

INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FORCE™ SERIES CAST IRON GAS-FIRED BOILER



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

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

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 Force™ Series Boiler. See the Massachusetts Board of Plumbers and Gas Fitters website, 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 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 an imminently hazardous situation which, if not avoided, will result in death, serious injury or substantial property damage.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in moderate or minor injury or property damage.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or substantial property damage.

NOTICE

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

Table of Contents

I. Pre-Installation.....	5	VII. System Start-up and Checkout	16
II. Unpack Boiler	6	VIII. Operation.....	19
III. Water Piping and Trim	7	IX. Service and Maintenance	21
IV. Gas Piping.....	10	X. Troubleshooting	24
V. Venting	11	XI. Repair Parts	26
VI. Electrical.....	13		



Table 1A: Ratings

Force Gas Ratings				
Boiler Model	Input (MBH)	DOE Heating Capacity (MBH)	Net AHRI Rating Water (MBH) ⁽¹⁾	AFUE (%)
FORCE02	37.5	30	26	82
FORCE03	62	50	43	82
FORCE04	96	78	68	82
FORCE05	130	106	92	82
FORCE06	164	134	117	82
FORCE07	198	164	143	82
FORCE08	232	191	166	82
FORCE09	266	218	190	82
FORCE10	299	244	212	82

⁽¹⁾ Net AHRI Water Ratings shown are based on a piping and pickup allowance of 1.15. Consult manufacturer before selecting boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc.

Table 1B: Dimensions and Connections

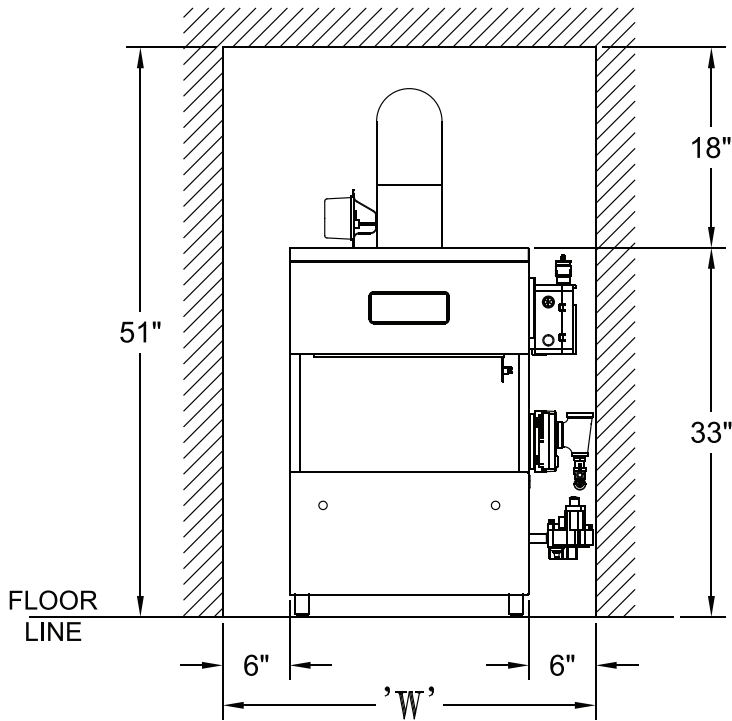
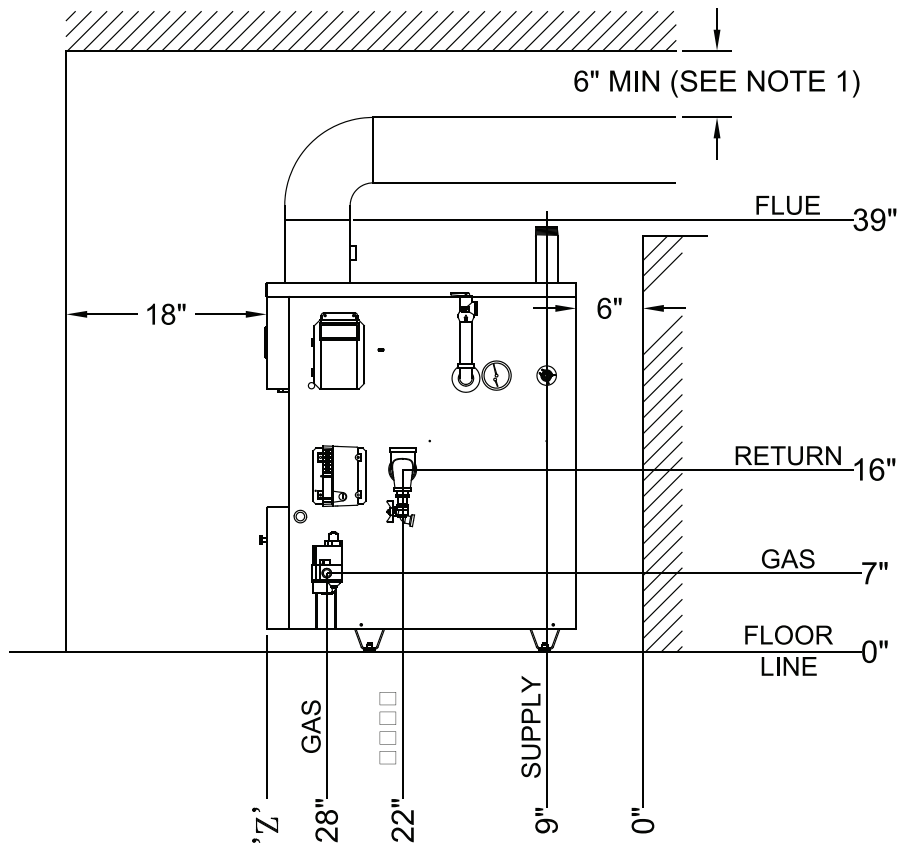
Boiler Model	Supply NPT (inch)	Return NPT (inch)	Vent (inch)	Gas NPT (inch)	Relief Valve NPT (inch)	Drain NPT (inch)
FORCE02	1¼	1¼	4	½	¾	¾
FORCE03	1¼	1¼	4	½	¾	¾
FORCE04	1¼	1¼	5	½	¾	¾
FORCE05	1¼	1¼	6	½	¾	¾
FORCE06	1¼	1¼	6	½	¾	¾
FORCE07	1¼	1¼	7	¾	¾	¾
FORCE08	1¼	1¼	7	¾	¾	¾
FORCE09	1¼	1¼	8	¾	¾	¾
FORCE10	1¼	1¼	8	¾	¾	¾

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

Maximum Allowable Working Pressure - 50 psi. Boiler shipped from factory with a 30 psi relief valve.

Table 1C: Weights and Volume

Boiler Model	Shipping Weight (lbs)	Water Content (gal)
FORCE02	220	2.4
FORCE03	270	3.2
FORCE04	320	4.0
FORCE05	370	4.7
FORCE06	420	5.5
FORCE07	470	6.3
FORCE08	520	7.0
FORCE09	570	7.8
FORCE10	620	8.6



MODEL	'W'	'Z'
FORCE02	22.50"	34"
FORCE03	23.75"	
FORCE04	27.00"	
FORCE05	30.25"	
FORCE06	33.50"	
FORCE07	36.75"	36"
FORCE08	40.00"	
FORCE09	43.25"	
FORCE10	46.50"	

NOTES:

1. MINIMAL RADIAL DISTANCE AROUND VENT PIPE AND BREECHING FOR SINGLE-WALL METAL PIPE VENT CONNECTOR. OTHERWISE, FOLLOW VENT CONNECTOR MANUFACTURER'S RECOMMENDED CLEARANCES.
2. ADD HEIGHT REQUIRED TO MAINTAIN 6" CLEARANCE FROM ALL BREECHING COMPONENTS.

Figure 1: Minimum Clearance to Combustible Materials

I. 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. Inspect shipment** carefully for any signs of damage. All equipment is carefully manufactured, inspected and packed. Our responsibility ceases upon delivery of boiler to carrier in good condition. Any claim for damage or shortage in shipment must be filed immediately against carrier by consignee. No claims for variances or shortages will be allowed by Boiler Manufacturer, unless presented within sixty (60) days after receipt of equipment.
- B. Installation must conform** to the requirements of the authority having jurisdiction. In the absence of such requirements, installation must conform to *National Fuel Gas Code*, ANSI Z223.1/NFPA 54. Where required by the authority having jurisdiction, the installation must conform to the *Standard for Controls and Safety Devices for Automatically Fired Boilers*, ANSI/ASME CSD-1.
- C. Appliance is design certified for installation on combustible flooring.** The boiler must not be installed on carpeting.
- D. Provide clearance between boiler jacket and combustible material** in accordance with local fire ordinance. Refer to Figure 1 for minimum clearance from combustible material for alcove installation. Provide 1/2" clearance from water piping to combustible materials.
- E. Provide practical service clearances.** A minimum of 24" from the right side and front jacket panels is recommended for servicing but may be reduced to minimums shown in Figure 1.
- 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, 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.

The following guideline is based on the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54.

