

Peerless Pinnacle

Oil Boilers



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

Installation, Operation & Maintenance Manual



PeerlessBoilers.com

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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. Pinnacle Oil boilers are supplied factory assembled with pressure vessel, base, and jacket panels. A trim box containing the relief valve, drain valve, temperature / pressure gauge and associated pipe fittings is included in the crate.
2. The burner, acoustic shroud and venting are shipped separately for field assembly. The POC control is shipped separately for maximum flexibility.
3. The package should be carefully inspected for damage upon receipt and any damage to the unit should be reported to the shipping company and wholesale distributor.
4. The boiler should be stored in a clean, dry location.
5. Carefully read these instructions and be sure to understand the functions of all mechanical and electrical connections before beginning the installation. Contact your PB Heat, LLC representative for help in answering questions.
6. This boiler must be installed by a qualified contractor. The boiler warranty may be voided if the boiler is not installed correctly.
7. This boiler may be installed at high altitudes above 5,000 feet elevation. Consult burner manual (included) for burner requirements.

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 appliance installation.
2. In absence of local requirements the following codes and standards should be followed.
 - a) ASME Boiler & Pressure Vessel Code, Section IV – Heating Boilers
 - b) ASME Boiler & Pressure Vessel Code, Section VI – Recommended Rules for the Care and Operation of Heating Boilers.
 - c) ANSI/NFPA 70 – National Electrical Code
 - d) NFPA 31 – Standard for the Installation of Oil-Burning Equipment.
 - e) ANSI/NFPA 211 – Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.

3. Where required by the authority having jurisdiction, the installation of this equipment must comply with ANSI/ASME CSD-1 – Standard for Controls and Safety Devices for Automatically Fired Boilers.

C. ACCESSIBILITY CLEARANCES

1. The Pinnacle Oil boiler is design certified for closet installations with zero clearance to combustible construction. In addition, it is certified for use on combustible floors provided the boiler is not installed on carpeting.



DANGER

Do not install this boiler on carpeting.

2. Refer to Figure 1.1 for the recommended clearances to allow for reasonable access to the boiler. Local codes or special conditions may require greater clearances.

D. COMBUSTION & VENTILATION AIR

1. The Pinnacle Oil boiler is designed for several options for combustion air and venting.
 - a) Concentric Sidewall Venting
 - b) Concentric Vertical Chimney Venting
 - c) Single Wall Vertical Chimney Venting using the chimney as a chase for inlet air.
 - d) Concentric Vertical Roof Venting
2. The concentric venting options are designed for operation with combustion air piped from the outside (sealed combustion). For these options, no additional ventilation air is required.



WARNING

This appliance must be supplied with adequate combustion air to properly burn the fuel. Failure to supply an adequate air supply will result in incomplete combustion resulting in sooting and carbon monoxide emission. This may result in severe personal injury, death or major property damage.

E. PLANNING THE LAYOUT

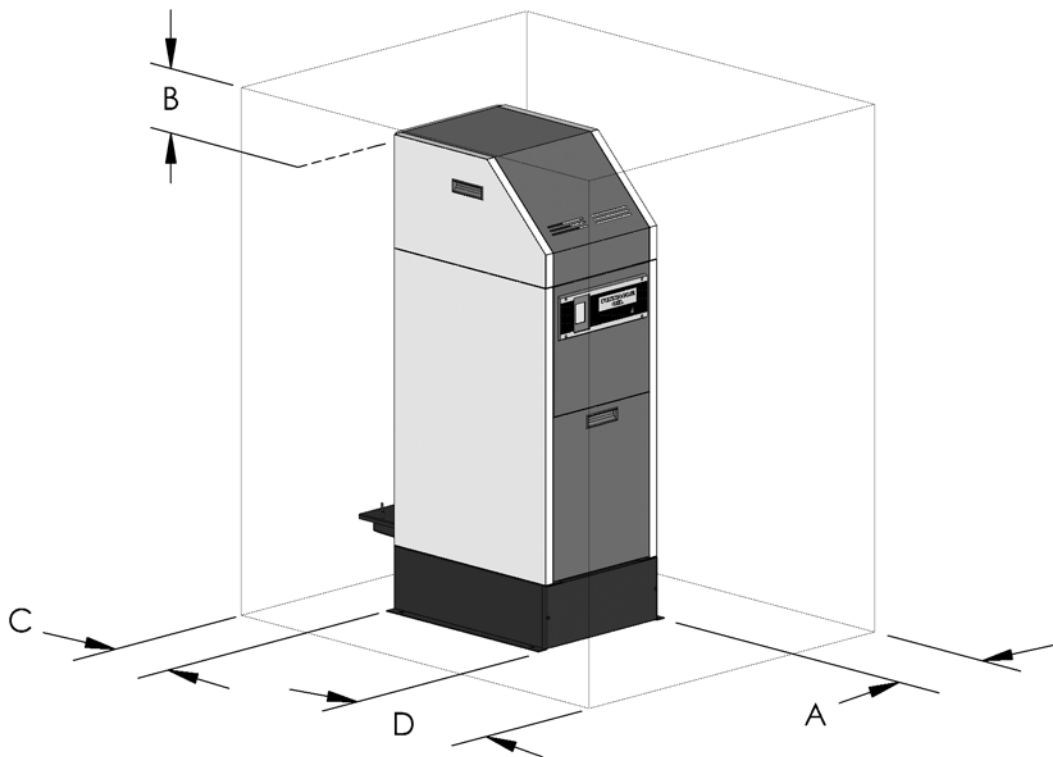
1. Prepare sketches and notes showing the layout of the boiler installation to minimize the possibility of interferences with new or existing equipment, piping, venting and wiring.
2. Review the following sections of this manual for consideration of the limitations with respect to:
 - a) Venting: Section 3
 - b) Air Intake Piping: Section 3
 - c) Condensate Removal: Section 3
 - d) Water Piping: Section 4
 - e) Oil Burner & Fuel Piping: Section 5
 - f) Electric and Controls: Section 6

**WARNING**

This appliance 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.



Service Clearances		
Designation	Description	Dimension
"A"	Burner Swing Clearance (Left or Right)	16" [406 mm]
"B"	Jet/Acoustic Shroud Removal Clearance	13" [330 mm]
"C"	Vent/Air Intake Sampling Clearance	12" [305 mm]
"D"	Control Panel Access Clearance	24" [610 mm]

Figure 1.1: Recommended Service Clearances

2. BOILER SET-UP

A. GENERAL

1. Pinnacle Oil boilers are to be installed in either 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. This boiler is not intended to support external piping. All venting and other piping should be supported independently of the boiler.
3. Provide a level foundation, located as close as practicable to the center of the heating system.
4. After removing the boiler from the packaging and setting it on its foundation, open the burner swing door on the top of the boiler and make sure the jet inserts are seated properly in the combustion chamber. Refer to the repair parts in Section 11 to identify these parts. Close the burner swing door before continuing.



CAUTION

Be sure that any packing material that is in the combustion chamber to protect the Jet Inserts is removed before firing the appliance. Failure to do this may result in minor personal injury or property damage.

5. Install the boiler level to prevent condensation from blocking the vent system.

3. VENTING, INLET AIR & CONDENSATE

A. GENERAL

1. All venting and air inlet piping is to be installed in accordance with local building codes, NFPA 31 and these instructions.



⚠ DANGER

This vent system operates under a positive pressure. Do not connect vent connectors serving appliances vented by natural draft into any portion of mechanical draft systems operating under positive pressure. Failure to comply will result in severe personal injury, death or major property damage.

2. This appliance may be vented in any one of the following three ways. Examples of these systems are detailed in this section.
 - a) Concentric Sidewall Venting
 - b) Concentric Vertical Chimney Venting
 - c) Single Wall Vertical Chimney Venting using the chimney as a chase for inlet air
 - d) Concentric Vertical Roof Venting

B. APPROVED MATERIALS FOR EXHAUST VENT AND INLET AIR PIPING

1. The venting system for this boiler has been approved under UL-726 for use with this boiler. No substitutions are to be made for this material.
2. The venting components shown in Table 3.2 and the venting kits shown in Figures 3.2 through 3.5 are to be purchased separately from your distributor. Questions regarding the proper vent material are to be directed to your PB Heat, LLC representative.

C. EXHAUST VENT/INLET AIR LOCATION

1. The concentric vent piping for this boiler is approved for zero clearance to combustible construction.
2. The Pinnacle Oil boiler, like all high efficiency products, is likely to produce a visible vapor plume due to condensation. Surfaces near the vent termination will likely be coated with condensation.
3. Care must be taken to locate the exhaust vent where the exhaust gas, vapor plume, and condensation do not cause a hazard or nuisance. For example, do not locate the exhaust vent termination under a deck where, under certain conditions, it could form a coating of ice causing a hazard or reduce the life of the deck materials.

4. Sidewall Vent System

- a) Sidewall vented products are susceptible to wind conditions that can effect combustion. To minimize the effects of wind, the exhaust and air inlet terminations must penetrate the same wall or vertical surface. In addition, the length of the exhaust and air inlet pipes must be roughly equivalent.
- b) Condensation from a sidewall vented appliance may cause paint and other surface coatings to deteriorate. In addition, soot stains may appear on surrounding surfaces if the boiler is not properly maintained.
- c) If the boiler is used to heat potable (tap) water, the boiler will operate year round. The effects of hot gases and odors must be taken into consideration during the summer months.
- d) See Figure 3.1 for an illustration of clearances for location of exit terminals for direct-vent, sidewall venting systems.
- e) The boiler vent system shall terminate at least 3 feet (0.9 m) above any forced air inlet located within 10 feet (3 m). Note: This does not apply to the combustion air inlet of a direct-vent appliance.
- f) Provide a minimum of 1 foot (300 mm) distance from any door, operable window, or gravity air inlet into any building.
- g) Do not locate the exhaust termination directly under an operable window.
- h) Provide a minimum of 1 foot (300 mm) clearance from the bottom of the exhaust termination above the expected snow accumulation level. Snow removal may be necessary to maintain clearance.
- i) Provide 4 feet horizontal clearance from electrical meters, gas meters, air conditioning condensers or other external equipment. In no case shall the exit terminal be above or below the aforementioned equipment unless a 4 foot horizontal distance is maintained.
- j) Do not locate the exit termination over public walkways where condensate could drip or freeze, causing a hazard or nuisance.
- k) When the exhaust termination is adjacent to a public walkway, it is to be located at least 7 feet (2100 mm) above grade.
- l) Do not locate exhaust termination directly under roof overhangs to prevent icicles from forming.
- m) Provide 3 feet (0.9 m) clearance from the inside corner of adjacent walls.

D. CONCENTRIC VENTING SYSTEM

1. The concentric venting system used with this appliance consists of an inner pipe constructed of polypropylene or stainless steel and an outer pipe made of aluminum.
2. The inner pipe provides a path for the exhaust gases to exit the boiler to the outdoors while space between the pipes allows outdoor air to be conveyed to the boiler.
3. The minimum vent length is 14 equivalent feet for models PO-70 and PO-84 and 25 feet for models PO-70A and PO-84A. This minimum length is required to obtain the efficiency rating of this product. The maximum vent length is 80 equivalent feet. Since the air inlet pipe is integral to the vent, the same minimum and maximum vent lengths apply.
4. The following chart gives equivalent lengths for several common venting components.

Fitting Description	Equivalent Length
Elbow, 90°	5
Cleanout Tee	5
Elbow, 45°	3
Vertical Vent Termination	0
Sidewall Vent Termination	0

E. EXHAUST VENT AND AIR INLET PIPE INSTALLATION

1. Only polypropylene vent material supplied by PB Heat, LLC is to be used with this appliance.
2. Horizontal lengths of vent pipe must slope towards the boiler at a pitch not less than 1/4" per foot (20 mm per meter) to allow condensate to drain from the vent pipe into the boiler. If the vent pipe must be piped around an obstacle that causes a low point in the pipe, a drain pipe must be connected to this low point to provide drainage.
3. All piping must be fully supported. Use pipe hangers at a minimum of 4 foot (1.2 meter) intervals to prevent sagging of the vent pipe where condensate may form.
4. Do not use the boiler to support any piping. All piping is to be supported externally.

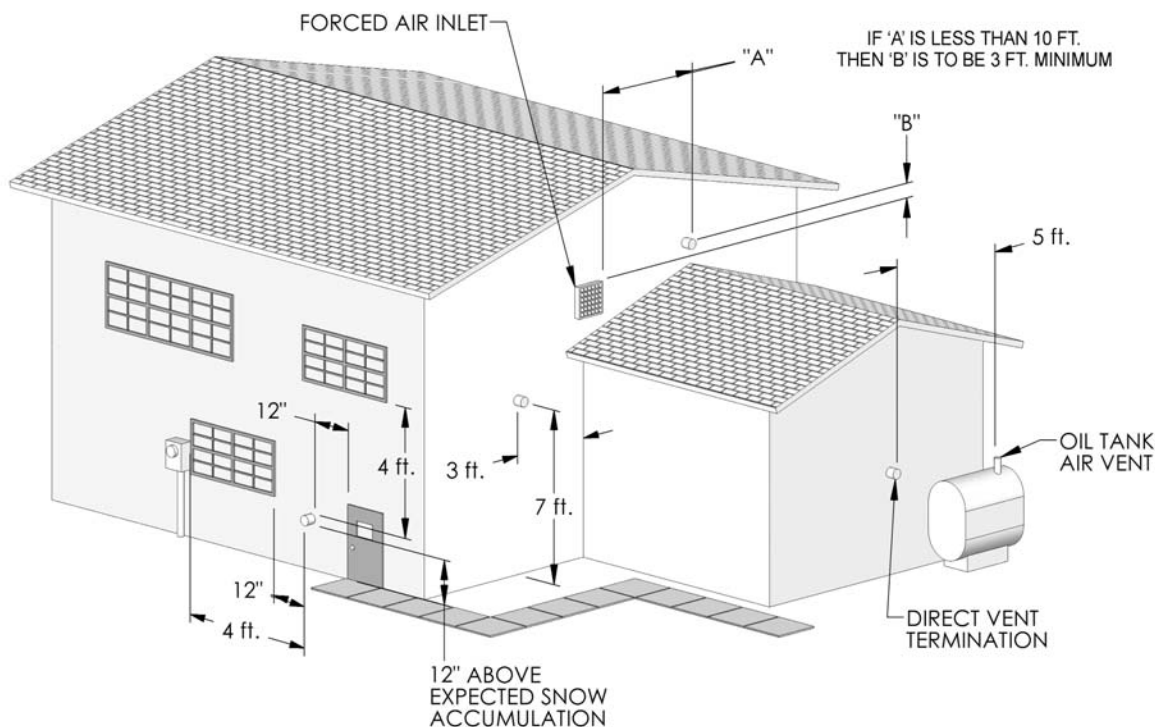
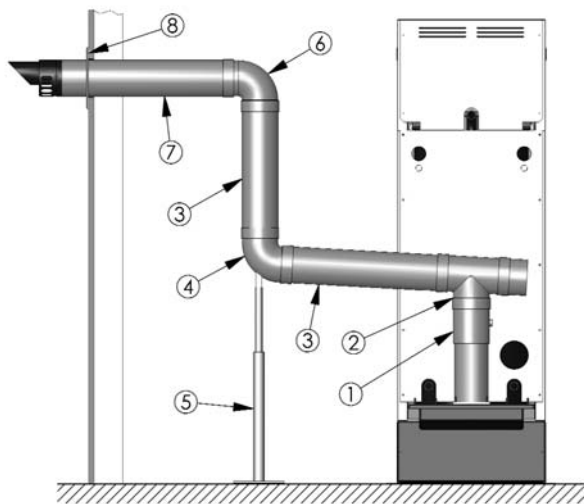


Figure 3.1: Location of Exit Terminals of Mechanical Draft and Direct-Venting Systems

F. STANDARD VENT KITS

1. **Common Vent Kit (54044):** The common vent kit is required for each Pinnacle Oil Boiler. This includes:
 - a) (54000) Concentric Sample Port Adapter
 - b) (54001) Concentric Clean-out Tee
 - c) (54006) Adjustable Length Vent Pipe - 19-1/2" Max.
 - d) (54002) Concentric 90° Support Elbow
 - e) (54048) Vent Pipe Support
2. **Concentric Sidewall Vent Kit (54045):** A concentric sidewall vent kit is used for boilers that are vented through a building wall. This type of installation is shown in Figure 3.2. This kit includes:
 - a) (54029) Concentric Sidewall Termination
 - b) (54003) Concentric 90° Elbow
 - c) (54007) Concentric Wall Plate

Additional vent pipe and fittings may be required to complete the installation. Refer to the component list for vent pipe in Table 3.2.



