



D E S I G N E D T O L E A D

AWR Series

Gas-Fired Natural Draft Hot Water Boilers

INSTALLATION INSTRUCTIONS

These instructions must be affixed on or adjacent to the boiler

Models:

- **AWR038B**
- **AWR070B**
- **AWR105B**
- **AWR140B**
- **AWR175B**
- **AWR210B**
- **AWR245B**
- **AWR280B**

**Models Equipped with
Honeywell S9361A and
Hydrolevel IDL 1200
LWCO (5.1)**

WARNING

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



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Intertek
9902339



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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.

 DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death, serious injury or substantial property damage.

 CAUTION

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

 WARNING

Indicates a potentially hazardous situation which, if not avoided, 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.

 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.
- **Burn Hazard.** This boiler contains very hot water 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.

 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.

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I Product Description

The AWR series boiler is a cast iron gas fired water boiler designed for use in closed forced circulation heating systems. This boiler is a Category I drafthood equipped appliance, which must be vented by natural draft using a lined masonry or listed metal chimney system. An adequate supply of air for combustion, ventilation and dilution of flue gases must be available in the boiler room.

II Specifications

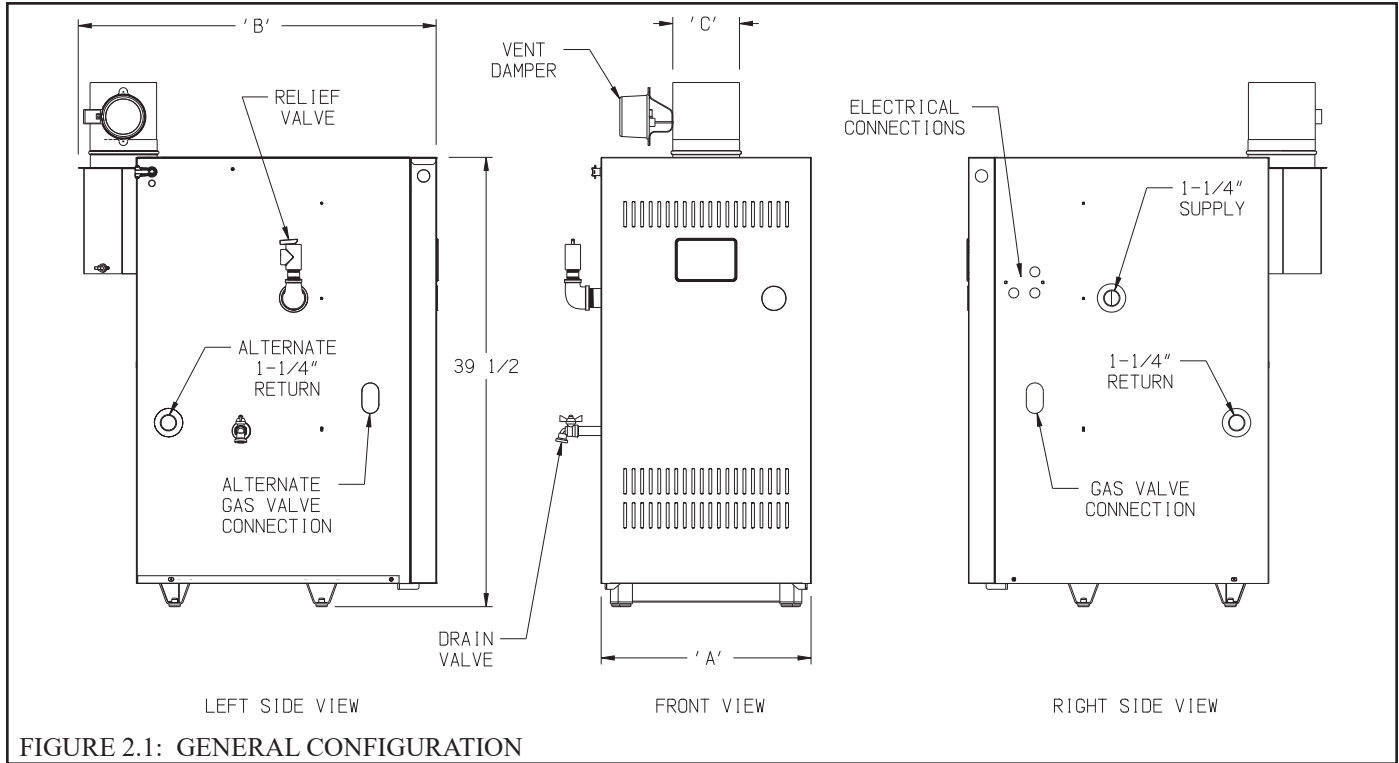


TABLE 2.2 SPECIFICATIONS

BWF Space Heating Ratings						# of Sections	'A' Width	'B' Width	Connection Size		Water Content	Approx. Shipping Weight
Basic Boiler Model ⁽³⁾	Input ⁽¹⁾	Heating Capacity	Net AHRI Rating, Water ⁽²⁾	AFUE					'C' Vent	Gas		
	MBH	MBH	MBH	%			(inch)	(inch)	(inch)	(NPT)	(gal)	(lbs)
AWR038B	38	32	28	84.0	2	9-3/4	31-1/2	4	1/2	1	234	
AWR070B	70	59	51	84.0	3	12-7/8	31-1/2	4	1/2	2	284	
AWR105B	105	88	77	84.0	4	15-3/8	31-1/2	5	1/2	3	334	
AWR140B	140	117	102	84.0	5	18-1/2	31-1/2	6	1/2	4	384	
AWR175B	175	146	127	84.0	6	21-1/2	31-3/4	7	1/2	5	434	
AWR210B	210	176	153	84.0	7	24-5/8	33-1/2	7	3/4	6	484	
AWR245B	245	205	178	84.0	8	27-5/8	33-1/2	8	3/4	7	533	
AWR280B	280	234	203	84.0	9	30-3/4	33-1/2	8	3/4	8	583	

⁽¹⁾ Input ratings can be used for elevations up to 2000 ft above sea level. Refer to Appendix A for elevations 2000 ft or higher.

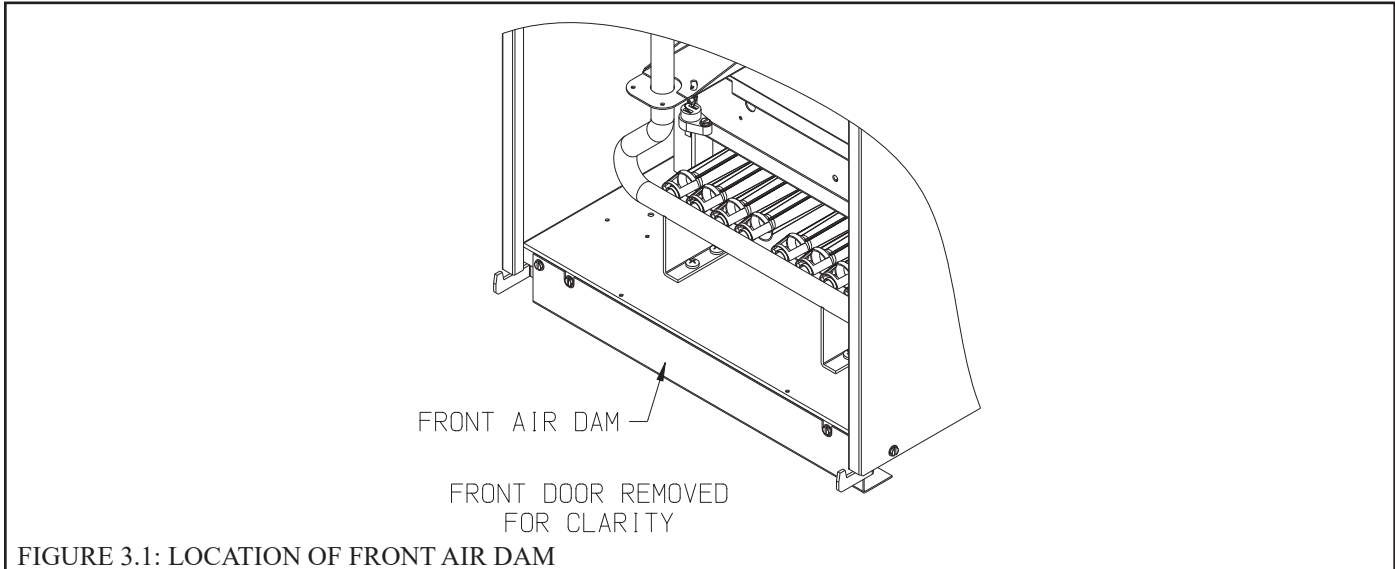
⁽²⁾ Net AHRI Water Ratings shown are based on a piping and pickup allowance of 1.15. Consult manufacturer before selecting boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc.

⁽³⁾ Add Suffix N for Natural Gas or Suffix L for Propane Gas to basic Boiler Model shown (Example: AWR210BN, AWR210BL)

III Pre-Installation

WARNING

- Carefully read all instructions before installing boiler. Failure to follow all instructions in proper order can cause personal injury or death.
- Assure that Front Air Dam (Figure 3.1) is in place and undamaged. A damaged front air dam will negatively affect the performance of this boiler, which can cause serious property damage, personal injury or death.



- 1) 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.
- 2) 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.
 - 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*).
 - 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 VI of this manual, and the *National Fuel Gas Code* for additional information on venting requirements.
- 4) Make sure that the boiler is correctly sized:
 - For heating systems employing convection radiation (baseboard or radiators) use an industry accepted sizing method such as the *I=B=R Guide RHH* published by the Air-Conditioning, Heating and Refrigeration Institute (AHRI).
 - For new radiant heating systems refer to the radiant tubing manufacturer's boiler sizing guidelines.
 - For systems that incorporate indirect water heaters, refer to the indirect water heater manufacturer's instructions for boiler output requirements.

- 5) Make sure that the boiler received is configured for the correct gas (natural or LP).

 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.
- Before attempting to operate this boiler altitudes above 2000ft, follow the instructions shown in Appendix A of this manual.

- 6) Boilers built for installations at altitudes above 2000 ft. require different main burner orifice. Make sure that the boiler is configured for use at the correct altitude.

NOTICE: This boiler is not approved for use in Canada above 2000ft.

IV Locating the Boiler

WARNING

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

1) Clearances:

- 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 Figures 4.1 and 4.2.

Front (38-210MBH) - 6"

Front (245-280MBH) - Alcove

Left Side - 1" (requires relocation of relief valve to right hand side of boiler - Figure 8.2)

Right Side - 4"

Rear (To all combustible construction) - 6"

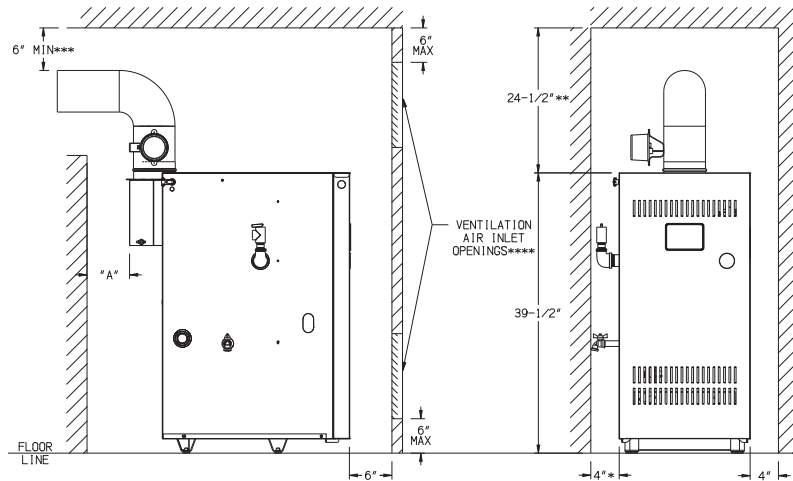
Rear (38-210MBH To non-combustible wall) - 1"

Rear (245-280MBH To non-combustible wall) - 6"

Top - 24-1/2" Additional Height May Be Required To Maintain 6" Clearance From All Breeching Components

- A 24" 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 Figures 4.1 & 4.2, however servicing the boiler will become increasingly difficult as these service clearances are reduced.

- 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.
- 9) Install on level floor. For basement installation provide concrete base if floor is not level or if water may be encountered on floor around boiler.



NOTES:

MIN. DIM. "A": TO COMBUSTIBLE CONSTRUCTION - 6"
TO NON-COMBUSTIBLE WALL - 1"

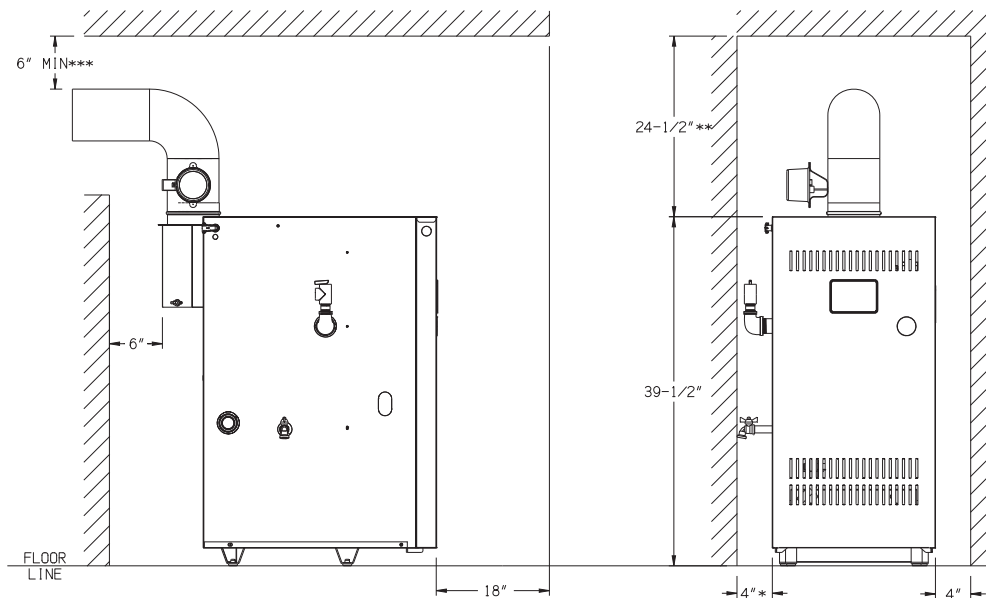
* LEFT SIDE CLEARANCE MAY BE REDUCED TO 1" IF RELIEF VALVE IS RELOCATED TO SUPPLY PIPING NEXT TO RIGHT SIDE OF BOILER (FIG 8.2) AND THE DRAIN VALVE IS RELOCATED TO THE RETURN PIPING ON THE RIGHT SIDE OF THE BOILER (FIG 8.3).

** ADDITIONAL HEIGHT MAY BE REQUIRED TO MAINTAIN REQUIRED CLEARANCE FROM VENT SYSTEM.

*** MINIMAL RADIAL DISTANCE FROM VENT PIPE TO COMBUSTIBLE CONSTRUCTION.

**** AREA OF EACH OPENING TO BE 1 SQ. INCH FOR EACH 1000 BTUH INPUT - WITH MINIMUM OF 100 SQ. INCHES. HEIGHT OF OPENING SHOULD BE HALF THE WIDTH.

FIGURE 4.1: 38-210MBH MINIMUM CLEARANCE FROM BOILER TO ALL TYPES OF COMBUSTIBLE CONSTRUCTION AND NONCOMBUSTIBLE CEILINGS, WALLS AND DOORS (CLOSET)



NOTES:

* LEFT SIDE CLEARANCE MAY BE REDUCED TO 1" IF RELIEF VALVE IS RELOCATED TO SUPPLY PIPING NEXT TO RIGHT SIDE OF BOILER (FIG 8.2) AND THE DRAIN VALVE IS RELOCATED TO THE RETURN PIPING ON THE RIGHT SIDE OF THE BOILER (FIG 8.3).

** ADDITIONAL HEIGHT MAY BE REQUIRED TO MAINTAIN REQUIRED CLEARANCE FROM VENT SYSTEM.

*** MINIMAL RADIAL DISTANCE FROM VENT PIPE TO COMBUSTIBLE CONSTRUCTION.

FIGURE 4.2: 245-280MBH MINIMUM CLEARANCE FROM BOILER TO ALL TYPES OF COMBUSTIBLE CONSTRUCTION AND NONCOMBUSTIBLE CEILINGS AND WALLS (ALCOVE)

V 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:

$$\text{Volume (ft}^3\text{)} = \text{Length (ft)} \times \text{Width (ft)} \times \text{Height (ft)}$$

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 1000BTU/hr, and neither of the conditions described in (6) below are met, normal infiltration should provide adequate fresh air into the boiler room.
- 5) If the result is less than 50 ft³ per 1000BTU/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” of the ceiling and the bottom edge of the lower opening must be within 6” of the floor (Figure 5.1):
 - Each opening must have a free area of 1 square inch per 1000 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.
 - If the total volume of both the boiler room and the room to which the openings connect is less than 50 cubic feet

per 1000 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 1000 BTU/hr of input.

- The “free area” of an opening takes into account the blocking effect of mesh, grills, and louvers. Where screens are used, they must be no finer than ¼” (4 x 4) mesh.
- If providing openings into adjacent rooms is undesirable, use the Outdoor Combustion Air Method.

6) Do not use the Indoor Combustion Air Method described above if either of the following are true:

- The indoor space is so tightly constructed that the number of air changes per hour is known to be 0.4 or less.
- 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 105MBH 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 30000 BTU/hr:

Total input in thousands of BTU/hr = (105000 BTU/hr + 30000 BTU/hr) ÷ 1000 = 135

Volume of room = 6.25 ft x 7 ft x 8 ft = 350 ft³

350 ÷ 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 20ft x 45ft x 8ft high. If two openings are installed into this basement that each have a free area of 135in², the combined volume of the boiler room and basement will be:

350ft³ + 6400ft³ = 6750ft³ and:

6750 ÷ 135 = 50ft³ per 1000 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.

