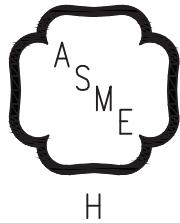


# INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FOR

## Series 2<sup>®</sup> Gas - Fired Boiler



**Intertek**  
9700609



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.

Model Number 2	Boiler Serial Number	Installation Date
Heating Contractor		Phone Number
Address		



NOTE: The 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.

All wiring on boilers installed in the USA shall be made in accordance with the *National Electrical Code* and/or local regulations.

All wiring on boilers installed in Canada shall be made in accordance with the *Canadian Electrical Code* and/or local regulations.

The City of New York requires a Licensed Master Plumber supervise the installation of this product.

The Massachusetts Board of Plumbers and Gas Fitters has approved the Series 2 boiler. See the Massachusetts Board of Plumbers and Gas Fitters website, [http://license.reg.state.ma.us/pubLic/pl\\_products/pb\\_pre\\_form.asp](http://license.reg.state.ma.us/pubLic/pl_products/pb_pre_form.asp) for the latest Approval Code or ask your local Sales Representative.

The Commonwealth of Massachusetts requires this product to be installed by a Licensed Plumber or Gas Fitter.

The following defined terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning the life of the product.

### **DANGER**

Indicates presence of a hazard which will cause severe personal injury, death or substantial property damage if ignored.

### **CAUTION**

Indicates presence of a hazard which will or can cause minor personal injury or property damage if ignored.

### **WARNING**

Indicates presence of a hazard which can cause severe personal injury, death or substantial property damage if ignored.

### **NOTICE**

Indicates special instructions on installation, operation, or maintenance which are important but not related to personal injury hazards.

## **DANGER**

**DO NOT store or use gasoline or other flammable vapors or liquids in the vicinity of this or any other appliance.**

**If you smell gas vapors, DO NOT try to operate any appliance - DO NOT touch any electrical switch or use any phone in the building. Immediately, call the gas supplier from a remotely located phone. Follow the gas supplier's instructions or if the supplier is unavailable, contact the fire department.**

## WARNING

This boiler requires regular maintenance and service to operate safely. Follow the instructions contained in this manual.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Read and understand the entire manual before attempting installation, start-up operation, or service. Installation and service must be performed only by an experienced, skilled and knowledgeable installer or service agency

This boiler must be properly vented.

This boiler needs fresh air for safe operation and must be installed so there are provisions for adequate combustion and ventilation air.

The interior of the venting system must be inspected and cleaned before the start of the heating season and should be inspected periodically throughout the heating season for any obstructions. A clean and unobstructed venting system is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the boiler's efficiency.

Installation is not complete unless a pressure relief valve is installed into the tapping located on top of boiler. - See the Boiler Water Piping Section of this manual for details.

This boiler is supplied with safety devices which may cause the boiler to shut down and not re-start without service. If damage due to frozen pipes is a possibility, the heating system should not be left unattended in cold weather; or appropriate safeguards and alarms should be installed on the heating system to prevent damage if the boiler is inoperative.

This boiler contains very hot water under high pressure. Do not unscrew any pipe fittings nor attempt to disconnect any components of this boiler without positively assuring the water is cool and has no pressure. Always wear protective clothing and equipment when installing, starting up or servicing this boiler to prevent scald injuries. Do not rely on the pressure and temperature gauges to determine the temperature and pressure of the boiler. This boiler contains components which become very hot when the boiler is operating. Do not touch any components unless they are cool.

Boiler materials of construction, products of combustion and the fuel contain alumina, silica, heavy metals, carbon monoxide, nitrogen oxides, aldehydes and/or other toxic or harmful substances which can cause death or serious injury and which are known to the state of California to cause cancer, birth defects and other reproductive harm. Always use proper safety clothing, respirators and equipment when servicing or working nearby the boiler.

Failure to follow all instructions in the proper order can cause personal injury or death. Read all instructions, including all those contained in component manufacturers manuals which are provided with the boiler before installing, starting up, operating, maintaining or servicing.

All cover plates, enclosures and guards must be in place at all times.

## NOTICE

This boiler has a limited warranty, a copy of which is included with this boiler. It is the responsibility of the installing contractor to see that all controls are correctly installed and are operating properly when the installation is complete.

<b>TABLE OF CONTENTS</b>	
I. Product Description, Specifications and Dimensional Data.....	4
II. Pre-Installation & Boiler Mounting .....	6
III. Gas Piping.....	8
IV. Boiler Water Piping.....	9
V. Venting.....	14
VI. Electrical.....	18
VII. System Start-up and Checkout.....	22
VIII. Operation.....	26
IX. Service and Maintenance.....	30
X. Troubleshooting.....	34
XI. Repair Parts .....	39
Appendix A - Figures.....	56
Appendix B - Tables.....	58

---

## **I. PRODUCT DESCRIPTION, SPECIFICATIONS AND DIMENSIONAL DATA**

---

The Series 2 boilers are low pressure cast iron gas fired hot water boilers designed for use in closed hot water heating systems. These boilers are Category I draft hood equipped appliances, which must be

vented by natural draft using a lined masonry or listed metal chimney system. An adequate supply of air for combustion, ventilation and dilution of flue gases must be available in the boiler room.



## II. PRE-INSTALLATION AND BOILER MOUNTING

### WARNING

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

- A. 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.
- B. BOILER INSTALLATION** must conform to the requirements of the authority having jurisdiction, or in the absence of such requirements, to:
- U.S.A. - *National Fuel Gas Code, ANSI Z223.1/ NFPA 54.*
- CANADA - *Natural and Propane Installation Code, CAN/CSA B149.1.*
- Where required by authority having jurisdiction, installation must conform to Standard for *Controls and Safety Devices for Automatically Fired Boilers, ANSI/ ASME CSD-1.*
- C. These Gas Boilers are DESIGN CERTIFIED FOR INSTALLATION ON COMBUSTIBLE FLOORING. DO NOT INSTALL THESE BOILERS ON CARPETING.**

### NOTICE

**Do not drop boiler. Do not bump boiler jacket against floor.**

- D. LOCATE BOILER** in front of or behind installation position before removing Crate. Locate on a level floor as close to chimney as possible. For basement installations, provide a solid base such as concrete, if floor is not level or if water may be encountered on floor around Boiler.
- 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.).

### DANGER

**Do not install boiler where gasoline or other flammable vapors or liquids, or sources of hydrocarbons (i.e. bleaches, cleaners, chemicals, sprays, paint removers, fabric softeners, etc.) are used or stored.**

### CAUTION

**Avoid operating this boiler in an environment where saw dust, loose insulation fibers, dry wall dust, etc. are present. If boiler is operated under these conditions, the burner interior and ports must be cleaned and inspected daily to insure proper operation.**

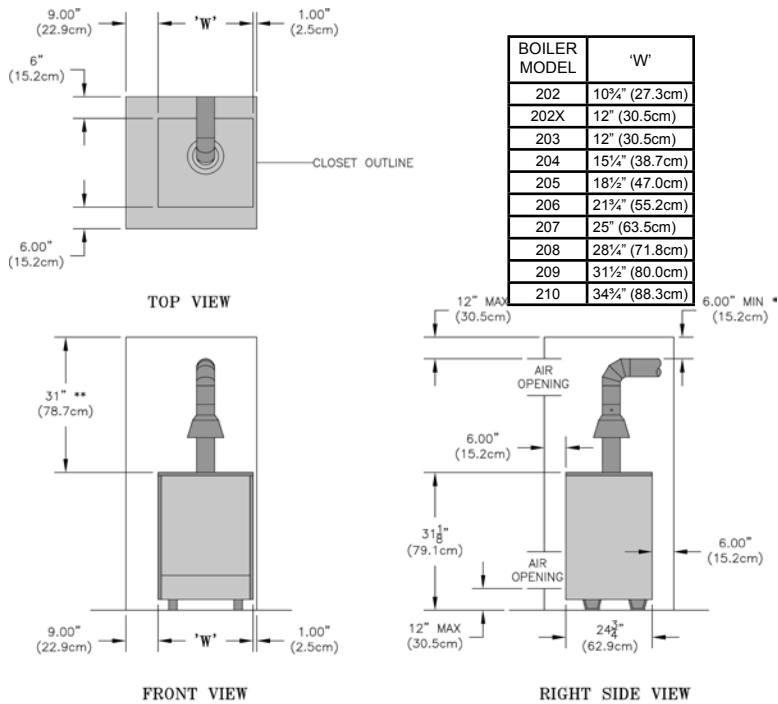
- E. REMOVE CRATE -**
1. Remove all crate fasteners. Lift off outside container.
  2. Remove all screws and brackets securing boiler to skid.
  3. Save two of the wooden slats from the container sleeve for use in Steps 4, 5 and 6.
  4. Tilt the boiler to one side and slide a wooden slat under the two raised feet.
  5. Tilt the boiler to the other side and slide another wooden slat under the two raised feet.
  6. Slide the boiler forward or backward off the skid using the two wooden slats as runners.
- F. Move boiler to permanent position.**
- G. PROVIDE CLEARANCE and AIR for COMBUSTION and VENTILATION.**

### WARNING

**Adequate combustion and ventilation air must be provided to assure proper combustion.**

1. CLEARANCES
  - a. ALL INSTALLATIONS - Practical service clearances must be considered (see Figure 2). A minimum of 24" (6.0cm) from the left side and front jacket panels is recommended for servicing but may be reduced to minimum shown in Figure 2. Subject to boiler and system piping, right side clearance may be reduced to 1" (2.5cm) if left side clearance is increased to 9" (22.9cm).
  - b. ALCOVE INSTALLATIONS - An alcove is considered a closet as shown in Figure 2 less front. Height clearance may be reduced to 27" (68.6cm).
  - c. UNCONFINED SPACE (see definition, paragraph (2) below) - Height clearance may be reduced to 27" (68.6cm).
2. PROVIDE COMBUSTION AND VENTILATION AIR in accordance with the section "Air for Combustion and Ventilation", of the *National Fuel Gas Code, ANSI Z223.1/NFPA*, or Sections 8.2, 8.3,

## II. PRE-INSTALLATION AND BOILER MOUNTING (continued)



\* MINIMUM RADIAL CLEARANCE AROUND DRAFT HOOD AND BREECHING.  
 \*\* ADD HEIGHT REQUIRED TO MAINTAIN 6" (15.2cm) CLEARANCE FROM ALL BREECHING COMPONENTS. VENT DAMPER MAY BE INSTALLED IN VERTICAL OR HORIZONTAL SECTION OF BREECHING WITHIN REACH OF CONTROL HARNESS.

**Figure 2: Minimum Clearances**

or 8.4 of *Natural Gas and Propane Installation Code*, CAN/CSA B149.1, or applicable provisions of local building codes.

a. CLOSET INSTALLATIONS (confined space) in a building of *other than unusually tight construction* (see definition below), provide combustion and ventilation air as shown in Figure 2.

b. Installations other than closet in paragraph (a) :

i. Determine volume of space (boiler room). Rooms communicating directly with space (through openings not furnished with doors) are considered part of space.

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

ii. Determine Total Input of all appliances in space. Round result to nearest 1,000 Btu per hour (Btuh).

iii. Determine type of space. Divide Volume by Total Input.

- If result is greater than or equal to 50 ft<sup>3</sup> (1.4m<sup>3</sup>) per 1,000 Btuh, space is considered an *unconfined space*.

- If result is less than 50 ft<sup>3</sup> (1.4m<sup>3</sup>) per 1,000 Btuh, space is considered a *confined space*.

iv. Determine building type. A building of *unusually tight construction* has the following characteristics:

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

- v. For boiler located in a building of other than *unusually tight construction*, adequate combustion and ventilation air is normally provided by fresh air infiltration through cracks around windows and doors.
- vi. For boiler located in building of *unusually tight construction*, provide outdoor air through two permanent openings which communicate directly or by duct with the outdoors or spaces (crawl or attic) freely communicating with the outdoors. Locate one opening within 12 inches (30.5cm) of top of space. Locate remaining opening within 12 inches (30.5cm) of bottom of space. Minimum dimension of air opening is 3 inches (7.6cm). Size each opening per following:

- Direct communication with outdoors. Minimum free area of 1 square inch (6.5cm<sup>2</sup>) per 4,000 Btu per hour input of all equipment in space.
- Vertical ducts. Minimum free area of 1 square inch (6.5cm<sup>2</sup>) per 4,000 Btu per hour input of all equipment in space. Duct cross-sectional area shall be same as opening free area.
- Horizontal ducts. Minimum free area of 1 square inch (6.5cm<sup>2</sup>) per 2,000 Btu per hour input of all equipment in space. Duct cross-sectional area shall be same as opening free area.

- vii. Ventilation Duct Louvers and Grilles. Equip outside openings with louvers to prevent entrance of rain and snow, and screens to prevent entrance of insects and rodents. Louvers and grilles must be fixed in open position or interlocked with equipment to open automatically before burner operation. Screens must not be smaller than 1/4 inch mesh. Consider the blocking effect of louvers, grilles and screens when calculating the opening size to provide the required free area. If free area of louver or grille is not known, assume wood louvers have 20-25 percent free area and metal louvers and grilles have 60-75 percent free area.

### III. GAS PIPING

**A. CONNECT GAS SERVICE** from Meter to gas control assembly in accordance with Local Piping Codes and requirements of Gas Company. They may require piping of larger size than Control Assembly Connection, especially if run from meter is long or includes several elbows. See Figure 1 for size of Gas Connection to gas control assembly.

This piping is to be supplied by the installer and must include a trap, a ground joint union and a manual shutoff valve upstream of the gas control assembly outside of the jacket when codes require, see Figure 3. 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 and shutoff valve must be disconnected from the gas supply piping system during any pressure testing at pressures greater than ½ psig (3.5kPa).

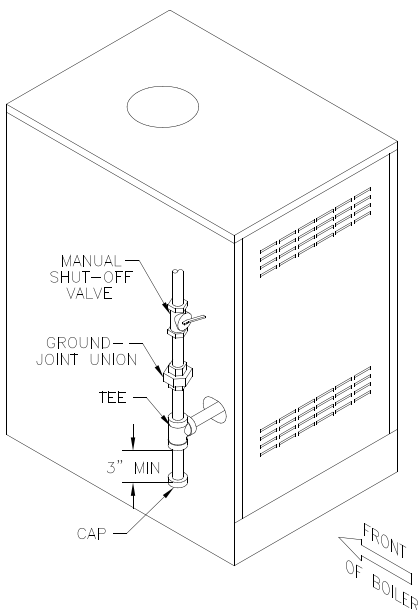
The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at pressures equal to or less than ½ psig (3.5kPa).

**RECOMMENDED SIZING OF GAS SUPPLY PIPING TO BOILER FOR NATURAL GAS** - 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 the Tables 2, 3 and 4. The following shall be taken into account:

1. Allowable loss of pressure to assure a burner manifold pressure of 3½" (8.9cm) water for natural gas.
2. Supply of gas to be provided in cubic feet.
3. Length of piping and number of fittings.
4. Specific gravity of gas.
5. Correction factor for specific gravity.

**Table 2: Maximum Capacity of Schedule 40 Pipe in CFH for Natural Gas Pressures of ½ psig or Less**

Length [Feet]	0.3 Inch w.c. Pressure Drop				0.5 Inch w.c. Pressure Drop			
	½	¾	1	1¼	½	¾	1	1¼
10	132	278	520	1,050	175	360	680	1,400
20	92	190	350	730	120	250	465	950
30	73	152	285	590	97	200	375	770
40	63	130	245	500	82	170	320	660
50	56	115	215	440	73	151	285	580
60	50	105	195	400	66	138	260	530
70	46	96	180	370	61	125	240	490
80	43	90	170	350	57	118	220	460
90	40	84	160	320	53	110	205	430
100	38	79	150	305	50	103	195	400



**Figure 3: Recommended Gas Piping**

**Table 3: Equivalent Length of Fittings**

Fitting	Nominal Pipe Size			
	½	¾	1	1¼
45° Ell	0.7	1	1.2	1.6
90° Ell	1.6	2.1	2.6	3.5
Tee (As Elbow)	3.1	4.1	5.2	6.9

**Table 4: Specific Gravity Correction Factors for Natural Gas**

Specific Gravity	Correction Factor	Specific Gravity	Correction Factor
0.50	1.10	1.30	1.07
0.55	1.04	1.40	1.04
0.60	1.00	1.50	1.00
0.65	0.96	1.60	0.97
0.70	0.93	1.70	0.94
0.75	0.90	---	---
0.80	0.87	---	---



## IV. BOILER WATER PIPING

### A. BOILER WATER PIPING

#### CAUTION

Failure to properly pipe boiler may result in improper operation and damage to boiler or building.

1. CLEARANCES - Hot water pipes do not require clearance from combustible construction.
2. Install drain valve and safety relief valve as shown in Figures 1 and 4. Note - Safety relief valve must be in vertical position.
3. Pipe safety relief valve discharge to floor.

#### WARNING

Safety relief valve discharge piping must be piped near floor to eliminate potential of severe burns. Do not pipe in any area where freezing could occur. Do not install any shut-off valves.

4. Install Temperature and Pressure gauge externally in boiler supply piping. All required components are included at factory supplied Miscellaneous Parts Bag (P/N 103669-01). See Figure 4 'Near Boiler Piping'.
5. Install circulator with flanges, gaskets and bolts and circulator harness provided.
6. For recommended water piping, see Figures 5 and 6. Also, consult Residential Hydronic Heating Installation and Design I=B=R Guide.
7. If this boiler is used in connection with refrigeration systems, the boiler must be installed so that the chilled medium is piped in parallel with the heating boiler using appropriate valves to prevent the chilled medium from entering the boiler, see Figure 7. Also consult Residential Hydronic Heating Installation and Design I=B=R Guide.

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.

8. 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 temperatures may be encountered (i.e. converted gravity circulation system, etc.).

Install a pipe tee at the boiler return along with a second tee in the supply piping as shown in Figures 5 and 6. The bypass should be the same size as the supply and return lines with valves located in the

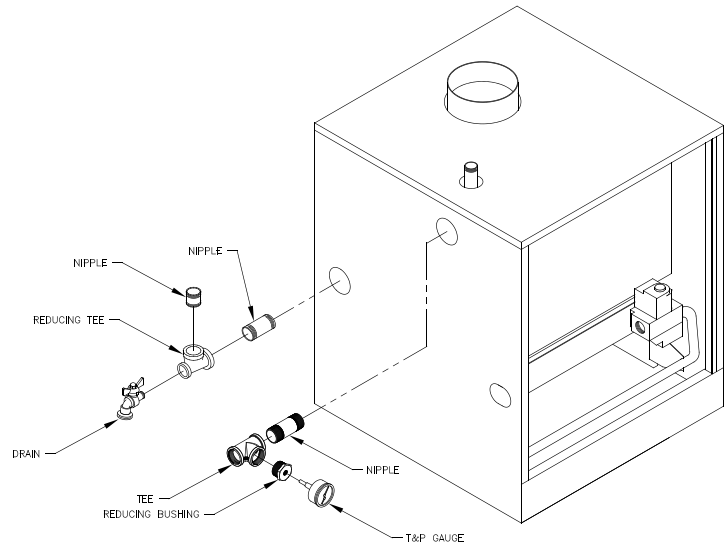


Figure 4: Near Boiler Piping

bypass and supply outlet as illustrated in Figures 5 and 6 in order to regulate water flow to maintain higher boiler water temperatures.

Set the boiler supply valve to fully open position, and the boiler bypass valve to half throttle. Operate the boiler and adjust the bypass valve to achieve 180°F to 200°F supply water temperature by closing the bypass valve to decrease supply temperature or opening the bypass valve to increase water temperature. If the bypass valve is fully opened and the boiler water temperature is still below 180°F, slowly begin closing the boiler supply valve to achieve 180°F to 200°F supply water temperature.

**Caution:** Never fully close the boiler supply valve.

10. 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.

11. 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 U.S. Boiler Company's standard warranty.

