

CROWN Boiler Co.

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

BWC Series

High Efficiency Gas-Fired Hot Water
Direct Vent Condensing Boilers

INSTALLATION INSTRUCTIONS

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



Models:

- BWC300
- BWC399
- BWC425

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. This boiler requires a special venting system. Read these instructions carefully before installing.

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I Product Description

The BWC is an aluminum gas fired condensing boiler designed for use in forced hot water heating systems requiring supply water temperatures of 180°F or less. This boiler may be vented vertically or horizontally with combustion air supplied from outdoors. This boiler is not designed for use in gravity hot water systems or systems containing significant amounts of dissolved oxygen.

II Specifications

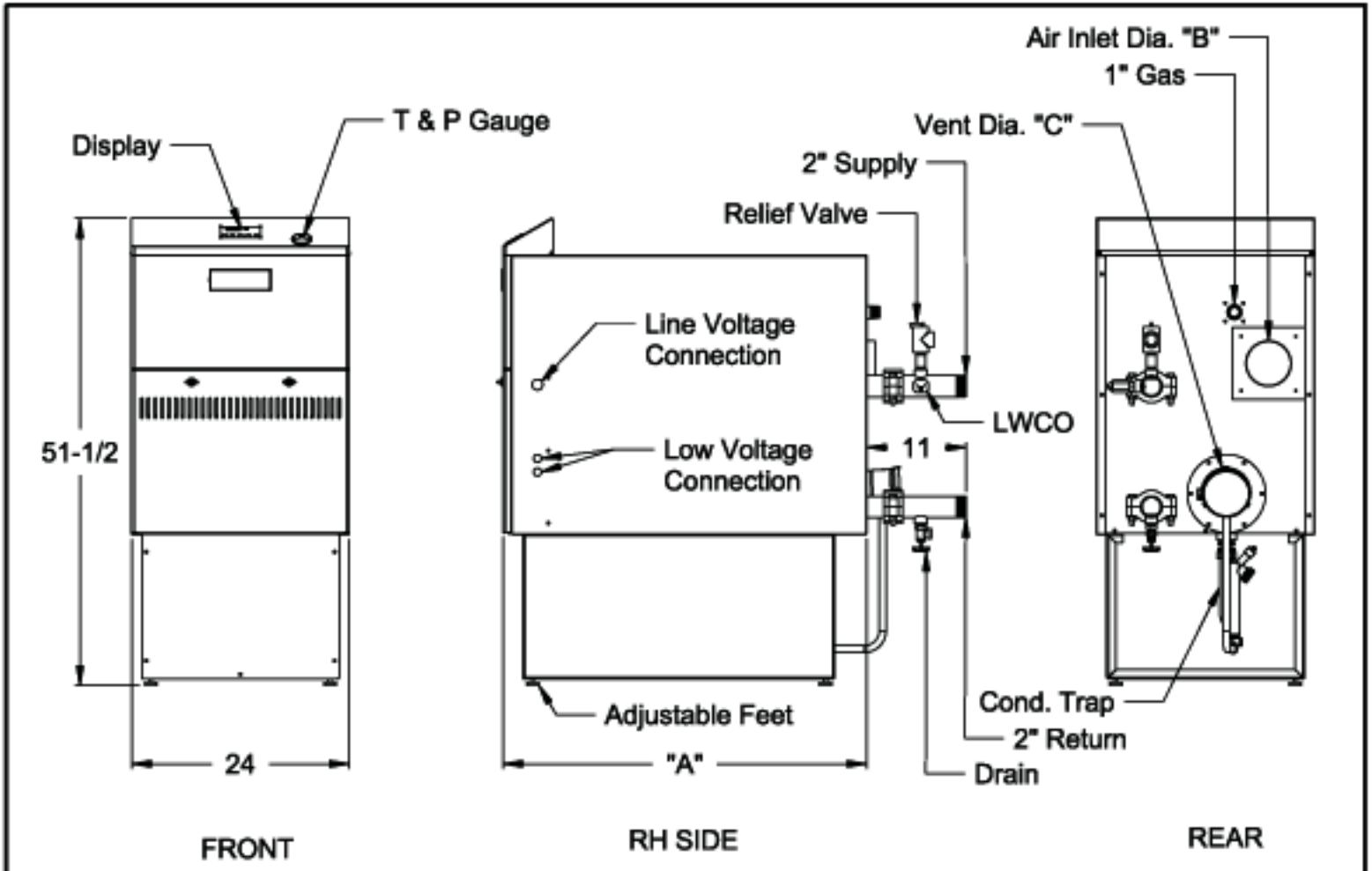


Figure 2.1: General Configuration

Table 2.2: Specifications

MODEL	NO. OF SECTIONS	MAXIMUM INPUT MBH	MINIMUM INPUT MBH	GROSS OUTPUT MBH	IBR NET RATING MBH	HIGH FIRE EFFICIENCY %		"A" LENGTH	VENT COLLAR DIAMETERS (IN.)	
						COMBUSTION	THERMAL		"B" INLET	"C" EXHAUST
BWC300	5	300	100	265	230	93.1	88.2	33-3/8"	4"	4"
BWC399	7	399	106	350	304	91.7	87.6	40-1/8"	5"	5"
BWC425	7	425	106	367	320	90.9	86.5	40-1/8"	5"	5"

PERFORMANCE RATINGS ARE THE SAME FOR NATURAL AND LP.

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 authority having jurisdiction.
 - In the absence of an authority having jurisdiction, installation must be in accordance with this manual and the *National Fuel Gas Code*, ANSI Z223.1. In Canada, installation must be in accordance with the B149.1 Installation Code
 - Where required by the authority having jurisdiction, this installation must conform to the *Standard for Controls and Safety Devices for Automatically Fired Boilers* (ANSI/ASME CSD-1).
- 2) BWC boilers utilize aluminum heat exchangers constructed, tested, and stamped in accordance with ASME Boiler and Pressure Vessel Code Case 2382. Some jurisdictions which require ASME boiler construction do not recognize this Code Case and may not approve the installation of an aluminum boiler. Consult the authority having jurisdiction before installing this boiler.
- 3) Read Section VI to verify that the maximum combustion air and exhaust pipe lengths will not be exceeded in the planned installation. Also verify that the vent terminal can be located in accordance with Section VI.
- 4) Make sure that the boiler is correctly sized:
 - For heating systems employing convection radiation (baseboard or radiators), use an industry accepted sizing method such as the *I-B-R Heat Loss Calculation Guide* (Pub. #H21 or #H22) published by the Hydronics Institute in Berkeley Heights, NJ.
 - For new radiant heating systems, refer to the radiant tubing manufacturer's boiler sizing guidelines.
 - For systems including a Crown Mega-Stor indirect water heater, size the boiler to have either the I=B=R Gross Output required for the Mega-Stor or the net rating required for the heating system, whichever results in the larger boiler.
 - For systems that incorporate other indirect water heaters, refer to the indirect water heater manufacturer's instructions for boiler output requirements.
 - Long runs of venting may reduce the maximum input of the boiler by as much as 10% (See Section VI for more information).
- 5) Make sure that the boiler received is configured for the correct gas (natural or LP).
- 6) Make sure that the boiler is configured for use at the altitude at which it is to be installed.

NOTICE

This product must be installed by a licensed plumber or gas fitter when installed within the Commonwealth of Massachusetts. See Appendix C for additional important information about installing this product within the Commonwealth of Massachusetts.

IV Locating the Boiler

- 1) Observe the minimum clearances shown in Figure 4.1. These clearances apply to both combustible and non-combustible materials. Observe the minimum clearances to combustibles for vent pipe shown in Table 4.2.
- 2) Note the recommended service clearances in Figure 4.1. The recommended service clearances may be reduced to the minimum combustible clearances provided:
 - a. Access to the front of boiler is provided through a door.
 - b. Access is provided to the condensate trap and fittings/trim located on the back of the boiler.
- 3) Boiler may be installed on non-carpeted combustible surface.
- 4) The relief valve must be installed in the factory specified location.
- 5) The boiler should be located so as to minimize the length of the vent system.

Figure 4.1: Clearances To Combustible Or Non-combustible Material

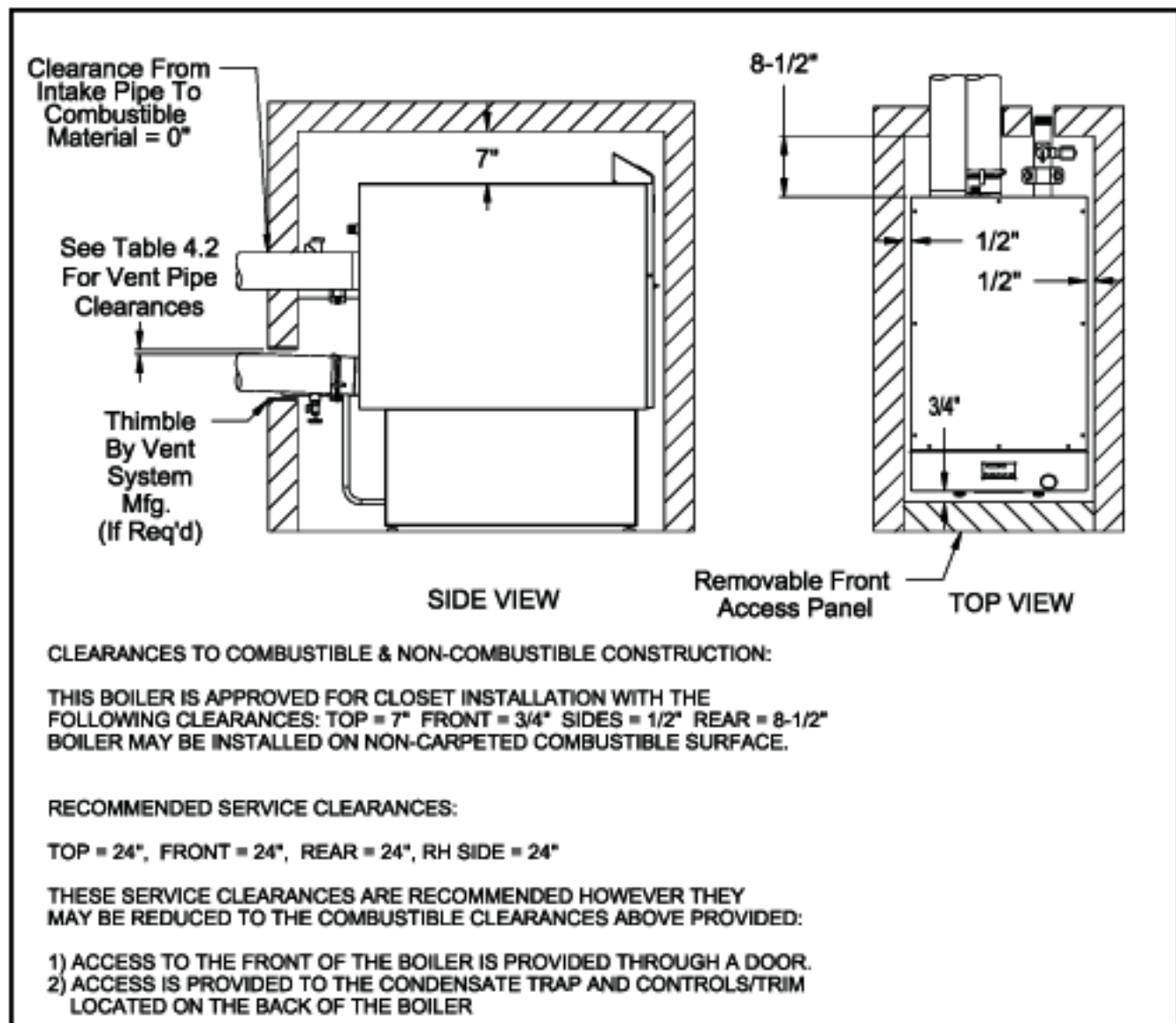


Table 4.2: Clearances From Vent Piping To Combustible Construction

TYPE OF VENT PIPE	PIPE DIRECTION	ENCLOSURE	MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL
HEAT FAB SAF-T VENT PROTECH FASNSEAL Z-FLEX Z-VENT III METAL-FAB CORR-GUARD	VERTICAL OR HORIZONTAL	AT LEAST ONE SIDE OPEN, COMBUSTIBLE MATERIAL ON A MAXIMUM OF THREE SIDES	1"
HEAT FAB SAF-T VENT PROTECH FASNSEAL Z-FLEX Z-VENT III METAL-FAB CORR-GUARD	HORIZONTAL OR VERTICAL WITH OFFSETS	ENCLOSED ON ALL FOUR SIDES	2-1/2"
HEAT FAB SAF-T VENT PROTECH FASNSEAL Z-FLEX Z-VENT III METAL-FAB CORR-GUARD	VERTICAL WITH NO OFFSETS	ENCLOSED ON ALL FOUR SIDES	2-1/2"
100/150MM CONCENTRIC VENTING	VERTICAL OR HORIZONTAL	ENCLOSED ON ALL FOUR SIDES	0"

- 6) The combustion air piping must terminate where outdoor air is available for combustion and away from areas that will contaminate combustion air. Avoid areas near chemical products containing chlorine, chloride based salts, chloro/fluorocarbons, paint removers, cleaning solvents and detergents.

WARNING

OUTDOOR COMBUSTION AIR MUST BE PIPED TO THE AIR INTAKE. NEVER PIPE COMBUSTION AIR FROM AREAS CONTAINING CONTAMINATES SUCH AS SWIMMING POOLS AND LAUNDRY ROOM EXHAUST VENTS. CONTAMINATED COMBUSTION AIR WILL DAMAGE THE BOILER AND MAY CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

V Air for Ventilation

Air for combustion must always be obtained directly from outdoors, however sufficient air for ventilation must still be provided in the boiler room. Air for ventilation is required to keep various boiler components from overheating and is always obtained from indoors. To ensure an adequate ventilation air supply, perform the following steps:

Step 1: Determine whether the boiler is to be installed in a confined space - A confined space is defined by the *National Fuel Gas Code* as having a volume less than 50 cubic feet per 1000 BTU/hr input of all appliances installed in that space. To determine whether the boiler room is a confined space:

- 1) Total the input of all appliances in the boiler room in thousands of BTU/hr. Round the result to the next highest 1000 BTU/hr.
- 2) Find the volume of the room in cubic feet. The volume of the room in cubic feet is:

Length (ft) x width (ft) x ceiling 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) Divide the volume of the boiler room by the input in thousands of BTU/hr. If the result is less than 50, the boiler room is a confined space.

Example:

A BWC300 and a water heater are to be installed in a room measuring 10ft – 3 in x 10ft with an 8 ft ceiling. The water heater has an input of 50,000 BTU/hr:

Total input in thousands of BTU/hr = (300,000 BTU/hr + 50,000 BTU/hr) / 1000 = 350 MBTU/hr

Volume of room = 10.25 ft x 10 ft x 8 ft = 820 ft³

820/350 = 2.34. Since 2.34 is less than 50, the boiler room is a confined space.

Step 2a: If the boiler is to be placed in a 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 (Fig 5.1). The minimum opening dimension is 3 inches.

- If the BWC boiler is the only gas-burning appliance in the boiler room, these openings must each have a minimum free area of 100 square inches.
- If other gas-burning appliances are in the boiler room, size the openings in accordance with the appliance manufacturer's instructions or the *National Fuel Gas Code*. Minimum opening free area is 100 square inches even if opening requirements for other appliances are less.

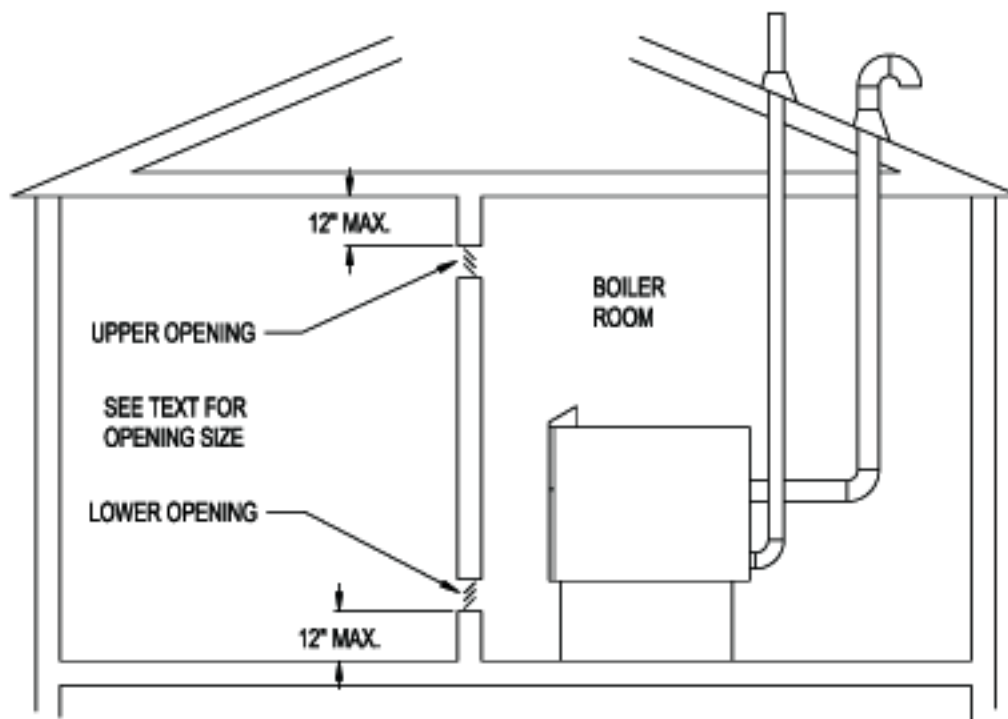


Figure 5.1: Boiler Installed In A Confined Space, Ventilation Air From Inside

- 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 ¼” (4 x 4) mesh.

Step 2b: If the boiler is to be placed in an unconfined space, the natural infiltration into the boiler room will provide adequate air for ventilation without additional openings into boiler room.

VI Venting

WARNING

Failure to vent this boiler in accordance with these instructions could result in unreliable boiler operation, severe damage to the boiler or property, personal injury or death:

- * Do not attempt to vent this boiler with galvanized, PVC, or any other vent system not listed in Table 4.
- * Do not attempt to mix components from different approved vent systems.
- * Do not obtain combustion air from within the building.
- * Do not install a barometric damper or draft hood on this boiler.
- * The vent system for this boiler must not be shared with any other appliance.
- * Moisture and ice may form on the surfaces around the vent termination. To prevent deterioration, surfaces should be in good repair (sealed, painted, etc.)

A. Vent System Design

There are four basic ways to vent this boiler:

- **Horizontal (“Side Wall”) Twin Pipe Venting** - Vent system exits the building through an outside wall. Combustion air and flue gas are routed between the boiler and outdoors using separate pipes.
- **Vertical Twin Pipe Venting** - Vent system exits the building through a roof. Combustion air and flue gas are routed between the boiler and outdoors using separate pipes.
- **Horizontal (“Side Wall”) Concentric Venting** - Vent system exits the building through an outside wall. Concentric venting consists of a “pipe within a pipe”. Flue gas exits the building through the inner pipe and combustion air is drawn into the boiler through the space between the inner and outer pipe.
- **Vertical Concentric Venting** - Vent system exits the building through the roof. Concentric venting consists of a “pipe within a pipe”. Flue gas exits the building through the inner pipe and combustion air is drawn into the boiler through the space between the inner and outer pipe.

All of these systems are considered “direct vent” because in all of them air for combustion is drawn directly from the outdoors into the boiler. A description of each of these venting options is listed in Tables 6.1 and 6.5. For clarity, these vent options are numbered from 1 to 10. **One of the vent option columns in Table 6.1 or in Table 6.5 must match the planned vent and air intake system exactly.** In addition, observe the following guidelines:

- 1) **Approved vent systems** - Use only one of the approved vent systems shown in Tables 6.1 or 6.5. These vent systems fall into two basic categories:
 - **Twin Pipe Vent Systems** - The standard approved vent systems are made of a special stainless steel alloy (AL29-4C) for protection against corrosive flue gas condensate. They are designed to provide a gas tight seal at all joints and seams so that flue gas does not enter the building. Each approved vent system has a unique method for installation - **do not attempt to mix components from different vent systems.** A list of approved twin pipe vent systems is shown in Table 6.4.
 - **Concentric Vent System** - The concentric vent system may only be used on the BWC 300. Each Crown concentric vent component consists of an inner pipe of polypropylene and the outer pipe of steel. Integral gaskets on each concentric fitting provide a gas tight seal. In this manual, concentric pipe sizes are called out in terms of the inner and outer pipe nominal diameters in millimeters. For example “100/150mm” pipe consists of a 100mm exhaust pipe inside a 150mm diameter outer pipe. A list of all Crown concentric vent components is shown in Table 6.10.

The BWC399 and BWC425 are supplied with stainless steel vent collar and a separate air intake collar for twin pipe venting. The BWC300 may be supplied with either a stainless steel vent adaptor kit (P/N 230557) for twin pipe venting or a concentric vent adaptor kit (P/N 230556) for concentric venting.

- 2) **Maximum Vent and Air Intake Lengths** - The maximum length of the vent air intake piping depends upon the vent option selected and the boiler size. See Tables 6.1 and 6.5 for the maximum vent lengths. All vent lengths shown in Tables 6.1 and 6.5 are in addition to one 90° elbow and the termination fitting.

If additional elbows are desired, the maximum allowable vent length must be reduced by the amount shown in Table 6.6 for each additional elbow used. Termination fittings are not counted when counting additional elbows.

Example:

A 4" twin pipe vent system is planned for a horizontally vented BWC300 which has the following components:

*4 ft vertical pipe
1 90 elbow
10 ft horizontal pipe
1 90 elbow
6 ft horizontal pipe
1 45 elbow
8 ft horizontal pipe*

The Vent Option #1 column in Table 6.1 describes a horizontal direct vent system using 4" vent pipe. From this column, we see that a BWC300 may have a vent length of up to 100ft. The first 90 elbow and the termination fitting are not considered. From Table 6.6, the equivalent length of the 4" 45 elbow is 4.5ft and the equivalent length of the 4" 90 degree elbow is 8ft. The maximum allowable run of straight pipe on this system is therefore:

$$100\text{ft} - 4.5\text{ft} - 8\text{ft} = 87.5\text{ft}$$

Since the planned installation has only 28 ft of straight pipe, the planned vent length is acceptable.

IMPORTANT

The length of the vent system has a minor impact on the maximum input of the boiler. The exact amount of this de-rate is dependent upon a number of factors including the type of venting, number of joints in the vent system, and the type of fuel. An estimate of the amount of de-rate that can be expected at the maximum vent length is as follows:

BWC300: Less than 10%
BWC399, BWC425: Less than 2%

- 3) Minimum Vent and Air Intake Lengths - Minimum vent length is 4ft. Minimum air inlet length is 2ft.
- 4) Permitted Terminals for Horizontal Venting (Vent Options 1,2&3)
 - **Vent Option 1, 2 & 3** - Exhaust terminal is either Crown PN 240513 (4" vent systems) or PN 240514 (5" vent systems). The air intake terminal is a 90 degree elbow with a rodent screen supplied by the installer. This elbow is made out of the same material as the rest of the air inlet system (either galvanized or PVC) and is installed as shown in Figure 6.2.
 - **Vent Option 4** - Crown P/N 23569.
- 5) Horizontal Vent and Air Intake Terminal Location - Observe the following limitations on the vent terminal location (also see Figure 6.7):
 - Vent terminals must be at least 1 foot from any door, window, or gravity inlet into the building.
 - Maintain the correct clearance and orientation between the vent and air intake terminals. The vent and air intake terminals must be at the same height and their center lines must be between 12 and 36 inches apart. Both terminals must be located on the same wall.
 - The bottom of the vent and air intake terminals must be at least 12" above the normal snow line. In no case should they be less than 12" above grade level.
 - The bottom of the vent terminal must be at least 7 feet above a public walkway.

- Do not install the vent terminal directly over windows or doors.
- The bottom of the vent terminal must be at least 3 feet above any forced air inlet located within 10 feet.
- USA Only: A clearance of at least 4 feet horizontally must be maintained between the vent terminal and gas meters, electric meters, regulators, and relief equipment. Do not install vent terminal over this equipment. In Canada, refer to B149.1 Installation Code for clearance to meters, regulators and relief equipment.
- Do not locate the vent terminal under decks or similar structures.
- Top of vent terminal must be at least 5 feet below eaves, soffits, or overhangs. Maximum depth of overhang is 3 ft.
- Vent terminal must be at least 6 feet from an inside corner.
- Under certain conditions, water in the flue gas may condense, and possibly freeze, on objects around the terminal including on the structure itself. If these objects are subject to damage by flue gas condensate, they should be moved or protected.
- If possible, install the vent and air intake terminals on a wall away from the prevailing wind. Reliable operation of this boiler cannot be guaranteed if the terminal is subjected to winds in excess of 40 mph.
- Air intake terminal must not terminate in areas that might contain combustion air contaminants, such as near swimming pools. See Section IV for more information on possible contaminants.

TABLE 6.1: SUMMARY OF HORIZONTAL VENTING OPTIONS

VENT OPTION #		1	2	3	4
CLASSIFICATION USED IN THIS MANUAL		HORIZONTAL TWIN PIPE	HORIZONTAL TWIN PIPE	HORIZONTAL TWIN PIPE	HORIZONTAL CONCENTRIC
ILLUSTRATED IN FIGURE		6.2	6.2	6.2	6.3
VENT PIPE STRUCTURE PENETRATION		WALL	WALL	WALL	WALL
AIR INTAKE PIPE STRUCTURE PENETRATION		WALL	WALL	WALL	WALL
VENT PIPE SIZE		4"	4"	5"	100/150mm CONCENTRIC
AIR INTAKE PIPE SIZE		4"	5"	5"	
MAXIMUM VENT PIPE LENGTH					
	BWC300	100FT			100FT
	BWC399		23FT	100FT	
	BWC425		23FT	100FT	
MAXIMUM INTAKE PIPE LENGTH					
	BWC300	100FT			100FT
	BWC399		23FT	100FT	
	BWC425		23FT	100FT	
VENT TERMINAL		CROWN PN 204513	CROWN PN 204513	CROWN PN 240514	CROWN 230569 CONCENTRIC TERMINAL
AIR INTAKE TERMINAL		4" 90 ELBOW	5" 90 ELBOW	5" 90 ELBOW	
VENT MATERIAL		APPROVED VENT SYSTEM SHOWN IN TABLE 6.4			CROWN 100/150mm VENT COMPONENTS SHOWN IN TABLE 6.10
AIR INTAKE MATERIAL		GALVANIZED OR PVC			

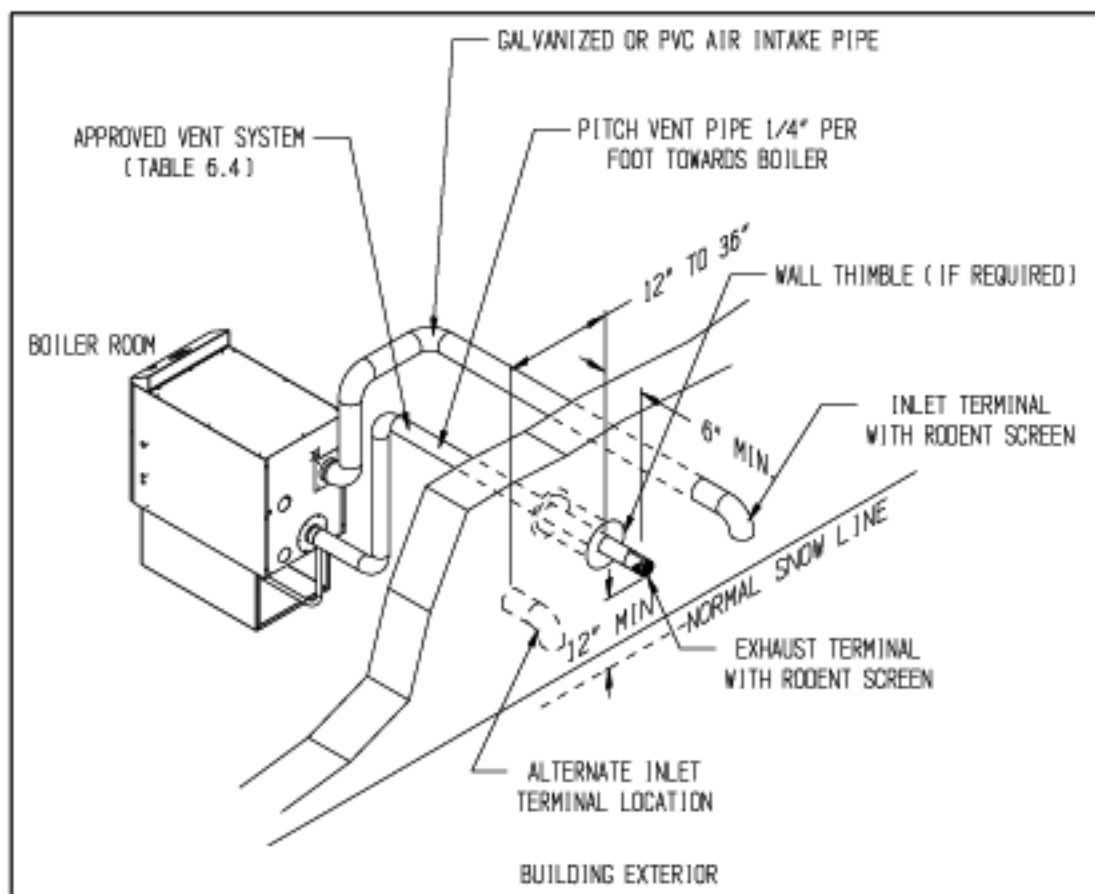


FIGURE 6.2: HORIZONTAL TWIN PIPE VENTING (VENT OPTIONS 1,2,3)

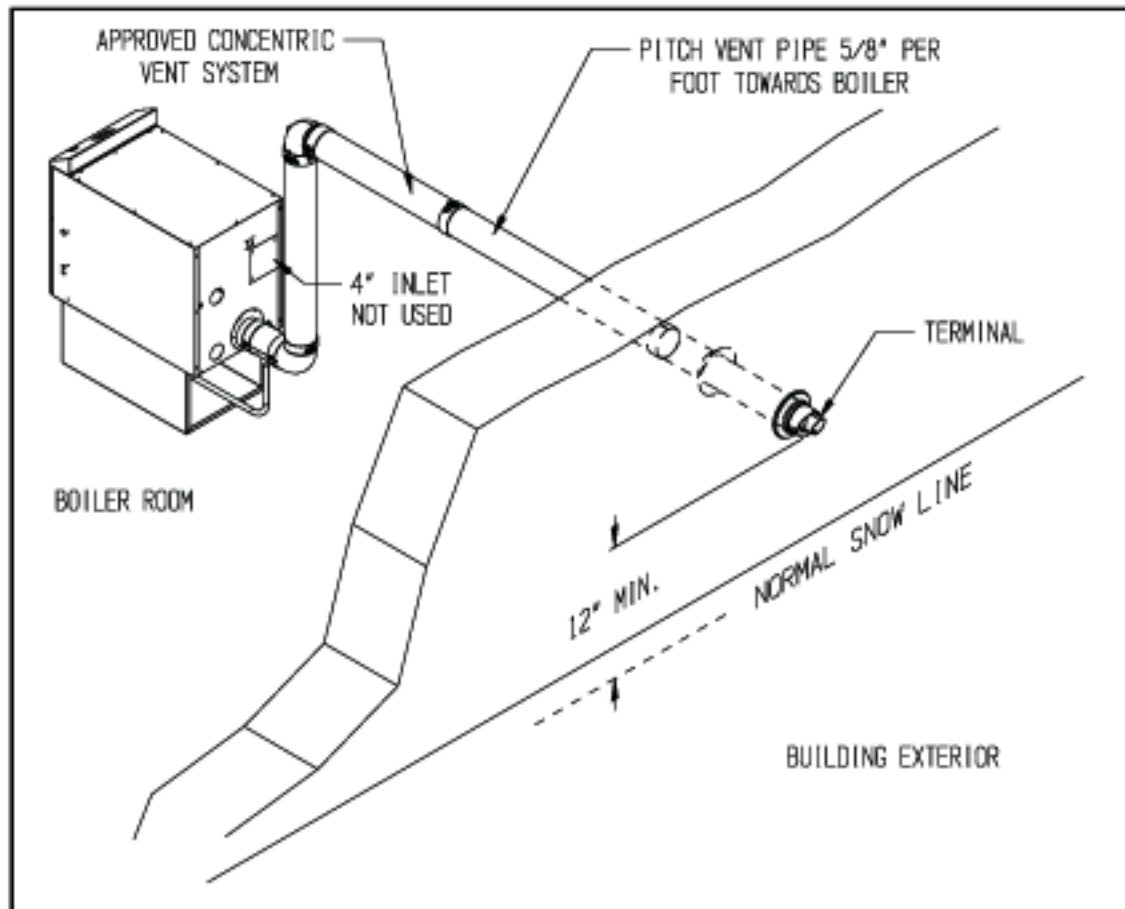


FIGURE 6.3: HORIZONTAL CONCENTRIC VENTING, BWC300 ONLY (VENT OPTION 4)

TABLE 6.4: PERMISSIBLE STAINLESS STEEL VENT SYSTEMS AND PRINCIPLE VENT COMPONENTS (VENT OPTIONS 1,2,3,7,8,9)

MANUFACTURER	VENT SYSTEM	SIZE	WALL THIMBLES	HORIZONTAL TERMINATION	VERTICAL TERMINATION
HEAT FAB	SAF-T VENT EZ SEAL	4	9493 9493S 5491C1	CROWN TERMINAL: 230513	9492
		5	5591C1	CROWN TERMINAL: 230514	9592
PROTECH SYSTEMS INC.	FASNSEAL	4	FSWT4	CROWN TERMINAL: 230513	FSBS4
		5	FSWT5	CROWN TERMINAL: 230514	FSBS5
Z-FLEX	Z-VENT SINGLE WALL	4	2SVSWTX04	CROWN TERMINAL: 230513	2SVSTPF04
		5	2SVSWTX05	CROWN TERMINAL: 230514	INSTALLER TO PROVIDE STAINLESS STEEL 1/2" (2X2) OR GREATER MESH
METAL-FAB	CORR/GUARD	4	CGSWWPK(4")	CROWN TERMINAL: 230513	CGSWHTM(4")
		5	CGSWWPK(5")	CROWN TERMINAL: 230514	CGSWHTM(5")

Notes:

- 1) BWC300 requires stainless steel vent adaptor kit P/N 230557 when used with the above stainless steel vent systems.
- 2) See vent system manufacturer's literature for other part numbers that are required such as straight pipe, elbows, firestops, and vent supports.

6) Permitted Terminals for Vertical Venting -

Vent Options 7, 8, 9 – A straight termination is installed in the end of the exhaust pipe. Vent manufacturer's part numbers for these terminals are shown in Table 6.4. The air inlet terminal consists of a 180 degree elbow (or two 90 degree elbows) with a rodent screen as shown in Figure 6.8.

Vent Option 10 – Use Crown PN 230570 with the appropriate flashing (Table 6.10).

7) Vertical Vent Terminal Locations (Vent Options 7,8,9&10) - Observe the following limitations on the location of all vertical vent terminals (see Figures 6.8 & 6.9):

- The top of the vent pipe must be at least 2 feet above any object located within 10 feet.
- For Vent Options 7, 8 & 9, the vertical distance between top of the vent and air inlet terminal openings must be at least 12".
- The bottom of the air inlet terminal must be at least 12" above the normal snow accumulation that can be expected on the roof. The terminal used in Vent Option 10 has a fixed distance above the storm collar of 19". If a greater distance is needed to provide the clearance above the snow line, build a chase on the roof and mount the vertical terminal on top of the chase.
- For Vent Options 7, 8 & 9, the air intake terminal must be located on the roof and must be no further than 24" horizontally from the exhaust pipe.

8) Wall thimbles – Wall thimbles are required where single wall vent pipe passes through combustible walls with less than the required clearance shown in Table 4.2 or as required by local codes. Stainless vent manufacturer's wall thimble part numbers are shown in Table 6.4. Note that concentric vent has a "zero" clearance to combustibles and therefore does not require the use of wall thimbles.

TABLE 6.5: SUMMARY OF VERTICAL VENTING OPTIONS

VENT OPTION #		7	8	9	10
CLASSIFICATION USED IN THIS MANUAL		VERTICAL TWIN PIPE	VERTICAL TWIN PIPE	VERTICAL TWIN PIPE	VERTICAL CONCENTRIC
ILLUSTRATED IN FIGURE		6.8	6.8	6.8	6.9
VENT PIPE STRUCTURE PENETRATION		ROOF	ROOF	ROOF	ROOF
AIR INTAKE PIPE STRUCTURE PENETRATION		ROOF	ROOF	ROOF	ROOF
VENT PIPE SIZE		4"	4"	5"	100/150mm CONCENTRIC
AIR INTAKE PIPE SIZE		4"	5"	5"	
MAXIMUM VENT PIPE LENGTH					
	BWC300	100 FT			100 FT
	BWC399		23 FT	100 FT	
	BWC425		23 FT	100 FT	
MAXIMUM INTAKE PIPE LENGTH					
	BWC300	100 FT			100 FT
	BWC399		23 FT	100 FT	
	BWC425		23 FT	100 FT	
EXHAUST TERMINAL		RODENT SCREEN BY VENT SYSTEM MANUFACTURER. SAME DIAMETER AS VENT SYSTEM. SEE TABLE 6.4.			CROWN 230570 CONCENTRIC TERMINAL
AIR INTAKE TERMINAL		4" 180 ELBOW	5" 180 ELBOW	5" 180 ELBOW	
VENT MATERIAL		APPROVED VENT SYSTEM SHOWN IN TABLE 6.4			CROWN 100/150mm VENT COMPONENTS SHOWN IN TABLE 6.10
AIR INTAKE MATERIAL		GALVANIZED OR PVC			

TABLE 6.6: VENT/ AIR INTAKE FITTING EQUIVALENT LENGTH

VENT FITTING	EQUIVALENT LENGTH (ft)
100/150mm 90° SWEEP CONCENTRIC ELBOW	8.0
100/150mm 45° CONCENTRIC ELBOW	3.0
100/150mm 90° CONCENTRIC SUPPORT ELBOW	10.0
4" 90 ELBOW	8.0
4" 45 ELBOW	4.5
5" 90 ELBOW	13.0
5" 45 ELBOW	6.5

NOTE: AIR INLET TERMINAL NOT SHOWN.

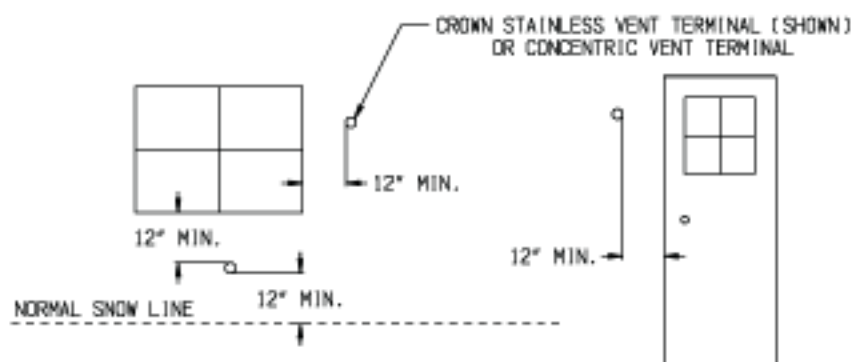


FIGURE 6.7a: LOCATION OF VENT TERMINAL RELATIVE TO WINDOWS, DOORS, GRADE

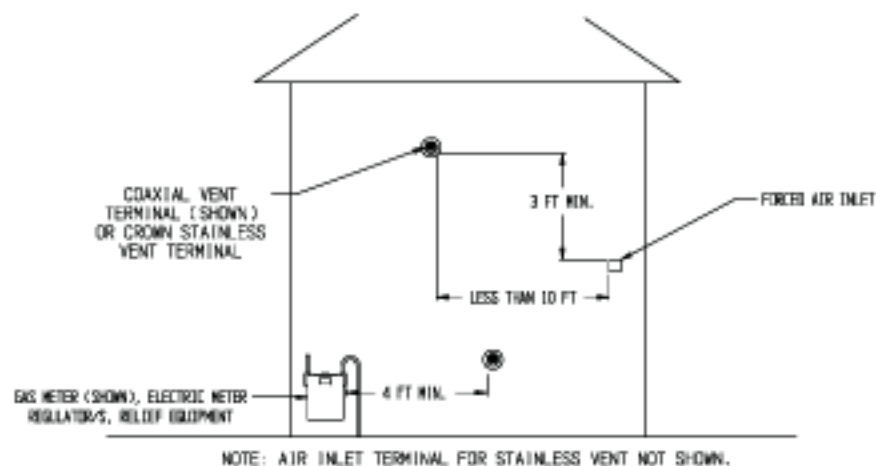
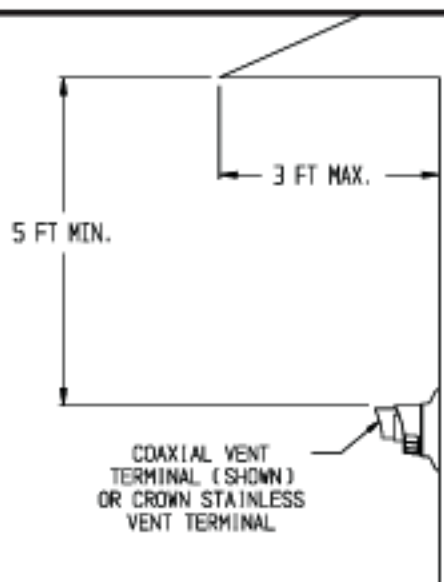


FIGURE 6.7b: LOCATION OF VENT TERMINAL RELATIVE TO METERS AND FORCED AIR INLETS



NOTE: AIR INLET TERMINAL FOR STAINLESS VENT NOT SHOWN.

