Peerless[®] CAST 92[™]

Gas Boilers



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:

\land 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.

A 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

- Cast 92[™] boilers are supplied completely assembled as packaged boilers. The package should be inspected for damage upon receipt and any damage to the unit should be reported to the shipping company and wholesaler. This boiler should be stored in a clean, dry area.
- 2. Carefully read these instructions and be sure to understand the function of all connections prior to beginning installation. Contact your PB Heat, LLC Representative for help in answering questions.
- 3. This boiler must be installed by a qualified contractor. The boiler warranty may be voided if the boiler is not installed correctly.
- 4. A hot water boiler installed above radiation or as required by the Authority having jurisdiction, must be provided with a low water fuel cut-off device either as part of the boiler or at the time of installation.

B. CODES & REGULATIONS

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

\land WARNING

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

- c. ANSI Z223.1/NFPA 54 "National Fuel Gas Code"
- d. ANSI/NFPA 70 "National Electrical Code"
- e. ANSI/NFPA 211 "Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances"
- 3. Where required by the authority having jurisdiction, the installation must conform to the Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1.

- **Please read if installing in Massachusetts** Massachusetts requires manufacturers of Side Wall Vented boilers to provide the following information from the Massachusetts code:
 - A hard wired carbon monoxide detector with an alarm and battery back-up must be installed on the floor level where the gas equipment is to be installed AND on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment.
 - In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.
 - Detector(s) must be installed by qualified licensed professionals.
 - APPROVED CARBON MONOXIDE DETECTORS: Each carbon monoxide detector shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
 - SIGNAGE: A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, "GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".
 - EXEMPTIONS to the requirements listed above:
 - The above requirements do not apply if the exhaust vent termination is seven (7) feet or more above finished grade in the area of the venting, including but not limited to decks and porches.
 - The above requirements do not apply to a boiler installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.
 - This boiler installation manual shall remain with the boiler at the completion of the installation.

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

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

PREINSTALLATION

C. BOILER LOCATION REQUIREMENTS

🕂 WARNING

Do not install the boiler unless the location meets all of the requirements in Sections 1 through 9 below. Failure to comply could result in severe personal injury, death or substantial property damage.

1. Indoor Installation Only:

- Do not install the boiler outside or in an area that would expose the boiler or its gas or electrical components to rain or dripping or spraying water.
- b. Do not install the boiler in a location that would subject the boiler to freezing. Where freeze protection is needed, follow the guidelines in this manual.

2. Flooring:

- a. The boiler can be installed on combustible flooring, but must not be installed on carpeting.
- b. The floor must be structurally sound and capable of supporting the weight of the boiler.
- c. The boiler must be leveled front to back and side to side. Use metal shims if necessary.

3. Accessibility:

Jacket parts will have to be removed for some service procedures. Ensure that the location provides a reasonable means for service and operation of the boiler.

4. System Piping, Fuel and Electrical Supply:

- The boiler must be located such that piping for water, gas, vent and air can reasonable be connected.
- b. There must be a reasonable means of providing electrical supply to the boiler.

5. Adjacent Construction:

Locate the boiler in an area that will prevent water damage to adjacent construction should a leak occur or during routine maintenance.

6. Combustion Air:

- a. Do not place the boiler in a location that would restrict the flow of combustion air into the air intake or subject the boiler to a negative air pressure in the space when using air from the boiler room.
- b. Provide required combustion air openings to the boiler room and the building (when required) when using air from the boiler room for combustion (see Section C, "Combustion Air Requirements"). If air is piped to the boiler air intake connection, combustion air openings are not required unless other appliances share the same room.

