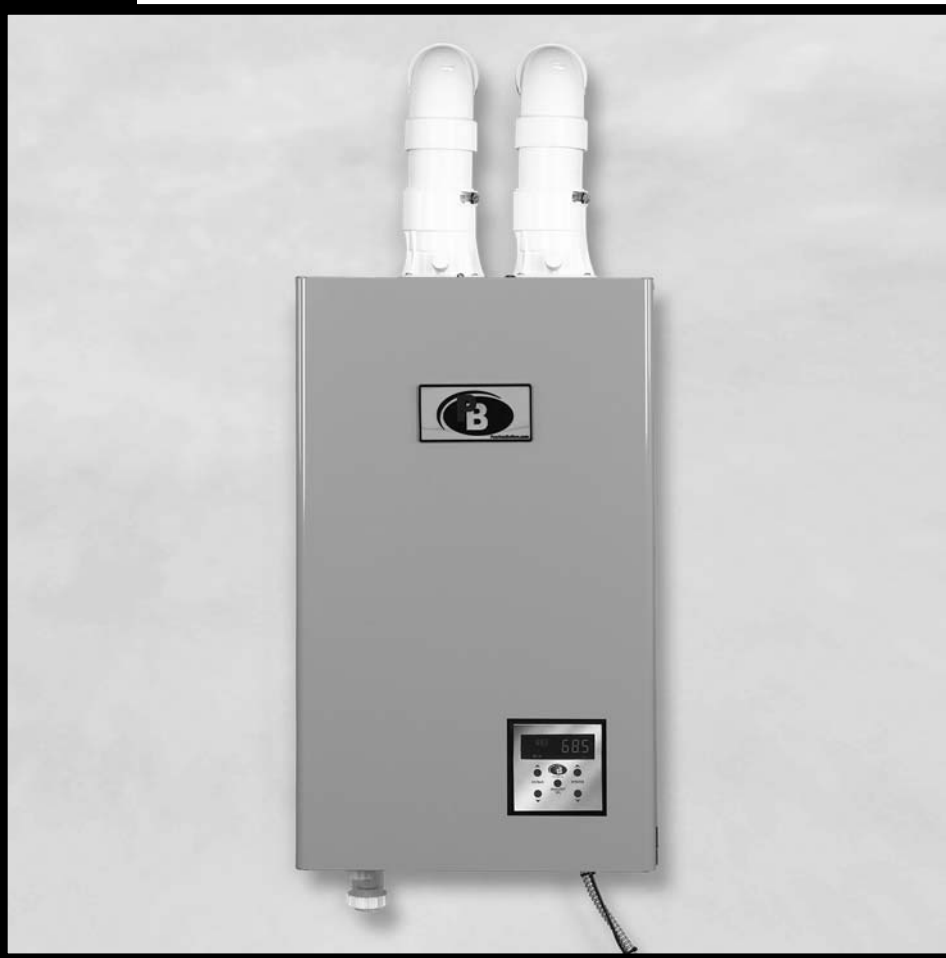


Series PBC™

Combination Gas Boilers

PBC-34™, PBC-40™, PBC-52™



Installation, Operation & Maintenance Manual



PeerlessBoilers.com

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USING THIS MANUAL

A. INSTALLATION SEQUENCE

Follow the installation instructions provided in this manual in the order shown. The order of these instructions has been set in order to provide the installer with a logical sequence of steps that will minimize potential interferences and maximize safety during boiler installation.

B. SPECIAL ATTENTION BOXES

Throughout this manual special attention boxes are provided to supplement the instructions and make special notice of potential hazards. The definition of each of these categories, in the judgement of PB Heat, LLC are as follows:

DANGER

Indicates a condition or hazard which will cause severe personal injury, death or major property damage. Indicates a condition or hazard which may cause severe personal injury, death or major property damage.

WARNING

Indicates a condition or hazard which will or can cause minor personal injury or property damage.

CAUTION

Indicates special attention is needed, but not directly related to potential personal injury or property damage.

NOTICE

Indicates special attention is needed, but not directly related to potential personal injury or property damage.

Compliance with the Energy Policy and Conservation Act:

IMPORTANT NOTICE

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.

1. PREINSTALLATION

A. GENERAL

⚠ WARNING

This manual is intended for use by Qualified Heating Professionals only. Installation, service, or adjustment of this heating appliance by anyone other than a Qualified Heating Professional may cause severe personal injury, death, or major property damage.

1. Series PBC™ boilers are supplied completely assembled as packaged boilers. The package should be inspected for damage upon receipt; any damage to the unit should be reported to the shipping company and wholesaler. The boiler should be stored in a clean, dry area.
2. Carefully read these instructions and be sure to understand the function of all connections prior to beginning installation. Contact your PB Heat, LLC Representative for help in answering questions.

⚠ DANGER



- Water temperatures over 125°F (52°C) can cause severe burns instantly, or death from scalds.
- Children, the disabled, and the elderly are at the highest risk of being scalded.

- Feel water before bathing or showering.
- Read this manual in its entirety before setting domestic hot water setpoint.
- A temperature limiting device (listed to ASSE 1070 or ASSE 1017) is required.

3. This boiler must be installed by a qualified contractor. The boiler warranty may be voided if the boiler is not installed correctly.
4. A hot water boiler installed above radiation or as required by the Authority having jurisdiction, must be provided with a low water fuel cut-off device either as part of the boiler or at the time of installation.
5. Series PBC™ boilers are capable of producing instantaneous domestic hot water to the dwelling. Hot water over 125°F can cause severe scald burns instantly. If utilizing the domestic water production features of the unit, be sure to:
 - a. Install a temperature limiting device per the device manufacturer's instructions to reduce scald hazard.
 - b. Set the temperature limiting device to the lowest practical temperature setting.
 - c. Always feel water before bathing or showering.
 - d. Do not leave children, the disabled, or the elderly unattended while bathing.
 - e. Additional point of use temperature limiting devices may be required at the fixtures to reduce scald hazard.

B. CODES & REGULATIONS

1. Installation and repairs are to be performed in strict accordance with the requirements of state and local regulating agencies and codes dealing with boiler and gas appliance installation.
2. In the absence of local requirements the following should be followed:
 - a. ASME Boiler and Pressure Vessel Code, Section IV - "Heating Boilers"

⚠ WARNING

Liquefied Petroleum (LP) Gas or Propane is heavier than air and, in the event of a leak, may collect in low areas such as basements or floor drains. The gas may then ignite resulting in a fire or explosion.

- b. ASME Boiler and Pressure Vessel Code, Section VI - "Recommended Rules for the Care and Operation of Heating Boilers"
 - c. ANSI Z223.1/NFPA 54 - "National Fuel Gas Code"
 - d. ANSI/NFPA 70 - "National Electrical Code"
 - e. ANSI/NFPA 211 - "Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances"
3. 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.

****Please read if installing in Massachusetts****

Massachusetts requires manufacturers of Side Wall Vented boilers to provide the following information from the Massachusetts code:

- A hard wired carbon monoxide detector with an alarm and battery back-up must be installed on the floor level where the gas equipment is to be installed AND on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment.
- In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.
- Detector(s) must be installed by qualified licensed professionals.
- APPROVED CARBON MONOXIDE DETECTORS: Each carbon monoxide detector shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.

- **SIGNAGE:** A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, **“GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS”**.
- **EXEMPTIONS** to the requirements listed above:
 - The above requirements do not apply if the exhaust vent termination is seven (7) feet or more above finished grade in the area of the venting, including but not limited to decks and porches.
 - The above requirements do not apply to a boiler installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.
- This boiler installation manual shall remain with the boiler at the completion of the installation.

See the latest edition of Massachusetts Code 248 CMR for complete verbiage and also for additional (non-vent related) requirements (248 CMR is available online).

If your installation is NOT in Massachusetts, please see your authority of jurisdiction for requirements that may be in effect in your area. In the absence of such requirements, follow the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, *Natural Gas and Propane Installation Code*.

C. ACCESSIBILITY CLEARANCES

1. The Series PBC™ boiler is certified for closet installations with zero clearance to combustible construction. In addition, it is design certified for use on combustible floors. Do not install on carpeting.

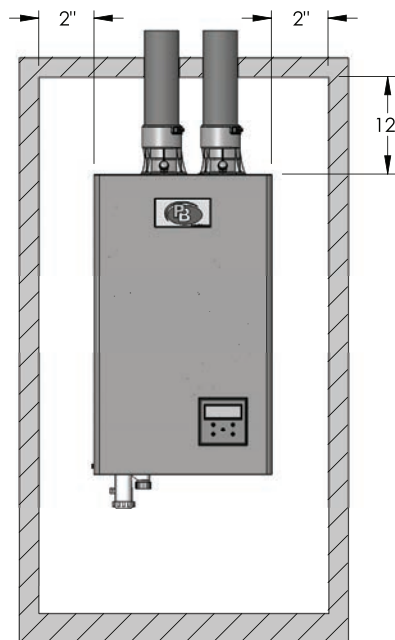
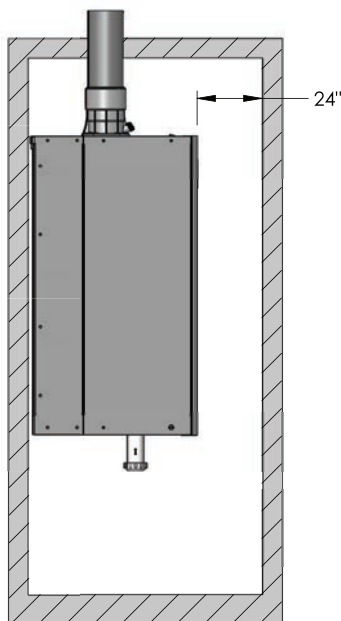


Figure 1.1: Minimum Accessibility Clearances – PBC-34™, PBC-40™, and PBC-52™

DANGER

DO NOT INSTALL ON CARPETING.

2. Figure 1.1 shows the minimum recommended clearances to allow reasonable access to the boiler for Models PBC-34™, PBC-40™ and PBC-52™. However, Local codes or special conditions may require greater clearances.

D. COMBUSTION AND VENTILATION AIR

1. The Series PBC™ boiler is designed for operation with combustion air piped directly to the boiler from outside the building (sealed combustion). Combustion air may be supplied from within the building only if adequate combustion air and ventilation air is provided in accordance with the National Fuel Gas Code or applicable sections of the local building code. Subsections 3 through 10 as follows are based on the National Fuel Gas Code requirements.
2. If the combustion air is piped directly to the boiler from outside the building, no additional combustion or ventilation air is required. Otherwise, follow the National Fuel Gas Code recommendations summarized in subsections 3 through 10.
3. *Required Combustion Air Volume:* The total required volume of indoor air is to be the sum of the required volumes for all appliances located within the space. Rooms communicating directly with the space in which the appliances are installed and through combustion air openings sized as indicated in Subsection 3 are considered part of the required volume. The required volume of indoor air is to be determined by one of two methods.

- a. **Standard Method:** The minimum required volume of indoor air (room volume) shall be 50 cubic feet per 1000 BTU/Hr (4.8 m³/kW). This method is to be used if the air infiltration rate is unknown or if the rate of air infiltration is known to be greater than 0.6 air changes per hour. As an option, this method may be used if the air infiltration rate is known to be between 0.6 and 0.4 air changes per hour. If the air infiltration rate is known to be below 0.4 then the *Known Air Infiltration Rate Method* must be used. If the building in which this appliance is to be installed is unusually tight, PB Heat recommends that the air infiltration rate be determined.

- b. **Known Air Infiltration Rate Method:**

where:

$$\text{Required Volume}_{fan} = \frac{15 \text{ ft}^3}{\text{ACH}} \frac{I_{fan}}{1000 \text{ Btu/hr}}$$

I_{fan} = Input
of the fan assisted appliances
in Btu/hr

ACH = air change per hour (percent of the
volume of the space exchanged per
hour, expressed as a decimal)

Note: These calculations are not to be used for
infiltration rates greater than 0.60 ACH.

4. **Indoor Air Opening Size and Location:** Openings connecting indoor spaces shall be sized and located as follows:

- a. **Combining Spaces on the Same Floor:** Provide two permanent openings communicating with additional spaces that have a minimum free area of 1 in² per 1000 Btu/hr (22 cm² per 1000 W) of the total input rating of all gas fired equipment but not less than 100 in² (645 cm²). One opening is to begin within 12 inches (305 mm) from the top of the space and the other is to begin within 12 inches (305 mm) from the floor. The minimum dimension of either of these openings shall be 3 inches (76 mm). See Figure 1.2 for an illustration of this arrangement.

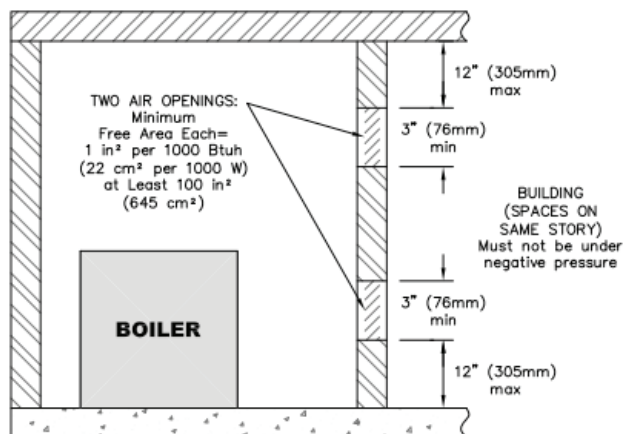


Figure 1.2: Air Openings – All Air from Indoors on the Same Floor

- b. **Combining Spaces on Different Floors:** Provide one or more permanent openings communicating with additional spaces that have a total minimum free area of 2 in² per 1000 Btu/hr (44 cm² per 1000 W) of total input rating of all equipment. See Figure 1.3 for an illustration of this arrangement.

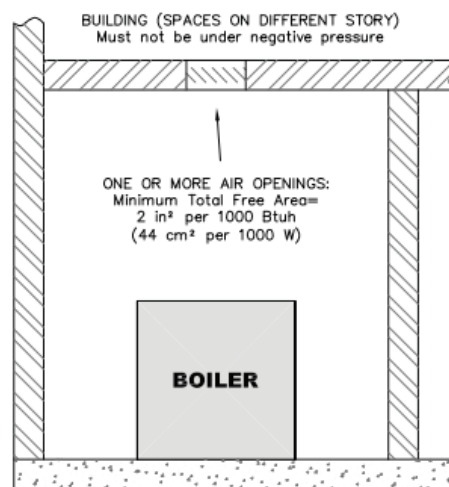


Figure 1.3: Air Openings – All Air from Indoors on Different Floors

5. **Outdoor Combustion Air:** Outdoor combustion air is to be provided through one or two permanent openings. The minimum dimension of these air openings is 3 inches (76 mm).

- a. **Two Permanent Opening Method:** Provide two permanent openings. One opening is to begin within 12 inches (305 mm) of the top of the space and the other is to begin within 12 inches (305 mm) of the floor. The openings are to communicate directly or by ducts with the outdoors or with spaces that freely communicate with the outdoors. The size of the openings shall be determined as follows:
 - i. Where communicating directly or through vertical ducts with the outdoors each opening shall have a minimum free area of 1 in² per 4000 Btu/hr (22 cm² per 4000 W) of total input rating for all equipment in the space. See Figure 1.4 for openings directly communicating with the outdoors or Figure 1.5 for openings connected by ducts to the outdoors.
 - ii. Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 in² per 2000 Btu/hr (22 cm² per 2000 W) of total rated input for all appliances in the space. See Figure 1.6.

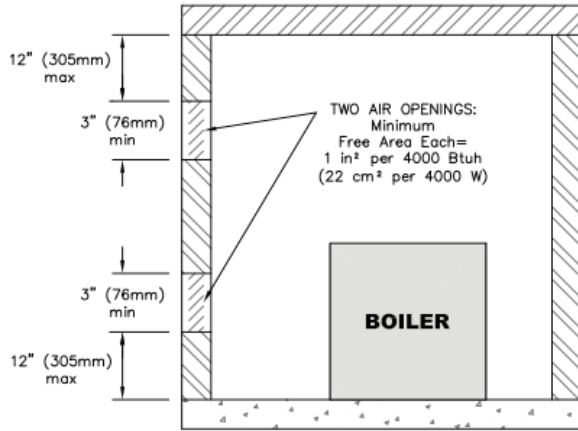


Figure 1.4: Air Openings – All Air Directly from Outdoors

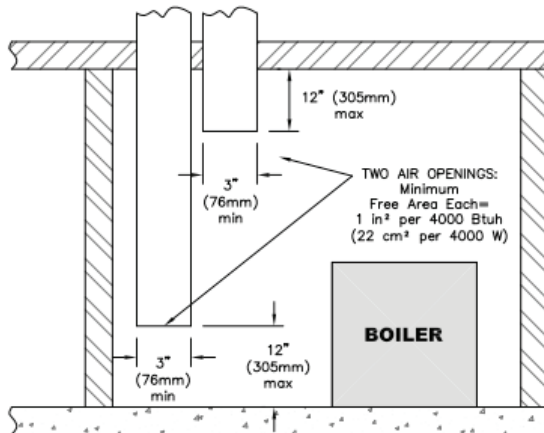


Figure 1.5: Air Openings – All Air from Outdoors through Vertical Ducts

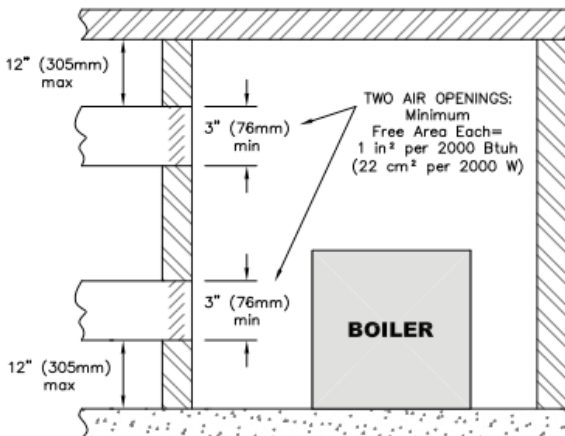


Figure 1.6: Air Openings – All Air from Outdoors through Horizontal Ducts

- b. One Permanent Opening Method: Provide one permanent opening beginning within 12 inches (305 mm) of the top of the space. The opening shall communicate directly with the outdoors, communicate through a vertical or horizontal duct, or communicate with a space that freely communicates with the outdoors. The opening shall have a minimum free area of 1 in² per 3000 Btu/hr. of total rated input for all appliances in the space and not less than the sum of the cross sectional areas of all vent connectors in the space. The gas-fired equipment shall have clearances of at least 1 inch (25 mm) from the sides and back and 6 inches (150 mm) from the front of the appliance. See Figure 1.7 for this arrangement.

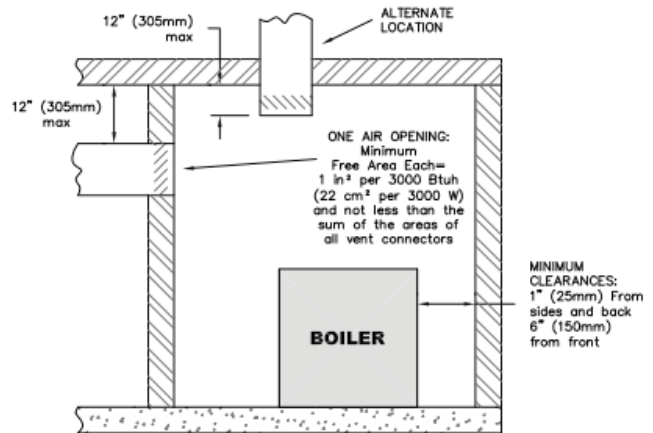


Figure 1.7: Air Openings – All Air from Outdoors

6. Combination Indoor and Outdoor Combustion Air: If the required volume of indoor air exceeds the available indoor air volume, outdoor air openings or ducts may be used to supplement the available indoor air provided:
- The size and location of the indoor openings comply with Subsection 3.
 - The outdoor openings are to be located in accordance with Subsection 4.
 - The size of the outdoor openings are to be sized as follows:

$$A_{req} = A_{full} \times \left(1 - \frac{V_{avail}}{V_{req}} \right)$$

where:

- A_{req} = minimum area of outdoor openings.
 A_{full} = full size of outdoor openings calculated in accordance with Subsection 4.
 V_{avail} = available indoor air volume
 V_{req} = required indoor air volume

7. Engineered Installations: Engineered combustion air installations shall provide an adequate supply of combustion, ventilation, and dilution air and shall be approved by the authority having jurisdiction.

8. Mechanical Combustion Air Supply:

- a. In installations where all combustion air is provided by a mechanical air supply system, the combustion air shall be supplied from the outdoors at the minimum rate of 0.35 ft³/min per 1000 Btu/hr (0.034 m³/min per 1000 W) of the total rated input of all appliances in the space.
- b. In installations where exhaust fans are installed, additional air shall be provided to replace the exhaust air.
- c. Each of the appliances served shall be interlocked to the mechanical air supply to prevent main burner operation when the mechanical air supply system is not in operation.
- d. In buildings where the combustion air is provided by the mechanical ventilation system, the system shall provide the specified combustion air rate in addition to the required ventilation air.

9. Louvers & Grills:

- a. The required size of openings for combustion, ventilation, and dilution air shall be based on the net free area of each opening.
 - i. Where the free area through a louver or grille is known, it shall be used in calculating the opening size required to provide the free area specified.
 - ii. Where the free area through a louver or grille is not known, it shall be assumed that wooden louvers will have 25% free area and metal louvers and grilles will have 75% free area.
 - iii. Non-motorized dampers shall be fixed in the open position.
- b. Motorized dampers shall be interlocked with the equipment so that they are proven in the full open position prior to ignition and during operation of the main burner.
 - i. The interlock shall prevent the main burner from igniting if the damper fails to open during burner startup.
 - ii. The interlock shall shut down the burner if the damper closes during burner operation.

10. Combustion Air Ducts:

- a. Ducts shall be constructed of galvanized steel or an equivalent corrosion-resistant material.
 - b. Ducts shall terminate in an unobstructed space, allowing free movement of combustion air to the appliances.
 - c. Ducts shall serve a single space.
 - d. Ducts shall not serve both upper and lower combustion air openings where both such openings are used. The separation between ducts serving upper and lower combustion air openings shall be maintained to the source of combustion air.
 - e. Ducts shall not be screened where terminating in an attic space.
 - f. Horizontal upper combustion air ducts shall not slope downward toward the source of the combustion air.
 - g. Combustion air intake openings located on the exterior of buildings shall have the lowest side of the combustion air intake opening at least 12 inches (305 mm) above grade.
11. Refer to Section 3 of this manual, Venting & Air Inlet Piping, for specific instructions for piping the exhaust and combustion air.

WARNING

This boiler is certified as an indoor appliance. Do not install this boiler outdoors or locate where it will be exposed to freezing temperatures.

WARNING

Do not install this boiler where gasoline or other flammable liquids or vapors are stored or are in use.

WARNING

Do not install this boiler in the attic.

2. BOILER SET-UP

A. GENERAL

1. Series PBC™ boilers are intended for installation in an area with a floor drain or in a suitable drain pan. Do not install any boiler where leaks or relief valve discharge will cause property damage.
2. The Series PBC™ boiler is not intended to support external piping. All venting and other piping should be supported independently of the boiler.
3. Install the boiler level to prevent condensate from backing up inside the boiler.

⚠ CAUTION

This boiler must be installed level to prevent condensate from backing up inside the boiler.

4. Series PBC™ boilers are wall mounted.

B. UNPACKING THE UNIT

1. Items included inside of the boiler cabinet:
 - a. Two vent adapters
 - b. Miscellaneous parts kit
2. Remove external foam packaging and remove the front panel from the unit. The unit can be easily lifted out of the carton by gripping the bottom front edge of the base panel and the inside of the front edge of the top panel.
3. With the boiler flat on the back panel, remove the right side panel to access the vent adapters and miscellaneous kit. Remove these components.
4. **Remove the internal packaging block behind the gas valve.**
5. The boiler can now be placed upright on a flat stable surface for further pre-installation work.

C. MOUNTING

1. A wall mounting bracket kit (5636) is included for wall mounting these boiler sizes.
2. Mount the bracket level on the wall using 5/16" lag bolts. Be sure the lag bolts are fully supported by wall studs or adequate wall structure.

3. The mounting bracket has (4) holes on 16" centers as shown in Figure 2.1. This is intended to give installers the ability to mount the bracket on two wall studs spaced at this interval. If existing wall studs are spaced differently or if the desired location is not in line with the wall studs additional support is required.
4. Install the two 1/2"-13 by 4" bolts supplied with the boiler into the weld nuts in the base of the unit. The depth that these are threaded into the base can be adjusted to assure the proper level of the boiler. Adjust the bolts until the unit is tilted slightly off level to the rear to aid in condensate draining.

⚠ WARNING

The wall mounting bracket is designed to support the boiler. External piping for water, venting, air intake and fuel supply is to be supported separately

5. Be sure that the wall provides adequate support for the boiler.

⚠ WARNING

Make sure the boiler wall bracket is adequately supported. Do not install this bracket on dry wall unless adequately supported by wall studs.

6. Be sure to adequately support the boiler while installing external piping or other connections.
7. Be sure that condensate piping is routed to a suitable drain or condensate pump.

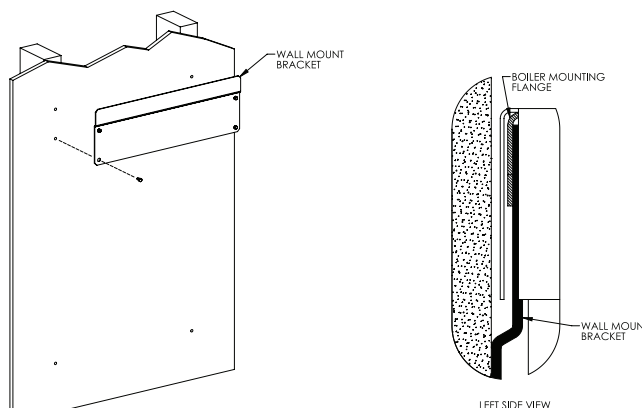


Figure 2.1: Wall Mounting Bracket

3. VENTING & AIR INLET PIPING

A. GENERAL

1. Install the Series PBC™ boiler venting system in accordance with these instructions and with the National Fuel Gas Code, ANSI Z223.1/NFPA 54, CAN/CGA B149, and/or applicable provisions of local building codes.
2. The Series PBC™ boiler is a direct vent appliance and is ETL Listed as a Category IV appliance with Intertek Testing Laboratories, Inc.
3. Sources of combustion air contaminated with chlorine, ammonia or alkali agents must be avoided. Do not install this boiler near a swimming pool, hot tubs or laundry. Do not store chemicals near the boiler.
4. The Exhaust Vent and Air Intake adapters are provided loose inside of the boiler cabinet and must be installed securely using the provided screws and gaskets. See Figure 3.1 below for proper orientation.

