PEERLESS® PUREFIRE®

Gas Boilers

PF-850 PF-1000 PF-1500

Installation, Operation & Maintenance Manual

PeerlessBoilers.com

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USING THIS MANUAL

A. INSTALLATION SEQUENCE

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

B. SPECIAL ATTENTION BOXES

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

⚠ DANGER

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

⚠ 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. *PUREFIRE®* 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.

C. ACCESSIBILITY CLEARANCES

1. The *PUREFIRE®* 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 AND VENTILATION AIR

1. The *PUREFIRE®* 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 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.

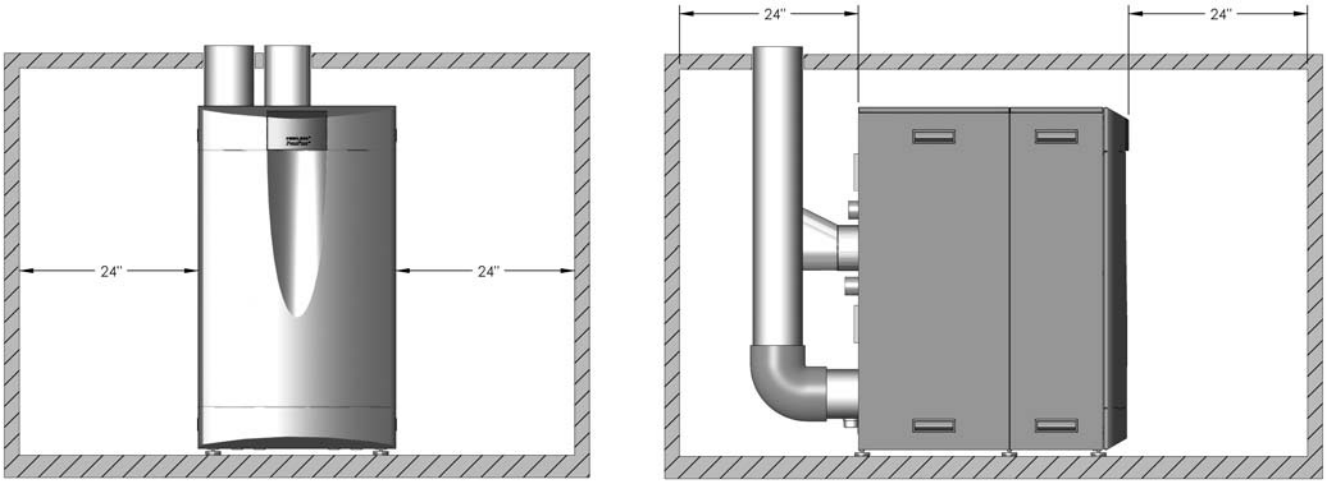


Figure 1.1: Minimum Accessibility Clearances – PF-850, PF-1000, PF-1500

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.

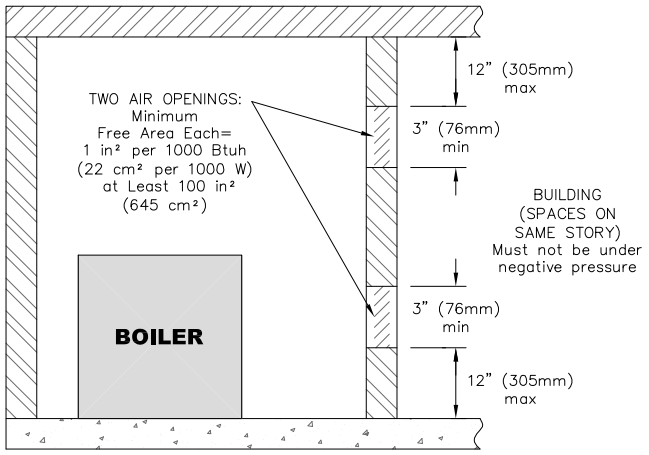


Figure 1.2: Air Openings – All Air from Indoors on the Same Floor

   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.

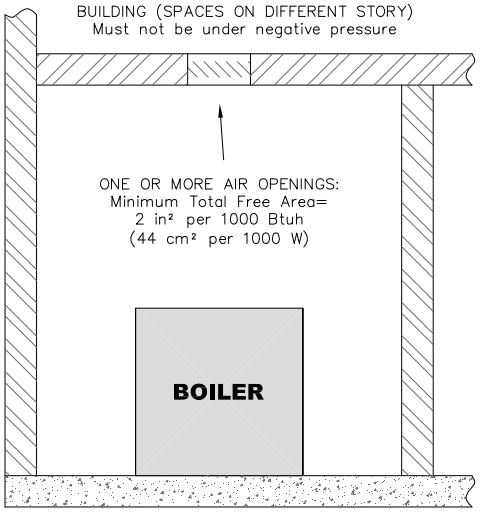


Figure 1.3: Air Openings – All Air from Indoors on Different Floors

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.

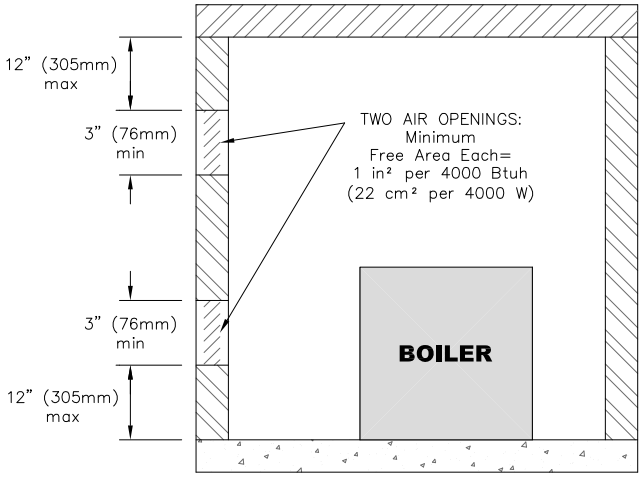


Figure 1.4: Air Openings – All Air Directly from Outdoors

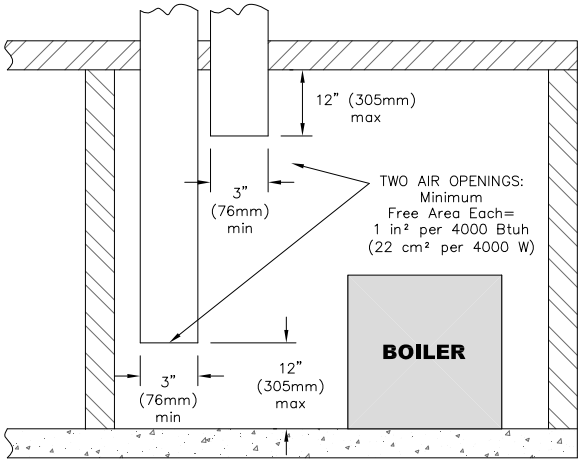


Figure 1.5: Air Openings – All Air from Outdoors through Vertical Ducts

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.

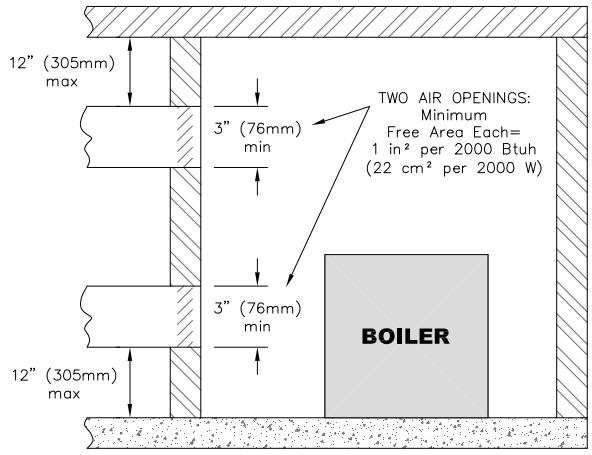


Figure 1.6: Air Openings – All Air from Outdoors through Horizontal Ducts

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.

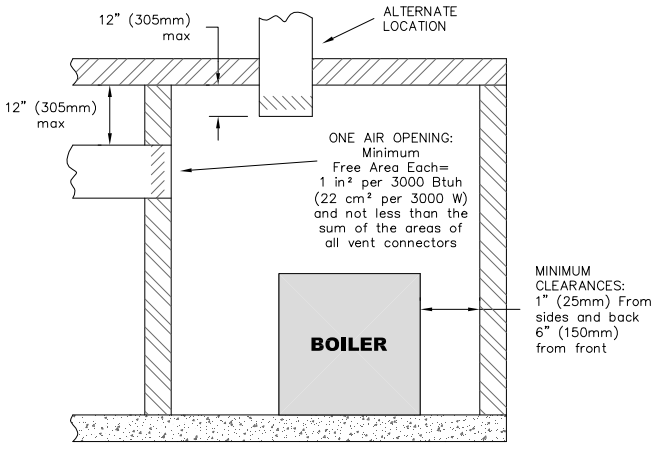


Figure 1.7: Air Openings – All Air from Outdoors through One Opening

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. *PUREFIRE®* 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 *PUREFIRE®* 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 PF-850, PF-1000 or PF-1500 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.

1. Remove all side jacket panels from the both boilers and the top jacket panels from the lower boiler.

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. Lift the upper boiler into place by passing 5 to 10 foot (2-3 meter) lengths of 1" to 1-1/4" Schedule 40 or 80 steel pipe through the holes provided in the boiler frame.

4. Insert spacers, washers and bolts (provided) through the holes provided in the frame of the lower boiler and thread them into the threaded inserts on the base of the upper boiler. Figure 2.1 shows this assembly. Tighten the bolts securely.

5. Replace all the side jacket panels and discard the top jacket panels from the lower boiler.

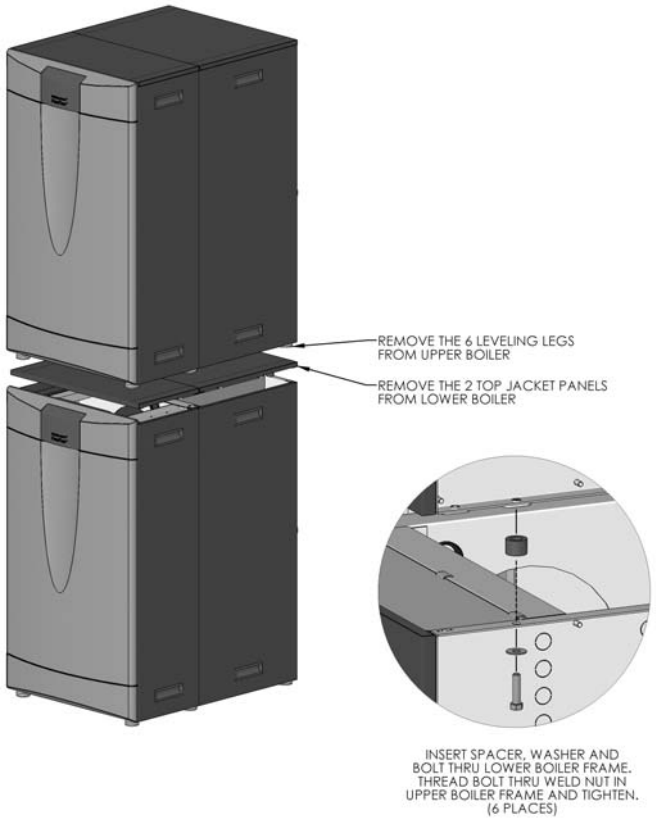


Figure 2.1: Stacking and Securing Boilers

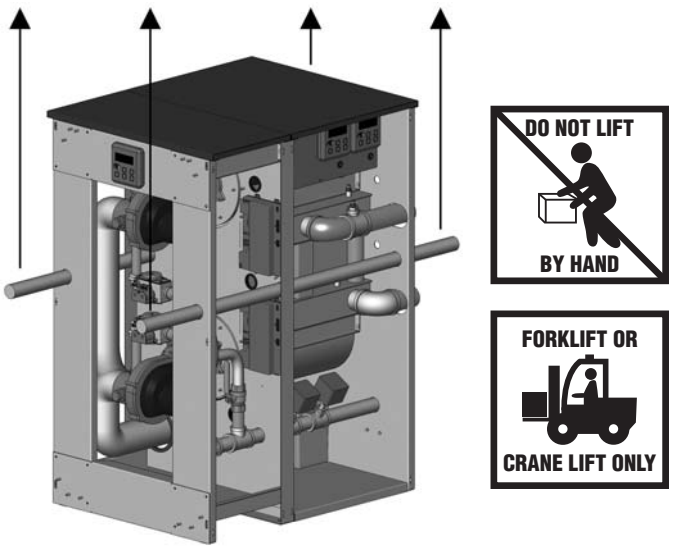


Figure 2.2: Lifting the Upper Boiler

3. VENTING & AIR INLET PIPING

A. GENERAL

1. Install the *PUREFIRE®* 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 *PUREFIRE®* 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® (polyphenolsulfone) 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	PVC (Sch 40 or 80)*	ANSI/ASTM D1785
	CPVC (Sch 40 or 80)	ANSI/ASTM D1785
	PVC-DWV*	ANSI/ASTM D2665
	DuraVent FasNSeal© AL29-4c Stainless	UL-1738
	DuraVent PolyPro© Polypropylene	ULC-S636
	CentroTherm InnoFlue© Polypropylene	ULC-S636

* 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 joins 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 Peerless® *PUREFIRE*® 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 vent length for the Peerless® *PUREFIRE*® boiler is about 200 equivalent feet (60 m).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 1 foot (30 cm) clearance from the bottom of the air intake pipe to the level of maximum snow accumulation. Snow removal may be necessary to maintain clearances.
   b. Do not locate air intake pipe in a parking area where machinery may damage the pipe.
   c. If the vent pipe and air inlet pipe terminations penetrate the wall at the same level the minimum distance between them is 8" center-to-center.
   d. For multiple boiler installations, the minimum horizontal distance between the inlet of one boiler to the exhaust of an adjacent boiler is 8" center-to-center. In addition, the minimum vertical distance between the exhaust and air inlet is 6". See Figure 3.1 for an illustration.
   e. The exhaust outlet of the vent pipe should not be angled any more than 5° from horizontal.
   f. Precautions should be taken to prevent recirculation of flue gases to the air inlet pipe of the boiler or other adjacent appliances.

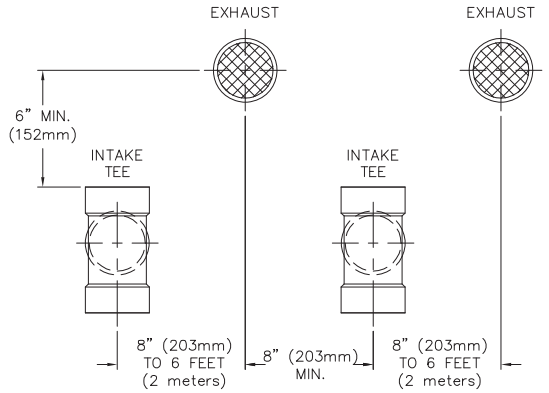


Figure 3.1: Vent Pipe Spacing for Multiple *PUREFIRE*® Boilers

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.
      - 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.

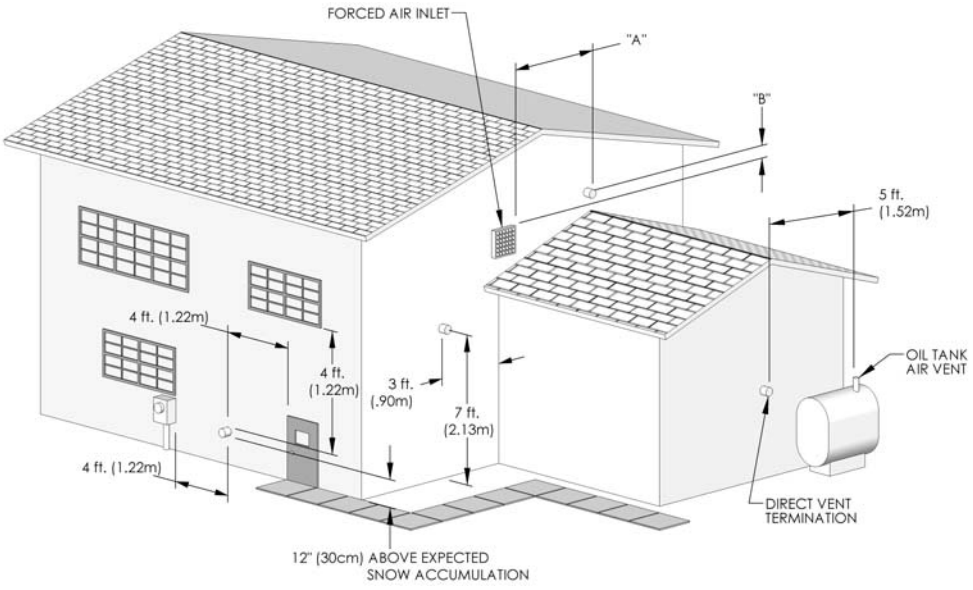


Figure 3.2: Exit Terminal Location for Mechanical Draft and Direct-Vent Venting Systems

- 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.

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 or 24" (600 mm) above the roof surface, whichever is greater.

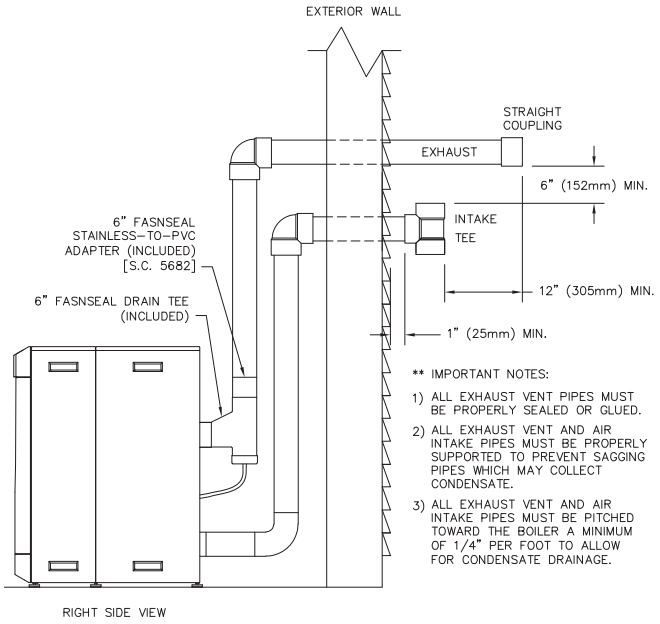


Figure 3.3: Sidewall Exhaust Vent and Air Inlet Pipe

   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.

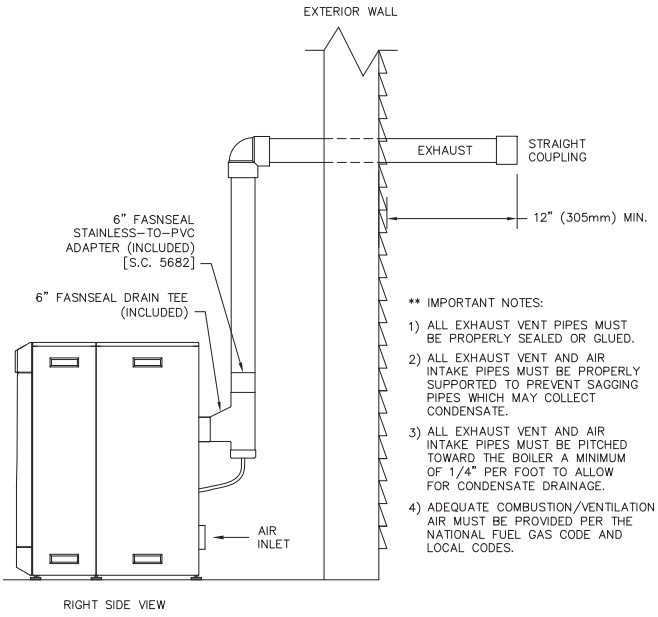


Figure 3.4: Sidewall Exhaust Vent with Indoor Air

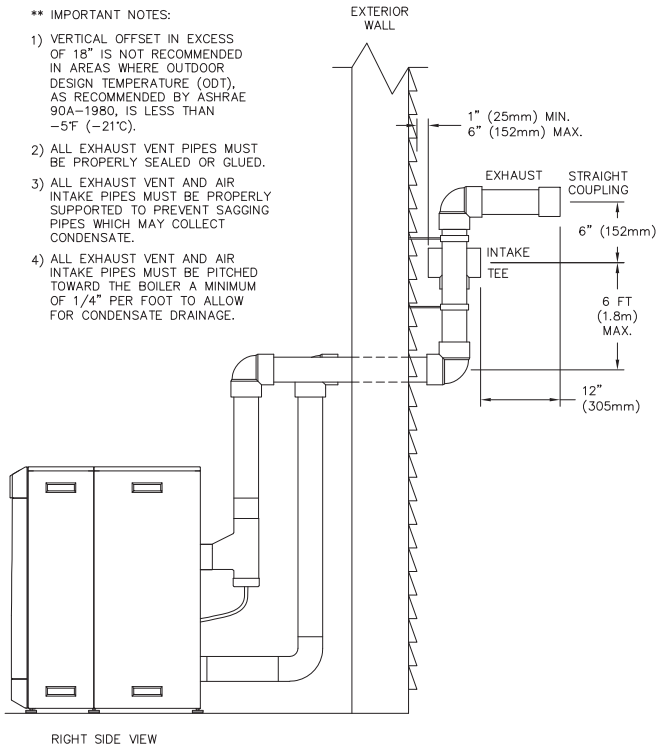


Figure 3.5: Offset Sidewall Exhaust Vent and Air Inlet Pipe

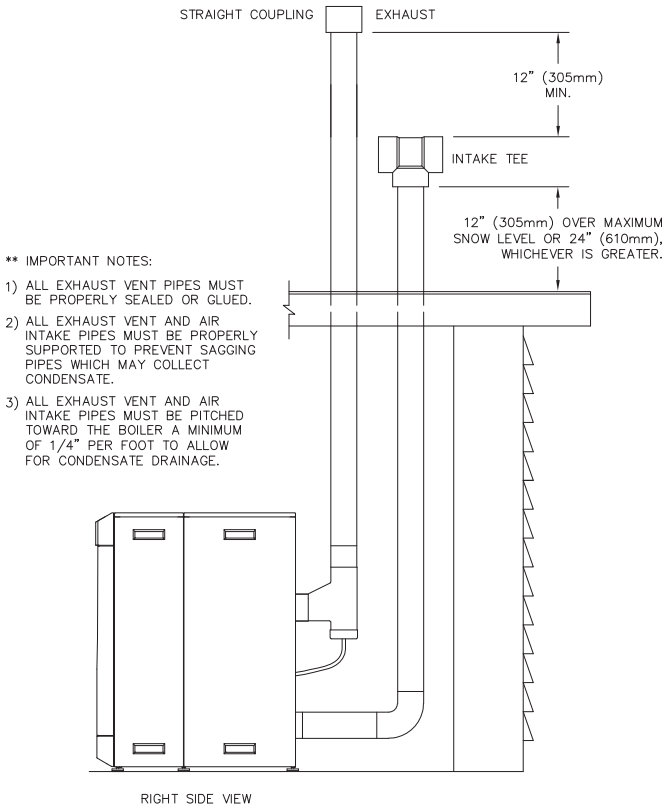


Figure 3.6: Vertical Exhaust and Air Inlet Pipe

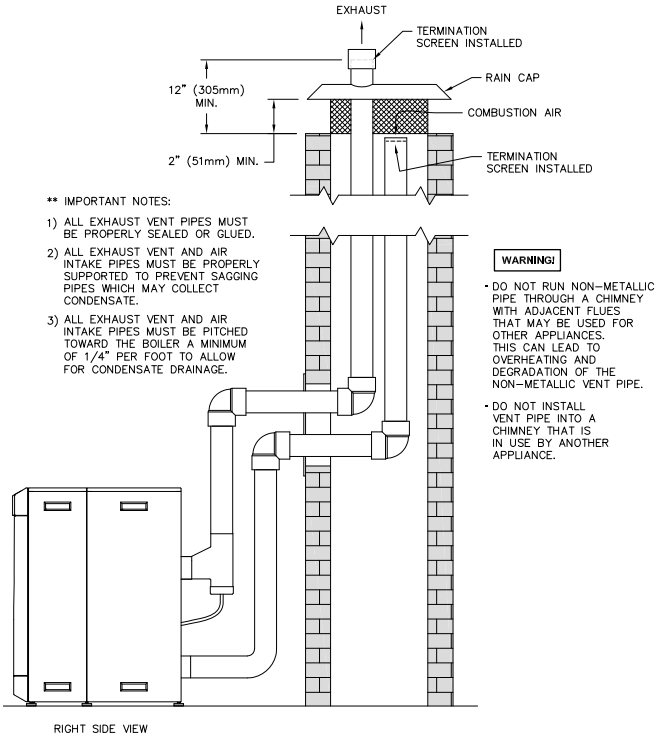


Figure 3.8: Vertical Exhaust Routed Through an Unused Chimney with Outdoor Air

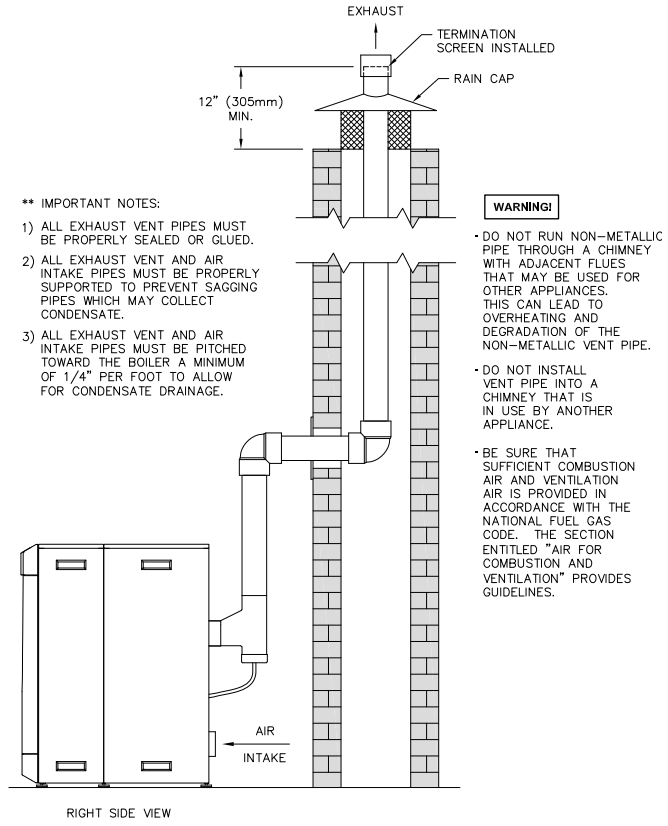


Figure 3.7: Vertical Exhaust Routed Through an Unused Chimney with Indoor Air

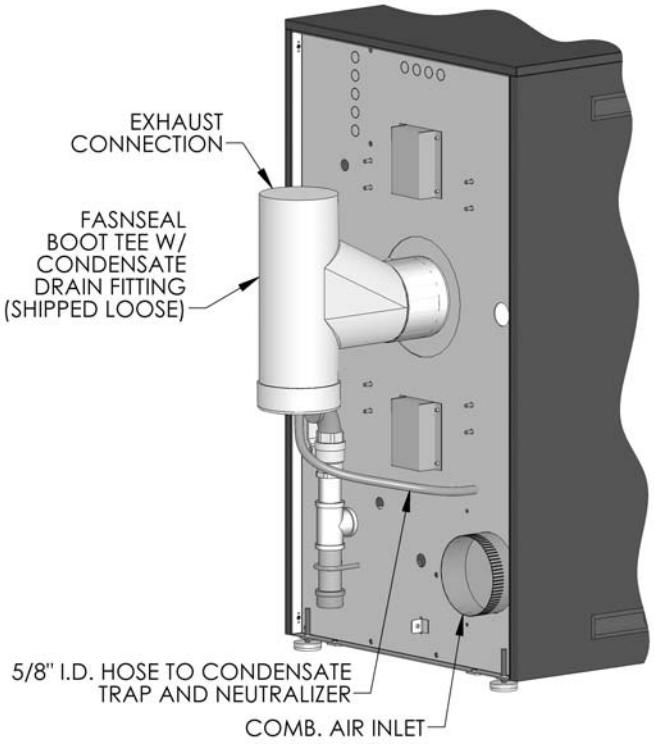


Figure 3.9: Drain Tee and Air Inlet Connections

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.

2. The total combined length of exhaust vent and air intake piping is 200 equivalent feet (60 m).
   a. *PureFire*® 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 Radiusz	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 INSTALLATION

1. Figure 3.10 shows the exhaust connection on the rear of the boiler on the vertical centerline. The exhaust connection is a FasNSeal stainless steel boot tee with a drain which is included with each PF-850, PF-1000 and PF-1500 boiler. The tee provided is be connected directly to the rear of the boiler as shown in Figure 3.10.

2. The Air Intake connection for the PF-850 & PF-100 is a 6" galvanized collar to the right and below the exhaust connection. The PF-1500 has a 7" connection on the air box within the front blower/gas valve area. This can be connected to any of the approved air intake piping materials.

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.

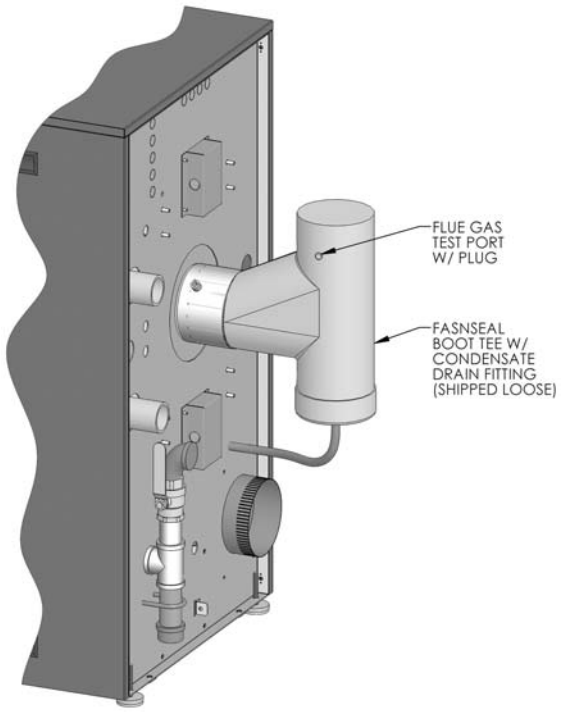


Figure 3.10: Exhaust Vent Connection

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 PF-850, PF-1000 and PF-1500 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. COMMON VENTING MULTIPLE BOILERS

1. Multiple *PUREFIRE®* PF-850, PF-1000 and PF-1500 boilers may be connected to a common venting system if they are set up to operate in the cascade mode described in Section 8.
   a. The boilers must communicate in a Master/Dependent relationship provided in the system software.
   b. The backflow prevention valves supplied on the gas/air premix inlet prevent products of combustion from backing up through the burners into occupied space.
   c. A safety control algorithm will operate the blower to prevent backflow in case of a backflow prevention valve failure.

2. Figure 3.11 shows two *PUREFIRE®* boilers connected with a common vent system.
   a. The drain tee from the common vent section should be trapped and neutralized separately from the boilers.
   b. The condensate drain from each boiler should be run separately to the drain system to prevent a clogged condensate line from shutting down multiple boilers.
   c. Table 3.5 shows recommended sizing for common vent piping.

Table 3.5: Common Exhaust Vent Sizing

Number of Boilers	Boiler Model		
	PF-850	PF-1000	PF-1500
2	8"	9"	10"
3	10"	12"	12"
4	12"	12"	14"
5	14"	14"	16"
6	14"	16"	18"
7	16"	16"	18"
8	16"	18"	20"
9	18"	18"	22"
10	18"	20"	22"
11	20"	20"	24"
12	20"	22"	24"
13	20"	22"	26"
14	22"	24"	26"
15	22"	24"	28"
16	24"	24"	28"

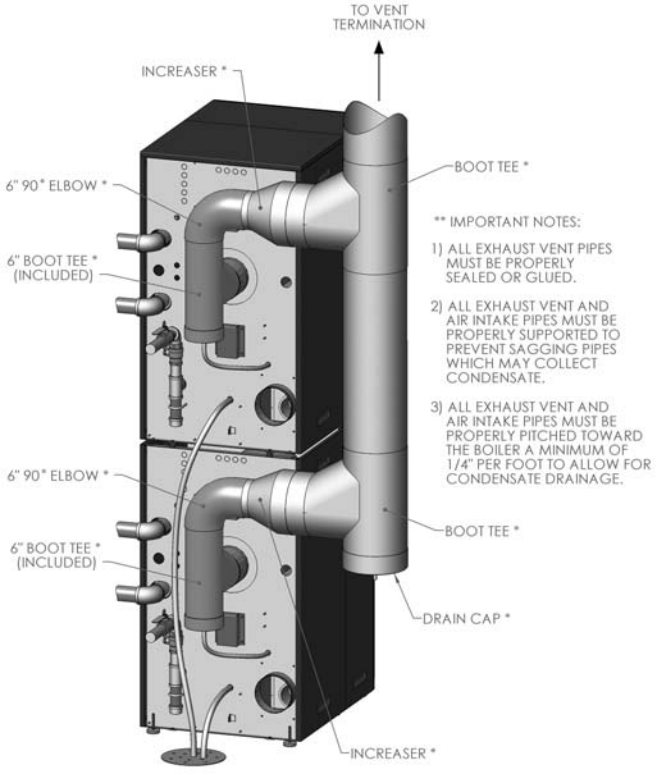


Figure 3.11: Multiple Boilers with Common Venting

H. 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

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

2. If the *PUREFIRE®* 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. 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.).

