

# CROWN Boiler Co.

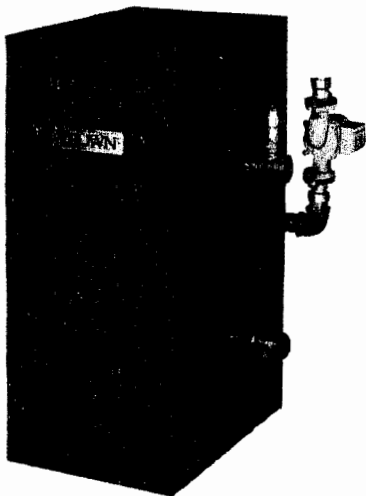
D E S I G N E D T O L E A D

## CSC Series

Gas-Fired Hot Water Sealed Combustion Boilers

### INSTALLATION INSTRUCTIONS

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



#### Models

- CSC-050
- CSC-075
- CSC-100
- CSC-125
- CSC-150
- CSC-175
- CSC-200



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

## CROWN Boiler Co.

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## I Product Description

The CSC series boiler is a cast iron gas fired boiler designed for use in forced hot water heating systems. 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.

The CSC boiler is not designed for use in gravity or "open" heating systems.

## II Specifications

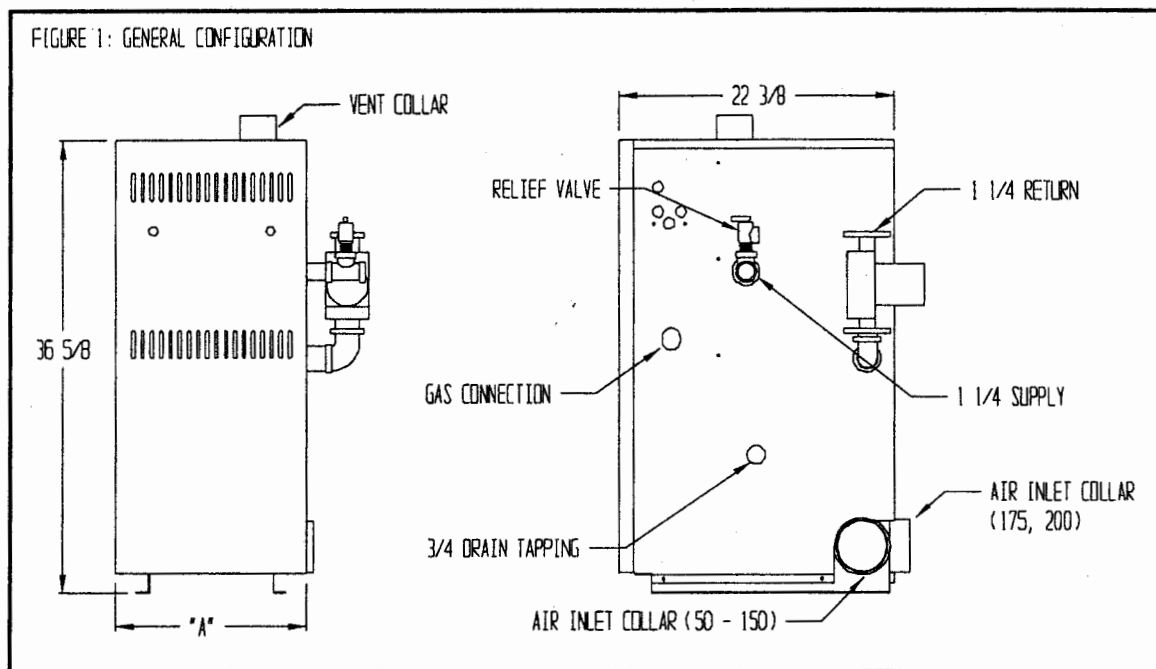


TABLE 1: SPECIFICATIONS

MODEL*	NO. SECTIONS	INPUT (BTU/hr)	D.O.E. HEATING CAPY. (BTU/hr)	IBR NET RATING (BTU/hr)	AFUE (%)	FIG. 1 DIMENSION "A" (IN.)	VENT COLLAR DIMAMETERS (IN.)		WATER CONTENT (GAL.)
							INLET	EXHAUST	
CSC-50	3	50,000	42,000	37,000	84.0	15 1/2	4	3	2.0
CSC-75	4	75,000	63,000	55,000	83.8	15 1/2	4	3	2.5
CSC-100	5	100,000	84,000	73,000	83.6	18 1/4	4	3	3.0
CSC-125	6	125,000	105,000	91,000	83.5	21	4	3	3.5
CSC-150	7	150,000	126,000	110,000	83.3	23 3/4	4	3	4.1
CSC-175	8	175,000	147,000	128,000	83.1	26 1/2	4	4	4.6
CSC-200	9	200,000	167,000	145,000	83.0	29 1/4	4	4	5.1

\* MODELS SHOWN ARE FOR NATURAL GAS. ADD "LP" SUFFIX TO MODEL NUMBER SHOWN FOR PROPANE MODEL NUMBER (e.g. CSC-50LP). PERFORMANCE RATINGS ARE THE SAME FOR BOTH FUELS

### 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 Berkely 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) For installations at altitudes above 2000ft, special orifice and pressure switches may be required. Make sure that the boiler is configured for use at the correct altitude.

### IV Locating the Boiler

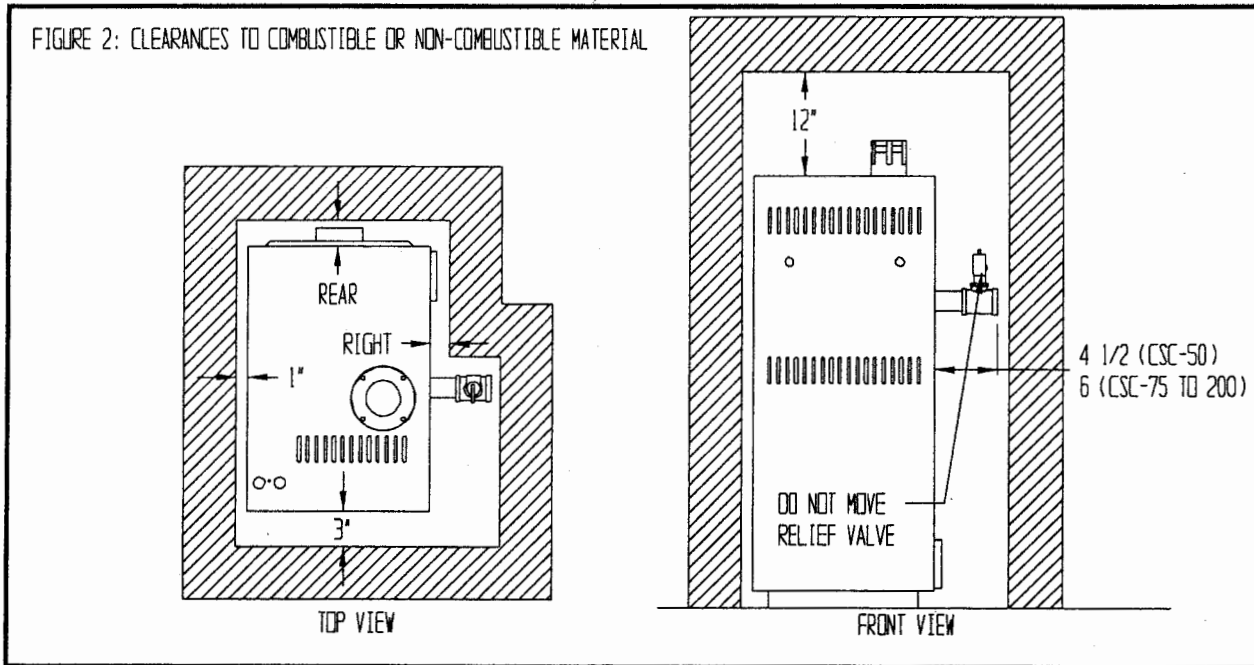
- 1) Observe the minimum clearances shown in Figure 2 and Table 2. These clearances apply to both combustible and non-combustible materials.
- 2) Boiler may be installed on non-carpeted combustible surface.
- 3) The relief valve must not be moved from the factory location.
- 4) When combustion air is obtained from the boiler room, a 6" clearance is required from the inlet collar to any combustible or non-combustible obstruction. This 6" clearance is reflected in the Table 2 clearances.
- 5) The boiler should be located so as to minimize the length of the vent system.

TABLE 2: CSC CLEARANCES (INCHES)

CLEARANCES APPLY TO BOTH COMBUSTIBLE AND NON COMBUSTIBLE CONSTRUCTION

MODEL	RIGHT		REAR	
	DIRECT VENT (OUTDOOR COMB. AIR)	DIRECT EXHAUST (INDOOR COMB. AIR)	DIRECT VENT (OUTDOOR COMB. AIR)	DIRECT EXHAUST (INDOOR COMB. AIR)
CSC-50	1	6 5/8	1	1
CSC-75	1	6 5/8	1	1
CSC-100	1	6 5/8	1	1
CSC-125	1	6 5/8	1	1
CSC-150	1	6 5/8	1	1
CSC-175	1	1	1	7 1/2
CSC-200	1	1	1	7 1/2

ALL BOILERS: TOP = 12 FRONT = 3 LEFT SIDE = 1  
CLEARANCE FROM EXHAUST PIPE TO COMBUSTIBLES = 3



## 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 ductwork 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 building of unusually tight construction is defined by the *National Fuel Gas Code* as 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:

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 CSC-200 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:*

*Total input in thousands of BTU/hr = (200000 BTU/hr + 30000 BTU/hr) / 1000 = 230*

*Volume of room = 6.25 ft x 7 ft x 8 ft = 350 ft<sup>3</sup>*

*350/230 = 1.52. Since 1.52 is less than 50, the boiler room is a confined space.*

Step 3: Determine what other uses (if any) the boiler room will have - Also determine whether the building has an indoor pool.

Step 4: 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 boiler is to be installed in a workshop
- The building in which the boiler is installed has an indoor pool

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

### **If the boiler is direct vented**

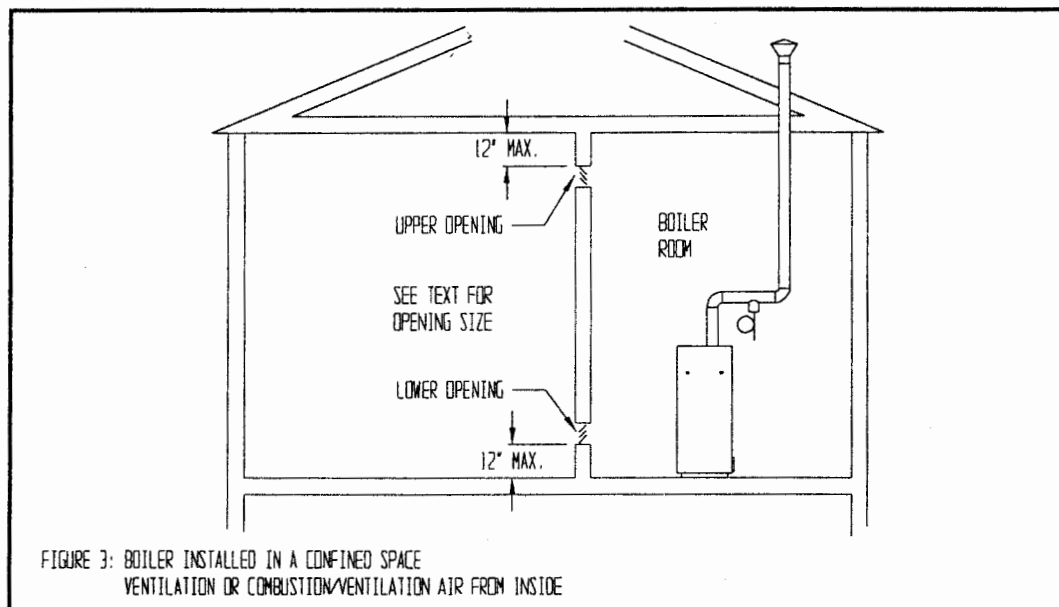
1) Combustion air piping must not exceed 35 ft of straight pipe plus two elbows plus terminal. See Section VI for additional information on air intake system design and installation.

- 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 CSC 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.



### If Inside Combustion Air is Used

- 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 ¼” (4 x 4) mesh.

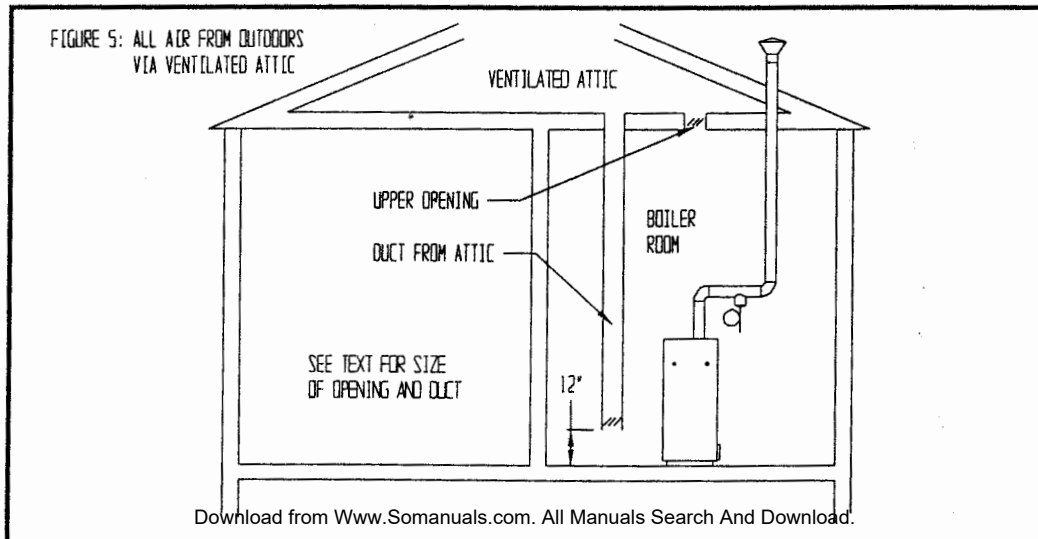
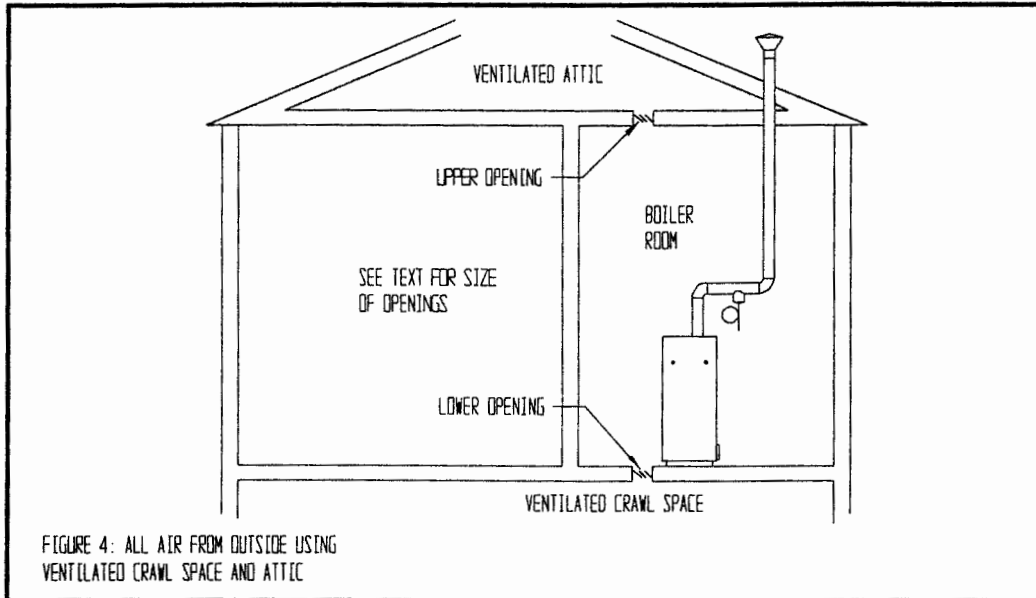
2) Buildings of unusually tight construction:

- a) If at all possible, direct vent the boiler (see (1) above.)
- b) 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.

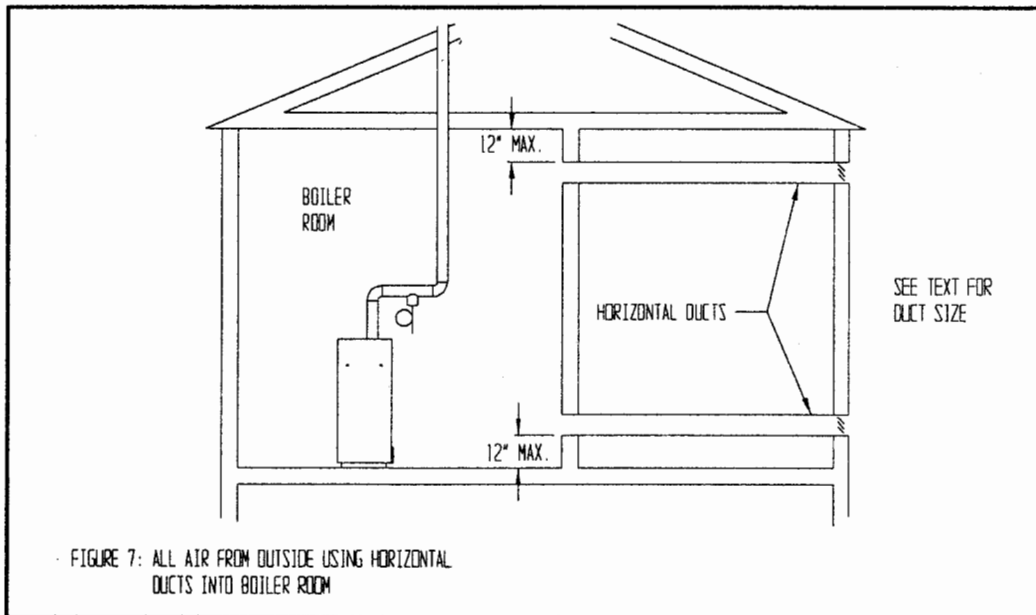
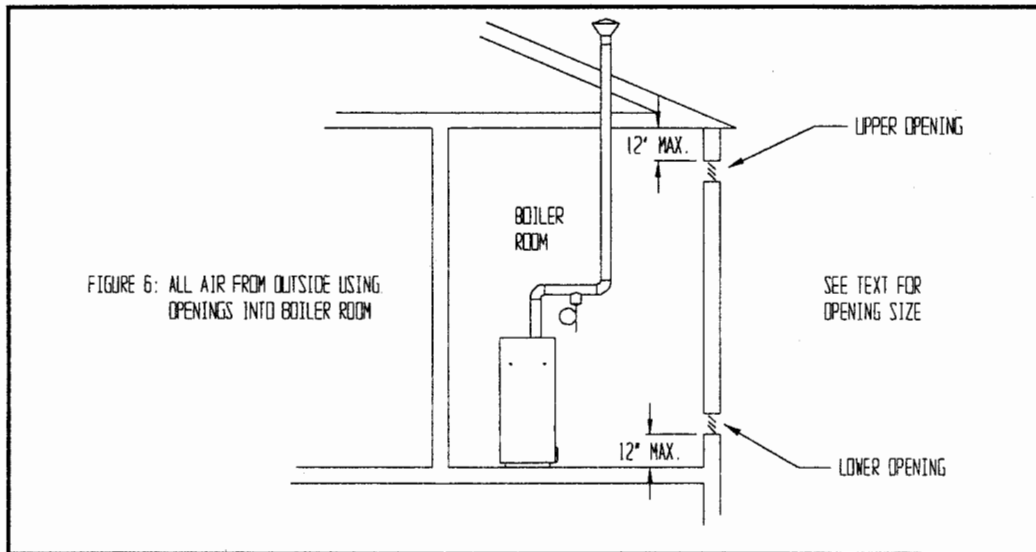
Two openings are required. The top edge of the upper opening must be within 12 inches of the ceiling. The bottom edge of the lower opening must be within 12 inches of the floor.

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 ¼” (4 x 4) mesh.







## VI Venting

There are two basic ways to vent the CSC boiler:

- Horizontal ("side wall") venting using an approved AL29-4C stainless steel vent system
- Vertical venting using an approved AL29-4C stainless steel vent system

In each case, combustion air can either be piped directly to the boiler (direct vent installation) or obtained from the boiler room (direct exhaust installation). This means that there are a total of four venting options.

Table 3 summarizes these four venting options. One of the columns in Table 3 must describe the planned vent and air intake system exactly. If the boiler is direct vented the intake system and exhaust system must both be either vertical or horizontal.

TABLE 3: SUMMARY OF VENTING OPTIONS

ONE OF THE COLUMNS IN THIS CHART MUST DESCRIBE THE FINAL EXHAUST AND AIR INTAKE SYSTEM EXACTLY

CLASSIFICATION USED IN THIS MANUAL	HORIZONTAL DIRECT VENT	HORIZONTAL DIRECT EXHAUST	VERTICAL DIRECT VENT	VERTICAL DIRECT EXHAUST
COMB. AIR SOURCE	OUTDOORS	BOILER ROOM	OUTDOORS	BOILER ROOM
<b>EXHAUST SYSTEM:</b>				
STRUCTURE PENETRATION	WALL	WALL	ROOF	ROOF
MAXIMUM LENGTH:				
CSC-50 - CSC-150	30 FT + 1 EL	30 FT + 1 EL	22.5 FT + 2 ELS	22.5 FT + 2 ELS
CSC-175, CSC-200	30 FT + 1 EL	30 FT + 1 EL	20 FT + 2 ELS	20 FT + 2 ELS
NOMINAL DIA.:				
CSC-50 - CSC-150	3"	3"	3"	3"
CSC-175, CSC-200	4"	4"	4"	4"
MATERIAL	AL29-4C(*)	AL29-4C(*)	AL29-4C(*)	AL29-4C(*)
EXHAUST TERMINAL	90 ELBOW OR COAXIAL TERM.	90 ELBOW OR VH-1 TERM.	BY VENT MFR. (TABLE 6)	BY VENT MFR. (TABLE 6)
<b>COMBUSTION AIR INTAKE SYSTEM:</b>				
STRUCTURE PENETRATION	WALL	N.A.	ROOF	N.A.
MAXIMUM LENGTH	35 FT + 2 ELS	PER PART V OF THIS MANUAL	35 FT + 2 ELS	PER PART V OF THIS MANUAL
DIA	4"	OR SECTION 5.3 OF THE NATIONAL FUEL GAS CODE	4"	OR SECTION 5.3 OF THE NATIONAL FUEL GAS CODE
MATERIAL	GALVANIZED OR PVC		GALVANIZED OR PVC	
TERMINAL	90 ELBOW OR COAXIAL TERM.		180 ELBOW	

(\*) FLEX-L-INTL STAR-34, ZFLEX SVE SERIES II, HEAT FAB SAF-T VENT, PROTECH SYSTEMS FASNSEAL

### Horizontal Exhaust System Design

- 1) See Figure 8 for the general horizontal exhaust configuration. For the purposes of this manual, a "horizontal exhaust system" is one that exits the structure through a wall.
- 2) Approved Systems – Use one of these four approved vent systems:
  - Flex-L-International *Star-34*
  - Z-FLEX *SVE Series II* ("Z-Vent II")
  - Heat Fab *Saf-T Vent*
  - ProTech Systems *FasNSeal*
- 3) Exhaust Pipe Size:
  - CSC-50 to CSC-150 – 3"
  - CSC-175, CSC-200 – 4"
- 4) Maximum Exhaust Pipe Length:
  - 30 ft + (1) 90 degree elbow + terminal
  - Reduce the 30-ft maximum straight pipe run by the equivalent length from Table 4 for each additional elbow.