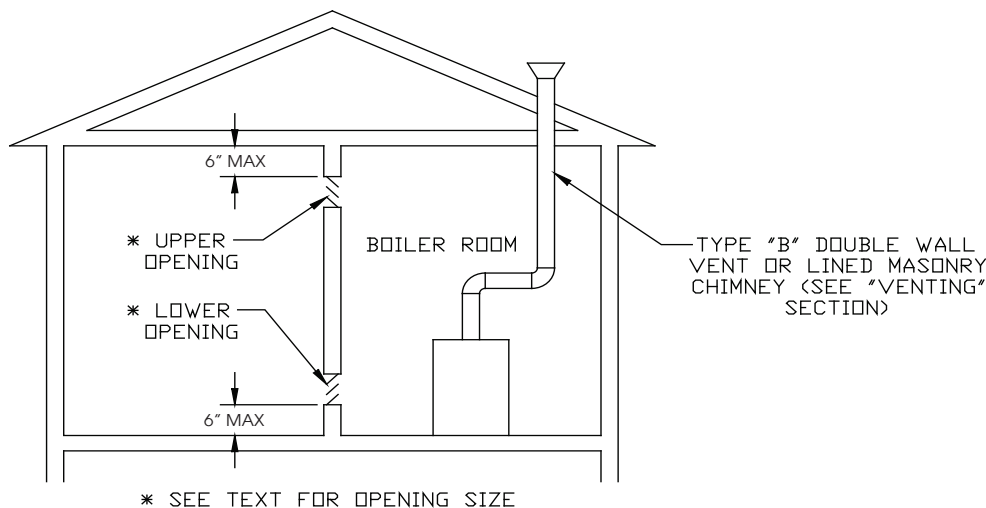


FIGURE 5.1: INDOOR COMBUSTION AIR METHOD

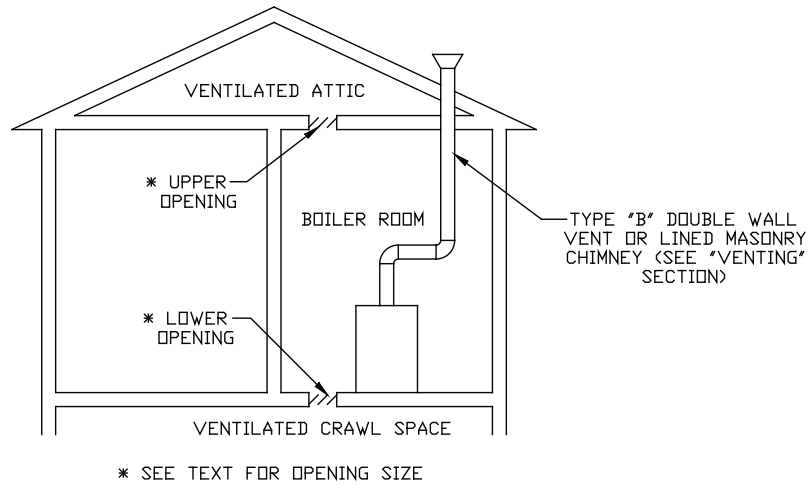


FIGURE 5.2: ALL AIR FROM OUTDOORS, VENTILATED CRAWL SPACE AND ATTIC

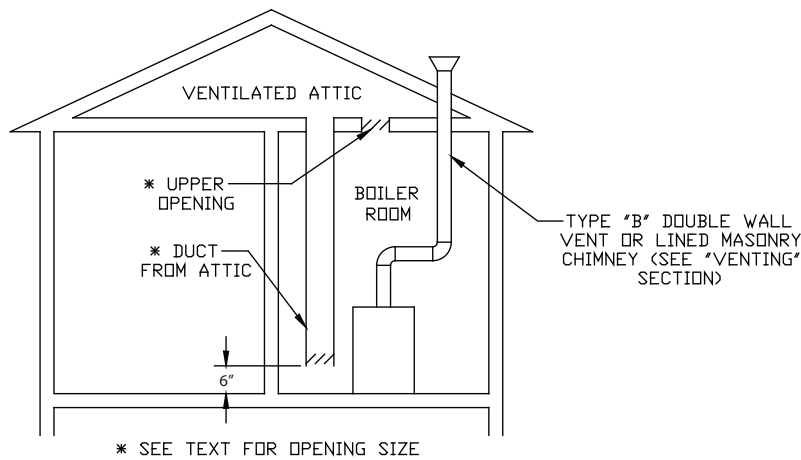


FIGURE 5.3: ALL AIR FROM OUTDOORS, VIA VENTILATED ATTIC

Using the Outdoor Combustion Air Method

- 1) 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.
- 2) 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:
 - Vertical ducts or openings directly outdoors (Figure 5.2, Figure 5.3, and Figure 5.4) - Each opening must have a free cross sectional area of 1 square inch per 4000 BTU/hr of the total input of all gas-fired appliances in the boiler room. Minimum opening size is 3 inches.
 - Openings to outdoors via horizontal ducts (Figure 5.5) - Each opening must have a free cross sectional area of 1 square inch per 2000 BTU/hr of the total input of all gas fired appliances in the boiler room. Minimum opening size is 3 inches.

- The “free area” of an opening takes into account the blocking effect of mesh, grills, and louvers. Where screens are used, they must be no finer than $\frac{1}{4}$ " (4 x 4) mesh.
- If motorized louvers are installed in the openings to the outdoors, they must be interlocked to prevent operation of the fuel burning appliances in the boiler room unless the louvers are open.

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 1000 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.

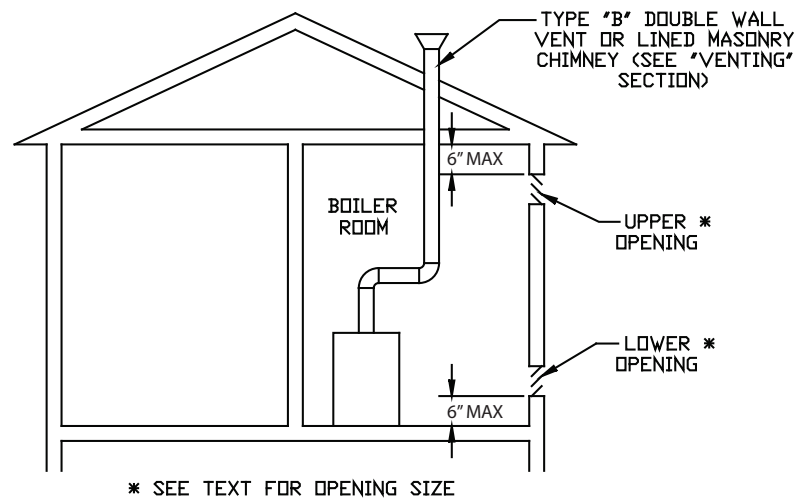


FIGURE 5.4: OUTDOOR COMBUSTION AIR METHOD: USING OPENINGS INTO BOILER ROOM

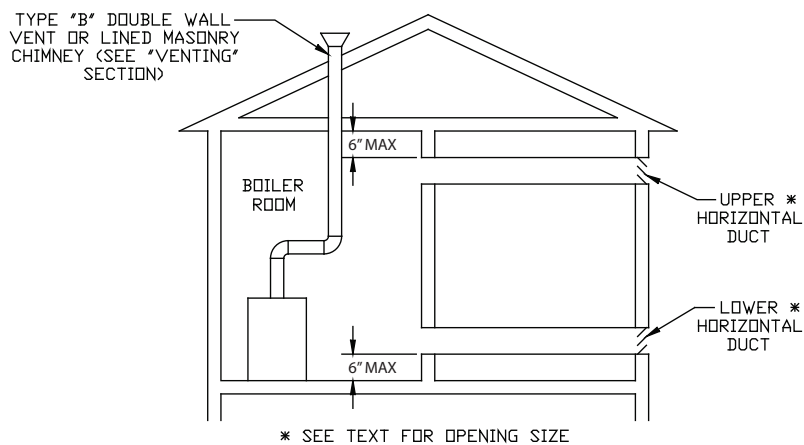


FIGURE 5.5: OUTDOOR COMBUSTION AIR METHOD: USING HORIZONTAL DUCTS INTO BOILER ROOM

VI 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.

The vent system installation must be 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).

A typical vent installation is illustrated by Figure 6.1. The components of vent installation are boiler draft diverter, vent damper, vent connector and chimney. This boiler is equipped with a draft hood which is built into the boiler; do not attempt to install an external draft hood.

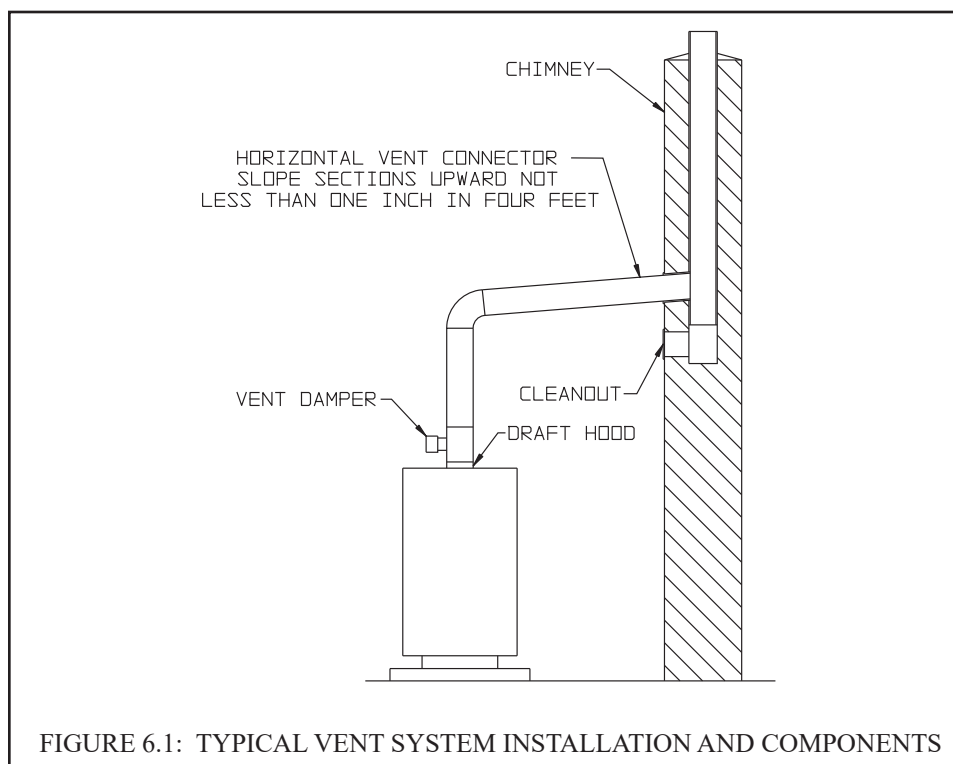
1) Acceptable Chimneys - The following chimneys may be used to vent this boiler:

- Listed Type B or L gas vent - Install in accordance with the manufacturer's instructions, the terms of its listing, and applicable codes.
- Masonry Chimney - The masonry chimney must be constructed in accordance with local codes, or in the absence of any, the *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances* (NFPA 211). The chimney must be lined with a clay liner or other listed lining system. Do not vent this boiler into an unlined chimney.

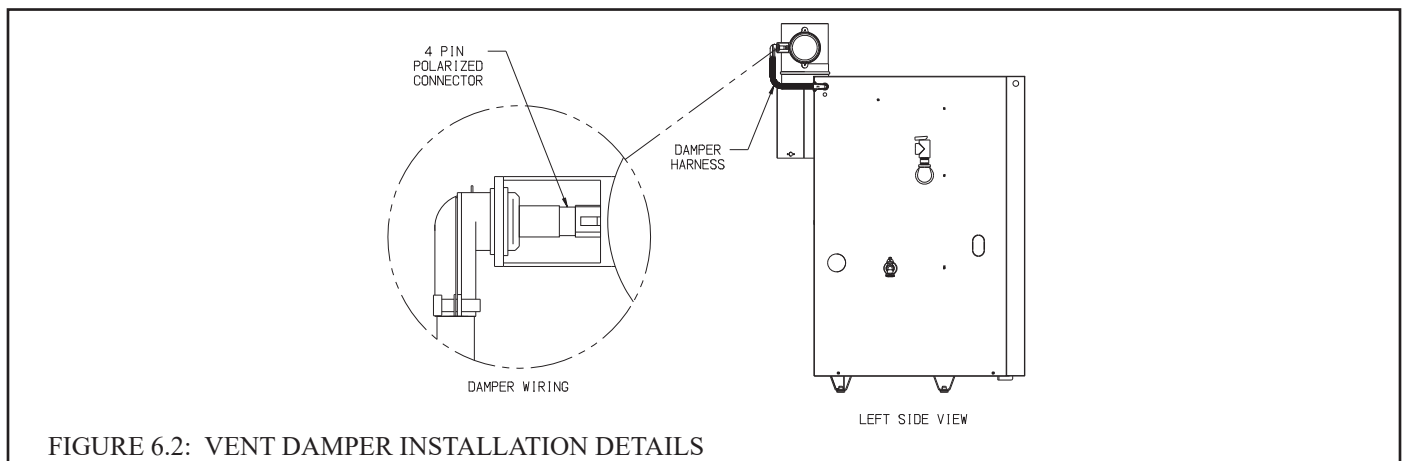
2) Acceptable Vent Connectors - The following may be used for vent connectors:

- Listed type B or L Gas Vent
- Single Wall Galvanized Pipe - Use 0.018" (26 gauge or heavier). The size and location of the chimney may not permit the use of a single wall connector in some cases. (see the *National Fuel Gas Code*). Do not use single wall pipe for vent connectors in attics.
- Other Vent Connectors Permitted by the *National Fuel Gas Code*.

3) Chimney and Vent Connector Sizing - Size the chimney and vent connector in accordance with the *National Fuel Gas Code*.



- 4) Exterior Chimneys - An exterior chimney has one or more sides exposed to the outdoors below the roof line. The *National Fuel Gas Code* prescribes two conditions under which an exterior chimney may be used:
 - In some very restrictive cases, this boiler may be vented into an exterior ceramic lined masonry chimney. See the *National Fuel Gas Code* for information on when exterior chimneys may be used.
 - An exterior masonry chimney may be used if it is lined with B vent or a listed chimney lining system.
- 5) This boiler may be vented using a listed power venter. The power venter must be in sized and installed in accordance with the power venter manufacturer's instructions, the terms of the power venter listing, and applicable codes. The boiler must be electrically interlocked with the power venter to prevent boiler operation if the power venter fails to operate. Before deciding to use a power venter, make certain that the flue gas exiting the power venter will not damage adjacent construction or other structures. Also make certain that the power venter terminal will not be subjected to winds which could affect power venter operation.
- 6) Do not connect the vent of this appliance into any portion of a mechanical vent system operating under positive pressure.
- 7) Do not connect the boiler into a chimney flue serving an open fireplace or other solid fuel appliance.
- 8) Prior to boiler installation, inspect chimney for obstructions or other defects and correct as required. Clean chimney as necessary.
- 9) Vent pipe should slope upward from draft diverter not less than one inch in four feet. No portion of vent pipe should run downward or have sags. Vent pipe must be securely supported.
- 10) The vertical section of vent pipe coming off the boiler should be as tall as possible, while still maintaining the proper clearance from the horizontal vent connector to combustibles and the proper pitch called for in (9) above.
- 11) Vent pipe should be installed above the bottom of the chimney to prevent blockage.
- 12) Vent pipe must be inserted flush with inside face of the chimney liner and the space between vent pipe and chimney sealed tight.
- 13) Do not install the vent damper in any portion of the vent system which is used by appliances other than the boiler being installed.
- 14) Installation of the vent damper supplied with this boiler is mandatory. Install vent damper (see Figure 6.2) as follows:
 - a) Open vent damper carton and remove installation instructions. Read the instructions thoroughly before proceeding. Verify that vent damper is same size as draft diverter outlet (Figure 2.1). Unpack vent damper carefully. **Do not force closed damper blade.** Forcing vent damper closed may result in damaged gear train and void warranty.
 - b) Vent damper is factory shipped having approximately 3/4" diameter hole in the vent damper blade, which must be plugged. Use the plug supplied with the damper.
 - c) Mount the vent damper on the flue collar without modification to either and secure with sheet metal screws. Make sure screws do not interfere with damper blade operation. Vent damper blade position indicator must be visible to users.
 - d) The damper wire harness is shipped pre-wired into the boiler. Plug the loose end of this harness into the damper and secure the flexible conduit to the damper using a connector nut provided. Provide adequate clearance to combustible construction and servicing.
 - e) Install vent connector pipe and vent fittings from vent damper outlet to chimney or gas vent. Secure with sheet metal screws and support as required.



Removing an Existing Boiler from a Common Chimney

In some cases, when an existing boiler is removed from a common chimney, the common venting system may be too large for the remaining appliances. At the time of removal of an existing boiler the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

- a) Seal any unused opening 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 practical, close all building doors and windows and all doors between the space in which all 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 instructions. Adjust thermostat so the appliance will operate continuously.
- 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 gas-burning appliances 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. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 10 of the National Fuel Gas Code, ANSI Z223.1.

VII System Piping

Standard Piping

WARNING

- Failure to properly pipe boiler may result in improper operation and damage to boiler or building.
- Install boiler so that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) During appliance operation and service (circulator replacement, etc.).
- Operation of this boiler with continuous return temperatures below 120°F can cause severe heat exchanger corrosion damage.
- Operation of this boiler in a system having significant amounts of dissolved oxygen can cause severe heat exchanger corrosion damage.
- Do not use toxic additives, such as automotive antifreeze, in a hydronic system.
- Pipe relief valve discharge to a safe location. The safety relief valve may discharge scalding hot water.
- Do not install a valve in the safety relief valve discharge line.
- Do not move relief valve from factory specified location.
- Do not plug relief valve discharge. Blocking the safety relief valve may result in boiler explosion.

Figure 7.3 shows typical boiler system connections on a single zone system. Additional information on hydronic system design may be found in the *I=B=R Guide RHH* published by the Air-Conditioning, Heating and Refrigeration Institute (AHRI). The components in this system and their purposes are as follows:

- 1) Relief valve (Required) - Mount the relief valve on the left side of the boiler as shown in Figure 8.1 using the 1-1/4 x 4 nipple, 1-1/4 x 3/4 reducing elbow and 3/4 x close nipple provided. The relief valve shipped with the boiler is set to open at 30 psi. This valve may be replaced with one having a pressure up to the “Maximum Allowable Working Pressure” shown on the rating plate. If the valve is replaced, the replacement must have a relief capacity in excess of the DOE heating capacity for the boiler.

Pipe the discharge of the 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 relief valve discharge is not piped to a drain it must terminate at least 6 inches above the floor. Do not run relief valve discharge piping through an area that is prone to freezing. The termination of the relief valve discharge piping must be in an area where it is not likely to become plugged by debris.

If necessary, the relief valve may be installed in the supply piping as shown in Figure 7.2. When this is done, the relief valve must be as close to the boiler supply tapping as possible with no intervening shut-off valves.

- 2) Circulator (Required) - The circulator and circulator flanges are shipped loose with the boiler. The ideal location for the circulator is in the supply piping, just downstream of the expansion tank, however installation in the return as shown in Figure 7.3 is usually acceptable.
- 3) Expansion Tank (Required) - If this boiler is replacing an existing boiler with no other changes in the system, the old expansion tank can generally be reused. If the expansion tank must be replaced, consult the expansion tank manufacturer’s literature for proper sizing.
- 4) Fill Valve (Required) - Either a manual or automatic fill valve may be used. The ideal location for the fill is at the expansion tank.
- 5) Automatic Air Vent (Required) - At least one automatic air vent is required. Manual vents will usually be required in other parts of the system to remove air during initial fill.
- 6) Low Water Cut-Off (factory supplied) This boiler is equipped with a low water cut-off (LWCO) that prevents the boiler from firing if there is inadequate water in the boiler. This LWCO is an automatic reset type, meaning that it will allow the boiler to restart automatically if the low water condition is corrected. This LWCO satisfies the requirements of most installation codes used for residential installations, however some jurisdictions may require a manual reset low water cut-off which requires a reset button to be pushed to restart the boiler.

If a manual reset LWCO is required, it must be installed in the supply piping just above the boiler in accordance with the LWCO manufacturer’s instructions (the factory supplied LWCO is left in place). No intervening valves may be installed between an externally piped LWCO and the boiler. Wire on external manual reset LWCO to either break 120VAC power to the boiler, or break the external limit connection shown in Section IX.

