

Cast Iron Gas Boiler
For Forced Hot Water

**INSTALLATION, OPERATION &
MAINTENANCE MANUAL**

Models

BWBCAN000060

BWBCAN000095

BWBCAN000120

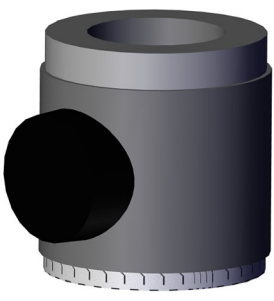
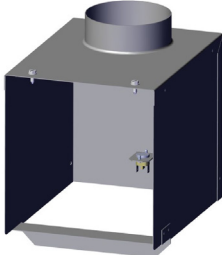
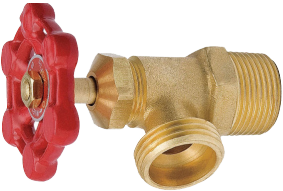
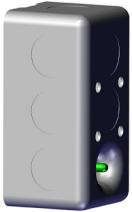
BWBCAN000150

BWBCAN000175

BWBCAN000205

BWBCAN000235



			
Fully Assembled Boiler	Vent Damper	Draft Hood	Pump (Optional)
			
*Drain Valve	*ASME Safety Relief Valve	*Tridicator	*Black Iron Fittings (see parts list for sizes and use)
Includes Essential Documents and Warranty 11x17 Wire Diagrams			
Document Package	*Junction Box	*Circulator Harness	

* Items found in parts box included with your boiler.

For Parts lists see manual PB-BWBC-01 included with your boiler literature package.

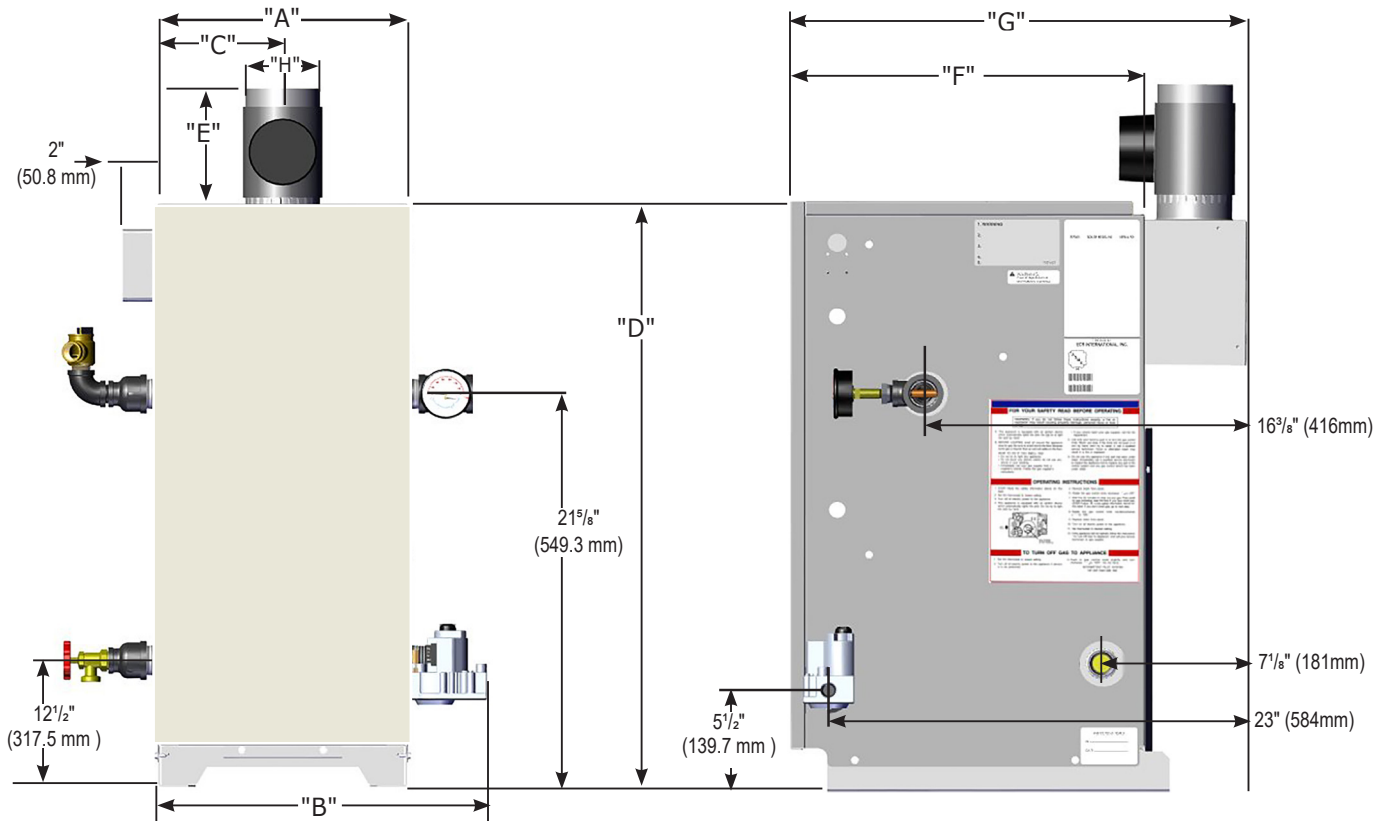
KEEP THIS MANUAL NEAR BOILER
RETAIN FOR FUTURE REFERENCE

Information and specifications outlined in this manual in effect at the time of printing of this manual. Manufacturer reserves the right to discontinue, change specifications or system design at any time without notice and without incurring any obligation, whatsoever.

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2 - DIMENSIONS

Model	BWBC60	BWBC95	BWBC120	BWBC150	BWBC175	BWBC205	BWBC235
# Sections	3	4	5	6	7	8	9
A Width (Jacket)	13- ³ / ₈ "	13- ³ / ₈ "	16- ¹ / ₄ "	19"	21- ⁷ / ₈ "	27- ¹ / ₂ "	27- ¹ / ₂ "
	340 mm	340 mm	411 mm	483 mm	555 mm	700 mm	700 mm
B Width W/ External Gas Valve	17- ⁵ / ₈ "	19- ¹ / ₄ "	22"	24- ⁷ / ₈ "	27 - ³ / ₄ "	32- ³ / ₄ "	33- ¹ / ₂ "
	448 mm	489 mm	559 mm	632mm	705 mm	832 mm	851 mm
C Vent Location (Half Width)	6- ³ / ₄ "	6- ³ / ₄ "	8- ¹ / ₈ "	9- ¹ / ₂ "	10- ¹⁵ / ₁₆ "	13- ³ / ₄ "	13- ³ / ₄ "
	171 mm	171 mm	206 mm	241 mm	278 mm	349 mm	349 mm
D Height	32- ¹ / ₈ "	32- ¹ / ₈ "	32- ¹ / ₈ "	32- ¹ / ₈ "	32- ¹ / ₈ "	32- ¹ / ₈ "	32- ¹ / ₈ "
	816 mm	816 mm	816 mm	816 mm	816 mm	816 mm	816 mm
E Damper Height	5 ³ / ₄ "	5 ³ / ₄ "	6"	6"	6- ³ / ₄ "	6- ³ / ₄ "	6- ³ / ₄ "
	146 mm	146 mm	152 mm	152 mm	178 mm	178 mm	178 mm
F Depth w/o Draft Hood Installed	20"	20"	20"	20"	20"	20"	20"
	508 mm	508 mm	508 mm	508 mm	508 mm	508 mm	508 mm
G Depth W/ Draft Hood Installed	24-1/8"	24-1/8"	24-1/8"	24-1/8"	24-1/8"	24-1/8"	24-1/8"
	613 mm	613 mm	613 mm	613 mm	613 mm	613 mm	613 mm
H Flue Diameter	4"	5"	6"	6"	7"	7"	7"
	102 mm	127 mm	153 mm	153 mm	178 mm	178 mm	178 mm
Supply & Return Tappings	1- ¹ / ₄ " NPT	1- ¹ / ₄ " NPT	1- ¹ / ₄ " NPT	1- ¹ / ₄ " NPT	1- ¹ / ₄ " NPT	1- ¹ / ₄ " NPT	1- ¹ / ₄ " NPT
Natural Gas Inlet	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT	3/4" NPT	3/4" NPT
Relief Valve NPT	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT
Drain Valve NPT	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT
Heating Water Content, Gal (Liter)	1.9 (7.2)	2.3 (8.8)	2.8 (10.5)	3.2 (12.2)	3.7 (13.9)	4.1 (15.6)	4.6 (17.3)
Air Cushion Tank, Gal (Liter) Estimate* (Actual Based on System Size)	15 (57)*	30 (114)*	30 (114)*	30 (114)*	30 (114)*	30 (114)*	30 (114)*
Weight less pkg lbs (KG)	170 (77)	210 (96)	250 (114)	280 (128)	320 (145)	350 (159)	390 (177)
Shipping Weight lbs (KG)	215 (98)	250 (114)	295 (134)	335 (152)	385 (175)	420 (191)	465 (211)



2 - SAFETY SYMBOLS AND WARNINGS

2.1. Safety Information

Boiler installation shall be completed by qualified agency.

WARNING

Fire, explosion, asphyxiation and electrical shock hazard. Improper installation could result in death or serious injury. Read this manual and understand all requirements before beginning installation.

WARNING

Do not tamper with or use this boiler for any purpose other than its intended use. Failure to follow these instructions could result in death or serious injury. Use only manufacturer recommended parts and accessories.

CAUTION

Laceration, burn hazard. Metal edges and parts may have sharp edges and/or may be hot. Use appropriate personal protection equipment to include safety glasses and gloves when installing or servicing this boiler. Failure to follow these instructions could result in minor or moderate injury.

Become familiar with symbols identifying potential hazards.



This is the safety alert symbol. Symbol alerts you to potential personal injury hazards. Obey all safety messages following this symbol to avoid possible injury or death.

DANGER

Indicates a hazardous situation which, if not avoided, WILL result in death or serious injury.

WARNING

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

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Used to address practices not related to personal injury.

FOR YOUR SAFETY READ BEFORE OPERATING

DANGER



Hot Water Can Scald!

Water heated to temperature for clothes washing, dish washing and other sanitizing needs can scald and cause permanent injury.

Children, elderly, and infirm or physically handicapped persons are more likely to be permanently injured by hot water. Never leave them unattended in bathtub or shower. Never allow small children to use a hot water tap or draw their own bath.

If anyone using hot water in the building fits the above description, or if state laws or local codes require certain water temperatures at hot water taps, you must take special precautions:

- Use lowest possible temperature setting.
- Install some type of tempering device, such as an automatic mixing valve, at hot water tap or water heater. Automatic mixing valve must be selected and installed according to manufacturer's recommendations and instructions.
- Water passing out of drain valves may be extremely hot. To avoid injury:
 - Make sure all connections are tight.
 - Direct water flow away from any person.

Water Temperature Setting	1st Degree Burn Exposure Time For An Adult	2nd and 3rd Degree Burn Exposure Time For An Adult
120° F	1 minute	5 minutes
130° F	5 seconds	30 seconds
140° F	2 seconds	5 seconds
150° F	1 second	1.5 seconds
160° F	Instantaneous	0.5 seconds

Note: Warning for Infants, Children, and Elderly: Great care must be taken when exposing the aforementioned groups to warm or hot water as they can be badly burned in exposure times less than half of the time for an adult.

2 - SAFETY SYMBOLS AND WARNINGS

WARNING

Combustion chamber insulation in this product contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group1). Avoid breathing dust and contact with skin and eyes. Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH website <https://www.cdc.gov/niosh/topics/silica/>. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website. Wear long-sleeved, loose fitting clothing, gloves, and eye protection. Apply enough water to the combustion chamber lining to prevent dust. Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.

NIOSH stated First Aid. Eye: Irrigate immediately. Breathing: Fresh air.

WARNING

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

DO NOT obstruct air openings to the boiler room. Modification, substitution or elimination of factory equipped, supplied or specified components may result in personal injury or loss of life.

Installation and service of this boiler shall be performed by a qualified installer.

When this product is installed in the Commonwealth of Massachusetts the installation shall be performed by a Licensed Plumber or Licensed Gas Fitter.

WARNING

Fire, Explosion, Asphyxiation, Electrical shock hazard! Flooding will result in damages such as electrical problems, corrosion, inoperative parts, mold and other unforeseen issues which can occur over time. Any equipment determined by a professional as damaged by a flood, defined as excess of water or other liquid, shall be replaced. Failure to follow these directions will result in a Hazardous Situation.

CAUTION

Laceration, burn hazard. Metal edges and parts may have sharp edges and/or may be hot. Use appropriate personal protection equipment to include safety glasses and gloves when installing or servicing this boiler. Failure to follow these instructions could result in minor or moderate injury.

2.2 For Your Safety

Manufacturer recommends a carbon monoxide detector located on each floor of your home. Follow your detector's instructions for operation and verification. Some jurisdictions may, by law, require.

3 - LOCATING THE BOILER

⚠ WARNING

Fire hazard! Do not install boiler on carpeting. Failure to follow these instructions could result in death or serious injury.

⚠ CAUTION

Boiler weight exceeds 200 pounds (90.7 kg). Do not lift boiler without assistance.

3.1 Installation Requirements

1. Installation shall conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, and/or *Natural Gas and Propane Installation Code*, CAN/CSA B149. Where required by the authority having jurisdiction, the installation must conform to the *Standard for Controls and Safety Devices for Automatically fired Boilers*, ANSI/ASME CSD-1.
2. Boiler series is classified as a Category I. Vent installation shall be in accordance with "Venting of Equipment", of the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, or "Venting Systems and Air Supply for Appliances," of the *Natural Gas and Propane Installation Code*, CAN/CSA B149.1, or applicable provisions of the local building codes.
3. Boiler has met safe lighting and other performance criteria with the gas manifold and control assembly on the boiler per the latest revision of ANSI Z21.13/CGA 4.9.
4. Install boiler such that gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service, (circulator replacement, condensate trap, control replacement, etc.).
5. Locate boiler on level, solid base as near chimney as possible and centrally located with respect to heat distribution system as practical.
6. Horizontal vent run to chimney shall be as short as practicable. Refer to NFPA 54 to determine maximum permissible horizontal run for chimney type and height.
7. Verify floor will support weight of boiler, water and equipment.
8. May be installed on combustible floor. **Do not install boiler on carpeting.**
9. Do not install where gasoline or other flammable liquids or vapors will be stored or used. See Table 3-1, Contaminants.
10. Chimney shall be lined in a manner acceptable to the authority having jurisdiction.
11. If installing in a garage boiler shall be 18" above floor.
12. Do not install outdoors.

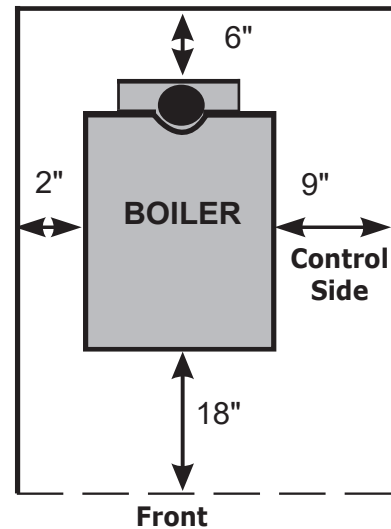
3.2 Minimum Clearances to Combustible Construction

1. Minimum clearances to combustible construction are:

Top	10 inches (254 mm)
Front	Alcove*
Flue Connector	6 inches (152 mm)
Rear	6 inches (152 mm)
Gas Valve Side (Right Side)	9 inches (229 mm)
Left Side	2 inches (51 mm)
Hot Water Piping	Per Local Code

* Definition of Alcove is three sided space with no wall in front of boiler. ANSI standard for alcove is 18 inches from front of appliance to leading edge of side walls as shown below.

Minimum Clearances To Combustible Construction (As Seen From Above)



NOTE: Greater clearances for access and servicing should supersede fire protection clearances.

3.3 Recommended Clearances for Service

1. Allow 24 inches (610 mm) at front and one side for servicing and cleaning.
2. When installed in utility room, door should be wide enough to allow largest boiler part to enter, or to permit replacement of another appliance such as a water heater.

3 - LOCATING THE BOILER

3.3 Boiler Location Considerations

- Ambient room temperature always above 32°F (0°C) to prevent the potential of freezing.
- Drainage of water (or water/ antifreeze solution) during boiler service or from safety relief valve discharge.
- Access to system water piping, gas supply, and electrical service.
- Boiler shall be installed on flat surface which is capable of supporting the weight of the boiler, water, and equipment.
- Raise boiler above the floor on blocks if floor may get wet.
- Horizontal run to chimney shall be as short a possible.
- System piping exposed to freezing conditions: Use inhibited propylene glycol solutions certified by fluid manufacturer for use with closed water heating system. Do not use automotive or ethylene glycol. Maximum recommended mixture 50% glycol.

