

Peerless® Pinnacle®

Stainless Steel Gas Boilers PI-399

WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- **WHAT TO DO IF YOU SMELL GAS**
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.



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As an ENERGY STAR® Partner, PB Heat, LLC has determined that certain firing rates of this product meet the ENERGY STAR® guidelines for energy efficiency.

Installation, Operation & Maintenance Manual



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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 you will see special attention boxes intended to supplement the instructions and make special notice of potential hazards. These categories mean, in the judgment of PB Heat, LLC:



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 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.
5. This boiler can be installed at high altitudes above 5,000 feet elevation with no burner adjustments. For boilers equipped for firing liquefied petroleum (LP) gas at elevations above 7,000 feet contact the factory.

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.

C. ACCESSIBILITY CLEARANCES

1. The Pinnacle boiler is certified for closet installations with zero clearance to combustible construction. In addition, it is design certified for use on combustible floors.
2. Refer to Figure 1.1 for the recommended clearance to allow for reasonable access to the boiler. Local codes or special conditions may require greater clearances.

D. COMBUSTION AND VENTILATION AIR

1. The Pinnacle boiler is designed only for operation with combustion air piped from outside (sealed combustion). PVC pipe must be supplied between the air inlet connection at the rear of the boiler and an outside wall.
2. No additional combustion or ventilation air is required for this appliance.



DANGER

Do not install this boiler on carpeting.

3. Refer to Section 5 of this manual, Venting, for specific instructions for piping 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. Water Piping: Section 3
 - b. Fuel Piping: Section 4
 - c. Venting: Section 5
 - d. Air Intake Piping: Section 5
 - e. Condensate Removal: Section 5
 - f. Electrical Wiring: Section 6

**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.

NOTE: THE PINNACLE BOILER IS
RATED FOR ZERO CLEARANCE
TO COMBUSTIBLES

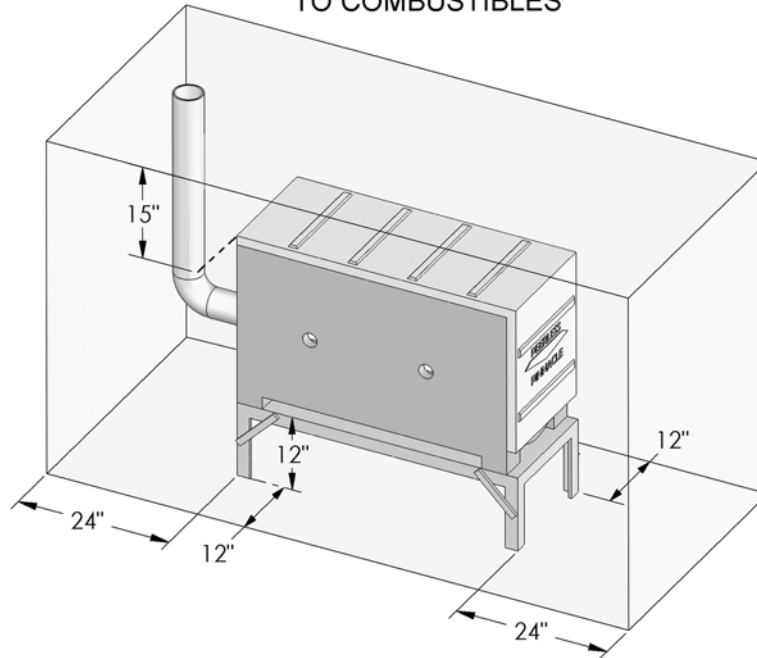


Figure 1.1:

2. BOILER SET-UP

A. GENERAL

1. Pinnacle boilers are to be installed 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. This boiler is not intended to support external piping. All venting and other piping should be supported independently of the boiler.
3. Install this boiler level to prevent condensate from backing up inside the boiler.



CAUTION

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

4. An optional boiler stand is available for Pinnacle boilers. Two part number 91439 boiler stands are required for the PI-399.

3. WATER PIPING AND CONTROLS

A. GENERAL

1. The water supply and return piping of this appliance are to be sized according to system requirements. Do not use piping smaller than the boiler connections.
2. In hydronic systems where sediment may exist, install a strainer device in the boiler return piping to prevent large particles and pipe scale from entering the boiler heat exchanger coil. Use a large mesh screen in the strainer.
3. Install this boiler so that the gas ignition system components are protected from water (dripping, spraying, etc.) during appliance operation and service (circulator replacement, condensate trap cleaning, control replacement, etc.).

B. OPERATING PARAMETERS

1. The Pinnacle boiler is designed to operate in a closed loop hydronic system at approximately 15 psi. A pressure limit in the boiler header will prevent the unit from operating if the pressure drops below 10 psi. This is to keep the appliance from operating in the event of a system leak or other condition in which water is not flowing through the heat exchanger.
2. Table 3.1 shows minimum water flow rates for the Pinnacle PI-399 Boiler. If a glycol solution is to be used, contact the factory for minimum flow rates.

Table 3.1 – Minimum Flow Rate and Water Volume

Boiler Model	Total Water Volume-Gallon (Liter)	Minimum Flow Rate-GPM (LPM)
PI-399	1.30 (4.92)	20 (75.7)

C. SYSTEM COMPONENTS

1. Figure 3.1 shows the symbol key for piping diagrams in this section. The following are brief descriptions of system components.
2. *Pressure/Temperature Gauge:* A combination pressure/temperature gauge is provided with each Pinnacle boiler to be mounted in the piping from the boiler supply to the system. Most local codes require this gauge.
3. *Air Elimination:* Any closed loop hydronic system in which the Pinnacle boiler is installed must have an air elimination device. As the system water is heated, dissolved oxygen and carbon dioxide will separate from the liquid. An air elimination device (such as a TACO 430 Series Air Scoop with automatic air vent) is required to remove the dissolved gasses from the system preventing corrosion in the piping system and eliminating system noise.

4. *Expansion Tank:* An expansion tank (such as a Bell & Gossett Series HFT) is required to provide room for expansion of the heating medium (water or glycol solution). Consult the expansion tank manufacturer's instructions for specific information regarding installation. The expansion tank is to be sized for the required system volume and capacity. In addition, be sure that the expansion tank is sized based on the proper heating medium. Glycol solutions may expand more than water for a similar temperature rise.

CAUTION




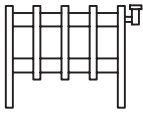

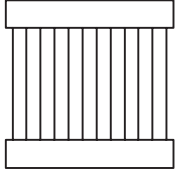





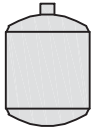




Use only inhibited propylene glycol solutions which are specifically formulated for hydronic systems. Unlike automotive antifreeze, solutions for hydronic applications contain corrosion inhibitors that will protect system components from premature failure due to corrosion.

WARNING

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

5. *Y-Type Strainer:* In older 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 often and cleaned during the first few months of operation to assure that sediment does not reach the heat exchanger and clog the passages. Use a large mesh screen in the strainer.
6. *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.
7. *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.
8. *Back Flow Preventer:* A back flow preventer (check valve) is required by some jurisdictions to prevent the hydronic system water from backing up into the city water supply. This is especially important on systems in which glycol solution is used as the heating medium.

Figure 3.1: Piping Symbol Key

ISOLATION VALVE		BASEBOARD RADIATION	
BALANCING VALVE		RADIATOR	
PRESSURE REGULATOR		RADIANT PANEL	
THREE WAY MIXING VALVE		AIR VENT	
ZONE VALVE		AIR SEPARATOR	
DIFFERENTIAL PRESSURE BYPASS VALVE		EXPANSION TANK	
CHECK VALVE (BACKFLOW PREVENTER)			
CIRCULATOR			
DIVERTER TEE			
TEMPERATURE PRESSURE GAUGE			

9. *Pressure Relief Valve:* The boiler pressure relief valve is factory installed into the right side boiler manifold (inside the jacket). Pipe the discharge of the relief valve to within 12" of the floor and close to a floor drain. Provide piping that is the same size or larger than the relief valve outlet.

- b. The circulator should be sized based on the net output of the boiler. The Table 3.2 shows the Boiler Output as reported to the Hydronics Institute division of GAMA. These values are based on a pickup factor of 1.15.

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.

10. *Circulator:* The boiler circulator is to be sized to overcome the pressure drop of the system while providing the flow required by the boiler.
- 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.

Table 3.2 – Boiler Inputs and Outputs

Boiler Model	Boiler Input (Btu/hr [kW])	Gross Output (Btu/hr [kW])
PI-399	399,000 (116.9)	379,000 (111.1)

- 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 PI-399 with a design temperature difference of 20°F the calculation is as follows:

$$\text{Required Flow} = \frac{\text{Output}}{\Delta T \times 500} = \frac{379,000}{20 \times 500} = 37.9 \text{ GPM}$$

- d. Table 3.3 shows the pressure drop (in feet of water) for a flow rate which gives a 20°F temperature difference for the PI-399 boiler.

Table 3.3 – Flow Rate and Pressure Drop

Boiler Model	Flow Rate (GPM [LPM])	Pressure Drop (Feet [meters])
PI-399	37.9 (143.5)	17.9 (5.46)

- e. The boiler pressure drop for various flow rates can be determined by using Figure 3.2, the Pinnacle Circulator Sizing Graph.
- f. Table 3.4 gives the recommended circulators for a boiler on a secondary loop with water as the heating medium.

Table 3.4 – Recommended Circulators

Boiler Model	TACO Circulator	Bell & Gosset Circulator	Grundfos Circulator
PI-399	1400-50	PL-130	UP43-70

The recommended circulators are based on water using primary secondary piping with the boilers on a secondary loop.



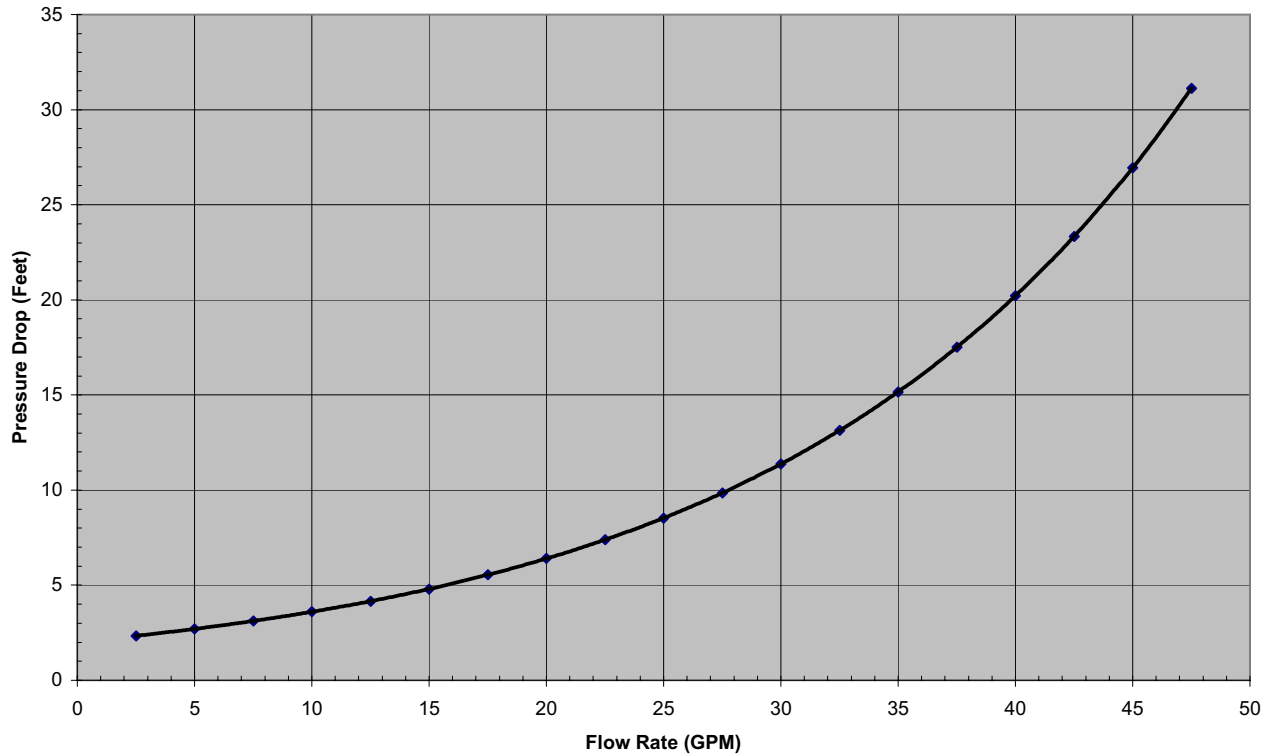
NOTICE

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

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

11. *Indirect Water Heater:* An indirect water heater should be piped in a dedicated zone. It consists of a water tank that is heated by boiler water passing through an internal coil. Examples of indirect water heating are shown in the System Piping subsection of this Section.

Figure 3.2: Pinnacle Circulator Sizing Graph



D. SYSTEM PIPING

- Figure 3.3 shows a single boiler with two zones. In this application, the Peerless Partner indirect water heater and the single heating zone require similar water temperature.
- Figure 3.4 shows an additional zone in which baseboard radiation is the heat load. This zone also requires water temperatures similar to the indirect water heater.
- Figure 3.5 shows diverter tees used in combination with conventional hydronic radiators on an additional zone. A second boiler is also added to the system. Notice that the boilers are piped in parallel on the secondary loop. It is important that the common headers are sized to match the system piping. Smaller headers may result in flow fluctuations through the boilers.
- Figure 3.6 shows a system in which several different types of loads and multiple boilers are shown. This system illustrates how different temperature zones can be supplied from the same source by mixing down the temperature using a three way mixing valve. Radiant flooring typically requires much lower temperatures than baseboard radiation and indirect water heating. Notice that a third boiler is included in this system.
- Figure 3.7 shows zone valves used in place of zone circulators. Notice that this system utilizes reverse return piping which makes it easier to balance the system. If the heating zones are very different in length, the balancing valves on the return side of each loop are required.

