

# INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FOR

# INDEPENDENCE® PV 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 IN_PVSNL_	Boiler Serial Number	Installation Date
Heating Contractor		Phone Number
Address		



The New York City Department of Buildings has approved the Independence® PV boiler: Approval No. MEA 154-93-E.

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

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

The following 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.**

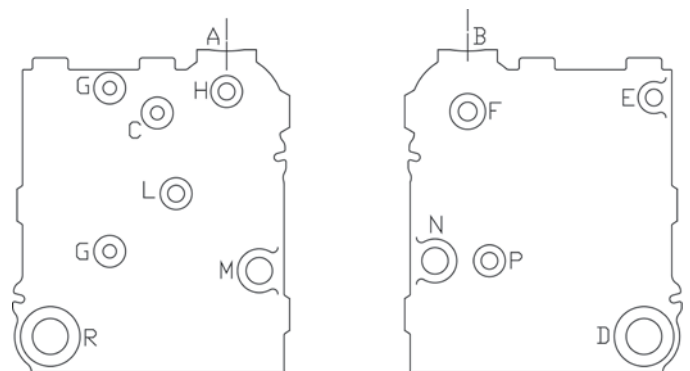
**Table 1: Dimensions and Clearances**

Boiler Model	Dimensions [inches]								Approx. Shipping Weight Lbs.
	Minimum Clearances from Combustible Materials [inches]								
	(A) Width	(B) Flue Connector	Left Side	Right Side	Front	Rear	Top	Vent	
IN3PV	14-1/2	4	18	6	Alcove	6	12	*	355
IN4PV	17-3/4	8-1/4							425
IN5PV	21	9-1/4							490
IN6PV	24-1/4	9-1/4							560

\* Vent pipe minimum clearance to combustible material is five (5) inches when vent is installed in a fully enclosed (chase) application or four (4) inches when vent is installed with at least one side open, similar to a joist bay application.

**Table 2: Purpose of Tappings**

Tapping	Size	IN3PV	IN4PV - IN6PV
A	2	Supply	Plugged
B	2	Plugged	Supply
C	1/2	Pressure Gauge (with 1/2 x 1/4 bushing)	
D	2	Drain Valve (with 2 x 3/4 bushing)	
E	3/4	Safety Valve	
F	1	Surface Blow-Off, Plugged	
G	1/2	Gauge Glass	
H	3/4	Limit (with 3/4 x 1/4 bushing)	
L	3/4	Low Water Cut-Off	
M	1 1/4	Indirect Water Heater Return, Plugged	
N	1 1/4	Indirect Water Heater Supply, Plugged	
P	3/4	Indirect Water Heater Control, Plugged	
R	2	Return	



LEFT END SECTION      RIGHT END SECTION

**Figure 2: Tapping Locations**

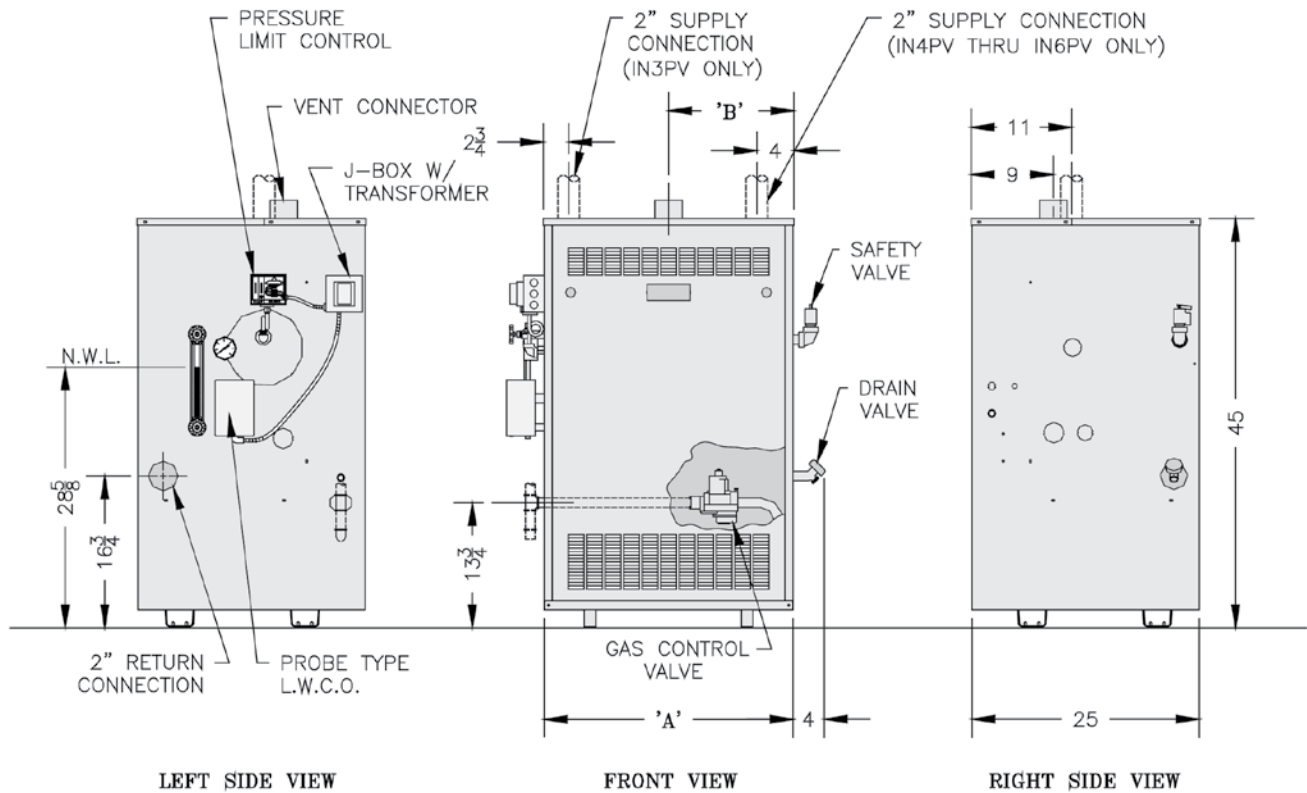


Figure 1: Elevation Views

## WARNING

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

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

This boiler must be properly vented.

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

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

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

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

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### WARNING

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

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

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

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

## I. Pre-Installation

- A.** Installation must conform to the requirements of the authority having jurisdiction. In the absence of such requirements, installation must conform to the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1. 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.
- B.** Boiler is design certified for installation on combustible flooring. The boiler must not be installed on carpeting.
- C.** Provide clearance between boiler jacket and combustible material in accordance with local fire ordinance. Refer to Table 1 for minimum listed clearance from combustible material. Recommended service clearance is 24 inches from left side, right side and front. Service clearances may be reduced to minimum clearances to combustible materials.
- D.** Install on level floor. For basement installation provide solid base, such as concrete, if floor is not level or if water may be encountered on floor around boiler.
- E.** Protect gas ignition system components from water (dripping, spraying, rain, etc.) during boiler operation and service (circulator replacement, condensate trap, control replacement, etc.).
- F.** Provide combustion and ventilation air in accordance with applicable provisions of local building codes, or *National Fuel Gas Code*, NFPA 54/ANSI Z223.1, Air for Combustion and Ventilation.
- The following guideline is based on the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1.
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 ft<sup>3</sup> per 1,000 Btuh, space is considered an *unconfined space*.
    - b. If result is less than 50 ft<sup>3</sup> 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

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## I. Pre-Installation (continued)

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- 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:
    - 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.

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

### CAUTION

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

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## II. Unpack Boiler

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### 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. Steam Piping and Trim

#### WARNING

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

Do not use softened water in steam boilers. Accelerated boiler corrosion will result. Tie in fresh water supply to the boiler upstream of a water softener.

Oxygen contamination of boiler water will cause corrosion of iron and steel boiler components, and can lead to boiler failure. U.S. Boiler Company's Standard Warranty does not cover problems caused by oxygen contamination of boiler water or scale (lime) build-up caused by frequent addition of water.

#### NOTICE

Before using copper for steam piping, consider the following characteristics of copper piping:

- 1) high coefficient of thermal expansion can induce mechanical stresses and cause expansion/contraction noises if not accounted for in the piping system design and installation,
- 2) high heat transfer rate (heat loss) of uninsulated copper piping must be included in the normal piping and pickup factors used to size the boiler,
- 3) soldering or brazing pastes and fluxes that end up in the system can cause poor heat transfer, surging, an unsteady water line and wet steam if not thoroughly removed during the boil out procedure and,
- 4) galvanic corrosion of the adjoining metal may occur due to dissimilar metals in certain water chemistries if dielectric unions are not used.

- 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 sources by repairing system leaks, repairing fittings, and using nonpermeable materials in distribution system.
- B. Connect system supply and return piping to boiler. Refer to Figure 4 for IN3PV or Figure 5 for IN4PV, IN5PV and IN6PV. Also consult Residential Hydronic Heating Installation and Design I=B=R Guide. Maintain minimum ½ inch clearance from combustible materials.
- C. Install Safety Valve in Tapping "E". See Figure 3. Use ¾ NPT x 3" nipple and ¾ NPT elbow provided. Safety Valve must be installed with spindle in vertical position.

#### WARNING

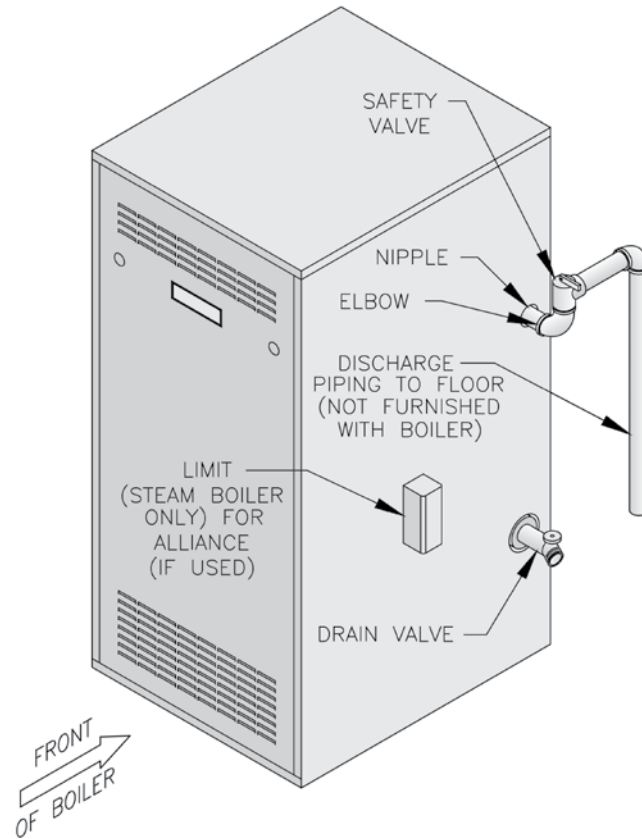
Installation is not complete unless a safety valve is installed.

#### WARNING

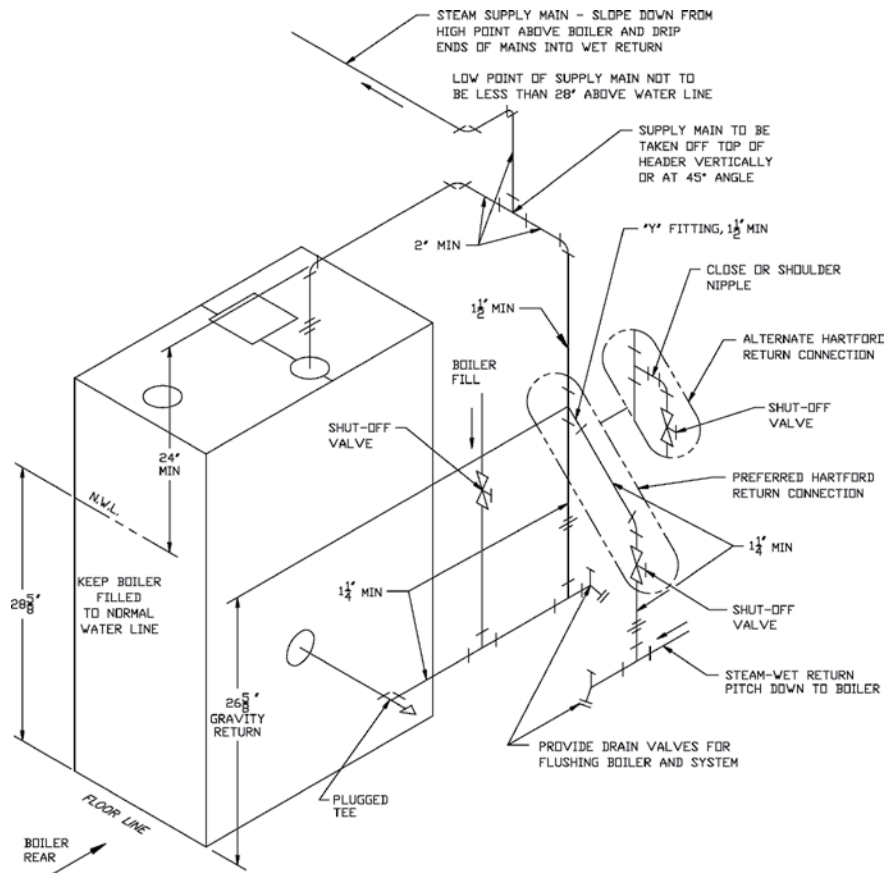
Safety valve discharge piping must be piped near floor to eliminate potential of severe burns. DO NOT pipe in any area where freezing could occur. DO NOT install any shut-off valves.

- D. Install Drain Valve in Tapping "D". See Figure 3. Use 2 NPT x ¾ NPT bushing provided.
- E. Alliance SL™ Indirect Water Heater (if used). Refer to Alliance SL™ Installation, Operating and Service Instructions for additional information.
1. Supply and Return Piping. Connect supply piping to Tapping "N" and return piping to Tapping "M". See Figure 2. Install zone circulator and strainer in supply piping. Install check valve to prevent gravity circulation of boiler water.
  2. Limit. Install temperature limit control (Honeywell L4006A or equal) in Tapping "P". See Figure 3. Set at 180°F to prevent steam production during non-space heating periods.

### III. Steam Piping and Trim (continued)



**Figure 3: Trim Installation**



**Figure 4: Steam Piping, IN3PV**

### III. Steam Piping and Trim (continued)

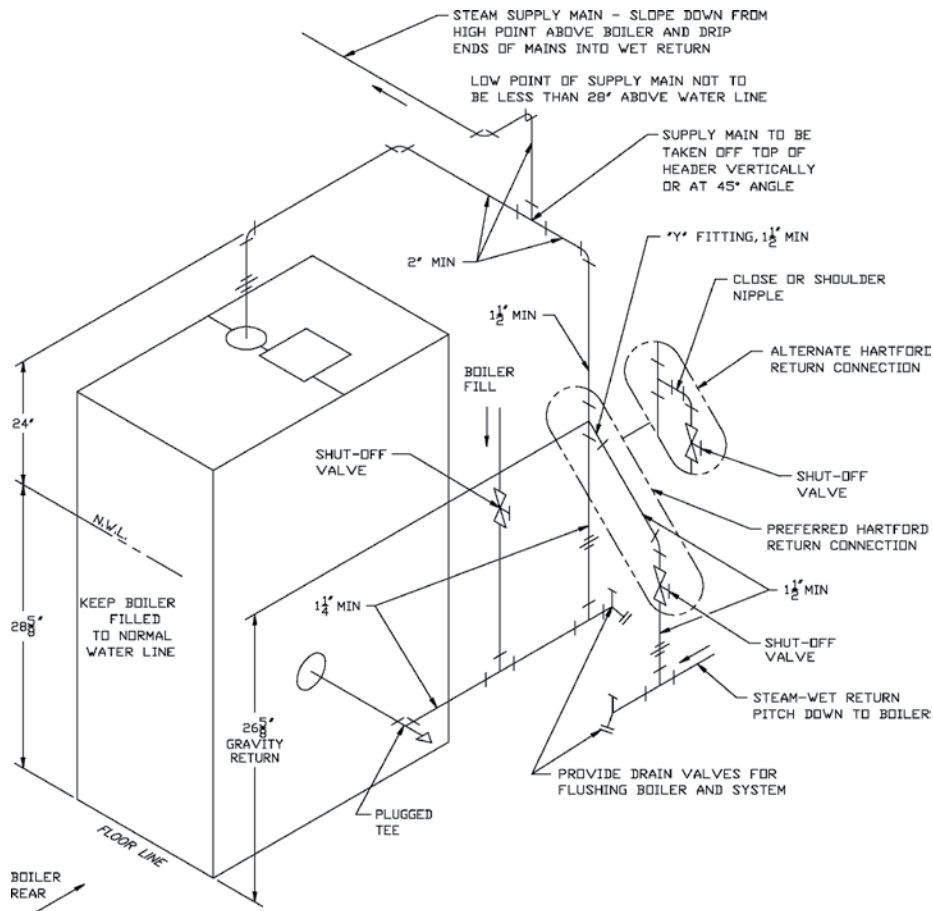


Figure 5: Steam Piping, IN4PV, IN5PV and IN6PV

### 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 1/2 psig. Actual point of delivery pressure may be less; contact gas supplier for additional information. Minimum gas valve inlet pressure for natural gas is 4.5 inch w.c.