Table 3-1: CONTAMINANTS

Items to Avoid	Products Which May Contain These Items	Areas Where These Items May Be Found
Chlorine, Fluorine, and Compounds	Spray cans containing chlorofluorocarbons Chlorinated waxes/cleaners Chlorine-based swimming pool chemicals Calcium chloride used for thawing Sodium chloride used for water softening Swimming pool or spa chemicals De-icing salts or chemicals Carbon Tetrachloride	Swimming pools and pool storage areas Laundry room (Note 2) Confined storage areas
Airborne Particulates	Drywall dust Road or gravel dust Dryer lint Cat litter	Construction or remodelling areas (Note 1) Laundry room (Note 2)
Acids, Solvents, etc.	Paint, Varnish, Turpentine, etc. Cleaning Solvents Hydrochloric acid/muriatic acid Cements, adhesives and glues	Photo processing plants Garages with workshops Furniture refinishing areas and establishments
Laundry Chemicals	Laundry detergents, bleaches, fabric softeners, etc. Antistatic fabric softeners (dryer sheets)	Dry cleaning/laundry areas and establishments
Other	Permanent wave solutions Refrigerants (Freon, etc) (only where the refrigerant may be leaking from the appliance)	Beauty shops Refrigeration repair shops
Notes:	1. It is recommended the boiler be isolated and not operated during construction/ renovation. Excessive particles ingested by the boiler may accumulate in the flueway passages possibly resulting in unsafe operation. In this case, unit servicing shall include cleaning of flueway passages and burner ports. 2. If locating boiler in laundry room is unavoidable, it is manufacturer recommended the room be generously ventilated (well in excess of combustible air requirements), and homeowner seal laundry supply containers, and minimize room vapors. 3. Piping allowing fresh air in should also be considered. See Section 5-1.	

4 - CONNECTING SUPPLY & RETURN PIPING

4.1 Connection Locations

- Boiler has one supply and one return tapping on each side (4 total). Boiler supplied with dust caps only. Remove all four (4) caps and plumb before filling boiler with water.
- Supply and return may be piped to either side of boiler, as desired.
- Drain valve may be located off of unused return tapping, as desired.
- **ASME relief valve may be located off unused supply tapping IN UPRIGHT POSITION ONLY.**
- Unused supply and return tapplings may be capped, as desired. Relief valve and drain valve may be located on near boiler piping using contractor supplied tees with no valves.

⚠ WARNING

Burn and scald hazard. Safety relief valve could discharge steam or hot water during operation. Install discharge piping per these instructions. Failure to follow these instructions could result in death or serious injury.

⚠ WARNING

Burn and scald hazard. Safety relief valve shall be installed with spindle in ***upright position only***, following ASME BPV code. Failure to follow these instructions could result in death or serious injury.

4.2 Safety Relief Valve Installation

See Figure 4-1

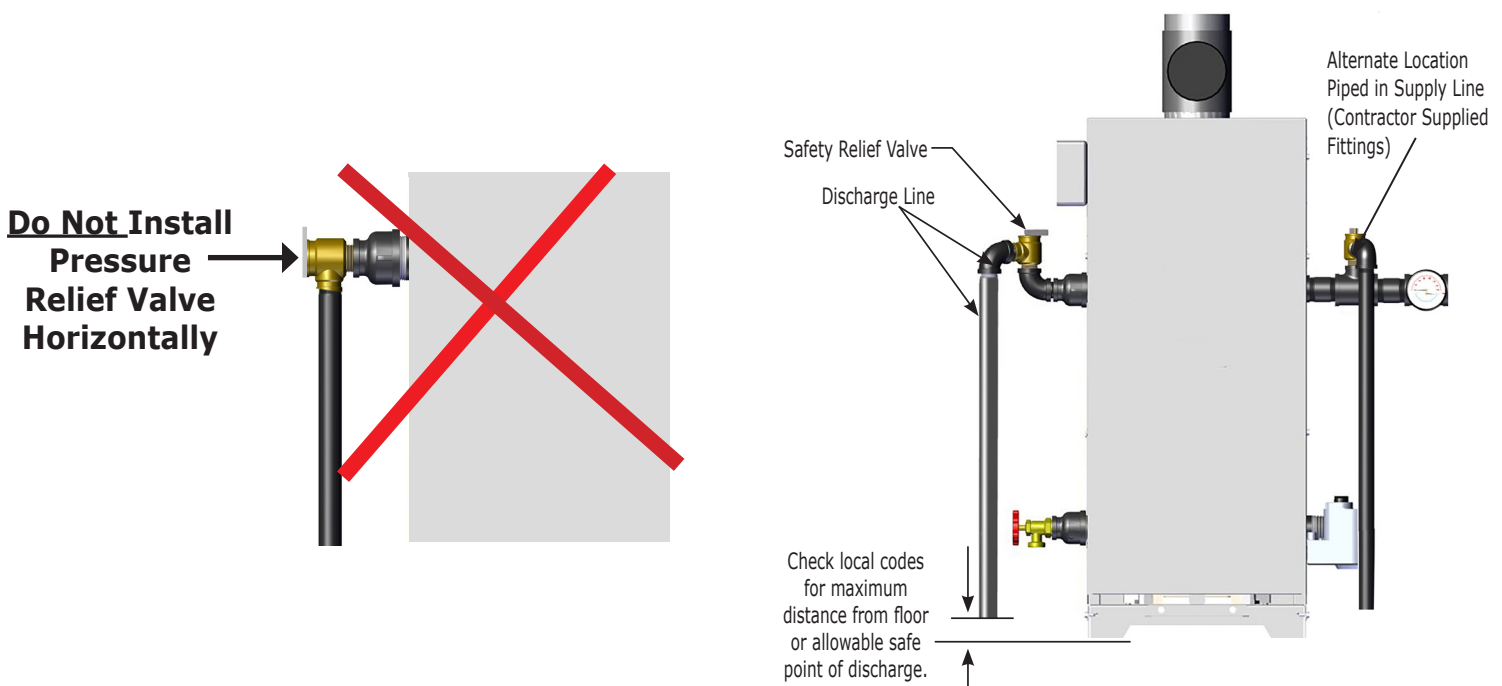
Discharge line shall be installed to relief valve outlet connection to avoid burns, scalding, or water damage due to discharge of steam and/or hot water during operation.

Discharge line shall:

- connect to relief valve outlet and piped down to safe point of disposal. Check local codes for maximum distance from floor or allowable safe point of discharge.
- be of pipe size equal to or greater than that of the relief valve outlet over the entire length of discharge line;
- have no intervening shutoff valve between safety relief valve and discharge to atmosphere (do not plug or place any obstruction in discharge line.
- terminate freely to atmosphere where any discharge will be clearly visible and at no risk of freezing;
- allow complete drainage of the valve and the discharge line;
- be independently supported and securely anchored to avoid applied stress on the relief valve;
- be as short and straight as possible;
- terminate with plain end (not threaded);
- be constructed of material suitable for exposure to temperatures of 375° F (191°C); or greater.

Refer to local codes and appropriate ASME Boiler and Pressure Vessel Code for additional installation requirements.

Figure 4-1 - Safety Relief Valve





WARNING

- Poison hazard. Ethylene glycol is toxic. Do not use ethylene glycol.
- Never use automotive or standard glycol antifreeze, even ethylene glycol made for hydronic systems.
- Ethylene glycol can attack gaskets and seals used in hydronic systems.
- Do not use petroleum based cleaning or sealing compounds boiler system.
- Do not fill boiler or boiler system with softened water.
- Use only inhibited propylene glycol solutions certified by fluid manufacturer as acceptable for use with closed water heating system.
- Thoroughly clean and flush any system that used glycol before installing new Boiler.
- Provide user with Material Safety Data Sheet (MSDS) on fluid used.

4.4 Water Treatment

Manufacturer recommends a water analysis be done on water used to fill the system. Treatment may be required based on the analysis results.

For hard water or pH below 7.0 consult your local water treatment company.

- If CH water is very hard or full of impurities, it must be adequately filtered and treated, otherwise damage and/or malfunction could be caused. Recommended water quality is:
 - o Hardness Less than 150 mg/L
 - o Acidity level 7-8 pH
 - o Sediments Particle size less than 50 micron
- If the water quality is outside these ranges, consult a local water treatment specialist for recommendations.
- If the water is treated, do not use petroleum based products or products containing mineral oil or hydrocarbons in order to avoid likely damage to parts made from rubber compounds (o-rings).

NOTICE

If damage due to frozen pipes is a possibility, install appropriate safeguards and alarms on the heating system to prevent property damage due to frozen and burst pipes should the boiler heating system become inoperative due to a power outage, safety lockout or component failure.

4.3 Flush and Rinse System

Flush the entire system and rinse thoroughly to ensure no sludge will be introduced into the heating body of the boiler.

Install a low water cutoff device when the boiler is connected to the high point of the heating system.

4 - CONNECTING SUPPLY & RETURN PIPING

4.5 Supply and Return Requirements

1. Boiler used in connection with refrigeration system, install so chilled medium is piped in parallel with boiler with appropriate valves to prevent chilled medium from entering boiler. See Figure 4-2.
2. Boiler piping system of hot water boiler connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation must be equipped with flow control valves or other automatic means to prevent gravity circulation of boiler water during cooling cycle.
3. Hot water boilers installed above radiation level or as required by authority having jurisdiction must be provided with low water cut-off device (factory equipped).

WARNING

Asphyxiation hazard! Gradual flueway blocking resulting from condensate induced corrosion may block boiler passages, resulting in carbon monoxide and or flame rollout. Install bypass piping if return temperature is under 130°F. Failure to follow these instructions could result in death or serious injury.

4. Boiler connected to heating system utilizing multiple zoned circulators, each circulator must be supplied with flow control valve to prevent gravity circulation.
5. Bypass piping gives ability to adjust supply boiler water temperature to fit system or condition of installation. This method of piping, however, is not typically required for baseboard heating systems. Typical installations where bypass piping is required are as follows:
 - A. This method is used to protect boilers from condensation forming due to low temperature return water (Below 130° F). Generally noticed in large converted gravity systems or other large water volume systems. Figures 4-3 and 4-4 page 13.
 - B. These methods are used to protect systems using radiant panels and material they are encased in from high temperature supply water from boiler and protect boiler from condensation.

NOTE#1: When using bypass piping, adjust valves V1 & V2 until desired system temperature is obtained.

NOTE#2: Bypass loop must be same size piping as supply and return piping.

6. Installation using circulators and zone valves are shown in Figures 4-2 through 4-7. For further piping information refer to AHRI Installation and Piping Guide.
7. Install discharge piping from safety relief valve. See Warning, Page 9 and Figure 4-1.

4.6 Special Conditions

Note

Do not expose boiler and piping to freezing temperatures.

- System piping exposed to freezing conditions: Use inhibited propylene glycol solutions certified by fluid manufacturer for use with closed water heating system. Do not use automotive or ethylene glycol.
- Boiler installed above radiation level or as required by authority having jurisdiction. Integral low water cutoff is provided in boiler.
- Boiler used in connection with refrigeration system. Install piping in parallel with boiler, with appropriate valves to prevent chilled medium from entering boiler.
- System piping connected to heating coils located in air handling unit exposed to refrigerated air circulation. Install flow control valves or other automatic means to prevent gravity circulation of boiler water during cooling cycle.

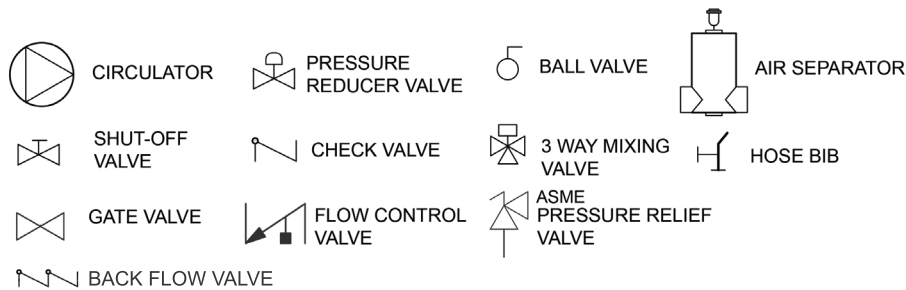
4 - CONNECTING SUPPLY & RETURN PIPING

Note Do not expose boiler and piping to freezing temperatures.

4.6 Special Conditions

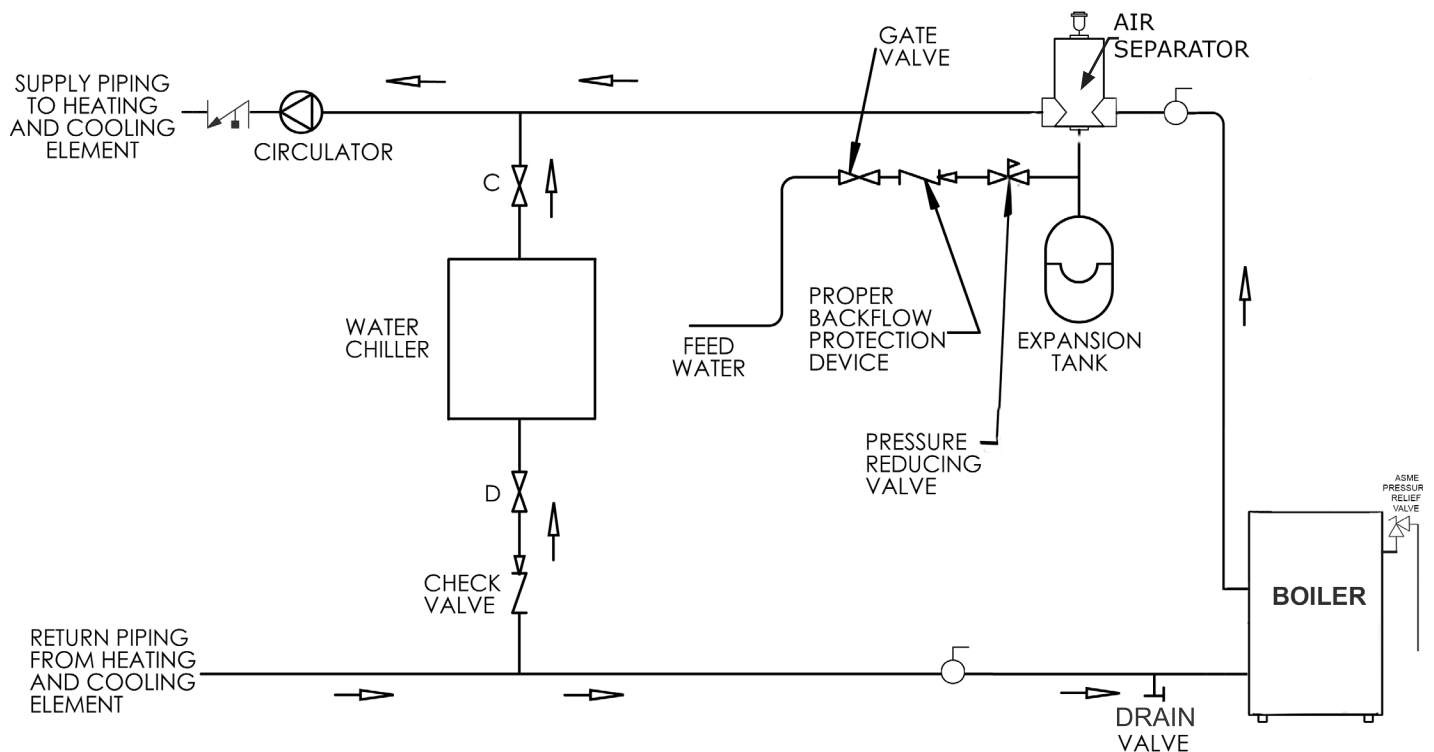
- System piping exposed to freezing conditions: Use inhibited propylene glycol solutions certified by fluid manufacturer for use with closed water heating system. Do not use automotive or ethylene glycol.
- Boiler installed above radiation level (or as required by authority having jurisdiction). Integral low water switch is provided in boiler.
- Boiler used in connection with refrigeration system. Install piping in parallel with boiler, with appropriate valves to prevent chilled medium from entering boiler.
- System piping connected to heating coils located in air handling unit exposed to refrigerated air circulation. Install flow control valves or other automatic means to prevent gravity circulation of boiler water during cooling cycle.

PIPING LEGEND:



Circulators in following illustrations are mounted on system supply side, mounting on system return side is also acceptable practice.

