Installation, Operating and Service Instructions for

Residential

Models:

- IN3I
- IN4I
- IN5I
- IN6I
- IN7I
- IN8I
- IN9I

•	Steam	Roi	ler
	OtGairi	וטטו	IUI

- Cast Iron
- Chimney Vent

• IN4I • IN5I	 Gas Fired 	
• IN6I • IN7I		Independence' Bolier
• IN8I • IN9I		
Manual Contents	<u>Page</u> Agency, or Gas Supplier Read	
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9. Air for Combustion and Vo	entilation	
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⚠ WARNING

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

12. Indirect Water Heating Piping......26

> Attention Building Owner - Retain these instructions for future reference. Contact a qualified installer, service agency or gas supplier for all issues and support.

WARNING

Read these instructions carefully before installing. This boiler must only be installed, serviced, or repaired by a qualified installer, service agency or gas supplier. Improper installation, adjustment, alteration, service, or maintenance can cause severe personal injury, death, or substantial property damage. For assistance or additional information, consult a qualified installer, service agency or gas supplier.



Tea Married Broad of Black and One Filler

The Massachusetts Board of Plumbers and Gas Fitters has approved these boilers. See the Massachusetts Board of Plumbers and Gas Fitters website 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.

A DANGER

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

A WARNING

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

A CAUTION

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

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

DANGER

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

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

WARNING

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

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

1 Qualified Installer, Service Agency or Gas Supplier Read Before Proceeding

WARNING

Asphyxiation Hazard. Fire Hazard. Explosion Hazard. 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.
- Asphyxiation Hazard. 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. 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 in the supply piping. - See the Water Piping Section of this manual for details.
- This boiler is supplied with safety devices
 which may cause the boiler to shut down and
 not re-start without service. If damage due to
 frozen pipes is a possibility, the heating system
 should not be left unattended in cold weather;
 or appropriate safeguards and alarms should
 be installed on the heating system to prevent
 damage if the boiler is inoperative.
- Do not obstruct the combustion or ventilation air supply to the boiler.

WARNING

- Burn Hazard. This boiler contains very hot water and 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 temperature and pressure of the boiler. This boiler contains components which become very hot when the boiler is operating. Do not touch any components unless they are cool.
- Respiratory Hazard. 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 appliance.
- Failure to follow all instructions in the proper order can cause personal injury or death. Read all instructions, including all those contained in component manufacturers manuals which are provided with the boiler before installing, starting up, operating, maintaining or servicing.
- All cover plates, enclosures and guards must be in place at all times.

A DANGER

Explosion Hazard. Electrical Shock Hazard. Burn Hazard. This boiler uses flammable gas, high voltage electricity, moving parts, and very hot water under high pressure.

Assure that all gas and electric power supplies are off and that the water temperature is cool 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.

2 User/Homeowner Read Before Proceeding

WARNING

Asphyxiation Hazard. Fire Hazard.

- A qualified installer, service agency or gas supplier should annually inspect boiler.
- If you are not qualified to install or service boilers, do not install or service this one.
- Carbon monoxide is an odorless, deadly gas that may be introduced into your home by any malfunctioning fuel burning product or vent system failure. The installer must verify that at least one carbon monoxide alarm has been installed within a residential living space or home following the alarm manufacturer's instructions and applicable local codes before putting the appliance into operation. Consider installing CO alarms near bedrooms in all levels of building to warn you and your family of potential CO exposure.
- Do not block air flow into or around boiler or opening for fresh air into boiler room. Insufficient air may cause the boiler to produce carbon monoxide or start a fire.

NOTICE: Protect your home in freezing weather. A power outage, operating control, or component failure will prevent your boiler from lighting. In winter your pipes may freeze and cause extensive property damage. Do not leave heating system unattended during cold weather unless alarms or other safeguards are in place to prevent such property damage.

A CAUTION

Burn Hazard.

Keep children and pets away from hot surfaces of the boiler including boiler piping, vent piping, and vent terminals.

NOTICE: Boiler may leak water or steam at the end of its useful life. Be sure to protect walls, carpets, and valuables from water or steam that could leak from boiler.

NOTICE: This boiler contains controls which may cause the boiler to shut down and not restart without service. If damage due to frozen pipes is a possibility, heating system should not be left unattended in cold weather; or appropriate safeguards and alarms should be installed on heating system to prevent damage if boiler is inoperative.

3 Specifications

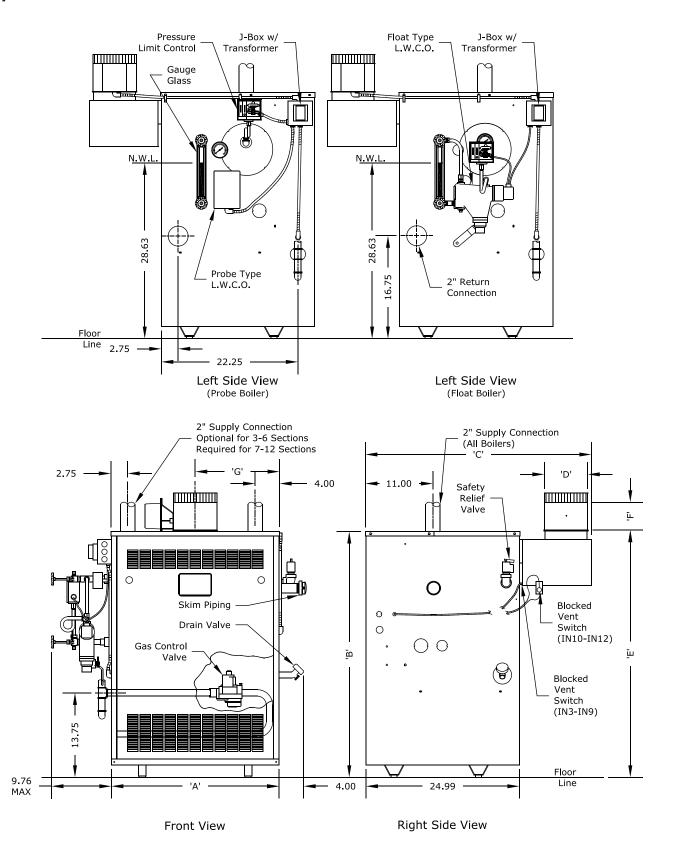


Figure 3-1: IND Boilers - General Configuration

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3 Specifications (continued)

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Table 3-2: IND Specifications

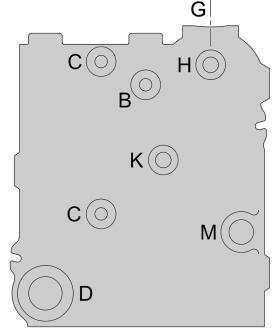
				_				_
Approx. Shipping	Weight (Lbs.)	320	420	485	222	620	069	260
lume .)	(2)	1.2	1.5	1.8	2.1	2.4	2.7	3.0
Water Volume (Gal.)	Steam Boiler	5.1	6.5	7.9	9.3	10.7	12.1	13.5
Gas	(NPT)		2	1/2 .			3/4 in.	
Recommended Min. Round Chimney Size	(Diameter x Height) (1)	4 in. x 15 ft.	5 in. x 15 ft.	‡ ;;	0 III. X 13 II.	7 in v 16 #	/ III. X 13 II.	8 in. x 15 ft.
	'G' (in.)	7-1/4	8-7/8	10-1/2	12-1/8	13-3/4	15-3/8	17
	'F' (in.)	V/C V	4-0/4		1/d	7-1/2		
ns	'E' (in.)			3	40-1/4			
Dimensions	'D' (in.)	4	2	Q	0	7	_	8
Q	'C' (in.)	33-3/4	34-3/4	05 0 14	90-9/4	116 36	90-9/4	37-3/4
	'B' (in.)				40			
	'A' (in.)	14-1/2	17-3/4	21	24-1/4	27-1/2	30-3/4	34
No.	Sec.	3	4	5	9	7	8	6
AFUE	(%)	82.0	82.0	82.0	82.1	82.1	82.2	82.2
AHRI Net Rating Steam (MBH)	MBH	38	65	98	108	130	152	173
AHF Rating (M	Sq. ft.	158	271	358	450	545	633	721
Heating Capacity (MBH)		51	87	115	144	173	202	231
Input (MBH)		62	105	140	175	210	245	280
Boiler		IN3I	IN4I	ISNI	INGI	IV7I	I8NI	I6NI

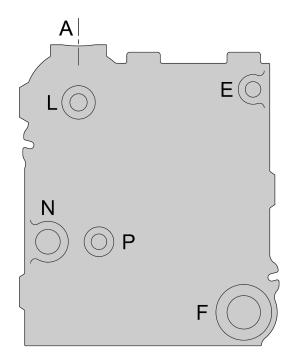
(1) 15 ft. chimney height is from bottom of Draft Hood opening to top of Chimney.

(2) 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)

3 Specifications (continued)





LEFT END SECTION

RIGHT END SECTION

Figure 3-3: Tapping Locations

Table 3-4: Trim and Control Installation in Section Tappings

Tapping	Size (NPT)	Boiler with Probe L.W.C.O.	Boiler with Float L.W.C.O.
А	2	Supply	Supply
В	1/2	Bush to ¼ Pressure Gauge	Plug
С	1/2	Gauge Glass	Nipple, 1/2 Union Gauge, L.W.C.O., Street Elbow, Syphon & Limit
D	2	Return	Return
Е	3/4	3 in. Nipple & Street Elbow Safety Valve	3 in. Nipple & Street Elbow Safety Valve
F	2	Contractor Installed Bush to 3/4 Drain Valve and/or Optional Return	Contractor Installed Bush to ¾ Drain Valve and/or Optional Return
G	2	Optional Supply (IN3I-6) Required Supply (IN7I-9)	Optional Supply (IN3I-6) Required Supply (IN7I-9)
Н	3/4	Bush to ¼ & Syphon, Limit	Bush to ¼ & Pressure Gauge
J	3/4	Not Applicable	Not Applicable
K	3/4	Low Water Cutoff	Plug
L	1 1/4	Skimming Connection (6 in. Nipple and Cap)	Skimming Connection (6 in. Nipple and Cap)
М	11/4	Factory Plugged Indirect Water Heater (IWH) Return	Factory Plugged Indirect Water Heater (IWH) Return
N	11/4	Factory Plugged Indirect Water Heater (IWH) Supply	Factory Plugged Indirect Water Heater (IWH) Supply
Р	3/4	Factory Plugged Limit Control	Factory Plugged Limit Control

4 Pre-Installation

A WARNING

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

- Inspect shipment carefully for signs of damage. 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.
- Safe, reliable operation of this boiler depends upon installation by a professional heating contractor in strict accordance with this manual and the requirements of the authority having jurisdiction.
 - A. In the absence of an authority having jurisdiction, installation must be in accordance with this manual and the *National Fuel Gas Code*, ANSI Z223.1-latest edition. In Canada, follow CAN/CSA B149.1 (*Natural Gas and Propane Installation Code*).
 - B. Where required by the authority having jurisdiction, this installation must conform to the *Standard for Controls and Safety Devices for Automatically Fired Boilers* (ANSI/ASME CSD-1)-latest edition.
- 3. Make sure that a properly sized chimney is available which is in good condition. Consult the authority having jurisdiction, Part 9 of this manual, and the *National Fuel Gas Code* for additional information on venting requirements.

- 4. Make sure the boiler is properly sized. A steam boiler must be sized to match the amount of connected radiation. If the boiler is undersized for the connected radiations, radiators furthest from the boiler will remain cold, resulting in uneven heat. This will happen even if the output of the boiler matches the design heat loss of the structure. Conversely, a boiler that is too large for the connected radiation will short cycle on pressure, resulting in inefficient operation. Determine the boiler size required for the connected radiation using a reference such as the *I=B=R Residential Hydronic Heating Guide*(Pub. RHH) published by Air Conditioning Contractors of America (ACCA).
- 5. Make sure that the boiler received is configured for the correct gas (natural or LP).
- 6. This boiler is not configured for installation at altitudes above 2,000 ft.

A DANGER

- Do not attempt to operate a natural gas boiler on LP, or an LP boiler on natural gas without first converting it using a kit provided by the factory.
- Failure to properly convert this boiler for the fuel being used will result in operation of the boiler at high Carbon Monoxide (CO) levels and/or other unsafe conditions, resulting in personal injury or loss of life. Improper conversion may also result in unreliable operation and severe property damage.

5 Locating Boiler

WARNING

Failure to observe the following location requirements could result in a fire, explosion or Carbon Monoxide (CO) hazard.

1. Clearances:

A. Observe minimum clearances shown below to avoid potential fire hazard. Except as noted, these clearances apply to all combustible construction as well as noncombustible walls, ceilings and doors. Also see Figure 5-1.

Front - Alcove Left Side - 18 in. Right Side - 6 in. Rear - 6 in. Top - 17 in.

- B. A 24 in. service clearance from the jacket is recommended on the left, right, and front of the boiler. These clearances may be Reduced to those shown in Figure 5-1, however servicing the boiler will become increasingly difficult as these service clearances are reduced.
- C. If the left side 24 in. service clearance is reduced, adequate clearance must be maintained to easily read and access the controls. Alternatively, access may be provided using a door.

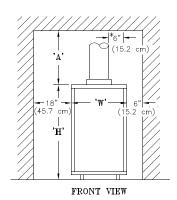
6" (15.2 cm)

|---18"--| (45.7 cm)

- 2. The boiler must be installed on a hard level surface. This surface may be combustible.
- 3. Do not install this boiler in a location 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.
- 4. Do not install this boiler in an area where large amounts of airborne dust will be present, such as a workshop.
- 5. The boiler should be located as close to the chimney as possible.
- 6. Do not install this boiler over carpeting. This may cause a fire.
- 7. Do not install this boiler directly on a surface that may get wet. Raise the boiler on a pad.
- 8. Protect ignition system components from sources of water that may spray, drip or rain on them during installation or service.
- For basement installation provide concrete base if floor is not level or if water may be encountered on floor around boiler.

DIMENSION		'A'	'H'	'w'
	IN3	17" (43.2 cm)	40"	14 1 "
S	IN4	17" (43.2 cm)	40"	17 <mark>3</mark> "
BOILER MODELS	IN5	17" (43.2 cm)	40"	21"
ER MO	IN6	17" (43.2 cm)	40"	24 1 "
BOILI	IN7	17" (43.2 cm)	40"	27 <u>1</u> "
	IN8	17" (43.2 cm)	40"	30 3 "
	IN9	17" (43.2 cm)	40"	34"

* MINIMUM RADIAL CLEARANCE AROUND FLUE.



TOP VIEW

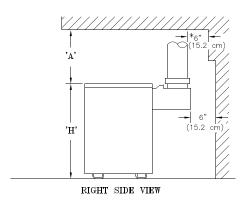


Figure 5-1: Clearances to Combustible Construction and Noncombustible Ceilings, Walls, and Doors

ALCOVE OUTLINE

6 Knocked-Down Boiler Assembly

A WARNING

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

A DANGER

- Use precautions and appropriate rigging apparatus when moving heavy objects.
- Use proper Personal Protective Equipment (PPE) during assembly.
- When handling heavy objects, use appropriate rigging.
- When handling sharp objects such as sheet metal, use proper PPE, like gloves.

1. Install Base-Burner-Manifold Assembly

- A. Base-Burner-Manifold is shipped assembled from factory (Gas Valve and Pilot/Burner Assembly is shipped in the "Gas Controls Carton").
- B. Unpack base assembly and place in location where boiler is to be installed (Refer to Section 4: Pre-Installation).
- 2. **Install assembled cast iron sections** on base assembly:
 - A. Install (4) 5/16 in. x ¼ in. 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.
 - B. Install ceramic fiber gasket. See Figure 6-1.



Figure 6-1: Base Gasket Installation

- C. 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 in. locknuts and washers provided. See Figure 6-2.
- D. Loosen nuts on tie rods until only finger tight.
- E. If Steam boiler less tankless heater, proceed to Paragraph 3.

- Note: If tankless heater is not installed, heater opening cover plate must remain in place.
- 3. **Test boiler for leaks** before connecting to system and installing controls, trim and jacket.
 - A. Attach pressure gauge (capable of indicating 30 psi) on boiler.



