PEERLESS® PUREFIRE®

Gas Boilers

PFC-625 PFC-750

As an ENERGY STAR® Partner, PB Heat, LLC has determined that this product meets the ENERGY STAR guidelines for energy efficiency.

Installation, Operation & Maintenance Manual

PeerlessBoilers.com

TABLE OF CONTENTS

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.

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

1. PREINSTALLATION

A. GENERAL

1. Series PFC™ boilers are supplied completely assembled as packaged boilers. The package should be inspected for damage upon receipt and any damage to the unit should be reported to the shipping company and wholesaler. This 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.

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.

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"

   b. ASME Boiler and Pressure Vessel Code, Section VI - "Recommended Rules for the Care and Operation of 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.

   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.

- PVC venting installations are restricted to only approved materials listed on the Massachusetts Plumber's Board website. These changes went into effect with the April 30th, 2021 revision to Massachusetts Code 248 CMR. IPEX 1738 PVC is listed venting material with the Massachusetts Plumber's Board and is listed for use with all PureFire® model boilers.

NOTICE

The installer must verify that at least one carbon monoxide alarm has been installed within a residential living space or home following the alarm manufacturer's instructions and applicable local codes before putting the appliance into operation.

L'installateur est tenu de vérifier qu'au moins une alarme de détection de monoxyde de carbone soit installée dans un espace résidentiel ou dans un domicile conformément aux directives du fabricant de l'alarme et aux codes locaux applicables avant de mettre l'appareil en service.

C. ACCESSIBILITY CLEARANCES

1. The Series PFC™ 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.

2. Figure 1.1 shows the minimum recommended clearances to allow reasonable access to the boiler for inspection and maintenance. However, local codes or special conditions may require greater clearances.

D. COMBUSTION & VENTILATION AIR

1. The Series PFC™ boiler is designed for operation with combustion air piped directly to the boiler from outside the building (sealed combustion). Combustion air can be supplied from within the building only if adequate combustion and ventilation air is provided in accordance with the section of the National Fuel Gas Code entitled, "Air for Combustion and Ventilation" or applicable provisions of the local building codes.

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, LLC recommends that the air infiltration rate be determined.

   b. *Known Air Infiltration Rate Method*:

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

   where:
   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.

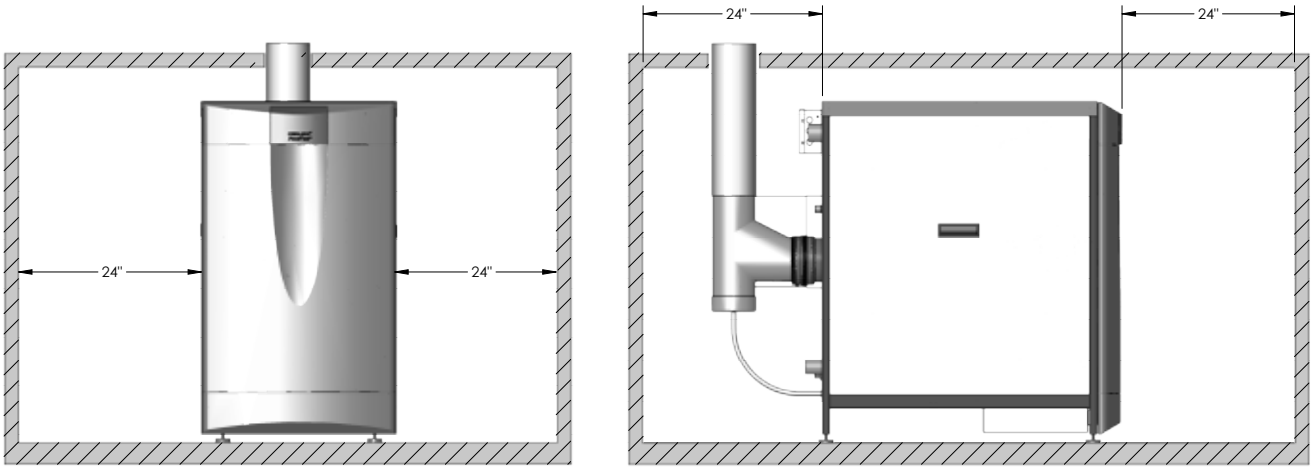


Figure 1.1: Minimum Accessibility Clearances – PFC-625 & PFC-750

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 in^2 per 1000 Btu/hr (22 cm^2 per 1000 W) of the total input rating of all gas fired equipment but not less than 100 in^2 (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.

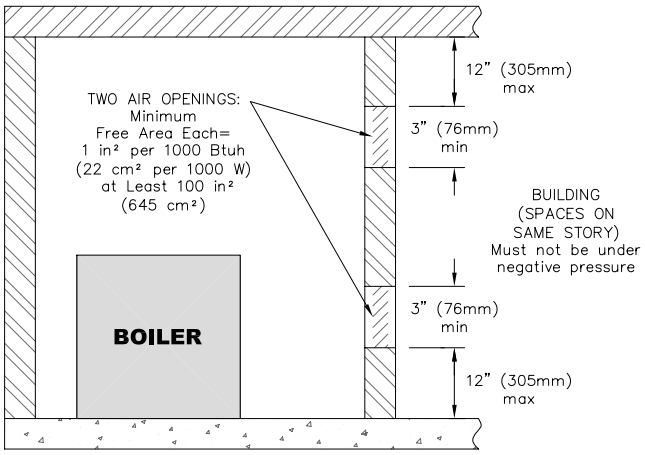


Figure 1.2: Air Openings – All Air from Indoors on the Same Floor

   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 in^2 per 1000 Btu/hr (44 cm^2 per 1000 W) of total input rating of all equipment. See Figure 1.3 for an illustration of this arrangement.

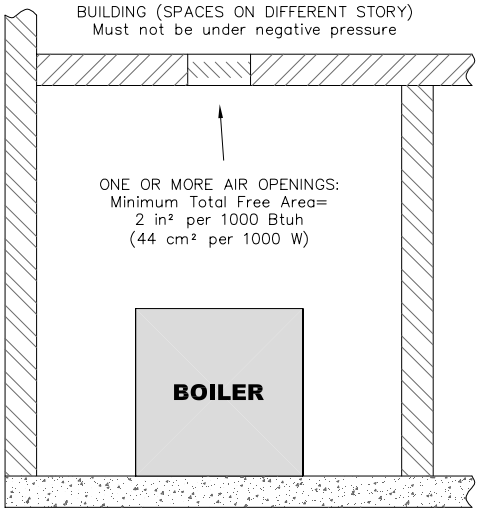


Figure 1.3: Air Openings – All Air from Indoors on Different Floors

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 in^2 per 4000 Btu/hr (22 cm^2 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.

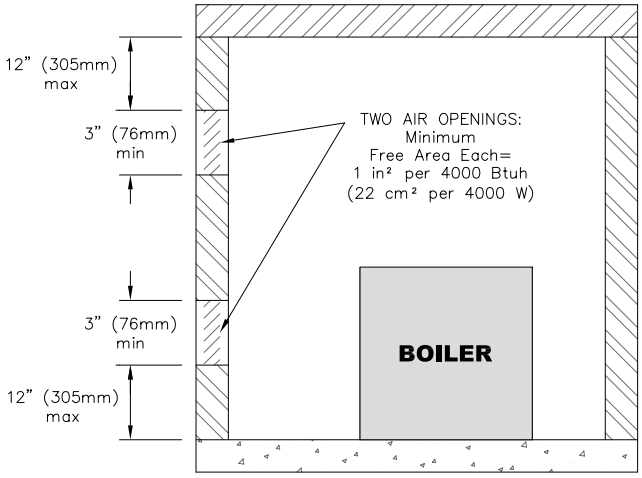


Figure 1.4: Air Openings – All Air Directly from Outdoors

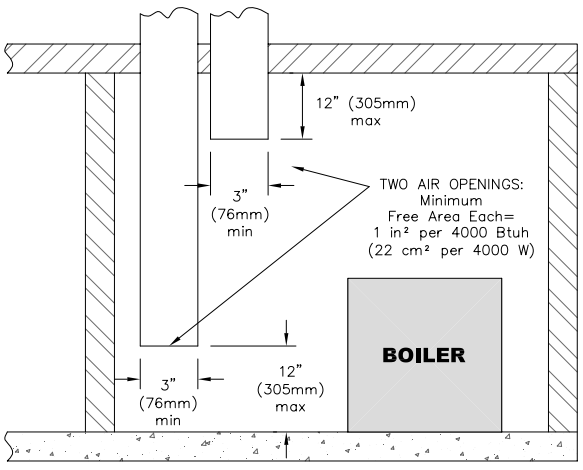


Figure 1.5: Air Openings – All Air from Outdoors through Vertical Ducts

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.

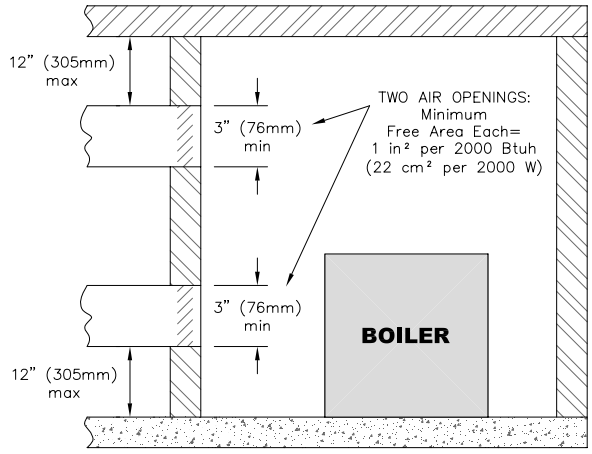


Figure 1.6: Air Openings – All Air from Outdoors through Horizontal Ducts

b. <u>*One Permanent Opening Method*</u>: 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.

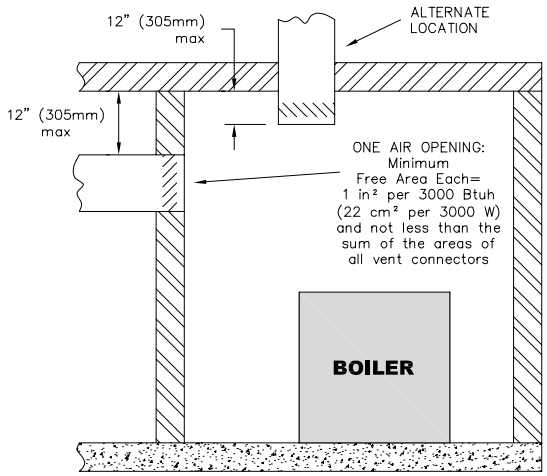


Figure 1.7: Air Openings – All Air from Outdoors through One Opening

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:
   a. The size and location of the indoor openings comply with Subsection 3.
   b. The outdoor openings are to be located in accordance with Subsection 4.
   c. 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.

E. PLANNING THE LAYOUT

1. Prepare sketches and notes showing the layout of the boiler installation to minimize the possibility of interferences with new or existing equipment, piping, venting and wiring.

2. The following sections of this manual should be reviewed for consideration of limitations with respect to:
    a. Venting and Air Inlet Piping: Section 3
    b. Water Piping: Section 4
    c. Fuel Piping: Section 5
    d. Condensate Removal: Section 6
    e. Electrical Connections: Section 7
    f. Boiler Control: Section 8
    g. Boiler Dimensions and Ratings: Section 12

⚠ 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 PFC™ 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 PFC™ boiler is not intended to support external piping. All venting and other piping should be supported independently of the boiler.

3. Many jacket panels on the *PUREFIRE*® boiler are removable to allow inspection and maintenance. Do not attached fixed brackets for piping or wiring on removable jacket parts. Piping and/or wiring should not obstruct access to removable panels.

⚠ CAUTION

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

4. Install the boiler level to prevent condensate from backing up inside the boiler.

5. Use leveling feet to assure that the boiler is completely level. This will prevent condensate from collecting in the boiler and causing degradation of the heat exchanger.

B. STACKING MULTIPLE BOILERS

Identical PFC-625 and PFC-750 boilers can be stacked to save floor space on the installation. Figure 2.1 shows how the upper boiler is to be attached to the lower boiler.

Table 2.1: Required Hardware for Stacking

Item	Qty
3/8-16 x 3" High Strength Hex Head Bolt	4
3/8-16 Heavy Nut	4
3/8 Flat Washer	8
3/8 Lock Washer	4
Optional Hardware for Lifting	
3/8-16 x 2" High Strength Eye Bolt	4

1. Remove all side jacket panels from the both boilers.

2. Remove the leveling legs from the boiler to be installed on top.

⚠ WARNING

Do not lift these boilers by hand. Failure to comply may result in serious injury, death or major property damage.

3. The boiler can be lifted several way; with a fork lift, with a chain hoist using eyebolts through the top mounting holes of the unit as shown in Figure 2.2, or by passing 5 to 10 foot (2-3 meter) lengths of 1 to 1-1/4" schedule 40 or 80 pipe through the boilers frame.

4. Insert washers and bolts (not provided - See Table 2.1) through the holes provided in the frame of the lower boiler and holes in the base of the upper boiler. Figure 2.1 shows this assembly. Tighten the bolts securely.

5. Replace all the side jacket panels.

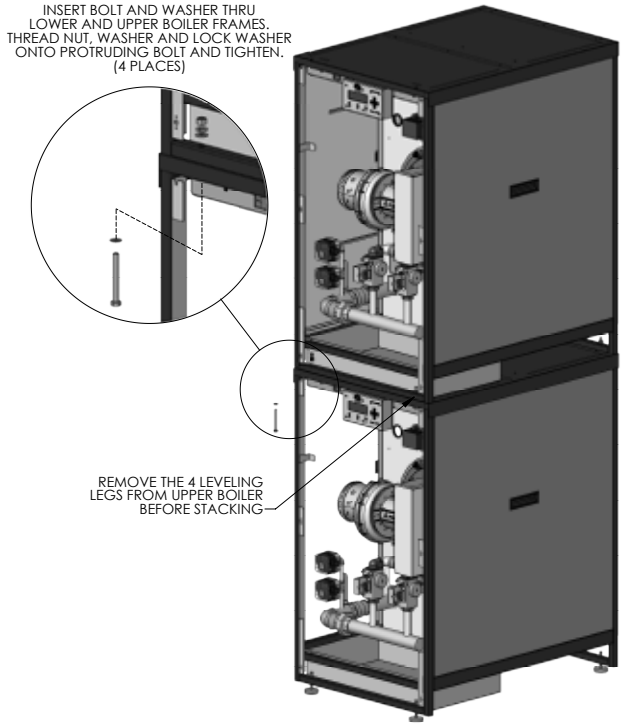


Figure 2.1: Stacking and Securing Boilers

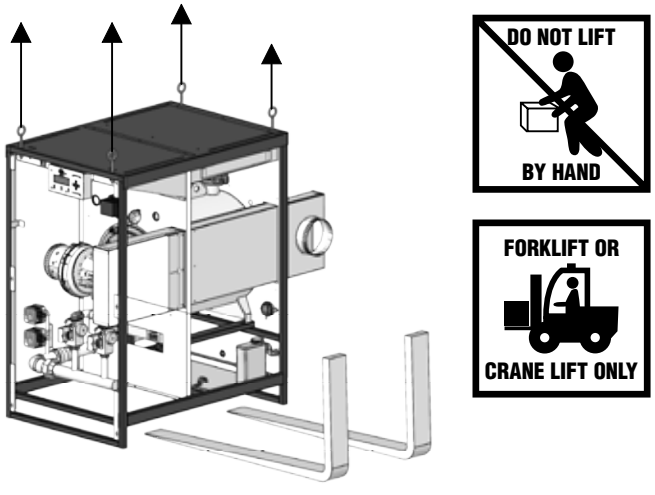


Figure 2.2: Lifting the Upper Boiler

C. REMOVING VENT COVER

The PFC-625 and PFC-750 comes with a vent cover on the back of the unit to protect the 6” PVC Female exhaust connection from damage during shipping and installation. Once the unit is in its final position, the cover can be removed by removing the 5 screws holding it in place. This will expose the exhaust connection and drain connection on the boiler.

This pan serves as an optional front cabinet pan after it is removed from the rear of the boiler. The pan can be inserted when the burner assembly is removed from the boiler or it can be discarded.

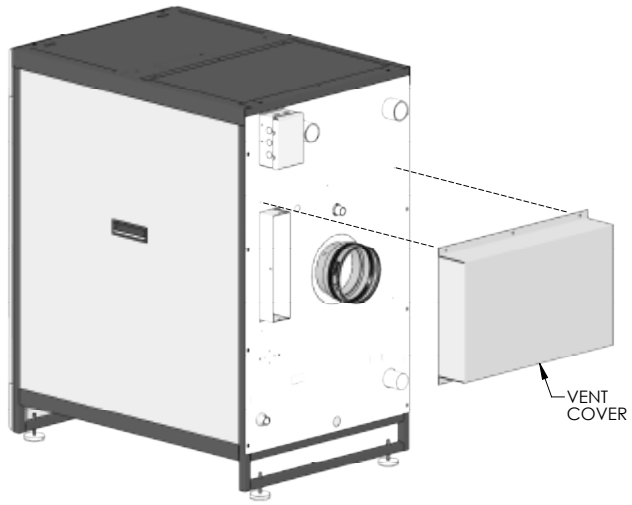


Figure 2.3: Removing Vent Cover

3. VENTING & AIR INLET PIPING

A. GENERAL

1. Install the Series PFC™ 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 PFC™ boiler is approved for positive pressure exhaust venting using either indoor air or air piped from outside. It is ETL Listed as a Category IV (Positive Pressure, Condensing Exhaust Vent) Appliance.

⚠ 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.

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 exhaust venting in confined spaces such as closet or alcove installations or vent pipe that passes through attics.

3. Table 3.2 lists appropriate materials for air inlet piping. Air inlet piping is to be sealed suitably to prevent introduction of dirt, chemicals or other contaminants to the inlet air stream.

4. Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenylsulfone) in venting systems shall be prohibited. Covering non-metallic vent pipe and fittings with thermal insulation shall be prohibited.

⚠ WARNING

Use of cellular core pipe for any exhaust vent component is prohibited. Use of cellular core pipe may result in severe personal injury, death, or major property damage.

⚠ WARNING

Only the materials listed below are approved for use with the *PUREFIRE*® 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
Exhaust Vent Piping & Fittings	IPEX PVC (Sch 40 or 80)*	
	PVC (Sch 40 or 80)*	ANSI/ASTM D1785
	CPVC (Sch 40 or 80)	ANSI/ASTM F441
	PVC-DWV*	ANSI/ASTM D2665
	DuraVent FasNSeal© AL29-4c Stainless	UL-1738
	DuraVent PolyPro© Polypropylene	ULC-S636
	CentroTherm InnoFlue© Polypropylene	ULC-S636

* Listed by the Massachusetts Plumbers Board and is listed for use with all *PUREFIRE*® model boilers. 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.

Table 3.2: Approved Materials for Air Inlet Piping

Description	Material
Air Inlet Pipe & Fittings	PVC (Cellular Core or Solid)
	CPVC
	ABS
	Smoke Pipe (Galvanized or Steel)
	Dryer Vent Pipe
	Flexible Duct
	Stainless Steel
	Polypropylene

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.

⚠ WARNING

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

4. The Series PFC™ 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.

⚠ WARNING

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

5. The maximum combined vent and air inlet pipe length for PFC-625 and PFC-750 boilers is 200 equivalent feet (61 meters) for horizontal venting and 500 equivalent feet (152 meters) for vertical venting. Be sure that the boiler is located such that the maximum vent length is not exceeded.

NOTICE

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

6. Air Intake Pipe Location – Sidewall Venting:
   a. Provide a minimum of 1 foot (30 cm) clearance from the bottom of the air intake pipe above expected snow accumulation level. 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. If the vent pipe and air inlet pipe terminations penetrate the wall at the same level the minimum distance between them is 12” edge-to-edge.

NOTICE

Maximize the horizontal and vertical spacing to the greatest extent possible as shown in Figure 3.1. Take into account prevailing on-site wind conditions during planning as well.

   d. For multiple boiler installations, the minimum horizontal distance between the inlet of one boiler to the exhaust of an adjacent boiler is 12” edge-to-edge. In addition, the minimum vertical distance between the exhaust and air inlet is 6”. See Figure 3.1 for an illustration.

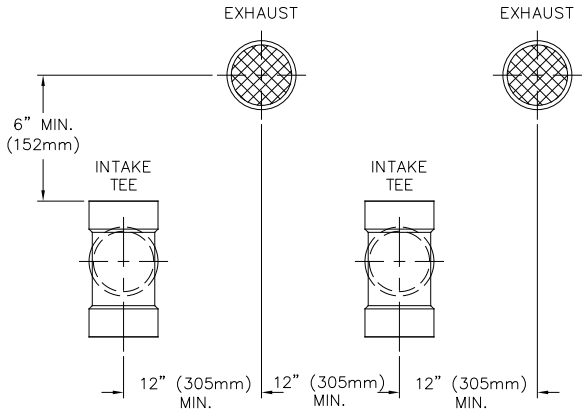


Figure 3.1: Vent Pipe Spacing for Multiple Series PFC™ Boilers

NOTICE

The values shown in Figure 3.1 are the minimum allowable spacing for intake and exhaust piping. Steps should be taken in all cases to locate the air intake and exhaust points with the maximum allowable spacing the installation space can accomodate.

   e. The exhaust outlet of the vent pipe should not be angled any more than 5º 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.

7. Sidewall Venting Configuration:
   a. See Figure 3.2 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.

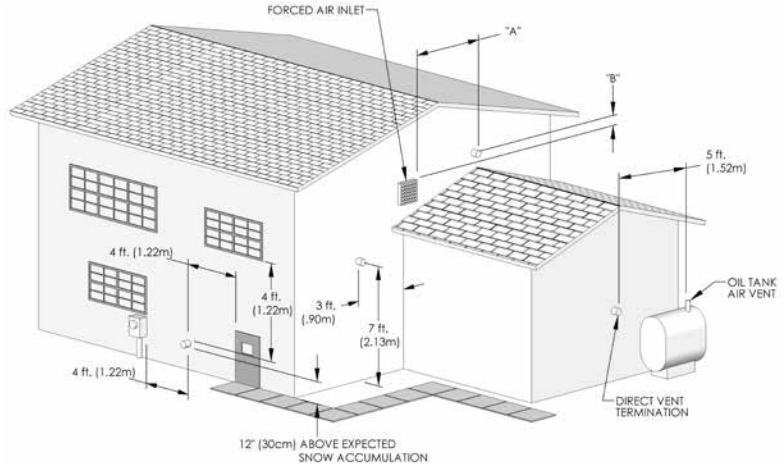


Figure 3.2: Exit Terminal Location for Mechanical Draft and Direct-Vent Venting Systems

- Provide a minimum of 4 feet (1.22 m) clearance distance from any door, operable window, or gravity air intake into any building.
- Provide a minimum of 6 feet (1.83 m) clearance to adjacent facing walls.
- 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.

⚠ CAUTION

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

- Provide 3 feet clearance from the inside corner of adjacent walls.

b. Figure 3.3, 3.4 and 3.5 show approved sidewall venting configurations using standard PVC or CPVC fittings. A similar configuration using FasNSeal stainless steel exhaust pipe can be used with either PVC or other approved material for the combustion air intake piping.

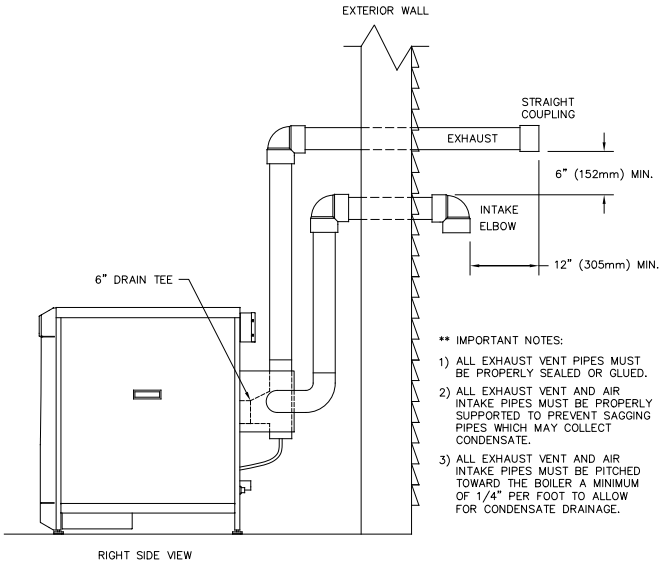


Figure 3.3: Sidewall Exhaust Vent and Air Inlet Pipe

8. Figures 3.6 through 3.8 show recommended vertical venting configurations.
   a. Figure 3.6 illustrates a vertical venting configuration using PVC inlet and exhaust. A similar configuration can be constructed using a FasNSeal stainless steel vent termination. PVC or other approved materials may be used for air inlet piping.
      i. The opening of the air inlet piping is to be a minimum of 12" (300 mm) above the expected snow accumulation on the roof surface.