1. Determine volume of space (boiler room). Rooms communicating directly with space (through openings not furnished with doors) are considered part of space.
$$\text{Volume [ft}^3\text{]} = \text{Length [ft]} \times \text{Width [ft]} \times \text{Height [ft]}$$
2. Determine Total Input of all appliances in space. Round result to nearest 1,000 Btu per hour (Btuh).
3. Determine type of space. Divide Volume by Total Input.
 - a. If result is greater than or equal to 50 ft³ per 1,000 Btuh, space is considered an *unconfined space*.
 - b. If result is less than 50 ft³ per 1,000 Btuh, space is considered a *confined space*.
4. Determine building type. A building of *unusually tight construction* has the following characteristics:
 - a. 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;
 - b. Weather-stripping has been added on openable windows and doors, and;
 - c. 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.
5. For boiler located in an *unconfined space 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.
6. For boiler located within *unconfined space in building of unusually tight construction* or within *confined space*, 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 of top of space. Locate remaining opening within 12 inches of bottom of space. Minimum dimension of air opening is 3 inches. Size each opening per following:

I. Pre-Installation (continued)

- a. Direct communication with outdoors. Minimum free area of 1 square inch per 4,000 Btu per hour input of all equipment in space.
- b. Vertical ducts. Minimum free area of 1 square inch per 4,000 Btu per hour input of all equipment in space. Duct cross-sectional area shall be same as opening free area.
- c. Horizontal ducts. Minimum free area of 1 square inch per 2,000 Btu per hour input of all equipment in space. Duct cross-sectional area shall be same as opening free area.

Alternate method for boiler located within confined space. Use indoor air if two permanent openings communicate directly with additional space(s) of sufficient volume such that combined volume of all spaces meet criteria for unconfined space. Size each opening for minimum free area of 1 square inch per 1,000 Btu per hour input of all equipment in spaces, but not less than 100 square inches.

7. 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 ¼ 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.

- I. **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.

II. Unpack Boiler

CAUTION

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

- A. Move boiler to approximate installed position.
- B. Remove all crate fasteners.
- C. Lift outside container and remove with all other inside protective spacers and bracing. Save two of the wooden slats from the container sleeve for use in Steps E and F.

- D. Remove all boiler hold-down fasteners.
- E. Tilt the boiler to one side and slide a wooden slat under the two raised feet.
- F. Tilt the boiler to the other side and slide another wooden slat under the two raised feet.
- G. Slide the boiler forward or backward off the skid using the two wooden slats as runners.
- H. Move boiler to its permanent location.

III. Water Piping and Trim

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 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 area where freezing could occur. Do not install any shut-off valves.

- D. Connect system supply and return piping** to boiler. Refer to Figures 2, 3, 4, & 5. Maintain minimum ½ inch clearance from hot water piping to combustible materials.
- E. If boiler is used in connection with refrigeration systems,** boiler must be installed with chilled medium piped in parallel with the heating boiler using

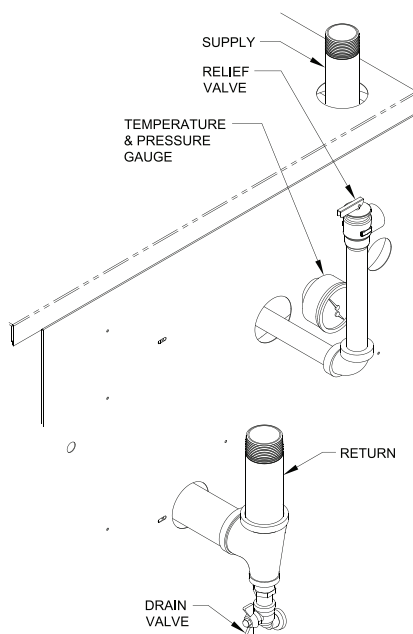


Figure 2: Near Boiler Piping

appropriate valves to prevent chilled medium from entering boiler. See Figure 3.

- F. 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.

- G. 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.).

Remove circulator and install pipe tee between circulator and boiler return along with second tee in supply piping as shown in Figures 4 and 5. Bypass should be same size as the supply and return lines with valves located in bypass and supply outlet as illustrated in Figures 4 and 5 in order to regulate water flow to maintain higher boiler water temperatures.

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

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

- H. 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.

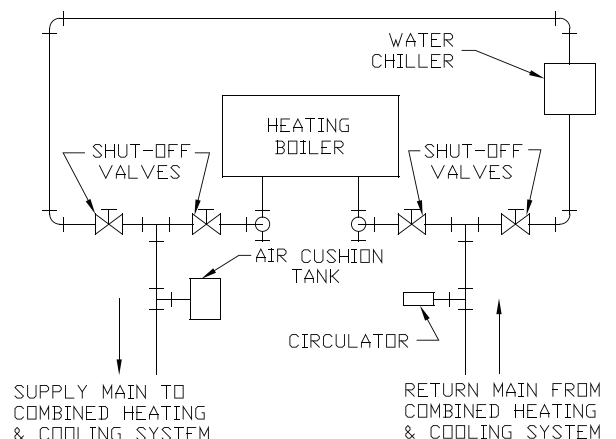


Figure 3: Recommended Piping for Combination Heating & Cooling (Refrigeration) Systems

III. Water Piping and Trim (continued)

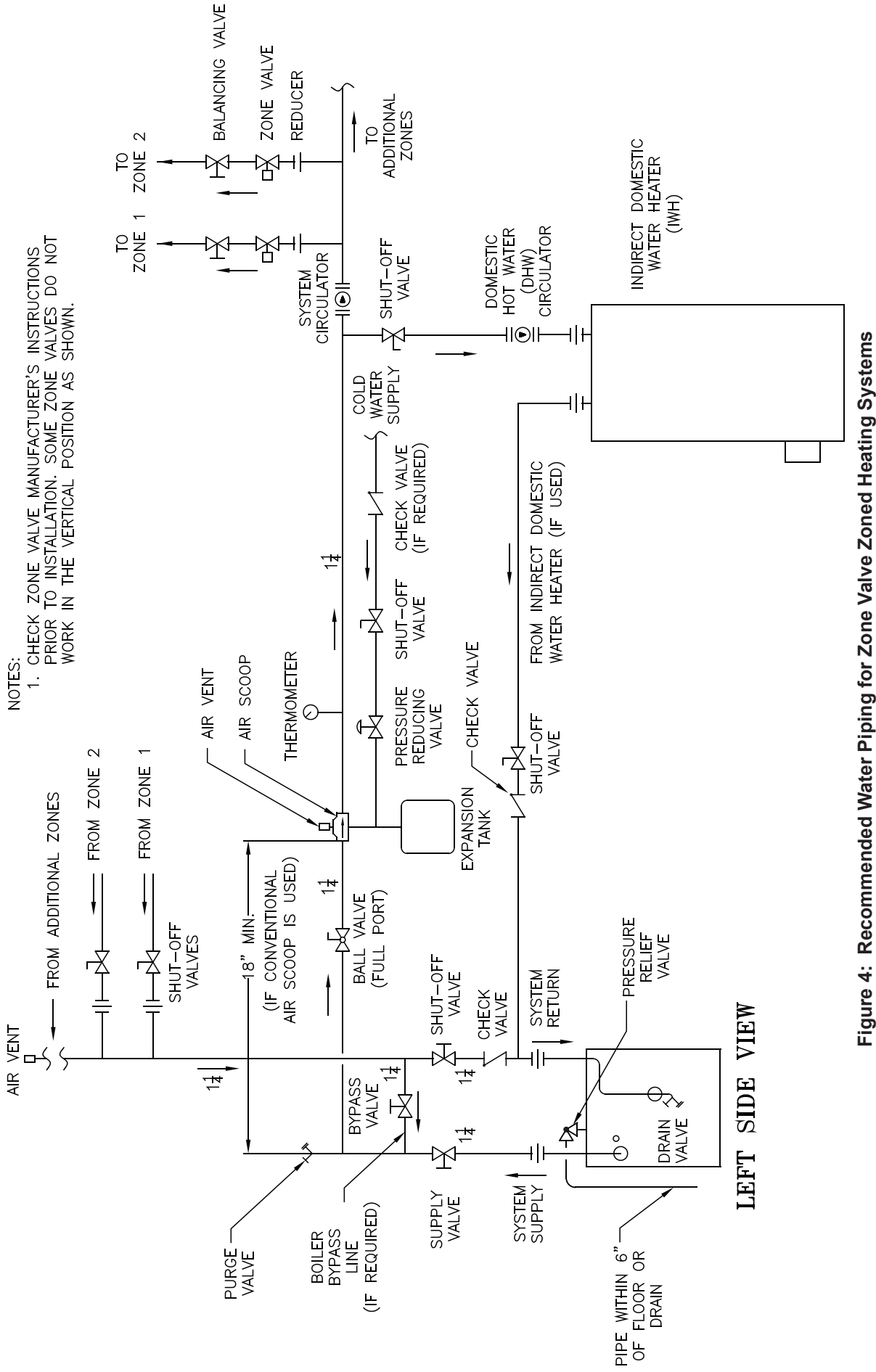


Figure 4: Recommended Water Piping for Zone Valve Zoned Heating Systems

NOTES:

1. FOR SINGLE ZONE HEATING ONLY SYSTEMS, OMIT FLOW CONTROL VALVE.

LEFT SIDE VIEW

9

IV. 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 $\frac{1}{2}$ psig. Actual point of delivery pressure may be less; contact gas supplier for additional information. Minimum gas valve inlet pressure is listed on rating label.
2. Maximum gas demand. Consider existing and expected future gas utilization equipment (i.e. water heater, cooking equipment).

B. Connect boiler gas valve 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 (joint) 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 6.

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. The boiler and its gas connection must be leak tested before placing boiler in operation.

1. Protect boiler gas control valve. For all testing over $\frac{1}{2}$ psig, boiler and its individual shutoff valve must be disconnected from gas supply piping. For testing at $\frac{1}{2}$ psig or less, isolate boiler from gas supply piping by closing boiler's individual manual shutoff valve.
2. Locate leaks using approved combustible gas detector, soap and water, or similar nonflammable solution. Do not use matches, candles, open flames, or other ignition source.