Figure 4-2 - Circulators Mounted on Supply System, Boiler Used In Configuration with Chiller System. See Special Conditions, Page 9



4 - CONNECTING SUPPLY & RETURN PIPING

PIPING LEGEND:

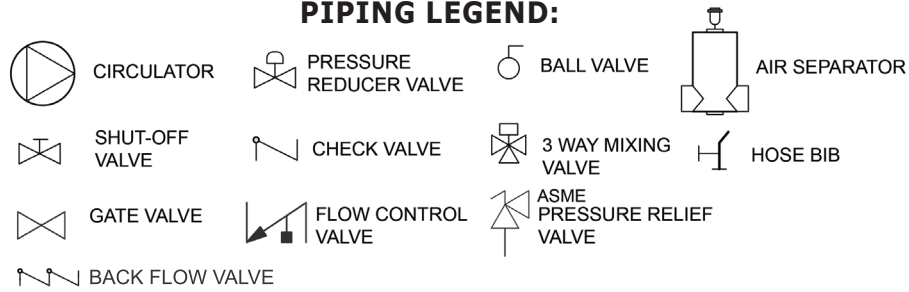
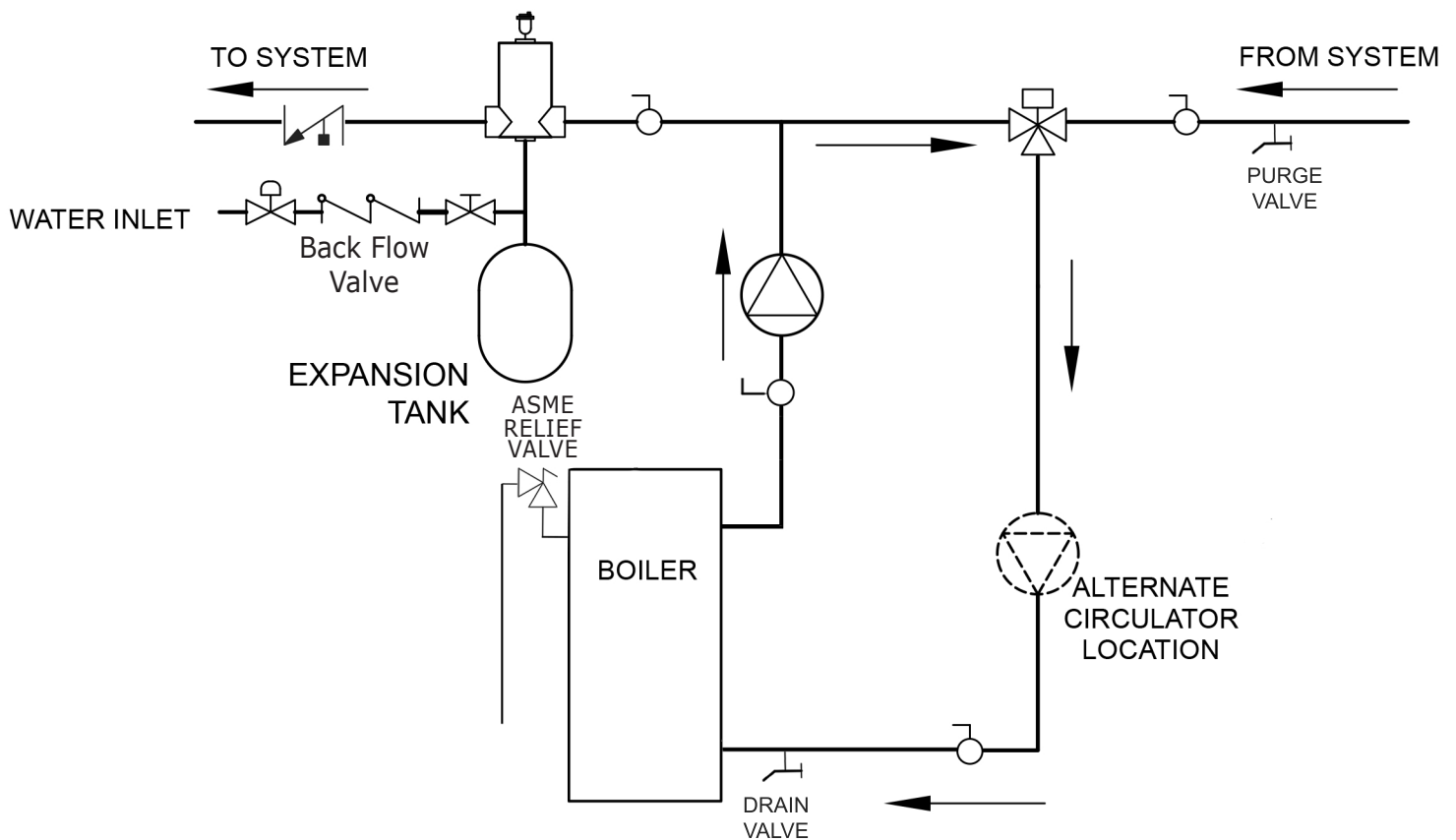


Figure 4-3 - Bypass Piping With Automatic Mixing Valve



4 - CONNECTING SUPPLY & RETURN PIPING

PIPING LEGEND:

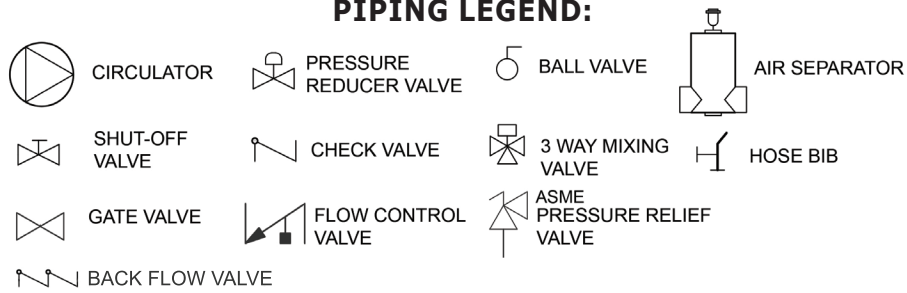
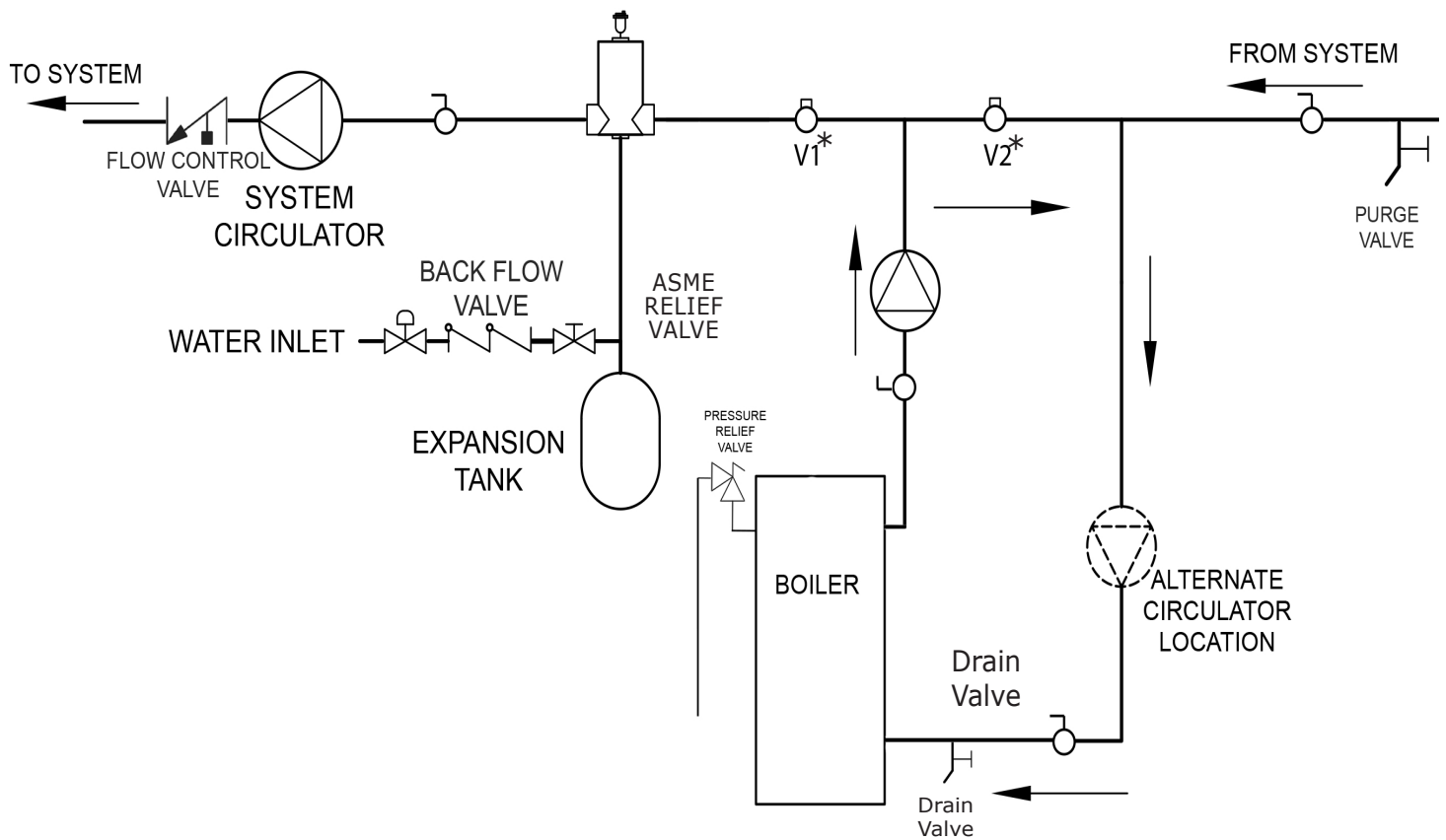


Figure 4-4 - Bypass Piping - Fixed Low Temp Only With Zone Valve



* Manually adjust until proper system temperature is reached.

4 - CONNECTING SUPPLY AND RETURN PIPING

PIPING LEGEND:

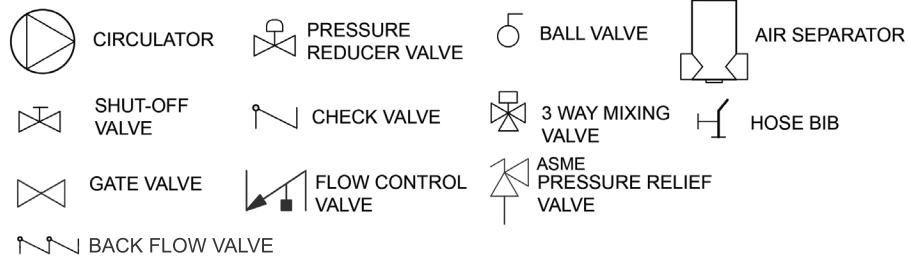
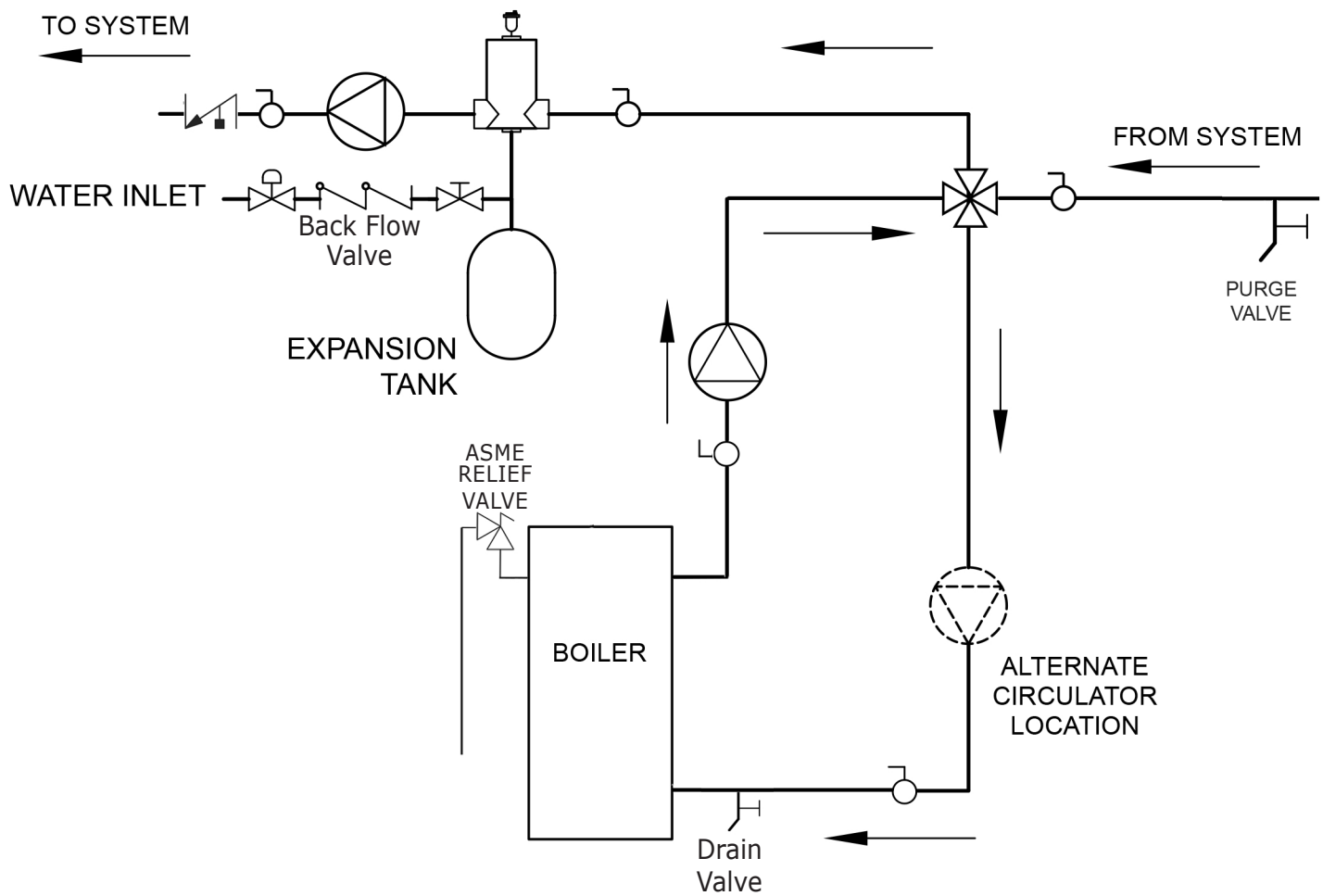


Figure 4-5 - Bypass Piping (4-Way Valve Option With Circulator On Supply side)





4 - CONNECTING SUPPLY AND RETURN PIPING

PIPING LEGEND:

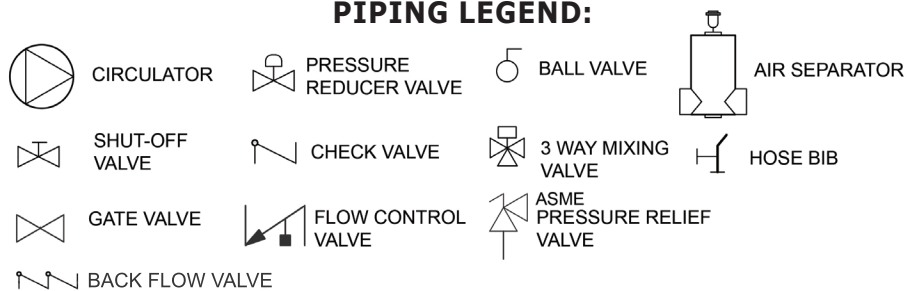
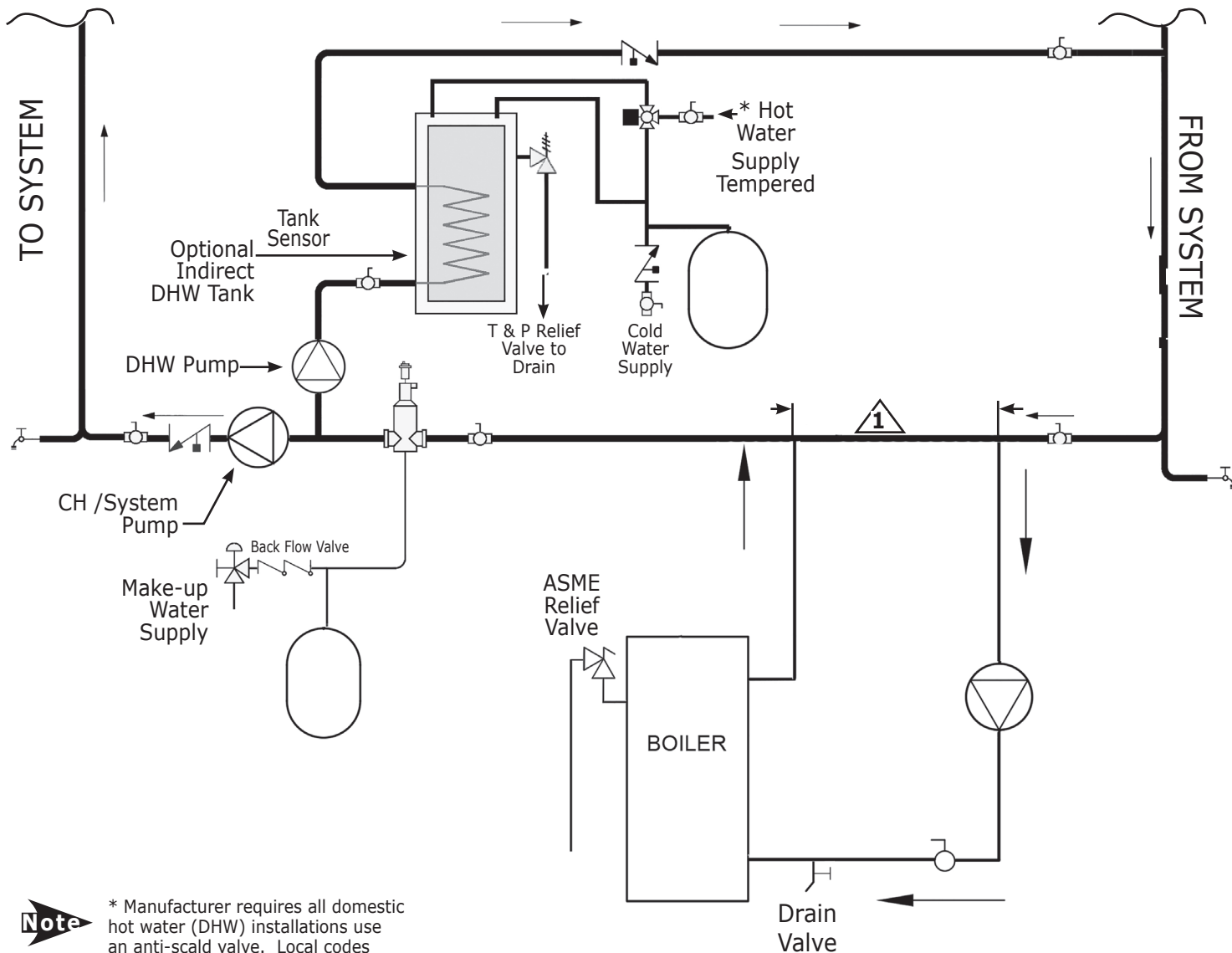


Figure 4-7 - Multi Zone System With Zone Valves And DHW Priority (With Zone Valve)



Note * Manufacturer requires all domestic hot water (DHW) installations use an anti-scald valve. Local codes may require additional equipment (expansion tank, relief valves, etc.) Select and size equipment to suit installation and meet code requirements.

Note **1** 12" (305mm) Recommended distance. Do not exceed 12".

Note Refer to pump manufacturer literature for proper pump sizing.

5 - VENTILATION & COMBUSTION AIR

5.1 Requirements

⚠ WARNING

Asphyxiation Hazard! Provide enough air openings to boiler/combustion area to dilute flue gases and allow for consistent, quality combustion. Do not obstruct air openings. Follow instructions below, to maintain adequate combustion air. Failure to follow these instructions good result in ignition failure, overheating, carbon monoxide, and accumulation of flue gases.

Provide combustion air and ventilation air in accordance with the section "Air for Combustion and Ventilation," of the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, or Sections 8.2, 8.3 or 8.4 of *Natural Gas and Propane Installation Code*, CAN/CSA B149.1, or applicable provisions of local building codes.

Provide make-up air where exhaust fans, clothes dryers, and kitchen ventilation equipment interfere with proper operation. If inadequate makeup air is suspected it is always acceptable to add additional ventilation.

National Fuel Gas Code recognizes several methods of obtaining adequate ventilation and combustion air. Requirements of the authority having jurisdiction may override these methods.

- Engineered Installations. Must be approved by authority having jurisdiction.
- Mechanical Air Supply. Provide minimum of 0.35 cfm per [(BTU/HR)/1,000] for all appliances located within space. Additional requirements where exhaust fans installed. Interlock each appliance to mechanical air supply system to prevent main burner operation when mechanical air supply system not operating.
- All Indoor Air. Calculate minimum volume for all appliances in space. Use a different method if minimum volume not available.
 - A. Standard Method. Cannot be used if known air infiltration rate is 0.40 air changes per hour. See Table 3 for space with boiler only. Use equation for multiple appliances.

$$\text{Volume} \geq 50 \text{ ft}^3 \times \text{Total Input [(BTU/HR)/1,000]}$$

- B. Known Air Infiltration Rate. See Table 5-1 for space with boiler only. Use equation for multiple appliances. Do not use an air infiltration rate (ACH) greater than 0.60. $\text{Volume} \geq 21 \text{ ft}^3/\text{ACH} \times \text{Total Input [(BTU/HR)/1,000]}$.
- C. Refer to National Fuel Gas Code for opening requirements between connected indoor spaces.
- All Outdoor Air. Provide permanent opening(s) communicating directly or by ducts with outdoors.
 - A. Two Permanent Opening Method. Provide opening commencing within 12 inches of top and second opening commencing within 12 inches of bottom of enclosure.
 - Direct communication with outdoors or communicating through vertical ducts. Provide minimum free area of 1 in² per 4 [(BTU/HR)/1,000] of total input rating of all appliances in enclosure.
 - Communicating through horizontal ducts. Provide minimum free area of 1 in² per 2 [(BTU/HR)/1,000] of total input rating of all appliances in enclosure.
 - B. One Permanent Opening Method. Provide opening commencing within 12 inches of top of enclosure. Provide minimum clearance of 1 inch on sides/back and 6 inches on front of boiler (does not supersede clearance to combustible materials).
- Refer to National Fuel Gas Code for additional requirements for louvers, grilles, screens and air ducts.
- Combination Indoor and Outdoor Air. Refer to National Fuel Gas Code for application information.

National Gas and Propane Installation Code Requires providing air supply in accordance with:

- Section 8.2 and 8.3 when combination of appliances has a total input of up to and including 400 [(BTU/HR)/1,000] (120 kW).
- Section 8.4 when combination of appliances has total input exceeding 400 [(BTU/HR)/1,000] (120 kW).
- Refer to Natural Gas and Propane Installation Code for specific air supply requirements for enclosure or structure where boiler is installed, including air supply openings and ducts.

Table 5-1 - Space With Boiler Only

Room Cubic Feet Volume								
# Sections	Input [(BTU/HR)/1,000]	Standard Method	Known Air Infiltration Rate Method (ACH - Air Changes Per Hour)					
			0.1	0.2	0.3	0.4	0.5	0.6
3	59,000	2950	12390	6195	4130	3098	2478	2065
4	92,500	4625	19425	9712.5	6475	4856	3885	3238
5	120,000	6000	25200	12600	8400	6300	5040	4200
6	149,000	7450	31290	15645	10430	7823	6258	5215
7	175,000	8800	36960	18480	12320	9240	7392	6160
8	205,000	10250	43050	21525	14350	10763	8610	7175
9	235,000	11750	49350	24675	16450	12338	9870	8225

6 - VENT SYSTEM MODIFICATION

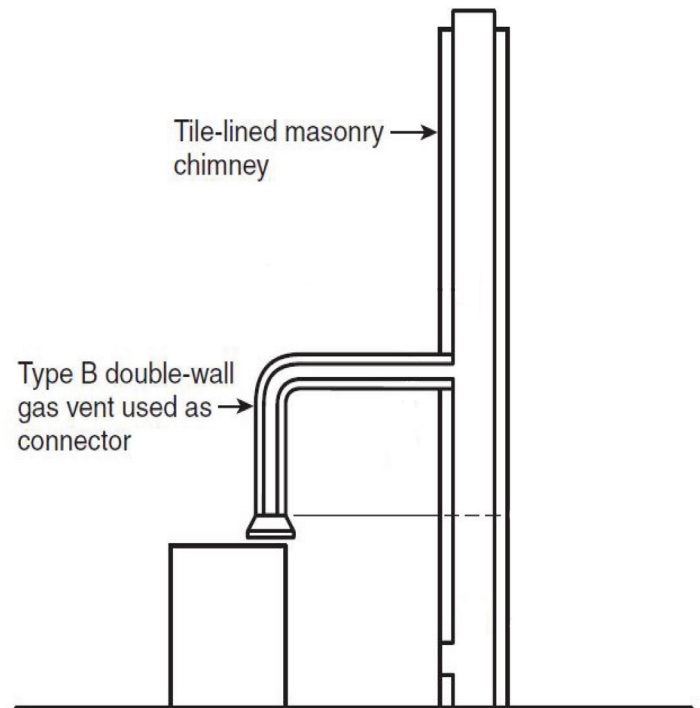
6.1 Removal Of Existing Boiler From Venting System

When an existing boiler is removed from a common venting system, the system is likely too large for proper venting of appliances still connected to it. If this occurs, follow this test procedure:

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

1. Seal an unused opening in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any other appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
6. Minimum draft should be $-.02$ w.c.
7. After it has been determined that each appliance remaining connected to a 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.
8. Any improper operation of the common venting system should be corrected so the installation conforms with the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, and/or the *Natural Gas and Propane Installation Code*, CAN/CSA B149.1. When re-sizing any portion of the common venting system, the common venting system should be re-sized to approach the minimum size determined using the appropriate tables in Chapter 13 of the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, and/or the *Natural Gas and Propane Installation Code*, CAN/CSA B149.1.
9. Draft pressure must be negative under all conditions with all appliances operating.

Figure 6-1 - Typical Masonry Chimney Requirements



See NFPA for Installation Specifications
Type B Vent Masonry Chimney Requirements

7 - VENT INSTALLATION

WARNING

Boiler and venting installations shall be performed by a qualified expert and in accordance with the appropriate manual. Installing or venting boiler or other gas appliance with improper methods or materials may result in serious injury or death due to fire or to asphyxiation from poisonous gases such as carbon monoxide which is odorless and invisible.

WARNING

Do not connect boiler to any portion of mechanical draft system operating under positive pressure.

7.1 Check Your Chimney

It must be clean, the right size, properly constructed and in good condition. A chimney shall be lined in a manner acceptable to the authority having jurisdiction.

Chimney Sizing

Chimney sizing, and vent installation must be in accordance with The National Fuel Gas Code, ANSI Z223.1/NFPA 54 or CAN/CSA B149.1, or applicable provisions of local building codes.

This is a high efficiency boiler with low stack temperature.

Following recommendations are in addition to requirements of the National Fuel Gas Code.

1. Type B double wall vent pipe is recommended for vent connector. Single wall vent connectors should not be used unless following conditions are true:
 - a. Except for basement, boiler is not installed in unheated space.
 - b. Total horizontal portion of vent connector, not including elbows is less than 5 feet in length.
2. Outside chimneys (i.e. chimneys exposed to outdoors below roof line on one or more sides) do not use unless they are:
 - a. enclosed in a chase, or
 - b. lined with type B vent pipe, or listed flexible vent liner, or other certified chimney lining system.
3. Where possible it is recommended to common vent boiler and water heater.
4. For multiple Category I boiler installations, consult boiler manufacturer for venting recommendations.
5. Minimize horizontal vent length.

7.2 Requirements

1. Vent pipe must slope upward from the boiler not less than 1/4 inch for every 1 foot (21 mm/m) to vent terminal.
2. Horizontal portions of venting system shall be supported rigidly every 5 feet and at the elbows. No portion of vent pipe should have any dips or sags.

3. Boiler series is classified as a Category I. Vent installation shall be in accordance with "Venting of Equipment," of the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54, or "Venting Systems and Air Supply for Appliances," of the *Natural Fuel Gas and Propane Installation Code*, CAN/CSA B149.1, or applicable provisions of the local building codes.
4. Inspect chimney. Chimney shall be lined. Verify chimney is constructed according to NFPA 211 and NFPA 54. Vent or vent connector shall be Type B or metal pipe having resistance to heat and corrosion not less than that of galvanized sheet steel or aluminum not less than 26 gauge thick, 24 gauge for 6 and 7 inch.
5. Connect flue pipe from draft hood to chimney. Bolt or screw joints together to avoid sags. Flue pipe should not extend beyond inside wall of chimney more than 1/4 inch. Do not install manual damper in flue pipe or reduce size of flue outlet except as provided by the latest revision of *National Fuel Gas Code*, ANSI Z223.1/NFPA 54. Protect combustible ceiling and walls near flue pipe with as required by National Fuel Gas Code. Where two or more appliances vent into a common flue, the area of the common flue must be at least equal to the area of the largest flue plus 50 percent of the area of each additional flue.

7.3 Chimney Inspection

Chimney must be clean, right size, properly constructed and in good condition.

Installation must conform to requirements of the authority having jurisdiction or, in absence of such requirements, to The *National Fuel Gas Code*, ANSI Z223.1/NFPA 54.

7.4 Vent Pipe

- Connect draft hood to boiler using 2 screws (provided) onto flue collector. Connect two safety circuit wires (attached to vent damper harness) to blocked vent switch. See Figure 13-1.
- Fasten sections of vent pipe with 3 sheet metal screws at each joint to make piping rigid.
- Support horizontal portions of vent system to prevent sagging.
- Use stovepipe wires or metal strapping every 5' to support pipe from above.
- Vent pipe through crawl space, use double wall vent pipe.
- Vent pipe passing through combustible wall or partition, use ventilated metal thimble. Thimble should be 4" larger in diameter than vent pipe.

NOTICE

Minimum Vent Pipe Clearance - Wood and other combustible materials must not be closer than 6" from any surface of single wall metal vent pipe. Listed Type B vent pipe or other listed venting systems shall be installed in accordance with their listing.

8 - VENT DAMPER INSTALLATION & INSTRUCTIONS

8.1 Vent Damper

Connecting The Vent Damper And Vent Connector

Refer to page 4 for size and location of vent (flue opening).

NOTICE

Damper blade on furnished vent damper has 1/2 square inch hole (approximately 3/4" diameter). Boilers equipped with intermittent ignition, hole should be plugged by using plug supplied with vent damper.

1. Follow damper installation instructions provided with damper.
2. Position furnished vent damper on top of flue outlet collar. Fasten damper securely to flue outlet collar with sheet metal screws. Verify damper blade has clearance to operate inside of diverter. Do not modify either draft diverter or vent damper during installation.

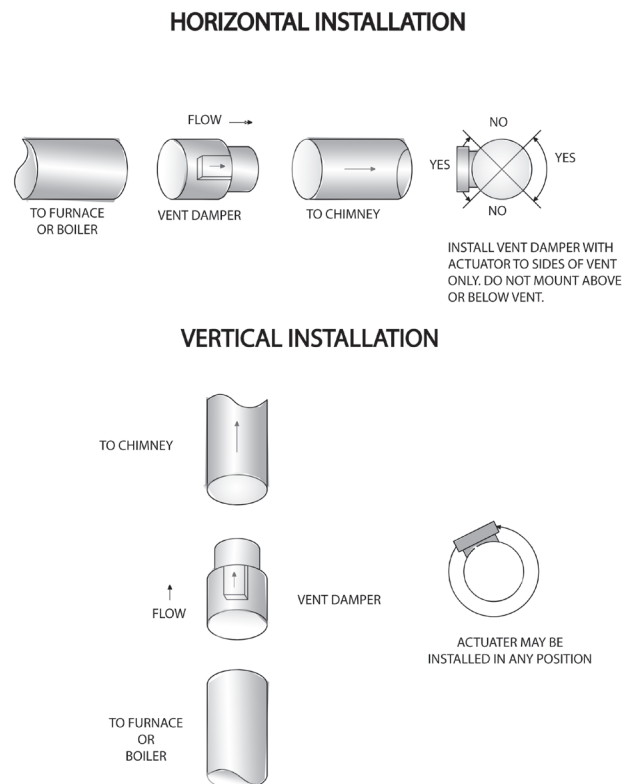
As An Option

Damper may be installed in horizontal or vertical position, closer to flue outlet collar preferred. See Figures 8-1, 8-2, 8-3 and enclosed vent damper instructions.