2. Maximum gas demand. Table 3 lists boiler input rate. Also consider existing and expected future gas utilization equipment (i.e. water heater, cooking equipment).
3. Length of piping and number of fittings. Refer to Table 4 for maximum capacity of Schedule 40 pipe carrying natural gas. Table 5 lists equivalent pipe length for standard fittings.
4. Specific gravity of gas. Corrections for the specific gravity of natural gas can be found in Table 6.

For materials or conditions other than those listed above, refer to *National Fuel Gas Code*, NFPA 54/ANSI Z223.1, or size system using standard engineering methods acceptable to authority having jurisdiction.

Table 3: Rated Input

Boiler Model Number	Input Rate [cubic feet per hour]	Gas Connection Size
	Natural Gas	
IN3PV	62	1/2
IN4PV	105	1/2
IN5PV	140	1/2
IN6PV	175	1/2

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*, NFPA 54/ANSI Z223.1.



## IV. Gas Piping (continued)

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 and outside jacket. 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.

**Table 4: Maximum Capacity of Schedule 40 Pipe in CFH of Natural Gas For Gas Pressures of 0.5 psig or Less**

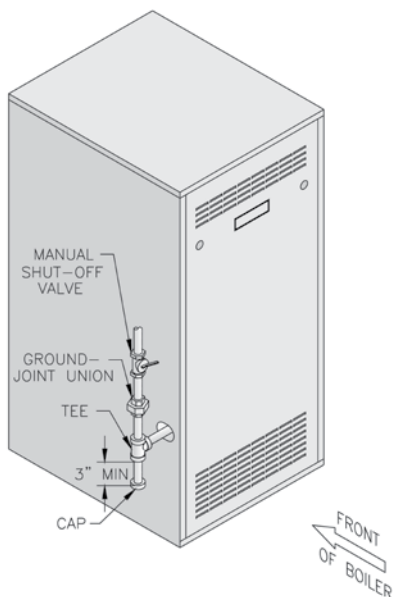
Length [Feet]	0.3 inch w.c. Pressure Drop				0.5 inch w.c. Pressure Drop			
	½	¾	1	1¼	½	¾	1	1¼
10	132	278	520	1,050	175	360	680	1,400
20	92	190	350	730	120	250	465	950
30	73	152	285	590	97	200	375	770
40	63	130	245	500	82	170	320	660
50	56	115	215	440	73	151	285	580
60	50	105	195	400	66	138	260	530
70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

**Table 5: Fitting Equivalent Lengths**

Fitting	Nominal Pipe Size			
	½	¾	1	1¼
45° Ell	0.7	1.0	1.2	1.6
90° Ell	1.6	2.1	2.6	3.5
Tee (As Elbow)	3.1	4.1	5.2	6.9

**Table 6: Specific Gravity Correction Factors for Natural Gas**

Specific Gravity	Multiplier
0.55	1.40
0.60	1.00
0.65	0.96
0.70	0.93
0.75	0.90
0.80	0.87



**Figure 6: Recommended Gas Piping**

- 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 ½ psig, boiler and its individual shutoff valve must be disconnected from gas supply piping. For testing at ½ 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.

## V. Venting

### NOTICE

The gasketed vent system components pictured below in Figure A are being phased in and each vent component is interchangeable with the previously supplied gasket-less venting components. The newer vent components are generally quicker and easier to join, as they do not require the sealant application and their clamp bands are attached.

In the event a gasketed vent component and a gasket-less vent component must be interconnected, follow the instructions associated with Figure 8B or 8C. The two guiding principles of these instructions are as follows:

- 1) Any joining of vent components that involves at least one gasket-less vent component always requires the sealant application.
- 2) The female end of a gasket-less vent component always requires a clamp band, regardless of the design of the mating male vent component.

Each gasket-less vent component is supplied with a clamp band and sealant.

A Vent Transition Kit, part number 6116302, is available that contains one clamp band and one 3 ounce tube of sealant.

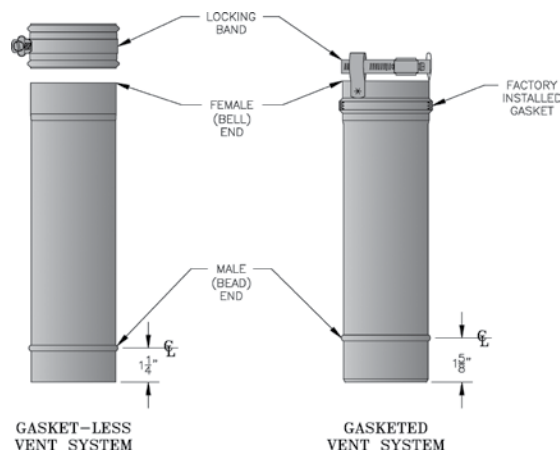


Figure A: U.S. Boiler Company Vent

#### A. General Guidelines

1. Vent system installation must be in accordance with *National Fuel Gas Code*, NFPA 54/ANSI Z221.3, Venting of Equipment, or applicable provisions of local building codes. Contact local building or fire officials about restrictions and installation inspection in your area.
2. This boiler requires a Special Gas Vent. The product is designed to use supplied AL 29-4C® Stainless Steel vent system components. The following manufacturer's offer similar AL 29-4C® components and are approved for use with this product: Heat-Fab - Saf-T-Vent (800-772-0739); Flex-L International - Star-34 (800-561-1980); Protech Systems, Inc. - FasNSeal™ (800-766-3473); and Z-Flex U. S., Inc. - Z-Vent (800-654-5600). The use of these alternate manufacturer's venting systems will require adapters to connect to the supplied vent connector and vent terminal. These adapters are not supplied with this boiler and should be obtained from the supplier of the alternate manufacturer's venting system. See Table 8 for complete parts list.

length of vent pipe (total length of straight pipe plus equivalent length of fittings). Maximum vent length is listed in Table 7. Do not exceed maximum lengths. Minimum vent length is 8 feet. Table 8 lists equivalent length for fittings. Do not include Vent Terminal in equivalent feet calculation.

Table 7: Maximum Equivalent Vent Length

IN3PV	IN4PV	IN5PV	IN6PV
45	35	35	35

4. Do not install venting system components on the exterior of the building except as specifically required by these instructions.

**B. Removal of Existing Boiler.** For installations not involving the replacement of an existing boiler, proceed to Step C.

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 remaining appliances. At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation:

1. Seal any unused openings in the common venting system.

### WARNING

**Do not use this boiler with galvanized, 304 or 316 stainless steel or any other non AL29-4C® based vent systems.**

3. Vent length restrictions are based on equivalent

## V. Venting (continued)

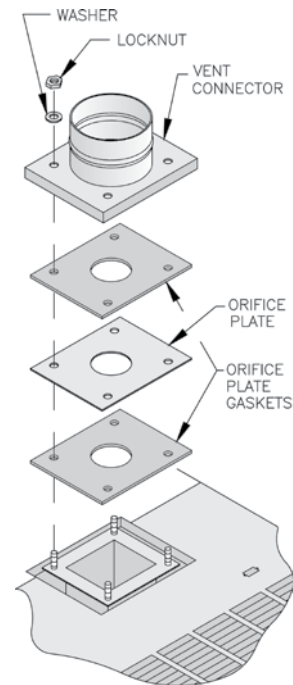
**Table 8: Vent System Components**

Vent System Component	Part Number	Equivalent Feet of Pipe
3" Dia. Pipe x 1 Ft	8116296U	1
3" Dia. Pipe x 3 Ft	8116298U	3
3" Dia. Pipe x 5 Ft	8116300U	5
3" Dia. Pipe x Adjustable	8116319U	Equal to Installed Length (1.1 to 1.7)
3" Dia. 90° Elbow	8116294U	5
3" Dia. 45° Elbow	8116292U	5
3" Dia. Horizontal Drain Tee	8116302U	½
3" Dia. Vertical Drain Tee	8116304U	7½
3" Single Wall Thimble	8116116	---
3" Double Wall Thimble	103877-01	---

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 drafthood 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 conditions of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms with the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 in the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1.

### C. Install Vent Connector.

1. Remove vent connector from vent accessory carton.
2. Remove gaskets, orifice plate and hardware from blower outlet flange.
3. Assemble orifice plate gaskets, orifice plate, and vent connector. See Figure 7.
4. Secure vent connector with washers and locknuts. Do not overtighten.



**Figure 7: Vent Connector Installation**

### D. Install Vent Pipe, General.

1. Plan venting system to avoid possible contact with plumbing or electrical wires. Start at vent connector. Work toward vent terminal.
2. Use non-combustible ¾ inch pipe strap to support horizontal runs and maintain vent location and slope while preventing sags in pipe. Do not restrict thermal expansion or movement. Maximum support spacing is 5 feet. Do not penetrate any part of the venting system with fasteners.
3. Provide and maintain minimum clearances to combustible materials. Use single wall thimble (Part No. 8116116) when penetrating combustible wall. Other wall thimble manufacturers are American Metal Products, Hart & Cooley, and Metal Fab.
4. Once a vent pipe manufacturer and system is chosen never mix and match vent systems.
5. If a non-standard length pipe is required, the use of the adjustable length pipe (P/N 8116319U) is recommended to complete a non-standard pipe length. This pipe requires a minimum installed

## V. Venting (continued)

length of 12¾ inch and can adjust across a 7 inch gap up to a maximum of 19¾ inch long. (Note for the adjustable pipe the installed length should be measured from the centerline of the bead on the male end of the first pipe to the end of the female pipe excluding the locking band of the second pipe with a single gasket.)

### WARNING

**Never exceed maximum installed length of 19¾ inches for adjustable length pipe.  
Risk of flue gas leakage is possible.**

Only in the event the adjustable length pipe is not sufficient a standard length pipe may be cut using the following procedure.

Carefully cut pipe to length using a hacksaw with minimum 32 teeth per inch or circular saw with metal abrasive wheel. Remove male (bead) end only – female (bell) end accepts next fitting or pipe.

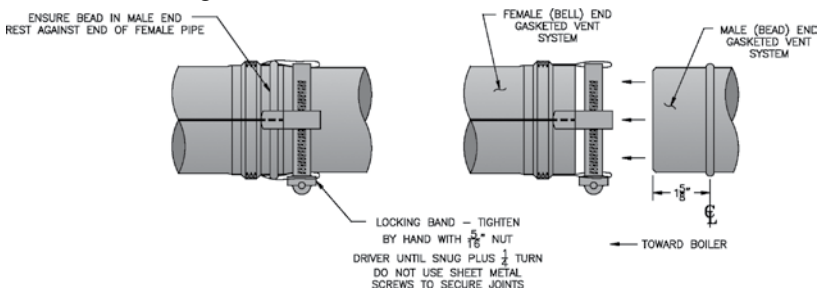
### NOTICE

**Cut must be square with pipe and filed or sanded smooth before joining. Carefully ensure roundness of cut pipe by hand with gloves before installing. Seal joint with RTV specified in this manual.**

6. Seal all U.S. Boiler Company Gasket-Less vent, U.S. Boiler Company mixed vent (Gasket-Less and Gasketed) and field cut joints using Dow Corning Silastic 732 RTV, Dow Corning Silastic 736 RTV, GE RTV106, Polybac #500 RTV, Sil-bond RTV 4500 (Acetoxy) and Sil-bond RTV 6500. Do not use other adhesives or sealants.

### E. Install Vent Pipe, U.S. Boiler Company Gasketed Vent System.

1. Procedure for Joining U.S. Boiler Company Gasketed Vent Pipe and Fittings. See Figure 8A.
  - a. Wipe the male end of each joint using an alcohol pad to remove any dirt and grease.
  - b. Align weld seams in pipes and use a slight twisting motion to FULLY insert male end into



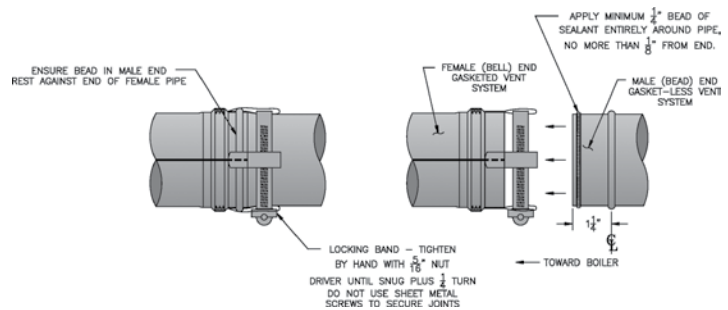
**Figure 8A: U.S. Boiler Company Gasketed Vent Joint Detail**

female end of joint. Ensure bead in male end of pipe is below locking band and rest against the end of the female pipe. Verify the factory-installed gasket is not dislodged or cut.

- c. Tighten locking band by HAND with a 5/16" nut driver until snug plus ¼ turn. DO NOT SECURE JOINTS WITH SHEET METAL SCREWS OR POP RIVETS. DO NOT PUNCTURE THE VENT SYSTEM!
- d. Once the installation is complete, operate boiler and inspect all joints to ensure that flue gases and/or liquid condensate will not escape.

### F. Install Vent Pipe, U.S. Boiler Company Gasket-Less & Gasketed Vent System.

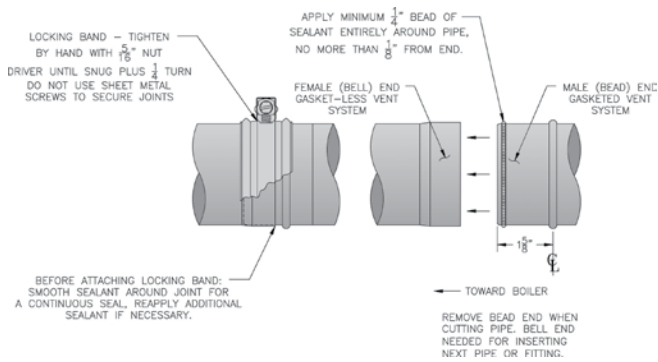
1. Procedure for joining the male end of U.S. Boiler Company Gasket-Less Vent with the female end of U.S. Boiler Company Gasketed Vent. See Figure 8B.



**Figure 8B: U.S. Boiler Company Gasket-Less Male and Gasketed Female Vent Joint Detail**

- a. Clean the male end of each joint using an alcohol pad to remove any dirt and grease.
- b. Apply a continuous ¼ inch bead of sealant around male end of joint no more than 1/8 inch from end.
- c. Align weld seams in pipes and use a slight twisting motion to FULLY insert male end into female end of joint. Ensure bead in male end of pipe is below locking band and rest against the end of the female pipe. Verify the factory-installed gasket is not dislodged or cut.
- d. Smooth sealant around joint for a continuous seal. Reapply sealant if necessary.
- e. Tighten locking band by HAND with a 5/16" nut driver until snug plus ¼ turn. DO NOT SECURE JOINTS WITH SHEET METAL SCREWS OR POP RIVETS. DO NOT PUNCTURE THE VENT SYSTEM!
- f. Once the installation is complete, operate boiler and inspect all joints to ensure that flue gases and/or liquid condensate will not escape.

