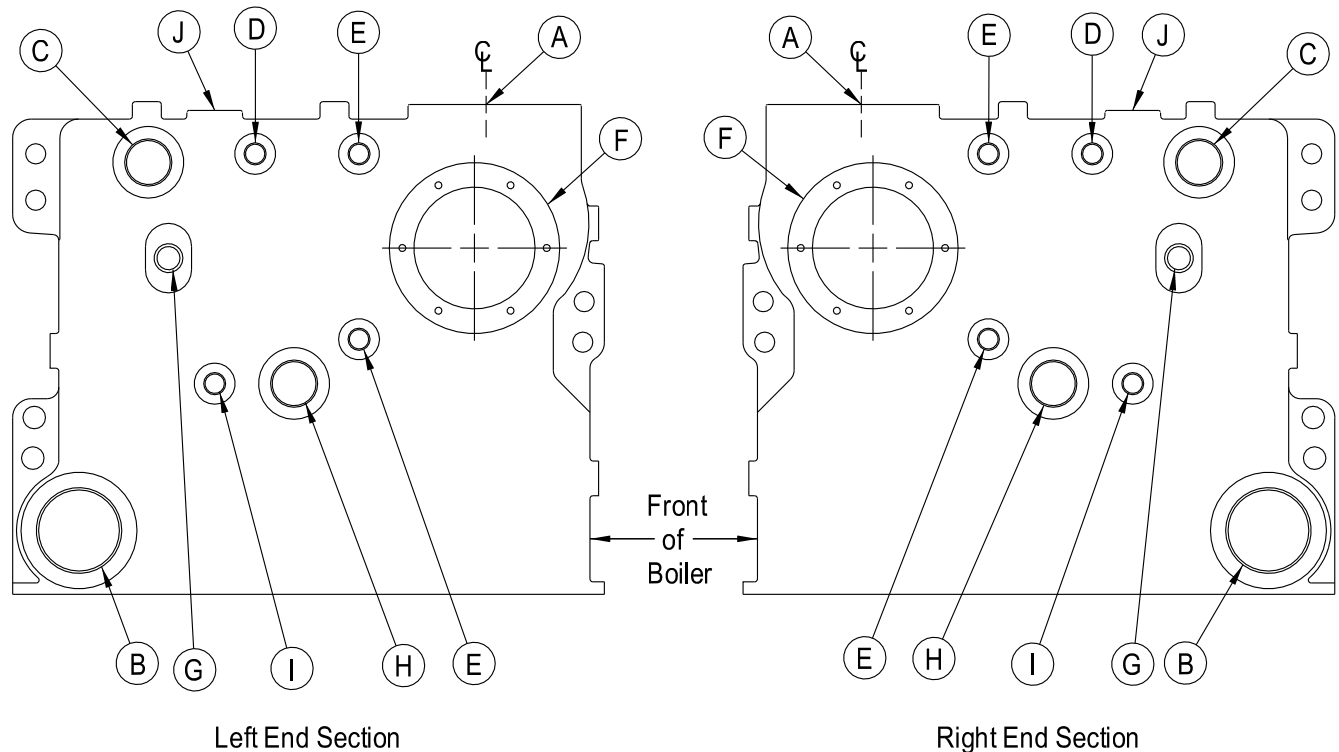


Figure 22: Steam Boiler Tapping Locations

Tapping Uses Chart For Steam Boilers₁

Component Description	Tapping Location	Tapping Size (in)	Standard Equipment	CSD-1 Package
Supply Piping	A	3	N	N
Return Piping	B	3	N	N
Safety Relief Valves (With Inlet Opening Up To & Including 1-1/2" NPT Inlet)	C ₂	1-1/2	Y	Y
Safety Relief Valves (With Inlets Larger Than 1-1/2" NPT Inlet)	Riser (See Figure 27c)	-	Y	Y
Pressure Gauge	D	1/2	Y	Y
Water Gauge Glass Fittings	E	1/2	Y	Y
M & M #67 Low Water Cut-Off	E	1/2	Y	N
M & M #67M Low Water Cut-Off with Manual Reset	E	1/2	N	Y
Hydrolevel CG450 Probe Low Water Cut-Off	G	3/4	N	Y
Steam Equalizer Installed On The End Not Equipped With Trim (With Optional M & M #150 Float Low Water Cut-Off / Pump Controller)	Between B & J	3 & 1	N	N
Honeywell PA404A Or L404A Pressure Limit	D	1/2	Y	Y
Honeywell L404C Manual Reset Pressure Limit Control	1/4" Tapping on Top of #67 LWCO	-	N	Y
Boiler Drain Valve	B	3	Y	Y
Bottom Blowoff Piping	B	3	N	N
Cover Plate	F	-	Y	Y
Indirect Water Heater Connection	H	1-1/2	N	N
Indirect Water Heater Aquastat	I	3/4	N	N

1. Trim May Be Installed On Either End Section.

2. Use The Tapping Located On The End Not Equipped With Trim For The Safety Relief Valve & The Surface Blow off .

Table 5

- f. Boiler Drain Valve - Install with a 3" x 3/4" bushing into one of the two return tappings "B". The drain valve may also be installed in the return piping, but it must be installed in the leg of a tee so that it is directly opposite and as close as possible to the return tapping. The leg of the tee must be at least 1 1/2" pipe size.
- A bottom blowoff using a valve must also be connected to one of the return tappings (B). The 3/4" Drain Valve may be used for a bottom blowoff for the boiler model 32-570 or smaller boilers. Bottom blowoff piping and valves for the boiler models 32-665 through the 32-1520 must be at least 1". Bottom blowoff piping and valves for the boiler models 32-1615 through the 32-2850 must be at least 1 1/4".
- g. Install the "Lowest Permissible Water Level Plate" using the holes provided in the jacket panel near the LWCO.

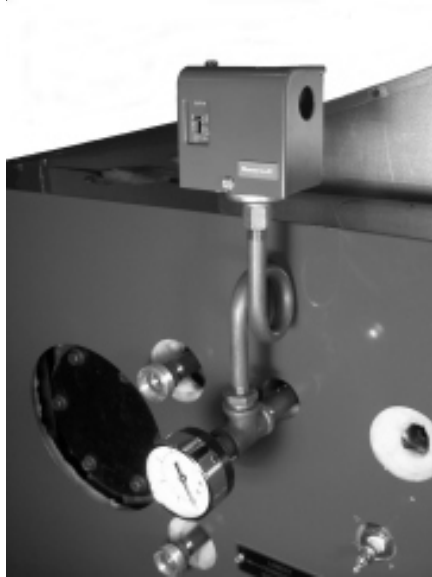


Figure 23: Pressuretrol / Gauge Installation



Figure 24: CG450 Installation

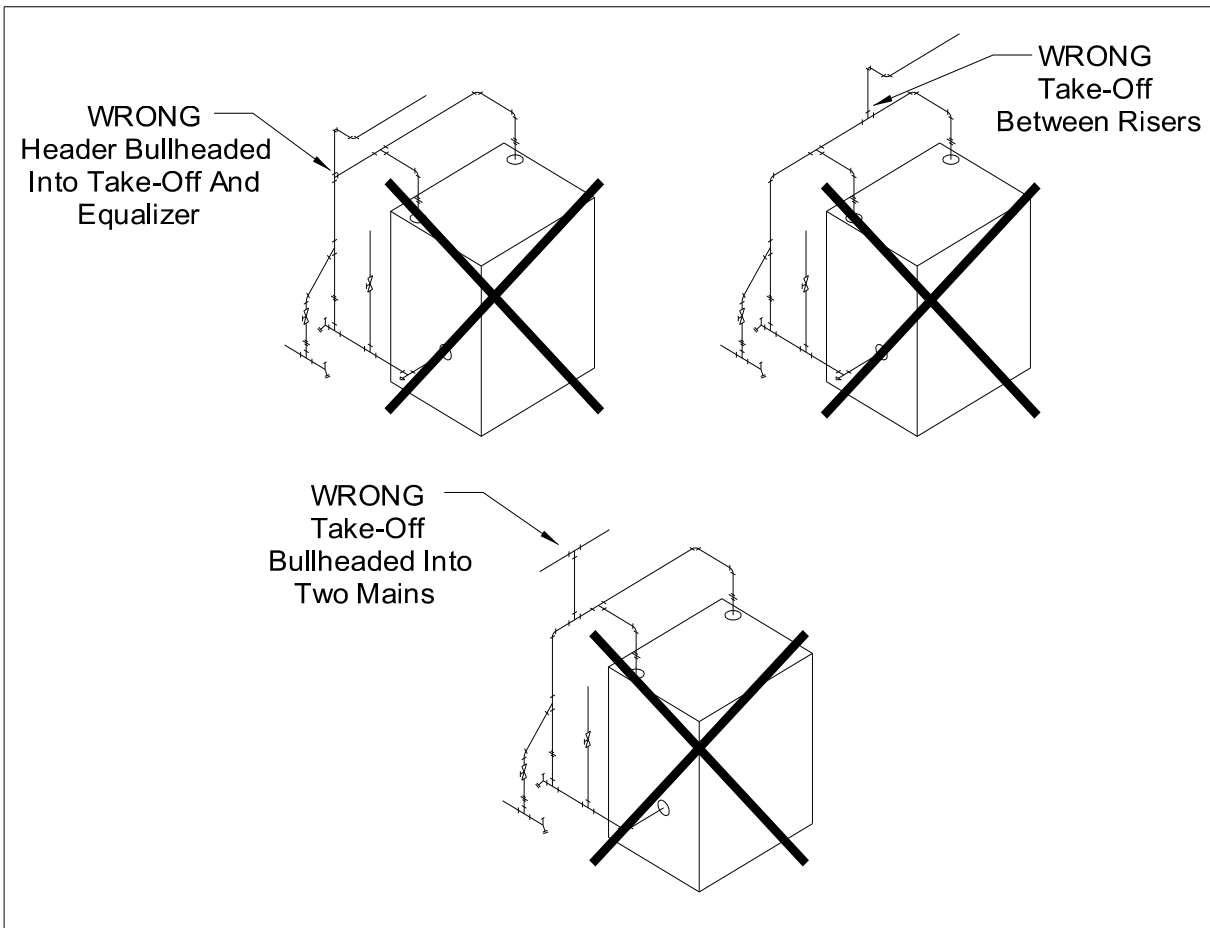
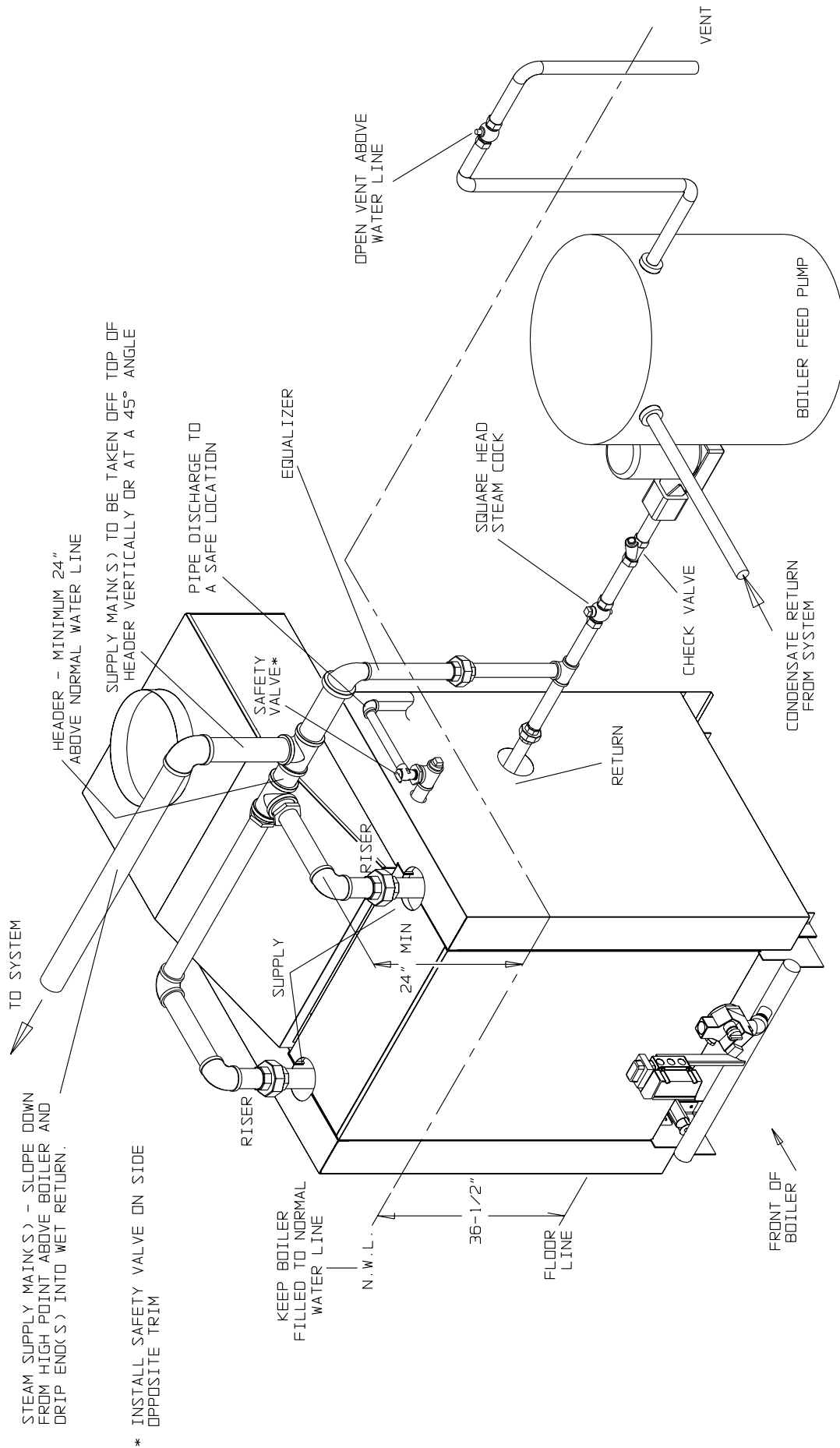


Figure 25: Common Near-Boiler Piping Mistakes

Boiler Model	Steam Header Size (in)	Steam Riser Pipe		Return Header Size (in)	Condensate Return Pipe		Equalizer Pipe	
		Quantity	Size (in)		Quantity	Size (in)	Quantity	Size (in)
32-380	3	1	3	1 1/2	1	1 1/2	1	2
32-475	3	1	3	1 1/2	1	1 1/2	1	2
32-570	4	2	3	1 1/2	1	1 1/2	1	2
32-665	4	2	3	2	1	2	1	2 1/2
32-760	4	2	3	2	1	2	1	2 1/2
32-855	4	2	3	2	1	2	1	2 1/2
32-950	5	2	3	2	1	2	1	2 1/2
32-1045	5	3	3	2	1	2	1	2 1/2
32-1140	5	3	3	2 1/2	1	2	1	2 1/2
32-1235	5	3	3	2 1/2	1	2	1	2 1/2
32-1330	5	3	3	2 1/2	1	2	1	2 1/2
32-1425	5	3	3	2 1/2	1	2	1	2 1/2
32-1520	6	3	3	2 1/2	1	2	1	2 1/2
32-1615	6	4	3	2 1/2	1	2	1	2 1/2
32-1710	6	4	3	2 1/2	1	2	1	2 1/2
32-1805	6	4	3	2 1/2	1	2 1/2	1	3
32-1900	6	4	3	2 1/2	1	2 1/2	1	3
32-1995	6	4	3	3	1	2 1/2	1	3
32-2090	6	5	3	3	1	2 1/2	1	3
32-2185	8	5	3	3	1	2 1/2	1	3
32-2280	8	5	3	3	1	2 1/2	1	3
32-2375	8	5	3	3	1	2 1/2	1	3
32-2470	8	5	3	3	1	2 1/2	1	3
32-2565	8	5	3	3	1	3	1	4
32-2660	8	6	3	3	1	3	1	4
32-2755	8	6	3	3	1	3	1	4
32-2850	8	6	3	4	1	3	1	4

Note: 1. The pipe sizes listed above are nominal trade sizes for Schedule 40 pipe.

