

CROWN Boiler Co.

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

CWD Series

Gas-Fired Direct Vent Hot Water Boilers

INSTALLATION INSTRUCTIONS

These instructions must be affixed on or adjacent to the boiler

Models:

- CWD060
- CWD083
- CWD110
- CWD138
- CWD165
- CWD193
- CWD220
- CWD245

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

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I Product Description

The CWD series boiler is a cast iron gas fired boiler designed for use in forced hot water heating systems. It is a low pressure boiler intended for use in closed heating systems with water temperatures under 240F. This boiler may be vented either vertically or horizontally with combustion air supplied from either outdoors or (under certain conditions) indoors. It is ideal for use in installations where a reliable source of clean indoor combustion air cannot be guaranteed.

II Specifications

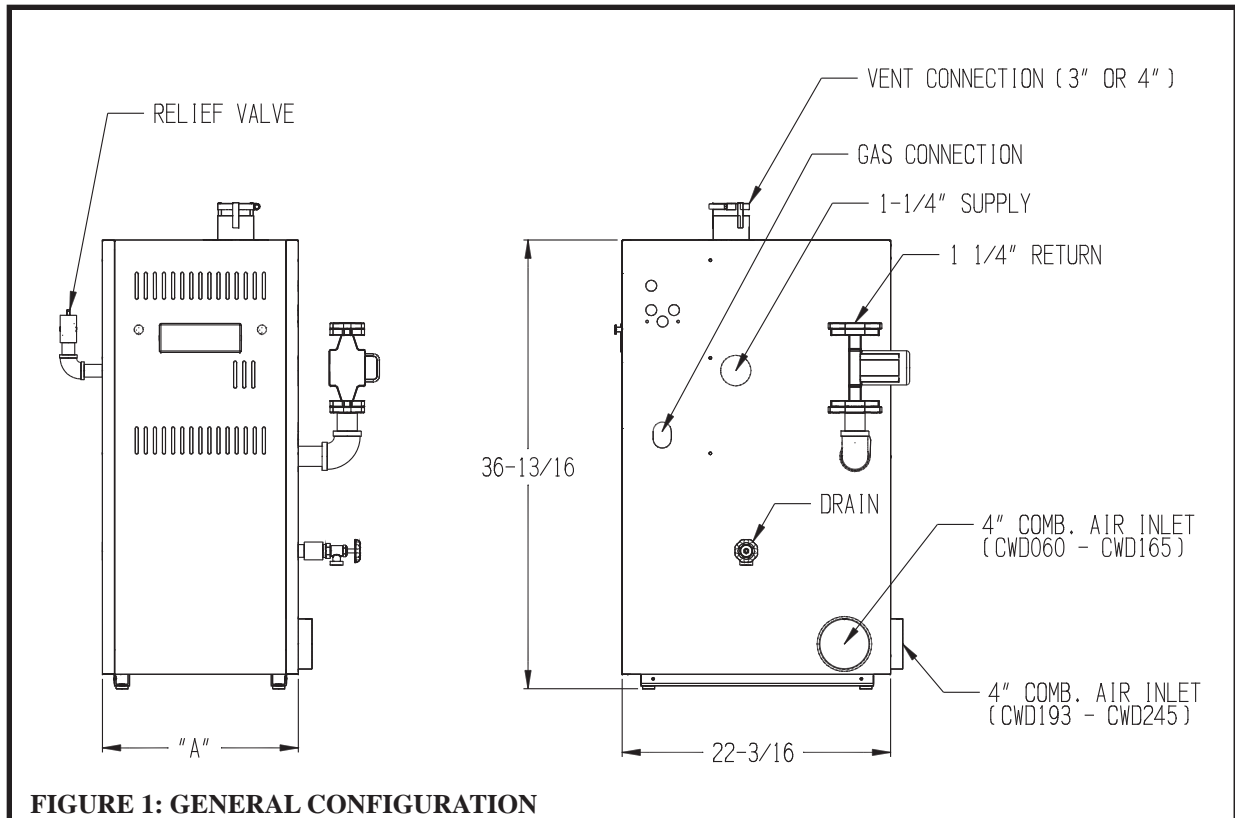


TABLE 1: SPECIFICATIONS

MODEL	SECTIONS	INPUT (MBH)	DOE HTG. CAPY (MBH)	I=B=R NET RATING (MBH)	AFUE (%)	FIG 1 DIM. "A" (in.)	VENT DIA. (in.)	WATER CONTENT (Gal.)
CWD060	3	60	51	44	85.1	16-1/8	3	2.0
CWD083	4	82.5	71	62	85.1	19-3/4	3	2.6
CWD110	5	110	94	82	85.2	23-3/8	3	3.1
CWD138	6	137.5	118	103	85.2	27	3	3.6
CWD165	7	165	142	123	85.2	30-5/8	3 OR 4	4.2
CWD193	8	192.5	165	143	85.2	34-1/8	3 OR 4	4.7
CWD220	9	220	189	164	85.2	37-3/4	3 OR 4	5.2
CWD245	10	245	211	183	85.3	41-3/8	3 OR 4	5.8

III Before Installing

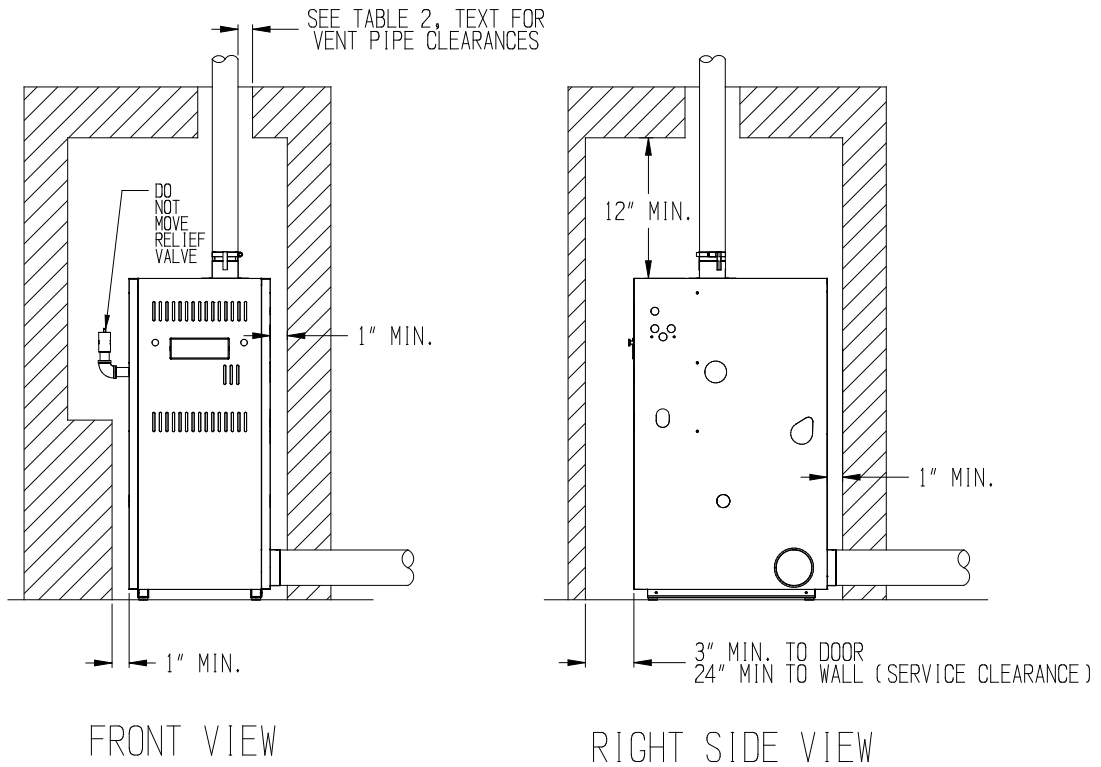
- 1) Safe, reliable operation of this boiler depends upon installation by a professional heating contractor in strict accordance with this manual and the authority having jurisdiction.
 - In the absence of an authority having jurisdiction, installation must be in accordance with this manual and the *National Fuel Gas Code*, ANSI Z223.1.
 - 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) 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.
- 3) 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 DOE Heating Capacity 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.
- 4) Make sure that the boiler received is configured for the correct gas (natural or LP).
- 5) This boiler is not designed for use with return temperatures under 120F for a sustained period of time. Some systems, such as those having large water contents, may require a return water bypass or other special provisions to protect the boiler against low return temperatures. Failure to provide such provisions if needed could result in severe corrosion damage to the boiler. For more information on when low water temperatures protection is required, and appropriate protection, see Part VIII.
- 6) For installations at altitudes above 2000ft, special orifice and pressure switches are required. Make sure that the boiler is configured for use at the correct altitude.

NOTICE

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

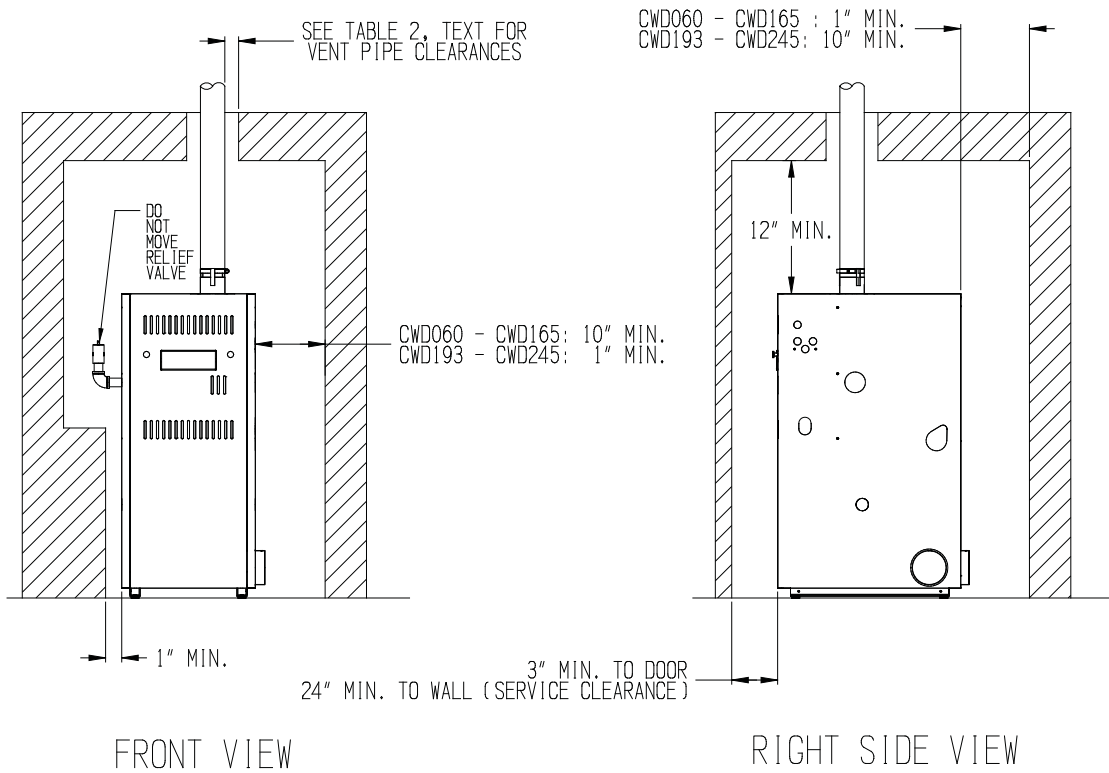
IV Locating the Boiler

- 1) Boiler clearances are shown in Figure 2. Figure 2a shows clearances from the boiler when outdoor combustion air is used. Figure 2b shows clearances from the boiler when combustion air is obtained from the boiler room. These minimum clearances apply to all types of combustible construction as well as noncombustible walls, ceilings and doors. At least 24" must be provided for servicing at the front of the boiler. This front clearance may be provided through a door, such as a closet door. Boiler will be much easier to service if at least 12" is provided from the sides and rear of the boiler to walls.
- 2) Clearances from venting to combustible material depends upon the type of venting, whether the vent pipe is enclosed, and whether the venting is vertical or horizontal. See Table 2 for vent clearance information.
- 3) Boiler may be installed on a non-carpeted combustible surface.
- 4) The relief valve must not be moved from the location shown in Figure 1.
- 5) When combustion air is obtained from the boiler room, a 10" clearance is required from the side of the boiler having the air inlet collar to combustible or non-combustible obstruction (Figure 2b).
- 6) The boiler should be located so as to minimize the length of the vent system.
- 7) Do not install this boiler in a location where gasoline or other flammable vapors or liquids will be stored or used. Do not install this boiler in an area where large amounts of airborne dust will be present, such as a workshop. When indoor combustion air is used, do not install in a location where sources of hydrocarbons will be stored or used. Some common sources of hydrocarbons include bleaches, fabric softeners, paints, cleaners, refrigerants, and cat boxes. Traces of these substances can be drawn into the boiler causing severe corrosion damage to the boiler and /or objectionable odors.



BOILER MAY BE INSTALLED DIRECTLY ON NON-CARPETED COMBUSTIBLE FLOOR
CLEARANCE FROM AIR INTAKE PIPING = 0"

FIGURE 2a: CLEARANCES WHEN BOILER IS DIRECT VENTED (OUTDOOR COMBUSTION AIR IS USED)



BOILER MAY BE INSTALLED DIRECTLY ON NON-CARPETED COMBUSTIBLE FLOOR

FIGURE 2b: CLEARANCES WHEN COMBUSTION AIR IS OBTAINED FROM BOILER ROOM

TABLE 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 PROTECH FASNSEAL W2 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	8"
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	6"
PROTECH FASNSEAL W2	VERTICAL OR HORIZONTAL	ENCLOSED ON ALL FOUR SIDES	3"
HEAT FAB SAF-T VENT SC	VERTICAL OR HORIZONTAL	UNENCLOSED OR ENCLOSED ON ALL SIDES	0"
"B" VENT CHASE USED AS PART OF CROWN COAXIAL VENT SYSTEM*	VERTICAL	PER "B" VENT MANUFACTUER'S INSTRUCTIONS	REFER TO "B" VENT MANUFACTURER'S INSTRUCTIONS

* "B" Vent is used as a chase to carry combustion air in this system - never attempt to vent a CWD boiler using "B" vent

V Air for Combustion and Ventilation

Sufficient fresh air must be supplied for both combustion and ventilation. In general, combustion air is obtained in one of two ways:

- Direct Vent Installations – Combustion air is piped directly to the boiler inlet collar from the outdoors. This is also sometimes called a “sealed combustion” installation.
- Direct Exhaust Installations – Combustion air is obtained from the boiler room. In some cases, openings or duct work may be run from the outdoors to the boiler room, however the ducting is not connected directly to the boiler.

Air for ventilation is required to keep various boiler components from overheating and is always obtained from indoors. To ensure an adequate combustion and ventilation air supply, perform the following steps:

Step 1: Determine whether the boiler is to be installed in a building of unusually tight construction

A good definition of “unusually tight construction” is construction having all of the following features:

- Walls and ceilings exposed to outside atmosphere have a continuous water vapor retarder with a rating of 1 perm or less with openings gasketed and sealed.
- Weather stripping has been added on openable windows and doors.
- Caulking and sealants are applied to areas such as joints around window and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical, and gas lines, and at other openings.

Step 2: 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:

$$\text{Length (ft) x width (ft) x ceiling height (ft)}$$

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 CWD245 and a water heater are to be installed in a room measuring 6ft – 3 in x 7ft with an 8 ft ceiling. The water heater has an input of 30000 BTU/hr:

$$\text{Total input in thousands of BTU/hr} = (245000 \text{ BTU/hr} + 30000 \text{ BTU/hr}) / 1000 = 275$$

$$\text{Volume of room} = 6.25 \text{ ft} \times 7 \text{ ft} \times 8 \text{ ft} = 350 \text{ ft}^3$$

$350/275 = 1.27$. Since 1.27 is less than 50, the boiler room is a confined space.

Step 3: Decide whether the boiler will be direct vented or direct exhausted

The boiler must be direct vented (combustion air piped directly to the boiler) if:

- The boiler is to be installed in a laundry room
- The building in which the boiler is installed has an indoor pool.
- The boiler is located in an area having any of the contaminants described in Section IV.

It is also strongly recommended that combustion air be piped from outside when the boiler is installed in a building of unusually tight construction.

Step 4: If the boiler is Direct Vented, Provide Air as Follows (If Indoor Combustion Air is used, Skip to Step 5):

- 1) Combustion air piping must not exceed the maximum lengths called for in Section VI.
- 2) Although combustion air is obtained directly from outdoors, openings may be required into the boiler room to allow for adequate equipment ventilation. The following guidelines apply regardless of whether or not the building is of unusually tight construction:

Unconfined Space– Natural infiltration into the boiler room will provide adequate air for ventilation without additional openings into boiler room.

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 3). The minimum opening dimension is 3 inches.

- If the CWD boiler is the only gas-burning appliance in the boiler room, these openings must each have a 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 regardless of opening requirements for other appliances.
- 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 5: If Indoor Combustion Air is Used, Provide Air as Follows:

1) Buildings of other than unusually tight construction:

Unconfined Space– Natural infiltration into the boiler room will normally provide adequate air for combustion and ventilation without additional louvers or openings into boiler room.

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 3).

- Each opening must have a free area of 1 square inch per 1000 BTU/hr input of all gas burning appliances in the boiler room. The minimum opening dimension is 3 inches. Minimum opening free area is 100 square inches per opening.
- If the total volume of both the boiler room and the room to which the openings connect is less than 50 cubic feet per 1000 BTU/hr of total appliance input, install a pair of identical openings into a third room. Connect additional rooms with openings until the total volume of all rooms is at least 50 cubic feet per 1000 BTU/hr of input.
- The “free area” of an opening takes into account the blocking effect of mesh, grills, and louvers. Where screens are used, they must be no finer than $\frac{1}{4}$ ” (4 x 4) mesh.

2) Buildings of unusually tight construction:

If at all possible, direct vent the boiler. Where the boiler must be installed in unusually tight construction and cannot be direct vented, openings must be installed between the boiler room and the outdoors or a ventilated space, such as an attic or crawl space, which communicates directly with the outdoors. Two openings are required. The top edge of the upper opening must be within 12 inches of the ceiling. The bottom edge of the lower opening must be within 12 inches of the floor. Size openings and ducts as follows:

- Vertical ducts or openings directly outdoors (Fig 4, Fig 5, Fig 6) – Each opening must have a free cross sectional area of 1 square inch per 4000 BTU/hr of the total input of all gas-fired appliances in the boiler room but not less than 100 square inches. Minimum opening size is 3 inches.
- Openings to outdoors via horizontal ducts (Fig 7) - Each opening must have a free cross sectional area of 1 square inch per 2000 BTU/hr of the total input of all gas fired appliances in the boiler room but not less than 100 square inches. Minimum opening size is 3 inches.
- 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 $\frac{1}{4}$ ” (4 x 4) mesh.

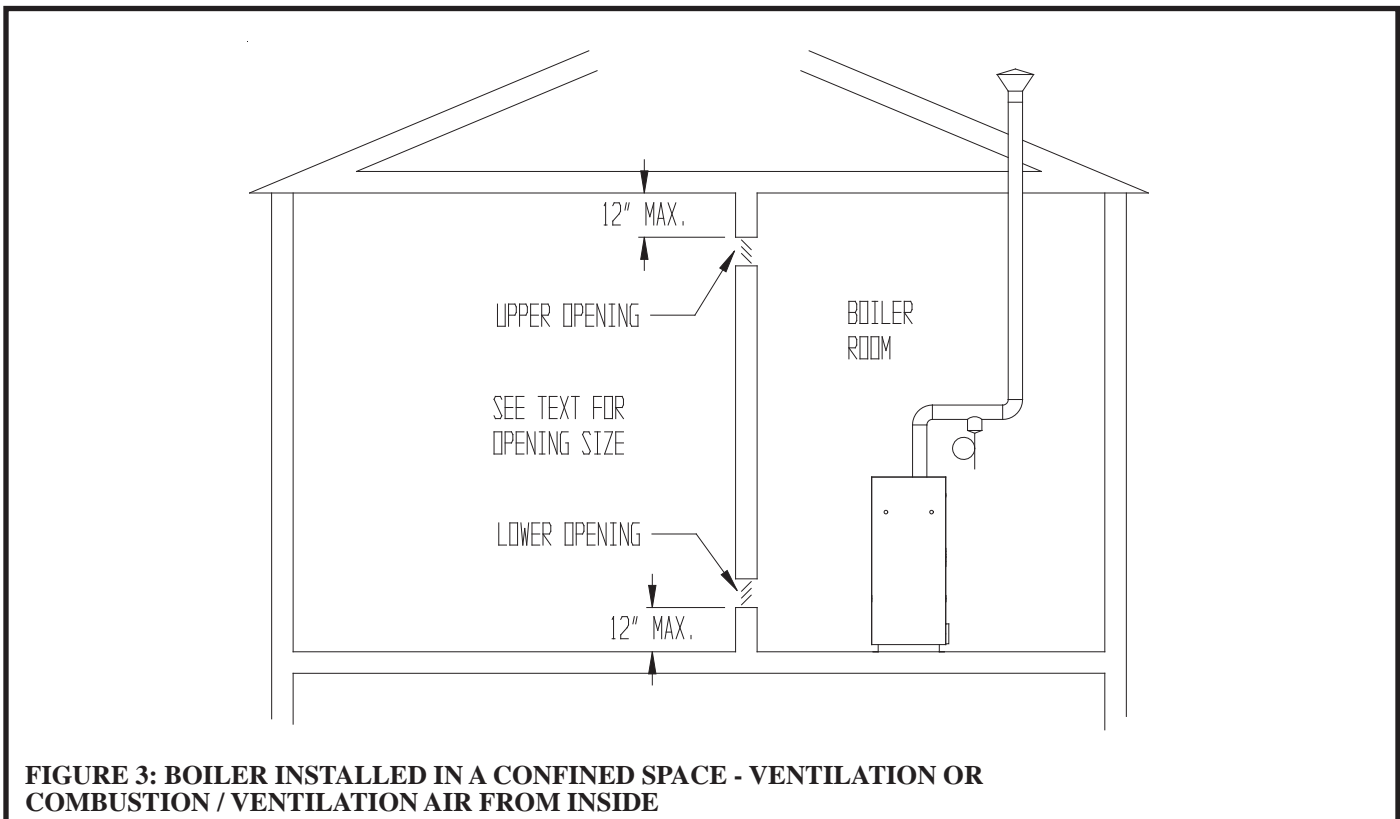


FIGURE 3: BOILER INSTALLED IN A CONFINED SPACE - VENTILATION OR COMBUSTION / VENTILATION AIR FROM INSIDE

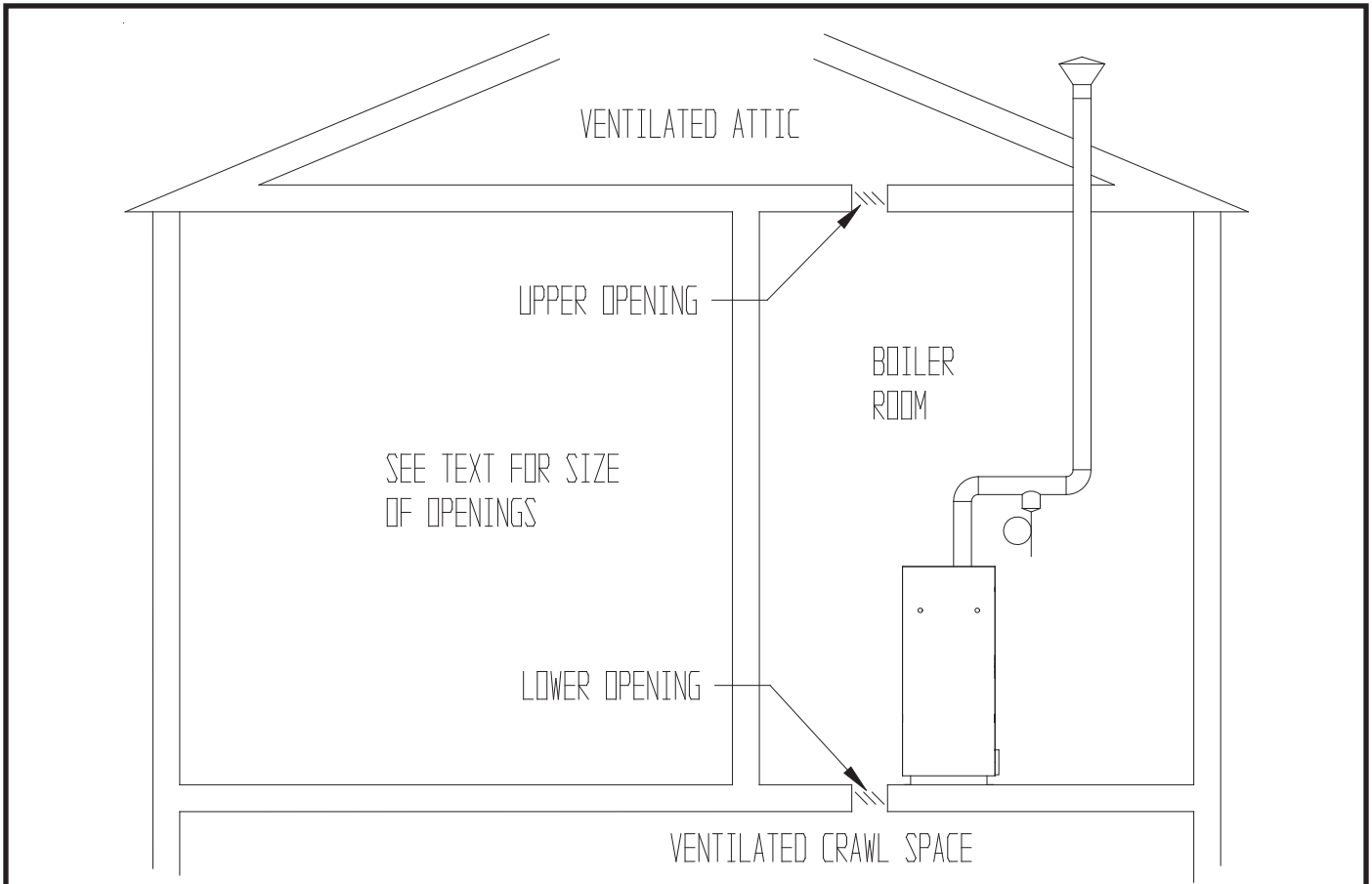


FIGURE 4: ALL AIR FROM OUTSIDE USING VENTILATED CRAWL SPACE AND ATTIC

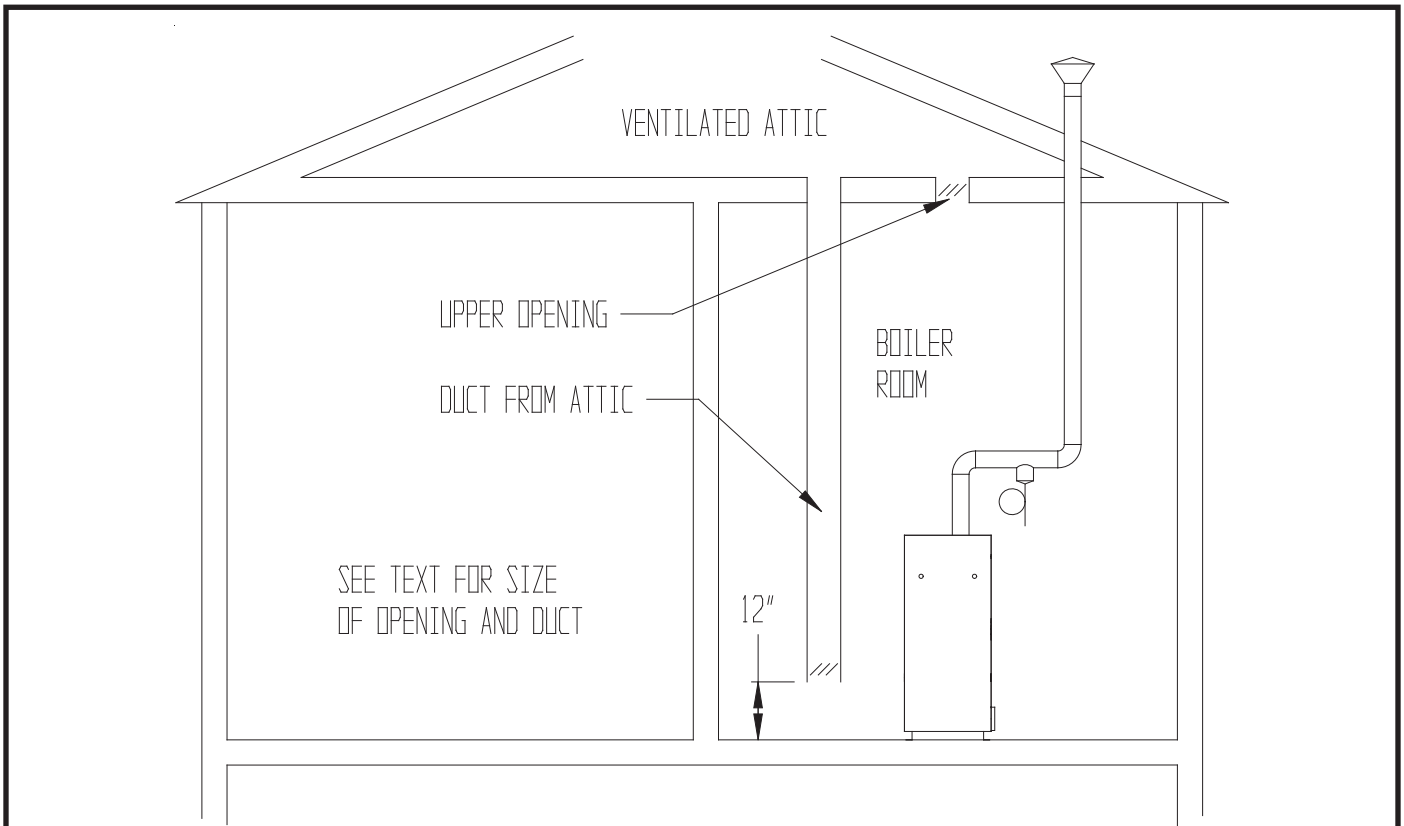


FIGURE 5: ALL AIR FROM OUTSIDE USING VENTILATED ATTIC

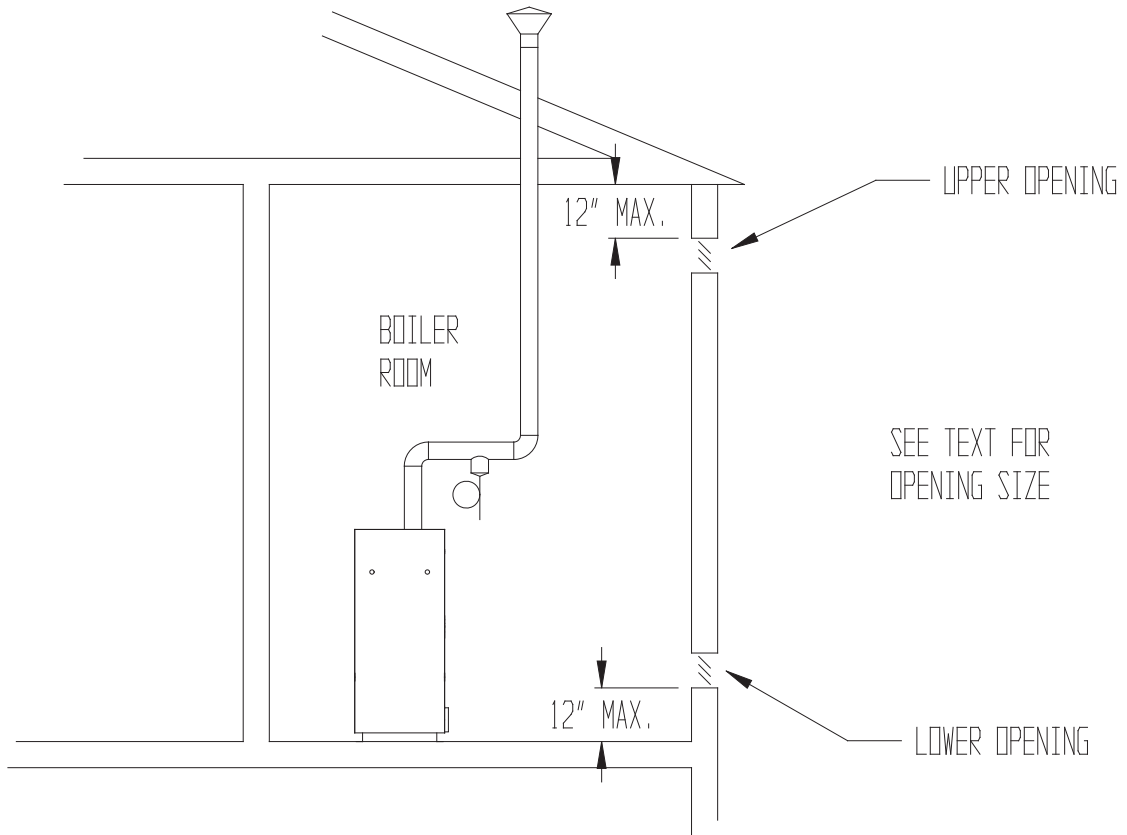


FIGURE 6: ALL AIR FROM OUTSIDE USING OPENINGS INTO BOILER ROOM

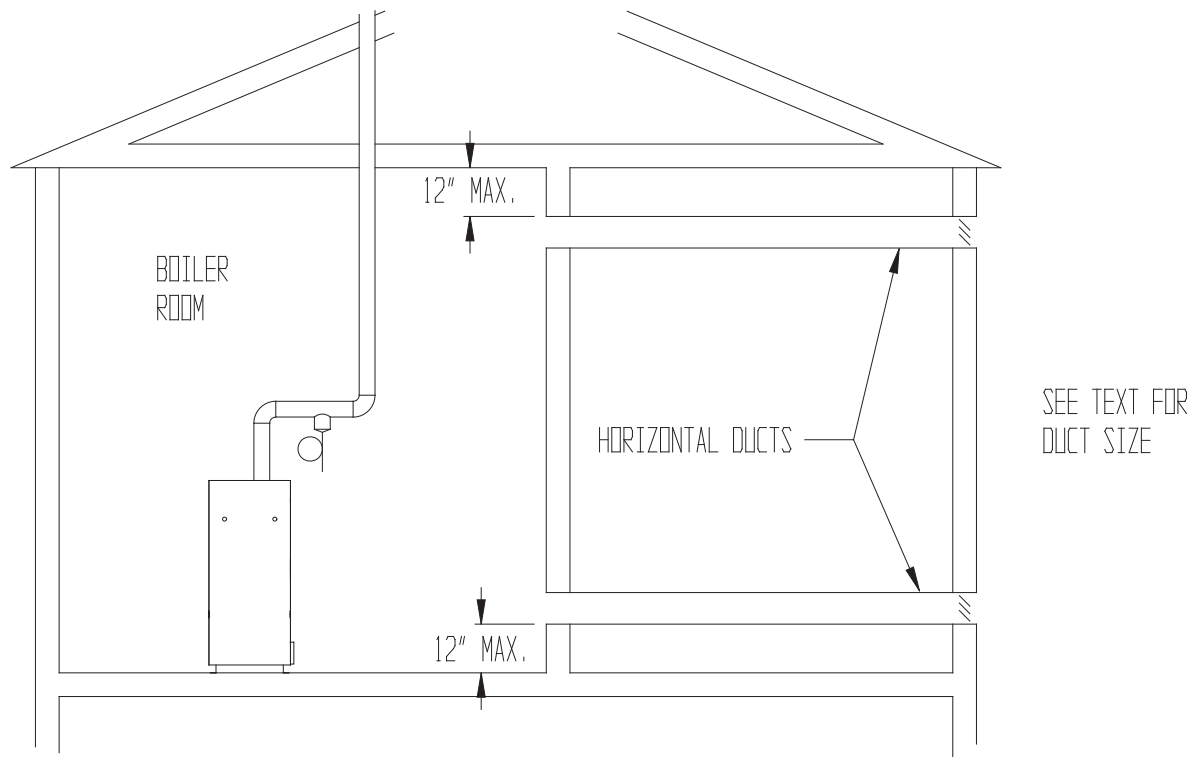


FIGURE 7: ALL AIR FROM OUTSIDE USING HORIZONTAL DUCTS INTO BOILER ROOM

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, or unsafe operation:

- * **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 install a barometric damper or draft hood on this boiler.**
- * **Do not attempt to use the vent system for this boiler 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 three basic ways to vent the CWD boiler:

- **Horizontal (“side wall”) Venting** - Vent system exits the building through an outside wall. Combustion air is either obtained through a separate pipe from outside (a “direct vent” installation) or obtained from the boiler room (a “direct exhaust” installation).
- **Vertical Non-Coaxial Venting** - Vent system exits the building through a roof. Combustion air is either obtained through a separate pipe from outside (a “direct vent” installation) or obtained from the boiler room (a “direct exhaust” installation).
- **Vertical Coaxial Venting** - Vent system exits the building through a roof. A portion of the vent system is coaxial, meaning that it consists of a “pipe within a pipe”. Flue gasses exit the building through the inner pipe and combustion air is drawn through the space between the two pipes.