E. FREEZE PROTECTION

- Glycol for hydronic 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 glycol concentration and inhibitor level.
- Use only inhibited propylene glycol solutions of up to 50% by volume. Ethylene glycol is toxic and can chemically attack gaskets and seals used in hydronic systems.
- The antifreeze solution should be tested at least once per year and as recommended by the antifreeze manufacturer.
- Antifreeze solutions expand more than water. For example, a 50% by volume solution expands 4.8% for 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.
- The flow rate in systems utilizing glycol solution should be increased compared with a water system to compensate for increased heating capacity.
- 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.

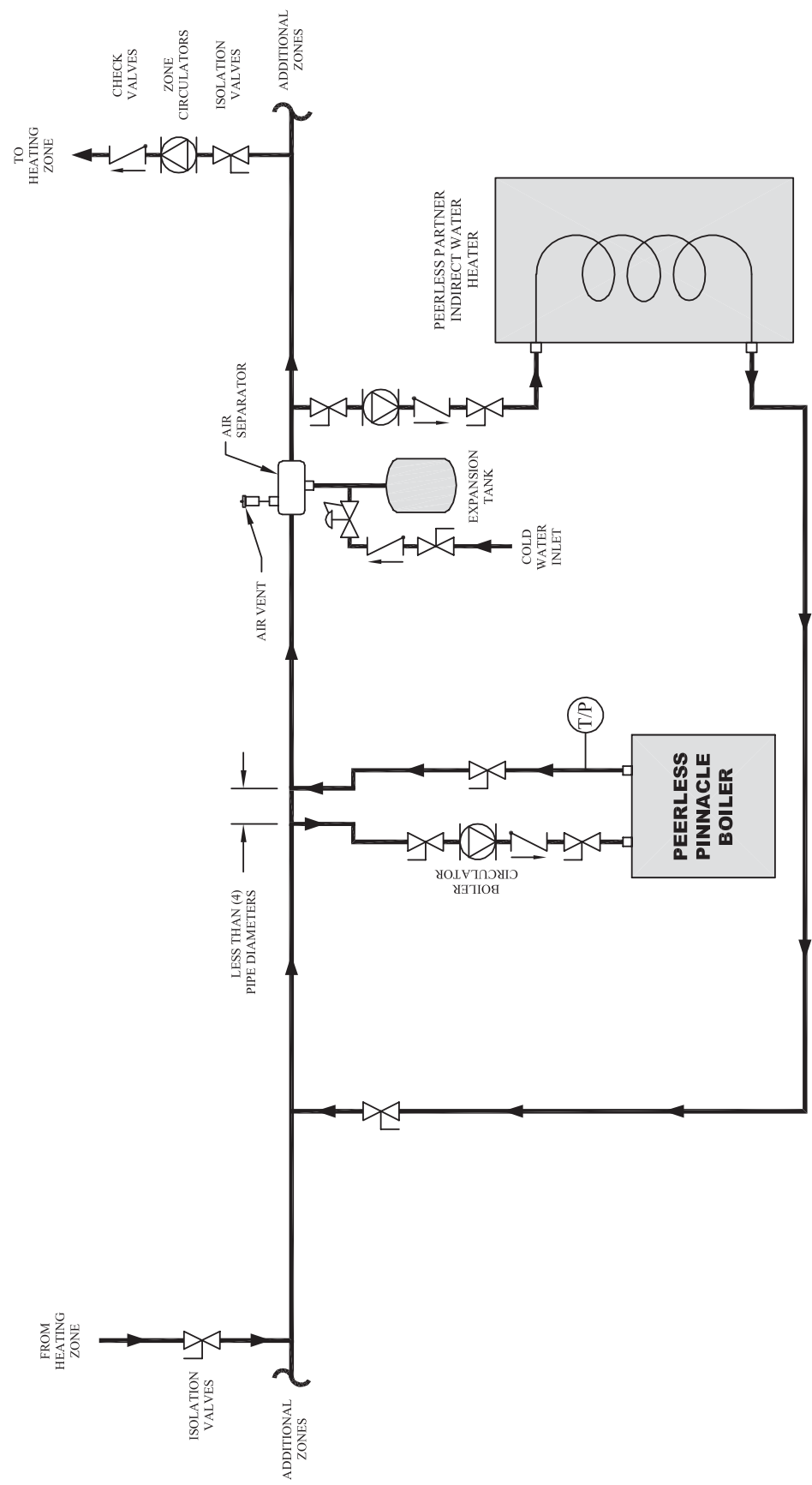


Figure 3.3: One Boiler, Primary/Secondary with Two Zones (Zone Circulator)

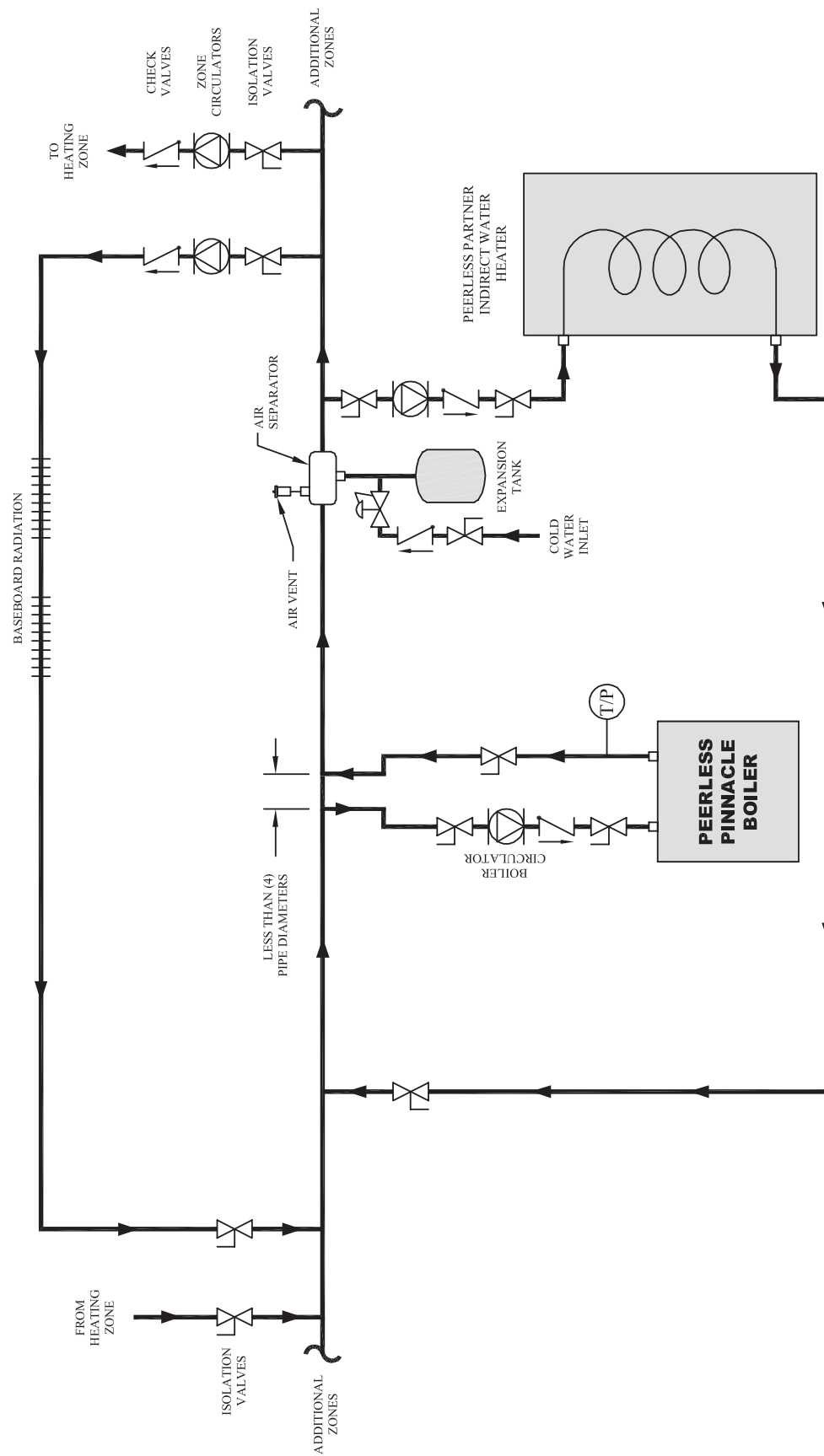


Figure 3.4: One Boiler, Primary/Secondary with Three Zones (Zone Circulator)

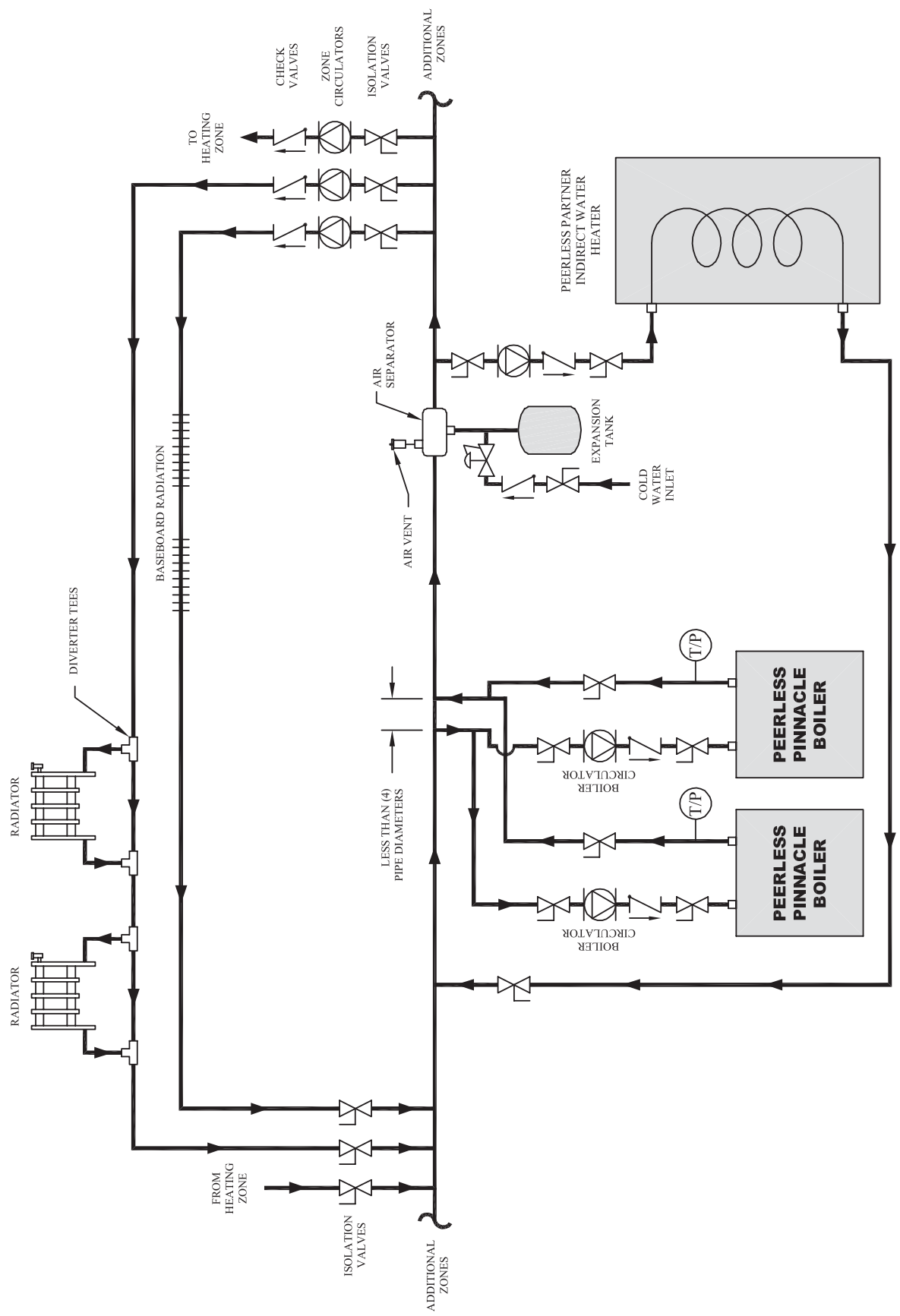


Figure 3.5: Two Boilers, Primary/Secondary with Four Zones (Zone Circulator)

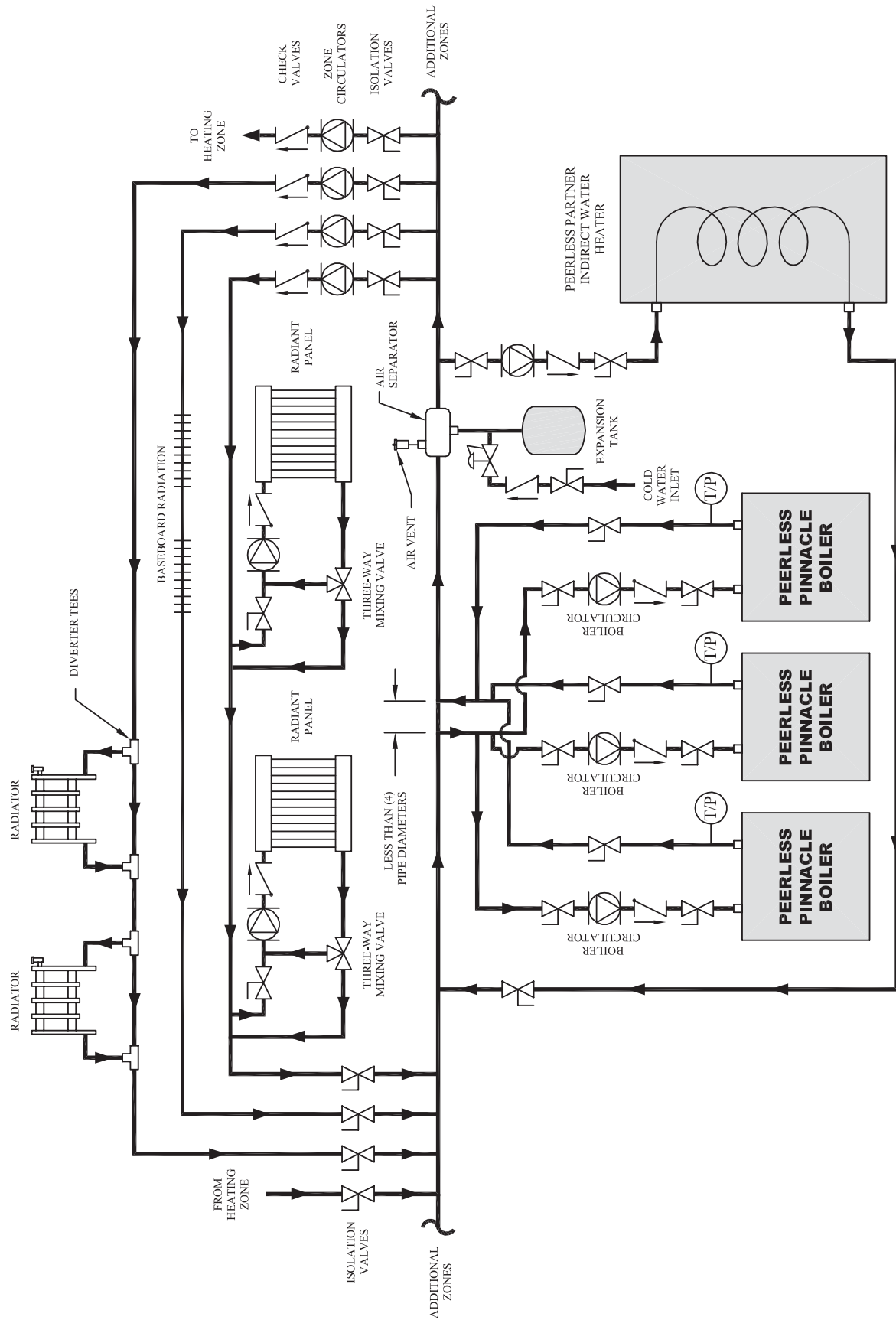


Figure 3.6: Three Boilers, Primary/Secondary with Five Zones (Zone Circulator)