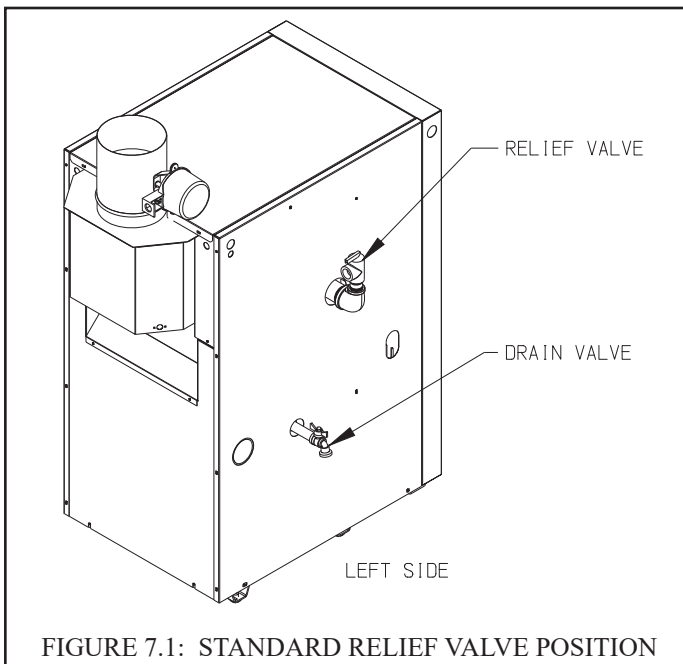


FIGURE 7.1: STANDARD RELIEF VALVE POSITION

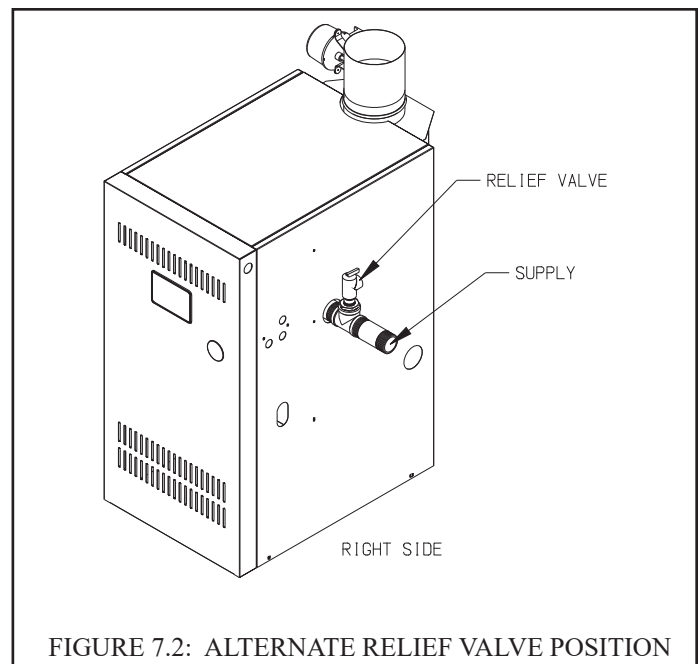


FIGURE 7.2: ALTERNATE RELIEF VALVE POSITION

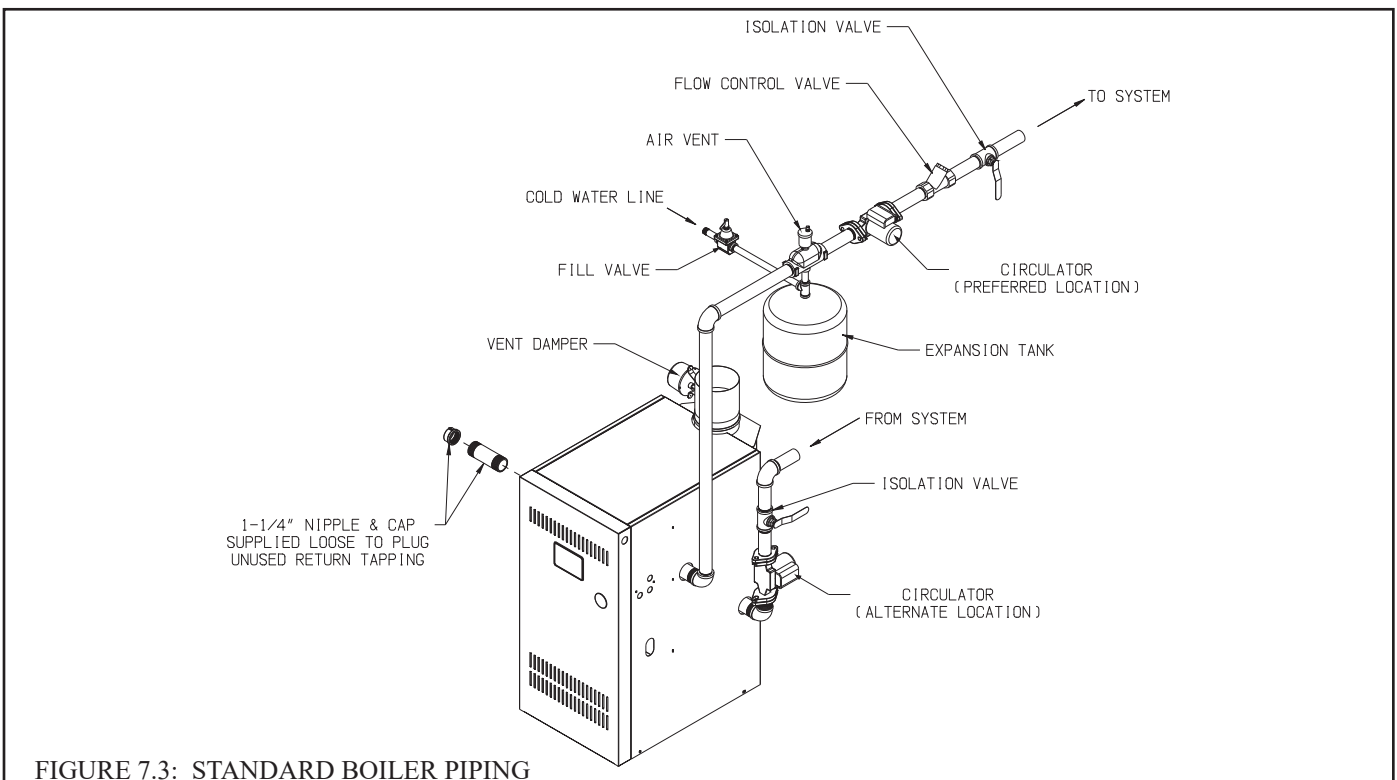


FIGURE 7.3: STANDARD BOILER PIPING

- 7) Manual Reset High Limit (Required by some codes) - This control is required by ASME CSD-1 and some other codes. Install the high limit in the boiler supply piping just beyond the boiler with no intervening valves. Set the manual reset high limit as far above the operating limit setting as possible, but not over 240°F. Wire the control to break either the 120 VAC electrical supply to the boiler, or break the external limit connection shown in Section IX.
- 8) Flow Control Valve (Required under some conditions) - The flow control valve prevents flow through the system unless the circulator is operating. A flow control valve may be necessary on converted gravity systems to prevent gravity circulation. Flow control valves are also used to prevent flow in circulator zone systems through zones that are not calling for heat.
- 9) Isolation Valves (Optional) - Isolation valves are useful if the boiler must be drained, as they will eliminate having to drain and refill the entire system.

- 10) Drain Valve - The drain valve is shipped in the boiler parts bag. Install it in the 3/4" tapping on the left side of the boiler as shown in Figure 2.1. Alternatively the drain valve can also be located in an installer supplied tee at the return connection.
- 11) Alternate Return Tapping - An unplugged 1-1/4" return tapping is provided on the left side of the boiler (see "Piping for Special Situations" below). Use the nipple and cap provided to plug whichever return tapping is not used. Both the supply and return connections must be made on the same side of the boiler.

Piping for Special Situations

Certain types of heating systems have additional requirements. Some of the more common variations follow:

- 1) "Left Piped" Boilers – If necessary, the supply and return may be connected to the left side of the boiler by moving the 1-1/4" cap and the relief valve fittings from the tapings in the left side of the boiler to the corresponding tapings on the right. Both the supply and return connections must be made on the same side of the boiler.
- 2) Indirect Water Heaters - Figure 7.4 shows typical indirect water heater piping. Boiler piping is the same as for any two-zone system. Figure 7.4 shows circulator zoning, which is usually preferred for indirect water heaters. Size the circulator and indirect water heater piping to obtain the boiler water flow through the indirect water heater called for by the indirect water heater manufacturer.
- 3) Large Water Volume Systems - The piping shown in Figure 7.5 will minimize the amount of time that the boiler operates with return temperatures below 120°F on these systems. A bypass is installed as shown to divert some supply water directly into the return water. The bypass pipe should be the same size as the supply. The two throttling valves shown are adjusted so that the return temperature rises above 120°F during the first few minutes of operation. A three-way valve can be substituted for the two throttling valves shown. If the circulator is mounted on the supply, the bypass must be on the discharge side of the circulator.
- 4) Low Temperature Systems - Some systems, such as radiant tubing systems, require the system water temperature to be limited to a value below the temperature of the water leaving the boiler. These systems also typically have return temperatures well below the 120°F minimum.

Figure 8.6 illustrates the use of a heat exchanger to connect the boiler to this type of system. The heat exchanger will permit the transfer of heat from the boiler water to the low temperature system while holding the system supply and boiler return temperatures within their limits. For this system to work properly the heat exchanger must be properly sized and the correct flow rates are required on either side of the heat exchanger. Consult the heat exchanger manufacturer for sizing information. The water in the boiler is completely isolated from the water in the system. This means that separate fill and expansion tanks are required for the heating system loop.

There are several other ways to connect low temperature systems to the non-condensing boilers like this one, such as four way mixing valve and variable speed injection pumping systems.

- 5) Systems containing oxygen - Many hydronic systems contain enough dissolved oxygen to cause severe corrosion damage to a cast iron boiler such as this one. Some examples include:
 - Radiant systems that employ tubing without an oxygen barrier.
 - Systems with routine additions of fresh water.
 - Systems which are open to the atmosphere.

If the boiler is to be used in such a system, it must be separated from the oxygenated water being heated with a heat exchanger as shown in Figure 7.6.

Consult the heat exchanger manufacturer for proper heat exchanger sizing as well as flow and temperature requirements. All components on the oxygenated side of the heat exchanger, such as the Circulator and expansion tank, must be designed for use in oxygenated water.

- 6) Piping with a Chiller - If the boiler is used in conjunction with a chiller, pipe the boiler and chiller in parallel as shown in Figure 7.7. Use isolation valves to prevent chilled water from entering the boiler.
- 7) Air Handlers - Where the boiler is connected to air handlers through which refrigerated air passes, use flow control valves in the boiler piping or other automatic means to prevent gravity circulation during the cooling cycle.

WARNING

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

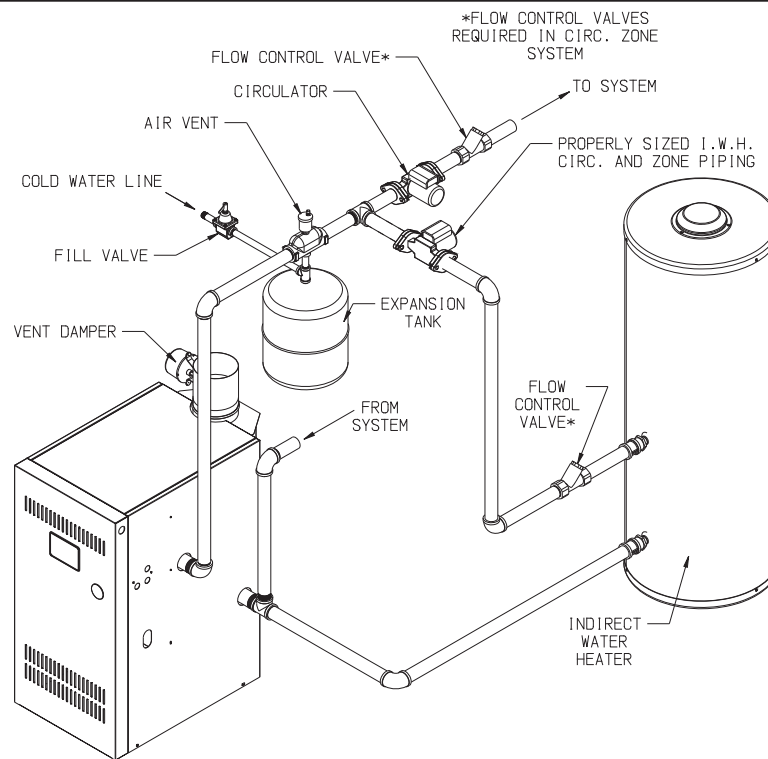


FIGURE 7.4: INDIRECT WATER HEATER BOILER SIDE PIPING

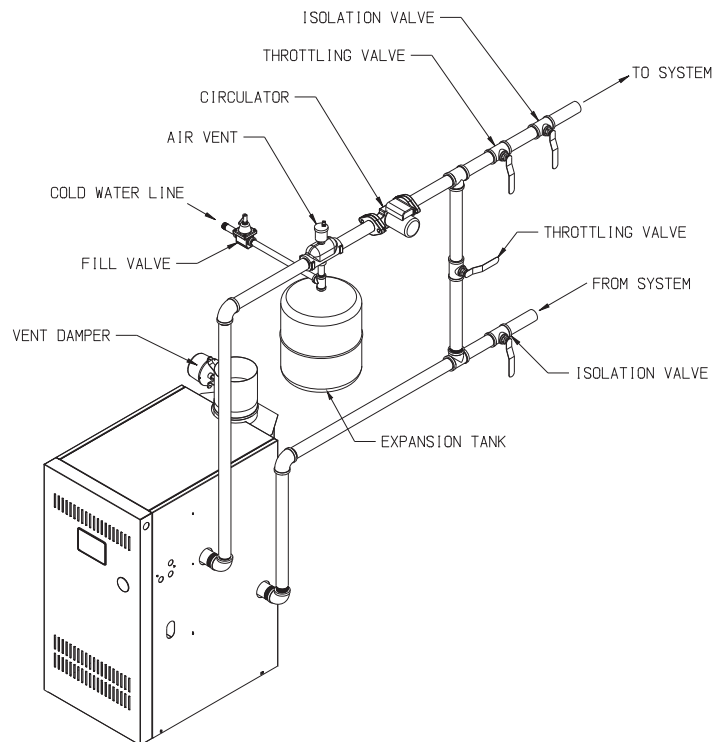


FIGURE 7.5: BOILER BYPASS PIPING

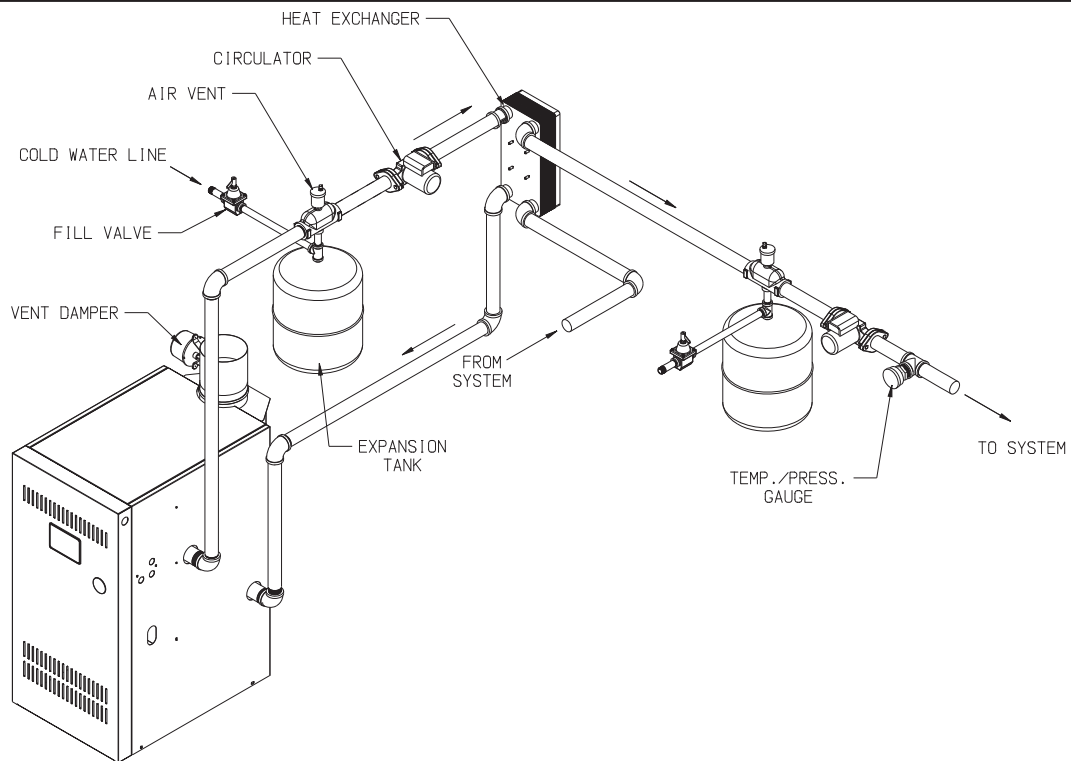


FIGURE 7.6: ISOLATION OF BOILER FROM SYSTEM WITH A HEAT EXCHANGER

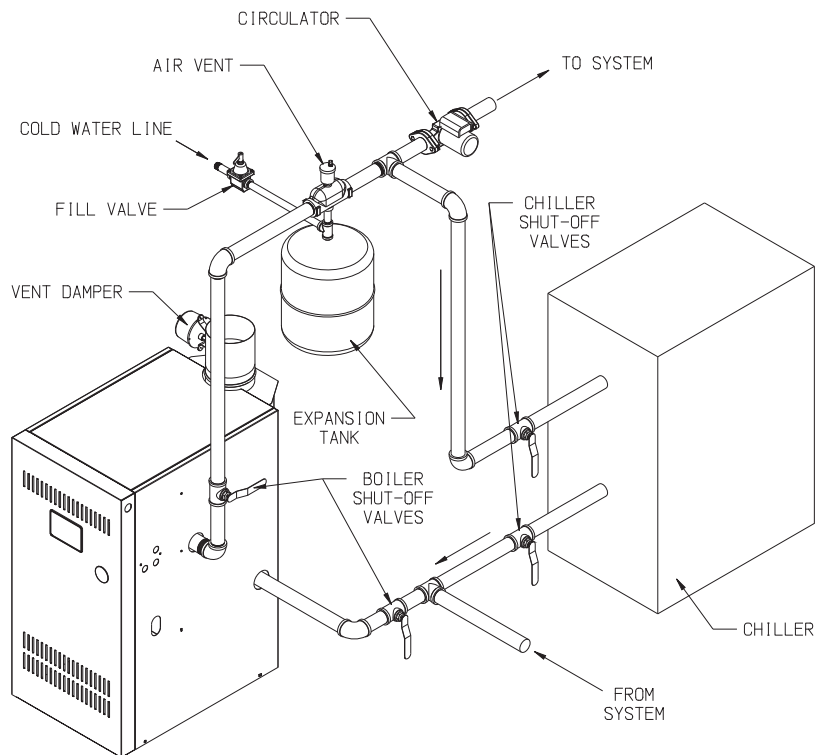


FIGURE 7.7: BOILER PIPING WITH CHILLER

VIII 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.

- 1) 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.
 - b) Maximum gas demand. Consider existing and expected future gas utilization equipment (i.e. water heater, cooking equipment).
- 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*.
 - 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 8.1.
 - 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*.
- 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.