For each of the above three basic methods, there are several variations, resulting in a total of 13 options for venting the CWD boiler. A description of each of these venting options is listed in Tables 3a - 3c. For clarity, these vent options are numbered from 1 to 13 in Table 3. **One of the vent option columns in Table 3 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 Table 4. These systems are made of a special stainless steel alloy (AL29-4C) for protection against corrosive flue gas condensate. They are also 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 unique method for installation - do not attempt to mix components from different vent systems. The only exceptions are:
 - Heat Fab Saf-T Vent SC may be combined with Saf-T Vent EZ Seal.
 - Protech FasNSeal W2 may be combined with Protech FasNSeal.

See the vent installation section of this manual for information on how this can be done.

Heat Fab Saf-T Vent SC is a double wall vent system which can be used in two ways on CWD installations. In vertical coaxial vent systems (Vent Options 12 and 13), the space between the inner and outer pipes is used as a conduit to bring combustion air to the boiler. In Horizontal (Vent Options 1 to 5) and Vertical (Option 6 to 10) vent systems, Saf-T Vent SC can be used to obtain a 0” clearance to combustible construction. When this is done, the space between the inner and outer pipes is used for ventilation, but boiler combustion air comes from elsewhere.

Protech FasNSeal W2 is also a double wall vent system. In some cases, it can be used to obtain closer clearances to combustible construction than are possible using Protech FasNSeal (see Table 2). The space between the inner and outer pipes on FasNSeal W2 cannot be used as a combustion air conduit.

The Crown Vertical coaxial vent system (Vent Option 11) is similar to that constructed using Heat Fab Saf-T Vent SC except it is constructed by running one of the 3” single wall vent systems shown in Table 4 inside 5” type “B” vent. The space between the 3” vent and the “B” vent forms a conduit to bring combustion air to the boiler. The advantage of this system is that it can be constructed using any of the vent systems shown in Table 4 except for Heat Fab Saf-T Vent SC and Protech FasNSeal W2. No turns are permitted in the coaxial section of this system.

TABLE 3a: SUMMARY OF HORIZONTAL VENTING OPTIONS

VENT OPTION #		1	2	3	4	5
CLASSIFICATION USED IN THIS MANUAL		HORIZONTAL DIRECT VENT	HORIZONTAL DIRECT VENT	(RESERVED FOR FUTURE USE)	HORIZONTAL DIRECT EXHAUST	HORIZONTAL DIRECT EXHAUST
ILLUSTRATED IN FIGURE		8a OR 8b	8a OR 8b		9	9
VENT PIPE STRUCTURE PENETRATION		WALL	WALL		WALL	WALL
AIR INTAKE PIPE STRUCTURE PENETRATION		WALL	WALL		N.A.	N.A.
VENT PIPE SIZE		3"	4"		3"	4"
AIR INTAKE PIPE SIZE		4"	4"		N.A.	N.A.
MAXIMUM VENT PIPE LENGTH	CWD060 - CWD138	55 FT	55 FT		55 FT	55 FT
	CWD165	35 FT	55 FT		35 FT	55 FT
	CWD193	25 FT	55 FT		25 FT	55 FT
	CWD220	15 FT	55 FT		15 FT	55 FT
	CWD245	N.R.	55 FT		10 FT	55 FT
MAXIMUM INTAKE PIPE LENGTH	CWD060 - CWD138	60 FT	60 FT		N.A.	N.A.
	CWD165	40 FT	60 FT		N.A.	N.A.
	CWD193	30 FT	60 FT		N.A.	N.A.
	CWD220	20 FT	60 FT		N.A.	N.A.
	CWD245	N.R.	60 FT		N.A.	N.A.
EXHAUST TERMINAL		3" 90 ELBOW, TEE, OR CROWN COAXIAL TERMINAL #50-003	4" 90 ELBOW, TEE, OR CROWN COAXIAL TERMINAL #50-004		3" 90 ELBOW OR TEE	4" 90 ELBOW OR TEE
AIR INTAKE TERMINAL		4" 90 ELBOW OR CROWN COAXIAL TERMINAL #50-003	4" 90 ELBOW OR CROWN COAXIAL TERMINAL #50-004	N.A.	N.A.	
VENT MATERIAL		APPROVED VENT SYSTEM SHOWN IN TABLE 4				
AIR INTAKE MATERIAL		GALVANIZED OR PVC			N.A.	N.A.

"N.R" - Not recommended "N.A." - Not applicable

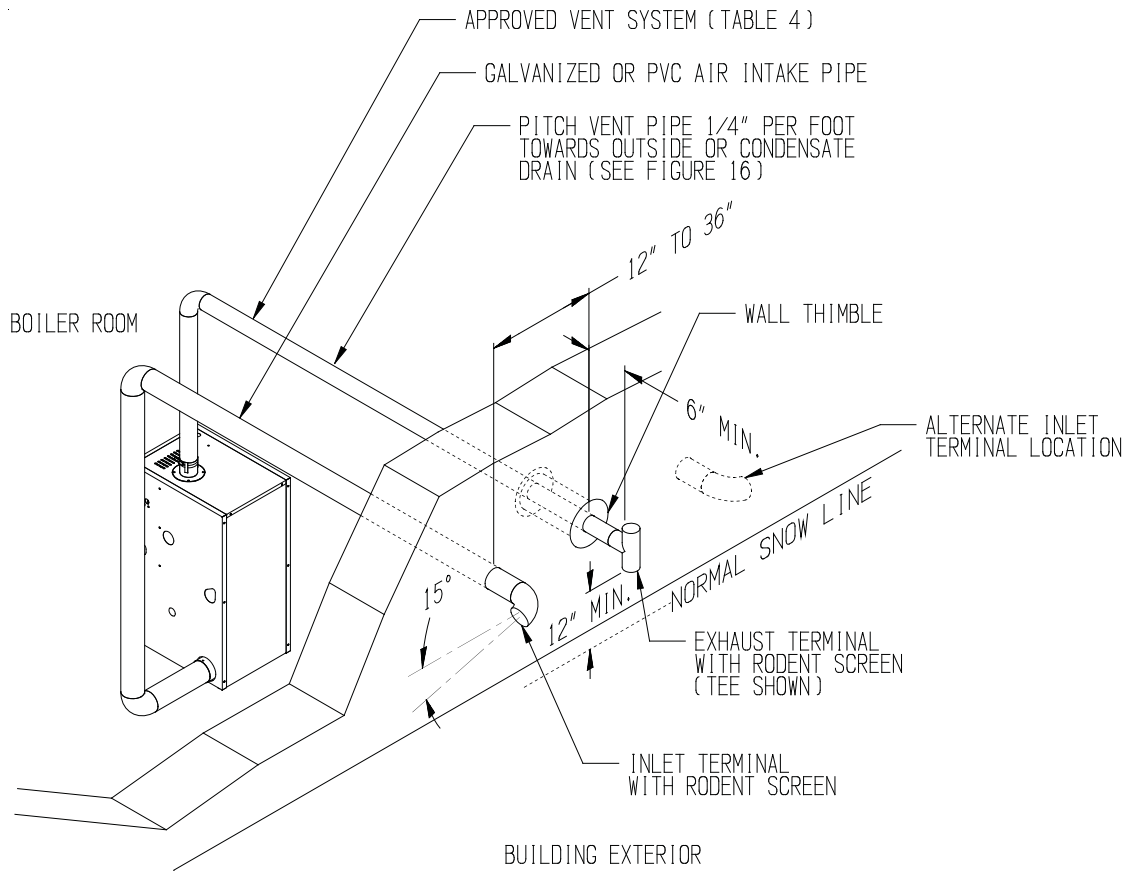


FIGURE 8a: HORIZONTAL DIRECT VENTING USING SEPARATE TERMINALS (VENT OPTIONS 1-2)

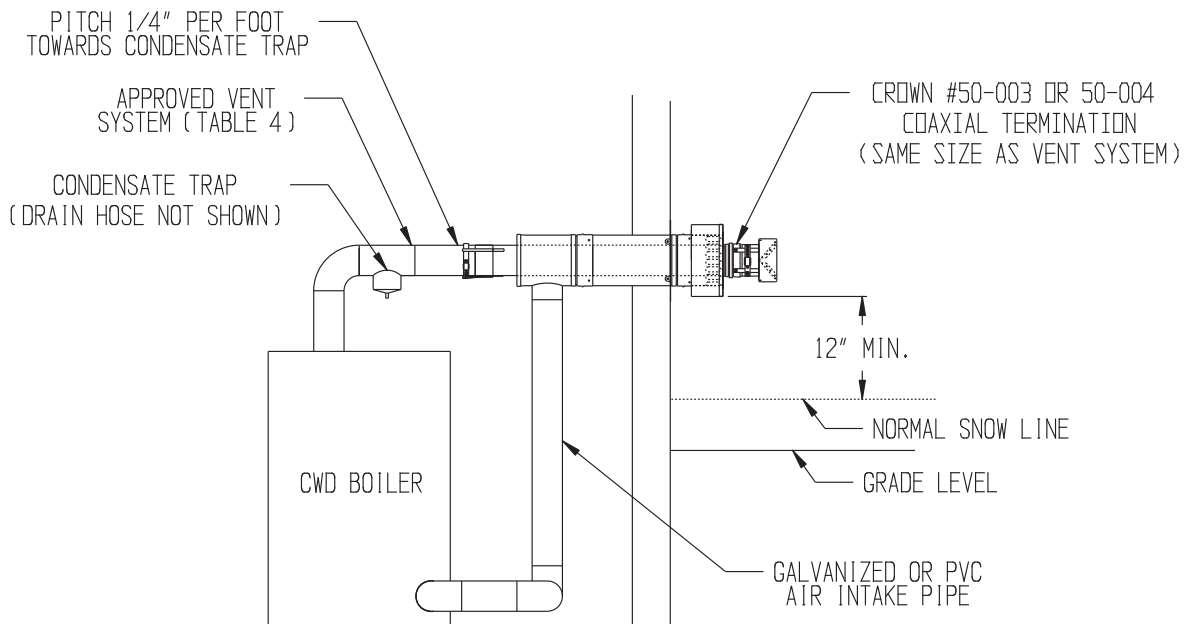


FIGURE 8b: HORIZONTAL DIRECT VENTING USING COAXIAL TERMINAL (VENT OPTIONS 1-2)

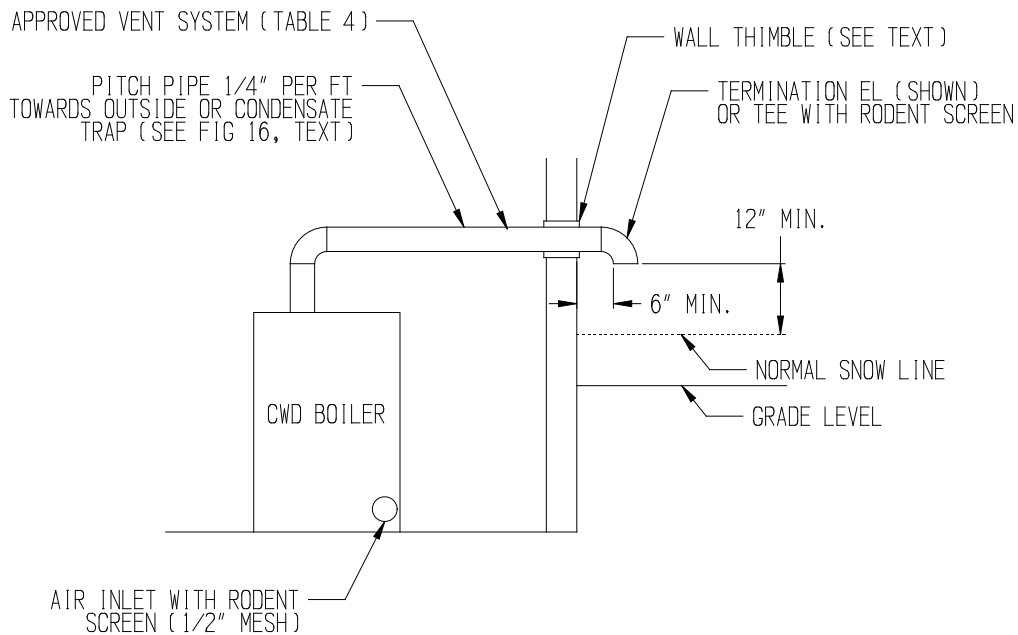


FIGURE 9: HORIZONTAL DIRECT EXHAUST VENT SYSTEM (VENT OPTIONS 4,5)

2) Maximum Vent and Air Intake Lengths - The maximum length of the vent air intake piping depends upon the vent option selected, the vent pipe size, and the boiler size. See Table 3 for the maximum vent length. In addition to the maximum length of piping shown in Table 3, the following fittings may also be used:

- Horizontal Vent Systems: One 90 deg. elbow
- Vertical Vent Systems: Two 90 deg. elbows
- Vertical Coaxial Vent Systems: Two 90 deg. elbows
- Air Intake Systems: Two 90 deg. elbows

If additional elbows are desired, the maximum allowable vent length must be reduced by the amount shown in Table 5 for each additional elbow used. Note: Termination fittings do not need to be counted when counting additional elbows.

Example:

A 3" vent system is planned for a horizontal direct vented CWD165 which has the following components:

- 2 ft vertical pipe*
- 1 90 elbow*
- 5 ft horizontal pipe*
- 1 90 elbow*
- 3 ft horizontal pipe*
- 1 45 elbow*
- 4 ft horizontal pipe*
- 1 termination elbow*

The Vent Option #1 column in Table 3a describes a horizontal direct vent system using 3" vent pipe. From this column, we see that a CWD165 may vent length of up to 35ft. The first 90 elbow and the termination elbow are not considered. From Table 5, the equivalent length of the 3" 45 elbow is 4ft and the equivalent length of the 3" 90 degree elbow is 5.5ft. The maximum allowable run of straight pipe on this system is therefore:

$$35\text{ft} - 4\text{ft} - 5.5\text{ft} = 25.5\text{ft}$$

Since the planned installation has only 14 ft of straight pipe, the planned vent length is acceptable.

3) Minimum Vent / Exhaust Pipe Length - Minimum vent length is 2ft. Minimum air inlet length is 0ft.

- 3) Permitted Terminals for Horizontal Venting (Vent Options 1 - 5) - Table 3a shows permitted types of terminals for both the vent and air inlet systems. On horizontal direct vent systems using 4" air inlet pipe (Vent Options 1 and 2), the following Crown co-axial terminals may be used. These terminals have the advantage of requiring only one wall penetration. Part numbers for the Crown coaxial terminals are as follows:

- 3" Vent - 50-003
- 4" Vent - 50-004

When separate vent and air intake terminals are used, or when the boiler uses indoor combustion air, the vent terminal is either a tee or an elbow supplied by the vent system manufacturer and equipped with a rodent screen. Vent system manufacturer's part numbers for these fittings are shown in Table 4. In some cases, the elbows and tees shown in Table 4 require separate adaptors and/or rodent screens. When this is the case, vent manufacturer part numbers for these additional parts are shown in Table 4 along with the termination fitting.

When Heat Fab Saf-T Vent SC is used, the Heat Fab 5300CI or 5400CI fitting is used between the last piece of Saf-T Vent CI and the terminal. These fittings physically adapt from the CI pipe to the terminal and also provide ventilation openings which must remain open for the Saf-T Vent CI to maintain its clearance rating.

Except when the Crown 50-003 or 50-004 coaxial terminals are used, the air intake fitting on a horizontal direct vent system (Options 1 - 2) is always a 90 degree elbow with a rodent screen. 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 8a.

- 4) Horizontal vent terminal location - Observe the following limitations on the vent terminal location (also see Fig 15a - d):
- Direct exhaust installations (installations using indoor combustion air) - Exhaust terminal must be at least 4 feet below or 4 feet horizontally from any window, door, or gravity air inlet into the building.
 - Direct vent installations - Exhaust elbow or coaxial terminal must be at least 1 foot from any door, window, or gravity inlet into the building.
 - Direct vent installations using termination elbows - Maintain the correct clearance and orientation between the inlet and exhaust elbows. The elbows must be at the same level and their center lines must be between 12 and 36 inches apart.
 - The bottom of the exhaust elbow, tee, or coaxial terminal must be at least 12" above the normal snow line. In no case should it be less than 12" above grade level.
 - The bottom of the exhaust elbow, tee, or coaxial terminal must be at least 7 feet above a public walkway.
 - The bottom of the exhaust elbow, tee, or coaxial terminal must be at least 3 feet above any forced air inlet located within 10 feet.
 - A clearance of at least 4 feet horizontally or 4 feet vertically must be maintained between the exhaust terminal and gas meters, electric meters, regulators, and relief equipment.
 - Do not locate the terminal under decks or similar structures.
 - Top of exhaust elbow, tee, or coaxial terminal must be at least 4 feet below eaves, soffits, or overhangs. Overhang may not exceed 3 feet (Figure 15d).
 - Terminal must be at least 3 feet from an inside corner.
 - Under certain conditions, water in the flue gas may condense on the structure in areas around the terminal. If these areas are made of materials subject to damage by flue gas condensate, they should be protected.
 - If possible, install the terminal 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.
 - The noise level in the vicinity of the terminal is approximately 65 dB (roughly the level of a normal conversation). Avoid positioning the terminal in areas where this might be objectionable.
- 5) Horizontal air intake terminal location - Horizontal air intake terminal must be at least 12" above the normal snow line.
- 6) Permitted Terminals for Vertical Venting (Vent Options 6 - 10) - Terminals used on these systems are caps. Vent manufacturer part numbers for these caps are shown in Table 4. When Heat Fab Saf-T Vent SC is used, the 5300CI or 5400CI fitting is used between the highest piece of Saf-T Vent CI and the cap. These fittings physically adapt from the CI pipe to the cap and also provide ventilation openings which must remain open for the Saf-T Vent CI to maintain its clearance rating.
- Vertical direct vent systems (Vent Options 6 - 8) can have combustion air obtained from either a vertical or horizontal air intake system. When combustion air is obtained from the roof, the air inlet terminal consists of a 180 degree elbow (or two 90 degree elbows) with a rodent screen as shown in Figure 10. When combustion air is obtained through a horizontal vent system, the air inlet termination is a 90 degree elbow with a rodent screen as shown in Figure 8a.
- 7) Permitted terminals for Vertical Coaxial Venting (Options 11 - 13) - When the Crown vertical coaxial vent kit is used (Vent Option 11), a cap compatible with the vent system is used (Figure 12, Table 4). The concentric air intake hood supplied in the Crown kit is the air inlet terminal (Figure 12).

When vertical coaxial venting is done using Heat Fab Saf-T Vent SC (Options 12, 13), the vent terminal is a SC03VT or SC04VT terminal installed with a 5300CI or 5400CI adaptor. The openings in this adaptor are used for combustion air.

TABLE 3b: SUMMARY OF VERTICAL VENTING OPTIONS

VENT OPTION #		6	7	8	9	10
CLASSIFICATION USED IN THIS MANUAL		VERTICAL DIRECT VENT	VERTICAL DIRECT VENT	(RESERVED FOR FUTURE USE)	VERTICAL DIRECT EXHAUST	VERTICAL DIRECT EXHAUST
ILLUSTRATED IN FIGURE		10	10		11	11
VENT PIPE STRUCTURE PENETRATION		ROOF	ROOF		ROOF	ROOF
AIR INTAKE PIPE STRUCTURE PENETRATION		ROOF OR WALL	ROOF OR WALL		N.A.	N.A.
VENT PIPE SIZE		3"	4"		3"	4"
AIR INTAKE PIPE SIZE		4"	4"		N.A.	N.A.
MAXIMUM VENT PIPE LENGTH	CWD060 - CWD138	47 FT	47 FT		47 FT	47 FT
	CWD165	27 FT	47 FT		27 FT	47 FT
	CWD193	17 FT	47 FT		17 FT	47 FT
	CWD220	N.R.	47 FT		N.R.	47 FT
	CWD245	N.R.	47 FT		N.R.	47 FT
MAXIMUM INTAKE PIPE LENGTH	CWD060 - CWD138	52 FT	50 FT		N.A.	N.A.
	CWD165	32 FT	50 FT		N.A.	N.A.
	CWD193	22 FT	50 FT		N.A.	N.A.
	CWD220	N.R.	50 FT		N.A.	N.A.
	CWD245	N.R.	50 FT		N.A.	N.A.
EXHAUST TERMINAL		BY VENT SYSTEM MANUFACTURER. SAME DIAMETER AS VENT SYSTEM. SEE TABLE 4.				
AIR INTAKE TERMINAL (ROOF PENETRATION)		4" 180 ELBOW	4" 180 ELBOW	N.A.	N.A.	
AIR INTAKE TERMINAL (WALL PENETRATION)		4" 90 ELBOW	4" 90 ELBOW	N.A.	N.A.	
VENT MATERIAL		APPROVED VENT SYSTEM SHOWN IN TABLE 4				
AIR INTAKE MATERIAL		GALVANIZED OR PVC			N.A.	N.A.

"N.R." - Not recommended "N.A." - Not applicable

- 8) Vertical Vent Terminal Locations (Vent Options 6 - 13) - Observe the following limitations on the location of all vertical vent terminals (see Figs. 10, 11, 12, 13):
 - The lowest discharge opening on the cap must be at least 2 feet above any object located within 10 feet.
 - If outside air is used for combustion (Options 6-7, 11-13), the vertical distance between 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.

- 9) Terminal offsets - Horizontal elbow or tee terminals may be offset by as much as 5 ft as shown in Figure 14. This sometimes helps maintain the 12" minimum clearance required above the snow line. The extra two elbows and the section of vertical pipe on the outside of the building must be counted when checking that the maximum vent / intake pipe length is not exceeded. On horizontal direct vent systems, both terminals must be offset by the same amount so that their relationship to one another is the same as shown in Figure 8a. When this offset is used, the horizontal section of vent pipe must be pitched away from the outside so that condensate cannot collect in the lower offset elbow.

- 10) Wall thimbles – Wall thimbles are required where the vent pipe passes through combustible walls with less than the required clearance shown in Table 2 or as required by local codes. Vent manufacturer’s wall thimble part numbers are shown in Table 4.

- 11) Condensate Traps and Pitch of Horizontal piping – All horizontal vent piping must be pitched ¼" per foot so that any condensate which forms in this piping will run towards either the outdoors or into a condensate trap. Vent manufacturer’s part numbers for suitable condensate traps are shown in Table 4.

All vertical vent systems must include at least one condensate trap as shown in Figures 10-13. This will collect any condensate that forms in the vent system as well as any rain water that gets around the vent cap.

The maximum allowable vertical run directly off of the boiler without a condensate trap is 7.5 ft (Figure 16). Install a condensate trap in longer vertical runs so that condensate which might form in this first vertical section will not run into the boiler fan.

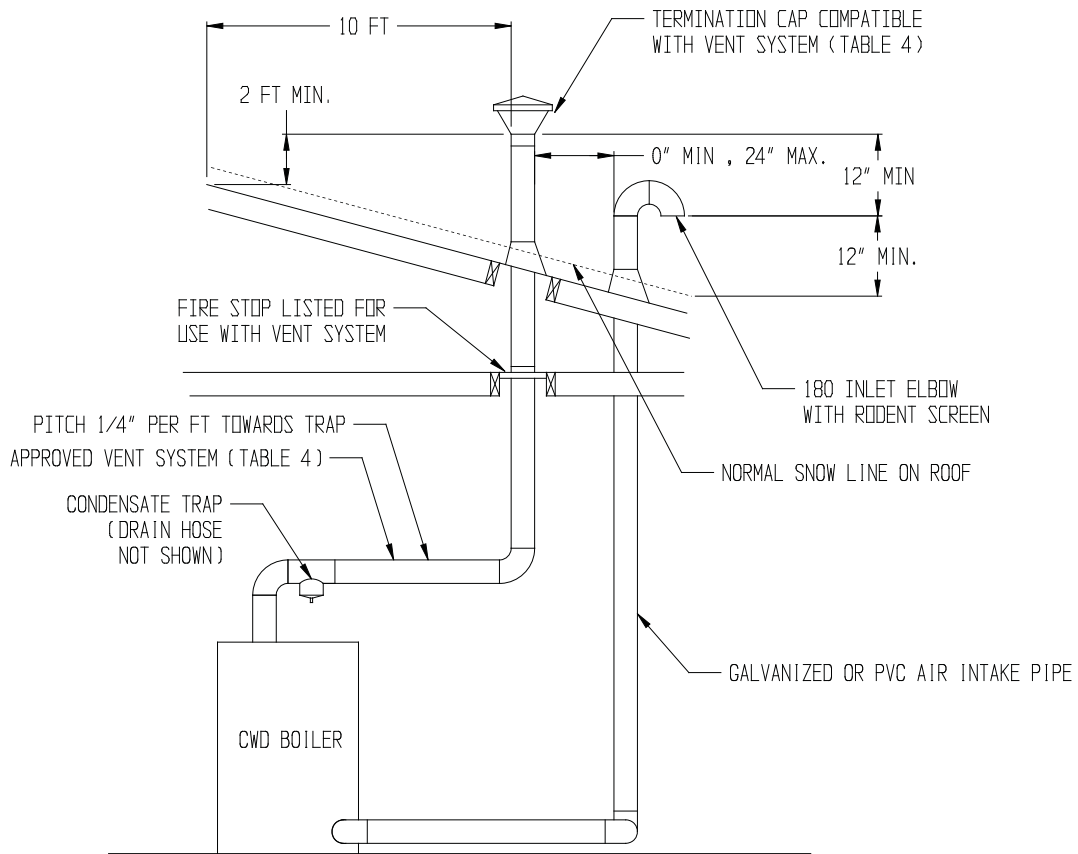


FIGURE 10: VERTICAL NON-COAXIAL DIRECT VENT SYSTEM (VENT OPTIONS 6, 7)

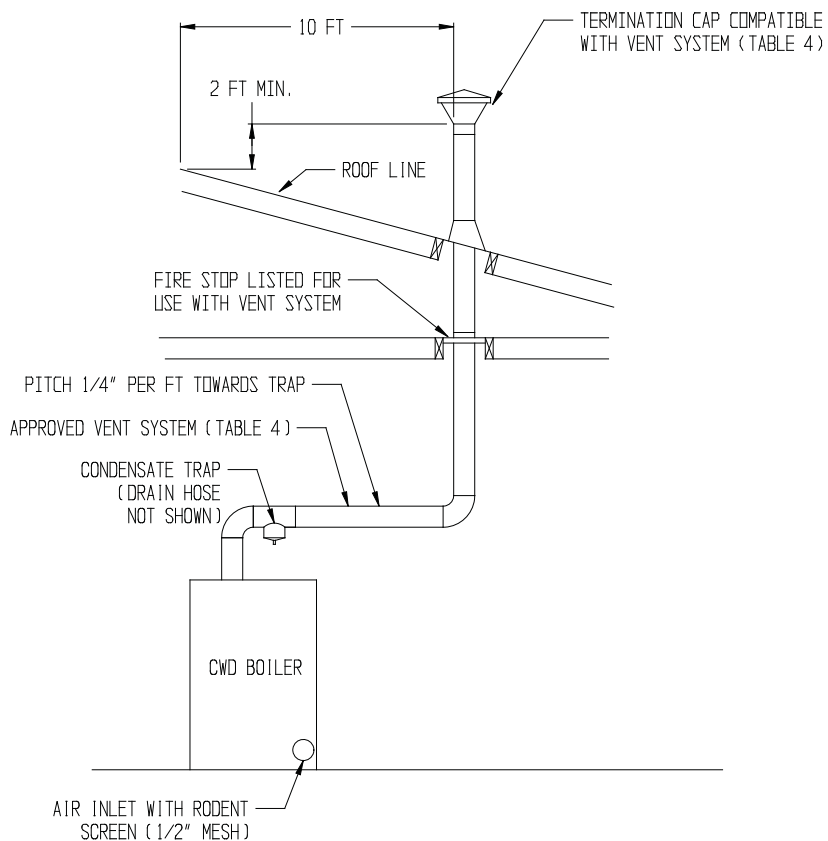


FIGURE 11: VERTICAL DIRECT EXHAUST SYSTEM (VENT OPTIONS 9, 10)

TABLE 3c : SUMMARY OF VERTICAL COAXIAL VENTING OPTIONS

VENT OPTION #		11	12	13
CLASSIFICATION USED IN THIS MANUAL		VERTICAL COAXIAL DIRECT VENT	VERTICAL COAXIAL DIRECT VENT	VERTICAL COAXIAL DIRECT VENT
VENT PIPE STRUCTURE PENETRATION		ROOF	ROOF	ROOF
AIR INTAKE PIPE STRUCTURE PENETRATION		ROOF	ROOF	ROOF
VENT PIPE SIZE		3"	3"	4"
AIR INTAKE PIPE SIZE (NON-COAXIAL SECTION)		4"	4"	4"
AIR INTAKE PIPE SIZE (COAXIAL SECTION)		5"	5"	7"
MAXIMUM VENT PIPE LENGTH	CWD060 - CWD138	47 FT	47 FT	CONSULT FACTORY
	CWD165	27 FT	27 FT	
	CWD193	N.R.	N.R.	
	CWD220	N.R.	N.R.	
	CWD245	N.R.	N.R.	
MAXIMUM LENGTH COAXIAL SECTION		30 FT OR AS LIMITED BY MAX VENT LENGTH, WHICHEVER IS LESS	AS LIMITED BY MAX VENT LENGTH	CONSULT FACTORY
MAXIMUM INTAKE PIPE LENGTH	CWD060 - CWD138	52 FT	50 FT	CONSULT FACTORY
	CWD165	32 FT	32 FT	
	CWD193	N.R.	N.R.	
	CWD220	N.R.	N.R.	
	CWD245	N.R.	N.R.	
EXHAUST TERMINAL		BY VENT SYSTEM MANUFACTURER. SAME DIAMETER AS VENT SYSTEM. SEE TABLE 4.	HEAT FAB #SC03RC	HEAT FAB #SC04RC
AIR INTAKE TERMINAL		SUPPLIED WITH CROWN #500005 COAXIAL VENT KIT	HEAT FAB #SC03VT	HEAT FAB #SC04VT
ADAPTOR FROM NON-COAXIAL TO COAXIAL SECTIONS		5" "B" VENT TEE + SUPPORT SUPPLIED WITH CROWN #500005 COAXIAL VENT KIT	HEAT FAB #SC03TAD4	HEAT FAB #SC04TAD4
VENT MATERIAL (NON-COAXIAL SECTION)		APPROVED VENT SYSTEM SHOWN IN TABLE 4	HEAT FAB SAF-T VENT	HEAT FAB SAF-T VENT
VENT MATERIAL (COAXIAL SECTION)		APPROVED VENT SYSTEM SHOWN IN TABLE 4	HEAT FAB SAF-T VENT SC	HEAT FAB SAF-T VENT SC
AIR INTAKE MATERIAL (NON-COAXIAL SECTION)		GALVANIZED OR PVC		
AIR INTAKE MATERIAL (COAXIAL SECTION)		5" TYPE "B" VENT	HEAT FAB SAF-T VENT SC	HEAT FAB SAF-T VENT SC

"N.R." - Not recommended "N.A." - Not applicable

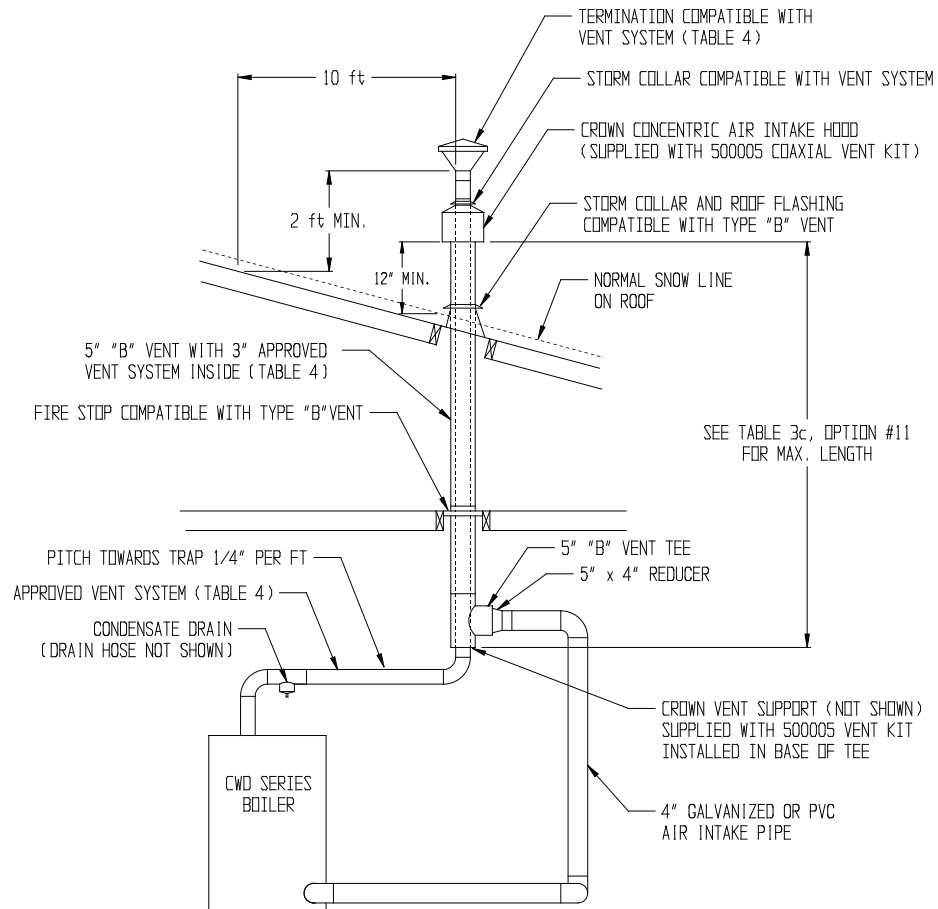


FIGURE 12: VERTICAL COAXIAL DIRECT VENT USING CROWN #50005 VENT KIT (VENT OPTION 11)