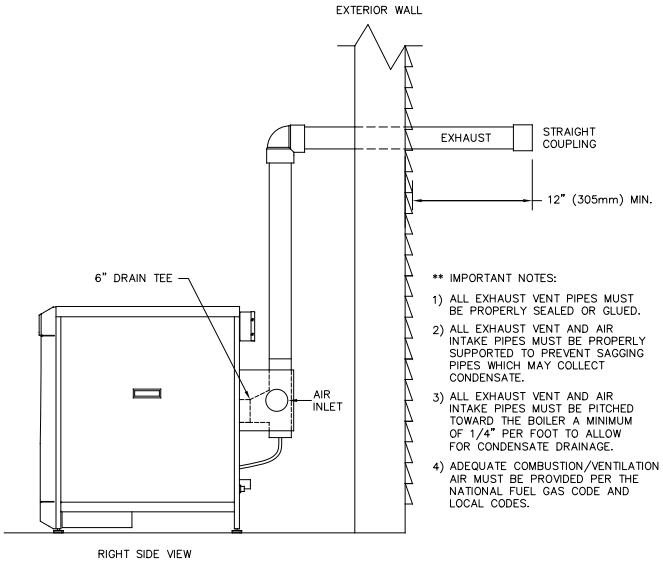


Figure 3.4: Sidewall Exhaust Vent with Indoor Air

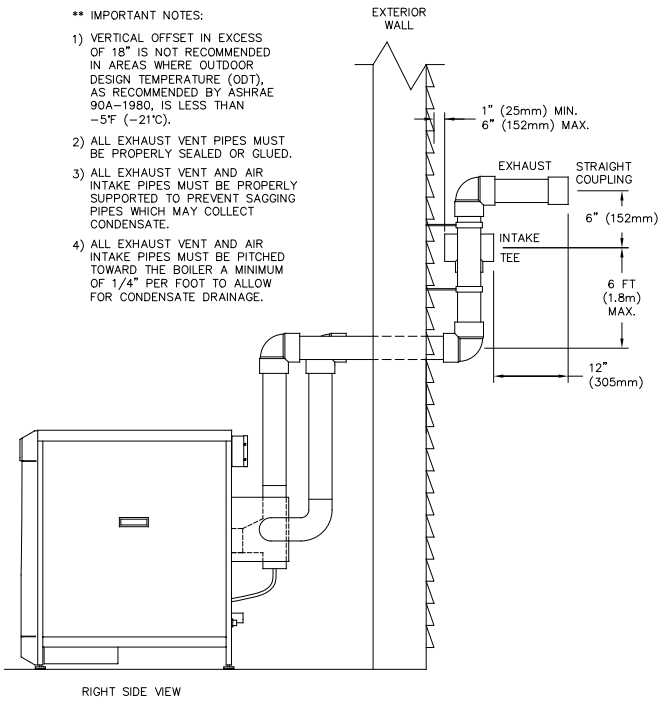


Figure 3.5: Offset Sidewall Exhaust Vent and Air Inlet Pipe

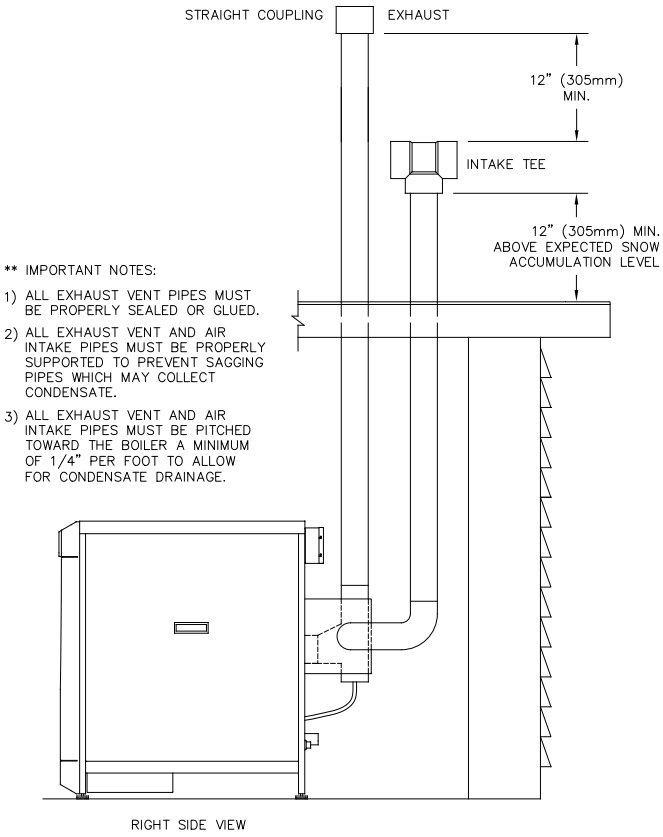


Figure 3.6: Vertical Exhaust and Air Inlet Pipe

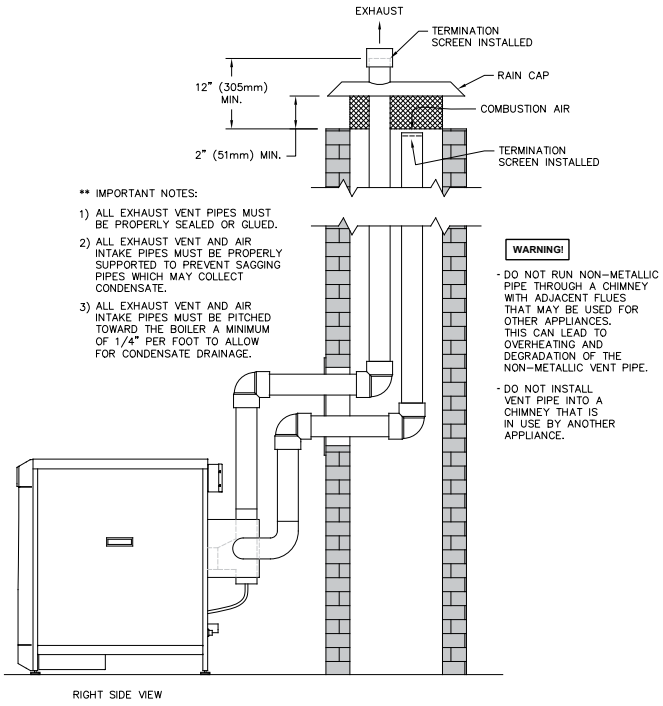


Figure 3.8: Vertical Exhaust Routed Through an Unused Chimney with Outdoor Air

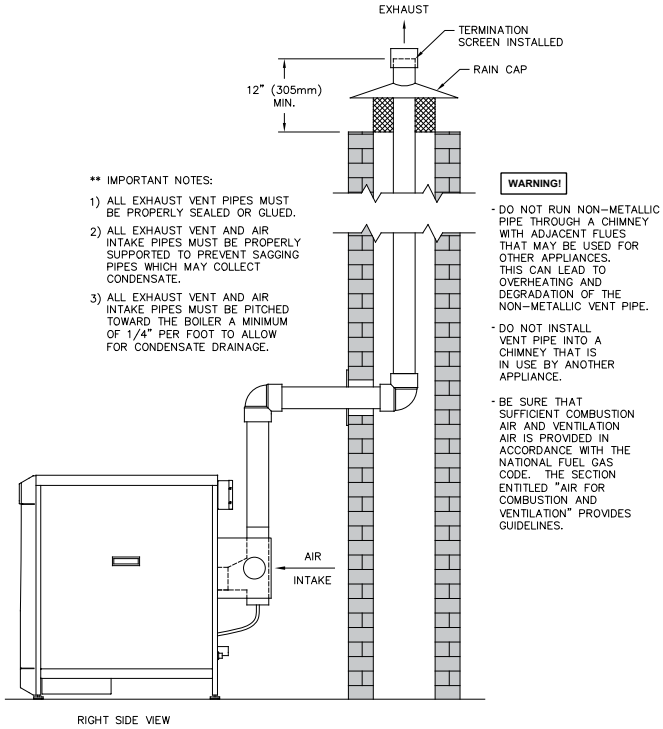


Figure 3.7: Vertical Exhaust Routed Through an Unused Chimney with Indoor Air

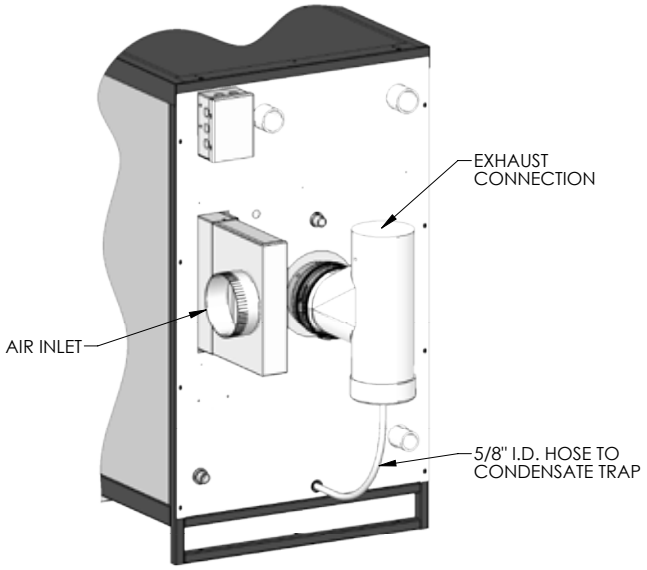


Figure 3.9: Drain Tee and Air Inlet Connections

ii. Locate the opening of the exhaust vent pipe a minimum of 12" above the air inlet opening to prevent flue gas from recirculating to the air inlet.

b. Figure 3.7 shows vertical exhaust venting through an unused chimney. In this case, combustion air is supplied from inside the building. Section 1.D provides guidelines for determining adequate inside air.

c. Figure 3.8 illustrates another vertical venting configuration through an unused chimney. In this arrangement the combustion air is supplied through the chimney as well.

D. EXHAUST VENT/AIR INTAKE PIPE SIZING

1. A list of approved venting materials for the exhaust is provided in Table 3.1 and a list of approved materials for air inlet is provided in Table 3.2 at the beginning of this section.

2. The total combined length of exhaust vent and air intake piping is 200 equivalent feet (60 m).
   a. Series PFC™ boilers may use air from the room in which they are installed as long as there is adequate combustion and ventilation air provided. See Section 1.D: Combustion and Ventilation Air of this manual for the minimum requirements. In this case, a maximum of 200 equivalent feet of exhaust vent pipe can be used.
   b. The equivalent length of elbows, tees and other fittings are listed in Table 3.3.

Table 3.3: Equivalent Length of Fittings

Fitting Description	Equivalent Length
Elbow, 90° Short Radius	5 feet (1.5 m)
Elbow, 90° Long Radius	4 feet (1.2 m)
Elbow, 45° Short Radius	3 feet (0.9 m)
Coupling	0 feet (0 m)
Air Intake Tee	0 feet (0 m)

c. The total equivalent length can be calculated as shown in Table 3.4.

Table 3.4: Sample Equivalent Length Calculation

	Exhaust	Air Inlet	Total
Straight Length of Pipe	100'	50'	150'
90° Elbows, SR	2 x 5'= 10'	1 x 5' = 5'	15'
45° Elbows, SR		2 x 3' = 6'	6'
Air Intake Tee		0'	0'
Outlet Coupling	0'		0'
	Total		171'

E. EXHAUST VENT/AIR INTAKE PIPE INSTALLATION

1. Figure 3.10 shows the exhaust connection on the rear of the boiler in the middle of the rear of the boiler. The exhaust connection is a 6" PVC/CPVC female connection. See Table 3.5 for common adapter fittings.

Table 3.5: Exhaust Adapters PVC to Other's

	Manufacturer	Part No.
PVC to Polypropylene	Duravent PolyPro 6"	6PPS-06PVCM-6PPF
	CentroTherm InnoFlue 6"	ISAAL0606
	Z-DENS 6"	2ZDCPVCG6
PVC to Stainless Steel	Duravent	FSA-6PVCM-6FNSF

2. A condensate collection tee is required immediately after the exhaust connection to the boiler to reduce the vent condensate draining through the heat exchanger. Use of an adapter from one vent material to another is permitted between the vent connection and tee. The tee can be a pre-fabricated component from an approved venting material manufacturer or a field made PVC assembly that is properly sealed and inspected for leakage.

⚠ CAUTION

Failure to install a condensate collection tee can shorten the lifespan of the heat exchanger and cause blockage of the heat exchanger condensate drain.

3. The Air Intake connection should be secured with (3) screws and sealed.

4. Remove all burrs and debris from the joints and fittings.

5. Care should be taken to prevent dirt or debris from entering the air intake connection. A screen is provided inside the Air Intake fitting to prevent large objects from entering the combustion system.

⚠ 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.

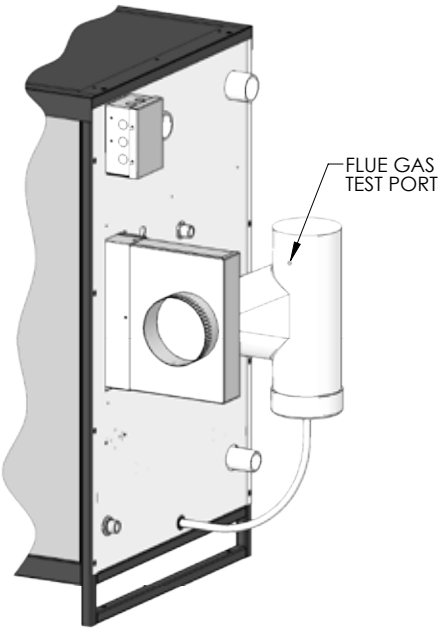


Figure 3.10: Exhaust Vent Connection

6. Horizontal lengths of exhaust vent must be installed with a slope of not less than 1/4" per foot (21mm 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.

   Les sections horizontales de l'évacuation doivent être installées avec une pente d'au moins 1/4 po au pied (21 mm par mètre) en direction de la chaudière afin que le condensat puisse s'évacuer du tuyau d'évacuation. Si le tuyau d'évacuation est acheminé autour d'un obstacle qui crée un point bas dans la tuyauterie, il est nécessaire alors d'installer un drain équipé d'une vidange adéquate.

7. 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.

   Tous les tuyaux doivent être parfaitement soutenus. Utiliser des attaches de tuyau tous les 4 pieds (1,22 mètres) pour éviter le fléchissement des tuyaux.

8. Exhaust and air inlet piping is to be supported separately and should not apply force to the boiler.

   Les tuyaux d'évacuation et d'arrivée d'air doivent avoir des dispositifs de support distincts et ne pas exercer de pression sur la chaudière.

9. Penetration openings around the vent pipe and air intake piping are to be fully sealed to prevent exhaust gases from entering building structures.

10. 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, attachment to the boiler stub, 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.
    c. A PVC or CPVC coupling can be used as an outside vent termination. In this configuration, place one of the screens provided between the coupling and exhaust connection before gluing it. This is intended to prevent birds or rodents from entering.
    d. A PVC or CPVC tee can be used as an outside air intake termination. When using this configuration, place one of the screens provided between the tee and the air inlet connection before gluing it. This is intended to prevent birds or rodents from entering.

F. TEST PORT FOR EXHAUST SAMPLING

1. Figure 3.10 shows an illustration of the plugged sample port on the outlet of the drain tee for the PFC-625 and PFC-750 boiler.

2. To obtain an exhaust sample during operation, remove the test port plug and insert the probe from a suitable combustion analyzer.

3. Be sure to replace the plug before leaving the boiler unattended.

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 sécheuses 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

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**
1-1/2”	25	220,000
2”	50	450,000
2-1/2”	80	850,000
3”	140	1,300,000
Copper Tubing		
Tube Size	**Maximum Flow (GPM)**	**BTU/HR**
1-1/2”	22	220,000
2”	45	450,000
2-1/2”	85	850,000
3”	130	1,300,000

1. Size water supply and return piping in accordance with system requirements rather than the boiler connections.

2. If the Series PFC™ boiler is used to replace an existing boiler, make sure the system piping is thoroughly cleaned and free from debris before installing this boiler. Sentinel Performance Solutions (http://www.sentinel-solutions.net/us/) offers a full line of cleaners (X300), sludge remover (X400), antifreeze (X500) and corrosion inhibitors (X100/X500) for hydronic applications.

3. 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.

4. For an existing or new system that uses iron pipe components install a magnetic filter to capture iron particulates that will bypass a screen filter.

5. 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.).

B. WATER QUALITY

Series PFC™ boilers are 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:

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 7.5 pH and 9.5 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 for recommended cleaning agents.

4. High oxygen levels in the system water will allow scale buildup to occur. Steps must be taken to minimize

⚠ 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 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

b. The Series PFC™ 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.

c. 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 system.

d. 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	X300	-	-
Sludge Remover	Cleaner F1, Protector F3	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.

C. OPERATING PARAMETERS

1. The Series PFC™ boiler is designed to operate in a closed loop hydronic heating system under forced circulation. This requires the system to be completely filled with water and requires a minimum water flow rate through the boiler to assure proper flow distribution.

2. The minimum system operating pressure is 14.5 PSI (100 kPa). Be sure to set the air-side pressure on the expansion tank to match the system water pressure before installing it.

3. Table 4.2 lists the minimum flow rates for each Series PFC™ model covered in this manual. Also shown is the minimum flow rate for 50% glycol solution. For other glycol concentrations, contact your PB Heat, LLC representative for the minimum flow rates.

Table 4.3: Minimum Boiler Flow Rates

***PureFire*® Model**	Minimum Flow Rate	
	Water GPM (LPM)	**50% Glycol Solution GPM (LPM)**
PFC-625	14.3 (54.2)	17.9 (67.8)
PFC-750	16.3 (61.7)	20.4 (77.2)

4. Section 4.F provides detailed information about using glycol for freeze protection. Table 4.3 provides the water volume of the heat exchangers for calculating the system volume.

Table 4.4: Heat Exchanger Water Capacity

***PureFire*® Model**	Total Water Capacity	
	Gallons	**Liters**
PFC-625	5.6	21.3
PFC-750	6.36	24.8

D. SYSTEM COMPONENTS

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

1. *Pressure/Temperature Gauge*: A combination pressure/temperature gauge is provided with each ***PureFire*®** boiler to be mounted in the piping from the boiler supply to the system as shown in Figure 4.2. Most local codes require this gauge.

2. *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.

⚠ 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.

3. *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.

4. *Y-Type Strainer or Filter Ball® Valve*: PB Heat, LLC 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.

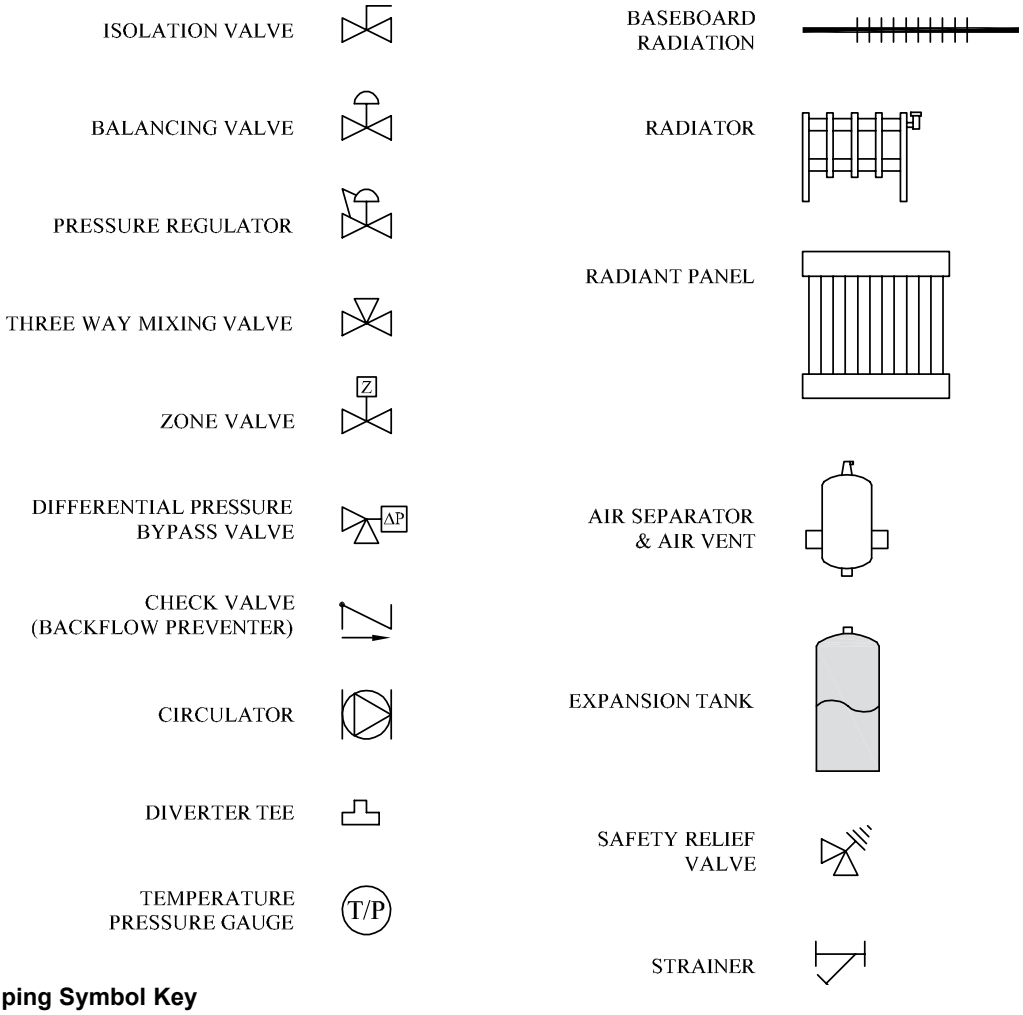


Figure 4.1: Piping Symbol Key

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 in the miscellaneous parts box for field installation. It is extremely important to install this device.

⚠ 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.

The valve is to be installed on the boiler supply pipe as shown in Figure 4.2. Pipe the discharge of the relief valve to within 12” of the floor and close to a floor drain.

⚠ 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.

Provide piping that is the same size or larger than the relief valve outlet.

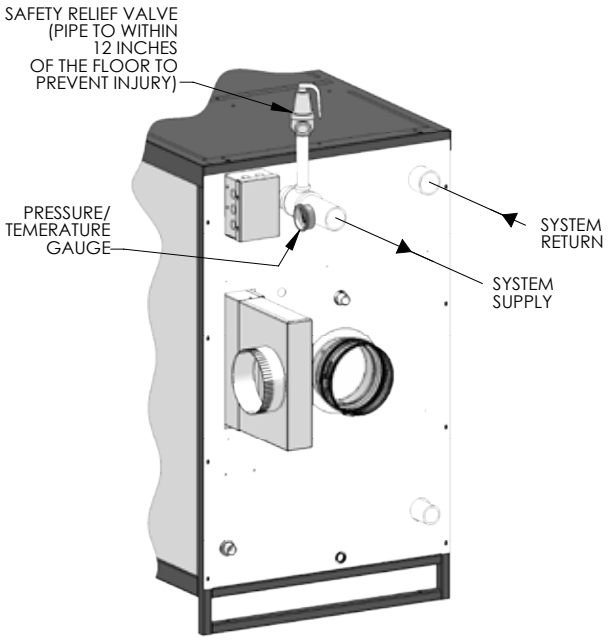


Figure 4.2: Relief Valve and Pressure/Temperature Gauge Installation

9. *Circulator*: The boiler circulator is to be sized to overcome the pressure drop of the system while providing the flow required by the boiler.
   a. If the boiler is piped in a secondary loop of a primary/secondary heating system, the circulator will need only to overcome the resistance of the boiler and any fittings in that loop.
   b. The circulator should be sized based on gross output of the boiler. Table 4.4 shows the Boiler Output as reported to the Hydronics Institute Section of AHRI.

Table 4.5: Boiler Input and Output

PUREFIRE® Model	Boiler Input		Boiler Output	
	Btu/hr	kW	Btu/hr	kW
PFC-625	625,000	183.2	612,000	179.4
PFC-750	750,000	219.8	735,000	215.4

   c. The required flow is calculated based on the design temperature difference from the return to the supply of the boiler. For a PFC-625 with a design temperature difference of 20°F the calculation is as follows:

$$\text{Required Flow} = \frac{\text{Output}}{\Delta T \times 500} = \frac{612{,}000}{20 \times 500} = 61.2 \text{ GPM}$$

   d. The boiler pressure drop for various flow rates can be determined using Figure 4.3, *PUREFIRE*® Circulator Sizing Graph below.

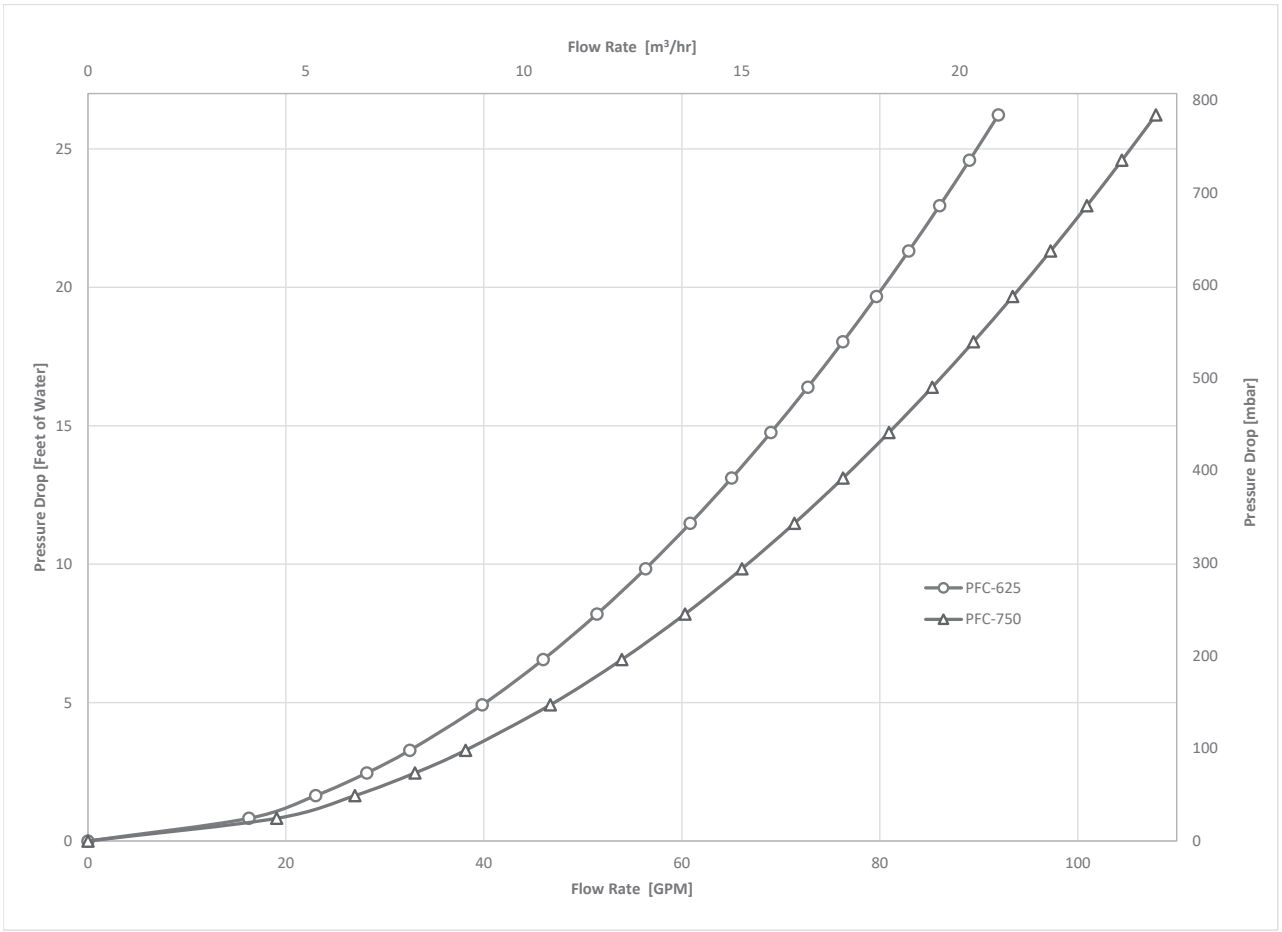


Figure 4.3: Series PFC™ Circulator Sizing Graph (General Pump – Primary/Secondary)

e. Table 4.5 provides the flow rate and pressure drop information that corresponds to various boiler temperature rise values (ΔT). The pressure drop shown is for the boiler only. If there is significant system pressure drop in the piping, this should be considered when specifying circulators.

f. Table 4.6 provides a list of recommended circulators for boilers on a secondary loop of a primary secondary system which uses water as a heating medium.

NOTICE

The circulator sizing given is for primary/secondary installations only. The system circulators must be sized based on the flow and pressure drop requirements of the system.

g. Special consideration must be given if a glycol based anti-freeze solution is used as a heating medium. Propylene glycol has a higher viscosity than water, therefore the system pressure drop will be higher.

Table 4.6: Flow Rate & Pressure Drop for Various System Temperature Rise Values

ΔT (°F)	PFC-625				PFC-750			
	Flow Rate		Pressure Drop		Flow Rate		Pressure Drop	
	GPM	m³/hr	FT	mbar	GPM	m³/hr	FT	mbar
10	122.4	27.8	46.44	1388.23	147	33.39	49.7	1485.59
15	81.6	18.53	20.64	616.99	98	22.26	22.09	660.26
20	61.2	13.9	11.61	347.06	73.5	16.69	12.43	371.4
25	48.96	11.12	7.43	222.12	58.8	13.35	7.95	237.69
30	40.8	9.27	5.16	154.25	49	11.13	5.52	165.07
35	34.97	7.94	3.79	113.32	42	9.54	4.06	121.27
40	30.6	6.95	2.9	86.76	36.75	8.35	3.11	92.85

Table 4.7: Circulator Selection Chart (General Pump – Primary/Secondary Piping)

Circulator Manufacturer	ΔT (°F)	PFC-625	PFC-750
Taco	20	VR15	VR15
Grundfos		UPS 50-60 F	UPS 50-8/4 F
Armstrong		E30.2	S55
Wilo		Stratos 2X3-35	Top S 2X35X3
Taco	25	VR15	VR15
Grundfos		UPS 43-100 F	UPS 50-60 F
Armstrong		E30.2	S55
Wilo		Top S 1.5X20X3	Stratos 2X3-35
Taco	30	VR3452	VR15
Grundfos		UPS 43-100 F	UPS 43-100 F
Armstrong		S55	S55
Wilo		—	—
Taco	35	VR3452	VR15
Grundfos		UPS 26-99	UPS 43-110 F
Armstrong		Compass 40-45	S55
Wilo		Star 17	Star 17
Taco	40	VR3452	VR3452
Grundfos		UPS 26-99	UPS 43-100 F
Armstrong		Compass R20-35	1B-0 & E16.2
Wilo		Star 17	Star 17

E. SYSTEM PIPING

1. Figure 4.4 shows a single boiler with multiple heating zones. In this case, the DHW zone is piped in parallel to the heating zones on the primary loop.

2. The configuration illustrated in Figure 4.5 is for multiple boilers. This figure shows an indirect DHW tank in parallel with the heating zones. Notice that the return to the boilers from the closely spaced tees in the primary secondary arrangement is reverse return to provide similar lengths of piping through each boiler. This configuration shows the boilers in groups of two to take advantage of the Series PFC™ PFC-625 or PFC-750 stacking capability.