FIGURE 6.7c: POSITIONING VENT TERMINAL UNDER OVERHANGS

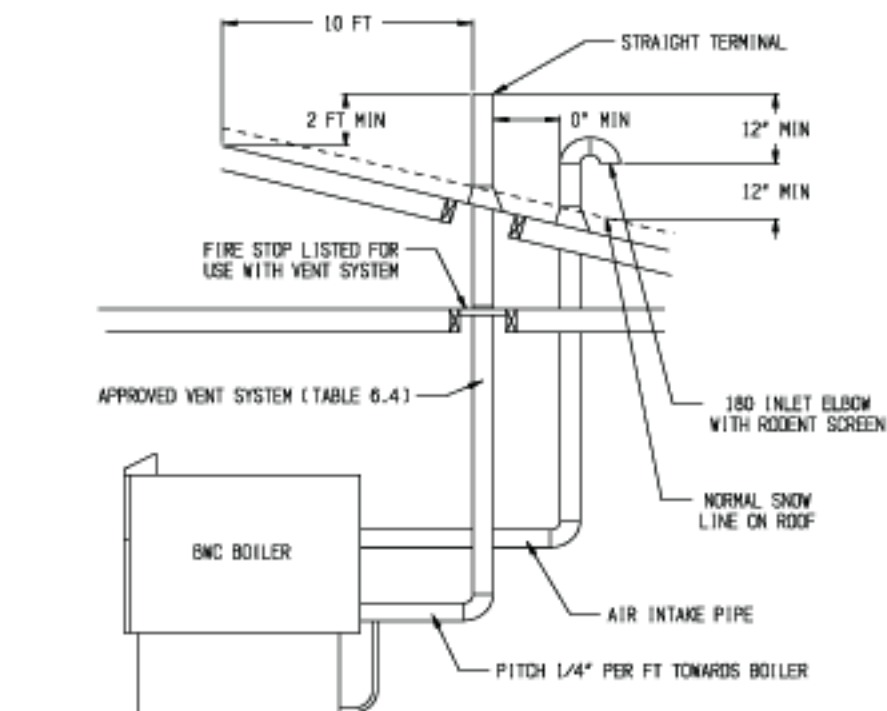


FIGURE 6.8: VERTICAL TWIN PIPE SYSTEM (VENT OPTIONS 7,8 & 9)

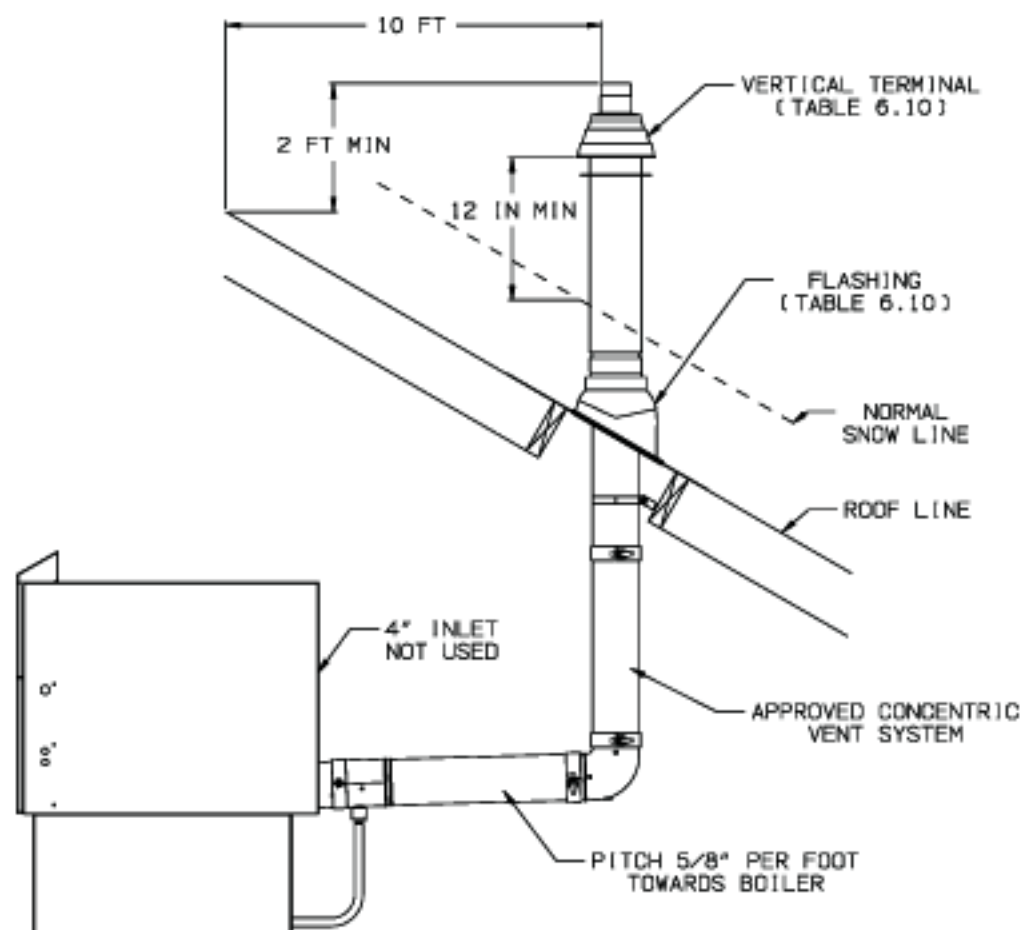


FIGURE 6.9: VERTICAL CONCENTRIC SYSTEM, BWC300 ONLY (VENT OPTION 10)

**TABLE 6.10: CROWN CONCENTRIC 100/150 VENT COMPONENTS
(VENT OPTIONS 4,10)**

CROWN PN	DESCRIPTION	SIZE	USED ON VENT OPTION #	COMMENTS
230556	BWC300 CONCENTRIC VENT ADAPTER KIT	100/150mm	4,10	REQUIRED FOR CONCENTRIC VENTING
230567	90 DEGREE EL (SWEEP)	100/150mm	4,10	
230565	45 DEGREE EL	100/150mm	4,10	
230560	19 1/2" STRAIGHT	100/150mm	4,10	CAN BE CUT
230562	39" STRAIGHT	100/150mm	4,10	CAN BE CUT
230561	39" STRAIGHT	100/150mm	4,10	MAY NOT BE CUT
230563	78" STRAIGHT	100/150mm	4,10	MAY NOT BE CUT
230564	TELESCOPING STRAIGHT	100/150mm	4,10	ADJUSTABLE FROM 12-1/2" TO 17-1/2"
230569	HORIZONTAL TERMINAL	100/150mm	4	
230570	VERTICAL TERMINAL	100/150mm	10	(NOTE #1)
230571	FLAT ROOF FLASHING	100/150mm	10	
230572	SLOPED ROOF FLASHING	100/150mm	10	(NOTE #2)
230568	SUPPORT ELBOW WITH CHIMNEY CHASE BRACKET	100/150mm	10	(NOTE #3)
230573	SUPPORT BAND	100/150mm	4,10	

Table 6.10 Notes:

- 1) Vertical terminal can be used with either of the roof flashings listed beneath it.
- 2) Sloped roof flashing suitable for roof angles between 25 and 45 degrees.
- 3) Used at base of vertical run inside unused masonry chimney.

9) Pitch of Horizontal Piping - Pitch all horizontal piping so that any condensate which forms in the piping will run towards the boiler:

- Pitch Crown concentric venting 5/8" per foot
- Pitch Stainless steel venting 1/4" per foot.

10) Supporting Pipe - Vertical and horizontal sections of pipe must be properly supported:

- Support Crown concentric venting near the female end of each straight section of pipe.

Exception: Vertical runs of concentric pipe in an unused chimney (Figure 6.22) need only be supported at the terminal and at the base of the run.

- Support stainless steel venting as called for by the vent manufacturer's instructions.

B. Removing an Existing Boiler From a Common Chimney

Read this only if the BWC boiler is replacing an existing boiler that is being removed 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 openings 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 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 re-sizing any portion of the common venting system, the common venting system should be re-sized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1.

WARNING

NEVER COMMON VENT A BWC BOILER WITH OTHER APPLIANCES

C. Vent Adapter Installation

- 1) Stainless Vent Adapter Installation - The stainless vent adapter and air intake collar are shipped loose and must be installed on the boiler before the vent system can be attached to the boiler. (see Fig. 6.11)
 - a) Place the orange silicone rubber gasket over the male end of the stainless vent adapter and line the hole pattern up with the hole pattern on the flange of the stainless vent adapter.
 - b) Lubricate the blue gasket in the cast aluminum vent collar on the boiler's sump with a few drops of water.
 - c) Insert the male end of the vent adapter into the sump of the boiler and push it in until the flange of the vent adapter is flush with the rear jacket panel.
 - d) Attach the vent adapter to the rear jacket panel with the (6) 1/4-20 self tapping screws supplied with the boiler.
 - e) Connect the loose end of the 1/2" clear plastic tubing connected to the condensate trap to the connection on the bottom of the adapter. Secure with the hose clamp provided.
 - f) Install the air intake collar on the rear of the boiler using the four 1/4-20 self tapping screws provided.
- 2) Concentric Vent Adapter Kit Installation - The concentric vent adapter kit includes:

P/N 230556 (BWC300)	Description
240491	Concentric Vent Adapter
90-212	#10 x 1/2" Sheet Metal Screws (3)
240507	100mm Polypropylene Vent Stub
230575	100/150mm Concentric Condensate Collector
240552	Condensate Collector Drain Adapter
240556	Straight Hose Barb
240495	4" Air Inlet Cover
900100	1/4-20 x 1/2 Self Tapping Screw (8)

- a) Start assembly of the Concentric Vent Adapter Kit by attaching the rubber gasket and concentric vent adapter to the vent opening found on the rear jacket panel with (4) 1/4-20 x 1/2" self tapping screws. (See Fig. 6.12)
- b) Insert the 100mm polypropylene vent stub through the concentric vent adapter and into the vent connection cast on the sump of the boiler until it bottoms out.
- c) Insert the 100/150 concentric condensate collector into the 100mm polypropylene vent stub and the concentric vent adapter until the bead on the collector bottoms out on the concentric vent adapter. Turn the condensate collector so that the threaded stub faces the floor. Attach the condensate collector to the concentric vent adapter with (3) #10 x 1/2" sheet metal screws in the holes provided on the concentric vent adapter.
- d) Apply pipe thread sealant tape (not supplied) to the straight hose barb fitting and attach it to the condensate collector drain adapter.
- e) Attach the condensate collector drain adapter to the threaded stub sticking out the bottom of the concentric condensate collector.
- f) Connect the loose end of the 1/2" clear plastic tubing connected to the condensate trap to the connection on the bottom of the adapter. Secure with the hose clamp provided.
- g) Install the cover plate shown in Figure 6.12 on the rear of the boiler using the 1/4-20 self tapping screws provided.

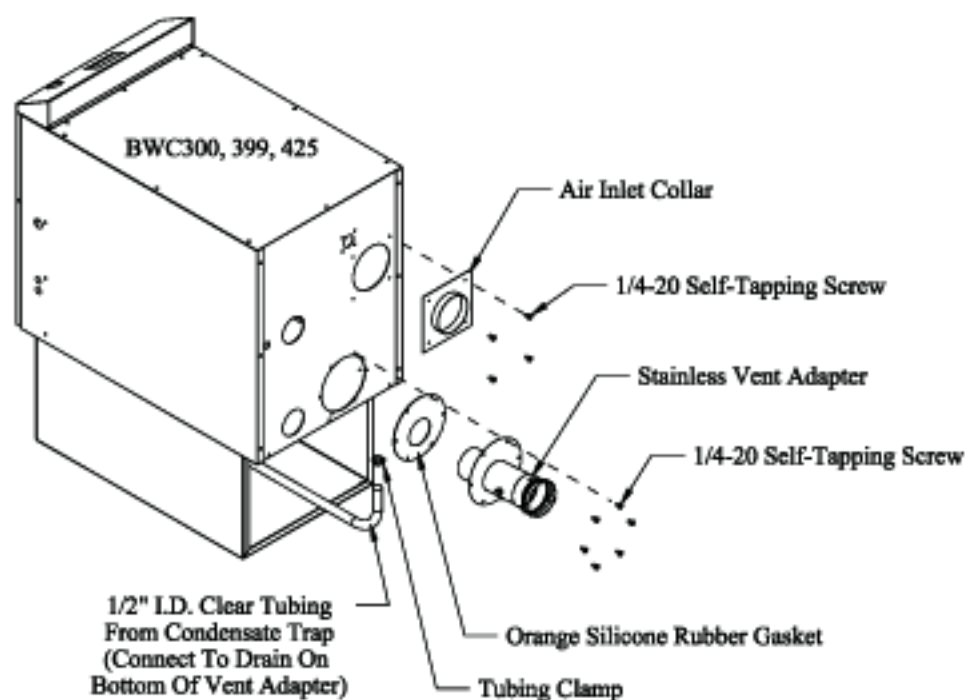


FIGURE 6.11: TWIN PIPE ADAPTER ASSEMBLY (VENT OPTIONS 1,2,3,7,8&9)

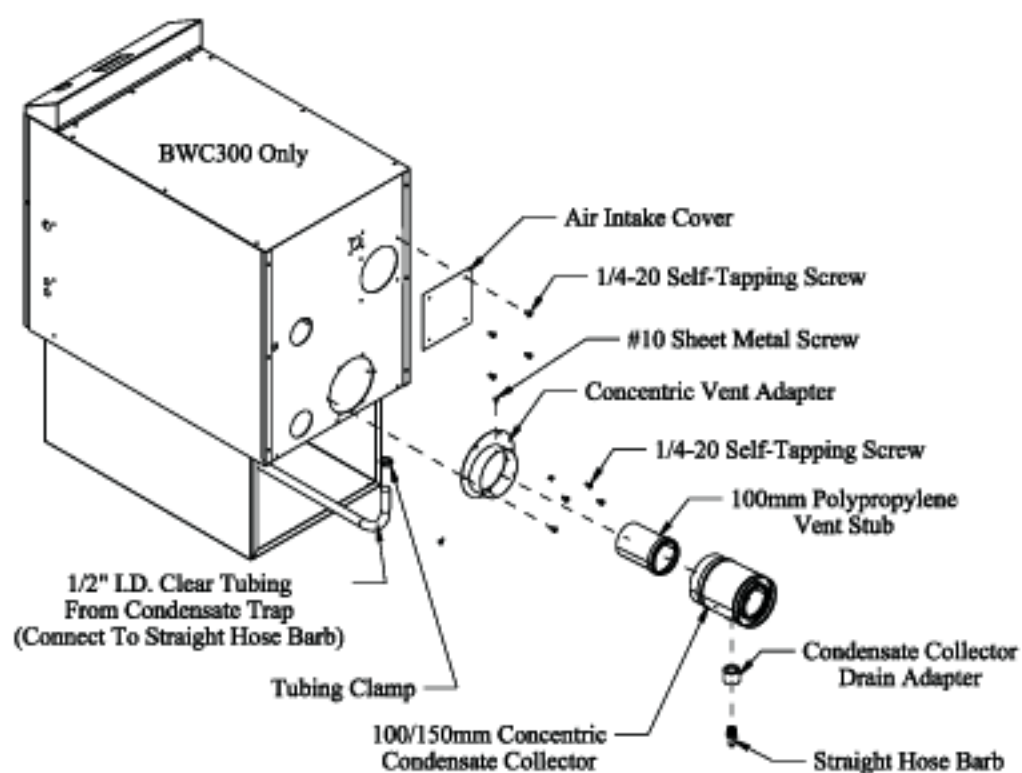


FIGURE 6.12: CONCENTRIC VENT ADAPTER ASSEMBLY (VENT OPTIONS 4&10)

D. Assembly of Stainless Steel Venting System

1) General Assembly Notes:

- a) Where the use of "silicone" is called for in the following instructions, use GE RTV 106 for the vent collar. Air inlet piping sections are sealed with any general-purpose silicone sealant such as GE RTV102. PVC air inlet piping sections are connected with PVC cement.
- b) Longitudinal welded seams should not be placed at the bottom of horizontal sections of exhaust pipe.
- c) Do not drill holes in vent pipe.
- d) Do not attempt to mix vent components of different vent system manufacturers.
- e) In some cases, there are differences between the vent system installation instructions in this manual and those in the vent system manufacturer's manual. Where such differences exist, this manual takes precedence over the vent system manufacturer's manual.

CAUTION

Vent systems made by Heat Fab, Protech, Corr/Guard and Z-Flex rely on gaskets for proper sealing. When these vent systems are used, take the following precautions:

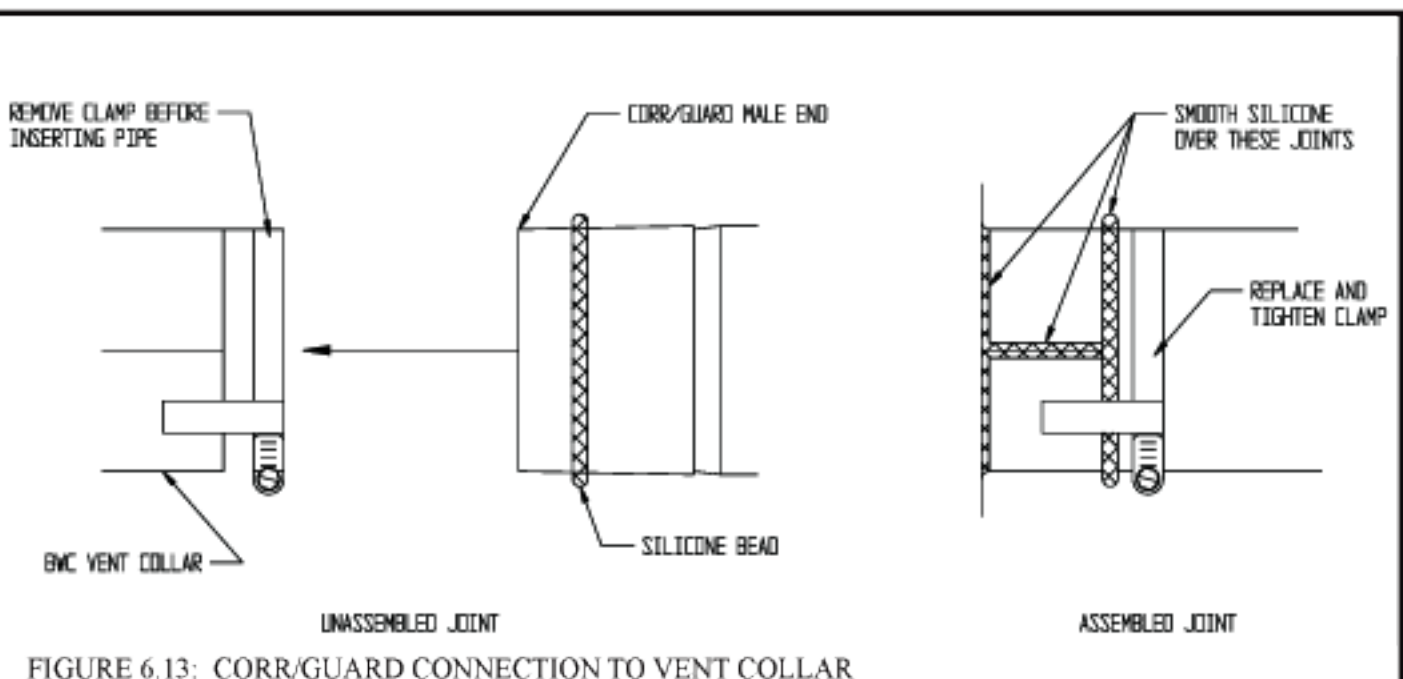
- Make sure that gasket is in position and undamaged in the female end of the pipe.
- Make sure that both the male and female pipes are free of damage prior to assembly.
- Only cut vent pipe as permitted by the vent manufacturer in accordance with their instructions. When pipe is cut, cut end must be square and carefully deburred prior to assembly.

2) Assembly of Metal-Fab Corr/Guard Vent System:

a) Corr/Guard General Notes:

- Do not cut Corr/Guard vent components.
- Refer to Corr/Guard installation instructions for proper methods of support.
- Orient Corr/Guard components so that the male ends of all fittings point in the direction of the boiler.

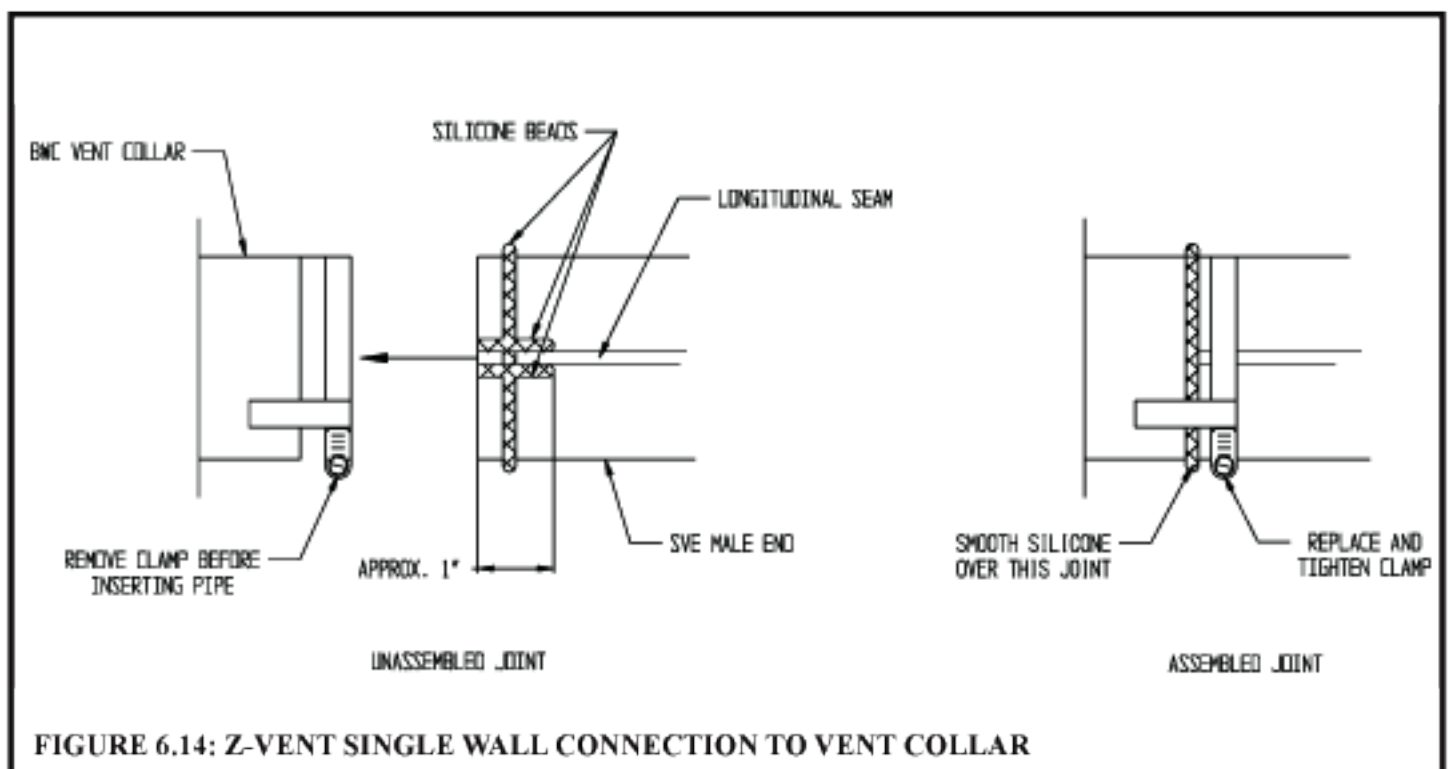
- b) Start assembly of the vent system at the boiler. Remove the hose clamp shipped on the BWC vent collar. Bend the three hose clamp tabs on this collar outward slightly.
- c) Clean the exterior of the male end of the first piece of pipe and the inside of the vent collar on the boiler. Remove dirt, grease, and moisture from the surfaces to be sealed. Dry surfaces or allow to dry thoroughly.
- d) On the male end of the pipe, apply a 1/4" wide bead of silicone approximately 1/2" from the end of the pipe (Fig 6.13).
- e) Insert the male end of the pipe into the boiler vent collar until it bottoms out.
- f) Apply an additional bead of silicone over the outside of the joint and smooth out.
- g) Replace and tighten the clamp on the vent collar.
- h) Assemble remaining Corr/Guard components in accordance with the Corr/Guard installation instructions.
- i) Allow the silicone to cure per the silicone manufacturer's instructions before operating the boiler.



3) Assembly of Z-Flex Z-Vent Single Wall:

a) General Notes:

- Non-expanded ends of Z-Vent Single Wall piping sections may be cut using aviation snips or a 24 thread per inch hacksaw. File or sand the cut end smooth before assembling. Expanded ends may be cut to adapt the Z-Vent to the boiler vent collar. See the following instructions.
 - Support horizontal piping sections at intervals of 48" or less.
 - Vertical venting systems must be supported by at least one Z-Flex fire stop. An additional vertical support is required after any offset and as required by the Z-Vent Single Wall installation instructions.
- b) Start assembly of the vent system at the boiler. Remove the hose clamp shipped on the BWC vent collar. Bend the three hose clamp tabs on this collar outward slightly.
 - c) Clean the exterior of the male end of the first piece of pipe and the inside of the vent collar on the boiler. Remove dirt, grease, and moisture from the surfaces to be sealed. Dry surfaces or allow to dry thoroughly.
 - d) On the male end of the pipe, apply a ¼" wide bead of high temperature silicone approximately ½ inch from the male end of the pipe. Apply ¼" beads of silicone along both sides of the longitudinal seam (Fig. 6.14).
 - e) Insert the male end of the pipe into the boiler vent collar until it bottoms out.
 - f) Apply an additional bead of silicone over the outside of the joint and smooth out.
 - g) Replace and tighten the clamp on the vent collar.
 - h) The female end of each Z-Vent Single Wall component has a silicone sealing gasket. Examine all vent components to insure that the gasket integrity has remained during shipping. Gaskets must be in the proper position or flue gas could leak resulting in carbon monoxide poisoning.
 - i) Align the second piece of pipe with the first and push them together as far as they will go, but not less than 1-3/4".
 - j) Tighten gear clamp to a minimum torque of 40 in-lbs and a maximum of 50 in-lbs.
 - k) Repeat Steps (h) – (j) for the remaining Z-Vent Single Wall components.
 - l) In horizontal vent systems, a locking band or gear clamp must be used at either side of the wall penetration to prevent shifting of the vent system in and out of the wall. This applies to both combustible and non-combustible walls.
 - n) Allow the silicone to cure per the silicone manufacturer's instructions before operating the boiler.



4) Assembly of Heat Fab Saf-T Vent EZ Seal:

a) Saf-T Vent General Notes:

These instructions cover the installation of Saf-T Vent EZ Seal. Saf-T Vent EZ Seal piping has integral gaskets installed in the female ends of the pipe which seal the joints.

- In general, Saf-T Vent pipe sections may not be cut. Exceptions to this are the Saf-T Vent slip connector and connections to the boiler vent collar. In these cases, use a sharp pair of aviation snips, an abrasive cut-off, or a plasma cutter. See the Saf-T Vent instructions for information on cutting the slip connector.
 - Orient Saf-T Vent components so that the arrows on the piping labels are in the direction of flue gas flow.
 - Support horizontal piping sections at intervals of 6 feet or less.
 - Vertical venting systems must be supported by at least one Heat Fab support. An additional vertical support is required after any offset.
- b) Connection to Boiler – Start assembly of the vent system at the boiler. Remove the hose clamp shipped on the BWC vent collar. Bend the three hose clamp tabs on this collar outward slightly. Cut the male “spigot” off of the first piece of pipe(Fig 6.15). If necessary, crimp the cut end of the pipe so that it can be inserted at least 1” into the collar. Clean the exterior of the male end of the first piece of pipe and the inside of the vent collar on the boiler with an alcohol pad. On the male end of the pipe, apply a ¼” wide bead of high temperature silicone approximately ½ inch from the male end of the pipe. Also apply a ¼” bead of silicone along the first 2 ½” of the longitudinal weld. Insert the male end of the pipe into the boiler vent collar until it bottoms out. Apply an additional bead of silicone over the outside of the joint and smooth out (Fig 6.15). Replace and tighten the clamp on the vent collar.
- c) Assembly of Saf-T Vent EZ Seal Vent Components - Clean the male end of the next piece of pipe with an alcohol pad and make sure that it is free of burrs. Check the female end of the first piece of pipe to make sure that the gasket is in place and is undamaged. Using a slight twisting motion, insert the male end of the second fitting into the female end of the first fitting, taking care not to dislodge or cut the factory gasket. In extremely arid conditions, it may be easier to assemble these fittings if the gasket is moistened with water prior to assembly. Bend the locking tabs over the locking ring on the adjacent piece of pipe. Repeat these steps for the remaining Saf-T-Vent components.

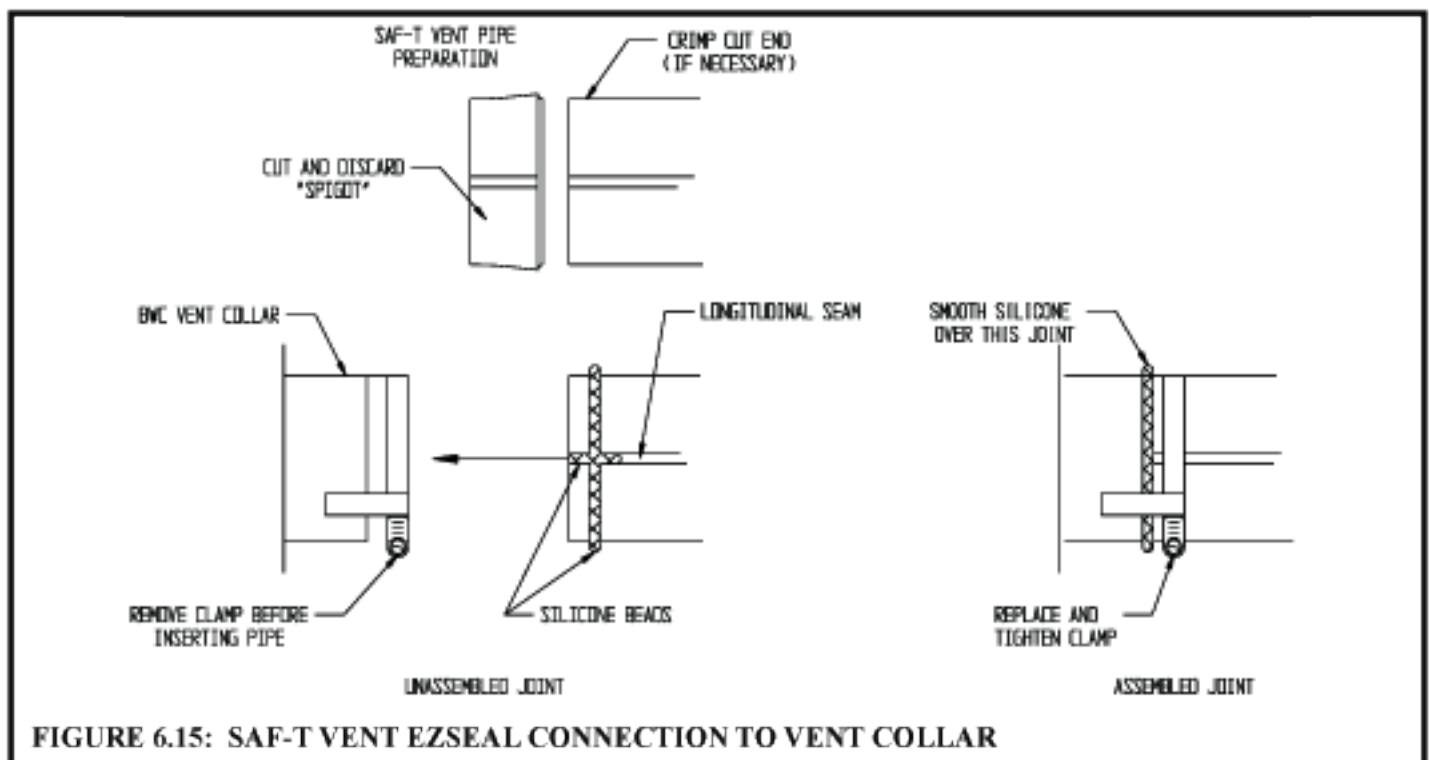


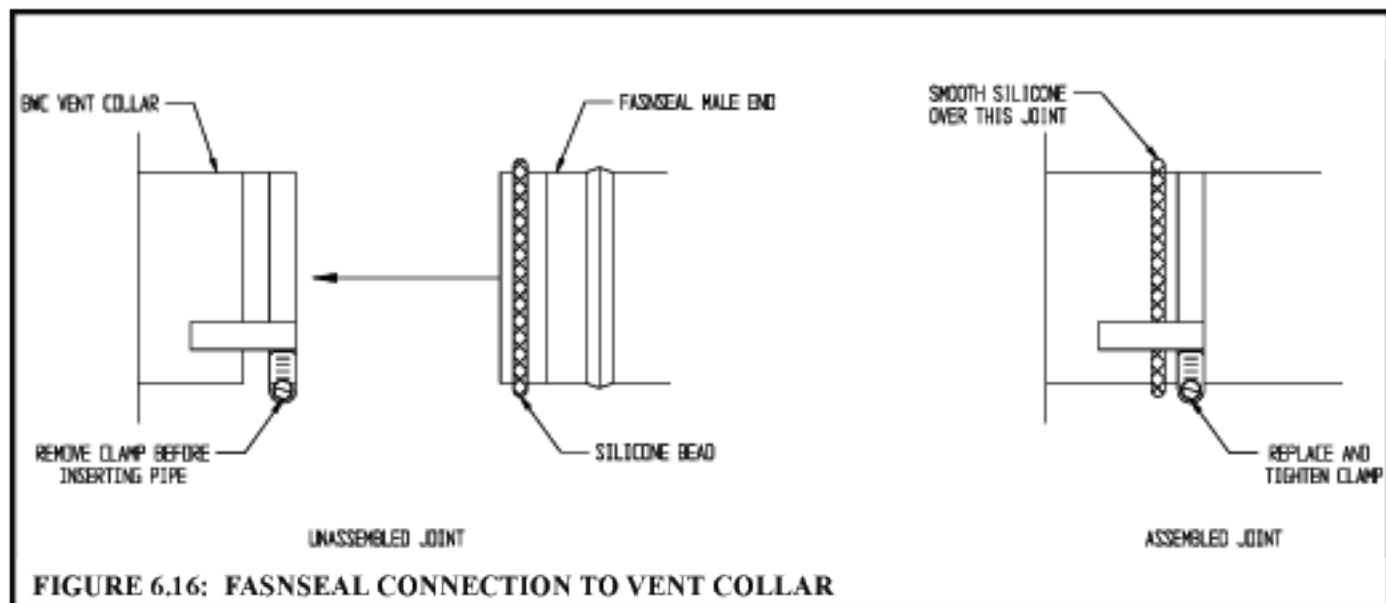
FIGURE 6.15: SAF-T VENT EZSEAL CONNECTION TO VENT COLLAR

5) Assembly of Protech FasNSeal

a) FasNSeal General Notes:

- Do not cut 4" FasNSeal pipe. Consult FasNSeal instructions for method of cutting other 3" pipe.
- Orient FasNSeal vent components so the arrows on the piping labels are in the direction of flue gas flow.
- Support horizontal piping sections at intervals of 6 feet or less.
- Vertical venting systems must be supported by at least one FasNSeal support. An additional vertical support is required after any offset.

- b) Remove the hose clamp shipped on the BWC vent collar. Bend the three hose clamp tabs on this collar outward slightly. Clean the exterior of the male end of the first piece of pipe and the inside of the vent collar on the boiler. Remove dirt, grease, and moisture from the surfaces to be sealed. On the male end of the pipe, apply a 1/4" wide bead of high temperature silicone approximately 1/4 inch from the male end of the pipe. Insert the male end of the pipe into the boiler vent collar until it bottoms out. Apply an additional bead of silicone over the outside of the joint and the seams on the vent collar and smooth out (Fig 6.16). Replace and tighten the clamp on the vent collar.
- c) All other joints in the FasNSeal venting system rely on a gasket in the female end of the pipe for a proper seal.
- d) Align the longitudinal seam of both pipes. Insert the male end of the second pipe into the female end of the first pipe until the bead on the male end contacts the flare on the female end.
- e) Tighten the locking band with a nut driver.
- f) Repeat (d) and (e) for the remaining FasNSeal components.
- g) Allow the silicone to cure per the silicone manufacturer's instructions before operating the boiler.



6) Installation of Horizontal Exhaust Terminal:

- a) When stainless steel venting is used, use either Crown stainless exhaust terminal PN 240508 (4" vent systems) or PN 240509 (5" vent systems). The outer edge of this terminal must be within 12 inches of the surface of the wall. **The joint between the terminal and the last piece of pipe must be outside of the building.**
- b) Male end of terminal will fit into the female end of any of the approved stainless vent systems.
- c) Apply a heavy bead of silicone to the male end of the terminal before inserting it into the last piece of pipe. Orient the terminal so that the seam in the terminal is at 12:00.
- d) Smooth the silicone over the seam between the terminal and the last piece of pipe, applying additional silicone if necessary to ensure a tight seal.
- e) Allow the silicone to cure per the silicone manufacturer's instructions before operating the boiler.
- 7) Installation of Vertical Exhaust Terminal - Use the terminal supplied by the vent system manufacturer shown in Table 6.4. Attach to the vent system, following the assembly instructions in this manual for the stainless vent system being used.

8) Assembly of the Air Intake System and Air Intake Terminals:

- a) Assemble the air intake system using either galvanized or PVC pipe.
- b) If PVC piping is used, use PVC cement to assemble the PVC intake system components.
- c) If galvanized piping is used, use at least two sheet metal screws per joint. Seal the outside of all joints.
- d) The air intake collar will accept a crimped piece of galvanized pipe. Secure with a single #10 sheet metal screw through the inlet collar and seal the outside of the joint with silicone. If PVC is used for the intake system, use a short piece of galvanized pipe to connect the PVC to the boiler. Silicone the outside of the joint between the PVC and galvanized pipe.
- e) Horizontal intake terminal is a 90 degree elbow pointing down. Elbow should protrude the same distance from the wall as the exhaust terminal.
- f) Vertical air intake terminal consists of a 180 degree bend (composed of two 90 degree elbows) as shown in Figure 6.8.
- g) Install a rodent screen (not supplied) in the inlet terminal. Use a screen having 1/2" (2 x 2) or larger mesh.

E. Crown Concentric Venting Assembly

WARNING

Failure to follow the instructions could result in flue gas leakage into the combustion air or indoor air, resulting in unsafe or unreliable operation.

- Do not lubricate concentric gaskets with anything other than water.
- Do not attempt to cut any piping except as permitted in this section. When cutting these sections, make sure all cuts are square and allow for proper insertion.
- Do not attempt to try to mix this concentric pipe with other venting systems.

1) Before starting assembly of the vent system, make sure that the planned installation is in accordance with the "Vent System Design" section of this manual and that all required vent components are on hand. These components are available through Crown distributors.

