

INSTALLATION, OPERATING AND SERVICE INSTRUCTIONS FOR

INDEPENDENCE® GAS - FIRED BOILER



Intertek
9700609



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

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



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

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® 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.

CAUTION

If, during normal operation, it is necessary to add water to this boiler more frequently than once a month, consult a qualified service technician to check your system for leaks. A leaky system will increase the volume of make-up water supplied to the boiler which can significantly shorten the life of the boiler. Entrained in make-up water are dissolved minerals and oxygen. When the fresh, cool make-up water is heated in the boiler the minerals fall out as sediment and the oxygen escapes as a gas. Both can result in reduced boiler life. The accumulation of sediment can eventually isolate the water from contacting the cast iron. When this happens the cast iron in that area gets extremely hot and may eventually crack. The presence of free oxygen in the boiler creates a corrosive atmosphere which, if the concentration becomes high enough, can corrode the cast iron through from the inside. Since neither of these failure types are a result of a casting defect the warranty does not apply. Clearly, it is in everyone's best interest to prevent this type of failure. The maintenance of system integrity is the best method to achieve this.

NOTICE

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

Surface rust on cast iron sections may be attributed to the manufacturing process as well as condensation during storage. Surface rust is normal and does not affect the performance or longevity of a boiler.

CAUTION

Probe type low water cutoff devices require annual inspection and maintenance! Although these devices are solid state in their operation, the probe is exposed to possible contamination in the boiler water and subject to fouling. Refer to Low Water Cutoff Service Instructions for complete, step-by-step inspection and cleaning instructions.

WARNING

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

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

This boiler must be properly vented.

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

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

Installation is not complete unless a safety (relief) valve is installed. See the Piping and Trim Section of this manual for details.

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

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

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.

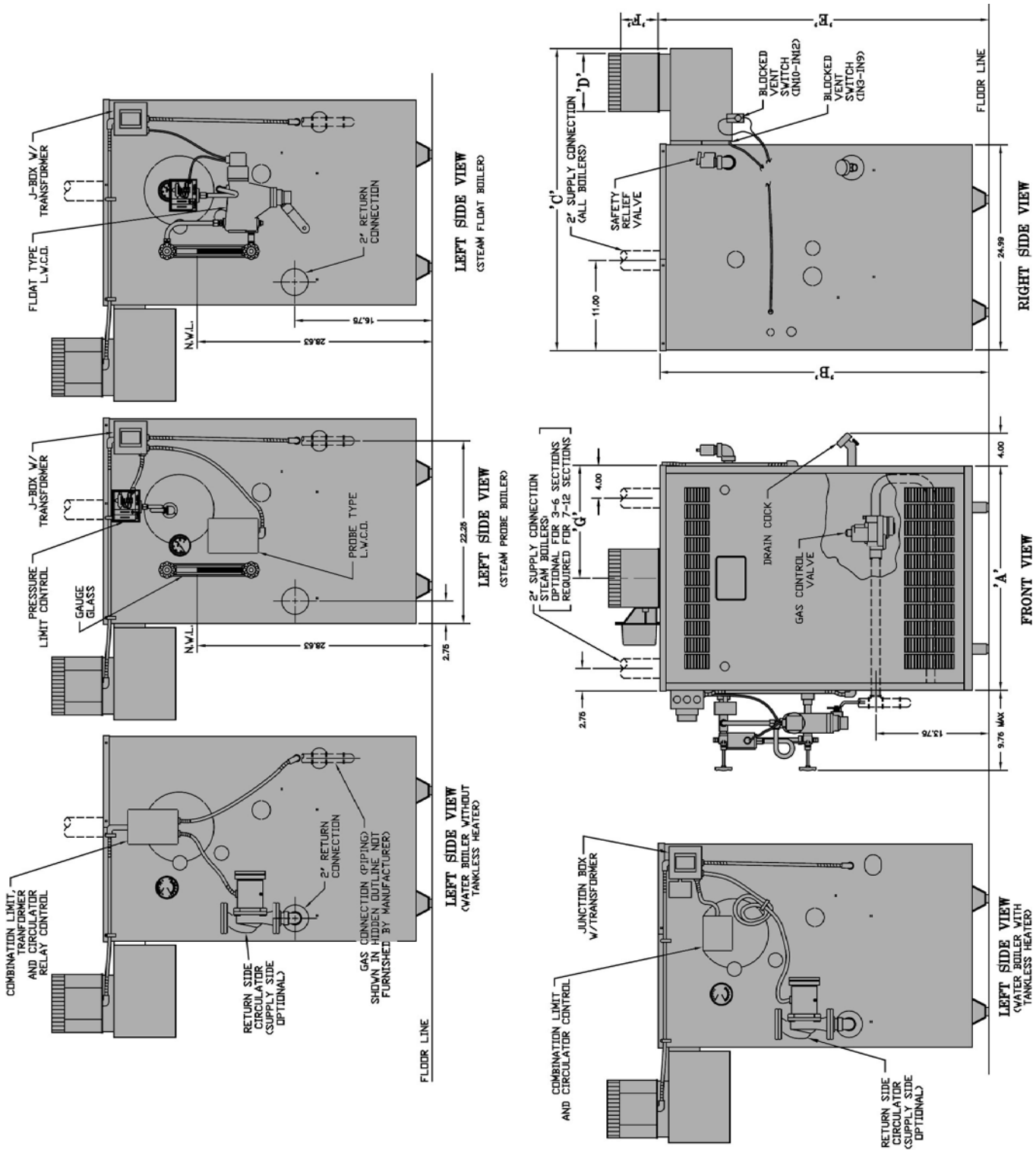


Figure 1: Dimensional Drawing

Dimensional Data

Boiler Model	Approx. Shipping Weight Lbs.	Dimensions (in inches)						Recommended Min. Round Chimney Size (Diameter x Height) (1)	Gas Conn. (NPT)	Water Volume (Gal.)			
		'A'	'B'	'C'	'D'	'E'	'F'			'G'	Steam Boiler	Water Boiler	(3)
IN3	350	14-1/2	40	33-3/4	4	40-1/4	4-3/4	7-1/4	4" x 15 ft.	1/2"	5.1	7.8	3.9
IN4	420	17-3/4		34-3/4	5			8-7/8	5" x 15 ft.		6.5	10.0	5.0
IN5	485	21		35-3/4	6		5-1/4	10-1/2	6" x 15 ft.		7.9	12.2	6.1
IN6	555	24-1/4		36-3/4	7		12-1/8	9.3			14.4	7.2	
IN7	620	27-1/2	45	38-3/4	9	45-1/2	7-1/2	13-3/4	7" x 15 ft.	3/4"	10.7	16.6	8.3
IN8	690	30-3/4						15-3/8			12.1	18.8	9.4
IN9	760	34						17	13.5		21.0	10.5	
IN10	815	37-1/4						18-5/8	14.9		23.2	11.6	
IN11	885	40-1/2	20-1/4	9	45-1/2	7-1/2	21-7/8	9" x 15 ft.	(2)	16.3	25.4	12.7	
IN12	955	43-3/4								17.7	27.6	13.8	

(1) 15' chimney height is from bottom of Draft Hood opening to top of Chimney.

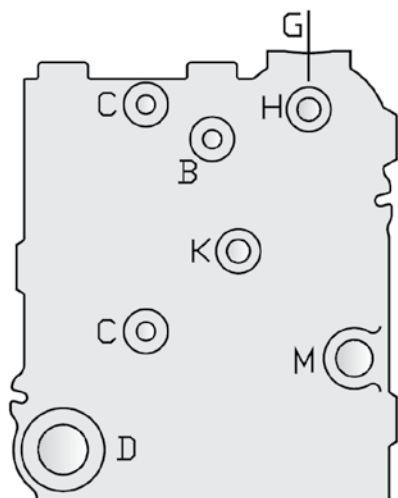
(2) Gas connection size on IN10-IN11 Continuous Ignition (Standing Pilot) is 1 NPT.

(3) Steam boiler's "steamable water volume": water volume from NWL (normal water level) to low water cutoff level.

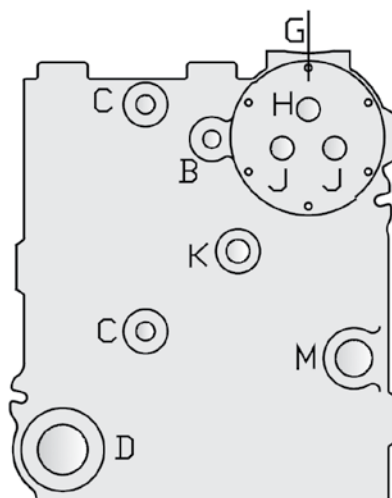
Heating Surface: 4.35 sq. ft. per flueway (steam); 5.72 sq. ft. per flueway (water)

TABLE OF CONTENTS

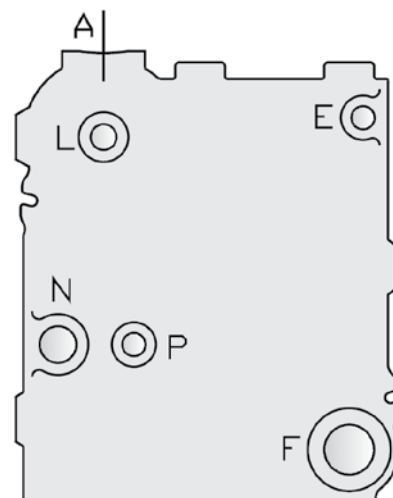
I. Pre-Installation.....	7
II. Knockdown Boiler Assembly.....	9
III. Semi-Pak Boiler Assembly.....	13
IV. Packaged Boiler Assembly.....	15
V. Piping and Trim.....	16
VI. Gas Piping.....	22
VII. Venting.....	24
VIII. Electrical	26
IX. System Start-up	50
X. Service and Maintenance	62
XI. Repair Parts	69
Appendix A - Low Water Cut Off (LWCO).....	90
Appendix B - Figures.....	91
Appendix C = Tables.....	93



LEFT END SECTION
STEAM OR WATER
LESS HEATER



LEFT END SECTION
WATER
OPTIONAL HEATER



RIGHT END SECTION
STEAM OR WATER

Figure 2: Section Tappings

Table 1: Trim and Control Installation in Section Tappings

Tapping	Size (NPT)	Steam Boiler with Probe L.W.C.O.	Steam Boiler with Float L.W.C.O.	Water Boiler	Water Boiler with Tankless Heater
A	2	Supply	Supply	Supply	Supply
B	½	Bush to ¼ Pressure Gauge	Plug	Plug	Plug
C	½	Gauge Glass	Nipple & ½ Union Gauge, L.W.C.O. Street Elbow, Syphon & Limit	Plug Lower Tapping Bush to ¼ Upper Tapping Press./Temp. Gauge	Plug Lower Tapping Bush to ¼ Upper Tapping Press./Temp. Gauge
D	2	Return	Return	Bush to 1½, 3" Npl, Elbow, 2" Npl, Circ. Flange, Gasket, Circulator Return	Bush to 1½, 3" Npl, Elbow, 2" Npl, Circ. Flange, Gasket, Circulator Return
E	¾	3" Nipple & Street Elbow Safety Relief Valve	3" Nipple & Street Elbow Safety Relief Valve	3" Nipple & Street Elbow Safety Relief Valve	3" Nipple & Street Elbow Safety Relief Valve
F	2	Bush to ¾ Drain Valve and/or Optional Return	Bush to ¾ Drain Valve and/or Optional Return	Bush to ¾ Drain Valve and/or Optional Gravity Return	Bush to ¾ Drain Valve and/or Optional Gravity Return
G	2	Optional Supply (IN3-6) Required Supply (IN7-12)	Optional Supply (IN3-6) Required Supply (IN7-12)	Plug (IN3-12) Optional Gravity Supply	Plug (IN3-12) Optional Gravity Supply
H	¾	Bush to ¼ & Syphon Limit	Bush to ¼ Pressure Gauge	Well Limit	Well Limit
J	¾	Not Applicable	Not Applicable	Not Applicable	Tankless Heater
K	¾	Low Water Cutoff	Plug	Plug	Plug
L	1	Factory Plugged Surface Blow-Off	Factory Plugged Surface Blow-Off	Factory Plugged	Factory Plugged
M	1¼	Factory Plugged Alliance SL™ Return	Factory Plugged Alliance SL™ Return	Factory Plugged	Factory Plugged
N	1¼	Factory Plugged Alliance SL™ Supply	Factory Plugged Alliance SL™ Supply	Factory Plugged	Factory Plugged
P	¾	Factory Plugged Alliance SL™ Limit	Factory Plugged Alliance SL™ Limit	Factory Plugged	Factory Plugged

I. Pre-Installation

WARNING

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

DANGER

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

NOTICE

Due to the low water content of the boiler, mis-sizing of the boiler with regard to the heating system load will result in excessive boiler cycling and accelerated component failure. U.S. Boiler Company DOES NOT warrant failures caused by mis-sized boiler applications. DO NOT oversize the boiler to the system.

- 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 the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1 and/or CAN/CSA B149.1 Installation Codes. 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 No. CSD-1.
- C. Boiler is design certified for installation on combustible flooring. Boiler must not be installed on carpeting.
- D. Provide clearance between boiler jacket and combustible material in accordance with local fire ordinance. See Figure 3 for minimum listed clearance to combustible material. Recommended service clearance is 24 inches from left side, right side, and front. Additional clearance may be required on left side

if optional tankless heater is installed. Service clearances may be reduced to minimum clearances to combustible materials.

- E. Install boiler on level floor as close to chimney as possible. For basement installation provide a solid base, such as concrete, steel or masonry if floor is not level or if water may be encountered on floor around boiler.
- F. Protect gas ignition system components from water (dripping, spraying, rain, etc.) during boiler operation and service (circulator replacement, control replacement, etc.).
- G. Provide combustion and ventilation air in accordance with applicable provisions of local building codes, or the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1, Section 5.3, Air for Combustion and Ventilation; or CAN/CSA B149.1 Installation Code.

WARNING

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

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.
Volume [ft³] = Length [ft] x Width [ft] x 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.

I. Pre-Installation (continued)

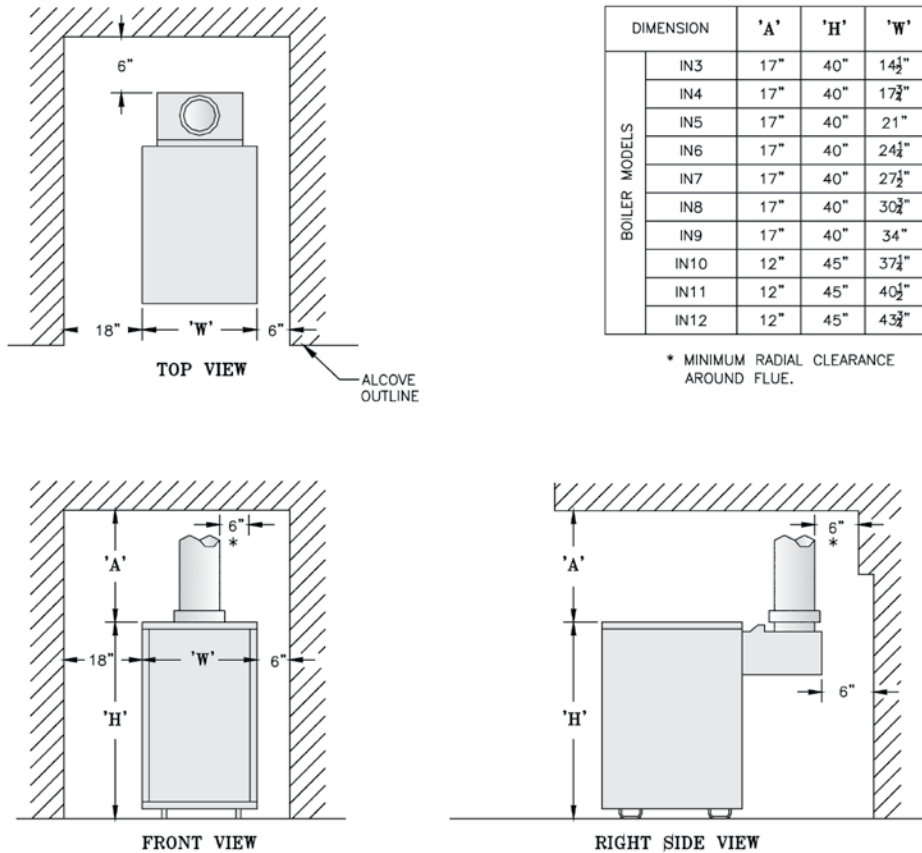


Figure 3: Clearance to Combustible Materials

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 $\frac{1}{4}$ inch mesh.

Consider the blocking effect of louvers, grilles and screens when calculating the opening size to provide the required free area. If free area of louver or grille is not known, assume wood louvers have 20-25 percent free area and metal louvers and grilles have 60-75 percent free area.

- H. 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. Knocked-Down Boiler Assembly

WARNING

Installation of this boiler should be undertaken only by trained and skilled personnel from a qualified service agency.

A. Install Base-Burner-Manifold Assembly

1. Base-Burner-Manifold is shipped assembled from factory (Gas Valve and Pilot/Burner Assembly is shipped in the "Gas Controls Carton").
2. Unpack base assembly and place in location where boiler is to be installed (Refer to Section I: Pre-Installation).

B. Install assembled cast iron sections on base assembly:

1. Install (4) 5/16" x 1/4" self-tapping screws through (4) holes in upper base flange with screw heads on underside of flange. Note: Screws are located in fiber gasket parts bag.
2. Install ceramic fiber gasket. See Figure 4.

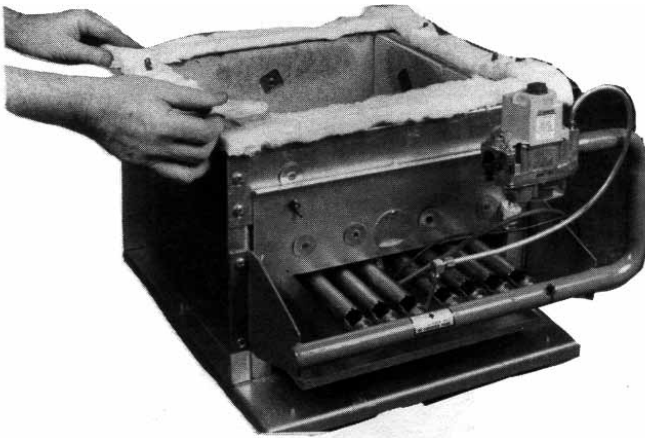


Figure 4: Base Gasket Installation

3. Position boiler above base with lugs cast in boiler sections centered over screws protruding from top of base. Lower boiler onto base taking care not to disturb ceramic fiber gasket. Secure with 5/16" locknuts and washers provided. See Figure 5.



Figure 5: Section Assembly Attachment

4. Loosen nuts on tie rods until only finger tight.
5. If Steam boiler or Water boiler less tankless heater, proceed to Step C.
6. Water Boiler with tankless heater. Remove heater opening cover plate and install tankless heater as follows:
 - a. Place rubber gasket over heater coil and against heater plate. Align holes in plate and gasket.
 - b. Install water heater coil through opening into top nipple ports of boiler and fasten with 3/8" hex head machine screws and flat washers.Note: If tankless heater is not installed, heater opening cover plate must remain in place.

C. Test boiler for leaks before connecting to system and installing controls, trim and jacket.

1. Attach pressure gauge (capable of indicating 30 psi) on boiler.
2. Attach fill valve and piping to return tapping and purge valve to supply tapping. See Figure 6.

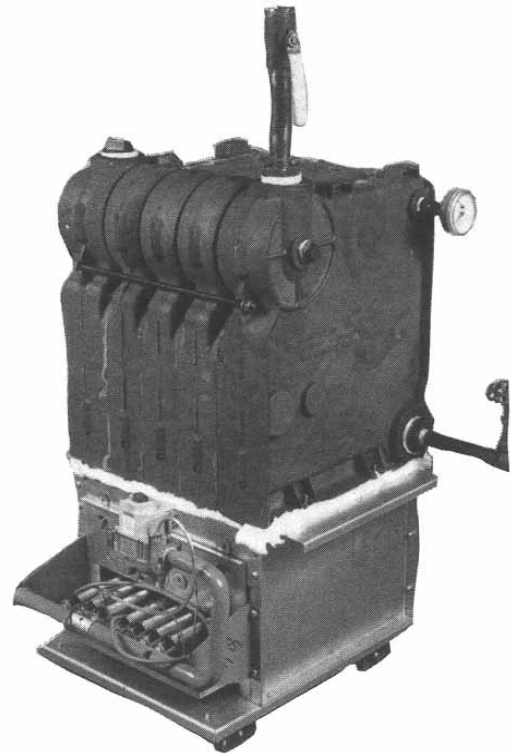


Figure 6: Hydrostatic Pressure Test

3. Install plugs in remaining tappings.
4. Fill boiler completely with water by venting air through purge valve. Close purge valve and apply water pressure of at least 10 psi but not exceeding 30 psi gauge pressure.
5. Examine boiler carefully inside and outside for leaks or damage due to shipment or handling.

II. Knocked-Down Boiler Assembly (continued)

D. Install Canopy.

1. Install ½" thick x 1" wide ceramic fiber gasket. See Figure 7.

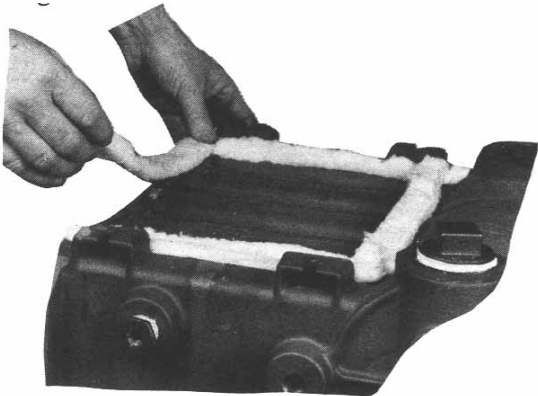


Figure 7: Canopy Gasket Installation

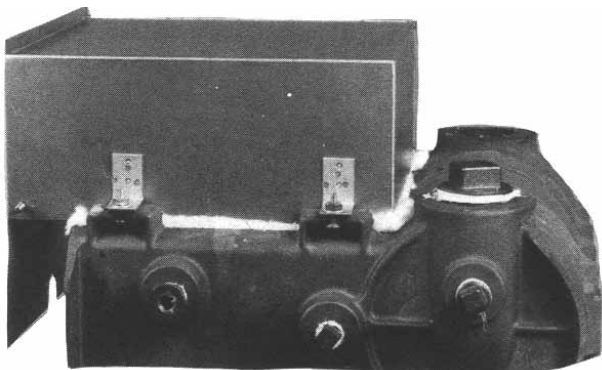


Figure 8: Canopy Installation

2. Position canopy on ceramic fiber gasket. See Figure 8.
3. Attach canopy using ¼" carriage bolts, nuts, and washers provided.

E. Inspect joints between sections. They were factory sealed. If there are any openings due to shipment or handling, reseal with boiler putty.

F. Install Jacket. See Figure 9.

1. Models IN7-IN12 steam boilers: remove 3 inch diameter knockouts in jacket top panels.
2. Raise rear panel under rear flange of canopy and rest on floor. Position rear panel and secure to jacket side panels with sheet metal screws. For Models IN10-IN12, secure jacket upper rear panels to side panels with sheet metal screws.
3. Secure both jacket side panels to base with sheet metal screws.
4. Position front tie bar and secure to jacket side panels with sheet metal screws.
5. Position vestibule panel and secure to side panels with sheet metal screws.
6. Attach Rating Label and Vent Damper Instruction Label at designated locations on vestibule panel.
7. Install top panels by placing over and around outside of side and rear panels. Seat fully and secure with sheet metal screws.

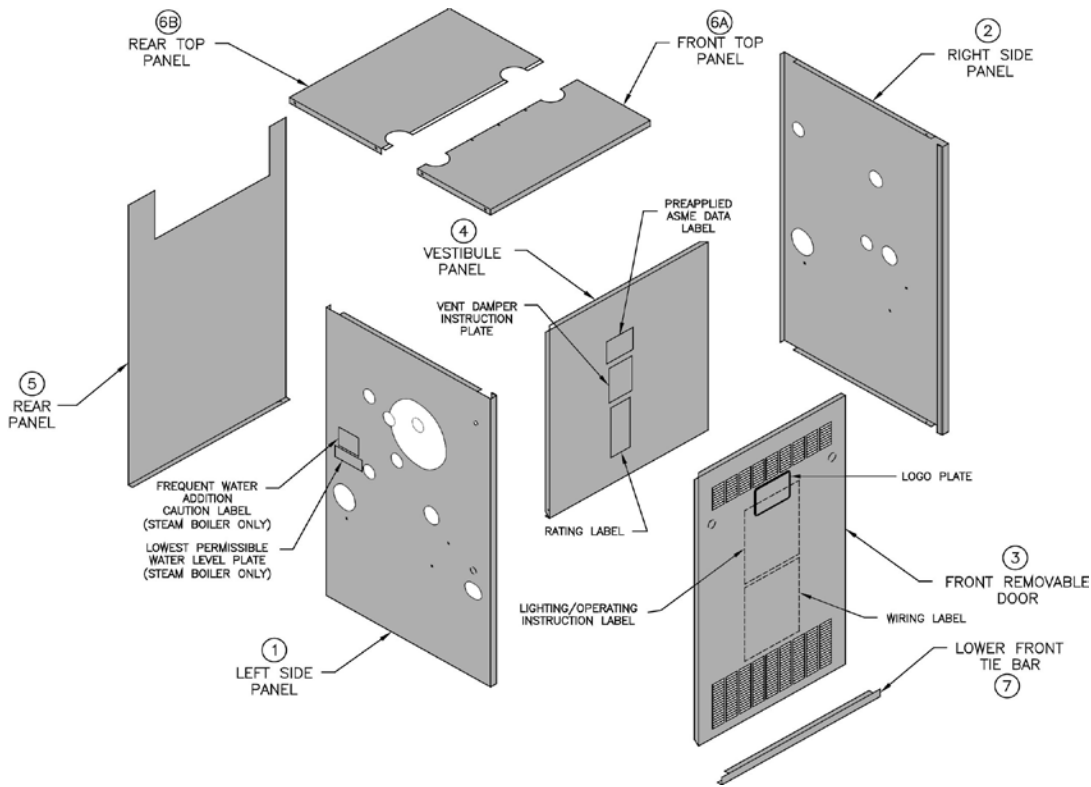


Figure 9: Jacket Assembly

II. Knocked-Down Boiler Assembly (continued)

8. Install black plastic rings into 1-3/32 inch diameter holes located below upper louvers of front removable door.
9. Install front removable door by engaging upper side edges of panel with side receiving flanges, sliding up and under top panel flange - seating front door fully - then sliding down to engage bottom flange behind lower front tie bar.

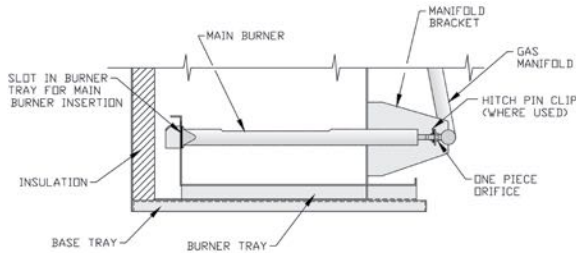


Figure 10: Combustion Chamber

G. Install Pilot/Burner Assembly (shipped in Gas Controls Carton). See Figure 10.

1. Remove jacket front removable door.
 - a. Remove burner access panel located above burners.
 - b. Install Pilot/Burner Assembly where noted on gas manifold.
 - i. Insert rear of burner in burner tray slot.
 - ii. Position burner over the orifice.
NOTE: The burner to the right may need to be lifted from the orifice to install pilot/burner assembly. Reinstall lifted burner over the orifice.
 - c. Reinstall burner access panel.

H. Install Gas Valve on main gas burner assembly (if not factory assembled). See Figure 11, 12, 13, or 14.

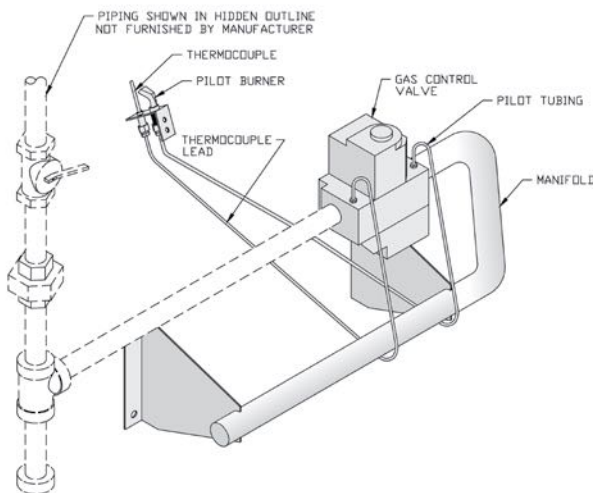


Figure 11: Pilot and Gas Piping, Continuous Ignition (Standing Pilot) (IN3 through IN9 Only)

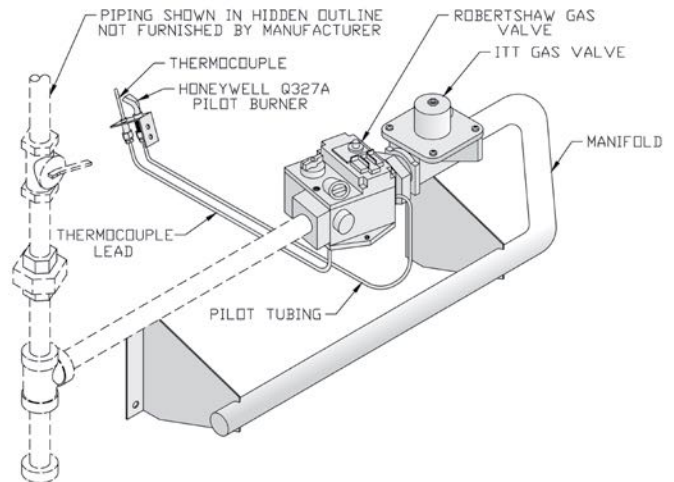


Figure 12: Pilot and Gas Piping, Continuous Ignition (Standing Pilot) (IN10 through IN12 Only)

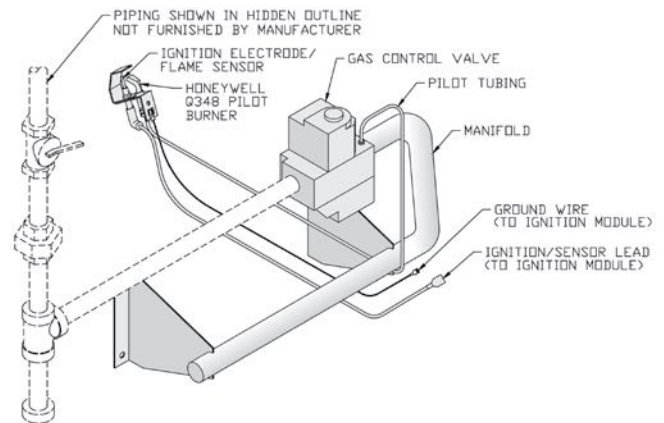


Figure 13: Pilot and Gas Piping, Intermittent Ignition (EI) (IN3 through IN11 Only)

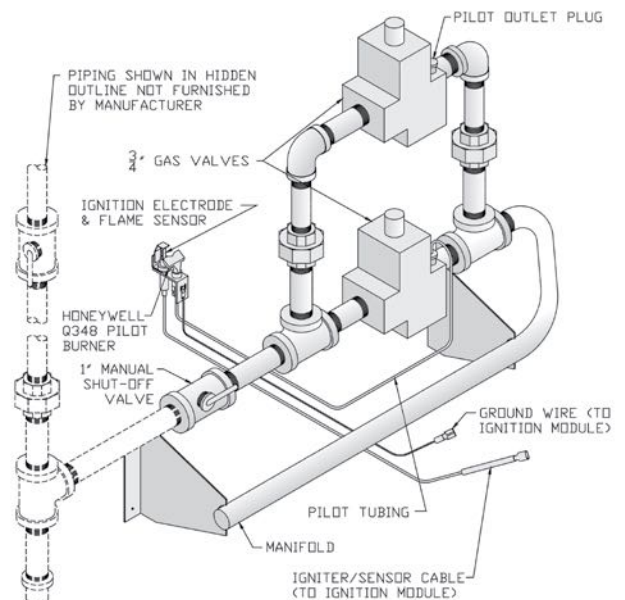


Figure 14: Pilot and Gas Piping, Intermittent Ignition (EI) (IN12 Only)

II. Knocked-Down Boiler Assembly (continued)

1. Connect gas valve to manifold.
2. Connect pilot tubing from pilot burner to gas valve pilot tapping.
3. Continuous Ignition (standing pilot): connect thermocouple to gas valve.

I. Install Blocked Vent Switch with sheet metal screws.

1. Models IN3 - IN9. Install on rear flange of canopy. See Figure 15.

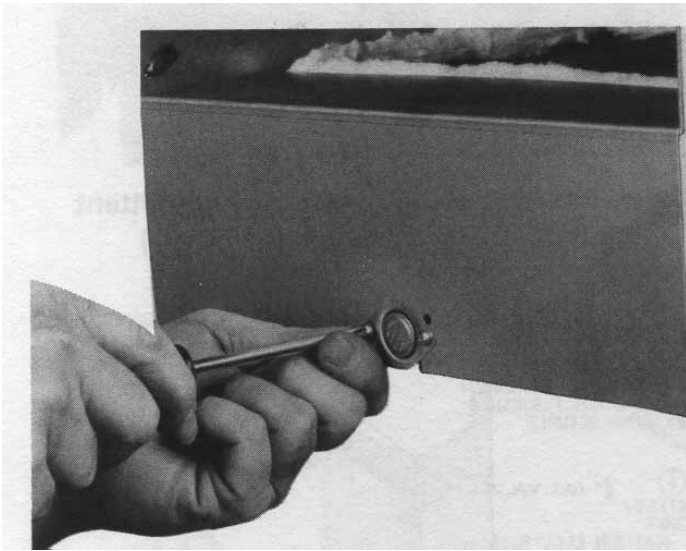


Figure 15: Blocked Vent Switch Installation, IN3 through IN9

2. Models IN10 - IN12. Install on right side of draft hood. See Figure 16. Reset switch must face away from draft hood relief opening.
3. Attach black 18-2 harness to Blocked Vent Switch terminals. Use end with two fully insulated disconnects.