- c. Buildings will require the installation of a fresh air duct or other means of providing make-up air if the intake air option isn't used. Any building utilizing other gas burning appliances, a fireplace, wood stove or any type of exhaust fan must be checked for adequate combustion air when all of these devices are in operation at one time. Sizing of an outside air duct must be done to meet the requirements of all such devices.
- d. The boiler must be supplied with combustion air in accordance with Section 5.3, "Air for Combustion and Ventilation," of the latest revision of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and all applicable local building codes. Canadian installations must comply with CSA B149.1 or .2 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

7. Negative Room Pressure:

Never operate the boiler in an environment subjected to a negative pressure unless it is Direct Vented. Failure to comply with this warning can result in excessive levels of carbon monoxide.

8. Combustion Air Contamination:

- a. Combustion air contaminated with fluorocarbons or other halogenated compounds such as cleaning solvents and refrigerants will result in the formation of acids in the combustion chamber. These acids will cause premature failure of the boiler.
- b. <u>Construction Dust</u>: If the boiler is operated while the building is under construction it must be protected from wood, concrete, sheet rock and other types of dust. Failure to properly protect the boiler from construction dust will damage the boiler.
- c. If the boiler has been operated with contaminated air, it must be thoroughly inspected. Where possible, boiler components must be cleaned, following instructions provided in this manual and/or supplementary instructions from PB Heat. Where cleaning is not possible, the boiler may have to be replaced.
- d. Never store combustible materials, gasoline or any product containing flammable vapors or liquids in the vicinity of the boiler.

9. Clearances:

- a. All installations must provide the minimum clearances to combustible materials given in Section B, "Clearance Requirements".
- b. The installation should provide the minimum service clearances given in Section B, "Clearance Requirements", when possible. If these clearances cannot be met, then:

Ensure that boiler components can be accessed for operation/start-up/maintenance as required in this manual.

D. CLEARANCE REQUIREMENTS

1. Clearances to Combustible Surfaces:

\land WARNING

All installations must provide the minimum clearances to combustible materials and surfaces given in Table 1.1. Failure to comply could result in a fire hazard, causing severe personal injury, death or substantial property damage.

Table 1.1: Minimum Clearances to CombustibleMaterials/Surfaces for ALL Installations(Figure 1.1)

From	Inches	Millimeters
Тор	6	153
Back	6	153
Left side	6	153
Right side	6	153
Front	6	153
Rear	6	153
Vent piping	2	51
System water piping	1	25.4



Figure 1.1: Clearance to Combustibles Materials

Λ WARNING

If the boiler is located in a closed room, the room must be provided with ventilation openings even if air is ducted to the boiler. See Figure 1.1. Size the openings with a free area no less than 1 square inch per BTUH input of all Cast 92[™] boilers in the room.

EXCEPTION: Ventilation openings are not required if the boiler room provides at least the minimum SERVICE/OPERATION clearances given in Table 1.2. Failure to provide adequate ventilation could result in overheating of the boiler components or the room, potentially causing severe personal injury, death or substantial property damage. 2. Clearances for Service and Operation:

WARNING

The installation must provide reasonable access and clearance for service and operation of the boiler. Table 2 gives recommended minimum clearances for service and operation. The boiler may be installed in a space that does not provide these recommended clearances provided it is accessible for the service and operation procedures required in this manual.

Flame observation port — The flame observation port on the LEFT side of the boiler must be accessible to view the combustion chamber during boiler start-up. Make sure that the installation allows serviceman access to the left side for this purpose.

Table 1.2: Recommended Minimum Clearances for Service/Operation (Figure 1.2)

From	Inches	Millimeters
Тор	24	610
Back	24	610
Left side	24	610
Right side	24	610
Front	36	914
Rear	18	457





E. COMBUSTION AIR REQUIREMENTS

1. Air Ducted to Boiler Air Intake:

- a. If air is ducted from outside to the boiler air intake, follow instructions in Section 3, "Venting & Air Inlet Piping".
- b. If the boiler is located in a small room (clearances less than the recommended SERVICE/OPERATION clearances given in Figure 1.2):

- i. No Other Appliances in the Room: Provide two ventilation openings through one of the enclosure walls. Each opening must be sized for a free area of at least 1 square inch per 1,000 BTUH input of the Cast 92[™] boilers in the room. One opening must be within 12 inches of the ceiling, the other within 12 inches of the floor.
- ii. Other Appliances in the Same Room: The room must have combustion air openings sized for the other appliances. Increase the free area of the air openings by one square inch per 1,000 BTUH of the Cast 92[™] boilers located in the room.