5. The *PUREFIRE®* heating boiler is intended for use in a closed-loop hydronic system. Leaks in the piping system may require constant make-up water which may include oxygen, calcium and other substances which may cause corrosion, calcium scale buildup, or other attack on the hydronic system piping. The system water should have a pH value of between 8.2 and 9.5. The water hardness is to be maintained between 50 ppm CaCO3 (3 gr/gal) and 150 ppm CaCO3 (9 gr/gal). Also, a minimum water pressure of 5 psi is required for proper performance.

B. OPERATING PARAMETERS

1. The *PUREFIRE®* 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 (69 kPa).

3. Table 4.1 lists the minimum flow rates for each *PUREFIRE®* 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 4.1: Minimum Boiler Flow Rates

PUREFIRE® Model	Minimum Flow Rate	
	Water GPM (LPM)	50% Glycol Solution GPM (LPM)
PF-850	39.5 (149.5)	49.4 (187.0)
PF-1000	46.5 (176.0)	58.2 (220.3)
PF-1500	69.8 (264.2)	87.3 (330.5)

4. Section 4.E provides detailed information about using glycol for freeze protection. Table 4.2 provides the water volume of the heat exchangers for calculating the system volume.

Table 4.2: Heat Exchanger Water Capacity

PUREFIRE® Model	Total Water Capacity	
	Gallons	Liters
PF-850	6.2	23.4
PF-1000	7.2	27.1
PF-1500	12.5	47.3

C. 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 any 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.

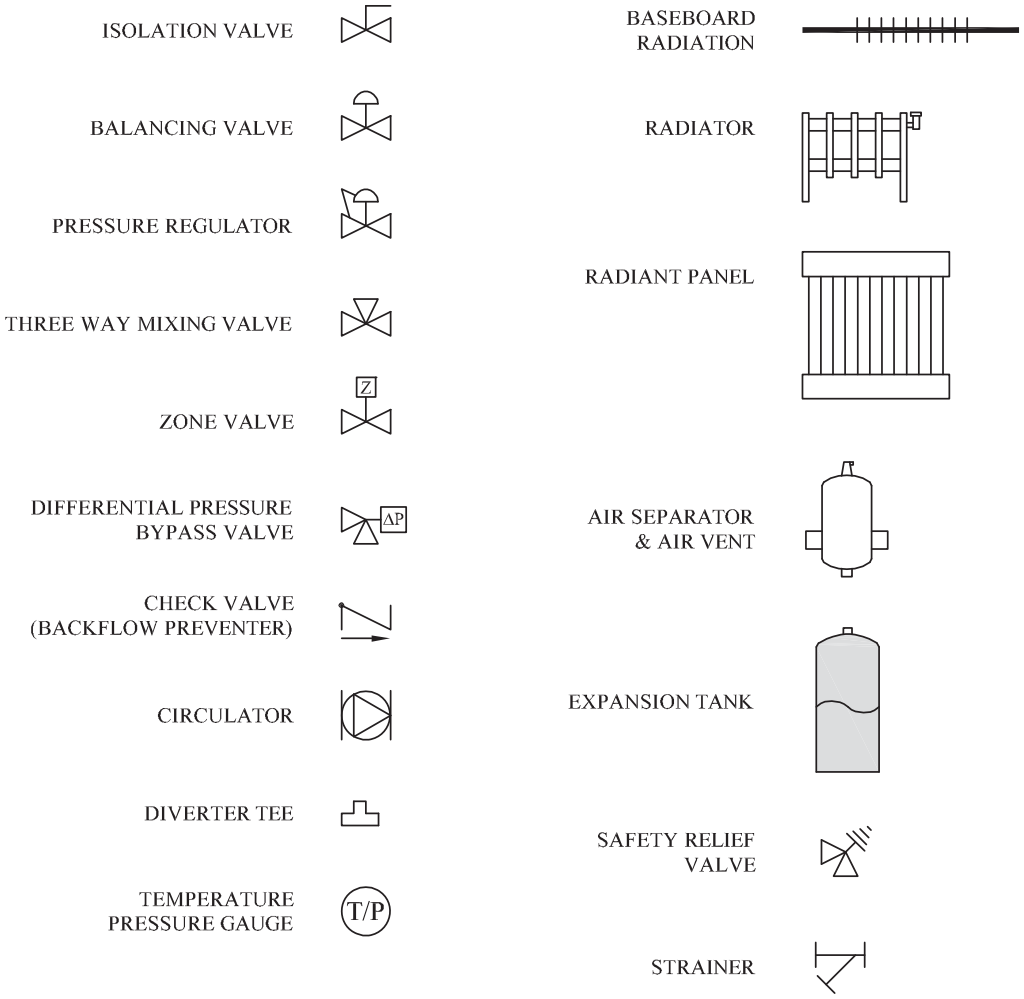


Figure 4.1: Piping Symbol Key

4. *Y-Type Strainer or Filter Ball® Valve*: PB Heat recommends the use of a strainer device in the system to prevent dirt or sediment from clogging the heat exchanger. A 20 mesh stainless steel screen is adequate to protect the heat exchanger. The strainer should be cleaned often in the first several months of operation. The Filter Ball® Valve from Jomar International incorporates a strainer into a ball valve which allows the technician to isolate the water circuit while cleaning the strainer.

5. *Flow Control Valve*: Flow control valves such as the TACO Flo-Chek or Bell & Gossett Flo-Control™ are used to prevent gravity circulation by incorporating a check valve with a weighted disc.

6. *Pressure Reducing Valve*: A pressure reducing valve, such as the Bell & Gossett B-38 or a TACO #329, is used in a hydronic system to automatically feed water to the system whenever pressure in the system drops below the pressure setting of the valve. These valves should not be used on glycol systems unless close supervision of the glycol solution is practiced.

7. *Back Flow Preventer*: A back flow preventer (check valve) is required by some jurisdictions to prevent water in the hydronic system from backing up into the city water supply. This is especially important on systems in which glycol solution is used as the heating medium.

8. *Pressure Relief Valve*: The boiler pressure relief valve is shipped 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.

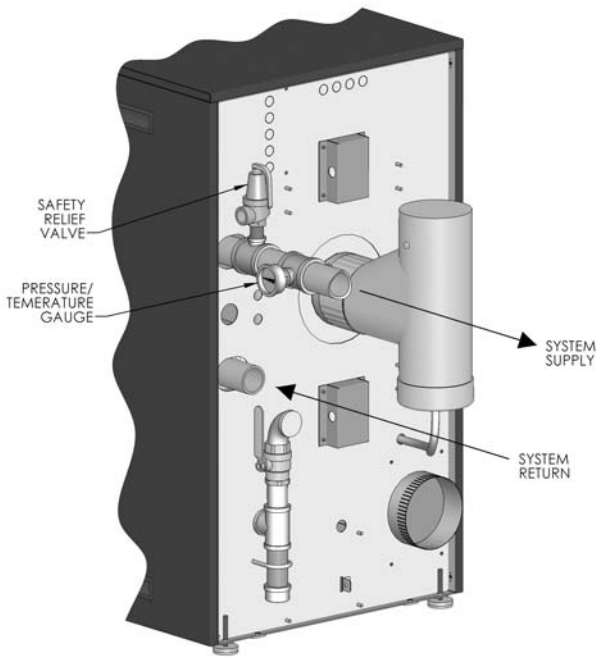


Figure 4.2: Relief Valve and Pressure/Temperature Gauge Installation

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 4.3 shows the Boiler Output as reported to the Hydronics Institute Section of AHRI.

Table 4.3: Boiler Input and Output

PUREFIRE® Model	Boiler Input		Boiler Output	
	Btu/hr	kW	Btu/hr	kW
PF-850	850,000	249	817,700	240
PF-1000	1,000,000	293	966,000	283
PF-1500	1,500,000	440	1,447,500	424

   c. The required flow is calculated based on the design temperature difference from the return to the supply of the boiler. For a PF-850 with a design temperature difference of 20°F the calculation is as follows:

$$\text{Required Flow} = \frac{\text{Output}}{\Delta T \times 500} = \frac{816{,}000}{20 \times 500} = 81.6 \text{ GPM}$$

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

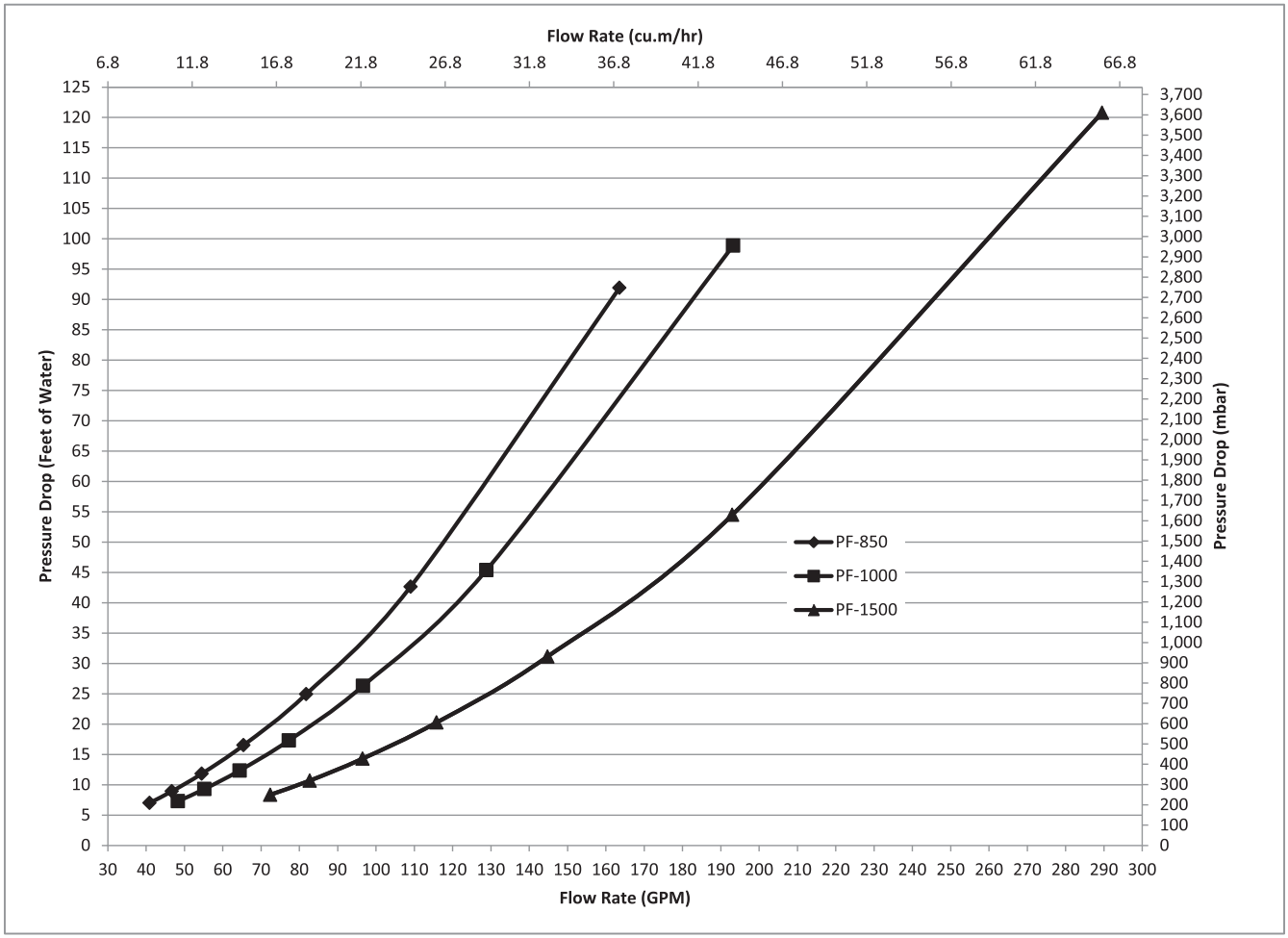


Figure 4.3: *PUREFIRE*® Circulator Sizing Graph (General Pump – Primary/Secondary)

e. Table 4.4 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 4.5 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.

Table 4.4: Flow Rate & Pressure Drop for Various System Temperature Rise Values

ΔT (°F)	PF-850				PF-1000				PF-1500			
	Flow Rate		Pressure Drop		Flow Rate		Pressure Drop		Flow Rate		Pressure Drop	
	GPM	m^3/hr	FT	bar	GPM	m^3/hr	FT	m	GPM	m^3/hr	FT	m
10	163.5	37.14	91.90	2747.01	193.2	43.88	98.87	2955.29	289.5	65.75	120.78	3610.20
15	109.0	24.76	42.65	1274.88	128.8	29.25	45.37	1356.14	193.0	43.84	54.49	1628.74
20	81.8	18.57	24.94	745.34	96.6	21.94	26.3	786.12	144.8	32.88	31.13	930.50
25	65.4	14.86	16.52	493.70	77.3	17.55	17.32	517.71	115.8	26.30	20.26	605.58
30	54.5	12.38	11.83	353.48	64.4	14.63	12.35	369.15	96.5	21.92	14.31	427.74
35	46.7	10.61	8.93	266.81	55.2	12.54	9.29	277.68	82.7	18.79	10.69	319.53
40	40.9	9.29	7.00	209.18	48.3	10.97	7.29	217.90	72.4	16.44	8.35	249.59

Table 4.5: Circulator Selection Chart (General Pump – Primary/Secondary Piping)

Circulator Manufacturer	ΔT (°F)	PF-850	PF-1000	PF-1500
Taco	20	1635/1935, 138, 133	1635/1935	1641/1941
Grundfos		UPS50-160/2F speed 2	UPS50-160/2F, speed 3	
Bell & Gossett		PD-38	PD-38	
Wilo - Top S (1 Ph)		2.0 x 50 (max)	2.0 x 50 (max)	
Wilo - Stratus		2.0 3 x 35	2.0 3 x 35	
Taco	25	1635/1935, 132	1635/1935, 132	1635/1935
Grundfos		UPS40-80/4F speed 3	UPS50-80/4F, speed 3	
Bell & Gossett		PL-130	PL-130	
Wilo - Top S (1 Ph)		1.5 x 30 (max)	1.5 x 30 (max)	
Wilo - Stratus		1.5 3 x 40	1.5 3 x 40	
Taco	30	1611/1911, 131, 122, 121	1635/1935, 131	1635/1935
Grundfos		UPS50-60F, speed 3	UPS40-80/4F, speed 3	
Bell & Gossett		2.5" / LD3	2.5" / LD3	
Wilo - Top S (1 Ph)		1.5 x 30 (min)	1.5 x 30 (min)	
Wilo - Stratus		1.5 3 x 40	1.5 3 x 40	
Taco	35	122, 121	122	1635/1935
Grundfos		UPS50-60F, speed 2	UPS50-60F, speed 3	
Bell & Gossett		PL-75	2.5" / LD3	
Wilo - Top S (1 Ph)		1.5 x 20 (max)	1.5 x 20 (max)	
Wilo - Stratus		1.25 3 x 30	1.25 3 x 30	
Taco	40	120	2400-60/2400-65	1635/1935
Grundfos		UPS43-44FC, speed 3	UPS50-60F, speed 2	
Bell & Gossett		PL-45/NRF-45	PL-45	
Wilo - Top S (1 Ph)		1.5 x 20 (min)	1.5 x 20 (min)	
Wilo - Stratus		1.25 3 x 30	1.25 3 x 30	

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.

D. 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 *PUREFIRE*® PF-850, PF-1000 or PF-1500 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.

E. 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 4.2 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.

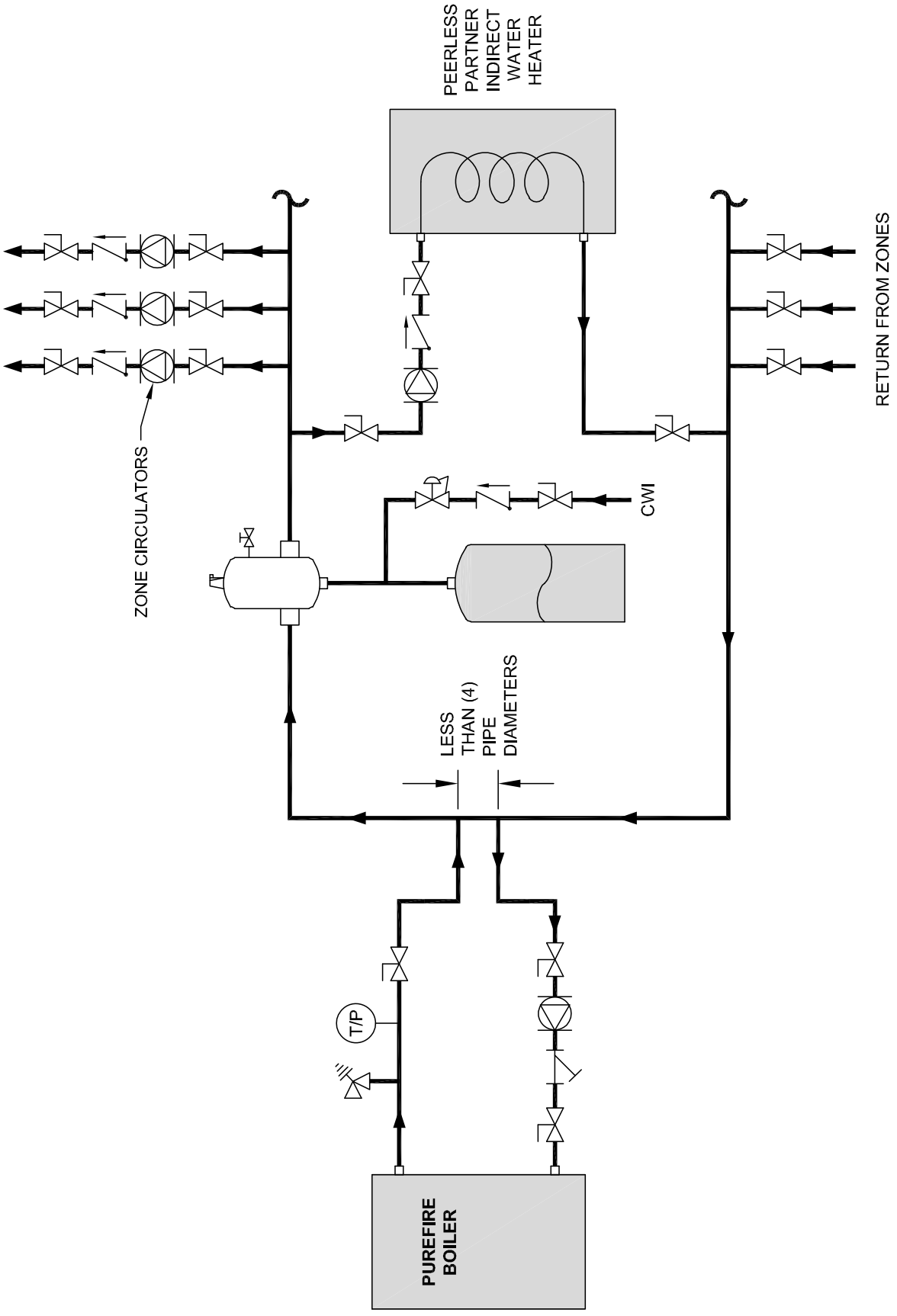


Figure 4.4: Recommended Piping – One Boiler with Multiple CH Zones & One DHW Tank

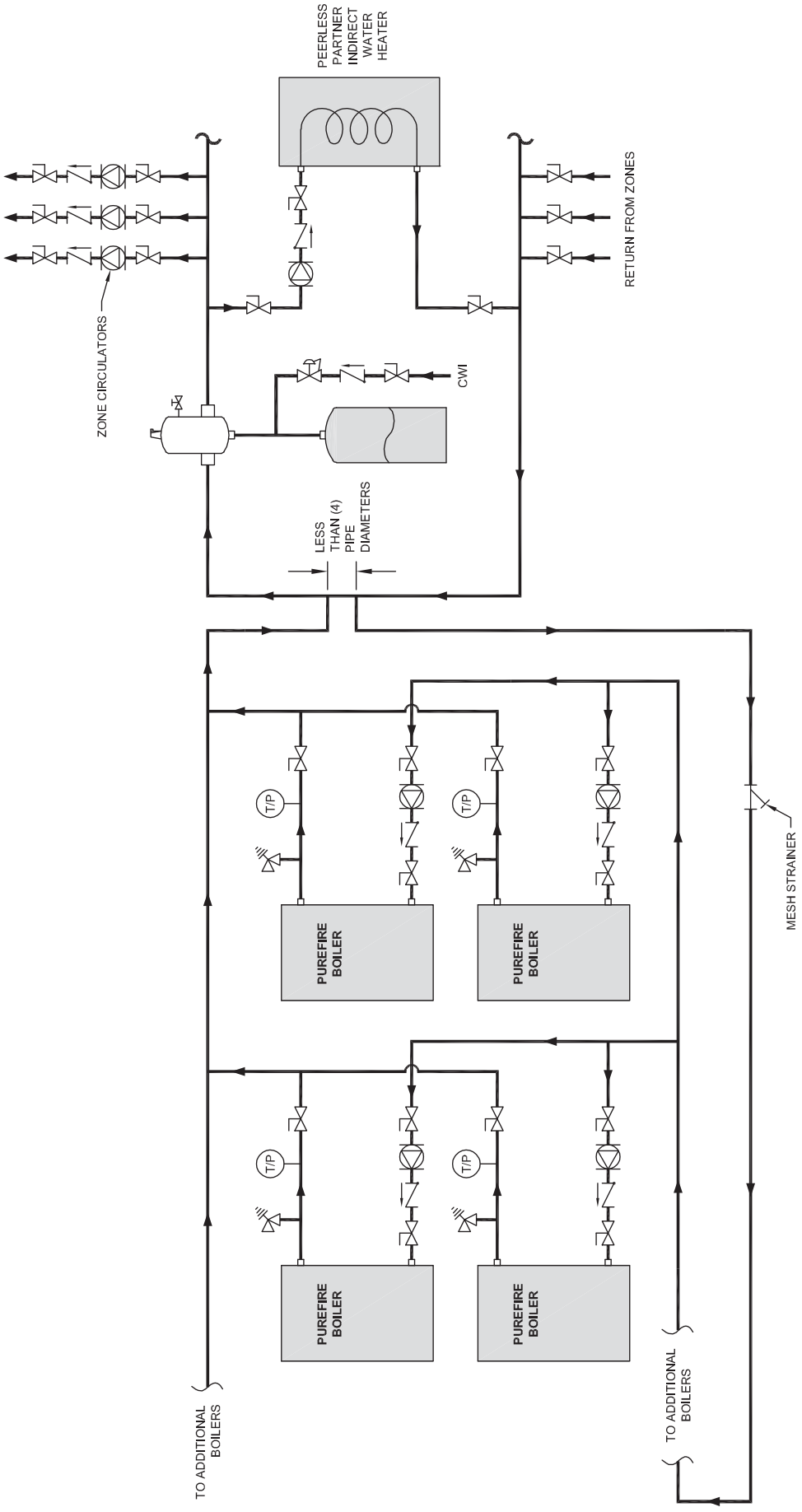


Figure 4.5: Recommended Piping – Multiple Boilers with Multiple CH Zones & One DHW Tank

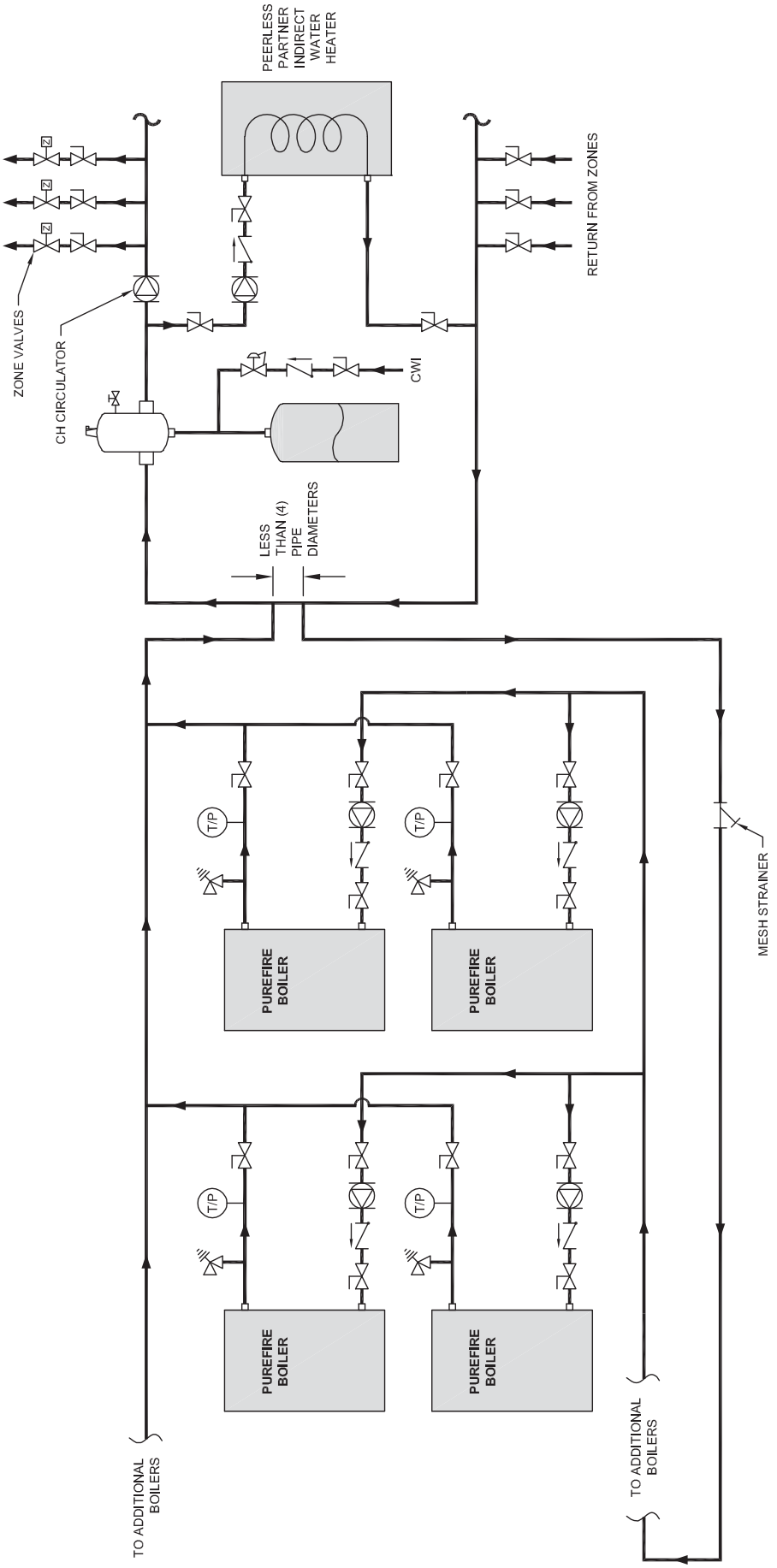


Figure 4.6: Alternate Piping – Multiple Boilers with Multiple CH Zones (Zone Valves) & One DHW Tank

F. SPECIAL APPLICATIONS

1. If the *PUREFIRE*® 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.

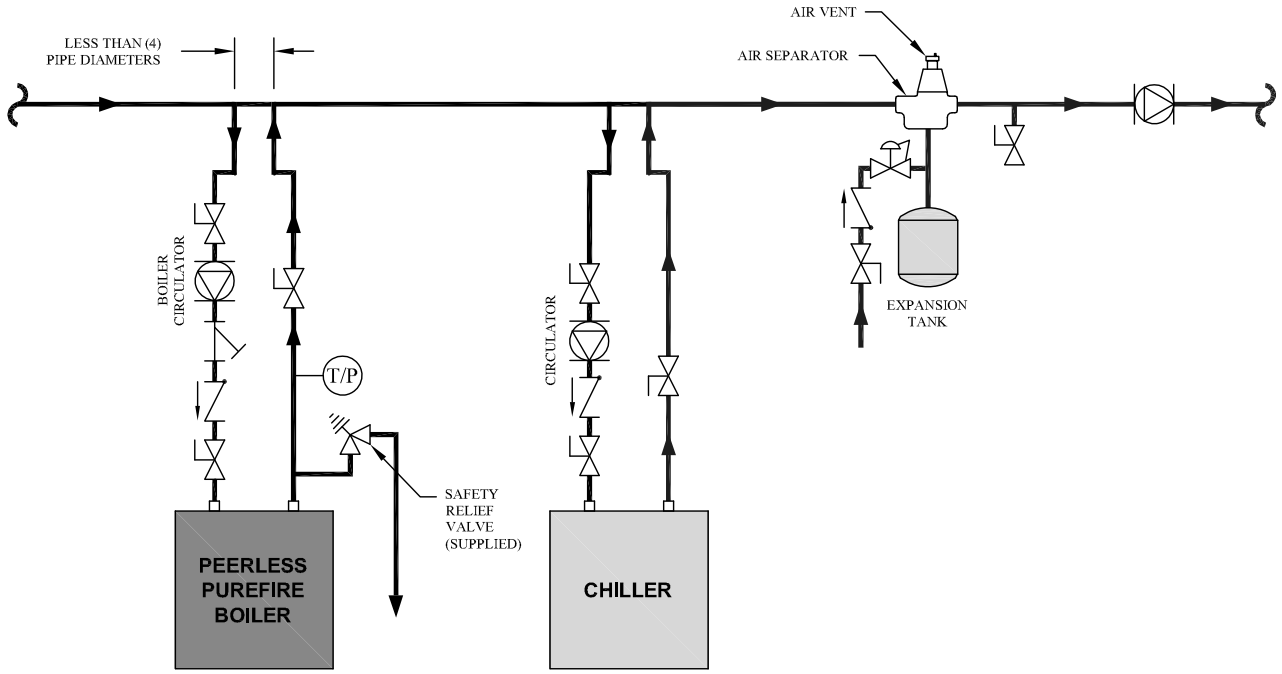


Figure 4.7: Boiler in conjunction with a Chilled Water System

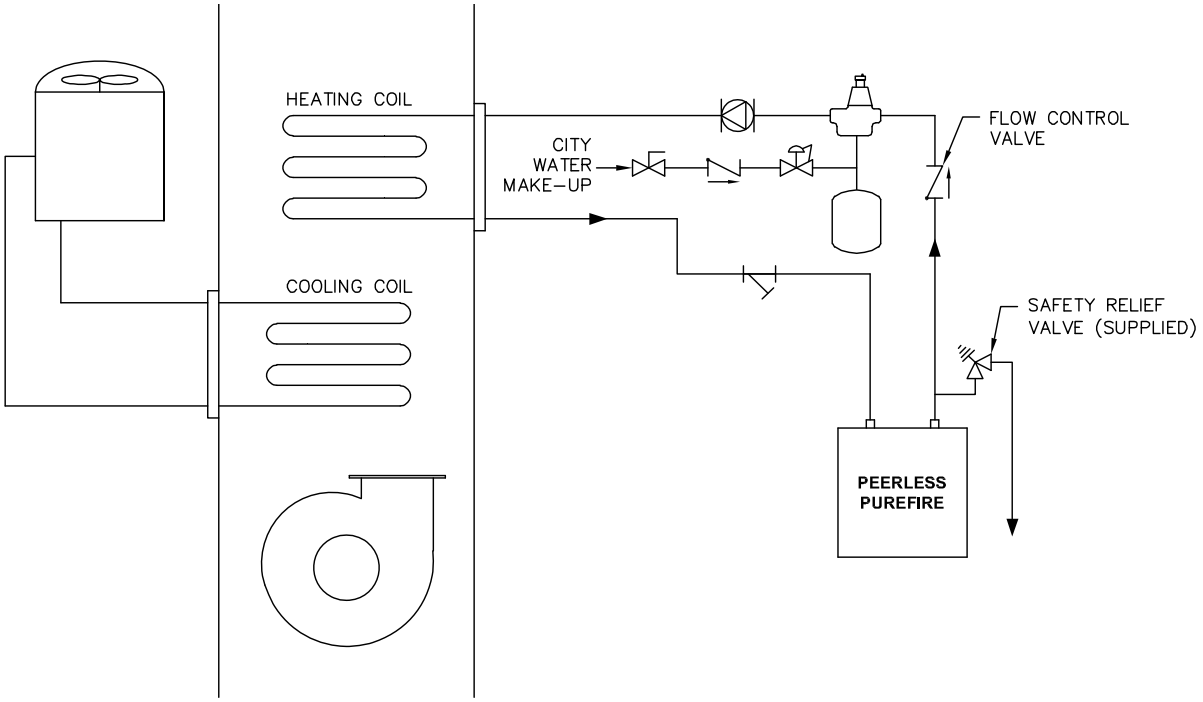


Figure 4.8: Boiler Connected to a Heating Coil in a Forced Air System

5. FUEL PIPING

A. GENERAL

1. All fuel piping to the *PUREFIRE*® 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:

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

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
PF-850	850	24.1	340	9.6
PF-1000	1,000	28.3	400	11.3
PF-1500	1,500	42.5	600	17.0

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.

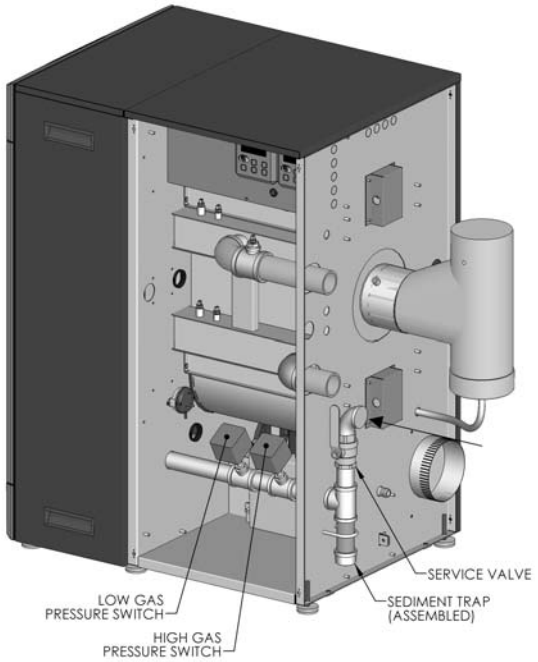


Figure 5.1: Gas Supply Pipe and Shutoff

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

	Fuel Inlet Pressure (at Gas Valve for each Burner)			
	Minimum		Maximum	
Fuel Type	in. w.c.	mbar	in. w.c.	mbar
Natural Gas	3.5	8.5	26	65
LP Gas	8.0	20	26	65

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 26 in. w.c. may result in damage to the automatic gas valve.

