

INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FOR

SPACEMASTER™ DIRECT VENT NATURAL GAS - FIRED BOILER



For service or repairs to boiler, call your heating contractor. When seeking information on boiler, provide Boiler Model Number and Serial Number as shown on Rating Label.

Boiler Model Number SM__ - _____	Boiler Serial Number 6_ - - - - -	Installation Date
Heating Contractor		Phone Number
Address		



IMPORTANT INFORMATION

PLEASE READ THIS PAGE CAREFULLY

This boiler has a limited warranty, a copy of which is printed on the back page of this manual.

All heating systems should be designed by competent contractors and only persons knowledgeable in the layout and installation of hydronic heating systems should attempt installation of any boiler.

This equipment shall be installed in accordance with those installation regulations in force in the area where the installation is to be made. These shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installations are made.

Boiler should be positioned to provide minimum side clearances of 1", minimum top clearance of 6", minimum front clearance of 2", minimum rear and flue system clearances of 0" and minimum floor clearance of 6" between boiler surfaces and any combustible materials. (See Figure 3).

Boiler must also be positioned to provide minimum clearances between edge of vent terminal and exterior obstructions. Provide minimum overhang clearance of 7", minimum above grade clearance of 12" and minimum side obstruction clearance of 18". (See Figure 2).

In all cases, clearance between boiler jacket and vent system surfaces and combustible materials must comply with the National Fuel Gas Code, ANSI Z223.1, and local jurisdictions.

Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors and liquids.

Do not place any obstruction in the boiler room that will hinder the flow of ventilating air.

Boiler must be installed with the vent/intake air system supplied as part of the unit, without alteration.

The wall thickness through which the unit may be installed must not exceed a minimum of 5" or a maximum of 15".

- a. Misc. Parts Carton — Part No. 6050301 (5" to 9" thick walls) — Standard
- b. Misc. Parts Carton — Part No. 6050302 (9" to 15" thick walls) — Optional

The boiler shall be installed such that the gas ignition system components are protected from water (dripping, spraying, rain etc.) during boiler operation and service (circulator replacement, control replacement, etc.).

It is the responsibility of the installing contractor to see that all controls are operating properly when the installation is completed.

Service on this boiler should be undertaken only by trained and skilled personnel.

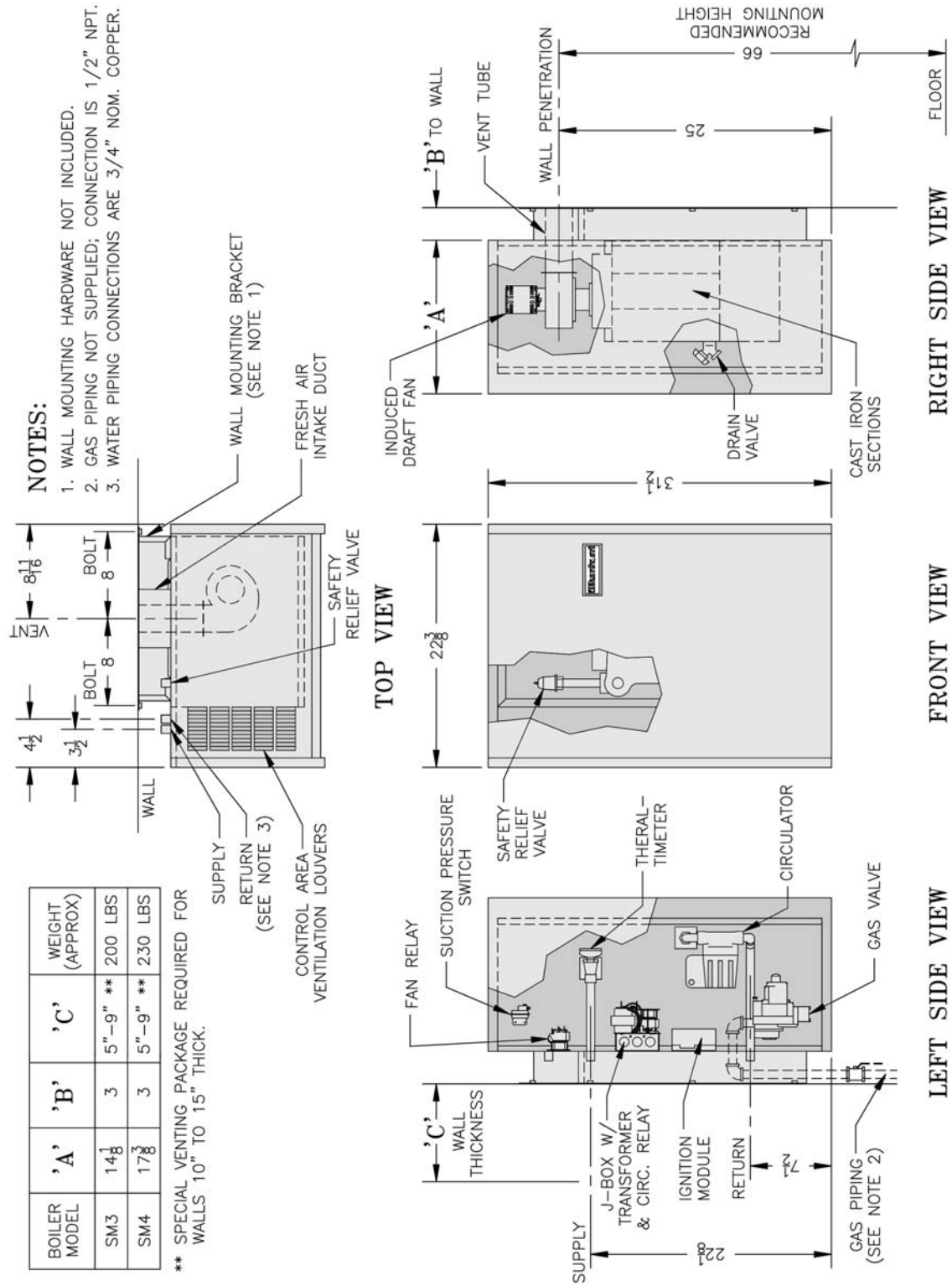
Post instructions near boiler for reference by owner and serviceman.

Maintain instructions in legible condition.

WARNING

When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it.

- 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 is practical, close all building doors and windows and all doors between the space in which 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 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 appliance to their previous conditions 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 in the National Fuel Gas Code, ANSI Z223.1.



MAXIMUM DESIGN WORKING PRESSURE – 45 PSI; WATER ONLY

Figure 1

SPACEMASTER WALL MOUNTED GAS BOILER – DIMENSIONAL DATA

Table of Contents

I.	General Installation Requirements.....	4
II.	Installation Instructions.....	7
III.	Operating Instructions.....	13
IV.	Service	23
V.	Repair Parts	26
VI.	APPENDIX	
	Low Water Cut Off.....	27

I. General Installation Requirements

1 INSPECT SHIPMENT carefully for any signs of damage. All equipment is carefully manufactured, inspected and packed. Our responsibility ceases upon delivery of Boiler to the carrier in good condition. Any claims for damage or shortage in shipment must be filed immediately against the carrier by the consignee. No claims for variances or shortages will be allowed by Boiler Manufacturer, unless presented within sixty (60) days after receipt of equipment.

2 BOILER INSTALLATION must conform to the requirements of the authority having jurisdiction, or in absence of such requirements to:

- a. "National Fuel Gas Code, ANSI Z223.1 obtainable from the American Gas Association, 1515 Wilson Blvd. Arlington (Rosslyn), VA 22209.
- b. When required by the authority having jurisdiction, the installation must conform to American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired boilers, No. CSD-1.
- c. The boiler must be electrically grounded in accordance with requirements of the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code, ANSI/NFPA No. 70.

3 THESE GAS BOILERS ARE DESIGN CERTIFIED FOR INSTALLATION on an exterior wall of buildings constructed with combustible materials (wood framed walls with, paneling, drywall, plaster, etc.) or masonry walls (brick, stone, stucco, or cinder block).

4 DO NOT INSTALL ON CARPETING. These gas boilers may be installed *above* carpeted areas. Note: Protect carpeting or flooring to avoid possible damage during installation and maintenance procedures.

5 BOILER LOCATION MUST MEET THE FOLLOWING SITE REQUIREMENTS:

- a. The boiler must be mounted on a flat wall, sufficiently strong enough to carry the weight of the unit. (See Figure 1). Minimum acceptable wall construction would consist of 2" x 4" studding on 24" centers. Unit is designed for installation on 16" centers. Therefore, adequate supports must be added between existing studding.
- b. A suggested mounting height, where practical, is five feet - six inches from floor to center line of intake air duct opening. (See Figure 1).
NOTE: depending on ceiling height, 6" combustible clearance height from jacket top panel to ceiling must be maintained. (See Figure 3).
- c. Consider location of heating supply and return lines, gas supply line, cold water piping and expansion tank in selecting boiler location.

d. Exterior wall surface must be flat to ensure that wall flange can be mounted without being distorted and also provide a positive weather-tight seal to prevent water damage.

If exterior wall surface is not flat (i.e., uneven masonry, stucco, aluminum siding, etc.) a flat surface must be provided of equal size or larger than the exterior wall flange and vent terminal cover.

e. Locate the vent terminal in relation to adjacent public walkways, adjacent buildings, operable windows and buildings, consistent with the National Fuel Gas Code Z223.1: Minimum clearance of 4 feet horizontally from and in no case above or below (unless four [4] foot horizontal distance is maintained), electric meters, gas meters, regulators and relay equipment. At least 12" from any door, window or other building opening. A minimum of 12" above grade, 7" from any overhang, 18" from any side obstruction or wall and 3' away from any adjacent building. Increase minimum height above grade to maintain adequate clearance above average snow fall for geographical area in which unit is installed. If the unit is to be vented over a public walkway, it must be at least 7" above grade. If the vent terminal is to be within 10' of a building fresh air intake, it must be at least 3' above the opening. In addition, avoid venting the unit in corners, niches or areas which might have reduced fresh air circulation. (See Figure 2).

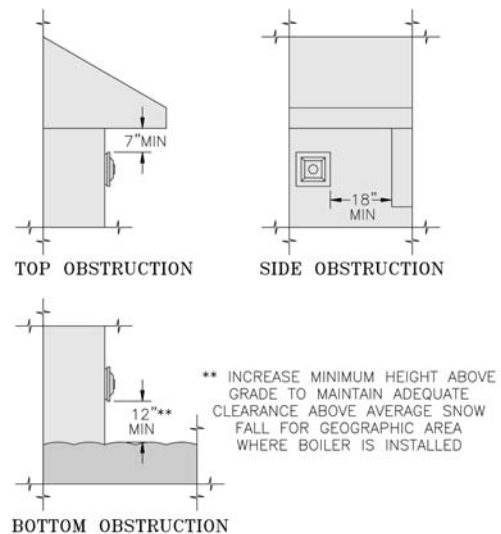


Figure 2

f. If boiler is to be installed above the level of the radiation, a low water cutoff must be installed.

6 PROVIDE CLEARANCE between boiler jacket, mounting bracket and vent system and combustible material in accordance with local fire ordinance.

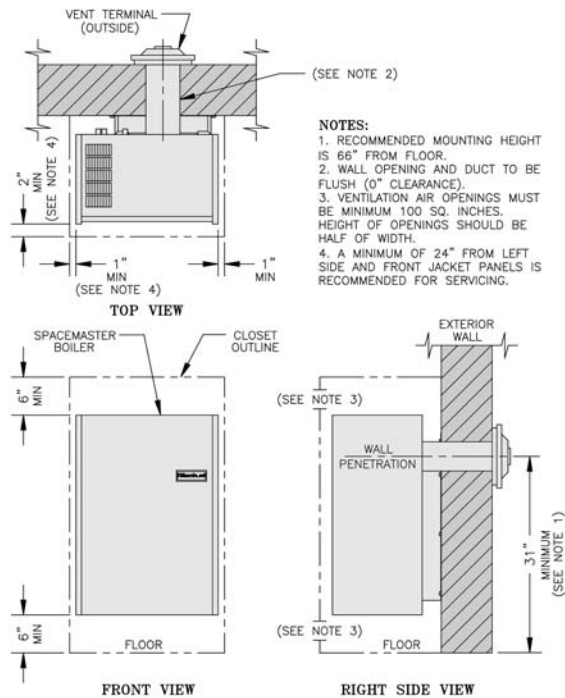


Figure 3

** A minimum of 24" from left side and front jacket panel is recommended for servicing.

MINIMUM CLEARANCE TO COMBUSTIBLE SURFACES

Minimum listed clearances from combustible materials for non-closet installation or closet installation. (See Figure 3).