Table 6: Steam Boiler Riser & Header Pipe Sizes

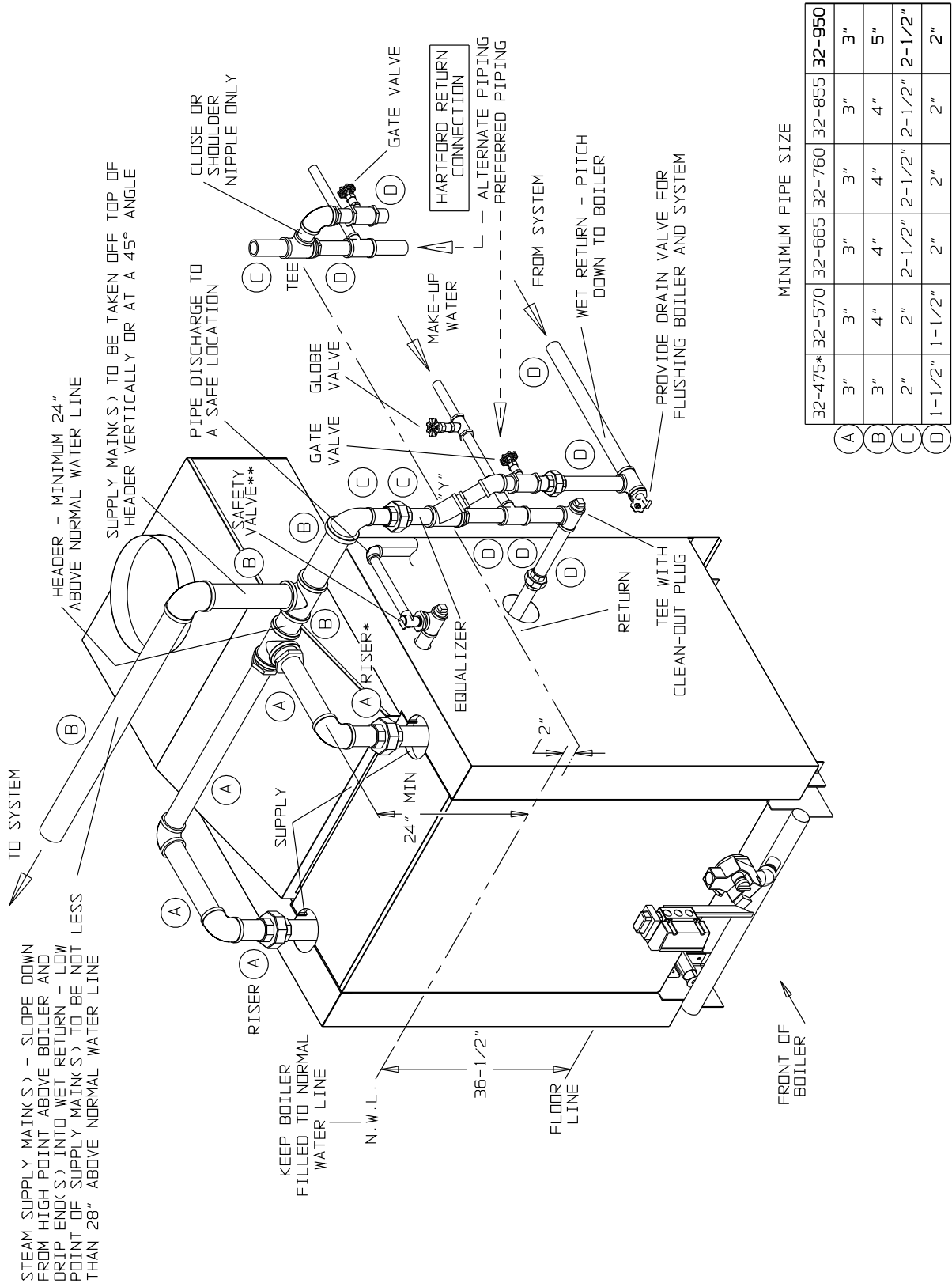


SEE FEED PUMP MANUFACTURER FOR MAKE-UP WATER PIPING & OTHER DETAILS

Figure 26: Typical Near-Boiler Piping When Using A Boiler Feed Pump

STEAM SUPPLY MAIN(S) - SLOPE DOWN FROM HIGH POINT ABOVE BOILER AND DRIP END(S) INTO WET RETURN.

* INSTALL SAFETY VALVE ON SIDE OPPOSITE TRIM



* SECOND SUPPLY RISER OPTIONAL
 ** INSTALL SAFETY VALVE ON SIDE OPPOSITE TRIM

Figure 27a: Recommended Steam Boiler Piping: 1 or 2 Supply Connections, Gravity Return

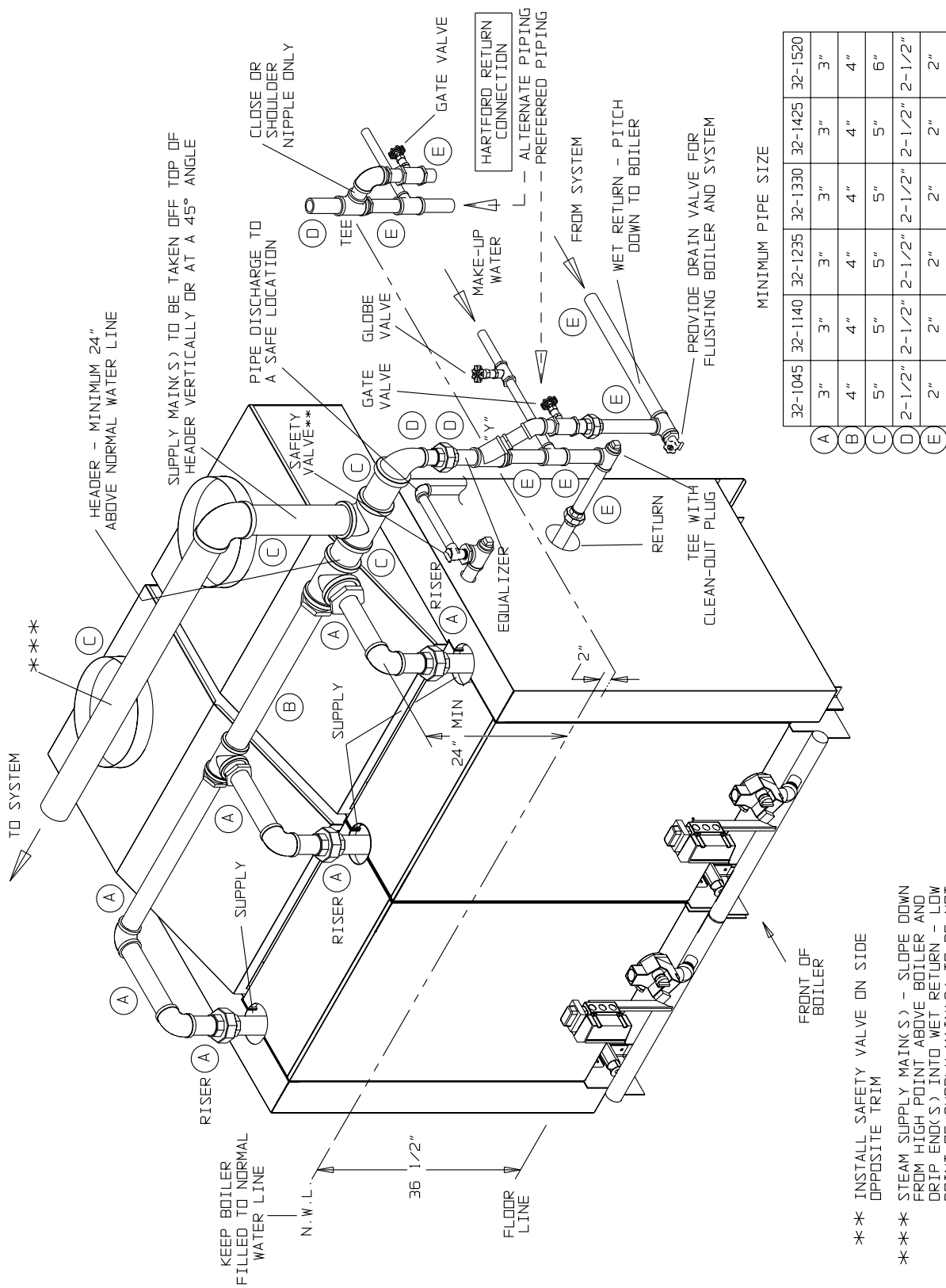
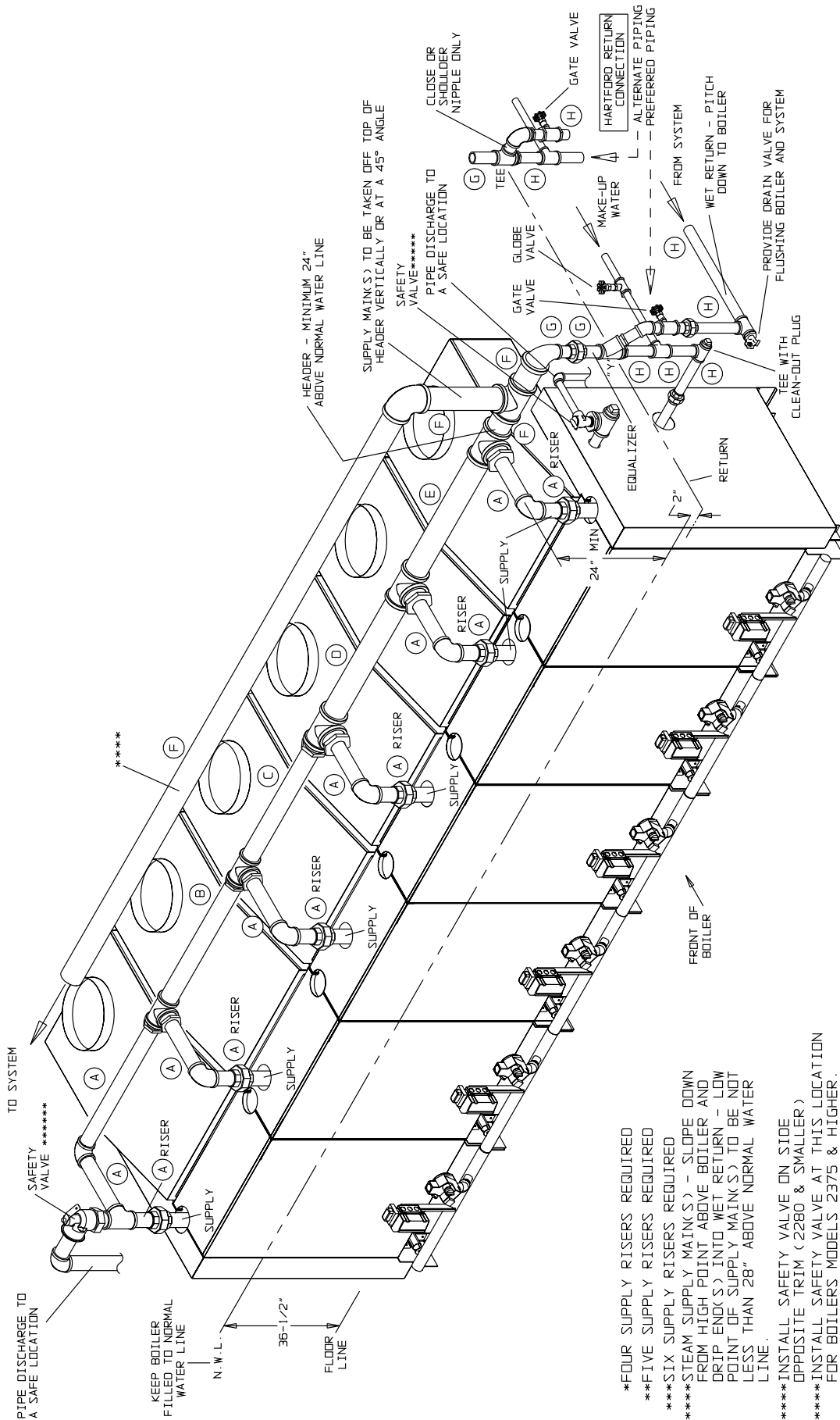


Figure 27b: Recommended Steam Boiler Piping: 3 Supply Connections, Gravity Return



*FOUR SUPPLY RISERS REQUIRED
 **FIVE SUPPLY RISERS REQUIRED
 ***SIX SUPPLY RISERS REQUIRED
 *****STEAM SUPPLY MAIN(S) - SLOPE DOWN FROM HIGH POINT ABOVE BOILER AND DRIP END(S) INTO WET RETURN - LOW POINT OF SUPPLY MAIN(S) TO BE NOT LESS THAN 28" ABOVE NORMAL WATER LINE.
 *****INSTALL SAFETY VALVE ON SIDE OPPOSITE TRIM (2280 & SMALLER)
 *****INSTALL SAFETY VALVE AT THIS LOCATION FOR BOILERS MODELS 2375 & HIGHER.

MINIMUM PIPE SIZE

	1615*	1710*	1805*	1900*	1995*	2090*	2185**	2280**	2375***	2470**	2565**	2660***	2755***	2850***
(A)	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"
(B)	4"	4"	4"	4"	4"	4"	4"	4"	4"	4"	4"	4"	4"	4"
(C)	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"
(D)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(E)	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"	6"
(F)	2-1/2"	2-1/2"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"	3"
(G)	2"	2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"
(H)	2"	2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"

- NOTE:
- FOR BOILER MODELS 1615 THRU 2090 IT IS PERMISSIBLE TO FABRICATE THE ENTIRE LENGTH OF THE STEAM HEADER USING THE LARGEST PIPE DIAMETER AS INDICATED IN (C) FOR A GIVEN SIZE BOILER IN THIS RANGE.
 - FOR BOILER MODELS 2185 THRU 2565 IT IS PERMISSIBLE TO FABRICATE THE ENTIRE LENGTH OF THE STEAM HEADER USING THE LARGEST PIPE DIAMETER AS INDICATED IN (E) FOR A GIVEN SIZE BOILER IN THIS RANGE.
 - FOR BOILER MODELS 2660 THRU 2850 IT IS PERMISSIBLE TO FABRICATE THE ENTIRE LENGTH OF THE STEAM HEADER USING THE LARGEST PIPE DIAMETER AS INDICATED IN (E) FOR A GIVEN SIZE BOILER IN THIS RANGE.

Figure 27c: Recommended Steam Boiler Piping: 4, 5 or 6 Supply Connections, Gravity Return

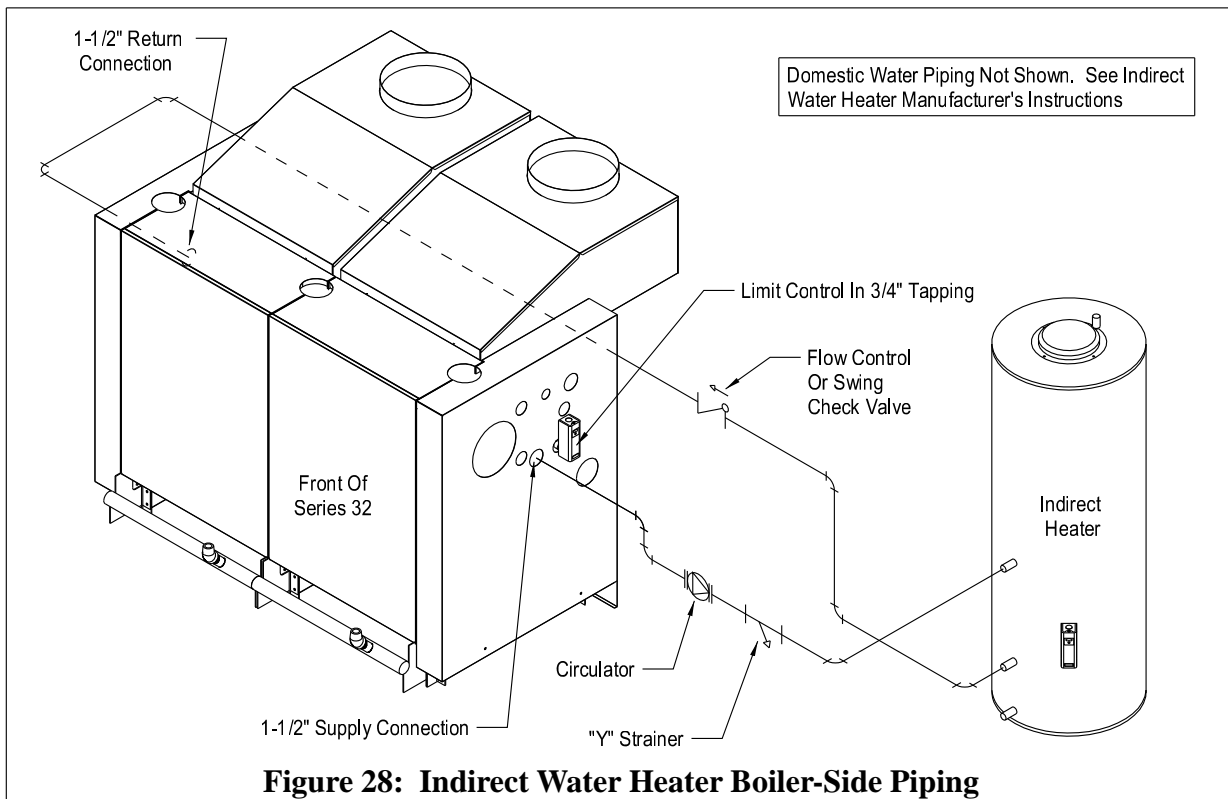
B. Indirect Water Heating Piping (Steam Boilers)

The steam version of the Series 32 boiler is equipped with tapings to permit the connection of a Crown Mega-Stor, or other indirect water heater. In this type of system, hot boiler water is drawn from below the water line and passed through the heat exchanger in the indirect water heater. This section describes boiler-side piping only. Refer to the indirect water heater instruction manual for domestic water piping. The components in this system and their functions are as follows:

- 1) Circulator - Mount the circulator as shown in Figure 28. The circulator should be located as low and as close to the boiler as practical. Do not install valves, or other devices having a significant pressure drop, between the boiler and the circulator inlet. All piping between the boiler and the circulator inlet should be 1-1/2", regardless of the size of the piping required in the rest of the system.
- 2) "Y" Strainer - Install a "Y" strainer to prevent sediment from accumulating inside the indirect water heater.
- 3) Check Valve - Prevents gravity circulation through the indirect water heater when the boiler is responding to a call for heat.
- 4) Boiler Limit Control - Use a SPST break-on-rise temperature limit control such as the Honeywell L4006A. Do not set the limit above 180F as doing so may cause the boiler to steam when there is no call for heat.
- 5) Valves and Unions - Install shut-off valves, drain valves, and unions in locations that will facilitate maintenance of the system. Do not install any valves between the boiler and circulator inlet.