*Example:*

*A vent system is planned which for a CSC-150 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*

*Since the boiler is a CSC-150, all piping must be done in 3" pipe. The first 90 elbow and the termination elbow are not considered. From Table 4, the equivalent length of the 3" 45 elbow is 4ft. The equivalent length of the 3" 90 degree elbow is 7.5ft. The maximum allowable run of straight pipe on this system is therefore:*

$$30\text{ft} - 4\text{ft} - 7.5\text{ft} = 18.5\text{ft}$$

*Since the planned installation has 14 ft of straight pipe, the length is acceptable*

**TABLE 4: ELBOW EQUIVALENT LENGTHS FOR AL29-4C EXHAUST AND AIR INLET PIPING (FT)**

FITTING	NOMINAL SIZE	
	3 INCH	4 INCH
90 DEG. ELBOW	7.5	10
45 DEG. ELBOW	4	5.5

**HORIZONTAL CONDENSATE TEE TREATED AS STRAIGHT PIPE**

- 5) Minimum Exhaust Pipe Length: 2 ft + (1) 90 degree elbow + terminal
- 6) Permitted Terminals:
  - **Direct Vent Boilers** - Choice of Crown coaxial terminal or 90 degree elbows with rodent screens. If Crown terminal is used select one of the following:  
  
CSC-50 to CSC-150: Crown #50-003 3" terminal  
CSC-175, CSC-200: Crown #50-004 4" terminal
  - **Direct Exhaust Boilers** - Choice of Tjernlund VH1 series terminal or a 90 degree elbow with rodent screen. If the Tjernlund terminal is used, select one of the following:  
  
CSC-50 to CSC-150: Tjernlund VH1-3 (Crown #50-032) 3" terminal  
CSC-175, CSC-200: Tjernlund VH1-4 (Crown #50-042) 4" terminal
  - If an elbow is used for the exhaust termination, it must be of the same type and manufacture as the rest of the exhaust system.
- 7) Wall thimbles – Wall thimbles are required where the vent pipe passes through combustible walls with less than a 4" clearance. Use the appropriate wall thimble shown in Table 5.
- 8) Pitch of horizontal piping – A ¼" per foot pitch towards the outside is preferred. Alternatively, the horizontal piping may be pitched ¼" per foot towards the boiler, however a condensate trap is required. See (9) below.

FIGURE 8a: HORIZONTAL EXHAUST SYSTEM - GENERAL REQUIREMENTS

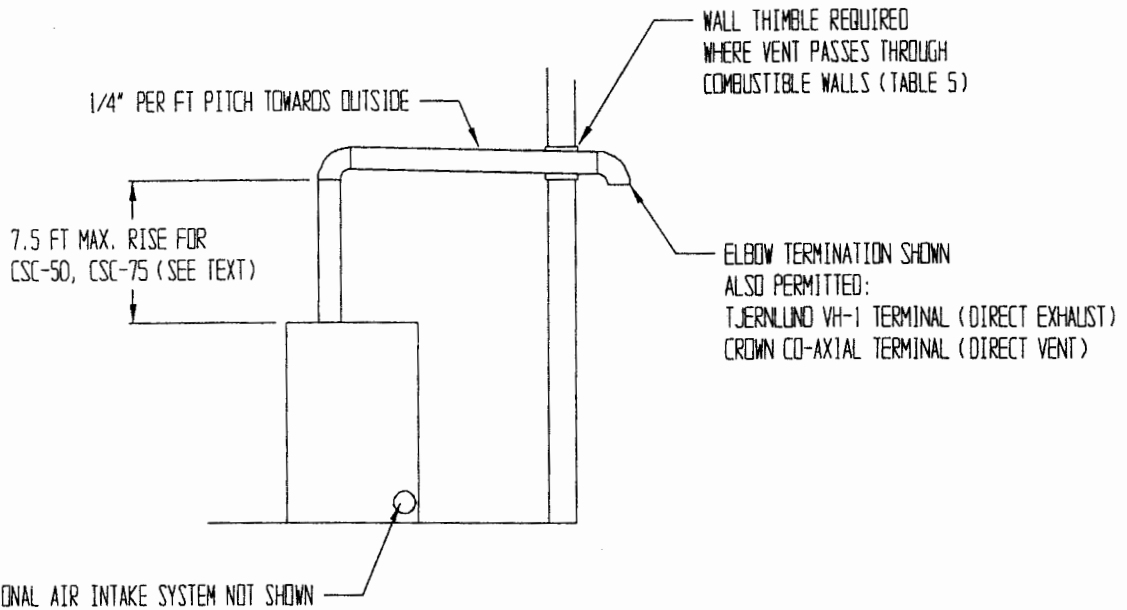


FIGURE 8b: HORIZONTAL EXHAUST SYSTEM - PITCH TOWARDS BOILER

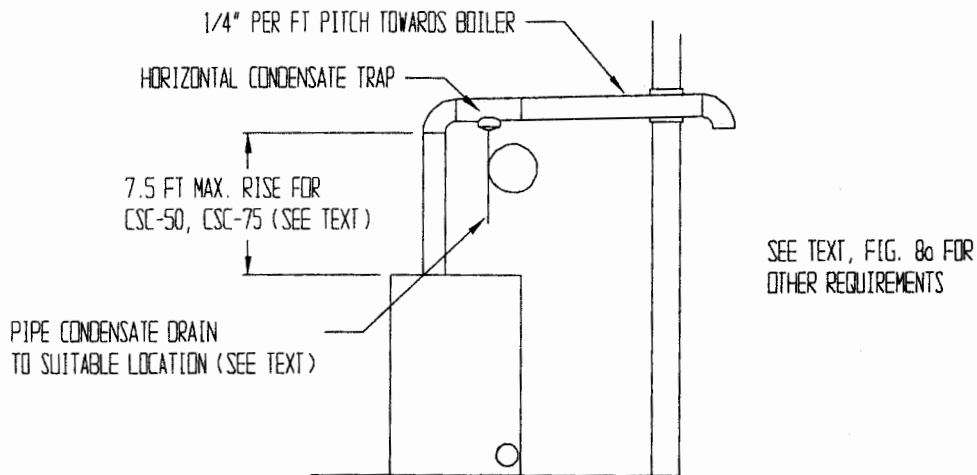
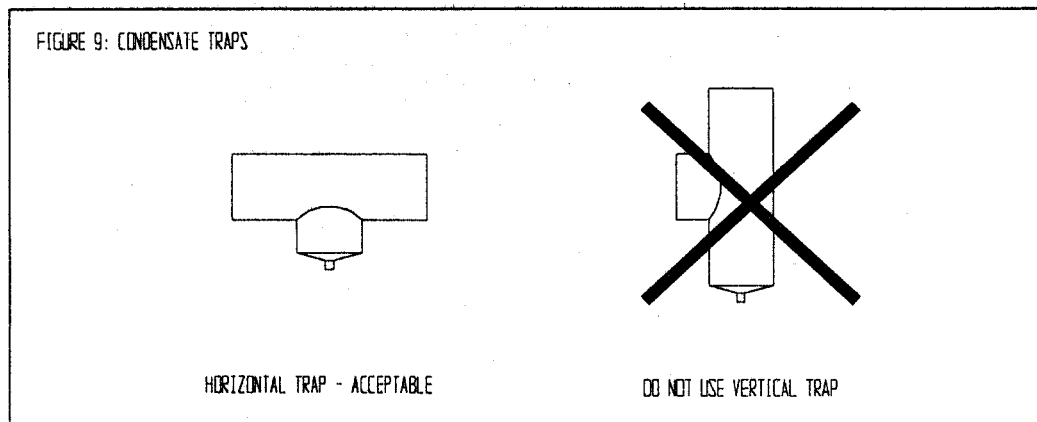


TABLE 5: WALL THIMBLES FOR AL29-4C EXHAUST SYSTEMS

VENT SYSTEM	VENT MANUFACTURER'S PART #	
	3 INCH	4 INCH
FLEX-L-INTL STAR-34	SRWT-03	SRWT-04
Z-FLEX SVE SERIES II	SVSWTX03	SVSWTX04
HEAT FAB SAF-T VENT	7393GC	7493GC
PROTECH SYSTEMS FASNSEAL	FSWT3	FSWT4

- 9) Condensate traps –In some horizontal installations, condensate traps may be needed to prevent condensate from running into the boiler or collecting in the vent system. A condensate trap must be used if the horizontal piping does not have a continuous slope to the outside. If this is the case, put a trap in the lowest section of horizontal piping (Fig 8b).
- 10) Use only a “horizontal” type condensate Tee (Fig 9).



- 11) Maximum vertical run off boiler (CSC-50, CSC-75 Only)– To prevent condensate from running into the boiler, the maximum length of the first vertical section connected to the CSC-50 or CSC-75 is 7.5 feet (Fig. 8). If a greater vertical run is required, an offset must be installed with a condensate trap.
- 12) Vertical and horizontal sections of piping must be properly supported. See the “Exhaust/Intake System Assembly” section of this manual for more information.
- 13) Exhaust system piping must be accessible for periodic inspection.
- 14) Location of Horizontal Vent Terminal – Observe the following limitations on the terminal location:
- 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 (Fig. 10).
  - 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 centerlines must be between 12 and 36 inches apart (Fig. 11)
  - The bottom of the exhaust elbow 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 (Fig 10).
  - The bottom of the exhaust elbow or coaxial terminal must be at least 7 feet above a public walkway.
  - The bottom of the exhaust elbow 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 or coaxial terminal must be at least 4 feet below eaves, soffits, or overhangs. Overhang may not exceed 3 feet (Fig. 12).
  - 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). Care should be taken when the terminal is positioned in areas where this might be objectionable, such as near bedroom windows.

FIGURE 10a: LOCATION OF DIRECT EXHAUST TERMINAL RELATIVE TO WINDOWS, DOORS GRAVITY OPENINGS, AND GRADE

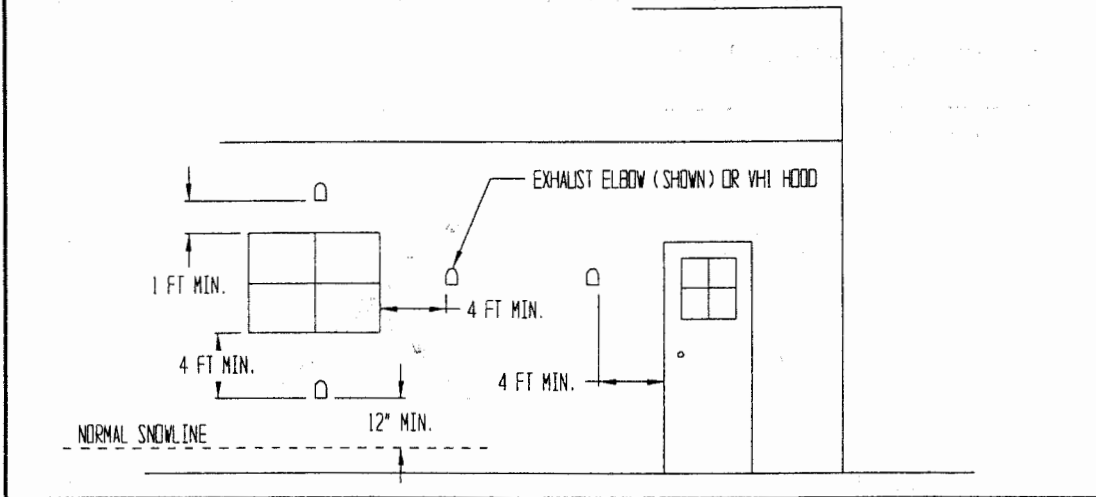


FIGURE 10b: LOCATION OF DIRECT VENT TERMINALS RELATIVE TO WINDOWS, DOORS, GRAVITY OPENINGS, GRADE

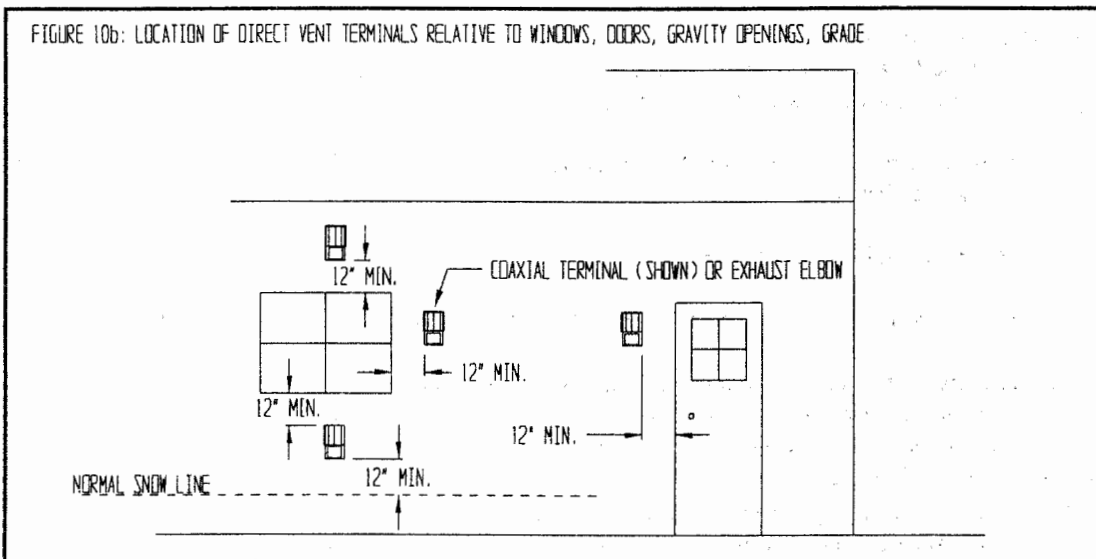
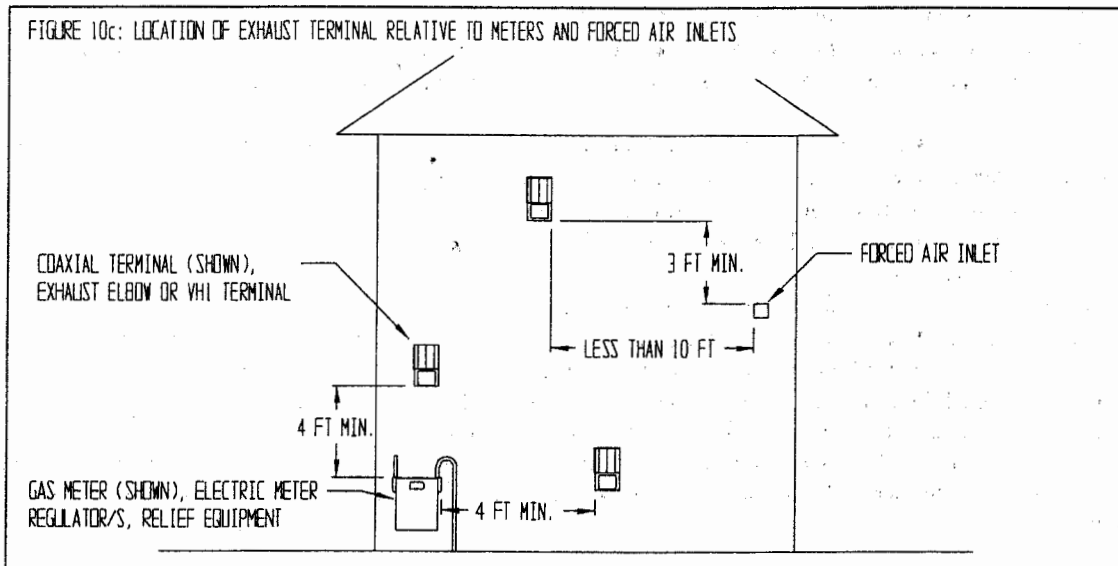
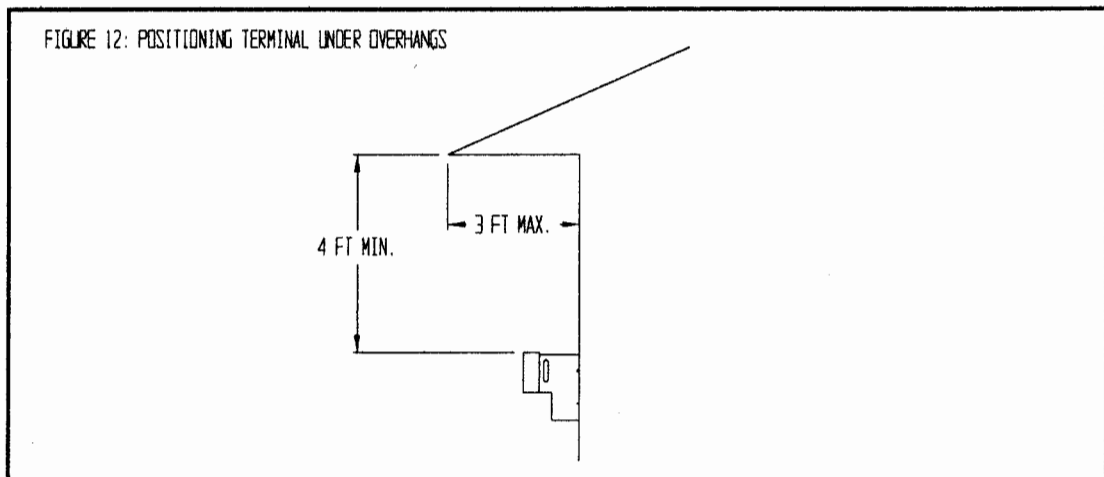
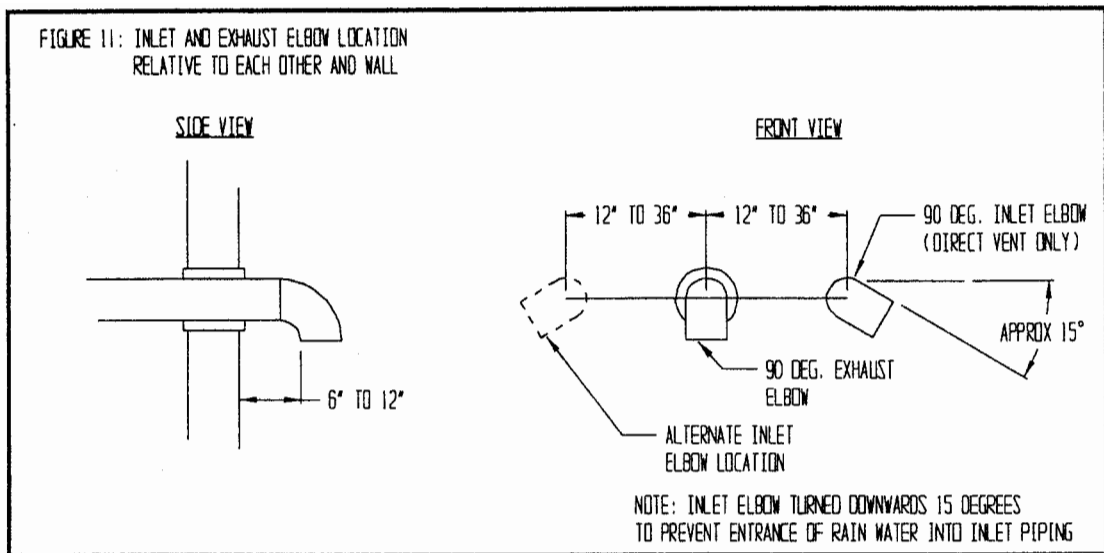


FIGURE 10c: LOCATION OF EXHAUST TERMINAL RELATIVE TO METERS AND FORCED AIR INLETS





### Vertical Exhaust System Design

- 1) See Figure 13 for the general vertical stainless steel venting configuration. For the purposes of this manual, a “vertical exhaust system” is one that exits the structure through a roof.
- 2) Approved Systems – Use one of these four approved vent systems:
  - Flex-L-International *Star-34*
  - Z-FLEX *SVE Series II* (“Z-Vent II”)
  - Heat Fab *Saf-T Vent*
  - ProTech Systems *FasNSeal*
- 3) Exhaust Pipe Size:
  - CSC-50 to CSC-150 – 3”
  - CSC-175, CSC-200 – 4”

4) Maximum Exhaust Pipe Length:

- CSC-50 to CSC-150 - 22.5 ft + (2) 90 degree elbows + cap
- CSC-175, CSC-200 - 20 ft + (2) 90 degree elbows + cap
- Reduce the 22.5-ft maximum straight pipe run by the equivalent length from Table 4 for each additional elbow.

*Example:*

*A vent system is planned for a CSC-150 that has the following components:*

- 2 ft vertical pipe*
- 1 90 Elbow*
- 1 condensate trap which has an is 18 inch long run*
- 1 90 Elbow*
- 1 ft vertical pipe*
- 1 45 elbow*
- 2 ft sloped pipe*
- 1 45 elbow*
- 7 ft vertical pipe*
- 1 Cap*

*Since the boiler is a CSC-150, all piping must be done in 3" pipe. The first two 90 elbows and the termination cap are not considered. The condensate trap is treated as a straight length of pipe 1.5 feet in length. The result is 13.5 ft of straight pipe and two 45 elbows. From Table 4, the equivalent length of the 45 elbow is 4ft. The maximum allowable run of straight pipe on this system is therefore:*

$$22.5\text{ft} - 4\text{ft} - 4\text{ft} = 14.5\text{ft}$$

*Since the planned installation has 13.5 ft of straight pipe, the length is within the maximum limit.*

- 5) Minimum Exhaust Pipe Length - 2 ft + (2) 90 degree elbows + cap
- 6) Permitted Terminals – A cap must be used which is compatible with the rest of the exhaust system. See Table 6 for the appropriate cap.

TABLE 6: CAPS FOR VERTICAL AL29-4C EXHAUST SYSTEMS

VENT SYSTEM	VENT MANUFACTURER'S PART #	
	3 INCH	4 INCH
FLEX-L-INTL STAR-34	SRRC-03	SRRC-04
Z-FLEX SVE SERIES II	SVSRCX03	SVSRCX04
HEAT FAB SAF-T VENT	5300CI	5400CI
PROTECH SYSTEMS FASNSEAL	FSRC3	FSRC4

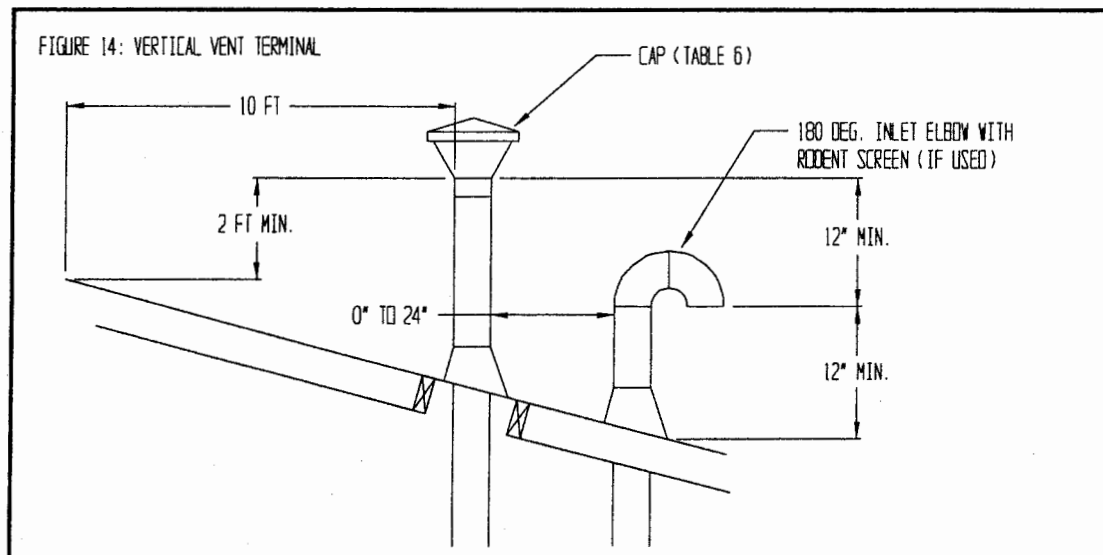
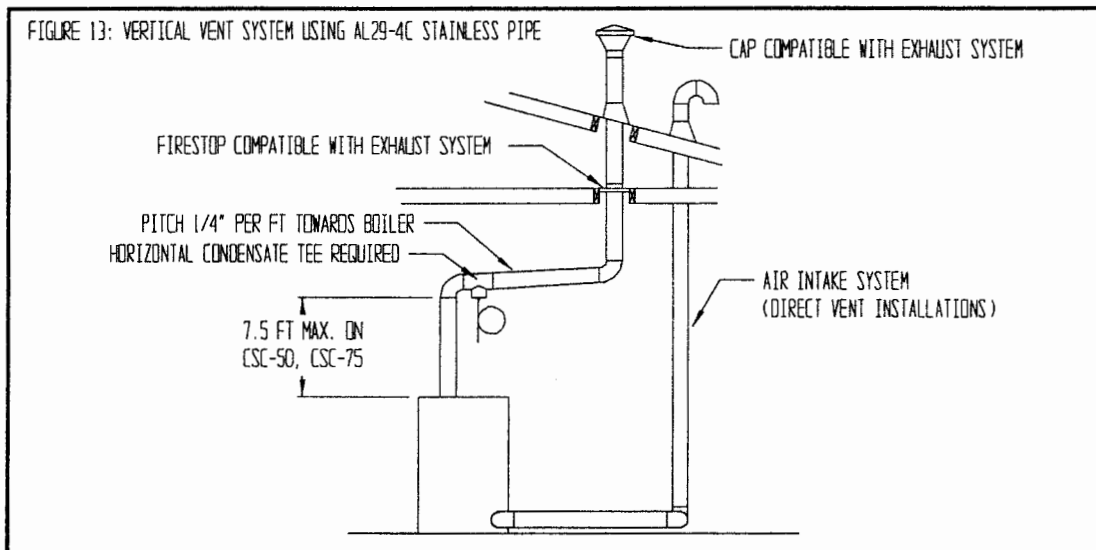
- 7) Condensate traps – A condensate trap is required on all vertical-venting systems. Install this trap as shown in Figure 13. On CSC-50 and CSC-75 installations, the maximum length of the vertical run before the elbow into the condensate trap is 7.5 ft (Fig. 13). If there are additional sections of horizontal piping in the vent system, they must either be equipped with their own condensate Tees or pitched so that condensate will run into the one required trap.
- 8) Use only a “horizontal” type condensate Tee (Fig. 9).
- 9) Pitch of horizontal piping – Pitch the lowest horizontal section of piping ¼” per foot towards the boiler. Other horizontal sections (if any) must be pitched so that condensate will run towards a condensate Tee.
- 10) Fire-stops and wall thimbles – A wall thimble is required where the exhaust pipe passes through combustible walls with less than a 4” clearance. Firestops are required where the vent passes through ceilings. These components must be compatible with the rest of the exhaust system. Table 5 shows wall thimble model numbers for the approved vent systems. Table 7 shows firestop model numbers for the approved vent systems.