⚠ CAUTION

Do not subject the gas valve to more than 26 in. w.c. (65 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 for the automatic valve being checked.
   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.

n. Repeat this procedure on the second gas valve.

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 26 in. w.c., the boiler must be isolated from the gas supply piping by closing the service valve.
   b. If the gas valve is exposed to pressure exceeding 26 in. w.c., the gas valve 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 valve, venturi and blower assembly for the *PUREFIRE®* boiler.

2. Do not make adjustments to the gas valve 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 with the other burner off.
   b. The exhaust emissions should be checked with both burners in operation to assure correct operation.
   c. See Section 9, Start-Up Procedure for specific information about commissioning and adjusting the boiler.

4. The recommended CO_2 settings are given in Table 5.5. In no case should the boiler be allowed to operate with CO emissions higher than 150 ppm.

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

Table 5.5: Combustion Settings

	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)	8.8% to 10.0%	8.5% to 9.5%	9.8% to 11.0%	9.5% to 10.5%
Excess Oxygen (O_2)	3.4% to 5.4%	4.2% to 6.0%	4.2% to 6.0%	4.9% to 6.5%
Excess Air	17.3% to 31.0%	22.4% to 35.8%	22.4% to 35.8%	27.3% to 40.1%

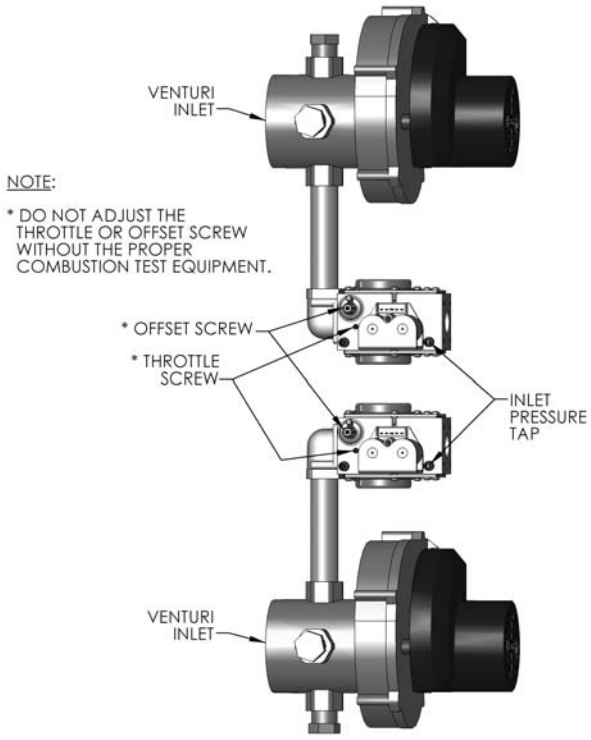


Figure 5.2: Gas Valve, Venturi, Blower Assembly – PF-850/1000

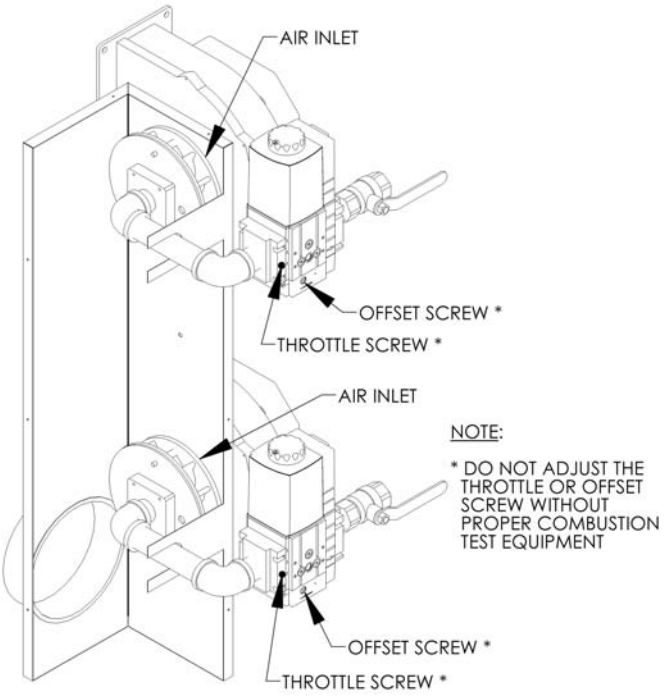


Figure 5.3: Gas Valve, Venturi, Blower Assembly – PF-1500

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 *PUREFIRE®* 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 *PUREFIRE®*.

3. Depending on several factors, the condensate from gas fired condensing appliances may have a pH value as low as 2.5 (similar to cola soft drinks). Some local codes require the use of neutralization equipment to treat acidic condensate.

B. CONDENSATE SYSTEM

1. The condensate system for PureFire 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
   c. Neutralize acidic condensate

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.

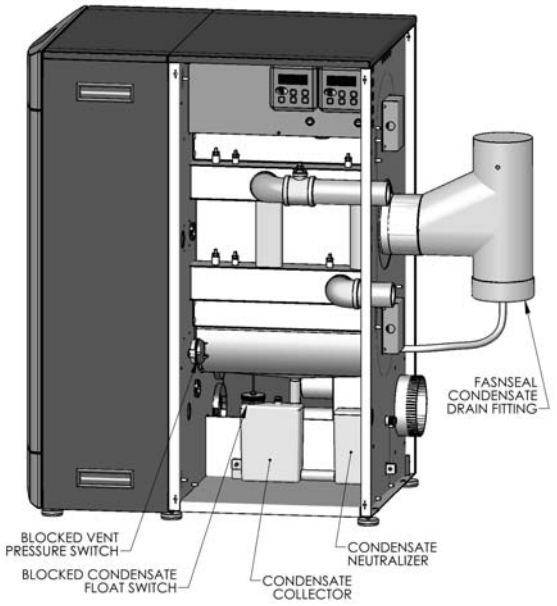


Figure 6.1: Condensate Trap System

   c. *Condensate Neutralizer Container*: This transparent vessel completes the trap system. It is also designed to hold the condensate neutralizing media that is supplied with the boilers. Open the screw cap and put neutralizing media into the container. The amount of media consumed depends on the acidity and amount of condensate produced. This vessel should be checked occasionally to determine if additional media is required. Neutralizing media is available from your PB Heat Distributor in 1 lb packages (#54159).
   d. *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 4.5" w.c. (11 mbar) and will prevent the boiler from continuing to operate with the condensate trap emptied due to high pressure.
   e. *FasNSeal 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 above 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 *PUREFIRE®* boiler is to be wired in accordance with the latest edition of the National Electrical Code, ANSI/NFPA 70.

The boiler must be electrically bonded to ground in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code, ANSI/NFPA 70, and/or the Canadian Electrical Code Part I, CSA C22.1, Electrical Code.

B. CUSTOMER CONNECTIONS

1. Electrical knockouts are provided on the rear panel of the PF-850, PF-1000 and PF-1500 boilers to connect supply wiring, circulator wiring, external controls and/or external sensors. Figure 7.1 shows these knockouts.

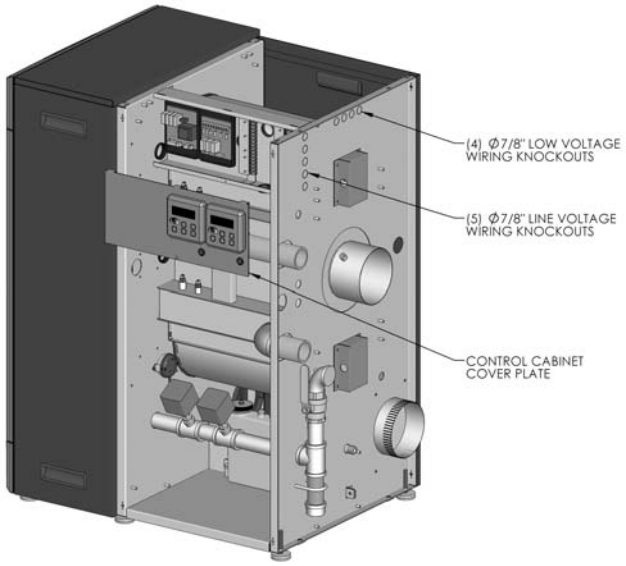


Figure 7.1: Electrical Terminal Access

   a. There are (5) 7/8" diameter knockouts for line voltage connections such as supply wiring, circulator wiring and low water cutoff (LWCO) wiring.
   b. There are (4) 7/8" diameter knockouts for low voltage connections such as outdoor sensors, domestic hot water (DHW) tank sensors and system sensors.

2. Electrical terminals are located behind the control cabinet cover plate where the Burner LCD Displays are mounted (See Figure 7.1).
   a. The cover plate can be removed by removing the single sheet metal screw on the lower center of the panel. The top of the panels is supported by tabs into the top of the cabinet enclosure.
   b. The terminal strips can be removed by gently pulling them away from the wired blocks. This allows the installer to attach wires to the connector before plugging the terminal strip into the mounted block.

3. Figure 7.2 show the customer electrical connections for PF-850, PF-1000, and PF-1500 boilers. Table 7.1 lists the terminal numbers with nominal voltage and detailed descriptions of the connections.

Table 7.1: Terminal Description

Terminal	Input/ Output	Voltage	Description
1	Output	24 VAC	CH Thermostat, Boiler Output from Zone Control Panel, or Zone Valve End Switches.
2			
3	Output	5 VDC	Outdoor Sensor (12 kΩ NTC Thermister) – To be located outside the building (north side in the shade).
4			
5	Output	5 VDC	DHW Sensor (12 kΩ NTC Thermister) or DHW Tank Thermostat.
6			
7	Input/ Output	24 VDC	Master Communication Link – Wire to terminals 9 & 10 on each Dependent Boiler.
8			
9	Input/ Output	24 VDC	Dependent Communication Link – Wire to terminals 7 & 8 on Master Boiler and 9 & 10 on more Dependent Burners.
10			
11	Output	24 VAC	Remove jumper to wire to external limit controls such as Low Water Cutoff, Damper or Power Vent Interlocks.
12			
13	Output	5 VDC	System Sensor (12 kΩ NTC Thermister) – To be located on the system supply header.
14			
15 (-)	Input	0-10 VDC	External analog input for boiler target setpoint temperature from Building Management System (BMS).
16 (+)			
17	Output	120 VAC	DHW Circulating Pump – Use this output to power the domestic hot water (DHW) circulator (Limited Priority).
18			
19	Output	120 VAC	CH Circulating Pump – Use this output to power the central heating (CH) circulator.
20			
21	Output	120 VAC	GEN Circulating Pump – Use this output to power the GEN (Boiler) circulator.
22			
23	Input	120 VAC	120 VAC, 60 Hertz, 1 Phase supply from a fused disconnect switch to power the boiler controls and blowers.
24			
25	Output	120 VAC	Line voltage output for probe-type low water cutoff (LWCO) power.
26			
27	Input	120 VAC	120 VAC, 60 Hertz, 1 Phase supply from a fused disconnect switch to power the boiler circulators.
28			
29	N/A	Ground	Earth ground.
30			
31	Dry Contacts		Alarm contacts (Operation may be changed from the Installer Menu to allow common venting of multiple boilers).
32			

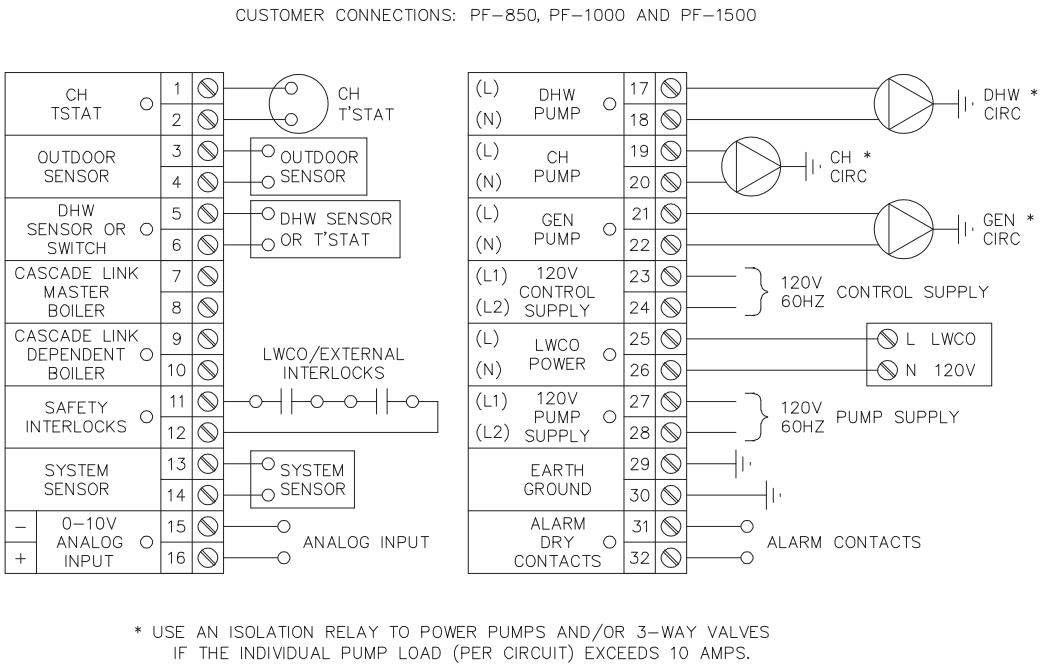


Figure 7.2: Customer Connection – PF-850, PF-1000 & PF-1500

C. ZONE CIRCULATOR WIRING

1. Wiring for a typical circulator zone panel is shown in figure 7.3.

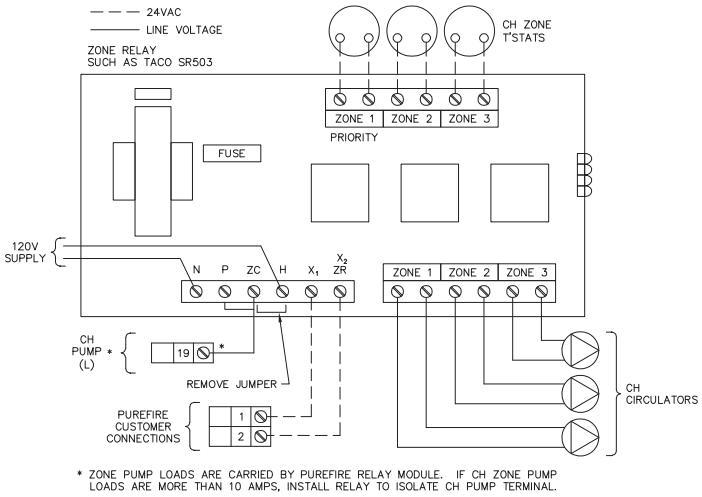


Figure 7.3: Typical Zone Circulator Relay Wiring

2. Note that the jumper between the hot leg of the supply (H) and the zone circulator power input (ZC) must be removed. Then a wire from terminal 19 of the main panel will power all of the zone circulators.

3. If the total current rating of all of the zone pumps exceeds 10 amps, an isolation relay must be used.

D. INTERNAL WIRING

Figure 7.4 shows the complete boiler wiring schematic for PF-850, PF-1000 and PF-1500 boilers. The following is a list of internal wiring components and a short description of each:

1. *User Interface Pixel Display*: A single user interface display is located on the front of the boiler behind the smoked lens on the jacket front panel. This interface provides information on the boiler system and allows the user to set the boiler address for cascade systems.

2. *Installer Interface Displays*: The installer interface display allow the installer or service contractor to display status information for many different values. These displays also allow the installer/contractor to change settings to optimize system efficiency and operation. A detailed description of the status and settings available is provided in Section 8 of this manual.

3. *Interface Module*: This component provides the following functions:
   a. Alarm Contacts: These dry contacts can be used to connect to an alarm bell, auto-dialer or other device to alert personnel in the event of a blocking or lockout error.
   b. Analog Input: This allows a 0-10 VDC input for external control of the system setpoint.
   c. Modbus Communication: This provides two way communication using Modbus interface for external control of the setpoint and feedback of system temperatures, error codes and other values.

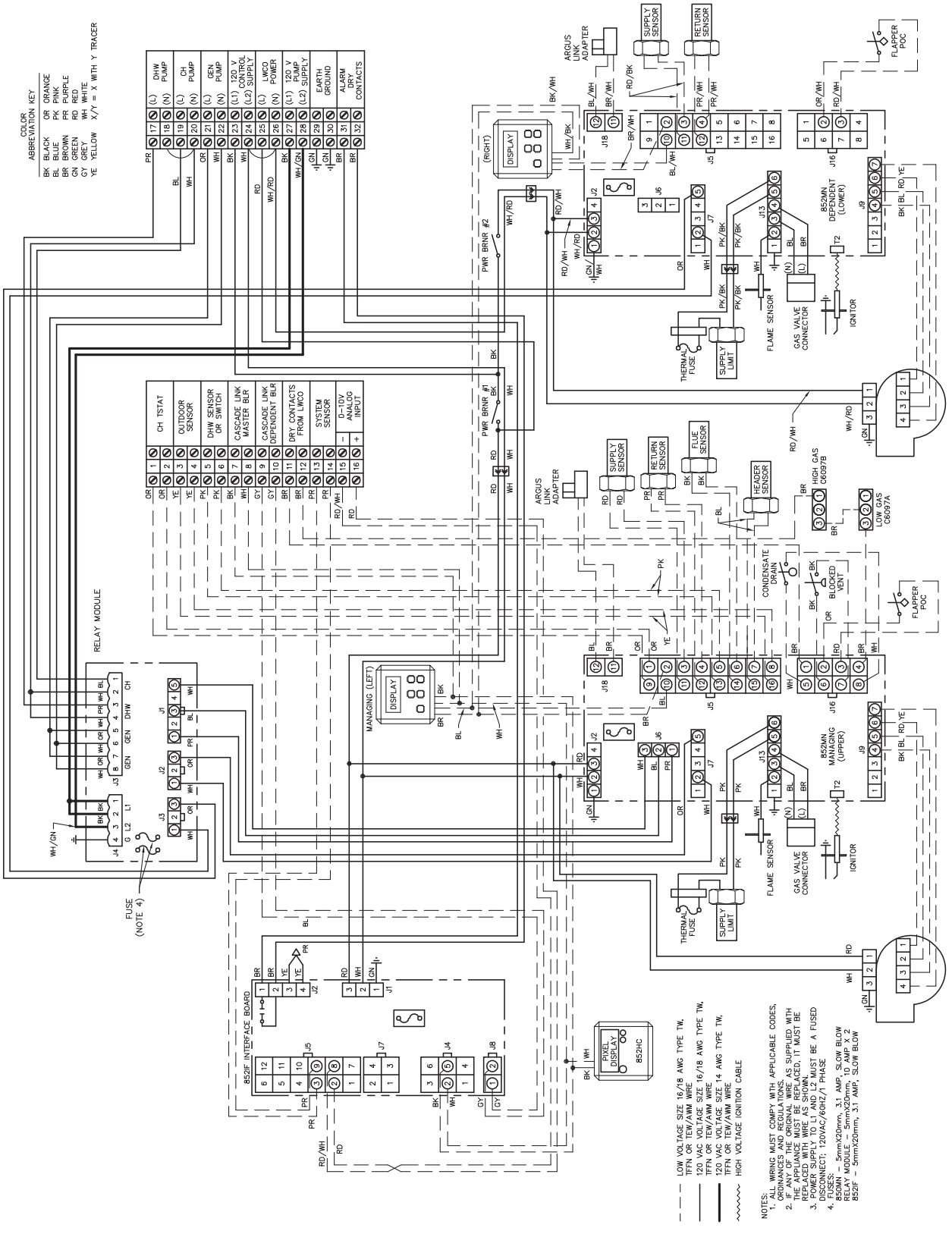


Figure 7.4: Internal Wiring Schematic for PF-850, PF-1000 & PF-1500 boilers

4. *Relay Module*: 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 will 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 27 and 28 on the right terminal strip.

5. *Integrated Primary Controls*: There are two primary ignition controls on the *PUREFIRE®* PF-850, PF-1000 and PF-1500 boiler. They are integrated controls that supervise all of the ignition timing as well as the burner modulation. The "managing burner" control is located in the blower vestibule area and is mounted adjacent to the top, "managing burner". The "dependent burner" control is located adjacent to the lower "dependent burner.

6. *Supply Temperature Sensors*: The supply temperature sensors provide input to their respective control which use them to determine the input rate of each burner. These sensors are 12kΩ NTC thermistors.

7. *Return Temperature Sensor*: The return temperature sensors provide information on the boiler return water temperature to prevent unsafe operation of the boiler. These sensors are 12kΩ NTC thermistors.

8. *Header Temperature Sensor*: The header temperature sensor provides the outlet supply temperature of the boiler to the managing control to control the overall boiler system operation. These sensors are 12kΩ NTC thermistors.

9. *Flue Temperature Sensor*: The 12kΩ flue temperature sensor provides the exhaust vent temperature to the managing control to prevent unsafe operation of the boiler.

10. *Supply Limit Switches*: The supply limit switches are UL353 certified temperature switches that prevent the boiler from exceeding 210°F (99°C) which is the maximum operating temperature allowed by ASME Boiler and Pressure Vessel Code, Section IV. These switches along with the manual reset circuitry of the primary controls meet the high limit requirements of ASME CSDAFB (CSD-1).

11. *Thermal Fuses*: The thermal fuses located at the rear of each combustion chamber prevent unsafe operation of the boilers in the event of ceramic deterioration in the combustion chamber target wall.

12. *Condensate Drain Float Switch*: This switch is connected to the managing primary control and prevents the boiler from operating if the condensate in the condensate collector vessel exceeds its maximum level.

13. *Blocked Vent Pressure Switch*: This switch is connected to the managing primary control and prevents the boiler from operating if the pressure in the combustion chamber exceeds 4.5 in. w.c. (11 mbar). This will prevent the boiler from operating with the condensate displaced from the trap due to pressure.

14. *Flapper Proof-of-closure Switches*: These switches transmit the position of the flapper to their respective primary control. If the switch indicates that the flapper is not closed on the inactive burner while the other burner is operating, it will start the blower for the inactive burner. This will assure a positive combustion chamber pressure and prevent combustion gases from back-feeding through the inactive burner in the event of a flapper failure.

8. BOILER CONTROL: OPERATION

A. IGNITION SEQUENCE

Figure 8.1 shows the ignition sequence for the *PUREFIRE®* boiler control. Table 8.1 describes each step in the sequence in detail. The *PUREFIRE®* boiler control provides dual sensing of the flame to maximize the reliability. The control senses the burner flame with both the flame sensor and the ignition electrode.

Igntion Cycle

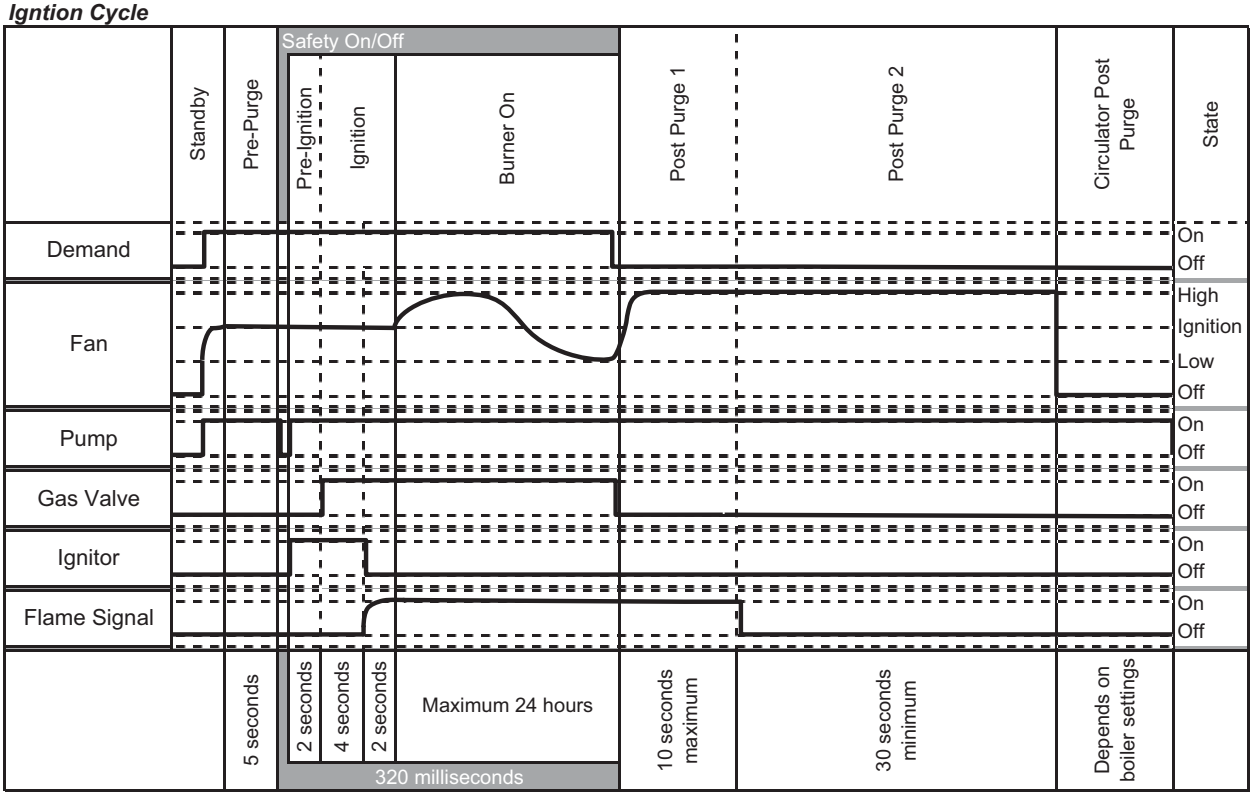


Figure 8.1: Ignition Cycle – Graphical Representation

Table 8.1: Ignition Sequence

Period	Demand Status	Burner LCD Display
Standby	No demand is present	16:36 STANDBY 160°F
	If the power is on to the *PUREFIRE®* boiler and there is no heat demand, the burner LCD will display "Standby" and show the boiler supply temperature in the lower right corner. The time, in 24 hour format, is shown in the upper right. When a heat demand (either CH or DHW) is present, the boiler begins the ignition cycle.	
Pre Purge	A CH or DWH demand must be present to initiate ignition. Once initiated the boiler will light.	16:36 CALL FOR HEAT Trial for Ignition 160°F
	When a demand is present, the *PUREFIRE®* control starts the combustion air fan. The fan speed then increases to ignition speed and the burner LCD displays the source of the call for heat along with "Trial for ignition." This screen is displayed until the burner is lit and stable or until a fault occurs. Once the ignition sequence begins it will continue through ignition even if the demand has ended.	

Table 8.1: Ignition Sequence (cont'd)

Period	Demand Status	Burner LCD Display
Safety On/Off	A heat demand has no influence in the Safety On/Off period. The Safety On/Off step will continue even if the demand has ended.	16:36 CALL FOR HEAT Trial for Ignition 160°F
	This step very quickly opens and closes the gas valve relays and determines if the control is operating correctly. The CH pump is turned off during this test.	
Pre-Ignition	A heat demand has no influence in the Pre-Ignition period.	16:36 CALL FOR HEAT Trial for Ignition 160°F
	Once the internal check is complete, the control begins a Pre-Ignition sequence. The igniter is energized while the gas valve remains off. If a flame is detected at the end of the pre-ignition period a lockout will occur.	
Ignition	A heat demand has no influence in the Ignition period.	The following displays occur on ignition failure only. 16:36 CALL FOR HEAT Ignition Retry 16:36 NO IGNITION Fan Post Purge
	The igniter remains energized for the first 4 seconds of the Ignition period. For the final 2 seconds of the Ignition period, the igniter is turned off and the control checks for a flame signal through both the ignition electrode and the flame sensor. If no flame signal is present at the end of the Ignition period, the control initiates a post-purge and then begins the ignition cycle again. If the number of ignition failures exceeds the allowable number in one call for heat, the control will post purge and lock out. If the "One Hour Retry" parameter is set to, "ON", the control will retry ignition one hour after an ignition failure. The control records 4 flame signal values during the last two seconds of this period that can be accessed from the "Installer Menu" under "Status".	
Burner On	A heat demand must be present for the control to stay in this period.	16:36 CENTRAL HEATING 100%Input 160°F
	Once a flame signal is established, the burner will run until a demand is satisfied, the setpoint is exceeded, or a blocking/lockout error occurs. The maximum run period for the burner is 24 hours. If the boiler runs continuously for 24 hours, the control will override the demand and turn off the burner. After this a restart will occur and the burner will continue to run.	
Post Purge 1	After the Post Purge period begins, a heat demand will be ignored until after this period.	The following screen is displayed when the demand has ended. 16:36 CENTRAL HEATING Fan Post Purge
	During post purge 1, the control monitors the flame signal to be sure that the flame has extinguished. If a flame is detected after the maximum 10 second time period, a control lockout will occur.	
Post Purge 2	During this period a heat demand has no effect on operation.	The following screen will be displayed if the supply temperature exceeds the target setpoint. 16:36 SUPPLY AT SETPOINT Fan Post Purge
	During this period, the combustion air fan runs at high speed to purge combustion gases from the heat exchanger. The default fan post purge period is 30 seconds. It is adjustable up to 120 seconds.	
Pump Purge	No heat demand is present.	16:36 CENTRAL HEATING Circulator ON
	The operation of the circulators and the boiler depend on the pump mode and the heat demand status.	

B. STATUS DISPLAY

The *PureFire*® boiler display screens are designed to provide the user and installer with useful information about the boiler function. PF-850, PF-1000 and PF-1500 boilers have three different display screens available.

1. Master Pixel Display: This display is located behind the smoked lens at the top of the boiler front panel. Removing the lens allows access to the display.
2. Managing Burner LCD Display: This display is located on the right side of the boiler behind the heat exchanger side panel. The managing burner display is located toward the front of the boiler and controls the upper burner assembly.
3. Dependent Burner LCD Display: This display is located on the right side of the boiler behind the heat exchanger side panel. The dependent display is toward the rear of the boiler and controls the lower burner assembly.

Table 8.2: Initialization Screens

	Pixel Displays	LCD Displays
Initialization Screens	PeerlessBoilers.com	P E E R L E S S P U R E F I R E - - i n i t i a l i z i n g - - V e r s i o n [x x x x] The software version indicated by [x x x x] indicates the version of the program for the display interface.

Initialization screens are displayed for the first few seconds after power is applied to the front Pixel display and both burner LCD displays.

