

# Installation, Operating and Service Instructions for

# FORCE™

- Water Boiler
- Cast Iron
- Chimney Vent
- Gas Fired

## Models:

- FORCE02E
- FORCE03E
- FORCE04E
- FORCE05E
- FORCE06E
- FORCE07E
- FORCE08E
- FORCE09E



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## TO THE INSTALLER:

Affix these instructions adjacent to boiler.  
Provide model number and serial number when seeking information and support.

## TO THE CONSUMER:

Retain these instructions for future reference.  
Contact heating contractor for all issues and support.



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## WARNING

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

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 listed the FORCE E Boiler. See the Massachusetts Board of Plumbers and Gas Fitters website, [http://licensing.reg.state.ma.us/pubLic/pl\\_products/pb\\_product.asp](http://licensing.reg.state.ma.us/pubLic/pl_products/pb_product.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 terms are used throughout this manual to bring attention to the presence of hazards of various risk levels, or to important information concerning product life.**

** DANGER**

**Indicates a hazardous situation** that, if not avoided, will result in death or serious injury.

** CAUTION**

**Indicates a hazardous situation** that, if not avoided, could result in minor or moderate injury.

** WARNING**

**Indicates a hazardous situation** that, if not avoided, could result in death or serious injury.

**NOTICE:** Indicates special instructions on installation, operation, or service which are important but not related to personal injury hazards.

** DANGER**

**Explosion Hazard.** 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 must only be serviced and repaired by skilled and experienced service technicians.**

- If any controls are replaced, they must be replaced with identical models.
- Read, understand and follow all the instructions and warnings contained in all the sections of this manual.
- If any electrical wires are disconnected during service, clearly label the wires and assure that the wires are reconnected properly.
- Never jump out or bypass any safety or operating control or component of this boiler.
- Assure that all safety and operating controls and components are operating properly before placing the boiler back in service.
- Annually inspect all vent gaskets and replace any exhibiting damage or deterioration.

# 1 Specifications



**Table 1A: Ratings**

Boiler Model Number	Input <sup>1</sup> (MBH)	DOE Heating Capacity (MBH)	AHRI Net Rating <sup>2</sup> (MBH)	AFUE
FORCE02E	38	32	28	84.0
FORCE03E	68	57	50	84.0
FORCE04E	102	85	74	84.0
FORCE05E	136	114	99	84.0
FORCE06E	170	142	123	84.0
FORCE07E	204	170	148	84.0
FORCE08E	238	199	173	84.0
FORCE09E	272	227	197	84.0

<sup>1</sup> Input ratings can be used for elevations up to 2,000 ft. Refer to System Start-up and Checkout section for elevation above 2,000 ft.

<sup>2</sup> The Net AHRI Water Ratings shown are based on a piping and pickup allowance of 1.15. The manufacturer should be consulted before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent operation, extensive piping systems, etc.

**Table 1B: Dimensions and Connections**

Boiler Model Number	No. of Sections	Depth (in)	Width (in)	Height (in)	Supply NPT	Return NPT	Vent (in)	Gas NPT	Relief Valve NPT	Drain NPT	Maximum Allowable Working Pressure (PSI)
FORCE02E	2	32	14	40	1-1/4	1-1/4	4	1/2	3/4	3/4	50
FORCE03E	3	32	14	40	1-1/4	1-1/4	4	1/2	3/4	3/4	50
FORCE04E	4	32	16	40	1-1/4	1-1/4	5	1/2	3/4	3/4	50
FORCE05E	5	32	19	40	1-1/4	1-1/4	6	1/2	3/4	3/4	50
FORCE06E	6	32	22	40	1-1/4	1-1/4	6	1/2	3/4	3/4	50
FORCE07E	7	32	25	40	1-1/4	1-1/4	7	3/4	3/4	3/4	50
FORCE08E	8	32	28	40	1-1/4	1-1/4	7	3/4	3/4	3/4	50
FORCE09E	9	32	31	40	1-1/4	1-1/4	8	3/4	3/4	3/4	50

**Table 1C: Weights and Volume**

Boiler Model Number	Shipping Weight (lbs)	Empty Weight (lbs)	Shipping Crate D (in)	Shipping Crate W (in)	Shipping Crate H (in)	Water Content (gal)	Heat Exchanger Surface Area ft <sup>2</sup>
FORCE02E	202	143	39 1/2	26	46	1	3.86
FORCE03E	254	180	39 1/2	26	46	2	7.72
FORCE04E	304	231	39 1/2	26	46	3	11.58
FORCE05E	357	284	39 1/2	26	46	4	15.44
FORCE06E	405	332	39 1/2	26	46	5	19.31
FORCE07E	462	382	39 1/2	35	46	6	23.17
FORCE08E	518	438	39 1/2	35	46	7	27.03
FORCE09E	564	484	39 1/2	35	46	8	30.81

Electrical Requirements: 120 VAC, 60 HZ, 1-ph, less than 12A

## 2 Pre-installation

### WARNING

Carefully read all instructions before installing boiler. Failure to follow all instructions in proper order can cause personal injury or death.

- A. FORCE E boiler is Category I, draft hood equipped appliance with vent damper.
- B. Installation must conform to requirements of authority having jurisdiction. In absence of such requirements, installation must conform to *National Fuel Gas Code*, ANSI Z223.1/NFPA 54.
- C. Appliance is design listed for installation on combustible flooring and must not be installed on carpeting.
- D. Provide clearance between boiler jacket and combustible material in accordance with authority having jurisdiction. Minimum clearances outlined in Figures 4-1 and 4-2.
- E. Provide practical service clearances. Minimum 24" from left side and front jacket panels is recommended for servicing.
- F. Install on level floor. For basement installation provide concrete base if floor is not level or if water may be encountered on floor around boiler.
- G. Protect gas ignition system components from water (dripping, spraying, rain, etc.) during boiler operation and service (circulator replacement, condensate trap, control replacement, etc.).

- H. 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 54, or applicable provisions of local building codes.

### WARNING

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

- I. Do not install boiler where gasoline or other flammable vapors or liquids are stored. Avoid areas near chemical products containing chlorine, chloride based salts, chloro/fluorocarbons, paint removers, cleaning solvent, and detergents.
- J. Consider using boiler bypass described in Section 6 "Water Piping" for systems which have a large volume or excessive radiation where low boiler water temperatures may be encountered.
- K. Where required by authority having jurisdiction, installation must conform to standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1.
- L. A hot water boiler installed above radiation level or as required by the authority having jurisdiction must be provided with a low water cutoff device. The Hydrostat 3200 LWCO is supplied with boiler.

### IMPORTANT

This boiler is equipped with a feature that saves energy by reducing the boiler water temperature as the heating load decreases. This feature is equipped with an override which is provided primarily to permit the use of an external energy management system that serves the same function. **THIS OVERRIDE MUST NOT BE USED UNLESS AT LEAST ONE OF THE FOLLOWING CONDITIONS IS TRUE:**

- An external energy management system is installed that reduces the boiler water temperature as the heating load decreases.
- This boiler is not used for any space heating.
- This boiler is part of a modular or multiple boiler system having a total input of 300,000 BTU/hr or greater.
- This boiler is equipped with a tankless coil.

### Components Shipped with Boiler:

- Vent damper
- Circulator
- Miscellaneous parts bag (Supply water manifold, Temperature/pressure gauge, 30 psi safety relief valve, drain valve, circulator flanges)

### 3 Removing Existing Boiler

#### A. 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.
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. 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 Chapter 13 of the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54.

### 4 Clearances

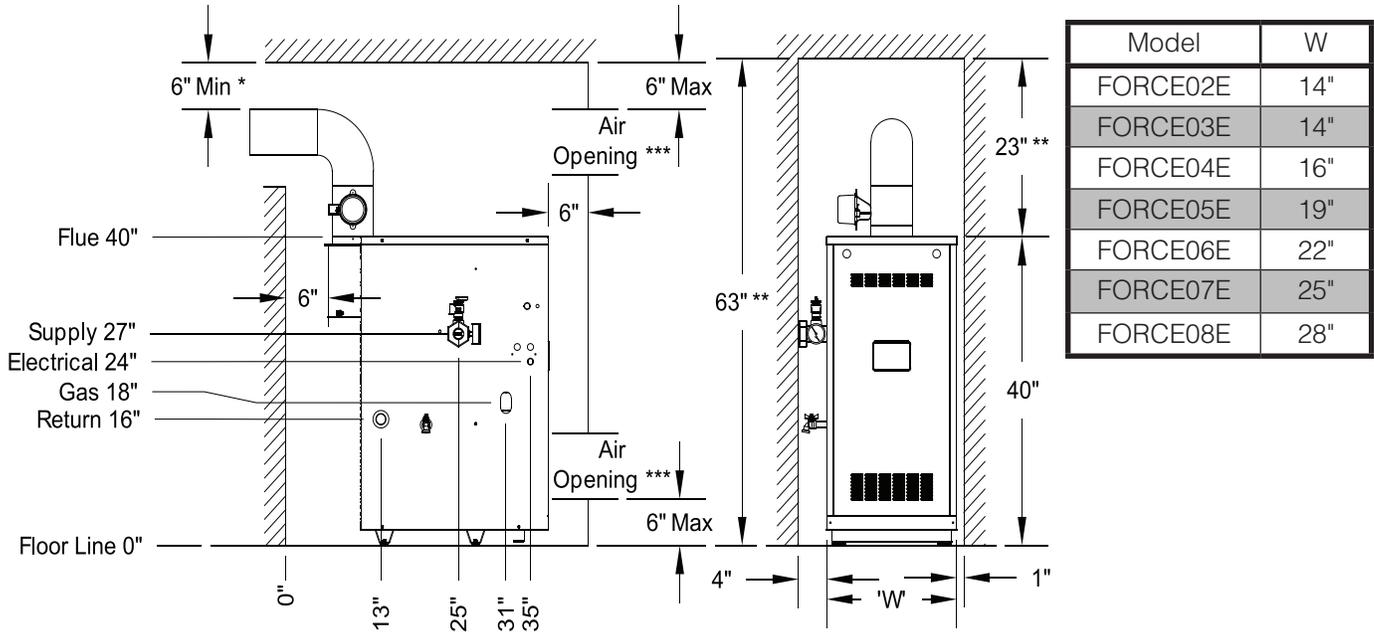
#### A. All Installations

1. Minimum clearances to combustibile materials are shown in Figures 4-1 and 4-2.  
**Recommended for servicing: 24" minimum for left side and front jacket panels.**
2. Closet Installation - Models FORCE02E, FORCE03E, FORCE04E, FORCE05E, FORCE06E, FORCE07E, & FORCE08E are listed for closet installation. See Figure 4-1.

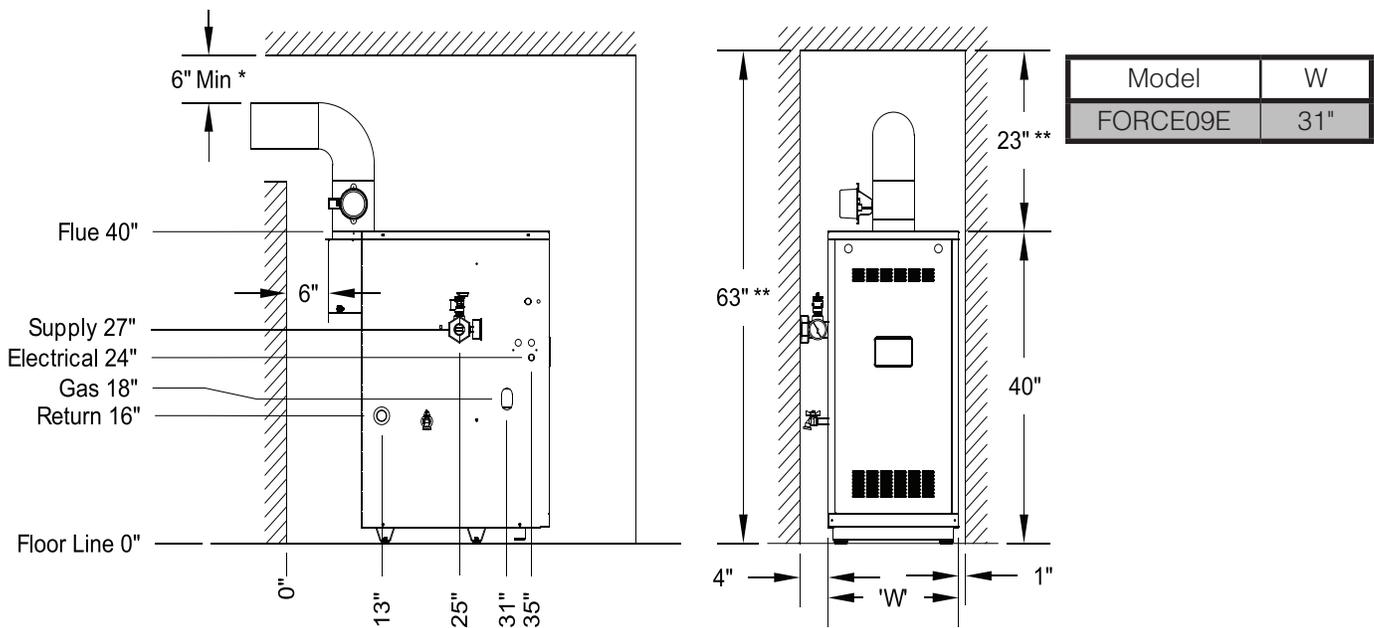
3. Alcove Installation (no front door)- Model FORCE09E is listed for alcove installation. See Figure 4-2.
4. Hot water pipes: at least 1/2" from combustibile material.

- #### B. 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 applicable provisions of local building codes.

# 4 Clearances *(continued)*



**Figure 4-1: Minimum Closet Clearances**



**Figure 4-2: Minimum Alcove Clearances**

- \* Minimum radial clearance around vent pipe and breaching for single-wall metal pipe vent connector. Otherwise, follow vent connector manufacturer's recommended clearances.
- \*\* Additional height required to maintain 6" clearance from all vent connector components. Vent damper may be installed in vertical or horizontal section of vent connector within reach of vent damper harness.
- \*\*\* Area of each opening to be 1 sq. inch for each 1000 BTU/hr input - with minimum of 100 sq. inches. Height of opening should be half of width. 3" minimum dimension for air openings.

## 5 Venting

- A. Inspect chimney and remove any obstructions or restrictions. Clean chimney if previously used for solid or liquid fuel-burning appliances or fireplaces.
- B. Locate blocked vent switch on boiler draft hood. Verify connections are made.

### C. Install Vent Damper

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

Automatic gas control valve supplied on each FORCE E boiler provides redundancy referenced in vent damper Installation Instructions.