Figure 6-2: Section Assembly Attachment

- B. Attach fill valve and piping to return tapping and purge valve to supply tapping. See Figure 6-3.
- C. Install plugs in remaining tappings.
- D. 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.
- E. Examine boiler carefully inside and outside for leaks or damage due to shipment or handling.

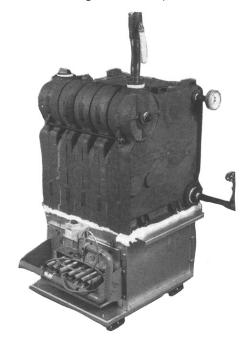


Figure 6-3: Hydrostatic Pressure Test

6 Knocked-Down Boiler Assembly (continued)

4. Install Canopy.

A. Install ½ in. thick x 1 in. wide ceramic fiber gasket. See Figure 6-4.

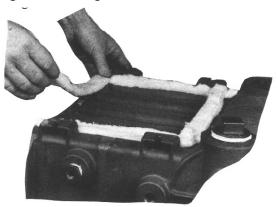


Figure 6-4: Canopy Gasket Installation

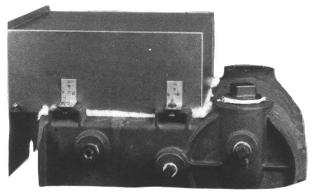


Figure 6-5: Canopy Installation

- B. Position canopy on ceramic fiber gasket. See Figure 6-5.
- C. Attach canopy using ½ in. carriage bolts, nuts, and washers provided.
- 5. **Inspect joints between sections.** They were factory sealed. If there are any openings due to shipment or handling, reseal with boiler putty.
- 6. Install Jacket. See Figure 6-6.
 - A. Models IN7I-IN9: remove 3 inch diameter knockouts in jacket top panels.
 - B. 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.
 - C. Secure both jacket side panels to base with sheet metal screws.
 - D. Position front tie bar and secure to jacket side panels with sheet metal screws.
 - E. Position vestibule panel and secure to side panels with sheet metal screws.
 - F. Attach Rating Label and Vent Damper Instruction Label at designated locations on vestibule panel.
 - G. Install top panels by placing over and around outside of side and rear panels. Seat fully and secure with sheet metal screws.

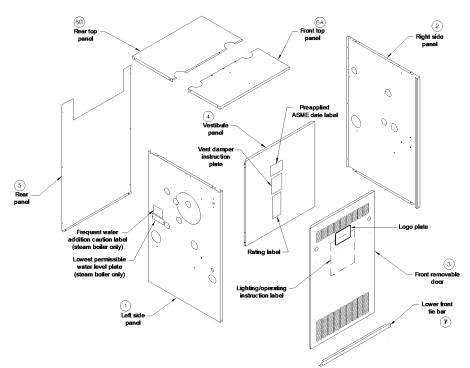


Figure 6-6: Jacket Assembly

6 Knocked-Down Boiler Assembly (continued)

- H. Install black plastic rings into 1-3/32 inch diameter holes located below upper louvers of front removable door.
- 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.

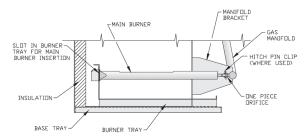


Figure 6-7: Combustion Chamber

- 7. **Install Pilot/Burner Assembly** (shipped in Gas Controls Carton). See Figure 6-7.
 - A. Remove jacket front removable door.
 - i. Remove burner access panel located above burners.
 - *ii.* Install Pilot/Burner Assembly where noted on gas manifold.
 - a. Insert rear of burner in burner tray slot.
 - 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.
 - iii. Reinstall burner access panel.
- Install Gas Valve on main gas burner assembly (if not factory assembled). See Figure 6-8.
 - A. Connect gas valve to manifold.
 - B. Connect pilot tubing from pilot burner to gas valve pilot tapping.
 - C. Continuous Ignition (standing pilot): connect thermocouple to gas valve.
- Install Blocked Vent Switch with sheet metal screws.
 - A. Install on rear flange of canopy. See Figure 6-9.
 - B. Attach black 18-2 harness to Blocked Vent Switch terminals. Use end with two fully insulated disconnects.

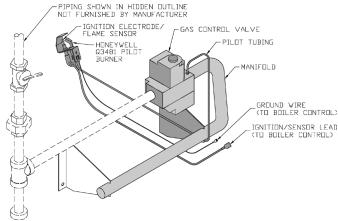


Figure 6-8: Pilot and Gas Piping, Intermittent Ignition (EI)

- C. Secure harness to right side jacket panel with clamp.
- D. Insert harness through ¾ inch hole in right side jacket panel. Secure with strain relief bushing.
- 10. Intermittent Ignition (EI): Install Ignition Module.
 - A. Mount ignition module mounting bracket to inside of right side panel using (2) #6 x ¾ in. sheet metal screws provided.

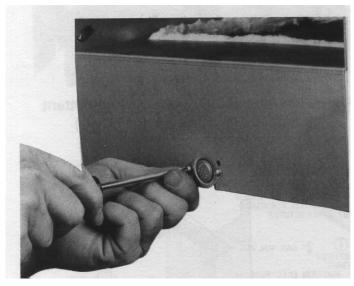


Figure 6-9: Blocked Vent Switch Installation

- B. Mount ignition module to bracket using (2) #8 x ½ in. sheet metal screws provided.
- C. Install (3) wire harness from ignition module to gas valve as shown in wiring diagrams.
- 11. **Continue** to Section 7: Semi-Pak Boiler Assembly, Paragraph 3.

7 Semi-Pak Boiler Assembly

WARNING

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

A DANGER

- Use precautions and appropriate rigging apparatus when moving heavy objects.
- Use proper Personal Protective Equipment (PPE) during assembly.
- When handling heavy objects, use appropriate rigging.
- When handling sharp objects such as sheet metal, use proper PPE, like gloves.

1. Remove Crate

- A. Remove all hold down screws and brackets.
- B. 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.
- C. Do not drop boiler at any time.
- 2. **Move Boiler To Permanent Position.** Refer to Section 4: Pre-Installation.

3. 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:

- A. EZ–Connect Carton includes trim, controls, wiring and wiring instructions for installation.
- B. Separate Trim Carton and Control Carton. Only wiring requiring special connections is provided. For wiring requirements, refer to Section 14: Electrical and appropriate wiring diagram.

4. Install Trim and Controls

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

A. Steam Boiler with Probe Low Water Cutoff

- i. Install pressure limit control into Tapping "H" with siphon, ¾ in. x ¼ in. hex bushing, ¾ in. elbow and ¾ in. x 3 in. nipple provided. See Figure 3-3 and Table 3-4. DO NOT TWIST CONTROL. Use wrench on hex fitting located at bottom of control. See Figure 7-1.
- The L404F pressure limit employs a snap action switch and does not require leveling. See Figure 7-1.

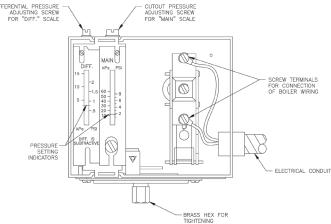


Figure 7-1: L404F Pressure Limit Control

- iii. Install pressure gauge into Tapping "B" (½ NPT bushed to ¼ NPT). See Figure 3-3 and Table 3-4. 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.
- iv. Install Low Water Cutoff Probe into Tapping "K" (34 NPT). HANDLE PROBE WITH CARE.
- v. Attach Low Water cutoff Control to Probe by following instructions packed with control.
- vi. Install gauge glass fittings into Tappings "C" (½ NPT). See Figure 3-3 and Table 3-4.Lower fitting has small drain valve.
- vii. Install gauge glass and protective rods in fittings.
- viii. Attach "Lowest Permissible Water Level" Plate with sheet metal screws in location indicated in Figure 6-6.
- ix. Attach "Frequent Water Addition" Label above the "Lowest Permissible Water Level" Plate.

B. Steam Boiler with McDonnell & Miller 67 Float Low Water Cutoff

- i. Install Low Water Cutoff, see instructions packed with control.
 - a. Screw brass nipples with union halves into Tappings "C" (½ NPT). See Figure 3-3 and Table 3-4.
 - b. Attach Gauge Glass/Low Water Cutoff Assembly to union halves.
 - c. Affix Blow-Down Card to Jacket Left Side Panel adjacent to low water cutoff.
 - d. Provide blow down discharge piping.
- ii. Attach street elbow siphon and pressure limit control to low water cutoff. DO NOT TWIST CONTROL. Use wrench on hex fitting

7 Semi-Pak Boiler Assembly (continued)

- located at bottom of control.
- *iii.* The L404F pressure limit employs a snap action switch and does not require leveling. See Figure 7-1.
- iv. Install pressure gauge into Tapping "H" (¾ NPT bushed to ¼ NPT). See Figure 3-3 and Table 3-4. 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.
- v. Attach "Lowest Permissible Water Level" Plate with sheet metal screws in location indicated in Figure 6-6.
- vi. Attach "Frequent Water Addition" Label above the "Lowest Permissible Water Level" Plate.

C. All Steam Boiler Controls Cartons

- i. Install Junction Box. See Figure 7-2.
 - Remove center knockout in rear of Junction Box and insert black plastic snap bushing in hole.
 - b. Install mounting bracket to rear of Junction Box with two (2) blunt sheet metal screws provided.
 - c. Align center and mounting holes of Junction Box with upper front corner of jacket left side panel.
 - d. Install Junction Box to jacket from inside vestibule area with two (2) blunt sheet metal screws provided.
- ii. 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 7-3.
- iii. Fork connector on yellow wire of gas valve harness must be removed and wire stripped before making wire connections. Refer to Section 14 for wiring.
- iv. Steam Boilers only. Secure the R8222 Thermostat Isolation Relay to upper left corner of jacket vestibule panel with sheet metal screws provided. See Figure 7-4.
- 5. Continue to Section 8. Packaged Boiler Assembly, Paragraph 5.

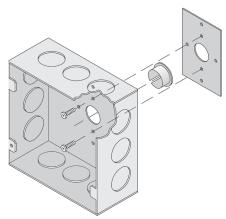


Figure 7-2: Junction Box and Mounting Bracket Assembly

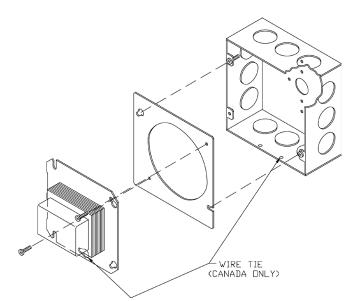


Figure 7-3: Junction Box and Transformer
Assembly

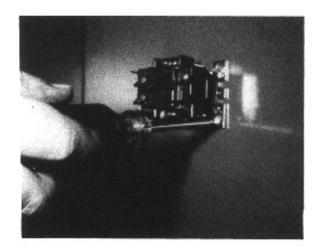


Figure 7-4: Thermostat Isolation Relay Attachment

8 Packaged Boiler Assembly

WARNING

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

A DANGER

- Use precautions and appropriate rigging apparatus when moving heavy objects.
- Use proper Personal Protective Equipment (PPE) during assembly.
- When handling heavy objects, use appropriate rigging.
- When handling sharp objects such as sheet metal, use proper PPE, like gloves.
- Remove crate and move boiler to permanent position as detailed in Section 7: Semi-Pak Boiler Assembly.
- Remove Jacket Front Panel. See Figure 15-1.
- 3. Remove poly bag from vestibule area.
- 4. **On Steam Boilers with probe low water cutoff** the L404 pressure limit/control has been packed in the vestibule area.
 - A. Screw the pressure limit/control onto the syphon. DO NOT TWIST CONTROL. Use wrench on hex fitting at bottom of control. See Figure 7-1.
 - B. Snap the electrical conduit from the adjacent junction box into the hole in the control.
 - C. Open the control's clear cover and attach the two (2) wires in the conduit to the two (2) unused screw terminals.
- 5. Install Jacket Front Panel.

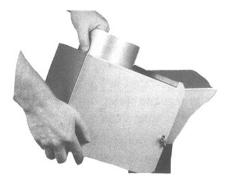


Figure 8-1: Draft Hood Attachment

6. Install Draft Hood.

- A. Locate and open "Drafthood Carton Assembly".
- B. Position Draft Hood on Canopy Rear Flange. See Figure 8-1. 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.
- C. Secure Rear Draft Hood to Canopy with wing nuts provided. See Figure 8-2.

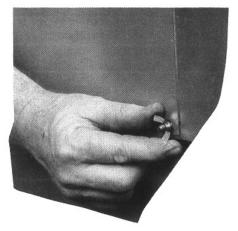


Figure 8-2: Securing Draft Hood to Canopy

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.

9 Air for Combustion and Ventilation

WARNING

- This boiler is not designed for use in a space that is depressurized relative to the outdoors. Operating this boiler in a depressurized space may cause severe personal injury or death.
- INSUFFICIENT COMBUSTION AIR SUPPLY may result in the production and release of deadly Carbon Monoxide (CO) into the home.
- PROVIDE ENOUGH AIR to ventilate the boiler room, and sustain combustion.
 Ignition failure, overheating, fire, carbon monoxide, and spillage of flue gases may result from poor air supply.
- Do not install this boiler in areas where it will draw combustion air from areas where chemicals, such as bleaches, fabric softeners, paints, cleaners, refrigerants, and cat boxes are used or stored. Do not draw combustion air containing large amounts of dust such as that generated by dry wall construction or woodworking. Failure to observe this warning could result in objectionable odors, severe boiler damage, personal injury or loss of life.

Sufficient fresh air must be supplied for combustion, ventilation, and flue gas dilution. Provisions for an adequate fresh air supply must be made in accordance with local codes, or in the absence of such codes, the *National Fuel Gas Code* (NFPA 54/ANSI Z223.1). In Canada, refer to the *Natural Gas and Propane Installation Code* (CAN/CSA 149.1). The *National Fuel Gas Code* describes three basic ways to supply this boiler with adequate fresh air:

Indoor Combustion Air – Combustion air is drawn into the boiler room from other parts of the building and from the outdoors through natural infiltration (cracks under doors, etc). **This method can not be used in all cases – see discussion below.**

Outdoor Combustion Air – Combustion air is brought directly into the boiler room from outdoors through ducts or grills sized and installed specifically for this purpose.

Mechanical Combustion Air Supply – Combustion air is brought into the room from outdoors using a blower system that is engineered specifically for this purpose.

Each of the above methods is described in more detail in the following sections. The *National Fuel Gas Code* also describes some acceptable variations on these techniques that do not appear here.

Using the Indoor Combustion Air Method

- 1. Total the input of all appliances in the boiler room in thousands of BTU/hr.
- 2. Find the volume of the boiler room in cubic feet: Volume (ft³) = Length (ft) x Width (ft) x Height (ft) If the boiler room adjoins another room and there is no door present between these two rooms, add the volumes of the rooms together. Repeat for any other connected rooms which do not have doors. Do not add the volume of two rooms separated by a door even if that door is "always left open".
- 3. Divide the volume obtained in Step 2 by the input calculated in Step 1.
- 4. If the result is at least 50 ft³ per 1,000BTU/hr, and neither of the conditions described in (6) below are met, normal infiltration should provide ad equate fresh air into the boiler room.
- 5. If the result is less than 50 ft³ per 1,000BTU/hr, provide two openings into the boiler room, one near the floor and one near the ceiling. The top edge of the upper opening must be within 6 in. of the ceiling and the bottom edge of the lower opening must be within 6 in. of the floor (Figure 9-1):
 - A. Each opening must have a free area of 1 square inch per 1,000 BTU/hr input of all gas burning appliances in the boiler room. The minimum opening dimension is 3 inches. Minimum opening free area is 100 square inches per opening.
 - B. If the total volume of both the boiler room and the room to which the openings connect is less than 50 cubic feet per 1,000 BTU/hr of total appliance input, install a pair of identical openings into a third room. Connect additional rooms with openings until the total volume of all rooms is at least 50 cubic feet per 1,000 BTU/hr of input.
 - C. The "free area" of an opening takes into ac count the blocking effect of mesh, grills, and louvers. Where screens are used, they must be no finer than 1/4 in. (4 x 4) mesh.
 - D. If providing openings into adjacent rooms is undesirable, use the Outdoor Combustion Air Method.