2. Air From Boiler Room:

When the Boiler Draws Combustion Air from the Boiler Room:

- i. If the room volume is at least 50 cubic feet per BTUH of the combined input of all appliances in the room, no special openings are needed UNLESS the building is of tight construction (see definition). If the building is of tight construction, provide openings to the building in accordance with all applicable codes.
- ii. If the boiler is in a space smaller than 50 cubic feet volume per BTUH input, provide air openings using one of the methods in Figure 1.3.

3. **Definitions:**

- a. <u>Free Area</u>: Louvers or grilles reduce the area of an opening. Free area is the area remaining with the louver or grille in place. If the free area of a louver is unknown, use the following:
 - i. *Metal Louver*: Multiply required free area of the opening times 1.7 to determine actual area of the required opening.
 - ii. Wood Louver: Multiply required free area of the opening times 5 to determine actual area of the required opening.
- b. <u>Tight Construction</u>: When a building is extensively sealed to prevent air infiltration, it cannot provide enough air for combustion unless openings are provided to the outside. The *National Fuel Gas Code* defines such buildings as having all of the following:
 - Walls and ceilings exposed to the outside atmosphere have a continuous water vapor retarder with a rating of 1 perm or less with openings gasketed.
 - ii. Weather-stripping has been added on openable windows and doors.
 - iii. Caulking or sealants are applied to areas such as joints around windows and door frames, between sole plates and floors, between wallceiling joints, between wall panels, at penetrations for plumbing, electrical, and gas lines, and in other openings.

4. Conversion Factors:

In²/1,000 BTUH to cm²/kw — Multiply In²/1,000 BTUH times 22 In²/2,000 BTUH to cm²/kw — Multiply In²/2,000 BTUH times 11 In²/3,000 BTUH to cm²/kw — Multiply In²/3,000 BTUH times 7.4 In²/4,000 BTUH to cm²/kw — Multiply In²/4,000 BTUH times 5.5

5. Air Opening Options for Combustion Air Drawn from Boiler Room:

\land WARNING

If other appliances are located in the same room as the boiler, increase the size of air openings to provide the free area required for the other appliances in addition to the air required for the Cast 92[™] boiler(s).



Figure 1.3: Air opening options for combustion air drawn from boiler room

Upper openings **(U)** must be within 12 inches of the ceiling. Lower openings **(L)** must be within 12 inches of the floor.

Option 1 – Air Openings Through Interior Wall: When air is supplied to the boiler room through openings in an interior wall (air supply from inside the building), size each opening to provide minimum free area of:

 $1\ in^2\ per\ 1,000\ BTUH$ of all Cast $92\ {}^{\rm \tiny TM}$ boilers in the room.

Option 2 – Air Openings Through Outside Wall: When air is supplied to the boiler room through

openings in an outside wall (air supply from outside the building), size each opening to provide minimum free area of:

 $1\ in^2\ per$ 4,000 BTUH of all Cast $92\ {}^{\rm \tiny M}$ boilers in the room.

Option 3 – Horizontal Ducts to Outside Wall:

When air is supplied to the boiler room through horizontal ducts to an outside wall (air supply from outside the building), size each opening to provide minimum free area of:

1 in 2 per 3,000 BTUH of all Cast 92 $^{\rm \tiny M}$ boilers in the room.