3. Install vent damper to service only single boiler for which it is intended. Damper position indicator shall be in visible location following installation. Locate damper so it is accessible for servicing. See Figure 8-2.
4. Damper must be in the open position when appliance main burners are operating.
5. Boiler is equipped with factory wired harness that plugs into vent damper.
6. Slope pipe up from boiler to chimney not less than 1/4" per foot.
7. Run pipe as directly as possible with as few elbows as possible.
8. Do not connect to fireplace flue.
9. End of vent pipe must be flush with inside face of chimney flue. Use a sealed-in thimble for chimney connection.
10. Clearance of not less than 6 inches (152mm) between Vent Damper and combustible material must be maintained. Additional clearance should be allowed for service of Vent Damper.
11. Vent Damper position indicator must be in visible location following installation.

Fasten sections of vent pipe with sheet metal screws to make piping rigid. Support horizontal portions of vent system to prevent sagging. Use stovepipe wires every 5' to support pipe from above. Use double wall vent pipe if vent pipe must go through crawl space. Where vent pipe passes through combustible wall or partition, use ventilated metal thimble. Thimble should be 4 inches larger in diameter than vent pipe.

Figure 8-1 - Vent Damper Installation



8 - VENT DAMPER INSTALLATION & INSTRUCTIONS

Figure 8-2 - Vent Damper Placement

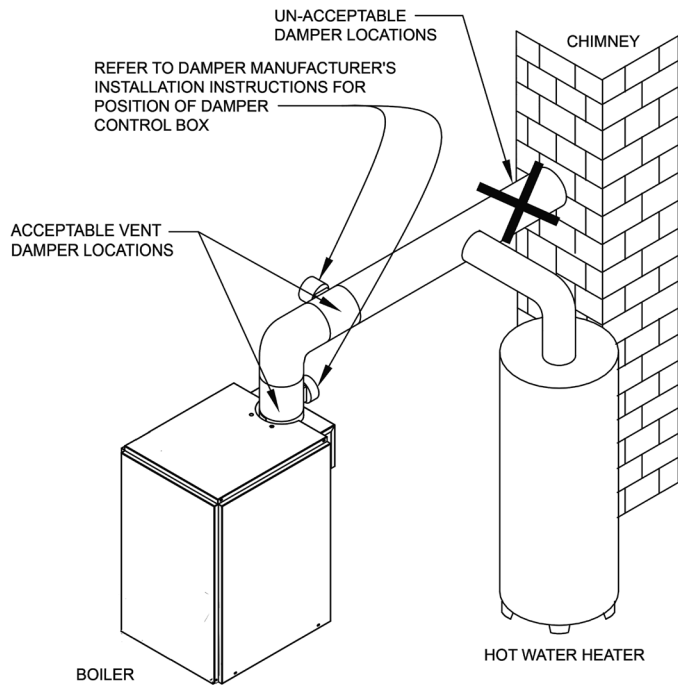
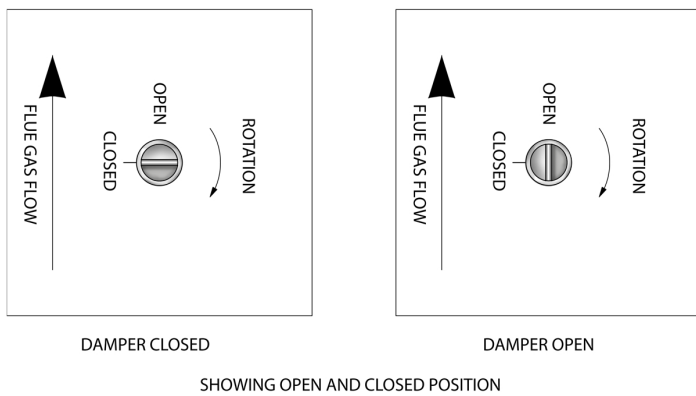


Figure 8-3 - Vent Damper Position Indicator



9 - CONNECTING GAS SERVICE

⚠ DANGER

Fire Hazard. Do not use matches, candles, open flames, or other methods providing ignition source. Failure to comply will result in death or serious injury.

⚠ CAUTION

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

⚠ WARNING

Fire, explosion, asphyxiation and burn hazard. Boiler piping and gas connections shall be leak tested before placing boiler in operation. Failure to follow these instructions and or improper installation could result in death or serious injury.

NOTICE

Use of CSA approved corrugated, semi-rigid stainless steel tubing with polyethylene jacketing is approved for use with boilers following tubing manufacturer's instructions.
Use of flexible appliance gas tubing also known as a "whip" is not allowed per NFPA 54.

9.1 General

- Use piping materials and joining methods acceptable to authority having jurisdiction. In absence of such requirements: USA - *National Fuel Gas Code*, ANSI Z223.1/NFPA 54
- Canada - *Natural Gas and Propane Installation Code*, CAN/CSA B149.1
- Size and install gas piping system to provide sufficient gas supply to meet maximum input at not less than minimum supply pressure. See Table 9-1.
- Support piping with hooks, straps, bands, brackets, hangers, or building structure components to prevent or dampen excessive vibrations and prevent strain on gas connection. Boiler will not support piping weight.
- Use thread (joint) compound (pipe dope) suitable for liquefied petroleum gas.
- Install field sourced manual main shutoff valve, ground joint union, and sediment trap upstream of gas valve using 2 wrenches. See Figure 9-1.

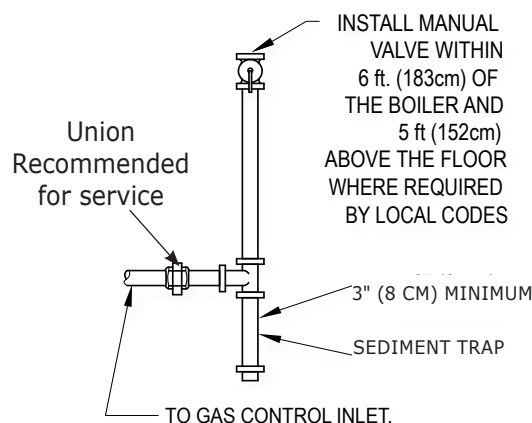
Table 9-1	Natural Gas	Propane
Min. Supply Pressure	5" w.c.	11" w.c.
Max. Supply Pressure	13.5" w.c.	13.5" w.c.
Manifold Pressure	3.5" w.c.	10" w.c. (4 sec. only)
		10.5" w.c.

9.2 Leak Check Gas Piping

Pressure test boiler and gas connection before placing boiler in operation.

- Pressure test over 1/2 psig (3.5 kPa). Disconnect boiler and its individual gas shutoff valve from gas supply system.
- Pressure test at 1/2 psig (3.5 kPa) or less. Isolate boiler from gas supply system by closing manual gas shutoff valve.
- Locate leakage using gas detector, non-corrosive detection fluid, or other leak detection method acceptable to authority having jurisdiction. Do not use matches, candles, open flames, or other methods providing ignition source.
- Correct leaks immediately and retest.

Figure 9-1 - Gas Piping



MAXIMUM CAPACITY OF PIPE IN CUBIC FEET OF GAS/HOUR

(Gas Pressure = 0.5 psig or less, Pressure Drop = 5 in. w/c)

Table 9-1				
Length of Pipe (Feet)	Nominal Iron Pipe Size			
	1/2"	3/4"	1"	1 1/4"
10	175	360	680	1400
20	120	250	465	950
30	97	200	375	770
40	82	170	320	660
60	66	138	260	530
80	57	118	220	460
100	50	103	195	400

For additional information refer to the *National Fuel Gas Code Handbook*.

WARNING

Electrical shock hazard. Turn OFF electrical power supply at service panel before making electrical connections. Failure to do so could result in death or serious injury.

10.1 Electrical Wiring

See wiring diagrams on the following pages for details.

- J-box and circulator harness are shipped in parts box, and may be wired on either side of boiler as desired.
- Electrically bond boiler to ground in accordance with requirements of authority having jurisdiction. Refer to:
USA - *National Electrical Code, ANSI/NFPA 70.*
Canada - Canadian Electrical Code, Part I, CSA C22.1: Safety Standard for Electrical Installations.
- Aluminum wiring /conductors not permitted. Use copper conductors only for all connections to the boiler.

10.2 Thermostat Installation

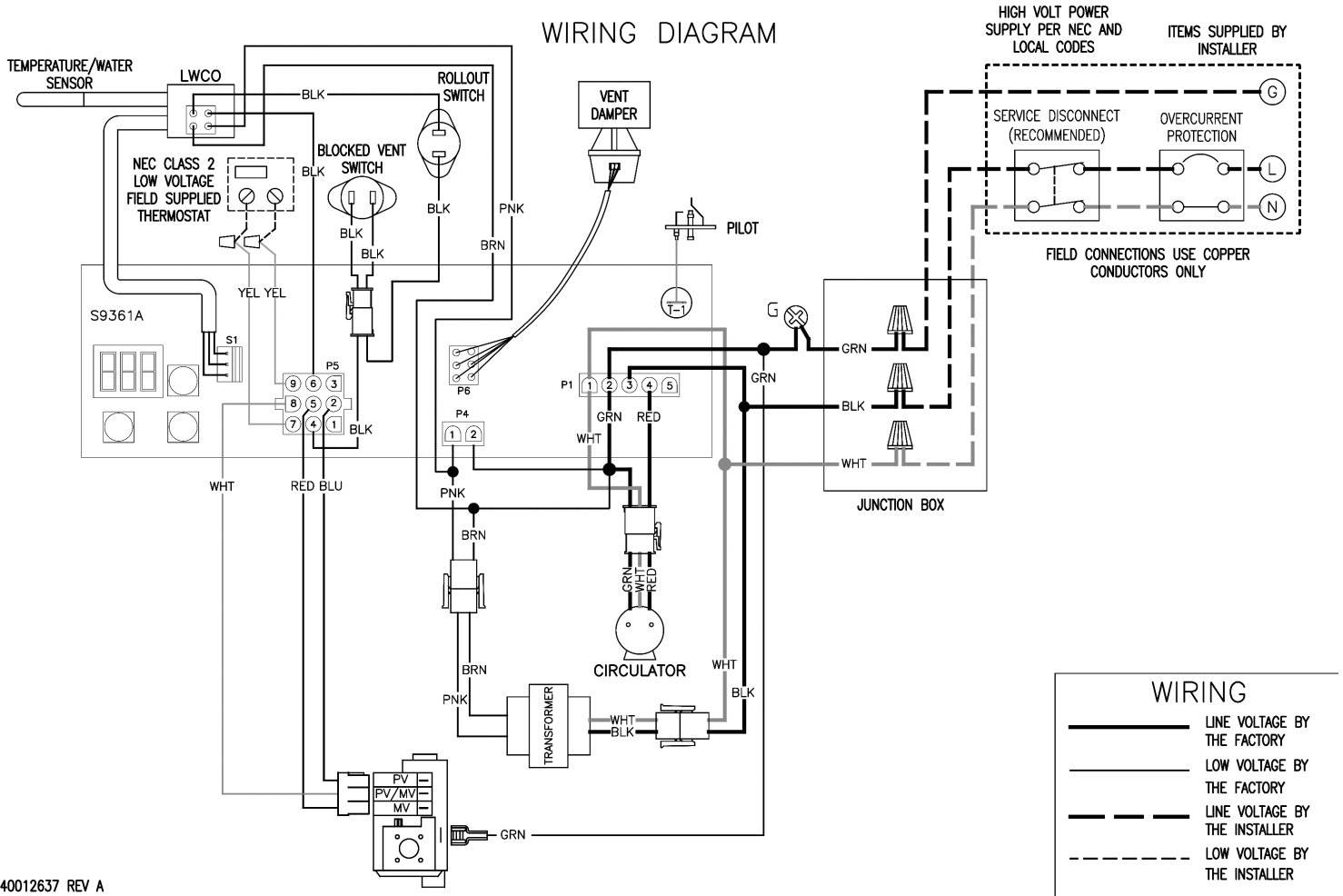
1. Use a thermostat with dry contacts which does not pull any load from the control. Use a separate transformer for zone valve wiring.
2. Thermostat should be installed on inside wall about four feet above floor.
3. NEVER install thermostat on outside wall.
4. Do not install thermostat where it will be affected by drafts, hot or cold pipes, sunlight, lighting fixtures, televisions, fireplace, or chimney.
5. Check thermostat operation by raising and lowering thermostat setting as required to start and stop burners.
6. Instructions for final adjustment of thermostat are packaged with thermostat (adjusting heating anticipator, calibration, etc.)
7. Thermostat's heat anticipator must be adjusted to match total current draw of all controls associated with boiler during heating cycle.

11 - WIRING DIAGRAM

⚠ WARNING

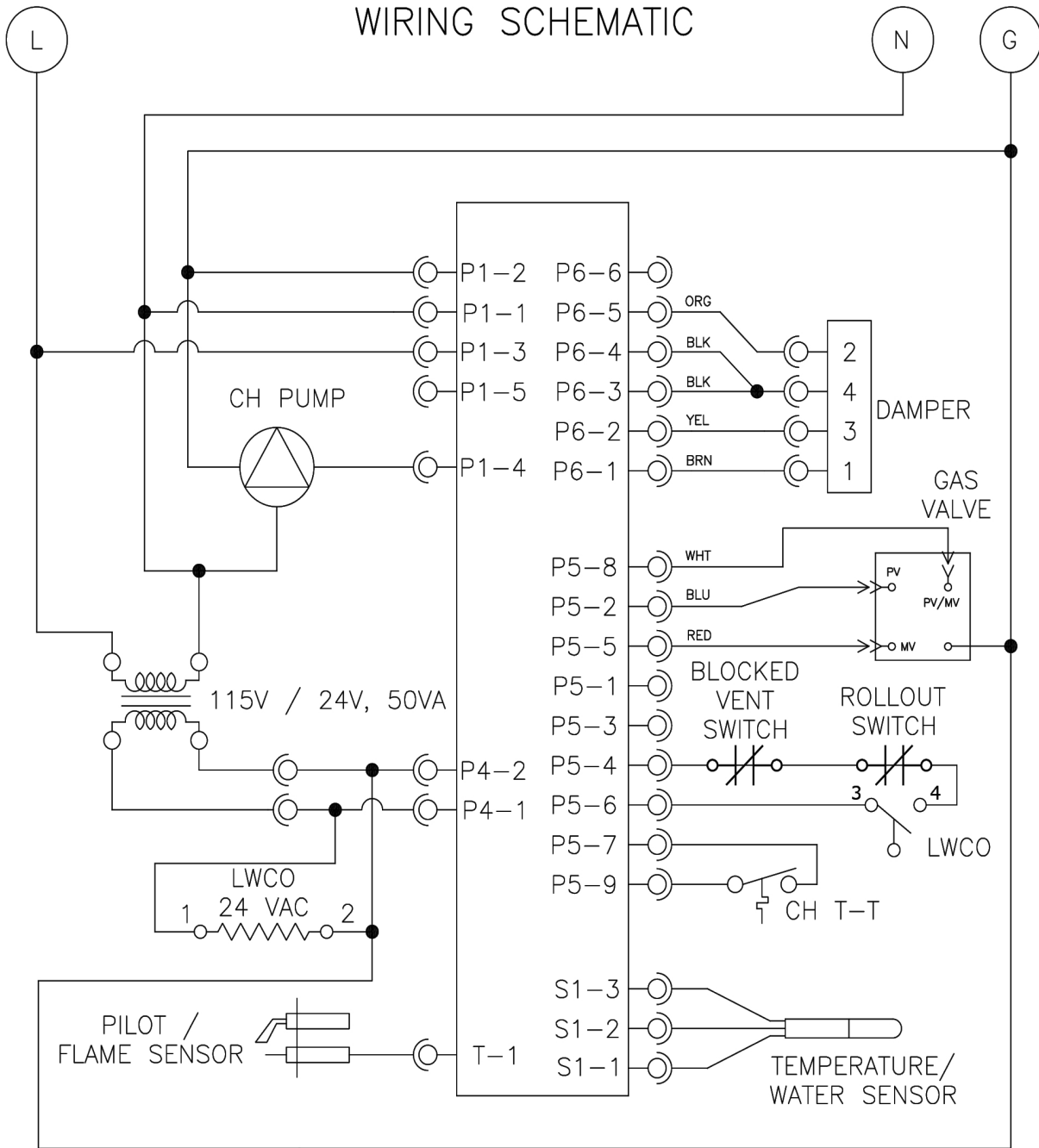
Modification, substitution or elimination of factory equipped, supplied or specified components may result in personal injury or loss of life.