3. Figure 4.6 shows a multiple boiler configuration which uses zone valves instead of zone circulators. Systems which combine both zone valves and zone circulators can help to minimize electrical loads if there are small zones in the system. Contact your PB Heat, LLC representative for assistance with larger systems.

NOTICE

Figures 4.4 through Figure 4.6 are recommended piping schematics. Other system piping designs are acceptable as long as steps are taken to ensure the minimum flow rates are met.

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. Table 4.3 provides the water capacity of the heat exchanger to help in system volume calculations.

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.

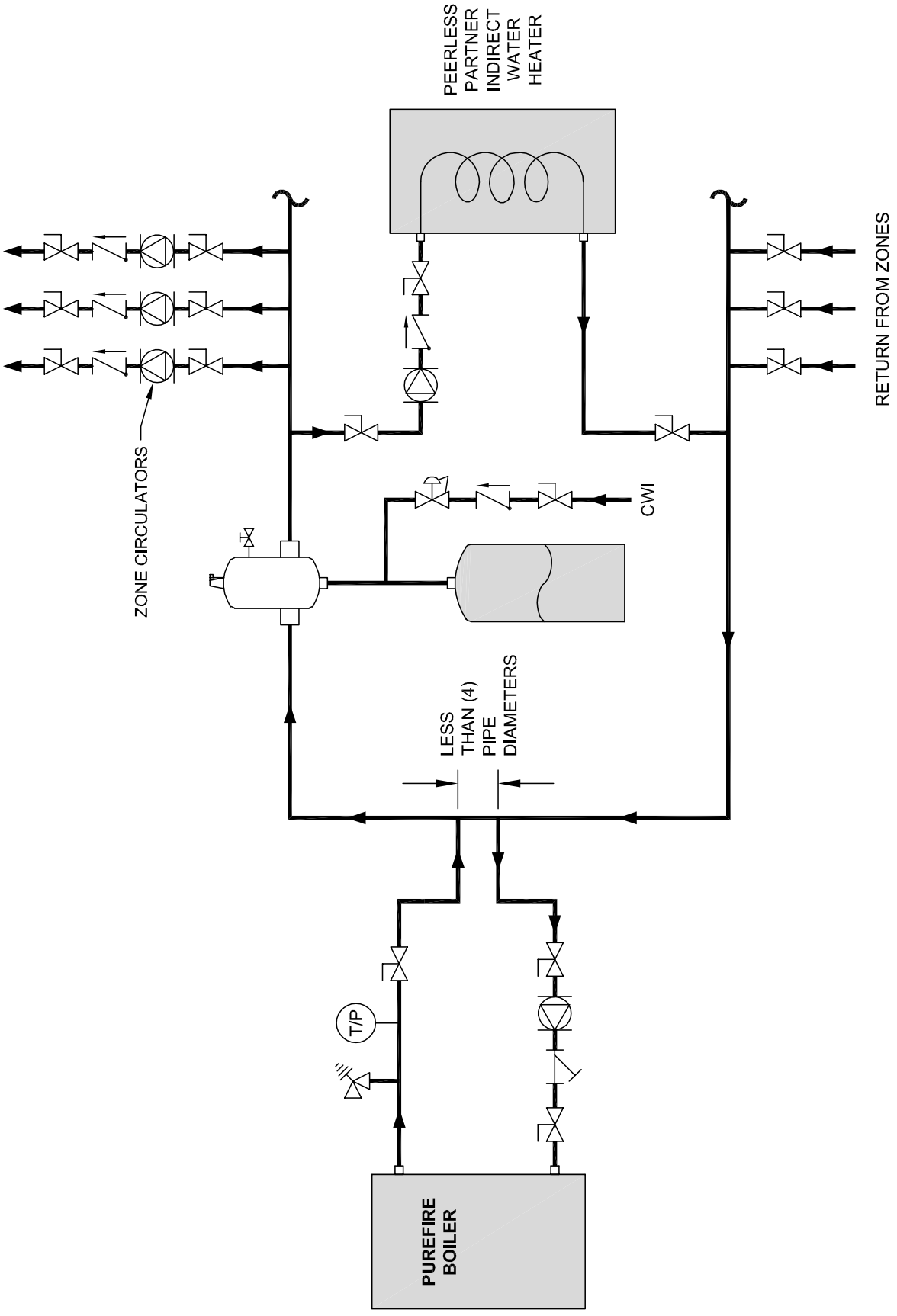


Figure 4.4: Recommended Piping – One Boiler with Multiple CH Zones & One DHW Tank

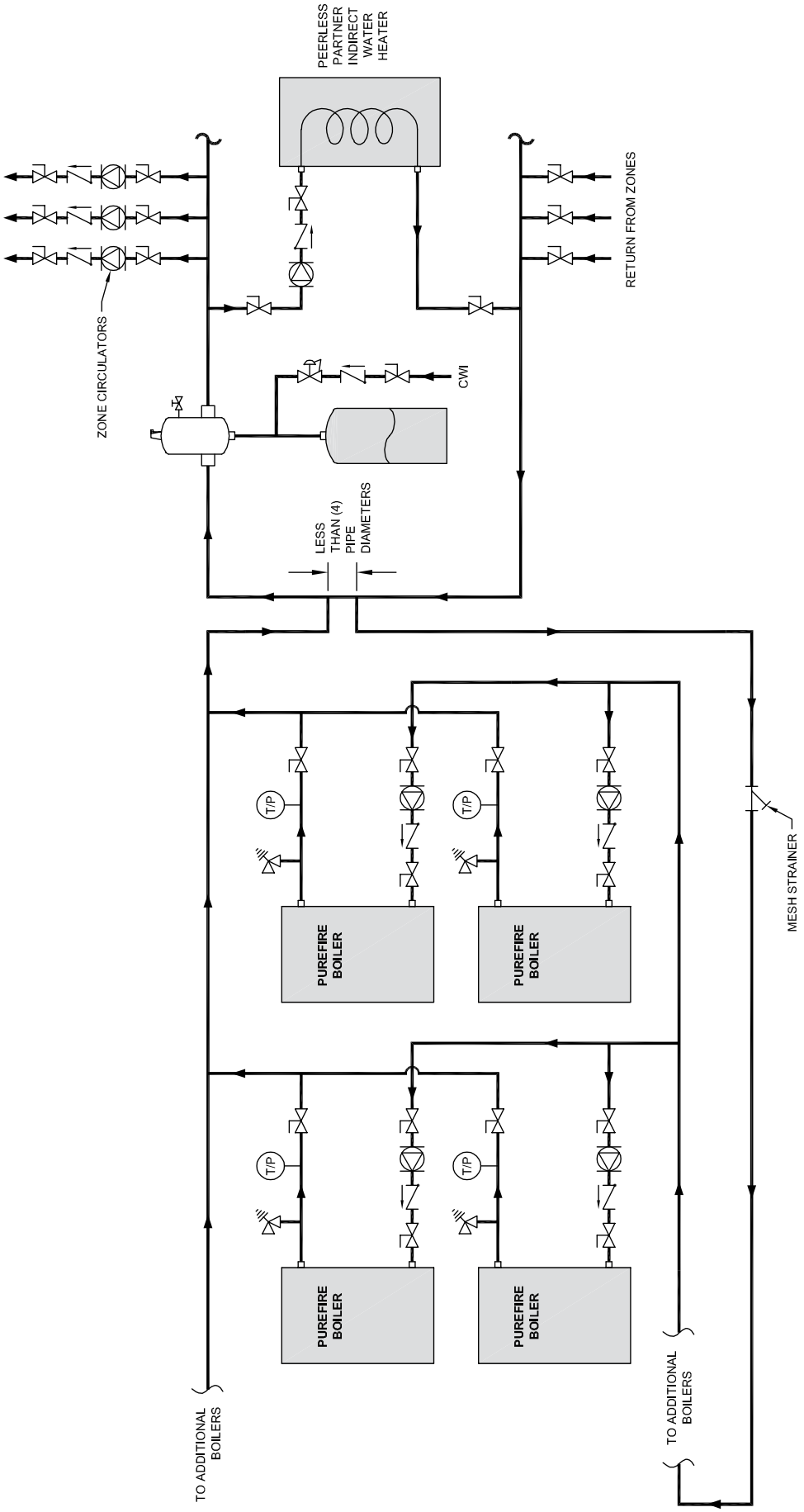


Figure 4.5: Recommended Piping – Multiple Boilers with Multiple CH Zones & One DHW Tank

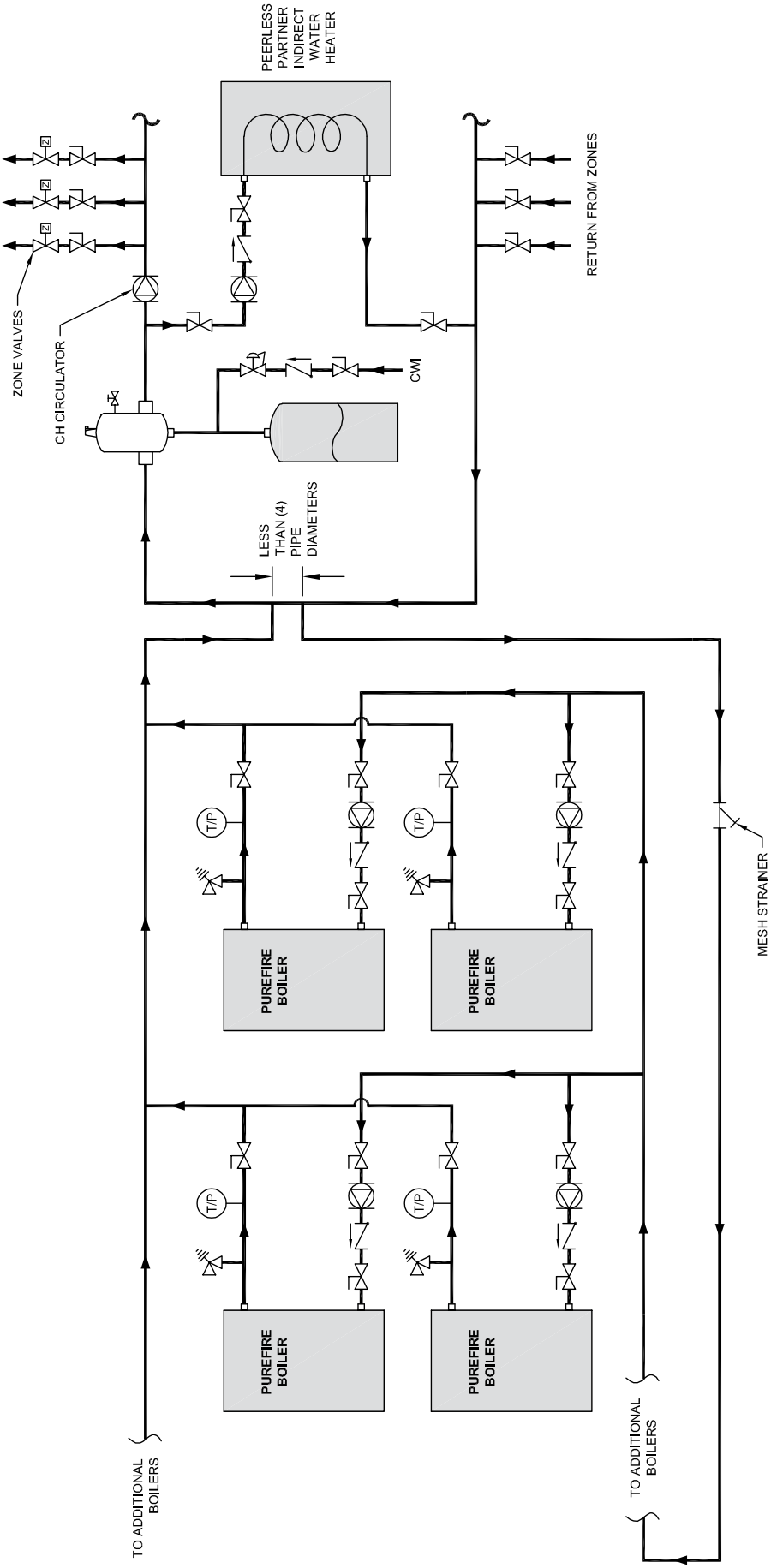


Figure 4.6: Alternate Piping – Multiple Boilers with Multiple CH Zones (Zone Valves) & One DHW Tank

G. SPECIAL APPLICATIONS

1. If the Series PFC™ boiler is used in conjunction with a chilled medium system, pipe the chiller in a separate secondary loop.
   a. Assure that the boiler circulator is disabled during chiller operation so that chilled water does not enter the boiler.
   b. Install a flow control valve (spring check valve) to prevent gravity flow through the boiler.
   c. See Figure 4.7 for recommended system piping for chiller operation.
2. For boilers connected to heating coils in a forced air system where they may be exposed to chilled air circulation, install flow control valves or other automatic means to prevent gravity circulation of the boiler water during cooling cycles. See Figure 4.8 for an illustration.

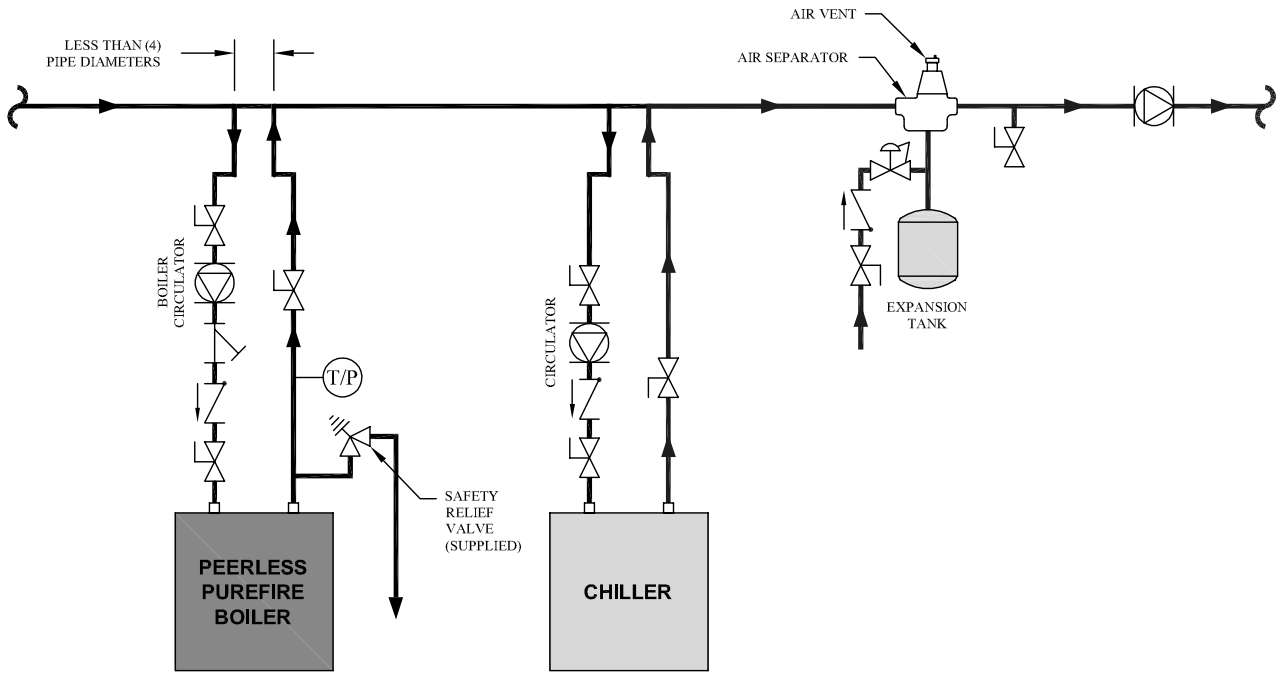


Figure 4.7: Boiler in conjunction with a Chilled Water System

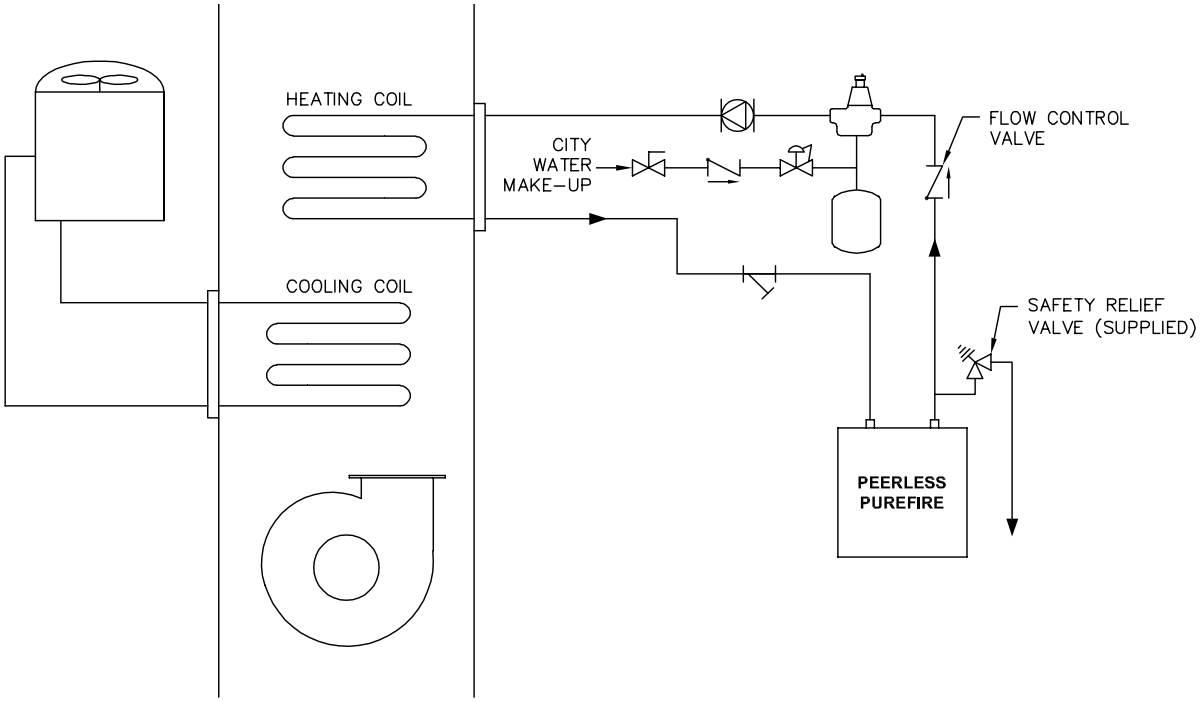


Figure 4.8: Boiler Connected to a Heating Coil in a Forced Air System

5. FUEL PIPING

A. GENERAL

1. All fuel piping to the Series PFC™ 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.

B. FUEL LINE SIZING

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

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

2. As an alternative, use Table 5.1 to determine the required gas flow rate. This table uses typical heating values for natural gas and liquefied petroleum (LP) gas.

Table 5.1: Required Fuel Input

PUREFIRE® Model	Required Input Rate			
	Natural Gas (1000 Btu/ft³)		LP Gas (2500 Btu/ft³)	
	ft³/hr	m³/hr	ft³/hr	m³/hr
PFC-625	625	17.7	250	7.1
PFC-750	750	21.2	300	8.5

3. Table 5.2 shows the maximum flow capacity of several pipe sizes based on 0.3" w.c. pressure drop. The values shown are based on a natural gas specific gravity of 0.60.

4. Table 5.3 shows the maximum capacity of pipe sizes for LP gas with a specific gravity of 1.50.

5. Size the fuel gas supply piping for no more than 0.5 in. w.c. pressure drop between the gas pressure regulator and the boiler.

C. GAS SUPPLY PIPING - INSTALLATION

1. Do not install any piping directly in front of the boiler or along either side. Always provide clearance for removal of the front cover or side panels for inspection and maintenance.

⚠ 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.

Table 5.2: Pipe Capacity – Natural Gas

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)	1-1/4" Pipe	1-1/2" Pipe	2" Pipe	2-1/2" Pipe	3" Pipe	4" Pipe	6" Pipe
10 (3.0)	1,050 (30)	1,600 (45)	3,050 (86)	4,800 (136)	8,500 (241)	17,500 (496)	44,000 (1246)
20 (6.1)	730 (21)	1,100 (31)	2,100 (59)	3,300 (93)	5,900 (167)	12,000 (340)	31,000 (878)
30 (9.1)	590 (17)	890 (25)	1,650 (47)	2,700 (76)	4,700 (133)	9,700 (275)	25,000 (708)
40 (12.2)	500 (14)	760 (22)	1,450 (41)	2,300 (65)	4,100 (116)	8,300 (235)	22,000 (623)
50 (15.2)	440 (12)	670 (19)	1,270 (36)	2,000 (57)	3,600 (102)	7,400 (210)	20,000 (566)
60 (18.3)	400 (11)	610 (17)	1,150 (33)	1,850 (52)	3,250 (92)	6,800 (193)	18,000 (510)
70 (21.3)	370 (10)	560 (16)	1,050 (30)	1,700 (48)	3,000 (85)	6,200 (176)	17,000 (481)
80 (24.4)	350 (10)	530 (15)	930 (26)	1,500 (42)	2,600 (74)	5,400 (153)	15,000 (425)
90 (27.4)	320 (9)	490 (14)	870 (25)	1,400 (40)	2,500 (71)	5,100 (144)	14,000 (396)
100 (30.5)	305 (9)	460 (13)	710 (20)	1,130 (32)	2,000 (57)	4,100 (116)	11,500 (326)

Table 5.3: Pipe Capacity – LP Gas (1.50 Specific Gravity)

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)	1-1/4" Pipe	1-1/2" Pipe	2" Pipe	2-1/2" Pipe	3" Pipe	4" Pipe	6" Pipe
10 (3.0)	662 (18.7)	1,008 (28.5)	1,922 (54.4)	3,024 (85.6)	5,355 (151.6)	11,025 (312.2)	27,720 (784.9)
20 (6.1)	460 (13.0)	693 (19.6)	1,323 (37.5)	2,079 (58.9)	3,717 (105.3)	7,560 (214.1)	19,530 (553.0)
30 (9.1)	372 (10.5)	561 (15.9)	1,040 (29.4)	1,701 (48.2)	2,961 (83.8)	6,111 (173.0)	15,750 (446.0)
40 (12.2)	315 (8.9)	479 (13.6)	914 (25.9)	1,449 (41.0)	2,583 (73.1)	5,229 (148.1)	13,860 (392.5)
50 (15.2)	277 (7.8)	422 (12.0)	800 (22.7)	1,260 (35.7)	2,268 (64.2)	4,662 (132.0)	12,600 (356.8)
60 (18.3)	252 (7.1)	384 (10.9)	725 (20.5)	1,166 (33.0)	2,048 (58.0)	4,284 (121.3)	11,340 (321.1)
70 (21.3)	233 (6.6)	353 (10.0)	662 (18.7)	1,071 (30.3)	1,890 (53.5)	3,906 (110.6)	10,710 (303.3)
80 (24.4)	221 (6.2)	334 (9.5)	586 (16.6)	945 (26.8)	1,638 (46.4)	3,402 (96.3)	9,450 (267.6)
90 (27.4)	202 (5.7)	309 (8.7)	548 (15.5)	882 (25.0)	1,575 (44.6)	3,213 (91.0)	8,820 (249.8)
100 (30.5)	192 (5.4)	290 (8.2)	447 (12.7)	712 (20.2)	1,260 (35.7)	2,583 (73.1)	7,245 (205.2)

2. A sediment trap is included from the factory into the supply piping at the boiler. Figure 5.1 shows the sediment trap at the rear of the boiler near the base.

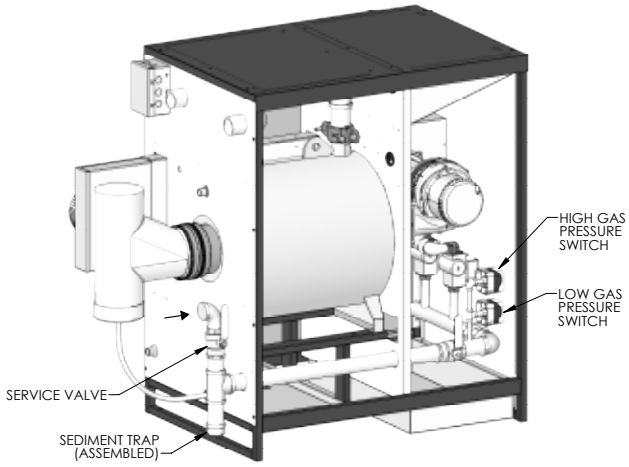


Figure 5.1: Gas Supply Pipe and Shutoff

3. High and low gas pressure switches are provided on the gas supply header inside the boiler cabinet. Figure 5.1 shows the pressure switch location.

4. Install the service valve, supplied by the factory, as shown in Figure 5.1 on the inlet to the boiler gas piping.

5. Install a ground joint union upstream of the service valve to allow service to the appliance.

6. Maintain a minimum distance of 5 feet between the supply gas pressure regulator and the appliance.

⚠ 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. Check all gas piping for leaks prior to placing the boiler in service. Use an approved gas detector, non-corrosive leak detection fluid, or other leak detection method to determine if there are leaks in the system. If leaks are found, turn off the gas flow at the service valve and repair as necessary.

8. Gas shutoff valves, located in the blower vestibule cabinet area, are provided for each individual burner. These valves are to be used in addition to the gas service valve to interrupt gas flow to the individual burners.

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.

⚠ 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.

2. Table 5.4 shows the maximum and minimum fuel gas supply pressure to the boiler.

Table 5.4: Maximum and Minimum Fuel Supply Pressure

Model	Fuel Type	Fuel Inlet Pressure (at Gas Valve for each Burner)			
		Minimum		Maximum	
		in. w.c.	kPa	in. w.c.	kPa
PFC-625/750	Natural Gas	3.5	0.9	13.5	3.4
	LP Gas	8.0	2.0		

a. Gas pressures below 3.5 in. w.c. may result in burner ignition failures and hard ignitions. A low gas pressure switch has been provided with the boiler to prevent low pressure conditions.

b. Gas pressures above 13.5 in. w.c. may result in damage to the automatic gas valve. A high gas pressure switch has been provided with the boiler to prevent high pressure conditions.

c. The high and low gas pressure switch locations can be seen in Figure 5.1.

⚠ CAUTION

Do not subject the gas valve to more than 13.5 in. w.c. (34 mbar) of gas pressure. Doing so may damage the gas valve.

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 pressure tap fitting (see Figure 5.2) one turn counterclockwise.
   d. Attach the tube from the manometer to the inlet pressure tap fitting.
   e. Turn on the burner service switch.
   f. Open the manual gas valve and start the boiler.
   g. Read and record the gas pressure while the boiler is firing.
   h. Remove the call for heat and allow the burner to shutdown normally with a full postpurge.
   i. Turn off the burner service switch and close the gas shutoff valve.
   j. Remove the manometer tube from the inlet pressure tap fitting.
   k. Turn the internal screw clockwise to close the valve.

l. Turn on the gas shutoff valve and the boiler service switch.

m. Start 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 required leak test pressure is higher than 13.5 in. w.c., the boiler must be isolated from the gas supply piping by closing the service valve.
   b. If the gas valves are exposed to pressure exceeding 13.5 in. w.c., both gas valves must be replaced.

5. Install the boiler such that the gas ignition system components are protected from water (dropping, spraying, rain, etc.) during operation and service (circulator replacement, condensate collector and neutralizer clean out, control replacement, etc.).

E. MAIN GAS VALVES - OPERATION

1. Figure 5.2 is an illustration of the main gas valves, venturi and blower assembly for the Series PFC™ boiler.

2. Do not make adjustments to the gas valves without instrumentation to measure carbon dioxide (CO_2) and carbon monoxide (CO) emissions in the exhaust vent pipe.

3. Turning the throttle screw clockwise will decrease the gas flow (decreasing CO_2) and turning it counterclockwise will increase the gas flow rate (increasing CO_2). Markings adjacent to the throttle screw show + and – indicating this operation.
   a. Throttle adjustments should be made only at full input rate.
   b. See Section 9, Start-Up Procedure for specific information about commissioning and adjusting the boiler.