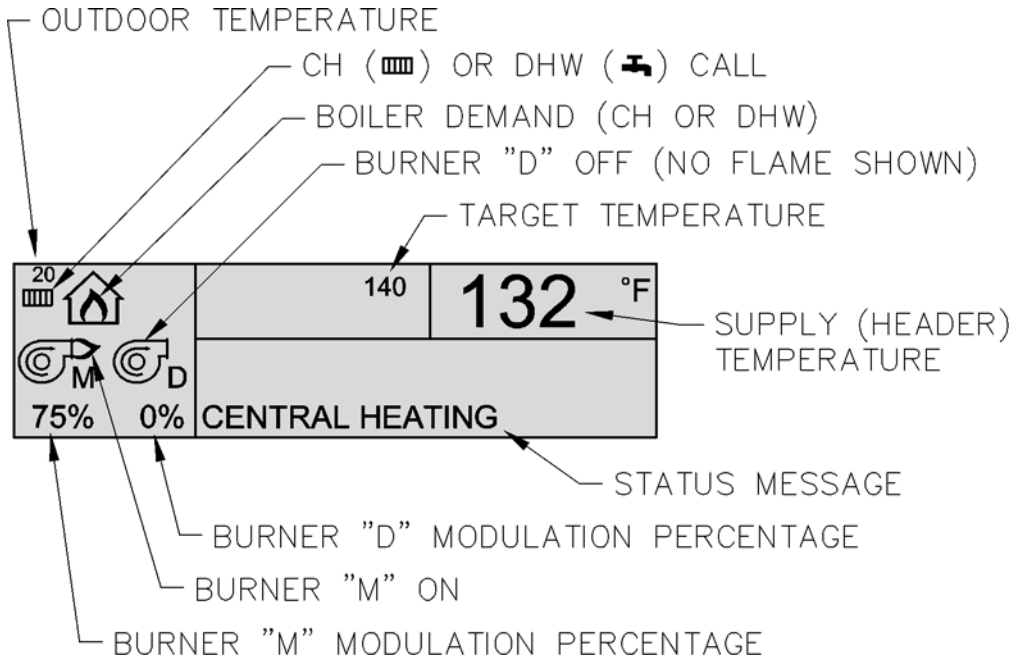


Figure 8.2: Pixel Display Illustration

Table 8.3: Display Screens Under Various Conditions

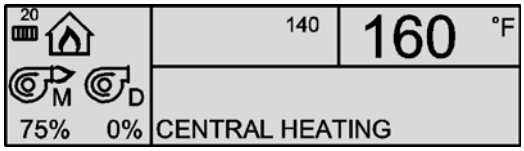
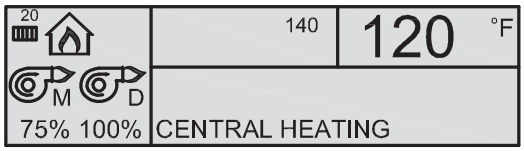
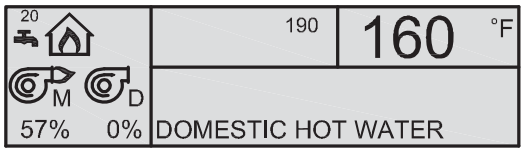
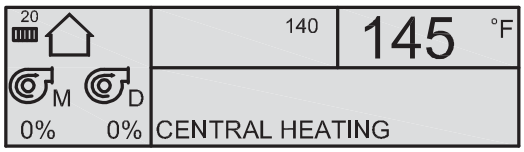
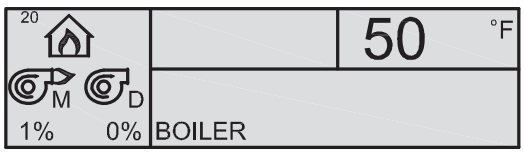
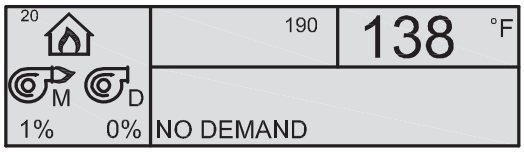
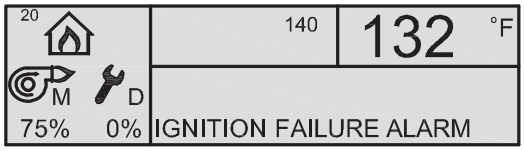
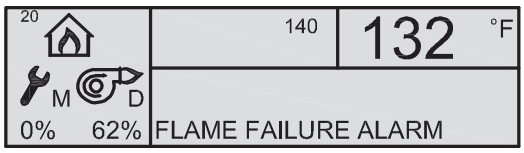
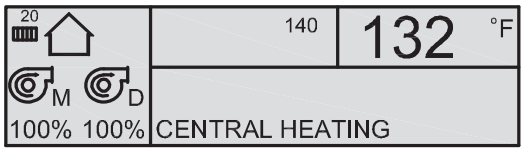
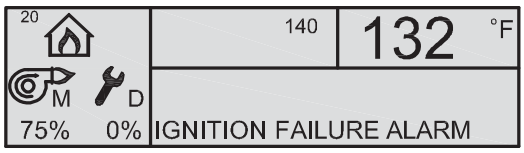
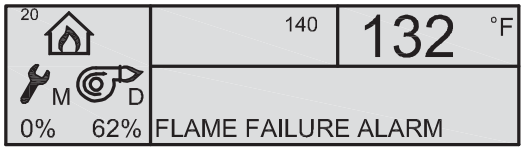
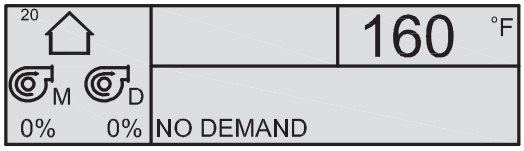
	Pixel Displays	LCD Displays
Standby		Managing (Boiler—Pressing the up or down key displays the boiler system information) 16:36 Cascade Standby 0 Burners ON 160°F Dependent 16:36 STANDBY 160°F
Central Heating (CH) Demand		Managing (Boiler) 16:36 CALL FOR HEAT 2 Burners ON 160°F
		Dependent 16:36 CALL FOR HEAT 120°F 75%INPUT 120°F
Domestic Hot Water (DHW) Demand		Managing 16:36 CALL FOR HEAT 2 Burners ON 160°F
		Dependent 16:36 CALL FOR HEAT 120°F 75%INPUT 120°F
Supply at Setpoint		16:36 SUPPLY AT SETPOINT Fan Post Purge 16:36 SUPPLY AT SETPOINT Circulator ON
Special Demand Functions		16:36 CENTRAL HEATING Freeze Protection 1%INPUT 50°F
		16:36 DOMESTIC HOT WATER Store Warm Hold 1%INPUT 138°F

Table 8.3: Display Screens Under Various Conditions (cont'd)

	Pixel Displays	LCD Displays
Ignition Failure Error Handling		16:36 NO IGNITION Fan Post Purge
Flame Failure Error Handling		16:36 FLAME FAILURE Fan Post Purge
Ignition Retry		16:36 CENTRAL HEATING Ignition Retry 16:36 DOMESTIC HOT WATER Ignition Retry

	Pixel Displays	Dependent LCD Displays
Error Handling	 	16:36 BLOCKING ERROR Fan Post Purge 16:36 BLOCKING ERROR Fan Post Purge 16:36 LOCKOUT ERROR Fan Post Purge
	Managing LCD Display	
	16:36 CALL FOR HEAT LOCKOUT ALARM B-01 1 Burner ON 132°F	16:36 LOCKOUT ERROR #A01 Ignition Error

	Pixel Displays	LCD Displays
Service Notification		SERVICE 16:36 STANDBY

C. USER MENU

To access the user menu for each burner, simply press the "Menu" key on the corresponding managing or dependent LCD display located on the right side of the boiler behind the heat exchanger access panel. The managing display is on the left and corresponds to the upper burner. The dependent display is on the right and corresponds to the lower burner. Use the "▲" and "▼" keys on the display to move the cursor to the desired selection. Pressing "Select" will access the submenu for the selection. The submenus are described in detail below.

Figure 8.3: User Menu

1. **LCD Status Menu**
   Status Menu: The user status menu gives the user or installer access to basic information about the boiler system. The first screen shows the Current Supply Setpoint. If the boiler is in CH Mode 0, 2 or 6, this is the temperature that the boiler targets. As the boiler approaches this target, the burners will modulate their input.

Figure 8.4: Status – Supply Setpoint

The next screens show temperature values read by the temperature sensors in the control system. The supply and return temperatures are measured at the header on the outlet side of the heat exchanger. There is a supply and return sensor for each burner. In addition to the supply and return sensors, there is a header (system) sensor on the boiler supply (outlet) pipe.

Figure 8.5: Status – Temperature

Typical Values for Water Sensors: (Supply/Return/System/DHW): 70°F (21°C) to 200°F (93°C).

A value of 14°F (-10°C) indicates an open sensor and a value of 244°F(118°C) indicates a short for these sensors.

Typical Values for the Vent Sensor are: 70°F (21°C) to 200°F (93°C).

A value of 50°F (-10°C) indicates an open sensor and a value of 244°F(118°C) indicates a short. Since boilers installed in low temperature environments such as a garage may experience vent temperatures below 50°F, the control works as follows:

a. If the Vent Temperature Sensor reads less than 50°F, the boiler will continue to operate normally, unless,
b. If the return temperature exceeds 80°F (27°C) or the supply temperature exceeds 120°F (49°C) the burners will operate at their minimum modulation until the call for heat ends or the vent temperature exceeds 50°F.

The outdoor sensor temperature should correspond to the current outdoor temperature. If the sensor is mounted in direct sunlight or near an appliance exhaust vent, erratic operation can result due to large changes in the apparent outdoor temperature.

A value of -40°F (-40°C) indicates an open sensor and a value of 244°F(118°C) indicates a short for this sensor.

The final screen of the status menu provides information on the status of each of the circulators. Since these circulators on the PF-850 and PF-1000 boilers are connected to the managing burner, only the statuses of these circulators are of interest.

Figure 8.6: Status – Circulators

2. **LCD Settings Menu**
   The user settings menu provides access to basic settings on the *PUREFIRE®* control. After choosing the "Settings Menu" the Central Heating Setpoint menu appears. To access the other menus, press the ▼ key. Some of the menus shown below will not appear depending on the CH or DHW mode chosen.
   a. Central Heating Setpoint: Depending on the CH Mode chosen (in the Installer Menu), the user may be able to adjust the boiler water temperature that is targeted by the control on a central heat demand. If the CH Mode is 1 or 2 (Outdoor Reset), this screen will show "OD RESET" along with the target temperature calculated by the control algorithm. The user is not allowed to override the calculated temperature. If CH Mode 0 or 6 is chosen, the target temperature can be changed by pressing the "Select" key and using the "▲" and "▼" keys to increase or decrease the value. The following shows the range and default values for the Central Heating Setpoint.

Figure 8.7: Settings – CH Setpoint

Table 8.4: CH Setpoint Range & Defaults

	Minimum	Maximum	Default
Central Heating Setpoint	50°F	195°F	160°F
	10°C	91°C	71°C

⚠ NOTICE

DHW Boiler Setpoint Setting is only available in DHW Mode 1 & 2.

b. DHW Boiler Setpoint: This value determines the target temperature for the boiler supply to an indirect domestic hot water (DHW) storage tank. This should not be confused with the DHW Tank temperature. If the DHW Mode is set to Mode 0 (No DHW) this screen will not be visible.

Figure 8.8: Settings – DHW Boiler Setpoint

Table 8.5: DHW Boiler Setpoint Range & Defaults

	Minimum	Maximum	Default
DHW Boiler Setpoint	122°F	195°F	180°F
	50°C	91°C	82°C

⚠ NOTICE

DHW Tank Setpoint Setting is only available in DHW Mode 1.

c. DHW Tank Setpoint: This screen allows the user to select the target temperature for the indirect DHW storage tank. This screen is only visible if the DHW Mode is set to Mode 1 (DHW Tank with Sensor) and an optional 12 kΩ DHW Tank sensor is purchased (PB Stock Code 54157).

Figure 8.9: Settings – DHW Tank Setpoint

⚠ DANGER

Water temperatures over 125°F can instantly cause severe burns or death from scalding. Children, elderly and disabled individuals are at the highest risk of scalding. See instruction manual for the indirect tank before setting the water heater temperature. Instruct users to feel the water temperature before bathing or showering. Anti-scald valves are recommended.

⚠ WARNING

Be sure to only use the 12 kΩ tank sensor indicated. Other sensors will not provide accurate tank temperatures and may cause severe personal injury due to scalding.

Table 8.6: DHW Tank Setpoint Range & Default

	Minimum	Maximum	Default
DHW Tank Setpoint	50°F	158°F	120°F
	10°C	70°C	49°C

d. Time & Date: This screen allows the user to set the current date & time for the burner. Setting the current date and time allows the installer to set up alert messages for routine inspection and maintenance.

Figure 8.10: Settings – Date & Time

- Press the "Select" key. The third line will alternately flash the day of the week and "---".
- Use the "⇧" and "⇩" keys to change the day. Press the "Select" key to select the correct day.
- The date value will flash. Use the "⇧" and "⇩" keys to change the date. Press the "Select" Key.
- The month value will flash. Use the "⇧" and "⇩" keys to change the month. Press the "Select" Key.
- The year value will flash. Use the "⇧" and "⇩" keys to change the year. Press the "Select" Key.
- The hour value will flash. Use the "⇧" and "⇩" keys to change the hour. Press the "Select" Key. (Note that the hour is displayed in the 24 hour format so that 3:00 pm = 15:00.)
- The minute value will flash. Use the "⇧" and "⇩" keys to change the minutes. Press the "Select" Key.

The date and time will be stored in non-volatile memory so the date will not require resetting if the power is disconnected.

e. Temperature Units: This screen allows the user to change the temperature unit display. The default units are Fahrenheit °F. To change the unit display, press the "Select" key. The current unit system will flash. Use the "⇧" and "⇩" keys to change the value to Celsius °C. Press the "Select" key again to choose the units.

Figure 8.11: Settings – Temperature Units

3. **LCD Message Menu**
The messages menu allows the user to view the last blocking error or last lockout error. The display will also show the interval between the last blocking or lockout error and the error before the last. To determine the interval between the current time and the error displayed, create an error by disconnecting the supply sensor wire.

a. Last Lockout Error: The last lock menu allows the user to view the reason for the last lockout. See Table 10.2 for a list of locking errors and the associated codes. Note that a value of #255 indicates that there are no lockout errors in the control history. Also, note that the errors displayed may have occurred during the factory fire test or field commissioning of the equipment.

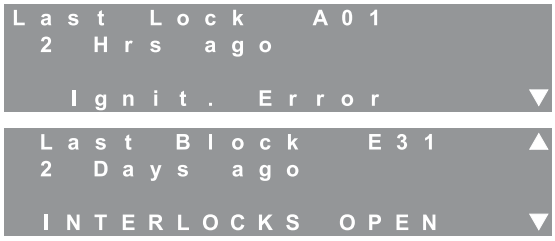


Figure 8.12: Messages – Last Errors

b. Last Blocking Error: The last block screen allows the user to view the reason for the last blocking error. See Table 10.1 for a list of blocking errors and the associated "E" codes. Note that a value of #255 indicates that there are no blocking errors in the control history. Also, note that the errors displayed may have occurred during the factory fire test or during field commissioning of the equipment.

D. INSTALLER MENU

1. **Menu Overview**
The installer menu allows installing or service contractors to view and/or make adjustments to the permanent boiler settings based on the installation configuration, desired operation and local codes. The menu structure is shown in Figure 8.13.

Figure 8.13: Installer Menu

To access the installer menu, press and hold the "Menu" and "Select" key on the LCD display corresponding to the burner on which the parameter change is to be made.

a. Managing Burner (Burner M): The top burner on each PF-850, PF-1000 or PF-1500 boiler is designated as "Burner M" or "managing burner". This burner control is connected to the GEN (Boiler) circulator, the CH and/or DHW circulator* and all external sensors*. In the following section, all parameters which affect only the managing burner will be designated with "(M)".

***Stand-Alone configuration or Master Boiler in multiple boiler configuration.**

b. Dependent Burner (Burner D): The bottom burner on each boiler is designated as the "Burner D" or "dependent" burner. This burner control is started and stopped by the managing burner only. Its operation is not affected by external inputs.

2. **Status**
The status menu is designed to monitor key parameters and aids the installer or service contractor in determining if there are problems with boiler operation.

a. Current Supply Setpoint: The setpoint value will change for DHW demands or CH demands depending on the setpoint chosen for these modes of operation. When outdoor reset modes are selected, this value is the calculated target for the system.

Figure 8.14: Status – Supply Setpoint

b. Fan Speeds: Screens #2 & #3 display fan speed information. The current fan speed will vary during operation between the low power and high power values. The Low Power, Ignition, and Hi Power values are preset at the factory for a specific model size. Table 12.3, in Section 12 of this manual, shows the fan speed presets for each model size. Note that these values may vary slightly due to air setting changes.

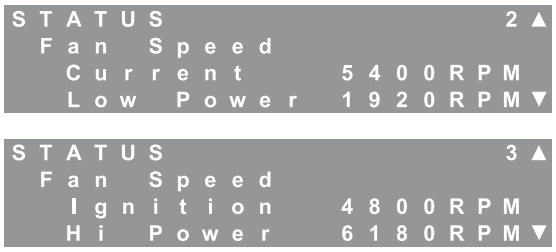


Figure 8.15: Status – Fan Speeds

c. Flame Measurements: Screens #4, #5 & #6 display flame signal information. The first value, Flame Signal, is the current flame rectification signal in micro amps (μA). The minimum value for this signal that will allow the burner to continue running is 2.8 μA the maximum value for this is 10 μA.

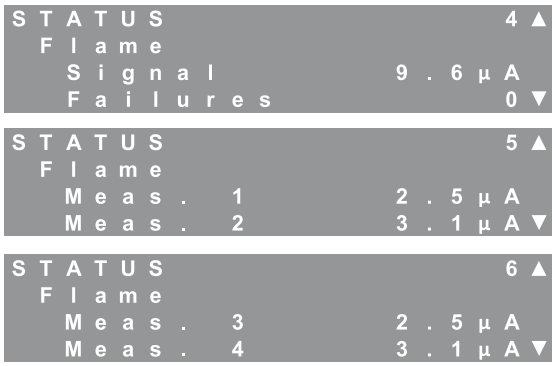


Figure 8.16: Status – Flame Signal

The next value, Flame Failures, is the number of times the burner has dropped out due to flame failure. Several flame failures may have occurred during the factory firetests and installation. If there are a large number of flame failures showing on this screen, contact your Peerless® Representative.

On Screens #5 and #6, the Flame Measurement values 1-4 are logged in the last two seconds of the most recent ignition sequence in 1/2 second intervals. This helps service contractors to diagnose ignition issues.

d. Ignition Attempts: Screen #7 provides information about ignition attempts. Obviously, the total ignition attempts are the sum of the successful and failed attempts. Several ignition failures may occur during factory firetest and equipment commissioning. However, if there are a large number of failed ignition attempt showing on this screen, contact your Peerless® Representative. If there is an unusually large number of total ignition attempts, there may be a problem with the boiler short cycling.

Figure 8.17: Status – Ignition

e. Burner Run Time: Screen #8 provides information about the total run time of each burner. The total burner run time is the sum of the central heating (CH) and domestic hot water (DHW) hours. The total boiler run time is the sum of both burner run times.

Figure 8.18: Status – Burner Run Time

f. Blocking Errors: Screen #9 provides error history about the last 16 blocking errors. Blocking errors are errors that prevent the burner from operating until the condition causing the error is corrected. Sensor errors, low water, and blocked vent are examples of this type of error. To review previous errors, press the select key. The number in the upper right changes from the status screen "9" to a blinking "0" indicating that this is the most recent error. Use the arrow keys to scroll through previous errors from 0 to 15. If the screen shows "#255" in the error number location, this indicates that there is no error stored in this location. All errors on screens higher than one showing "#255" should also indicate no error. Table 10.1 (in Section 10) provides a list of blocking errors.

Figure 8.19: Status – Blocking Errors

g. Lockout Errors: Screen #10 provides error history about the last 15 locking errors. Locking errors are errors that require a manual reset on the control board (pushing the "Reset" key on the display) to reset the burner once the condition causing the error has been corrected. Ignition Failure, Flame Failure and High Limit Temperature are examples of this type of error. To review previous errors, press the "Select" key. The number in the upper right changes from the status screen number "10" to a blinking "0" indicating that the screen is showing the most recent lockout error. If the burner is not in lockout, this position should show "#255" in the error number location. Use the arrow keys to scroll through previous errors from 1 to 15. As with blocking errors, "#255" always indicates that no error is stored in this location. Table 10.2 provides a list of lock out errors.

Figure 8.20: Status – Locking Errors

3. **Burner Settings**
The burner settings menu allows the installation or service contractor to change settings which effect the burner operation. The following are descriptions of the available settings.

a. Burner Mode: The burner modes are set by default from the factory. The upper burner, which corresponds to the display closest to the front of the boiler, is always the "managing burner". The lower burner, with its display toward the rear, is always the "dependent burner". These values are not intended to be changed in the field.

b. Boiler Address: *PureFire*® boilers can be operated in cascade with as many as 15 identical boilers by adding 2 wire communication links between the boilers. The following chart shows the role of the boiler depending on the boiler address. Multiple boiler operation is covered in-depth at the end of this section of the manual. This screen is available only on the managing burner.

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Figure 8.21: Burner Settings – Burner Mode & Boiler Address

Table 8.7: Boiler Address

Boiler Address Value	Description
0	Stand-Alone Boiler
1	Master Boiler in a Cascade System
2-16	Dependent Boilers in a Cascade System

c. Installation Location & Vent Material: Due to differing national codes in the United States and Canada, there are different material requirements for exhaust vent pipe. Therefore, the maximum vent limit temperature is different depending on the material used.

Screens #3 and #4 allow the installer to select the installation location and vent material. Based on the information given, Table 8.8 shows the exhaust temperature that the control will allow before reducing the burner input rate. If the temperature of the exhaust gas approaches these values, the control will reduce the input rate on both burners until the temperature begins to drop. If the flue temperature continues to rise, the control will shut down both burners.

Figure 8.22: Burner Settings – Location & Vent Material

Table 8.8: Vent Temperature Limits

Vent Material	Location	
	U.S.A.	Canada
PVC	190°F (80°C)	149°F (65°C)
CPVC	230°F (110°C)	190°F (80°C)
Polypropylene (PPs)	230°F (110°C)	230°F (110°C)
Stainless Steel	230°F (110°C)	230°F (110°C)

Note: Although stainless steel can withstand a temperature higher than 230°F (110°C) the temperature limit is set to this temperature since the vent temperature should not exceed this temperature unless there is a problem with the heat exchanger.

Table 8.9: Location & Vent Material Default

Parameter	Default
Location	U.S.A.
Vent Material	PVC

d. Freeze Protection: Freeze protection is intended to prevent freezing the central heating system.

Figure 8.23: Burner Settings – Freeze Protection

- First, the control activates pumps to distribute heat uniformly through the system.
  - – If the boiler supply (header) temperature drops below the value selected for "Freeze Protection starts at:", the General (boiler) circulator is activated.
  - – If either of the boiler return sensors reports a value below this temperature, the CH circulator is started.
- Next, if Burner M return temperature drops more than 9°F (5°C) below the "Freeze Protection starts at:" value, the control activates Burner M (managing burner) at it minimum rate.
  - – If a central heat demand is detected while the burner is operating for Freeze Protection, the burner will run normally to satisfy the demand.
  - – Finally, once the return temperature increases to 9°F (5°C) above the chosen value, the burner is switched off and the pumps are deactivated.

Table 8.10: Freeze Protection Range & Default

Freeze Protection Starts at	Default	Minimum	Maximum
	50°F (10°C)	45°F (7°C)	56°F (13°C)

e. Blower Postpurge Time: The blower postpurge time can be increased to address problems under extreme conditions (long exhaust vent runs, high winds, etc.) where the products of combustion are not fully expelled from the venting system. This feature should be used sparingly as it may lead to decreased efficiency and higher fuel bills in certain situations.

Figure 8.24: Burner Settings – Blower Post Purge

Table 8.11: Blower Post Purge Range & Default

Blower Post Purge Time	Default	Minimum	Maximum
	30 sec	30 sec	120 sec

f. Additional Safety Functions: This feature allows the installer to choose between using a low water cut-off or a flow switch to assure proper water circulation and operation of the boiler. Either of these devices should be wired to the terminals 11 & 12 (Safety Interlocks) of the *PUREFIRE®* PF-850 or PF-1000 boilers. Note that these terminals are connected internally to the high & low gas pressure switches so that a "Safety Interlock Open" error may occur due to high or low gas pressure in addition to anything connected to these terminals.

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Figure 8.25: Burner Settings – Additional Safety Functions

- Low Water Cut Off: This is the default selection on the control. When installing a probe type low water cut off, locate the LWCO in the boiler supply above the top jacket panel. A probe type LWCO, such as the Hydrolevel 1150 or the McDonnell & Miller RB-120 is recommended. Refer to Figure 8.27 for recommended wiring.
- FlowSwitch: A flow switch, such as the McDonnell & Miller FS250, is designed to trigger a blocking error immediately on a loss of flow in the system. To protect from a false flow reading on this type of device, the control assures that the flow switch is open (indicating no flow) before activating the General and the CH or DHW circulator. After these pumps are activated, it will not proceed into a trial for ignition until the switch closes.

g. Ignition Attempts: The control is configured from the factory to not allow the burner to recycle after a failed ignition attempt. At installation, the control can be configured to allow up to 3 ignition attempts before locking out and requiring a manual reset. In addition, the control may be configured to retry for ignition, one hour after lockout without a manual reset. Check applicable codes before changing these parameters.

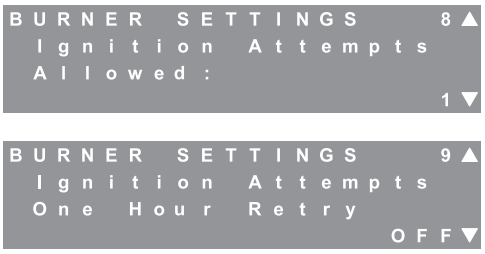

Figure 8.26: Burner Settings – Ignition Attempts Allowed

Table 8.12: Ignition Attempts Ranges & Defaults

Parameter	Default	Minimum	Maximum
Ignition Attempts Allowed	1	1	3
Ignition Attempts 1 Hr Retry	OFF	OFF	ON

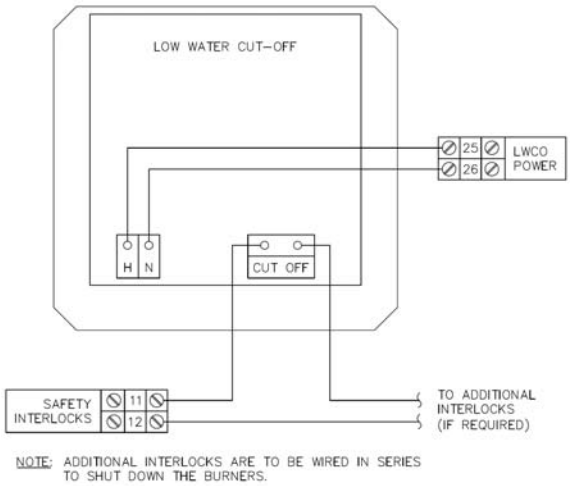

Figure 8.27: Low Water Cut-off (LWCO) Wiring

h. Flame Failures: The control is configured from the factory to not allow the burner to recycle after a flame failure. At installation, the control can be configured to allow up to 2 retries after a flame failure before locking out and requiring a manual control reset. In addition, the control may be configured to retry for ignition one hour after a lockout without a manual reset. Check applicable codes before changing these parameters.

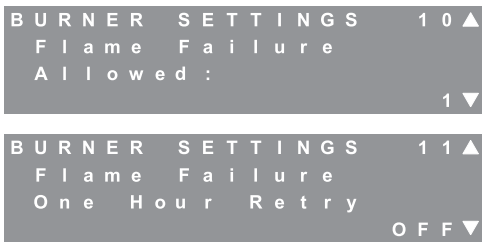

Figure 8.28: Burner Settings – Flame Failures Allowed

Table 8.13: Flame Failures Allowed Ranges & Defaults

Parameter	Default	Minimum	Maximum
Flame Failure Retries Allowed	0	0	2
Flame Failure 1 Hr Retry	OFF	OFF	ON

i. Air Adjustment: Screens #12 and #13 allow the fan speed to be increased if required. The following is an explanation of the conditions under which these adjustments should be made.

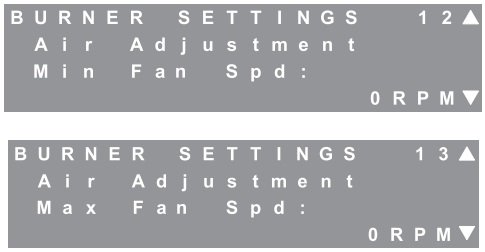

Figure 8.29: Burner Settings – Air Adjustment

j. Minimum Fan Speed: The minimum fan speed adjustment is intended to respond to potential issues with the loss of flame due to pressure fluctuations in the venting system. These concerns may be due to wind gusts on sidewall vented boilers or other sources of exhaust vent pressure spikes. The minimum fan speed may be adjusted in 30 RPM increments up to the minimum fan speed + 540 RPM. This feature should only be used to address nuisance flame failure or flapper valve failure lockout errors.

k. Maximum Fan Speed: The maximum fan speed adjustment is intended to compensate for long exhaust vent runs if the boiler fails to keep up with the required load. Since the input rate may drop off slightly under increased resistance due to long exhaust vent installations, the boiler input may be incrementally increased to compensate. This adjustment should only be made if both of the following conditions are met:

- The boiler is not keeping up with the required load.
- The input rate has been determined to be below the rated input by timing the gas supply meter.

If these conditions are not met, contact your Peerless® Representative for assistance.

Table 8.14: Air Adjustment Ranges & Defaults

Parameter	Default	Minimum	Maximum
Air Adjustment Min Fan Speed	0 rpm	0 rpm	540 rpm
Air Adjustment Max Fan Speed	0 rpm	0 rpm	540 rpm

l. Alarm Mode: The alarm mode allows the installing contractor to set the menu to the mode appropriate for the installation. The default setting is "Stand Alone" in which the alarm contacts (Terminals #31 & #32) simply close if an alarm condition exists. Figure 8.31 shows the proper wiring arrangement for the "Common Vent" alarm mode. In this configuration, the alarm will sound if a boiler loses power.

Figure 8.30: Burner Settings – Alarm Mode

4. **Central Heating (CH) Settings**
CH settings manage the boiler temperature and circulators for the central heating load. Although the menu items that follow are factory set, by default, to values that can operate in any installation, they can be adjusted to maximize the efficiency of this product. The boiler can be configured to operate with a fixed setpoint or using outdoor reset to vary the boiler target temperature according to the load implied by the outdoor temperature.

a. Setpoint Operation: When using a setpoint strategy, the boiler targets a fixed setpoint which is set in the User Menu on the *PUREFIRE®* control. As the boiler supply (outlet) temperature approaches this target, the burner begins to modulate the fuel input, reducing the output rate of the boiler. If the boiler reaches a temperature of 9°F (5°C) above the setpoint before the heat demand ends, the burner will shut down. If the heat demand continues and the boiler temperature drops 9°F (5°C) below the setpoint, the burner will restart.

b. Outdoor Reset Operation: Outdoor reset strategies are ideal for condensing boilers for two reasons:

- Heat distribution units, such as radiators, radiant floors and copper baseboard are sized to deliver the heat required on the coldest day at a set temperature. For the remainder of the heating season, the maximum output is not required, so the distribution can be set to a cooler temperature.
- Condensing boilers, like the *PUREFIRE®*, are designed to withstand acidic condensate and therefore can be operated at as low a temperature that is reasonable. At lower temperatures [below 120°F (49°C) return temperature], these boilers condense more and are more efficient.

c. CH Modes: The CH modes allow the operator to change the way the boiler operates to satisfy central heating demands.

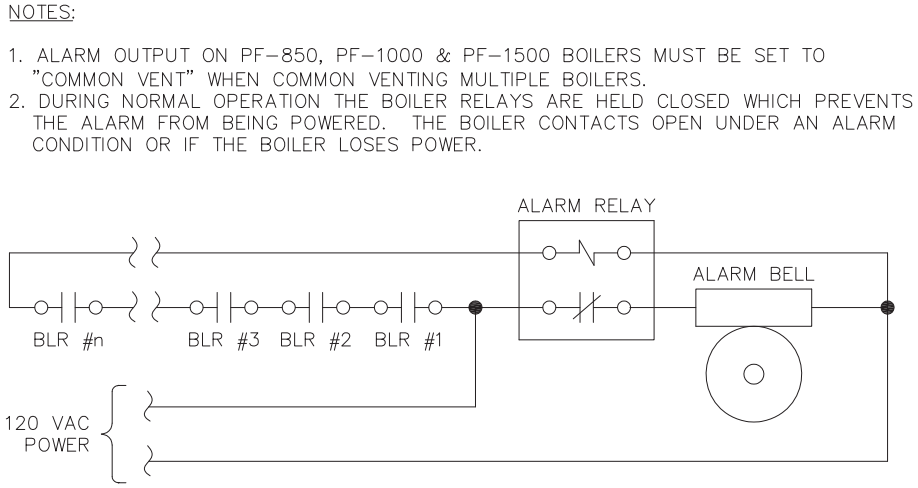

Figure 8.31: Alarm Wiring for Common Venting

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Figure 8.32: CH Settings – CH Modes

Table 8.15: CH Modes

Mode	Display	Target Temperature	Action when Terminals #1 & #2 Closed
0	Indoor Thermostat	Fixed Setpoint	Call for Central Heating
1	Indoor Thermostat with OD Reset	Outdoor Reset Calculation	Call for Central Heating
2	Permanent Demand & OD Reset	Outdoor Reset Calculation	18°F (10°C) Target Setback
3	Permanent Demand	Fixed Setpoint	18°F (10°C) Target Setback
4	0-10 V Input to Modulate Setpoint	External Analog (0-10 VDC) Input of Setpoint	No Effect

- *Mode 0, Indoor Thermostat*: This is the default mode in which the boiler responds to a demand from an indoor thermostat or zone control panel at terminals #1 and #2 in the *PUREFIRE®* control panel. The control targets a fixed setpoint and as the boiler water temperature approaches the target, the control begins to reduce the fuel input. This mode doesn't require an outdoor sensor.
- *Mode 1, Indoor Thermostat with Outdoor Reset*: When operating in this mode, the control uses the outdoor temperature and installer selected data to calculate a target boiler water temperature. A detailed description of outdoor reset is presented later in this section.
- *Mode 2, Permanent Demand and Outdoor Reset*: In this mode, the boiler operates to maintain a supply (header) temperature calculated by the outdoor reset algorithm. The boiler operates independently of any room thermostats. This is useful in buildings with many zones which operate on independent thermostats to prevent the boost function (described later in this text) from increasing the target temperature due to a long sustained call for central heat resulting from overlapping individual calls.
- *Mode 3, Permanent Demand*: This mode is similar to Full Outdoor Reset except that the control targets a fixed setpoint instead of a calculated setpoint based on the outdoor temperature. Again, the boiler control operates independently of input from room thermostats. If a switch between terminals #1 and #2 is closed, the target temperature will be set back by 18°F (10°C).
- *Mode 4, 0 -10V Input to Modulate Setpoint*: This allows the boiler supply target to be set by an external analog 0-10 volt signal. The input for this signal is at terminals #15 & #16. A call for heat will be generated by a signal of 1.5 VDC or higher. The setpoint for an input voltage between 1.5 and 2.0 VDC will result in a boiler setpoint of 68°F (20°C). An input voltage of 10 VDC will result in a setpoint of 195°F (91°F).
- *Setback*: If a switch is closed across terminals #1 & #2, a setback of 18°F (10°C) is applied to the calculated target temperature. This feature is useful in a building (such as an office building) that is unoccupied during certain times. A switch or timer can be used to set back the boiler target temperature during unoccupied periods.

d. Pump Purge Time: The installer can define the length of time that the circulators operate after the end of call for heat. The CH and General circulator post purge time can be set independently. The following chart shows the range and default values for both of these pumps.