# IV. BOILER WATER PIPING (continued)

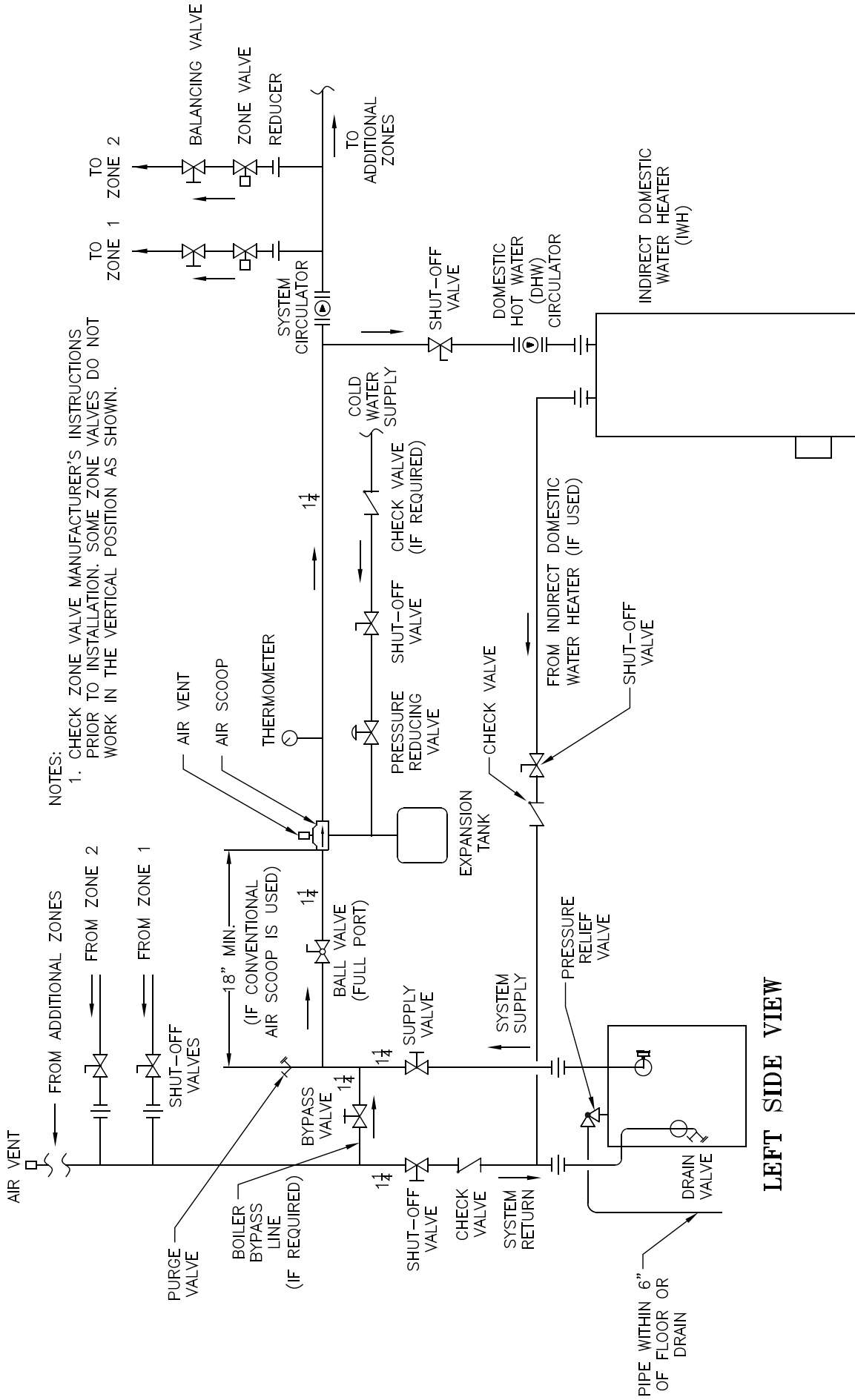


Figure 5: Recommended Water Piping for Zone Valve Zoned Heating Systems

# IV. BOILER WATER PIPING (continued)

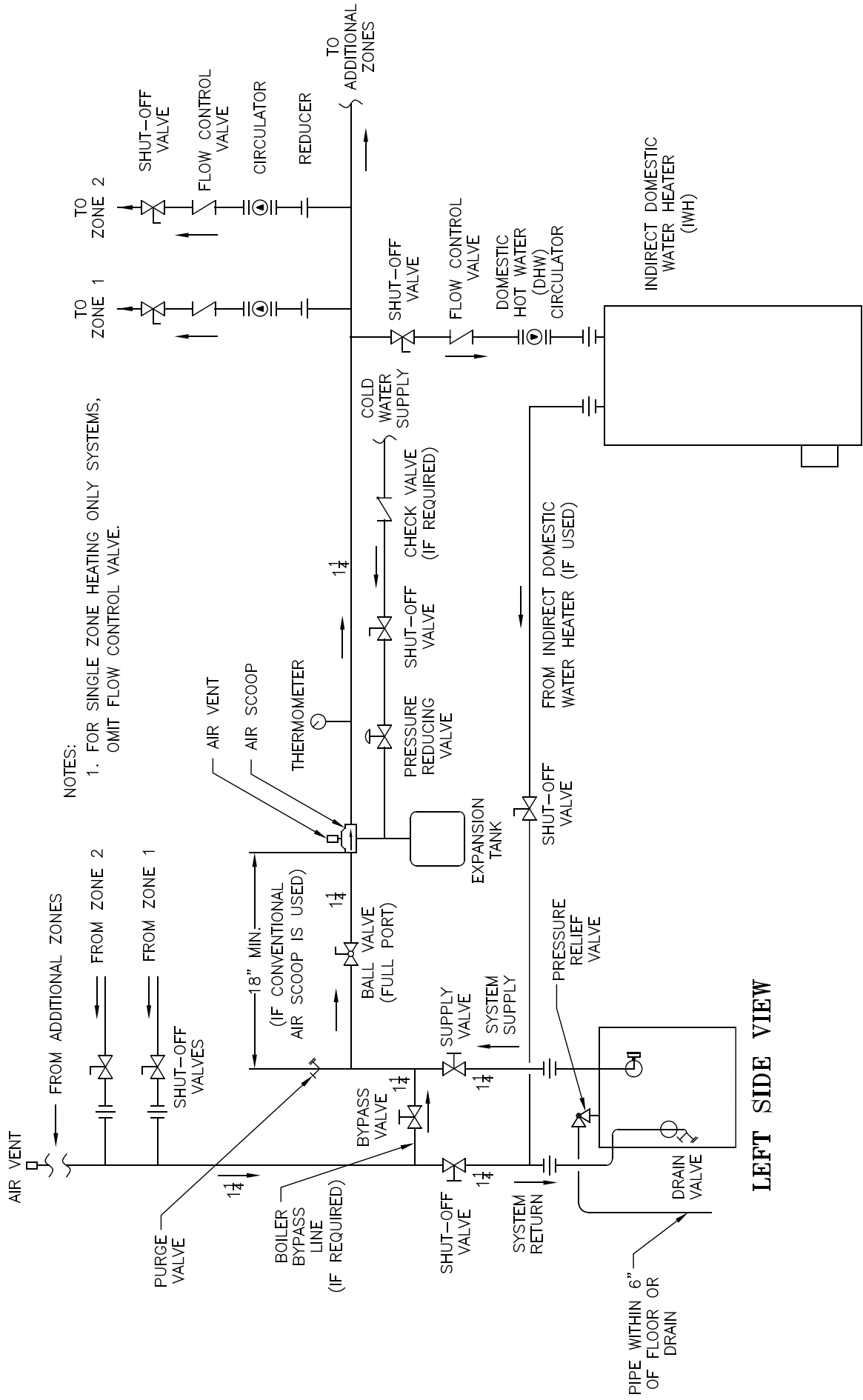
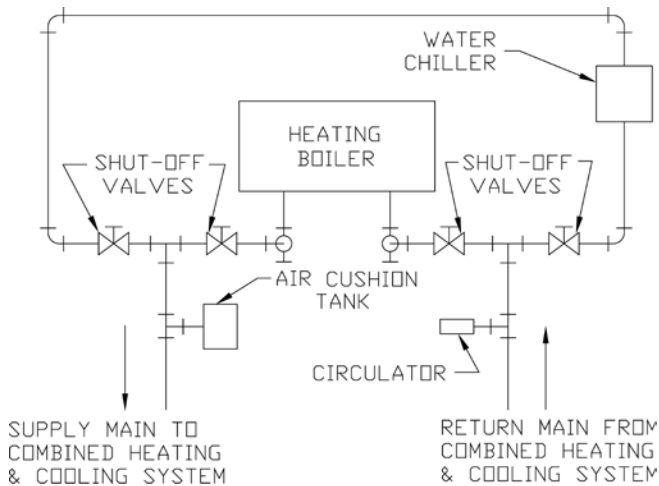


Figure 6: Recommended Water Piping for Circulator Zoned Heating Systems

## IV. BOILER WATER PIPING (continued)



**Figure 7: Recommended Piping for Combination Heating & Cooling (Refrigeration) Systems**

There are many possible causes of oxygen contamination such as:

- Addition of excessive make-up water as a result of system leaks.
- Absorption through open tanks and fittings.
- 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:

- Repairing system leaks to eliminate the need for addition of make-up water.
- Eliminating open tanks from the system.
- Eliminating and/or repairing fittings which allow oxygen absorption.
- Use of non-permeable materials in the distribution system.
- Isolating the boiler from the system water by installing a heat exchanger.

## B. OPTIONAL PROBE LWCO INSTALLATION

### WARNING

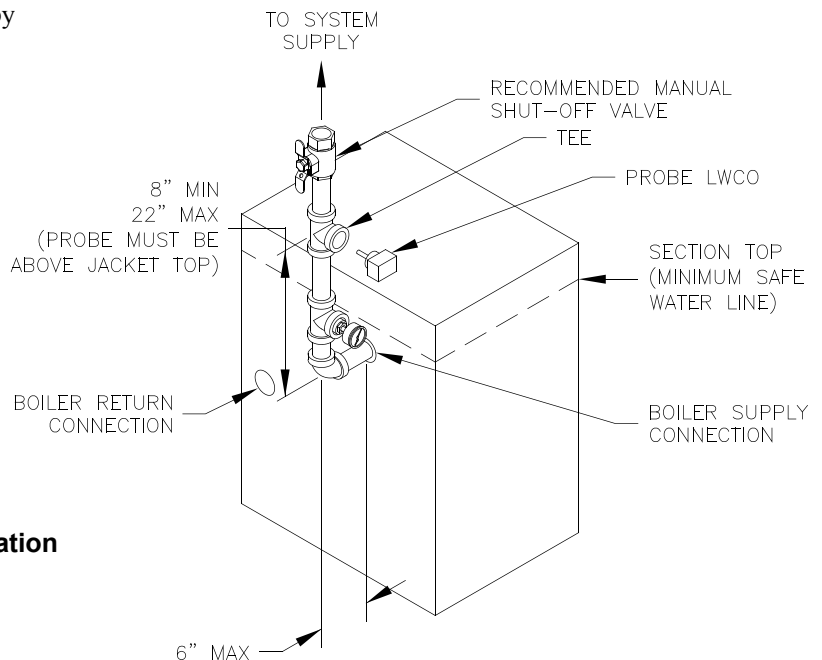
**DO NOT ATTEMPT to cut factory wires to install an aftermarket Low Water Cut Off (LWCO). Only use connections specifically identified for Low Water Cut Off.**

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

- A low water cutoff is required to protect a gas-fired 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 as a redundant safety control.

It is recommended that the LWCO control is installed above the boiler to provide the highest level of protection. However, where the LWCO control is approved by the LWCO control manufacturer for installation in a high boiler tapping of a water boiler, the use of the listed LWCO control is permitted when it is installed according to the LWCO manufacturer's instructions.

- The recommended location for a LWCO on gas hot water boilers is above the boiler, in the supply 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.
- 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.



**Figure 8: Recommended Probe LWCO Location**

## IV. BOILER WATER PIPING (continued)

4. Piping and fittings required to install LWCO are **field supplied**.
5. When constructing a piping tree to install LWCO select fittings (tees, elbows etc) and nipples to have the same size (NPT) as boiler supply connection. At minimum, 1-1/4" tee with 3/4" branch outlet is required to connect the probe LWCO to the supply piping. See Figure 8 for location and piping of the LWCO. **DO NOT REDUCE THE SIZE OF NEAR BOILER SUPPLY FITTINGS AND NIPPLES.**
6. Installation of manual shutoff valve located above the LWCO and the boiler is recommended to allow servicing. Thus LWCO probe can be removed for inspection without draining the heating system. An annual inspection of the probe is recommended.
7. The presence of water covering properly installed LWCO probe will cause the normally open contact of the LWCO to close, thus providing continuity of the 24 VAC service to the boiler gas valve. When water level drops below probe, LWCO contact opens up breaking 24V supply to gas valve and preventing the boiler to fire.
8. 2012 compliant Series 2 gas hot water boilers have a "plug-in" provision in factory wiring that will accept optional 24VAC probe LWCO harness connector. The optional LWCO kit (P/N 104083-01) includes 24VAC probe LWCO, Harness and Instructions addressing piping, wiring and testing after installation. See Figure 13 for wiring of the LWCO.

### C. OPTIONAL AUXILIARY LIMIT INSTALLATION

1. Some jurisdictions may require the use of an Auxiliary Limit control with a hot water boiler as a redundant safety control.
2. The recommended location for an Auxiliary Limit on gas hot water boilers is in the supply piping. See Figure 9 for recommended location.
3. Piping and fittings required to install an Auxiliary Limit are **field supplied**.
4. When constructing a piping tree to install an Auxiliary Limit select fittings (tees, elbows etc) and nipples to have the same size (NPT) as boiler supply connection. At minimum, 1-1/4" tee with 1/2" branch outlet is required to install the limit well into the supply piping. See Figure 9. **DO NOT REDUCE THE SIZE OF NEAR BOILER SUPPLY FITTINGS AND NIPPLES.**
5. When boiler water temperature reaches or exceeds Auxiliary Limit setting, the limit normally closed contact will open, thus interrupting the 24 VAC service to the boiler gas valve. When boiler water temperature drops below limit differential, limit contact closes restoring 24V supply to gas valve and allowing the boiler to fire.
6. Gas hot water boilers equipped with Intelligent Hydronic Control have a "plug-in" provision in factory wiring that will accept optional 24VAC Auxiliary Limit harness connector. The optional Auxiliary Limit kit (P/N 103696-01) includes 24VAC Auxiliary Limit, Well, Harness and Instructions addressing wiring and testing after installation.

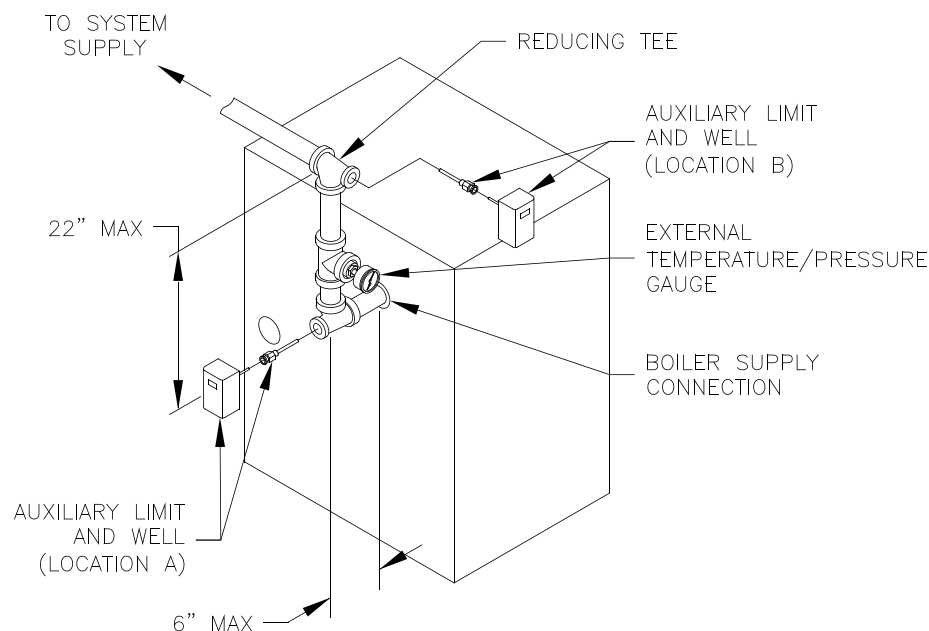


Figure 9: Recommended Auxiliary Limit Location

## V. VENTING

- A. INSTALL DRAFT HOOD without modification on outlet of flue collector (See Figure 1). Secure with sheet metal screws.

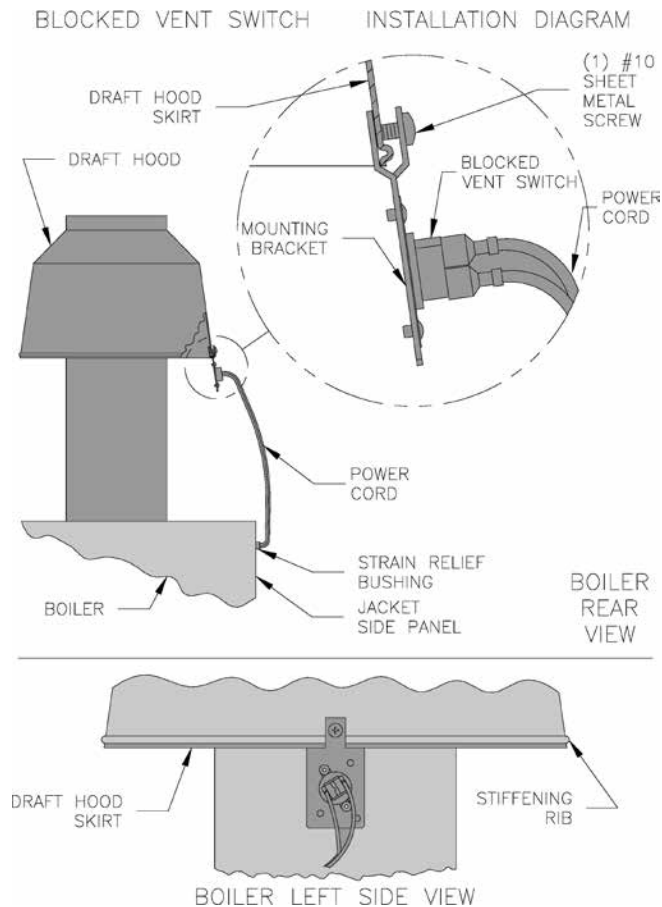
### WARNING

**Do not alter boiler draft hood or place any obstruction or non-approved damper in the breeching or vent system. Flue gas spillage can occur. ETL certification will become void.**

### B. INSTALL BLOCKED VENT SWITCH

The blocked vent switch assembly shipped taped to the top of the boiler includes a power cord and a switch attached to a mounting bracket. The mounting bracket has a three tooth staggered comb stamping at one end with a #10 sheet metal screw in the center tooth.

1. Untape the blocked vent switch assembly from the top of the boiler and uncoil the power cord.
2. Blocked vent switch power cord (black and black with white stripe wires) is attached to vent damper harness with wire ties. The length of the cord is sufficient to reach the blocked vent switch installed at the left side of the draft hood skirt (see Figure 10). However, if required, use flat blade screwdriver to dislodge black strain relief bushing, securing the harness to boiler left side jacket, to adjust the length as needed.
3. Position the mounting bracket (with switch attached) onto the lower edge of the draft hood skirt by locating the center tooth (with the #10 sheet metal screw) on the outside and the other two teeth inside the draft hood skirt. See Figure 10.
4. Slide the mounting bracket up tight against the lower edge of the draft hood skirt, so that the #10 sheet metal screw is above the skirt's stiffening rib.
5. Secure the bracket in this position by tightening the #10 sheet metal screw against the outer surface of the draft hood skirt.
6. If required, reinsert the excess power cord through the jacket side panel hole to take the slack out of the wires running to up to the switch and vent damper.
7. Reposition the strain relief bushing around the power cord at the jacket side panel, pinch the two halves of the bushing together, and snap it back into the hole in the jacket side panel to secure the power cord to the jacket.
8. Be sure the power cord, mounting bracket, and switch are secure and located as shown in Figure 10.



**Figure 10: Blocked Vent Switch Installation Diagram**

### WARNING

**Failure to properly install and use this Blocked Vent Switch may result in property damage, personal injury or loss of life.**

### C. INSTALL VENT DAMPER

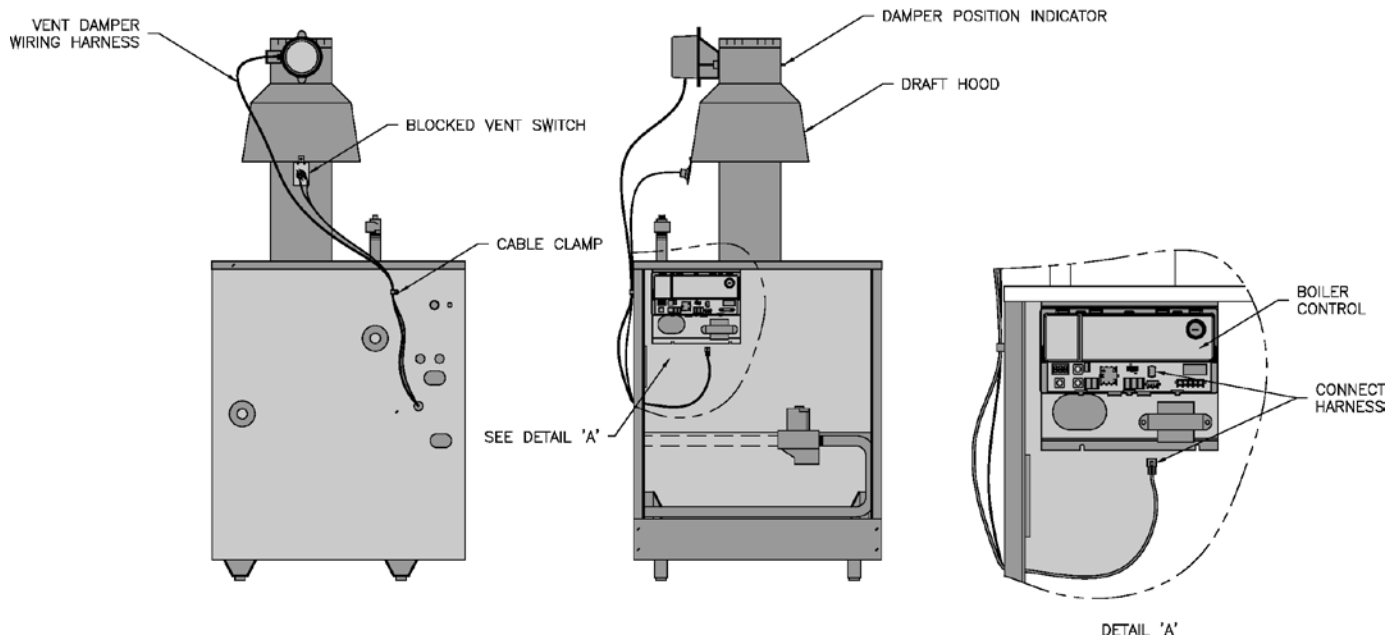
OPEN THE VENT DAMPER CARTON and remove the Installation Instructions. READ THE INSTALLATION INSTRUCTIONS THOROUGHLY before proceeding.

The automatic gas control valve supplied on each Series 2® boiler provides the redundancy referenced in the vent damper Installation Instructions.

### CAUTION

**Do not use one vent damper to control two heating appliances.**

## V. VENTING (continued)



**Figure 11: Plug-in Damper Installation**

1. The vent damper must be the same size as the outlet of the Draft Hood supplied with the boiler (see Figure 1). Unpack the damper carefully - **DO NOT FORCE IT CLOSED!** Forcing the damper may damage the gear train and void the warranty.
2. Mount the vent damper assembly after the draft hood, as close to the draft hood as practicable without modification to the draft hood or vent damper. (Refer to Figure 11 and to instructions packed with the vent damper for specific instructions). This is a must for the wiring harness to fit and the damper position indicator to be visible to the users.

### NOTICE

**Provide adequate clearance for servicing.**

### WARNING

**Provide 6" (15.2cm) minimum clearance between damper and combustible construction.**

3. Plug the factory harness vent damper connector into damper motor polarized receptacle and secure the harness to the damper motor bracket with provided strain relief bushing.

### DANGER

**Inspect existing chimney before installing boiler. Failure to clean or replace perforated pipe or tile lining will cause severe injury or death.**

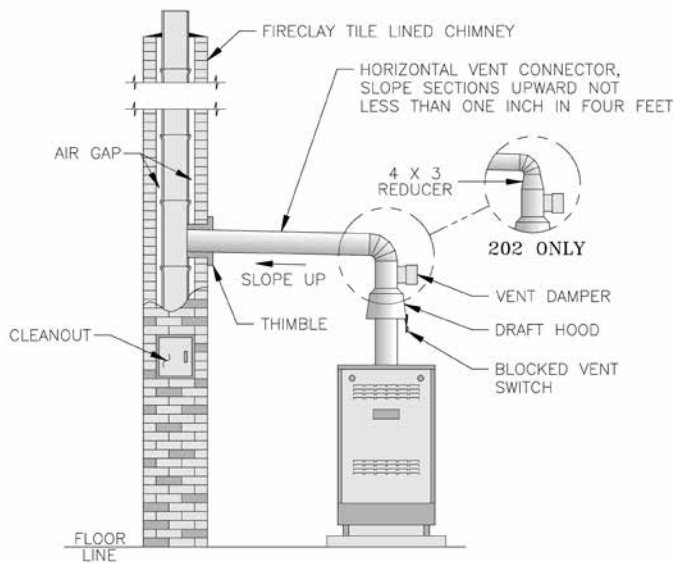
### D. INSTALL VENT CONNECTOR

1. Size 202 only - Install provided 4" x 3" vent reducer into vent damper outlet, then, install vent connector from reducer outlet to chimney.
2. All other sizes - Install vent connector from vent damper outlet to chimney.
3. Install vent system in accordance with local building codes; or local authority having jurisdiction; or "Venting of Equipment", of the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, or "Venting Systems and Air Supply for Appliances", of the *Natural Gas and Propane Installation Code*, CAN/CSA B149.1.