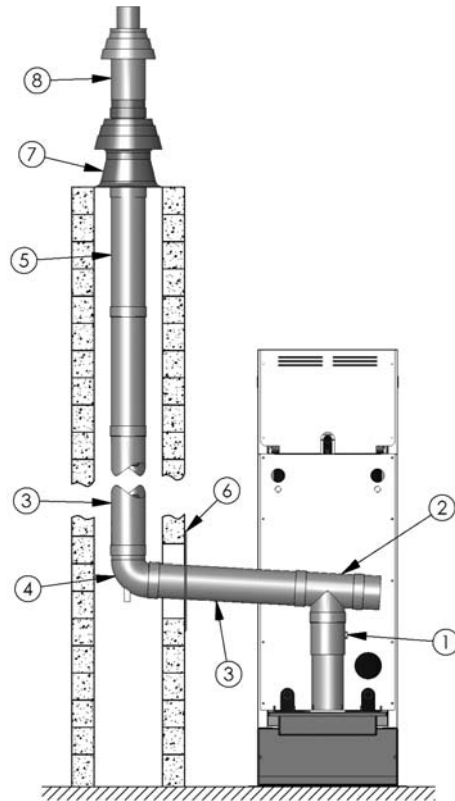
ITEM	STOCK CODE	DESCRIPTION
1	54000	80/125 CONCENTRIC SAMPLE PORT ADAPTER
2	54001	80/125 CONCENTRIC CLEAN-OUT TEE
3	54006	80/125 CONCENTRIC ADJUSTABLE LENGTH PIPE 19 1/2" MAX
4	54002	80/125 CONCENTRIC SUPPORT ELBOW
5	54048	VENT PIPE SUPPORT 39" TO 45"
6	54003	80/125 CONCENTRIC ELBOW
7	54029	80/125 CONCENTRIC SIDE WALL TERMINATION
8	54007	125 WALL PLATE - 8 3/4" SQUARE

Figure 3.2: Sidewall Venting

3. **Concentric Vertical Chimney Vent Kit (54047):** A concentric vertical chimney vent kit is used to pipe both the exhaust vent and the inlet air through an existing chimney. An example of this type of installation is shown in Figure 3.3. This kit includes:
 - a) (54012) Aluminum Shaft Cover Assembly
 - b) (54015) Vertical Vent Termination

Additional concentric vent pipe components may be required to complete the installation. Refer to the component list for vent pipe in Table 3.2.
4. **Single Wall Vertical Chimney Vent Kit (54046):** A single wall vertical chimney vent kit is used to pipe the exhaust vent through an existing chimney while drawing the inlet air down through the chimney around the exhaust vent pipe. An example of this type of installation is shown in Figure 3.4. This kit includes:
 - a) (54036) Stainless Steel End Pipe
 - b) (54013) Aluminum Shaft Cover

Additional vent pipe components may be required to complete the installation. Refer to the component list for vent pipe in Table 3.2.



ITEM	STOCK CODE	DESCRIPTION
1	54000	80/125 CONCENTRIC SAMPLE PORT ADAPTER
2	54001	80/125 CONCENTRIC CLEAN-OUT TEE
3	54005	80/125 CONCENTRIC ADJUSTABLE LENGTH PIPE 39" MAX
4	54002	80/125 CONCENTRIC SUPPORT ELBOW
5	54019	80/125 CONCENTRIC PIPE - 78"
6	54007	125 WALL PLATE - 8 3/4" SQUARE
7	54012	5" ALUMINUM SHAFT COVER
8	54015	80/125 STAINLESS STEEL VENT TERMINATION

Figure 3.3: Concentric Vertical Chimney Venting

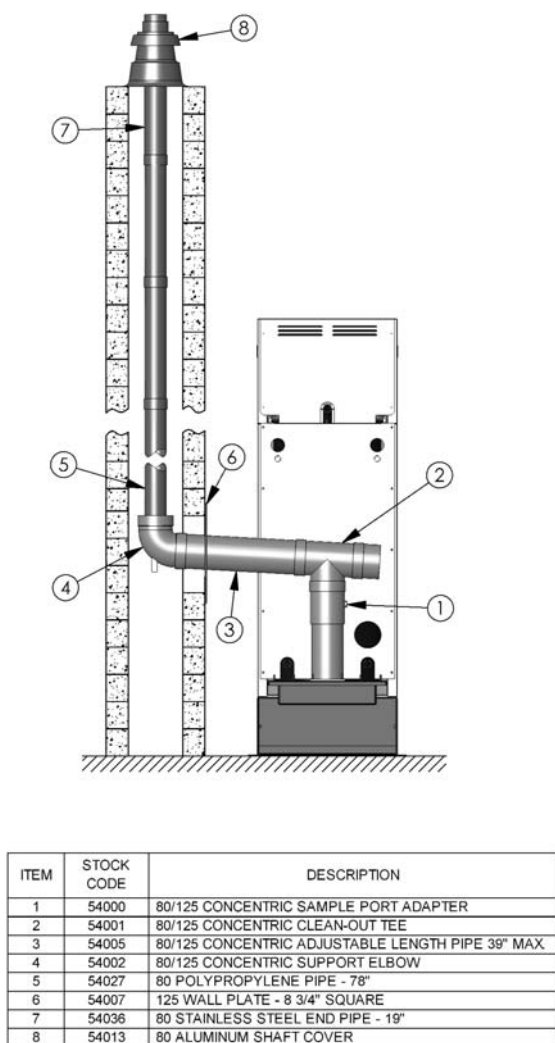


Figure 3.4: Single Wall Vertical Chimney Venting

- Concentric Vertical Roof Vent Kit (54049): The concentric vertical roof vent kit is used without a chimney to vent through the building roof. This type of installation is shown in Figure 3.5. Additional concentric vent pipe components may be required to complete the installation. Refer to the component list for vent pipe in Table 3.2.

G. CONDENSATE

- 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.
- The condensate from oil-fired condensing appliances may have a pH value as low as 2. Some local codes require the use of neutralization equipment to treat the condensate.
- A condensate neutralizer (91438), available from your distributor is recommended to reduce the acidity of the condensate before it is piped to a drain.

- This appliance must be fitted with a condensate trap to prevent flue gas leakage.
- Figure 3.6 shows a simple condensate trap that can be utilized with this equipment. A 3/4" Female NPT x 3/4" O.D. Barb Adapter is used to attach a 3/4" ID PVC (Tygon) Hose.
- If the condensate outlet of the Pinnacle boiler is below the drain level, a condensate pump must be used.
- All piping for the condensate drain should be corrosion resistant material such as PVC or polypropylene. Do not use galvanized, aluminized, or materials containing copper (such as brass or bronze) for pipe or fittings.

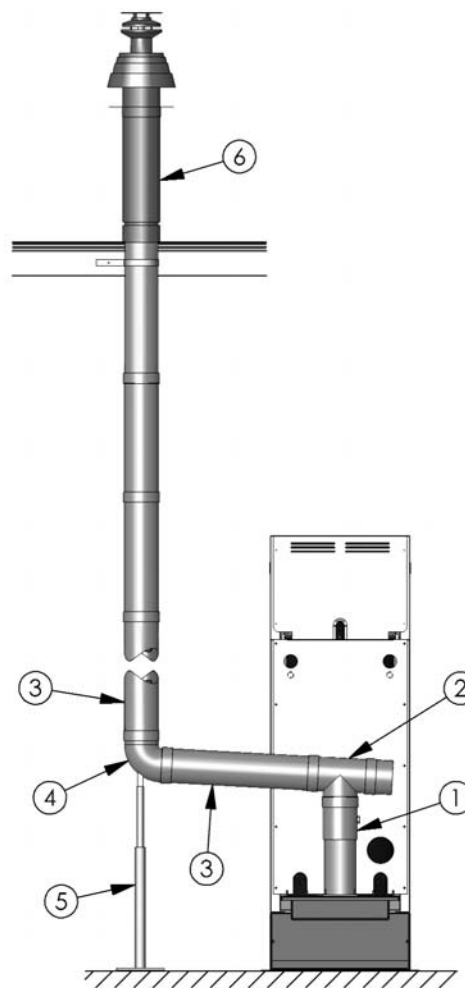


Figure 3.5: Concentric Vertical Roof Venting

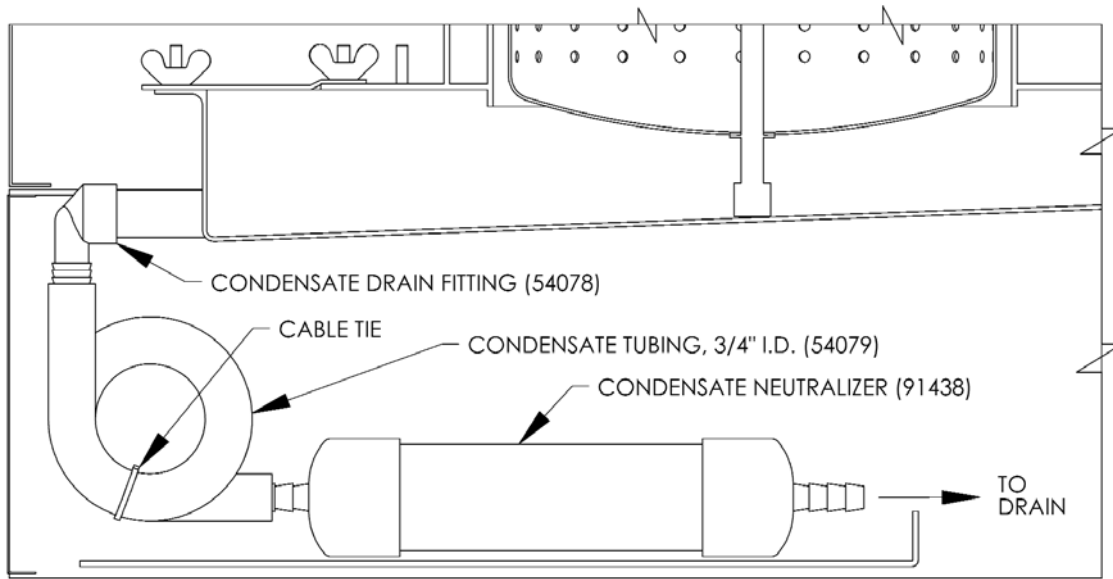


Figure 3.6: Condensate Trap & Neutralization

Table 3.2: Vent Pipe Component List

Stock Code	Description
54017	Concentric Vent Pipe 19" Long
54018	Concentric Vent Pipe 39" Long
54006	Adjustable Length Concentric Vent Pipe - 19-1/2" Maximum Length
54005	Adjustable Length Concentric Vent Pipe - 39" Maximum Length
54003	90° Concentric Elbow
54062	Wall Clamp for Concentric Vent Pipe
54063	Universal Lead Tile for Vertical Vent Termination
54064	Flat Roof Flashing for Vertical Vent Termination
54024	9" Polypropylene Vent Pipe
54025	19" Polypropylene Vent Pipe
54026	39" Polypropylene Vent Pipe
54027	78" Polypropylene Vent Pipe
54023	90° Polypropylene Elbow
54058	45° Polypropylene Elbow

4. WATER PIPING

A. GENERAL

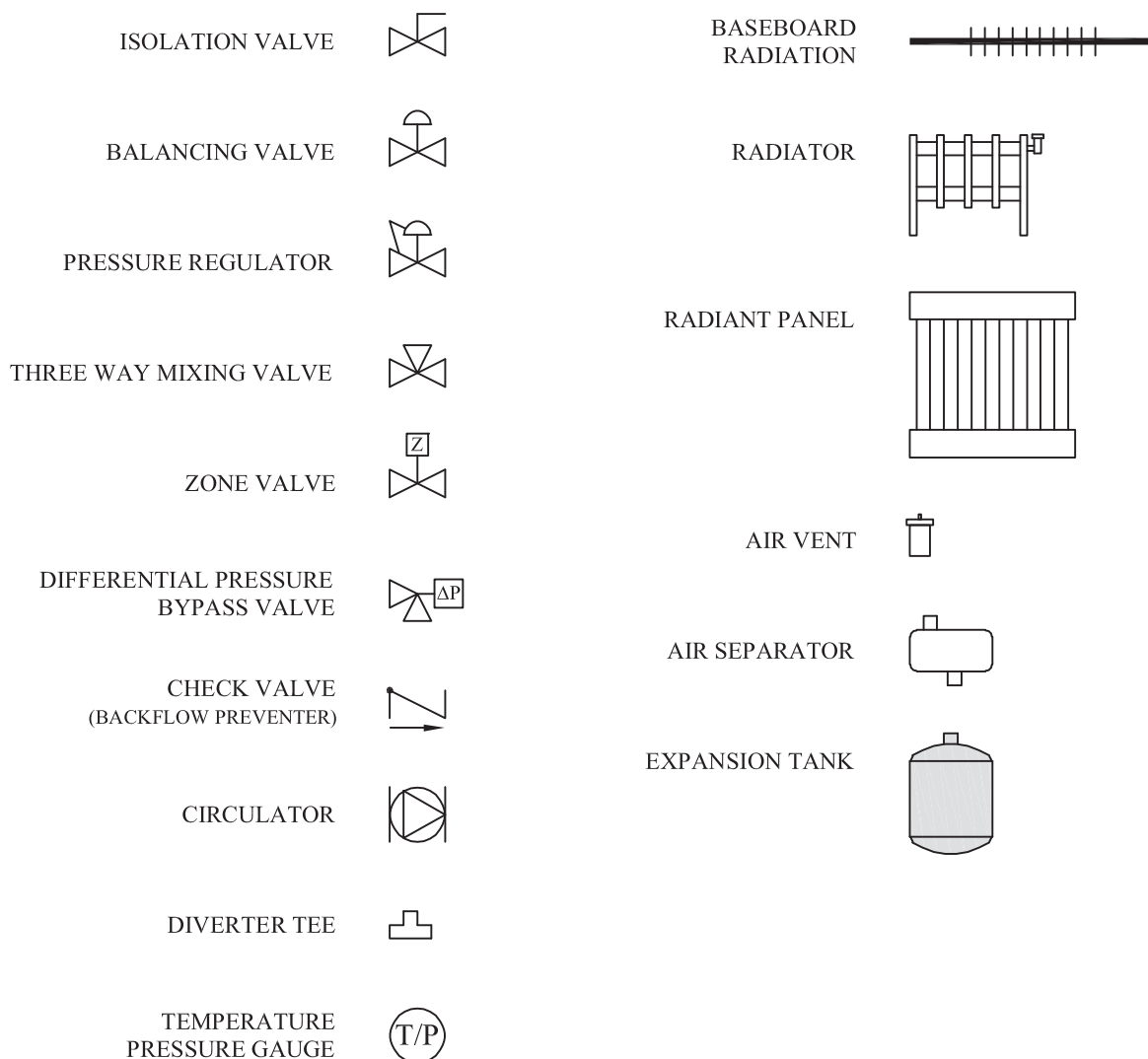
1. All boiler piping is to be installed in accordance with local building codes and these instructions.
2. This appliance is to be installed so that the electrical components of the burner and ignition system are protected from water (dripping, spraying, etc.) during operation and service. Service includes circulator replacement, condensate system cleaning, control replacement and other general maintenance procedures.

B. 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 the unit to be mounted in the piping from the boiler supply to the system. Installation of this gauge is required by most local codes.