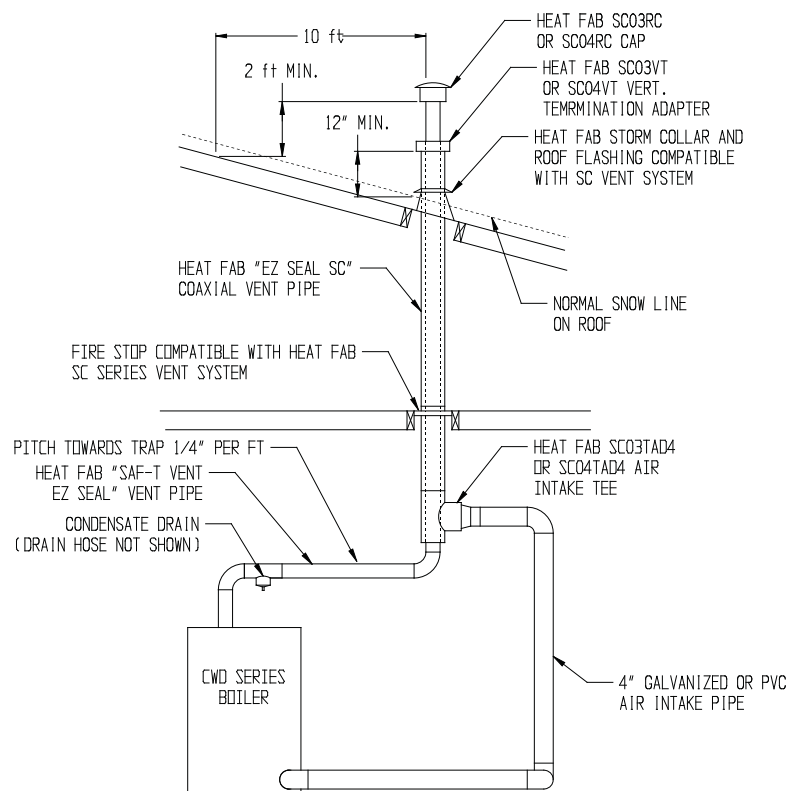


FIGURE 13: VERTICAL COAXIAL DIRECT VENT USING HEAT FAB SAF-T VENT SC (VENT OPTIONS 12, 13)

TABLE 4: PERMISSIBLE VENT SYSTEMS AND PRINCIPLE VENT COMPONENTS

MANUFACTURER	VENT SYSTEM	SIZE	CONDENSATE TRAP	WALL THIMBLES	HORIZONTAL TERMINATION	VERTICAL TERMINATION
HEAT FAB	SAF-T VENT EZ SEAL	3	9321 (NOTE 3)	7393GC 7393GCS 5391CI	ELBOW: 7314TERM TEE: 7390TEE	5300CI
		4	9421 (NOTE 3)	7493GC 7493GCS 5491CI	ELBOW: 7414TERM TEE: 7490TEE	5400CI
	SAF-T VENT SC	3	SC03DRN (NOTE 3)	SC03FS SC03FSA	ELBOW (NOTE 5): SC03HT + 7314TERM TEE (NOTE 5): SC03HT + 7390TEE	5300CI + SC03VT (NOTE 6)
		4	SC04DRN (NOTE 3)	SC04FS SC04FSA	ELBOW (NOTE 5): SC04HT + 7414TERM TEE (NOTE 5): SC04HT + 7490TEE	5400CI + SC04VT (NOTE 6)
PROTECH SYSTEMS INC.	FASNSEAL	3	FSHDT3	FSWT3	ELBOW: FSELB9003 + FSBS3 TEE: FSTT3	FSRC3
		4	FSHDT4 OR FSCD4 (NOTE 4)	FSWT4	ELBOW: FSELB9004 + FSBS4 TEE: FSTT4	FSRC4
	FASNSEAL W2	3	W2-T3 +W2-DF3	W2-WT3	ELBOW: FSA-SWDW3 + FSELB9003 + FSBS3 TEE: FSA-SWDW3 + FSTT3	W2-RC3
		4	W2-T4 + W2-DF4	W2-WT4	ELBOW: FSA-DWSW4 + FSELB9004 + FSBS4 TEE: FSA-SWDW4 + FSTT4	W2-RC4
Z-FLEX	SVE SERIES III ("Z-VENT III")	3	SVEDWCF03	2SVSWTEF03	ELBOW: 2SVSTEX0390 TEE: 2SVSTTF03	2SVSRCF03
		4	SVEDWCF04	2SVSWTEF04	ELBOW: 2SVEWCF0490 + 2SVSTPF TEE: 2SVSTTF04	2SVSRCF04
METAL-FAB	CORR/GUARD	3	CGSWDS(3")	CGSWWPK(3")	ELBOW: CGSW90LTM(3") TEE: CGSWTTM(3")	CGSWC(3")
		4	CGSWDS(4")	CGSWWPK(4")	ELBOW: CGSW90LTM(4") TEE: CGSWTTM(4")	CGSWC(4")

NOTES:

- 1) See vent system manufacturer's literature for other part numbers that are required such as straight pipe, elbows, firestops and vent supports.
- 2) In addition to terminals shown, Crown coaxial terminals may be used in some cases. See Table 3 for applications and Crown part numbers.
- 3) All Heat Fab condensate traps shown may be installed in vertical or horizontal run.
- 4) Protech FSCD4 condensate trap may be installed in a vertical or horizontal run. All other Protech traps must be installed in a horizontal run only.
- 5) Heat Fab Saf-T Vent SC may not be used for horizontal coaxial venting - a separate air inlet pipe must be provided for horizontal direct vent systems. SC03HT or SC04HT adapters are used to adapt from SC pipe to terminal. Use of SC pipe in horizontal systems does allow for reduced clearances to combustibles in some applications. See Table 2.
- 6) Heat Fab SC03VT or SC04VT adapters are required on any vertical vent system using Saf-T Vent SC even when combustion air is obtained through a separate pipe or from the boiler room.
- 7) Metal-Fab CGSWDS condensate traps may only be installed in a horizontal run.

- 12) Vertical and horizontal sections of piping must be properly supported. See vent system manufacturer’s instructions for more information.
- 13) Non-coaxial vent piping must be accessible for periodic inspection.
- 14) Fire stops and wall thimbles – Use fire stops where required by code or by the vent system manufacturer. Consult vent system manufacturer’s literature for information on suitable fire stops.
- 15) Supports - Vertical and horizontal sections of vent pipe must be properly supported. See the Vent System assembly section of this manual for more information.

B. Removing an Existing Boiler From a Common Chimney

Read this only if the CWD boiler is replacing an existing boiler that is being removed from a common chimney. This section does not apply to the installation of a CWD boiler.

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 resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1.

WARNING

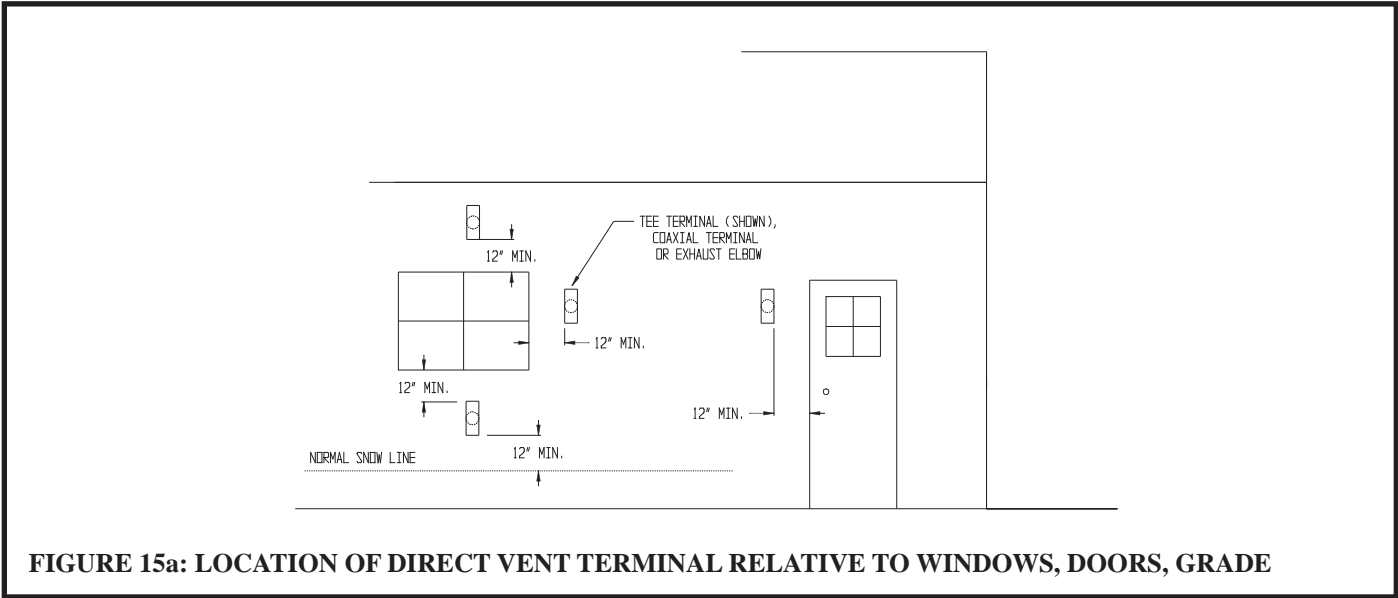
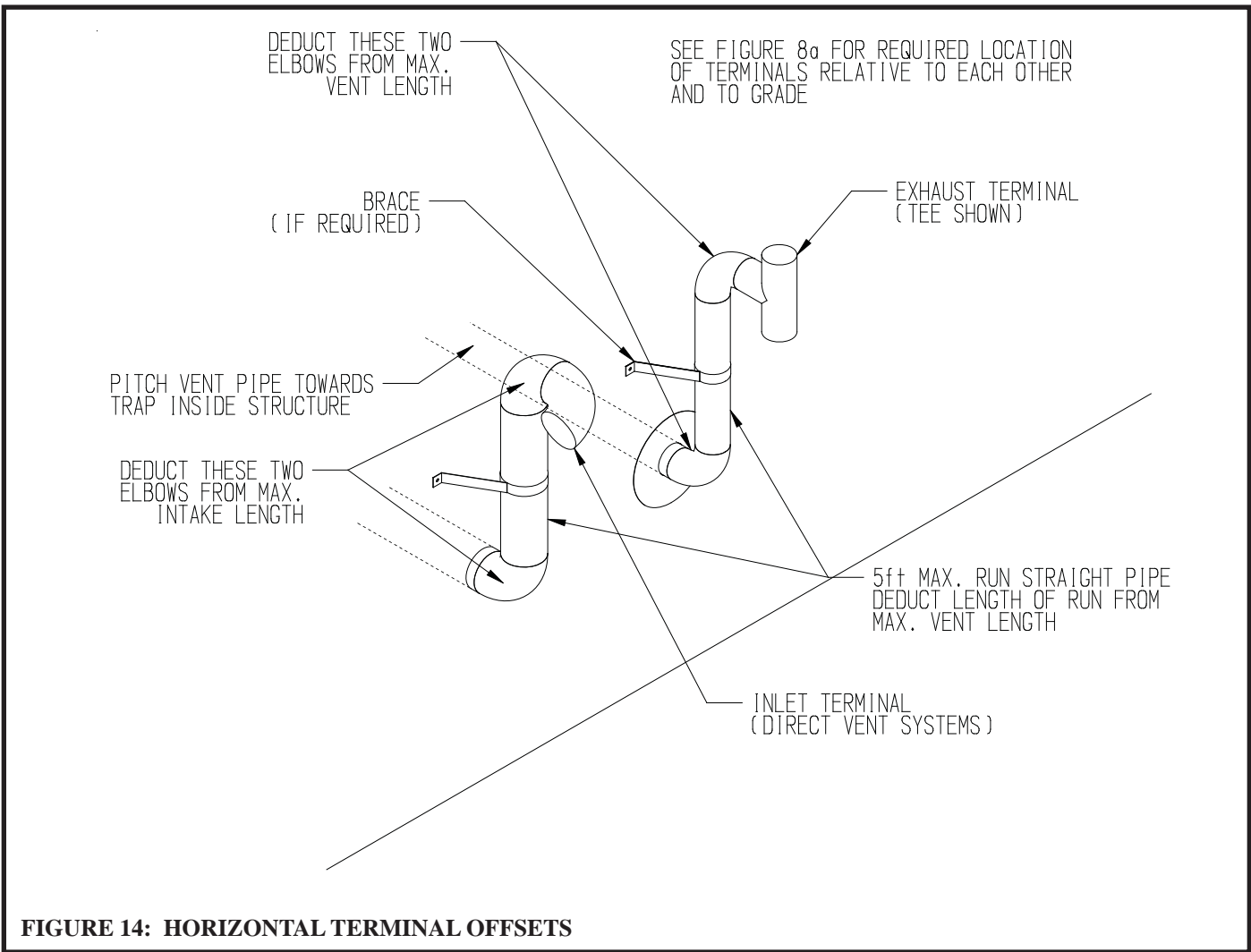
NEVER COMMON VENT A CWD BOILER WITH OTHER APPLIANCES

TABLE 5a: VENT FITTING EQUIVALENT LENGTH

VENT FITTING	EQUIVALENT LENGTH (ft)
3" 90 ELBOW	5.5
3" 45 ELBOW	4.0
HEAT FAB SC03E90 (3" COAXIAL 90 ELBOW)	5.5
HEAT FAB SC03E45 (3" COAXIAL 45 ELBOW)	4.0
4" 90 ELBOW	8.0
4" 45 ELBOW	4.5
HEAT FAB SC04E90 (4" COAXIAL 90 ELBOW)	8.0
HEAT FAB SC04E45 (4" COAXIAL 45 ELBOW)	4.5

TABLE 5b: AIR INTAKE FITTING EQUIVALENT LENGTH

INTAKE FITTING	EQUIVALENT LENGTH (ft)
4" 90 ELBOW	8.0
4" 45 ELBOW	4.5
HEAT FAB SC03E90 (3" COAXIAL 90 ELBOW)	CONSULT CROWN
HEAT FAB SC03E45 (3" COAXIAL 45 ELBOW)	
HEAT FAB SC04E90 (4" COAXIAL 90 ELBOW)	
HEAT FAB SC04E45 (4" COAXIAL 45 ELBOW)	



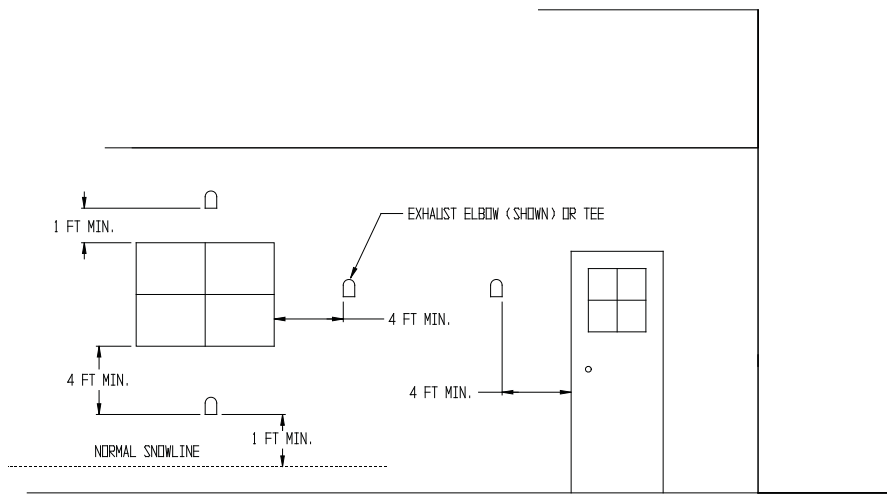


FIGURE 15b: LOCATION OF DIRECT EXHAUST TERMINAL RELATIVE TO WINDOWS, DOORS, GRADE

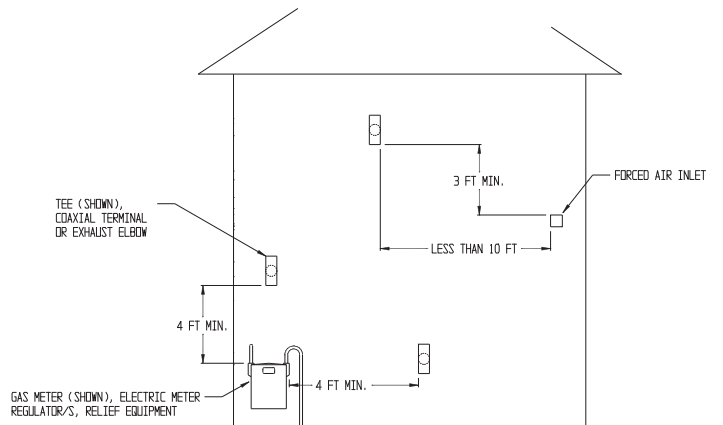


FIGURE 15c: LOCATION OF VENT TERMINAL RELATIVE TO METERS AND FORCED AIR INLETS

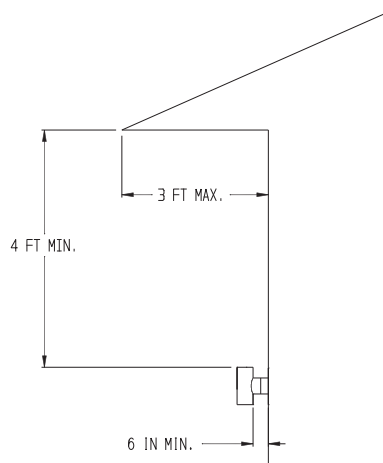


FIGURE 15d: POSITIONING VENT TERMINAL UNDER OVERHANGS

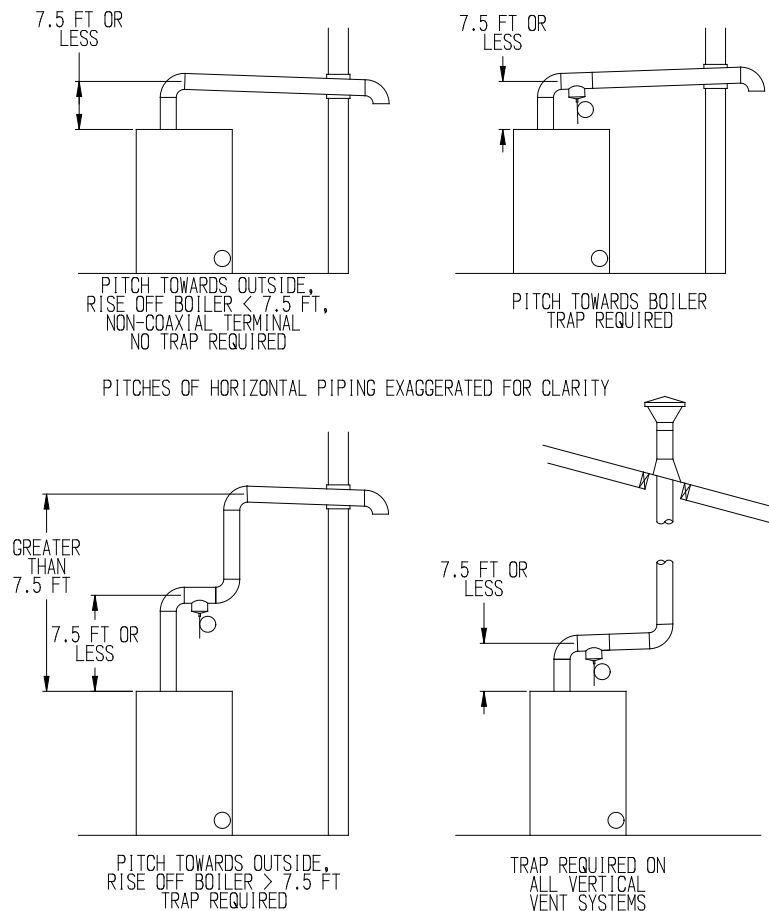


FIGURE 16: USE OF CONDENSATE TRAPS

C. Vent / Intake System Assembly

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 and coaxial terminal. 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, 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) Vent Collar Installation – The vent collar is shipped loose in the accessory bag along with two collar gaskets, the outlet orifice, and four 10-32 mounting screws. Verify that the 6 digit part number model number marked on the outlet exhaust orifice matches that shown in Table 6. Mount the collar and orifice as shown in Figure 17. If desired, the first piece of exhaust pipe can be connected to the collar before mounting the collar on the boiler.

TABLE 6: FAN OUTLET ORIFICE

BOILER MODEL	ORIFICE PART #
CWD060	620133
CWD083	650136
CWD110	620135
CWD138	620136
CWD165	620137
CWD193	620138
CWD220	620139
CWD245	650138

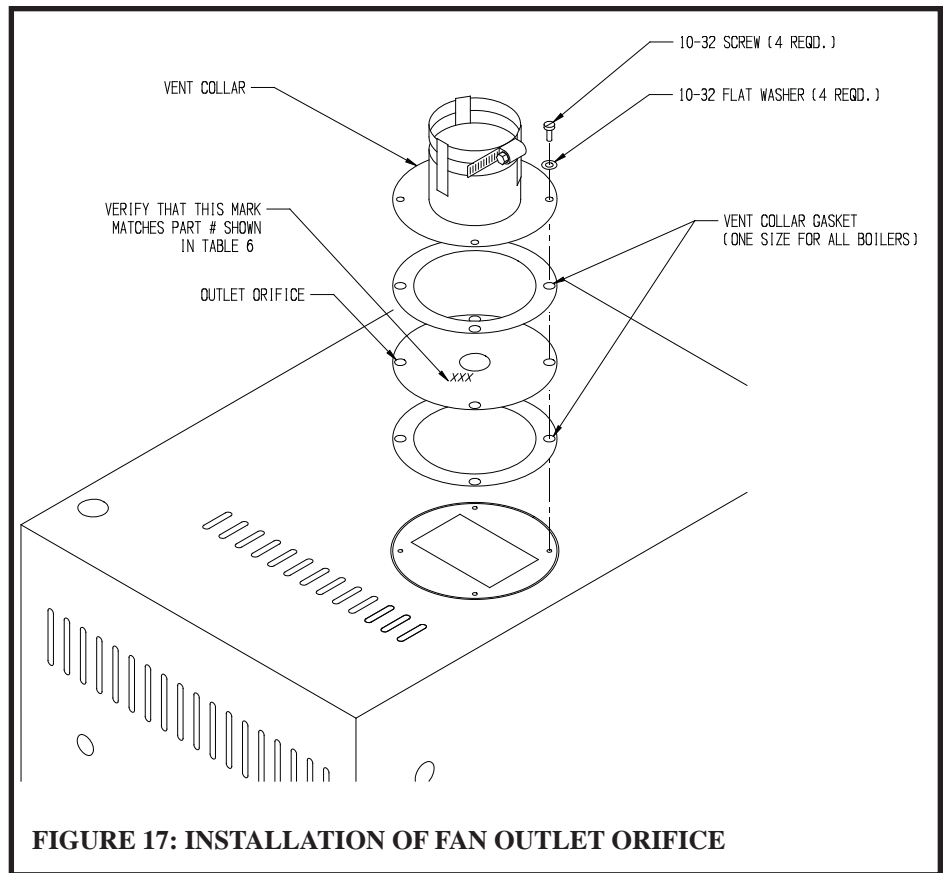


FIGURE 17: INSTALLATION OF FAN OUTLET ORIFICE

- 3) Optional Coaxial Terminal Installation – If the optional coaxial terminal is used, it should be installed in the wall before vent assembly is started. Install the terminal in accordance with the following procedure (Figures 18a & 18b):

NOTE

- **Coaxial portion of inside terminal section may be installed in direct contact with combustible construction.**
- **Maximum wall thickness through which this terminal can be installed is 10”**

- Position the wall face plate on the outside wall in the desired terminal location. Verify that this location will permit the terminal, and connected venting, to clear any obstructions on the inside of the wall with the appropriate clearances. Mark the location of the round opening on the wall.
- For 3” terminals, cut a 5 1/4” Diameter hole through the wall at this location. For 4” terminals, cut a 7 1/4” opening.
- Attach the mounting plate to the outside wall with suitable fasteners.
- Attach the intake terminal to the straight coaxial section. To do this, clean the male and female ends of the inner pipes with an alcohol pad. Lubricate the gasket in the female end of the straight section with a package of the silicone lubricant provided and then push the intake terminal firmly onto the straight section until the intake terminal makes contact with the bead on the straight section. Secure the two fittings together with the self-drilling screws provided. Use a low torque setting to install these screws so as not to strip out the holes.
- Pass the assembled intake terminal and straight section through the wall from the outside. Bend the four Tabs in the wall face plate towards the outside when doing this. Do not attach the pipe to the plate yet.
- Adjust the position of the terminal in the wall so that the edge of the intake skirt is 2-3” from the wall plate (Figure 18b). Also verify that the terminal is pitched in the same direction as the rest of the vent system.
- Attach the intake/straight section to the wall face plate using the self drilling screws provided.
- Loosen the hose clamp on the end of the exhaust terminal. Mount the exhaust terminal onto the intake terminal with the “V” horizontal (flue gas openings on top and bottom) as shown in Figure 18b. Slip the hose clamp over the “fingers” on the intake terminal and tighten the clamp.
- Seal all exposed exterior joints, including the joint between the wall face plate and the wall and between the wall face plate and the straight section with an exterior grade silicone sealant.

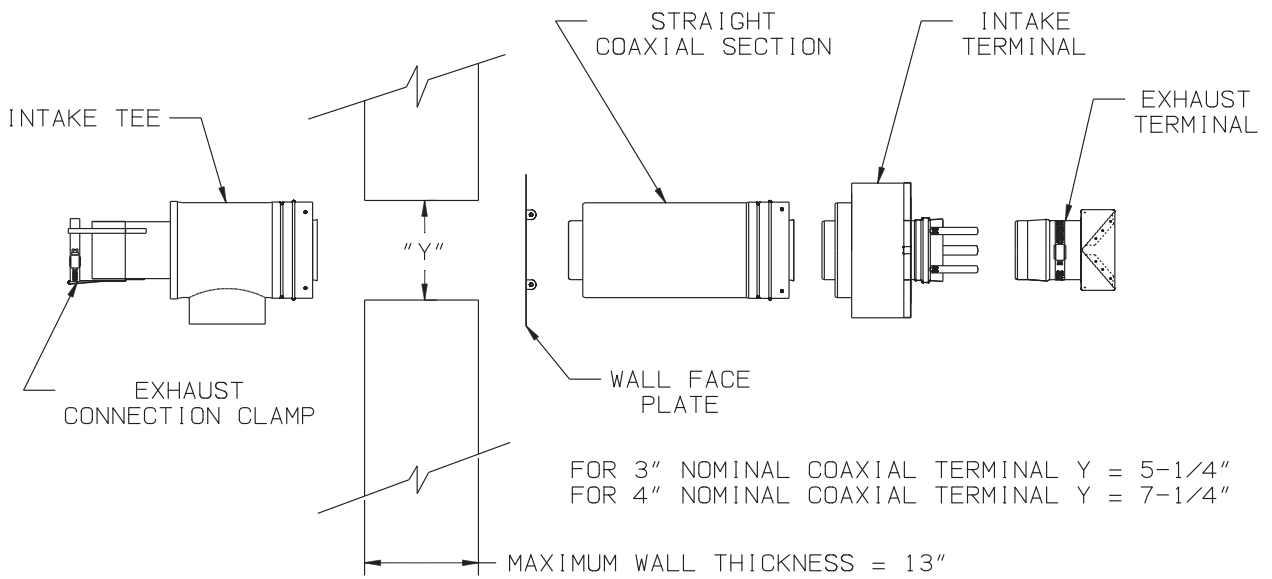


FIGURE 18a: CROWN COAXIAL TERMINAL EXPLODED VIEW

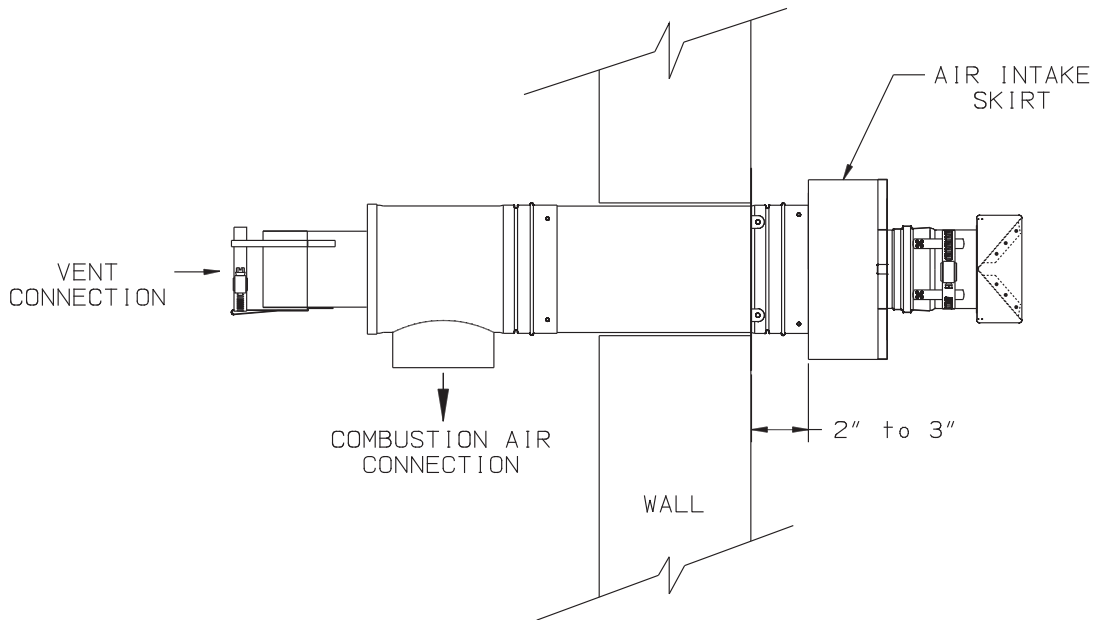


FIGURE 18b: CROWN COAXIAL TERMINAL ASSEMBLY

- j) Attach the intake tee to the end of the straight section protruding from the inside wall. Use the procedure described in (d) to clean and assemble these parts.
- k) If the inside terminal section is not supported by the wall through which it passes, install additional supports or bracing to support the terminal. Bracing in contact with the coaxial section of the terminal may be combustible.

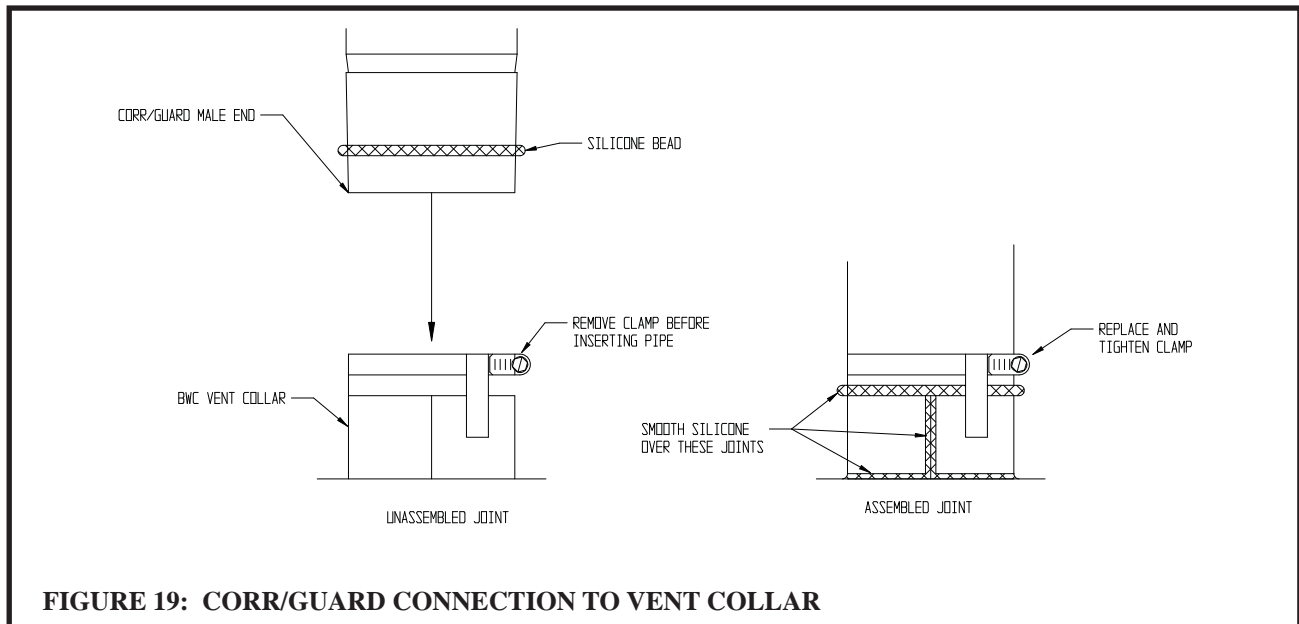
4) Assembly of Metal-Fab Corr/Guard Vent System:

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 males 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 7.47).
- 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.

Note: To join Corr/Guard to a Crown coaxial terminal, leave the Corr/Guard gasket in place. Apply a 1/4" bead of silicone to the terminal connection about 1/4" from its end. Slip the Corr/Guard female end over the terminal end so that there is an overlap of approximately 1 3/4 inches. Apply and smooth silicone over the outside of the joint including the tabs in the female end of the Corr/Guard pipe. Tighten the terminal hose clamp to mechanically lock the pipe onto the terminal.



5) Assembly of Z-Flex Z-Vent III:

a) General Notes:

- Non-expanded ends of SVE Series III 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 SVE series III to the vent collar or Crown coaxial terminal. 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 III installation instructions.
- b) Start assembly of the vent system at the boiler. Remove the hose clamp shipped on the CWD 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 high temperature silicone approximately 1/2 inch from the male end of the pipe. Apply 1/4" beads of silicone along both sides of the longitudinal seam (Fig. 20).
 - 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. Also apply silicone over the seams in the collar (Fig 20).
 - g) Replace and tighten the clamp on the vent collar.
 - h) The female end of each Z-Vent III 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 III components. If a termination elbow is used, use this procedure to complete the vent system.
 - l) If a termination elbow or tee is used, 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.
 - m) To join Z-Vent III to a Crown coaxial terminal, a male end must be present at the end of the piping to be joined to the terminal. It will therefore be necessary to cut off the expanded end of the pipe before it can be joined to the terminal. This male end of the pipe must be inserted into the terminal connection with at least a 1" overlap. It may be necessary to crimp the end of the vent pipe before it can be inserted into the terminal. Apply silicone to the male end of the pipe as in (d) above, insert into the terminal, and apply an additional bead of silicone over the outside of the joint. Smooth out the excess silicone and tighten the hose clamp on the terminal.
 - n) Allow the silicone to cure per the silicone manufacturer's instructions before operating the boiler.