Option 4 – Openings to Attic/Crawl Space:

Air openings can be connected to a ventilated attic or crawl space. The upper opening must be to the attic. The lower opening can be a vertical duct from the attic or an opening in the floor from the crawl space. Size each opening to provide minimum free area of:

1 in² per 3,000 BTUH of all Cast 92^{TM} boilers in the room.

Option 5 – Single Opening (not shown):

A single opening directly connected to the outdoors through a wall or a vertical or horizontal duct can be used if the installation provides the clearances of Figure 1.2, and the top of the opening is within 12 inches of the ceiling. Size the opening to provide minimum free area of:

 $1\ in^2\ per\ 3,000\ BTUH$ of all Cast $92\ {}^{\rm \tiny TM}$ boilers in the room.

2. BOILER SET-UP

A. REMOVE THE BOILER FROM THE CRATE

CAUTION

Cold weather handling — The boiler jacket includes plastic parts. If the boiler has been in a cold environment (below 0° F), allow the boiler to warm to room temperature before handling.

A CAUTION

Do not drop the boiler or allow the jacket to bump against the floor or wall when handling.

- 1. Remove the crate from the skid. But leave the boiler on the skid to move the boiler near its location.
- 2. Inspect the boiler thoroughly for any possible damage that may have occurred in shipping or handling.
- 3. Slide the boiler off of the skid into position.
- 4. Use a spirit level to check whether the boiler sides and front are vertically plumb. If not, slide metal shims under the base until the boiler is level.

B. INSTALL THE RELIEF VALVE

Check Relief Valve Pressure Setting:

Inspect the boiler relief valve before installing to ensure it is set at the pressure required for the system. You should also verify that all water system components are rated for at least the pressure setting of the relief valve to avoid component damage due to excess pressure.

\land WARNING

The boiler maximum allowable working pressure is 100 psig (700 kPa). The relief valve must never have a setting greater than 100 psig. Using a higher pressure relief valve could result in an explosion, causing possible severe personal injury, death or substantial property damage.

 Connecting the Relief Valve: Connect 3/4" NPT black iron pipe and fitting so the relief valve as shown in Figure 2.1. Follow all instructions provided in the relief valve manufacturer's instructions and labeling.

\land WARNING

Never install any type of valve between the boiler and the relief valve, or in the relief discharge piping. An explosion could occur, causing severe personal injury, death or substantial property damage. General piping requirements.



Figure 2.1: Relief valve piping

C. BOILER PIPING — GENERAL

ΜARNING

Improper piping of the boiler will void the manufacturer's warranty, and can cause boiler failure, resulting in possible severe personal injury, death or substantial property damage.

\land NOTICE

Install a shut-off valve in the boiler supply and return connections to allow isolation of the boiler for servicing when necessary.

Piping Guidelines:

- All installations must be installed by a qualified technician in accordance with the latest revision of the ANSI/ASME Boiler and Pressure Vessel Code, Section IV.
- Where required, the installation must comply with ANSI/ASME CSD-1, Standard for Controls and Safety Devices for Automatically Fired Boilers.

BOILER SET-UP

- All applicable local codes and ordinances must also be followed.
- A minimum clearance of 1" (25 mm) must be maintained between heating system pipes and all combustible construction.
- All heating system piping must be supported by suitable hangers not by the boiler.
- The thermal expansion of the system must be considered when supporting the system.
- A minimum system pressure of 12 psig (84 kPa) must be maintained.

3. VENTING & AIR INLET PIPING

\land WARNING

DO NOT install a Cast 92[™] boiler on a common vent system. All Cast 92[™] boilers must be individually vented. Failure to comply could result in improper operation of any of the appliances on the vent system, resulting in possible severe personal injury, death or substantial property damage.

When a Cast 92^{TM} boiler replaces a boiler that shared a common vent system, follow the guidelines below to check operation of the remaining appliance(s).