- | | |
|-------------|-----------------|
| Top — 6" | *Left Side — 1" |
| Rear — 0" | Right Side — 1" |
| *Front — 2" | Flue — 0" |
| Floor — 6" | |

Since the above dimensions are measured between boiler jacket and combustible walls or ceiling, practical service clearances for all external adjoining equipment must be considered (see Figure 1). * A minimum of 24" from left side and front jacket panel is recommended for servicing.

In utility room installations, the door must be wide enough to allow boiler to enter or to permit replacement of another appliance in this room.

7 VENTILATION AND COMBUSTION AIR.

Provide provisions for combustion and ventilation air in accordance with Section 5.3, Air for combustion and ventilation, of the National Fuel Gas Code, ANSI Z223.1 or applicable provisions of local building codes. This boiler is equipped with a fan which produces an induced draft through the unit. Combustion air is pulled in from outdoors and the flue gases are exhausted to the outdoors through the intake air/vent system. (See Figure 4).

- a. Combustion air is provided 100% from the outdoors. Air is pulled in on all four sides of vent terminal cover, through the air intake duct and to the combustion area enclosure. The vent terminal must be mounted on a flat surface which is flush or protrudes outward from the exterior wall. Avoid recesses, niches or areas which might have reduced fresh air circulation.
- b. Ventilation — When the boiler is installed in an unconfined space in a building of normal or unusually tight construction, there is no additional provision required to insure adequate air for ventilation of the jacket or control compartment. When the boiler is installed in a confined space, two openings in a wall or door to an adjoining interior area which has adequate air supply shall be provided. One opening should be near the floor and the other near the ceiling. Each shall have a free area of not less than one (1) square inch for each thousand (1000) BTU input to all appliances in the boiler room. (See Figure 3).

8 CONNECT GAS SERVICE from meter to gas control assembly in accordance with local piping codes and requirements of gas company, see Figure 1. They may require piping of larger size than 1/2" control assembly connection, especially if run from meter is long or includes several elbows.

This piping is to be supplied by the installer and must include a trap, a ground joint union and a manual shut-off valve upstream of the gas control assembly outside of the jacket when codes require, see Figure 1. A pipe thread compound resistant to the action of liquefied petroleum gases should be applied to all threaded joints in the gas piping. Pressure testing of the gas supply piping, boiler and its connections is required before placing the boiler in operation.

The boiler must be isolated from the gas supply piping system by closing the manual shut-off during any pressure testing at pressures equal to or less than 1/2 psig.

The boiler and shut-off valve must be disconnected from the gas supply piping system during any pressure testing at pressures greater than 1/2 psig.

RECOMMENDED SIZING OF GAS SUPPLY PIPING TO BOILER shall be such as to provide the required supply of gas without undue loss of pressure between meter and the boiler. Gas supply piping should be sized in accordance with Tables, I, II and III.

The following shall be taken into account:

- a. Allowable loss of pressure to assure a burner manifold pressure of 3 1/2" water.
- b. Supply of gas to be provided in cubic feet.
- c. Length of piping and number of fittings.
- d. Specific gravity of gas.
- e. Correction factor for specific gravity.

TABLE I

Maximum Capacity of Piping in Cubic Feet
of Gas Per Hour

(Based on a Pressure Drop of 0.3" Water
and 0.6 Specific Gravity)

Length in Feet	Nominal Iron Pipe Size		
	1/2	3/4	1
10	132	278	520
20	92	190	350
30	73	152	285
40	63	130	245
50	56	115	215
60	50	105	195
70	46	96	180
80	43	90	170
90	40	84	160
100	38	79	150

TABLE II

Maximum Capacity of Piping in Cubic Feet of
Gas Per Hour

(Based on a Pressure Drop of 0.5" Water and
0.6 Specific Gravity)

Length in Feet	Nominal Iron Pipe Size		
	1/2	3/4	1
10	175	360	680
20	120	250	465
30	97	200	375
40	82	170	320
50	73	151	285
60	66	138	260
70	61	125	240
80	57	118	220
90	53	110	205
100	50	103	195
125	44	93	175
150	40	84	160
175	37	77	145

*NOTE – For all practical purposes, each 90° elbow
can be considered as the following equivalent in
length of straight pipe:

1/2" – 1.6 ft. 1" – 2.6 ft.
3/4" – 2.1 ft.

TABLE III

Multipliers to be used with Tables I and II for
Specific Gravity Other Than 0.60

Specific Gravity	Correction Factors
.50	1.10
.55	1.04
.60	1.00
.65	.96
.70	.93

II. Installation Instructions

DETERMINE BEST MOUNTING LOCATION for boiler which meets site requirements outlined in Section I, pages 4 through 6.

1 INSTALLING BOILER MOUNTING WALL BRACKET (See Figure 5).

- a. Locate wall bracket packed in miscellaneous parts carton.
- b. Hold wall bracket in desired location. On studded walls, mounting bracket must be secured directly to main vertical support studs. Interior wall coverings such as paneling, plaster and drywall are not suitable to support the unit's weight. Place a 24" level across top corners, adjust wall bracket until level. Using the wall bracket as a template, mark the eight (8) securing holes along the sides and the 4½" x 5¼" rectangular opening at the top. Remove wall bracket from wall.

NOTE: The boiler mounting wall bracket is suitable for two main methods of wall construction. Masonry-built walls and stud-framed walls where the main vertical support studs are on 16" centers or alternately where adequate supports are added between existing studs.

- c. Drill eight (8) pilot holes, properly sized for the fastener determined suitable for the type of wall construction in the area where the boiler is to be mounted (i.e., lag screw for wood, machine screw with toggle for cinder block, etc.).
- d. Before cutting rectangular opening on interior wall, use a straight edge to draw an "X" inside the box using the four (4) corners. Drill a hole in the center of the "X" straight through the wall to the outside. On the exterior wall draw a 4½" x 5¼" rectangular box centered around the reference hole which matches the rectangular box on the interior wall.
- e. Cut along outside edge of lines on interior and exterior surfaces of the wall and remove all material within the rectangular box. Check the wall penetration by inserting one-half of the telescoping intake air duct through the opening. Remove any jagged edges or webbing that prevents the duct from penetrating through the wall or from being level. Remove duct from wall penetration.
- f. Lay the wall bracket face down. Apply a ¼" thick bead of silicone rubber type caulking around the rectangular opening approximately 1" from the edge.
- g. Reposition boiler mounting wall bracket on wall, using a 24" level across top corners, level wall bracket and secure to wall with suitable fasteners.
- h. Attach lower R.S. jacket mounting bracket to right side of boiler mounting wall bracket with sheet metal screws provided. (See Figure 5)

2 INSTALLING BOILER AND INTERIOR TELESCOPING INTAKE AIR DUCT (See Figure 5)

- a. Separate two halves of telescoping intake air duct. Interior half of duct has a 1" wide rectangular gasket flange with four (4) weld studs for attaching to back plate of boiler. Exterior half of duct has the 9" square stainless steel wall flange for securing to exterior wall. (See Figure 5)

NOTE: 1. *Standard* telescoping intake air duct, part No. 6110301, is for wall thickness from 5" to 9".

NOTE: 2. *Optional* telescoping intake air duct, part No. 6110302, is for wall thickness from 9" to 15".

- b. Insert interior half of duct into rectangular opening and push it all the way back against wall plate.
- c. Place 6" x 7" rectangular gasket on interior duct flange and ¼" weld studs.
- d. Remove boiler from packaging.
 1. Remove surrounding packaging material from boiler and skid.
 2. Remove screws holding enclosure cover.
 3. Remove enclosure cover.
 4. Locate and remove two (2) lag screws which secure back plate of boiler to skid. One is located in the upper left corner of the controls area and the second one is located in the lower right corner under the gas burner.
 5. Remove boiler from skid and set unit upright on floor in front of installation site.

NOTE: On the back plate of the boiler is a "Z" bracket approximately 10" long. When the boiler is lifted into place, this bracket must be lowered into the ½" wide x 11" long slot at the top of the boiler mounting wall bracket. (See Figures 4 and 5)

- e. Attach upper RS jacket mounting bracket to the upper corner of back plate. Loosen the two (2) corner screws, position bracket with flange facing forward and engage slots over screws. Re-tighten screws to secure bracket. **IMPORTANT:** Bracket must be installed before lifting boiler into position.
- f. Lift boiler up into position. Make sure that "Z" bracket is properly engaged into slot and is resting on ¼" wide flange in front of slot before releasing the weight of the boiler.
- g. Move boiler slightly to the left or right to align the five (5) clearance holes in the back plate with the fasteners on boiler mounting wall bracket.

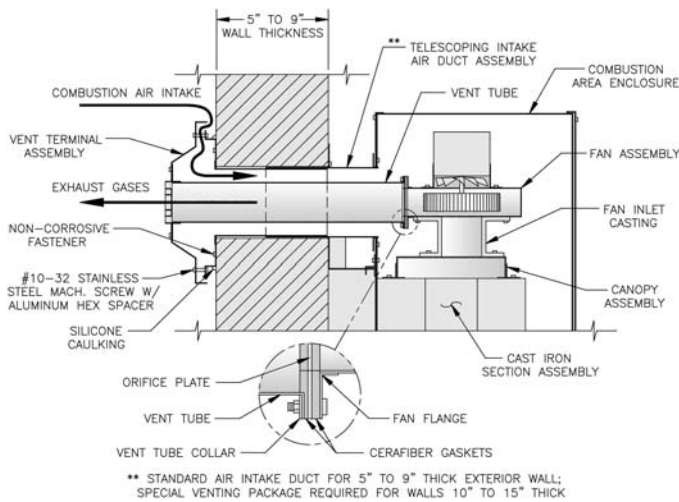


Figure 4
VENT SYSTEM CROSS SECTION

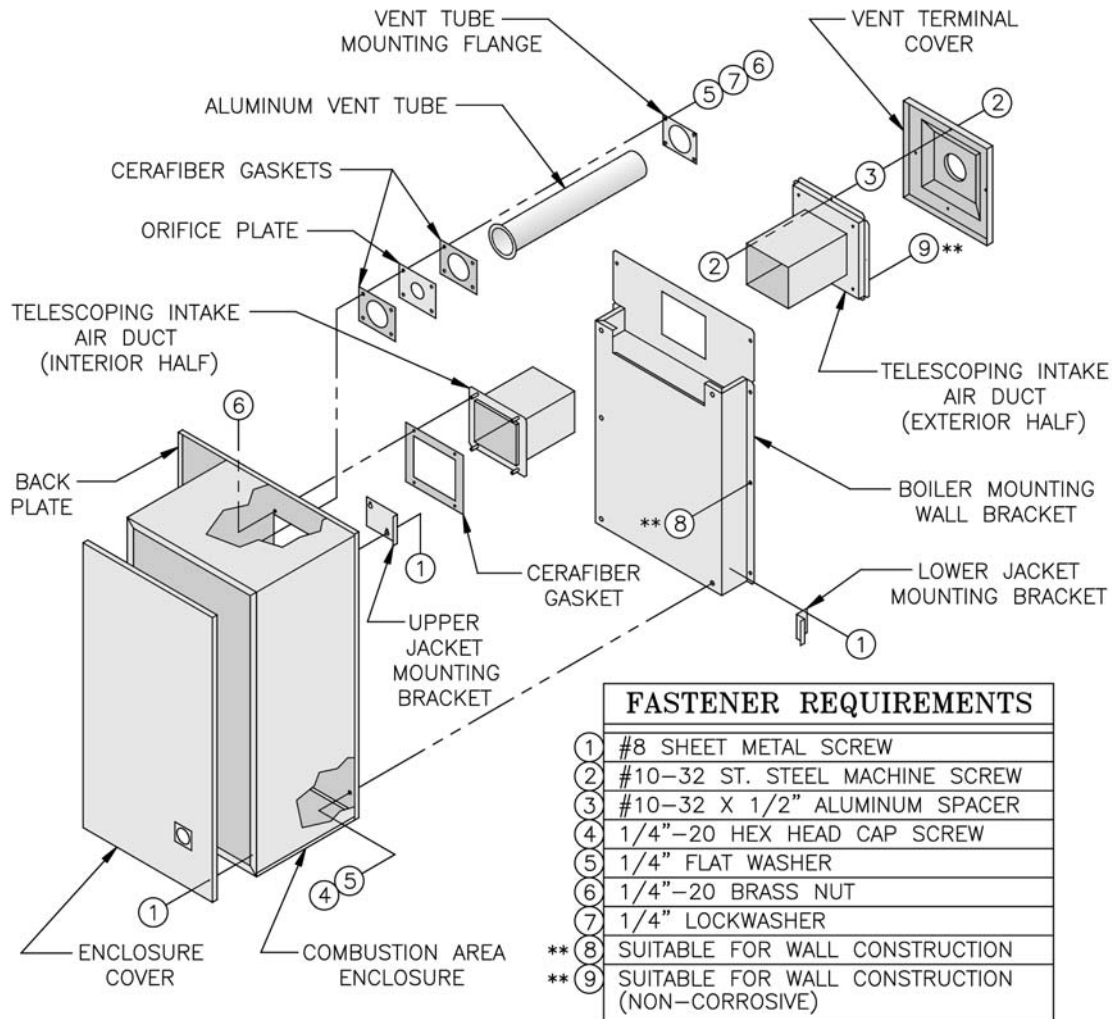
h. Secure boiler to boiler mounting wall bracket with five (5) 1/4"-20 x 3/4" long machine screws and washers provided.