Figure 11-1 - Integrated High Limit & Electronic Ignition Control



11 - WIRING DIAGRAM

Figure 11-2 - Integrated High Limit & Electronic Ignition Control



12 - LIGHTING INSTRUCTIONS

⚠ WARNING

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

- This appliance is equipped with an ignition device which automatically lights burner. **Do NOT try to light this burner by hand.**
- Before operating smell all around appliance area for gas. Be sure to smell next to floor because some gas is heavier than air and will settle to the floor.
- **Use only your hand to turn the gas shutoff valve.** Never use tools. If valve will not turn by hand, do not try to repair it, call a qualified service technician. Force or attempted repair may result in fire or explosion.
- **Do not use this appliance if any part has been under water.** Immediately call a qualified service technician to inspect appliance and to replace any part of control system and any gas control which has been under water.

NOTICE

Before lighting pilot burner, verify hot water boiler and system are full of water to minimum pressure of 12 psi in the system, also verify system is vented of air. Set operating control of thermostat to "below" normal setting. Refer to following appropriate lighting instruction.

12.1 Lighting Procedure For Boiler With Intermittent Pilot System

- A. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the appliance by hand.

⚠ CAUTION

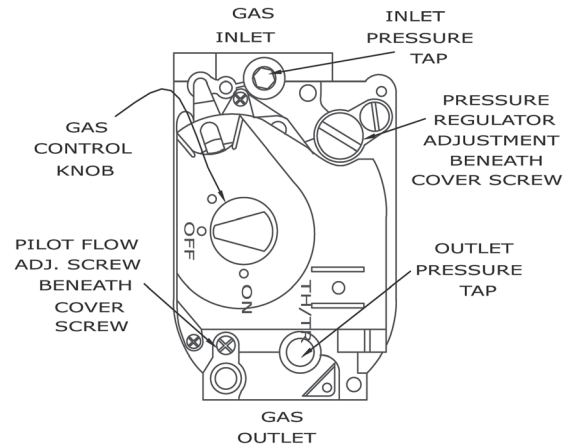
WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switches; 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.

12.2 Operating Instructions For Intermittent Pilot System

1. STOP! Read the safety information to the left.
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 pilot by hand.

Figure 12-1 - Intermittent Pilot



5. Turn gas control knob clockwise  to "OFF."
6. Wait (5) minutes to clear out any gas. If you then smell gas, STOP! Follow "What To Do If You Smell Gas" in the safety information to the left. If you don't smell gas, go on to the next step.
7. Turn gas control knob counterclockwise  to "ON."
8. Turn on all electric power to the appliance.
9. Set thermostat to desired setting.
10. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance", and call qualified service technician or your gas supplier.

12.3 TO TURN OFF GAS TO THE 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.
4. Call qualified service technician.

13 - NORMAL SEQUENCE OF OPERATION

⚠ WARNING

Burn Hazard. View port on burner door may be hot. Wear personal protection when servicing this boiler.

WARNING

Fire and Asphyxiation hazard. Do not attempt to place boiler in operation if safety switches shut the main burner gas off. Contact a qualified service agency. Failure to follow these instructions could result in death or serious injury.

13.1 General

1. Thermostat actuates on call for heat, completing circuit to control.
 - A. Completed circuit to control will energize the vent damper. The circulator will be energized if the boiler water temperature is above 125°F
 - B. When the vent damper is fully open the damper end switch completes the circuit to ignition system, ignition takes place.
2. In event boiler water temperature exceeds high limit setting on boiler mounted high limit control, power is interrupted between control system and ignition system.

- A. Power remains off until boiler water temperature drops below high limit setting.
- B. Circulator continues to operate under this condition until thermostat is satisfied.

3. In event the flow of combustion products through boiler venting system becomes blocked:

- A. Blocked vent safety switch shuts main burner gas off.
- B. If boiler flue-way becomes blocked: flame rollout safety switch shuts main burner gas off. See Figure 13-1.

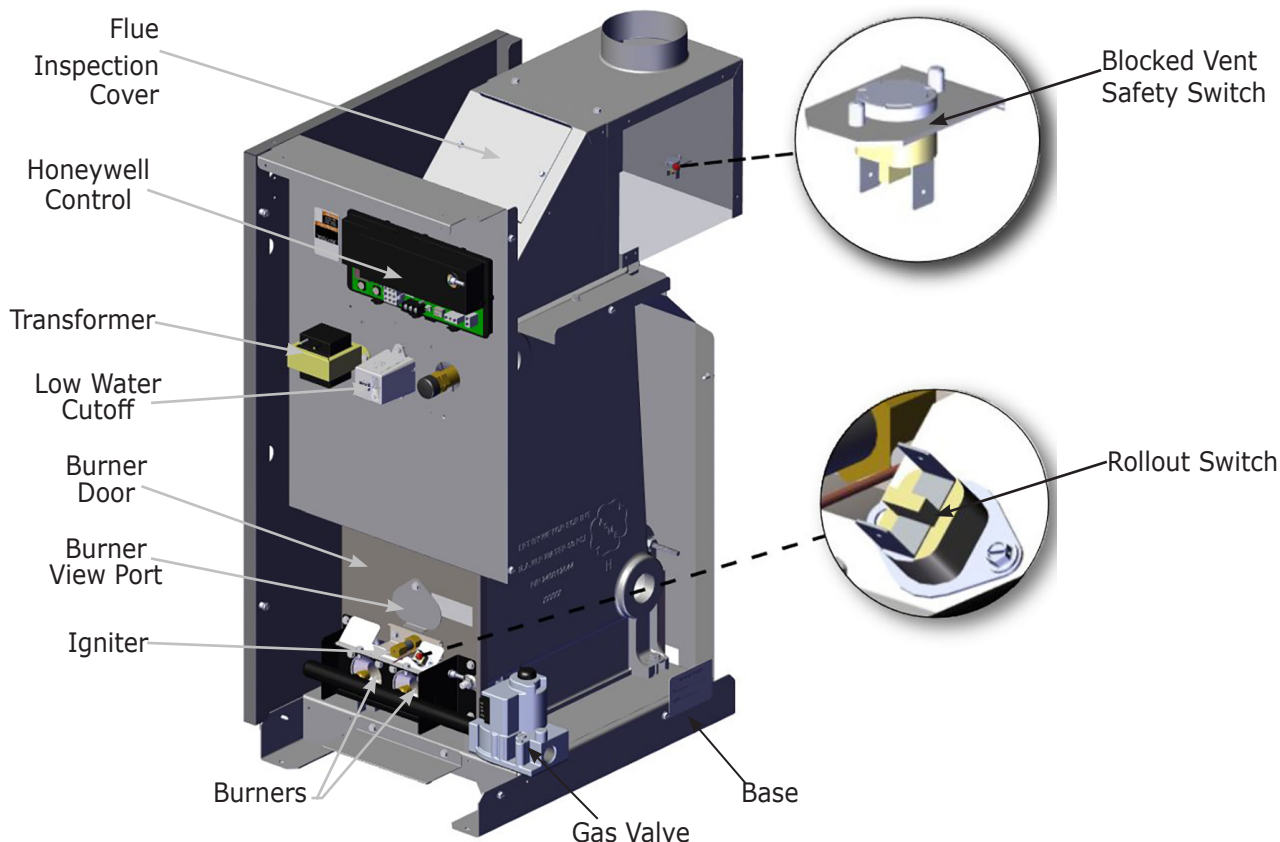
If either of these conditions A or B exist:

Do not attempt to place boiler back into operation. Contact certified service agency. Do not jumper safety switch(s).

For detailed sequence of control, see Appendix A

* Burner shipping retention clips (not shown) may be removed if desired.

Figure 13-1 Blocked Vent Safety Switch, Roll-out Safety Switch



WARNING

Label all wires prior to disconnection when servicing controls. Wiring errors could cause improper and dangerous operation.

14.1 Seasonal Startup

- Before seasonal start-up, have a certified service agency check boiler for soot and scale in flues, clean burners and check gas input rate to maintain high operating efficiency.
- Verify proper operation after servicing.
- Service agency will verify system is filled with water to minimum pressure and open air vents, if used, to expel any air accumulated in the system. Check entire piping system and, if any leaks appear, have them repaired.
- *Circulators need to be checked and maintained. Refer to circulator manufacturer's instructions.*
- Inspect venting system at the start of each heating season.
 - ◇ Check vent pipe from boiler to chimney for signs of deterioration by rust or sagging joints. Repair if necessary.
 - ◇ Remove vent pipe at base of chimney or flue and using a mirror, check vent for obstruction and verify vent is in good working order.
- Boiler flue gas passageways may be inspected by a light and mirror.
 - ◇ Remove burner door. Figure 13-1 page 28.
 - ◇ Place trouble lamp in flue collector through draft relief opening or flue inspection cover.
 - ◇ With mirror positioned above burners, flue gas passageways can be checked for soot or scale.

14.2 Clean Flue Gas Passageways

Follow this procedure to clean flue gas passageways:

1. Remove burner tray from heat exchanger by disconnecting gas valve, remove two (2) nuts and pull out the assembly. See Figure 14-1 page 30.
2. Remove top jacket panel.
3. Remove flue inspection cover.
4. Place sheet of heavy paper or similar material over bottom of base and brush down flue passageways. Soot and scale will collect on paper and is easily removed with the paper.
5. With paper still in place in base, clean top of boiler castings of boiler putty or silicone used to seal between castings and flue collector. Verify chips are not lodged in flue passageways.

When cleaning process is complete, restore boiler components to their original position. Use IS-808 GE silicone (available from distributor) to seal around flue collector, and inspection cover if required.

14.3 General Maintenance

- Visually inspect main burner and pilot flames at start of heating season and again in mid-season.
 - ◊ Main burner flame should have well defined inner blue mantel with lighter blue outer mantel.
 - ◊ Check burner throats and burner orifices for lint or dust obstruction. Figures 14-1 and 14-3.
- Pilot flame should envelop $\frac{3}{8}$ to $\frac{1}{2}$ inch of tip of ignition/sensing electrode. See Figure 14-2.
- To adjust pilot flame: remove pilot adjustment cover screw and turn inner adjustment screw counterclockwise  to increase or clockwise  to decrease pilot flame. Replace cover screw after adjustment to prevent possible gas leakage. See Figure 12-1, Page 27.
- Check burners and pilot for signs of corrosion, rust or scale buildup.
- Area around boiler shall be clear and free of combustible materials, gasoline and other flammable vapors and liquids.
- Free flow of combustion and ventilating air to boiler and boiler room shall not be restricted or blocked.
- Inspect factory supplied and field sourced low water cutoffs annually, or as recommended by low water cutoff manufacturer. Flush float type low water cutoffs per manufacturer's instructions.
- Contact a **Qualified Service Agency** to make annual inspection of boiler and heating system. This should include:
 1. Check casting and vent for signs of corrosion from condensate.
 2. Examine pilot lint screen and clean if needed.
 3. Check venting for any signs of corrosion, rust, damage or deterioration. Contact a **Qualified Service Agency** immediately if you observe any of these conditions.
 4. Clean oxidation on igniter/flame sensor with abrasive cloth as needed.

Figure 14-1 - Burner Tray

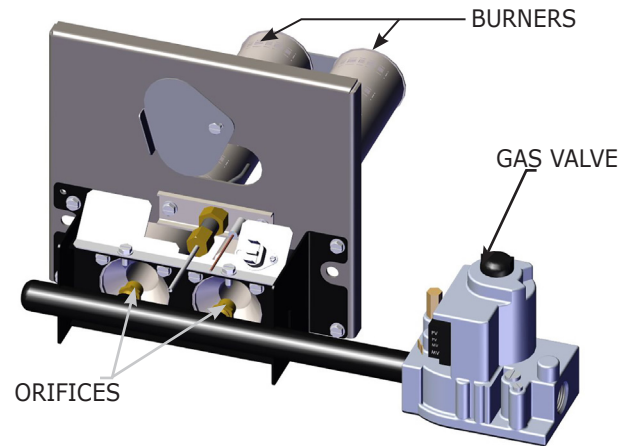


Figure 14-2 - Gas Burner Pilot

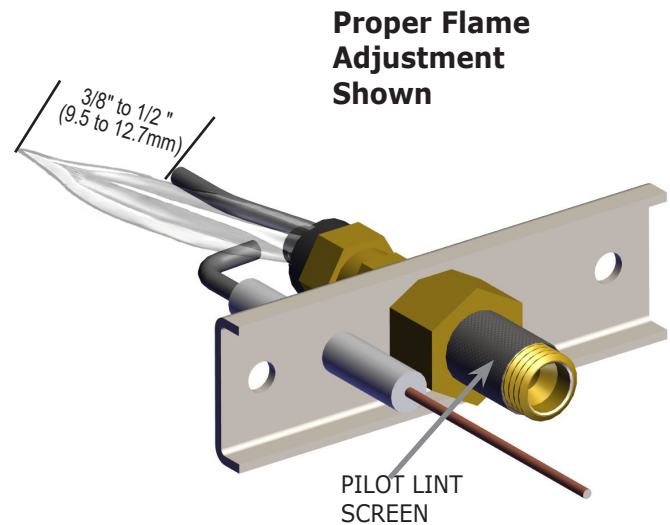
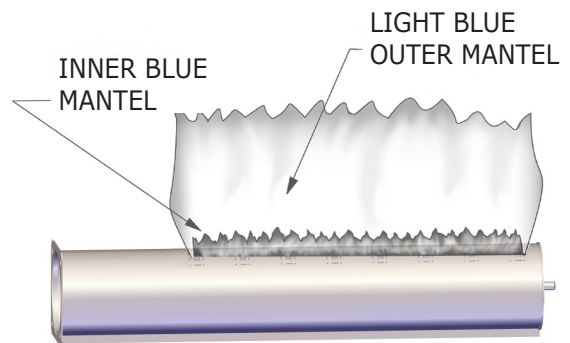


Figure 14-3 - Gas Burner Flame



14.4 Adjusting Gas Input

1. Adjust gas input to boiler by removing protective cap on pressure regulator, and turning screw clockwise  to increase input and counterclockwise  to decrease input. See Figure 12-1 page 27.
2. Manifold pressures are taken at outlet side of gas valve. See page 23 for proper pressure recommendations.
3. To check for proper flow of natural gas to boiler, divide input rate shown on rating plate by heating value of gas obtained from local gas company. This determines number of cubic feet of gas required per hour.
4. Determine flow of gas through meter for two minutes and multiply by 30 to get hourly rate with all other gas appliances off.
5. Make minor adjustments to gas input as described above. See Figure 12-1 page 27.
6. Change burner orifices if final manifold pressure varies more than plus or minus 0.3 inches water column from specified pressure listed on boiler rating plate.
7. Primary air adjustment is not necessary, therefore air shutters are not furnished.

CHECK SAFETY CONTROL CIRCUIT. Test ignition system safety shutoff device after placing boiler in operation. Test ignition system safety shutoff device after placing boiler in operation. Blocked vent switch and rollout switch can be tested by removing one of the wires. See Figure 13-1 page 28.

8. **Intermittent Pilot:** With main burner operating, turn pilot gas adjusting screw clockwise  until pilot gas is turned off. Within 90 seconds main gas control closes, shutting off gas to main burner.
9. **High Limit Control:** Remove front cover and note temperature setting. Refer to appendix A for adjustment procedure. Decrease setting to minimum and operate boiler. When boiler water temperature exceeds control temperature setting, control will open circuit, closing automatic main gas valve.

1 - RATINGS & DATA - NATURAL GAS & PROPANE GAS



Table 1 - Ratings and Capacities

Model No.	Number of Sections	(1) Input BTU/HR	(1) Heating Capacity BTU/HR	(2) Net AHRI Rating Water BTU/HR	AFUE	Flue Diameter Inches	(1) High Altitude Input BTU/HR	(3) Recommended Air Cushion Tank
BWBCAN000060	3	59,000	50,000	43,000	84.0	4	53,100	15
BWBCAN000095	4	92,500	78,000	68,000	84.0	5	83,200	30
BWBCAN000120	5	120,000	101,000	88,000	84.0	6	108,000	30
BWBCAN000150	6	149,000	125,000	109,000	84.0	6	134,100	30
BWBCAN000175	7	175,000	147,000	128,000	84.0	7	157,500	30
BWBCAN000205	8	205,000	172,000	150,000	84.0	7	184,500	30
BWBCAN000235	9	235,000	197,000	171,000	84.0	7	211,500	30

EXPLANATORY NOTES

- All boilers are design certified for installation on noncombustible floor.
- Recommended chimney height 20 feet. In special cases where conditions permit, chimney height may be reduced to 10 feet. Refer to the latest revision of NFPA part 11.
- Electric service to be 120 Volts, 15 Amps, 60 Hz.
- The MEA number for the this boiler is 19-79-E.
- (1) Input rating for sea level to 2,000 ft. (610m) above sea level.
United States, over 2000 ft (610m) above sea level. Reduce input rate 4% for every 1,000 ft (304m) above sea level.
Canada, 2000 ft (610m) to 4500 (1350m) above sea level. Reduce input per table. Over 4500 ft (1350m) above sea level. Contact Provincial authority having jurisdiction.
- (2) Net AHRI Water Ratings shown based on 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.
For forced hot water systems where boiler and all piping within area to be heated, boiler may be selected on basis of its heating capacity.
- (3) Tank sized for non-ferrous baseboard or radiant panel systems. Increase size for cast iron baseboard and radiation.