Figure 4.1



2. *Air Elimination:* Any closed-loop hydronic system in which a Pinnacle Oil boiler is installed must have an air elimination device. As the system water is heated, dissolved oxygen, carbon dioxide and nitrogen gases will separate from the liquid. An air elimination device (such as a TACO 430 Series Air Scoop with an automatic air vent) is required to remove the dissolved gasses from the system preventing corrosion in the piping system and eliminating system noise.
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 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 for the proper heating medium. Glycol solutions may expand more than water for a given temperature rise.

CAUTION

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

WARNING

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

4. *Y-Type Strainer:* In older heating systems where a significant amount of sediment may be present, it may be necessary to install a Y-type strainer. The strainer should be checked and cleaned often in the first few months of operation to assure that sediment does not build up in the heat exchanger.
5. *Flow Control Valve:* Flow control valves such as the Taco Flo-Check 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 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 in glycol solution systems unless the glycol concentration is closely monitored.

NOTICE

Valves which automatically feed water under low water conditions can allow leaks to go unnoticed. This may allow large amounts of fresh water to be added to the system resulting in scaling in the boiler heat exchanger or dilution of glycol solutions.

7. *Back Flow Preventer:* A back flow preventer is required in some jurisdictions to prevent hydronic system water from backing up into the potable water supply. This is especially important on systems in which glycol solution is used as the heating medium.
8. *Pressure Relief Valve:* A pressure relief valve is supplied with each boiler for installation in the supply piping. Figure 4.2 shows the installation of the pressure relief valve and the temperature/pressure gauge. The relief valve discharge is to be piped within 12" (305mm) of the floor and close to a floor drain. Provide piping that is the same size or larger than the relief valve outlet.

CAUTION

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

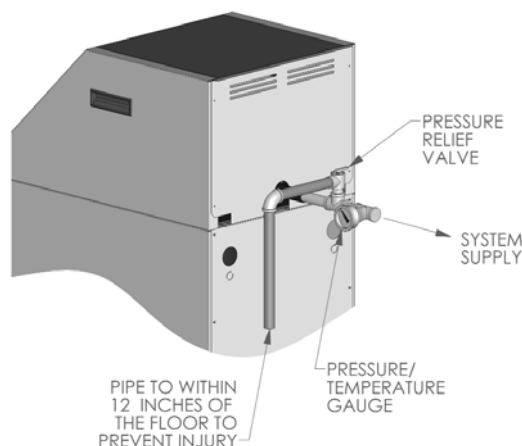


Figure 4.2

9. *Isolation Valve:* Isolation valves are intended to provide a positive shut-off for isolating sections of system piping. Ball valves and gate valves are examples of valves for this purpose. These types of valves are not intended for throttling flow.
10. *Balancing Valve:* Balancing valves are intended to throttle water flow. Examples of this type of valve are globe and needle valves.
11. *Zone Valve:* Zone valves are electronically activated valves intended for use with zone thermostats to provide heat only in the zone in which it is required.
12. *Differential Bypass Valve:* A differential bypass valve is used to allow minimum circulation in a system employing zone valves if all the zone valves close before the circulator stops. This prevents the circulator from "dead heading."
13. *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. In the case of the Pinnacle Oil boiler, the pressure drop through the boiler is nearly negligible.
- b) The circulator should be sized based on the boiler net output. The boiler “Net I=B=R Output” for each Pinnacle Oil Model is listed in the chart below. This value includes a piping pickup factor of 1.15.

Boiler Model	Boiler Input		Net I=B=R Output (Btu/hr)
	(gph)	(Btu/hr)	
PO-70 & PO-70A	0.50	70,000	56,000
PO-84 & PO-84A	0.60	84,000	67,000

- c) The required flow rate can be calculated based on the design temperature difference from the return to the supply of the boiler. For a PO-50 with a design water temperature rise of 20°F the calculation is as follows:

$$\text{Required Flow} = \frac{\text{Output}}{(\Delta T \times 500)} = \frac{56,000}{20 \times 500} = 5.6 \text{ GPM}$$

- d) The pressure drop of the system then determines the circulator that should be used.
- e) Special consideration must be given if propylene glycol solution is to be used as a heating medium.
 - Propylene glycol has a higher viscosity than water; therefore the system pressure drop will be higher.
 - Propylene glycol has a lower heating capacity than water and therefore requires a higher flow rate (14% for a 50% glycol solution) to transfer heat similar to water.

14. *Indirect Water Heater:* An indirect water heater, such as the Peerless Partner, should be piped into a dedicated zone. It consists of a water tank that is heated by boiler water passing through an internal coil.

C. SYSTEM PIPING

1. *Figure 4.3:* This illustration shows a single Pinnacle Oil Boiler, a Peerless Partner Indirect Water Heater, and a single heating zone.
 - a) The standard POC #1 control will accept separate inputs for heating and hot water. This will allow the heating zone to be supplied with a variable temperature depending on outdoor temperature (outdoor reset) while the domestic hot water zone will have a pre-designated set point. A complete description of this control will be given in Section 6 of this manual, Electrical & Controls. Note: Outdoor reset operation requires an optional Outdoor Sensor (54034).
 - b) By upgrading to the POC #2 control (54031), the boiler may give domestic hot water full priority over the heat load.

2. *Figure 4.4:* This diagram shows an additional zone in which baseboard radiation is the heat load. Baseboard radiation can be operated using the outdoor reset function to maximize the boiler efficiency.
3. *Figure 4.5:* This figure shows diverter tees used in combination with conventional hydronic radiators on an additional zone.
 - a) Also, a second boiler is shown piped in parallel with the first. It is important that the common headers are sized to match the system piping. Smaller headers may result in flow fluctuations through the boilers.
 - b) An upgrade to the POC #3 control (54032) allows a second boiler with a POC #1 control to act as a second stage, firing only when the first boiler fails to meet the load demand.
4. *Figure 4.6:* This illustration shows two boilers piped in parallel feeding a primary/secondary system with 5 zones using zone circulators. In this configuration, the supply water temperatures become increasingly cooler when all zones are calling. Therefore, the hottest and smallest zones should be piped closest to the boiler for best results.
5. *Figure 4.7:* This illustration shows a system in which zone valves are used in place of zone circulators. Notice that this system utilizes reverse return piping (where the first zone supplied is the last zone on the return), which makes it easier to balance the system. If the heating loops are very different in length, balancing valves, shown on the return side of each loop, are required.

D. FREEZE PROTECTION

1. Propylene glycol for hydronic heat transfer applications is specially formulated for this purpose. It includes inhibitors which prevent the glycol from attacking metallic system components. Make certain that the system fluid is checked for the correct concentration and inhibitor level.

⚠ NOTICE

Do not use more than 50% propylene glycol. This provides freeze protection to -28°F. Higher concentrations will inhibit heat transfer and reduce the system flow rate.

2. Do not use galvanized pipe in systems using propylene glycol solutions.
3. Use water low in mineral content and make sure there is no petroleum based solution in the mixture.
4. Make sure the heating system is clean.
5. Mix propylene glycol solution at room temperature.
6. Do not use a chromate treatment.
7. Do not use automotive type glycol. Use an inhibited propylene glycol specifically formulated for hydronic heat transfer.