Ensure that the vent adapter is fully inserted in the heat exchanger outlet gasket and that the foam seal is installed between the jacket and the flange of the adapter.

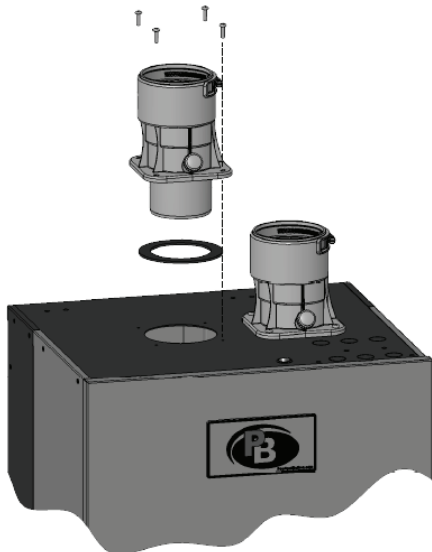


Figure 3.1: Exhaust and Air Intake Location and installation

⚠ WARNING

Improper installation of the Vent adapter could result in the escape of combustion products causing severe personal injury, death or major property damage.

⚠ WARNING

The venting system for this product is to be installed in strict accordance with these venting instructions. Failure to install the vent system properly may result in severe personal injury, death or major property damage.

⚠ WARNING

This vent system operates under positive pressure. Vent connectors serving appliances vented by natural draft shall not be connected into any portion of this venting system. Failure to comply may result in serious injury, death or major property damage.

⚠ CAUTION

Steps must be taken to ensure that the boiler room is not under a negative pressure when any appliance or combination of appliances are in operation. Series PBC™ boilers are sealed combustion units but negative pressure inside of the installation area can lead to contaminants and recirculated flue gasses being drawn into the unit which can cause component or heat exchanger failures.

B. APPROVED MATERIALS

1. Table 3.1 lists approved materials for vent pipe (and adhesives where applicable). Use only these materials for exhaust vent piping.
2. PVC pipe and fittings are not to be used for venting in confined spaces such as closet installations. Use only CPVC, AL29-4C Stainless or polypropylene (InnoFlue or PolyPro) vent pipe under these conditions.

⚠ NOTICE

- All 3" SCH40 PVC applications require 9 inches of straight vent pipe between the vent adapter the first elbow.
- All 2" SCH40 PVC applications require the first 10 equivalent feet to be of CPVC material

3. Cellular core piping is approved for inlet air piping only.

⚠ WARNING

Only the materials listed below are approved for use with the Series PBC™ boiler. Use only these components in accordance with these instructions. Failure to use the correct material may result in serious injury, death, or major property damage.

Table 3.1: Approved Materials for Exhaust Vent Pipe

Description	Material	Conforming to Standard
Vent Piping & Fittings	PVC (Sch 40 or 80)*	ANSI/ASTM D1785
	CPVC (Sch 40 or 80)	ANSI/ASTM F441
	PVC-DWV*	ANSI/ASTM D2665
	Duravent FastNSeal® AL29-4C Stainless Steel	UL1738 & ULC-S6
	PolyPro® (Polypropylene)	ULC-S636
	InnoFlue® (Polypropylene)	ULC-S636
	Z-DENS® (Polypropylene)	ULC-S636
Pipe Cement (PVC & CPVC Only)	PVC/CPVC Cement	ANSI/ASTM D2564

* PVC pipe/fittings are not to be used for venting within confined spaces.

Notice: Installations in Canada require compliance with ULC S636 - Standard for Type BH Gas Venting Systems.

⚠ WARNING

Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulphone) for exhaust vent is prohibited. Use of these materials as exhaust vent may result in severe personal injury, death, or major property damage.

C. EXHAUST VENT/AIR INTAKE PIPE LOCATION

1. Install vent piping before installing water, fuel, or condensate piping. Working from largest to smallest diameter reduces the complexity of piping interferences.
2. Vent and air intake piping is to be installed so that there is sufficient access for routine inspection as required in Section 11, of this manual.

3. The vent piping for this boiler is approved for zero clearance to combustible construction. However, a fire stop must be used where the vent pipe penetrates walls or ceilings.
4. The Peerless® Series PBC™ boiler, like all high efficiency, gas-fired appliances, is likely to produce a vapor plume due to condensation. Surfaces near the vent termination will likely become coated with condensation.

⚠ NOTICE

If the maximum equivalent vent length is exceeded, the maximum burner input rate may be reduced.

5. Air Intake Pipe Location – Sidewall Venting:
 - a. Provide 1 foot (30 cm) clearance from the bottom of the air intake pipe to the level of maximum snow accumulation. Snow removal may be necessary to maintain clearances.
 - b. Do not locate air intake pipe in a parking area where machinery may damage the pipe.
 - c. Maintain a minimum of 8" horizontal distance between exhaust vent and the air intake. Increasing this distance minimizes the potential for contamination of the inlet air with exhaust.
 - d. For multiple boiler installations, the minimum horizontal distance between the inlet of one boiler to the exhaust of an adjacent boiler is 8" center-to-center. In addition, the minimum vertical distance between the exhaust and air inlet is 6". See Figure 3.2 for an illustration.
 - e. The exhaust outlet of the vent pipe should not be angled any more than 5° from horizontal.
 - f. Precautions should be taken to prevent recirculation of flue gases to the air inlet pipe of the boiler or other adjacent appliances.

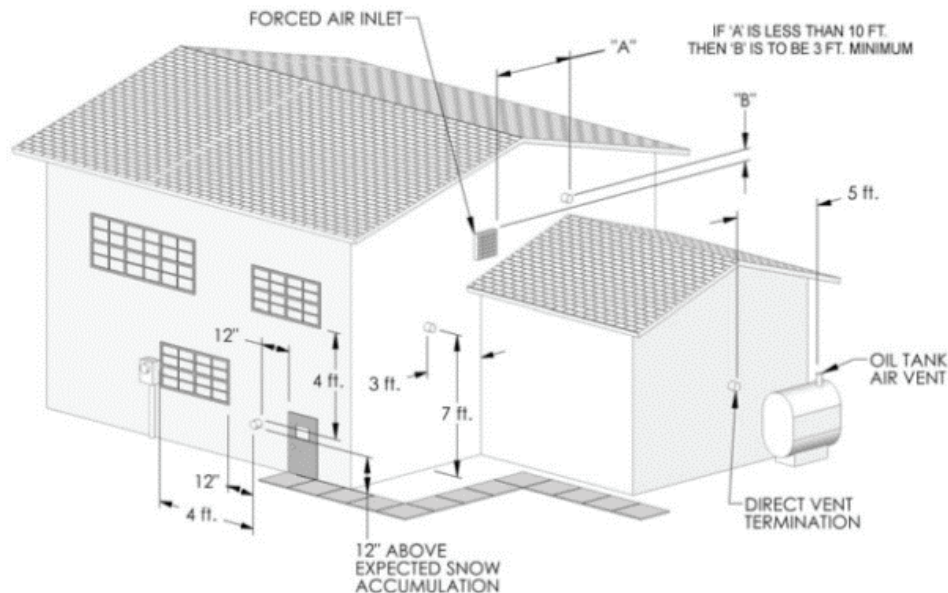


Figure 3.3: Exit Terminal Location for Mechanical Draft and Direct-Vent Venting Systems

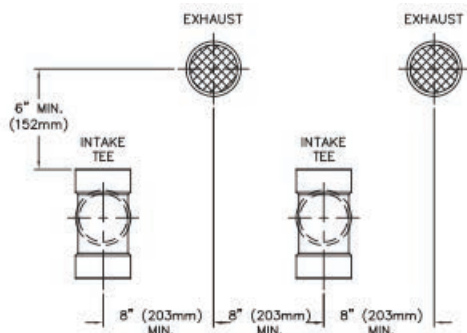


Figure 3.2: Vent Pipe Spacing for Multiple Series PBC™ Boilers

7. Sidewall Venting Configuration:

- a. See Figure 3.3 for an illustration of clearances for location of exit terminals of direct-vent venting systems.
 - This boiler vent system shall terminate at least 3 feet (0.9 m) above any forced air inlet located within 10 ft (3 m). Note: This does not apply to the combustion air intake of a direct-vent appliance.
 - Provide a minimum of 1 foot (30 cm) distance from any door, operable window, or gravity intake into any building.
 - Provide a minimum of 1 foot (30 cm) clearance from the bottom of the exit terminal above the expected snow accumulation level. Snow removal may be required to maintain clearance.
 - Provide a minimum of 4 feet (1.22 m) horizontal clearance from electrical meters, gas meters, gas regulators, and relief equipment. In no case shall the exit terminal be above or below the aforementioned equipment unless the 4 foot horizontal distance is maintained.
 - Do not locate the exhaust exit terminal over public walkways where condensate could drip and create a hazard or nuisance.
 - When adjacent to public walkways, locate the exit terminal at least 7 feet above grade.
 - Do not locate the exhaust termination directly under roof overhangs to prevent icicles from forming or recirculation of exhaust gases from occurring.
 - Provide 3 feet clearance from the inside corner of adjacent walls.

CAUTION

Condensing flue gases can freeze on exterior building surfaces which may cause discoloration and degradation of the surfaces.

- b. Figures 3.4 through 3.7 show approved sidewall venting configurations using the standard fittings supplied.
- c. Figure 3.5 is only approved for locations in which the outdoor temperature is above -5°F (-21°C) in accordance with ASHRAE 90A-1980 recommendations.

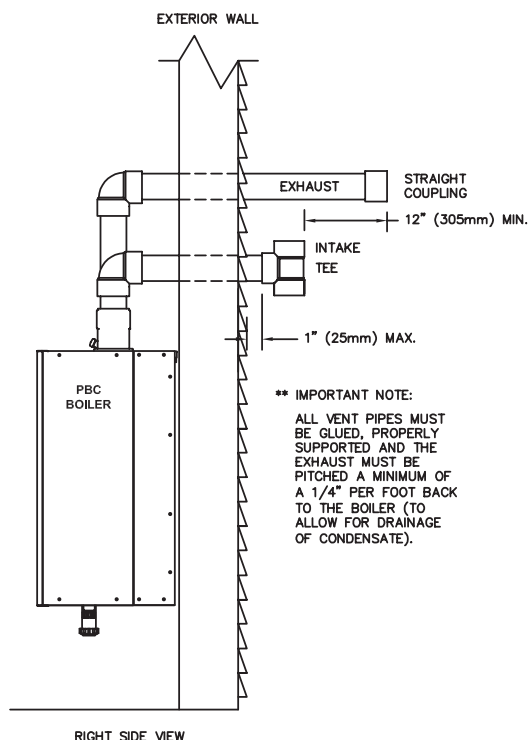


Figure 3.4: Standard Exhaust & Air Inlet Pipe Terminations

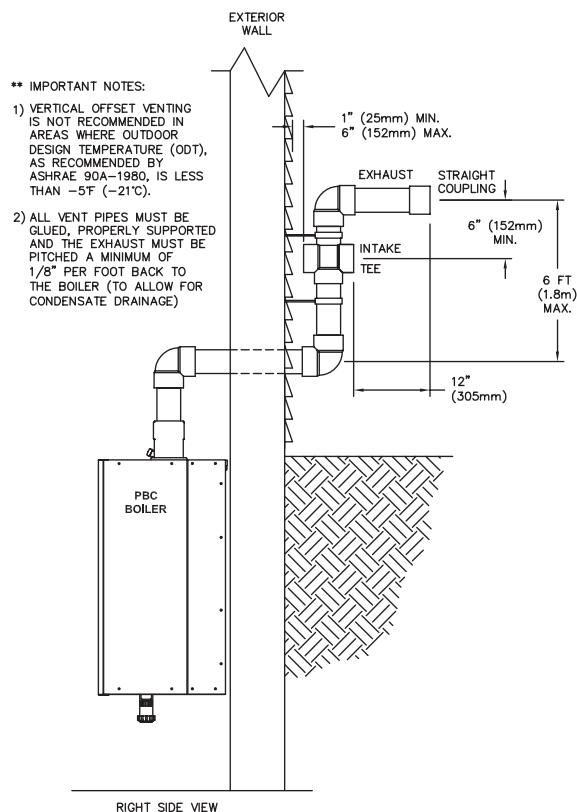


Figure 3.5: Offset Exhaust and Air Inlet Terminations

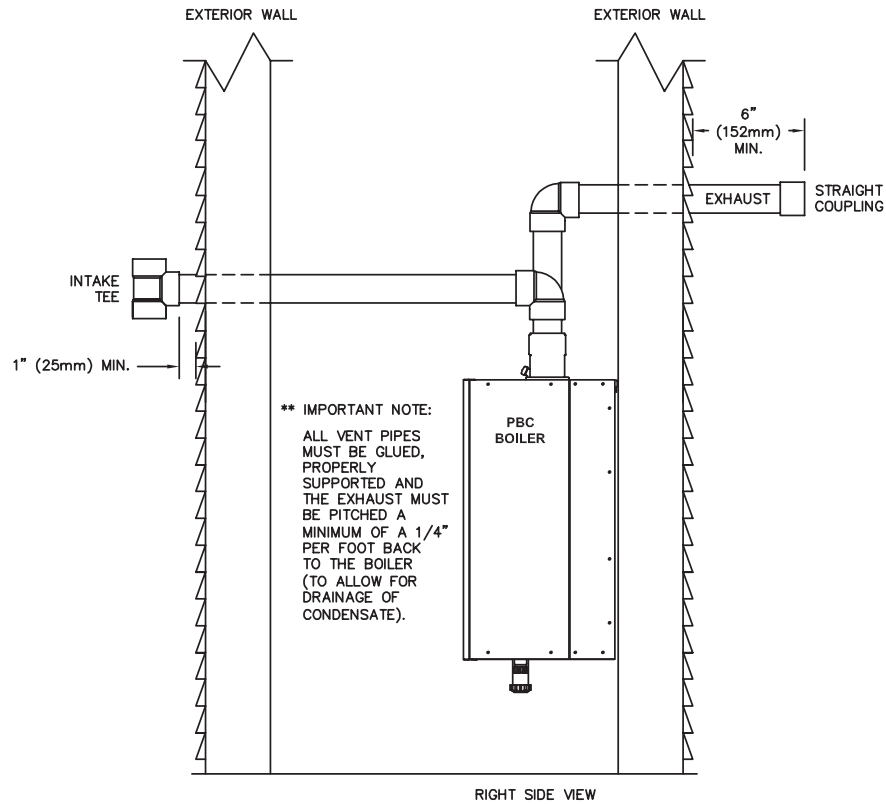


Figure 3.6: Exhaust and Air Inlet on Opposite Walls

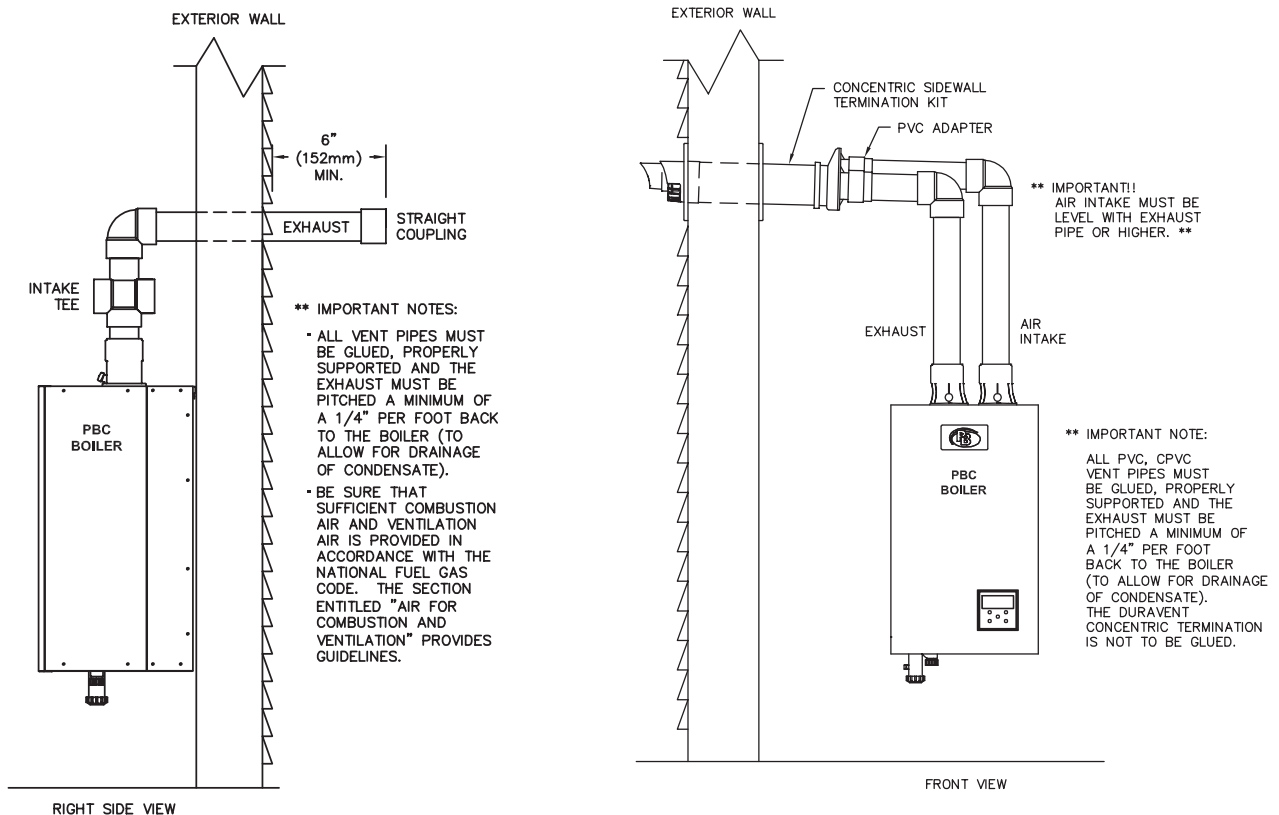


Figure 3.7: Sidewall Exhaust with Indoor Air

Figure 3.8: Optional Concentric Vent Kit Installation

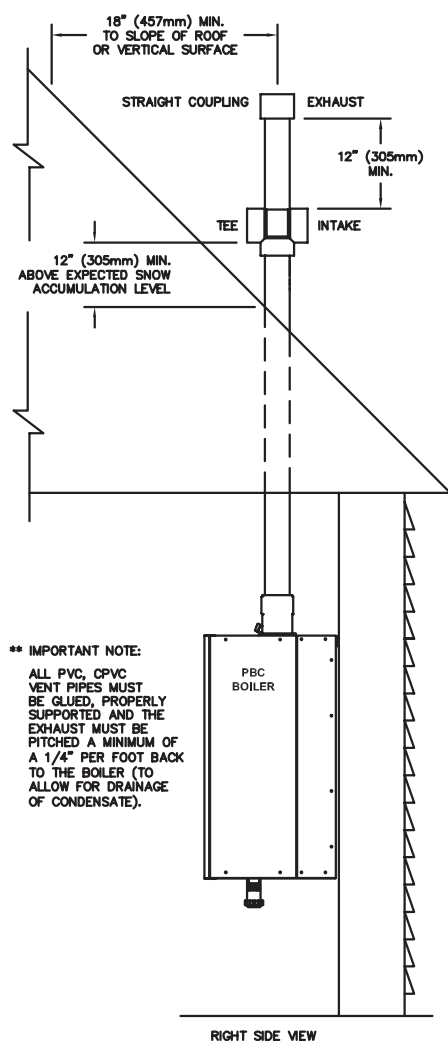


Figure 3.9: Standard Vertical Vent Installation

- d. Figure 3.8 shows approved sidewall vent configuration using an optional concentric vent termination kit. 2" (54837) or 3" (54498).
8. Vertical Venting Configuration:
 - a. Figure 3.9 shows the approved venting configuration for vertical venting using the standard fittings supplied.
 - b. Locate the air intake pipe inlet a minimum of 12" above the expected snow accumulation on the roof surface.
 - c. Locate the end of the exhaust vent pipe a minimum of 12" above the inlet to the air intake pipe.
 - d. Figure 3.10 shows an approved vertical vent configuration using the optional concentric vent termination kit.
 - e. Figure 3.11 shows an option for routing the exhaust and air inlet piping through an unused chimney.
 - f. Figure 3.12 shows this option using inlet air from a sidewall position.

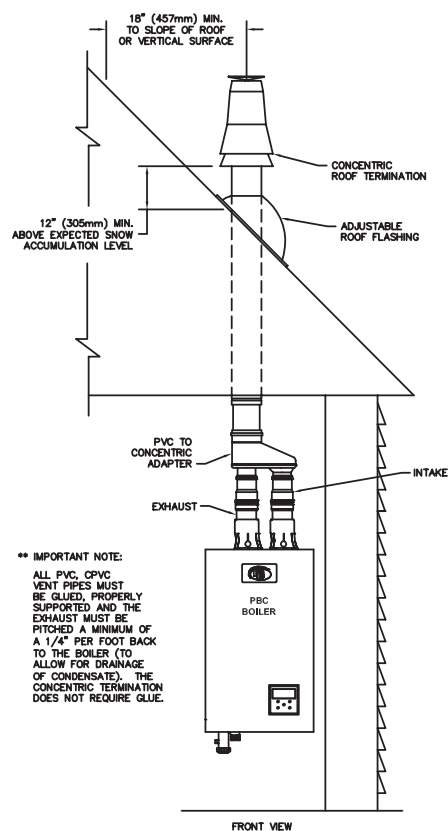


Figure 3.10: Concentric Vertical Vent Installation

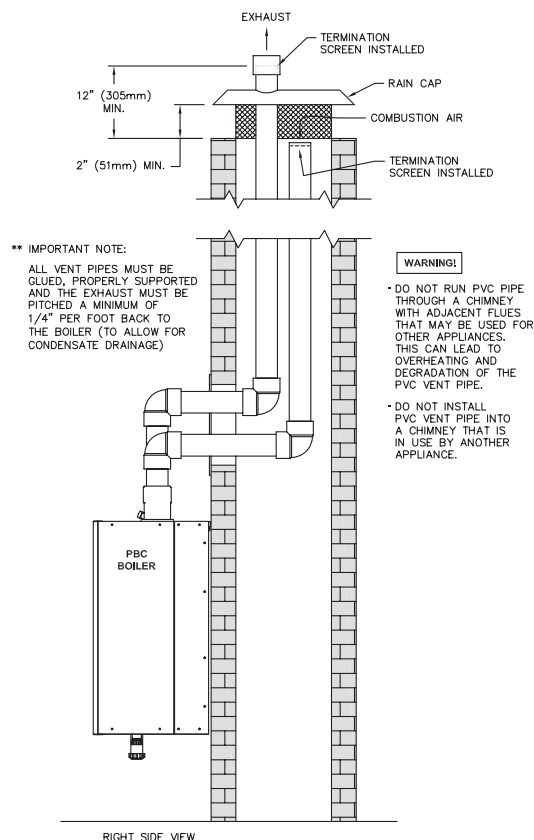


Figure 3.11: Venting Through a Chimney Using Outside Air

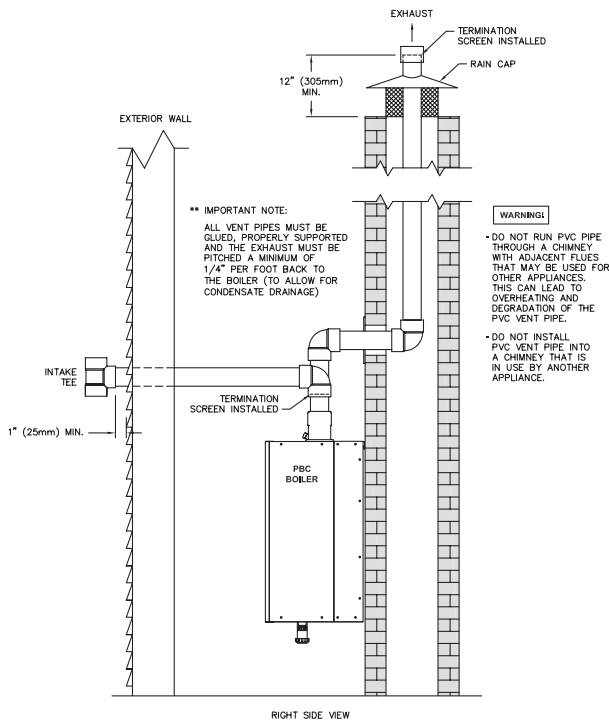


Figure 3.12: Venting Through a Chimney Using Sidewall Outside Air

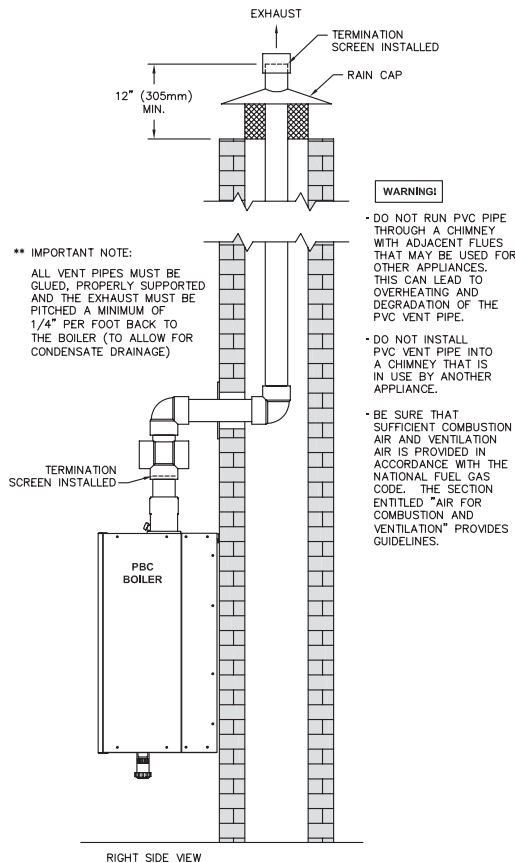


Figure 3.13: Venting with a Chimney Using Inside Air

- g. Figure 3.13 shows an option for routing the exhaust through an unused chimney with the combustion air supplied from inside the building. Be sure to note the requirements for combustion air as listed under Section 1.D. "Combustion and Ventilation Air". These requirements are in accordance with the National Fuel Gas Code.

D. EXHAUST VENT/AIR INTAKE PIPE SIZING

- Series PBC™ boilers can be installed with 2" or 3" Exhaust Vent/Air Intake piping with the vent length restrictions shown in table 3.2 below. 2" applications require a 3" initial connection with a reduction to 2" venting.