TABLE 7: FIRESTOPS FOR VERTICAL AL29-4C EXHAUST SYSTEMS

VENT SYSTEM	VENT MANUFACTURER'S PART #	
	3 INCH	4 INCH
FLEX-L-INTL STAR-34	SRFS03	SRFS04
Z-FLEX SVE SERIES II	SVSFSX03	SVSFSX04
HEAT FAB SAF-T VENT	7373GC	7473GC
PROTECH SYSTEMS FASNSEAL	FSFS3	FSFS4

- 11) Piping supports – Vertical and horizontal sections of piping must be properly supported. See the “Exhaust/Intake System Assembly” section of this manual for more information.
- 12) Exhaust system piping must be accessible for periodic inspection.
- 13) Location of exhaust cap– Observe the following limitations on location of the cap (Fig. 14):
  - 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, the vertical clearance between the vent and intake pipes cannot exceed 24 inches.
  - If outside air is used for combustion, the vertical distance between the lowest discharge opening on the cap and the bottom of the 180 degree inlet elbow cannot be less than 12 inches.



## Air Intake System (Horizontal or Vertical)

CAUTION  
IF EXHAUST SYSTEM IS VERTICAL, THE AIR INTAKE SYSTEM MUST BE VERTICAL  
IF EXHAUST SYSTEM IS HORIZONTAL, THE AIR INTAKE SYSTEM MUST BE HORIZONTAL

- 1) Air intake-piping materials:
  - Galvanized “smoke pipe”
  - Schedule 20 or 40 PVC
- 2) Air Intake Size – 4” for all size CSC boilers
- 3) Maximum Air Intake length:
  - 35 ft + (2) 90 degree elbows + terminal
  - Reduce the 35-ft maximum straight pipe run by the equivalent length from Table 4 for each additional elbow.

*Example:*

*A horizontal air intake system for a CSC-150 which has the following components:*

*1 ft horizontal pipe  
1 90 Elbow  
5 ft vertical pipe  
1 90 Elbow  
5 ft Horizontal pipe  
1 45 degree elbow  
4 ft horizontal pipe  
1 90 degree termination elbow*

*Air intake piping for all size boilers is 4”. The first two elbows and the termination elbow are ignored. This leaves 15 ft of straight pipe and one 45 elbow. From Table 4, the equivalent length of the 4” 45 degree elbow is 5.5 ft. The maximum allowable run of straight pipe on this system is therefore:*

$$35 \text{ ft} - 5.5 \text{ ft} = 29.5 \text{ ft}$$

*Since the planned installation has only 15 ft of straight pipe, the length is within the maximum limit.*

- 4) Minimum Air Intake Length – 2 ft + (1) 90 degree elbow + termination
- 5) Permitted Terminals - Choice of Crown coaxial terminal, 4 inch 90 degree elbow (horizontal venting), or 4 inch 180 degree elbow (vertical venting) with a rodent screen. If an elbow is used, it must be either galvanized or PVC, depending on the material used for the rest of the intake system. Two 90-degree elbows may be joined to form a 180 elbow when the intake is vertical.
- 6) Location of Horizontal Air Intake Vent Terminal:
  - Horizontal Venting – Where the Crown coaxial terminal is used, see Figure 10 and the “horizontal venting” section for terminal locations. Where an elbow is used for a termination, the correct clearance must be maintained between the inlet and exhaust elbows. The elbows must be at the same level and their centerlines must be between 12 and 36 inches apart (Fig. 11).
  - Vertical Venting – The bottom of the inlet elbow must be at least one foot above the roof. The inlet and exhaust pipes must be no more than two feet apart. A vertical separation of at least one-foot must be maintained between the opening in the inlet elbow and the lowest discharge opening in the vent cap (Fig. 14).

## Removing an Existing Boiler From a Common Chimney

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

<p><b>WARNING</b> NEVER COMMON VENT A CSC BOILER WITH OTHER APPLIANCES</p>
--

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.

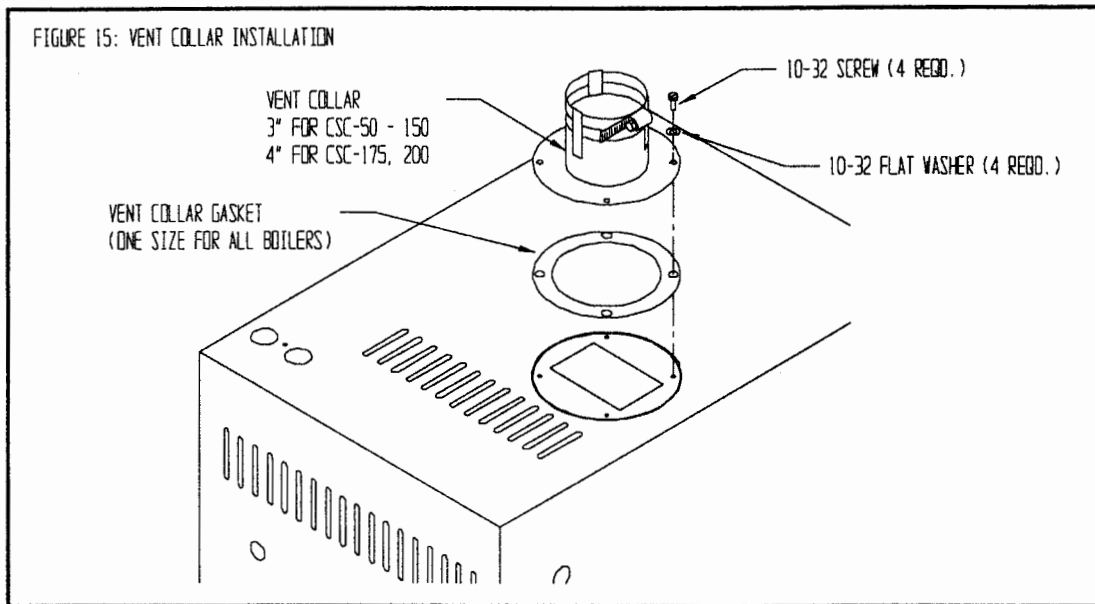
- (a) Seal any unused openings in the common venting system.
- (b) Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- (c) Insofar as practical, close 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.

### Exhaust/Intake System Assembly

#### 1) General Assembly Notes:

- a) Where the use of "silicone" is called for in the following instructions, use only the following sealants:
  - Flex-L-International *Star-34* – GE RTV106 or GE IS806.
  - Z-FLEX *SVE Series II* ("Z-Vent II") – GE RTV 106 or Z-Flex Z-Vent Sealant
  - Heat Fab *Saf-T Vent* – GE RTV 106
  - ProTech Systems *FasNSeal* - Silicone not required for joints between pipe sections.
  - Use the same silicone used to seal vent pipe sections to seal the boiler vent collar and the Crown coaxial terminal (if used). For ProTech FasNSeal, use GE RTV 106 for the vent collar and co-axial 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.

- 2) Vent Collar Installation – The vent collar is shipped loose in the accessory bag along with the collar gasket and four 10-32 mounting screws. Mount the collar as shown in Figure 15. If desired, the first piece of exhaust pipe can be connected to the collar before mounting the collar on the boiler.



- 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 (Fig. 16):
- Remove the mounting plate from the outside terminal section. Position this plate on the wall in the desired terminal location. Mark the center of the round opening on the wall.
  - Cut a 6 1/4" diameter hole through the wall at this location.

**NOTE**

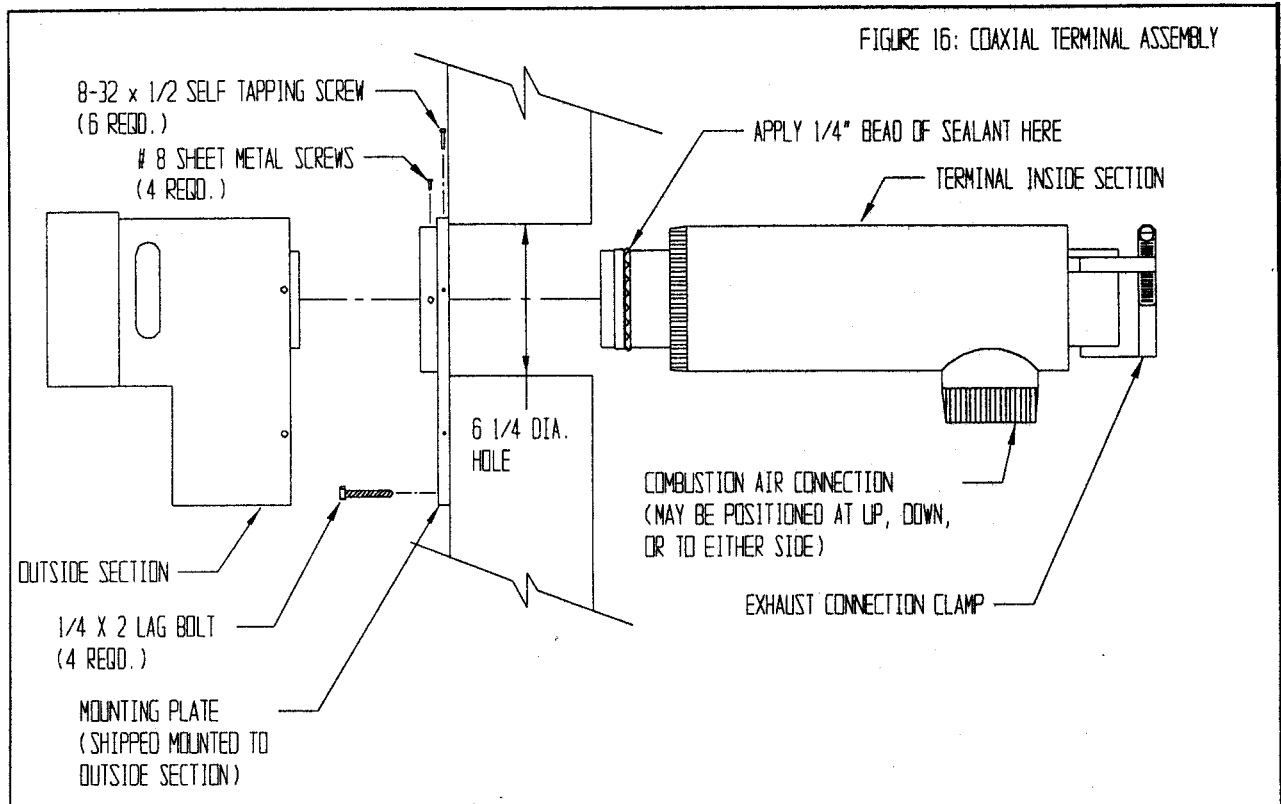
COAXIAL PORTION OF INSIDE TERMINAL SECTION MAY BE INSTALLED IN DIRECT CONTACT WITH COMBUSTIBLE CONSTRUCTION

- Attach the mounting plate to the outside wall with the 1/4 x 2" lag screws provided or other suitable fasteners. Tighten only until the heads of these bolts are snug with the mounting plate.
- Pass the co-axial section through the wall from the inside and secure to the mounting plate with the four #8 x 3/8 screws provided.
- Apply a 1/4" bead of silicone to the outside terminal section as shown in Figure 16.

**WARNING**

FAILURE TO APPLY THIS BEAD OF SILICONE CAN CAUSE FLUE GAS TO RECIRCULATE INTO THE AIR INLET RESULTING IN A CARBON MONOXIDE HAZARD.

- Slip the outside section of the terminal over the mounting plate and secure with the six screws removed in step (a).
- To prevent rainwater from seeping behind the terminal, seal the terminal to the outside wall using any standard construction caulk.
- 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.



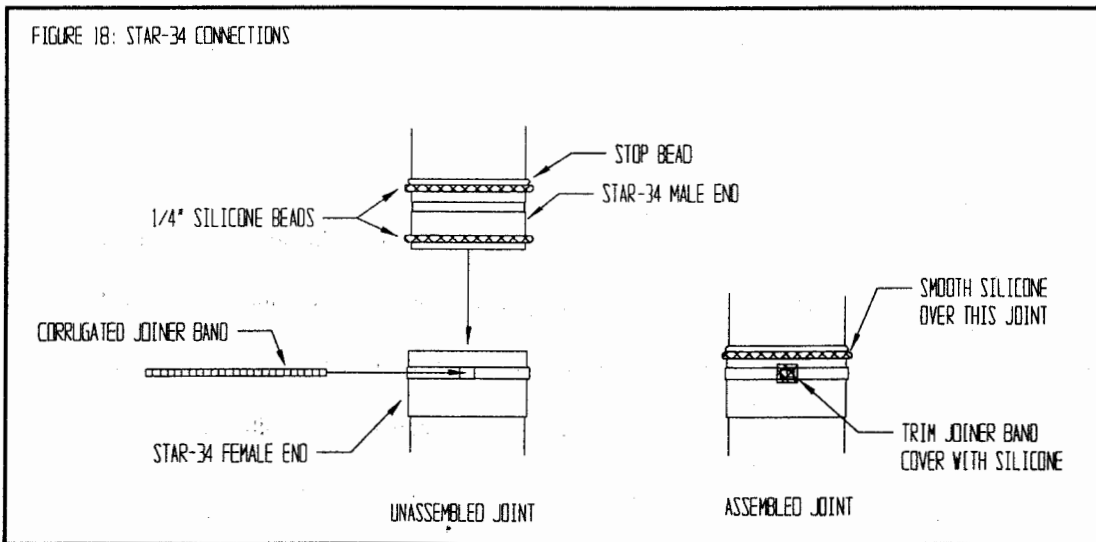
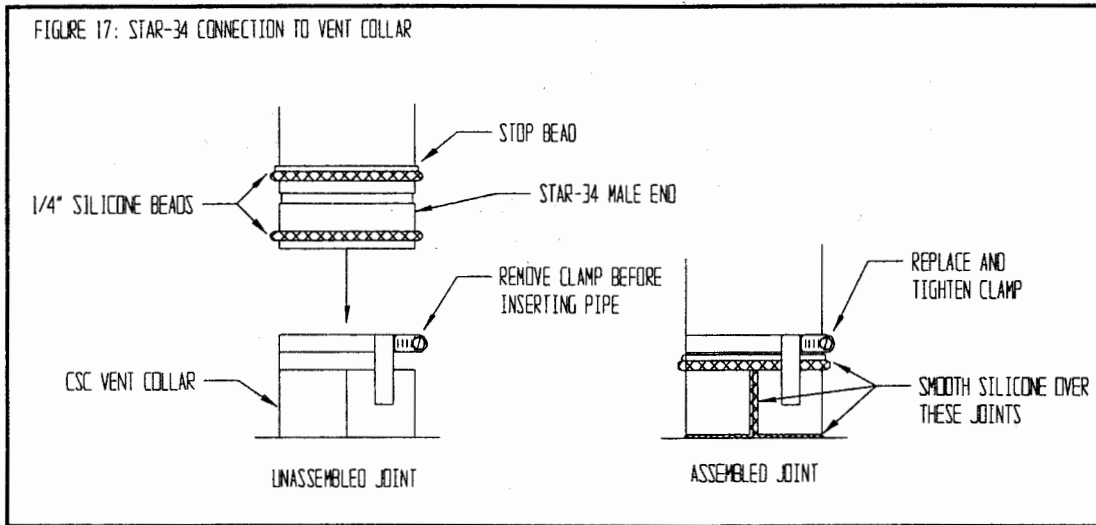
4) Assembly of Flex-L-Intl. Star-34 Vent System:

a) Star-34 General Notes:

- Do not cut Star-34 vent components.
- Support horizontal piping sections at intervals of 48" or less.
- Vertical venting systems must be supported by at least one Star-34 Firestop. An additional vertical support is required after any offset.
- Orient Star-34 components so that the arrows on the piping labels are in the direction of flue gas flow.

- b) Start at assembly of the vent system at the boiler. Remove the hose clamp shipped on the CSC 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. Use a cleaner such as Methyl Ethyl Keytone (MEK) or naphtha.
- d) On the male end of the pipe, apply a 1/4" wide bead of silicone approximately 1/4" from the end of the pipe and another 1/4" bead against the joint side of the stop bead (Fig 17).
- 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 vent collar (Fig 17).
- g) Replace and tighten the clamp on the vent collar.
- h) Clean the female end of the first piece of pipe. Also clean the male end of the next piece of pipe.
- i) Apply silicone as in step (d) (Fig 18).
- j) Align the longitudinal seams of the pipe and insert the male end of the second pipe into the female end of the first pipe.
- k) Insert a StaR joiner band into the inlet of the beaded channel. Feed the joiner band in so that it makes its way around the channel and overlaps by approximately 1/2" (Fig 18).
- l) Cut the excess joiner band so that it lays flat in the beaded channel (Fig 18).
- m) Fill the inlet of the beaded channel with silicone. Smooth the silicone over the channel inlet as well as the silicone between the female end and the stop bead of the male end (Fig 18).

- n) Repeat Steps (h) – (m) for the remaining Star-34 components. If a termination elbow is used, use this procedure to complete the exhaust system.
- o) To connect Star-34 to a Crown coaxial terminal, the vent system must be configured so that the female end of the last piece of Star-34 will fit over the vent connection on the terminal. Before permanently making this joint, clean both the male end of the terminal and the female end of the last piece of pipe with Methyl Ethyl Keytone or Naptha. Apply a ¼ inch bead of silicone ¼" from the male end of the terminal. Slip the female end of the vent pipe over the male end of the terminal until it bottoms out. Apply a second bead of silicone over the joint between the vent pipe and the terminal as well as over the channel inlet. Tighten the terminal clamp to lock the vent pipe in place.
- p) Allow the silicone to cure for 24 hours before operating the boiler.



### 5) Assembly of Z-Flex SVE Series II:

#### a) SVE Series II General Notes:

- Non-expanded ends of SVE Series II 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 II to the vent collar or Crown co-axial terminal. See the instructions below.

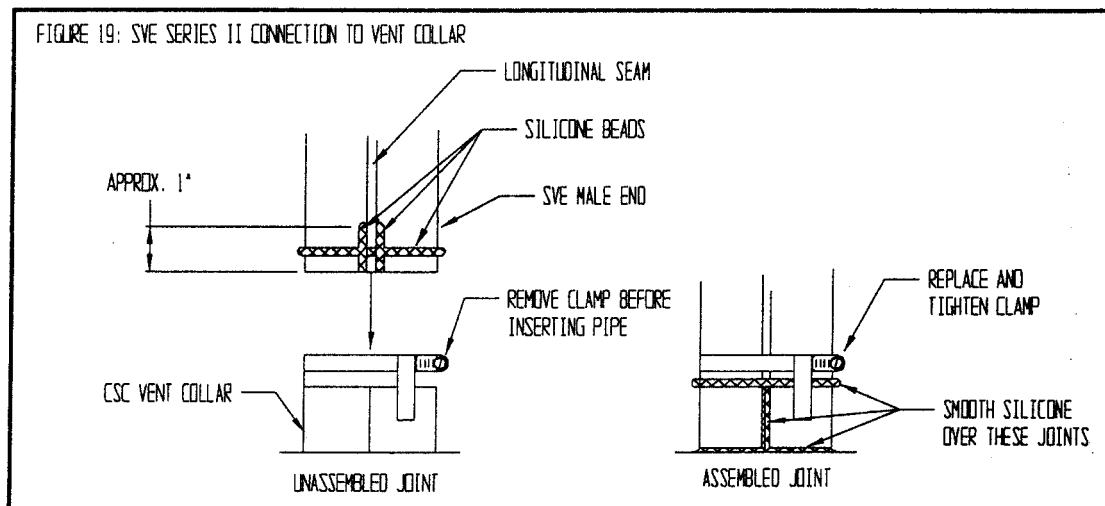
- Orientation of SVE Series II depends upon the direction of vent system pitch:

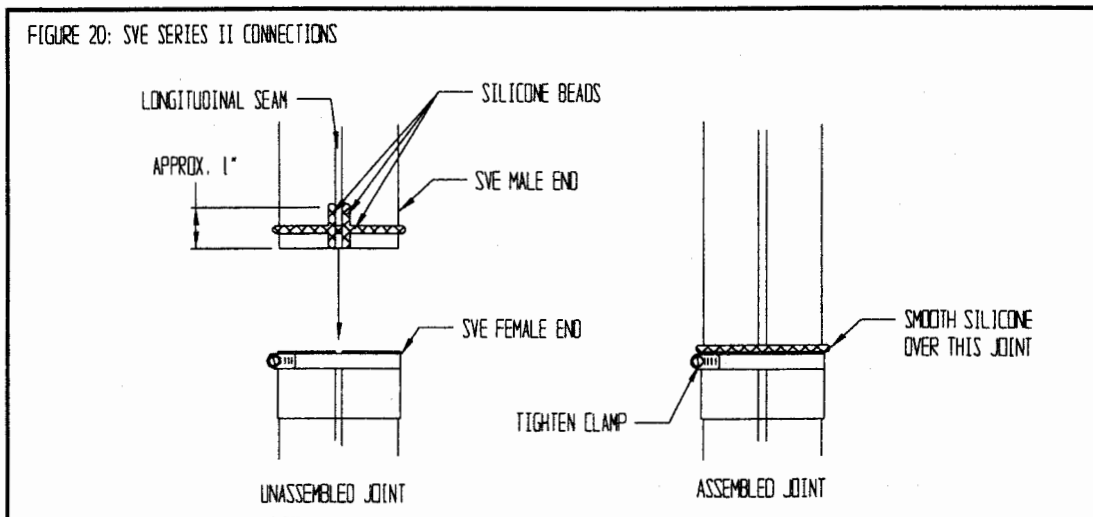
Horizontal vent systems pitched towards the outside (Fig. 8a) - Male ends point towards the terminal.

Horizontal vent systems pitched towards the boiler (Fig 8b) - Male ends point towards the boiler

Vertical vent systems (Fig 13) - Male ends point towards the boiler.