A. COMMON VENT SYSTEMS

If an existing boiler is removed from a common venting system, the common venting system may then be too large for the proper venting of the remaining appliances connected to it. At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

- 1. Seal any unused openings in the common venting system.
- 2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- 3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhaust, so they will operate at maximum speed. Do not operate a summer exhaust fan for a boiler installation. Close fireplace dampers.
- 4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
- 5. 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.
- 6. 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.





Heat-fab EZ Seal Joint Assembly

VENTING & AIR INLET PIPING

 Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Appendix F in the National Fuel Gas Code, ANSI Z223.1/ NFPA 54 and or CSA B149 Installation Codes.

B. VENT AND AIR PIPING, GENERAL

- 1. Pages 9 through 13 are a brief overview of the options for vent and air piping configurations and give a summary and brief list of requirements for each of the vent/air configuration options.
- 2. When air is taken from the boiler room (no air pipe connected to the boiler air inlet fitting), follow the instructions in this manual to ensure the boiler room has proper openings for combustion air and ventilation.

C. VENT PIPING

1. Category II & IV Venting Only:

All Cast 92[™] boilers require vent piping listed for use in pressurized, condensing operation. Use only the materials specified in this manual. When venting category II the flue pipe must be increased to 5 inch for the 92-2 and 6 inch for the 92-4.

2. Vent Pipe Options:

Use only Heat-fab Saf-T Vent® EZ Seal or Z-Flex® Z-Vent vent pipe and components. You will find specific component information for each configuration in this manual.

3. Vent Pipe Joint Assembly:

EZ Seal and Z-Vent vent piping use a silicon rubber ring-style gasket in each joint. Joints are secured using metal tabs that wrap around a ring on the adjacent piping component for Heat-fab vent pipe, or gear clamps for Z-Flex vent pipe. Never use screws in the vent piping. Screws are only applied to the air piping portion of Heat-fab SC concentric vent, used for concentric vent/air sidewall terminations.

D. AIR PIPING

1. Air Options:

Combustion air can be piped through the side wall or through the roof of the building. Sidewall air intake can be done with either through-the-roof or sidewall venting.

2. Air Piping Materials:

The best choices for air piping are PVC, CPVC or ABS. These materials are easy to work with and yield a clean final appearance. Joint sealing is easier than other methods because it only requires use of the standard joint sealant for the type of plastic pipe used. And there are not horizontal seams requiring sealing like on metal air piping. Other materials suitable for combustion air venting are galvanized pipe, aluminum pipe and flexible aluminum pipe. All joints, including the seams, of these piping materials must be sealed with silicone adhesive sealant, such as Dow Corning 732.

E. TERMINATIONS

1. Through-the-roof Terminations:

Both vent and air piping must terminate with a Heatfab or Z-Flex rain cap.

2. Sidewall Terminations:

Vent and air pipes can be individually terminated using Heat-fab or Z-Flex termination elbows with built-in screen, or concentrically terminated using Heat-fab type SC concentric vent/air pipe (only when using Heat-fab vent piping) Termination components as given in this manual.

F. VENT PIPED THROUGH THE ROOF (COMBUSTION AIR FROM THE BOILER ROOM)

Vent Componente	9	2-2	92-4	
Vent Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal 3"	Z-Vent 3"	EZ-Seal 4"	Z-Vent 4"
Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)	Not Required	2SVSHTA03	Not Required	2SVSHTA04
Rain Cap Vent Termination	5300CI	2SVSRCF03	5400CI	2SVSRCF04
Joint Sealant, as Needed		GE RTV106	or Equivalen	t