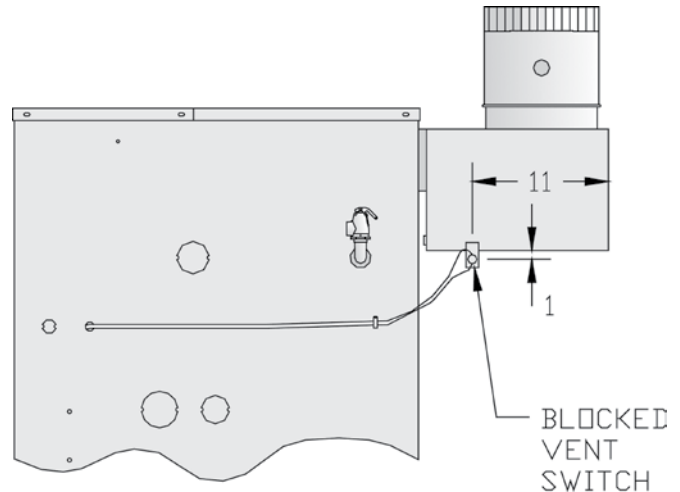


Figure 16: Blocked Vent Switch Installation, IN10 through IN12

4. Secure harness to right side jacket panel with clamp.
5. Insert harness through $\frac{3}{4}$ inch hole in right side jacket panel. Secure with strain relief bushing

J. Intermittent Ignition (EI): Install Ignition Module.

1. Mount ignition module mounting bracket to inside of right side panel using (2) #6 x $\frac{3}{4}$ " sheet metal screws provided.
2. Mount ignition module to bracket using (2) #8 x $\frac{1}{2}$ " sheet metal screws provided.
3. Install (3) wire harness from ignition module to gas valve as shown in wiring diagrams.

K. Continue to Section III: Semi-Pak Boiler Assembly, Step C.

III. Semi-Pak Boiler Assembly

WARNING

Installation of this boiler should be undertaken only by trained and skilled personnel from a qualified service agency.

A. Remove Crate

1. Remove all hold down screws and brackets.
2. Slide boiler to rear of skid and carefully remove from crate skid onto 2 inch thick piece of wood and then onto floor. Do not bump boiler jacket against floor.
3. Do not drop boiler at any time.

B. Move Boiler To Permanent Position. Refer to Section I: Pre-Installation.

C. Identify Trim and Controls

FIRST - Determine controls ordered with boiler and refer to appropriate section(s) following:

There are two ordering methods for trim and controls:

1. EZ-Connect Carton (either steam or water) includes trim, controls, wiring and wiring instructions for installation.
2. Separate Trim Carton (steam or water) and Control Carton (steam or water). Only wiring requiring special connections is provided. For wiring requirements, refer to Section VIII: Electrical and appropriate wiring diagram.

D. Install Trim and Controls

Refer to appropriate paragraphs (following) for trim and controls to be installed.

1. Steam Boiler with Probe Low Water Cutoff

- a. Install pressure limit control into Tapping "H" with siphon, $\frac{3}{4}$ " x $\frac{1}{4}$ " hex bushing, $\frac{3}{4}$ " elbow and $\frac{3}{4}$ " x 3" nipple provided. See Figures 1 and 2. DO NOT TWIST CONTROL. Use wrench on hex fitting located at bottom of control. See Figure 18.

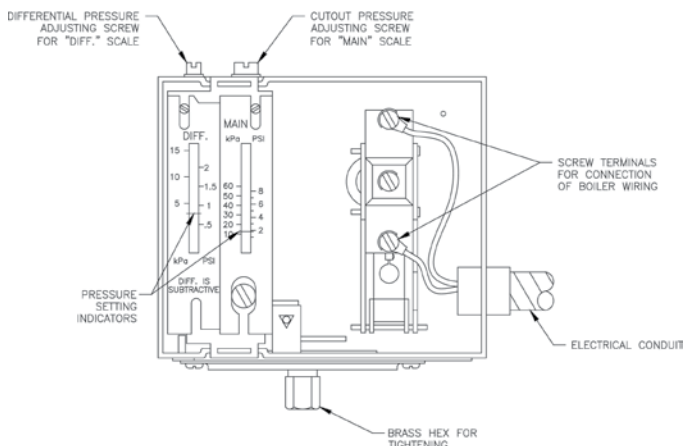


Figure 18: L404F Pressure Limit Control

- b. The L404F pressure limit employs a snap action switch and does not require leveling. See Figure 18.
 - c. Install pressure gauge into Tapping "B" ($\frac{1}{2}$ NPT bushed to $\frac{1}{4}$ NPT). See Figures 1 and 2. Tighten with wrench applied to square shank on back of gauge. DO NOT APPLY PRESSURE ON GAUGE CASE since this may destroy calibration of gauge.
 - d. Install Low Water Cutoff Probe into Tapping "K" ($\frac{3}{4}$ NPT). HANDLE PROBE WITH CARE.
 - e. Attach Low Water cutoff Control to Probe by following instructions packed with control.
 - f. Install gauge glass fittings into Tappings "C" ($\frac{1}{2}$ NPT). See Figures 1 and 2. Lower fitting has small drain valve.
 - g. Install gauge glass and protective rods in fittings.
 - h. Attach "Lowest Permissible Water Level" Plate with sheet metal screws in location indicated in Figure 9.
 - i. Attach "Frequent Water Addition" Label above the "Lowest Permissible Water Level" Plate.
- ##### 2. Steam Boiler with McDonnell & Miller 67 Float Low Water Cutoff
- a. Install Low Water Cutoff, see instructions packed with control.
 - i. Screw brass nipples with union halves into Tappings "C" ($\frac{1}{2}$ NPT). See Figure 1 and 2.
 - ii. Attach Gauge Glass/Low Water Cutoff Assembly to union halves.
 - iii. Affix Blow-Down Card to Jacket Left Side Panel adjacent to low water cutoff.
 - iv. Provide blow down discharge piping.
 - b. Attach street elbow siphon and pressure limit control to low water cutoff. DO NOT TWIST CONTROL. Use wrench on hex fitting located at bottom of control.
 - c. The L404F pressure limit employs a snap action switch and does not require leveling. See Figure 18.
 - d. Install pressure gauge into Tapping "H" ($\frac{3}{4}$ NPT bushed to $\frac{1}{4}$ NPT). See Figures 1 and 2. Tighten with wrench applied to square shank on back of gauge. DO NOT APPLY PRESSURE ON GAUGE CASE since this may destroy calibration of gauge.
 - e. Attach "Lowest Permissible Water Level" Plate with sheet metal screws in location indicated in Figure 9.
 - f. Attach "Frequent Water Addition" Label above the "Lowest Permissible Water Level" Plate.

III. Semi-Pak Boiler Assembly (continued)

3. All Steam Boilers and Water Boilers except "EZW" and "WC" Controls Cartons

- a. Install Junction Box. See Figure 19A.
 - i. Remove center knockout in rear of Junction Box and insert black plastic snap bushing in hole.
 - ii. Install mounting bracket to rear of Junction Box with two (2) blunt sheet metal screws provided.
 - iii. Align center and mounting holes of Junction Box with upper front corner of jacket left side panel.
 - iv. Install Junction Box to jacket from inside vestibule area with two (2) blunt sheet metal screws provided.

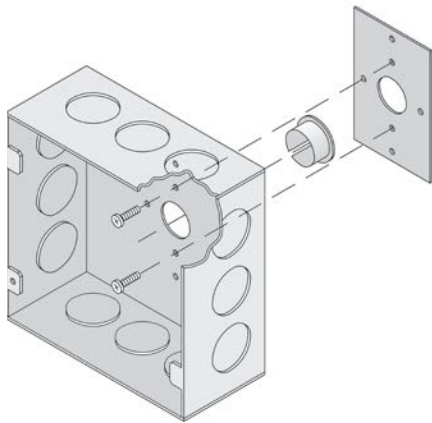


Figure 19A: Junction Box and Mounting Bracket Assembly

- b. Mount transformer on Junction Box. For Canadian boiler provide strain relief by loosely securing Transformer to Junction Box with wire tie inserted through Transformer plate and a Junction Box mounting hole. See Figure 19B.
- c. Fork connector on yellow wire of gas valve harness must be removed and wire stripped before making wire connections. Refer to Section VIII for wiring.
- d. Steam Boilers only. Secure the R8222 Thermostat Isolation Relay to upper left corner of jacket vestibule panel with sheet metal screws provided. See Figure 20.
- e. Water with tankless heater only (EZWT and WCT). Secure R8225D relay to Junction Box. See Figure 1.

4. Water Boiler

- a. Install Temperature/Pressure Gauge into upper Tapping "C" ($\frac{1}{2}$ NPT bushed to $\frac{1}{4}$ NPT). See Figure 1 and 2. Tighten by wrench applied to

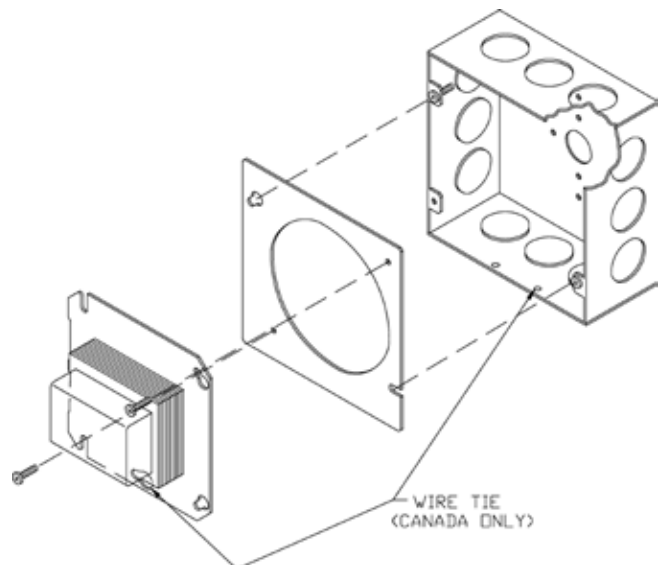


Figure 19B: Junction Box and Transformer Assembly

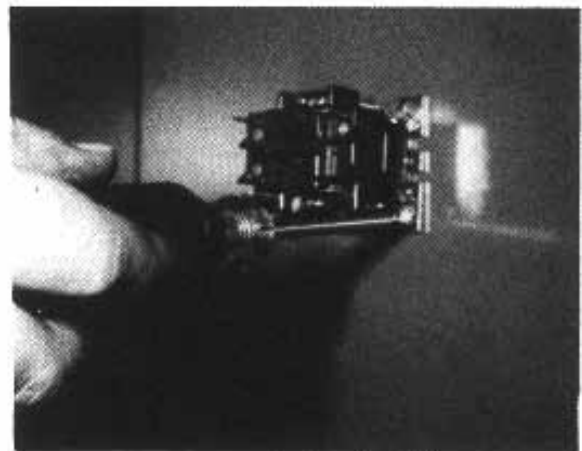


Figure 20: Thermostat Isolation Relay Attachment

square shank on back of gauge. DO NOT APPLY PRESSURE ON GAUGE CASE since this may destroy calibration of gauge.

- b. Install hot water temperature limit and/or combination control. Remove well from control. Screw well into Tapping "H" ($\frac{3}{4}$ NPT). See Figure 1 and 2. Install bulb in well as far as possible, then tighten set screw.
- c. On boilers equipped with a circulator without tankless heater in areas where condensation of flue gases is encountered in boiler flueways, a reverse-acting circulator control should be installed in supply as close as possible to boiler in order to avoid condensation.

E. Continue to Section IV. Packaged Boiler Assembly, Paragraph E.

IV. Packaged Boiler Assembly

WARNING

Installation of this boiler should be undertaken only by trained and skilled personnel from a qualified service agency.

- A. Remove crate and move boiler to permanent position as detailed in Section III: Semi-Pak Boiler Assembly.
- B. Remove Jacket Front Panel. See Figure 45.
- C. Remove poly bag from vestibule area.
- D. On Steam Boilers with probe low water cutoff the L404 pressure limit/control has been packed in the vestibule area.
 1. Screw the pressure limit/control onto the syphon. DO NOT TWIST CONTROL. Use wrench on hex fitting at bottom of control. See Figure 18.
 2. Snap the electrical conduit from the adjacent junction box into the hole in the control.
 3. Open the control's clear cover and attach the two (2) wires in the conduit to the two (2) unused screw terminals.

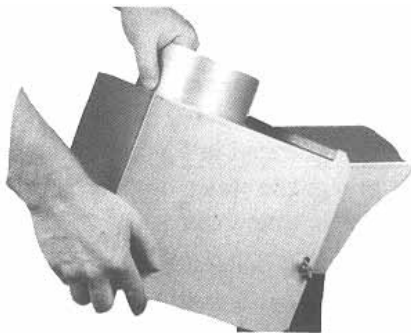


Figure 21: Draft Hood Attachment

E. Install Jacket Front Panel.

F. Install Draft Hood. Models IN3 through IN9.

1. Locate and open "Rear Draft Hood Carton".
2. Position Draft Hood on Canopy Rear Flange. See Figure 21. Top canopy flange must fully engage "U"-shaped draft hood flange for proper installation and operation. Care must be taken to assure that draft hood is level.
3. Secure Rear Draft Hood to Canopy with wing nuts provided. See Figure 22.

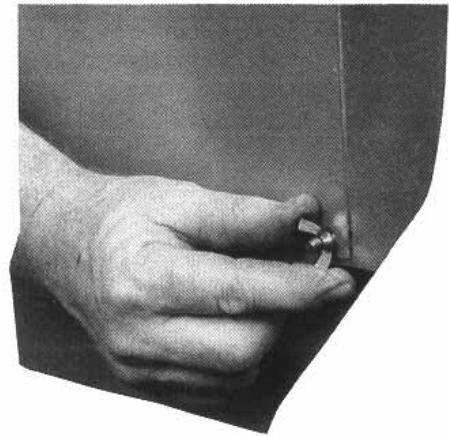


Figure 22: Securing Draft Hood to Canopy

WARNING

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

V. 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.

- A. Design and install boiler and system piping to prevent oxygen contamination of boiler water. Sources of oxygen contamination 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, using nonpermeable materials in distribution system, and eliminating open tanks in system, or isolating boiler from system with heat exchanger.
- B. Install Safety (Relief) Valve in Tapping "E" ($\frac{3}{4}$ NPT). See Figure 23. Use $\frac{3}{4}$ NPT x 3" nipple and $\frac{3}{4}$ NPT elbow provided. Safety (Relief) Valve must be installed with spindle in vertical position.

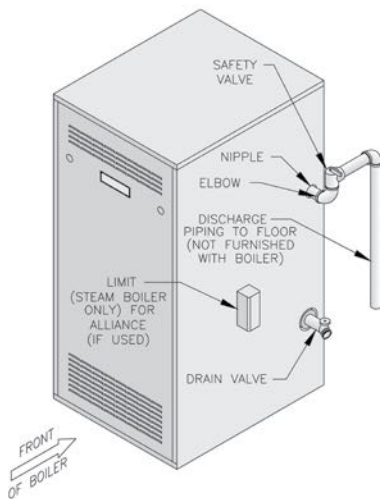


Figure 23: Trim Installation

WARNING

Safety (relief) valve discharge piping must be piped such that the potential of severe burns is eliminated. DO NOT pipe in any area where freezing could occur. DO NOT install any shut-off valves, plugs or caps. Consult Local Codes for proper discharge piping arrangement.

- C. Install Drain Valve in Tapping "F" (2 NPT bushed to $\frac{3}{4}$ NPT). See Figure 23.
- D. Connect supply and return piping to heating system. Maintain minimum $\frac{1}{2}$ inch clearance from combustible materials.
1. For STEAM HEATING see Figure 24. Consult Residential Hydronic Heating Installation and Design I=B=R Guide.
 2. For HOT WATER HEATING with Circulator (forced) see Figure 25 and 25A. Consult Residential Hydronic Heating Installation and Design I=B=R Guide.
 3. If boiler is used in connection with refrigeration systems, boiler must be installed with chilled medium piped in parallel with heating boiler using appropriate valves to prevent the chilled medium from entering the boiler. See Figure 26. Also consult Residential Hydronic Heating Installation and Design I=B=R Guide.

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.

V. Piping and Trim (continued)

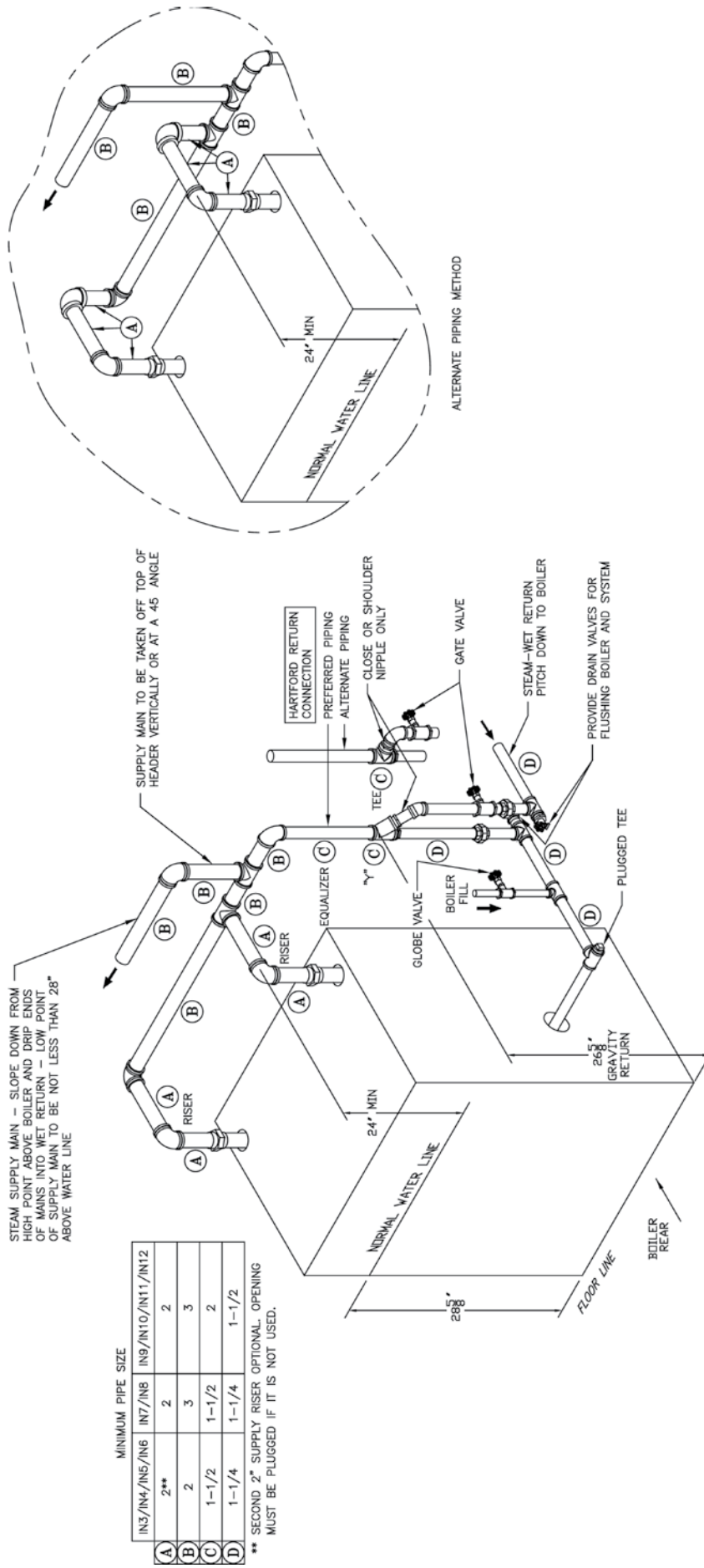
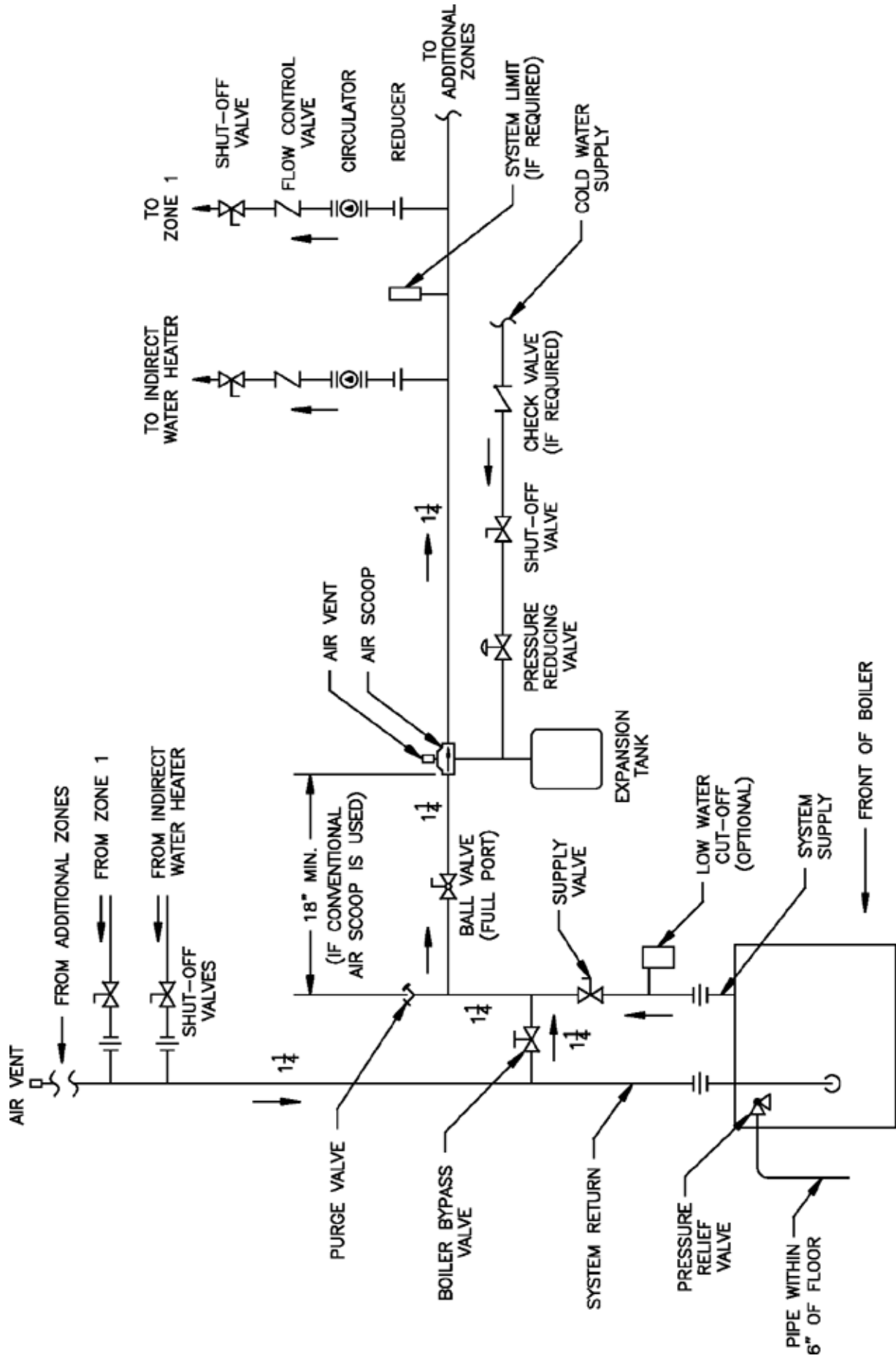


Figure 24: Steam Boiler Piping (Minimum)

NOTICE

Failure to pipe boiler as specified in this manual may result in excessive system noise, water line fluctuations and water carry over.

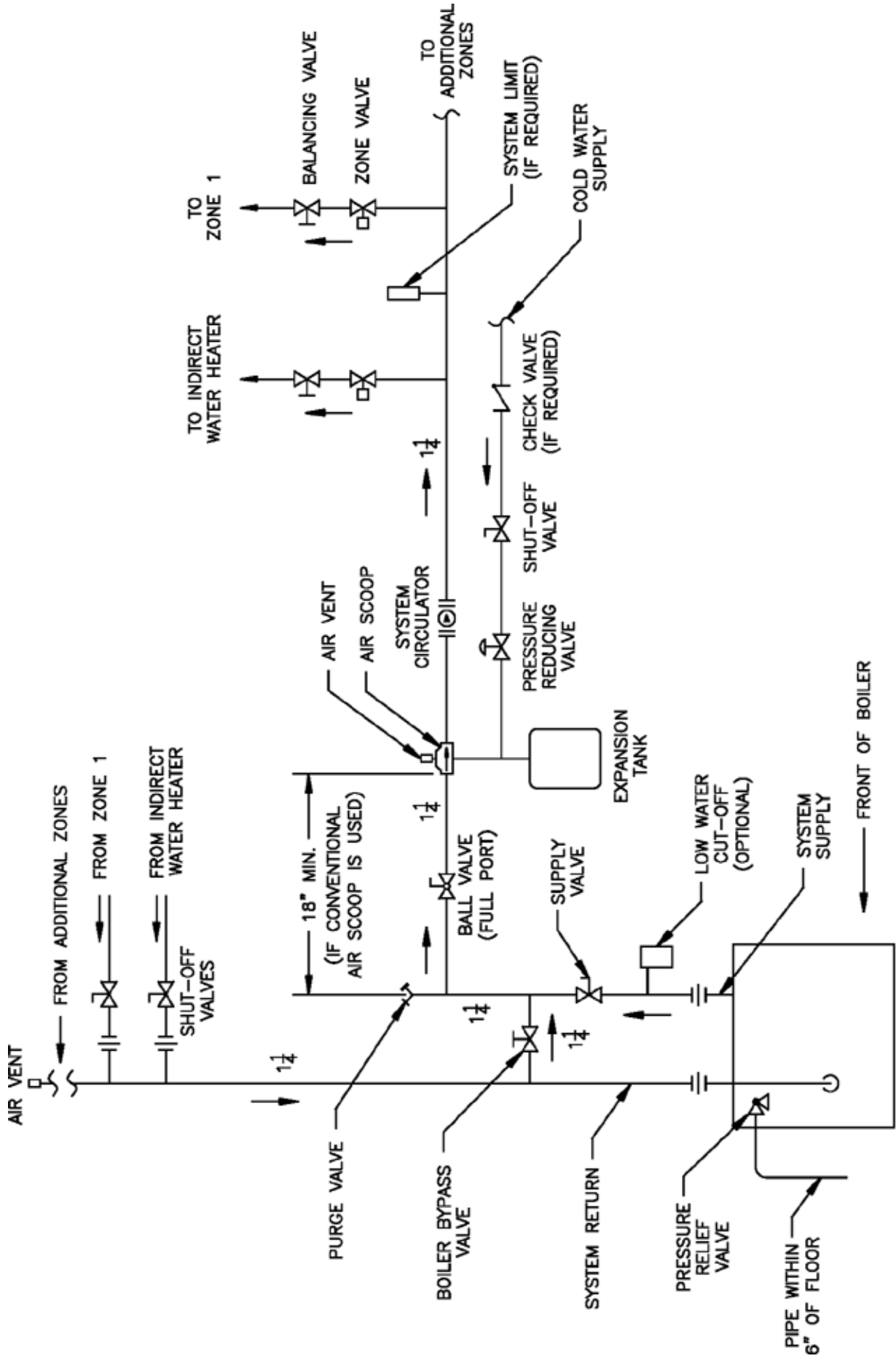
8 V. Piping and Trim (continued)



LEFT SIDE VIEW

Figure 25: Recommended Water Piping for Circulator Zoned Heating System

V. Piping and Trim (continued)



LEFT SIDE VIEW

Figure 25A: Recommended Water Piping for Zone Valve Zoned Heating System

V. Piping and Trim (continued)

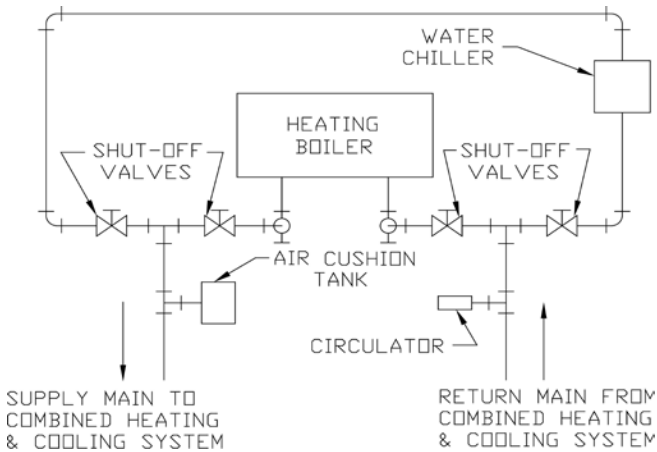


Figure 26: Recommended Piping for Combination Heating and Cooling (Refrigeration) Systems

4. 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 to prevent gravity circulation of boiler water during cooling system operation.
5. Use boiler bypass if boiler is operated in system which has a large volume or excessive radiation where low boiler water temperatures may be encountered (i.e. converted gravity circulation system, etc.).
 - a. Bypass should be same size as supply and return lines with valves located in bypass and supply outlet as illustrated in Figures 25 and 25A in order to regulate water flow to maintain higher boiler water temperatures.
 - b. Set bypass and boiler supply valves to a half throttle position to start.
 - c. After installation is complete, operate boiler according to Section IX: System Start-up.
6. A hot water boiler installed above radiation level must be provided with a low water cutoff device as part of installation.

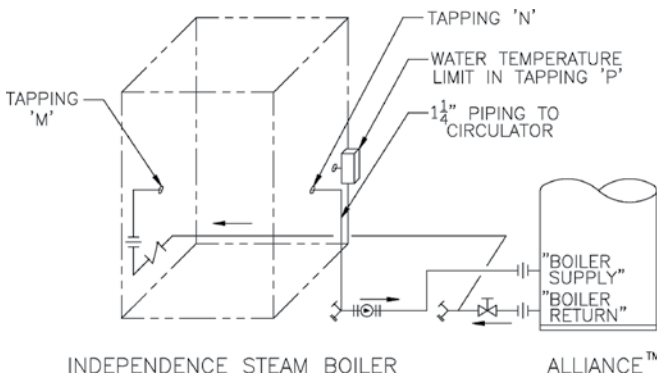


Figure 27: Recommended Piping for Indirect Water Heater

The low water cut off must be mounted in the system piping above the boiler. The minimum safe water level of a hot water boiler is just above the highest water containing cavity of the boiler; that is, a hot water boiler must be full of water to operate safely (see XII. Appendix for further details).

7. If a tankless heater coil is used, connect water lines to $\frac{3}{4}$ NPT tappings in coil plate.

E. Alliance SL™ Indirect Water Heater (if used). Refer to Alliance SL™ Installation, Operating and Service Instructions for additional information.

1. Steam. See Figure 27 for piping recommendations.
 - a. Supply and Return Piping. Connect supply piping to Tapping "N" ($\frac{1}{4}$ NPT) and return piping to Tapping "M" ($\frac{1}{4}$ NPT). Install zone circulator and strainer in supply piping. Install check valve to prevent gravity circulation of boiler water.
 - b. Limit. See Figure 23. Install temperature limit control (Honeywell L4006A or equal) in Tapping "P" ($\frac{3}{4}$ NPT). See Figure 2. Set at 180°F to prevent steam production during non-space heating periods.
2. Water without tankless heater. Install in same manner as space heating zone.

F. Tankless Heater (if used). See Figure 28.

1. Install automatic tempering or mixing valve to prevent delivery of scalding hot water to fixtures. Higher temperature water for dishwashers and automatic washers is possible by piping hot water from heater prior to entering mixing valve. Install per manufacturer's instructions.

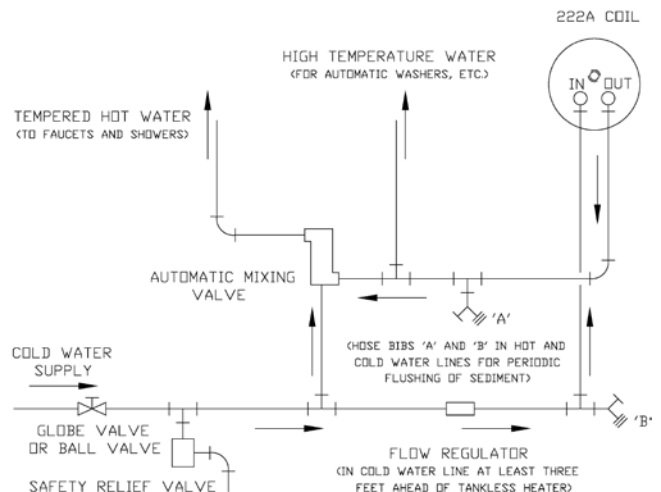


Figure 28: Tankless Heater Piping

V. Piping and Trim (continued)

WARNING

Install automatic mixing valve at tankless heater outlet to avoid risk of burns or scalding due to excessively hot water at fixtures.

2. Install flow regulator. Match regulator rating to tankless heater rating. Install in cold water inlet below and minimum 3 feet downstream of tankless heater inlet.

3. Install water softener in areas of hard water, this will reduce mineral deposits which could hinder heat transfer and delivery of hot water.

- G.** If a long term pressure test of the hydronic system is required, 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.

VI. Gas Piping

WARNING

Failure to properly pipe gas supply to boiler may result in improper operation and damage to the boiler or structure. Always assure gas piping is absolutely leak free and of the proper size and type for the connected load.

An additional gas pressure regulator may be needed. Consult gas supplier.

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 indicated on Rating Label, located on the vestibule panel.
2. Maximum gas demand. Table 2 lists boiler input rate. Also consider existing and expected future gas utilization equipment (i.e. water heater, cooking equipment).

Table 2: Rated Input

Boiler Model Number	Rated Capacity [cubic feet per hour]		Gas Connection Size
	Natural	LP/Propane	
IN3	62	24 $\frac{3}{4}$	$\frac{1}{2}$
IN4	105	42	$\frac{1}{2}$
IN5	140	56	$\frac{1}{2}$
IN6	175	70	$\frac{1}{2}$
IN7	210	84	$\frac{3}{4}$
IN8	245	98	$\frac{3}{4}$
IN9	280	112	$\frac{3}{4}$
IN10	315	126	$\frac{3}{4}$ *
IN11	349	139 $\frac{1}{2}$	$\frac{3}{4}$ *
IN12	385	154	1

* Gas connection size is 1" on IN10 and IN11 Continuous Ignition (Standing Pilot)

3. Length of piping and number of fittings. Refer to Table 3 for maximum capacity of Schedule 40 pipe. Table 4 lists equivalent length for standard fittings.
4. Corrections for the specific gravity of natural gas can be found in Table 5.

For materials or conditions other than those listed above, refer to the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1 and/or CAN/CSA B149.1. Installation Codes, or size system using standard engineering methods acceptable to authority having jurisdiction.

WARNING

Failure to use proper thread compounds on all gas connectors may result in leaks of flammable gas.