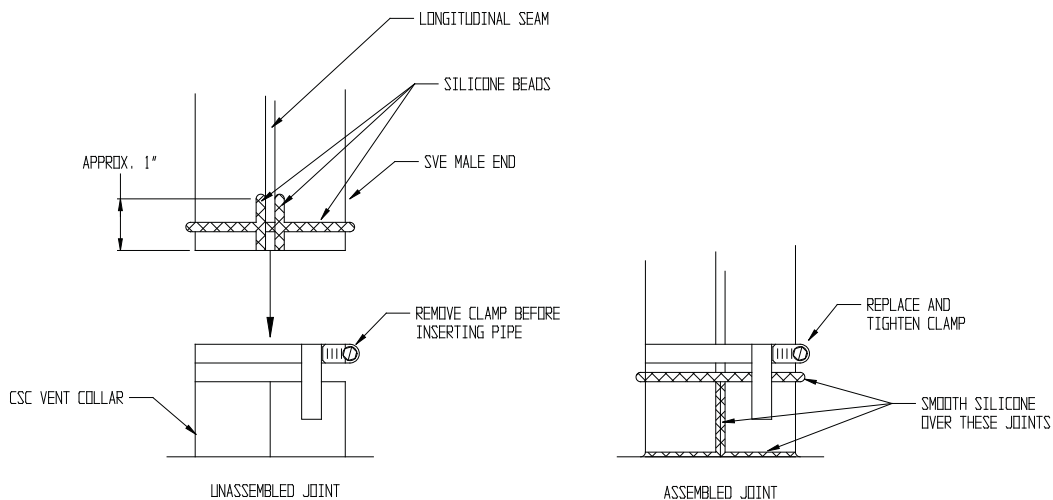


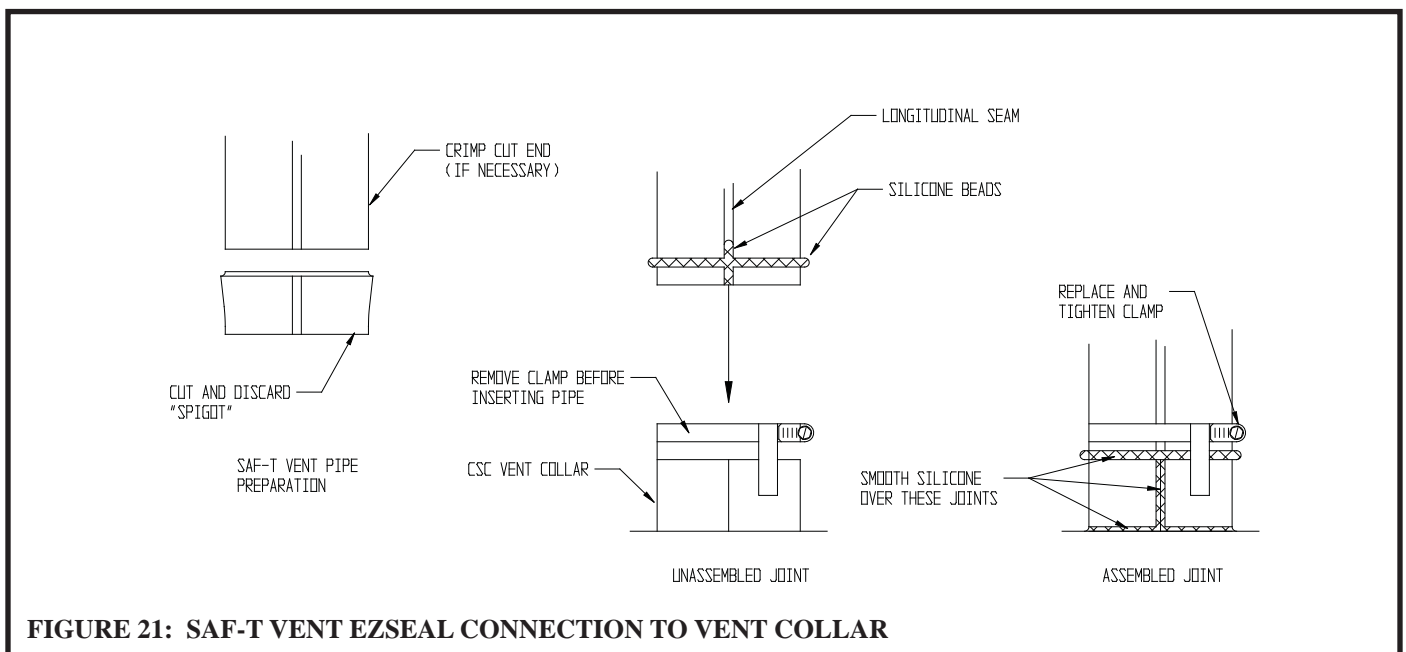
FIGURE 20: Z-VENT III CONNECTION TO VENT COLLAR

6) 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 and Crown coaxial terminal. 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 CWD 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 21). 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 21). Apply silicone over the seams in the vent collar. 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. If a termination elbow is used, use this procedure to complete the exhaust system.
- d) Connection of Saf-T Vent to Crown coaxial terminal - Cut the locking tabs off of the female end of the Saf-T Vent pipe to be joined to the co-axial terminal. Apply a ¼” bead of silicone around the terminal connection about ¼” from the end. Slip the Saf-T Vent pipe over the terminal and apply a second bead of silicone over the joint. Silicone must be applied even though there is a gasket on the female end of the pipe. Smooth the excess silicone over the joint, making sure that there are no visible voids in the silicone. Tighten the terminal clamp. Allow the silicone to cure per the silicone



manufacturer's instructions before operating the boiler.

- 7) Assembly of Heat Fab Saf-T Vent SC - On CWD Boiler installations where Saf-T Vent SC is used, some Saf-T Vent EZ Seal (single wall pipe) will always be required between the boiler and the Saf-T Vent SC. Install this pipe as described above. On all systems except vertical coaxial systems (Options 12, 13), the following Heat Fab adapters will be needed to adapt from Saf-T Vent EZ Seal to Saf-T Vent SC:

Vent Size	Heat Fab Part Number
3"	SC03ADEZ
4"	SC04ADEZ

On vertical coaxial vent systems employing Saf-T Vent SC, the transition from Saf-T Vent to Saf-T Vent SC is made with one of the following Air Intake Tees:

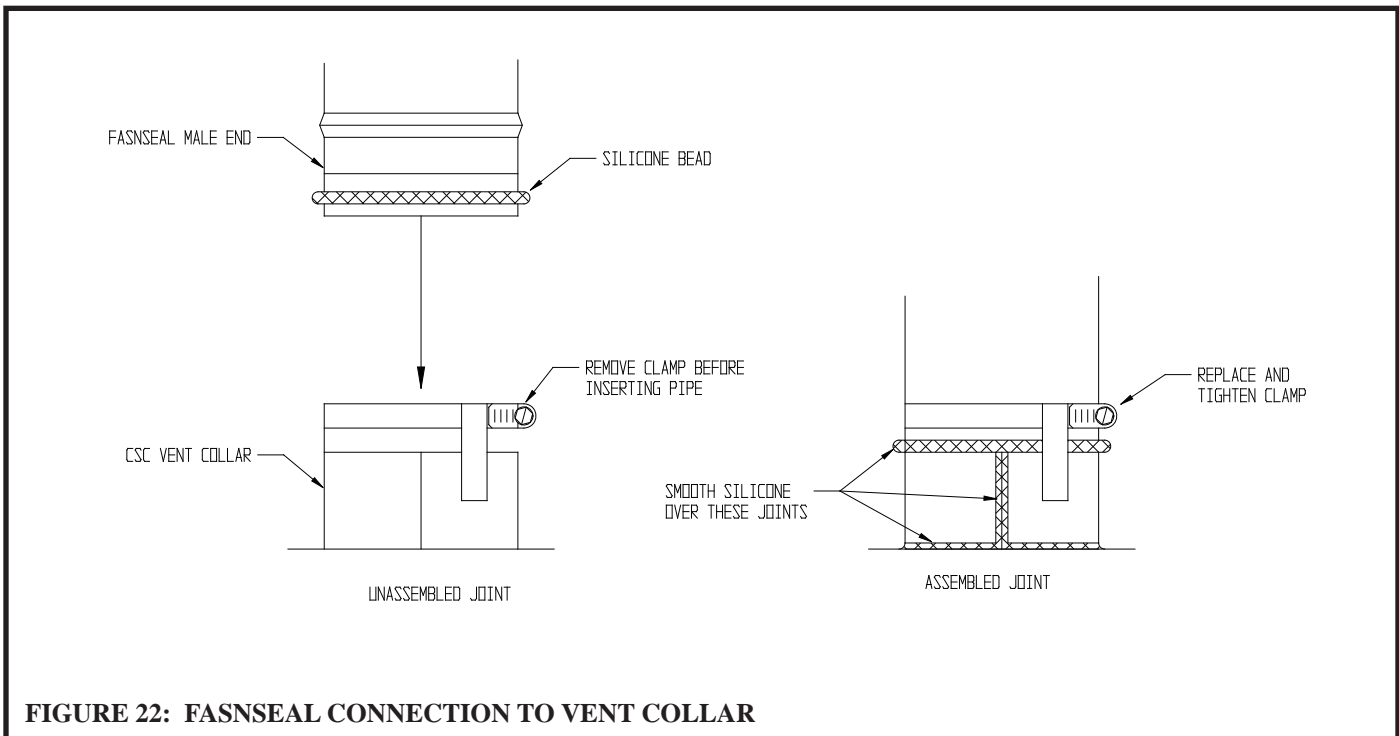
Vent Size	Heat Fab Part Number
3"	SC03TAD4
4"	SC04TAD4

Assemble the Saf-T Vent EZ Seal to the boiler and the adapter as described in (6) above. Proceed as follows to assemble the Saf-T Vent SC:

- Clean both ends of the inner pipes to be joined with an alcohol pad. This will remove any foreign matter which may effect the integrity of the seal. Insert the male end of the first piece of pipe into the adaptor. In extremely dry conditions it may be helpful to moisten the gasket with clean water prior to assembly.
- Push the first Saf-T Vent SC section into the adaptor until the outer jacket has made contact with the snap ring located inside the female end of the adaptor. When fully assembled the outer female end will overlap the male end by 1".
- Use the three self tapping screws provided with the vent to attach the first piece of pipe to the adaptor. No pre drilling is required. If using a variable torque screw gun, use the low torque setting to install the screws so as not to strip out the holes. If a hole does become stripped due to over tightening, a larger (1/2" long max.) screw or short pop rivet may be used.
- Seal all the joints in the outer jacket with foil tape or exterior grade silicone sealant.
- Repeat steps (a - d) to assemble the remaining sections of Saf-T Vent SC.
- Support the Saf-T Vent SC as called for in Heat Fab's installation instructions. Also make sure that fire stops are provided as called for in Heat Fab's instructions and local codes.
- After the Saf-T Vent SC exits the building, one of the following adaptors will be needed to install the terminal:

Vent Size	Heat Fab Part Number
3"	5300CI
4"	5400CI

On vertical coaxial vent systems (Vent Options 12, 13) this adapter also acts as the combustion air intake terminal. In other installations, the openings in this adapter provide ventilation between the inner and outer walls.



8) 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 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 FasNSeal support. An additional vertical support is required after any offset.

- a) Remove the hose clamp shipped on the CWD 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. Dry surfaces or allow to dry thoroughly. 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 22). Replace and tighten the clamp on the vent collar.
- b) All other joints in the FasNSeal venting system rely on a gasket in the female end of the pipe for a proper seal.
- c) 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 (Fig. 17b).
- d) Tighten the locking band with a nut driver.
- e) Repeat (c) and (d) for the remaining FasNSeal components. If a termination elbow is used, use this procedure to complete the exhaust system.
- f) To join FasNSeal to a Crown coaxial terminal, remove the hose clamp from the female FasNSeal end to be joined to the terminal. Leave the FasNSeal gasket in place. Apply a 1/4" bead of silicone to the terminal connection about 1/4" from its end. Slip the FasNSeal female end over the terminal end so that there is an overlap of 1 3/4 inches. Apply and smooth silicone over the outside of the joint including the rectangular hose clamp opening in the FasNSeal pipe. Tighten the terminal hose clamp to mechanically lock the pipe onto the terminal.
- g) Allow the silicone to cure per the silicone manufacturer's instructions before operating the boiler.

9) Assembly of Protech FasNSeal W2 - On CWD Boiler installations where Protech FasNSeal W2 is used, some Protech FasNSeal (single wall pipe) will always be required between the boiler and the FasNSeal W2. Install this pipe as described above. On all systems, the following components will be needed to adapt from Protech FasNSeal to FasNSeal W2:

<u>Vent Size</u>	<u>Protech Part Number</u>
3"	FSA-SWDW3
4"	FAS-SWDW4

Follow the joint connection instructions provided with the FasNSeal W2. In vertical vent systems, terminate the vent system with the cap called for FasNSeal W2 in Table 4. In horizontal vent systems one of the following adapters will be required between the FasNSeal W2 and the terminal:

<u>Vent Size</u>	<u>Protech Part Number</u>
3"	FSA-DWSW3
4"	FAS-DWSW4

10) Assembly of the air intake system:

- 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) A 4" galvanized smoke pipe will fit inside the inlet collar on the CWD boiler. Depending upon the exact OD of the pipe used, it may be necessary to crimp this pipe. Secure with a single #10 sheet metal screw through the hole in 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 4" galvanized pipe to connect the PVC to the boiler. Silicone the outside of the joint between the PVC and galvanized pipe.
- e) Either PVC or galvanized pipe will fit over the combustion air connection on the Crown coaxial terminal. Secure the pipe to the terminal with at least two #10 sheet metal screws. Seal the outside of the joint between the inlet pipe and the coaxial terminal.
- f) Two 90-degree elbows may be used to make the 180-degree air intake termination elbow used on vertical direct vent installations.

11) Assembly of Vertical Coaxial Vent System Using Crown #500005 Coaxial Vent Kit (Vent Option #11)

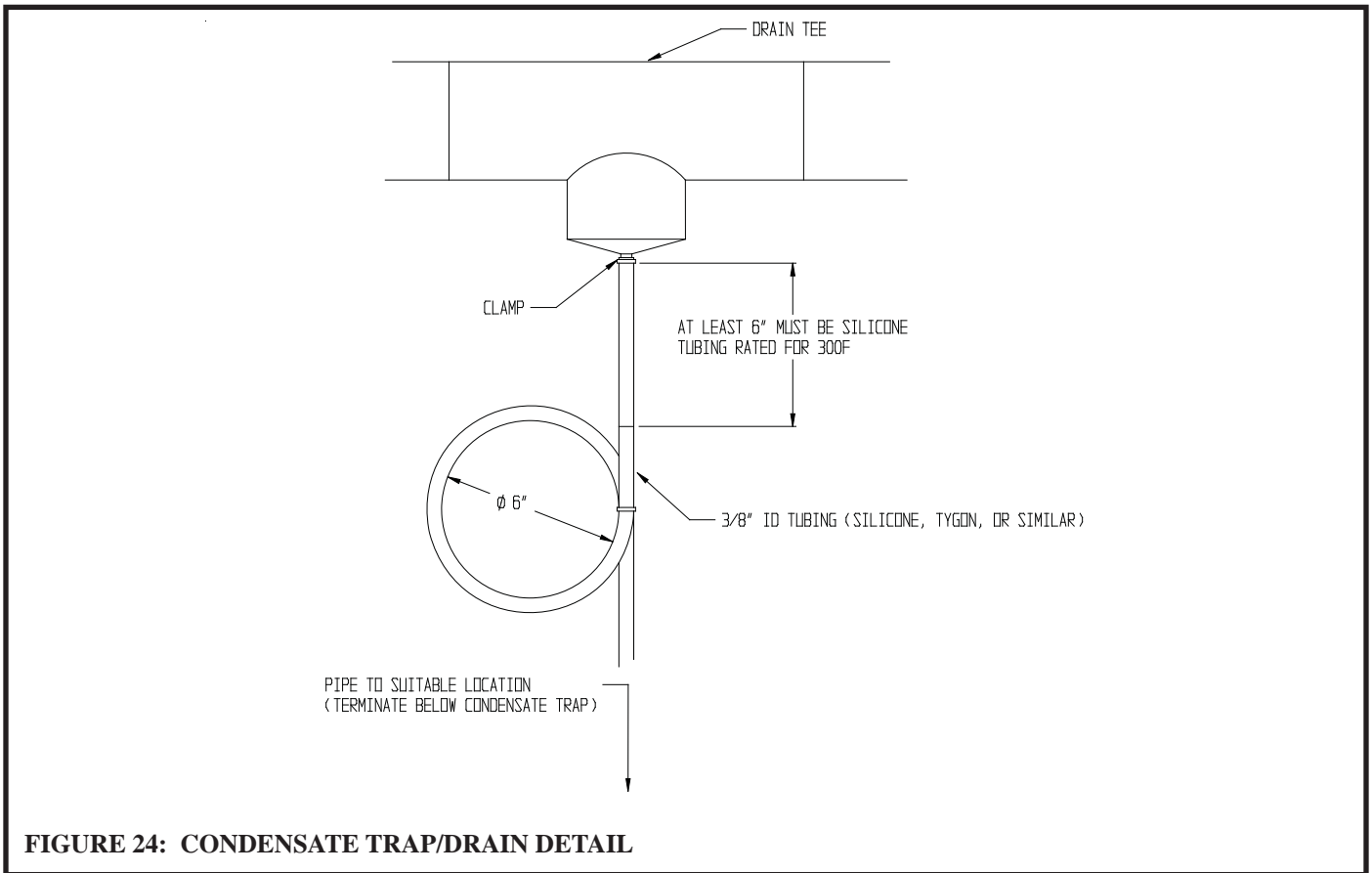
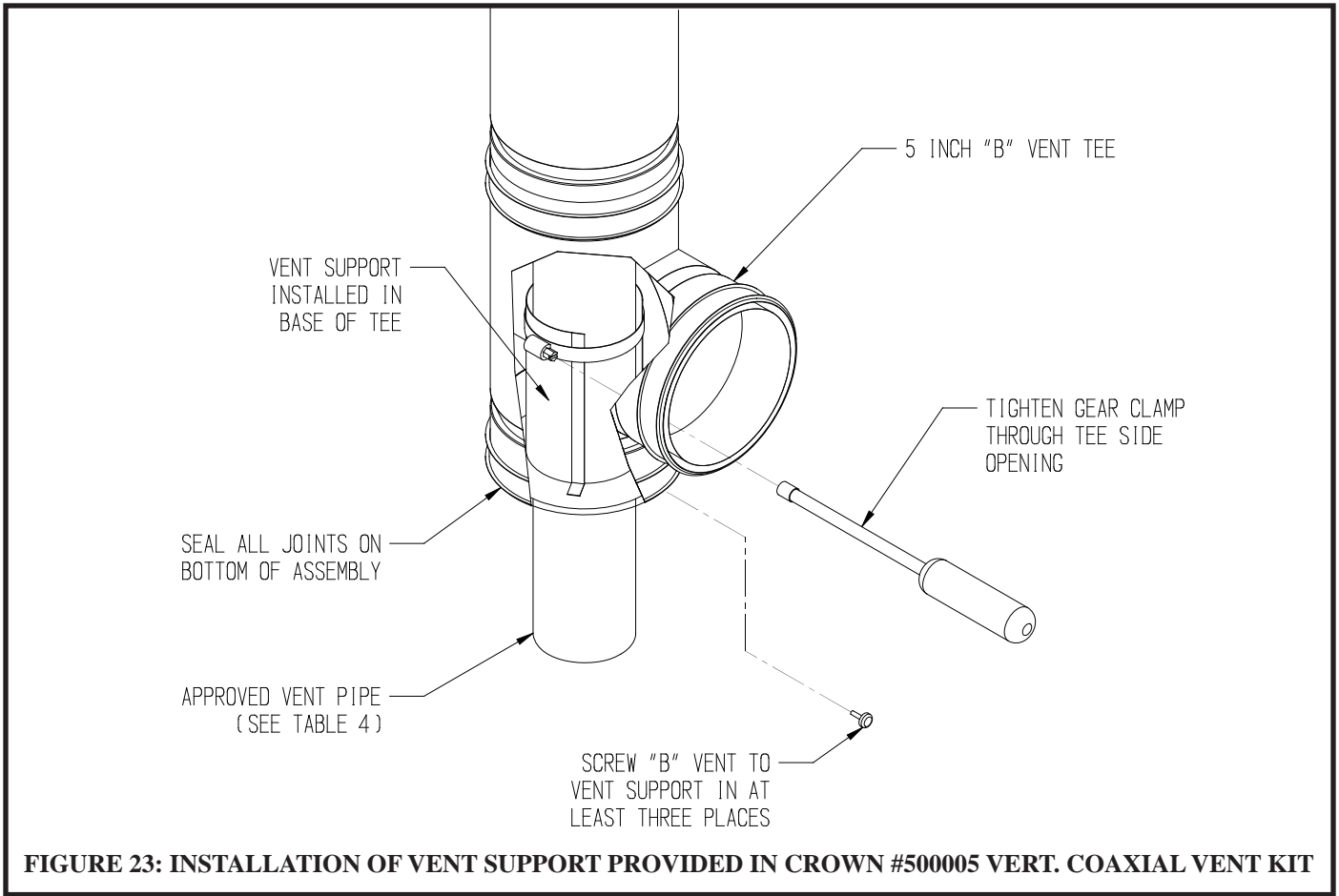
- a) Start by installing the “B” vent piping. Install and assemble this piping in accordance with the “B” vent manufacturer’s instructions. Seal the joints between sections of “B” vent with GE RTV 106 or Dow 732 RTV sealant. Consult the “B” vent manufacturer’s instructions for the clearance to combustibles (typically 1”) as well as for fire stop and support requirements.
Install a 5” “B” vent Tee on the bottom of the run of “B” vent as shown in Figure 12. Extend the run of “B” vent far enough above the roof so that the bottom of the air intake hood will be at least one foot above the normal snow line that can be expected on the roof. Seal the roof penetration with a “B” vent roof flashing and storm collar in accordance with the “B” vent manufacturer’s instructions.
- b) Assemble the vent piping that is to be run inside the “B” vent and drop it through the “B” vent. Join and seal the vent piping in accordance with the instructions 4, 5,6 or 8 above. Use the longest sections of vent piping possible so as to minimize the number of joints inside the “B” vent. Temporarily support the vertical section of vent pipe from underneath so that the top of the vent pipe is at the correct height (Figure 12).
- c) Slip the Crown concentric air intake hood over the vent pipe and seat it on the “B” vent. Secure the concentric air intake hood to the “B” vent with at least three sheet metal screws. Install a storm collar compatible with the vent system over the vent pipe. Secure and seal it in accordance with the vent manufacturer’s instructions. Note: this collar provides a watertight seal between the vent piping and the concentric air intake hood and also supports the vent piping. Once the storm collar is installed, remove the temporary vent support. Install a compatible rain cap on the top of the vent system (Table 4).
- d) Slip the Crown vent support over the vent pipe protruding from the bottom of the “B” vent. Orient the vent support so that it will be possible to tighten the gear clamp by reaching through the side opening in the “B” vent Tee (Figure 23). Attach the vent support to the “B” vent Tee with at least three sheet metal screws. Tighten the gear clamp. Seal all joints in between the vent support, the vent pipe, and the “B” vent.
- e) Install the vent piping between the boiler and the vertical section of “B” vent already installed. Observe the clearance and support requirements in the installation manual.
- f) Install a 5 x 4 single wall reducer in the side connection of the “B” vent Tee. Install 4” galvanized or PVC piping between this reducer and the combustion air intake on the boiler. Seal all joints in the air intake piping.

12) Condensate Traps:

- a) Trap should have the basic configuration shown in Figure 24. All tubing is 3/8 I.D.
- b) All drain tubing must be acid resistant.
- c) At least the first 6 inches of tubing must be silicone with a 300F temperature rating.
- d) Pipe condensate to a drain or other suitable location. Make sure that condensate disposal method is in accordance with local regulations. Ensure condensate is not subjected to freezing temperatures.

13) Rodent Screens:

- a) A rodent screen is provided with the CWD boiler. On direct exhaust boilers, this screen is installed in the air inlet collar on the boiler and held in place with screws or RTV sealant.
- b) The Crown coaxial terminal has integral inlet and exhaust rodent screens. The rodent screen supplied with the boiler is not used when the boiler is installed with the coaxial terminal.
- c) In horizontal direct vent installations using termination elbows or tees, the rodent screen provided is mounted in the air inlet elbow. A second screen is required for the exhaust elbow. This second screen can be any one of the following items:
 - A rodent screen provided by the vent system manufacturer.
 - A second Crown rodent screen (Crown #60-601).
 - A rodent screen made of stainless steel screen having a ½” (2 x 2) or greater mesh.
- d) In vertical direct vent or direct exhaust systems, no rodent screen is required on the exhaust terminal. The rodent screen is installed either on the 180-degree inlet elbow (direct vent installations) or on the boiler inlet collar (direct exhaust installations).



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 a line 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 25 shows typical gas piping connections to the CWD boiler. A sediment trap must be installed upstream of all gas controls. Install a manual shutoff valve outside the jacket and 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 ½ psi. When pressure testing the gas system at pressures of ½ psi or less, isolate the boiler from the gas supply system by closing its individual manual shut-off valve.

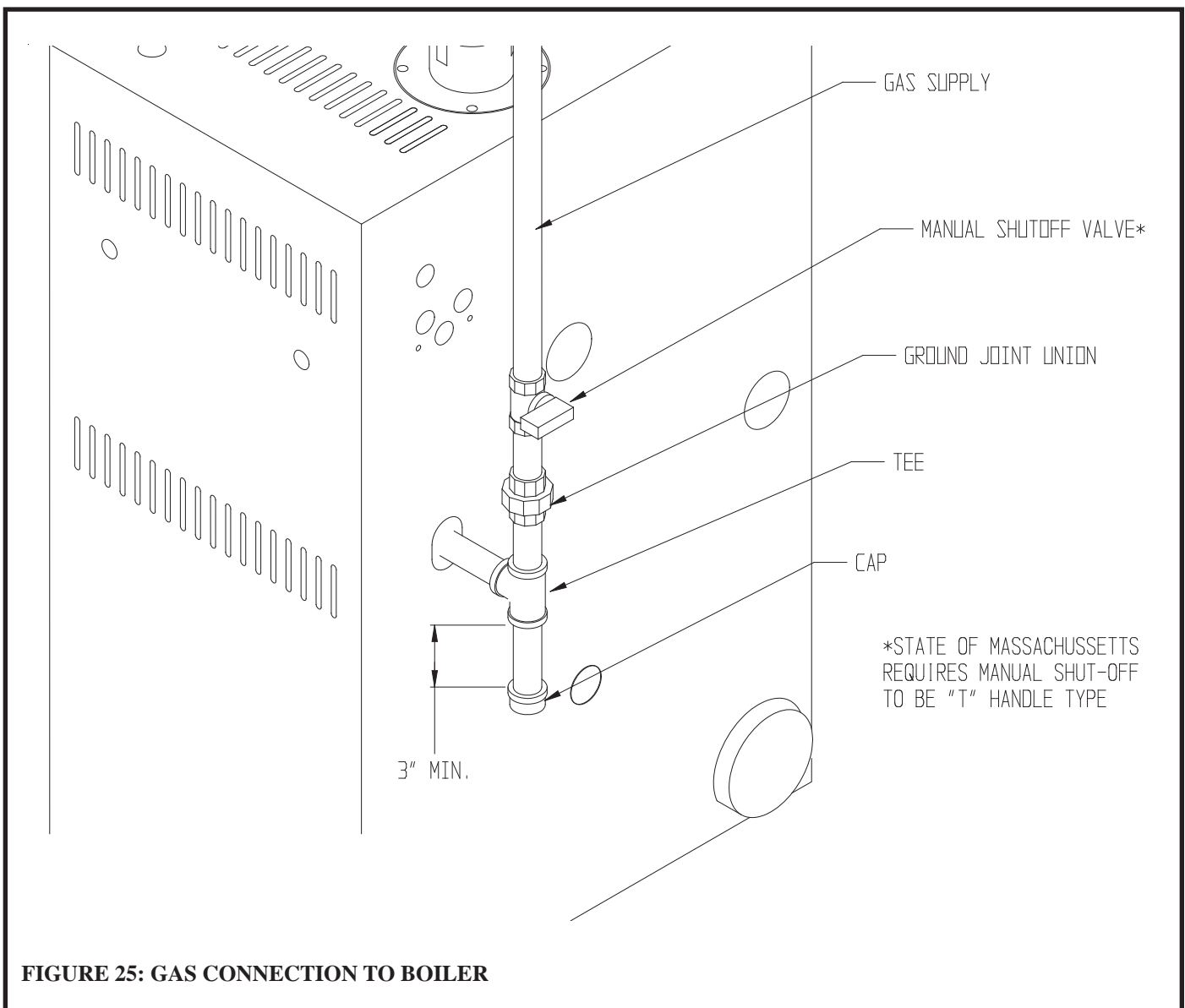


FIGURE 25: GAS CONNECTION TO BOILER

VIII System Piping

CAUTION

- **Install boiler so that the gas ignition system components are protected from water (dripping, spraying, rain, etc) during appliance operation and service (circulator replacement, etc).**
- **Operation of this boiler with continuous return temperatures below 120F can cause severe heat exchanger corrosion damage.**
- **Operation of this boiler in a system having significant amounts of dissolved oxygen can cause severe heat exchanger corrosion damage.**
- **Do not use toxic additives, such as automotive antifreeze, in a hydronic system.**

A. Standard Piping

Figure 26 shows typical boiler system connections on a single zone system. 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. The components in this system and their purposes are as follows:

- 1) Relief valve (Required) – Install the relief valve in the 3/4” tapping on the left side of the boiler as shown in Figure 1. The relief valve shipped with the boiler is set to open at 30 psi. This valve may be replaced with one having a setting of up to the Maximum Allowable Working Pressure (MAWP) shown on the rating plate. 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 move relief valve from factory location.**
- **Do not plug relief valve discharge.**

- 2) Circulator (Required) – Although the circulator is shipped on the boiler return, it can be installed on the boiler supply. If the circulator is moved to the supply it should be positioned just downstream of the expansion tank as shown in Figure 26.
- 3) 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.
- 4) Fill Valve (Required) – Either a manual or automatic fill valve may be used. The ideal location for the fill is at the expansion tank.
- 5) 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.
- 6) Low Water Cut-Off (Required in some situations) – A low water cut-off is required when the boiler is installed above radiation. In addition, some codes, such as ASME CSD-1, require low water cut-offs. Codes may also require that this low water cut-off have a manual reset function. The low water cut-off may be a float type or probe type but must be designed for use in a hot-water system. The low water cut-off should be piped into the boiler supply just above the boiler with no intervening valve between it and the boiler.
Use a low water cut-off that breaks the 120 VAC supply to the boiler. **Do not attempt to connect a 24-volt low water cut-off into the boiler factory wiring.**
- 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 beyond the boiler with no intervening valves. Set manual reset high limit as far above the operating limit setting as possible, but not over 240F. Wire the control to break the 120 VAC electrical supply to the boiler.

- 8) Flow control valve (Required under some conditions) – The flow control valve prevents flow through the system unless the circulator is operating. A flow control valve may be necessary on converted gravity systems to prevent gravity circulation. Flow control valves are also used to prevent “ghost flows” in circulator zone systems through zones that are not calling for heat.
- 9) Isolation Valves (Optional) – Isolation valves are useful if the boiler must be drained, as they will eliminate having to drain and refill the entire system.
- 10) Drain Valve – The drain valve is shipped in the boiler parts bag. Install it in the location shown in Figure 1.

B. Piping for Special Situations

Certain types of heating systems have additional requirements. Some of the more common variations follow:

- 1) Indirect Water Heaters – Figure 27 shows typical indirect water heater piping. Boiler piping is the same as for any two-zone system. Figure 27 shows circulator zoning, which is usually preferred for indirect water heaters. Size the circulator and indirect water heater piping to obtain the boiler water flow through the indirect water heater called for by the indirect water heater manufacturer. The standard CWD control system will operate two circulator zones. See the Wiring section of this manual.
- 2) Gravity and “Large Water Volume” Systems – The piping shown in Figure 28 will minimize the amount of time that the boiler operates with return temperatures below 120F on these systems. A bypass is installed as shown to divert some supply water directly into the return water. The bypass pipe should be the same size as the supply. The two throttling valves shown are adjusted so that the return temperature rises above 120F during the first few minutes of operation. A three-way valve can be substituted for the two throttling valves shown. If the circulator is mounted on the supply, the bypass must be on the discharge side of the circulator.
- 3) Low Temperature Systems – Some systems, such as radiant tubing systems, require the system water temperature to be limited to a value below the temperature of the water leaving the CWD. These systems also typically have return temperatures well below the 120F minimum.

Figure 29 illustrates the use of a heat exchanger to connect a CWD boiler to this type of system. The heat exchanger will permit the transfer of heat from the boiler water to the low temperature system while holding the system supply and boiler return temperatures within their limits. For this system to work properly, the heat exchanger must be properly sized and the correct flow rates are required on either side of the heat exchanger. Consult the heat exchanger manufacturer for sizing information. The water in the boiler is completely isolated from the water in the system. This means that separate fill and expansion tanks are required for the heating system loop.

There are several other ways to connect low temperature systems to the non-condensing boilers like the CWD such as four way mixing valve and variable speed injection pumping systems.

- 4) Systems containing oxygen – Many hydronic systems contain enough dissolved oxygen to cause severe corrosion damage to a cast iron boiler such as the CWD. 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 29.

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.

- 5) 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 30. Use isolation valves to prevent chilled water from entering the boiler.
- 6) Air Handlers – Where the boiler is connected to air handlers through which refrigerated air passes, use flow control valves in the boiler piping or other automatic means to prevent gravity circulation during the cooling cycle.