G. VENT PIPED THROUGH THE ROOF (AIR PIPED THROUGH SIDE WALL)

	92-2			92-4	
Vent Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex	
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal 3"	Z-Vent 3"	EZ-Seal 4"	Z-Vent 4"	
Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)	Not Required	2SVSHTA03	Not Required	2SVSHTA04	
Rain Cap Vent Termination	5300CI	2SVSRCF03	5400CI	2SVSRCF04	
Joint Sealant, as Needed	GE RTV106 or Equivalent				
Air Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex	
Termination Elbow	9314TERM	2SVSTEX0390	9414TERM	2SVSTEX0490	
Termination Pipe Section (1 ft)	9302	2SVEPWCF0301	9402	2SVEPWCF0401	
Termination Thimble	9393S	2SVSWTE03	9493S	2SVSWTE04	
Gear Clamp (Nose Clamp)	3" Clamp	7HS44XX	4" Clamp	7HS64XX	
Air Piping/Components (Incl. Supports, Thimbles, etc.)	3" PVC, CPVC, ABS, Galvanized or Aluminum			, CPVC, ABS, ed or Aluminum	



H. VENT & AIR PIPED THROUGH THE ROOF (SEPARATE VENT AND AIR TERMINATIONS)

	92-2			92-4
Vent Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal 3"	Z-Vent 3"	EZ-Seal 4"	Z-Vent 4"
Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)	Not Required	2SVSHTA03	Not Required	2SVSHTA04
Rain Cap Vent Termination	5300CI	2SVSRCF03	5400CI	2SVSRCF04
Joint Sealant, as Needed	GE RTV106 or Equivalent			
Air Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Rain Cap Termination	5300CI	2SVSRCF03	5400CI	2SVSRCF04
Termination Pipe Section (3 ft)*	9307	2SVEPWCF0303	9407	2SVEPWCF0304
*Note: Standard air piping termination pipe section is 3 feet. A longer length can be used if needed.				er length can be
Air Piping/Components (Incl. Supports, Thimbles, etc.)		, CPVC, ABS, ed or Aluminum		, CPVC, ABS, ed or Aluminum



I. VENT PIPED THROUGH A SIDE WALL (COMBUSTION AIR FROM THE BOILER ROOM)

Next Common and	92-2			92-4
Vent Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal 3"	Z-Vent 3"	EZ-Seal 4"	Z-Vent 4"
Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)	Not Required	2SVSHTA03	Not Required	2SVSHTA04
Joint Sealant, as Needed	GE RTV106 or Equivalent			
Termination Elbow	9314TERM	2SVSTEX0390	9414TERM	2SVSTEX0490
Termination Pipe Section (1 ft)	9302	2SVEPWCF0301	9402	2SVEPWCF0401
Termination Thimble	9393S	2SVSWTE03	9493S	2SVSWTE04
Gear Clamp (Nose Clamp)	3" Clamp	7HS44XX	4" Clamp	7HS64XX



J. VENT & AIR PIPED THROUGH A SIDE WALL (SEPARATE VENT AND AIR TERMINATIONS)

	92-2			92-4
Vent Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal 3"	Z-Vent 3"	EZ-Seal 4"	Z-Vent 4"
Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)	Not Required	2SVSHTA03	Not Required	2SVSHTA04
Termination Elbow	9314TERM	2SVSTEX0390	9414TERM	2SVSTEX0490
Termination Pipe Section (1 ft)	9302	2SVEPWCF0301	9402	2SVEPWCF0401
Termination Thimble	9393S	2SVSWTE03	9493S	2SVSWTE04
Gear Clamp (Nose Clamp)	3" Clamp	7HS44XX	4" Clamp	7HS64XX
Joint Sealant, as Needed		GE RTV106	or Equivalen	t
Air Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Termination Elbow	Same as Vent Termination		Same as V	lent Termination
Air Piping/Components (Incl. Supports, Thimbles, etc.)	3" PVC, CPVC, ABS, Galvanized or Aluminum			, CPVC, ABS, ed or Aluminum