WARNING

Gas supply to boiler and system must be absolutely shut off prior to installing or servicing boiler gas piping.

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 the *National Fuel Gas Code*, NFPA 54/ANSI Z223.1 and/or CAN/CSA B149.1 Installation Codes.
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 valve and outside jacket. See Figure 29.

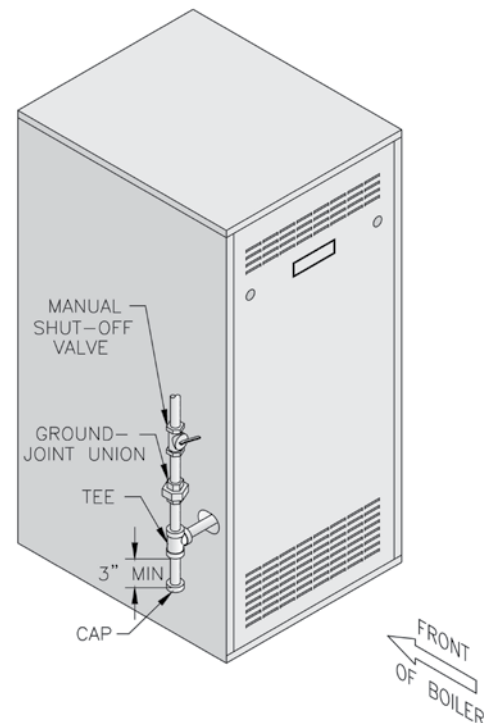


Figure 29: Recommended Gas Piping

VI. Gas Piping (continued)

4. All above ground gas piping upstream from manual gas valve must be electrically continuous and bonded to a grounding electrode. Do not use gas piping as a grounding electrode. Refer to the *National Electrical Code*, ANSI/NFPA 70 and/or CSA C22.1 Electrical Code.

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

1. Protect boiler gas valve. For all testing over ½ psig, boiler an its individual shut-off 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 shut-off valve.

2. Using soap solution, or similar non-combustible solution, electronic leak detector or other approved method. Check that boiler gas piping valves, and all other components are leak free. Eliminate any leaks.

DANGER

Do not use matches, candles, open flames or other ignition source to check for leaks.

Table 3: Maximum Capacity of Schedule 40 Pipe in CFH for Natural 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: Specific Gravity Correction Factors for Natural Gas

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

Table 4: 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

NOTICE

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

IN - _ 2 less than 2000 ft. elevation
 IN - _ 4 2000 to 4500 ft. elevation (Canada)
 IN - _ 5 2000 to 5000 ft. elevation (USA)

VII. Venting

WARNING

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

Read, understand and follow combustion air instruction restrictions contained in the Pre-Installation instructions of this manual.

Do not operate 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, stored and/ or present in the air.

A. Install vent system in accordance with local building codes; or local authority having jurisdiction; or *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, Part 7, Venting of Equipment and/or CAN/CSA B149.1 Installation Codes. Install any of the following for this Independence 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 and/or *National Building Code of Canada*.

Masonry chimney must be lined with approved clay flue lining or listed chimney lining system except as provided in ANSI Z223.1/NFPA 54, Paragraph 7.5.4(a): *Exception: Where permitted by the authority having jurisdiction, existing chimneys shall be permitted to have their use continued when an appliance is replaced by an appliance of similar type, input rating, and efficiency.*

3. Single wall metal vent. Allowed by ANSI Z223.1/NFPA 54 under very restrictive conditions.

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. Boiler Equipped With Vent Damper

1. Open Vent Damper Carton and remove Installation Instructions. Read Installation Instructions thoroughly before proceeding.

CAUTION

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

Provide adequate clearance for servicing - 6" minimum clearance between damper and combustible construction.

NOTICE

DO NOT force the vent damper over the rolled bead on the draft hood collar. The vent damper should rest on the rolled bead.

Please refer to the specifications, installation instructions and trouble shooting guide packed in the vent damper carton for complete detailed installation instructions.

2. Vent damper should be same size as draft hood outlet. See Figure 1. Unpack vent damper carefully - **DO NOT FORCE CLOSED!** Forcing vent damper may damage gear train and void warranty. Vent damper assembly includes pre-wired connection harness with polarized plug for use on all 24V standing pilot or intermittent ignition (EI) control systems.
3. Mount vent damper assembly on draft hood without modification to either (Refer to instructions packed with vent damper for specific instructions). Vent damper position indicator to be visible to users.
4. USA - Do not install Non-listed vent damper or other obstruction in vent pipe.
Canada - Do not install Non-listed vent damper or other obstruction in vent pipe.

VII. Venting (continued)

D. Install Vent Connector from draft hood or vent damper to chimney. See Figure 30.

1. Do not connect into same leg of chimney serving an open fireplace.
2. Vent pipe to chimney must not be smaller than outlet on draft hood or vent damper. Type B is recommended, but single-wall vent pipe may be used. Arrange venting system so boiler is served by vent damper device.
3. Where two or more appliances vent into a common vent, the area of the common vent should be at least equal to the area of the largest vent plus 50% of the area in the additional vent(s). Do not connect the vent of this appliance into any portion of mechanical draft systems operating under positive pressure.
4. Horizontal run should be as short as possible. The maximum length of an uninsulated horizontal run must not exceed 75% of the height of the chimney.
5. Vent pipe should have the greatest possible initial rise above draft hood consistent with headroom available and required clearance from adjacent combustible building structure. Vent pipe should be installed above bottom of chimney to prevent blockage.
6. Vent pipe should slope upward from draft hood to chimney not less than one inch in four feet. No portion of vent pipe should run downward or have dips or sags. Vent pipe must be securely supported.
7. Vent pipe must be inserted into but not beyond inside wall of chimney liner. Seal tight between vent pipe and chimney.

E. If an Existing Boiler is Removed:

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

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

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, and other deficiencies which could cause an unsafe condition.

3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range-hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Place in operation the appliance being inspected. Follow the Lighting (or Operating) Instructions. Adjust thermostat so appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms with the *National Fuel Gas Code*, 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.

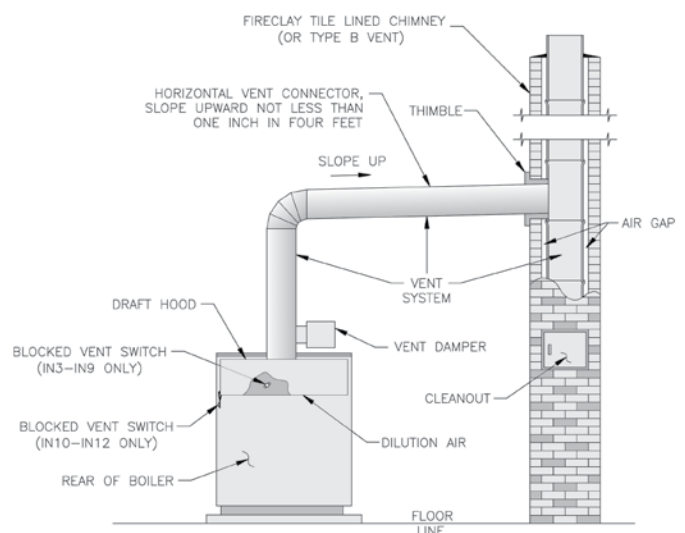


Figure 30: Typical Vent Installation

VIII. Electrical

DANGER

Positively assure all electrical connections are unpowered before attempting installation or service of electrical components or connections of the boiler or building. Lock out all electrical boxes with padlock once power is turned off.

WARNING

Failure to properly wire electrical connections to the boiler may result in serious physical harm.

Electrical power may be from more than one source. Make sure all power is off before attempting any electrical work.

Each boiler must be protected with a properly fused disconnect.

Never jump out or make inoperative any safety or operating controls.

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 and/or CSA C22.1 Electrical Code.

B. Wire Vent Damper (if used).

1. Steam or Water with gravity circulation or tankless heater.
 - a. Remove one (1) 7/8" knockout from junction box. Carefully remove transformer - avoid undue strain on wires.
 - b. Install Vent Damper Harness into top of junction box.
 - c. Remove factory installed jumper plug (if so equipped) from Vent Damper Receptacle. Plug Vent Damper Harness into Vent Damper Receptacle. See Figure 31.

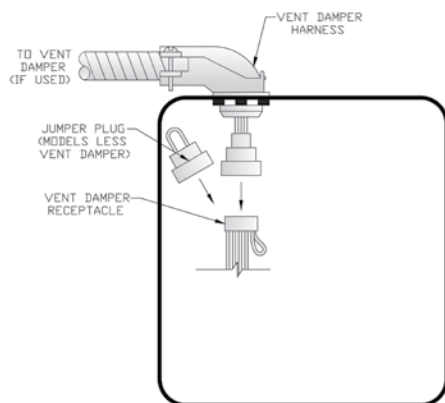


Figure 31: Vent Damper Connection Detail

- d. Install cable clamp around flexible Vent Damper Harness. Attach to jacket top panel. See Figure 32.

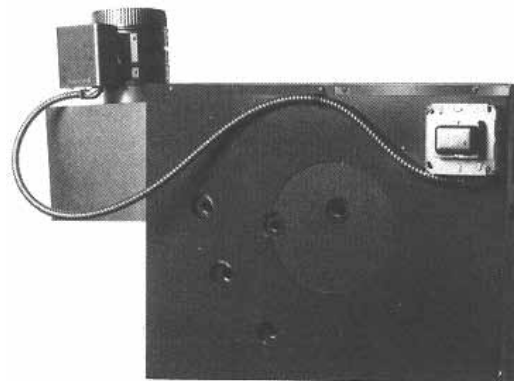


Figure 32: Vent Damper Harness to Junction Box

2. Water with intermittent circulation and without tankless heater.
 - a. Remove 7/8" knockout and cover from limit control.
 - b. Install Vent Damper Harness into top of limit.
 - c. Remove factory installed jumper plug from Vent Damper Receptacle. Plug Vent Damper Harness into Vent Damper Receptacle. See Figure 31.
 - d. Install cable clamp around flexible Vent Damper Harness. Attach to jacket top panel. See Figure 33.
 3. Note: After vent damper is installed and operated through one (1) cycle, the control circuit will operate only when vent damper is in control circuit.

C. 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 pipes, lighting fixtures, television, or sunlight. Allow free air movement by avoiding placement of furniture near thermostat.

VIII. Electrical (continued)

Set heat anticipator to match system requirements. See Table 6. In general, setting heat anticipator too low will cause boiler to short cycle without bringing heated space up to temperature. Setting heat anticipator too high will allow boiler to operate longer than necessary and overheat space.

D. Wire thermostat. Provide Class II circuit between thermostat and boiler.

1. Steam or Water with gravity circulation or tankless heater. Remove transformer from junction box. Connect one wire from thermostat to blue wire(s). Connect additional wire from thermostat to brown wire or red wire for water with tankless heater.
2. Water with intermittent circulation and without tankless heater. Connect one wire from thermostat to Terminal "T" and additional wire to terminal "TV".

E. Alliance SL™ Indirect Water Heater (if used).

1. For wiring refer to wiring diagrams located in this section and Alliance SL™ Installation Operating and Service Instructions.
2. Attach junction box extension (4 - 11/16 square) to junction box on boiler.
3. Steam Boilers only. Verify temperature limit (Honeywell L4006 or equal, which is installer supplied) is installed in Tapping "P", refer to Section V: Piping and Trim.

F. Wire control circuit as shown in the appropriate wiring diagram. See Table 6.

1. 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. Boiler is rated for 120 VAC, 60 hertz, less than 12 amperes.
2. For zone valve wiring, provide separate 24V transformer rather than attempting to use boiler mounted control. Consult zone valve manufacturer for assistance.

G. Wiring diagram and sequence of operation. Locate the system type you are interested in from Table 6, then refer to the page indicated.

1. Vent Damper Sequence of Operation. See Figure 34.
 - a. Vent Damper is continuously powered at Terminal 1.
 - b. When there is a call for heat, the damper relay coil is energized through Terminal 5 if all limits ahead of the damper are satisfied.
 - c. Relay coil closes contacts, energizing damper motor, causing damper to open.
 - d. When the damper blade reaches the fully open position, power is sent back to the boiler limit/ignition circuit through Terminal 2 and the damper motor is de-energized.
 - e. When the call for heat is satisfied, the damper relay coil is de-energized—closing contacts which energize the damper motor. This causes the damper to close. When the damper blade reaches the fully closed position, the damper motor is de-energized.

Table 6: Thermostat Heat Anticipator Settings

System Type	Ignition System		Heat Anticipator Setting (1)
	Continuous (Standing Pilot)	Intermittent (EI)	
Steam with Probe (McDonnell & Miller PS-802 or Hydrolevel CGB-400) Low Water Cutoff	Figure 35, Page 30	Figure 36, Page 32	0.8
Steam with Float (McDonnell & Miller 67) Low Water Cutoff	Figure 37, Page 34	Figure 38, Page 36	0.8
Water (Intermittent Circulation)	Figure 39, Page 38	Figure 40, Page 40	0.3
Water (Gravity Circulation)	Figure 41, Page 42	Figure 42, Page 44	0.3
Water with Tankless Heater	Figure 43, Page 46	Figure 44, Page 48	0.6

(1) If system tends to overheat above thermostat's temperature setting, reduce heat anticipator setting by 0.1 or 0.2 amps. If system tends to shortcycle without reaching desired room temperature, increase heat anticipator setting by 0.1 or 0.2 amps.

VIII. Electrical (continued)

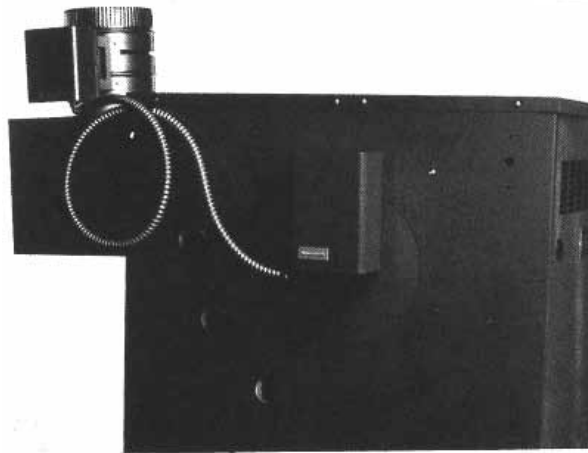


Figure 33: Vent Damper Harness to Limit

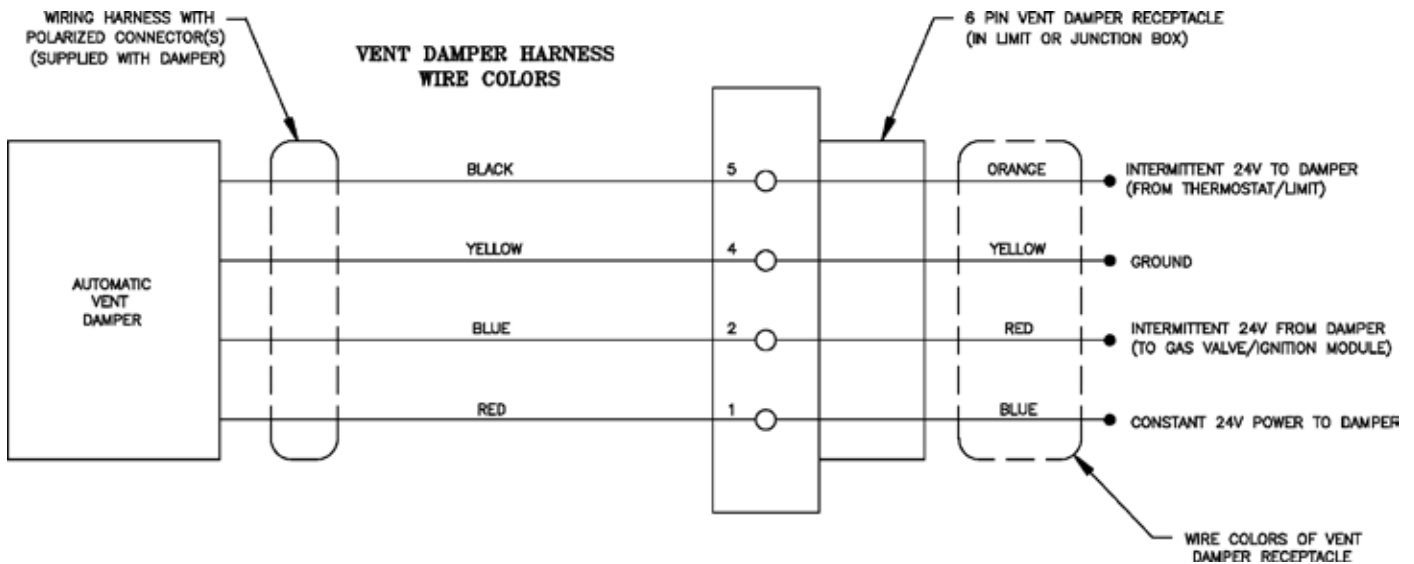


Figure 34: Vent Damper Schematic Wiring Diagram

THIS PAGE LEFT INTENTIONALLY BLANK

VIII. Electrical (continued)

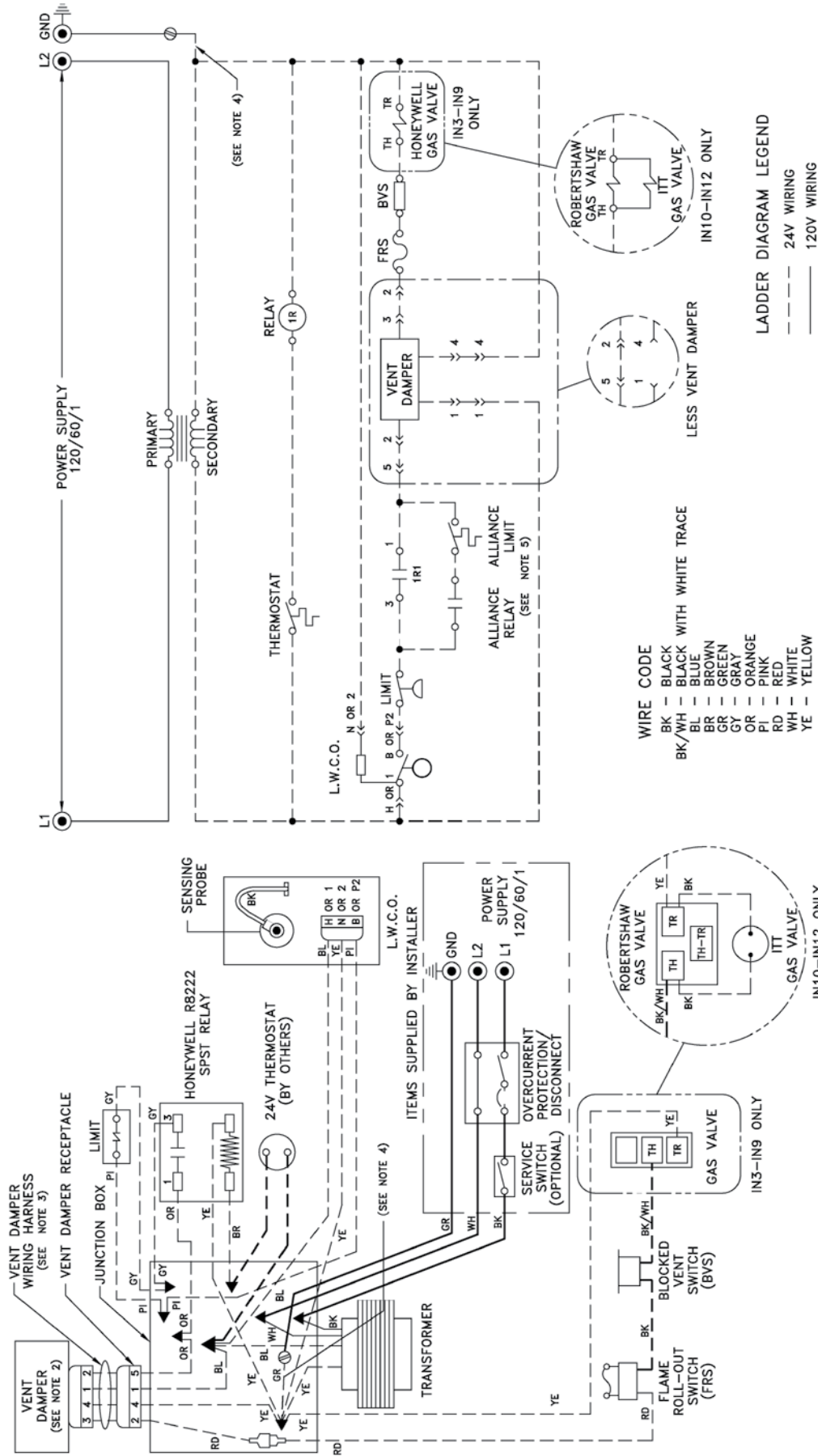


Figure 35: Wiring Diagrams, Steam, Continuous Ignition (Standing Pilot), Probe Low Water Cutoff

VIII. Electrical (continued)

H. Steam Boiler with Continuous Ignition (Standing Pilot) and Probe Low Water Cutoff. See Figure 35.

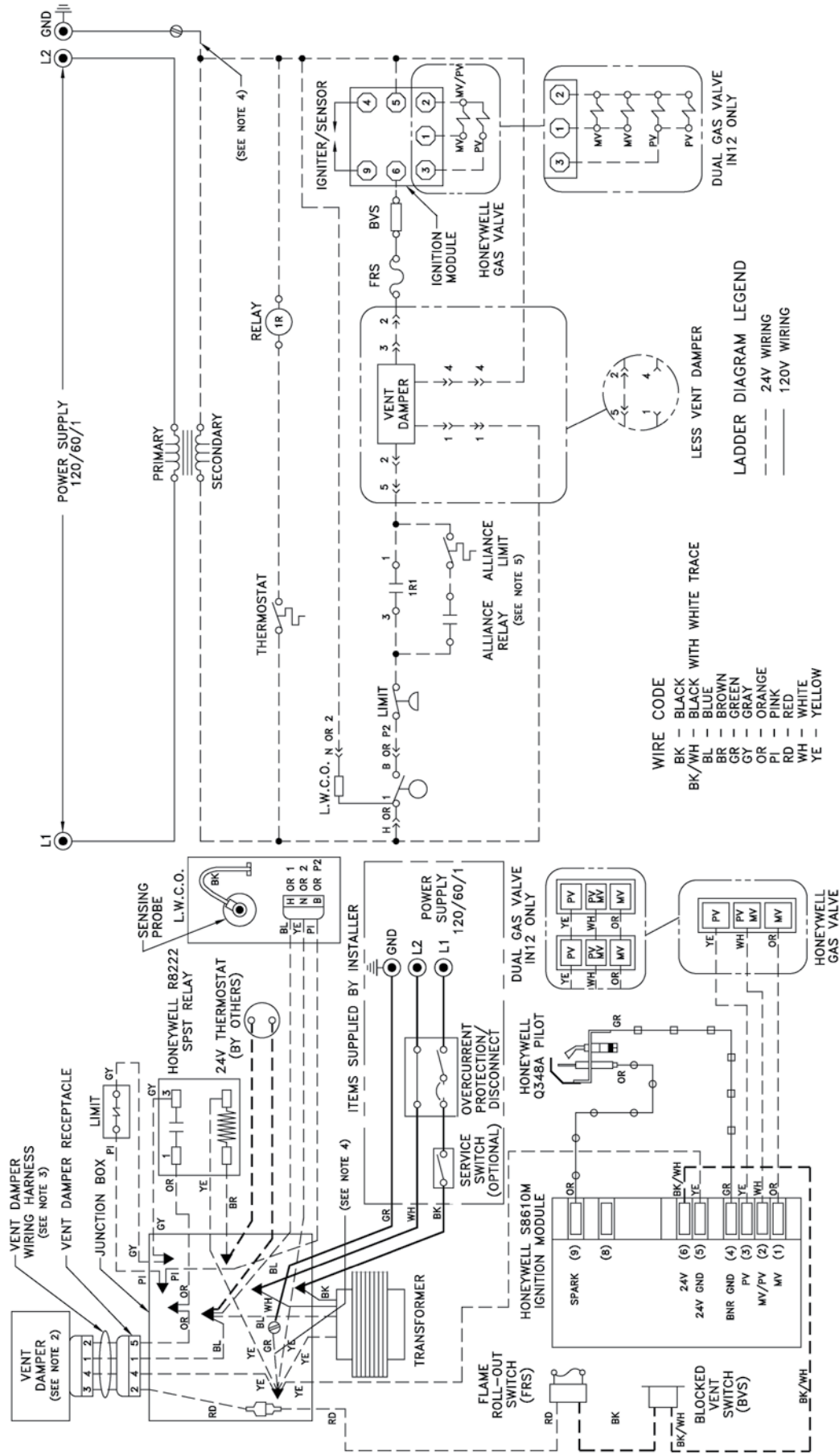
1. Normal Operation

- a. Thermostat calls for heat. Thermostat Isolation Relay is energized, closing contacts.
- b. Vent Damper (if used) opens as stated in Vent Damper Sequence of Operation.
- c. Gas Valve(s) is energized allowing main gas flow and ignition of Main Burners.
- d. After Thermostat is satisfied Gas Valve(s) is de-energized, extinguishing main flame. Vent Damper (if used) closes.

2. Safety Shutdown

- a. Limit: Automatically interrupts main burner operation when steam pressure exceeds set point. Maximum allowable pressure is 15 psi. Normal operation resumes when system pressure falls below set point.

- b. Low Water Cutoff (LWCO): Automatically interrupts main burner operation when surface of boiler water falls to lowest permissible operating level. Normal operation resumes when water returns to normal level.
- c. Blocked Vent Switch. Automatically interrupts main burner operation when excessive vent system blockage occurs. Control is a multiple use device. If blocked vent switch is activated do not attempt to place boiler in operation. Correct source of blockage and reset blocked vent switch.
- d. Flame Roll-out Switch. Automatically interrupts boiler operation when flames or excessive heat are present in vestibule. Control is single use device. If flame roll-out switch is activated do not attempt to place boiler in operation. Correct source of blockage and replace flame roll-out switch.
- e. Thermocouple: senses pilot flame and causes gas valve to turn off main burner and pilot burner gas flow should pilot burner flame extinguish.



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. VENT DAMPER REQUIRED FOR MODELS IN3 THRU IN9. VENT DAMPER OPTIONAL FOR IN10 THRU IN12.
3. FOR BOILER LESS VENT DAMPER ONLY, VENT DAMPER WIRING HARNESS REPLACED WITH JUMPER PLUG.
4. CANADA ONLY - ATTACH GREEN GROUND WIRE FROM TRANSFORMER SECONDARY TO GREEN GROUND SCREW.
5. ALLIANCE WATER HEATER CONTROLS SUPPLIED BY INSTALLER.

Figure 36: Wiring Diagrams, Steam, Intermittent Ignition (EI), Probe Low Water Cutoff

VIII. Electrical (continued)

I. Steam Boiler with Intermittent Ignition (EI) and Probe Low Water Cutoff. See Figure 36.

1. Normal Operation

- a. Thermostat calls for heat. Thermostat Isolation Relay is energized, closing contacts.
- b. Vent Damper (if used) opens as stated in Vent Damper Sequence of Operation.
- c. Ignition Module is energized. Pilot Valve opens and Igniter is energized to ignite Pilot Burner.
- d. Sensor proves presence of pilot flame. Main Valve(s) opens and ignites Main Burners.
- e. After Thermostat is satisfied Ignition Module is de-energized, extinguishing pilot and main flame. Vent Damper (if used) closes.

2. Safety Shutdown

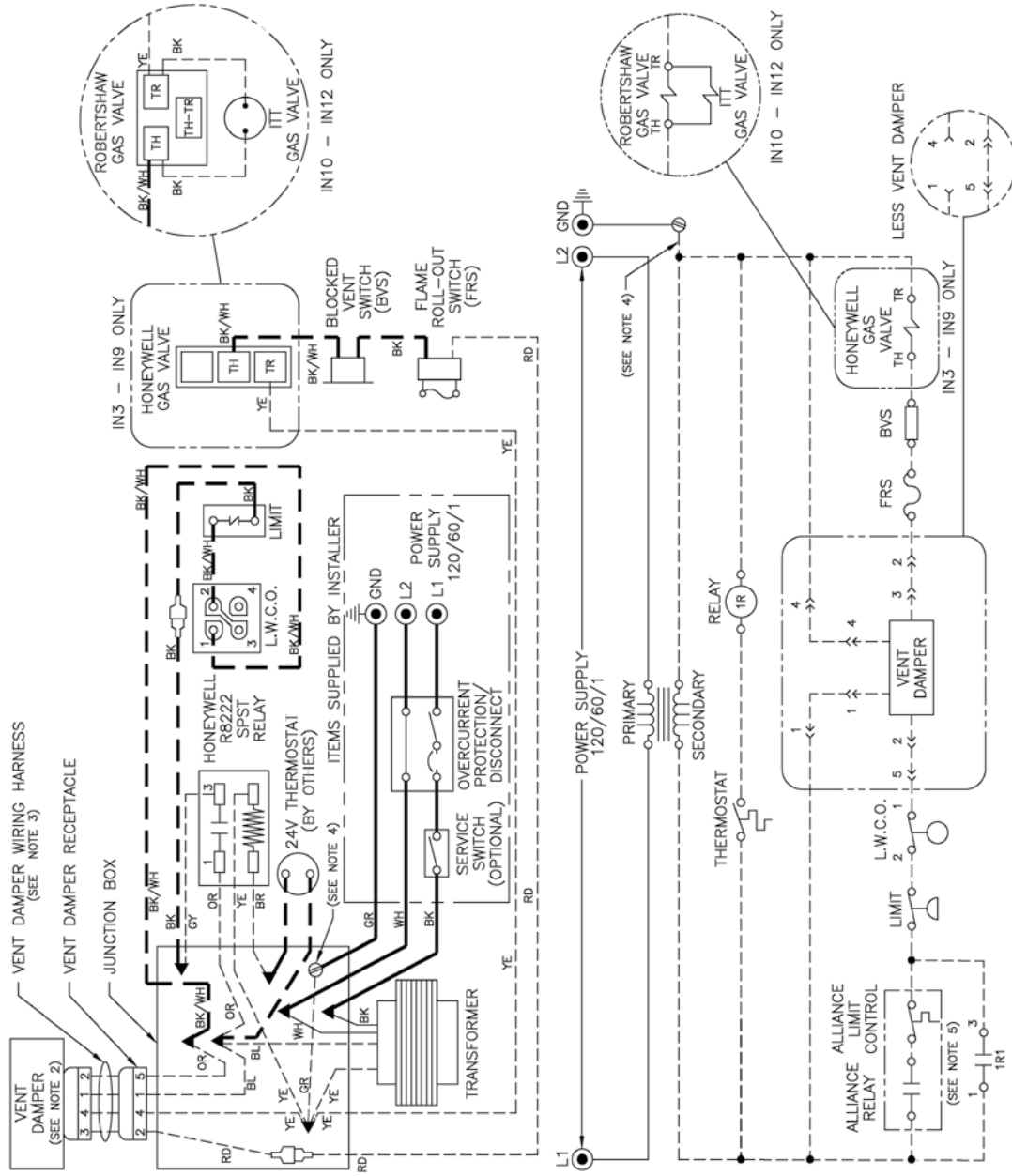
- a. Limit: Automatically interrupts main burner operation when steam pressure exceeds set point. Maximum allowable pressure is 15 psi. Normal operation resumes when system pressure falls below set point.
- b. Low Water Cutoff (LWCO): Automatically interrupts main burner operation when surface of boiler water falls to lowest permissible operating

level. Normal operation resumes when water returns to normal level.

- c. Blocked Vent Switch. Automatically interrupts main burner operation when excessive vent system blockage occurs. Control is a multiple use device. If blocked vent switch is activated do not attempt to place boiler in operation. Correct source of blockage and reset blocked vent switch.
- d. Flame Roll-out Switch. Automatically interrupts boiler operation when flames or excessive heat are present in vestibule. Control is single use device. If flame roll-out switch is activated do not attempt to place boiler in operation. Correct source of blockage and replace flame roll-out switch.
- e. Igniter/Sensor: senses pilot flame and causes ignition module to turn off main burner and pilot burner gas flow should pilot burner flame extinguish. Five to six minutes after shutdown, Ignition Module restarts ignition sequence.

For Electronic Ignition Trouble Shooting Guide, see Page 66. For LED Status Codes, see Table 8 on page 55.

VIII. Electrical (continued)



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

WIRE CODE

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

LADDER DIAGRAM LEGEND

- 24V WIRING
- 120V WIRING

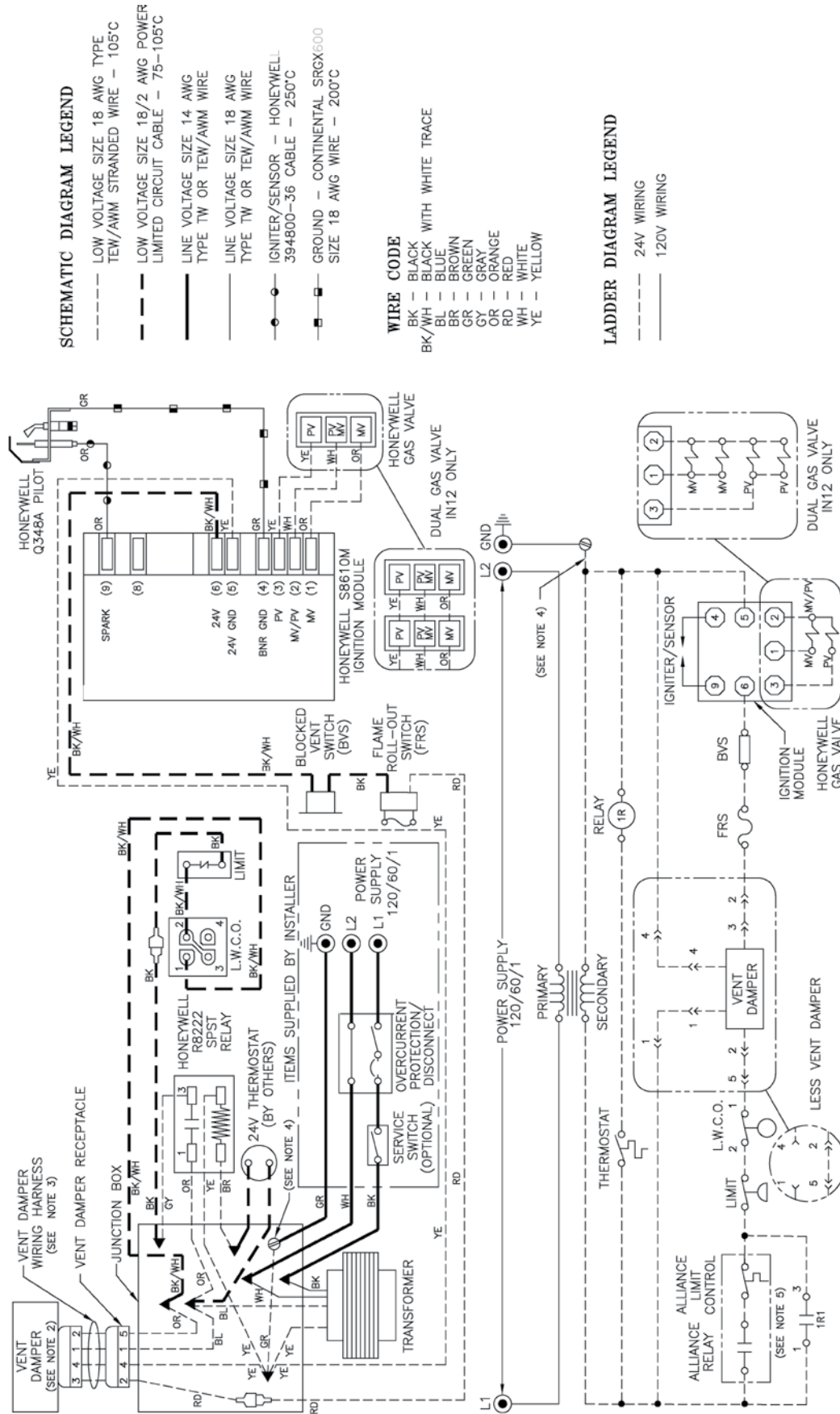
NOTES:

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. VENT DAMPER REQUIRED FOR MODELS IN3 THRU IN9. VENT DAMPER WIRING HARNESS REPLACED WITH JUMPER PLUG.
3. FOR BOILER LESS VENT DAMPER ONLY, VENT DAMPER WIRING HARNESS REPLACED WITH JUMPER PLUG.
4. CANADA ONLY - ATTACH GREEN GROUND WIRE FROM TRANSFORMER SECONDARY TO GREEN GROUND SCREW.
5. ALLIANCE WATER HEATER CONTROLS SUPPLIED BY INSTALLER.