Install any of the following for this Series 2 Category I, draft hood equipped appliance:

- a. Type B or Type L gas vent. Install in accordance with listing and manufacturer's instructions.
- b. Masonry or metal chimney. Build and install in accordance with local building codes; or local authority having jurisdiction; or *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances*, ANSI/NFPA 211 and/or *National Building Code of Canada*.  
Masonry chimney must be lined with approved clay flue lining or listed chimney lining system.
- c. Single wall metal vent. Allowed by ANSI Z223.1/NFPA 54 under very restrictive conditions.
- d. Do not use cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone).
- e. Do not cover non-metallic vent pipe and fittings with thermal insulation. Note: Non-metallic vent cannot be used with this boiler.

## V. VENTING (continued)



**Figure 12: Typical Vent Installation**

4. Do not connect into same leg of chimney serving an open fireplace.
5. Inspect chimney for obstructions or restrictions and remove. Clean chimney if necessary.
6. Vent pipe to chimney must not be smaller than outlet on draft hood or damper. Although single wall vent pipe may be used, Type B is recommended. The venting system must be arranged so that only the boiler is served by the damper device. Installation per paragraph (C) complies with this provision.

Exception: *National Fuel Gas Code*, ANSI Z223.1/ NFPA 54, and *Natural Gas and Propane Installation Code*, CAN/CSA B149.1, allow vent downsizing when vent size determined by their Vent Sizing Tables is smaller than draft hood outlet/vent damper. These codes require all of the following:

- (a) Total vent height (H) is at least 10 ft (3 m);
  - (b) Vent not reduced more than one table size; and
  - (c) Draft hood outlet/vent damper is greater than 4 in. (102 mm) in diameter (202, 202X and 203 cannot use smaller vent size).
7. Where two or more appliances vent into a common vent, the area of the common vent should at least equal the area of the largest vent plus 50% of the area in the additional vents. Do not connect the vent of this appliance into any portion of mechanical draft system operating under positive pressure.
  8. Vent pipe should have the greatest possible initial rise above the draft hood consistent with the head room available and the required clearance from adjacent combustible building structure. Vent Pipe should be installed above the bottom of chimney to prevent blockage.

9. Slope horizontal portions of vent pipe upwards not less than 1/4 in/ft (21 mm/m) from boiler to vent terminal.  
les chaudières de catégories I doivent présenter des tronçons horizontaux dont la pente montante est d'au moins 1/4 po par pied (21 mm/m) entre la chaudière et l'évent.
10. Support horizontal portions of venting system to prevent sagging. Use pipe straps, brackets or hangers spaced 4 ft (1.2 m) or less.  
Soutenez parties horizontales de ventilation pour éviter l'affaissement. Utilisez des colliers de serrage, des crochets ou cintres espacées de 4 pieds (1,2 m) ou moins.
11. Vent pipe must be inserted into but not beyond inside wall of chimney liner. Seal tight between vent pipe and chimney.
12. Do not install non-listed (AGA, CGA, CSA, ETL or UL) vent damper or other obstruction in vent pipe.

### WARNING

#### E. IF AN EXISTING BOILER IS REMOVED -

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.

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:

1. Seal any unused openings in the common venting system.
2. 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.
3. 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.
4. Place in operation the appliance being inspected. Follow the Lighting (or Operating) Instructions. Adjust thermostat so appliance will operate continuously.



## V. VENTING (continued)

5. 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.
6. 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 condition of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms with the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, and/or the *Natural Gas and Propane Installation Code*, CAN/CSA B149.1. 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 Appendix F in the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, and/or the *Natural Gas and Propane Installation Code*, CAN/CSA B149.1.

Au moment du retrait d'une chaudière existante, les mesures suivantes doivent être prises pour chaque appareil toujours raccordé au système d'évacuation commun et qui fonctionne alors que d'autres appareils toujours raccordés au système d'évacuation ne fonctionnent pas:

1. Sceller toutes les ouvertures non utilisées du système d'évacuation.
2. Inspecter de façon visuelle le système d'évacuation pour déterminer la grosseur et l'inclinaison horizontale qui conviennent et s'assurer que le système est exempt d'obstruction, d'étranglement, de fuite, de corrosion et autres défaillances qui pourraient présenter des risques.
3. Dans la mesure du possible, fermer toutes les portes et les fenêtres du bâtiment et toutes les portes entre l'espace où les appareils toujours raccordés au système d'évacuation sont installés et les autres espaces du bâtiment. Mettre en marche les sècheuses, tous les appareils non raccordés au système d'évacuation commun et tous les ventilateurs d'extraction comme les hottes de cuisinière et les ventilateurs des salles de bain. S'assurer que ces ventilateurs fonctionnent à la vitesse maximale. Ne pas faire fonctionner les ventilateurs d'été. Fermer les registres des cheminées.
4. Mettre l'appareil inspecté en marche. Suivre les instructions d'allumage. Régler le thermostat de façon que l'appareil fonctionne de façon continue.
5. Faire fonctionner le brûleur principal pendant 5 min ensuite, déterminer si le coupe-tirage déborde à l'ouverture de décharge. Utiliser la flamme d'une allumette ou d'une chandelle ou la fumée d'une cigarette, d'un cigar ou d'une pipe.
6. Une fois qu'il a été déterminé, selon la méthode indiquée ci-dessus, que chaque appareil raccordé au système d'évacuation est mis à l'air libre de façon adéquate. Remettre les portes et les fenêtres, les ventilateurs, les registres de cheminées et les appareils au gaz à leur position originale.
7. Tout mauvais fonctionnement du système d'évacuation commun devrait être corrigé de façon que l'installation soit conforme au *National Fuel Gas Code*, ANSI Z223.1/NFPA 54 et (ou) aux codes *d'installation* CAN/CSA-B149.1. Si la grosseur d'une section du système d'évacuation doit être modifiée, le système devrait être modifié pour respecter les valeurs minimales des tableaux pertinents de l'appendice F du *National Fuel Gas Code*, ANSI Z223.1/NFPA 54 et (ou) des codes *d'installation* CAN/CSA-B149.1.

---

## VI. ELECTRICAL

---

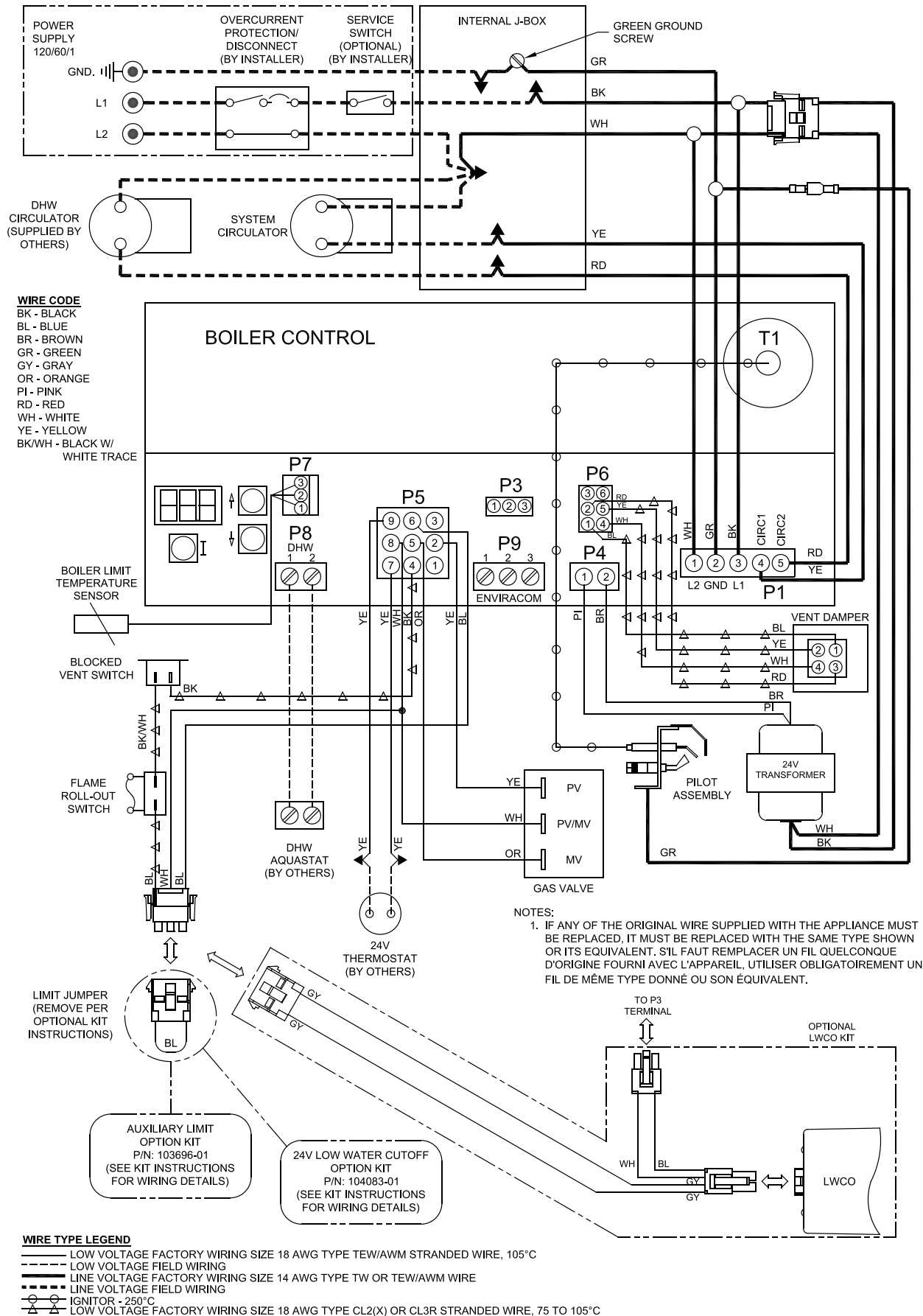
- A. INSTALL A ROOM THERMOSTAT** on an inside wall about four feet above floor. Never install thermostat on an outside wall or where it will be influenced by drafts, hot or cold water pipes, lighting fixtures, television, rays of the sun or near a fireplace. Keep large furniture away from thermostat so there will be free movement of room air around this control. Heat Anticipator in Thermostat should be set to 0.6 amp. If system tends to overheat above the thermostat's temperature setting, reduce heat anticipator setting by .1 or .2 amps. If system tends to short cycle without reaching desired room temperature, increase heat anticipator setting by .1 or .2 amps.
- B. INSTALL ELECTRIC WIRING** in accordance with National Electric Code or the *Canadian Electrical Code* and local regulations. See Figures 13 through 16 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. When installed, the boiler must be electrically grounded in accordance with the requirements of authority having jurisdiction or, in the absence of such requirements, with the *National Electrical Code*, ANSI/NFPA 70, and/or the *Canadian Electrical Code* part 1, CSA C22.1 Electrical Code. For zone valve wiring, a separate 24V transformer is required rather than attempting to use the boiler mounted control. Consult zone valve manufacturer for assistance.

### WARNING

**The combined boiler and circulator amperage must not exceed 15 amps. Install over-current protection in accordance with authority having jurisdiction or, in the absence of such requirements, follow the National Electric Code, NFPA 70, and/or CSA C22.1 Electrical Code. Do not provide over-current protection greater than 15 amperes.**

- C.** Refer to Figures 13 and 14 for details on the internal wiring.

## VI. ELECTRICAL (continued)



**Figure 13: Connection Wiring Diagram, Intelligent Hydronic Control**

# VI. ELECTRICAL (continued)

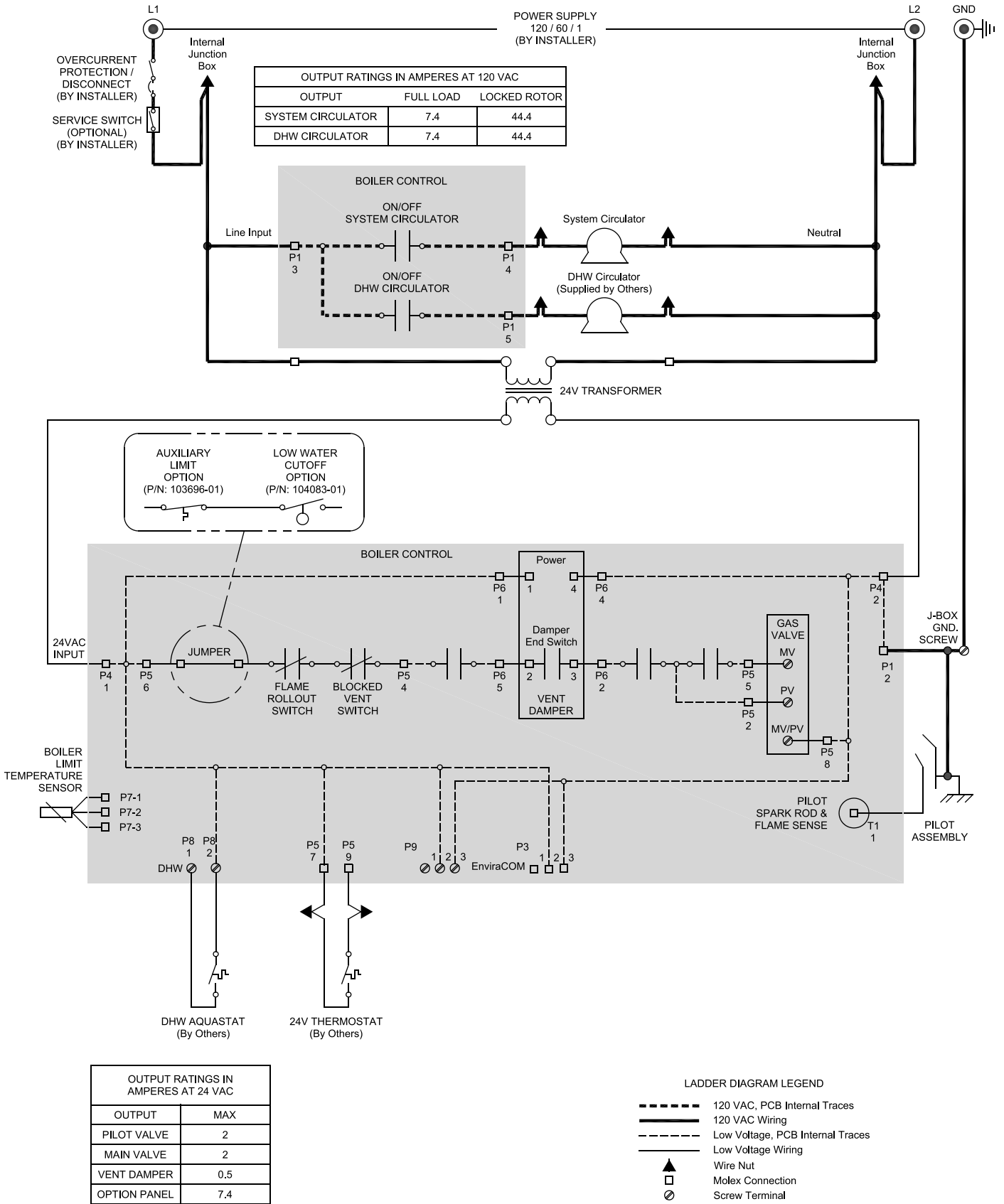


Figure 14: Ladder Wiring Diagram, Intelligent Hydronic Control

## VI. ELECTRICAL (continued)

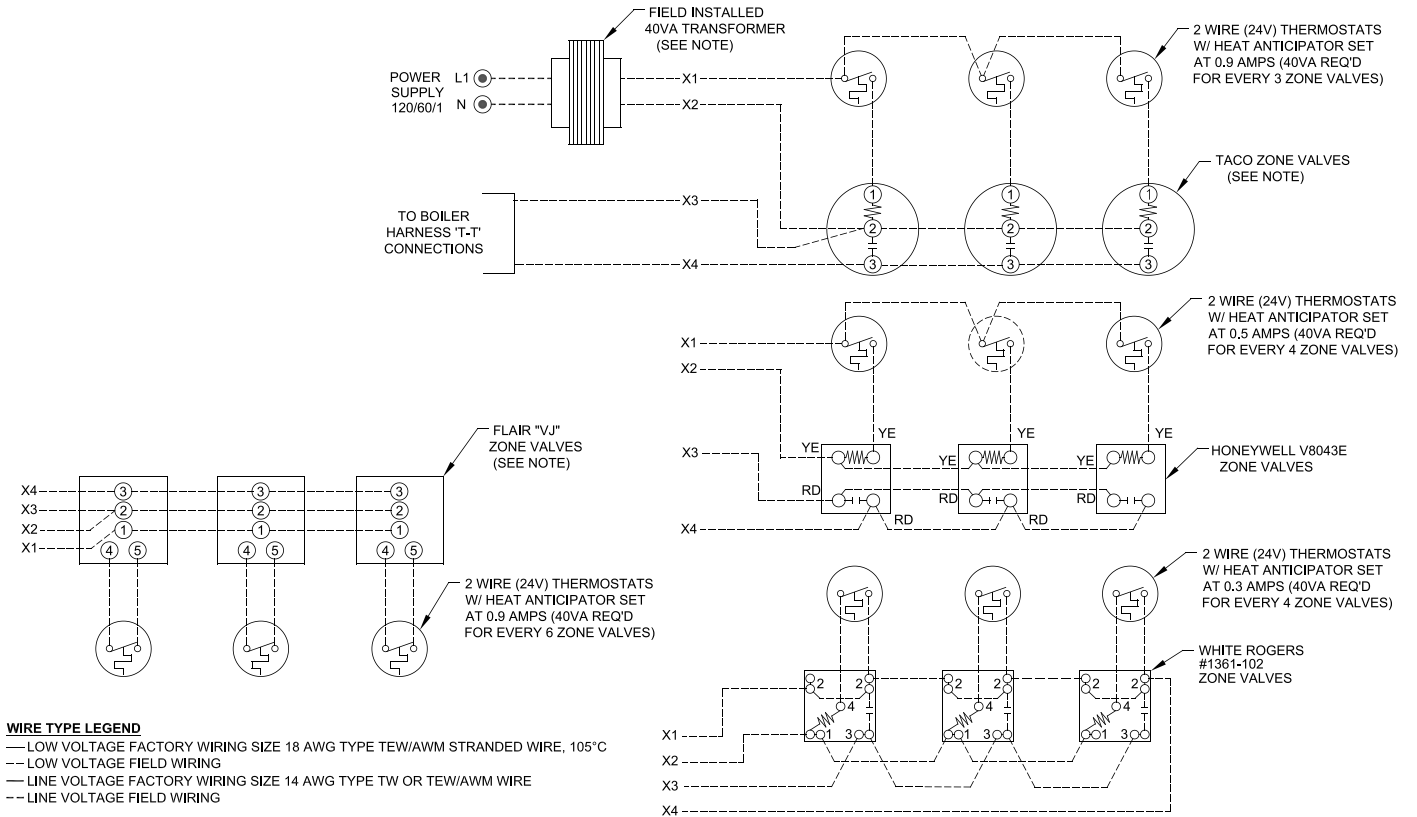


Figure 15: Wiring Schematic, Zone Valves

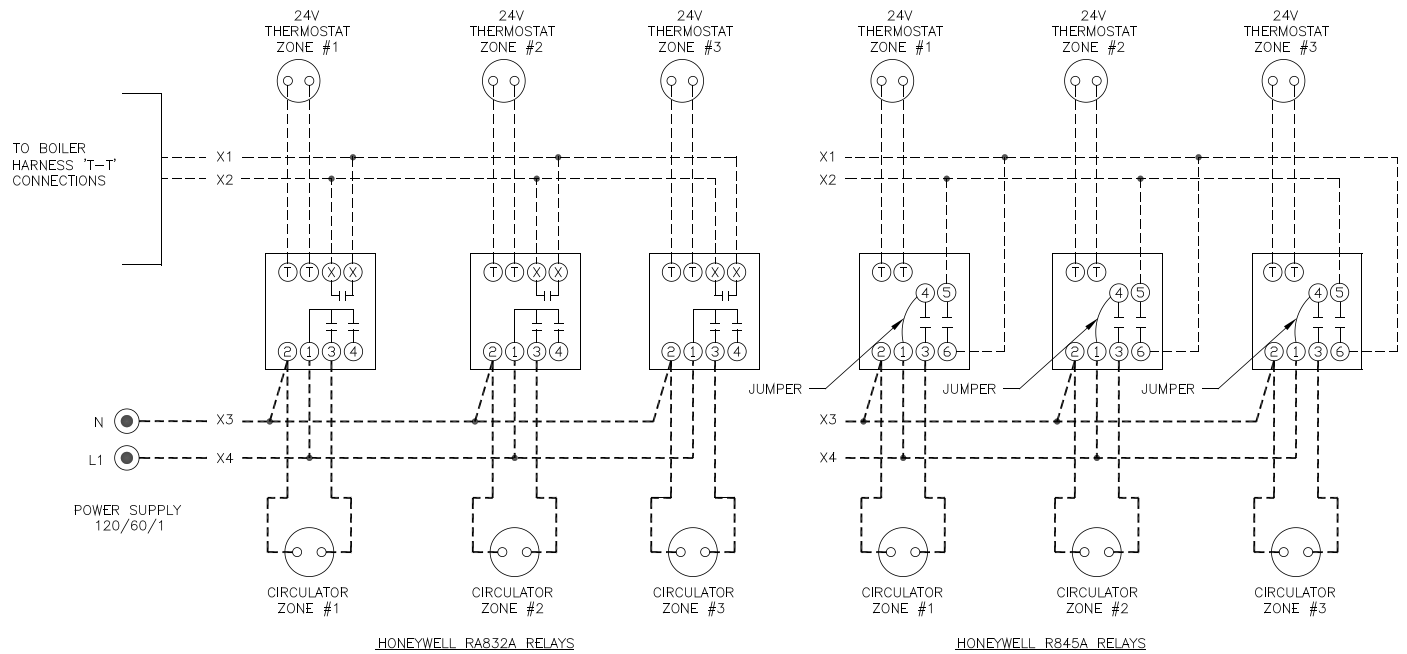


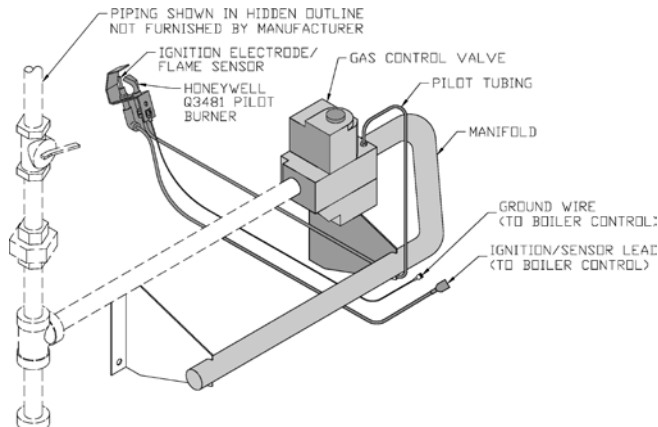
Figure 16: Wiring Schematic, Zone Circulators

## VII. START-UP AND CHECKOUT

**A. MAIN BURNER CHECK** - Check main burners to see that they were not dislodged during shipment. Rear of burners should be in the slots in the rear of burner tray and the front of the burners should be seated completely on the orifices.