#### ⚠ CAUTION

Do not use one vent damper to control more than one heating appliance.

1. Vent damper must be same size as outlet of vent supplied with boiler (see Table 1B). Unpack damper carefully - DO NOT FORCE IT CLOSED! Forcing damper may damage motor and void warranty.

Insert pilot vent plug into gate and fold over tabs.

2. Mount the vent damper assembly onto draft hood. (Refer to Figure 5-1 and to instructions packed with vent damper for specific instructions). Do not modify either draft hood or vent damper.

**NOTICE:** Provide adequate clearance for servicing.

3. Locate vent damper position indicating means to be visible following installation.
4. Plug factory harness vent damper connector into damper motor polarized receptacle.

#### ⚠ WARNING

Do not alter draft hood or place any obstruction or non listed damper in breeching or vent system. Flue gas spillage and carbon monoxide production can occur.

- D. Install vent system in accordance with "Venting of Appliances" of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or applicable provisions of local building codes. The FORCE E boiler is a Category I, draft hood equipped appliance with vent damper.

1. Type B or Type L gas vent. Install in accordance with manufacturer's installation instructions.
2. 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*, NFPA 211.

Masonry chimney must be lined with listed clay flue lining or listed chimney lining system.

3. Single wall metal vent. Allowed by ANSI Z223.1/NFPA 54 under very restrictive conditions.
4. Do not use CPVC, PVC, Polypropylene or any other non-metallic vent pipe. Do not use cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone).
5. Do not cover non-metallic vent pipe and fittings with thermal insulation.

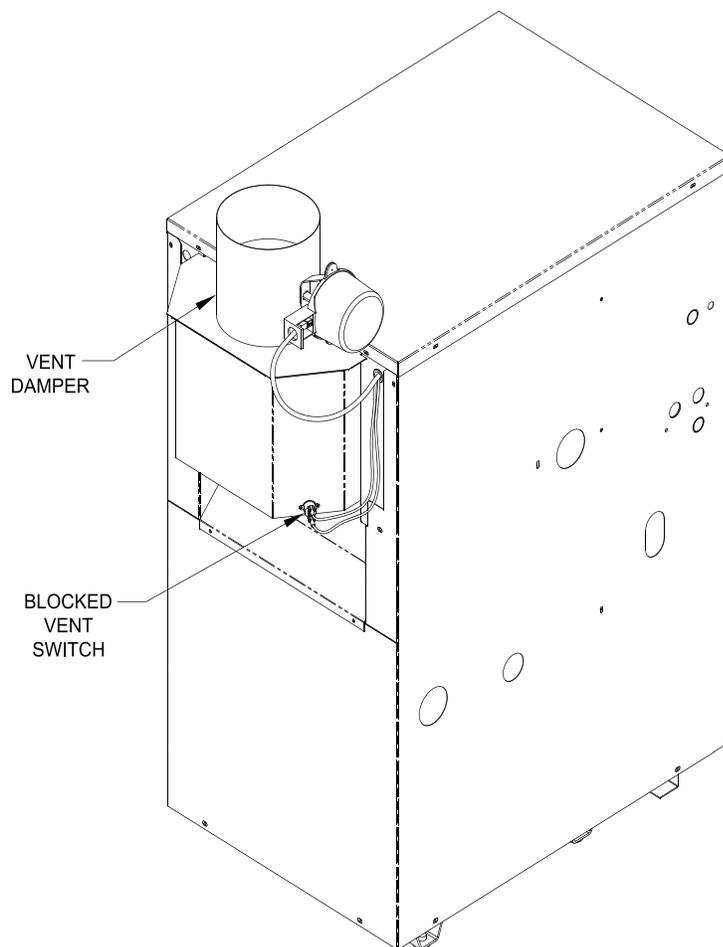
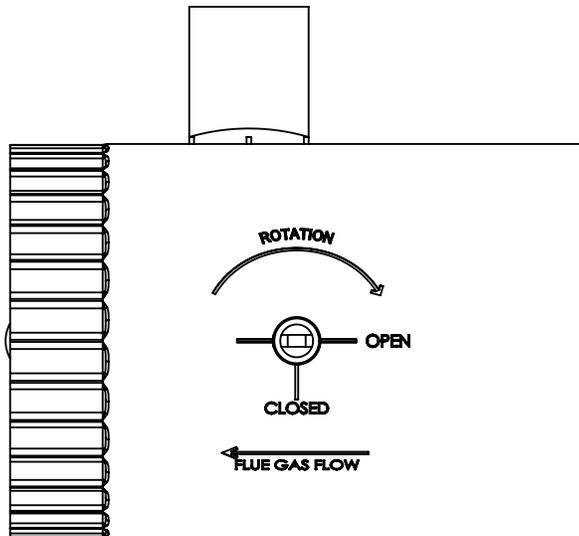


Figure 5-1 : Vent Damper Installation

## 5 Venting *(continued)*



**Figure 5-2 : Vent Damper Position Indicator**

### E. Install Vent Piping

1. Install vent piping from vent damper outlet to chimney.
2. Vent pipes serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.
3. Do not connect into same flue of chimney serving an open fireplace.

### **⚠ DANGER**

Inspect existing chimney before installing boiler. Look for corrosion holes. Failure to clean chimney or replace corroded pipe or tile lining will cause severe injury or death.

4. Vent pipe to chimney must not be smaller than outlet on draft diverter or vent damper. Arrange venting system so boiler is served by vent damper device.

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

- a. Total vent height (H) is at least 10 ft;
- b. Vent not reduced more than one table size;  
and

- c. Draft diverter outlet/vent damper is greater than 4 in. in diameter.

5. Vent pipe should have greatest possible initial rise above draft diverter consistent with head room available and required clearance from adjacent combustible building structure. Vent pipe should be installed above bottom of chimney to prevent blockage.
6. Slope vent pipe upward from draft diverter to vent terminal not less than 1/4" per foot.
7. Support horizontal portions of venting system to prevent sagging. Use pipe straps, brackets or hangers spaced 4 ft. or less.
8. Vent pipe must be inserted into but not beyond inside wall of chimney liner. Seal tight between vent pipe and chimney.

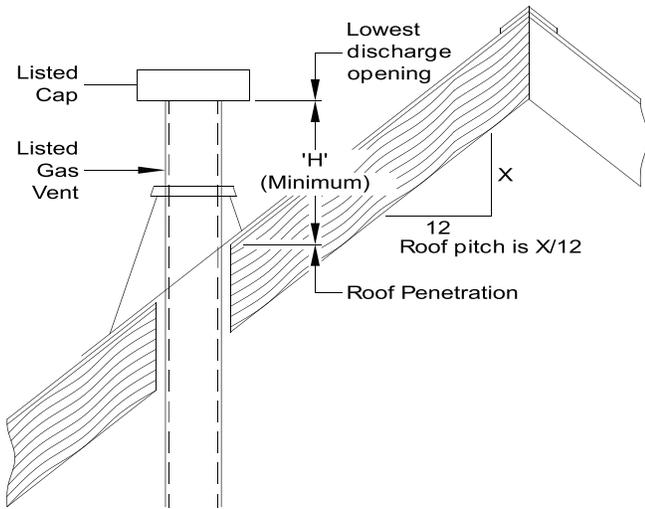
### F. Install vent termination (Masonry chimney and single wall metal pipe)

1. Termination shall extend at least 5 ft. in vertical height above highest connected appliance vent outlet.
2. Termination shall extend at least 3 ft. (2 ft. for single wall metal pipe) above roof penetration and at least 2 ft. above any portion of building within horizontal distance of 10 ft.

### G. Install vent termination: (Gas Vent)

1. Termination shall extend at least 5 ft. in vertical height above highest connected appliance vent outlet.
2. For terminations located at least 8 ft. from vertical wall or similar obstruction, termination shall extend above roof in accordance with Figure 5-3.
3. For terminations located less than 8 ft. from vertical wall or similar obstruction, termination shall extend at least 2 ft. above roof penetration and at least 2 ft. above any portion of building within horizontal distance of 10 ft.
4. Termination shall be at least 3 ft. above forced air inlet located within 10 ft.

# 5 Venting *(continued)*



**Figure 5-3 : Termination Location for Gas Vent**

Roof Slope Heights	
Roof Slope	ft.
Flat to 6/12	1.0
Over 6/12 to 7/12	1.25
Over 7/12 to 8/12	1.5
Over 8/12 to 9/12	2.0
Over 9/12 to 10/12	2.5
Over 10/12 to 11/12	3.25
Over 11/12 to 12/12	4.0
Over 12/12 to 14/12	5.0
Over 14/12 to 16/12	6.0
Over 16/12 to 18/12	7.0
Over 18/12 to 20/12	7.5
Over 20/12 to 21/12	8.0

## 6 Water Piping

### ⚠ WARNING

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

- A. Design and install boiler and system piping to prevent oxygen contamination of boiler water. Oxygen contamination sources are system leaks requiring addition of makeup water, fittings, and oxygen permeable materials in distribution system. Eliminate oxygen contamination by repairing system leaks, repairing fittings, and using non-permeable materials in distribution system.
- B. Install circulator with flanges, gaskets and bolts provided.
- C. Install safety relief valve. See Figure 6-1 and 6-2. Safety relief valve must be installed with spindle in vertical position.

### ⚠ WARNING

Safety relief valve discharge piping must be piped near floor to eliminate potential of severe burns. Do not pipe in any shut-off valves between:

1. Safety relief valve and boiler
2. Safety relief valve and discharge

Union may be installed in safety relief valve piping.

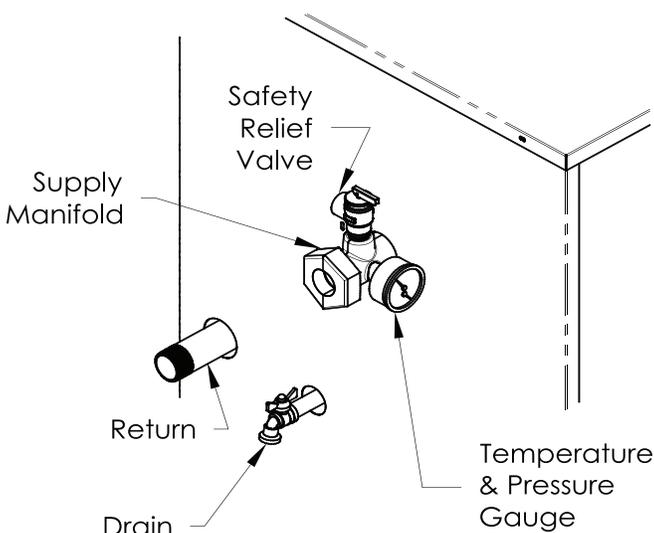


Figure 6-1: Standard Near Boiler Piping

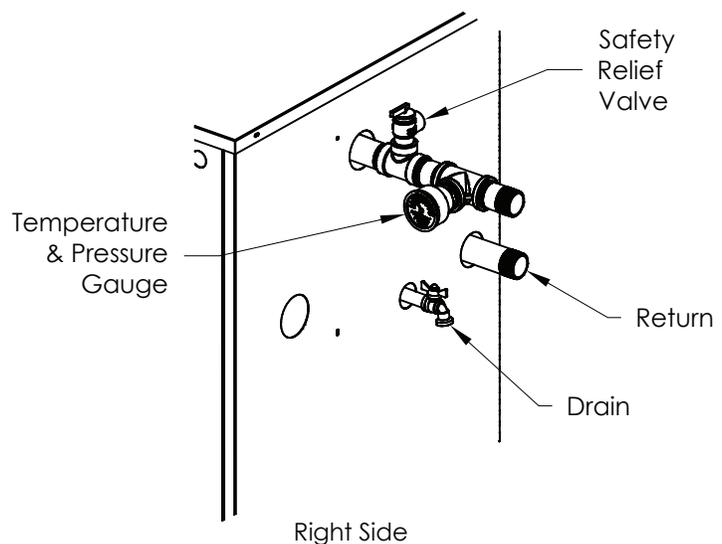


Figure 6-2: Alternate Near Boiler Piping

- D. Connect system supply and return piping to boiler. Refer to Figures 6-3 and 6-4. Also consult Residential Hydronic Heating Installation and Design I=B=R Guide. Maintain minimum ½ inch clearance from hot water piping to combustible materials.
- E. If necessary, supply and return may be connected to right side of boiler by removing 1-1/4" plugs from right side of block (under knockouts in jacket).
  - NOTICE:** Both supply and return connections must be made on same side of boiler.
- F. If boiler is used in connection with refrigeration system, See Appendix: "Combination Refrigeration/Heating System".
- G. Use a system bypass if 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.). (See Appendix "Low Return Water Temperatures").
- H. Perform a long term pressure test of hydronic system, isolate boiler to avoid a pressure loss due to escape of air trapped in 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.