## V. Venting (continued)

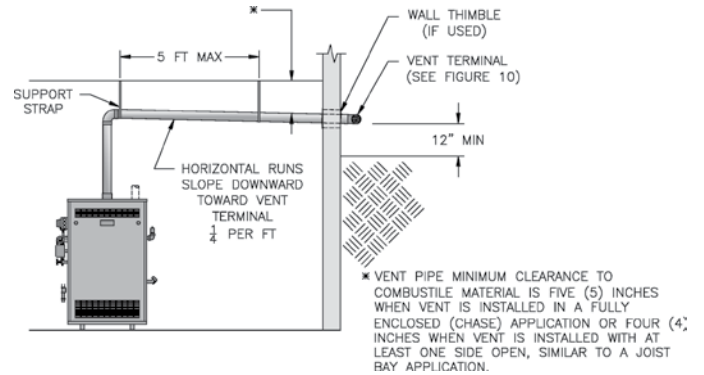


**Figure 8C: U.S. Boiler Company Gasket-Less Female and Gasketed Male Vent Joint Detail**

2. Procedure for joining the female end of U.S. Boiler Company Gasket-Less Vent with the male end of U.S. Boiler Company Gasketed Vent. See Figure 8C.
  - a. Clean joints of pipe or fittings using an alcohol pad to remove any dirt and grease.
  - b. Slip a locking band over female (bell) end of pipe/fitting.
  - c. Apply a continuous  $\frac{1}{4}$  inch bead of sealant around male end of joint no more than  $\frac{1}{8}$  inch from end.
  - d. Align weld seams in pipes and use a slight twisting motion to FULLY insert male end into female end of joint.
  - e. Smooth sealant around joint for a continuous seal. Reapply sealant if necessary.
  - f. Slip the locking band over joint and align closest bead in locking band with bead in male end of pipe.
  - g. Tighten locking band by HAND with a  $\frac{5}{16}$ " nut driver until snug plus  $\frac{1}{4}$  turn. DO NOT SECURE JOINTS WITH SHEET METAL SCREWS OR POP RIVETS. DO NOT PUNCTURE THE VENT SYSTEM!
  - h. Once the installation is complete, operate boiler and inspect all joints to ensure that flue gases and/or liquid condensate will not escape.

### G. Horizontal (Through Wall) Vent Installation.

1. Recommended Installation: Maintain minimum  $\frac{1}{4}$  inch per foot slope in horizontal runs. Slope toward vent terminal. Position weld seams in vent pipes in all horizontal runs at the top to avoid condensate from lying on the seams. See Figure 9.
2. Alternate Installation: Maintain minimum  $\frac{1}{4}$  inch per foot slope in horizontal runs. Slope toward boiler. Install a horizontal condensate drain tee after first elbow. Position seams in vent pipes in horizontal runs at top to avoid condensate from lying on the seams.



**Figure 9: Horizontal Vent Installation**

## CAUTION

**Moisture and ice may form on surfaces around vent terminal. To prevent deterioration, surfaces should be in good repair (sealed, painted etc.)**

3. Vent terminal location restricted per following:
  - a. Minimum 12 inches above grade or normally expected snow accumulation level, or 7 feet above grade if located adjacent to public walkway. Do not install over public walkway where local experience indicates condensate or vapor from Category III appliances creates a nuisance or hazard .
  - b. Minimum 3 feet above any forced air inlet located within 10 feet.
  - c. Minimum 4 feet below, 4 feet horizontally from, or 1 foot above any door, window, or gravity air inlet.
  - d. Minimum 4 feet horizontally from electric meters, gas meters, regulators, and relief valves.
  - e. Minimum 12 inches from overhang or corner.
4. Use single wall thimble when passing through combustible outside wall (thimble use optional for noncombustible wall). Insert thimble through wall from outside. Secure outside flange to wall with nails or screws, and seal with adhesive material. Install inside flange to inside wall, secure with nails or screws, and seal with adhesive material.
5. For noncombustible wall when thimble is not used, size opening such that female (bell) end with locking band attached cannot pass through.
6. Join vent terminal to vent pipe. Locate vent pipe such that bell/locking band is flush with outside wall (or outside flange of thimble, if used) when joined to inside vent piping. See Figure 10.
7. Insert vent pipe through thimble/opening from outside and join to vent system. Apply sealant between vent pipe and opening/thimble to provide weathertight seal.

## V. Venting (continued)

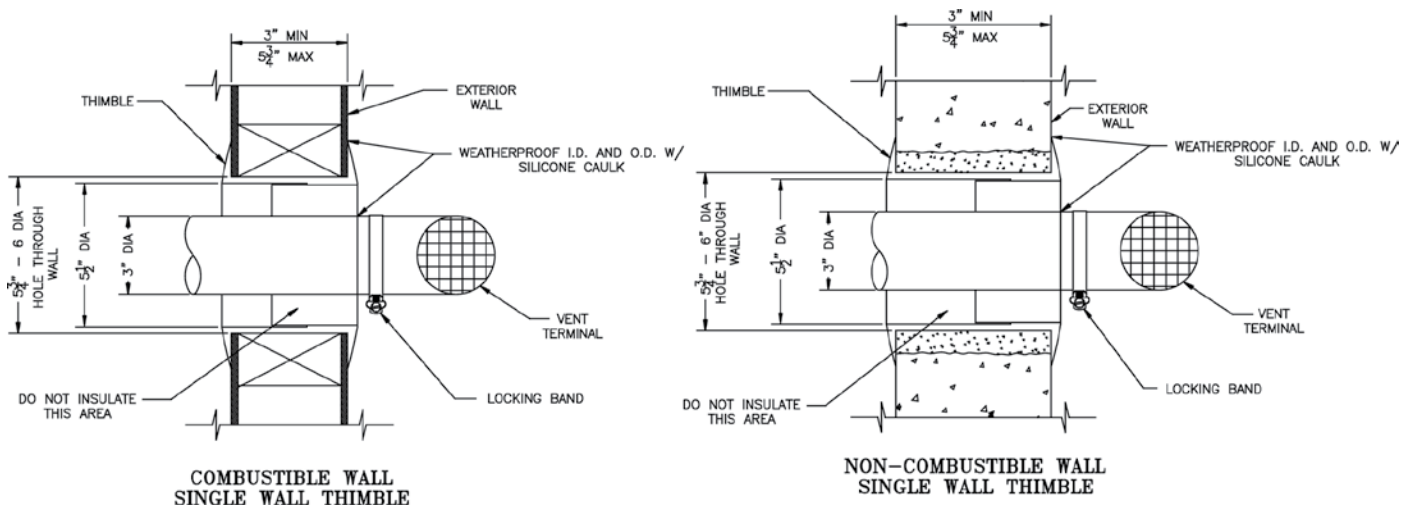


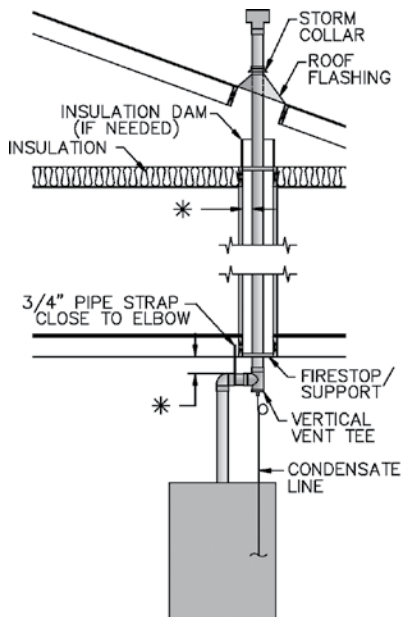
Figure 10: Horizontal Vent Terminal

## H. Vertical (Through Roof) Vent Installation

1. Install vertical vent drain tee. See Figures 11 and 12. Attach tee directly to elbow or horizontal pipe from elbow.
2. Slope horizontal runs minimum 1/4 inch per foot. Slope toward vertical vent drain tee. Position weld seams in vent pipes in all horizontal runs at the top to avoid condensate from lying on the seams.
3. Install firestops at floor and ceiling where vent passes through floor, ceiling, or framed wall. The firestop must close the floor or ceiling opening between vent pipe and structure.
4. Enclose vent passing through unoccupied or occupied spaces above the boiler with materials having a fire resistance rating at least equal to the rating of adjoining floor or ceiling. Maintain minimum clearance to combustible materials.

Note: For one- or two-family dwellings fire resistance rating requirement may not need to be met, but is recommended.

5. Whenever possible install vent straight through roof. Refer to Figure 13 if offset is necessary. Maintain minimum clearance to combustible materials.
6. Install Vent Terminal. See Figure 14.
  - a. Locate roof opening to allow vertical vent penetration. Size opening to maintain minimum clearance from combustible materials.
  - b. Install roof flashing.
  - c. Extend vent pipe to maintain minimum height [H] above roof as specified in Table 9. Vent terminal must be minimum 2 feet horizontally from roof surface and minimum 8 feet from any vertical wall or similar obstruction. Provide bracing as required in Table 9.

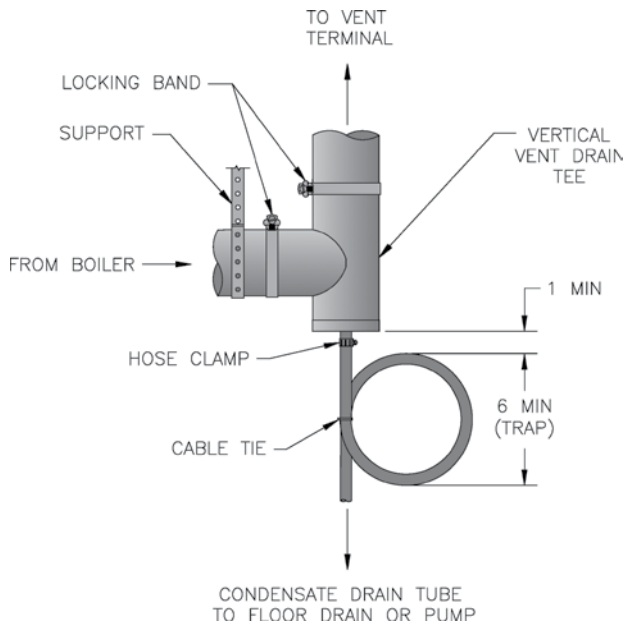


\* VENT PIPE MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL IS FIVE (5) INCHES WHEN VENT IS INSTALLED IN A FULLY ENCLOSED (CHASE) APPLICATION OR FOUR (4) INCHES WHEN VENT IS INSTALLED WITH AT LEAST ONE SIDE OPEN, SIMILAR TO A JOIST BAY APPLICATION.

Figure 11: Vertical Vent Installation

## V. Venting (continued)

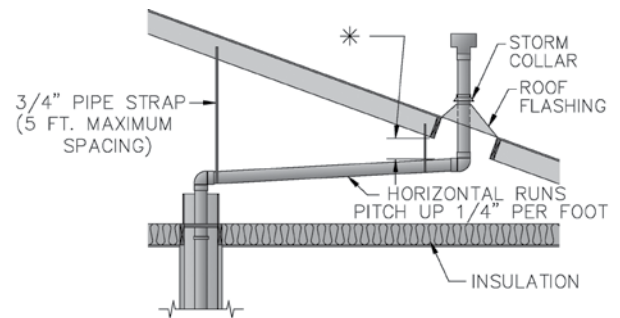
- d. Install storm collar on vent pipe immediately above flashing. Apply sealant between vent pipe and storm collar.
  - e. Attach Vent Terminal.
7. Install condensate drain line. Use 3/8 inch i.d. high temperature flexible tubing such as silicone rubber or EPDM. See Figure 12.
    - a. Form condensate trap with 6 inch diameter loop. Secure loop with plastic cable tie. Fill with water.
    - b. Secure to vertical vent tee with hose clamp or plastic cable tie.
    - c. Run condensate drain line to floor drain or condensate pump. Condensate disposal must be acceptable to authority having jurisdiction.



**Figure 12: Vertical Vent Tee Installation**

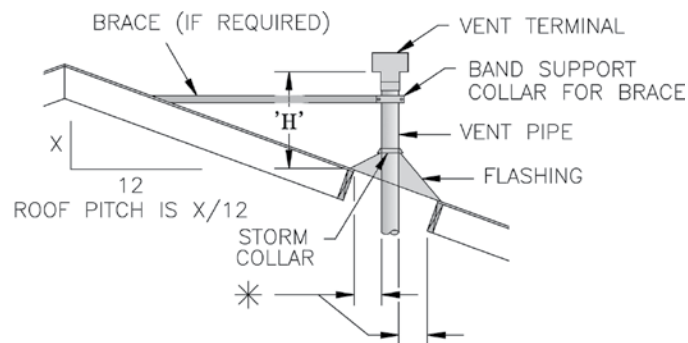
**Table 9: Minimum Vent Height Above Roof**

Roof Pitch	Minimum Height [H]
Flat to 6/12	1 ft.
Over 6/12 to 7/12	1 ft. 3 in.
Over 7/12 to 8/12	1 ft. 6 in.
Over 8/12 to 9/12	2 in.
Over 9/12 to 10/12	2 ft. 6 in.
Over 10/12 to 11/12	3 ft. 3 in.
Over 11/12 to 12/12	4 ft.
Over 12/12 to 14/12	5 ft.
Over 14/12 to 16/12	6 ft.
Over 16/12 to 18/12	7 ft.
Over 18/12 to 20/12	7 ft. 6 in.
Over 20/12 to 18/12	8 ft.



\* VENT PIPE MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL IS FIVE (5) INCHES WHEN VENT IS INSTALLED IN A FULLY ENCLOSED (CHASE) APPLICATION OR FOUR (4) INCHES WHEN VENT IS INSTALLED WITH AT LEAST ONE SIDE OPEN, SIMILAR TO A JOIST BAY APPLICATION.

**Figure 13: Attic Offset**



\* VENT PIPE MINIMUM CLEARANCE TO COMBUSTIBLE MATERIAL IS FIVE (5) INCHES WHEN VENT IS INSTALLED IN A FULLY ENCLOSED (CHASE) APPLICATION OR FOUR (4) INCHES WHEN VENT IS INSTALLED WITH AT LEAST ONE SIDE OPEN, SIMILAR TO A JOIST BAY APPLICATION.

**Figure 14: Vertical Vent Termination**

## VI. Electrical

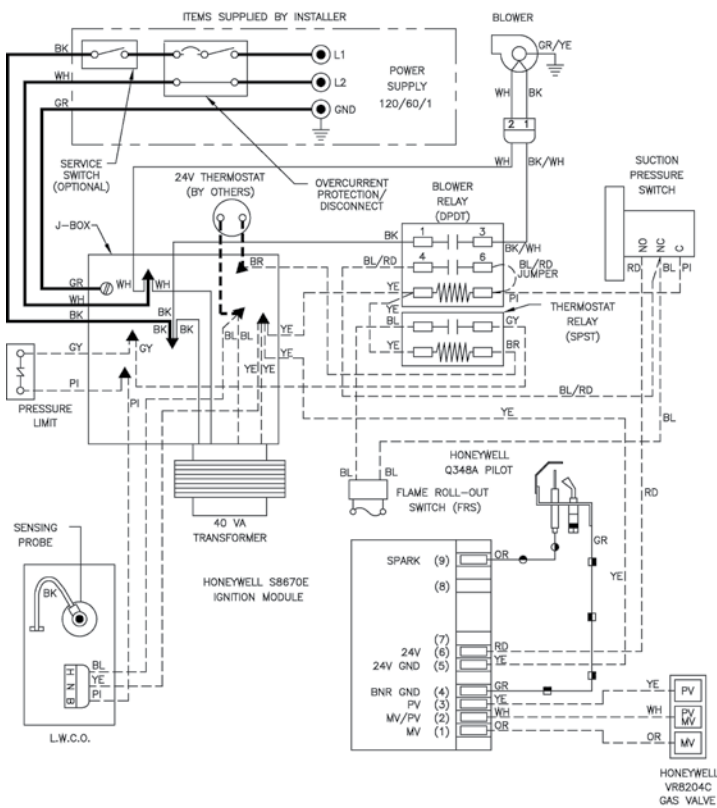
- A. General** Install wiring and ground boiler in accordance with requirements of authority having jurisdiction, or in absence of such requirements the *National Electrical Code*, ANSI/NFPA 70.
- B. Install thermostat.** Locate on inside wall approximately 4 feet above floor. Do not install on outside 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 thermostat.** Remove transformer from junction box. Provide Class II circuit between thermostat and boiler. Connect circuit to blue wires to provide power to thermostat. Connect circuit to brown wire to control boiler operation. Set thermostat heat anticipator to 0.4 amps. See Figure 15.

- D. Alliance SL™ Indirect Water Heater (if used)** See Figure 15, Ladder Diagram.

1. Attach extension junction box to junction box.
2. Provide two wire circuit between junction box and temperature limit control (See Section III: Steam Piping and Trim, Paragraph E.2). Use one red and one orange wire if possible. Refer to Alliance SL™ Installation, Operating and Service Instructions.