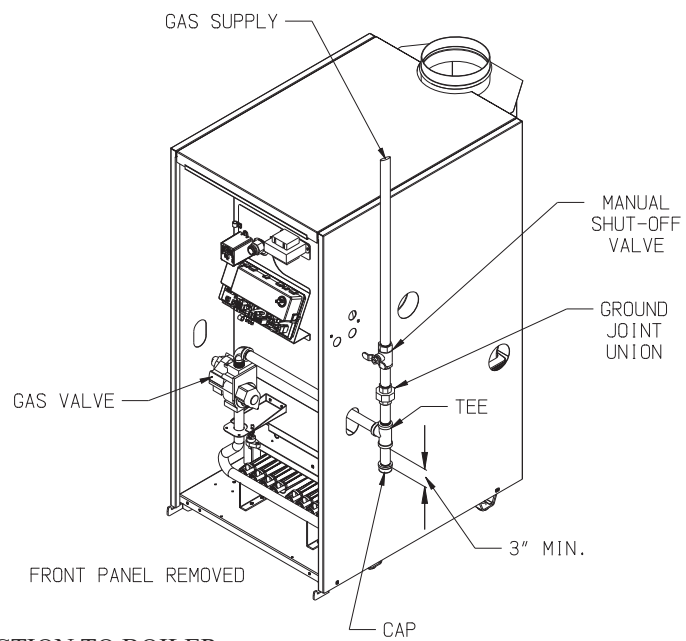


FIGURE 8.1: GAS CONNECTION TO BOILER

IX 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/NFPA 70)*. In Canada, all wiring and grounding must be done in accordance with the Canadian Electrical Code, Part 1 (CSA C22.1 - latest edition).
- 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 temperature limit devices, so as to break the 120V power supply to the boiler. Alternatively, some 24V safety limits can be wired in place of the limit jumper shown in Figure 9.2. Do not alter the boiler's factory wiring when adding a field supplied limit device.

NOTICE: This boiler is equipped with a listed high water temperature limit function. This limit provides boiler shutdown in the event the boiler water temperature exceeds the set point of the limit control. Certain Local Codes require an additional water temperature limit. If necessary, install an additional water temperature limit (P/N 106056-01) or equivalent Honeywell L4006 Aquastat. Wire as indicated in Figure 9.2.

- 1) Line Voltage (120 VAC) Field Connections – See Figure 9.1 for line voltage connections. Provide a dedicated circuit for the boiler of 15A or greater. A service switch is recommended and is required by many local codes. Locate this switch in accordance with local codes or, in the absence of any, in a location where it can be safely accessed in an emergency involving the boiler. All 120VAC connections to the boiler itself are made inside the junction box on the right side of the boiler (accessible through the cover plate on the right side jacket panel). 120VAC connections are:

- Ground
- 120VAC Hot (Black)
- 120VAC Neutral (White)
- Heating Circulator Hot (Yellow)
- Heating Circulator Neutral (White)
- DHW Circulator Hot (Red)
- DHW Circulator Neutral (White)

The use of the Circulator outputs are as follows (also refer to the Piping Section)

- a) Heating Circulator - Pumps water upon a call for heat (CH) from a heating thermostat connected to the leads shown in Figure 9.1 or from an EnviraCom thermostat.
- b) DHW Circulator - Pumps boiler water to an indirect water heater upon a call for domestic hot water (DHW) from the DHW thermostat terminals shown in Figure 9.2. This output can also be used for a second space heating zone. See Section XI of this manual for additional information.

Maximum circulator current draw is 5.0 FLA.

- 2) Low Voltage Connections – Low voltage field connections are located as shown in Figure 9.3 and are as follows:

- a) Heating (CH) Thermostat - Connect to a 24 volt thermostat or other “dry contacts” (such as a zone panel end switch) that close upon a call for heat. Follow thermostat manufacturer's 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 (or zone controls) and boiler.

- b) DHW Thermostat - If used, connect to a 24VAC domestic hot water thermostat or 2nd space heating thermostat.
- c) Auxiliary Limit Jumper - Used to connect auxiliary limit device. If no such devices are installed, the factory supplied jumper shown in Figures 9.3 and 9.4 must be installed for boiler to operate.
- d) EnviraCOM - Used to connect an EnviraCom thermostat or other approved EnviraCom device to this boiler.

⚠ 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 use EnviraCom connections for any purpose not explicitly permitted by the factory. Attempting to do so may result in unreliable operation and/or damage to controls.
- Do not use the transformer provided on the boiler to power external devices such as zone valves. Doing so may cause damage to the transformer.

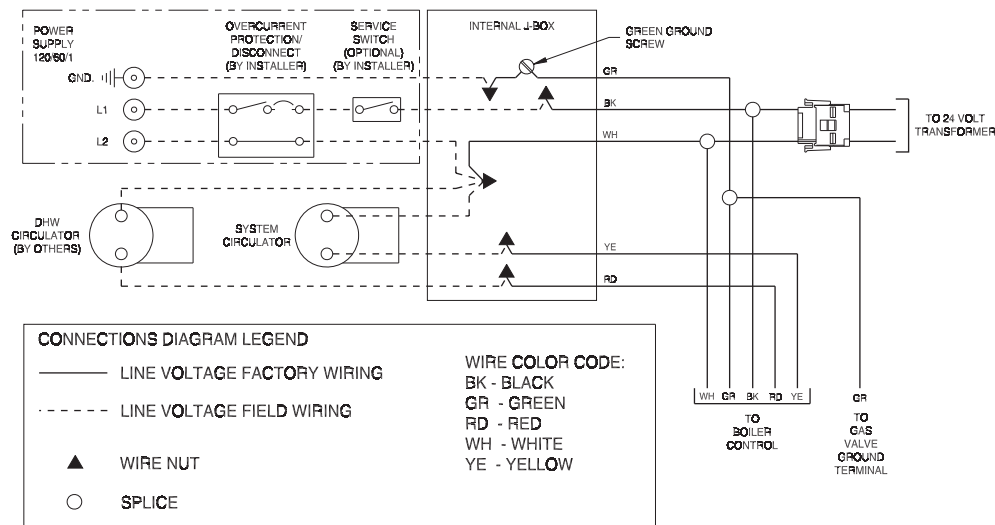


FIGURE 9.1: LINE VOLTAGE FIELD CONNECTIONS

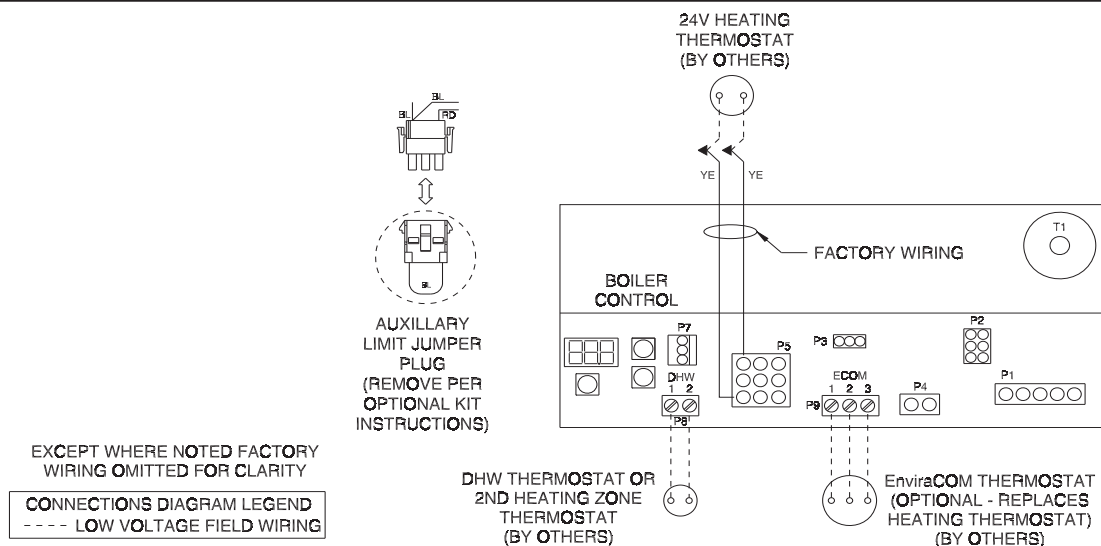


FIGURE 9.2: LOW VOLTAGE FIELD CONNECTIONS

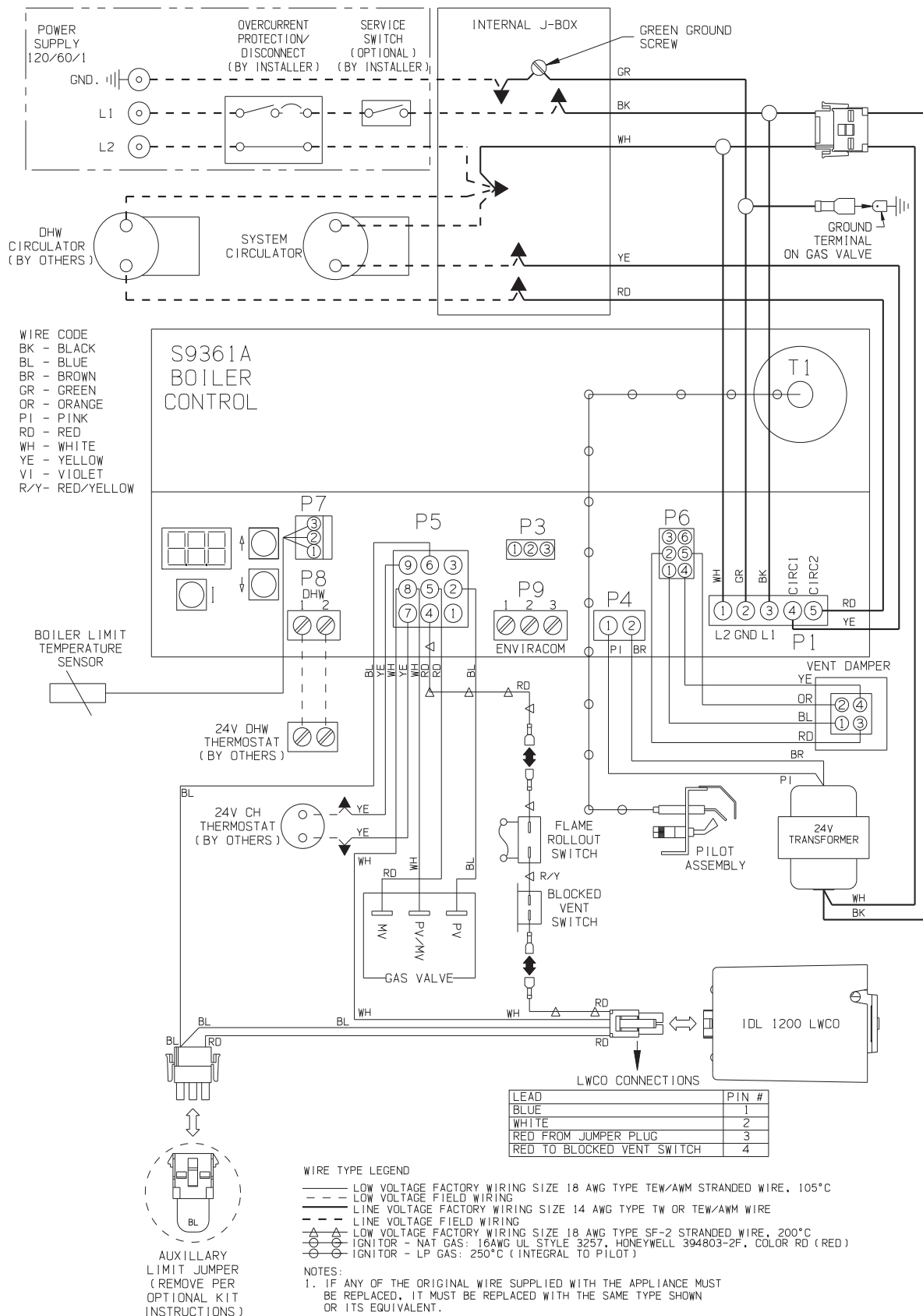


FIGURE 9.3: CONNECTIONS DIAGRAM

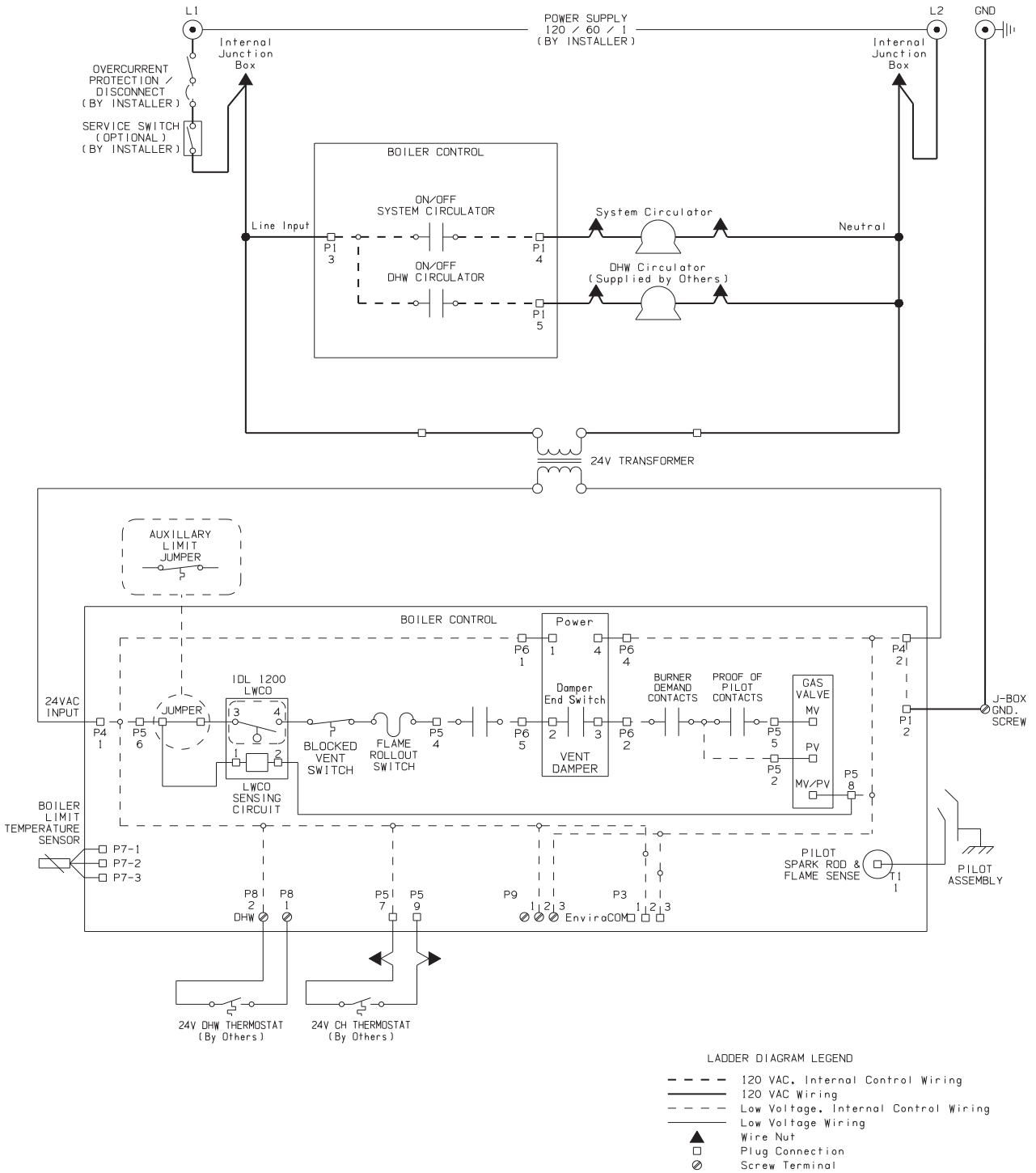


FIGURE 9.4: LADDER DIAGRAM

X 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.

- 1) Start with the boiler dry and the gas supply to the boiler shut off.
- 2) Main Burner Check - Check main burners to see that they were not dislodged during shipment. Rear of burners should be in the vertical slots in the rear of burner tray and the front of the burners should be seated completely on the orifices.
- 3) LWCO Probe Check - Turn on power to the boiler. Both the green power light and the yellow low water light should come on (Figure 10.1)

⚠ WARNING

If the yellow light on the LWCO is not illuminated when the boiler is powered and there is no water in the boiler, shut down power to the boiler and contact the factory for assistance before proceeding further.

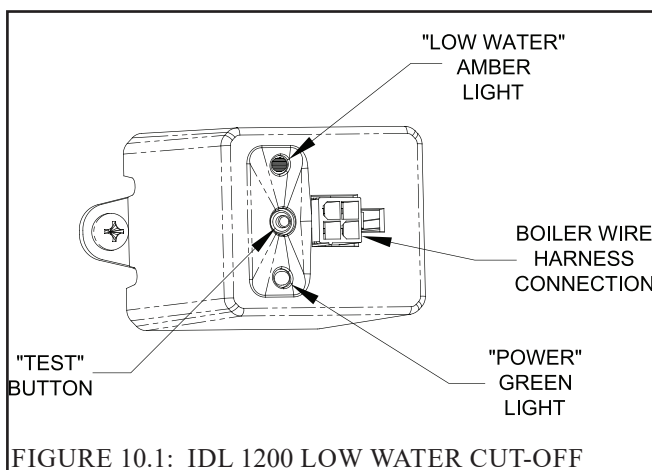


FIGURE 10.1: IDL 1200 LOW WATER CUT-OFF

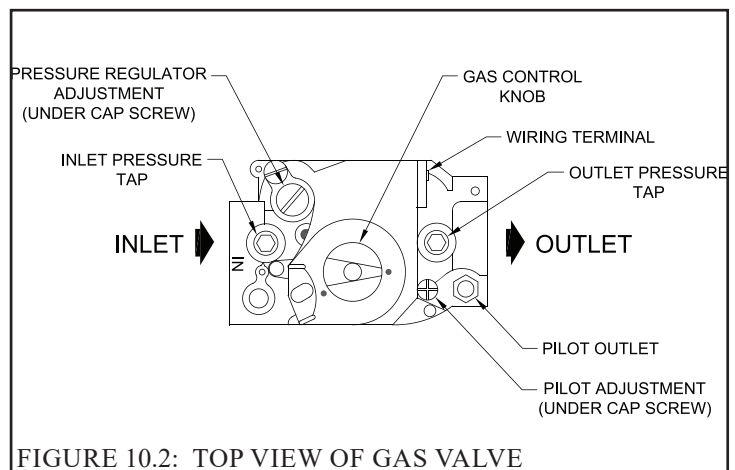


FIGURE 10.2: TOP VIEW OF GAS VALVE

- 4) Fill the boiler and system with water and purge the system of as much air as possible.
- 5) Turn on the gas supply to the boiler. Check the gas line for leaks and purge piping sections that are full of air. Refer to the *National Fuel Gas Code*, the *Natural Gas and Propane Installation Code*, the gas supplier, or the authority having jurisdiction for additional information on testing and purging gas lines.
- 6) Verify that the vent system is complete and free of obstructions before attempting to fire boiler.
- 7) Inspect all wiring for loose or uninsulated connections.
- 8) Adjust thermostat to the highest setting.
- 9) Start the boiler using the lighting instructions shown in Figure 10.3. Upon initial start-up, the gas train will be filled with air. Even if the gas line has been completely purged of air, it may take several tries for ignition before a flame is established. Once a flame has been established for the first time, subsequent calls for burner operation should result in a flame on the first try.
- 10) Make sure vent damper is in open position when main burners are firing
- 11) Check entire gas train for leaks using non corrosive leak detection fluid or other approved leak detection method while boiler is firing. Fix any leaks found immediately.