# 6 Water Piping (continued)

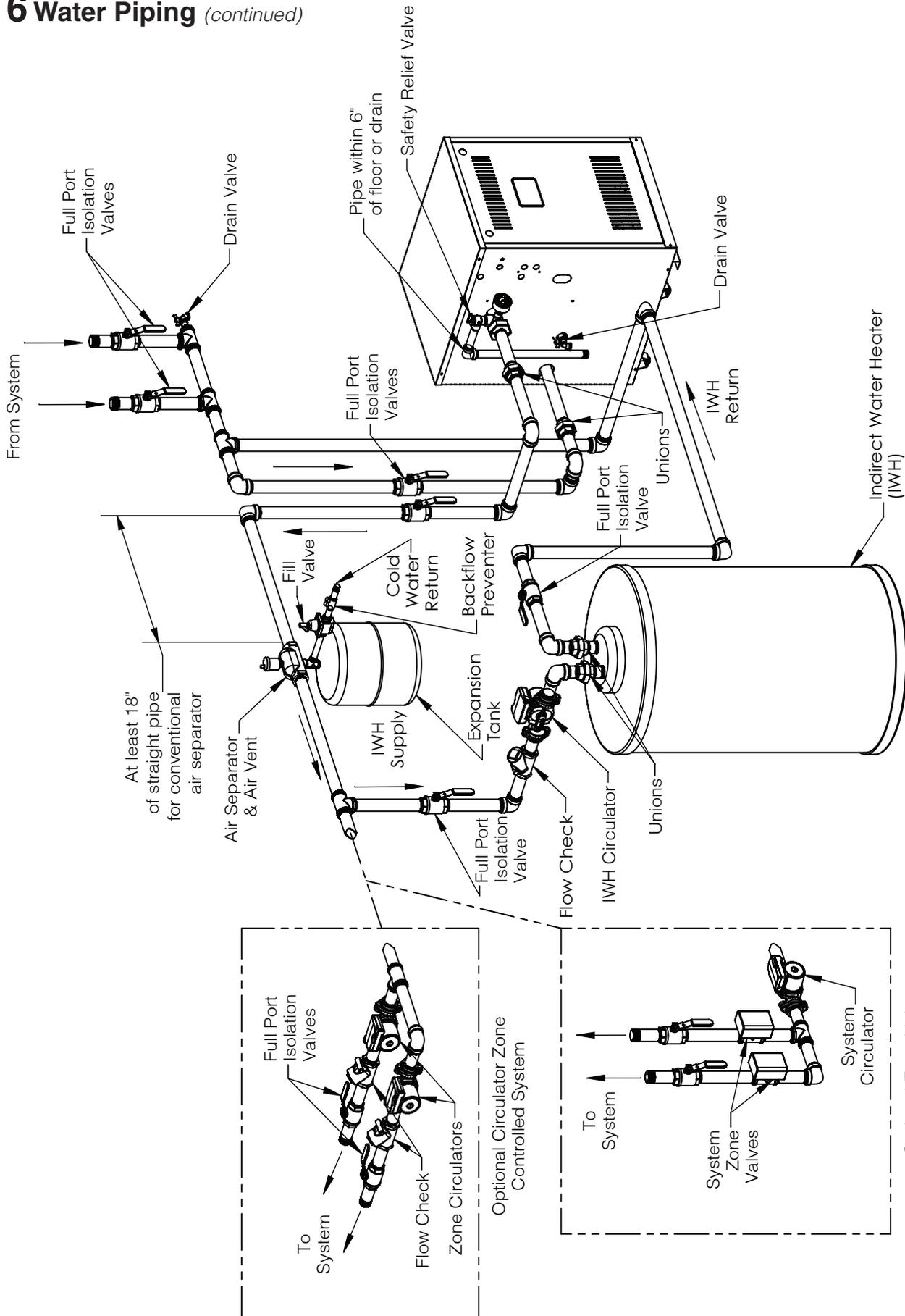


Figure 6-3: Recommended Water Piping Direct Connection System (left side)

# 6 Water Piping (continued)

- A. At least eight pipe diameters upstream of boiler return tee.
- B. No further apart than 12" (~30cm) or four pipe diameters, whichever is smaller.
- C. At least 18" (~46cm) of straight pipe for Conventional Air Scoop.

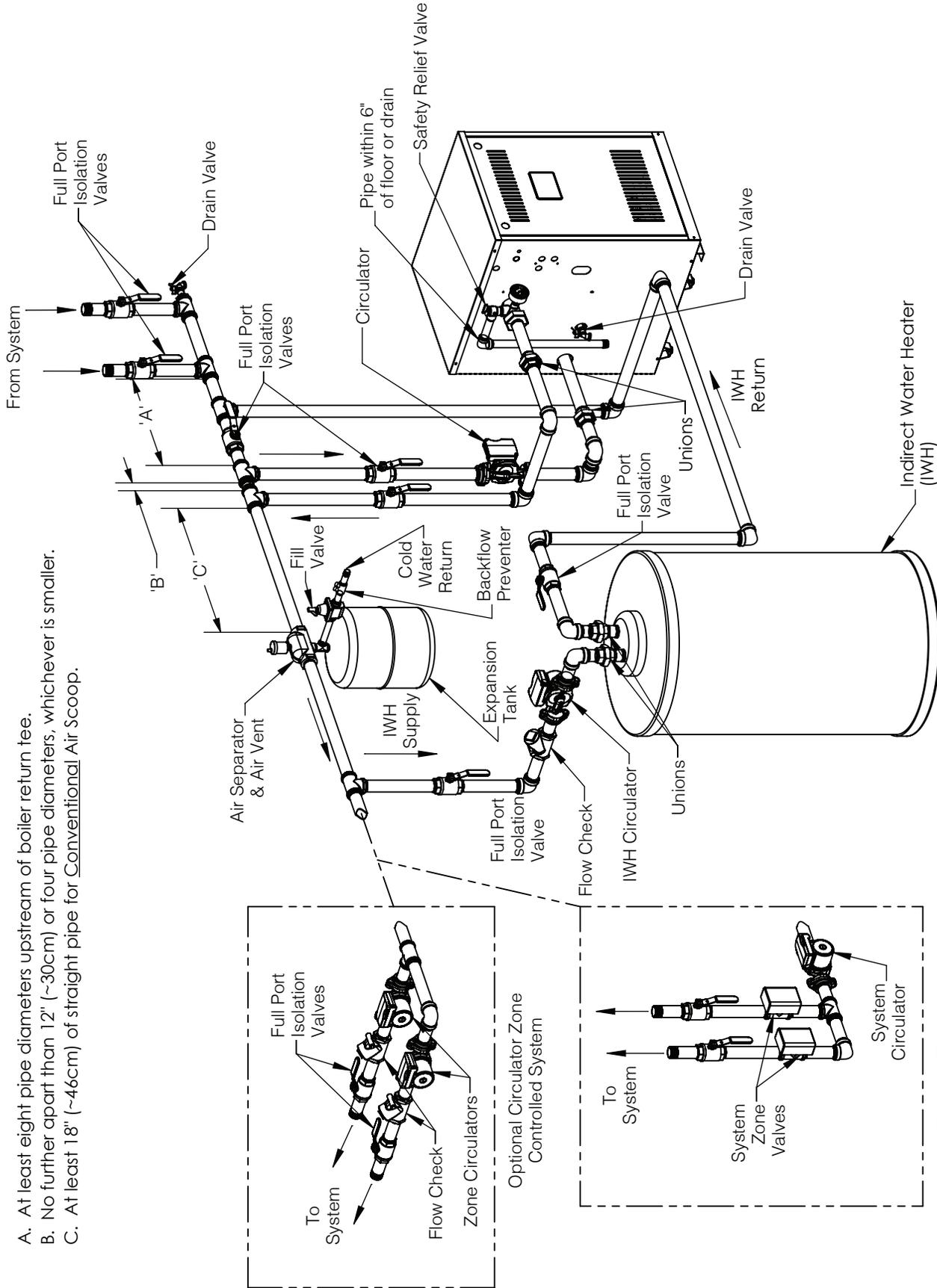


Figure 6-4: Recommended Piping for Primary/Secondary System (left side)

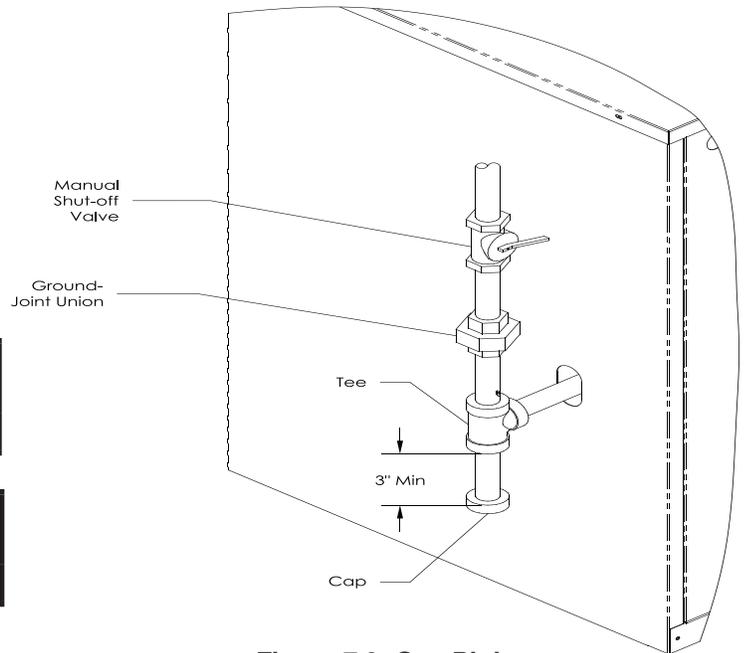
# 7 Gas Piping

- A. Size gas piping. Design system to provide adequate gas supply to boiler. Consider these factors:
  1. Allowable pressure drop from point of delivery to boiler. Maximum allowable system pressure is ½ psig. Minimum gas valve inlet pressure is listed on rating label. See Table 7-1.

**Table 7-1: Gas Pressure**

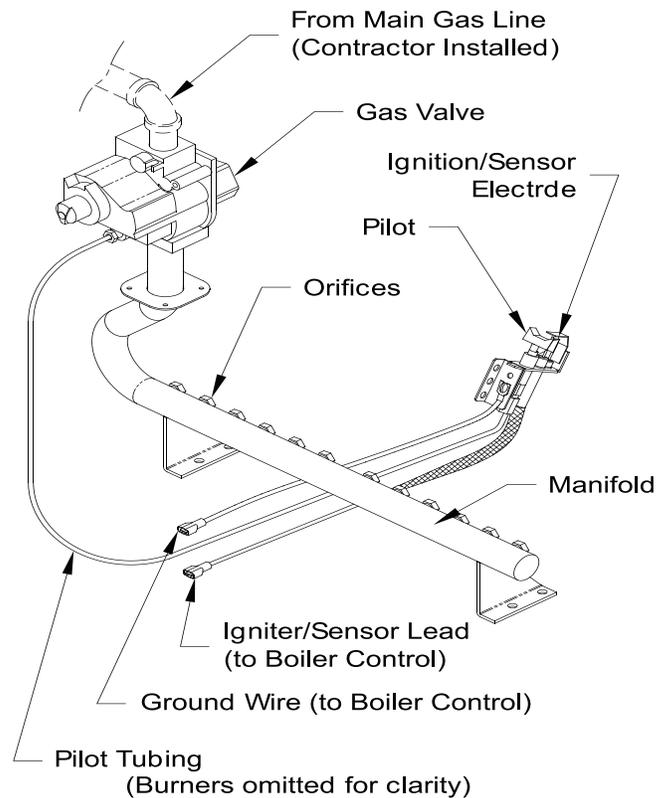
Natural Gas	Inlet Min (in. wc.)	Inlet Max (in. wc.)	Manifold (in. wc.)
All Sizes	4.5	14.0	3.5

LP	Inlet Min (in. wc.)	Inlet Max (in. wc.)	Manifold (in. wc.)
All Sizes	11.0	14.0	10.0



**Figure 7-2: Gas Piping**

2. Maximum gas demand. Consider existing and expected future gas utilization equipment (i.e. water heater, cooking equipment).
- B. Connect boiler to gas supply system.
    1. Use methods and materials in accordance with local plumbing codes and requirements of gas supplier. In absence of such requirements, follow *National Fuel Gas Code, ANSI Z223.1/ NFPA 54*.
    2. Use thread compounds (pipe dope) resistant to action of liquefied petroleum gas.
    3. Install sediment trap, ground-joint union and manual shut-off valve upstream of boiler gas control valve. See Figure 7-2 (within 6 ft. of boiler).
    4. All above ground gas piping upstream from manual shut-off valve must be electrically continuous and bonded to a grounding electrode. Do not use gas piping as grounding electrode. Refer to *National Electrical Code, ANSI/NFPA 70*.
  - C. Pressure test. Boiler and its gas connection must be leak tested before placing boiler in operation. See Startup and Checkout Section E and H "Gas Leak Test" for guidance.



**Figure 7-3: Gas Manifold and Control Assembly**

## 8 Electrical

### WARNING

Electrical Shock Hazard. Wiring errors can cause improper or dangerous operation. Verify proper operation after installation.

- A. Install wiring so boiler is electrically bonded to ground in accordance with requirements of authority having jurisdiction, or in absence of such requirements, with the *National Electrical Code*, ANSI/NFPA 70.
- B. Install thermostat. Locate on inside wall approximately 4 feet above floor. Do not install on outside wall, near fireplace, or where influenced by drafts or restricted air flow, hot or cold water pipes, lighting fixtures, television, or sunlight. Allow free air movement by avoiding placement of furniture near thermostat.

- C. Wire boiler. Boiler is rated for 120 VAC, 60 HZ, less than 12 A. 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. Connect to L1, L2, and green ground wires. See Figures 8-1 and 8-2.
- D. For installations using zone valves provide separate transformer for zone valve wiring. Consult zone valve manufacturer for assistance.

### CAUTION

This boiler contains controls which may cause the boiler to shut down and not restart 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.



8 Electrical (continued)

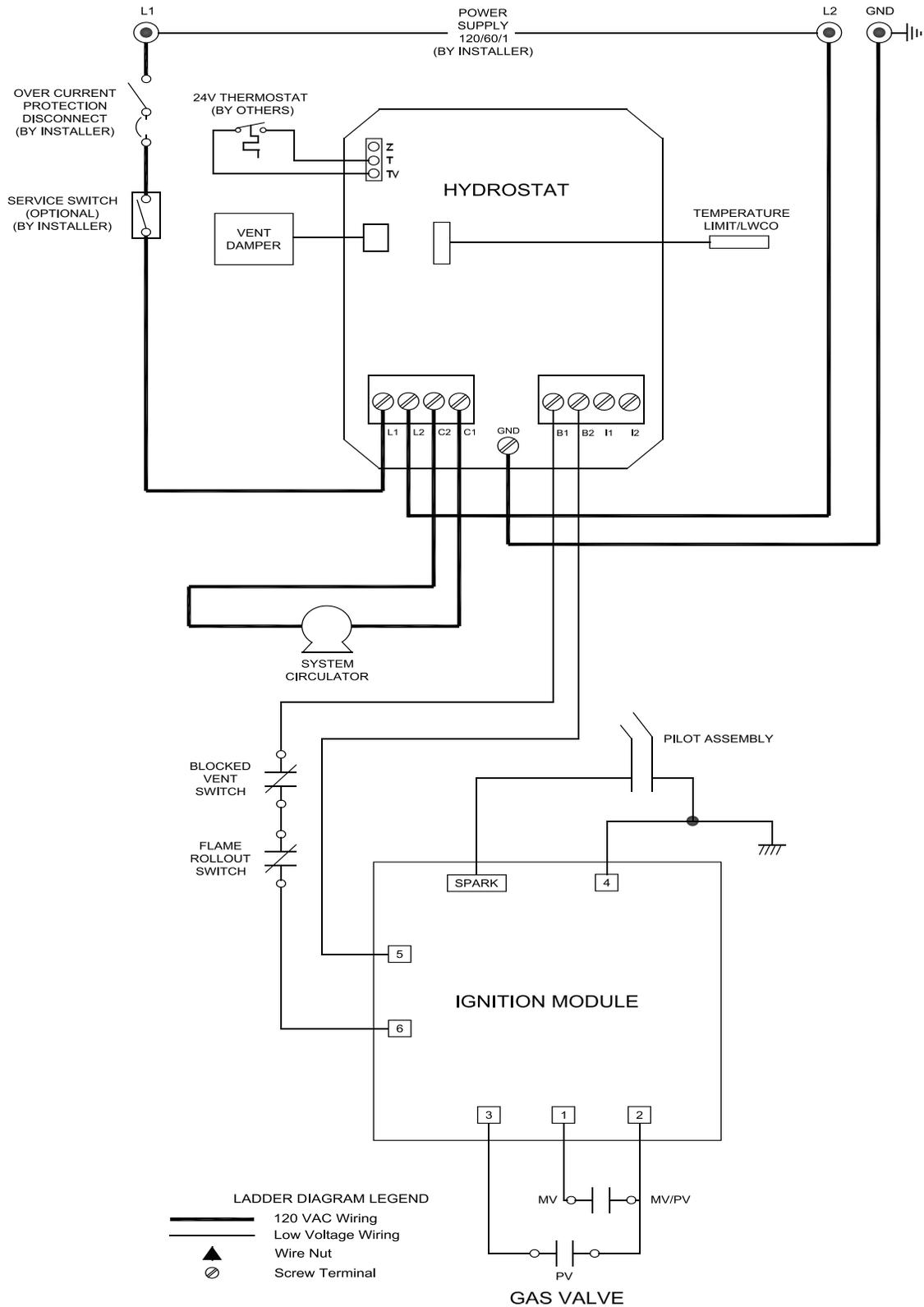


Figure 8-2: Schematic Ladder Diagram

## 9 System Start-Up and Checkout

### A. Visual Main Burner Check

Inspect burners for dislodgement during shipment. Rear of burners should be in vertical slots in rear of burner tray and front of burners should be seated completely on orifices.