- Support horizontal piping sections at intervals of 48" or less.
  - Vertical venting systems must be supported by at least one Z-Flex Firestop. An additional vertical support is required after any offset.
- Start assembly of the vent system at the boiler. Remove the hose clamp shipped on the CSC vent collar. Bend the three hose clamp tabs on this collar outward slightly.
  - If the vent system is horizontal with a pitch towards the outside (Fig 8a) it will be necessary to cut the expanded end off the first piece of pipe to make a "double male" pipe.
  - 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 ¼" wide bead of high temperature silicone approximately ½ inch from the male end of the pipe. Apply ¼" beads of silicone along both sides of the longitudinal seam (Fig. 19).
  - 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. Also apply silicone over the seams in the collar (Fig 19).
  - Replace and tighten the clamp on the vent collar.
  - Clean the opposite end of the first piece of pipe. Also clean the mating end of the next piece of pipe.
  - Repeat Step (e) (Fig 20).
  - Align the longitudinal seams of the pipe and insert the male end of the second pipe into the female end of the first pipe until it bottoms out.
  - Apply an additional bead of silicone around the outside of the joint and smooth out (Fig 20).
  - Tighten the gear clamp. Maximum torque must not exceed 15 in-lbs.
  - Repeat Steps (i) – (m) for the remaining SVE components. If a termination elbow is used, use this procedure to complete the exhaust system.
  - If a termination elbow 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.
  - To join SVE Series II to a Crown coaxial terminal, a male end must be present at the end of the piping to be joined to the terminal. If the horizontal vent system is pitched towards the boiler (Fig 8b), it will 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 (e) 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.
  - Allow the silicone to cure for one hour before operating the boiler.





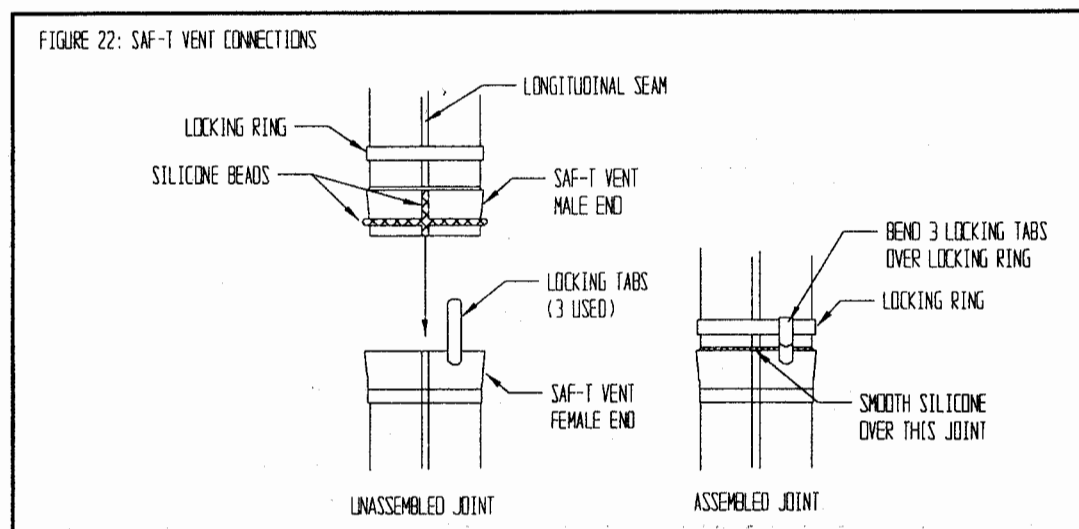
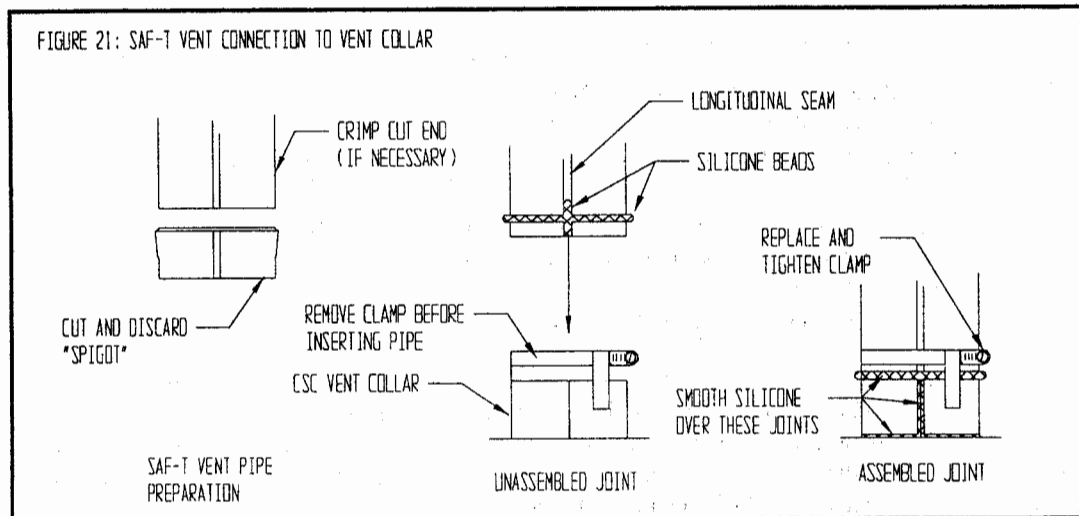
6) Assembly of Heat Fab Saf-T Vent:

a) Saf-T Vent General Notes:

- 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) Start assembly of the vent system at the boiler. Remove the hose clamp shipped on the CSC vent collar. Bend the three hose clamp tabs on this collar outward slightly.
- c) 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.
- d) 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.
- e) 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. Also apply a 1/4" bead of silicone along the first 2 1/2" of the longitudinal weld.
- f) Insert the male end of the pipe into the boiler vent collar until it bottoms out.
- g) Apply an additional bead of silicone over the outside of the joint and smooth out (Fig 21). Also apply silicone over the seams in the vent collar.
- h) Replace and tighten the clamp on the vent collar.
- i) Clean the male end of the next piece of pipe. Also clean the female end of the first piece of pipe.
- j) Apply a 1/4" bead of silicone around the male end of the second piece of pipe between 1/4" and 3/8" from the end of the pipe. Also run a 1/4" bead of silicone along the longitudinal welded seam from the end of the pipe to the top of the spigot (Fig 22).
- k) Align the longitudinal seams of the pipe and insert the male end of the second pipe into the female end of the first pipe until it bottoms out.
- l) With a moistened finger or flat tool, spread out any silicone that oozes out of the joint.
- m) Bend the locking tabs over the locking ring as shown in Figure 22.
- n) Apply silicone over any visible voids around the joint and smooth it into any crevices.
- o) Repeat Steps (i) – (n) for the remaining Saf-T-Vent components. If a termination elbow is used, use this procedure to complete the exhaust system.
- p) To join to a 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 1/4" bead of silicone around the terminal connection about 1/4" from the end. Slip the Saf-T Vent pipe over the terminal and apply a second bead of silicone over the joint. Smooth the excess silicone over the joint, making sure that there are no visible voids in the silicone. Tighten the terminal clamp.
- q) Allow the silicone to cure for 24 hours before operating the boiler.





7) Assembly of Protech FasNSeal:

a) FasNSeal General Notes:

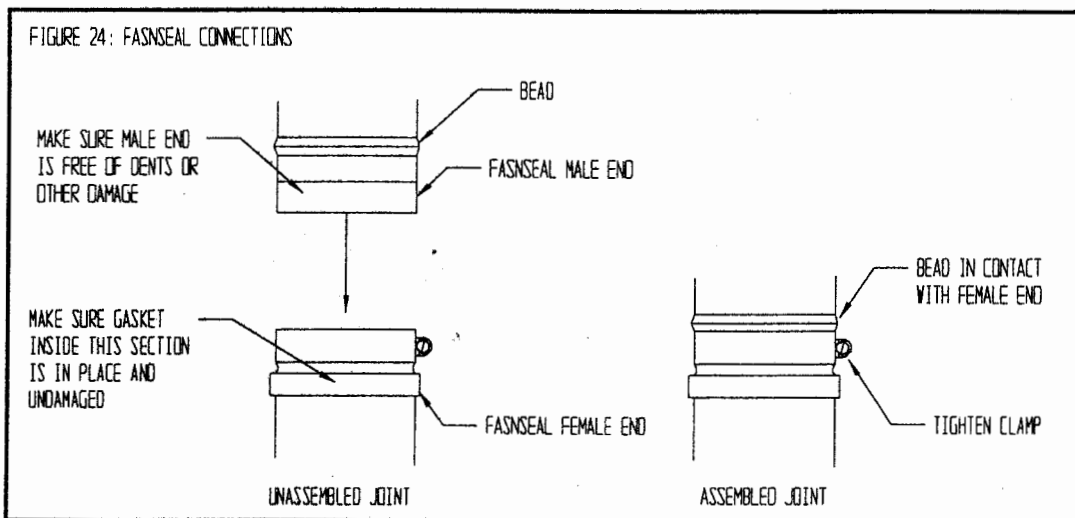
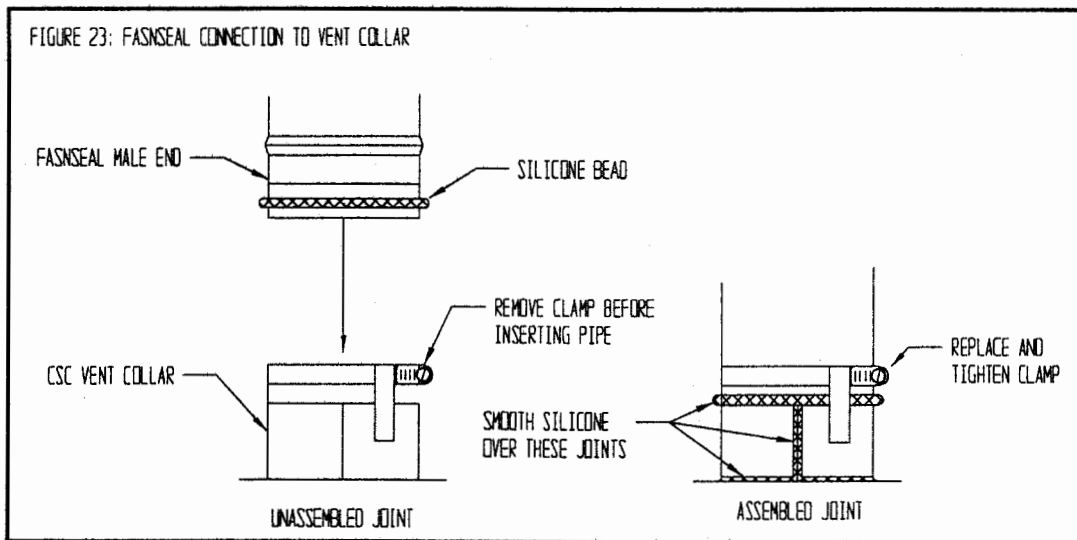
- Do not cut 4" FasNSeal pipe. The male end of 3" FasNSeal may be cut. Cut must be square to ensure a proper seal.
- Orient FasNSeal vent components so that the arrows on the piping labels are in the direction of flue gas flow
- Support horizontal piping sections at intervals of 6 feet or less.
- Vertical venting systems must be supported by at least one FasNSeal support. An additional vertical support is required after any offset.

- b) Start assembly of the vent system at the boiler. Remove the hose clamp shipped on the CSC 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 1/4 inch from the male end of the pipe.
- 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 the seams on the vent collar and smooth out (Fig 23).
- g) Replace and tighten the clamp on the vent collar.
- h) All other joints in the FasNSeal venting system rely on a gasket in the female end of the pipe for a proper seal.

**CAUTION**

- 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
- IF 3" PIPE IS CUT, CUT END MUST BE SQUARE AND CAREFULLY DEBURRED PRIOR TO ASSEMBLY

- i) Align the longitudinal seams of the pipe. 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. 24).
- j) Tighten the locking band with a nut driver.
- k) Repeat Steps (i) and (j) for the remaining FasNSeal components. If a termination elbow is used, use this procedure to complete the exhaust system.
- l) 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 ¼" bead of silicone to the terminal connection about ¼" from its end. Slip the FasNSeal female end over the terminal end so that there is an overlap of 1 ¼ 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.
- m) Allow the silicone to cure for 24 hours before operating the boiler.

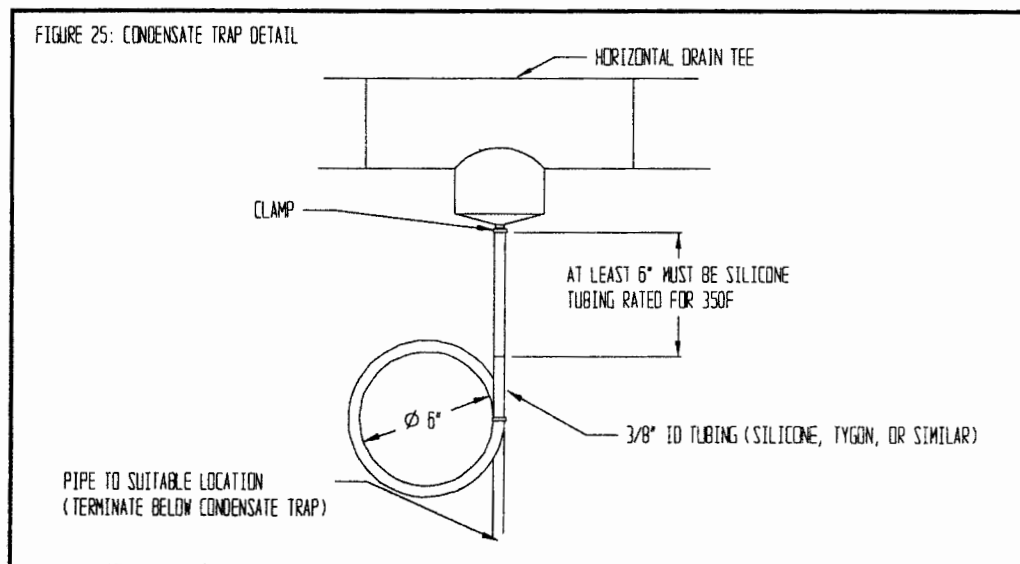


8) Assembly of the air intake system:

- 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) 4" galvanized smoke pipe will fit inside the inlet collar on the CSC boiler. Depending upon the exact OD of the pipe used, it may be necessary to crimp this pipe. Secure with a single #8 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 #8 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.

9) Condensate Traps:

- a) Trap should have the basic configuration shown in Figure 25. 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 350F 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.



10) Rodent Screens:

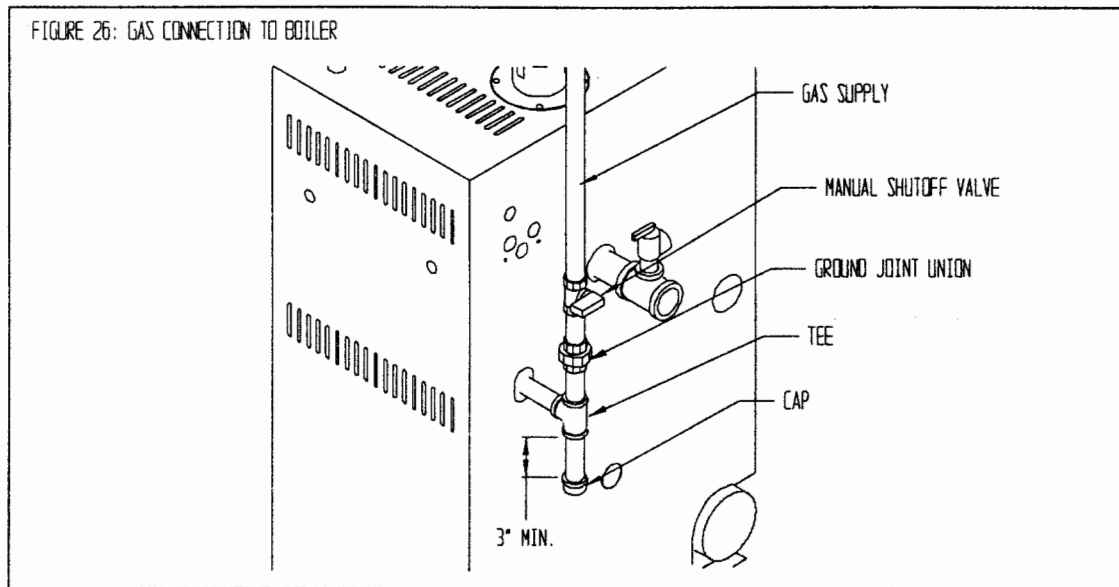
- a) A rodent screen is provided with the CSC boiler. On direct exhaust boilers this screen is installed in the air inlet collar on the boiler and held in place with a few dabs of silicone.
- b) The Crown coaxial terminal has integral inlet and exhaust rodent screens. The rodent screen supplied with the boiler is not used when the boiler is installed with the coaxial terminal.
- c) In horizontal direct vent installations using termination elbows, 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 AL29 vent system manufacturer.
  - A second Crown rodent screen (Crown #60-601).
  - A rodent screen made of stainless steel screen having a 1/2" (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 Part 2 of the *National Fuel Gas Code*.

Figure 26 shows typical gas piping connections to the CSC 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.



## 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 AN 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

### Standard Piping

Figure 27 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 Berkely Heights NJ. The components in this system and their purposes are as follows:

- 1) Relief valve (Required) – The relief valve is factory mounted and must not be moved. 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 60 psi. If the valve is replaced, the replacement must have a relief capacity in excess of the DOE heating capacity for the boiler.

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**

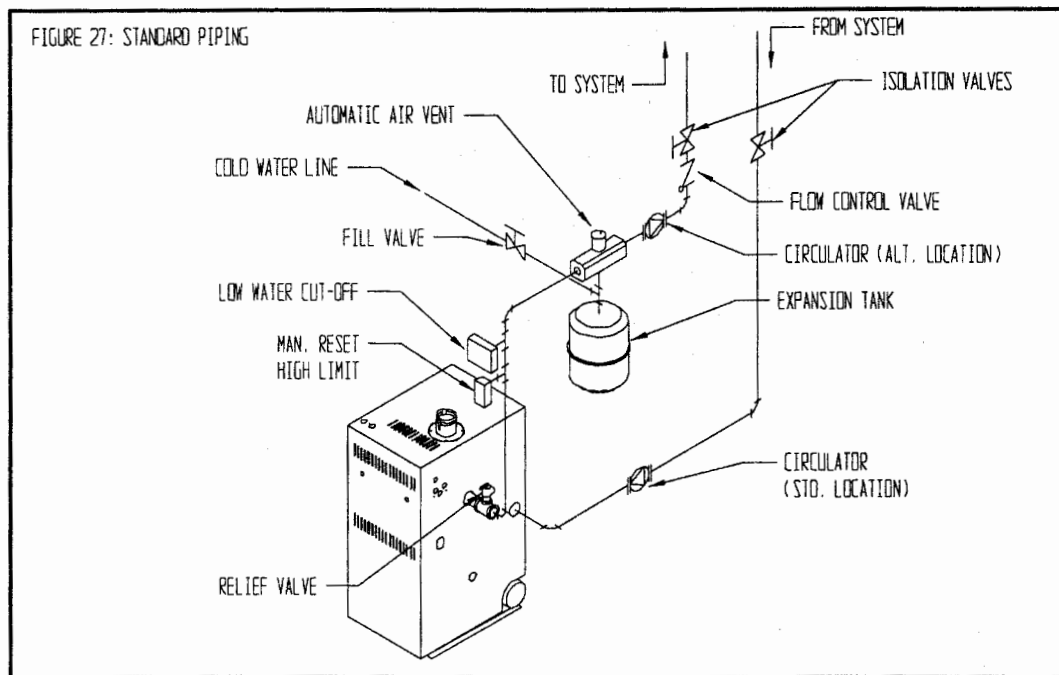
- PIPE RELIEF VALVE DISCHARGE TO A SAFE LOCATION
- DO NOT INSTALL A VALVE IN THE RELIEF VALVE DISCHARGE LINE
- DO NOT MOVE RELIEF VALVE FROM FACTORY LOCATION
- DO NOT PLUG RELIEF VALVE DISCHARGE

- 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 27.
- 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 wire 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.

### **Piping for Special Situations**

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

- 1) Indirect Water Heaters – Figure 28 shows typical indirect water heater piping. Boiler piping is the same as for any two-zone system. Figure 28 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 CSC control system will operate two circulator zones. See the Wiring section of this manual.

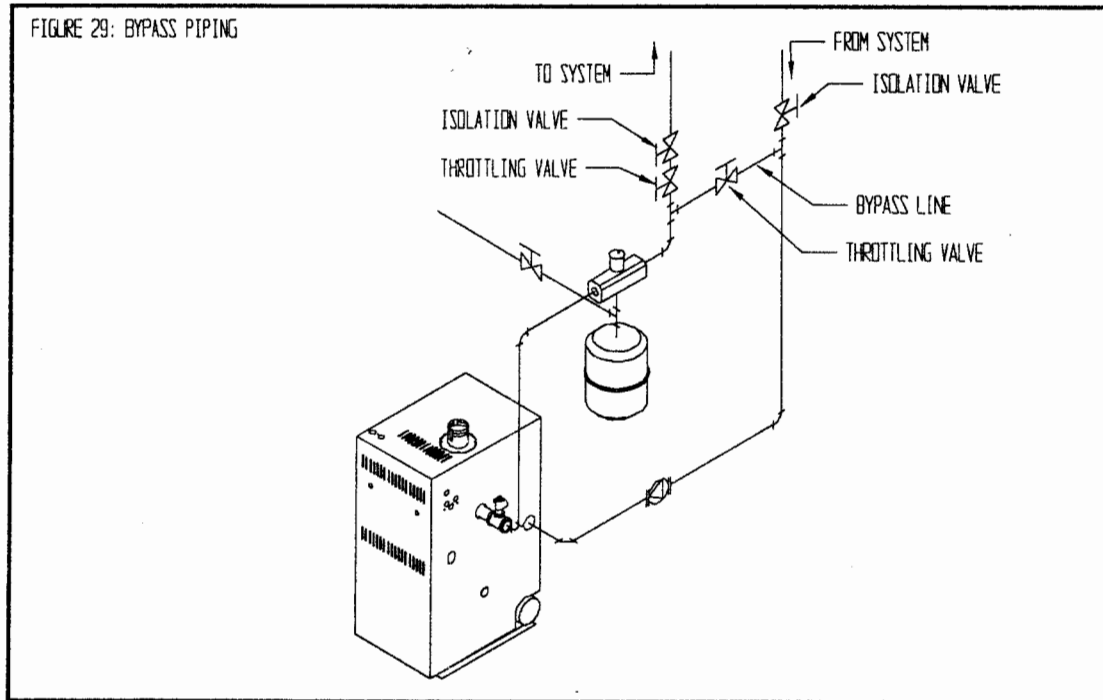
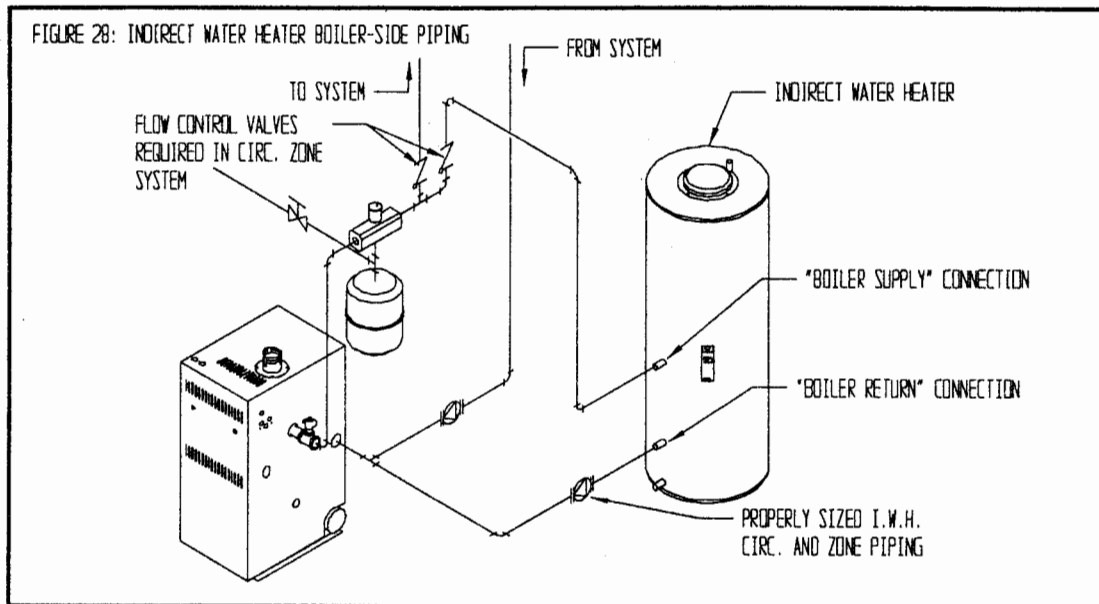


- 1) Gravity and “Large Water Volume” Systems – The piping shown in Figure 29 will minimize the amount of time that the boiler operates with return temperatures below 120F on these systems. A bypass is installed as shown to divert some supply water directly into the return water. The bypass pipe should 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.
- 2) 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 CSC. These systems also typically have return temperatures well below the 120F minimum.
 