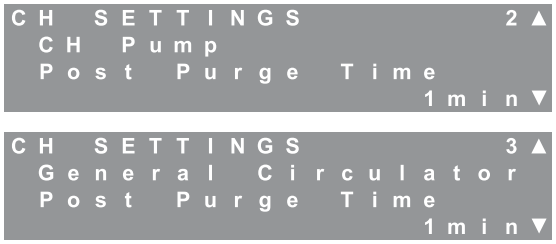

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Figure 8.33: CH Settings – Pump Purge Time

Table 8.16: Pump Purge Time Ranges & Defaults

Circulating Pump	Minimum	Default	Maximum
Central Heating (CH)	0	1 minute	60 minutes
General	0	1 minute	60 minutes

e. Outdoor Reset: Since heating loads are typically lower when the outdoor temperature rises, outdoor reset lets the installer reduce the boiler target temperature as the outdoor temperature increases. As mentioned above, this increases the efficiency of the boiler. This is especially true with condensing boilers because it helps to recover the heat from the water vapor which, in conventional boilers, carries valuable energy out with the exhaust.

f. System Type Presets: For convenience, the *PUREFIRE®* boiler control provides preset values for the outdoor reset parameters based on the system type. Table 8.17 shows the values that are applied when different system preset types are selected. If the system type, "User Defined" is chosen the outdoor reset definition values may be adjusted. If changes are made to the boiler design or mild weather boiler temperatures, the system type is automatically switched to, "User Defined".

Table 8.17: System Type Presets

System Type	Temperatures	
	Boiler Design	Mild Weather Boiler
1. Finned Tube Baseboard	180	140
2. Hydro Air Unit	190	140
3. Cast Iron Radiator	160	120
4. Cast Iron Baseboard	150	110
5. Low Mass Radiant	140	70
6. High Mass Radiant	120	70
7. user Defined (Default)	180	70

g. Warm Weather Shutdown: If the boiler is set to operate in CH Mode 1 or 2, the *PUREFIRE®* control is set by default to prevent the boiler from operating to satisfy a central heat demand if the outdoor temperature is above 70°F (21°C). This value can be adjusted using the values shown below.

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Figure 8.34: CH Settings – Warm Weather Shutdown

Table 8.18: Warm Weather Shutdown Range & Default

Parameter	Minimum	Default	Maximum
Warm Weather Shutdown	35°F (-18°C)	70°F (21°C)	100°F (38°C)

If the installer prefers to use custom values for the outdoor reset parameters, the following provides guidance.

h. Design Point: The design point is defined by the **outdoor design temperature** and the **boiler design temperature**.

i. Boiler Design Temperature: The boiler design temperature is the temperature at which the boiler is designed to operate in order to meet the load. Copper finned tube radiators are typically rated at 180°F (82°C). The Table 8.19 shows typical boiler design temperatures for different types of head distribution units.

j. Outdoor Design Temperature: The heat loss for the structure is determined by considering the coldest sustained outdoor temperature that is expected at the site location. For a detailed list of outdoor design temperatures by state, refer to the H-22 heat loss calculation guide published by AHRI.

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Figure 8.36: CH Settings – Reset Curve Design

Table 8.19: Reset Curve Design Ranges & Defaults

Parameter	Minimum	Default	Maximum
Boiler Design Temp.	61°F (16°C)	180°F (82°C)	195°F (91°C)
Outdoor Design Temp.	-40°F (-40°C)	0°F (-18°C)	70°F (21°C)

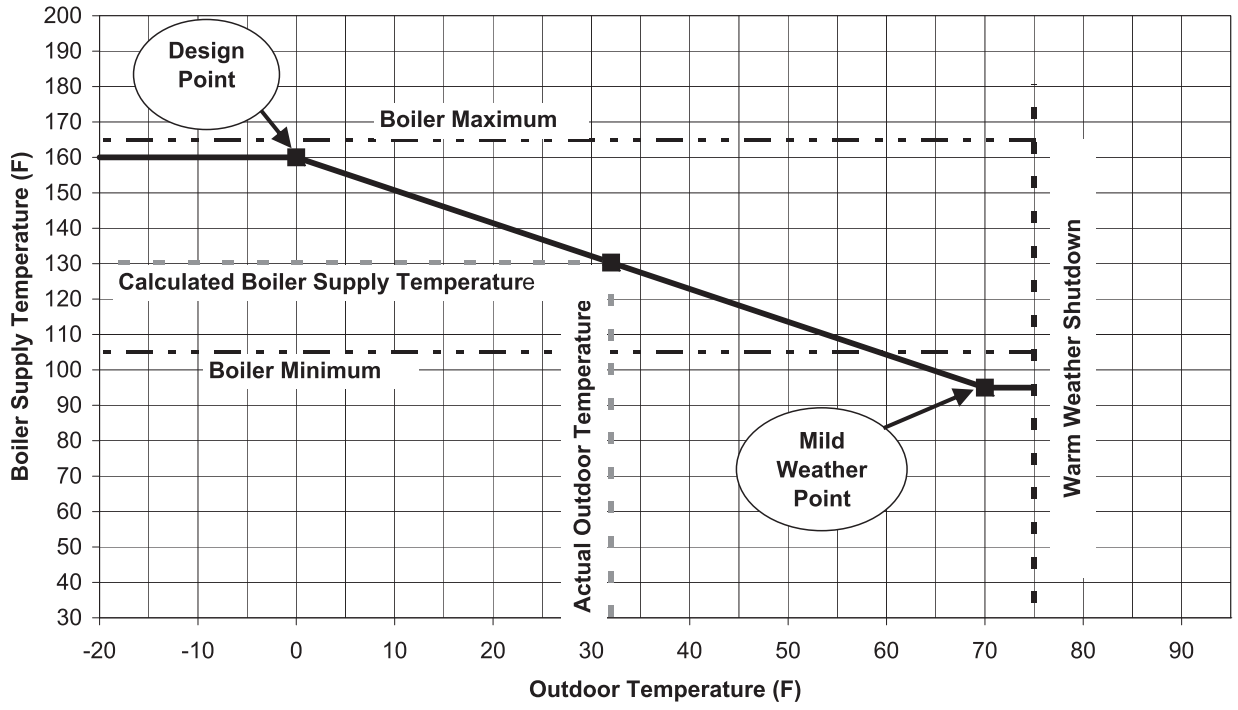

Figure 8.35: Outdoor Reset Operation

k. Mild Weather Point: The mild weather point is defined by the mild weather outdoor temperature and the mild weather boiler temperature.

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Figure 8.37: CH Settings – Reset Curve Mild Weather

l. Mild Weather Boiler Temperature: This is the minimum temperature that the boiler will target to satisfy a CH demand. In radiant floor design, this temperature can be set very low. However, avoid setting the temperature too low in systems with limited radiator surface and in lower floors with open stairways that can allow heat to migrate up to higher floors.

m. Mild Weather Outdoor Temperature: This temperature is the highest outdoor temperature at which the boiler is expected to run. The default value for this is 70 which equals the default warm weather shutdown value.

Table 8.20 Reset Curve Mild Weather Ranges & Defaults

Parameter	Minimum	Default	Maximum
Mild Weather Boiler Temp.	36°F (2°C)	70°F (21°C)	160°F (71°C)
Mild Weather Outdoor Temp.	36°F (2°C)	70°F (21°C)	85°F (29°C)

The example in Figure 8.35 shows an outdoor temperature of 0°F (-18°C) which corresponds to the value for Springfield, Massachusetts. The boiler temperature is shown at 160°F (71°C) to meet the load as determined by the system designers. The mild weather point is at an outdoor temperature of 70°F (21°C) and a boiler temperature of about 85°F (29°C). When the outdoor temperature is 32°F (0°C), the boiler will target 130°F (54°C).

n. Boiler Limits: The boiler limits are available to limit the minimum and maximum temperature that the boiler can target. Note that these limits will override the values set in the outdoor reset design and mild weather outdoor reset parameters.

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Figure 8.38: CH Settings – Reset Curve Min/Max

o. Boiler Min: The boiler will not target a temperature lower than what is chosen in this menu screen. The default for this is, "Off" since low temperatures will not affect the boiler. However, it may be useful in installations that require a minimum temperature to operate (like a fan coil unit that will not allow a fan to operate below a certain temperature).

p. Boiler Max: The boiler will not target a temperature higher than that chosen in this menu. This can be useful to prevent damage due to high temperatures in temperature sensitive situations such as radiant floors.

Table 8.21: Reset Curve Min/Max Ranges & Defaults

Parameter	Minimum	Default	Maximum
Boiler Minimum	"Off" or 40°F (4°C)	OFF	180°F (82°C)
Boiler Maximum	81°F (27°C)	195°F (91°C)	195°F (91°C)

q. Boost: The boost function is designed to compensate for a system that is not meeting the required load. If there is a constant call for central heat for the length of time specified, the target temperature will be increased by the temperature value selected. The boiler will never target a temperature higher than that specified by the boiler max. parameter.

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Figure 8.39: CH Settings – Temperature Boost

There are several reasons why the boost function may or may not be implemented.

- In buildings which have many zones, there may seldom be a period when none of the zones is calling for heat. In this case, the boiler will very often be operating at the temperature selected by the "boiler max." parameter, and much of the advantage of a condensing boiler may be lost. Therefore, it may be better to use CH Mode 2, "Permanent Demand and Outdoor Reset" in these situations. In this mode, the boost function is not applied therefore the boiler will continue to run at the temperature calculated by the outdoor reset algorithm.
- Programmable thermostats can give a building owner the ability to set back the thermostat significantly during unoccupied periods. After an aggressive setback, it may take the boiler a significant amount of time to recover. However, this may lead to the boiler frequently operating at higher temperatures, where it is less efficient. Before using setback thermostats, the building owner should be made aware that aggressive setback s of 10°F (6°C) or more may not have the desired effect.
- If the outdoor reset parameters are set for design conditions at a certain outdoor design temperature, and the outdoor temperature drops below that temperature for a significant amount of time causing cold indoor temperatures, the boost function can allow the boiler to target temperatures up to the boiler maximum to satisfy the load.

Table 8.22: Temperature Boost Ranges & Defaults

Parameter	Minimum	Default	Maximum
Boost Temperature	0°F (0°C)	18°F (10°C)	36°F (20°C)
Boost Time	1 minute	20 minutes	60 minutes

r. Anti-Cycling Time: This function allows the installer to set the minimum amount of time that the boiler can be off on setpoint before recycling. If the supply temperature drops by a value higher than Tdiff, the boiler will ignore the minimum off time and resume operation. If excessive cycling occurs due to cycling of the thermostat or zone relay, then the operation of these items should be examined.

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Figure 8.40: CH Settings – Anti-Cycling

Table 8.23: Anti-Cycling Ranges & Defaults

Parameter	Minimum	Default	Maximum
Anti-Cycling Time	0 minutes	3 minutes	15 minutes
Anti-Cycling Tdiff	20°F (11°C)	30°F (17°C)	40°F (22°C)

s. System Response Time: To modify the reaction time of the system for a CH demand, the I-value parameter can be changed. The following chart shows the range of values with descriptions of the corresponding response speed.

Figure 8.41: CH Settings – System Response

Table 8.24: System Response Range & Default

I-Value	Response Time Description
15-20	Very Fast
25-40	Fast
45-80 (Default = 60)	Medium
85-110	Slow
115-120	Very Slow

Increase this value to reduce cycling in systems with smaller zones. Decrease this value for a more aggressive reaction to CH loads. This parameter effects only the CH response time, a similar parameter is available in the DHW Settings menu.

t. Maximum Allowable CH Rate: If the boiler is sized primarily for a DHW load that is significantly higher than the CH load, this value can be decreased to limit the input rate of the boiler for central heating. The following chart shows the effective input values for various modulation percentages. As an example, if the DHW load is 1000 MBH and the CH load is 680 MBH, set the "Max Allowable CH Rate" to 60%.

Figure 8.42: CH Settings – Maximum CH Rate

Table 8.25: Maximum CH Rate Range & Default

% Modulation	Input Rate per Burner		
	PF-850	PF-1000	PF-1500
	Btu/hr	Btu/hr	Btu/hr
50%	255	300	450
60%	289	340	510
70%	323	380	570
80%	357	420	630
90%	391	460	690
100%	425	500	750

5. **Domestic Hot Water (DHW) Settings**
DHW settings manage the boiler temperature and circulators for the domestic water heating load. The boiler can be configured to operate without a domestic hot water load, with an indirect-fired hot water tank which incorporates a conventional thermostat, or with an indirect-fired hot water tank equipped with a water tank temperature sensor (PB#54157). The configuration using the optional tank temperature sensor allows the control to maximize the efficiency of the system by limiting the input rate to recover from standby losses.

a. Domestic Hot Water Modes: This menu is used to change the control response to calls for DHW.

Figure 8.43: DHW Settings – DHW Modes

Table 8.26: DHW Modes

Mode	Display	Input to Terminals #5 & #6
0	No DHW	None Required
1	DHW Tank with Sensor	NTC Thermistor Temperature Input
2	DHW Tank with Thermostat	Dry Contacts from DHW Thermostat

- *Mode 0, No DHW*: Mode 0 indicates that there is no DHW load. The DHW pump outputs will be deactivated and the control will not respond to any signals at terminals #5 & #6.
- *Mode 1, DHW Tank with Sensor*: Mode 1 is used with a temperature sensor input from the DHW tank. The optional sensor (PB #54157) transmits the tank temperature to the control which allows the control to determine the most efficient boiler operation to address the heat demand.

When this mode is chosen, the DHW Boiler Temperature and the DHW Tank Temperature setpoint values are available on the User Menu. The control will modulate the burner input based on feedback from the boiler supply temperature sensor. Therefore, if the tank temperature meets its setpoint before the boiler supply is close to its setpoint, the boiler may shut down while still in high fire. If this occurs often, lowering the DHW boiler supply setpoint will help to initiate modulation sooner.

Mode 1 can also decrease operating costs by assuring that the boiler operates at its minimum firing rate to address loads due only to standby losses.

- *Mode 2, DHW Tank with Thermostat*: This is the default DHW mode and it operates with a contact closure from a typical indirect tank thermostat. In this mode, the control targets the DHW boiler setpoint in the User Menu.

b. DHW Switch Time: When the *PUREFIRE®* boiler control is supervising the CH and DHW circulating pumps, it operates with a limited DHW priority strategy.

Figure 8.44: CH Settings – DHW Priority Swtich Time

- If there is a CH demand from the thermostat when the DHW tank calls for heat, the control will immediately switch from CH to satisfy the DHW demand.
  - The control will continue to attempt to satisfy the DHW load until the selected switch time is reached.
  - Once the switch time is reached, the boiler will switch back to the CH demand.
  - If either the CH or DHW demand is satisfied, the boiler will then focus on satisfying the remaining load.
- If there is a CH demand during a call for DHW, the boiler will continue satisfying the tank load until the switch time is reached.
  - After that it will alternate loads at the end of each switch time until one of the loads is satisfied.
  - Then again, it will focus on the remaining call for heat.

Table 8.27: DHW Priority Swtich Time Range & Default

Parameter	Minimum	Default	Maximum
CH/DHW Switch Time	5 minutes	30 minutes	60 minutes

c. DHW Heat Dump: Scientists at Brookhaven National Laboratories have performed experiments which suggest that diverting heat from the boiler into an indirect storage tank at the end of each cycle improves the overall efficiency of the heating system. The heat dump function is designed to take advantage of this principal.

Figure 8.45: DHW Settings – Heat Dump

- At the end of a heating cycle, when the CH demand is satisfied, the control switches off the CH circulating pump and turns on the DHW pump for the **Max Time** period.
- If the temperature difference between the supply and return of the boiler drops lower than the **Min Diff** value, the pumps shut down.

Table 8.28: DHW Heat Dump Ranges & Defaults

Parameter	Minimum	Default	Maximum
DHW Heat Dump	OFF	OFF	ON
Maximum Time	0 minutes	1 minute	60 minutes
Minimum Difference	0°F (0°C)	5°F (3°C)	10°F (6°C)

d. System Response Time: The system response time works identically for DHW demands as it does for CH demands. These values are designed to allow independent modification of the response time for CH and DHW loads. For small DHW loads, the I-Value can be increased. For large DHW loads, this value can be decreased. If the burner doesn't modulate when it satisfies a DHW load, this value should be increased.

Figure 8.46: DHW Settings – Response Time

e. Maximum Allowable DHW Rate: If the boiler is sized primarily for a CH load that is significantly higher than the DHW load, this value can be decreased to limit the input rate of the boiler for domestic hot water.

Figure 8.47: DHW Settings – Maximum DHW Rate

6. **Service Notification**
The *PUREFIRE®* boiler control gives installers several options to notify building owners when boiler service should be performed. The first screen that appears, after choosing Service Notification, is Reset Notifications. Pressing select resets the hours and cycles to "0".

The default for this optional feature is, "OFF". However, if it is enabled, the installer can choose the number of hours, the number of cycles or the date when, "SERVICE" appears on the LCD menu screens.

The following chart shows the range and default values for the Service Notification feature.

If desired, the installer can select a specific date for the Service Notification. Simply press the "Select" key when viewing the "Notification on:" date screen. Use the "⇩" and "⇧" keys to set the value. Pressing "Select" activates the next date parameter.

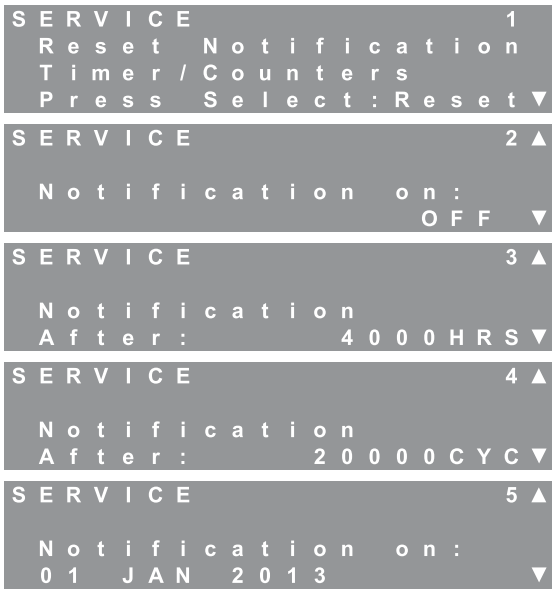


Figure 8.48: Service Notification

Table 8.29: Service Notification Ranges & Defaults

Notification On	Minimum	Default	Maximum
	OFF	OFF	ON
Hours	0	4,000	8,000
Cycles	0	50,000	20,000

7. **System Test**
System Test settings allow the installer or service person to operate each burner manually at it maximum, minimum and ignition rates. The following outlines the system test operation.

a. Managing Burner Only:

- Eliminate all heat demands to the boiler by disconnecting the CH thermostat from terminals #1 & #2 and disconnecting the DHW sensor or thermostat from terminals #5 & #6.

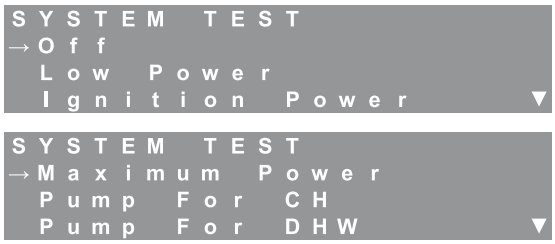


Figure 8.49: System Test Menu

- Use the "⇩" and "⇧" keys to position the arrow at the desired power setting.
- Press select to activate System Test. The burner will ignite and then operate at the selected input rate until "Off" is selected from the System Test menu or for 1 hour. The burner may cycle off on limit if the input rate exceeds the heating load.

b. Dependent Burner Only:

- Eliminate all heat demands to the boiler by disconnecting the CH thermostat from terminals #1 & #2 and disconnecting the DHW sensor or thermostat from terminals #5 & #6.
- Use the "⇩" and "⇧" keys to position the arrow at the desired power setting.
- Press select to activate System Test. The burner will ignite and then operate at the selected input rate until "Off" is selected from the System Test menu or for 1 hour. The burner may cycle off on limit if the input rate exceeds the heating load.

c. Both Burners:

- Eliminate all heat demands to the boiler by disconnecting the CH thermostat from terminals #1 & #2 and disconnecting the DHW sensor or thermostat from terminals #5 & #6.
- Start the managing burner, setting it to Ignition Power in the Service menu.
- Start the dependent burner, setting it to Ignition Power in the Service menu.
- Change the individual burner Power to the required input rate. Avoid setting a burner to minimum power and one to high power. (This may cause a flame failure or flapper valve error.)

d. Pump For CH/DHW:

- This function can be used to check the function of the CH and DHW circulating pump outputs.
- While in "Standby" on both burners, choose the desired pump output from the Installer Menu, System Test screen on the managing burner display.
- The pump terminals should be activated. If the pumps don't appear to be operating, check the voltage on the pump output terminals.

e. Multiple Boiler Systems:

- These selections may also be used in a multiple boiler, cascade system when testing a dependent burner.
- In multiple boiler systems, these pumps are to be connected to the master boiler in the cascade. Therefore, when a dependent boiler is being tested, there will not likely be sufficient heating load to run the boiler for very long.
- In this case, choose "Pump For CH" or "Pump for DHW" from the System Test menu on the managing burner display of the master boiler in the system before running the dependent boilers.

Table 8.30: Sequence Menu, Ranges & Defaults

Menu Screen	Ranges & Defaults		
	Minimum	Default	Maximum
SEQUENCE 1 Start Delay Time: 2 min▼	1 Minute	2 Minutes	15 Minutes
SEQUENCE 2 Stop Delay Time: 2 min▼	1 Minute	2 Minutes	15 Minutes
SEQUENCE 3 Start Burner Diff: 9 °F▼	1°F (0.6°C)	9°F (5°C)	23°F (13°C)
SEQUENCE 4▲ Stop Burner Diff: 18 °F▼	1°F (0.6°C)	18°F (10°C)	45°F (25°C)
SEQUENCE 5▲ Calculated Setpoint Max offset up: 36 °F▼	0°F (0°C)	18°F (10°C)	36°F (20°C)
SEQUENCE 7▲ Calculated Setpoint Max offset down: 9 °F▼	0°F (0°C)	9°F (5°C)	36°F (20°C)
SEQUENCE 8▲ Next Burner Start Rate: 50%▼	40%	50%	95%
SEQUENCE 9▲ Next Burner Stop Rate: 9%▼	5%	9%	40%
SEQUENCE 10▲ Rotation Interval 5Days▼	0 Days (No Rotation)	5 Days	30 Days

8. **Sequence (Managing Burner Display Only)** Adjustments in the sequence menu affect the sequence of burner operation. The first six parameters will stop and start burners as follows:

   a. On a call for heat (either CH or DHW) the 1st burner will start. The 1st burner can be either the managing or dependent burner based on the **Rotation Interval** chosen.

   b. After the 1st burner is activated, the 2nd burner will come on if all three of the following conditions are met:

      i. Supply Temperature < Target Temperature – **Start Burner Differential**

      ii. 1st Burner Input Rate > **Next Burner Start Rate**

      iii. **Start Delay Time** has elapsed (Time from when both prior parameters are met)

   c. The 2nd burner will be deactivated if the following conditions are met:

      i. Supply Temperature > Target Temperature + **Stop Burner Differential**

      ii. Both Burner Input Rates < **Next Burner Stop Rate**

      iii. **Stop Delay Time** has elapsed (Time from when both prior parameters are met)

   d. Calculated Setpoint Max Offset Up/Down: The target supply temperature of both burners are adjusted if the system supply temperature is above or below the targeted value. For example, if the system supply target temperature is 150°F, each burner will target this temperature. However, if they approach their individual target temperature before the system supply approaches its target, a temperature offset is applied. This offset is calculated based on the **Calculated Setpoint Max** offset up. Similarly, if the system target is above its target a calculated negative offset based on the **Calculated Setpoint Max offset down** is applied. The maximum increased setpoint temperature is 195°F (91°C).

E. DEFAULTS

1. **Factory Defaults – Restore:** By pressing the "Select" key while in the "Factory Defaults" screen. All factory settings will be restored on the control.

Figure 8.50: Restore Factory Defaults Screen

2. **Site Defaults – Save:** To save the current settings as "Site Defaults," press the "Select" key while in the following menu.

Figure 8.51: Save Site Defaults Screen

3. **Site Defaults – Reset:** To restore the "Site Defaults," press the "Select" key while in the following menu.F: MULTIPLE BOILERS

Figure 8.52: Restore Site Defaults Screen

F. MULTIPLE BOILERS

1. **Multiple Boiler Wiring:** Two methods for connecting the master boiler to the dependent boilers are allowed.
   a. Figure 8.53 shows a daisy chain configuration. This method is convenient but can lead to more than one boiler shutting down in the case of an open circuit.
   b. Figure 8.54 shows the master boiler connected to each dependent boiler. This method creates independent connections to each dependent boiler.
   c. 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.
   d. All external inputs (Outdoor Temperature Sensor, DHW Tank Temperature Sensor and System Sensor must be connected to the master boiler.
   e. The domestic hot water (DHW) circulating pump should be connected to the master boiler.
   f. The central heating (CH) circulating pump(s) should be connected to the master 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. Remove the grey plastic front panel of the boiler to get full access to the Pixel display module.
      ii. Open the lower cover on the display to expose the extended menu keys.
      iii. Press and hold the "⌂" key for 5 seconds and release: The boiler address selection will be displayed. This is the only menu option unless the boiler is configured as the master boiler with a boiler address of "1".
      iv. Use the "▼" and "▲" key to scroll through the option list. The bullet "●" will appear to the left of the option.
      v. Pressing the "OK" key selects the parameter to change. The bullet "●" on the screen will appear between the option name and its value.
      vi. Use the "▼" and "▲" key to change the value and press "OK" to update.
      vii. Pressing the "MENU" key on the pixel display will return to the standard display screen.

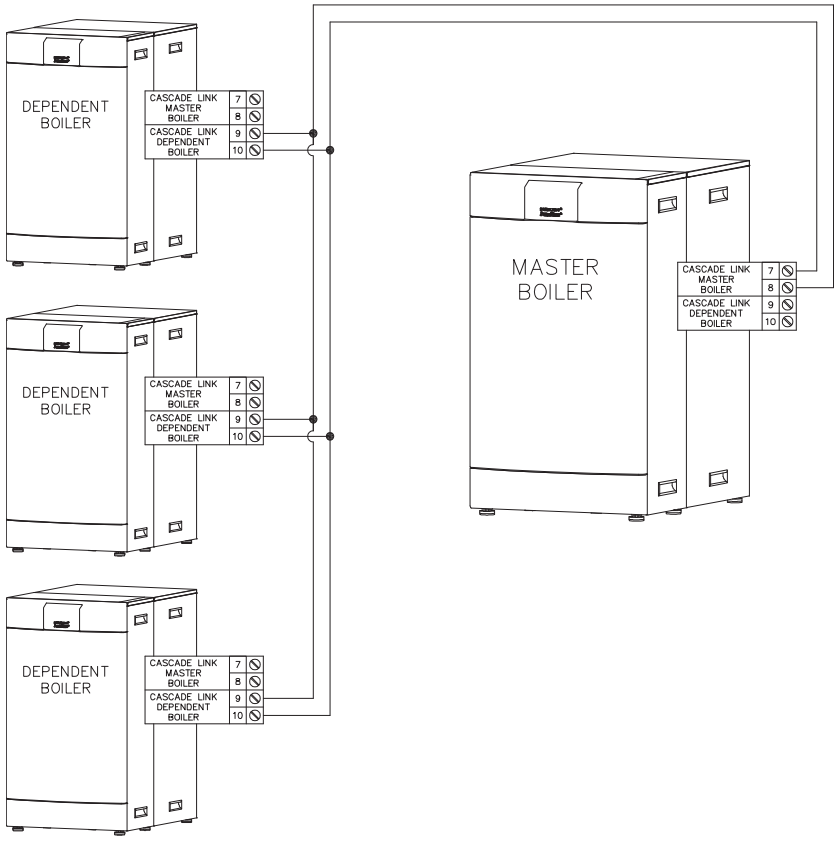


Figure 8.53: Mutiple Boiler Wiring – Daisy Chain Configuration

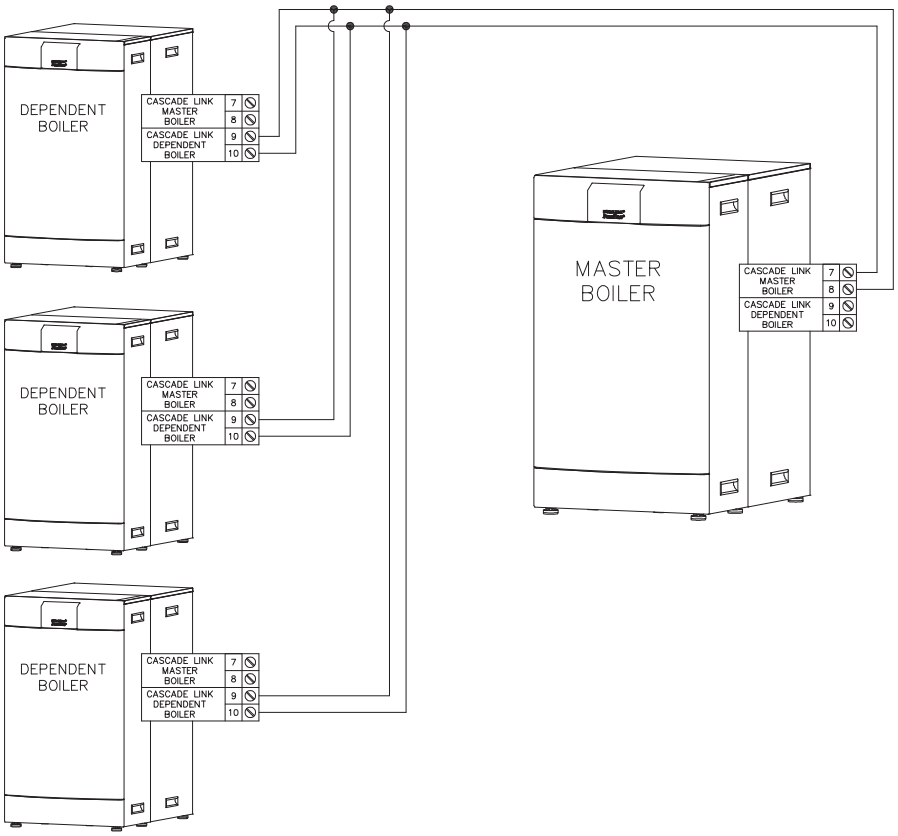


Figure 8.54: Multiple Boiler Wiring – Independent Connection to each Dependent Boiler

Table 8.31: Multiple Boiler Menu Options (Pixel Display on the front of the boiler)

Boiler Address	Min	0	This value determines the status of the boiler in a cascade system. The default, "0", indicates it is a stand-alone boiler. "1" is to be assigned to the master boiler in the system and "2" up to "16" are assigned to dependent boilers. In a cascade system, be sure that no boiler address is duplicated.
	Max	16	
	Default	**0**	
Start Delay Time	Min	1 min	The master control waits for this delay period before bringing on the next boiler. The system temperature must be less than the target temperature by the "Start Boiler Differential" temperature for this period of time before operation of another boiler is initiated.
	Max	15 min	
	Default	**2 min**	
Stop Delay Time	Min	1 min	The master control waits for this delay period before shedding a boiler from the system. The system temperature must be more than the target temperature by the "Stop Boiler Differential" temperature for this period of time before operation of a dependent boiler is terminated.
	Max	15 min	
	Default	**2 min**	
Start Boiler Diff.	Min	1°F (0.5°C)	The master control compares the system temperature to the target value to determine whether to add a dependent boiler. If [Target Temp.] – [System Temp.] > [Start Boiler Differential] for longer than the Start Delay Time, then the next dependent boiler will be initiated.
	Max	23°F (13°C)	
	Default	**9°F (5°C)**	
Stop Boiler Diff.	Min	1°F (0.5°C)	The master control compares the system temperature to the target value to determine whether to shed a dependent boiler. If [System Temp.] – [Target Temp.] > [Stop Boiler Differential] for longer than the Stop Delay Time, then operation of a dependent boiler will be terminated.
	Max	45°F (25°C)	
	Default	**9°F (5°C)**	
Stop All Boiler Diff.	Min	1°F (0.5°C)	The master control compares the system temperature to the target value to determine whether to stop all boilers in the cascade system. If [System Temp.] – [Target Temp.] > [Stop All Boiler Diff.] for longer than the Stop Delay Time, then operation of all boilers will be terminated.
	Max	45°F (25°C)	
	Default	**18°F (10°C)**	
Max Offset Up	Min	0°F (0°C)	The master control uses a PID function to scale a target temperature offset for boilers in order to approach the system target temperature. Increased values are scaled between the "**Max Offset Up**" and the system target.
	Max	36°F (20°C)	
	Default	**9°F (5°C)**	
Max Offset Down	Min	0°F (0°C)	The master control uses a PID function to scale a target temperature offset for boilers in order to approach the system target temperature. Decreased values are scaled between the "**Max Offset Down**" and the system target.
	Max	36°F (20°C)	
	Default	**36°F (20°C)**	
Rotation Interval	Min	0 (off)	The master boiler determines which boiler starts first based on the "Rotation Interval". After that it initiates the next boiler in the address sequence in accordance with the cascade parameters. Boilers are shed in an order reverse of the initiation.
	Max	30 days	
	Default	**5 days**	
P Value	Min	0	The P- Value is the temperature range where the PID function operates in degrees Celsius and is symmetrical across the target temperature. The default value of "20" corresponds to 36°F above and below the target temperature. For example, if the target temperature is 140°F, the temperature range will be from 104°F to 176°F.
	Max	255	
	Default	**20**	
I Value	Min	0	The "I-term" determines the speed at which the control allows the temperature offset for the dependent boilers to change. A lower value makes changes to the target more aggressively than a larger value. This value can be increased for systems which have excess capacity and decreased if the system does not respond quickly enough.
	Max	120	
	Default	**40**	
D Value	Min	0	The "D-Term" should be set to "0" to most effectively utilize the P-Band of the function. Do not change this value without specific direction from the factory.
	Max	255	
	Default	**0**	
Slew Rate	Min	1	The slew rate limits the rate of change for target temperatures on dependent boilers. A larger value allows faster corrections to the dependent boiler offset temperatures.
	Max	255	
	Default	**1**	

b. The default address for each boiler is "0"

c. Selecting a boiler address of "1" assigns the boiler as the master. Be sure that this is the boiler that is connected to the system pumps and external sensors.

d. Once a boiler is configured as the master boiler, a menu containing all cascade options listed in Table 8.31 will be displayed. The remaining options are intended to operate well with most boiler systems using the default parameters. However, the descriptions below allow the experienced installer or service person to modify the operation of the cascade system if improvements are warranted

e) Figures 8.55 and 8.56 show how the P-Value, Max Offset Up and Max Offset Down values affect the dependent boiler setpoints.

i) The graphs illustrate the default values for the control with a target temperature of 140°F.

ii) The control scales the actual supply temperature to a 1-255 scale in the range defined by the target temperature and the P-Value. From Figure 8.55 we can see that if the supply temperature is above 176°F the output from the P-Value will be 1.

iii) Conversely, if the supply temperature is below 104°F the output from the P-Value will be 255. At any point within the range, the P-Value will be scaled. As an example, if the supply temperature is at the 140°F setpoint the scaled value will be 128.

f) Figure 8.56 illustrates the range defined by the **Max Offset Down** and **Max Offset Up** parameters.

i) If the output from the P-Value is 1, the dependent setpoint will be set to the minimum value (104°F in this case).

ii) If the output from the P-Value is 255, the dependent setpoint will be set to the maximum value (149°F).

iii) From the previous example, the output value from a supply temperature of 140°F yields a value of 128. Transferring this value to the dependent setpoint scale indicates that the dependent boiler setpoints will be approximately 127°F.

g) The I-Value determines how quickly the setpoint changes. Larger values result in a slower response time and smaller values decrease the response time.

h) The Slew Rate limits the rate of change in dependent boiler setpoint. In this case, a larger value allows a faster change in setpoint while a lower value limits the rate of change.