4. The recommended CO2 settings are given in Table 5.5 and Table 5.6 for PFC-625 and PFC-750, respectively. In no case should the boiler be allowed to operate with CO emissions higher than 200 ppm.

5. Refer to Section 3, Venting and Air Inlet Piping for information on obtaining exhaust vent samples from this boiler.

Table 5.5: PFC-625 Combustion Settings

PFC-625	Natural Gas		Propane (LP)	
	Low Fire	High Fire	Low Fire	High Fire
Carbon Monoxide (CO)	< 50 ppm	< 200 ppm	< 50 ppm	< 200 ppm
Carbon Dioxide (CO_2)	8.6% to 9.2%		10.3% to 10.7%	9.8% to 10.2%
Excess Oxygen (O_2)	4.8% to 5.8%		4.6% to 5.2%	5.4% to 6.0%
Excess Air	26.5% to 34.1%		25.1% to 29.4%	31.0% to 35.8%

Table 5.6: PFC-750 Combustion Settings

PFC-750	Natural Gas		Propane (LP)	
	Low Fire	High Fire	Low Fire	High Fire
Carbon Monoxide (CO)	< 50 ppm	< 200 ppm	< 50 ppm	< 200 ppm
Carbon Dioxide (CO_2)	8.6% to 9.2%		9.8% to 10.2%	
Excess Oxygen (O_2)	4.8% to 5.8%		5.4% to 6.4%	
Excess Air	26.5% to 34.1%		31.0% to 39.2%	

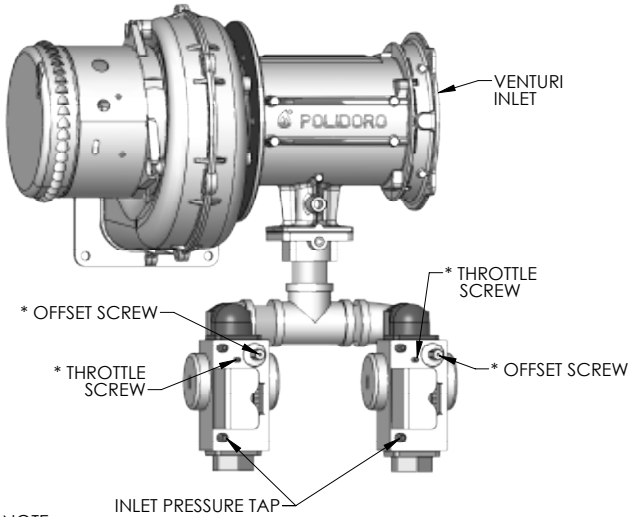


Figure 5.2: Gas Valve, Venturi, Blower Assembly – PFC-625/750

NOTICE

PFC-625 and PFC-750 boilers utilize a dual gas valve system. When making combustion adjustments, throttle and offset changes MUST be made equally on both valves.

Reference Section 9.G of this IOM for valve adjustment and zeroing procedure.

6. CONDENSATE TRAP & DRAIN SYSTEM

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.

   L'élimination de tout condensat dans les systèmes d'évacuation publics des eaux usées doit s'effectuer conformément aux codes et règlements en vigueur. Si ces codes font défaut, suivre alors ces 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 PFC™ boiler operates correctly.

   Pour le bon fonctionnement d'un appareil à condensation, l'installation d'une tuyauterie adéquate et la bonne évacuation de la condensation de la combustion sont indispensables au fonctionnement d'un appareil à condensation. Suivre attentivement ces instructions pour assurer le fonctionnement optimal de la chaudière Series PFC™.

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.

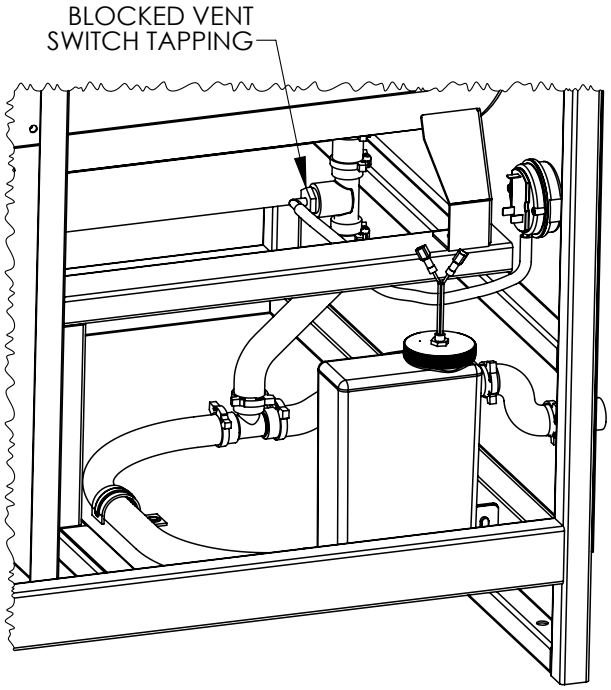


Figure 6.1: Condensate Trap System

B. CONDENSATE SYSTEM

1. The condensate system for Series PFC™ boilers perform the following functions:
   a. Prevent condensate from backing up into the heat exchanger.
   b. Trap the condensate to prevent combustion gases from escaping.

2. Figure 6.1 shows the components of the condensate system.
   a. *Condensate Collector Container*: This vessel is a transparent plastic container designed to catch the condensate separately from the heat exchanger and from the exhaust venting system. This vessel also acts as part of the trap to prevent combustion gases from escaping. The container is fitted with a blocked condensate float switch.
   b. *Blocked Condensate Float Switch*: This switch will cause a blocking error on the boiler control and prevent the boiler from operating if the level of condensate in the vessel becomes too high. High condensate levels can occur as a result of a blocked condensate drain or similar problem.
   c. *Blocked Vent Switch*: A blocked vent switch is connected to the condensate system to shut the burner down in case of a vent blockage. The switch will trip if the pressure in the combustion chamber exceeds 3.5" w.c. (8.7 mbar) and will prevent the boiler from continuing to operate with the condensate trap emptied due to high pressure.
   d. *Condensate Drain Tee*: The condensate drain tee, included in a separate box inside the crate, drains condensate to the trap and neutralization system separately from the heat exchanger. This prevents dirt and debris from the venting system from entering the heat exchanger.

C. CONDENSATE DRAIN PIPING

1. *Material*: The condensate drain is to be piped using PVC, polypropylene, or other material resistant to acidic condensate. Do not use steel, brass, or galvanized pipe for this purpose. The acidic condensate will attack most metals and cause corrosion.

2. *Tubing Size*: The connection at the rear of the heat exchanger is designed for connection to 3/4" ID PVC or similar tubing. Do not reduce the size of the condensate drain tubing.

3. *Tubing Pitch*: Be sure that the pipe or tubing is pitched away from the boiler with a slope of no less than 1/4" per foot.

4. *Multiple Boilers*: Condensate drain tubes from multiple boilers should be run separately to prevent a nuisance lockout of multiple boilers due to a single clogged drain tube.

5. *Condensate Pumps*: If the boiler drain is below the level of a gravity drain, a condensate pump should be used. Table 6.1 lists several available brands. Contact your PB Heat, LLC Distributor for availability.

Table 6.1: Recommended Condensate Pumps

Brand Name	Model Number
ITT Bell & Gossett	LS
Little Giant	VCMA-15UL
Beckett	CB151LSUL
Hartell	KT-15-1UL

7. ELECTRICAL CONNECTIONS & INTERNAL WIRING

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 PFC™ 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 back panel of the boiler to connect supply wiring, circulator wiring and wiring to various instruments via the electrical access channel.
2. Electrical terminals are located on the right-hand side of the electrical tray.
3. Figure 7.4 shows customer connections for the Series PFC™ boiler.
   a. All **LINE** voltage connections are on the left terminal strip, a detailed description is shown in Table 7.1.
   b. All **LOW** voltage connections are on the right terminal strip, a detailed description is shown in Table 7.2.

Table 7.1: Line Voltage Terminal Description

Terminal		Input/ Output	Voltage	Description	
1	L	Output	120 VDC	Alarm Relay	120 VAC, 60Hz, output energized when boiler enters lockout state.
2	N				
3	L1	Input	120 VAC	Control Supply	120 VAC, 60 Hz, 1 Phase supply from a fused disconnect switch to power the boiler, boiler control and combustion air blower.
4	L2				
5	L1	Input	120 VAC	Pump Supply	120 VAC, 60 Hz, 1 Phase supply from a fused disconnect switch to power the boiler circulators.
6	L2				
7	L	Output	120 VAC	GEN Pump	General Circulation Pump – Use this output to power the GEN (boiler) circulator.
8	N				
9	L	Output	120 VAC	DHW Pump	DHW Circulation Pump – Use this output to power the Domestic Hot Water (DHW) circulator.
10	N				
11	L	Output	120 VAC	CH Pump	CH Circulation Pump – Use this output to power the Central Heating (CH) circulator.
12	N				

Table 7.2: Low Voltage Terminal Description

Terminal		Input/ Output	Voltage	Description	
13	0V	Input	5 VDC	Water Pressure Switch	Optional dry contact for water pressure switch.
14	Sensor				
15	+5V	Input	5 VDC	Heat Exchanger Flow Switch	Optional dry contact for flow switch safety. Can also be used for additional LWCO safety.
16	Sensor				
17	GND	Output		MODBUS	For connection to external BMS via Modbus communication protocol.
18	B/-				
19	A/+				
20	0V	% PWM	10 VDC	Pump Speed	Optional modulating pump control. PWM signal output.
21	PWM				
22	-	Input	0-10 VDC	Analog 0-10V	Input for 0-10Vdc boiler control for CH mode 4 and 5.
23	+				
24		Input/ Output	24 VDC	Cascade Dependent	Wire to Terminals #26 & #27 of Managing Boiler
25					
26		Input/ Output	24 VDC	Cascade Managing	Wire to Terminals #24 & #25 of all Dependent Boilers
27					
28		Input	5 VDC	System Sensor	Managing boiler must have System/ Cascade Sensor
29					
30		Input	5 VDC	Outdoor Sensor	Connection point for 12 kOhm outdoor sensor.
31					
32		Input	24 VAC	DHW Sensor/ Stat	Connection point for tank sensor or DHW thermostat.
33					
34		Input	24 VAC	CH Stat	Connection point for CH thermostat.
35					

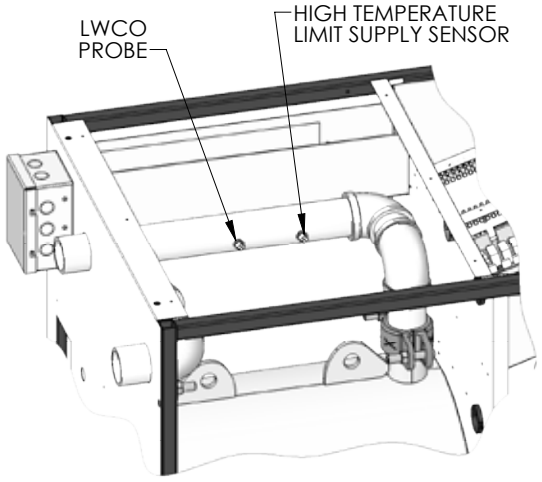


Figure 7.1: Sensor Locations

4. An Outdoor Sensor is provided with the Series PFC™ 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 if the Outdoor Sensor is not installed in the central heat modes 1 and 2.
   a. Connect the sensor to terminals #30 and #31 on the low voltage side (right side) 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.

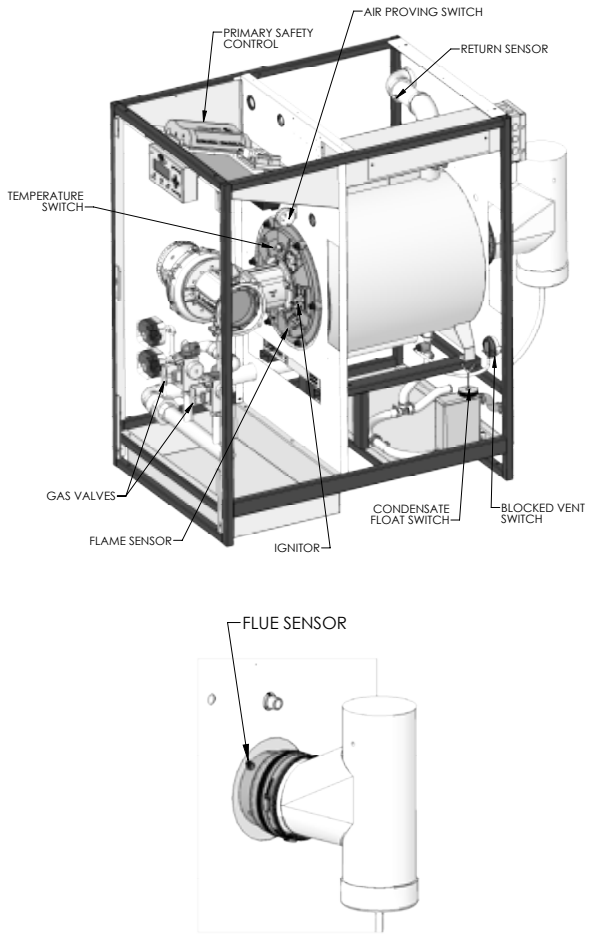


Figure 7.2: Safety Device Locations

C. INTERNAL WIRING

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

1. *User Interface:* The user interface, 975PB Display, is attached to the front of the electrical tray behind the smoked lens on the jacket 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. *Primary Ignition and Safety Control:* : The ignition control is located on the left-hand side of the electrical tray.

3. *Relay Module:* The relay module is located in the center back edge of the electrical tray. This fused module provides isolation for the pump contacts on the main control board. The maximum rating for each pump attached is 10 Amps. Since only two pumps operate at any one time, this limits the incoming power required for this module to 20 Amps. This separate power supply is to be connected to terminals #5 and #6.

4. *Line Voltage Terminals*: The line voltage terminals are located on the right side of the electrical tray. Terminals #1 through #12 are the designated line voltage terminals. They are the left-hand column of terminals. (A more detailed description of the terminals can be seen in Table 7.1).

5. *Low Voltage Terminals*: The low voltage terminals are located on the right side of the electrical tray. Terminals #13 through #35 are the designated low voltage terminals. They are the right-hand column of terminals. (A more detailed description of the terminals can be seen in Table 7.2).

6. *PC Communication Adapter (Green Plug)*: The PC Communication Adapter (PFC7008) is detached and located inside the electrical tray, below the terminals. This connection allows Factory Engineers to review control settings and view advanced diagnostic features.

7. *Return Sensor*: The return sensor is located on the left side, above the heat exchanger. This component 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 PFC™ return sensor.

8. *Dual Supply Sensor*: The dual supply sensor is located on the right side, above the heat exchanger, attached to the supply line. This component contains 2 – 10 kΩ NTC sensors in the sensor body. The 900 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. The dual supply sensor acts as a high temperature limit as well.

9. *LWCO*: The low water cutoff probe is located on the right side, above the heat exchanger, attached to the supply line next to the dual supply sensor. This sensor will shut down the boiler if the water level drops below the sensor location above the heat exchanger to ensure the boiler does not dryfire.

10. *Flue Temperature Sensor*: The flue temperature sensor is located on the right side of the vent of the rear of the boiler. This sensor provides flue temperature information to the control.

11. *Blocked Vent Pressure & Blocked Condensate Drain Float Switches*: The blocked vent pressure and blocked condensate drain float switches are located on the right side, beneath the heat exchanger. The blocked vent pressure switch is a normally closed switch that is activated when the pressure exceeds 3.5”w.c. in the vent, indicating a vent blockage. The blocked condensate drain float switch is activated when there is a blockage in the condensate drainage system. When either of these switches are activated the boiler will automatically shut down by the control.

12. *Service Switch*: The service switch is located on the front, left-hand side of the boiler. The service switch interrupts the power to the Series PFC boiler to allow service to be performed. The front panel must be removed to access it.

13. *Combustion Air Blower*: The combustion air blower is located directly below the electrical tray in front of the heat exchanger. The blower has 2 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.

14. *High & Low Gas Pressure Switches*: The high and low gas pressure switches are located in front of the heat exchanger, on the lower left-hand side. The high gas pressure switch is located above the low gas pressure switch. The high pressure switch is set at 13.5" wc and the low pressure switch is set at 3.5" wc. If the gas pressure exceeds 13.5" wc or falls below 3.5" wc, the control will shut down the boiler.

15. *Gas Valves*: The gas valves are located in front of the heat exchanger, on the lower right-hand side. The gas valves are connected through special cord and connector with the connector secured with a screw.

16. *High Temperature Limit:* The high temperature limit is centered on the front plate of the heat exchanger next to the viewer window. This component is used to detect overheating of the burner plate, primarily caused by broken insulation on the inside of the boiler plate. Only use a factory provided Series PFC™ High Limit switch/ Burner Plate Switch.

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 7.3 for location of Boiler Control fuse and spare fuse.

17. *Air Proving Switch:* The air proving switch is mounted on the inner front panel above the heat exchanger on the right-hand side. This switch indicates that the air inlet is not blocked and that the boiler has enough fresh air supply for safe operation.

18. *Flame Sensor:* The flame sensor is located on the lower right-hand side of the front plate of the heat exchanger (white wire). The flame sensor uses the principal of flame rectification to sense the burner flame.

19. *Ignition Electrode & Ignitor Ground:* The ignition electrode and ignitor ground are located on the right-hand side of the front plate of the heat exchanger. The ignition electrode has a black cable and the ignitor ground is the green cable. A high voltage charge is supplied from the control to provide spark for lighting the burner. The ignition electrode also provides flame sensing after the ignition spark period.

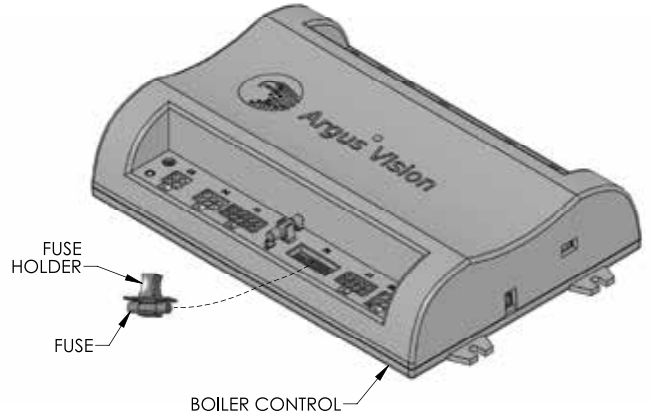


Figure 7.3: Control Fuse Location

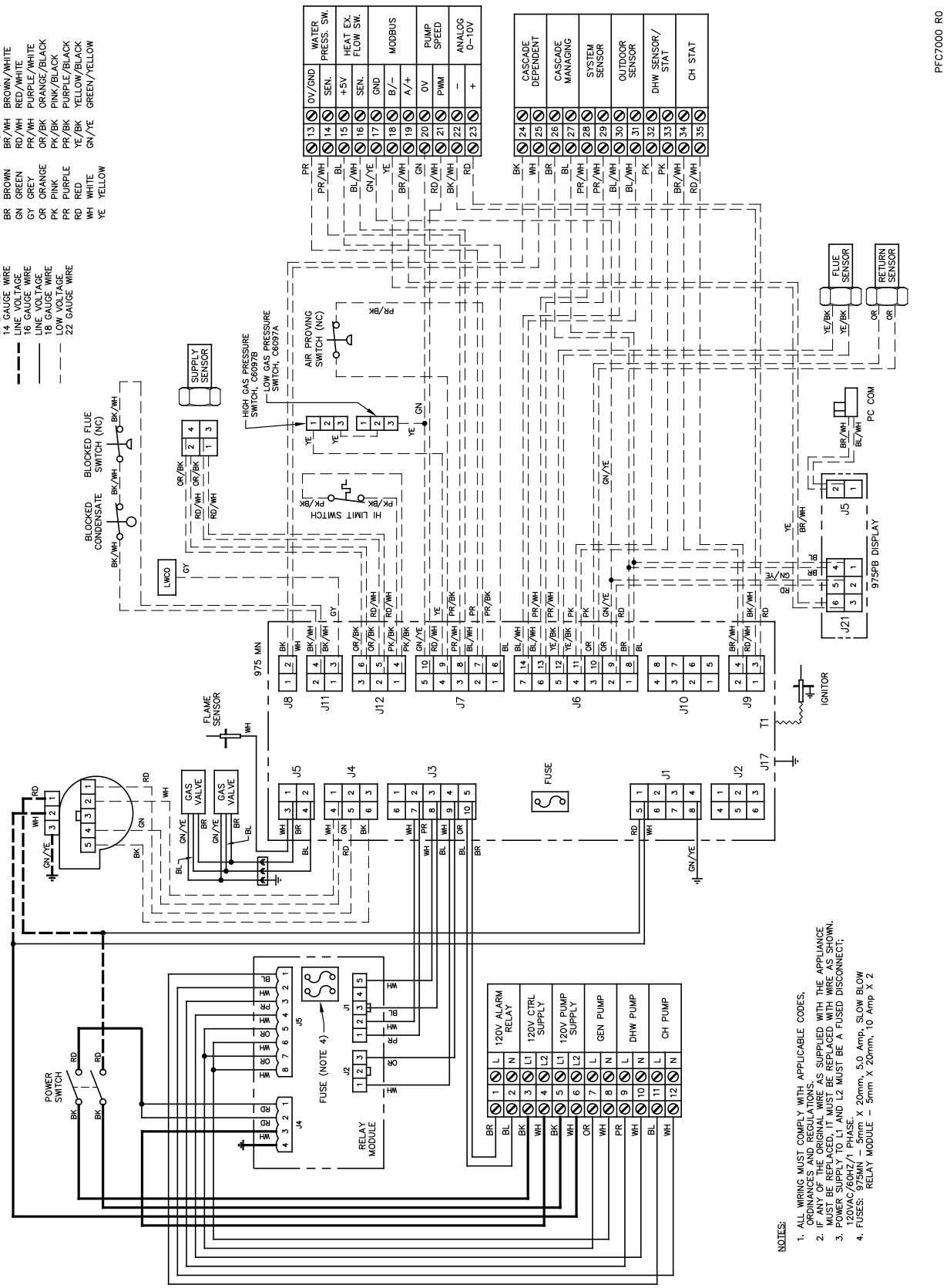


Figure 7.4: Internal Wiring Schematic for PFC-625 & PFC-750 boilers

8. BOILER CONTROL: INTERNAL WIRING & OPERATION

A. CONTROL OVERVIEW

The Series PFC™ 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 Priority
- Fan Speed
- LWCO

B. AVAILABLE CENTRAL HEAT MODES

Table 8.1: Series PFC™ Central Heat Modes

Central Heating Mode	Mode Description	Mode Operation
0	Fixed Setpoint	– Demand initiated by T/TT closure. – User selected fixed setpoint. – When demand is present, the boiler targets CH setpoint and operates based on the Supply temperature hysteresis. – Not for space heating. Used for combustion testing.
1	Outdoor reset with Thermostat	– Demand initiated by T/TT closure. – Setpoint is calculated based on the Outdoor temperature and CH demand period to improve fuel usage and boiler efficiency. – Setpoint Boost function for long CH demand periods. – When demand is present, the boiler targets calculated CH setpoint and operates based on the Supply temperature hysteresis. – When the Boost Function is active and CH demand is not present, CH setpoint decreases back to the calculated setpoint.
2	Outdoor reset with Permanent Demand	– Demand initiated by control logic. Always present. – Setpoint is calculated based on the Outdoor temperature to improve fuel usage and boiler efficiency. – Boiler targets calculated CH setpoint and operates based on the Supply temperature hysteresis. – When CH demand is not present, calculated setpoint decreases gradually.
3	Fixed Setpoint with Permanent Demand	– Demand initiated by control logic. Always present. – User selected fixed setpoint. – Boiler maintains CH setpoint and operates based on Supply temperature hysteresis. – Not for space heating.
4	Analog Input Control of Setpoint	– Demand initiated by an analog input of 1.5 Vdc or higher. – Demand will be removed when the voltage drops below 1 Vdc. – Boiler setpoint is controlled by an analog input signal provided by a Building Management System or controller. – Setpoint modulation occurs between 2 and 9 V. – Setpoint range is 60°F (15.5°C) to 185°F (85°C).
5	Analog Input Control of Power Output	– Demand initiated by an analog input of 1.5 Vdc or higher. – Demand will be removed when the voltage drops below 1 Vdc. – Boiler fan speed (power output) is controlled by an analog input signal provided by a Building Management System (BMS) or controller.

*While accessible via the Installer menu, CH Modes 4 and 5 are not functional with the Series PBC™ boiler.
NOTE: Hysteresis is similar to differenctial.

C. AVAILABLE DOMESTIC HOT WATER MODES

Table 8.2: Series PFC™ Domestic Hot Water Modes

Central Heating Mode	Mode Description	Mode Operation
0	No Domestic Hot Water	– Disables DHW sensor and functionality. – Boiler will function only for Central Heat.
1	Storage with Sensor	– Demand initiated by Tank Sensor dropping below Setpoint. – Boiler targets chosen (115) DHW Store Setpoint + (38) DHW Tank Supply Extra. Example: Boiler Setpoint= (115) DHW Store Setpoint + (38) DHW Tank Supply Extra= 120°F +40°F= 160°F.
2	Storage with Thermostat	– Demand initiated by DHW T/TT Closure. – Boiler targets user defined (48) DHW/Tank Setpoint parameter.

NOTES:
While accessible via the Installer menu, DHW modes 3, 4, 5, 6, 7, and 8 are not functional with the Series PFC™ boiler.
Numbers in parentheses refer to Boiler Parameter setting numbers. See Table 8.2.J.1.

D. DISPLAY UTILIZATION

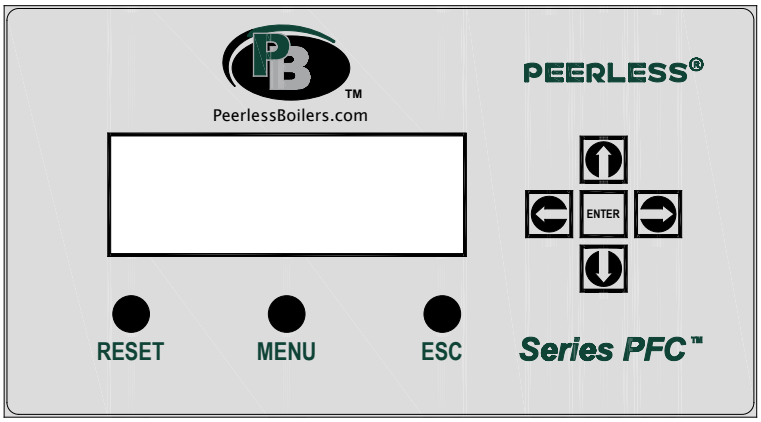


Figure 8.1: 900PB Display Buttons

Table 8.3: Display Button Functions

Button	Default Screen	Menu Selection - User/Installer Level
RESET	Reset Lockout Error	Press and hold to clear lockout errors.
MENU	Enter the Main Menu	Enter menu structures for user and installer access.
ESC	Return to the Status Overview	
ARROWS	Main Screen Menus	Navigation.

NOTICE

All Parameter changes must be confirmed with a press of the ENTER button.