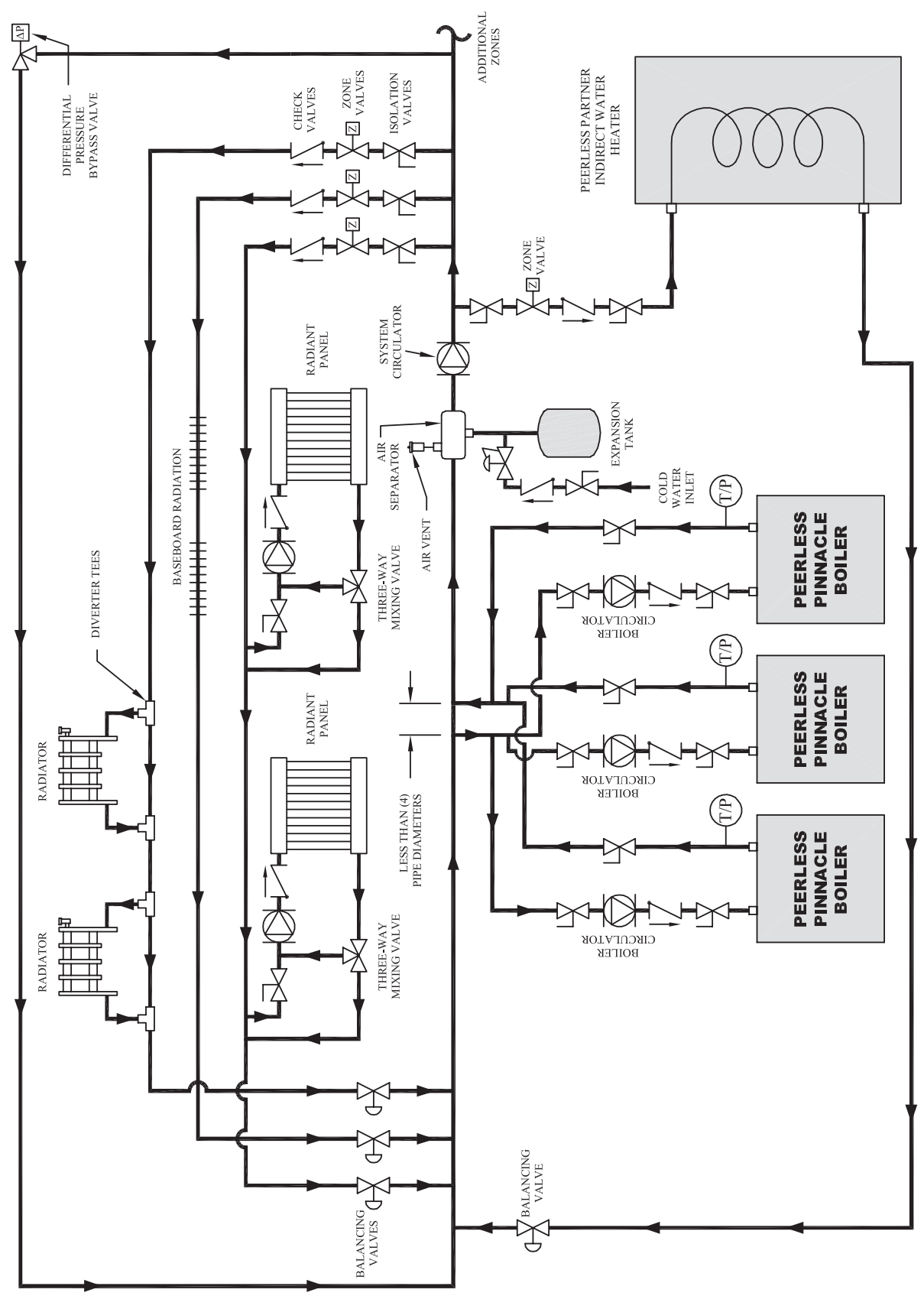


Figure 3.7: Three Boilers, Primary/Secondary with Four Zones (Zone Valves)

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 solution 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 a glycol solution is used. Adding make-up water may significantly dilute the system.
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 there are no petroleum products in the solution.
12. Mix solution at room temperature.
13. Do not use a chromate treatment.
14. Do not use glycol solution in a system that may reach temperatures above 250°F.
15. Refer to Technical Topics, #2a published by the Hydronics Institute Division of GAMA for further glycol system considerations.

F. SPECIAL APPLICATIONS

1. If the 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 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 3.8 for recommended system piping.
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 3.9 for illustration.

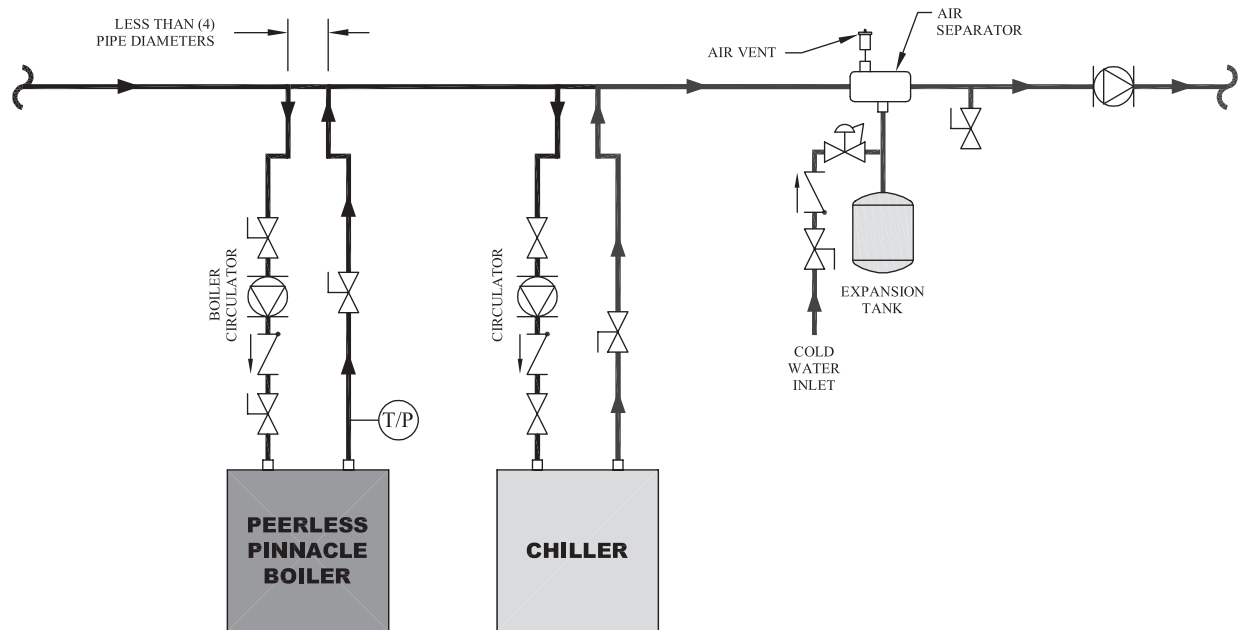


Figure 3.8: Boiler in conjunction with a Chilled Water System

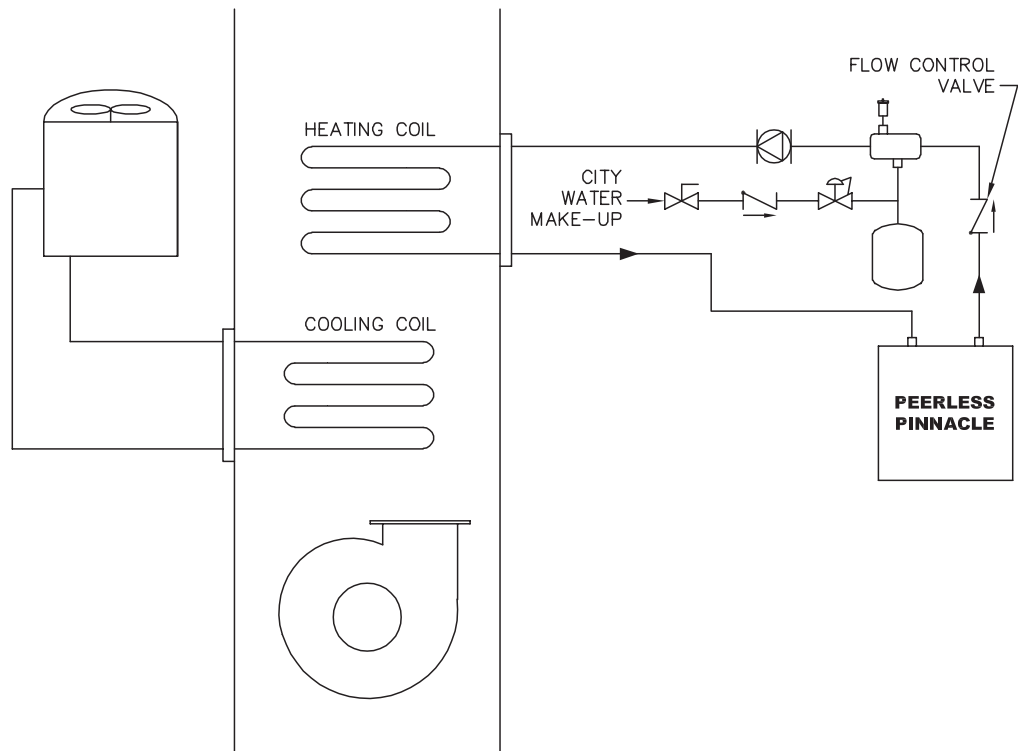


Figure 3.9: Boiler Connected to a Heating Coil in a Forced Air System

4. GAS PIPING

A. GENERAL

1. All fuel piping to the 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 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 rate of gas to be provided to the boiler can be determined by the following:

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

Obtain the gas heating value from the gas supplier.

2. As an alternative use Table 4.1 which uses typical heating values for natural gas and liquefied petroleum (LP) gas.

Table 4.1: Gas Input Rates

Boiler Model	Gas Input Rate* (ft ³ /hr)	
	Natural Gas	LP Gas
PI-399	399	160
*Natural gas input rates are based on 1000 Btu/ft ³ , LP input rates are based on 2500 Btu/ft ³ .		

3. Table 4.2 shows the maximum flow capacity of several pipe sizes based on 0.3" of pressure drop.
 - a. The values shown are based on a gas specific gravity of 0.60 (Typical for natural gas).
 - b. Multiply the capacities listed by the factors indicated in Table 4.3 for gas with a specific gravity other than 0.60 to obtain the corrected capacity.

Table 4.2: Maximum Capacity of Pipe (CFH) for a Pressure Drop of 0.3" of Water

Pipe Length (Feet)	1-1/4" NPT Pipe	1-1/2" NPT Pipe	2" NPT Pipe	2-1/2" NPT Pipe
10	1,050	1,600	3,050	4,800
20	730	1,100	2,100	3,300
30	590	890	1,650	2,700
40	500	760	1,450	2,300
50	440	670	1,270	2,000
60	400	610	1,150	1,850
70	350	560	1,050	1,700
90	320	490	930	1,500
100	305	460	870	1,400
150	250	380	710	1,130
The values are based on a specific gravity of 0.60 (typical for natural gas). See table 4.3 for capacity correction factors for gases with other specific gravities.				

Table 4.3: Maximum Capacity Correction Factors for Specific Gravity other than 0.60

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

4. The gas piping to the boiler must be a minimum of 1-1/4" pipe. The boiler is supplied with a 1-1/4" NPT x 1" NPT bell reducer. Do not remove the reducer.
5. Size and install the gas supply piping for no more than 0.5 inches of water pressure drop between the gas regulator and the boiler.

C. GAS SUPPLY PIPING INSTALLATION

1. Do not install any piping directly over or in front of the boiler. Locate the drop pipe adjacent to the boiler.

2. Install a sediment trap as shown in Figure 4.1. Be sure to allow clearance from the floor for removal of the pipe cap.

⚠ WARNING

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

3. Install a ground joint union between the sediment trap and the boiler to allow service of the appliance.
4. Install a service valve as shown in Figure 4.1 to allow the gas supply to be interrupted for service.