3) **Cascade Display:** When the master boiler has no heat demand, there is no heat demand to the system. Therefore, each boiler in the cascade will read "CASCADE BOILER #" followed by its boiler address.

a) The master boiler will display, "CASCADE BOILER #1".

b) Pressing the down arrow will display the cascade system information including the master supply sensor temperature and the status of all boilers with which it is communicating. See Figure 8.57 for the cascade status screen illustration.

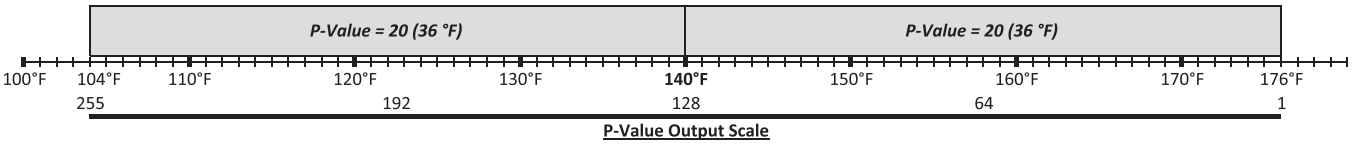


Figure 8.55: P-Value Output

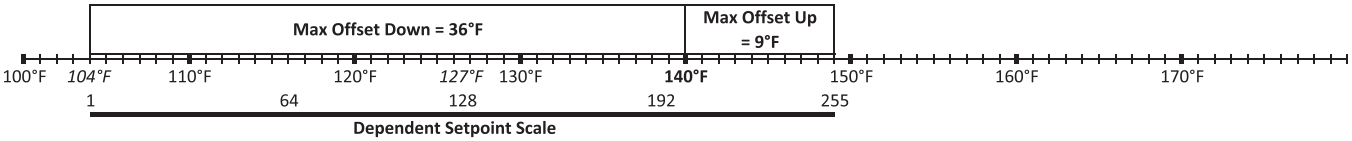


Figure 8.56: Dependent Setpoint

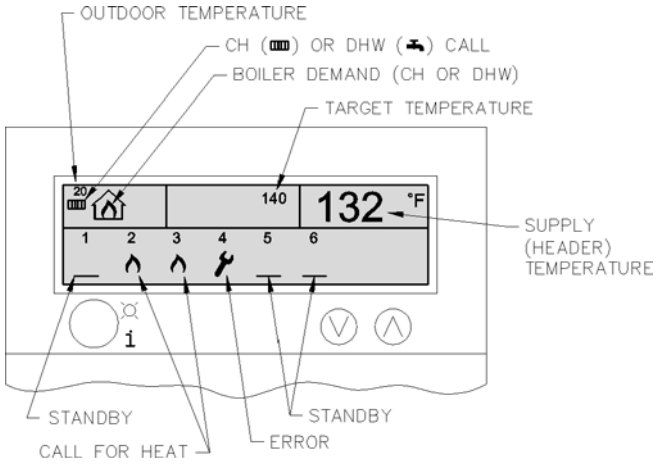


Figure 8:57: Cascade Status Screen

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 and electrical wiring are installed in accordance with this manual and good engineering practice.

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 both burner switches (Managing & Dependent) on the cover of the electrical enclosure located on the right side of the boiler under the heat exchanger jacket panel. "0" indicates that the switch is off while "1" indicates on. Note that these switches do not disconnect power from the circulation pump outputs.

2. Turn on the main power, then turn on the individual burner switches. Verify that both displays on the electrical enclosure panel are lit. Also, be sure that the "Pixel" display on the front of the boiler is on.

3. 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.

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

4. 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 volts. If the readings are significantly different than this, assure that an appropriate earth ground is connected to the system. The *PUREFIRE*® main control is not designed to operate in a phase-phase power supply configuration.

D. CHECK GAS PIPING

1. Turn off the gas shut-off valve to each burner. These valves are 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 "INTERLOCKS OPEN" if the gas pressure switches are not reset or if any of the interlocks connected to terminals #11 & #12 are open.

3. Connect a manometer to the incoming gas line and be sure that the pressure is regulated to between 3.5" and 21.0" 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.

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.

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 each burner individually and with both burners firing.

2. Test the operating control on each burner

3. Test the high limit for each burner

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

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

F. COMBUSTION TEST

1. Disconnect the CH thermostat and DHW tank thermostat/sensor input or set these inputs to assure no call for heat is present.

2. Turn on the electrical power and all manual gas valves to the burners. Be sure that both LCD Screens on the control cabinet cover are lit and that the main display on the front of the boiler is lit. The LCD screens should show "Standby" and the Pixel display should show "No Demand".

3. Managing burner combustion test at high fire (100% Modulation):

⚠ NOTICE

Be sure that the dependent burner is not running when performing the combustion test on the managing burner. If the other blower is running, the test results will not be valid.

   a. **ON THE MANAGING BURNER**, enter the "Installer Menu" by pressing and holding the "Select" & "Menu" keys simultaneously for 3 seconds.
   b. Use the "⇩" key to scroll down until the cursor (→) is at "System Test". Press "Select".
   c. Use the "⇩" key to scroll down to "High Power". Pressing select will initiate the burner operation.
   d. The burner will ignite and, after a short stabilization period, run at 100% of modulation. If the supply temperature exceeds the setpoint (or the boiler design temperature if an outdoor reset CH mode is chosen) the burners will shut down.
   e. Using a suitable combustion analyzer (Testo 330-2 or equivalent) determine the exhaust emissions of the boiler.
   f. Using Table 9.1, determine the appropriate emissions levels.

Table 9.1: Recommended Combustion Settings

	Natural Gas		Propane (LP)	
	Low Fire	**High Fire**	**Low Fire**	**High Fire**
Carbon Monoxide (CO)	< 50 ppm	< 100 ppm	< 50 ppm	< 100 ppm
Carbon Dioxide (CO_2)	8.8% to 10.0%	8.5% to 9.5%	9.8% to 11.0%	9.5% to 10.5%
Excess Oxygen (O_2)	3.4% to 5.4%	4.2% to 6.0%	4.2% to 6.0%	4.9% to 6.5%
Excess Air	17.3% to 31.0%	22.4% to 35.8%	22.4% to 35.8%	27.3% to 40.1%

   g. If the emissions are incorrect, adjust the throttle screw to correct the combustion. Note that increasing the throttle adjustment (counterclockwise) will decrease the O_2 and increase the CO_2. Decreasing the throttle will have the opposite effect.

4. Managing burner combustion test at low fire (1% modulation):
   a. Enter the "Installer Menu" and choose "System Test". Press "Select".
   b. Use the "⇩" key to scroll down to "Low Power". Pressing select will initiate the burner operation.
   c. The burner will ignite and, after a short stabilization period, run at 1%.
   d. Using a suitable combustion analyzer (Testo 330-2 or equivalent) determine the exhaust emissions of the boiler and compare them with Table 9.1.
   e. Do not make throttle adjustments in Low Power system test. If the low fire values are out of specification, contact your PB Heat representative.

5. Dependent burner combustion test at high fire (100% modulation).

⚠ NOTICE

Be sure that the managing burner is not running when performing the combustion test on the dependent burner. If the other blower is running, the test results will not be valid.

   a. **ON THE DEPENDENT BURNER** enter the "Installer Menu" and choose "System Test".
   b. Press select and use the "⇩" key to scroll down to "High Power".
   c. The burner will ignite and, after a short stabilization period, run at 100%.
   d. Using a suitable combustion analyzer determine the exhaust emissions of the boiler and compare them with Table 9.1.
   e. Adjust the throttle screw if necessary to correct the combustion.

6. Dependent burner combustion test at low fire (1% modulation).
   a. **ON THE DEPENDENT BURNER**, enter the "Installer Menu" and choose, "System Test".
   b. Press select and use the "⇩" key to scroll down to "Low Power".
   c. The burner will ignite and, after a short stabilization period, run at 1%.
   d. Using a suitable combustion analyzer (Testo 330-2 or equivalent) determine the exhaust emissions of the boiler and compare them with Table 9.1.
   e. Do not make throttle adjustments in Low Power system test. If the low fire values are out of specification, contact your PB Heat representative.

7. Turn "System Test" to "Off" on both burner displays.

G. TEST OPERATING LIMIT

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

1. On the LCD display for each burner, note the boiler setpoint by accessing the User Menu, Status Display.
   a. Press the "Menu" key on the keypad.
   b. Choose "Status" by pressing the "Select Key".
   c. Use the "⇧" and "⇩" key to scroll through the CH and DHW setpoints (Refer to Appendix B for an overview of the User Menu).

2. Enter the "Installer Menu" by pressing and holding the "Select" & "Menu" keys simultaneously for 3 seconds.
   a. Use the "⇩" key to scroll down until the cursor (→) is at "System Test".

b. Press select and use the "⇩" key to scroll down to "High Power".

c. The burner will ignite and, after a short stabilization period, run at 100%.

3. Monitor the boiler temperature on the temperature gauge (factory supplied for field mounting) and on the Status display.
   a. The boiler should shut down at the boiler setpoint plus 9°F (5°C).
   b. If it does not shut down turn off the boiler and contact your PB Heat representative.

H. TEST HIGH LIMIT

Check that each 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" & "Menu" keys simultaneously for 3 seconds.
   a. Use the "⇩" key to scroll down until the cursor (→) is at "System Test".
   b. Press select and use the "⇩" key to scroll down to "Low Power".
   c. The burner will ignite and, after a short stabilization period, run at 1% modulation.

2. Disconnect the wire connection to the high limit (in the lower right side header with red connector).
   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 representative.

3. Enter the Installer menu on the managing burner and select, "System Test".
   a. Press select and use the "⇩" key to scroll down to "Low Power".
   b. The burner will ignite and, after a short stabilization period, run at 1% modulation.

4. Disconnect the wire connection to the high limit (in the upper right side header with red connector).
   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 representative.

5. Turn "System Test" to "Off" on both burner displays.

I. MULTIPLE BOILER SYSTEMS

1. Since all heat distribution circulating pumps (CH/DHW) are connected to the master boiler, it may be necessary to run one of these pumps to get sufficient run time on the boiler for any of the commissioning tests indicated in this section. To do this, choose "System Test" from the "Installer Menu" on the master boiler, managing burner display.
   a. Use the "⇩" and "⇧" keys to select "Pump for CH" or "Pump for DHW" from the "System Test" menu.
   b. Note that it is not necessary to operate these pumps manually when running commissioning tests on the master boiler. In fact, the master boiler will automatically activate the CH pump terminals when operating under system test.

2. If using common venting on multiple boiler systems, be sure that the Alarm Mode (INSTALLER MENU → Burner Settings → Alarm Mode) is set to "Common Venting" to prevent operation of any of the boilers without monitoring the flapper valve closure switches. Turn the power off to one of the boilers (in Standby) in the system to be sure that the alarm sounds.

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

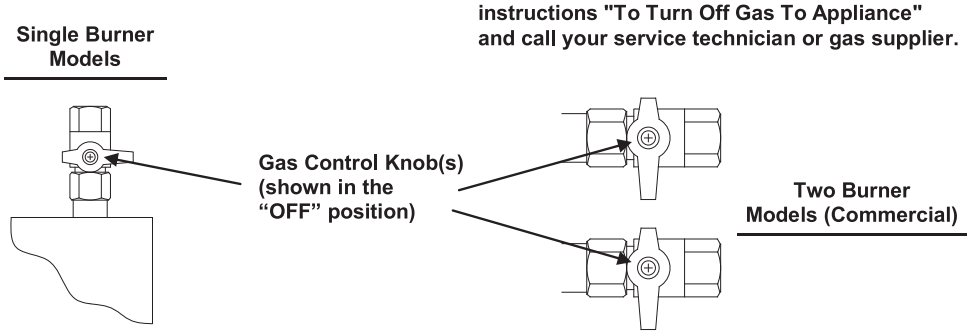
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

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 REV 0

Figure 9.1: Lighting & Operating Instructions

10. TROUBLESHOOTING

A. ERRORS

1. When an error occurs, the pixel display on the front of the boiler will display a wrench instead of one of the blowers and a message will appear indicating what the error is.

2. These error messages indicate on which burner the error occurred: (M) for managing or (D) for Dependent.

3. There are three kinds of errors that can occur:
   a. Blocking Errors – These are errors which will prevent the boiler from operating until the condition which caused the error is corrected. Then the boiler will restart without intervention.
   b. Locking Errors – These errors will prevent the boiler from operating and require a manual reset to allow the boiler to return to operation. The reset buttons for each burner are on the LCD display screens located behind the right rear jacket panel.
   c. Warning Errors – These errors are typically associated with temperature sensors (Outdoor, DHW or Flue) with circuits that are either open or shorted. These errors will cause the LCD screens on the control cabinet cover to blink. These LCD screens are located behind the right rear jacket panel.

4. The pixel display on the front of the boiler is primarily for status display.

B. BLOCKING ERRORS

1. When a blocking error occurs, the LCD display that corresponds to the burner with the error will show a message in English and an “E” code (E31 Interlocks Open).

Figure 10.1: Blocking Error Display

2. Table 10.1 provides a list of blocking error codes, descriptions and corrective actions for these errors.

3. Certain blocking errors will, if uncorrected, become locking errors as described in the next paragraph.

C. LOCKING ERRORS

1. When a locking error occurs, the LCD display that corresponds to the burner with the error will show a message in English and an “A” code (A01 Ignition Error).

Figure 10.2: Locking Error Display

2. Table 10.2 provides a list of locking error codes, descriptions and corrective actions for these errors.

3. These errors require a manual reset of the display for the burner with the error. These displays are located behind the right rear jacket panel and are designated “Managing” and “Dependent”.

D. WARNING ERRORS

The individual LCD burner displays will display a blinking screen under several conditions. Several of these conditions provide the error information directly on the screen. Table 10.3 shows sensor errors and corresponding corrective actions.

1. **Outdoor Sensor Error:**
   a. If the boiler control is set to a CH mode in which an outdoor sensor is required and the sensor is shorted, the screen will blink. Pressing the “Reset” key will display the following error screen.

Figure 10.3: Warning – Outdoor Sensor Shorted

   b. The boiler will not operate until this problem is corrected.
   c. If the Outdoor Sensor is open, the status screen will read -40°F and the boiler will run at the boiler design temperature as set up in the installer menu.

Figure 10.4: User Menu – Temperature Status Screen

2. **DHW Sensor Error:**
   a. If the boiler control is set to operate on DHW Mode 1 (DHW Sensor), and there is no sensor connected the boiler will not satisfy a DHW call for heat.
   b. The display will blink and the DHW temperature will read 14°F if there is an open circuit at the sensor terminals. Pressing the “Reset” key will display the following error screen.

Figure 10.5: Warning – DHW Sensor Open

c. This will also occur if the wires are not properly connected.

d. If there is a short at the DHW sensor terminals and the DHW mode is set to Mode 1, the DHW system will not operate. The display will blink to indicate a warning error. Pressing the "Reset" key will display the following error screen.

Figure 10.6: Warning – DHW Sensor Shorted

3. **Flue Sensor Error:**

a. If the control senses that the flue temperature does not rise to above 50°F after ignition, and either the supply water temperature rises above 120°F or the return water temperature rises above 80°F, the control will display "Flue Sensor Hold" and run at 1% Input.

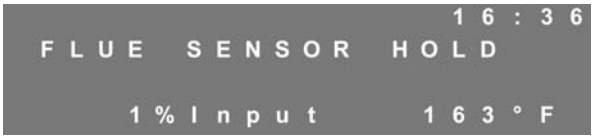


Figure 10.7: Warning – Flue Sensor Hold

b. If "Flue Sensor Hold" continues for an extended period of time, the display will blink. Pressing the "Reset" key will display the following error screen.

Figure 10.8: Warning – Flue Sensor Open

4. **Cascade – System Sensor Error:**

a. The system (header) sensor is mounted in the supply (outlet) header on the PF-850, PF-1000 and PF-1500 boiler. If no system (header) sensor is connected or if there is an open circuit, the display will blink and the supply temperature on the front pixel display will read 14°F.

b. If there is a short circuit in the system sensor wiring, the display screen will blink and the supply temperature on the front pixel display will read 244°F.

c. Under either of these conditions, the managing burner will set the supply setpoints of both burners to match the system setpoint. It will continue to bring on and shut off boilers based on the thermostat demand (terminals #1 and #2) and the Boiler Start/Stop Delay Time.

5. **No Comm. Error:**

a. If the dependent burner is not communicating with the managing burner and it is set as "dependent burner" in the Installer Menu, the screen will blink and the following message will be displayed on the dependent burner LCD screen.

Figure 10.9: Warning – No Communication Cascade

b. The burner will stay off until the condition is corrected. The managing burner will operate normally. However, if there is a NO COMM CASCADE error, check the Installer Menu, under Burner Options, on the managing burner to be sure that it is set to "managing burner.

E. SPECIAL IGNITION/FLAME FAILURE

1. Depending on local codes the allowable number of ignition attempts or flame failures may be different. The "Installer Menu" may allow up to three ignition attempts and three recycle attempts on flame failure. In addition, it allows the installer to choose a "One Hour Retry" option that can restart the boiler after one hour of a lockout due to ignition or flame failure. These values are set to the most restrictive from the factory but can be changed at the boiler installation.

2. As a diagnostic tool, the *PUREFIRE®* control logs the flame signal four times during the last 2 seconds of each ignition period. Each successive ignition will overwrite the values from the previous ignition. This is to aid in troubleshooting ignition errors. A flame signal below 3.0 μA at the end of this period will result in a failed ignition.

a. If the recorded flame signal values are low, 1.0 to 3.0 μA:

- assure that the flame at ignition is visible through the observation window
- check that the position of the flame rod is within 5/16" (9 mm) of the burner. Figure 10.10 shows the correct position of the flame rod and ignition electrode
- clean the flame rod with abrasive cloth

b. If the recorded flame signal values are below 1.0 μA:

- check for an appropriate spark gap
- check the flame rod for cracks in the ceramic or corrosion bridging to metal

F. INTERLOCKS OPEN

1. An error message displaying, "E31 Interlocks Open" may indicate several conditions:

a. Any interlock connected to terminals #11 & #12 on the boiler terminal blocks is open

b. The low or high gas pressure switch is tripped

2. If a temporary jumper between terminals #11 & #12 allows the boiler to proceed to "Trial for Ignition" then one of the external interlocks (LWCO, etc.) may be open. Do not leave a jumper installed if there are interlocks attached to these terminals.

⚠ CAUTION

Do not leave a jumper between terminals #11 & #12 if interlocks are attached to these terminals. Failure to comply may lead to severe personal injury, death or major property damage.

3. Pressing the reset buttons on both high and low gas pressure switches may reset the error. However, if this doesn't reset the error, check the incoming gas pressure. If it is between 3.5" and 21" of water then the switches should reset. If the error is occurring at or after ignition, check the gas pressure when the boiler lights off. It may be that the gas pressure drops significantly when the gas valve opens. In this case, contact the gas supplier to increase the available gas pressure.

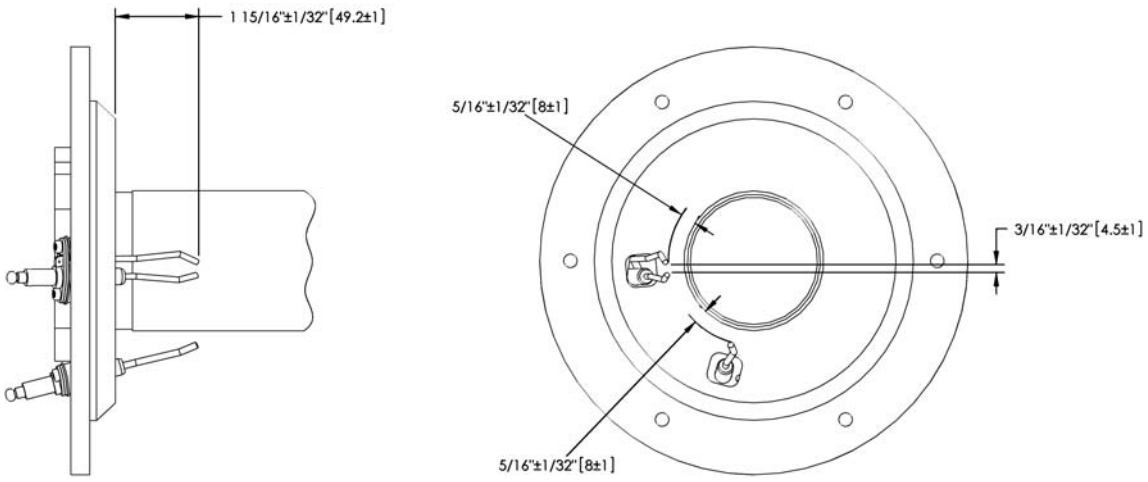


Figure 10.10: Correct Flame Rod and Ignition Electrode Position

Table 10.1: Blocking Error Codes (automatic reset):

"E" CODE	Error Display	Error Description	Corrective Actions
E01	SUPPLY SENSOR NOT CONNECTED	Supply sensor circuit is open.	1. Check sensor connection to be sure it is fully engaged. 2. Check continuity of both harness leads. 3. Read the temperature sensor value in the "User Menu" under status. 14°F indicates an open circuit.
E02	RETURN SENSOR NOT CONNECTED	Return sensor circuit is open.	
E04	DHW SENSOR NOT CONNECTED	DHW Sensor is open. (DHW Mode 1 only)	
E05	FLUE SENSOR NOT CONNECTED	Flue sensor circuit is open.	Check the flue sensor as described above. 50°F indicates an open sensor in the "User Menu" in this case.
E11	SUPPLY SENSOR SHORT	Supply Sensor is short circuited.	1. Check wires for signs of damage. 2. If temporarily connecting the harness to another sensor clears the error, the sensor is probably defective. 3. Read the temperature sensor value in the "User Menu" under status. 255°F indicates a short circuit..
E12	RETURN SENSOR SHORT	Return sensor is short circuited.	
E13	DHW SENSOR SHORT	DHW Sensor is short circuited.	
E14	FLUE SENSOR SHORT	Flue Sensor is short circuited.	
E19	COMMUNICATION ERROR E2PROM ERROR	Internal software error.	1. Disconnect all external wires except for the 120 VAC control power. 2. If problem is corrected, systematically replace wires to determine which pump/sensor is malfunctioning. 3. If problem persists, replace the control.
E20	FALSE FLAME DETECTED	Unexpected flame was detected.	1. Verify that no flame or spark is present. 2. Check & clean flame sensor. 3. Check boiler ground by assuring 0-5 VAC between neutral and ground.
E21	HOT/NEUTRAL REVERSED	Polarity of power supply wires is reversed.	1. Reverse polarity of power supply wires. 2. Check boiler ground by assuring 0-5 VAC between neutral and ground.
E22	POOR GROUND	No earth ground connected or internal hardware error.	1. Check boiler ground by assuring 0-5 VAC between neutral and ground. 2. Check incoming frequency (hz) if power supply is from a generator.
E23	NET FREQUENCY ERROR	Frequency of incoming power is < 40 hz or > 70 hz.	1. If power supply is from a generator, check that the system is phase/neutral (line voltage between hot/ground). 2. Check boiler earth ground by assuring 0-5 VAC between neutral & ground.
E24	POOR GROUND	No earth ground connected or internal hardware error.	1. Check boiler ground by assuring 0-5 VAC between neutral and ground. 2. Check incoming frequency (hz) if power supply is from a generator.
E25	BLOCKED VENT	Combustion chamber pressure exceeds 4.5" w.c.	1. Check for blocked exhaust outlet. 2. Check the combustion chamber pressure (height difference between condensate vessels).

Table 10.1 (cont'd): Blocking Error Codes (automatic reset):

"E" CODE	Error Display	Error Description	Corrective Actions
E26	BLOCKED CONDENSATE DRAIN	Open Float switch circuit in condensate collector cap.	1. Check for blockage in condensate system. 2. Clean condensate system. 3. Check for broken wires or bad connections.
E30	HIGH FLUE TEMPERATURE	Flue gas is above the maximum temperature.	1. Check flue temperature in "User Menu" under "Status" on Managing Display. – 244°F indicates a short circuit. 2. Check flue pipe for temperature. – If temperature exceeds 190°F, clean and inspect the heat exchanger. – If temperature is below 190°F, check flue sensor and harness.
E31	INTERLOCKS OPEN	Open circuit in interlocks or high/low gas press. switch.	1. Is gas pressure within the range listed on the nameplate? 2. Press reset buttons on gas pressure switch located on the gas line inside the jacket. 3. Check any interlocks connected to terminals #11 & #12.
E32	HIGH RETURN TEMP	Return temperature is above 195°F.	1. Check return temperature in "User Menu" under "Status" on both Managing & Dependent Displays. 2. Is GEN pump (boiler pump) operating correctly? 3. Is the pump reversed? 4. Are supply (outlet) and return (inlet) water connections piped correctly?
E42 E45 E46 E47 E48	INTERNAL HDWRE ERROR	Internal error in boiler controls.	Systematically disconnect all wires except the incoming control power that were not supplied with by the factory. If the error code continues, determine which wires may be the source of electrical interference and make sure the circuit is free from shorts or unexpected voltage.
E51	RESET BUTTON ERROR PLEASE WAIT	Reset button pushed more than 7 times in one minute.	1. Wait five minutes for the control to recycle. 2. Exercise patience when resetting errors.
E52	FLAP NOT CLOSED	Flap valve at blower outlet isn't proving closed as expected.	1. If error doesn't clear within 1 minute: – Check the orange and red wire on the flap valve. – Remove the blower and check for blockage in the flap valve. 2. If the error clears, check for excessive draft on the exhaust outlet.
E53	FLAP NOT OPEN	Flap valve at blower outlet isn't proving open as expected.	1. Check to be sure the combustion fan is operating. 2. Remove the blower and check for blockage in the flap valve.
E65	LEADER ERROR	Managing burner experiencing a blocking or locking error.	1. Does the managing burner show an error code? – If so, address the error code on the managing burner and reset the dependent control. 2. If the managing burner does not show an error code, check to be sure it is set to "Managing Burner" under "Burner Settings" in the "Installer Menu".
E66	FLOW SWITCH NOT CLOSED BLOCK	When Flow Switch option is chosen in the Burner Setting menu, interlock circuit or gas pressure switches are not closed when pump is running.	1. If a flow switch is not connected to terminals #11 & #12, change Additional Safety Functions to LWCO in the "Installer Menu" under "Burner Settings" on the managing burner. 2. If a flow switch is connected, check for continuity from terminal #11 to #12 with the pumps off. – Clean any debris from flow switch paddle.

Table 10.2: Locking Error Codes (manual reset):

"A" CODE	Error Display	Error Description	Corrective Actions
A01	IGNIT ERROR	Maximum number of ignition attempts has been reached.	1. Watch igniter through the observation window. 2. If a flame is present but the burner shuts down: – Check the flame signal ignition log in the "Installer Menu" under "Status". – If values are below 3.1 μA, check the flame sensor position with respect to the burner. – The sensor should be between 1/8" and 1/4" of the burner. 3. If a spark is present but no flame appears: – Check gas pressure at the gas valve inlet with the boiler off and when the boiler starts. Use a U-tube manometer to be sure to register momentary pressure drops. 4. If no spark is present: – Check the spark electrode for the proper gap. – Check ignition wire for damage. – Check the porcelain insulator on the electrode for cracks or dirt that may create a path to ground. – Remove any corrosion from the spark electrode.
A02	FLAME FAILURE	Flame failures have exceeded the maximum number allowed.	1. Check gas pressure at gas valve inlet with the boiler off and with both burners at high fire. If the pressure drops significantly, check for blockage in the gas inlet piping. 2. Check the burner flame signal at high and low fire. If the flame signal is below 5.0 μA, check the flame sensor position with respect to the burner.
A03	OVERHEAT LIMIT OPEN	High Temperature limit switch is open (set at 210°F).	1. If the supply temperature does not exceed 208°F before the burner shuts off, the overheat limit switch may be faulty. Replace the switch. 2. Watch the two leftmost lights on the circulator pump relay module in the control cabinet. If these do not come on when any burner is firing, check for wiring issues. 3. With the boiler operating, assure that the difference between supply and return temperatures on each control in the "User Menu" under "Status" is always less than 40°F.
A04	INTERNAL ERROR GAS VALVE ERROR	Gas valve is not reacting correctly to software commands.	Persistent locking errors, A04 – A18, may indicate feedback or high current on boiler wiring. – Systematically, disconnect each set of wires with the exception of the power supply to the control & pumps (Terminals #23, 24, 27 & 28). – If the error code goes away determine which circuit may be causing the issue. – If the error persists after all of these wires are disconnected, contact your PB Heat representative or call PB Heat Technical Service, at (610) 845-6130, press 3 then 4.
A05	INTERNAL ERROR SAFETY RELAY ERROR	Safety relay is not reacting correctly to software commands.	
A09	INTERNAL SOFTWARE ERR	The software is not operating correctly.	
A10	COMMUNICATION ERROR E2PROM ERROR	No communication with the nonvolatile memory in the control board.	
A12	SOFTWARE OUT OF DATE E2PROM OUT OF DATE	Possible version mismatch between control and other components.	
A13	INTERNAL ERROR STATE ERROR	Internal error with the main control software.	
A14	INTERNAL ERROR ROM ERROR		
A15	INTERNAL ERROR 15MS XRL ERROR		
A16	INTERNAL ERROR 20MS XRL ERROR		
A18	INTERNAL ERROR STACK ERROR		

Table 10.2 (cont'd): Locking Error Codes (manual reset):

"A" CODE	Error Display	Error Description	Corrective Actions
A19	FALSE FLAME DETECTED AFTER SHUTDOWN	Unexpected flame signal detected more than 10 seconds after closing the gas valve.	1. Check for presence of flame in the combustion chamber. 2. Check igniter for a short to ground 3. Check flame sensor for a short to ground.
A20	FALSE FLAME DETECTED BEFORE IGNITION	Unexpected flame signal detected before opening the gas valve.	1. Check for presence of flame in the combustion chamber. 2. Check igniter for a short to ground. 3. Check flame sensor for a short to ground.
A21	FLAPPER VALVE NOT OPEN	Flap Valve on the blower outlet isn't proving open as expected.	1. Check to be sure the combustion fan is operating. 2. Remove the blower and check for blockage in the flap valve.
A22	FLAPPER VALVE NOT CLOSED	Flap Valve on the blower outlet isn't proving closed as expected.	1. Check the orange and red wire on the flap valve. 2. Remove the blower and check for blockage in the flap valve. 3. If the error clears, check for excessive draft on the exhaust outlet.
A23	FLOW SWITCH NOT CLOSED	When Flow Switch option is chosen in the Burner Setting menu, interlock circuit or gas pressure switches are not closed when pump is running.	1. If a flow switch is not connected to terminals #11 & #12, change Additional Safety Functions to LWCO in the "Installer Menu" under "Burner Settings" on the managing burner. 2. If a flow switch is connected, check for continuity from terminal #11 to #12 with the pumps off. – Clean any debris from flow switch paddle.
A24	FLOW SWITCH NOT OPEN	When Flow Switch option is selected in the Burner Setting Menu, interlock circuit is not open when pump is off.	1. If a flow switch is not connected to terminals #11 & #12, change Additional Safety Functions to LWCO in the "Installer Menu" under "Burner Settings" on the managing burner. 2. If a flow switch is connected, check for continuity from terminal #11 to #12 with the pumps off. – Clean any debris from flow switch paddle.
A32	FAN NOT RUNNING	No tachometer feedback from blower.	1. If the fan is running, check the 4-wire harness connections to blower and control. – Check current fan speed under "Installer Menu", "Status". 2. If the fan is not running, check the 3-wire harness connections to the blower. – Be sure there is line voltage on the red and white wires in the connector.
A33	FAN SPEED ERROR	Fan speed differs from targeted value by more than 300 rpm for more than 60 seconds.	1. If the fan is running, check the 4-wire harness connections to blower and control. – Check current fan speed under "Installer Menu", "Status". 2. If the fan is not running, check the 3-wire harness connections to the blower. – Be sure there is line voltage on the red and white wires in the connector.
A50	RETURN TEMPERATURE HIGHER THAN RETURN	Return sensor temperature reads higher than supply for more than 5 ignition attempts.	1. Check system piping to be sure that the water is entering the return connection to the boiler and exiting the supply connection. 2. Compare temperature readings on the supply sensor to the temperature gauge. If the gauge reads significantly higher, check the sensor and replace if necessary.