NOTE: Tools required — 7/16" socket, extension bar(s) and drive ratchet

i. Secure interior telescoping intake air duct to back plate of boiler. Pull duct forward until duct and weld studs are engaged through 4 1/2" x 5 1/2" rectangular opening and holes in back plate. Make sure gasket is in place and flat against back plate. Attach duct with four (4) 1/4"-20 brass hex nuts, lockwashers and flat washers.

3 INSTALLING EXTERIOR TELESCOPING INTAKE AIR DUCT (See Figures 4 and 5)

a. Position the exterior telescoping intake air duct into wall penetration and insert duct inside interior duct already in place. Push duct inward until wall flange is against the wall, check for level and mark the four (4) 1/4" diameter clearance holes for securing wall flange to exterior wall. Remove duct from wall.



** NOT FURNISHED BY MANUFACTURER

Figure 5
EXPLODED BOILER ASSEMBLY

- b. Drill four (4) pilot holes, properly sized for the non-corrosive fasteners (stainless steel, brass or aluminum) to be used to secure the wall flange to wall.
- c. Attach four (4) ½” long threaded aluminum spacers to the outer flanges of the exterior telescoping intake air duct wall flange with four (4) #10-32 x ¼” long stainless steel machine screws provided. (See Figure 5).
- d. Apply a ¼” thick continuous bead of silicone rubber type caulking to the rear of the exterior telescoping intake air duct wall flange approximately 1” from duct.
- e. Re-install exterior telescoping intake air duct and secure to wall.
NOTE: Non-corrosive (stainless steel, brass or aluminum) fasteners must be used.
- f. Apply a bead of silicone rubber caulking to perimeter of wall flange, where the wall and flange join. Use a tool or your finger and apply pressure while smoothing caulking to provide a weather-tight seal.

4 INSTALLING VENT TUBE, ORIFICE PLATE AND VENT TERMINAL COVER (See Figures 4 and 5).

- a. The vent tube furnished has a standard length of 24”. This length is suitable for a wall thickness from 5” to 15”.
- b. To determine the proper length required, place a 24” level horizontally across the exterior wall flange, just below the aluminum spacers, measure the distance between the outlet flange on the fan and the level. Add 1” to this measurement for the total length of the vent tube.
- c. Measuring from the flange end of the vent tube, mark the total length required. Cut off and discard the remaining piece.
- d. IMPORTANT! Before connecting vent tube to fan, install the orifice plate and two (2) cerafibre gaskets on the fan outlet flange weld studs in the proper order of assembly, gasket first, orifice plate second and remaining gasket last. (See Figures 4 and 5).
- e. Insert the vent tube, flange first, through the intake air duct and secure to fan outlet flange with four (4) ¼” flat washers, ¼” lock washers and ¼”-20 brass hex nuts provided.
- f. Position vent terminal cover over exterior intake air duct. Insert end of vent tube into collar on rear of vent terminal cover. Align four (4) holes on cover with ½” long threaded aluminum spacers. Secure vent terminal cover with four (4) #10-32 x ¼” long stainless steel machine screws provided.

5 DO NOT REPLACE ENCLOSURE COVER until boiler piping is completed and system is filled, vented and checked for water leaks.

6 CONNECT SUPPLY AND RETURN PIPING TO heating system.

OXYGEN CORROSION:

Oxygen contamination of the boiler water will cause corrosion of the iron and steel boiler components, which can lead to failure. As such, any system must be designed to prevent oxygen absorption in the first place or prevent it from reaching the boiler. Problems caused by oxygen contamination of boiler water are not covered by Burnham’s standard warranty.

There are many possible causes of oxygen contamination such as:

1. Addition of excessive make-up water as a result of system leaks.
2. Absorption through open tanks and fittings.
3. Oxygen permeable materials in the distribution system.

In order to insure long product life, oxygen sources should be eliminated. This can be accomplished by taking the following measures:

1. Repairing system leaks to eliminate the need for addition of make-up water.
2. Eliminating open tanks from the system.
3. Eliminating and/or repairing fittings which allow oxygen absorption.
4. Use of non-permeable materials in the distribution system.
5. Isolating the boiler from the system water by installing a heat exchanger.
 - a. For heating only, see Figure 6. Consult I=B=R Installation Guides. Clearance between hot water pipes and combustible material must not be less than ½”.
 - b. If this boiler is used in connection with refrigeration systems, the boiler must be installed so that the chilled medium is piped parallel with the heating boiler using appropriate valves to prevent the chilled medium from entering the boiler, see Figure 7. Also consult I=B=R Installation and Piping Guides. If this boiler is connected to heating coils located in air handling units where they may be exposed to refrigerated air, the boiler piping must be equipped with flow control valves to prevent gravity circulation of boiler water during the operation of the cooling system.
 - c. Pipe safety relief valve to suitable drain.

CAUTION: Safety relief valve should be piped to an open drain — full size of discharge outlet on relief valve without any provision of “shut-off” between the relief valve and discharge into drain.

- d. Install diaphragm type expansion tank (not furnished) in system piping.

- e. A hot water boiler installed above radiation level must be provided with a low water cutoff device as part of the installation.

If a low water cut-off is required, it must be mounted in the system piping above the boiler. The minimum safe water level of a hot water boiler is just above the highest water containing cavity of the boiler; that is, a hot water boiler must be full of water to operate safely.

- f. Use a boiler bypass if the boiler is to be operated in a system which has a large volume or excessive radiation where low boiler water temperature may be encountered (i.e., converted gravity circulation system, etc.). The bypass should be the same size as the supply and return lines with valves located in the by-pass and supply outlet as illustrated in order to regulate water flow for maintenance of higher boiler water temperatures. See Figure 6.

Set the by-pass and boiler supply valves to a half throttle position to start. Operate boiler until the system water temperature is at a normal operating range.

Adjust the valves to provide 180° to 200°F supply water temperature. Opening the boiler supply valve will raise the system temperature, while opening the by-pass valve will lower the system supply temperature.

If it is required to perform a long term pressure test of the hydronic system, the boiler should first be isolated to avoid a pressure loss due to the escape of air trapped in the boiler.

To perform a long term pressure test including the boiler, ALL trapped air must first be removed from the boiler.

A loss of pressure during such a test, with no visible water leakage, is an indication that the boiler contained trapped air.

7 INSTALL BOILER FLUSH JACKET (See Figure 9).

- Open jacket carton and locate side panels. Note that jacket left side panel is not insulated and right side panel is insulated.
- Position the rear flange on jacket left side panel behind the boiler back plate. Position flange support notches over jacket support hooks on back panel and engage jacket on both support hooks to keep the panel from moving front to rear.
- Position rear flange on jacket right side panel behind upper and lower jacket support brackets. Engage jacket with jacket support hooks in similar manner as left side panel to provide proper positioning and support.
- Take jacket top and bottom panel from carton. Top panel can be identified by the front channel used to