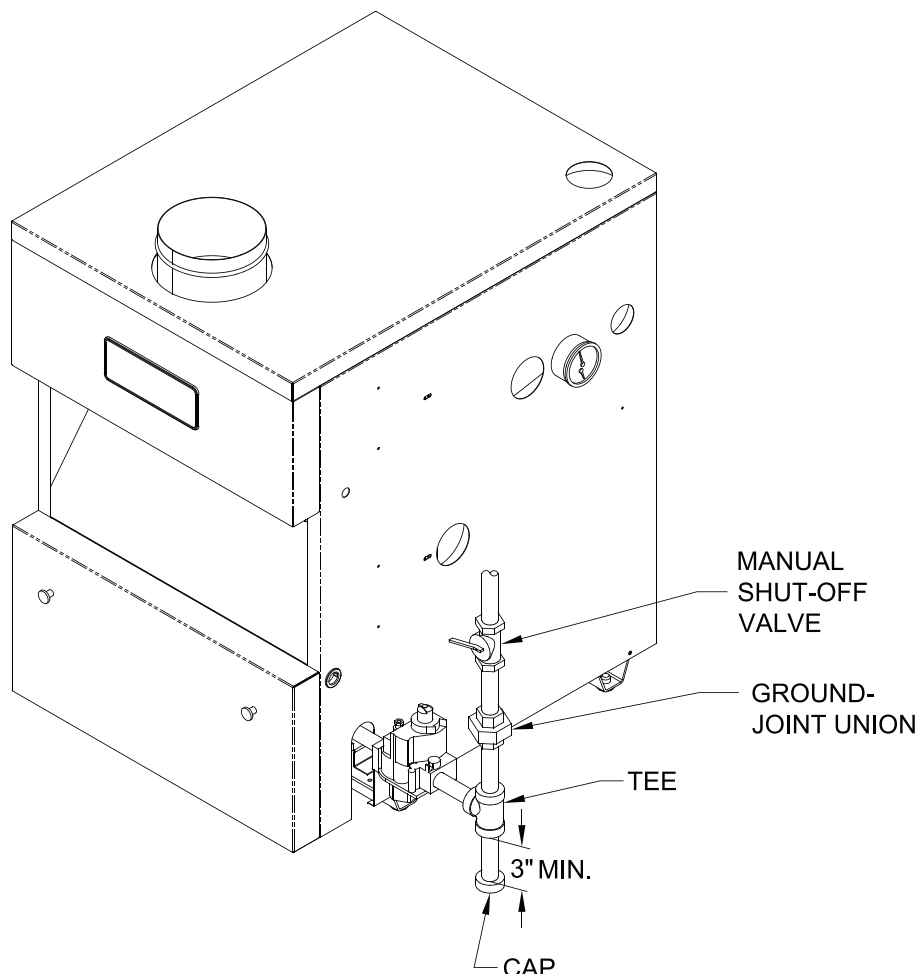


Figure 6: Pilot and Gas Piping

V. Venting

A. Install vent system in accordance with "Venting of Equipment" of the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, or applicable provisions of local building codes. Install any of the following for this Force Series Category I, draft hood equipped appliance:

1. Type B or Type L gas vent. Install in accordance with listing and manufacturer's 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*, ANSI/NFPA 211.
Masonry chimney must be lined with approved 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 cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone).
5. Do not cover non-metallic vent pipe and fittings with thermal insulation. Note: Non-metallic vent cannot be used with this boiler.

B. Inspect chimney and remove any obstructions or restrictions. Clean chimney if previously used for solid or liquid fuel-burning appliances or fireplaces.

DANGER

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

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 Force Series boiler provides the redundancy referenced in the vent damper Installation Instructions.

CAUTION

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

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

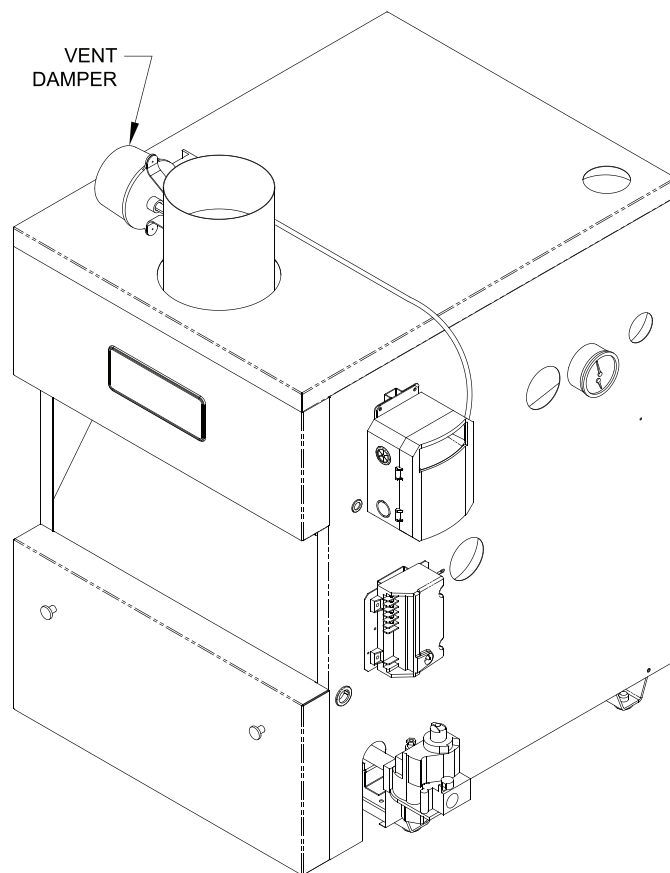


Figure 7: Vent Damper Installation

2. Mount the vent damper assembly onto the canopy/diverter. (Refer to Figure 7 and to instructions packed with the vent damper) for specific instructions). Do not modify either the draft hood or vent damper.

NOTICE

Provide adequate clearance for servicing.

3. Locate vent damper position indicating means to be visible following installation.

WARNING

Provide 6" minimum clearance between damper and combustible construction.

4. Plug the factory harness vent damper connector into damper motor polarized receptacle.

V. Venting (continued)

D. Install Vent Connector

1. Install vent connector from vent damper outlet to chimney.
2. Vent connectors 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 leg of chimney serving an open fireplace.
4. Inspect chimney for obstructions or restrictions and remove. Clean chimney if necessary.
5. Vent pipe to chimney must not be smaller than outlet on draft hood or damper. Type B Vent Connector 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.
6. 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.
7. Vent pipe should slope upward from draft hood to vent terminal not less than 1/4" per foot.
8. Support horizontal portions of venting system to prevent sagging. Use pipe straps, brackets or hangers spaced 4 ft. or less.
9. Vent pipe must be inserted into but not beyond inside wall of chimney liner. Seal tight between vent pipe and chimney.
10. 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:

- a. Seal any unused openings in the common venting system.
- b. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, and other deficiencies which could cause an unsafe condition.
- c. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- d. Place in operation the appliance being inspected. Follow the Lighting (or Operating) Instructions. Adjust thermostat so appliance will operate continuously.
- e. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
- f. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.
- g. Any improper operation of the common venting system should be corrected so the installation conforms with the *National Fuel Gas Code*, ANSI Z223.1/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.

VI. Electrical

- A. General.** Install wiring and electrically bond boiler 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 hertz, less than 12 amperes. 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 screw. See Figures 8 and 9.

- 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.