2) Cutting Straight Pipe - The following straight pipe sections may be cut:

100/150 Part #	Description
230560	19 1/2" Straight
230562	39" Straight

These sections have a plain male end (without beads - see Figure 6.17a). They are always cut from the male end. Sections not shown on the above list may not be cut. These sections have beads on the male end (Figure 6.17b).

To cut the straight sections listed above refer to Figure 6.18 and the following instructions:



FIGURE 6.17a: CUTTABLE STRAIGHT SECTION

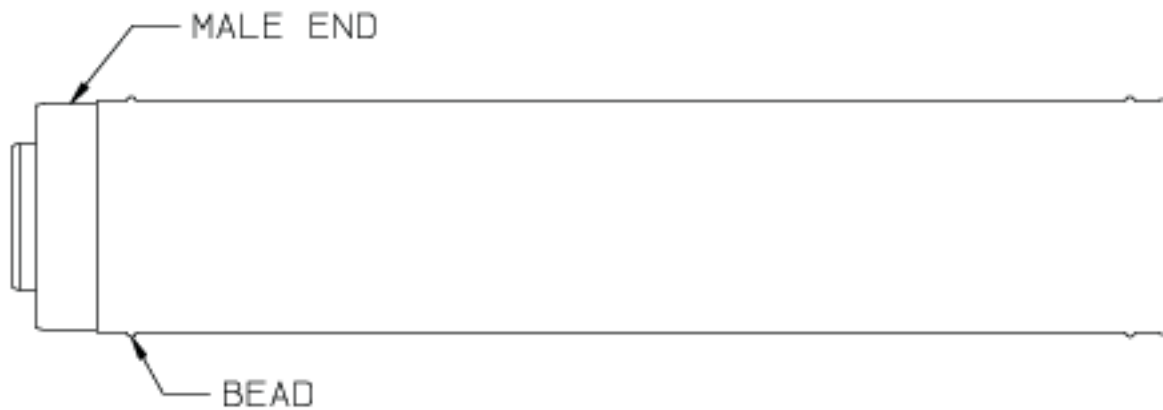


FIGURE 6.17b: NON CUTTABLE STRAIGHT SECTION

- Determine the required length of the outer pipe. When doing this allow an additional 1" of length for insertion into the female end of the adjoining pipe. Mark the cut line on the outer pipe.
- Remove the plastic inner pipe by pulling it out from the female end.
- Cut the **OUTER PIPE ONLY** at the point marked in Step (a) using aviation shears, a hacksaw, or an abrasive wheel cutter. Be careful to cut the pipe square. De burr the cut end with a file or emery cloth.
- Make an insertion mark 1" from the male end of the outer pipe.
- Cut the plastic inner pipe so that it will protrude 3/8" beyond the male end of the outer pipe when reinstalled in the outer pipe. Use a fine tooth hacksaw or a PVC saw to cut the plastic pipe and be careful to cut the pipe square. De burr the cut edge of the plastic pipe with a file, razor blade, or fine sandpaper.
- Reinstall the inner pipe.

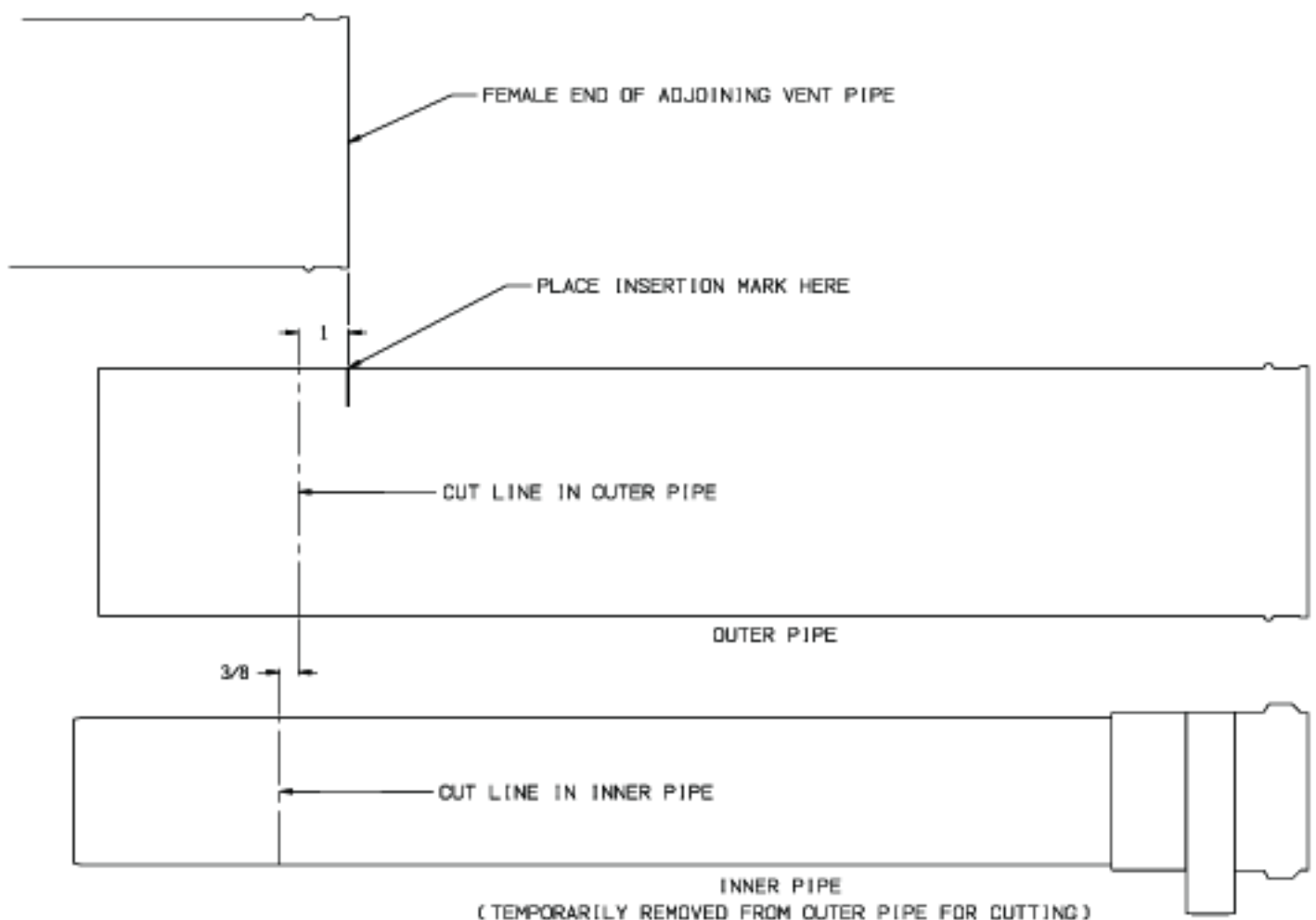
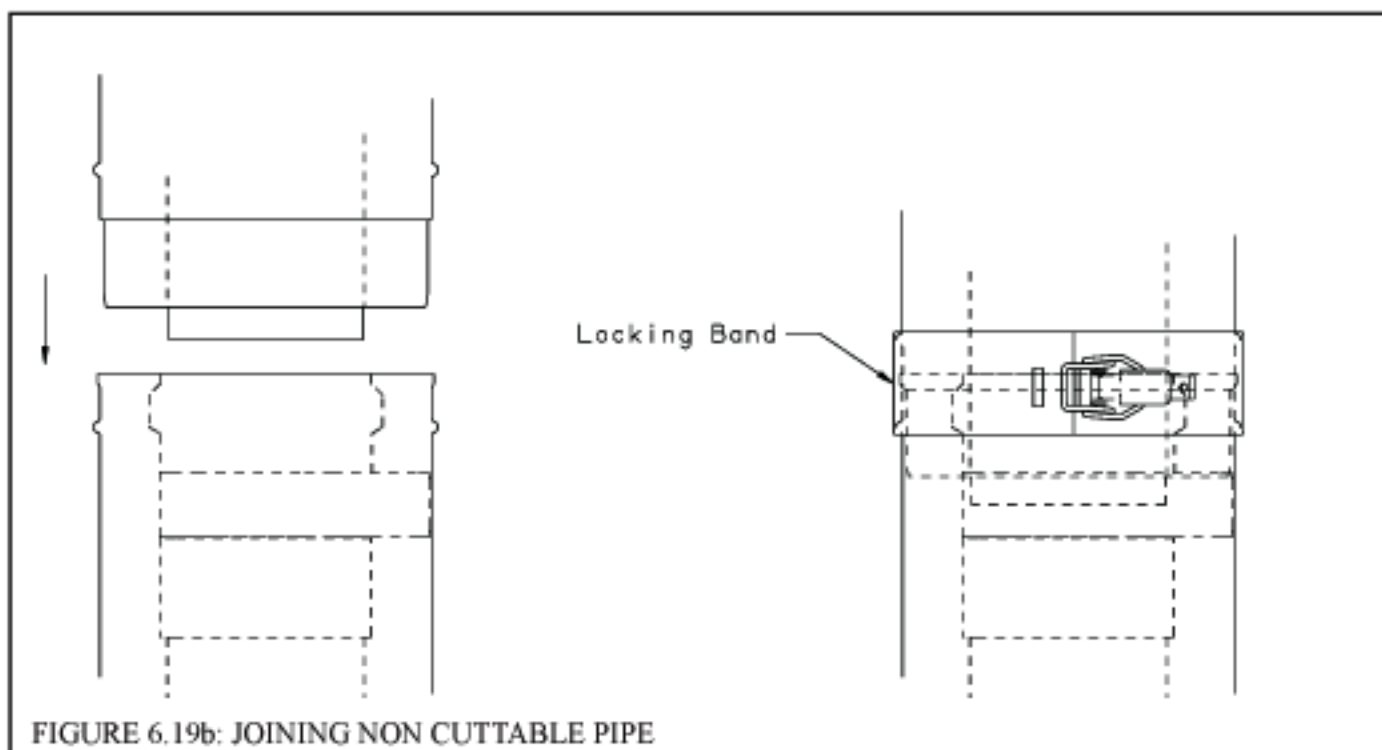
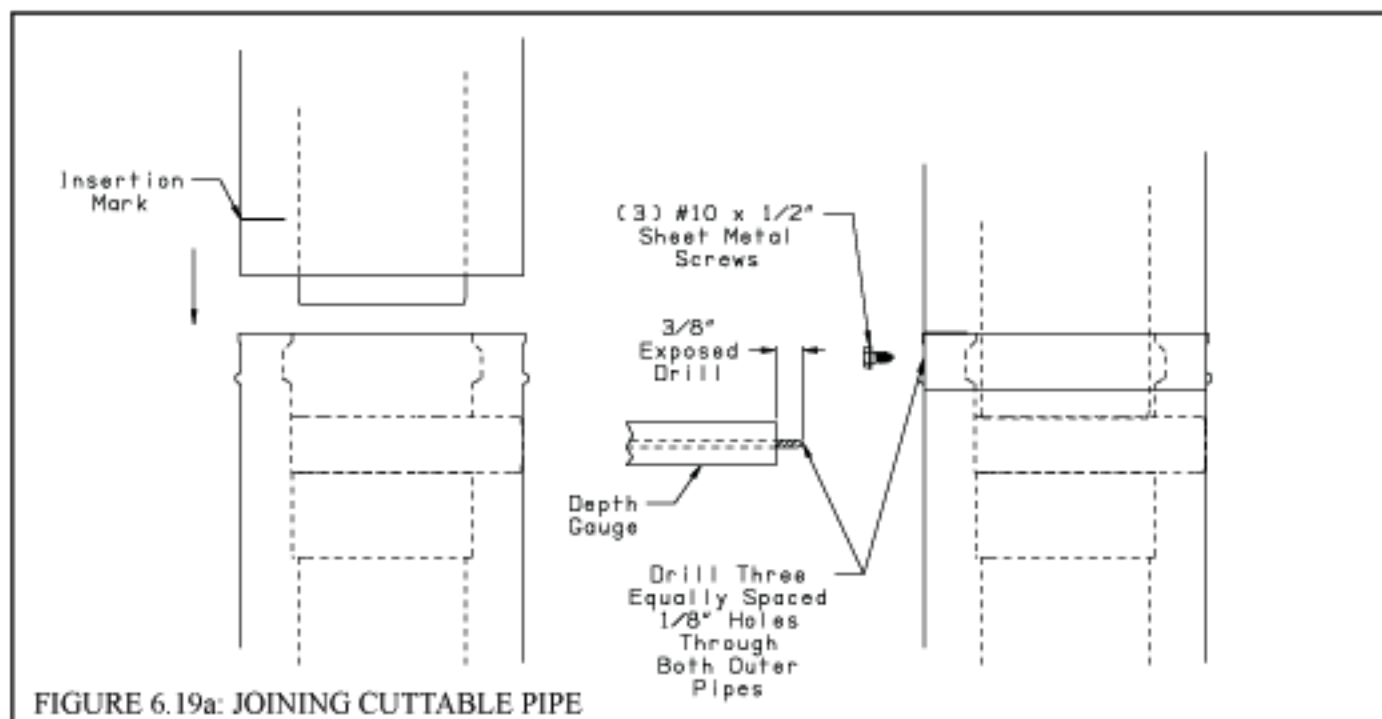


FIGURE 6.18: CUTTING STRAIGHT PIPE

3) Joining Pipe -

- Start assembly of the vent system at the boiler. Lubricate the brown gasket in the boiler vent collar with a few drops of water.
- Push the male end of the first fitting into the boiler collar until it bottoms out. The male end of cuttable sections should go 1" into the collar until the insertion mark (made in Step 2d above) is covered. On other fittings, the bead on the male pipe will bottom out on the collar (Figure 6.19b).
- The male end of cuttable fittings must be held to the collar with three #10 x 1/2" sheet metal screws. Drill a 1/8" hole through both outer pipes to start this screw. **Use a drill stop or other means to ensure that the drill bit does not penetrate more than 3/8" into the outer pipe. Do not use a sheet metal screw longer than 1/2"** (Figure 6.19a).
- Use locking bands (provided with all fittings) to secure non-cuttable pipe, as well as fittings, to the boiler collar (Figure 6.19b).
- Use the same method to join all remaining vent components except for the terminal.



4) Horizontal Terminal Installation

- a) Cut a 6-1/2" diameter hole for the 100/150 terminal through the exterior wall at the planned location of the horizontal terminal.
- b) Measure distance "L" from the outside surface of the exterior wall to the end of the last fitting as shown in Figure 6.20a.
- c) Add 1-1/4" to distance "L". Carefully mark this length on the pipe as shown in Figure 6.20b.
- d) Remove the aluminum inner pipe from the terminal, by gently pulling on it from the male end. Set aside.
- e) Cut the **outer pipe only** at the point marked in Step (c) using aviation shears, a hacksaw, or an abrasive wheel cutter. Be careful to cut the pipe square. De-burr the cut end with a file or emory cloth.
- f) Reinstall the aluminum inner pipe in the terminal, making sure that the female end of this pipe is completely bottomed out over the aluminum male connection visible behind the air intake grill. Place a mark on the aluminum inner pipe 3/8" beyond the end of the outer pipe (Figure 6.20c). Use a fine tooth hacksaw or hand shears to cut the aluminum pipe and be careful to cut the pipe square (if necessary, the aluminum pipe can be removed from the terminal again for cutting). De-burr the cut edge of the aluminum pipe with a file or fine sandpaper.
- g) Make a mark on the terminal section 1" from the cut end of the outer pipe as shown in Figure 6.20c.
- h) Slip the terminal section through the wall from the outside. Pass the terminal through the inner wall plate and push into the last section of vent pipe until the mark made in Step (h) is no longer visible (Figure 6.20d). Secure the terminal to the last piece of pipe with three #10 x 1/2" sheet metal screws. Drill a 1/8" hole through both outer pipes to start these screws. Use a **drill stop or other means to ensure that the drill bit does not penetrate more than 3/8" into the outer pipe. Do not use a sheet metal screw longer than 1/2"**.
- i) Slip the outer wall plate over the terminal and secure to the wall (Figure 6.20d). Apply a 1/8" bead of weather resistant RTV over the joint between the outside wall plate and the terminal. Secure the other wall plate to the inside wall.

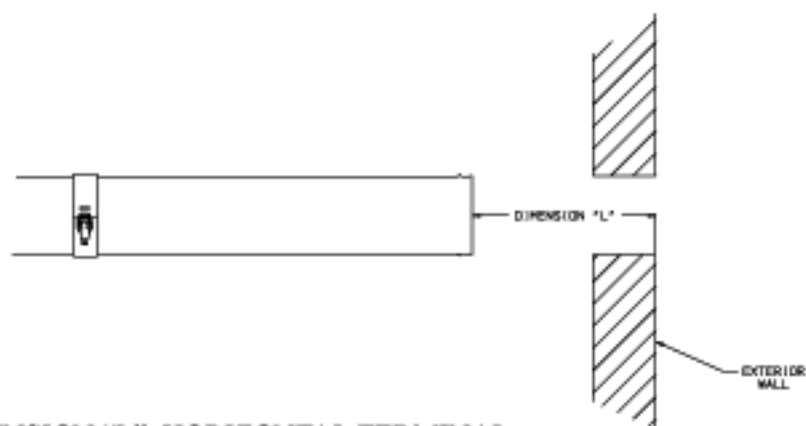


FIGURE 6.20a: DIMENSION "L", HORIZONTAL TERMINAL

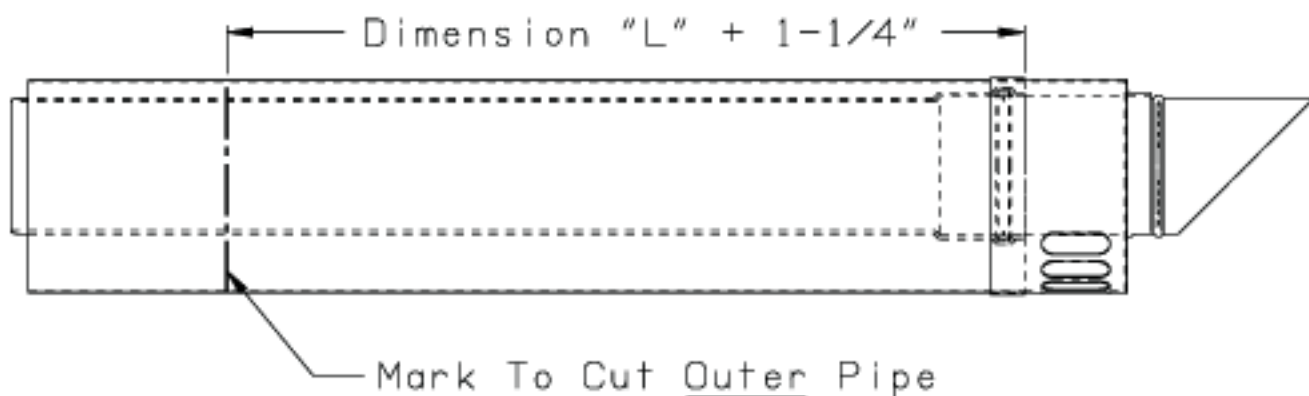


FIGURE 6.20b: CUTTING OUTER PIPE OF HORIZONTAL TERMINAL

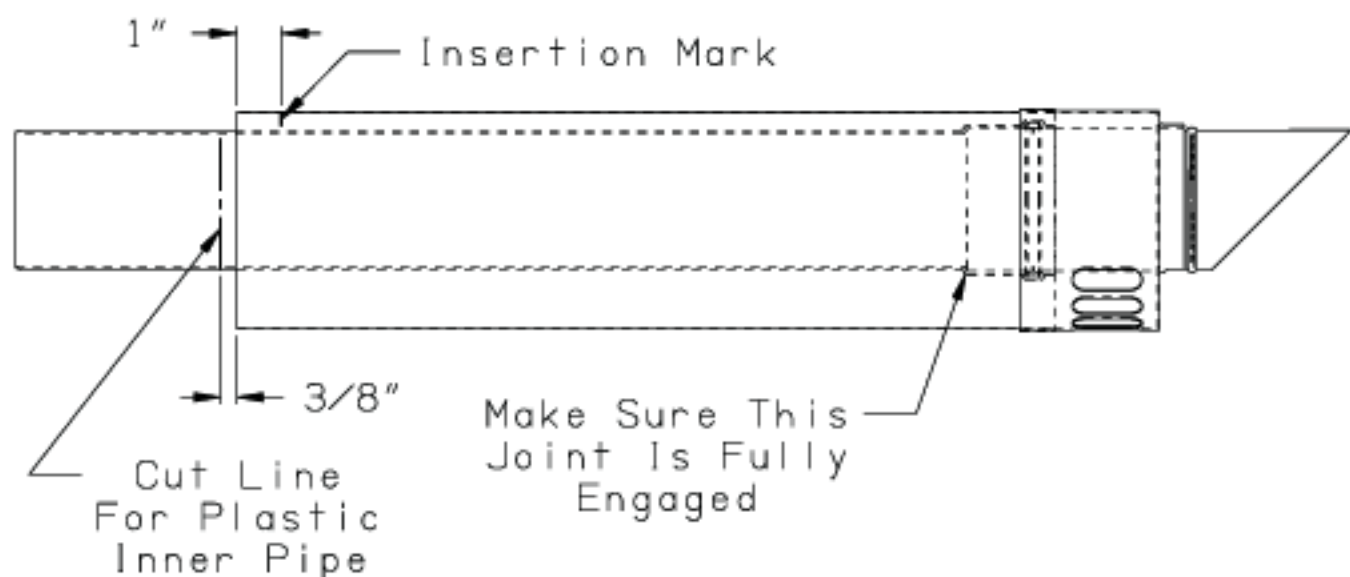


FIGURE 6.20c: CUTTING INNER PIPE OF HORIZONTAL TERMINAL

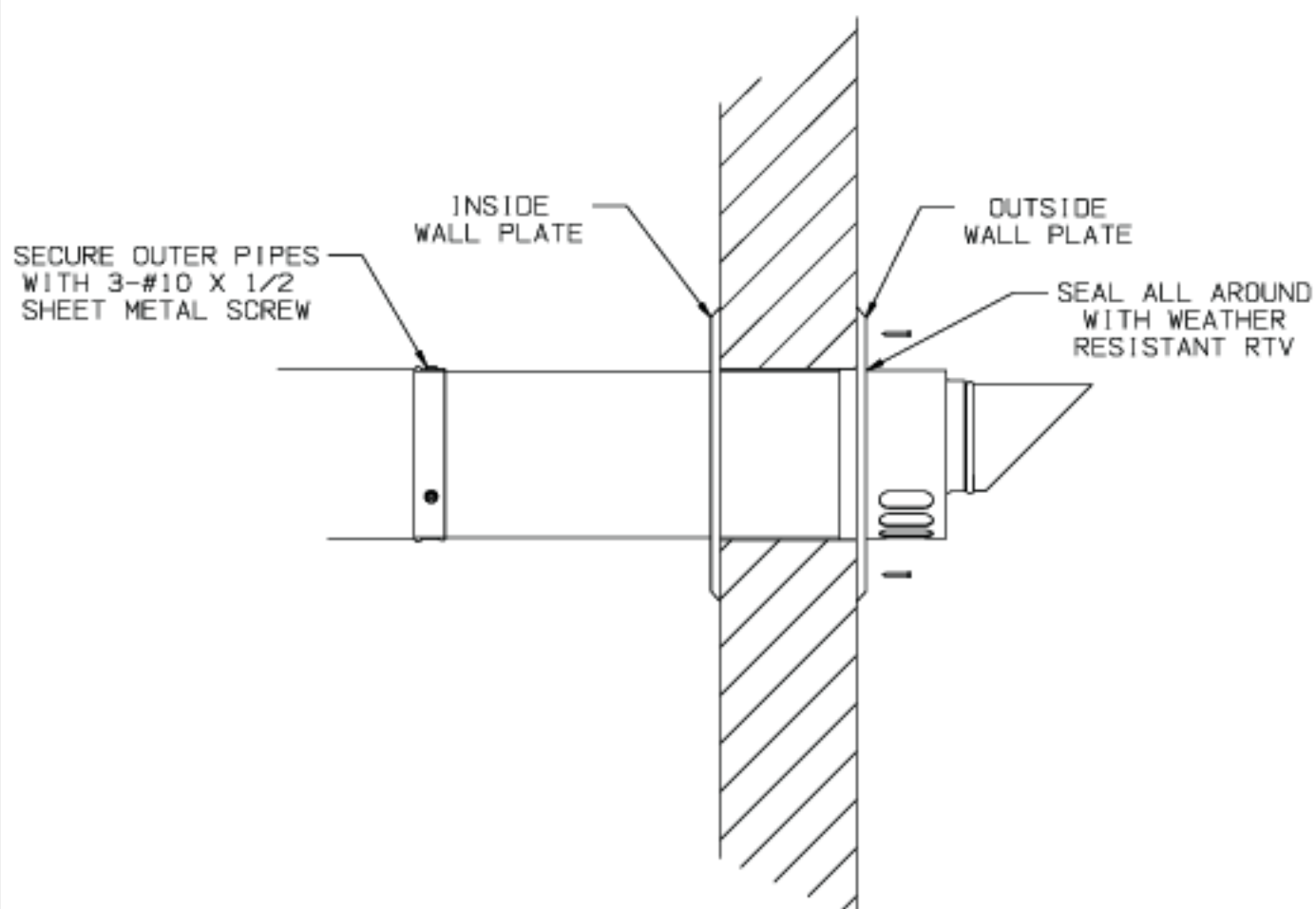


FIGURE 6.20d: COMPLETING HORIZONTAL TERMINAL INSTALLATION

- 6) **Vertical Terminal Installation** - In addition to the vertical terminal, either a Flat Roof Flashing (100/150 PN 230571) or Sloped Roof Flashing (100/150 PN 230572) is required for this installation.
- Determine the center line of the terminal location on the roof. If the roof is flat, cut a 6-1/2" diameter hole for the 100/150 terminal. If the roof is sloped, cut a hole large enough for the terminal to pass through the roof while remaining plumb.
 - Install the roof flashing using standard practice for the roofing system on the structure.
 - If not already done, assemble the venting system inside the building. The last section of pipe needs to be on the same center line as the terminal and within 28" of the top edge of the roof flashing (Figure 6.21a).
 - Measure distance "H" from the top edge of the storm collar to the end of the last fitting as shown in Figure 6.21a.
 - Add 1" to distance "H". Carefully mark this length on the pipe as shown in Figure 6.21b.
 - Cut the **outer pipe only** at the point marked in Step (e) using aviation shears, a hacksaw, or an abrasive wheel cutter. Be careful to cut the pipe square. De-burr the cut end with a file or emery cloth.
 - Place a mark on the aluminum inner pipe 3/8" beyond the end of the outer pipe (Figure 6.21b). Use a fine tooth hacksaw to cut the aluminum pipe and be careful to cut the pipe square. De-burr the cut edge of the aluminum pipe with a file or emery cloth.
 - Make a mark on the terminal section 1" from the cut end of the outer pipe as shown in Figure 6.21b.
 - Slip the terminal section through the roof from the outside. Push into the last section of vent pipe until the mark made in Step (h) is no longer visible. Secure the terminal to the last piece of pipe with three #10 x 1/2" sheet metal screws. Drill a 1/8" hole through both outer pipes to start these screws. **Use a drill stop or other means to ensure that the drill bit does not penetrate more than 3/8" into the outer pipe. Do not use a sheet metal screw longer than 1/2".**
 - Secure the terminal section to the inside of the roof structure using the mounting bracket provided with the terminal (Figure 6.21c).
- 7) **Chimney Chase Installation** - A vertical vent system can be installed in an unused masonry chimney. This installation is similar to other vertical installations with the following exceptions (Also see Figure 6.22):
- The chimney chase elbow kit (100/150 PN 230568) is used at the base of the chimney. This kit consists of a support elbow and a mounting bracket. Slip the elbow over the M10 x 35 screw in the support bracket. Determine the desired vertical location of the support elbow in the chimney and mark the location of the pin on the back of the support bracket on the back wall of the chimney. Drill a 7/16" dia x 2-1/2" deep hole at this location to support the back of the bracket. The front of the elbow mounting bracket is supported by the bottom of the opening into the chimney or by an installer supplied bracket.
 - Construct a weather-tight flat roof to cover the top of the old chimney. Install the vertical terminal through this roof using the flat roof flashing.

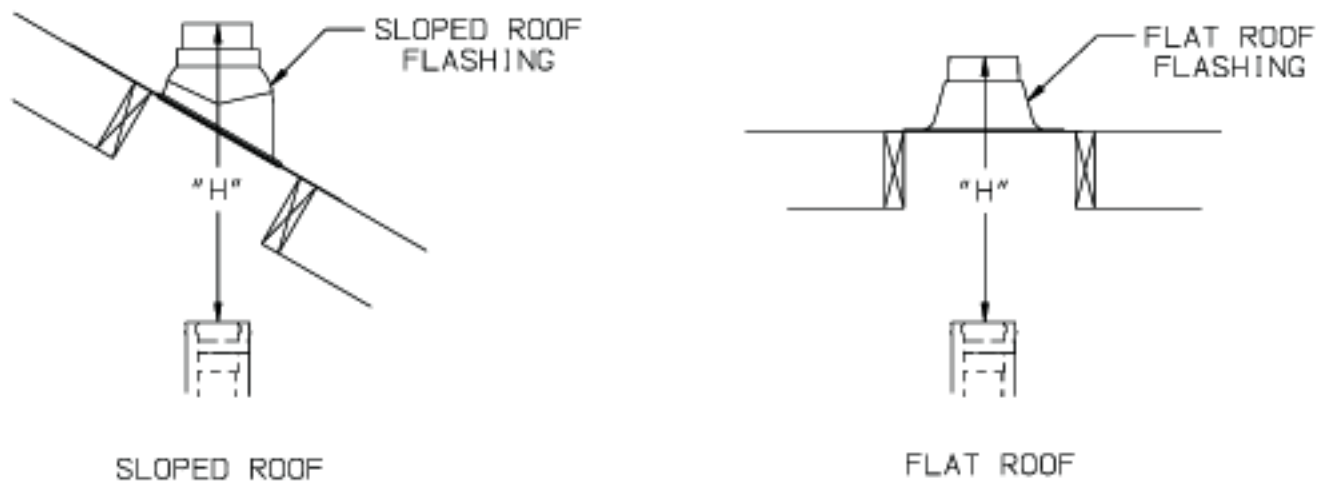


FIGURE 6.21a: DIMENSION "H"

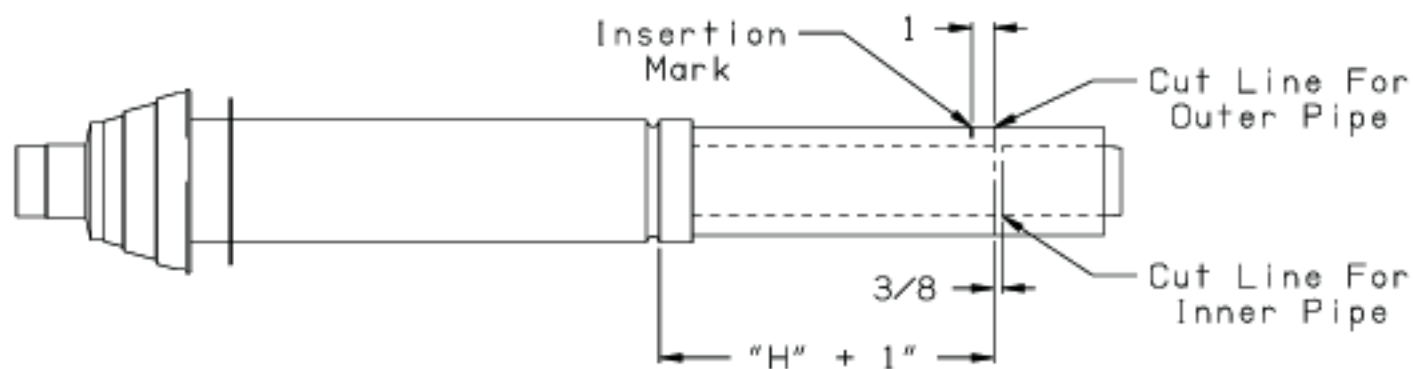


FIGURE 6.21b: CUTTING VERTICAL TERMINAL

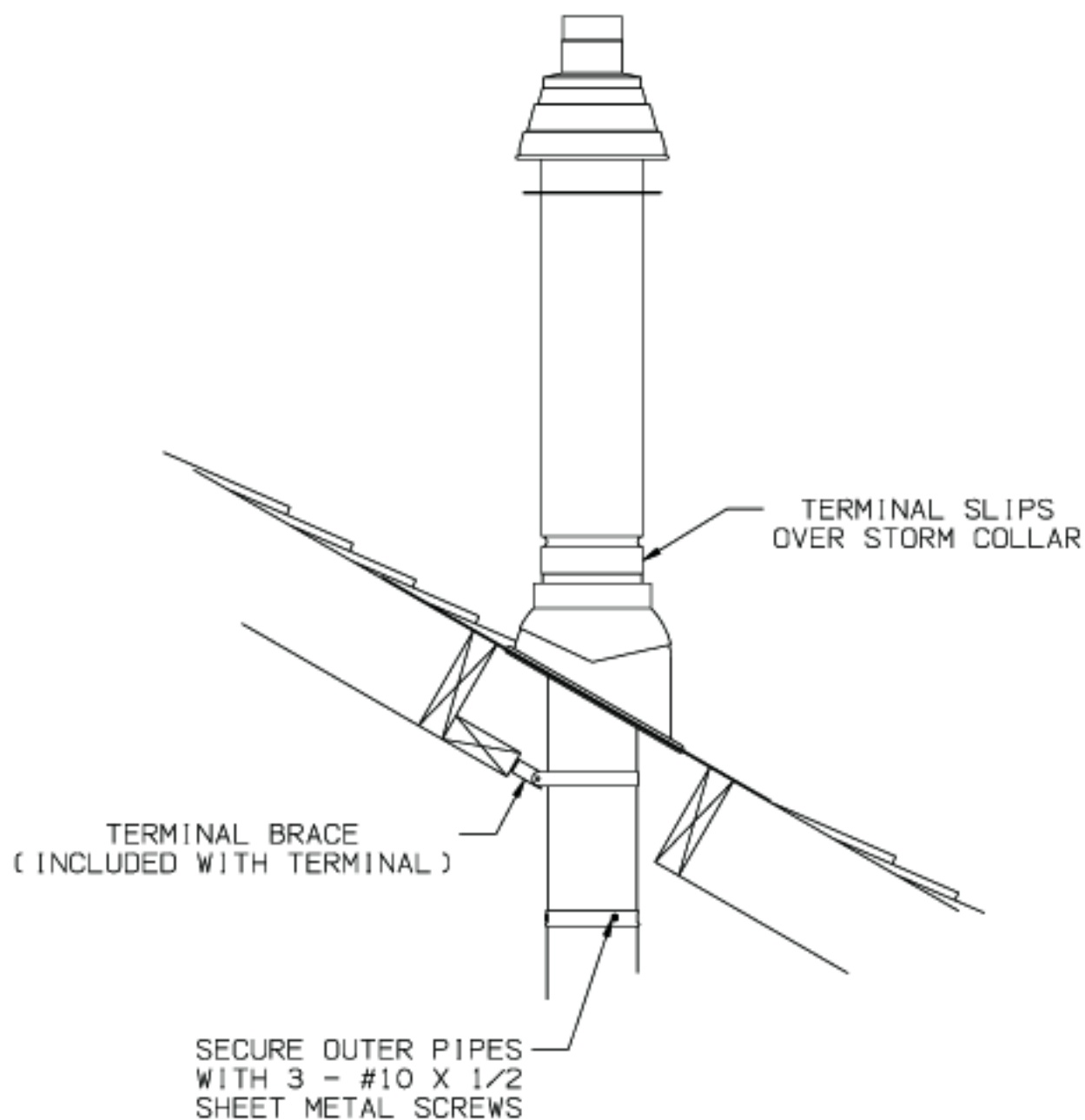


FIGURE 6.21c: COMPLETING VERTICAL TERMINAL INSTALLATION

WARNING

- Do not attempt to construct a vertical vent system inside a chimney that is used to vent a fireplace or other appliances.
- Do not attempt to construct a vertical vent system inside a chimney flue adjacent to another flue used by a fireplace or other appliances.

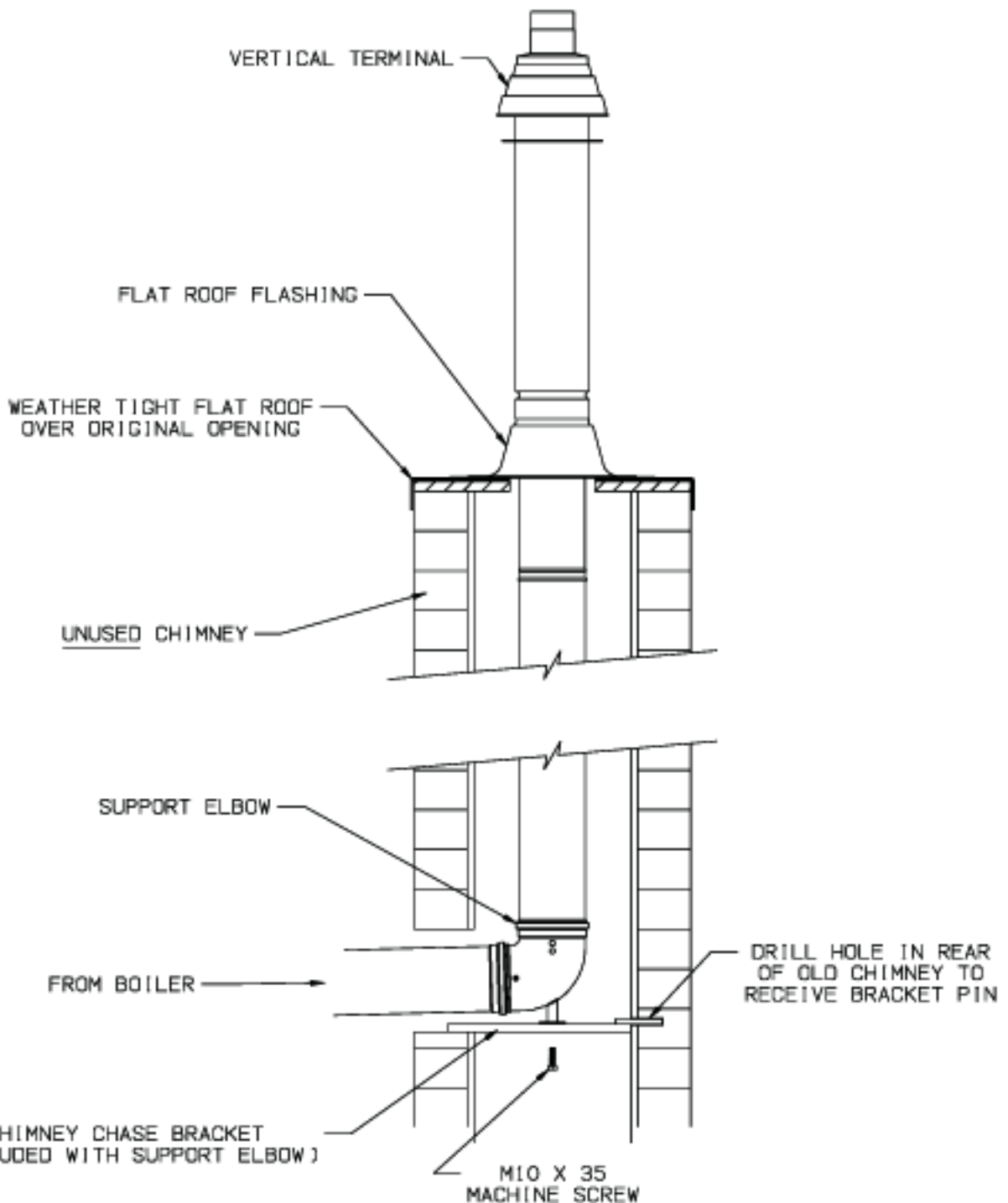


FIGURE 6.22: CHIMNEY CHASE INSTALLATION

F. Condensate Trap & Drain Line

All condensate which forms in the boiler and vent system collects in both the sump under the heat exchanger and the vent adapter (either stainless or concentric vent adapters) and leaves the boiler through the condensate trap. This trap allows condensate to drain from the sump and the vent adapter while retaining flue gases in the boiler. A length of corrugated drain hose is supplied with the boiler and is connected to the trap as shown in Figure 6.23. This hose should be routed through the back of the boiler. Route this hose to a drain or other suitable point for disposal. Note the following when disposing of the condensate:

- a) If the condensate drain line must be extended, construct the extension from PVC or CPVC pipe. Insert the hose provided with the boiler into the end of the extension as shown in Figure 6.23.
- b) Condensate is slightly acidic. Do not use metallic pipe or fittings in the condensate drain line. Do not route the drain line through areas that could be damaged by leaking condensate.
- c) Some jurisdictions may require that the condensate be neutralized before disposing it. Dispose of condensate in accordance with local codes.
- d) Do not route, or terminate, the condensate drain line in areas subjected to freezing temperatures.
- e) If the point of condensate disposal is above the trap, it will be necessary to use a condensate pump to move the condensate to the drain. In such cases, select a condensate pump that is approved for use with condensing furnaces. If overflow from this pump would result in property damage, select a pump with an overflow switch and use this switch to shut down the boiler. Alternatively, if heat is a necessity, use the overflow switch to trigger an alarm.
- f) Do not attempt to move the trap from its mounted position on the sump. Do not attempt to substitute another trap for the one provided with the boiler.
- g) The vent shown in Figure 6.23 must be left open for the trap to work properly.