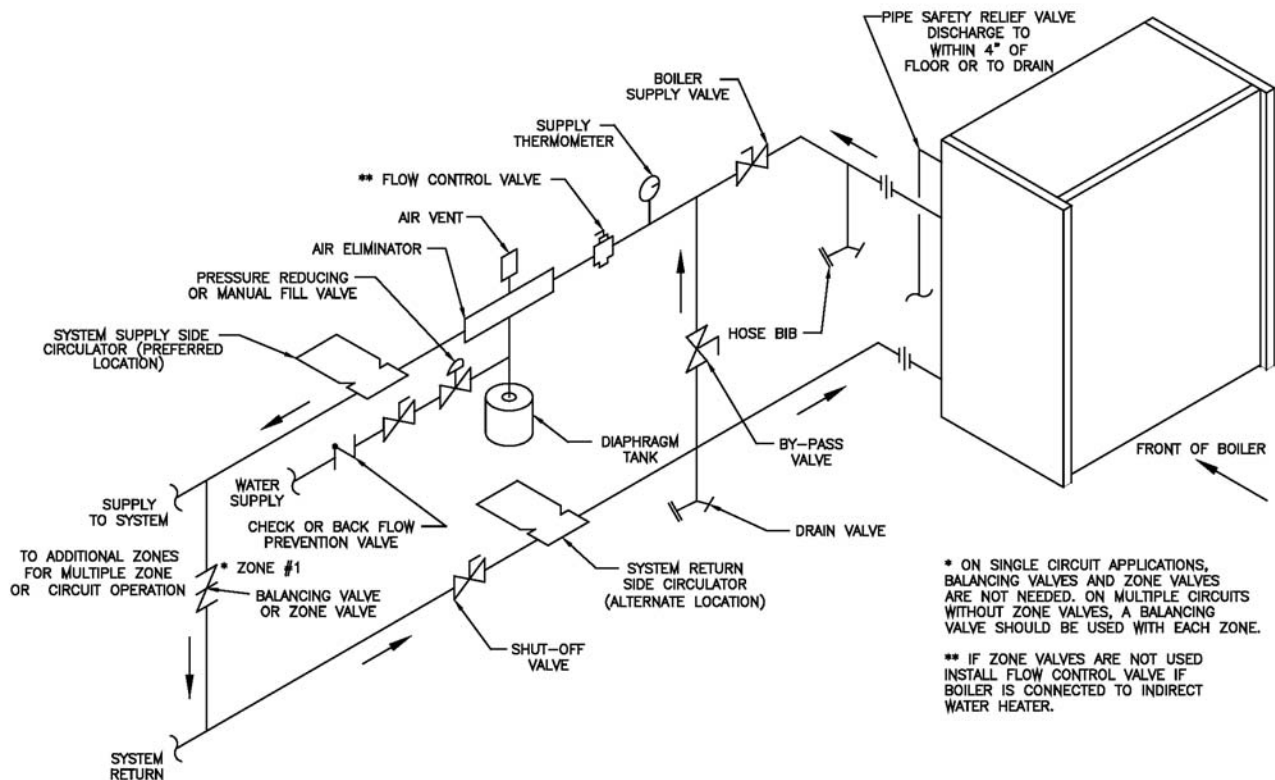


Figure 6

RECOMMENDED BOILER PIPING

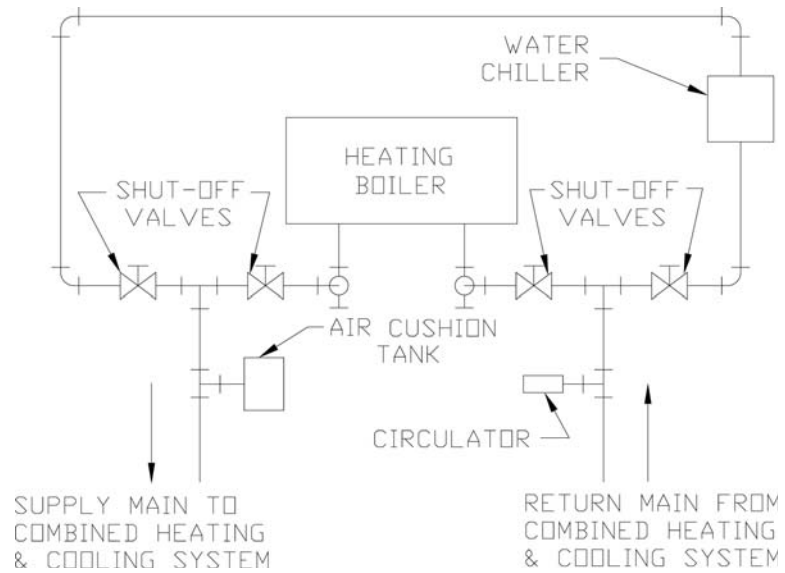


Figure 7

RECOMMENDED PIPING FOR COMBINATION HEATING & COOLING (REFRIGERATION) SYSTEMS

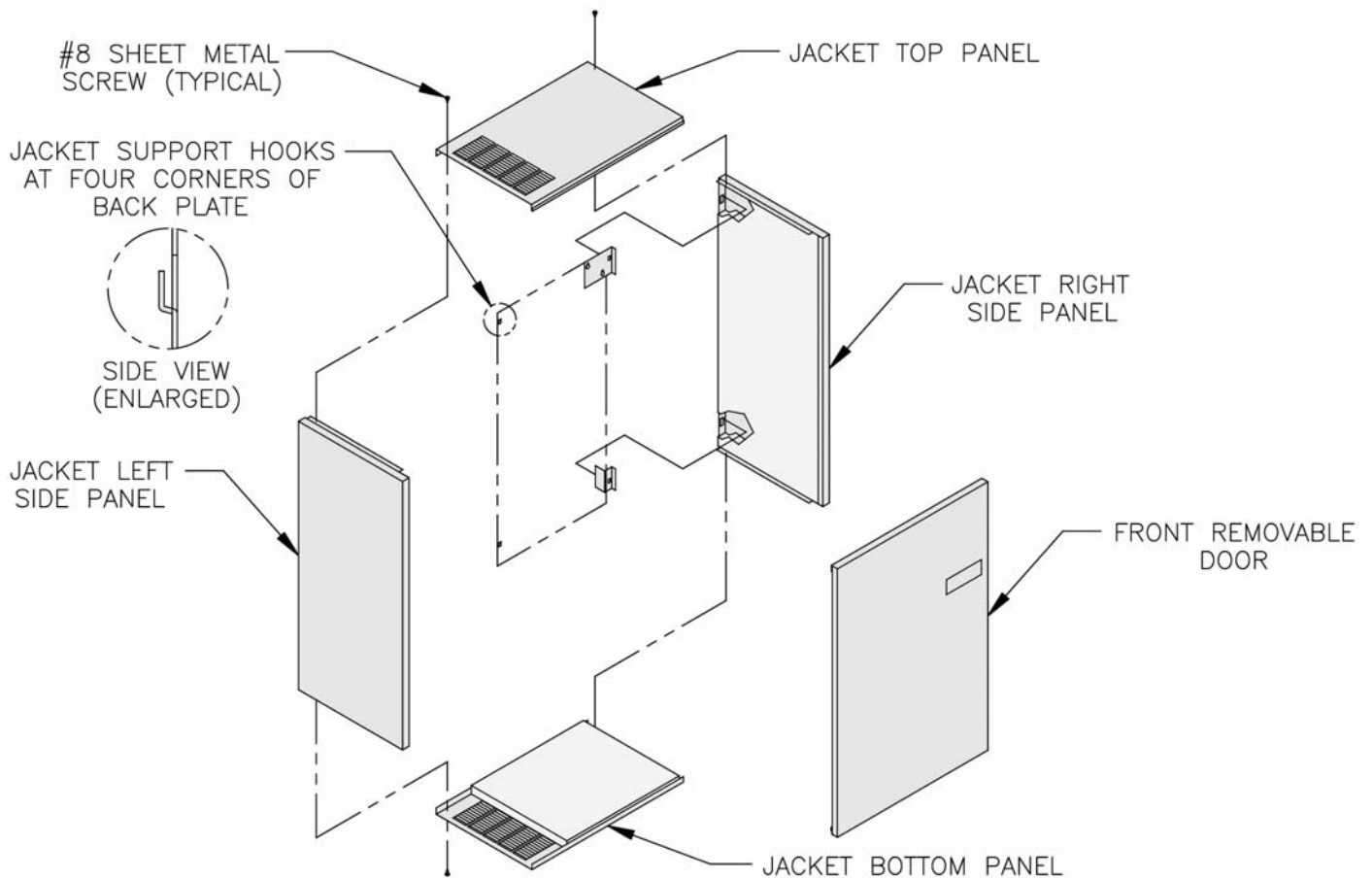


Figure 9

EXPLODED JACKET ASSEMBLY

support the removable door. (See Figure 9). Place jacket top panel over top side panels with ventilation louvers to the left. Secure top panel with four (4) #8 x ½" long sheet metal screws provided.

- e. Lift jacket bottom panel up to bottom of side panels with front channel forward and ventilation louvers to the left. Secure bottom panel with four (4) #8 x ½" long sheet metal screws provided.
- f. Install jacket removable door. Hold door parallel with top of door slightly above flat top panel. Insert door between side panels. Lower door engaging top panel reverse bend and lower panel flange in the mating door flanges. Door is now locked into position.
- g. Reverse procedure to remove door.

8 INSTALL ROOM THERMOSTAT on an inside wall about four feet above floor. Never install thermostat on an outside wall or where it will be influenced by drafts, hot or cold water pipes, lighting

fixtures, television, rays of the sun or near a fireplace. Keep large furniture away from thermostat so there will be free movement of room air around this control. Heat anticipator in thermostat should be set at .4.

9 ELECTRIC WIRING INSTALLATION.

See Figures 11 and 12 for applicable wiring diagram. A separate electrical circuit must be run from the main electrical service with an over-current device/disconnect in the circuit. A service switch is recommended and may be required by some local jurisdictions. The circuit should be run to the junction box mounted on the front of the boiler back plate in the control compartment (See Figure 1), and connected to the proper leads therein. Wires from the low voltage thermostat should be run to terminals R and G on the transformer. Install wiring and ground boiler in accordance with requirements of authority having jurisdiction, or in absence of such requirements the *National Electrical Code*, ANSI/NFPA 70.

III. Operating Instructions

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

1 INSPECT INSTALLATION BEFORE STARTING.

2 INITIAL START

- a. FILL ENTIRE HEATING SYSTEM WITH WATER and vent air from system. Vent air from all heat distributing units and all high points in the piping of the system. When venting air from system keep fill valve in open position to maintain water pressure. Make certain pressure reducing valve is installed between the fill valve and the boiler. (See Figure 7)

Use the following procedure on a series loop system equipped with zone valves.

1. Close all but one zone valve.
 2. Attach a hose to drain valve on purge fitting and extend hose to drain.
 3. Open drain valve on purge fitting.
 4. Close purge valve.
 5. Open relief valve on boiler.
 6. Open fill valve.
 7. When water discharges from relief valve, release the lever on top of the relief valve, allowing it to close.
 8. Allow water to run out of drain valve until zone has been purged of air and filled with water.
 9. Open zone valve to the second zone to be purged, then close the first. Repeat this step until all zones have been purged but always have one zone open. At completion open all zone valves.
 10. Close drain valve on purge fitting.
 11. Continue filling the system until the pressure gauge reads 12 psi. Close fill valve.
NOTE: If make-up water line is equipped with pressure reducing valve, system will automatically fill to the set pressure of valve (normally 12 psi). Leave globe valve open.
 12. Open purge valve.
- b. Set ROOM THERMOSTAT below room temperature.

- c. Be sure that gas to pilot and main burners has been off for at least five minutes.
- d. Open valve on main gas line at meter.
- e. PURGE AIR FROM GAS PIPING. During the purge adequate ventilation must be provided and no smoking or open flame permitted. (See Figure 10)
 1. Open manual shutoff valve upstream of combination gas valve.
 2. Loosen or remove inlet pressure tap plug in combination gas valve and when purging is complete, tighten or replace plug.
 3. Check pipe and fittings from meter to combination gas valve using soap solution or other approved methods.
- f. TEST GAS PIPING — Test gas piping and connections between combination gas valve and manifold, manifold orifices, and pilot piping for leaks after boiler is operating. Use soap solution or other approved method.
- g. Install enclosure cover and secure with #8 x 1/2" long sheet metal screws.

3 OPERATING INSTRUCTIONS - See page 14.

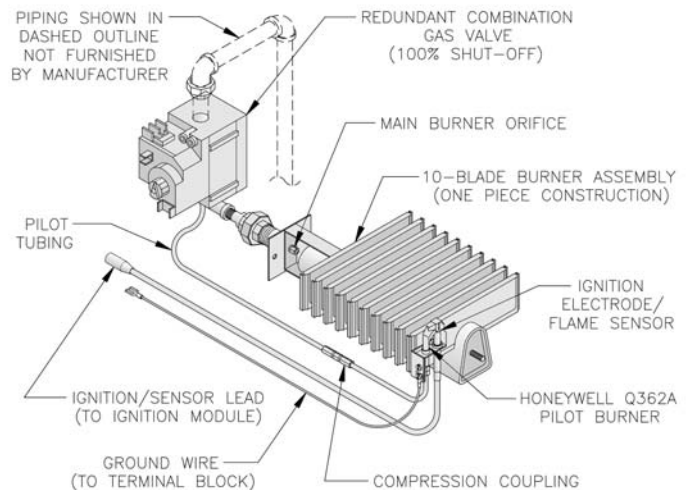


Figure 10
SCHEMATIC PILOT AND GAS PIPING

NOTE: YOUR BOILER IS EQUIPPED WITH A HONEYWELL VR8204 OR VR8304 GAS VALVE. PLEASE FOLLOW THESE OPERATING INSTRUCTIONS:

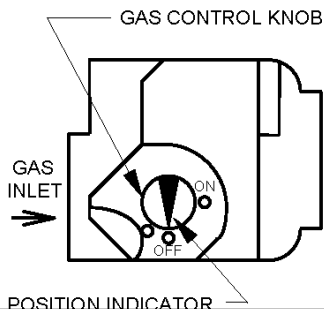
FOR YOUR SAFETY READ BEFORE OPERATING

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

- A. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
- B. BEFORE 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.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.
- If you cannot reach your gas supplier, call the fire department.

OPERATING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
5. Remove front door.
6. Locate the gas control valve at the end of the gas supply pipe going into the boiler. The gas control knob is the brown or blue plastic knob located on top of the gas control valve.
7. Rotate gas control knob clockwise from "ON" position to "OFF". Make sure knob rests against stop.
8. 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 do not smell gas, go to the next step.
9. Rotate gas control knob counterclockwise from "OFF" to "ON". Make sure knob rest against stop. Do not force.
10. Replace front door.
11. Turn on all electric power to the appliance.
12. Set thermostat to desired setting.
13. If the appliance will not operate, follow the instructions "TO TURN OFF GAS TO APPLIANCE" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove front door.
4. Rotate gas control knob clockwise from "ON" position to "OFF". Make sure knob rests against stop.
5. Replace front door.