Table 10.3: Control Board Warning Error Codes

"W" CODE	Error Display	Error Description	Corrective Action
#W01	 Blinking Screen – Press "Reset" key to view this message	Outdoor Sensor Shorted	1) Check wiring connection to Outdoor Sensor. 2) Remove the wires from terminals #3 and #4 on the boiler and check the resistance between them. • If this reading is below 3000 Ω check the reading at the sensor. • If the reading is the same at the sensor, replace the sensor. • If the reading is higher at the sensor, replace the wiring.
#W02	 Blinking Screen – Press "Reset" key to view this message	DHW Sensor Open	1) Be sure the optional DHW Sensor (54157) is connected. 2) Remove the wires from terminals #5 and #6 on the boiler and check the resistance between them. a. If the resistance is above 10 k Ω, check the resistance at the sensor. b. If the reading at the sensor is the same, replace the sensor. c. If the reading at the sensor is lower, replace the wiring.
#W03	 Blinking Screen – Press "Reset" key to view this message	DHW Sensor Shorted	1) Check wiring connection to DHW Sensor. 2) Remove the wires from terminals #5 and #6 on the boiler and check the resistance between them. a. If this reading is below 1000 Ω, check the reading at the sensor b. If the reading is the same at the sensor, replace the sensor. c. If the reading is higher at the sensor, replace the wiring.
#W04		Flue Sensor Open	1) Check wiring connection to flue sensor. 2) Compare sensor resistance to Figure 8.7. If resistance value is incorrect, replace sensor.

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 (apr(s l'entietien'), 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:

<u>Precautionary Measures:</u>
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.

<u>First Aid Procedures:</u>
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 by the manufacturer of the device.
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 left rear 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 burners, by removing (6) hex nuts on each burner mounting plate and opening the combustion chambers. Replace the burners 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 Containers:
   a. Close the manual gas shutoff valve at the rear of the boiler and turn off both burner service switches.
   b. Remove the right rear jacket panel.
   c. Remove the wing nuts from both the condensate collector and condensate neutralizer container.

d. Disconnect both condensate hoses from the top of the condensate collector.

e. Disconnect the float switch wires from the wiring harness.

f. Lift the front (condensate collector) container above the level of the other container to empty some condensate from the system.

g. Disconnect the condensate drain connection from the rear of the boiler and remove the containers from the boiler.

2. Cleaning the Containers:
   a. Dump the contents of the containers and flush them with water.
   b. Be sure that there is free movement of liquid between the containers through the bottom port.
   c. Check for leaks at all of the hose clamps.

3. Re-installing the Containers:
   a. Place the tanks in position and attach both wing nuts.
   b. Connect the hoses to the top of the condensate collector.
   c. Attach the drain hose to the outlet of the system.
   d. Connect the wires to the blocked condensate float switch in the lid of the condensate collector.
   e. Fill the condensate neutralizer container with 1-2 inches of neutralizing media.

4. Restarting the Boiler:
   a. Open the manual gas valve at the rear of the boiler.
   b. Turn both burner service switches 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 brass brush (not steel)

– "Rydlyme" (recommended for best results) (available online www.rydlyme.com) or "CLR" (available at most hardware stores)

1. Shut the boiler down and access the heat exchanger using the following steps:
   a. Close the manual gas shutoff valve and wait for the unit to be cool to the touch.
   b. Disconnect the condensate piping from the outside connections (not from the *PUREFIRE®* side) so the flow can be observed.
   c. Disconnect compression nut on gas valve inlet and disconnect the gas valve electrical connector.
   d. Remove the six 10 mm nuts from the burner plate assembly. Disconnect wire leads to the spark igniter and flame sensor. Disconnect two Molex plugs from blower motor.
   e. Pull the entire burner plate towards you to access the heat exchanger coils.

2. Using a spray bottle filled with the recommended product "Rydlyme" or "CLR", spray liberally on the coils, making sure the solution penetrates and funnels down through the condensate hose. If the condensate hose is blocked, let the chemical penetrate for at least 15 minutes or until it drains.

3. Use the nylon or brass brush (do not use steel) and scrub coils to remove any buildup, then vacuum the debris from the coils.

4. Spray coils with clear water, making sure to confine the spray to the area being cleaned (try to avoid wetting the back ceramic wall of the unit). Flush the combustion chamber with fresh water. At this point, the *PUREFIRE®* should be ready to power back up.

5. Reinstall the burner plate assembly using the following steps:
   a. Inspect the inside of the heat exchanger for dirt and debris.
   b. Install the burner plate assembly and replace the six 10 mm nuts.
   c. Reconnect the wire leads to the spark igniter, flame sensor and gas valve. (Be sure that the spark igniter is connected to the lead with the large insulated connection boot.) Reconnect two Molex plugs on blower motor.
   d. Connect the compression nut on the gas valve inlet and reattach the gas valve electrical connector.
   e. Reset thermostats. **(IMPORTANT: BE SURE THAT THE VENT CONNECTION IS NOT BLOCKED.)**

⚠ WARNING

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

   f. Turn the power to the *PUREFIRE®* on. Observe the display module to assure proper operation.
   g. Initiate a call for heat** and observe the condensate flow.

h. Reconnect the condensate piping to the drain connection.

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

6. Inspect exhaust vent and air intake vents for proper support and joint integrity. Repair as necessary. Refer to Section 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

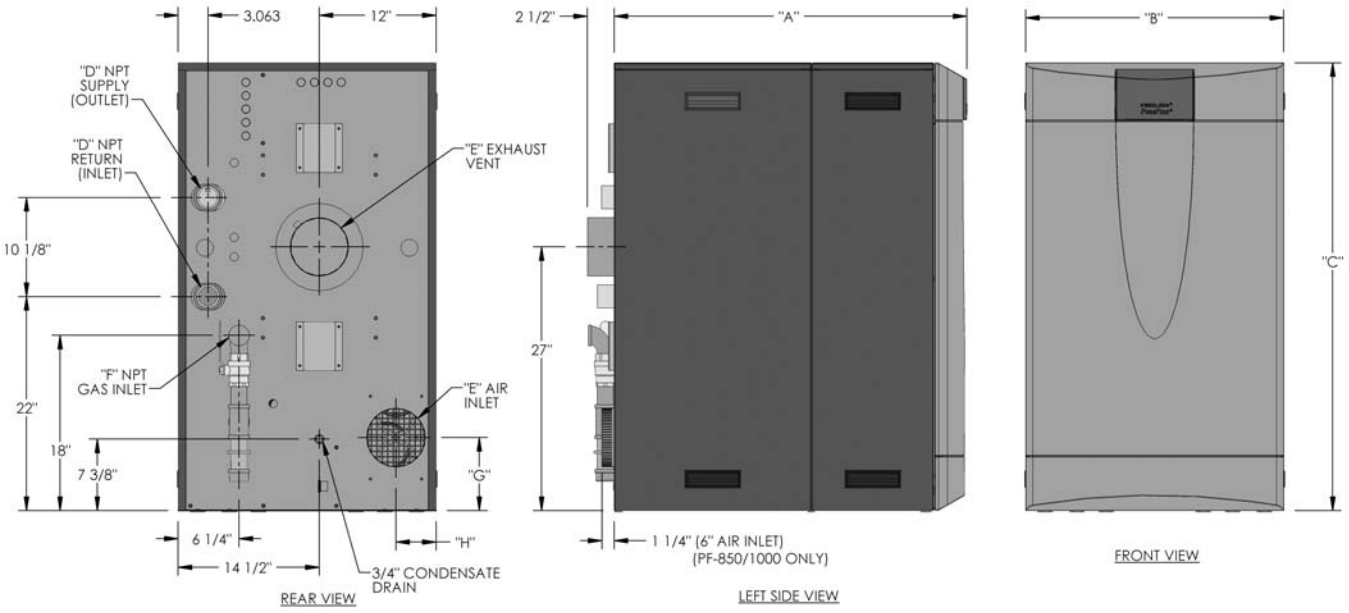


Figure 12.1: Dimensional Drawing – PF-850, PF-1000 & PF-1500

Table 12.1: Boiler Dimensions

SERIES PEERLESS® *PUREFIRE*® DIMENSIONS								
Boiler Model	**"A"**	**"B"**	**"C"**	**"D"**	**"E"**	**"F"**	**"G"**	**"H"**
PF-850	36-1/4	26-1/2	46	2	6	1-1/4	3-3/4	4-1/8
PF-1000	39-1/8	26-1/2	46	2	6	1-1/4	3-3/4	4-1/8
PF-1500	60-3/4	26-1/2	46	2-1/2	7	2	8-1/2	5-1/2

Table 12.2: Boiler Ratings

SERIES PEERLESS® *PUREFIRE*® BOILER RATINGS									
Series Peerless® *PUREFIRE*®									
Boiler Model	**Input**				**Gross Output[2]**		**Net Water Ratings[1]**		**Thermal Efficiency**
	Minimum		**Maximum**						
	MBH	**kW**	**MBH**	**kW**	**MBH**	**kW**	**MBH**	**kW**	**%**
PF-850	85	24.9	850	249.1	818	239.7	711	208.4	96.2
PF-1000	100	29.3	1,000	293.1	966	283.1	840	246.2	96.6
PF-1500	150	43.9	1,500	439.6	1,448	424.3	1,259	368.9	96.5

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 BTS 2000 TESTING STANDARD FOR HEATING BOILERS and are 3rd Party verified.

Table 12.3: Combustion Air Fan Speeds

SERIES PEERLESS® *PUREFIRE*® COMBUSTION AIR FAN SPEEDS					
Boiler Model	**Maximum Input**		**Fan Speed***		
	MBH	**kW**	**Low Power**	**Ignition**	**High Power**
PF-850	850	249.1	1,860	4,530	5,790
PF-1000	1,000	293.1	1,920	4,800	6,180
PF-1500	1,500	439.6	1,530	4,990	5,310

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

Table 12.4: *PUREFIRE*® Main Control Specifications

SERIES PEERLESS® *PUREFIRE*® MAIN CONTROL SPECIFICATIONS		
Power Supply	Voltage	120 VAC Nominal (102-132 VAC)
	Frequency	60 Hz Nominal (40 Hz to 70 Hz)
Fuses	Primary Control	3.15 Amp, 250 VAC
	Pump Relay (3)	10 Amp, 250 VAC
Blower	Voltage	120 VAC
Gas Valve	Voltage	120 VAC
Thermostat Contacts	Voltage	24 VAC
DHW Contacts	Voltage	24 VAC
Flame Current Limits	Current	Minimum (running): 2.8 μA
		Minimum (ignition): 3.1 μA
		Maximum: 10.0 μA
Temperature Sensors NTC Thermistors 12kΩ at 77°F (25°C)	Supply	14°F (-10°C) to 244°F (118°C)
	Return	14°F (-10°C) to 244°F (118°C)
	Flue	50°F (10°C) to 280°F (138°C)
	Header	14°F (-10°C) to 244°F (118°C)
	Outdoor	-40°F (-40°C) to 185°F (85°C)
	Optional Sensors	
	DHW	14°F (-10°C) to 244°F (118°C)
	System	14°F (-10°C) to 244°F (118°C)
Standards	North America	ANSI Z21.20 / CSA C22.2
	Europe	CE EN298

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.

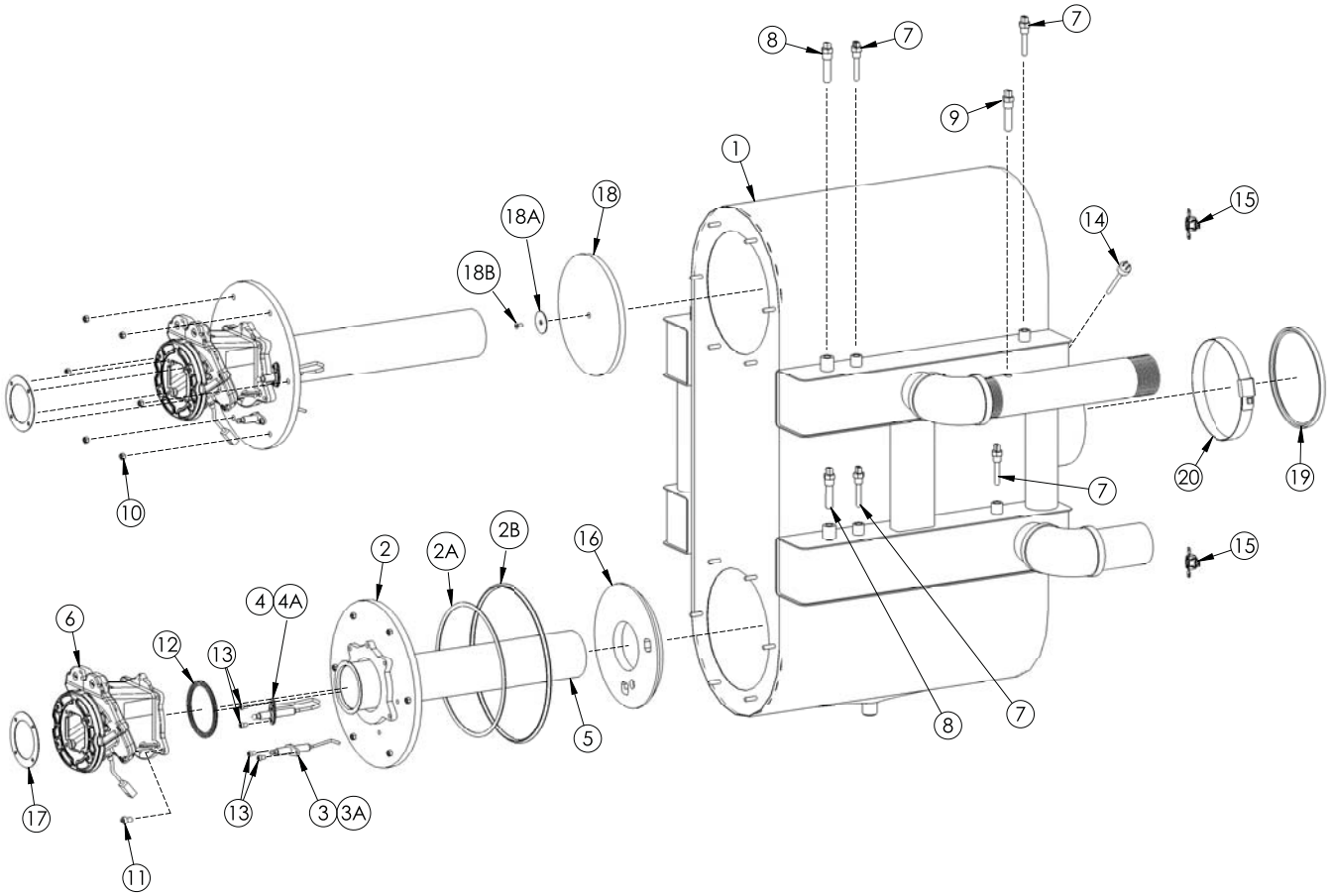


Figure 13.1: Heat Exchanger Repair Parts

Table 13.1: Heat Exchanger

	Description	Quantity Required			Stock Code
		PF-850	PF-1000	PF-1500	
1	Heat Exchanger - PF-850	1	–	–	5651
	Heat Exchanger - PF-1000	–	1	–	5652
	Heat Exchanger - PF-1500	–	–	1	5703
2	Burner Mounting Plate (Includes 2A & 2B)	2	2	2	54430
2A	Burner Mounting Plate Fiberglass Rope Gasket	52"	52"	52"	54188
2B	Burner Mounting Plate Rubber Gasket	2	2	2	54655
3	Flame Sensor Electrode (Includes 3A)	2	2	2	54432
3A	Flame Sensor Electrode Graphite Gasket	2	2	2	54605
4	Ignition Electrode (Includes 4A)	2	2	2	54431
4A	Ignition Electrode Graphite Gasket	2	2	2	54123
5	Burner Element (MESH) - PF-850/1000	2	2	–	54433
	Burner Element (MESH) - PF-1500	–	–	2	54624
6	Flapper Valve Assembly - PF-850/1000	2	2	–	54434
	Flapper Valve Assembly - PF-1500	–	–	2	54625
7	Supply/Return Sensor - 1/8" NPT 12 kΩ	4	4	4	54438
8	High Limit Switch - 1/4" NPT	2	2	2	54419
9	Header Supply Sensor 1/4" NPT 12 kΩ	1	1	1	54418
10	Hex Flange Nut M6 Fine Thread	12	12	12	51614
11	Flapper Valve Screw - M5-0.80 x 16 mm Zinc	10	10	10	–
12	Burner Gasket	2	2	2	54467
13	Ignitor/Flame Sensor Screw - M4 x 8mm Zinc	8	8	8	6507
14	Flue Temperature Sensor - 1/4" BSP 12 kΩ	1	1	1	54111
15	Thermal Fuse - 318 C, 605 F	2	2	2	54466
16	Burner Mounting Plate Insulation - PF-850/1000	2	2	–	54653
	Burner Mounting Plate Insulation - PF-1500	–	–	2	54654
17	Blower Gasket - PF-850/1000	2	2	–	54504
	Blower Gasket - PF-1500	–	–	2	54505
18	Target Insulation	2	2	2	54185
18A	Target Insulation Washer M4 SS Fender	2	2	2	–
18B	Target Insulation Screw M4 x 16 SS	2	2	2	–
19	Exhaust Vent Gasket - 6" PF-850/1000	1	1	–	54658
	Exhaust Vent Gasket - 7" PF-1500	–	–	1	54659
20	Exhaust Vent Clamp - 6" PF-850/1000	1	1	–	54660
	Exhaust Vent Clamp - 7" PF-1500	–	–	1	54661

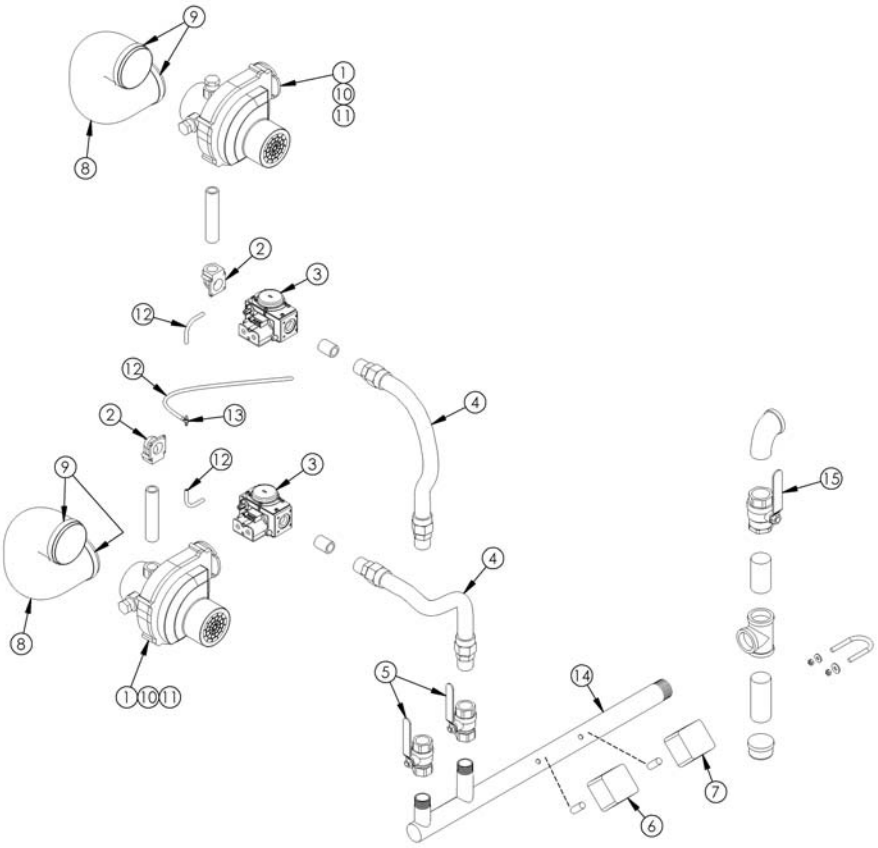


Figure 13.2a: Blower Gas Train Assembly – PF-850/1000

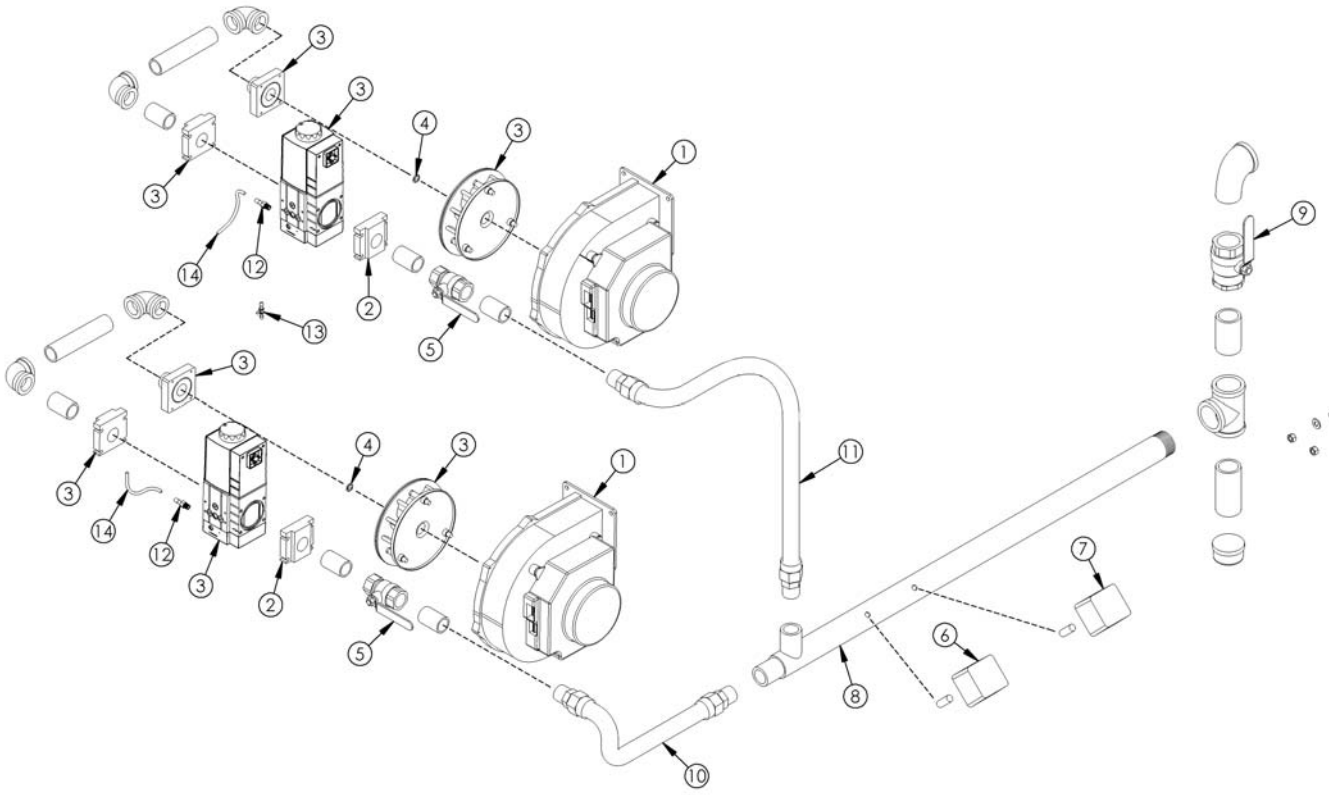


Figure 13.2b: Blower Gas Train Assembly – PF-1500

Table 13.2a: Blower/Gas Train Assembly – PF-850/1000

	Description	Quantity Required		Stock Code
		PF-850	PF-1000	
1	Combustion Air Blower - PF-850/1000	2	2	54428
2	3/4" Flanged Elbow	2	2	5543
3	Gas Valve GB-057	2	2	54429
4	1" NPT x 16" Flexible Gas Line	2	2	54439
5	1" NPT Gas Shutoff Valve	2	2	51703
6	Low Gas Pressure Switch	1	1	50700
7	High Gas Pressure Switch	1	1	50701
8	3" Flexible Air Hose	7.5 ft	7.5 ft	54444
9	4" Hose Clamp	4	4	54443
10	Socket Head Cap Screw - M5-0.80 x 12 mm	6	6	5415
11	Hex Head Cap Screw - M5-0.80 x 12 mm	2	2	5688
12	1/8" ID Reference Tube	5 ft	5 ft	1052
13	1/8" Hose Tee	1	1	6159
14	Gas Inlet Header - PF-850	1	–	54473
	Gas Inlet Header - PF-1000	–	1	54474

Table 13.2b: Blower/Gas Train Assembly – PF-1500

	Description	Quantity Required	Stock Code
		PF-1500	
1	Combustion Air Blower - PF-1500	2	54595
2	Gas Valve Inlet Flange 1" NPT	2	54601
3	Gas Valve w/Shutter, Swirl Plate & Adapter	2	54598
4	Gas Valve Nozzle 12 MM	2	54602
5	1" NPT Gas Shutoff Valve	2	51703
6	Low Gas Pressure Switch	1	50700
7	High Gas Pressure Switch	1	50701
8	Gas Inlet Header – PF-1500	1	54608
9	1-1/2" Gas Shutoff Valve	1	51705
10	1" NPT x 16" Flexible Gas Line	2	54439
11	1" NPT x 36" Flexible Gas Line	2	54612
12	1/8" BSP x 1/8" Tube Adapter	2	5766
13	1/8" x 1/8" x 1/4" Barb Tee	1	6164
14	1/8" ID Reference Tube	2 ft	1052

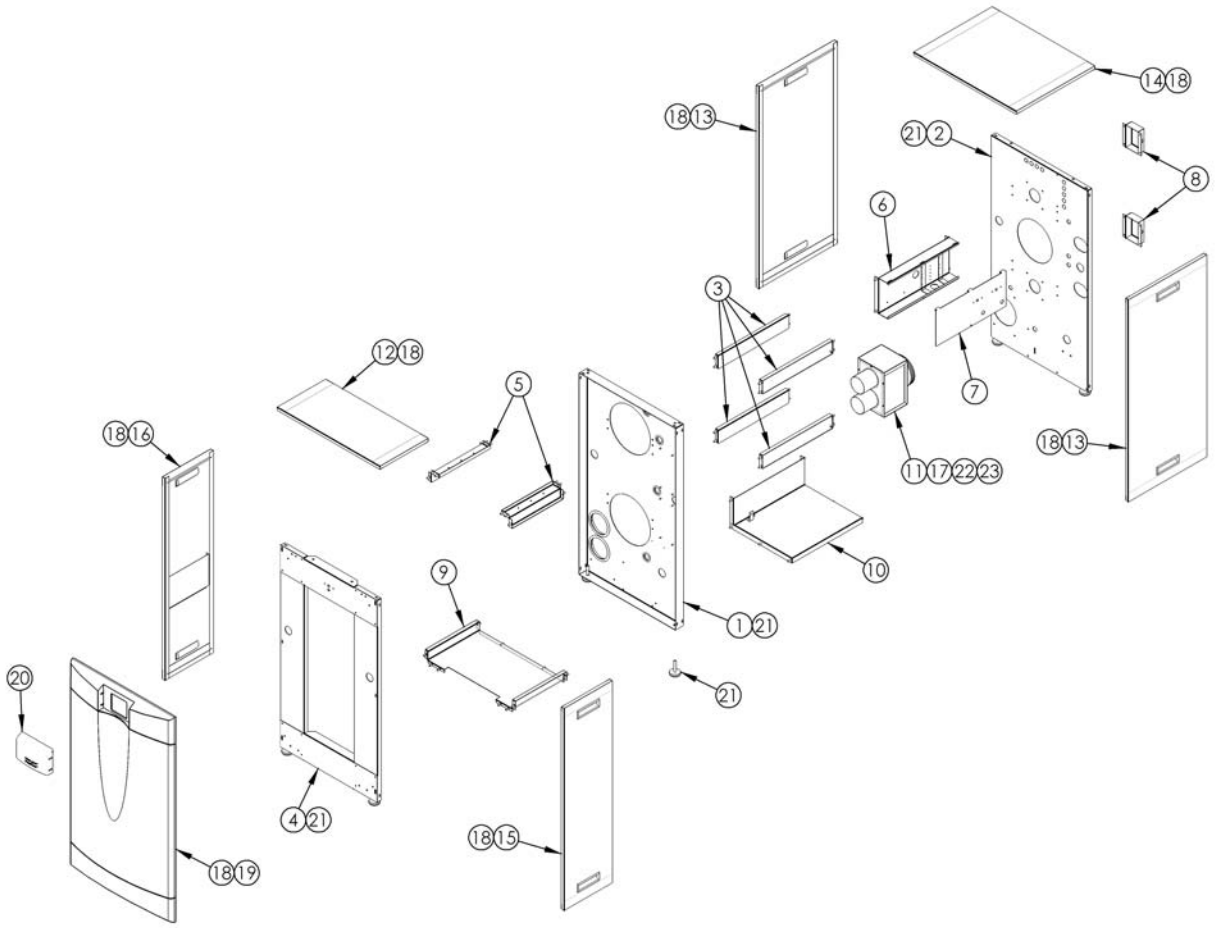


Figure 13.3a: Jacket Assembly – PF-850/1000

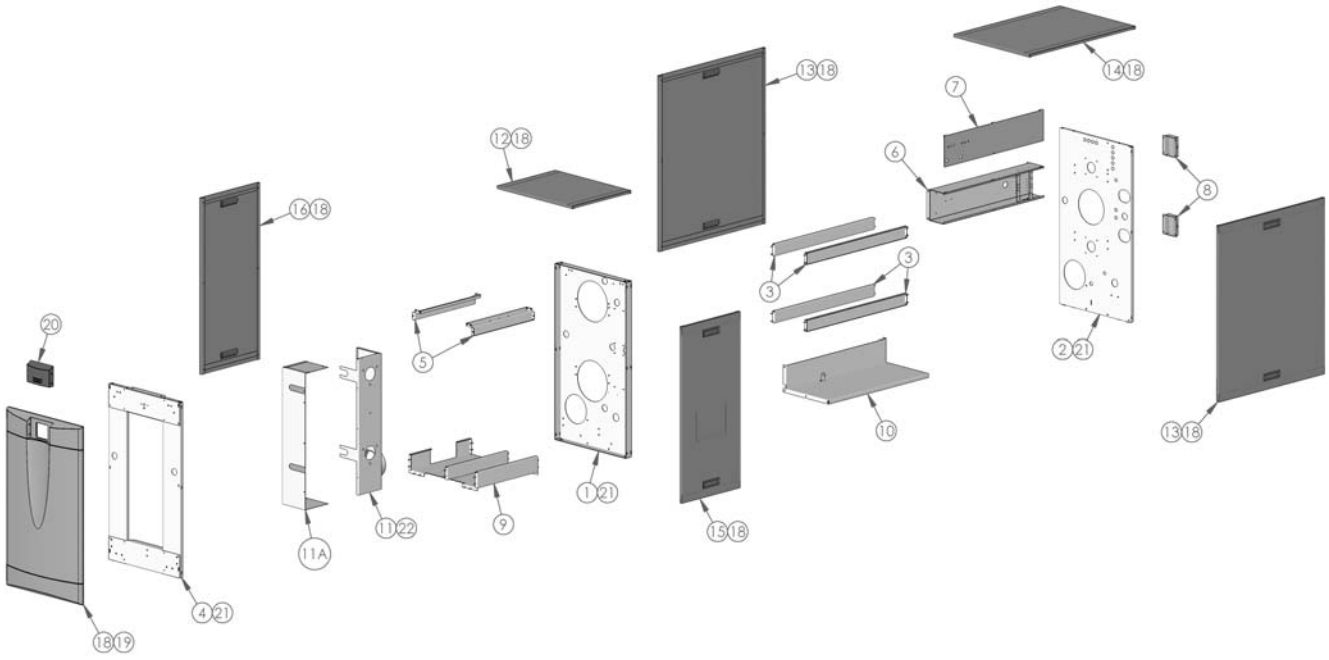


Figure 13.3b: Jacket Assembly – PF-1500

Table 13.3: Jacket Assembly

	Description	Quantity Required			Stock Code
		PF-850	PF-1000	PF-1500	
1	Heat Exchanger Support Panel - Front PF-850/1000	1	1	–	PF2016
	Heat Exhcanger Support Panel - Front PF-1500	–	–	1	PF2037
2	Heat Exchanger Support Panel - Rear PF-850/1000	1	1	–	PF2017
	Heat Exchanger Support Panel - Rear PF-1500	–	–	1	PF2038
3	Heat Exchanger Support Rails - PF-850	4	–	–	PF2018
	Heat Exchanger Support Rails - PF-1000	–	4	–	PF2018-1
	Heat Exchanger Support Rails - PF-1500	–	–	4	PF2018-2
4	Blower Cabinet Frame Assembly	1	1	–	PF2027
	Blower Cabinet Frame Assembly	–	–	1	PF2027-1
5	Blower Cabinet Support Rails - PF-850/1000	2	2	–	PF2026
	Blower Cabinet Support Rails - PF-1500	–	–	2	PF2026-1
6	Electrical Terminal Enclosure - PF-850	1	–	–	PF2029
	Electrical Terminal Enclosure - PF-1000	–	1	–	PF2029-1
	Electrical Terminal Enclosure - PF-1500	–	–	1	PF2029-2
7	Terminal Enclosure Cover - PF-850	1	–	–	PF2030
	Terminal Enclosure Cover - PF-1000	–	1	–	PF2030-1
	Terminal Enclosure Cover - PF-1500	–	–	1	PF2030-2
8	Thermal Fuse Cover	2	2	2	PF2031
9	Blower Cabinet Floor Pan	1	1	–	PF2033
	Blower Cabinet Floor Pan	–	–	1	PF2039
10	Condensate System Tray - PF-850	1	–	–	PF5027
	Condensate System Tray - PF-1000	–	1	–	PF5027-1
	Condensate System Tray - PF-1500	–	–	1	PF5027-2
11	Air Inlet Plenum Assembly - PF-850/1000	1	1	–	PF5044
	Air Inlet Plenum Base - PF-1500	–	–	1	PF5051
11A	Air Inlet Plenum Cover - PF-1500	–	–	1	PF5052
12	Blower Cabinet Top Panel - PF-850/1000	1	1	–	PF6069-1
	Blower Cabinet Top Panel - PF-1500	–	–	1	PF6069-1
13	Side Heat Exchanger Access Panel - PF-850	2	–	–	PF6064
	Side Heat Exchanger Access Panel - PF-1000	–	2	–	PF6064-1
	Side Heat Exchanger Access Panel - PF-1500	–	–	2	PF6064-2
14	Top Heat Exchanger Access Panel - PF-850	1	–	–	PF6066
	Top Heat Exchanger Access Panel - PF-1000	–	1	–	PF6066-1
	Top Heat Exchanger Access Panel - PF-1500	–	–	1	PF6066-2
15	Blower Cabinet Right Side Panel - PF-850/1000	1	1	–	PF6067
	Blower Cabinet Right Side Panel - PF-1500	–	–	1	PF6067-2
16	Blower Cabinet Left Side Panel - PF-850/1000	1	1	–	PF6067-1
	Blower Cabinet Left Side Panel - PF-1500	–	–	1	PF6067-3
17	Air Inlet Screen	1	1	1	54447
18	Ball Studs	38	38	38	5433
19	Front Cover Panel	1	1	1	54292
20	Control Lens	–	–	–	54127
21	Leveling Legs	–	–	–	5659
22	1/4" Rubber Grommet	–	–	–	6158