FOR YOUR SAFETY READ BEFORE LIGHTING

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

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

WHAT TO DO IF YOU SMELL GAS

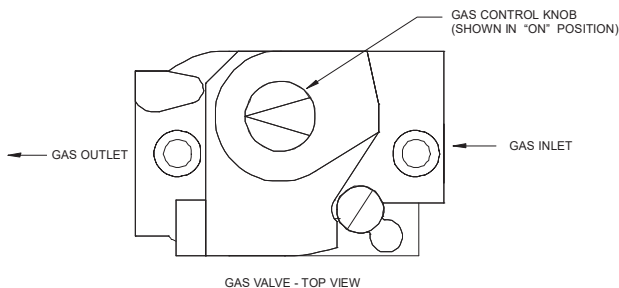
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.

- If you cannot reach your gas supplier, call the fire department.

- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.



5. Remove front access panel.
6. Rotate the gas control knob clockwise ↻ to OFF.
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you then smell gas, **STOP!** Follow "B" in the safety information above on this label. If you don't smell gas go to the next step.
8. Rotate the gas control knob counter clockwise ↻ to "ON".
9. Replace front access panel.
10. Turn on all electric power to the appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Push in gas control knob slightly and turn clockwise ↻ to "OFF". Do not Force.

FIGURE 10.3: OPERATING INSTRUCTIONS

12) Check the manifold pressure and adjust if necessary. To do this, use the following procedure:

- a) Connect a manometer to the inlet pressure tap on the gas valve (see Figure 10.2).
- b) Check the inlet line pressure with all gas appliances on and off. The inlet pressure at the boiler must be within the following limits regardless of what combination of appliances is firing:

Inlet Press (inches w.c.)	Natural Gas	LP Gas
Minimum	5.0	11.0
Maximum	14.0	14.0

- c) If the inlet pressure falls outside of these limits, find and correct the cause of the problem before proceeding further.
- d) Connect a manometer to the manifold (outlet) pressure tap on the gas valve (Figure 10.2).
- e) Read the manifold pressure. It should be set at:

	Natural Gas	LP Gas
Manifold Press. (inches w.c.)	3.5	10.0

- f) If a manifold pressure adjustment is needed, make the adjustment by turning the regulator screw (see Figure 10.2) clockwise to raise the pressure and counter-clockwise to reduce the pressure. If a manifold pressure adjustment is made, recheck the inlet pressure after making the adjustment to be certain that it is still within acceptable limits. Replace the cover screw on the regulator.

13) Check Main Burner Flame - See Figure 10.5. Flame should have a clearly defined inner cone with no yellow tipping. Orange-yellow streaks caused by dust should not be confused with true yellow tipping.

14) Check Pilot Burner Flame.

Natural Gas Only. Pilot produces single flame. Flame should be steady medium hard blue enveloping 3/8 to 1/2 inch of igniter/sensor tip. See Figure 10.5

LP Gas Only. The pilot burner produces three (3) flames. The center flame should be steady, medium hard blue enveloping 3/8 to 1/2 inch of sensing probe. See Figure 10.6.

CAUTION

Avoid operating this boiler in an environment where saw dust, loose insulation fibers, dry wall dust, etc. are present.

15) Gas valve safety shutdown test - With main burners firing, disconnect ignition cable from ignition module. Both pilot burner and main burners should stop firing.

16) Check High Limit Control - Jumper thermostat connections in boiler wiring harness. Allow burners to operate until shutdown by limit (factory setting is 180F). REMOVE JUMPER WHEN TEST IS COMPLETE.

17) Check LWCO Operation - Push and hold the LWCO TEST button while the boiler is firing (Fig 10.1). The burners should shut down and the yellow light illuminate on the LWCO. Upon releasing the TEST button, the yellow light should go off and the boiler fire.

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

19) Check of External Safety Devices - Verify proper operation of any field installed safety devices, such as external limits.

20) Combustion Chamber Burn-off

- a) The mineral wool combustion chamber panels may contain a cornstarch based binder that must be burned out at installation to prevent odors during subsequent boiler operation.
- b) Ventilate the boiler room, set the high limit to its maximum setting, set the thermostat to call for heat. Allow the boiler to fire for at least an hour or until the odor from the cornstarch has dissipated.
- c) Return the high limit and thermostat to their desired settings.

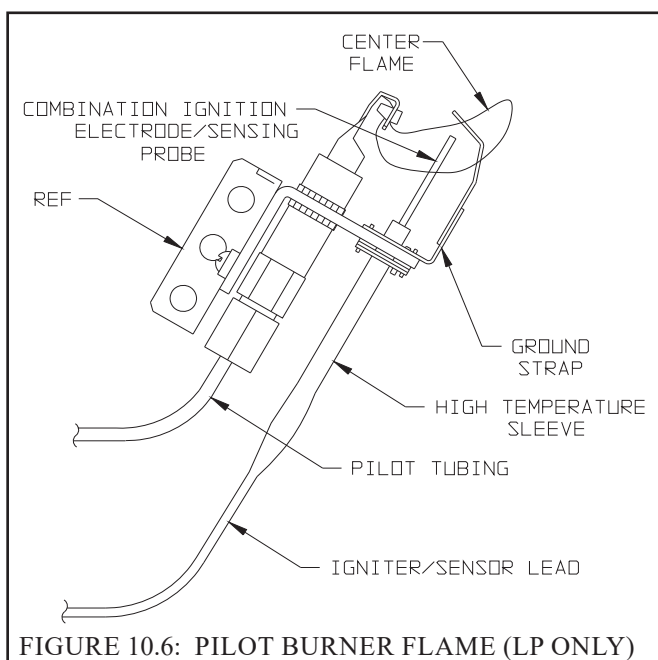
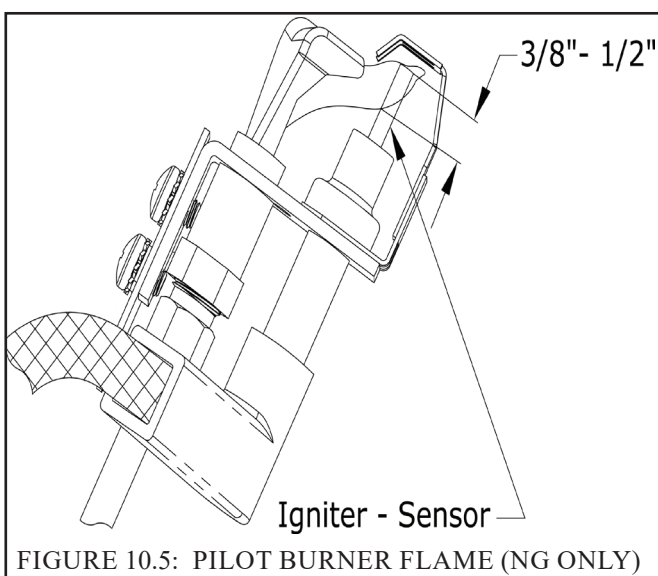
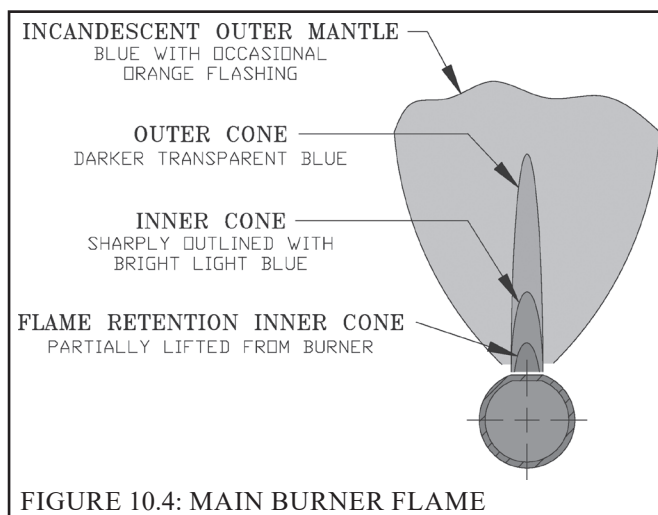
21) System Leak Check - After the boiler has operated for at least 30 minutes, check the boiler and heating system piping for leaks. Repair any leaks found at once.

CAUTION

System leaks can cause severe boiler damage.

22) Inspect the vent system for flue gas leaks - Repair any leaks found before leaving the boiler in operation.

- 23) Review User's Information Manual and system operation with owner or operator.



XI Operation

A. General Information

This boiler uses a proprietary version of the Honeywell S9361A “integrated boiler control” to manage all boiler functions including flame supervision, temperature control, and Circulator operation. This control can operate one or two circulator zones without the use of additional relays.

In accordance with the 2007 Energy and Independence Security Act, this control first attempts to use residual heat in the boiler to satisfy a space heating demand before firing the burner. In this manual, this function is referred to as a “thermal purge”. For additional information see Part C of this section.

B. Reading Status and Using Menu

The boiler’s status, as well as all parameters, are viewed and adjusted using the 3 digit LED and three buttons shown in Figure 11.0. The S9361A has four basic modes of operation (also see Figure 11.1):

- 1) Status Mode - This is the default mode of operation for the control. In it, the display alternates between *5ŁH* and a number indicating the current status of the boiler. A list and description of these status numbers is shown in Table 11.2 and is also shown on the face of the control itself.
- 2) Operating Mode - Provides additional information about the current status of the boiler. Operating mode is entered by pressing the **I** button shown in Figure 11.0. When this button is first pressed in Status mode, the display will alternately display *hŁ* and the current boiler water temperature as shown in Figure 11.3. Pressing the **I** button again will display the next line item shown in Table 11.2. In the same manner it is possible to advance through all of the “parameters” shown in Table 11.2. To return to Status mode, press **I** repeatedly until *5ŁH* once again appears on the display. Alternatively, the control will return to Status mode if no key is touched for 30 minutes.
- 3) Error Mode - In Error mode, the control alternately displays *Err* and an error code. A list of these error codes is found on the front of the control, as well as in Section XIII of this manual (along with suggested corrective actions).
- 4) Adjustment Mode - Used to change parameters, such as high limit setting. See Part C for using Adjustment Mode.

C. Using Adjustment Mode

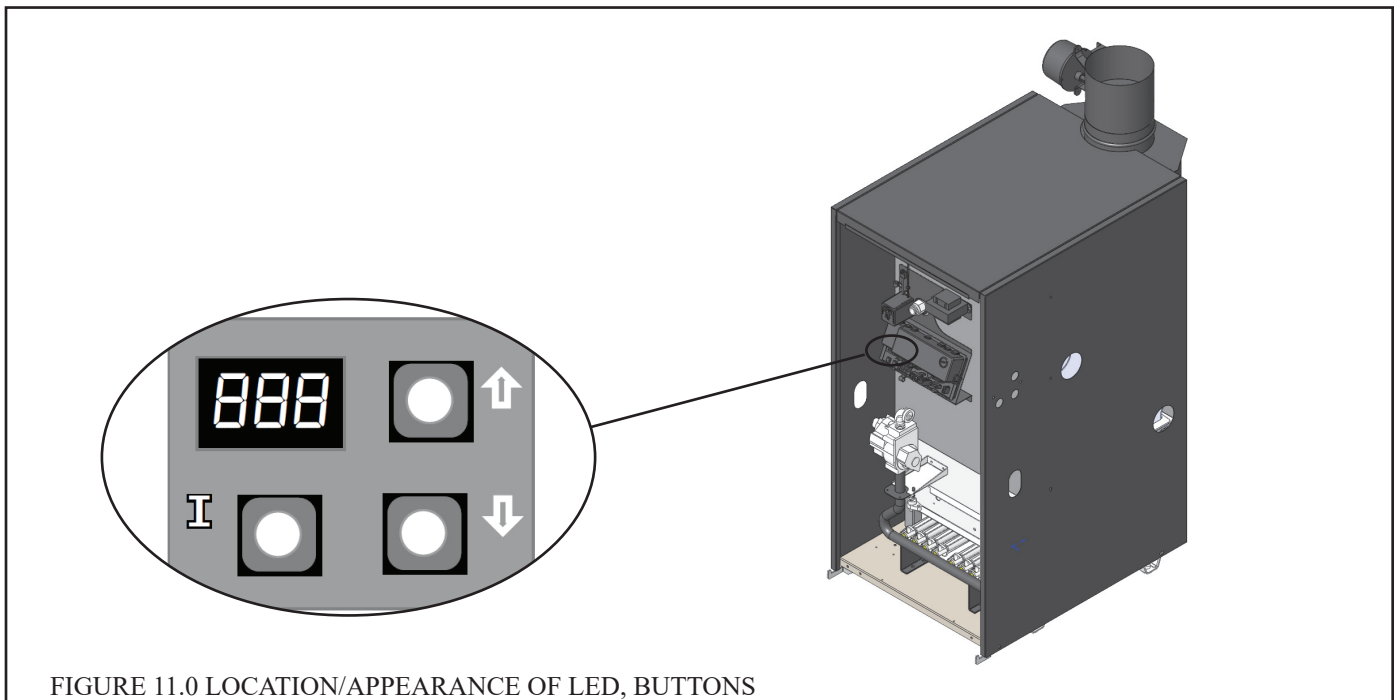
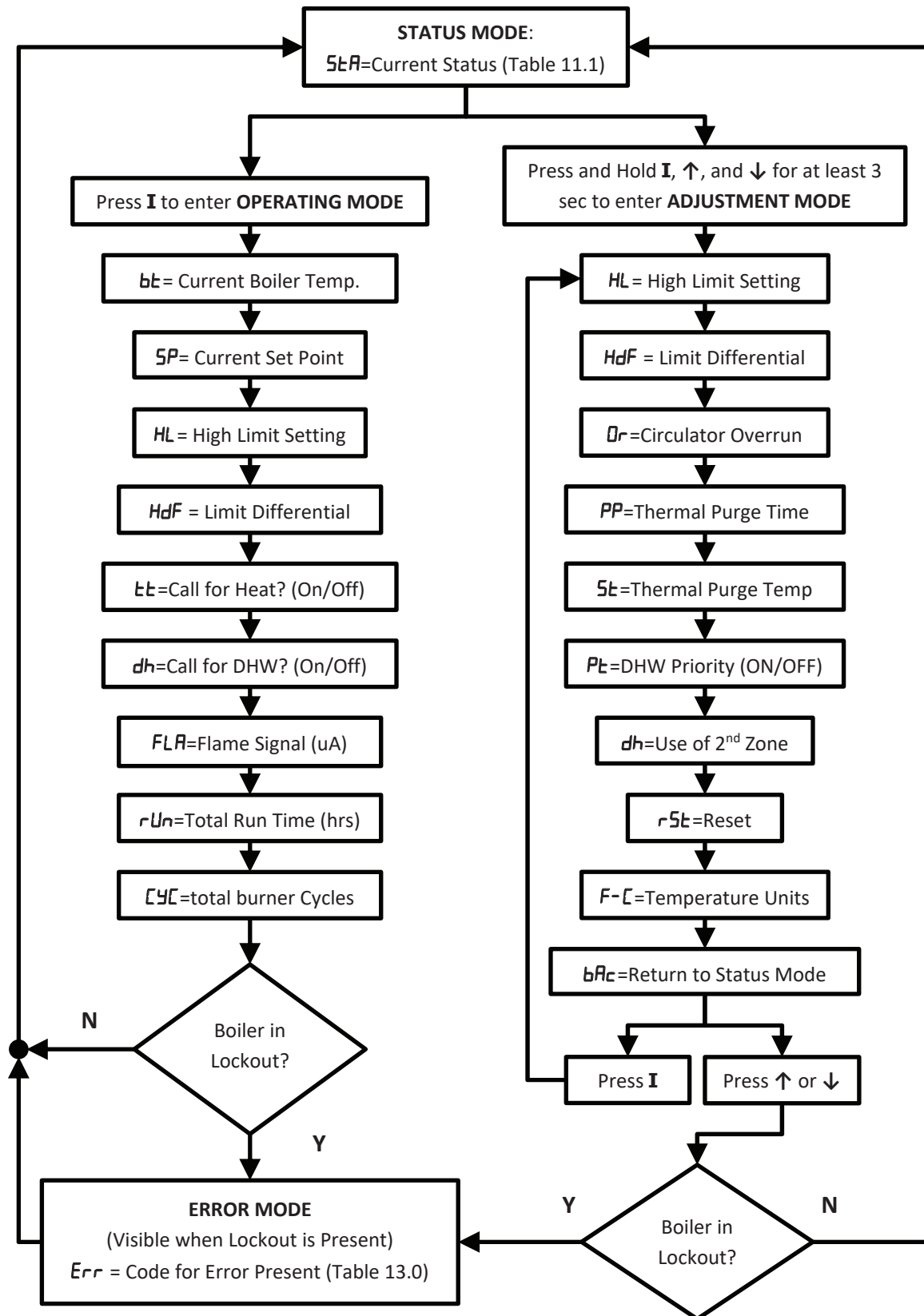


FIGURE 11.1: BOILER CONTROL MENU



- Except as shown above, press **I** to navigate through menu.
- Use **↑**, **↓** to change parameters in Adjustment Mode

TABLE 11.2: STATUS CODES

Status #	Description	Meaning
1	Standby	No call for heat or DHW OR Call for heat present , but boiler is in thermal purge (See <i>PP</i> on page 36) OR Call for heat/DHW present but boiler temperature is above set point (<i>SP</i>) setting.
4	Prepurge	Damper has opened and control is briefly waiting before starting trial for ignition (pre-purge time is 1.7s).
6	Spark	Control is attempting to light pilot
7	Flame proving	Control is verifying that the pilot flame is on and stable.
8	Running	Main burner is on
10	Retry/Recycle Delay	Control was unable to establish pilot and is waiting 5 minutes before trying again OR Proof of pilot was lost after pilot was established and control is waiting 10 seconds before attempting to relight.
13	Soft Lockout	A fault is preventing the boiler from firing. Boiler will be allowed to fire after problem clears itself AND a forced delay period has passed.
14	Hard Lockout	A fault has occurred which requires manual intervention before the boiler will again operate. This intervention can be in the form of interruption of the power supply to the boiler or resetting the control in Adjustment mode.
15	Waiting for limit to close	A call for heat/dhw is present, but there is an open safety device, such as a blocked vent switch, that is preventing the boiler from operating.
16	Flame Present out of Sequence	A flame was detected when none should have been present.
17	Self test	Boiler was just energized and control is running a self check.
18	Waiting for Damper to open	Control is waiting for vent damper to prove open
20	Damper failed to open	Damper failed to prove open 60 seconds after being called to open.

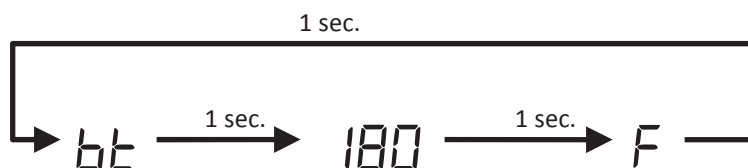


FIGURE 11.3: TYPICAL OPERATING MODE DISPLAY (BOILER TEMP SHOWN)

NOTE: In operating mode, holding either the $\uparrow$ or $\downarrow$ button while viewing a given parameter will keep the display on the actual reading. For example, pressing $\uparrow$ while reading boiler temperature as shown in Figure 11.3 will keep the display on 180 for as long as this button is held. This makes it easier to view readings “live” if they are changing rapidly.