VI. Electrical (continued)

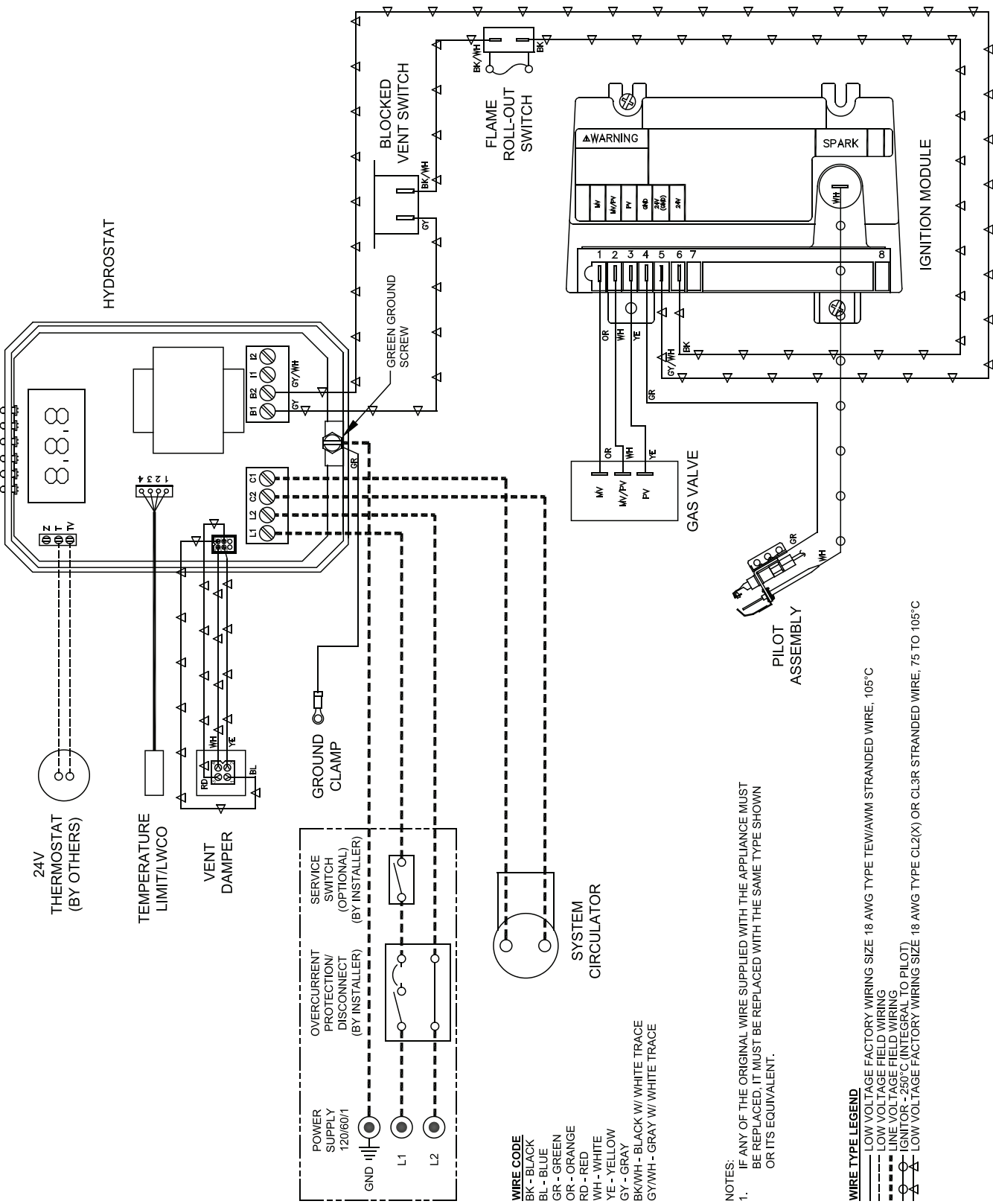


Figure 8: Wiring Connection Diagram

VI. Electrical (continued)

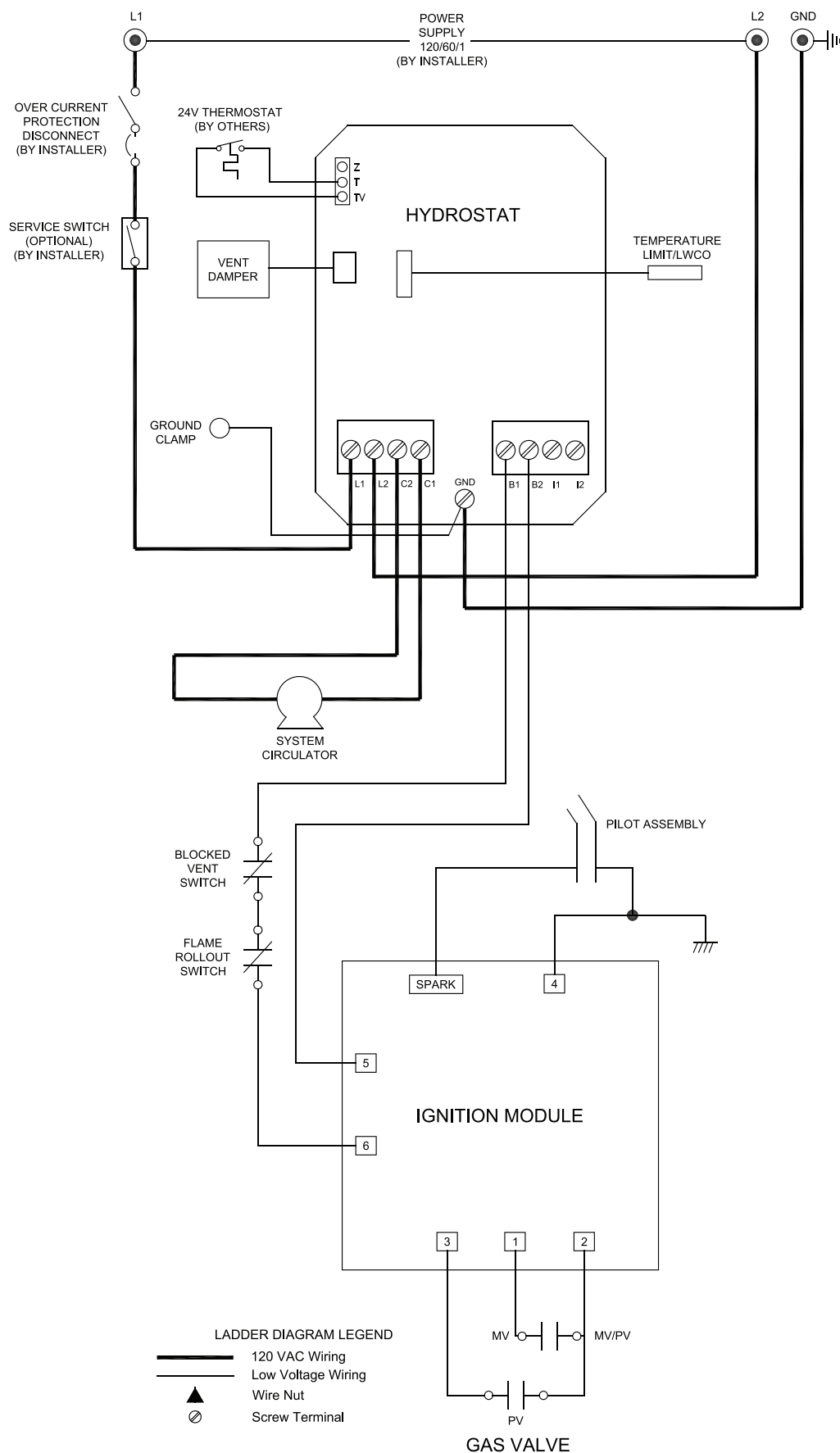


Figure 9: Schematic Ladder Diagram

VII. System Start-up and Checkout

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.

A. Main Burner Check - Check main burners to see that they were not dislodged during shipment. Rear of burners should be in the vertical 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.
 - 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.**
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 10).
10. Check pipe and fittings from meter to Combination Gas Valve using soap solution or other approved methods.

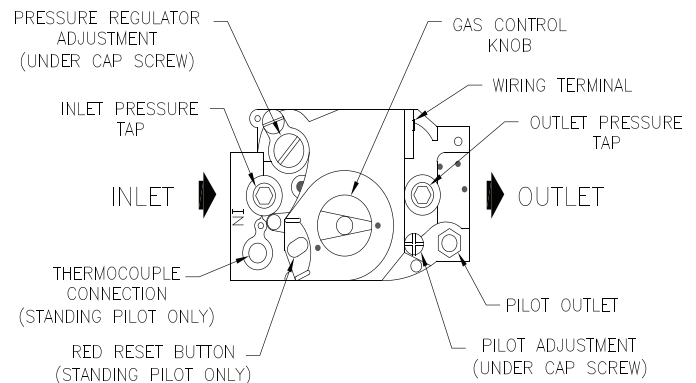


Figure 10: Top View of Honeywell Gas Valves

VII. System Start-up and Checkout (continued)

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.

C. Check Gas Input to Boiler

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 10). 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 3½ inches water column. Turning Regulator Adjusting Screw Clockwise increases pressure, Counter-clockwise rotation decreases pressure.

- D. Check Main Burner Flame.** See Figure 11. Flame should have a clearly defined inner cone with no yellow tipping. Orange-yellow streaks caused by dust should not be confused with true yellow tipping.

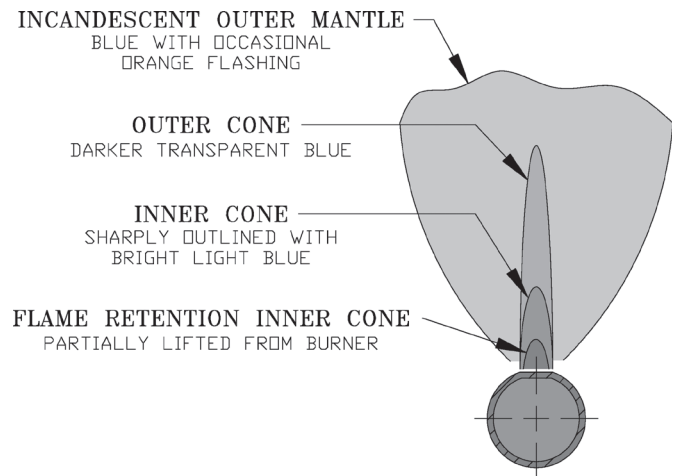


Figure 11: 1 Inch Main Burner Flame

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. Check Pilot Burner Flame.

1. See Figure 12. The pilot burner should be lit only if thermostat is calling for heat. The pilot burner produces three (3) flames. The center flame should be steady, medium hard blue enveloping 3/8 to 1/2 inch of thermocouple.

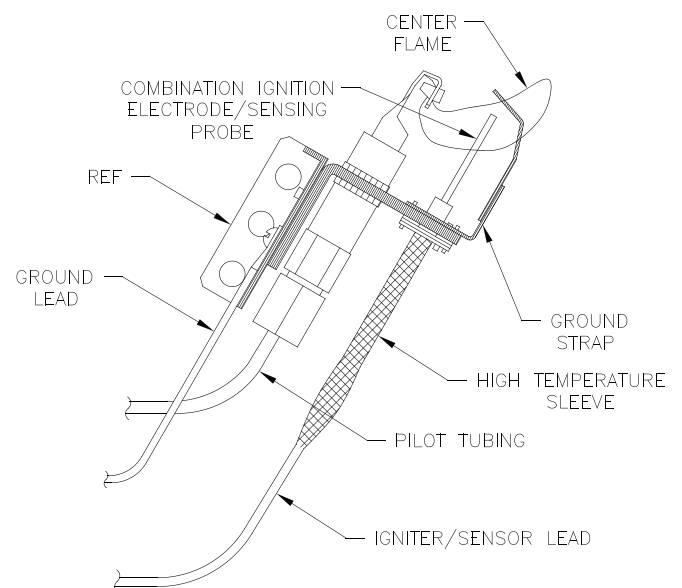


Figure 12: Pilot Burner Flame

VII. System Start-up and Checkout (continued)

F. 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.

G. Check Vent Damper Operation. Vent Damper must be in open position when main burners are operating.

H. Check High Limit Control.

Jumper Thermostat connections 'TW' and 'TR' in AquaSmart Control. See Figures 8 and 9. Allow burners to operate until shutdown by limit. REMOVE JUMPER.