1. **Select parameter with ENTER or RIGHT button**
2. **Change parameter with UP OR DOWN buttons while parameter is flashing**
3. **Confirm change with ENTER button. Parameter will stop flashing and show new setting.**

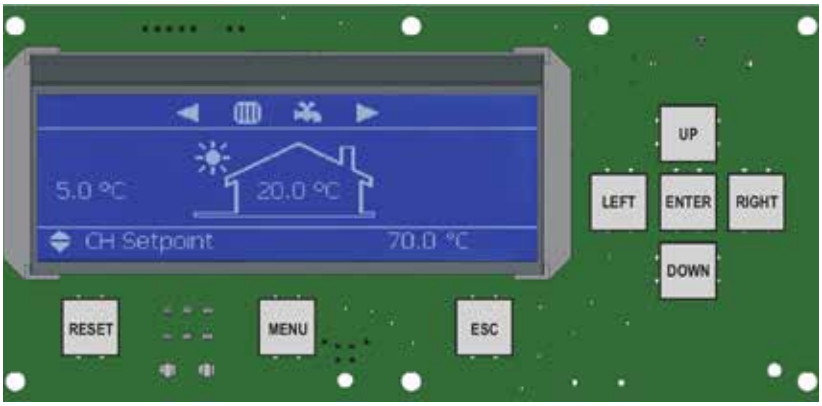
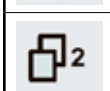
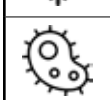


Figure 8.2: 900PB Display Icons

Table 8.4: Display Icons

Icon	Description
	Central Heating enabled. CH demand active when flashing.
	Central Heating disabled.
	Domestic Hot Water enabled. DHW demand active when flashing.
	Domestic Hot Water disabled.
	Burner Active.
	Emergency mode active. (Cascade Only)
	Error Present on control. Description in the bottom of the display.
	Cascade Managing unit.
	Cascade Dependent unit. Number indicates address.
	Frost Protection active.
	Anti-Legionella active.

E. USER INTERFACE MENU STRUCTURE

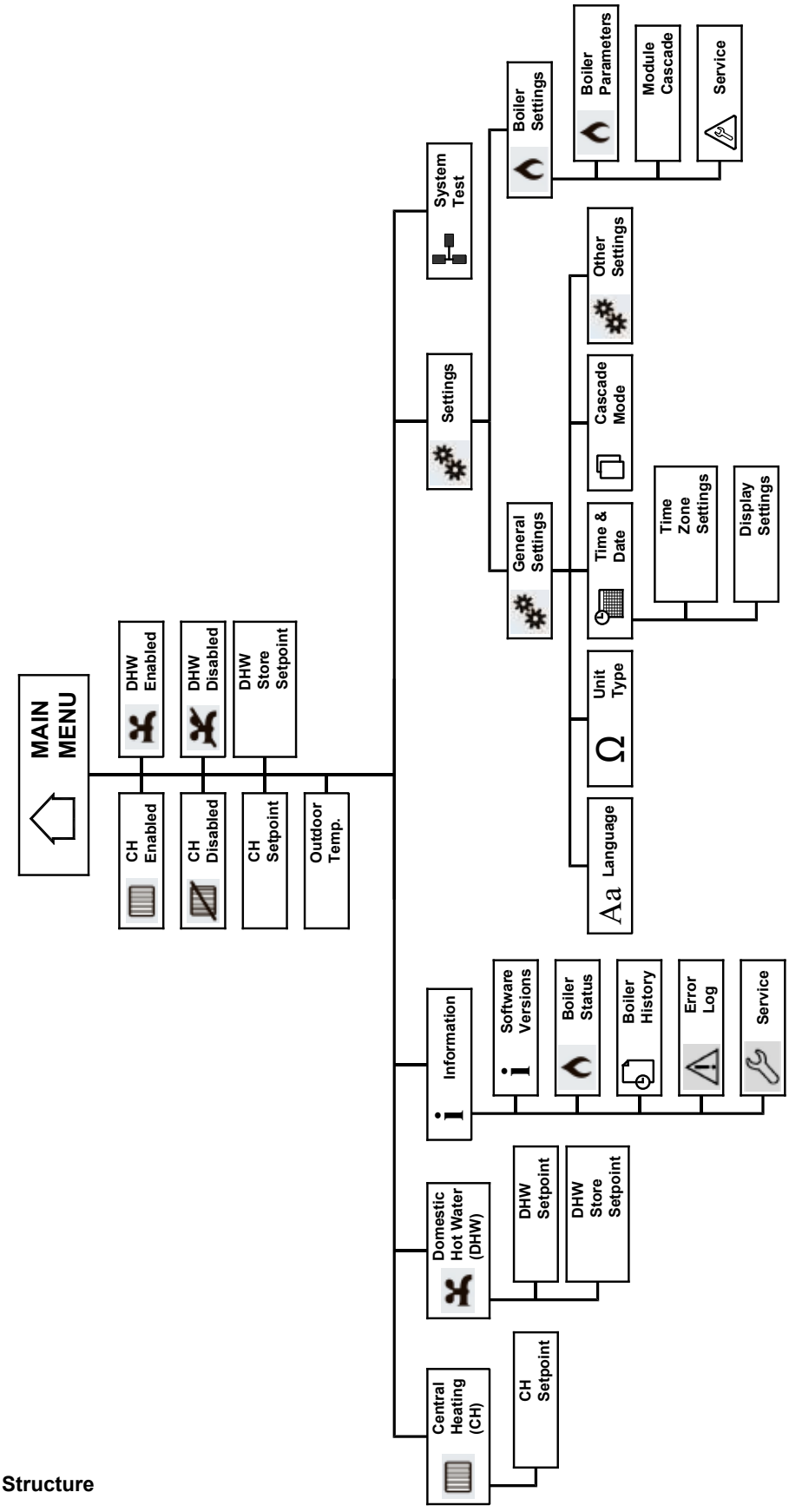


Figure 8.3: Menu Structure

F. MAIN MENU

Table 8.F.0: Main Menu

Menu Item	Function/Description
Central Heating (CH)	Enter the Central Heating (CH) menu
Domestic Hot Water (DHW)	Enter the Doemstic Hot Water (DHW) menu
Information	Enter the Information menu
Settings	Enter the Settings menu
System Test	Enter the System Test menu

G. CENTRAL HEATING (CH)

Table 8.G.0: Central Heating (CH)

Menu Item	Function/Description	Units	Default Value
CH Setpoint	Set the CH Setpoint	^{O}F (^{O}C)	159.8 (71.0)

H. DOMESTIC HOT WATER (DHW)

Table 8.H.0: Domestic Hot Water (DHW)

Menu Item	Function/Description	Units	Default Value
DHW Store Setpoint	Set the DHW Store Setpoint for DHW Modes 1 & 2	^{O}F (^{O}C)	180 (82.5)

I. INFORMATION

Table 8.I.0: Information

Menu Item	Function/Description
Software Versions	Enter the Software Versions menu
Boiler Status	Enter the Boiler Status menu
Boiler History	Enter the Boiler History menu
Error Log	Enter the Error Log menu
Service	Enter the Service menu

Table 8.I.1: Information -> Software Versions

Menu Item	Function/Description	Revision
Display	Display the Software Checksum	[xxxx xxxx]
Boiler	Display the Boiler Software Checksum	[xxxx xxxx]
Device Group	Display the Boiler Group ID	xxxMN

Table 8.I.2: Information -> Boiler Status

Menu Item	Function/Description	Default Value
Supply Temperature	Actual Supply Temperature From Supply Dual Sensor	^{O}F (^{O}C)
Supply 2 Temperature	Actual Supply 2 Temperature From Supply Dual Sensor	^{O}F (^{O}C)
Return Temperature	Actual Return Temperature	^{O}F (^{O}C)
DHW Temperature	Actual DHW Temperature	^{O}F (^{O}C)
DCW Temperature	Actual DCW Temperature	^{O}F (^{O}C)
Outside Temperature	Actual Outside Temperature	^{O}F (^{O}C)
Flue Temp	Actual Flue Gas Temperature From Flue Gas Dual Sensor	^{O}F (^{O}C)
System Temperature	Actual System Temperature	^{O}F (^{O}C)
0-10V Input	Actual 0-10V External Input	V
RT Input	Actual Room Thermostat Status	open/closed
Fan Speed	Actual Fan Speed	RPM
Ionization	Actual Flame Signal Ionization Current	uA
State	Actual Burner State	Standby
		PrePurge0
		PrePurgePreIgnit
		Ignit
		FlameProving
		Burn
		PostBurn
		PostPurge0
		PostPurge1
		ExtendedPostPurge
		Alarm
Error	Actual Lock, Block or Warning Error Code	#
Calculated Setpoint	Actual CH Setpoint	^{O}F (^{O}C)

Table 8.I.3: Information -> Boiler History

Menu Item	Function/Description	Default Value
Successful Ignitions	Displays the number of Successful Ignitions	#
Failed Ignitions	Displays the number of Failed Ignitions	#
Flame Failures	Displays the number of Flame Losses	#
Operation Days	Displays the total time in operation	days
CH Burner Hours	Displays the amount of burn hours for CH	hrs.
DHW Burner Hours	Displays the amount of burn hours for DHW	hrs.

Table 8.I.4: Information -> Error Log

Menu Item	Function/Description	Options	Default Value
Error Log	Display the complete Error Log		
Filter Error Type	Set the Error Log Filter	Disabled = All Errors Shown Lockout Blocking	Disabled
Clear Error Type	Clear the complete Error Log	Yes/No	No

Table 8.I.5: Information -> Service

Menu Item	Function/Description	Options	Default Value
Service History	Display the Service History		
Burn hours since last Service	Display the burn hours since last service	hrs.	
Burn hours till Service	Display the burn hours remaining until next service	hrs.	
Reset Service Reminder	Reset the Service Reminder	Yes/No	No

J. SETTINGS

Table 8.J.0: Settings

Menu Item	Function/Description
General Settings	Enter the General Settings menu
Boiler Settings	Enter the Boiler Settings menu

Table 8.J.1.0: Settings -> General Settings

Menu Item	Function/Description
Language	Enter the Language menu
Unit Type	Enter the Unit Type menu
Date & Time	Enter the Date & Time menu
Cascade Mode	Enter the Cascade Mode menu
Other Settings	Enter the Other Settings menu

Table 8.J.1.1: Settings -> General Settings -> Language

Menu Item	Function/Description
English	Select the English language
Italiano	Select the Italian language
Русский	Select the Russian language
INTERNATIONAL	Select the International language
中文	Select the Chinese language
Français	Select the French language
Español	Select the Spanish language
Türkçe	Select the Turkish language
Deutsch	Select the German language
Slovenský	Select the Slovak language
Nederlands	Select the Dutch language

Table 8.J.1.2: Settings -> General Settings -> Unit Type

Menu Item	Function/Description	Units
Metric (^{O}C, bar)	Select Metric units	^{O}C/bar
Imperial (^{O}F, psi)	Select Imperial units	^{O}F/psi

Table 8.J.1.3.0: Settings -> General Settings -> Date & Time

Menu Item	Function/Description	Default Value
Date	Set the current Date	day, mm-dd-yyyy
Time	Set the current Time	hh:mm:ss
Time Zone Settings	Enter the Time Zone Settings menu	
Display Settings	Enter the Display Settings menu	

Table 8.J.1.3.1: Settings -> General Settings -> Date & Time -> Time Zone Settings

Menu Item	Function/Description	Units	Default Value
Time Zone Correction	Set the Time Zone Correction	UTC -12:00 to UTC +14:00	UTC +00:00
Daylight Savings Time	Select the Daylight Savings Time mode	Disabled Europe N, C America	Disabled

Table 8.J.1.3.2: Settings -> General Settings -> Date & Time -> Display Settings

Menu Item	Function/Description	Units	Default Value
Time Notation	Select 24h or 12h Time Notation	24h/12h	24h
Date Order	Select the Date-format	MDY DMY YMD	MDY
Day of Month	Select how the Day of Month is displayed	1 or 2 digits	2Digits
Month	Select how the Month is displayed	1 or 2 digits Short Text Full Text	2Digits
Year	Select how the Year is displayed	2 or 4 digits	4Digits
Date Separation Character	Select the Date Separation Character	“ ” “–“ “.” “/”	“–”
Day of Week	Select how the Day of Week is displayed	Disabled Short Text Full Text	Short Text
Seconds	Select if Seconds are displayed	yes/no	Yes

Table 8.J.1.4: Settings -> General Settings -> Cascade Mode

Menu Item	Function/Description
Full	Select Full cascade mode (setup for max. 8 burners where the 900PB requires information from the depending burners).
Basic	Select Basic cascade mode (setup for max. 16 burners, where the 900PB does not require information from the dependent burners, which results in a faster bus communication).

Table 8.J.1.5: Settings -> General Settings -> Other Settings

Menu Item	Function/Description	Units	Default Value
Status Overviwe Settings	Enter Status Overview Menu		
Modbus Address	Select the Modbus Communication Address	0...255	1
Modbus Stopbits	Select the no. of Modbus Communication stop bits	1 - 2	2

Table 8.J.1.6: Settings -> General Settings -> Other Settings -> Status Overview Settings

Parameter	Parameter Description	Option	Default
Water Pressure	Display water pressure on main screen	On/Off	Off
State	Display boiler state on main screen	On/Off	On
Temperature Selection ID	Display Temperature ID	On/Off	Off
Temperature Selection	Enter temperature selection menu		

Table 8.J.1.7: Settings -> General Settings -> Other Settings -> Status Overview Settings -> Temperature Selection

Option	Description
Outside Temperature	Display outdoor temperature on main screen
Demand Based (Flow/DHW)	Display DHW or CH flow rate (Not Functional)
Supply Temperature	Display supply temperature on main screen (default)
DHW Temperature	Display DHW temperature on main screen
System Temperature	Display System temperature on main screen
Cascade Temperature	Display Cascade temperature on main screen

Table 8.J.2.0: Settings -> Boiler Settings

Menu Item	Function/Description
Boiler Parameters	Enter the Boiler Parameters menu
Module Cascade Settings	Enter the Module Cascade Settings menu

Table 8.J.2.1: Settings -> Boiler Settings -> Boiler Parameters

Parameter	Parameter Description	Unit/Option	Default Option
(1) CH Mode	Set the CH Mode	0: CH with RT Input 1: CH with RT Input & Outdoor Reset 2: CH with Full Outdoor Reset 3: CH with Permanent Demand 4: Analog Input for Setpoint 5: Analog Input for Power	1: CH with RT Input & Outdoor Reset
(3) CH Setpoint	Set the CH Setpoint	^{O}F (^{O}C)	159.8 (71.0)
(109) Calc. Setp. Offset	Set the offset for CH mode 1 & 2 calculated setpoint	^{O}F (^{O}C)	0.0 (0.0)
(110) CH Min Setpoint	Set the minimum CH setpoint	^{O}F (^{O}C)	85.1 (29.5)
(111) CH Max Setpoint	Set the maximum CH setpoint	^{O}F (^{O}C)	185.0 (85.0)
(5) Boiler Pump Overrun	Set the post-circulation time for the boiler/CH pump	sec.	60
(7) CH Hysteresis Up	Set the CH Hysteresis Up	^{O}F (^{O}C)	9.0 (5.0)
(112) CH Hysetesis Down	Set the CH Hysteresis Down	^{O}F (^{O}C)	7.2 (4.0)
(9) Anti Cycle Period	Set the burner Anti-Cycling Period	sec.	180
(10) Anti Cycle Temp. Mod.	Set the burner Anti-Cycling Differntial	^{O}F (^{O}C)	16.2 (9.0)
(14) Max. Power CH	Set the max. CH burner power	%	100
(15) Min. Power CH	Set the min. CH burner power	%	1
(19) Design Supply Temp.	Set CH setpoint when outdoor temperature equals Design Outdoor Temperature	^{O}F (^{O}C)	179.6 (82.0)
(20) Design Outdoor Temp.	Set the outdoor temperature at which CH setpoint is set to Design Supply Temperature	^{O}F (^{O}C)	10.4 (-12.0)

NOTE: Night Setback only available in CH mode 4 & 5.

Table 8.J.2.1 (cont.): Settings -> Boiler Settings -> Boiler Parameters

Parameter	Parameter Description	Unit/Option	Default Option
(21) Baseline Supply Temp.	Set CH setpoint when outdoor temperature equals Baseline Outdoor Temperature	°F (°C)	104.0 (40.0)
(22) Baseline Outdoor Temp.	Set the outdoor temperature at which CH setpoint is set to Baseline Outdoor Temperature	°F (°C)	65.3 (18.5)
(23) Design Supply Min. Limit	Set the outdoor reset curve minimum setpoint	°F (°C)	68.0 (20.0)
(24) Design Supply Max. Limit	Set the outdoor reset curve maximum setpoint	°F (°C)	185.0 (85.0)
(25) Warm Weather Shutdown	Set outdoor temperature above which CH demand is blocked	°F (°C)	71.6 (22.0)
(26) Boost Temp Increment	Set the setpoint boost function temperature increment	°F (°C)	0.0 (0.0)
(27) Boost Time Delay	Set the setpoint boost function delay time	min.	120
(28) Night Setback Temp.	Set the CH setpoint night setback temperature	°F (°C)	9.9 (5.5)
		°F (°C)	71.6 (22.0)
(35) DHW Mode	Set the DHW mode	0: No DHW 1: DHW Store with Sensor 2: DHW Store with Thermostat	2: DHW Store with Thermostat
(113) Max. Power DHW	Set the maximum DHW burner power	%	100
(114) Min. Power DHW	Set the minimum DHW burner power	%	0%
(36) DHW Tank Hyst. Down	Set the DHW tank hysteresis down	°F (°C)	7.2 (4.0)
(37) DHW Tank Hyst. Up	Set the DHW tank hysteresis up	°F (°C)	9.0 (5.0)
(38) DHW Tank Supply Extra	Set the DHW tank supply setpoint offset	°F (°C)	54.0 (30.0)
(42) DHW Priority	Set the DHW priority mode	0: Time 1: Off 2: On	0: Time
(43) DHW Max. Priority Time	Set the maximum DHW priority time	min.	30
(44) DHW Pump Overrun	Set the DHW post-circulation time	sec.	60
(48) DHW/Tank Setpoint	Set the DHW setpoint	°F (°C)	120.2 (49.0)
(115) DHW Store Setpoint	Set the DHW storage setpoint	°F (°C)	180.0 (82.5)
(116) Prog. Input 1.	**Do Not Change Without Factory Approval.** Select the function for programmable input 1	# 0-3 0: Disabled 1: Water Pressure Sensor 3: Water Pressure Switch	3: Water Pressure Switch
(117) Prog. Input 2.	**Do Not Change Without Factory Approval.** Select the function for programmable input 2	# 0-4 0: Disabled 1: DHW Flow Sensor 2: DHW Flow Switch 3: CH Flow Sensor 4: CH Flow Switch	4: CH Flow Switch
(118) Prog. Input 3.	**Do Not Change Without Factory Approval.** Select the function for programmable input 3	# 0-2 0: Disabled 2: Gas Pressure Switch	2: Gas Pressure Switch
(120) Prog. Input 5.	**Do Not Change Without Factory Approval.** Select the function for programmable input 5	# 0-1 0: Disabled 1: Return Sensor	1: Return Sensor
(121) Prog. Input 6.	**Do Not Change Without Factory Approval.** Select the function for programmable input 6	# 0-2 0: Disabled 1: Flue Sensor 2: Flue Switch	1: Flue Sensor

Table 8.J.2.1 (cont.): Settings -> Boiler Settings -> Boiler Parameters

Parameter	Parameter Description	Unit/Option	Default Option
(122) Prog. Input 7.	**Do Not Change Without Factory Approval.** Select the function for programmable input 7	# 0-5 0: Disabled 1: Flue 2 Sensor 3: Cascade Sensor 5: CH Sensor	3: Cascade Sensor
(123) Prog. Input 8.	**Do Not Change Without Factory Approval.** Select the function for programmable input 8	# 0-8 0: Disabled 1: DHW Return Sensor 3: Air Pressure Switch (NO) 4: Air Pressure Switch (NC) 5: Flue Pressure Switch (NO) 6: Flue Pressure Switch (NC)	6: Flue Pressure Switch (NC)
(124) Prog. Input RT.	**Do Not Change Without Factory Approval.** Select the function for the programmable RT input	# 0-1 0: Disabled 1: Roomstat Input	1: Roomstat Input
(125) Prog. Output 1.	**Do Not Change Without Factory Approval.** Select the function for programmable output 1	0: Disabled 1: Module Pump 2: CH Pump 3: DHW Pump 4: System Pump 5: Cascade Pump 6: Alarm Relay 7: Filling Valve 8: LPG Tank 9: External Igniter 10: Air Damper	2: CH Pump
(126) Prog. Output 2.	**Do Not Change Without Factory Approval.** Select the function for programmable output 2	0: Disabled 1: Module Pump 2: CH Pump 3: DHW Pump 4: System Pump 5: Cascade Pump 6: Alarm Relay 7: Filling Valve 8: LPG Tank 9: External Igniter 10: Air Damper	6: Alarm Relay
(127) Prog. Output 3.	**Do Not Change Without Factory Approval.** Select the function for programmable output 3	0: Disabled 1: Module Pump 2: CH Pump 3: DHW Pump 4: System Pump 5: Cascade Pump 6: Alarm Relay 7: Filling Valve 8: LPG Tank 9: External Igniter 10: Air Damper	0: Disabled

Table 8.J.2.1 (cont.): Settings -> Boiler Settings -> Boiler Parameters

Parameter	Parameter Description	Unit/Option	Default Option
(128) Prog. Output 4.	**Do Not Change Without Factory Approval.** Select the function for programmable output 4	0: Disabled 1: Module Pump 2: CH Pump 3: DHW Pump 4: System Pump 5: Cascade Pump 6: Alarm Relay 7: Filling Valve 8: LPG Tank 9: External Igniter 10: Air Damper 17: 3-way Valve CH 18: 3-way Valve DHW 19: 3-way Valve CH (powered when Idle 20: 3-way Valve DHW (powered when Idle)	3: DHW Pump
(133) Mod. Pump dT	Set the modulating pump target delta temperature	°F (°C)	19.8 (11.0)
(134) Mod. Pump Start Time	Set the modulating pump start up time	sec.	240
(135) Mod. Pump Type	Set the modulating pump model	Linear, Linear Inv.	Linear
(136) Mod. Pump Mode	Set the modulating pump mode	On/Off, Modulating, Fixed 20% - 100%	On/Off
(137) Mod. Pump Min Pwr	Set the modulating pump minimum duty cycle	%	10
(138) Appliance Type	Set the appliance type	50: PFC-625 (NAT) 51: PFC-750 (NAT) 52: PFC-625 (LP 53: PFC-750 (LP)	Model Dependent
(139) Dair Configuration	Enable/disable the De-Air function	0, 1, 2	1
(107) Anti Legionella Day	Select the day for the anti-legionella cycle	Sunday – Saturday	Sunday
(108) Anti Legionella Hour	Select the time for the anti-legionella cycle	hrs.	1
(205) Frost Protection	Enable Frost Protection	Enabled/Disabled	Enabled
(206) Anti-Legionella	Enable Anti-Legionella Protection	Enabled/Disabled	Enabled

Table 8.J.2.2: Settings -> Boiler Settings -> Module Cascade

Parameter	Parameter Description	Unit/Option	Default Option
(184) Burner Address	Set the cascade burner address	Stand-alone Managing Dep. 1-7	Stand-alone
(72) Permit EmergencyMode	Enable/disable the cascade emergency mode	yes/no	Yes
(74) Emergency Setpoint	Set the emergency mode setpoint	°F (°C)	158.0 (70.0)
(75) Delay Per Start Next Mod.	Set the delay time before the next module is started	sec.	300
(76) Delay Per Stop Next Mod.	Set the delay time before the next module is stopped	sec.	120
(142) Delay Quick Start Next	Set the fast delay time before the next module is started	sec.	60
(143) Delay Quick Stop Next	Set the fast delay time before the next module is stopped	sec.	30
(77) Hyst. Down Start Module	Set the hysteresis down after which a module is started	°F (°C)	9.0 (5.0)
(78) Hyst. Up Stop Module	Set the hysteresis up after which a module is stopped	°F (°C)	7.2 (4.0)

Table 8.J.2.2 (cont.): Settings -> Boiler Settings -> Module Cascade

Parameter	Parameter Description	Unit/Option	Default Option
(144) Hyst. Down Quick Start	Set the fast hysteresis down after which a module is started	°F (°C)	18.0 (10.0)
(145) Hyst. Up Quick Stop	Set the fast hysteresis up after which a module is stopped	°F (°C)	10.8 (6.0)
(146) Hyst. Up Stop All	Set the hysteresis up at which all modules are stopped	°F (°C)	14.4 (8.0)
(147) Number of Units	Set the no. of modules expected in the cascade system	#0-8	1
(148) Power Mode	Set the power mode	#0-3	3
(79) Max. Setp. Offset Down	Set the maximum setpoint offset down	°F (°C)	0.0 (0.0)
(80) Max. Setp. Offset Up	Set the maximum setpoint offset up	°F (°C)	5.4 (3.0)
(81) Start Mod. Delay Factor	Set the setpoint modulation delay time	min.	10
(82) Next Module Start Rate	Set the next module start rate	%	80
(83) Next Module Stop Rate	Set the next module stop rate	%	25
(84) Module Rotation Interval	Set the rotation interval	days	5
(149) First Module to Start	Set the first module to start in the rotation cycle	#	1
(152) PwrMode2 Min Power	Set the power mode 2 minimum power	%	20
(153) PwrMode2 Hysteresis	Set the power mode 2 hysteresis	%	40
(154) Post-Pump Period	Set the cascade post-circulation period	sec.	60
(155) Frost Protection	Set the frost-protection setpoint	°F (°C)	50

K. SYSTEM TEST

Table 8.K.0: System Test

Parameter	Parameter Description	Unit/Option
Test State	Select the system test mode	0: Off 1: Fan Max 2: Low Power 3: Ignition Power 4: High Power 5: CH Max 6: Max Temperature 7: LWCO/Air Int 8: LWCO 2
Fan Speed	Display the actual fan speed	RPM
Ionization	Display the actual ionization current	µA

L. INSTALLER MENU CODE

The Installer access only Menus are accessible by inputting the proper PIN number into the PASSWORD screen of the User Menu. The following menus require the Installer Password to access:

Boiler Parameters

Module Cascade Settings

Settings → Boiler Settings → BOILER PARAMETERS

Settings → Boiler Settings → MODULE CASCADE SETTINGS

Use the "↑" and "↓" buttons to select the proper number for the flashing place in the PIN. Pressing ENTER or RIGHT will advance to the next digit. If an incorrect number is selected, press "←" to reselect.

Once the 4-digit passcode has been entered, press "ENTER" or "→" once to display the Installer access only menus.

NOTICE

Installer Code is 0231

Figure 8.4: Installer Menu Password Screen

M. OUTDOOR RESET OPERATION

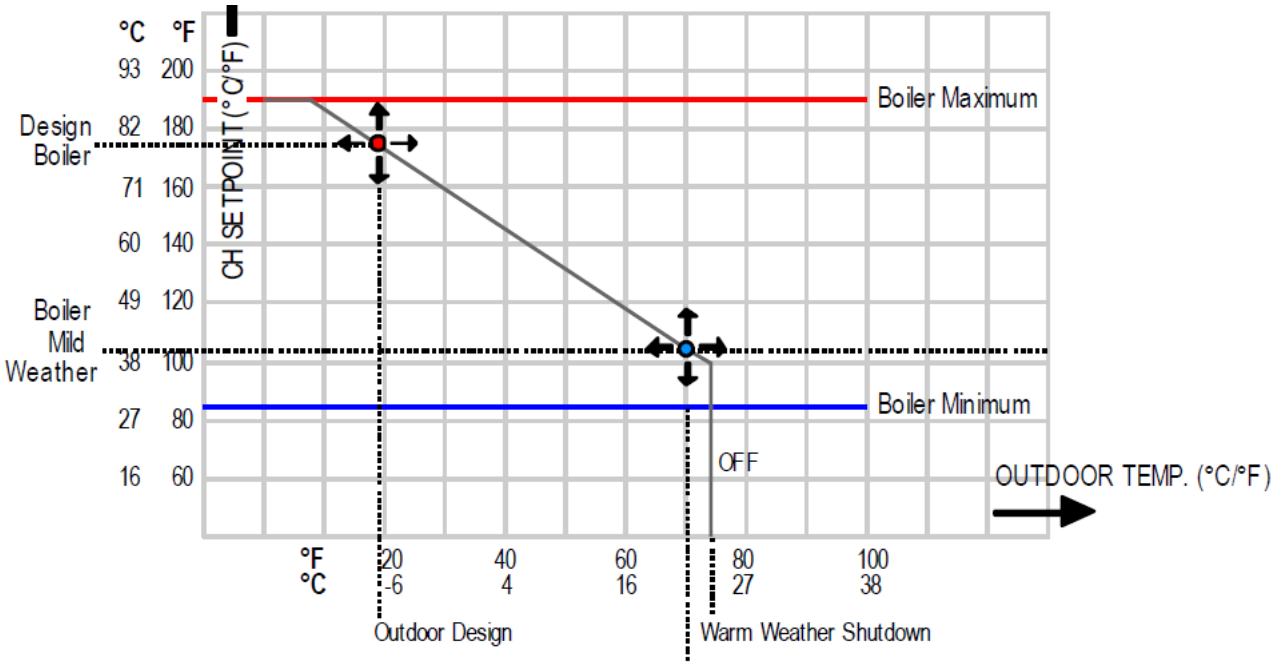


Figure 8.5: Outdoor Reset Curve Logic

All Series PFC™ 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 8.5 above visualizes the curve that is controlled by parameters 19 through 27.