- E. 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. Connect circuit to black and white wires and green ground screw. A service switch is recommended and may be required by some local jurisdictions. See Figure 15.

- F. Mount transformer on junction box.**

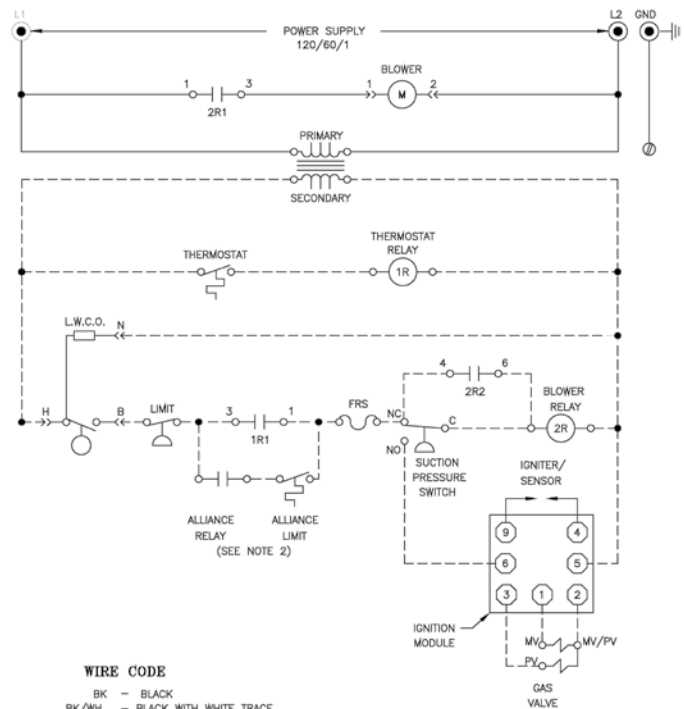


### SCHEMATIC DIAGRAM LEGEND

- LOW VOLTAGE SIZE 18 AWG TYPE TEW/AWM STRANDED WIRE - 105°C
- LOW VOLTAGE SIZE 18/2 AWG POWER LIMITED CIRCUIT CABLE - 75-105°C
- LINE VOLTAGE SIZE 14 AWG TYPE TW OR TEW/AWM WIRE
- LINE VOLTAGE SIZE 18 AWG TYPE TW OR TEW/AWM WIRE
- IGNITER/SENSOR - HONEYWELL 394800-36 CABLE - 250°C
- GROUND - CONTINENTAL SRGX600 18 AWG WIRE - 200°C

### NOTES:

1. IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH WIRE AS SHOWN OR ITS EQUIVALENT.
2. ALLIANCE WATER HEATER CONTROLS SUPPLIED BY INSTALLER.



### WIRE CODE

- BK - BLACK
- BK/WH - BLACK WITH WHITE TRACE
- BL - BLUE
- BL/RD - BLUE WITH RED TRACE
- BR - BROWN
- GR - GREEN
- GR/YE - GREEN WITH YELLOW TRACE
- GY - GRAY
- OR - ORANGE
- PI - PINK
- RD - RED
- WH - WHITE
- YE - YELLOW

### LADDER DIAGRAM LEGEND

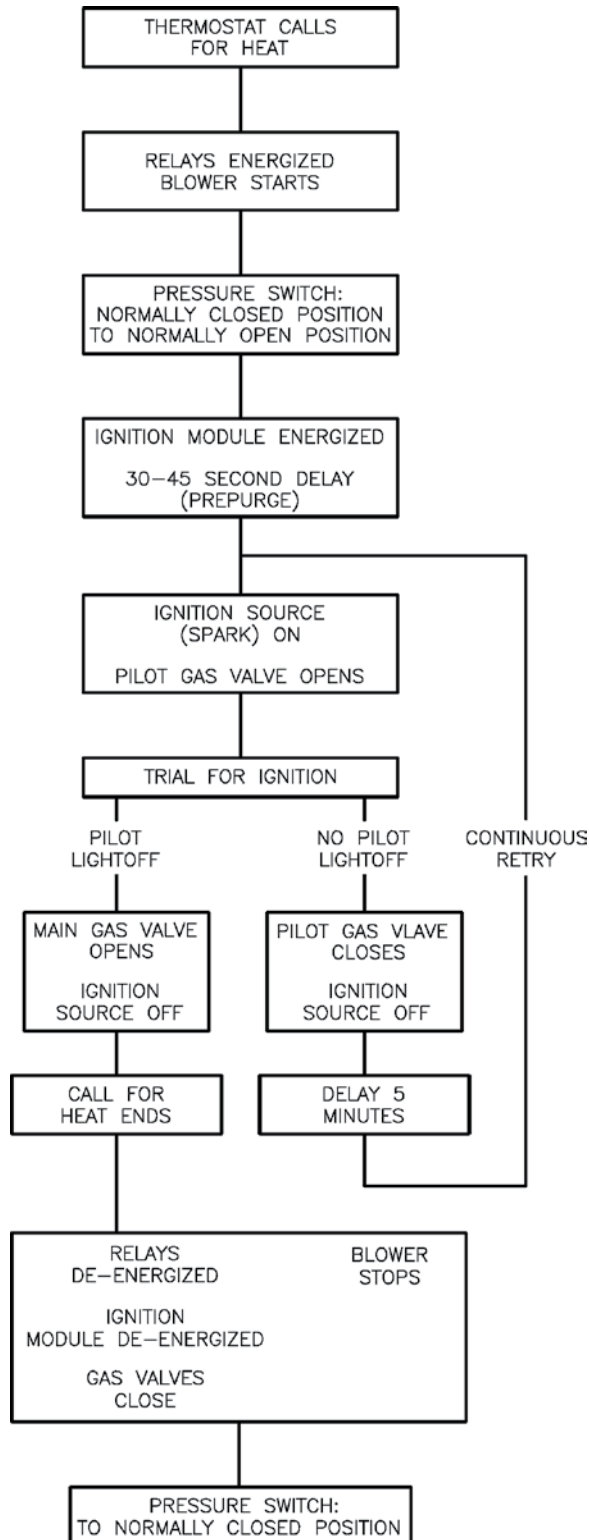
- 24V WIRING
- 120V WIRING

Figure 15: Wiring Diagram



## VII. System Start-up

**A. Safe operation** and other performance criteria were met with gas manifold and control assembly provided on boiler when boiler underwent tests specified in *American National Standard for Gas-Fired Low-Pressure Steam and Hot Water Boilers, ANSI Z21.13.*



**Figure 16: Sequence of Operation**

**B. Fill boiler** with water to normal water line.

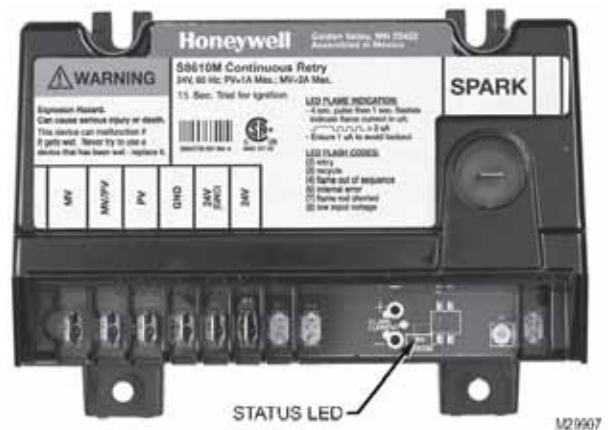
**C. Prepare to check operation.**

1. Obtain gas heating value (in Btu per cubic foot) from gas supplier.
2. Adjust limit. Set cutout pressure (MAIN scale) on the pressure limit for (1) PSI and differential pressure (DIFF.) for .5 PSI. These pressures may be varied to suit individual requirements of the system. See Figure 25.
3. Connect manometer to gas manifold. Use 1/8 NPT tapping provided.
4. Temporarily turn off all other gas-fired appliances.

**D. Follow Operating Instructions** to place boiler in operation. See Figure 21.

**E. Sequence of Operation** See Figure 16.

1. If boiler fails to operate properly, see Troubleshooting Tree on pages 30 and 31.
2. Enhanced Electronic Ignition Module with single Status LED indicator. See Figure 17A “Location of LED”.



**Figure 17A: Location of LED**

Table 10 “Ignition Module Terminal Cross-reference” cross-references the ignition module terminal designations to the ignition terminal numbers in the wiring ladder diagrams.

Table 11 “Green LED Status Codes” provides green LED status codes and recommended service action where applicable.

See Figure 18 for Troubleshooting Guide.

3. Flame Current Measurement Procedure

See Figure 17B “Measuring Pilot Flame Current with Micro-ammeter”.

## VII. System Start-up (continued)

**Table 10: 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	9

**Table 11: Green LED Status 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 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.

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

- Flash Fast: rapid blinking
- Heartbeat: Constant ½ second bright, ½ 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.

## VII. System Start-up (continued)

- a. 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 17B.
- b. Flame current **must be measured with pilot valve open/pilot lit but the main valve closed.**
- c. 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.
- d. The **minimum steady pilot flame signal must be 1  $\mu$ Amp** (microampere) DC (direct current).
- e. **For reliable operation** the flame current should be **2  $\mu$ Amp 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
  - 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 18 “Honeywell Electronic Ignition Troubleshooting Guide”

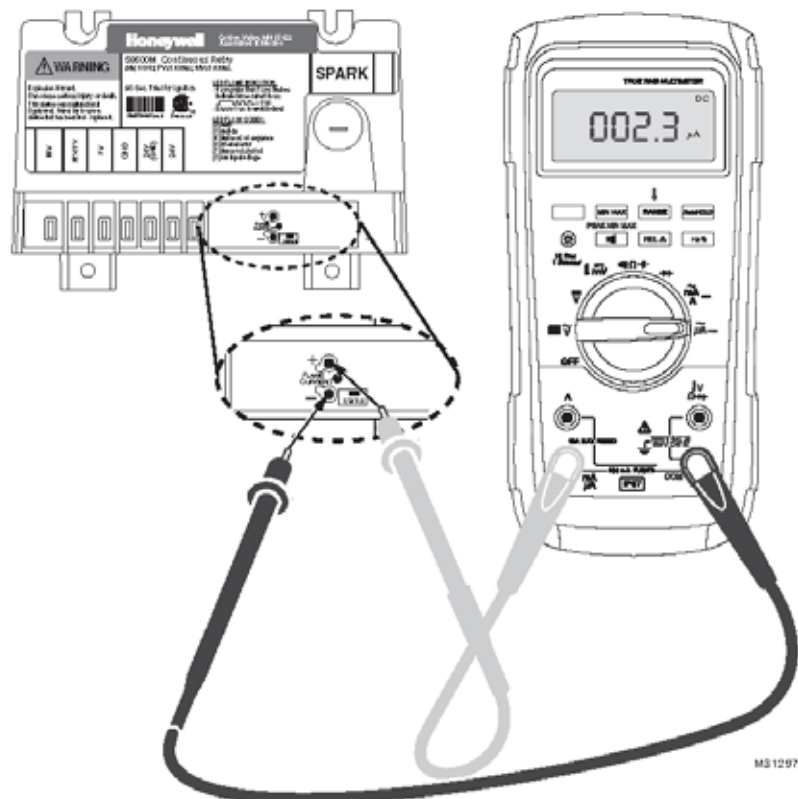


Figure 17B: Measuring Pilot Flame Current with Micro-ammeter

# VII. System Start-up (continued)

## Honeywell Electronic Ignition Troubleshooting Guide

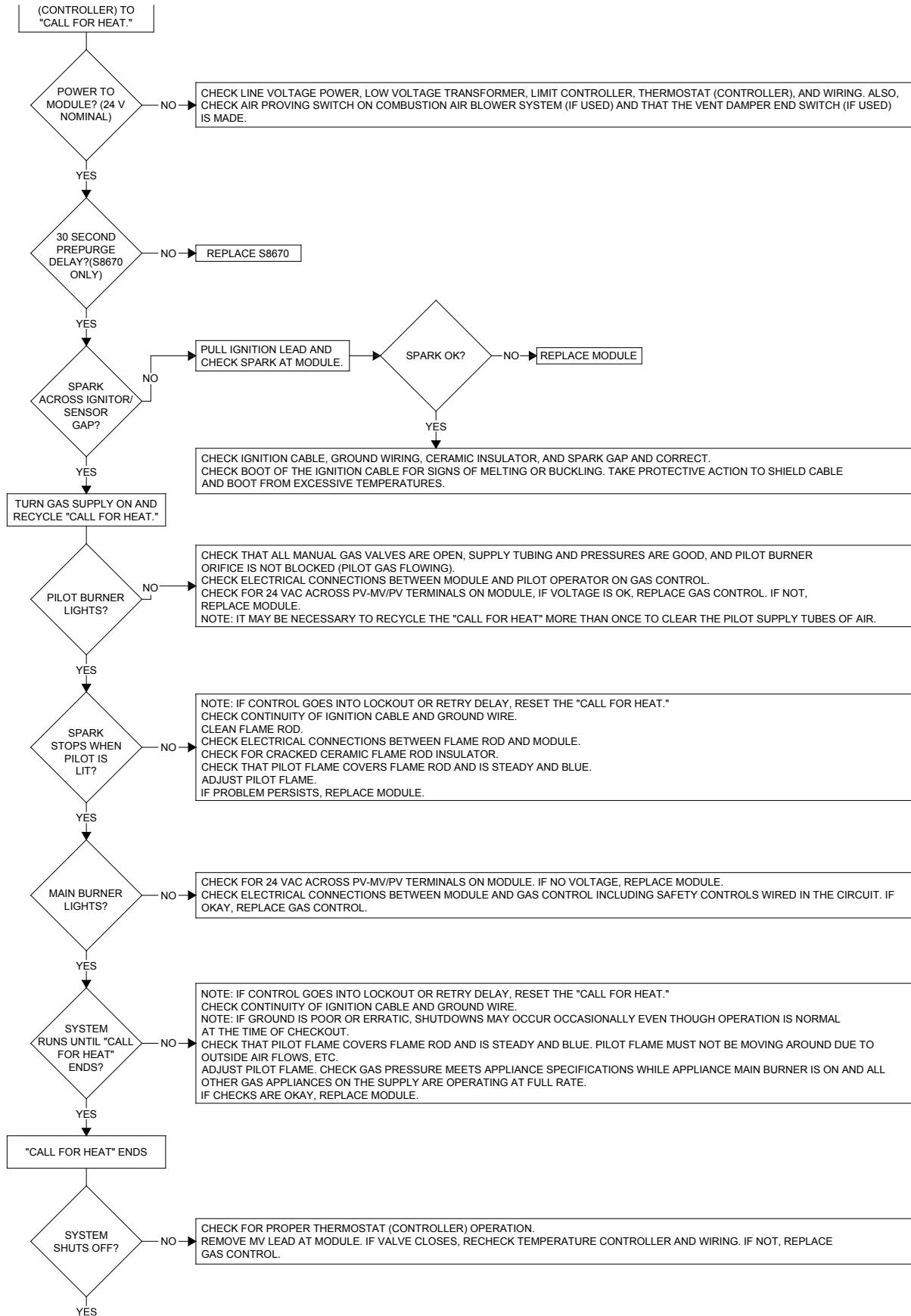
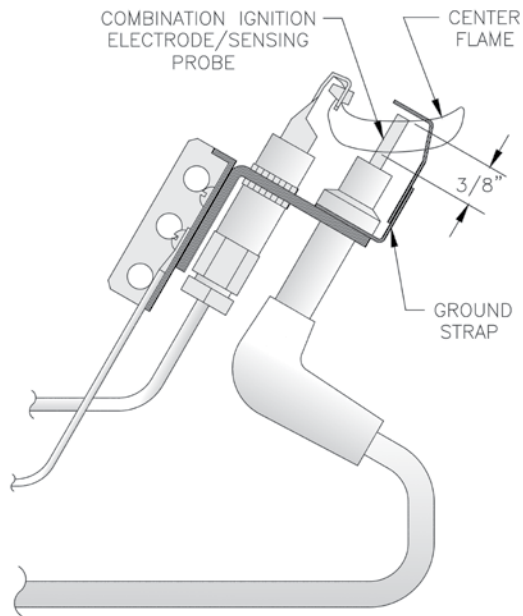


Figure 18: Troubleshooting Guide

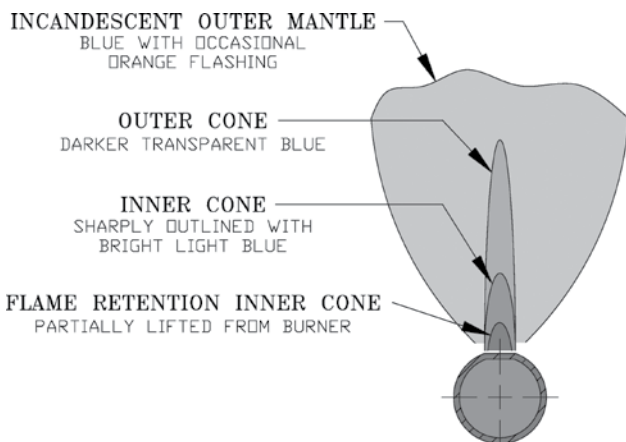
## VII. System Start-up (continued)

- F. Check pilot burner flame.** See Figure 19. Flame should be steady, medium hard blue enveloping 3/8 to 1/2 inch of sensing probe.