I. Check Thermostat Operation. Raise and lower temperature setting to start and stop boiler operation. Adjust thermostat to normal setting.

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.

K. Review User's Information Manual and system operation with owner or operator.

L. Post instructions near boiler for reference by owner and service personnel.

VIII. Operation

A. Temperature Limit/LWCO Control

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

B. Electronic Ignition Module

See Figure 13 for electronic ignition (EI). Electronic Ignition Modules with LED indicators. Table 2 cross-references the ignition module terminal designations to the ignition terminal numbers in the wiring ladder diagrams. Table 3 provides green LED status codes and recommended service action where applicable.. See Figure 13 for Location of LED. See Figure 16 for Troubleshooting Guide.

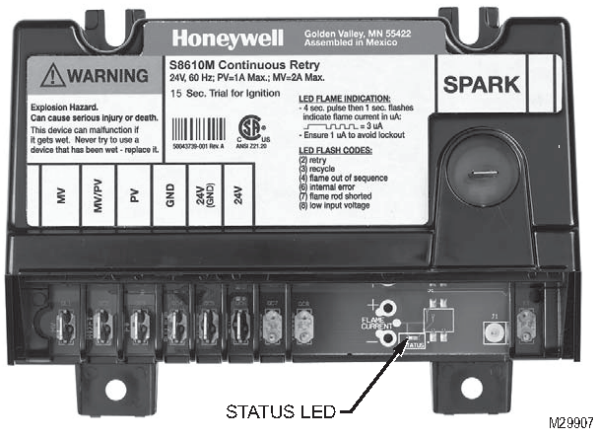


Figure 13: Location of LED

Table 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

- Flame Current Measurement Procedure. See Figure 14 “Measuring pilot flame current with micro-ammeter”
 - Pilot flame current in micro amps can be measured using any standard micro-ammeter by inserting the meter probes into the module holes labeled FLAME CURRENT as shown in Figure 14.

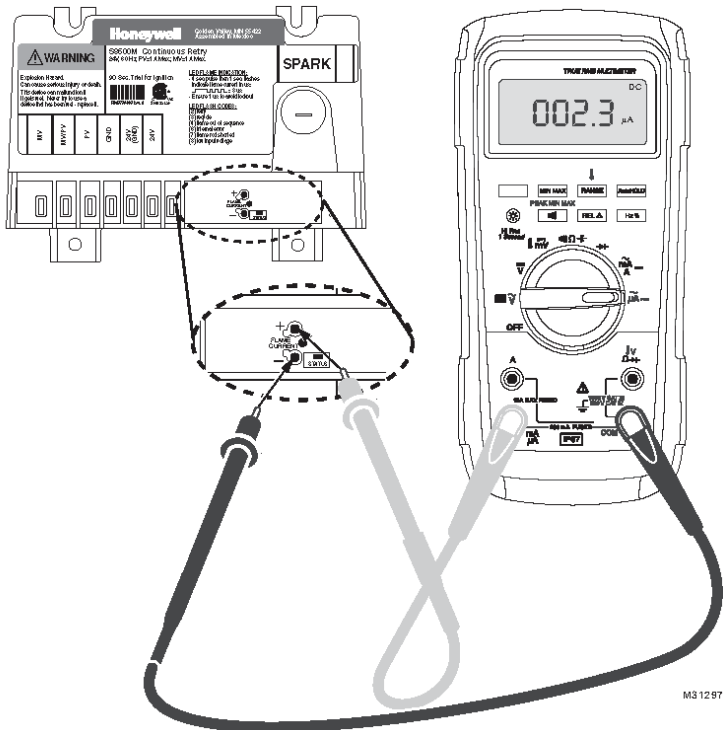


Figure 14: Measuring Pilot Flame Current with Micro-ammeter

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

VIII. Operation (continued)

- v. Check the pilot flame. It must be blue, steady and envelop the 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 the module upon satisfactory completion of pilot flame current measurement.
- h. Check the 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 16 "Honeywell Electronic Ignition Troubleshooting Guide".

Table 3: Green LED Flame Codes

Green LED Flash Code ^a	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 μ 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 the 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 the 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 the 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 the fault corrects, control resumes normal operation.	Check transformer and AC line for proper input voltage to the control. Check with full system load on the transformer.

^aFlash 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 μ 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.

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)

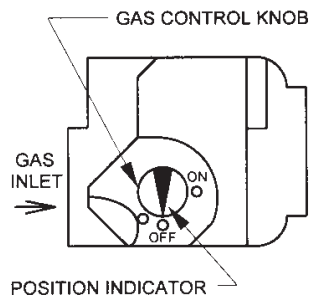
FOR YOUR SAFETY READ BEFORE OPERATING

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. 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.
6. Rotate gas control knob clockwise from "ON" position to "OFF". Make sure knob rests against stop.
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you do not smell gas, go to the next step.
8. Rotate gas control knob counterclockwise from "OFF" to "ON". Make sure knob rest against stop. Do not force.
9. Turn on all electric power to the appliance.
10. Set thermostat to desired setting.
11. 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. Rotate gas control knob clockwise from "ON" position to "OFF". Make sure knob rests against stop.

Figure 15: Operating Instructions

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. 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 15.

CAUTION

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

B. Inspect Vent System.

1. Remove obstructions in vent pipe and chimney.
2. Remove soot accumulations with wire brush and vacuum.
3. Repair or replace deteriorated vent pipe and vent accessories.
4. Provide proper support. Repair sags, particularly in horizontal sections.
5. Repair leaking joints.

C. Inspect Boiler Flue Passages for blockage or soot accumulation.

1. Remove vent pipe, vent damper, blocked vent switch and draft hood.
2. Remove sheet metal screws securing upper front panel. Remove panel by sliding down.
3. Remove sheet metal screws securing Jacket Top Panel. Lift panel and rotate about supply piping until top of boiler is exposed. If piping or wall prevent full rotation of top panel for access to canopy, cut slot into supply opening and remove top panel.
4. Remove carriage bolts securing Canopy to Section Assembly.
5. 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. Replace canopy and seal.

6. Install new gasket material (See Section XI: Repair Parts). Install canopy.
7. Install Jacket Top Panel, Blocked Vent Switch, Vent Damper, and vent pipe.

D. Clean Main Burners and Firebox.

1. To remove burners for cleaning, changing orifices, or repairs:
 - a. Remove Jacket Lower Front Panel.
 - b. Disconnect pilot tubing at gas valve.
 - c. Disconnect 3-wire plug at the gas valve.
 - d. Remove wires to flame rollout switch.
 - e. Remove the burner access panel.
 - f. Mark the location of the pilot main burner on the manifold if the marking on manifold is missing or obliterated.
 - g. 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.
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 in Step 1. Make sure burner with pilot assembly is in same location as original installation.

Check burners to see that they are located properly in slot at rear of burner tray.

E. Check Operation. Follow steps C through J from Section VII: System Start-up and Checkout.

F. Lubrication. There are no parts requiring lubrication by service technician or owner. Circulator bearings are water lubricated.