Figure 37: Wiring Diagrams, Steam, Continuous Ignition (Standing Pilot), Float Low Water Cutoff

VIII. Electrical (continued)

- J.** Steam Boiler with Continuous Ignition (Standing Pilot) and Float Low Water Cutoff. See Figure 37.
1. Normal Operation
 - a. Thermostat calls for heat. Thermostat Isolation Relay is energized, closing contacts.
 - b. Vent Damper (if used) opens as stated in Vent Damper Sequence of Operation.
 - c. Gas Valve(s) is energized allowing main gas flow and ignition of Main Burners.
 - d. After Thermostat is satisfied Gas Valve(s) is de-energized, extinguishing main flame. Vent Damper (if used) closes.
 2. Safety Shutdown
 - a. Limit: Automatically interrupts main burner operation when steam pressure exceeds set point. Maximum allowable pressure is 15 psi. Normal operation resumes when system pressure falls below set point.
 - b. Low Water Cutoff (LWCO): Automatically interrupts main burner operation when surface of boiler water falls to lowest permissible operating level. Normal operation resumes when water returns to normal level.
 - c. Blocked Vent Switch. Automatically interrupts main burner operation when excessive vent system blockage occurs. Control is a multiple use device. If blocked vent switch is activated do not attempt to place boiler in operation. Correct source of blockage and reset blocked vent switch.
 - d. Flame Roll-out Switch. Automatically interrupts boiler operation when flames or excessive heat are present in vestibule. Control is single use device. If flame roll-out switch is activated do not attempt to place boiler in operation. Correct source of blockage and replace flame roll-out switch.
 - e. Thermocouple: senses pilot flame and causes gas valve to turn off main burner and pilot burner gas flow should pilot burner flame extinguish.



SCHEMATIC DIAGRAM LEGEND

- LOW VOLTAGE SIZE 18 AWG TYPE TEW/AWM STRANDED WIRE - 105°C
- 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 SIZE 18 AWG WIRE - 200°C

WIRE CODE

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

LADDER DIAGRAM LEGEND

- 24V WIRING
- 120V WIRING

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. VENT DAMPER REQUIRED FOR MODELS IN3 THRU IN9. VENT DAMPER OPTIONAL FOR IN10 THRU IN12.
3. FOR BOILER LESS VENT DAMPER ONLY, VENT DAMPER WIRING HARNESS REPLACED WITH JUMPER PLUG.
4. CANADA ONLY - ATTACH GREEN GROUND WIRE FROM TRANSFORMER SECONDARY TO GREEN GROUND SCREW.
5. ALLIANCE WATER HEATER CONTROLS SUPPLIED BY INSTALLER.

Figure 38: Wiring Diagrams, Steam, Intermittent Ignition (EI), Float Low Water Cutoff

VIII. Electrical (continued)

K. Steam Boiler with Intermittent Ignition (EI) and Float Low Water Cutoff. See Figure 38.

1. Normal Operation

- a. Thermostat calls for heat. Thermostat Isolation Relay is energized, closing contacts.
- b. Vent Damper (if used) opens as stated in Vent Damper Sequence of Operation.
- c. Ignition Module is energized. Pilot Valve opens and Igniter is energized to ignite Pilot Burner.
- d. Sensor proves presence of pilot flame. Main Valve(s) opens and ignites Main Burners.
- e. After Thermostat is satisfied Ignition Module is de-energized, extinguishing pilot and main flame. Vent Damper (if used) closes.

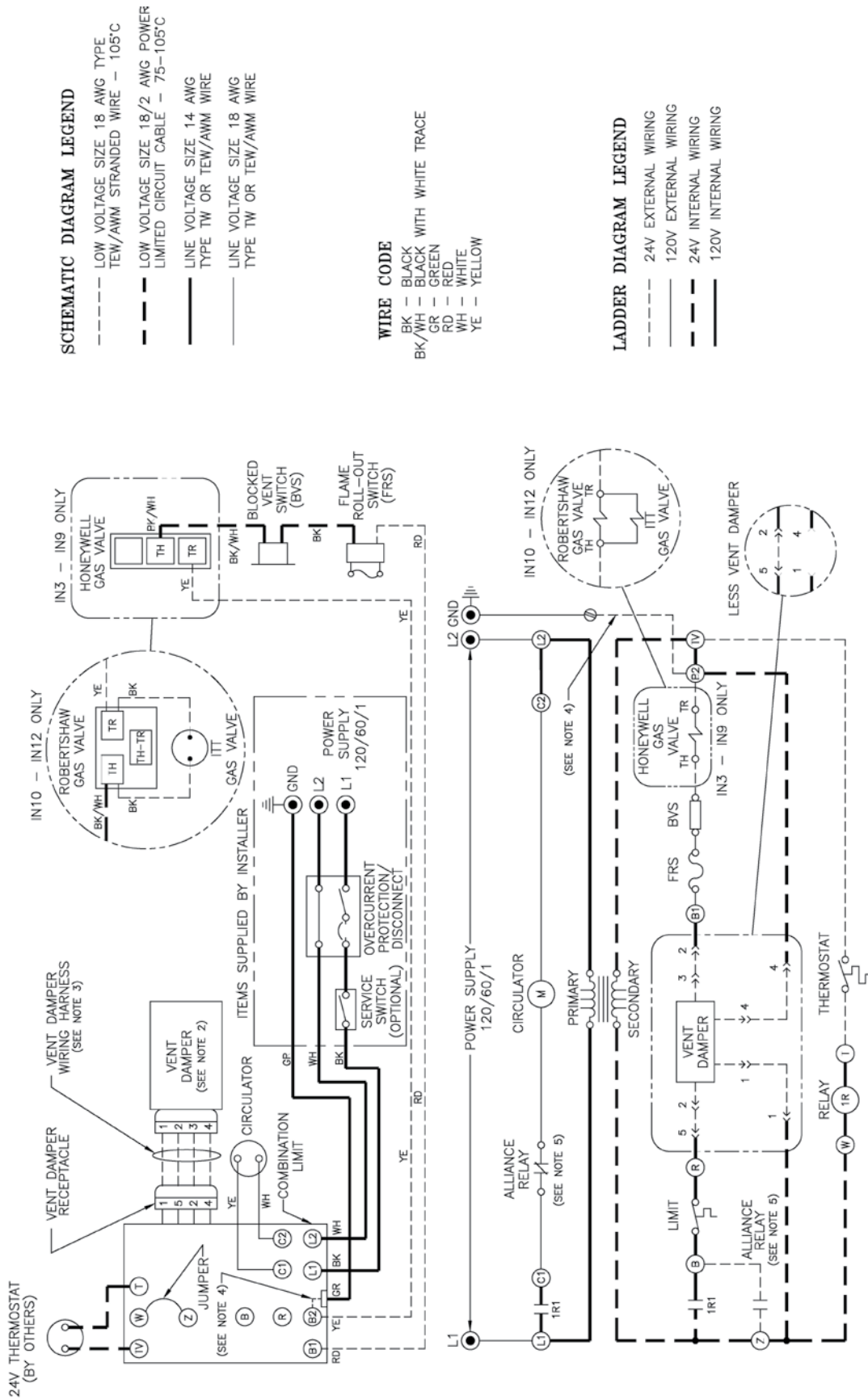
2. Safety Shutdown

- a. Limit: Automatically interrupts main burner operation when steam pressure exceeds set point. Maximum allowable pressure is 15 psi. Normal operation resumes when system pressure falls below set point.
- b. Low Water Cutoff (LWCO): Automatically interrupts main burner operation when surface of boiler water falls to lowest permissible operating

level. Normal operation resumes when water returns to normal level.

- c. Blocked Vent Switch. Automatically interrupts main burner operation when excessive vent system blockage occurs. Control is a multiple use device. If blocked vent switch is activated do not attempt to place boiler in operation. Correct source of blockage and reset blocked vent switch.
- d. Flame Roll-out Switch. Automatically interrupts boiler operation when flames or excessive heat are present in vestibule. Control is single use device. If flame roll-out switch is activated do not attempt to place boiler in operation. Correct source of blockage and replace flame roll-out switch.
- e. Igniter/Sensor: senses pilot flame and causes ignition module to turn off main burner and pilot burner gas flow should pilot burner flame extinguish. Five to six minutes after shutdown, Ignition Module restarts ignition sequence.

For Electronic Ignition Trouble Shooting Guide, see Page 66. For LED Status Codes, see Table 8 on page 55.



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

WIRE CODE

- BK - BLACK
- BK/WH - BLACK WITH WHITE TRACE
- GR - GREEN
- RD - RED
- WH - WHITE
- YE - YELLOW

LADDER DIAGRAM LEGEND

- 24V EXTERNAL WIRING
- 120V EXTERNAL WIRING
- 24V INTERNAL WIRING
- 120V INTERNAL WIRING

NOTES:

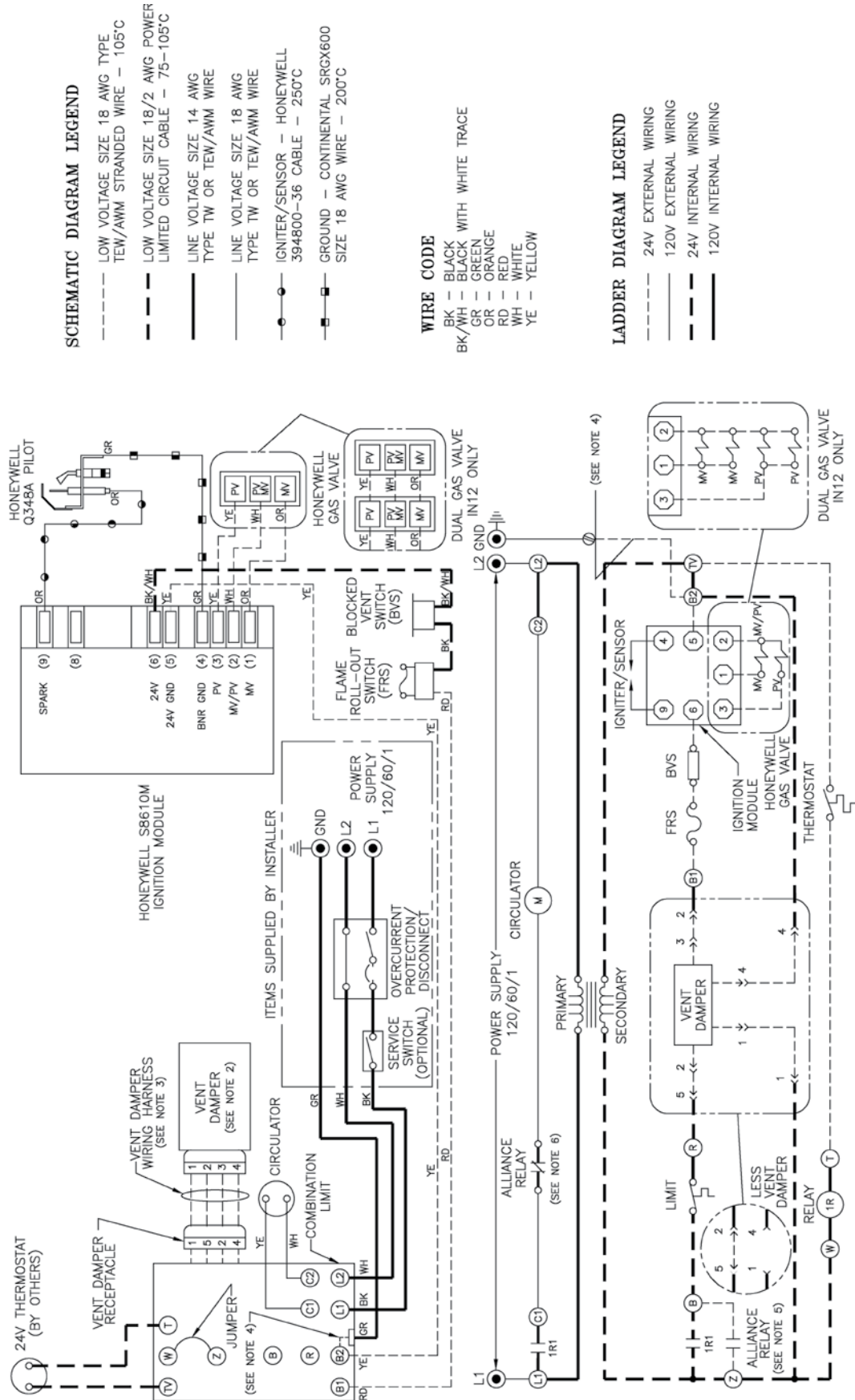
1. IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH WIRE AS SHOWN OR ITS EQUIVALENT.
2. VENT DAMPER REQUIRED FOR MODELS IN3 THRU IN9. VENT DAMPER OPTIONAL FOR IN10 THRU IN12.
3. FOR BOILER LESS VENT DAMPER ONLY, VENT DAMPER WIRING HARNESS REPLACED WITH JUMPER PLUG.
4. CANADA ONLY - ATTACH GREEN GROUND WIRE FROM TRANSFORMER SECONDARY TO GREEN GROUND SCREW.

Figure 39: Wiring Diagrams, Water, Continuous Ignition (Standing Pilot), Intermittent Circulation

VIII. Electrical (continued)

- L.** Water Boiler with Continuous Ignition (Standing Pilot) and Intermittent Circulation. See Figure 39.
1. Normal Operation
 - a. Thermostat calls for heat.
 - b. Vent Damper (if used) opens as stated in Vent Damper Sequence of Operation.
 - c. Gas Valve(s) is energized allowing main gas flow and ignition of Main Burners.
 - d. After Thermostat is satisfied Gas Valve(s) is de-energized, extinguishing main flame. Vent Damper (if used) closes.
 2. Safety Shutdown
 - a. Limit: Automatically interrupts main burner operation when water temperature exceeds set point. Maximum allowable temperature is 250°F. Normal operation resumes when water temperature falls below set point.
 - b. Blocked Vent Switch. Automatically interrupts main burner operation when excessive vent system blockage occurs. Control is a multiple use device. If blocked vent switch is activated do not attempt to place boiler in operation. Correct source of blockage and reset blocked vent switch.
 - c. Flame Roll-out Switch. Automatically interrupts boiler operation when flames or excessive heat are present in vestibule. Control is single use device. If flame roll-out switch is activated do not attempt to place boiler in operation. Correct source of blockage and replace flame roll-out switch.
 - d. Thermocouple: senses pilot flame and causes gas valve to turn off main burner and pilot burner gas flow should pilot burner flame extinguish.

4 VIII. Electrical (continued)



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 SRCX600 SIZE 18 AWG WIRE - 200°C

WIRE CODE

- BK - BLACK
- BK/WH - BLACK WITH WHITE TRACE
- GR - GREEN
- OR - ORANGE
- RD - RED
- WH - WHITE
- YE - YELLOW

LADDER DIAGRAM LEGEND

- 24V EXTERNAL WIRING
- 120V EXTERNAL WIRING
- 24V INTERNAL WIRING
- 120V INTERNAL WIRING

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. VENT DAMPER REQUIRED FOR MODELS IN3 THRU IN9. VENT DAMPER OPTIONAL FOR IN10 THRU IN12.
3. FOR BOILER LESS VENT DAMPER ONLY, VENT DAMPER WIRING HARNESS REPLACED WITH JUMPER PLUG.
4. CANADA ONLY - ATTACH GREEN GROUND WIRE FROM TRANSFORMER SECONDARY TO GREEN GROUND SCREW.
5. ALLIANCE WATER HEATER CONTROLS SUPPLIED BY INSTALLER.

Figure 40: Wiring Diagrams, Water, Intermittent Ignition (EI), Intermittent Circulation

VIII. Electrical (continued)

M. Water Boiler with Intermittent Ignition (EI) and Intermittent Circulation. See Figure 40.

1. Normal Operation

- a. Thermostat calls for heat.
- b. Vent Damper (if used) opens as stated in Vent Damper Sequence of Operation.
- c. Ignition Module is energized. Pilot Valve opens and Igniter is energized to ignite Pilot Burner.
- d. Sensor proves presence of pilot flame. Main Valve(s) opens and ignites Main Burners.
- e. After Thermostat is satisfied Ignition Module is de-energized, extinguishing pilot and main flame. Vent Damper (if used) closes.

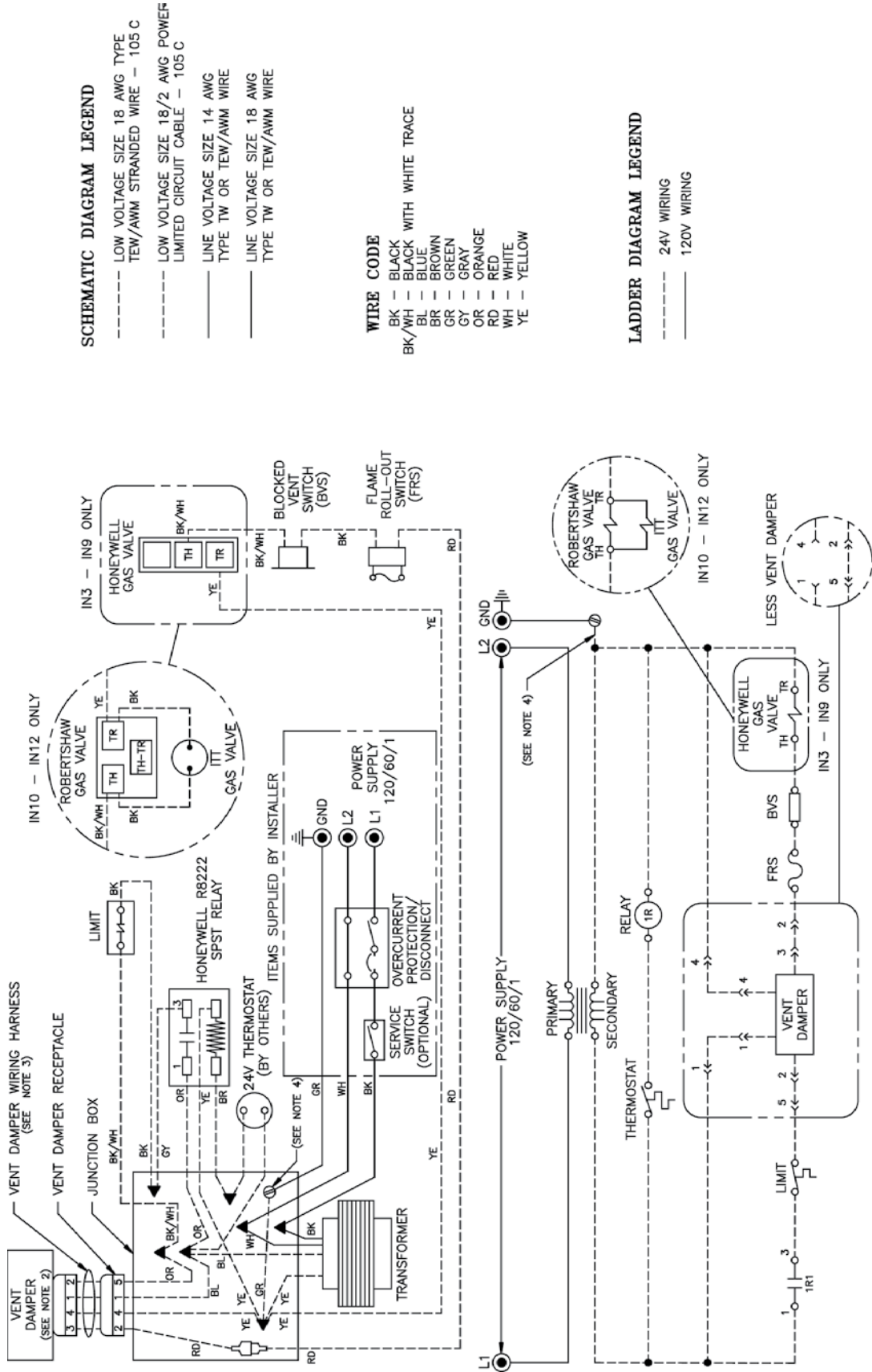
2. Safety Shutdown

- a. Limit: Automatically interrupts main burner operation when water temperature exceeds set point. Maximum allowable temperature is 250°F. Normal operation resumes when water temperature falls below set point.

- b. Blocked Vent Switch. Automatically interrupts main burner operation when excessive vent system blockage occurs. Control is a multiple use device. If blocked vent switch is activated do not attempt to place boiler in operation. Correct source of blockage and reset blocked vent switch.
- c. Flame Roll-out Switch. Automatically interrupts boiler operation when flames or excessive heat are present in vestibule. Control is single use device. If flame roll-out switch is activated do not attempt to place boiler in operation. Correct source of blockage and replace flame roll-out switch.
- d. Igniter/Sensor: senses pilot flame and causes ignition module to turn off main burner and pilot burner gas flow should pilot burner flame extinguish. Five to six minutes after shutdown, Ignition Module restarts ignition sequence.

For Electronic Ignition Trouble Shooting Guide, see Page 66. For LED Status Codes, see Table 8 on page 55.

VIII. Electrical (continued)



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. VENT DAMPER OPTIONAL FOR IN10 THRU IN12.
3. FOR BOILER LESS VENT DAMPER ONLY, VENT DAMPER WIRING HARNESS REPLACED WITH JUMPER PLUG.
4. CANADA ONLY - ATTACH GREEN GROUND WIRE FROM TRANSFORMER SECONDARY TO GREEN GROUND SCREW.

Figure 41: Wiring Diagrams, Water, Continuous Ignition (Standing Pilot), Gravity Circulation

VIII. Electrical (continued)

N. Water Boiler with Continuous Ignition (Standing Pilot) and Gravity Circulation. See Figure 41.

1. Normal Operation

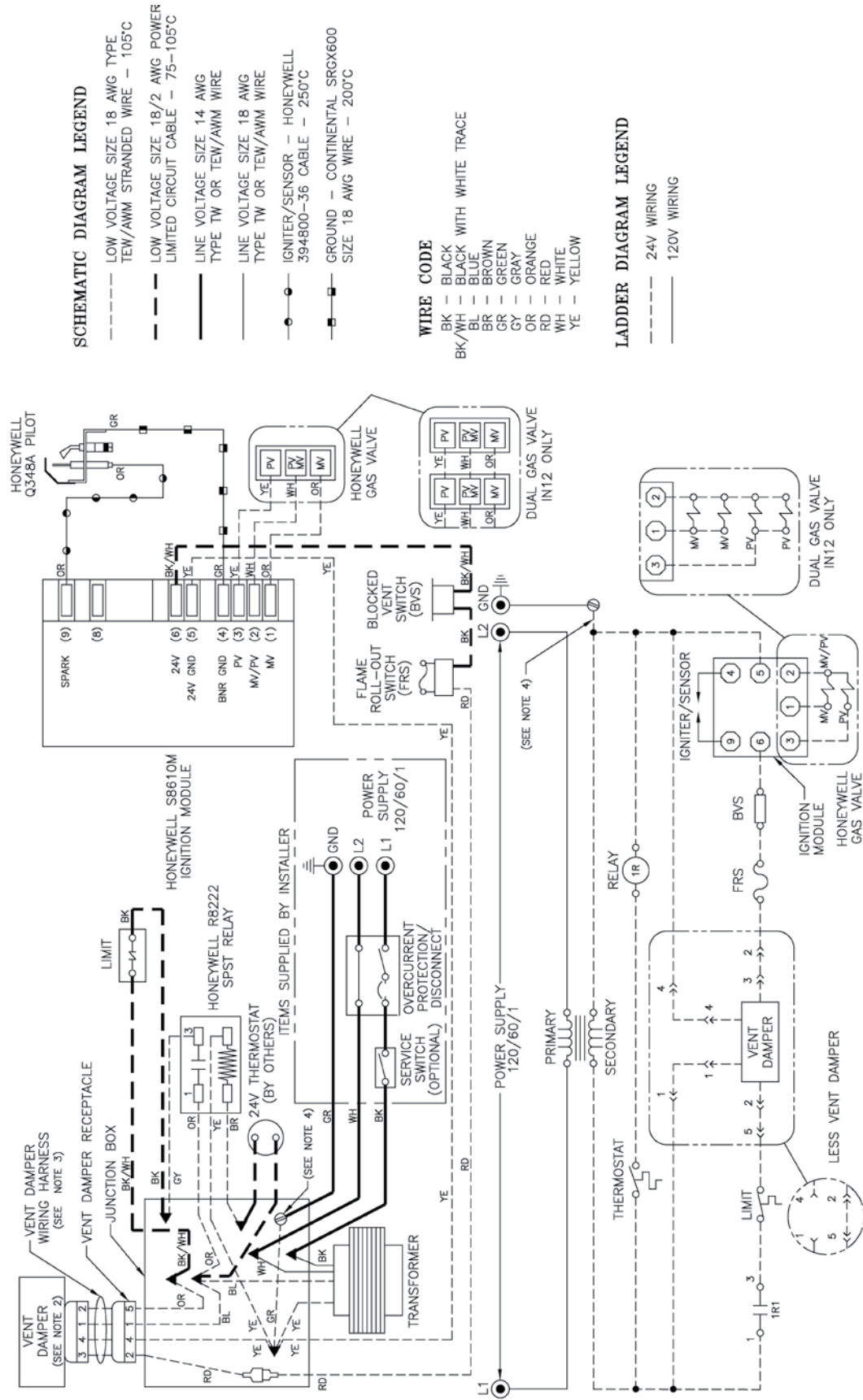
- a. Thermostat calls for heat. Thermostat Isolation Relay is energized, closing contacts.
- b. Vent Damper (if used) opens as stated in Vent Damper Sequence of Operation.
- c. Gas Valve(s) is energized allowing main gas flow and ignition of Main Burners.
- d. After Thermostat is satisfied Gas Valve(s) is de-energized, extinguishing main flame. Vent Damper (if used) closes.

2. Safety Shutdown

- a. Limit: Automatically interrupts main burner operation when water temperature exceeds set point. Maximum allowable temperature is 250°F. Normal operation resumes when water temperature falls below set point.

- b. Blocked Vent Switch. Automatically interrupts main burner operation when excessive vent system blockage occurs. Control is a multiple use device. If blocked vent switch is activated do not attempt to place boiler in operation. Correct source of blockage and reset blocked vent switch.
- c. Flame Roll-out Switch. Automatically interrupts boiler operation when flames or excessive heat are present in vestibule. Control is single use device. If flame roll-out switch is activated do not attempt to place boiler in operation. Correct source of blockage and replace flame roll-out switch.
- d. Thermocouple: senses pilot flame and causes gas valve to turn off main burner and pilot burner gas flow should pilot burner flame extinguish.

4 VIII. Electrical (continued)



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. VENT DAMPER REQUIRED FOR MODELS IN3 THRU IN9. VENT DAMPER OPTIONAL FOR IN10 THRU IN12.
3. FOR BOILER LESS VENT DAMPER ONLY, VENT DAMPER WIRING HARNESS REPLACED WITH JUMPER PLUG.
4. CANADA ONLY - ATTACH GREEN GROUND WIRE FROM TRANSFORMER SECONDARY TO GREEN GROUND SCREW.

Figure 42: Wiring Diagrams, Water, Intermittent Ignition (EI), Gravity Circulation

VIII. Electrical (continued)

O. Water Boiler with Intermittent Ignition (EI) and Gravity Circulation. See Figure 42.

1. Normal Operation

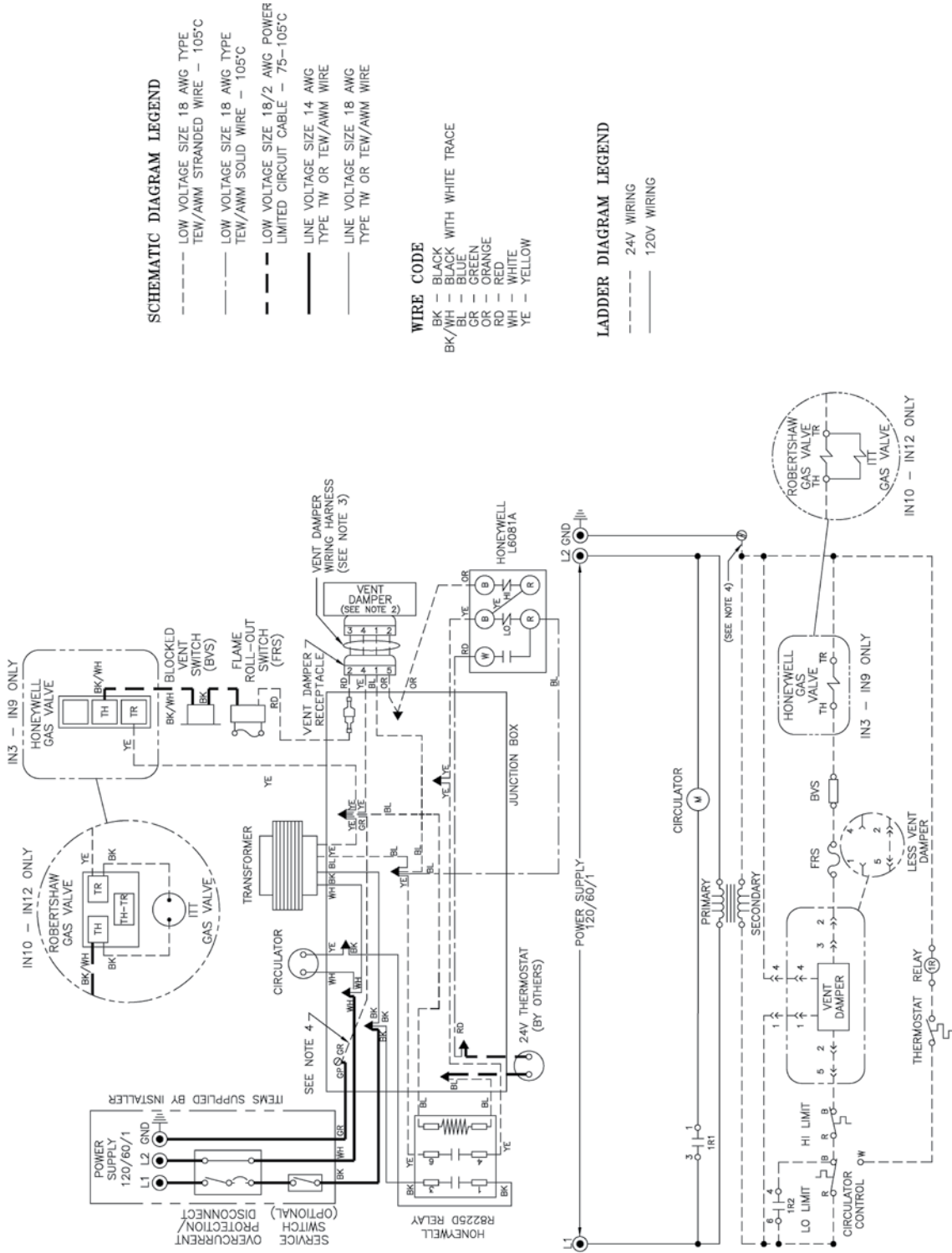
- a. Thermostat calls for heat. Thermostat Isolation Relay is energized, closing contacts.
- b. Vent Damper (if used) opens as stated in Vent Damper Sequence of Operation.
- c. Ignition Module is energized. Pilot Valve opens and Igniter is energized to ignite Pilot Burner.
- d. Sensor proves presence of pilot flame. Main Valve(s) opens and ignites Main Burners.
- e. After Thermostat is satisfied Ignition Module is de-energized, extinguishing pilot and main flame. Vent Damper (if used) closes.

2. Safety Shutdown

- a. Limit: Automatically interrupts main burner operation when water temperature exceeds set point. Maximum allowable temperature is 250°F. Normal operation resumes when water temperature falls below set point.

- b. Blocked Vent Switch. Automatically interrupts main burner operation when excessive vent system blockage occurs. Control is a multiple use device. If blocked vent switch is activated do not attempt to place boiler in operation. Correct source of blockage and reset blocked vent switch.
- c. Flame Roll-out Switch. Automatically interrupts boiler operation when flames or excessive heat are present in vestibule. Control is single use device. If flame roll-out switch is activated do not attempt to place boiler in operation. Correct source of blockage and replace flame roll-out switch.
- d. Igniter/Sensor: senses pilot flame and causes ignition module to turn off main burner and pilot burner gas flow should pilot burner flame extinguish. Five to six minutes after shutdown, Ignition Module restarts ignition sequence.

For Electronic Ignition Trouble Shooting Guide, see Page 66. For LED Status Codes, see Table 8 on page 55.