Table 3.2: Maximum Allowable Vent Length for Series PBC™ Boiler Installations

	Maximum Allowable Vent Length (Ft)	
	2" (60mm) Diameter Feet (Meters)	3" (60mm) Diameter Feet (Meters)
PBC-34	60 (18.28)	100 (30.48)
PBC-40	60 (18.28)	100 (30.48)
PBC-52	20 (6.1)	100 (30.48)

- Polypropylene vent systems can be installed using the vent adapters provided with the boiler. The adapters are compatible with 3" PVC or CPVC, 3" or 80mm polypropylene and 3" AL-29-4C grade stainless steel.
- Combined systems using separate polypropylene exhaust & air inlet pipes which transitions to concentric can also be installed. Contact your Centrotherm, Duravent or NovaFlex representative for more information.
- All 2" SCH40 PVC applications require the first 10 equivalent feet to be of CPVC or Polypropylene material.**
 - The equivalent length of elbows, tees and other fittings are listed in Table 3.3.

Table 3.3: Equivalent Length of Fittings

	Equivalent Length (Feet)	
	Vent Size	
	2" Vent	3" Vent
Elbow, 90°	7 feet	5 feet
Elbow, 45°	4 feet	3 feet
Coupling	0 feet	0 feet
Air Intake Tee	0 feet	0 feet
Concentric Vent Kit	3 feet	3 feet

⚠ NOTICE

Exhaust Vent/Air Intake length in excess of maximum listed equivalent feet may result in reduced input due to excessive pressure drop.

E. EXHAUST VENT/AIR INTAKE INSTALLATION

WARNING

Covering non-metallic exhaust venting material is prohibited and may result in severe personal injury, death, or major property damage.

1. Figures 12.1 & 12.2 show the exhaust connection on top of the boiler, near the rear in the center.
 - a. The exhaust connection for PBC-34™, PBC-40™, and PBC-52™ boilers is a 3" polypropylene adapter that will accept PVC, polypropylene or AL29-4C stainless steel piping. All materials are secured using the built in band clamp. Tighten securely. **DO NOT USE CEMENT ON BOILER CONNECTIONS.**
 - b. All PVC/CPVC connections after the boiler connection are to be joined with suitable PVC/CPVC adhesives in accordance with manufacturers' instructions.
2. The Air Intake connection is to the right of the exhaust.

WARNING

This appliance uses a positive pressure venting system. All joints must be sealed completely to prevent leakage of flue products into living spaces. Failure to do this may result in severe personal injury, death or major property damage.

3. Remove all burrs and debris from the joints and fittings.
4. Horizontal lengths of exhaust vent must be installed with a slope of not less than 1/4" per foot (21 mm per meter) toward the boiler to allow condensate to drain from the vent pipe. If the vent pipe must be piped around an obstacle that causes a low point in the piping, a drain with an appropriate trap must be installed.
5. All piping must be fully supported. Use pipe hangers at a minimum of 4 foot (1.22 meter) intervals to prevent sagging of the pipe.
6. Exhaust and air inlet piping is to be supported separately and should not apply force to the boiler.
7. Penetration openings around the vent pipe and air intake piping are to be fully sealed to prevent exhaust gases from entering building structures.
8. PVC & CPVC Piping:
 - a. Use only solid PVC or CPVC Schedule 40 or 80 pipe for exhaust venting. Cellular core PVC or CPVC is not approved for exhaust vent.
 - b. All joints in vent pipe, fittings, and all vent termination joints must be properly cleaned, primed and cemented. Use only cement and primer approved for use with PVC or CPVC pipe that conforms to ANSI/ASTM D2564. Boiler connections do NOT require cement.

- c. **A straight coupling is to be used as an outside vent termination. One of the two screens is to be installed to prevent birds or rodents from entering.**
- d. An air intake tee should be used as an air intake termination. A screen is to be installed to prevent birds or rodents from entering.
- e. The following are optional combination air intake/exhaust terminations that are available separately from your PB Heat, LLC distributor for use with Series PBC™ boilers.

Table 3.4: Concentric Vent Termination Kits

3"		2"	
Description	Stock Code	Description	Stock Code
Sidewall Termination Kit – PolyPro 3PPS-HK	54498	Sidewall Termination Kit – PolyPro 2PPS-HKL	54837
Vertical Vent Termination Kit – PolyPro 3PPS-VK	54500	Vertical Vent Termination Kit – PolyPro 2PPS-VKL	54838

- f. Refer to Figures 3.4 through 3.8 for sidewall venting options using PVC or CPVC pipe.
- g. Refer to Figures 3.9 through 3.13 for vertical venting options using PVC or CPVC pipe.

F. EXHAUST TAPPING FOR VENT SAMPLE

To properly install the Series PBC™ boiler, carbon dioxide (CO₂) and carbon monoxide (CO) levels in the exhaust vent must be determined from a sample of combustion products. To do this use the built in sampling port in the 3-in-1 adapters. Be sure to replace the cap after sampling the combustions.

G. BOILER REMOVAL FROM COMMON VENTING SYSTEM

At the time of removal of an existing boiler, follow these steps 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:

Retrait de la chaudière d'un système d'évacuation commun. Au moment de retirer une chaudière existante, il est important de suivre les étapes suivantes pour chaque appareil raccordé au système d'évacuation commun qui sont en service, alors que les autres appareils demeurant raccordés au système d'évacuation commun ne sont pas en service:

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

Sceller toute ouverture du système d'évacuation commun non utilisée.

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.

Effectuer un contrôle visuel du système d'évacuation pour vérifier la taille et la pente horizontale et s'assurer qu'il n'existe aucun blocage ou obstruction, fuite, corrosion ni tout autre problème pouvant menacer la sécurité.

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.

Dans la mesure du possible, fermer toutes les portes et fenêtres de l'immeuble ainsi que toutes les portes entre l'espace dans lequel les appareils qui demeurent raccordés au système d'évacuation commun se trouvent et le reste de l'immeuble.

4. Turn on any clothes dryers and any appliance not connected to 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.

Mettre en marche les sècheuses et tout autre appareil non raccordé au système d'évacuation commun. Mettre en marche tous les ventilateurs aspirant, tels que les hottes de cuisinière et les ventilateurs de salle de bain, en les faisant fonctionner à vitesse maximum.

5. Close fireplace dampers.

Ne pas faire fonctionner les ventilateurs aspirant d'été. Fermer les registres de foyers.

6. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

Mettre en service l'appareil à inspecter. Suivre les instructions concernant l'allumage. Régler le thermostat afin que l'appareil fonctionne sans arrêt.

7. 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.

Vérifier toute fuite à l'orifice de décharge du coupe-tirage après que le brûleur ait fonctionné pendant 5 minutes. Utiliser la flamme d'une allumette ou d'une chandelle ou encore la fumée d'une cigarette, d'un cigare ou d'une pipe.

8. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use.

Après avoir établi que les résidus de combustion de chaque appareil qui demeure raccordé au système commun sont adéquatement évacués lorsque soumis au test décrit ci-dessus, remettre en place les portes, fenêtres, portes intérieures, ventilateurs aspirants, registres de foyer et appareils fonctionnant au gaz.

9. Any improper operation of the common venting system should be corrected so that the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 or CAN/CGA B149 Installation Codes.

Tout fonctionnement inadéquat du système d'évacuation commun doit être corrigé de manière à respecter les normes du National Fuel Gas Code, ANSI Z223.1/NFPA 54 et/ou des Codes d'installation CAN/ACG B149.

10. When resizing any portion of the common venting system, the common venting system should be resized to approach minimum size as determined using the appropriate tables located in the chapter "Sizing of Category I Venting Systems," of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 or CAN/CGA B149 Installation codes.

Lorsqu'il est nécessaire de modifier les dimensions de toute portion du système d'évacuation commun, ces dernières doivent être modifiées de manière à respecter les dimensions minimums indiquées dans les tableaux du chapitre « Sizing of Category I Venting Systems » du National Fuel Gas Code, ANSI Z223.1/NFPA 54 ou des Codes d'installation CAN/ACG B149.

4. WATER PIPING & CONTROLS

A. GENERAL

1. Size water supply and return piping in accordance with system requirements rather than the boiler connections.
2. In hydronic systems where sediment may exist, install a strainer in the boiler return piping to prevent large particles and pipe scale from entering the boiler heat exchanger. Use a large mesh screen in the strainer.
3. Install this boiler so that the gas ignition system components are protected from water (dripping, spraying, etc.) during operation and service (circulator replacement, condensate trap cleaning, sensor replacement, etc.).

Table 4.1: Guide of Maximum Flow Rates for Different Pipe Sizes with Input

Maximum Flow Rates and Input		
Steel Pipe		
Pipe Size	Maximum Flow (GPM)	BTU/HR
1/2"	2	15,000
3/4"	4	40,000
1"	8	80,000
1-1/4"	16	140,000
1-1/2"	25	220,000
2"	50	450,000
Copper Tubing		
Tube Size	Maximum Flow (GPM)	BTU/HR
1/2"	1.50	15,000
3/4"	4	40,000
1"	8	80,000
1-1/4"	14	140,000
1-1/2"	22	220,000
2"	45	450,000

B. WATER QUALITY

The Series PBC™ boiler is intended for use in a closed-loop hydronic system. Make-up fresh water for the system will include oxygen, calcium and other substances which may cause corrosion, calcium scale buildup or other attacks on the hydronic system and boiler components.

The following steps should be taken to maximize the longevity of the boiler and system:

Central Heat System:

1. Water hardness must be between 3 Grains/Gal (gpg) and 9 Grains/Gal (gpg). Use of a water treatment system may be required on make-up water in areas with hard water.
2. The systems water pH level should fall between 6 pH and 8 pH. The slightly alkaline water will work to prevent corrosion and neutralize any acidic buildup over time minimizing potential sources of corrosive attacks on the heat exchanger.
3. The system should be flushed and cleaned thoroughly with fresh water and a rinsing agent prior to boiler installation. Any new system must be cleaned to remove any flux or welding residue. Any existing system must be cleaned to remove scale and particulate matter prior to boiler connection to the system. Thoroughly flush any cleaning agent from the system with clean water prior to connecting the boiler. See Table 4.1 below for recommended cleaning agents.
4. High oxygen levels in the system water will allow scale buildup to occur. Steps must be taken to minimize oxygen levels in the system. The following items are recommended during installation:

WARNING

Failure to properly analyze and treat system water when installing a high efficiency boiler can cause heat exchanger failure due to water passageway fouling. Black oxide sludge (magnetite – Fe_3O_4), red oxide sludge (iron oxide – Fe_2O_3), and calcium scale (limescale) will settle over the hottest portion of the heat exchanger coils. This buildup will reduce thermal transfer in the areas where the buildup is greatest resulting in an increased fouling rate. The high temperatures in these locations will compromise the natural corrosion resistance of the stainless steel material leading to accelerated failure of the heat exchanger.

Failure to address the causes of the fouling in the system can void heat exchanger warranty, and risk property damage, personal injury or death.

System must be cleaned before the boiler is connected!

- Flush the system with fresh water.
- Use a cleaning agent appropriate for the system material and debris to be removed.
- Thoroughly flush cleaning agent residue from the system with fresh water.

The following actions must be taken after the boiler is connected to the system:

- Treat the system water with a corrosion and scale inhibitor to prevent oxidization and scale buildup. Follow the inhibitor manufacturer's instructions when treating the system water.

- Provide Air Elimination Means: An automatic air vent should be installed at the highest point in the system and at any points air could potentially be trapped. When replacing an existing boiler, ensure any automatic air vents installed in the system are functioning correctly and installed in a proper location. A hydronic separator is another option to provide a low velocity zone for trapped air bubbles to separate and be eliminated from the system while providing primary/secondary operation.
- The Series PBC™ is provided with a manual air vent and hose to remove any air trapped in the heat exchanger on filling. Refer to Section 9: Start Up for more details.
- The Series PBC™ has a built in De-Air feature that activates on initial power up. Allow this cycle to run fully to help drive any trapped air out of the unit and to the air vent or vents. Refer to Section 8 for more details on the De-Air Cycle.
- It is recommended that a water meter be installed on the system fresh water intake to monitor the system for any leaks by monitoring make-up water usage. Untreated fresh water sources will introduce oxygen, minerals and contaminants into the system.
- Correct any system leaks prior to placing the boiler in operation.

Table 4.2: Recommended Water Treatment Products for use in Stainless Steel Condensing Boiler Applications

	Supplier			
	Fernox	Sentinel	Sotin	ADEY
Universal Cleaner	Restorer F3 or F5	X300	–	–
Sludge Remover	Cleaner F3 or F5	X400	Sotin 212	–
Inhibitors	Protector F1/Alphi 11	X100, X500	Sotin 212	MC1+
Antifreeze	Alphi 11	X500	–	–

WARNING

Do not use petroleum based cleaners when cleaning the boiler system. Damage to the gaskets found in typical system components can occur resulting in significant property damage.

Domestic Heat System:

The Series PBC™ boilers use a high efficiency flat plate heat exchanger to quickly heat cold domestic water. This plate heat exchanger has small passageways that can become clogged with sediment and scale of steps are not taken to protect it.

- Water hardness is to be maintained between 50 ppm CaCO₃ (3gr/gal and 150 ppm CaCO₃ (9 gr/gal).
- A sediment filter is provided with the flow restrictor in the unit. This filter should be checked annually. An additional filter or y-strainer can also be installed prior to the unit.
- Annual cleaning of the plate heat exchanger is also recommended to prevent scaling.

C. OPERATING PARAMETERS

- The Series PBC™ boiler is designed to operate in a closed loop hydronic system under forced circulation. This requires the system to be completely filled with water and requires a minimum water flow through the boiler to operate effectively.
- The minimum system pressure is 11.6 psig (80 kPa). The maximum allowable pressure is 40 psig (275 kPa).
- The recommended minimum system pressure for optimal operation at higher temperature is 14.5 psi (100kPa).
- The internal pump is sized appropriately to allow for the minimum flow rate required through the heat exchanger. Ensure that the piping up to the boiler is capable of handling a minimum flow rate of 5.0 GPM to allow for proper flow rates when the boiler is in CH mode.

D. SYSTEM COMPONENTS

Figure 4.1 shows the symbol key for piping diagrams in this section. The following are brief descriptions of system components.

- Pressure/Temperature Gauge:** A combination pressure/temperature gauge is provided with each Series PBC™ boiler to be mounted in the piping from the boiler supply to the system as shown in Figures 4.2 & 4.3. Most local codes require this gauge.
- Air Elimination:** Closed loop hydronic systems require air elimination devices. As the system water is heated, dissolved oxygen and other gases will separate from the liquid. An air elimination device (such as a TACO Vortech® Air Separator) is required to remove the dissolved gases preventing corrosion in the piping system and eliminating noise.
- Expansion Tank:** An expansion tank (such as a Bell & Gossett Series HFT) is required to provide room for expansion of the heating medium (water or glycol solution). Consult the expansion tank manufacturer's instructions for specific information regarding installation. The expansion tank is to be sized for the required system volume and capacity. In addition, be sure that the expansion tank is sized based on the proper heating medium. Glycol solutions may expand more than water for a similar temperature rise.

CAUTION

Use only inhibited propylene glycol solutions which are specifically formulated for hydronic systems. Unlike automotive antifreeze, solutions for hydronic applications contain corrosion inhibitors that will protect system components from premature failure due to corrosion.

WARNING

Use only inhibited propylene glycol solutions which are specifically formulated for hydronic systems. Ethylene glycol is toxic and may cause an environmental hazard if a leak or spill occurs.

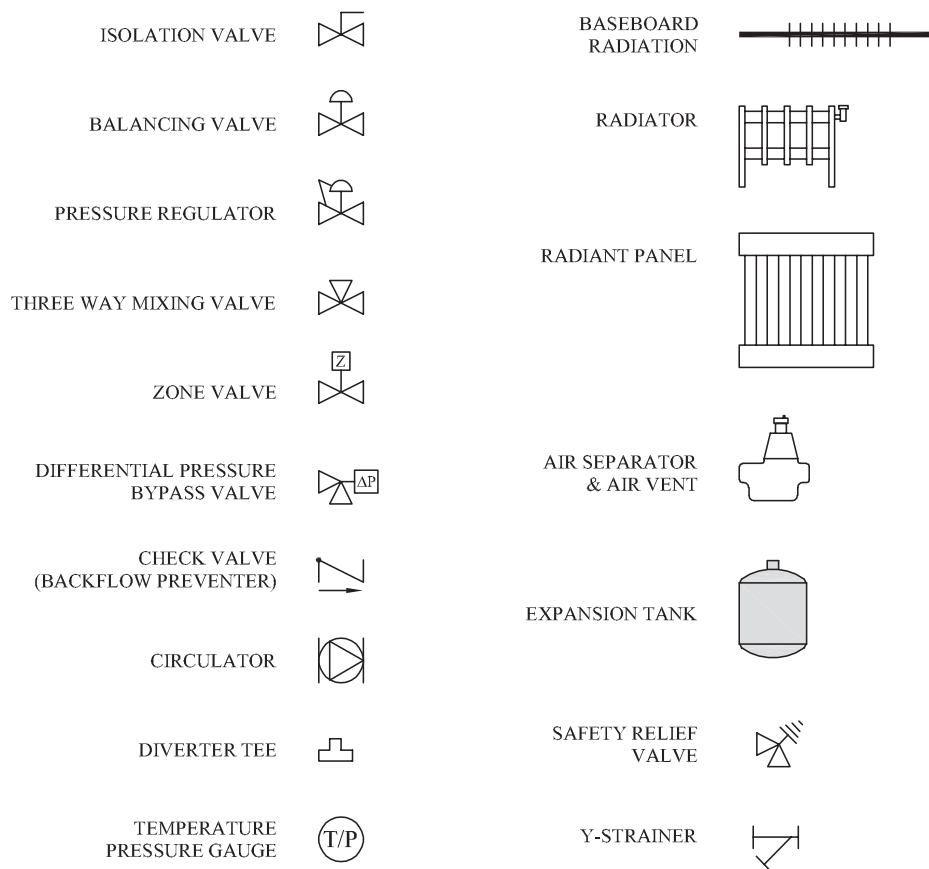


Figure 4.1: Piping Symbol Key

4. *Y-Type Strainer or Filter Ball® Valve:* PB Heat recommends the use of a strainer device in the system to prevent dirt or sediment from clogging the heat exchanger. A 20 mesh stainless steel screen is adequate to protect the heat exchanger. The strainer should be cleaned often in the first several months of operation. The Filter Ball® Valve from Jomar International incorporates a strainer into a ball valve which allows the technician to isolate the water circuit while cleaning the strainer.
5. *Flow Control Valve:* Flow control valves such as the TACO Flo-Chek or Bell & Gossett Flo-Control™ are used to prevent gravity circulation by incorporating a check valve with a weighted disc.
6. *Pressure Reducing Valve:* A pressure reducing valve, such as the Bell & Gossett B-38 or a TACO #329, is used in a hydronic system to automatically feed water to the system whenever pressure in the system drops below the pressure setting of the valve. These valves should not be used on glycol systems unless close supervision of the glycol solution is practiced.
7. *Back Flow Preventer:* A back flow preventer (check valve) is required by some jurisdictions to prevent water in the hydronic system from backing up into the city water supply. This is especially important on systems in which glycol solution is used as the heating medium.
8. *Pressure Relief Valve:* The boiler pressure relief valve is shipped separately for field installation. The valve is to be installed as shown in Figures 4.2 or 4.3. Pipe the discharge of the relief valve to within 12" of the floor and close to a floor drain. Provide piping that is the same size or larger than the relief valve outlet.
9. *Low Water Cut Off:* When installing a probe type LWCO, locate the LWCO in the boiler supply above the top jacket panel. Refer to Section 7. Electrical Connection in this manual for wiring details.
10. *Circulator:* The Central Heat circulator is to be sized to overcome the pressure drop of the system while providing the flow required by the boiler. The PBC™ Series boilers have a built in circulator that guarantees the minimum flow rate is maintained through the unit.

WARNING

Do not operate this appliance without installing the pressure relief valve supplied with the boiler or one with sufficient relieving capacity in accordance with the ASME Rating Plate on the boiler heat exchanger.

CAUTION

Pipe the discharge of the relief valve as close as possible to the floor and away from high traffic areas. Pipe the discharge to a floor drain. Failure to do so may result in personal injury and/or property damage.

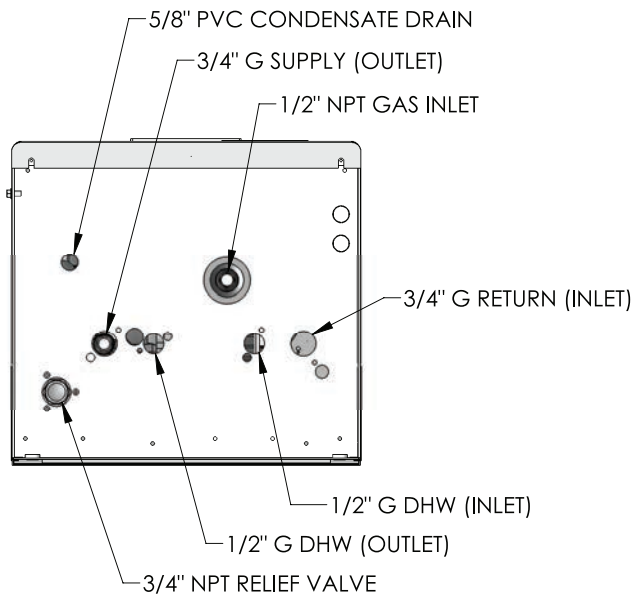


Figure 4.2: Water and Condensate Connection Points

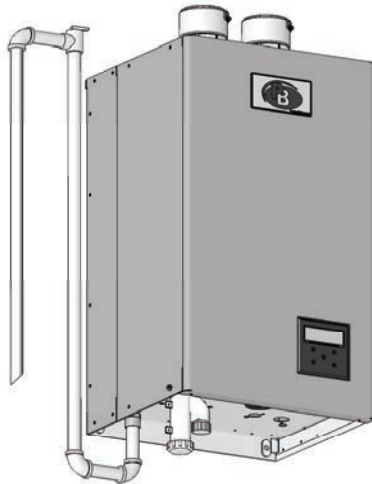


Figure 4.3: Safety Relief Valve Location

E. SYSTEM PIPING

The following section describes the piping requirements for the Series PBC™ boilers as well as some best practices that will improve the operation and lifetime of the unit. See Figure 4.6 and 4.7 for suggested boiler piping for Central Heat and Domestic.

⚠ NOTICE

For existing systems that use iron pipe for heating piping, the installation of a magnetic filter and a Y-Type strainer is highly recommended. A modulating condensing boiler such as the Series PBC™ when operating at ideal system temperatures can cause scaling to release from older iron pipe systems that will cause restrictions in the heat exchanger passages.

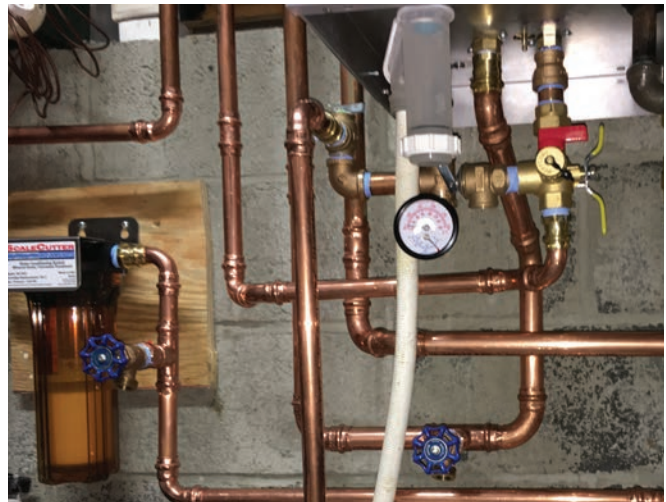


Figure 4.4: Final Piping Example with Webstone Plumb Kit.



Figure 4.5: ScaleCutter® Water Treatment System for Domestic Water Plate Heat Exchanger Protection.

1. Central Heat Piping
 - a. **Primary secondary piping required** - Series PBC™ boilers utilize a water tube heat exchanger that requires a minimum flow rate through the unit. The internal pump provides enough flow to maintain this minimum flow rate. For the pump to consistently perform the boiler must be piped in a primary/secondary fashion.
 - i. Use closely spaced tees, less than 4 pipe diameters apart.
 - ii. Use a low loss header system or a hydronic separator such as a Caleffi 548 series.
 - b. **Central Heat Circulator**-A properly sized circulator should be installed to provide heat out to the system off of the Primary secondary header.