**Figure 19: Pilot Burner Flame**

- G. Check main burner flame.** See Figure 20. Flame should have clearly defined inner cone with no yellow tipping. Orange-yellow streaks should not be confused with true yellow tipping.



**Figure 20: Main Burner Flame**

- H. Check thermostat operation.** Raise and lower temperature setting to start and stop boiler operation.
- I. Check ignition control module shutoff.** Disconnect igniter/sensor cable from Terminal 9 (SPARK). Gas valve should close and pilot and main burners extinguished.

**J. Check low water cutoff.**

1. Adjust thermostat to highest setting.
2. With boiler operating, open drain valve and slowly drain boiler.

### CAUTION

**Do not drain below gauge glass.**

3. Main burners and pilot burner will extinguish and blower stop when water level drops below low water cutoff probe. Verify limit, thermostat or other controls have not shut off boiler.
4. Adjust thermostat to lowest setting. Refill boiler to normal water line.

**K. Check limit.**

1. Adjust thermostat to highest setting.
2. Observe pressure gauge. When pressure is indicated, adjust limit to setting below observed pressure. Main burners and pilot burner should extinguish, and blower stop.
3. Adjust limit to setting above observed pressure. Ignition sequence should begin.
4. Adjust thermostat to lowest setting. Adjust limit to desired setting.

**L. Adjust gas input rate to boiler.**

1. Adjust thermostat to highest setting.
2. Check manifold gas pressure. Pressure should be as printed on the rating label. Adjust gas valve pressure regulator as necessary (turn adjustment screw counterclockwise to decrease manifold pressure, or clockwise to increase manifold pressure). If specified pressure can not be attained, check gas valve inlet pressure. If less than 4.5 inch w.c., contact gas supplier for assistance.
3. Clock gas meter for at least 30 seconds. Use Table 13 to determine gas flow rate in Cubic Feet per Hour.
4. Determine Input Rate. Multiply gas flow rate by gas heating value.
5. Compare measured input rate to input rate stated on rating label.
  - a. Boiler must not be overfired. Reduce input rate by decreasing manifold pressure. Do not reduce by more than 0.3 inch w.c. If boiler is still overfired, contact your U.S. Boiler distributor or Regional Office for replacement Gas Orifice.
  - b. Increase input rate if less than 98% of rating label input. Increase manifold gas pressure by as much as 0.3 inch w.c. If measured input rate is still less than 98% of rated input:

## VII. System Start-up (continued)

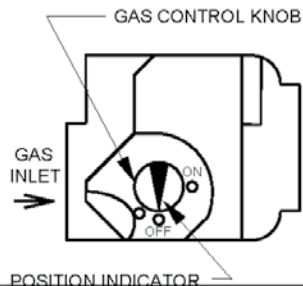
### FOR YOUR SAFETY READ BEFORE OPERATING

**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.

Figure 21: Operating Instructions

- i. Remove Main Burners per procedure in Section VIII: Service.
  - ii. Remove gas orifices. Drill one (1) drill size larger (drill size is stamped on orifice, or see Key No. 4D).
  - iii. Reinstall gas orifices and main burners. Measure input rate.
  6. Recheck Main Burner Flame.
  7. Return other gas-fired appliances to previous conditions of use.
- M. Clean Heating System.** Oil from new piping connections and sediment in existing piping must be removed from system to prevent unsteady water line and carry-over of entrained water into supply main.

## VII. System Start-up (continued)

**Table 13: Gas Flow Rate in Cubic Feet per Hour**

Seconds for One Revolution	Size of Gas Meter Dial		
	One-Half Cu. Ft.	One Cu. Ft.	Two Cu. Ft.
30	60	120	240
32	56	113	225
34	53	106	212
36	50	100	200
38	47	95	189
40	45	90	180
42	43	86	172
44	41	82	164
46	39	78	157
48	37	75	150
50	36	72	144
52	35	69	138
54	33	67	133
56	32	64	129
58	31	62	124
60	30	60	120

1. Fill boiler to normal waterline.
2. Follow Operating Instructions to place boiler in operation. See Figure 21.
3. Operate boiler with steam in entire system for several days to bring system oil and dirt back to boiler.
4. Drain condensate from drain valve in wet return. Operate boiler until condensate runs clean.

A local qualified water treatment chemical specialist is a suggested source for recommendations regarding appropriate chemical compounds and concentrations which are compatible with local environmental regulations.

### N. Boil-out Boiler.

1. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 21.
2. Fill boiler to normal waterline.
3. Remove safety valve.
4. Pour recommended boil-out compound into boiler through safety valve opening.
5. Reinstall safety valve in Tapping "E" with spindle in vertical position.

6. Follow Operating instructions to place boiler in operation. See Figure 21. Check controls operation per Paragraphs F to K. Boil water for at least 5 hours.
7. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 21. Drain boiler and system piping.
8. Remove drain valve. Thoroughly wash boiler water passages with high pressure spray through drain valve tapping.
9. Reinstall drain valve in Tapping "D".

### O. Second Boilout for Stubborn Cases.

If all oil and grease is not removed a second boilout using surface blow-off is necessary.

1. Run 1 NPT pipe from Surface Blow-Off Tapping "F" to open drain. Do not install shut-off valve or other restriction.
2. Fill boiler to top of gauge glass.
3. Remove safety valve.
4. Pour recommended boil-out compound into boiler through safety valve opening.
5. Reinstall safety valve in Tapping "E" with spindle in vertical position.
6. Follow Operating Instructions to place boiler in operation. See Figure 21. Boil water for approximately 5 hours without producing steam.
7. Open boiler fill shut-off valve to produce steady trickle of water from surface blow-off pipe. Continue boil-out for several hours until surface blow-off water runs clear.
8. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 21. Drain boiler and system piping.
9. Remove drain valve. Thoroughly wash boiler water passages with high pressure spray through drain valve tapping.
10. Fill boiler to normal waterline. If water in gauge glass is not clear, repeat procedure starting at step 2.
11. Remove surface blow-off piping. Install 1 NPT plug in Tapping "F".

If unsteady water line, foaming or priming persist:

12. Follow Operating Instructions to place boiler in operation. See Figure 21.
13. Install gate valve (shut-off valve) in Hartford Loop. Install drain valves in return main and at boiler. See Figure 4 or 5.
14. Connect hoses from drain valves to floor drain. Close gate valve in Hartford Loop. Open drain valve in return main.

---

## VII. System Start-up (continued)

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15. Fill boiler to normal water line. Follow Operating Instructions to place boiler in operation. See Figure 21.
  16. Operate boiler for at least 30 minutes after condensate begins to run hot. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 21.
  17. Close all radiator valves. Remove all supply main air valves. Plug openings in supply main.
  18. Drain approximately 5 gallons of boiler water into container. Mix in recommended boil-out compound.
  19. Remove safety valve. Pour recommended compound into boiler through safety valve opening. Reinstall safety valve in Tapping "E" with spindle in vertical position.
  20. Follow Operating Instructions to place boiler in operation. See Figure 21. Slowly feed water to boiler. Water will rise slowly into supply main and back through return main. Adjust flow to maintain approximately 180°F water from return main hose. Continue until water runs clear from hose for at least 30 minutes.
  21. Turn off water to boiler. Continue to operate until excess water is removed from boiler and system (by steaming) and boiler water reaches normal waterline.
  22. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 21. Open all radiator valves. Reinstall all supply main air valves. Open gate valve in Hartford Loop.
  23. Allow boiler to cool until crown sheet is no longer too hot to touch. Close drain valves at boiler and in return main. Fill boiler slowly to normal waterline.
  24. Follow Operating Instructions to place boiler in operation. See Figure 21. Allow boiler to steam for 10 minutes. Drain one quart of water from lower Gauge Glass fitting.
  25. Drain second quart sample from lower Gauge Glass fitting. If sample is not clear, repeat cycle of draining boiler and return main and refilling boiler until sample is clear.
  26. If after normal operation boiler water becomes dirty from additional system piping sediment returning to boiler.
    - a. Complete steps 12 through 25.
    - b. Complete steps 1 through 11.
- P. Add Boiler Water Treatment**
1. Remove safety valve.
  2. Pour recommended compound into boiler through safety valve opening.
  3. Reinstall safety valve in Tapping "E" with spindle in vertical position.
  4. Follow Operating Instructions to place boiler in operation. See Figure 21.
  5. Boil water or heat water to 180°F.
  6. Test the pH of the water in the system. This can easily be done by drawing a small sample of boiler water and testing with Hydrion paper which is used in the same manner as litmus paper, except it gives specific readings. A color chart on the side of the small Hydrion dispenser gives the reading in pH. Hydrion paper is inexpensive and obtainable from any chemical supply house or through your local druggist. The pH should be higher than 7 but lower than 11. Add recommended water treatment chemicals, if necessary, to bring the pH within the specified range. With this lower level of protection, care must be exercised to eliminate all of the free oxygen in the system.
  7. Boiler is now ready to be put into service.
- Q. Review User's Information Manual** and system operation with owner or operator.



## VIII. Service Instructions

### 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 21.

#### CAUTION

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

### B. Low water cutoff

Clean probe.

1. Drain boiler to point below Tapping "L".
2. Disconnect the (3) wire multipin connector from the control and disconnect the control's black wire from the probe's screw terminal.
3. Remove control from probe.
4. Unscrew probe from Tapping "L".

#### NOTICE

**Carefully remove, clean, and reinstall probe. Platinum guard ring must not be exposed to rough treatment, or useful life of probe may be shortened.**

5. Remove deposits from probe using diluted phosphoric acid ( $H_2PO_4$ ) solution, 3 parts water to 1 part phosphoric acid. Normal operation will occur with up to 0.2 inch of contamination. If scale or contamination exceeds 0.2 inches clean probe more frequently.
6. Reinstall probe in Tapping "L". Mount control on probe. Attach control's black wire to probe's screw terminal and reconnect the (3) wire multipin connector to the control.

### C. Water Feeder and Additional Low Water Cut-Off

Refer to manufacturer's instructions.

### D. Vent System

Inspect for obstructions, soot accumulation, proper support, and deterioration of pipe, fittings, and joints.

1. Clean vent terminal screens. Vent terminal must be free of obstruction, undamaged, with screens securely in place.
2. Vent terminal and wall thimble (if used) must be weather-tight.

3. Vent pipe must be full round shape, and show no damage from impact or excessive temperature.
4. Vent pipe must be supported at minimum 5 foot intervals and must not sag.
5. All joints must be secure and watertight.
6. Condensate drain must have minimum 6 inch trap and allow condensate to flow freely. To clean:
  - a. Disconnect condensate drain from drain fitting.
  - b. Flush condensate drain with water. Fill trap with water.
  - c. Securely fasten condensate drain to drain fitting, providing gas-tight and watertight seal.
7. If vent pipe must be disassembled for removal of obstructions or resealing of joint, see Venting Section.

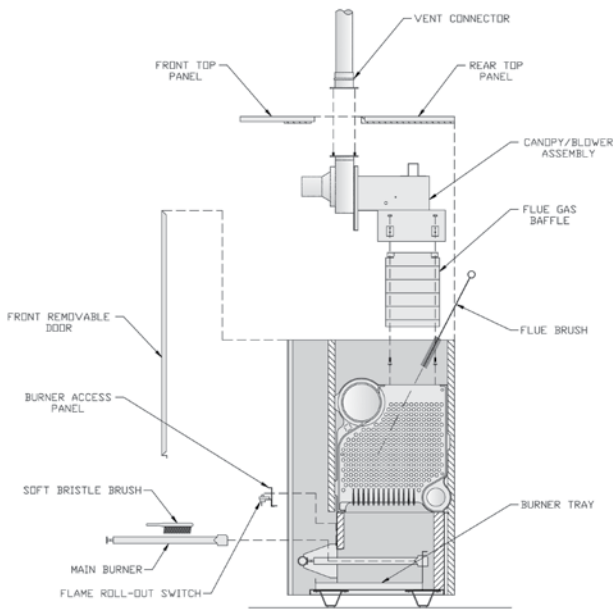
### E. Boiler Flue Passages.

Inspect for blockage or soot accumulation.

1. Remove Main Burners.
  - a. Disconnect Pilot Tubing from Gas Valve.
  - b. Disconnect Igniter/Sensor Wire and Pilot Ground Wire from Ignition Module.
  - c. Disconnect (2) wires to Flame Roll-out Switch.
  - d. Remove Burner Access Panel.
  - e. Mark manifold with location of Main Burner with Pilot Bracket.
  - f. Hold Main Burner on throat. Lift slightly to clear orifice. Pull Main Burner from combustion chamber. Main Burner with Pilot Bracket can only be removed by lifting at 45° angle after adjacent Main Burner to right is removed.
2. Disconnect Junction Box to Vestibule Wiring Harness from Blower.
3. Remove (4) locknuts securing vent connector. See Figure 7. Disconnect vent connector and vent pipe from blower outlet.
4. Remove Jacket Top Panels.
5. Disconnect Silicone Tubing from Canopy. Pull tubing through Blower Access Panel into vestibule.
6. Remove Blower Access Panel.
7. Loosen (4) carriage bolts. Remove Canopy/Blower Assembly.
8. Remove Gasket and Flue Gas Baffles. Inspect Flue Baffles for deterioration.

## VIII. Service Instructions (continued)

9. Inspect flue passages. Clean with flue brush. See Figure 22.



**Figure 22: Cleaning Boiler Flue Passages**

10. Inspect heating surface in combustion chamber. Clean with straight handle wire brush.
12. Install Flue Gas Baffles.
13. Install new Gasket (Key No. 2E). Do not reuse existing material.
14. Install Canopy/Blower Assembly. Tighten Carriage Bolts to fully compress Gasket.
15. Install Blower Access Panel.
16. Connect Silicone Tubing between Pressure Fitting on Canopy Assembly and Pressure Switch. Route through bushings in Blower Access Panel and Canopy Assembly.
17. Install Jacket Top Panels.
18. Connect vent system. See Figure 7.
19. Connect Blower to Junction Box to Vestibule Wiring Harness.

### F. Main Burners and Firebox

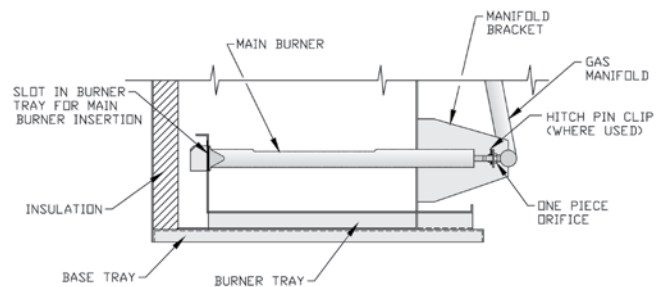
1. Vacuum firebox. Exercise care - do not damage base insulation.
2. Clean main burners. Brush top of burners with soft bristle brush. Vacuum to remove any dirt and lint.
3. Vacuum tip of pilot burner.
4. Check gas orifices for lint and dirt. Clean as necessary.

5. Install main burners by reversing procedure to remove burners.
  - a. Pilot burner must be installed in original location. See Table 14.
  - b. Main burners must be properly secured in burner tray slot at rear of firebox and over gas orifice. See Figure 23.
  - c. Pilot gas supply, igniter/sensor cable and ground wire must be reconnected.
  - d. Burner access panel must be securely in place.
  - e. Flame rollout switch wires must be reconnected.