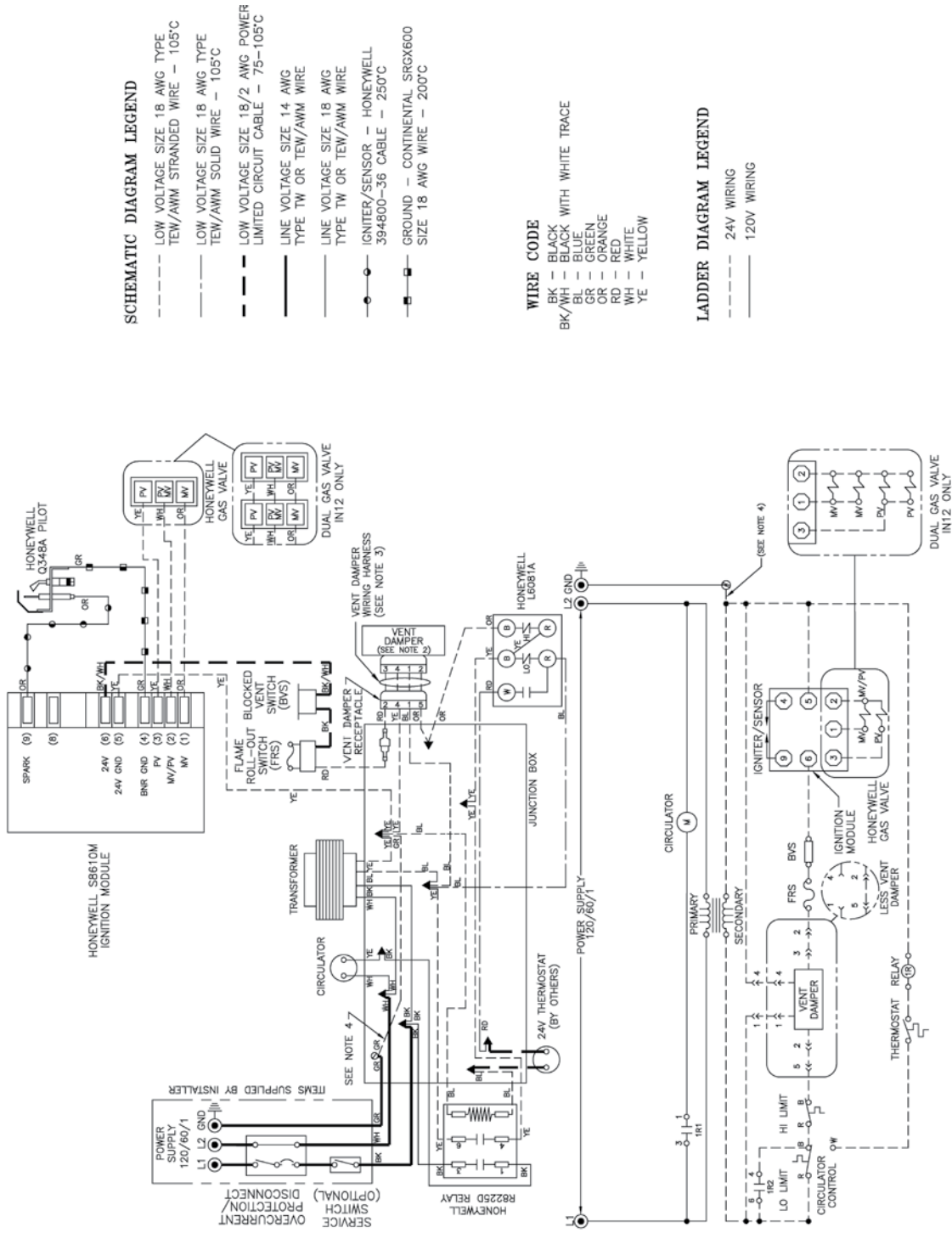


- NOTES:**
1. IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE APPLIANCE MUST BE REPLACED, IT MUST BE REPLACED WITH WIRE AS SHOWN OR ITS EQUIVALENT.
 2. VENT DAMPER REQUIRED FOR MODELS IN3 THRU IN9. VENT DAMPER OPTIONAL FOR IN10 THRU IN12.
 3. FOR BOILER LESS VENT DAMPER ONLY, VENT DAMPER HARNESS REPLACED WITH JUMPER PLUG.
 4. CANADA ONLY - ATTACH GREEN GROUND WIRE FROM TRANSFORMER SECONDARY TO GREEN GROUND SCREW.

Figure 43: Wiring Diagrams, Water, Continuous Ignition (Standing Pilot), Tankless Heater

VIII. Electrical (continued)

- P.** Water Boiler with Continuous Ignition (Standing Pilot) and Tankless Heater. See Figure 43.
1. Normal Operation
 - a. Thermostat calls for heat or low limit senses water temperature below set point.
 - b. Vent Damper (if used) opens as stated in Vent Damper Sequence of Operation.
 - c. Gas Valve(s) is energized allowing main gas flow and ignition of Main Burners.
 - d. After Thermostat or low limit is satisfied Gas Valve(s) is de-energized, extinguishing main flame. Vent Damper (if used) closes.
 2. Safety Shutdown
 - a. Limit: Automatically interrupts main burner operation when water temperature exceeds set point. Maximum allowable temperature is 250°F. Normal operation resumes when water temperature falls below set point.
 - b. Blocked Vent Switch. Automatically interrupts main burner operation when excessive vent system blockage occurs. Control is a multiple use device. If blocked vent switch is activated do not attempt to place boiler in operation. Correct source of blockage and reset blocked vent switch.
 - c. Flame Roll-out Switch. Automatically interrupts boiler operation when flames or excessive heat are present in vestibule. Control is single use device. If flame roll-out switch is activated do not attempt to place boiler in operation. Correct source of blockage and replace flame roll-out switch.
 - d. Thermocouple: senses pilot flame and causes gas valve to turn off main burner and pilot burner gas flow should pilot burner flame extinguish.



SCHEMATIC DIAGRAM LEGEND

- LOW VOLTAGE SIZE 18 AWG TYPE TEW/AWM STRANDED WIRE - 105°C
- LOW VOLTAGE SIZE 18 AWG TYPE TEW/AWM SOLID 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 SIZE 18 AWG WIRE - 200°C

WIRE CODE

- BK - BLACK
- BK/WH - BLACK WITH WHITE TRACE
- CL - CLAY
- GR - GREEN
- OR - ORANGE
- RD - RED
- WH - WHITE
- YE - YELLOW

LADDER DIAGRAM LEGEND

- 24V WIRING
- 120V WIRING

- 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. VENT DAMPER REQUIRED FOR MODELS IN3 THRU IN9. VENT DAMPER OPTIONAL FOR IN10 THRU IN12.
 3. FOR BOILER LESS VENT DAMPER ONLY, VENT DAMPER WIRING HARNESS REPLACED WITH JUMPER PLUG.
 4. CANADA ONLY - ATTACH GREEN GROUND WIRE FROM TRANSFORMER SECONDARY TO GREEN GROUND SCREW.

Figure 44: Wiring Diagrams, Water, Intermittent Ignition (EI), Tankless Heater

VIII. Electrical (continued)

Q. Water Boiler with Intermittent Ignition (EI) and Tankless Heater. See Figure 44.

1. Normal Operation

- a. Thermostat calls for heat or low limit senses water temperature below set point.
- b. Vent Damper (if used) opens as stated in Vent Damper Sequence of Operation.
- c. Ignition Module is energized. Pilot Valve opens and Igniter is energized to ignite Pilot Burner.
- d. Sensor proves presence of pilot flame. Main Valve(s) opens and ignites Main Burners.
- e. After Thermostat or low limit is satisfied Ignition Module is de-energized, extinguishing pilot and main flame. Vent Damper (if used) closes.

2. Safety Shutdown

- a. Limit: Automatically interrupts main burner operation when water temperature exceeds set point. Maximum allowable temperature is 250°F. Normal operation resumes when water temperature falls below set point.

- b. Blocked Vent Switch. Automatically interrupts main burner operation when excessive vent system blockage occurs. Control is a multiple use device. If blocked vent switch is activated do not attempt to place boiler in operation. Correct source of blockage and reset blocked vent switch.
- c. Flame Roll-out Switch. Automatically interrupts boiler operation when flames or excessive heat are present in vestibule. Control is single use device. If flame roll-out switch is activated do not attempt to place boiler in operation. Correct source of blockage and replace flame roll-out switch.
- d. Igniter/Sensor: senses pilot flame and causes ignition module to turn off main burner and pilot burner gas flow should pilot burner flame extinguish. Five to six minutes after shutdown, Ignition Module restarts ignition sequence.

For Electronic Ignition Trouble Shooting Guide, see Page 66. For LED Status Codes, see Table 8 on page 55.

IX. System Start-up

WARNING

Completely read, understand and follow all instructions in this manual before attempting start up.

A. Safe lighting and other performance criteria were met with the 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.

B. Check Main Burners. Main burners must be in slots in rear of burner tray and seated on main burner orifices.

C. Fill boiler with water:

1. Steam: fill to normal water line. See Figure 1.
2. Water: fill heating system to approximately 12 PSI. Vent air from system.

D. Prepare to check operation.

1. Obtain gas heating value (in Btu per cubic foot) from gas supplier.
2. Adjust limit:
 - a. Steam: With an L404A1354 - set cut-out pressure (MAIN scale) on the pressure limit for (2) PSI and differential pressure (DIFF. scale) below (2) PSI. With an L404A1651 or an L404F1367 - set cut-out 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 18.
 - b. Water without tankless heater: set at 200°F.
 - c. Water with tankless heater: set limit at 220°F and operating control to 200°F.
3. Remove front removable panel. See Figure 45.

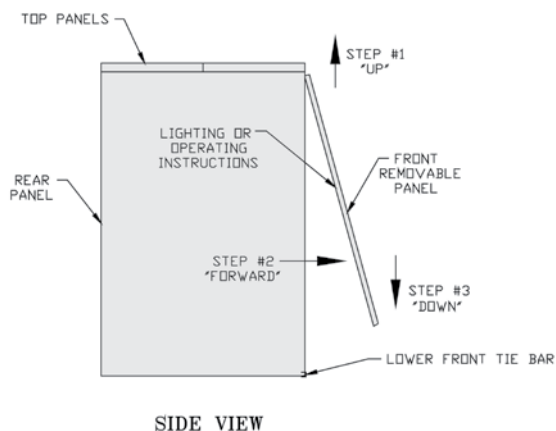


Figure 45: Front Door Removal

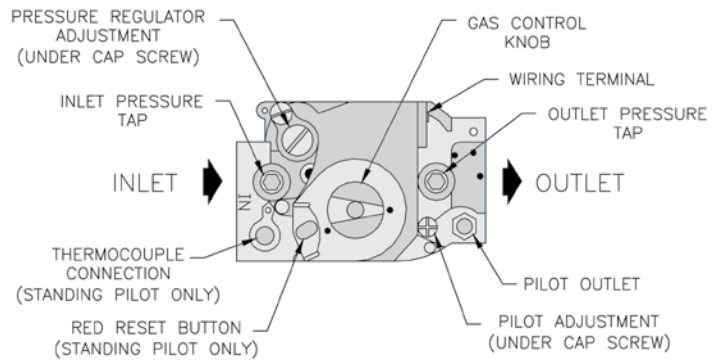
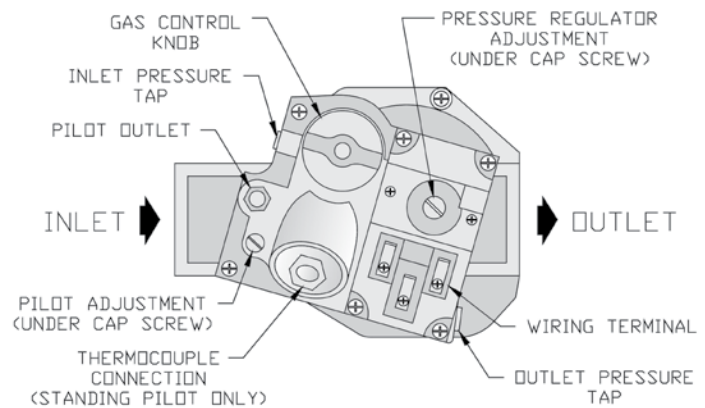


Figure 46: Gas Valve Pressure Tap, Honeywell Gas Valves



TOP VIEW OF ROBERTSHAW GAS VALVE

Figure 47: Gas Valve Pressure Tap, Robertshaw Gas Valve

4. Connect manometer to gas valve pressure tapping (for IN12 connect to gas valve with pilot control). See Figure 46 or 47.
5. For natural gas fired boiler, temporarily turn off all other gas-fired appliances.

E. Follow Lighting or Operating Instructions.

1. To place boiler in operation. See Figure 48, 49, 50 or 51. Sequence of Operation is outlined with wiring diagrams in Section VIII: Electrical.
2. Enhanced Electronic Ignition Module with single Status LED indicator. See Figure 52A "Location of LED".

Table 7 "Ignition Module Terminal Cross-reference" cross-references the ignition module terminal designations to the ignition terminal numbers in the wiring ladder diagrams.

Table 8 "Green LED Status Codes" provides green LED status codes and recommended service action where applicable.

See Page 66 for Troubleshooting Guide.

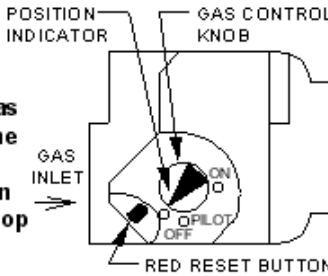
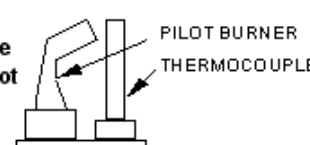
IX. System Start-up (continued)

FOR YOUR SAFETY READ BEFORE LIGHTING

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 has a pilot which must be lighted by hand. When lighting the pilot, follow these instructions exactly.
- B. BEFORE LIGHTING smell all around the appliance 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.

LIGHTING INSTRUCTIONS

1. STOP! Read the safety information above.
2. Read the lighting instructions all the way through before starting the procedure.
3. If equipped with a vent damper, set the room thermostat to highest setting and wait two (2) minutes for the damper to open.
4. Turn off all electric power to the appliance.
5. Set the room thermostat to lowest setting.
6. Remove front door.
7. Locate the gas control valve at the end of the gas supply pipe going into the boiler. The gas control knob is the blue or brown plastic knob located on top of the gas control valve.
 
8. Rotate gas control knob clockwise from "ON" position to "OFF" position.
9. 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. NOTE: Vent damper must be open during this five (5) minute wait period.
10. Remove the burner access panel located above the burners.
 
11. Find the pilot by following the aluminum tube from the gas control valve to the pilot located between the steel tube burners.
12. Turn gas control knob counterclockwise to "PILOT" position.
13. Push in red reset button and hold in. Immediately light the pilot with a match. Continue to hold the red reset button for about one (1) minute after the pilot is lit. Release button and it will pop back up. Pilot should remain lit. If it goes out, repeat Steps 8 - 13.
 - If button does not pop up when released, stop and immediately call your service technician or gas supplier.
 - If the pilot will not stay lit after several tries, turn gas control knob clockwise to "OFF" and call your service technician or gas supplier.
14. Replace burner access panel.
15. Turn gas control knob counterclockwise to "ON" position. Knob can be turned to "ON" only if red reset button is up.
16. Replace front door.
17. Turn on all electric power to the appliance.
18. Set room thermostat to desired setting.

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. Turn gas control knob clockwise to "OFF". Do not force.
5. Replace front door.

Figure 48: Lighting Instructions, Continuous Ignition System, VR8200 and VR8300 Gas Valves

IX. System Start-up (continued)

FOR YOUR SAFETY READ BEFORE LIGHTING

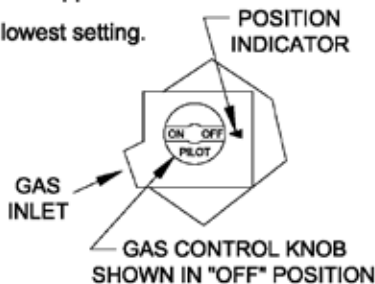
WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

- A. This appliance has a pilot which must be lighted by hand. When lighting the pilot, follow these instructions exactly.
- B. BEFORE LIGHTING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
- WHAT TO DO IF YOU SMELL GAS:**
- Do not try to light any appliance.
 - Do not touch any electric switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not 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.

LIGHTING INSTRUCTIONS

1. STOP! Read the safety information above on this label.
2. Read the lighting instructions all the way through before starting the procedure.
3. If equipped with vent damper, set the room thermostat to highest setting and wait two (2) minutes for the damper to open.
4. Turn off all electric power to the appliance.
5. Set the room thermostat to lowest setting.
6. Remove front door.

7. Locate the gas control valve at the end of the gas supply pipe going into the boiler. The gas control knob is the gray or brown plastic knob located on top of the gas control valve.



8. Push in gas control knob slightly and turn clockwise to "OFF". NOTE: Knob cannot be turned from "PILOT" to "OFF" unless knob is pushed in slightly. Do not force.
9. 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. NOTE: Vent damper must be open during this five (5) minute wait period.

10. Remove burner access panel.

11. Find the pilot by following the aluminum tube from the gas control valve to the pilot located between the steel tube burners.



12. Turn gas control knob counterclockwise to "PILOT" position.

13. Push in control knob all the way and hold in. Immediately light the pilot with a match. Continue to hold the control knob for about one (1) minute after the pilot is lit. Release knob and it will pop back up. Pilot should remain lit. If it goes out, repeat steps 8-13.

- If knob does not pop up when released, stop and immediately call your service technician or gas supplier.
- If the pilot will not stay lit after several tries, turn gas control knob to "OFF" and call your service technician or gas supplier.

14. Replace burner access panel.

15. Turn gas control knob counterclockwise to "ON" position.

16. Replace front door.

17. Turn on all electric power to the appliance.

18. Set room thermostat to desired setting.

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to the lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove front door.
4. Push in gas control knob slightly and turn clockwise to "OFF". Do not force.
5. Replace front door.

Figure 49: Lighting Instructions, Continuous Ignition System, 7000 ERHC Gas Valve

IX. System Start-up (continued)

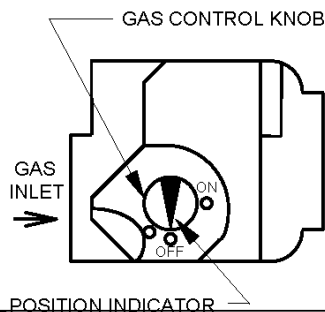
FOR YOUR SAFETY READ BEFORE OPERATING

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.
- If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not 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.

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 50: Operating Instructions, Intermittent Ignition System, VR8204 and VR8304 (except IN12) Gas Valves





IX. System Start-up (continued)

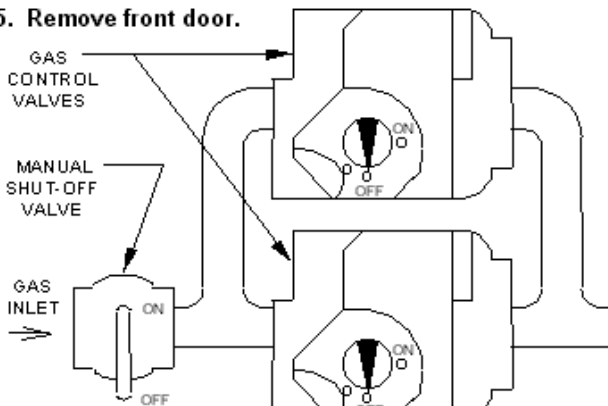
FOR YOUR SAFETY READ BEFORE OPERATING

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.
- If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not 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.

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 manual shut-off valve and both gas control valves at the end of the gas supply pipe going into the boiler.
7. Rotate handle on manual shut-off valve clockwise  from "ON" position to "OFF".
8. Rotate gas control knob on BOTH gas valves clockwise  from "ON" position to "OFF".
9. 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.
10. Rotate gas control knob on BOTH gas valves counterclockwise  from "OFF" position to "ON". Do not force.
11. Rotate handle on manual shut-off valve counterclockwise  from "OFF" position to "ON". Do not force.
12. Replace front door.
13. Turn on all electric power to the appliance.
14. Set thermostat to desired setting.
15. 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 handle on manual shut-off valve clockwise  from "ON" position to "OFF".
5. Rotate gas control knob on BOTH gas valves clockwise  from "ON" position to "OFF".
6. Replace front door.

(DUAL VR8304)

Figure 51: Operating Instructions, Intermittent Ignition System (EI), VR8304 (IN12 only) Gas Valves

IX. System Start-up (continued)

Table 7: 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

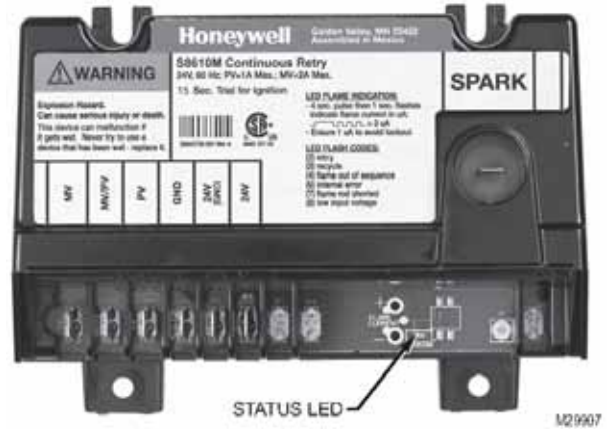


Figure 52A: Location of LED

TABLE 8: Green LED Status 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 ½ second bright, ½ 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.

IX. System Start-up (continued)

3. Flame Current Measurement Procedure

See Figure 52B "Measuring Pilot Flame Current with Micro-ammeter".

- 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 52B.
- 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 μ Amp** (microampere) DC (direct current).
- e. **For reliable operation** the flame current should be **2 μ 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 "Honeywell Electronic Ignition Troubleshooting Guide" located in Section X "Service Instructions".

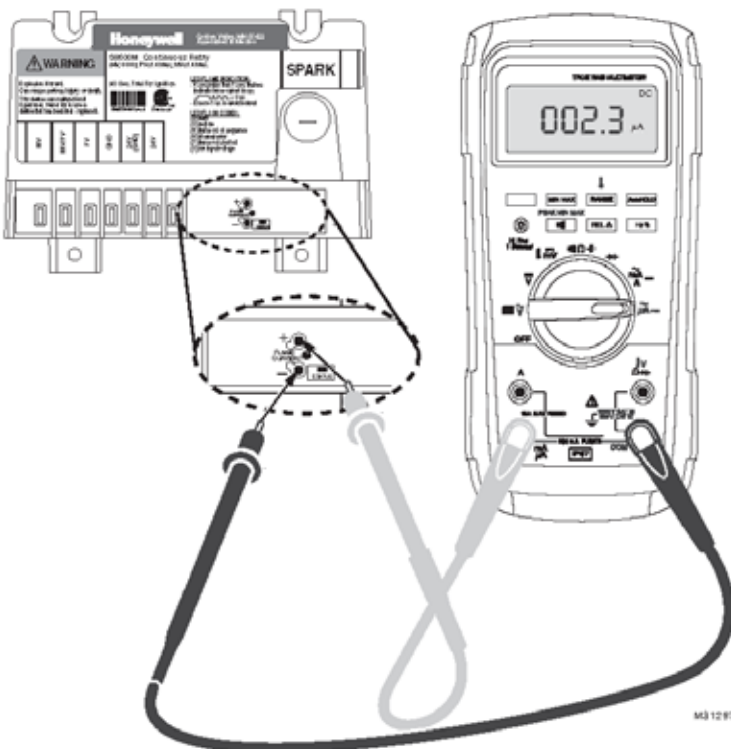


Figure 52B: Measuring Pilot Flame Current with Micro-ammeter

F. Check pilot burner flame and main burner flames through observation port.

1. Check pilot flame.
 - a. Continuous Ignition (Standing Pilot), Models IN3 through IN7. See Figure 53. Pilot burner produces a single flame. Flame should be steady, medium hard blue enveloping $3/8$ to $1/2$ inch of thermocouple.
 - b. Continuous Ignition (Standing Pilot), Models IN8 through IN12. See Figure 54. Pilot burner produces three (3) flames. Center flame should be steady, medium hard blue enveloping $3/8$ to $1/2$ inch of thermocouple.
 - c. Electronic Ignition (EI), Models IN3 through IN12. See Figure 55. Pilot should be lit only after completing Step 3. Pilot burner produces three (3) flames. Center flame should be steady, medium hard blue enveloping $3/8$ to $1/2$ inch of sensing probe.

IX. System Start-up (continued)

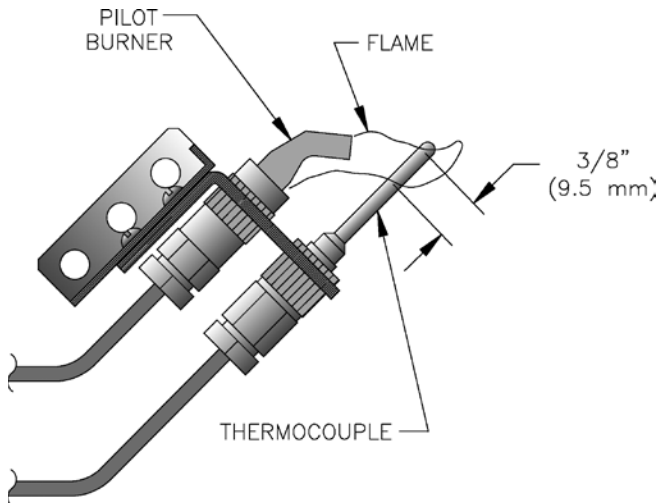


Figure 53: Pilot Burner Flame, Honeywell Q350

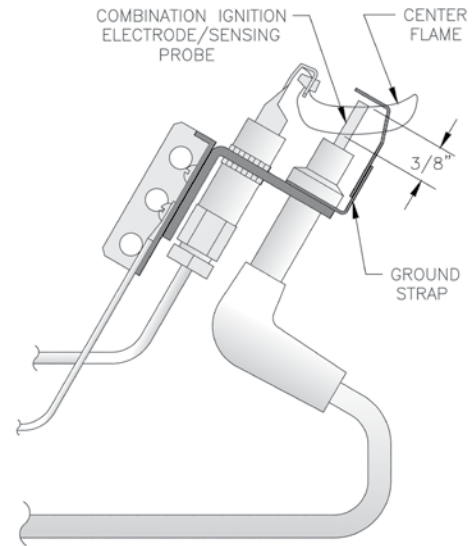


Figure 55: Pilot Burner Flame, Honeywell Q348

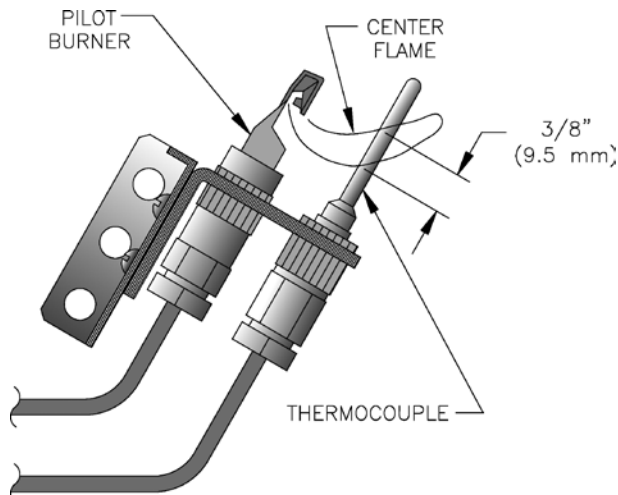


Figure 54: Pilot Burner Flame, Honeywell Q327

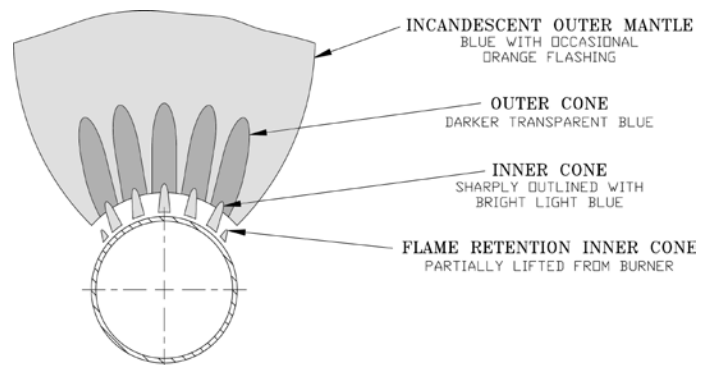


Figure 56: 40mm Main Burner Flame

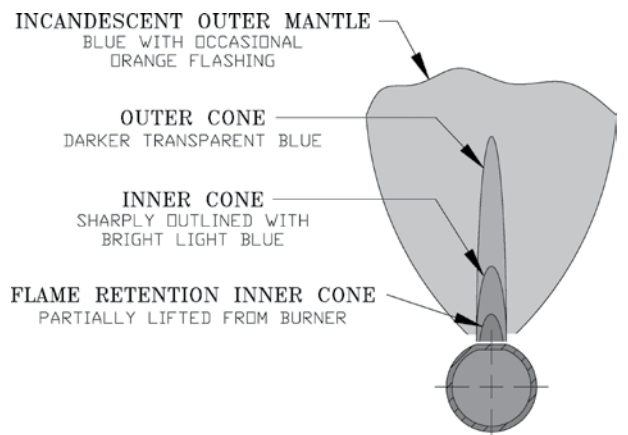


Figure 57: 1" Main Burner Flame

1. Continuous Ignition (Standing Pilot): disconnect thermocouple from gas valve.
 2. Electronic Ignition (EI): disconnect igniter/sensor cable from ignition module terminal "9".
- I. Check low water cutoff (steam only).**
1. Adjust thermostat to highest setting.
 2. With boiler operating, open drain and slowly drain boiler.

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.

2. Adjust thermostat to highest setting.
3. Check main burner flames. See Figure 56 or 57. Flame should have clearly defined inner cones with no yellow tipping. Orange-yellow streaks caused by dust should not be confused with true yellow tipping.
4. Adjust thermostat to normal setting.

G. Check thermostat operation. Raise and lower temperature setting to start and stop boiler operation.

H. Check ignition system shutoff. Gas valve should close and pilot and main burners extinguish.

IX. System Start-up (continued)

CAUTION

Do not drain below gauge glass.

3. Main burners will extinguish when water level drops below low water cutoff. Water should still be visible in gauge glass. Verify limit, thermostat or other controls have not shut off boiler.
4. Adjust thermostat to lowest setting. Refill boiler to normal water line.

J. Check Limit.

1. Adjust thermostat to highest setting.
2. Steam: Observe pressure gauge. When pressure is indicated, adjust limit to setting below observed pressure. Main burners should extinguish.

WARNING

Failure to properly adjust gas input rate will result in over firing or under firing of the boiler. Improper and unsafe boiler operation may result.

3. Water: Observe temperature gauge. When temperature exceeds limit set point main burners should extinguish.
4. Adjust limit to setting above observed reading. Main burners should reignite.
5. Adjust thermostat to lowest setting. Adjust limit to desired setting.

K. Adjust gas input rate to boiler. Natural Gas.

1. Adjust thermostat to highest setting.
2. Check manifold gas pressure. Manifold pressure is listed on Rating Label.
 - a. Models IN3-IN12 with Standing Pilot, IN3-IN9 with Hot Surface to Pilot and IN3-IN11 with Electronic Ignition. Adjust gas valve pressure regulator as necessary (turn adjustment screw counterclockwise to decrease manifold pressure, or clockwise to increase manifold pressure). If pressure can not be attained, check gas valve inlet pressure. If less than minimum gas supply pressure listed on Rating Label, contact gas supplier for assistance.
 - b. Model IN12 with Electronic Only.
 - i. Turn off gas valve not having pilot control.
 - ii. On gas valve with pilot control, adjust gas valve pressure regulator to obtain required manifold pressure, or if unattainable, highest pressure without forcing adjustment screw (turn adjustment screw counterclockwise to decrease manifold pressure, or clockwise to increase manifold pressure).

iii. Turn on gas valve not having pilot control. Adjust gas valve pressure regulator to obtain required manifold pressure. Manifold pressure may not change during initial turns of adjustment screw.

3. Clock gas meter for at least 30 seconds. Use Table 9 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 more than 0.3 inch w.c. If boiler is still overfired, contact your local distributor for replacement Gas Orifice.
 - b. Increase input rate if less than 98% of Rating Label input. Increase manifold gas pressure no more than 0.3 inch w.c. If measured input rate is still less than 98% of rated input:
 - i. Remove Main Burners per procedure in Section X: Service Instructions.
 - ii. Remove gas orifices. Drill one (1) drill size larger (drill size is stamped on orifice).
 - 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.

L. Adjust gas input rate to boiler. LP/Propane.

1. Set thermostat to highest setting.
2. Adjust tank regulator for gas valve inlet pressure of 13.5 inches w.c. or less.
3. Gas valve has step opening regulator which initially opens to 1.4 or 2.5 inch w.c. and steps to full pressure after approximately 30 seconds. Check manifold pressure after step has occurred. Adjust gas valve pressure regulator as necessary for 10.0 inches w.c. (turn adjustment screw counterclockwise to decrease manifold pressure, or clockwise to increase manifold pressure). If 10.0 inches w.c. can not be attained, check gas valve inlet pressure. If less than 11.0 inches w.c., contact gas supplier for assistance.

M. Clean Heating System (Steam). 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.

1. 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.

IX. System Start-up (continued)

Table 9: Input Rate

Seconds for One Revolution	Size of Gas Meter Dial			
	One-Half Cu. Ft.	One Cu. Ft.	Two Cu. Ft.	Five Cu. Ft.
30	60	120	240	600
32	56	113	225	563
34	53	106	212	529
36	50	100	200	500
38	47	95	189	474
40	45	90	180	450
42	43	86	172	430
44	41	82	164	410
46	39	78	157	391
48	37	75	150	375
50	36	72	144	360
52	35	69	138	346
54	33	67	133	333
56	32	64	129	321
58	31	62	124	310
60	30	60	120	300
62	29	58	116	290
64	29	56	112	281
66	29	54	109	273
68	28	53	106	265
70	26	51	103	257
72	25	50	100	250
74	24	48	97	243
76	24	47	95	237
78	23	46	92	231
80	22	45	90	225

- a. Fill boiler to normal waterline.
 - b. Follow Lighting or Operating Instructions to place boiler in operation. See Figure 48, 49, 50, or 51.
 - c. Operate boiler with steam in entire system for several days to bring system oil and dirt back to boiler.
 - d. Drain condensate from drain valve in wet return. Operate boiler until condensate runs clean.
2. Boil-out boiler.
- a. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 48, 49, 50, or 51.
 - b. Fill boiler to normal waterline.
 - c. Remove safety valve.
 - d. Pour recommended boil-out compound into boiler through safety valve opening.