### B. Initial LWCO Test

Before filling boiler with water, turn on power to boiler and set thermostat to call for heat. Both the green "ACTIVE LED" and amber "LOW WATER" LED should illuminate. Burner should not fire.

### WARNING

If the burner fires with no water at probe, immediately shut down power to boiler and contact customer service for assistance.

### C. Fill boiler with water

1. Proceed to fill boiler with water. When water reaches temp/LWCO sensor "LOW WATER" LED will turn off and burner will fire.
2. Turn off power to boiler and finish filling system.

### D. Purge air from system

1. Fill entire heating system with water and vent air from boiler, radiators and system, one zone at a time.
2. Isolate boiler by closing isolation valves.
3. Isolate all circuits by closing zone valves or turning off zone circulators.

4. Attach hose to drain valve located on return piping (see Figure 6-3 and 6-4). Note-Terminate hose in five gallon bucket, at a suitable floor drain, or outdoor area).
  5. Starting with one circuit, open zone valve or start circulator.
  6. Open drain valve.
  7. Open fill valve.
  8. Allow water to flow through system until discharge from hose is bubble free for 30 seconds.
  9. Open zone valve or start circulator to second zone to be purged, then close first. Repeat this step until all zones have been purged, but always have one zone open. At completion, open all zone valves.
  10. Close hose bib, open boiler isolation valve, continue filling system until 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).
  11. Remove hose from drain valve.
- ### E. Perform gas leak test upstream of boiler shutoff valve.
1. Protect boiler gas valve.
    - a. For all testing over ½ psig, boiler and manual shutoff valve must be disconnected from gas supply piping.
    - b. For testing at ½ psig or less, isolate boiler from gas supply piping by closing boiler manual shutoff valve.
  2. Locate leaks using listed combustible gas detector, a noncorrosive leak detection fluid or other listed leak detection method.
  3. Tighten appropriate pipe connections.

### DANGER

Do not use matches, candles, open flames, or other ignition sources.

## 9 System Start-Up and Checkout *(continued)*

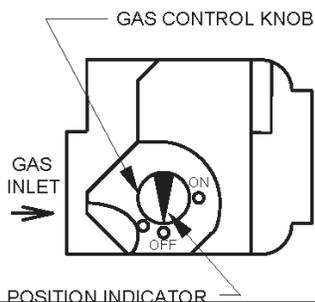
### FOR YOUR SAFETY READ BEFORE OPERATING

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

- A. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
- B. **BEFORE OPERATING** smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
- WHAT TO DO IF YOU SMELL GAS**
- Do not try to light any appliance.
  - Do not touch any electric switch; do not use any phone in your building.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.
- If you cannot reach your gas supplier, call the fire department.

### OPERATING INSTRUCTIONS

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



### TO TURN OFF GAS TO APPLIANCE

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

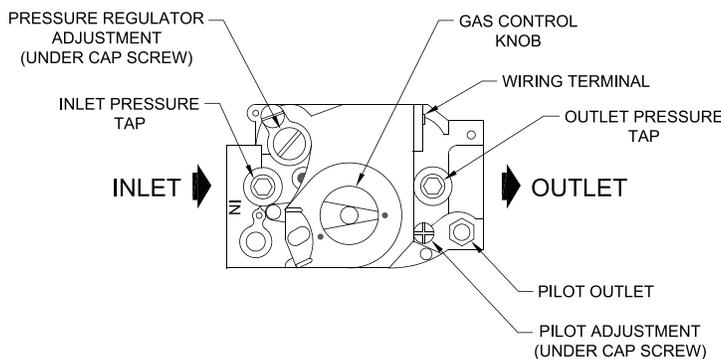
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Figure 9-1: Operating Instructions

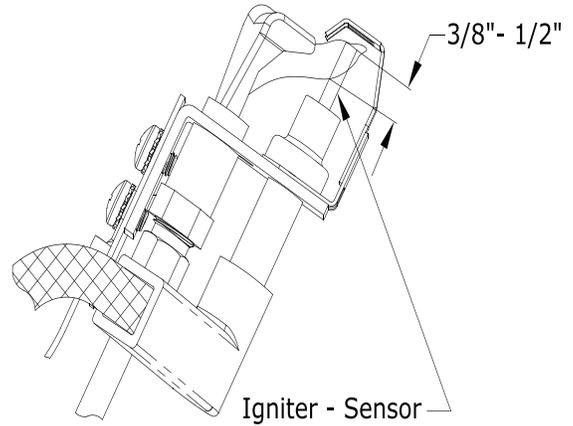
## 9 System Start-Up and Checkout *(continued)*

- F. Perform limit check
  1. Ensure gas to boiler is off
  2. Set ROOM THERMOSTAT to lowest setting.
  3. If limits are functioning properly (LWCO, flame rollout switch, blocked vent switch, damper), boiler should spark. If boiler does not spark, see Section 14 "Troubleshooting" for guidance.
  4. Turn "OFF" the electric switch to boiler.
- G. Start boiler according to "Operating Instructions" in Figure 9-1.
- H. Perform gas leak test downstream of boiler manual shutoff valve.
  1. Open manual shutoff valve.
  2. PURGE AIR FROM GAS PIPING by loosening (or removing) "Inlet Pressure Tap" plug on gas valve (See Figure 9-2). Tighten (or replace) plug when you start to smell gas. Adequate ventilation must be provided and no smoking or open flame permitted.
  3. Locate and address leaks using listed combustible gas detector, a non corrosive leak detection fluid or other listed leak detection method.
    - a. Check pipe fittings up to inlet of gas valve
    - b. Check piping between gas valve and orifices (after boiler is operating).
    - c. Check piping between gas valve and pilot (after boiler is operating).
  4. Tighten appropriate pipe connections.
- I. Check pilot burner flame.

**Natural Gas Only.** Pilot produces single flame. Flame should be steady medium hard blue enveloping 3/8 to 1/2 inch of igniter-sensor tip. See Figure 9-3.

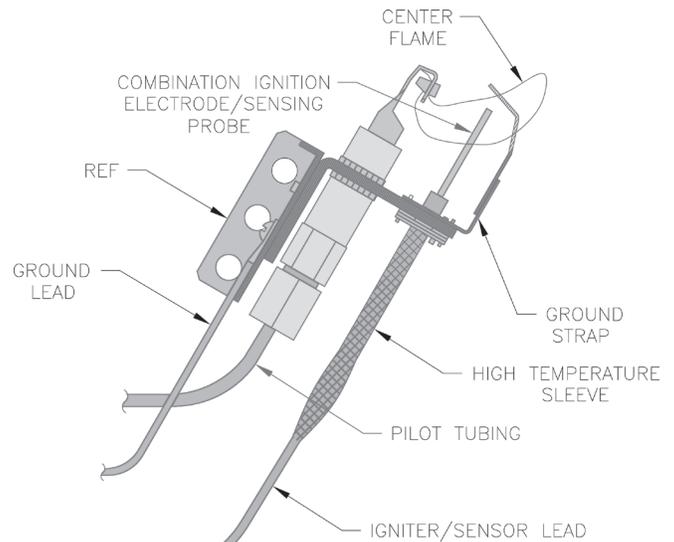


**Figure 9-2: Top View of Gas Valves**



**Figure 9-3: Pilot Burner Flame (NG Only)**

**LP Gas Only.** Pilot burner produces three (3) flames. The center flame should be steady, medium hard blue enveloping 3/8 to 1/2 inch of sending probe. See Figure 9-4.

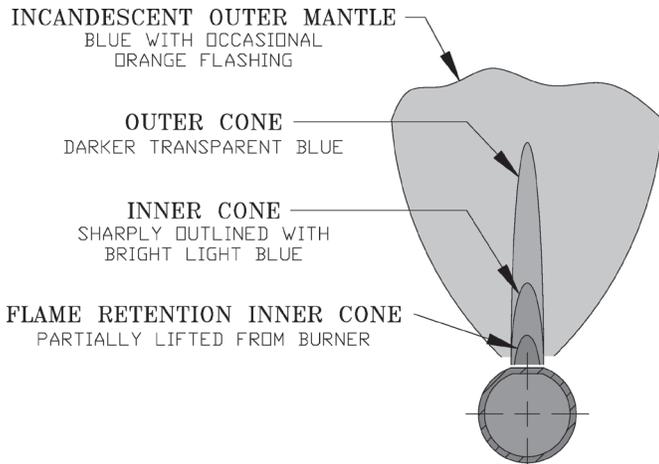


**Figure 9-4: Pilot Burner Flame (LP Only)**

## 9 System Start-Up and Checkout *(continued)*

- J. Check Main Burner Flame (see Figure 9-5)
1. NORMAL FLAME:
    - a. Clearly defined inner cone with no yellow tipping.
    - b. Orange-yellow streaks caused by dust should not be confused with true yellow tipping.
  2. ABNORMAL FLAME (if found, check inlet and outlet gas pressure. Procedure found in following steps):
    - a. Overfired - large flame
    - b. Underfired - small flames
    - c. Lack of primary air - yellow tipping on flames.

- L. Check gas outlet (manifold) pressure
  1. Install manometer on 1/8" outlet pressure tap on gas valve (see Figure 9-2). Use of shutoff valve between manometer and gas valve can prevent pressure surge that blows out manometer fluid.
  2. Adjust regulator on gas valve so manifold pressure matches values listed on rating label.
  3. Turning regulator adjustment screw clockwise (↻) increases pressure.
  4. Turning regulator adjustment screw counterclockwise (↺) decreases pressure.
- M. Check gas input rate to boiler
  1. When checking rate, ensure all other appliances connected to same meter as boiler are off.
  2. Input ratings shown on boiler rating label can be used for elevations up to 2,000 ft. For elevations 2,000 ft. or higher, reduce input rate to 4 percent per 1,000 ft. above sea level. Do not install at elevations above 12,000 ft. See Table below.



**Figure 9-5: Main Burner Flame**

**⚠ CAUTION**

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

- K. Check gas Inlet pressure
1. While boiler and all other gas appliances are not firing, gas inlet pressure should not exceed 1/2 psig.
  2. While boiler and all other gas appliances are firing, gas inlet pressure must be between minimum and maximum shown on rating label.

- N. Measure carbon monoxide (CO) level in vent after 5 minutes of main burner operation. CO should not exceed 400ppm air free.
- O. Check vent damper operation.  
Vent damper must be in open position when

Boiler Mode	Rating Label	Input (MBH)		
		5,000 ft.	7,000 ft.	10,000 ft.
FORCE02E	38	30.5	27.5	23.0
FORCE03E	68	54.5	49.0	41.0
FORCE04E	102	81.5	73.5	61.0
FORCE05E	136	109	98.0	81.5
FORCE06E	170	136	122.5	102.0
FORCE07E	204	163	147.0	122.5
FORCE08E	238	190.5	171.5	143.0
FORCE09E	272	217.5	196.0	163.0

## 9 System Start-Up and Checkout *(continued)*

appliance main burners are operating.

- P. Check ignition system safety shut-off device.  
After control has finished sparking, remove ignitor/ flame sense wire from control. Burners will shut down.
- Q. Test LWCO functionality  
Press "TEST"/SETTINGS button on Hydrostat 3200. Boiler should shut down.
- Set thermostat to call for heat and push "TEST"/SETTINGS button on Hydrostat 3200 to simulate low water condition.
  - Red "LOW WATER" LED will illuminate and burner will shut down.
  - Release "TEST"/SETTINGS button and burner will light off.
- R. Check high limit control. Set thermostat to higher than normal setpoint. Allow boiler to run until high limit is achieved. (190°F default) Burners will shut down.
- S. Check thermostat operation. Raise and lower temperature setting to start and stop boiler operation. Adjust thermostat to normal setting.
- T. Review User's Information Manual and system operation with owner or operator.

# 10 Operation

## A. Temperature Limit/LWCO Control

Refer to HydroStat 3200 Installation Instructions and Operating Manual included with these instructions.

## B. Electronic Ignition Module

See Figure 10-1 for electronic ignition (EI). Electronic Ignition Modules with LED indicators. Table 10-2 cross-references ignition module terminal designations to ignition terminal numbers in wiring ladder diagrams. Table 10-4 provides green LED status codes and recommended service action where applicable. See Figure 10-1 for Location of LED. See Figure 14-1 for Troubleshooting Guide.