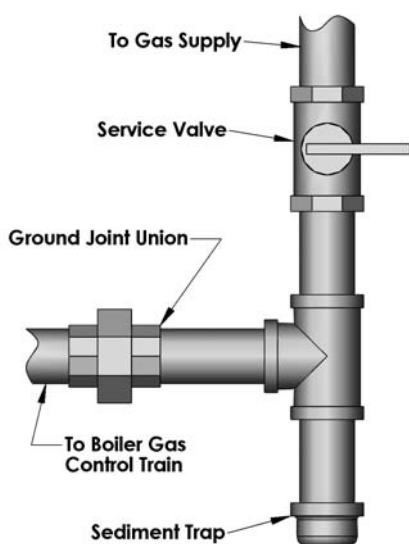


Figure 4.1: Gas Supply Piping – Sediment Trap

5. Maintain a minimum distance of 10 feet between the gas pressure regulator and the boiler.
6. Check all gas piping for leaks prior to placing the boiler in operation. Use an approved gas detector, non-corrosive leak detection fluid, or other leak detection method. If leaks are found, turn off all gas flow and repair as necessary.

⚠ WARNING

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

7. Figure 4.2 shows the gas shutoff valve for the Pinnacle Boiler. This valve is to be used in addition to the gas service valve shown in Figure 4.1.

D. GAS SUPPLY PIPING - OPERATION

1. The gas line must be properly purged of air to allow boiler to operate. Failure to do so may result in burner ignition problems.
2. Table 4.4 shows the maximum and minimum supply pressure to the boiler.
 - a. Gas pressure below the minimum pressure may result in burner ignition problems.
 - b. Gas pressure above the maximum may result in damage to the gas valve.

⚠ WARNING

Do not adjust the throttle screw without monitoring the carbon dioxide (CO₂) and carbon monoxide (CO) in the vent pipe. Vent CO emissions above 400 ppm are in excess of most safety standards.

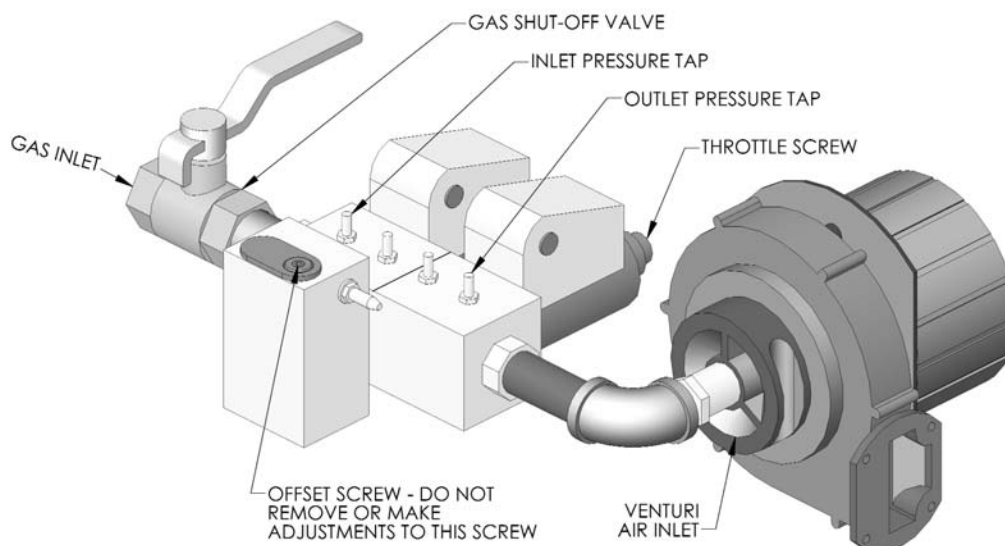


Figure 4.2: Gas Valve/Venturi PI-399



CAUTION

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

3. To check the gas supply pressure on the gas valve:
 - a. Turn off the power at the service switch.
 - b. Turn off the gas shutoff valve.
 - c. Using a flat screwdriver, turn the screw inside the inlet pressure tap fitting (see figure 4.4 and 4.5) one turn counterclockwise.
 - d. Attach the manometer tube to the pressure tap fitting.
 - e. Open the gas shutoff valve and start the boiler.
 - f. Read and record the gas pressure while the boiler is firing.
 - g. Turn off the boiler and gas shutoff valve.
 - h. Remove the manometer tube from the pressure tap fitting and turn the screw to close the internal valve.
 - i. Turn on the gas shutoff valve and boiler service switch.
4. All gas piping must be leak tested prior to placing the boiler in operation.
 - a. If the leak test pressure requirement is higher than the maximum inlet pressure noted in Table 4.4, the boiler must be isolated from the gas supply piping system.
 - b. If the gas valve is exposed to pressures exceeding 13.5" of water, the gas valve must be replaced.
5. Install the boiler such that the gas ignition system components are protected from water (dripping, spraying, rain, etc) during operation and service (circulator replacement, condensate trap cleanout, and control replacement, etc).

Table 4.4: Maximum and Minimum Fuel Pressure

Gas Type	Fuel Pressure (inches of water)	
	Minimum	Maximum
Natural	3.5	13.5
LP	3.5	13.5



WARNING

Do not adjust the throttle screw without monitoring the carbon dioxide (CO₂) and carbon monoxide (CO) in the vent pipe. Vent CO emissions above 400 ppm are in excess of most safety standards.

E. MAIN GAS VALVE - OPERATION

1. Figure 4.2 shows an illustration of the gas valve/venturi assembly for the Pinnacle PI-399.
 - a. The throttle screw on the valve should not be adjusted without a means to measure carbon monoxide (CO) and carbon dioxide (CO₂) emissions.
 - b. Turning the throttle screw clockwise will decrease the gas flow (decreasing CO₂) and turning it counterclockwise will increase the gas flow (increasing CO₂).
 - c. The recommended CO₂ settings are given in Table 4.5. In no case should the boiler be allowed to operate with CO emissions in excess of 150 ppm.
2. Refer to Section 5, Venting for information on obtaining vent samples from this boiler.

Table 4.5: Recommended Vent CO₂ Settings

Gas Type	Firing Rate	Vent CO ₂	Vent CO
Natural	Low	8-1/2% to 9-1/2%	< 50 ppm
	High	8-1/2% to 9-1/2%	< 100 ppm
LP	Low	9-1/2% to 10-1/2%	< 50 ppm
	High	9-1/2% to 10-1/2%	< 100 ppm

5. VENTING, INLET AIR AND CONDENSATE

A. GENERAL

1. Install the 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. This boiler is a direct vent appliance and is listed as a Category IV appliance with Underwriters Laboratories, Inc.

WARNING

This vent system will operate with a positive pressure in the pipe. Do not connect vent connectors serving appliances vented by natural draft into any portion of mechanical draft systems operating under positive pressure.

WARNING

Follow these venting instructions carefully. Failure to do so may result in severe personal injury, death, or substantial property damage.

B. APPROVED MATERIALS FOR EXHAUST VENT AND INLET AIR PIPE

1. Use only Non Foam Core venting material. The following materials are approved for use as vent pipe for this boiler:
 - a. Non Foam Core PVC (Polyvinyl Chloride) Pipe conforming to ASTM D-1784 Class 12454-B (formerly designated Type 1, Grade 1).
 - b. Non Foam Core CPVC (Chlorinated Polyvinyl Chloride) Pipe conforming to ASTM D-1784 Class 23447-B (formerly designated Type IV, Grade 1).
 - c. Non Foam Core ABS (Acrylonitrile-Butadiene-Styrene) Pipe conforming to ASTM D3965 Class 3-2-2-2-2.

WARNING

Do not use Foam Core Pipe in any portion of the exhaust piping from this boiler. Use of Foam Core Pipe may result in severe personal injury, death, or substantial property damage.

2. Cellular foam core piping may be used on air intake piping only. Never use cellular foam core material for exhaust piping.

C. EXHAUST VENT / AIR INTAKE PIPE LOCATION

1. Determine exhaust vent location:
 - a. The vent piping for this boiler is approved for zero clearance to combustible construction.
 - b. See Figure 5.1 for an illustration of clearances for location of exit terminals of direct-vent venting systems.
 - c. This boiler vent system shall terminate at least 3 feet (0.9 m) above any forced air intake located within 10 ft (3 m). Note: this does not apply to the combustion air intake of a direct-vent appliance.
 - d. Provide a minimum of 1 foot distance from any door, operable window, or gravity intake into any building.
 - e. Provide a minimum of 1 foot clearance from the bottom of the exit terminal above the expected snow accumulation level. Snow removal may be necessary to maintain clearance.
 - f. Provide 4 feet 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.
 - g. Do not locate the exit terminal over public walkways where condensate could drip and/or freeze and create a nuisance or hazard.
 - h. When adjacent to a public walkway, locate exit terminal at least 7 feet above grade.
 - i. Do not locate the exit termination directly under roof overhangs to prevent icicles from forming.
 - j. Provide 3 feet clearance from the inside corner of adjacent walls.
2. Determine air intake pipe location.
 - a. Provide 1 foot clearance from the bottom of the air inlet pipe and 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. Maximum distance between air intake and exhaust vent is 6 feet (1.8 m). Minimum distance between exhaust vent and air intake on single Pinnacle is 8" (0.2 m) center-to-center. Minimum distance between vents and intake on multiple Pinnacles is 8" (0.2 m) center-to-center. See Figure 5.2.

VENTING, INLET AIR AND CONDENSATE

Figure 5.1: Location of exit terminals of mechanical draft and direct-vent venting systems.

(Reference: National Fuel Gas Code ANSI Z223.1/NFPA 54 2002).

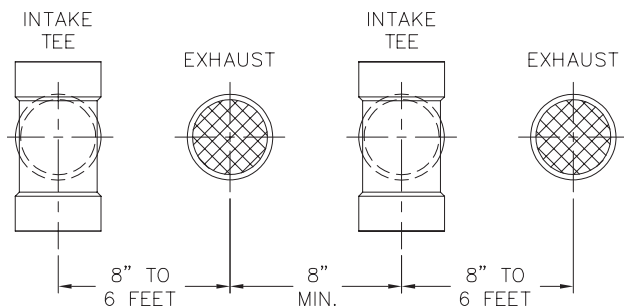
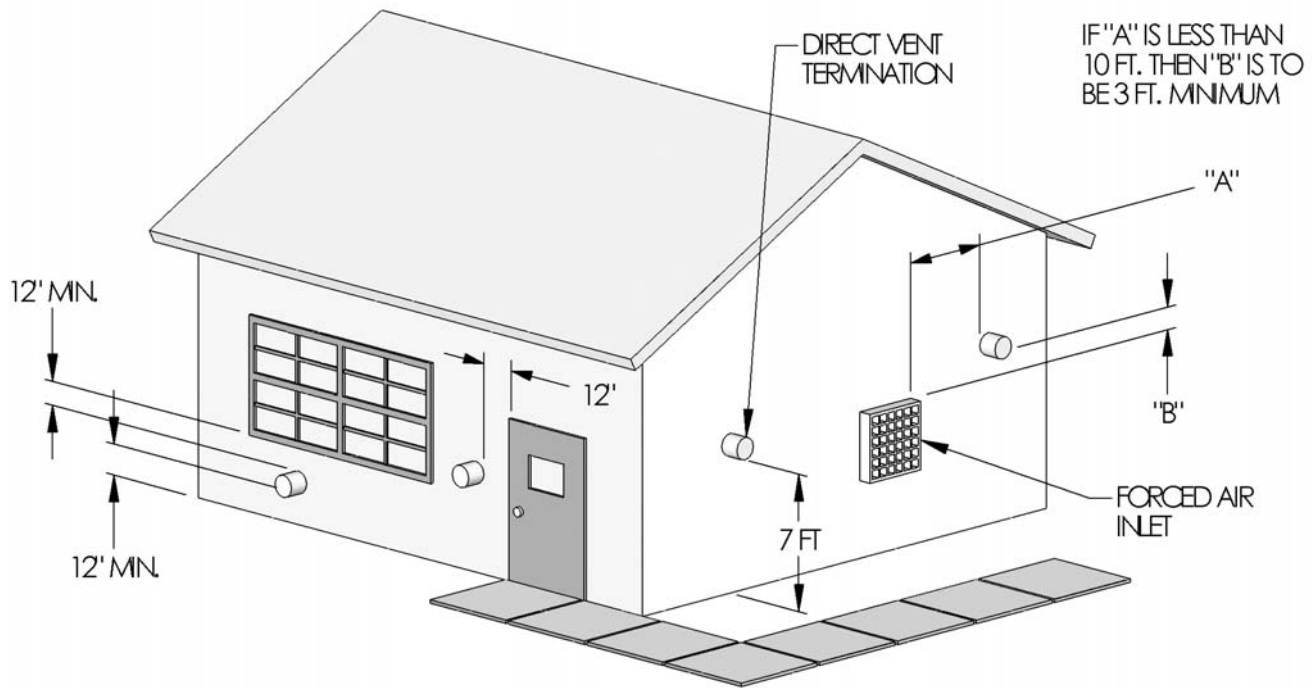


Figure 5.2: Multiple Pinnacle Vent Spacing

D. EXHAUST VENT AND INTAKE AIR PIPE SIZING

- For the PI-399 Boilers the exhaust vent and air intake pipes should be 4" Schedule 40 or 80.
- The total combined equivalent length of exhaust vent and intake air pipe should not exceed 85 feet.
 - The equivalent length of elbows, tees, and other fittings are listed in Table 5.1.
 - For example: If the exhaust vent has two 90° elbows and 10 feet of PVC pipe we will calculate:

Table 5.1: Fitting Equivalent Length Table 4" or 6"

Fitting Description	Equivalent Length
Elbow, 90°, Short Radius	5
Elbow, 45°, Short Radius	3
Coupling	0
Air Intake Tee	0
V2000 Vent Kit	0

Exhaust Vent Pipe Equivalent Length = $(2 \times 5) + 10 = 20$ feet

Further, if the intake air pipe has two 90° elbows, one 45° elbow and 10 feet of PVC pipe, the following calculation applies:

Air Intake Pipe Equivalent Length = $(2 \times 5) + 3 + 10 = 23$ feet

Finally, the combined vent length is found by:

Total Combined Equivalent Length = $20 + 23 = 43$ feet

Therefore, the total combined equivalent length is 43 feet which is below the maximum of 85 feet.

- The intake air pipe and the exhaust vent are intended to penetrate the same wall or roof of the building.