K. VENT & AIR PIPED THROUGH A SIDE WALL (CONCENTRIC VENT/AIR TERMINATION)

	92-2	92-4
Vent Components	Heat-Fab	Heat-Fab
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal, 3" Piping Saf-T Vent SC Fittings for Termination Assembly	EZ-Seal, 4" Piping Saf-T Vent SC Fittings for Termination Assembly
Termination Assembly: • Single-wall Adapter • Air Intake Tee • 6" Straight Section • 12" Straight Section • Wall Plate (2 Required) • Termination Adapter • Mitered Termination	SC03ADEZ SC03TAD3 SC0366 SC03L12 SC03FS SC03HT 9390	SC04ADEZ SC04TAD3 SC0466 SC04L12 SC04FS SC04FT 9490
Joint Sealant, as Needed	GE RTV106	or Equivalent
Air Components	Heat-Fab	Heat-Fab
Air Piping/Components (Also Supports, Thimbles, etc.)	3" PVC, CPVC, ABS, Galvanized or Aluminum	4" PVC, CPVC, ABS, Galvanized or Aluminum



3A. VENT & AIR PIPING: THROUGH THE ROOF (COMBUSTION AIR FROM THE BOILER ROOM)

WARNING

The vent piping operates with positive pressure. The vent piping must be completely sealed and securely supported.

Use only the vent components listed in this manual. Use of any other materials could result in vent system failure.

Exposed vent pipe poses a potential burn hazard to people and pets. Insulate or shield the pipe where necessary to prevent risk.

Never drill through, or install screws into, the vent pipe or vent components.

Failure to properly install the vent piping could result in flue gas leakage, causing possible severe personal injury, death or substantial property damage.

\land NOTICE

Code compliance – Follow all applicable local codes when installing the vent system. Where codes differ from this manual, follow code requirements. Contact PB Heat if you have any questions regarding the installation.

\Lambda WARNING

Terminate the vent following the guidelines in this manual. Avoid vent termination locations likely to be affected by winds, snowdrifts, people and pets. Protect building materials and vegetation from degradation caused by the flue gases and condensation.

A. BOILER VENT CONNECTION

1. The vent connection at the boiler is for Heat-Fab EZ-Seal vent piping only. To use Z-Flex Z-Vent venting you must install the Z-Vent adapter, part number 2SVSHTA03 (92-2) or 2SVSHTA04 (92-4).



EZ-Seal Vent Attachment Z-Vent Adapter



Attachment

- 2. EZ-Seal Connection: Insert EZ-Seal pipe male end into the boiler connection. Make sure the locking tabs slide under the EZ-Seal locking ring. Bend back locking tabs to complete the joint. Follow EZ-Seal instructions to complete the vent piping installation.
- 3. Z-Vent adapter Installation: Insert male end of adapter into boiler vent connection. Make sure the locking tabs slide under the gear clamp on the adapter. Bend back the locking tabs (as in left illustration above). Then tighten the adapter gear clamp to finish the connection. Follow Z-Vent instructions to connect Z-Vent piping.



Figure 3A.1: Vertical Venting

4. Slope horizontal runs toward the boiler. All horizontal runs of vent pipe must slope continuously at least 1/4" per foot (21 mm per meter) to ensure condensate drains completely back to the boiler. DO NOT install the vent piping with any sections that could trap condensate.