X. Troubleshooting

A. Temperature Limit/LWCO Control

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

B. Electronic Ignition Module (see Figure 16)

X. Troubleshooting (continued)

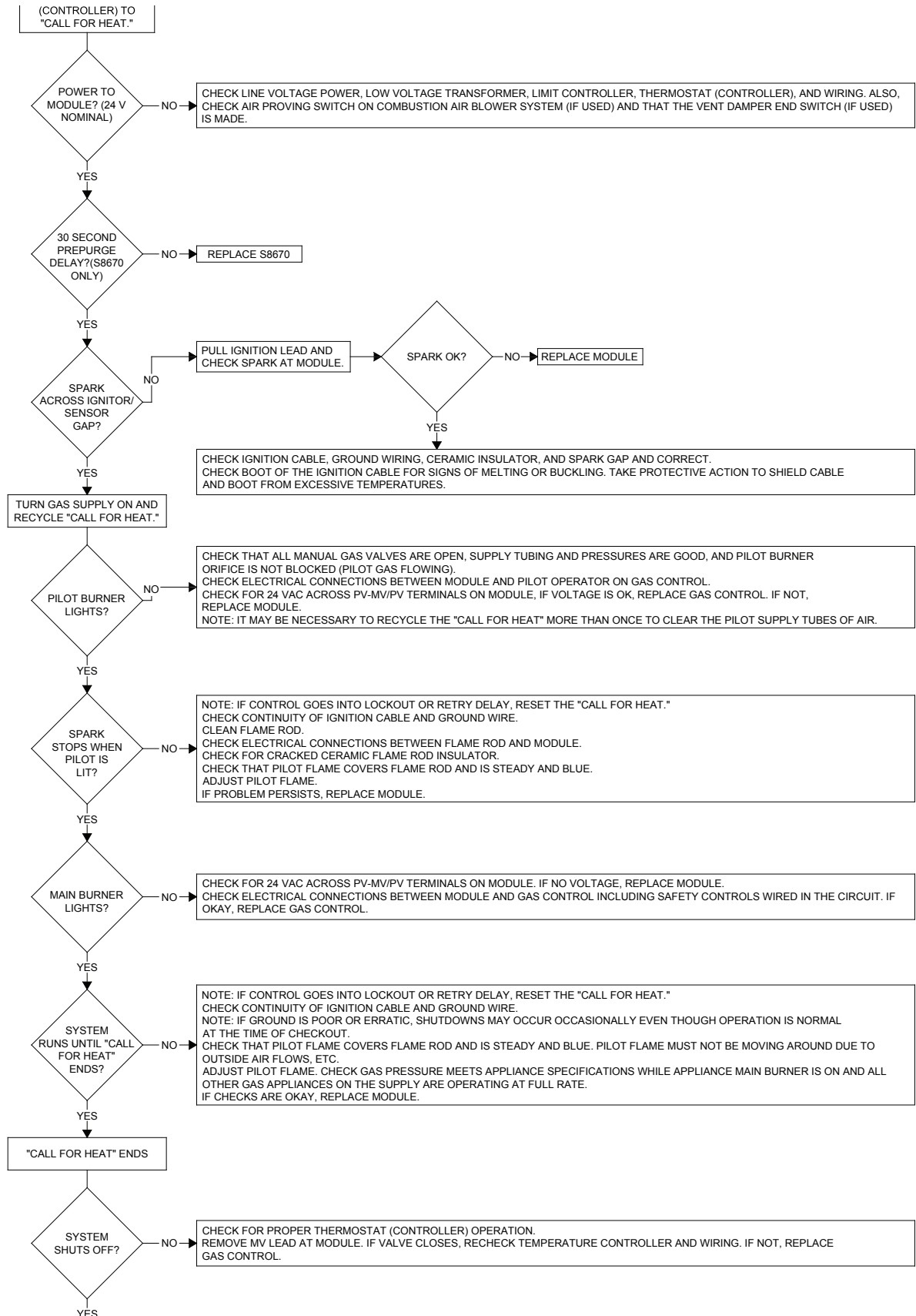
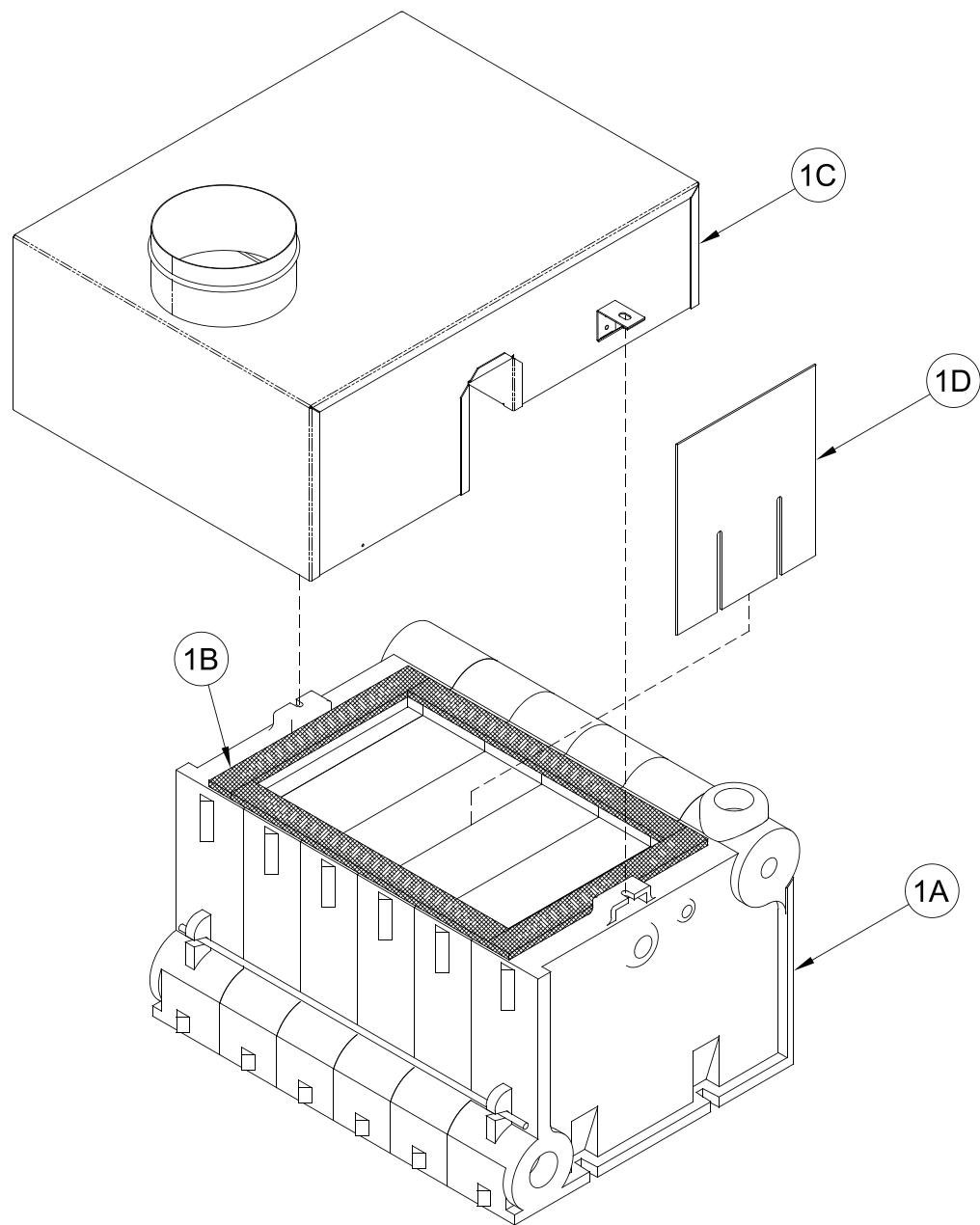


Figure 16: Troubleshooting Guide, Honeywell Electronic Ignition (EI)

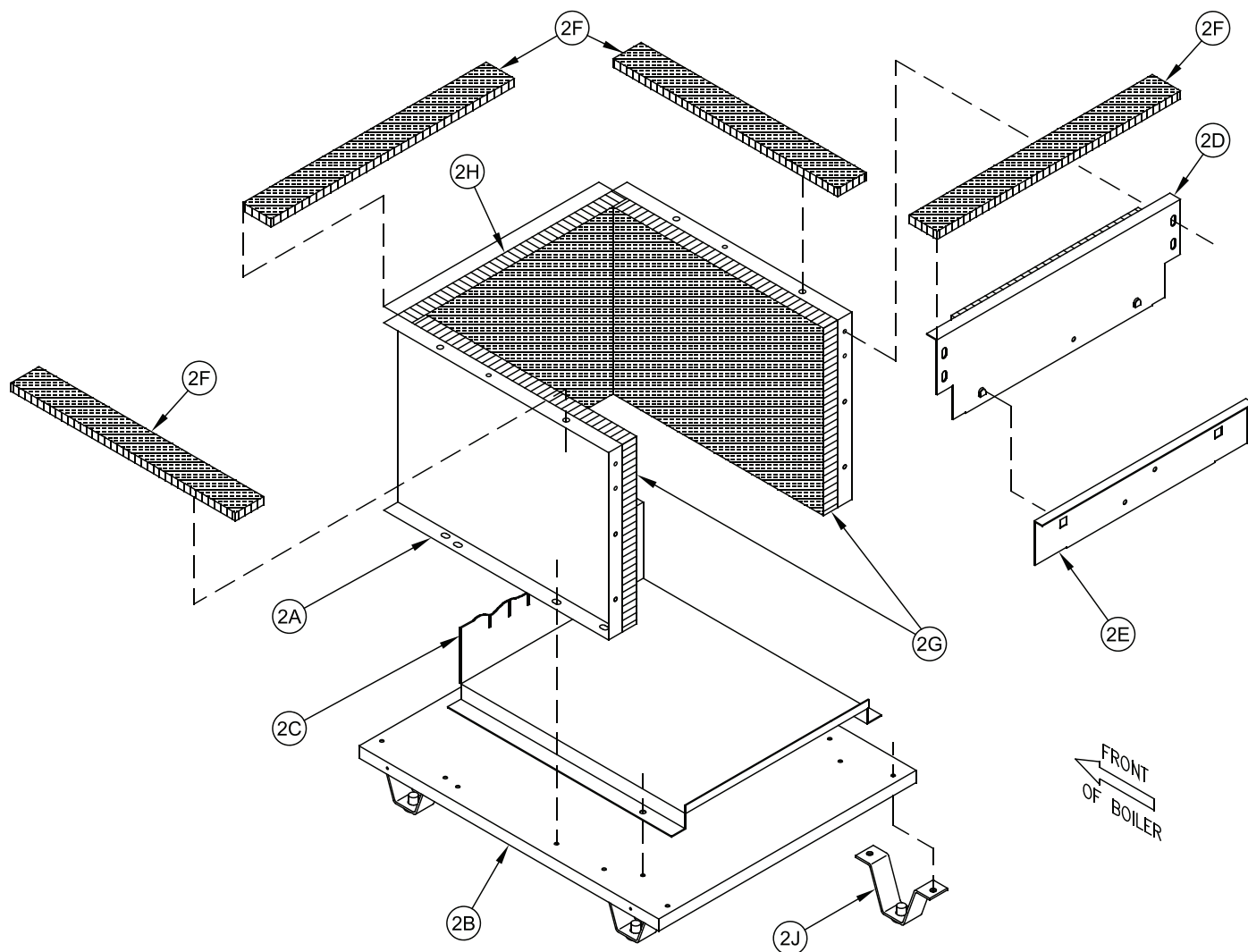
XI. Repair Parts

All Force™ Repair Parts may be obtained by contacting your local Ferguson branch.