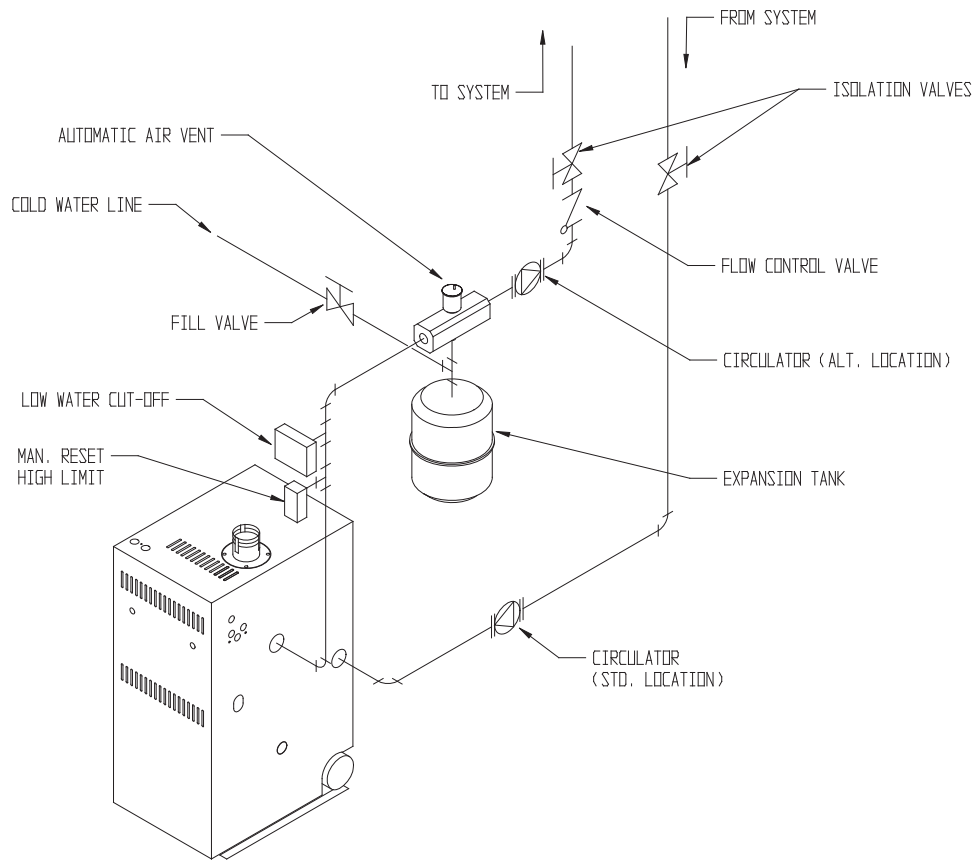


FIGURE 26: BASIC PIPING

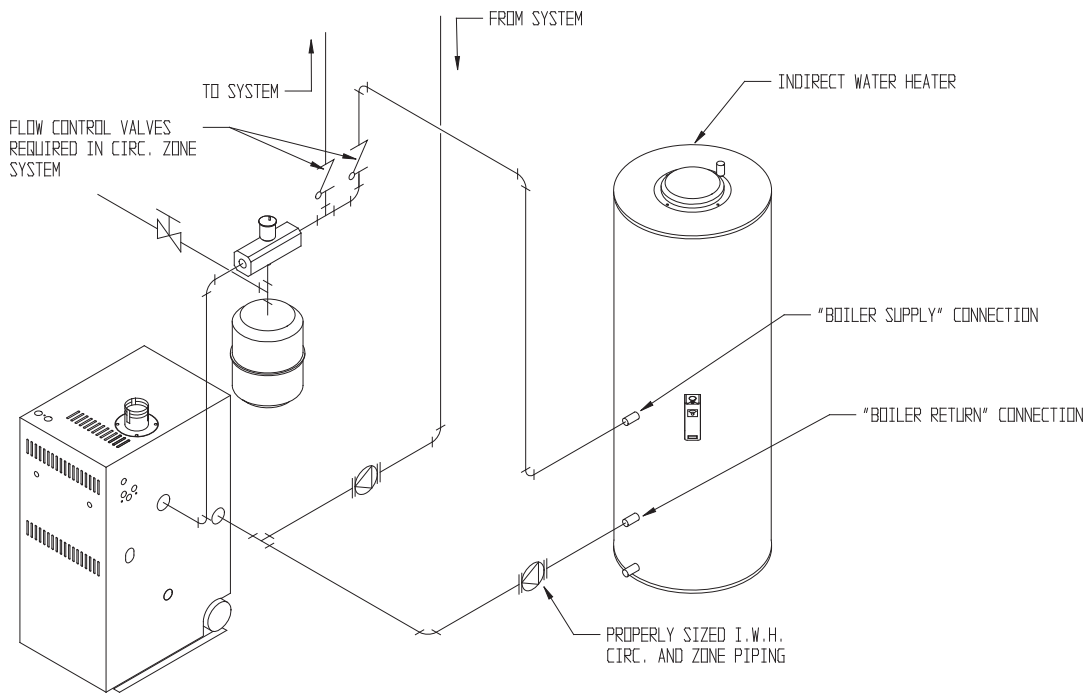


FIGURE 27: INDIRECT WATER HEATER BOILER-SIDE PIPING

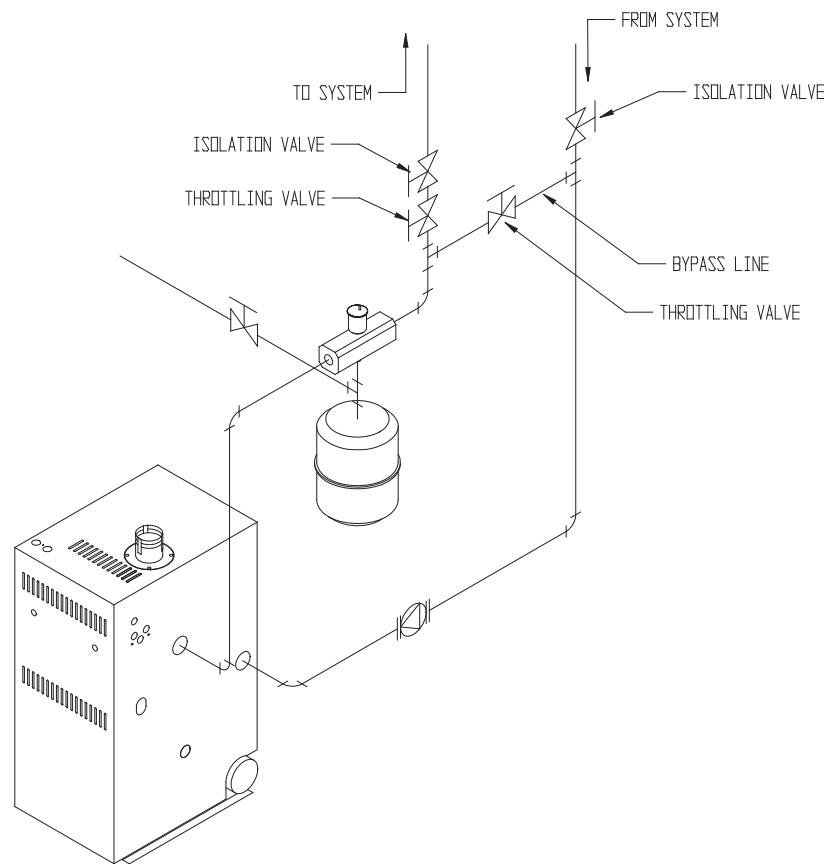


FIGURE 28: BYPASS PIPING

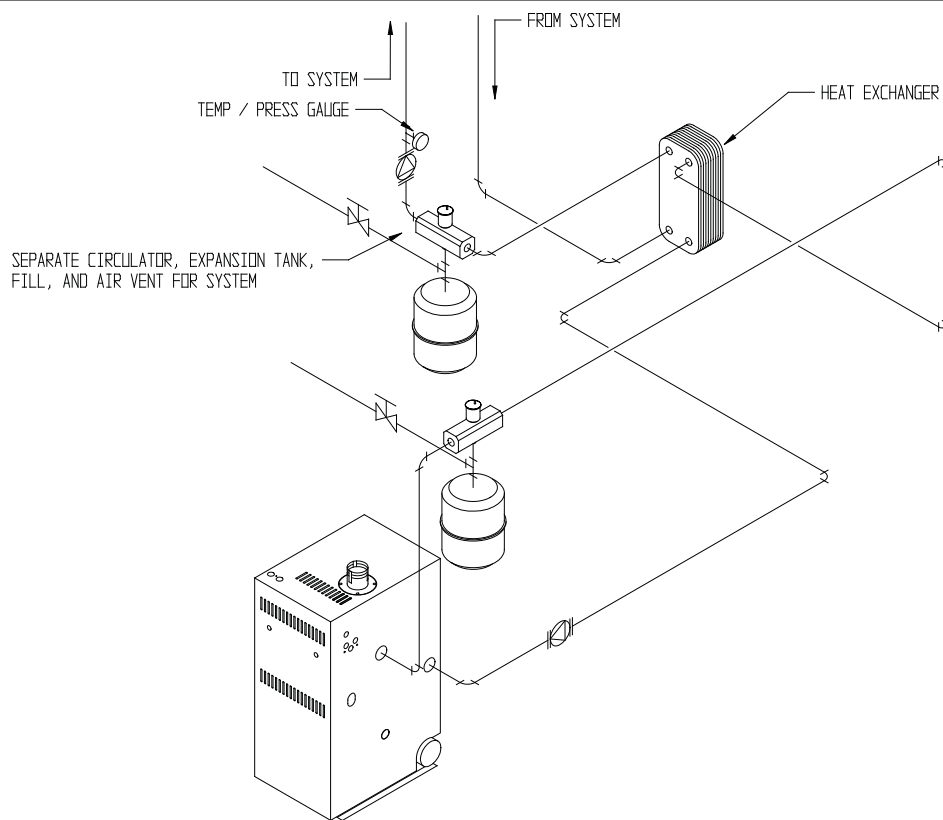


FIGURE 29: ISOLATION OF BOILER FROM SYSTEM WITH HEAT EXCHANGER

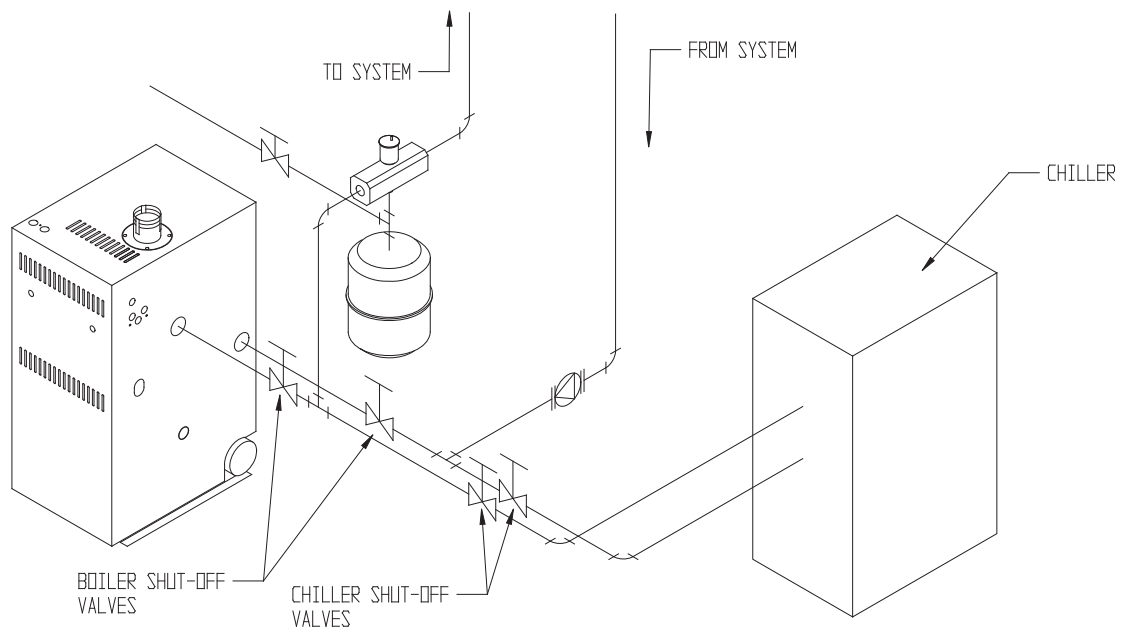


FIGURE 30: CHILLER PIPING

IX Wiring

The CWD Series boiler is offered with two different types of control systems:

- **CB502 Control System** - Basic operation of the boiler is controlled with a “CB502 control” (Crown part #42-502) located in the left side of the boiler vestibule. This device controls one or two circulator zones without the use of additional controls and includes LEDs to show the status of the circulators, inducer, and other boiler controls.
- **R8285 Control System** - Basic operation of the boiler is controlled by a Honeywell R8285 fan center. This system controls a single zone, although it can be used in a multiple zone system through the use of additional controls. No diagnostic LEDs are included in this system.

Both of these control systems use the same gas valves, ignition system components, and pressure switches. Separate wiring instructions are provided for each of these two control systems in the following two sections.

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).**
- **If a low water cut-off is installed, wire it to break the 120VAC supply to the boiler. Attempting to wire a 24 volt low water cut-off into the boiler, or otherwise modifying any of the 24 volt boiler wiring, will void the ANSI Z21.13 certification of this boiler and may cause unsafe boiler operation.**

A. CB502 System - Single Zone Wiring

- 1) **Line Voltage (120 VAC) Connections (Fig 31)** – The line voltage connections are located in the junction box under the transformer 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” (This wire is not used in single zone installations)
 - Green – Ground connection
- 2) **Maximum circulator continuous current draw** = 10A
- 3) **Low Voltage (24 VAC) Connections (Fig 31)** – These connections are screw terminals located on the front edge of the relay board:
 - T-T Heat 1 – “Heating” thermostat connections
 - T-T DHW/H2 – “Indirect Water Heater” thermostat connections
 - Heat anticipator setting for both thermostat connections is 0.03 A.
- 4) **Priority Switch** – When this switch is “on”, the “heating” circulator is turned off when a call for heat is present from “indirect water heater” zone. It is used to ensure that the entire output of the boiler is available to the indirect water heater. This switch should come from the factory in the “off” position and should be turned on only when absolutely necessary to provide adequate domestic water.
- 5) **Auxiliary Jumpers** – Two jumpers are located on the relay board as shown in Figure 32. They are present for connection and configuration of an auxiliary control. Unless instructions provided with the control call for these jumpers to be moved, they should remain as shown in Figure 32.

CAUTION

A problem with the indirect water heater zone could result in a total lack of heat and freeze damage to the building if this switch is in the priority “on” position.

- **Ensure that the priority switch is “off” when it is not to be used.**
- **Set the priority switch “on” only when absolutely necessary.**
- **Do not leave the priority switch “on” when the building will be empty for an extended period of time.**

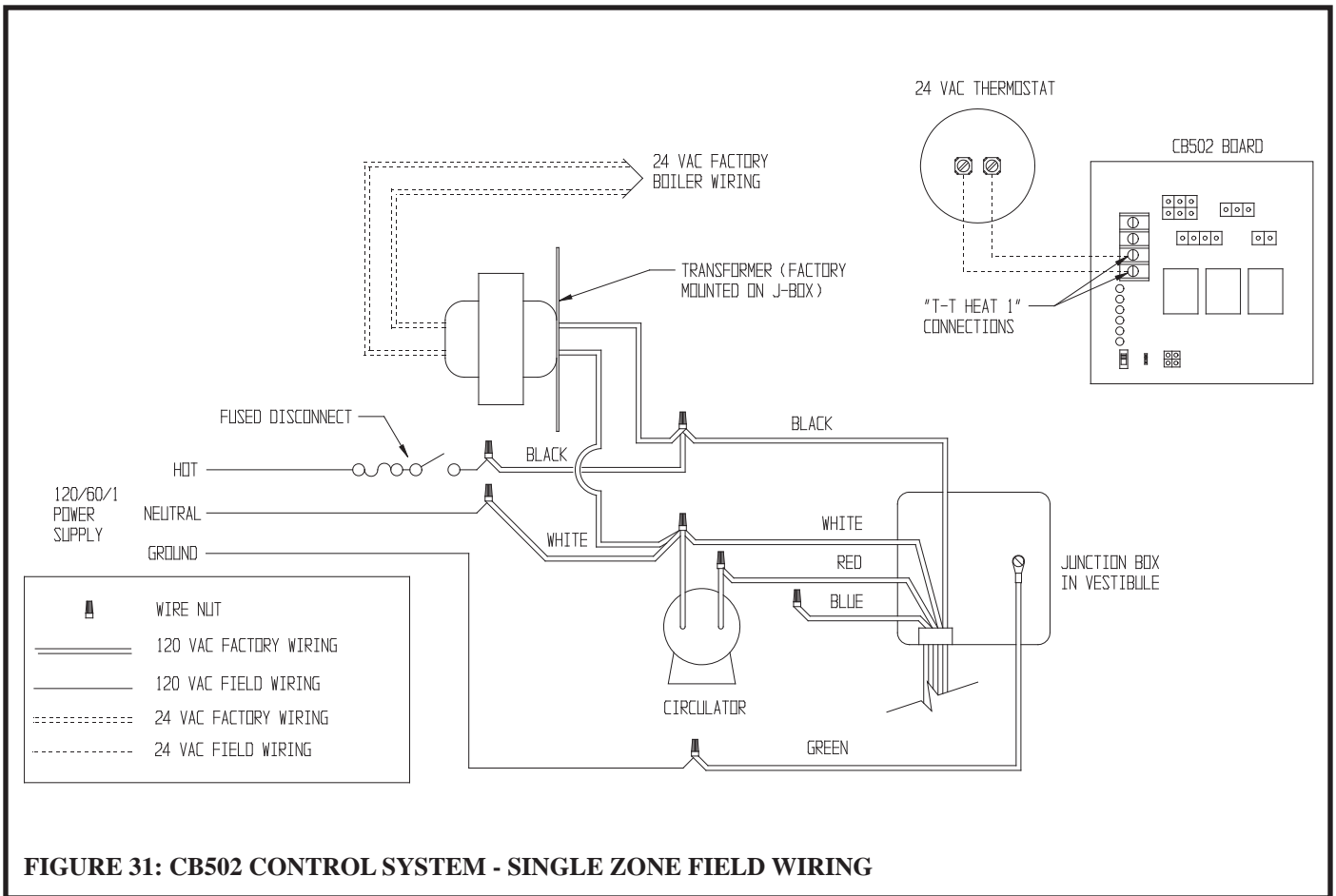


FIGURE 31: CB502 CONTROL SYSTEM - SINGLE ZONE FIELD WIRING

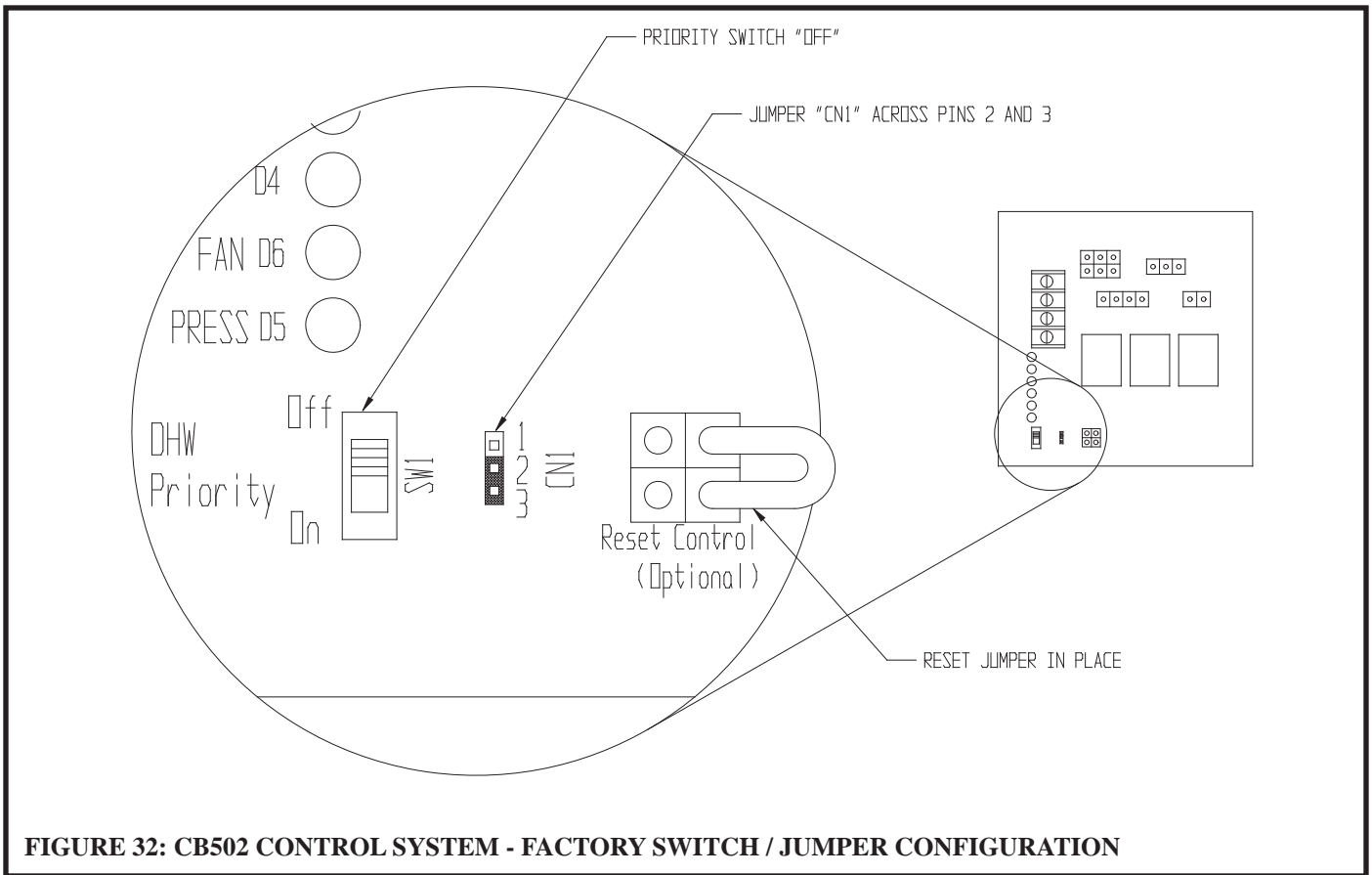


FIGURE 32: CB502 CONTROL SYSTEM - FACTORY SWITCH / JUMPER CONFIGURATION

B. CB502 System - Wiring Variations

- 1) Two Circulator Zones – Figure 33 shows wiring for two circulator zones. The second zone may be either an indirect water heater or a heating zone. No additional electrical controls are required to operate two circulator zones with a standard CWD boiler.
- 2) Hybrid Zone Valve/Circulator Zone System using Honeywell V8043Fs – The system shown in Figure 34 is useful when zone valves are to be used for space heating zones but not the indirect water heater zone. Two circulators are wired into the CWD boiler as shown in Figure 34. The zone valve end switches are connected in parallel and connected to the “T – T Heat” thermostat connections. A separate transformer is required to power the zone valves – **do not attempt to use the transformer supplied with the boiler.**

When a given heating thermostat calls, it opens the zone valve to which it is wired. When the zone valve opens, its end switch makes, sending a call for heat to the CWD board. This starts the heating circulator and fires the boiler.

The indirect water heater thermostat is connected directly to T-T DHW/H2. Upon a call for heat, it starts the indirect water heater circulator and fires the boiler. If the priority switch is “on”, a call from the indirect water thermostat also turns off the heating circulator. CAUTION: Do not use the factory supplied transformer to power zone valves or other loads external to the boiler.

C. CB502 Control System – Sequence of Operation

(Refer to Figures 35 and 36 for ladder and connection diagrams)

- 1) When no call for heat is present and 120 VAC power is supplied to the boiler, the transformer is energized. The “PWR” LED connected across the transformer secondary glows.
- 2) Assuming that no call for heat is present from the “DHW/H2” thermostat connections, a call for heat from the “Heat 1” thermostat will apply voltage across relay coil 1K and the “Heat” LED.
- 3) When the 1K relay coil is energized, contacts 1K1 make, starting the heating circulator. Contacts 1K2 also make, sending power to the high limit.
- 4) Assuming that the high limit is made, voltage will appear across the “Limit” LED which will illuminate, verifying that the high limit switch is closed.
- 5) At this point, the pressure switch should be open and continuity should be present between the COM” and “N.C.” contacts on the pressure switch. If this is the case, relay coil 3K will be energized along with the “FAN” LED. In the event that the pressure switch is stuck in “fan proven” position at the beginning of the operating sequence, the “NC” contact on the pressure switch will be open at this point and the operating sequence will not proceed further. This prevents the boiler from firing if the pressure switch is stuck in the “fan proven” position.
- 6) Once relay coil 3K1 is energized, contacts 3K1 and 3K2 make. Contacts 3K1 energize the fan. Contacts 3K2 provide a “latch” for coil 3K, ensuring that coil 3K remains energized after the pressure switch “normally closed” contacts open.
- 7) Once the combustion fan has created an adequate pressure differential across the pressure switch, the pressure switch “NO” contacts will make. Voltage is then applied across both the “PRESS” LED and the ignition module.
- 8) After 30 seconds has passed, the ignition module will initiate an ignition spark and apply 24 VAC across the pilot valve (terminals “PV” and “MV/PV” on the gas valve).
- 9) If pilot flame is established before the 90 second trial for ignition period has ended, the spark will stop. Voltage is then applied across the main valve (gas valve terminals “MV” and “MV/PV”) opening the valve and establishing main flame.
- 10) If no pilot flame is detected during the 90-second trial for ignition period, the pilot valve will close and the module will wait 30 seconds. It will then go through at least one more 90 second trial for ignition period, depending on the exact module supplied with the boiler.
- 11) A call for heat from the DHW/H2 thermostat will energize relay coil 2K and the “DHW” LED. Relay contacts 2K1 make, starting the domestic water circulator. SPDT contacts 2K2 also change position, breaking one current path to relay coil 1K and energizing the high limit. The boiler will then start following the sequence outlined in Steps (4) - (10).
- 12) The “priority switch “SW1” is “on” when it is open and “off” when it is closed. If the priority switch is “off”, a current path will still exist to relay coil 1K after the 2K2 N.C. contacts have opened. If the priority switch is “on” (as shown in Figure 35), relay coil 1K will be de-energized, causing contacts 1K1 and 1K2 to open. The “heat” circulator will be de-energized, but the burner will continue to fire because the 2K2 “NO” contacts are made.

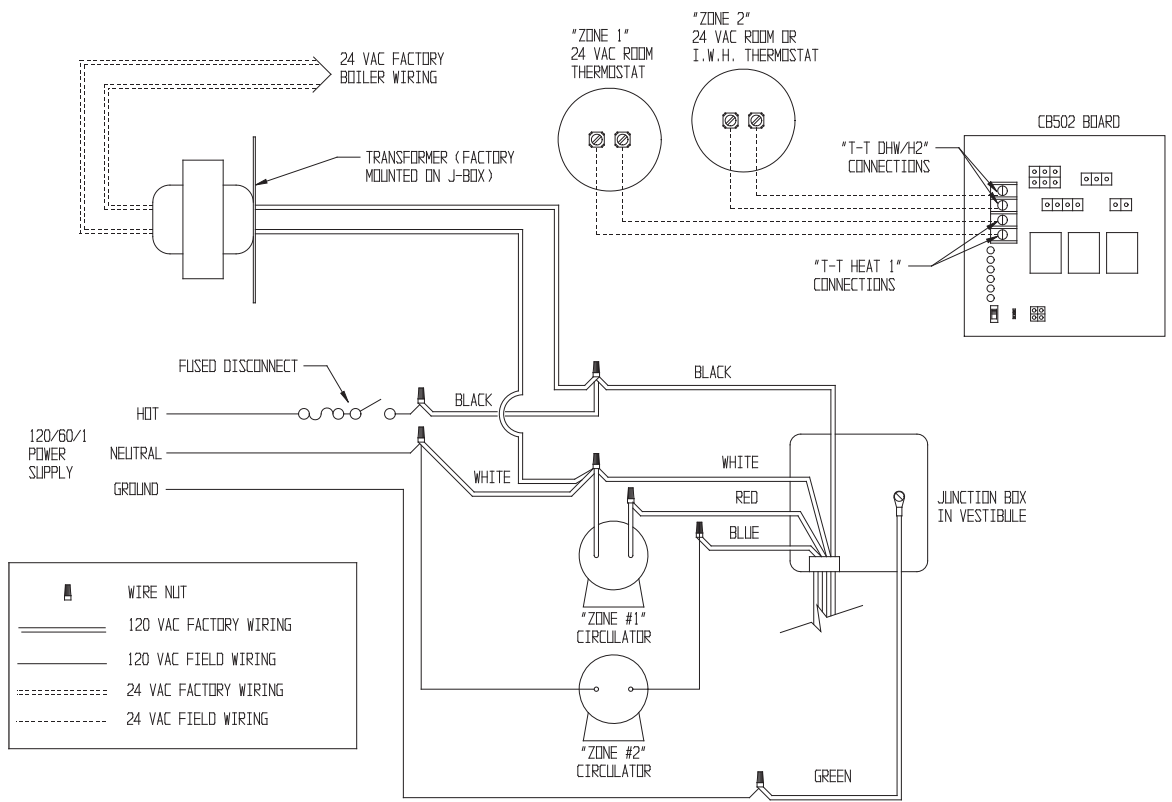


FIGURE 33: CB502 CONTROL SYSTEM - FIELD WIRING FOR TWO CIRCULATOR ZONES

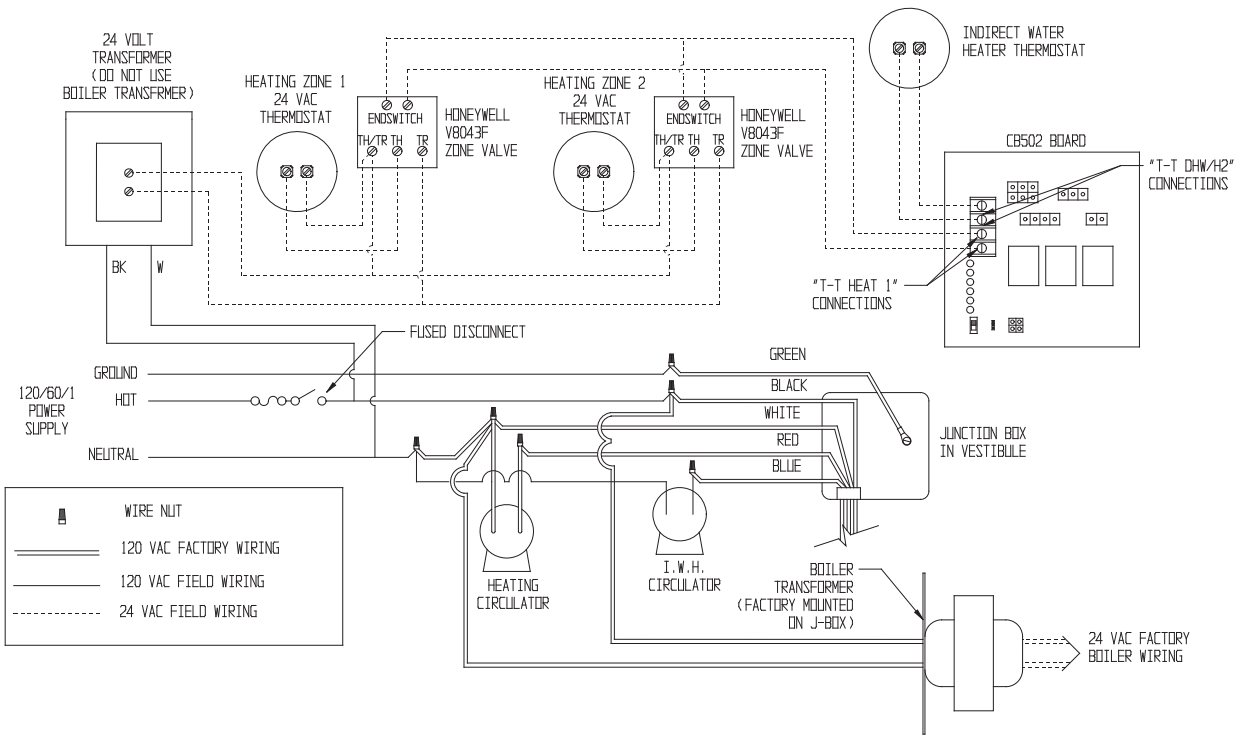


FIGURE 34: CB502 CONTROL SYSTEM - FIELD WIRING FOR HYBRID CIRCULATOR/ZONE VALVE SYSTEM

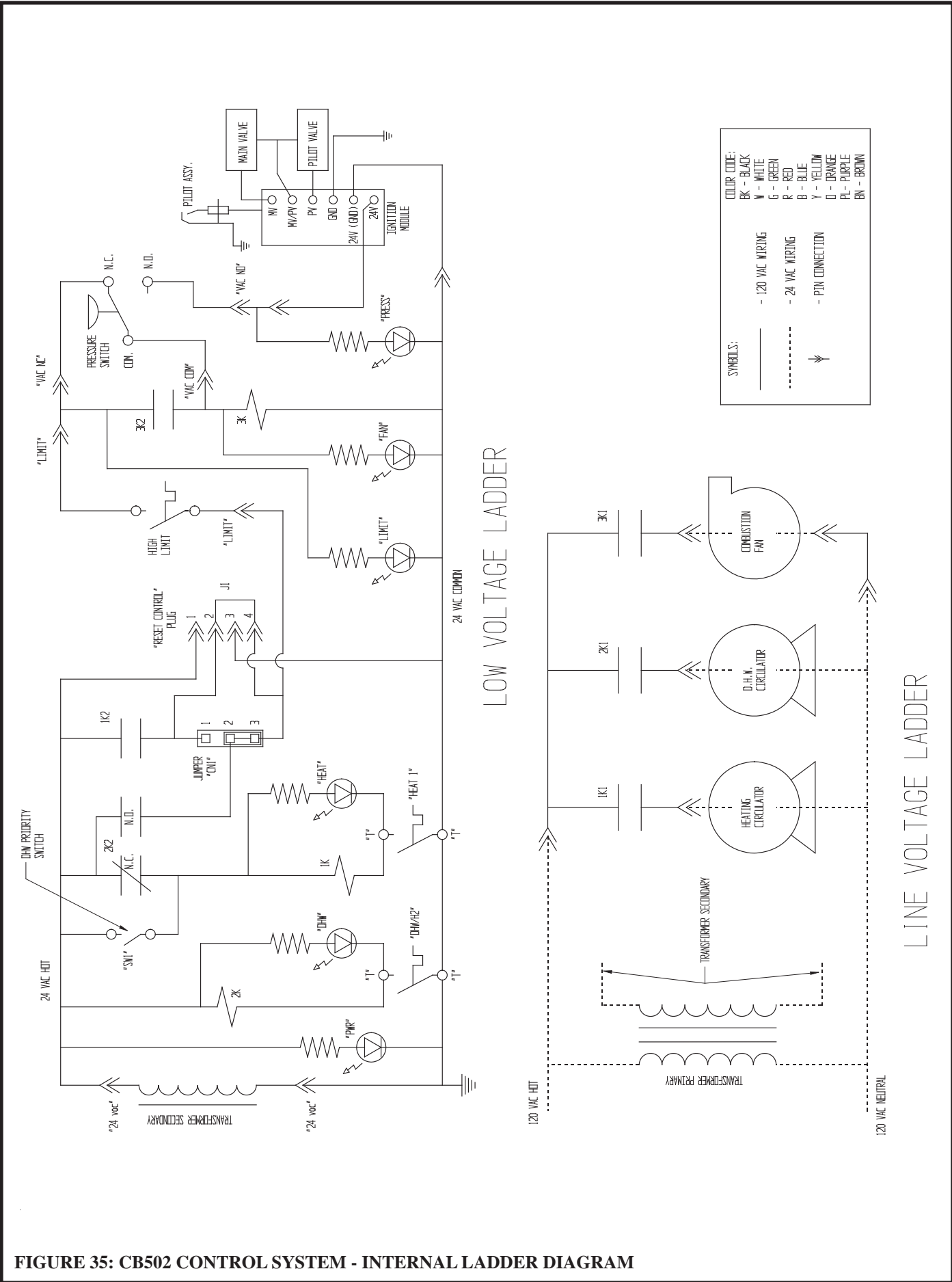
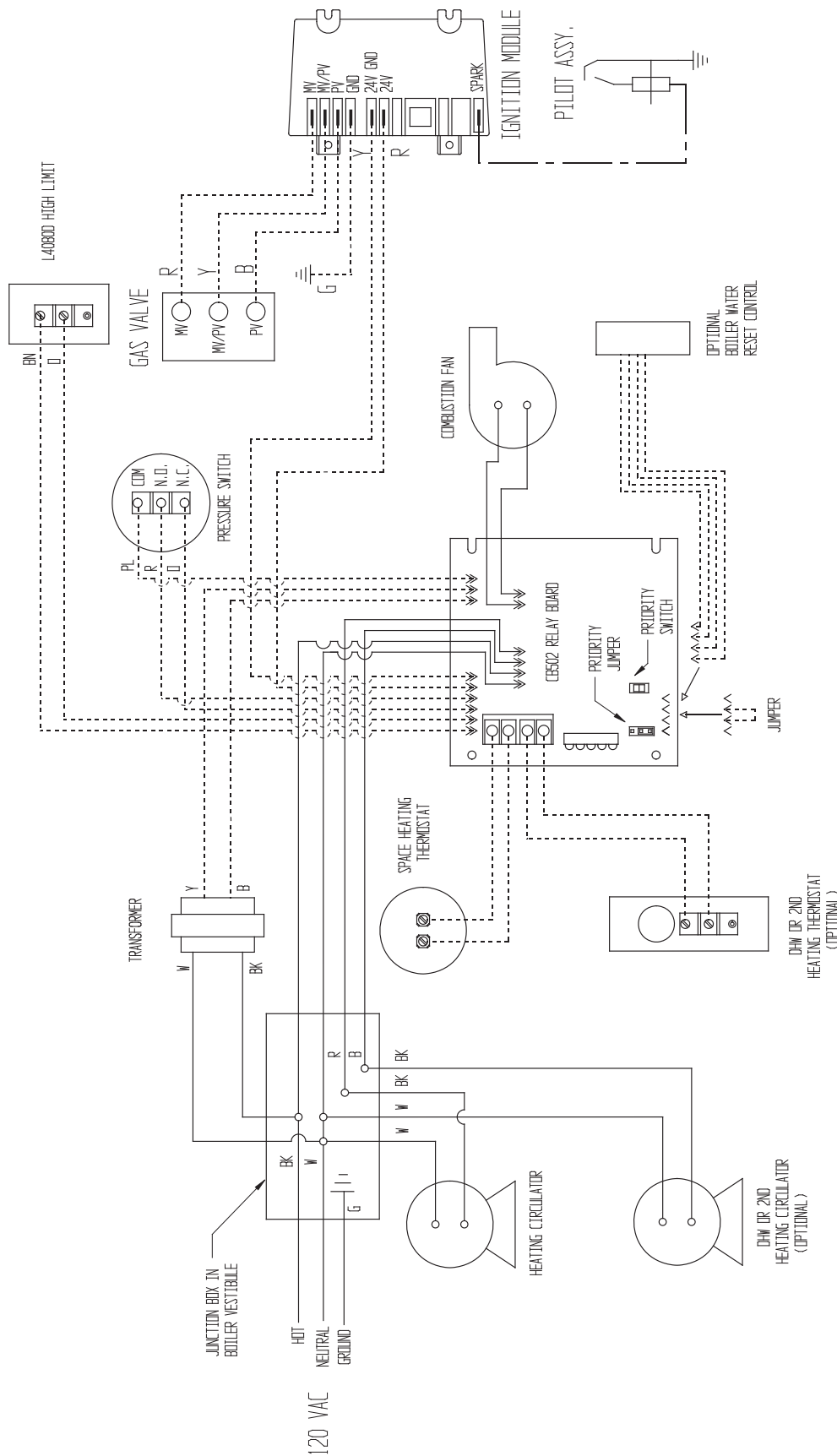


FIGURE 35: CB502 CONTROL SYSTEM - INTERNAL LADDER DIAGRAM



COLOR CODE:

BK	- BLACK
W	- WHITE
G	- GREEN
R	- RED
B	- BLUE
Y	- YELLOW
O	- ORANGE
PL	- PURPLE
BN	- BROWN

SYMBOLS:

—	- 120 VAC WIRING
- - -	- 24 VAC WIRING
↗	- PIN CONNECTION

- NOTES:**
- 1.) IF ANY OF THE ORIGINAL WIRE SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH 105C TYPE AWM OR ITS EQUIVALENT.
 - 2.) EXACT LOCATION OF LABELED TERMINALS ON IGNITION MODULE MAY BE DIFFERENT THAN SHOWN.