9 Air for Combustion and Ventilation (continued)

- 6. Do not use the Indoor Combustion Air Method described above if either of the following are true:
 - A. The indoor space is so tightly constructed that the number of air changes per hour is known to be 0.4 or less.
 - B. The boiler room is depressurized relative to the outdoors. This depressurization is possible if the structure is tightly constructed and/or is equipped with exhaust fans.

Example:

A 103MBH input boiler and a water heater are to be installed in a room measuring 6 ft. - 3 in. x 7 ft. with an 8 ft. ceiling. The water heater has an input of 30,000 BTU/hr:

Total input in thousands of BTU/hr. = (103,000 BTU/hr. + 30,000 BTU/hr.) ÷ 1.000 = 133

Volume of room = 6.25 ft. x 7 ft. x 8 ft. = 350 ft.³

 $350 \div 135 = 2.59$. Since 2.59 is less than 50, there will be an inadequate fresh air supply in the boiler room unless openings are installed between the boiler room and at least one adjacent room. It turns out that the boiler room in this example is adjacent to a full basement which is 20 ft. \times 45 ft. \times 8 ft. high. If two openings are installed into this basement that each have a free area of 135 in.2, the combined volume of the boiler room and basement will be:

 $350 \text{ ft.}^3 + 6,400 \text{ ft.}^3 = 6,750 \text{ ft.}^3 \text{ and:}$ $6,750 \div 133 = 50.8 \text{ ft.}^3 \text{ per 1,000 BTU/hr.}$ In the absence of one of the conditions described in (6) above, this arrangement should provide an adequate fresh air supply to all the appliances in the boiler room.

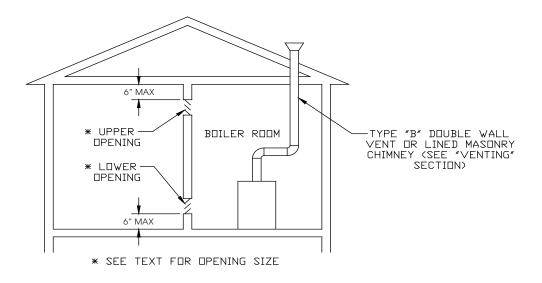


Figure 9-1: Indoor Combustion Air Method

9 Air for Combustion and Ventilation (continued)

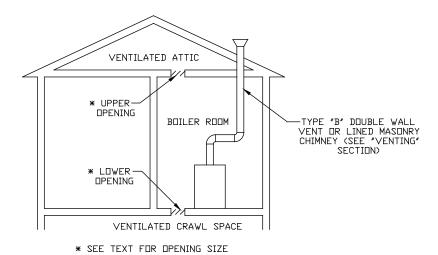


Figure 9-2: All Air From Outdoors, Ventilated Crawl Space and Attic

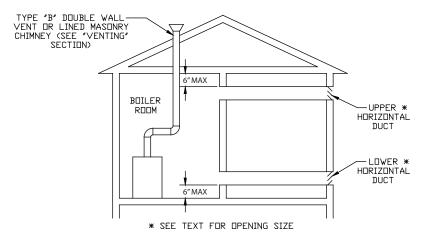


Figure 9-3: All Air From Outdoors, Via Ventilated Attic

<u>Using the Outdoor Combustion Air</u> Method

- Openings must be installed between the boiler room and the outdoors or a ventilated space, such as an attic or crawl space, which communicates directly with the outdoors.
- Two openings are required. The top edge of the upper opening must be within 6 inches of the ceiling. The bottom edge of the lower opening must be within 6 inches of the floor.
- 3. Size openings and ducts as follows:
 - A. Vertical ducts or openings directly outdoors (Figure 9-2, Figure 9-3, and Figure 9-4) - Each opening must have a free cross sectional area of 1 square inch per 4,000 BTU/hr of the total input of all gas-fired appliances in the boiler room. Minimum opening size is 3 inches.

- B. Openings to outdoors via horizontal ducts (Figure 9-5) Each opening must have a free cross sectional area of 1 square inch per 2,000 BTU/hr of the total input of all gas fired appliances in the boiler room. Minimum opening size is 3 inches.
- C. The "free area" of an opening takes into ac count the blocking effect of mesh, grills, and louvers. Where screens are used, they must be no finer than 1/4 in. (4 x 4) mesh.
- D. If motorized louvers are installed in the openings to the outdoors, they must be inter locked to prevent operation of the fuel burning appliances in the boiler room unless the louvers are open.

9 Air for Combustion and Ventilation (continued)

Mechanical Combustion Air Supply

A mechanical system may be used to bring all combustion air to the boiler which meets all of the following requirements:

- 1. The system must be manufactured specifically for this purpose.
- 2. Size the system to deliver combustion air at the rate prescribed by the system manufacturer's instructions, but no less than 0.35 CFM for each 1,000 BTU/hr of the combined input of all fuel burning appliances in the boiler room. If exhaust fans are present within the building, additional capacity may be required to prevent the boiler room from being depressurized.
- 3. The system must be interlocked to prevent operation of the fuel burning appliances in the boiler room if the system is not operating.

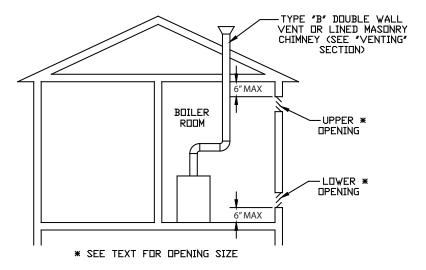


Figure 9-4: Outdoor Combustion Air Method: Using Openings into Boiler Room

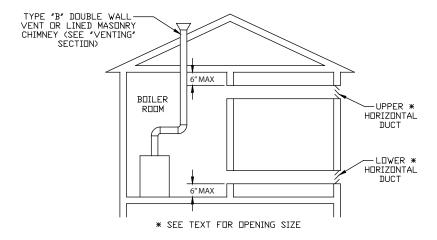


Figure 9-5: Outdoor Combustion Air Method: Using Horizontal Ducts into Boiler Room

10 Venting

WARNING

- Improper venting may result in property damage and/or the release of flue gases, which contain deadly Carbon Monoxide (CO), into the home, which can cause severe personal injury or death.
- Do not use plastic venting materials (such as CPVC, PVC and RADEL) to vent this boiler.
- Inspect existing chimney before installing boiler. Failure to clean or replace damaged pipe or tile lining will cause severe injury or death.
- Install vent system in accordance with local building codes; or local authority having jurisdiction; or "Venting of Equipment", of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or "Venting Systems and Air Supply for Appliances", of the National Gas and Propane Installation Code, CAN/CSA B149.1.

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

- A. Type B or Type L gas vent. Install in accordance with listing and manufacturer's instructions.
- B. Masonry or metal chimney. Build and install in accordance with local building codes; or local authority having jurisdiction; or Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances, ANSI/NFPA 211 and/or National Building Code of Canada.
 Masonry chimney must be lined with approved clay flue lining or listed chimney lining system.
- C. Single wall metal vent. Allowed by ANSI Z223.1/NFPA 54 under very restrictive conditions.
- D..Do not cover non-metallic vent pipe and fittings with thermal insulation. Note: Non-metallic vent cannot be used with this boiler.
- Inspect chimney and remove any obstructions or restrictions. Clean chimney if previously used for solid or liquid fuel-burning appliances or fireplaces.
- 3. Boiler Equipped With Vent Damper
 - A. Open Vent Damper Carton and remove Installation Instructions. Read Installation Instructions thoroughly before proceeding.

A CAUTION

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

Provide adequate clearance for servicing - 6 in. (152 mm) 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.

- B. Vent damper should be same size as draft hood outlet. See Figure 3-1. 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.
- C. 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 following installation.
- D. 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.
- E. Arrange venting system so only the boiler is served by vent damper supplied with boiler.
- Install Vent Connector from draft hood or vent damper to chimney. See Figure 10-1.
 - A. Do not connect into same leg of chimney serving an open fireplace.
 - B. 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.

10 Venting (continued)

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

- i. Total vent height (H) is at least 10 ft (3 m);
- *ii.* Vent not reduced more than one table size: and
- iii. Draft hood outlet/vent damper is greater than 4 in. (102 mm) in diameter (IN3I cannot use smaller vent size).
- C. 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).
- D. Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.
- E. 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.
- F. 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.
- G. Slope horizontal portions of vent pipe upwards not less than 1/4 in/ft (21 mm/m) from boiler to vent terminal.
 - les chaudières de catégories I doivent présenter des tronçons horizontaux dont la pente montante est d'au moins 1/4 po par pied (21 mm/m) entre la chaudière et l'évent.
- H. Support horizontal portions of venting system to prevent sagging. Use pipe straps, brackets or hangers spaced 4 ft (1.2 m) or less.
 Soutenez parties horizontales de ventilation pour éviter l'affaisement. Utilisez des colliers de serrage, des crochets on cintres espacées de 4 preds (1,2 m) ou moins.
- I. Vent pipe must be inserted into but not beyond inside wall of chimney liner. Seal tight between vent pipe and chimney.

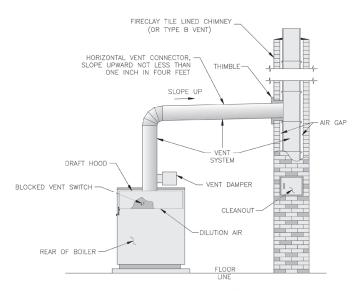


Figure 10-1: Typical Vent Installation

5. Removing an Existing Boiler from a Common Chimney

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

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

- A. Seal any unused openings in the common venting system.
- B. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, and other deficiencies which could cause an unsafe condition.
- C. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range-hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- D. Place in operation the appliance being inspected. Follow the Lighting (or Operating) Instructions. Adjust thermostat so appliance will operate continuously.

10 Venting (continued)

- E. Test for spillage at the draft hood relief opening after five (5) minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
- F. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gasburning appliance to their previous condition of use.
- G. Any improper operation of the common venting system should be corrected so the installation conforms with the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, and/ or the *Natural Gas and Propane Installation Code*, CAN/CSA B149.1. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Appendix F in the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, and/or the *Natural Gas and Propane Installation Code*, CAN/CSA B149.1.

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

- A. Sceller toutes les ouvertures non utilisées du système d'évacuation.
- B. Inspecter de façon visuelle le système d'évcuation pour déterminer la grosseur et l'inclinaison horizontale qui conviennent et s'assurer que le système est exempt d'obstruction, d'étranglement, de fuite, de corrosion et autres défaillances qui pourraient présenter des risques.

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

11 Steam Piping

WARNING

- Do not use softened water in steam boilers.
 Accelerated boiler corrosion will result. Tie in fresh water supply to 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. Check for and correct system leaks.

NOTICE:

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

- High coefficient of thermal expansion can induce mechanical stresses and cause expansion/contraction noises if not accounted for in piping system design and installation. This can especially be an issue in multiple riser installations.
- 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 skimming procedure.
- Galvanic corrosion of adjoining metal may occur due to dissimilar metals in certain water chemistry (such as pH less than 7.0 or greater than 11.0) if dielectric unions are not used.

General Piping Notes

Figure 11-2 shows recommended near boiler piping for most common types of gravity return steam systems. Additional information on steam system design may be found in the *I=B=R Residential Hydronic Heating Guide* (Pub. RHH) published by Air Conditioning Contractors of America (ACCA).

One of the primary purposes of this near boiler piping is to separate tiny water droplets from the steam exiting the boiler so that "dry" steam is sent to the system. If the near boiler piping is not correct, wet steam will enter the system and the following problems may occur:

- 1. Short cycling on low water
- 2. Boiler or system Flooding
- Hammering
- 4. Failure to heat one or more radiators

Avoid the three common piping mistakes shown in Figure 11-3. This applies even if the existing boiler has one of the piping mistakes shown in Figure 11-3 and appears to be working. If two or more steam mains must be connected to the boiler, connect a separate take-off for each main into the header between the riser(s) and equalizer. Also note the following points:

- 1. A size reduction must be made to connect the header to the equalizer. This reduction must be made in the equalizer line. Do not make this size reduction in the horizontal header.
- 2. One pipe steam systems require air vents on each radiator, as well as at the end of each main. For the system to work properly, these vents must be properly installed, sized, and be in good condition. Inspect and replace any defective vents. If there are no vents at the ends of the mains, install them.
- 3. The use of gravity returns on a multiple steam boiler installation is not recommended due to potential problems maintaining a uniform water line in all boilers (even a one ounce per square inch difference in the pressure of adjacent boilers will cause a 1 ¾ inch difference in their water lines).
- 4. For installations with condensate or boiler feed pumps, follow the pump manufacturer's selection and installation instructions. Such systems generally do not require Hartford loops.
- 5. Do not use a check valve in place of, or in addition to, a Hartford loop on a gravity return system.
- 6. Pipe the fill connection from a clean source of cold water. When the water supply is from a well, make sure that a strainer is installed in the well system.
- 7. The single most important factor in determining expected life cycle of a steam boiler is the amount of fresh water added to boiler during operation. Fresh water brings minerals and oxygen into the boiler. These contaminants greatly accelerate corrosion of cast iron boiler sections. Assure all system radiators, piping and vents are absolutely leak tight.
 - A. If system contains hidden piping (hidden behind walls, buried in concrete, etc.) pressure test this piping and repair any leaks found.

11 Steam Piping (continued)

B. Providing a means of monitoring the amount of fresh water added to the system will allow an increase in water loss to be identified, and the cause corrected, before significant damage to the boiler occurs. This can be accomplished using water meter installed in the water feed line. Alternatively, some automatic water feeders, such as the Hydrolevel VXT Series, have the ability to monitor the total amount of water they have added to the system.

Near-Boiler Piping Installation

- Install safety valve (spindle must be in vertical position) into tapping on boiler right side using the 3/4 in. NPT nipples and elbow supplied (Figure 11-1).
- 2. Pipe the discharge of the safety relief valve to a location where water or steam will not create a hazard or cause property damage if the valve opens. The end of the discharge pipe must terminate in an unthreaded pipe. If the safety valve discharge is not piped to a drain it must terminate at least 6 inches above the floor. The termination of the safety valve discharge piping must be in an area where it is not likely to become plugged by debris or subjected to freezing.

DANGER

- Do not install any valves between boiler and relief valve.
- Do not install any valves between relief valve and discharge.
- Do not move relief valve from factory specified location.
- Do not plug relief valve discharge.
- Do not install a relief valve with a setting greater than 15 psi.

WARNING

- Pipe discharge of relief valve to a location where water or steam will not create a hazard or cause property damage if the relief valve opens.
- End of discharge pipe must terminate in an unthreaded pipe.
- Termination of the relief valve discharge piping must be in an area where it is not likely to become plugged by debris or subjected to freezing.

- 3. Install drain valve into tapping on boiler right side using the 2 x 3/4 bushing provided (see Figure 11-1).
- 4. Install the nipple and cap provided in the 1-1/4 skimmer tapping as shown in Figure 11-1.
- 5. The IN3 IN6 may be piped with either one or two Supply risers as shown in Figure 11-2. If only one supply riser is used, use a 2 in. nipple and cap to plug the unused supply tapping (Figure 11-1).
- 6. The optional "drop header" piping shown in "Alternate Piping Method" of Figure 11-2 is useful when there is limited overhead clearance between the boiler and the mains. The riser closest to the equalizer can be omitted on the IN3 through IN6.
- 7. The piping shown in Figure 11-2 is shown with the equalizer and return connections on the left side. This piping can be "flipped" so that the equalizer/return are on the right side and the boiler drain located on the left. If only one riser is used on the IN3 through IN6 it must be located on the side opposite the equalizer/return.
- 8. A second system supply tee may be installed adjacent to the first supply tee. Both supply tees are to be located after the riser(s) but before the equalizer line. See Figure 11-3 for common near-boiler piping mistakes.