WARNING

FAILURE TO INSTALL THE CONDENSATE TRAP AND CONDENSATE DRAIN IN ACCORDANCE WITH THE ABOVE INSTRUCTIONS COULD CAUSE FLUE GAS TO ENTER THE BUILDING, RESULTING IN PERSONAL INJURY OR DEATH.

WARNING

BOILER CONDENSATE IS CORROSIVE. ROUTE CONDENSATE DRAIN LINE IN A MANNER SUCH THAT ANY CONDENSATE LEAKAGE WILL NOT CAUSE PROPERTY DAMAGE.

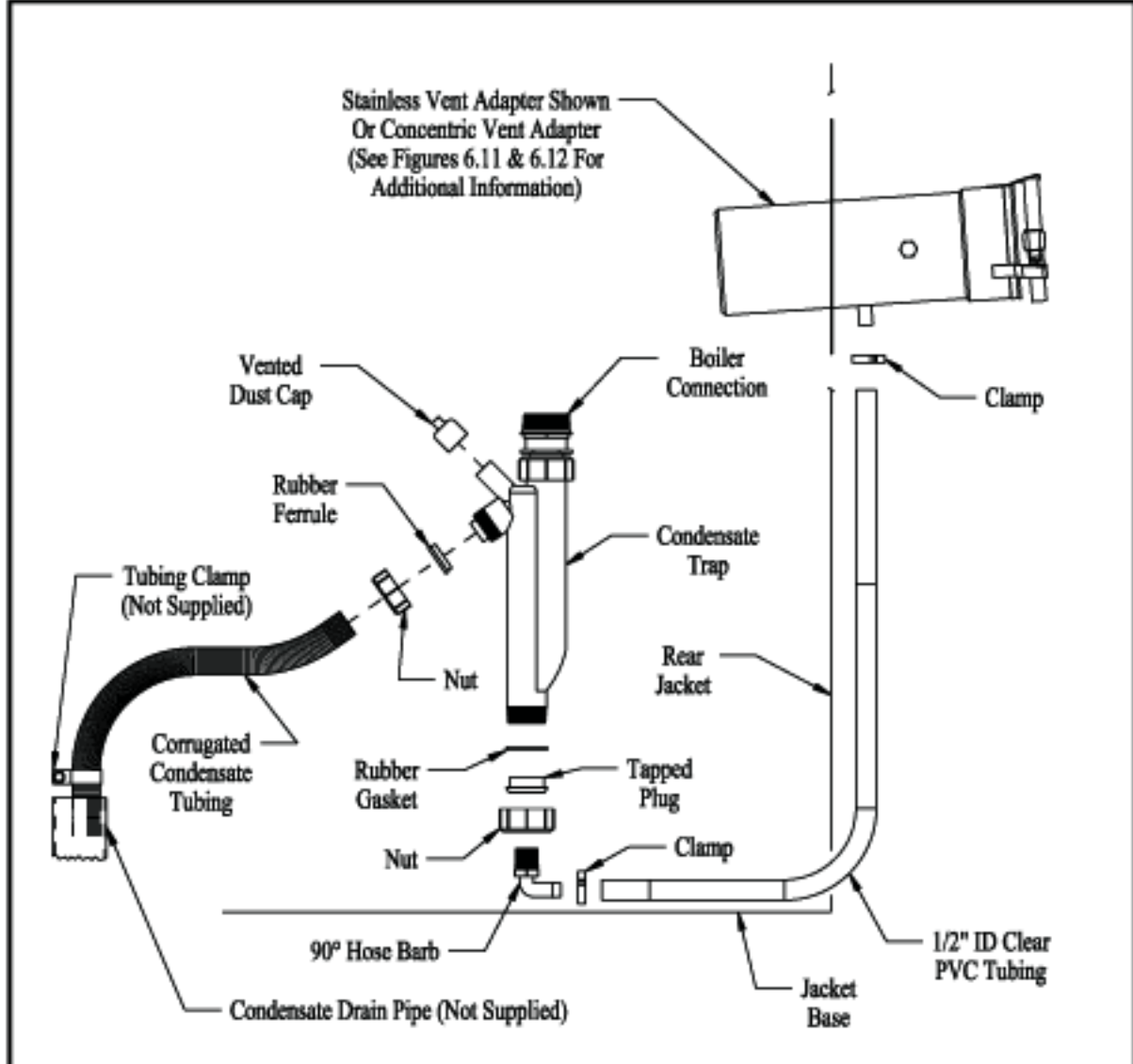


FIGURE 6.23: CONDENSATE PIPING ARRANGEMENT

VII Gas Piping

Gas piping to the boiler must be sized to deliver adequate gas for the boiler to fire at the nameplate input at an inlet pressure 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*.

Figure 7.1 shows typical gas piping connection to the BWC boiler. A sediment trap must be installed upstream of all gas controls. Install the factory provided manual shut-off valve outside the jacket with a ground joint union as shown.

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.

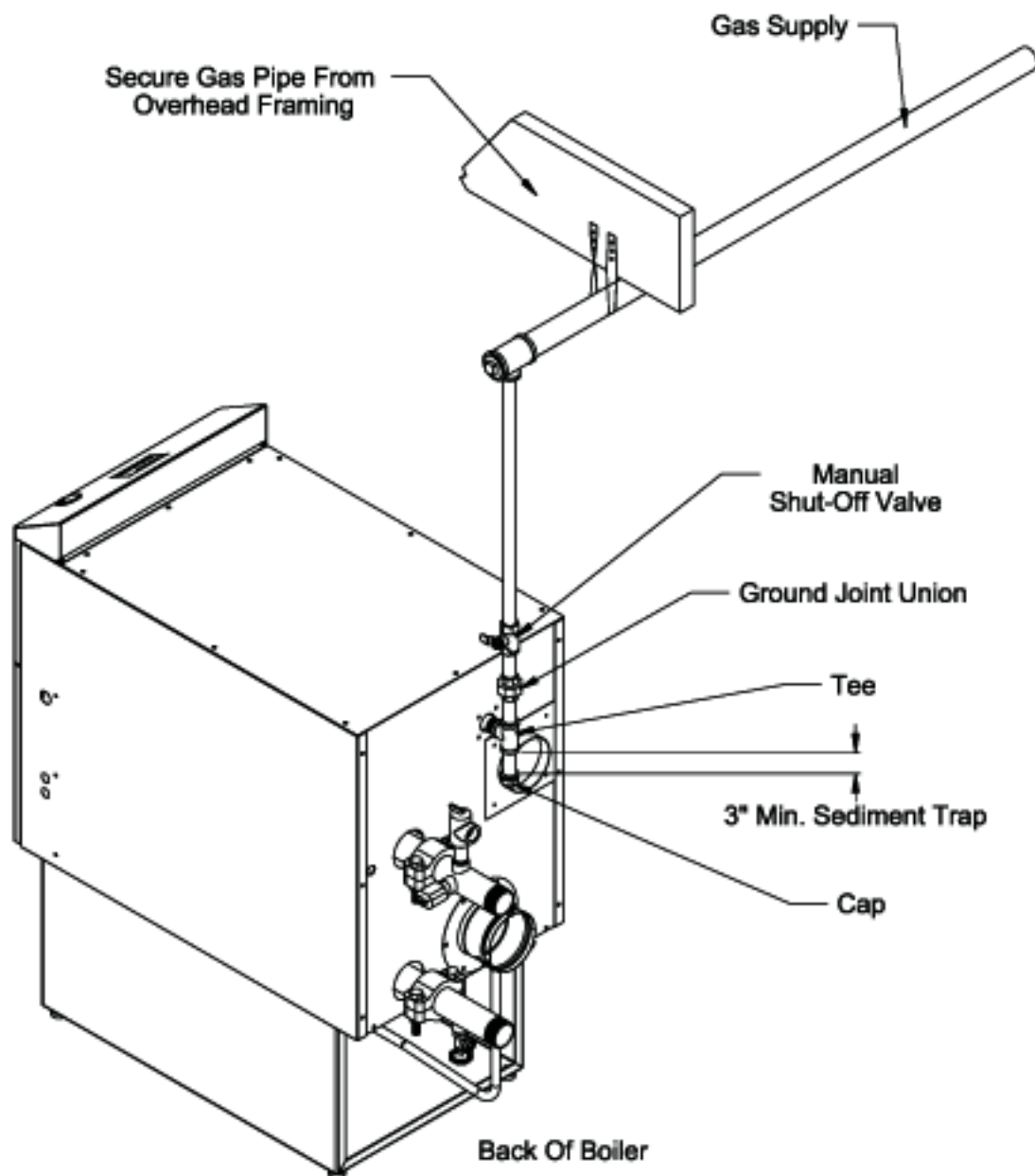


Figure 7.1: Gas Connection To Boiler

VIII System Piping

A. General System Piping Precautions

WARNING

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).

CAUTION

THE HEAT EXCHANGER USED IN THE BWC IS MADE FROM A SPECIAL ALUMINUM ALLOY. FAILURE TO TAKE THE FOLLOWING PRECAUTIONS COULD RESULT IN SEVERE BOILER DAMAGE.

- BEFORE CONNECTING BOILER, MAKE SURE THAT THE SYSTEM IS FREE OF SEDIMENT, FLUX AND ANY RESIDUAL BOILER WATER ADDITIVES. FLUSH THE SYSTEM IF NECESSARY TO ENSURE THAT THESE CONTAMINATES ARE REMOVED.
- DO NOT CONNECT THIS BOILER TO A SYSTEM THAT IS SUBJECT TO REGULAR ADDITIONS OF MAKEUP WATER OR ONE WHICH EMPLOYS RADIANT TUBING WITHOUT AN OXYGEN BARRIER.
- DO NOT ADD ANTIFREEZE OR OTHER BOILER WATER TREATMENT CHEMICALS EXCEPT THOSE LISTED IN PART X OF THIS MANUAL.
- MAINTAIN THE PRESSURE IN THE BOILER AT A MINIMUM OF 12 PSI.
- DESIGN SYSTEM TO ENSURE THAT THE FLOW FALLS WITHIN THE LIMITS CALLED FOR IN TABLE 8.1.
- THE BOILER IS FURNISHED WITH 2" GROOVED COUPLINGS. IF THE RUBBER SEAL IN THESE COUPLINGS MUST BE REPLACED, USE ONLY COMPATIBLE GRADE EDPM (GREEN COLOR CODE) REPLACEMENTS.

B. System Design

Proper operation of the BWC boiler requires that the water flow through the boiler remain within the limits shown in Table 8.1. Failure to maintain the flow within these limits could result in erratic operation or premature boiler failure. There are two basic methods that can be used to pipe the BWC boiler. Method #1 is almost always preferred. The instructions on the following pages describe these methods for piping BWC boilers and explain how to size the circulator and piping. Additional information on hydronic system design may be found in Installation of Residential Hydronic Systems (Pub. #200) published by the Hydronics Institute in Berkeley Heights, NJ.

TABLE 8.1: FLOW REQUIREMENTS THROUGH BOILER

BOILER MODEL	MIN. REQUIRED FLOW AT HIGH FIRE (GPM)	MAX. ALLOWABLE FLOW (GPM)
BWC300	15	30
BWC399	20	45
BWC425	21	45

Method 1: Primary/Secondary Piping

This method can be used in heat-only applications as shown in Figure 8.2 or with an indirect water heater as shown in Figure 8.3. This method relies on primary/secondary pumping to ensure that the required flow is always maintained through the boiler. In this system, the flow rate through the boiler is completely independent of the flow rate through the heating system. Use the following guidelines to ensure that the boiler will have the required flow shown in Table 8.1 regardless of the flow in the heating system.

- 1) **Primary Loop Piping** - Size the primary circulator and piping to obtain the design flow rate through the heating system as you would on any other heating system. All piping between the expansion tank and secondary connection tees must be at least as large as that shown in Table 8.5, column (a). In order to keep the flow rates in the primary and secondary loops independent of each other, provide at least 8 diameters of straight pipe upstream of the first secondary tee and 4 diameters downstream of the second secondary tee. Keep the distance between the expansion tank and the first secondary tee as short as practical.
- 2) **Secondary Loop ("Boiler Loop") Piping** - The secondary (or "boiler loop") piping is shown shaded in figure 8.4a. All piping in this loop must be the size shown for the boiler in Table 8.5, column (a). To size the circulator for this loop:
 - a) Select one of the boiler water flow rates shown in Table 8.5, column (b) for the boiler and pipe size being installed. When selecting the required boiler flow rate, keep in mind that if the flow rate in the primary loop exceeds the flow rate through the boiler, it will not be possible to obtain a 180°F supply temperature in the primary loop. This is because the supply water exiting the boiler will be mixed with cooler system return water before entering the radiation.
 - b) Count all fittings in the planned secondary loop. In doing so, do not count the secondary connection tees, unions, or the fittings supplied with the boiler (these have already been accounted for).
 - c) Using Table 8.6, find the equivalent lengths of all fittings in the secondary loop. Total these equivalent lengths and add them to the total length of planned straight pipe in the secondary loop. The result is the total equivalent length of the secondary loop.
 - d) Refer back to the row in Table 8.5 from which the flow rate and pipe size were selected:
 - If the maximum equivalent length shown in column (e) is in excess of the total equivalent length calculated in Step (c) above, use the pipe size selected, along with the circulator shown in Table 8.5, column (d).
 - If the maximum equivalent length shown in column (e) is in less than the total equivalent length calculated in Step (c) above, a larger pipe size and/or larger circulator is required. Select another circulator/pipe size combination from Table 8.5 and repeat steps (b-d) above.
- 3) **Indirect Water Heater Loop Piping (If Indirect Water Heater is Used)** - The indirect water heater loop piping is shown shaded in Figure 8.4b. Some of the piping in this loop is common to the secondary loop sized above. Piping common to both loops is always sized from Table 8.5, column (a) as described above. All indirect water heater loop piping that is not common (the "I.W.H branch") is sized from Table 8.7, column (a). If the indirect water heater connections are smaller than the pipe size called for in Table 8.7, column (a), reduce the pipe size at the indirect water heater connections. To size the circulator:
 - a) Count all fittings in the planned Indirect Water Heater Loop (all shaded piping in Figure 8.4b). In doing so, you will be counting some piping and fittings which are common to the heating system secondary ("boiler loop") piping and which were counted in Step 2a above. Do not count the fittings supplied with the boiler. If Table 8.7 requires a bypass, do not count the pipe and fittings in the by-pass.
 - b) Using Table 8.6, find the equivalent lengths of all fittings in the indirect water heater loop. If the I.W.H. branch pipe size is smaller than the secondary loop pipe size, calculate the equivalent lengths for all fittings (including the larger size fittings common to both loops) based on the smaller size. Total these equivalent lengths and add them to the total length of planned straight pipe (of both sizes) in the indirect water heater loop. The result is the total equivalent length of the indirect water heater loop.
 - c) Refer back to the row in Table 8.7 from which the flow rate and I.W.H. branch pipe size were selected:
 - If the maximum equivalent length shown in column (f) is in excess of the total equivalent length calculated in Step (b) above, use the IWH branch pipe size selected, along with the circulator shown in Table 8.7, column (c).
 - If the maximum equivalent length shown in column (f) is in less than the total equivalent length calculated in Step (b) above, a larger pipe size and/or larger circulator is required. Select another circulator/pipe size combination from Table 8.7 and repeat steps (a-b) above.

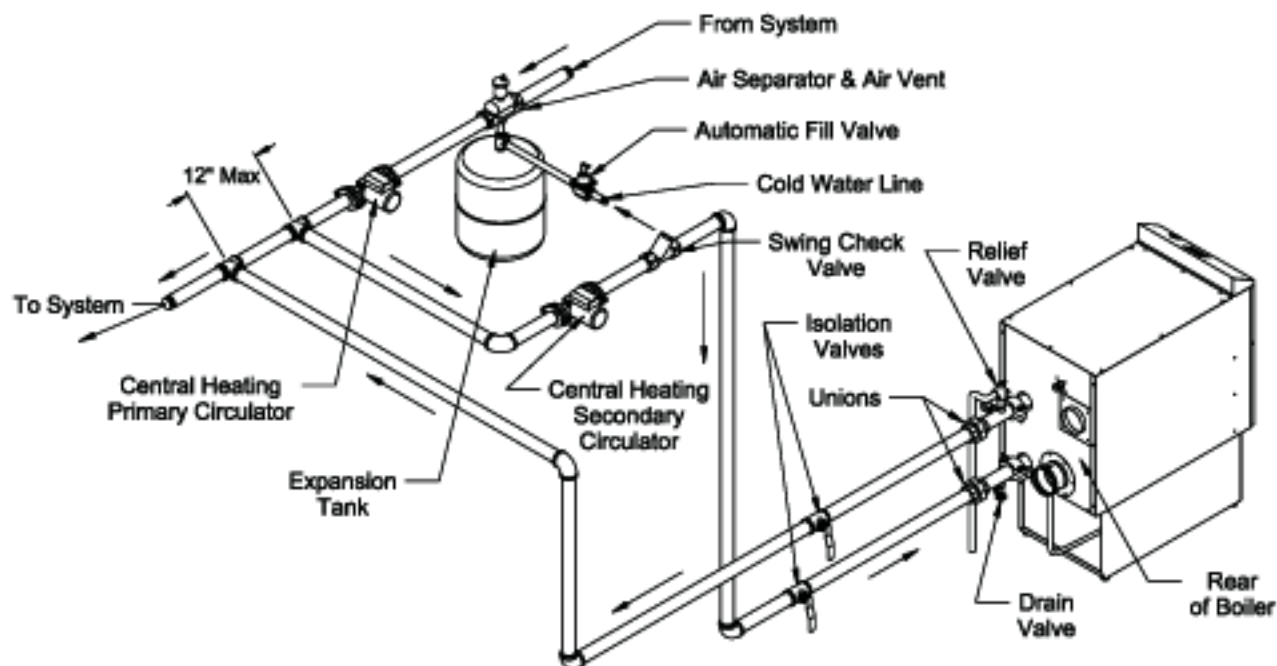


Figure 8.2: Piping Method #1 - Heat Only

Example – Assume that a BWC300 is to be installed in a heating system along with a Crown MS-40 indirect water heater as shown in Figure 8.3. A total of 15 ft of straight pipe will be installed between the boiler and the primary loop. A total of 25 ft of straight pipe will be installed between the boiler and the indirect water heater. Of this 25 ft of straight piping, 10ft is common to both the secondary and indirect water heater loop. The MS-40 requires a flow rate of 8 GPM and has a head loss of 3.0 ft. 20GPM is required through the secondary loop.

Total fittings in Secondary loop (“boiler loop”):

- 4 90 Elbows*
- 2 Runs of Tees*
- 1 Swing Check*
- 2 Isolation Valves*

Note: Unions, Secondary Connection Tees, and factory supplied fittings are ignored.

We would prefer to use 1-1/2” piping. Based on this, calculate total equivalent length from Table 8.6:

15ft Straight Pipe + 4 Elbows x 4.5 + 2 Runs of Tees x 2.8 + 1 Swing Check x 12.5 + 2 valves x 1.0 = 53.1 Equivalent Feet Straight Pipe. From Table 8.5, we see that a Taco 0012 will pump 20 GPM through a BWC300 with 89 equivalent feet of 1 1/2” pipe, so Taco 0012 will work in this application with 1 1/2” piping.

Total fittings in Indirect Water Heater Loop:

- 4 90 Elbows*
- 2 Turns in Tees*
- 1 Swing Check*
- 2 Isolation Valves*

All options shown in Table 8.7 for the MS-40 show the use of 1” I.W.H branch piping. Although there is 10ft of piping common to both loops which is 1-1/2”, we calculate the equivalent length for the I.W.H. loop as though it were entirely 1”. Therefore, the total equivalent length for the I.W.H. loop is calculated from Table 8.6 as:

25 Straight Pipe + 4 Elbows x 2.8 + 2 Turns in Tees x 5.5 + 1 Swing Check x 7 + 2 valves x 0.6 = 55.4 Equivalent

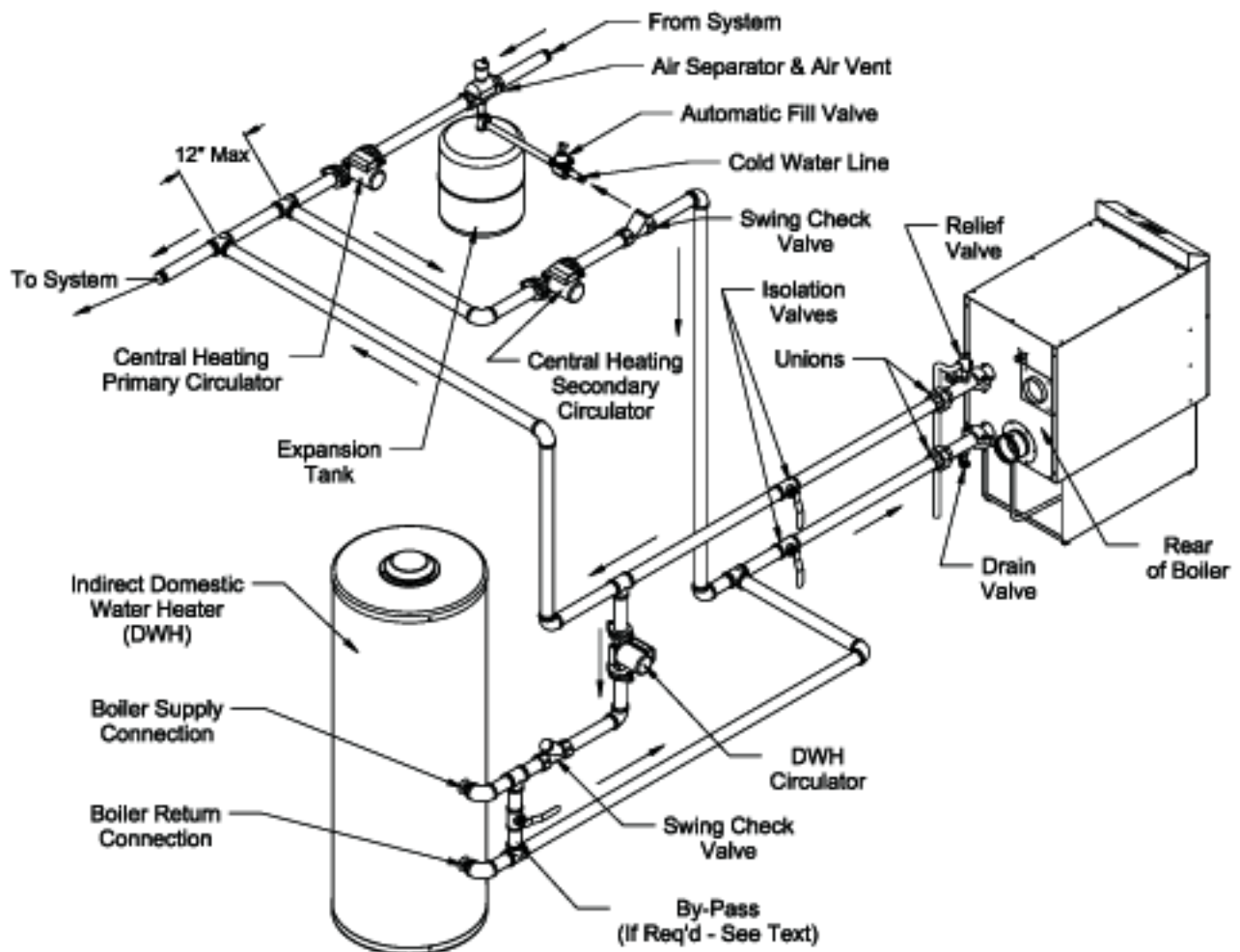


Figure 8.3: Piping Method #1 - Heat + Indirect Water Heater

Feet Straight Pipe. From Table 8.7, we see that a Taco 008 will pump at 8 GPM through a BWC300 with 56 equivalent feet and an MS-40. The Taco 008 is just large enough to work in this application (a Taco 009 could also be used if desired).

The MS-40 has 3/4" connections. 1" piping is used in the indirect water heater branch from the 1-1/2 x 1-1/2 x 1 Tees in the secondary loop all the way to the coil connections on the MS-40.

4) Multiple Indirect Water Heaters - Pipe multiple indirect water heaters as shown in Figure 8.8. The use of reverse-return manifold ensures that the boiler water flow will be evenly divided between the two indirects. Table 8.7 shows pump/piping sizing guidelines for up to two of Crown's indirect water heaters. Measure the length of the I.W.H. loop to the furthest indirect water heater. When figuring the equivalent length, do not count the two Tees in the indirect water heater manifold.

5) Indirect Water Heater By-pass - Some of the piping options shown in Table 8.7 require the use of a bypass around the indirect water heater. This is done when the required boiler water flow through the indirect water heater is far lower than the absolute minimum required flow through the boiler. The use of a bypass permits the use of a much smaller pump than would otherwise be required. Refer to Figure 8.3 for the location of this bypass. The bypass pipe size should be the same as the rest of the I.W.H. loop.

When the boiler is set-up, start with the throttling valve in the bypass fully open. Initiate a domestic hot water draw and make sure that the boiler is operating at high fire in response to a call for DHW. Then slowly close the bypass valve until the temperature rise across the boiler is 40°F or less.

6) Maximum Input on Call for DHW - In most of the applications shown in Table 8.7, the boiler output required for the indirect water heater is significantly less than the maximum boiler output. This means that when the boiler is responding to a call for DHW, the flow rate through the boiler can be smaller than is required when responding to a call for space heating. As a result, smaller piping and circulators can often be used for the IWH loop. In order to take advantage of this, however, it is necessary to limit the boiler's firing rate when it is responding to a call for DHW. Table 8.9 shows the maximum firing rate that is permissible at various boiler water flow rates. The input of this boiler is determined by the fan speed. The maximum fan speed allowed when responding to a call for DHW is defined by parameters 15 and 16 in the MCBA (See Appendix A for more information on settings and parameters). Both the firing rate and maximum DHW fan speed are shown in Table 8.9 for various flow rates. Factory default maximum DHW fan speeds are shown in bold. In most cases, it should not be necessary to change these parameters in the field.

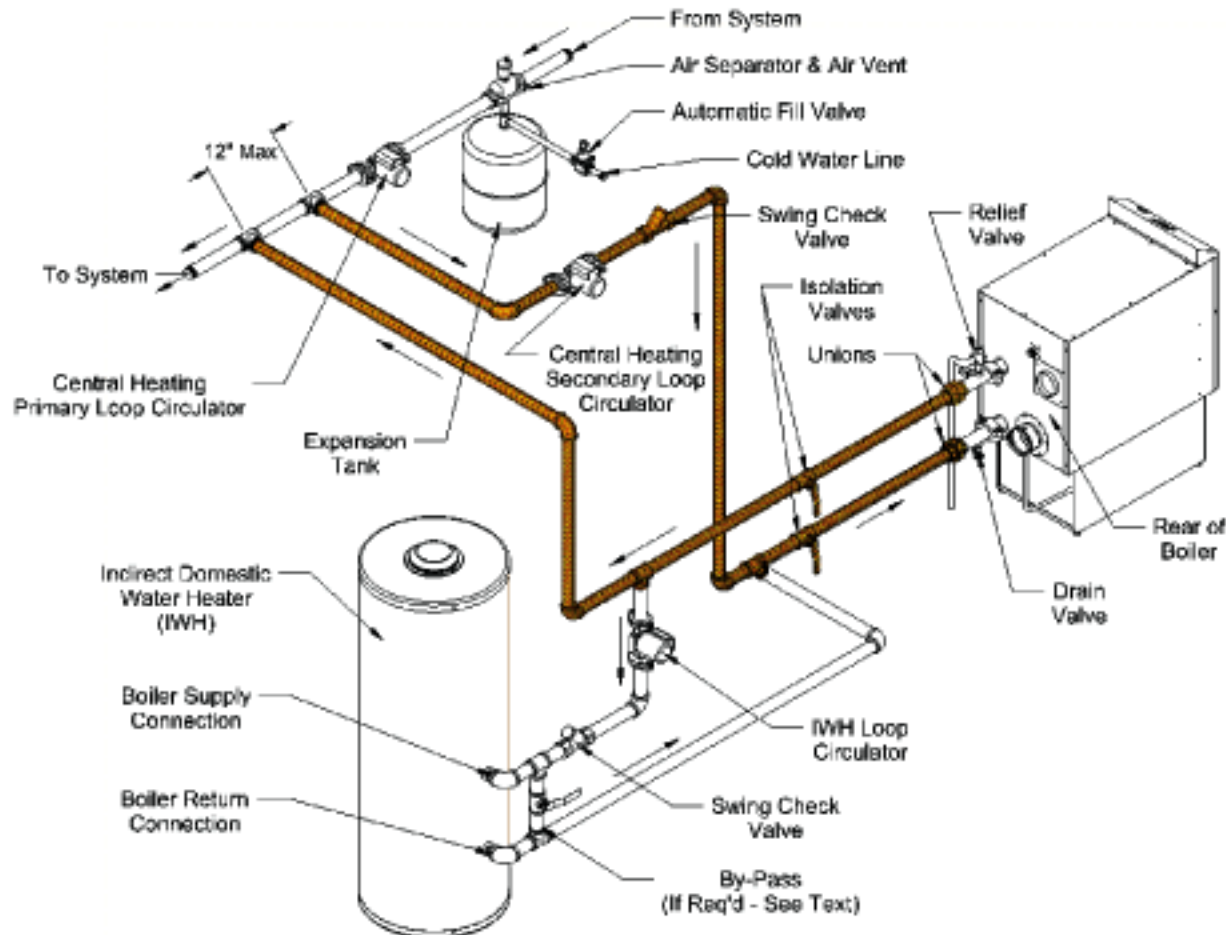


Figure 8.4a: Piping Method #1 - Secondary Loop Piping (Shaded)

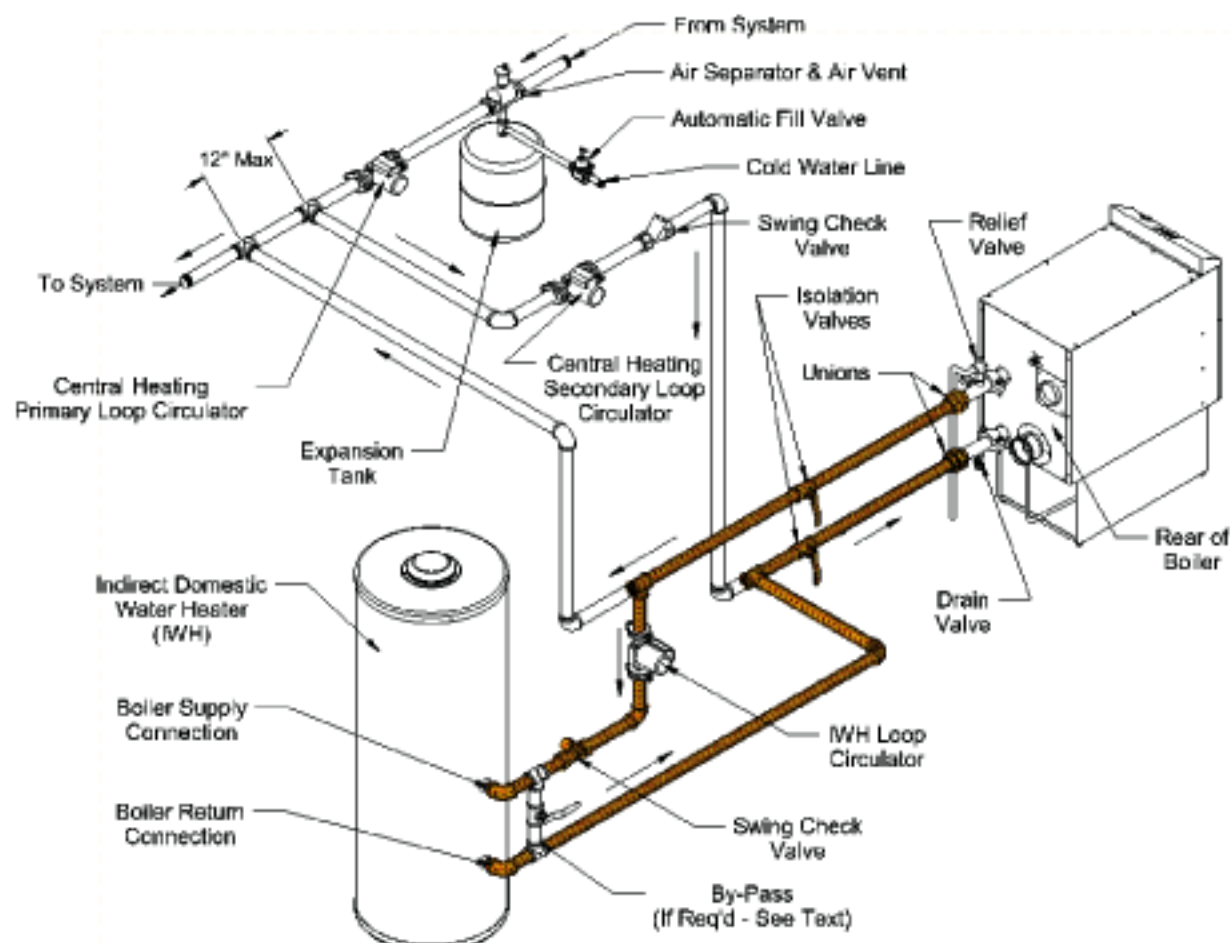


Figure 8.4b: Piping Method #1 - Indirect Water Heater Loop Piping (Shaded)

TABLE 8.5: PIPE AND CIRCULATOR SIZING FOR BOILER LOOP

BOILER MODEL	(a)	(b)	(c)	(d)	(e)
	PIPE SIZE	FLOW	TEMP RISE	CIRCULATOR MODEL	BOILER LOOP MAX EQUIVALENT LENGTH
	(in NPT)	(GPM)	(F)		(ft)
BWC300	1-1/2	15.0	35	Taco 0010	124
BWC300	1-1/2	15.0	35	Taco 0012	234
BWC300	1-1/2	20.0	27	Taco 0012	89
BWC300	2	20.0	34	Taco 0012	455
BWC300	2	25.0	21	Taco 0012	116
BWC399	1-1/2	20.0	35	Taco 0012	128
BWC399	2	20.0	35	Taco 0012	618
BWC399	2	26.0	27	Taco 0012	199
BWC399	2-1/2	33.0	21	Taco 0012	108
BWC425	1-1/2	21.0	35	Taco 0012	111
BWC425	2	21.0	35	Taco 0012	512
BWC425	2	28.0	26	Taco 0012	147
BWC425	2-1/2	35.0	21	Taco 0012	50

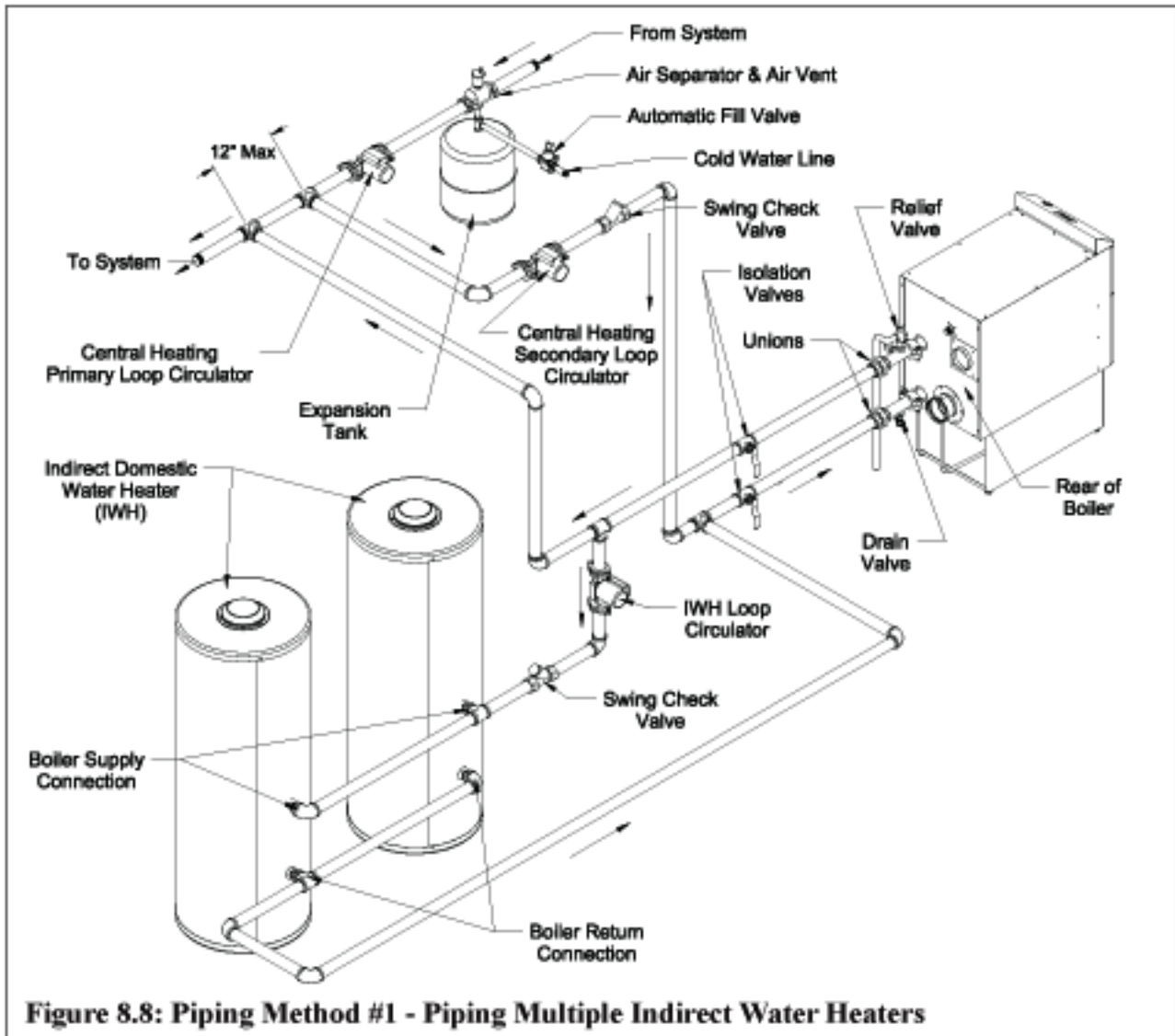
TABLE 8.6: FITTING EQUIVALENT LENGTHS

FITTING	PIPE SIZE	EQUIVALENT LENGTH (ft)
90 ELBOW	1	2.8
TURN IN TEE	1	5.5
RUN OF TEE	1	1.8
SWING CHECK	1	7.0
GATE VALVE	1	0.6
90 ELBOW	1-1/4	3.8
TURN IN TEE	1-1/4	8.0
RUN OF TEE	1-1/4	2.5
SWING CHECK	1-1/4	10.0
GATE VALVE	1-1/4	0.8
90 ELBOW	1-1/2	4.5
TURN IN TEE	1-1/2	10.0
RUN OF TEE	1-1/2	2.8
SWING CHECK	1-1/2	12.5
GATE VALVE	1-1/2	1.0

FITTING	PIPE SIZE	EQUIVALENT LENGTH (ft)
90 ELBOW	2	5.5
TURN IN TEE	2	12.5
RUN OF TEE	2	3.5
SWING CHECK	2	15.0
GATE VALVE	2	1.3
90 ELBOW	2-1/2	7.0
TURN IN TEE	2-1/2	15.0
RUN OF TEE	2-1/2	4.0
SWING CHECK	2-1/2	17.5
GATE VALVE	2-1/2	1.5

TABLE 8.7: PIPE AND CIRCULATOR SIZING FOR INDIRECT WATER HEATER LOOP

BOILER MODEL	(a)	(b)	(c)	(d)	(e)	(f)	(g)
	I.W.H. BRANCH PIPE SIZE	I.W.H. LOOP FLOW	MAX. I.W.H. PRESS. DROP	CROWN INDIRECT WATER HEATERS	CIRC. MODEL	I.W.H. LOOP MAX EQ. LENGTH	I.W.H. BY-PASS REQ'D?
	(in NPT)	(GPM)	(ft HEAD)			(ft)	
BWC300	1	8.0	3.0	MS-26, MS-40 MSH-40H MT040GBR - MT080GBR	Taco 008	56	N
BWC300	1	8.0	3.0	MS-26, MS-40 MSH-40H MT040GBR - MT080GBR	Taco 009	112	N
BWC300	1	8.0	5.0	MS-53, MS-79 MSH-53H	Taco 008	32	N
BWC300	1	8.0	5.0	MS-53, MS-79 MSH-53H	Taco 009	87	N
BWC300	1-1/4	12.7	8.0	MS-119	Taco 0014	72	N
BWC300	1-1/2	16.0	5.0	(2 ea.) MS-26 - MS-79 (2 ea.) MSH-40H, MS-53H (2 ea.) MT040GBR - MT080GBR	Taco 0014	73	N
BWC399 BWC425	1-1/4	8.0	3.0	MS-26, MS-40 MSH-40H MT040GBR - MT080GBR	Taco 0010	45	Y
BWC399 BWC425	1-1/4	8.0	3.0	MS-26, MS-40 MSH-40H MT040GBR - MT080GBR	Taco 0012	107	Y
BWC399 BWC425	1-1/4	8.0	5.0	MS-53, MS-79 MSH-53H	Taco 0012	72	Y
BWC399 BWC425	1-1/4	12.7	8.0	MS-119	Taco 0014	81	N
BWC399 BWC425	1-1/2	16.0	5	(2 ea.) MS-26 - MS-79 (2 ea.) MSH-40H, MS-53H (2 ea.) MT040GBR - MT080GBR	Taco 0014	113	N



**TABLE 8.9: MAXIMUM ALLOWABLE D.H.W. FIRING RATE
(Inputs in Bold are Factory Settings)**

BOILER MODEL	FLOW THROUGH BOILER DURING CALL FOR D.H.W. (GPM)			MAX. ALLOWABLE D.H.W. FIRING RATE (MBH)	MAX ALLOWABLE D.H.W. FAN SPEED (par. 15/16 - RPM)	BOILER D.H.W. OUTPUT (MBH)
	BOILER	I.W.H.	I.W.H. BYPASS			
BWC300	8.0	8.0	N/A	168	3250	150
BWC300	12.7	12.7	N/A	262	5000	245
BWC300	15.0	15.0	N/A	300	5500	265
BWC399 BWC425	12.0	8.0	4.0	254	3000	236
BWC399 BWC425	12.7	12.7	N/A	272	3250	245
BWC399 BWC425	16	16	N/A	335	4000	310
BWC399	20.0	20.0	N/A	399	4800	350
BWC425	22.0	22.0	N/A	425	5000	367

Method 2: Direct Connection to Heating System (Generally NOT Recommended)

The BWC can be connected directly to the heating system as is done with conventional boilers (Figure 8.10). If this is done, the flow rate through the boiler will equal the flow rate through the system. The flow rate through the system must therefore always remain within the limits shown in Table 8.1. For this reason, the pressure drop through the entire system must be known, added to the boiler pressure drop, and a circulator selected which will provide the required flow at the total calculated pressure drop.