FIGURE 36: CB502 CONTROL SYSTEM - INTERNAL CONNECTION DIAGRAM

D. R8285 Control System - Single Zone Wiring

- 1) Line Voltage (120 VAC) Connections (Fig 37) – The line voltage connections are located in the junction box under the R8285 fan center on the right side of the boiler.
 - Black – Line voltage “hot”
 - White – “Neutral” for boiler and circulators
 - Green – Ground connection
- 2) The circulator is factory wired. If a different circulator is wired to the boiler, its full load current draw must not exceed 12A.
- 3) Connect the 24-volt thermostat to terminals “R” and “G” on the R8285 fan center. Set the heat anticipator to 0.34 Amps.

E. R8285 Control System - Wiring Variations

- 1) Multiple Circulator Zones – Figure 38 shows wiring for two or more circulator zones using Honeywell R845As. One fewer R845A is used than the total number of circulator zones. A DPST Honeywell RA832A may be substituted in place of the R845A using the “X” and “X” terminals in place of the “5” and “6” terminals on a R845A.

A call for heat from the “zone #1” thermostat causes the zone #1 circulator to start and the boiler to fire exactly as in a single zone system (see “Sequence of Operation”). A call for heat from any other thermostat will energize the DPST relay in that zone’s R845A. When this relay is energized, electrical continuity is created between terminals 3 and 4, energizing the circulator for that zone. At the same time, electrical continuity is created between terminals 5 and 6 on the R845A, creating a current path from terminal “R” to “Y” on the R8285 fan center in the CWD. Assuming that the supply water temperature is below the high limit setting, the normal ignition sequence will be initiated. If this happens when there is no call from the zone #1 thermostat, the relay on the R8285A will not be energized and the zone #1 circulator will remain off.
- 2) Multiple Zones using Zone Valves – Figure 39 shows wiring for multiple zones using Honeywell V8043F zone valves. This wiring diagram may be used for other 24-volt zone valves as long as they are equipped with end switches. Do not attempt to use the transformer on the R8285 to power the zone valves; use a separate transformer. Up to five V8043Fs may be powered by one 40VA transformer, such as the Honeywell AT87A.

A call for heat from a given thermostat will result in the application of 24 volts across the TH and TR terminals on the corresponding zone valve, energizing the zone valve motor. The zone valve opens and the end switch contacts are then made. The end switches are connected in parallel with each other and to the CWD “thermostat” connections so that any zone valve that opens will also start the circulator and fire the boiler (assuming the high limit is not open). Zone valve terminal TH/TR has no internal connection on the zone valve; it is merely a “binding post” used to connect two or more wires.

F. R8285 Control System – Sequence of Operation

(Refer to Figures 40 and 41 for ladder and connection diagrams)

- 1) A call for heat from the thermostat energizes relay coil 1K (the relay on the R8285), causing contacts 1K1 and 1K2 to make. Contact 1K1 starts the circulator. Contact 1K2 sends power to the high limit.
- 2) Assuming that the high limit is made, current will flow through the normally closed contacts on the pressure switch to relay coil “2K” (the R8222 relay coil). Contacts 2K1 make, starting the combustion blower. Contacts 2K2 make, creating a current path in parallel with the normally closed pressure switch contacts.
- 3) As the combustion fan comes up to full speed, the normally closed contacts on the vacuum switch break. Power remains applied to the 2K coil, however, through the 2K2 contacts. Once the combustion fan has created adequate pressure across the pressure switch, the normally open contacts on the pressure switch will make, sending power to the ignition module.
- 4) After 30 seconds has passed, the ignition module will initiate an ignition spark and apply 24 VAC across the pilot valve (terminals “PV” and “MV/PV” on the gas valve).
- 5) If pilot flame is established before the 90 second trial for ignition period has ended, the spark will stop. Voltage is then applied across the main valve (gas valve terminals “MV” and “MV/PV”) opening the valve and establishing main flame.
- 6) If no pilot flame is detected during the 90-second trial for ignition period, the pilot valve will close and the module will wait 30 seconds. It will then go through at least one more 90 second trial for ignition period, depending on the exact module supplied with the boiler.

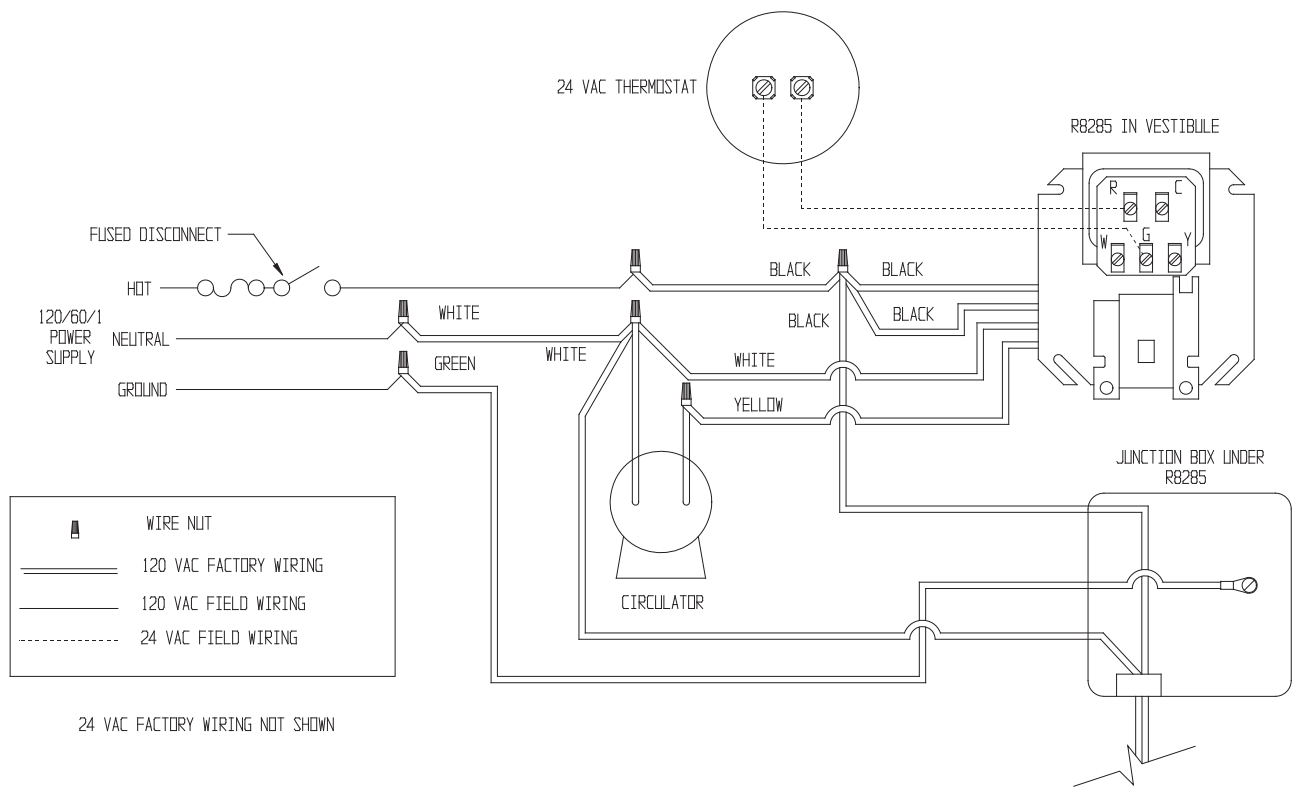


FIGURE 37: R8285 CONTROL SYSTEM - SINGLE ZONE FIELD WIRING

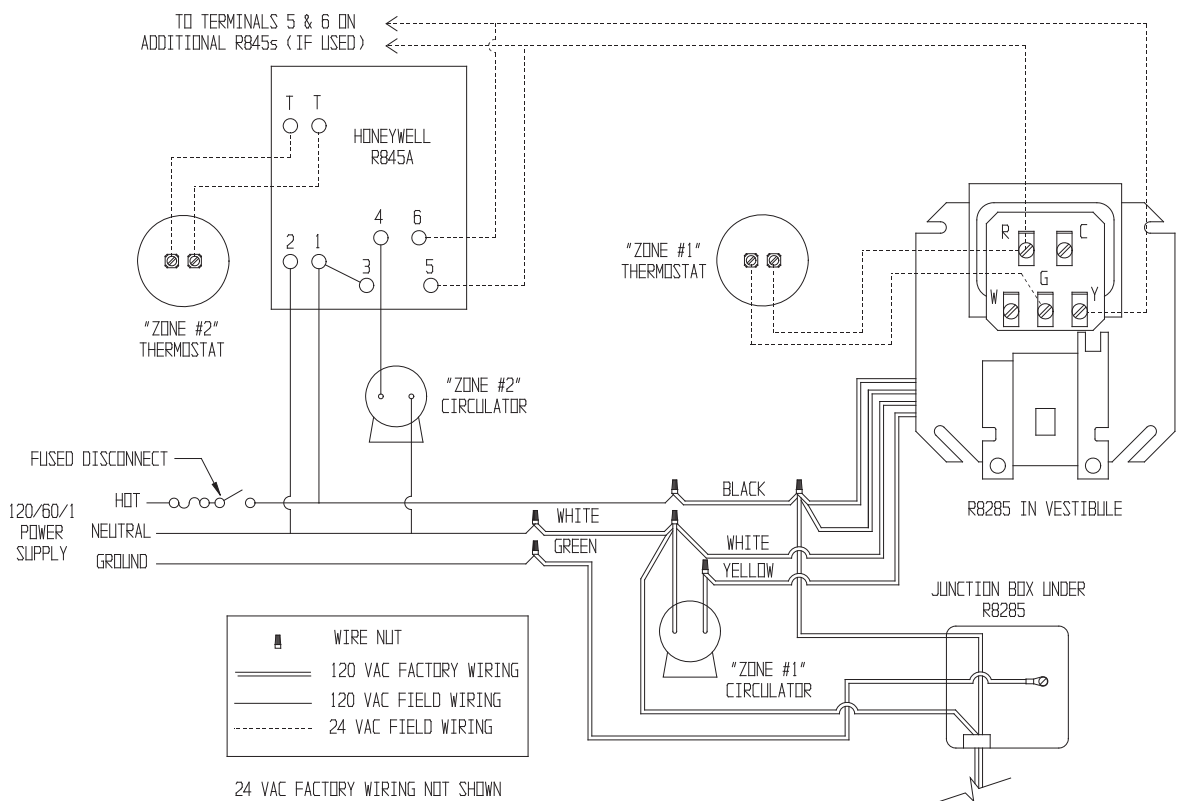


FIGURE 38: R8285 CONTROL SYSTEM - FIELD WIRING FOR TWO CIRCULATOR ZONES

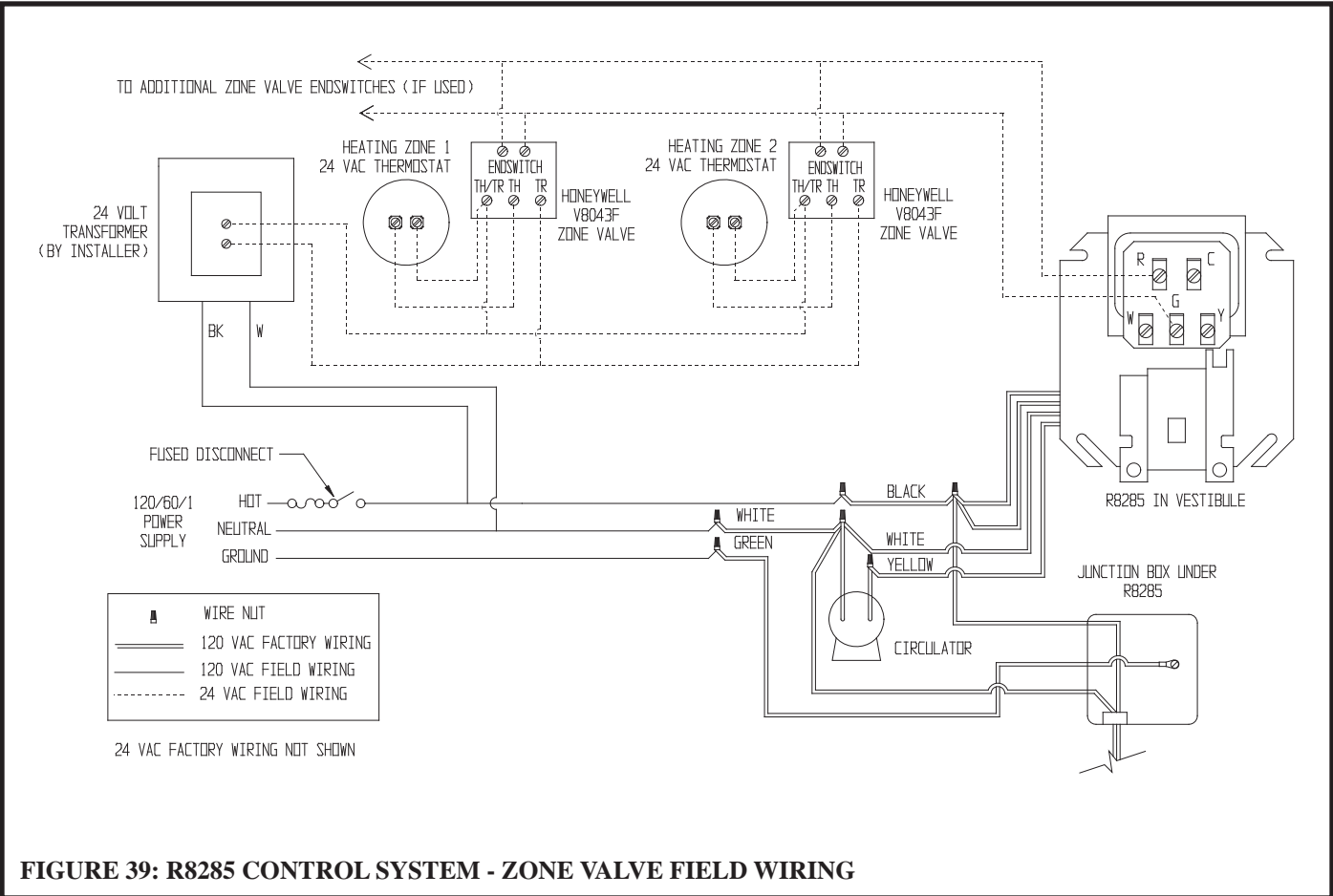


FIGURE 39: R8285 CONTROL SYSTEM - ZONE VALVE FIELD WIRING

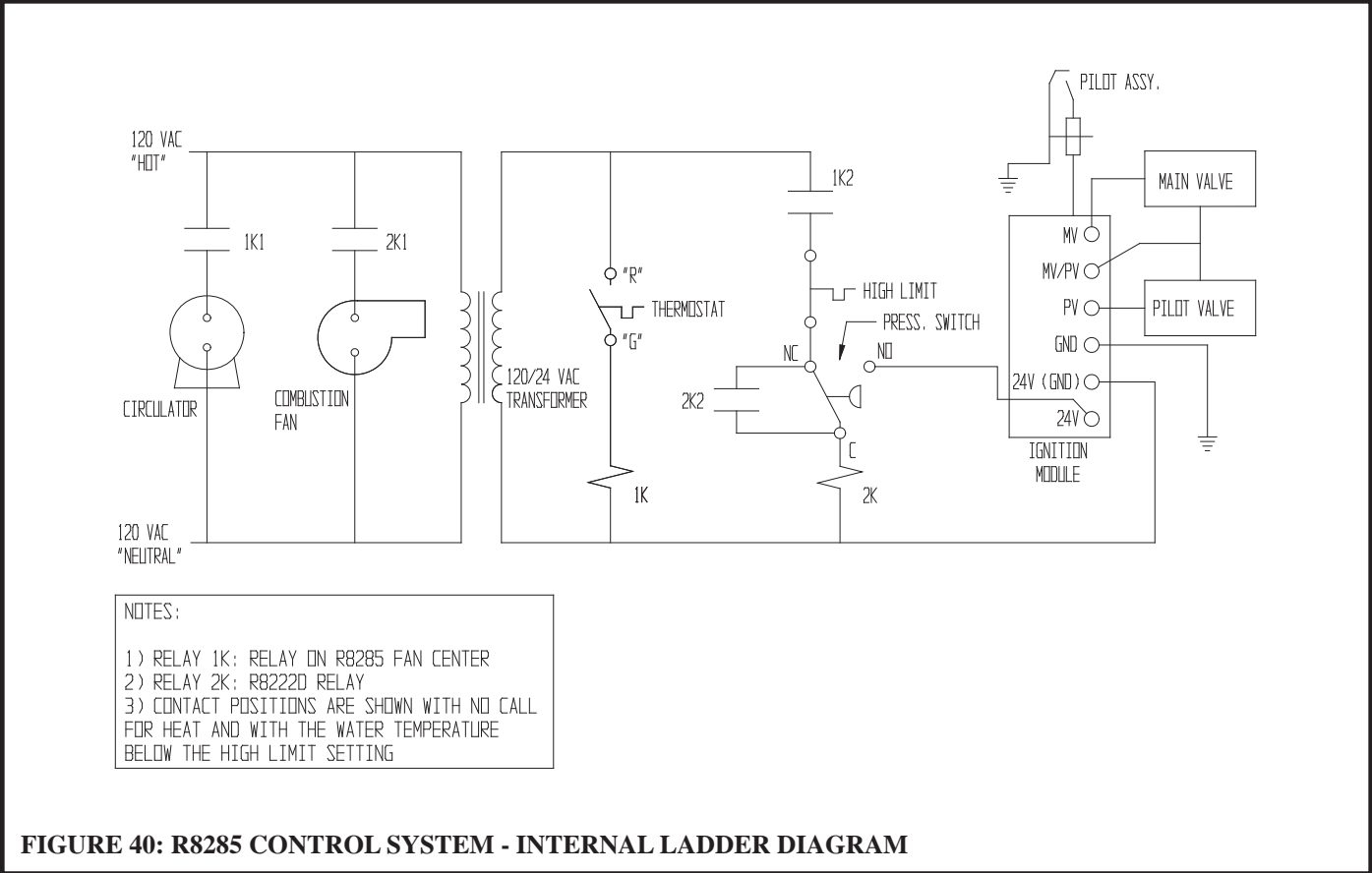


FIGURE 40: R8285 CONTROL SYSTEM - INTERNAL LADDER DIAGRAM

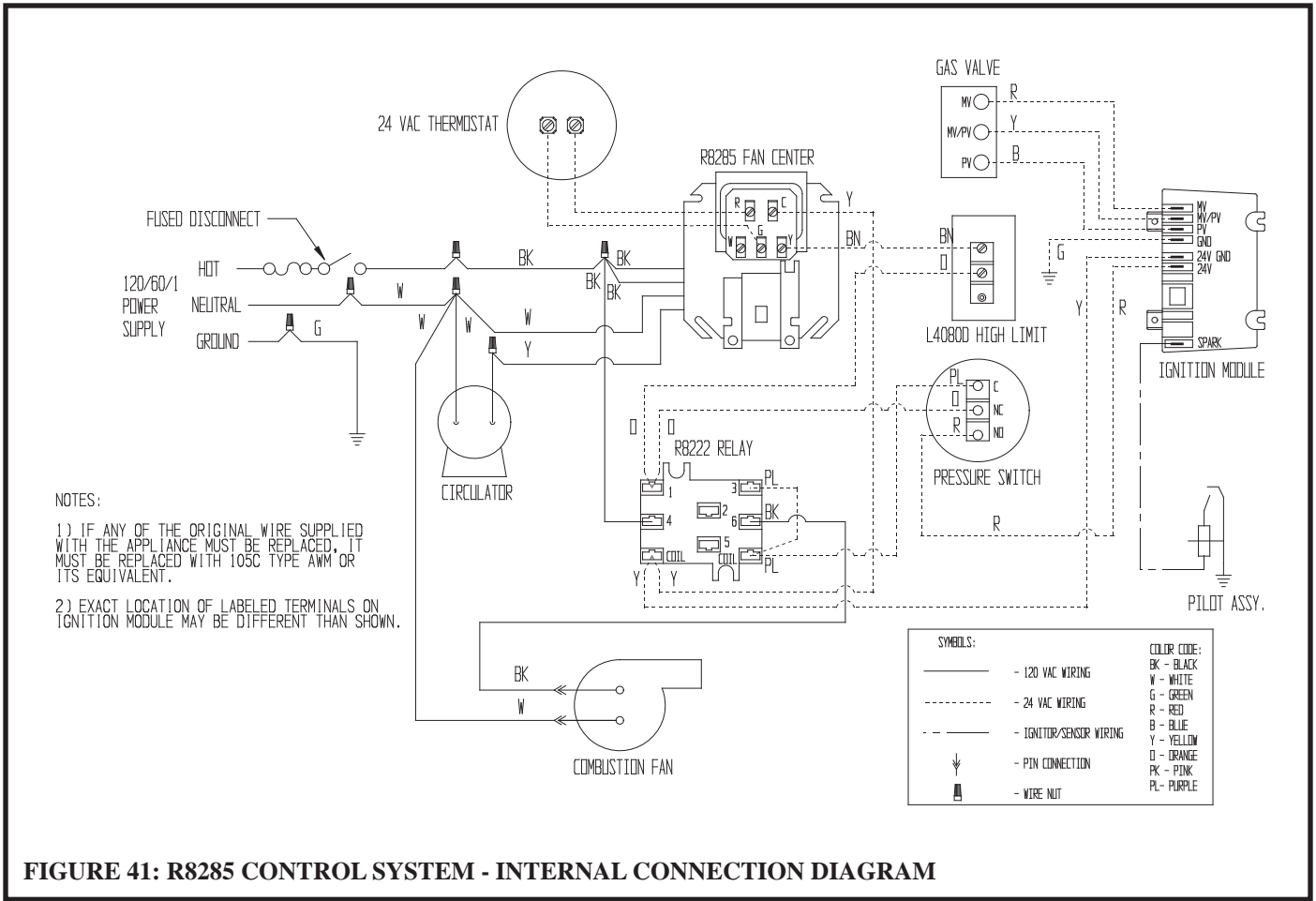


FIGURE 41: R8285 CONTROL SYSTEM - INTERNAL CONNECTION DIAGRAM

X Start-up and Checkout

WARNING

- **Never attempt to fill a hot empty boiler.**
- **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.**
- **If antifreeze is used in the system, it must be a nontoxic type such as propylene glycol.**

NOTE

Safe lighting and other performance criteria were met with the gas manifold and control assembly provided on the boiler when the boiler underwent the tests specified in Z21.13.

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

- 1) Make sure that the boiler and system are filled with water.
- 2) Check all new gas piping for leaks and purge piping sections that are filled with air. See the *National Fuel Gas Code* for additional information on testing and purging gas lines.
- 3) Verify that vent system is complete and free of obstructions before attempting to fire boiler. Make sure that the silicone cure time called for in the vent assembly instructions has passed before firing boiler.
- 4) Inspect all wiring for loose or uninsulated connections.
- 5) Adjust thermostat to the highest setting.
- 6) Start the boiler using the lighting instructions on the opposite page.
- 7) Upon initial start-up, the gas train will be filled with air. Even if the gas line has been completely purged of air, it may take several tries for ignition before a flame is established. Once a flame has been established for the first time, subsequent calls for burner operation should result in a flame on the first try.
- 8) Observe pilot burner flame. Pilot burner produces three flames. The center one should be a steady medium blue flame covering around 3/8" to 1/2" of spark electrode / flame rod (Figure 42).
- 9) Inspect the main burner flames visible through the observation port in burner access panel. The flame should be stable and mostly blue. No yellow tipping should be present; however, intermittent flecks of yellow and orange in the flame are normal (Figure 43).
- 10) Check entire gas train for leaks using soap and water or other approved leak detection method while boiler is firing. Fix any leaks found immediately.
- 11) Run gas valve safety shutdown test. With main burners firing, disconnect ignition cable from ignition module. Both pilot burner and main burners should stop firing.

FOR YOUR SAFETY READ BEFORE OPERATING

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

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

WHAT TO DO IF YOU SMELL GAS

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

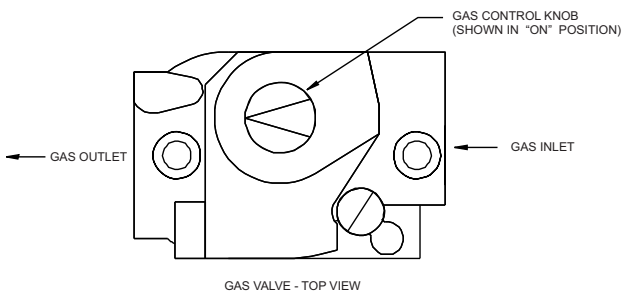
- If you cannot reach your gas supplier, call the fire department.

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

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

OPERATING INSTRUCTIONS

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



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

TO TURN OFF GAS TO APPLIANCE

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

WARNING

Failure to follow the following procedure exactly could result in over-firing of the boiler and a carbon monoxide hazard.

12) Check the manifold pressure and adjust if necessary. To do this, use the following procedure:

- a) Connect a manometer to the line pressure tap on the gas valve (see Figure 44).
- b) Check the line pressure with all gas appliances on and off. The line pressure at the boiler must be within the following limits regardless of what combination of appliances is firing:

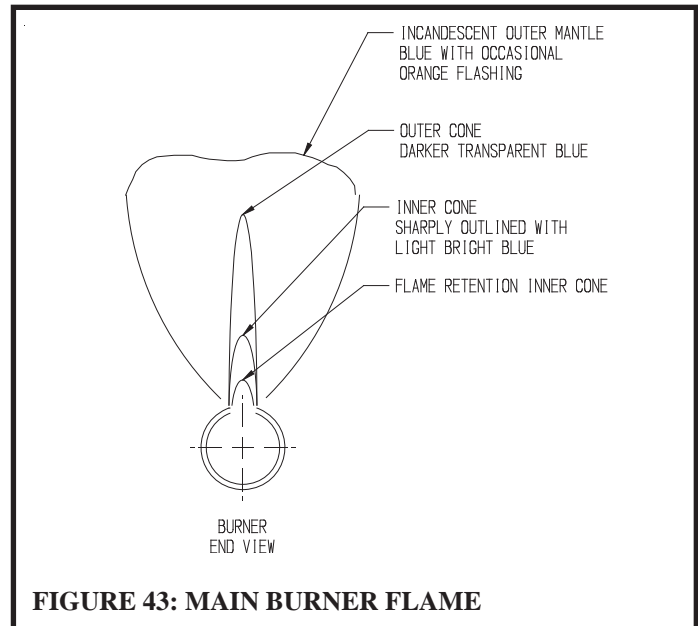
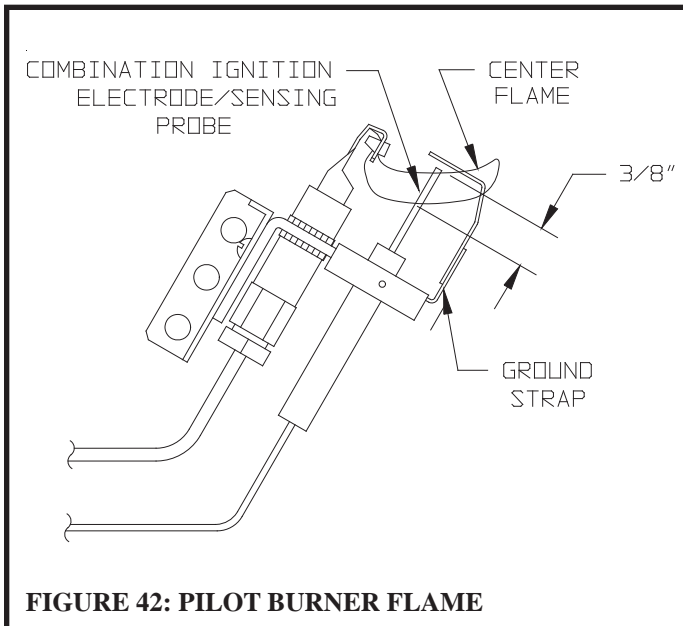
<u>Line Press (inches w.c.)</u>	<u>Natural Gas</u>	<u>LP Gas</u>
Minimum	5.0	11.0
Maximum	14.0	13.0

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

- c) Disconnect the silicone regulator tube from the hose barb on the gas valve (Figure 45).
- d) Connect a manometer to the manifold (outlet) pressure tap on the gas valve (Figure 44).
- e) Read the manifold pressure. It should be set at:

<u>Manifold Press. (inches w.c.)</u>	<u>Natural Gas</u>	<u>LP Gas</u>
	3.5	10.0

- e) If a manifold pressure adjustment is needed, make the adjustment by turning the regulator screw (see Figure 44) clockwise to raise the pressure and counter-clockwise to reduce the pressure. If a manifold pressure adjustment is made, recheck the line pressure to be certain that it is still within acceptable limits. Replace the cover screw on the regulator.
 - f) Reconnect the silicone regulator tube disconnected in Step (c)
- 13) Test thermostat operation while the boiler is running. Turn the thermostat to the lowest setting. Circulator should stop running. Raise the thermostat back to the highest setting. Circulator should restart. The pilot burner and main burners should relight.
- 14) Verify high limit operation. Allow the boiler water temperature to increase to high limit setting. Circulator should continue running and pilot burner and main burners should stop firing. When water temperature drops below the limit setting, the pilot burner and main burners should relight.
- 15) After the boiler has operated for approximately 30 minutes, check the boiler and heating system piping for leaks. Repair any leaks found at once.
- 16) Inspect the vent system for flue gas leaks. Repair any leaks found before leaving the boiler in operation.