IMPORTANT

- Some indirect water heaters may not be suitable for use with a steam boiler. Consult the water heater manufacturer's guidelines before installing it in this type of system.
- Boiler water temperatures and flow rates in this type of system may be considerably lower than those upon which the water heater manufacturer's ratings are based. This may result in substantially longer water heater recovery times.



IX Water Boiler Piping

CAUTION

- INSTALL BOILER SO THAT THE GAS IGNITION SYSTEM COMPONENTS ARE PROTECTED FROM WATER (DRIPPING, SPRAYING, RAIN, ETC.) DURING APPLIANCE OPERATION AND SERVICE (CIRCULATOR REPLACEMENT, ETC.).
- OPERATION OF THIS BOILER WITH CONTINUOUS RETURN TEMPERATURES BELOW 120°F CAN CAUSE SEVERE HEAT EXCHANGER CORROSION DAMAGE.
- OPERATION OF THIS BOILER IN A SYSTEM HAVING SIGNIFICANT AMOUNTS OF DISSOLVED OXYGEN CAN CAUSE SEVERE HEAT EXCHANGER CORROSION DAMAGE.
- DO NOT USE TOXIC ADDITIVES, SUCH AS AUTOMOTIVE ANTIFREEZE, IN A HYDRONIC SYSTEM.

A. Heating System Piping

- 1) Figure 30 shows the recommended water boiler system piping. Use Table 8 to determine the supply riser, supply header, return header and boiler return piping connection sizes for the appropriate boiler model. On boilers requiring one supply riser, use the supply connection opposite the return connection. Install the trim on the same end as the supply connection. Additional information on hydronic system design may be found in the *I=B=R Advanced Installation and Piping Guide* (Pub. #250) published by the Hydronics Institute in Berkeley Heights, NJ or the *ASHRAE Systems Handbook*. Table 7 shows the use of all boiler tapings on water boilers. The tapping letter designations referenced are shown in Figure 29. The water trim components are as follows:
 - a. **Pressure Gauge** – Install in tapping “D”. Tapping “D” must be reduced from ½” to ¼”. DO NOT TIGHTEN THE GAUGE BY ITS CASE.
 - b. **Low Water Cut-off** – (Required in some situations) - A low water cutoff is required when the boiler is installed above radiation. In addition, some codes, such as ASME CSD-1, require low water cutoffs. Codes may also require that this low water cutoff have a manual reset function. When a probe low water cut-off is used, install it in the supply piping above the boiler with no intervening valves between it and the boiler.
 - c. **Limit Controls** – All Series 32 water boilers are supplied with an L4006A operating temperature limit control. In addition, a L4006E manual reset control is supplied on boilers with the CSD-1 control package. Install the immersion well supplied with the L4006A in Tapping “C” with a bushing. Insert the bulb of the control in the well until it rests against the bottom of the well. Bend the tubing if necessary to provide enough force to hold the bulb against the bottom of the well. Avoid making a sharp bend in the tubing as this can cause the control to malfunction. Tighten the screw on the bottom of the control so that it is securely clamped onto the well. When an L4006E is used, install it in the supply riser on the same side of the boiler as the L4006A. Install it in a well in the same manner as the L4006A.
 - d. **Pressure Relief Valve** (Required) - Before installing the relief valve, examine the tag on the valve and confirm that it has a capacity greater than or equal to the boiler’s gross output. Also confirm that its pressure setting is less than or equal to that marked on the boiler sections for water. Install Relief Valves in the “C” tapping on the opposite end of the boiler from the other trim. Install the relief valve using the elbow and nipples provided so that its’ spindle is vertically oriented (Figure 30).

Pipe the discharge of the relief valve to a location where hot water and steam will not create a hazard or cause property damage if the valve opens. The discharge pipe must be the same size as the outlet connection on the safety valve and must terminate in unthreaded pipe. The relief valve discharge piping must be in an area where it is not likely to become plugged by debris or subjected to freezing.

DANGER

- CONFIRM RELIEF VALVE HAS THE CORRECT PRESSURE SETTING AND CAPACITY FOR THE BOILER.
- PIPE THE PRESSURE RELIEF VALVE DISCHARGE TO A SAFE LOCATION.
- DO NOT INSTALL A VALVE IN THE RELIEF VALVE DISCHARGE LINE.
- DO NOT PLUG RELIEF VALVE DISCHARGE.

3) In addition to the boiler trim, the following system components are required:

- a. Circulator - The best circulator location is usually on the supply piping just downstream of the expansion tank as shown in Figure 30.
- b. Expansion Tank - Consult the expansion tank manufacturer's literature for proper sizing.
- c. Fill Valve - Either a manual or automatic fill valve may be used. The fill connection should be located at the expansion tank. On large systems with an automatic fill valve, it is recommended that a small water meter be installed in the make-up water line to monitor the amount of water added to the system.
- d. Air Elimination Device - At least one automatic air elimination device is required and should be located at the expansion tank. Manual vents will usually be required in other parts of the system to facilitate the removal of air during initial fill.

4) Certain systems will require additional considerations:

- a. Low System Return Temperatures - The bypass piping shown in Figure 30 will minimize the amount of time that the boiler operates with return temperatures below 120°F on these systems. A bypass is installed as shown to divert some supply water directly into the return water. The bypass pipe should be the same size as the supply. The two throttling valves shown are adjusted so that the return temperature rises above 120°F during the first few minutes of operation. A three-way valve can be substituted for the two throttling valves shown.
- b. Systems containing oxygen - Many hydronic systems contain enough dissolved oxygen to cause severe corrosion damage to a cast iron boiler such as the Series 32. Some examples include:
 - Radiant systems that employ tubing without an oxygen barrier.
 - Systems with routine additions of fresh water.
 - Systems which are open to the atmosphere.

If the boiler is to be used in such a system, it must be separated from the oxygenated water being heated with a heat exchanger. Consult the heat exchanger manufacturer for proper heat exchanger sizing as well as flow and temperature requirements. All components on the oxygenated side of the heat exchanger, such as the pump and expansion tank, must be designed for use in oxygenated water.

- c. Piping with a Chiller - If the boiler is used in conjunction with a chiller, pipe the boiler and chiller in parallel. Use isolation valves to prevent chilled water from entering the boiler. See Figure 31.
- d. Air Handlers - Where the boiler is connected to air handlers through which refrigerated air passes, use flow control valves in the boiler piping or other automatic means to prevent gravity circulation during the cooling cycle.

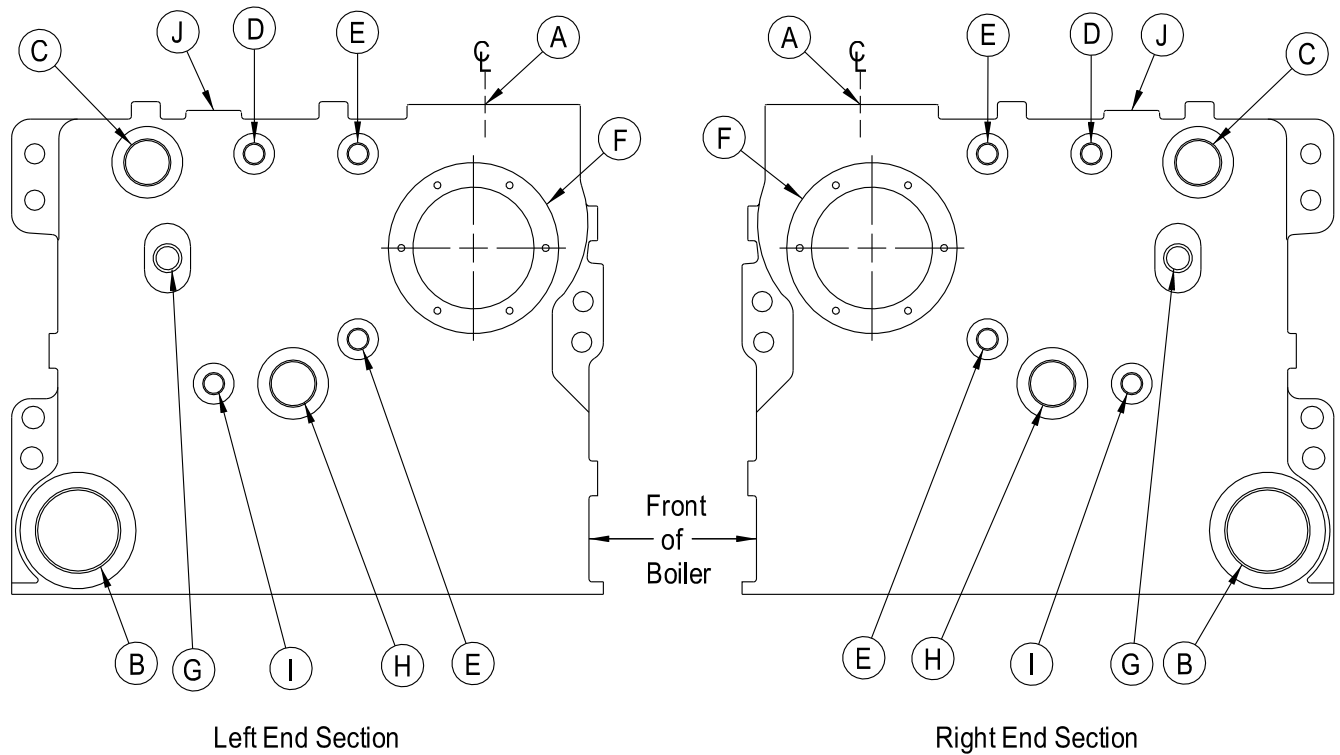


Figure 29: Water Boiler Tapping Locations

Tapping Uses Chart For Water Boilers¹

Component Description	Tapping Location	Tapping Size (in)	Standard Equipment	CSD-1 Package
Supply Piping	A	3	N	N
Return Piping	B	3	N	N
Pressure Relief Valves	C ₂	1-1/2	Y	Y
Combination Pressure / Temperature / Altitude Gauge	E	1/2	Y	Y
Hydrolevel #750 Probe Low Water Cut-Off	Supply Riser	-	N	Y
Honeywell L4006A Pressure Limit Control	D	1/2	Y	Y
Honeywell L4006E Manual Reset Pressure Limit Control (To Be Installed On The Same Side As L4006A)	Supply Riser	-	N	Y
Boiler Drain Valve	B	3	Y	Y
Cover Plate	F	-	Y	Y
Optional Tankless Heater	F	-	N	N

¹ Trim May Be Installed On Either End Section.

² Use The Tapping Located On The End Not Equipped With Trim For The Pressure Relief Valve.

Table 7

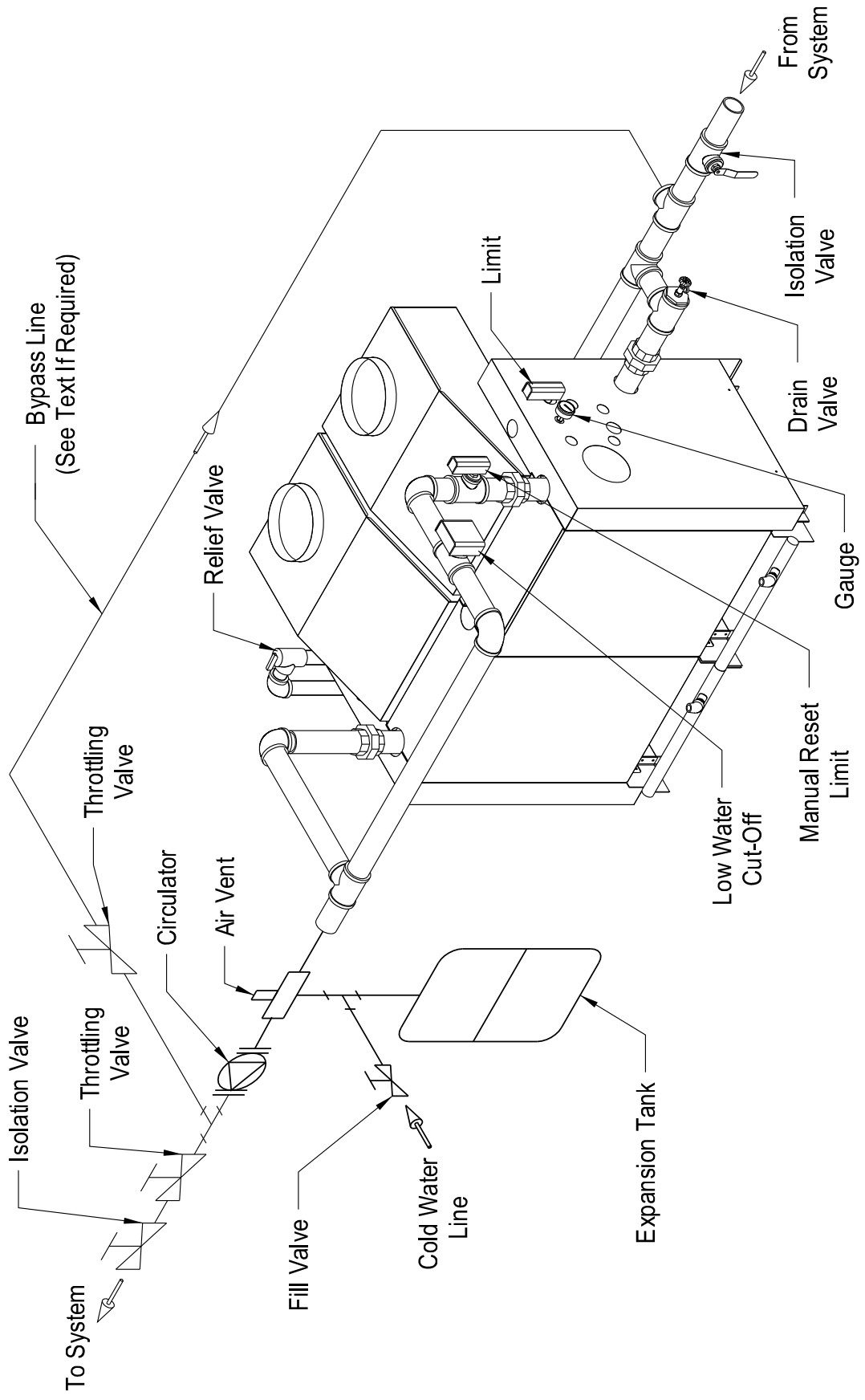


Figure 30: Typical Water Boiler System Piping

Boiler Model	Supply Header Size (in)	Supply Water Riser Connections		Return Header Size (in)	Return Water Connections	
		Quantity	Size (in)		Quantity	Size (in)
32-475	2	1	2	2	1	2
32-570	2	1	2	2	1	2
32-665	2 1/2	1	2 1/2	2 1/2	1	2 1/2
32-760	2 1/2	1	2 1/2	2 1/2	1	2 1/2
32-855	2 1/2	1	2 1/2	2 1/2	1	2 1/2
32-950	3	1	3	3	1	3
32-1045	3	1	3	3	1	3
32-1140	3	1	3	3	1	3
32-1235	3	1	3	3	1	3
32-1330	3	1	3	3	1	3
32-1425	3	1	3	3	1	3
32-1520	3	2	2 1/2	3	2	2 1/2
32-1615	3	2	2 1/2	3	2	2 1/2
32-1710	3	2	2 1/2	3	2	2 1/2
32-1805	3	2	2 1/2	3	2	2 1/2
32-1900	3	2	3	3	2	3
32-1995	4	2	3	4	2	3
32-2090	4	2	3	4	2	3
32-2185	4	2	3	4	2	3
32-2280	4	2	3	4	2	3
32-2375	4	2	3	4	2	3
32-2470	4	2	3	4	2	3
32-2565	4	2	3	4	2	3
32-2660	4	2	3	4	2	3
32-2755	4	2	3	4	2	3
32-2850	4	2	3	4	2	3

Note: 1. The pipe sizes listed above are nominal trade sizes for Schedule 40

Table 8: Water Boiler Supply & Return Pipe Sizes

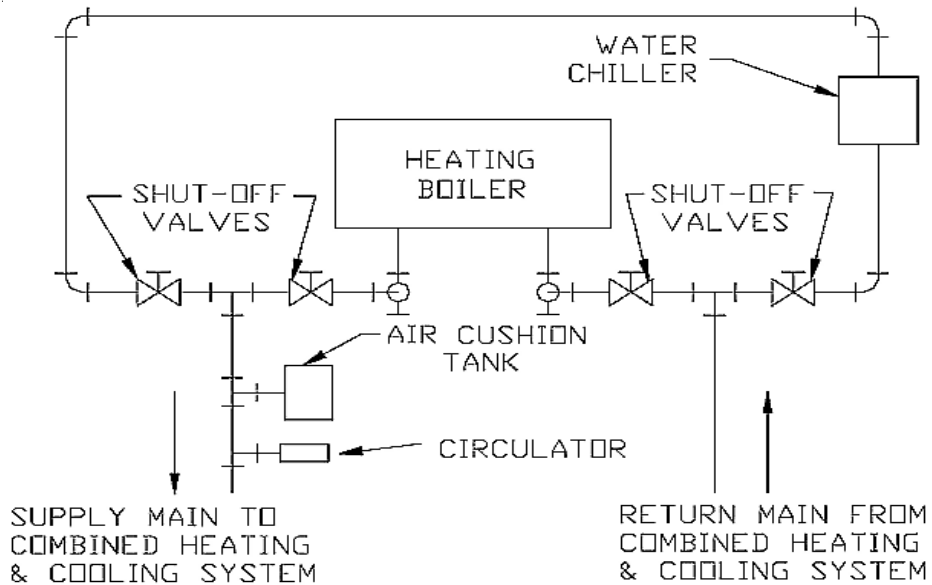


Figure 31: Recommended Boiler Piping For Combination Heating & Cooling Systems

B. TANKLESS HEATER PIPING

If the Series 32 water boiler is installed with an optional tankless heater, pipe the heater as shown in Figure 32. The components in this system and their functions are as follows:

- 1) Mixing Valve (Required) - During the heating season, the water exiting the tankless heater may be 180 degrees or more. The mixing valve blends hot water leaving the tankless heater with cold water so as to maintain the hot water supplied to the fixtures at a fixed temperature. This saves energy, increases the amount of usable hot water available to the homeowner, and reduces the risk of scalding.