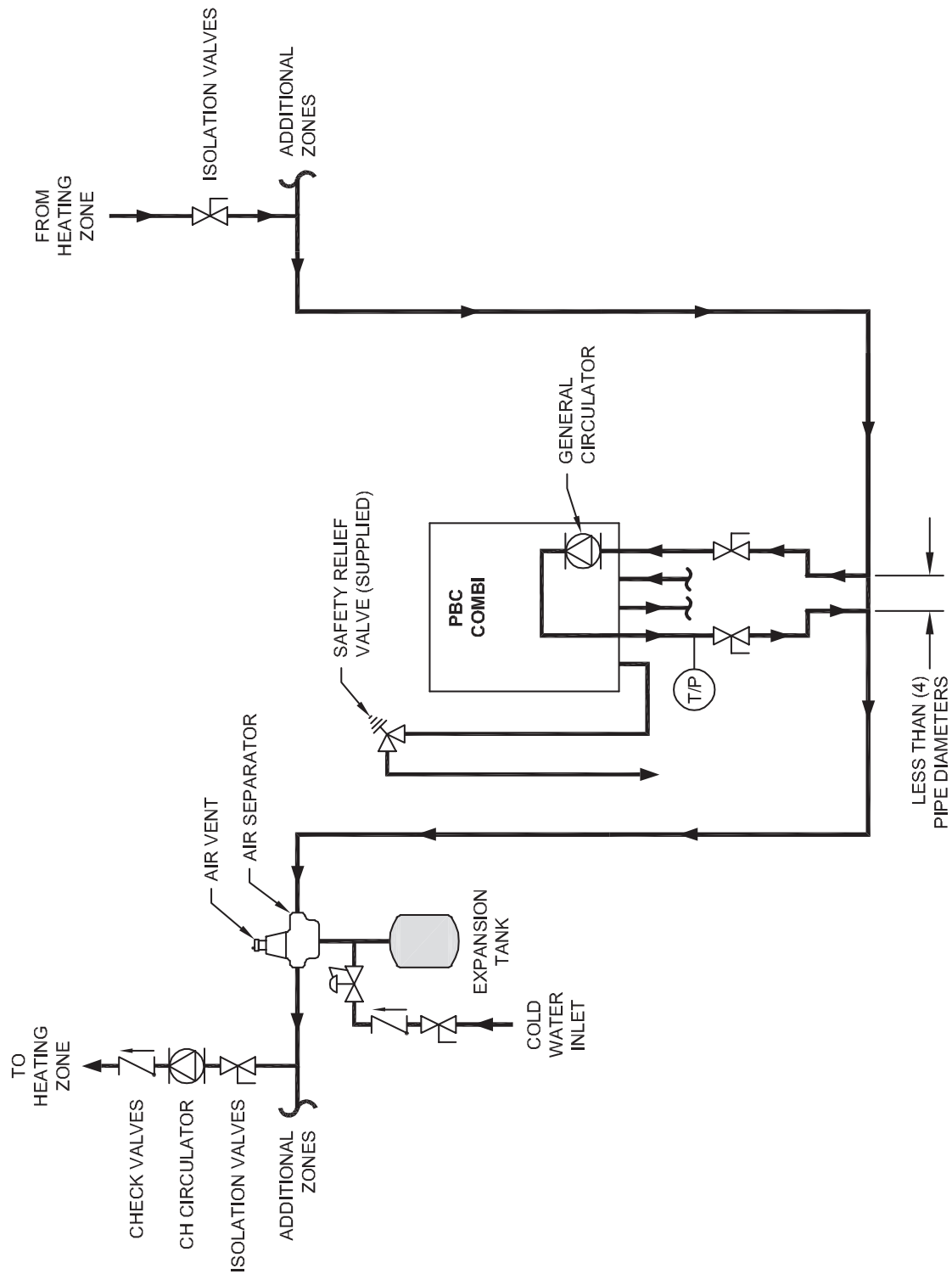


Figure 4.6: Recommended Central Heat Piping

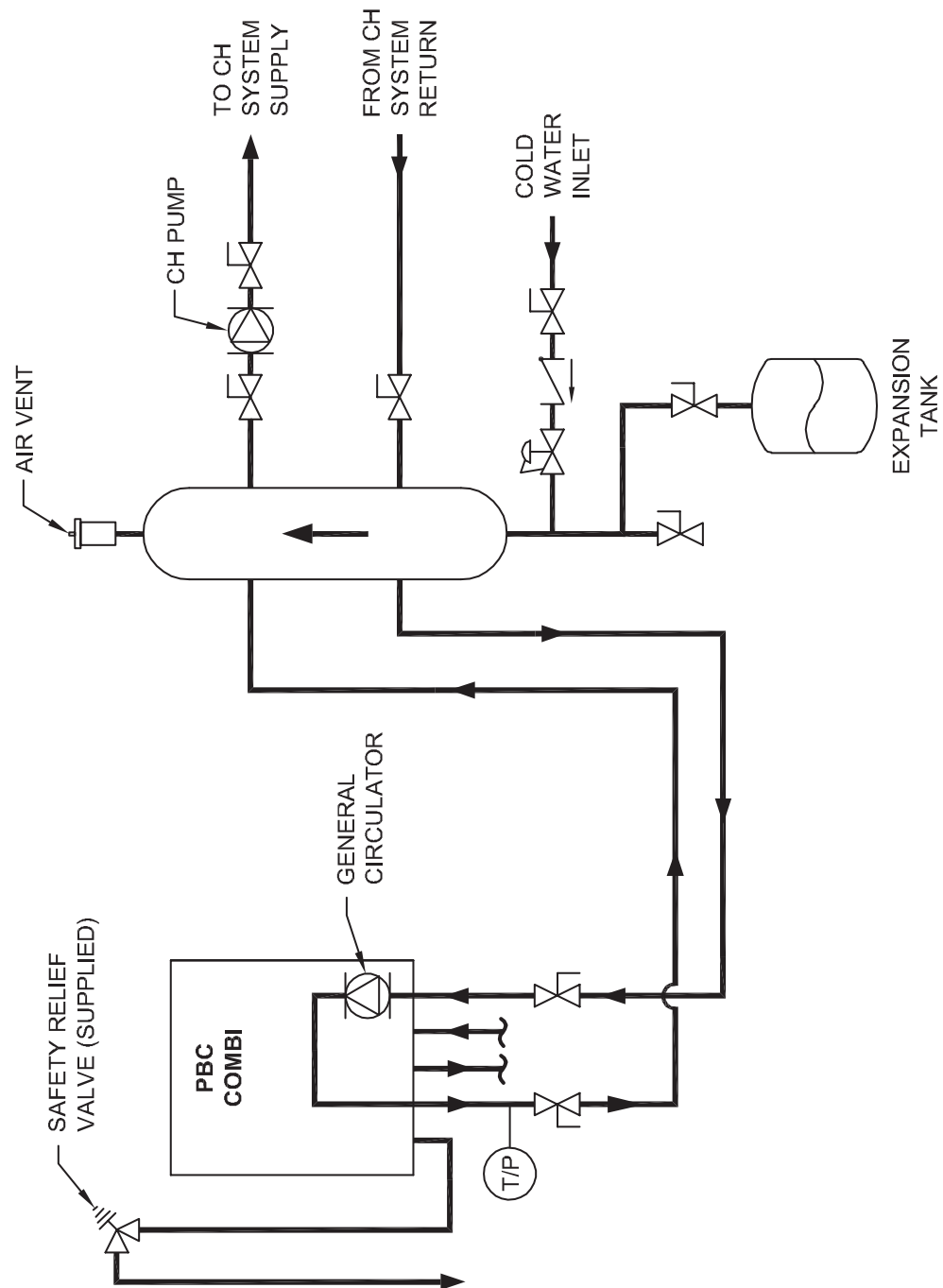


Figure 4.7: Recommended Central Heat Piping with Hydronic Separator

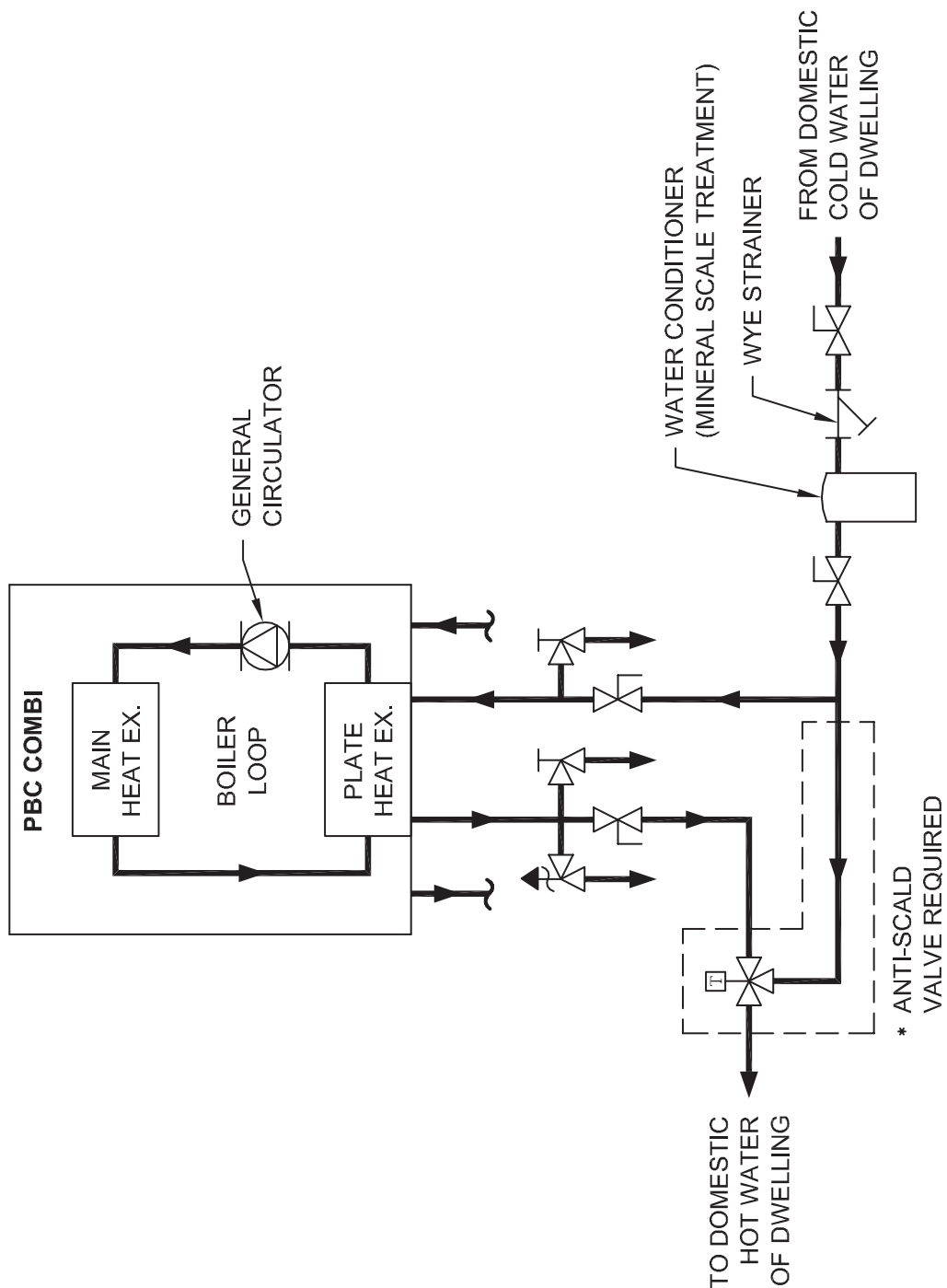


Figure 4.8: Recommended Domestic Hot Water Piping

Piping Recommendations:

- Use 6 wraps of Teflon tape on the supply and return connections if using a direct NPT adapter.
- Use two 45° elbows to offset the CH piping either in front of or behind the domestic water piping. This allows for easy installation of a shutoff and cleaning kit along with a domestic relief valve.
- c. PB Heat recommends treating the boiler loop water with water treatment products such as those made by Sentinel, Fernox, or other equivalent water treatment systems to help extend the lifetime of the heat exchangers.

2. Domestic Water Piping

DANGER

- Water temperatures over 125°F (52°C) can cause severe burns instantly, or death from scalds.
- Children, the disabled, and the elderly are at the highest risk of being scalded.

- Feel water before bathing or showering.
- Read this manual in its entirety before setting domestic hot water setpoint.
- A temperature limiting device (listed to ASSE 1070 or ASSE 1017) is required.

NOTICE

All Series PBC™ Units require a minimum hot water draw rate of 0.30 GPM to initiate a DHW demand. Ensure flow to all fixtures in the structure will meet this demand.

- a. The installer supplied temperature limiting device must be installed consistent with local, national, and international plumbing codes as well as the device manufacturer's instructions.
- b. Additional temperature limiting devices may be required at the domestic water fixtures in the dwelling.
- c. Choose the lowest practical DHW setpoint.
- d. The domestic hot water can be piped directly off of the structure's main cold water supply.
- e. It is required to install a filtration/water treatment system before the boiler to protect the plate heat exchanger from scale build up. This is good practice even in areas with high quality water to extend the life of the heat exchanger PB Heat recommends products such as those made by ScaleCutter® (shown in Figure 4.5) or other equivalent water treatment systems to improve the water quality before it enters the boiler.
- f. A properly sized safety relief valve (not provided) is required on the domestic outlet side of the boiler.

- g. A drain valve should be located immediately before the domestic inlet and after the domestic outlet of the boiler. This allows for easy flushing and descaling of the plate heat exchanger. A set of shutoff valves should be placed before the domestic inlet drain valve and after the domestic outlet drain valves as well in order to isolate the rest of the domestic supply to the structure (as shown in Figure 4.7). Domestic water service valve kits, like Webstone kit 4443WPR or other similar valve kits, meet the needs listed above.

Flow Restriction:

All Series PBC™ boilers contain a built-in flow restrictor on the domestic water side of the boiler. This restrictor protects the flow sensor from abnormal wear and contains a screen filter to protect against large sediment. Regular maintenance of this screen is recommended. See Section 11 for further maintenance instructions.

The Flow restrictor is sized at 4.75 gallons per minute. If it is found that an application for the PBC-52™ requires additional DHW flow rate, the flow regulator can be removed if the following conditions are met:

1. Replace the default 18L flow restrictor with an optional 24L restrictor (PB Heat Stock Code 54848). See section 11. Maintenance, part G. Flow restrictor Maintenance of this manual for flow restrictor removal instructions.

-OR-

2. An inline filter is installed prior to the Domestic Inlet connection of the unit.

DHW Flow rate is limited to 6.5GPM or below through the boiler by some means.

Table 4.3: Series PBC™ Series Heating Input and Gross Outputs

Series PBC™ Model	Boiler Input Btu/hr (kW)	Gross Output Btu/hr (kW)
PBC-34™	80,000 (23.4)	76,000 (22.3)
PBC-40™	100,000 (29.3)	95,000 (27.8)
PBC-52™	120,000 (35.2)	114,000 (33.4)

F. FREEZE PROTECTION

1. Glycol for hydronic applications is specially formulated for heating systems. It includes inhibitors which prevent the glycol from attacking metallic system components. Make sure that the system fluid is checked for correct glycol concentration and inhibitor level.
2. Use only inhibited polypropylene glycol solutions of up to 50% by volume. Ethylene glycol is toxic and can chemically attack gaskets and seals used in hydronic system.
3. The anti-freeze solution should be tested at least once per year and as recommended by the manufacturer of the product.

4. Anti-freeze solutions expand more than water. For example, a 50% by volume solution expands 4.8% with a 148°F temperature rise while water expands about 3% for the same temperature increase. Allowance for this expansion must be considered in sizing expansion tanks and related components.
5. The flow rate in systems utilizing glycol solutions should be higher than in a water system to compensate for decreased heating capacity of the fluid.
6. Due to increased flow rate and fluid viscosity, the circulator head requirement will increase. Contact the pump manufacturer to correctly size the circulator for a particular application based on the glycol concentration and heating requirements.
7. A strainer, sediment trap, or some other means for cleaning the piping system must be provided. It should be located in the return line upstream of the boiler and must be cleaned frequently during the initial operation of the system. Glycol is likely to remove mill scale from new pipe in new installations.
8. Glycol solution is expensive and leaks should be avoided. Weld or solder joints should be used where possible and threaded joints should be avoided. Make-up water should not be added to the system automatically when glycol solution is used. Adding make-up water will dilute the system and reduce the ability of the solution to protect from freezing.
9. Check local regulations to see if systems containing glycol solutions must include a back-flow preventer or require that the glycol system be isolated from the water supply.
10. Do not use galvanized pipe in glycol systems.
11. Use water that is low in mineral content and make sure that there are no petroleum products in the solution.
 - a. Less than 50 ppm of calcium
 - b. Less than 50 ppm of magnesium
 - c. Less than 100 ppm (5 grains/gallon) of total hardness
 - d. Less than 25 ppm of chloride
 - e. Less than 25 ppm of sulfate
12. Check with the local water supplier for chemical properties of the water.
13. The following test will determine if the water is of the appropriate hardness. Collect a sample of 50% water to 50% propylene glycol. Let the solution stand for 8-12 hours shaking it occasionally. If white sediment forms, the water is too hard and should not be used to dilute the glycol.
14. Mix the solution at room temperature.
15. Do not use a chromate treatment.
16. Refer to Technical Topics #2a published by the Hydronics Institute for further glycol system considerations.

5. FUEL PIPING

A. GENERAL

1. All fuel piping to the Series PBC™ boiler is to be in accordance with local codes. In the absence of local regulations refer to the National Fuel Gas Code, ANSI Z223.1/NFPA 54.
2. Size and install fuel piping to provide a supply of gas sufficient to meet the maximum demand of all appliances supplied by the piping.
3. Series PBC™ boilers are intended for operation with Natural Gas or Propane with sulfur content of less than 105 ppm (150 mg/m³) peak with an annual average of less than 20 ppm (30 mg/m³). Excessive sulfur content in fuel input can result in black deposits resembling coffee grounds in the combustion chamber of the boiler.

B. FUEL LINE SIZING

1. The required flow rate of gas fuel to the boiler can be determined by the following.

$$\text{Input Rate (ft}^3/\text{hr)} = \frac{\text{Boiler Input Rate (Btu/hr)}}{\text{Gas Heating Value (Btu/ft}^3\text{)}}$$

The gas heating value can be supplied by the gas supplier.

2. As an alternative, use Table 5.1 to determine the required gas flow rate which uses typical heating values for natural gas and liquefied petroleum (LP) gas.
3. Table 5.1 shows the maximum flow capacity of several pipe sizes based on 0.3" of pressure drop.
 - a. The values shown are based on a gas specific gravity of 0.60 (Typical for natural gas).
 - b. Multiply the capacities listed by the correction factors listed for gas with a specific gravity other than 0.60 to obtain the corrected capacity.
4. Size and install the fuel gas supply piping for no more than 0.5 inches of water pressure drop between the gas regulator and the boiler.

C. GAS SUPPLY PIPING - INSTALLATION

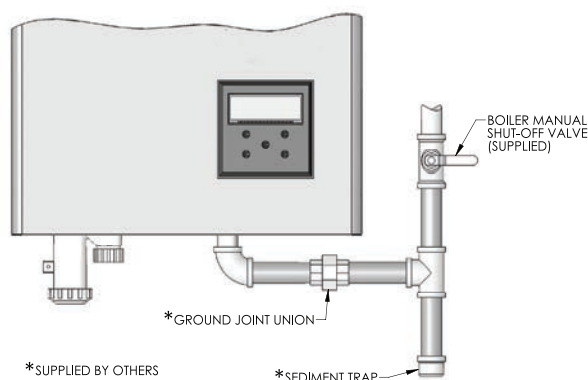


Figure 5.1: Suggested Near Boiler Gas Piping

⚠ CAUTION

Use a backing wrench on the gas valve inside of the unit when threading the gas pipe into the gas valve flange. Over torquing the gas valve can cause damage to the blower, gas valve or other components inside the unit.

Table 5.1: Pipe Capacity:

Maximum Capacity of pipe in cubic feet per hour (cubic meters per hour) with a pressure drop of 0.3" of water (75 Pa).

Pipe Length ft (m)	1/2" NPT Pipe	3/4" NPT Pipe	1" NPT Pipe	1-1/4" NPT Pipe	1-1/2" NPT Pipe
10 (3.0)	132 (3.7)	278 (7.9)	520 (14.7)	1,050 (29.7)	1,600 (45.3)
20 (6.1)	92 (2.6)	190 (5.4)	350 (9.9)	730 (20.7)	1,100 (31.1)
30 (9.1)	73 (2.1)	152 (4.3)	285 (8.1)	590 (16.7)	890 (25.2)
40 (12.2)	63 (1.8)	130 (3.7)	245 (6.9)	500 (14.2)	760 (21.5)
50 (15.2)	56 (1.6)	115 (3.3)	215 (6.1)	440 (12.5)	670 (19.0)
60 (18.3)	50 (1.4)	105 (3.0)	195 (5.5)	400 (11.3)	610 (17.3)
70 (21.3)	46 (1.3)	96 (2.7)	180 (5.1)	370 (10.5)	560 (15.9)
80 (24.4)	43 (1.2)	90 (2.5)	170 (4.8)	350 (9.9)	530 (15.0)
90 (27.4)	40 (1.1)	84 (2.4)	160 (4.5)	320 (9.1)	490 (13.9)
100 (30.5)	38 (1.1)	79 (2.2)	150 (4.2)	305 (8.6)	460 (13.0)

The values are based on a specific gravity of 0.60 (typical for natural gas). See Table 4.3 for capacity correction factors for gases with other specific gravities.

Specific Gravity	0.50	0.55	0.60	0.65	0.70	0.75
Correction Factor	1.10	1.04	1.00	0.96	0.93	0.90
Specific Gravity	0.80	0.85	0.90	1.00	1.10	1.20
Correction Factor	0.87	0.84	0.82	0.78	0.74	0.71
Specific Gravity	1.30	1.40	1.50	1.60	1.70	1.80
Correction Factor	0.68	0.66	0.63	0.61	0.59	0.58

1. Do not install any piping directly in front of the boiler or along either side. Always provide access to the front cover and side panel openings.
2. Install a sediment trap as shown in Figure 5.1. Be sure to allow clearance from the floor or other horizontal surface for removal of the pipe cap.

WARNING

Use a pipe joint sealing compound that is resistant to liquefied petroleum gas. A non-resistant compound may lose sealing ability in the presence of this gas, resulting in a gas leak. Gas leaks may potentially cause an explosion or fire.

* Natural gas input rates are based on 1,000 Btu/ft³, LP input rates are based on 2,500 Btu/ft³.

3. Install a ground joint union between the sediment trap and the boiler to allow service to the appliance.
4. Install a service valve as shown in Figure 5.1 to allow the gas supply to be interrupted for service.
5. Maintain a minimum distance of 10 pipe diameters between the gas pressure regulator and the boiler.
6. Check all gas piping for leaks prior to placing the boiler in operation. Use an approved gas detector, non-corrosive lead detection fluid, or other leak detection method. If leaks are found, turn off gas flow and repair as necessary.

WARNING

When checking for leaks, do not use matches, candles, open flames or other methods that provide an ignition source. This may ignite a gas leak resulting in a fire or explosion.

7. Figure 5.1 shows the gas shutoff valve for the Series PBC™ boiler. This valve is to be used in addition to the gas service valve shown upstream of the sediment trap.

D. GAS SUPPLY PIPING - OPERATION

1. The gas line must be properly purged of air to allow the boiler to operate properly. Failure to do so may result in burner ignition problems.
2. Table 5.3 shows the maximum and minimum fuel gas supply pressure to be measured at the gas valve inlet pressure tap. See figure 5.2.
 - a. Gas pressure below 3.5 inches of water column for Natural gas and 8 inches of water column for LP gas may result in ignition failures and hard ignitions.
 - b. Gas pressure above 13.5 inches of water may result in damage to the automatic gas valve.

CAUTION

Do not subject the gas valve to more than 1/2 psi (13.5" W.C.) of pressure. Doing so may damage the gas valve.

Table 5.2: Maximum and Minimum Fuel Pressure

Fuel Type	Pressure Inches W.C. (Pa)	
	Minimum	Maximum
Natural Gas	3.5	13.5
LP Gas	8	13.5

3. To check the gas supply pressure to the gas valve:
 - a. Turn off the power at the service switch.
 - b. Close the gas shutoff valve.
 - c. Using a flat screwdriver, turn the screw inside the inlet tap fitting (see Figure 5.2) one turn counter clockwise.
 - d. Attach the tube from the manometer to the pressure tap fitting.
 - e. Open the gas valve and start the boiler.
 - f. Read and record the gas pressure while the boiler is firing at max input as well as with any other appliances to the same gas line at their maximum inputs.
 - g. Turn off the boiler and close the gas shutoff valve.
 - h. Remove the manometer tube from the pressure tap fitting.
 - i. Turn the internal screw clockwise to close the valve.
 - j. Turn on the gas shutoff valve and boiler service switch.
 - k. Fire the boiler and check for fuel gas odor around the gas valve. If an odor is evident check to make sure that the pressure tap fitting is closed.
4. All gas piping must be leak tested prior to placing the boiler in operation.
 - a. If the leak test pressure requirement is higher than 13.5 inches of water column, the boiler must be isolated from the gas supply piping system.
 - b. If the gas valve is exposed to pressure exceeding 13.5 inches of water column, the gas valve must be replaced.
5. Install the boiler such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during operation and service (circulator replacement, condensate collector and neutralizer cleanout, control replacement etc.)

E. MAIN GAS VALVE - OPERATION

1. Figure 5.2 is an illustration of the gas valve/venturi assembly for the Series PBC™ boiler.
 - a. Adjustments should not be made to the gas valve without instrumentation to measure carbon dioxide (CO₂) and carbon monoxide (CO) emissions in the vent pipe.
 - b. Turning the throttle screw clockwise will decrease the gas flow (decreasing CO₂) and turning it counterclockwise will increase the gas flow rate (increasing CO₂). Markings adjacent to the throttle screw show + and - indicating this operation.
 - c. The recommended CO₂ settings are given in Table 5.4. In no case should the boiler be allowed to operate with CO emissions above 200 ppm.

2. Refer to Section 3, Venting and Air Intake for information on obtaining vent samples from this boiler.

Table 5.3: Recommended CO₂ Settings

	Natural Gas		Propane (LP)	
	Low Fire	High Fire	Low Fire	High Fire
Carbon Monoxide (CO)	< 75 ppm	< 200 ppm	< 75 ppm	< 200 ppm
Carbon Dioxide (CO ₂)	8.8% to 11.6%	8.5% to 9.7%	9.8% to 12.5%	9.5% to 10.5%

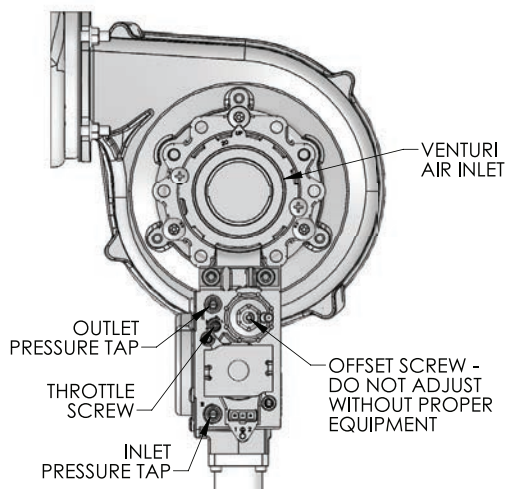


Figure 5.2: PBC-34™ Gas Valve and Venturi Detail

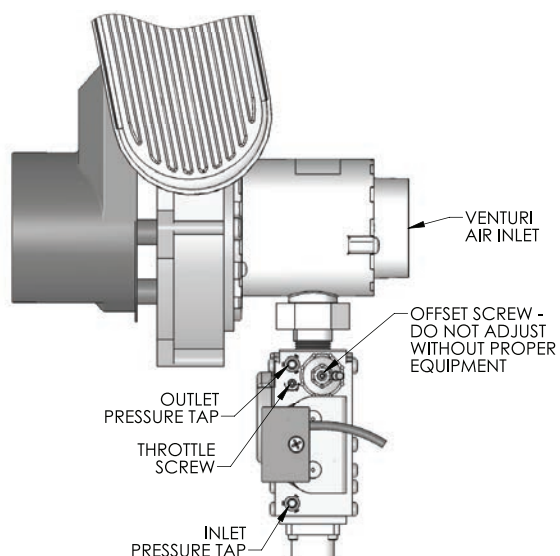


Figure 5.3: PBC-40/52™ Gas Valve and Venturi Detail

6. CONDENSATE DRAIN PIPING

A. GENERAL

1. The disposal of all condensate into public sewage systems is to be in accordance with local codes and regulations. In the absence of such codes, follow these instructions.
2. Proper piping and removal of condensation from combustion is critical to the operation of a condensing appliance. Follow these instructions carefully to assure that your Series PBC™ boiler operates correctly.
3. Depending on several factors, the condensate from gas fired condensing appliances may have a pH value as low as 2.5 (similar to cola soft drinks). Some local codes require the use of neutralization equipment to treat acidic condensate.

B. CONDENSATE SYSTEM

The condensate system for the Series PBC™ is designed to prevent condensate back-up into the heat exchanger and the passage of flue gases through the system.

The condensate trap must be installed by the installer:

⚠ WARNING

Failure to or improper installation of the condensate trap will cause the release of combustion products into the dwelling leading to severe injury or death.

⚠ NOTICE

Ensure the blocked vent pressure tap is not dislodged while attaching the condensate drain.