This method is generally not recommended because it is often very difficult to accurately calculate the pressure drop through the system. In replacement installations, it may be impossible to get an accurate measurement of the amount of piping and number of fittings in the system. In addition, if the system is zoned, the system flow may drop well below the minimum required when only one zone is calling for heat.

The one advantage to this method is its installation simplicity. It may make sense to use this method when the boiler is to be installed with a new single zone system having a low-pressure drop. Pressure drop curves for the BWC Series boilers are shown in Figure 8.11. Calculation of the system pressure drop, and selection of the circulator, must be performed by someone having familiarity with pressure drop calculations, such as an HVAC engineer.

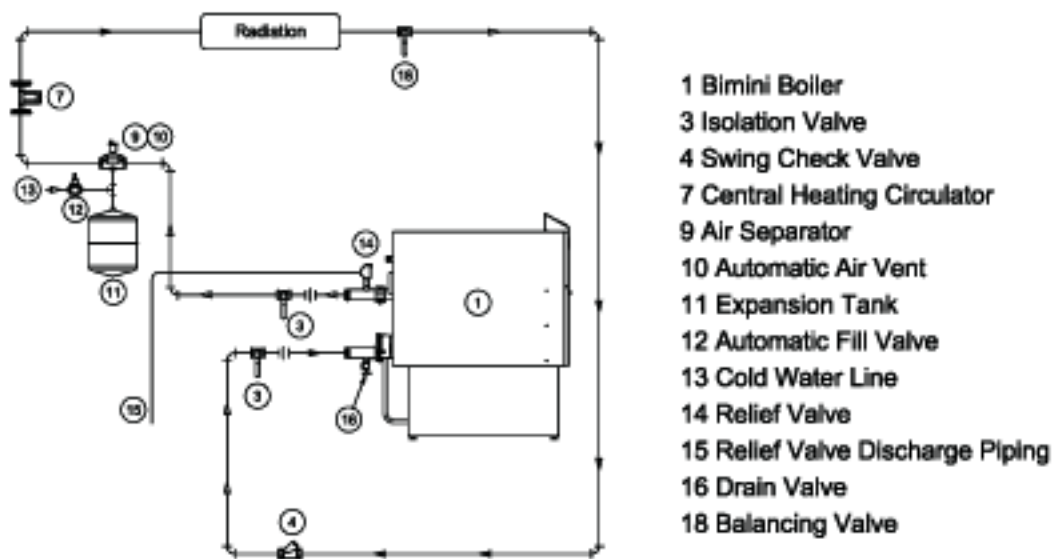


Figure 8.10: Piping Method #2 - Direct Connection of Boiler to Heating System

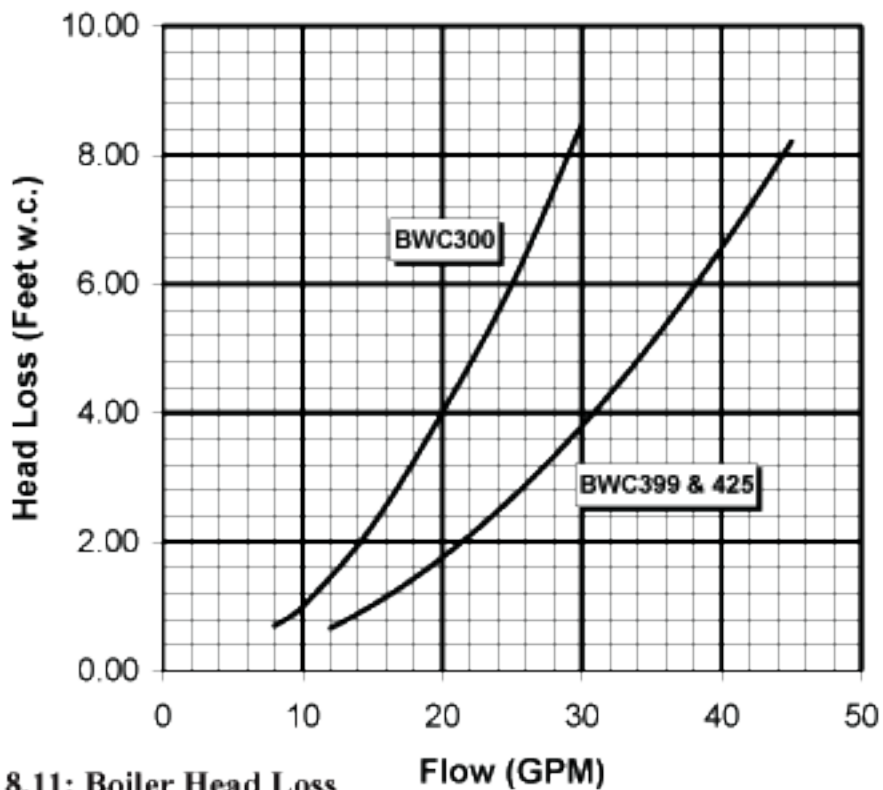


Figure 8.11: Boiler Head Loss

C: Standard Piping Installation Requirements

Observe the following guidelines when making the actual installation of the boiler piping:

- 1) The relief valve, low water cut-off (LWCO), and boiler drain are mounted in special fittings that are attached to the boiler supply and return connections using groove couplings as shown in Figure 2.1. The relief valve and LWCO are mounted in the supply fitting and the boiler drain is mounted in the return fitting. In order to avoid damage to these components, it is generally recommended that they be installed in the supply and return fittings after the connections to the system are made.
- 2) **Relief Valve** - The factory-supplied relief valve is set to open at 30 psi. If the valve is replaced, the replacement must have a relief capacity in excess of the minimum relief valve capacity shown on the rating plate. Pipe the discharge of the relief valve to a location where water or steam will not create a hazard or cause property damage if the valve opens. The end of the discharge pipe must terminate in an unthreaded pipe. If the relief valve discharge is not piped to a drain, it must terminate at least 6 inches above the floor. Do not run relief valve discharge piping through an area that is prone to freezing. The termination of the relief valve discharge piping must be in an area where it is not likely to become plugged by debris.

DANGER

- PIPE RELIEF VALVE DISCHARGE TO A SAFE LOCATION.
- DO NOT INSTALL A VALVE IN THE RELIEF VALVE DISCHARGE LINE.
- DO NOT INSTALL RELIEF VALVE IN A LOCATION OTHER THAN THAT SPECIFIED BY THE FACTORY.
- DO NOT PLUG THE RELIEF VALVE DISCHARGE.

- 3) Circulator (Required) - Usually at least two circulators will be required to properly install a BWC Series boiler. See previous section (System Design) for information on sizing the circulators.
- 4) Expansion Tank (Required) - If this boiler is replacing an existing boiler with no other changes in the system, the old expansion tank can generally be reused. If the expansion tank must be replaced, consult the expansion tank manufacturer's literature for proper sizing.
- 5) Fill Valve (Required) - Either a manual or automatic fill valve may be used. The ideal location for the fill is at the expansion tank.
- 6) Automatic Air Vent (Required) - At least one automatic air vent is required. Manual vents will usually be required in other parts of the system to remove air during initial fill.
- 7) Manual Reset High Limit (Required by some codes) - This control is required by ASME CSD-1 and some other codes. Install the high limit in the boiler supply piping just above the boiler with no intervening valves. Set the manual reset high limit to 200°F. Wire the limit per Figures 9.1 & 9.2 in the Wiring section.
- 8) Flow Control Valve (Required) - The flow control valve prevents flow through the system unless the circulator is operating. Flow control valves are used to prevent gravity circulation or "ghost flows" in circulator zone systems through zones that are not calling for heat.
- 9) Isolation Valves (Required) - Isolation valves are required to permit servicing of the boiler and groove couplings, as they will eliminate having to drain and refill the entire system.
- 11) Drain Valve (Required) - The drain valve is installed in the return fitting on the back of the boiler as shown in Figure 2.1.
- 12) Low Water Cut-off (Required) - The low water cut-off supplied with this boiler must not be removed. It is installed in the side of the supply fitting as shown in Figure 2.1. Plug the harness protruding from the back of the boiler into the low water cut-off.

D. Piping for Special Situations

- 1) Systems containing oxygen - Many hydronic systems contain enough dissolved oxygen to cause severe corrosion damage to an aluminum boiler such as the BWC. 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 as shown in Figure 8.12. 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.

- 2) Piping with a Chiller - If the boiler is used in conjunction with a chiller, pipe the boiler and chiller in parallel as shown in Figure 8.13. Use isolation valves to prevent chilled water from entering the boiler.
- 3) 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.
- 4) Multiple Boiler Piping - Recommended piping for multiple BWC Series Boilers is shown in Figure 8.14. Each boiler is piped into two closely spaced tees in a "cross-over bridge" connecting the supply and return sides of the primary loop. The cross-over bridges are the same size as the primary loop piping and are piped in a reverse-return manner so that the flow through the primary loop is evenly divided among the bridges. At least 8 diameters of straight pipe must be located upstream of the return tee in the bridge and at least 4 diameters of straight pipe downstream of the supply tee in the bridge.

Figure 8.12: Isolation of the Boiler From Oxygenated Water with A Plate Heat Exchanger

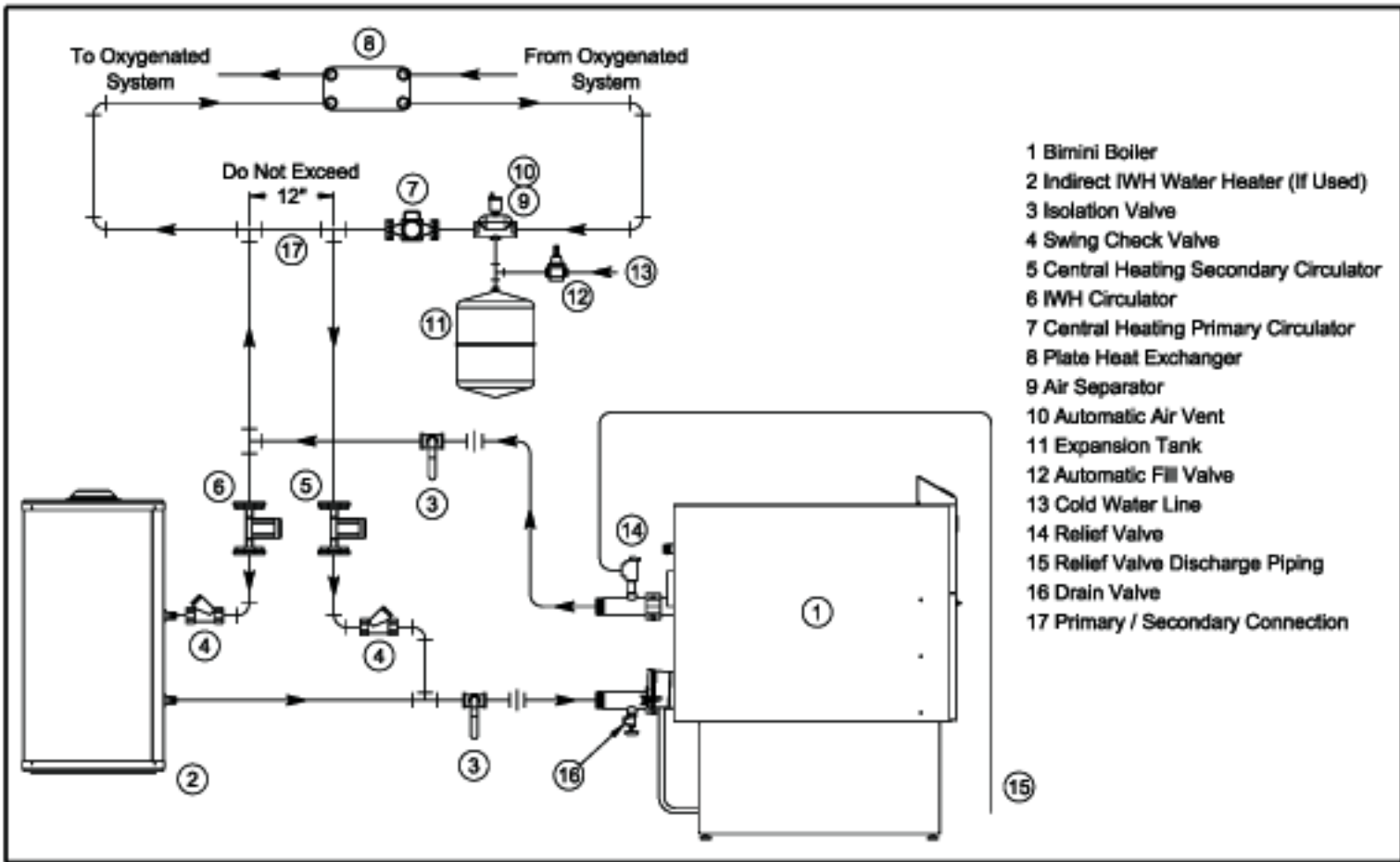
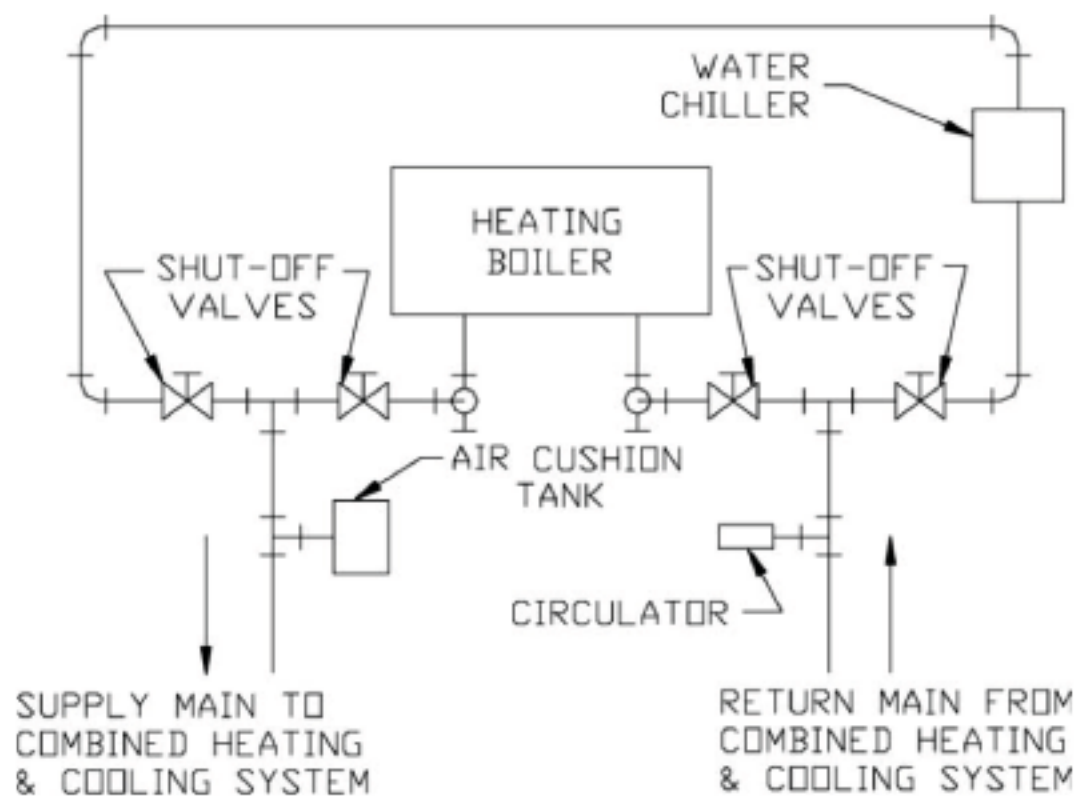


Figure 8.13: Chiller Piping



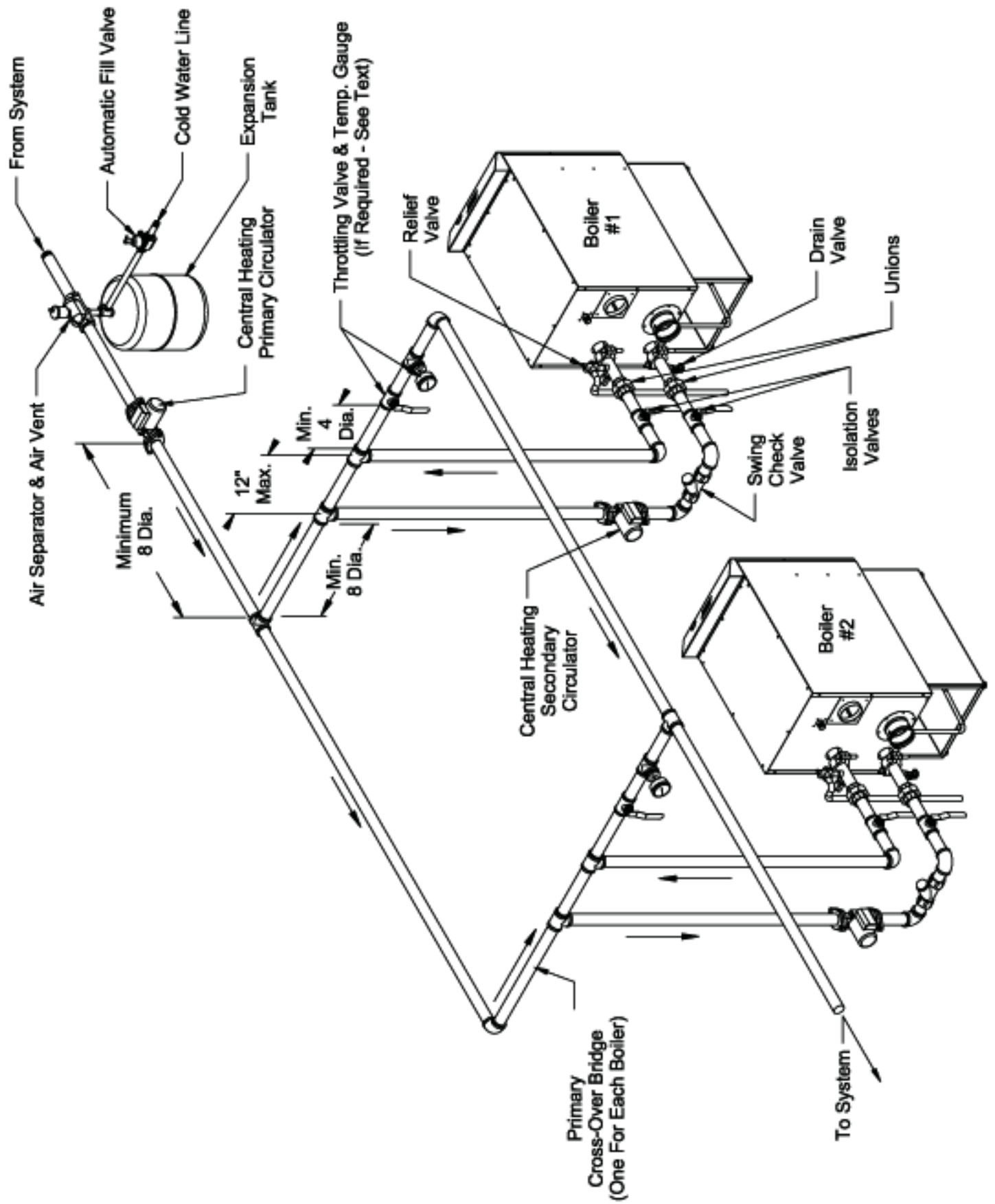


Figure 8.14: Multiple Boiler Piping

IX 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) Line Voltage (120 VAC) Connections (Fig 9.1) – The line voltage connections are located in the junction box on the right side of the vestibule:
 - Black – Line voltage “hot”
 - White – “Neutral” for boiler and circulators
 - Red – “Heating” circulator “hot”
 - Blue – “Indirect Water Heater” circulator “hot”
 - Green – Ground connection
- 2) Maximum circulator continuous current draw is 2A. When Piping Method #1 is used, it may be desirable to use the boiler to directly control the primary circulator in addition to the secondary circulator. If this is done, control both heating circulators using a relay with a 120VAC coil, such as a Honeywell R4222, as shown in Figure 9.3. Select a relay with a contact rating in excess of the combined draw of the two circulators.
- 3) Low Voltage Connections (Fig 9.1) – These connections are screw terminals located on the terminal strip next to the junction box on the left:
 - Terminals 1 and 2 – “Heating” thermostat connections
 - Terminals 3 and 4 – “External Limit Control” connections
 - Terminals 5 and 6 – “Outdoor Reset Sensor” connections
 - Terminals 7 and 8 – “Domestic Indirect Water Heater” thermostat connections
 - Terminal 9 – “Flame Signal Reading”
 - Terminal 10 – “0-10 VDC (+)” external analog input signal
 - Terminal 11 – “0-10 VDC (-)” external analog input signal
 - Heat anticipator setting for the thermostat connection is 0.1 A when thermostat is connected directly to terminals 1 and 2.

CAUTION

- WHEN MAKING LOW VOLTAGE CONNECTIONS, MAKE SURE THAT NO EXTERNAL POWER SOURCE IS PRESENT IN THE THERMOSTAT OR LIMIT CIRCUITS. IF SUCH A POWER SOURCE IS PRESENT, IT COULD DESTROY THE BOILER’S MICROPROCESSOR CONTROL (MCBA). ONE EXAMPLE OF AN EXTERNAL POWER SOURCE THAT COULD BE INADVERTENTLY CONNECTED TO THE LOW VOLTAGE CONNECTIONS IS A TRANSFORMER IN OLD THERMOSTAT WIRING.

- 4) If the outdoor sensor is connected to terminals 5 and 6, the boiler will adjust the target space heating set point supply water temperature downwards as the outdoor air temperature increases. If used, this sensor should be located on the outside of the structure in an area where it will sense the average air temperature around the house. Avoid placing this sensor in areas where it may be covered with ice or snow. In general, locations where the sensor will pick up direct radiation from the sun should also be avoided. Avoid placing the sensor near potential sources of electrical noise such as transformers, power lines, and fluorescent lighting. Wire the sensor to the boiler using 22 gauge or larger wire. As with the sensor, the sensor wiring should be routed away from sources of electrical noise. Where it is impossible to avoid such noise sources, wire the sensor using a 2 conductor, UL Type CM, AWM Style 2092, 300Volt 60°C shielded cable. Connect one end of the shielding on this cable to ground.

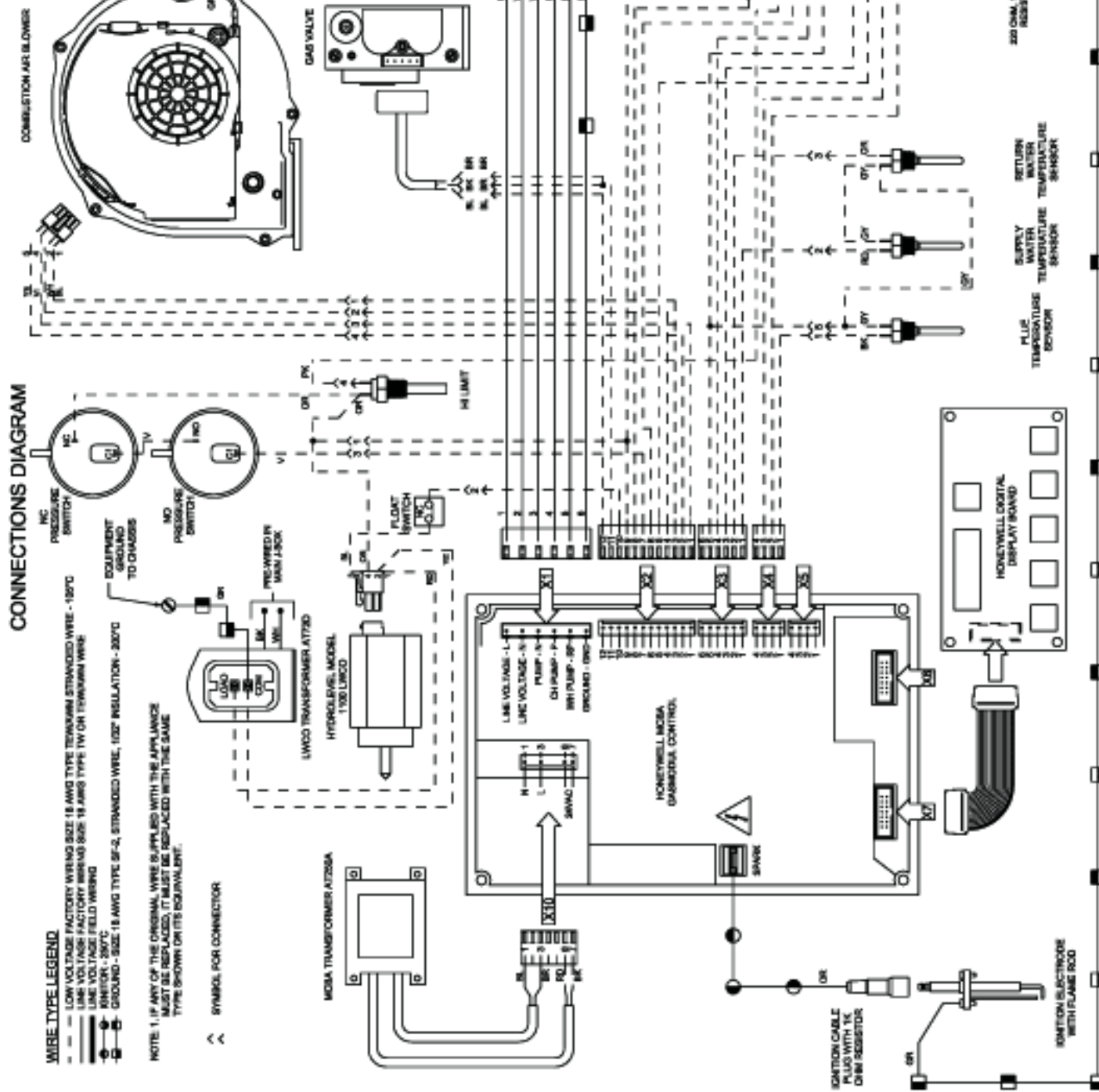
CONNECTIONS DIAGRAM

WIRE TYPE LEGEND

- LOW VOLTAGE FACTORY WIRING SIZE 18 AWG TYPE THERMURM STRANDED WIRE - 120°C
- LINE VOLTAGE FACTORY WIRING SIZE 18 AWG TYPE TW OR THHN/THWN WIRE
- LINE VOLTAGE FIELD WIRING
- KNOTION - 250°C
- GROUND - SIZE 18 AWG TYPE SF-2, STRANDED WIRE, 102° INSULATION - 307°C

NOTE 1: IF ANY OF THE ORIGINAL WIRE IS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH THE SAME TYPE SHOWN ON ITS EQUIVALENT.

⋈ SYMBOL FOR CONNECTOR



WIRE CODE

BK	BLACK
BL	BLUE
BRN	BROWN
GRN	GREEN
GRY	GRAY
OR	ORANGE
PK	PINK
RD	RED
WH	WHITE
YE	YELLOW

LOW VOLTAGE TERMINAL STRIP

1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11
1	2	3	4	5	6	7	8	9	10	11

Figure 9.1: Wiring Connections Diagram

LADDER DIAGRAM

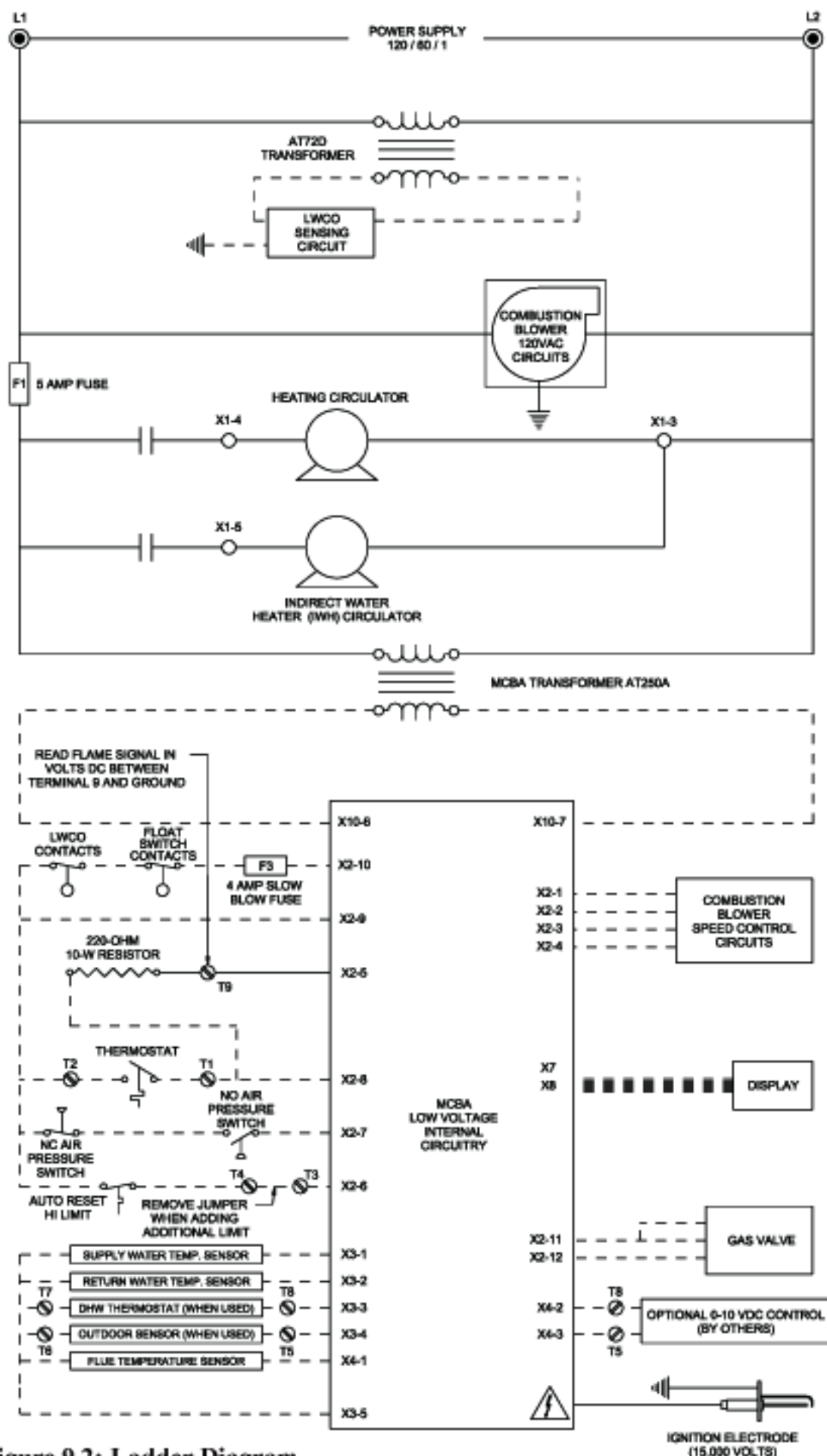


Figure 9.2: Ladder Diagram

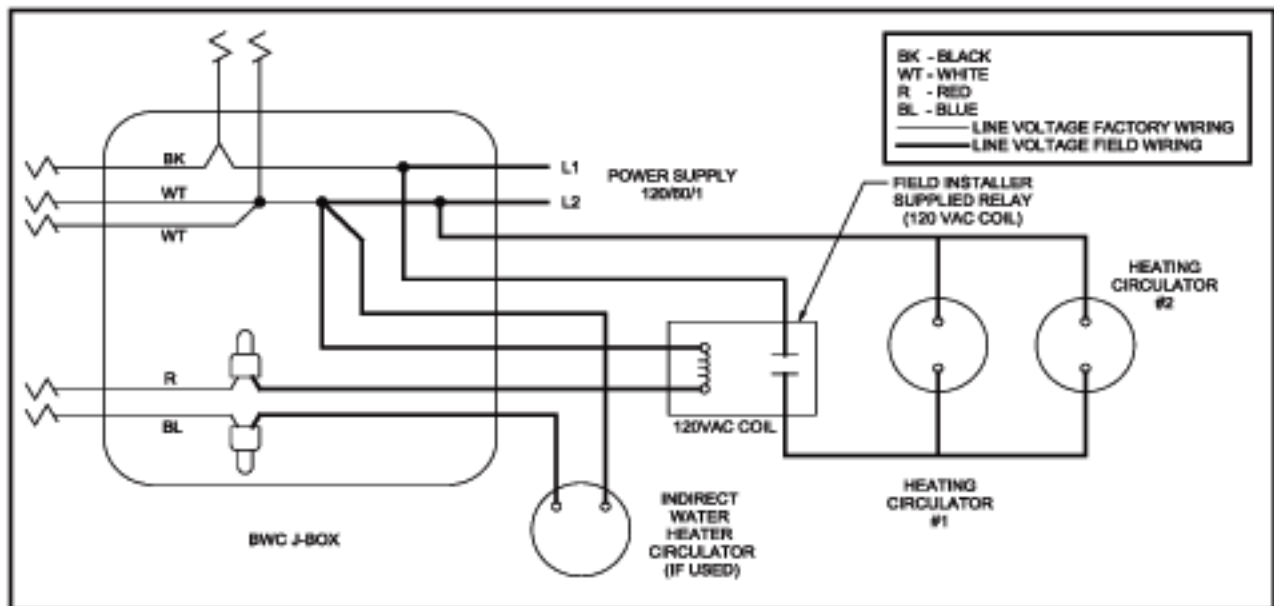


Figure 9.3: Wiring of Isolation Relay for Control of Two Heating Circulators

- 5) A 0-10 VDC external analog control signal installed across terminals 10 and 11 can be used to either adjust the boiler water setpoint or to control the firing rate. Refer to the 0-10VDC control manufacturer's instructions for the size and type of wire to use for the 0-10VDC connections between the external control and the boiler. In general, it is a good idea to route this wiring away from potential sources of electrical noise, such as transformers, power lines, and fluorescent lighting. Where such sources cannot be avoided, it may be necessary to use properly grounded shielded cable.

The MCBA (boiler control) must be reprogrammed in order to accept the 0-10VDC signal. Refer to Appendix A for information on how to do this.

X Start-up and Checkout

NOTE

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

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

- 1) If not already done, flush the system to remove sediment, flux, and traces of boiler additives. This should be done with the boiler isolated from the system.
- 2) Fill the boiler and hydronic system with water meeting the following requirements:
 - pH between 6.5 and 8.5
 - Total Solids less than 2500 PPM
 - Hardness less than 120 PPM (7 Grains/Gallon)
 - Pressurize the system to at least 12 psi at the boiler

WARNING

- NEVER ATTEMPT TO FILL A HOT EMPTY BOILER.

- 3) Check all new 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.

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

- 4) Vent system must be complete and free of obstructions before attempting to fire boiler. Make sure that the silicone cure time called for in the vent assembly instructions has passed before firing boiler.
- 5) Inspect all line voltage wiring for loose or uninsulated connections.
- 6) Remove the dust cap from the condensate trap (Fig 6.11). Add water to the trap until water runs out the condensate drain. Reinstall the dust cap.

WATER QUALITY AND BOILER WATER ADDITIVES

IMPORTANT NOTE

This boiler is equipped with an aluminum heat exchanger that can be seriously damaged by failure to follow the following guidelines:

- 1) Flush the system before connecting the boiler - In a replacement installation, flushing the system will remove sediment, solder flux, and traces of old boiler additives. Even if the system is new, do not omit this step - new systems will contain solder flux and may even contain sediment.
- 2) Make sure that the system is tight - **This is the single most important guideline.** Tap water contains dissolved oxygen which causes corrosion. In a tight system, this oxygen comes out of solution and is quickly removed from the system through the automatic air vent. The system then remains essentially free of oxygen. If the system is not tight, however, frequent additions of make-up water can expose the heat exchanger to oxygen on a continuous basis. In addition, frequent additions of hard make-up water can cause calcium deposits to collect in the heat exchanger, causing severe damage.

To minimize additions of make-up water:

- Inspect the system thoroughly for leaks before placing it in service.
- If the system includes underground piping, or other piping in which a leak might go undetected, consider isolating the boiler from the system with a heat exchanger. Alternatively, consider installing a water meter in the fill line to record additions of make-up water.
- Make sure that the expansion tank is properly sized and in good condition. If it is not, the relief valve may open frequently, resulting in regular additions of make-up water.

3) Radiant Tubing and Oxygen Barriers - Even if the system is tight, oxygen can be introduced into the system through some types of non-metallic tubing used in radiant or snow melt systems. Other non-metallic tubing is equipped with an oxygen barrier to prevent migration of oxygen into the water. If the boiler is to be installed in a system containing non-metallic tubing without an oxygen barrier, it must be isolated from the boiler with a heat exchanger as shown in Figure 8.12.

4) Antifreeze - Do not use antifreeze unless absolutely necessary. If antifreeze must be used, the only permitted antifreezes are:

- Fernox Alpha-11
- Fernox CHP in USP Grade virgin propylene glycol (available from Crown)

If either of the above antifreezes are used, test the boiler water on an annual basis to ensure that the antifreeze remains non-corrosive. This is done with Fernox test kit I-TK (available from Crown).