1. The Boiler Design Temperature (19) and Outdoor Design Temperature (20) control the maximum setpoint and the temperature at which it will be targeted.
2. The Boiler Mild Weather Temperature (21) and Outdoor Mild Weather Temperature (22) control the minimum setpoint and temperature at which it will be targeted.
3. The Minimum CH setpoint (23) controls how low the calculated setpoint can fall.
4. The maximum CH setpoint (24) controls how high the calculated setpoint can rise when boost is active.
5. The Mild Weather Shutdown Temperature (25) allow for control over what outdoor temperature the boiler will begin ignoring CH demands.
6. The Boost Function Increment (26) 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

Outdoor Reset Parameters	Parameter Function	Unit/Value	Default Options
19	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 180°F when the outdoor temperature is 23°F or lower.	°F (°C)	179.6 (82.0)
20	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 (°C)	11.3 (-11.5)
21	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 (°C)	100.4 (38.0)
22	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 (°C)	68.0 (20.0)
23	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 (°C)	79.7 (26.5)
24	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 (°C)	179.6 (82.0)
25	Warm Weather Shutdown Temperature – Outdoor temperature that will block all CH demands until temperature falls below this value.	°F (°C)	71.6 (22.0)
26	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 (°C)	0.0 (0.0)
27	Boost Function: Delay – Time delay before boost function activates during a single demand.	min.	120

N. IGNITION SEQUENCE

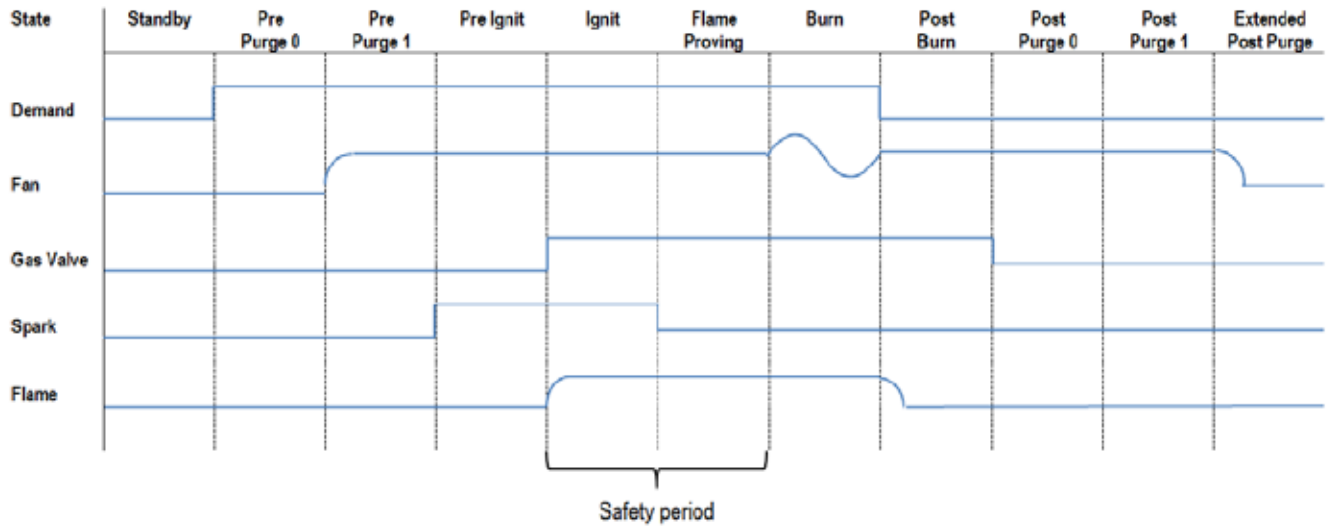


Figure 8.6: Ignition Sequence

Figure 8.6 shows a typical ignition and burn cycle for the Series PFC™ boiler. Pre-purge and Post Pure periods are shown in a compressed fashion to show the ignition process in detail.

1. Boiler receives a demand either CH or DHW.
2. Blower ramps up to ignition high speed to prove air flow.
3. Blower ramps down to ignition speed and holds for Pre-purge period of 30 seconds.
4. Spark is initiated 1 second before gas valve.
5. Gas valve opens.
6. Gas valve remains open for flame proving period. If no flame is detected, the gas valve closes and the blower moves to Post-purge.
7. If flame is detected, the boiler will begin to modulate to maintain setpoint until the demand is removed.
8. Once demand is removed, gas valve closes and blower moves to Post-purge for 30 seconds.
9. After Post-purge, blower shuts down and awaits next demand.

O. ADDITIONAL SAFETY FUNCTIONS

1. *Ignition Failure Protection*: The Series PFC™ control allows for 1 failed ignition attempts before the control goes into a lockout state showing “IGNITION ERROR (1)”. Manual control reset is required, this lockout can be reset by pressing and holding the reset button, left most button, on the display. The control can also be manually reset by pressing the “**RESET**” button below the control state LED on the main control board.

2. *Flame Failure Protection*: The Series PFC™ control 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 “TOO MANY FLAME LOSS (22)”. Manual control reset is required, this lockout can be reset by pressing the manual “**RESET**” button below the control state LED on the main control board.

3. *Flue Temperature Protection*: Series PFC™ 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 PFC™ control actively monitors the ionization current though the flame sensor. If Flame Signal drops to below 1.0 µA, the control will increase the minimum fan speed in order to attempt to maintain flame signal. If this fails, the control will enter a lockput state. 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 PFC™ control allows the unit to run at 1% input until the Stayburn temperature is reached at 193°F (88°F). The boiler will always shutdown at this temperature and will never exceed it. The Series PFC™ 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). If the Stayburn temperature is exceed a “MAX TEMP ERROR (15)” will be produced.

6. *Frost Protection*: The Series PFC™ 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 50°F (10°C) the boiler pump will start. If the temperature continues to fall the burner will ignite to and heat the unit at minimum input until the supply temperature reaches 59°F (15°C).

7. *Filling Protection (Optional)*: The Series PFC™ control comes equipped with connections to install a pressure switch to monitor system pressure. This connection has a jumper installed by default across dry contacts. DO NOT USE a high voltage contact for this purpose.

8. *De-air*: Upon boiler power initiation, the Series PFC™ 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 PFC™ control comes equipped with a probe style LWCO located on the supply pipe. 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 PFC™ control monitors a pressure switch that will enter the boiler into a blocking state. This switch will display “BLOCKED CONDENSATE FLUE PRESSURE ERROR (156)”. Clearing of the flue or condensate line will automatically clear this error.

8. Once demand is removed, gas valve closes and blower moves to Post-purge for 30 seconds.

9. After Post-purge, blower shuts down and awaits next demand.

P. MULTIPLE BOILERS

1. Multiple Boiler Wiring: The connection from the managing boiler to the dependent boilers should be in parallel.
   a. Figures 8.9 and 8.10 shows the wiring configurations. This method creates independent connections to each dependent boiler to reduce risk of communication loss between boilers.
   b. Each boiler controls its own “General” pump that operates any time that boiler is operating. It is extremely important to have water flow through the boiler during burner operation.
   c. All external inputs (Outdoor Temperature Sensor, DHW Tank Temperature Sensor and System Sensor) must be connected to the managing boiler.
   d. The domestic hot water (DHW) circulating pump should be connected to the managing boiler.

e. The central heating (CH) circulating pump(s) should be connected to the managing boiler if they are intended to be controlled by the boiler system.

2. Multiple Boiler Address & Menu Options: In order to operate multiple boilers in cascade, a unique address must be assigned to each of the dependent boilers.
   a. To access the cascade menu:
      i. Press the "MENU" button and select the following:
         Settings →
            Boiler Settings →
               MODULE CASCADE SETTINGS
      ii. Use the "↑" and "↓" buttons to select the proper number for the flashing place in the PIN. Pressing "ENTER" or "→" will advance to the next digit. If an incorrect number is selected, press "←" to reselect.
      iii. Once the 4-digit passcode has been entered, press "ENTER" or "→" once to display the Installer access only menus.
      iv. Use the "↑" and "↓" buttons to select the scroll through the parameter list. Descriptions and default parameters for Cascade System operation can be seen in Table 8.J.2.2.
      v. Press "ENTER" or "→" to select the parameter to change. The parameter value will then be highlighted and flash.
      vi. Use the "↑" and "↓" buttons to select the proper parameter option. Pressing "ENTER" to finalize selection.
      vii. Once all parameters are set, press "BACK" or "←" to return to the main display screen.
   b. The default address for each boiler is "Stand-Alone".
   c. Selecting a boiler address of "Managing" assigns the boiler as the manager. Be sure that this is the boiler that is connected to the system pumps and external sensors.
      i. Once a boiler is configured as the managing boiler, continue on to the remaining cascade parameter options listed in Table 8.J.2.2. The remaining options are intended to operate well with most boiler systems using the default parameters. However, the descriptions shown allow the experienced installer or service person to modify the operation of the cascade system if improvements are warranted.
      ii. The main screen with display  in the upper left hand corner to let the user know this is the managing boiler.
      iii. Number of Units (147) must match the total number of boilers in the cascade system, including the managing boiler. If any of the expected number of dependent boilers is not present, the control will generate a "Comm. Lost with module" (200) warning error.
   d. Once a boiler is configured as a dependent boiler, the control switch, shown in Figure 8.7, must be in the OFF position to operate.
      i. The cascade depending boiler address must be set in logical numbered order starting from 1.
      ii. The main screen will display  in the upper left hand corner as well as "Dependent" in the center of the screen to let the user know this is a dependent boiler. Dep. #1 will show a "2" as shown in the example.
   f. Figure 8.8 illustrates the range defined by the Max Offset Down and Max Offset Up parameter.

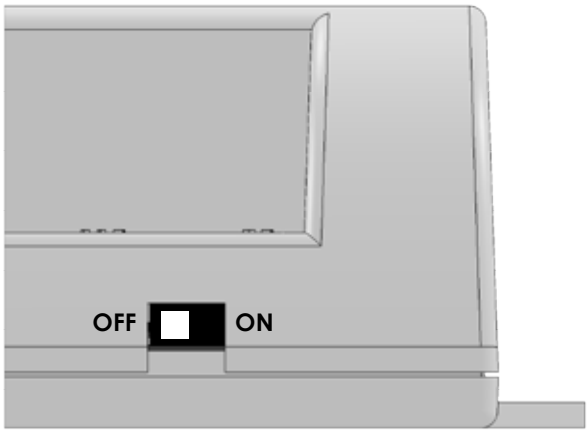


Figure 8.7: Dependent Cascade Boiler Control Switch Position

NOTICE

ALL DEPENDING boilers in the cascade system must have the control switch, shown in Figure 8.6, to the OFF position to operate.

NOTICE

(147) Number of Units must match the total number of units in cascade including the Managing boiler for the cascading system to operate correctly.

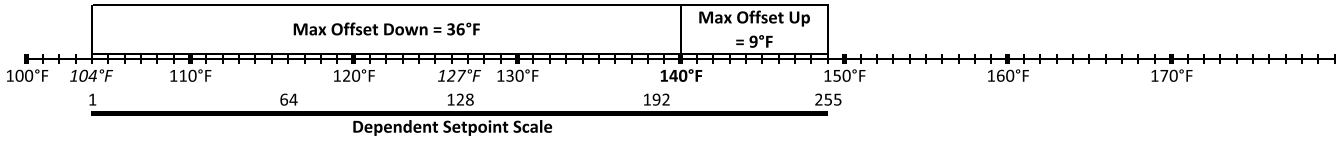


Figure 8.8: Dependent Setpoint

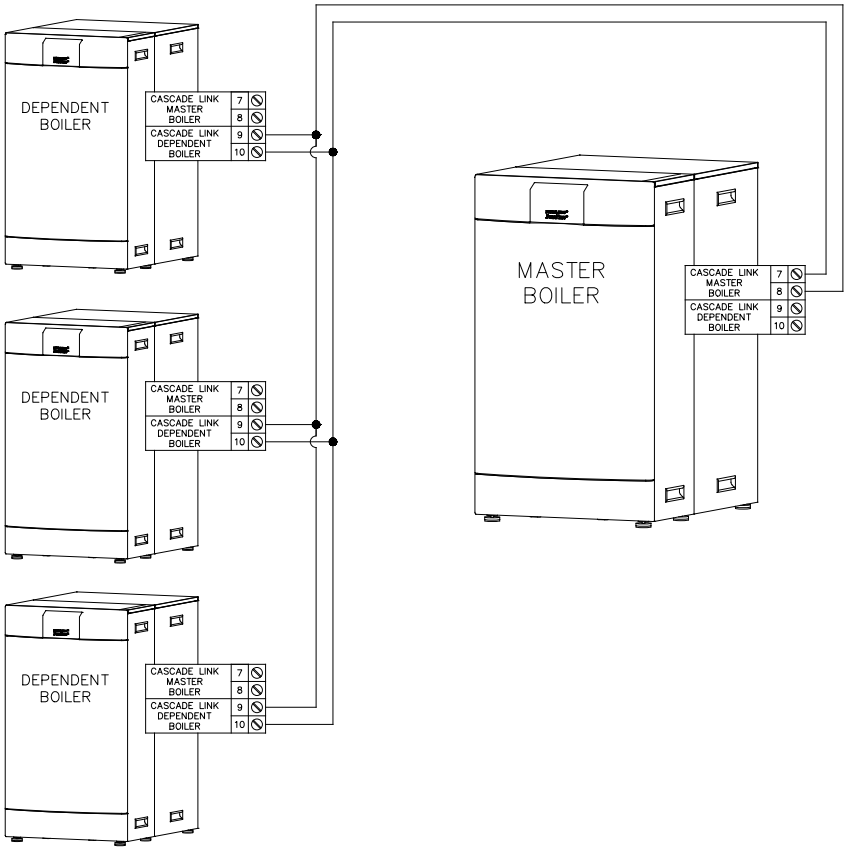


Figure 8.9: Multi Boiler Wiring - Daisy Chain

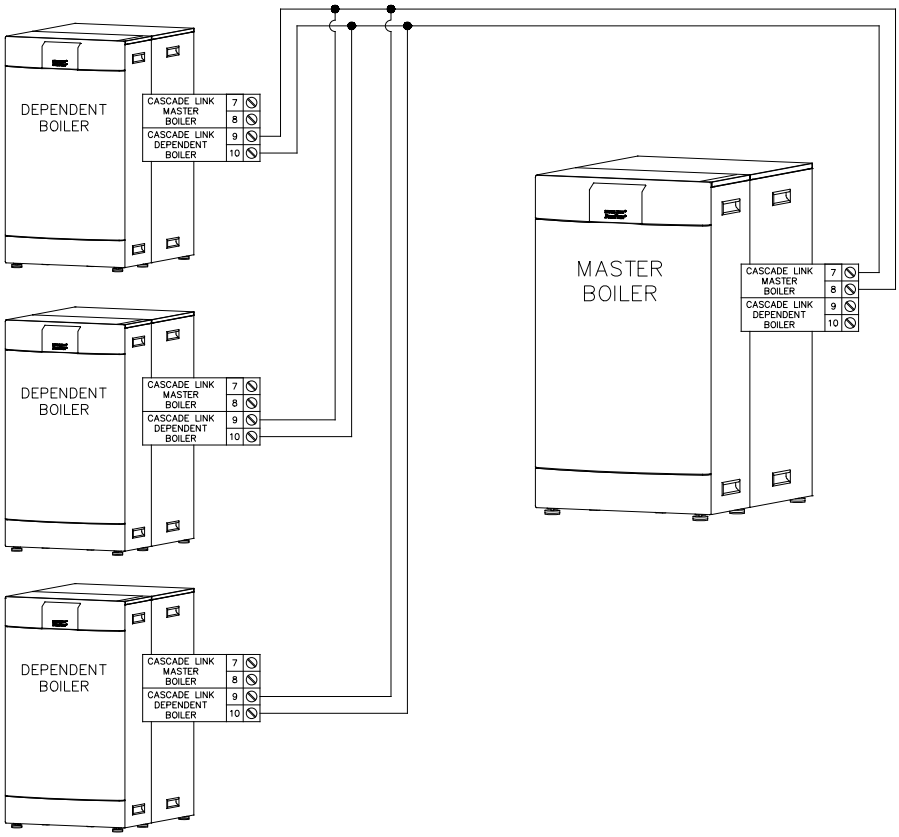


Figure 8.10: Multi Boiler Wiring - Independent Connection

9. START-UP PROCEDURE

A. GENERAL

1. Confirm all water, gas and electricity supplies to the boiler are 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. Be sure that the expansion tank is sized, installed and charged in accordance with the manufacturer's instructions and system requirements.

2. Fill the boiler and system with water, making certain to purge all air from the system.

3. Check joints and fittings throughout the system for leaks and repair as required. Do not allow water to drip on the boiler to prevent damage from corrosion.

C. CHECK ELECTRIC POWER

1. Turn off the burner switch on the cover of the electric tray located on the left side of the boiler display under the heat exchanger front jacket panel. "○" indicates that the switch is off while "|" indicates on.

2. Turn on the main power, verify that the display, located on the front of electrical enclosure tray, is lit. Check to be sure that the incoming power is within specification. The incoming power should be phase- neutral (Voltage between Neutral & Ground approximately 0 volts) with minimal electrical noise.

Table 9.1: Main Supply Electrical Specifications

	Minimum	Maximum
Supply Voltage	102 volts	132 volts
Supply Frequency	40 hertz	70 hertz

3. The voltage reading between the hot (L1) and neutral should approximately equal the voltage between hot (L1) and earth ground (GND). The voltage reading between neutral (L2) and earth ground (GND) should be approximately 0 VAC. If the readings are significantly different than this, assure that an appropriate earth ground is connected to the system. The Series PFC™ main control is not designed to operate in a phase-phase power supply configuration.

D. CHECK GAS PIPING

1. Turn on the gas shut-off valve to the burner. The valve is located in the vestibule area at the front of the boiler.

2. Open the gas shut-off valve on the rear of the boiler and allow the gas header to be pressurized. Press the reset buttons on both gas pressure switches to be sure that they are reset and operational. The burner LCD displays on the control cabinet will read "GAS PRESSURE ERROR" if the gas pressure switches are not reset.

3. Connect a manometer to the incoming gas line and be sure that the pressure is regulated to between 3.5" and 13.5" of water at the inlet to the boiler. Contact the gas supplier if the pressure to the boiler is too high or too low.

4. Perform gas line pressurization test while the manual shut-off valves to the burners are in the "OFF" position. This will prevent damage to the gas safety valves during the test due to over-pressurization. For boilers running on LP gas the minimum pressure to the valve is 8" W.C.

5. Check the incoming gas pressure while the boiler is running to be sure that the pressure doesn't drop to an unacceptable level during operation. A pressure drop between static and running pressure of more than 2" W.C. can cause hard or failed ignitions.

E. CHECK OPERATION

The installation is not complete until the following systems are tested and the control is set up:

1. Test combustion emissions on the burner.

2. Test the operating control on the burner.

3. Test the high limit for the burner.

4. Test the interlock circuit (LWCO, etc.).

The following paragraphs (F-H) describe this testing.

F. COMBUSTION TEST

1. Disconnect the CH thermostat (#34 & #35) and DHW tank thermostat/sensor input (#32 & #33) or set these inputs to ensure no call for heat is present. If the system volume is low a CH and/or DHW demand may need to be initiated to keep water temperatures below the boiler setpoint.

2. Turn on the electrical power and all manual gas valves to the burner. Be sure the display on the front of the boiler is lit. The display should show an outline of a house, CH/DHW Setpoint, Outdoor Temperature, and the Time.

3. Refer to Section 8, Boiler Control & Operation, 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.
7. Combustion Test at High Fire (100% Modulation):
   a. Enter the "Main Menu"
      • "System Test"
         • "Test State" → "High Power"
   b. The burner will ignite and after a short stabilization period, run at 100% of modulation.
   c. Verify that the fan speed indicated is within 100 rpm of the High Fire fan speed listed in Table 12.3.
   d. Using a suitable, calibrated combustion analyzer determine the exhaust emissions of the boiler.
   e. Use Table 5.5 & Table 5.6, Combustion Settings, to determine the appropriate emissions levels.
   f. If emissions are incorrect, adjust both throttle screws the same amount to correct the combustion. Note that increasing the throttle adjustment (counterclockwise) will decrease O_2 and increase the CO_2. Decreasing the throttle (clockwise) will have the opposite effect.
8. Combustion Test at Low Fire (1% Modulation):
   a. Enter the "Main Menu"
      • "System Test"
         • "Test State" → "Low Power"
   b. The burner will ignite and after a short stabilization period, run at 1% of modulation.
   c. Verify that the fan speed indicated is within 100 rpm of the Low Fire fan speed listed in Table 12.3.
   d. Using a suitable, calibrated combustion analyzer determine the exhaust emissions of the boiler.
   e. Use Table 5.5 & Table 5.6, Combustion Settings, to determine the appropriate emissions levels.
   f. If emissions are incorrect, adjust both offset screws the same amount to correct the combustion. Note that increasing the offset adjustment (clockwise) will decrease O_2 and increase the CO_2. Decreasing the offset (counterclockwise) will have the opposite effect.
9. Turn System Test mode to "Off" so that the boiler will modulate correctly in accordance with the load.
10. After removing the analysis probe from the vent pipe, securely screw the analysis port cap back onto the vent.
11. Record the combustion readings in the "Start-up Combustion Record" in Appendix A. It is very important to record all the information requested on the sheet for follow up and troubleshooting.

G. VALVE ZEROING PROCEDURE

In case of valve replacement or operational issues with the boiler, the procedure below can be used to re-establish an equal setting on both valves.

The desired CO_2 for Natural Gas is 8.80 % with an inlet gas pressure of nominal 7.0 INWC for both models. The desired CO_2 for LP gas is 10.0% with an inlet pressure of 11" w.c. for the PFC-625 and 9.8% for the PFC-750. The procedure for setting and adjusting the duel gas valves is as follows:

1. With the boiler powered off and no call for heat possible. Turn the throttle screw all the way in on one of the gas valves by rotating it clockwise until you just meet resistance. (Refer to Figure 5.2 for throttle screw location).
2. Note the radial location and turn the throttle screw out counterclockwise 7 full turns for Natural gas and 4.5 turns for LP gas. You should not meet resistance. If you do, ensure you are rotating in the correct direction.
3. Complete Steps 1 and 2 on the second gas valve. The order in which you initially set each gas valve will not affect the adjustments.
4. Ensure proper water flow and power boiler on placing it in high fire mode (See Table 8.K.0). If the boiler does not ignite, increase the throttle screws in 1/2" turn increments until ignition is achieved. Give the boiler time to reach its max fan speed and reach a steady state approximately 1 to 2 minutes. Once steadied the CO_2 should read close to 8.80% if it does not proceed to step 5 otherwise skip to step 6.
5. Any adjustment made to one valve should be made exactly the same on the other gas valve. Start with making small 1/8 turn adjustments on both until you reach your desired CO_2 percentage. If the CO_2 at high fire is above 8.8% turn both throttle screws clockwise. If it is below 8.8% turn both throttle screws counter clockwise. After each adjustment allow at least 45 seconds for the CO_2 reading to adjust. Repeat this step until you reach the desired CO_2%.
6. With high fire CO_2 at 8.8% turn the boiler to low fire mode. If low fire is near 8.8% skip to step 8 otherwise proceed to step 7.
7. Low fire adjustments are made using the offset screw on each valve. Any adjustment made to one valve should be made exactly the same on the other valve. Start with making small 1/8 turn adjustments on both until you reach your desired CO_2 percentage. If the CO_2 at low fire is reading higher than 8.8 % turn both offset screws counter clockwise. If it is below 8.8 % turn both offset screws clockwise. (refer to Figure 5.2 for screw location) Repeat this step until you reach the desired CO_2%. Note: Adjustments on low fire offset screws are opposite direction to the high fire throttle screw adjustments and should only be made in low fire mode.
8. Set the boiler back to high fire mode and monitor CO_2. Significant adjustments to the valve offset can cause high fire settings to drift. If the CO_2% is no longer close to 8.8% repeat steps 5-8 until the readings are accurate are at the desired setting for both high and low fire.

H. TEST OPERATING LIMIT

Check that the burner will shut down when the supply water temperature reaches the control setpoint + 9°F (5°C).

1. Enter the “Installer Menu” by pressing and holding the “Select” & “Menu” keys simultaneously for 3 seconds:
   a. Enter the “Main Menu”
      • “System Test”
      • “Test State” → “High Power”
   b. The burner will ignite and after a short stabilization period, run at 100% of modulation.
2. On the LCD display for each burner, note the boiler setpoint by accessing the User Menu:
   a. Enter the “Main Menu”
      • “Settings”
         • “Boiler Settings”
            • “Boiler Parameters”
   b. Use the “⇧“ and “⇩” keys to scroll through the CH and DHW setpoints (Refer to Appendix B for an overview of the User Menu).
3. Monitor the boiler temperature on the temperature gauge (factory supplied for field mounting) and on the Status display.
   a. Enter the “Main Menu”
      • “Information”
         • “Boiler Status”
   b. The boiler should shut down at the boiler setpoint plus 9°F (5°C).
   c. If it does not shut down, turn off the boiler and contact your PB Heat, LLC representative.

I. TEST HIGH LIMIT

Check that the burner will shut down when the high limit circuit is open.

1. On the LCD display for the Dependent burner enter the “Installer Menu” by pressing and holding the “Select” and “Menu” keys simultaneously for 3 seconds.

a. Enter the “Main Menu”

- “System Test”
- “Test State” → “Low Power”

b. The burner will ignite and, after a short stabilization period, run at 1% modulation

2. Disconnect the wire connection to the high limit (the 4-pin connector located on the supply line header).
   a. The burner should shut down immediately and enter a lockout condition.
   b. Press the reset button on the control to enable normal operation.
   c. If it does not shut down turn off the boiler and contact your PB Heat, LLC representative.
3. Turn System Test mode to “Off” so that the boiler will modulate correctly in accordance with the load.

Table 9.2: Combustion Settings

CO_2% Maximum, Nominal and Minimum Allowances								
Boiler Model	PFC-625				PFC-750			
Gas Type	Natural		LP		Natural		LP	
Firing Rate	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Low Fire
Min	8.6	8.6	9.8	10.3	8.6	8.6	9.6	9.6
Nominal	**8.8**	**8.8**	**10.0**	**10.5**	**8.8**	**8.8**	**9.8**	**9.8**
Max	9.0	9.0	10.2	10.7	9.0	9.0	10.0	10.0

J. LIGHTING & OPERATING INSTRUCTIONS

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.

WHAT TO DO IF YOU DO SMELL GAS

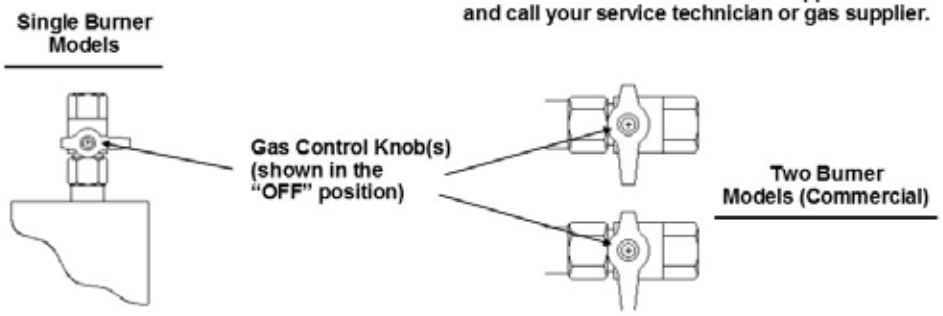
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

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.