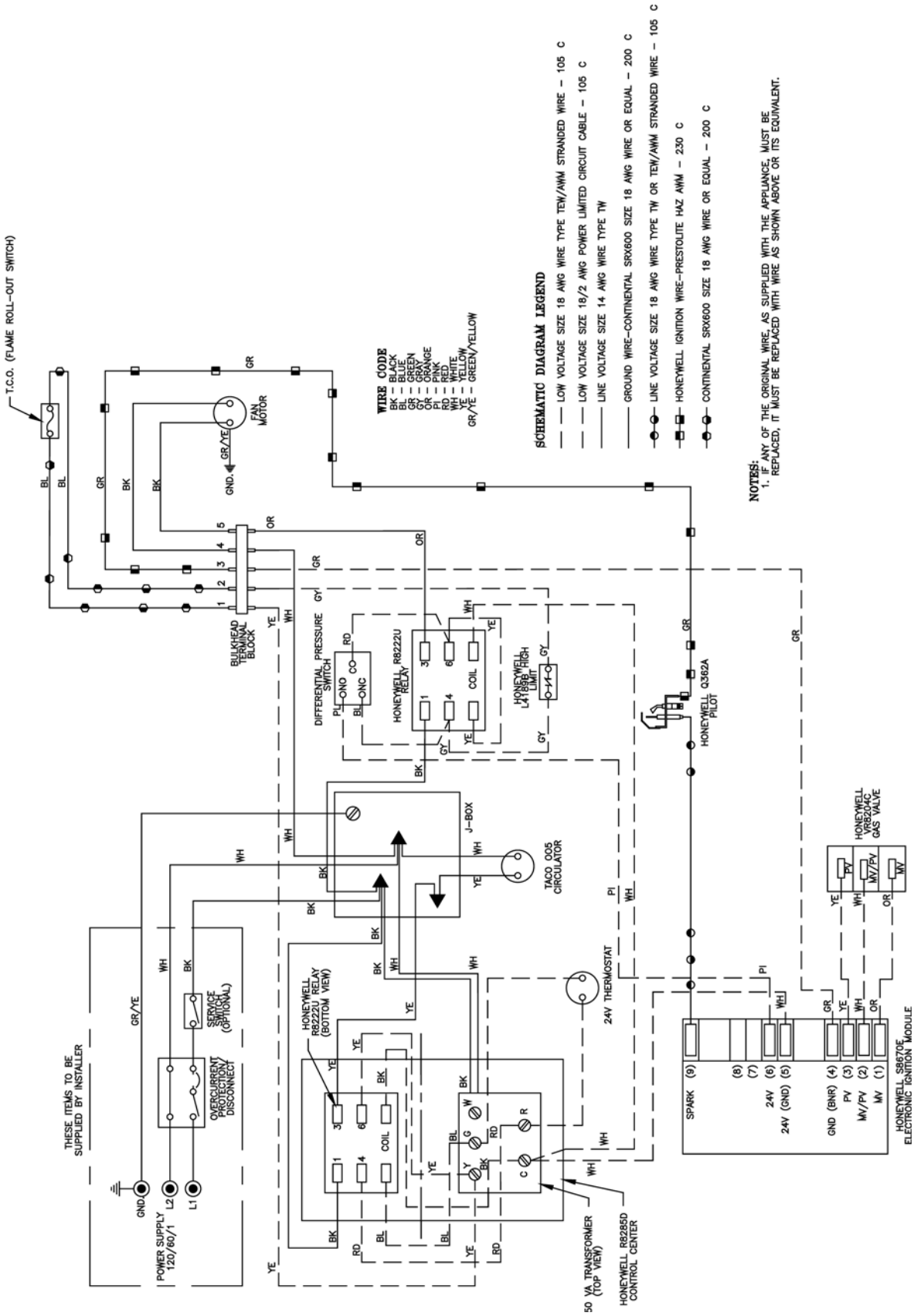
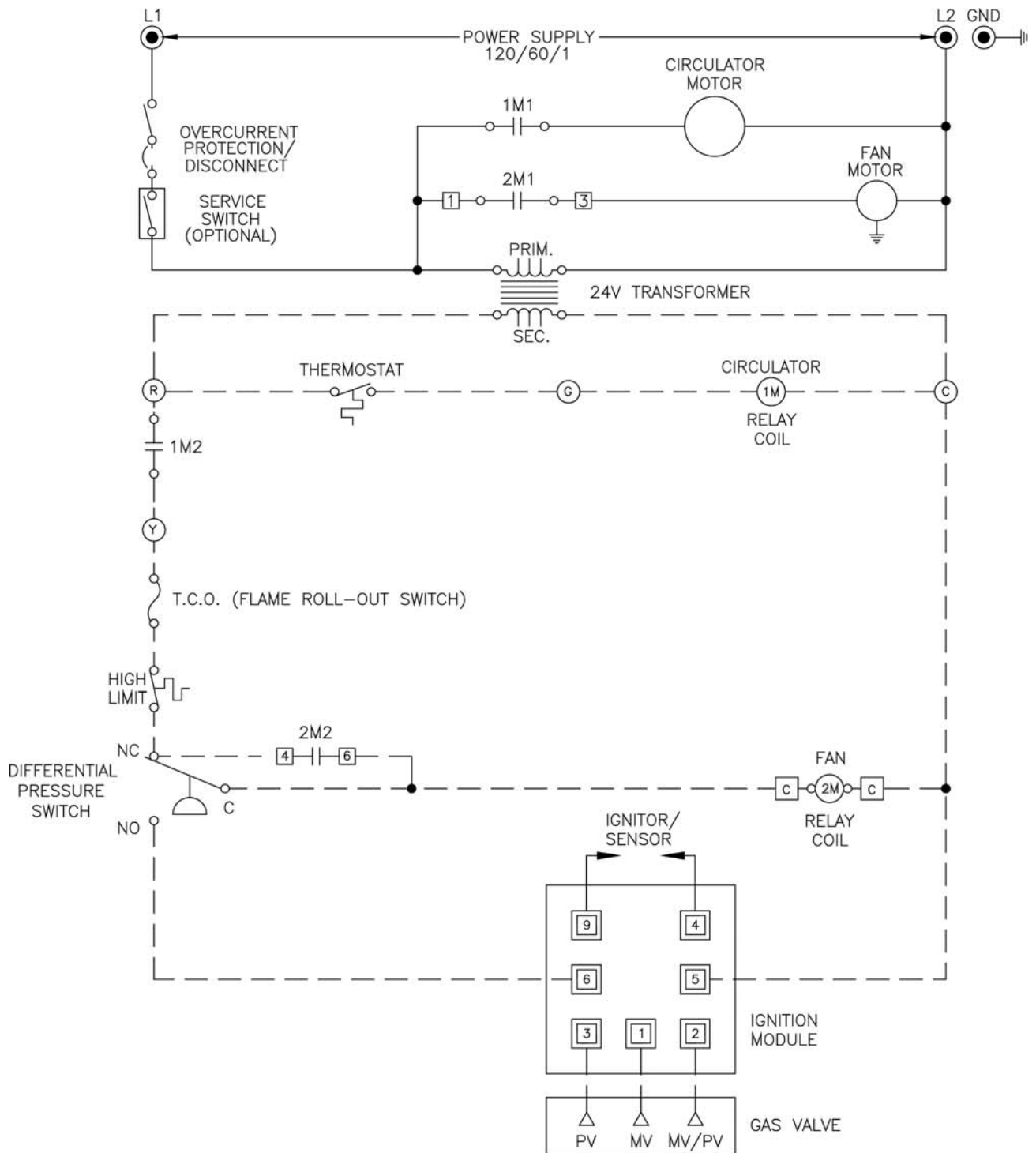


Figure 11
 SCHEMATIC WIRING DIAGRAM



LADDER DIAGRAM LEGEND

- | | |
|-----------------------------------|---------------------------|
| ○ R8285D CONTROL CENTER TERMINAL | — — — 24V EXTERNAL WIRING |
| □ FAN RELAY TERMINAL | — — — 24V INTERNAL WIRING |
| ▣ S8670E IGNITION MODULE TERMINAL | ———— 120V EXTERNAL WIRING |
| △ GAS VALVE TERMINAL | ———— 120V INTERNAL WIRING |

Figure 12
LADDER WIRING DIAGRAM

SEQUENCE OF OPERATION

1. When the thermostat calls for heat, relay coil (1M) is energized closing two sets of NO contacts. One set (1M2) energizes the 24 volt limit circuit and the other set (1M1) completes the 120 volt circulator circuit.
 2. With the thermal cutout switch (on the burner access panel), the high limit switch, and the suction pressure switch in their normally closed positions, the fan relay coil (2M) is energized closing two sets of NO contacts. One set (2M1) completes the 120 volt fan circuit and the other set (2M2) energizes the 24V suction pressure “check” circuit.
 3. With the fan operating, the suction pressure switch closes its NO contacts. The “check” circuit contacts (2M2) keep power on the fan relay (2M) during the heating cycle.
 4. When the suction pressure switch proves fan operation the ignition module is energized, beginning a 30-50 second prepurge. During prepurge the module performs a safe-start check that tests the internal components of the module for a flame simulating condition. If a flame simulating condition is present in the module, the heating system will not start.
 5. After prepurge, the module energizes the pilot gas valve operator. The pilot gas valve opens, allowing gas to flow to the pilot burner. At the same time, the electronic spark generator in the module generates a spark at the ignitor-sensor to light the pilot.
 6. If the pilot does not light within 90 seconds, or the pilot flame current is not at least 1.0 milliamps and steady, the module will not energize the main gas valve and the main burner will not light. Then the module goes into safety lockout, de-energizing the pilot gas valve operator causing the pilot gas valve to close. Five to six minutes after shutdown, the Ignition Module restarts the ignition sequence.
 7. When the sensor senses pilot flame during the 90 second trial for ignition the module will shut off the spark generator, reset the safety lockout timer, and energize the main gas valve operator. The main gas valve opens allowing gas to flow to the main burners where it is ignited by the pilot burner. Since the main gas valve is a step-opening valve, a limited amount of gas will be admitted to main burners for ignition (low fire). After a short time interval, the regulator on the gas valve will permit full flow through the main gas valve (high fire).
- Should a loss of flame occur, the main valve closes and the spark reoccurs within 0.8 second. The ignition module has an internal 100% lockout function to completely shutdown the system should the pilot gas fail to ignite with approx. 90 seconds. Five to six minutes after shutdown, the Ignition Module restarts the ignition sequence. The ignition trial, shutdown, and wait sequence continues until either the pilot lights or the Thermostat is set below room temperature (to end the call for heat). The ignition sequence can be reset by setting down the Thermostat for one minute.
8. Burners, circulator and fan will continue to operate until the thermostat is satisfied.
 9. If the high limit setting is reached before the thermostat is satisfied, the switch in the high limit will open to de-energize the ignition module and fan relay coil (2M), causing the gas valves to close and the fan to stop. (The circulator will continue to operate as long as the thermostat is calling for heat). When the boiler water temperature drops to a point where the high limit switch closes, the fan will restart (via 2M) and the ignition module will be energized to repeat the sequence in Steps 4 through 7 above.
 10. If for any reason (such as flame roll out into the vestibule) the thermal cutoff switch located on the burner access panel is subjected to temperatures above its setting the TCO switch will open to de-energize the ignition module and fan relay coil (2M), causing the gas valves to close and the fan to stop. (The circulator will continue to operate as long as the thermostat is calling for heat). Since the TCO switch is a one-time fusible link, the reason for overheating must be determined and the switch replaced in order for the boiler to function again.
 11. In the event the fan is inoperative or fails to provide sufficient air flow, the suction pressure switch connected at the inlet of the fan will not activate, the NO contacts will not close, the ignition module will not be energized, and hence the gas valves cannot be opened.
 12. If the contacts in the suction pressure switch were to weld together during the heating cycle (COM to NO), the ignition module could not be energized on the next call for heat due to the fact the fan relay coil (2M) could not be energized through either the suction pressure switch or the now open “check circuit” contacts.

TROUBLE SHOOTING

Use the Trouble Shooting Guide (pages 19 to 21) to assist in locating where a malfunction in the control system is occurring.

4 PROCEDURE FOR MEASURING FAN DIFFERENTIAL PRESSURE (See Figure 13).

- With boiler off, remove black silicone tubing from low side of pressure switch.
- With tee and 1/4" aluminum stubs, connect manometer as shown with additional tubing.
- Start boiler and read differential pressure on manometer. Should be -0.6" wc or greater (example -0.7" wc).
- Stop boiler, remove manometer and reconnect black silicone tubing to duct.

5 CHECK GAS INPUT RATE TO BOILER

- Input rate and maximum inlet pressure shown on rating label must not be exceeded. Inlet pressure must not be lower than minimum inlet pressure shown on rating label.
- All rate checks and all adjustments are to be made while boiler is firing - all other appliances connected to the same meter as the boiler must be off.
- Water manometer or water column gauge should be connected to a shutoff valve installed in the 1/8" pipe tapping in the gas valve - boiler off. By installing gas valve up stream of manometer, gas pressure can be introduced gradually - without shutoff valve, surge of pressure when boiler is turned on, could blow liquid out of manometer. Replace plug in gas valve when rate check is finished.
- Approximate input - Adjust pressure regulator on combination gas control so that manifold pressure is equal to that shown on rating label. Determine what

flow (cu. ft.) should be in 3 minutes using formula below:

$$\text{cu. ft. per 3 min.} = \frac{\text{Btuh Input (from Rating Label)}}{20000}$$

Clock gas meter for three (3) minutes using second hand or stop watch.

For minor input changes readjust pressure regulator on combination gas control. Increase or decrease manifold pressure to obtain corresponding increase or decrease in gas input.

Turning regulator adjusting screw clockwise increases pressure. Counterclockwise rotation decreases pressure. If it is necessary to increase manifold pressure more than 0.3" of water to obtain rated input, remove orifices and drill one size larger. Reinstall and recheck input rate.