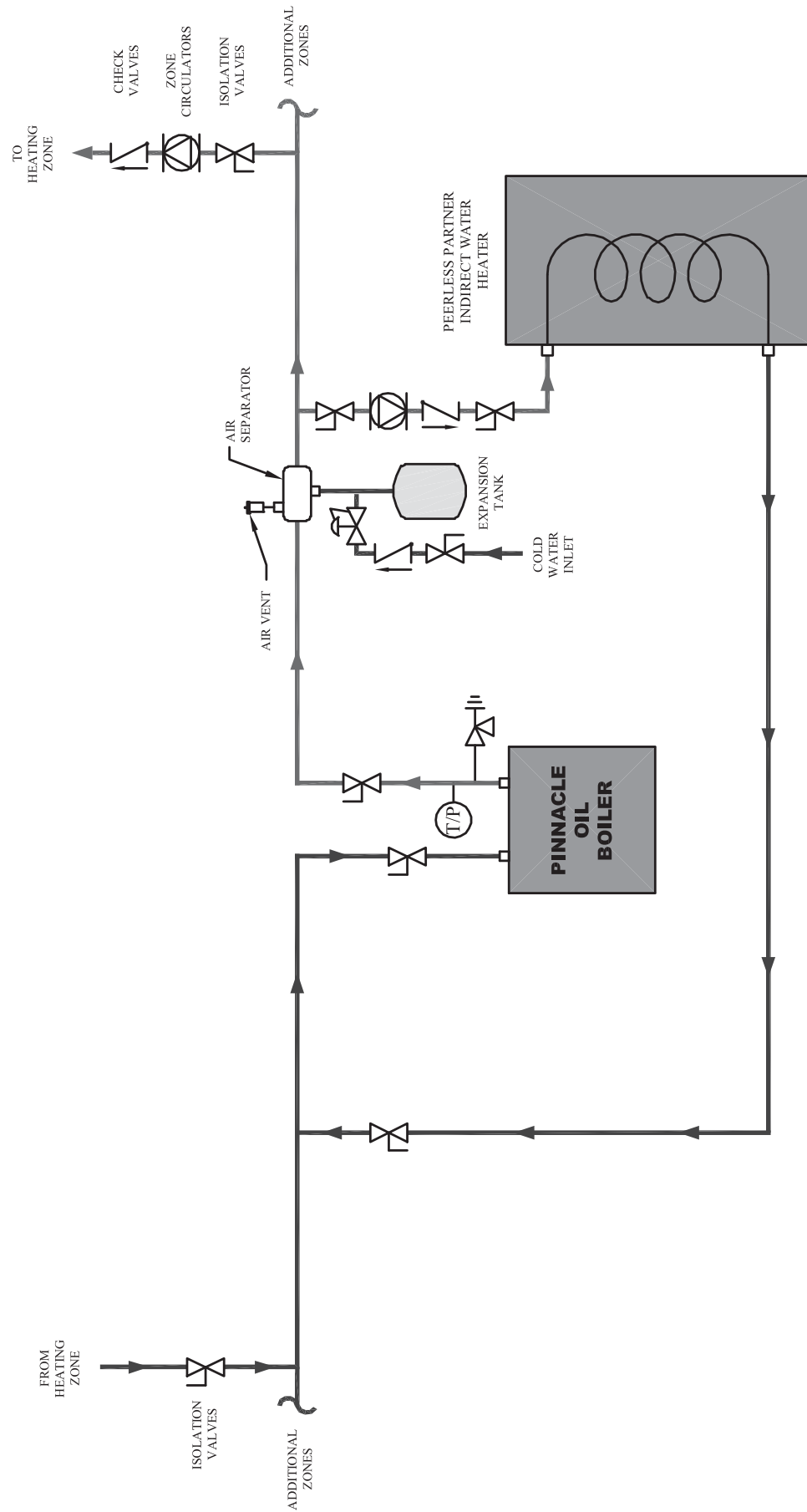


Figure 4.3: One Boiler with Two Zones using Zone Circulators

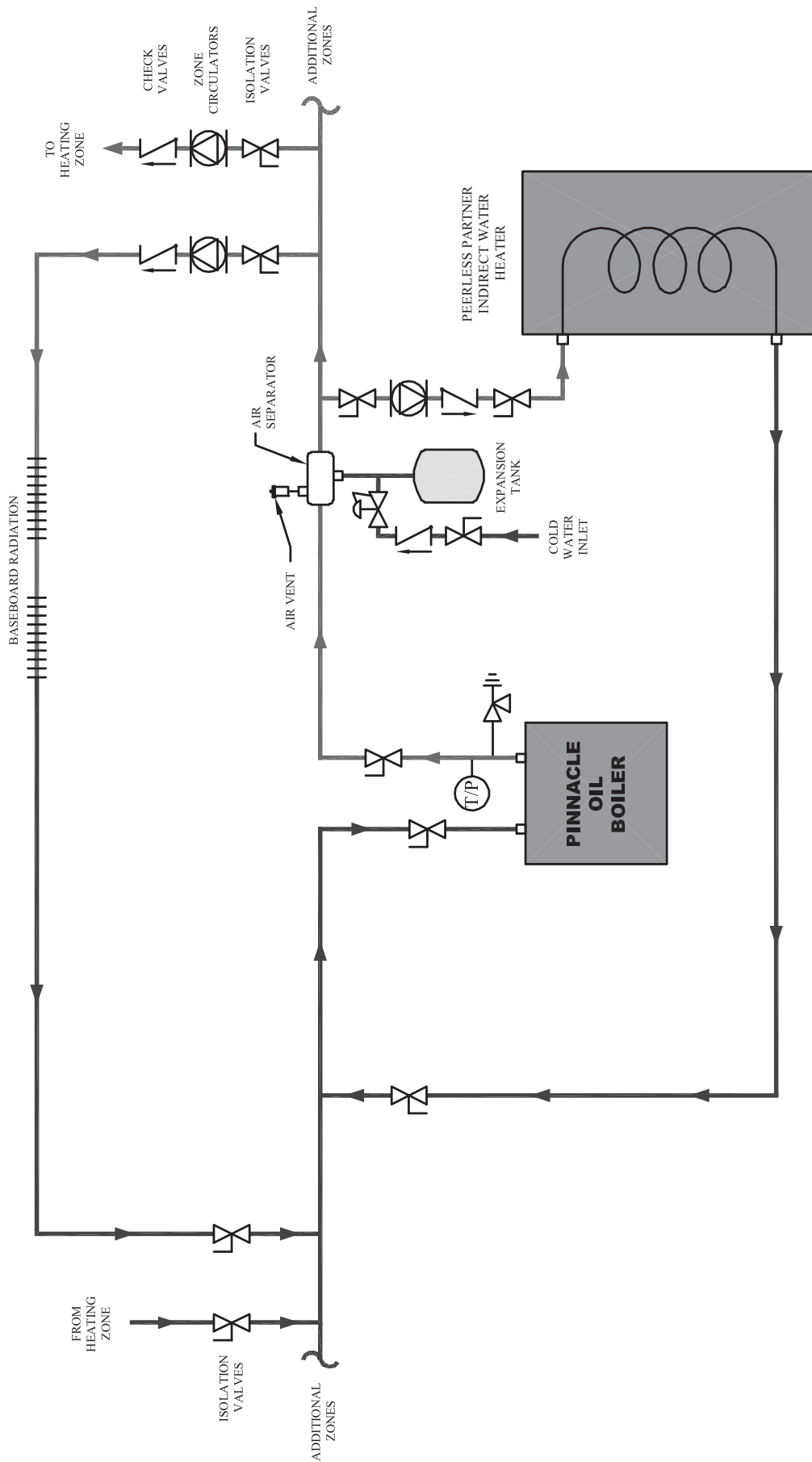


Figure 4.4: One Boiler with Three Zones using Zone Circulators

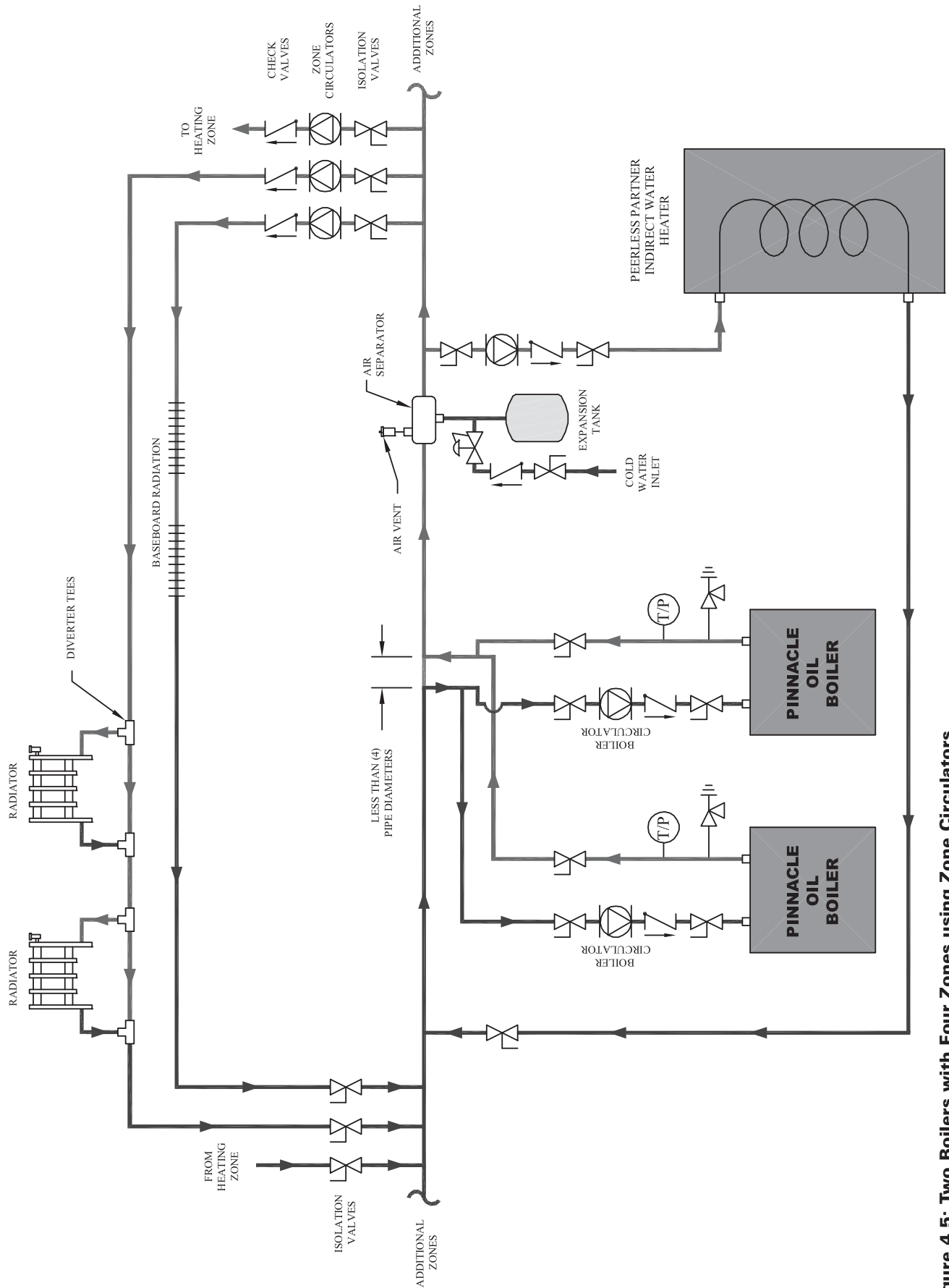


Figure 4.5: Two Boilers with Four Zones using Zone Circulators

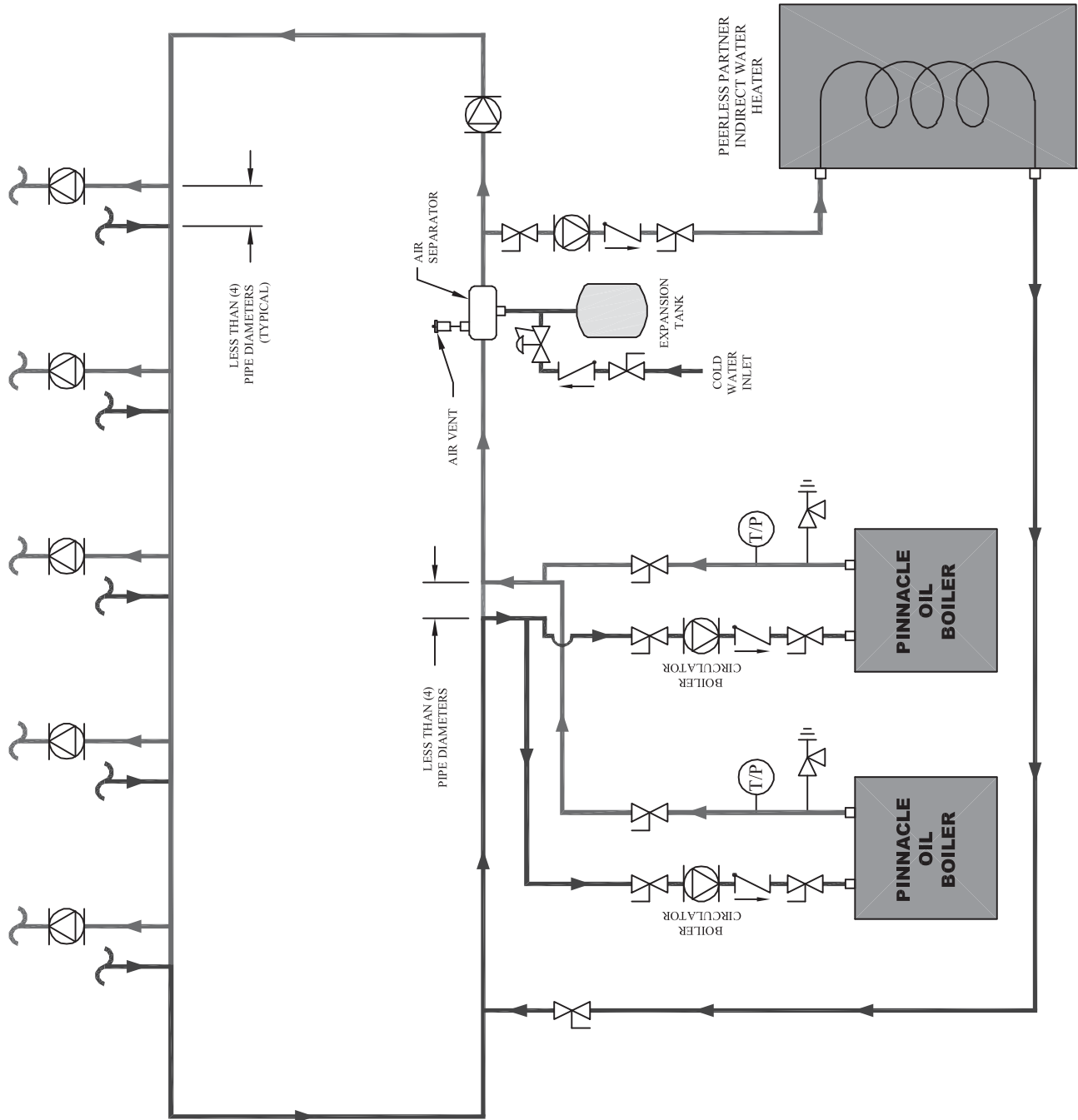


Figure 4.6: Two Boilers with Five Primary/Secondary Zones using Zone Circulators

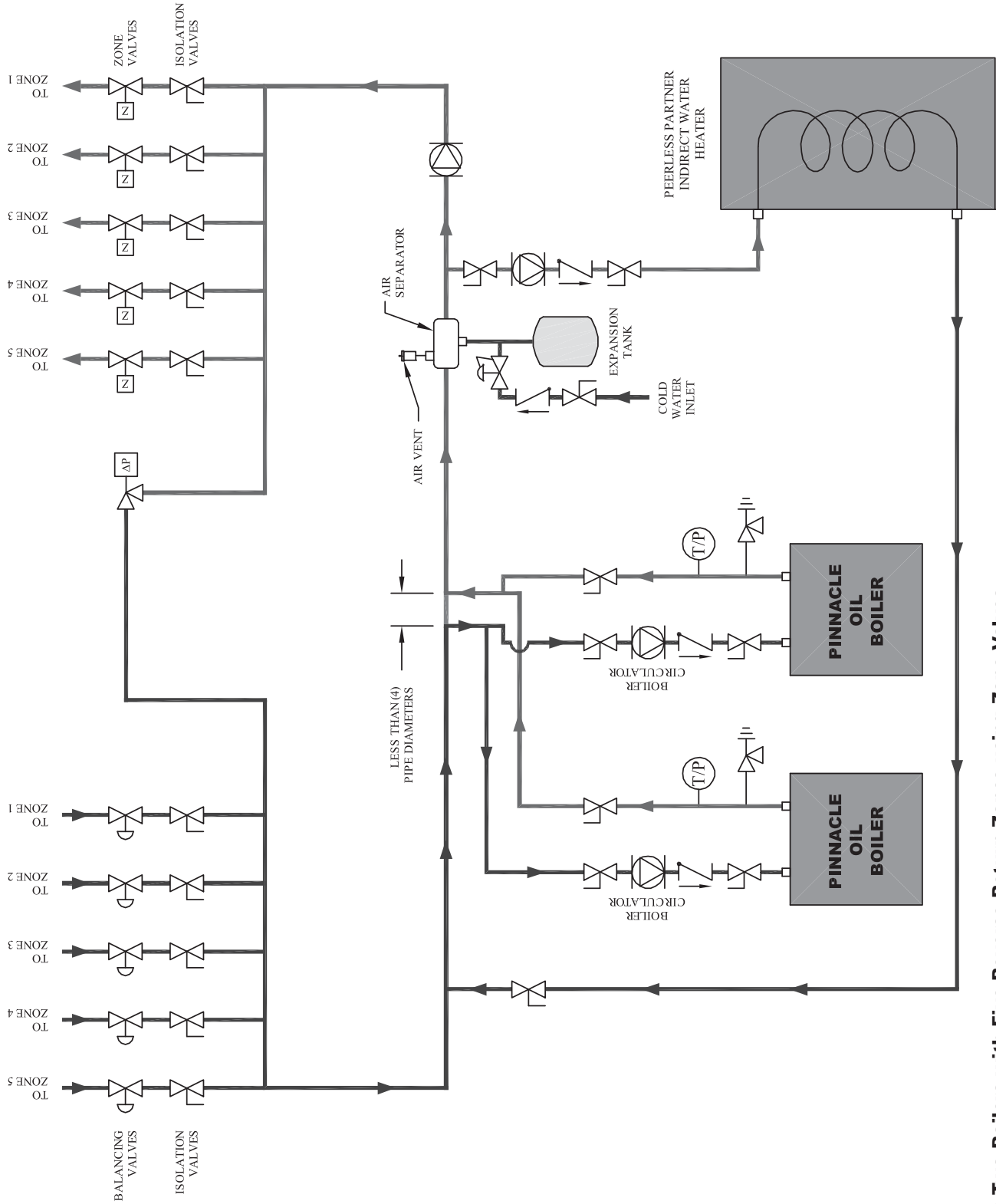


Figure 4.7: Two Boilers with Five Reverse Return Zones using Zone Valves

8. Propylene glycol solution is expensive and is more prone to leaks than water. Use welded or sweat joints where possible to minimize leaks. Where threaded joints must be used, inspect them regularly for leaks.
9. The propylene glycol solution must be checked at least once per year as recommended by the propylene glycol supplier. It includes a corrosion inhibitor that can diminish over time causing the solution to become corrosive.
10. Check local regulations to see if a system containing propylene glycol solutions must include a back-flow preventer or require that the glycol system be isolated from the water supply.

E. SPECIAL APPLICATIONS

1. Boilers used in conjunction with a chiller.
 - a) If the boiler is used in conjunction with a chilled water system, pipe the chiller in a separate parallel loop.
 - b) Assure that the boiler circulator is disabled during chiller operation so chilled water does not enter the boiler.
 - c) Install a flow control valve (spring check) to prevent gravity flow through the boiler.
 - d) See figure 4.8 for recommended system piping.
2. Boilers connected to heating coils in a forced air system:
 - a) If the heating coil is exposed to chilled air circulation, install flow control valves or other automatic means to prevent gravity circulation of the water during cooling cycles.
 - b) See figure 4.9 for recommended system piping.

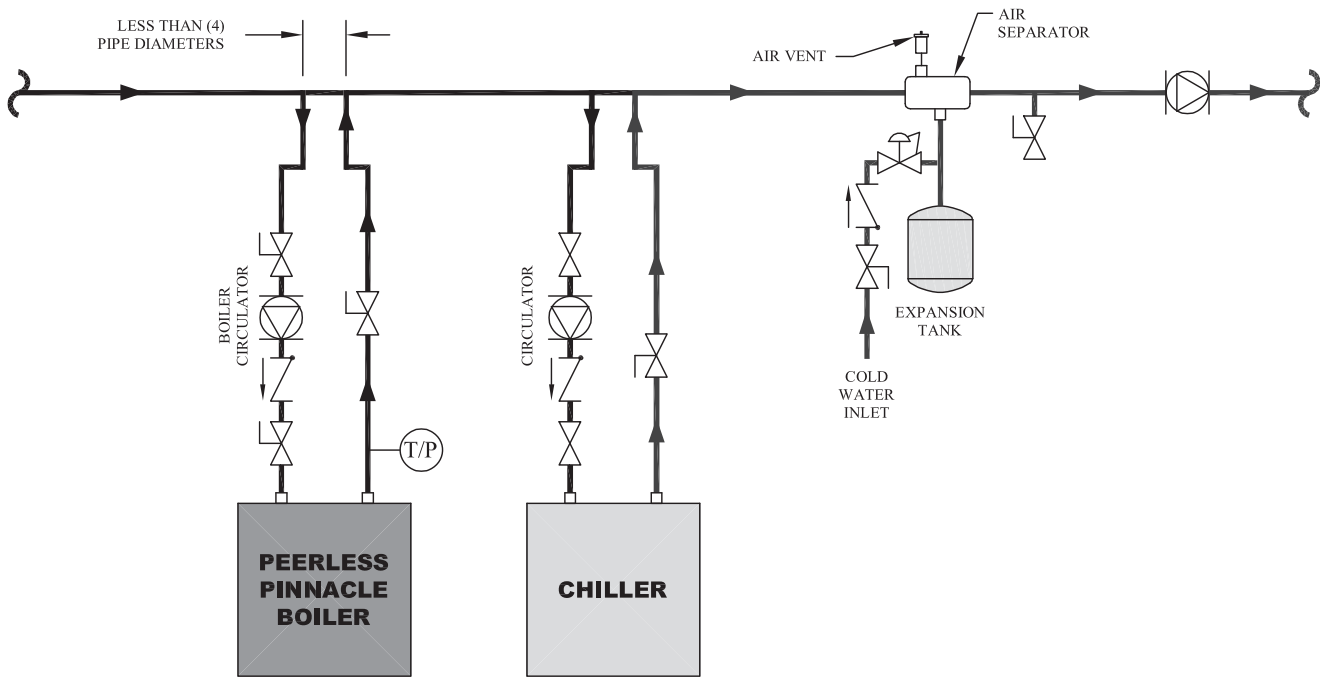


Figure 4.8: Boiler in conjunction with a Chilled Water System

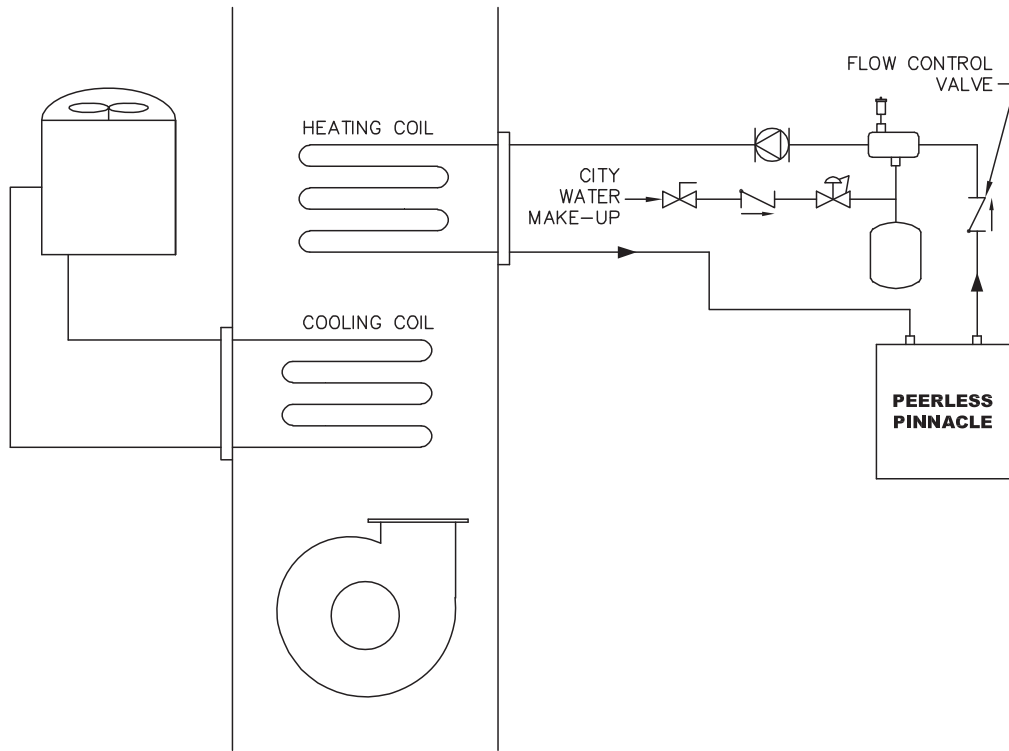


Figure 4.9: Boiler Connected to a Heating Coil in a Forced Air System

5. OIL BURNER INSTALLATION

WARNING

This combustion equipment must be installed by qualified service person who is responsible for the correct installation and adjustment of this equipment. Failure to comply with this may cause a condition which may cause severe personal injury, death, or major property damage.