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(s) 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(s) 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.



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(s) clockwise ↻ "OFF". Handle will be perpendicular to pipe, do not force.

(PF) 9512 REV1

Figure 9.1: Lighting & Operating Instructions

10. TROUBLESHOOTING

A. LOCKOUT ERRORS

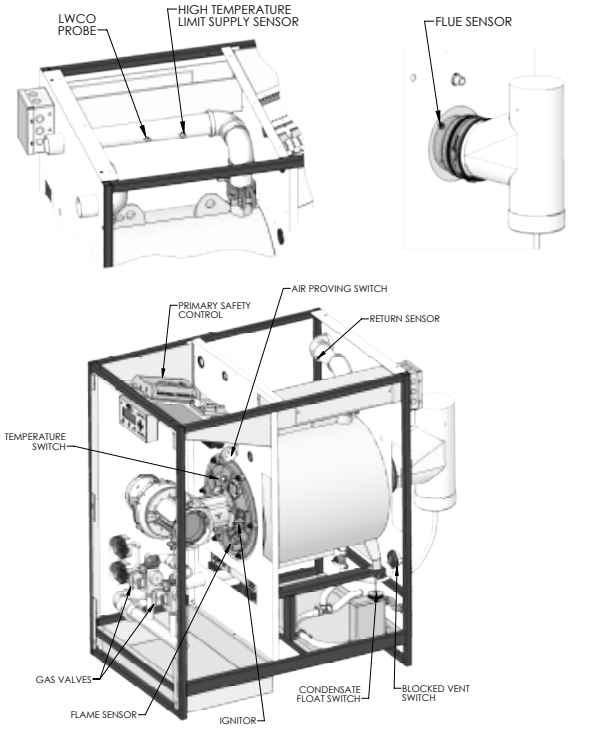


Figure 10.1: Additional Safety Locations

1. When a lockout error occurs the display will flash, show which error occured and the wrench symbol.
2. Lockout codes require that the control be manually reset either by holding the 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.
4. These error messages and some suggested actions are listed in Table 10.1.

B. BLOCKING ERRORS

1. When a blocking error occurs the display will flash, show which error occured and the wrench symbol.
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. These error messages and some suggested actions are listed in Table 10.3.

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. Boiler pump and CH pump start.
4. Blower begins Pre-purge for 30 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. Pumps remain energized for pump post purge period.
14. Full unit standby.

E. TYPICAL OPERATION CYCLE – DHW

1. Boiler is in standby. No demand. Domestic Faucet symbol is constant.
2. DHW demand is applied. Domestic Faucet symbol begins flashing.
3. Boiler pump starts.
4. Blower begins Pre-purge for 30 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.**

⚠ 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.**

⚠ 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.

⚠ 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 Errors

Error Number	Error Display	Corrective Action
0	E2PROM_READ_ERROR	Internal Software error. Replace control.
1	IGNIT_ERROR	ONE unsuccessful ignition attempt. – Check for spark by ear. Check for correct spacing on ignition & flame sensor as described in Section 10.E.5.b. – 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. – Go to last blocking error code. Correct cause.
5	FAN_ERROR_NOT_RUNNING	Fan is not running for more than 60 secs. – 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 – 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 Errors

Error Number	Error Display	Corrective Action
7	FAN_ERROR_TOO_FAST	Fan runs too fast for more than 60 seconds – 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.
13	APS_NOT_OPEN	Check short in APS switch.
14	APS_NOT_CLOSED_IN_PRE_PURGE	Blower not running & blocked air intake – Check air filter for any blockages. – Check air intakes for blockages.
15	MAX_TEMP_ERROR	Boiler supply temperature exceeded 195°F (90.5°C): – Check operation of general, CH, DHW and anyother system pumps. – Ensure sufficient flow through the heat exchanger. – Check for blockages of flue passages in combustion chamber. Blockages can lead to excess heat being trapped in the combustion chamber and cause delayed temperature rises. - OR - Thermal switch on the front burner plate has opened: – Check target wall and burner door insulation for degradation. – Look for signs of excessive recirculation of flue gases. – Thermal switch is located top center of the burner door. – Reset switch by pressing center button. – Ensure connection sand wiring are secure and sound.
16	FLUE_GAS_ERROR	Flue Temperature exceeded the maximum flue temperature limit (192.2°F (89°C)). – 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. – 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. – 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. – 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
25	TSUPPLY_DIFF_ERROR	The 2 supply sensors deviate too much for more than 60 seconds. Replace supply sensor. Check supply sensor wiring and connectors.
29	PSM_ERROR	Internal software error. Replace control.
30	REGISTER_ERROR	Internal software error. Replace control.
32	T_EXCHANGE_DIFF_ERROR	The 2 exchange sensors deviate too much for more than 60 seconds. Check water flow.

Table 10.1 (cont.): Lockout Errors

Error Number	Error Display	Corrective Action
33	LWCO_1_ERROR	Low water cut off error. – Check system for leaks and filling valve for operation, ensure there is no air in the system. – 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
34	LWCO_2_ERROR	Low Water Cut-Off 2 error.
35	APS_NOT_CLOSED_IN_POST_PURGE	Air Pressure Switch is not closing during post-purge cycle.
36	GAS_PRESSURE_ERROR	Gas pressure switch is open for more than E2_GPS_Timeout – Is the gas pressure within the range listed on the nameplate? – Press the reset buttons on each of the gas pressure switches located on the gas line inside the jacket.
37	AIR_DAMPER_LOCKING	More than 3 consecutive Air_Damper_Error have occurred.
38	FLUE_PRESSURE_LOCKING	More than 3 Blocked Flue/ Condensate Switch in 24 hours. – 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 Actions
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	WD_ERROR_XRL	Internal software error. If error persists, replace control.
105	HIGH_TEMP_ERROR	T_Supply and T_Supply_2 over High limit 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. – 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.
117	BLOCKED_DRAIN	Blocked drain switch is active/Open float switch circuit in condensate collector cap – 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. – Clean condensate system. – Check for broken wires or bad connections.
118	WD_COMM_ERROR	Watchdog communication error. If error persists, replace control.
119	RETURN_OPEN	Return Sensor open – 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 – 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 – 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 – 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 – 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 Number	Error Display	Corrective Actions
124	FLUE2_OPEN	Flue 2 sensor open
125	OUTDOOR_OPEN	Outdoor Sensor open – Check sensor wiring for solid connection and continuity. Replace wiring if bad or repair break. – Check for resistance though 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 kΩ and 500 Ω. If no resistance is present, replace sensor.
127	SUPPLY_SHORTED	Supply Sensor 1 Shorted – 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. Resistance should be between 15 kΩ and 500 Ω. If no resistance is present, replace sensor.
128	SUPPLY2_SHORTED	Supply Sensor 2 Shorted – 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. Resistance should be between 15 kΩ and 500 Ω. If no resistance is present, replace sensor.
129	DHW_SHORTED	DHW Sensor Shorted – Check for resistance through the sensor by touching meter lead across both pins on the sensor. Resistance should be between 15 kΩ 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 kΩ 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 kΩ 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. Frequency of incoming power is either less than 40Hz or greater than 70Hz. – If power supply is from a generator, check that the system is phase/neutral (line voltage between hot/ground) – Check boiler earth ground by assuring 0-5 VAC between neutral and ground.
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.
163	FLUE_BLOCKED	Flue is blocked, demand needs to be stopped with fan at ignition speed, but no error needed to be stored at this time/Combustion chamber pressure exceeds 3.5” w.c. – Check for blocked exhaust outlet. – Check the combustion chamber pressure (height difference between condensate vessels.)

Table 10.2 (cont.): Blocking Errors

Error Number	Error Display	Corrective Actions
164	LOWEXFLOW_PROTECTION	Flow is too low, demand needs to be stopped with fan at ignition speed, but no error needed 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 102 Volts.
166	VSUPPLY_TOO_HIGH	Main supply voltage too high for more than 60 seconds – Check supply voltage or values above 132 Volts.

Table 10.3: Warning Errors

Error Number	Error Display	Corrective Actions
200	CC_LOSS_COMMUNICATION	Cascade System: Managing cascade control lost communication with one of the depending controls. – Check if expected number of dependent boilers are all powered on and wired to managing boiler. – Check for broken wires or bad connections on terminals #24 & #25 if dependent boilers or #26 & #27 if managing boiler. – If error persists, reference proper connection and set up in Section 8 of this manual.
202	APP_SELECTION_ERROR	Unknown appliance model is selected. Verify correct appliance model selection using Table 8.5.2.1 in this manual.
204	OUTDOOR_WRONG	Outdoor sensor is either open or shorted. Remove the wires from terminals #30 &#31 on the boiler and check the resistance between them. – If this reading is below 3000Ω check the reading at the sensor. – If the reading is the same at the sensor, replace the sensor. – If this reading is higher at the sensor, replace the wiring.
205	T_SYSTEM_WRONG	System sensor is either open or shorted. Remove the wires from terminals #28 &#29 on the boiler and check the resistance between them. – If this reading is below 3000Ω check the reading at the sensor. – If the reading is the same at the sensor, replace the sensor. – If this reading is higher at the sensor, replace the wiring. Note: Outdoor reset will not function with this error present.

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 THE START OF HEATING SEASON)

⚠ CAUTION

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

1. Check boiler room floor drains to assure proper drainage.
2. Check the function of the safety relief valve by performing the following test:
   a. Check the relief valve piping to determine that it is properly installed:
      i. No manual valves are to be between the relief valve and the boiler.
      ii. No manual valves on the outlet side of the relief valve.
      iii. No reduction in pipe size on the outlet side of the relief valve.
      iv. The outlet to the valve should be piped to within 12 inches of the floor away from people and pets to prevent personal injury in the event of valve discharge.
   b. Check the boiler operating temperature and pressure.

⚠ WARNING

Opening the relief valve will result in the discharge of hot water and/or steam. Be sure that there is no one near the outlet of the relief valve piping during this test. Failure to do so may result in severe personal injury or death.

   c. Lift the try lever on the relief valve to the fully open position and hold it for at least 5 seconds.
   d. Release the try lever and allow the relief 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 closed 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 their normal condition.
   g. Check again to confirm that the valve has closed completely and is not leaking.
3. Test the low water cutoff (LWCO) as described in Table 10.1 Error Number 33.
4. Test the limit operation as described in Section 9.

⚠ DANGER

When servicing or replacing components, be absolutely sure 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. Remove the right jacket panel and open the air plenum cover by removing (6) sheet metal screws. Inspect the inside of the plenum for any foreign debris that may have entered through the air intake opening. Also, check the screen for blockage.
6. Inspect the burner, by removing (6) hex nuts on the burner mounting plate and opening the combustion chamber as described in Section E below. Replace the burner if necessary.
7. With the boiler in operation, check that condensate is dripping from the condensate tubing. Check for any blockage or restriction in the condensate drain lines.

D. CONDENSATE SYSTEM CLEANING INSTRUCTIONS

1. Removal of Condensate Container:
   a. Close the manual gas shutoff valve at the rear of the boiler and turn off the burner service switch.
   b. Remove the right jacket panel.
   c. Remove the wing nut from the condensate collector container.
   d. Disconnect the condensate hose from the bottom of the heat exchanger.
   e. Disconnect the float switch wires from the wiring harness.
   f. Disconnect the blocked flue switch hose from the condensate hose tee assembly.
   g. Disconnect the vent drain hose.
   h. Lift the (condensate collector) container above the level of the other vent drain hose to empty some condensate from the system through the vent hose.
   i. Disconnect the condensate drain connection from the rear of the boiler and remove the container from the boiler.
2. Cleaning the Container:
   a. Dump the contents of the container and flush it with water.
   b. Be sure that there is free movement of liquid through the bottom port.
   c. Check for leaks at all of the hose clamps.
3. Re-installing the Container:
   a. Place the tank in position and attach the wing nut.
   b. Connect the hose to the heat exchanger drain. Reconnect the blocked flue switch hose to the barb fitting.
   c. Reconnect the vent hose.

d. Attach the drain hose to the outlet of the system.

e. Connect the wires to the blocked condensate float switch in the lid of the condensate container.

f. Fill the condensate container with 1-2 inches of water.

4. Restarting the Boiler:
   a. Open the manual gas valve at the rear of the boiler.
   b. Turn the burner service switch on.
   c. Observe the boiler function to make sure you see condensate flow.
   d. If no flow of condensate is evident, repeat this procedure.
5. If the problem persists it is possible that there is a problem with material deposits in the heat exchanger. Follow the Combustion Chamber Coil Cleaning Instructions in this section.

E. COMBUSTION CHAMBER COIL CLEANING INSTRUCTIONS

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

– a nylon or plastic brush (not steel or any other metal)

– "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 PFC™ side) so the flow can be observed.
   c. Remove the (4) 1/4-20 bolts from the venturi to air filter box.
   d. Disconnect union joint on gas inlet and disconnect the gas valve electrical connections.
   e. Remove the six 10 mm Allen bolts from the burner plate assembly. Disconnect wire leads to the spark igniter, flame sensor, and igniter ground. Disconnect one Molex (1x5) plug and one MatnLok (1x3) plug from blower motor.
   f. Pull the entire burner plate towards you to access the heat exchanger coils. It is heavy.
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 plastic brush (not steel or any other metal) 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 PFC™ 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. Confirm ignitor and sensor gap dimensions. Sensor location is 7/16" (12mm) off of the burner. Igniter location is 8mm off of the burner with a gap of 3/16" (4.5mm) between the electrodes.
   c. Install the burner plate assembly and replace the six 10 mm Allen nuts. Application of an anti-seize compound is optional but recommended.
   d. 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.
   e. Connect the union on the gas header and reattached the gas valve electrical connector.
   f. Reinstall the (4) 1/4-20 bolts connecting the venturi to the air filter box.
   g. 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.

   h. Turn the power to the Series PFC™ on. Observe the display module to assure proper operation.
   i. Initiate a call for heat** and observe the condensate flow.
   j. 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 5, VENTING.

⚠ 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.

12. BOILER DIMENSIONS & RATINGS

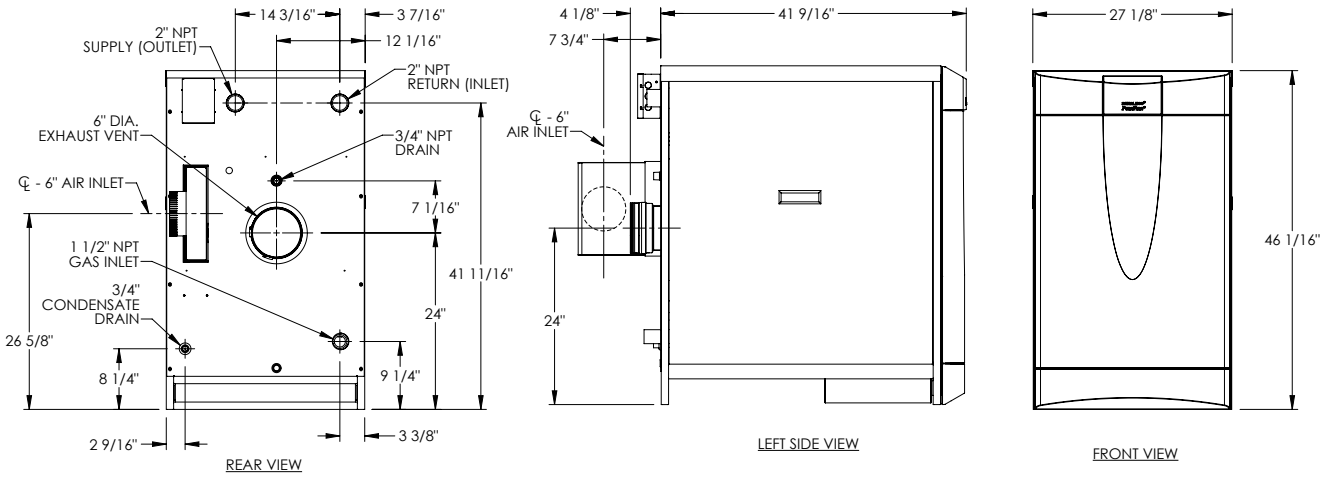


Figure 12.1: Dimensional Drawing – PFC-625 & PFC-750

Table 12.1: Boiler Ratings

SERIES PFC™ BOILER RATINGS									
Series PFC™									
Boiler Model	Input				Gross Output[2]		Net Water Ratings[1]		Thermal Efficiency
	Minimum		Maximum						
	MBH	kW	MBH	kW	MBH	kW	MBH	kW	%
PFC-625	125	36.6	625	183.2	612	179.4	532.2	156	97.9
PFC-750	150	43.9	750	219.8	735	215.4	639.1	187.3	98.0

Note: Consult factory before selecting a boiler for installations with unusual piping and/or pickup requirements, such as intermittent system operation, extensive pipe system, etc.

1. Net water ratings are based on a piping an pickup allowance of 1.15
2. Gross Output and Thermal Efficiency are based on testing in accordance with ANSI/AHRI STANDARD 1500 – 2015 TESTING STANDARD FOR PERFORMANCE RATING OF COMMERCIAL SPACE HEATING BOILERS and are 3rd Party verified.

Table 12.2: Combustion Air Fan Speeds

SERIES PFC™ COMBUSTION AIR FAN SPEEDS						
Boiler Model	Maximum Input		Fuel	Fan Speed*		
	MBH	kW		Low Power	Ignition	High Power
PFC-625	625	183.2	Natural Gas	2700	3500	7250
			LP Gas	2600		7300
PFC-750	750	219.8	Natural Gas	2650	3500	7350
			LP Gas	2700		7400

*Fan speed values may vary depending on menu changes made to compensate for increased exhaust vent length and wind conditions.

Table 12.3: Series PFC™ Main Control Specifications

SERIES PFC™ MAIN CONTROL SPECIFICATIONS			
Power Supply	Voltage		120 VAC Nominal (102-132 VAC)
	Frequency		60 Hz Nominal (40 Hz to 70 Hz) Phase Neutral
Fuses	Primary Control		5AT, 250 VAC (Type GDG)
	Pump Relay (2)		10 Amp, 250 VAC
Blower	Voltage		120 VAC/8.5 Amps AC RMS
Gas Valve	Voltage		120 VAC
Thermostat Contacts	Voltage		24 VAC
DHW Contacts	Voltage		24 VAC
Flame Current Limits	Current		Minimum (running): 1.0 µA
			Minimum (ignition): 1.5 µA
			Maximum: 10.0 µA
Temperature Sensors NTC Thermistors	Dual Supply	**10kΩ at 77°F (25°C)**	14°F (-10°C) to 244°F (118°C)
	Return	**12kΩ at 77°F (25°C)**	14°F (-10°C) to 244°F (118°C)
	Flue	**12kΩ at 77°F (25°C)**	50°F (10°C) to 280°F (138°C)
	Header	**12kΩ at 77°F (25°C)**	14°F (-10°C) to 244°F (118°C)
	Outdoor	**12kΩ at 77°F (25°C)**	-40°F (-40°C) to 185°F (85°C)
	Optional Sensors		
	DHW	**12kΩ at 77°F (25°C)**	14°F (-10°C) to 244°F (118°C)
	System	**12kΩ at 77°F (25°C)**	14°F (-10°C) to 244°F (118°C)
Standards	North America		ANSI Z21.20 / CSA C22.2
	Europe		CE EN298

Table 12.4: Series PFC™ Electrical Ratings and Specifications

SERIES PFC™ ELECTRICAL RATINGS AND SPECIFICATIONS									
Boiler Model	**Supply Voltage** (-15%, +10%)	**Frequency** (±10%)	**Blower**		**Gas Valve**		**Total Control Circuit Max. Current**	**Circulating Pumps Max. Current**	**Total Pump Circuit Max. Current**
	(VAC)	(Hz)	*Voltage* (VAC)	*Current* (Amps)	*Voltage* (VAC)	*Current* (Amps)	(Amps)	(Amps)	(Amps)
PFC-625 PFC-750	120	60	120	8.5	120	0.21 x 2	5.0	10.0 x 2	20.11

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.

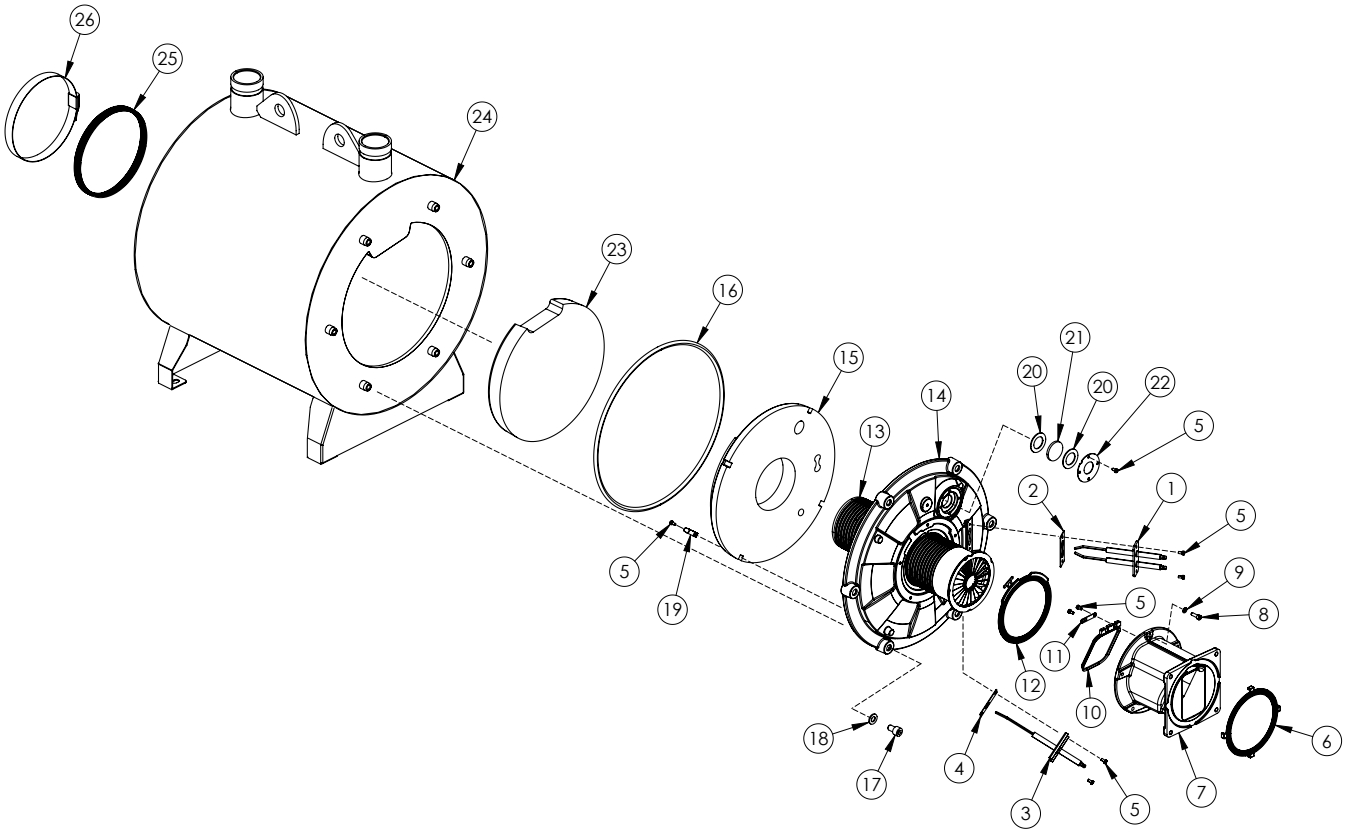


Figure 13.1: Heat Exchanger Repair Parts

Table 13.1: Heat Exchanger

	Description	Qty.	Stock Code	
			625	750
1	Igniter Electrode	1	54883	
2	Gasket, Igniter Electrode	1	54882	
3	Ionization Electrode	1	54891	
4	Gasket, Ionization Electrode	1	54890	
5	Screw, M4 x 8	14	54878	
6	Gasket, Intake Manifold	1	54889	
7	Intake Manifold, GM10-20-141	1	5940	
8	Screw, M5 x 16	5	54888	
9	Washer, M5	5	54887	
10	Flap	1	54886	
11	Flap Retaining Bracket	1	54885	
12	Gasket, Intake Manifold to Burner	1	54884	
13	Burner, Bluejet	1	54870	54871
14	Combustion Chamber Cover Plate	1	54869	
15	Insulation, Combustion Chamber Cover Plate	1	54877	
16	Gasket, Siliconized Fiberglas Braid	1	54876	
17	Screw, M10 x 20	6	54874	
18	Washer, M10	6	54873	
19	Burner Door Insulation Clip	4	54879	
20	Gasket, Sight Glass	2	54880	
21	Sight Glass Lens	1	54881	
22	Sight Glass Plate, GM10-15-3169	1	5941	
23	Insulation, Target Wall	1	54875	
24	Heat Exchanger, PFC-625/750	1	98109	98110
25	Gasket, Exhaust Outlet	1	54872	
26	Exhaust Outlet Band Clamp, GM10-35-572	1	5942	