Install a mixing valve with a setting range of approximately 110 to 130F. Follow the manufacturer's instructions for installing this valve. Usually a "heat trap" will be required between the coil and the "hot" connection on the mixing valve.

WARNING

A mixing valve does not eliminate the risk of scalding.

- Set the mixing valve and boiler low limit adjustments as low as possible.
- Feel water before showering or bathing
- If anti-scald or anti-chill protection is required, use devices specifically designed for such service. Install and maintain these devices in accordance with the manufacturer's instructions. Do not use the mixing valve as a substitute for pressure balancing valves or other devices required by plumbing codes to protect against scalding.

- 2) Flow Restrictor (Recommended) - If water is drawn from the tankless coil at a rate in excess of the rating in Table 9, the temperature of the hot water may be too low to be of use. The use of a flow restrictor will prevent this problem by limiting the rate at which water can pass through the tankless heater. If a restrictor is used, select one having a rating in GPM approximately equal to the rating shown in Table 9. If possible, locate this restrictor at least 3 feet from the tankless heater inlet so that it is not subjected to excessive temperatures when no water is flowing through the coil.
- 3) Pressure Relief Valve (Required) - Limits the pressure in the tankless heater and piping. Use an ASME constructed valve designed for domestic water service, such as the Watts #3L. Note that this is a pressure relief valve, not a T&P valve. Select a valve with a pressure setting less than or equal to the working pressure marked on the tankless coil. Pipe the discharge to a safe location using piping the same size as the discharge connection on the valve.
- 4) Hose Bib Valves (Recommended) - These valves permit the coil to be periodically "backflushed" to remove sediment.
- 5) Globe or Ball Valve (Recommended) - Used to adjust the flow through the entire tankless heater system if needed.
- 6) Unions (Required) - Tankless heaters may require periodic gasket replacement or other maintenance which requires removal of the heater from the boiler. Install unions anywhere in the tankless heater piping that will facilitate removal of the heater.
- 7) Backflow Preventer (Required in Massachusetts) - If required by local codes, install a backflow preventer in the cold water connection to the tankless coil just upstream of the piping shown in Figure 32. Install in accordance with local codes and the backflow preventer's installation instructions. Also install a potable water expansion tank on the outlet side of the backflow preventer (between the backflow preventer and the piping shown in Figure 32).

- 8) Multiple Tankless Heaters - If two tankless heaters are installed in the boiler, it is recommended that each heater be installed in parallel with its own mixing valve, relief valve, flow restrictor, etc.. This will permit either heater to be removed from service for maintenance while still providing some domestic water to the building.

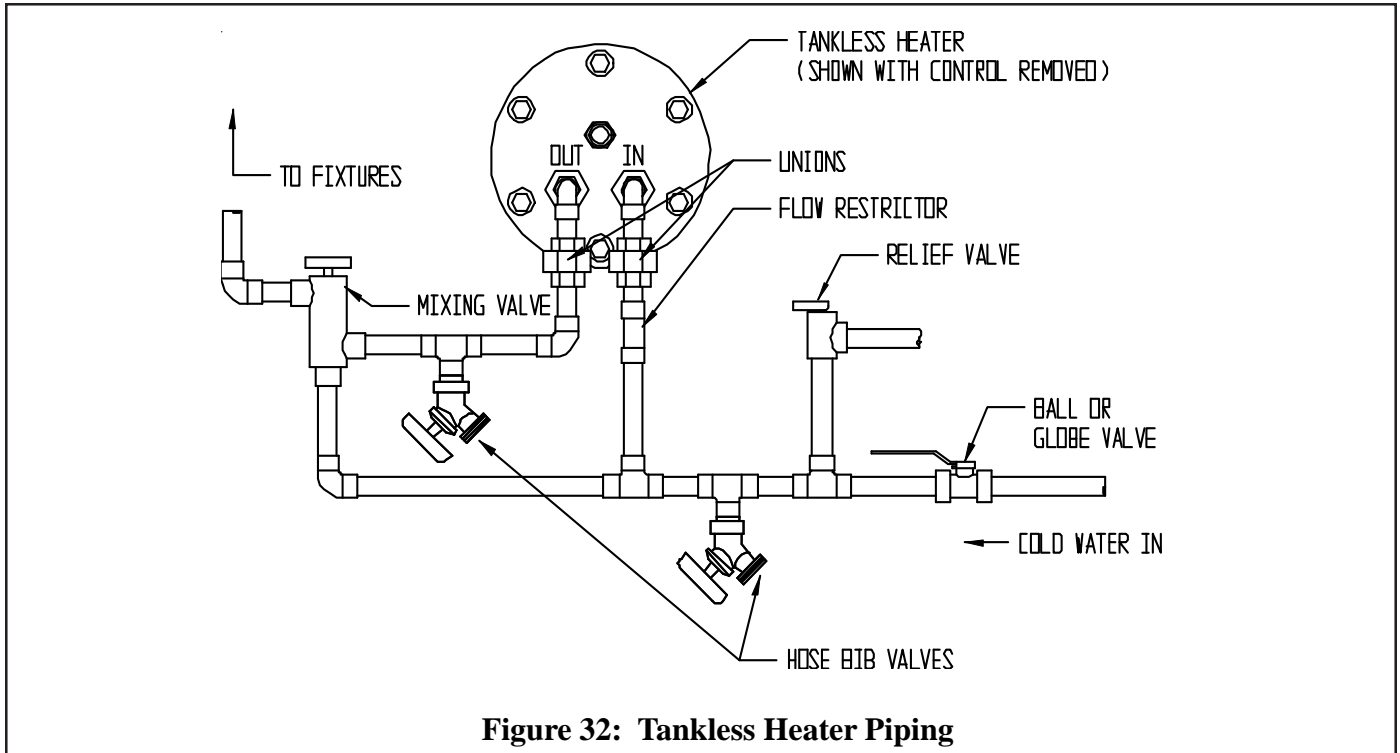


Figure 32: Tankless Heater Piping

Tankless Heater Model Number	For Use In Boilers	Continuous Draw Heater Ratings 40° - 140° Rise with 200°F Boiler Temperature	Pressure Drop Through Heater (psi)	Minimum Number of Sections Required Per Heater	Clearance Requirement For Heater Removal
T-1	All Sizes	4.5 GPM	8.8	5	27"
T-2	All Sizes	5.0 GPM	18.0	6	32"
T-3	32-665 & Larger	6.0 GPM	1.2	8	42"

All Series 32 boilers are furnished with left and right heater end sections. It is possible to install a heater in both ends provided the number of sections in the boiler is not less than the sum of the number of sections required for each heater as indicated in the table. Example: T2 + T3 = 6 + 8 = 14 section or larger boiler.

Table 9: Tankless Heater Specifications

X Gas Piping

- 1) Gas piping to the boiler must be sized to deliver an adequate supply of gas for the boiler to fire at the nameplate input with the inlet pressure at the gas valves between the minimum and maximum values shown on the rating plate. For more information on gas line sizing, consult the Utility or the *National Fuel Gas Code*.
- 2) Figure 33 shows the typical gas piping connection(s) to the Series 32 boiler. A sediment trap must be installed upstream of all gas controls. Install a manual shut-off valve and ground joint union as shown.
- 3) The boiler and its gas connection must be leak tested before placing the boiler in operation. When doing this, the boiler and its individual shut-off must be disconnected from the rest of the system during any pressure testing of that system at pressures in excess of 1/2 psi. When pressure testing the gas system at pressures of 1/2 psi or less, isolate the boiler from the gas supply system by closing its individual manual shut-off valve.

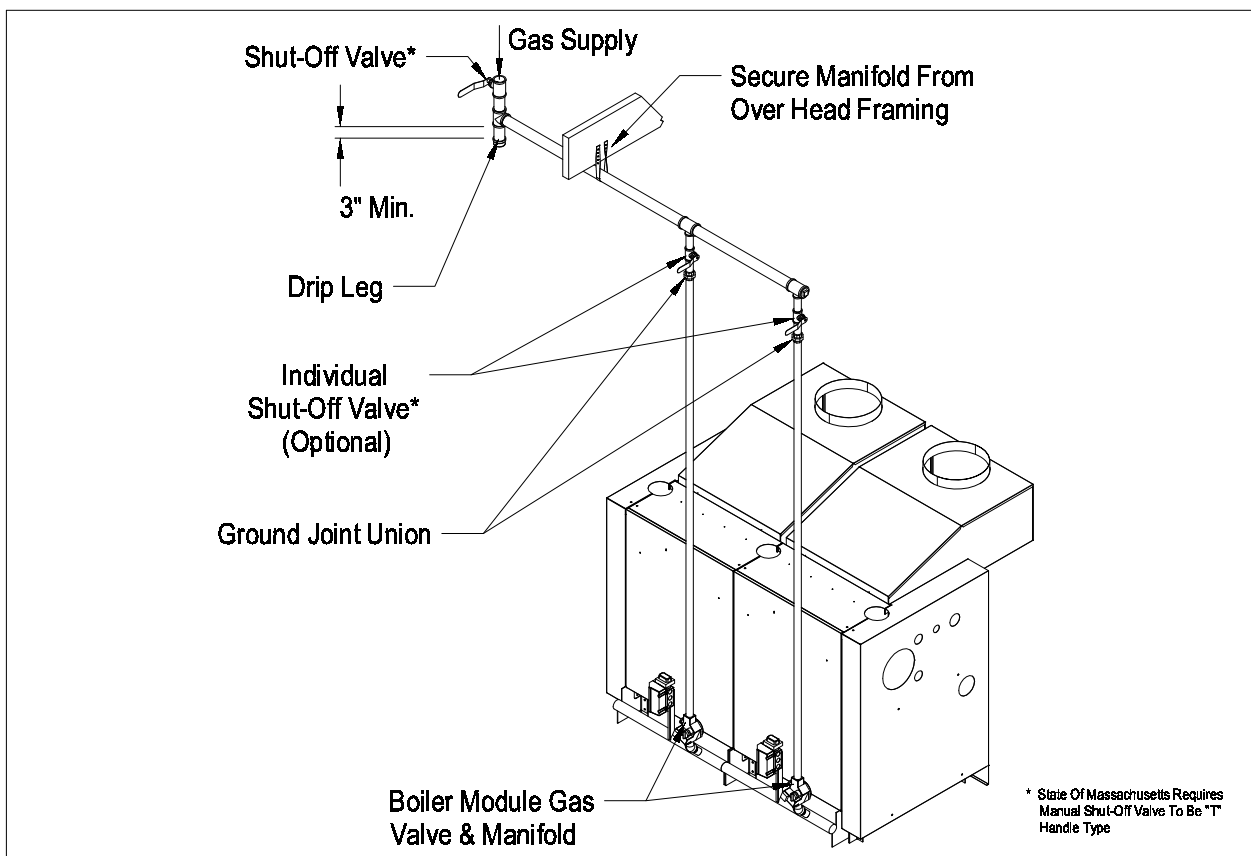


Figure 33: Gas Main Piping And Branch Connections To Boiler

XI Control System Wiring

WARNING

All wiring and grounding must be done in accordance with the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code (ANSI/NFPA 70).

- 1) Provide the boiler with a dedicated branch circuit with a fused disconnect. The minimum rating of this circuit must be 15A.
- 2) Wire the boiler following the appropriate wiring diagram in Figures 35 or 36. Use 14 gauge wire for all 120 volt boiler wiring. Use wire with a temperature rating of 105°C for wiring routed along gas manifolds. Install the junction box provided on one of the end panels. This junction box is to become the hub for all limit and low water cut-off wiring. All 120 volt boiler wiring must be enclosed in conduit. Route wiring to base modules in flexible conduit along the gas manifolds. See Figure 34 for typical wire routing.
- 3) Make sure that all single pole switches and safety controls are in the “hot” (ungrounded) side of the circuit.
- 4) The “operating control” shown in Figures 35 and 36 is not supplied. It is the control that turns on the boiler in response to a call for heat. If a 24 volt thermostat is to be used as the operating control a 24 volt relay center, such as the Honeywell R845, may be used to cycle the boiler in response to a call for heat. An R845A may also be used to start a system circulator if necessary as long as it’s contact rating is not exceeded.

On water boilers with multiple base modules, the bases may be “staged” by using a set of operating control contacts to break the 24 volt “hot” (ungrounded) lead connecting the base transformer to the ignition module. Do not stage steam boilers with multiple bases.

WARNING

OPERATING CONTROL CONTACTS MUST BE “DRY” (ELECTRICALLY ISOLATED FROM ALL OTHER CIRCUITS IN THE OPERATING CONTROL). IF OPERATING CONTROL CONTACTS ARE NOT DRY, THE BOILER SAFETY DEVICES COULD BE DEFEATED RESULTING IN PROPERTY DAMAGE, INJURY OR LOSS OF LIFE.

Sequence of Operation – Standard Boiler Wiring

- 1) All low water cut-offs, limit controls, and the operating contacts are wired in series so that the boiler will not operate if any of these controls are open. Under normal circumstances, only the operating control contacts will be open.
- 2) Upon a call for heat, the operating control will make and 120 volts will be applied to all base module transformers, which are wired in parallel.
- 3) 24 volts will then appear across the “24V” and “24V (GND)” terminals on the ignition modules.
- 4) Upon application of voltage across the “24V” and “24V (GND)” terminals, the ignition module will start an ignition spark at the pilot and apply 24 volts across the pilot valve.
- 5) Once the pilot is established, the pilot flame will act as a diode, converting the AC current at the electrode to a half wave DC current at the pilot’s ground strap. This DC current flows through the boiler to the “GND (BURNER)” connection on the ignition module.

- 6) Once the ignition module detects the presence of a pilot flame, voltage is applied across the main valve, opening the valve and establishing main flame.
- 7) The way in which the ignition module handles failure to establish pilot or the loss of an already established pilot depends upon the exact ignition module supplied with the boiler. For more information on module operation, consult the ignition module instructions supplied with the boiler or the local Crown representative.

Sequence of Operation – CSD-1 Boiler Wiring

- 1) All low water cut-offs, limit controls, and the operating contacts are wired in series so that the boiler will not operate if any of these controls are open. Under normal circumstances, only the operating control contacts will be open.
- 2) Upon a call for heat, the operating control will make and 120 volts will be applied to all base module transformers, which are wired in parallel.
- 3) 24 volts will then appear across the “24V” and “24V (GND)” terminals on the ignition modules and on the “24VAC” and “COM” terminals on the 1145-2 Daughter Board.
- 4) The ignition module will start an ignition spark at the pilot and apply 24 volts across the pilot valve.
- 5) Once a pilot is established, the pilot flame will act as a diode, converting AC current at the pilot electrode to a half wave DC current at the pilot’s ground strap. This DC current flows through the boiler to the “GND” terminal on the ignition module.
- 6) Once the ignition module detects the presence of a pilot flame, voltage is applied across the main valve, opening the valve and establishing main flame.
- 7) If the pilot flame is not established during the trial for ignition period, or if the pilot signal is lost after the main flame is established, the module will de-energize the open pilot valve and main valve (if open) and wait 5 minutes. It will then repeat steps 4-6. If the pilot is still not established, the Alarm contacts on the ignition module will make. This will cause the 1145-2 Daughter Board to break power to the ignition module and illuminate the red LED on the Daughter Board. The ignition module will remain de-energized until the reset button on the daughter board is pressed.