11 Steam Piping (continued)

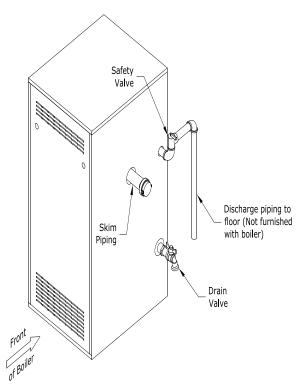


Figure 11-1: Installation of Factory Supplied Fittings

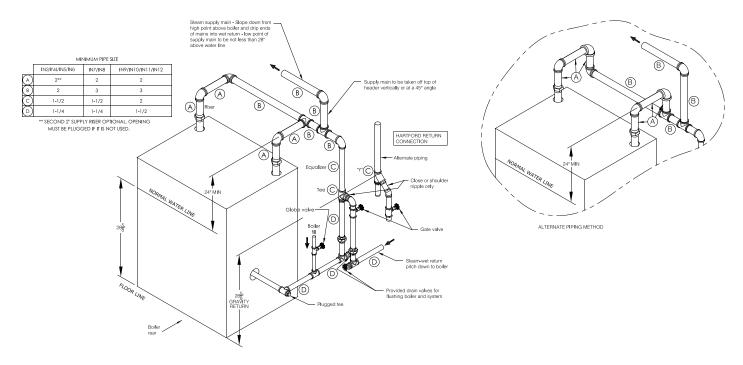


Figure 11-2: Steam Boiler Piping (Minimum)

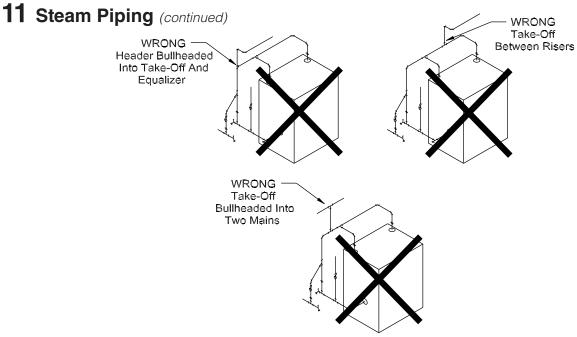


Figure 11-3: Common Near-Boiler Piping Mistakes

12 Indirect Water Heater Piping

NOTICE:

- Some indirect water heaters may not be suitable for use with a steam boiler. Consult the water heater manufacturer's guidelines before installing it in this type of system.
- Boiler water temperatures and flow rates in this type of system may be considerably lower than those upon which the water heater manufacturer's ratings are based. This may result in substantially longer water heater recovery times.

All boilers are equipped with tappings to permit the connection of an indirect water heater. In this type of system, hot boiler water is drawn from below the water line and passed through the heat exchanger in the indirect water heater. This section describes boiler-side piping only. Refer to the indirect water heater instruction manual for domestic water piping. The components in this system and their functions are as

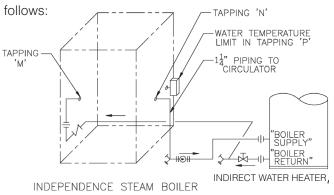


Figure 12-1: Indirect Water Heater Boiler-Side Piping

- 1. <u>Circulator</u> Mount the circulator as shown in Figure 12-1. The circulator should be located as low and as close to the boiler as practical. Do not install valves, or other devices having a significant pressure drop, between the boiler and the circulator inlet. All piping between the boiler and the circulator inlet should be 1 in., regardless of the size of the piping required in the rest of the system. See Figure 14-6 in Part 14 for wiring information
- 2. <u>"Y" Strainer</u> Install a "Y" strainer to prevent sediment from accumulating inside the indirect water heater.
- 3. <u>Check Valve</u> Prevents gravity circulation through the indirect water heater when the boiler is responding to a call for heat.
- 4. <u>Boiler Limit Control</u> Use a SPST break-on-rise temperature limit control such as the Honeywell L4006A. Do not set the limit above 180°F as doing so may cause the boiler to steam when there is no call for heat. See Figure 14-6 for wiring information.
- 5. <u>Valves and Unions</u> Install shut-off valves, drain valves, and unions in locations that will facilitate maintenance of the system. Do not install any valves between the boiler and circulator inlet.

13 Gas Piping

WARNING

- Shut off gas supply before servicing the boiler.
- All gas piping must be gas tight. Use thread compound that is listed for gas service on all threaded joints to avoid leaks, which may result in fire or explosion.
- Size gas piping, regulators, valves and meters so as to provide an adequate gas flow and pressure to the boiler during operation. Failure to do so may cause poor combustion, noise, injury or death.
- Size gas piping Design system to provide adequate gas supply to boiler. Consider these factors:
 - A. Allowable pressure drop from point of delivery to boiler. Maximum allowable system pressure is ½ psig. Actual point of delivery pressure may be less; contact gas supplier for additional information. Minimum gas valve inlet pressure is listed on rating label and Table 13-1.

Table 13-1: Minimum Inlet Gas Pressure (inch w.c.)

Boiler Model Number	Natural	LP/Propane
IN3I	4.5	11.0
IN4I	4.5	11.0
IN5I	4.5	11.0
IN6I	4.8	11.0
IN7I	4.5	11.0
IN8I	4.5	11.0
IN9I	4.5	11.0

B. Maximum gas demand. Consider existing and expected future gas utilization equipment (i.e. water heater, cooking equipment). Table 13-2 lists boiler input rate.

Table 13-2: Rated Input

Boiler	Rated Capacity		Gas
Model	[cubic fee	et per hour]	Connection
Number	Natural	LP/Propane	Size
IN3I	62	24¾	1/2
IN4I	105	42	1/2
IN5I	140	56	1/2
IN6I	175	70	1/2
IN7I	210	84	3/4
IN8I	245	98	3/4
IN9I	280	112	3/4

- C. Length of piping and number of fittings. Refer to Table 13-5 for maximum capacity of Schedule 40 pipe. Table 13-3 lists equivalent length for standard fittings.
- D. Corrections for the specific gravity of natural gas can be found in Table 13-4.

Table 13-3: Fitting Equivalent Lengths

Eitting	Nominal Pipe Size				
Fitting	1/2	3/4	1	11/4	
45° EII	0.7	1.0	1.2	1.6	
90° EII	1.6	2.1	2.6	3.5	
Tee (As Elbow)	3.1	4.1	5.2	6.9	

Table 13-4: Specific Gravity Correction Factors for Natural Gas

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

Table 13-5: Maximum Capacity of Schedule 40 Pipe in CFH for Natural Gas Pressures of 0.5 psig or Less

Length\	(0.3 inch w.c. Pressure Drop			re Drop 0.5 inch w.c. Pressure Drop			
[Feet]	1/2	3/4	1	11/4	1/2	3/4	1	11/4
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

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13 Gas Piping (continued)

- 2. Connect boiler gas valve to gas supply system -
 - A. Use methods and materials in accordance with local plumbing codes and requirements of gas supplier. In absence of such requirements, follow *National Fuel Gas Code, ANSI Z223.1/NFPA 54* and/or *Natural Gas and Propane Installation Code*, CAN/CSA B149.1.
 - B. Use thread compounds (pipe dope) resistant to action of liquefied petroleum gas.
 - C. Install sediment trap, ground-joint union and manual shut-off valve upstream of boiler gas control valve. See Figure 13-6.
 - D. All above ground gas piping upstream from manual shut-off valve must be electrically continuous and bonded to a grounding electrode. Do not use gas piping as grounding electrode. Refer to *National Electrical Code, ANSI/NFPA 70* and/or CSA C22.1 Electrical Code.
- 3. Pressure test Boiler and its gas connection must be leak tested before placing boiler in operation.
 - A. Protect boiler gas control valve. For all testing over ½ psig, boiler and its individual shutoff valve must be disconnected from gas supply piping. For testing at ½ psig or less, isolate boiler from gas supply piping by closing boiler's individual manual shutoff valve.
 - B. Locate and address leaks using listed combustible gas detector, a non corrosive leak detection fluid or other listed leak detection method. Do not use matches, candles, open flames, or other ignition source.

DANGER

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

WARNING

- If gas pressure in the building is above ½ psig (3.5 kPa), an additional gas pressure regulator is required. Using one additional regulator for multiple gas appliances may result in unsafe boiler operation. The additional regulator must be able to properly regulate gas pressure at the input of the smallest appliance. If the regulator can not do this, two or more additional regulators are required. Consult regulator manufacturer and/or local gas supplier for instructions and equipment ratings.
- If an additional regulator is used to reduce boiler inlet pressure below 1/2 psig (3.5 kPa) it must be at least 6 to 10 ft. upstream of the boiler.
- It is very important that the gas line is properly purged by the gas supplier or utility company.

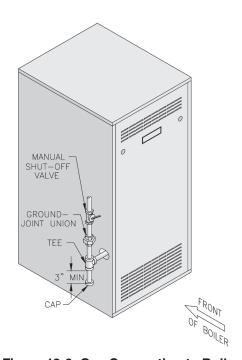


Figure 13-6: Gas Connection to Boiler

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

_IN___- - _ _ 2 less than 2,000 ft. elevation _IN__ - - _ _ 5 2000 to 5,000 ft. elevation (USA)

14 Wiring

WARNING

- All wiring and grounding must be done in accordance with the authority having jurisdiction or, in the absence of such requirements, with the *National Electrical Code (ANSI/INFPA 70)* and/or *Canadian Electrical Code*, Part 1, CSA 22.1 *Electrical Code*.
- Electrical power may be supplied from more than one circuit. Disconnect electrical power to the boiler and heating system before servicing. Positively assure that no voltage is present. Lock electrical boxes to prevent someone from inadvertently restoring power before the heating system is safe to operate.
- Never defeat or jump out safety devices.
- Protect each boiler circuit with a properly sized over-current protection device.
- Make electrical connections carefully according to the boiler's wiring diagram and instructions.
 Failure to properly wire electrical connections to the boiler may result in serious physical harm or property damage.
- Wire additional field supplied safety limits, such as low water cut-offs and pressure limit devices, so as to break the 120V power supply to the boiler. Do not alter the boilers factory wiring when adding a field supplied limit device.
- 120 Volt Wiring The boiler should be provided with its own 15A branch circuit with fused disconnect. All 120 volt connections are made inside the junction box on the left side of the boiler. Remove the transformer to gain access to this box:
 - A. Hot ("black") Wire nut to black transformer lead
 - B. Neutral ("white") Wire nut to white transformer lead
 - C. Ground ("green" or bare) Ground screw inside junction box
- 2. Wire Vent Damper (if used).
 - A. Steam or tankless heater.
 - i. Remove one (1) 7/8 in. knockout from junction box. Carefully remove transformer avoid undue strain on wires.
 - *ii.* Install Vent Damper Harness into top of junction box.
 - iii. Remove factory installed jumper plug (if so equipped) from Vent Damper Receptacle.Plug Vent Damper Harness into Vent Damper Receptacle. See Figure 14-1.

- iv. Install cable clamp around flexible Vent Damper Harness. Attach to jacket top panel. See Figure 14-2.
- B. 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.

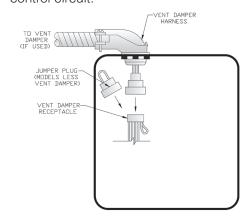


Figure 14-1: Vent Damper Connection Detail

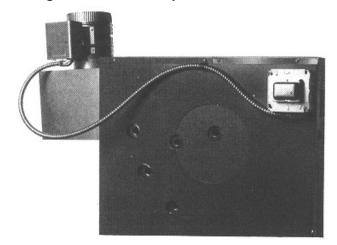


Figure 14-2: Vent Damper Harness to Junction Box

3. Thermostat Wiring - Follow thermostat manufacturer instructions. To insure proper thermostat operation, avoid installation in areas of poor air circulation, hot spots (near any heat source or in direct sunlight), cold spots (outside walls, walls adjacent to unheated areas, locations subject to drafts). Provide Class II circuit between thermostat and boiler. Connect thermostat wire leads to the blue transformer lead and brown relay lead inside the junction box.

Set thermostat appliance type or cycle rate per thermostat instructions. On thermostats that include a heat anticipator, set anticipator per Table 14-3.

Table 14-3: Thermostat Heat Anticipator Settings

	Ignition System	
System Type	Intermittent (EI) All Sizes	Heat Anticipator Setting (1)
Probe (McDonnell & Miller PS-802 or Hydrolevel CGB-400) Low Water Cutoff	Figure 14-4, Page 31	0.8
Float (McDonnell & Miller 67) Low Water Cutoff	Figure 14-5, Page 32	0.8

⁽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.

A CAUTION

- When making low voltage connections, make sure that no external power source is present in the thermostat circuits. If such a power source is present, it could destroy the boiler's control. One example of an external power source that could be inadvertently connected to the low voltage connections is a transformer in old thermostat wiring.
- Do not attempt to connect a McDonnell & Miller model #101A feeder, or other feeder without a delay, to a IND boiler equipped with a Hydrolevel CG400 low water cutoff. Doing so could destroy the boiler transformer and/or flood the system.
- Do not use the transformer provided on the boiler to power external devices other than the feeders specified in (3). Doing so may cause damage to the transformer.
- 4. <u>Wire control circuit</u> as shown in the appropriate wiring diagram. See Table 14-3.
 - A. A separate electrical circuit must be run from the main electrical service with an over-current device/disconnect in the circuit. A service switch is recommended and may be required by some local jurisdictions. Boiler is rated for 120 VAC, 60 hertz, less than 12 amperes.
 - B. For zone valve wiring, provide separate 24V transformer rather than attempting to use boiler mounted control. Consult zone valve manufacturer for assistance.

 Feeder Wiring – Follow wiring instructions provided with feeder. Use only electronic feeders such as Hydrolevel VXT-24 or McDonnell Miller WF2-U-24. Do not use McDonnell Miller #101A which does not include a delay timer. Do not alter any of the factory wiring on the boiler.

A CAUTION

- When making low voltage connections, make sure that no external power source is present in the thermostat circuits. If such a power source is present, it could destroy the boiler's control. One example of an external power source that could be inadvertently connected to the low voltage connections is a transformer in old thermostat wiring.
- Do not attempt to connect a McDonnell & Miller model #101A feeder, or other feeder without a delay, to a boiler equipped with a Hydrolevel CG400 low water cutoff. Doing so could destroy the boiler transformer and/or flood the system.
- Do not use the transformer provided on the boiler to power external devices other than the feeders specified in (5). Doing so may cause damage to the transformer.
 - A. Probe LWCO boilers Use only electronic feeders such as Hydrolevel VXT-24 or McDonnell Miller WF2-U-24. Do not use McDonnell Miller #101A which does not include a delay timer. Do not alter any of the factory wiring on the boiler.
 - B. Float LWCO boilers If using non-electronic feeder such as McDonnell Miller #101A feeder, use separate transformer to isolate feeder circuit. #101A-24 includes a transformer for this purpose. Do NOT install a jumper between terminals 2 and 3 on the #67 LWCO.