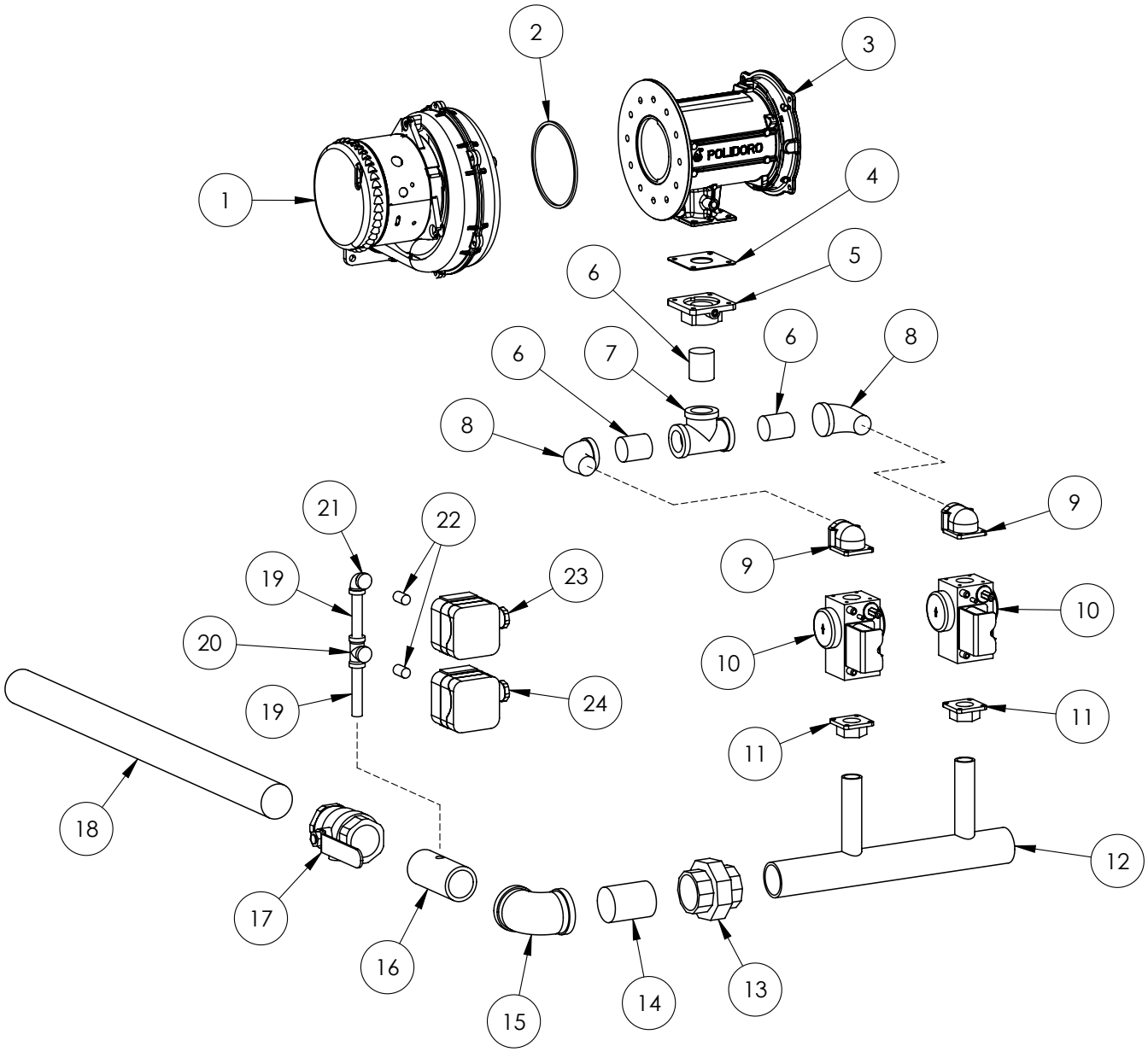


Figure 13.2: Blower/Gas Train Assembly

Table 13.2: Blower/Gas Train Assembly

	Description	Qty.	Stock Code
N/S	Screw (Blower to Heat Exchanger), M8 x 55mm Hex Zinc	4	Local Hardware
N/S	Nut Flange (Blower to Heat Exchanger), M8-1.25 Zinc	4	Local Hardware
1	Blower, Ametek Naut 8.9	1	54635
N/S	Screw (Blower to Venturi), M8-1.25 x 20mm Hex	6	Local Hardware
2	Gasket (Blower to Venturi)	14"	5939
3	Venturi, HM500, Injectors 9.0/10.0	1	5966
	Venturi, HM500, Injectors 8.0/8.6	1	5967
	Venturi, HM500, Injectors 10.0/11.0	1	5968
	Venturi, HM500, Injectors 9.0/9.2	1	5969
N/S	Screw (Venturi to Airbox), 1/4"-20 x 3/4" Hex Washer HD	4	Local Hardware
4	Gasket (Venturi to Gas Manifold)	1	PFC4003
N/S	Set Screw (Venturi to Upper Manifold), M5 x 20mm	4	Local Hardware
N/S	Nut Flange (Venturi to Upper Manifold), M5	8	Local Hardware
5	Straight Flange, 1"	1	5926
6	Nipple, 1 x 1-1/2" (Close) SCH40 Black	3	99212
7	Tee, 1"	1	424
8	Street Elbow, 1 x 3/4" Black	2	7064
9	90° Flange Kit, 3/4" NPT	2	5543
N/S	Screw (Gas Valve to Flange), M5 x 30 Hex Skt HD	4	Local Hardware
N/S	Screw (Gas Valve to Flange), M5 x 12 Hex Skt HD	4	Local Hardware
N/S	O-Ring (90° Flange)	2	
10	Gas Valve, GB-WND-057	2	54429
11	Straight Flange Kit, 3/4" NPT	2	5855
N/S	Screw (Gas Valve to Flange), M5 x 12 Hex Skt HD	8	Local Hardware
N/S	O-Ring (Straight Flange)	2	
12	Gas Manifold Header (or Iron Fitting Assembly)	1	PFC4001
13	Union Ground Joint, 1-1/2"	1	418
14	Nipple, 1-1/2 x 2-1/2 (Short) SCH40	1	99247
15	Elbow, 1-1/2"	1	442
16	Nipple, Pressure Switch	1	PFC4000
17	Manual Gas Valve, 50-GB7-A1	1	51705
18	Nipple, 1-1/2 x 30 STD Black (PFC-625)	1	5933
	Nipple, 1-1/2 x 27 STD Black (PFC-750)	1	1025
19	Nipple, 1/4 x 3 SCH40 Black	2	99132
20	Tee, 1/4"	1	422
21	Elbow, 1/4"	1	436
22	Nipple, 1/4 x Close SCH40 Black	2	5834
23	High Gas Pressure Switch, GMH-A4-4-4	1	50844
24	Low Gas Pressure Switch, GML-A4-4-4	1	50845

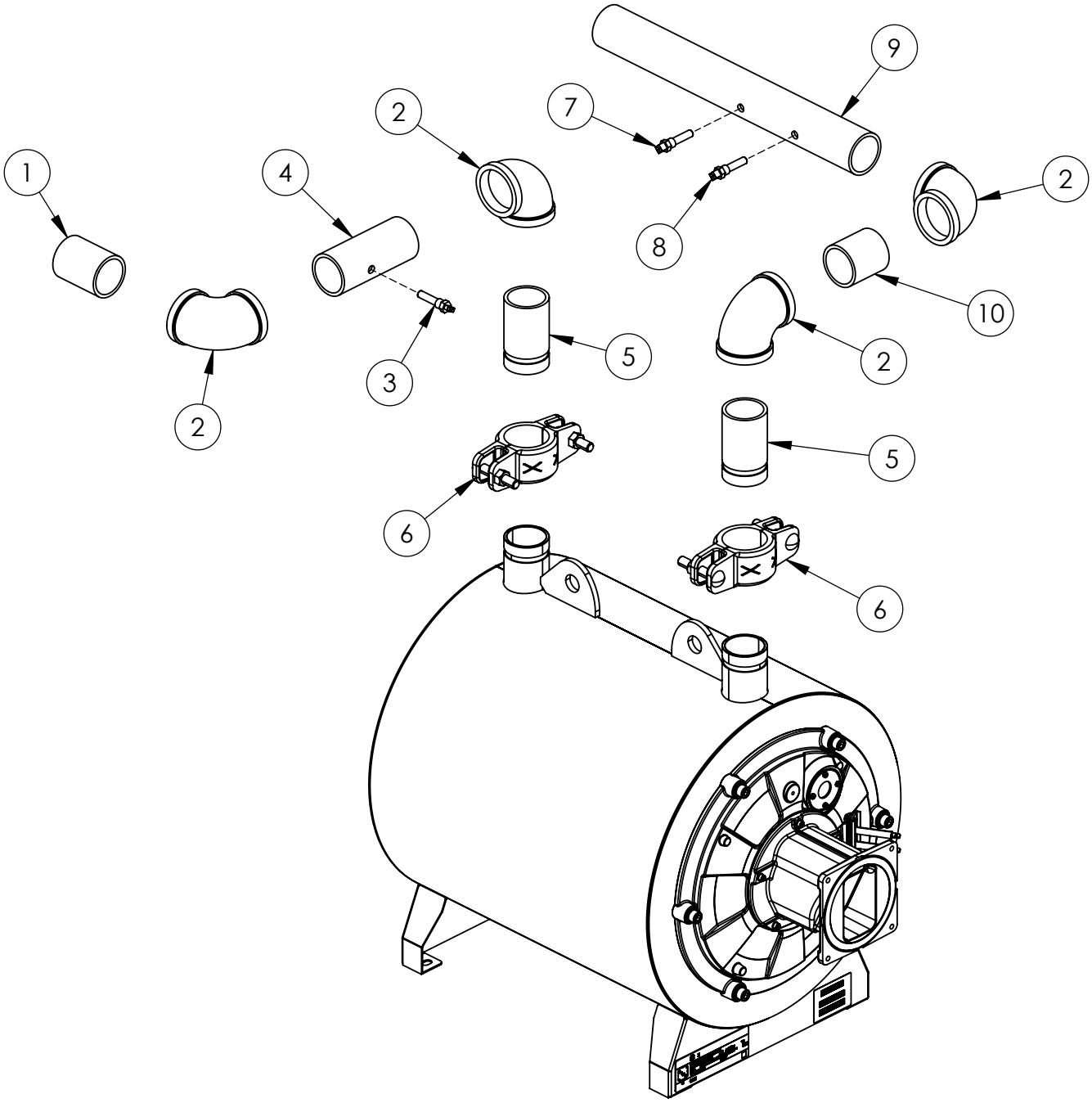


Figure 13.3: Supply/Return Piping

Table 13.3: Supply/Return Piping

	Description	Qty.	Stock Code
1	Nipple, 2 x 3" SCH40 BLK	1	99263
2	Elbow, 2" BLK	4	443
3	Return Sensor, TSD00BS	1	54418
4	Nipple, 2 x 5.5" NPT with 1/4" NPT Hot Tap	1	PFC1001
5	Adapter, NPT x GRV	2	PFC1000
6	Coupling, Slidelok 2" Rigid	2	5921
7	LWCO Probe, 35mm	1	54834
8	Dual Supply Sensor, TSD01AS	1	54634
9	Nipple, 2 x 19" NPT with (2) 1/4" NPT Tap	1	PFC1002
10	Nipple, 2 x 2-1/2"	1	99262

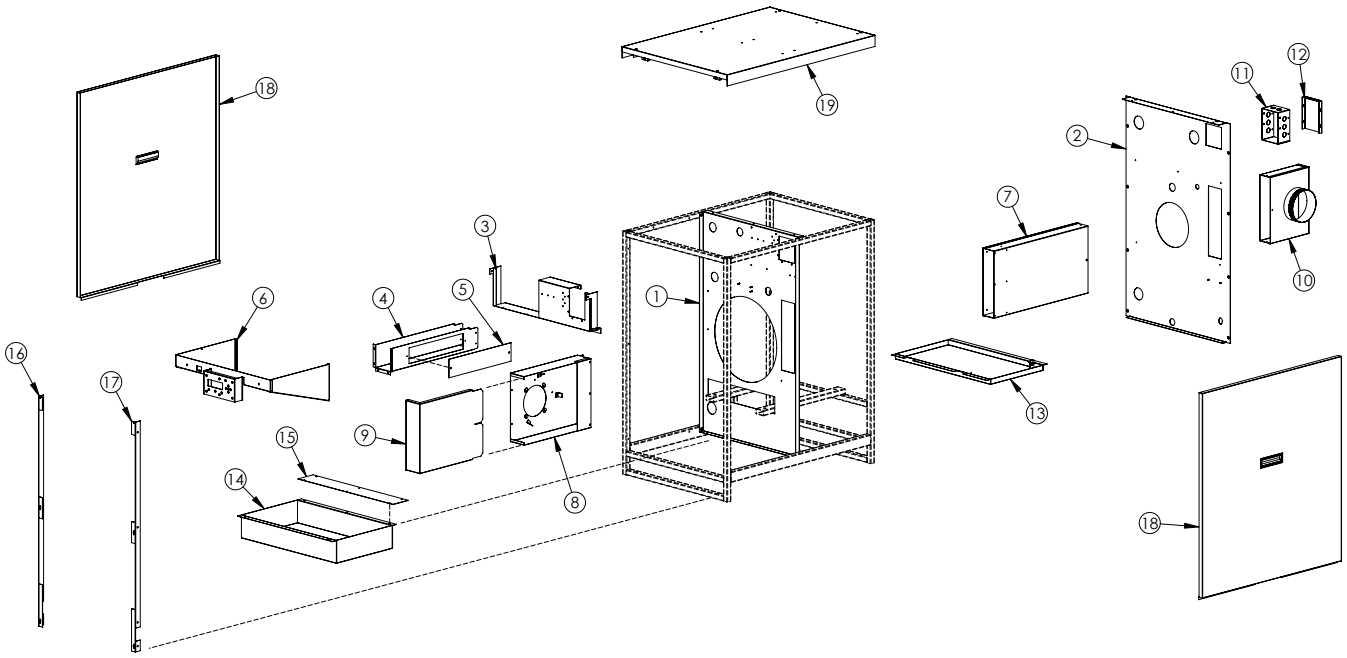
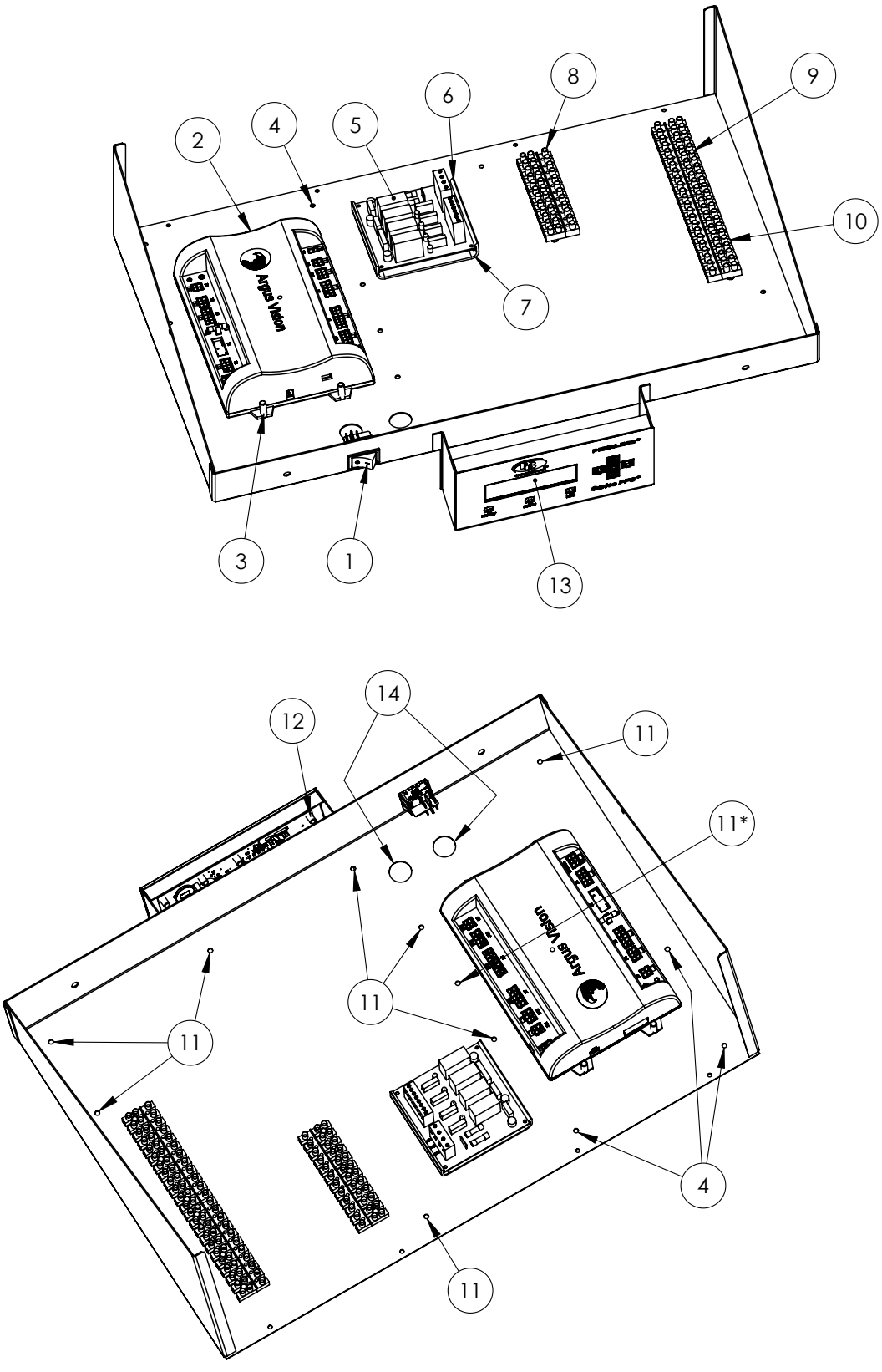


Figure 13.4: Jacket Assembly

Table 13.4: Jacket Assembly

	Description	Qty.	Stock Code	
			625	750
1	Inner Panel	1	PFC2001	
2	Rear Panel	1	PFC2002	
3	Electrical Tray Mounting Bracket	1	PFC2006	N/A
4	Electrical Chase	1	PFC2010	
5	Electrical Chase Cover	1	PFC2011	
6	Electrical Tray	1	PFC2005	
7	Air Box - Heat Exchanger Cabinet	1	PFC5001	
8	Air Box - Venturi Cabinet	1	PFC5000	
9	Air Box - Venturi Cabinet Cover	1	PFC5002	
10	Air Inlet Box	1	PFC5003	
11	Rear Electrical Box	1	PFC2012	
12	Rear Electrical Box Cover	1	PFC2013	
13	Condensate Pan	1	PFC2009	
14	Blower Cabinet Pan	1	PFC2007	
15	Blower Cabinet Pan Support	1	PFC2008	N/A
16	Front Panel Mounting Bracket - Left Hand	1	PFC2003	
17	Front Panel Mounting Bracket - Right Hand	1	PFC2004	
18	Side Panel	2	PFC6004	
19	Top Panel	1	PFC6005	



* THIS WIRE LATCH GATE GOES IN FROM THE BOTTOM SIDE;
THE REMAINING LATCHES GO IN FROM THE TOPSIDE.

Figure 13.5: Electrical Tray Control Locations

Table 13.5: Electrical Tray Control Locations

	Description	Qty.	Stock Code
1	Switch, DPST (20A, 125V)	1	5918
2	Control Module, PFC-625/750	1	54867
3	Nut, Hex (#8-32)	4	51573
4	Wire Holder, Top Entry	3	5917
5	Pump Relay Module, 10A	1	54556
6	Track, Pump Relay Module	1	54551
7	Screw, #6-32 X 1/2 PHIL	2	5449
8	Terminal Block, 6 Pole	6	5547
9	Spacer, Nylon (.25"OD X .141"ID X .281"L)	9	5448
10	Nut, Hex (#6-32)	9	51553
11	Wire Holder, Latching Side Entry	9	5916
12	Spacer, Nylon (.217"OD X .147"ID X .230"L)	7	5931
13	User Interface Display, PFC-625/750	1	54868
14	Bushing, Snap (7/8")	2	5438

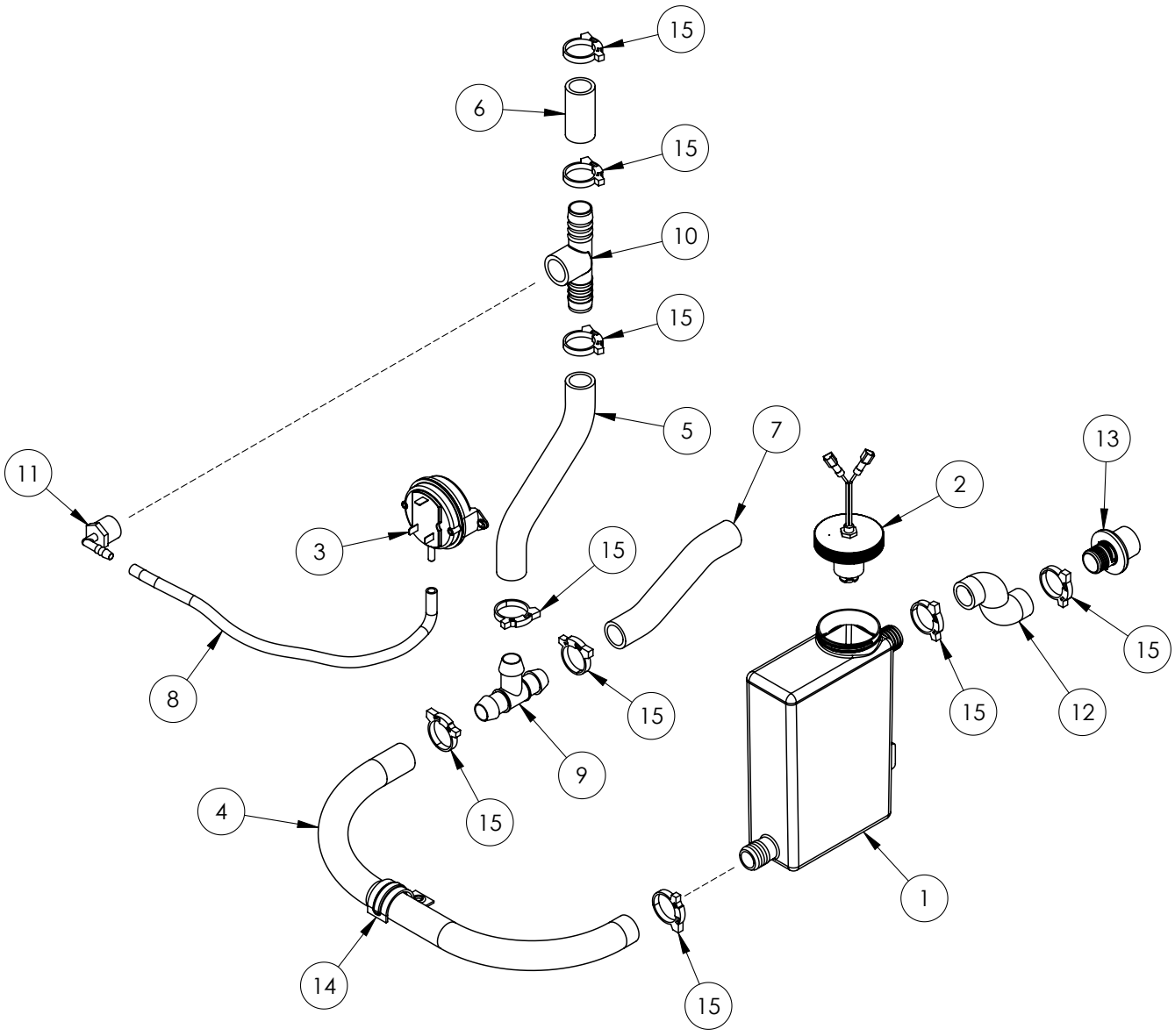


Figure 13.6: Condensate System

Table 13.6: Condensate System

	Description	Qty.	Stock Code
1	Condensate Collector Container	1	54120
2	Condensate Blocked Drain Switch w/ Cap	1	54137
3	Blocked Vent Pressure Switch, 3.5" W.C.	1	54208
4	Tubing, 1" OD x 3/4" ID	22"	5417
5	Tubing, 1" OD x 3/4" ID	3"	5417
6	Tubing, 1" OD x 3/4" ID	3"	5417
7	Tubing, 7/8" OD x 5/8" ID	26"	5416
8	Tubing, 5/16" OD x 3/16" ID	18"	5563
9	Hose Barb Tee, 3/4" x 3/4" x 3/4"	1	5915
10	Hose Barb Tee, 3/4" x 3/4" x 1/2" NPT	1	5913
11	90 degree Hose Barb, 1/4" x 1/2" NPT	1	5914
12	Condensate Drain Tube	1	5420
13	Bulk Head Fitting	1	54140
14	Clamp, Stainless Steel, 8897T23	1	5938
15	Hose Clamp	9	54276

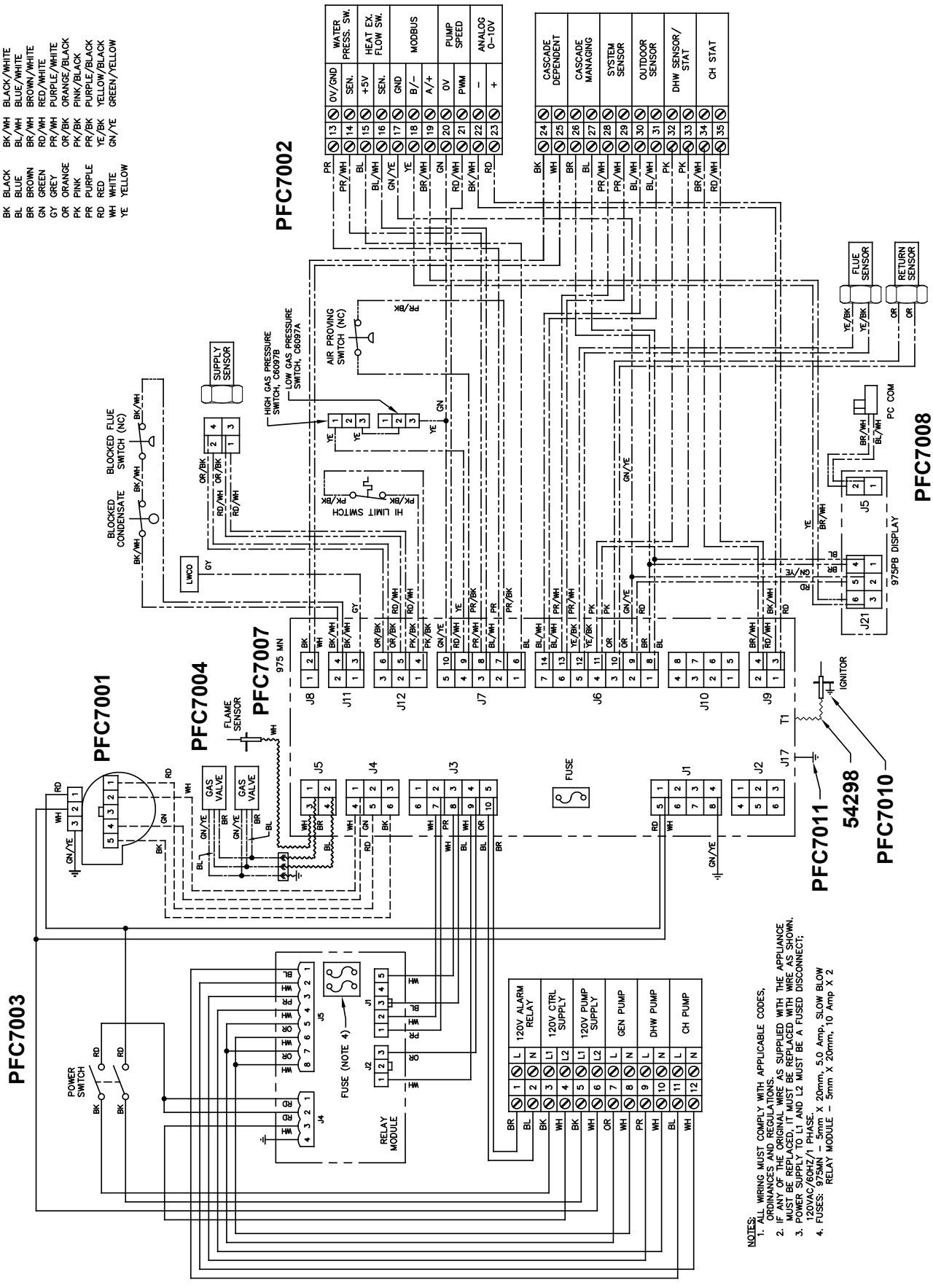
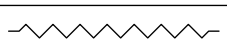


Figure 13.7: Wiring Harnesses

Table 13.7: Wiring Harnesses

WIRING HARNESS LINE TYPE KEY		
STOCK CODE	**LINE TYPE**	**DESCRIPTION**
PFC7001	– — — — — — –	**BLOWER CONTROL (J4)**
PFC7002	——— – – ———	**LOW VOLTAGE (RIGHT SIDE)**
PFC7003	———————	**POWER (RIGHT SIDE)**
PFC7004	— - —— - —— - —	**GAS VALVE (NAT & LP)**
PFC7007		**GAS VALVE & FLAME SENSOR (J5)**
PFC7008	——— – – ———	**PC COM / ARGUS LINK ADAPTER**
54298		**IGNITION CABLE**
PFC7010	———————	**IGNITION GROUND WIRE**
PFC7011	———————	**CONTROL GROUND WIRE**

APPENDIX A. COMBUSTION TEST RECORD

Installation Information			
Contact:		Phone Number:	
Service Contractor:		Fax Number:	
Contractor Address:		Email Address:	
Job Name:		Jobsite Address:	
Boiler Model:		Boiler Serial No.:	
Manufacture Date:		Conversion Date:	
Pressure Readings			
Inlet Gas Pressure – Static (in. w.c.):		Inlet Gas Pressure Drop at Startup (in. w.c.):	
High Fire Inlet Gas Pressure (in. w.c.):		Low Fire Inlet Gas Pressure (in. w.c.):	
Combustion Readings			
Flame Signal High Fire (µA):		Flame Signal Low Fire (µA):	
CO_2 High Fire (%):		CO_2 Low Fire (%):	
CO High Fire (ppm):		CO Low Fire (ppm):	
Fan Speed High Fire (RPM):		Fan Speed Low Fire (RPM):	
Exhaust Temperatures			
Exhaust Temp High Fire (ºF):		Exhaust Temp Low Fire (ºF):	

SERVICE LOG

Serial Number	

Date	Serviced By	Description of Service

PEERLESS® PUREFIRE®

Gas Boilers

PFC-625 PFC-750

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.

CONTROLS

PeerlessBoilers.com

PB HEAT, LLC
131 S. CHURCH STREET • BALLY, PA 19503

PFC8024 R1 (02/24-1.5C)
Printed in U.S.A.