1. The condensate trap is installed in the condensate drain hole in the front left side of the unit
2. Insert the barbed and thread portion on the top of the trap through the hole and secure using the 3/4" G plastic locknut.
3. Press the condensate drain hose onto the barbed fitting on the trap and secure using the provided hose clamp.
4. The condensate traps outlet is a compression fitting compatible with 3/4" SCH40 PVC piping, 3/4" clear PVC tubing, as well as 1" flexible corrugated tubing.

⚠ WARNING

Condensate from a condensing boiler is highly acidic. A condensate neutralization system is required by many local codes and is highly recommended. Older homes with cast iron or metal drain systems are highly susceptible to damage and eventual failure if condensate is not treated properly before disposal.

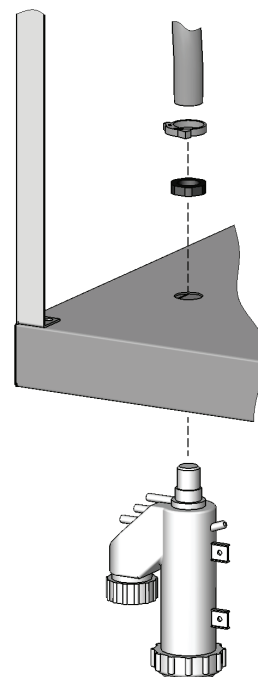


Figure 6.1: Condensate Trap System

7. ELECTRICAL CONNECTIONS

A. GENERAL

This appliance is to be wired in accordance with local codes and regulations as defined by the Authority having jurisdiction. In the absence of such local codes, the Series PBC™ boiler is to be wired in accordance with the latest edition of the National Electrical Code, ANSI/NFPA 70.

B. CUSTOMER CONNECTIONS

1. Electrical knockouts are provided on the top panel of the boiler to connect supply wiring, circulator wiring and wiring to various instruments. There are additional optional knockouts located in the bottom of the boiler for circulator wiring.
2. Electrical terminals are located in the top right portion of the unit.
3. Figure 7.4 shows customer connections and wiring schematic for the Series PBC™ boiler.
 - a. All Low voltage terminals are on the right terminal strip.
 - b. All Line voltage connections are on the left terminal strip.
 - c. The orange jumper is to be removed if a 120V connection to an external LWCO is used. This connection will disable power to the boiler if the LWCO is activated and is not meant to power the external LWCO at this time.

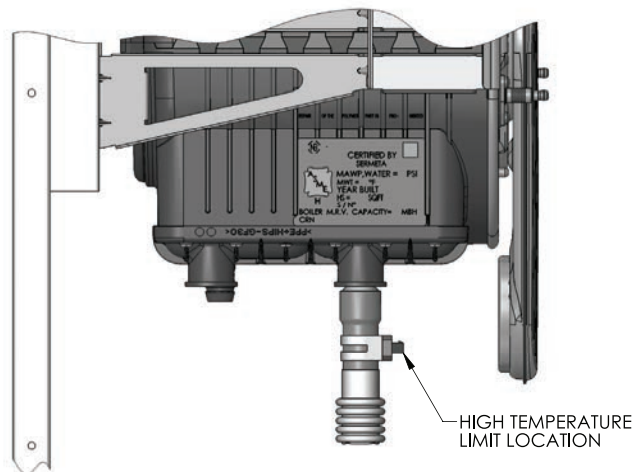


Figure 7.1: High Temperature Limit Location

4. An Outdoor Sensor is provided with the Series PBC™ boilers. It must be installed for the unit to operate properly and to maximize the efficiency of the unit. A warning message will be displayed on the display of the Outdoor Sensor is not installed in the default central heat mode.

- a. Connect the sensor to terminals 3 and 4 on the right hand terminal strip.
- b. The sensor should be installed in a location outside the dwelling that is protected from harsh weather conditions, such as driving rain and accumulated snow, and not exposed to direct sunlight.

C. INTERNAL WIRING

Figure 7.4 also shows all internal wiring and sensors for Series PBC™ boilers.

1. *User Interface:* The user interface, 975LB Display, is attached to the front of the electrical panel and is accessible through the front panel. This interface allows users and installer to access information on the boiler operation and change settings on the control. (See Section 8 for more information).
2. *Return Sensors:* This component, located on the right side of the Combination Hydronic Block (CHB), above the pump cartridge, monitors the return temperature inside the boiler loop. The thermistor is a 10 kΩ NTC immersion Sensor with a bayonet style connection. Only use a factory provided Series PBC™ return sensor.
3. *Dual Supply Sensor:* This component is located on the left side of the boiler attached to the copper portion of the supply line. There are two 10 kΩ NTC sensors in the sensor body that allows it to function as the boiler safety limit. The 975 control monitors the deviation between the two sensor readings. If the deviation is too large the control will shut down the boiler. This ensures that the supply temperature is accurate.
4. *Flue Sensor:* This thermistor provide flue temperature information to the control. It is located on the top of the heat exchanger in the front of the vent outlet. The sensor uses a quarter turn bayonet connection. Use care if replacing as the plastic housing can be damaged.
5. *Blocked Vent/Condensate Pressure Switch:* This switch is used to determine if there is a blockage in the vent system and also if there is a blockage in the condensate drain line after the condensate trap. A rise in condensate greater than 3.5" above the pressure switch tap with open the switch.
6. *Service Switch:* The service switch interrupts the power to the Series PBC™ boiler to allow service to be performed.
7. *Flame Sensor:* The flame sensor uses the principal of flame rectification to sense the burner flame. This is located on the right side of the heat exchanger burner door.
8. *Gas Valve:* The gas valve is connected through a special cord and connector. The PBC-40™ and PBC-52™ connector is secured with a screw.

9. **Ignition Electrode:** This electrode is located on the left side of the burner door. A high voltage charge is provided by the external spark generator to provide spark for lighting the burner.
10. **Combustion Air Blower:** The combustion air blower has two connections. There is a 120 Volt power connection (3-wire) and a low voltage control connection (4-Wire). Disconnecting the control wires will run the blower at full speed.
11. **External Spark Generator:** The generator is located on the inside of the electrical panel above the main control. It receives 120 volts from the main control and transforms it into a high voltage spark across the ignition electrode.
12. **PC Communication Adapter (Green Plug):** This connection allows Factory Engineers to review control settings and view advanced diagnostic features.
13. **Domestic Supply Sensor:** This component is located on the lower left side of the CHB unit. It is the same 10 k Ω NTC immersion sensor with a bayonet style connection as the return sensor. The control uses this sensor to target the domestic hot water setpoint when the unit is operating in DHW mode.
14. **Rotary Flow Sensor:** This component is located on the CHB unit just to the left of the pump cartridge. When a flow greater than 0.4 gallons per minute is detected the boiler will fire in DHW mode to provide domestic hot water.
15. **Stepper Motor:** The stepper motor is located in the CHB behind the flow sensor. The motor controls the position of the diverting valve in the CHB that determines where the boiler loop supply water can flow. The stepper motor defaults to the DHW position for faster response times.
16. **Pressure Sensor:** The pressure sensor is located on the left hand side of the CHB unit. It provides a live readout of the system pressure to the main control and user interface. The control will not operate the boiler if the pressure falls below 11.6 psig. This feature is acceptable as a LWCO in some locations. Check your local codes.
17. **Pump Cartridge:** The pump is located on the CHB unit. The Series PBC™ boiler is equipped with a Grundfos UPS15-78 pump head that provides all internal flow requirements for the boiler. It can be replaced by any UPS series pump cartridge.

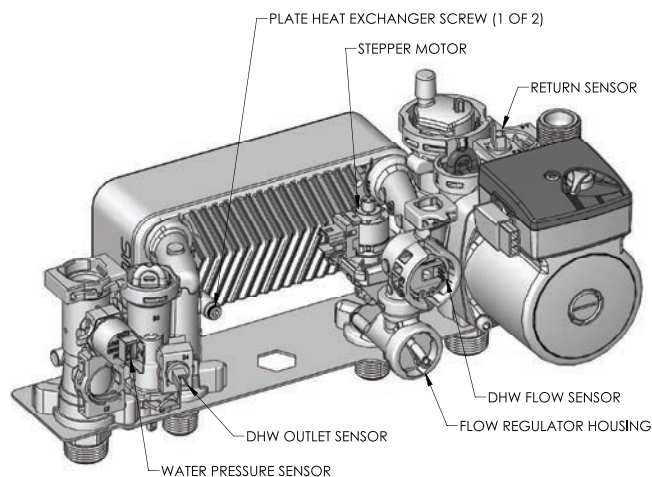


Figure 7.2: CHB Electrical Component Locations

⚠ NOTICE

Maximum Amp Draw for Circulator pumps on the PBC-34/40/52™ is 3.5 amps total for boiler pump and CH pump.

⚠ NOTICE

IF the fuse blows in the boiler control, a spare fuse (found in a holder on the control cover) can be used as a replacement. DIAGNOSE POSSIBLE CAUSES FOR BLOWN FUSE BEFORE REPLACING. Additional fuses can be ordered as need from your Peerless Boiler Distributor (Part #5562). See Figure 7.2 for location of Boiler Control fuse and spare fuse.

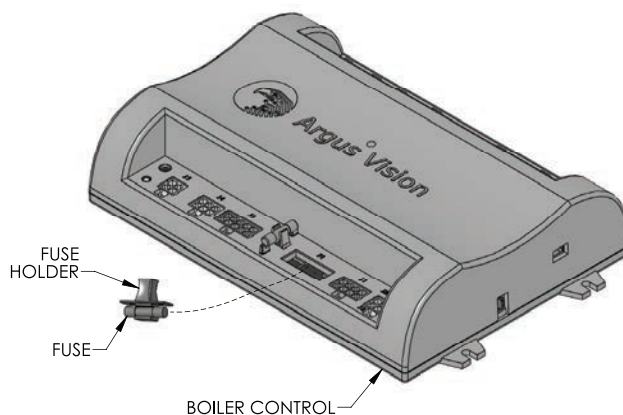
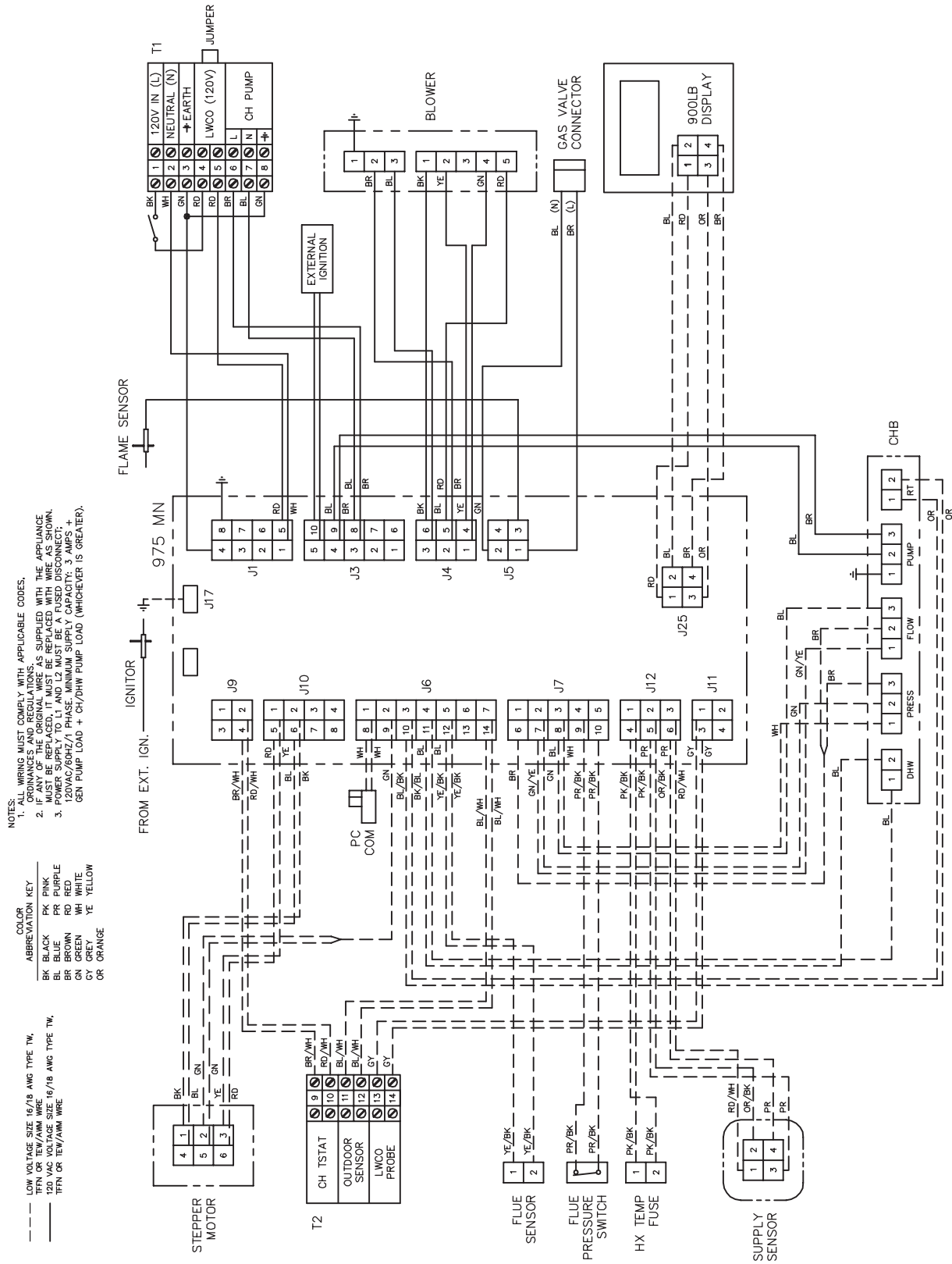


Figure 7.3: Control Fuse Location



(PBC)

PBC7010 R2

Figure 7.4: Wiring Schematic and Connection

8. BOILER CONTROL: INTERNAL WIRING & OPERATION

A. CONTROL OVERVIEW

The Series PBC™ boiler control is one of the primary safety devices for the boiler. It controls:

- Ignition sequence
- Temperature Limits
- Circulators
- Gas Flow
- Setpoints
- Domestic Hot Water Valve
- Fan Speed
- LWCO (When optional LWCO probe is used)

B. AVAILABLE CENTRAL HEAT MODES

Table 8.1: Series PBC™ Central Heat Modes

Central Heating Mode	Mode Description	Mode Operation	Restrictions
0	Fixed Setpoint	<ul style="list-style-type: none"> – Demand initiated by T/TT closure – User chosen fixed setpoint – Boiler targets CH setpoint and operates of Supply temperature hysteresis when demand is present 	Not for space heating
1	Outdoor reset with Thermostat	<ul style="list-style-type: none"> – Demand initiated by T/TT closure – Setpoint is calculated based off of Outdoor temperature and CH demand period to improve fuel usage and boiler efficiency. – Setpoint Boost function for long CH demand periods. – Boiler targets calculated CH setpoint and operates off of Supply temperature hysteresis when demand is present – When the Boost Function was active and CH demand is not present, the CH setpoint decreases back to the calculated setpoint. 	No restrictions
2	Outdoor reset with Permanent Demand	<ul style="list-style-type: none"> – Demand initiated by control logic. Always present. – Setpoint is calculated based off of Outdoor temperature to improve fuel usage and boiler efficiency. – Boiler targets calculated CH setpoint and operates off of Supply temperature hysteresis. – When CH demand is not present, calculated setpoint decreases gradually. 	No restrictions
3	Fixed Setpoint with Permanent Demand	<ul style="list-style-type: none"> – Demand initiated by control logic. Always present. – User chosen fixed setpoint – Boiler maintains CH setpoint and operates of Supply temperature hysteresis 	Not for space heating

*While accessible via the Installer menu, CH Modes 4 and 5 are not functional with the Series PBC™ boiler.

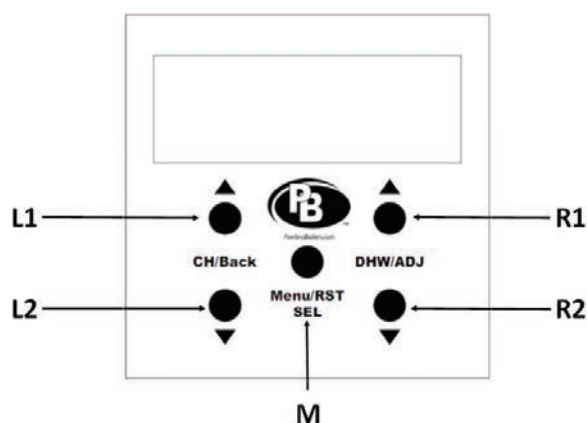
C. AVAILABLE DOMESTIC HOT WATER MODES

Table 8.2: Series PBC™ Domestic Hot Water Modes

Central Heating Mode	Mode Description	Mode Operation
0	No Domestic Hot Water	<ul style="list-style-type: none"> – Disables DHW sensor and functionality. – Boiler will function only for Central Heat.
5	Instantaneous Domestic Hot Water	<ul style="list-style-type: none"> – Demand initiated by Domestic Flow Sensor detecting an open tap. – Boiler Targets user chosen DHW setpoint. – 30 min domestic hot water priority (installer adjustable). – Domestic hot water pre-heat.

*While accessible via the Installer menu, DHW modes 2, 3, 4, 6, 7, and 8 are not functional with the Series PBC™ boiler.

D. DISPLAY UTILIZATION

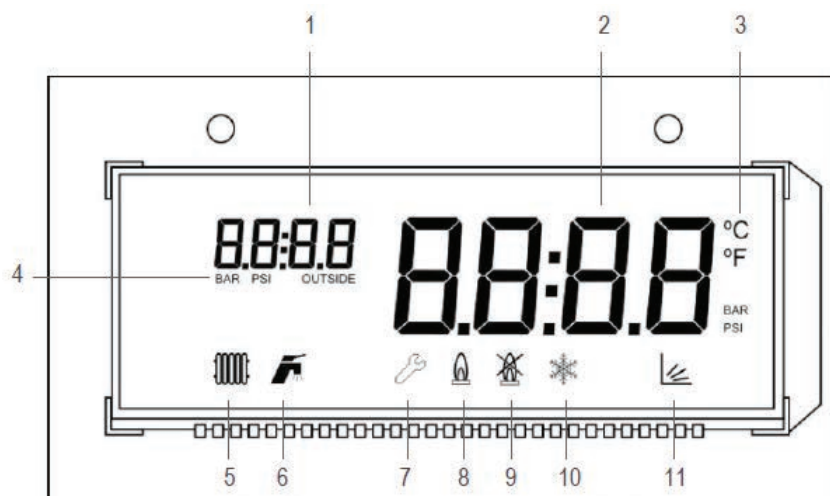

Figure 8.1: 900LB Display Buttons
Table 8.3: Display Button Functions

Button	Default Screen	Menu Selection- User/Installer Level	Lockout
L1	Adjust CH setpoint up (CH Mode 0 and 3 only)	Back	None
L2	Adjust CH setpoint down (CH Mode 0 and 3 only)	Back	None
R1	Adjust DHW setpoint up	Change Selection Up	None
R2	Adjust DHW setpoint down	Change Selection Down	None
M	Enter Menu Selection	Enter menu Select item for change, Confirm change (return to menu selection) Confirm PIN digit (Password menu)	Hold for Manual Reset (2sec)

⚠ NOTICE

All Parameter changes must be confirmed with a second press of the select (M) button.

1. Select parameter with select button
2. Change parameter with adjust buttons while parameter is flashing
3. Confirm change with select button. Parameter will stop flashing and show new setting.


Figure 8.2: 900LB Display Buttons
Table 8.4: Display Icon Descriptions

Icon #	Description and Use	
	Default Screen	Menu Selection
1	<ul style="list-style-type: none"> CH loop water pressure and/or Outdoor temperature. OUTSIDE is lit when temperature is shown. Pressure unit is lit when pressure is shown. Alternates every 2 seconds Special Status codes <ul style="list-style-type: none"> “ALEg”- Anti-Legionella active “Loc”- Boiler in Lockout state “Err”- Boiler in Blocking error state “AttE”- Non-blocking warning present requiring attention. 	<ul style="list-style-type: none"> Menu or Parameter number “CODE” when PIN input is enabled
2	<ul style="list-style-type: none"> CH Temperature DHW Temperature Special Status Code number 	<ul style="list-style-type: none"> Parameter value Blinking parameter value- Parameter actively being adjusted
3	<ul style="list-style-type: none"> Units of value being displayed by Icon #2 	Not used
4	<ul style="list-style-type: none"> Pressure unit when Icon #1 is displaying CH loop water pressure “OUTSIDE” when Icon #1 is displaying Outdoor Temperature 	Not used
5	<ul style="list-style-type: none"> Shown when Central Heat is enabled Flashing when CH demand is being handled 	Not used
6	<ul style="list-style-type: none"> Shown when Domestic Hot Water is enabled Flashing when DHW demand is being handled 	Not used
7	<ul style="list-style-type: none"> Flashing when service is required 	Not used
8	<ul style="list-style-type: none"> Shown when burner is ON 	
9	<ul style="list-style-type: none"> Shown when appliance is unable to start. Lockout or Blocking error present 	Not used
10	<ul style="list-style-type: none"> Shown when Frost Protection is active 	Not used
11	<ul style="list-style-type: none"> Shown when Outdoor Reset is active 	Not used

E. USER MENU

The User menu is accessible from the default screen by pressing the M button once to enter the menu level selection screen and pressing M again when “0000” is shown in the small digits.

The User Menus allow access to basic setpoints, system test, and unit settings. Use buttons R1 and R2 to move between parameters.

Table 8.5: User Menus (0000 Level)

User (0000) Parameters	Parameter Function	Units/Options
0003	– CH Setpoint, CH enable/disable	Temperature
0048	– DHW Setpoint, DHW enable/disable	Temperature
0200	<ul style="list-style-type: none"> – 10 minute System Test. Once 10 minute timer is over boiler will return to normal state. – Additional Access with Installer access PIN – Input installer PIN using CODE menu then return to User Menu for advanced system test functions. 	<ul style="list-style-type: none"> – OFF-System Test Disabled – FAN-Test blower (fixed speed) – Lo-Test burner at low power – Ign-Test burner at ignition power – Hi-Test burner on high power – REg-Test burner at high power with supply setpoint enabled <p>Installer level only:</p> <ul style="list-style-type: none"> – Stb-Test maximal thermostat – LCO1-Test Low Water Cut-off 1
0901	– Temperature unit setting	°C/°F
0902	– Pressure unit setting	Bar/psi
0997	<ul style="list-style-type: none"> – Screen Test – Pressing select activates all LCD options 	No options

F. STATUS MENU – 1000 LEVEL

The Status Menu is accessible from the default screen by pressing the M button once to enter the menu level selection screen. Using R1 and R2, select “1000” in the small digit area. Press M to enter the Status Menu.

The Status Menu allows for in-depth boiler information to be viewed but cannot access parameters for modification.

Table 8.6: Status Menus (1000 Level)

Status (1000) Parameters	Parameter Function	Value/Options
1001	Supply temperature	Temperature
1002	DHW temperature	Temperature
1004	Outside temperature	Temperature
1005	2nd Supply temperature	Temperature
1006	Flue temperature	Temperature
1007	Return temperature	Temperature
1008	Ionization / flame current	μA
1010	CH Pump	On/Off
1012	Actual CH setpoint	Temperature
1013	Room Thermostat (RT) input	Open/Closed

Table 8.6 (cont.): Status Menus (1000 Level)

Status (1000) Parameters	Parameter Function	Value/Options
1030	State	#
1031	Error Number	#
1033	CH Pressure	Pressure
1040	Actual fan speed	RPM
1041	Ignition fan speed	RPM
1042	Minimum fan speed	RPM
1043	Maximum fan speed	RPM
1051	Last lockout error number	#
1052	Last blocking error number	#
1053	Number of flame failures	#
1054	Number of successful ignitions	#
1055	Number of failed ignitions	#
1056	Total hours of operation for CH	Hours x 10
1057	Total hours of operation for DHW	Hours x 10
1058	Total system run time	Days
1059	Interval between lockout	1:MIN 2:HRS 3:DAY 4:WK
1060	Interval between blocking error	1:MIN 2:HRS 3:DAY 4:WK
1061	Instantaneous turbine speed (value used to measure parameter 1062)	RPM
1062	Water flow (rate)	l/min
1063	0-10V input	Volt
1098	975MN Group number	Hexadecimal
1099	975MN CRC (Software Version)	Hexadecimal
1995	975LB CRC (Software Version)	Hexadecimal

G. INSTALLER MENU – 2000 LEVEL

The Installer Menu is accessible by inputting the proper PIN number into screen CODE of the User Menu. When CODE is the parameter selected press the M button. Use the R1 and R2 buttons to select the proper number for the flashing place in the PIN. Pressing M will advanced to the next digit. If an incorrect number is selected, it is required to cycle through all four places with the M button to return and correct the number.