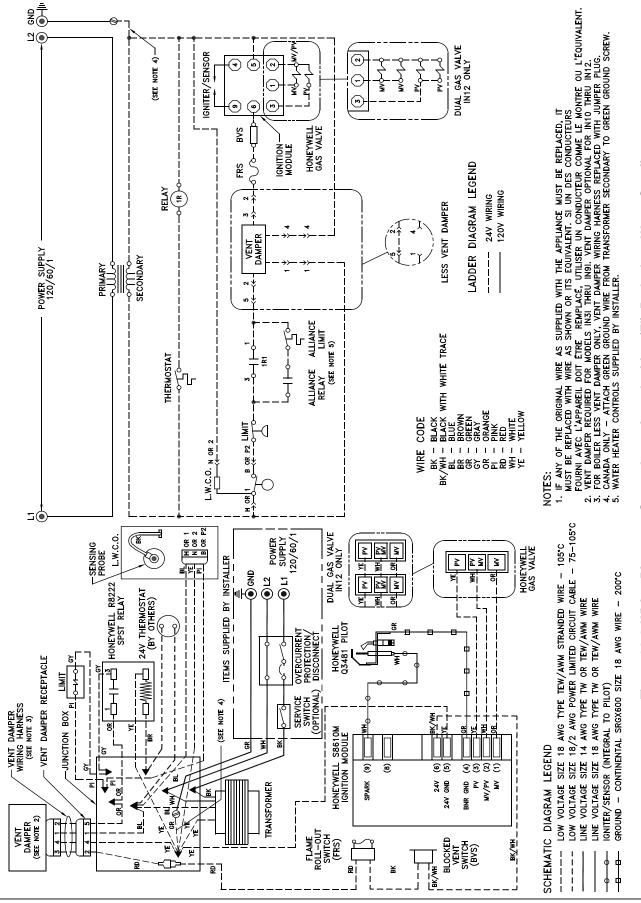
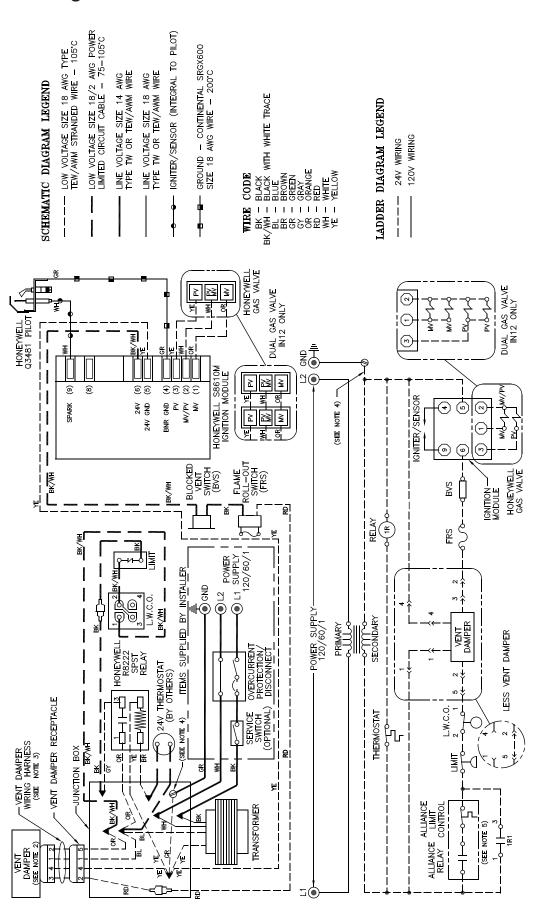


Figure 14-4: Wiring Diagrams, Steam, Intermittent Ignition (EI), Probe Low Water Cutoff



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. SI UN DES CONDUCTEURS FOURNI AVEC L'APPAREIL DOIT ÊTRE. REMPLACÉ, UTILISER UN CONDUCTEUR COMME LE
- MONTRE OU L'ÉQUIVALENT.

 2. VENT DAMPER REQUIRED FOR MODELS IN31 THRU IN91. 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. WATER HEATER CONTROLS SUPPLIED BY INSTALLER.

Figure 14-5: Wiring Diagrams, Steam, Intermittent Ignition (EI), Float Low Water Cutoff

Indirect Water Heater Wiring

Figure 14-6 shows field wiring for an indirect water heater. A Honeywell R845A or equivalent DPST relay and transformer is required. The high limit described in Part 12 must also be supplied by the installer. A call for heat from the indirect water heater thermostat will energize the relay making both sets of contacts. One set of these contacts then energizes the circulator. The other set of contacts will make the "T" and "T" contacts on the burner primary control, firing the burner. If the boiler water temperature exceeds the high limit setting of 180°F, the high limit will open the "T" - "T" circuit and the burner will shut down. If there is a call for space heat, the heating thermostat will make the "T"-"T" circuit and the boiler will fire without regard to the status of the indirect water heater. The low water cut-off and pressure limit control will interrupt 120 volt power to the burner in the event of a low water or excessive pressure condition.

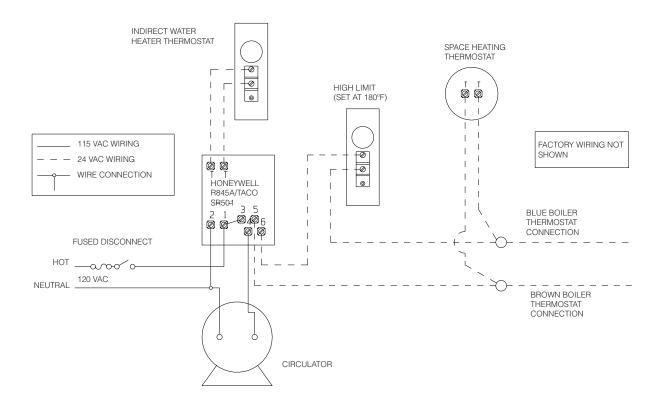


Figure 14-6: Wiring Indirect Water Heater to Boiler

15 System Start-Up and Checkout

WARNING

Do not leave the boiler in service if it fails any of the following start-up checks. Doing so may result in fire, explosion, or Carbon Monoxide (CO) poisoning.

WARNING

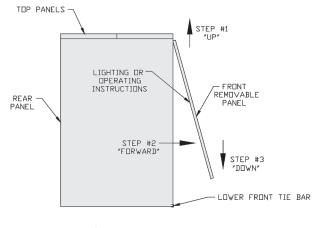
- Gas leaks may result in fire or explosion.
- Never use a flame to check for gas leaks.
- Make sure that the area around the boiler is clear and free from combustible materials, gasoline and other flammable vapors and liquids.
- Water leaks may cause extensive property damage.

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.

- The installer must verify that at least one carbon monoxide alarm has been installed within a residential living space or home following the alarm manufacturer's instructions and applicable local codes before putting the appliance into operation.
- 2. **Check Main Burners.** Main burners must be in slots in rear of burner tray and seated on main burner orifices.
- 3. **Fill boiler** with water to normal water line. See Figure 3-1.

4. Prepare to check operation.

- A. Obtain gas heating value (in Btu per cubic foot) from gas supplier.
- B. Adjust limit: 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 7-1.
- C. Remove front removable panel. See Figure 15-
- D. Connect manometer to gas valve pressure tapping. See Figure 15-2.
- E. For natural gas fired boiler, temporarily turn off all other gas-fired appliances.



SIDE VIEW

Figure 15-1: Front Door Removal

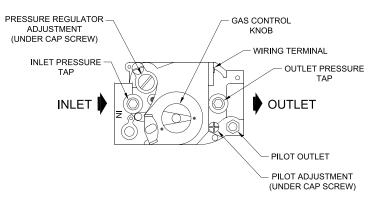


Figure 15-2: Gas Valve Pressure Tap, Honeywell Gas Valves

5. Follow Lighting or Operating Instructions.

- A. To place boiler in operation. See Figure 15-3. Sequence of Operation is outlined with wiring diagrams in Section 14: Wiring.
- B. Enhanced Electronic Ignition Module with single Status LED indicator. See Figure 15-5 "Location of LED".
 - Table 15-4 "Ignition Module Terminal Cross-reference" cross-references the ignition module terminal designations to the ignition terminal numbers in the wiring ladder diagrams.
 - Table 15-6 "Green LED Status Codes" provides green LED status codes and recommended service action where applicable.
 - See Page 36 for Troubleshooting Guide.
- C. Flame Current Measurement Procedure See Figure 15-7 "Measuring Pilot Flame Current with Micro-ammeter".
 - Pilot flame current in micro amps can be measured using any standard microammeter by inserting the meter probes into the module holes labeled FLAME CURRENT as shown in Figure 15-7.

15 System Start-Up and Checkout (continued)

FOR YOUR SAFETY READ BEFORE OPERATING/POUR VOTRE

SECURITE LISEZ AVANT DE METTRE EN MARCHE

WARNING:

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

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

- A. This appliance is equipped with an ignition device which automatically lights the burner. Do <u>not</u> try to light the burner by hand.
- B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS:

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

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

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:

- Ne pas tenter d'allumer d'appareil.
- Ne touchez à aucun interrupteur ; ne pas vous servir des téléphones se trouvant dans le bâtiment.
- Appelez immédiatement votre fournisseur de gaz depuis voisin. Suivez les instructions du fournisseur.
- Si vous ne pouvez rejoindre le fournisseur, appelez le service des incendies.
- C. Ne poussez ou tournez la manette d'admission du gaz qu'à la main; ne jamais utiliser d'outil. Si la manette reste coincee, ne pas tenter de la réparer; appelez un technicien qualifié. Le fait de forcer la manette ou de la réparer peut déclencher une explosion ou un incendie.
- D. N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau.

OPERATING INSTRUCTIONS/INSTRUCTIONS DE FONCTIONNEMENT

- 1. STOP! Read safety information above (to the left) on this label.
- 2. Set the thermostat to lowest setting.
- 3. Turn off all electric power to the appliance.
- This appliance is equipped with an ignition device which automatically lights the burner. Do <u>not</u> try to light the burner by hand.
- 5. Remove front door.
- Locate the gas control valve at the end of the gas supply pipe going into the boiler. The gas control is the brown or blue plastic knob located on top of the gas control valve.
- Rotate gas control knob clockwise from "ON" position to "OFF". Make sure know rests against stop.
- Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above to the left on this label. If you don't smell gas, on to the part standard.
- above (to the left) on this label. If you don't smell gas, go to the next step.

 9. Rotate gas control knob counterclockwise from "OFF" to "ON". Make sure knob rest against stop. Do not force.
- 10. Replace front door.
- 11. Turn on all electric power to the appliance.
- 12. Set the thermostat to the desired setting.
- 13. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.
 - GAS CONTROL KNOB
 (I.A PERILLA DEL
 CONTROL DEL GAS)

 GAS INLET
 (IA CALA
 DEL GAS)

 POSITION INDICATOR
 (POSICIONE INDICATOR

- ARRÊTEZ! Lisez les instructions de sécûrité sur la portion supérieure (a gauche) cette étiquette.
- 2. Réglez le thermostat à la température la plus basse.
- 3. Coupez l'alimentation électrique de l'appareil.
- Cet appareil est équipé de l' dispositif d'allumage qui automobile allume maticallyle brûleur. Ne pas essayer d'allumer le brûleur près main.
- 5. Enlevez la porte de devant.
- Localisez la valve du controle du Gaz a la fin du depart de la pipe de la proovision du gaz dans l'appareil. Le bouton plastique brun ou bleu localise sur la valve du controle du gaz. Voyez le diagramme.
- sur la valve du controle du gaz. Voyez le diagramme.

 7. Faites pivoter le bouton de contrôle du gaz dans le sens inverse des aiguilles d'une montre de "OFF" pour "ON".
- 8. Attendre cinq (5) minutes pour laisser échapper tout le gaz. Reniflez tout autour de l'appareil, y compris près du plancher, pour déceler une odeur de gaz, ARRÊTEZ! Passez à l'étape B des instructions de sécûrité sur la portion supérieure (a gauche) cette étiquette. S'il n'y a pas d'odeur de gaz, passez à l'étape suivante.
- 10. Remplacer la porte de devant.
- 11. Allumer toute l'énergie électrique au appareil.
- 12. Réglez le thermostat à la température désirée.
- 13. Si l'appareil ne se met pas en marche, suivez les instructions intitulées "Comment couperl'admission de gaz de l'appareil" et appelez un technicien qualifié ou le foumisseur de gaz.

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

DE L'APPAREIL

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

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

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Figure 15-3: Operating Instructions, Intermittent Ignition System, VR8204 and VR8304

Gas Valves

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15 System Start-Up and Checkout (continued)

Table 15-4: Ignition Module Terminal Cross-Reference

Ignition Module Terminal Designation	Wiring Ladder Diagram Terminal Number
MV	1
MV/PV	2
PV	3
GND	4
24V (GND)	5
24V	6
SPARK	9

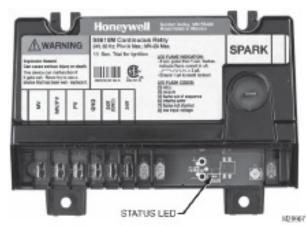


Table 15-6: Green LED Status Codes

Figure 15-5: Location of LED

: Green LED Status Codes Figure 15-5: Location of LED		e 15-5. Location of LED
Indicates	Next System Action	Recommended Service Action
No "Call for Heat"	N/A	None
Power up - internal check	N/A	None
Normal startup - ignition sequence started (including prepurge)	N/A	None
Device in run mode. "x" = flame current to the nearest µA.	N/A	None
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.
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.
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.
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.
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.
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.
	Indicates No "Call for Heat" Power up - internal check Normal startup - ignition sequence started (including prepurge) Device in run mode. "x" = flame current to the nearest μΑ. 5 minute Retry Delay - Pilot flame not detected during trial for ignition Recycle - Flame failed during run Flame sensed out of sequence Control Internal Error Flame rod shorted to ground Low secondary voltage supply-	Indicates Next System Action No "Call for Heat" N/A Power up - internal check Normal startup - ignition sequence started (including prepurge) Device in run mode. "x" = flame current to the nearest μA. 5 minute Retry Delay - Pilot flame not detected during trial for ignition Recycle - Flame failed during run Initiate new trial for ignition. Flash code will remain through the ignition trial until flame is proved. 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. Control Internal Error Flame rod shorted to ground Control remains in wait mode. When the fault corrects, control resumes normal operation. Control remains in wait mode. When the fault corrects, control resumes normal operation. Control remains in wait mode. When the fault corrects, control resumes normal operation. Control remains in wait mode. When the fault corrects, control resumes normal operation. Control remains in wait mode. When the fault corrects, control resumes normal operation. Control remains in wait mode. When the fault corrects, control resumes normal operation.

^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 μA. 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.

- 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 μAmp (microampere) DC (direct current).
- e. For reliable operation the flame current should be 2 μAmp or greater.
- f. To ensure adequate flame current:
 - 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 in. to ½ in.

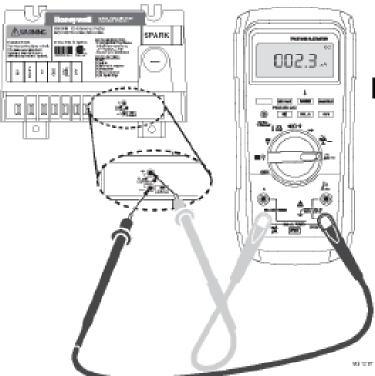


Figure 15-7: Measuring Pilot Flame Current with Micro-ammeter

- 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:
 - 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 18 "Troubleshooting".
- 6. Check pilot burner flame and main burner flames through observation port.
 - A. Check pilot flame. Pilot burner produces three (3) flames. Center flame should be steady, medium hard blue enveloping 3/8 to ½ inch of sensing probe. See Figure 15-8.

A 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.

- B. Adjust thermostat to highest setting.
- C. Check main burner flames. See Figure 15-9 or 15-10. Flame should have clearly defined inner cones with no yellow tipping. Orangeyellow streaks caused by dust should not be confused with true yellow tipping.

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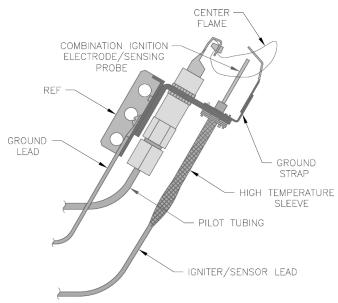


Figure 15-8: Typical Pilot Flame, Honeywell Q3481B

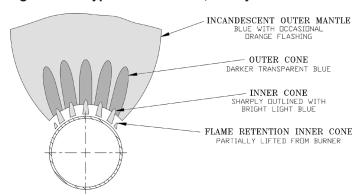


Figure 15-9: 40mm Main Burner Flame

- D. Adjust thermostat to normal setting.
- Check thermostat operation. Raise and lower temperature setting to start and stop boiler operation.
- 8. **Check ignition system shutoff.** Gas valve should close and pilot and main burners extinguish.
 - A. Continuous Ignition (Standing Pilot): disconnect thermocouple from gas valve.
 - B. Electronic Ignition (EI): disconnect igniter/ sensor cable from ignition module terminal "9".
- 9. Check low water cutoff.
 - A. Adjust thermostat to highest setting.
 - B. With boiler operating, open drain and slowly drain boiler.

A CAUTION

Do not drain below gauge glass.

- C. 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.
- D. Adjust thermostat to lowest setting. Refill boiler to normal water line.

10. Check Limit.

- A. Adjust thermostat to highest setting.
- B. Observe pressure gauge. When pressure is indicated, adjust limit to setting below observed pressure. Main burners should extinguish.
- C. Adjust limit to setting above observed reading. Main burners should reignite.