TABLE 11.4: OPERATING MODE PARAMETERS

Parameter #	Description	Meaning
<i>b_t</i>	Boiler Temperature	Current boiler water temperature measured by the control's sensor.
<i>SP</i>	Boiler water set point	Current target temperature (always the same as the high limit setting.)
<i>HL</i>	High Limit Set point	Boiler will stop firing if boiler water temperature exceeds this value (Circulator/s will continue to operate)
<i>HdF</i>	High Limit Differential	If high limit setting is reached, boiler water temperature will need to drop by this amount before boiler will again fire during the same call for heat.
<i>tt</i>	Heat Request Status	Shown as either ON or OFF. Indicates whether there is a call for heat.
<i>dh</i>	DHW Request Status	Shown as either ON or OFF. Indicates whether there is a call for domestic hot water (DHW). Note that if the dh zone on the S9361A is used as a second heating zone (see Table 11.5), this parameter will be shown as OFF and tt will be shown as ON when this zone calls for heat.
<i>FLA</i>	Flame Current	Flame rectification signal (uA)
<i>run</i>	Run Time Hours	Total amount of time gas valve has been open (burner firing) since control was new (hours, starting from 1).
<i>CYC</i>	Boiler Cycles	Total number of burner cycles on the control
<i>Err</i>	Error Number	Present only if the control has detected a problem. See Table 13.0 for a list of error codes and suggested corrections.

TABLE 11.5: ADJUSTMENT MODE PARAMETERS

Status #	Description	Factory Setting	Permissible Range
<i>HL</i>	High Limit Set point	180F	140-220F
<i>dF</i>	High Limit Differential	15F	10-30F
<i>Or</i>	Circulator overrun	0 min	0-10 minutes
<i>PP</i>	Thermal Purge time	2 min	2-20 minutes
<i>St</i>	Thermal Purge Start Temp	140F	140-180F
<i>Pt</i>	DHW Priority	ON	ON or OFF
<i>dh</i>	Use of Second Zone	dh	dh (dhw) or tt2 (2nd heating zone).
<i>rst</i>	Reset	N/A	OFF or Momentary ON
<i>F-C</i>	Temperature Units	F	F or C
<i>baC</i>	Exit Adj. mode	N/A	N/A

A list of parameters which can be changed on this control are shown in Table 11.5. To enter Adjustment mode and change

 WARNING

Improper adjustments to control parameters could result in unreliable boiler operation, property damage, personal injury, or loss of life. Adjustments should only be made by a qualified heating technician.

parameters:

- 1) Press and hold **I**, **↑**, **↓** together for at least 3 seconds.
- 2) Use **I** to advance to the parameter which is to be changed.
- 3) Use the **↑** or **↓** buttons to change the setting or select from possible choices. See below for additional information on the use of these parameters.
- 4) If other parameters are to be changed, use the **I** button to advance to the next parameter needing adjustment and change it in the same way.
- 5) After all parameters have been changed, use the **I** button to advance until **bPc** is shown on the display.
- 6) Press either the **↑** or **↓** key to return to Status mode. Alternatively, the control will return to Status mode if no key is touched for 5 minutes.

HL (High limit Set point) - Burners shut down if the boiler water temperature exceeds this setting. The circulator will continue to run. Unless the Crown outdoor reset card is installed, the high limit setting also serves as the water temperature set point (**SP**) during calls for both heat and DHW.

dF (High limit differential) - If the boiler shuts off on high limit, the water temperature must fall by an amount equal to the differential during the same call for heat before the burners will again start. For example, with HL=180 and dF=15, the burners will shut off if the water temperature exceeds 180F and stay off until the temperature falls to 165F (180 - 15). Note that if all calls for heat end while the burners are off on high limit, the burner will not restart during the next call for heat until the thermal purge requirements described below are met.

Or (Circulator Overrun) - Determines how long the Heating Circulator will operate after the call for heat ends. In some cases, this can help reduce energy consumption by sending heat stored in the boiler out into the system. At the same time, caution should be exercised before setting this value to something other than zero. Before doing so, verify that the system will permit flow (e.g. flow is not completely cut-off by closed zone valves) and that the overrun will not cause overheating problems.

Circulator overrun is only possible on the heating zone. The DHW Circulator will not over-run, even if the DHW zone is used as a second heating zone.

PP (Thermal Purge Time) - Upon a call for heat, the boiler will prevent burner operation until either:

- The water temperature drops below the Thermal Purge start temperature (**St**) OR:
- The thermal purge time has passed

For some examples of this operation, see Table 11.6. If the “DHW” zone is used for space heating (dh=tt2), this thermal purge function will also keep the burner off at the beginning of a call from the thermostat connected to the “DHW” terminals in the manner described above. If the “DHW” zone is being used for DHW (dh=dh), the burners will immediately come on upon a call for DHW as long as the water temperature is below the high limit setting.

Thermal purge is only invoked when a call for heat first appears and the boiler is not already firing. For this reason, if the boiler is already firing in response to an call for heat, and a call for heat appears at the second zone, the boiler will continue to fire.

St (Thermal Purge Start Temperature) - See description for Thermal Purge Time above.

Pt (DHW Priority) - If this feature is turned on, and simultaneous calls for heat and DHW are present, the heating circulator will be forced off for as long as it takes the boiler to satisfy the call for DHW. This feature is sometimes useful when the boiler size is marginal for the peak DHW demand, but should be used with caution as it can result in lack of heat if the DHW call is very long,

TABLE 11.6 EXAMPLES OF THERMAL PURGE OPERATION

Example #	Call for Heat From	Use of DHW Zone	Thermal Purge Settings		Boiler Temp at Begin Call	Boiler Behavior
			Time (P _t)	Start Temp (S _t)		
1	T-T	N/A	2 min.	140F	130	• Heating Circulator starts immediately • Burner fires immediately
2	T-T	N/A	2 min.	140F	150	• Heating Circulator starts immediately • Burner fires when either: 2 minutes have passed OR Temperature falls below 140
3	DHW	DHW (dh=dh)	2 min.	140F	150	• DHW Circulator starts immediately • Burner fires immediately
4	Heat T'stat on DHW terminals	Heat (dh=tt2)	2 min.	140F	150	• "DHW" Circulator starts immediately • Burner fires when either: 2 minutes have passed OR Temperature falls below 140
5	T-T	N/A	2 min.	145F	150	• Heating Circulator starts immediately • Burner fires when either: 2 minutes have passed OR Temperature falls below 145
6	T-T	N/A	3 min.	140	150	• Heating Circulator starts immediately • Burner fires when either: 3 minutes have passed OR Temperature falls below 140

or if there is a problem with the DHW zone which causes the DHW demand to be indefinite. Figure 11.7 describes the behavior of both the Heating and DHW Circulators with P_t turned both ON and OFF.

dh (Use of DHW zone) - Although the second zone on the boiler is designated "DHW", it can be used as a second heating zone by setting dh = "tt2" instead of dh="dh". When the "DHW" zone is used for heating, the thermal purge function is active when this zone calls for heat. When dh = tt2, the setting of P_t (DHW priority) is ignored.

r5t (Reset) - Used to reset the boiler from a hard lockout (as an alternative to momentarily interrupting power to the control). Pressing the up key will turn rst momentarily to on. When it goes back off (typically within one or two seconds), the control is reset.

F-L (Temperature Units) - Determines whether temperature units on the S9361A are displayed in F or C. Note that this selection only applies to the temperature displayed on the LED shown in Figure 11.0.

TABLE 11.7 SUMMARY OF CIRCULATOR BEHAVIOR

Thermostat Inputs		Use of “DHW” Zone	Parameters		Circulator Outputs	
T-T	“DHW”		2nd Zone (dh)	DHW Priority (Pt)	Heating (Red Circ. Lead)	“DHW” (Blue Circ. Lead)
ON	OFF	DHW	dh=dh	On	ON	OFF
OFF	ON	DHW	dh=dh	On	OFF	ON
ON	ON	DHW	dh=dh	On	OFF	ON
ON	ON	DHW	dh=dh	OFF	ON	ON
ON	OFF	DHW	dh=dh	OFF	ON	OFF
OFF	ON	DHW	dh=dh	OFF	OFF	ON
ON	OFF	Heat	dh=tt2	On or OFF	ON	OFF
OFF	ON	Heat	dh=tt2	On or OFF	OFF	ON
ON	ON	Heat	dh=tt2	On or OFF	ON	ON

bAc (Return to Status mode) - Exits adjustment mode. Any changes made to the parameters described above are saved, and become effective, as soon as they are made; bAc only exits adjustment mode.

D. Sequence of Operation

(Refer to Figures 9.3 or 9.4 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.
- A call for heat from the thermostat connected to T-T energizes the Heating Circulator (connected to red and white leads in J-box).
- Depending on the boiler water temperature at the time of the call for heat, the control will do one of two things:
 - If the water temperature is below the thermal purge start temperature (5t), the control will continue the ignition sequence.
 - If the boiler water temperature is above the thermal purge start temperature, the boiler will wait until either of the following conditions are met before continuing the ignition sequence:
 - The boiler water temperature falls below the thermal purge start temperature (5t) Factory default is 140F.
 - The thermal purge time elapses (PP). Factory default is 2 minutes.
- If the blocked vent switch, flame roll-out switch, LWCO and any external limits are made, 24 VAC will be applied across pin terminal 2 (orange) and 4 (yellow) at the vent damper and the damper will open.
- Once the vent damper is fully open, an end switch inside the damper will make, energizing pin 3 (red) at the damper. The control reads 24VAC between this pin and pin 4 (yellow) as proof that the damper has opened.
- The control waits for a 1.7s “prepurge period” to pass before attempting to light the pilot.
- The control starts an ignition spark at the pilot and applies 24 volts across the pilot valve (terminals PV and MV/PV on the gas valve).
- 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 ground connection on the S9361A. 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.
- If the pilot is not proven within 90 seconds of the beginning of the trial for ignition, the pilot valve will close and wait 5 minutes before the ignition sequence is retried.
- Once the ignition module detects the presence of a pilot flame, voltage is applied across the main valve (terminals MV and MV/PV on the valve), opening the valve and establishing main flame.
- If the water temperature climbs above the high limit setting during the call for heat, the burner will shut down, and the vent

damper close, while the Heating Circulator continues to operate. The ignition sequence will restart (from Step 4) when the water temperature falls to the high limit setting (*HL*) minus the high limit differential (*HdF*).

- 12) A call for DHW results in a sequence of operation that is identical to that described above except for omission of the thermal purge function described in (3).

E. Safety Control Operation

Blocked Vent Switch - Automatically interrupts main burner operation in the event that a blocked vent causes flue gas to spill 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 and/or the combustion air supply. If the blocked vent switch opens, the cause of this problem must be found and corrected by a qualified gas service technician before the blocked vent switch is reset.

Flame Roll-out Switch - Automatically interrupts boiler 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 identical switch 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 identical one, before the boiler is returned to operation.

Low Water Cut-off (LWCO) – The probe type low water cut-off supplied with this boiler prevents the boiler from firing if the water level in the boiler is below that of the supply tapping. The water temperature sensor is installed in a special insulated “electro well” that doubles as an electrode for the LWCO. The LWCO applies voltage between this well and the boiler ground. If water is present at the well, the LWCO sensing circuit will detect current flowing from the well to ground through the water and will close a set of contacts in the limit circuit, allowing the burners to fire.

A green LED illuminates when the LWCO is powered. A yellow LED illuminates when water is not present at the level of the well. The TEST button simulates the absence of water in the boiler by breaking the circuit described above.

Important Product Safety Information: Refractory Ceramic Fiber Product

WARNING

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

Precautionary Measures:

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

First Aid Procedures:

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

 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.

The following routine maintenance should be performed on an annual basis:

- 1) Turn off electrical power and gas supply to the boiler.
- 2) Inspect the flue passages for signs of blockage. If there is any carbon in the combustion chamber or the flue passages, clean the heat exchanger before proceeding further. See the cleaning procedure below.
- 3) Remove all burners, noting the location of the pilot main burner. If burners show signs of deterioration, they should be replaced (some discoloration around the burner ports is normal). Clean the burners by first brushing the ports with a soft bristle brush and then vacuuming out any debris through the venturi opening.
- 4) Remove any debris found in the combustion chamber, being careful not to disturb combustion chamber insulation.
- 5) Inspect the pilot assembly. Clean any deposits found on the electrode and grounding strap. The ideal gap between the electrode and the ground strap is 1/8". Inspect the porcelain for cracks or other deterioration. Replace pilot assembly if deterioration is found.
- 6) Inspect the base insulation for deterioration. Replace if necessary.
- 7) Inspect the ignition cable insulation for cracks or other deterioration. If deterioration is found, replace cable.
- 8) Reinstall burners, being careful to put the pilot main burner in its original location.
- 9) Inspect all boiler wiring for loose connections or deterioration.
- 10) Inspect the vent system:
 - Make sure that the vent system is free of obstructions.
 - Make sure that all vent system supports are intact.
 - Inspect joints for signs of condensate or flue gas leakage.
 - Inspect venting components for corrosion or other deterioration. Replace any defective vent components.
- 11) Inspect the boiler and hydronic system for leaks.
- 12) Place the boiler back in operation using the procedure outlined in "Start-up". Check the pilot line and any other gas piping disturbed during the inspection process for leaks.

Heat Exchanger Cleaning Procedure

WARNING

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 collector so that the sample is taken in the area directly over the heat exchanger. Do not take a 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
- Damaged base
- Inadequate supply of combustion air

- 1) Turn off electrical power and gas supply to the boiler.
- 2) Disconnect the damper and vent connector from the boiler.
- 3) Remove the top jacket panel. If possible, remove the rear and left side jacket panels.
- 4) Remove the burners.
- 5) Disconnect the wiring at the blocked vent switch.
- 6) Remove the four #10 sheet metal screws holding the flue collector onto the block. Also remove the two #10 sheet metal screws securing the flue collector to the rear jacket panel.
- 7) Remove the flue collector from the heat exchanger.
- 8) Carefully remove the flue collector gasket strips and set them aside.
- 9) Clean the flue passageways using a stiff bristle brush. Be certain that all foreign material is removed from the gaps between the pins.
- 10) Clean the bottom surfaces of the heat exchanger.
- 11) Put a light in the combustion chamber and look through the flue passages from the top to verify that they have been thoroughly cleaned.
- 12) Replace the flue collector gasket strips. If desired, RTV-732 silicone sealant with a 500F intermittent duty temperature rating may be substituted for this rope gasket. The flue collector must be thoroughly sealed to the heat exchanger.
- 13) Reassemble the rest of the boiler in reverse order of above.

XIII Troubleshooting

A. Before 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 X (Start-up and Checkout).
- 3) 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 9.3 and 9.4. Ensure that incoming 120 VAC power polarity is correct and that the boiler is properly grounded. Further, ensure that the control power supply is 24 VAC (minimum 18 VAC to maximum 30 VAC).
- 4) All controls on the boiler 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.
- 5) 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.

B. If Display is Blank

- 1) Check for 24 VAC on transformer secondary connections (screws to which blue and yellow leads are connected). If voltage across these screws is between 18 and 30 VAC, possible causes include:
 - Loose connection at either plug or transformer end of transformer harness (blue/yellow harness).
 - Defective transformer harness
 - Defective boiler control
- 2) If voltage is less than 18VAC at transfer secondary, possible causes include:
 - Service switch off
 - Trip 120VAC breaker
 - Miswired or loose connection in 120VAC boiler circuit.
 - Loose connection inside J-box between transformer primary and 120VAC line.
 - Defective transformer (possibly caused by short circuit in 24VAC wiring or additional loads connected to the transformer in the field).

C. If Control Shows *Err* Code

Use Table 13.0 to help identify and correct the cause of the problem.

D. If Control Shows *5EA* Code, but Other Problem Present

If no *Err* Code is observed (even after repeatedly pressing **I** to cycle through Operation Mode), use Table 13.1 to help identify and correct the cause of the problem.

TABLE 13.0 - ERROR CODES

Error Code	Meaning	Possible Cause
4	Low Flame Signal	- Low gas pressure at gas valve inlet - Partially plugged pilot tubing or pilot orifice - Loose connection in ignition cable or ground wiring - Dirty pilot electrode/ground strap - Pilot electrode porcelain cracked - Damaged pilot hood/ assembly - Defective control
6	Pilot Flame detected when no flame should be present	- Defective gas valve - High gas pressure - Defective control
18	Internal electronics failure	Possible internal problem with boiler control. Cycle power to the boiler and replace control if problem persists.
23	Flame sensed during 1.7s pre-purge (before pilot valve opened)	- Defective gas valve - High gas pressure - Defective control
32	Boiler water temperature sensor failure	- Loose sensor connection at control - Defective Sensor - Defective control
35	Duplicate Zone	Error code reserved for future use
55	Damper failed to open after 60s	- Loose or defective damper harness - Obstruction in path of damper blade - Defective damper - Defective control
56	Power at end of limit string when it shouldn't be.	Control, vent damper, or damper harness is defective. With Error 56 present, and no call for heat, unplug damper harness from control and check for 24VAC between terminal P6-5 on control (see Figure 9.2 for location) and ground. If voltage is present, replace control. If not, inspect the damper harness for shorts or miswired connections. If no harness defect is found, replace vent damper.
57	Grounded pilot electrode	- Condensate or foreign material is shorting pilot electrode to ground. - Ignition cable insulation is damaged and touching ground. - Pilot is damaged
58	AC Power Frequency Error	120VAC power supply frequency is incorrect (Should be 60Hz) 120VAC power supply is dirty (consult electrician and/or Utility) - Boiler water temperature sensor common (center wire) is damaged and shorted to ground
59	Line voltage error (Supply voltage too high or low)	- Power supply voltage is incorrect (should be 120VAC nominal) - Defective or incorrect 24VAC transformer - Loose 120VAC connection or 24VAC connection between transformer and control
60	Thermostat input higher than threshold	External voltage is applied to thermostat connections (most common cause is external transformer in old thermostat wiring).
61	Line Voltage Unstable	120VAC power supply is dirty (consult electrician and/or Utility) - Loose 120VAC connection or 24VAC connection between transformer and control - Large electrical loads elsewhere on the installation are switching on and off, causing incoming voltage to swing excessively at boiler.
63	Maximum recycles exceeded	See Error Code 4 above (boiler lost proof of pilot 6 times in a row)
64	Internal failure	- Loose or defective damper harness - Obstruction in path of damper blade - Defective damper - Improper pilot operation - If problem persists, replace control
89	EnviraCom communication lost	Communication lost between boiler control and EnviraCom thermostat