5) Other Antifreezes and Boiler Additives - Do not add other additives unless they are specifically approved in writing by Crown for use with this boiler. This includes other "aluminum safe" antifreezes.


6) System pH - Maintain the pH in the system between 6.5 and 8.5.

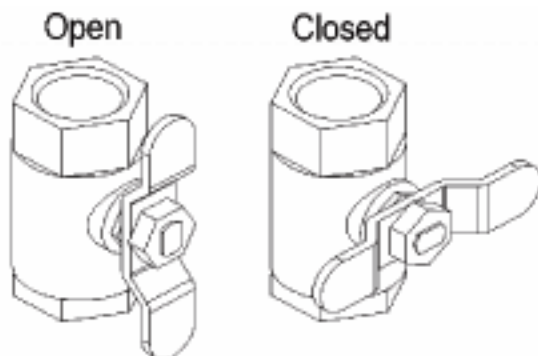
FOR YOUR SAFETY READ BEFORE LIGHTING

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 does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
 - If you cannot reach your gas supplier, call the fire department.
 - B. BEFORE OPERATING 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.


OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to the lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Remove the front door panel and the upper boiler access panel.
6. Turn the external boiler manual gas valve T-handle counterclockwise to open gas supply. 
7. Smell for gas in the boiler enclosure. If you smell gas, STOP! Follow "B" in the safety information above. If you don't smell gas, go to the next step.
8. Turn on all electric power to the appliance.
9. Set the thermostat to the desired setting.
10. The first digit of the control display panel will show a series of numbers that indicate the boiler control sequence. The number 3 or 4 means the burner is firing. The number 0 means there is no call for heat from the thermostat or the domestic water heater.
11. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" below and call your service technician or gas supplier.
12. Replace the upper boiler access panel and the front door panel.



External Boiler Manual Gas Valve

TO TURN OFF GAS TO THE APPLIANCE

1. Turn off all electric power to the appliance if service is to be performed.
2. Set the thermostat to the lowest setting.
3. Turn the external boiler manual gas valve T-handle clockwise to close the gas supply. 
4. Replace the upper boiler access panel and the front door panel.

- 7) Start the boiler using the lighting instructions on page 53. After the boiler is powered up, it should go through the following sequence.

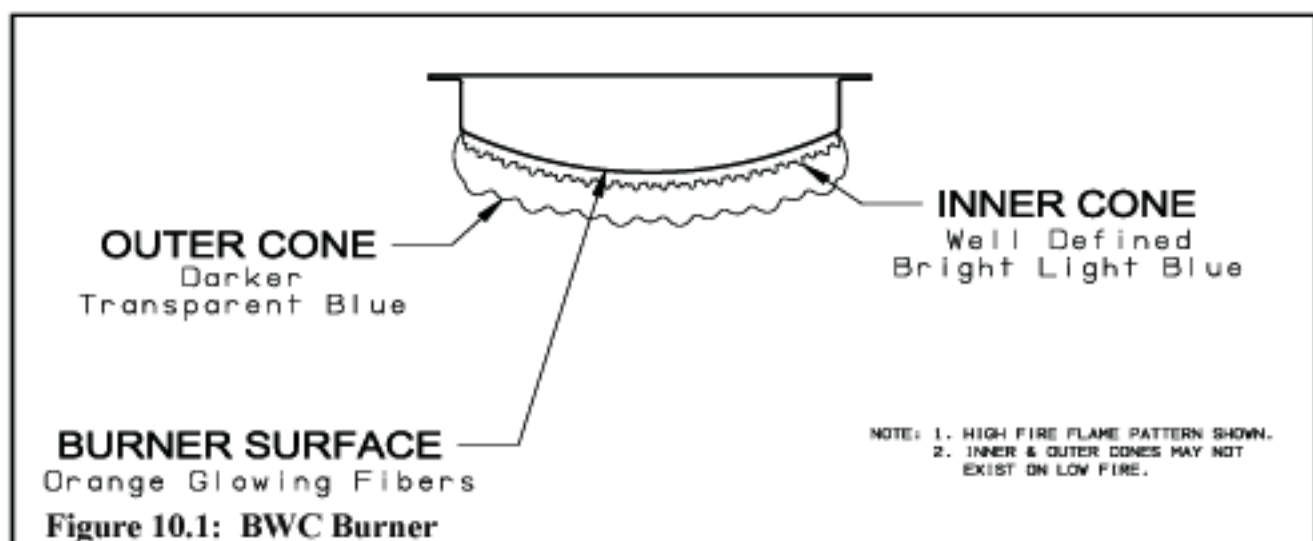
Sequence	Display	Meaning
1	<i>U.126</i> or Blank	Checking internal software (power-up only)
2	<i>0.5WT</i>	Boiler in standby. <i>5WT</i> = Supply Water Temp. No call for heat. (After call for heat from heating thermostat)
3	<i>A.5WT</i>	Self-Check on Start-up
4	<i>5.5WT</i>	Blower and circulator on. Checking for adequate air flow.
5	<i>1.5WT</i>	Prepurge
6	<i>2.5WT</i>	Trial for ignition
7	<i>3.5WT</i>	Flame established. Boiler responding to a call for heat.

- 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. The maximum number of tries are as follows:

- BWC300 - 5
- BWC399/425 - 2

If more tries for ignition are needed, it will be necessary to press the reset button to restart the boiler. 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) Inspect the flame visible through the window. On high fire the flame should be stable and mostly blue (Fig.10.1). No yellow tipping should be present; however, intermittent flecks of yellow and orange in the flame are normal.



- 10) Check the inlet pressure and adjust if necessary. Verify that the inlet pressure is between the upper and lower limits shown on the rating plate with all gas appliances on and off.

WARNING

THE CORRECT OUTLET PRESSURE FOR THE GAS VALVE HAS BEEN FACTORY SET AND REQUIRES NO FIELD ADJUSTMENT. THIS SETTING IS SATISFACTORY FOR BOTH NATURAL GAS AND PROPANE. ATTEMPTING TO ADJUST THE OUTLET PRESSURE MAY RESULT IN DAMAGE TO THE GAS VALVE AND CAUSE PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

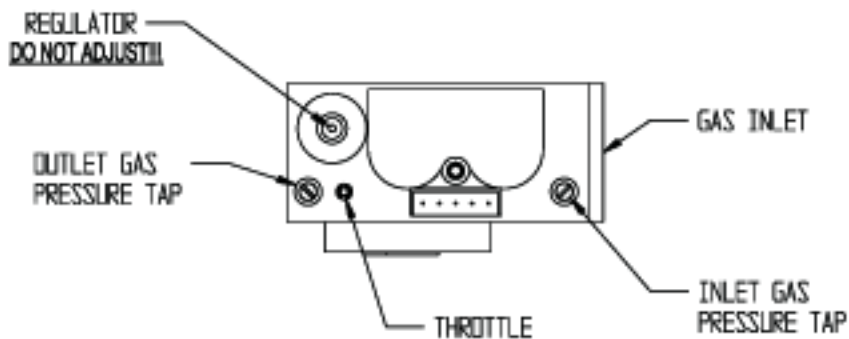


Figure 10.2: Dungs Gas Valve Detail

- 11) Perform a combustion test. The flue gas sample may be drawn from any of the following points:
- All stainless steel vent adaptors are equipped with a combustion test port
 - The optional concentric vent adaptor used with the BWC300 has no test port, but a sample can be drawn from the condensate drain connection on the bottom of the adaptor. If this is done, disconnect the plastic tubing from the bottom of the adaptor and temporarily plug it.
 - A sample can be drawn by inserting the combustion analyzer probe into the vent terminal.

There is also a sample port under the control console from which the combustion air in the cabinet can be sampled (this is useful if flue gas recirculation is suspected). If this port is used, be sure to replace the rubber plug when the test is completed.

Check CO₂ (or O₂) and CO at both high and low fire. The boiler may be temporarily locked into high or low fire for 15 minutes as follows:

- To lock the boiler in high fire, simultaneously press and hold the "Mode" button and "+" button until the display flashes "H", indicating that the boiler has been driven to high fire. After this happens, allow the boiler to operate for approximately 5 minutes before taking combustion readings.
- To lock the boiler in low fire, simultaneously press and hold the "Mode" button and "-" button until the display flashes "L", indicating that the boiler has been driven to low fire. After this happens, allow the boiler to operate for approximately 5 minutes before taking combustion readings.

At both high and low fire, CO readings should be less than 75 PPM. Typical CO₂ readings are shown in Table 10.3. Normal modulation should return 15 minutes after the boiler is locked in high or low fire.

- 12) Test any external limits or other controls in accordance with the manufacturer's instructions.
- 13) Verify that the boiler starts and stops in response to calls for heat from the heating thermostat and indirect water heater thermostat. Make sure that the appropriate circulators also start and stop in response to the thermostats.

Table 10.3: Typical Sea Level CO₂/O₂ Combustion

Model	Fuel	%CO ₂	%O ₂
BWC300 (Dungs Valve)	Natural Gas	9.0	5.1
BWC399 (Dungs Valve)	Natural Gas	9.0	5.1
BWC425 (Dungs Valve)	Natural Gas	9.0	5.1
BWC300 (Dungs Valve)	Propane	10.2	5.4
BWC399 (Dungs Valve)	Propane	10.2	5.4
BWC425 (Dungs Valve)	Propane	10.2	5.4

WARNING

EACH BWC SERIES BOILER IS TESTED AT THE FACTORY AND ADJUSTMENTS TO THE AIR-FUEL MIXTURE ARE NORMALLY NOT NECESSARY. CONSULT A CROWN REPRESENTATIVE BEFORE ATTEMPTING TO MAKE ANY SUCH ADJUSTMENTS. IMPROPER GAS VALVE OR MIXTURE ADJUSTMENTS COULD RESULT IN PROPERTY DAMAGE, PERSONAL INJURY, OR LOSS OF LIFE.

XI Operation

- 1) The BWC boiler uses a microprocessor based control, known as a "MCBA", to manage all boiler functions including flame supervision and modulation. Two set point or "target" boiler supply temperatures are stored in the MCBA's memory; one for space heating and one for domestic water production. If an outdoor temperature sensor is connected to the boiler, the space heating supply set point will automatically adjust downwards as the outdoor temperature increases. For more information on this feature see the discussion on boiler water reset below.

The MCBA modulates the boiler input by varying the fan speed. As the fan speed increases, so does the amount of gas drawn into the blower. As a result, a fairly constant air-fuel ratio is maintained across all inputs.

The MCBA determines the input needed by looking at both current and recent differences between the supply temperature and the set point temperature. As the supply temperature approaches the set point temperature, the fan will slow down and the input drop.

The MCBA also monitors boiler return and flue temperatures. In addition, all other safety controls, including the low water cut-off and safety limit, are connected into the MCBA. The MCBA uses input from all of these controls to either shut down the boiler when an unsafe condition exists or, in some cases, to correct the problem.

- 2) The display panel has three primary modes of operation. These are:
 - Standby Mode – Displays boiler's current status. This is the default operating mode.
 - Parameter Mode – Used to change control settings
 - Information Mode – Displays boiler operating temperatures

Under normal conditions, the boiler is in standby mode and the display looks like that shown in Figure 11.1. The three digits to the right of the decimal point are the boiler's supply temperature. The digit to the left of the decimal point is the boiler's status code. A list of status codes, and their meanings, is shown in Table 11.3. Figure 11.2 is a map of the menu structure for the control panel. Push the mode key to move from one mode to the next. As you change modes, the mode you are entering is shown on the display:

- a) "PRR" for Parameter Mode
- b) "InFo" for Information Mode
- c) "Stby" for Standby Mode. Upon entering standby mode, "Stby" will briefly appear on the display and then the display will show the boiler's status along with the supply temperature (Figure 11.1).

The control will return to standby mode from any other mode if no key is pressed for 20 minutes.

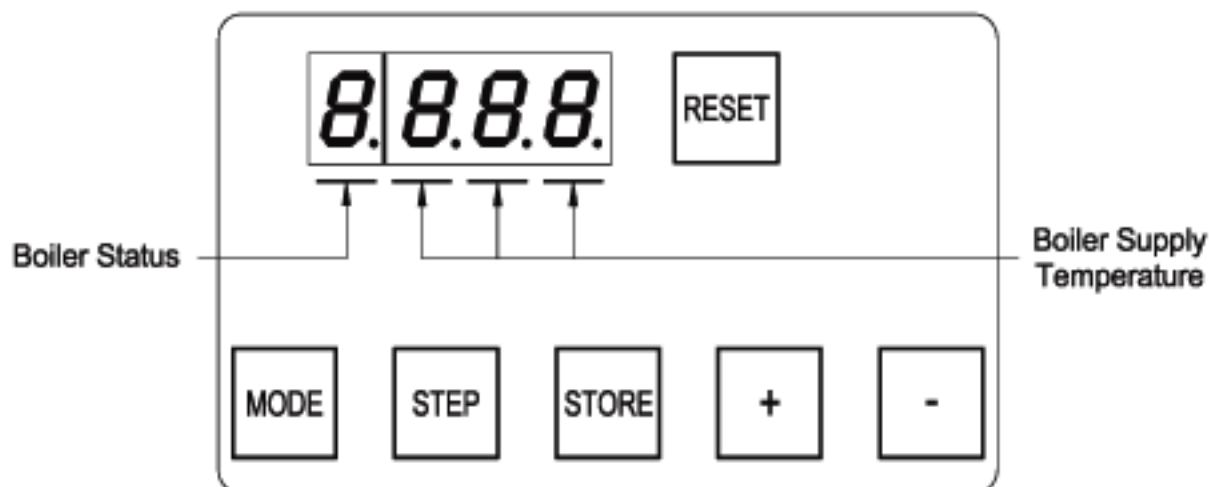


Figure 11.1: Normal Display In Standby Mode

In standby mode, it is possible to view both the heating supply set point temperature and the “domestic hot water reference set point”. The “domestic hot water reference set point” plus 45°F equals the boiler supply set point when it is responding to a call from the indirect water zone. It is not the actual domestic hot water set point. The BWC is designed for use with a storage type indirect water heater such as the Crown Mega-Stor. The domestic water set point is controlled by the thermostat on the indirect water heater. The “default domestic water reference set point” is 135°F and target boiler supply temperature when responding to a call from the indirect water heater is therefore 180°F (135°F + 45°F). The default heating supply set point (parameter 4) is 180°F.

In standby mode it is also possible to turn on or off either the heating or domestic water zone. There is normally no reason to turn off either of these zones and doing so is not recommended.

CAUTION

PUSHING AND HOLDING THE “+” WHILE IN STANDBY MODE WILL PREVENT THE BOILER FROM RESPONDING TO A CALL FOR HEAT. PUSHING AND HOLDING THE “-” WHILE IN STANDBY MODE WILL PREVENT THE BOILER FROM RESPONDING TO A CALL FOR DOMESTIC WATER. IF THIS HAPPENS, “cOFF” or “dOFF” WILL APPEAR ON THE DISPLAY. TO TURN BACK ON THE HEATING FUNCTION, PRESS AND HOLD “+” UNTIL “c” AND THE SET POINT TEMPERATURE APPEARS ON THE DISPLAY. TO TURN BACK ON THE DOMESTIC WATER FUNCTION, PRESS AND HOLD “-” UNTIL “d” AND THE SET POINT TEMPERATURE APPEARS ON THE DISPLAY. AFTER PRESSING ANY KEYS, AND BEFORE LEAVING THE INSTALLATION, VERIFY THAT THE BOILER FIRES IN RESPONSE TO A CALL FOR HEAT AND DOMESTIC WATER.

In standby mode, if “Mode” and either “+” or “-” are simultaneously pushed and held for at least 2 seconds, the burner can be forced into either high or low fire. This feature is used for running combustion tests. After 15 minutes, the burner will automatically revert to modulation. If it is desired to revert to modulation before 15 minutes has passed, simultaneously pushing “+” and “-” will restore modulation.

In Parameter mode both set points can be changed and both zones turned on or off. In addition, both zones can be configured for continuous pump operation. If the heating zone is set for continuous pump operation (parameter 3 set to 3), the heating pump will still shut down when there is a call for domestic hot water.

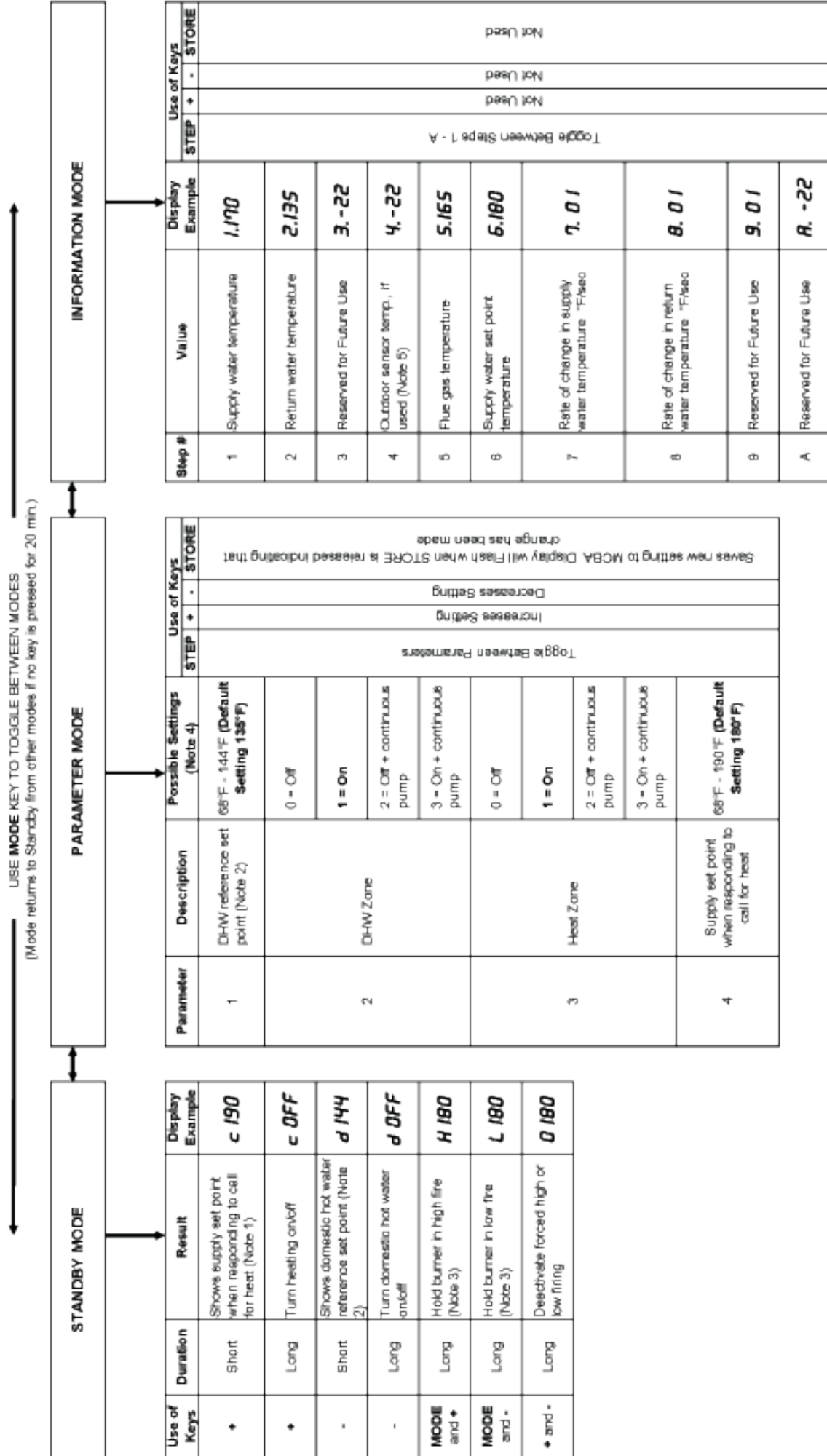
If either the heating supply set point (parameter 4), or the DHW reference set point (parameter 1) are set above their factory set values, the boiler supply temperature will exceed 180°F and there is a possibility that the safety temperature limit will open. If this happens, the boiler will shut down and a “b26” error will appear on the display. The boiler will resume normal operation without manual intervention when the safety limit closes (this behavior is common on conventional boilers).

Information mode is used to view various temperatures and settings but cannot be used to change parameters or otherwise control the boiler. The information available is shown in Figure 11.2 and is largely self-explanatory. The digit to the left of the decimal point is the Step number and the digits to the right are the corresponding temperature.

In information mode, the “supply water temperature set point” (Step 6), is the supply temperature set point for the zone to which the boiler is currently responding (either heat or DHW). If an outdoor sensor is connected to the boiler, and the boiler is responding to a call for heat, this value will be the current point on the reset curve. When no call for heat or DHW is present, Step 6 shows the heating supply set point.

In some cases a “-22” will appear in Information Mode for a particular reading. This means that the reading is not applicable. For example, “-22” will appear for the outdoor temperature (Step 4) if no outdoor sensor is connected to the boiler.

FIGURE 11.2: BASIC MENU TREE



Notes

- 1) If outdoor sensor is connected, this temperature is the supply temperature setpoint when the outdoor temperature is 0°F.
- 2) "Domestic water reference set point" + 45°F = boiler supply set point when boiler is responding to a call for domestic hot water (default = 180°F).
- 3) Boiler will automatically resume modulation after 15 minutes.
- 4) Factory default settings are shown in bold.
- 5) If no outdoor sensor is connected, display reads "4.-22".

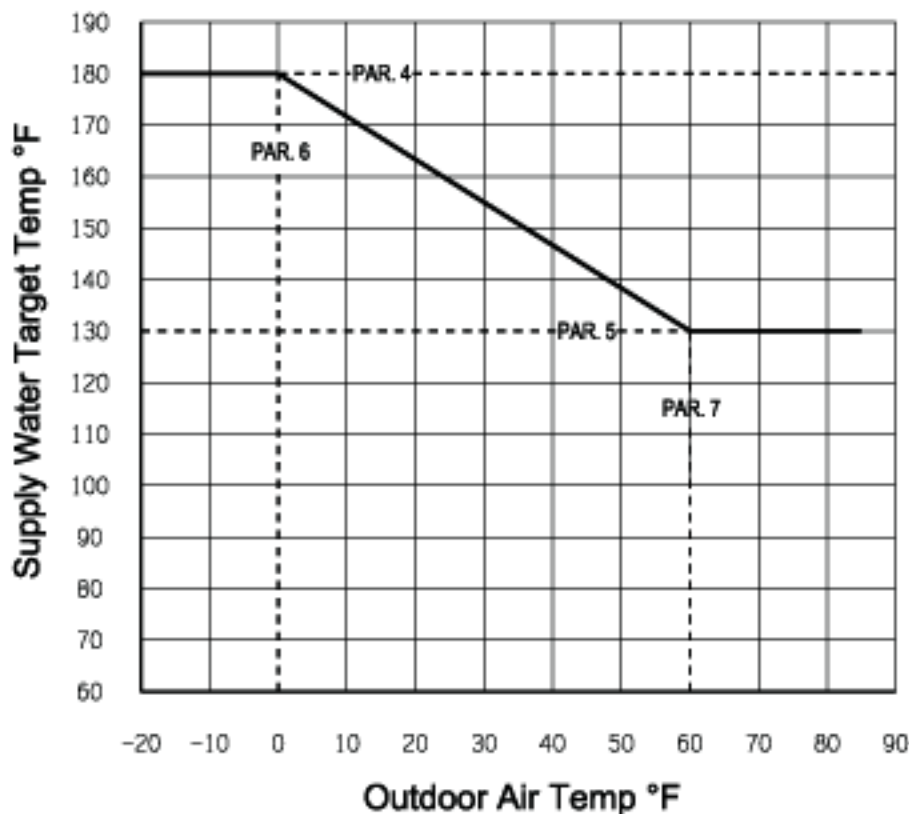
3) Two basic types of errors codes are shown on the display:

- **Soft Lockout Codes** – When a soft lockout occurs, the boiler will shut down and the display will alternate between the number “9” and the letter “b” followed by a two digit service code. A list of these codes, and their meanings, is shown in Table 11.3. The boiler will automatically restart once the condition that caused the lockout is corrected.
- **Hard Lockout Codes** – When a hard lockout occurs, the boiler will shut down and the display will flash the letter “E” followed by a two digit service code. A list of these codes, and their meanings, is shown in Table 11.3. Once the condition that caused the lockout is corrected, the boiler will need to be

First Digit	Boiler Status
0	Burner off - No call for heat or DHW
1	Pre-purge or post-purge
2	Ignition
3	Burner responding to call for heat
4	Burner responding to call for DHW
5	Checking air pressure switch
6	Burner off - Set point temperature has been reached
7	Call for heat ended. 10s heating post pump period
8	Call for DHW ended. 10s DHW post pump period
9 and b Flashing	Burner off - on soft lockout. See Troubleshooting Section to determine meaning of error code.
A	Boiler responding to call from heating zone
H	Burner on - Held in high fire
L	Burner on - Held in low fire

Table 11.3: Boiler Status

- 4) If an outdoor sensor is installed, the boiler will automatically adjust the heating zone set point temperature based on the outdoor reset curve in Figure 11.4. The maximum set point is defined by parameter 4 (factory set to 180°F) when the outdoor temperature is 0°F or below. The minimum set point temperature shown is 130°F when the outdoor temperature is also 60°F or above. As the outdoor temperature falls, the supply water target temperature increases. For example, if the outdoor air temperature is 30°F, the set point temperature for the supply water is 155°F.
- 5) An indirect water heater thermostat can be connected between terminals 7 and 8 on the terminal strip. When this thermostat closes, the central heating circulator will be turned off and the DHW circulator will be turned on.
- 6) An external limit control can be installed between terminals 3 and 4 on the terminal strip. Be sure to remove the jumper between terminals 3 and 4 when adding an external limit control to the system. If the external limit opens, the boiler will shut down and error code “b 26” will be displayed. If the limit installed is a manual reset type, it will need to be reset before the boiler will operate.



In This Example:

Par. 4 = 180F

Par. 5 = 130F

Par. 6 = 0F

Par. 7 = 60F

Figure 11.4: Outdoor Reset Curve

- 7) The sequence of operation for a BWC series boiler on a call for heat from a thermostat is as described below:
 - a) When power is first turned on, 120V is provided to the MCBA, the combustion fan and the LWCO transformer. A separate 50VA transformer, connected directly to the MCBA, powers all other low voltage circuits.
 - b) For the first few seconds after power-up the control module goes through a self check.
 - c) When there is a call for heat, the control module checks to make sure the air pressure switch is open. If it is, the combustion fan will be energized and will ramp up to ignition speed. When the air pressure switch closes, a 10 second prepurge is activated.
 - d) After the prepurge, the control module energizes the gas control valve and the spark for 3 seconds. If a flame is established and proved, the control allows the flame to stabilize for 5 seconds at the combustion fan ignition speed setting. If the flame fails to prove, the control module will attempt to light the burner 4 more times. If a flame is still not established, the control will lockout.
 - e) Once the flame stabilization period has ended, the MCBA allows the burner to modulate. The actual firing rate is dependent upon the measured current and recent differences between the set point temperature and the supply temperature. If an outdoor sensor is connected to the control module and the boiler is responding to a call for heat, the set point temperature will be determined by the outdoor reset curve shown in Figure 11.4.
 - f) Once the set point temperature is reached, the MCBA will turn the burner off.
 - g) The central heating pump will continue to operate until the room thermostat has been satisfied.
 - h) A demand for domestic hot water (DHW) is given priority on BWC series boilers. If a call for DHW is received while the boiler is responding to a call for heat, the heating circulator is deenergized until the call for DHW is satisfied.

XII. Service and Maintenance

IMPORTANT

WARRANTY DOES NOT COVER BOILER DAMAGE OR MALFUNCTION IF THE FOLLOWING STEPS ARE NOT PERFORMED AT THE INTERVALS SPECIFIED

1) Continuously:

- a. Keep the area around the boiler free from combustible materials, gasoline and other flammable vapors and liquids.
- b. Keep the area around the combustion air inlet terminal free from contaminants .
- c. Keep the boiler room ventilation openings open and unobstructed.

2) Monthly Inspections:

- a. Inspect the vent piping and outside air intake piping to verify they are open, unobstructed and free from leakage or deterioration. Call the service technician to make repairs if needed.
- b. Inspect the condensate drain system to verify it is leak tight, open and unobstructed. Call the service technician if the condensate drain system requires maintenance.
- c. Inspect the water and gas lines to verify they are free from leaks. Call the service technician to make repairs if required.

CAUTION

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

4) Annual Inspections and Service: In addition to the inspections listed above the following should be performed by a service technician once every year.

- a. Test the low water cutoff by pressing the "Test" button located at its end. The yellow light should come on and "E12" should flash on the display. Push the reset button on the display to restore normal operation. If the yellow light does not come on, determine why the low water cutoff is not working properly.
- b. Follow the procedure for turning the boiler off found in the BWC Series Lighting and Operating Instructions.
- c. Inspect the wiring to verify the conductors are in good condition and attached securely.

CAUTION

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

- d. Remove the ignition electrode and inspect it for oxides. Clean the oxides off the electrode with steel wool. Inspect the ceramic insulator for cracks and replace the ignitor assembly as necessary.
- e. Remove the combustion fan/gas valve assembly and inspect the fan and fan blade for lint and dust. Vacuum as required.
- f. Remove the burner hood to access the burner and the chamber.
- g. Remove the burner and vacuum any dust or lint from the burner. Wipe the inside of the burner with a clean soft cloth. Do not wipe the mesh side of the burner. If the burner shows signs of deterioration or corrosion, replace it immediately. Inspect the burner gasket and replace, if necessary.
- h. With the burner removed, inspect the combustion chamber and clean as necessary.
- i. Inspect the heat exchanger and vacuum any debris found on the pins and other surfaces. Clean the casting pins by flushing with clean water. A soft nylon brush may be used in accessible areas. Drain and flush the inside of the heat exchanger and condensate collector as required. Do not use any cleaning agents or solvents.
- j. Inspect the condensate trap to verify it is open and free from debris. Clean if necessary.
- k. Reinstall the burner, burner hood, combustion fan and gas valve assembly.
- l. Reconnect any wiring which has been disconnected.
- m. Qualified service personnel should thoroughly inspect the heating system and correct any deficiencies prior to restarting the boiler.
- n. Follow Section X Start-up and Checkout instructions before leaving installation.
- o. Perform the combustion test outlined in Section X.
- p. Verify that the system pH is between 6.5 and 8.5

XIII. Troubleshooting

WARNING

TURN OFF POWER TO BOILER BEFORE REPLACING FUSES OR WORKING ON WIRING.

A. Troubleshooting problems where no error code is displayed:

Table 13.1: No Error Code Displayed

CONDITION	POSSIBLE CAUSES
Display Blank, Fan off, LWCO lights off	<ul style="list-style-type: none">• No 120VAC Power at boiler. Check breaker and wiring between breaker panel and boiler
Display Panel Blank, Fan running	<ul style="list-style-type: none">• Loose 120VAC connection wiring between boiler J-Box and MCBA• Blown "F1" fuse in MCBA (see Figure 13.2 for location). Replace with 5A fuse provided
Display reads "U.125" continuously, Fan running	<ul style="list-style-type: none">• Defective AT250 transformer• Blown "F3" fuse in MCBA (see Figure 13.2 for location). Replace with 4A slow-blow fuse provided
Boiler not responding to call for heat, Status code on display = "0" (see Figure 11.1)	<ul style="list-style-type: none">• Boiler is not seeing call for heat. Check thermostat or zone wiring for loose connection, miswiring, or defective thermostat/zone control.
Boiler fires, but display panel is blank	<ul style="list-style-type: none">• Loose ribbon cable• Defective display

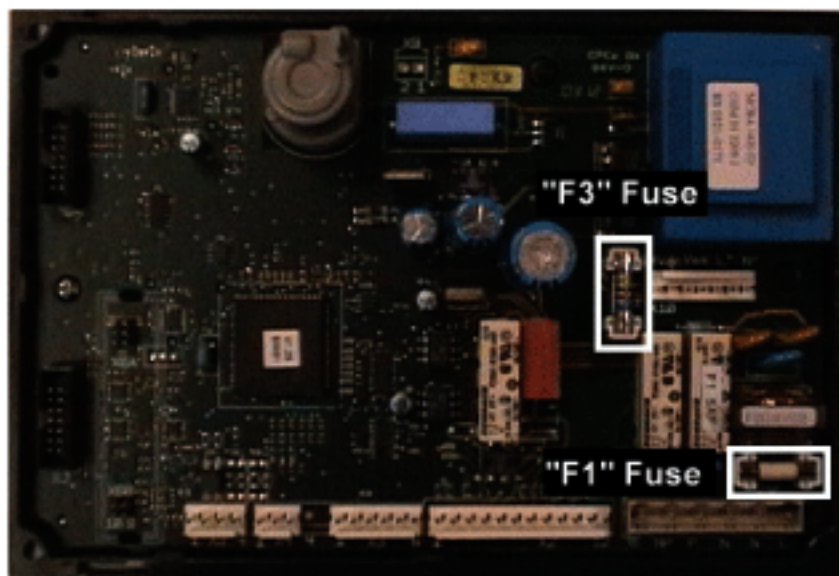


Figure 13.2: MCBA Fuse Location

B. Trouble shooting problems where a soft lockout code is displayed. When a soft lockout occurs, the boiler will shut down and the display will alternate between the number "9" and the letter "b" followed by a two digit service code. The boiler will automatically restart once the condition that caused the lockout is corrected.

Table 13.3: Soft Lockout Codes Displayed

CODE	CONDITION	POSSIBLE CAUSES
b 08	Pressure switch circuit open	<ul style="list-style-type: none"> • Blockage in intake or vent system. • Vent and/or intake system not constructed in accordance with Part VI. • Blocked or leaking pressure switch tubing • Heat exchanger or burner blockage • Terminals exposed to high winds • Blockage in condensate trap above vent.
b 18	MCBA supply sensor detected temperatures in excess of 200°F	<ul style="list-style-type: none"> • Heating load at time of error was far below the minimum firing rate of the boiler • Defective primary pump or no flow in primary loop (Piping Method 1) • Control system miswired so that boiler operation is permitted when no zones are calling
b 19	MCBA return sensor detected temperatures in excess of 200°F	<ul style="list-style-type: none"> • See possible causes for "b18" • Flow through boiler reversed • Sensor wiring reversed
b 24	MCBA is reading a return sensor temperature higher than the supply sensor temperature. Condition must be present for at least 75s for this error code to appear.	<ul style="list-style-type: none"> • Flow through boiler reversed. Verify correct piping and pump orientation. • No boiler water flow. Verify that system is purged of air and that appropriate valves are open. • Sensor wiring reversed. • Supply or return sensor defective.
b 25	Supply water temperature has risen too quickly	<ul style="list-style-type: none"> • See possible causes for "b18" • Inadequate boiler water flow. Verify that pump is operating and that pump and piping are sized per Part VIII of this manual
b 26	Boiler safety limit, or external limit wired across terminals 3&4, is open.	<ul style="list-style-type: none"> • See possible causes for "b18" • Defective supply sensor.
b 30	Temperature rise between supply and return is too high.	<ul style="list-style-type: none"> • Inadequate boiler water flow. Verify that pump is operating and that pump and piping are sized per Part VIII of this manual
b 61	Pressure switch circuit closed with fan off	<ul style="list-style-type: none"> • Blockage in pressure switch hose • Pressure switch wires shorted together • Defective pressure switch • Loose or miswired fan speed harness (if "b61" error code is observed while fan is running)
b 65	Fan is not achieving set point speed	<ul style="list-style-type: none"> • Loose or incorrect fan speed control connection • Defective fan

C. Trouble shooting problems where a hard lockout code is displayed. When a hard lockout occurs, the boiler will shut down and the display will flash the letter "E" followed by a two digit service code. Once the condition that caused the lockout is corrected, the boiler will need to be manually reset using the RESET button on the display.

Table 13.4: Hard Lockout Codes Displayed

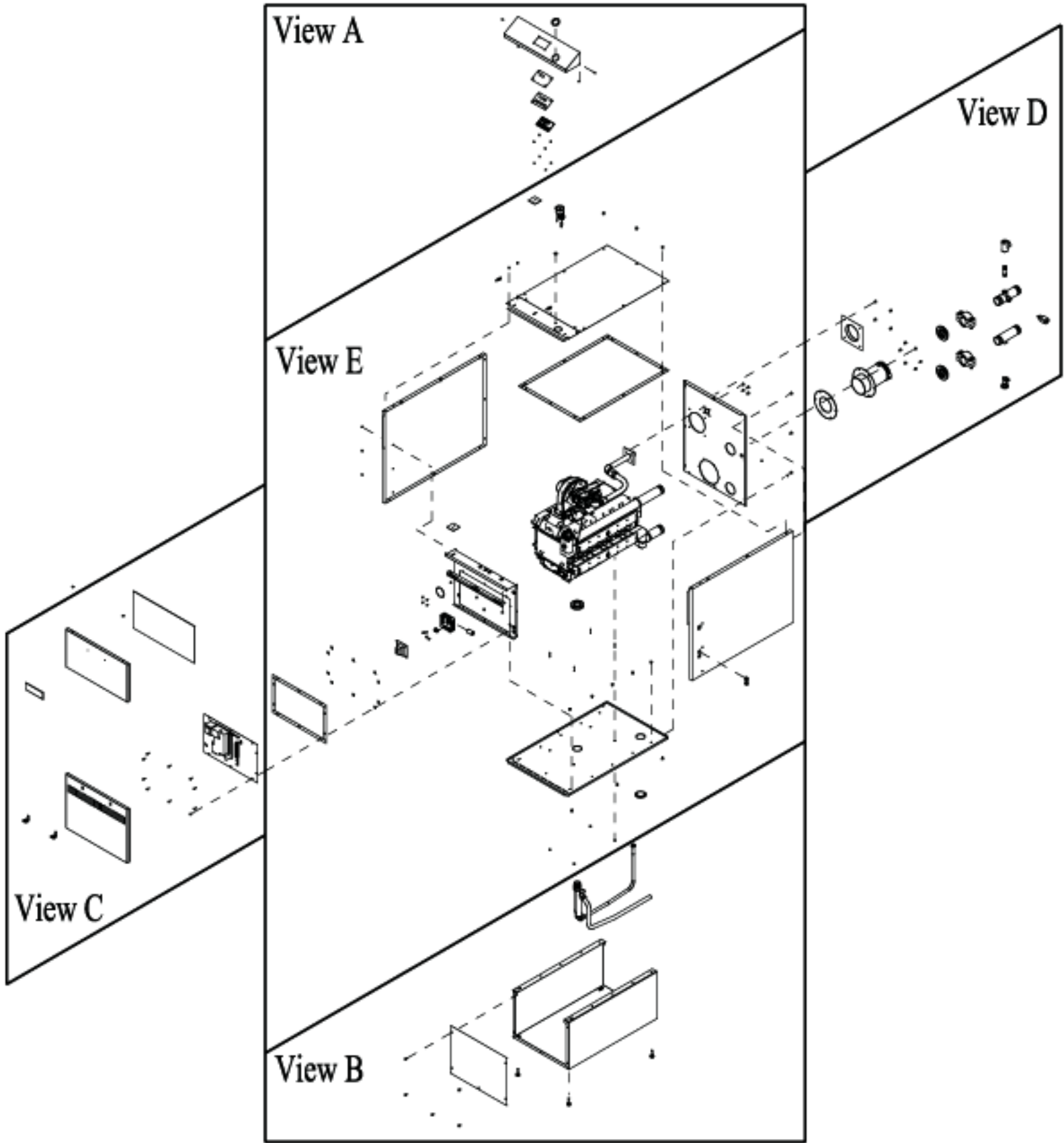
CODE	CONDITION	POSSIBLE CAUSES
E 00	A flame signal was present when there should be no flame.	<ul style="list-style-type: none"> Defective gas valve - make sure inlet pressure is below maximum on rating plate before replacing valve.
E 02	BWC300: Flame failure after 5 tries to restart BWC399/425: Flame failure after 2 tries to restart	<ul style="list-style-type: none"> No gas pressure Gas pressure under minimum value shown on rating plate Gas line not completely purged of air Defective Electrode Loose burner ground connection Defective Ignition Cable Defective gas valve (24 VAC should be present between blue and black and between blue and brown leads during trial for ignition) Air-fuel mixture out of adjustment - consult factory
E 03	Gas valve error	<ul style="list-style-type: none"> Loose or defective gas valve harness. Check electrical connections. Defective gas valve (check for 24 VAC at harness during trial for ignition before replacing valve)
E 04	Power failure occurred after lockout	<ul style="list-style-type: none"> Some other error on this list occurred and power to the boiler was then interrupted. Reset control and see if hard lockout reoccurs.
E 05 E 06 E 07 E 11	Internal control failure	<ul style="list-style-type: none"> Reset the control. If problem reoccurs, replace the MCBA.
E 12	Low water cut-off or float switch open	<ul style="list-style-type: none"> If yellow light on LWCO is on, system is low on water If neither yellow nor green light is on, check LWCO harness and check for 24VAC across AT140 transformer Check the condensate trap for a blockage
E 13 E 14 E 15 E 16 E 17	Internal control failure	<ul style="list-style-type: none"> Reset the control. If problem reoccurs, replace the MCBA.
E 18	MCBA supply sensor detected temperatures in excess of 200°F for an extended period of time	<ul style="list-style-type: none"> See possible causes for "b18" error. Also, check safety limit for proper operation.
E 19	MCBA return sensor detected temperatures in excess of 200°F for an extended period of time	<ul style="list-style-type: none"> See possible causes for "b19" error.
E 28	Blower is not running when it should or fan speed signal not being detected by MCBA	<ul style="list-style-type: none"> Loose connection in 120 VAC fan wiring Loose or miswired fan speed harness Defective fan
E 29	Blower fan speed has not returned to zero rpm	<ul style="list-style-type: none"> Miswired fan speed harness Defective fan
E 31	Shorted supply temperature sensor	<ul style="list-style-type: none"> Shorted or miswired supply sensor wiring Defective supply sensor
E 32	Shorted return temperature sensor	<ul style="list-style-type: none"> Shorted or miswired return sensor wiring Defective return sensor
E 35	Flue gas temperature sensor short circuit	<ul style="list-style-type: none"> Shorted or miswired flue temp sensor wiring Defective flue temp sensor
E 36	Supply water temperature sensor circuit open	<ul style="list-style-type: none"> Loose or miswired supply sensor wiring Defective supply sensor
E 37	Return water temperature sensor circuit open	<ul style="list-style-type: none"> Loose or miswired return sensor wiring Defective return sensor
E 40	Flue gas temperature sensor circuit open	<ul style="list-style-type: none"> Loose or miswired flue temp sensor wiring Defective flue temp sensor
E 44	Internal control failure	<ul style="list-style-type: none"> Reset the control. If problem reoccurs, replace the MCBA.