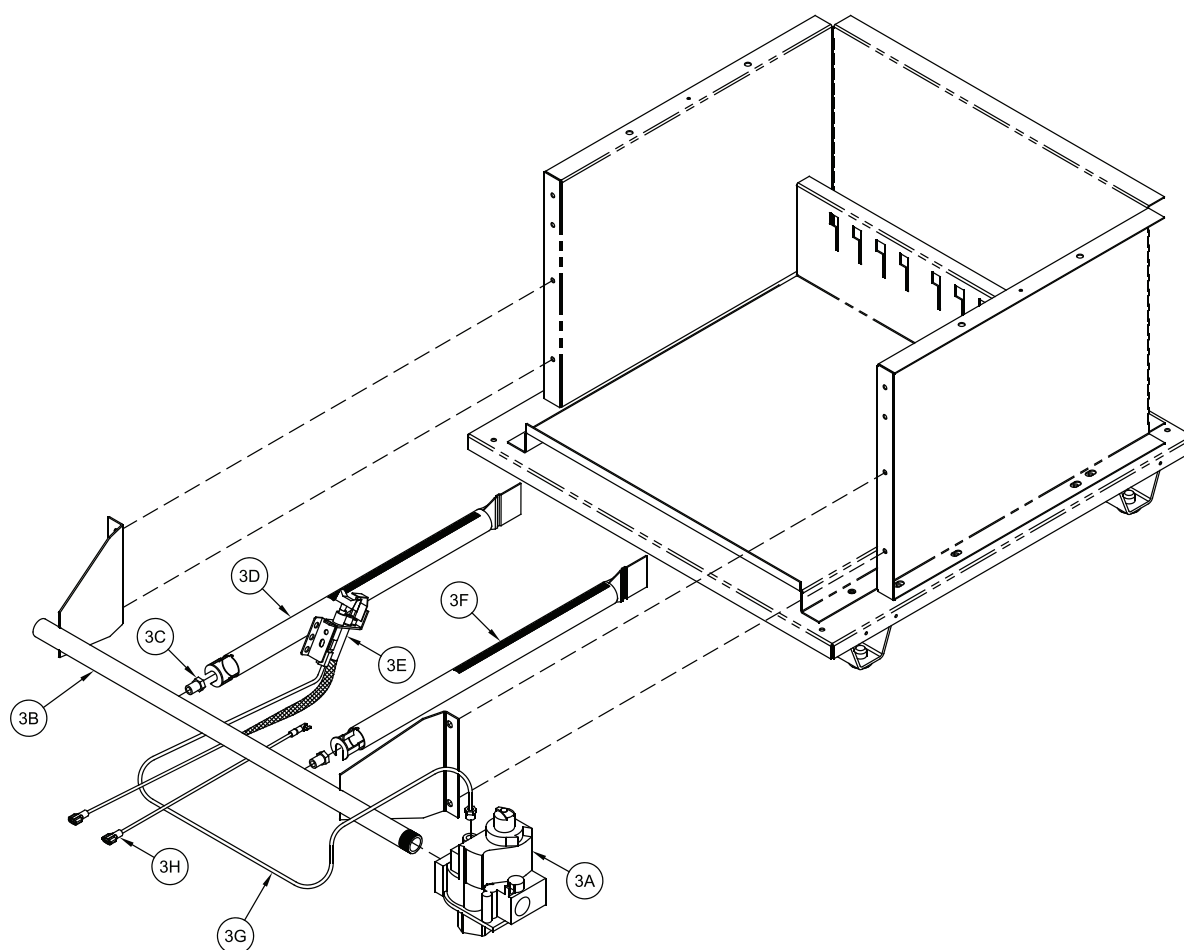
Key No.	Description	[Quantity] Part Number									
		FORCE02	FORCE03	FORCE04	FORCE05	FORCE06	FORCE07	FORCE08	FORCE09	FORCE10	
1A	Block Assembly	617190204	617190304	617190404	617190504	617190604	617190704	617190804	617190904	617191004	
1B	Canopy Gasket Kit	6206001									
1C	Canopy Assembly	611191021	611191031	611191041	611191051	611191061	611191071	611191081	611191091	611191101	
1D	Flue Baffles	N/A					(6) 71106001	(7) 71106001	(8) 71106001	(9) 71106001	
	Blocked Vent Switch Assembly (not shown)	6016058									

XI. Repair Parts (continued)



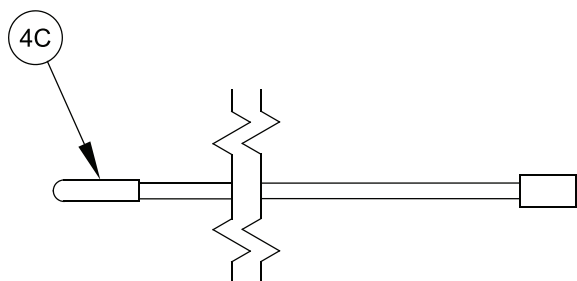
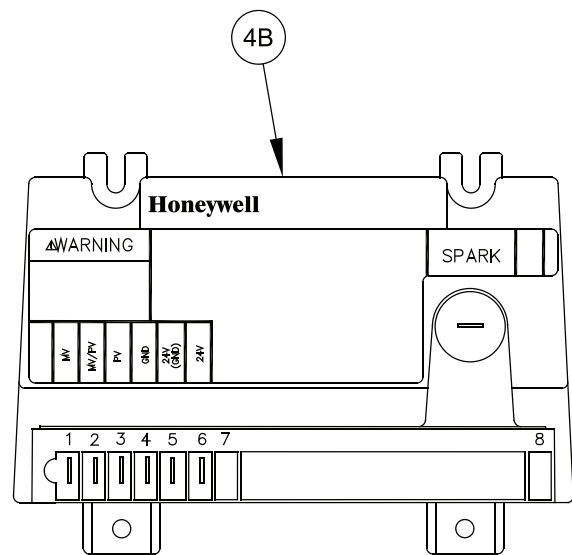
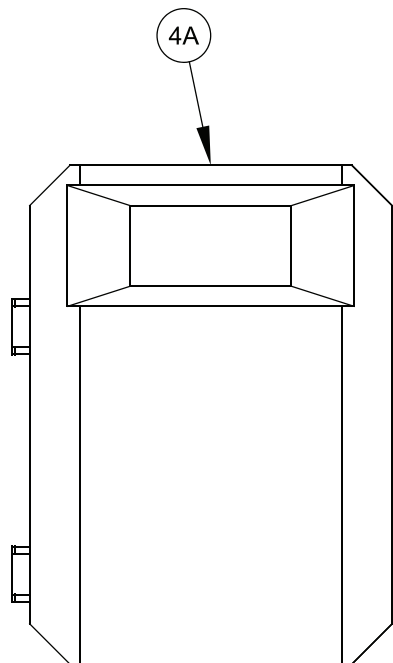
Key No.	Description	[Quantity] Part Number									
		FORCE02	FORCE03	FORCE04	FORCE05	FORCE06	FORCE07	FORCE08	FORCE09	FORCE10	
2A	Base Wrapper	718600211	718600311	718600411	718600511	718600611	718600711	718600811	718600911	718601011	
2B	Base Tray	718600291	718600391	718600491	718600591	718600691	718600791	718600891	718600991	718601091	
2C	Burner Tray Assembly	718600205	718600305	718600405	718600505	718600605	718600705	718600805	718600905	718601005	
2D	Base Front Panel	618600241	618600341	618600441	618600541	618600641	618600741	618600841	618600941	618601041	
2E	Burner Access Panel	718600261	718600361	718600461	718600561	718600661	718600761	718600861	718600961	718601061	
2F	Base Gasket Kit	6206002									
2G	Base Side Insulation	(2) 720601									
2H	Base Rear Insulation	72060025	72060035	72060045	72060055	72060065	72060075	72060085	72060095	72060105	
2J	Base Leg Assembly	(4) 6186001									
	Flame Rollout Switch Assembly (not shown)	6016060									