**Table 14: Pilot Burner Location**

Boiler Model	Main Burner with 60° Pilot Bracket *	Pilot Burner Located Between Main Burners *
IN3PV	1	1 & 2
IN4PV	2	2 & 3
IN5PV	3	3 & 4
IN6PV	4	4 & 5

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



**Figure 23: Main Burner Installation**

**G. Check operation.** Follow steps B through L from Section VII: System Start-up.

**H. Procedure for Measuring Fan Inlet Pressure (vacuum),** See Figure 24.

1. With boiler off, remove hose at pressure switch.
2. With Tee and ¼ inch aluminum stubs, connect water manometer as shown with additional tubing.
3. Start boiler and read Pressure on Manometer when boiler water temperature reaches operating temperature. Refer to Table 15 for minimum readings.

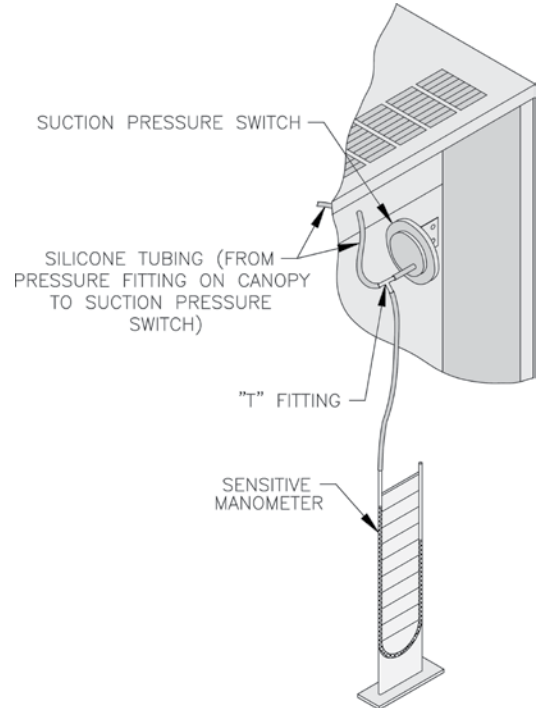
NOTE: If switch drops-out before boiler reaches temperature or if pressure readings are below minimums shown in Table 15, check for cracks in hose or contact your nearest U.S. Boiler Company representative.

## VIII. Service Instructions (continued)

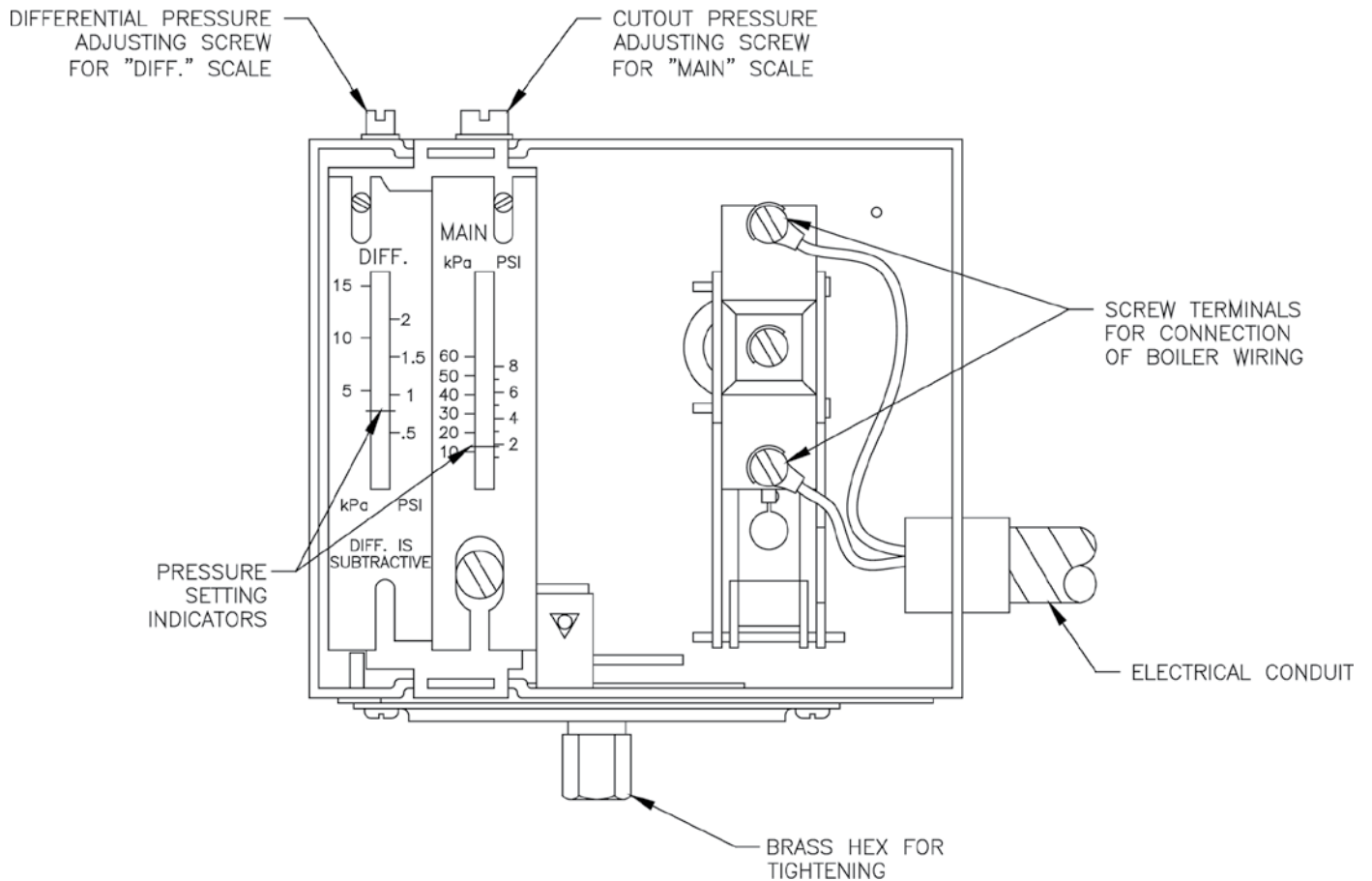
4. Stop boiler, remove manometer and reconnect hose to pressure switch. See Figure 24.

**Table 15: Minimum Vacuum**

Boiler Model	Minimum Vacuum
IN3PV	-0.40 inches w.c.
IN4PV	-0.40 inches w.c.
IN5PV	-0.70 inches w.c.
IN6PV	-0.70 inches w.c.



**Figure 24: Inlet Fan Vacuum Measurement**



**Figure 25: L404F Pressuretrol**

## **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 about 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:**

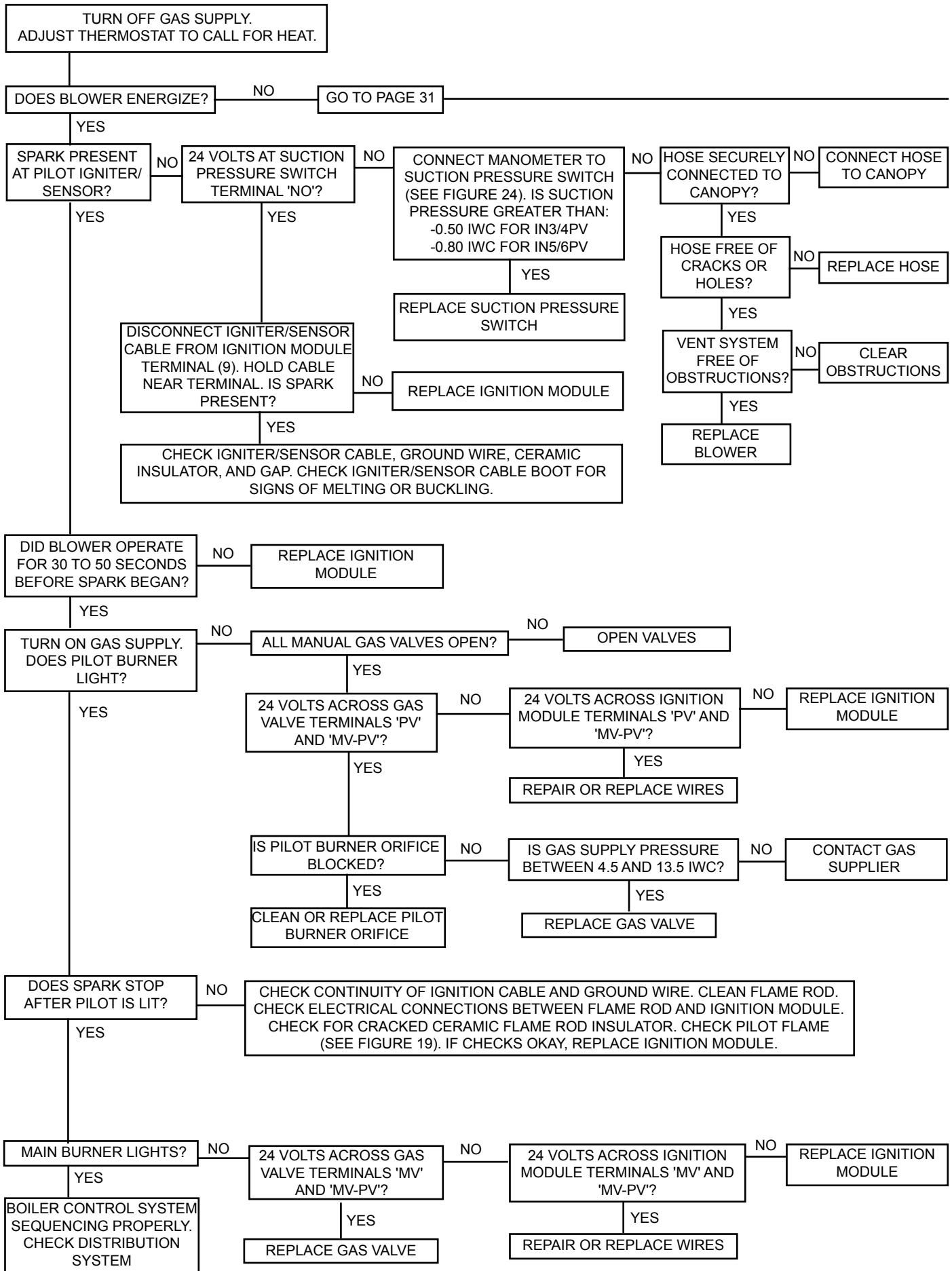
Do not remove or replace RCF parts or attempt any service or repair work involving RCF without wearing the following protective gear:

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.

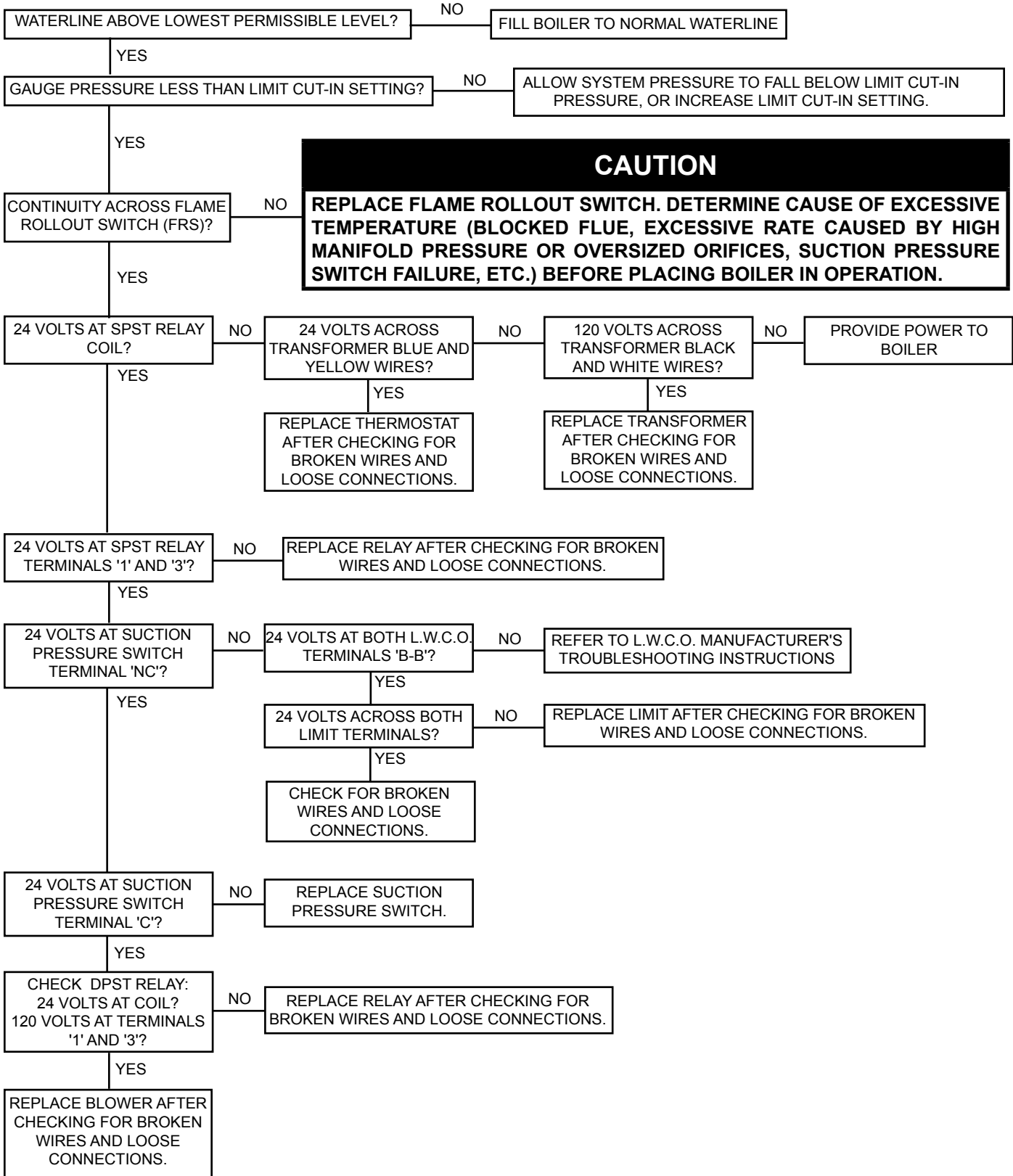
### **First Aid Procedures:**

- 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.