DANGER

This appliance is intended for use with Commercial Standard #2 Oil fuel as specified in ASTM D396. Use with other fuels, including gasoline and crankcase oil, will void the appliance warranty.

A. GENERAL

- The oil burner for this appliance is supplied separately but must be as specified for this equipment. At the time of this printing, the following burners are Listed in accordance with UL-726, Oil Fired Boiler Assemblies:
 - Beckett AFG
 - Heat Wise Pioneer I (Not Yet Available)
- Check for concealed damage to the burner or controls when it is unpacked. If concealed damage is found, notify the carrier and/or wholesale distributor at once.
- Install the burner in accordance with instructions given in this section and with those provided by the burner manufacturer.

B. BURNER INSTALLATION

- The burner is supplied with a mounting flange fixed in position to provide the proper insertion depth.
- Be sure that a high temperature gasket is installed between the burner mounting flange and the combustion chamber cover plate.

- Care must be taken when routing the oil lines so they do not interfere with opening and closing the combustion chamber cover plate. Flexible oil lines may be installed to allow opening the cover plate for servicing.

NOTICE

Since the burner on this appliance is located at the top of the appliance in a down-fired configuration, disconnecting the oil lines while the burner door is closed will allow oil to drip into the combustion chamber. To avoid this, install the burner with flexible oil lines and only disconnect the lines after the combustion chamber cover plate is swung open.

- Oil Burner Specifications: The following charts indicate the nozzle specification, fuel pressure and initial air settings for firing the burner. Final adjustments shall be made using combustion analysis equipment and a smoke spot tester.

Table 5.1: Beckett Burner Specification

Boiler Model	Danfoss Nozzle Specification	Pump Pressure (psig)	Air Damper Setting
PO-70 & PO-70A	0.45 gph 60° AS	130	1.5
PO-84 & PO-84A	0.55 gph 60° AS	130	2.5

- Refer to Section 7, Start-Up Procedure, for information on proper CO₂ and smoke levels.

6. ELECTRICAL & CONTROLS

⚠ WARNING

The wiring diagrams in this manual are for general reference only and apply only to the appliance as it is specified from the factory which includes a burner primary control and a boiler temperature control (POC#1, POC#2, or POC#3).

A. GENERAL

1. 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, it shall be wired in accordance with the latest edition of the National Electrical Code, ANSI/NFPA 70.

B. BURNER WIRING

1. Burners intended for use with this boiler will come equipped with a wiring harness that terminates in a quick-disconnect style connector that mates with the connector supplied with the boiler.
2. If the burner supplied does not have such a harness and connector, contact your boiler/burner supplier and/or your PB Heat, LLC representative.

⚠ WARNING

Do not bypass the wiring harness provided with this boiler or burner. Failure to apply the correct harness can result in severe personal injury, death or substantial property damage.

3. Refer to the wiring diagram shown in Figure 6.1 for reference and further details.

C. BOILER WIRING

1. To open the boiler control panel the two screws at the top of the upper front panel must be removed. The burner cover must be removed to access these screws.
2. Figure 6.2 shows the customer connections to the boiler control terminals. All customer connections are to be made to the labeled screw terminations in the electrical control panel.

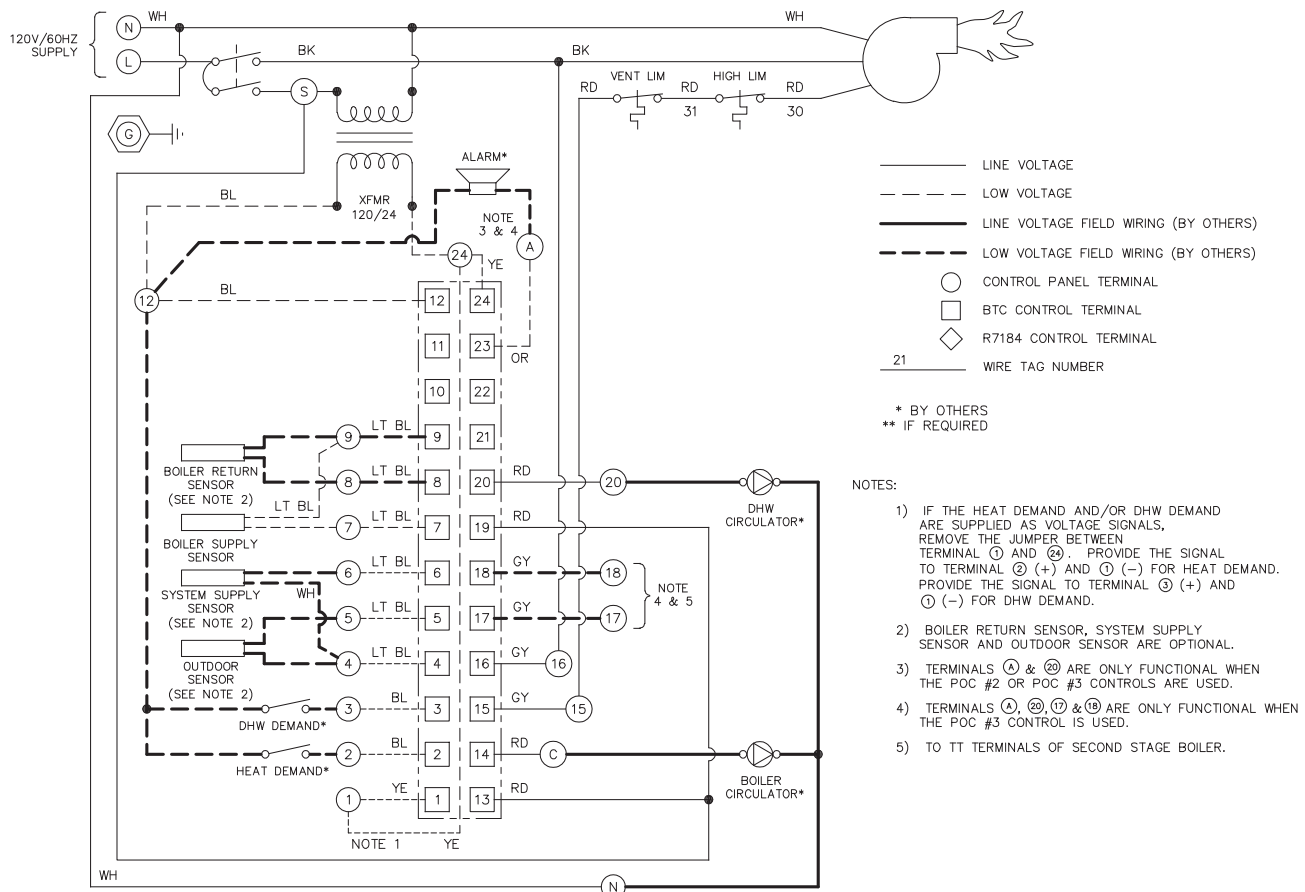


Figure 6.1: Boiler Wiring Diagram

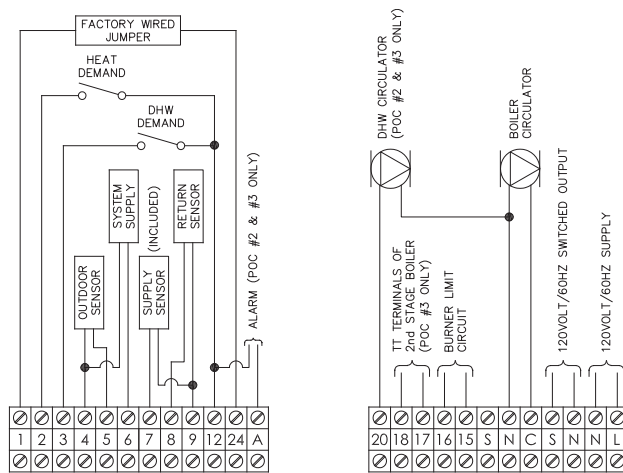


Figure 6.2: Customer Electrical Connections

D. CONTROL TERMS

To describe the operation of this appliance, there are several terms that must be defined. The following is a short glossary of terms.

1. **Parallel Piping:** In parallel piping applications the boiler outlet goes directly to the system. In these cases, only one sensor, the boiler supply sensor, is required to control the boiler target temperature.

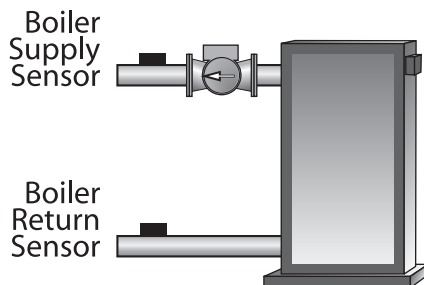


Figure 6.3: Parallel Piping

2. **Primary/Secondary Piping:** In primary/secondary piping applications, the system supply temperature may be lower than the boiler outlet temperature. An additional sensor (54033) is required to control the boiler based on the system supply, while the boiler supply sensor continues to limit the boiler target based on the programmed values.

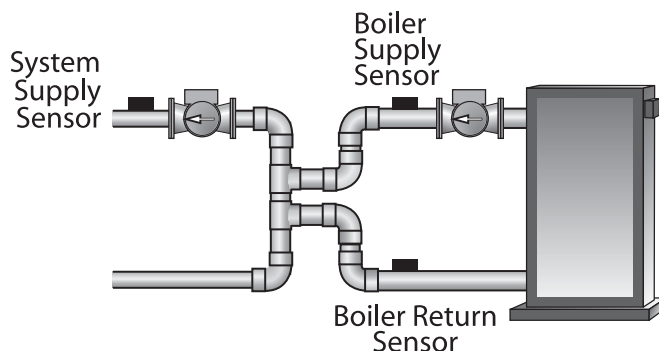


Figure 6.4: Primary/Secondary Piping

3. **Setpoint demand:** A setpoint demand is a fixed target temperature that is programmed into the control by the installer. For example, if the system requires 180°F water when a call for heat is initiated, the control targets that temperature.
4. **Outdoor Reset:** Outdoor reset describes a system where the boiler target temperature is calculated based on outdoor temperature. As the outdoor temperature increases, the system requirement decreases. This allows the boiler to operate at a lower, more efficient temperature.

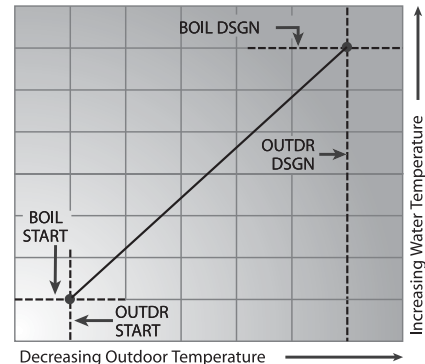


Figure 6.5: Outdoor Reset Ratio

$$\text{Boiler Target} = \text{Boiler Start} + \text{RR} (\text{Outdoor Start} - \text{Actual Outdoor})$$

$$\text{RR} = \frac{(\text{Boiler Design} - \text{Boiler Start})}{(\text{Outdoor Start} - \text{Outdoor Design})}$$

5. **Reset Override:** Reset override occurs when a boiler is operating on an outdoor reset temperature and a setpoint demand is introduced. Reset override changes the target temperature to the setpoint target, overriding the outdoor reset temperature.
6. **Domestic Hot Water Priority:** Domestic hot water (DHW) priority is when a system uses reset override and controls circulators to provide a higher temperature water to a DHW tank while preventing this high temperature water from circulating to the heating zones. To provide control of the DHW circulator the POC #2 (54031) or POC #3 (54032) is required.
7. **Boiler Differential:** In order to operate a boiler without frequent cycling on and off a boiler differential is used. All POC controls work on an automatic differential that will change between 2°F and 42°F based on the system response. The differential is split across the target temperature. For example, if the target temperature is 160°F and the differential is at 10°F, the boiler will shut down at 165°F and turn on at 155°F.

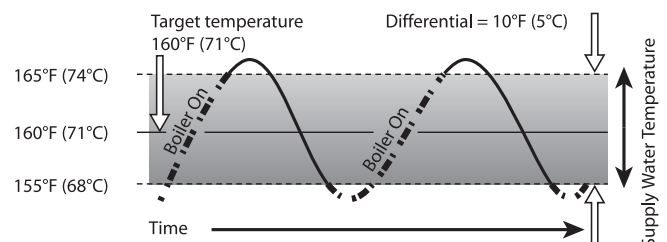


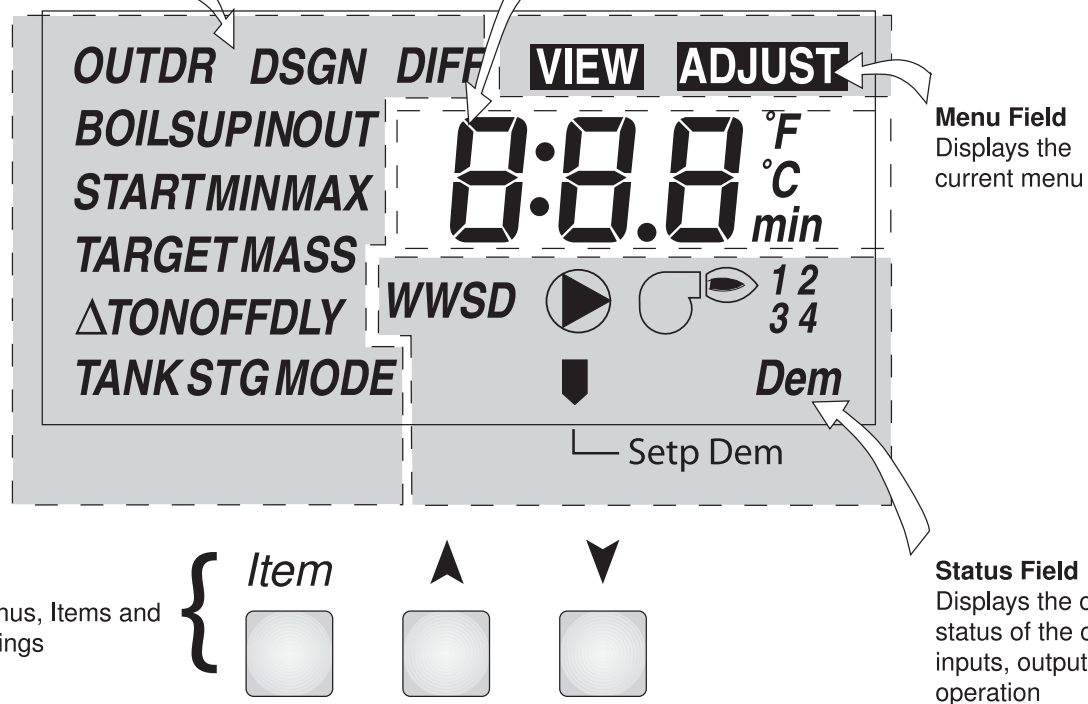
Figure 6.6: Boiler Differential

Figure 6.7: Control Display**Item Field**

Displays an abbreviated name of the selected item

Number Field

Displays the current value of the selected item

**Buttons**

Selects Menus, Items and adjusts settings

Status Field

Displays the current status of the control's inputs, outputs and operation

Symbol Description

	Circulator: Displays when a circulator is in operation.	<i>°F, °C</i>	°F, °C: Units of Measurement
	Burner: Displays when the burner is operating. When the POC #3 Control is used it will display either 1 or 2 to show what stage of the boiler is on.		Pointer: Displays the operation as indicated by the text

E. SEQUENCE OF OPERATION

1. System Power-up:
 - a) When power is first applied the control turns on all segments in the display for 2 seconds.
 - b) Next, the software version is displayed for 2 seconds.
 - c) Finally the control enters the normal operating mode.
2. Heating Cycle:
 - a) On a call for heat (or DHW), the boiler runs according to the control modes listed in Section 6H.
 - b) The boiler continues to run until either the call for heat (or DHW) is satisfied or the boiler reaches the target temperature plus half of the differential.
 - c) When the boiler turns off, a 2 minute post-purge (air evacuation of the combustion chamber) is initiated.
 - d) If the boiler cycles off on temperature, it will allow the temperature to drop to the target temperature minus half of the differential before cycling back on.
 - e) When the boiler satisfies the load, the control will go into a standby mode and the target temperature is displayed as " - - - ".