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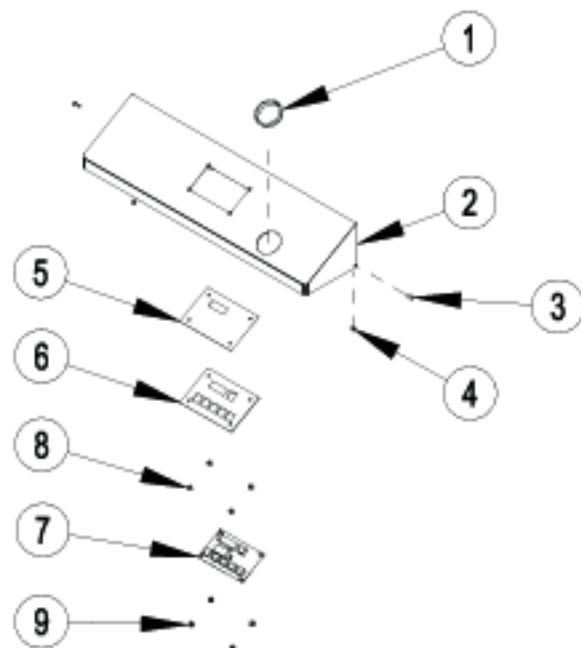
XIV Parts

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:

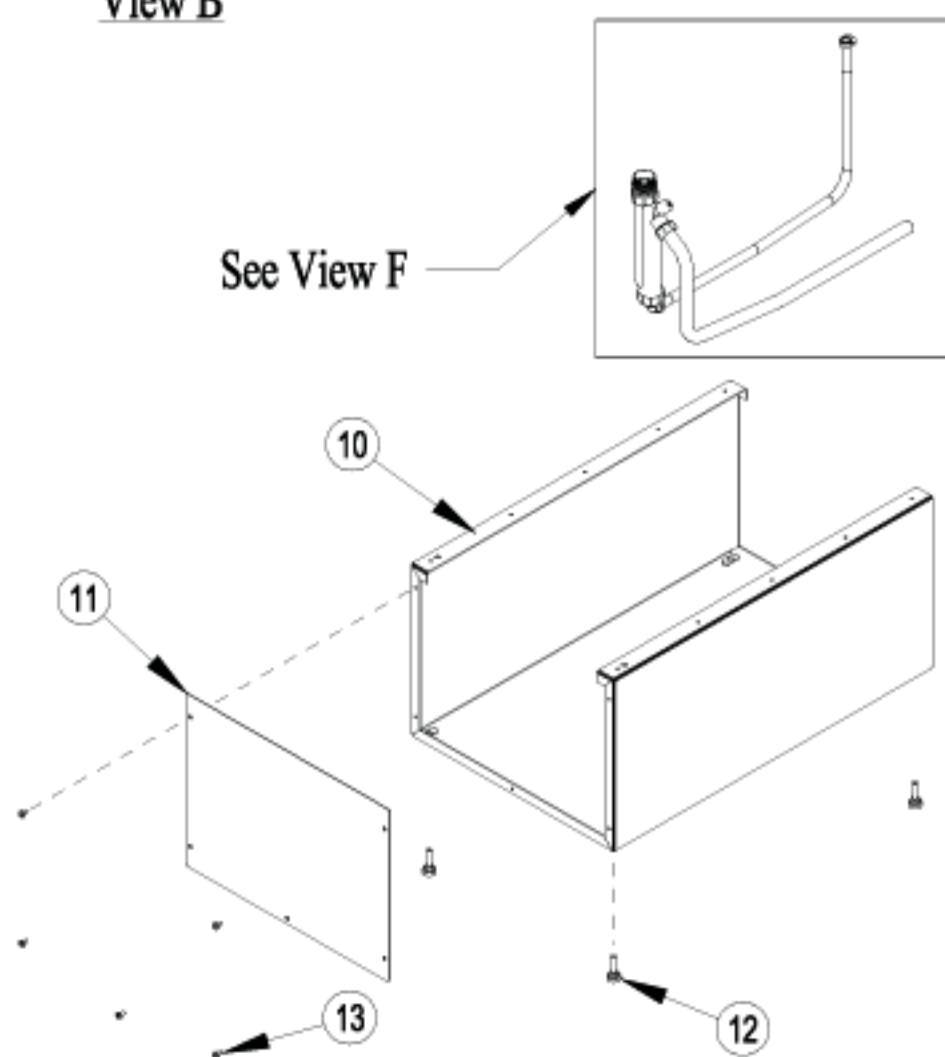
Crown Boiler Co.
Customer Service
P.O. Box 14818
Philadelphia, PA 19134
www.crownboiler.com



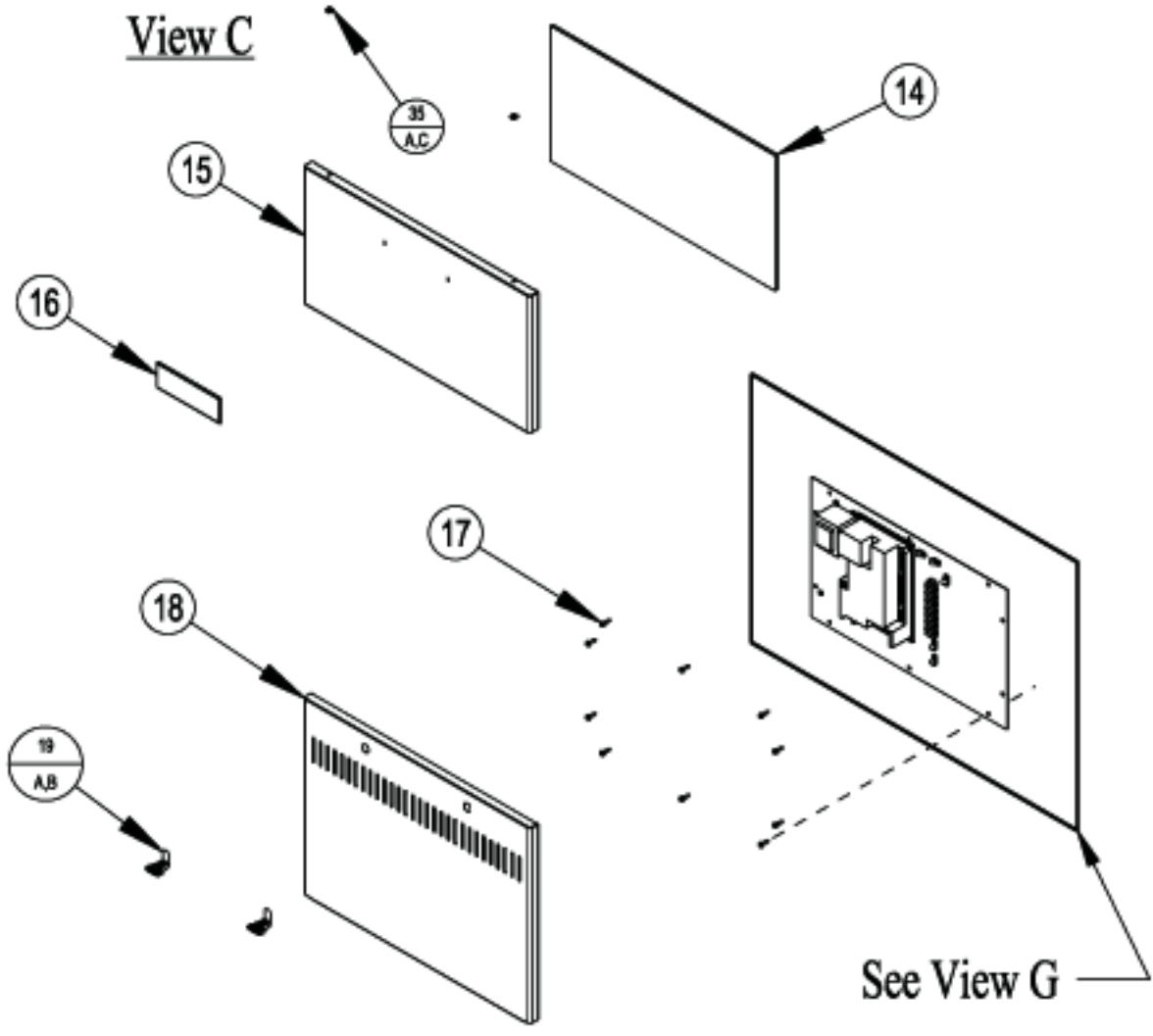
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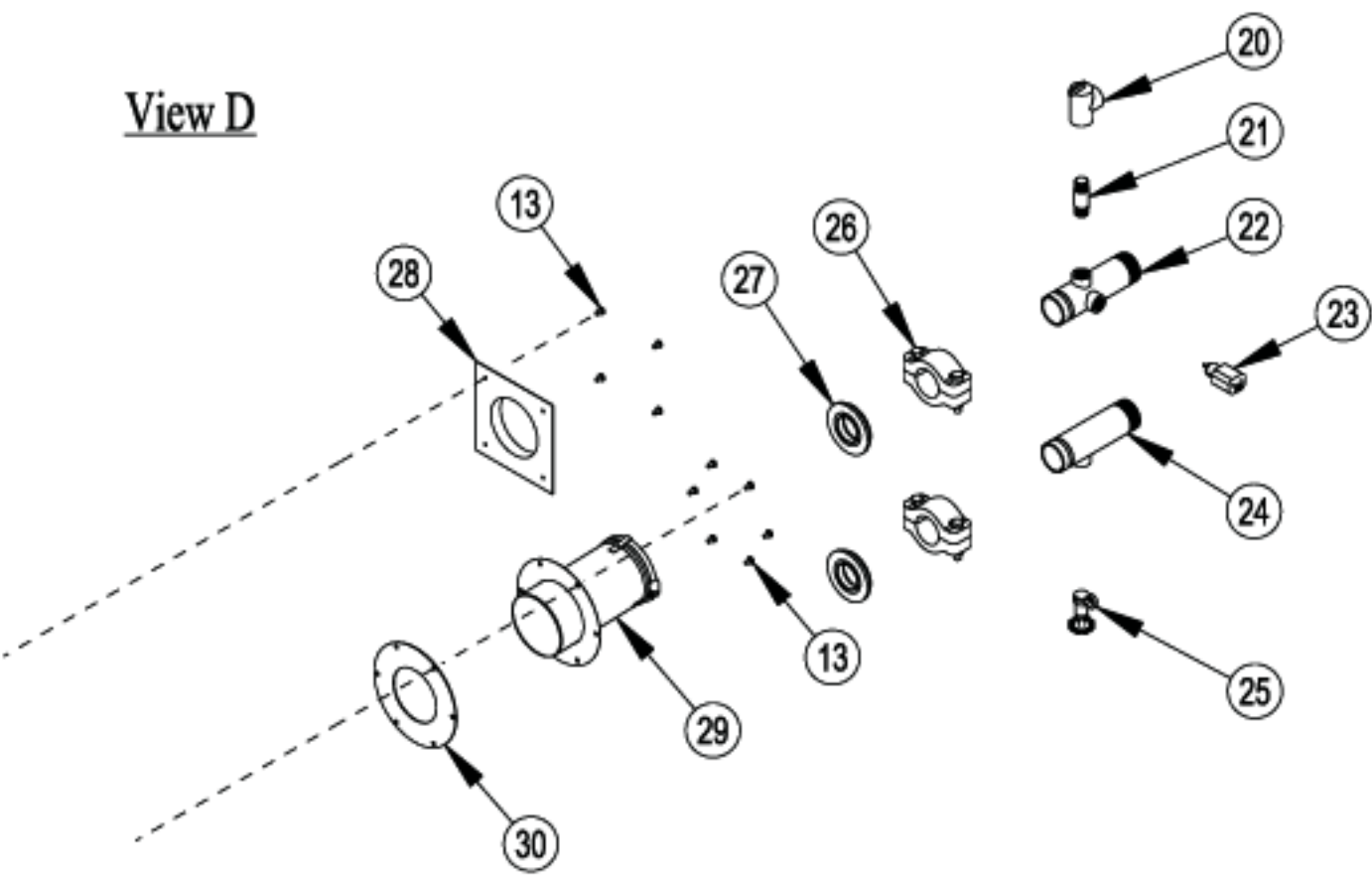
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View C



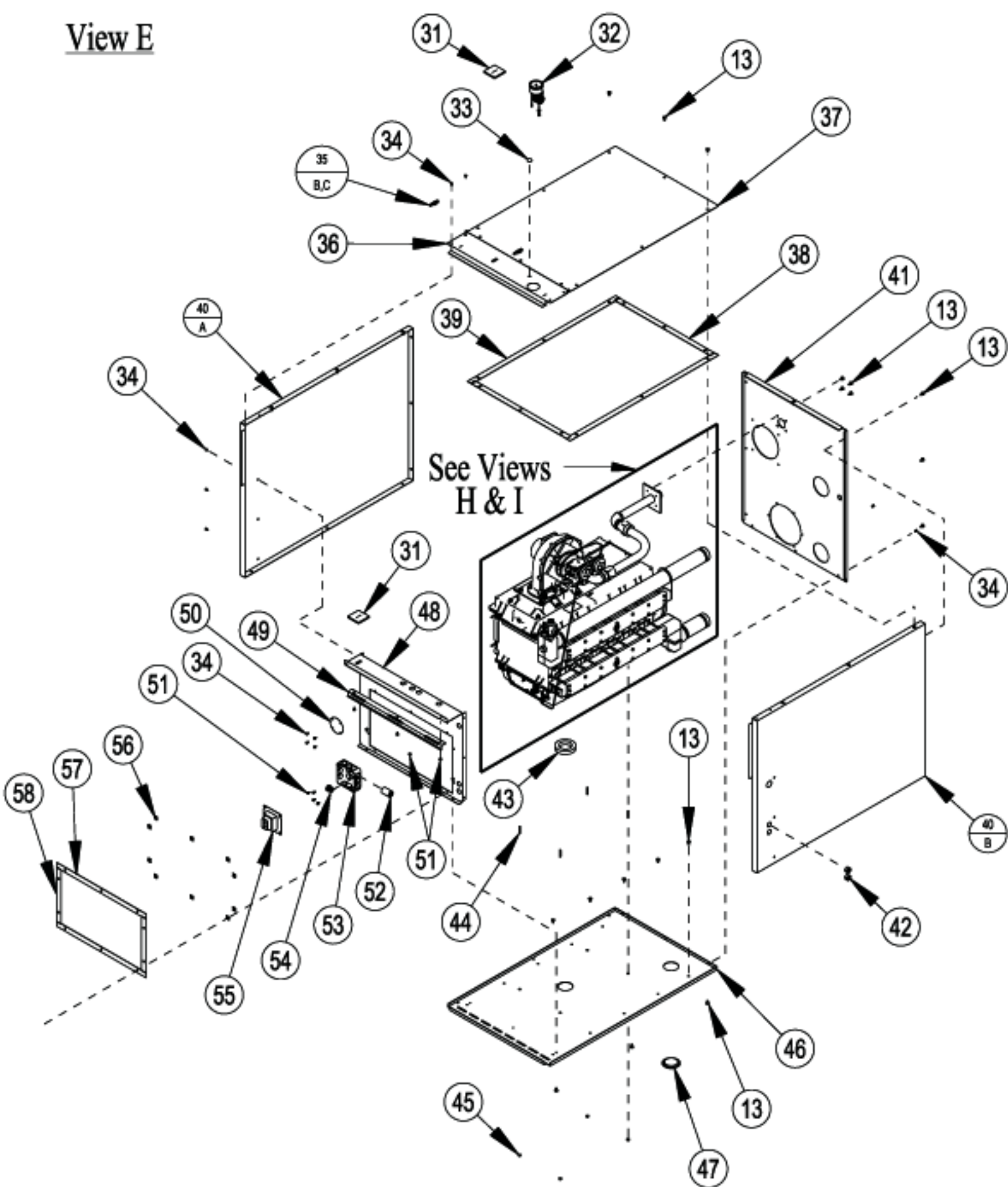
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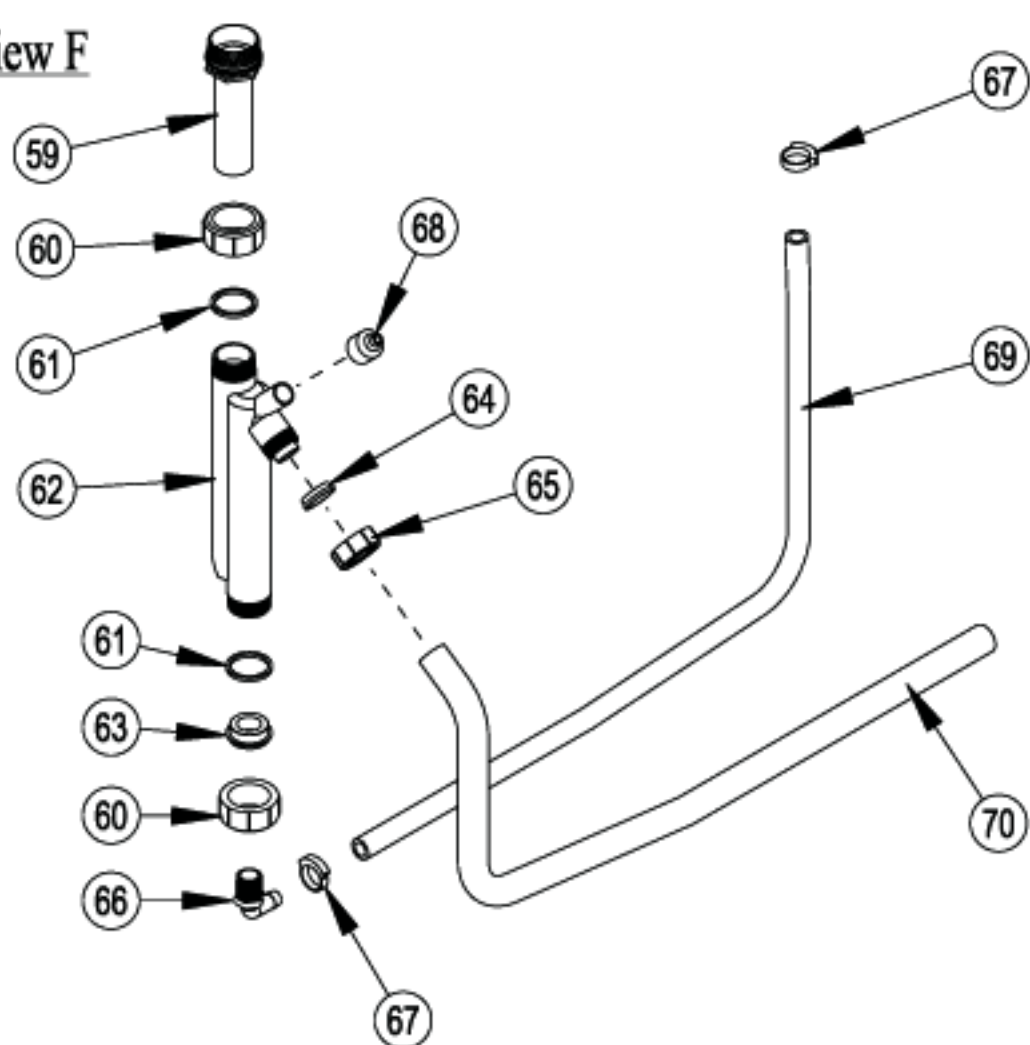
PARTS LIST

KEY	DESCRIPTION	BWC300		BWC399		BWC425	
		CROWN PART #	QUANTITY	CROWN PART #	QUANTITY	CROWN PART #	QUANTITY
1	Heyco 2" Window	900723	1	900723	1	900723	1
2	Console	240333	1	240333	1	240333	1
3	3/16 x 1/2 Silic Pin	230200	2	230200	2	230200	2
4	Nylon Spacer, #10 x 0.125	230212	2	230212	2	230212	2
5	Graphic Overlay Membrane For Display	980030	1	980030	1	980030	1
6	Graphics Overlay Mounting Plate	240390	1	240390	1	240390	1
7	Display Board	3501600	1	3501600	1	3501600	1
8	Zinc Plated Brass Spacer	960054	4	960054	4	960054	4
9	8-32 Lock Nut	900706	4	900706	4	900706	4
10	Base	240435	1	240437	1	240437	1
11	Base Front Panel	240415	1	240415	1	240415	1
12	Leveling Foot	900742	4	900742	4	900742	4
13	1/4-20 x 1/2 Self Tapping Screw	900100	42	900100	42	900100	42
14	Upper Door Gasket	240374	1	240374	1	240374	1
15	Upper Door	240355	1	240355	1	240355	1
16	Crown Aluminum Nameplate	98-004	1	98-004	1	98-004	1
17	#10 x 3/4" Hex Wash Hd Screw	90-054	10	90-054	10	90-054	10
18	Control Access Door	240332	1	240332	1	240332	1
19A	Latch CM Cam	230206	2	230206	2	230206	2
19B	Straight Cam	230208	2	230208	2	230208	2
20	3/4" x 3/4" 30 psi Relief Valve	95-040	1	95-040	1	95-040	1
21	3/4 x 2" Nipple	950062	1	950062	1	950062	1
22	Supply Outlet Adapter Pipe	950720	1	950720	1	950720	1
23	Hydro Level Model 1100 Probe LWCO	450600	1	450600	1	450600	1
24	Return Outlet Adapter Pipe	950721	1	950721	1	950721	1
25	3/4" Boiler Drain Valve	95-041	1	95-041	1	95-041	1
26	2" Groove Coupling w/ EDPM Gasket	950726	2	950726	2	950726	2
27	2.375" ID Vinyl Grommet	2409035	2	2409035	2	2409035	2
28	Air Intake Collar	240510	1	240511	1	240511	1
29	Vent Adapter	240492	1	240517	1	240517	1
30	Vent Adapter Gasket	240516	1	240518	1	240518	1

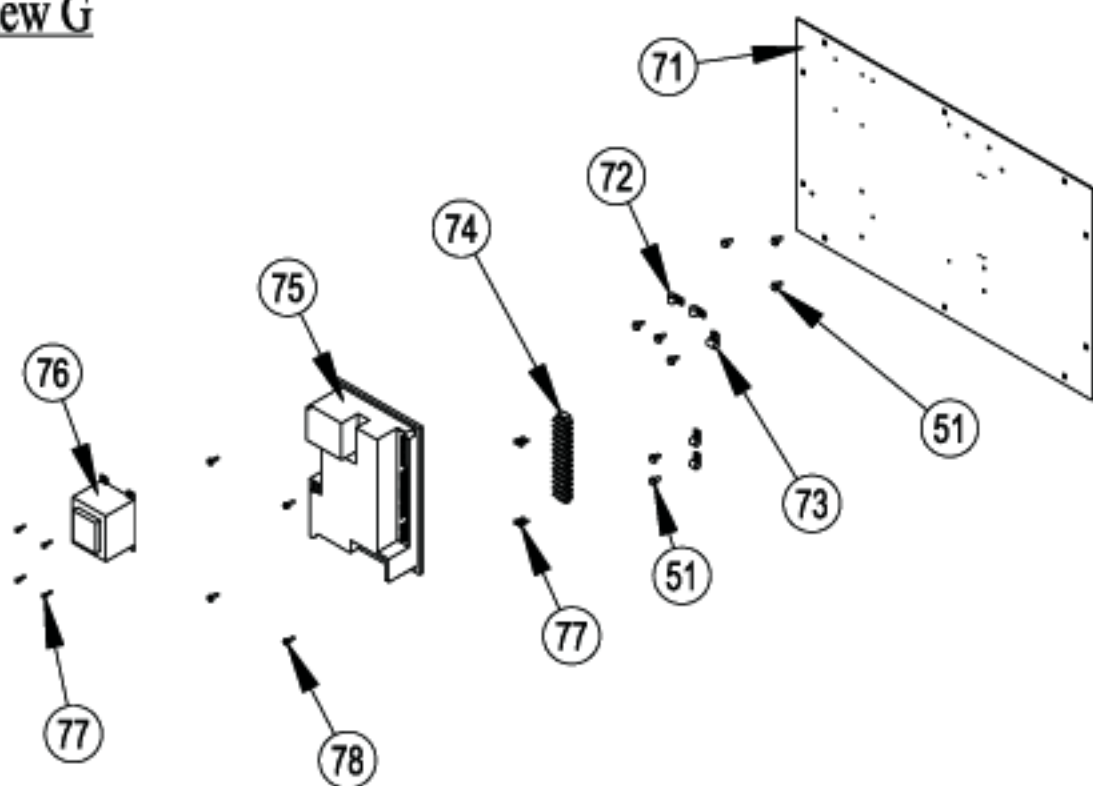
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View F

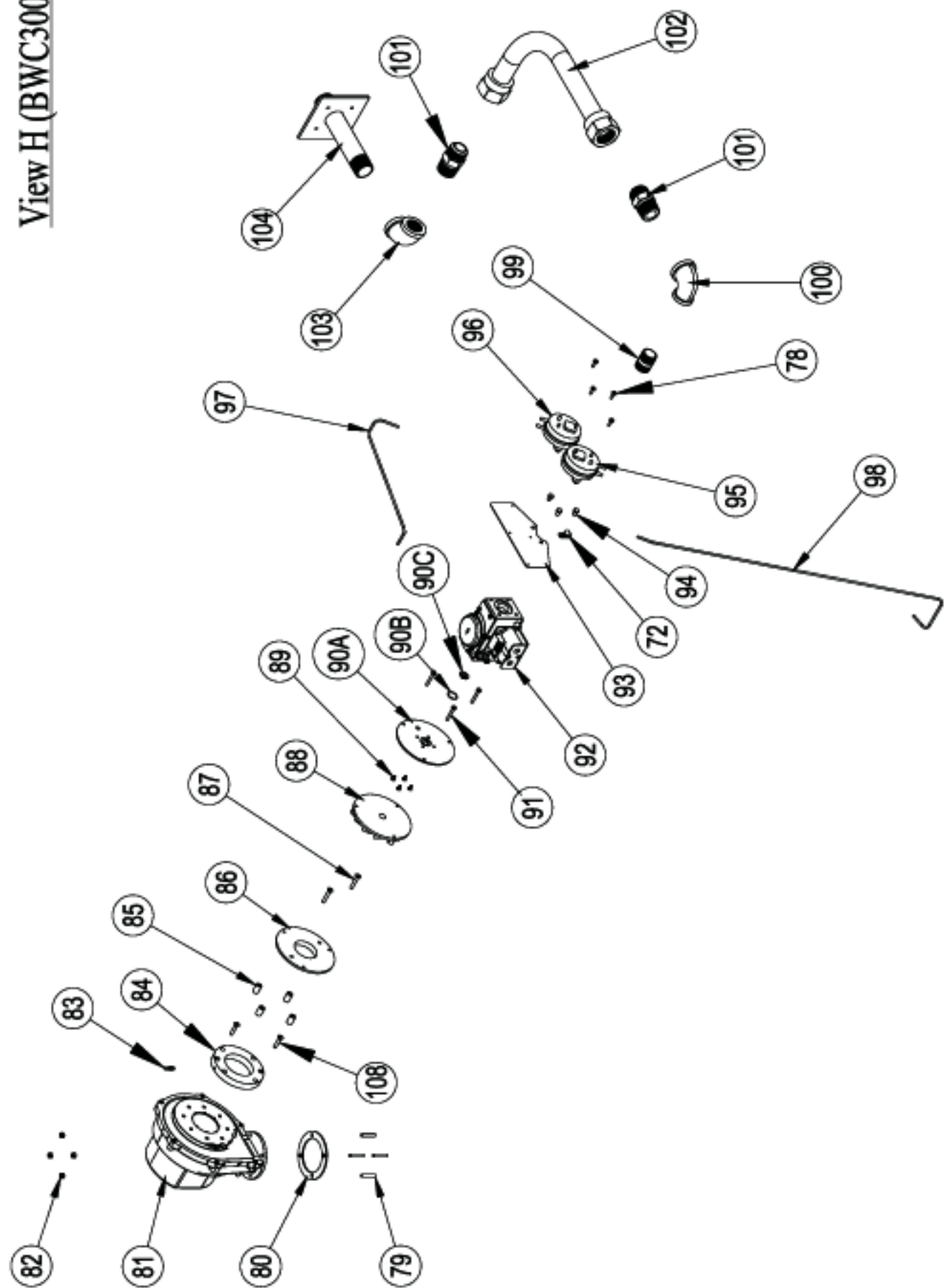


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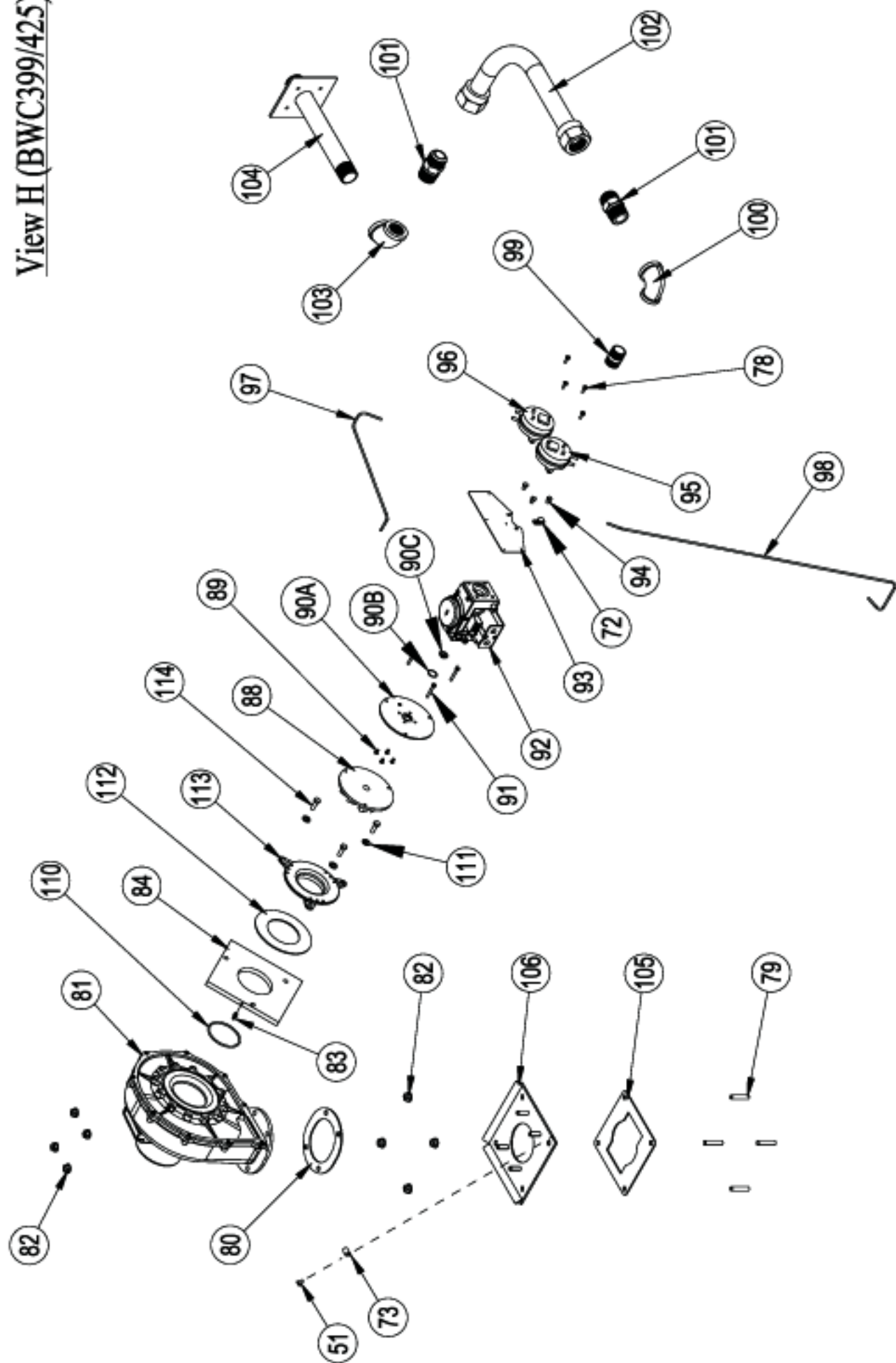


PARTS LIST

KEY	DESCRIPTION	BWC300		BWC399		BWC425	
		CROWN PART #	QUANTITY	CROWN PART #	QUANTITY	CROWN PART #	QUANTITY
31	Display Harness Seal	240520	2	240520	2	240520	2
32	Gauge	230100	1	230100	1	230100	1
33	Test Port Plug	900740	1	900740	1	900740	1
34	#10 x 1/2 Truss Head Sheet Metal Screw	900120	17	900120	17	900120	17
35A	Draw Keeper	230204	2	230204	2	230204	2
35B	Draw Latch	230202	2	230202	2	230202	2
35C	1/8" Aluminum Pop Rivet	90-068	7	90-068	7	90-068	7
36	Top Front Panel	240321	1	240321	1	240321	1
37	Top Rear Panel	240325	1	240327	1	240327	1
38	Top Front & Rear Gasket	240373	2	240373	2	240373	2
39	Top Side Gasket	240370	1	240380	1	240380	1
40A	Left Side Panel	2403015	1	2403017	1	2403017	1
40B	Right Side Panel	2403005	1	2403007	1	2403007	1
41	Rear Panel	240307	1	240307	1	240307	1
42	Shutter Bushing for .875" Hole	96-050	2	96-050	2	96-050	2
43	Condensate Trap Gasket	240005	1	240005	1	240005	1
44	M6 x 40 Hex Socket Set Screw	230940	4	230940	4	230940	4
45	M6 Serrated Hex Flange Nut	900731	4	900731	4	900731	4
46	Bottom Panel	240365	1	240367	1	240367	1
47	2.5" Vinyl Plug	900640	1	900640	1	900640	1
48	Partition	240405	1	240405	1	240405	1
49	Door Catch	240410	1	240410	1	240410	1
50	Inspection Port Window	980035	1	980035	1	980035	1
51	#10 x 1/2 sheet metal screw	90-212	9	90-212	10	90-212	10
52	1/2" Conduit Coupling	960021	1	960021	1	960021	1
53	4 X 4 J-Box	96-055	1	96-055	1	96-055	1
54	1/2" Box Adapter	960022	1	960022	1	960022	1
55	40VA Transformer AT72D	35-2100	1	35-2100	1	35-2100	1
56	#10 Tinnerman Clip	900727	2	900727	2	900727	2
57	Control Chassis Top & Bottom Gasket	240334	2	240334	2	240334	2
58	Control Chassis Side Gasket	240335	2	240335	2	240335	2
59	Condensate Trap Tail Piece	240956	1	240956	1	240956	1
60	Condensate Trap Nut	240996	2	240996	2	240996	2
61	Rubber Gasket	240997	2	240997	2	240997	2
62	Condensate Trap Assembly (200mm)	241120	1	241120	1	241120	1
63	Tapped Plug	240550	1	240550	1	240550	1
64	Rubber Ferrule	240998	1	240998	1	240998	1
65	Compression Nut	240999	1	240999	1	240999	1
66	90° Hose Barb	240555	1	240555	1	240555	1
67	Clamp	240557	2	240557	2	240557	2
68	Vented Dust Cap	240990	1	240990	1	240990	1
69	1/2" I.D. Clear Poly Tubing	240560	2.5FT	240560	3FT	240560	3FT
70	Corrugated Trap Tubing	240008	2.5FT	240008	3FT	240008	3FT
71	Control Chassis	240331	1	240331	1	240331	1
72	Nylon Cable Clamp	960030	5	960030	5	960030	5
73	Resistor Clamp .312" Dia	960090	1	960090	2	960090	2
74	12 Pole Terminal Block	960096	1	960096	1	960096	1
75	Boiler Control Module (MCBA)	3524300U	1	3524399U	1	3524425U	1
76	50VA Transformer AT250A	3502600	1	3502600	1	3502600	1
77	#4-40 x 1/2" Slotted H.W.H. Type F Screw	900470	8	900470	8	900470	8
78	#6 -32 x 1 " H.W.H. Screw Type F Screw	900712	8	900712	8	900712	8



View H (BWC399/425)