Once the 4 digit passcode has been entered, press L1 or L2 until the menu selection screen is shown. Press R1 or R2 until 2000 is shown in the small digits. Press M to enter the Installer Menu



NOTICE

Installer Code is 0231

Table 8.7: Installer Menus (2000 Level)

Status (2000) Parameters	Parameter Function	Unit/Value	Default Options
2001	Central Heat Mode	#	1
2003	CH Setpoint	°F	160
2005	CH Post Purge – Circulator	Seconds	10
2007	CH Hysteresis UP – Controls Boiler shutoff point above Setpoint	°F	9
2009	Anti-cycling period – Delay period during which boiler will not fire the burner if a supply temperature of CH Setpoint + CH Hysteresis is reached during a single demand period.	Seconds	180
2010	Anti-cycling Differential – Supply temperature drop below CH setpoint that must be reached before the burner will fire if a supply temperature of CH Setpoint + CH Hysteresis is reached during a single demand period. – Overrides Anti-Cycling Period	°F	16
2014	Maximum CH Power – Limits maximum CH input available to the control to satisfy a demand – Default values should not be changed	%	PBC-34™: 57 PBC-40™: 61 PBC-52™: 54
2015	Minimum CH Power – Limits the minimum power available to the boiler to satisfy a demand	%	1
2019	Boiler Supply Design Temperature – Sets the reset curve design temperature that will be targeted when the outdoor temperature is at the chosen outdoor design temperature. – For default: Boiler will target 190°F when the outdoor temperature is 23°F or lower.	°F	190
2020	Outdoor Design Temperature – Sets the Outdoor Temperature at which the boiler will target the Boiler Supply Design Temperature. – For default: Boiler will target 190°F when the outdoor temperature is 23°F or lower.	°F	23
2021	Boiler Mild Weather Temperature – Sets the reset curve design temperature that will be targeted when the outdoor temperature is at the Outdoor Mild Weather temperature. – For default: Boiler will target 104°F when the outdoor temperature is 68°F.	°F	104
2022	Mild Weather Design Outdoor Temperature – Sets the Outdoor Temperature at which the boiler will target the Boiler Mild Weather Design Temperature. – For default: Boiler will target 104°F when the outdoor temperature is 68°F.	°F	68
2023	Minimum CH Setpoint – Design Supply Minimum (limit) – Sets lower limit of Calculated CH setpoint – Calculated CH setpoint will always be at or above this value	°F	68
2024	Maximum CH Setpoint – Design Supply Maximum (limit) – Sets upper limit of Calculated CH setpoint – Calculated CH setpoint will always be at or below this value	°F	180

Table 8.7 (cont.): Installer Menus (2000 Level)

Status (2000) Parameters	Parameter Function	Unit/Value	Default Options
2025	Warm Weather Shutdown Temperature – Outdoor temperature that will block all CH demands until temperature falls below this value	°F	72
2026	Boost Function: Increment – Calculated Setpoint increase after boost delay time period is met – Boost will continually increase setpoint every boost time period until demand is met or Maximum CH Setpoint design limit is reached.	°F	0
2027	Boost Function: Delay – Time delay before boost function activates during a single demand	Minutes	120
2028	CH Night Setback Temperature – Calculated CH Setpoint setback value when the Night Setback Function is activated	°F	10
2035	DHW mode	#	5
2036	NON FUNCTIONAL		
2037	NON FUNCTIONAL		
2038	NON FUNCTIONAL		
2042	Domestic Hot Water Priority – Does not function for Series PBC™ Applications	0/1/2/3	2
2043	Domestic Hot Water Priority Time – Does not function in Series PBC™ Applications	Minutes	60
2044	DHW Post Purge- Circulator	Seconds	10
2048	DHW Setpoint	°F	122
2064	Preheat Mode – 0: OFF – 1: Anti Frost – plate heat exchanger is kept above 41°F – 2: Eco Mode – plate heat exchanger is kept above 86°F for faster response at expense of fuel utilization. – 3: Comfort Mode – plate heat exchanger is kept at DHW for fastest response at greatest expense to fuel utilization	#	1
2091	Maximum DHW Setpoint	°F	176
2096	Minimum DHW Setpoint	°F	
2109	CH Calculated Setpoint Offset – Allows the manual adjustment of the Calculated CH Setpoint by this value	°F	0
2110	Minimum CH Setpoint	°F	68
2111	Maximum CH Setpoint	°F	180
2112	CH Hysteresis Down	°F	9
2113	Maximum DHW Power – Limits the maximum available input to the boiler to satisfy DHW demands	%	100
2114	Minimum DHW Power – Limits the minimum available input to the boiler to satisfy DHW demands	%	1
2115	NON FUNCTIONAL		
2124	-FACTORY SET. DO NOT CHANGE -WARNING: CHANGING THESE SETTINGS WILL CAUSE BOILER TO NOT OPERATE PROPERLY	#	0
2125		#	2
2126		#	9
2127		#	0
2128		#	0
2129		#	0
2130	Flow Scaling Factor – NON FUNCTIONAL		
2131	Minimum CH Loop Pressure – Pressure at Boiler will shut down after “FILL” warning will appears	PSI	10.2

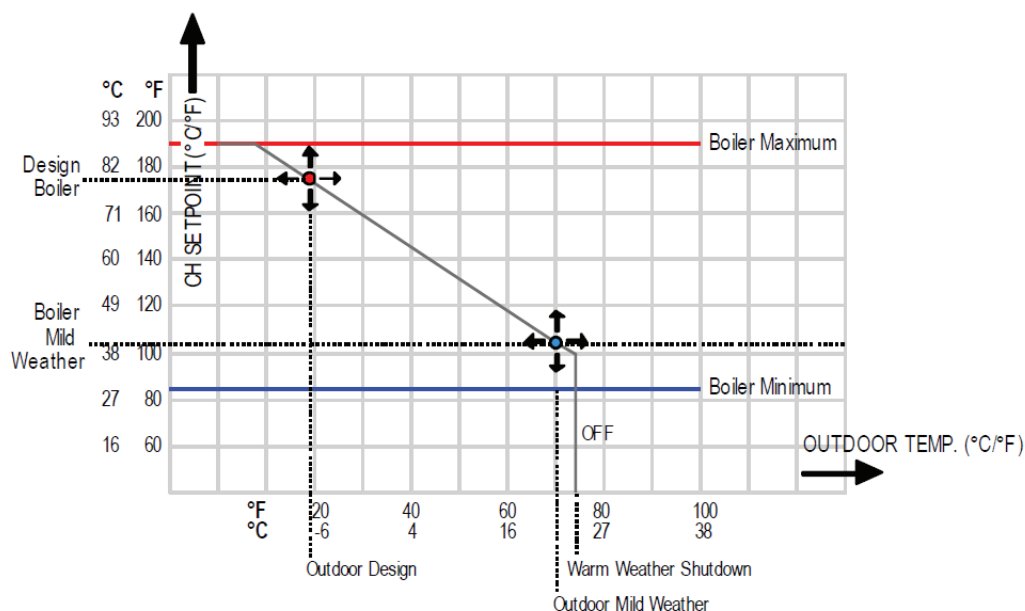
Table 8.7 (cont.): Installer Menus (2000 Level)

Status (2000) Parameters	Parameter Function	Unit/Value	Default Options
2132	Fill Hysteresis – NON FUNCTIONAL		
2133	NON FUNCTIONAL		
2134	NON FUNCTIONAL		
2135	NON FUNCTIONAL		
2136	NON FUNCTIONAL		
2137	NON FUNCTIONAL		
2138	Appliance Mode – Determines Fan Speeds of appliance – ALWAYS ENSURE THIS SETTING MATCHES THE UNIT BEING INSTALLED – WARNING: FAILURE TO PROPERLY SET THE APPLIANCE MODE CAN LEAD TO BOILER FAILURE CAUSING PROPERTY DAMAGE, SEVERE PERSONNEL INJURY OR DEATH	#	PBC-34- 50 PBC-40- 51 PBC-40-LP- 53 PBC-52- 52
2139	De-Air Functionality – On power cycle the unit will go through a period of 3 minutes of pump cycling to drive air out of the system	Enable/Disable	Enable
2140	NON FUNCTIONAL		
2141	NON FUNCTIONAL		
2201	CH Enable Setting – Enables or Disables Central Heat Boiler Functions	Enable/Disable	Enable
2202	DHW Enable Setting – Enables or Disables Domestic Hot Water Boiler Functions	Enable/Disable	Enable
2203	Service Remainder Setting – Allows for a service notification to be displayed after the Service Days time period is met	ON/OFF/Reset	OFF
2204	Service Days	Days	0

H. MENU LEVELS 3000, 4000 AND 5000

Menu levels 3000, 4000 and 5000 are non-functional for the Series PBC™ and shouldn't be modified.

I. OUTDOOR RESET OPERATION



Reset Curve

Figure 8.3: Outdoor Reset Curve Logic

All Series PBC™ boilers come with the default Central Heat mode set to outdoor reset with room thermostat (ODR). This feature uses the information from the provided Outdoor Sensor to automatically adjust the boiler setpoint based on the required heat load on the building as the outdoor temperature changes. Figure 8.3 above visualizes the curve that is controlled by parameters 2019 through 2027.

1. The Boiler Design Temperature (2019) and Outdoor Design Temperature (2020) control the maximum setpoint and the temperature at which it will be targeted.
2. The Boiler Mild Weather Temperature (2021) and Outdoor Mild Weather Temperature (2022) control the minimum setpoint and temperature at which it will be targeted
3. The Minimum CH setpoint (2023) controls how low the calculated setpoint can fall.
4. The maximum CH setpoint (2024) controls how high the calculated setpoint can rise when boost is active.
5. The Mild Weather Shutdown Temperature (2025) allow for control over what outdoor temperature the boiler will begin ignoring CH demands.
6. The Boost Function Increment (2026) allows for control over how aggressively the Boost function will increase the calculated setpoint after the boost delay is met.
7. The Boost Function Delay allows for control over the timeframe the CH demand must be present without the call being satisfied before the Boost Function will begin increasing the calculated setpoint.

Table 8.8: Outdoor Reset Parameters

Status (2000) Parameters	Parameter Function	Unit/Value	Default Options
2019	Boiler Supply Design Temperature – Sets the reset curve design temperature that will be targeted when the outdoor temperature is at the chosen outdoor design temperature. – For default: Boiler will target 190°F when the outdoor temperature is 23°F or lower.	°F	190
2020	Outdoor Design Temperature – Sets the Outdoor Temperature at which the boiler will target the Boiler Supply Design Temperature. – For default: Boiler will target 190°F when the outdoor temperature is 23°F or lower.	°F	23
2021	Boiler Mild Weather Temperature – Sets the reset curve design temperature that will be targeted when the outdoor temperature is at the Outdoor Mild Weather temperature. – For default: Boiler will target 104°F when the outdoor temperature is 68°F.	°F	104

Table 8.8 (cont.): Outdoor Reset Parameters

Status (2000) Parameters	Parameter Function	Unit/Value	Default Options
2022	Mild Weather Design Outdoor Temperature – Sets the Outdoor Temperature at which the boiler will target the Boiler Mild Weather Design Temperature. – For default: Boiler will target 104°F when the outdoor temperature is 68°F.	°F	68
2023	Minimum CH Setpoint – Design Supply minimum (limit) – Sets lower limit of Calculated CH setpoint – Calculated CH setpoint will always be at or above this value	°F	190
2024	Maximum CH Setpoint – Design Supply Maximum (limit) – Sets upper limit of Calculated CH setpoint – Calculated CH setpoint will always be at or below this value	°F	68
2025	Warm Weather Shutdown Temperature – Outdoor temperature that will block all CH demands until temperature falls below this value	°F	72
2026	Boost Function: Increment – Calculated Setpoint increase after boost delay time period is met – Boost will continually increase setpoint every boost time period until demand is met or Maximum CH Setpoint design limit is reached.	°F	5
2027	Boost Function: Delay – Time delay before boost function activates during a single demand	Minutes	20

J. IGNITION SEQUENCE

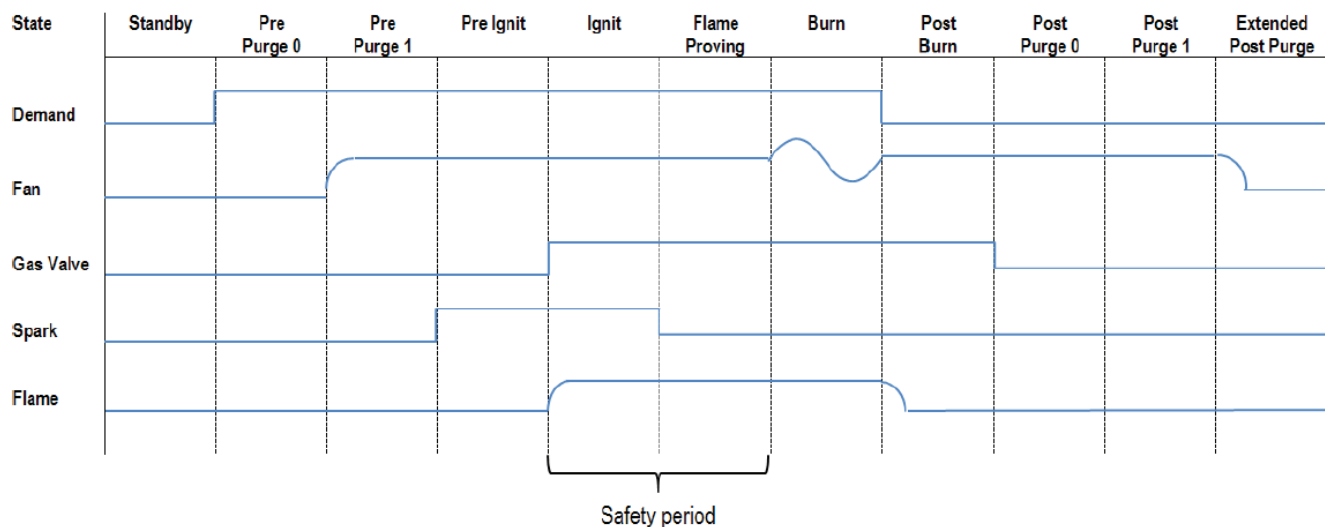

Figure 8.4: Ignition Sequence

Figure 8.4 shows a typical ignition and burn cycle for the Series PBC™ boiler. Pre-purge and Post Pure periods are shown in a compressed fashion to show the ignition process in detail.

- Boiler receives a demand either CH or DHW
- Blower ramps up to ignition speed and hold for Pre-purge period of 7 seconds
- Spark is initiated 1 second before gas valve
- Gas valve opens
- Gas valve remains open for flame proving period. If no flame is detected, the gas valve closes and the blower moves to Post-purge.
- If flame is detected, the boiler will begin to modulate to maintain setpoint until the demand is removed.
- Once demand is removed, gas valve closes and blower moves to Post-purge for 10 seconds.
- After Post-purge, blower shuts down and awaits next demand.

K. ADDITIONAL SAFETY FUNCTIONS

1. Ignition Failure Protection: The Series PBC™ control allows for 3 failed ignition attempts before the control goes into a lockout state showing Loc 1. This lockout can be reset by holding the Menu button until “rst” appears on the display or by pressing the manual reset button below the control state LED on the main control board.
2. Flame Failure Protection: The Series PBC™ control allows monitors for flame failure during a demand. If the flame signal is lost more than 3 times during a single demand the control will go into a lockout state showing Loc 22. This lockout can be reset by holding the Menu button until “rst” appears on the display or by pressing the manual reset button below the control state LED on the main control board.
3. Flue Temperature Protection: Series PBC™ control monitors the flue temperature sensor for high temperatures. If the flue temperature approaches 190°F (88°C), the boiler will begin to modulate input down regardless of setpoint or demand. If the flue temperature reaches 190°F (89°C) the boiler will shut down and run the blower for 5 minutes before re-ignition.
4. Flame Recovery: The Series PBC™ control actively monitors the ionization current through the flame sensor. If Flame Signal drops to below 1.5 μ A, the control will increase the minimum fan speed in order to attempt to maintain flame signal. If this fails, the control will retry with a further increased minimum fan speed. If a second flame loss occurs, the control will retry again at ignition fan speed as the minimum. If at any point the demand is met the control will reset the minimum fan speed to default.
5. Stayburn and Startburn Temperatures: When the supply temperature of the boiler exceeds the maximum boiler setpoint due to the off hysteresis of 9°F and a demand is still present, the Series PBC™ control allows the unit to run at 1% input until the Stayburn temperature is reached at 190°F (88°F). The boiler will always shutdown at this temperature and will never exceed it. The Series PBC™ is not designed to run beyond this temperature. Steps should be taken to improve the system to lower the required setpoint if the Stayburn Temperature is ever reached. The boiler will not re-ignite until the Startburn temperature is reached below the setpoint. The Startburn Temperature is 185°F (85°C).
6. Frost Protection: The Series PBC™ control monitors the unit for potential freeze situation which would cause damage to the internal piping of the unit. If the water temperature inside the unit falls below 41°F (5°C) the boiler pump will start. If the temperature continues to fall the burner will ignite to and heat the unit until the supply temperature reaches 59°F (15°C).
7. Filling Protection: The Series PBC™ control monitors the system pressure for drops below the required system pressure of 11.6psig. Pressures below 17.5 psig will cause the pressure display on the unit to flash as a warning. Pressures below 10.15 psig will cause the boiler to shut down and display a “FILL” error. The unit will not run until the pressure is again above the minimum pressure.
8. De-air: Upon boiler power initiation, the Series PBC™ control will enter a de-air state during which it will purge any air remaining in the system by cycling the pump on and off and changing the position of the switching valve. This period lasts for 4 minutes. It can be canceled by holding buttons L2 and R2 for 3 seconds simultaneously.
9. Low Water Cut Off: The Series PBC™ control comes equipped with a probe style LWCO function built into the control. With the addition of the optional LWCO probe kit installed in the piping above the boiler, the control will monitor for low water conditions. If such a condition occurs the control will go into a lockout state and must be manually reset.
10. Flue Pressure and Block Condensate Switch: The Series PBC™ control monitors a pressure switch that will enter the boiler into a blocking state. This switch will display Err 156. Clearing of the flue or condensate line will automatically clear this error.

9. START-UP PROCEDURE

A. GENERAL

1. Confirm that all water, gas and electricity are turned off.
2. Verify that the water piping, venting & air intake piping, gas piping, electrical wiring and electrical components are installed in accordance with the manufacturer's instructions. Be sure that the boiler is installed in accordance with this manual and good engineering practice.
3. Turn on electricity and gas to the boiler.

B. CHECK WATER PIPING

1. Fill the boiler and system with water, making certain to purge all air from the system. Open each vent in the system until all air is released and water begins to be discharged. Then close the vent.
2. Attach the provided 5/16" hose to the barb tapping in the top left portion of the heat exchanger. While holding the open end of the hose into a bucket, loosen the manual air vent until air begins to flow. Once all air has been purged and only water is draining, close the manual air vent and remove the hose.

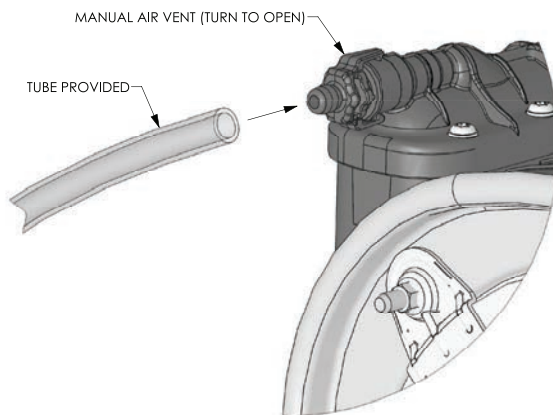


Figure 9.1: Manual Air Vent Location

3. The pressure reducing valve on the fill line will typically allow the system to be pressurized to 12 PSI. Consult manufacturers instructions for operation of the valve and expansion tank. Adjustment of the system pressure will most likely be required to meet the 17.5 psig requirement of the control. Lower system pressures run the risk of steam flashing in the unit when a high setpoint and low temperature delta is present. System fill pressure and expansion tank should be adjusted.

⚠ NOTICE

Recommended system pressure is 17.5 psig. Adjust expansion tank before filling system.

4. Check joints and fittings throughout the system and repair as required.

C. CHECK GAS PIPING

1. Turn on gas to the boiler using the shut-off valve upstream of the sediment trap. Be sure that the gas shut-off valve supplied with the boiler is in the closed position.
2. Connect a manometer to the gas supply upstream of the supplied manual gas valve.
3. Confirm that the gas supply pressure to the boiler is between the minimum and maximum values as indicated in Section 5.
4. If a supply pressure check is required, isolate the boiler and gas valve before performing the pressure test. If the supply pressure is too high or too low, contact the fuel gas supplier.
5. Double check the fuel gas supply pressure after the boiler is running to be sure that the pressure doesn't drop off significantly under operation.

D. CHECK OPERATION

1. Either disconnect or set the CH thermostat to ensure there is no call for heat. Also confirm there is no DHW flow by shutting the isolation valve to the DHW inlet connection.
2. Turn on electricity and all manual gas valves to the boiler. Check to see if the LCD display is lit. The control will display Supply temperature and water pressure.
3. Refer to Section 8, Boiler Control, to set up the control for the desired operation.
4. Use the ignition sequence, Figure 8.4 to follow the light off and shutdown sequences and to assist in troubleshooting operation problems. If the boiler does not function properly, consult Section 10, Troubleshooting.
5. After starting the boiler, be certain that all controls are working properly and that the combustion is properly set up. Paragraphs 6 and 7 below provide instructions on how to do this.
6. Check that the boiler will shut down when the supply water temperature reaches the control setpoint.
 - a. Note the boiler setpoint by accessing the Status Menu and viewing parameter 1012.
 - b. Use the System Test Mode, parameter 0200 in the User Menu to choose High Input Power.
 - c. Monitor the boiler temperature on the temperature gauge (supplied for field mounting) and on the Status display.

START-UP PROCEDURE

- d. The boiler should shut down at the boiler setpoint plus 10°F (5.6°C). If it does not shut down turn off the boiler and contact your PB Heat representative.
7. Check combustion readings in the boiler vent pipe utilizing the built in analysis port on the vent adapter (White threaded cap).

WARNING

Ensure the analysis port is tightly sealed once combustion readings are taken. Leaving the port unsealed will allow combustion products to vent into the indoor space which can lead to severe injury or death.

COMBUSTION
TEST PORT
(REPAIR PART
54852)

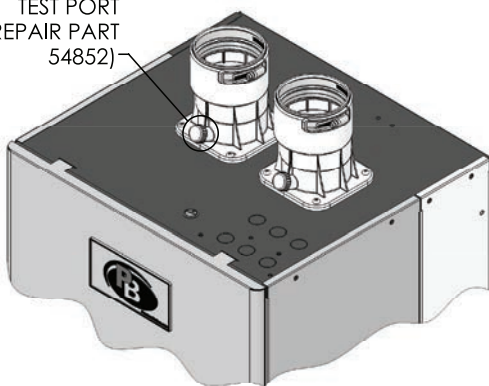


Figure 9.2: Combustion Test Port Location

- a. Using a combustion analyzer with the capability to read carbon dioxide (CO₂) and carbon monoxide (CO), place the probe into the combustion test port. See Figure 9.2.
- b. Manually set the boiler to Maximum power by entering the System Test Mode.
 - Verify that the fan speed indicated is within 50 rpm of the maximum power fan speed in Table 12.3. Status Menu parameter 1040.
 - Verify that the CO and CO₂ emissions are within the parameters specified in Table 5.4.
- c. Manually set the boiler to Low Power by entering the System Test Mode.
 - Verify that the fan speed indicated is within 100 rpm of the Low Power fan speed listed in Table 12.3. Status Menu parameter 1040.
 - Verify that the CO and CO₂ emissions are within the parameters specified in Table 5.4.
- d. If the values in either of these instances falls outside the parameters listed in Table 5.4, turn off the boiler and contact your PB Heat representative. For best results, the value should be set for the middle of the range (9% for Natural Gas and 10% for LP Gas).
- e. Be sure to set the System Test mode to Off so that the boiler will modulate correctly in accordance with the load.
- f. After removing the analysis probe from the vent pipe, securely screw the analysis port cap back onto the vent adapter.
- g. Record the combustion readings on the “Start-up Combustion Record” in Appendix D. It is very important to record all of the information requested on the sheet for follow up and troubleshooting.

NOTICE

To prevent moisture damage to control and blower:

During Boiler operation verify that there are no water leaks from any fittings on the boiler header and that all vent connections are water tight and properly assembled.

E. LIGHTING & OPERATING PROCEDURES

FOR YOUR SAFETY READ BEFORE OPERATING



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

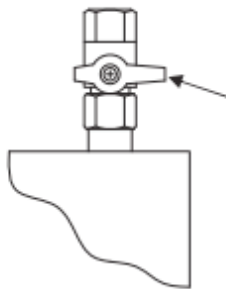
- A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
- C. If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to turn the gas control valve. Never use tools. If the handle will not turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

WHAT TO DO IF YOU DO 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.


OPERATING INSTRUCTIONS

1. STOP! Read the safety information above.
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 burner. Do not try to light the burner by hand.
5. Turn gas shutoff valve clockwise  to "OFF". Handle will be perpendicular to pipe, do not force.
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.
7. Turn gas shutoff valve counterclockwise  to "ON". Handle will be in line with the pipe.
8. Turn on all electric power to 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 your service technician or gas supplier.



Gas Control Knob
(show in the "OFF"
position)

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. Turn the gas shutoff valve clockwise  "OFF". Handle will be perpendicular to pipe, do not force.

(PF)

9474 REV 0

10. TROUBLESHOOTING

A. LOCKOUT ERRORS

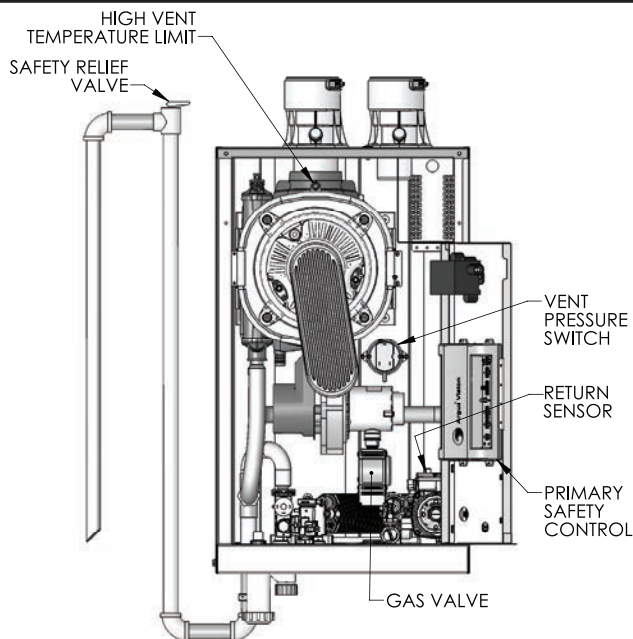


Figure 10.1: Additional Safety Locations

1. When a lockout error occurs the display will show "Loc" followed by a number code.
2. Lockout codes require that the control be manually reset either by holding the center reset button on the display or by pressing the reset button on the main control board itself.
3. Lockout errors should be investigated further to determine the cause of the by a qualified service technician.

B. BLOCKING ERRORS

1. When a blocking error occurs the display will show "Err" followed by a number code.
2. Blocking errors will automatically clear if the condition is corrected.
3. These error messages and some suggested actions are listed in Table 10.2

C. WARNING ERRORS

1. When a warning error occurs the boiler display will "Atte" followed by a number code.
2. Warning errors will automatically clear once the condition is corrected and will not prevent the boiler from operating.
3. Warning 204 is for Outdoor Sensor not Connected. The Series PBC™ units will display this warning on start-up if the provided outdoor sensor is not connected.

D. TYPICAL OPERATION CYCLE – CENTRAL HEAT

1. Boiler is in standby. No demand. Central Heat Radiator symbol is constant.
2. Demand is applied. Central Heat Radiator symbol begins flashing
3. Switching valve stepper motor extends to Central heat position, boiler pump and CH pump start
4. Blower begins Pre-purge for 7 seconds at ignition speed.
5. Spark engages 2 seconds
6. Gas valve opens.
7. Spark remains engaged for 2 more seconds.
8. Two second flame proving period holds valve open while control checks for flame signal
9. Boiler holds at ignition speed for 10 seconds before modulation begin.
10. Demand is met and removed.
11. Gas valve closes, Fan returns to ignition speed.
12. 10 second post purge period.
13. Switching valve returns to DHW position.
14. Pumps remain energized for pump post purge period.
15. Full unit standby

E. TYPICAL OPERATION CYCLE – DHW

1. Boiler is in standby. No demand. Domestic Faucet symbol is constant.
2. Demand is applied when flow sensor detects hot water flow. Domestic Faucet symbol begins flashing
3. Boiler pump starts
4. Blower begins Pre-purge for 7 seconds at ignition speed.
5. Spark engages 2 seconds
6. Gas valve opens.
7. Spark remains engaged for 2 more seconds.
8. Two second flame proving period holds valve open while control checks for flame signal
9. Boiler holds at ignition speed for 10 seconds before modulation begin.
10. Demand is met and removed.