- d. Effort should be made to keep a minimum difference in equivalent length between the air intake pipe and the exhaust vent.
3. The minimum combined equivalent length is 16 equivalent feet.
4. The maximum combined equivalent length can be extended by increasing the diameter of the vent pipe. However, the transitions to a larger size should begin 15 equivalent feet from the boiler.
 - a. Transitions should always be made in vertical sections of pipe to prevent the condensate from pooling in the vent pipe.
 - b. Use a 4" x 6" reducing coupling to transition from the PI-399 boiler connections to 6" vent.
 - c. The maximum equivalent length for the increased diameter vent pipes is 125 feet.
 - d. If the transition occurs at a distance greater than 15 equivalent feet from the boiler, the maximum equivalent length will be reduced. See Table 5.2.

Table 5.2: Maximum Equivalent Vent Length for Oversized Vent Pipe

Transition Point (ft from boiler)	TEL of Standard 4" Vent Pipe (ft)	TEL of Oversized 6" Vent Pipe (ft)	Maximum TEL of all Vent Pipe (ft)
15	30	95	125
20	40	77-1/2	117-1/2
25	50	60-1/2	110-1/2
30	60	43	103
35	70	26	96
40	80	8-1/2	88-1/2
None	85	0	85

TEL = Total Equivalent Length

E. EXHAUST VENT AND AIR INTAKE PIPE INSTALLATION

1. On the PI-399 the 4" exhaust vent connection is located on the rear of the boiler and the air intake is higher and toward the left side when the boiler is viewed from the front. See Figure 10.1. The air intake connection is intended for a slip fit. No sealant or adhesive is required.
2. Use only solid PVC, CPVC, or ABS schedule 40 or 80 pipe. FOAM CORE PIPING IS NOT APPROVED.

3. Remove all burrs and debris from joints and fittings.
4. All joints must be properly cleaned, primed, and cemented. Use only cement and primer approved for use with the pipe material. Cement must conform to ASTM D2564 for PVC or CPVC pipe and ASTM D2235 for ABS pipe.



WARNING

All joints of positive pressure vent systems must be sealed completely to prevent leakage of flue products into the living space.

5. Horizontal lengths of exhaust vent must slope back towards the boiler not less than 1/4" per foot 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 pipe, a drain pipe must be connected to allow condensate to drain.
6. All piping must be fully supported. Use pipe hangers at a minimum of 4 foot intervals to prevent sagging of the pipe where condensate may form.
7. Do not use the boiler to support any piping.
8. A screened straight coupling is provided with the boiler for use as an outside exhaust termination.
9. A screened inlet air tee is provided with the boiler to be used as an outside intake termination.
10. An optional stainless steel inlet air/exhaust vent termination (91401) is available from your PB Heat, LLC distributor for use with Pinnacle Boilers.
11. Refer to Figure 5.3 to 5.5 for sidewall venting and Figure 5.6 for vertical venting.

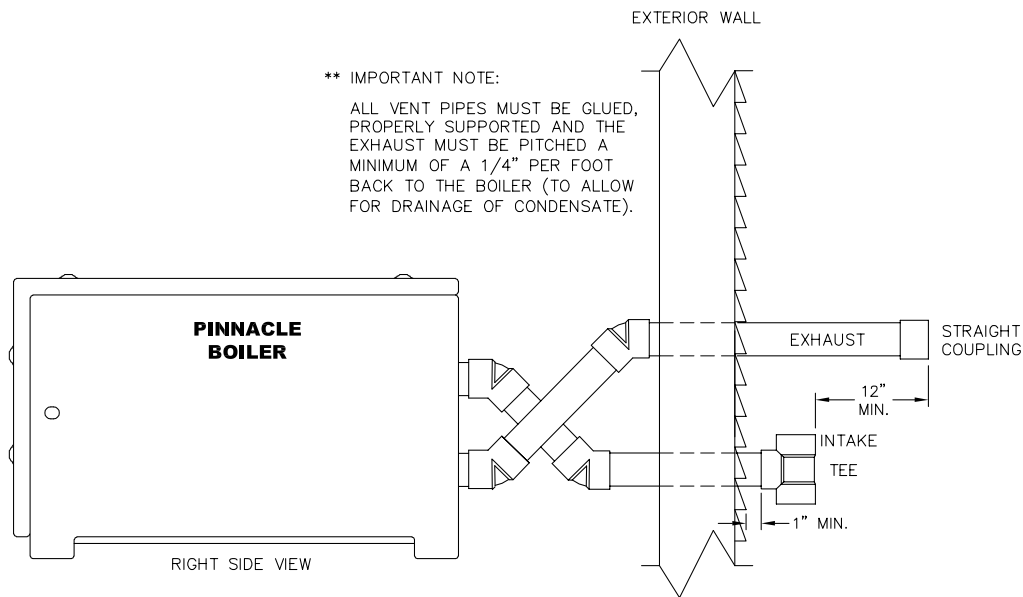


Figure 5.3: PI-399 Sidewall Venting with 4" Pipe (Exhaust Termination at Higher Elevation than Air Intake).

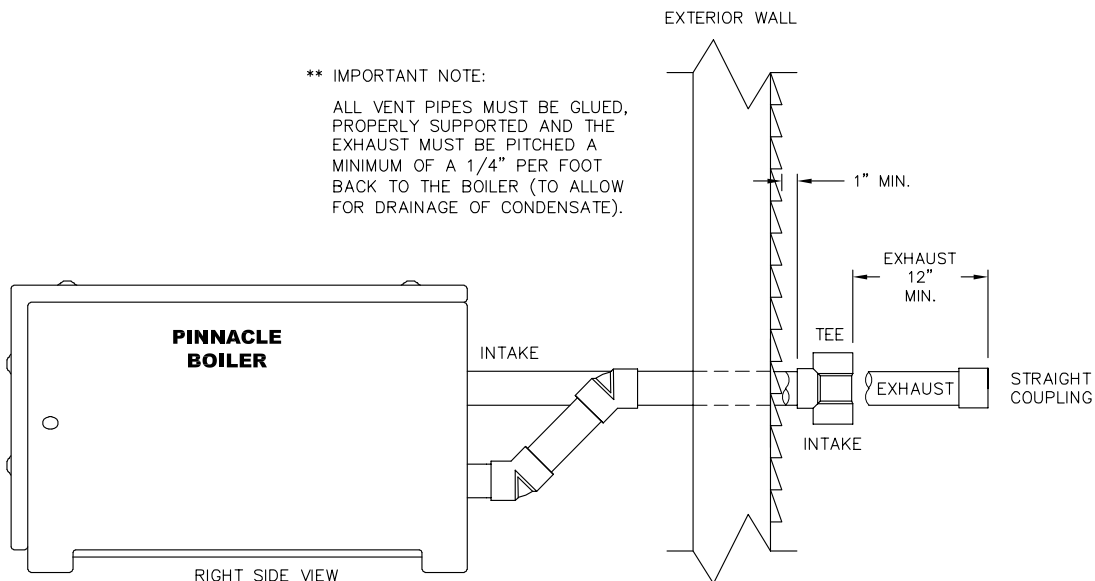


Figure 5.4: PI-399 Sidewall Venting with 4" Pipe (Air Intake and Exhaust on the same Elevation).



WARNING

All exhaust vent pipes must be glued, properly supported, and pitched at a minimum of 1/4" per foot back to the boiler. Failure to do so may result in severe personal injury, death, or substantial property damage.

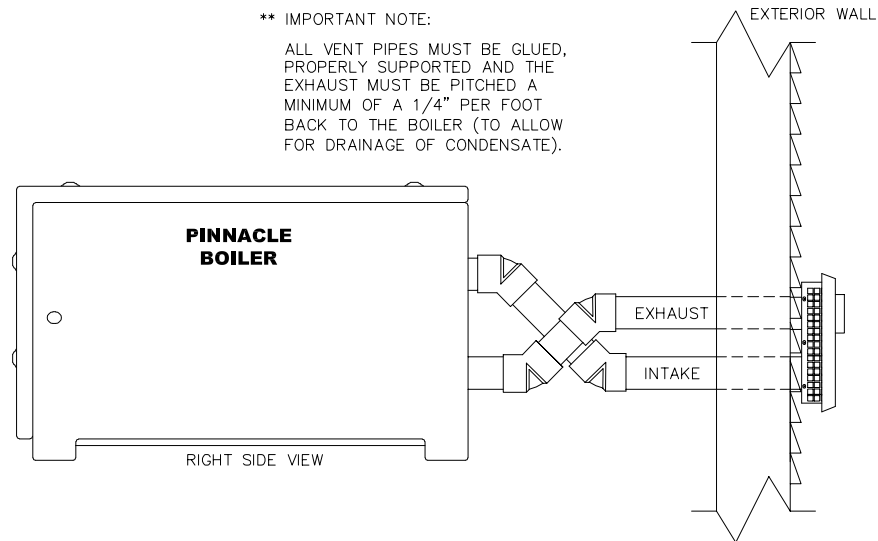


Figure 5.5: PI-399 Sidewall Venting with 4" Pipe (Stainless Steel Vent Kit).

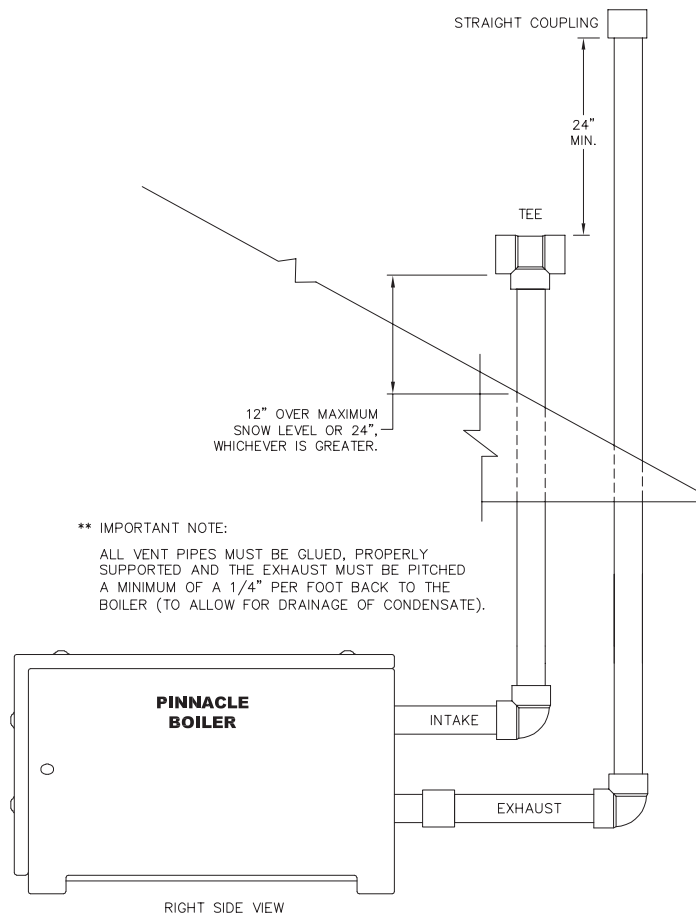


Figure 5.6: PI-399 Vertical Venting with 4" Pipe.



WARNING

All exhaust vent pipes must be glued, properly supported, and pitched at a minimum of 1/4" per foot back to the boiler. Failure to do so may result in severe personal injury, death, or substantial property damage.

F. EXHAUST TAPPING FOR VENT SAMPLE

To obtain a combustion sample a hole must be drilled in the exhaust vent pipe just above the first elbow at the outlet of the boiler.

- a. Drill a 21/64" diameter hole in the vent pipe just above the first elbow.
- b. Tap the hole with a 1/8" NPT Pipe Tap.
- c. Take combustion samples through the tapped hole.
- d. Thread a standard 1/8" NPT Pipe Plug into the hole.

G. CONDENSATE DRAIN INSTALLATION

1. This boiler is a high efficiency unit that produces condensate. The condensate must be drained from the unit.
2. The white hose under the unit is a condensate trap which prevents products of combustion from exiting the boiler through the condensate drain.
3. The black plastic 3/4" NPT fitting at the left rear corner of the boiler is intended for connection to plastic piping. Do not block vent hole at the top of the fitting.

4. Slope the condensate drain piping down away from the unit into a floor drain or condensate pump.

Check with local codes or ordinances to determine if the condensate must first be neutralized before running it to a drain.



CAUTION

Make sure the condensate drain piping is below the level of the boiler to prevent condensate from filling up the combustion chamber and damaging the boiler.

5. Do not route the condensate piping through unheated spaces that may reach freezing temperatures.
6. Use only plastic piping for the condensate drain line. Metal pipes will corrode and cause blockage of the condensate drain.
7. To allow for proper drainage on large horizontal runs, a second line vent may be required and the required tubing size may increase to 1" I.D.
8. A condensate removal pump is required if the boiler is below the drain.

H. BOILER REMOVAL FROM COMMON VENTING SYSTEM

1. At the time of removal of an existing boiler from a common venting system, follow these steps with each appliance that remains connected. These steps are to be completed while all components which remain connected to the common venting system are not in operation.
 - a. Seal any unused openings in the common venting system.
 - b. Visually inspect the venting system for proper size and horizontal pitch. Verify there is no blockage or restriction, leakage, corrosion, and other deficiencies which could cause an unsafe condition.
 - c. Where practical, close all building doors and windows, including interior doors between the space in which the appliances that remain connected to the common venting system are located and other areas of the building.
 - d. Turn on any clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhaust fans, at their maximum speed. (Do not operate a summer exhaust fan).
 - e. Close fireplace dampers.
 - f. Place the appliance being inspected in operation. Follow the lighting instructions and adjust the thermostat so that the appliance operates continuously.
 - g. 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.
 - h. 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 condition of use.
 - i. 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 and/or CAN/CGA B149*.
 - j. The common venting system should be resized to approach the minimum size determined by using the appropriate tables located in the *National Fuel Gas Code, ANSI Z223.1/NFPA 54, "Sizing of Category I Venting."*

6. ELECTRICAL

Install all electrical wiring in accordance with the National Electrical Code, ANSI/NFPA 70, and local requirements.



NOTICE

This unit when installed must be electrically grounded in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the current edition of the National Electrical Code, ANSI/NFPA 70.