### B. INITIAL START -

1. FILL ENTIRE HEATING SYSTEM WITH WATER and vent air from system. Use the following procedure on a System equipped with zone valves. (See Figure 5).
  - a. Close isolation valve in boiler supply piping.
  - b. Isolate all circuits by closing zone valves or balancing valves.
  - c. Attach a hose to hose bib located just below isolation valve in boiler supply piping. (Note - Terminate hose in five gallon bucket at a suitable floor drain or outdoor area).
  - d. Starting with one circuit, open zone valve.
  - e. Open hose bib.
  - f. Open fill valve (Make-up water line should be located directly above isolation valve in boiler supply piping).
  - g. Allow water to overflow from bucket until discharge from hose is bubble free for 30 seconds.
  - h. 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.
  - i. Close hose bib, 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 12 psi. Leave globe valve open).
  - j. Open isolation valve in boiler supply piping.
  - k. Remove hose from hose bib.
2. Turn ROOM THERMOSTAT to lowest setting.
3. Be sure that gas to pilot and main burners has been off for at least five minutes and vent damper has been in the open position.
4. Turn "OFF" the electric switch serving boiler.
5. Open valve on main gas line at meter.
6. PURGE AIR FROM GAS PIPING. **Adequate ventilation must be provided and no smoking or open flame permitted.**

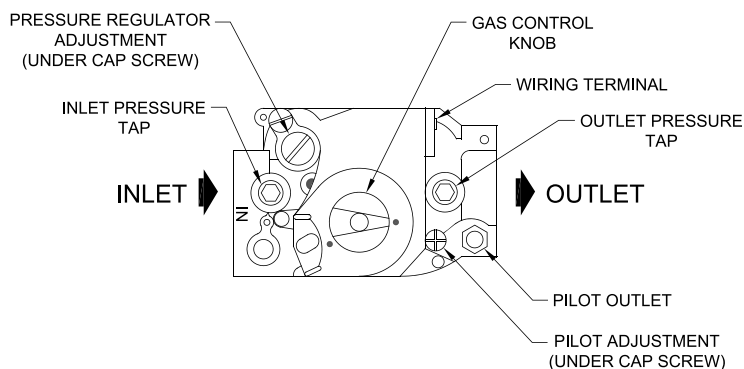


**Figure 17: Schematic Pilot and Gas Piping**

7. Turn "ON" electric switch serving boiler.
8. Open Manual Shut-off Valve upstream of Combination Gas Valve.
9. Loosen or remove Inlet Pressure Tap Plug in Combination Gas Valve and when purging is complete, tighten or replace plug. See Figure 18.
10. Check pipe and fittings from meter to Combination Gas Valve using soap solution or other approved methods.

### CAUTION

11. Test gas piping and connections between Combination Gas Valve and manifold, orifices, and pilot piping for leaks after boiler is operating. Use soap solution or other approved method.



**Figure 18: Top View of VR Gas Valves**

## VII. START-UP AND CHECKOUT (continued)

### FOR YOUR SAFETY READ BEFORE OPERATING/POUR VOTRE

### SECURITE LISEZ AVANT DE METTRE EN MARCHÉ

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

**AVERTISSEMENT:** Quiconque ne respecte pas à la lettre les instructions dans la présente notice risque de déclencher un incendie ou une explosion entraînant des dommages, des blessures ou la mort.

- A. This appliance 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 push in or turn the gas control knob. Never use tools. If the knob will not 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.

- A. Cet appareil est muni d'un dispositif d'allumage qui allume automatiquement la veilleuse. Ne tentez pas d'allumer la veilleuse manuellement.
- B. AVANT DE FAIRE FONCTIONNER, reniflez tout autour de l'appareil pour détecter une odeur de gaz. Reniflez près du plancher, car certains gaz sont plus lourds que l'air et peuvent s'accumuler au niveau du sol.

#### QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:

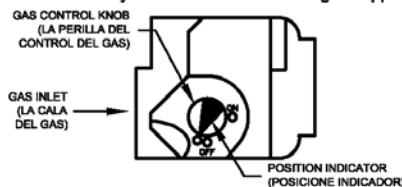
- Ne pas tenter d'allumer d'appareil.
- Ne touchez à aucun interrupteur ; ne pas vous servir des téléphones se trouvant dans le bâtiment.
- Appelez immédiatement votre fournisseur de gaz depuis voisin. Suivez les instructions du fournisseur.
- Si vous ne pouvez rejoindre le fournisseur, appelez le service des incendies.

- C. Ne poussez ou tournez la manette d'admission du gaz qu'à la main; ne jamais utiliser d'outil. Si la manette reste coincée, ne pas tenter de la réparer; appelez un technicien qualifié. Le fait de forcer la manette ou de la réparer peut déclencher une explosion ou un incendie.

- D. N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau.

### OPERATING INSTRUCTIONS/INSTRUCTIONS DE FONCTIONNEMENT

1. STOP! Read safety information above (to the left) 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 the burner 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 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 (to the left) on this label. If you don't 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 the thermostat to the 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.



1. ARRÊTEZ ! Lisez les instructions de sécurité sur la portion supérieure (à gauche) cette étiquette.
2. Réglez le thermostat à la température la plus basse.
3. Coupez l'alimentation électrique de l'appareil.
4. Cet appareil est équipé de l' dispositif d'allumage qui automobile allume maticallyle brûleur. Ne pas essayer d'allumer le brûleur près main.
5. Enlevez la porte de devant.
6. Localisez la valve du controle du Gaz a la fin du depart de la pipe de la provision du gaz dans l'appareil. Le bouton plastique brun ou bleu localise sur la valve du controle du gaz. Voyez le diagramme.
7. Faites pivoter le bouton de contrôle du gaz dans le sens inverse ↺ des aiguilles d'une montre de "OFF" pour "ON".
8. Attendez cinq (5) minutes pour laisser échapper tout le gaz. Reniflez tout autour de l'appareil, y compris près du plancher, pour détecter une odeur de gaz, ARRÊTEZ ! Passez à l'étape B des instructions de sécurité sur la portion supérieure (à gauche) cette étiquette. S'il n'y a pas d'odeur de gaz, passez à l'étape suivante.
9. Faites pivoter gas contrôle bouton clockwise ↻ la position "ON" à "OFF". Assurez-vous que pommeau repose contre stop. Ne forcez pas.
10. Remplacer la porte de devant.
11. Allumer toute l'énergie électrique au appareil.
12. Réglez le thermostat à la température désirée.
13. Si l'appareil ne se met pas en marche, suivez les instructions intitulées "Comment couper l'admission de gaz de l'appareil" et appelez un technicien qualifié ou le fournisseur de gaz.

### TO TURN OFF GAS TO APPLIANCE/COMMENT COUPER L'ADMISSION DE GAZ DE L'APPAREIL

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.

1. Regler le thermostat au plus bas regle.
2. Coupez l'alimentation électrique de l'appareil si le service devrait être exécuté.
3. Enlever la porte de devant.
4. Tourner le gaz regle le bouton dans le sens des aiguilles d'une montre a partir ↻ de position a de. Assurer que le se repose contre arete.
5. Remplacer le porte de devant

103028-02

Figure 19: Operating Instructions, VR8204 and VR8304 Gas Valves

## VII. START-UP AND CHECKOUT (continued)

### C. CHECK GAS INPUT RATE TO BOILER

#### NOTICE

USA boilers built for installation at altitudes greater than 2,000 feet above sea level have been specially orificed to reduce gas input rate 4 percent per 1,000 feet above sea level per the National Fuel Gas Code, NFPA 54/ANSI Z223.1, Section 8.1.2 and Appendix F. Canadian boilers' orifice sizing is indicated on the rating label. High altitude boiler models are identifiable by the fourth digit after the dash in the model number. 2: 0-2000', 4 or 5: above 2000'.

1. 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.
2. 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.
3. With boiler off, water Manometer or water column gauge should be connected to a shut-off valve installed in the 1/8" outlet pressure tap in the gas valve (see Figure 18). By installing gas valve upstream of manometer, gas pressure can be introduced gradually - without shut-off 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.
4. LP Gas Input:  
Adjust Regulator on Gas Valve so that manifold pressure is 10 inches water column. Turning Regulator Adjusting Screw Clockwise increases pressure. Counterclockwise rotation decreases pressure.

#### 5. Natural Gas Input

- a. Approx. Input - Adjust regulator on Gas Valve so that manifold pressure is three and a half (3½) inches water column. Turning Regulator Adjusting Screw Clockwise increases pressure, Counterclockwise rotation decreases pressure. If more accurate check on input is necessary see (2) below.

For minor input changes readjust Regulator Gas Valve to increase or decrease manifold pressure to obtain corresponding increase or decrease in gas input. 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.

- b. Additional Check on Input - Since input is a function of heating value, specific gravity, and

volume of gas flow contact your utility for the first two items in order to utilize the formula below. The gas meter should then be clocked for three (3) minutes with stop watch and substituting the appropriate values in the formula below, determine what the gas flow should be in this 3 minute period to give the input shown on the Rating Label:

$$\text{Gas Input (cu. ft.) per 3 min.} = \frac{\text{Heating Value of Gas (Btu / cu. ft.)} \times \text{Multiplier from Table 4}}{\text{Btuh Input}}$$

- D. MAIN BURNER FLAMES should have a clearly defined inner cone (see Figure 20 or 21) with no yellow tipping. Orange-yellow streaks caused by dust should not be confused with true yellow tipping. The main burners in this boiler will not operate cleanly or efficiently if they are contaminated with dirt and/or construction dust. Burners should be cleaned and the combustion chamber vacuumed following instructions in Section IX. Service and Maintenance.

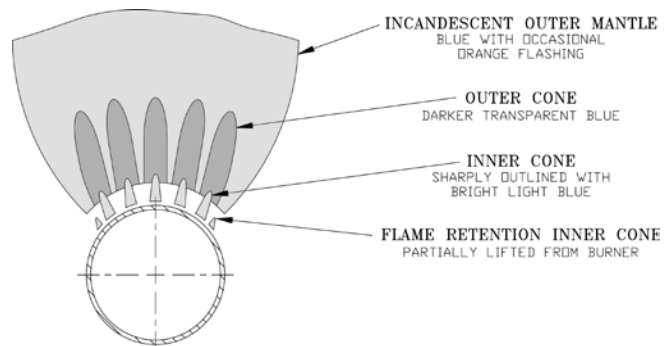


Figure 20: 40mm Main Burner Flame

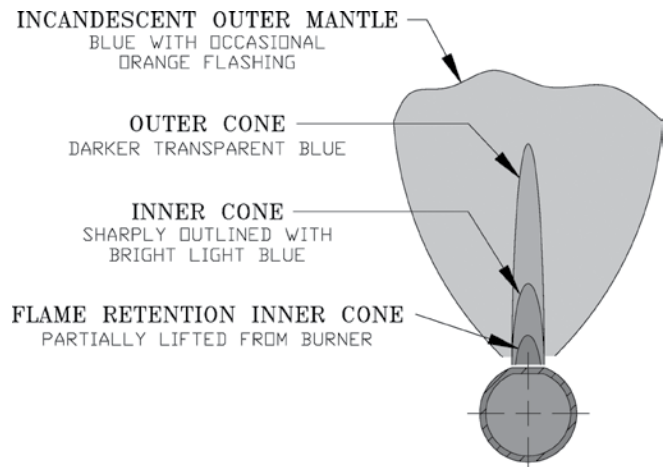


Figure 21: 1 Inch Main Burner Flame



## VII. START-UP AND CHECKOUT (continued)

### E. CHECK PILOT BURNER FLAME.

See Figure 22.

The pilot produces three (3) flames. The center flame should be steady, medium hard blue enveloping 3/8" to a 1/2 inch of sensing probe.

### F. CHECK THERMOSTAT OPERATION. Raise and lower temperature setting as required to start and stop burners.

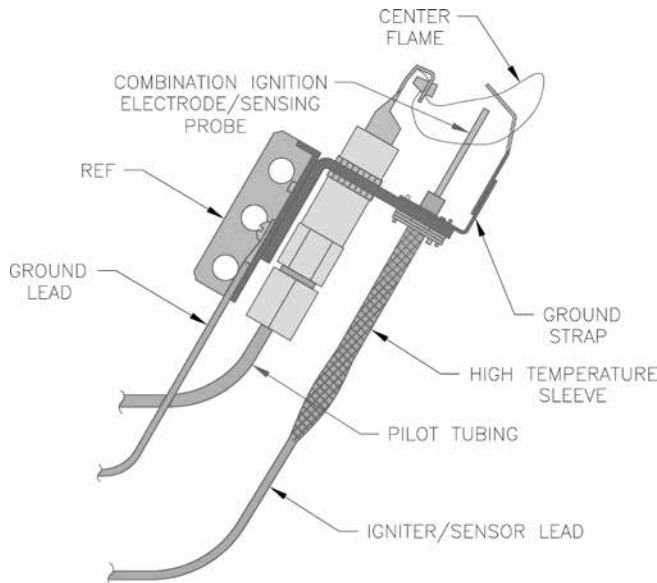


Figure 22: Typical Pilot Flame, Honeywell Q3481B

### G. CHECK HIGH LIMIT CONTROL. Jumper Thermostat connections in boiler wiring harness. Allow burners to operate until shutdown by limit. REMOVE JUMPER.

### H. CHECK DAMPER OPERATION. Vent Damper must be open when boiler is running. Le registre doit être ouvert lorsque le brûleur principal de l'appareil fonctionne. Start boiler, refer to instructions on damper to determine if damper is in the full open position.

### I. CHECK IGNITION SYSTEM SAFETY SHUT-OFF DEVICE.

Remove 3-wire plug from gas valve.

If burners do not shut down determine cause of malfunction. Replace necessary items and check operation.

### J. COMBUSTION CHAMBER BURN-OFF

1. The mineral wool combustion chamber panels may contain a cornstarch based binder that must be burned out at installation to prevent odors during subsequent boiler operation.
2. Ventilate the boiler room, set the high limit to its maximum setting, set the thermostat to call for heat. Allow the boiler to fire for at least an hour or until the odor from the cornstarch has dissipated.
3. Return the high limit and thermostat to their desired settings.

## VIII. OPERATION

### A. BOILER SEQUENCE OF OPERATION

#### NORMAL OPERATION


- The Series 2 Boilers are equipped with an Intelligent Hydronic Control (control). This control replaces the traditional separate ignition control, high limit switch and circulator relay and adds energy saving thermal purge features. Energy is saved by starting the circulator and delaying the burner start when there is residual heat available in the boiler.
- The boiler's sequence of operation is shown in Table 5.
- When the thermostat calls for heat the control starts the system circulator and the thermal purge (circulator Pre-purge time) begins. If the time is completed or boiler temperature is less than the Start Temperature (140°F default) the start sequence continues by energizing the vent damper. Once the vent damper is fully open the ignition sequence is started allowing gas flow and ignition of the burners. Damper must be in open position when appliance main burners are operating.  
Le registre doit être ouvert lorsque le brûleur principal de l'appareil fonctionne.
- If the thermostat is not satisfied and the operating setpoint is reached the system circulator will continue to operate and the burners will stop. When the boiler water temperature drops below the setpoint less the differential setting the burners will restart.
- After the thermostat is satisfied the burners and circulator are stopped and vent damper is closed.
- When an indirect water heater aquastat call for heat is wired to the DHW input, the control starts the Domestic Hot Water circulator and, if the boiler temperature is less than the operating setpoint less differential, the vent damper is energized without delay. Once the vent damper is fully open, the ignition sequence is started allowing gas flow and ignition of the burners.

### B. BOILER FAULT

In the event the boiler fails to start, the control provides status information to help determine the cause of the problem. Table 6 provides a list of boiler status codes that are reported. Refer to the Troubleshooting Section for more information.

### C. USING DISPLAY

The control is located inside the boiler front door. (Figure 23).

The control display, along with Up ↑, Down ↓, and “” keys may be used to view boiler operating status (Figure 24).

**Table 5: Sequence of Operation**

Status Codes displayed in 5LR Mode		
Status	5LR	Description
Standby (Burner off Circulator off)	1	No call for heat detected
Circulator Pre-purge (burner off circulator on)	1	Either condition is true: a. Call for heat detected and boiler temperature higher than operating setpoint. b. Call for heat detected and boiler temperature higher than Start Temperature (140°F default) and Circulator Pre-purge Time has not expired.
Self Test	17	Control internal checking
Drive Damper Open	18	The damper is energized. The control is waiting for the damper switch to close. If the damper end switch doesn't close within 60 seconds, the control goes to 5LR 20
Pre-purge	4	Damper is open for a 2 second delay
Spark	6	The pilot fuel valve is open and sparking is started.
Flame Proving	7	The main fuel valve is open and flame is being proven.
Running	8	The burner runs until the call for heat is satisfied or the operating setpoint is reached.

**Table 6: Sequence Fault**

Status Codes displayed in 5LR Mode		
Status	5LR	Description
Retry / Recycle Delay	10	If the burner fails to light off (no flame signal), it waits 5 minutes and retries or if the control loses flame signal during running, it will wait 10 seconds and then recycle.
Soft Lockout	13	System is shutdown and will restart following a one hour enforced delay.
Hard Lockout	14	System is locked out. A manual or power reset is required to be able to light off again.
Limit Open	15	There is a call for heat from the thermostat, but a Safety Limit is open.
Flame Present Out of Sequence	16	Flame signal is still present when expected to be 0 (no flame).
Damper Failed to Open	20	The damper is still energized and the damper end switch has not closed.

## VIII. OPERATION (continued)

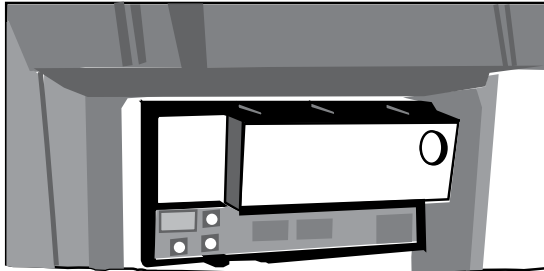


Figure 23: Intelligent Hydronic Control

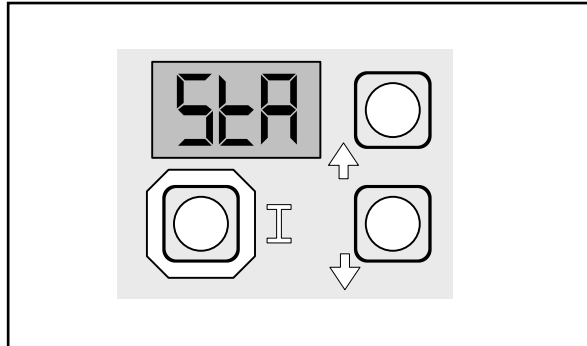


Figure 24: Boiler Display

### D. VIEWING THE OPERATING MODE OPTIONS

In operating mode the user may view (but not change) boiler operating status, settings and troubleshooting information. To view control display information:

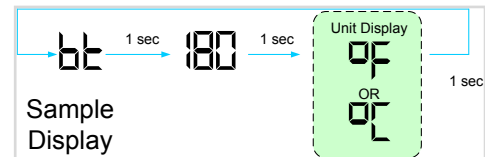
1. Press and release the “**IT**” key on the control to change from one parameter to the next. Each setting will alternately flash between the relevant display code and its corresponding value.

Operating Mode Options	
<i>5tA</i>	Status
<i>bE</i>	Boiler Temperature
<i>SP</i>	Operating Setpoint (Outdoor Reset)
<i>HL</i>	High Limit Setting
<i>HdF</i>	High Limit Differential
<i>tE</i>	Heat Request Status
<i>dh</i>	DHW Heat Request Status
<i>FLA</i>	Flame Current
<i>rUn</i>	Run Time Hours
<i>CYC</i>	Boiler Cycles
<i>Err</i>	Error (see Error Numbers)

The *5tA* (status) display code has the below listed values. This list is also available on the control cover.

Status Code Displayed in <i>5tA</i> Mode	
1	Standby
4	Prepurge
6	Spark
7	Flame Proving
8	Running
10	Retry/Recycle Delay
13	Soft Lockout
14	Hard Lockout
15	Waiting for Limit to Close
16	Flame Present Out of Sequence
17	Self Test
18	Waiting for Damper to Open
20	Damper Failure to Open

For example, when the “**IT**” key is pressed on the control until “*bE*” is displayed, it will then flash a three digit number (such as “*180*”) followed by either “*F*” (or “*C*”). This indicates that the boiler water temperature is 180°F. Other operating parameters display the information in a similar fashion.



Please note that in operating mode to hold the display on the value the user can press and hold either the Up  $\uparrow$  or Down  $\downarrow$  keys and the value will be continuously shown. This may be helpful in watching a value “live”.

## VIII. OPERATION (continued)

### E. CHANGING THE ADJUSTABLE PARAMETERS

To adjust parameters such as High Limit Setpoint and High Limit Differential:

1. Access the adjustment mode by pressing and holding the Up ↑, Down ↓, and “**⏏**” keys simultaneously for three (3) seconds. This procedure is intended to discourage unauthorized changes or accidental changes to limit settings.
2. Press the “**⏏**” key to display available Adjustment Mode options. Select an option.

Adjustment Mode Options		
HL <sub>-</sub>	140-220°F	Adjust High Limit Setting
dF <sub>-</sub>	10-30°F	Adjust High Limit Differential
Or <sub>-</sub>	0-10 minutes	Circulator Overrun Time
PP <sub>-</sub>	2-20 minutes	Circulator Pre-purge Time
St <sub>-</sub>	140-180°F	Start Temperature
Pt <sub>-</sub>	On or Off	Priority time
dh <sub>-</sub>	dh or ttc	DH Terminal Function
rSt		Reset Lockout
F-C	F or C	Select degrees F or C Mode
bRc		Back to Operating Mode

3. Press the Up ↑ and Down ↓ keys to adjust the displayed item to the desired value.
4. To return to the normal operating mode from the Adjustment Mode, when the “bRc” option is displayed, press either the Up ↑ or Down ↓ key. If no keys are pressed, after five (5) minutes the control will automatically return to the Operating Mode.