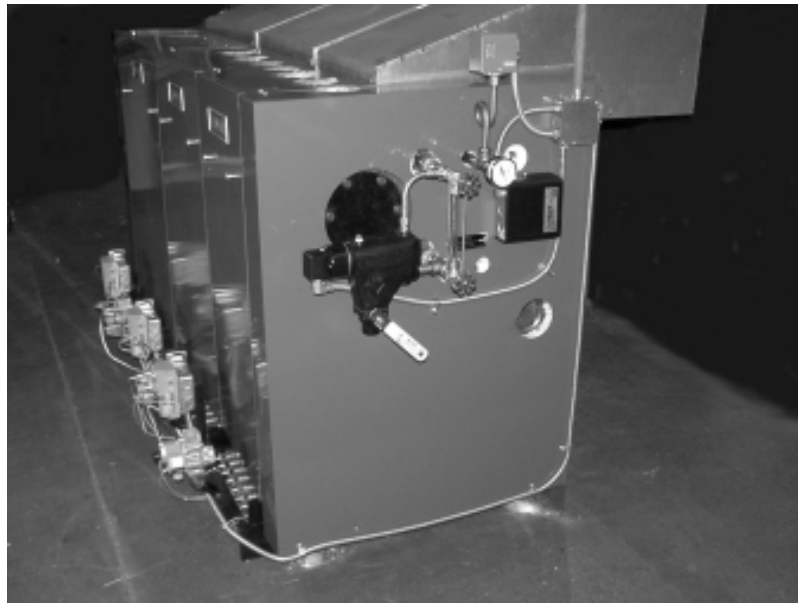
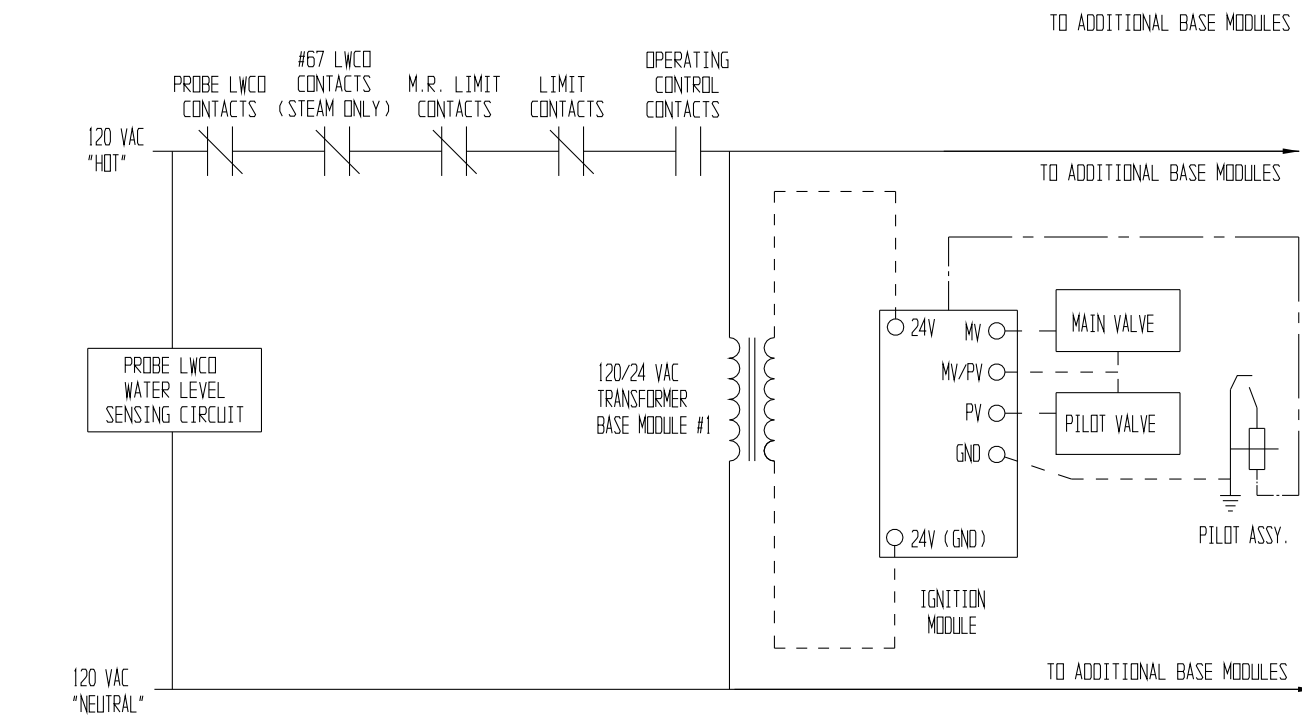
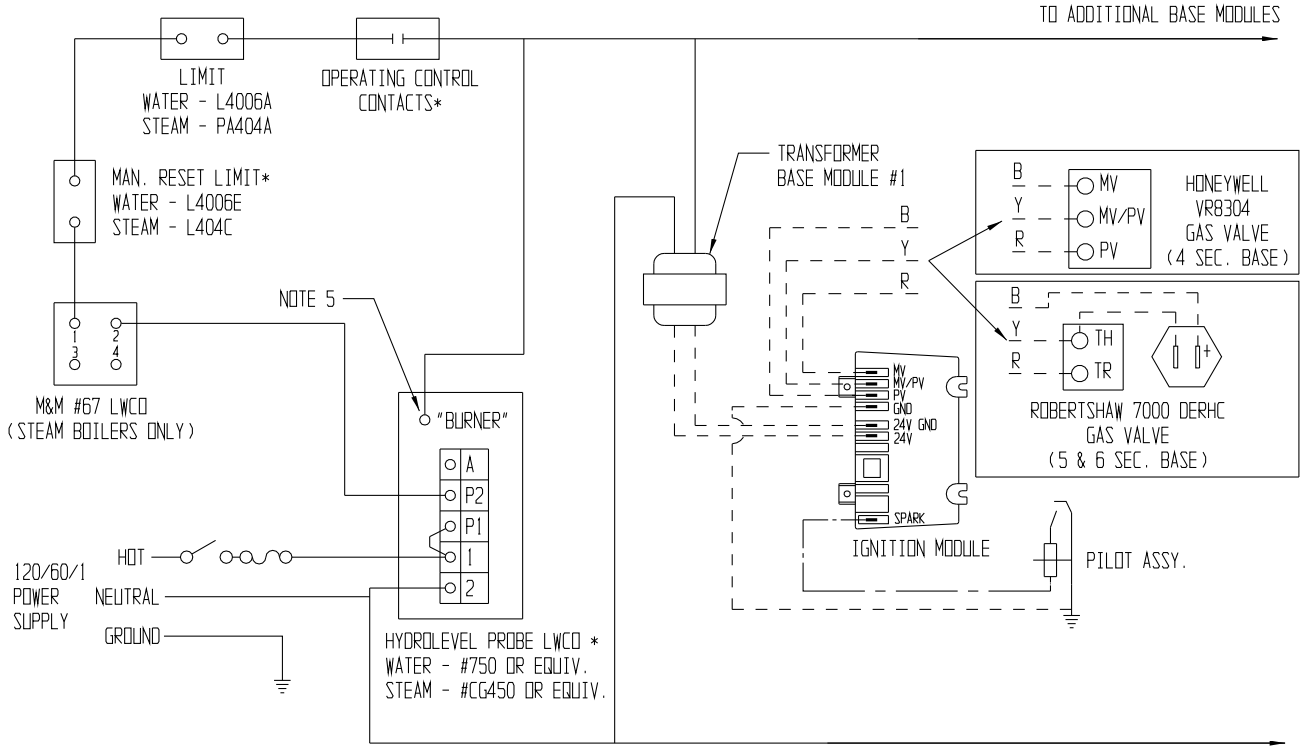


Figure 34: Typical Wire Routing

SERIES 32 - BASIC BOILER WIRING



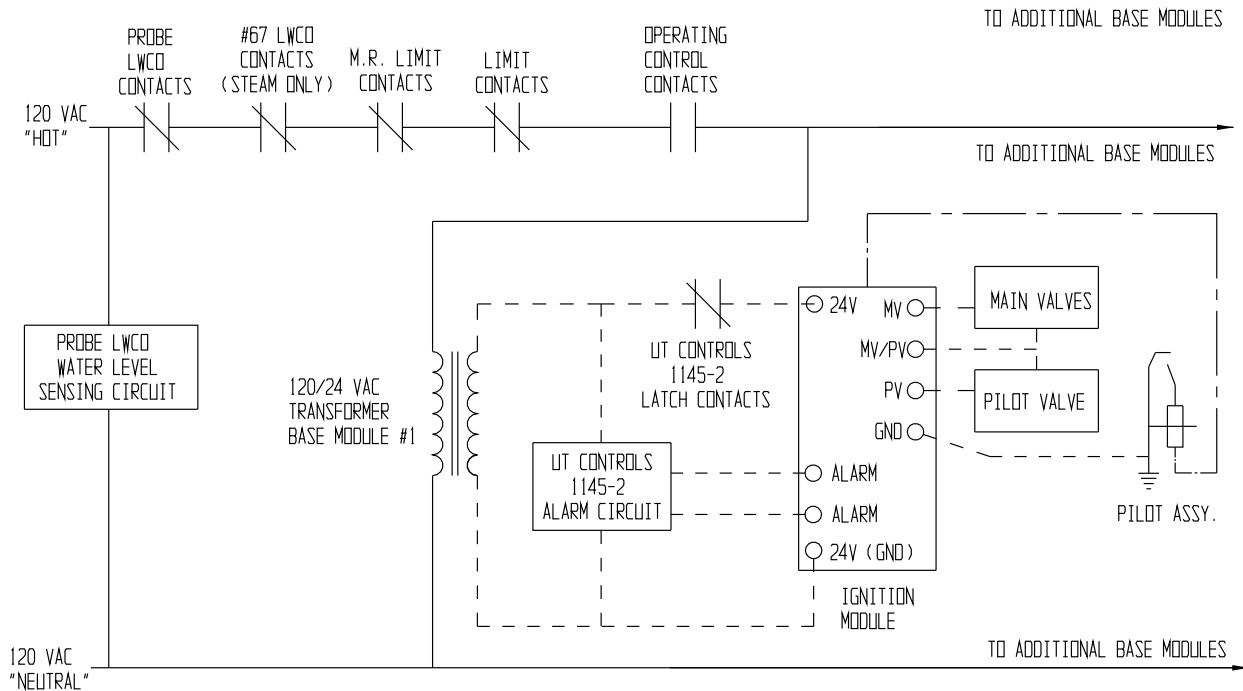
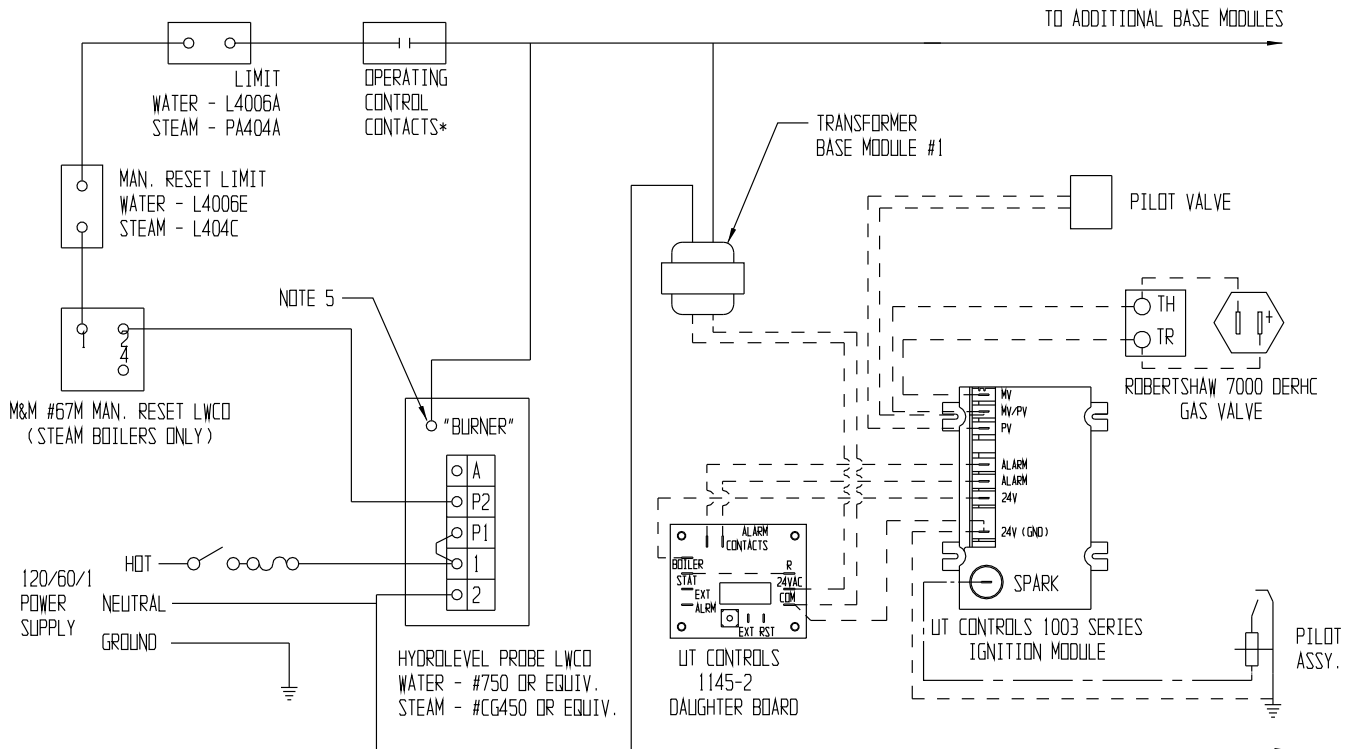
NOTES:

- 1) CONTROLS MARKED WITH AN ASTERISK (*) ARE NOT SUPPLIED WITH THE BOILER
- 2) IF A STEAM BOILER IS EQUIPPED WITH BOTH A PROBE AND FLOAT TYPE LWCO, THE FLOAT MUST BE A MANUAL RESET TYPE.
- 3) DO NOT CONNECT A WATER FEEDER TO A MANUAL RESET LWCO
- 4) IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH THE FOLLOWING WIRE OR ITS EQUIVALENT:
 FOR 120 OR 24 VAC WIRING - TYPE AWM (105C)
 FOR SPARK CABLE - HONEYWELL 3501186 CABLE ASSY
- 5) "BURNER" CONNECTION PRESENT ON CG450 ONLY

SYMBOLS:	
—————	- 120 VAC WIRING
- - - - -	- 24 VAC WIRING
- · - · -	- IGNITOR/SENSOR WIRING

Figure 35: Series 32 Standard Boiler Wiring

SERIES 32 - CSD-1 BOILER WIRING



NOTES:

- 1) CONTROLS MARKED WITH AN ASTERISK (*) ARE NOT SUPPLIED WITH THE BOILER
- 2) IF A STEAM BOILER IS EQUIPPED WITH BOTH A PROBE AND FLOAT TYPE LWCO, THE FLOAT MUST BE A MANUAL RESET TYPE.
- 3) DO NOT CONNECT A WATER FEEDER TO A MANUAL RESET LWCO
- 4) IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH THE FOLLOWING WIRE OR ITS EQUIVALENT:
 FOR 120 OR 24 VAC WIRING - TYPE AWM (105C)
 FOR SPARK CABLE - HONEYWELL 3501186 CABLE ASSY
- 5) "BURNER" CONNECTION PRESENT ON CG450 ONLY

SYMBOLS:	
—	- 120 VAC WIRING
- - -	- 24 VAC WIRING
· · ·	- IGNITOR/SENSOR WIRING

Figure 36: Series 32 - CSD-1 Boiler Wiring

Safety Control Operation

Temperature Limit Control (Water Boilers) – The temperature limit control interrupts burner operation when the supply water temperature exceeds the set point. Maximum allowable water temperature in a water boiler is 250F. The L4006A will reset itself when the water temperature drops below the set point less the differential (typically 15F). Manual reset water limit controls, such as the Honeywell L4006E, must be manually reset. For this reason, they should be set well above the operating limit control to avoid nuisance boiler shut-downs.

Pressure Limit Control (Steam Boilers) – The pressure limit control interrupts burner operation when the steam pressure exceeds the set point. Maximum allowable steam pressure is 15psi, however the pressure limits should be set below this to prevent the safety valve from opening unnecessarily. Manual reset pressure limit controls, such as the Honeywell L404C, must be manually reset. For this reason, they should be set well above the operating pressure limit control to avoid nuisance boiler shut-downs.

Low Water Cut-off (Steam and Water Boilers) – Low water cut-offs interrupt burner operation if the water level in the boiler drops below a safe level. Steam boilers may be equipped with two low water cutoffs so that there is a back up low water cut-off if the first one fails to shut down the boiler in a low water condition. In this case, the back up low water cutoff must be installed below the “operating” low water cut-off and is usually a manual reset type.

XII Start-up and Checkout

NOTE

SAFE LIGHTING AND OTHER PERFORMANCE CRITERIA WERE MET WITH THE GAS MANIFOLD AND CONTROL ASSEMBLY PROVIDED ON THE BOILER WHEN THE BOILER UNDERWENT THE TESTS SPECIFIED IN Z21.13.

Use the following procedure for initial start-up of the boiler:

- 1) Make sure that the boiler is filled with water.
- 2) Check all new gas piping for leaks and purge piping sections that are filled with air. See the *National Fuel Gas Code* for additional information on testing and purging gas lines.
- 3) Verify that vent system is complete and free of obstructions before attempting to fire boiler.
- 4) Inspect all wiring for loose or uninsulated connections.
- 5) Make sure the main burners are seated properly in the rear of burner tray and on orifices.
- 6) Adjust thermostat to the highest setting.
- 7) Start the boiler using the appropriate lighting instructions for the gas valve on the boiler on pages 54 and 55.
- 8) Upon initial start-up, the gas train will be filled with air. Even if the gas line has been completely purged of air, it may take several tries for ignition before a flame is established. Once a flame has been established for the first time, subsequent calls for burner operation should result in a flame on the first try.
- 9) Observe pilot burner flame. See Figure 37. The pilot flame should be a steady medium blue flame covering around 3/8" to 1/2" of the spark electrode/flame rod.
- 10) Inspect the main burner flames visible through the observation port in burner access panel. The flame should be stable and mostly blue (See Figure 38). No yellow tipping should be present; however, intermittent flecks of yellow and orange in the flame are normal.
- 11) Check entire gas train for leaks using soap and water or other approved leak detection method while boiler is firing. Fix any leaks found immediately.