STANDARD EQUIPMENT: Boiler Jacket, Cast Iron Boiler Battery, High Limit Control, Intermittent Electric Ignition Pilot System, Vent Damper Relay, Main Gas Burners, Gas Control (Includes Automatic Gas Valve, Intermittent Pilot, Safety Shutoff, Pilot Flow Adjustment, Pilot Filter), A.S.M.E. Relief Valve, Drain Valve, Spill Switch, Rollout Switch, Combination Gas Control, Automatic Vent Damper, Wiring Harness, Non-linting Safety Pilot.

⚠ WARNING

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

- **Do not use this appliance if any part has been under water.** Immediately call a qualified service technician to inspect appliance and to replace any part of control system and any gas control which has been under water.
- Do not allow water to drip on controls. Prevent condensation by allowing air circulation around module and gas control.
- Do not use corrosive chemicals around or on module or gas control.

A.1 Installation Environment Considerations

Controls can be damaged by excessively high temperatures. Verify adequate air circulation around control is maintained when installing boiler.

A.2 Electrical Connections

Connect Module Connectors Figure 11-1, Page 25

- Connect L, N, G leads inside J box using wire nuts. Secure J-box cover.
- Connect Circulator harness to circulator. Harness comes plugged into module with Molex[®] plug.
- Connect thermostat connection to yellow wires marked TT using wire nuts.
- Ensure remaining Molex[®] plug connectors have not worked loose during transit.
- Check sensing bulb is fully inserted in well and is not loose.
- Verify vent damper connection is made. See page 42.

A.3 Adjusting Settings

To discourage unauthorized changing of settings, procedure to enter adjustment mode is required.

To enter adjustment mode, press UP, DOWN, and I buttons simultaneously for three seconds. Press and release I button until parameter requiring adjustment is displayed.

See Figure A-1 below.

- "SP_" Setpoint (180 °F default setting; adjustable between 130 and 220 °F). Note: on some models this is "HL" High Limit.
- "Df_" Setpoint Differential (15 °F default setting; adjustable between 10 and 30 °F)
- "°F_" Degrees Fahrenheit

Press UP or DOWN button until parameter has reached desired value. After 60 seconds without any button inputs, control automatically returns to READ mode.

A.4 Display

In RUN mode, status items and parameters are viewable.

Example, to display setpoint, control flashes "sp" (setpoint) followed by temperature (i.e., 135), followed by °F or °C.

To read settings, press and release I key to find parameter of interest.

Example, press and release I until setpoint (sp) is displayed, followed by three-digit number, i.e., 190, followed by °F or °C. Press I button again will display (S1T) Sensor 1 Temperature followed by three-digit number and corresponding degree designator.

See Display Readout.

Figure A-1 - Display Readout

TEXT	DESCRIPTION	DISPLAY SHOWS
STA	STATUS (SEE STATUS NUMBERS)	Sta
BT	BOILER TEMPERATURE	bT
SP	OPERATING SETPOINT	SP
HL	HIGH LIMIT SETPOINT	HL
HDF	DIFFERENTIAL SETPOINT	HdF
FLA	FLAME CURRENT	FLA
RUN	RUN TIME HOURS	run
CYC	BOILER CYCLES	CYC
ERR	ERROR (SEE ERROR NUMBERS)	Err

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A.5 Operation

Module continuously monitors boiler water temperature and fires or shuts off burner based on this temperature data.

1. When "Call for Heat" occurs, control enables circulator and monitors boiler water temperature to determine whether thermostat can be satisfied without firing burners.
2. Control determines burner operation is required, module proceeds to start burner (see state codes list) and heats water in boiler until setpoint temperature is achieved or thermostat is satisfied. .
3. Burner is de-activated, ignition module completes heating cycle, returns to idle and waits for temperature to drop again.
4. Circulator is turned on throughout "Call for Heat."

Table A1 - Vent Damper Models Operation State Codes

1. State code sequence through a normal heat cycle

Order	State Code Number	Definition	Explanation
a	1	Idle	There is no call for heat and or:
b	1	Circulator	Thermostat has call for heat. Control has activated system circulator pump and is waiting to see if there is enough heat to satisfy the thermostat without firing the burners. This may last as long as 2 minutes, but will typically be much less.
c	17	Diagnostics	Pilot valve diagnostics/current leakage detection. Typically a few seconds.
d	18	Wait for damper to open	Vent damper should be closed while boiler is off to conserve energy. Now, the vent damper must open before burner can safely be lit. The vent damper must confirm it is open (a switch closes to do this). The control is waiting for this to occur. This may last up to one minute. If the vent damper switch has not closed after one minute, ERR 55 will be displayed.
e	17	Diagnostics	Another diagnostic check. The control will also check the safety switches (rollout and vent) are closed. This will be so quick the control may move on before the STA code is flashed. Should the safety switches be detected open, the control will show STA15 for as long as the switches are open.
f	6	Spark	Spark for ignition. There should be an audible sparking (buzzing) noise. This will last until the control detects a pilot flame, but not more than 30 seconds (90 for S9361A2095). (If no flame is detected after the trial period, sparking will cease, and a 5 minute delay will occur before the control tries again. STA10 will be displayed during this period).
g	7	Flame stabilization	The pilot flame must be strong enough(1 μ A) for the control to release the main burners. This will last up to 10 seconds. (If the flame is still not strong enough after 10 seconds, the control will shut off the pilot, wait 5 minutes, then try again. STA10 will be displayed during the 5 minute period).
h	8	Running	Main burners are providing heat. This will continue as long as the thermostat requires. During this period, the control will monitor the pilot signal, boiler temperature, damper, and limit switches to assure safe operation.
g	1	Post operation	The damper will close again to conserve heat, and the circulator pumps will continue for a short time to deliver stored heat to the house before it has a chance to escape during the upcoming off period.

APPENDIX A - CONTROL MODULE

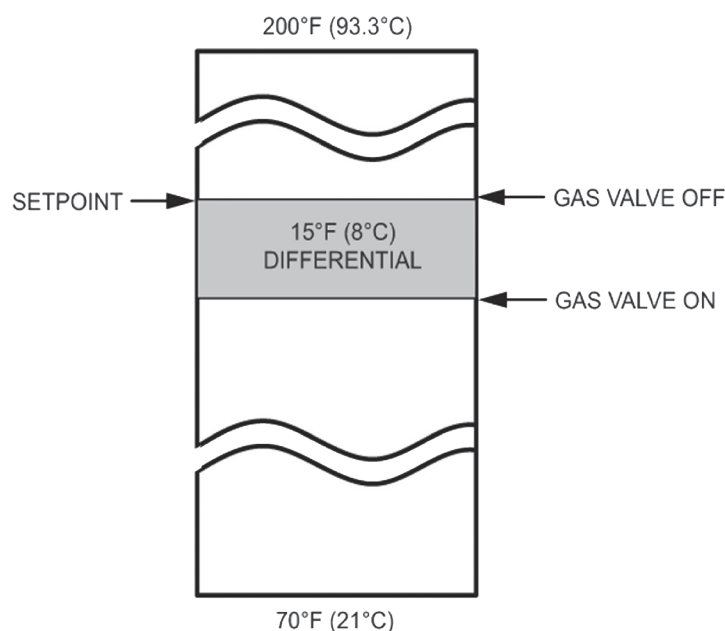
Table A1 conti. - Vent Damper Models Operation State Codes

Order	State Code Number	Definition	Explanation
2. Other possible state codes			
h	4	Pre-purge	System is purging before ignition trial; includes Pilot Valve circuit diagnostics. On vent damper models, this is so quick it will typically be over before the display can flash this code, and therefore will rarely be visible.
i	9	Post-purge	System is purging after heat cycle. On vent damper models, this is so quick it will typically be over before the display can flash this code, and therefore will rarely be visible.
j	10	Retry Recycle Delay	5 minute delay after pilot signal is lost. Either: 1. Control failed to detect flame after spark period. Check pilot for contamination, check ignition wire; check electrical ground; Check pilot flame. 2. Control lost pilot flame signal AFTER main burners were lit. Check for adequate draft and combustion air. Check gas line for adequate pressure.
k	13	Soft lock out	Soft lock out duration is one hour, may override with manual reset. Appropriate error code will flash alternately.
l	14	Hard lock out	Requires manual reset. Unacceptable high water temperature (err 65) and onboard electronics failure (err 18) are the only two (2) hard lockouts on this model.
m	15	Wait for limit to close	One of the safety limits - rollout, vent spill, or low water cutoff has been activated. Control will resume normal operation once limit is reset. Underlying cause why the limit switch opened MUST be investigated.
n	16	Flame out of sequence	Flame signal sensed before trial ignition. Appropriate alarm is sent. OR Flame signal sensed out of sequence during post purge OR Flame signal present when not expected. Appropriate alarm is sent.
o	17	Diagnostics	Onboard self check performed at various points during the operation sequence.
p	19	Wait for damper switch to close	Damper is closed and control waits for damper switch to close. Checked at beginning of heat cycle before opening damper. If damper does not open in 60 seconds, control goes to State 20. Control may also be in state 15 if one of the safety limits is open.
q	20	Wait for damper to open (Failed close)	Damper has not opened (end switch not closed) at beginning of heat cycle. Alarm message is sent, control is NOT in lockout. Control will resume normal operation once the damper opens.
r	21	Wait for damper to close (Failed open)	Damper has not closed despite actuator de-energized. Alarm message sent, control is NOT in lockout.

A.6 Boiler High Limit Temperature Controller

- When water temperature reaches setpoint, controller ends heating cycle.
- When water temperature drops below setpoint minus differential, controller restarts heat cycle to re-heat boiler water.
- If water temperature exceeds maximum allowed temperature (220°F or 104°C), controller enters manual reset lockout state.
- For models having reset capability, press any onboard button or cycle power to reset.

Figure A-2 - Basic Control Algorithm Example



A.7 Troubleshooting

- Following service procedures are provided as general guide.
- On lockout and retry models, meter readings between gas control and ignition module must be taken within trial for ignition period. Once ignition module shuts off, lockout models must be reset through key buttons and display. On retry models, wait for retry or reset at thermostat.
- Check for correct installation and wiring before replacing any component.
- Control module cannot be repaired. If it malfunctions, it must be replaced.
- Use only qualified service agent to service ignition systems.

1. Perform checkout as first step in troubleshooting. Check troubleshooting guide to pinpoint cause of problem. See Table A7.
2. If troubleshooting indicates ignition problem, see Ignition System Checks to isolate and correct the problem.
3. Perform checkout procedure following troubleshooting guide again to verify system is operating normally.

A.8 Troubleshooting Error Codes

Integrated boiler control uses advanced diagnostic capability to assist in troubleshooting error conditions. Table A7 shows codes that could arise on integrated display during fault. Suggestions are provided in Table A1 page 34 and Table A7 for servicing these potential errors.

APPENDIX A - CONTROL MODULE

Table A7 - Troubleshooting Error Codes

Error Code Number	Definition	Error Display clearing (once error condition has disappeared)					
		Clears itself when root problem is solved	Cycle Power OFF	Push any key	Up/down key when status is displayed	Explanation	Things to look for
4	Flame current lower than threshold	*	*			Control requires a strong enough signal to verify flame is present. Signal too low.	1. Check pilot flame sense is clean. 2. Check for proper ground 3. Check wiring 4. Check for correct pilot orifice 5. Check there are no gas leaks in pilot tubing
6	Flame sensed out of normal sequence		*			Control circuit is sensing flame rectification when there should be none.	1. Check gas valve 2. Check all electrical connections are tight
18	Electronic failure			*	*	Control believes it is defective	1. Try reset by cycling power or push any key 2. Check wiring to pilot and main valve 3. Control requires replacement
23	Flame sensed during Pre-purge		*			Primarily for induced draft models although present in vent damper software. Pilot is being sensed to soon in ignition sequence.	1. Check gas valve 2. Check all electrical connections are tight
24	Flame sensed during Post-purge		*		*	Primarily for induced draft models although present in vent damper software. Pilot is being sensed to late in shutdown sequence.	1. Check gas valve 2. Check all electrical connections are tight
32	Temperature sensor failure	*	*		*	Temperature sensor is not providing expected reading.	1. Check sensor is plugged into control board 2. Check sensor wiring is not damaged 3. Scroll display reading to "bt" and hold sensor bulb securely in you hand. It should read a temperature close to body temperature. If not, replace sensor.
55	Damper end switch failed to close	*	*			Vent damper must confirm it is open (switch closes to do this). Control did not receive this signal after waiting one minute, and is still waiting.	1. Check vent damper harness is securely connected to both vent damper and control board. 2. Check vent damper harness is not damaged. 3. Check vent damper mechanism is operating freely. 4. See Appendix B
56	Damper end switch failed to open	*	*			Vent damper must confirm it is closed (switch opens to do this) after a heat call. The control did not receive this signal after waiting one minute, and is still waiting.	1. Check vent damper harness is connected to both vent damper and control board. 2. Check vent damper harness is not damaged. 3. Check vent damper mechanism is operating freely. 4. See Appendix B
57	Flame rod shorted to burner ground	*	*			Control did not detect a voltage difference between flame sense wire and ground.	1. Check flame sense wire on pilot assembly is not frayed or damaged. If so, replace pilot assembly. <i>Note! These are high temperature wires. DO NOT attempt field repair.</i> 2. Check there is no moisture collecting on the control board.
58	AC line frequency error	*	*			AC frequency is incorrect or noisy.	1. Some electric or electronic devices may generate electromagnetic interference. Verify none is present. 2. Check thermostat connection.

APPENDIX A - CONTROL MODULE

Table A7 - Troubleshooting Error Codes - conti.

Error Code Number	Definition	Error Display clearing (once error condition has disappeared)					Explanation	Things to look for
		Clears itself when root problem is solved	Cycle Power OFF	Push any key	Up/down key when status is displayed			
59	Line voltage error	*	*				Line voltage (or, possibly thermostat) is either too high or too low.	Source problem is likely in the electrical external to the boiler. Control will clear itself and resume normal operation once the situation is resolved. Check BOTH line power and thermostat wiring.
60	Thermostat input higher than threshold	*	*				Some types of thermostat may not be compatible with control circuitry.	Verify boiler works properly by jumping yellow thermostat wires. If so, replace thermostat (or thermostat wires).
61	Line Voltage unstable	*	*				Unstable line voltage - possibly too many heavy loads switching on and off.	1. Check current draw on this branch circuit from house breaker box might have very heavy loads switching on or off. 2. Check power coming into the house. Source problem is likely in the electrical external to the boiler. Control will clear itself and resume normal operation once the situation is resolved.
62	Soft Lockout-Max retries exceeded		*	*			Control sensed consecutive instances of no flame signal while trying to light pilot. Note: not present on S9261A2095.	1. Check control ground connection. 2. Check pilot ignition wire for good condition and connection. 3. Clean pilot tip. 4. Check pilot tube, assure no gas leaks. 5. Check correct pilot orifice is being used. 6. Check gas line pressure.
63	Soft Lockout - Max recycles exceeded		*	*			Control sensed consecutive instances of loss of pilot flame signal AFTER main burners are lit. Note: not present on S9261A2095.	1. Check gas valve & gas supply. 2. Check all electrical connections are tight. 3. Check pilot rod is clean. 4. Check for adequate draft. 5. Check for adequate combustion air.
64	Soft Lockout - Internal failure		*	*			Control is sensing something wrong with electrical circuitry.	1. Check all wiring is correct. Refer to wiring diagram. 2. Check there is a good ground to pilot bracket.
65	Hard Lockout - Temperature above limit (Soft Lockout on S9361A2098)	* (S9361A2098)	*	*			Control sensed water temperature too high for safe boiler operation	1. Check water is circulating properly through boiler. 2. Check there is not air in the system. 3. If pressure relief valve is opened, there is definitely a problem with water circulation! 4. If any of the above 3 are true, root problem is in the hot water circulation. 5. Scroll display reading to "bt", and hold sensor bulb securely in your hand. It should read a temperature close to body temperature. If not, replace sensor.

Note: In event of multiple errors, the highest error number is displayed first.

Note: Error codes 18 and 65 - Hard Lockout will not expire. Requires operator reset. No volatile memory (error will not be remembered if power is off).