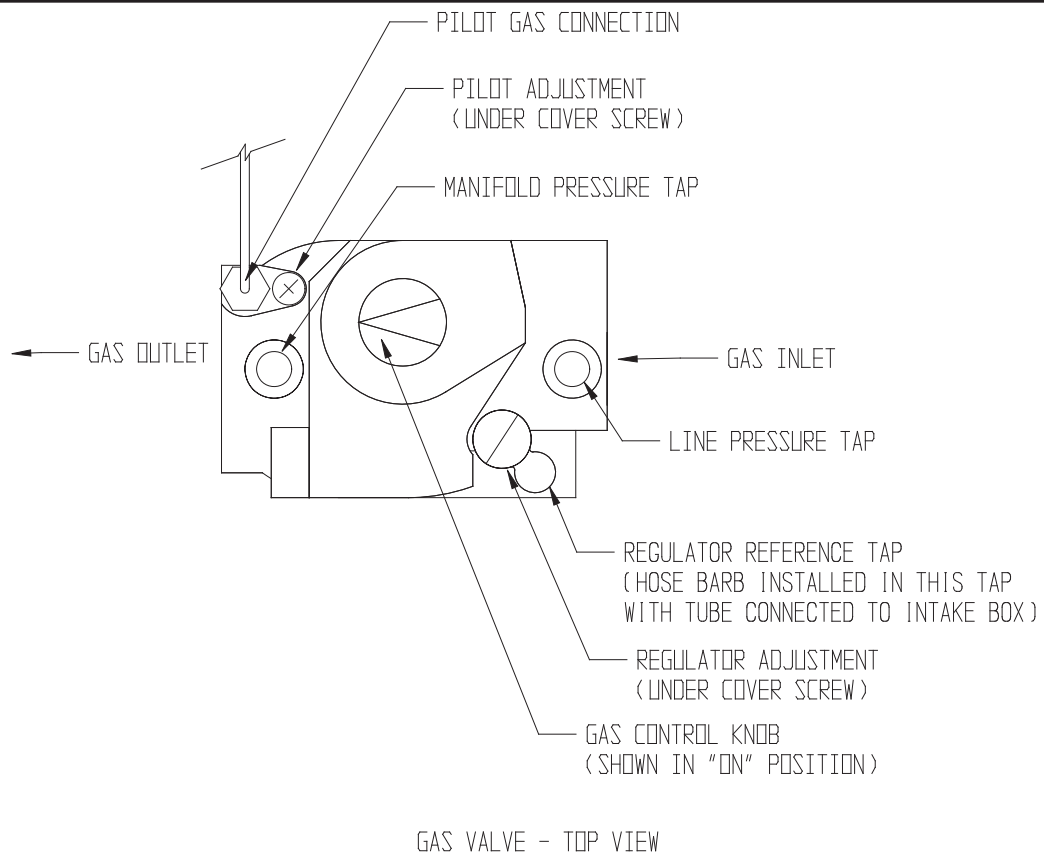


FIGURE 44: GAS VALVE

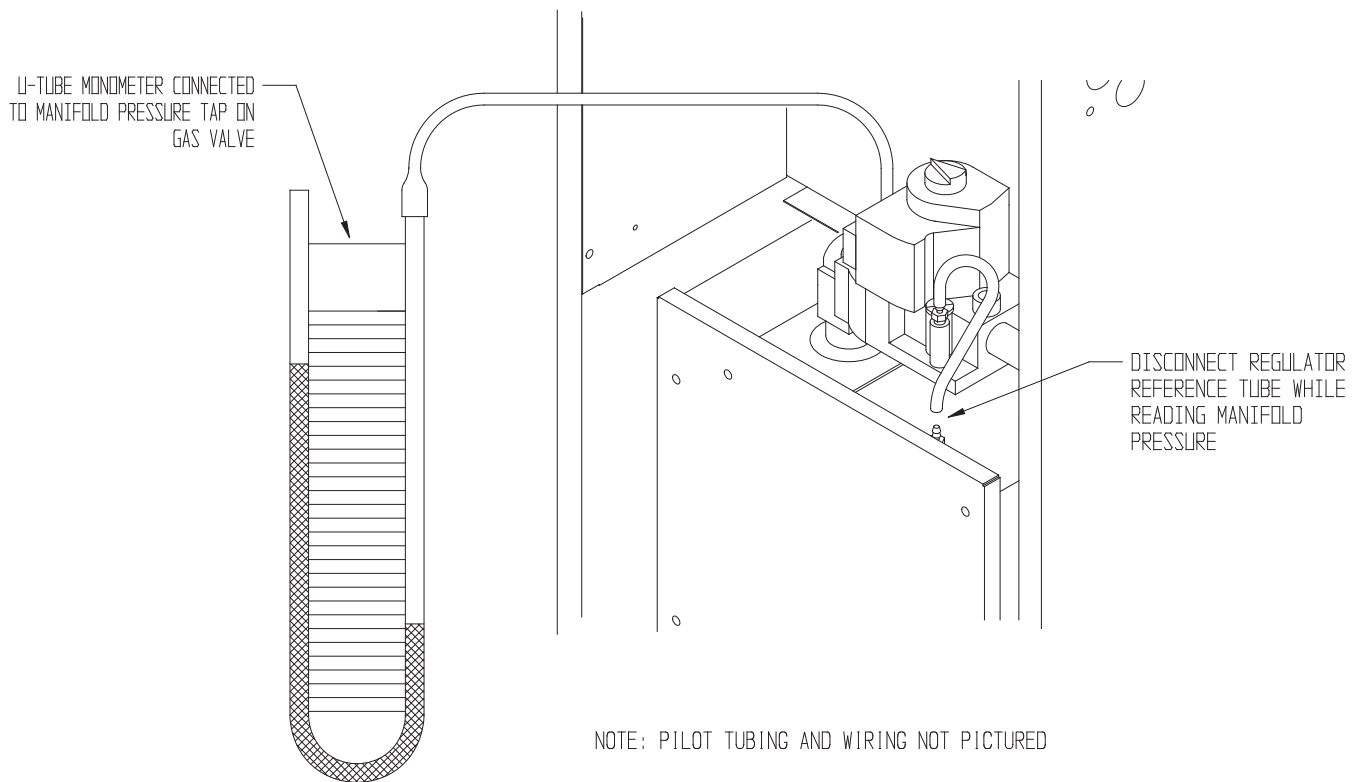


FIGURE 45: MEASURING MANIFOLD PRESSURE

XI Service and Maintenance

The following routine maintenance should be performed on an annual basis:

- 1) Turn off electrical power and gas supply to the boiler.
- 2) Remove the burner tray. To do this:
 - a) Remove the intake cover.
 - b) Remove the four Allen head screws holding the elbow flange onto the gas valve.
 - c) Remove the three 10-32 screws holding the manifold gasket plate to the intake box.
 - d) Remove the four 5-16 nuts holding the burner tray in the boiler.
 - f) Carefully remove the burner assembly being careful not to damage the firedoor insulation or the manifold gasket.
- 3) Inspect the flue passages for signs of blockage. If there is any carbon in the combustion chamber or the flue passages, clean the heat exchanger before proceeding further. See the cleaning procedure below.
- 4) Remove any debris found in the combustion chamber, being careful not to disturb combustion chamber insulation.
- 5) Inspect and clean the burners. Clean the burners by first brushing the ports with a soft bristle brush and then vacuuming out any debris through the venturi opening. If burners show signs of deterioration, they should be replaced (some discoloration around the burner ports is normal).
- 6) Inspect the pilot assembly. Clean any deposits found on the electrode and grounding strap. The ideal gap between the electrode and the ground strap is 1/8". Inspect the porcelain for cracks or other deterioration. Replace pilot assembly if deterioration is found. Inspect the ignition cable insulation for cracks or other deterioration. If deterioration is found, replace cable assembly.
- 7) Inspect the combustion chamber insulation for deterioration. Replace insulation if necessary.
- 8) Inspect all boiler wiring for loose connections or deterioration.
- 9) Inspect the vent system:
 - Make sure that the vent system is free of obstructions.
 - Make sure that all vent system supports are intact.
 - Inspect joints for signs of condensate or flue gas leakage.
 - Inspect venting components for corrosion or other deterioration. Replace any defective vent components.
- 10) Inspect the boiler and hydronic system for leaks.
- 11) Place the boiler back in operation using the procedure outlined in Part X. Check the pilot line and any other gas piping disturbed during the inspection process for leaks.

CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

CAUTION

Water leaks can cause severe corrosion damage to the boiler or other system components. Repair any leaks found immediately.

Heat Exchanger Cleaning Procedure

WARNING

Soot deposits in the flue passages are a sign that the boiler may be operating at high carbon monoxide (co) levels. After cleaning the boiler of soot deposits, check the CO level in the flue gas to insure that the boiler is operating properly.

If it is necessary to check CO, use a combustion analyzer, or other instrument which is designed to measure CO in flue gas. A CO “sniffer” designed for testing CO levels in ambient air cannot be used to check boiler combustion. Take a flue gas sample by inserting a sample probe through the vent terminal. Do not take a sample until the boiler has been firing for at least five minutes.

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

Some causes of excessive CO include:

- Incorrectly sized or drilled burner orifice
- Partially plugged flue passages
- Improper manifold pressure
- Partial blockage of vent or intake system
- Foreign material in burner venturis or burner ports
- Missing regulator cover or disconnected regulator reference tube
- Damaged fan impeller or housing
- Damaged or missing fan gasket
- Leak in seal between flue collector and heat exchanger
- Distorted or missing combustion chamber floor
- Damaged base
- Flue gas leak in the concentric section of the coaxial terminal

- 1) Turn off electrical power and gas supply to the boiler.
- 2) Remove the burner tray. To do this:
 - a) Remove the intake cover.
 - b) Remove the four Allen head screws holding the elbow flange onto the gas valve.
 - c) Remove the three 10-32 screws holding the manifold gasket plate to the intake box.
 - d) Remove the four 5-16 nuts holding the burner tray in the boiler.
 - e) Carefully remove the burner assembly being careful not to damage the firedoor insulation or the manifold gasket.
- 3) Disconnect the vent system from the boiler by removing the four 10-32 screws holding the vent collar in place.
- 4) Remove the top jacket panel. If possible, remove the rear and left side jacket panels.
- 5) Unplug the fan and remove the fan cover plate.
- 6) Disconnect the pressure switch hoses.
- 7) Loosen the two ¼-20 nuts and washers in the flue collector lugs. Slide the flue collector lugs off of each flue collector flange.
- 8) Score the silicone seal around the flue collector with a utility knife or similar tool.
- 9) Pry the flue collector off of the heat exchanger, being careful not to damage the flue collector or fan.
- 10) Remove the stainless steel flue baffle from each flue passage.
- 11) Clean the flue passageways using a stiff bristle brush. Be certain that all foreign material is removed from the gaps between the pins.
- 12) Clean the bottom surfaces of the heat exchanger.
- 13) Put a light in the combustion chamber and look through the flue passages from the top to verify that they have been thoroughly cleaned.
- 14) Replace the flue baffles.
- 15) Apply a heavy (1/4”) bead of silicone with a temperature rating of at least 400F around the perimeter of the heat exchanger.

- 16) Set the flue collector onto the block and press down so that the flue collector is set into the silicone applied in the previous step.
- 17) Slide the flue collector lugs back into position and retighten the ¼-20 bolts. **DO NOT OVER TIGHTEN.**
- 18) Apply a bead of silicone around the outside of the joint between the heat exchanger and the flue collector.
- 19) Reattach all the jacket components.
- 20) Reconnect the pressure switch tubes (see Figure 46 for correct tubing orientation).
- 21) Reconnect the fan.
- 22) Reconnect the vent system.
- 23) Reinstall the burner tray.

Service Notes

- 1) Orifice Size – Sea level orifice sizes are:

Natural Gas – #50 Drill Size
LP Gas – Consult Factory

Consult your Crown representative for correct orifice sizes for use at altitudes above 2000 ft. Orifice for this boiler cannot be drilled in the field.

- 2) Operating the Boiler with Intake Cover Removed – For inspection and troubleshooting purposes, this boiler may be started and run with the intake cover removed. When this is done, a resonance (“hum”) may be observed. This is normal and should disappear as soon as the intake cover is replaced.

WARNING

Do not leave the boiler in service with the intake cover removed.

- 3) Pressure Switch – This boiler is equipped with a differential pressure switch which makes when there is adequate flue gas flow through the boiler. This switch measures the pressure drop across an orifice plate inside the flue collector - the higher the flue gas flow through this plate, the higher the pressure drop. The N.O. contacts on the pressure switch make, allowing the boiler to fire, when the pressure drop across the flue collector orifice plate switch exceeds the “make setting” shown in Table 7. Once the switch is made, the boiler will fire as long as the pressure at the switch is above the “break setting” shown in Table 7. The pressure at both pressure switch tappings is actually below atmospheric (“negative”) with the pressure at the upper flue collector tap being the more negative of the two pressures. Figure 46a shows the pressure switch connections.
Figure 46b shows the correct method of reading the pressure across the pressure switch tappings. It is normal for the pressure reading across the switch to drop as the boiler heats up.
- 4) Burner and Pilot Removal - If necessary, the pilot can be removed without removing the burner tray. To do so, remove the screws holding the main burners on each side of the pilot bracket. The main burners will then be loose enough to allow the pilot hood to slip between them.
Main burners cannot be removed without removing the burner tray from the boiler.

TABLE 7: PRESSURE SWITCH SETTINGS

ALTITUDE	CROWN PN	MAKE SETTING* (inches w.c.)	BREAK SETTING* (inches w.c.)
SEA LEVEL - 5200 ft	620009	1.26	1.16
ABOVE 5200 ft	620010	1.10	1.00

*Settings shown are based on “plus tolerance” - actual setting may be lower.

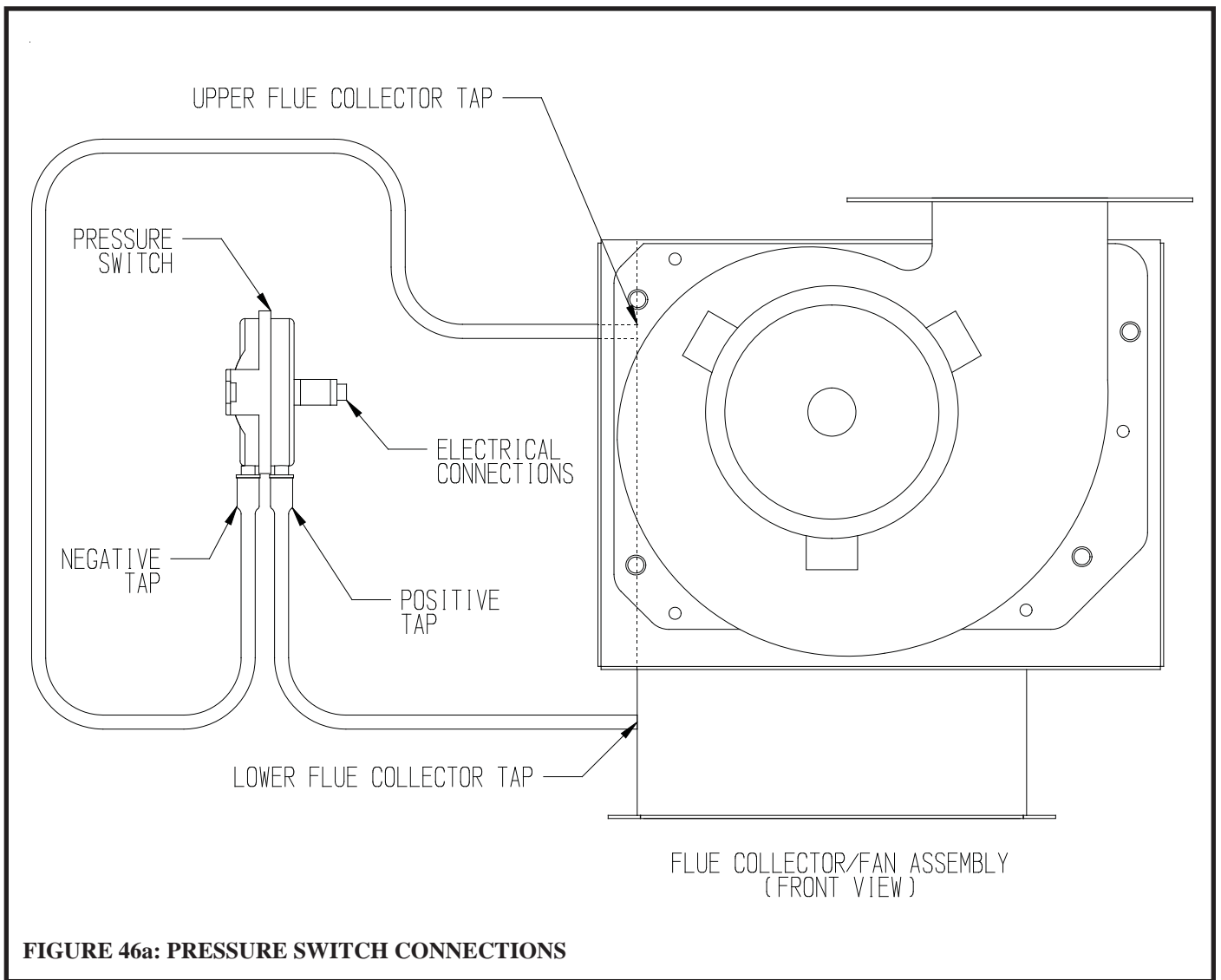


FIGURE 46a: PRESSURE SWITCH CONNECTIONS

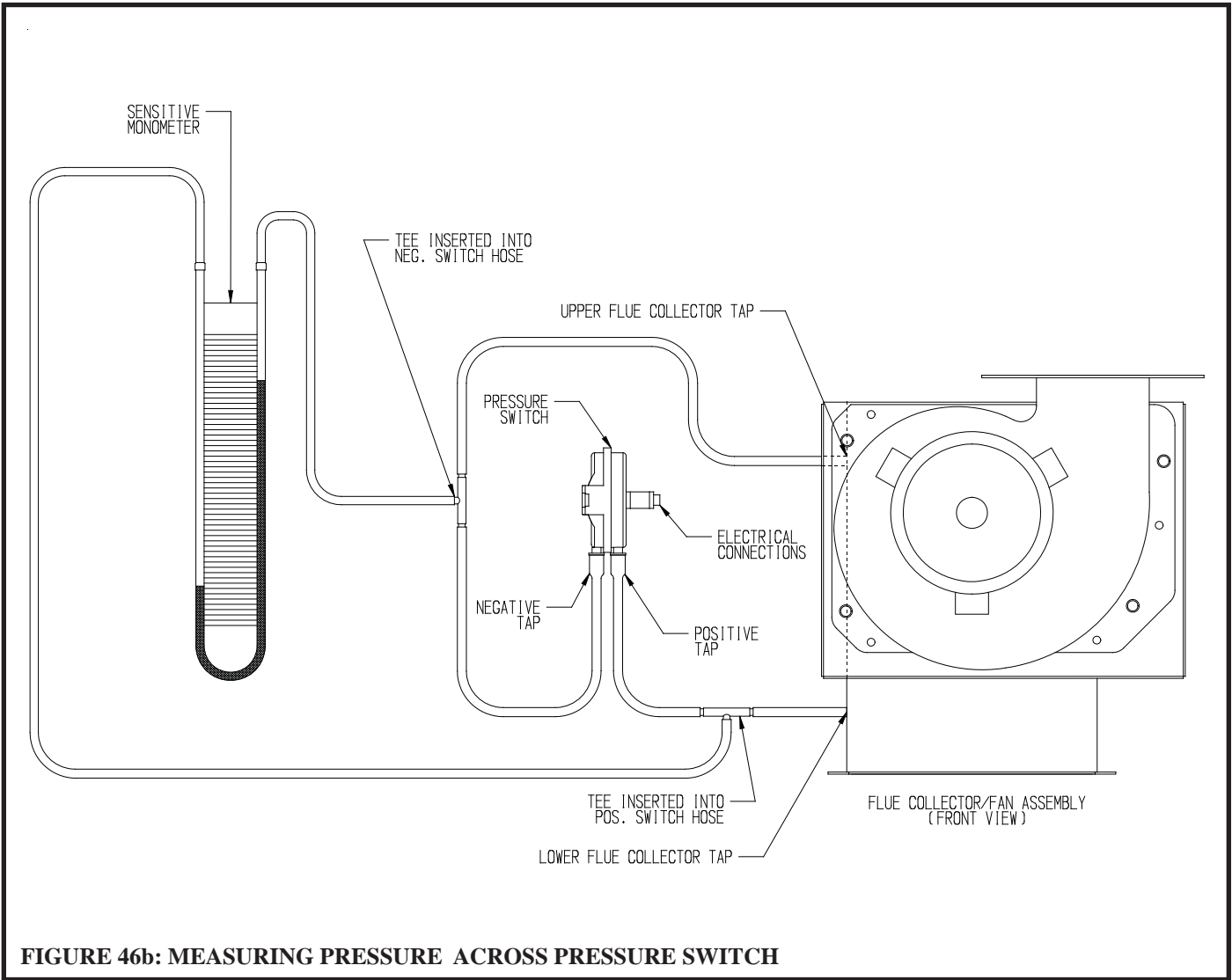
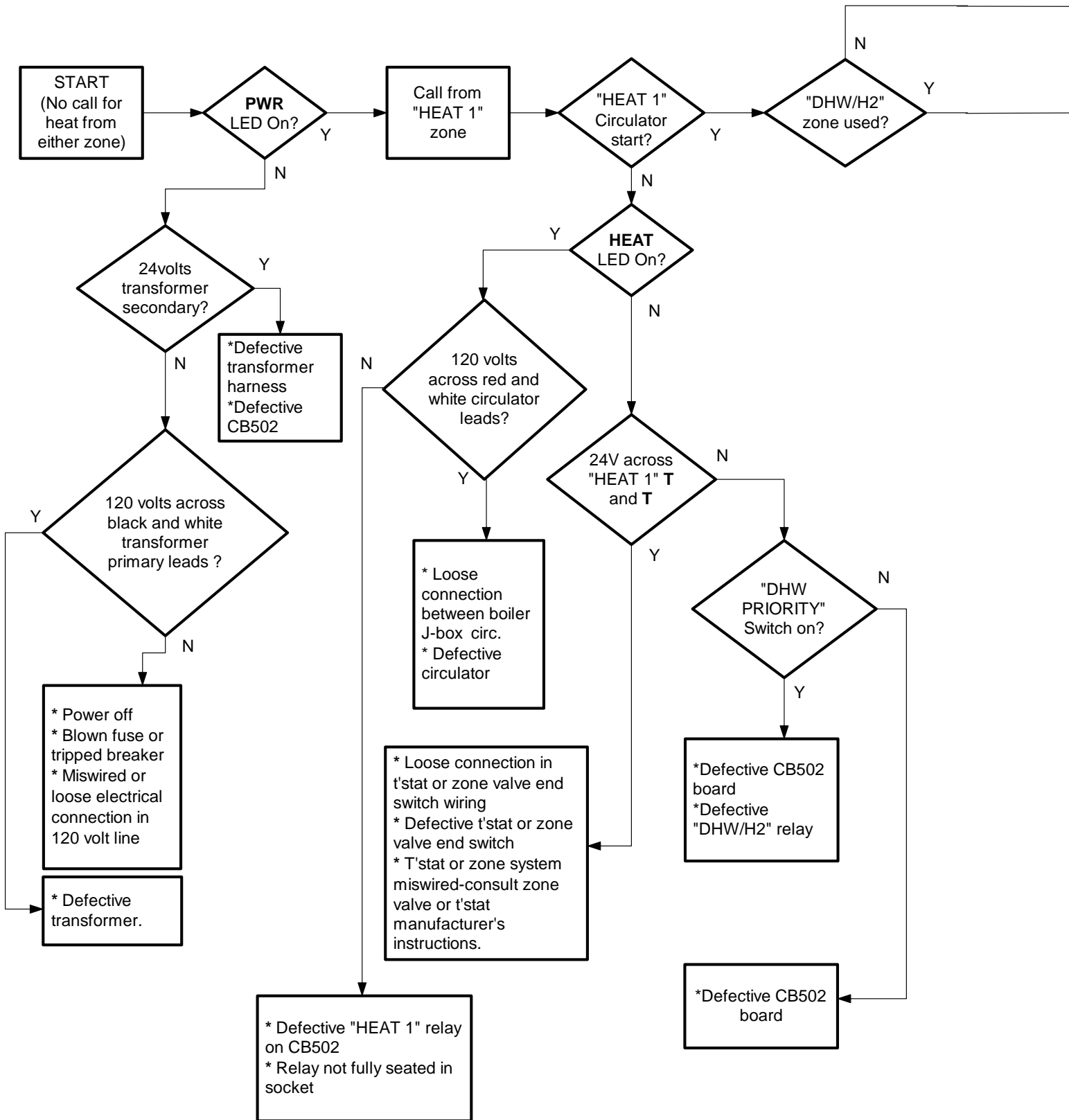


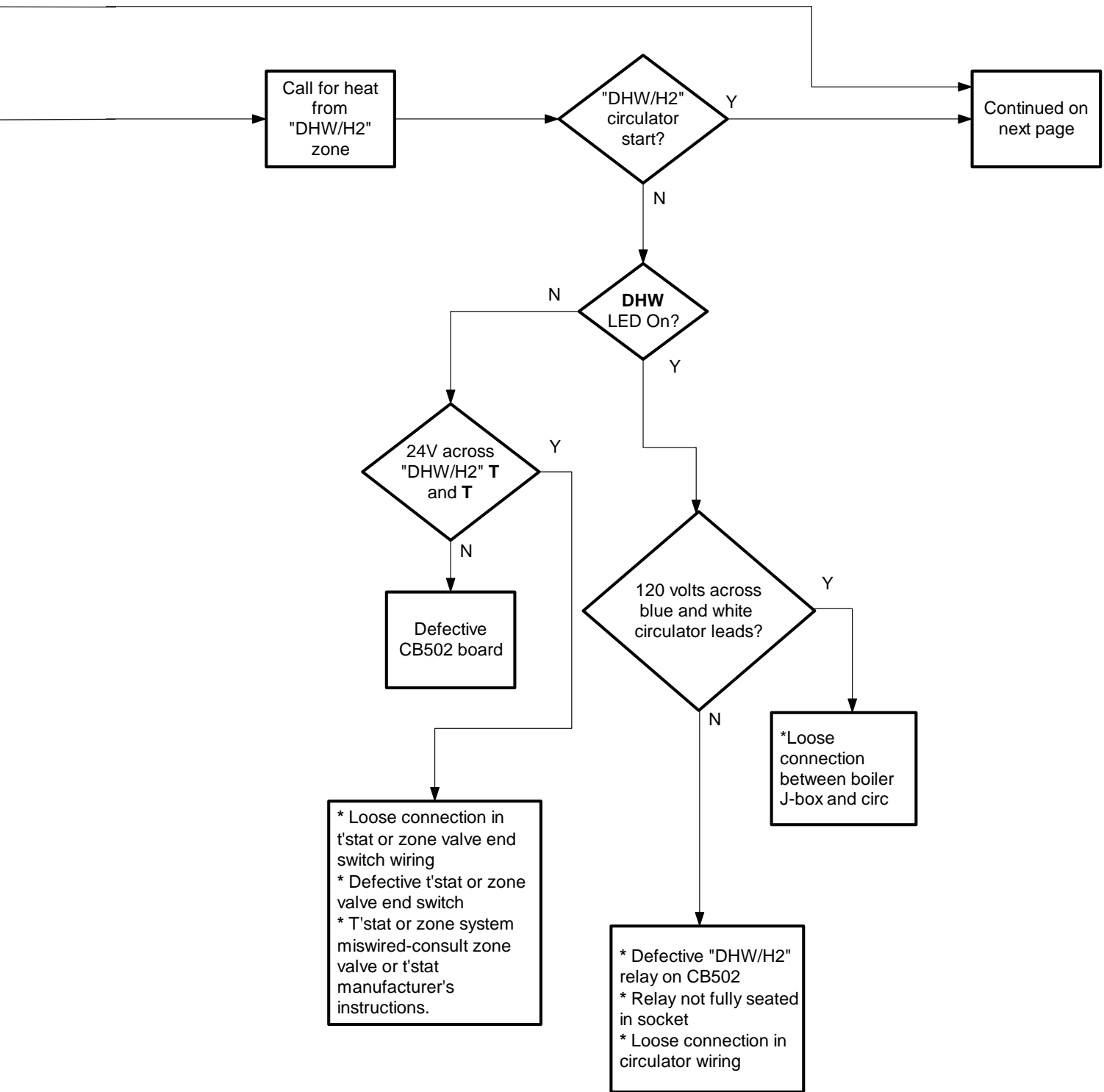
FIGURE 46b: MEASURING PRESSURE ACROSS PRESSURE SWITCH

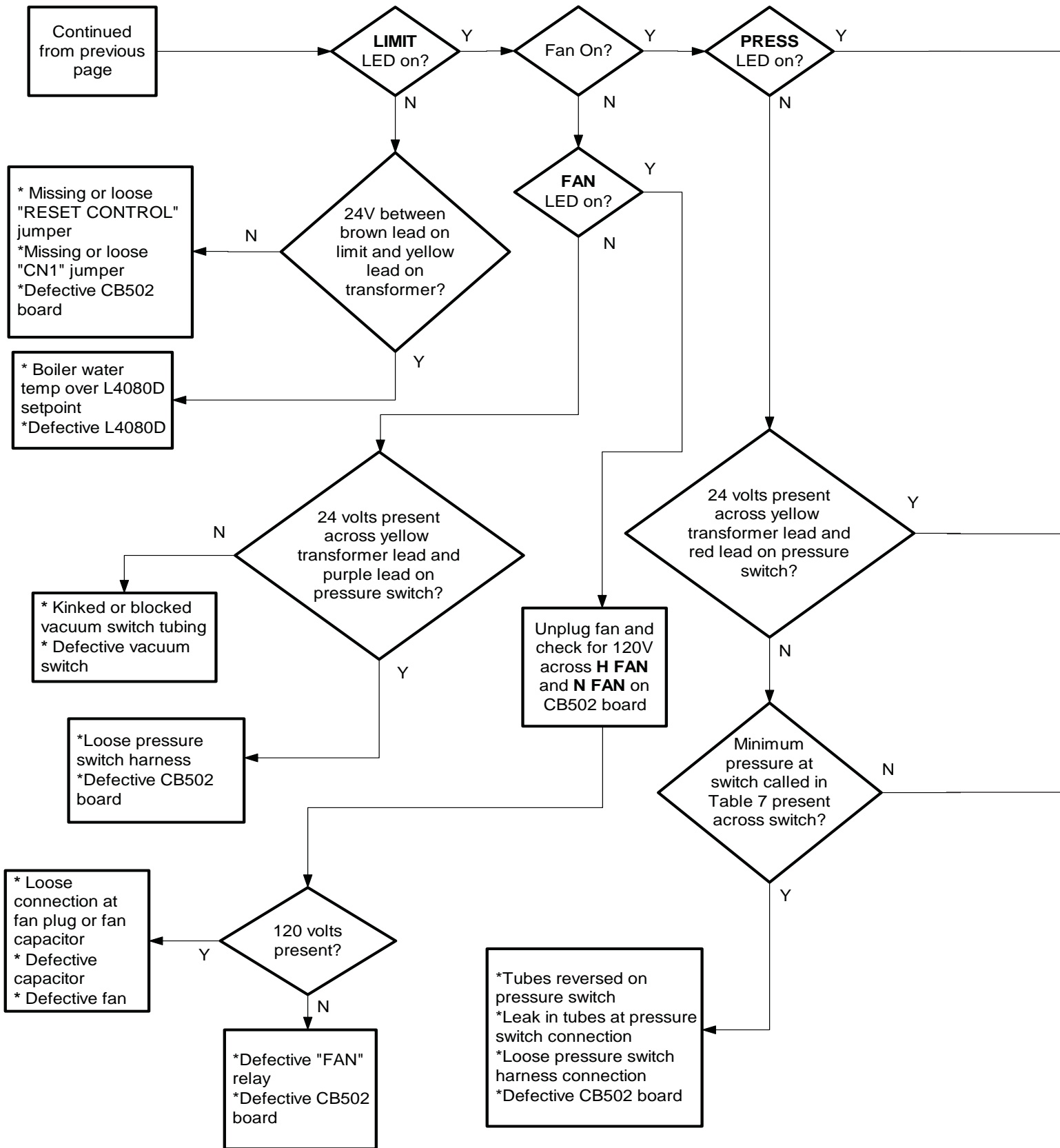
XII Troubleshooting

The following pages contain troubleshooting charts for use in diagnosing control problems. If troubleshooting a CB502 control system, go to the box marked "Start" at the top of the chart on page 58 and follow the appropriate path through the chart until a box with a list of possible causes is reached. If troubleshooting a R8285 control system, go to the box marked "Start" at the top of the chart on page 62 and follow the appropriate path through the chart until a box with a list of possible causes is reached. If the problem is known to be within the ignition system, go directly to the ignition system troubleshooting guide on page 64. In using these charts, the following should be kept in mind:

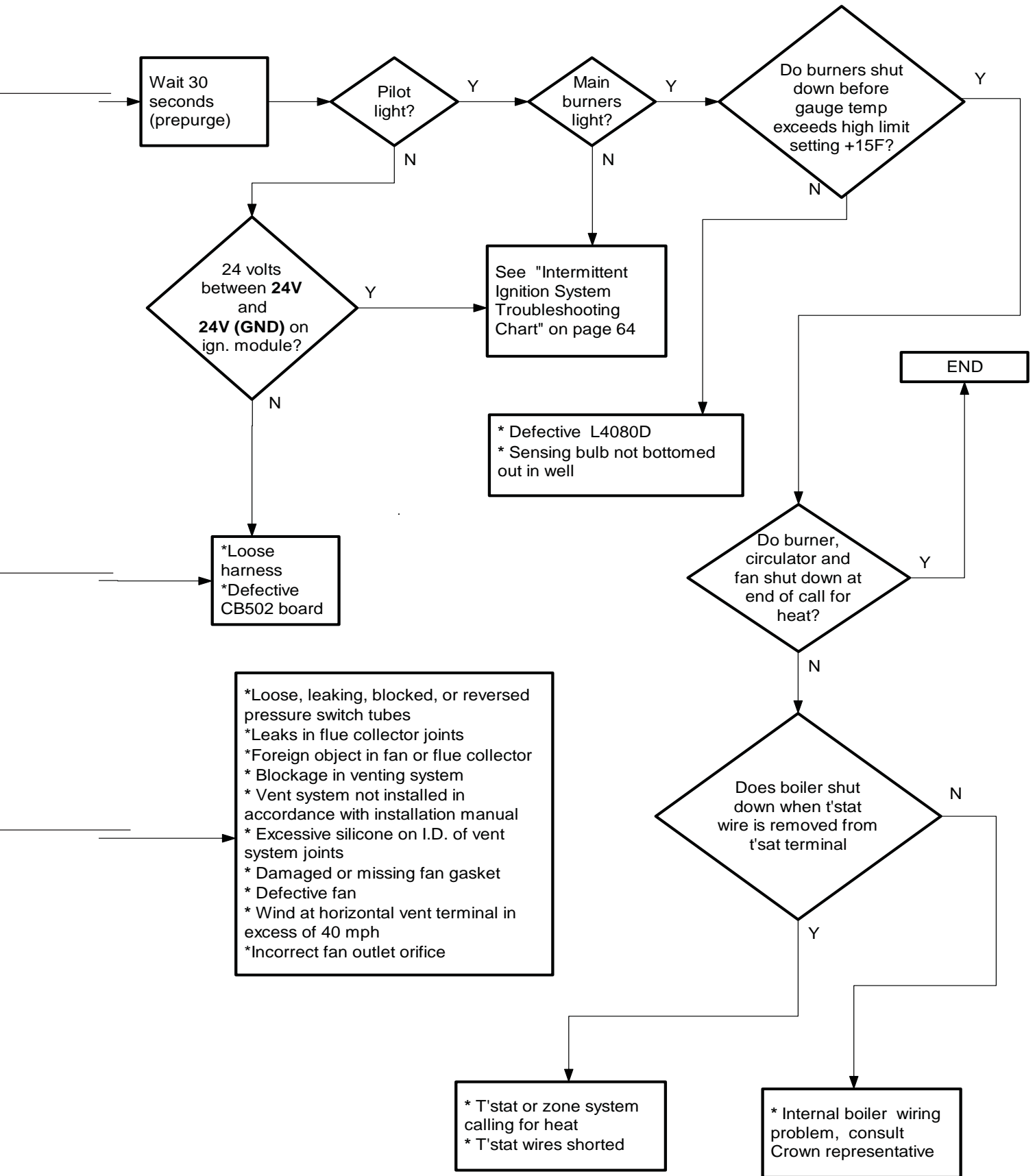
- 1) These charts are only meant to be used by a professional heating technician as an aid in diagnosing control problems.
- 2) Where applicable, follow all precautions outlined in the appropriate lighting instructions on page 49.
- 3) In general, these charts assume that there are no loose or miswired electrical connections. Before using these charts, inspect all electrical connections on the boiler to make sure that they are tight. Also, check the wiring on the boiler against the appropriate wiring diagrams in the Wiring section.
- 4) The possible causes at the end of each branch in these charts are not listed in order of likelihood. All controls on the CWD are tested at least once in the manufacturing process and a defective control or component is generally the least likely cause. Before replacing a component, try to rule out all other possible causes.
- 5) If the charts indicate that the boiler transformer is defective, it is possible that this transformer has been destroyed by a short circuit in the boiler wiring. Before replacing the transformer, carefully inspect all low voltage wiring on the boiler for places where it is touching the frame of the boiler or wiring on the other side of the transformer.
- 6) If the charts indicate that one of the relays in the CB502 board or the R8285 are defective, it is possible that a second transformer is present in the thermostat or zone valve circuit, resulting in the application of 48 volts across the relay coil. In older buildings, this transformer may be hidden in a location far from the boiler. If this second transformer exists, it must be found and removed before the relay is replaced.