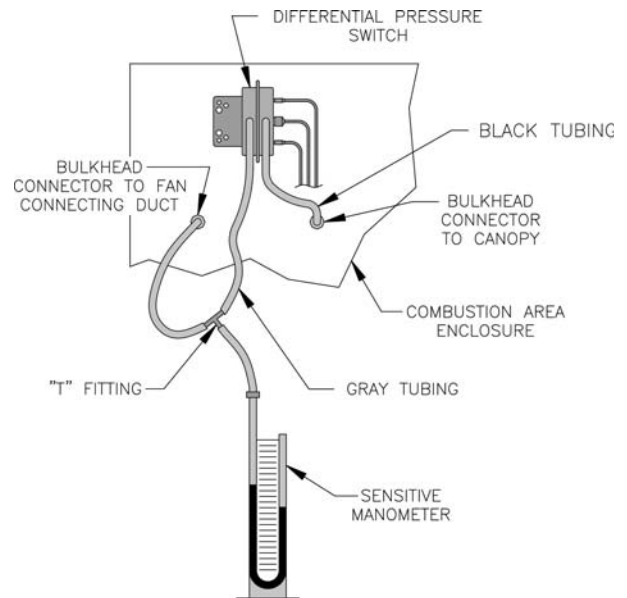
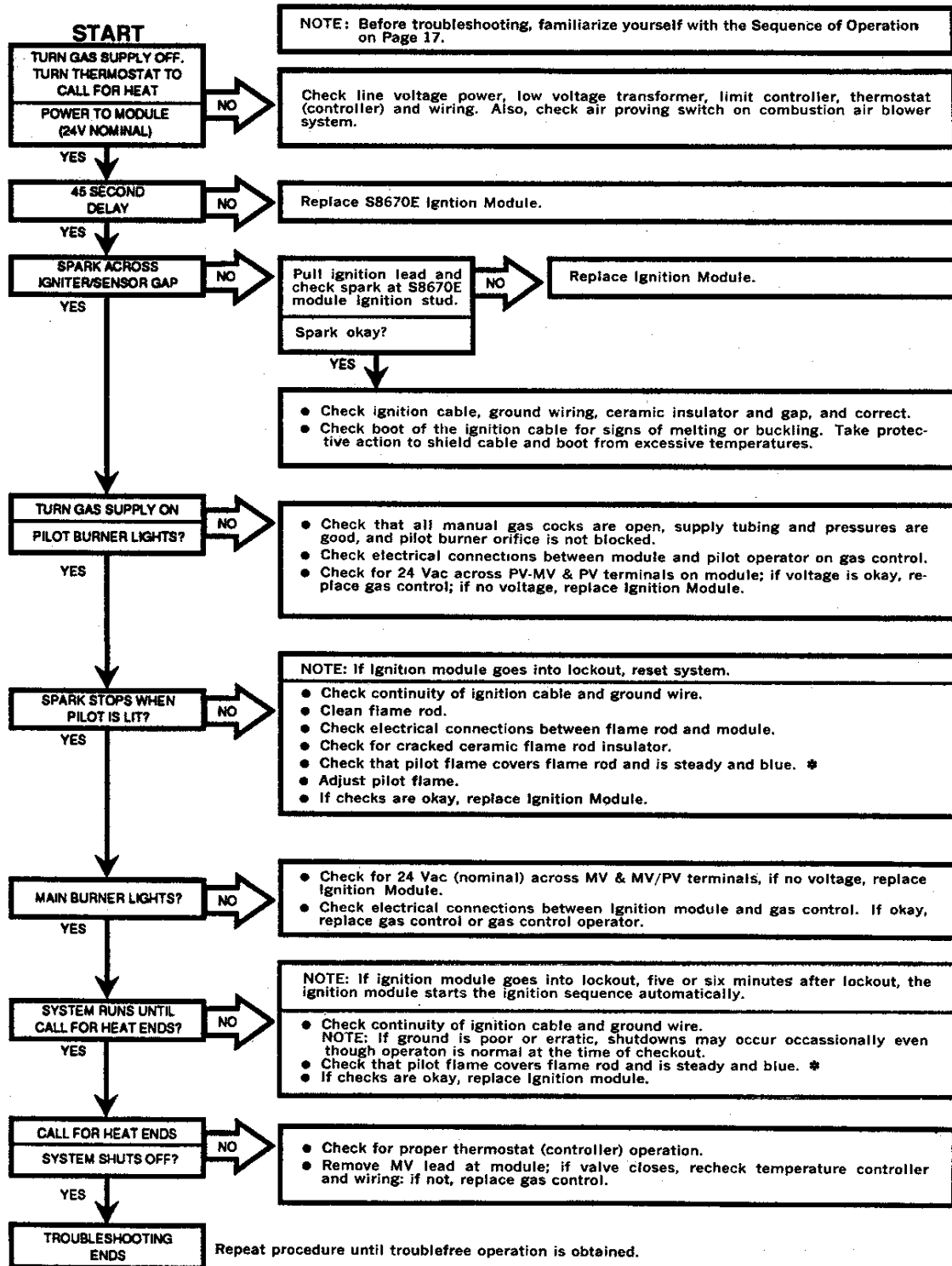


Figure 13

PROCEDURE FOR MEASURING FAN DIFFERENTIAL PRESSURE

**IGNITION SYSTEM TROUBLESHOOTING GUIDE
HONEYWELL S8670E IGNITION MODULE
(Boiler Troubleshooting Guide Begins on Page 20)**



* Minimum pilot signal should be 1.0 microamps, Disconnect Pilot Ground wire from Module and connect DC microammeter between Ground Terminal and pilot Ground wire.

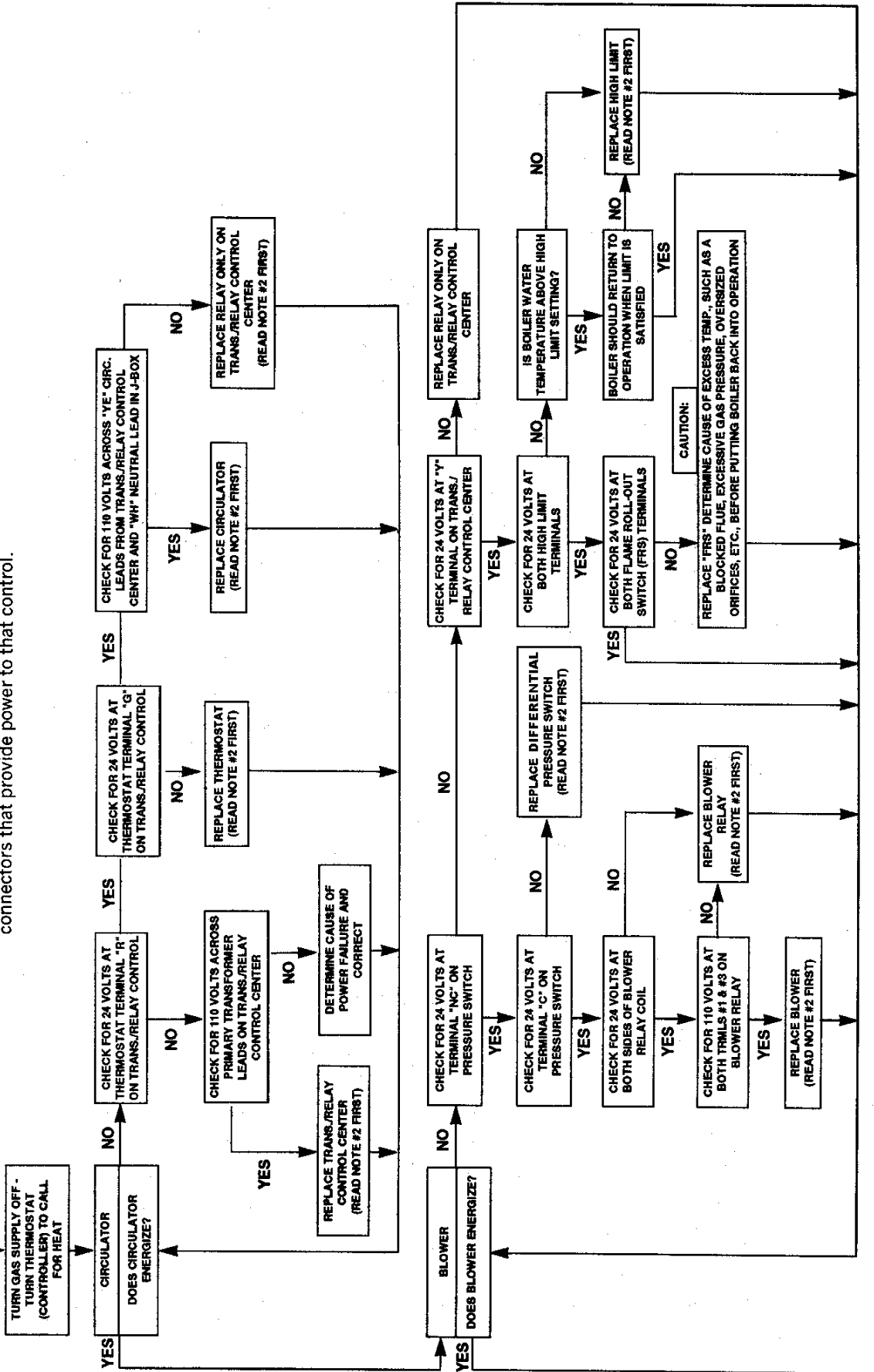
TROUBLE SHOOTING GUIDE

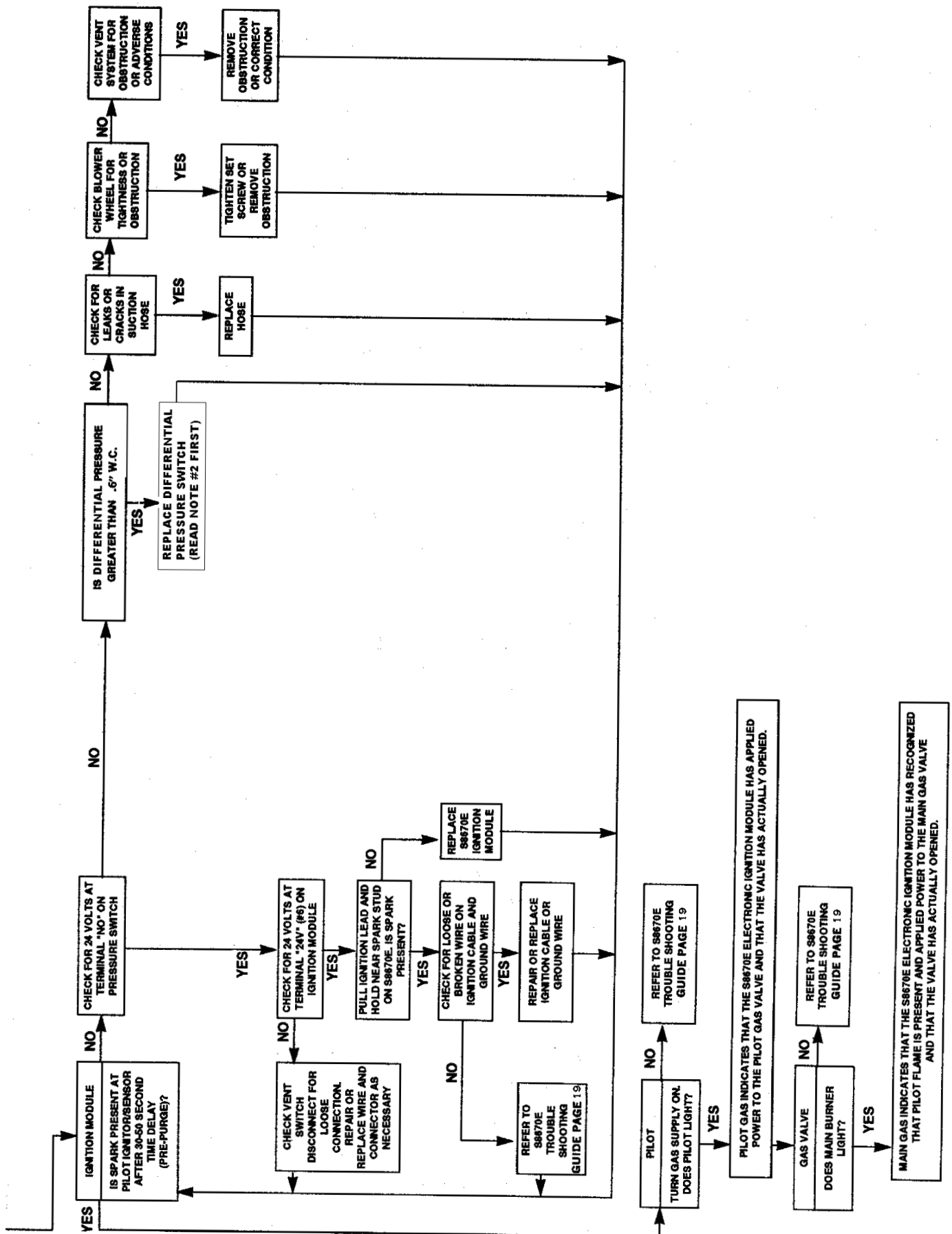
SPLIT (SEPARATE) CONTROLS, 24 VOLT OPERATION WITH ELECTRONIC IGNITION AND INTERMITTENT CIRCULATION

START CHECK-OUT PROCEDURE HERE

NOTE: 1. Read Sequence of Operation prior to using Trouble Shooting Guide. See Page 17.

2. Prior to replacing a control, always check for broken wires or loose connectors that provide power to that control.





- 6 CHECK PILOT FLAME. Flame should be a blue medium hard flame enveloping approximately 3/8" of the end of the sensing probe, see Figure 14.
- 7 CHECK THERMOSTAT OPERATION. Raise and lower thermostat setting as required to start and stop burners.
- 8 CHECK HIGH LIMIT CONTROL. Allow boiler to operate until burners are shut down by limit control (approximately 235°F). If burners are not shut down by limit control, determine cause of malfunction. Replace control if necessary and check its operation.
- 9 CHECK IGNITION SYSTEM SAFETY SHUTOFF DEVICE. Remove pilot ground lead from electrical junction block. If burners are not shut down by module, determine cause of malfunction. Replace module or gas valve if necessary.
- 10 MAIN BURNER FLAMES should have a clearly defined inner cone, see Figure 15, with no yellow tipping. Orange-yellow streaks caused by dust should not be confused with true yellow tipping.
- 11 CHECK LWCO OPERATION (if so equipped). Drain boiler water below LWCO set point. Burners should shutdown. If burners do not shut down determine cause of malfunction and repair.
- 12 WARNING – BEFORE INSTALLATION OF THE BOILER IS CONSIDERED COMPLETE, THE OPERATION OF THE BOILER CONTROLS SHOULD ALL BE CHECKED, PARTICULARLY THE LOW WATER CUT-OFF AND THE HIGH LIMIT CONTROL.