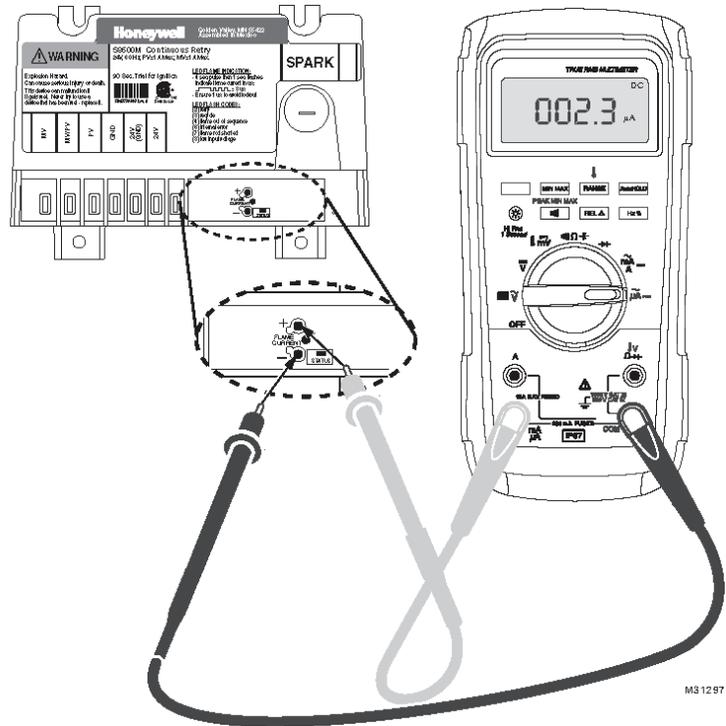


Figure 10-3: Measuring Pilot Flame Current with Micro-ammeter

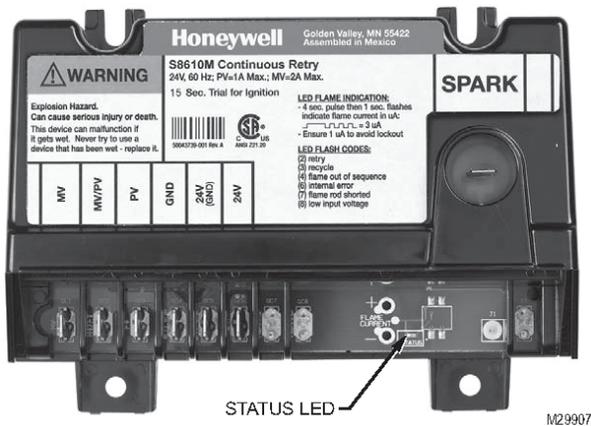


Figure 10-1: Location of LED

Table 10-2: Ignition Module Terminal Cross-Reference

Ignition Module Terminal Designation	Wiring Ladder Diagram Terminal Number
MV	1
MV/PV	2
PV	3
GND	4
24V (GND)	5
24V	6
SPARK	SPARK

### 1. Flame Current Measurement Procedure. See Figure 10-3 “Measuring pilot flame current with micro-ammeter”

- a. Pilot flame current in micro amps can be measured using any standard micro-ammeter by inserting meter probes into module holes labeled FLAME CURRENT as shown in Figure 10-3.

- b. Flame current **must be measured with pilot valve open/pilot lit but main valve closed.**
- c. Disconnect MV lead wire from module before measuring flame current. Trying to measure pilot flame current in series with the wiring will not yield accurate reading.
- d. **Minimum steady pilot flame signal must be 1 µAmp** (microampere) DC (direct current).
- e. **For reliable operation** flame current should be **2 µAmp or greater.**
- f. To ensure **adequate flame current:**
  - i. Turn off boiler power at circuit breaker or fuse box.
  - ii. Clean the flame rod with emery cloth if required.
  - iii. Make sure electrical connections are clean and tight, and wiring not damaged, repair/replace as needed.
  - iv. Check for igniter/sensor cracked ceramic insulator, replace if needed.

## 10 Operation *(continued)*

- v. Check pilot flame. It must be blue, steady and envelop flame sensing rod 3/8" to 1/2".
- vi. If needed, adjust pilot flame by turning the gas valve pilot adjustment screw clockwise to decrease or counterclockwise to increase pilot flame. Always reinstall pilot adjustment screw cover and tighten securely upon completion to assure proper gas valve operation.
- g. Reconnect MV lead wire to module upon satisfactory completion of pilot flame current measurement.
- h. Check pilot burner operation/ignition sequence during ignition cycle:
  - i. Restore boiler power at circuit breaker or fuse box.
  - ii. Set thermostat to call for heat.
  - iii. Watch ignition sequence at burner.
  - iv. If spark does not stop after pilot lights, replace ignition module.
  - v. If main burners do not light or if main burners light but system locks out, check the module ground wire and gas control as described in Figure 14-1 "Honeywell Electronic Ignition Troubleshooting Guide".

**Table 10-4: Green LED Flame Codes**

Green LED Flash Code <sup>a</sup>	Indicates	Next System Action	Recommended Service Action
OFF	No "Call for Heat"	N/A	None
Flash Fast	Power up - internal check	N/A	None
Heartbeat	Normal startup - ignition sequence started (including prepurge)	N/A	None
4 Seconds ON then "x" flashes	Device in run mode. "x" = flame current to the nearest $\mu$ A.	N/A	None
2	5 minute Retry Delay - Pilot flame not detected during trial for ignition	Initiate new trial for ignition after retry delay completed.	If system fails to light on next trial for ignition check gas supply, pilot burner, spark and flame sense wiring, flame rod contamination or out of position, burner ground connection.
3	Recycle - Flame failed during run	Initiate new trial for ignition. Flash code will remain through ignition trial until flame is proved.	If system fails to light on next trial for ignition, check gas supply, pilot burner, flame sense wiring, contamination of flame rod, burner ground connection.
4	Flame sensed out of sequence	If situation self corrects within 10 seconds, control returns to normal sequence. If flame out of sequence remains longer than 10 seconds, control will resume normal operation 1 hour after error is corrected.	Check for pilot flame. Replace gas valve if pilot flame present. If no pilot flame, cycle "Call for Heat." If error repeats, replace control.
6	Control Internal Error	Control remains in wait mode. When fault corrects, control resumes normal operation.	Cycle "Call for Heat". If error repeats, replace control.
7	Flame rod shorted to ground	Control remains in wait mode. When fault corrects, control resumes normal operation.	Check flame sense lead wire for damage or shorting. Check that flame rod is in proper position. Check flame rod ceramic for cracks, damage or tracking.
8	Low secondary voltage supply- (below 15.5 Vac)	Control remains in wait mode. When fault corrects, control resumes normal operation.	Check transformer and AC line for proper input voltage to control. Check with full system load on the transformer.

<sup>a</sup>Flash Code Descriptions:

- Flash Fast: rapid blinking
- Heartbeat: Constant 1/2 second bright, 1/2 second dim cycles.
- 4 second solid on pulse followed by "x" 1 second flashes indicates flame current to the nearest  $\mu$ A. This is only available in run mode.
- A single flash code number signifies that the LED flashes X times at 2Hz, remains off for two seconds, and then repeats the sequence.

# 11 Before Leaving Jobsite

Before Leaving Jobsite:

- Boiler and system filled with water
- Performed gas leak test
- Checked pilot burner flame
- Checked main burner flames
- Checked gas input rate
- Checked gas inlet pressure
- Checked gas manifold pressure
- Checked CO level in vent
- Checked vent damper operation
- Check ignition system safety shut-off device
- Tested LWCO functionality
- Tested high limit operation
- Tested additional field-installed controls for functionality outlined by manufacturer. (i.e. additional LWCO, additional high limit, or other controls if used)
- Button on blocked vent switch pushed in
- Reviewed User's Information Manual and system operation with owner or operator

## 12 Service and Maintenance

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

#### WARNING

**Some boiler components use materials that contain refractory ceramic fibers (RCF). RCF has been classified as a possible human carcinogen. When exposed to elevated temperatures, RCF may change 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 RCF particulates and dust.**

#### Precautionary Measures:

- Do not handle RCF parts or attempt any service or repair work involving RCF without wearing the following protective gear:
  1. A properly fitting National Institute for Occupational Safety and Health (NIOSH)-certified air-purifying respirator with a filter efficiency of at least 95%. Respirator should also include a full facepiece when handling used RCF. Other types of respirators may be required depending on site conditions. Current NIOSH recommendations may be found on the NIOSH website <http://www.cdc.gov/niosh/homepage.html>. NIOSH-approved manufacturers, respirators and associated user instructions are listed on the NIOSH website.
  2. Long sleeved, loose fitting clothing that is sufficiently tight around potential entry points for RCF dust.
  3. Gloves.
  4. Eye protection, such as goggles, safety glasses with side shields, or full facepiece.
- Take steps to assure adequate ventilation.
- Handle RCF carefully to minimize airborne dust. Use hand tools whenever possible.
- Dampen used RCF with light water spray prior to removal to prevent airborne dust.
- Do not use compressed air or dry sweeping for clean-up. Frequently clean work area with a vacuum or by wet sweeping to minimize debris accumulation.
- Vacuum work clothes before leaving work area. Wash work clothes separately from other laundry and rinse washing machine after use to avoid contaminating other clothes.
- Wash all exposed body areas gently with soap and water after contact.
- Discard used RCF components by sealing in an airtight plastic bag or container. Refer to local, regional, state or provincial regulations to identify applicable disposal requirements.

#### First Aid Procedures:

- Eye contact: Flush with water for at least 15 minutes. Do not rub eyes. Seek immediate medical attention if irritation persists.
- Skin contact: Wash affected area gently with soap and water. Do not rub or scratch affected skin. Seek immediate medical attention if irritation persists.
- Nose and throat contact: If these become irritated, leave the area and move to a location with clean fresh air. Drink water and blow nose. Seek immediate medical attention if symptoms persist.

## 12 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.

### DANGER

**Explosion Hazard. Electrical Shock Hazard. Burn Hazard.** This boiler uses flammable gas, high voltage electricity moving parts, and very hot water under high pressure. Assure that all gas and electric power supplies are turned off and that water temperature is cool before attempting any disassembly for service.

### CAUTION

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

#### Annual Inspection

- Vent system
- Boiler flue passages
- Burners
- Water piping
- Temperature/pressure gauge
- Relief valve operation
- Gas piping
- Air openings
- Pilot flame
- Main burner flame
- Gas inlet pressure
- Gas outlet pressure

#### Annual Test

- Gas input rate to boiler
- Measure CO in vent
- Vent damper operation
- LWCO
- High limit control
- Thermostat operation
- CO detector operation

- A. General. Inspection and service should be conducted annually. Turn off electrical power and gas supply while conducting service or maintenance. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 9-1.
- B. Inspect Vent System.
  1. Remove obstructions in vent pipe and chimney.
  2. If masonry chimney is lined, verify lining is in good condition and there are no openings into chimney.
  3. Remove soot accumulations with wire brush and vacuum.
  4. Repair or replace deteriorated vent pipe and vent accessories.
  5. Inspect piping to determine that it is adequately supported. Repair sags.
  6. Repair leaking joints.
- C. Inspect boiler flue passages for blockage or soot accumulation.
  1. Remove vent pipe, vent damper and blocked vent switch.
  2. Remove sheet metal screws securing Jacket Top Panel. Remove Top Panel.
  3. Remove screws securing Canopy to Section Assembly. Remove Canopy.
  4. Using flashlight, examine all flue passageways.
    - a. If passageways are free of soot and obstruction, replace canopy, secure and seal.
    - b. If passageways need cleaning, remove burners as described in Paragraph D. Using long handle wire or bristle flue brush and vacuum, brush flueways thoroughly from top of boiler.
  5. Install new gasket material (See Section 15: Service Parts). Install canopy.
  6. Install Jacket Top Panel, Blocked Vent Switch, Vent Damper, and vent pipe.

## 12 Service and Maintenance *(continued)*

- D. Clean Main Burners and Firebox.
1. To remove burners for cleaning, changing orifices, or repairs:
    - a. Remove Jacket Front Panel.
    - b. Disconnect pilot tubing at gas valve.
    - c. Disconnect 3-wire plug at the gas valve.
    - d. Remove wires to flame roll-out switch.
    - e. Disconnect ignitor sensor cable at boiler control.
    - 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.
    - h. Hold burner at throat. Lift front of burner to clear orifice. Pilot burner can only be removed by lifting the burner adjacent to its right first.
  2. Brush top of burners with a soft bristle brush. Vacuum burners.
  3. Check orifices. Drilled passageways must be free of lint or dirt.
  4. Vacuum tip of Pilot Burner.
  5. Clean firebox by vacuuming. Exercise care not to damage base insulation.
  6. Install burners by reversing procedure used to remove burners. Make sure burner with pilot assembly is in same location as original installation.
- E. Inspect Water Piping
1. Check all system piping for leaks.
  2. Repair any leaks before placing back into service.
- F. Inspect Temperature/Pressure Gauge
1. Water temperature needle should move with variation in water temperature.
  2. Pressure needle should move with variation in pressure.
  3. Replace gauge if needed.
- G. Operate Safety Relief Valve
1. When manually operating the relief valve, water will discharge. Take precautions to avoid contact with hot water and avoid water damage. Inspect relief valve and lift lever to verify flow.
  2. If relief valve leaks or will not seat properly, replace relief valve.
- H. Inspect Gas Piping
1. Sniff around boiler area for indication of gas leak.
  2. Locate leaks using approved gas detector, a non corrosive leak detector fluid or other approved leak detection methods.
  3. Repair any leaks before placing back into service and retest.
- I. Inspect Air Openings
1. Keep boiler area clear of combustible materials.
  2. Remove any obstructions in boiler room that will hinder flow of combustion and ventilation air and dilution air.
- J. Follow "Operating Instructions" outlined in Figure 9-1.
- K. Inspect Pilot Flame  
See "Start-up and Checkout - Check Pilot Burner Flame"
- L. Inspect Main Burner Flames  
See "Start-up and Checkout - Check Main Burner Flame"
- M. Check gas inlet pressure  
See "Start-up and Checkout - Check gas inlet pressure"
- N. Check gas outlet pressure  
See "Start-up and Checkout - Check gas outlet pressure"
- O. Check Gas Input Rate to Boiler  
See "Start-up and Checkout - Check Gas Input to Boiler"
- P. Measure CO in vent. See "Start-up and Checkout - Measure Carbon Monoxide Level".

### WARNING

Be careful handling pilot tubing. Do not crimp or crack gas pilot tube. Leaking pilot tubing could result in serious injury, or substantial property damage.

Check burners to see that they are located properly in slot at rear of burner tray. Reinstall burner access panel. Reconnect flame roll-out switch wires, pilot gas supply, or pilot lead.

7. Connect pilot gas supply, igniter/sensor wire, and ground wire at Boiler Control.
8. Install Burner Access Panel. Connect Flame Rollout Switch wires.