Figure 30 illustrates the use of a heat exchanger to connect a CSC 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.

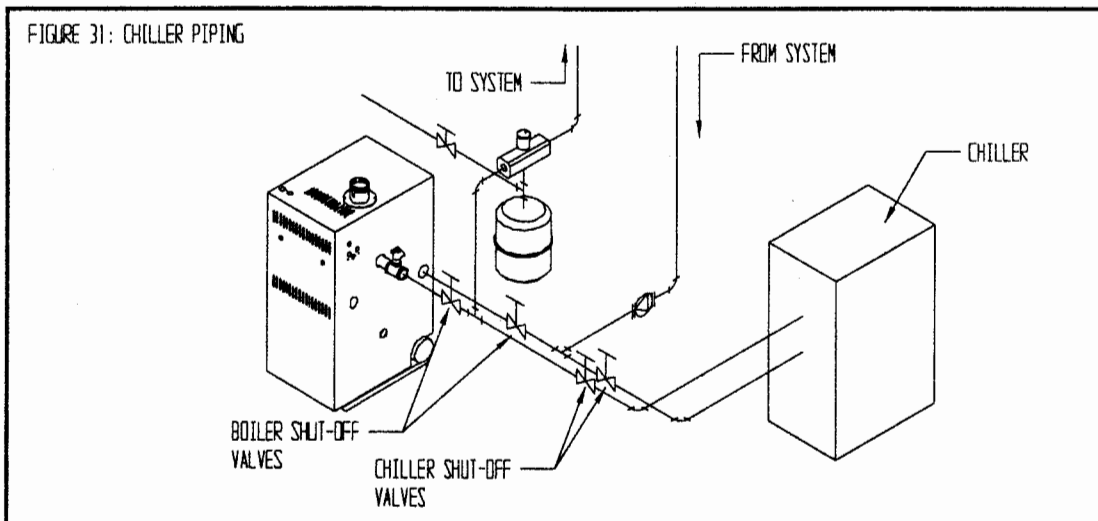
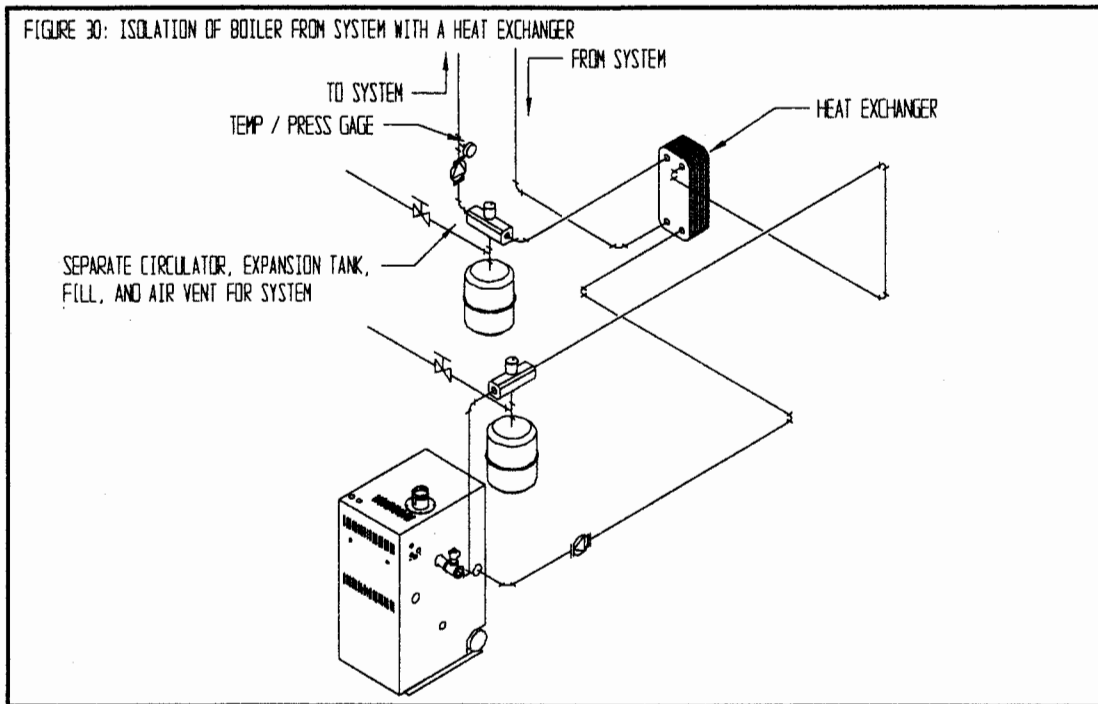
There are several other ways to connect low temperature systems to the non-condensing boilers like the CSC such as four way mixing valve and variable speed injection pumping systems.
- 3) Systems containing oxygen – Many hydronic systems contain enough dissolved oxygen to cause severe corrosion damage to a cast iron boiler such as the CSC. 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 30.



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.

- 4) 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 31. Use isolation valves to prevent chilled water from entering the boiler.
- 5) 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.



## IX Wiring

### WARNING

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

### Single Zone Wiring

1) Line Voltage (120 VAC) Connections (Fig 32) – The line voltage connections are located in the junction box on the right side of the vestibule:

- Black – Line voltage “hot”
- White – “Neutral” for boiler and circulators
- Red – “Heating” circulator “hot”
- Blue – “Indirect Water Heater” circulator “hot” (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 32) – These connections are screw terminals located on the front edge of the relay board:
  - T-T Heat – “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.

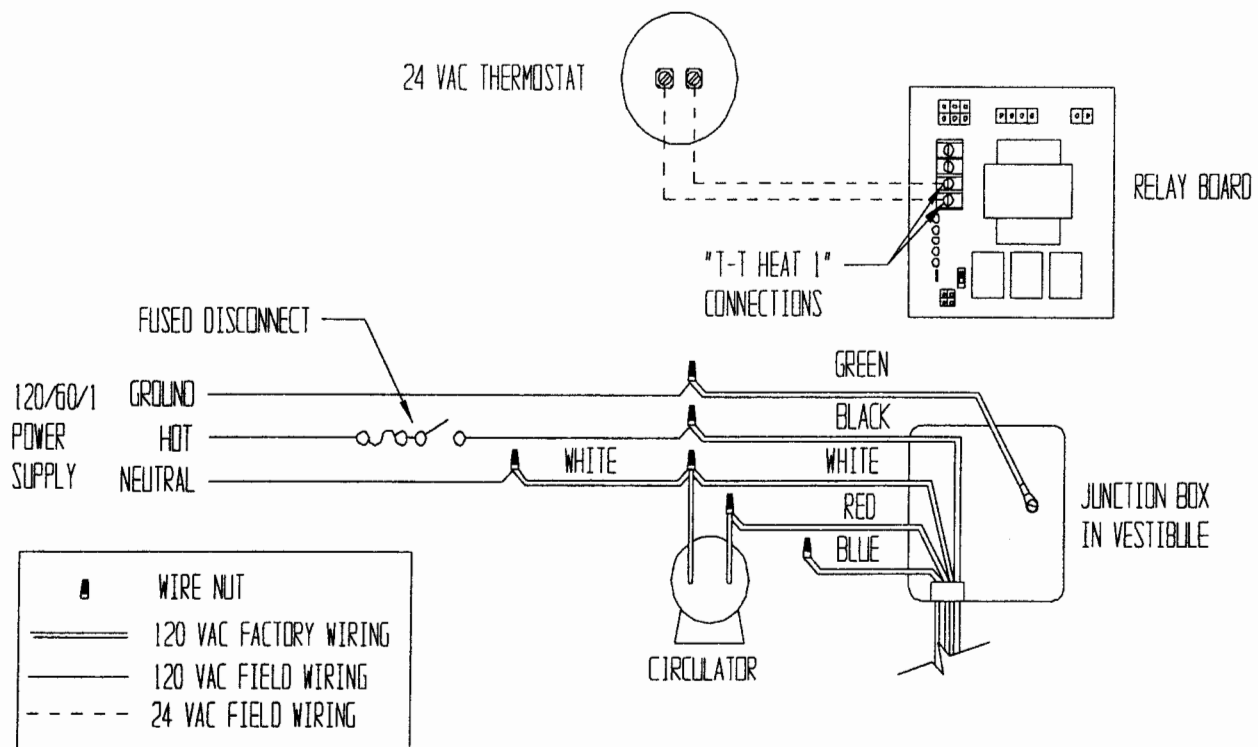
**CAUTION**

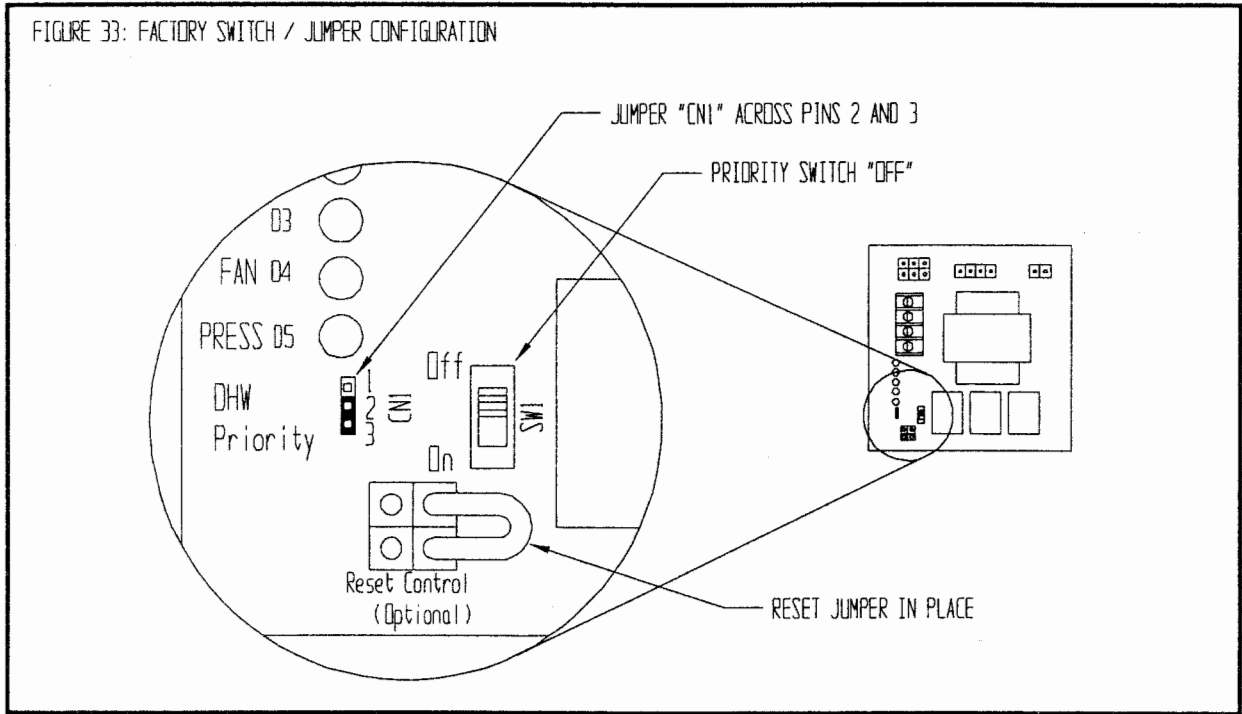
A PROBLEM WITH THE INDIRECT WATER HEATER ZONE COULD RESULT IN A TOTAL LACK OF HEAT AND FREEZE DAMAGE TO THE BUILDING IF THIS SWITCH IS IN THE PRIORITY “ON” POSITION.

- 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.

- 5) Auxiliary Jumpers – Two jumpers are located on the relay board as shown in Figure 33. 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 33.

FIGURE 32: SINGLE ZONE FIELD WIRING





### Wiring Variations

- 1) Two Circulator Zones – Figure 34 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 CSC boiler.
- 2) Hybrid Zone Valve/Circulator Zone System using Honeywell V8043Fs – The system shown in Figure 35 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 CSC boiler as shown in Figure 35. 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.
 

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 CSC 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.
- 3) Three or More Circulator Zones – Additional relays must be used in systems with three or more circulator zones. One less relay is required than the number of circulators to be zoned. In Figure 36, Honeywell R845As are used to control the all but one of the circulators. The “heating” zone circulator connection is not used. A call for heat from either one of the thermostats connected to R845As will start its respective circulator and cause terminals 5 and 6 to make. This will send a call for heat to the “T-T Heat 1” thermostat connections causing the boiler to fire. A call for heat from the “Zone #3” thermostat will energize the “Zone #3” circulator and fire the boiler.

FIGURE 34: TWO CIRCULATOR ZONE FIELD WIRING

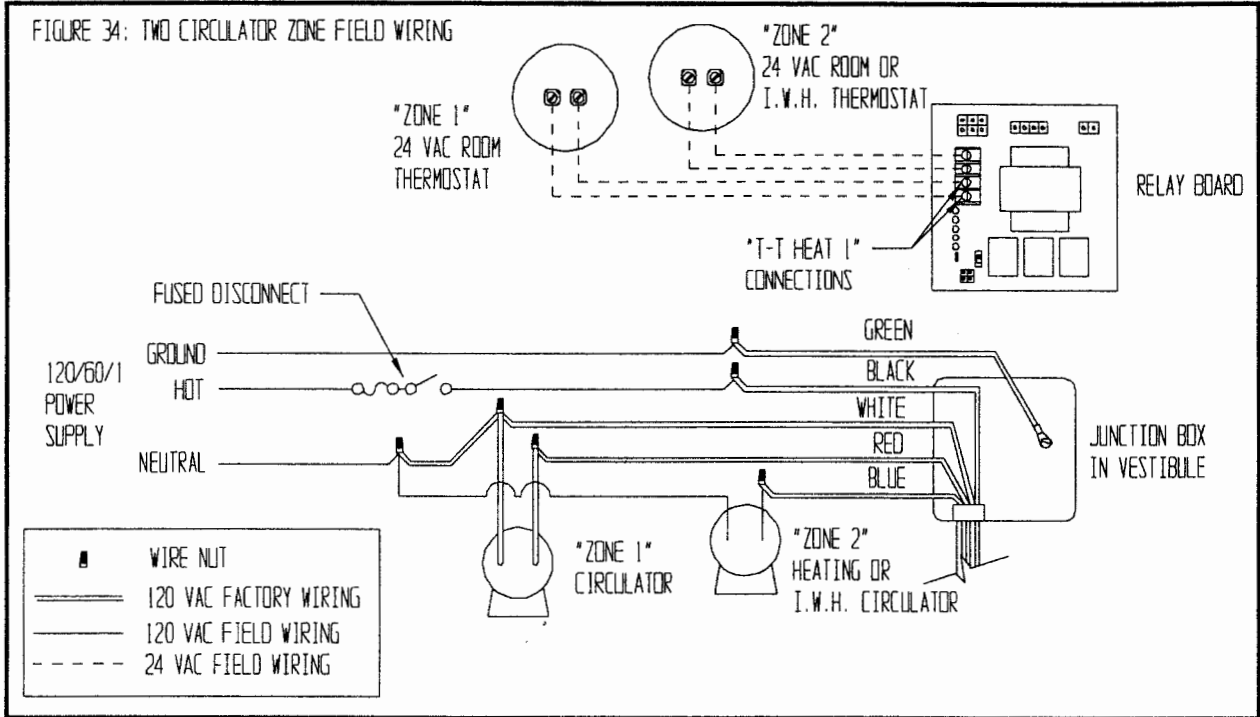
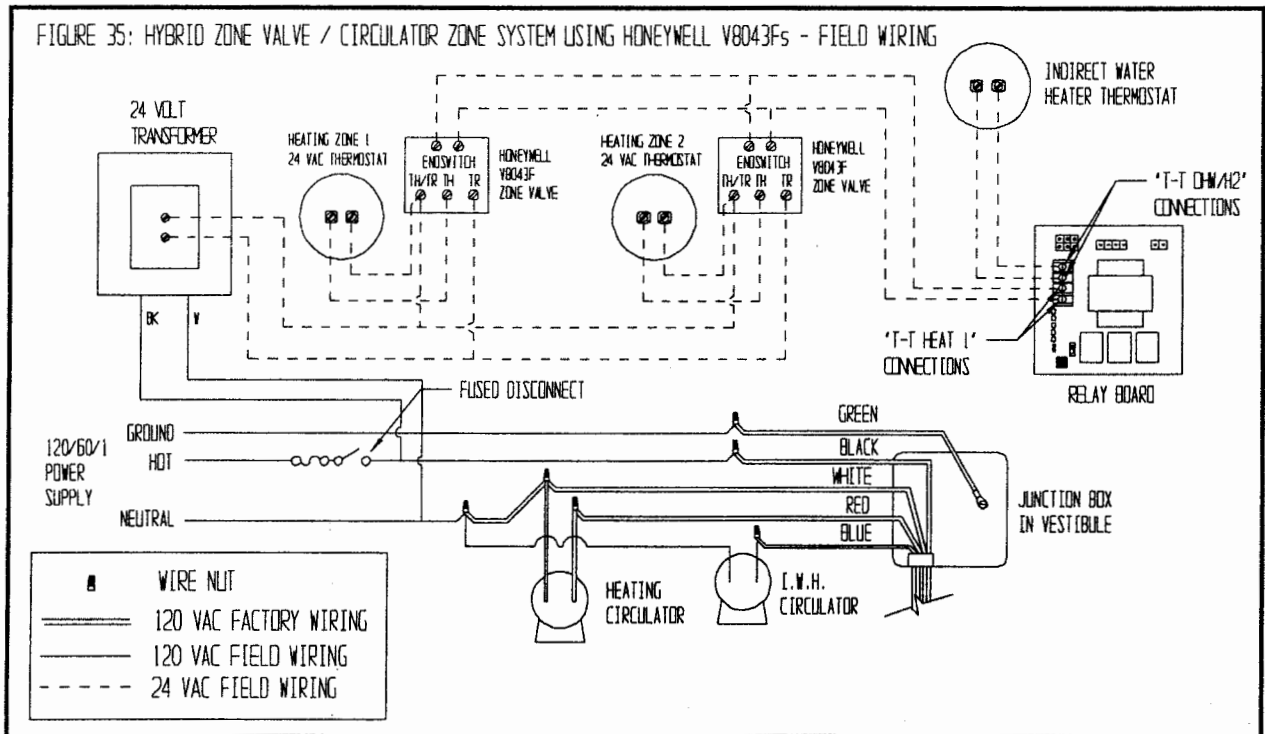
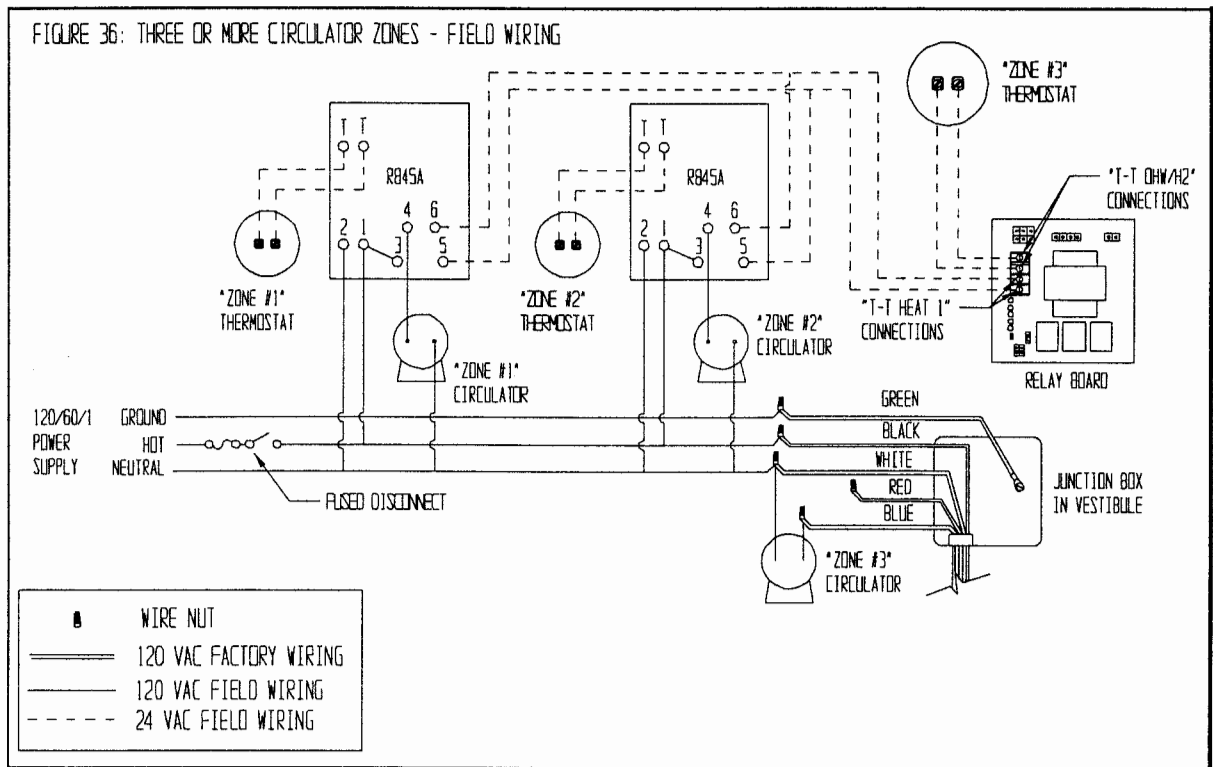


FIGURE 35: HYBRID ZONE VALVE / CIRCULATOR ZONE SYSTEM USING HONEYWELL V8043F5 - FIELD WIRING





### CSC Control System – Sequence of Operation

(Refer to Figures 37, 38, and 39 for CSC 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, both relay coil 3K and the “FAN” LED are energized. This causes contacts 3K1 and 3K2 to make, starting the combustion fan.
- 5) Once the combustion fan has created an adequate pressure differential across the pressure switch, the pressure switch will make. Voltage is then applied across both the “PRESS” LED and the ignition module.
- 6) The red LED on the ignition module will illuminate as soon as voltage appears across the “W” and “C/COM” terminals on the DSI module. The DSI module will then start a 30-second pre-purge period during which nothing will happen.
- 7) After 30 seconds has passed, the DSI module will initiate an ignition spark and apply 24 VAC across the “MV” terminals on the gas valve.
- 8) If main flame is established before the 4 second trial for ignition period has ended, the spark will stop and the main burner will stay lit until the call for heat ends, the high limit switch opens, or the flame signal is lost.
- 9) After 4 seconds the spark will stop but the gas valve will stay open for one additional second. If flame is detected during this last second, the gas valve will stay open as in (8).
- 10) If no flame is detected during the 5-second trial for ignition, the control goes back into the 30 second pre-purge. Steps (7) (8) and (9) are then repeated four more times. If main burner is never established during these 5 tries for ignition, the control goes into a soft lockout, during which the red LED on the module flashes. The DSI module will stay in lockout for 8 hours or until power to the module is interrupted. After 8 hours it will repeat the ignition sequence outlined above.
- 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 trip, breaking one current path to relay coil 1K and energizing the high limit.
- 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 37), 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 N.O. contacts are made.