A. WIRING

1. Refer to Figures 6.1 for connecting the power supply to the boiler.

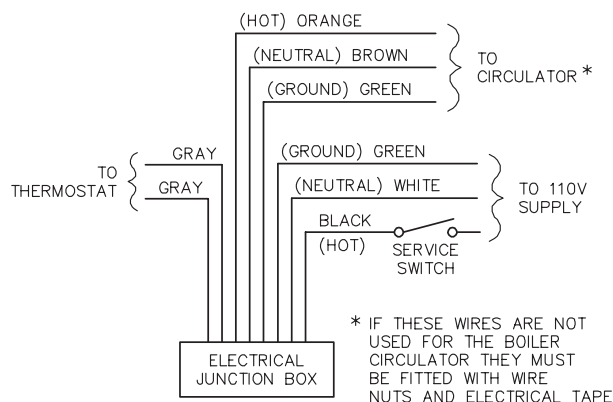


Figure 6.1: Wiring Connections to Boiler Junction Box

2. Connect boiler to a 110 volt, single phase, 60 hertz electrical supply line with a fused disconnect switch. The boiler is fused for a load of 6.3 amperes.
3. The boiler electrical connection is located on the left side of the boiler in the junction box which houses the service switch.
4. Wire the burner service switch in the hot line to the boiler as shown in Figure 6.1.
5. Make sure to maintain correct polarity on the incoming power supply wires. If polarity is reversed, the boiler control will not sense the main burner flame.
6. Connect the ground wire from the incoming power supply to the green ground screw in the junction box. Also, the boiler ground should be connected to this screw.
7. Figure 6.1 shows connections to system circulator.
 - a) The maximum current load for the circulator circuit is 4.0 amperes.
 - b) For loads greater than 4.0 amps, isolate the circulator using a switching relay.

- c) An example of this wiring using a Honeywell R845A relay is shown in Figure 6.2

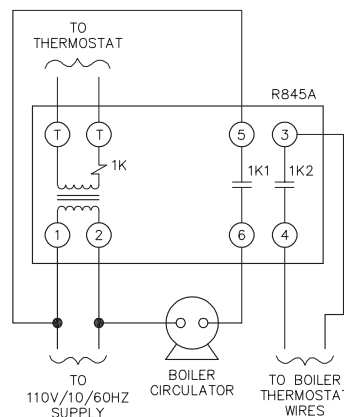


Figure 6.2: Wiring Circulator with R845A Switching Relay

8. The thermostat connections are shown in Figure 6.1 or 6.2. The setting for the thermostat anticipator is 0.56 amps.
9. The boiler control board and factory wiring are shown in figure 6.3.

B. SEQUENCE OF OPERATION

1. System Power-Up:
 - a) When power is first applied to the boiler, the control will initially run through a self-diagnostic routine. The interface unit shows the system supply temperature.
 - b) Next, it will power the combustion air fan for a 10 second purge cycle.
 - c) Finally the combustion air shuts down and if there is no call for heat the control board enters a standby mode.
2. Heating Cycle:
 - a) When the thermostat calls for heat (closing the contact between the two gray [TT] wires) and the boiler control senses a supply temperature lower than the set point by more than the differential, the boiler initiates a heating cycle.
 - b) The control then powers the combustion air fan at the speed prescribed for the particular boiler model and performs a 6 second pre-purge of the combustion chamber.
 - c) 0.5 second before the pre-purge is complete power is applied to the spark igniter.
 - d) Once the pre-purge cycle is complete, the fan speed decreases to the programmed ignition speed.

- e) The main gas valve is then energized to allow gas to mix with the combustion air.
- f) If the main flame is not detected in 5 seconds, the gas valve closes and the combustion fan goes into post-purge. Otherwise, the combustion fan stays at the ignition speed for the length of the flame stabilization period. (10 to 25 seconds).
- g) After the flame stabilization period is complete, the combustion air fan ramps down to its low fire setting. Then the boiler will begin to modulate depending on the supply temperature to maintain the set point temperature.
- h) As the supply temperature approaches the set point, the combustion control will reduce the input rate. The supply temperature will continue to climb to about 7°F above the boiler set point before it cycles off.
- i) The differential is applied from this point. For example if the boiler set point is at 180°F with a 10°F differential, the supply temperature will reach 187°F before shutting down. It will not re-start until the supply temperature drops below 177°F.

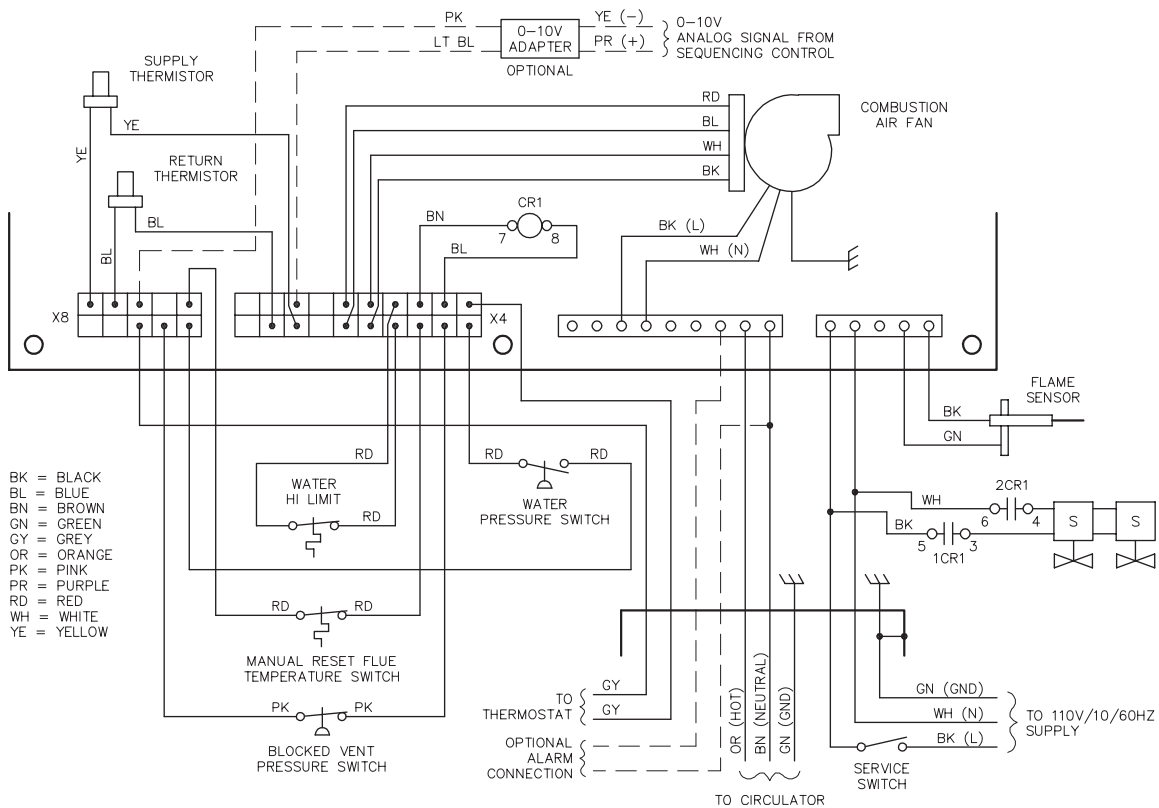


Figure 6.3: Boiler Control Board Wiring Schematic

C. SAFETY INTERLOCKS

1. *Low Water Pressure Limit Switch:* This boiler is intended to operate at pressures exceeding 10 psig. If the water pressure drops to below 10 psig, there is a water pressure limit switch that interrupts boiler operation and displays the message "PR0" on the display module. The combustion air fan completes a post-purge in this event. Once the low water pressure condition is corrected the boiler will reinitiate a heating cycle if there remains a call for heat.
2. *High Water Temperature Limit Switch:* The boiler is equipped with a limit switch that will interrupt the heating cycle and execute a post-purge if the water temperature increases to above the limit set point of 225°F.
3. *High Flue Temperature Limit Switch:* The high flue temperature limit switch will interrupt the heating cycle if it senses flue gas temperatures above 210°F.
4. *Blocked Vent Pressure Limit Switch:* This switch prevents the boiler from operating if the vent pressure exceeds 2 inches water column. This will prevent the boiler from operating if the vent pipe is blocked. The boiler will indicate "FLU" on the display module.

D. CONTROL FUNCTIONS

1. This Pinnacle boiler is equipped with a P125 Control Board. This control board with display module has the following functions:
 - a. Shows the boiler supply (outlet) water temperature on the LED Display as default.
 - b. Allows user to adjust the supply water set point, the set point differential, and change the display mode between Fahrenheit and Celsius.
 - c. Provides Error and Fault Codes on the LED Display.
 - d. Shows the supply and return temperatures, fan speed, flame signal (μA), boiler circulator status, boiler set point, total power on hours, boiler on hours, and the number of cycles.
 - e. Allows manual control of the firing rate using the Service Mode.
2. *Default Display:* Under normal operating conditions the default display shows the temperature of the water supply (boiler outlet) to the system. This may be displayed in Fahrenheit or Celsius according to user preferences.
3. *Program Functions:* By using the S3 "Program" key, the settings shown in Table 6.1 may be programmed.
 - a. To access the menu, press and hold the S3 "Program" key on the display module.
 - b. The control will enter the Supply Set Point selection.
 - i. The display will alternately show "C" and then the current set point temperature.

Table 6.1: Program Functions

Description	Alternating Display Character	Allowable Range
Supply Set Point	C	50°F to 201°F (10°C to 94°C)
Set Point Differential	Ch	5°F to 30°F (3°C to 17°C)
Not Applicable	dh	
Measurement Units	t	C or F

- ii. The set point may be adjusted by using the S1/- (to decrease) or S2/+ (to increase) keys on the display module.
 - c. Pressing the S3 "Program" key again will advance to the next adjustable value, Set Point Differential, and the display will alternate between: "Ch" and the programmed value:
 - i. The differential adjustment is the difference between the temperature that the boiler shuts down (high) and the temperature at which it re-starts (low).
 - ii. The differential may be set to values between 5°F (3°C) and 30°F (17°C) in 1°F increments.
 - iii. The boiler will always shut down at a temperature 7°F (4°C) above the set point. The differential temperature is then applied to this value.
 - iv. The set point differential may be adjusted by using the S1/- (to decrease) or S2/+ (to increase) keys on the display module.
 - d. Pressing the S3 "Program" key again will advance to the next adjustable value. The display will read "dh" and alternate with numerical value. This value is not applicable to the Pinnacle boiler.
 - e. Finally, by pressing the S3 "Program" key again, the display will advance to the Measurement Units selection. The display will alternate between "t" and either "F" or "C" depending on the units selected. This value may be changed by using the S1/- or S2/+ keys on the display module.
 - f. Pressing the S3 "Program" key once more will exit the program mode and again display the supply temperature.
4. *Error Codes:* The LED Display will display error codes if the boiler is in a temporary fault condition. Table 8.1 shows Error Codes and descriptions. In some cases, if the temporary fault is not corrected within 60 seconds the controller will go into a Fault Code.
 5. *Fault Codes:* A Fault Code indicates the controller is locked-out. Press the S4 "Reset" key to resume operation after repairing the problem. Table 8.2 shows Fault Codes for this control.

6. **Status Menu:** The status menu, as shown in Table 6.3, allows the installer to display the current boiler supply (outlet) temperature, return (inlet temperature), fan speed, flame signal (μA), boiler circulator status, boiler set point, total power on hours, boiler on hours, and the number of cycles.
- To access this menu press and hold the S4 "Reset" key on the display module for 3 seconds.
 - The display will alternate between "d1" and the value of the supply temperature.
 - To scroll through the other status codes, simply press S4 "Reset" key again.
 - To exit this menu, press the S3 "Program" key.

Table 6.3: Status Menu

Status Code	Description
d1	Supply (Outlet) Temperature (F or C)
d2	Return (Inlet) Temperature (F or C)
d3	Fan Speed (rpm \div 10) [ex. 200 = 2000 rpm]
d4	Flame Signal (μA)
d5	Boiler Circulator Status (0 = Off, 1 = On)
d6	Boiler Set Point (F or C)
d7	Power On Time (Hrs \div 1000) [ex. 0.1 = 100 hrs]
d8	Boiler On Time (Hrs \div 1000)
d9	Boiler Cycles (n \div 1000)

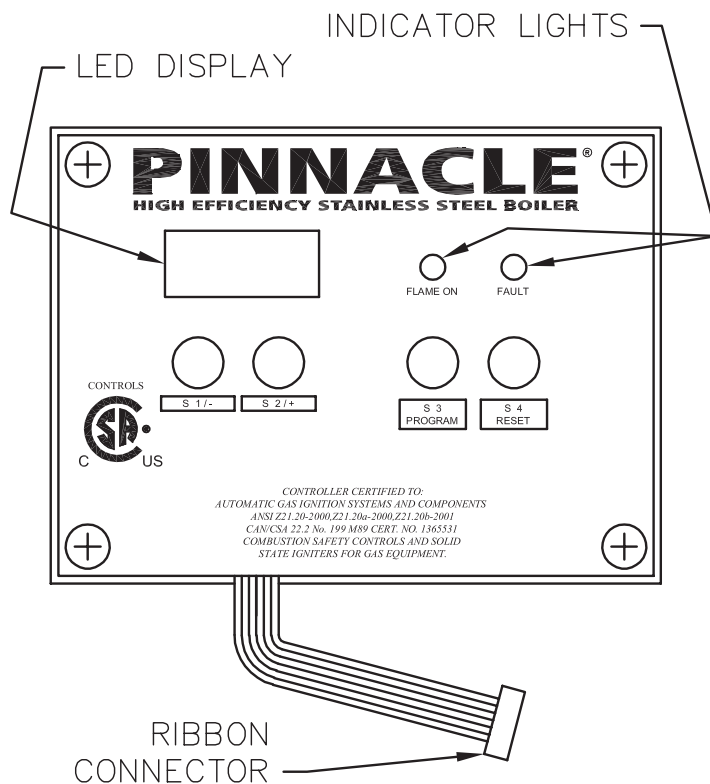
7. **Service Mode:** The Pinnacle boiler can be operated in Service Mode to allow the installer to manually set the fan speed/input rate of the boiler.
- To enter service mode, press and hold the S2/+ key and the S3 "Program" key simultaneously.
 - The display will alternately display "SER" and the fan speed in RPMs \div 10. As default, the fan speed will start at the ignition fan speed (this value is listed in Section 10, Dimensions and Ratings, for each boiler size).
 - The fan speed can be adjusted by using the S1/- key (to decrease speed) or S2/+ key (to increase speed) on the display module.
 - The fan speed will stay in this mode for 10 minutes or until the boiler reaches 7 degrees above the set point temperature.
 - To exit the Service Mode, press the S1/- and S2/+ keys simultaneously.
8. **Installer Menu:** The Pinnacle boiler can be programmed to be controlled by an external analog input controlling set point temperature or fan speed. In addition, it can be programmed for a 6 minute step modulation sequence.