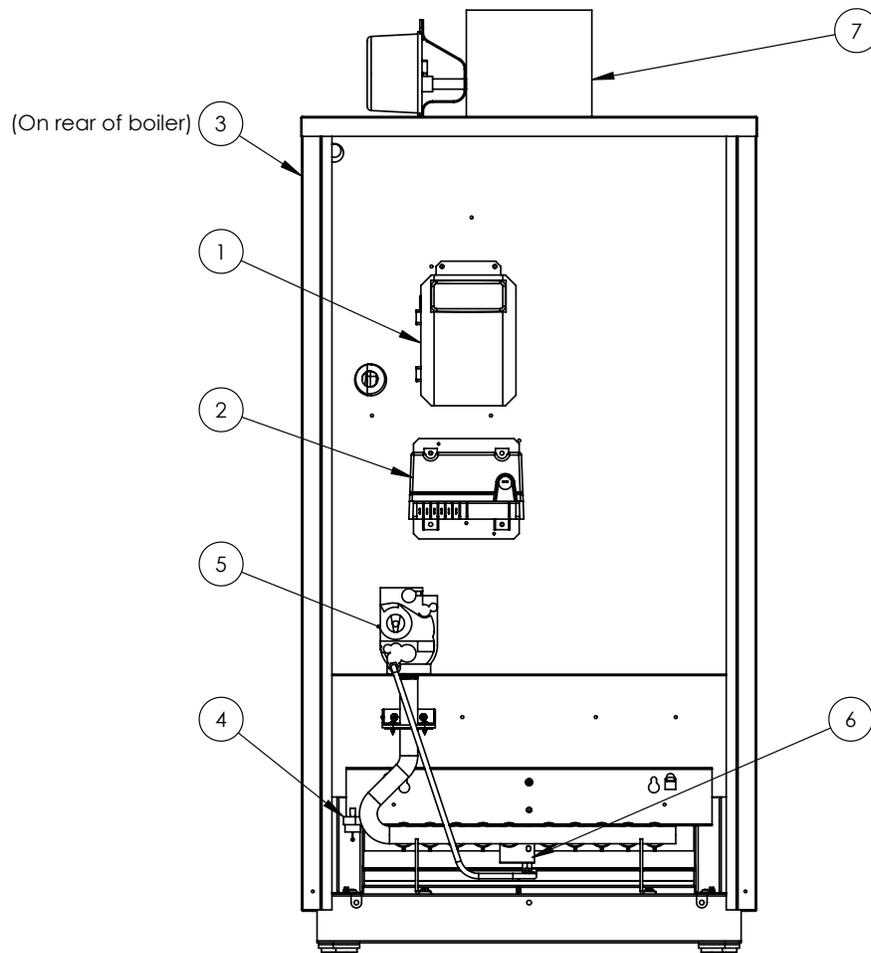
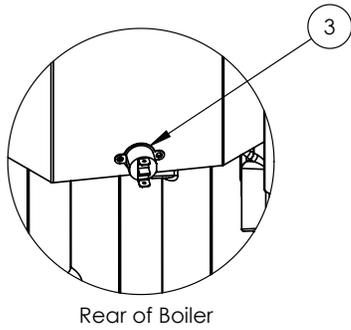
## 12 Service and Maintenance *(continued)*

- Q. Test Vent Damper Operation  
Vent damper must be in open position when main burners are operating.
- R. Test Functionality of LWCO  
See "Start-up and Checkout - Check LWCO Functionality."
- S. Check High Limit Control  
See "Start-up and Checkout - Check High Limit Control."
- T. Check Thermostat Operation  
See "Start-up and Checkout - Check Thermostat Operation"
- U. Check CO detector operation (if available).
- V. Lubrication. There are no parts requiring lubrication by service technician or owner. Circulator bearings are water lubricated.
- W. If remodeling has occurred, verify combustion air supply is adequate.

# 13 How It Works

1/2	Hydrostat 3200	FORCE E boilers are equipped with Hydrostat 3200 and Honeywell S8610M Ignition module. Hydrostat 3200 contains features such as high limit switch, LWCO and circulator relay. Energy is saved by using a thermal target feature which adjusts boiler target temperature depending on heat required.
		Honeywell S8610M provides ignition control.
		Dual sensor for boiler temperature control and protection against potentially damaging low water conditions in boiler. In event of low water condition, "LOW WATER" LED will turn on and control will shutdown burner. Can be configured for auto reset or manual reset LWCO.
		When thermostat calls for heat, Hydrostat 3200 starts system circulator, checks safety limits, and activates vent damper.
		When vent damper is opened completely, ignition module opens pilot valve and activates ignition spark.
	Honeywell S8610M Ignition Module	Ignition module will sense pilot flame. Once pilot flame is established, ignition module opens gas valve and main burners will ignite.
		When thermostat is satisfied, ignition module turns off gas valve, deactivates damper, and deactivates circulator.
		Hydrostat 3200 indicates boiler status. Indicator lights provide assistance with troubleshooting. See Hydrostat 3200 installation instructions and operating manual for more information.
Honeywell S8610M indicator lights provide assistance with troubleshooting. See Table 10-4 for more information.		
3	Draft Hood	Provides adequate dilution air and ensures proper draft for boiler operation.
	Blocked Vent Switch	If vent becomes blocked, switch will open (requiring manual reset) and cause burners to shut down.
4	Flame Roll-Out Switch	If flames roll out of burner tubes, switch will open (requiring replacement) and cause burners to shut down. If switch trips, determine cause of flame roll-out.
5	Gas Valve	Regulates gas flow to boiler.
6	Pilot	Provides ignition source for burner lighting.
7	Vent Damper	Closes during off cycles to reduce heat loss from house to vent.

# 13 How It Works *(continued)*



# 14 Troubleshooting

## A. Before Troubleshooting

When troubleshooting boiler, keep in mind:

1. Troubleshooting should be completed by a professional heating technician.
2. Before seeking technical assistance, the servicing technician should have an electrical meter and gas pressure gauge available for use.
3. Check electrical connections on boiler before proceeding (see Figure 8-1 and Figure 8-2).
4. Ensure 120VAC power polarity is correct, and boiler is properly grounded.
5. Controls are tested during manufacturing process. Defective control is least likely cause of failure.

## B. Temperature Limit/LWCO Control

Refer to the HydroStat 3200 Installation Instructions and Operating Manual included with these instructions.

## C. Electronic Ignition Module (see Figure 14-1)

# 14 Troubleshooting *(continued)*

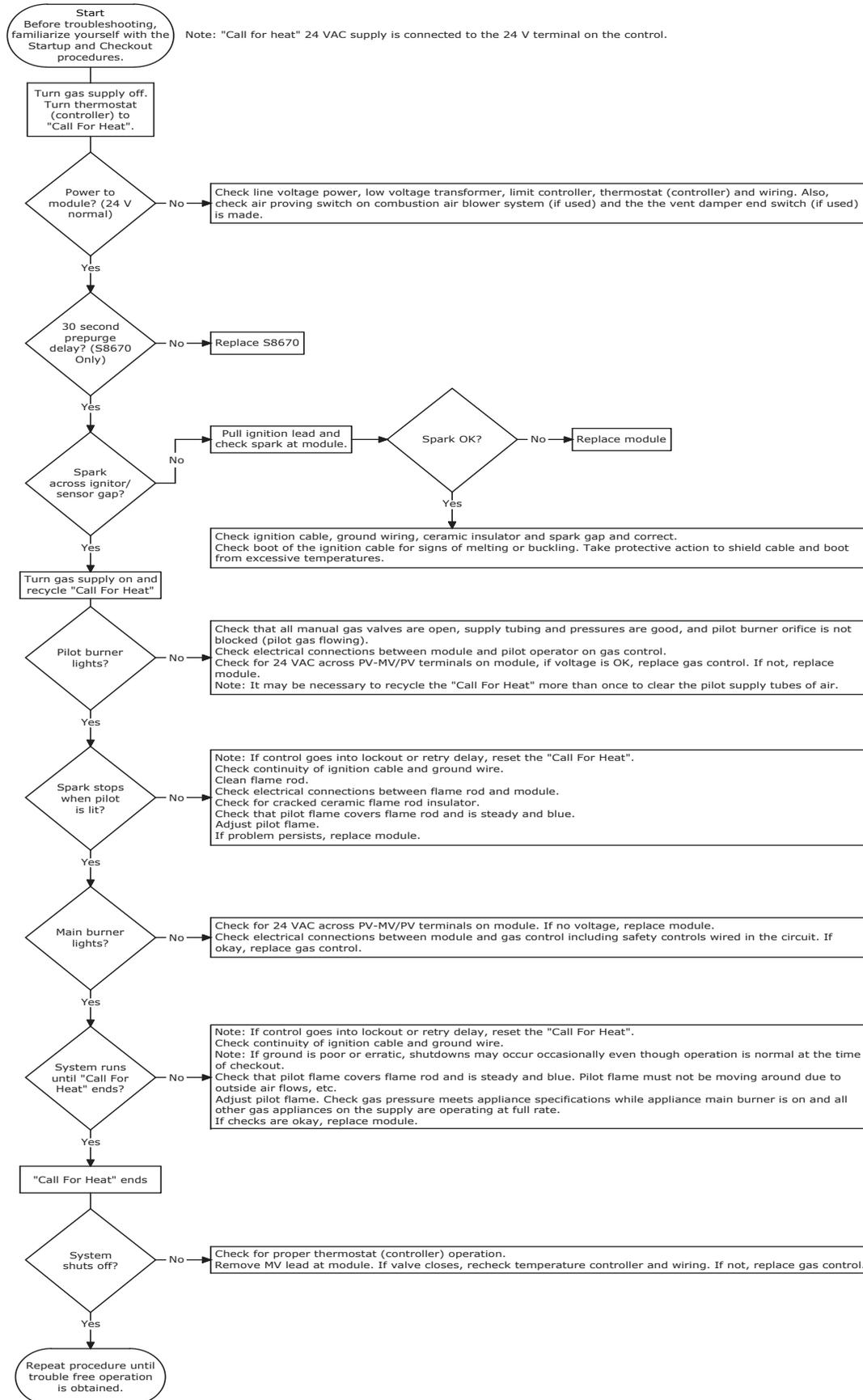
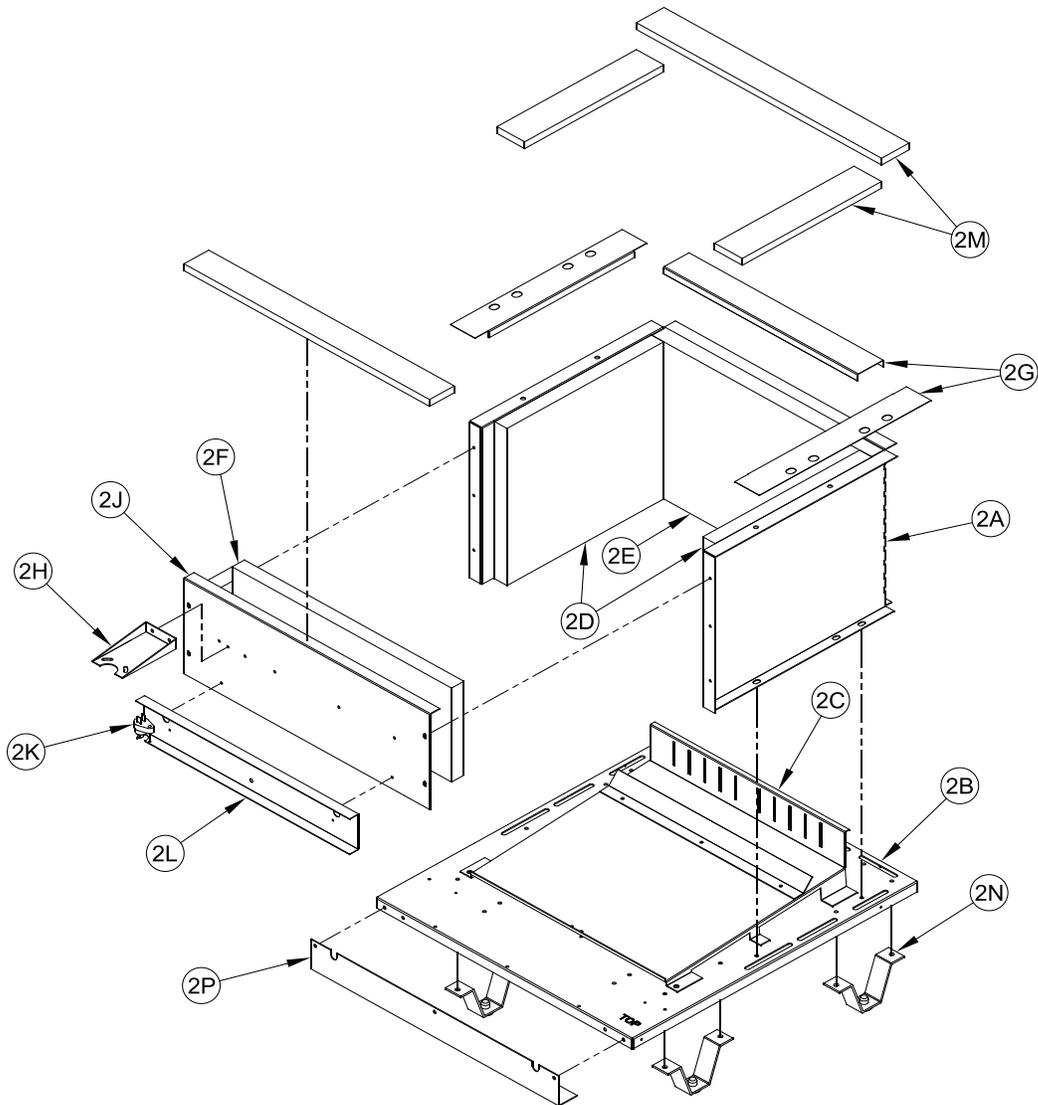


Figure 14-1: Troubleshooting Guide, Honeywell Electronic Ignition (EI)