11. Gas valve closes, Fan returns to ignition speed.

12. 10 second post purge period.

13. Pump remain energized for pump post purge period.

14. Full unit standby

WARNING

When servicing or replacing any components of this boiler be certain that:

- The gas is off.
- All electrical power is disconnected.

WARNING

Do not use this appliance if any part has been under water. Improper or dangerous operation may result. Contact a qualified service technician immediately to inspect the boiler and to repair or replace any part of the boiler which has been under water.

DANGER

When servicing or replacing components that are in direct contact with the boiler water, be certain that:

- There is no pressure in the boiler. (Pull the release on the relief valve. Do not depend on the pressure gauge reading).
- The boiler water is not hot.
- The electrical power is off.

CAUTION

If overheating occurs or the gas supply fails to shut off, do not turn off electrical power to the circulating pump. This may aggravate the problem and increase the likelihood of boiler damage. Instead, shut off the gas supply to the boiler at the gas service valve.

CAUTION

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

Table 10.1: Lockout Codes

Error Number	Error Display	Corrective Action
0	E2PROM_READ_ERROR	Internal Software error. Replace control.
1	IGNIT_ERROR	Three unsuccessful ignition attempts in a row. <ul style="list-style-type: none"> – Check for spark by ear. Also check for 120V across the blue and brown control output wire to the spark module. If not spark is present but voltage is. Replace module. If no voltage is present check parameter 2126. Should be set to 9. If setting is correct, replace control. – Remove flame sensor and check for white build-up. Clean sensor, re-install and attempt ignition. If ignition still fails perform other actions listed here. Replace sensor. If sensor appears cracked or bent, replace sensor. – Confirm fuel pressure at the valve inlet when the valve is open. Low gas pressure can cause ignition failures. High gas pressure can cause the valve to not operate and or damage the valve.
2	GV_RELAY_ERROR	Failure detected in the Gas Valve Relay. Replace Control
3	SAFETY_RELAY_ERROR	Failure detected in the safety relay. Replace Control.
4	BLOCKING_TOO_LONG	Blocking error present for more than 20 hours. <ul style="list-style-type: none"> – Go to parameter 1052 for last blocking error code. Correct cause.
5	FAN_ERROR_NOT_RUNNING	Fan is not running for more than 60 secs. <ul style="list-style-type: none"> – Check fan condition by disconnecting the 5 pin control plug on the blower. Fan should ramp to full power when the unit is turned on. – If fan does not power on, check for 120 volts across the brown and blue wires in the three pin connector. If voltage is present, replace blower. – If fan powers on check for continuity through blower control harness, 5 pin connector to J4 connector on control board. If continuity is found replace control. If no continuity is found, replace harness.
6	FAN_ERROR_TOO_SLOW	Fan runs too slow for more than 60 seconds <ul style="list-style-type: none"> – Check voltage to the blower. A low voltage can cause the blower to run at the incorrect speed due to lack of power. Replace blower if voltage is correct. – Check for continuity through blower control harness, 5 pin connector to J4 connector on control board. If continuity is not found, replace harness. – Replace control if other actions do not correct issue.

Table 10.1 (cont.): Lockout Codes

Error Number	Error Display	Corrective Action
7	FAN_ERROR_TOO_FAST	Fan runs too fast for more than 60 seconds <ul style="list-style-type: none"> – Check for continuity through blower control harness, 5 pin connector to J4 connector on control board. If continuity is not found, replace harness. – Replace control if other actions do not correct issue.
8	RAM_ERROR	Internal software error. Replace Control.
9	WRONG_EEPROM_SIGNATURE	Contents of E2prom is not up to date. Replace Control.
10	E2PROM_ERROR	Wrong safety parameters in E2prom. Replace Control.
11	STATE_ERROR	Internal software error. Replace Control.
12	ROM_ERROR	Internal software error. Replace Control.
15	MAX_TEMP_ERROR	Thermal Fuse in the main heat exchanger body has tripped. This fuse should only open if extreme conditions have occurred within the unit. <ul style="list-style-type: none"> – Replace Heat exchanger or entire boiler. – Check all safety limits and sensors before resuming operation of the unit. – Check target wall and burner door insulation for degradation on old heat exchanger. Evidence of heavy recirculation. – Check internal pump operation. – The thermal fuse is located on the top right of the heat exchanger and is connected to a set of pink/black wires. Ensure connection is secure. – If error occurred during installation start-up, reset the control to clear error. If error reoccurs, contact your Factory Representative.
16	FLUE_GAS_ERROR	Flue Temperature exceeded the maximum flue temperature limit (192.2°F (89°C)). <ul style="list-style-type: none"> – Lower system setpoint to decrease flue temperature. – Check temperature delta across the boiler supply and return. A low delta will cause increased flue temperatures due to poor energy transfer.
17	STACK_ERROR	Internal software error. Replace Control.
18	INSTRUCTION_ERROR	Internal software error. Replace Control.
19	ION_CHECK_FAILED	Internal software error. Replace Control.
20	FLAME_OUT_TOO_LATE	Flame still present 10 seconds after closing the gas valve. <ul style="list-style-type: none"> – Check flame sensor for a short to ground. Replace sensor, sensor gasket or harness if short is found. – Check solenoid on gas valve for operation. Gas valve might not be closing properly. Replace gas valve.
21	FLAME_BEFORE_IGNIT	Flame is detected before ignition. <ul style="list-style-type: none"> – Check flame sensor for a short to ground. Replace sensor, sensor gasket or harness if short is found.
22	TOO_MANY_FLAME_LOSS	Flame signal was lost 3 times during a single demand cycle. <ul style="list-style-type: none"> – Remove flame sensor and check for white build-up. Clean sensor, re-install and attempt ignition. If ignition still fails perform other actions listed here. Replace sensor. If sensor appears cracked or bent, replace sensor. – Confirm fuel pressure at the valve inlet when the valve is open. Low gas pressure can cause flame failures. If another appliance is connected to the gas line, confirm gas pressure at the gas valve when both appliances are in operation.
23	CORRUPTED_ERROR_NR	Error code RAM byte was corrupted to an unknown error codes. Replace control
29	PSM_ERROR	Internal software error. Replace control.
30	REGISTER_ERROR	Internal software error. Replace control.
33	LWCO_1_ERROR	Low water cut off error. <ul style="list-style-type: none"> – If using LWCO probe kit, check system for leaks and filling valve for operation. Check wiring to LWCO probe and that the connector to the probe is securely attached. Check grounding to piping where the LWCO probe is installed. Ensure that the probe is installed in a location that is not collecting air. – If not using the LWCO probe kit, check the jumper across terminal 5 and 6 on the low voltage terminal block. If broken replace with a 15 kΩ or similar resistor.
38	FLUE_PRESSURE_LOCKING	More than 3 Blocked Flue/ Condensate Switch in 24 hours. <ul style="list-style-type: none"> – Check for blockages in the vent pipe or heat exchanger. – Check for blockages in the condensate system inside or after the condensate trap. A slow drainage of condensate could cause condensate back up that will trip this switch under certain conditions.

Table 10.2: Blocking Errors

Error Number	Error Display	Corrective Action
100	WD_ERROR_RAM	Internal software error. If error persists, replace control.
101	WD_ERROR_ROM	Internal software error. If error persists, replace control.
102	WD_ERROR_STACK	Internal software error. If error persists, replace control.
103	WD_ERROR_REGISTER	Internal software error. If error persists, replace control.
104	WE_ERROR_XRL	Internal software error. If error persists, replace control.
105	HIGH_TEMP_ERROR	T_Supply and T_Supply_2 over Stayburn temperature of 190°F
106	REFHI_TOO_HIGH	Internal hardware error. If error persists, replace control.
107	REFHI_TOO_LOW	Internal hardware error. If error persists, replace control.
108	REFLO_TOO_HIGH	Internal hardware error. If error persists, replace control.
109	REFLO_TOO_LOW	Internal hardware error. If error persists, replace control.
110	REFHI2_TOO_HIGH	Internal hardware error. If error persists, replace control.
111	REFHI2_TOO_LOW	Internal hardware error. If error persists, replace control.
112	REFLO2_TOO_HIGH	Internal hardware error. If error persists, replace control.
113	REFLO2_TOO_LOW	Internal hardware error. If error persists, replace control.
114	FALSE_FLAME	Flame detected in a state in which no flame should be present. <ul style="list-style-type: none"> – Check flame sensor for a short to ground. Replace sensor, sensor gasket or harness if short is found. – Check solenoid on gas valve for operation. Gas valve might not be closing properly. Replace gas valve.
115	LOW_WATER_PRESSURE_ERROR	Low water pressure sensor error <ul style="list-style-type: none"> – Replace sensor if error does not correct itself
116	LOW_WATER_PRESSURE_SENSOR	Low water pressure in system <ul style="list-style-type: none"> – Check system pressure – Check filling valve setting and expansion tank pressure – Check system for leaks.
118	WD_COMM_ERROR	Watchdog communication error. If error persists, replace control.
119	RETURN_OPEN	Return Sensor open <ul style="list-style-type: none"> – Check sensor wiring for solid connection and continuity. Replace harness if wiring is bad. – Check for resistance though the sensor by touching meter leads across both pins on the sensor. If no circuit is present replace sensor.
120	SUPPLY_OPEN	Supply Sensor 1 open <ul style="list-style-type: none"> – Check sensor wiring for solid connection and continuity. Replace harness if wiring is bad. – Check for resistance though the sensor by touching meter leads across the left two pins on the sensor using when the retaining clip is towards you. If no circuit is present replace sensor.
121	SUPPLY2_OPEN	Supply Sensor 2 open <ul style="list-style-type: none"> – Check sensor wiring for solid connection and continuity. Replace harness if wiring is bad. – Check for resistance though the sensor by touching meter leads across the right two pins on the sensor using when the retaining clip is towards you. If no circuit is present replace sensor.
122	DWH_OPEN	DHW Sensor open <ul style="list-style-type: none"> – Check sensor wiring for solid connection and continuity. Replace harness if wiring is bad. – Check for resistance though the sensor by touching meter leads across both pins on the sensor. If no circuit is present replace sensor
123	FLUE_OPEN	Flue Sensor open <ul style="list-style-type: none"> – Check sensor wiring for solid connection and continuity. Replace harness if wiring is bad. – Check for resistance though the sensor by touching meter leads across both pins on the sensor. If no circuit is present replace sensor.

Table 10.2 (cont.): Blocking Errors

Error No.	Error Display	Corrective Action
125	OUTDOOR_OPEN	Outdoor Sensor open – Check sensor wiring for solid connection and continuity. Replace wiring if bad or repair break. – Check for resistance through the sensor by touching meter leads across both pins on the sensor. If no circuit is present replace sensor.
126	RETURN_SHORTED	Return Sensor Shorted – Check for resistance through the sensor by touching meter lead across both pins on the sensor. Resistance should be between 15 k Ω and 500 Ω . If no resistance is present replace sensor.
127	SUPPLY_SHORTED	Supply Sensor 1 Shorted – Check for resistance through the sensor by touching meter leads across the left two pins on the sensor using when the retaining clip is towards you. Resistance should be between 15 k Ω and 500 Ω . If no resistance is present replace sensor.
128	SUPPLY2_SHORTED	Supply Sensor 2 Shorted – Check for resistance through the sensor by touching meter leads across the left two pins on the sensor using when the retaining clip is towards you. Resistance should be between 15 k Ω and 500 Ω . If no resistance is present replace sensor.
129	DHW_SORTED	DHW Sensor Shorted – Check for resistance through the sensor by touching meter lead across both pins on the sensor. Resistance should be between 15 k Ω and 500 Ω . If no resistance is present replace sensor.
130	FLUE_SHORTED	Flue Sensor Shorted – Check for resistance through the sensor by touching meter lead across both pins on the sensor. Resistance should be between 15 k Ω and 500 Ω . If no resistance is present replace sensor.
132	OUTDOOR_SHORTED	Outdoor Sensor Shorted – Check for resistance through the sensor by touching meter lead across both pins on the sensor. Resistance should be between 15 k Ω and 500 Ω . If no resistance is present replace sensor.
133	NET_FREQ_ERROR	Net freq. error detected by the watchdog. If error persists, replace control.
134	RESET_BUTTON_ERROR	Too many resets in a short time period – Allow a 1 hour wait period for error to clear. – Cycle power
135	PHASE_NEUTRAL_RESERVED_ERROR	The line and neutral of the main voltage power supply input are reversed. – Check line in power polarity. Correct if reversed.
155	WD_CONFIG_ERROR	Watchdog fan configuration setting error. If error persists, replace control.
156	FLUE_PRESSURE_ERROR	Blocked Flue/ Condensate Switch closed. – Check for blockages in the vent pipe or heat exchanger. – Check for blockages in the condensate system inside or after the condensate trap. A slow drainage of condensate could cause condensate back up that will trip this switch under certain conditions.
162	FILL_WARNING	Pressure is too low, demand has stopped, but no error needs to be stored at this time
165	VSUPPLY_TOO_LOW	Main supply voltage too low for more than 60 seconds – Check supply voltage for values below 108 Volts
166	VSUPPLY_TOO_HIGH	Main supply voltage too high for more than 60 seconds – Check supply voltage or values above 132 Volts.

11. MAINTENANCE

WARNING

Product Safety Information Refractory Ceramic Fiber Product

This appliance contains materials made from refractory ceramic fibers (RCF). Airborne RCF fibers, when inhaled, have been classified by the International Agency for Research on Cancer (IARC), as a possible carcinogen to humans. After the RCF materials have been exposed to temperatures above 1800°F, they can change into crystalline silica, which has been classified by the IARC as carcinogenic to humans. If particles become airborne during service or repair, inhalation of these particles may be hazardous to your health.

Avoid Breathing Fiber Particulates and Dust

Suppliers of RCF recommend the following precautions be taken when handling these materials:

Precautionary Measures:

Provide adequate ventilation.

Wear a NIOSH/MSHA approved respirator.

Wear long sleeved, loose fitting clothing and gloves to prevent skin contact.

Wear eye goggles.

Minimize airborne dust prior to handling and removal by water misting the material and avoiding unnecessary disturbance of materials.

Wash work clothes separately from others. Rinse washer thoroughly after use.

Discard RCF materials by sealing in an airtight plastic bag.

First Aid Procedures:

Inhalation: If breathing difficulty or irritation occurs, move to a location with fresh clean air. Seek immediate medical attention if symptoms persist.

Skin Contact: Wash affected area gently with a mild soap and warm water. Seek immediate medical attention if irritation persists.

Eye Contact: Flush eyes with water for 15 minutes while holding eyelids apart. Do not rub eyes. Seek immediate medical attention if irritation persists.

Ingestion: Drink 1 to 2 glasses of water. Do not induce vomiting. Seek immediate medical attention.

A. GENERAL (WITH BOILER IN USE)

General boiler observation can be performed by the owner. If any potential problems are found, a qualified installer or service technician/agency must be notified.

1. Remove any combustible materials, gasoline and other flammable liquids and substances that generate flammable vapors from the area where the boiler is contained.
2. Observe general boiler conditions (unusual noises, vibrations, etc.)
3. Observe operating temperature and pressure on the combination gauge located in the supply piping on the left side of the boiler. Boiler pressure should never be higher than 5 psi below the rating shown on the safety relief valve (25 psig maximum for a 30 psig rating). Boiler temperature should never be higher than 240° F.
4. Check for water leaks in boiler and system piping.
5. Smell around the appliance area for gas. If you smell gas, follow the procedure listed in the Lighting Operating Instructions to shut down appliance in Section 9, Start-Up Procedure Part B.

B. WEEKLY (WITH BOILER IN USE)

Flush float-type low-water cut-off (if used) to remove sediment from the float bowl as stated in the manufacturer's instructions.

C. ANNUALLY (BEFORE START OF HEATING SEASON)

CAUTION

The following annual inspection must be performed by a qualified service technician.

1. Check boiler room floor drains for proper functioning.
2. Check function of the safety relief valve by performing the following test:
 - a. Check valve piping to determine that it is properly installed and supported.
 - b. Check boiler operating temperature and pressure.
 - c. Lift the try lever on the safety relief valve to the full open position and hold it for at least five seconds or until clean water is discharged.
 - d. Release the try lever and allow the valve to close. If the valve leaks, operate the lever two or three times to clear the valve seat of foreign matter. It may take some time to determine if the valve has shut completely.
 - e. If the valve continues to leak, it must be replaced before the boiler is returned to operation.
 - f. Check that operating pressure and temperature have returned to normal.

- g. Check again to confirm that valve has closed completely and is not leaking.

3. Test low-water cut-off (if used) as described by the manufacturer.
4. Test limit as described in Section 9, Part D, "Check Operation".

DANGER

When servicing or replacing components, be absolutely certain that the following conditions are met:

- **Water, gas and electricity are off.**
- **The boiler is at room temperature.**
- **There is no pressure in the boiler.**

5. Test function of ignition system safety shut-off features as described in Section 9, Part D, "Check Operation".
6. Remove the top/front jacket panel and inspect for any foreign debris that may have entered through air intake vent.
7. Inspect burner for deterioration. Replace if necessary.
8. With boiler in operation check that condensate is dripping from condensate tubing. Check for any restriction in condensate drain line.

D. CONDENSATE CLEANING INSTRUCTIONS

1. Check trap for blockages and that the check ball is free floating. Remove the screw bottom of the condensate trap to allow any sediment to clear the trap. The check ball can be removed and cleaned with a small brush. Replace ball and secure bottom cap once done.
2. Check the condition of any condensate pumps that are installed. Impellers can deteriorate over time do to exposure to the acidic condensate.
3. Check the condition of any neutralization systems installed. Replace neutralizing agent if needed.
4. Check that the pressure switch tap has not been blocked or clogged with debris.

E. INSPECTION AND CLEANING OF COMBUSTION CHAMBER COILS

Before beginning this procedure, you must have on hand the following items:

- a nylon or brass brush (not steel)
- "Rydlyme" (recommended for best results) (available online www.rydlyme.com) or "CLR" (available at most hardware stores)

1. Shut the boiler down and access the heat exchanger using the following steps:
 - a. Close the manual gas shutoff valve and wait for the unit to be cool to the touch.

- b. Disconnect the condensate piping from the outside connections (not from the Series PBC™ side) so the flow can be observed.
 - c. Disconnect compression nut on gas valve inlet and disconnect the gas valve electrical connector.
 - d. Remove the four 10 mm nuts from the burner plate assembly. Disconnect wire leads to the spark igniter and flame sensor. Disconnect two Molex plugs from blower motor.
 - e. Pull the entire burner plate towards you to access the heat exchanger coils.
 - f. Significant deposits may be caused by the recirculation of exhaust gasses, poor fuel quality or contamination of the air supply. Review Section 3, Venting & Air Inlet Piping, if deposits are evident.
2. Using a spray bottle filled with the recommended product “Rydlyme” or “CLR”, spray liberally on the coils, making sure the solution penetrates and funnels down through the condensate hose. If the condensate hose is blocked, let the chemical penetrate for at least 15 minutes or until it drains.
 3. Use the nylon or brass brush (do not use steel) and scrub coils to remove any buildup, then vacuum the debris from the coils.
 4. Spray coils with clear water, making sure to confine the spray to the area being cleaned (try to avoid wetting the back ceramic wall of the unit). Flush the combustion chamber with fresh water. At this point, the Series PBC™ should be ready to power back up.
 5. Reinstall the burner plate assembly using the following steps:
 - a. Inspect the inside of the heat exchanger for dirt and debris.
 - b. Install the burner plate assembly and replace the four 10 mm nuts.
 - c. Reconnect the wire leads to the spark igniter, flame sensor and gas valve. (Be sure that the spark igniter is connected to the lead with the large insulated connection boot.) Reconnect two Molex plugs on blower motor.
 - d. Connect the compression nut on the gas valve inlet and reattach the gas valve electrical connector.
 - e. Reset thermostats. **(IMPORTANT: BE SURE THAT THE VENT CONNECTION IS NOT BLOCKED.)**

⚠ WARNING

It is extremely important to check for leaks when reconnecting the gas valve. Failure to do so may result in severe personal injury, death or major property damage.

- f. Turn the power to the Series PBC™ on. Observe the display module to assure proper operation.

- g. Initiate a call for heat** and observe the condensate flow.
- h. Reconnect the condensate piping to the drain connection.

****NOTE: When firing the boiler the first few times you may experience some fluttering of the gas burner that may result in a flame lockout. This is normal and will require you to recycle the unit until this clears up. This is caused by water still present in the combustion chamber.**

6. Inspect exhaust vent and air intake vents for proper support and joint integrity. Repair as necessary. Refer to Section 3, Venting & Air Inlet Piping.

⚠ WARNING

Leaks in the vent system will cause products of combustion to enter structure (vent system operates under positive pressure).

7. Inspect exhaust vent and air intake vent terminations for obstructions or corrosion. Corrosion is an indication of exhaust gas recirculation.

F. HEAT EXCHANGER GASKET REPLACEMENT

If at any point the silicon burner door gasket shows signs of damage or after two years of operation it needs to be replaced. Inspection during annual cleaning is the best time to check and replace this gasket.

G. FLOW RESTRICTOR MAINTENANCE

The Series PBC™ has a 4.75 GPM flow restrictor installed inside the CHB block that contains a screen filter. This filter protects the plate heat exchanger from sediment infiltration that would be large enough to become stuck inside the plate heat exchanger passages. This filter should be checked and flushed clean on an annual basis. More frequent cleaning might be required in poor water areas.

The following steps can be taken to clean or replace the flow regulator:

1. Power off the boiler.
2. Isolate the unit from the main domestic water supply of the dwelling and remove pressure on the Domestic side of the unit.
3. The flow regulator is located below the flow sensor on the right half of the CHB unit, immediately left of the pump. Insert a small screw driver into the rounded tab or use a pair of pliers to turn the regulator housing counter-clockwise.
4. When the locking tab are in line with the openings in the main housing, pull the flow regulator housing out of the CHB body.
5. The flow regulator is the small white cartridge inside of the housing. It can be removed by pushing it out of the housing.

6. Clean and flush the flow regulator with clean water or air to remove sediment.
7. Replace the flow regulator cartridge into the housing with the screen facing towards to open end of the housing.
8. Fully insert the housing back into the CHB unit until the locking tabs are below the grooves in the CHB body.
9. Turn counter clockwise until the resistance is felt.
10. Pressurize the DHW side of the boiler and open a hot water tap to drain air from the system. Check for leaks around the flow regulator housing.

H. PLATE HEAT EXCHANGER

The Series PBC™ uses a high efficiency Plate Heat Exchanger (PHE) to heat the domestic hot water side of the unit. The high efficiency nature of the PHE leaves it susceptible to calcium build up and passage narrowing if the domestic water is not properly treated before passing through the PHE. Regular cleaning of the PHE will greatly extend the lifetime and ease of maintenance for the PHE. The steps below can be taken to remove and clean the PHE.

Complete Removal Cleaning

1. Power off the Boiler.
2. Isolate and drain BOTH the Central Heat loop of the Boiler and the Domestic side of the boiler.
3. Optional: Close the gas shutoff valve to the unit and disconnect the gas line from the gas valve. The entire burner plate can be pulled by removing the 4 10mm nuts on the front of the main heat exchanger. This will give much more access to the PHE.
4. Using a 4mm or 5/32" Allen wrench, remove the two flanged screws on the front of the CHB. Hold the PHE in place when removing the screws. Pull the PHE up and out of the unit being careful to not get water onto any of the components.
5. The PHE has 4 gaskets that seal the connections. Remove and check these gaskets for wear or degradation. Replace if necessary.
6. The PHE can be cleaned using a solution of "Rydlyme" (recommended for best results) (available online www.rydlyme.com) or "CLR" (available at most hardware stores).
7. Thoroughly flush the PHE with clean water.
8. Replace the gaskets.
9. Place the PHE back in place behind the CHB and tighten the two screws back in place.
10. Optional: Re-install the burner plate and gas line connections. Return gas pressure to the unit ensuring there are no leaks.
11. Return water pressure to the unit and ensure all air is removed from the Central Heat Side of the boiler.
12. Open the domestic outlet drain (or a nearby faucet's hot water valve) and flush the PHE for 1 minute to ensure all cleaning solution is removed.
13. Close water flow and power on the boiler.

Quick Cleaning (With Webstone kit or isolation and drain valves installed)

1. Power off the unit.
2. Close both inlet and outlet DHW isolation valves.
3. Open both DHW inlet and outlet drain valves.
4. Flush a solution of "Rydlyme" (recommended for best results) (available online www.rydlyme.com) or "CLR" (available at most hardware stores) through the PHE repeatedly to loosen any debris or buildup.
5. Flush system with clean water. Do not allow cleaning water into dwellings piping.
6. Once flushing water is running clear, close all drain valves.
7. Open isolation valves and a hot water tap. Allow water to flow for one minute to ensure all cleaning solution is out of the system.
8. Close tap and power on boiler.