- To enter the installer menu, press and hold the S3 "Program" key and S4 "Reset" key simultaneously for 3 seconds. The display will show a blinking "000."
- Use the S1/- and S2/+ keys to change the display to read 125. Press and hold the S3 "Program" key to enter the installer menu. (The control will shut down the boiler if it is in operation.) The display will alternate between 1, which represents the Parameter Number, and either 0 or 1, which represents the Function setting.

Table 6.4: Installer Menu

Parameter No.	Function
1	0 = Internal Control 1 = External Input from 0-10 volt adapter
2	0 = External Temperature Input 1 = External Fan Speed Input
3	0 = Step Modulation Disabled 1 = Step Modulation Enabled

- Table 6.4 shows the Parameter numbers and Functions. Press S3 "Program" to advance through the parameters and use the S1/- and S2/+ keys to change the function values. **Do not change to external input without external input device installed!**
- To exit the Installer Menu, press and hold the S4 "Reset" key for 3 seconds.

**Figure 6.4: Display Module**

7. START-UP PROCEDURES

A. COMPLETING THE INSTALLATION

1. Confirm that all water, gas and electricity are turned off.
2. Verify that water piping, venting, gas piping and electrical wiring and components are installed properly and where applicable in accordance with manufacturers' instructions. Be sure that the boiler is installed in accordance with this manual and good engineering practice.
3. Fill the boiler and system with water, making certain to vent all air from each high point in the system. Open each vent in the system until all air is released and water begins to be discharged, and then close the vent.
4. The pressure reducing valve on the fill line will typically allow the system to be filled and pressurized to 12 PSI. Consult the manufacturer's instructions for operation of the valve and expansion tank.
5. Check joints and fittings throughout the system and repair as required.
6. Connect a manometer at or near the service valve to the boiler.
7. Confirm that the gas supply pressure to the boiler is between the minimum and maximum values for the gas being used. These values can be found in Table 4.4 of Section 4.
8. If a full supply pressure test is required, isolate the boiler and gas valve before performing the pressure test. If the supply pressure is too high or too low, contact the fuel gas supplier.
9. Turn on electricity and gas to the boiler. Check to see if the LED display is lit. The combustion air fan will begin a 5 second purge cycle and then the control will go into Standby Mode.
10. Adjust set point temperatures and differential temperatures by pressing and holding the S3, "Program" key for 3 seconds.
 - a) The control will enter the Supply Set Point selection.
 - b) The display will alternately show "C" and then the current set point temperature.
 - c) The set point may be adjusted by using the S1/- (to decrease) or S2/+ (to increase) keys on the display module.
 - d) Pressing the S3 "Program" key again will advance to the next adjustable value, Set Point Differential and the display will alternate between.
 - e) The differential adjustment is the difference between the temperature at which the boiler shuts down (high) and the temperature at which it re-starts (low).
 - f) The differential may be set to values between 5°F (3°C) and 30°F (17°C) in 1°F increments.
 - g) The boiler will always shut down at a temperature 7°F (4°C) above the set point. The differential temperature is then applied to this value.
 - h) The set point differential may be adjusted by using the S1/- (to decrease) or S2/+ (to increase) keys on the display module.
 - i) Pressing the S3 "Program" key again will advance to the next adjustable value. The display will read "dh" and alternate with numerical value. This value is not applicable to the Pinnacle boiler.
 - j) Finally, by pressing the S3 "Program" key again, the display will advance to the Measurement Units selection. The display will alternate between "t" and either "F" or "C" depending on the units selected. This value may be changed by using the S1/- or S2/+ keys on the display module.
11. Light the boiler by following the Lighting/Operating instructions in this section. The initial ignition may fail several times before the gas piping is completely purged of air.
12. Use the sequence of operation description and Figure 6.3, Control Board Wiring Schematic to follow light off and shutdown sequences and to assist in diagnosing problems. If the boiler does not function properly, consult Section 8, Troubleshooting.


B. LIGHTING AND OPERATING PROCEDURES

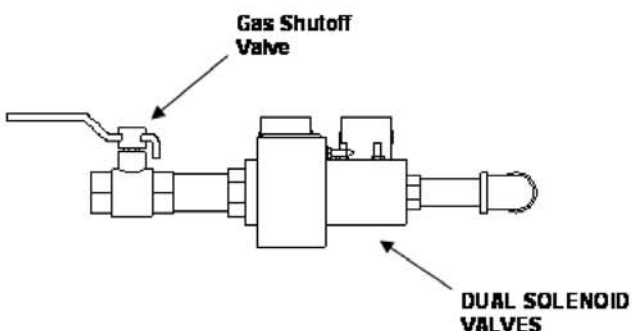
FOR YOUR SAFETY READ BEFORE OPERATING

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

- A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
- 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 knob. 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. Remove Front Cover.
6. Turn gas shutoff valve clockwise  to "OFF". Handle will be perpendicular to pipe, do not force.
7. 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.
8. Open the gas shutoff valve. Handle will be in line with the pipe.
9. Install Front Cover.
10. Turn on all electric power to appliance.
11. Set thermostat to desired setting.
12. 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. Remove Front Cover.
4. Turn the gas control knob clockwise  to "OFF".
5. Install Front Cover.

C. CHECK-OUT PROCEDURE

1. After starting the boiler, be certain that all controls are working properly. Check to be sure that the boiler will shut down when the water temperature reaches the control board set point.
2. To check operation of the ignition system safety shut-off features:
 - a) Turn off gas supply.
 - b) Set thermostat or controller above room temperature to call for heat.
 - c) The boiler should perform 3 attempts at ignition before going into lock-out.
 - d) Turn gas supply on.
 - e) Reset by pushing S4 "Reset" key.
 - f) Observe boiler operation through one complete cycle.
3. Turn off the automatic fill to the boiler and drain some water to drop the system pressure below 10 psig. Verify that the display module reads "PRO" after 5 seconds and does not allow the boiler to operate. Close the boiler drain and turn on the automatic fill valve.
4. Low Water Cut-Off (if used) - Consult the manufacturer's instructions for the low water cut-off operational check procedure.
5. 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.
6. Check the expansion tank and automatic fill valve (if used) to confirm that they are operating correctly. If either of these components causes high pressure in the system, the boiler relief valve will weep or open, allowing fresh water to enter the system.
7. Check the condensate drain hose (and pump if installed) and make sure all condensate is being removed from heat exchanger.
8. Review operation with end-user.
9. Complete the Warranty Card and submit it to PB Heat.
10. Hang the Installation, Operation, and Maintenance Manual in an accessible position near the boiler.

8. TROUBLESHOOTING

A. BOILER ERROR

1. When an error condition occurs the controller will display an error code on the display module.
2. These error codes and several suggested corrective actions are included in Table 8.1.
3. In the case of E00, E13, and E14 this error, if uncorrected, will go into a fault condition as described in Paragraph B.

B. BOILER FAULT

1. When a fault condition occurs the controller will illuminate the red "fault" indication light and display a fault code in the format "F###" on the display module.
2. Note the fault code and refer to Table 8.2 for an explanation of the fault code along with several suggestions for corrective actions.
3. Press the reset key to clear the fault and resume operation. Be sure to observe the operation of the unit to prevent a recurrence of the fault.

WARNING

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

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

DANGER

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

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

WARNING

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

CAUTION

This appliance has wire function labels on all internal wiring. Observe the position of each wire before removing it. Wiring errors may cause improper and dangerous operation. Verify proper operation after servicing.

CAUTION

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

Table 8.1: P125 Control Board Error Codes

Code	Description	Duration	Corrective Action
E00	High Limit Exceeded	50 Sec.	<ol style="list-style-type: none"> 1. Check circulation pump operation. 2. Assure that there is adequate flow through the boiler by accessing the status menu and assuring that there is less than a 50°F rise from the return thermistor to the supply thermistor. 3. Replace switch if faulty.
E13	Combustion Fan Speed Low. The boiler combustion air fan speed less than 70% of expected.	60 Sec.	<ol style="list-style-type: none"> 1. Check the combustion air fan wiring. 2. Replace the combustion air fan. 3. Replace the control board.
E14	Combustion Fan Speed High. The boiler combustion air fan speed is more than 130% of expected.	60 Sec.	<ol style="list-style-type: none"> 1. Check the combustion air fan wiring. 2. Replace the combustion air fan. 3. Replace the control board.
PRO	Water Pressure Switch Open	Until Corrected	<ol style="list-style-type: none"> 1. Assure that the system pressure is above 10 psig. 2. Check for leaks in the system piping. 3. Check the switch operation by applying a jumper. (If the switch is not functioning properly replace it.)
FLu	Blocked Vent Pressure Switch Open	Until Corrected	<ol style="list-style-type: none"> 1. Assure that the vent is not blocked. 2. Check the switch operation by applying a jumper. (If the switch is not functioning properly replace it.)

Table 8.2: P125 Control Board Fault Codes

Fault Code	Description	Corrective Action
F00	High Limit Exceeded.	<ol style="list-style-type: none"> 1. Check circulation pump operation. 2. Assure that there is adequate flow through the boiler by accessing the status menu and confirming that there is less than a 50°F rise from the return thermistor to the supply thermistor. 3. If gray thermostat wires are being used, disconnect them and jump them together. If F00 code can be reset check thermostat circuit for short circuit or stray voltage. 4. Check supply temperature reading on LED display. Replace High Limit Switch if supply temperature is below 210°F. 5. Temporarily jump out Water Pressure Switch. If F00 code can be reset check wiring harness and connections. If wiring harness is okay replace Water Pressure Switch.
F01	Vent Temperature Limit Exceeded.	<ol style="list-style-type: none"> 1. Push the red reset button on the switch. 2. Check the flue temperature during operation using a combustion analyzer. 3. Replace the switch if faulty.
F02	Interrupted or Shorted Supply (Outlet) Thermistor.	<ol style="list-style-type: none"> 1. Check the electrical connection to the thermistor on the outlet manifold. 2. Replace thermistor if necessary.
F03	Interrupted or Shorted Return (Inlet) Thermistor.	<ol style="list-style-type: none"> 1. Check the electrical connection to the thermistor on the inlet manifold. 2. Replace thermistor if necessary.
F05	Supply (Outlet) Temperature exceeded 230°F.	<ol style="list-style-type: none"> 1. Check circulation pump operation. 2. Assure that there is adequate flow through the boiler by accessing the status menu and confirming that there is less than a 50°F rise from the return thermistor to the supply thermistor.
F06	Return (Inlet) Temperature exceeded 230°F.	<ol style="list-style-type: none"> 1. Check circulation pump operation. 2. Assure that there is adequate flow through the boiler by accessing the status menu and confirming that there is less than a 50°F rise from the return thermistor to the supply thermistor.
F09	No flame detected – The boiler will make three attempts at ignition before the control goes into this lockout condition.	<ol style="list-style-type: none"> 1. Watch the igniter through the observation window provided. 2. If there is no spark, check the spark electrode for the proper 1/4" gap. 3. Remove any corrosion from the spark electrode. 4. If there is a spark but no flame, check the gas supply to the boiler. 5. If there is a flame, check the flame sensor.
F10	Loss of Flame Signal – The boiler will relight 4 times before the control goes into this lockout condition.	<ol style="list-style-type: none"> 1. Check the gas pressure to the gas valve while the unit is in operation. 2. Assure that the flame is stable when lit. 3. Check to see if the green light on the display module is out while the boiler is running. 4. If the green light doesn't come on or goes off during operation check the flame signal on the status menu. 5. If the signal reads less than 1 microampere, clean the flame sensor. 6. If the sensor continues to read low, replace it.
F11	False Flame Signal – The boiler will lock out if it senses a flame signal when there should be none present.	<ol style="list-style-type: none"> 1. Turn the gas off to the unit at the service valve. 2. If the flame signal is still present replace the igniter. 3. If the flame signal is not present after turning off the gas supply, check the gas valve electrical connection. 4. If there is no power to the gas valve, remove the valve and check for obstruction in the valve seat or replace the gas valve. 5. Turn the gas on at the service valve after corrective action is taken.
F13	Combustion Fan Speed Low – The boiler will lock out if it senses that the fan speed is less than 70% of expected for more than 60 seconds.	<ol style="list-style-type: none"> 1. Check the combustion air fan wiring. 2. Replace the combustion air fan. 3. Replace the control board.
F14	Combustion Fan Speed High – The boiler will lock out if the fan speed is more than 130% of expected for more than 60 seconds.	<ol style="list-style-type: none"> 1. Check the combustion air fan wiring. 2. Replace the combustion air fan. 3. Replace the control board.
F18	Gas Valve Error	<ol style="list-style-type: none"> 1. Make sure the connector is correctly connected to the gas valve. 2. Check the electrical wiring from the valve to the control board. 3. Replace the gas valve. 4. Replace control board.
F30	Watchdog	Call factory for further assistance.
F31	Parameter Memory	Call factory for further assistance.
F32	Parameter Memory Write Error	Call factory for further assistance.
F33	Programming Error	Call factory for further assistance.
NC	Neutral Fault – Boiler locks out if it senses a voltage drop or power feedback on the neutral wire.	<ol style="list-style-type: none"> 1. Check for adequate supply voltage. 2. Check for power feedback on the neutral wire.

9. MAINTENANCE

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 7, Start-Up Procedure Part B.

B. WEEKLY (WITH BOILER IN USE)

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

C. ANNUALLY (BEFORE START OF HEATING SEASON)

CAUTION

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

1. Check boiler room floor drains for proper functioning.
2. Check function of the safety relief valve by performing the following test:
 - a. Check valve piping to determine that it is properly installed and supported.
 - b. Check boiler operating temperature and pressure.
 - c. Lift the try lever on the safety relief valve to the full open position and hold it for at least five seconds or until clean water is discharged.