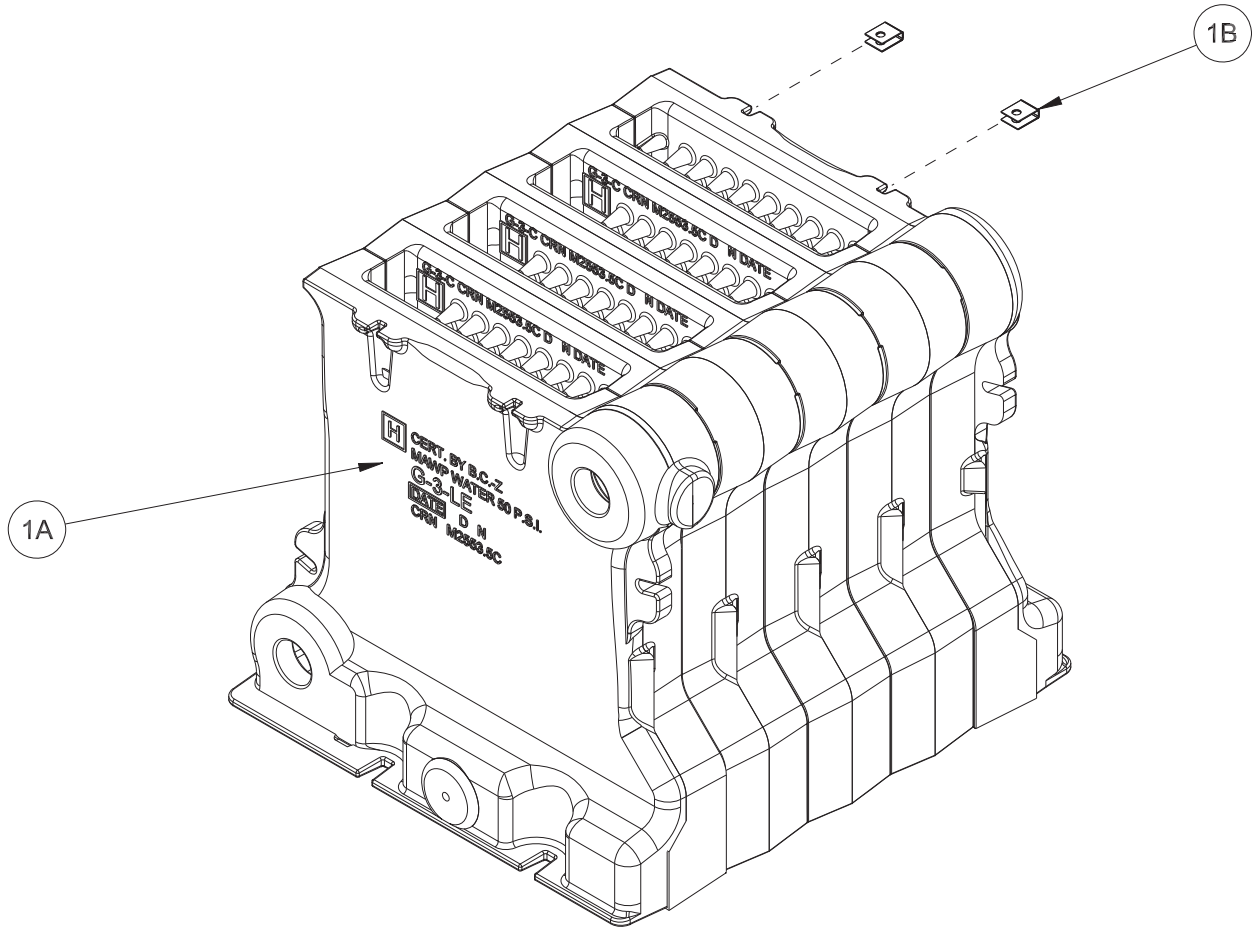
TABLE 13.1 - FAULTS WITHOUT ERROR CODE PRESENT

Displayed Codes	Problem	Possible Cause
5tA 1 tE OFF dh OFF	Burners and Circulator Off	- Thermostat/s not calling for heat - Loose connection in thermostat, zone valve end switch, or zone panel wiring. - Thermostat, zone valve, or zone panel miswired - Defective thermostat, zone valve, or zone panel
5tA 1 tE On	Burners Off Circulator On Boiler Warm	- Boiler off on high limit (normal operation) - Boiler off on thermal purge (normal operation - See Table 11.6)
tE On	Heating Circulator Off	- Heating Circulator is being forced off on DHW priority (normal operation if P_E=ON - see Table 11.7). - See causes for “DHW Circulator off “ below
dh On	DHW Circulator Off	- Loose connection in circulator wiring - Defective circulator - Circulator is running, but system problem is preventing circulation
5tA 15	Burners Off and Damper is closed. Green LWCO light is on. Yellow light is off.	- External limit is open or jumper plug is missing. - Blocked vent switch (BVS) open due to problem with vent system, such as a blocked chimney, or a combustion air supply problem. Correct and press reset button on BVS. - Flame roll-out switch (FRS) open due to blocked heat exchanger. Correct problem and replace FRS with exact replacement (see parts list)
5tA 15	Burners Off and Damper Closed. Both Green and Yellow lights are on.	- Low water condition exists in boiler. Verify that boiler and heating system are completely filled with water. - Temperature probe is not inserted into well.
5tA 6	No spark at pilot	- Loose connection in ignition cable or pilot ground - Damaged electrode porcelain or ignition wire insulation (replace pilot) - Pilot electrode or Ground strap damaged (replace pilot) - If you cannot hear spark at all , replace control
5tA 6	Spark, but no pilot flame	- Low inlet gas pressure - Plugged, kinked, or leaking pilot tubing - Plugged pilot orifice - Gas line not purged of air - Defective pilot assembly - Defective gas valve (before replacing, confirm that there is 24VAC between PV and MV/ PV. If there is not, control harness is loose or the control itself is defective). - Loose connection in harness between control and gas valve.
5tA 6	Pilot flame present, but spark does not shut off	- Low inlet gas pressure - Partially plugged, kinked, or leaking pilot tubing - Partially plugged pilot orifice - Loose connection in ignition cable or pilot ground - Damaged electrode porcelain or ignition wire insulation (replace pilot) - Pilot electrode or Ground strap damaged (replace pilot) - Defective Control
5tA 8	Pilot flame present, spark off, but Main Burner does not light at all	- Loose connection in harness between control and gas valve - Defective gas valve (before replacing, confirm that there is 24VAC between MV and MV/ PV. If there is not either there is a loose connection in the control harness or the control itself is defective).
5tA 10	Main burner lights, but shuts off immediately	- Low inlet gas pressure - Partially plugged, kinked, or leaking pilot tubing - Partially plugged pilot orifice
5tA 10 or 5tA 13	No spark or pilot	Pilot was either never established or proof of pilot was lost after it was lit. Cycle power to the boiler and look for symptoms above.

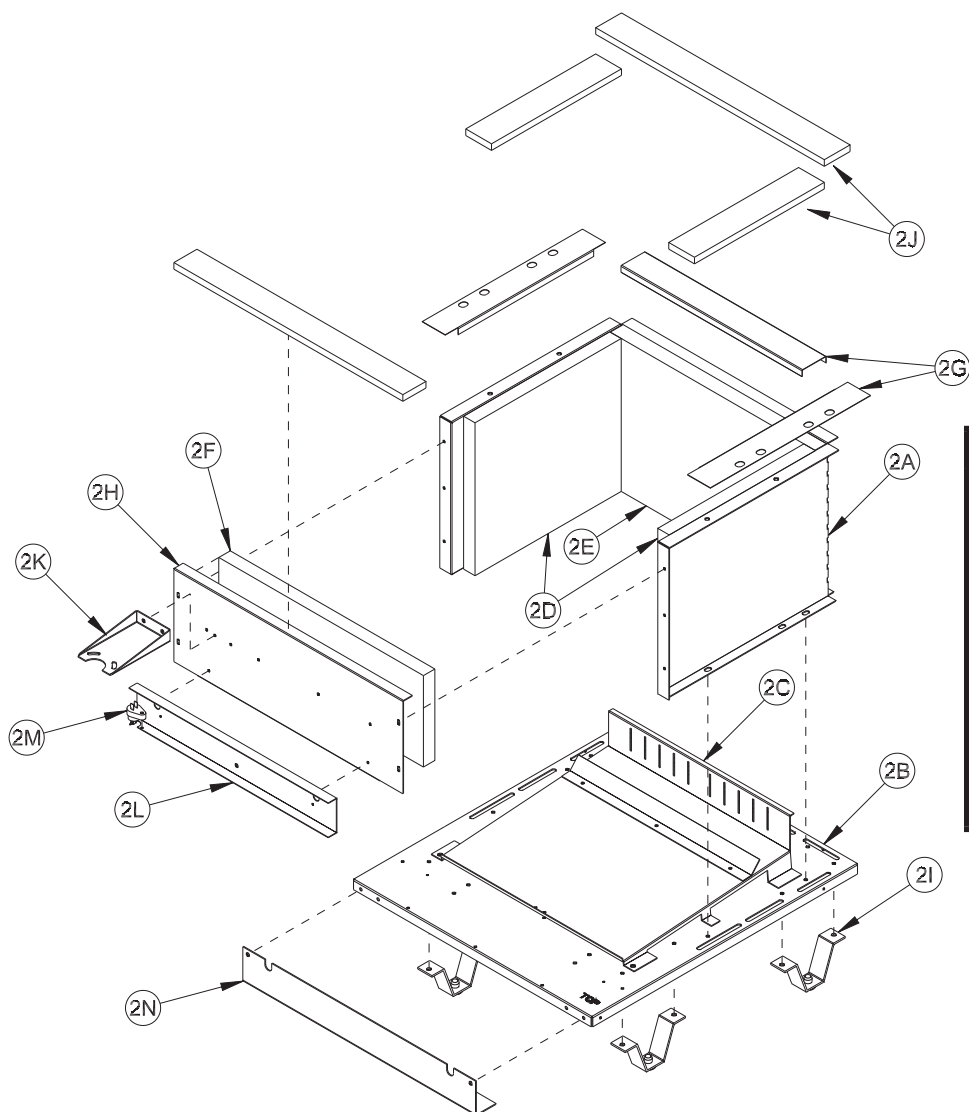
XIV PARTS

All Service Parts may be obtained through your local Crown distributor. Should you require assistance in locating a Crown distributor in your area, or have questions regarding the availability of products or service parts, please contact us at (215) 535-8900 or Fax (215) 535-9736.

Main burner orifice shown are for sea level configured boilers. For boilers installed at elevations above 2000 ft, consult the local Crown representative or the factory for the correct main burner orifice.



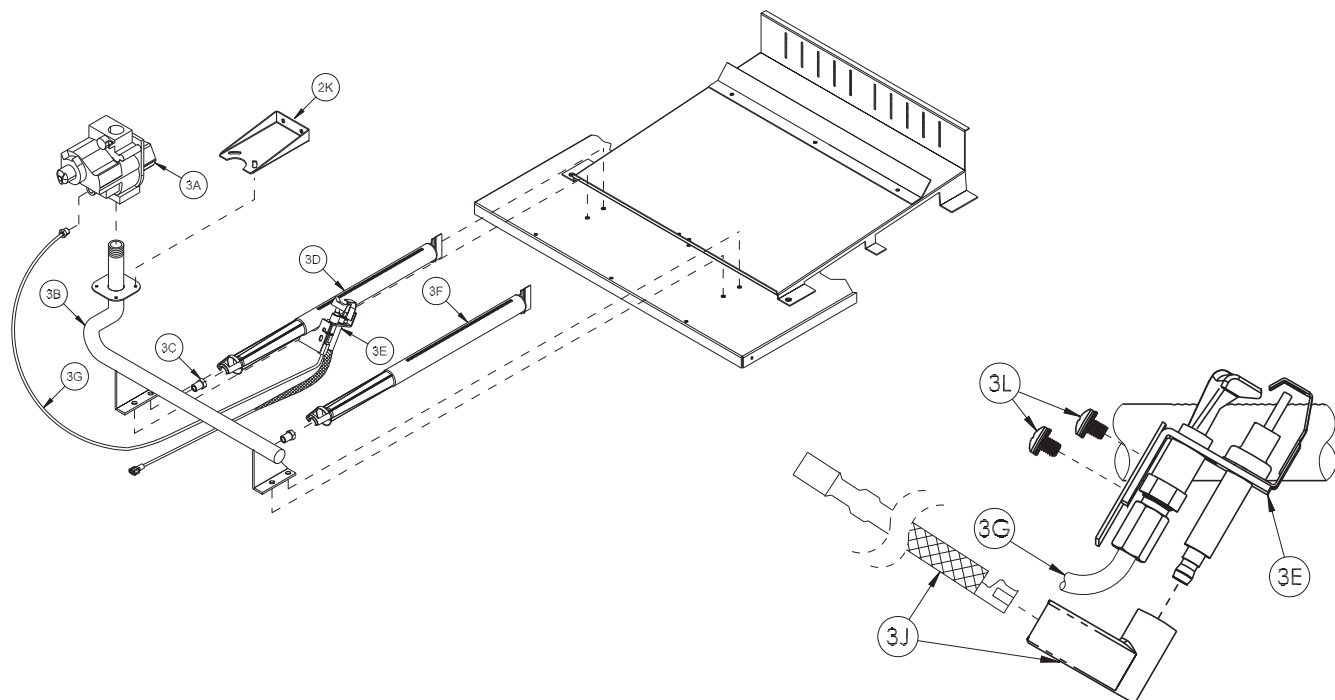
Key	Description	Part Number [Quantity]							
		2 Section	3 Section	4 Section	5 Section	6 Section	7 Section	8 Section	9 Section
1A	Section Assembly	760012 [1]	760013 [1]	760014 [1]	760015 [1]	760016 [1]	760017 [1]	760018 [1]	760019 [1]
1B	Tinnerman Clip	900164 [4]							



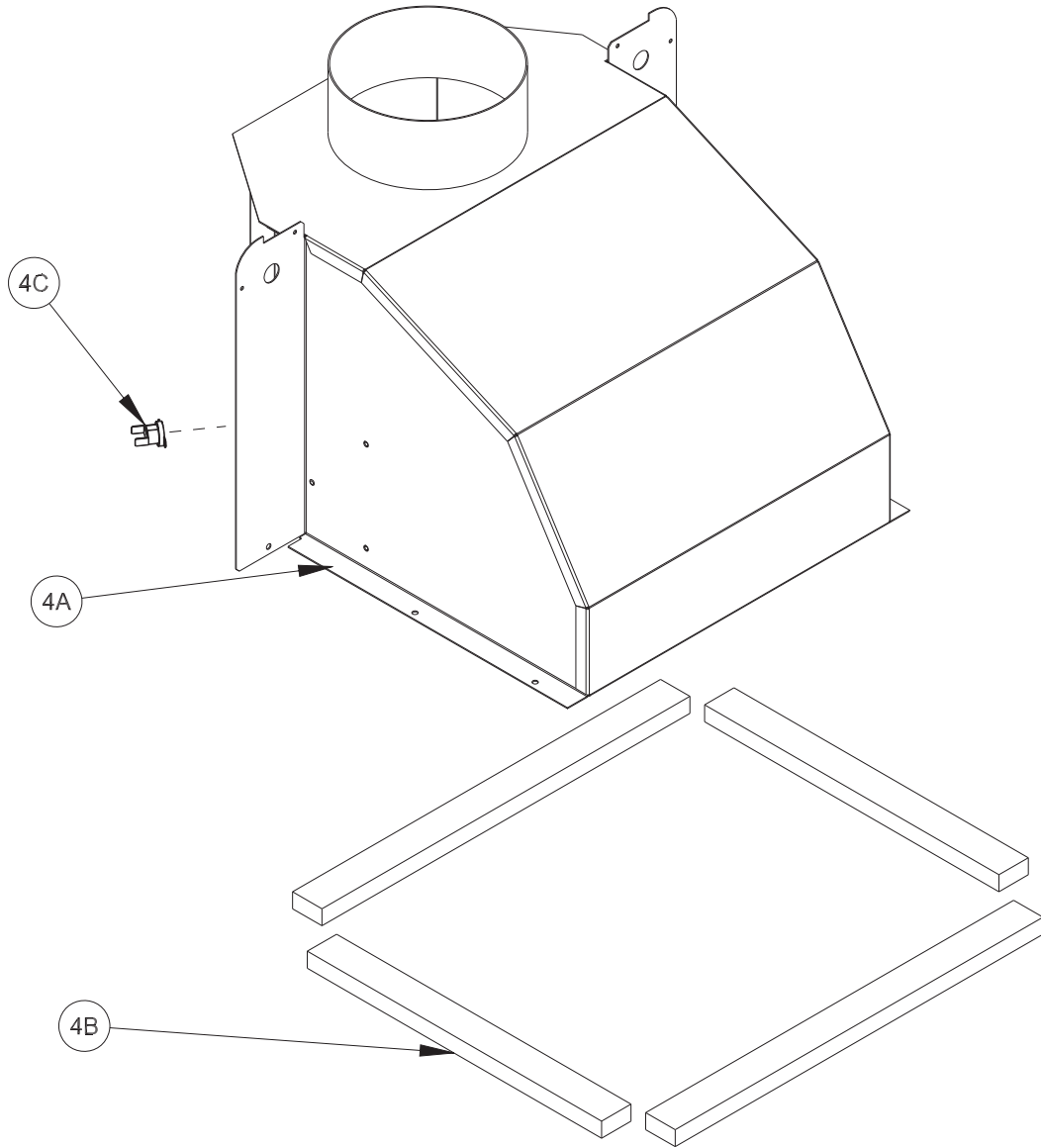
WARNING

If base must be replaced, there is a good chance pilot assembly and pilot tubing will need to be replaced as well. Replacement pilot assemblies are shown on page 48. Also check condition of manifold and gas valve and replace if they show any signs of heat, corrosion, or water damage.