### F. MORE INFORMATION ABOUT ADJUSTABLE PARAMETERS

1. High Limit (HL<sub>-</sub>)  
The control is factory programmed with a High Limit Setpoint of 180°F. The burner turns “off” when the boiler water temperature (bT) is above this value. The High Limit setpoint is adjustable between 140° and 220°F. The Operating Setpoint (SP) will equal the High Limit Setpoint.
2. Differential (dF<sub>-</sub>)  
The control is factory programmed with a Differential of 15°F. The Differential is the number of degrees the boiler temperature must decrease below the Operating Setpoint before the boiler can restart. The differential is adjustable between 10° through 30°F.
3. Circulator Overrun Time (Or<sub>-</sub>)  
The control is factory programmed with a Circulator Overrun Time of 0 minutes. Circulator Overrun Time (also called “circulator off delay” or “circulator post purge”) continues circulator operation after a call for heat has ended, sending excess heat from the boiler into the system. Ensure

system piping and zone panel settings allow water flow to the priority zone after the call for heat ends. The Circulator Overrun Time is adjustable between 0 through 10 minutes.

#### 4. Circulator Pre-purge Time (PP<sub>-</sub>)

When the boiler is warm (boiler water temperature higher than 140°F (adjustable using Start Temperature parameter)) and there is a thermostat call for heat, the system circulator is started and boiler firing is delayed Circulator Pre-purge minutes. If the temperature drops below 140°F or there is a DHW call for heat the boiler is started without delay. Additionally, the boiler is started without delay if the thermostat call for heat is initiated when the boiler water temperature is less than 140°F. This feature helps save energy by satisfying home heating needs with residual boiler heat rather than cycling the boiler. The Circulator Pre-purge time has a factory setting of 2 minutes and is field adjustable between 2 and 20 minutes. Refer to Table 7.

**Table 7: Circulator Pre-purge Time example, (PP<sub>-</sub> = 2 minutes)**

Call for Heat Source	DHW Terminal Selection	Boiler Temperature	Burner Status
TT = on	-	<140	Start with no delay
TT = on	-	>140	Start after 2 minute delay
DHW = on	ttc	<140	Start with no delay
DHW = on	ttc	>140	Start after 2 minute delay
DHW = on	dh	<140	Start with no delay
DHW = on	dh	>140	Start with no delay

#### 5. Start Temperature (St<sub>-</sub>)

Amount of “Heat available” is calculated by taking the difference between measured boiler water temperature and the Start Temperature setting. Useful “Heat Available” is dependent on the type of heating emitter installed in the home. Heat emitters require a certain minimum temperature to operate effectively. Our default settings reflect cast iron radiators. Fan Coils may require a start temperature setting of 180°F or 160°F before providing heat to the home. The Start Temperature has a factory setting of 140°F and is field adjustable between 140°F and 180°F.

#### 6. Priority Time (Pt<sub>-</sub>)

When the Priority Time parameter is set to “on” and Domestic Hot Water (DHW) call for heat is “on” the DHW demand will take “Priority” over home heating demand. During Priority Time the system circulator will be forced “off”. Priority Time ends and the system circulator is released to service home heating demand when Domestic Hot Water call for heat is over. When Priority Time parameter is set to “Off” the DHW call for heat does not force “off” the

## VIII. OPERATION (continued)

system circulator. The Priority Time has a factory setting of “On” and is field adjustable between “On” and “Off” Refer to Table 8.

### 7. Domestic Hot Water (DHW) Terminal Function ( $dh_{-}$ )

The control allows configuration of the DHW Circulator output functionality to help the Series 2 integrate into each installation more effectively. The DHW Circulator output can be connected to a domestic hot water circulator or a second heating zone circulator. These applications are selected as follows:

- a. When  $dh_{-}$  is set equal to Domestic Hot Water Demand ( $dh$ )

When there is an Indirect Water Heater (IWH) the control provides “DHW” input terminals for the IWH Aquastat and “DHW Circulator” output terminals for the DHW Circulator.

When there is a DHW call for heat, the System Circulator is “forced off”, the DHW Circulator terminal is energized and the circulator pre-purge time delay control logic is bypassed to allow the boiler to fire without delay. When DHW demand ends the System Circulator “force off” is removed, the circulator can respond normally, and the DHW Circulator is de-energized. The DHW call for heat is detected by a voltage on to the “DHW” terminal. When the Priority Time parameter is set to “OFF” the System Circulator is not forced off for a DHW call for heat. Refer to Table 8.

- b. When  $dh_{-}$  is set equal to Second Heating Zone ( $tt2$ )

When there is no IWH the “DHW Circulator” output may be configured to control a second heating zone. This is particularly helpful when the home uses only two heating zones. The control replaces the need for a two circulator zone panel. When DHW Terminal Function ( $dh_{-}$ ) is set to “ $tt2$ ” the control’s two circulator outputs are used to control two independent heating zones. Refer to Table 9. A “TT” input causes a call for heat and energizes the “System Circulator” output to service heating zone 1 and a second zone’s thermostat wired to the “DHW” input causes a call for heat and energizes heating zone 2 circulator wired to the “DHW Circulator” output.

When there is a Second Heating Zone (call for heat) the boiler is started and the DHW Circulator terminal is energized. When Second Heating Zone terminal is de-energized the call for heat is ended and the DHW Circulator is de-energized. A Second Heating Zone is detected by sensing a voltage on the DHW terminal.

**Table 8: DHW Terminal Function ( $dh_{-}$ )**  
Selection = Domestic Hot Water Demand,  
(Parameter  $dh_{-} = dh$ )

Call for Heat		Priority Time ( $Pt_{-}$ )	Circulator Status	
T-T Input	DHW Input		System Circulator Output	DHW Circulator Output
on	off	On	on	off
on	on	On	off	on
off	on	On	off	on
on	off	OFF	on	off
on	on	OFF	on	on
off	on	OFF	off	on

**Table 9: DHW Terminal Function ( $dh_{-}$ )**  
Selection = Second Heating Zone,  
(Parameter  $dh_{-} = tt2$ )

Call for Heat		Circulator Status	
T-T Input	DHW Input	System Circulator Output (Zone 1)	DHW Circulator Output (Zone 2)
off	off	off	off
on	off	on	off
on	on	on	on
off	on	off	on

---

## IX. SERVICE AND MAINTENANCE

---

### **Important Product Safety Information** **Refractory Ceramic Fiber Product**

#### **Warning:**

The Repair Parts list designates parts that contain refractory ceramic fibers (RCF). RCF has been classified as a possible human carcinogen. When exposed to temperatures above 1805°F, such as during direct flame contact, RCF changes into crystalline silica, a known carcinogen. When disturbed as a result of servicing or repair, these substances become airborne and, if inhaled, may be hazardous to your health.

#### **AVOID Breathing Fiber Particulates and Dust**

#### **Precautionary Measures:**

Do not remove or replace RCF parts 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 airtight plastic bag. RCF and crystalline silica are not classified as hazardous wastes in the United States and Canada.

#### **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.

## IX. SERVICE AND MAINTENANCE (continued)

### WARNING

Service on this boiler should be undertaken only by trained and skilled personnel from a qualified service agency. Inspections should be performed at intervals specified in this manual. Maintain manual in a legible condition.

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

Do not place any obstructions in boiler room that will hinder flow of combustion and ventilation air.

- A. 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.

**ATTENTION.** Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Les erreurs de câblage peuvent nuire au bon fonctionnement et être dangereuses.

S'assurer que l'appareil fonctionne adéquatement une fois l'entretien terminé.

- B. VENT SYSTEM. Vent system (see Figure 12 for typical installation) should be checked annually for:
1. Obstructions.
  2. Accumulations of soot.
  3. Deterioration of vent pipe or vent accessories due to condensation or other reasons.
  4. Proper support - no sags, particularly in horizontal runs.
  5. Tightness of joints.
  6. Proper vent damper operation - see Section VII. Start-up and Checkout, paragraph H.
  7. Remove all accumulations of soot with wire brush and vacuum, see Figure 25. Remove all obstructions. Replace all deteriorated parts and support properly. Seal all joints.

C. CLEANING BOILER FLUES, see Figure 25.

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

1. Remove vent pipe, damper, blocked vent switch, and draft hood.
2. Remove sheet metal screws securing Jacket Top Panel, lift panel and rotate about relief valve piping until top of boiler is exposed.

3. Remove bolts securing Canopy to Boiler Sections. Remove Canopy - flueways are now exposed.
4. Using flashlight, examine all flue passageways. If passageways are free of soot and obstruction, replace canopy and seal. Reinstall Jacket Top Panel, draft hood, blocked vent switch, damper and vent pipe. If the flue passageways need cleaning, remove burners as described in paragraph (D) below. Using long handle wire or bristle flue brush and vacuum, brush flueways thoroughly from top of boiler as illustrated in Figure 25. Replace canopy and seal. Reinstall Jacket Top Panel, draft hood, blocked vent switch, damper and vent pipe.

### NOTICE

- D. BURNERS AND FIREBOX SHOULD BE CLEANED ANNUALLY, AND IF NECESSARY ADJUSTED ONCE A YEAR BY A QUALIFIED SERVICE AGENCY.

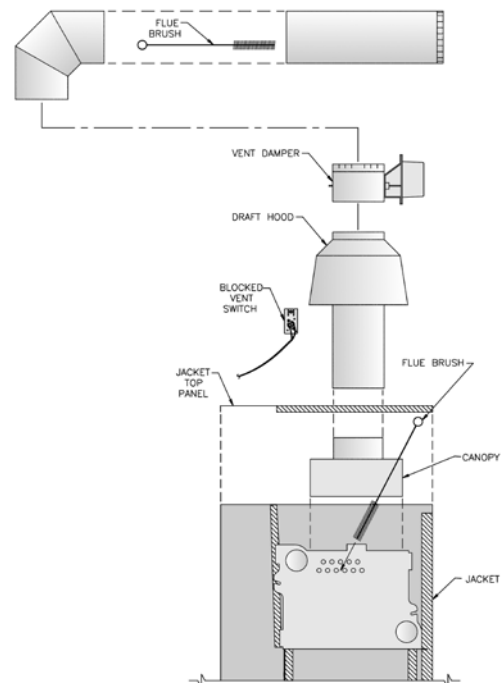


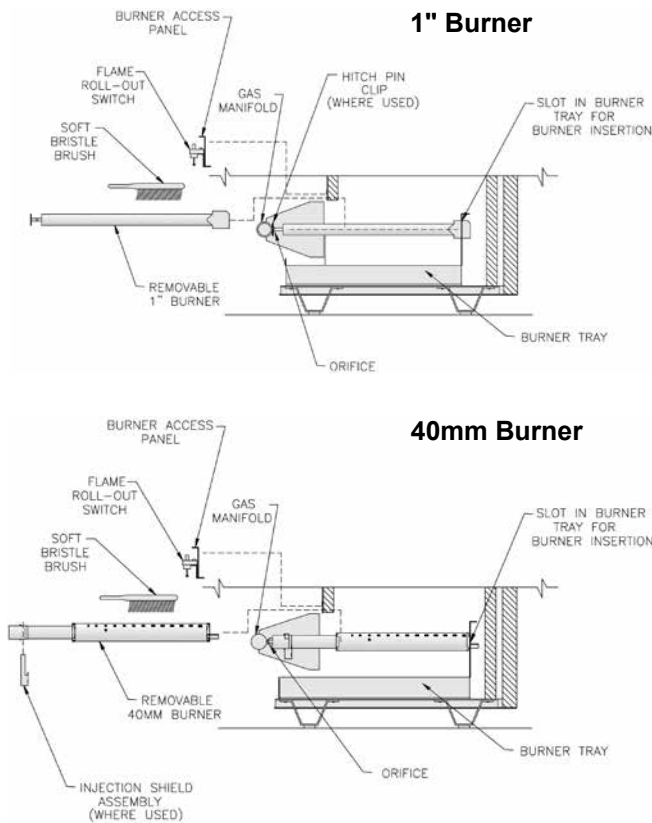
Figure 25: Cleaning of Vent System and Boiler Flues

## IX. SERVICE AND MAINTENANCE (continued)

**Table 10: Pilot Burner Location**

Boiler Model	Main Burner with Pilot Bracket *		Pilot Burner Located Between Main Burners *	
	1 Inch	40mm	1 Inch	40mm
202	1	1	1 & 2	---
202X	1	1	1 & 2	1 & 2
203	1	1	1 & 2	1 & 2
204	2	2	2 & 3	2 & 3
205	3	2	3 & 4	2 & 3
206	4	3	4 & 5	3 & 4
207	6	3	6 & 7	3 & 4
208	7	4	7 & 8	4 & 5
209	8	4	8 & 9	4 & 5
210	9	5	9 & 10	5 & 6

\* Main burners numbered left to right as viewed from front of boiler.



**Figure 26: Burner Cleaning and Installation**

1. TO REMOVE BURNERS FOR CLEANING, CHANGING ORIFICE PLUGS, OR REPAIRS.
  - a. Remove the jacket front panel.
  - b. Disconnect pilot tubing at the gas valve. See Figure 17.
  - c. Disconnect 3-wire plug at the gas valve.
  - d. 40mm burners only. Remove injection shield assembly, where used. See Figure 26.
  - e. Remove wires to flame roll-out switch.
  - f. Remove the burner access panel.
  - g. Mark the location of the pilot main burner on the manifold if the marking on manifold is missing or obliterated.
  - h. Hold burner at throat. Lift front of burner to clear orifice. Burner which holds pilot can only be removed by lifting the burner adjacent to its right first.
  - i. Brush top of burners with a soft bristle brush, see Figure 26. Vacuum burners. Check orifices to see that drilled passageways are free of lint or dirt.
  - j. Vacuum tip of Pilot Burner.
2. CLEAN FIREBOX by vacuuming. Exercise care not to disturb insulation inside the base.
3. INSTALL BURNERS by reversing procedure used to remove burners. Make sure burner with pilot assembly is in same location as original installation - see Table 10.

Check burners to see that they are located properly in slot at rear of burner tray, see Figure 26. Reinstall injection shield assembly (40mm burners only, where used) and burner access panel. Reconnect flame roll-out switch wires, gas valve wires and pilot lead.

4. CHECK MAIN BURNER and PILOT FLAMES, see procedure in Section VII Start-up and Checkout, paragraphs D and E.
- E. CHECK ALL CONTROLS AND DAMPER OPERATION ANNUALLY see procedure in Section VII Start-up and Checkout, paragraphs F through I.
- F. INSPECT LOW WATER CUTOFF (if used)
  1. Clean and test probe-type per manufacturer's instruction.
  2. Flush float-type weekly or as recommended by manufacturer.
- G. REMOVAL OR REPLACEMENT OF PILOT ASSEMBLY OR PILOT ASSEMBLY PARTS
 

If pilot assembly or pilot orifice spud need replacing, remove main burner with pilot using procedure described in paragraph (D).

  1. To replace orifice spud:
    - a. Disconnect pilot tubing. The Honeywell Q3481B pilot orifices are spud type retained by the compression fitting. Replace with desired orifice spud. See Key No. 5B in Repair Parts Section.
    - b. Reconnect pilot tubing and check for leaks.
  2. To replace complete pilot assembly.
    - a. Remove machine screw holding pilot burner to pilot bracket.



## **IX. SERVICE AND MAINTENANCE (continued)**

- b. Disconnect pilot piping.
  - c. Disconnect all other leads to pilot.
  - d. Select pilot assembly with identical model number, reconnect leads and pilot tubing - re-secure to pilot bracket.
3. To adjust or check spark gap between electrode and hood on Honeywell Q3481B pilot.
    - a. Use round wire gauge to check spark gap.
    - b. Spark gap should be 1/8 inch for optimum performance.
  4. Reinstall main burner following procedure described in paragraph D.

### **H. LUBRICATION**

There are no parts requiring lubrication on the part of the service technician or the User. Circulator bearings are water lubricated.

## X. TROUBLESHOOTING

### A. BEFORE TROUBLESHOOTING

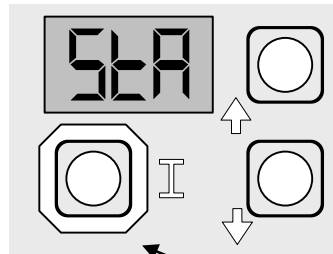
The following pages contain trouble shooting tables for use in diagnosing control problems. When using these tables the following should be kept in mind:

1. This information is only meant to be used by a professional heating technician as an aid in diagnosing boiler problems.
2. Where applicable, follow all precautions outlined in the lighting instruction on page 23 .
3. In general, these tables assume that there are no loose or miswired electrical connections. Before using these tables inspect all electrical connections on the boiler to make sure that they are tight. Also, check the wiring on the boiler against the wiring diagram in Figures 13 and 14. Ensure that incoming

120 Vac power polarity is correct and that the boiler is properly grounded. Further, ensure that the control power supply is 24 VAC (minimum 18 VAC to maximum 30 VAC) and polarity is correct.

4. All controls on the Series 2 are tested at least once in the manufacturing process and a defective control or component is generally the least likely cause. Before replacing a component, try to rule out all other possible causes.
5. When checking voltage across wiring harness pins be careful not to insert the meter probes into the pins. Doing so may damage the pin, resulting in a loose connection when the harness is reconnected.

<b>Operating Mode Parameters</b>	
<b>StA</b>	Status (see Status Numbers)
<b>bt</b>	Boiler Temperature
<b>SP</b>	Operating Setpoint (Outdoor Reset)
<b>HL</b>	High Limit Setpoint
<b>HdF</b>	High Limit Differential Setpoint
<b>tt</b>	Heat Request Status
<b>dh</b>	DHW Heat Request Status
<b>FLA</b>	Flame Current
<b>run</b>	Run Time Hours
<b>CYC</b>	Boiler Cycles
<b>Err</b>	Error (see Error Numbers)



Press "I" key on the control to change from one parameter to the next. Each setting will alternate between display code (for example *StA*) and value.

When *Err* (error) is shown:

Value	Description
4	Flame current lower than threshold
6	Flame Out of Normal Sequence
18	Electronics Failure
23	Flame Sensed During Pre-purge
32	Temperature Sensor Failure
55	Damper Failed to Open
56	Damper Failed to Close
57	Flame Rod Shorted to Ground
58	AC Line Frequency
59	Line Voltage Error
60	Thermostat input higher than threshold
61	Line Voltage Unstable
63	Soft Lockout – Recycles Exceeded
64	Soft Lockout – Internal Failure

Possible *StA* (status) values:

Value	Description
1	Standby
4	Pre-purge
6	Spark
7	Flame Proving
8	Running
10	Retry/Recycle Delay
13	Soft Lockout
14	Hard Lockout
15	Waiting for Limit to Close
16	Flame Present Out of Sequence
17	Self Test
18	Waiting for Damper to Open
19	Waiting for Damper to Close
20	Damper Failure to Open
21	Damper Failure to Close

**Figure 27: Using Control Display to Troubleshoot Series 2 Boiler**

## X. TROUBLESHOOTING (continued)

### B. USE CONTROL DISPLAY *Err* (ERROR) NUMBER TO DIRECT TROUBLESHOOTING EFFORTS

If the control detects an error it will flash “*Err*” (error) followed by a number. Use this number to identify the boiler problem and corrective action in the table below. If there is no *Err* display proceed to Paragraph C:

Display	Status	Recommended Corrective Action
Blank	Boiler or Control is not powered	No 120 Vac Power at boiler, check breaker and wiring between breaker panel and boiler
<i>Err</i> 4	Flame Current Lower than Threshold	Check pilot assembly. Refer to Troubleshooting Section, C6.
<i>Err</i> 5	Flame Sensed Out of Normal Sequence	Flame sensed out of normal sequence (before opening gas valve or after closing gas valve). Check the gas valve for proper operation.
<i>Err</i> 18	Electronics Failure	Cycle power to control. Replace control if problem persists.
<i>Err</i> 23	Flame Sensed During Pre-purge	Flame sensed during post-purge (before gas valve signaled open). Check the gas valve for proper operation. Replace gas valve if problem persists.
<i>Err</i> 32	Temperature Sensor Failure	Temperature sensor or interface failure (open or short connection, increased connection resistance, dual sensor mismatch) or control hardware failure. <ul style="list-style-type: none"> <li>- Check sensor is securely attached to control P7 connector.</li> <li>- Check sensor wire is not damaged.</li> <li>- If secure and in good condition, replace sensor.</li> <li>- If problem persists, replace control.</li> </ul>
<i>Err</i> 55	Damper Failed to Open	Atmospheric Damper End Switch failed to close (end switch contacts stuck open). Refer to Troubleshooting Section, C5.
<i>Err</i> 56	Damper Failed to Close	Damper open. Voltage should not be present on P6-5. Control, vent damper or wire harness is defective. While the <i>Err</i> 56 is displayed by the control, perform the following tasks: <ul style="list-style-type: none"> <li>• Remove the call for heat (adjust thermostat or remove wire from TT terminals).</li> <li>• Check for 24Vac between P6-5 and ground.</li> <li>• If voltage not present, attempt to start boiler again.</li> <li>• If 24Vac is present, unplug the vent damper harness from control.</li> <li>• With wire harness unplugged, check for 24Vac between P6-5 (on Control) and ground.</li> <li>• If voltage present, replace the control.</li> <li>• If voltage not present, failed vent damper or wiring harness.</li> <li>• Check wiring harness for shorts or mis-wiring. Replace if defective.</li> <li>• If harness not defective, replace vent damper.</li> </ul>
<i>Err</i> 57	Flame Rod Shorted to Burner Ground	Flame Rod shorted to burner ground, this can result from excessive flue gas condensation. <ul style="list-style-type: none"> <li>- Check for excessive condensate. Dry pilot. Adjust setpoint higher.</li> <li>- Check for loose or damaged ignition wire.</li> </ul>
<i>Err</i> 58	AC Line Frequency	Error AC Signal is too noisy or frequency is incorrect. Check supply voltage. Check Sensor for Common shorted to ground.
<i>Err</i> 59	Line Voltage Error	AC voltage out of specification high or low. Check supply voltage.
<i>Err</i> 60	Thermostat Input Higher than Threshold	Check thermostat wiring.
<i>Err</i> 61	Line Voltage Unstable	Possibly too many heavy loads switching on and off cause erratic supply voltage. Check supply voltage.
<i>Err</i> 63	Soft Lockout – Maximum Recycles Exceeded	Maximum number of recycles exceeded. Refer to Troubleshooting Section, C6.
<i>Err</i> 64	Soft Lockout – Internal Failure	The electronics has detected an error. This can be caused by an actual controller internal fault or wiring fault: <ul style="list-style-type: none"> <li>- Check vent damper, cycle power with vent damper disconnected. If error is cleared, reconnect the vent damper and refer to Recommended Corrective Action listed under <i>Err</i> 20, damper failed to open.</li> <li>- Check pilot assembly,</li> <li>- If problem persists, replace the control.</li> </ul>

## X. TROUBLESHOOTING (continued)

### C. USE 5t# (STATUS) NUMBER TO GUIDE TROUBLESHOOTING

The control will flash “5t#” followed by a number. Use this number to identify the boiler problem in the table below:

#### 1. Boiler and Circulator Off

Display / Status	Recommended Corrective Action
<p style="text-align: center;"><b>5t# 1</b></p> <p>Standby Burner off Circulator off</p>	<p>The boiler has not detected a call for heat (t<sub>t</sub> = oFF and dh = oFF).</p> <p>Check that the thermostat:</p> <ul style="list-style-type: none"> <li>- When a thermostat call for heat is detected control display “t<sub>t</sub>” will show “on”</li> <li>- Make sure thermostat is calling for heat and contacts (including appropriate zone controls) are closed. Check for loose connection.</li> </ul> <p>Check the DHW demand:</p> <ul style="list-style-type: none"> <li>- When a domestic call for heat is detected “dh” will show “on”</li> <li>- Make sure the DHW aquastat contact is closed. Check for loose connection.</li> </ul>