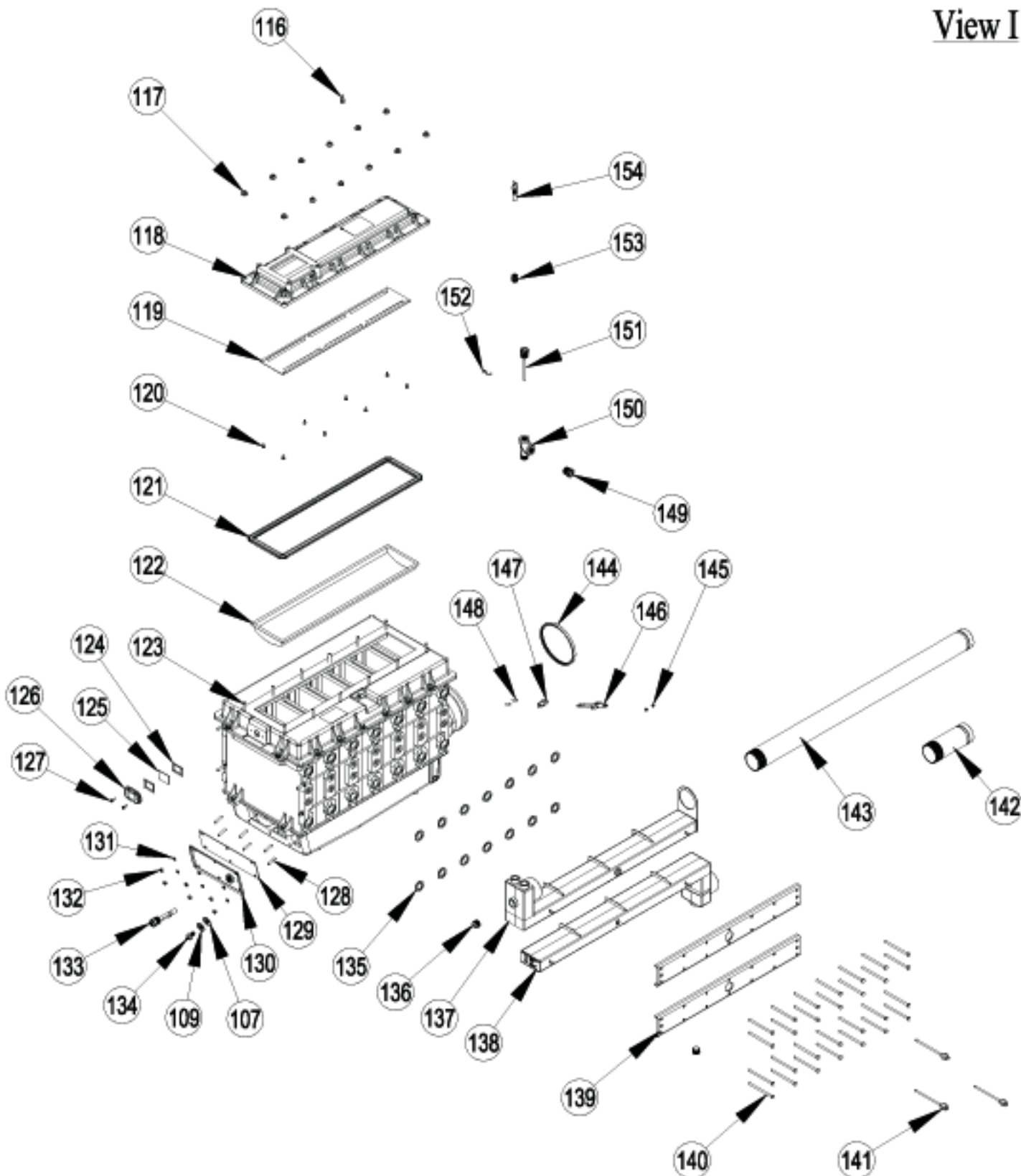


PARTS LIST

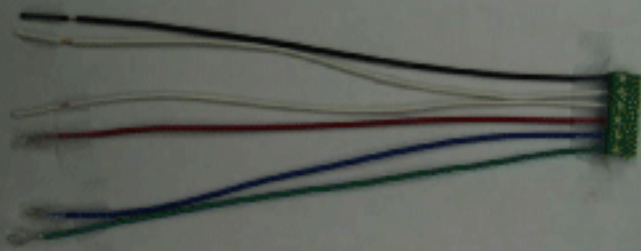
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		CROWN PART #	QUANTITY	CROWN PART #	QUANTITY	CROWN PART #	QUANTITY
79	M5 x 25mm, Stud	900002	4				
79	M8 x 40mm, Stud			900031	4	900031	4
80	Combustion Blower Flange Gasket	240001	1	240531	1	240531	1
81	Combustion Air Blower	240000	1	240003	1	240003	1
82	M5, Nylock Hex Nut	900003	4				
82	M8, Nylock Hex Nut			900030	8	900030	8
83	10-32 x 1/8 ID Hose Barb	90-222	1	90-222	1	90-222	1
84	Fan Inlet Block	240105	1	240107	1	240107	1
85	Spacer	960055	4				
86	42.5mm Short Fan Adaptor Plate	3507346	1				
87	M5 x 25mm Flat Hd Screws	900736	2	900736	2	900736	2
88	16mm Swirlplate (Black)	3507366	1	3507366	1	3507366	1
89	M4 x 10mm FH Machine Screw	900006	4	900006	4	900006	4
90A	Injector Plate	3507348	1	3507348	1	3507348	1
90B	1.5 x 17mm O-Ring	3507349	1	3507349	1	3507349	1
90C	9.50mm Orifice	3507365	1	3507365	1	3507365	1
91	M4 x 30mm Posi-drive Hd Screws	3507363	3	3507363	3	3507363	3
92	GB-WND 057 Gas Valve	3507360	1	3507360	1	3507360	1
93	Pressure Switch Mounting Bracket	240336	1	240336	1	240336	1
94	M5 x 6mm Phillips Head Screw	900733	3	900733	3	900733	3
95	Normally Closed Pressure Switch	240051	1	240051	1	240051	1
96	Normally Open Pressure Switch	240050	1	240050	1	240050	1
97	.125" ID x .250"OD Silicone Tubing	14-008	1 FT	14-008	1 FT	14-008	1 FT
98	.125" ID x .250"OD Silicone Tubing	14-008	2.3 FT	14-008	2.3 FT	14-008	2.3 FT
99	3/4" x Close Nipple	95-105	1	95-105	1	95-105	1
100	1" x 3/4" 90° Reducing Elbow	950116	1	950116	1	950116	1
101	1" ID x 1" NPT CSST Adaptor	230710	2	230710	2	230710	2
102	1/2" x 17" Yellow Coated CSST, Nut by Nut	230708	1	230708	1	230708	1
103	1" 90° Elbow	950190	1	950190	1	950190	1
104	1" Gas Line Adapter Plate Assembly	240605	1	240607	1	240607	1
105	Gasket Bet/ Fan Adapter Plate & Burner Hood			240532	1	240532	1
106	RG175 To AH7 Fan Adapter Plate			240530	1	240530	1
107	10mm EDPM Gasket	900024	1	900024	1	900024	1
108	M5 x 20mm Flat Head Screw	900732	2				
109	10mm Flat Washer	900025	1	900025	1	900025	1
110	4 x 110mm ID Buna-N O-Ring			230004	1	230004	1
111	M8 Lockwasher			9000085	3	9000085	3
112	Gasket Bet/ Swirl Plate & Fan Inlet Block			240533	1	240533	1
113	RG175 Fan Adapter Plate			3507368	1	3507368	1
114	M8 x 25mm Hex Head Screw			900032	3	900032	3

PARTS LIST

KEY	DESCRIPTION	BWC300		BWC399		BWC425	
		CROWN PART #	QUANTITY	CROWN PART #	QUANTITY	CROWN PART #	QUANTITY
116	Nipple, Pressure Measuring, G1/8"	240910	1	240910	1	240910	1
117	M6 x 1.0, Captive Washer Hex Nut	240905	10	240905	12	240905	12
118	Burner Hood	240053	1	240070	1	240070	1
119	Burner Air Distributor Plate	240058	1	240078	1	240078	1
120	4.2 x 9.5mm, Pan Head Screw	240915	8	240915	8	240915	8
121	Burner Hood Seal	240052	1	240072	1	240072	1
122	Burner	240055	1	240075	1	240075	1
123	M6 x 1.0 x 35mm, SS Hex Socket Set Screw	240965	10	240965	12	240965	12
124	Sight Glass Gasket, 5mm	240952	2	240952	2	240952	2
125	Sight Glass	240950	1	240950	1	240950	1
126	Sight Glass Holder	240951	1	240951	1	240951	1
127	M4 x 0.7 x 12mm, Phillips Pan Head Mach. Screw	240925	2	240925	2	240925	2
128	M6 x 1.0 x 30mm, SS Hex Socket Set Screw	240961	6	240961	6	240961	6
129	Inspection Cover Gasket, EDPM, Punched	240276	1	240276	1	240276	1
130	Inspection Cover Plate w/ 1/2" Coupling	240285	1	240285	1	240285	1
131	M6 x 1.0, Lock Washer	240962	6	240962	6	240962	6
132	M6 x 1.0, Nylock Hex Nut	240968	6	240968	6	240968	6
133	Float Switch	240060	1	240060	1	240060	1
134	M10 x 1/8" ID Tube Connector	240080	1	240080	1	240080	1
135	EDPM Header Gasket	2400200	10	2400200	14	2400200	14
136	1/2"NPT Flush Mount Hex Socket Plug	9502600	2	9502600	2	9502600	2
137	Supply Manifold	240255	1	240257	1	240257	1
138	Return Manifold	240245	1	240247	1	240247	1
139	Water Manifold Mounting Plate	210235	2	240237	2	240237	2
140	M6 x 1.0 x 75mm, Hex Head Screw	240960	20	240960	28	240960	28
141	Sensor	240012	3	240012	3	240012	3
142	Return Manifold Pipe	950723	1	950725	1	950725	1
143	Supply Manifold Pipe	950722	1	950724	1	950724	1
144	Exhaust Pipe Lip Ring Seal	240049	1	240079	1	240079	1
145	M4 x 0.7, Hex Nut, NP	240921	2	240921	2	240921	2
146	Ignition Electrode	240007	1	240007	1	240007	1
147	Ignition Electrode Gasket	240011	1	240011	1	240011	1
148	M4 x 0.7 x 20mm, SS Hex Socket Set Screw	240920	2	240920	2	240920	2
149	Gauge Pressure Fitting	230101	1	230101	1	230101	1
150	1/2" Male x Female X Female Tee	950084	1	950084	1	950084	1
151	Gauge Sensor Well	230104	1	230104	1	230104	1
152	Gauge Cap Tube Clamp	230103	1	230103	1	230103	1
153	3/8" x 1/4" Hex Reducing Bushing	95-046	1	95-046	1	95-046	1
154	High Limit	960124	1	960124	1	960124	1
155	AH3/4 X1 Harness	9602404	1	9602404	1	9602404	1
156	AH3/4 Tacho Harness	9602402	1	9602402	1	9602402	1
157	Pigtail Harness	9602407	1	9602407	1	9602407	1
158	Violet Jumper	9602412	1	9602412	1	9602412	1
159	AH5/7 X2 Harness	9602450	1	9602450	1	9602450	1
160	AH5/7 Display Harness	9602451	1	9602451	1	9602451	1
161	AH5/7 Dungs Gas Valve Harness	9602452	1	9602452	1	9602452	1
162	AH5/7 X3/X4 Harness	9602453	1	9602453	1	9602453	1
163	AH5/7 Ignition Harness	9602454	1	9602454	1	9602454	1
164	AH5/7 Line Voltage Blower Harness & Ignition Gnd	9602455	1	9602455	1	9602455	1
165	AH5/7 Sensor Harness	9602456	1	9602456	1	9602456	1
166	AH5/7 Limit Harness	9602457	1	9602457	1	9602457	1
167	AH5/7 Pressure Switch Jumper	9602458	1	9602458	1	9602458	1
Not Shown	Taco 0012	950162	1	950162	1	950162	1
Not Shown	Gas Cock	950605	1	950605	1	950605	1
Not Shown	M4 x 30mm Machine Screw (for gas valve harness)	3507342	1	3507342	1	3507342	1
Not Shown	Outdoor Sensor	240022	1	240022	1	240022	1
Not Shown	4A Fuse	960004	1	960004	1	960004	1
Not Shown	5A Fuse	960005	1	960005	1	960005	1
Not Shown	6" Nylon Wire Tie	97-090	13	97-090	15	97-090	15



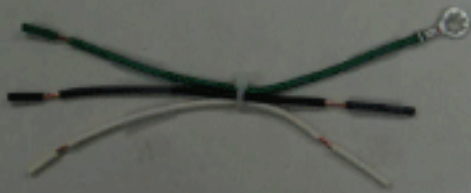
155



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162



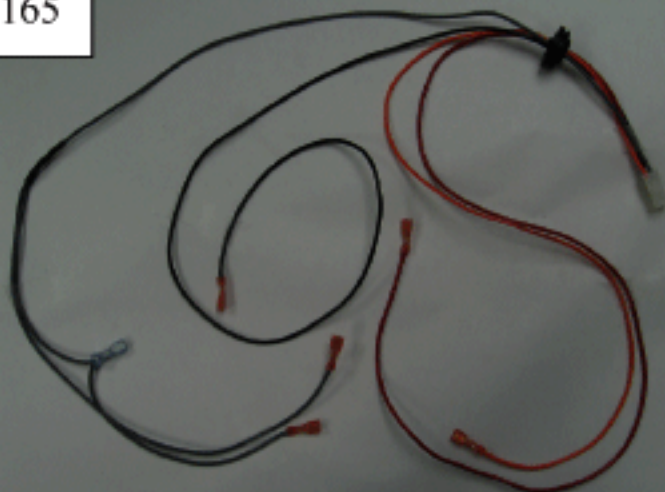
163



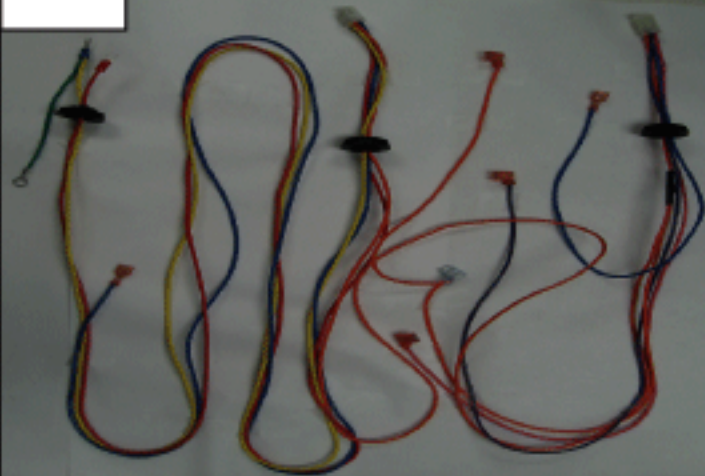
164



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Appendix A: Boiler Operating Parameters

A. Overview

All BWC Series boilers are equipped with a microprocessor-based Honeywell control module called a "MCBA". This control manages all boiler functions including flame supervision and modulation. A total of 46 field adjustable parameters are stored in the memory of this control. These parameters determine the exact operation of the MCBA under different conditions.

Crown has tried to program parameters into the MCBA at the factory that will result in satisfactory operation under most conditions. Because all systems are different, however, there are a few situations where boiler operation may be enhanced by adjusting a few of these parameters in the field. This section describes the parameters that may be changed and the method for changing them.

Parameters are numbered from "1" to "42-2". Parameters 1-4 are accessible by anyone. Parameters 5 through 42-2 may only be accessed by entering an access code. Parameters may be changed by either of two methods:

- 1) Using the keypad on the boiler
- 2) Using the GCI PC Interface Kit (PN 249905) available from Crown Boiler Company.

In addition to being used to change parameters, both the key pad and the GCI Interface can be used to obtain information about the boiler's current status and operating history. For more information on the use of the GCI PC interface refer to the instructions supplied with the kit.

WARNING

IMPROPER SETTING OF PARAMETERS CAN CAUSE UNRELIABLE OR UNSAFE OPERATION, RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY, OR LOSS OF LIFE:

- CHANGING PARAMETERS SHOULD ONLY BE ATTEMPTED BY A PROFESSIONAL HEATING SERVICE TECHNICIAN.
- DO NOT CHANGE ANY PARAMETERS NOT DESCRIBED IN THIS MANUAL WITHOUT FIRST CONSULTING THE FACTORY.
- BEFORE MAKING CHANGES, IT IS RECOMMENDED THAT INITIAL VALUES OF PARAMETERS BE RECORDED SO THAT THEY CAN BE RESTORED IF OPERATION OF THE BOILER IS NOT AS ANTICIPATED.
- AFTER CHANGING ANY PARAMETERS, CAREFULLY CONFIRM PROPER BOILER OPERATION BEFORE LEAVING THE INSTALLATION SITE.

B. Entering the Access Code

Note: If access to only Parameters 1-4 is desired you do not need to enter the access code. Skip to Section (C).

- 1) With the boiler running, toggle the Mode key until you reach the (STBY) Standby mode.
- 2) Depress and hold the Step key and then quickly depress and hold the Mode key for 2 – 5 seconds until the display reads (CODE). Release the Mode key, then the Step key. The display should show a 'C' followed by a random two digit number.
- 3) Use the + or – keys to scroll to the number 05.
- 4) Press the Store key momentarily and watch for the display to blink twice. If the access code has been successfully entered, the menu tree will be expanded to include the items shown inside the dashed lines in Figure A1.1. Access to parameters 5 - 42 will be possible by following the instructions in Section C. After 15 minutes have passed without any

keys being pressed, access to the expanded menu will end and the access code will need to be reentered to regain access to parameters 5-42.

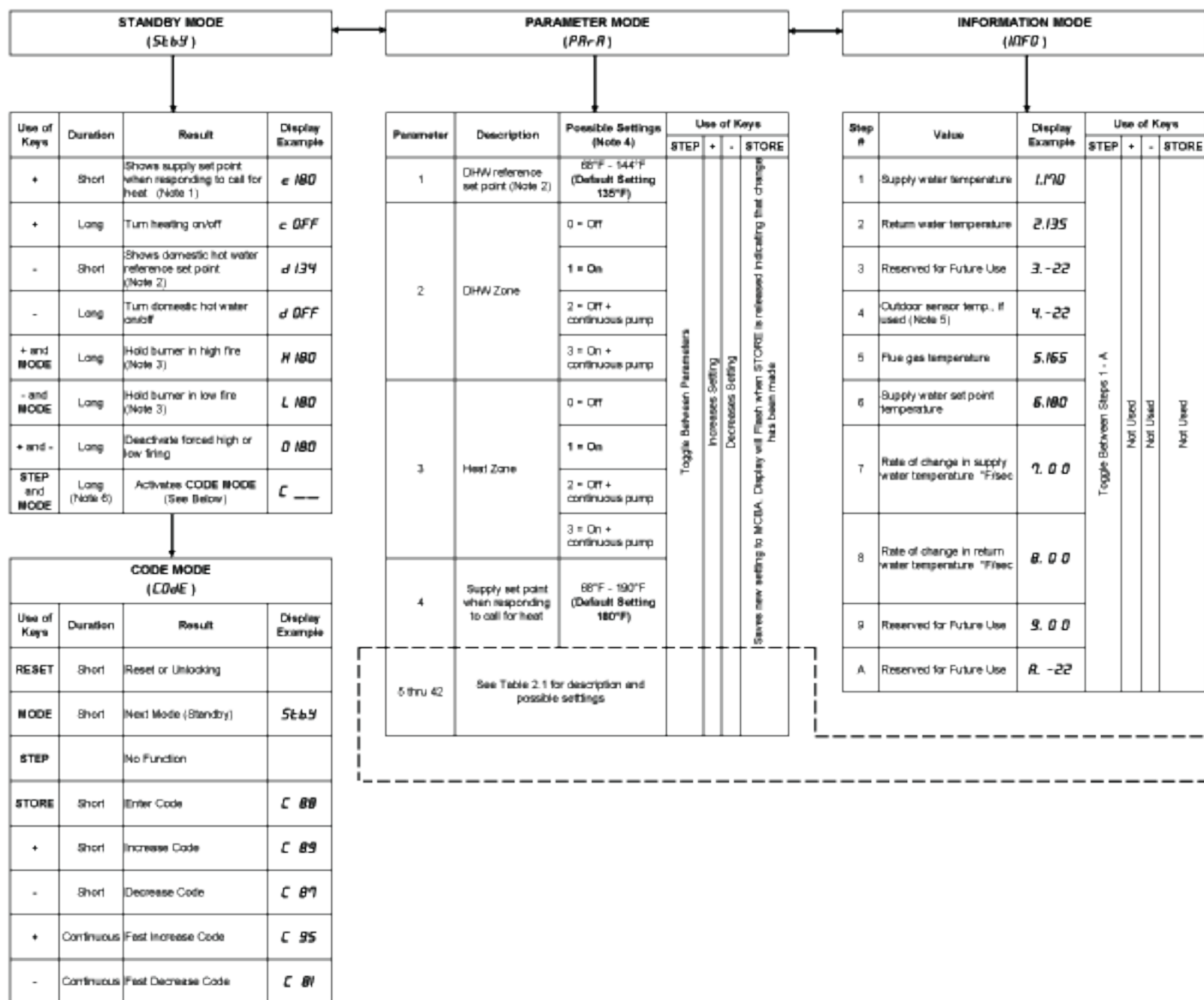
C. Changing Parameters

- 1) Toggle the Mode key until you reach (PARA) Parameter mode.
- 2) Press the Step key to scroll through the parameters until you reach the desired parameter number.
- 3) Use the + or – key to scroll to the desired parameter setting.
- 4) Press the Store key momentarily and watch for the display to blink once. The parameter setting has now stored its new value.
- 5) When using the keypad, all parameters show up on the boiler display as two-digit numbers. This creates the following special situations:
 - a) Two parameters are required to define some of the fan speeds. For example, the maximum CH fan speed is defined by Parameters 13 and 14; Parameter 13 defines the “thousands” and “hundreds” places and Parameter 14 defines the “tens” and “ones” places. The ignition fan speed is only adjustable in increments of hundreds, so only one parameter (19) is required to define it.
 - b) In some cases one two digit number defines two separate parameters. For example, if Parameter 34 is viewed on the boiler display, the “tens place” is Parameter 34-1 (default value is 0) and the “ones place” is Parameter 34-2 (default value is also 0). As viewed on the boiler display, the factory set Parameter 34 will therefore appear as “00”. If Parameter 34-2 is changed to accept a 0-10VDC reading from an AM-4 (see Section D), Parameter 34 will then read “04” as viewed on the boiler display.

FIGURE A.1: EXPANDED MENU TREE

USE **MODE** KEY TO TOGGLE BETWEEN MODES

(Mode returns to Standby from other modes if no key is pressed for 20 min.)



1) If outdoor sensor is connected, this temperature is the supply temperature setpoint when the outdoor temperature is 0°F.

2) "Domestic water reference set point" + 45°F = boiler supply set point when boiler is responding to a call for domestic hot water (default = 180°F).

3) Boiler will automatically resume modulation after 15 minutes.

4) Factory default settings are shown in bold.

5) If no outdoor sensor is connected, display reads "4.-22".

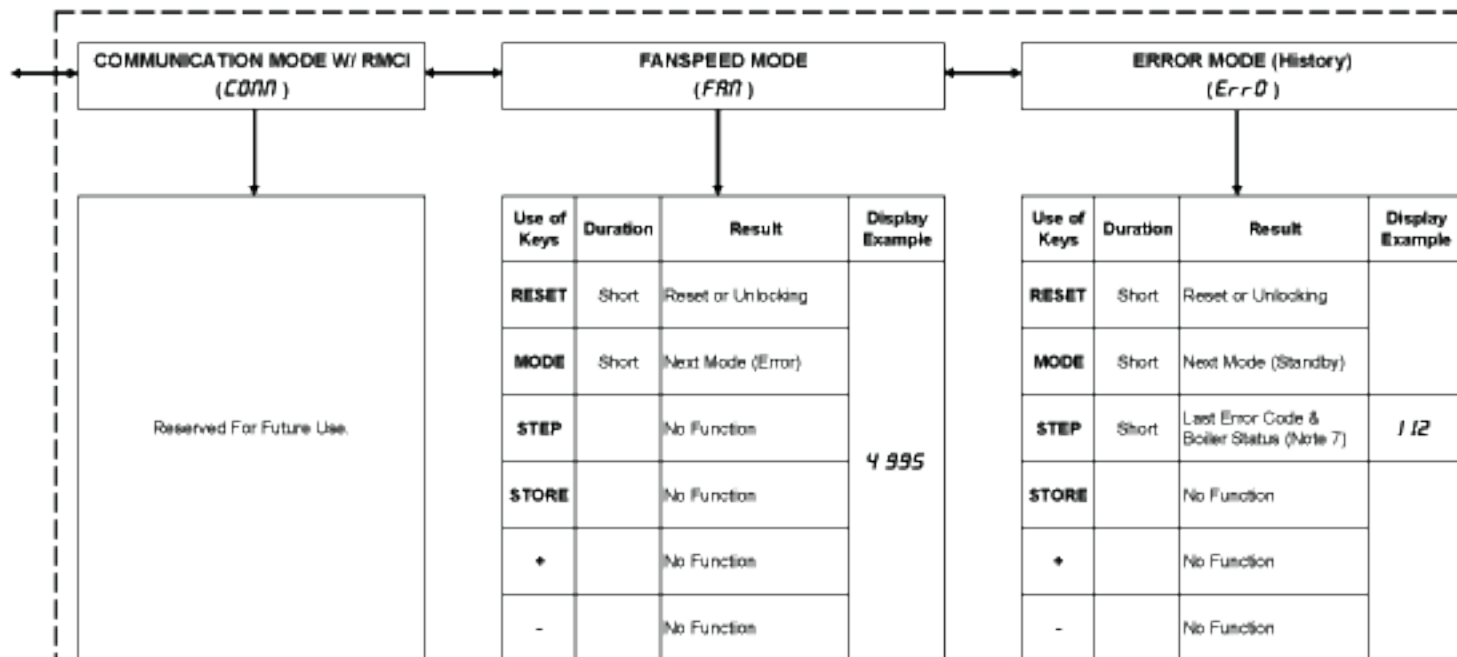
6) Depress and hold the **STEP** key and then quickly depress and hold the **MODE** key to activate **CODE MODE**. **CODE MODE** is active when the display shows a "C" followed by a 2 digit random number.

7) Displays the most recent error code and the boiler status at the time the error occurred.

FIGURE A.1: EXPANDED MENU TREE

USE **MODE** KEY TO TOGGLE BETWEEN MODES

(Mode returns to Standby from other modes if no key is pressed for 20 min.)



The data listed within the dashed boxed area is only accessible after the proper access code has been entered in Code Mode.

D. Field Adjustable Parameters

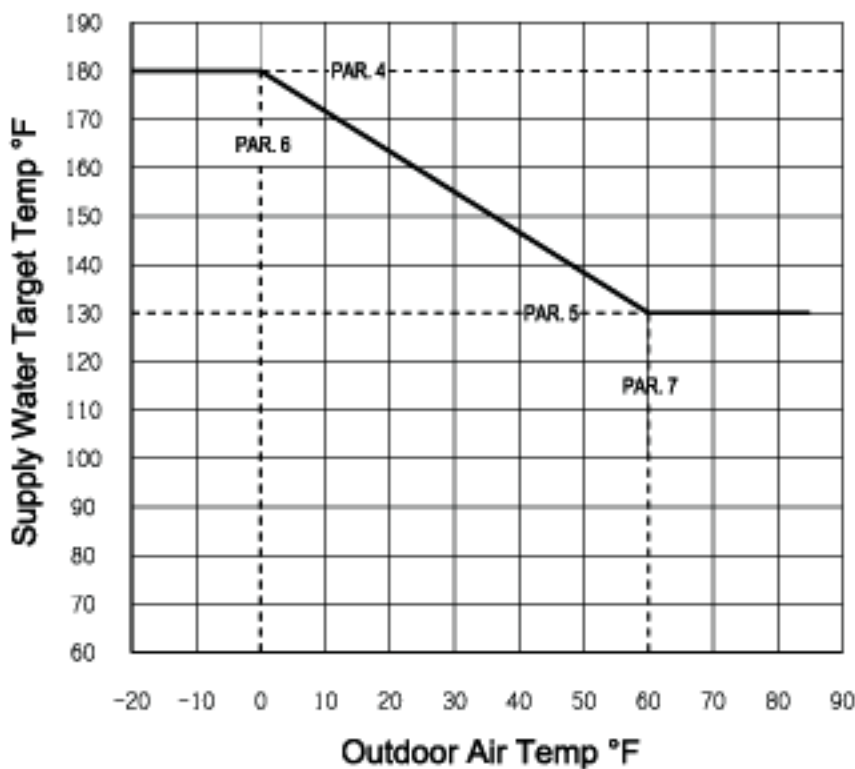
Table A.3 is a list of the parameters that can be adjusted in the field. Although it is physically possible to adjust all of these parameters, the parameters that are shaded gray should not need to be adjusted in the field. In the event that these parameters are changed by accident, they may be restored to their original factory values by referring to Table A.5.

1) Adjusting the target boiler supply temperature when responding to call from an indirect water heater - The default IWH target supply temperature is 180°F. Since most indirect water heaters have ratings based on 180°F boiler supply temperature, it should rarely be necessary to adjust this parameter.

2) Changing the boiler water reset curve - When an outdoor temperature sensor is connected to a BWC Series boiler, the MCBA will adjust the target boiler supply temperature based on outdoor temperature when the boiler is responding to a call for central heat. Figure A.2 is a graph showing the target boiler supply temperature as a function of outdoor temperature. The curve shown in Figure A.2 is that obtained with the factory set parameters. The shape of this curve may be changed by changing Parameters 4, 5, 6, and 7 as shown in Figure A.2.

If the outdoor sensor is not connected to the boiler, the target supply temperature is always defined by Parameter 4 when the boiler is responding to a call for central heat, regardless of the outdoor temperature. In this case, the settings of Parameters 5, 6, and 7 are meaningless.

3) Allowing the boiler to accept an input from an AM-4 module - In some applications (particularly multiple boiler installations) it may be desirable to allow an external control to directly manage modulation of the boiler. The control supplied with this boiler permits the BWC to be modulated using a 0-10VDC signal supplied by an external control. In order for the boiler to accept the 0-10VDC signal, Parameter 34-2 must be changed from "0" ("Room Thermostat") to "2" ("0-10V Capacity"). Once this parameter is changed, the boiler will ignore any call from a thermostat connected across terminals 1 and 2 on the boiler. It will continue to respond to calls from the indirect water heater thermostat.



In This Example:

Par. 4 = 180F
Par. 5 = 130F
Par. 6 = 0F
Par. 7 = 60F

Figure A.2 Adjusting Boiler Water Reset curve

Table A.3: Parameter Descriptions

PAR NO.	DESCRIPTION	PURPOSE	
1	T3set DHW	Factory set to 134°F. This value plus 46°F equals the target supply water temperature when the boiler responds to a call from the indirect water heater thermostat. With 134°F factory setting, target supply temperature is 180°F when boiler is responding to a call for DHW.	
2	DHW system	Factory set to "ON". Field change not recommended.	
3	CH system	Factory set to "ON". Field change not recommended.	
4	T1top CH Mode	Maximum target supply water temperature when boiler is responding to a call for central heating. When the outdoor air sensor is connected, this is the maximum supply water temperature on the reset curve (see Figure 1.2). Note: Settings higher than 180°F increase the risk of nuisance safety limit activation (b19 errors). Factory set to 180°F.	
5	T1foot CH Mode	When the outdoor sensor is connected, T1foot is the minimum supply water temperature (see Figure 1.2). Factory set to 100°F.	
6	T4 minimum	Outdoor temperature at and below which the boiler will operate at the maximum target supply water temperature (T1top). See Figure 1.2. Factory set to 0°F.	
7	T4 maximum	Outdoor temperature at and above which the boiler will operate at the minimum target supply water temperature (T1 foot). See Figure 1.2. Factory set to 60°F.	
8	T4 frost protection	Field Change Not Recommended	
9	T4 correction		
10	Tblocking		
11	Booster time		
12	Tparallel shift		
13/14	Maximum fanspeed CH		
15/16	Maximum fanspeed DHW		Maximum fan speed (firing rate) when responding to call for DHW
17/18	Minimum fanspeed		Field Change Not Recommended
19	Ignition fanspeed		
20	CH postpump time		
21	DHW postpump time		
22	CH modulation hysteresis on		
23	CH modulation hysteresis off		
24	DHW modulation hysteresis on		
25	DHW modulation hysteresis off		
26	DHW detection hysteresis on		
27	DHW detection hysteresis off		
28	CH blocking time	Field Change Not Recommended	
29	DHW blocking time		
30	DHW -> CH blocking time		
31	Modulate back difference T1 - T2		
32	RMCI Address		
33	Tplus: Setvalue addition for DHW	Field Change Not Recommended	
34-1	2nd CH-Circuit (1st digit)		
34-2	CH Type (2nd digit)	This parameter determines what device initiates a call for heat. The factory setting is "0" ("Room Thermostat" when selected using Gascom). If an AM-4 module is used for external modulation, this parameter is changed to "2" ("0-10V Analog on AM-4: Capacity" when using Gascom). When this parameter is set to "2", it ignores any call for heat from a thermostat connected to the boiler and instead responds to 0-10VDC signal connected to the AM-4 (also see AM-4 instructions).	
35-1	DHW 3-wayvalve or pump	Field Change Not Recommended	
35-2	DHW-type (2nd digit)		
36	Manual fanspeed		
37-1	PWM-pump level (1st digit)		
37-2	PWM-pump level (2nd digit)		
38	Tset hold boiler warm		
39	Ttop for 2nd CH circuit		
40	Tfoot for 2nd CH circuit		
41	Thysteresis for 2nd CH circuit		
42-1	Pump settings for CH and DHW		
42-2	Minimum Off Cycle (2nd digit)		

4) **Maximum Input when Responding to a Call for DHW** – Parameters 15/16 define the maximum fan speed (and therefore the maximum firing rate) when the boiler is responding to a call for heat from the DHW thermostat. Parameter 15 defines the “thousands” and “hundreds” places of this fan speed and Parameter 16 defines the “tens” and “ones” places. For example, if Parameter 15 is set to “42” and Parameter 16 is set to “51”, the maximum fan speed when responding to a call for DHW will be 4251 RPM.

The maximum DHW fan speed is factory set below the maximum central heating fan speed so as to permit the use of smaller sized piping and pumps (see Table 8.9). If adequate boiler water flow is provided through the indirect water heater loop, the DHW maximum firing rate can be set to full input (defined by parameters 13/14).

Although Parameters 2 and 3 should be left at the factory settings of “ON”, it is relatively easy to change them by accident (pushing and holding the “+” or “-” key while the boiler is in standby mode will change them). If the boiler does not respond to a call from one or both thermostats, verify that Parameters 2 and 3 are both “ON”.

E. Communication, Fan Speed and Error Modes

In addition to providing access to all field adjustable parameters, entering the access code also provides access to three additional mode menus using the boiler keypad. These are shown in Figure A.1:

- 1) **Communication Mode** - This mode does not currently have any function.
- 2) **Fan Speed Mode** - Allows the user to view the blower fan speed (firing rate is determined by fan speed).
- 3) **Error Mode** - Pressing STEP while in Error mode allows the user to view the last lockout error code that has occurred along with 5 other values which display the boiler status at the time of the last error. See Table A.4.

Table A.4: Error Mode Values

Step #	Value
1	Lockout Error Code
2	Boiler Status Code (See Table 11.3)
3	Supply Water Temperature
4	Return Water Temperature
5	DHW Temperature
6	Outdoor Temperature

Table A.5: Factory Parameter Settings BWC300, 399 & 425

PAR NO.	DESCRIPTION	Factory setting		
		BWC300	BWC399	BWC425
1	T3set DHW	135	135	135
2	DHW system	1 (On)		
3	CH system	1 (On)		
4	T1top CH Mode	180	180	180
5	T1foot CH Mode	130	130	130
6	T4 minimum	0	0	0
7	T4 maximum	60	60	60
8	T4 frost protection	-22	-22	-22
9	T4 correction	0	0	0
10	Tblocking	32	32	32
11	Booster time	0	0	0
12	Tparallel shift	0	0	0
13/14*	Maximum fanspeed CH	5500	4800	5000
15/16*	Maximum fanspeed DHW	3250	3000	3000
17/18*	Minimum fanspeed	2500	1700	1700
19	Ignition fanspeed	3000	3000	3000
20	CH postpump time	0	0	0
21	DHW postpump time	10.2	10.2	10.2
22	CH modulation hysteresis on	10	10	10
23	CH modulation hysteresis off	2	2	2
24	DHW modulation hysteresis on	10	10	10
25	DHW modulation hysteresis off	2	2	2
26	DHW detection hysteresis on	-8	-8	-8
27	DHW detection hysteresis off	10	10	10
28	CH blocking time	0	0	0
29	DHW blocking time	0	0	0
30	DHW -> CH blocking time	0	0	0
31	Modulate back difference T1 - T2	44	44	44
32	RMCI Address	-1	-1	-1
33	Tplus: Setvalue addition for DHW	45	45	45
34-1	2nd CH-Circuit (1st digit)	0 (2nd Heating Circuit Off)		
34-2	CH Type (2nd digit)	0 (Room Thermostat)		
35-1	DHW 3-wayvalve or pump (1st digit)	1 (Hot Water Pump)		
35-2	DHW-type (2nd digit)	3 (Storage Tank without NTC3)		
36	Manual fanspeed	-1	-1	-1
37-1	PWM-pump level (1st digit)	4	4	4
37-2	PWM-pump level (2nd digit)	1	1	1
38	Tset hold boiler warm	36	36	36
39	Ttop for 2nd CH circuit	176	176	176
40	Tfoot for 2nd CH circuit	68	68	68
41	Thysteresis for 2nd CH circuit	10	10	10
42-1	Pump settings for CH and DHW	0 (CH Normal Pump)		
42-2	Minimum Off Cycle (2nd digit)	0 (Not Active)		

* First parameter defines "Thousands" and "Hundreds" places. Second parameter defines "Tens" and "Ones" places

Appendix B: COMPONENT TEST PROCEDURES

A. Flame Signal Check

- 1) The flame signal can be checked between terminal number 9 on the low voltage terminal strip and ground. A good signal reading should be 6 VDC or greater.
- 2) If the signal is lower than 6 VDC, check the continuity of the ground wire between the ignitor and the junction box. If the ground wire is suspect, replace the ground wire.
- 3) If the ground wire is in good condition, remove the ignitor and inspect the ceramic insulator for cracks. If none are found, clean off any oxide deposits which formed on the electrode. If the insulator is cracked or the electrode can not be properly cleaned, replace the ignitor. When replacing the ignitor be sure to replace the ignitor gasket as well.
- 4) Other problems that can cause a low flame signal include:
 - An improperly adjusted throttle (confirm that the CO₂ is within the limits shown in the installation manual).
 - Fouling of the burner (remove the burner and clean with compressed air).
 - Low inlet gas pressure (verify that gas pressure is within the limits shown on the rating plate).
 - Grounded 24VAC or sensor wiring (this problem will result in no flame voltage reading, but will normally not result in an E02 error because there is still adequate flame current).

B. NTC Temperature Sensors

- 1) The supply, return, flue, and outdoor reset sensors used on the BWC are of the resistance type.
- 2) The Table B.1 shows the range of resistance values for these sensors at various temperatures.
- 3) To check a sensor, immerse it in an ice bath and read the resistance using an ohmmeter. Compare the measured resistance value against the value found in Table B.1 at 32°F. The measured value should fall within the range shown in Table B.1. If not replace the sensor.
- 4) Check the sensor at 212°F. This time immerse the sensor into a container of boiling water. Compare the measured resistance value against the value found in Table B.1 at 212°F. The measured value should fall within the range shown in Table B.1. If not replace the sensor.
- 5) Check the sensor at room temperature. Compare the measured resistance value against the value found in Table B.1 for your room temperature. The measured value should fall within the range shown in Table B.1. If not, replace the sensor.

Table B.1: NTC Sensor Resistance

Sensor Resistance Values			
Temperature (°F)	Minimum Value (Ohms)	Nominal Value (Ohms)	Maximum Value (Ohms)
0	82304	89787	97227
5	71959	78310	84863
10	62144	67449	72755
15	53074	57443	61814
20	46557	50262	53966
25	40650	43770	46890
30	35665	38312	40960
32	33669	36129	38590
35	31370	33622	35874
40	27543	29443	31340
45	24387	26028	27670
50	21422	22804	24187
55	19107	20301	21494
60	16887	17906	18925
65	15073	15948	16823
68	13981	14773	15566
70	13407	14157	14908
75	11970	12616	13262
80	10710	11268	11826
85	9571	10048	10524
90	8611	9026	9441
95	7699	8054	8409
100	6965	7275	7585
105	6259	6526	6794
110	5668	5899	6129
115	5118	5319	5519
120	4636	4810	4984
125	4208	4359	4510
130	3815	3945	4074
135	3479	3591	3703
140	3155	3252	3350
145	2880	2974	3087
150	2617	2705	2793
155	2391	2475	2559
160	2181	2261	2340
165	1993	2069	2146
170	1825	1898	1971
175	1670	1739	1808
180	1519	1600	1682
185	1406	1467	1529
190	1297	1355	1414
195	1192	1247	1302
200	1100	1153	1205
205	1014	1064	1114
210	937	984	1032
212	906	952	999

Appendix C: Special Requirements For Side-Wall Vented Appliances In The Commonwealth of Massachusetts

IMPORTANT

The Commonwealth of Massachusetts requires compliance with regulation 248 CMR 4.00 and 5.00 for installation of side-wall vented gas appliances as follows:

(a) For all side wall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the Commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. **INSTALLATION OF CARBON MONOXIDE DETECTORS.** At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors.

a. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.

b. In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.

2. **APPROVED CARBON MONOXIDE DETECTORS.** Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.

3. **SIGNAGE.** A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, "GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".

4. **INSPECTION.** The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

(b) **EXEMPTIONS:** The following equipment is exempt from 248 CMR 5.08(2)(a)1 through 4:

1. The equipment listed in Chapter 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and

2. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

(c) **MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM PROVIDED.** When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

1. Detailed instructions for the installation of the venting system design or the venting system components; and
2. A complete parts list for the venting system design or venting system.

(d) **MANUFACTURER REQUIREMENTS - GAS EQUIPMENT VENTING SYSTEM NOT PROVIDED.** When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:

1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and
2. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

(e) A copy of all installation instructions for all Product Approved side wall horizontally vented gas fueled equipment, all venting instructions, all parts lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

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