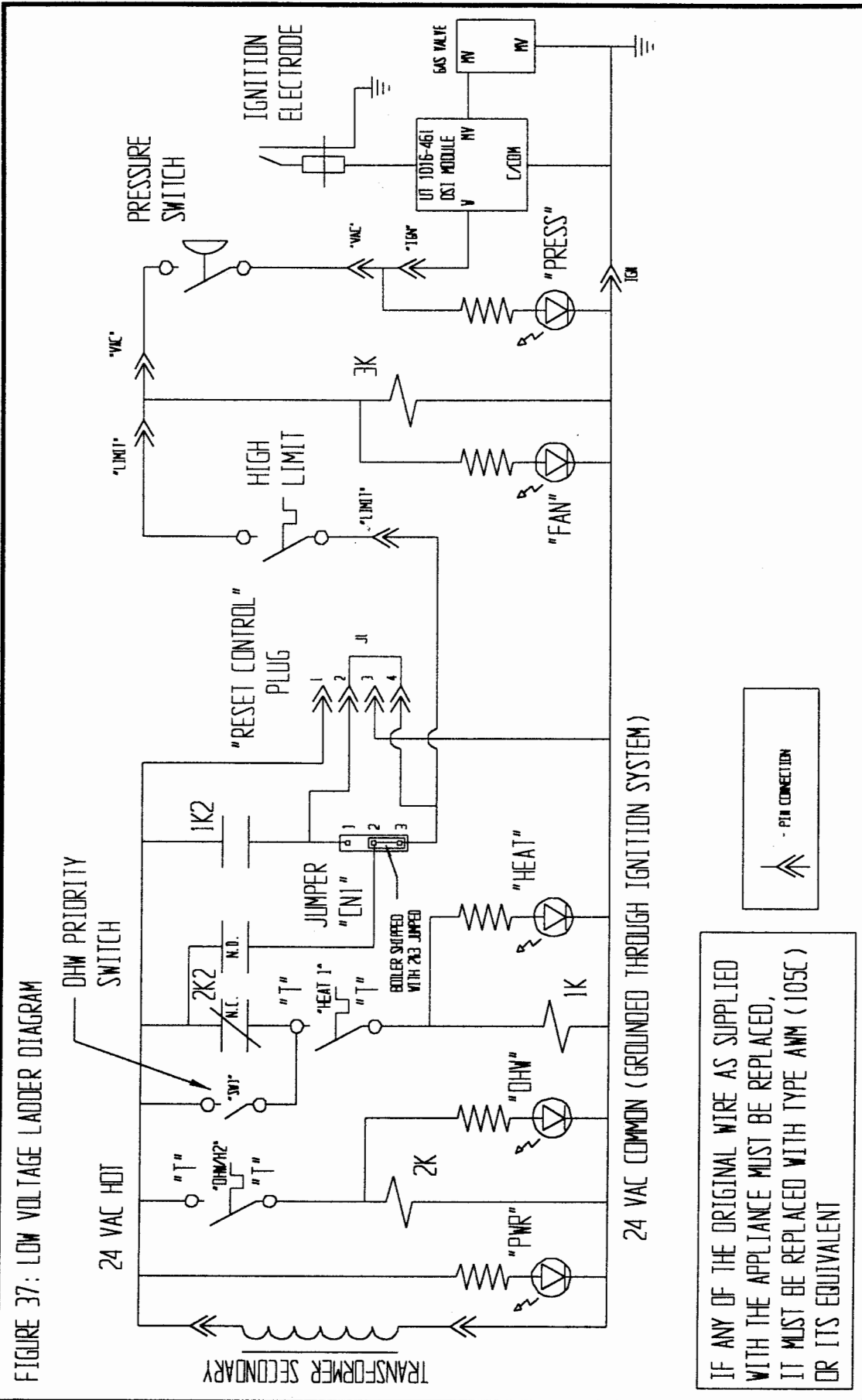
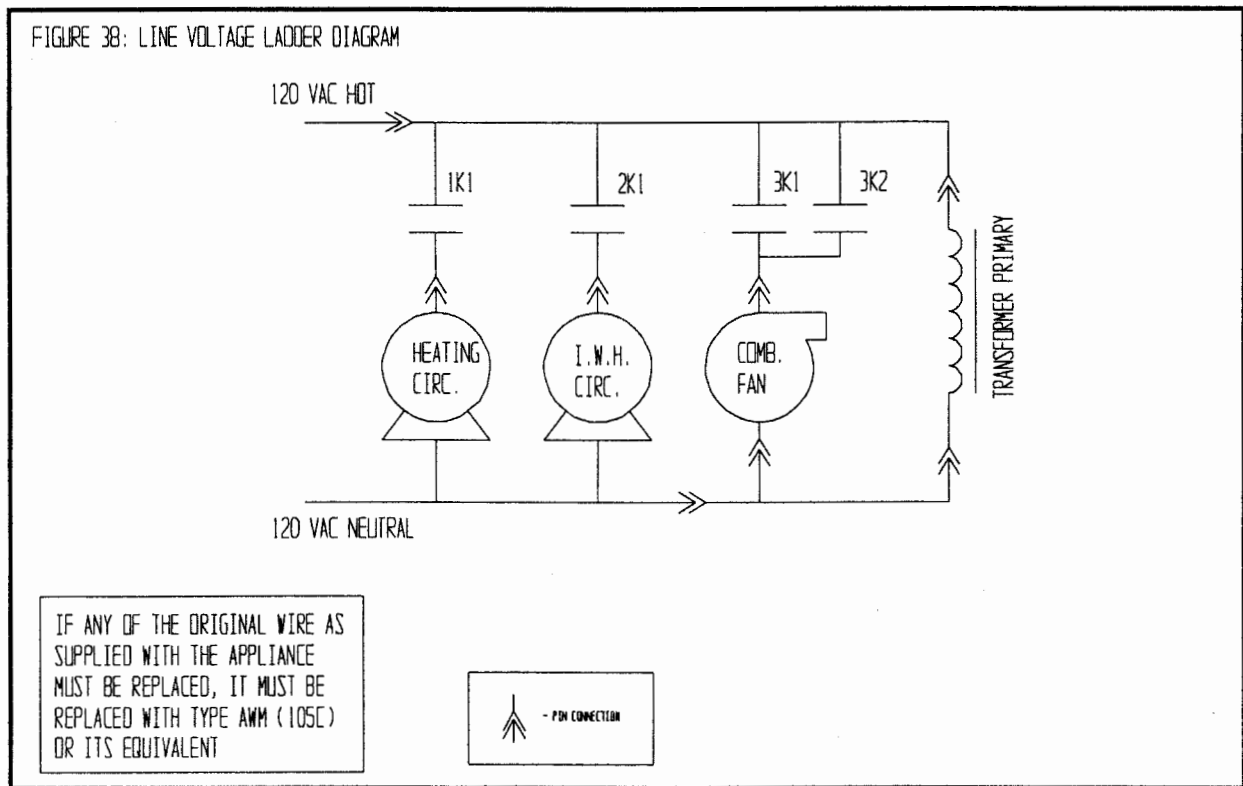


FIGURE 38: LINE VOLTAGE LADDER DIAGRAM



## IX Start-up and Checkout

### NOTE

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

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

- 1) Make sure that the boiler and system are filled with water.

### WARNING

- IF ANTIFREEZE IS USED IN THE SYSTEM, IT MUST BE A NONTOXIC TYPE SUCH AS PROPYLENE GLYCOL.
- NEVER ATTEMPT TO FILL A HOT EMPTY BOILER

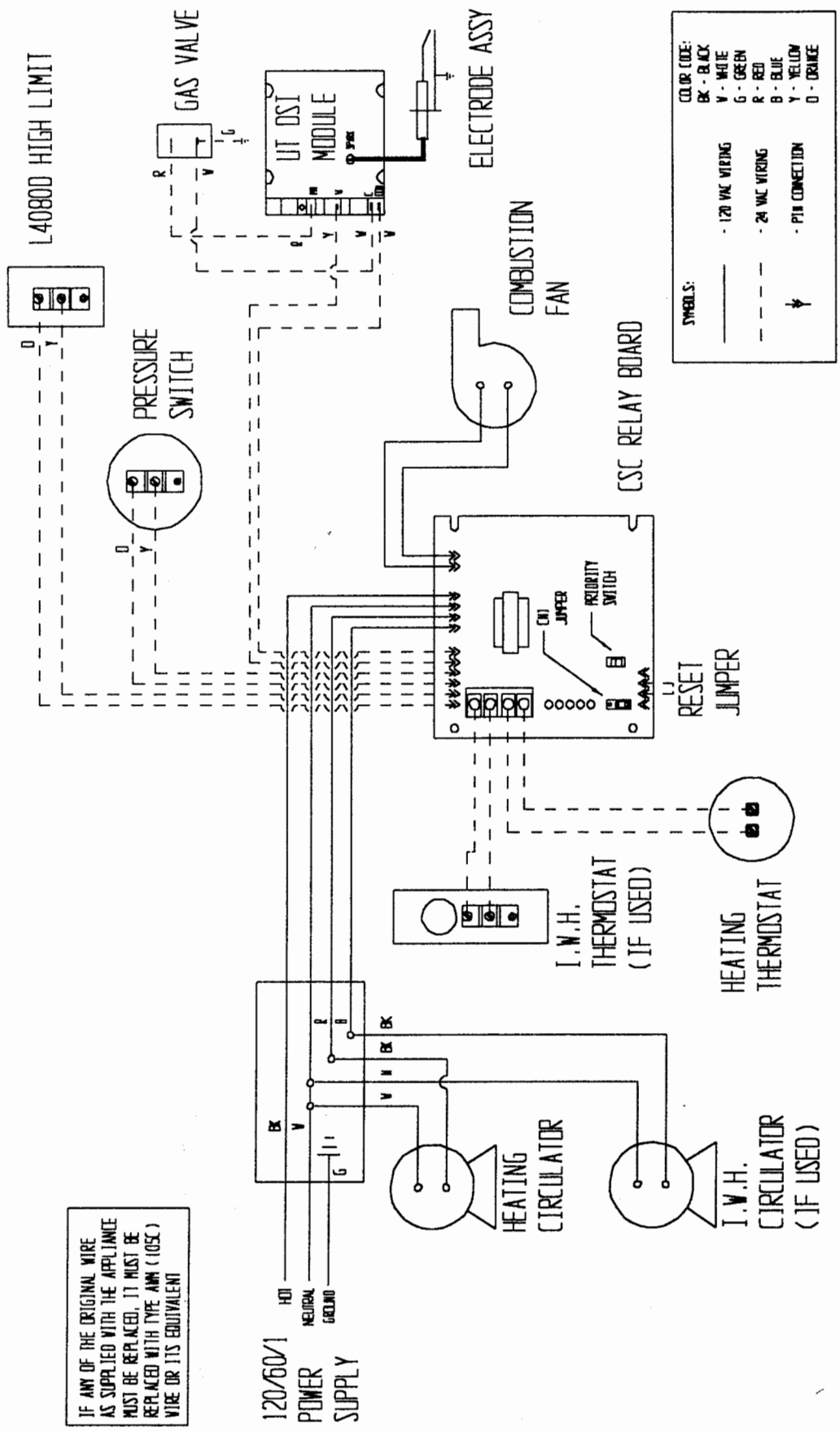
- 2) Check all new piping for leaks and purge piping sections that are filled with air. See Part 4 of the *National Fuel Gas Code* for additional information on testing and purging gas lines.

### WARNING

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

FIGURE 39: CSC INTERNAL CONNECTION DIAGRAM

IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH TYPE ANN (10SC) WIRE OR ITS EQUIVALENT

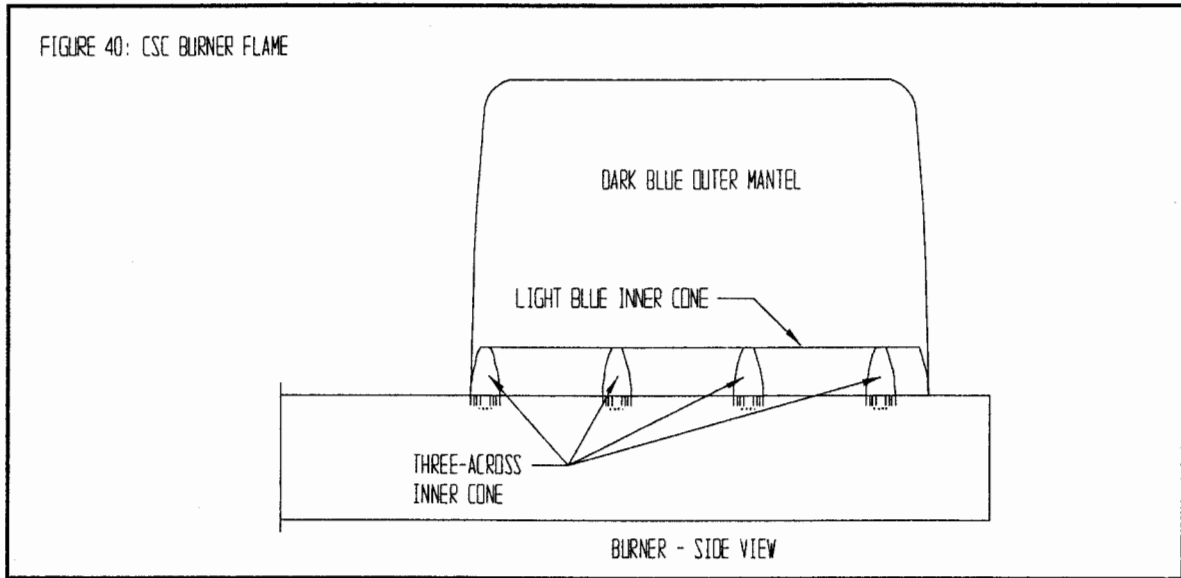


COLOR CODE:		
BK	- BLACK	
V	- WHITE	
G	- GREEN	
R	- RED	
B	- BLUE	
Y	- YELLOW	
O	- ORANGE	

SYMBOLS:		
—	- 120 VAC WIRING	
- - -	- 24 VAC WIRING	
⚡	- PIN CONNECTION	

- 3) Vent system must be complete and free of obstructions before attempting to fire boiler. Make sure that the silicone cure time called for in the vent assembly instructions has passed before firing boiler.
- 4) Inspect all line voltage wiring for loose or uninsulated connections.
- 5) Start the boiler using the lighting instructions on the opposite page.
- 6) 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. If more than five tries for ignition are needed, it will be necessary to momentarily interrupt power to the boiler to reset the ignition control. Once a flame has been established for the first time, subsequent calls for burner operation should result in a flame on the first try.
- 7) Inspect the flame visible through the window. The flame should be stable and mostly blue (Fig. 40). No yellow tipping should be present; however, intermittent flecks of yellow and orange in the flame are normal.



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

**WARNING**

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

- a) Connect a manometer to the line pressure tap on the gas valve
- 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:

Line Press (inches w.c.)	Natural Gas	LP Gas
Min.	5.0	11.0
Max.	14.0	13.0

- c) If the line pressure falls outside of these limits, find and correct the cause of the problem before proceeding further.
- d) Connect a manometer to the manifold pressure tap on the gas valve (Fig. 41a).
- e) Disconnect the silicone regulator tube from the hose barb on the gas valve (Fig. 41b).
- f) Read the manifold pressure. It should be set at:

Manifold Press. (inches w.c.)	Natural Gas	LP Gas
	4.0	8.0



## FOR YOUR SAFETY READ BEFORE LIGHTING

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

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

### WHAT TO DO IF YOU SMELL GAS

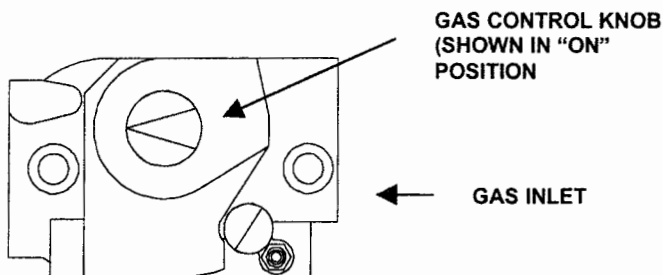
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.



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

- C. Use only your hand to 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 burner. Do not try to light burner by hand.
5. Remove control access panel.



6. Turn 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 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. Turn gas control knob counterclockwise to turn "ON." 
9. Replace control 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 APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove control access panel.
4. Turn gas control knob clockwise to "OFF." Do not force. 
5. Replace control access panel.

- g) If a manifold pressure adjustment is needed, make the adjustment by turning the regulator screw clockwise to raise the pressure and counter clockwise to reduce the pressure (Fig 41a).
- h) If a manifold pressure adjustment is made, repeat steps (a)-(c) to be certain that the line pressure is still within acceptable limits.
- i) Reconnect the regulator tube to the hose barb on the gas valve.
- j) Replace the cover screw on the regulator.
- k) When the regulator cover screw is replaced, the manifold pressure will appear to change. This is because, once the cover has been replaced, the gas valve regulator starts to maintain the correct manifold pressure between the manifold and the combustion chamber, rather than between the manifold and the boiler room. This apparent change in manifold pressure is not a cause for concern as long as the above procedure has been followed.

**NOTE**

IF CO OR CO<sub>2</sub> READINGS ARE TAKEN, BE CERTAIN THAT THE GAS VALVE TUBE IS CONNECTED AND THE REGULATOR COVER SCREW IS IN PLACE BEFORE TAKING A FLUE GAS SAMPLE.

**WARNING**

FAILURE TO REPLACE THE REGULATOR SCREW COVER OR RECONNECT THE TUBING BETWEEN THE GAS VALVE AND THE INTAKE BOX COULD RESULT IN INPROPER GAS PRESSURE REGULATION AND A CARBON MONOXIDE HAZARD

- 9) Before disconnecting the manometer from the manifold pressure tap, perform a test of the flame supervision system. To do this:
  - a) While the boiler is operating, turn the knob on the gas valve to the "off" position.
  - b) Wait 5 seconds and turn the knob back to the "on" position.
  - c) The manifold pressure should remain at zero until the next try for ignition, approximately 30 seconds after the valve was initially closed.
- 10) Allow the boiler temperature to increase to the high limit setting. Confirm that the high limit shuts down the burner.
- 11) Pinch or disconnect the pressure switch tube that is connected to the fan. The burner should go out after a few seconds.
- 12) Confirm that the thermostat/s cycle the burner and appropriate circulators
- 13) After the boiler has operated for approximately 30 minutes, check the boiler and heating system piping for leaks. Repair any leaks found at once.
- 14) Inspect the vent system for flue gas leaks. Repair any leaks found before leaving the boiler in operation.

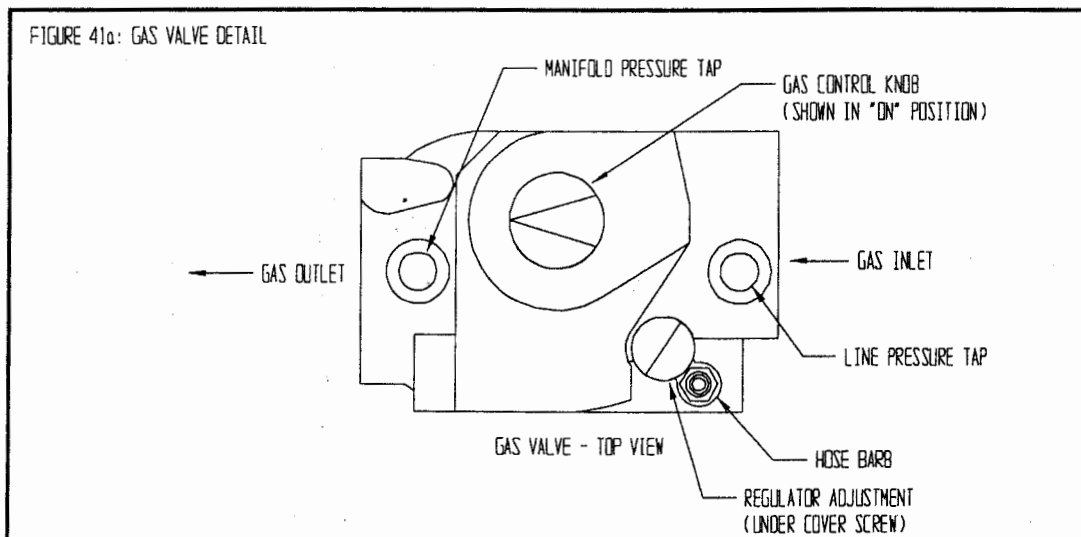
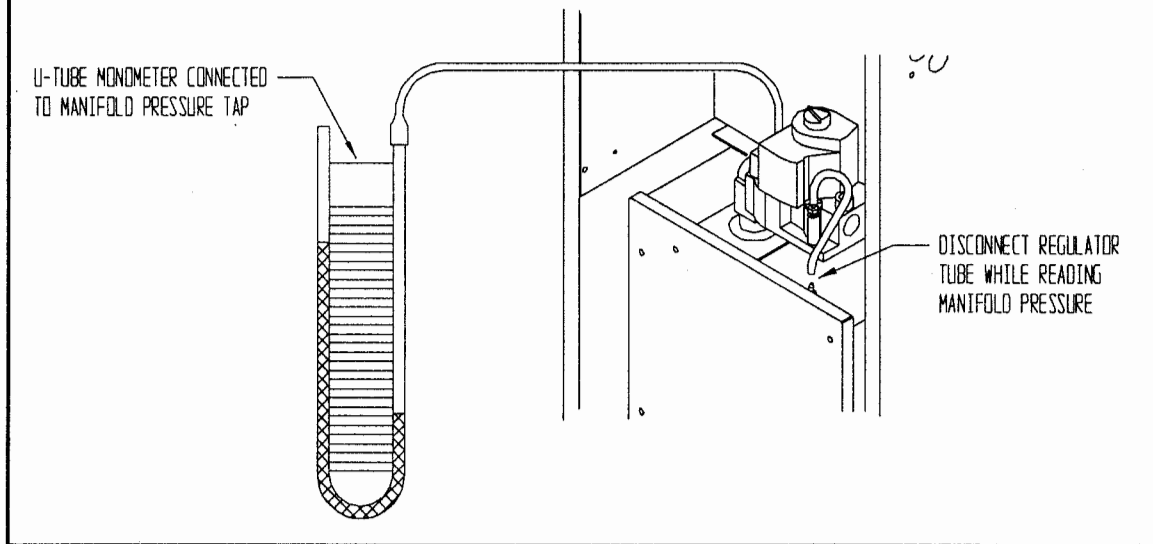


FIGURE 41b: READING MANIFOLD PRESSURE



## X Service and Maintenance

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

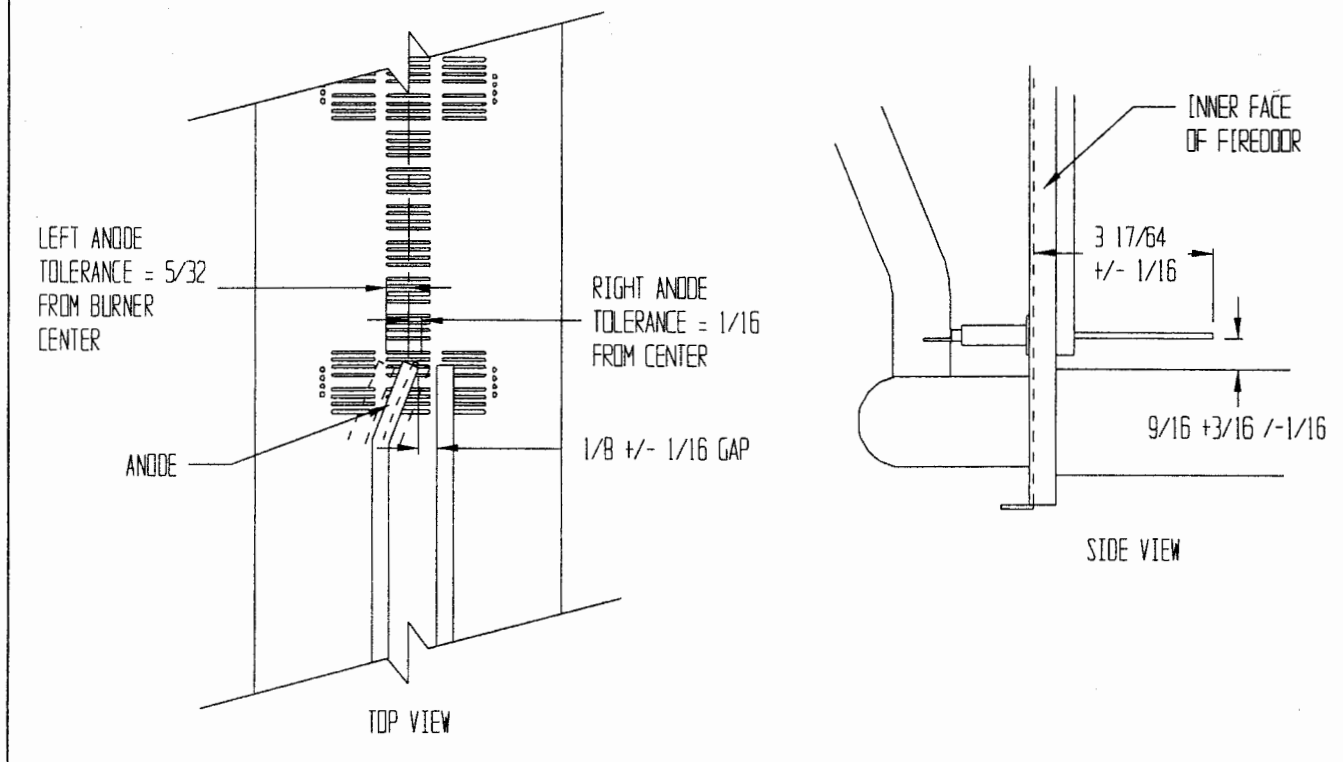
- 1) Turn off power to the boiler
- 2) Remove the burner tray from the boiler. To do this:
  - a) Remove the intake cover.
  - b) Remove the four allen screws holding the elbow flange onto the gas valve.
  - c) Remove the three 8-32 screws holding the manifold gasket plate to the intake box
  - d) Remove the four ¼-20 nuts holding the burner assembly in the boiler
  - e) Disconnect the ignition wire from the electrode.
  - 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 procedure on page 44.
- 4) Remove any debris found in the combustion chamber
- 5) Inspect and clean the burners. Make sure that all burner ports are free of obstructions. If burners show signs of deterioration, they should be replaced. Some discoloration around the burner ports is normal.
- 6) Inspect the electrode. Electrode tips should be as shown in Figure 42. Inspect the porcelain for cracks or other deterioration. Replace electrode assembly if deterioration is found.