WARNING

- NEVER USE A FLAME TO CHECK FOR GAS LEAKS.
- MAKE SURE THAT THE AREA AROUND THE BOILER IS CLEAR AND FREE FROM COMBUSTIBLE MATERIALS, GASOLINE, AND OTHER FLAMMABLE VAPORS AND LIQUIDS.

- 12) Run the gas valve safety shutdown test with the main burners firing. Disconnect ignition cable from the ignition module on the first base module. Both the pilot burner and main burners on the base module should stop firing. Repeat this procedure for each base module.

WARNING

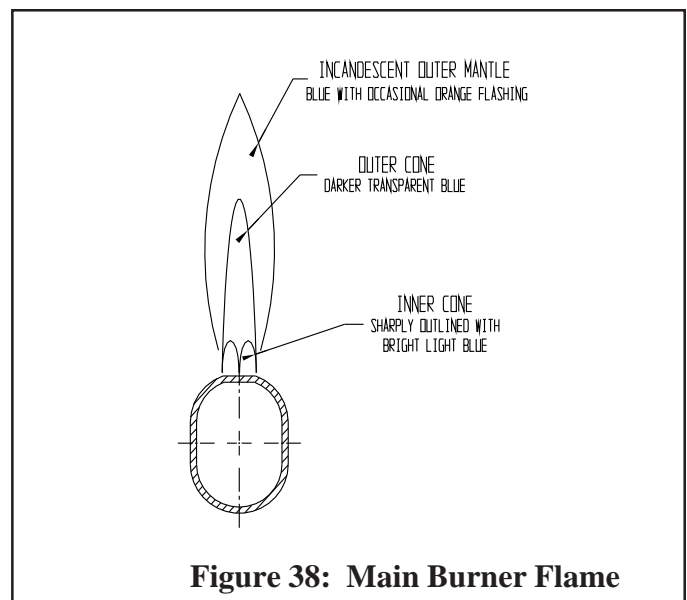
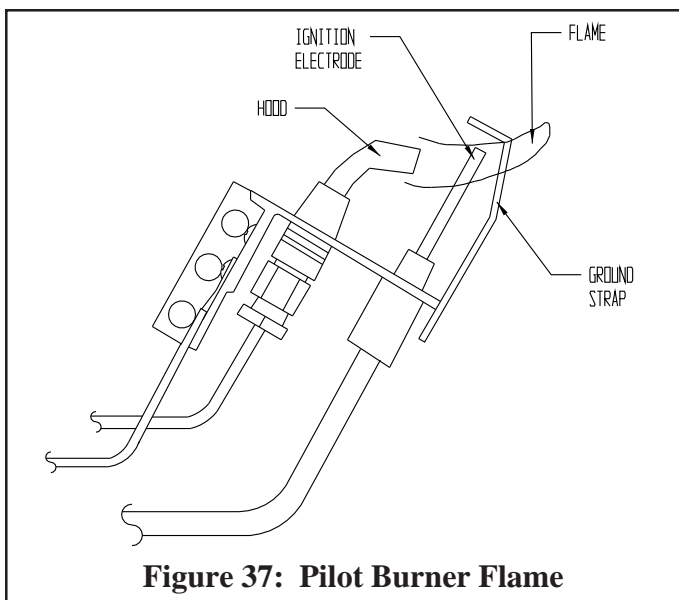
FAILURE TO FOLLOW THE FOLLOWING PROCEDURE EXACTLY COULD RESULT IN OVER-FIRING OF THE BOILER AND A CARBON MONOXIDE HAZARD.

- 13) Check the manifold pressure and adjust if necessary. To do this, use the following procedure:
- a. Connect a manometer to the inlet pressure tap on the gas valve (see Figures 39 - 41).
 - b. Check the inlet pressure with all gas appliances on and off. The inlet pressure at the inlet of each gas valve must be within the following limits regardless of what combination of appliances is firing:

Inlet Press (inches w.c.)	Natural Gas
Min.	5.0
Max.	14.0

If the inlet pressure falls outside of these limits, find and correct the cause of the problem before proceeding further.

- c. Connect a manometer to the manifold (outlet) pressure tap on the gas valve on the first base module. See Figures 39 - 41.
 - d. Read the manifold pressure. It should be set at 3.5 inches w.c..
 - e. If a manifold pressure adjustment is needed, make the adjustment by turning the pressure regulator (see Figures 39 - 41) screw clockwise to raise the pressure and counter clockwise to reduce the pressure. If a manifold pressure adjustment is made, recheck the line pressure at each base module to be certain that it is still within acceptable limits. Replace the cover screw on the regulator.
 - f. Repeat steps a - e for the remaining base modules.
- 14) Test thermostat operation while the boiler is running. Turn the thermostat to the lowest setting. Both pilot burner and main burners should stop firing. Raise the thermostat back to the highest setting. The pilot burner and main burners should relight.
- 15) (Water Boilers) - Verify high limit operation. Allow the boiler water temperature to increase to high limit setting. The burners should shut down and the circulator continue running. Allow the boiler water temperature to drop below high limit setting. The pilot burner and main burners should relight.

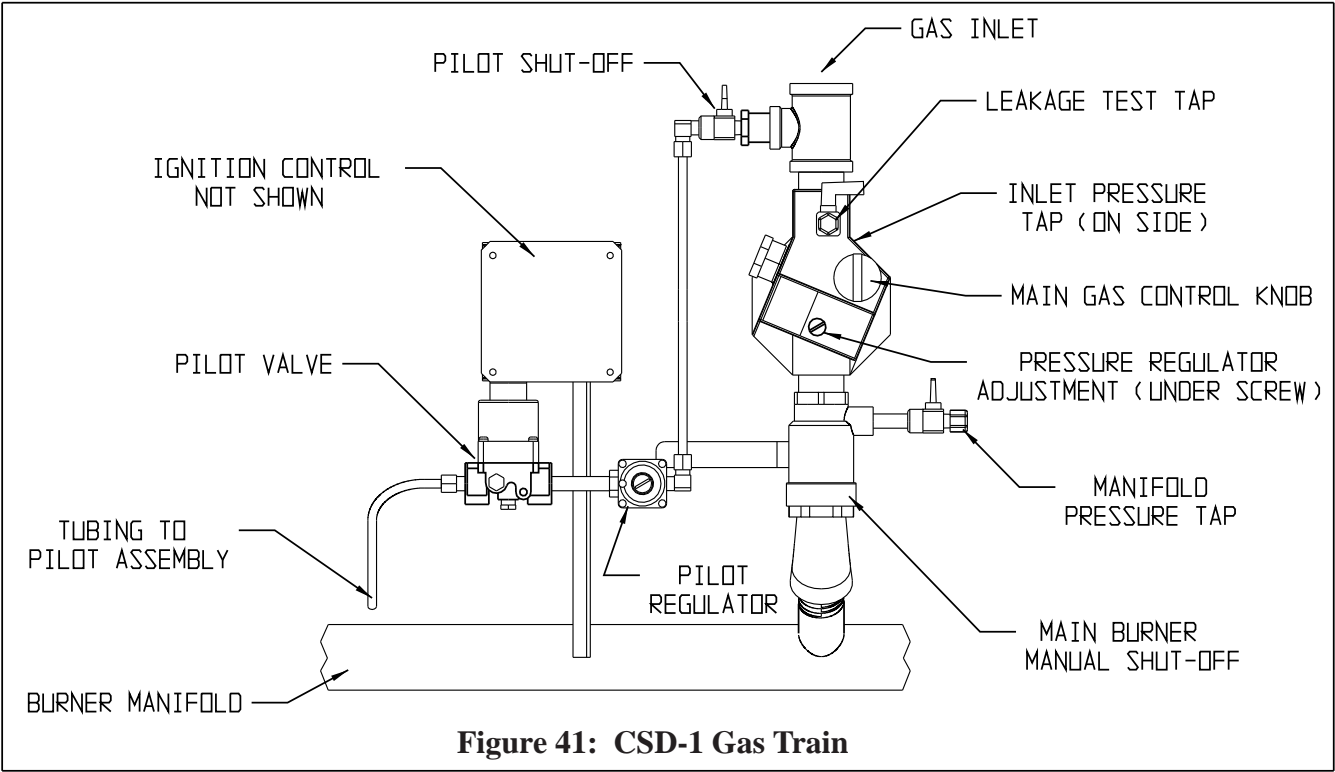
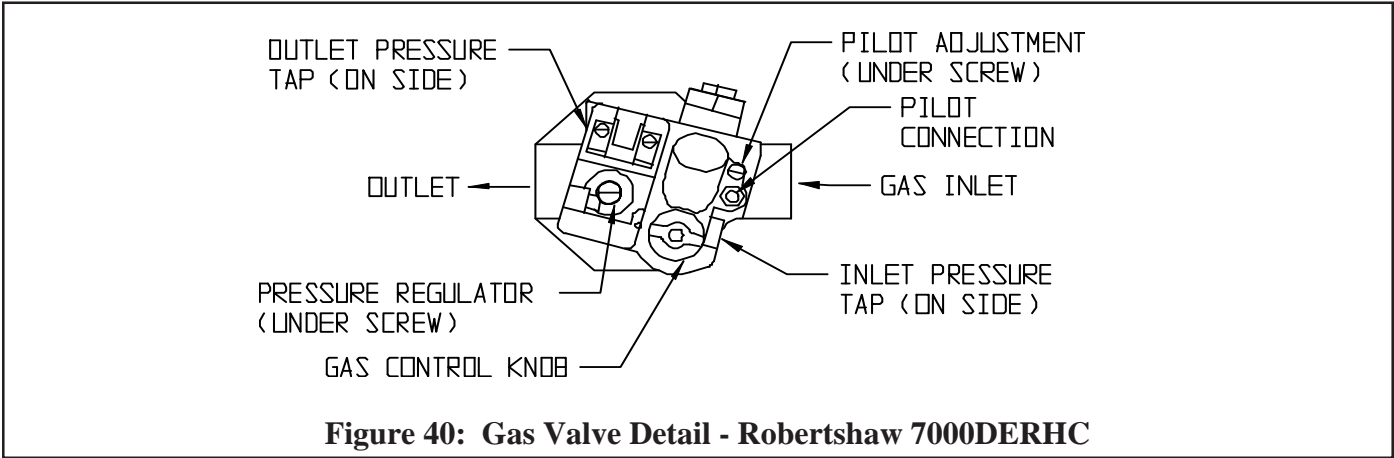
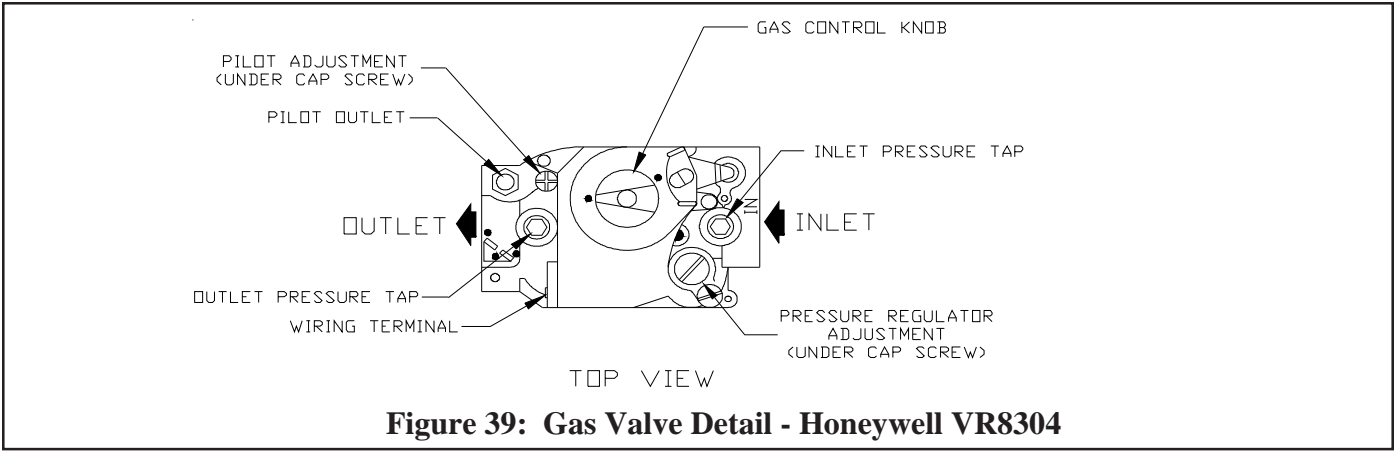


- 16) (Steam Boilers) - Verify low water cutoff operation while the boiler is running. Slowly open drain valve and drain boiler until the water level drops below low water cutoff line. Water still should be visible in the gauge glass when the low water cutoff shuts down the main burners. The pilot burner and main burners should stop firing. Make sure pressure limit, thermostat or other controls have not shut off the boiler. Upon test completion refill the boiler to the normal water level.
- 17) (Steam Boilers) - Check pressure limit control operation. When steam pressure is registered on pressure gauge, lower pressure limit setting below gauge reading. The pilot burner and main burners should stop firing. Raise pressure limit setting above gauge reading. The pilot burner and main burners should relight.
- 18) (Steam Boilers) - Replacement of a steam boiler tends to break loose accumulated scale from the system. During the first week of operation, blow down any float type water cut-offs at least three times following the blow down instructions provided by the low water cut-off manufacturer.
- 19) (Steam Boilers) - After the new boiler has been installed and put into continuous operation for several days, clean the boiler of oil, grease, sludge, and other contaminants that may have been present in existing piping. This will prevent unsteady water line and water carry over into supply main. The boiler boil-out should be done as follows:
- a. Turn off gas supply to boiler per the appropriate Lighting and Operating instructions on pages 54 and 55.
 - b. Drain water from boiler until about one inch of water is visible in gauge glass.
 - c. Run a hose or temporary piping from the boiler drain valve to a location where hot water can be safely discharged. Drain approximately five gallons of water from the boiler and mix-in an appropriate amount of an approved boil-out compound. Refill the boiler with prepared solution through funnel inserted into the surface skimmer tapping. Run a temporary drain line made of hose or piping from the surface skimmer tapping to a location where hot water can be safely discharged.
 - d. Light off the boiler per the appropriate instructions on pages 54 and 55. Run boiler for several hours, boiling the water, without generating steam pressure. Open the water feed valve sufficiently to allow a slight overflow of water through the temporary drain line attached to the surface skimmer tapping. Continue boiling until water coming out is clear.
 - e. Turn off gas supply to boiler per the appropriate Lighting and Operating instructions on pages 54 and 55. Drain hot water from boiler through boiler drain valve to a location where hot water can be safely discharged. Refill the boiler to normal water line level. If water in the gauge glass does not look clear, repeat above boil-out procedure again until water is clear.
 - f. Close the surface skimmer tapping.
 - g. Conduct pH and Alkalinity test of water in the system. The pH reading should be in 7 to 11 range.

NOTE

When substantial amount of make-up water is used due to lost condensate, or when make-up water is hard or corrosive, water treatment is required. Contact qualified water treatment company for recommended water treatment compounds and procedures.

- 20) (All Boilers) - Inspect the vent system for flue gas leaks. Repair any leaks found before leaving the boiler in operation.
- 21) (All Boilers) - After the boiler has operated for approximately 30 minutes, check the boiler and heating system piping for leaks. Repair any leaks found at once.



LIGHTING INSTRUCTIONS FOR BASE MODULES EQUIPPED WITH HONEYWELL VR8304 SERIES GAS VALVES

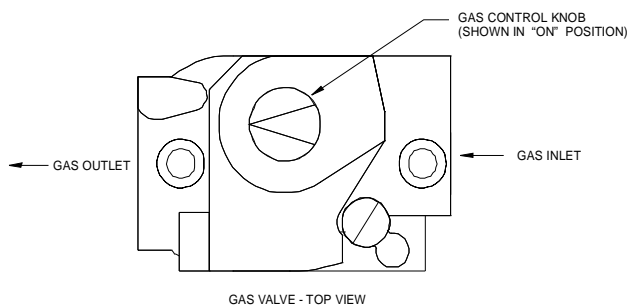
FOR YOUR SAFETY READ BEFORE LIGHTING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- A. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
- B. BEFORE LIGHTING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
- WHAT TO DO IF YOU SMELL GAS**
- Do not try to light any appliance.
 - Do not touch any electric switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
5. Remove front access panel.
6. Rotate the gas control knob clockwise ↻ to OFF.
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you then smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas go to the next step.
8. Rotate the gas control knob counter clockwise ↺ to "ON".
9. Replace front access panel.
10. Turn on all electric power to the appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Push in gas control knob slightly and turn clockwise ↻ to "OFF". Do not Force.