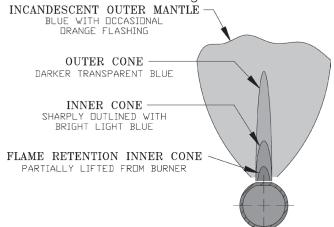


Figure 15-10: 1 in. Main Burner Flame

A 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.

- D. Adjust thermostat to lowest setting. Adjust limit to desired setting.
- 11. Adjust gas input rate to boiler. Natural Gas.
 - A. Adjust thermostat to highest setting.
 - B. Check manifold gas pressure. Manifold pressure is listed on Rating Label. 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.

- C. Clock gas meter for at least 30 seconds. Use Table 15-11 to determine gas flow rate in Cubic Feet per Hour.
- D. Determine Input Rate. Multiply gas flow rate by gas heating value.
- E. Compare measured input rate to input rate stated on Rating Label.
 - Adjust gas valve pressure regulator, if necessary, to change input rate (turn counter-clockwise to decrease pressure and decrease input rate).
 - ii. Contact your U.S. Boiler Company wholesale distributor for alternate main burner orifices if outlet pressure is less than 3.2 inches water column or greater than 3.8 inches water column. Provide current orifice size, outlet gas pressure and measured input rate.
- F. Recheck Main Burner Flame.
- G. Return other gas-fired appliances to previous conditions of use.

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

- A. Set thermostat to highest setting.
- B. Adjust tank regulator for gas valve inlet pressure of 13.5 inches w.c. or less.
- C. 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.

13. Steam Boiler Skimming

WARNING

Burn Hazard. The following procedure involves the handling of and/or close proximity to very hot water and steam.

- Keep away from the discharge side of valves when opening them.
- When buckets are used, fill them only to the point where they can be safely carried.
- Wear gloves and other protective equipment to minimize risk of exposure to hot water and steam.

Table 15-11: Input Rate

Seconds	S	ize of Gas	Meter Dial	
for One Revolution	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

ALL STEAM BOILERS REQUIRE PROPER SKIMMING. THIS NOTICE WILL HELP CONTRACTORS COMPLETE STEAM BOILER INSTALLATIONS AND AVOID CUSTOMER CALLBACKS

Skimming removes oil from the boiler water volume. If not removed properly oil can reduce steam generation and make the boiler surge. A boiler is surging when the water level in the gauge glass is bouncing or not visible while boiler is producing steam. Oil can originate from the inside of black pipe, or from petroleum based thread sealant or from the lubricant used in the cast iron hole threading process. Less than perfect near boiler piping may also make skimming more important.

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This process combines best practices learned from a number of skilled, experienced technicians, and it can be completed in about an hour. No chemical additives should be needed. For best practice, skim boiler at time of its commissioning before the system is filled with steam for the first time. This prevents any contaminants that may be present in the boiler from entering the system. Once the system has run for a number of days, subsequent skimming(s) may be required. Use the following procedure to skim the

Recommended Skimming Procedure:

- A. Prepare at least two empty buckets. Find a close place to dump water.
- B. Turn on the boiler. Run it until it is hot and starts to make steam.
- C. Turn off the boiler. **IMPORTANT DO NOT TURN BOILER ON DURING SKIMMING PROCESS.**
- D. With Caution, lift valve and verify that there is no steam pressure in the boiler.
- E. Install a full-port ball valve on the skim tapping pipe nipple provided and installed in Section 8. See Figure 8-1. This valve is a "just in case" valve. You will not close this valve after the skimming process starts. The large diameter of this pipe is necessary for effective skimming. Do not install an elbow on this pipe. We are trying to skim the water surface; therefore, the water must come off a horizontal pipe. There should not be water at this level yet.
- F. Open the ball valve just installed. Hang a bucket on the pipe.
- G. Find the manual fill valve. If there is no manual fill valve, add the water to the boiler through the bottom drain valve on the boiler.
- H. Open the manual fill valve until the water starts to flow slowly out of the pipe nipple and valve installed earlier. When water flows out the pipe nipple, close the fill valve and wait until the flow stops.
- I. Reopen the manual fill valve slightly so the stream of water coming from the pipe nipple is no larger than a wooden pencil. Slower flow is best.

- J. Continue to skim until the bucket is almost full. Remove the full bucket and use the second bucket while you dump the first. Do not shut off the valve while doing this. You cannot stop the water once you have started the flow. Remember - Do not re-fire the boiler.
- K. Keep skimming until the water temperature is comfortable to the human hand.
- L. When done skimming stop adding water. Drain the water to the proper fill level.
- M. Remove the pipe nipple and valve. Re-install the pipe cap.
- N. Turn the boiler back on and let it create steam. Decide if the surging stopped or improved or if debris is in gauge glass. If so, repeat the process.
- O. If there is no improvement after 3 or 4 tries then the problem is not oil related. Consider checking near boiler piping, flame impingement, or water pH. Low water pH or water treatment chemicals can also cause foaming and/or surging.
- P. The skimming process may also need to be repeated days or weeks after commissioning. If there is no improvement, check the items listed in step O.
- 14. Test System Water Quality.
 - A. After boiler and system have been cleaned and refilled as previously described, test water quality. Add recommended chemicals to bring chlorides, hardness and pH within limits outlined in Table 15-12.
 - Boiler is now ready to be put into service.
 - **NOTICE:** When substantial amount of make-up water is hard or corrosive water treatment is required. Contact qualified water treatment company for recommended water treatment compounds and procedures.
- 15. 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.

- Review User's Information Manual and system operation with owner or operator.
- 17. **Post instructions** near boiler for reference by owner and service personnel. Maintain instructions in legible condition.

Table 15-12: Concentration Limits for Make-up Water & Boiler Water

Constituent	Make-up Water	Boiler Water			
Chlorides	≤ 30 mg/L (ppm)	≤ 100 mg/L (ppm)			
Hardness (as Ca Co3)	≤ 100 mg/L (ppm)	≤ 200 mg/L (ppm)			
рН	7.0 ≤ pH ≤ 11.0				

16 Operation

Sequence of Operation (Refer to Figures 14-4 & 14-5 for connection and ladder diagrams)

- When the boiler is energized, 24 volts is immediately applied to terminals "1" (blue) and "4" (yellow) on the vent damper. Assuming that there is no call for heat, and that the damper switch is in the "automatic" position, the damper will close. On boilers equipped with Hydrolevel CG400A probe type low water cut-offs, voltage is also always applied to terminals "1" (blue) and "2" (yellow) on the low water cut-off to power the water level sensing circuit. On boilers equipped with #67 float type low water cut-offs, power is always applied to terminal "2" on the #67 LWCO.
- 2. Assuming that water is above the cut-off level, power will appear at terminal "3" on the CG400 LWCO or terminal "1" on the #67 LWCO.
- 3. Assuming that steam pressure is below the pressure limit setting, power will appear on one side of relay contact 1R1 (Gray lead). Relay 1R is the R8222 mounted on the vestibule panel.
- 4. A call for heat from the thermostat energizes relay coil 1R causing contacts 1R1 to make. Current then flows through contacts 1R1 to pin terminal "5" (orange) at the vent damper and the damper opens.
- 5. Once the vent damper is fully open, an end switch inside the damper will make, energizing pin "2" (red) at the damper.
- 6. Current passes from terminal "2" on the vent damper though the flame rollout and blocked vent ("spill") switches. Under normal conditions, both of these switches are made and voltage will therefore immediately appear across terminals "24V" and "24V (GND)" on the ignition module.
- Upon application of voltage across the "24V" and "24V (GND)" terminals, the ignition module will start an ignition spark at the pilot and apply 24 volts across the pilot valve (terminals "PV" and "MV/PV").

- 8. Once the pilot is established, the pilot flame will act as a diode, converting the AC current at the electrode to a half wave DC current at the pilot's ground strap. This DC current flows through the boiler to the "GND (BURNER)" connection on the ignition module. For the ignition module to recognize that a pilot flame is present, the DC current flowing into this terminal must be in excess of approximately 1.0 uA.
- 9. Once the ignition module detects the presence of a pilot flame, voltage is applied across the main valve (terminals "MV" and "MV/PV"), opening the valve and establishing main flame.
- 10. The way in which the ignition module handles failure to establish pilot or the loss of an already established pilot depends upon the exact ignition module supplied with the boiler.

Safety Control Operation

Hydrolevel CG400A Low Water Cut-off - Interrupts burner operation if the water in the boiler drops below a safe level. As the water drops past the cut-off point, the amber lamp on the CG400 will glow. The CG400 will interrupt power to the burners 15 seconds after the water level drops past the cut-off point. This feature prevents short cycling of the burners due to a bouncing water line. The burners will then remain off until 30 seconds after the water level has been raised above the cut-off point. The vent damper will close when the low water cut-off interrupts burner operation.

The CG400 is also equipped with a feature which will shut down the burners after they have been firing for 20 minutes, regardless of the water level status. The CG400 then keeps the burners off for 90 seconds, allowing the water level and any foam which is present to settle. During this 90 second interval, the green LED on the CG400 will glow. If the water level is still above the cut-off line at the end of this 90 second interval, the CG400 will restart the burners.

16 Operation (continued)

McDonnell & Miller #67 Low Water Cut-off - Interrupts burner operation if the water in the boiler drops below a safe level. Burner operation is restored when the water level in the boiler is raised above the cut-off point. The vent damper will close when the low water cut-off interrupts burner operation.

<u>Pressure Limit Control</u> - Interrupts burner operation when the pressure in the boiler exceeds the "Main" setting. Burner operation is restored when the pressure in the boiler drops to the "Main" pressure less the differential pressure. The vent damper will close when the pressure limit control interrupts burner operation.

Blocked Vent ("Spill") Switch - Interrupts burner operation in the event that flue gas spills from the draft diverter opening. This switch is equipped with a reset button which must be pressed to restore normal burner operation. An open blocked vent switch is indicative of a problem with the vent system or the combustion air supply. If the blocked vent switch opens, the cause of the venting problem must be found and corrected by a qualified gas service technician before the blocked vent switch is reset.

Flame Roll-out Switch - Interrupts burner operation when flames or excessive heat are present in vestibule. The flame roll-out switch is a single use device which must be replaced by an <u>identical switch</u> in order to restore normal operation. An open flame roll-out switch is usually indicative of a plugged heat exchanger. The cause of the flame roll-out must be found and corrected by a qualified gas service technician, and the switch replaced with an <u>identical</u> one, before the boiler is returned to operation.

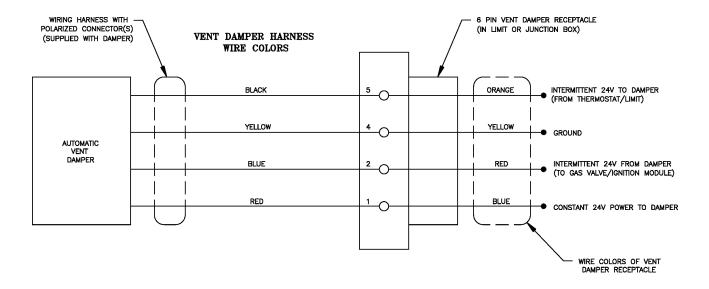


Figure 16-1: Vent Damper Schematic Wiring Diagram

17 Service and Maintenance

Important Product Safety Information: Refractory Ceramic Fiber Product

A WARNING

Some boiler components use materials that contain refractory ceramic fibers (RCF). RCF has been classified as a possible human carcinogen. When exposed to elevated temperatures, RCF may change into crystalline silica, a known carcinogen. When disturbed as a result of servicing or repair, these substances become airborne and, if inhaled, may be hazardous to your health. Avoid breathing RCF particulates and dust.

Precautionary Measures:

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

First Aid Procedures:

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

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A 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

- 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.

WARNING

- Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.
 - ATTENTION. Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Les erreurs de câblage peuvent nuire au bon fonctionnement et être dangereuses. S'assurer que l'appareil fonctionne adéquatement une fois l'entretien terminé.
- Failure to maintain the boiler in proper working condition may lead to fire, explosion, personal injury or death and extensive property damage.
- Turn off all gas and electric power supplies to the boiler before servicing. Contact with or release of dangerous flammable gas, electrical voltage, moving parts and very hot water under pressure may cause serious personal injury, property damage or death.
- Lock electrical boxes and gas valves closed to prevent someone from inadvertently restoring power or gas before the heating system is safe to operate.
- Water leaks can cause severe corrosion damage to the boiler or other system components. Repair any leaks found immediately.

 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 Figure 15-3.

2. Maintenance of Low Water Cutoff

- A. McDonnell & Miller PSE-802 or Hydrolevel CycleGard CG400 Probe Style Only.
 - *i.* Drain boiler to point below Tapping 'K'. See Figure 3-3.
 - *ii.* Disconnect wire(s) connecting control and probe.
 - iii. Remove control from probe.
 - *iv.* Unscrew probe from Tapping 'K'. Inspect for scale and sediment buildup.
 - v. Remove light deposits with damp cloth soaked with vinegar.
 - vi. Remove stubborn deposits using diluted phosphoric acid (H₂PO₄) 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.

A 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.

- vii. Clean Tapping 'K' to remove old pipe dope and other foreign matter.
- viii. 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.
- *ix.* Fill boiler to normal waterline. Add water treatment as needed.
- B. McDonnell & Miller 67 Float Style Only.
 - 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.
 - Annually. Dismantle to extent necessary to remove obstructions and insure proper function of working parts.
 - a. Inspect connecting lines to boiler for accumulation of mud and scale. Clean as necessary.
 - b. Examine wiring for brittle or worn insulation and clean electrical contact.
 - c. 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.
 - d. Five (5) Years or 100,000 switch cycles. Replace switch and float mechanisms.

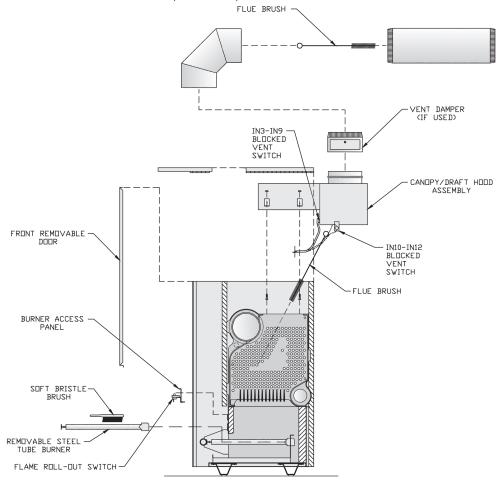


Figure 17-1: Boiler Flueway Cleaning

3. Water Feeder and Additional Low Water Cutoff.

Refer to manufacturer's instructions.

4. **Vent System.** Check annually for:

- A. obstructions
- B. accumulations of soot
- C. deterioration of vent pipe or vent accessories due to condensation or other reasons
- D. proper support—no sags, particularly in horizontal runs
- E. 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.

A CAUTION

Soot deposits in the flue passages are a sign that the boiler may be operating at high carbon monoxide (CO) levels. After cleaning the boiler of soot deposits, check the CO level in the flue gas to insure that the boiler is operating properly. If it is necessary to check CO, use a combustion analyzer, or other instrument which is designed to measure CO in flue gas. A CO "sniffer" designed for testing CO levels in ambient air cannot be used to check boiler combustion. Take a flue gas sample by inserting a sample probe through the draft diverter opening and into the flue collar so that the sample is taken in the area directly over the heat exchanger. Do not take sample until the boiler has been firing for at least five minutes. A normal CO reading for this series boiler is less than 50ppm (0.005%). A reading of more than 100ppm (0.01%) is indicative of a combustion problem.

Some causes of excessive CO include:

- Incorrectly sized or drilled burner orifice
- · Partially plugged flue passages
- Improper manifold pressure
- Foreign material in burner venturis or burner ports
- Leak in seal between canopy and heat exchanger
- · Inadequate supply of combustion air

5. Clean Boiler Flueways.

- A. Shut down gas boiler in accordance with lighting/operating instructions attached to inside of Front Removable Door. See Figure 15-1.
- B. Remove Burner Access Panel and Burners. See Step 6. Clean Burners if necessary.
- C. Remove Jacket Top Panels.
- D. Remove Canopy from top of boiler.
- E. Thoroughly clean the flueways with flue brush. See Figure 17-1.
- F. Clean boiler heating surface accessible from combustion chamber with straight handle wire brush. Reinstall burners and connect gas train. See Steps 6 & 7.
- G. Place boiler in operation in accordance with Lighting or Operating instructions. Test gas line for leaks in accordance with Section 13: Gas Piping.
- H. Replace Jacket Front Removable Door.