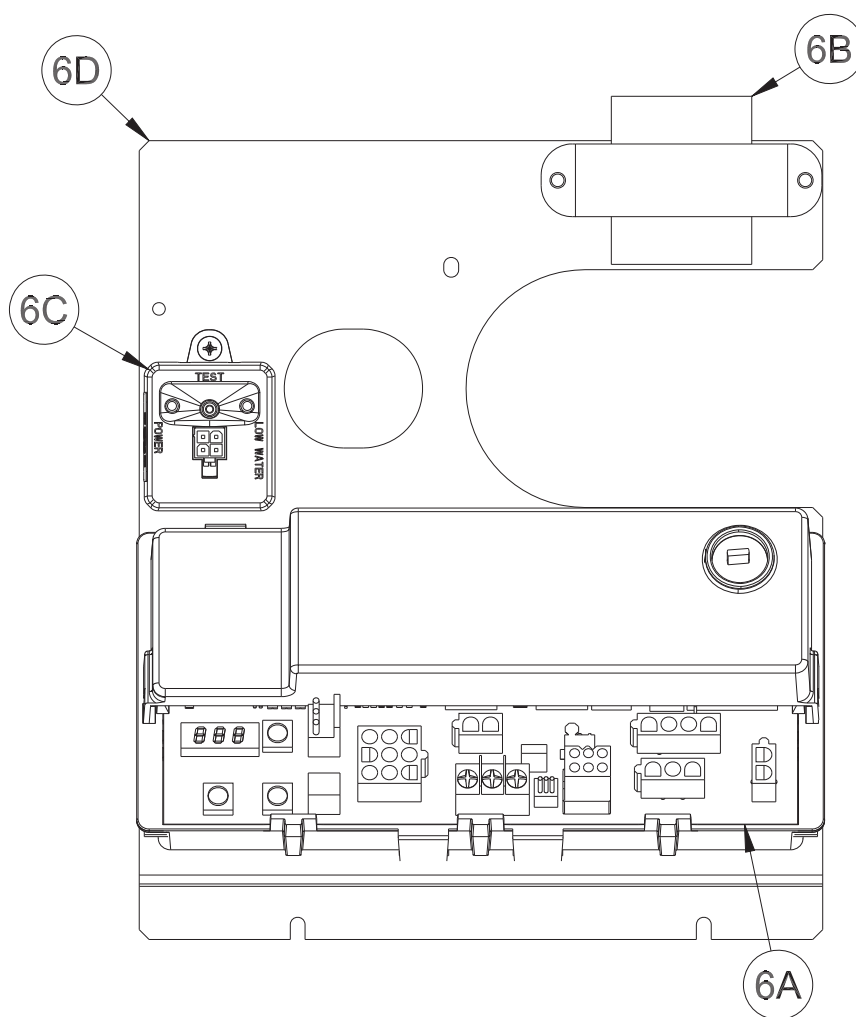
Key No.	Description	Part Number [Quantity]							
		2 Section	3 Section	4 Section	5 Section	6 Section	7 Section	8 Section	9 section
2A	Base Wrapper	660112 [1]	660113 [1]	660114 [1]	660115 [1]	660116 [1]	660117 [1]	660118 [1]	660119 [1]
2B	Base Tray								
2C	Burner Tray Assembly								
2D	Base Side Insulation								
2E	Base Rear Insulation								
2F	Base Front Insulation								
2G	Drip Shields								
2H	Base Front Panel								
2I	Base Leg Assembly								
2J	Base Gasket								
2J	Base Gasket Kit	6206002 [1]							
2K	Manifold Support Bracket	760150 [1]							
2L	Burner Access Panel	760622 [1]	760623 [1]	760624 [1]	760625 [1]	760626 [1]	760627 [1]	760628 [1]	760629 [1]
2M	Flame Rollout Switch G4AM0600240C	960122 [1]							
2N	Front Air Dam	760632 [1]	103718-03 [1]	103718-04 [1]	103718-05 [1]	103718-06 [1]	103718-07 [1]	103718-08 [1]	103718-09 [1]



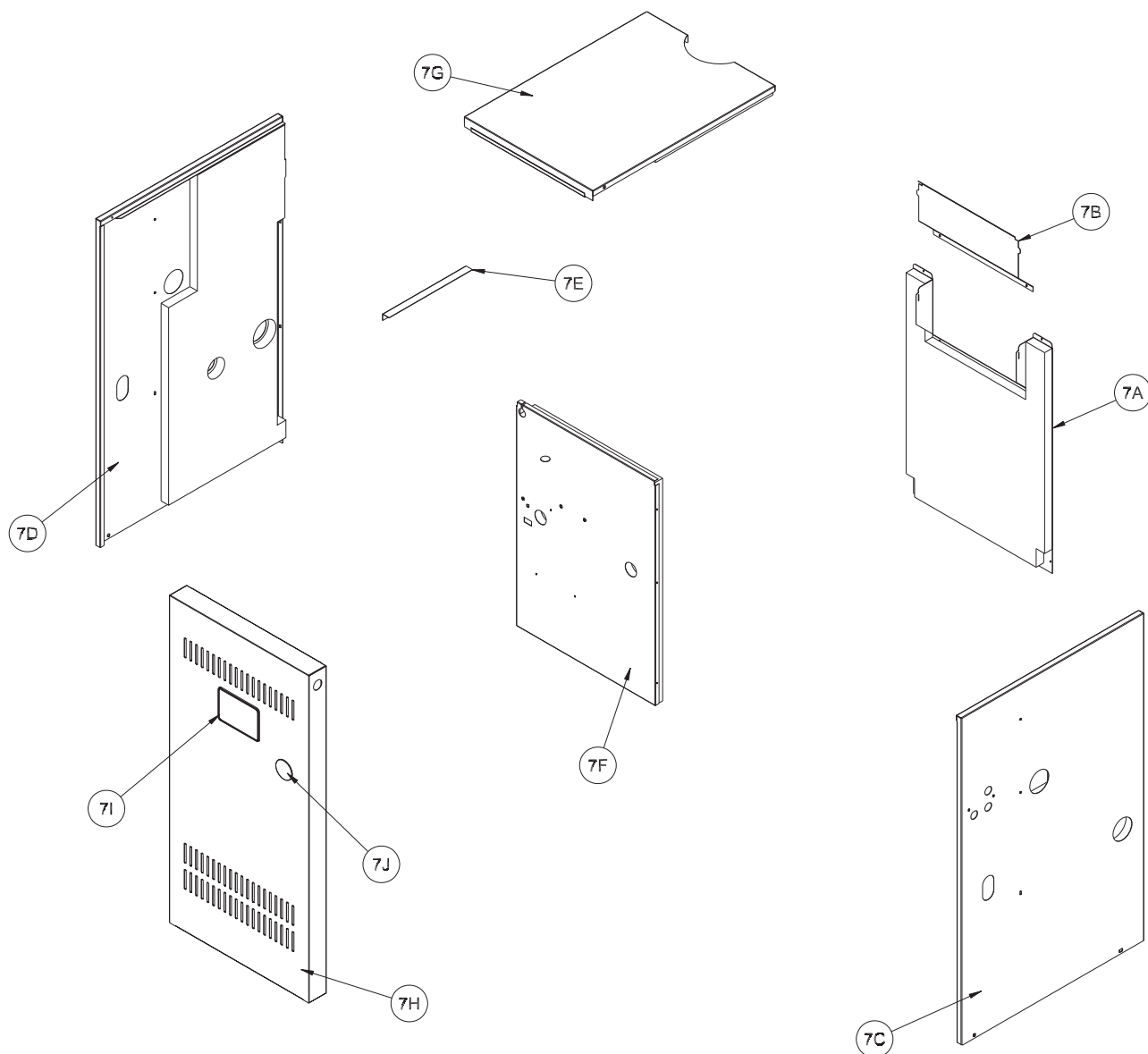
Key No.	Description	Part Number [Quantity]							
		2 Section	3 Section	4 Section	5 Section	6 Section	7 Section	8 Section	9 Section
3A	Gas Valve (Natural Gas), VR8204C6000	3507020 [1]					N/A		
	Gas Valve (Natural Gas), VR8304P4553	N/A					109882-01 [1]		
	Gas Valve (LP Gas), VR8204C6018	3507220 [1]					N/A		
	Gas Valve (LP Gas), VR8304P4280	N/A					3507240 [1]		
3B	Gas Manifold	760152 {1}	760153 [1]	760154 [1]	760155 [1]	760156 [1]	760157 [1]	760158 [1]	760159 [1]
3C	#46 Gas Orifice (Natural Gas, Sea Level - 2000ft)	950302 [2]	N/A						
	#47 Gas Orifice (Natural Gas, Sea Level - 2000ft)	N/A	950303 [4]	950303 [6]	950303 [8]	950303 [10]	950303 [12]	950303 [14]	950303 [16]
	1.25mm Gas Orifice (LP Gas, Sea Level - 2000ft)	950336 [2]	N/A						
	1.20mm Gas Orifice (LP Gas, Sea Level - 2000ft)	N/A	950346 [4]	950346 [6]	950346 [8]	950346 [10]	950346 [12]	950346 [14]	950346 [16]
	Gas Orifice (Natural Gas, 2001 - 10,000ft)	N/A	SEE APPENDIX TABLE A2 FOR CORRECT ORIFICE						
	Gas Orifice (LP Gas, 2001 - 10,000ft)	N/A	SEE APPENDIX TABLE A2 FOR CORRECT ORIFICE						
3D	Main Burner with Pilot Bracket	107652 [1]							
3E	Pilot Assembly - (Natural Gas) Honeywell Q345A2369	109597-01 [1]							
	Pilot Assembly - (LP Gas) Honeywell Q348A1511	3504085 [1]							
3F	Main Burner less Pilot Bracket	107651-01 [1]	107651-01 [3]	107651-01 [5]	107651-01 [7]	107651-01 [9]	107651-01 [11]	107651-01 [13]	107651-01 [15]
3G	Pilot Tubing with Ferrules	90-042 [1]						90-043 [1]	
3J	Ignition Cable Assembly (Natural Gas Only)	3501136 [1]							
3L	Machine Screw, 10-32 x 1/4" with External Tooth Washer	146-95-301 (Natural Gas [2], LP Gas [1])							



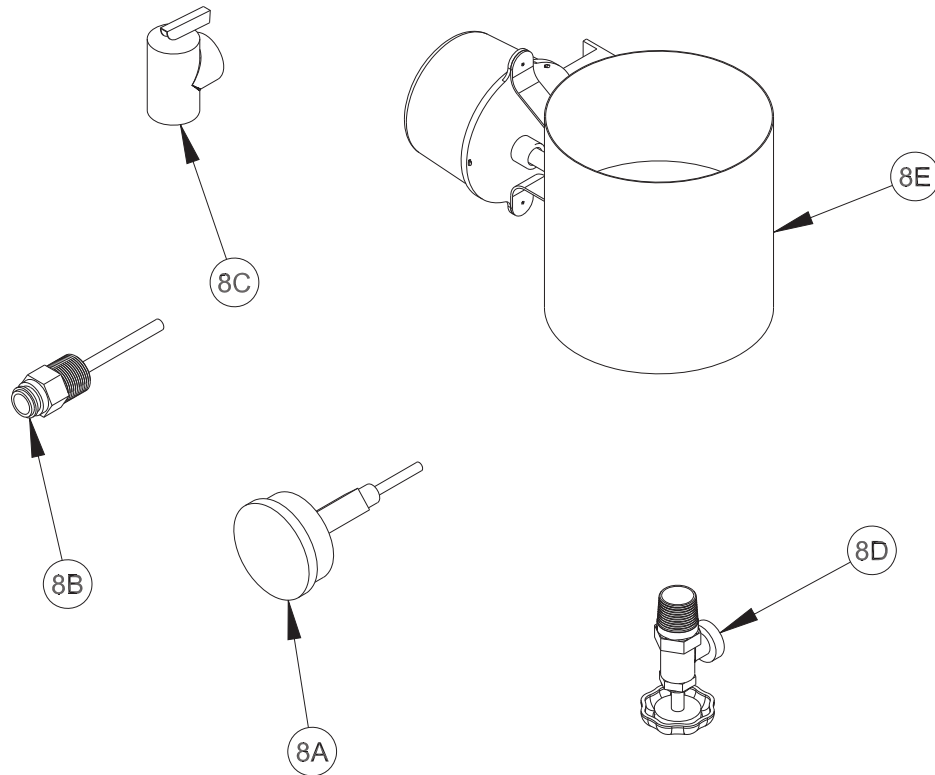
Key No.	Description	Part Number [Quantity]							
		2 Section	3 Section	4 Section	5 Section	6 Section	7 Section	8 Section	
4A	Drafthood	760122 [1]	760123 [1]	760124 [1]	760125 [1]	760126 [1]	760127 [1]	760128 [1]	760129 [1]
4B	Drafthood Gasket Kit	6206001 [1]							
4C	Blocked Vent Switch	960129 [1]							



Key No.	Description	Part Number [Quantity]							
		2 Section	3 Section	4 Section	5 Section	6 Section	7 Section	8 Section	9 Section
6A	Integrated Boiler Control (Honeywell S9361A2076)	3505076 [1]							
6B	Transformer (Honeywell AT140B1297)	106034-01 [1]							
6C	Hydrolevel IDL 1200 LWCO	450608 [1]							
6D	Control Bracket	109353-01 [1]							
Not Shown	Sensor Clamp	350077 [1]							



Key No.	Description	Part Number [Quantity]							
		2 Section	3 Section	4 Section	5 Section	6 Section	7 Section	8 Section	9 Section
7A	Rear Jacket Panel	760302 [1]	760303 [1]	760304 [1]	760305 [1]	760306 [1]	760307 [1]	760308 [1]	760309 [1]
7B	Rear Discharge Chute	760342 [1]	760343 [1]	760344 [1]	760345 [1]	760346 [1]	760347 [1]	760348 [1]	760349 [1]
7C	Right Jacket Panel	760400 [1]							
7D	Left Jacket Panel	760401 [1]							
7E	Wire Shield	760353 [1]							
7F	Vestibule Jacket Panel	760432 [1]	760433 [1]	760434 [1]	760435 [1]	760436 [1]	760437 [1]	760438 [1]	760439 [1]
7G	Top Jacket Panel	760322 [1]	760323 [1]	760324 [1]	760325 [1]	760326 [1]	760327 [1]	760328 [1]	760329 [1]
7H	Door Panel Assembly	762312 [1]	762313 [1]	762314 [1]	762315 [1]	762316 [1]	762317 [1]	762318 [1]	762319 [1]
7I	Logo Plate	110055-02 [1]							
7J	Heyco 2" Window Plug	900723 [1]							

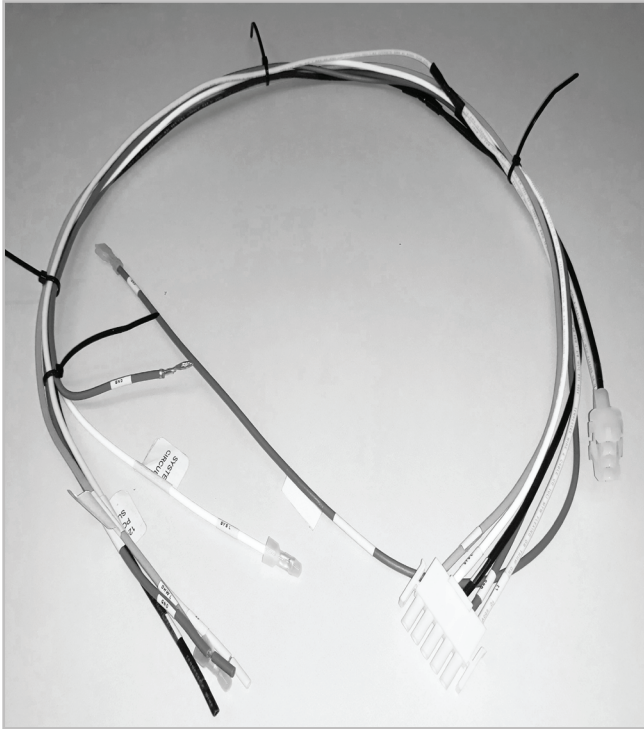


Key No.	Description	Part Number [Quantity]							
		2 Section	3 Section	4 Section	5 Section	6 Section	7 Section	8 Section	9 Section
8A	Temperature/Pressure Gauge	95-038 [1]							
8B	1/2" Short Electrowell (Hydrolevel 48-221)*	450353 [1]							
8C	3/4" Safety Relief Valve (30 psi)	95-040 [1]							
8D	Boiler Drain Valve	95-0415 [1]							
8E	Vent Damper	96-030 [1]	96-030 [1]	96-031 [1]	96-032 [1]	96-033 [1]	96-033 [1]	96-035 [1]	96-035 [1]

⚠ WARNING

Use of a control well other than that shown above may render the low water cut-off feature on this boiler inoperative.

9A



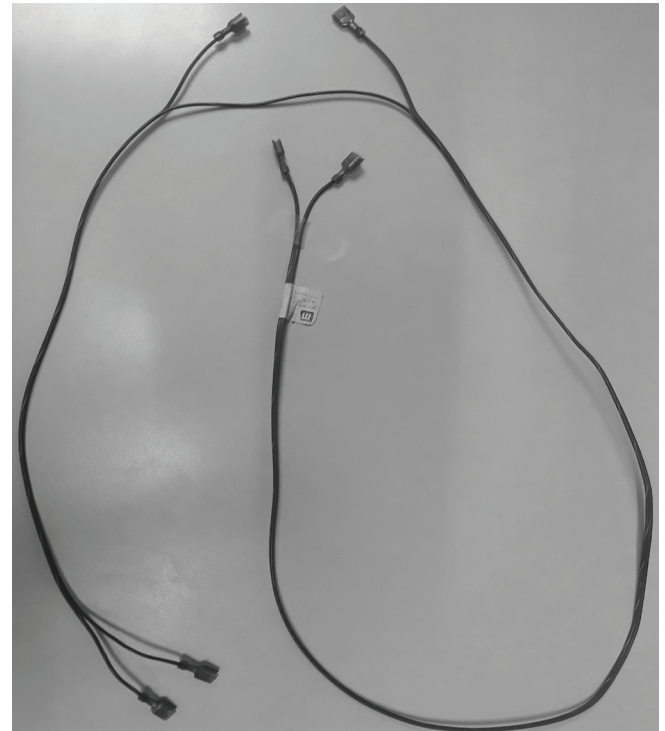
9B



9C



9D



Key No.	Description		Part Number [Quantity]							
		2 Section	3 Section	4 Section	5 Section	6 Section	7 Section	8 Section	9 Section	
9A	Line Voltage Wire Harness	110012-01 [1]					110011-01 [1]			
9B	Low Voltage Wire Harness	9601803 [1]								
9C	Vent Damper Harness	9601850 [1]								
9D	Blocked Vent Switch-Flame Rollout Switch Harness	9601805 [1]								

Appendix A: Instructions for High Altitude Installations (US Only)

As with most gas appliances, special consideration must be given when this boiler is installed at altitudes above 2000 ft:

- AWR Series boilers is not certified for installation above 2000ft in Canada.
- Do not install the AWR038B at altitudes above 2000ft anywhere.
- When installed above 2000ft, input ratings for the AWR070B – AWR280B are derated by 4% for each 1000 ft above sea level in accordance with *The National Fuel Gas Code* (NPA-54 ANSI Z223.1). For example, a boiler that is to be installed at 4000 ft must be derated by 16%. This input derate is accomplished through the use of smaller main burner orifice. This reduction in input results in a correspondingly lower output and must be considered when sizing the boiler. Approximate inputs as a function of altitude are shown in Table A1.

WARNING

- Safe operation of this boiler depends upon the use of the correct burner orifice. See the tables below for the correct configuration. Failure to properly configure this boiler for the installation altitude could cause personal injury or death due to Carbon Monoxide (CO) poisoning.
- Orifice for this boiler cannot be drilled in the field. Obtain orifice for the proper altitude from the local distributor (see Service Parts). Part Numbers for the correct size and style orifice are shown in Table A2.

Boilers that are factory configured for high altitudes have the altitude (or range of altitudes) for which the boiler is configured marked on the packaging. Since it is possible for the orifice to be changed between the factory and the end user, always verify that the correct orifice is in place for the installation altitude before placing the boiler in operation. The size of the orifice may be found on one of its wrench flats.

Manifold pressures, as well as minimum and maximum inlet pressures, are the same as at sea level.

CAUTION

- When orificing a boiler for an “odd” altitude, select the orifice for the higher altitude shown in the tables below. For example, orifice a boiler being installed at 4100ft as though it were being installed at 5000ft.
- When sizing a vent system for this boiler in accordance with the *National Fuel Gas Code* (NFPA-54/ANSI Z223.1), use the sea level input ratings to determine the maximum capacity of a given vent system. Use the high altitude input ratings in Table 1 to determine the minimum capacity of the vent system.

Table A1: Approximate Input (BTU/hr) at Various Altitudes*

Model	Altitude (ft)									
	Sea Level	2000	3000	4000	5000	6000	7000	8000	9000	10000
AWR070	70000	64400	61600	58800	56000	53200	50400	47600	44800	42000
AWR105	105000	96600	92400	88200	84000	79800	75600	71400	67200	63000
AWR140	140000	128800	123200	117600	112000	106400	100800	95200	89600	84000
AWR175	175000	161000	154000	147000	140000	133000	126000	119000	112000	105000
AWR210	210000	193200	184800	176400	168000	159600	151200	142800	134400	126000
AWR245	245000	225400	215600	205800	196000	186200	176400	166600	156800	147000
AWR280	280000	257600	246400	235200	224000	212800	201600	190400	179200	168000

* Based on the following Higher Heating Values: Natural Gas - 1020 BTU/scf, Propane - 2516 BTU/scf

Table A2: AWR Series Orifice Sizes at Various Altitudes				
Nominal Altitude	Natural Gas		Propane	
	Orifice size	Crown PN	Orifice size	Crown PN
Sea Level	47	950303	1.20mm	950346
2000	47	950303	1.20mm	950346
3000	47	950303	1.20mm	950346
4000	47	950303	56	950331
5000	48	950304	57	950332
6000	48	950304	57	950332
7000	49	950305	57	950332
8000	49	950305	57	950332
9000	50	950306	58	950333
10000	50	950306	59	950334



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