LIGHTING INSTRUCTIONS FOR BASE MODULES EQUIPPED WITH ROBERTSHAW 7000DERHC SERIES GAS VALVES

FOR YOUR SAFETY READ BEFORE LIGHTING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- A. This appliance is equipped with an ignition device which automatically lights the pilot. Do **not** try to light the pilot by hand.
- B. **BEFORE LIGHTING** smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

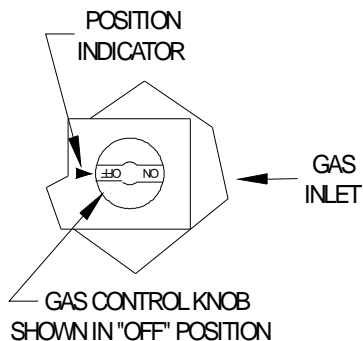
- If you cannot reach your gas supplier, call the fire department.

- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the pilot. Do **not** try to light the pilot by hand.



5. Remove front access panel.
6. Rotate the gas control knob clockwise ↻ to OFF.
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you then smell gas, **STOP!** Follow "B" in the safety information above on this label. If you don't smell gas go to the next step.
8. Rotate the gas control knob counter clockwise ↶ to "ON".
9. Replace front access panel.
10. Turn on all electric power to the appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Push in gas control knob slightly and turn clockwise ↻ to "OFF". Do not Force.

XIII Service and Maintenance

The following routine maintenance should be performed:

On a continuous basis:

- 1) Keep the area around the boiler free and clear from combustible materials, gasoline, and other flammable vapors and liquids.
- 2) Keep the area around the boiler and boiler room ventilation openings clear of objects which might obstruct the flow of combustion and ventilation air.

On at least a weekly basis:

For boilers equipped with a float type low water cut-off, blow down the low water cut-off by following the low water cut-off manufacturer's instructions. During this blow down, the low water cutoff should shut down the burners. If it does not, the low water cut-off should be replaced immediately.

On an annual basis:

- 1) Turn off electrical power and gas supply to the boiler
- 2) Inspect the flue passages for signs of blockage. If there is any carbon in the combustion chamber or the flue passages, clean the heat exchanger before proceeding further. See the cleaning procedure below.
- 3) Remove any debris found in the combustion chamber, being careful not to disturb combustion chamber insulation
- 4) Remove all burners, noting the location of the pilot main burner. If burners show signs of deterioration, they should be replaced (some discoloration around the burner ports is normal). Clean the burners by first brushing the ports with a soft bristle brush and then vacuuming out any debris through the venturi opening.
- 5) Inspect the pilot assembly. Clean any deposits found on the electrode and grounding strap. The ideal gap between the electrode and the ground strap is 1/8". Inspect the porcelain for cracks or other deterioration. Replace pilot assembly if deterioration is found.
- 6) Inspect the combustion chamber insulation for deterioration.
- 7) Inspect the ignition cable insulation for cracks or other deterioration. If deterioration is found, replace cable.

CAUTION

LABEL ALL WIRES PRIOR TO DISCONNECTION WHEN SERVICING CONTROLS. WIRING ERRORS CAN CAUSE IMPROPER AND DANGEROUS OPERATION. VERIFY PROPER OPERATION AFTER SERVICING

- 8) Reinstall burners, being careful to put the pilot main burner in its original location.
- 9) Inspect all boiler wiring for loose connections or deterioration.
- 10) Inspect the vent system:
 - Make sure that both the vent system is free of obstructions.
 - Make sure that all vent system supports are intact.
 - Inspect joints for signs of condensate or flue gas leakage.
 - Inspect venting components for corrosion or other deterioration. Replace any defective vent components.
- 11) Inspect the boiler system for leaks.

CAUTION

WATER LEAKS CAN CAUSE SEVERE CORROSION DAMAGE TO THE BOILER OR OTHER SYSTEM COMPONENTS. REPAIR ANY LEAKS FOUND IMMEDIATELY

- 12) Place the boiler back in operation using the procedure outlined in “Start-up”. Check the pilot line and any other gas piping disturbed during the inspection process for leaks.

Heat Exchanger Cleaning Procedure

- 1) Turn off electrical power and gas supply to the boiler
- 2) Disconnect the vent connectors from the boiler.
- 3) Remove the front, top and rear jacket panels.
- 4) Remove the burners.
- 5) Remove the nuts and washers holding the flue collector onto the heat exchanger.
- 6) Carefully remove the flue collector gasket strips and set them aside.
- 7) Remove the flue collector from the heat exchanger.
- 8) Clean the flue passageways using a stiff bristle brush. Be certain that all foreign material is removed from the gaps between the pins.
- 9) Clean the bottom surfaces of the heat exchanger.
- 10) Put a light in the combustion chamber and look through the flue passages from the top to verify that they have been thoroughly cleaned.
- 11) Replace the flue collector gasket strips.
- 12) Replace the nuts and washers that hold down the flue collector.
- 13) Reattach all the jacket components.
- 14) Reinstall burners, being careful to put the pilot main burner in its’ original location.
- 15) Reconnect the vent system.

WARNING

SOOT DEPOSITS IN THE FLUE PASSAGES ARE A SIGN THAT THE BOILER MAY BE OPERATING AT HIGH CARBON MONOXIDE (CO) LEVELS. AFTER CLEANING THE BOILER OF SOOT DEPOSITS, CHECK THE CO LEVEL IN THE FLUE GAS TO INSURE THAT THE BOILER IS OPERATING PROPERLY.

If it is necessary to check CO, use a combustion analyzer, or other instrument which is designed to measure CO in flue gas. A CO “sniffer” designed for testing CO levels in ambient air cannot be used to check boiler combustion. Take a flue gas sample by inserting a sample probe through the draft diverter opening and into the flue collector so that the sample is taken in the area directly over the heat exchanger. Do not take a sample until the boiler has been firing for at least five minutes.

A normal CO reading for a Series 32 boiler is less than 50ppm (0.005%). A reading of more than 100ppm (0.01%) is indicative of a combustion problem.

Some causes of excessive CO include:

- Incorrectly sized main burner orifice for the altitude at which boiler is installed
- Crooked or out-of-round orifice holes (never attempt to drill orifice for this boiler in the field)
- Partially plugged flue passages
- Improper manifold pressure
- Foreign material in burner venturis or burner ports

- Inadequate supply of combustion air

XIV PARTS

The following parts may be obtained from any Crown distributor. To find the closest Crown distributor, consult the area Crown representative or the factory at:

Crown Boiler Co.
Customer Service
P.O. Box 14818
Philadelphia PA. 19134
(215) 535-8900
www.crownboiler.com

For boilers installed at elevations above 2000 ft, consult the local Crown representative or the factory for the correct main burner orifice.

SERIES 32 MASTER PARTS LIST

DESCRIPTION	SECTIONS					QUANTITY												PART #					
	RIGHT END (ALL BOILERS)	LEFT END (ALL BOILERS)	INTERMEDIATE (WATER BOILERS)	INTERMEDIATE (STEAM BOILERS)	TAPPED INTERMEDIATE (STEAM BOILERS)	BASE CARTON			INTERMEDIATE CARTON			SECTION JOINER CARTON						BASE SIDE PANEL CARTON	JACKET SIDE PANEL CARTON	WATER TRIM CARTON	STEAM TRIM CARTON	BOILER CARTON (STD WATER)	BOILER CARTON (STD STEAM)
						285	380	475	285	380	475	A	B	C	D	E	311010						
PART # (STANDARD)	310000	310001	310002	310002	310003	311004	311005	311006	310404	310405	310406	311020	311021	311022	311023	311024	311010	310400	311025	311030	1 EA.	1 EA.	
PART # (CSD-1)	310000	310001	310002	310002	310003	311004	311005	311006	310404	310405	310406	311020	311021	311022	311023	311024	311010	310400	311025	311030	1 EA.	1 EA.	
BOILER MODEL																							
32-475	1	1	4	4				1			1	1					1	1	1	1	1	311040	311041
32-570	1	1	5	5		2			2				1				1	1	1	1	1	311040	311041
32-665	1	1	6	6		1	1		1	1				1			1	1	1	1	1	311044	311045
32-760	1	1	7	7		2	2		2	2					1		1	1	1	1	1	311044	311045
32-855	1	1	8	8		1	1		1	1						1	1	1	1	1	1	311044	311049
32-950	1	1	9	9				2			2	2					1	1	1	1	1	311050	311051
32-1045	1	1	10	9	1	1	2		1	2		1	1				1	1	1	1	1	311050	311051
32-1140	1	1	11	10	1	3	3						2				1	1	1	1	1	311050	311051
32-1235	1	1	12	11	1	1	2		2	2			1	1			1	1	1	1	1	311056	311051
32-1330	1	1	13	12	1	1	2		2	2			2				1	1	1	1	1	311056	311051
32-1425	1	1	14	13	1			3			3						1	1	1	1	1	311056	311051
32-1520	1	1	15	14	1		4				4						1	1	1	1	1	311056	311063
32-1615	1	1	16	14	2	1	1	2	1	1	2				1		1	1	1	1	1	311056	311063
32-1710	1	1	17	15	2	2	2	2	2	2	2						1	1	1	1	1	311056	311063
32-1805	1	1	18	16	2	1	1	3	1	3	1						1	1	1	1	1	311056	311063
32-1900	1	1	19	17	2			4			4						1	1	1	1	1	311056	311063
32-1995	1	1	20	18	2	2		3	2		3						1	1	1	1	1	311072	311063
32-2090	1	1	21	18	3		3	2		3	2				2		1	1	1	1	1	311074	311073
32-2185	1	1	22	19	3		2	3		2	3				1		1	1	1	1	1	311074	311073
32-2280	1	1	23	20	3		1	4		1	4						1	1	1	1	1	311074	311073
32-2375	1	1	24	21	3			5			5						1	1	1	1	1	311074	311075
32-2470	1	1	25	22	3	2		4	2		4						1	1	1	1	1	311074	311075
32-2565	1	1	26	23	3	1	1	4	1	1	4						1	1	1	1	1	311074	311075
32-2660	1	1	27	23	4		2	4		2	4						1	1	1	1	1	311074	311075
32-2755	1	1	28	24	4		1	5		1	5						1	1	1	1	1	311074	311075
32-2850	1	1	29	25	4			6			6						1	1	1	1	1	311074	311075

TANKLESS COILS PARTS

MODEL	PART #
T-1	310020
T-2	310021
T-3	310022

BASE CARTON

DESCRIPTION	PART #	QUANTITY		
		285	380	475
285 BASE ASSEMBLY (STD)	310114	1		
380 BASE ASSEMBLY (STD)	310115		1	
475 BASE ASSEMBLY (STD)	310116			1
285 BASE ASSEMBLY (CSD-1)	3101145	1		
380 BASE ASSEMBLY (CSD-1)	3101155		1	
475 BASE ASSEMBLY (CSD-1)	3101165			1
REAR TIE ROD CHANNEL BRACKET	310311	1	1	1
5/8 X 4 STUD	900309	1	1	1
5/8 USS WASHER	900312	2	2	2
5/8 NUT	900311	2	2	2
JACKET REAR PANEL SUPPORT BRACKET	310310	1	1	1
JACKET TOP SUPPORT BRACKET	310320	1	1	1
#10 X 1/2 HEX HD SHEET METAL SCREW	90-212	12	12	12
GASKET ROPE	900145	5 ft	6 ft	7 ft
5/16-18 X 5 CARRIAGE BOLT	900315	2	2	2
5/16-18 X 3 CARRIAGE BOLT	900313	2	2	2
5/16-18 WING NUT	900104	2	2	2
5/16 USS FLAT WASHER	900102	4	4	4
JACKET KNOBS	90-210	2	2	2
8-32 X 1/4 SCREW	90-211	2	2	2
3/8-16 X 3/4 CAP SCREW	90-035	4	4	4
3/8 USS FLAT WASHER	90-036	4	4	4
3/8-16 HEX NUT	90-221	4	4	4

INTERMEDIATE CARTON

DESCRIPTION	PART #	QUANTITY		
		285	380	475
285 FRONT PANEL	310314	1		
380 FRONT PANEL	310315		1	
475 FRONT PANEL	310316			1
285 TOP PANEL	310324	1		
380 TOP PANEL	310325		1	
475 TOP PANEL	310326			1
285 REAR PANEL *	310304	1		
380 REAR PANEL *	310305		1	
475 REAR PANEL *	310306			1
285 FLUE COLLECTOR	310124	1		
380 FLUE COLLECTOR	310125		1	
475 FLUE COLLECTOR	310126			1

* INCLUDES HEAT SHIELD

SECTION JOINER CARTON

DESCRIPTION	PART #	QUANTITY				
		"A"	"B"	"C"	"D"	"E"
7" PUSHNIPPLE	310005	5	6	7	8	9
3" PUSHNIPPLE	310006	5	6	7	8	9
5/8 X 9 3/4 TIE ROD	900310	15	18	21	24	27
5/8 HEX NUT	900311	30	36	42	48	54
5/8 FLAT WASHER	900312	30	36	42	48	54
LOCTITE # 592, 50 ml TUBE	900350	2	3	3		
LOCTITE # 592, 250 ml TUBE	900355				1	1
"SECTION SEAL", 1 QUART CAN	900360	2	2	2	2	2
WOOD WEDGE	970030	2	2	2	2	2

BASE SIDE CARTON

DESCRIPTION	PART #	QTY.
RH BASE SIDE PANEL ASSY.	310662	1
LH BASE SIDE PANEL ASSY.	310663	1
JACKET SIDE PANEL ZEE BRACKET	310302	2
JACKET TOP SUPPORT BRACKET	310320	1
JACKET TOP SUPPORT END ANGLE	310321	2
JACKET REAR PANEL SUPPORT BRACKET	310310	1
REAR TIE ROD CHANNEL BRACKET	310311	1
5/8 X 4 STUD	900309	1
5/8 USS WASHER	900312	2
5/8 NUT	900311	2
3/8-16 X 3/4 CAP SCREW	90-035	4
3/8 USS FLAT WASHER	90-036	4
3/8-16 HEX NUT	90-221	8
BLOCK ANCHOR	310010	4
3/8-16 X 2 CAP SCREW	900455	4
#10 X 1/2 HEX HD SHEET METAL SCREW	90-212	20

JACKET SIDE PANEL CARTON

DESCRIPTION	PART #	QTY.
RH JACKET SIDE PANEL ASSY.	310300	1
LH JACKET SIDE PANEL ASSY.	310301	1

BASE PARTS

KEY	DESCRIPTION	PART #	QTY PER BASE MODULE		
			285	380	475
1	BASE FRONT PANEL (285)	310604	1		
1	BASE FRONT PANEL (380)	310605		1	
1	BASE FRONT PANEL (475)	310606			1
2a	BASE FRONT LEG (RH)	310110	1	1	1
2b	BASE FRONT LEG (LH)	310111	1	1	1
3	INSULATION BASE FRONT (285)	312614	1		
3	INSULATION BASE FRONT (380)	312615		1	
3	INSULATION BASE FRONT (475)	312616			1
4	BASE REAR PANEL (285)	310664	1		
4	BASE REAR PANEL (380)	310665		1	
4	BASE REAR PANEL (475)	310666			1
5	RIGHT SIDE PANEL	310660	1 PER BOILER		
6	LEFT SIDE PANEL	310661	1 PER BOILER		
7	BASE SIDE INSULATION	312600	2 PER BOILER		
8	INSULATION BASE REAR (285)	312604	1		
8	INSULATION BASE REAR (380)	312605		1	
8	INSULATION BASE REAR (475)	312606			1
9	#10 x 1-1/4 CUP HEAD PIN	900203	8 PER MODULE, 6 PER SIDE PANEL		
10	#10 SPEED NUT	900200			
11	3/8-16 X 3/4 CARRIAGE BOLT	900440	4	4	4
12	3/8-16 HEX NUT	90-221	4	4	4
13	3/8-16 USS FLAT WASHER	90-036	4	4	4
15	BASE SIDE CHANNEL (RH)	310650	1	1	1
16	BASE SIDE CHANNEL (LH)	310651	1	1	1
17	BURNER ACCESS PANEL (285)	310624	1		
17	BURNER ACCESS PANEL (380)	310625		1	
17	BURNER ACCESS PANEL (475)	310626			1
18	#10 X 1/2 HEX HD SHEET METAL SCREW	90-212	2	2	2
19	1/4-20 X 3/4 GRADE 5 HEX WASH HD SCREW	900305	6	6	6