- e. Reinstall safety valve in Tapping "E" with spindle in vertical position. See Figures 1 and 2.
 - f. Follow Lighting or Operating Instructions to place boiler in operation. See Figure 48, 49, 50, or 51.
Check controls operation per Paragraphs F to J. Boil water for at least 5 hours.
 - g. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 48, 49, 50, or 51.
Drain boiler and system piping.
 - h. Remove drain valve. Thoroughly wash boiler water passages with high pressure spray through drain valve tapping.
 - i. Reinstall drain valve in Tapping "F". See Figures 1 and 2.
3. Second Boil-out for Stubborn Cases. If all oil and grease is not removed a second boilout using surface blow-off is necessary.
- a. Run 1 NPT pipe from Surface Blow-Off Tapping "L" to open drain. Do not install shut-off valve or other restriction. See Figure 2.
 - b. Fill boiler to top of gauge glass.
 - c. Remove safety valve.
 - d. Pour recommended boil-out compound into boiler through safety valve opening.
 - e. Reinstall safety valve in Tapping "E" with spindle in vertical position. See Figures 1 and 2.
 - f. Follow Lighting or Operating Instructions to place boiler in operation. See Figure 48, 49, 50, or 51. Boil water for approximately 5 hours without producing steam.
 - g. 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.
 - h. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 48, 49, 50, or 51. Drain boiler and system piping.
 - i. Remove drain valve. Thoroughly wash boiler water passages with high pressure spray through drain valve tapping.
 - j. Fill boiler to normal waterline. If water in gauge glass is not clear, repeat procedure starting at step b.
 - k. Remove surface blow-off piping. Install 1 NPT plug in Tapping "L". See Figure 2.
4. Add Boiler Water Treatment.
- a. Remove safety valve.
 - b. Pour recommended compound into boiler through safety valve opening.
 - c. Reinstall safety valve in Tapping "E" with spindle in vertical position. See Figures 1 and 2.

IX. System Start-up (continued)

- d. Follow Lighting or Operating Instructions to place boiler in operation. See Figure 48, 49, 50, or 51.
 - e. Boil water or heat water to 180°F.
 - f. Measure boiler water alkalinity. pH should be between 7 and 11. Add recommended water treatment chemicals, if necessary, to bring the pH within the specified range.
5. If unsteady water line, foaming or priming persist:
- a. Follow Lighting or Operating Instructions to place boiler in operation. See Figure 48, 49, 50, or 51.
 - b. Install gate valve (shut-off valve) in Hartford Loop. Install drain valves in return main and at boiler. See Figure 23.
 - c. Connect hoses from drain valves to floor drain. Close gate valve in Hartford Loop. Open drain valve in return main.
 - d. Fill boiler to normal water line. Follow Lighting or Operating Instructions to place boiler in operation. See Figure 48, 49, 50, or 51.
 - e. Operate boiler for at least 30 minutes after condensate begins to run hot. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 48, 49, 50, or 51.
 - f. Close all radiator valves. Remove all supply main air valves. Plug openings in supply main.
 - g. Drain approximately 5 gallons of boiler water into container. Mix in recommended boil-out compound.
 - h. Remove safety valve. Pour recommended compound into boiler through safety valve opening. Reinstall safety valve in Tapping "E" with spindle in vertical position. See Figures 1 and 2.
 - i. Follow Lighting or Operating Instructions to place boiler in operation. See Figure 48, 49, 50, or 51. 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.
 - j. 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.
 - k. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figure 48, 49, 50, or 51. Open all radiator valves. Reinstall all supply main air valves. Open gate valve in Hartford Loop.
 - l. 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.
 - m. Follow Lighting or Operating Instructions to place boiler in operation. See Figure 48, 49, 50, or 51. Allow boiler to steam for 10 minutes. Drain one quart of water from lower Gauge Glass fitting.
 - n. 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.
 - o. If after normal operation boiler water becomes dirty from additional system piping sediment returning to boiler.
 - i. Complete steps 5a through 5n.
 - ii. Complete steps 3a through 3k.
6. Make pH or Alkalinity Test.
- a. After boiler and system have been cleaned and refilled as previously described, 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.
 - b. Boiler is now ready to be put into service.
- N. Clean Heating System (Water).** 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.
1. Boiling Out of Boiler and System. Oil and grease which accumulate in a new hot water boiler can be washed out in the following manner.
 - a. Remove Safety Relief Valve using extreme care to avoid damaging it.
 - b. Partially fill boiler. Pour recommended compound into boiler through safety relief valve opening.
 - c. Replace Safety Relief Valve.
 - d. Fill entire system with water.

IX. System Start-up (continued)

- e. Start firing equipment.
 - f. Circulate the water through the entire system.
 - g. Vent the system, including the radiation.
 - h. Allow boiler water to reach operating temperature, if possible.
 - i. Continue to Circulate the water for a few hours.
 - j. Stop the firing equipment.
 - k. Drain the system in a manner and to a location that hot water can be discharged with safety.
 - l. Remove plugs from all available returns and wash the water side of the boiler as thoroughly as possible, using a high-pressure water stream.
 - m. Refill the system with fresh water.
 - n. Add recommended boiler water treatment.
2. Make pH or Alkalinity Test.
- a. After boiler and system have been cleaned and refilled as previously described, 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.

- b. Boiler is now ready to be put into service.

CONDENSATION — Following a cold start, condensation (sweating) may occur in a gas fired boiler to such an extent that it appears that the boiler is leaking. This condensation can be expected to stop after the boiler is hot.

- O. Check Damper Operation** - If boiler is equipped with vent damper, vent damper must be in open position when boiler main burners are operating. Start boiler, refer to instructions on damper to determine if damper is in full open position.
- P. Review User's Information Manual** and system operation with owner or operator.
- Q. Post instructions** near boiler for reference by owner and service personnel. Maintain instructions in legible condition.

X. Service Instructions

DANGER

This boiler uses flammable gas, high voltage electricity, moving parts, and very hot water under high pressure. Assure that all gas and electric power supplies are off and that the water temperature is cool before attempting any disassembly or service.

Assure that all gas valves and electrical disconnect switches are off before attempting any disassembly or service.

Do not attempt any service work if gas is present in the air in the vicinity of the boiler. Never modify, remove or tamper with any control device.

WARNING

This boiler must only be serviced and repaired by skilled and experienced service technicians.

If any controls are replaced, they must be replaced with identical models.

Read, understand and follow all the instructions and warnings contained in all the sections of this manual.

If any electrical wires are disconnected during service, clearly label the wires and assure that the wires are reconnected properly.

Never jump out or bypass any safety or operating control or component of this boiler.

Read, understand and follow all the instructions and warnings contained in ALL of the component instruction manuals.

Assure that all safety and operating controls and components are operating properly before placing the boiler back in service.

A. General. Inspection and service should be conducted annually, except as noted. Turn off electrical power and gas supply while conducting service or maintenance. Follow instructions TO TURN OFF GAS TO APPLIANCE. See Figures 48, 49, 50 or 51.

B. Maintenance of Low Water Cutoff

1. McDonnell & Miller PS-802 or Hydrolevel CycleGard CG400 Probe Style Only.
 - a. Drain boiler to point below Tapping 'K'. See Figure 2.
 - b. Disconnect wire(s) connecting control and probe.
 - c. Remove control from probe.

DANGER

Assure that the boiler is at zero pressure before removing the LWCO probe. Do not rely on the pressure gauge to indicate that the boiler is at zero pressure. Open the safety valve to relieve all internal pressure prior to proceeding. Safety valve discharge piping must be piped such that the potential for burns is eliminated.

- d. Unscrew probe from Tapping 'K'. Inspect for scale and sediment buildup.

- e. Remove light deposits with damp cloth soaked with vinegar.
- f. Remove stubborn deposits 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.
- g. Clean Tapping 'K' to remove old pipe dope and other foreign matter.
- h. Apply moderate amount of good quality pipe dope to probe threads, leaving two end threads bare. Install probe in Tapping 'K'. Mount control on probe. Attach wire(s) between control and probe.
- i. Fill boiler to normal waterline. Add water treatment as needed.

2. McDonnell & Miller 67 Float Style Only.

- a. Weekly (or more frequently if necessary). Open blow-off valve to flush sediment chamber. Follow instructions on Blow-Down Card affixed to Jacket adjacent to low water cutoff.
- b. Annually. Dismantle to extent necessary to remove obstructions and insure proper function of working parts.

X. Service Instructions (continued)

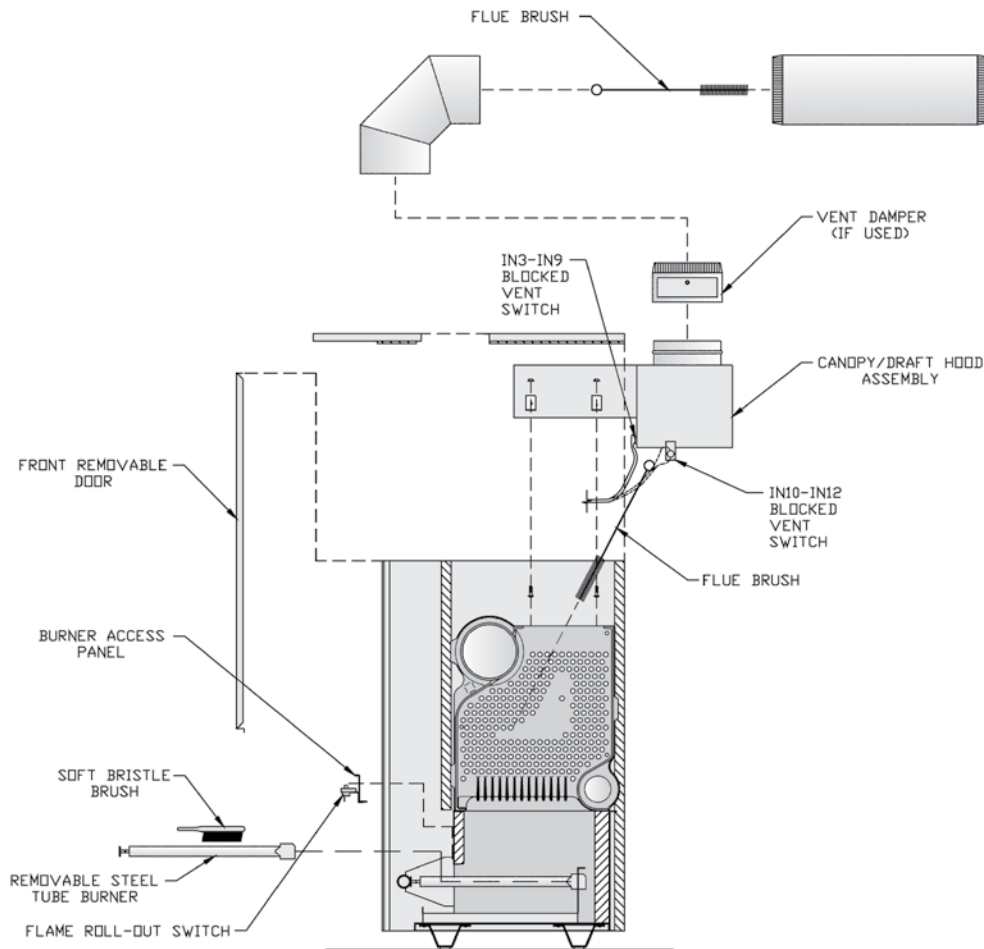


Figure 58: Boiler Flueway Cleaning

- i. Inspect connecting lines to boiler for accumulation of mud and scale. Clean as necessary.
 - ii. Examine wiring for brittle or worn insulation and clean electrical contact.
 - iii. Inspect solder joints on bellows and float. Check float for evidence of collapse. Check mercury bulb (where applicable) for mercury separation or discoloration. *Do not attempt to repair mechanisms in field.* Complete replacement mechanisms, including gaskets and instructions, are available from low water cutoff manufacturer.
- c. Five (5) Years or 100,000 switch cycles. Replace switch and float mechanisms.

C. Water Feeder and Additional Low Water Cutoff.

Refer to manufacturer's instructions.

D. Vent System. Check annually for:

1. obstructions
2. accumulations of soot
3. deterioration of vent pipe or vent accessories due to condensation or other reasons

4. proper support—no sags, particularly in horizontal runs
 5. tightness of joints. Remove all accumulations of soot with wire brush and vacuum
- Remove all obstructions. Replace all deteriorated parts and support properly. Seal all joints.

E. Clean Boiler Flueways.

1. Shut down gas boiler in accordance with lighting/operating instructions attached to inside of Front Removable Door. See Figure 45.
2. Remove Burner Access Panel and Burners. See Paragraph F. Clean Burners if necessary.
3. Remove Jacket Top Panels.
4. Remove Canopy from top of boiler.
5. Thoroughly clean the flueways with flue brush. See Figure 58.
6. Clean boiler heating surface accessible from combustion chamber with straight handle wire brush. Reinstall burners and connect gas train. See Paragraphs F & G.

X. Service Instructions (continued)

7. Place boiler in operation in accordance with Lighting or Operating instructions. Test gas line for leaks in accordance with Section VI: Gas Piping, Paragraph C.
8. Replace Jacket Front Removable Door.

CAUTION

When necessary to remove burners, be sure to reinstall them in the original manner by engaging the orifice and locating hole in the rear of the burner tray. Burners must be aligned with the burner manifold.

- F. Remove Burners** for cleaning, changing orifice plugs, or repairs.
1. Turn off electric service to boiler.
 2. Turn off gas supply to boiler.
 3. Remove jacket front panel.
 4. Disconnect pilot tubing at gas valve.
 5. Disconnect thermocouple tubing at gas valve (Continuous Ignition only). Disconnect igniter/sensor cable and ground wire at ignition module. Intermittent Ignition (EI) only. Disconnect flame roll-out switch wires.
 6. Remove burner access panel.
 7. Mark location of pilot main burner on manifold.
 8. Hold burner on throat. Lift slightly to clear orifice. Pull burner from combustion chamber. See Figure 10. Pilot main burner can only be removed by lifting at 45° angle after adjacent burner to right is removed (1" burners only).
 9. Check burners to be sure they do not contain foreign matter or restrictions. Clean burners with a soft bristle brush, blow any dirt out with compressed air or use a vacuum cleaner. See Figure 58.

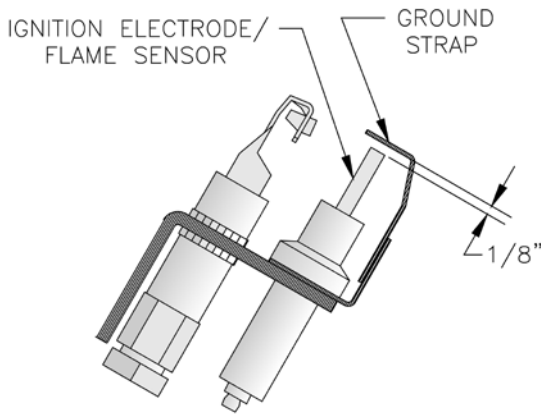


Figure 59: Honeywell Q348 Spark Gap

- G. Remove Pilot Assembly** for Servicing. Remove machine screw(s) holding pilot burner to pilot bracket, after first removing burner with pilot assembly as described in Step F, number 8 above. To adjust or check spark gap between electrode and hood on Honeywell Q348 intermittent (EI) pilot, see Figure 59.

Table 10: Pilot Burner Location

Boiler Size	Pilot Located Between Burners*	
	1 inch	40mm
IN3	1 & 2	1 & 2
IN4	2 & 3	2 & 3
IN5	3 & 4	2 & 3
IN6	4 & 5	3 & 4
IN7	6 & 7	3 & 4
IN8	7 & 8	4 & 5
IN9	8 & 9	4 & 5
IN10	9 & 10	---
IN11	11 & 12	---
IN12	12 & 13	---

* Burners numbered left to right as viewed from front of boiler.

1. Use a round wire gauge to check spark gap.
2. Spark gap should be 0.125" for optimum performance.

- H. Install Burners** by reversing procedures used to remove burner. Main burners must be in slots in rear of burner tray and seated on main burner orifices. Reconnect pilot gas supply, and thermocouple lead (continuous ignition) or igniter/sensor/ground. See Table 10 for Pilot Burner location.

- I. Lubrication.** Manufacturers Instruction should be followed on all parts installed on boiler requiring lubrication. This includes:

1. Type of lubricant to be used.
2. Frequency of lubrication.
3. Points to lubricate.

- J. Check operation.** Follow Steps B through L and Step O from Section IX: System Start-up.

- K. Conversion Kits.** Follow all instructions provided with kits. Note that Rating Label provided in kit must be used. Apply over or beside original Rating Label allowing the original Serial Number to remain visible.

X. Service Instructions (continued)

L. Tankless Heater.

1. Flushing of Heater. All water contains some sediment which settles on inside of coil. Consequently, heater should be periodically backwashed. See Figure 28. Allow water at city pressure to run into hosebib A, through heater, and out hosebib B until discharge is clear. The tees in which the hosebibs are located should be the same size as heater connections to minimize pressure drop.
2. Adjust and maintain mixing valve (tempering valve) in accordance with manufacturer's instructions.

M. Excessive Make-Up Water

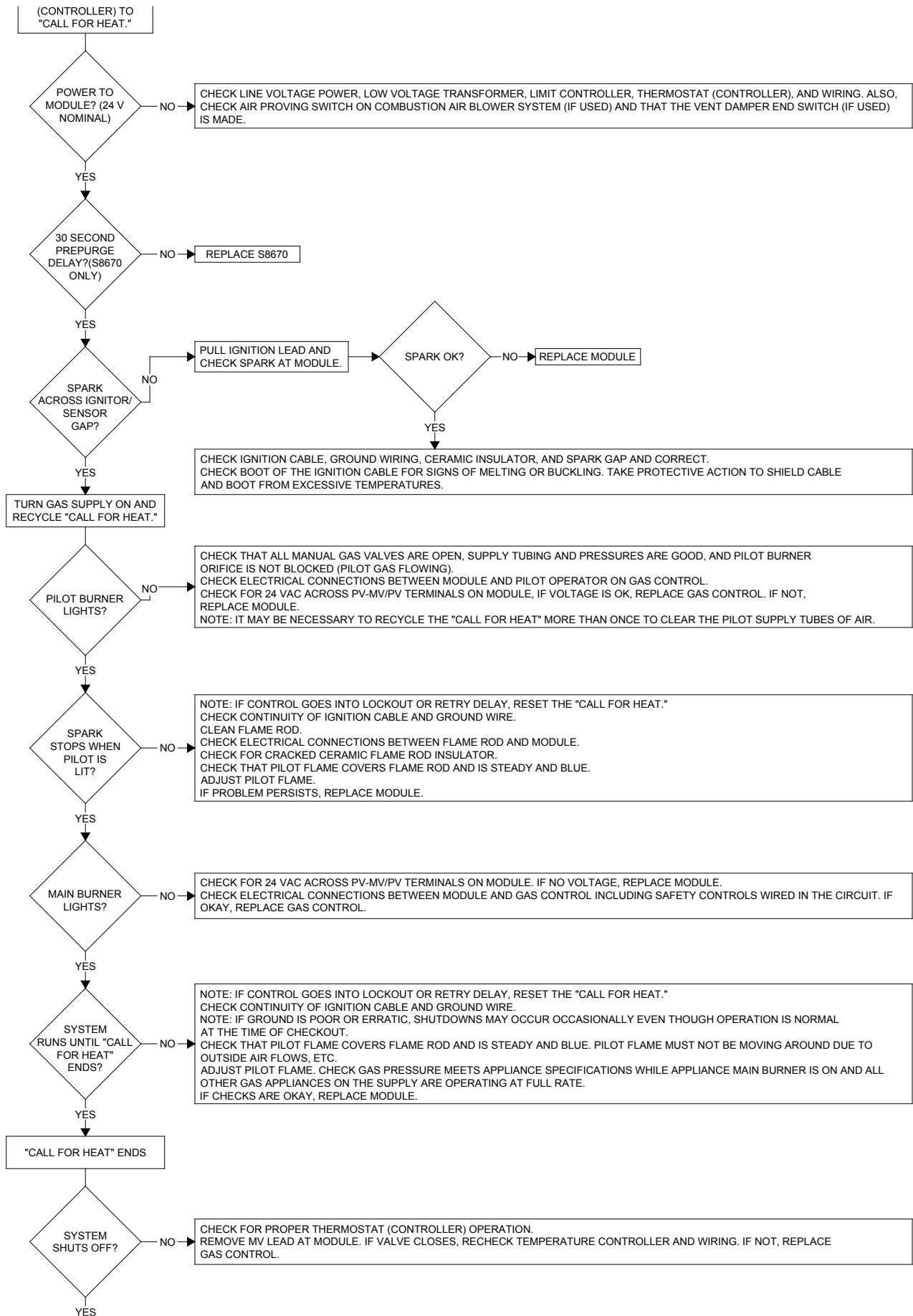
CAUTION

IF, DURING NORMAL OPERATION, IT IS NECESSARY TO ADD MORE WATER THAN INDICATED BELOW, CONSULT A QUALIFIED SERVICE TECHNICIAN TO CHECK YOUR SYSTEM FOR LEAKS.

Model No.	Gallons Per Month	Gallons Per Year
IN3	0.1	1
IN4	0.1	1
IN5	0.2	2
IN6	0.2	2
IN7	0.2	3
IN8	0.2	3
IN9	0.3	3
IN10	0.3	4
IN11	0.3	4
IN12	0.4	4

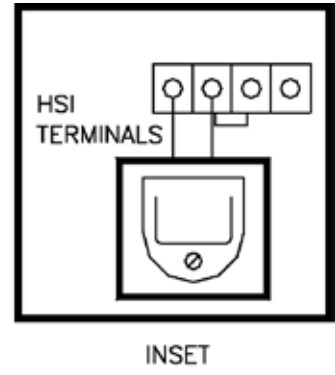
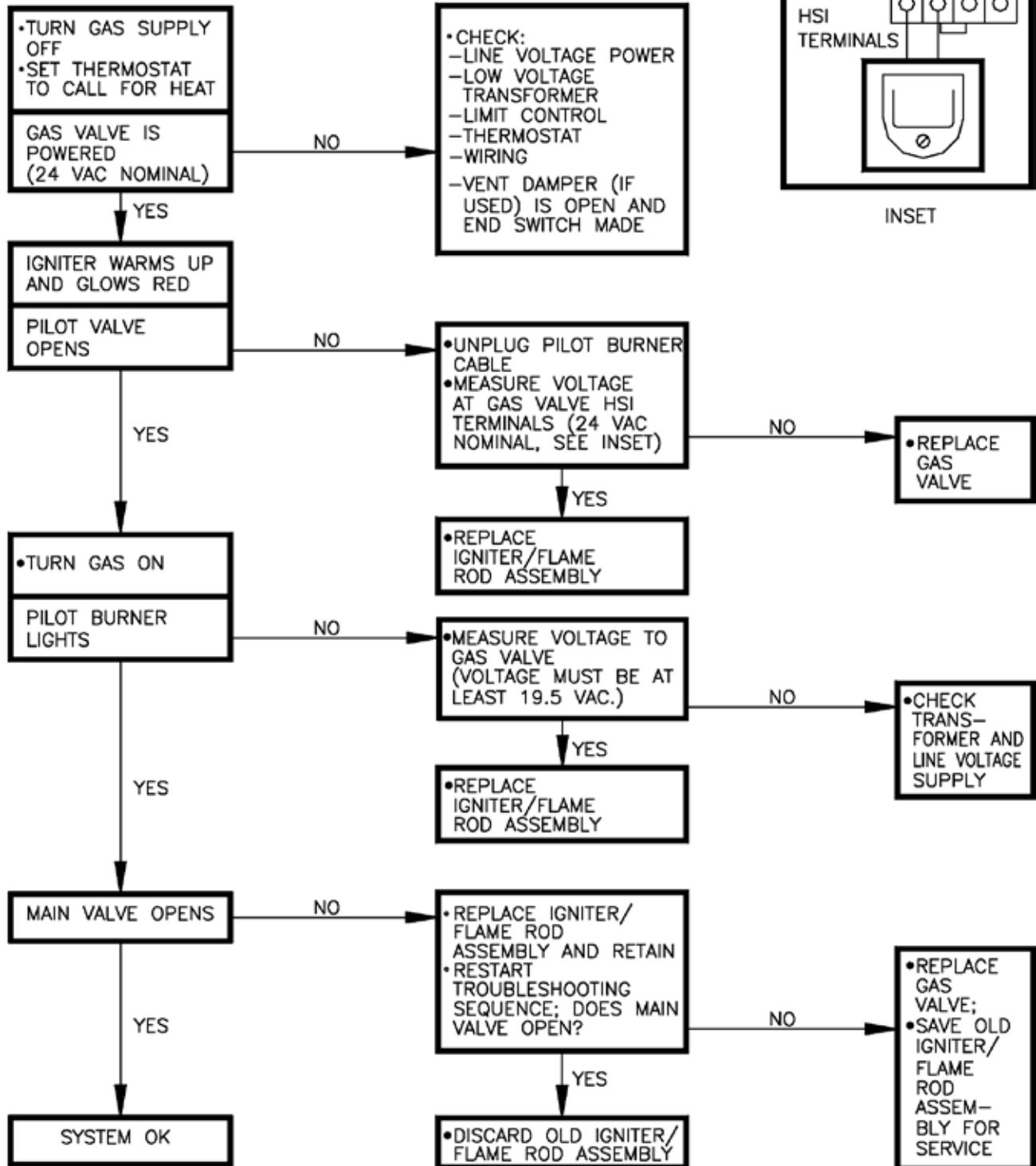
A leaky system will increase the volume of make-up water supplied to the boiler, which can significantly shorten the life of the boiler. Entrained in make-up water are dissolved minerals, salts, and oxygen. When the fresh, cool make-up water is heated in the boiler, the minerals fall out as sediment, the salts coat the inside of the boiler, and the oxygen escapes as a gas. The accumulation of sediment eventually isolates the water from contacting the cast iron. When this happens the cast iron in that area gets extremely hot and eventually cracks. The presence of free oxygen or chloride slats in the boiler corrodes the cast iron from the inside. More make-up water and higher concentrations of contaminants damage the boiler sooner. **Our warranty does not cover corrosion and sediment-related damage.** Clearly it is in everyone's best interest to prevent this type of failure. You can do your part by ensuring that your system is leak-free, keeping leakage to less than 2 percent of the total water volume each month.

Honeywell Electronic Ignition Trouble Shooting Guide



Honeywell Hot Surface to Pilot Trouble Shooting Guide

START



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.

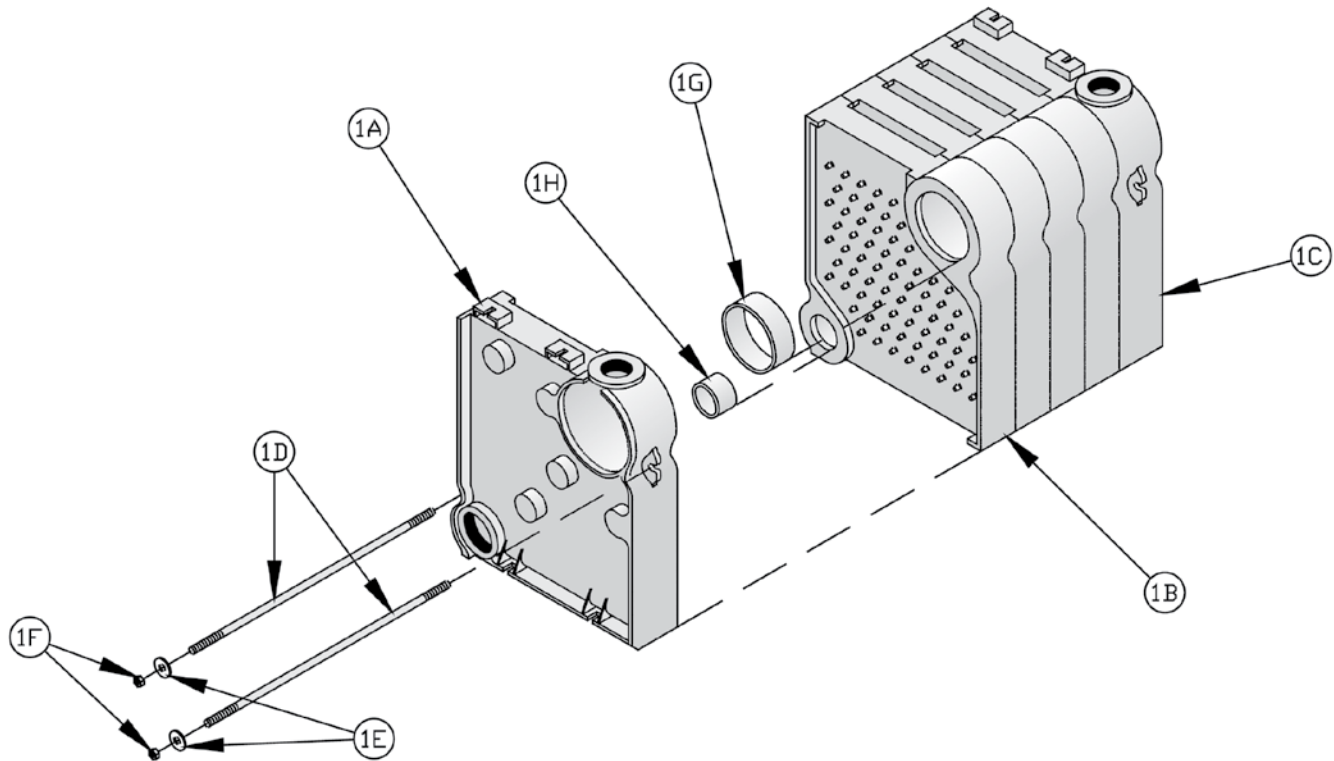
First Aid Procedures:

- 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.