12. BOILER DIMENSIONS & RATINGS

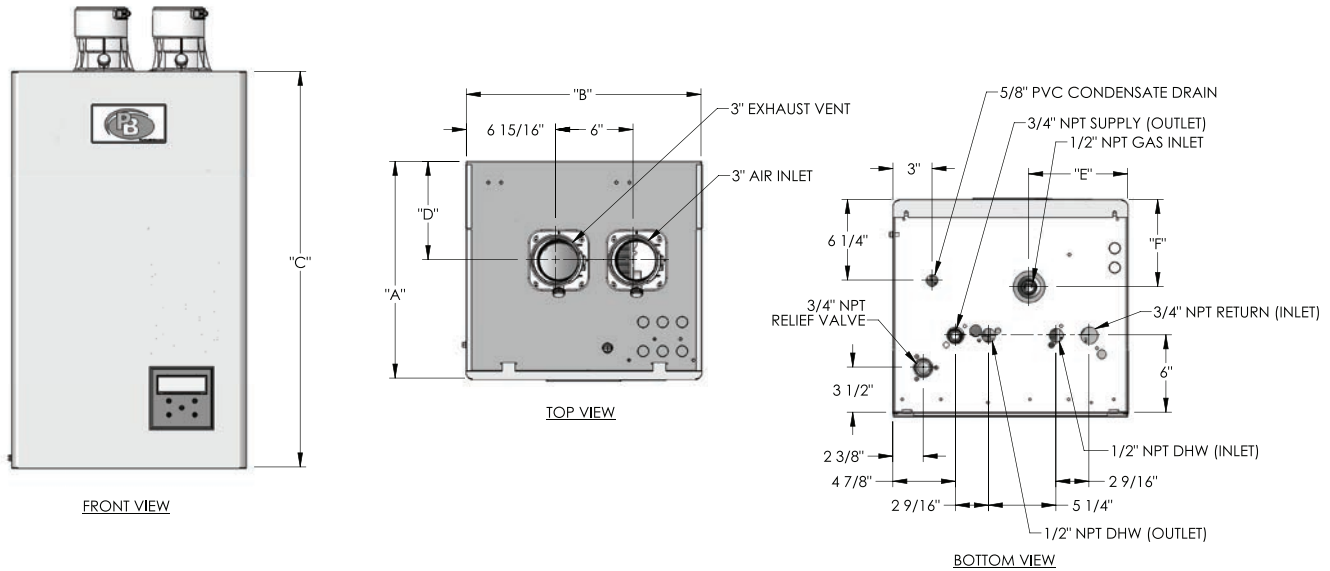


Figure 12.1: Boiler Dimensions

Table 12.1: Boiler Dimensions

PEERLESS® SERIES PBC™ DIMENSIONS						
Boiler Model	"A"	"B"	"C"	"D"	"E"	"F"
PBC-34	16-13/16"	18-3/16"	30-11/16"	7-13/16"	7-5/8"	7-3/16"
PBC-40	16-13/16"	18-3/16"	30-11/16"	7-13/16"	6-15/16"	7-5/8"
PBC-52	18-13/16"	18-3/16"	30-11/16"	6-1/16"	6-15/16"	7-5/8"

Table 12.2: Boiler Ratings

PEERLESS® SERIES PBC™ BOILER RATINGS							
Peerless® Series PBC™							
Boiler Model	CH Input (MBH)		DHW Input (MBH)		Heating Capacity (MBH)	Net Rating (MBH)	AFUE (%)
	Min.	Max.	Min.	Max.			
PBC-34	15.5	80	15.5	130	76.2	64.6	95.1
PBC-40	15.5	100	15.5	155	95.1	80.9	95.2
PBC-52	24.5	120	24.5	199	114.6	97.2	95.3

*Note: As an ENERGY STAR® Partner, PB Heat has determined that these firing rates meet the ENERGY STAR guidelines for energy efficiency.

For installations over 2000 Ft above sea level, the boiler will de-rate by 3.5% per every additional 1000 Ft in elevation with no adjustment to the boiler. Input values based on manufacturer's recommended CO₂ percentages.

BOILER DIMENSIONS & RATINGS

Table 12.3: Combustion Fan Speeds

PEERLESS® SERIES PBC™ FAN SPEEDS				
Boiler Model	Max Input Rate (MBH)	Fan Speed (rpm)		
		Low Power	Ignition	High Power
PBC-34	130	1400 - 1500	3000	6900 - 7000
PBC-40	155	1150 - 1300	4300	6350 - 6450
PBC-52	199	1250 - 1350	2500	6200 - 6350

Table 12.4: Main Control Specifications

PEERLESS® SERIES PBC™ MAIN CONTROL SPECIFICATIONS	
Power Supply	120 VAC Nominal (102-132 VAC); 60 Hertz (40-70 Hz) Phase Neutral
Fuse	5AT, 250V (Type GDG)
Blower Voltage	120 VAC
Gas Valve Voltage	120 VAC Nominal (102-132 VAC); 60 Hertz (40-70 Hz) Phase Neutral
Thermostat Contacts	24 VAC
Flame Current Limits	1.0 μ A Minimum 1.5 μ A Start Detection 14.0 μ A Maximum
Temperature Sensors	All Series PBC™ internal NTC Sensors are 10 k Ω They operate on 5 VDC. Dual Supply Sensor: Return Sensor : Flue Sensor: Outdoor Sensor: -40°F (-40°C) to 185°F (85°C)
Standards	North America: ANSI Z21.13 / CSA 4.9

Table 12.5: Electrical Ratings

PEERLESS® SERIES PBC™ ELECTRICAL RATINGS											
Boiler Model	Supply Voltage (-15%, +10%)	Frequency (± 1.2 Hz)	Blower		Gas Valve		Internal Gen. Pumps		CH Pump Contacts		Max Total Service Current to Boiler (Amps)
			Voltage (VAC)	Current (Amps)	Voltage (VAC)	Current (Amps)	Voltage (VAC)	Max. Current (Amps)	Voltage (VAC)	Max. Current (Amps)	
PBC-34	120 VAC	60 Hz	120	1.5	120	0.09	120	0.8	120	2	4
PBC-40	120 VAC	60 Hz	120	2	120	0.09	120	0.8	120	2	4
PBC-52	120 VAC	60 Hz	120	2	120	0.09	120	0.8	120	2	4

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13. REPAIR PARTS

Repair parts are available from your local PB Heat, LLC distributor or from Parts To Your Door at 1 (610) 916-5380 (www.partstoyourdoor.com).

Note: Remember to include the boiler model number and serial number when ordering parts.

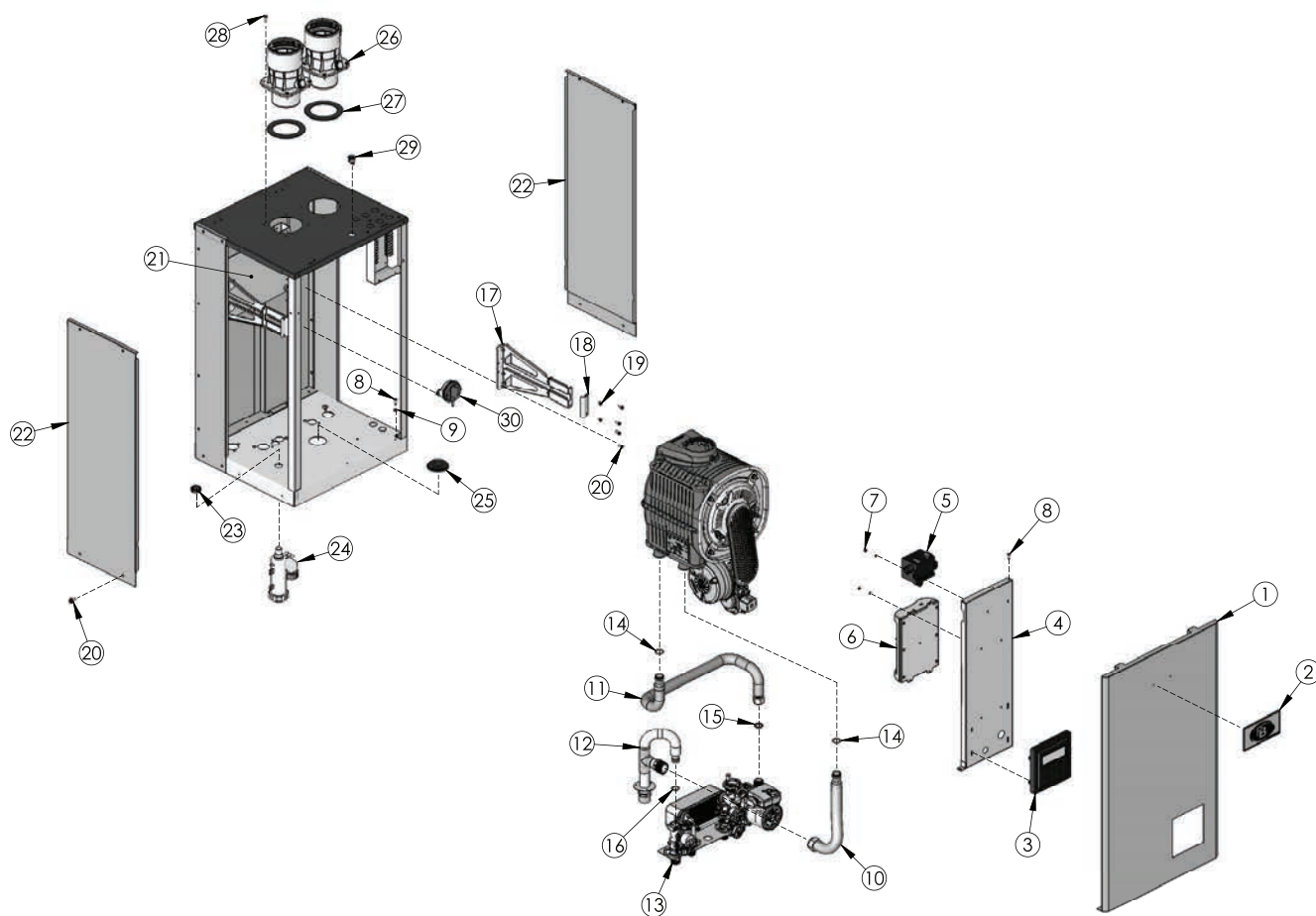


Figure 13.1: General Repair Parts

Table 13.1: General Repair Parts

	Description	Quantity Required	Stock Code
1	PBC Front Panel	1	PBC6000
2	Logo Plate	1	9372
3	900LB Display	1	5954
4	Electrical Panel	1	PBC6004
5	Carlin 4180002F External Spark Generator	1	54758
6	975MN Boiler Control: PBC-34-N / PBC-34-LP	1	54831
	975MN Boiler Control: PBC-40-N	1	54832
	975MN Boiler Control: PBC-52-N / PBC-52-LP	1	54833
	975MN Boiler Control: PBC-40-LP	1	54834
7	Nut #8-32	6	51573
8	Clevis Pin 3/16" by 1" (Local Hardware Supply)	2	—
9	Retaining Pin Cotter 1" Local Hardware (Local Hardware Supply)	2	—
10	1" Supply Flex Line w / Hx Fitting	1	5957
11	PBC-34/40 Return Piping	1	54762
	PBC-52 Return Piping	1	54763
12	Supply Manifold	1	54764
13	Combination Hydronic Block	1	54747
14	O-Ring 20MM for Heat Exchanger	2	5525
15	O-Ring CHB Return: Square #116	3	5909
16	O-Ring CHB Supply	1	5910
17	Heat Exchanger Rail: PBC-34/PBC-40	2	54725
	Heat Exchanger Rail: PBC-52	2	54726
18	Heat Exchanger Retention Clamp	2	54723
19	Screw M4 X 6mm	6	54724
20	Screw #10-24 X 1/2" Self Tapping	27	99129
21	Heat Exchanger Mount PBC-34/PBC-40	1	PBC2010
22	Side Panel- PBC-34/PBC-40	2	PBC6001-1
	Side Panel- PBC-52	2	PBC6001-1
23	Plastic Locknut 3/4"	1	5863
24	Condensate Trap 96	1	54753
25	Sealing Grommet 1/2" Pipe	1	5526
26	Vent Adapter 3-In-1	2	54571
27	EDPM Foam Vent Gasket	2	TBD
28	Screw #10 X 3/4" Sheet Metal-Pan Head Philips (Local Hardware Supply)	8	—
29	Switch Round Rocker OSLO	1	6050
30	Pressure Switch Cleveland 3.5" W.C.	1	54765
N/S	Condensate Hose Assembly With Tap	1	5950

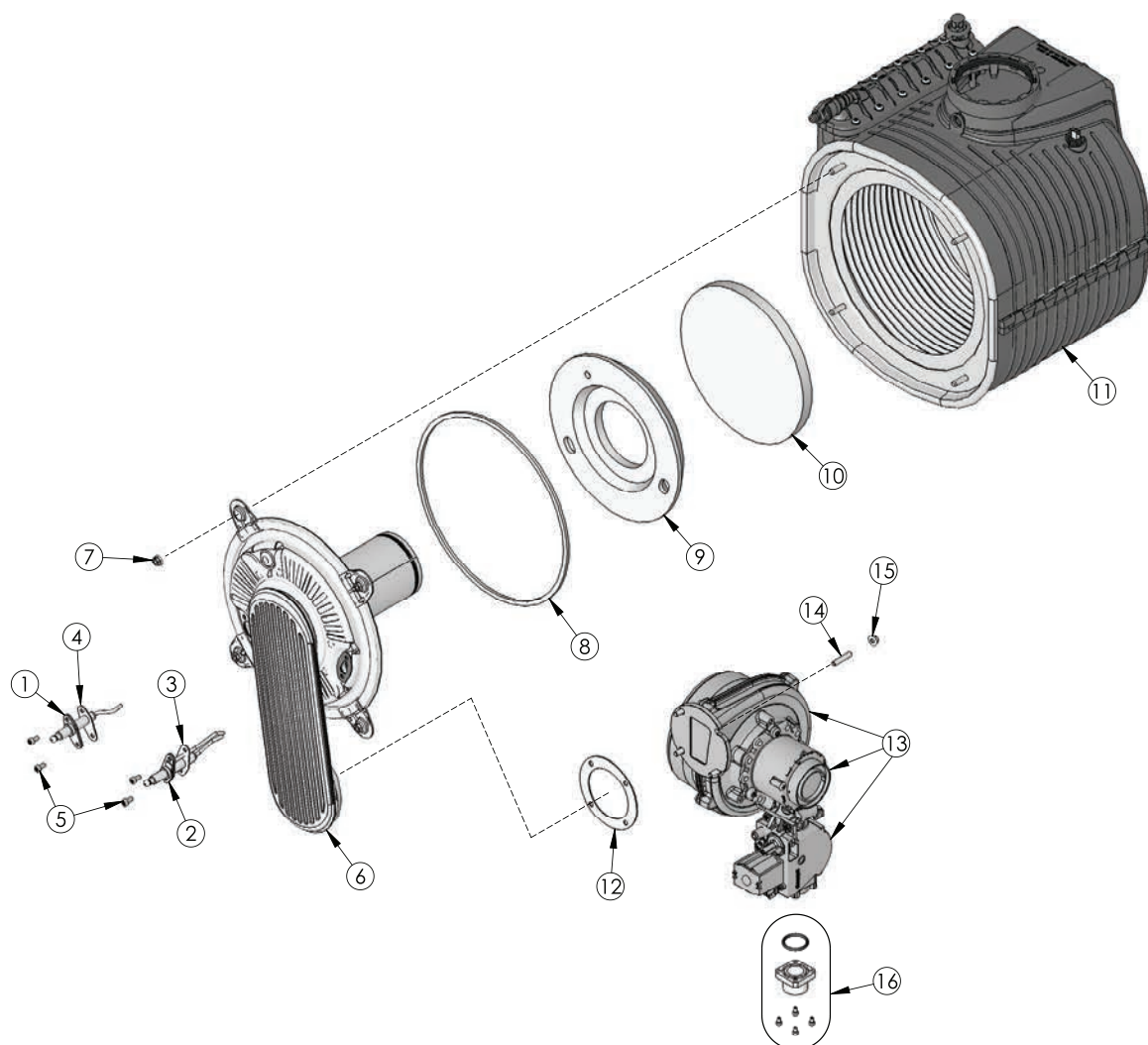


Figure 13.2: PBC-34 and PBC-40-LP Combustion Components

Table 13.2: PBC-34 and PBC-40-LP Combustion Components

	Description	Quantity Required	Stock Code
1	Sensor Electrode	1	54788
2	Ignition Electrode	1	54786
3	Ignition Electrode Graphite Gasket	1	54787
4	Sensor Electrode Graphite Gasket	1	54789
5	Screw M4 X 10mm For Electrodes	4	6512
6	Burner Door With Burner PBC-34/PBC-40	1	54795
	Burner Door With Burner PBC-40-LP	1	54851
7	M6 Flange Nut	4	6505
8	Burner Door Gasket	1	54790
9	Burner Door Insulation	1	54791
10	Target Wall Insulation	1	54793
11	PBC-34/PBC-40 Isothermic Heat Exchanger	1	98105
12	Blower Outlet Gasket	1	54122
13	Kit NRV118 Venturi w / Hardware	1	54823
	Kit LP NRV118 Venturi w / Hardware	1	54824
14	Set Screw M5 X 25mm	4	54774
15	Nut M5 Flange	4	54775
16	Flange 1/2" NPT w / Hardware	1	54785

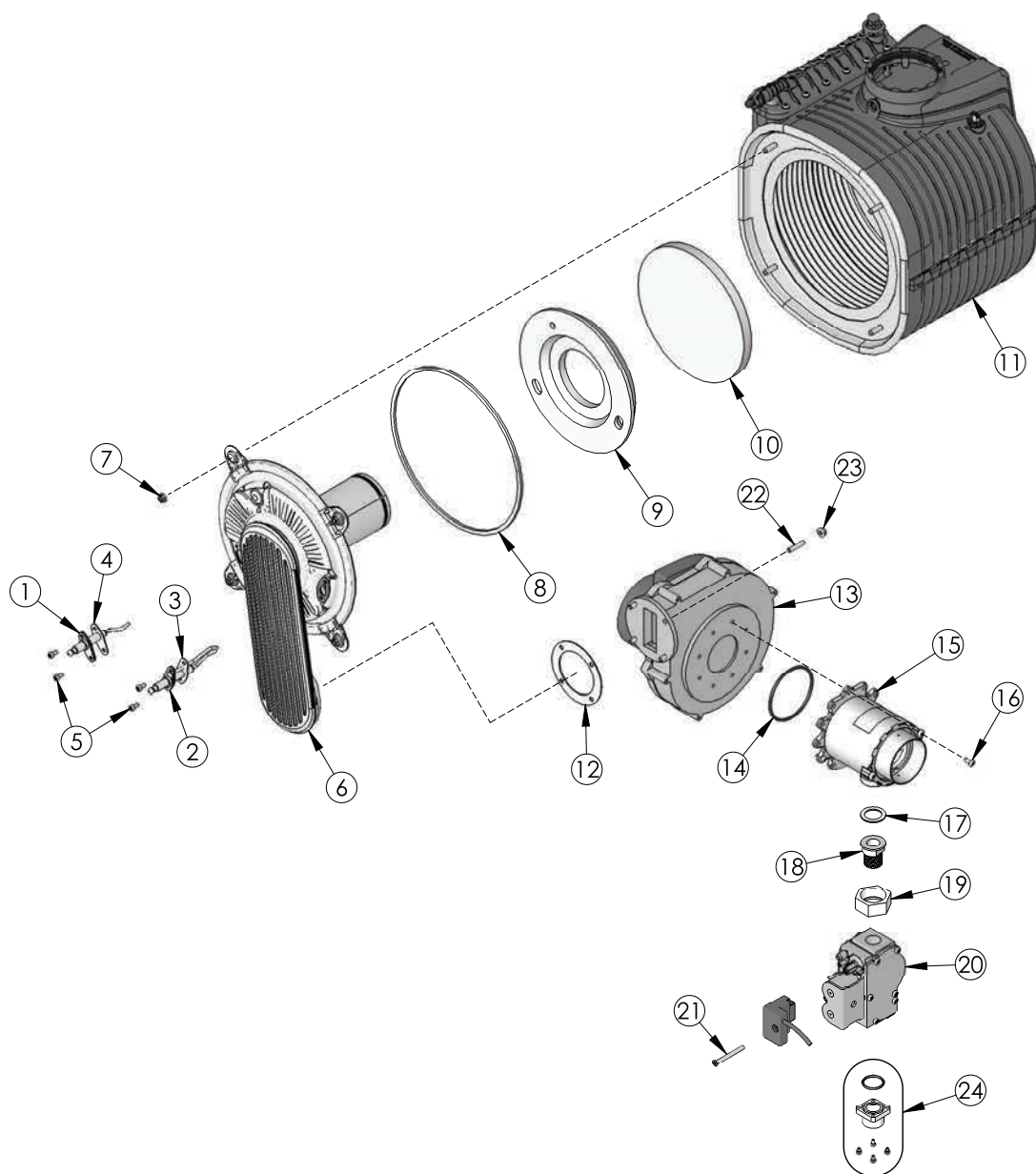


Figure 13.3: PBC-40, PBC-52, and PBC-52-LP Combustion Components

Table 13.3: PBC-40, PBC-52, and PBC-52-LP Combustion Components

	Description	Quantity Required	Stock Code
1	Sensor Electrode	1	54788
2	Ignition Electrode	1	54786
3	Ignition Electrode Graphite Gasket	1	54787
4	Sensor Electrode Graphite Gasket	1	54789
5	Screw M4 X 10mm for Electrodes	4	6512
6	Burner Door w / Burner PBC-34/PBC-40	1	54795
	Burner Door w / Burner PBC-52	1	54796
	Burner Door w / Burner PBC-52-LP	1	54850
7	M6 Flange Nut	4	6505
8	Burner Door Gasket	1	54790
9	Burner Door Insulation	1	54791
10	Target Wall Insulation	1	54793
11	PBC-34/PBC-40 Isothermic Heat Exchanger	1	98105
	PBC-52 Isothermic Heat Exchanger	1	98106
12	Blower Outlet Gasket (PBC-52-LP Qty: 2)	1	54122
13	RG148 Blower 130W	1	54720
14	O-Ring Venturi to Blower	1	5911
15	HM140 Mixer PBC-40 Natural Gas	1	54766
	HM140 Mixer PBC-40 LP Gas	1	54767
	HM140 Mixer PBC-52 Natural Gas	1	54768
	HM140 Mixer PBC-52 LP Gas	1	54844
16	Screw 4mm X 10mm Pan Head Phillips	3	54784
17	Gas Valve Adapter Gasket	1	54783
18	Gas Valve Adapter - Body	1	54770
19	Gas Valve Adapter - Nut	1	54771
20	GB-ND 055 D01 Gas Valve	1	54721
21	Screw M4 X 30mm Philips	1	54125
22	Set Screw M5 X 25mm	4	54774
23	Nut M5 Flange	4	54775
24	Fan Restrictor Plate (PBC-52-LP Only)	1	54843

Table 13.4: Misc. Trim Repair Parts

Quantity Required	Description	Stock Code
1	SRV Conbraco 10-407-05, 30# 535MBH	50664
1	Outdoor Sensor TSA00B4 (12 kOhm)	54112
1	Hose Clamp Small	54139
8	Screw #10 X 3/4 Phillips Pan Head for Vent adapters	5611
2	Vent Screen 3"	54196
2	Screw 1/2-13 X 1-1/2 Hex HD	99125
1	GVL Conbraco 94A-104-01 3/4	51805
2	PBC Field Connection - Central Heat	54761
2	PBC Field Connection - Domestic Hot Water	54760
2	O-Ring BUNA 3/32 - #112, Domestic field connection	5908
2	O-Ring BUNA 3/32 - #116	5909

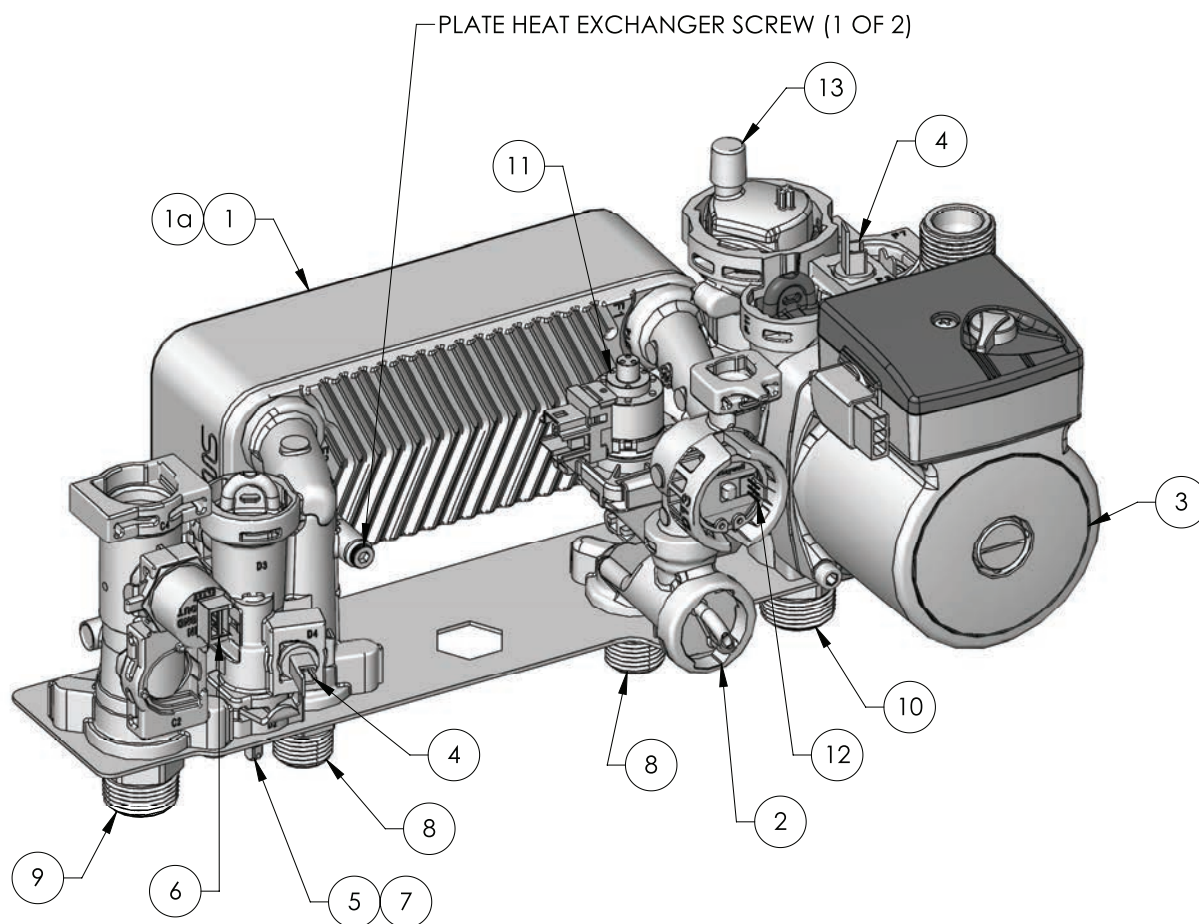


Figure 13.4: CHB Parts Detail

Figure 13.5: CHB Parts Detail

	Description	Quantity Required	Stock Code
1	Plate Heat Exchanger	1	54798
1a	O-Ring Heat Exchanger	4	54799
2	Flow Restrictor, 18l w / Filter	1	54800
3	Pump, Cartridge Only Motor, UPS/R	1	54801
4	Sensor NTC Variants (10k)	2	54802
5	Filling Valve, Short, w / Clip D13.5	1	54803
6	Pressure Sensor, Eltek	1	54804
7	Non Return Valve, ODB	1	54805
8	Union Brass 1/2" NPT	2	54806
9	Union Brass 3/4" NPT, Supply Flow Group	1	54807
10	Union Brass 3/4" NPT, Return, Pump Housing	1	54808
11	3-Way Stepper Motor	1	54809
12	Flow Sensor, Honeywell w / Impellor	1	54810
13	Air Vent, Caleffi Robacal, Bayonet U Cap	1	54812
14	Drain Screw, Not Shown, Under Pump	1	54813
15	Supply Manifold Clip & O-Ring Set, Not Shown	1	54811

Series PBC™

Combination Gas Boilers

PBC-34™, PBC-40™, PBC-52™

Installation, Operation & Maintenance Manual

TO THE INSTALLER:

This manual is the property of the owner and must be affixed near the boiler for future reference.

TO THE OWNER:

This boiler should be inspected annually by a Qualified Service Agency.



PeerlessBoilers.com

PB HEAT, LLC

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