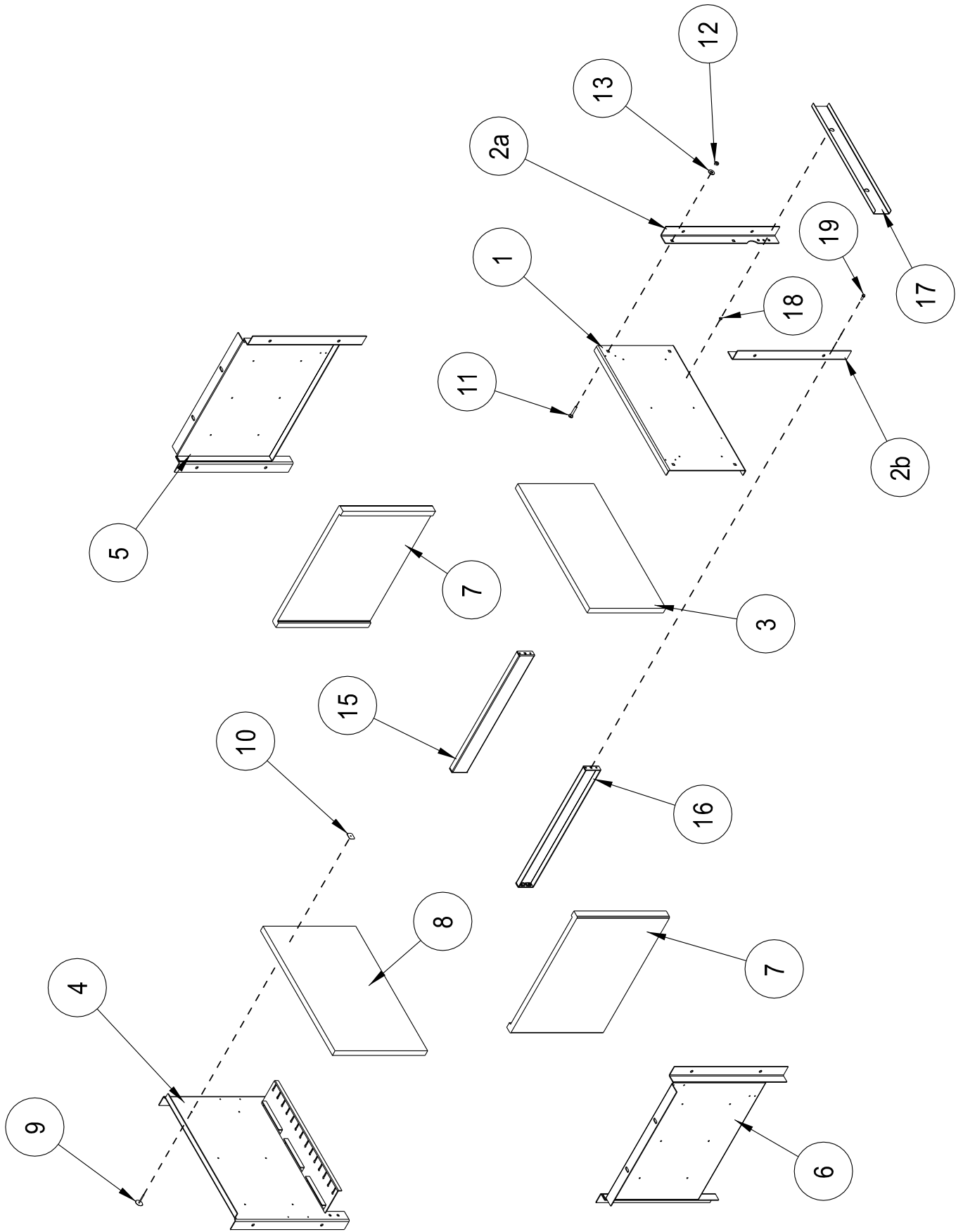


Figure 42: Exploded View - Base Parts

BASE PARTS (CONTD.)

KEY	DESCRIPTION	PART #	QUANTITY		
			285	380	475
20	MANIFOLD ASSY, COMPLETE (285)	310154	1		
20	MANIFOLD ASSY, COMPLETE (380)	310155		1	
20	MANIFOLD ASSY, COMPLETE (475)	310156			1
21	1/4-20 X 1/2 SELF TAPPING SCREW	900100	4	4	4
22	MAIN BURNER LESS PILOT BRKT	150321	7	10	13
23	MAIN BURNER WITH PILOT BRKT.	150320	1	1	1
24	PILOT ASSY, Q362A1037	3504060	1	1	1
24a	BCR-18 PILOT ORIFICE	3501550	1	1	1
24b	1/4" COMPRESSION FERRULE	3501150	2	2	2
25	10-32 X 3/16 MACHINE SCREW	146-95-301	2	2	2
*	GROUND WIRE	9601101	1	1	1
*	36" IGNITION CABLE	3501136	1	1	1
*	1/4" O.D. PILOT TUBING (ft)	900040	1.5	1.5	1.5
26	2.75mm MAIN BURNER ORIFICE (SEA LEVEL)	950380	8	11	14
27	ORIFICE HITCH PIN	950370	8	11	14
28	3/4" 45 DEGREE STREET EL	950044	1		
29	1" 45 DEGREE STREET EL	950045		1	1
30	GAS VALVE, VR8304P4306	3507250	1 (**)		
31	GAS VALVE, ROBERTSHAW 7000DERHC	3507310	(**)	1	1
*	PILOT VALVE (CSD-1 ONLY)	3503107	1	1	1
*	RV12L PILOT REGULATOR (CSD-1 ONLY)	3503115	1	1	1
32	JUNCTION BOX	96-055	1	1	1
33	JUNCTION BOX COVER	96-054	1	1	1
34	TRANSFORMER, AT140C1030	35-2000	1	1	1
35	8-32 X 1/2" SCREW	90-052	2	2	2
36	8-32 HEX NUT	90-053	2	2	2
37	IGNITION MODULE, S8610M 1011(STD ONLY)	3505015	1	1	1
*	TRANSFORMER HARNESS (STD ONLY)	9605110	2	2	2
*	IGNITION HARNESS (STD ONLY)	9601100	1		
*	IGNITION HARNESS (STD ONLY)	9605100		1	1
38	IGNITION MODULE, UT 1003-612A (CSD-1 ONLY)	3503100	1	1	1
*	DAUGHTER BOARD, UT 1145-2 (CSD-1 ONLY)	3503105	1	1	1
*	DAUGHTER BOARD MOUNTING BRACKET (CSD-1 ONLY)	310200	1	1	1
*	DAUGHTER BOARD COVER (CSD-1 ONLY)	310205	1	1	1
*	VALVE HARNESS (CSD-1 ONLY)	9605900	1	1	1
*	ALARM HARNESS (CSD-1 ONLY)	9605902	2	2	2
*	"R-STAT" JUMPER HARNESS (CSD-1 ONLY)	9605907	1	1	1
*	"IGNITION MODULE HARNESS" (CSD-1 ONLY)	9605905	1	1	1
*	"HOT" TRANSFORMER HARNESS (CSD-1 ONLY)	9605910	1	1	1
*	"COMMON" TRANSFORMER HARNESS (CSD-1 ONLY)	9605912	1	1	1
*	"PILOT COMPRESSION" x NPT THREAD ADAPTER (CSD-1 ONLY)	900460	1	1	1

* NOT PICTURED

** ROBERTSHAW 7000 DERHC USED ON CSD-1 285 BASES

NOTE: SOME STANDARD FITTINGS USED ON CSD-1 BASES NOT LISTED - PROCURE THESE LOCALLY

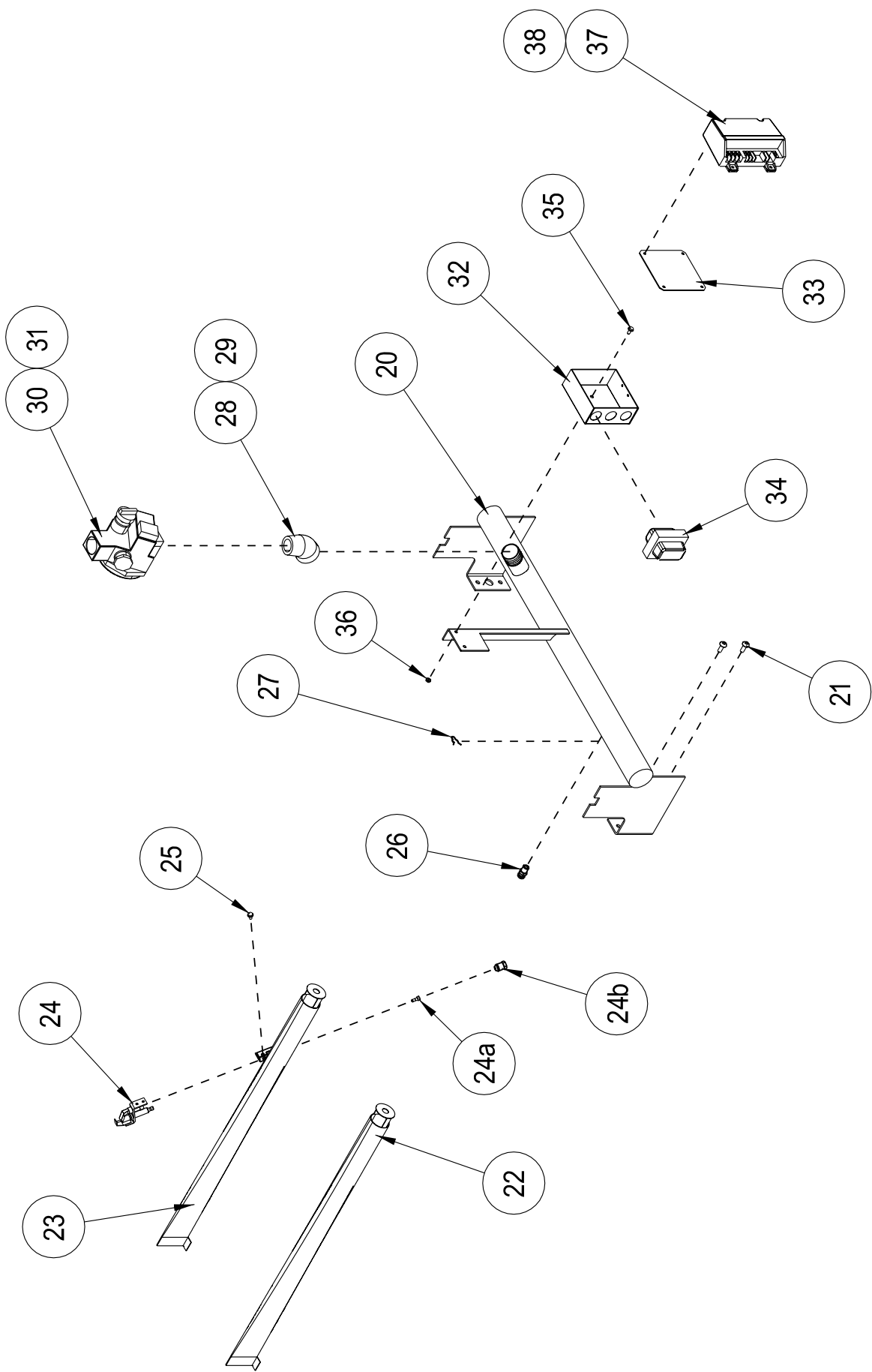


Figure 43: Exploded View - Gas Manifold / Burners / Pilot Assembly

WATER TRIM CARTON

DESCRIPTION	PART #	QTY
L4006A2015	35-3510	1
L4006E1109 MAN. RESET (CSD-1 ONLY)	35-3100	1
1/2 LONG WELL	35-1006	1
HYDROLEVEL 550 LWCO (CSD-1 ONLY)	450550	1
1-1/2 X 1/2 BLK BUSHING	950021	1
TRIDICATOR GAUGE	95-038	1
1/2 X 1/4 BLK BUSHING	95-053	1
BLANK COIL PLATE	270003	2
COIL GASKET	270001	2
3/8 USS FLAT WASHER	90-036	12
3/8-16 X 7/8 HEX HD CAP SCREW	900450	12
1-1/2" NPT BLK PLUG	95-143	2
1" NPT BLK PLUG	950100	2
3/4" NPT BLK PLUG	95-048	4
1/2" NPT BLK PLUG	95-052	7
3 X 3/4 BLK BUSHING	950035	1
BOILER DRAIN	95-041	1

STEAM TRIM CARTON

DESCRIPTION	PART #	QTY
LWCO, #67 CR-3 (STANDARD)	400680	1
LWCO, CG450 (CSD-1 ONLY)	45-460P	1
GLASS SET (20-104-10, 8" CTR TO CTR)	950080	1
PA404A1009	35-5020	1
L404C1147 (CSD-1 ONLY)	35-3020	1
STRAIGHT BRASS PIGTAIL	95-060	1*
1/2 X 4 BRASS NIPPLE	950004	1
1/2 BRASS TEE	951441	1
1/2 BRASS PLUG	95-091	1
PRESSURE GAUGE	95-070	1
1/2 X 1/4 BRASS BUSHING	95-146	2
1/2 X 3 BR NIPPLES	95-116	2
1/2" BR. UNION	95-150	2
1/2 X CL BRASS NIPPLES	95-147	2
BLANK COIL PLATE	270003	2
COIL GASKET	270001	2
3/8 USS FLAT WASHER	90-036	12
3/8-16 X 7/8 HEX HD CAP SCREW	900450	12
1-1/2" NPT BLK PLUG	95-143	3
1" NPT BLK PLUG	950100	2
3/4" NPT BLK PLUG	95-048	4
1/2" NPT BLK PLUG	95-052	5
3 X 3/4 BLK BUSHING	950035	1
BOILER DRAIN	95-041	1

* 2 REQD. ON CSD-1 BOILERS

WATER BOILER CARTON

DESCRIPTION	BOILER MODEL	98-111	980888	980425	980920	900365	95-040	95-081	95-134	950500	95-096	95-027	95-057	95-105	950185	950114	950190	950110	95-047	95-033	95-058	95-031	
	32-475W	1	1	1	1	1	1				1	1	1	1				1 X CL BLK NIPPLE	1-1/2 X 1-1/4 BLK BUSHING	1-1/4 X 4 BLK NIPPLE	1-1/4 ELBOW	1-1/4 X CL BLK NIPPLE	
	32-570W	1	1	1	1	1	1				1	1	1	1									
	32-665W	1	1	1	1	1		1			1	1	1	1									
	32-760W	1	1	1	1	1		1			1	1	1	1									
	32-855W	1	1	1	1	1		1			1	1	1	1									
	32-950W	1	1	1	1	2		1			1	1	1	1									
	32-1045W	1	1	1	1	2		1			1	1	1	1									
	32-1140W	1	1	1	1	2		1			1	1	1	1									
	32-1235W	1	1	1	1	2		1			1	1	1	1									
	32-1330W	1	1	1	1	2		1			1	1	1	1									
	32-1425W	1	1	1	1	2		1			1	1	1	1									
	32-1520W	1	1	1	1	2		1			1	1	1	1									
	32-1615W	1	1	1	1	2		1			1	1	1	1									
	32-1710W	1	1	1	1	2		1			1	1	1	1									
	32-1805W	1	1	1	1	2		1			1	1	1	1									
	32-1900W	1	1	1	1	2		1			1	1	1	1									
	32-1995W	1	1	1	1	2		1		1	1	1	1	1						1	1	1	1
	32-2090W	1	1	1	1	3		1		1	1	1	1	1						1	1	1	1
	32-2185W	1	1	1	1	3		1		1	1	1	1	1						1	1	1	1
	32-2280W	1	1	1	1	3		1		1	1	1	1	1						1	1	1	1
	32-2375W	1	1	1	1	3		1		1	1	1	1	1						1	1	1	1
	32-2470W	1	1	1	1	3		1		1	1	1	1	1						1	1	1	1
	32-2565W	1	1	1	1	3		1		1	1	1	1	1						1	1	1	1
	32-2660W	1	1	1	1	3		1		1	1	1	1	1						1	1	1	1
	32-2755W	1	1	1	1	3		1		1	1	1	1	1						1	1	1	1
	32-2850W	1	1	1	1	3		1		1	1	1	1	1						1	1	1	1

STEAM BOILER CARTON

DESCRIPTION	BOILER MODEL	98-111	980888	980425	980920	900365	950510	950515	950520	950525	950530	950124	950180	950175	950170	95-096	950185	95-047
	32-475S	1	1	1	1	1	1					1	1		1	1		
	32-570S	1	1	1	1	1	1					1	1		1	1		
	32-665S	1	1	1	1	1	1	1				1	1		1	1		
	32-760S	1	1	1	1	1	1	1				1	1		1	1		
	32-855S	1	1	1	1	1	1	1	1			1	1		1	1		
	32-950S	1	1	1	1	2	2	1	1			1	1		1	1		
	32-1045S	1	1	1	1	2	2	1	1			1	1		1	1		
	32-1140S	1	1	1	1	2	2	1	1			1	1		1	1		
	32-1235S	1	1	1	1	2	2	1	1			1	1		1	1		
	32-1330S	1	1	1	1	2	2	1	1			1	1		1	1		
	32-1425S	1	1	1	1	2	2	1	1			1	1		1	1		
	32-1520S	1	1	1	1	2	2			1		1	1		1	1		
	32-1615S	1	1	1	1	2	2			1		1	1		1	1		
	32-1710S	1	1	1	1	2	2			1		1	1		1	1		
	32-1805S	1	1	1	1	2	2			1		1	1		1	1		
	32-1900S	1	1	1	1	2	2			1		1	1		1	1		
	32-1995S	1	1	1	1	2	2			1		1	1		1	1		
	32-2090S	1	1	1	1	3	3			1		1	1		1	1		
	32-2185S	1	1	1	1	3	3			1		1	1		1	1		
	32-2280S	1	1	1	1	3	3			1		1	1		1	1		
	32-2375S	1	1	1	1	3	3			1		1	1		1	1		
	32-2470S	1	1	1	1	3	3			1		1	1		1	1		
	32-2565S	1	1	1	1	3	3			1		1	1		1	1		
	32-2660S	1	1	1	1	3	3			1		1	1		1	1		
	32-2755S	1	1	1	1	3	3			1		1	1		1	1		
	32-2850S	1	1	1	1	3	3			1		1	1		1	1		

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