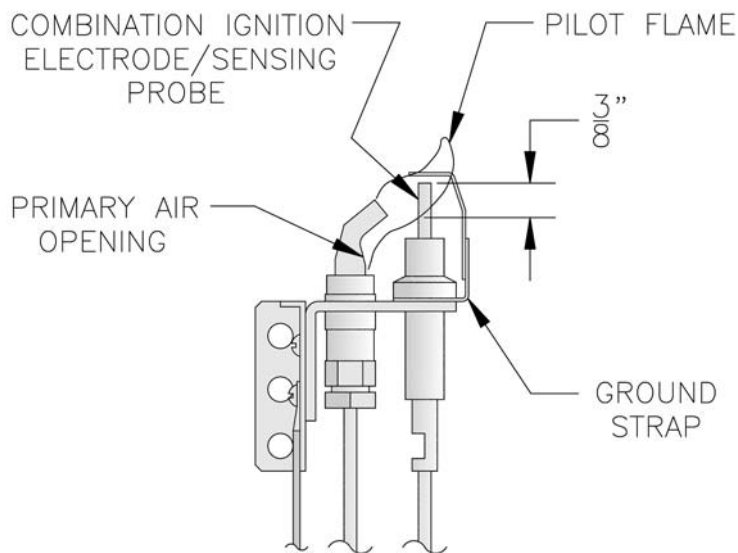


Figure 14
TYPICAL PILOT FLAME

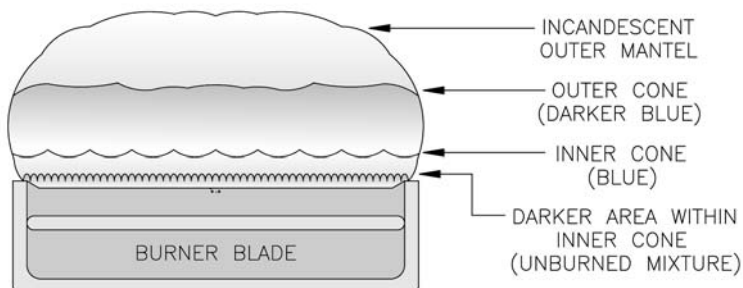


Figure 15
MAIN BURNER FLAME

IV. Service

- 1 GENERAL — Inspection should be conducted annually. Service as frequently as specified in paragraphs below. While service or maintenance is being done, Electrical Power and all Gas Supply to the Boiler must be “off.”

CAUTION

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

- 2 VENT SYSTEM — Vent system (see Figure 4 for typical installation) should be checked annually for:
 - a. Obstructions
 - b. Accumulations of soot
 - c. Deterioration of vent pipe or vent accessories due to condensation or other reasons
 - d. Proper attachment of vent cap and sealant around wall penetration
 - e. Remove vent cap and clean accumulations of soot and dirt with wire brush and vacuum. See Figure 16. Remove any obstructions. Replace all deteriorated parts.
- 3 CLEANING BOILER FLUES (See Figure 16).

Flue passageways in the boiler sections should be checked annually for any blockage or accumulation of soot. To obtain access to flueways:

 - a. Remove jacket front panel.
 - b. Remove sheet metal screws securing combustion area enclosure cover and remove cover. Exercise care when removing to prevent damage to enclosure gasket.
 - c. Remove fan assembly after disconnecting electrical leads and vent tube. Care should be exercised to avoid damage to gaskets.
 - d. Remove four (4) bolts securing canopy and remove canopy — flueways are now exposed.

Using a flashlight, examine all flue passageways. If passageways are free of soot and obstruction, replace canopy, secure and seal using kit available from Burnham distributors.
 - e. Replace fan, connect vent tube and electrical wiring.
 - f. Reinstall and secure enclosure cover and jacket front panel.

If the flue passageways need cleaning, remove burners as described in paragraph 4 below. Using long handle wire or bristle flue brush and vacuum,

brush flueways thoroughly from top of boilers as illustrated in Figure 16. Replace canopy and seal.

- 4 BURNERS AND FIREBOX SHOULD BE CLEANED ANNUALLY
 - a. Remove jacket front panel.
 - b. Remove sheet metal screws securing enclosure cover and remove cover exercising care with gasket.
 - c. Remove TCO leads from TCO and remove burner access panel.
 - d. Brush top of burner with a soft bristle brush and vacuum burner, see Figure 16. Check orifice to see that drilled passageway is free of lint and dirt.
 - e. Vacuum tips of pilot burner.
 - f. Clean firebox by vacuuming. Exercise care not to disturb insulation inside base.
- 5 REMOVAL OF BURNER ASSEMBLY
 - a. Disconnect pilot tubing coupling, ignition cable and ground wire from pilot assembly.
 - b. Disconnect gas valve at union between valve and bulkhead penetration.
 - c. Remove two fasteners attaching burner to bulkhead and single fastener for burner end support.
 - d. Grasp burner, tilt upward and remove from unit.
 - e. INSTALL BURNER by reversing procedure used to remove.
- 6 REMOVAL OR REPLACEMENT OF PILOT ASSEMBLY OR PILOT ASSEMBLY PARTS
 - a. If pilot assembly, sensor or pilot orifice need replacement, remove jacket front panel, enclosure cover and burner access panel using procedure described in paragraph 4 above.
 - b. Disconnect pilot tubing, ground wire and ignition sensor cable.
 - c. Remove two machine screws holding pilot burner to pilot bracket.
 - d. Reinstall pilot burner by reversing above procedure.
 - e. Check pilot and main burner flames, refer to Figures 14 & 15.
- 7 CHECK MAIN BURNER AND PILOT FLAMES, refer to Section III, paragraphs 6 and 10.
- 8 CHECK ALL CONTROLS ANNUALLY, see procedure in Section III, paragraphs 7, 8, 9, 11 and 12.

MAINTENANCE OF LOW WATER CUTOFF — During the heating season, if an external float type low water cutoff is on the boiler, the blow off valve should be opened once a month (use greater frequency

where conditions warrant) to flush out the sediment chamber so the device will be free to function properly.

Low water fuel cutoffs and water feeders should be dismantled annually by qualified personnel, to the extent necessary to insure freedom from obstructions and proper functioning of the working parts. Inspect connecting lines to boiler for accumulation of mud, scale, etc. and clean as required. Examine all visible wiring for brittle or worn insulation and make sure electrical contacts are clean and that they function properly. Give special attention to solder joints on bellows and float when this type of control is used. Check float for evidence of collapse and check mercury bulb (where applicable) for mercury separation or

discoloration. Probe type low water cutoff should be removed once a year, examined and cleaned of any dirt accumulations to assure proper operation. Do not attempt to repair mechanisms in the field. Complete replacement mechanisms including necessary gaskets and installation instructions are available from the manufacturer.

9 LUBRICATION

There are no parts requiring lubrication on the part of the serviceman or the homeowner. Circulator bearings are water lubricated. Fan motor bearings are factory sealed.

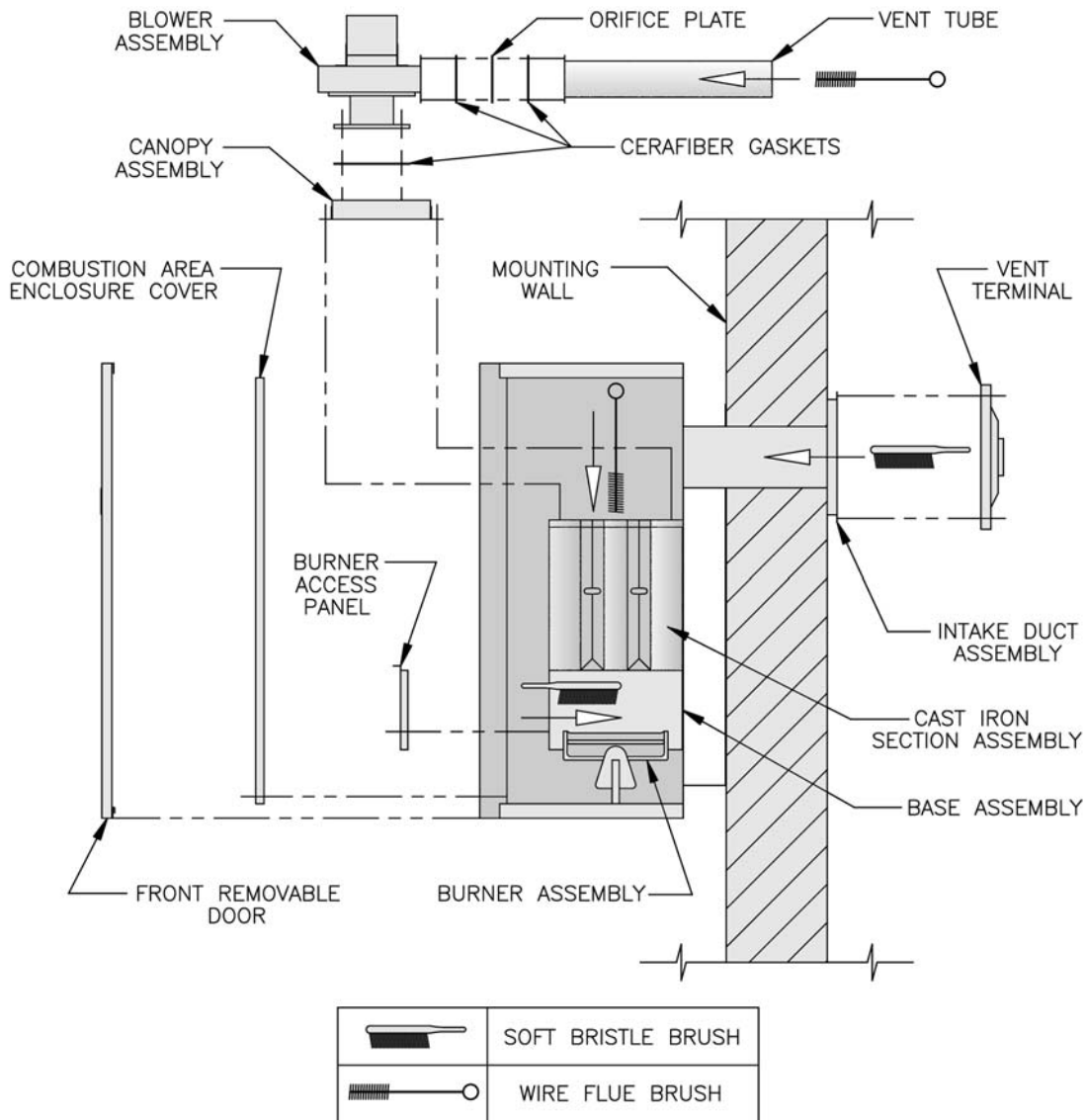


Figure 16
CLEANING OF VENT SYSTEM, BOILER FLUES, AND BURNERS

Important Product Safety Information

Refractory Ceramic Fiber Product

Warning:

This product contains refractory ceramic fibers (RCF). RCF has been classified as a possible human carcinogen. After this product is fired, RCF may, when exposed to extremely high temperature (>1800F), change into a known human carcinogen. When disturbed as a result of servicing or repair, RCF becomes airborne and, if inhaled, may be hazardous to your health.

AVOID Breathing Fiber Particulates and Dust

Precautionary Measures:

Do not remove or replace previously fired RCF (combustion chamber insulation, target walls, canopy gasket, flue cover gasket, etc.) or attempt any service or repair work involving RCF without wearing the following protective gear:

1. A National Institute for Occupational Safety and Health (NIOSH) approved respirator
 2. Long sleeved, loose fitting clothing
 3. Gloves
 4. Eye Protection
- Take steps to assure adequate ventilation.
 - Wash all exposed body areas gently with soap and water after contact.
 - Wash work clothes separately from other laundry and rinse washing machine after use to avoid contaminating other clothes.
 - Discard used RCF components by sealing in an air tight plastic bag.

First Aid Procedures:

- If contact with eyes: Flush with water for at least 15 minutes. Seek immediate medical attention if irritation persists.
- If contact with skin: Wash affected area gently with soap and water. Seek immediate medical attention if irritation persists.
- If breathing difficulty develops: Leave the area and move to a location with clean fresh air. Seek immediate medical attention if breathing difficulties persist.
- Ingestion: Do not induce vomiting. Drink plenty of water. Seek immediate medical attention.