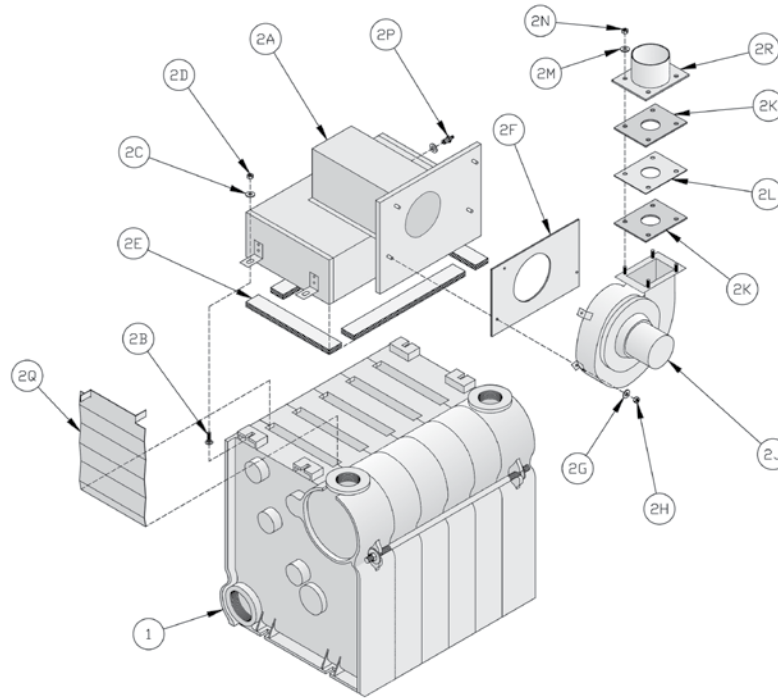


## Troubleshooting Tree for Section VII, Step E



## IX. Repair Parts

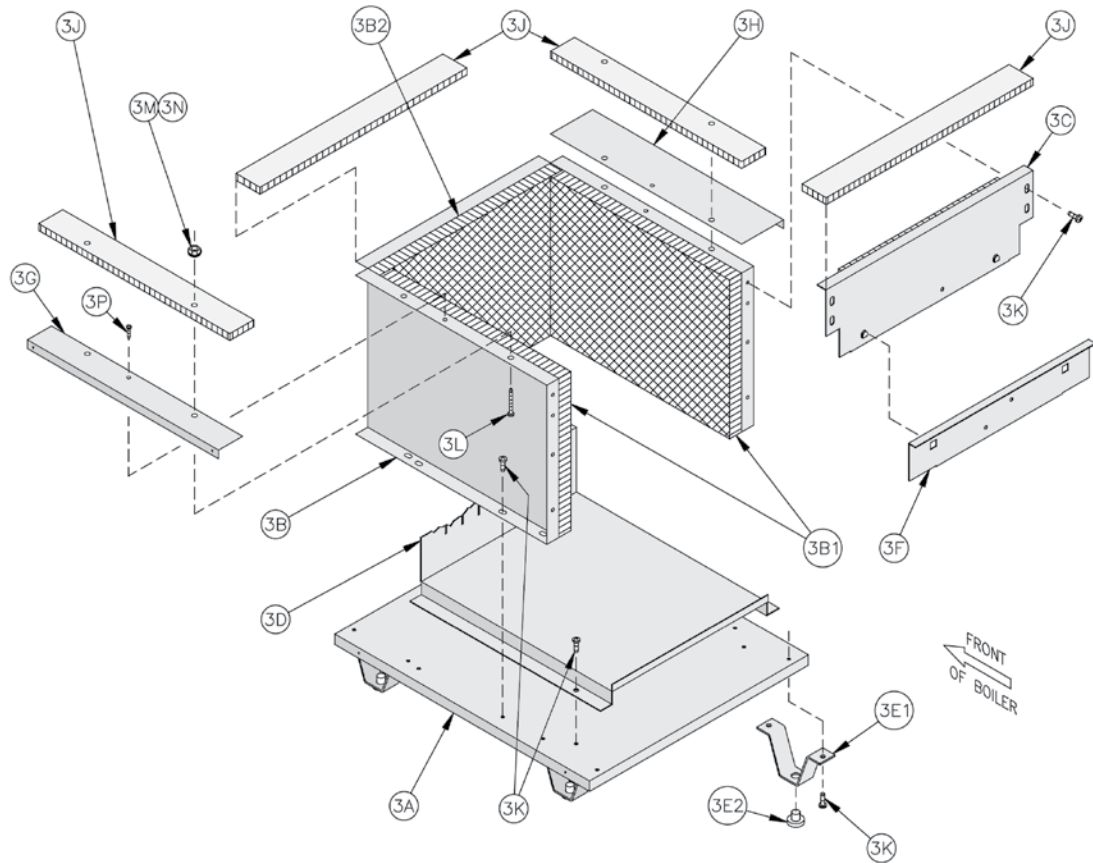
All Independence® PV Repair Parts may be obtained through your local Burnham product distributor. Should you require assistance in locating a Burnham product distributor in your area, or have questions regarding the availability of Burnham brand products or repair parts, please contact U.S. Boiler Company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



Key No.	Description	[Quantity] Part Number			
		IN3PV	IN4PV	IN5PV	IN6PV
<b>1. Section Assembly</b>		61710033	61710043	61710053	61710063
<b>2. Canopy/Blower Assembly</b>					
2A	Canopy	[1] 611100301	[1] 611100401	[1] 611100501	[1] 611100601
2B	Carriage Bolt, 1/4 -20 x 1"	[4] 80860115			
2C	Washer, 1/4, USS, Plated	[4] 80860603			
2D	Nut, 1/4 -20, Heavy Hex, Plated	[4] 80860407			
2E	Gasket	[1] 6206001			
2F	Blower Mounting Gasket [Included in Key No. 2J]	[1] 8206048	[1] 8206049		
2G	Washer, 1/4", SAE	[4] 80860633			
2H	Hex Nut, 1/4 -20, Brass [(4) Included in Key No. 2J]	[4] 80860424			
2J	Blower	[1] 6111714			[1] 6111715
2K	Orifice Plate Gasket [(2) Included in Key No. 2J]	[2] 8206042			[2] 8206035
2L	Orifice Plate	[1] 61110036	[1] 61110046	[1] 61110056	[1] 61110066
2M	Washer, 1/4"	[4] 80860603			
2N	Hex Locknut, 1/4 -20	[4] 80860456			
2P	Pressure Fitting, Dwyer A308	[1] 822657			
2Q	Flue Gas Baffle	[2] 711102000	[3] 711102000	[4] 711102000	[5] 711102000
2R	Vent Connector	See Key No. 11A			

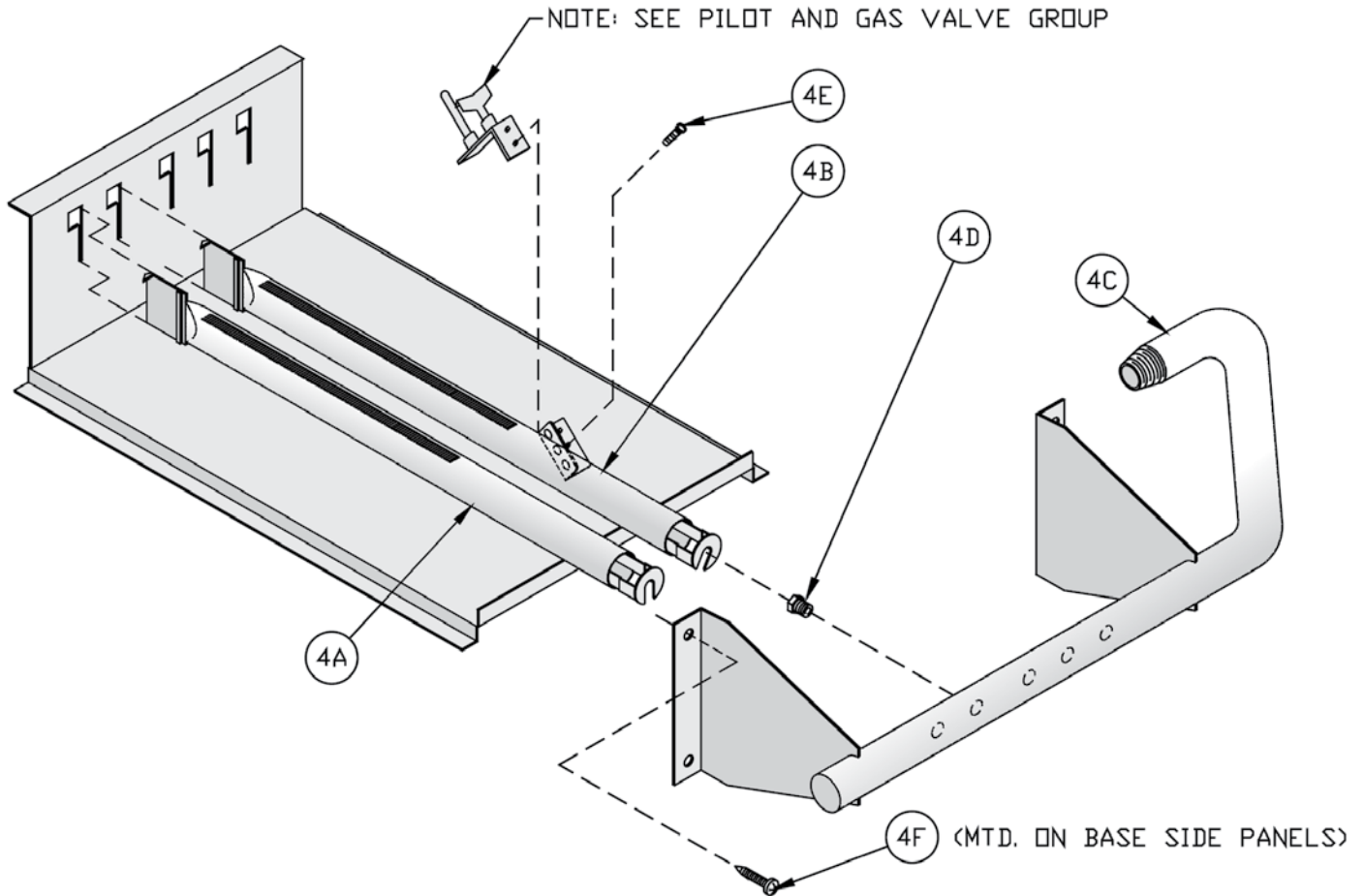


## IX. Repair Parts (continued)



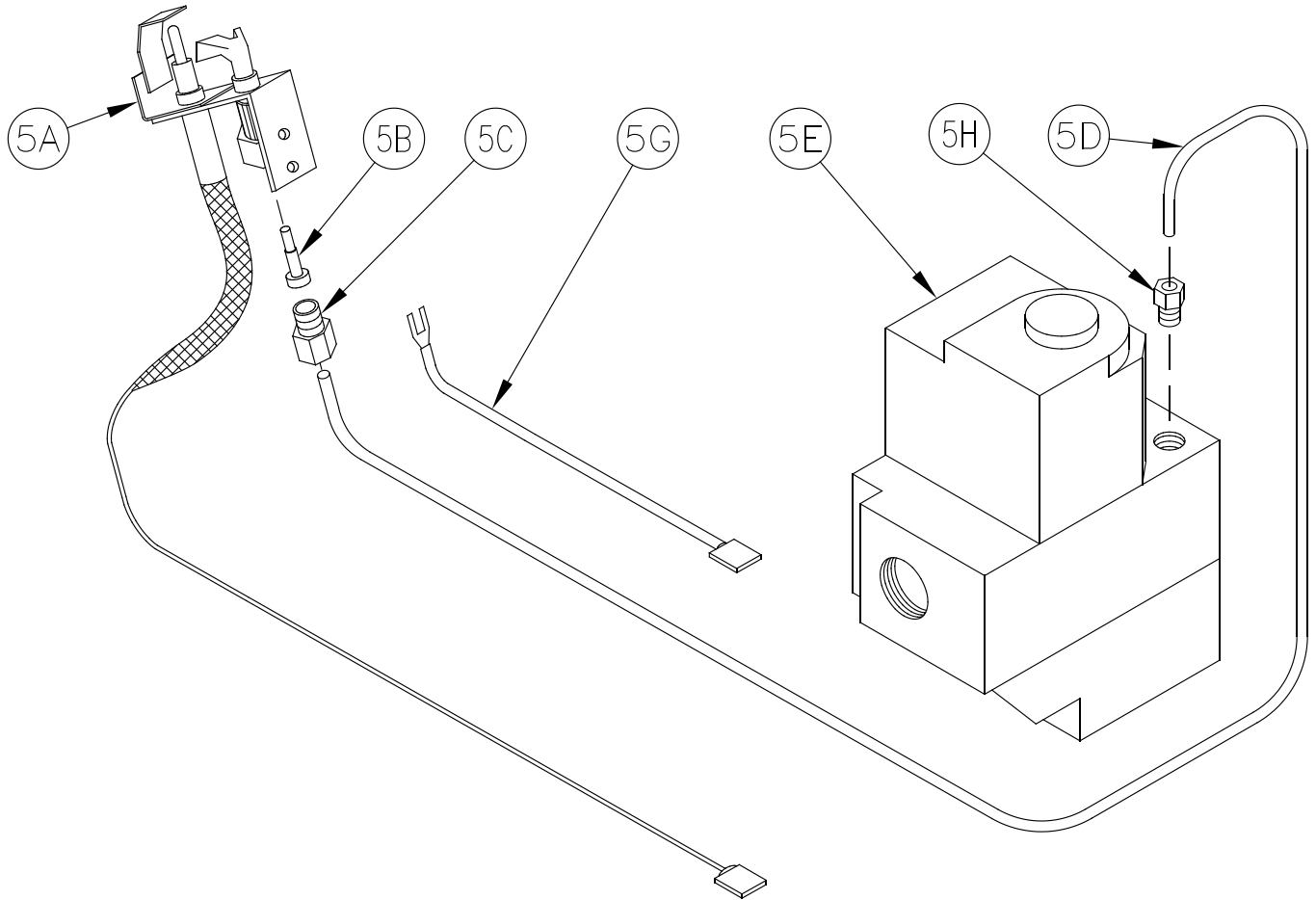
Key No.	Description	[Quantity] Part Number			
		IN3PV	IN4PV	IN5PV	IN6PV
<b>3. Base Assembly Group</b>					
3A	Base Tray	[1] 71860391	[1] 71860491	[1] 71860591	[1] 71860691
3B	Base Wrapper	[1] 718600311	[1] 718600411	[1] 718600511	[1] 718600611
3B1	Base End Insulation	[2] 720601			
3B2	Base Rear Insulation	[1] 72060035	[1] 72060045	[1] 72060055	[1] 72060065
3C	Base Front Panel Assembly	[1] 618600341	[1] 618600441	[1] 618600541	[1] 618600641
3D	Burner Tray	[1] 718600305	[1] 718600405	[1] 718600505	[1] 718600605
3E	Base Leg Assembly	[4] 6186001			
3E1	Base Leg [Included in Key No. 3E]	[4] 71860021			
3E2	Nylon Glide [Included in Key No. 3E]	[1 per leg] 8186006			
3F	Burner Access Panel	[1] 618600361	[1] 618600461	[1] 618600561	[1] 618600661
3G	Left End Jacket Attachment Bracket	[1] 7046011			
3H	Right End Jacket Attachment Bracket	[1] 7046012			
3J	Cerafelt Gasket, 1/2" x 2" Johns-Mansville CRF-400	[1] 6206002			
3K	Screw, Self Tapping Type F, Phillips Pan Head, 1/4 -20 x 1/2", Plated	[26] 80860700	[27] 80860700	[27] 80860700	[28] 80860700
3L	Screw, Self Tapping, Type F, Hex Head, 5/16 -18 x 1-1/4", Plated	[4] 80860717			
3M	Washer, 5/16, USS	[4] 80860601			
3N	Hex Lock Nut, 5/16 -18	[4] 80860464			
3P	Screw, Sheet Metal, #8 x 1/2"	[2] 80860000			

## IX. Repair Parts (continued)



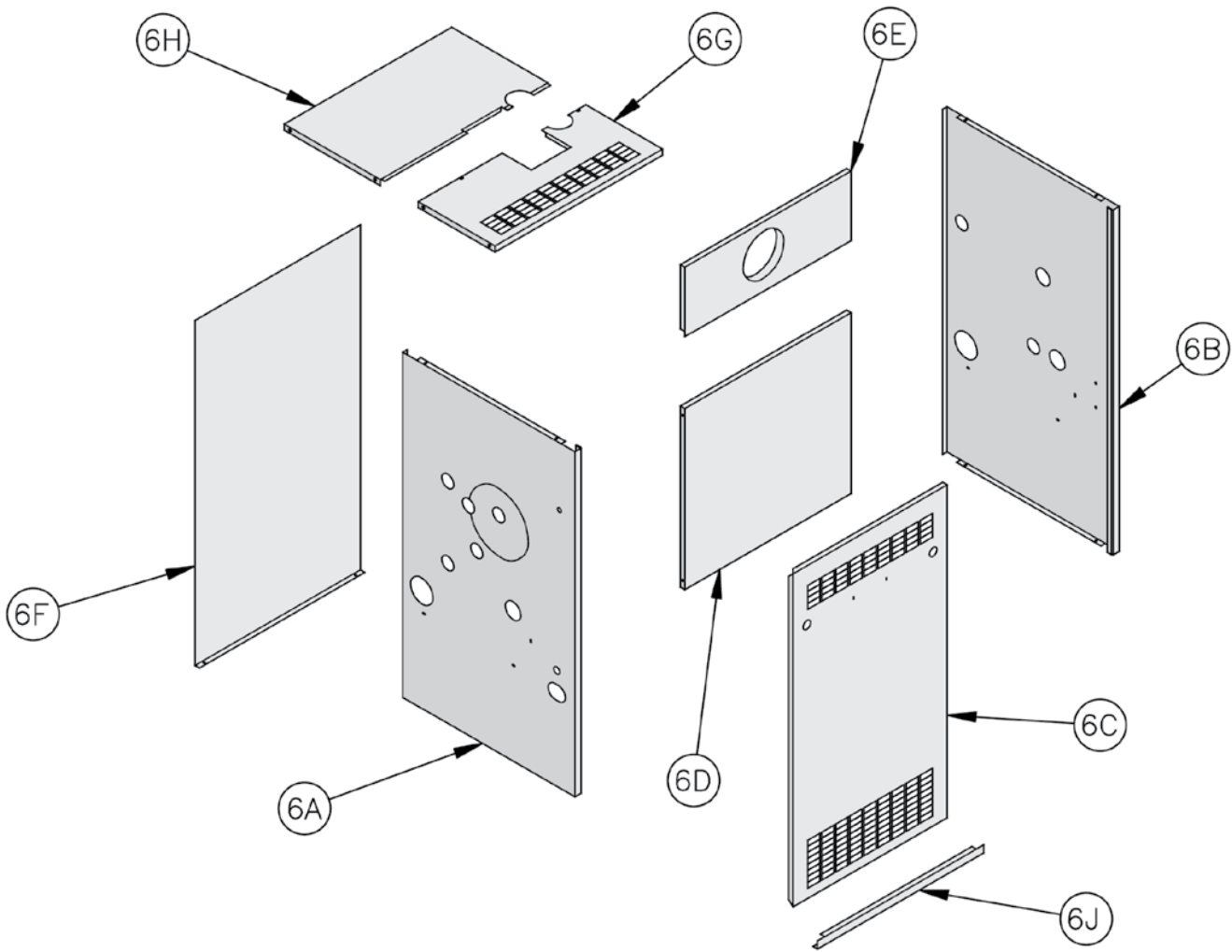
Key No.	Description	(Quantity) Part Number			
		IN3PV	IN4PV	IN5PV	IN6PV
<b>4. Manifold and Main Burners</b>					
4A	Main Burner	[2] 8236099	[4] 8236099	[6] 8236099	[8] 8236099
4B	Main burner with 60° Pilot Bracket	[1] 8236098			
4C	Manifold	[1] 82260033	[1] 82260043	[1] 82260053	[1] 82260063
4D	Main Burner Orifice, #45, Pink	[3] 822711	[5] 822711	[7] 822711	[9] 822711
4E	Screw, Machine, #10-32 x 3/16"	[2] 80860700			
4F	Screw, Self-Tapping Type F, Phillips Pan Head, 1/4-20 x 1/2", Plated	[4] 80860700			