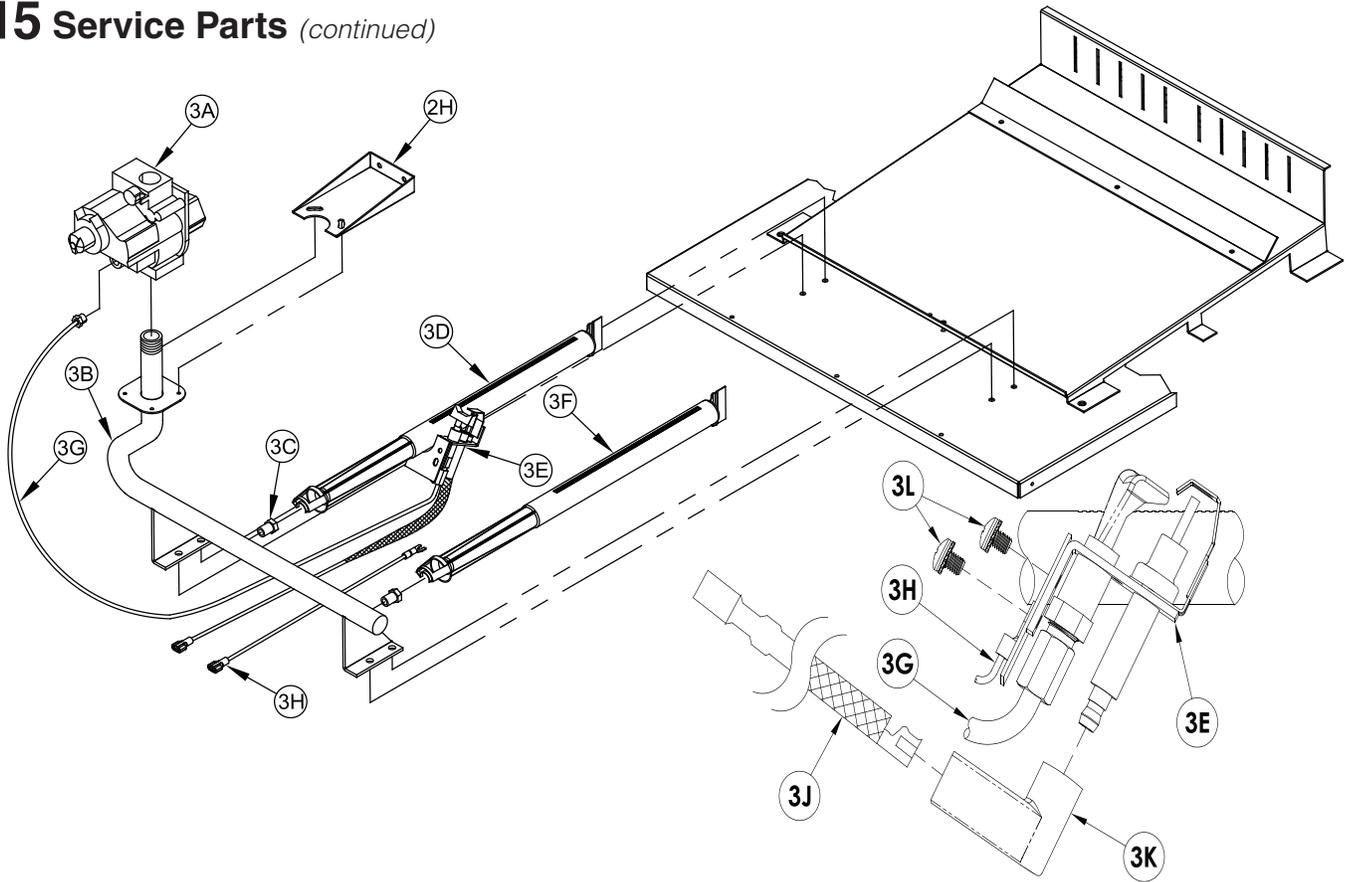


# 15 Service Parts *(continued)*



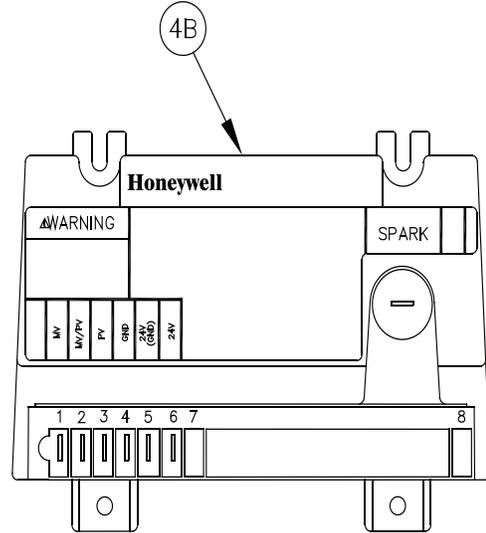
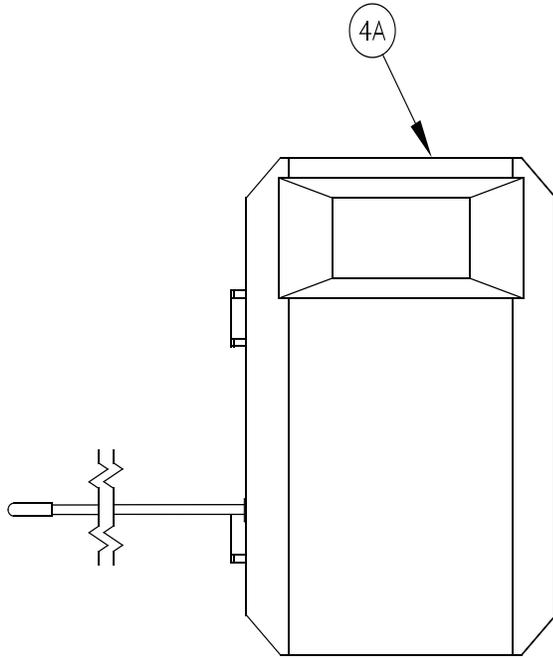
Key No.	Description	Part Number [Quantity]							
		FORCE02E	FORCE03E	FORCE04E	FORCE05E	FORCE06E	FORCE07E	FORCE08E	FORCE09E
2A	Base Wrapper								
2B	Base Tray								
2C	Burner Tray								
2D	Base Side Insulation								
2E	Base Rear Insulation								
2F	Base Front Insulation								
2G	Drip Shields	109941-02 [1]	109941-03 [1]	109941-04 [1]	109941-05 [1]	109941-06 [1]	109941-07 [1]	109941-08 [1]	109941-09 [1]
2H	Manifold Support Bracket								
2J	Base Front Panel								
2K	Flame Rollout Switch								
2L	Burner Access Panel								
2N	Base Ray Leg								
2P	Front Air Dam								
2M	Base Gasket	109940-0 1[1]							
2K	Flame Rollout Switch	109947-01 [1]							

# 15 Service Parts *(continued)*



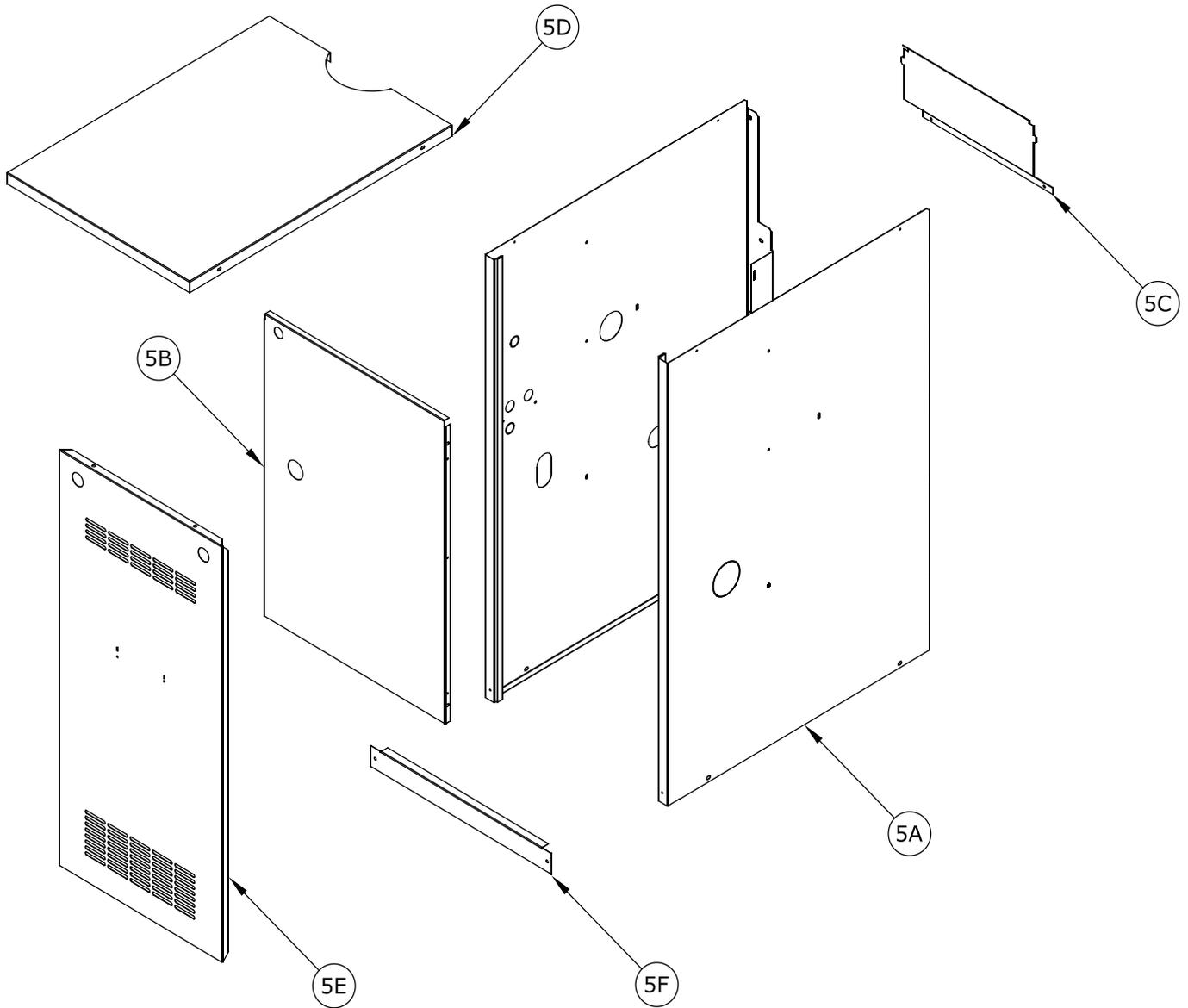
Key No.	Description	Part Number [Quantity]							
		FORCE02E	FORCE03E	FORCE04E	FORCE05E	FORCE06E	FORCE07E	FORCE08E	FORCE09E
3A	Gas Valve (Natural Gas), Honeywell VR8204C3007	109948-01 [1]					N/A		
	Gas Valve (Natural Gas), Honeywell VR8304P4496	N/A					109951-01 [1]		
	Gas Valve (LP Gas), Honeywell VR8204C3015	109949-01 [1]					N/A		
	Gas Valve (LP Gas), Honeywell VR8304P4314	N/A					109950-01 [1]		
3B	1/2" Gas Manifold	109958-02 [1]	109958-03 [1]	109958-04 [1]	109958-05 [1]	109958-06 [1]	N/A		
	3/4" Gas Manifold	N/A				109958-07 [1]	109958-08 [1]	109958-09 [1]	
3C	#47 Orifice [Natural Gas]	109959-01 [1] (16 orifices)							
	1.20 mm Orifice [LP Gas]	109954-01 [1] (16 orifices)							
3D	Pilot Burner	109961-01 [1]							
3E	Pilot Assembly - Natural Gas	109960-01 [1]							
	Pilot Assembly - LP Gas	109955-01 [1]							
3F	Main Burner	109956-01 [3 burners per kit]							
3G	1/4" Pilot Tubing	109962-01 [1]							
3H	Ground Wire Assembly	109963-01 [1]							
3J	Ignition Cable/Boot-Natural Gas only	Available with 3E							
3K	Ignition Cable Boot-Natural Gas only								
3L	Machine Screw, 10-32 x 1/4" with External Tooth Washer	Source Locally Natural Gas [2], LP Gas [1]							

# 15 Service Parts *(continued)*



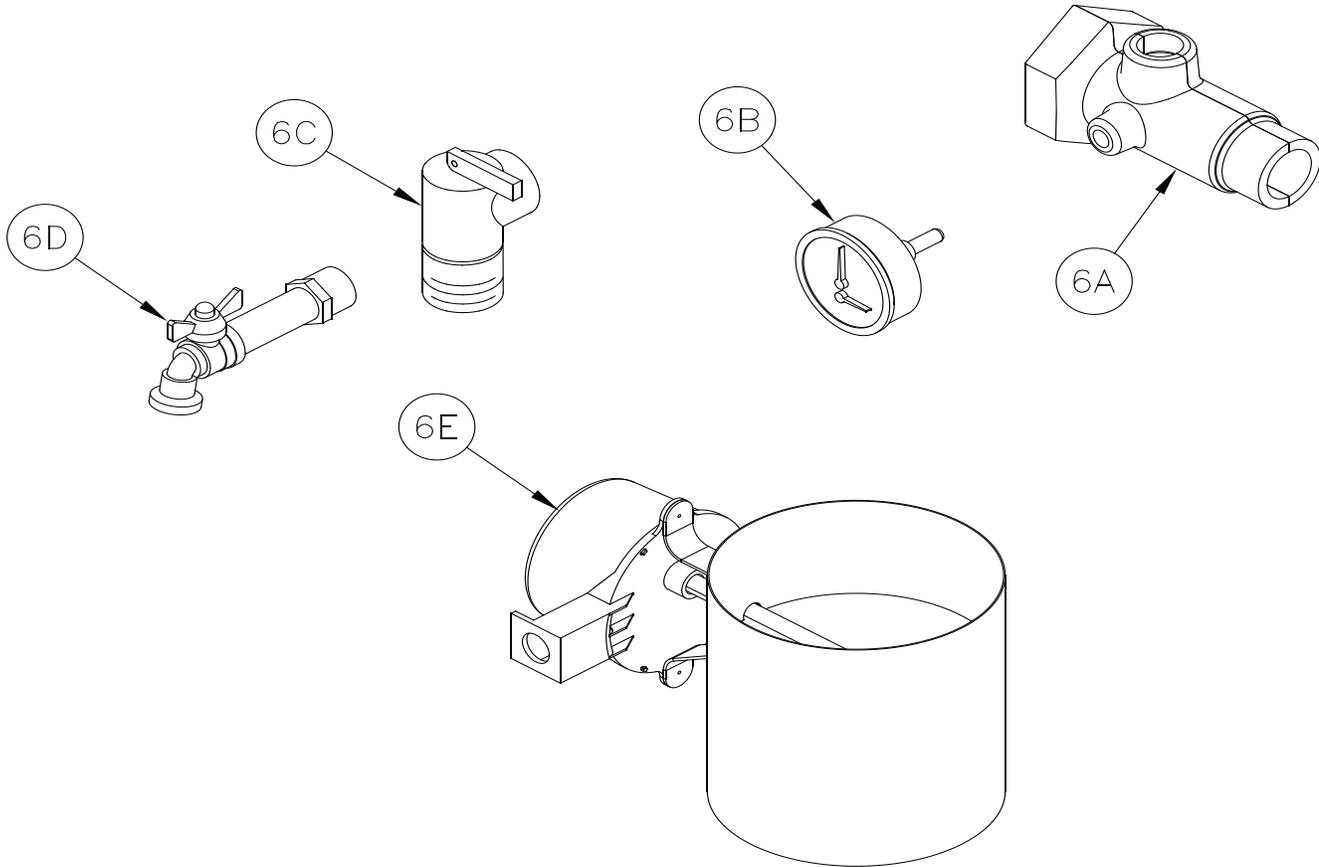
Key No.	Description	Part Number [Quantity]							
		FORCE02E	FORCE03E	FORCE04E	FORCE05E	FORCE06E	FORCE07E	FORCE08E	FORCE09E
4A	Hydrostat 3200 LWCO/High Limit	109952-01 [1]							
4B	Honeywell S8610M EI Module	109945-01 [1]							