### DANGER

- IF ELECTRODE MUST BE REPLACED, USE ONLY AN ELECTRODE ASSEMBLY APPROVED BY CROWN BOILER COMPANY FOR USE WITH THIS BOILER.
- IF THE IGNITION MODULE MUST BE REPLACED USE ONLY A UNITED TECHNOLOGIES MODEL 1016-461 OR OTHER MODULE SPECIFICALLY APPROVED BY CROWN BOILER COMPANY FOR USE ON THE CSC BOILER. MAXIMUM TRIAL FOR IGNITION IS 4 SECONDS.

- 7) Inspect the insulation in the front and back firedoors for deterioration. Hairline cracks in the insulation are normal. These cracks are not a problem as long as the insulation is otherwise intact.
- 8) Reinstall the burner assembly.
- 9) Inspect the ignition wire for damage. Replace if necessary.
- 10) Inspect all boiler wiring for loose connections or deterioration.

FIGURE 42: ELECTRODE POSITION



**CAUTION**

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

- 11) Inspect the pressure switch hoses for deterioration. Clean out any condensate or other blockage found in these tubes
- 12) Replace the intake cover.
- 13) Disconnect the vent system from the boiler using the four 10-32 screws in the vent collar. Inspect the blower wheel and fan housing for corrosion damage. If damage is found, replace the fan assembly.
- 14) Inspect the vent system:
  - a) Make sure that both the inlet and exhaust terminals are free of obstructions.
  - b) Make sure that all vent system supports are intact.
  - c) If inside air is used for combustion make sure that the air inlet screen is clear and that there are no objects or other obstructions within 6" of the vent terminal.
  - d) Inspect joints for signs of condensate or flue gas leakage.
  - e) If the vent system contains a condensate trap, make sure that the trap is in good condition and clear of blockages.
- 15) Inspect the boiler and hydronic system for leaks. Some CSC boilers have flanged supply and return connections. These flanges are under the right side jacket panel. They may be inspected by removing the top or rear jacket panel. Three  $3/4$  inch plugs are located under the left side jacket. These should also be inspected periodically for leaks.

**CAUTION**

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

- 16) Place the boiler back in operation using the procedure outlined in "Start-up".

## Heat Exchanger Cleaning Procedure

- 1) Turn off power to the boiler
- 2) Disconnect the vent system from the boiler by removing the four 10-32 screws holding the vent collar in place
- 3) Remove the top jacket panel. If possible, remove the rear and left side jacket panels
- 4) Unplug the fan and remove the fan cover plate
- 5) Disconnect the pressure switch hoses
- 6) Remove the burner assembly (see (2) on page 42).
- 7) Remove the two ¼-20 nuts and washers holding the flue collector onto the heat exchanger.
- 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) Clean the flue passageways using a stiff bristle brush. Be certain that all foreign material is removed from the gaps between the fins
- 11) Clean the bottom surfaces of the heat exchanger
- 12) Put a light in the combustion chamber and look through the flue passages from the top to verify that they have been thoroughly cleaned.
- 13) Apply a heavy (1/4") bead of silicone with a temperature rating of at least 400F around the perimeter of the heat exchanger.
- 14) 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.
- 15) Replace the ¼-20 nuts and washers that hold down the flue collector
- 16) Apply a bead of silicone around the outside of the joint between the heat exchanger and the flue collector.
- 17) Reattach all the jacket components except for the fan cover plate
- 18) Reconnect the "positive" pressure switch tube to the flue collector (Fig 43)
- 19) Install the fan cover plate
- 20) Connect the fan to the relay board and reconnect the "negative" pressure switch tube (Fig. 43).
- 21) Reconnect the vent system.

### WARNING

SOOT DEPOSITS IN THE FLUE PASSAGES ARE A SIGN THAT THE BOILER MAY BE OPERATING AT HIGH CARBON MONOXIDE LEVELS. AFTER CLEANING THE BOILER OF SOOT DEPOSITS, CHECK BOTH CO AND CO2 LEVELS IN THE VENT BEFORE LEAVING THE BOILER IN OPERATION. CO AND CO2 READINGS SHOULD BE BELOW THE MAXIMUM LIMITS SHOWN IN TABLE 8.

### Service Notes

- 1) Measuring CO and CO2 – If it is necessary to check CO or CO2, the best place to take a gas sample will usually be at the vent terminal. Table 8 shows typical and maximum readings for CO and CO2 on both natural and LP gas. Do not leave the boiler in operation if the either the CO or CO2 exceeds the maximum limit in this table. Some causes of excessive CO or CO2 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 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

TABLE 8: TYPICAL AND MAXIMUM  
ACCEPTABLE CO<sub>2</sub> AND CO READINGS IN FLUE  
GAS

	NATURAL GAS	LP GAS
TYPICAL CO <sub>2</sub> (%)	8.0	9.5
MAXIMUM CO <sub>2</sub> (%)	9.5	11.0
TYPICAL CO (PPM)	20	20
MAX. CO (PPM)	70	70

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

Natural Gas – 2.30mm  
LP Gas – 1.55 mm

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.**

- 3) 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

- 4) Pressure Switch – This boiler is equipped with a differential pressure switch. The positive side of the switch is connected to the flue collector. The negative side of the switch is connected to the fan housing. The pressure at both tappings is actually below atmospheric (“negative”) with the fan tapping being the more negative of the two pressures.

Figure 43b shows the correct method of reading the pressure across these two tappings. Greater combustion air/flue gas flow will result in a greater pressure differential. The pressure switch electrical contacts on this boiler are set to open as the pressure drops past the following settings:

CSC-50 to CSC-150: 1.86 +/- 0.06 inches w.c.  
CSC-175, CSC-200: 2.06 +/-0.06 inches w.c.

The differential for both switches is 0.07 inches w.c. These are sea level pressure switch settings. Consult your Crown representative for possible variations in settings at altitudes over 2000ft.

FIGURE 43a: PRESSURE SWITCH CONNECTIONS

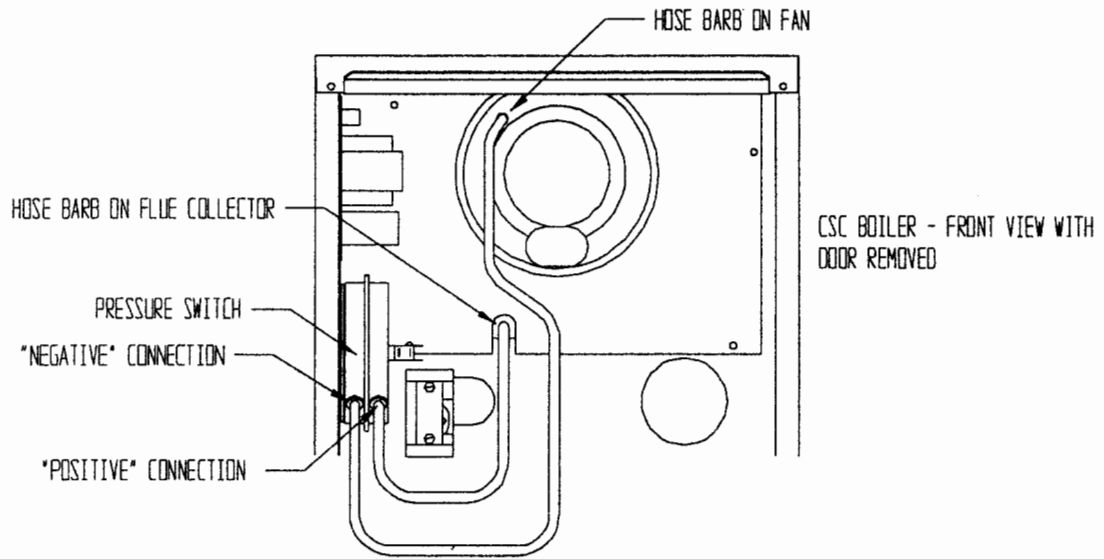
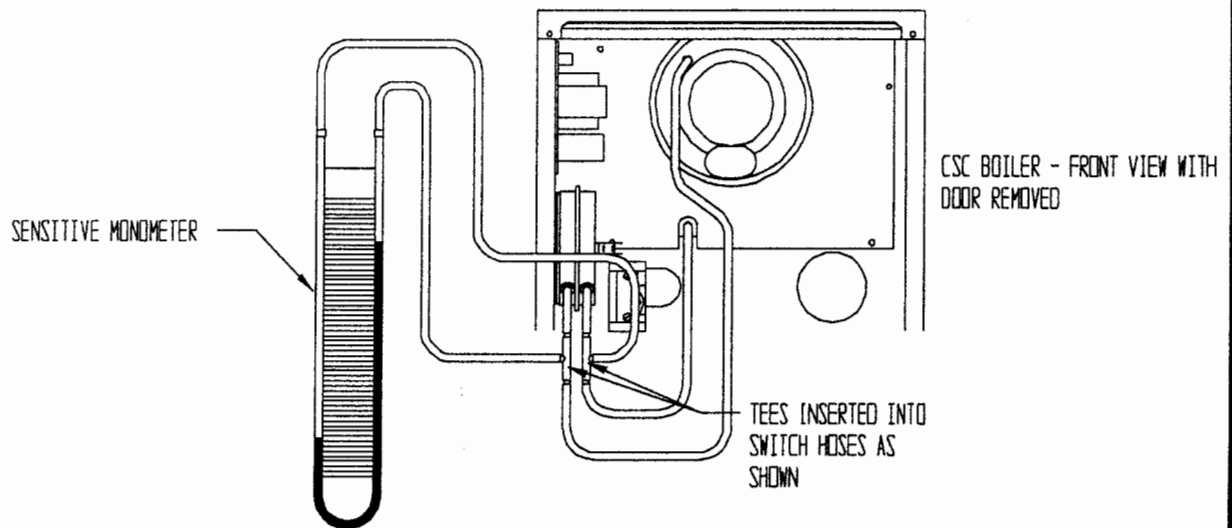


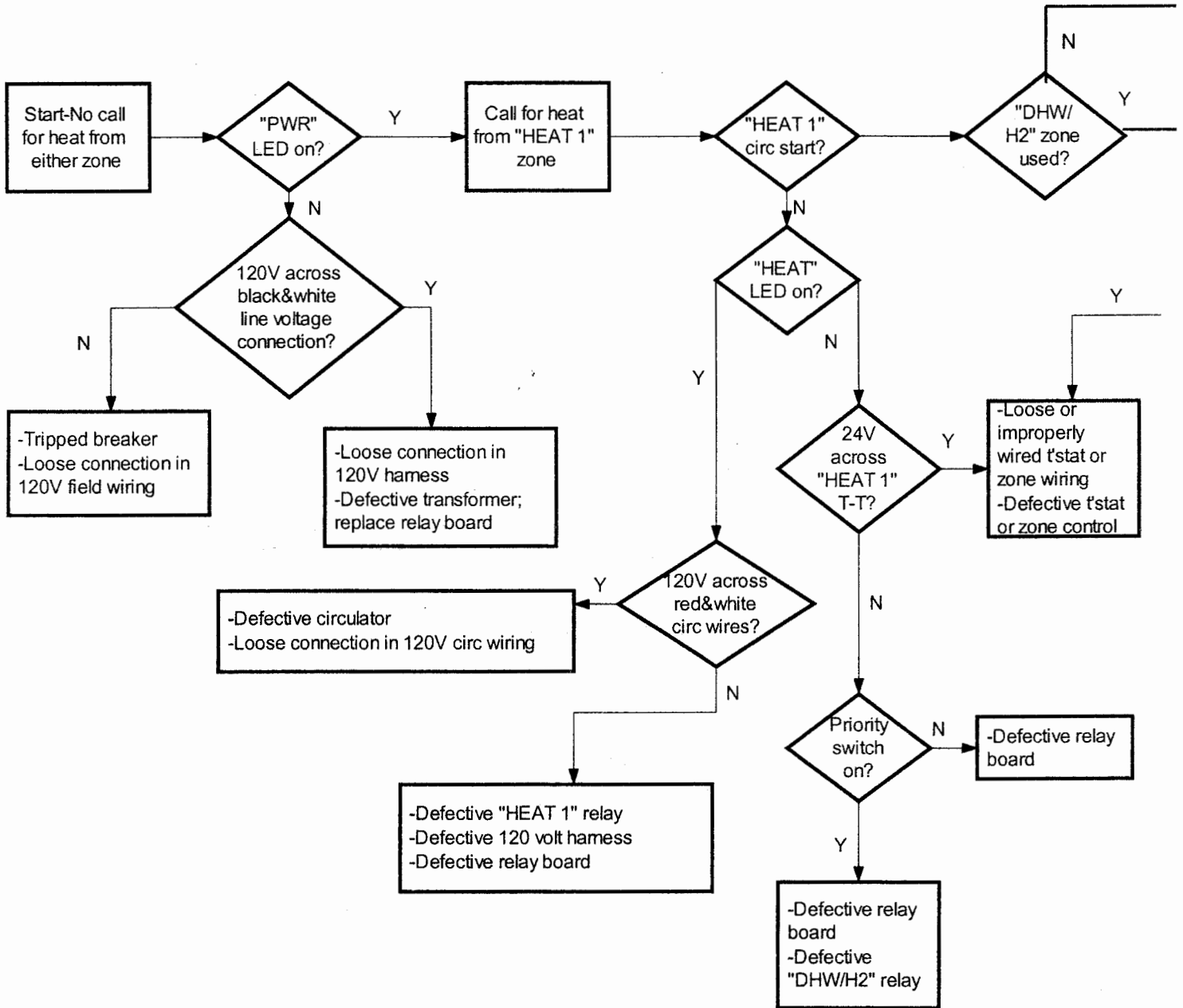
FIGURE 43b: CHECKING PRESSURE ACROSS PRESSURE SWITCH

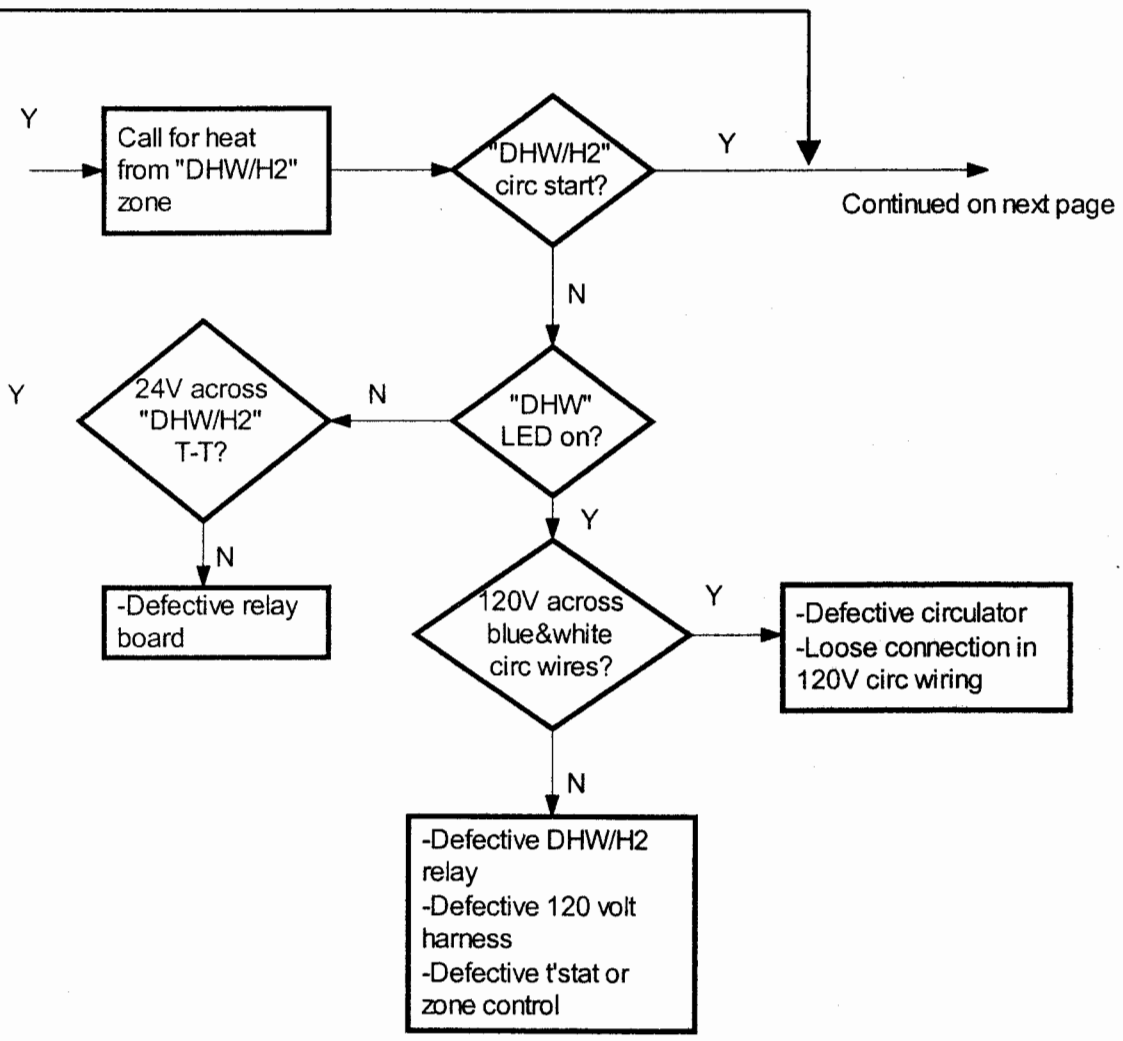


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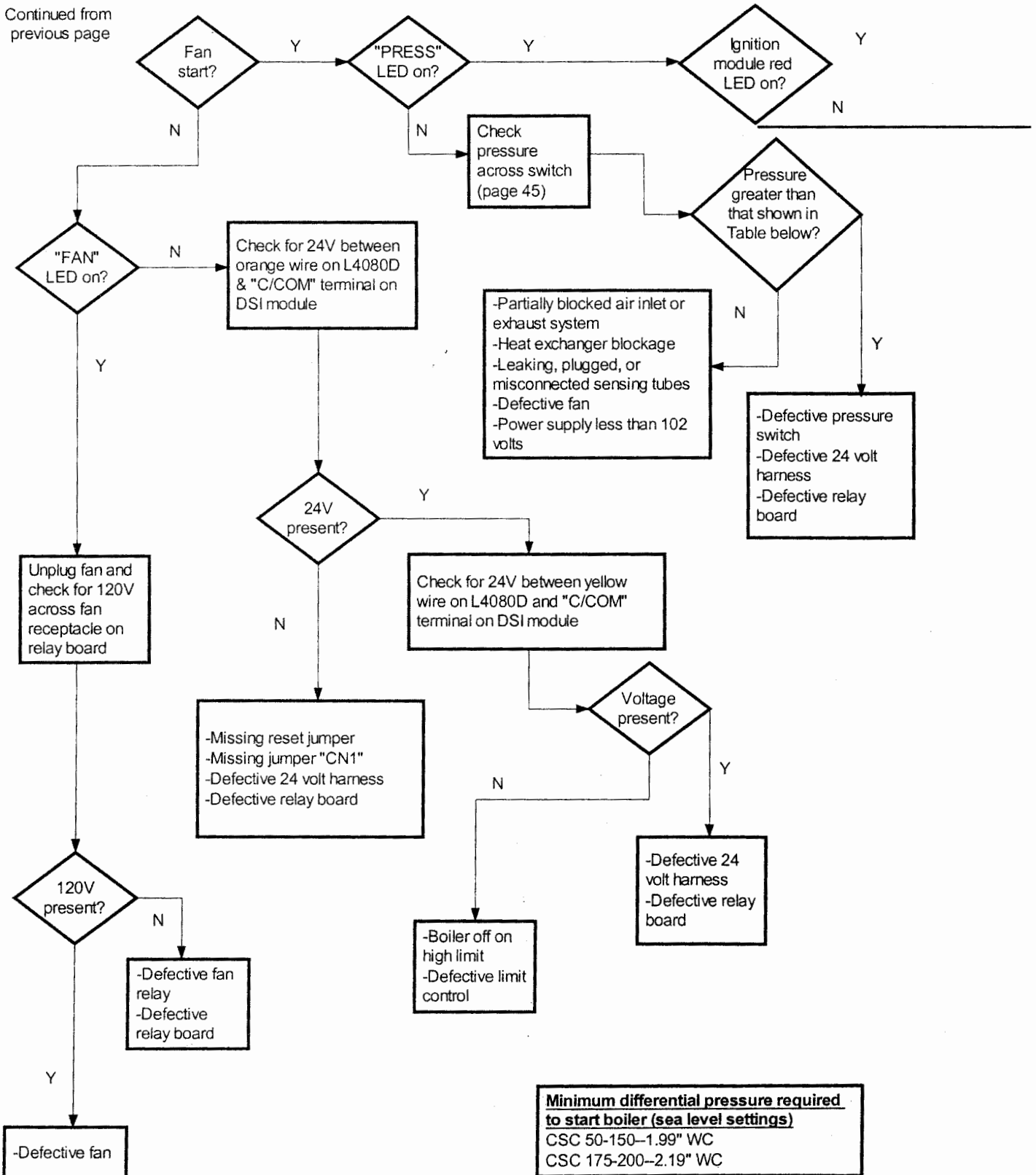