## IX. Repair Parts (continued)



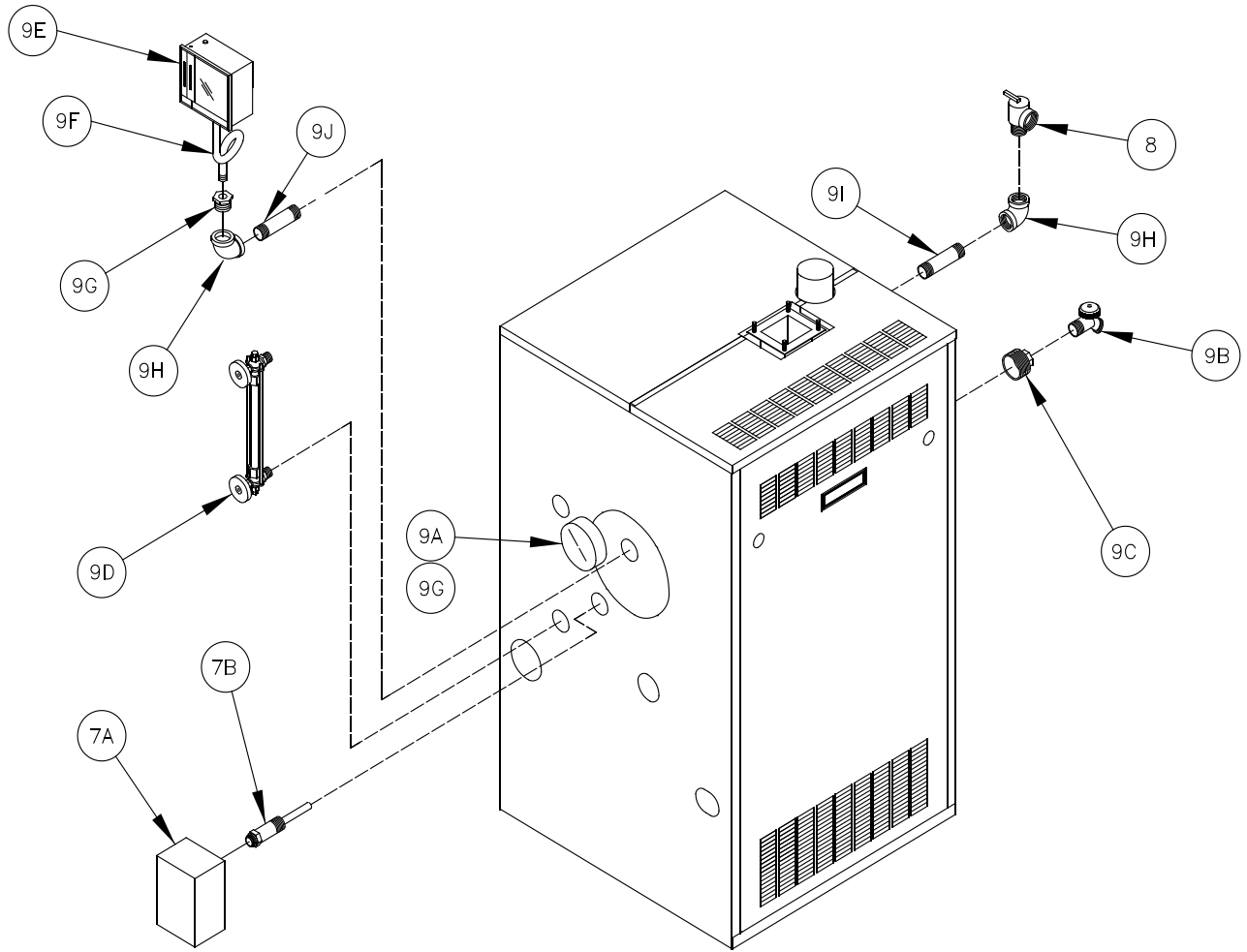
Key No.	Description	(Quantity) Part Number			
		IN3PV	IN4PV	IN5PV	IN6PV
<b>5. Gas Train Group</b>					
5A	Pilot Assembly, Natural Gas, Honeywell Q3481B1206			[1] 103704-01	
5B	Pilot Orifice, Natural Gas Honeywell 388146NE			Included with Key No. 5A	
5C	Compression Nut/Fitting, 1/8" OD x 1/4 NPT			Included with Key No. 5A and 5E	
5D	Pilot Tubing, 1/8" OD x 40"			[1] 8236100	
5E	Gas Valve, 1/2 x 1/2, Natural Gas, Honeywell VR8204C6000			[1] 81660176	
5G	Ground Wire Assembly			[1] 6136054	

## IX. Repair Parts (continued)



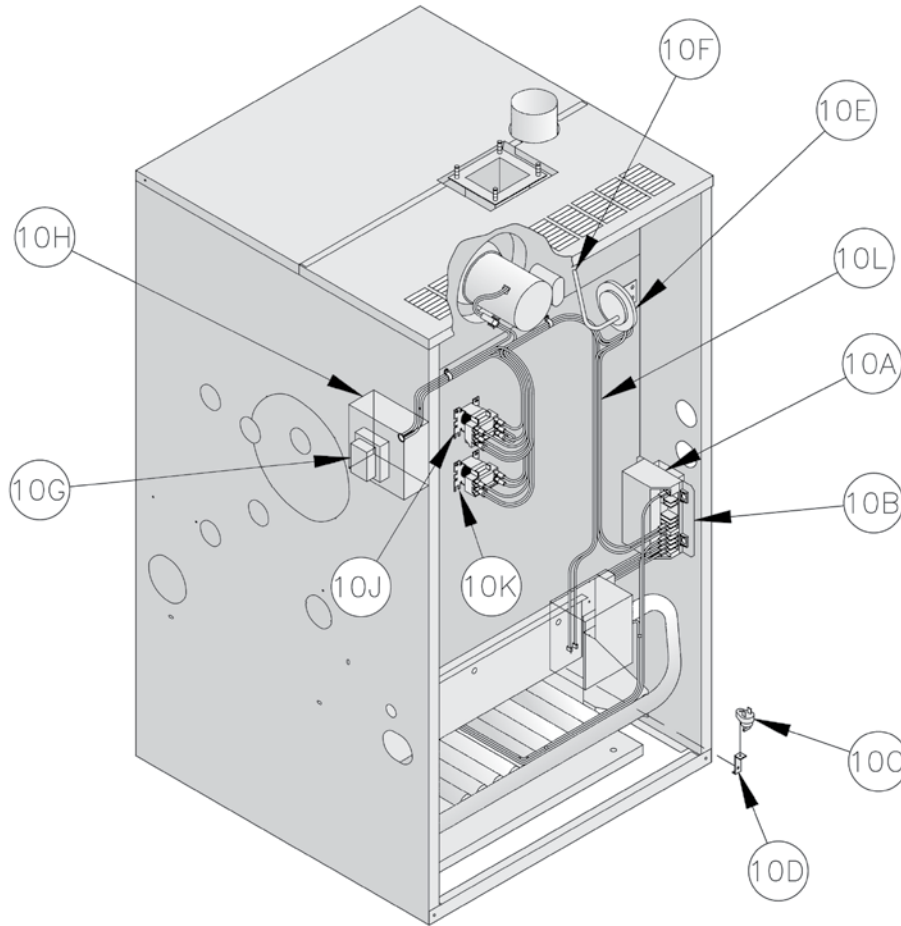
Key No.	Description	(Quantity) Part Number			
		IN3PV	IN4PV	IN5PV	IN6PV
<b>6. Jacket</b>					
6A	Left Side Panel	[1] 60410023			
6B	Right Side Panel	[1] 60410022			
6C	Front Removable Door	[1] 604100330	[1] 604100430	[1] 604100530	[1] 604100630
6D	Vestibule Panel	[1] 604100340	[1] 604100440	[1] 604100540	[1] 604100640
6E	Blower Access Panel	[1] 604100371	[1] 604100471	[1] 604100571	[1] 604100671
6F	Rear Panel	[1] 604100350	[1] 604100450	[1] 604100550	[1] 604100650
6G	Front Top Panel	[1] 604100360	[1] 604100460	[1] 604100560	[1] 604100660
6H	Rear Top Panel	[1] 6041003610	[1] 6041004610	[1] 6041005610	[1] 6041006610
6J	Lower Front Tie Bar	[1] 70410034	[1] 70410044	[1] 70410054	[1] 70410064
---	Screw, Sheet Metal, #8 x 1/2"	[28] 80860000	[29] 80860000		

## IX. Repair Parts (continued)



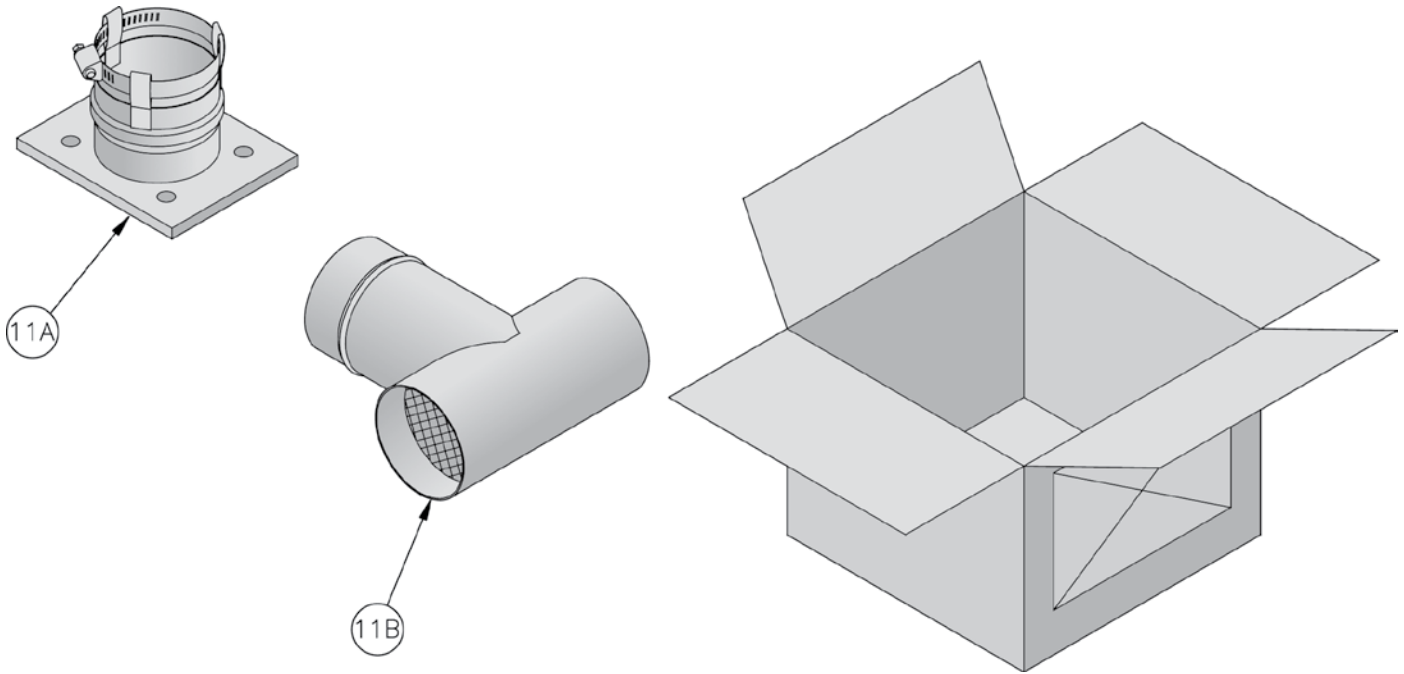
Key No.	Description	(Quantity) Part Number			
		IN3PV	IN4PV	IN5PV	IN6PV
7A	McDonnell & Miller PS-802		[1] 80160720		
	Hydrolevel CG400-2090		[1] 80160725		
7B	Probe, [Included with 7A]		---		
8	Safety Valve, 3/4, 15 psi, Conbraco 13-511-08		[1] 81660530		
9A	Steam Gauge, 0-30 psi, 2-1/2" Dia.		[1] 100325-01		
9B	Drain Valve, Conbraco 31-612-02		[1] 806603012		
9C	Bushing, Hex, 2 NPT x 3/4 NPT		[1] 806600515		
9D	Gauge Glass Set, 9" Glass, Conbraco 21-104-10		[1] 8056128		
9E	Limit, Honeywell L404F1367		[1] 80160369		
9F	Siphon, 1/4 NPT		[1] 806603030		
9G	Bushing, 3/4 NPT x 1/4 NPT		[2] 806600508		
9H	Elbow, 3/4 NPT		[1] 806601502		
9I	Nipple, 3/4 NPT x 3-1/2"		806600038		
9J	Nipple, 3/4 NPT x 4"		806600014		

## IX. Repair Parts (continued)



Key No.	Description	(Quantity) Part Number			
		IN3PV	IN4PV	IN5PV	IN6PV
<b>10. Controls</b>					
10A	Ignition Module with Prepurge, Honeywell S8670E3003		[1] 100959-01		
10B	Ignition Module Support Bracket		[1] 7016001		
10C	Flame Roll-out Switch		[1] 80160044		
10C1	Screw, Sheet Metal, #8 x 3/4"		[1] 80860030		
10D	Flame Roll-out Switch Mounting Bracket		[1] 7186018		
10D1	Screw, Sheet Metal, #8 x 1/2"		[1] 80860019		
10E	Suction Pressure Switch [Red]	[1] 60160876			---
	Suction Pressure Switch [Lt. Blue]	---		[1] 60160877	
10F	Silicone Tubing, 1/8" O.D. x 20"		[1] 7016020		
10G	Transformer, 40VA, Honeywell AT140D1012 or Honeywell AT72D1188		[1] 80160039		
10H	Junction Box		[1] 8136176		
10J	Relay, DPST, Honeywell R8222U1006		[1] 80160096		
10K	Relay, SPST, Honeywell R8222K1000		[1] 80160127		
10L	Wiring Harness, Junction Box to Vestibule		[1] 8131003		
---	Screw, Sheet Metal, #8 x 1/2"		[10] 80860000		

## IX. Repair Parts (continued)



Key No.	Description	(Quantity) Part Number			
		IN3PV	IN4PV	IN5PV	IN6PV
<b>11. Gasketed Vent Accessory Carton (Includes 11A &amp; 11B)</b>		61110128		61110129	
11A	Vent Connector	[1] 8116306		[1] 8116307	
11B	Vent Terminal	[1] 8116310			

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## Appendix A - Figures

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