XI. Repair Parts

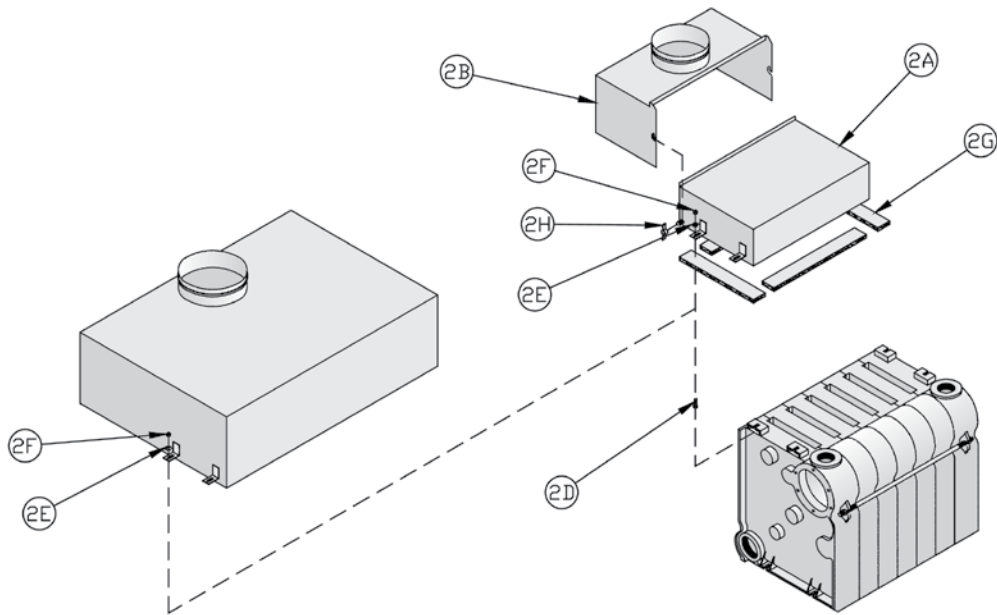
All Independence® Repair Parts may be obtained through your local Burnham product distributor. Should you require assistance in locating a Burnham product distributor in your area, or have questions regarding the availability of Burnham brand products or repair parts, please contact U.S. Boiler Company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

XI. Repair Parts (continued)



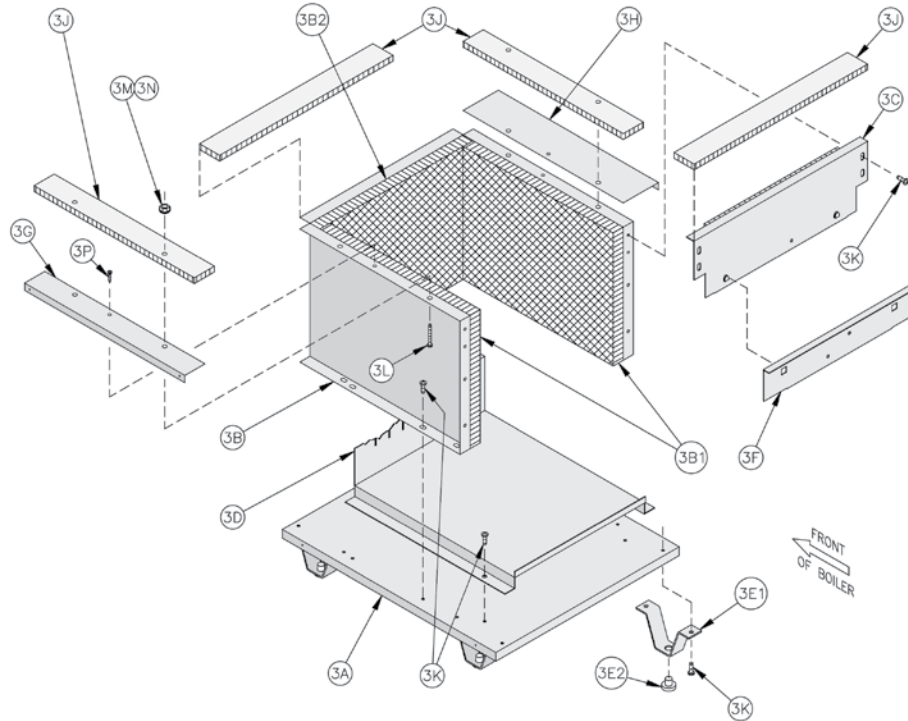
Key No.	Description	Part No.	Quantity									
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12
1. Section Assembly												
1A	Left End Section (less tankless heater)	717100022	1	1	1	1	1	1	1	1	1	1
	Left End Section (with tankless heater)	717100042	1	1	1	1	1	1	1	1	1	1
1B	Center Section	717100031	1	2	3	4	5	6	7	8	9	10
1C	Right End Section	717100011	1	1	1	1	1	1	1	1	1	1
1D	Tie Rod, 3/8-16 x 10"	80861071	2	---	---	---	---	---	---	---	---	---
	Tie Rod, 3/8-16 x 12-1/2"	80861010	---	2	---	---	---	---	---	---	---	---
	Tie Rod, 3/8-16 x 17"	80861011	---	---	2	---	---	---	---	---	---	---
	Tie Rod, 3/8-16 x 20-3/4"	80861012	---	---	---	2	---	---	---	---	---	---
	Tie Rod, 3/8-16 x 23"	80861049	---	---	---	---	2	---	---	---	---	---
	Tie Rod, 3/8-16 x 27-1/2"	80861014	---	---	---	---	---	2	---	---	---	---
	Tie Rod, 3/8-16 x 29"	80861034	---	---	---	---	---	---	2	---	---	---
	Tie Rod, 3/8-16 x 32-3/4"	80861035	---	---	---	---	---	---	---	2	---	---
	Tie Rod, 3/8-16 x 36-1/2"	80861036	---	---	---	---	---	---	---	---	2	---
	Tie Rod, 3/8-16 x 39"	80861020	---	---	---	---	---	---	---	---	---	2
1E	Washer, 3/8"	80860600	4	4	4	4	4	4	4	4	4	4
1F	Nut, 3/8-16	80860400	4	4	4	4	4	4	4	4	4	4
1G	Slip Nipple, 5"	7066003	2	3	4	5	6	7	8	9	10	11
1H	Slip Nipple, 22B	806600375	2	3	4	5	6	7	8	9	10	11

XI. Repair Parts (continued)



Key No.	Description	Part No.	Quantity									
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12
2. Canopy and Draft Hood Canopy/Draft Hood Parts												
2A	Canopy Assembly	6111003	1	---	---	---	---	---	---	---	---	---
		6111004	---	1	---	---	---	---	---	---	---	---
		6111005	---	---	1	---	---	---	---	---	---	---
		6111006	---	---	---	1	---	---	---	---	---	---
		6111007	---	---	---	---	1	---	---	---	---	---
		6111008	---	---	---	---	---	1	---	---	---	---
		6111009	---	---	---	---	---	---	1	---	---	---
2B	Rear Draft Hood Carton Assembly	61110033	1	---	---	---	---	---	---	---	---	---
		61110043	---	1	---	---	---	---	---	---	---	---
		61110053	---	---	1	---	---	---	---	---	---	---
		61110063	---	---	---	1	---	---	---	---	---	---
		61110073	---	---	---	---	1	---	---	---	---	---
		61110083	---	---	---	---	---	1	---	---	---	---
		61110093	---	---	---	---	---	---	1	---	---	---
2C	Canopy/Draft Hood Carton Assembly (complete)	61110102	---	---	---	---	---	---	---	1	---	---
		61110112	---	---	---	---	---	---	---	---	1	---
		61110122	---	---	---	---	---	---	---	---	---	1
2D	Carriage Bolt, ¼ -20 x 1"	80860115	4	4	4	4	4	4	4	4	4	4
2E	Flat Washer, ¼"	80860603	4	4	4	4	4	4	4	4	4	4
2F	Hex Nut, ¼ -20	80860407	4	4	4	4	4	4	4	4	4	4
2G	Gasket	6206001	1	1	1	1	1	1	1	1	1	1
2H	Wingnut, ¼ -20	80860900	2	2	2	2	2	2	2	---	---	---

XI. Repair Parts (continued)



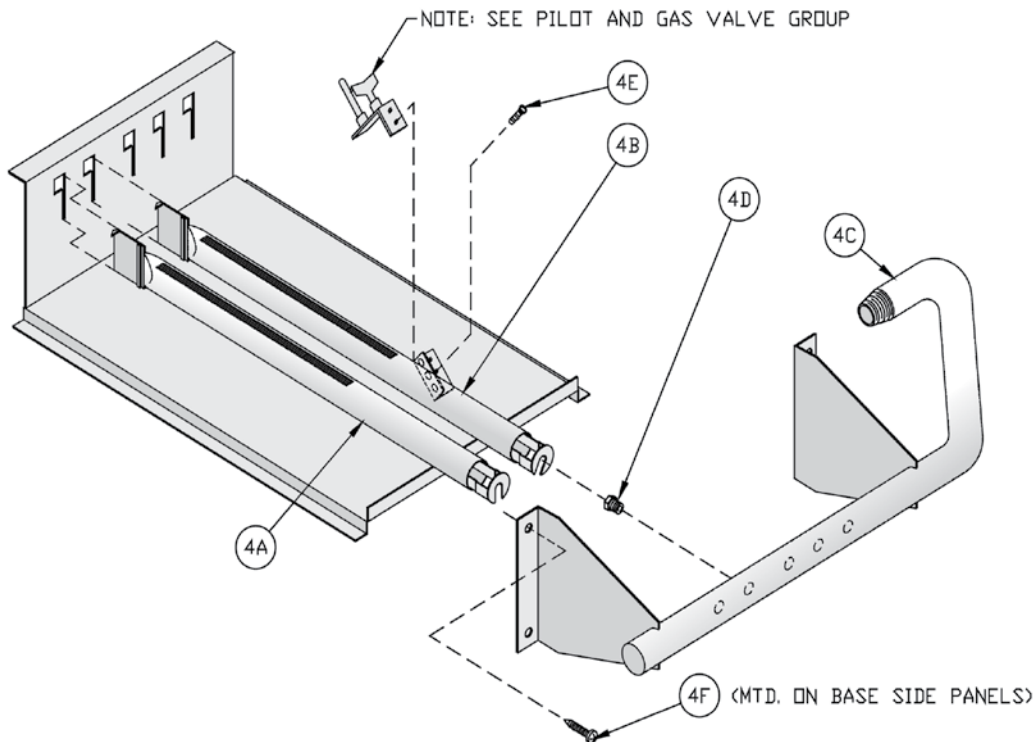
Key No.	Description	Part No.	Quantity									
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12
3. Base Assembly												
3A	Base Tray	718600391	1	---	---	---	---	---	---	---	---	---
		718600491	---	1	---	---	---	---	---	---	---	---
		718600591	---	---	1	---	---	---	---	---	---	---
		718600691	---	---	---	1	---	---	---	---	---	---
		718600791	---	---	---	---	1	---	---	---	---	---
		718600891	---	---	---	---	---	1	---	---	---	---
		718600991	---	---	---	---	---	---	1	---	---	---
		718601091	---	---	---	---	---	---	---	1	---	---
		718601191	---	---	---	---	---	---	---	---	1	---
		718601291	---	---	---	---	---	---	---	---	---	1
3B	Base Wrapper	718600311	1	---	---	---	---	---	---	---	---	---
		718600411	---	1	---	---	---	---	---	---	---	---
		718600511	---	---	1	---	---	---	---	---	---	---
		718600611	---	---	---	1	---	---	---	---	---	---
		718600711	---	---	---	---	1	---	---	---	---	---
		718600811	---	---	---	---	---	1	---	---	---	---
		718600911	---	---	---	---	---	---	1	---	---	---
		718601011	---	---	---	---	---	---	---	1	---	---
		718601111	---	---	---	---	---	---	---	---	1	---
		718601211	---	---	---	---	---	---	---	---	---	1
3B1	Base End Insulation	720601	2	2	2	2	2	2	2	2	2	

XI. Repair Parts (continued)

Key No.	Description	Part No.	Quantity									
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12
3. Base Assembly (Continued)												
3B2	Base Rear Insulation	72060035	1	---	---	---	---	---	---	---	---	---
		72060045	---	1	---	---	---	---	---	---	---	---
		72060055	---	---	1	---	---	---	---	---	---	---
		72060065	---	---	---	1	---	---	---	---	---	---
		72060075	---	---	---	---	1	---	---	---	---	---
		72060085	---	---	---	---	---	1	---	---	---	---
		72060095	---	---	---	---	---	---	1	---	---	---
		72060105	---	---	---	---	---	---	---	1	---	---
		72060115	---	---	---	---	---	---	---	---	1	---
		72060126	---	---	---	---	---	---	---	---	---	1
3C	Base Front Panel Assembly	618600341	1	---	---	---	---	---	---	---	---	---
		618600441	---	1	---	---	---	---	---	---	---	---
		618600541	---	---	1	---	---	---	---	---	---	---
		618600641	---	---	---	1	---	---	---	---	---	---
		618600741	---	---	---	---	1	---	---	---	---	---
		618600841	---	---	---	---	---	1	---	---	---	---
		618600941	---	---	---	---	---	---	1	---	---	---
		618601041	---	---	---	---	---	---	---	1	---	---
		618601141	---	---	---	---	---	---	---	---	1	---
		618601241	---	---	---	---	---	---	---	---	---	1
3D	Burner Tray (1 Inch Main Burners)	718600305	1	---	---	---	---	---	---	---	---	---
		718600405	---	1	---	---	---	---	---	---	---	---
		718600505	---	---	1	---	---	---	---	---	---	---
		718600605	---	---	---	1	---	---	---	---	---	---
		718600705	---	---	---	---	1	---	---	---	---	---
		718600805	---	---	---	---	---	1	---	---	---	---
		718600905	---	---	---	---	---	---	1	---	---	---
		718601005	---	---	---	---	---	---	---	1	---	---
		718601105	---	---	---	---	---	---	---	---	1	---
		718601205	---	---	---	---	---	---	---	---	---	1
	Burner Tray (40mm Main Burners)	71806037	1	---	---	---	---	---	---	---	---	---
		71806047	---	1	---	---	---	---	---	---	---	---
		71806057	---	---	1	---	---	---	---	---	---	---
		71806067	---	---	---	1	---	---	---	---	---	---
		71806077	---	---	---	---	1	---	---	---	---	---
		718600806	---	---	---	---	---	1	---	---	---	---
718600906	---	---	---	---	---	---	1	---	---	---		
3E	Base Leg Assembly	6186001	4	4	4	4	4	4	4	4	6	6
3E1	Base Leg [Included in Key No. 3E]	71860021	4	4	4	4	4	4	4	4	6	6
3E2	Nylon Glide [Included in Key No. 3E]	8186006	4	4	4	4	4	4	4	4	6	6

XI. Repair Parts (continued)

Key No.	Description	Part No.	Quantity									
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12
3. Base Assembly (Continued)												
3F	Burner Access Panel	718600361	1	---	---	---	---	---	---	---	---	---
		718600461	---	1	---	---	---	---	---	---	---	---
		718600561	---	---	1	---	---	---	---	---	---	---
		718600661	---	---	---	1	---	---	---	---	---	---
		718600761	---	---	---	---	1	---	---	---	---	---
		718600861	---	---	---	---	---	1	---	---	---	---
		718600961	---	---	---	---	---	---	1	---	---	---
		718601061	---	---	---	---	---	---	---	1	---	---
		718601161	---	---	---	---	---	---	---	---	1	---
		718601261	---	---	---	---	---	---	---	---	---	1
3G	Left End Jacket Attachment Bracket	7046011	1	1	1	1	1	1	1	1	1	
3H	Right End Jacket Attachment Bracket	7046012	1	1	1	1	1	1	1	1	1	
3J	Base Sealant	6206002	1	1	1	1	1	1	1	1	1	
3K	Screw, Self Tapping, Type F, Phillips Pan Head, 1/4 -20 x 1/2", Plated	80860700	16	16	16	16	17	17	17	17	21	21
3L	Screw, Self Tapping, Type F, Hex Head, 5/16 -18 x 1-1/4", Plated	80860717	4	4	4	4	4	4	4	4	4	4
3M	Washer, 5/16, USS	80860601	4	4	4	4	4	4	4	4	4	4
3N	Hex Lock Nut, 5/16 -18	80860464	4	4	4	4	4	4	4	4	4	4
3P	Screw, Sheet Metal, #8 x 1/2"	80860000	2	2	2	2	2	2	2	2	2	2



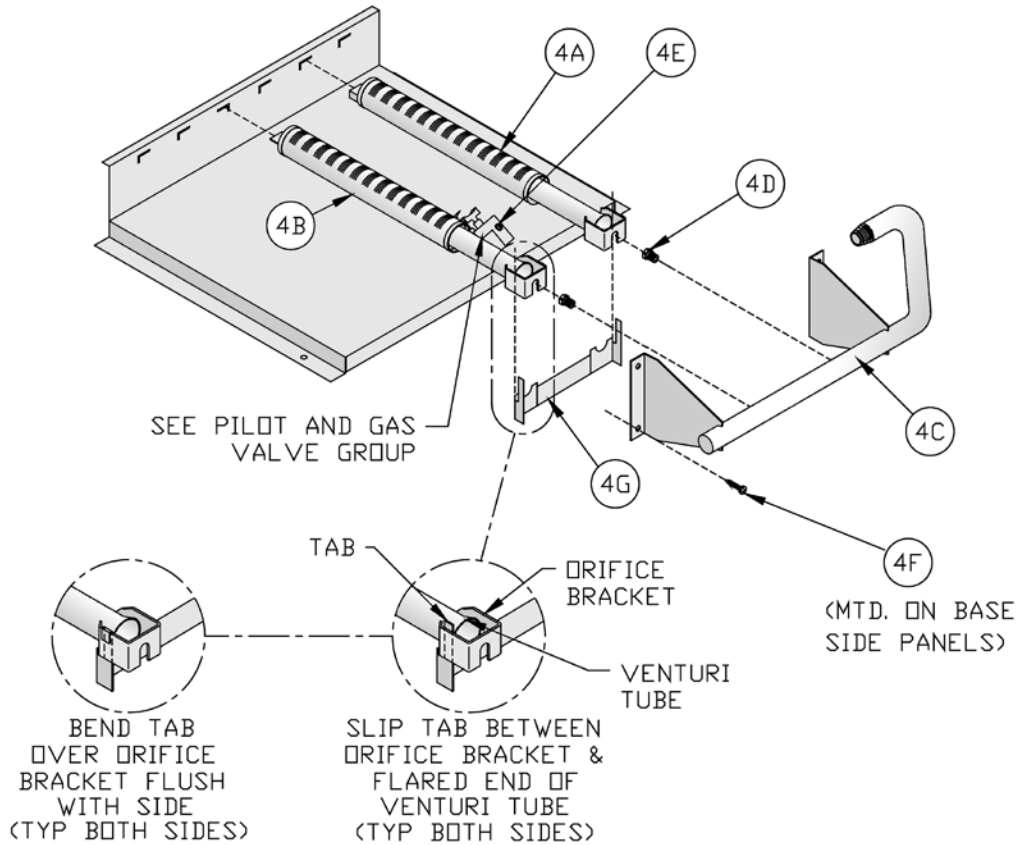
Manifold and 1" Main Burners

XI. Repair Parts (continued)

Key No.	Description	Part No.	Quantity									
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12
4. Manifold and Main Burners (1 Inch Main Burners Only)												
4A	Main Burner	8236099	2	4	6	8	11	13	15	17	20	22
4B	Main Burner with Pilot Bracket (Continuous Ignition) (Q350 Pilot)	8236097	1	1	1	1	1	---	---	---	---	---
	Main Burner with Pilot Bracket (Continuous Ignition) (Q327 Pilot)	8236098	---	---	---	---	---	1	1	1	1	1
	Main Burner with Pilot Bracket (Intermittent Ignition) (Q348 Pilot)	8236098	1	1	1	1	1	1	1	1	1	1
4C	Manifold	82260033	1	---	---	---	---	---	---	---	---	---
		82260043	---	1	---	---	---	---	---	---	---	---
		82260053	---	---	1	---	---	---	---	---	---	---
		82260063	---	---	---	1	---	---	---	---	---	---
		82260073	---	---	---	---	1	---	---	---	---	---
		82260083	---	---	---	---	---	1	---	---	---	---
		82260093	---	---	---	---	---	---	1	---	---	---
		82260103	---	---	---	---	---	---	---	1	---	---
		82260113	---	---	---	---	---	---	---	---	1	---
82260123	---	---	---	---	---	---	---	---	---	1		
4D Natural Gas Only	Main Burner Orifice, #45 Pink	822711	3	5	7	9	---	---	---	---	---	---
	Main Burner Orifice, #47 White	822710	---	---	---	---	12	14	16	18	21	23
4D LP Only	Main burner Orifice, #55 Green	822708	3	---	---	---	---	---	---	---	---	---
	Main Burner Orifice, 1.25 mm, Purple	822705	---	5	7	9	---	---	---	---	---	---
	Main Burner Orifice, 3/64", Blue	822704	---	---	---	---	12	14	16	---	---	---
4E	Screw, Machine, Slotted Round Head, 10-32 x 3/16"	80860800	2	2	2	2	2	2	2	2	2	2
4F	Screw, Self Tapping, Phillips Pan Head, 1/4 -20 x 1/2"	80860700	4	4	4	4	4	4	4	4	4	4

Note: Orifice Sizes shown for normal altitude (0-2000 feet). For High Altitude consult factory.

XI. Repair Parts (continued)



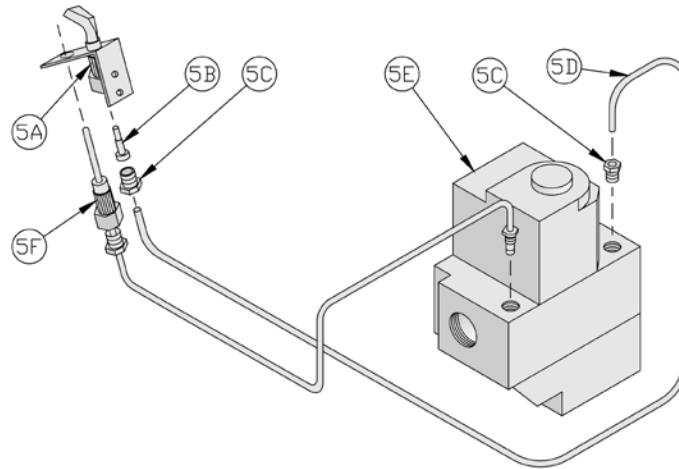
Manifold and 40mm Main Burners

Key No.	Description	Part No.	Quantity						
			IN3	IN4	IN5	IN6	IN7	IN8	IN9
4. Manifold and Main Burners (40MM MAIN BURNERS ONLY)									
4A	Main Burner	8236135	1	2	3	4	5	6	7
Intermittent Ignition Only									
4B	Main Burner with 41° Pilot Bracket	8236136	1	1	1	1	1	1	1
24-Volt Continuous Ignition (Standing Pilot) Natural Gas									
4B	Main Burner with 48° Pilot Bracket	8236143	1	1	1	1	---	---	---
	Main Burner with 41° Pilot Bracket	8236136	---	---	---	---	1	1	1
24-Volt Continuous Ignition (Standing Pilot) LP Gas									
4B	Main Burner with 41° Pilot Bracket	823136	1	1	1	1	1	1	1
4C	Manifold	82260038	1	---	---	---	---	---	---
		82260048	---	1	---	---	---	---	---
		82260058	---	---	1	---	---	---	---
		82260068	---	---	---	1	---	---	---
		82260078	---	---	---	---	1	---	---
		82260088	---	---	---	---	---	1	---
		82260098	---	---	---	---	---	---	1

XI. Repair Parts (continued)

Key No.	Description	Part No.	Quantity						
			IN3	IN4	IN5	IN6	IN7	IN8	IN9
4. Manifold and Main Burners (40MM MAIN BURNERS ONLY) Continued									
Natural Gas, High Altitude (2000-5000 Ft.) USA Only									
4D	Main Burner Orifice #39	822727	2	3	---	---	---	---	---
	Main Burner Orifice #38	822720	---	---	4	5	6	7	8
LP Gas, High Altitude (2000-5000 Ft.) USA Only									
4D	Main Burner Orifice #53	822722	2	3	4	5	6	7	8
Natural Gas, High Altitude (5000-9000 Ft.) USA Only									
4D	Main Burner Orifice #41	822729	2	3	---	---	---	---	---
	Main Burner Orifice #42	822728	---	---	4	5	6	7	8
LP Gas, High Altitude (5000-9000 Ft.) USA Only									
4D	Main Burner Orifice #54	822734	2	---	---	---	---	---	---
	Main Burner Orifice #53	822722	---	3	4	5	6	7	8
Natural Gas, High Altitude (2000-4500 Ft.) Canada Only									
4D	Main Burner Orifice #37	822719	2	---	---	---	---	---	---
	Main Burner Orifice #36	822771	---	3	4	5	6	7	8
LP Gas, High Altitude (2000-4500 Ft.) Canada Only									
4D	Main Burner Orifice #52	822721	2	3	4	5	6	7	8
4E	Screw, Machine, Slotted Round Head, #10-32 x 3/16"	80860800	2	2	2	2	2	2	2
4F	Screw, Self Tapping, Phillips Pan Head, 1/4 - 20 x 1/2"	80860700	4	4	4	4	4	4	4
4G	Injection Shield Assembly	718600362	1	---	---	---	---	---	---
		718600462	---	1	---	---	---	---	---
		718600562	---	---	1	---	---	---	---
		718600662	---	---	---	1	---	---	---
		718600762	---	---	---	---	1	---	---
		718600862	---	---	---	---	---	1	---
		718600962	---	---	---	---	---	1	

XI. Repair Parts (continued)

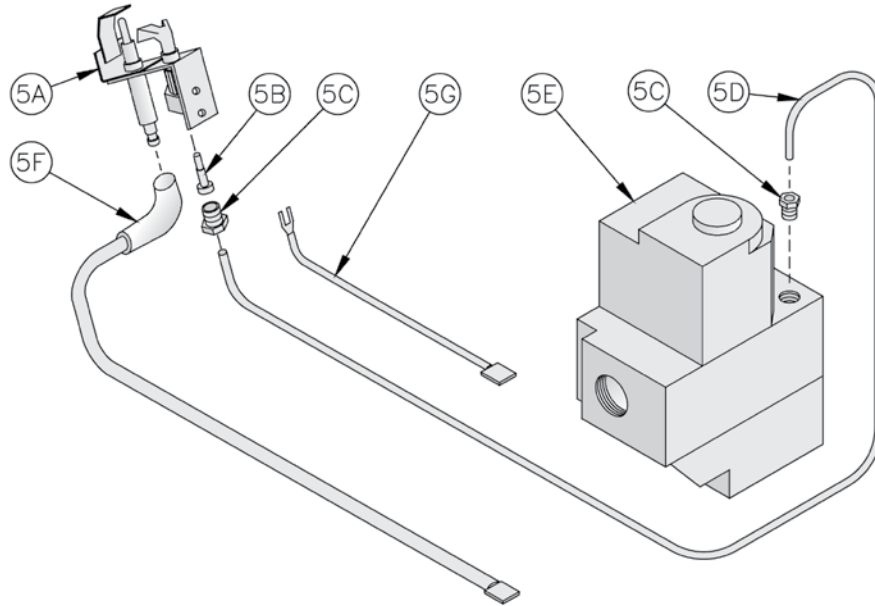


Key No.	Description	Part No.	Quantity									
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12
5. Pilot Burner and Gas Valve, Continuous Ignition (Standing Pilot), Natural Gas												
5A	Pilot Burner, Honeywell Q350A1321	8236065	1	1	1	1	1	---	---	---	---	---
	Pilot Burner, Honeywell Q327A1006	8236022	---	---	---	---	1**	1	1	1	1	1
5B	Pilot Orifice, Honeywell 390686-22	Included with 5A	1	1	1	1	1	---	---	---	---	---
	Pilot Orifice, Honeywell 388146AG		---	---	---	---	---	1	1	1	1	1
5C	Compression Nut/Fitting, 1/4" OD x 1/4 C.C. (Included with 5A)	8236109	2	2	2	2	2	2	2	2	2	2
5D	Pilot Tubing, 1/4" OD x 30"	8236122	1	1	1	1	1	---	---	---	---	---
	Pilot Tubing, 1/4" OD x 40"	8236123	---	---	---	---	---	1	1	1	1	1
5E	Gas Valve, Honeywell VR8200C3005	81660143	1	1	1	1	---	---	---	---	---	---
	Gas Valve, Honeywell VR8200C6065	100333-01	1**	1**	1**	1**	---	---	---	---	---	---
	Gas Valve, Honeywell VR8300C4027	81660154	---	---	---	---	1	1	1	---	---	---
	Gas Valve, Honeywell VR8300C4266	100334-01	---	---	---	---	1**	1**	1**	---	---	---
	Gas Valve, Robertshaw 7000ERHC-S7C	81660156	---	---	---	---	---	---	---	1	1	1
	Gas Valve, ITT K3A451	81660080	---	---	---	---	---	---	---	1	1	1
5F	Thermocouple, Honeywell Q309A	8236024	1	1	1	1	1	1	1	1	1	1
5. Pilot Burner and Gas Valve, Continuous Ignition (Standing Pilot), LP/Propane												
5A	Pilot Burner, Honeywell Q350A1339	8236066	1	1	1	1	1	---	---	---	---	---
	Pilot Burner, Honeywell Q327A1147	8236023	1**	1**	1**	1**	1**	1	1	---	---	---
5B	Pilot Orifice, Honeywell 390686-23	Included with 5A	1	1	1	1	1	---	---	---	---	---
	Pilot Orifice, Honeywell 388146KR		---	---	---	---	---	1	1	---	---	---
5C	Compression Nut/Fitting, 1/4" OD x 1/4 C.C. (Included with 5A and 5E)	8236109	2	2	2	2	2	2	2	---	---	---
5D	Pilot Tubing, 1/4" OD x 30"	8236122	1	1	1	1	1	---	---	---	---	---
	Pilot Tubing, 1/4" OD x 40"	8236123	---	---	---	---	---	1	1	---	---	---
5E	Gas Valve, Honeywell VR8200C3013	81660144	1	1	1	1	---	---	---	---	---	---
	Gas Valve, Honeywell VR8300C4035	81660163	---	---	---	---	1	1	1	---	---	---
5F	Thermocouple, Honeywell Q309A	8236024	1	1	1	1	1	1	1	---	---	---

Note: Gas Valve specifications shown for normal altitude (0-2000 feet). For High Altitude consult factory.

** 40mm Burners Only

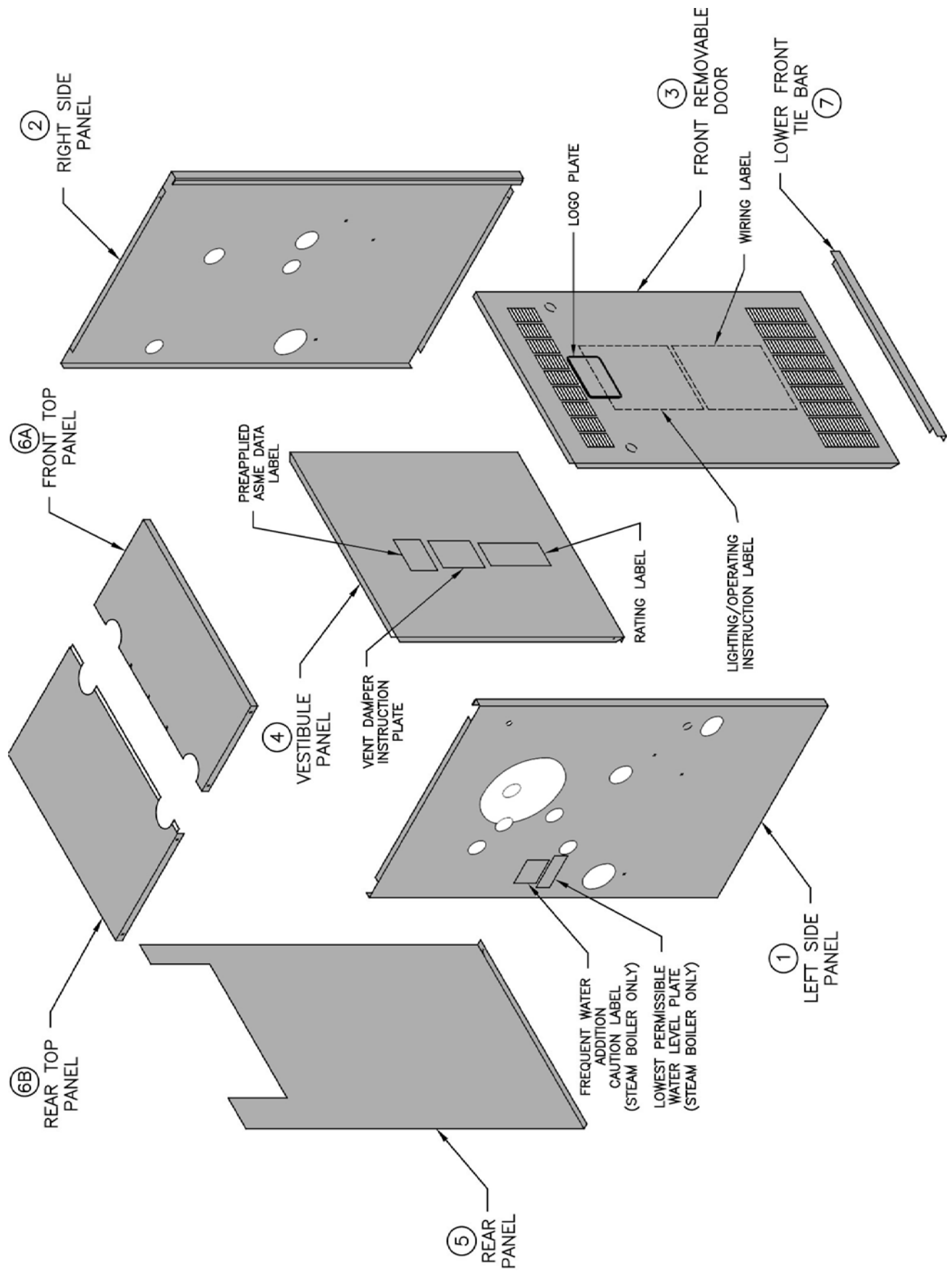
XI. Repair Parts (continued)



Key No.	Description	Part No.	Quantity									
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12
5. Pilot Burner and Gas Valve, Intermittent Ignition (EI), Natural Gas												
5A	Pilot Burner, Honeywell Q348A1002	8236072	1	1	1	1	1	1	1	1	1	1
5B	Pilot Orifice, Honeywell 388146NE	Included with 5A	1	1	1	1	1	1	1	1	1	1
5C	Compression Nut/Fitting, 1/4" OD x 1/4 C.C. (Included with 5A and 5E)	8236109	2	2	2	2	2	2	2	2	2	2
5D	Pilot Tubing, 1/4" OD x 30"	8236122	1	1	1	1	1	---	---	---	---	---
	Pilot Tubing, 1/4" OD x 40"	8236123	---	---	---	---	---	1	1	1	1	1
5E	Gas Valve, Honeywell VR8204C3007	81660145	1	1	1	1	---	---	---	---	---	---
	Gas Valve, Honeywell VR8304P4306	81660161	---	---	---	---	1	1	1	1	1	2
5F	Igniter/Sensor Cable, 36", Honeywell 394800-36	8236084	1	1	1	1	1	1	1	1	1	1
5G	Ground Wire Assembly	6136054	1	1	1	1	1	1	1	1	1	1
5. Pilot Burner and Gas Valve, Intermittent Ignition (EI), LP/Propane												
5A	Pilot Burner, Honeywell Q348A1010	8236081	1	1	1	1	1	1	1	---	---	---
5B	Pilot Orifice, Honeywell 388146KP	Included with 5A	1	1	1	1	1	1	1	---	---	---
5C	Compression Nut/Fitting, 1/4" OD x 1/4 C.C. (Included with 5A and 5E)	8236109	2	2	2	2	2	2	2	---	---	---
5D	Pilot Tubing, 1/4" OD x 30"	8236122	1	1	1	1	1	---	---	---	---	---
	Pilot Tubing, 1/4" OD x 40"	8236123	---	---	---	---	---	1	1	---	---	---
5E	Gas Valve, Honeywell VR8204C3015	81660146	1	1	1	1	---	---	---	---	---	---
	Gas Valve, Honeywell VR8304P4314	81660160	---	---	---	---	1	1	1	---	---	---
5F	Igniter/Sensor Cable, 36" Honeywell 394800-36	8236084	1	1	1	1	1	1	1	---	---	---
5G	Ground Wire Assembly	6136054	1	1	1	1	1	1	1	---	---	---

Note: Gas Valve specifications shown for normal altitude (0-2000 feet). For High Altitude consult factory.