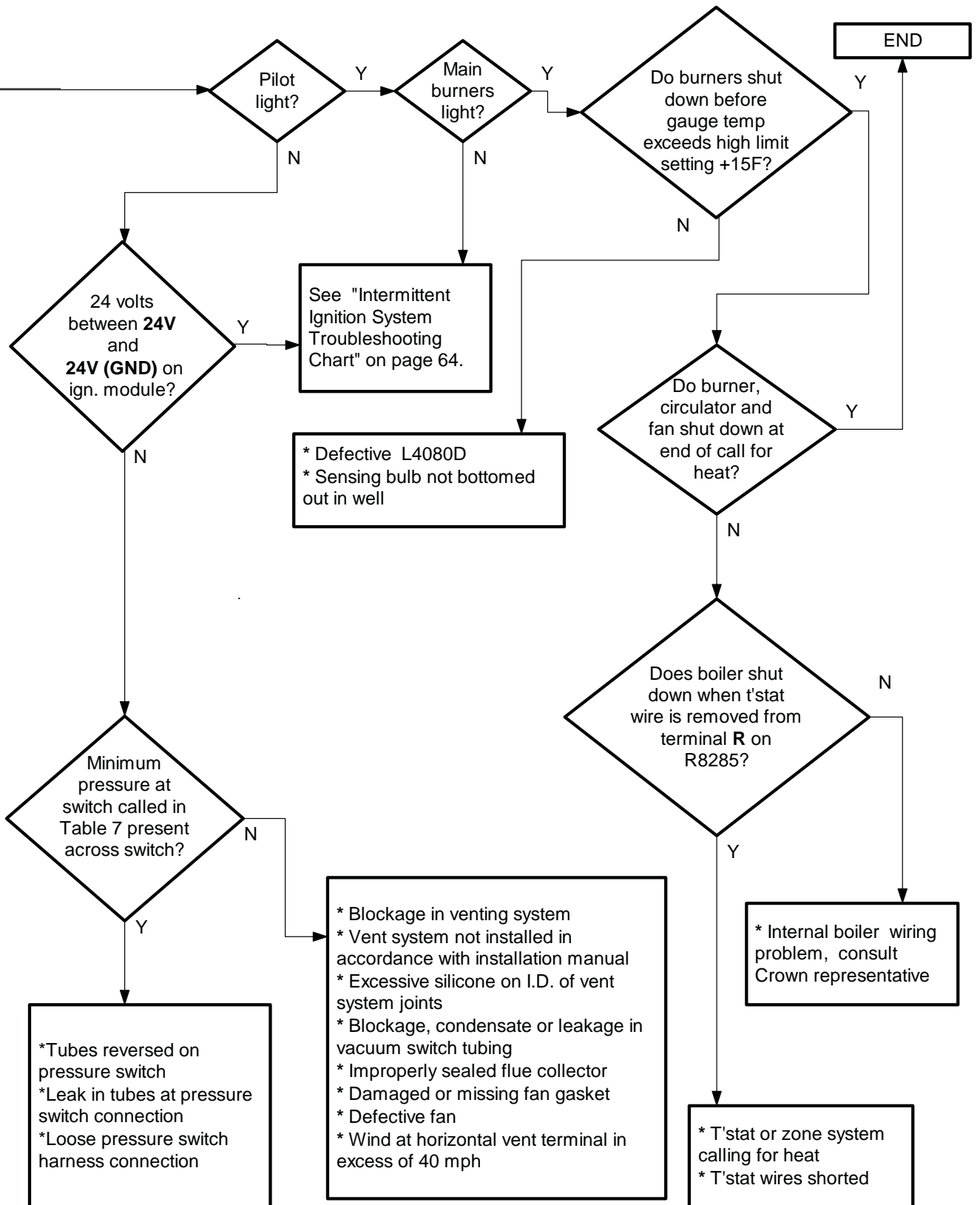




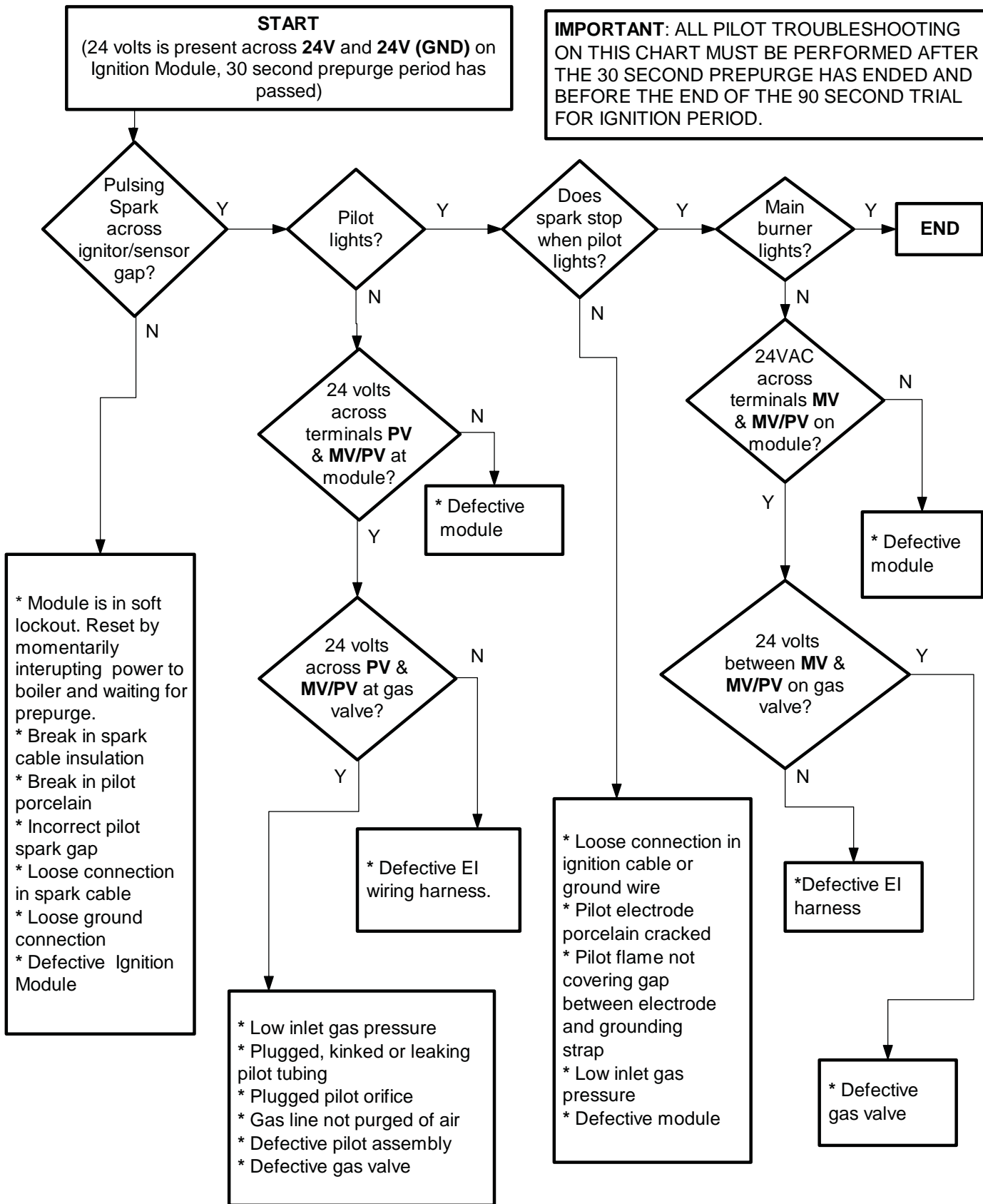


TROUBLESHOOTING CHART FOR BOILERS WITH CB502 CONTROL SYSTEM (USING #42-502A BOARD)
PAGE 3 OF 4





IMPORTANT: ALL PILOT TROUBLESHOOTING ON THIS CHART MUST BE PERFORMED AFTER THE 30 SECOND PREPURGE HAS ENDED AND BEFORE THE END OF THE 90 SECOND TRIAL FOR IGNITION PERIOD.



TROUBLESHOOTING CHART FOR IGNITION SYSTEMS USING UT 1003-626A IGNITION MODULE

XIII 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

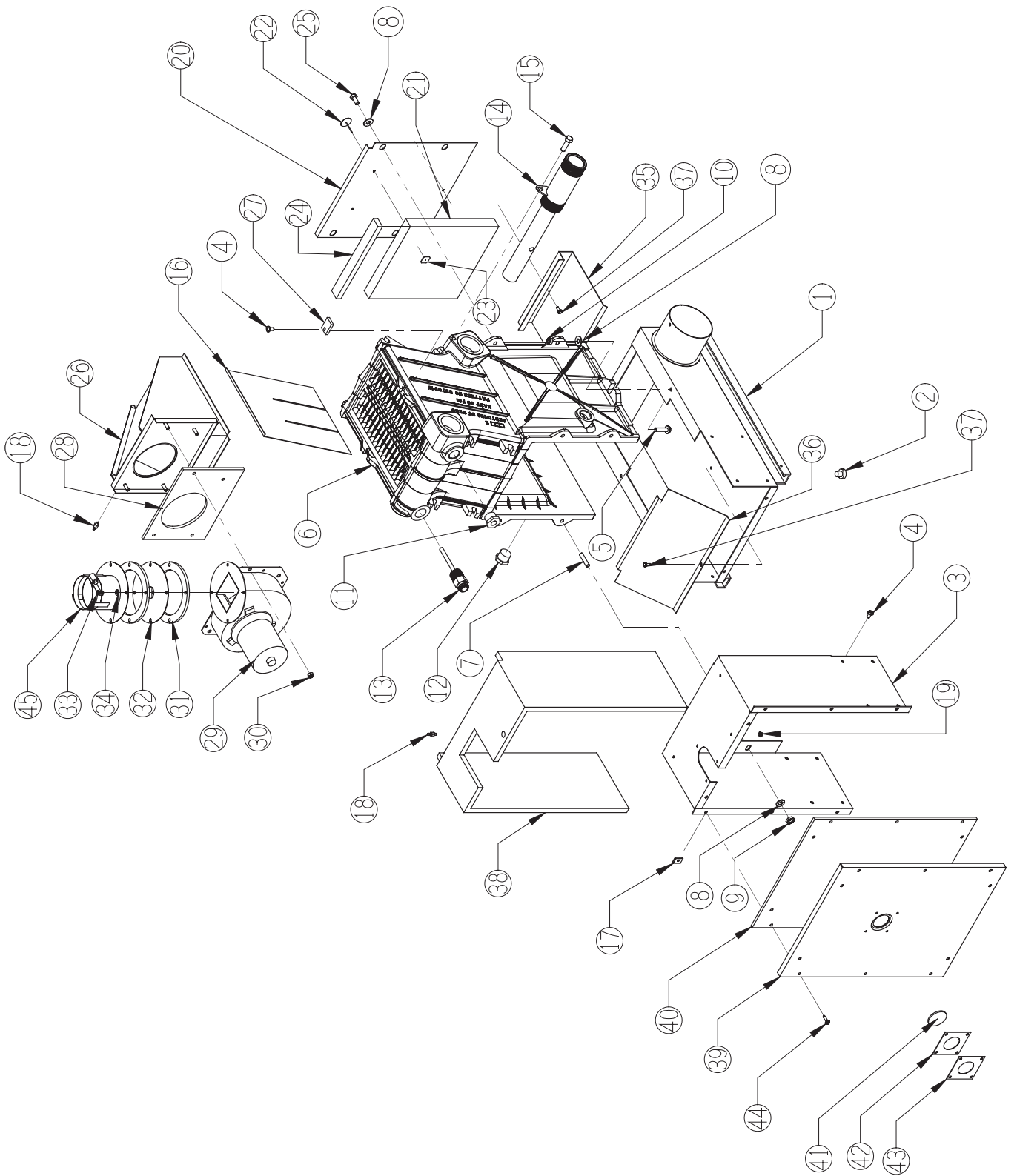
Main burner orifice shown are for sea level configured boilers. For boilers installed at elevations above 2000 ft, consult the local Crown representative or the factory for the correct main burner orifice.

In some cases, the following parts lists do not include Crown part numbers because they were not available at the time of printing. Order these parts by their description, specifying the boiler model number on which they are to be used.

BLOCK, BASE, FLUE COLLECTOR COMPONENTS

KEY	DESCRIPTION	PART # OR QTY.	PART # OR QTY.							
			CWD060	CWD083	CWD110	CWD138	CWD165	CWD193	CWD220	CWD245
1	BASE	1	620113	620114	620115	620116	620117	620118	620119	620120
2	NYLON FEET (GLIDES)	700111	4	4	4	4	4	4	4	4
3	INTAKE BOX	1	620233	620234	620235	620236	620237	620238	620239	620240
4	1/4-20 X1/2 PAN HEAD SCREW	900100	14	14	14	14	14	14	14	14
5	5/16-18 X 1 1/4 TAP BOLT	900101	2	2	2	2	2	2	2	2
6	COMPLETE CAST IRON BLOCK ASSEMBLY	1	620013	620014	620015	620016	620017	620018	620019	620020
*	LEFT END SECTION	620011	1	1	1	1	1	1	1	1
*	INTERMEDIATE SECTION	620006	1	2	3	4	5	6	7	8
*	RIGHT END SECTION	620012	1	1	1	1	1	1	1	1
*	PUSH NIPPLE	620008	4	6	8	10	12	14	16	18
7	5/16-18 X 1 1/2 FULLY THREADED ZINC PLATED STUDS	900425	4	4	4	4	4	4	4	4
8	5/16 USS FLAT WASHER	900102	14	14	14	14	14	14	14	14
9	5/16-18 S.S HEX NUT	90-010	8	8	8	8	8	8	8	8
10	5/16-18 NYLON INSERT HEX NUT	900103	2	2	2	2	2	2	2	2
11	3/4 X 1/4 BLACK IRON REDUCING BUSHING	950017	1	1	1	1	1	1	1	1
12	3/4 IN BLACK IRON PLUG	95-048	2	2	2	2	2	2	2	2
13	3/4" HIGH LIMIT WELL	35-1010	1	1	1	1	1	1	1	1
14	CWD DISTRIBUTOR PIPE	1	620143	620144	820145	620146	620147	620148	620149	620150
15	3/8-16 X 1 1/4 ZINC PLATED HEX HEAD CAP SCREW	900452	1	1	1	1	1	1	1	1
16	FLUE BAFFLE	620100	2	3	4	5	6	7	8	9
17	TINNERMAN NUT	90-217	10	10	12	12	12	12	12	12
18	10-32 X 1/8 I.D.HOSE BARB	90-222	3	3	3	3	3	3	3	3
19	10-32 HEX NUT	90-219	3	3	3	3	3	3	3	3
20	REAR FIREDOOR	1	620203	620204	620205	620206	620207	620208	620209	620210
21	REAR FIREDOOR INSULATION	1	620533	620534	620535	620536	620537	620538	620539	620540
22	1 1/4 CUP HEAD PIN	900203	4	4	6	6	6	6	6	6
23	1 1/4 SELF LOCKING WASHER	900200	4	4	6	6	6	6	6	6
24	1" CERAFELT SEALING STRIP	900145	0.75 FT	1.05 FT	1.35 FT	1.65 FT	1.95 FT	2.25FT	2.55 FT	2.85 FT
25	5/16-18 X 3/4 HEX CAP SCREW	900400	4	4	4	4	4	4	4	4
26	FLUE COLLECTOR	1	620123	620124	620125	620126	620127	620128	620129	620130
27	FLUE COLLECTOR LUG	60-501	2	2	2	2	2	2	2	2
28	FAN GASKET	1	620002	620002	620002	650002	650002	650002	650002	650002
29	FAN ASSEMBLY	1	620001	620001	620001	60-001	60-001	60-001	60-001	60-001
*	REPLACEMENT FAN CAPACITOR	1	620003	620003	620003	60-003	60-003	60-003	60-003	60-003
30	1/4-20 HEX NUT	90-202	4	4	4	4	4	4	4	4
31	COLLAR GASKET	60-600	2	2	2	2	2	2	2	2
32	FAN OUTLET ORIFICE	1	620133	650136	620135	620136	620137	620138	620139	650138
33	10-32 X1/2 SLOTTED ROUND SCREW	90-058	6	6	6	6	6	6	6	6
34	#10 FLAT WASHER	90-057	4	4	4	4	4	4	4	4
35	COMB CHAMBER FLOOR	1	620223	620224	620225	620226	620227	620228	620229	620230
36	DISTRIBUTOR SCREEN	1	620253	620254	620255	620256	620257	620258	620259	620260
37	10-32 X1/2 SLOTTED HEX WASHER SCREW, TYPE "F", ZINC PLATED	900155	25	31	37	43	49	55	61	67
38	INTAKE BOX INSULATION	1	620553	620554	620555	620556	620557	620558	620559	620560
39	INTAKE COVER	1	620213	620214	620215	620216	620217	620218	620219	620220
40	INTAKE COVER GASKET	1	620613	620614	620615	620616	620617	620618	620619	620620
41	SIGHT GLASS	60-052	1	1	1	1	1	1	1	1
42	SIGHT GLASS GASKET	60-056	1	1	1	1	1	1	1	1
43	SIGHT GLASS FRAME	60-055	1	1	1	1	1	1	1	1
44	#10 X 3/4 HEX HEAD TYPE "B" SCREW	90-054	10	10	12	12	12	12	12	12
45	3 " VENT COLLAR	60-603	1	1	1	1	1	1	0	0
45	4" VENT COLLAR	60-604	0	0	0	0	1	1	1	1
*	10.1 oz TUBE SILICONE SEALANT	90-045	1	1	1	1	1	1	1	1

* NOT PICTURED

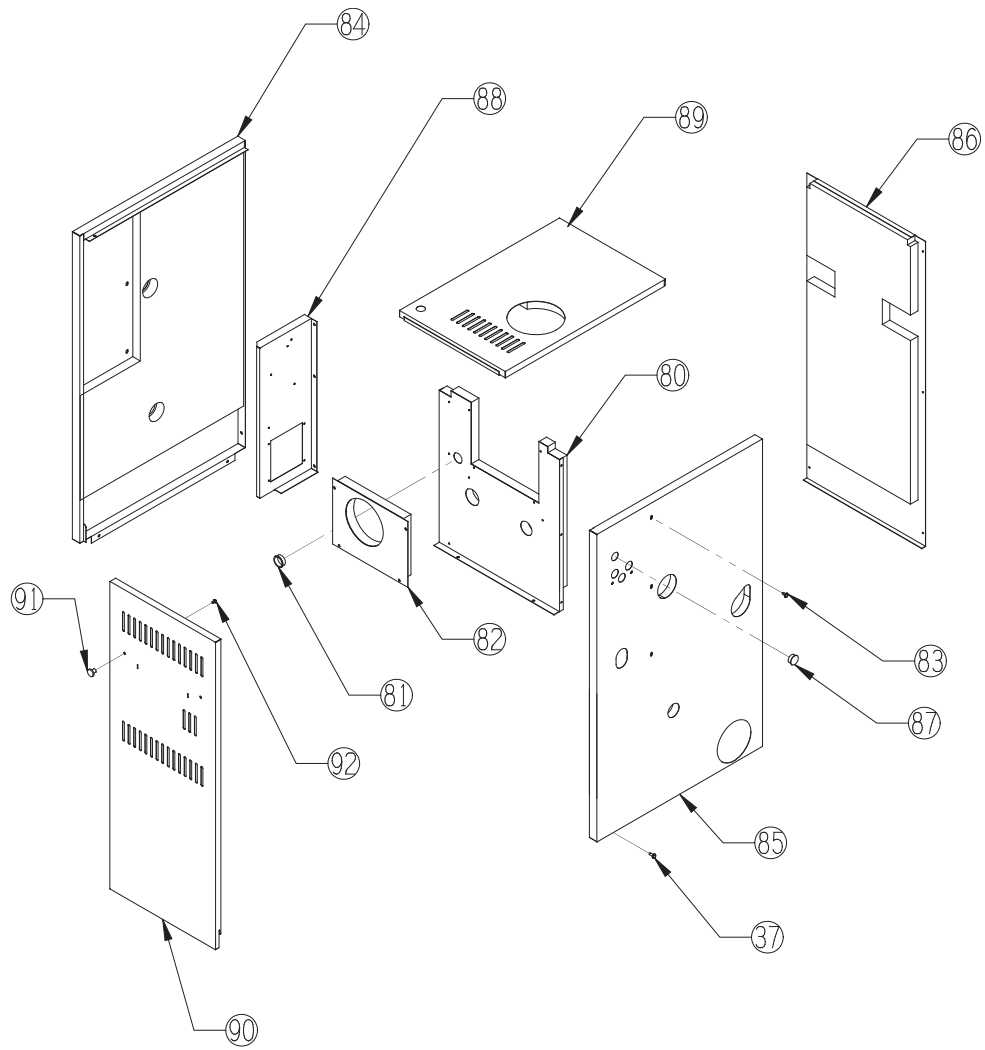


BURNER TRAY COMPONENTS

KEY	DESCRIPTION	PART# OR QTY.	PART # OR QTY.							
			CWD060	CWD083	CWD110	CWD138	CWD165	CWD193	CWD220	CWD245
50	FRONT FIREDOOR	1	620543	620544	620545	620546	620547	620548	620549	620550
51	FRONT FIREDOOR INSULATION	1	620523	620524	620525	620526	620527	620528	620529	620530
52	INSULATION SUPPORT BRACKET	620101	2	2	2	2	2	4	4	4
53	MICA SIGHT GLASS	60-050	1	1	1	1	1	1	1	1
54	1/8 ALUMINUM POP RIVET	90-068	2	2	2	2	2	2	2	2
55	BURNER MANIFOLD	1	620153	620154	620155	620156	620157	620158	620159	620160
56	#49 ORIFICE (SEA LEVEL, NAT GAS)	950305	4	0	0	0	0	0	0	0
56	#50 ORIFICE (SEA LEVEL, NAT GAS)	950306	0	6	8	10	12	14	16	18
56	#56 ORIFICE (SEA LEVEL, LP GAS)	950331	4	0	0	0	0	0	0	0
56	#57 ORIFICE (SEA LEVEL, LP GAS)	950332	0	6	8	10	12	14	16	18
57	MANIFOLD GASKET	60-151	1	1	1	1	1	1	1	1
58	MANIFOLD GASKET PLATE	60-150	1	1	1	1	1	1	1	1
59	3/4" 90 DEGREE FLANGE	35-1055	1	1	1	1	1	1	1	1
60	HONEYWELL VR8204C2328 GAS VALVE (NAT GAS)	3507400	1	1	1	1	1	0	0	0
60	HONEYWELL VR8304P2342 GAS VALVE (NAT GAS)	3507410	0	0	0	0	0	1	1	1
60	HONEYWELL VR8204P2294 GAS VALVE (LP GAS)	3507405	1	1	1	1	1	0	0	0
60	HONEYWELL VR8304P3522 GAS VALVE (LP GAS)	3507245	0	0	0	0	0	1	1	1
61	1/8" GAS VALVE HOSE BARB HW#394537	35-1060	1	1	1	1	1	1	1	1
62	BECKETT GAS BURNERS	150620	4	6	8	10	12	14	16	18
63	PILOT BRACKET	150625	1	1	1	1	1	1	1	1
64	Q3481B1131 PILOT ASSEMBLY (NAT GAS) - INCLUDES IGNITION CABLE	3504100	1	1	1	1	1	1	1	1
64	Q3481B1149 PILOT ASSEMBLY (LP GAS) - INCLUDES IGNITION CABLE	3504105								
65	30" X 1/8" PILOT TUBING	90-043	1	1	1	1	1	1	1	1
66	IGNITION GROUND HARNESS	9601101	1	1	1	1	1	1	1	1
67	10-32 X 3/16 HEX HEAD PILOT SCREW	146-95-301	1	1	1	1	1	1	1	1
68	1/8 SHORT FERRULE (INCLUDED WITH GAS VALVE)	35-1600								
69	1/8 LONG FERRULE (INCLUDED WITH PILOT ASSY.)	35-1650								
70	KF24 PILOT ORIFICE (NAT GAS) - INCLUDED WITH PILOT ASSY.		1	1	1	1	1	1	1	1
70	K14 PILOT ORIFICE (LP GAS) - INCLUDED WITH PILOT ASSY.		1	1	1	1	1	1	1	1

JACKET COMPONENTS

KEY	DESCRIPTION	PART# OR QTY	PART # OR QTY							
			CWD060	CWD083	CWD110	CWD138	CWD165	CWD193	CWD220	CWD245
80	VESTIBULE PANEL	1	620323	620324	620325	620326	620327	620328	620329	620330
81	LARGE PLASTIC BUSHING	960051	1	1	1	1	1	1	1	1
82	FAN COVER PLATE	1	620302	620302	620302	60-300	60-300	60-300	60-300	60-300
83	#10 X 1/2 SHEET METAL SCREW	90-212	31	31	32	31	34	36	36	36
84	LH JACKET PANEL	620301	1	1	1	1	1	1	1	1
85	RH JACKET PANEL	620300	1	1	1	1	1	1	1	1
86	REAR JACKET PANEL	1	620303	620304	620305	620306	620307	620308	620309	620310
87	PLASTIC BUSHING	96-050	2	2	2	2	2	2	2	2
88	CONTROL PANEL	620350	1	1	1	1	1	1	1	1
89	TOP JACKET PANEL	1	620323	620324	620325	620326	620327	620328	620329	620330
90	CWD FRONT JACKET PANEL	1	620323	620324	620325	620326	620327	620328	620329	620330
91	DOOR KNOB	90-210	2	2	2	2	2	2	2	2
92	8-32 X 1/4 MACH. SCREWS	90-211	2	2	2	2	2	2	2	2



COMMON CONTROLS & TRIM

KEY	DESCRIPTION	PART# OR QTY	PART # OR QTY							
			CWD060	CWD083	CWD110	CWD138	CWD165	CWD193	CWD220	CWD245
*	1/8" SILICONE TUBING	14-008	2.5 FT	2.5 FT	2.5 FT	2.5 FT	2.5 FT	2.5 FT	2.5 FT	2.5 FT
100	HONEYWELL L4080D LIMIT	35-3300	1	1	1	1	1	1	1	1
101	TRIDICATOR GAUGE	95-069	1	1	1	1	1	1	1	1
102	UT IGNITION MODULE 1003-626A	3503062	1	1	1	1	1	1	1	1
103	MODULE BRACKET	905000	0	0	0	0	1	1	1	1
*	INTERMITTENT IGNITION HARNESS	9601100	1	1	1	1	1	1	1	1
104	4X4 JUNCTION BOX	96-055	1	1	1	1	1	1	1	1
105	SEA LEVEL PRESSURE SWITCH (ALL SIZES)	620009	1	1	1	1	1	1	1	1
105	PRESSURE SWITCH (AS NEEDED ABOVE 5200FT)	620010								
106	#8 X1/2 SHEETMETAL SCREWS	900130	2	2	2	2	2	2	2	2
111	1 1/2 X 1 1/4 BLACK 90 DEGREE ELBOW	950200	1	1	1	1	1	1	1	1
112	ISOLATION FLANGE SET	95-061	1	1	1	1	1	1	1	1
113	TACO 007 CIRCULATOR	95-012	1	1	1	1	1	1	1	1
114	3/4" X 5" NIPPLE	95-044	1	1	1	1	1	1	1	1
115	3/4" 90 DEGREE ELBOW	95-057	1	1	1	1	1	1	1	1
116	3/4" CLOSE NIPPLE	95-105	1	1	1	1	1	1	1	1
117	3/4" ASME RELIEF VALVE	95-040	1	1	1	1	1	1	1	1
118	3/4" X 4 1/2" NIPPLE	95-102	1	1	1	1	1	1	1	1
119	3/4" COUPLING	95-056	1	1	1	1	1	1	1	1
120	3/4" BOILER DRAIN	95-041	1	1	1	1	1	1	1	1
*	CWD FAN EXTENSION HARNESS	9601630	0	0	0	0	0	0	1	1

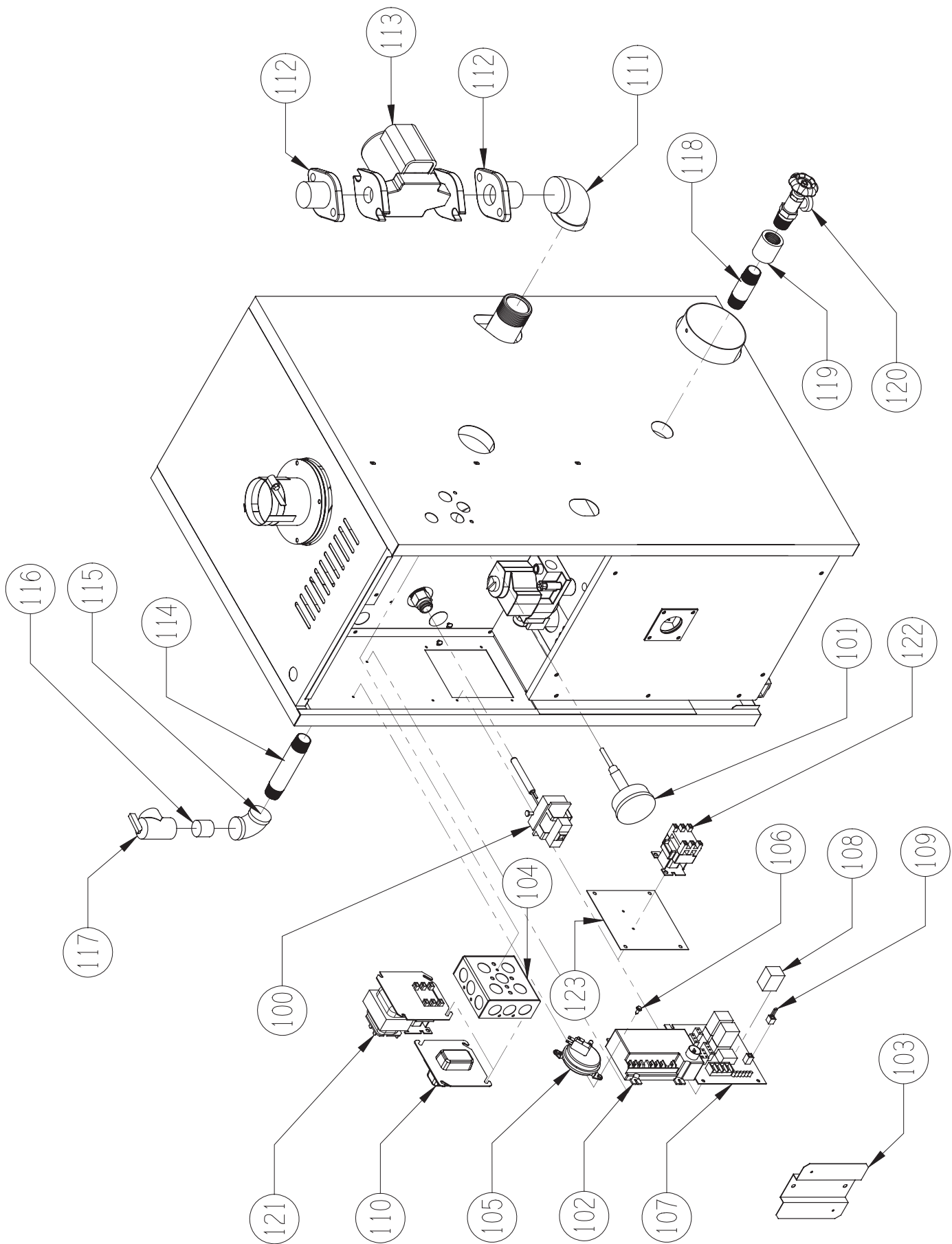
CONTROLS UNIQUE TO CB502 CONTROL SYSTEM

KEY	DESCRIPTION	PART# OR QTY	PART # OR QTY							
			CWD060	CWD083	CWD110	CWD138	CWD165	CWD193	CWD220	CWD245
107	CB502A RELAY BOARD	42-502A	1	1	1	1	1	1	1	1
108	REPLACEMENT RELAY FOR CB502A	42-503	3	3	3	3	3	3	3	3
109	RESET PLUG FOR CB502A	42-504	1	1	1	1	1	1	1	1
*	HIGH VOLTAGE HARNESS	1	96-1005	96-1005	96-1005	96-1005	96-1006	96-1006	96-1006	96-1006
*	CWD/CB502 TRANSFORMER HARNESS	1	9601620	9601620	9601620	9601620	9601625	9601625	9601625	9601625
*	CWD LOW VOLTAGE HARNESS	1	9601635	9601635	9601635	9601635	9601635	9601635	9601635	9601635
110	TRANSFORMER-AT72D1006	35-2100	1	1	1	1	1	1	1	1

CONTROLS UNIQUE TO R8285 CONTROL SYSTEM

KEY	DESCRIPTION	PART# OR QTY	PART # OR QTY							
			CWD060	CWD083	CWD110	CWD138	CWD165	CWD193	CWD220	CWD245
*	CWD/R8285 HARNESS #1	1	9601600	9601600	9601600	9601600	9601605	9601605	9601605	9601605
*	CWD/R8285 HARNESS #2	1	9601610	9601610	9601610	9601610	9601615	9601615	9601615	9601615
*	BWF HARNESS #4	1	9601120	9601120	9601120	9601120	9601120	9601120	9601120	9601120
121	R8285D5001 FAN CENTER	3505555	1	1	1	1	1	1	1	1
122	R8222U1006 RELAY	3505556	1	1	1	1	1	1	1	1
123	R8222 MOUNTING PLATE	620102	1	1	1	1	1	1	1	1

* NOT PICTURED



Appendix A: 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:

1. For direct-vent appliances, mechanical-vent heating appliances or domestic hot water equipment, where the bottom of the vent terminal and the air intake is installed below four feet above grade the following requirements must be satisfied:
 - a. If there is not already one present, on each floor level where there are bedroom(s), a carbon monoxide detector and alarm shall be placed in the living area outside the bedroom(s). The carbon monoxide detector shall comply with NFPA 720 (2005 Edition).
 - b. A carbon monoxide detector shall be located in the room that houses the appliance or equipment and shall:
 - i. Be powered by the same electrical circuit as the appliance or equipment such that only one service switch services both the appliance and the carbon monoxide detector;
 - ii. Have battery back-up power;
 - iii. Meet ANSI/UL 2034 Standards and comply with NFPA 720 (2005 Edition); and
 - iv. Have been approved and listed by a Nationally Recognized Testing Laboratory as recognized under 527 CMR.
 - c. A product-approved vent terminal must be used, and if applicable, a product-approved air intake must be used. Installation shall be in strict compliance with the manufacturer's instructions. A copy of the installation instructions shall remain with the appliance or equipment at the completion of the installation.
 - d. A metal or plastic identification plate shall be mounted at the exterior of the building, four feet directly above the location of the vent terminal. The plate shall be of sufficient size to be easily read from a distance of eight feet away, and read "Gas Vent Directly Below".
2. For direct-vent appliances, mechanical-vent heating appliances or domestic hot water equipment, where the bottom of the vent terminal and the air intake is installed above four feet above grade the following requirements must be satisfied:
 - a. If there is not already one present, on each floor level where there are bedroom(s), a carbon monoxide detector and alarm shall be placed in the living area outside the bedroom(s). The carbon monoxide detector shall comply with NFPA 720 (2005 Edition).
 - b. A carbon monoxide detector shall :
 - i. Be located in the room that houses the appliance or equipment
 - ii. Be either hard-wired or battery powered or both; and
 - iii. Comply with NFPA 720 (2005 Edition)
 - c. A product-approved vent terminal must be used, and if applicable, a product-approved air intake must be used. Installation shall be in strict compliance with the manufacturer's instructions. A copy of the installation instructions shall remain with the appliance or equipment at the completion of the installation.

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