#### 2. Circulator is On, But Boiler is Off

Display / Status	Recommended Corrective Action
<p style="text-align: center;"><b>5t# 1</b></p> <p>Circulator Pre-purge Burner off Circulator on</p>	<p>The boiler is warm and circulator is providing residual boiler heat to building:</p> <p>Check boiler temperature</p> <ul style="list-style-type: none"> <li>- The boiler will not start until boiler water temperature is less than the Setpoint (5P) minus differential (dF)</li> <li>- If boiler water temperature is higher than Start Temperature (5t<sub>-</sub>, default = 140 F) and the Circulator Pre-purge (PP<sub>-</sub>, default = 2 minutes) time has not expired, boiler start will be delayed until water temperature drops or time expires. To permit the boiler to start sooner increase Start Temperature parameter. Refer to Operation Section for additional information.</li> </ul>

#### 3. Boiler is On, But Circulator is Off

Display / Status	Recommended Corrective Action
<p style="text-align: center;"><b>5t# 8</b></p> <p>Burner on Circulator off</p>	<p>Domestic Hot Water (DHW) Priority Forcing Circulator Off</p> <ul style="list-style-type: none"> <li>- When there is a DHW heat request wired to the Control’s DHW terminal the System Circulator will be “forced off” for the duration of the DHW heat request. When the DHW heat request ends the System Circulator “force off” is removed, the circulator can respond normally. When the Priority Time, (Pt<sub>-</sub>) Parameter is set to “oFF” the System Circulator is not “forced off” for a DHW call for heat.</li> </ul> <p>Wiring / Circulator Issue:</p> <ul style="list-style-type: none"> <li>- Check wiring for loose connection, miswiring</li> <li>- Check circulator</li> </ul>

#### 4. Circulator is On But Damper is Not Open

Display / Status	Recommended Corrective Action
<p style="text-align: center;"><b>5t# 15</b></p> <p>Limit Open</p>	<p>Waiting for Limit to Open.</p> <ul style="list-style-type: none"> <li>- Check Blocked Vent Switch, in the event of a blocked vent or poor draft condition, the blocked vent switch will open interrupting power to control P5-4. The main burners will be extinguished immediately and the circulator will remain on until the thermostat is turned off. The source of blockage must be corrected by trained and skilled personnel from a qualified service agency before resetting switch. Blocked Vents are caused by a collapsed chimney resulting in full or partial blockage, chimney cross sectional area too small, height insufficient or cold chimney causing sustained poor draft. Always follow the recommendations in Section I, Figure 1 and Section V, Venting.</li> <li>- Check Flame Rollout Switch, in the event of excessive blockage of the boiler section flue passageways is developed the flame rollout switch will open interrupting power to control P5-4. The main burners will be extinguished immediately and the circulator will remain on until the thermostat is turned off. If the flame rollout switch is activated, do not attempt to place the boiler in operation. The source of the blockage must be corrected and the identical flame rollout switch replaced by trained and skilled personnel from a qualified service agency.</li> <li>- Check External Limit.</li> </ul>

## X. TROUBLESHOOTING (continued)

### 5. Circulator is On But Damper is Not Open

Display / Status	Recommended Corrective Action
<b>5tA 20</b> Damper Failed to Open	The control is waiting for the damper to open. Damper end switch has failed to close (end switch contact is stuck open). Combustion can never take place unless the damper blade is in the fully open position. Check the following: <ul style="list-style-type: none"> <li>- During status "5tA 18" or "5tA 20" the control terminal "P6 - 5" (yellow wire) is energized.</li> <li>- Check for loose connection between control and vent damper, check damper harness.</li> <li>- Check for obstruction in path of damper</li> <li>- When damper is open (end switch closed) control terminal "P6 - 2" should receive power from the vent damper.</li> <li>- Place jumper between control terminal P6-5 and P6-2. If error 55 does not clear, replace control.</li> <li>- Defective harness or vent damper.</li> </ul>

### 6. Circulator is On, Damper is Open But Boiler Fails to Start

Display / Status	Description
<b>5tA 10</b> Retry / Recycle Delay	The Boiler is in "Retry Delay": <ul style="list-style-type: none"> <li>- The burner failed to light (no flame signal). After a 5 minute delay, Control will attempt to light the burner again. There is no limit to the number of retries.</li> </ul> Recycle Delay <ul style="list-style-type: none"> <li>- The burner loses flame during running mode, ("5tA B"). After a 10 second delay, Control will attempt to light the burner again. If the burner loses flame during running mode, "5tA B" during the next six recycles, Control will progress to a soft lockout.</li> </ul>
<b>5tA 13</b> Soft Lockout	When a soft lockout occurs, boiler will shut down. Boiler automatically restarts once condition that caused the lockout is corrected and the one-hour time delay is completed. Boiler can be restarted sooner than the time delay by using Adjustment Mode and selecting the reset button (see Adjustment Mode instructions) or by cycling power. Soft Lockout is caused by one of the following: <ul style="list-style-type: none"> <li>- Err 63, Maximum Recycles Exceeded – The burner lost flame during running mode, "5tA B" six times in a row. Refer to recommended corrective actions on next page to help determine the cause of the problem.</li> <li>- Err 64, Internal Failure, refer to Error code listing for recommended corrective action.</li> <li>- Err 23, Flame sensed during post-purge (before gas valve signaled open). Check the gas valve for proper operation. Replace gas valve is problem persists.</li> </ul>
<b>5tA 14</b> Hard Lockout	When a hard lockout occurs boiler shuts down.
<b>5tA 16</b> Flame Out of Sequence	If flame is detected in pre-purge Control goes to Flame Out of Sequence Before trial, "5tA 16" and "Err 23" is reported. The control gives a flame 10 seconds to disappear. If flame goes away, control resumes heating cycle from the beginning. If it doesn't "Err 23" is cleared and "Err 5" is reported. When flame is off control goes to Soft Lockout and "Err 5" is cleared. Check the gas valve for proper operation.

## X. TROUBLESHOOTING (continued)

### 6. Circulator is On, Damper is Open But Boiler Fails to Start (continued)

Display / Status	Recommended Corrective Action
<p style="text-align: center;"><b>5ER 10</b> Retry / Recycle Delay</p> <p style="text-align: center;"><b>5ER 13</b> Soft Lockout</p>	<p><b>1. No Spark</b></p> <p>a. Can you hear sparking while 5ER 5 is displayed?</p> <ul style="list-style-type: none"> <li>- If there is no spark noise replace the control.</li> </ul> <p>b. If you can hear spark noise check the following:</p> <ul style="list-style-type: none"> <li>- Loose connection in ignition cable or ground wire</li> <li>- Continuity of ignition cable</li> <li>- Break in ignition cable insulation</li> <li>- Loose ground connection</li> <li>- Break in pilot ceramic insulator</li> <li>- Incorrect pilot spark gap</li> </ul>
	<p><b>2. No Pilot Flame</b></p> <p>a. If pilot does not light check the following:</p> <ul style="list-style-type: none"> <li>- All manual gas valves are open</li> <li>- Supply tubing is not plugged, kinked or leaking</li> <li>- Gas line pressures are good</li> <li>- Gas line is purged of air</li> <li>- Pilot orifice is not plugged (pilot gas is flowing)</li> <li>- Condensate quenching pilot</li> </ul> <p><b>Note:</b> It may be necessary to recycle the "call for heat" more than once to clear the pilot supply tubes of air.</p> <p>b. If no gas flow check the following:</p> <ul style="list-style-type: none"> <li>- 24 volts across PV and MV/PV at gas valve, if voltage ok replace defective gas valve</li> <li>- Check for break in wiring harness to gas valve</li> <li>- 24 volts across control connector P5-2 and P5-5, if no voltage at control replace defective control</li> </ul>
	<p><b>3. Spark does Not Stop When Pilot Lights</b></p> <p>If the spark does not stop when the pilot lights check the following:</p> <ul style="list-style-type: none"> <li>- Loose connection in ignition cable or ground wire</li> <li>- Continuity of ignition cable</li> <li>- Clean flame rod</li> <li>- Pilot electrode porcelain cracked</li> <li>- Pilot flame covers flame rod and is steady and blue, if not adjust pilot flame</li> <li>- Low gas pressure at gas valve inlet</li> <li>- Defective control</li> </ul>
	<p><b>4. Main Flame Does Not Light</b></p> <p>If the main burners do not light check the following:</p> <ul style="list-style-type: none"> <li>- Check orifice size and/or blockage</li> <li>- 24 volts across control terminals P5-8 and P5-5? If no voltage while in 5ER 7 defective control.</li> <li>- 24 volts across MV and MV/PV at gas valve? Check for break in wiring harness to gas valve</li> <li>- Defective gas valve</li> </ul>

---

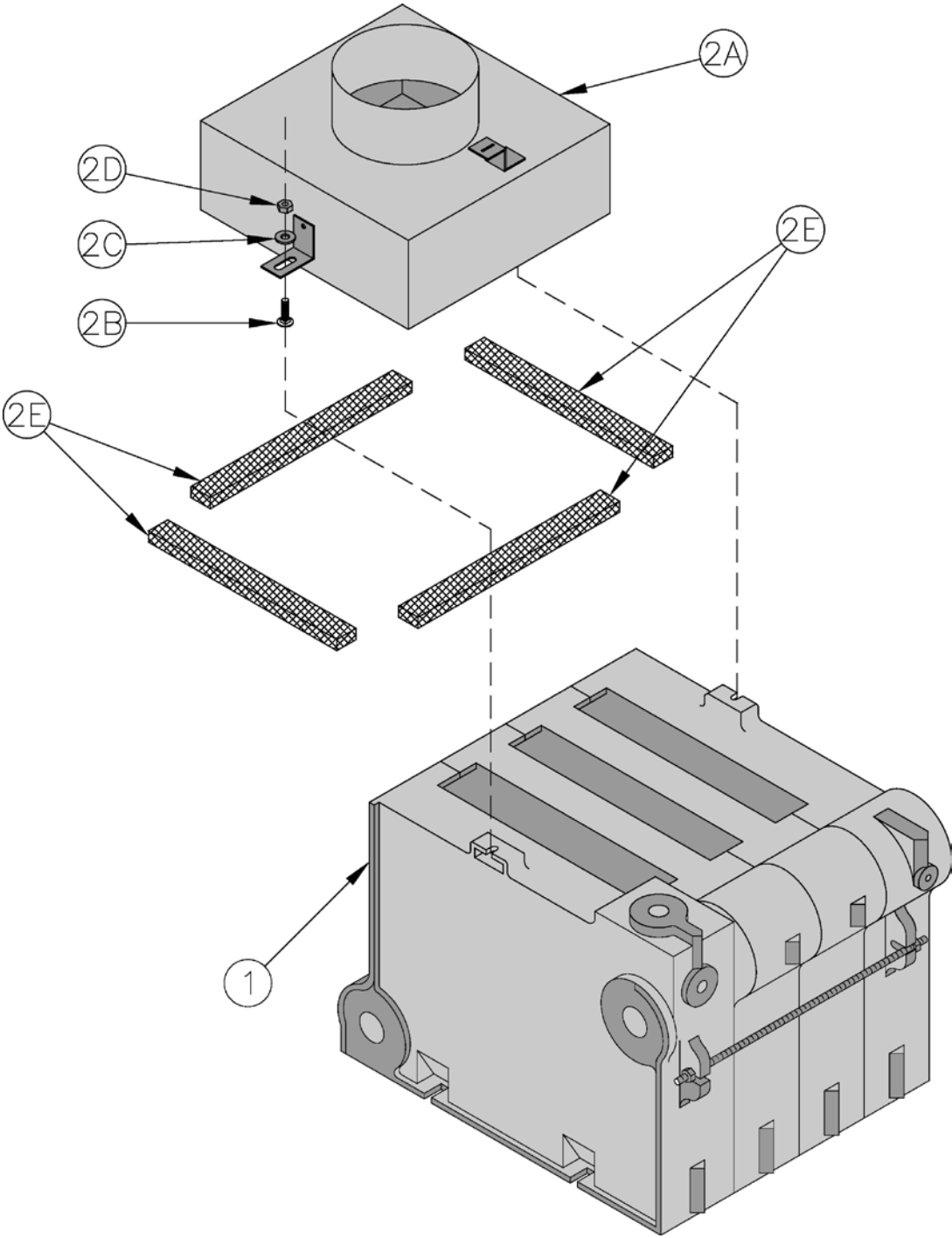
## XI. REPAIR PARTS

---

All Series 2® Repair Parts may be obtained through your local U.S. Boiler Company Wholesale distributor. Should you require assistance in locating a U.S. Boiler Company Distributor in your area, or have questions regarding the availability of U.S. Boiler Company products or repair parts, please contact U.S. Boiler Company Customer Service at (717) 481-8400 or Fax (717) 481-8408.

<b>Section Assembly and Canopy Group.....</b>	<b>40</b>
<b>Base Assembly .....</b>	<b>42</b>
<b>Manifold and Main Burners</b>	
<b>1 Inch Main Burners.....</b>	<b>44</b>
<b>40mm Main Burners.....</b>	<b>46</b>
<b>Pilot Burner and Gas Valve.....</b>	<b>48</b>
<b>Jacket Assembly .....</b>	<b>49</b>
<b>Water Trim --.....</b>	<b>52</b>
<b>Controls.....</b>	<b>54</b>
<b>Draft Hood and Vent Damper.....</b>	<b>55</b>

**XI. REPAIR PARTS (continued)**



**Section Assembly and Canopy Group**

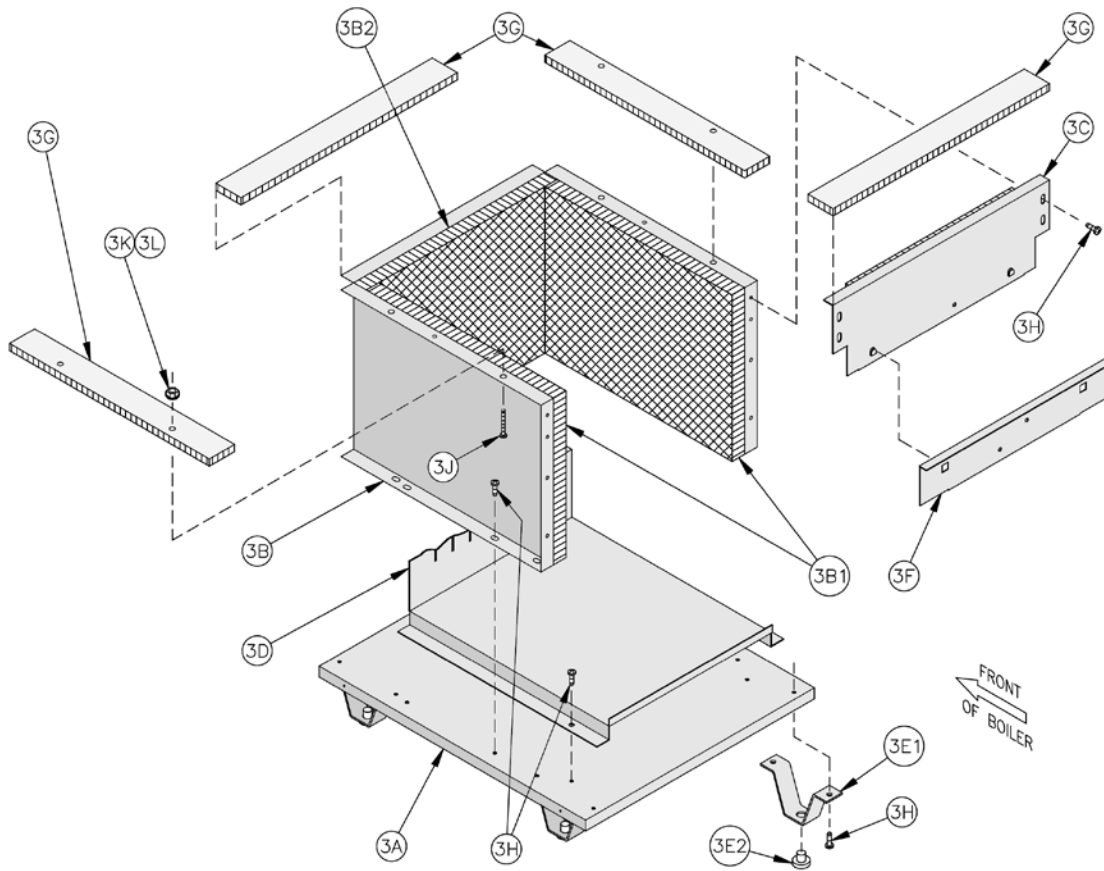


## XI. REPAIR PARTS (continued)

Key No.	Description	Part No.	Quantity									
			202	202X	203	204	205	206	207	208	209	210
<b>1. Section Assembly</b>												
1	Section Assembly, Complete	103918-02	1	---	---	---	---	---	---	---	---	---
		103918-03	---	1	1	---	---	---	---	---	---	---
		103918-04	---	---	---	1	---	---	---	---	---	---
		103918-05	---	---	---	---	1	---	---	---	---	---
		103918-06	---	---	---	---	---	1	---	---	---	---
		103918-07	---	---	---	---	---	---	1	---	---	---
		103918-08	---	---	---	---	---	---	---	1	---	---
		103918-09	---	---	---	---	---	---	---	---	1	---
		103918-10	---	---	---	---	---	---	---	---	---	1

Key No.	Description	Part No.	Quantity									
			202	202X	203	204	205	206	207	208	209	210
<b>2. Canopy Group</b>												
2A	Canopy Assembly	61117022	1	---	---	---	---	---	---	---	---	---
		611170300	---	1	---	---	---	---	---	---	---	---
		611170302	---	---	1	---	---	---	---	---	---	---
		611170402	---	---	---	1	---	---	---	---	---	---
		611170502	---	---	---	---	1	---	---	---	---	---
		611170602	---	---	---	---	---	1	---	---	---	---
		611170702	---	---	---	---	---	---	1	---	---	---
		611170802	---	---	---	---	---	---	---	1	---	---
		611170902	---	---	---	---	---	---	---	---	1	---
		611171002	---	---	---	---	---	---	---	---	1	
2B	Carriage Bolt, 1/4-20 x 1"	80860115	2	2	2	2	2	2	2	2	2	
2C	Flat Washer, 1/4"	80860603	2	2	2	2	2	2	2	2	2	
2D	Nut, Hex, 1/4-20	80860407	2	2	2	2	2	2	2	2	2	
2E	Cerafelt Sealing Strip, 1/2" x 1" x 10'	6206001	1	1	1	1	1	1	1	1	1	

## XI. REPAIR PARTS (continued)



**Base Assembly**

Key No.	Description	Boiler Size	Part No.	Qty.
<b>3. Base Assembly</b>				
3	Base Assembly (Complete) Available for 1 Inch Burners Only	202	618600291	1
		202X	618600391	1
		203	618600391	1
		204	618600491	1
		205	618600591	1
		206	618600691	1
		207	618600791	1
		208	618600891	1
		209	618600991	1
		210	618601091	1
3A	Base Tray	202	718600291	1
		202X	718600391	1
		203	718600391	1
		204	718600491	1
		205	718600591	1
		206	718600691	1
		207	718600791	1
		208	718600891	1
		209	718600991	1
		210	718601091	1

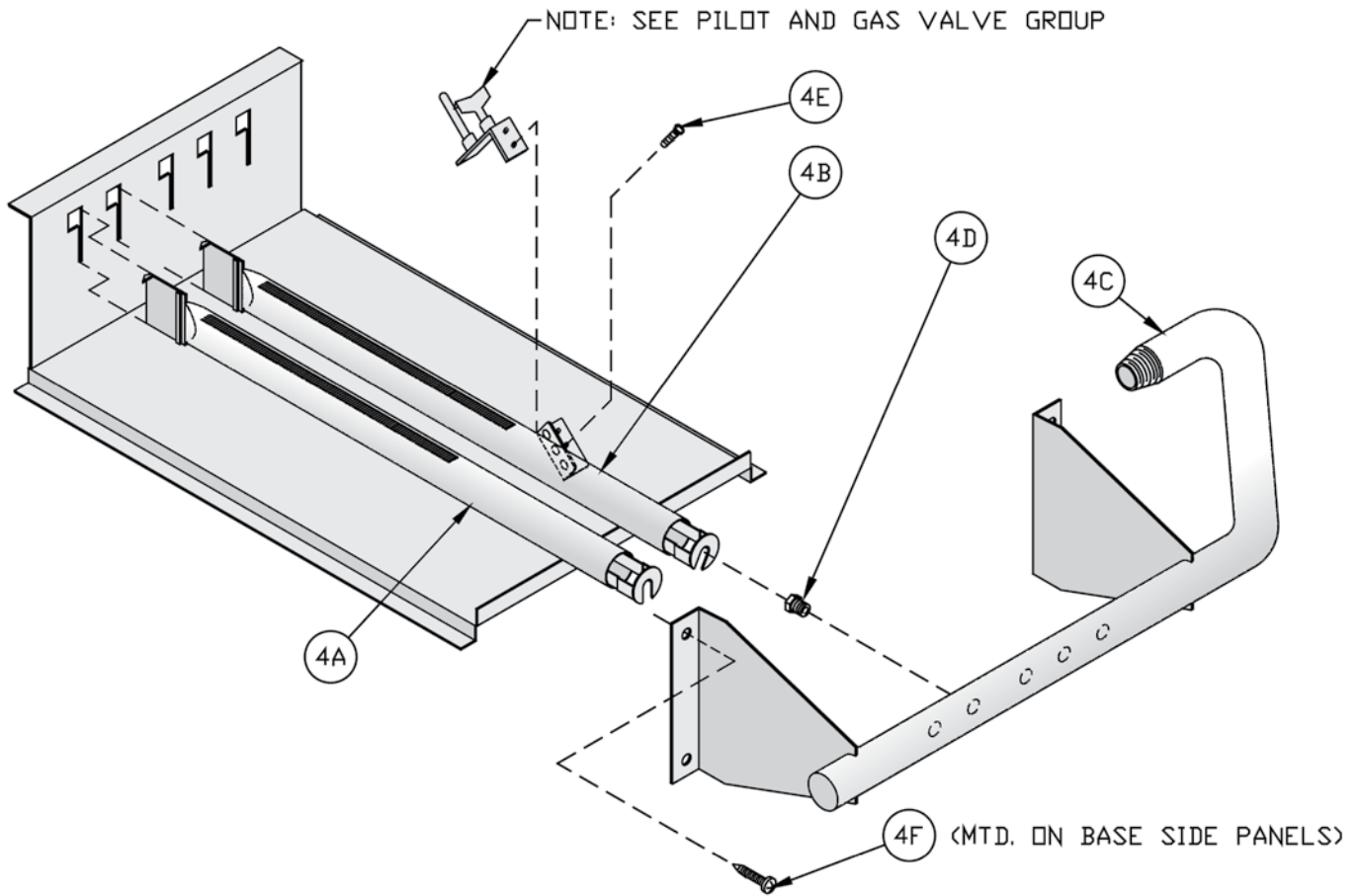
Key No.	Description	Boiler Size	Part No.	Qty.
<b>3. Base Assembly Continued</b>				
3B	Base Wrapper	202	718600211	1
		202X	718600311	1
		203	718600311	1
		204	718600411	1
		205	718600511	1
		206	718600611	1
		207	718600711	1
		208	718600811	1
		209	718600911	1
		210	718601011	1
3B1	Base End Insulation	All	720601	2
3B2	Base Rear Insulation	202	72060025	1
		202X	72060035	1
		203	72060035	1
		204	72060045	1
		205	72060055	1
		206	72060065	1
		207	72060075	1
		208	72060085	1
		209	72060095	1
		210	72060105	1