V. Repair Parts

All Spacemaster™ Repair Parts may be obtained through your local Burnham Wholesale distributor. Should you require assistance in locating a Burnham distributor in your area, or have questions regarding the availability of Burnham products or repair parts, please contact Burnham Customer Service at (717) 481-8400 or Fax (717) 481-8408.

Any parts not listed can be ordered by description or part number on the item.

	<u>Part No.</u>
1. Gas Valve - Honeywell VR8204C3007	81660145U
2. Ignition Module - Honeywell S8670E1007*	80160108
3. Differential Pressure Switch	60160880
4. High Limit - Honeywell L4189B2012	80160460
4a. Honeywell #45900409-003B Immersion Well (½"NPT)	80160461
5. Circulator - TACO #005-T1	8056054
6. Pilot - Honeywell Q362A1037	8236068
7. Ignition/Sensor Cable Honeywell 394799-36	8236085
8a. Main Gas Burner with Pilot Bracket and Orifice #AB24040 (3 section)	8236070
8b. Main Gas Burner with Pilot Bracket and Orifice #AB24042 (4 section)	8236074
9. Induced Draft Fan Replacement Assembly - Includes Fan (8116055), Canopy Outlet Gasket, Fan Inlet Gasket and two (2) Fan Outlet Gaskets	6110303
10. Fan Inlet Casting	8116056
11. Temperature/Pressure Gauge	8056235
12a. Lower Circulator Return Piping Assembly - 3 section	8060301
12b. Lower Circulator Return Piping Assembly - 4 section	8060305
13a. Supply Piping Assembly - 3 section	8060302
13b. Supply Piping Assembly - 4 section	8060304
14. Upper Circulator Return Piping Assembly	8060303
15. Enclosure Gasket	8200301
16. Canopy Outlet Gasket	8206034
17. Fan Inlet Gasket	8206011
18. Fan Outlet/Orifice Plate Gasket (2 required)	8200306
19. Transformer/Relay Combination - Honeywell R8285D5001	80160156U
20. Relay - Honeywell R8222U1006	80160096U
21. Misc. Parts Carton 5" to 9" thick walls	6050301
22. Misc. Parts Carton 9" to 15" thick walls	6050302
23. Vent Tube - 2½" O.D. x 24" Lg.	8110301
24. Vent Tube Mounting Flange	7110311
25a. Orifice Plate - 3 section	61103036
25b. Orifice Plate - 4 section	61103046
26. Air Inlet Duct Gasket	8200307
27. Flame Roll-Out Switch	80160044

*** WARNING — The Honeywell S8670E Ignition Module incorporates a prepurge feature that is necessary for the safe operation of this boiler. Do not substitute any other Ignition Module.**

VI. Low Water Cut Off (LWCO)

WARNING

DO NOT ATTEMPT to cut factory wires to install an aftermarket Low Water Cut Off (LWCO). Only use connections specifically identified for Low Water Cut Off.

In all cases, follow the Low Water Cut Off (LWCO) manufacturer's instructions.

When

A low water cutoff is required to protect a hot water boiler when any connected heat distributor (radiation) is installed below the top of the hot water boiler (i.e. baseboard on the same floor level as the boiler). In addition, some jurisdictions require the use of a LWCO with a hot water boiler.

Where

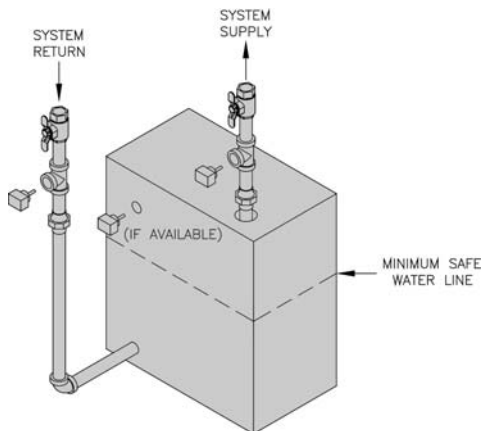
The universal location for a LWCO on both gas and oil hot water boilers is above the boiler, in either the supply or return piping. The minimum safe water level of a water boiler is at the uppermost top of the boiler; that is, it must be full of water to operate safely.

What Kind

Typically, in residential applications, a probe type LWCO is used instead of a float type, due to their relative costs and the simplicity of piping for a probe LWCO.

How to Pipe

A “tee” is commonly used to connect the probe LWCO to the supply or return piping, as shown below.



LWCO Location

Select the appropriate size tee using the LWCO manufacturer's instructions. Often, the branch connection must have a **minimum** diameter to prevent bridging between the probe and the tee. Also, the run of the tee must have a minimum diameter to prevent the end of the probe from touching or being located too close to the inside wall of the run of the tee. Ideally, manual shutoff valves should be located above the LWCO and the boiler to allow for servicing. This will allow probe removal for inspection without

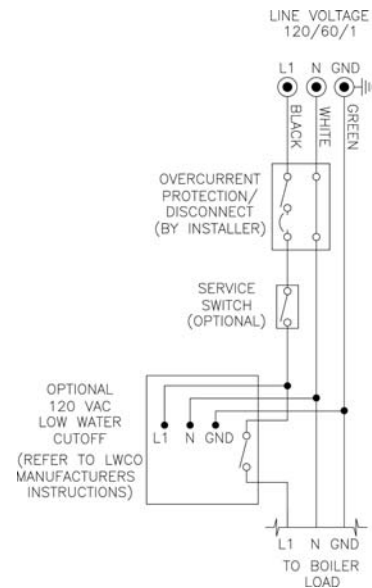
draining the heating system. Many probe LWCO manufacturers recommend an annual inspection of the probe.

How to Wire

LWCO's are available in either 120 VAC or 24 VAC configurations. The 120 VAC configuration can be universally applied to both gas and oil boilers by wiring it in the line voltage service to the boiler (after the service switch, if so equipped).

The presence of water in a properly installed LWCO will cause the normally open contact of the LWCO to close, thus providing continuity of the 120 VAC service to the boiler.

It is recommended to supply power to the probe LWCO with the same line voltage boiler service as shown below.



Wiring of Typical LWCO

A 24 VAC LWCO is used primarily for gas fired boilers where a 24 volt control circuit exists within the boiler. However, a 24 VAC LWCO can only be used if the boiler manufacturer has provided piping and wiring connections and instructions to allow for this application.

How to Test

Shut off fuel supply. Lower water level until water level is BELOW the LWCO. Generate a boiler demand by turning up thermostat. Boiler should not attempt to operate. Increase the water level by filling the system. The boiler should attempt to operate once the water level is above the LWCO.

Limited Warranty

FOR RESIDENTIAL CAST IRON WATER BOILERS

Subject to the terms and conditions set forth below, U.S. Boiler Co., Inc. Lancaster, Pennsylvania hereby extends the following limited warranties to the original owner of a residential grade water boiler manufactured and shipped on or after July 1, 1991:

ONE YEAR LIMITED WARRANTY ON RESIDENTIAL GRADE WATER BOILERS

U.S. Boiler Co., Inc. warrants to the original owner that its residential grade water boilers comply at the time of manufacture with recognized hydronic industry standards and requirements then in effect and will be free of defects in material and workmanship under normal usage for a period of one year from the date of original installation. If any part of a water boiler is found to be defective in material or workmanship during this one year period, U.S. Boiler Co., Inc. will, at its option, repair or replace the defective part.

LIFETIME LIMITED WARRANTY ON HEAT EXCHANGER

U.S. Boiler Co., Inc. warrants to the original owner that the heat exchanger of its residential grade water boilers will remain free from defects in material and workmanship under normal usage for the lifetime of the original owner at the original place of installation. If a claim is made under this warranty during the first ten years from the date of original installation, U.S. Boiler Co., Inc. will, at its option, repair or replace the heat exchanger. If a claim is made under this warranty after the expiration of ten years from the date of original installation, U.S. Boiler Co., Inc. will, at its option and upon payment of the pro-rated service charge set forth below, repair or replace the heat exchanger. The service charge applicable to a heat exchanger warranty claim is based upon the number of years the heat exchanger has been in service and will be determined as a percentage of the retail price of the heat exchanger model involved at the time the warranty claim is made as follows:

Years In Service	1-10	11	12	13	14	15	16	17
Service Charge as % of Retail Price	No Charge	5	10	15	20	25	30	35

Years In Service	18	19	20	21	22	23	24	25 and above
Service Charge as % of Retail Price	40	45	50	55	60	65	70	75

NOTE: If the heat exchanger model involved is no longer available due to product obsolescence or redesign, the value used to establish the retail price will be the published price as shown in the Burnham Hydronics Repair Parts Price Sheet where the heat exchanger last appeared or the current retail price of the then nearest equivalent heat exchanger.

ADDITIONAL TERMS AND CONDITIONS

- 1. Applicability:** The limited warranties set forth above are extended only to the original owner at the original place of installation within the United States and Canada. These warranties are applicable only to water boilers designated as residential grade by U.S. Boiler Co., Inc. and installed in a single or two-family residence and do not apply to steam boilers of any kind or to commercial grade boilers.
- 2. Components Manufactured by Others:** Upon expiration of the one year limited warranty on residential grade water boilers, all boiler components manufactured by others but furnished by U.S. Boiler Co., Inc. (such as oil burner, circulator and controls) will be subject only to the manufacturer's warranty, if any.
- 3. Proper Installation:** The warranties extended by U.S. Boiler Co., Inc. are conditioned upon the installation of the residential grade water boiler in strict compliance with U.S. Boiler Co., Inc. installation instructions. U.S. Boiler Co., Inc. specifically disclaims liability of any kind caused by or relating to improper installation.
- 4. Proper Use and Maintenance:** The warranties extended by U.S. Boiler Co., Inc. are conditioned upon the use of the residential grade water boiler for its intended purposes and its maintenance accordance with U.S.

Boiler Co., Inc. recommendations and hydronics industry standards. These warranties will be inapplicable if the residential grade water boiler is used or operated over its rated capacity, is subjected to unauthorized modification, or is damaged as a result of being otherwise improperly operated or serviced including, but not limited to, damage from any of the following: operation with insufficient water, allowing the boiler to freeze, subjecting the boiler to flood conditions, and operation with unapproved water or fuel additives which cause deposits or corrosion.

- 5. Removal and Installation:** These warranties do not cover expenses of removal or reinstallation. The owner is responsible for the cost of removing and reinstalling any defective part and its replacements and all labor and material connected therewith.
- 6. Exclusive Remedy:** U.S. Boiler Co., Inc. obligation for any breach of these warranties is limited to the repair or replacement of its parts in accordance with the terms and conditions of these warranties.
- 7. Limitation of Damages:** Under no circumstances shall U.S. Boiler Co., Inc. be liable for incidental, indirect, special or consequential damages of any kind whatsoever under these warranties, including, but not limited to, injury or damage to persons or property and damages for loss of use, inconvenience or loss of time. U.S. Boiler Co., Inc. liability under these warranties shall under no circumstances exceed the purchase price paid by the owner for the residential grade water boiler involved. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.
- 8. Limitation of Warranties:** These warranties set forth the entire obligation of U.S. Boiler Co., Inc. with respect to any defect in a residential grade water boiler and U.S. Boiler Co., Inc. shall have no express obligations, responsibilities or liabilities of any kind whatsoever other than those set forth herein. These warranties are given in lieu of all other express warranties.

ALL APPLICABLE IMPLIED WARRANTIES, IF ANY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY LIMITED IN DURATION TO A PERIOD OF ONE YEAR EXCEPT THAT IMPLIED WARRANTIES, IF ANY, APPLICABLE TO THE HEAT EXCHANGER IN A RESIDENTIAL GRADE WATER BOILER SHALL EXTEND TO THE ORIGINAL OWNER FOR THE LIFETIME OF THE ORIGINAL OWNER AT THE ORIGINAL PLACE OF INSTALLATION. SOME STATES DO NOT ALLOW LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

PROCEDURE FOR OBTAINING WARRANTY SERVICE

In order to assure prompt warranty service, the owner is requested to complete and mail the attached Warranty Card within ten days after the installation of the boiler, although failure to comply with this request will not void the owner's rights under these warranties.

Upon discovery of a condition believed to be related to a defect in material or workmanship covered by these warranties, the owner should notify the installer, who will in turn notify the distributor. If this action is not possible or does not produce a prompt response, the owner should write to U.S. Boiler Co., Inc., Burnham Hydronics, at P.O. Box 3079, Lancaster, PA 17604, giving full particulars in support of the claim.

The owner is required to make available for inspection by U.S. Boiler Co., Inc. or its representative the parts claimed to be defective and, if requested by U.S. Boiler Co., Inc. to ship these parts prepaid to U.S. Boiler Co., Inc. at the above address for inspection or repair. In addition, the owner agrees to make all reasonable efforts to settle any disagreement arising in connection with a claim before resorting to legal remedies in the courts.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