# TROUBLESHOOTING

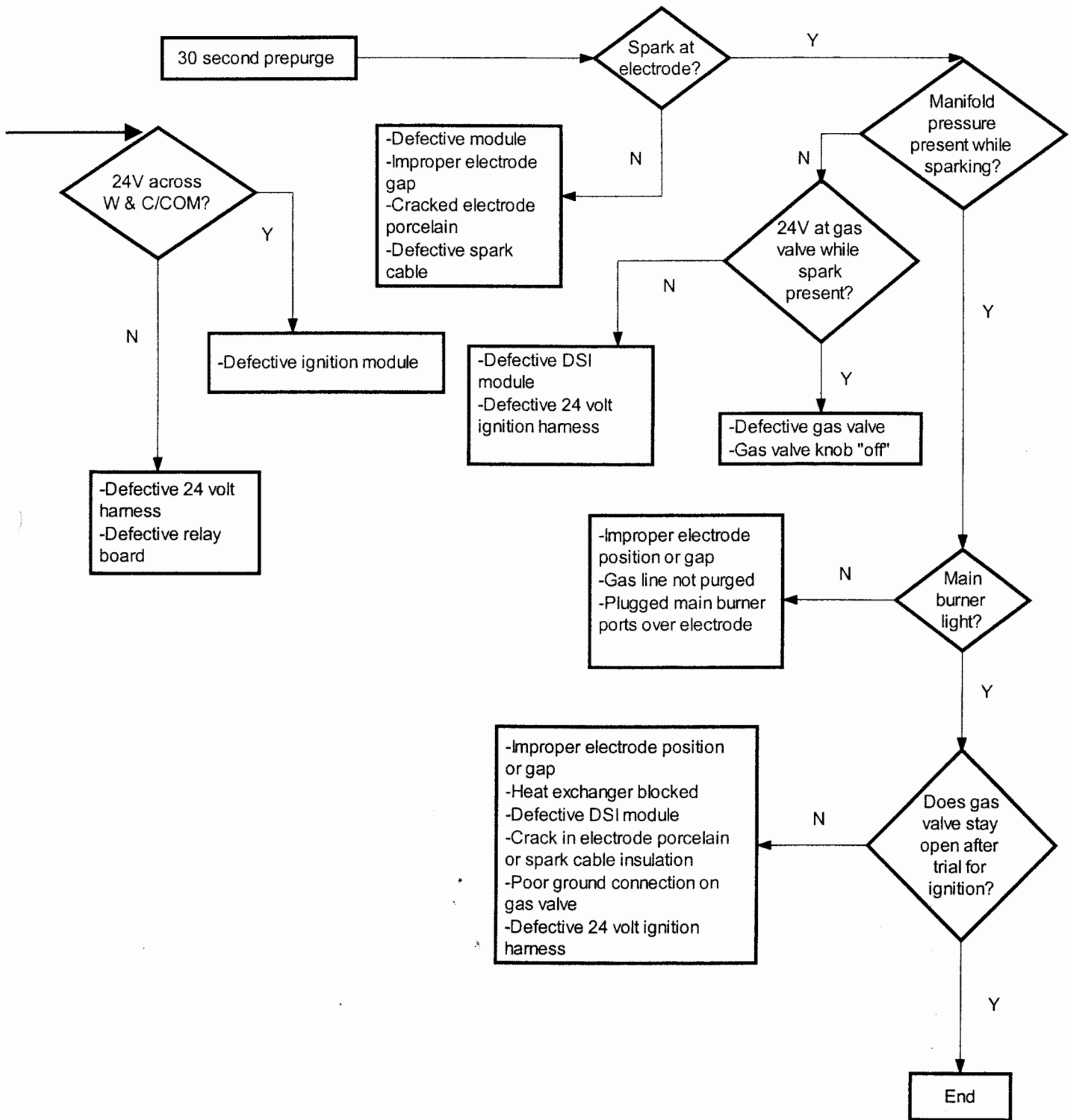




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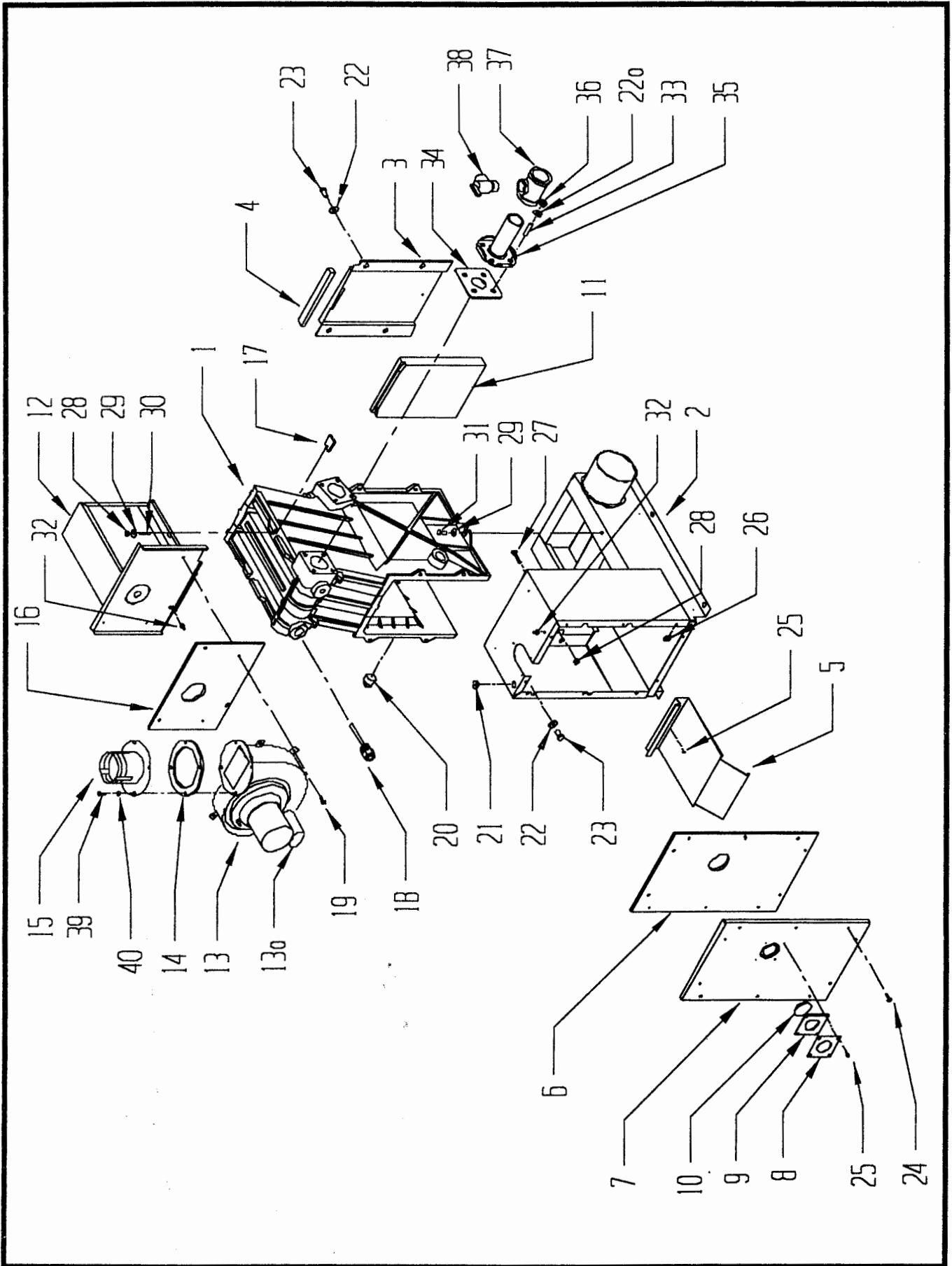
**Minimum differential pressure required to start boiler (sea level settings)**  
 CSC 50-150--1.99" WC  
 CSC 175-200--2.19" WC



## PARTS

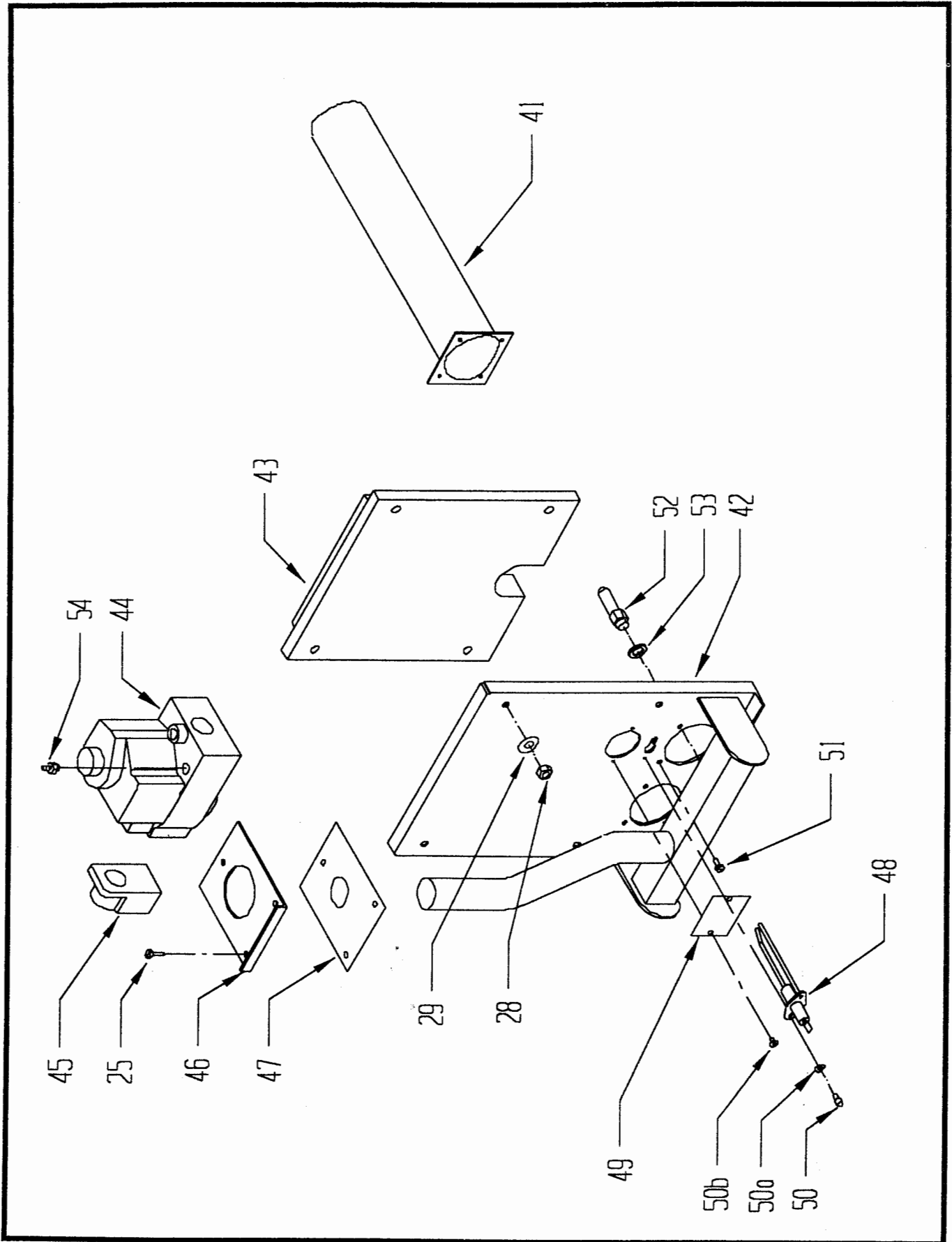
KEY #	DESCRIPTION	QTY. OR CROWN P.N.	QUANTITY PER BOILER OR CROWN P.N.						
			50	75	100	125	150	175	200
1	COMPLETE BLOCK ASSY.	1 ea.	60-013	60-014	60-015	60-016	60-017	60-018	60-019
N.A.	LEFT END SECTION	60-011	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
N.A.	RIGHT END SECTION	60-012	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
N.A.	INTERMEDIATE SECTION	60-006	1 ea.	2 ea.	3 ea.	4 ea.	5 ea.	6 ea.	7 ea.
N.A.	PUSHNIPPLE	60-000	4 ea.	6 ea.	8 ea.	10 ea.	12 ea.	14 ea.	16 ea.
2	BASE ASSEMBLY	1ea.	60-113	60-114	60-115	60-116	60-117	60-118	60-119
3	REAR FIREDOOR	1ea.	60-203	60-204	60-205	60-206	60-207	60-208	60-209
4	REAR FIREDOOR GASKET	90-046	0.7 ft	0.9 ft	1.1 ft	1.4 ft	1.6 ft	1.8 ft	2.1 ft
5	CHAMBER FLOOR	1 ea.	60-223	60-224	60-225	60-226	60-227	60-228	60-229
6	INTAKE COVER INSULATION	1 ea.	60-613	60-614	60-615	60-616	60-617	60-618	60-619
7	INTAKE COVER	1 ea.	60-213	60-214	60-215	60-216	60-217	60-218	60-219
8	SIGHT GLASS FRAME	60-055	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
9	SIGHT GLASS GASKET	60-056	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
10	SIGHT GLASS	60-052	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
11	REAR FIREDOOR INSULATION	1 ea.	60-533	60-534	60-535	60-536	60-537	60-538	60-539
12	FLUE COLLECTOR ASSY.	1 ea.	60-123	60-124	60-125	60-126	60-127	60-128	60-129
13	FAN ASSY.	60-001	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
13a	REPLACE. FAN CAPACITOR	60-003	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
14	COLLAR GASKET	60-600	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
15	VENT COLLAR	1 ea.	60-603	60-603	60-603	60-603	60-603	60-604	60-604
16	FAN GASKET	60-002	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
17	FLUE COLLECTOR LUG	60-501	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
18	HIGH LIMIT WELL	35-1010	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
19	#10 X 3/4 SHEET METAL SCREW	90-054	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.
20	3/4 NPT PLUG	95-048	3 ea.	3 ea.	3 ea.	3 ea.	3 ea.	3 ea.	3 ea.
21	SPARK CABLE GROMMET	60-005	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
22	3/8" SAE FLAT WASHER	90-060	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.
22a	3/8" USS FLAT WASHER (*)	90-036	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.
23	3/8-16 X 3/4" CAP SCREW	90-035	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.
24	10-24 X 3/4 H.W.H SCREW	90-218	10 ea.	10 ea.	12 ea.	12 ea.	12 ea.	12 ea.	12 ea.
25	8-32 X 1/2" "F" SELF TAP SCREW	90-223	14 ea.	14 ea.	14 ea.	14 ea.	14 ea.	14 ea.	14 ea.
26	10-24 TINNERMAN NUT	90-217	10 ea.	10 ea.	12 ea.	12 ea.	12 ea.	12 ea.	12 ea.
27	1/4-20 X 1 1/4" TAP BOLT	90-214	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.
28	1/4-20 NUT	90-202	10 ea.	10 ea.	10 ea.	10 ea.	10 ea.	10 ea.	10 ea.
29	1/4" USS FLAT WASHER	90-215	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.
30	1/4-20 X 1 1/4" STUD	90-216	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
31	1/4-20 X 3/4" CAP SCREW	90-213	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
32	10-32 X 1/8 I.D. HOSE BARB	90-222	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
N.A.	10-32 SS NUT (USE WITH 90-222)	90-219	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
33	3/8-16 X 1 1/2" STUD (*)	90-220	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.
34	FLANGE GASKET (*)	60-401	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
35	FLANGE (*)	60-400	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
36	3/8-16 NUT (*)	90-221	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.	8 ea.
37	1 1/4 X 1 1/4 X 3/4 BLK TEE	95-100	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
38	3/4" ASME RELIEF VALVE	95-040	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
39	10-32 X 1/2" R.H. SCREW	90-058	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.
40	#10 FLAT WASHER	90-057	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.	4 ea.
N.A.	10.1 oz TUBE SILICONE SEALANT (FOR BOILER JOINTS ONLY)	90-045	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
N.A.	AIR INLET SCREEN	60-601	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.

\* Approximately 600 of the first CSC boilers are equipped with the supply and return flanges shown. Subsequent boilers will have blocks tapped 1 1/4" NPT and the above astrixed flanges, flange gaskets, 3/8 studs and 3/8 nuts have been replaced with 1 1/4" NPT nipples.



## PARTS

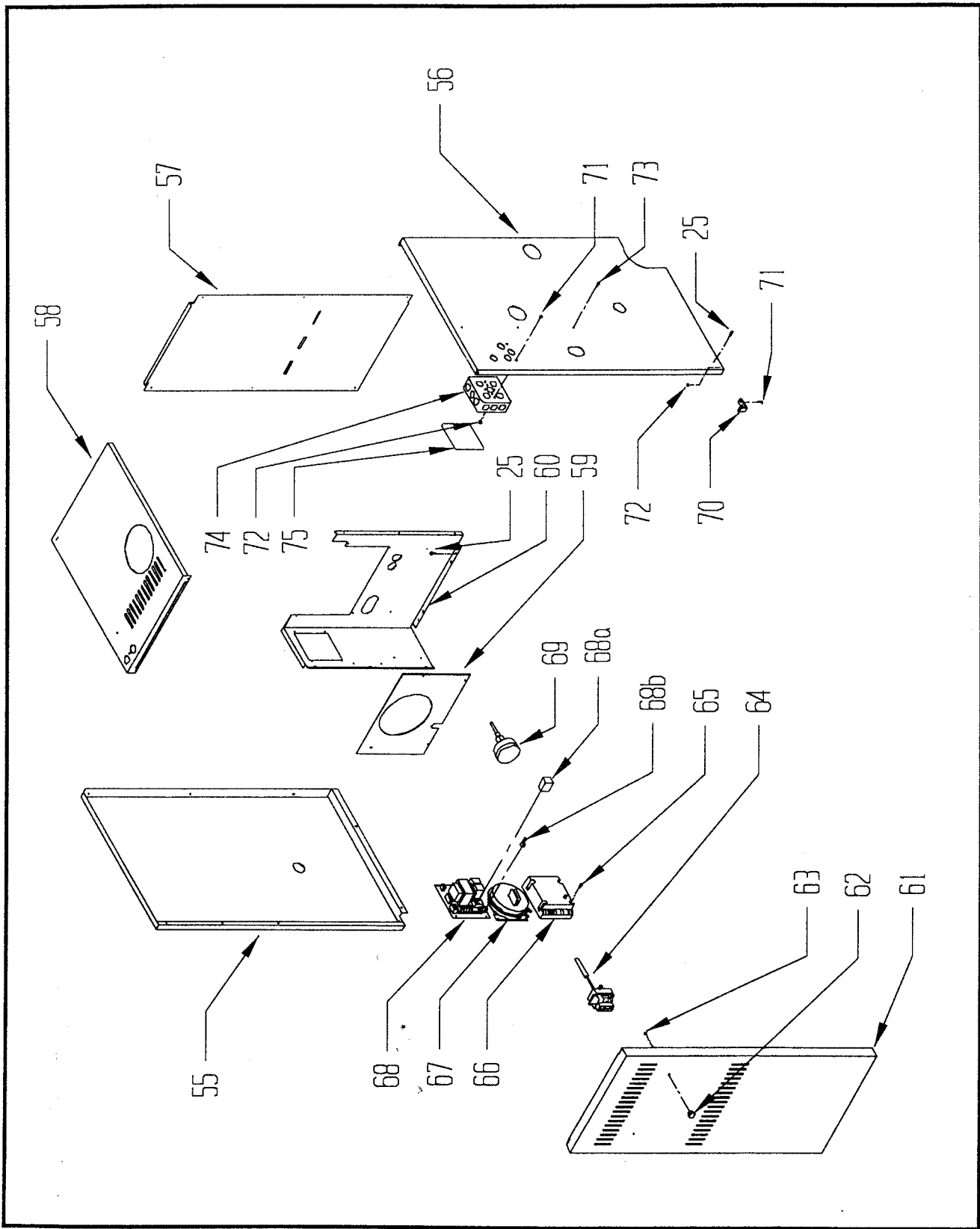
KEY #	DESCRIPTION	QTY. OR CROWN P.N.	QUANTITY PER BOILER OR CROWN P.N.						
			50	75	100	125	150	175	200
41	MAIN BURNER	60-500	2 ea.	3 ea.	4 ea.	5 ea.	6 ea.	7 ea.	8 ea.
42	FIREDOOR/MANIFOLD ASSY.	1 ea.	60-543	60-544	60-545	60-546	60-547	60-548	60-549
43	FRONT FIREDOOR INSULATION	1 ea.	60-523	60-524	60-525	60-526	60-527	60-528	60-529
44	GAS VALVE (NAT GAS) (CSC-50 - CSC-150)	35-7500 VR8205A2131	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	0 ea.	0 ea.
44	GAS VALVE (NAT GAS) (CSC-175, CSC-200)	35-7600 VR8305M2177	0 ea.	0 ea.	0 ea.	0 ea.	0 ea.	1 ea.	1 ea.
44	GAS VALVE (LP GAS) (ALL SIZE LP BOILERS)	35-7550 VR8205M2484	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
45	3/4" 90 DEGREE FLANGE (INCLUDES O RING & ALLEN SCREWS)	35-1055 HONEYWELL #393690-5	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
46	MANIFOLD GASKET PLATE	60-150	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
47	MANIFOLD GASKET	60-151	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
48	ELECTRODE ASSY.	42-000	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
49	MICA SIGHT GLASS	60-050	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
50	6-32 X 1/4" SOCKET HD SCREW	90-066	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
50a	#6 FLAT WASHER	90-067	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
50b	1/8" ALUMINUM POP RIVET	90-068	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
51	#8 X 3/8" SHEET METAL SCREW	90-056	8 ea.	12 ea.	16 ea.	20 ea.	24 ea.	28 ea.	32 ea.
52	NAT GAS SEA LEVEL ORIFICE	60-020	2 ea.	3 ea.	4 ea.	5 ea.	6 ea.	7 ea.	8 ea.
52	LP GAS SEA LEVEL ORIFICE	60-021	2 ea.	3 ea.	4 ea.	5 ea.	6 ea.	7 ea.	8 ea.
53	ORIFICE WASHER	60-030	2 ea.	3 ea.	4 ea.	5 ea.	6 ea.	7 ea.	8 ea.
54	1/8 GAS VALVE HOSE BARB (HONEYWELL #394537)	35-1060	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.





## PARTS

KEY #	DESCRIPTION	QTY. OR CROWN P.N.	QUANTITY PER BOILER OR CROWN P.N.						
			50	75	100	125	150	175	200
55	LEFT SIDE JACKET PANEL	60-302	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
56	RIGHT SIDE JACKET PANEL	60-301	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
57	REAR JACKET PANEL	1 ea.	60-304	60-304	60-305	60-306	60-307	60-308	60-309
58	TOP JACKET PANEL	1 ea.	60-324	60-324	60-325	60-326	60-327	60-328	60-329
59	FAN COVER PLATE	60-300	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
60	INNER PANEL	1 ea.	60-334	60-334	60-335	60-336	60-337	60-338	60-339
61	DOOR	1 ea.	60-314	60-314	60-315	60-316	60-317	60-318	60-319
62	DOOR KNOB	90-210	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
63	8-32 X 1/4" H.W.H. SCREW	90-211	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
64	HONEYWELL L4080D LIMIT	35-3300	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
65	#8 X 3/4" SHEET METAL SCREW	90-048	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
66	UT 1016-461 DSI MODULE	42-500	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
67	SEA LEVEL PRESSURE SWITCH (CSC-50 - CSC-150)	60-009	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	0 ea.	0 ea.
67	SEA LEVEL PRESSURE SWITCH (CSC-175, CSC-200)	60-010	0 ea.	0 ea.	0 ea.	0 ea.	0 ea.	1 ea.	1 ea.
68	RELAY BOARD, COMPLETE	42-502	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
68a	REPLACE. RELAY FOR 42-502	42-503	3 ea.	3 ea.	3 ea.	3 ea.	3 ea.	3 ea.	3 ea.
68b	RESET PLUG FOR 42-502	42-504	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
69	TRIDICATOR GUAGE	95-038	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
70	DOOR BRACKET	60-303	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.	2 ea.
71	8-32 X 1/2" SCREW	90-052	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.
72	8-32 NUT	90-053	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.	6 ea.
73	#10 X 1/2" SHEET METAL SCREW	90-212	26 ea.	26 ea.	26 ea.	26 ea.	26 ea.	26 ea.	26 ea.
74	4 X 4 JUNCTION BOX	96-055	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
75	JUNCTION BOX COVER	96-054	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.	1 ea.
N.A.	120 VOLT HARNESS	1 ea.	96-1005	96-1005	96-1005	96-1005	96-1006	96-1006	96-1006
N.A.	24 VOLT HARNESS	1 ea.	96-1004	96-1004	96-1004	96-1004	96-1004	96-1004	96-1004
N.A.	GROUND PIGTAIL	1 ea.	96-1015	96-1015	96-1015	96-1015	96-1015	96-1015	96-1015
N.A.	IGNITION HARNESS	1 ea.	96-1010	96-1010	96-1010	96-1010	96-1011	96-1011	96-1011
N.A.	SPARK CABLE	1 ea.	42-025	42-025	42-025	42-025	42-030	42-030	42-030



# INSTALLATION NOTES

# INSTALLATION NOTES

# INSTALLATION NOTES

# INSTALLATION NOTES

**CROWN**  
**Boiler Co.**

**Manufacturer of Hydronic Heating Products**

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CSC-02/00-10M

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