## XI. REPAIR PARTS (continued)

Key No.	Description	Boiler Size	Part No.	Qty.
<b>3. Base Assembly Continued</b>				
3C	Base Front Panel Assembly	202	618600241	1
		202X	618600341	1
		203	618600341	1
		204	618600441	1
		205	618600541	1
		206	618600641	1
		207	618600741	1
		208	618600841	1
		209	618600941	1
		210	618601041	1
		3D	Burner Tray (1" Main Burners)	202
202X	718600305			1
203	718600305			1
204	718600405			1
205	718600505			1
206	718600605			1
207	718600705			1
208	718600805			1
209	718600905			1
210	718601005			1
Burner Tray (40mm Main Burners)	202		718600206	1
	202X		718606037	1
	203		718606037	1
	204		718606047	1
	205		718606057	1
	206		718606067	1
	207		718606077	1
	208		718600806	1
	209		718600906	1
210	718601006	1		

Key No.	Description	Boiler Size	Part No.	Qty.
<b>3. Base Assembly Continued</b>				
3E	Base Leg Assembly	All	6186001	4
3E1	Base Leg	All	71860021	4
3E2	Nylon Glide	All	8186006	4
3F	Burner Access Panel	202	718600261	1
		202X	718600361	1
		203	718600361	1
		204	718600461	1
		205	718600561	1
		206	718600661	1
		207	718600761	1
		208	718600861	1
		209	718600961	1
		210	718601061	1
		3G	Cerafelt Sealing Strip, 1" x 2" x 10' (Section Assembly to Base)	All
3H	Self-Tapping Screw, 1/4" -20 x 1/2"	202 thru 206	80860700	20
		207 thru 210	80860700	21
3J	Self-Tapping Screw, 5/16" -18 x 1-1/4"	All	80860717	4
3K	Flat Washer, 5/16", USS	All	80860601	4
3L	Hex Lock Nut, 5/16 -18	All	80860464	4

## XI. REPAIR PARTS (continued)

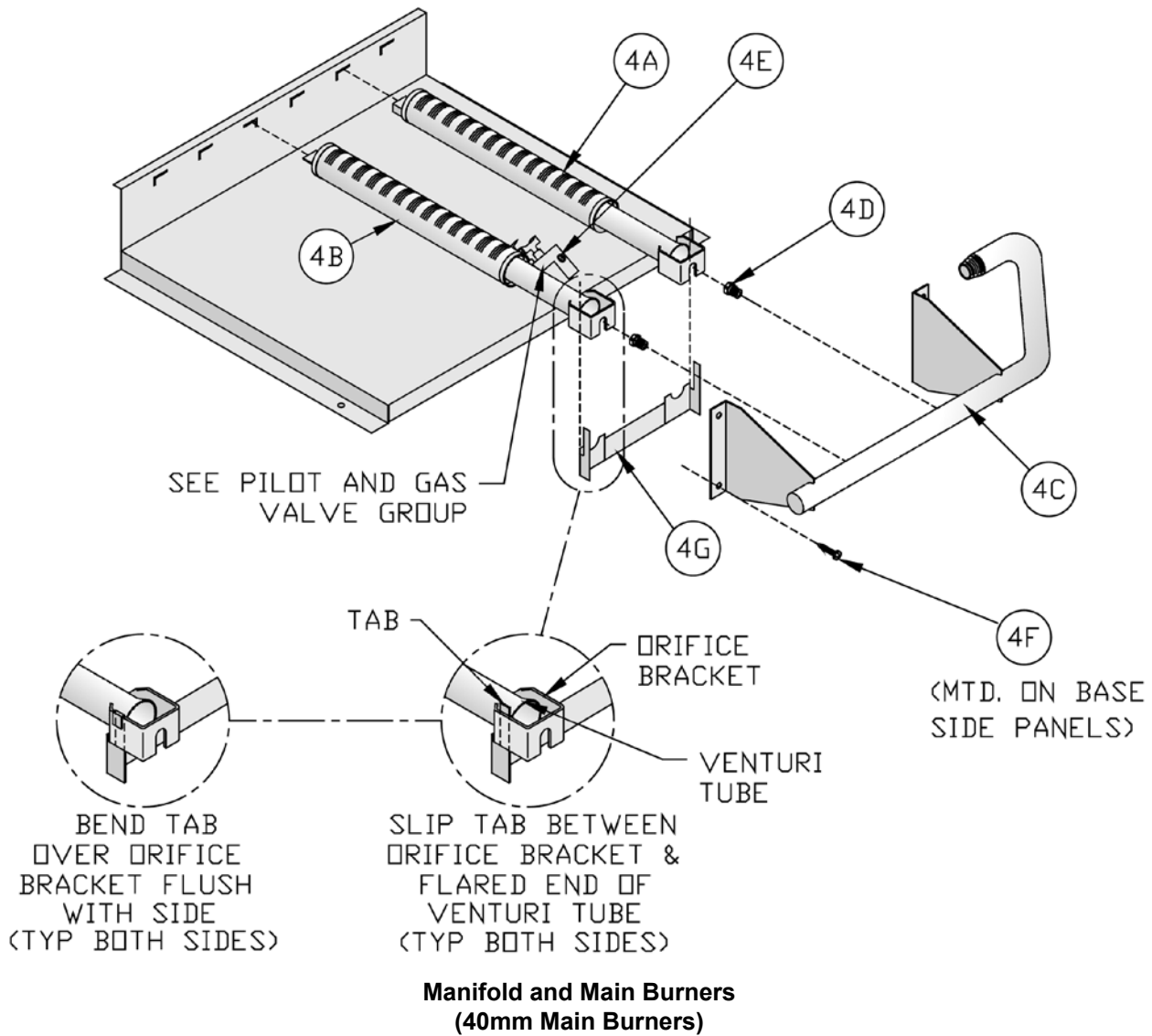


**Manifold and Main Burners  
(1 Inch Main Burners)**

## XI. REPAIR PARTS (continued)

Key No.	Description	Part No.	Quantity									
			202	202X	203	204	205	206	207	208	209	210
<b>4. Manifold and Main Burners (1 Inch Main Burners Only)</b>												
4A	Main Burner	8236099	1	2	2	4	6	8	11	13	15	17
4B	Main Burner with Pilot Bracket	-----	See Table Below									
4C	Manifold	82260023	1	---	---	---	---	---	---	---	---	---
		82260033	---	1	1	---	---	---	---	---	---	---
		82260043	---	---	---	1	---	---	---	---	---	---
		82260053	---	---	---	---	1	---	---	---	---	---
		82260063	---	---	---	---	---	1	---	---	---	---
		82260073	---	---	---	---	---	---	1	---	---	---
		82260083	---	---	---	---	---	---	---	1	---	---
		82260093	---	---	---	---	---	---	---	---	1	---
		82260103	---	---	---	---	---	---	---	---	1	
4D	Main Burner Orifice	-----	See Table Below									
4E	Screw, Machine, Slotted Round Head, #10 -32 x 3/16" (Standing Pilot)	80860800	2	2	2	2	2	2	2	2	2	2
	Screw, Machine, Phillips Head w/Captive Lockwasher, #10 -32 x 1/4" (Electronic Ignition)	80860874	1	1	1	1	1	1	1	1	1	1
4F	Screw, Self Tapping, Phillips Pan Head, 1/4 - 20 x 1/2"	80860700	4	4	4	4	4	4	4	4	4	4
<b>4B. 1 Inch Main Burner with Pilot Bracket</b>												
4B	Main Burner with 60° Pilot Bracket	8236098	1	1	1	1	1	1	1	1	1	1
<b>4D. 1 Inch Main Burner Orifices, Sea Level to 2000 Ft. U.S.A. and Canada</b>												
4D	Main Burner Orifice, #47 (White)	822710	2	3	---	---	---	---	12	14	16	18
	Main Burner Orifice, #45 (Pink)	822711	---	---	3	5	7	9	---	---	---	---
<b>4D. 1 Inch Main Burner Orifices, LP/Propane, Sea Level to 2000 Ft. U.S.A. and Canada</b>												
4D	Main Burner Orifice, 1.25 mm (Purple)	822705	2	---	---	5	7	9	---	---	---	---
	Main Burner Orifice, #55 (Green)	822708	---	---	3	---	---	---	---	---	---	---
	Main Burner Orifice, 3/64" (Blue)	822704	---	3	---	---	---	---	12	14	16	18

## XI. REPAIR PARTS (continued)



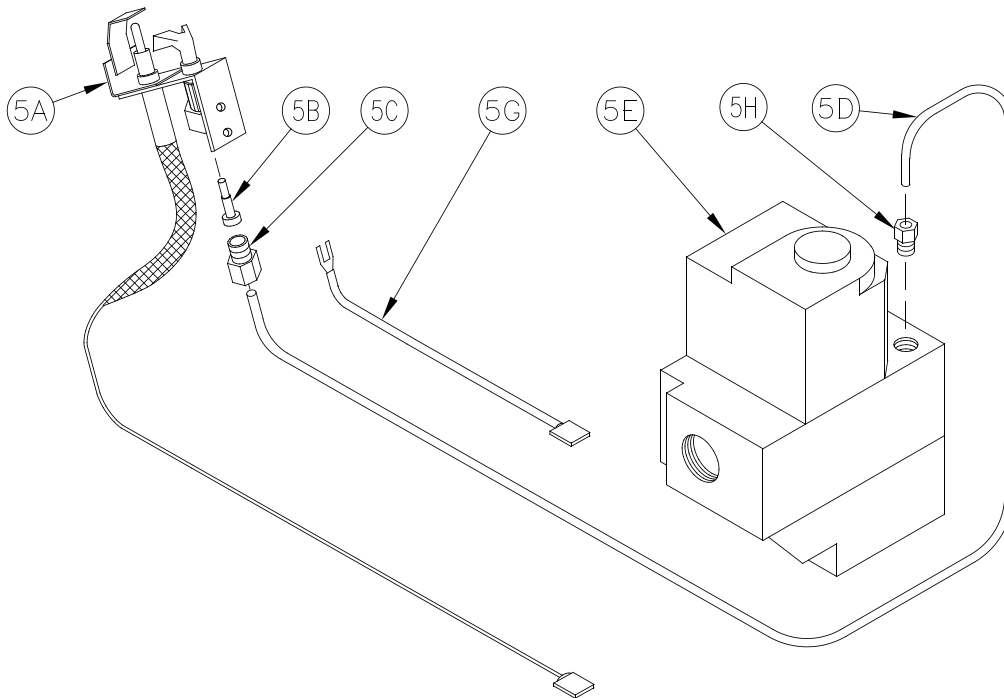
Key No.	Description	Part No.	Quantity								
			203	202X	204	205	206	207	208	209	210
<b>4. 40 MM Main Burners Only</b>											
4A	Main Burner	8236135	1	1	2	3	4	5	6	7	8
<b>4B. 40 MM Main Burner with Pilot Bracket</b>											
4B	Main Burner with 41° Pilot Bracket	8236136	1	1	1	1	1	1	1	1	1

## XI. REPAIR PARTS (continued)

Key No.	Description	Part No.	Quantity								
			202X	203	204	205	206	207	208	209	210
<b>4. 40 MM Main Burners Only (Continued)</b>											
<b>4C. 40MM Main Burner Manifold</b>											
4C	Manifold	82260038	1	1	---	---	---	---	---	---	---
		82260048	---	---	1	---	---	---	---	---	---
		82260058	---	---	---	1	---	---	---	---	---
		82260068	---	---	---	---	1	---	---	---	---
		82260078	---	---	---	---	---	1	---	---	---
		82260088	---	---	---	---	---	---	1	---	---
		82260098	---	---	---	---	---	---	---	1	---
		82260108	---	---	---	---	---	---	---	---	1
<b>4D. 40 MM Main Burner Orifices Natural Gas, 2001-5000 Ft. USA Only</b>											
4D	#43	822713	2	---	---	---	---	---	---	---	---
	#39	822727	---	2	3	---	---	---	---	---	---
	#38	822720	---	---	---	4	5	6	7	8	9
<b>4D. 40 MM Main Burner Orifices, LP Gas, 2001-5000 Ft. USA Only</b>											
4D	#54	822734	2	---	---	---	---	---	---	---	---
	#53	822722	---	2	3	4	5	6	7	8	9
<b>4D. 40 MM Main Burner Orifices, Natural Gas, 5001-9000 Ft. USA Only</b>											
4D	#41	822729	N/A	2	3	---	---	---	---	---	---
	#40	822728	---	---	---	4	5	6	7	8	9
<b>4D. 40 MM Main Burner Orifices, LP Gas, 5001-9000 Ft. USA Only</b>											
4D	#54	822734	N/A	2	---	---	---	---	---	---	---
	#53	822722	---	---	3	4	5	6	7	8	9
<b>4D. 40 MM Main Burner Orifices, Natural Gas, 2001-4500 Ft. Canada Only</b>											
4D	#37	822719	N/A	2	3	4	---	---	---	---	---
	#36	822771	---	---	---	---	5	6	7	8	9
<b>4D. 40 MM Main Burner Orifices, LP Gas, 2001-4500 Ft. Canada Only</b>											
4D	#52	822721	N/A	2	3	4	5	6	7	8	9
4E	Screw, Machine, Slotted Round Head, #10-32 x 3/16" (Standing Pilot)	80860800	2	2	2	2	2	2	2	2	2
	Screw, Machine, Phillips Head w/Captive Lockwasher, #10-32 x 1/4" (Electronic Ignition)	80860874	1	1	1	1	1	1	1	1	1
4F	Screw, Self Tapping, Phillips Pan Head, 1/4 -20 x 1/2"	80860700	4	4	4	4	4	4	4	4	4
4G	Injection Shield Assembly, as required (A/R)	71860__62	A/R	A/R	A/R	A/R	A/R	A/R	A/R	A/R	A/R

\_\_ : number of cast iron sections

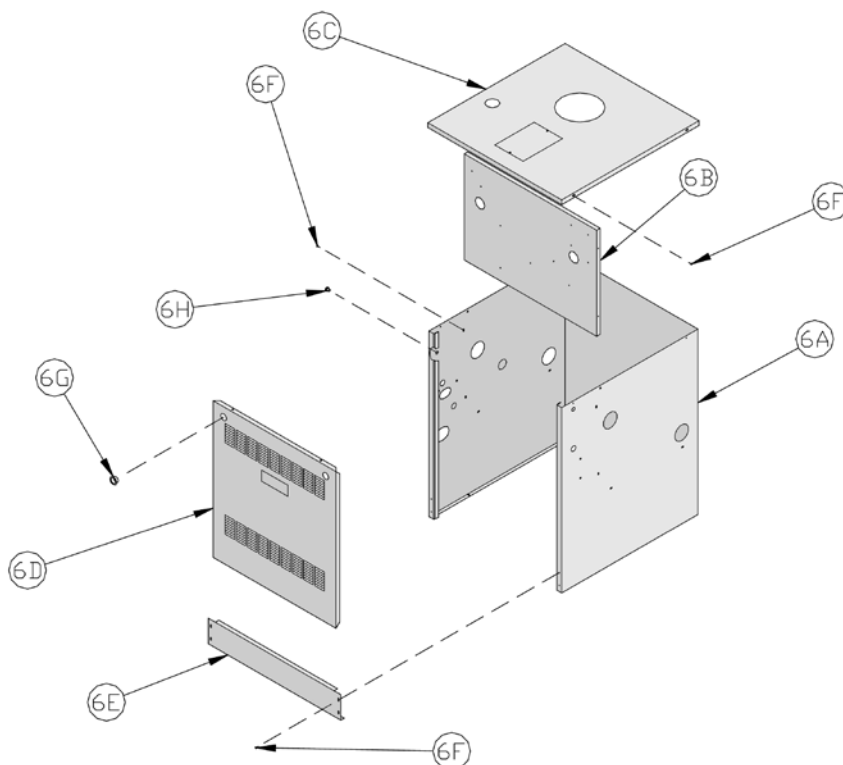
## XI. REPAIR PARTS (continued)



Key No.	Description	Part No.	Quantity									
			202	202X	203	204	205	206	207	208	209	210
<b>5. Pilot Burner and Gas Valve, Natural Gas</b>												
5A	Pilot Burner, Honeywell Q3481B1206 with Fiberglass Insulated Integral 36" lg. Igniter/Sensor Cable	106125-01	1	1	1	1	1	1	1	1	1	1
5B	Pilot Burner Orifice, Honeywell KF24, 0.024" dia.	Included with 5A	1	1	1	1	1	1	1	1	1	1
5C	Compression Fitting, 7/16" Hex x 5/8" lg., Honeywell 386449-4		1	1	1	1	1	1	1	1	1	1
5D	Pilot Tubing, 1/4" OD x 30" lg.	8236122	1	1	1	1	1	1	1	---	---	---
	Pilot Tubing, 1/4" OD x 40" lg.	8236123	---	---	---	---	---	---	---	1	1	1
5E	Gas Valve, Honeywell VR8204C3007	81660145	1	1	1	1	1	1	---	---	---	---
	Gas Valve, Honeywell VR8304P4306	81660161	---	---	---	---	---	---	1	1	1	1
5G	Ground Wire Assembly	103776-01	1	1	1	1	1	1	1	1	1	1
5H	Compression Fitting, 1/4" OD x 1/4" CC, Honeywell 386449-1/B	8236109	1	1	1	1	1	1	1	1	1	1
<b>5. Pilot Burner and Gas Valve, LP Gas</b>												
5A	Pilot Burner, Honeywell Q3481B1420 with Fiberglass Insulated Integral 36" lg. Igniter/Sensor Cable	106126-01	1	1	1	1	1	1	1	1	1	1
5B	Pilot Burner Orifice, Honeywell KR14, 0.014" dia.	Included with 5A	1	1	1	1	1	1	1	1	1	1
5C	Compression Fitting, 7/16" Hex x 5/8" lg., Honeywell 386449-4		1	2	1	1	1	1	1	1	1	1
5D	Pilot Tubing, 1/4" OD x 30" lg.	8236122	1	1	1	1	1	1	1	---	---	---
	Pilot Tubing, 1/4" OD x 40" lg.	8236123	---	---	---	---	---	---	---	1	1	1
5E	Gas Valve, Honeywell VR8204C3015	81660146	1	1	1	1	1	1	---	---	---	---
	Gas Valve, Honeywell VR8304P4314	81660160	---	---	---	---	---	---	1	1	1	1
5G	Ground Wire Assembly	103776-01	1	1	1	1	1	1	1	1	1	1
5H	Compression Fitting, 1/4" OD x 1/4" CC, Honeywell 386449-1/B	8236109	1	1	1	1	1	1	1	1	1	1

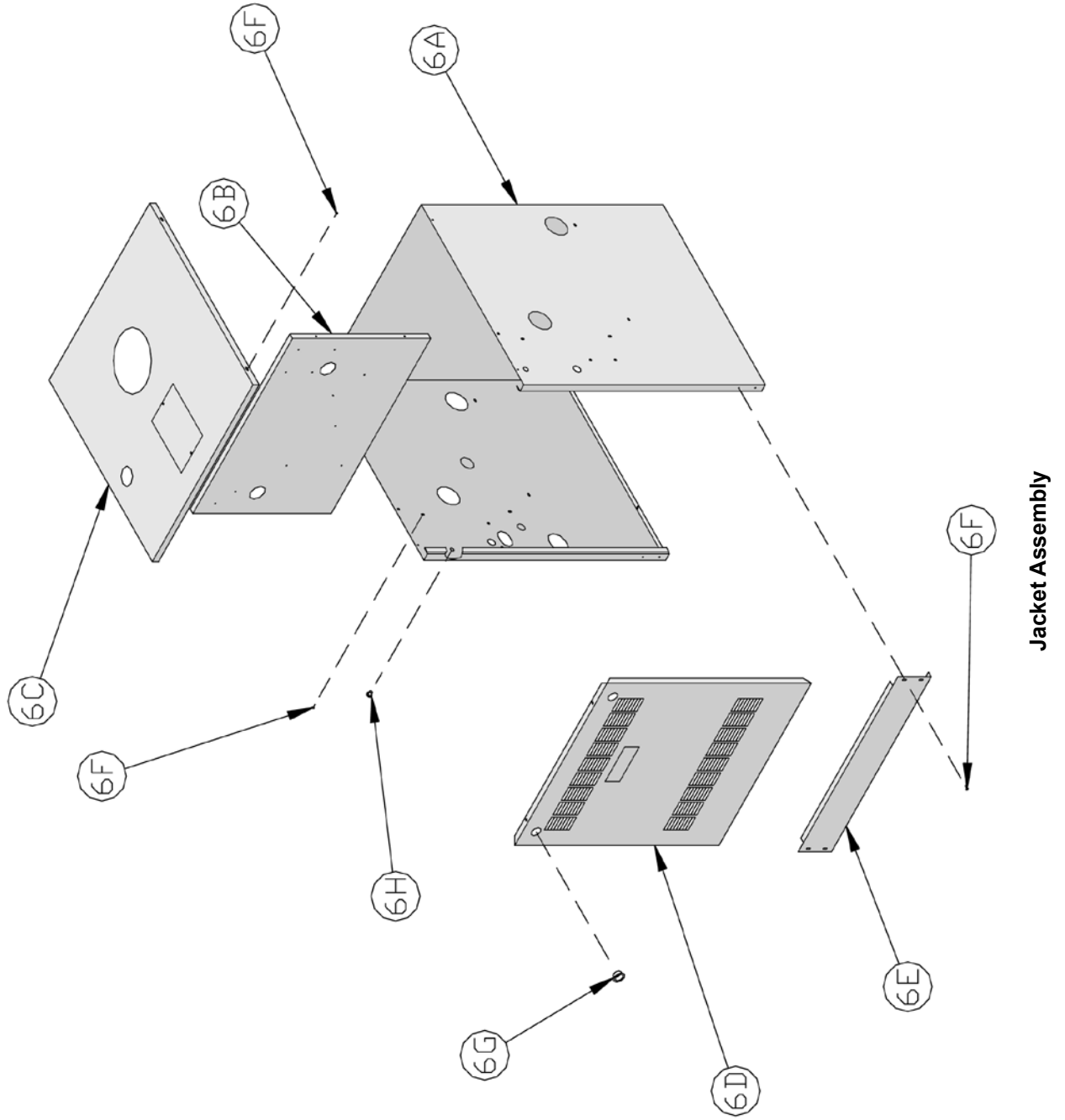


## XI. REPAIR PARTS (continued)



Key No.	Description	Part No.	Quantity									
			202	202X	203	204	205	206	207	208	209	210
<b>6. Jacket Assembly, Complete</b>												
6	Jacket Assembly, Complete	604170254	1	---	---	---	---	---	---	---	---	---
		604170354	---	1	1	---	---	---	---	---	---	---
		604170454	---	---	---	1	---	---	---	---	---	---
		604170554	---	---	---	---	1	---	---	---	---	---
		604170654	---	---	---	---	---	1	---	---	---	---
		604170754	---	---	---	---	---	---	1	---	---	---
		604170854	---	---	---	---	---	---	---	1	---	---
		604170954	---	---	---	---	---	---	---	---	1	---
		604171054	---	---	---	---	---	---	---	---	---	1
<b>6. Jacket Assembly</b>												
6A	Jacket Wrap-Around Panel	604170215	1	---	---	---	---	---	---	---	---	---
		604170315	---	1	1	---	---	---	---	---	---	---
		604170415	---	---	---	1	---	---	---	---	---	---
		604170515	---	---	---	---	1	---	---	---	---	---
		604170615	---	---	---	---	---	1	---	---	---	---
		604170715	---	---	---	---	---	---	1	---	---	---
		604170815	---	---	---	---	---	---	---	1	---	---
		604170915	---	---	---	---	---	---	---	---	1	---
		604171015	---	---	---	---	---	---	---	---	---	1