XI. Repair Parts (continued)



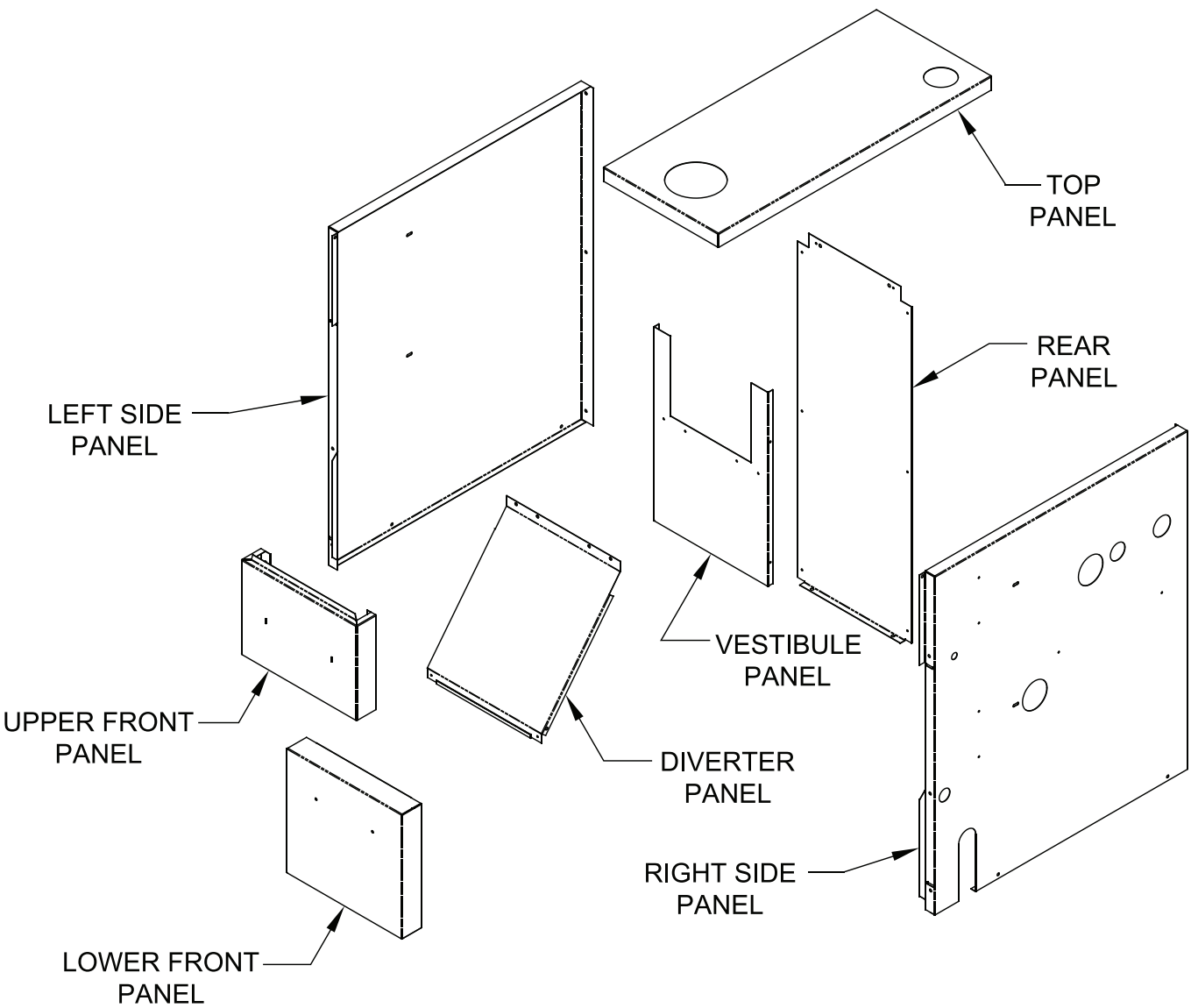
Key No.	Description	[Quantity] Part Number									
		FORCE02	FORCE03	FORCE04	FORCE05	FORCE06	FORCE07	FORCE08	FORCE09	FORCE10	
3A	Gas Valve (Natural Gas), Honeywell	81660145					81660161				
	Gas Valve (LP Gas), Honeywell	81660146					81660160				
3B	Gas Manifold	104810-02	104810-03	104810-04	104810-05	104810-06	104810-07	104810-08	104810-09	104810-10	
3C	Burner Orifices - Natural Gas #47	(2) 822710	---				(12) 822710	(14) 822710	(16) 822710	(18) 822710	
	Burner Orifices - Natural Gas #45	---	(3) 822711	(5) 822711	(7) 822711	(9) 822711	---				
	Burner Orifices - LP Gas 1.25mm	(2) 822705	---	(5) 822705	(7) 822705	(9) 822705	---				
	Burner Orifices - LP Gas #55	---	(3) 822708	---			---				
	Burner Orifices - LP Gas 3/64"	---					(12) 822704	(14) 822704	(16) 822704	(18) 822704	
3D	Pilot Burner	8236118									
3E	Pilot Assembly - Natural Gas	103704-01									
	Pilot Assembly - LP Gas	103705-01									
3F	Main Burner	(1) 8236119	(2) 8236119	(4) 8236119	(6) 8236119	(8) 8236119	(11) 8236119	(13) 8236119	(15) 8236119	(17) 8236119	
3G	Pilot Tubing	8236122						8236123			
3H	Ground Wire Assembly	6136054									

XI. Repair Parts (continued)



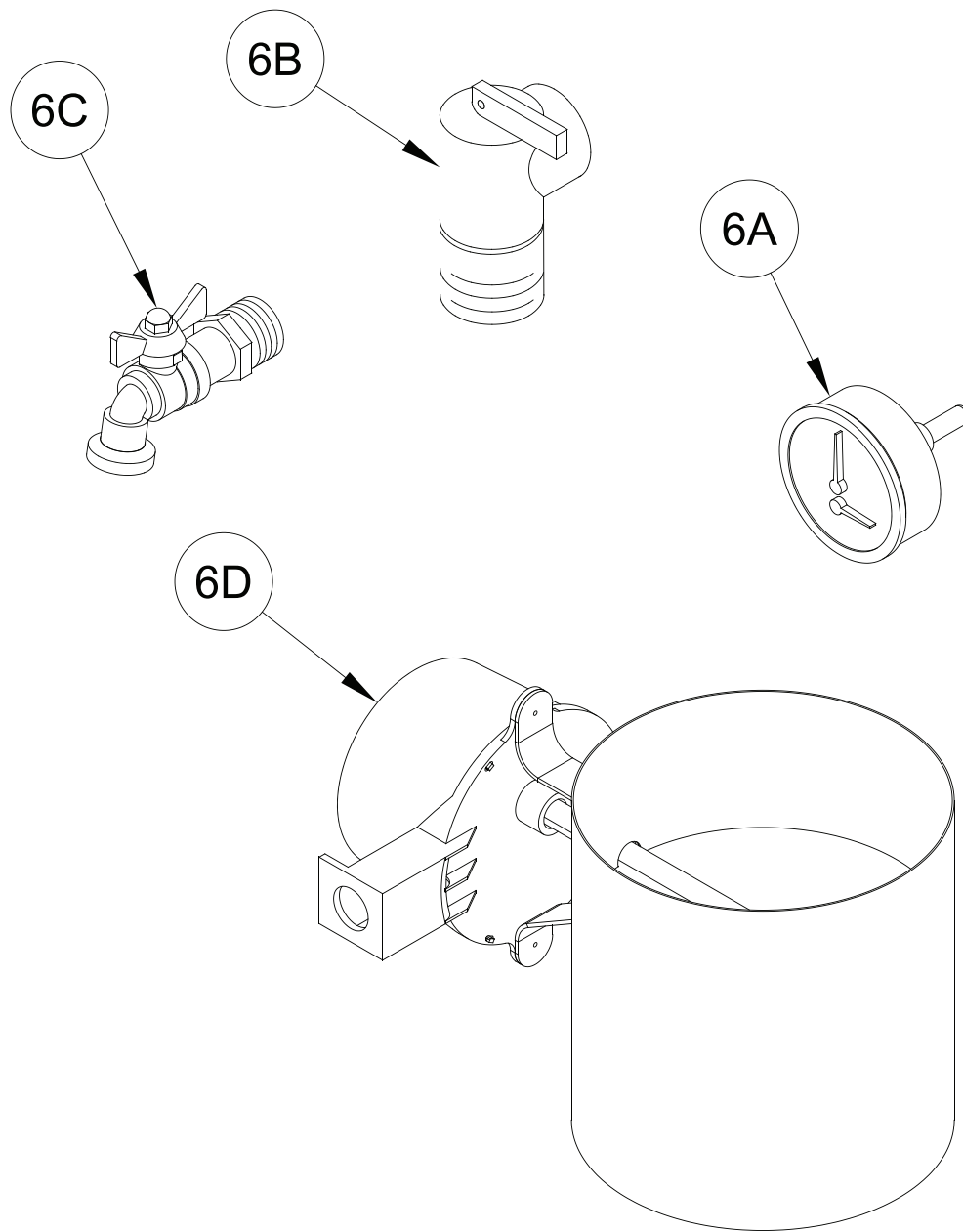
Key No.	Description	[Quantity] Part Number									
		FORCE02	FORCE03	FORCE04	FORCE05	FORCE06	FORCE07	FORCE08	FORCE09	FORCE10	
4A	HydroStat 3200	105943-01									
4B	Honeywell S8610M EI Module	100958-02									
4C	Temp/LWCO Sensor	105944-03									

XI. Repair Parts (continued)



Key No.	Description	[Quantity] Part Number								
		FORCE02	FORCE03	FORCE04	FORCE05	FORCE06	FORCE07	FORCE08	FORCE09	FORCE10
5	Complete Jacket Kit	105519-02	105519-03	105519-04	105519-05	105519-06	105519-07	105519-08	105519-09	105519-10
	Jacket Horizontal Clip (not shown)	7041920								
	Jacket Vertical Clip (not shown)	7041921								

XI. Repair Parts (continued)



Key No.	Description	[Quantity] Part Number									
		FORCE02	FORCE03	FORCE04	FORCE05	FORCE06	FORCE07	FORCE08	FORCE09	FORCE10	
6A	Temperature/ Pressure Gauge	100282-04	100282-01								
6B	30 PSI Relief Valve	81660319									
6C	Drain Valve	806603061									
6D	Vent Damper	102284-01	102284-02	102284-03	102284-04	102284-05					
	Grundfos UPS 15-58 Circulator (not shown)	102805-02									
	Circulator Flange Kit 1-1/4" (not shown)	105640-01									

XI. Repair Parts (continued)

Common Replacement Parts (All Sizes)

Description	Part Number
HydroStat 3200	105943-01
Temp/LWCO HydroStat Sensor	105944-03
HydroLevel ElectroWell 4" Insulation Length	105310-01
HydroLevel ElectroWell 1" Insulation Length	105203-01
Honeywell S8610M EI Module	100958-01
Flame Rollout Switch	80160044
Blocked Vent Switch	80160157
Natural Gas Pilot Assembly - Honeywell Q3481B1206, 36" Lead	103704-01
Propane Gas Pilot Assembly - Honeywell Q3481B1420, 36" Lead	103705-01
½" Natural Gas Valve - Honeywell VR8204C3007	81660145
¾" Natural Gas Valve - Honeywell VR8304P4306	81660161
½" Propane Gas Valve - Honeywell VR8204C3015	81660146
¾" Propane Gas Valve - Honeywell VR8304P4314	81660160
Ground Wire for Pilot	6136054