- d. Release the try lever and allow the valve to close. If the valve leaks, operate the lever two or three times to clear the valve seat of foreign matter. It may take some time to determine if the valve has shut completely.
 - e. If the valve continues to leak, it must be replaced before the boiler is returned to operation.
 - f. Check that operating pressure and temperature have returned to normal.
 - g. Check again to confirm that valve has closed completely and is not leaking.
3. Test low-water cut-off (if used) as described by the manufacturer.
 4. Test limit as described in Section 7, Part C, "Check-Out Procedure".
 5. Test function of ignition system safety shut-off features as described in Section 7, Part C, "Check-Out Procedure".

DANGER

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

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

6. Remove the top/front jacket panel and inspect for any foreign debris that may have entered through air inlet vent.
7. Inspect burner for deterioration. Replace if necessary.
8. With boiler in operation check that condensate is dripping from condensate tubing. Check for any restriction in condensate drain line.
 - a. CONDENSATE CLEANING INSTRUCTIONS:
 1. Turn the thermostat down or off so the Pinnacle will not cycle and then follow the steps below.
 - a. Close manual gas shutoff valve.
 - b. Disconnect the condensate tubing from the outside connection (not from the Pinnacle) so flow can be observed.
 - c. Block the air flow in the exhaust by temporarily plugging the exhaust from the outside vent.

- d. Remove boiler service switch plate. Disconnect two gray thermostat wires from thermostat circuit and jump them together. (Refer to Control Wiring Schematic, Figure 6.3.) This will cause the fan to run at 100% which will then blow out any sediment that has accumulated in the condensate line. (This process should only take a few minutes.)
 - e. The unit should now be ready to re-start.
2. Before re-starting the Pinnacle follow the steps below:
 - a. Reconnect the gray wires and unblock the vent. **(IMPORTANT: MAKE SURE EXHAUST VENT IS NO LONGER BLOCKED!)**
 - b. Open the manual gas shutoff valve and reset the thermostats.
 - c. Observe the boiler function to make sure you see a condensate flow.
 - d. If you do not observe a condensate flow, repeat the above procedure.
 3. If the problem is not corrected at this point, it is possible that there is a material deposit problem. Follow the Coil Cleaning instructions (Section b) included in this section to dissolve deposits and clean condensate line.
- c. Remove the (6) 10mm nuts from the burner plate assembly to access the coils.
 - d. Pull gas tube out of venturi on left side of blower. Disconnect two Molex plugs from blower motor.
 - e. Pull the entire burner plate assembly towards you, while removing or pushing aside any wiring to allow the removal of the assembly.
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 the coils with clear water, making sure to confine the spray to the area being cleaned (try to avoid getting the back ceramic wall of the unit wet). Flush the combustion chamber with fresh water. At this point, the Pinnacle should be ready to power back up.
 5. Before powering up the Pinnacle follow the steps below:
 - a. Reinstall the burner assembly. Slide gas tube into venturi.
 - b. Replace the (6) 10mm nuts to the burner plate.
 - c. Reconnect the wiring.
 - d. Turn the gas back on. **(IMPORTANT: CHECK FOR GAS LEAKS)**
 - e. Reset thermostats **(IMPORTANT: MAKE SURE EXHAUST VENT IS NO LONGER BLOCKED!)**
 - f. Turn the Pinnacle back on** and observe condensate flow.
 - g. Reconnect the condensate tubing to the outside connection.



DANGER

It is extremely important to make sure the exhaust vent is not longer blocked. Failure to do so may result in personal injury or death.

b. 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 Pinnacle down by using the following steps:
 - a. Close the manual gas shutoff valve, shut down the unit and wait for the unit to be cool to the touch.
 - b. Disconnect the condensate tubing from the outside connections (not from the Pinnacle side) so the flow can be observed.



DANGER

It is extremely important that you check for leaks when reconnecting the gas valve and make sure the exhaust vent is no longer blocked. Failure to do so may result in severe personal injury or death.

****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.

9. Inspect exhaust vent and air inlet 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).

10. Inspect exhaust vent and air inlet vent terminations for obstructions.



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10. BOILER DIMENSIONS & RATINGS

A. BOILER DIMENSIONS

- Figure 10.1 shows the dimensions of the PI-399.

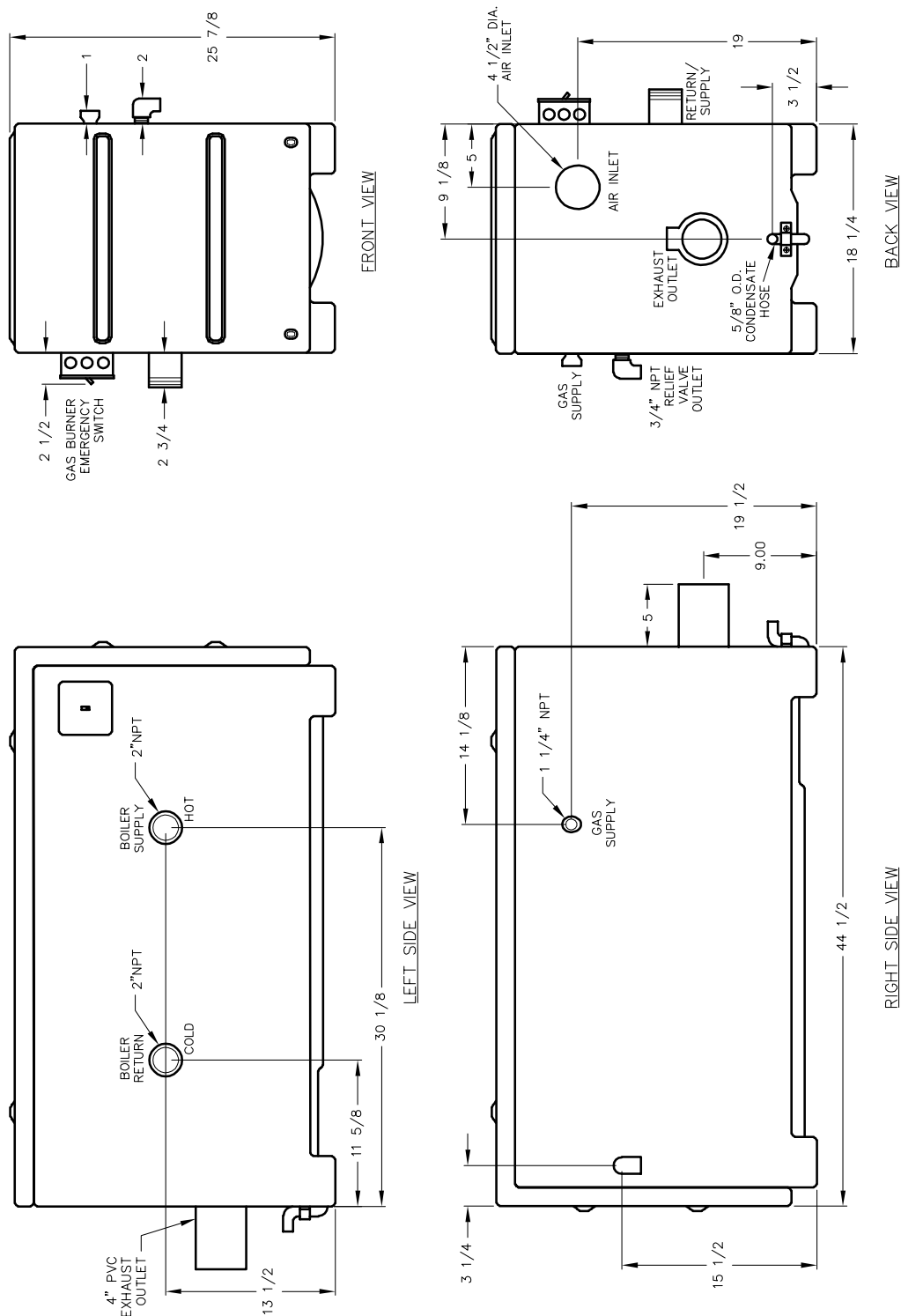


Figure 10.1: PI-399 Dimensions

Table 10.1: Boiler Ratings

Boiler Model	Input Btu/hr	Gross Output Btu/hr	Net I=B=R Water Rating^{1,2} Btu/hr	Combustion Efficiency %	Thermal Efficiency %	Shipping Weight lbs.
PI-399	100,000 to 399,000	93,000 to 379,000	330,000	95.1	93.4	252

1. Net I=B=R ratings are based on an allowance of 1.15.
2. Consult factory before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc.

Table 10.2: Combustion Air Fan Speed

Boiler Model	Fan Speed – RPM		
	High Fire	Ignition	Low Fire
PI-399	8250	5000	2500

Note: These values are subject to change without notice.

11. REPAIR PARTS

Repair parts are available from your installer or by contacting PB Heat, LLC, New Berlinville, PA. Use the Figures and Tables on Pages 38-39 to assist in ordering parts.

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

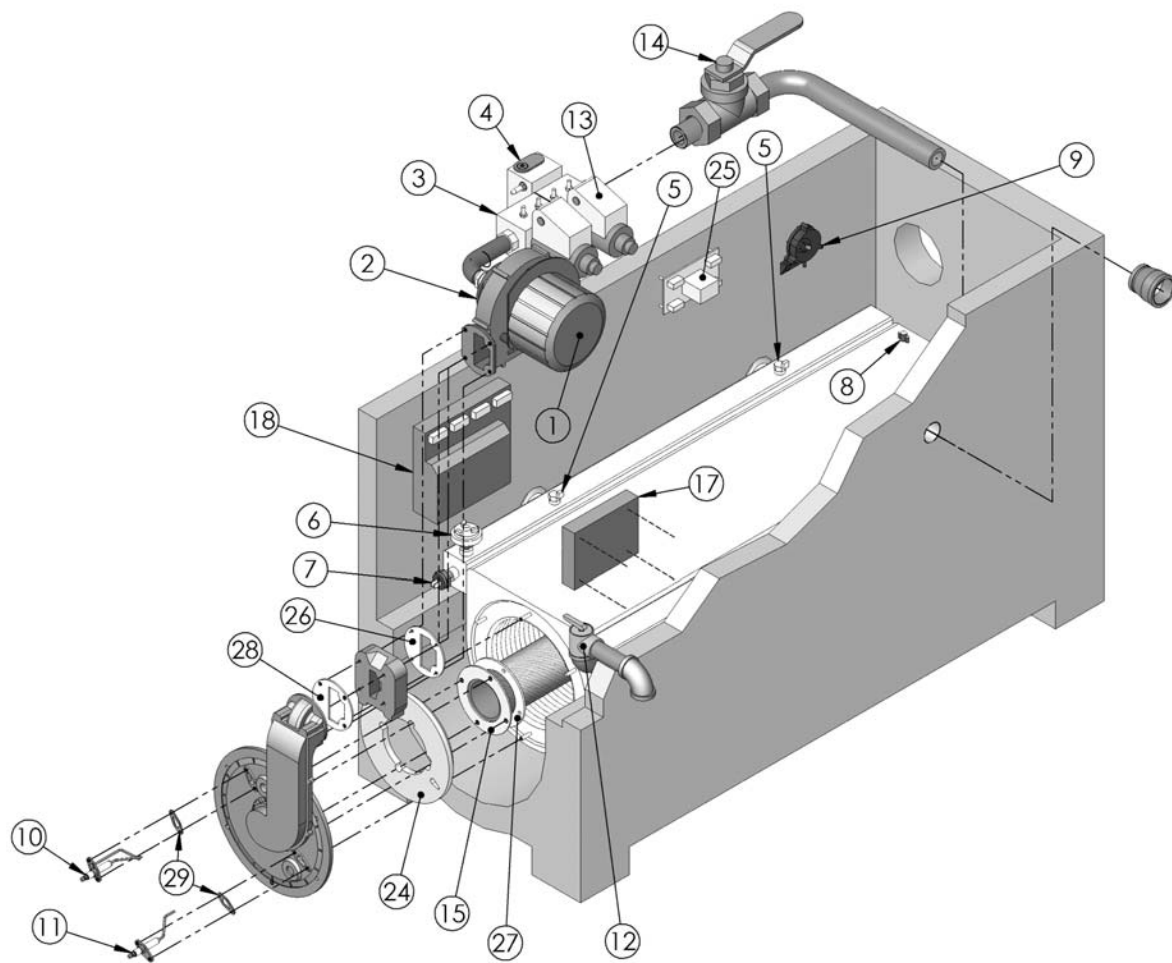


Figure 11.1: Pinnacle P399 Repair Parts

Item No.	Description	Stock Code
1	Combustion Air Blower (Includes Gasket)	91509
2	Air/Gas Venturi Mixer	91510
3	Gas Valve Body Main	91534
4	Gas Valve Body Inlet	91533
5	Supply/Return Thermistor	91532
6	Minimum Water Pressure Limit Switch	91530
7	High Water Temperature Limit Switch	91410
8	High Vent Temperature Limit Switch	91429
9	Blocked Vent Pressure Switch	91498
10	Ignition Electrode (Includes Gasket)	91411
11	Flame Sensor (Includes Gasket)	91412
12	Relief Valve	91430
13	Gas Valve Solenoid Actuator	91535
14	Manual Gas Shutoff Valve	91515
15	Burner (Includes Gasket)	91516
16	Target Wall (Not Pictured)	91432
17	P125 Display Module (Includes Ribbon Cable)	91461
18	P125 Control Board (Includes Transformer)	91519
19	Wiring Harness - 10/20 Pin, Low Voltage (Not Shown)	91520
20	Wiring Harness - 9 Pin, 120 Volt (Not Shown)	91474
21	Wiring Harness - 5 Pin, 120 Volt (Not Shown)	91473
22	Ignition Cable (Not Shown)	91476
23	Control Board Fuse (Not Shown)	91471
24	Molded Ceramic Refractory	91433
25	Gas Valve Relay	91517
26	Combustion Air Outlet Gasket	91441
27	Burner Gasket	91440
28	Spacer Block Outlet Gasket	91442
29	Ignition Electrode/Flame Sensor Gasket	91491
30	Condensate Trap Drain (Not Shown)	91531

Peerless® Pinnacle®

Stainless Steel Gas Boilers PI-399

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.



HI Division
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ASME

CONTROLS



C US



MH27745

US LISTED



PB HEAT, LLC

P.O. BOX 447 • NEW BERLINVILLE, PA 19545-0447

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