F. BOILER SAFETY INTERLOCKS

1. **High Water Temperature Limit Switch:** This boiler has a maximum operating temperature of 210°F. If the boiler water temperature reaches 210°F, the high temperature limit will interrupt the heating cycle and begin a post-purge. After the temperature drops 10°F, the switch will automatically reset and allow the boiler to reinitiate.
2. **High Vent Temperature Limit Switch:** The vent system for this boiler has a maximum temperature limit of 248°F. If the exhaust vent temperature reaches or exceeds 248°F (120°C), the limit will interrupt the heating cycle and initiate a post-purge. The limit will not reset until the red button under the burner hood is pressed.

G. BOILER TEMPERATURE CONTROL OPTIONS

The Pinnacle Oil boiler is offered with the POC #1 control board as standard. This boiler may be ordered with the POC #2 or POC#3 control upgrades. The features of each of these are as follows:

1. **POC #1 Control:** This control is factory set for on/off operation. It can be easily programmed to provide outdoor reset with reset override (requires Outdoor Sensor #54034). This control can be used with an external zone control that controls a DHW circulator for DHW priority. It will provide a fixed setpoint water temperature on a call for DHW.
2. **POC #2 Control:** This control offers the same features of POC #1 with the added benefit of a DHW circulator relay to provide full domestic hot water priority without relying on an external zone control.
3. **POC #3 Control:** This control offers the same features of POC #2 while allowing a second boiler with a POC #1 control to be added to provide a second stage of heating. If the first boiler does not meet the demand in a reasonable time, the second boiler will be started.

H. CONTROL MODES

The POC control allows 6 modes of operation.

1. **Mode 1:** This is designed to operate the boiler at a fixed set point for systems which use parallel piping. Once a heat demand signal is present, the control operates the boiler to maintain a fixed temperature at the boiler outlet. This is the default control mode and requires no additional sensors.
2. **Mode 2:** This is designed to operate the boiler at a fixed set point for systems using primary/secondary piping. Once a heat demand is present, the control operates the boiler to maintain a fixed temperature at the system supply. This mode requires an additional system supply sensor (54033).
3. **Mode 3:** This is designed to operate a parallel-piped boiler with outdoor reset when a heat demand signal is introduced. This requires an outdoor sensor (54034). A setpoint demand (such as domestic hot

water) will override (reset override) the heat demand and change the target temperature to the setpoint value. For full DHW priority, control of the system and DHW circulators is required. This can be accomplished using the POC #2 or POC#3 control from PB Heat. This can also be accomplished using an external zone relay as shown later in this section.

4. **Mode 4:** This is designed to operate a primary/secondary-piped boiler with outdoor reset when a heat demand signal is introduced. This requires an outdoor sensor (54034) in addition to a system supply sensor (54033). A setpoint demand (such as domestic hot water) will override (reset override) the heat demand and change the target temperature to the setpoint value. For full DHW priority, control of the system and DHW circulators is required. This can be accomplished using the POC #2 or POC#3 control from PB Heat. This can also be accomplished using an external zone relay as shown later in this section.
5. **Mode 5:** Mode 5 is designed for external boiler control for multiple boiler installations. In this case, the POC #1 control is used to provide boiler circulator control only. The staging and sequencing is controlled by the external control. This can be used in a two boiler system to provide 2-stage operation as we will show later in this section.

I. USER INTERFACE

1. The POC controls offer status display of the boiler circulator, burner, and heat or DHW demand.
2. It also displays the boiler supply temperature (°F or °C) as standard while allowing the user to scroll through 6 other temperature displays as well as a display of the overall run time on the boiler.
3. The three push buttons on the face of the POC Controls are labeled “Item”, “▲” and “▼” are used for selecting and adjusting settings.
4. **Menus:** All of the selectable items displayed by the control are organized into two menus designated **VIEW** and **ADJUST**. Advanced options in both menus are accessible by switching the Installer/Advanced dip switch located behind the lower control cover.
 - a) **VIEW** This is the default menu for all three POC controls and is displayed in the Menu Field above the Number Field when accessing the View menu. Table 6.1 shows the View Menu for the POC controls.
 - The first column shows the item field with the default values (where applicable) for the control.
 - The next two columns show the access level at which these items are available.
 - The fourth column shows the description of the item field and if the item is only available in certain control modes, the modes in which it is shown are listed.
 - The fifth column shows the range of values that may be displayed on this screen.

- b) **ADJUST** To enter the Adjust Menu press the “Item”, “▲” and “▼” keys simultaneously for 1 second.
- The Items in this menu allow the installer to set up the control for a particular installation.
 - Once in the ADJUST menu, use the “Item” key to scroll through the parameters listed in Table 6.2.
 - Use the “▲” and “▼” keys to change the values. A blank column entitled, “Actual Setting” allows the installer to record the settings for reference.

J. CONTROL ACCESS LEVELS

1. Each POC control has an “Advanced” and “Installer” Access level. These are selectable by the control dip switch.
 - a) The “Advanced” access level includes all the settings and displays available in the control.
 - b) The “Installer” access level includes only the settings and displays that are required for system setup.



Advanced Installer













Figure 6.8: Control Dip Switch

2. To access the control dip switch:
 - a) Remove the snap-on outer cover.
 - b) Remove the screw and lower cover plate on the control.
 - c) The dip switch is located under this panel and may be switched between “Advanced” and “Installer”. The dip switch is shown in Figure 6.8.

Table 6.1: View Menu

Item Field	Access Level		Description	Range
	INSTALLER	ADVANCED		
	●	●	Current outdoor air temperature as measured by outdoor sensor. This is the default display for the control. MODE = 3, 4	-60 to 190°F (-51 to 88°C)
	●	●	Target boiler supply is the temperature the control is currently trying to maintain at the boiler or system supply temperature MODE = 1, 2, 3, 4	---, 35 to 226°F (2 to 108°C)
	●	●	Current boiler supply water temperature as measured by the boiler supply sensor. MODE = 2, 4	14 to 266°F (-10 to 130°C)
	●	●	Current system supply water temperature as measured by the system supply sensor. MODE = 1, 3, 5 (Installer Level) MODE = 2, 4 (Advanced Level)	14 to 266°F (-10 to 130°C)
	●	●	Current boiler inlet water temperature as measured by the optional boiler inlet sensor. This value will be displayed if the optional boiler return sensor is connected. MODE = ALL	14 to 266°F (-10 to 130°C)
		●	Current difference in temperature between the boiler supply and the boiler return sensors. This value will be displayed if the optional boiler return sensor is connected. MODE = ALL	0 to 252°F (0 to 140°C)
		●	The total number of running hours of the boiler since this item was last cleared. MODE = ALL	0 to 999

Table 6.2: Adjust Menu

Item Field	Access Level		Description	Range	Actual Setting
	INSTALLER	ADVANCED			
	●	●	Sets the operating mode for the control	1, 2, 3, 4 or 5	Default (1) _____
	●	●	Minimum boiler target temperature during setpoint operation MODE = 1, 2, 3, 4	OFF, 70 to 220°F (OFF, 21 to 104°C)	Default (180°F) _____
	●	●	The outdoor temperature used to calculate the reset ratio and the boiler target temperature. MODE = 3, 4	35 to 85°F (2 to 29°C)	Default (70°F) _____
	●	●	The design outdoor temperature used to calculate the reset ratio. MODE = 3, 4	-60 to 32°F (-51 to 0°C)	Default (10°F) _____
	●	●	The starting water temperature used to calculate the reset ratio and the boiler target temperature. MODE = 3, 4	14 to 266°F (-10 to 130°C)	Default (70°F) _____
	●	●	The design boiler water Temperature used in the reset ratio calculation. MODE = 3, 4	0 to 252°F (0 to 140°C)	Default (180°F) _____
		●	The maximum boiler water temperature. This maximum supersedes any differential or outdoor reset targets.	120 to 210°F (49 to 99°C)	Default (200°F) _____
		●	The minimum temperature allowed for the boiler target temperature. MODE = 1, 2, 3, 4	OFF, 80 to 180°F (27 to 82°F)	Default (OFF) _____
		●	The differential that the control is to use when it is operating the boiler. MODE = 1, 2, 3, 4	AUTO, 2 to 42°F (1 to 23°C)	Default (AU) _____
		●	Determines when to stop pump purging. MODE = ALL	OFF, 0:20 to 9:55 min, ON	Default (0:20) _____
	●	●	System warm weather shutdown temperature. MODE = 3, 4	35 to 100°F, OFF (2 to 38°C)	Default (70°F) _____
	●	●	Units of measurement MODE = ALL	°F or °C	Default (°F) _____

K. TROUBLESHOOTING

1. Table 6.3 shows Error Codes that may be encountered with the POC series controls.
 - a) The first column shows error code display screen.
 - b) The next column shows descriptions of error codes.
 - c) The last column shows several steps to be taken to correct the error code.
2. To test control functions, first turn off the service switch on the boiler control bezel. Then, the harness may be disconnected by pushing down on the tab on the side of the harness connector and gently removing the harness.
 - a) A good quality electrical multimeter capable of reading 0-300V as a minimum and at least 0-2,000,000 Ohms is required to test the control.

**WARNING**

Service and maintenance must be performed by properly trained and experienced personnel. Failure to comply with this requirement may cause severe personal injury, death or major property damage.

- b) *Testing the Sensors:* To test the sensors, the actual temperature at each sensor location must be measured. If a temperature gauge is not mounted in the boiler piping near the sensor to be tested, a good quality digital thermometer with a surface temperature probe is recommended for the best accuracy.
 - Measure the temperature at the location of the sensor.
 - Measure the resistance through the sensor.

Table 6.3: Error Code Menu

Item Field	Description	Required Action
	The control was unable to read an item from its read-only memory (ROM).	Check that all settings in the adjust menu are correct.
	The control is no longer able to read the boiler supply sensor due to a short circuit. If the boiler inlet sensor is present and operational, the boiler will continue to operate using the boiler inlet sensor.	Check the wiring to the boiler supply sensor. If no problem is found, replace the sensor.
	The control is no longer able to read the boiler supply sensor due to an open circuit. If the boiler inlet sensor is present and operational, the boiler will continue to operate using the boiler inlet sensor.	Check the wiring to the boiler supply sensor. If no problem is found, replace the sensor.
	The control is no longer able to read the boiler return sensor due to a short circuit. The boiler will continue to operate.	Check the wiring to the boiler supply sensor. If no problem is found, replace the sensor.
	The control is no longer able to read the boiler return sensor due to an open circuit. The boiler will continue to operate.	Check the wiring to the boiler supply sensor. If no problem is found, replace the sensor.
	The control is no longer able to read the system supply sensor due to a short circuit. If the boiler outlet sensor is present and operational, the control will operate based on the boiler outlet sensor.	Check the wiring to the boiler supply sensor. If no problem is found, replace the sensor.
	The control is no longer able to read the system supply sensor due to an open circuit. If the boiler outlet sensor is present and operational, the control will operate based on the boiler outlet sensor.	Check the wiring to the boiler supply sensor. If no problem is found, replace the sensor.
	The control is no longer able to read the outdoor sensor due to a short circuit. The boiler will continue to operate based on an assumed outdoor temperature of 32°F (0°C).	Check the wiring to the boiler supply sensor. If no problem is found, replace the sensor.
	The control is no longer able to read the outdoor sensor due to an open circuit. The boiler will continue to operate based on an assumed outdoor temperature of 32°F (0°C).	Check the wiring to the boiler supply sensor. If no problem is found, replace the sensor.

- Using table 6.4, estimate the temperature at the sensor.
 - If the resistance is much higher than expected, there may be a broken wire, a poor connection, or a defective sensor.
 - If the resistance is much lower than expected, there may be a short in the wiring, moisture in the sensor, or a defective sensor.
- c) *Test the Power Supply:* Make sure exposed wires and bare terminals are not in contact with other wires or grounded surfaces
- Turn on the power using the boiler service switch located on the control bezel.
 - Measure the voltage between terminals 12 and 24 on the harness connector (These are the top two connections on the control and are labeled on the back of the control) (See Figure 6.2).
 - The voltage should be between 22 and 26 VAC.
 - Turn off the boiler service switch before re-connecting the harness to the control.
- d) *Test the Heat Demand:* Turn on the boiler service switch, located on the control bezel.
- Measure the voltage between terminal (2) Ht D (Heat Demand) and terminal (1) CD (Common Demand).
 - When there is a heat demand signal, the voltage across these terminals should read between 20 and 260 VAC. When no call for heat is expected, the voltage should be less than 5 VAC.
 - Turn off the boiler service switch before re-connecting the harness to the control.
- e) *Test the Setpoint Demand:* Turn on the boiler service switch, located on the control bezel.
- Measure the voltage between terminal (3) Set D (Setpoint Demand) and terminal (1) CD (Common Demand).
 - When there is a setpoint demand signal, the voltage across these terminals should read between 20 and 260 VAC. When no call for heat is expected, the voltage should be less than 5 VAC.
 - Turn off the boiler service switch before re-connecting the harness to the control.
- f) *Test the Control's Output Functions:* All POC controls feature a built-in test routine for testing the control outputs. The test routine is initiated when the "▲" button is pressed in and held in while in the view menu. The outputs are tested in the following sequence:
- *Step 1:* After 1 second, the boiler circulator is turned on.
 - *Step 2:* After 4 seconds, the DHW circulator is turned on (POC #2 & POC#3 Only).
 - *Step 3:* After 7 seconds the burner demand is activated.
 - *Step 4:* After 10 seconds the second stage burner is activated (POC #3 Only)
 - *Step 5:* After 13 seconds, the Alarm terminal is activated.
 - After the "▲" button is released, the control continues normal operation.

L. POC TECHNICAL DATA

Control: Microprocessor based PI control.