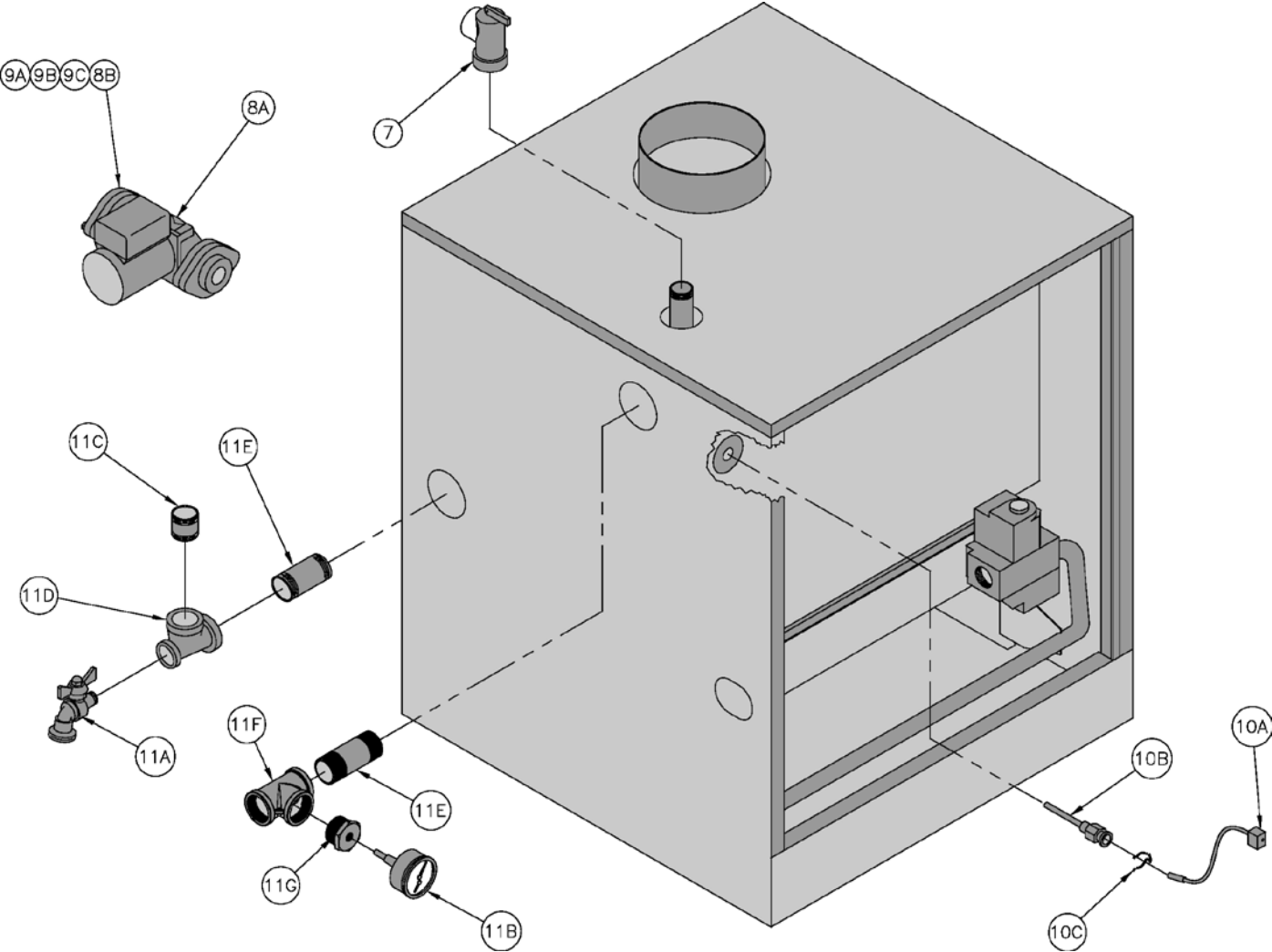
**XI. REPAIR PARTS (continued)**



## XI. REPAIR PARTS (continued)

Key No.	Description	Part No.	Quantity									
			202	202X	203	204	205	206	207	208	209	210
<b>6. Jacket Assembly (Continued)</b>												
6B	Jacket Vestibule Panel	604170223	1	---	---	---	---	---	---	---	---	---
		604170323	---	1	1	---	---	---	---	---	---	---
		604170423	---	---	---	1	---	---	---	---	---	---
		604170523	---	---	---	---	1	---	---	---	---	---
		604170623	---	---	---	---	---	1	---	---	---	---
		604170723	---	---	---	---	---	---	1	---	---	---
		604170823	---	---	---	---	---	---	---	1	---	---
		604170923	---	---	---	---	---	---	---	---	1	---
		604171023	---	---	---	---	---	---	---	---	1	
6C	Jacket Top Panel	604170233	1	---	---	---	---	---	---	---	---	---
		604170333	---	1	1	---	---	---	---	---	---	---
		604170433	---	---	---	1	---	---	---	---	---	---
		604170533	---	---	---	---	1	---	---	---	---	---
		604170633	---	---	---	---	---	1	---	---	---	---
		604170733	---	---	---	---	---	---	1	---	---	---
		604170833	---	---	---	---	---	---	---	1	---	---
		604170933	---	---	---	---	---	---	---	---	1	---
		604171033	---	---	---	---	---	---	---	---	1	
6D	Jacket Front Removable Door	604170242	1	---	---	---	---	---	---	---	---	---
		604170342	---	1	1	---	---	---	---	---	---	---
		604170442	---	---	---	1	---	---	---	---	---	---
		604170542	---	---	---	---	1	---	---	---	---	---
		604170642	---	---	---	---	---	1	---	---	---	---
		604170742	---	---	---	---	---	---	1	---	---	---
		604170842	---	---	---	---	---	---	---	1	---	---
		604170942	---	---	---	---	---	---	---	---	1	---
		604171042	---	---	---	---	---	---	---	---	1	
6E	Jacket Lower Front Panel	604170216	1	---	---	---	---	---	---	---	---	---
		604170316	---	1	1	---	---	---	---	---	---	---
		604170416	---	---	---	1	---	---	---	---	---	---
		604170516	---	---	---	---	1	---	---	---	---	---
		604170616	---	---	---	---	---	1	---	---	---	---
		604170716	---	---	---	---	---	---	1	---	---	---
		604170816	---	---	---	---	---	---	---	1	---	---
		604170916	---	---	---	---	---	---	---	---	1	---
		604171016	---	---	---	---	---	---	---	---	1	
6F	Sheet Metal Screw, Type AB, Phillips Truss Head, #8 x 1/2"	80860000	26	26	26	26	26	26	26	26	26	26
6G	Snap Bushing, Heyco SB-1093-15	8136257	2	2	2	2	2	2	2	2	2	2
6H	Snap Bushing, Heyco SB-437-5	8136048	1	1	1	1	1	1	1	1	1	1

# XI. REPAIR PARTS (continued)



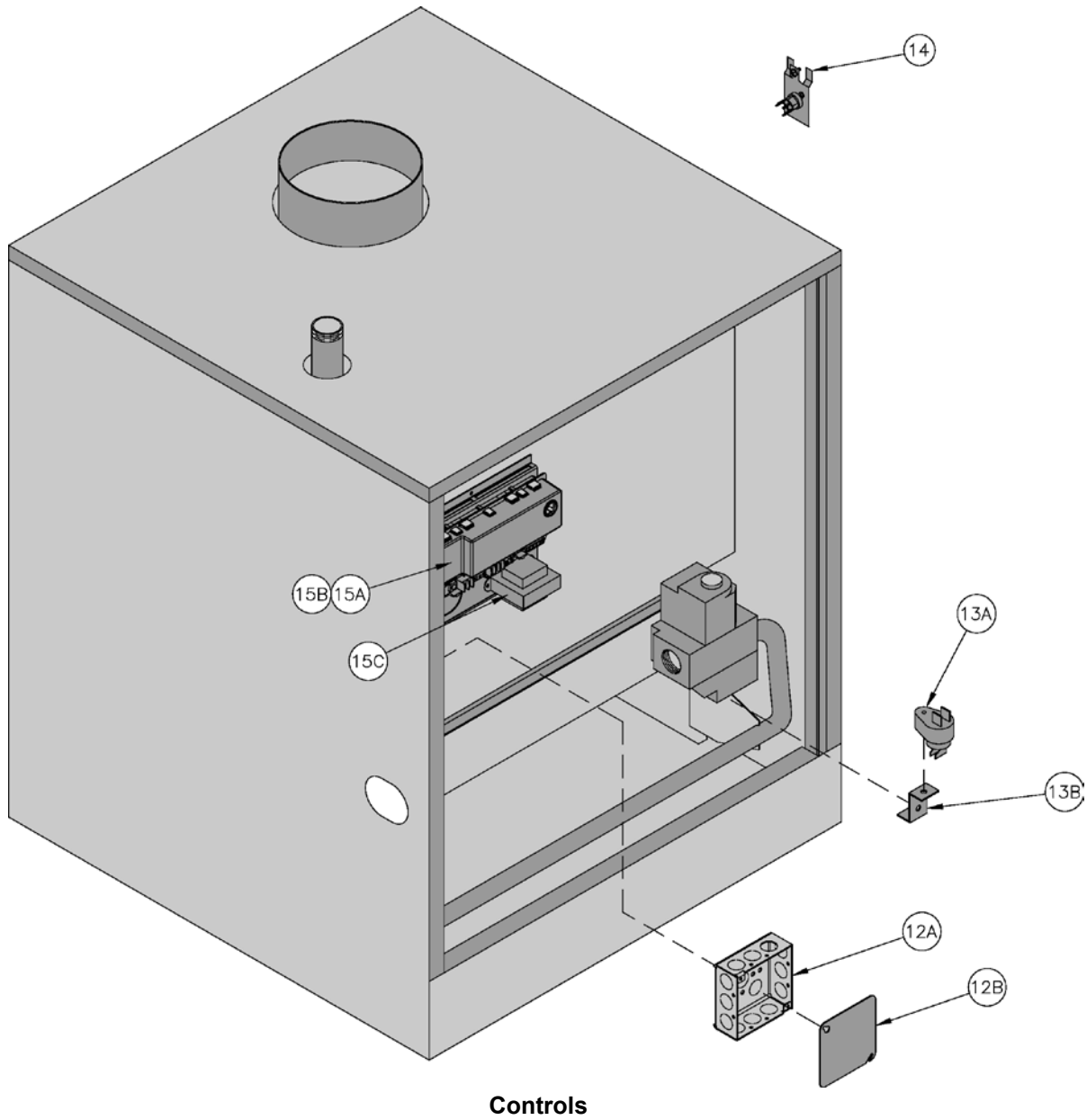
**Water Trim**

## XI. REPAIR PARTS (continued)

Key No.	Description	Part No.	Quantity
7	Safety Relief Valve, 30 psi, 3/4 NPT, Conbraco 10-408-05	81660319	1
	Safety Relief Valve, 50 psi, 3/4 NPT, Conbraco 10-303-10	101662-01	1
<b>8. Circulator, Bell &amp; Gossett SLC-30 Option</b>			
8A	Circulator with Gaskets, Bell & Gossett NRF-22	8056174	1
8B	Gasket, Bell & Gossett NRF-22	806602029	2
<b>8. Circulator, Grundfos Options</b>			
8A	Circulator with Gaskets, Grundfos UPS 15-58FC	105654-01	1
	Circulator with Gaskets, Grundfos Alpha	See Note 1	1
8B	Gasket, Grundfos 510179	806602016	2
<b>8. Circulator, Taco 007 Option</b>			
8A	Circulator with Gaskets, Taco 007F	8056170	1
8B	Gasket, Taco '00' Series	806602006	2
<b>9. Miscellaneous Circulator Hardware</b>			
9A	Flange, 1-1/4 NPT	806602013	2
9B	Screw, Cap Hex Head, 7/16 -14 x 1-1/2"	80861301	4
9C	Nut, Hex, 7/16 -14	80860406	4
<b>10. Limit Control</b>			
10A	12" Limit Rated Temperature Sensor, Honeywell 50001464-001	103195-01	1
10B	½" Immersion Well, Honeywell 123869A	80160456	1
10C	Temperature Sensor Clip, Honeywell 32002656-001`	102422-01	1
10D	Limit, Honeywell 4080B1212 (Dual Limit Only)	80160474	1
<b>11. Miscellaneous Trim</b>			
11A	Drain Valve, Conbraco 35-302-03	806603061	1
11B	Temperature - Pressure Gauge	100282-01	1
11C	Hex Reducing Bushing, 1-1/4 x 1/4 NPT	806600528	1
11D	Tee, 1-1/4 x 3/4 x 1-1/4 NPT	806601002	1
11E	Nipple, 1-1/4 NPT x 4"	806600028	1

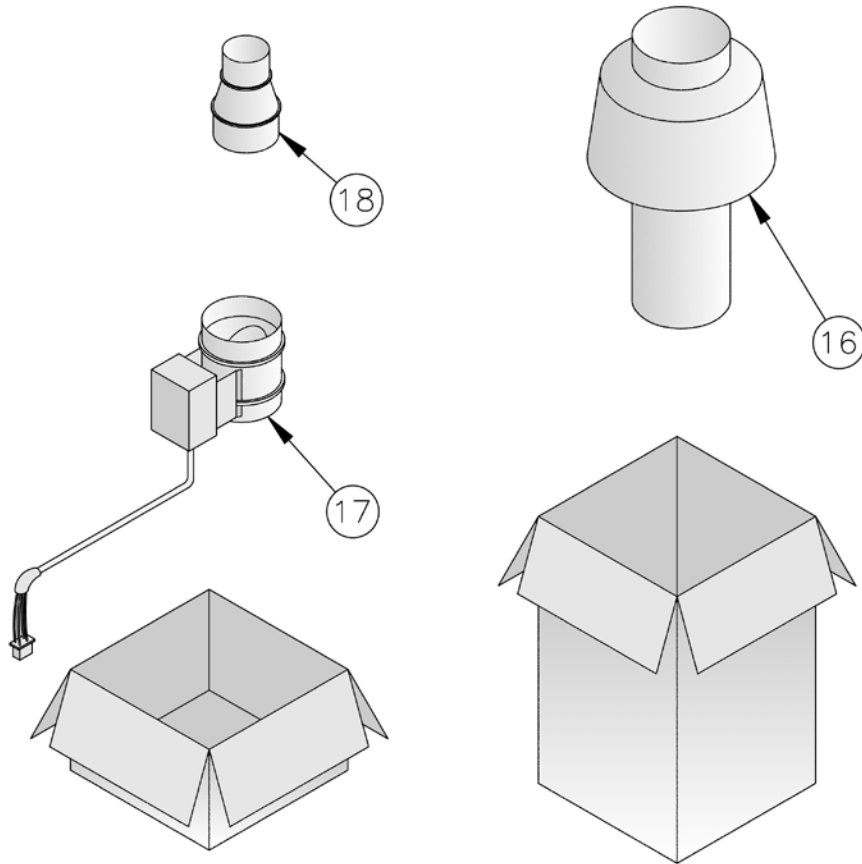
Note 1: Replacement Grundfos Alpha circulator available through Grundfos spare parts service.

## XI. REPAIR PARTS (continued)



Key No.	Description	Part No.	Quantity
<b>12. Transformer/J-Box/Controls</b>			
12A	Junction Box, 4" x 4" x 1-1/2"	8136259	1
12B	Junction Box Cover	8136027	1
13A	Flame Rollout Switch	80160044	1
13B	Flame Rollout Switch Mounting Bracket (All Models Except 202)	7186018	1
14	Blocked Vent Switch Replacement Assembly	6016058	1
15A	Intelligent Hydronic Control, Honeywell S9361A2072	103660-01	1
15B	Control Panel	103659-01	1
15C	Transformer, 40 VA, Honeywell AT140D1297	102516-01	1

## XI. REPAIR PARTS (continued)



VENT DAMPER CARTON

DRAFT HOOD CARTON

### Draft Hood

Key No.	Description	Part No.	Quantity									
			202	202X	203	204	205	206	207	208	209	210
<b>16. Draft Hood Carton</b>												
16	Draft Hood	8116067	1	1	1	---	---	---	---	---	---	---
		8111702	---	---	---	1	---	---	---	---	---	---
		8111703	---	---	---	---	1	1	---	---	---	---
		8111704	---	---	---	---	---	---	1	1	---	---
		8111705	---	---	---	---	---	---	---	---	---	1
<b>17. Vent Damper</b>												
17	4"	102284-01	1	1	1	---	---	---	---	---	---	---
	5"	102284-02	---	---	---	1	---	---	---	---	---	---
	6"	102284-03	---	---	---	---	1	1	---	---	---	---
	7"	102284-04	---	---	---	---	---	---	1	1	---	---
	8"	102284-05	---	---	---	---	---	---	---	---	1	1
<b>18. Vent Reducer</b>												
18	Reducer, 4" x 3"	8116164	1	---	---	---	---	---	---	---	---	---

---

## APPENDIX A - FIGURES

---

<b>Figure Number</b>	<b>Page Number</b>	<b>Description</b>
<b>Section I - Product Description, Specifications &amp; Dimensional Data</b>		
Figure 1	5	Line Drawing
<b>Section II - Pre-Installation &amp; Boiler Mounting</b>		
Figure 2	7	Minimum Clearances
<b>Section III - Gas Piping</b>		
Figure 3	8	Recommended Gas Piping
<b>Section IV - Boiler Water Piping</b>		
Figure 4	9	Near Boiler Piping
Figure 5	10	Recommended Water Piping for Zone Valve Zoned Heating Systems
Figure 6	11	Recommended Water Piping for Circulator Zoned Heating Systems
Figure 7	12	Recommended Piping for Combination Heating & Cooling (Refrigeration) Systems
Figure 8	12	Recommended Probe LWCO Location
Figure 9	13	Recommended Auxiliary Limit Location
<b>Section V - Venting</b>		
Figure 10	14	Blocked Vent Switch Installation Diagram
Figure 11	15	Plug-in Damper Installation
Figure 12	16	Typical Vent Installation
<b>Section VI - Electrical</b>		
Figure 13	19	Connection Diagram Schematic, Intelligent Hydronic Control
Figure 14	20	Ladder Diagram Schematic, Intelligent Hydronic Control
Figure 15	21	Wiring Schematic, Zone Valves
Figure 16	21	Wiring Schematic, Zone Circulators
<b>Section VII - Start-up and Checkout</b>		
Figure 17	22	Schematic Pilot and Gas Piping
Figure 18	22	Top View of VR Gas Valves
Figure 19	23	Operating Instructions, VR8204 and VR8304 Gas Valves
Figure 20	24	40mm Main Burner Flame
Figure 21	24	1 Inch Main Burner Flame
Figure 22	25	Typical Pilot Flame, Honeywell Q3481B
<b>Section VIII - Operation</b>		
Figure 23	27	Intelligent Hydronic Control
Figure 24	27	Boiler Display
<b>Section IX - Service and Maintenance</b>		
Figure 25	31	Cleaning of Vent System and Boiler Flues
Figure 26	32	Burner Cleaning and Installation
<b>Section X - Troubleshooting</b>		
Figure 27	34	Using Control Display to Troubleshoot Series 2 Boiler



## APPENDIX A - FIGURES (continued)

<b>Figure Number</b>	<b>Page Number</b>	<b>Description</b>
<b>Section XI - Repair Parts</b>		
N/A	40	Section Assembly & Canopy Group
N/A	42	Base Assembly
N/A	44	Manifold & Main Burners (1 inch Main Burners)
N/A	46	Manifold & Main Burners (40mm Main Burners)
N/A	48	Pilot Burner & Gas Valve
N/A	49	Jacket Assembly
N/A	52	Water Trim
N/A	54	Controls
N/A	55	Draft Hood & Vent Damper

---

## APPENDIX B - TABLES

---

Table Number	Page Number	Description
<b>Section III - Gas Piping</b>		
Table 1	5	Dimensions
Table 2	8	Maximum Capacity of Schedule 40 Pipe in CFH for Natural Gas Pressures of ½ psig or Less
Table 3	8	Equivalent Length of Fittings
Table 4	8	Specific Gravity Correction Factors for Natural Gas
<b>Section VIII - Operation</b>		
Table 5	26	Sequence of Operation
Table 6	26	Sequence Fail
Table 7	28	Circulator Pre-purge Time example, (PP_ = 2 minutes)
Table 8	29	DHW Terminal function (dh_) Selection = Domestic Hot Water Demand (Parameter dh_ = dh)
Table 9	29	DHW Terminal Function (dh_) Selection = Zone Request (Parameter dh_ = tt2)
<b>Section IX - Service and Maintenance</b>		
Table 10	32	Pilot Burner Location
<b>Section XI - Repair Parts</b>		
N/A	41	Section Assembly & Canopy Group
N/A	42	Base Assembly
N/A	45	Manifold & Main Burners (1 inch Main Burners)
N/A	46	Manifold & Main Burners (40mm Main Burners)
N/A	48	Pilot Burner & Gas Valve
N/A	49	Jacket Assembly
N/A	53	Water Trim
N/A	54	Controls
N/A	55	Draft Hood & Vent Damper



**U.S. Boiler Company, Inc.**  
**P.O. Box 3020**  
**Lancaster, PA 17604**  
**1-888-432-8887**  
**[www.usboiler.net](http://www.usboiler.net)**