A 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.

6. **Remove Burners** for cleaning, changing orifice plugs, or repairs.

Table 17-2: Pilot Burner Location

Boiler Size	Pilot Located Be	Pilot Located Between Burners*				
Doller Size	1 inch	40mm				
IN3I	1 & 2	1 & 2				
IN4I	2 & 3	2 & 3				
IN5I	3 & 4	2 & 3				
IN6I	4 & 5	3 & 4				
IN7I	6 & 7	3 & 4				
IN8I	7 & 8	4 & 5				
IN9I	8 & 9	4 & 5				

- * Burners numbered left to right as viewed from front of boiler.
 - A. Turn off electric service to boiler.
 - B. Turn off gas supply to boiler.
 - C. Remove jacket front panel.
 - D. Disconnect pilot tubing at gas valve.
 - E. 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.
 - F. Remove burner access panel.
 - G. Mark location of pilot main burner on manifold.
 - H. Hold burner on throat. Lift slightly to clear orifice. Pull burner from combustion chamber. See Figure 6-7. Pilot main burner can only be removed by lifting at 45° angle after adjacent burner to right is removed (1 in. burners only).
 - 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 17-6.

- 7. **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 6.H above.
 - A. Use a round wire gauge to check spark gap.
 - B. Spark gap should be 1/8 in. for optimum performance.
- 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 17-2 for Pilot Burner location.
- 9. **Lubrication.** Manufacturers Instruction should be followed on all parts installed on boiler requiring lubrication. This includes:
 - A. Type of lubricant to be used.
 - B. Frequency of lubrication.
 - C. Points to lubricate.
- 10. **Check operation.** Follow Steps 2 through 12 and Step 15 from Section 15: Start-Up and Checkout.
- 11. 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.
- 12. Check CO detector operation.

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
IN3I	0.1	1
IN4I	0.1	1
IN5I	0.2	2
IN6I	0.2	2
IN7I	0.2	3
IN8I	0.2	3
IN9I	0.3	3

13. Excessive Make-Up Water

- A. 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 form scales on the inside of the boiler, and the oxygen escapes as a gas. The accumulation of scale 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 salts 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.
- B. Test boiler water quality every 3 months. If chloride, total hardness, or pH levels in the boiler water are outside of the levels shown in Table 15-12, check for:
 - Excessive make-up water.
 - Hard or corrosive make-up water. Water treatment is required. Contact qualified water treatment company for recommended water treatment compounds and procedures.
- C. Use a flashlight to inspect bottom row of push nipples for accumulated scale or mud. If a significant amount of scale or mud is present, contact a qualified water treatment company for recommended chemical cleaning methods.
- D. Find and repair all system leaks, drain, and refill the boiler with fresh make-up water that meets the criteria in Table 15-12. Then bring the boiler to pressure for 15 minutes to dive off excess oxygen.
- 14. Keep the area around the boiler free and clear from combustible materials, gasoline, and other flammable vapors and liquids.

Keep the area around the boiler and boiler room ventilation openings clear of objects which might obstruct the flow of combustion and ventilation air.

18 Troubleshooting

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

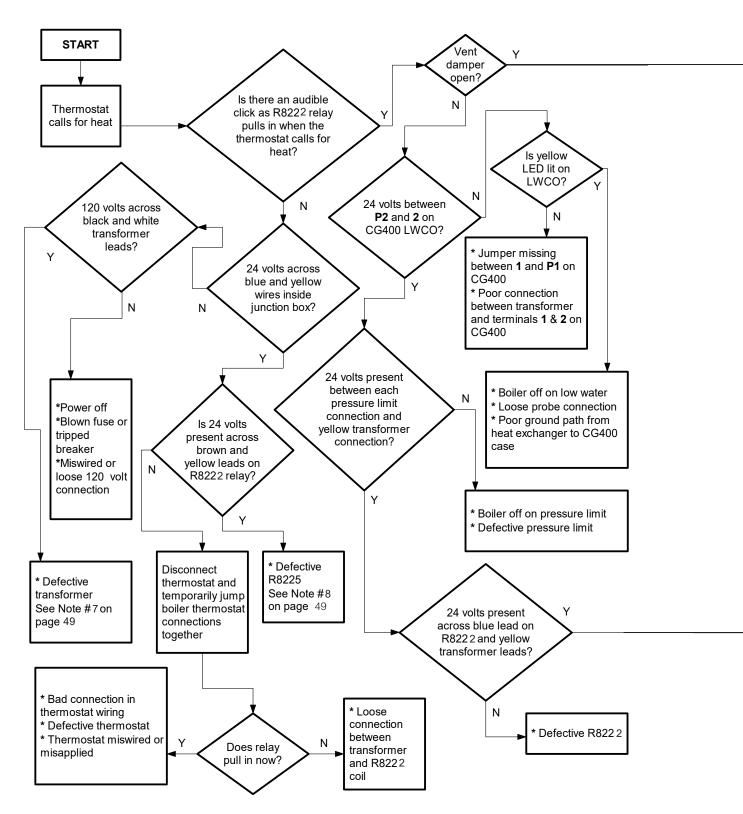
- 1. This information is only meant to be used by a professional heating technician as an aid in diagnosing boiler problems.
- 2. Where applicable, follow all precautions outlined in the Section 15 (Start-Up and Checkout).
- In general, these tables assume that there are no loose or miswired electrical connections.
 Before using these tables inspect all electrical connections on the boiler to make sure that they are tight. Also, check the wiring on the boiler against the wiring diagram in Figures 14-4 and 14-5.
- 4. When checking voltage across at wiring connectors (such as at the vent damper harness plug) be careful not to insert the meter probes into the metal sockets. Doing so may damage the socket, resulting in a loose connection when the harness is reconnected.
- 5. The possible causes at the end of each branch in these charts are <u>not</u> listed in order of likelihood. All controls on the IND are tested at least once in the manufacturing process and a defective control or component is generally the least likely cause. Before replacing a component, try to rule out all other possible causes.
- 6. These troubleshooting charts assume that the vent damper is closed at the beginning of the troubleshooting process. With 120 volts applied to the boiler and no call for heat, the damper should go to the closed position. If it does not, do the following:
 - A. Confirm that 120 volts is applied to the boiler and that there is no call for heat.
 - B. Make sure that the switch on the damper is in the "automatic" position.
 - C. Unplug the harness from the damper and check for 24 volts across pin #1 (blue) and pin #4 (yellow).
 - D. If voltage is present, the damper is defective or there is an obstruction in the path of the damper blade.
 - E. If no voltage is present, there is either a loose connection in the damper harness or the transformer is defective.

- 7. If the charts indicate that the transformer is defective, it is possible that this transformer has been destroyed by a short circuit in the boiler wiring. Before replacing the transformer, carefully inspect all low voltage wiring on the boiler for places where it is touching the frame of the boiler or wiring on the other side of the transformer.
- 8. If the charts indicate that the R8222 relay is defective, there is a good chance that a second transformer is present in the thermostat circuit, resulting in the application of 48 volts across the relay coil. In older buildings, this transformer may be hidden in a location far from the boiler. If this second transformer exists, it must be found and removed before the R8222 is replaced.

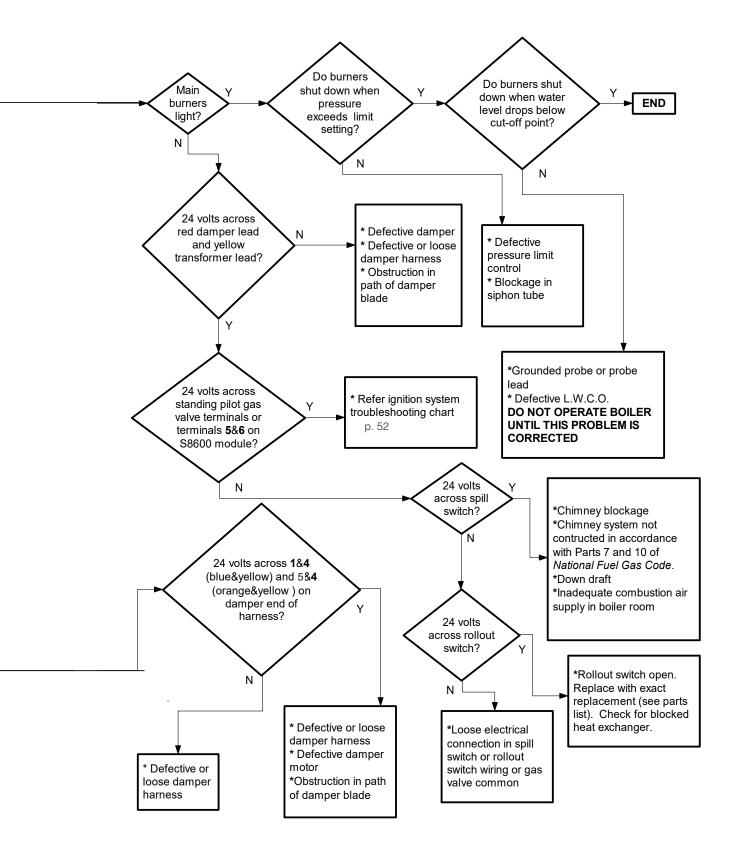
18 Troubleshooting (continued)

Troubleshooting Chart for Boilers Equipped with Hydrolevel CG400A Low Water Cut-offs and Vent Dampers

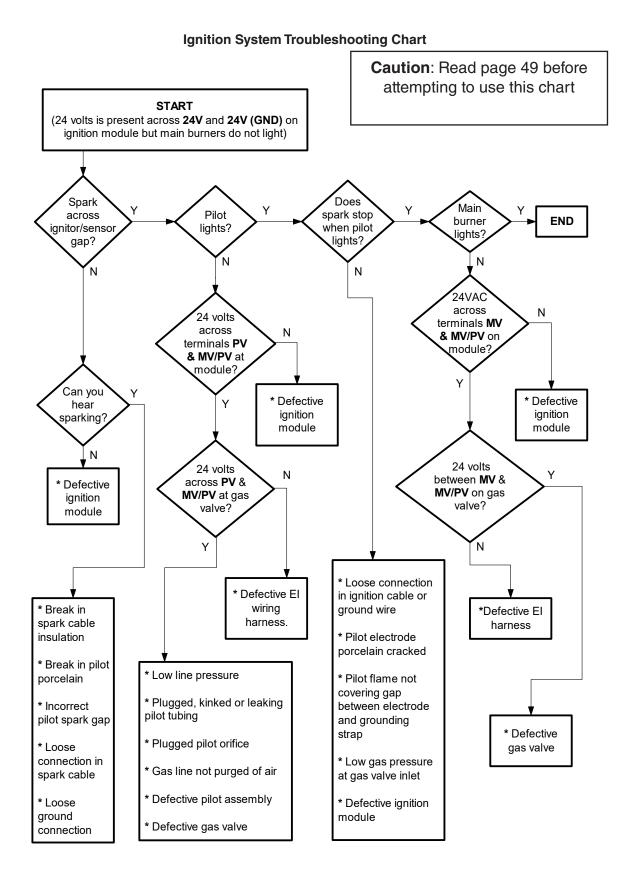
Caution: Read page 49 before attempting to use this chart



18 Troubleshooting (continued)

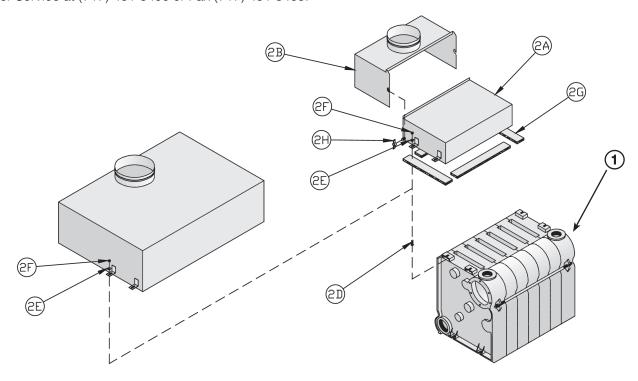


18 Troubleshooting (continued)

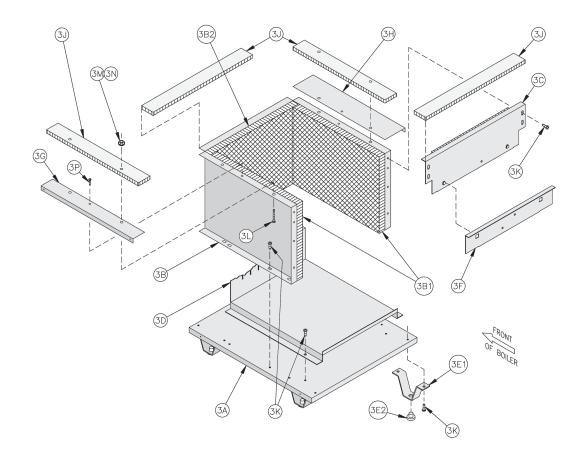


19 Service Parts

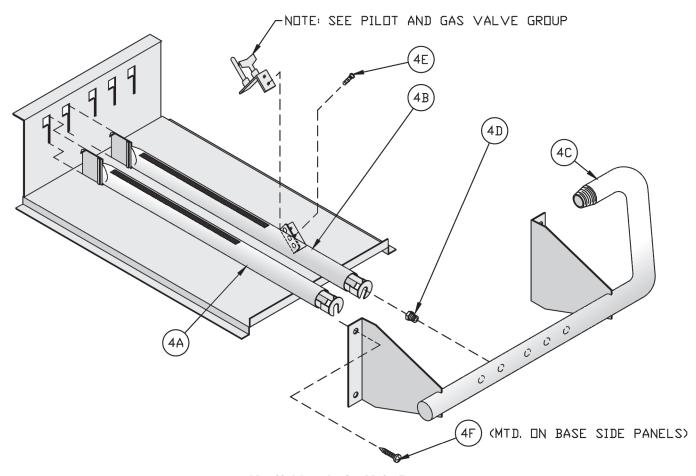
All Independence® Repair Parts may be obtained through your local U.S. Boiler Company Wholesale distributor. Should you require assistance in locating a U.S. Boiler Company Distributor in your area, or have questions regarding the availability of U.S. Boiler Company products or repair parts, please contact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



Key	December			Part i	Number [Qu	antity]		
No.	Description	IN3I	IN4I	IN5I	IN6I	IN7I	IN8I	IN9I
1. Se	1. Section Assembly (Complete)							
1	Heat Exchanger Assembly (Complete)	109454-01 [1]	109455-01 [1]	109456-01 [1]	109547-01 [1]	109458-01 [1]	109459-01 [1]	109460-01 [1]
2. Cai	nopy and Draft Hood Canop	oy/Draft Hoo	d Parts					
2A	Canopy Assembly	61110032 [1]	61110042 [1]	61110052 [1]	61110062 [1]	61110072 [1]	61110082 [1]	61110092 [1]
2B	Drafthood Carton Assembly	61110033 [1]	61110043 [1]	61110053 [1]	61110063 [1]	61110073 [1]	61110083 [1]	61110093 [1]
2D	Carriage Bolt, ¼ -20 x 1 in.			0	btain Locally	[4]		
2E	Flat Washer, 1/4 in.		Obtain Locally [4]					
2F	Hex Nut, 1/4 -20	Obtain Locally [4]						
2G	Gasket	Obtain Locally [1]						
2H	Wingnut, 1/4 -20			0	btain Locally	[2]		



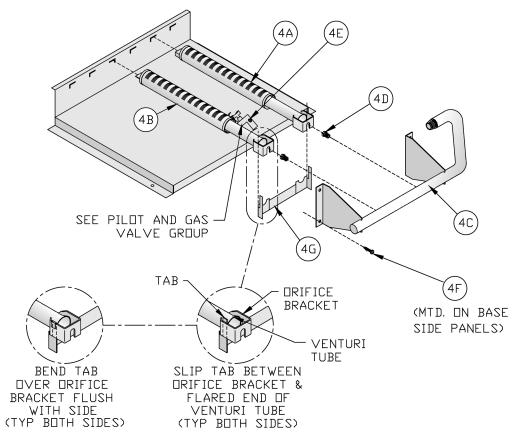
Key	Description			Part N	Number [Qua	intity]				
No.	Description	IN3I	IN4I	IN5I	IN6I	IN7I	IN8I	IN9I		
3. Ba	3. Base Assembly									
ЗА	Base Tray									
3B	Base Wrapper									
3B1	Base End Insulation									
3B2	Base Rear Insulation									
3C	Base Front Panel Assembly									
3D	Burner Tray (1 Inch Main Burners)									
30	Burner Tray (40mm Main Burners)									
3E	Base Leg Assembly									
3E1	Base Leg [Included in Key No. 3E]									
3E2	Nylon Glide [Included in Key No. 3E]									
3F	Burner Access Panel	102424-03	102424-04	102424-05	102424-06	102424-07	102424-08	102424-09		
3G	Left End Jacket Attachment Bracket	[1]	[1]	[1]	[1]	[1]	[1]	[1]		
ЗН	Right End Jacket Attachment Bracket									
3J	Base Sealant									
3K	Screw, Self Tapping, Type F, Phillips Pan Head, 1/4 -20 x 1/2 in., Plated									
3L	Screw, Self Tapping, Type F, Hex Head, 5/16 -18 x 1-1/4 in., Plated									
ЗМ	Washer, 5/16, USS									
3N	Hex Lock Nut, 5/16 -18									
3P	Screw, Sheet Metal, #8 x 1/2 in.									