Enclosure Material: Black Noryl plastic

Dimensions: 4-3/4 x 2-7/8 x 1-7/8 inches
(120 x 74 x 48 mm)

Approvals: CSA C US, meets ICES & FCC regulations for EMI/RFI

Ambient Conditions: Indoor use only, -40 to 140°F (-40 to 60°C), <90% Relative Humidity

Power Supply: 24V ±10% 50/60Hz 75 VA

Stage 1 Relay: 120 VAC, 5A 1/6 hp, pilot duty

Circulator Relays: 120 VAC, 5 A 1/6 hp, pilot duty

Stage 2* Relay: 120 VAC, 3 A, 1/6 hp

Alarm** Relay: 24 VAC, 3 A, 1/6 hp

Sensors included – NTC thermistor, 10 kΩ @ 77°F (25°C), β = 3892

* POC #3 Control Only

** POC #2 & #3 Controls Only

Table 6.4: Sensor Resistance Tables

Temperature Resistance			Temperature Resistance			Temperature Resistance			Temperature Resistance		
°F	°C	Ω	°F	°C	Ω	°F	°C	Ω	°F	°C	Ω
-50	-46	490,813	20	-7	46,218	90	32	7,334	160	71	1,689
-40	-40	336,606	30	-1	34,558	100	38	5,828	170	77	1,403
-30	-34	234,196	40	4	26,099	110	43	4,665	180	82	1,172
-20	-29	165,180	50	10	19,900	120	49	3,760	190	88	983
-10	-23	118,018	60	16	15,311	130	54	3,050	200	93	829
0	-18	85,362	70	21	11,883	140	60	2,490	210	99	703
10	-12	62,465	80	27	9,299	150	66	2,045	220	104	598



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7. START-UP PROCEDURE

A. GENERAL

1. Confirm that all electricity is turned off and that valves for water and oil supply are closed.
2. Inspect the water piping, venting, oil piping, and electrical wiring. Be sure that all components are installed properly and, where applicable, in accordance with the manufacturer's instructions.
3. Be sure that this boiler is installed as instructed in this manual and in accordance with good engineering practice.

B. FILL THE SYSTEM WITH WATER

1. Fill the boiler and system with water, making certain to vent all air from each high point in the system. Open each manual air vent in the system until all air is released and water begins to be discharged. Close the manual air vents.
2. The pressure reducing valve on the cold water inlet will allow the system to be pressurized to the required system pressure. This pressure is not to exceed 30 psig.

CAUTION

This boiler is equipped with a pressure relief valve that is set at 30 psi. If the system is pressurized to above 30 psi, the relief valve will activate and allow water to flow from the boiler.

WARNING

Blocking or restricting the pressure relief valve will cause a condition that may cause severe personal injury, death and/or severe property damage.

3. Check piping joints and fittings throughout the system and repair leaks as required.

C. CHECK ELECTRIC CIRCUITS

1. Inspect the electrical system to make sure all connections are made.
2. Disconnect the jumper on the t-t terminals of the burner primary control.
3. Turn on any boiler disconnect switches that are connected to the incoming power.
4. Turn on the boiler service switch.
5. The POC Control will go through the start-up sequence as indicated in section 6.

6. Once the control is on and the default display (no error codes) is shown, turn off the electrical power and replace the jumper on the t-t terminals of the boiler primary control.

D. PRIME THE FUEL UNIT

WARNING

Do not attempt to start this appliance when excess fuel or vapor has accumulated in the combustion chamber. Starting the burner under these conditions may result in hazardous operation and may cause severe personal injury, death or major property damage.

1. Since the oil pump on this boiler is located at the top of the unit, particular attention must be paid to assuring that the oil line to the boiler is filled.
2. Bleed air from the fuel unit as soon as the burner motor begins rotating. Follow the burner manufacturer's instructions, included with the burner, to bleed the air.

E. SET COMBUSTION

WARNING

The burner combustion must be adjusted using appropriate test instruments to measure carbon dioxide (CO₂), over-fire pressure and smoke. Failure to do so may result in hazardous operation and may cause severe personal injury, death or major property damage.

1. Instruments Required:
 - a) Combustion analysis instrument that reads O₂ or CO₂ such as the Testo 325M. An absorption type analyzer such as the Bacharach Fyrite analyzer may also be used.
 - b) Draft gauge or inclined manometer such as a Dwyer 1227 Flextube or a digital manometer such as the Testo 506.
 - c) Smoke spot tester such as the Testo 0554.1317 or Bacharach True Spot.
2. Adjust the burner air settings in accordance with the burner manufacturer's instructions to obtain a clean flame with no smoke. A value of 12% to 12.5% CO₂ should be achievable without a smoke spot.
3. The following steps are to properly adjust the burner:
 - a) Decrease the burner air until a trace of smoke is obtained.
 - b) Measure the CO₂ (or O₂) and record the reading.

- c) Increase air to reduce CO₂ (or increase O₂) by about 1%.
 - d) Re-check the smoke level. It should be zero.
- 4. Install the sound absorbing burner cover.
 - 5. After about 15 minutes of operation, check the smoke level and CO₂ level. If the CO₂ level has increased significantly, re-adjust the air damper.

F. CHECK BOILER FUNCTION

- 1. Start and stop the burner several times to assure satisfactory operation.
- 2. Observe boiler operation under normal operation for a short time. Assure that the boiler temperature is not increasing too rapidly.
- 3. Check the system to assure that there are no leaks or overfilling problems which may cause excessive make up water to be added. Make up water may cause liming in the boiler and corrosion in ferrous system parts.

8. TROUBLESHOOTING

A. GENERAL

The following table shows conditions that may possibly occur with the Pinnacle Oil Boiler and instructions on how to troubleshoot these conditions.

Condition	Remedy
The boiler does not run and the control screen is blank.	<ol style="list-style-type: none"> 1. Make sure that 120 VAC power is present at Terminals L & N in the control panel. 2. Make sure the boiler service switch is switched on.
The boiler does not run and the control screen is on.	<ol style="list-style-type: none"> 1. Check if the "Dem" segment is visible on the control display. This indicates that the control is getting a demand from either the thermostat or the DHW tank. 2. Check for the burner symbol on the control display. This symbol indicates that the temperature control is calling for the burner to operate. 3. Check indicator light on the Burner Primary control. <ol style="list-style-type: none"> a. If it is on, it is detecting light, connections are shorted or the cad cell or control is defective. Shield cad cell from light source. <ol style="list-style-type: none"> i. If the indicator light goes off, eliminate the external light source or permanently shield the cad cell. ii. If the indicator light stays on, replace cad cell. If indicator light does not turn off, remove cad cell lead wires. If light goes off replace cad cell bracket assembly. If indicator light does not turn off, replace controller. b. If it is off, jumper the limit terminal and L1. <ol style="list-style-type: none"> i. If the burner starts, check the limit circuit (See Step 4). ii. If the burner doesn't start, disconnect line voltage power by turning off the service switch. Check all wiring connections. Tighten any loose connections and recheck. If burner still doesn't start, replace the primary control 4. Check the boiler water temperature gauge. If the boiler water is above 210°F check boiler circulator operation. Be sure that all air is purged from the system. 5. Depress the vent temperature limit reset button. Check all wiring in the limit circuit.
The burner starts, and then locks out on safety with indicator light flashing.	<ol style="list-style-type: none"> 1. Check that limit switches are closed and contacts are clean. 2. Check for line voltage power at the oil primary control. Voltage should be 110 VAC to 130 VAC. 3. Reset primary control by pushing in and releasing the red reset button. <ol style="list-style-type: none"> a. If the indicator light stops flashing go to step (4). b. If the indicator light continues to flash, verify that the primary control is not in restricted mode. If not in restricted mode, replace primary control. 4. Burner will re-try for ignition. Listen for spark after burner turns on (after 2 second delay). <ol style="list-style-type: none"> a. If there is no spark, check for line voltage at the igniter terminals, if line voltage is present, replace the igniter. b. If there is a spark, check to see if oil is being sprayed into the combustion chamber. If there is no oil, check oil valve, oil valve wiring, pump and oil supply. 5. Check indicator light after the flame is established but before the oil primary control locks out. <ol style="list-style-type: none"> a. If the indicator light is on until the control locks out and starts flashing during lockout, replace the primary control. b. If the indicator light stays off, go to step (6).

Condition	Remedy
<p>(Cont'd from previous page) The burner starts, and then locks out on safety with indicator light flashing.</p>	<ol style="list-style-type: none"> 6. Check cad cell sighting for view of the flame. <ol style="list-style-type: none"> a. Turn off the service switch on the front of the boiler b. Unplug cad cell and clean the face with a soft cloth. Check the sighting of the cad cell for a view of the flame. c. Re-install cad cell and turn on the service switch. d. Re-start burner. 7. If the burner locks out, check the cad cell. <ol style="list-style-type: none"> a. Turn off the service switch on the front of the boiler. b. Replace cad cell and disconnect jumper from t-t terminals on primary control to assure that no call for heat is present. c. Turn on the service switch. Expose the cad cell to a bright light such as a flashlight. <ol style="list-style-type: none"> i. If the indicator light is on, re-install control and go back to step 3. ii. If the indicator light is off, go to step 8 8. Check the cad cell bracket assembly <ol style="list-style-type: none"> a. Turn off the service switch on the front of the boiler b. Remove cad cell leads from the primary control and leave the control lead wires open. Turn on the service switch. Place a jumper across the cad cell terminals after the burner motor turns on. <ol style="list-style-type: none"> i. If the indicator light is on, replace the cad cell bracket assembly. ii. If the indicator light is off, replace the primary control.
<p>Burner runs with poor combustion, #1 or higher smoke spot.</p>	<ol style="list-style-type: none"> 1. Check CO₂ Level. If the CO₂ has increased or decreased beyond the recommended 11.0% to 13.0% CO₂ then adjust the air damper to correct the problem. 2. Check the oil supply piping for leaks. <ol style="list-style-type: none"> a. Air leaks can cause excessive smoke and poor combustion. These may or may not be made evident by fuel leakage. Assure that all joints have been properly sealed. b. Check the fuel filter fittings and gaskets for proper sealing. 3. Connect a clear polycarbonate hose to the fuel unit's bleed connection. Position a container to receive the fuel at the end of the bleed hose. Observe the oil in the container for air bubbles or evidence of water. If there is evidence of air bubbles, re-check the supply piping for leaks. 4. If there is no evidence of air or water in the fuel line, replace the oil nozzle. The nozzle is to be replaced only with the nozzle recommended in Section 5, Oil Burner Installation or as recommended by the Factory. Oil nozzles are inexpensive; however they are critical to the operation of the boiler. They should be kept in their protective sleeve, away from dirt and debris until ready to install. It is a good idea to have an extra nozzle in case of problems.

Bleeding the fuel unit:

In order to assure a good stream of incoming fuel, it is a good idea to bleed fuel from the bleed port on the fuel unit.

- 1) Attach a 36" clear plastic tube to the "bleed" connection on the burner fuel unit.
- 2) Position a fuel oil safe container near the boiler with the end of the bleed hose in the container.
- 3) Turn on the burner, open the bleed port, and observe the fuel in the bleed hose for evidence of air bubbles or water.

Isolating Fuel System Problems:

To isolate problems originating in the fuel supply system from those originating in the burner, the boiler may be run using flexible rubber hose and a clean bucket of commercial standard #2 fuel oil.

- 1) Connect the rubber hose to the fuel inlet connection on the fuel unit.
- 2) Be sure that the hose is filled before starting the burner.
- 3) Run the burner from the clean bucket and check CO₂ and Smoke levels.
- 4) If the combustion is clean with this set-up then the problem is most likely in the fuel supply system.

9. MAINTENANCE

A. GENERAL MAINTENANCE (WITH BOILER IN USE)

All boilers require periodic inspection and maintenance. General boiler inspection can be performed by a homeowner. However, 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 installed.
2. Observe general boiler conditions (unusual noises, vibrations, etc.)
3. Observe operating temperature and pressure on the combination gauge located in the supply piping at the rear of the boiler.
 - a) Boiler pressure should never be higher than 25 psig.
 - b) Boiler temperature should never be higher than 210°F.
4. Check for water leaks in the boiler and system piping.

NOTICE

This is a fully condensing appliance. If there is a large amount of moisture around the base of the boiler, check the condensate removal system for proper operation.

5. Check for leaks originating from the condensate removal system under the boiler.
6. During boiler operation, check the vent termination outside the building. Condensing boilers will often emit a white plume of water vapor. If dark smoke is evident, turn off the boiler and contact your service technician immediately.

B. ANNUAL MAINTENANCE (BEFORE THE START OF HEATING SEASON)

CAUTION

The following annual inspection and maintenance must be performed by a qualified service technician using appropriate test equipment.

NOTICE

If this boiler is used in combination with an indirect water heating tank (such as the Peerless Partner), the following annual maintenance should also be performed after the heating season.

1. With the boiler service switch turned off, check the function of the safety relief valve by performing the following test:
 - a) Check valve piping to determine that it is properly installed and supported.

WARNING

The safety relief valve is to be piped with no valves on its inlet or outlet. No reductions in pipe size or other restrictions to flow are allowed in this piping.

WARNING

The safety relief valve is to be piped to within 12 inches of the floor to assure that, in the event of an overpressure situation, no one is injured by a sudden burst of hot water and steam.

- b) Check boiler operating temperature and pressure.
- c) With a bucket under the outlet pipe, lift the try lever on the safety relief valve to the full open position and hold it for at least five seconds until clean water is discharged.
- d) Release the try lever and allow the valve to close. If the valve leaks, operate the lever two or three times to clear the valve seat of foreign matter. It may take a few moments to determine if the valve seat is completely closed.
- e) If the valve continues to leak, it must be replaced before the boiler is returned to operation.

WARNING

The safety relief valve is to be replaced only with a valve with identical inlet and outlet size and a minimum flow rating that meets or exceeds the rating listed on the boiler nameplate. Failure to do so may cause severe personal injury, death or major property damage.

- f) Check that the operating pressure and temperature on the boiler combination gauge, located in the supply piping, have returned to normal levels.
- g) Before leaving the installation, check the pressure relief valve again to assure that it is completely closed and not leaking.
2. Check the condensate drain and condensate removal system.
 - a) Remove the condensate hose from the boiler connection behind the base front panel.
 - b) Check the condensate hose for blockage.
 - c) Disassemble the condensate trap and check for potential blockage.

- d) Add water to the condensate pump (if used) to assure proper operation.
3. Test low water cut-off (if used) as described by the manufacturer of the component.
4. Check the boiler operating control as follows:
 - a) With the boiler in operation, change the set point temperature on the POC control to a temperature lower than the supply temperature.
 - b) Assure that the boiler shuts down when the set point temperature is at or below the supply temperature.
 - c) Return the set point parameters to the required temperatures.
5. Remove the burner acoustical shroud to access boiler control panel.
6. Check the operation of the boiler limit circuit.
 - a) Turn off the boiler service switch on the front of the boiler.
 - b) Remove two #10 Jacket Screws from the Control Panel Cover at the front of the boiler.
 - c) Disconnect one of the insulated female spade connectors on the Vent Temperature Limit Switch. This is the limit switch mounted on the panel above the control panel on the right hand side.
 - d) Turn on the boiler service switch. If the boiler operates, there is a wiring problem. Turn off the boiler and contact your PB Heat Representative.
 - e) If the boiler does not start, turn off the boiler service switch and re-connect the limit switch. Restart the boiler.
 - f) Repeat this procedure with the Boiler Temperature Limit Switch directly adjacent to the Vent Temperature Limit Switch.
 - g) Replace the #10 jacket screws in the Boiler Control Panel Cover.
7. Inspect and clean the boiler.
 - a) Turn off the boiler service switch on the front of the appliance and disconnect the electric power from the appliance.
 - b) Disconnect the burner wiring harness at the Molex® connector.
 - c) If the condensate drain is connected to neutralization media, by-pass this connection and pipe the condensate drain directly to a sewer drain.
 - d) The burner door is designed so it can be opened in either the left or right direction.
 - If the burner is not equipped with flexible oil lines, these must be disconnected before opening the Burner Door.

- Loosen and remove the the M12-1.75 nuts and washers on the side of the burner door that is to be opened.
- Making sure there is adequate clearance for the burner and door, swing the burner door open.

- e) Inspect the burner, oil nozzle, and air vane and perform burner maintenance as indicated by the burner manufacturer's instructions.
- f) Using the Jet Insert Removal Tool shown in Figure 9.1, that is included with the boiler, remove the two sets of jet inserts. Figure 9.2, 9.3 and 9.4 show the removal of the inserts.