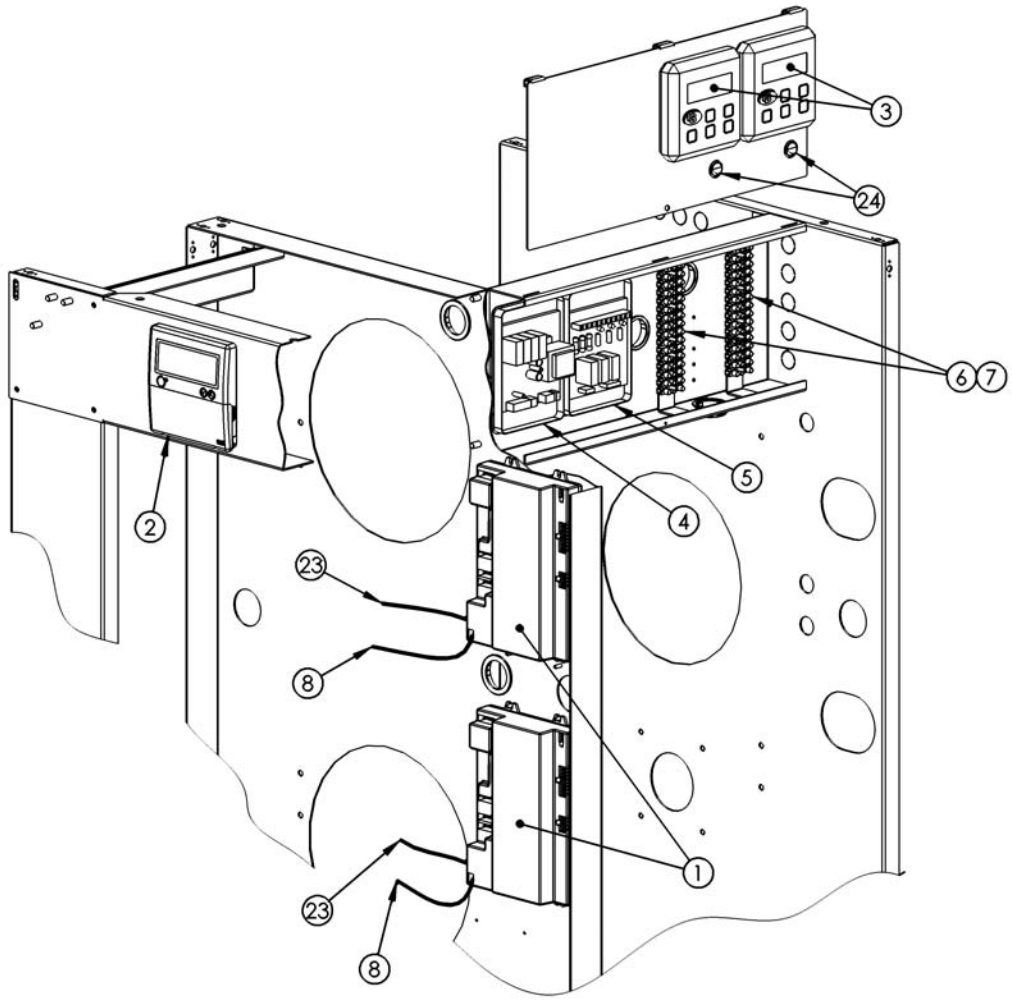


Figure 13.4: Control System

Table 13.4: Control System

	Description	Quantity Required			Stock Code
		PF-850	PF-1000	PF-1500	
1	Primary Burner Safety Control - PF-850	2	–	–	54468
	Primary Burner Safety Control - PF-1000	–	2	–	54469
	Primary Burner Safety Control - PF-1500	–	–	2	54613
2	User Interface Pixel Display	1	1	1	54441
3	Installer Interface LED Display	2	2	2	54445
4	Interface Module	1	1	1	54442
5	Pump Relay Module 10 Amp	1	1	1	54556
6	Terminal Block - 10 Pole	2	2	2	5450
7	Terminal Block - 6 Pole	2	2	2	5547
8	Ignition Cable with 1K	2	2	2	54298
9	Harness J5M Managing Control Sensors PF-850/1000*	1	1	–	54448
	Harness J5M Managing Control Sensors PF-1500*	–	–	1	54614
10	Harness J5D Dependent Control Sensors PF-850/1000*	1	1	–	54449
	Harness J5D Dependent Control Sensors PF-1500*	–	–	1	54615
11	Harness J16M Managing Flapper/Limits PF-850/1000*	1	1	–	54450
	Harness J16M Managing Flapper/Limits PF-1500*	–	–	1	54616
12	Harness J16D Dependent Flapper/Limits*	1	1	1	54451
13	Harness J2M Managing Control/Blower Power PF-850/1000*	1	1	–	54452
	Harness J2M Managing Control/Blower Power PF-1500*	–	–	1	54617
14	Harness J2D Dependent Control/Blower Power PF-850/1000*	1	1	–	54453
	Harness J2D Dependent Control/Blower Power PF-1500*	–	–	1	54618
15	Harness J13M Managing Gas Valve/Flame Sensor/Limit PF-850/1000*	1	1	–	54454
	Harness J13M Managing Gas Valve/Flame Sensor/Limit PF-1500*	–	–	1	54619
16	Harness J13D Dependent Gas Valve/Flame Sensor/Limit PF-850/1000*	1	1	–	54455
	Harness J13D Dependent Gas Valve/Flame Sensor/Limit PF-1500*	–	–	1	54620
17	Harness J7 General Circulator PF-850/1000*	2	2	–	54456
	Harness J7 General Circulator PF-1500*	–	–	2	54621
18	Harness J6M Managing CH/DHW Circulator*	1	1	1	54457
19	Harness Line Voltage Terminal Strip/Power Switch PF-850/1000*	1	1	–	54587
	Harness Line Voltage Terminal Strip/Power Switch PF-1500*	–	–	1	54622
20	Harness J9 Blower Contol PF-850/1000*	2	2	–	54459
	Harness J9 Blower Contol PF-1500*	–	–	2	54623
21	Harness Managing Thermal Fuse w/Conduit*	1	1	1	54460
22	Harness Dependent Thermal Fuse w/Conduit*	1	1	1	54461
23	Harness Ground	2	2	2	54465
24	Rocker Switch	2	2	2	6049

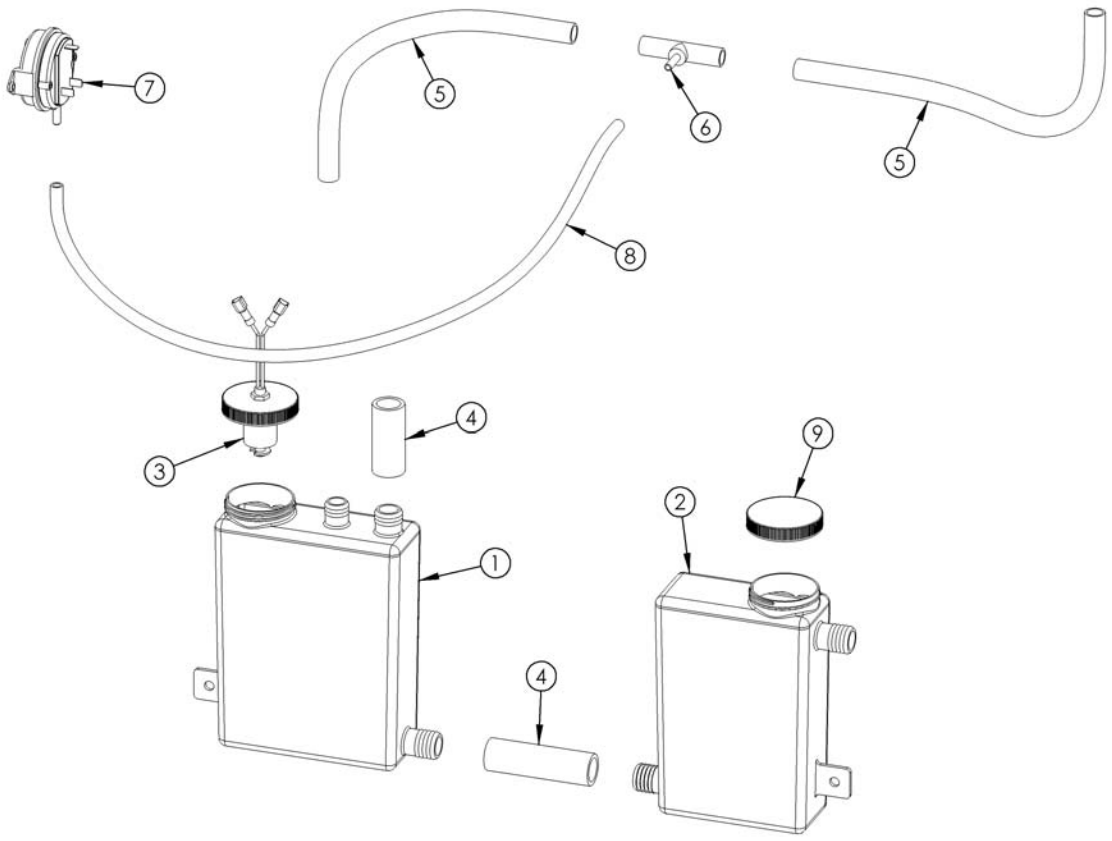


Figure 13.5: Condensate System

Table 13.5: Condensate System

	Description	Quantity Required			Stock Code
		PF-850	PF-1000	PF-1500	
1	Condensate Receiver Container	1	1	1	54120
2	Condensate Neutralizer Container	1	1	1	54121
3	Condensate Blocked Drain Switch	1	1	1	54137
4	1" OD x 3/4" ID PVC Condensate Hose	6 in	6 in	15 in	5417
5	5/8" OD x 1/2" ID PVC Condensate Hose	4 ft	4 ft	5 ft	5416
6	5/8" x 5/8" x 1/4" Hose Barb Tee	1	1	1	5665
7	Blocked Vent Pressure Switch	1	1	1	54208
8	1/4" ID PVC Tubing	2 ft	2 ft	2 ft	5563

Table 13.6: Miscellaneous Components

	Description	Quantity Required			Stock Code
		PF-850	PF-1000	PF-1500	
1	Relief Valve - PF-850	1	–	–	51300
	Relief Valve - PF-1000/1500	–	1	1	51301
2	Temperature/Pressure Gauge	1	1	1	51324
3	6" Stainless Steel Boot Tee with Test Port	1	1	–	5680
	7" Stainless Steel Boot Tee with Test Port	–	–	1	5747
4	6" Stainless Steel Drain Fitting	1	1	–	5681
	7" Stainless Steel Drain Fitting	–	–	1	5748
5	6" Stainless Steel x 6" PVC Adapter	1	1	–	5682
	7" Stainless Steel x 8" PVC Adapter	–	–	1	5749
6	6" Diameter Exhaust/Air Intake Screen	1	1	–	54446
	8" Diameter Exhaust/Air Intake Screen	–	–	1	54682
7	Stacking Spacer	6	6	6	1457
8	Outdoor Sensor	1	1	1	54112
9	DHW Tank Sensor	(Optional)			54157
10	Condensate Neutralizing Media (1 lb bag)	2	2	4	54159

APPENDIX A. PIXEL DISPLAY SCREEN

A. STAND ALONE PIXEL DISPLAY

Figure A.1 below is a map of the boiler pixel display screen for a multiple boiler. When operating as a "stand-alone" boiler, the keys on the pixel display are not active. Section 8 provides information about status messages for this display.

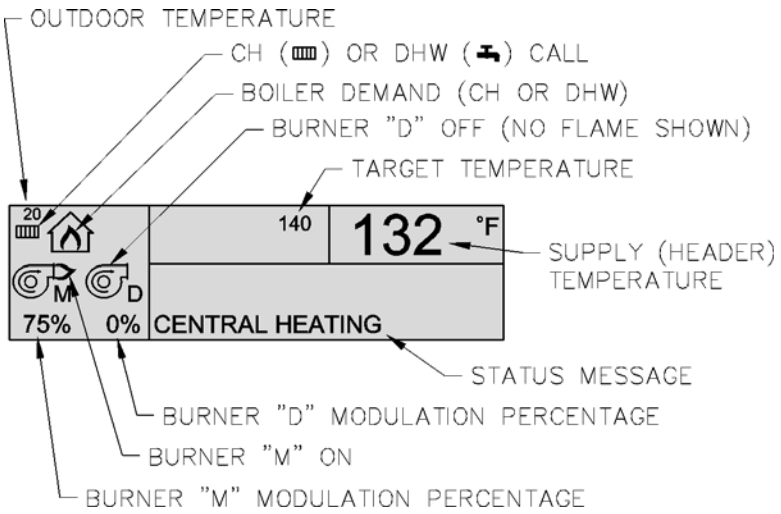


Figure A.1: Pixel Display Screen – Stand Alone Boilers

B. MULTIPLE BOILER (CASCADE) PIXEL DISPLAY

To operate 2 or more boilers in cascade, the boilers must be connected by 2-wire link connections as described is Section 8.

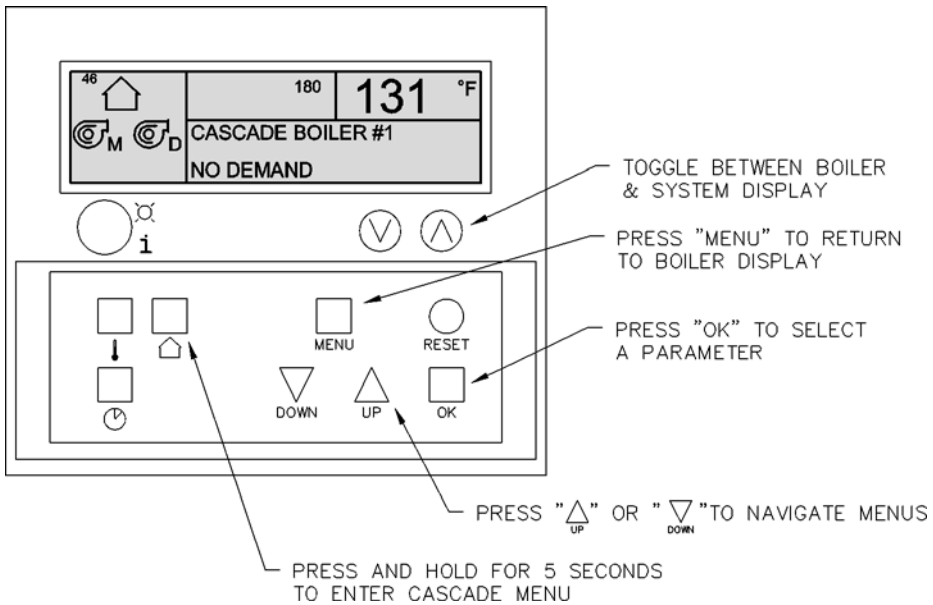


Figure A.2: Pixel Display Module

Table A.1 shows the cascade menu screen which is accessed by pressing the button labeled ▲ for 5 seconds and releasing it.

Table A.1: Cascade Menu

Cascade Menu		
● Boiler Address:	0	
Start Delay Time:	4	min
Stop Delay Time:	4	min
Start Boiler Diff:	9	°F
Stop Boiler Diff:	9	°F
Stop All Boiler Diff:	18	°F
Max Offset Up:	36	°F
Max Offset Down:	9	°F
Rotation Interval:	5	days
P-Value	20	
I-Value	40	
D-Value	0	
Stew Rate	1	

Figure A.3 shows the System Display Screen. As shown in Figure A.2, this is accessed by toggling the "Ⓥ Ⓐ" keys.

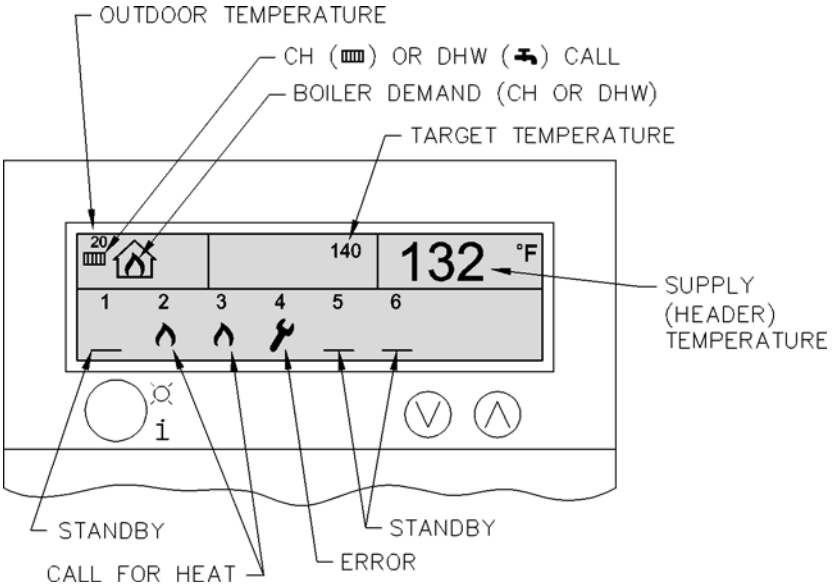


Figure A.3: Cascade Status Display

APPENDIX B. BURNER LCD STATUS SCREENS

Initialization Screen

S1

Status Screens

S2

S3

S4

S5

S6

Boiler Screens

CS1

CS2

CS3

Failure Screens

FS1

FS2

FS3

FS4

Error Handling – Blocking Errors

E1

E2

Warning Screen

WS1

Error Handling – Locking Errors

E3

E4

CH Burn Cycle	DHW Burn Cycle	Special Functions
CH1 16:36 STANDBY 160°F	D1 16:36 STANDBY 160°F	16:36 CALL FOR HEAT Freeze Protection 40°F
CH2 16:36 CALL FOR HEAT Trial for Ignition 160°F	D2 16:36 CALL FOR HEAT Trial for Ignition 160°F	16:36 CALL FOR HEAT Trial for Ignition 40°F
CH3 16:36 CALL FOR HEAT 100% Input 160°F	D3 16:36 CALL FOR HEAT 100% Input 160°F	16:36 CALL FOR HEAT Freeze Protection 1% Input 40°F
CH4 16:36 SUPPLY AT SETPOINT Fan Post Purge 160°F	D4 16:36 SUPPLY AT SETPOINT Fan Post Purge 160°F	**DHW Tank Warm Hold**
CH5 16:36 SUPPLY AT SETPOINT Circulator ON	D5 16:36 SUPPLY AT SETPOINT Circulator ON	16:36 DOMESTIC HOT WATER Trial for Ignition 160°F
		16:36 DOMESTIC HOT WATER DHW Warm Hold 160°F

APPENDIX C. USER MENU

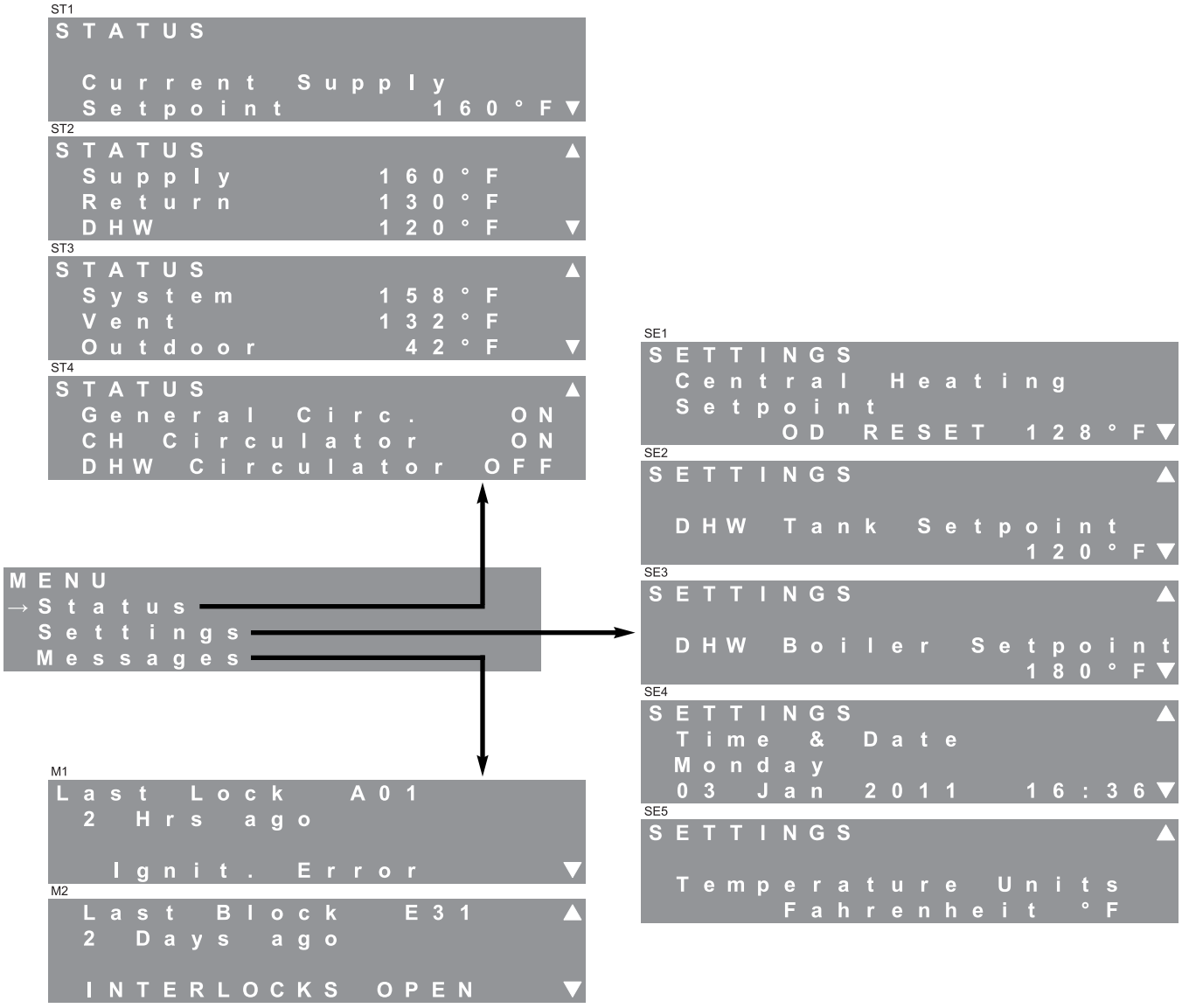


Figure C.1: User Menu – Managing Burner

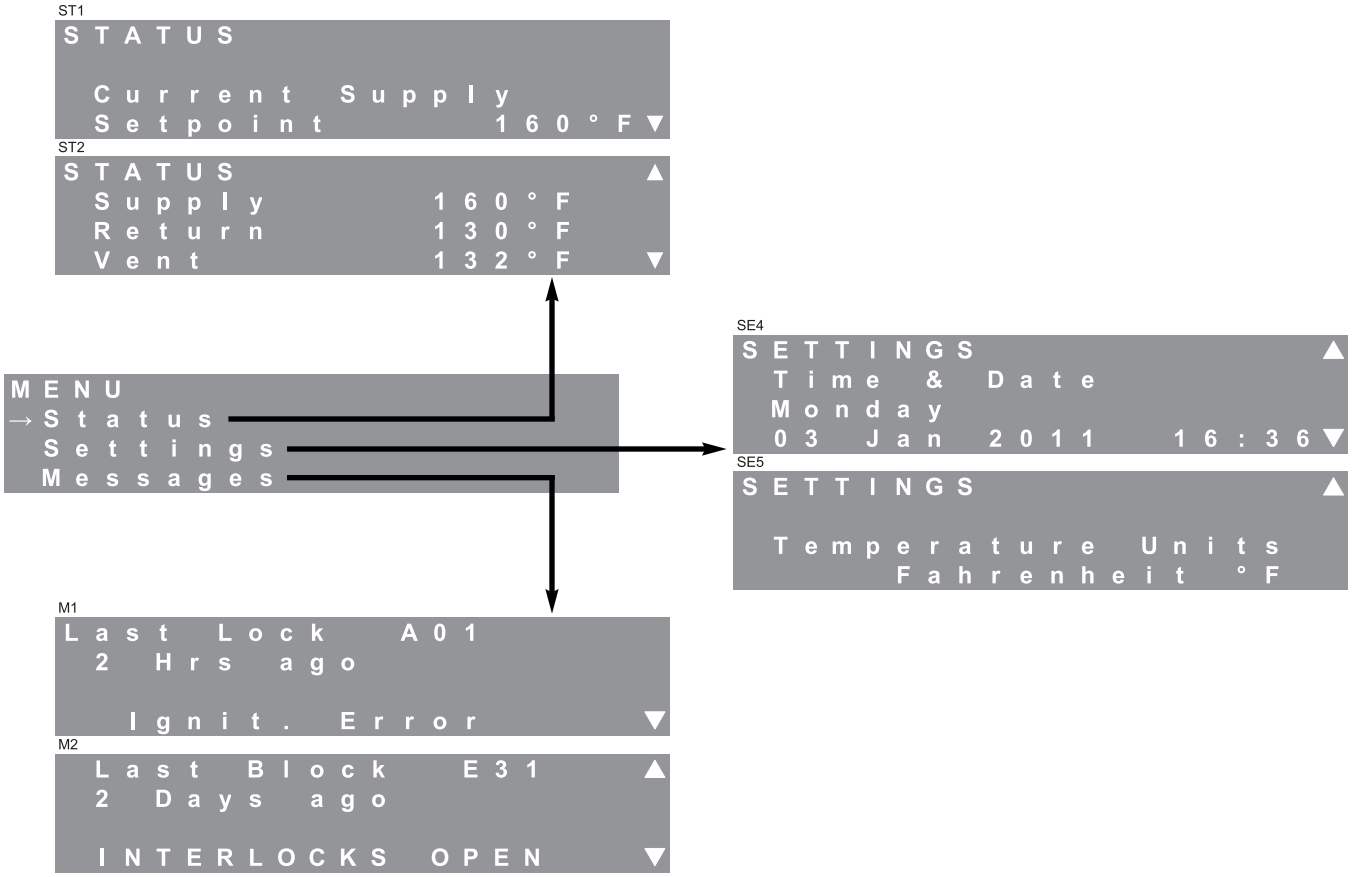
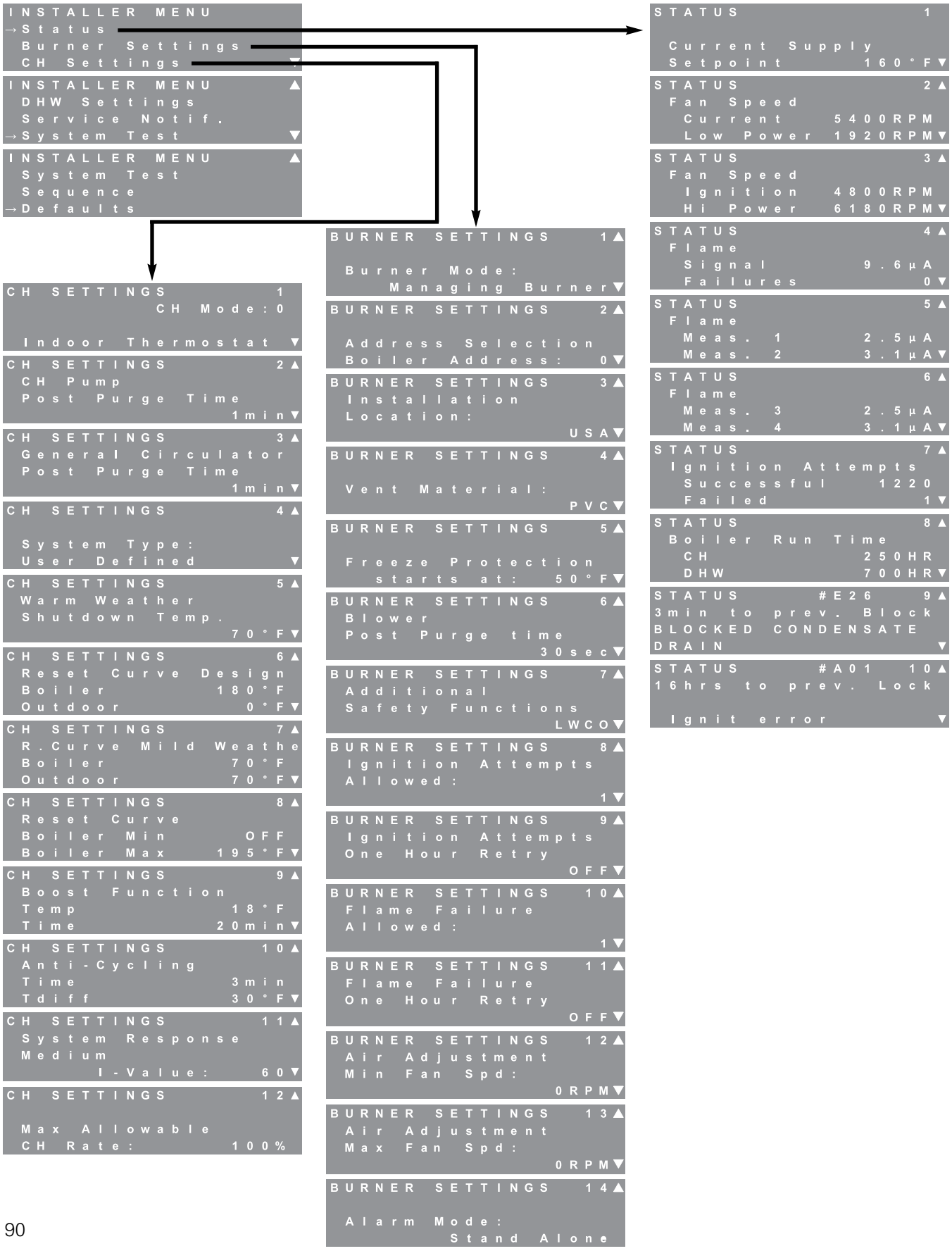


Figure C.1: User Menu – Dependent Burner

APPENDIX D. INSTALLER MENU STRUCTURE




SYSTEM TEST
→Off
Low Power
Ignition Power
SYSTEM TEST
→Maximum Power
Pump For CH
Pump For DHW
INSTALLER MENU
→Status
Burner Settings
CH Settings
INSTALLER MENU
DHW Settings
Service Notif.
System Test
INSTALLER MENU
System Test
Sequence
→Defaults
DHW SETTINGS 1
DHW Mode: MODE:2
DHW Tank
with Thermostat
DHW SETTINGS 2
CH / DHW Switch
Time 30min
DHW SETTINGS 3
DHW Heat Dump: OFF
Max Time: 1min
Min Diff: 5°F
DHW SETTINGS 4
System Response
Medium
I-Value: 60
DHW SETTINGS 5
Max Allowable
DHW Rate: 100%
SEQUENCE 1
Start Delay Time:
2 min
SEQUENCE 2
Stop Delay Time:
2 min
SEQUENCE 3
Start Burner Diff:
9°F
SEQUENCE 4
Stop Burner Diff:
18°F
SEQUENCE 5
Calculated Setpoint
Max offset up:
36°F
SEQUENCE 7
Calculated Setpoint
Max offset down:
9°F
SEQUENCE 8
Next Burner
Start Rate:
50%
SEQUENCE 9
Next Burner
Stop Rate:
9%
SEQUENCE 10
Rotation Interval
5Days
DEFAULT 1
Factory Defaults
Press Select:Reset
DEFAULT 2
Save Site Defaults
Press Select: Save
DEFAULT 3
Site Defaults
Press Select:Reset
SERVICE 1
Reset Notification
Timer/Counters
Press Select:Reset
SERVICE 2
Notification:
OFF
SERVICE 3
Notification
after: 4000HRS
SERVICE 4
Notification
after: 20000CYC
SERVICE 5
Notification on:
01 JAN 2013

APPENDIX E. 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 – Burner #1			
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):	
Combustion Readings – Burner #2			
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):	
Combustion Readings – Both Burners			
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 (°F):		Exhaust Temp Low Fire (°F):	

SERVICE LOG

Serial Number	

Date	Serviced By	Description of Service

NOTES

PEERLESS® PUREFIRE®

Gas Boilers

PF-850 PF-1000 PF-1500

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

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