Error codes 6, 23, 62, 63 and 64 - Soft Lockout of 1 hour duration if not reset. Control will then resume normal operation. If source error is still present a second soft lockout is possible.

All other codes - No lockout. Control will resume normal operation immediately when source error is resolved.

A.9 Intermittent Pilot

Ignition System Checks

STEP 1: Check ignition cable.

- Verify ignition cable does not make contact with metal surfaces.
- Verify only factory supplied Ignition cable (or approved replacement) is used.
- Verify connections to ignition module and igniter or igniter-sensor are clean and tight.
- Verify ignition cable provides good electrical continuity.

STEP 2:

Verify ignition system grounding. Nuisance shutdowns are often caused by poor or erratic grounding.

Common ground is required for module and pilot burner/igniter sensor.

- Check for good metal-to-metal contact between pilot burner bracket and the main burner.
- Check ground lead from GND (BURNER) terminal on module to pilot burner. Verify connections are clean and tight. If wire is damaged or deteriorated, replace with No. 14-18 gauge, moisture-resistant, thermoplastic insulated wire with 105°C [221°F] minimum rating.
- Check ceramic flame rod insulator for cracks or evidence of exposure to extreme heat, which can permit leakage to ground. Replace pilot burner/igniter sensor and provide shield if necessary.
- If flame rod or bracket is bent out of position, restore to correct position.

STEP 3: Check spark ignition circuit.

Disconnect ignition cable at SPARK terminal on module.

WARNING

Electrical shock hazard. Ignition circuit generates over 10,000 volts. Turn OFF electrical power supply at service panel before making electrical connections. Failure to do so could result in death or serious injury.

Energize module and listen for audible sparking noise. When operating normally, there should be a buzzing noise that turns on and off twice per second for duration of 1–7 seconds depending on model.

STEP 4: Verify pilot and main burner light-off.

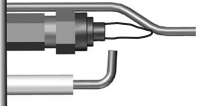
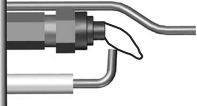
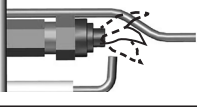
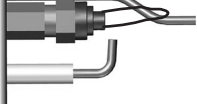
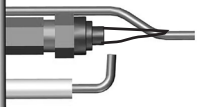
1. Initiate call for heat. Turn thermostat above room temperature. Ignition sequence may be delayed by thermal purge up to 2 minutes.
2. Watch pilot burner during ignition sequence.
 - Verify ignition spark stops within a few seconds after pilot is lit.
 - Verify Main burner lights within a few seconds of pilot lighting
 - a. Check pilot flame. Verify it is blue, steady and envelops 3/8 to 1/2 in. [10 to 13 mm] of flame rod. See Figure A-1 for possible flame problems and causes.
 - b. If necessary, adjust pilot flame by turning pilot adjustment screw on gas control clockwise to decrease or counterclockwise to increase pilot flame. Following adjustment, always replace pilot adjustment cover screw and tighten firmly to assure proper gas control operation. Figure 12-1, page 27.
3. If pilot does not stay lit, ensure adequate flame current as follows.
 - Turn off boiler at circuit breaker or fuse box.
 - Clean flame rod with emery cloth.
 - Verify electrical connections are clean and tight. Replace damaged wire.
 - Check for cracked ceramic insulator, which can cause short to ground, and replace pilot if necessary.

Set temperature below room set-point to end call for heat.

4. Recheck ignition sequence as follows.

- Adjust thermostat above room temperature.
- Verify ignition sequence at burner.

Figure A3 - Troubleshooting Pilot Flame

APPEARANCE	CAUSE
SMALL BLUE FLAME 	CHECK FOR LACK OF GAS FROM: • CLOGGED ORIFICE FILTER • CLOGGED PILOT FILTER • LOW GAS SUPPLY PRESSURE • PILOT ADJUSTMENT AT MINIMUM
LAZY YELLOW FLAME 	CHECK FOR LACK OF AIR FROM: • DIRTY ORIFICE • DIRTY LINT SCREEN, IF USED • DIRTY PRIMARY AIR OPENING IF THERE IS ONE • PILOT ADJUSTMENT AT MINIMUM
WAVY BLUE FLAME 	CHECK FOR: • EXCESSIVE DRAFT AT PILOT LOCATION • RECIRCULATING PRODUCTS OF COMBUSTION
NOISY LIFTING BLOWING FLAME 	CHECK FOR: • HIGH GAS PRESSURE
HARD SHARP FLAME 	THIS FLAME IS CHARACTERISTIC OF MANUFACTURED GAS CHECK FOR: • HIGH GAS PRESSURE • ORIFICE TOO SMALL

Correct Pilot Flame: 3/8 to 1/2 inch in flame.

⚠ WARNING

Asphyxiation, burn hazard. Improper operation of vent damper may result in serious injury or death due to fire or to asphyxiation from poisonous gases such as carbon monoxide which is odorless and invisible.

B.1 Damper Installation

Follow Damper installation instructions provided with damper. See Figure 1a & 1b.

1. Verify only boiler is serviced by Vent Damper. Figure 2.
2. Clearance of 6 inches (152 mm) between Vent Damper and combustible material shall be maintained. Allow additional clearance for service of Vent Damper.
3. Vent Damper shall be in the open position when appliance main burners are operating.
4. Vent Damper position indicator must be in visible location following installation.

B.2 Vent Damper

Check vent damper and all flue product carrying areas of boiler annually for deterioration from corrosion or other sources. Contact your service agent for repairs.

Check Vent Damper Operation as follows:

1. When boiler is off, check vent damper position indicator points to closed position. See Figure 3.
2. Turn thermostat or controller up to call for heat and check vent damper indicator points to open position See Figure 3.
3. Turn thermostat or controller down again and check damper position indicator returns to closed position.
4. Return thermostat to desired position.
5. Place vent damper in open position to permit burner operation by using "HOLD DAMPER OPEN" switch, located on damper controller.
6. Thermostat controls burner firing as before, while damper remains open.
7. **DO NOT** turn damper open manually, motor damage will result.
8. Set switch to "AUTOMATIC OPERATION" to close vent damper during burner off cycle.
9. For further information, and for vent damper troubleshooting guide, refer to manual packaged with vent damper.

Figure 1a - Horizontal Installations

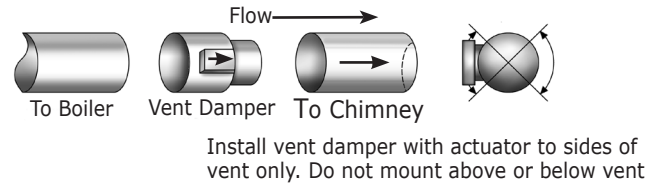


Figure B-1b - Vertical Installations

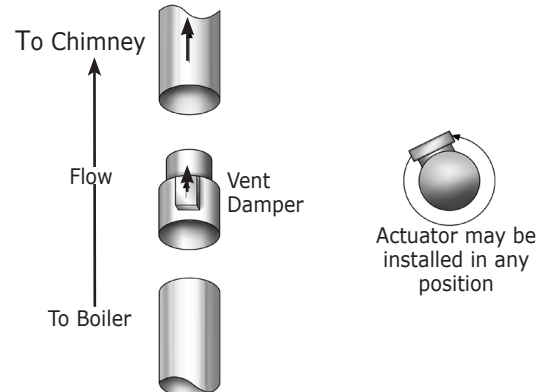


Figure 2 - Alternate Vent Damper Installation

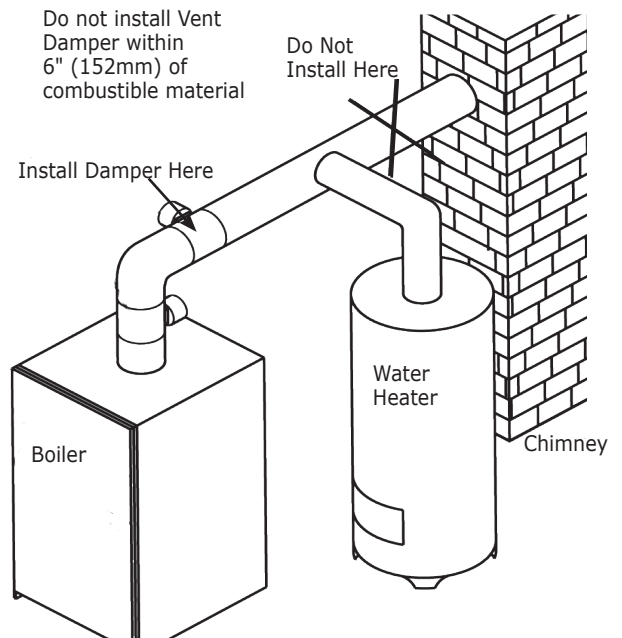
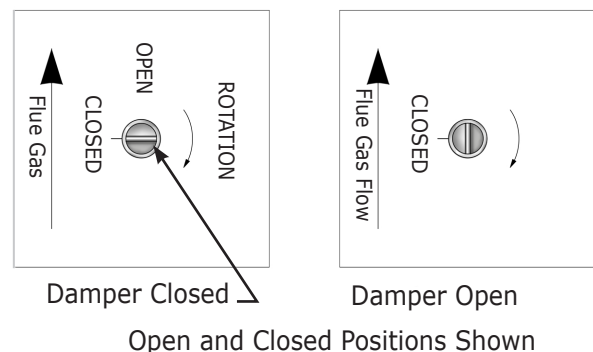


Figure 3 - Vent Damper Position Indicator



B.3 Vent Damper Harness - Molex Plugs

⚠ WARNING

Follow all instructions regarding safety operational controls in this manual. Failure to follow these instructions could result in death or serious injury.

Note When servicing controls, all wires must be labeled prior to disconnection. Wiring errors can cause improper and dangerous operation. Do not turn damper open manually or motor damage will result.

Do not cut plug off of damper motor assembly this will affect warranty coverage.

Check Molex Plugs on Vent Damper Harness:

Note Damper wiring harness is made up of 4 individual colored wires, Brown, Black, Yellow, and Orange. See Figure 4.

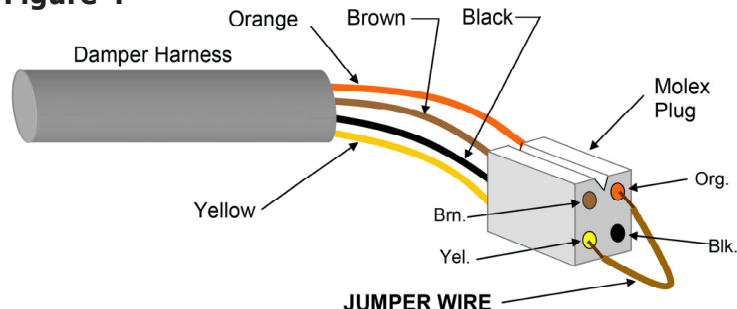
1. Disconnect thermostat wires.
2. Confirm the Molex plugs on each end of the damper harness are wired and operating properly. See Figures 4 and 5.

Damper end of wiring harness:

- A. Hold plug in hand with wiring harness behind Molex with "V" slot on top. Verify wire colors are in proper position.
- B. Take reading across brown and black wires in Molex plug, using test meter set for AC volts. 24 volts should be present.
 - i. IF NOT, source of the problem is not in damper; check line voltage and 24 volt supply.
 - ii. If 24 volts is present across brown and black, continue to step iii.
 - iii. Reconnect thermostat wires and turn up heat setting.
 - iv. Check voltage across black and orange wires in Molex plug. 24 volts AC should be present:
 - IF NOT, source problem is not the damper.
 - If 24 volts is present continue on to step v.
 - v. Place jumper wire across orange and yellow wires in Molex plug (see Figure 4). This will create bypass of the damper, boiler should then ignite.
 - If boiler ignites: Go to section B.4 "Vent Damper Troubleshooting Guide".
 - If boiler does not ignite: Problem is not the damper. Go to Damper harness Molex on Aquastat, Step C.

NOTE: Prior to replacing the damper, be sure the problem is not with wire connections between damper and wiring harness.

Figure 4

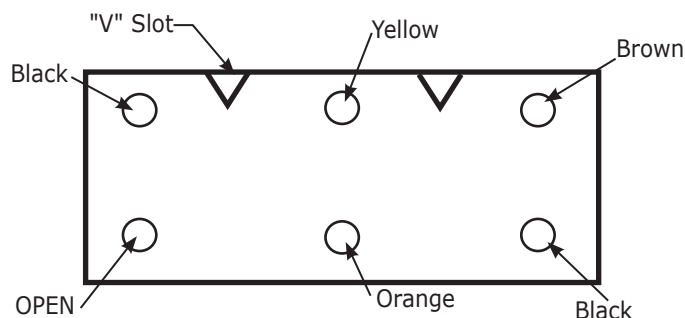


Verify Molex pins are fully seated in both ends of Molex plugs

Figure 5

Control End of wiring harness

Hold plug in hand with wiring harness behind Molex with "V" slot on top. Verify wires colors are in proper position



Check Molex Plugs on Vent Damper Harness:

- C. Remove damper harness from control. Jump Molex connector on control board between two center holes using ~18 ga. thermostat wire. See Figure 6
 - i. If boiler ignites, replace damper harness
 - ii. If boiler does not light, check for 24 volts at B1-B2 on aquastat. If no replace control.
 - iii. If 24 Volts are present Damper and Control are ok. Check ignition module, rollout switch, spill switch or gas valve.

APPENDIX B - VENT DAMPER TROUBLESHOOTING

B.4 Vent Damper Troubleshooting Guide

⚠ WARNING

Follow all instructions regarding safety operational controls in this manual. Failure to follow these instructions could result in death or serious injury.

Note

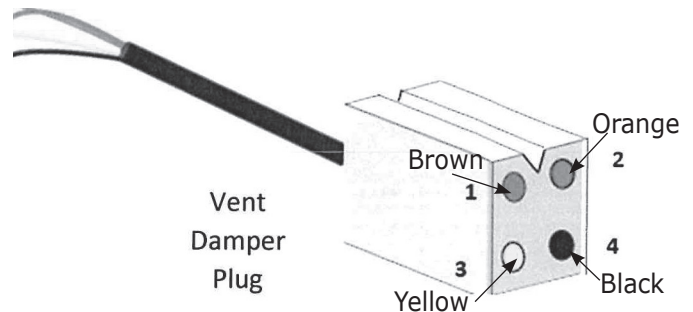
When servicing controls, all wires must be labeled prior to disconnection. Wiring errors can cause improper and dangerous operation. Do not turn damper open manually or motor damage will result and affect warranty coverage, use the service switch.

Do not cut plug off of damper motor assembly this will affect warranty coverage.

Normal Sequence of Operation

24 VAC Power	Power ON	Damper Position
4 & 1	All times	Open or Closed
4 & 2	Calling for Heat	Open or Opening
4 & 3	During combustion	Damper Open

Figure 6



Vent Damper Troubleshooting

Problem	Possible Cause	Recommended Solution
NO POWER Between 4 & 1	1. Off on limit (120VAC) 2. Bad transformer 3. Loose or broken connections 4. Blown fuse or circuit breaker 5. Disconnect switch off 6. Harness not plugged into receptacle on aquastat	1. turn limit on 2. Replace transformer 3. Tighten, repair, or replace connection 4. Replace fuse or reset circuit breaker 5. Turn switch on 6. Plug harness in
NO POWER Between 4 & 2 POWER Between 4 & 1 When calling for heat	1. Thermostat not calling for heat 2. Burned out heat anticipator 3. Loose or broken connections 4. Off/On operating limit, pressure control or low water cut off 5. Off/On blocked vent switch or flame roll out	1. Turn thermostat up to call for heat 2. Replace thermostat 3. Tighten, repair, or replace connection 4. Turn operating limit, pressure control, or low water cutoff ON 5. Reset or replace switch
POWER Between 4 & 1 Between 4 & 2 DAMPER OPEN	1. Loose or broken connection 2. Defective damper motor	1. Tighten, repair, or replace connection 2. Replace damper motor assembly

IMPORTANT

In accordance with Section 325 (f) (3) of the Energy Policy and Conservation Act, this boiler is equipped with a feature that saves energy by reducing the boiler water temperature as the heating load decreases.

This feature is equipped with an override which is provided primarily to permit the use of an external energy management system that serves the same function.

THIS OVERRIDE MUST NOT BE USED UNLESS AT LEAST ONE OF THE FOLLOWING CONDITIONS IS TRUE:

- An external energy management system is installed that reduces the boiler water temperature as the heating load decreases.
- This boiler is not used for any space heating
- This boiler is part of a modular or multiple boiler system having a total input of 300,000 BTU/hr or greater.
- This boiler is equipped with a tankless coil.