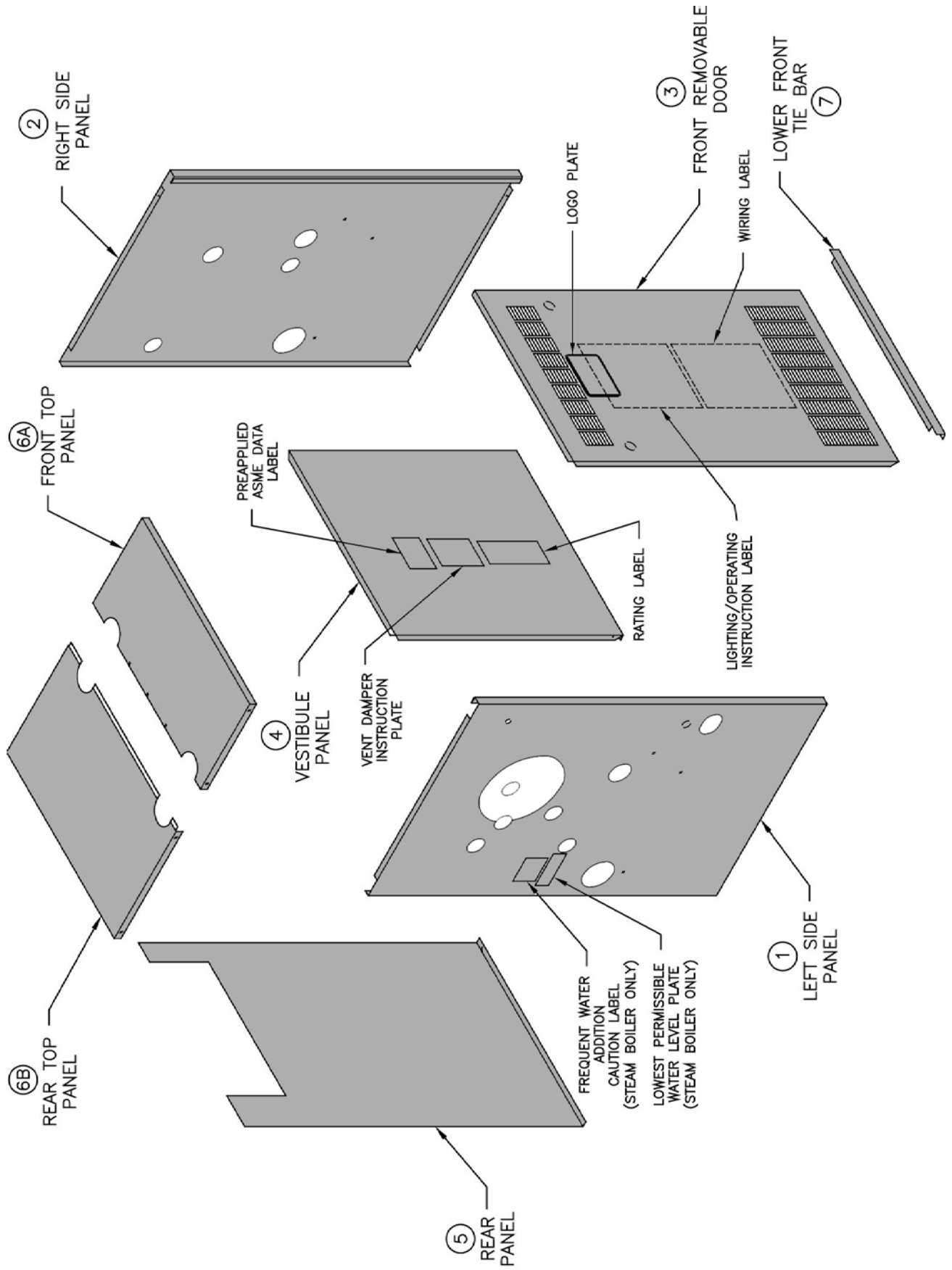
88 XI. Repair Parts (continued)



XI. Repair Parts (continued)

Key No.	Description	Part No.	Quantity										
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12	
Jacket Assembly													
1	Left Side Panel	60410013	1	1	1	1	1	1	1	1	---	---	---
		60410023	---	---	---	---	---	---	---	---	1	1	1
2	Right Side Panel	60410012	1	1	1	1	1	1	1	1	---	---	---
		60410022	---	---	---	---	---	---	---	---	1	1	1
3	Front Removable Panel	60410033	1	---	---	---	---	---	---	---	---	---	---
		60410043	---	1	---	---	---	---	---	---	---	---	---
		60410053	---	---	1	---	---	---	---	---	---	---	---
		60410063	---	---	---	1	---	---	---	---	---	---	---
		60410073	---	---	---	---	1	---	---	---	---	---	---
		60410083	---	---	---	---	---	1	---	---	---	---	---
		60410093	---	---	---	---	---	---	1	---	---	---	---
		60410103	---	---	---	---	---	---	---	1	---	---	---
4	Vestibule Panel	60410113	---	---	---	---	---	---	---	---	---	1	---
		60410123	---	---	---	---	---	---	---	---	---	---	1
		60410034	1	---	---	---	---	---	---	---	---	---	---
		60410044	---	1	---	---	---	---	---	---	---	---	---
		60410054	---	---	1	---	---	---	---	---	---	---	---
		60410064	---	---	---	1	---	---	---	---	---	---	---
		60410074	---	---	---	---	1	---	---	---	---	---	---
		60410084	---	---	---	---	---	1	---	---	---	---	---
5	Rear Panel IN10, IN11 & IN12 require 5A and 5B (see page 83)	60410094	---	---	---	---	---	---	---	1	---	---	---
		60410104	---	---	---	---	---	---	---	---	1	---	---
		60410114	---	---	---	---	---	---	---	---	---	1	---
		60410124	---	---	---	---	---	---	---	---	---	---	1
		60410035	1	---	---	---	---	---	---	---	---	---	---
		60410045	---	1	---	---	---	---	---	---	---	---	---
		60410055	---	---	1	---	---	---	---	---	---	---	---
		60410065	---	---	---	1	---	---	---	---	---	---	---
		60410075	---	---	---	---	1	---	---	---	---	---	---
		60410085	---	---	---	---	---	1	---	---	---	---	---
5	Rear Panel IN10, IN11 & IN12 require 5A and 5B (see page 83)	60410095	---	---	---	---	---	---	---	1	---	---	---
		60410105	---	---	---	---	---	---	---	---	1	---	---
		60410115	---	---	---	---	---	---	---	---	---	1	---
		60410125	---	---	---	---	---	---	---	---	---	1	

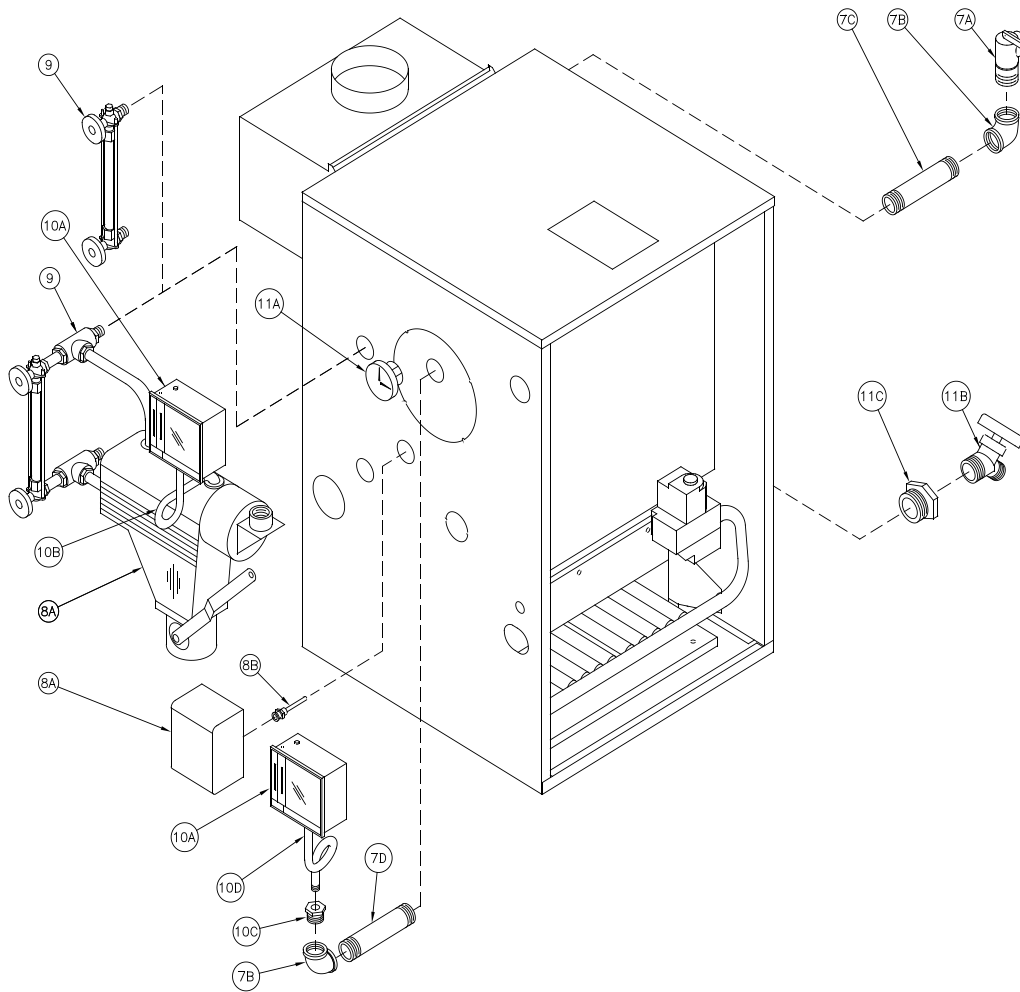
XI. Repair Parts (continued)



XI. Repair Parts (continued)

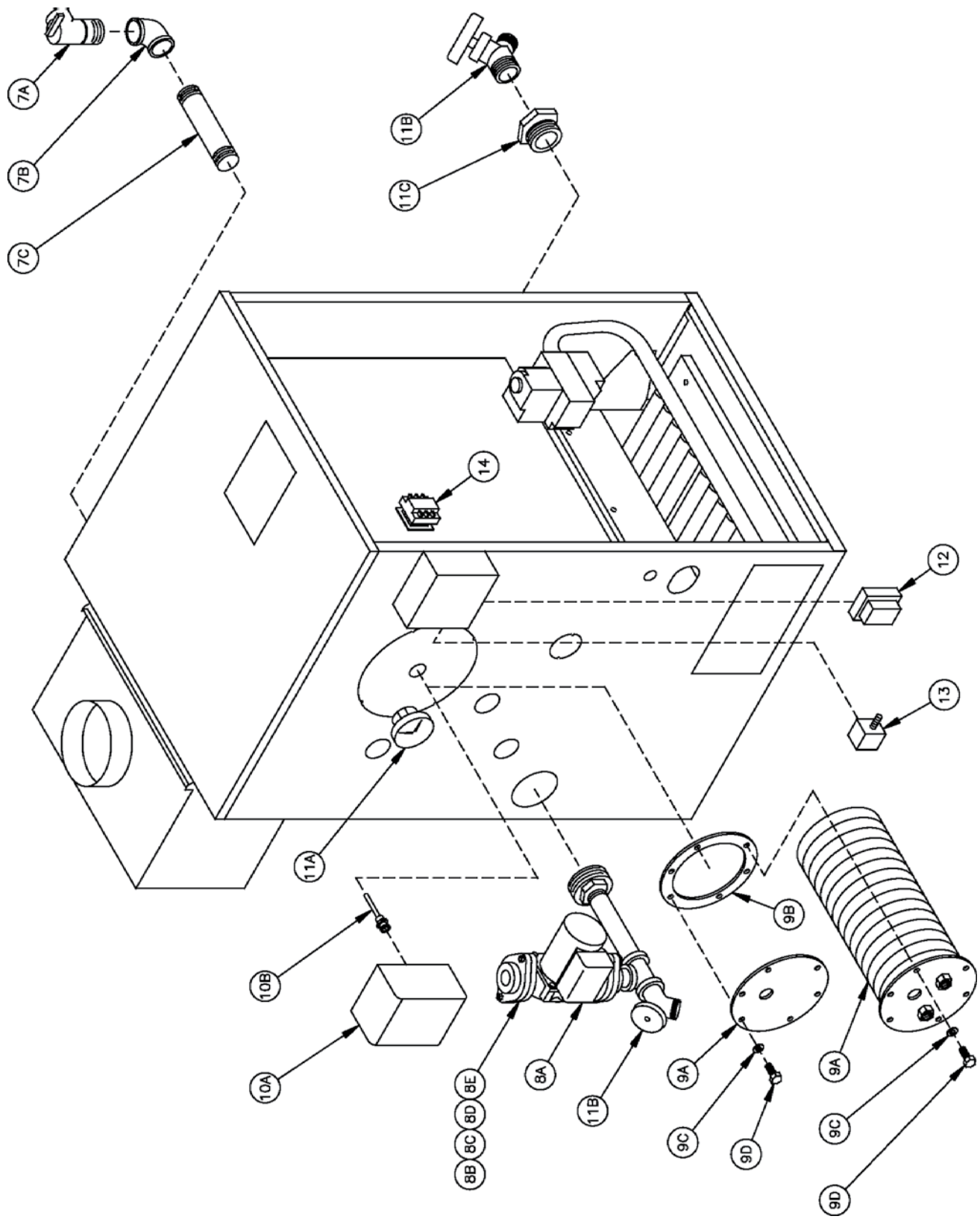
Key No.	Description	Part No.	Quantity										
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12	
Jacket Assembly (Continued)													
5A	Upper Left Rear Panel (not shown)	604101051	---	---	---	---	---	---	---	---	1	1	1
5B	Upper Right Rear Panel (not shown)	604101052	---	---	---	---	---	---	---	---	1	1	1
6A	Front Top Panel	60410036	1	---	---	---	---	---	---	---	---	---	---
		60410046	---	1	---	---	---	---	---	---	---	---	---
		60410056	---	---	1	---	---	---	---	---	---	---	---
		60410066	---	---	---	1	---	---	---	---	---	---	---
		60410076	---	---	---	---	1	---	---	---	---	---	---
		60410086	---	---	---	---	---	1	---	---	---	---	---
		60410096	---	---	---	---	---	---	1	---	---	---	---
		60410106	---	---	---	---	---	---	---	1	---	---	---
		60410116	---	---	---	---	---	---	---	---	---	1	---
		60410126	---	---	---	---	---	---	---	---	---	---	1
6B	Rear Top Panel	604100361	1	---	---	---	---	---	---	---	---	---	---
		604100461	---	1	---	---	---	---	---	---	---	---	---
		604100561	---	---	1	---	---	---	---	---	---	---	---
		604100661	---	---	---	1	---	---	---	---	---	---	---
		604100761	---	---	---	---	1	---	---	---	---	---	---
		604100861	---	---	---	---	---	1	---	---	---	---	---
		604100961	---	---	---	---	---	---	1	---	---	---	---
		604101061	---	---	---	---	---	---	---	1	---	---	---
		604101161	---	---	---	---	---	---	---	---	---	1	---
		604101261	---	---	---	---	---	---	---	---	---	---	1
7	Lower Front Tie Bar	70410034	1	---	---	---	---	---	---	---	---	---	---
		70410044	---	1	---	---	---	---	---	---	---	---	---
		70410054	---	---	1	---	---	---	---	---	---	---	---
		70410064	---	---	---	1	---	---	---	---	---	---	---
		70410074	---	---	---	---	1	---	---	---	---	---	---
		70410084	---	---	---	---	---	1	---	---	---	---	---
		70410094	---	---	---	---	---	---	1	---	---	---	---
		70410104	---	---	---	---	---	---	---	1	---	---	---
		70410114	---	---	---	---	---	---	---	---	---	1	---
		70410124	---	---	---	---	---	---	---	---	---	---	1

XI. Repair Parts (continued)



Key No.	Description	Part No.	Quantity
Steam Trim			
7A	Safety Valve, 3/4 NPT, 15 psi, Conbraco 13-511-08	81660530	1
7B	Elbow, 3/4 NPT	806601502	2
7C	Nipple, 3/4 NPT x 3-1/2"	806600038	1
7D	Nipple, 3/4 NPT x 4"	806600014	1
8A	Low Water Cutoff, McDonnell & Miller PS-802-24 (Probe Included)	80160720	1
	Low Water Cutoff, Hydrolevel CG400-2090 (Less Probe - See Key No. 8B)	80160725	
	Low Water Cutoff, McDonnell & Miller 67-BC-1 (Float Type)	80160517	
8B	Probe for CG400	80160629	1
9	Gauge Glass, Extended Shank (with Probe LWCO Only)	8056128	1
	Gauge Glass, Standard Shank (with Float LWCO Only)	8056020	
10A	Limit, Honeywell L404F1367	80160369	1
10B	Syphon, 1/4 NPT x 90°	806603010	1
10C	Bushing, 3/4 NPT x 1/4 NPT	806600508	1
10D	Syphon, 1/4 NPT x 180°	806603030	1
11A	Pressure Gauge	100325-01	1
11B	Drain Valve, Conbraco 31-612-02	806603012	1
11C	Bushing, 2 NPT x 3/4 NPT	806600515	1

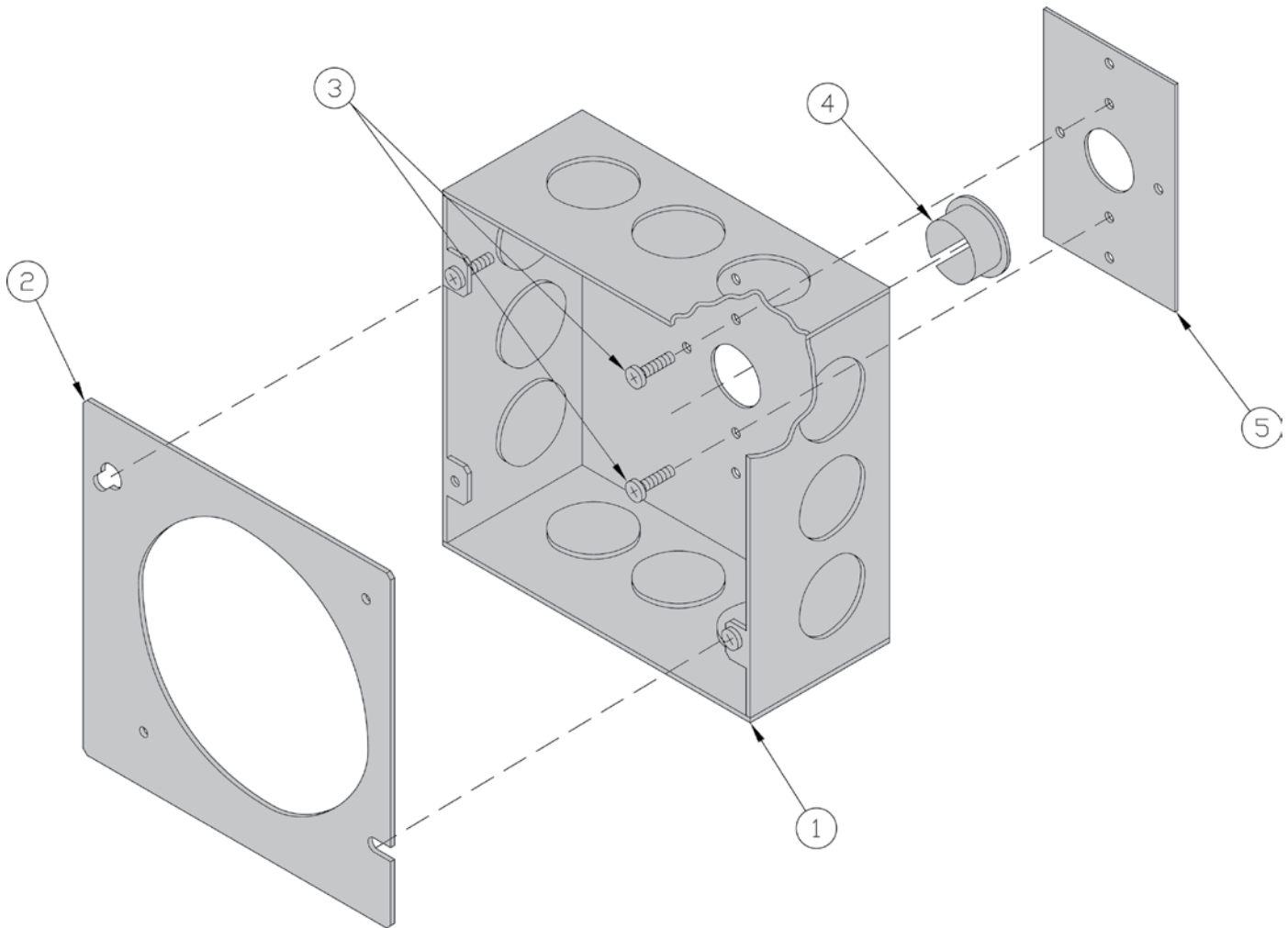
THIS PAGE LEFT BLANK INTENTIONALLY



XI. Repair Parts (continued)

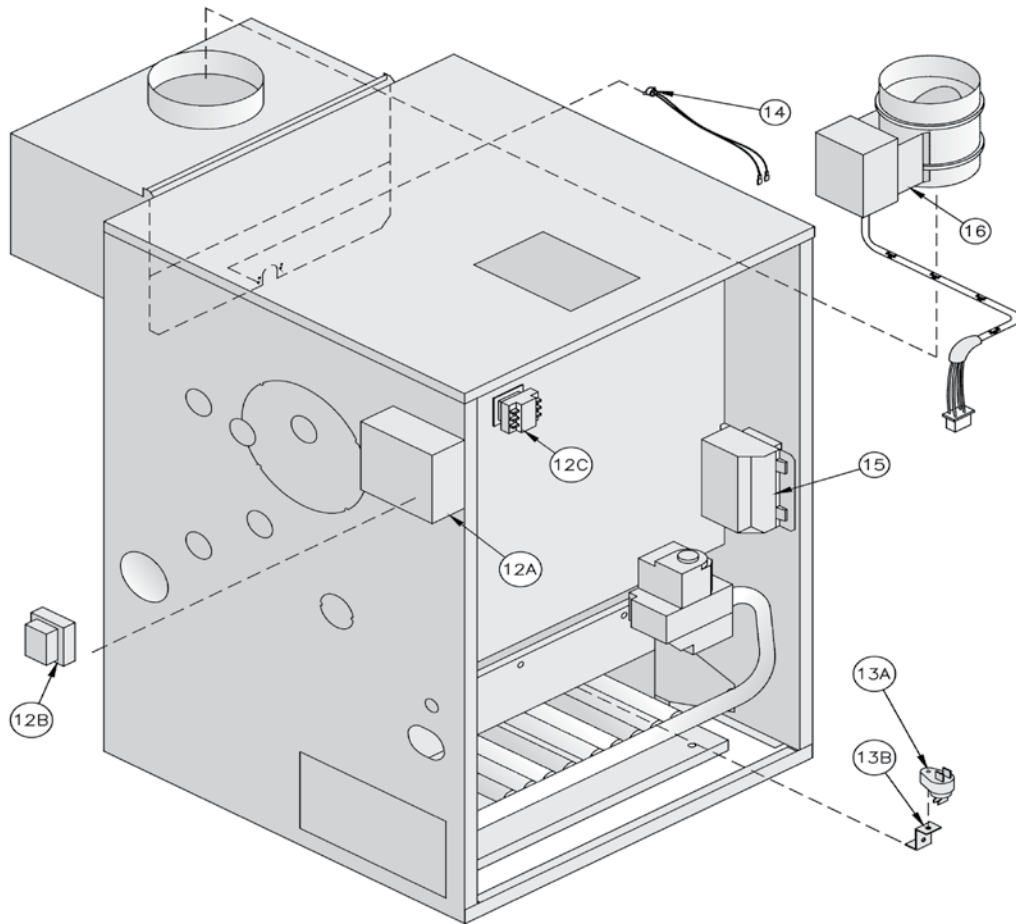
Key No.	Description	Part No.	IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12
Water Trim												
7A	Safety Relief Valve, 3/4 NPT, 30 psi, Conbraco 10-407-05	81660363	1	1	1	1	1	1	1	1	1	1
7B	Elbow, 3/4 NPT	806601520	1	1	1	1	1	1	1	1	1	1
7C	Nipple, 3/4 NPT x 3"	806600002	2	2	2	2	2	2	2	2	2	2
8A	Circulator, Bell & Gossett NRF-22 with Gaskets	8056174	1	1	1	1	1	1	1	1	1	1
	Circulator, Grundfos UP 15-42F	8056044										
	Circulator, Taco 007	8056007										
8B	Gasket, Bell & Gossett NRF-22	806602029	2	2	2	2	2	2	2	2	2	2
	Gasket, Grundfos 510179	806602016										
	Gasket, Taco '00' Series	806602006										
8C	Flange, 1-1/2 NPT	806602014	2	2	2	2	2	2	2	2	2	2
8D	Screw, Cap Hex Head, 7/16 -14 x 1-1/2"	80861301	4	4	4	4	4	4	4	4	4	4
8E	Nut, Hex, 7/16 -14	80860406	4	4	4	4	4	4	4	4	4	4
9A	Tankless Heater, #222	6036007	---	---	1	1	1	1	1	1	1	1
	Heater Cover Plate	7036001	1	1	1	1	1	1	1	1	1	1
9B	Gasket	8036068	1	1	1	1	1	1	1	1	1	1
9C	Washer, 3/8"	80860600	6	6	6	6	6	6	6	6	6	6
9D	Screw, Cap Hex Head, 3/8 -16 x 7/8"	80861337	6	6	6	6	6	6	6	6	6	6
10A	Limit, Honeywell L8148E1299 (Intermittent Circulation Only)	80160607	1	1	1	1	1	1	1	1	1	1
	Limit, Honeywell L6081A1010 (Tankless Heater Only)	80160469										
	Limit, Honeywell L4006A2015 (Gravity Circulation Only)	80160400U										
10B	Well, Honeywell 123871A (Tankless Heater Only)	80160452	1	1	1	1	1	1	1	1	1	1
	Well, Honeywell 123870A (Intermittent or Gravity Circulation Only)	80160426										
11A	Temperature/Pressure Gauge, ENFM 41042.5210	100282-01	1	1	1	1	1	1	1	1	1	1
11B	Drain Valve, Conbraco 31-612-02	806603012	1	1	1	1	1	1	1	1	1	1
11C	Bushing, 2 NPT x 3/4 NPT	806600515	1	1	1	1	1	1	1	1	1	1
12	Transformer, 50VA, Honeywell AT150D1019 (Tankless Heater or Gravity Circulation Only)	80160186	1	1	1	1	1	1	1	1	1	1
13	Relay, DPST, Honeywell R8225D1029 (Tankless Heater Only)	80160265	1	1	1	1	1	1	1	1	1	1
14	Relay, SPST, Honeywell R8222K1000 (Gravity Circulation Only)	80160127	1	1	1	1	1	1	1	1	1	1

XI. Repair Parts (continued)



Key No.	Description	Part No.	Quantity									
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12
Transformer/J-Box Adapter Plate												
1	Junction Box, 4-11/16" x 4-11/16" x 2-1/8"	81361761	1	1	1	1	1	1	1	1	1	1
2	Transformer/J-Box Adapter Plate	7011001	1	1	1	1	1	1	1	1	1	1
3	Sheet Metal Screw, #8 x 1/2, Type B, Phillips Head, Blunt	80860019	2	2	2	2	2	2	2	2	2	2
4	O/CL Bushing, Heyco OCB-875	8136066	1	1	1	1	1	1	1	1	1	1
5	J-Box Attachment Bracket	7131001	1	1	1	1	1	1	1	1	1	1

XI. Repair Parts (continued)



Key No.	Description	Part No.	Quantity									
			IN3	IN4	IN5	IN6	IN7	IN8	IN9	IN10	IN11	IN12
12. Transformer (Steam and Gravity Water Only)												
12A	Junction Box, 4-11/16" x 4-11/16" x 2-1/8"		Refer to Table on Page 88									
12B	Transformer, 50 VA, Honeywell AT150D1019	80160186	1	1	1	1	1	1	1	1	1	1
12C	Relay, SPST, Honeywell R8222K1000	80160127	1	1	1	1	1	1	1	1	1	1
13. Flame Rollout Switch												
13A	Flame Rollout Switch	80160044	1	1	1	1	1	1	1	1	1	1
13B	Flame Rollout Switch Bracket	7186018	1	1	1	1	1	1	1	1	1	1
14. Blocked Vent Switch												
14	Blocked Vent Switch	6016067	1	1	1	1	1	1	1	---	---	---
		6111001	---	---	---	---	---	---	---	1	1	1
15. Ignition Module (Intermittent Ignition Only)												
15	Ignition Module, Honeywell S8610M3009	100958-01	1	1	1	1	1	1	1	1	1	1
---	Ignition Module Support Bracket	7016001	1	1	1	1	1	1	1	1	1	1
16. Vent Damper												
16	4"	8116321	1	---	---	---	---	---	---	---	---	---
	5"	8116322	---	1	---	---	---	---	---	---	---	---
	6"	8116323	---	---	1	1	---	---	---	---	---	---
	7"	8116324	---	---	---	---	1	1	---	---	---	---
	8"	8116325	---	---	---	---	---	---	1	1	---	---
	9"	8116326	---	---	---	---	---	---	---	---	1	1

APPENDIX A - Low Water Cut Off (LWCO)

WARNING

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

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

When

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

Where

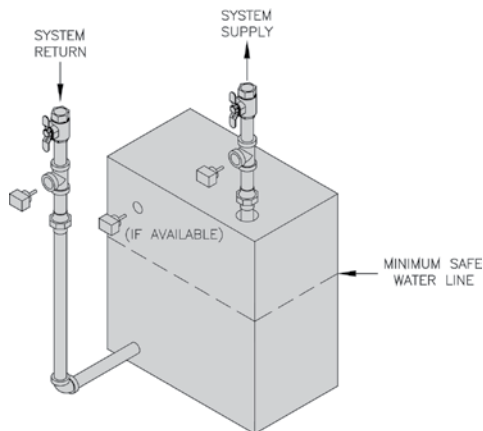
The universal location for a LWCO on both gas and oil hot water boilers is above the boiler, in either the supply or return piping. The minimum safe water level of a water boiler is at the uppermost top of the boiler; that is, it must be full of water to operate safely.

What Kind

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

How to Pipe

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



LWCO Location

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

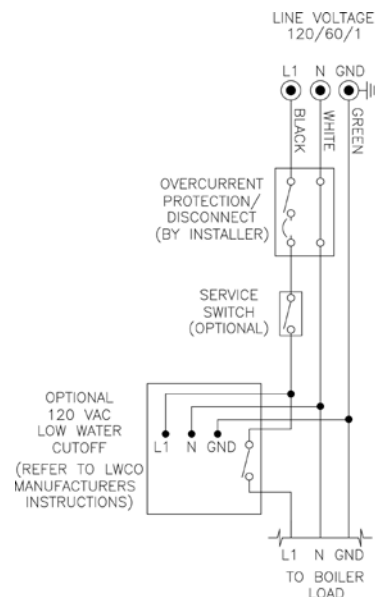
manufacturers recommend an annual inspection of the probe.

How to Wire

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

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

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



Wiring of Typical LWCO

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

How to Test

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

Appendix B - Figures

Figure Number	Page Number	Description
Figure 1	4	Dimensional Drawing
Figure 2	6	Section Tappings
Section I - Pre-Installation		
Figure 3	8	Clearance to Combustible Materials
Section II - Knocked-Down Boiler Assembly		
Figure 4	9	Base Gasket Installation
Figure 5	9	Section Assembly Attachment
Figure 6	9	Hydrostatic Pressure Test
Figure 7	10	Canopy Gasket Installation
Figure 8	10	Canopy Installation
Figure 9	10	Jacket Assembly
Figure 10	11	Combustion Chamber
Figure 11	11	Pilot and Gas Piping, Continuous Ignition (Standing Pilot) (IN3 through IN9 Only)
Figure 12	11	Pilot and Gas Piping, Continuous Ignition (Standing Pilot) (IN10 through IN12 Only)
Figure 13	11	Pilot and Gas Piping, Intermittent Ignition (EI) (IN3 through IN11 Only)
Figure 14	11	Pilot and Gas Piping, Intermittent Ignition (EI) (IN12 Only)
Figure 15	12	Blocked Vent Switch Installation, IN3 through IN9
Figure 16	12	Blocked Vent Switch Installation, IN10 through IN12
Section III - Semi-Pak Boiler Assembly		
Figure 18	13	L404F Pressure Limit Control
Figure 19A	14	Junction Box and Mounting Bracket Assembly
Figure 19B	14	Junction box and Transformer Assembly
Figure 20	14	Thermostat Isolation Relay Attachment
Section IV - Packaged Boiler Assembly		
Figure 21	15	Draft Hood Attachment
Figure 22	15	Securing Draft Hood to Canopy
Section V - Piping and Trim		
Figure 23	16	Trim Installation
Figure 24	17	Steam Boiler Piping (Minimum)
Figure 25	18	Recommended Water Piping for Circulator Zoned Heating System
Figure 25A	19	Recommended Water Piping for Zone Valve Zoned Heating System
Figure 26	20	Recommended Piping for Combination Heating and Cooling (Refrigeration) Systems
Figure 27	20	Recommended Piping for Indirect Water Heater
Figure 28	20	Tankless Heater Piping
Section VI - Gas Piping		
Figure 29	22	Recommended Gas Piping
Section VII - Venting		
Figure 30	25	Typical Vent Installation

Appendix B - Figures (continued)

Figure Number	Page Number	Description
Section VIII - Electrical		
Figure 31	26	Vent Damper Connection Detail
Figure 32	26	Vent Damper Harness to Junction Box
Figure 33	28	Vent Damper Harness to Limit
Figure 34	28	Vent Damper Schematic Wiring Diagram
Figure 35	30	Wiring Diagrams, Steam, Continuous Ignition (Standing Pilot), Probe Low Water Cutoff
Figure 36	32	Wiring Diagrams, Steam, Intermittent Ignition (EI), Probe Low Water Cutoff
Figure 37	34	Wiring Diagrams, Steam, Continuous Ignition (Standing Pilot), Float Low Water Cutoff
Figure 38	36	Wiring Diagrams, Steam, Intermittent Ignition (EI), Float Low Water Cutoff
Figure 39	38	Wiring Diagrams, Water, Continuous Ignition (Standing Pilot), Intermittent Circulation
Figure 40	40	Wiring Diagrams, Water, Intermittent Ignition (EI), Intermittent Circulation
Figure 41	42	Wiring Diagrams, Water, Continuous Ignition (Standing Pilot), Gravity Circulation
Figure 42	44	Wiring Diagrams, Water, Intermittent Ignition (EI), Gravity Circulation
Figure 43	46	Wiring Diagrams, Water, Continuous Ignition (Standing Pilot), Tankless Heater
Figure 44	48	Wiring Diagrams, Water, Intermittent Ignition (EI), Tankless Heater
Section IX - System Start-Up		
Figure 45	50	Front Door Removal
Figure 46	50	Gas Valve Pressure Tap, Honeywell Gas Valves
Figure 47	50	Gas Valve Pressure Tap, Robertshaw Gas Valve
Figure 48	51	Lighting Instructions, Continuous Ignition System, VR8200 and VR8300 Gas Valves
Figure 49	52	Lighting Instructions, Continuous Ignition System, 7000 ERHC Gas Valve
Figure 50	53	Operating Instructions, Intermittent Ignition System, VR8204 and VR8304 (except IN12) Gas Valves
Figure 52	54	Operating Instructions, Intermittent Ignition System (EI), VR8304 (IN12 only) Gas Valves
Figure 52A	55	Location of LED
Figure 52B	56	Measuring Pilot Flame Current with Micro-ammeter
Figure 53	57	Pilot Burner Flame, Honeywell Q350
Figure 54	57	Pilot Burner Flame, Honeywell Q327
Figure 55	57	Pilot Burner Flame, Honeywell Q348
Figure 56	57	40mm Main Burner Flame
Figure 57	57	1" Main Burner Flame
Section X - Service Instructions		
Figure 58	63	Boiler Flueway Cleaning
Figure 59	64	Honeywell Q348 Spark Gap
XI - Repair Parts		
N/A	Pages 70 through 89	

Appendix C - Tables

Table Number	Page Number	Description
Table 1	6	Trim and Control Installation in Section Tappings
Section VI - Gas Piping		
Table 2	22	Rated Input
Table 3	23	Maximum Capacity of Schedule 40 Pipe in CFH for Natural Gas Pressures of 0.5 psig or Less
Table 4	23	Fitting Equivalent Lengths
Table 5	23	Specific Gravity Correction Factors for Natural Gas
Section VIII - Electrical		
Table 6	27	Thermostat Heat Anticipator Settings
Section IX - System Start-Up		
Table 7	55	Ignition Module Terminal Cross-Reference
Table 8	55	Green LED Status Codes
Table 9	59	Input Rate
Table 10	64	Pilot Burner Location
Section XI - Repair Parts		
N/A	Pages 70 through 89	

U.S. Boiler Company, Inc.
P.O. Box 3020
Lancaster, PA 17604
(717) 397-4701
www.usboiler.net