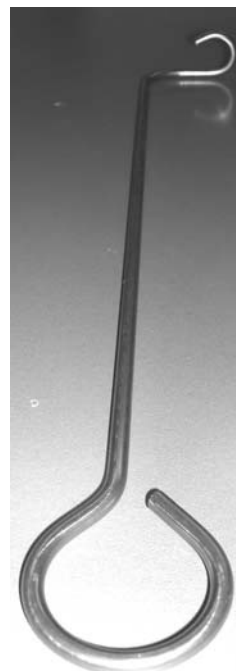


Figure 9.1: Jet Insert Removal Tool

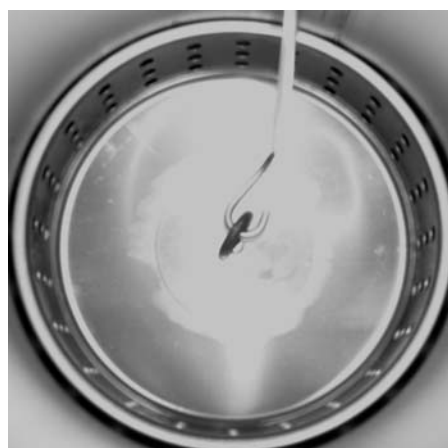


Figure 9.2: Jet Insert Removal, First Set



Figure 9.3: Jet Insert Removal, Second Set

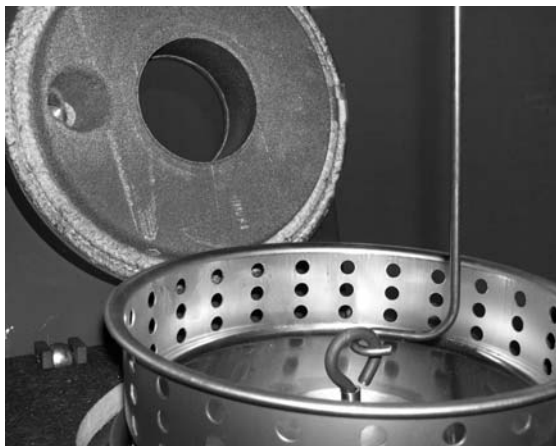


Figure 9.4: Jet Insert Removal

- g) Using a Nylon brush, clean the internal surfaces of the combustion chamber using warm water and a mild soap.
- h) Using the same brush, clean the jet inserts. Inspect the inserts for wear and determine if they need to be replaced.
- i) After cleaning, replace the jet inserts and close the Burner Mounting Door.



CAUTION

Do not attempt to start boiler without jet inserts in place.

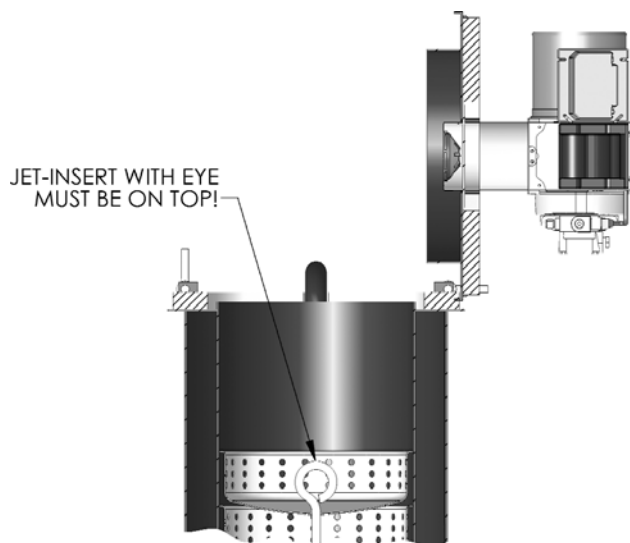


Figure 9.5: Jet Insert Orientation

- j) Replace and tighten the M12-1.75 nuts and washers.
- k) Re-connect the condensate neutralization system if applicable.
- l) Make sure that the Burner Mounting Door completely seals the boiler combustion chamber. This is a positive pressure combustion appliance and care must be taken in this regard.
- m) Re-attach the oil lines if necessary. If the oil lines were disconnected, it may be necessary to purge the oil delivery system again.
- n) Attach the Burner Wiring Harness.
- o) Re-connect electrical power to the boiler and turn on the boiler service switch.
- p) Simulate a call for heat to the boiler and start the appliance.
- q) After several minutes, take combustion readings of CO and CO₂ using a Testo 325M combustion analyzer or equivalent. Record these readings.
- r) Take a smoke sample using a Testo or Bacharach smoke spot tester. Record the smoke spot number if any.
- s) Replace the Acoustic Shroud Assembly and make sure all covers and panels are in place.

10. DIMENSIONS & RATINGS

A. BOILER DIMENSIONS

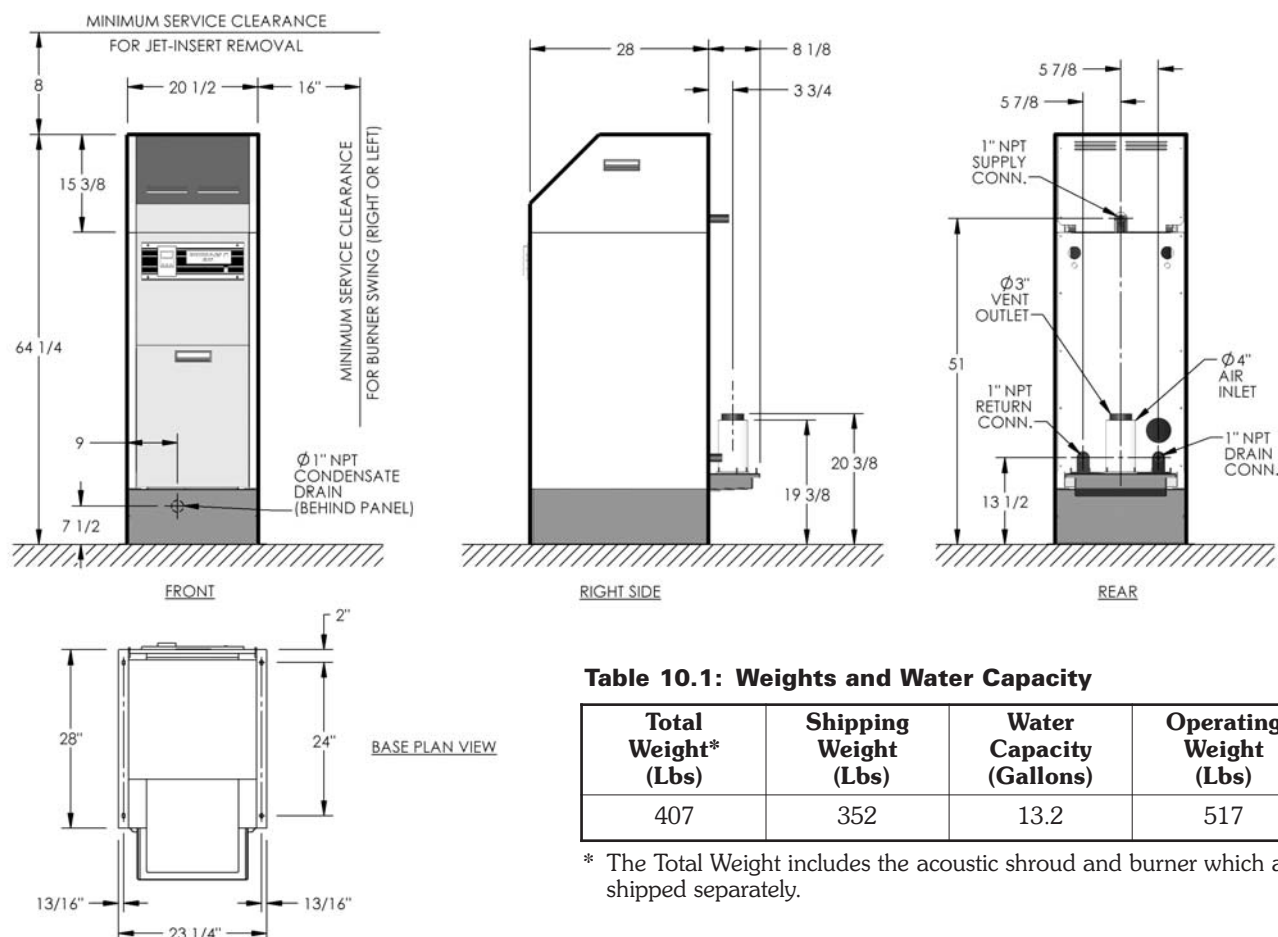


Table 10.1: Weights and Water Capacity

Total Weight* (Lbs)	Shipping Weight (Lbs)	Water Capacity (Gallons)	Operating Weight (Lbs)
407	352	13.2	517

* The Total Weight includes the acoustic shroud and burner which are shipped separately.

B. BOILER RATINGS

Table 10.2: Boiler Ratings

Boiler Model Number	Boiler Input ²		Heating Capacity ^{3,5} (MBH)	Net I=B=R Output ^{4,5} (MBH)	Seasonal Efficiency ⁵ (AFUE)
	(GPH)	(MBH)			
PO-70	0.50	70	64	56	91.7%
PO-70A ¹	0.50	70	65	56	92.0%
PO-84	0.60	84	77	67	91.3%
PO-84A ¹	0.60	84	77	67	91.8%

- Models PO-70A and PO-84A designate boilers using an alternate minimum vent length of 25 equivalent feet.
- Firing Rate is based on commercial standard #2 fuel oil with a heating value of 140,000 Btu/gallon. Burner input is based on a maximum altitude of 2,000 ft - for higher altitudes consult the factory.
- Heating Capacity ratings are based on U.S. Government standard tests, with 13.0% CO₂.
- The Net I=B=R Output Ratings are based on a pick-up allowance of 1.15. Consult the factory before selecting a boiler for gravity hot water installations or installations having unusual piping and pick-up requirements, such as intermittent system operation and extensive piping systems.
- Heating Capacity, Net I=B=R Output, and Annual Fuel Usage Efficiency (AFUE) are based on testing required by the FTC and are 3rd Party Verified.

11. REPAIR PARTS

Repair parts are available from your installer or by contacting PB Heat, LLC, PO Box 447, New Berlinville, PA 19545-0447. Remember to include Boiler Model Number and Serial Number when ordering parts.

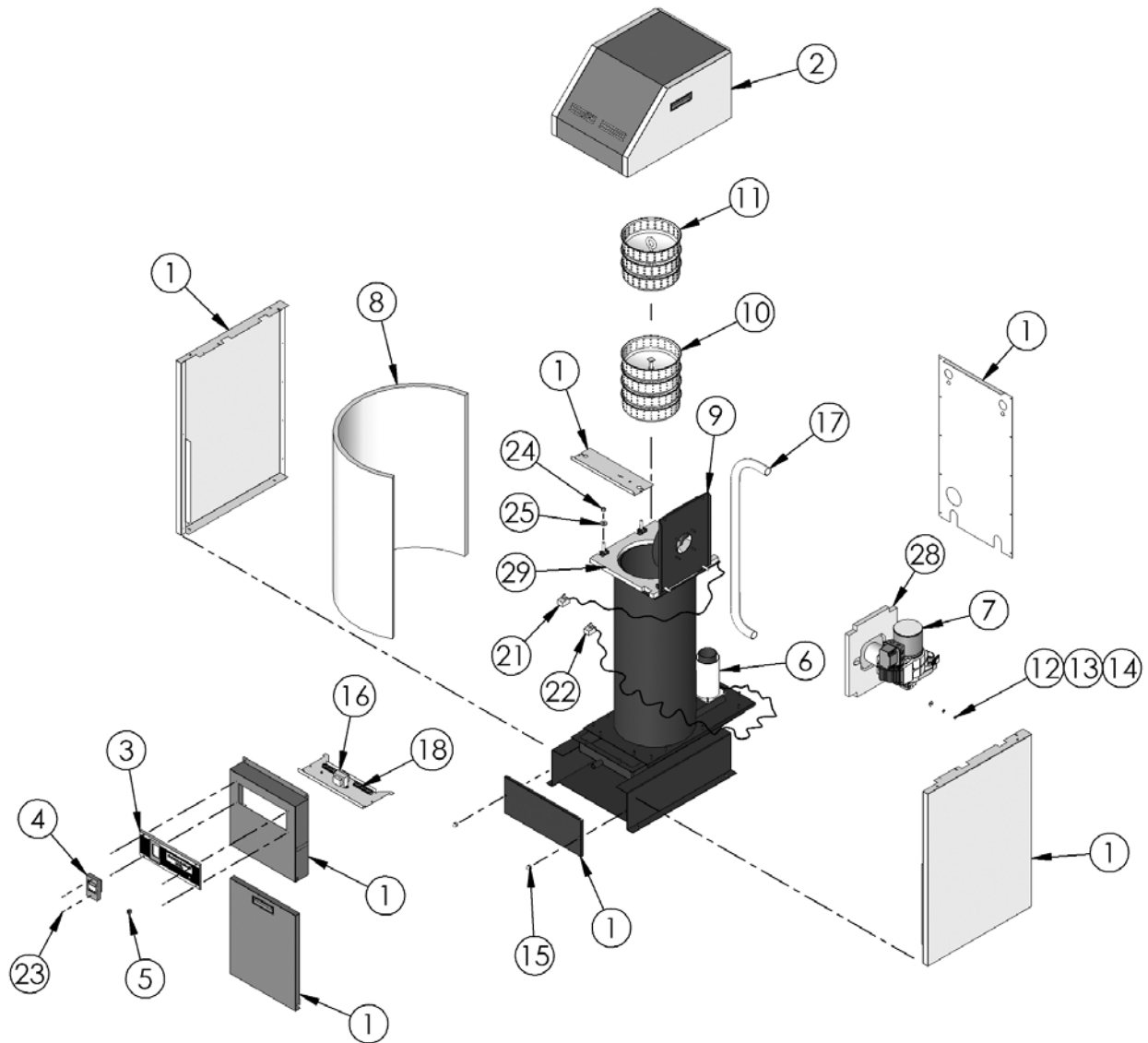


Figure 11.1: Repair Parts Illustration

Table 11.1: Repair Parts

Item No.	Description	Stock Code
1	Jacket - PO-70/84	54039
2	Burner Hood - PO-70/84	54038
3	Control Trim Plate	54043
4	POC #1 Control	54030
	POC #2 Control	54031
	POC #3 Control	54032
5	Service Switch	54041
6	Vent Adapter	54066
7	Burner Assembly - Beckett	54035
	Burner Assembly - Heat Wise	N/A
8	Insulation Blanket	6008
9	Burner Mounting Door Assembly	54067
10	Jet Insert - Lower Assembly	54068
11	Jet Insert - Upper Assembly	54069
12	M8-1.25 Hex Nut	6647
13	M8 Lock Washer	41
14	M8 Flat Washer	86
15	M8-1.25 Acorn Nut	6648
16	24/120 VAC Transformer	50788
17	Air Inlet Hose	54050
18	Terminal Block	54042
19	Wire Harness - Burner (Not Shown)	54054
20	Wire Harness - Control (Not Shown)	54053
21	Boiler Temperature Limit	54040
22	Vent Temperature Limit	54065
23	#6-32 x 3/4" Phillips Head Screw	7424
24	M12-1.75 Hex Nut	5051
25	M12 Flat Washer	5052
26	1/4-20 x 1/2" Hex Screw (Not Shown)	50705
27	1/4-20 U-Spring Clip (Not Shown)	6646
28	Burner Mounting Door Insulation	54070
29	Boiler Top Plate Insulation	54071

Peerless Pinnacle

Oil Boilers

Installation, Operation & Maintenance Manual

TO THE INSTALLER:

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

TO THE OWNER:

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



PeerlessBoilers.com

PB HEAT, LLC

131 S. CHURCH STREET • BALLY, PA 19503

Service Information

Name: _____

Address: _____

Phone: _____



ASME



Mixed Sources
Product group from well-managed
forests, controlled sources and
recycled wood or fibre
www.fsc.org Cert no. SCS-COC-001363
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