Manifold and 1 in. Main Burners

Key	Description			Part Nur	mber [Quan	tity]			
No.	Description	IN3I	IN4I	IN5I	IN6I	IN7I	IN8I	IN9I	
4. Manifold and Main Burners (1 Inch Main Burners Only)									
4A	Main Burner	112600-01 [3 burners per kit]							
4B	Main Burner with Pilot Bracket		112599-01 [1]						
4C	Manifold	112829-03 [1]	112829-04 [1]	112829-05 [1]	112829-06 [1]	112829-07 [1]	112829-08 [1]	112829-09 [1]	
	Natural Gas Main Burner Orifice	#45 Pi	nk, 112603-0 ⁻	1 [1] [7 orifice	es]	#47 Whi	#47 White, 109733-01 [1] [16 orifices]		
4D	LP Main Burner Orifice	#55 Green 112607-01 [1] [3 Orifices]		m, Purple 112		3/64 in., Blue 112860-01 [1] [12 Orifices]			
4E	Screw, Machine, Slotted Round Head, 10-32 x 3/16 in.	Obtain Locally [2]							
4F	Screw, Self Tapping, Phillips Pan Head, 1/4 -20 x 1/2 in.	Obtain Locally [4]							

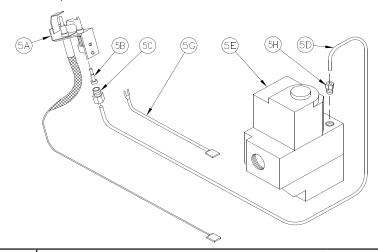
Note: Orifice Sizes shown for normal altitude (0-2,000 feet). For High Altitude consult factory.



Manifold and 40mm Main Burners

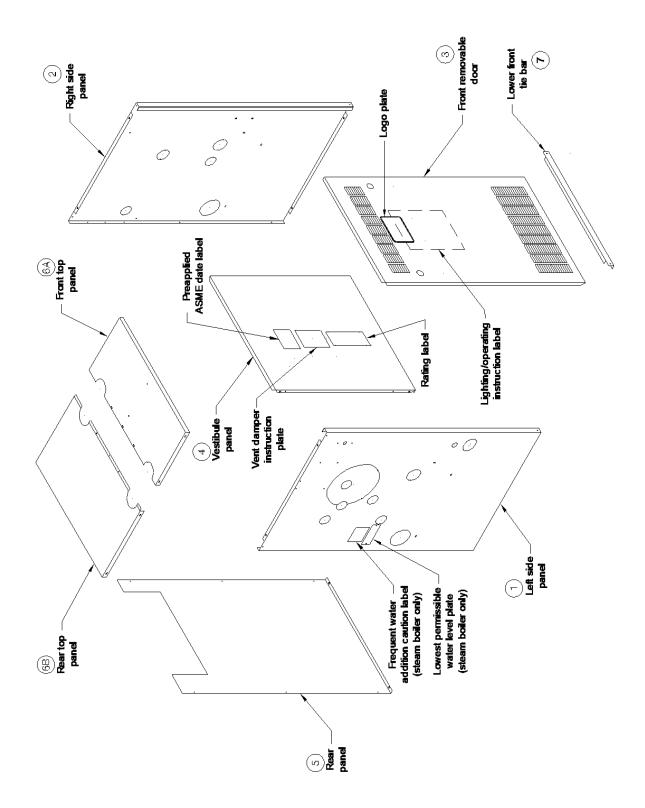
Key	Description	Part Number [Quantity]							
No.	Description	IN3I	IN4I	IN5I	IN6I	IN7I	IN8I	IN9I	
4. Mar	4. Manifold and Main Burners (40MM MAIN BURNERS ONLY)								
4A	Main Burner		112858-01 [4 Burners per kit]						
Interm	ittent Ignition O	nly							
4B	Main Burner with 41° Pilot Bracket	112859-01 [1]							

Key	Description			Part Nu	ımber[Quan	tity]		
No.	Description	IN3I	IN4I	IN5I	IN6I	IN7I	IN8I	IN9I
4. Ma	nifold and Main Bu	rners (40MM M	AIN BURNERS C	NLY) Continu	ied			
Natura	Natural Gas, High Altitude (2,000-5,000 Ft.) USA Only							
4D	Main Burner Orifice		861-01 [1] fices]		#38 11	2862-01 [1] [8 orifices]	
LP Ga	ns, High Altitude (2,0	000-5,000 Ft.) U	SA Only					
4D	Main Burner Orifice			#53 11286	3-01 [1] [8 or	ifices]		
Natura	al Gas, High Altitud	e (2,000-4,500 F	t.) Canada Only	1				
4D	Main Burner Orifice	#37 112864- 01 [1] [2 orifices]	01 [1] [2 #36 112865-01 [1] [8 orifices]					
LP Ga	LP Gas, High Altitude (2,000-4,500 Ft.) Canada Only							
4D	Main Burner Orifice			#52 11286	66-01 [1] [8 or	ifices]		
4E	Screw, Machine, Slotted Round Head, #10-32 x 3/16 in.			Obta	ain Locally [2]			
Natura	al Gas, High Altitud	e (2,000-5,000 F	t.) USA Only					
4F	Screw, Self Tapping, Phillips Pan Head, 1/4 - 20 x 1/2 in.		Obtain Locally [4]					
4G	Injection Shield Assembly	112867-03 [1]	112867-04 [1]	112867-05 [1]	112867-06 [1]	112867-07 [1]	112867-08 [1]	112867-09 [1]
4F	Screw, Self Tapping, Phillips Pan Head, 1/4 - 20 x 1/2 in.	Obtain Locally [4]						

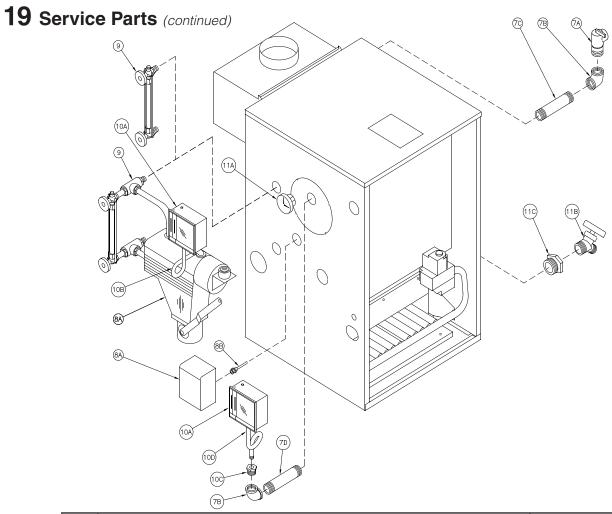


Key	Description			Part N	lumber [Quar	ntity]			
No.	Description	IN3I	IN4I	IN5I	IN6I	IN7I	IN8I	IN9I	
5. Pil	5. Pilot Burner and Gas Valve, Intermittent Ignition (EI), Natural Gas								
5A	Pilot Burner, Honeywell Q3481B1206 with Fiberglass Insulated Integral 36 in. lg. Igniter/Sensor Cable	106125-01 [1]							
5B	Pilot Burner Orifice, Honeywell KF24, 0.024 in. dia.								
5C	Compression Fitting, 7/16 in. Hex x 5/8 in. lg., Honeywell 386449-4		Included with 5A						
5D	Pilot Tubing, 1/4 in. OD x 30 109611-01 []				
30	Pilot Tubing, 1/4 in. OD x 40 in.					109611-02 [1]			
5E	Gas Valve, (Natural Gas) Honeywell VR8204C3007		10962	0-01 [1]					
) DE	Gas Valve, (Natural Gas) Honeywell VR8304P4306					1	12009-01 [1]		
5G	Ground Wire Assembly			-	109623-01 [1]				
5H	Compression Fitting, 1/4 in. OD x 1/4 in. CC, Honeywell 386449-1/B				109638-01 [1]				
5A	Pilot Burner, Honeywell Q3481B1420 with Fiberglass Insulated Integral 36 in. lg. Igniter/Sensor Cable	106126-01 [1]							
5E	Gas Valve, (LP Gas) Honeywell VR8204C3015		10961	5-01 [1]					
JL	Gas Valve, (LP Gas) Honeywell VR8304P4314				1	09621-01 [1]			

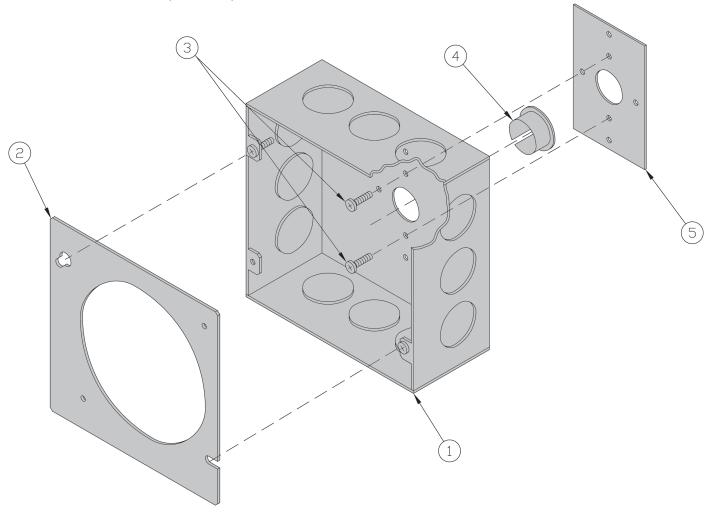
Note: Gas Valve specifications shown for normal altitude (0-2,000 feet). For High Altitude consult factory.



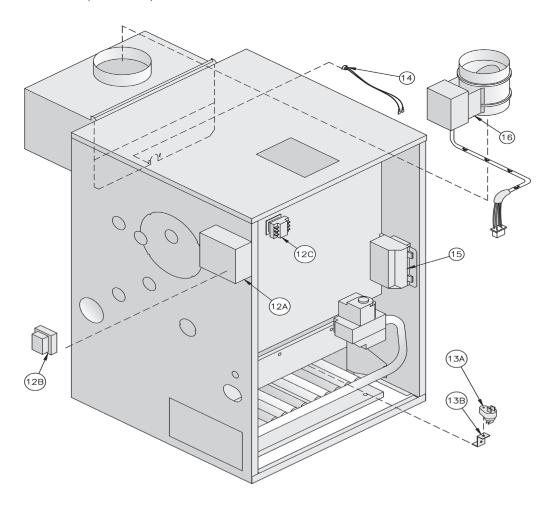
Key	Description	Part Number [Quantity]						
No.	No. Description	IN3I	IN4I	IN5I	IN6I	IN7I	IN8I	IN9I
Jack	et Assembly							
1	Left Side Panel							
2	Right Side Panel							
3	Front Removable Panel							
4	Vestibule Panel	108595-03 [1]	108595-04 [1]	108595-05	108595-06 [1]	108595-07 [1]	108595-08 [1]	108595-09 [1]
5	Rear Panel	[יין	נין	[1]				
6A	Front Top Panel							
6B	Rear Top Panel							
7	Lower Front Tie Bar							



Key No.	Description	Part No. [Quantity]					
Stear	Steam Trim						
7A	Safety Valve, 3/4 NPT, 15 psi, Conbraco 13-511-08						
7B	Elbow, 3/4 NPT	Obtain Locally					
7C	Nipple, 3/4 NPT x 3-1/2 in.	Obtain Locally					
7D	Nipple, 3/4 NPT x 4 in.						
	Low Water Cutoff, McDonnell & Miller PSE-802-24 (Probe Included)	111275-01 [1]					
8A	Low Water Cutoff, Hydrolevel CG400-2090 (Probe Included)	111272-01 [1]					
	Low Water Cutoff, McDonnell & Miller 67-BC-1 (Float Type)	80160517 [1]					
8B	Probe for CG400	110353-01 [1]					
9	Gauge Glass, Extended Shank (with Probe LWCO Only)	112622-01 [1]					
9	Gauge Glass, Standard Shank (with Float LWCO Only)	111780-01 [1]					
10A	Limit, Honeywell L404F1367	111280-01 [1]					
10B	Syphon, 1/4 NPT x 90°	111994-01 [1]					
10C	Bushing, 3/4 NPT x 1/4 NPT	Obtain Locally [1]					
10D	Syphon, 1/4 NPT x 180°	112832-01 [1]					
11A	Pressure Gauge	109707-01 [1]					
11B	Drain Valve, Conbraco 31-612-02	Obtain Locally [1]					
11C	Bushing, 2 NPT x 3/4 NPT	Obtain Locally [1]					



Key	Dosgription	Part Number [Quantity]							
No.	Description	IN3I	IN4I	IN5I	IN6I	IN7I	IN8I	IN9I	
Trans	Transformer/J-Box Adapter Plate								
1	Junction Box, 4-11/16 in. x 4-11/16 in. x 2-1/8 in.	Obtain Locally [1]							
2	Transformer/J-Box Adapter Plate	Included with Key No. 12B							
3	Sheet Metal Screw, #8 x 1/2, Type B, Phillips Head, Blunt	Obtain Locally [2]							
4	O/CL Bushing, Heyco OCB-875	Obtain Locally [1]							
5	J-Box Attachment Bracket	Obtain Locally [1]							



Key No.		Part Number [Quantity]							
	Description	IN3I	IN4I	IN5I	IN6I	IN7I	IN8I	IN9I	
12. T	ransformer								
12A	Junction Box, 4-11/16 in. x 4-11/16 in. x 2-1/8 in.	Obtain Locally [1]							
12B	Transformer, 50 VA, Honeywell AT150D1019	112868-01 [1]							
12C	Relay, SPST, Honeywell R8222K1000	111282-01 [1]							
13. F	13. Flame Rollout Switch								
13A	13A Flame Rollout Switch 109616-01 [1]]					
13B	BB Flame Rollout Switch Bracket 112593-01 [1]]					
14. B	14. Blocked Vent Switch								
14	Blocked Vent Switch	6016067 [1]							
15. lo	nition Module (Intermittent Ignition On	ly)							
15	Ignition Module, Honeywell S8610M3009	109633-01 [1]							
	Ignition Module Support Bracket	7016001 [1]							
16. V	16. Vent Damper								
16	Vent Damper	4 in., 109634-01 [1]	5 in., 109634-02 [1]	6 ir 109634			in., 4-04 [1]	8 in., 109634-05 [1]	

SERVICE RECORD				
DATE	SERVICE PERFORMED			

U.S. Boiler Company, LLC P.O. Box 3020 Lancaster, PA 17604 1-888-432-8887 www.usboiler.net