# 15 Service Parts *(continued)*



Key No.	Description	Part Number [Quantity]							
		FORCE02E	FORCE03E	FORCE04E	FORCE05E	FORCE06E	FORCE07E	FORCE08E	FORCE09E
5A	Wrap-around Jacket Panel	Not available							
5B	Jacket Vestibule Panel								
5C	Rear Discharge Chute								
5D	Top Jacket Panel	109618-02 [1]	109618-03 [1]	109618-04 [1]	109618-05 [1]	109618-06 [1]	109618-07 [1]	109618-08 [1]	109618-09 [1]
5E	Front Door Jacket Panel								
5F	Tie Bar Jacket Panel								

# 15 Service Parts *(continued)*

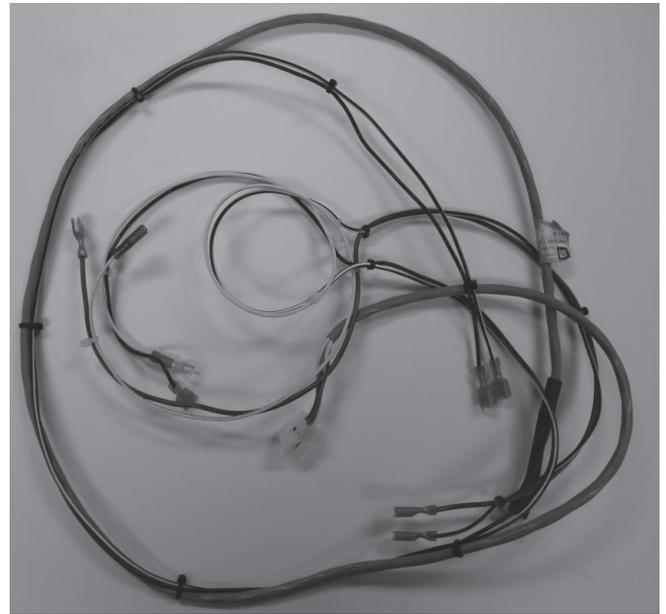


Key No.	Description	Part Number [Quantity]							
		FORCE02E	FORCE03E	FORCE04E	FORCE05E	FORCE06E	FORCE07E	FORCE08E	FORCE09E
6A	Water Manifold	109968-01 [1]							
6B	Temperature/Pressure Gauge	109966-01 [1]							
6C	30 PSI Safety Relief Valve	109964-01 [1]							
6D	Drain Valve	Source Locally (3/4" NPT boiler connection)							
6E	Vent Damper	109967-01 [1]	109967-02 [1]	109967-03 [1]	109967-04 [1]	109967-05 [1]			
Not Shown	Grundfos UPSIS-88 Circulator	Obtain Locally							

# 15 Service Parts *(continued)*



7A



7B



7C

Key No.	Description	Part Number [Quantity]							
		FORCE02E	FORCE03E	FORCE04E	FORCE05E	FORCE06E	FORCE07E	FORCE08E	FORCE09E
7A	Power Supply Harness	109963-01 [1]							
7B	Main Control Harness	109957-01 [1]							
7C	Ignition Harness	109953-01 [1]							

**Accessories:**

Key No.	Description	Part Number [Quantity]							
		FORCE02E	FORCE03E	FORCE04E	FORCE05E	FORCE06E	FORCE07E	FORCE08E	FORCE09E
Not Shown	Boiler Bypass Kit	107795-01 [1]							

## Appendix: Combination Refrigeration/ Heating System

- A. If boiler is used in connection with refrigeration systems, boiler must be installed with chilled medium piped in parallel with the heating boiler using appropriate valves to prevent chilled medium from entering boiler. See Figure A-1. Also consult Residential Hydronic Heating Installation and Design I=B=R Guide.
- B. If boiler is connected to heating coils located in air handling units where they may be exposed to refrigerated air, boiler piping must be equipped with flow control valves or other automatic means to prevent gravity circulation of boiler water during operation of cooling system.

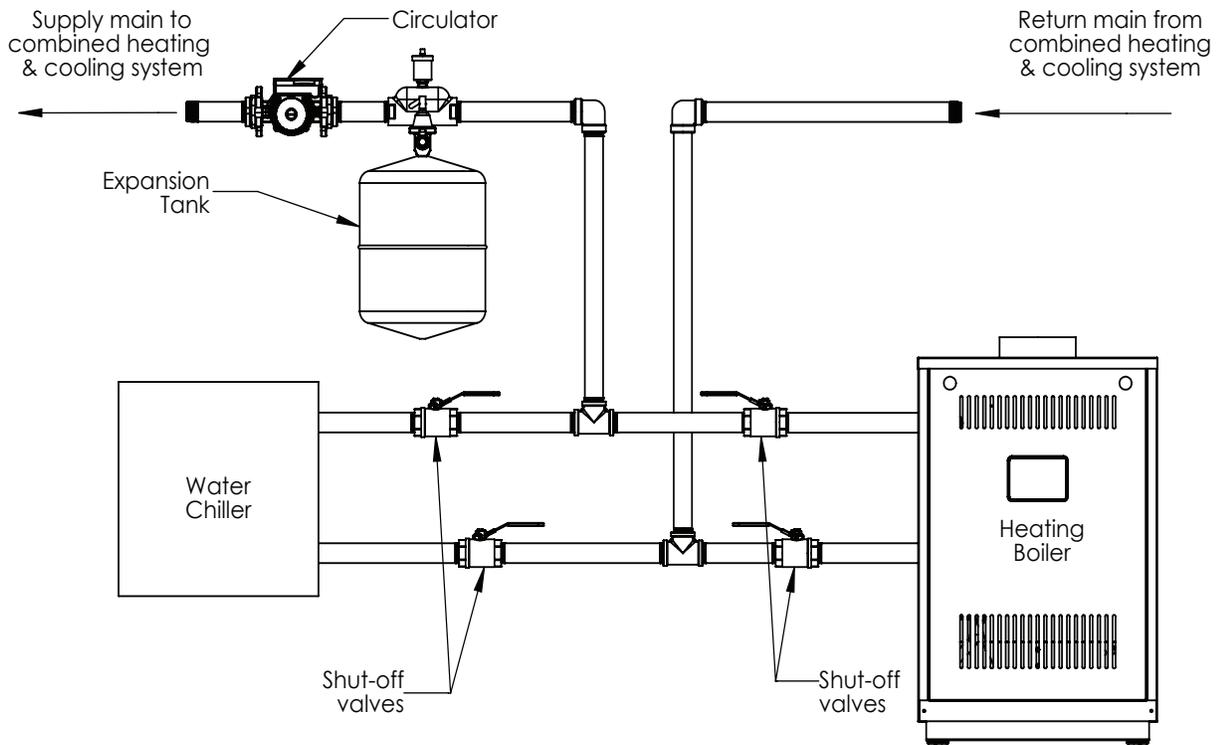


Figure A-1: Isolated Boiler from Refrigeration System

## Appendix: Low Return Water Temperatures

### Thermal Shock:

Cast iron boilers are very robust. 110°F and below return water temperatures will not cause thermal shock to castings.

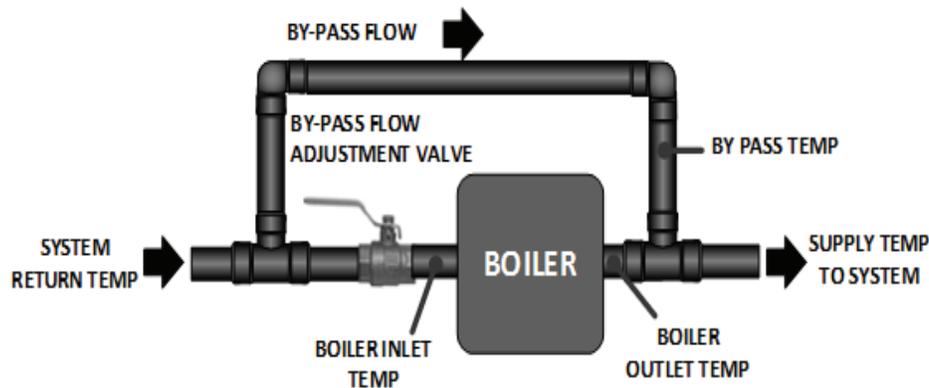
### Condensation is a different matter:

Cast iron boilers will tolerate intermittent periods of condensation, but are not designed for extended condensation periods. Water temperatures below 120°F cause condensation that damage cast iron, burners and other components. This is not unique to boiler design. All cast iron boilers act the same way.

Typical high temperature [170°F and higher] fin tube radiation heating systems will have short condensation cycles in 'shoulder' seasons, early and late parts of the heating season. Short term condensing during these heating season 'shoulders' is unlikely to cause problems.

Larger volume systems during the 'shoulder' heating seasons or systems with aggressive set back or low temperature systems will cause extended condensation periods that will shorten boiler life.

**Simple Boiler By-Pass systems** are common and they can solve flow problems. These simple by-pass piping arrangements can help reduce condensation.



Regardless of by-pass flow, boiler will have inlet temperatures that are same as system return temperature. When boiler inlet temperatures fall below 120°F, boiler will condensate. As by-pass flow is increased, less water flows through boiler which increases boiler temperature rise. This will help reduce propensity for condensation but will not stop it.

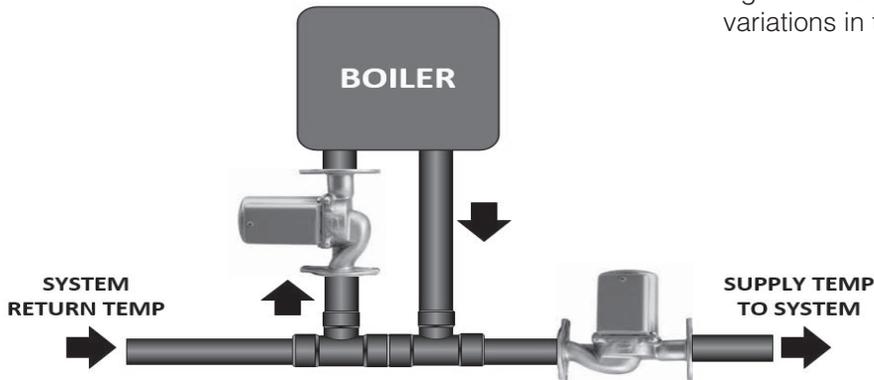
The problem with these fixed by-pass arrangements is just that. They are fixed. As flow changes with different zones opening or water temperatures change, a simple by-pass system cannot react since it is fixed.

## Appendix: Low Return Water Temperatures *(continued)*

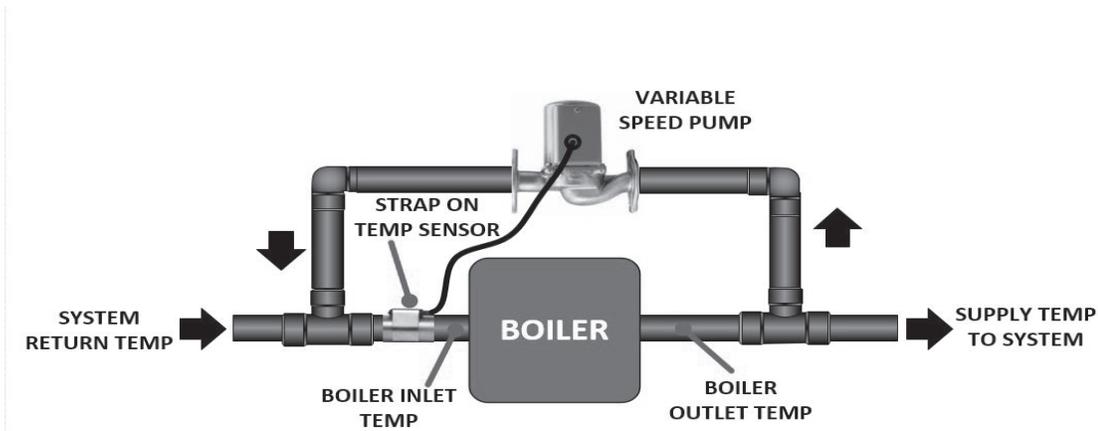
### Primary-Secondary Pumping:

This is an improvement over simple by-pass piping to reduce condensation.

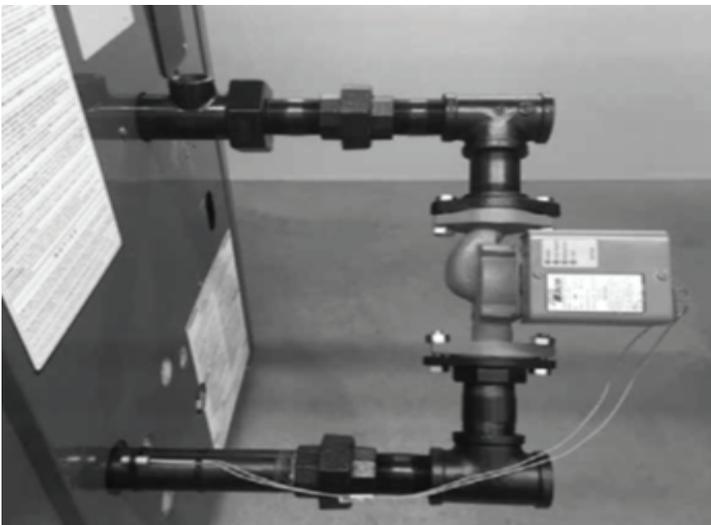
Again this is a fixed system. It can not adapt to variations in temperature and flow.



**Best Alternative:** System by-pass kit [part number 107795-01] that addresses these situations.



A strap on temperature sensor measures boiler inlet temperatures. This temperature signal is sent to a variable speed pump that will ensure boiler inlet temperatures are always greater than the factory by-pass kit set point of 120°F.



Kit includes all fittings, pump, sensor and instructions for installation.