B. VENT PIPING COMPONENTS

- 1. See Table 3A.1 for acceptable vent components. NO OTHER vent materials are acceptable.
- 2. Carefully follow the instructions supplied by the vent piping manufacturer.
- 3. The vent joints seal with elastomer rings in the pipe and fittings. Avoid damaging these seals.
- 4. Cutting Z-Vent Pipe (Z-Vent only DO NOT cut EZ-Seal Pipe): Length adjustments with Z-Vent pipe can be made by cutting the pipe, following the Z-Vent instructions. Be sure to cut the pipe squarely and to file the cut edge smooth after cutting. Rough pipe ends will damage the seals. Support the pipe when cutting to avoid making the pipe out of round.
- 5. Adjustable Lengths of EZ-Seal Pipe: Length adjustments with EZ-Seal piping are made with slip-fit adjustable length sections, not by cutting the pipe. Make sure the adjustable length does not jut into elbows or terminations. This could block flue gas and condensate flow.
- 6. Maximum Vent Piping Length: See the table in Figure 3A.1 for the maximum allowable length. Each elbow causes the same pressure drop as 10 feet of vent pipe, so the allowable length reduces 10 feet for each elbow used in the piping. When 45° elbows are used, two 45° elbows are equivalent to one 90° elbow.
- 7. Insulate the vent piping where it passes through unheated areas to prevent condensate freeze-up.
- 8. If the pipe passes through an occupied space, install a chase around the pipe, following the vent pipe instructions and applicable codes.
- 9. *Clearance from Combustible Materials*: Provide minimum clearance to all combustible materials of at least 2 inches (51 mm).
- 10. Using an Existing Chimney as a Chase: The vent piping can be routed through an existing UNUSED and STRAIGHT chimney. DO NOT vent directly into the chimney. Install the vent piping so it can be inspected after installation. Follow vent pipe manufacturer's instructions for chimney-as-chase installations.

C. SUPPORT THE VENT PIPING COMPLETELY

1. DO NOT use the boiler vent connection to support the vent piping. Provide support straps from the ceiling or noncombustible saddle or pedestal supports from the floor. This is required on ALL installations, regardless of the length of the horizontal piping connected to the boiler.

- 2. Vent piping cannot be supported from above (such as relying on roof jack sections). You must install supports on the horizontal piping before the vent turns upward.
- 3. Install at least one support on every horizontal run. For horizontal runs longer than 5 feet (1.5 m), install a support every 3 feet (0.9 m).
- 4. Follow the vent pipe manufacturer's instructions for placement and installation of supports.

D. FLOOR AND WALL PENETRATIONS

- 1. Follow applicable codes and the vent pipe instructions to install fire stops, thimbles or other devices at all floor and wall penetrations.
- 2. Provide minimum 2 inches (51 mm) clearance to all combustible construction.

E. ROOF PENETRATIONS

Follow applicable codes and the vent pipe instructions to install a roof jack, flashing and support. Long extensions of vent pipe above the roof may require the use of guy supports as specified in the vent pipe instructions.

F. RAIN CAP TERMINATION

1. Use only the rain caps listed in Table 3A.1.

Table 3A.1: Vent and Air System Components

Vant Components	9	92-2		2-4
Vent Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal 3"	Z-Vent 3"	EZ-Seal 4"	Z-Vent 4"
Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)	Not Required	2SVSHTA03	Not Required	2SVSHTA04
Rain Cap Vent Termination	5300CI	2SVSRCF03	5400CI	2SVSRCF04
Joint Sealant, as Needed		GE RTV106	or Equivalen	t

- 2. The rain cap exhaust opening must be at least 2 feet (0.6 m) above the highest roof point within 10 feet, as shown in Figure 3A.1. See the *National Fuel Gas Code, ANSI/NFPA 54* for details on pitched roof applications.
- 3. See Figure 3A.2 for additional minimum clearances.



Figure 3A.2: Vent Termination Minimum Clearances

G. COMBUSTION AIR OPENINGS

Combustion air must be supplied from the boiler room as shown in Figure 1.1. Make sure the installation provides air openings as required by applicable codes and this manual.

H. MULTIPLE BOILER INSTALLATIONS

- 1. Each boiler must be individually vented. DO NOT use combined venting.
- 2. Install multiple vents through the roof following all guidelines for single-vent installations.
- 3. Install the vents so they are no closer than 12 inches on centers.

3B. VENT & AIR PIPING: THROUGH THE ROOF (AIR PIPED THROUGH SIDE WALL)

\land WARNING

The vent piping operates with positive pressure. The vent piping must be completely sealed and securely supported.

Use only the vent components listed in this manual. Use of any other materials could result in vent system failure.

Exposed vent pipe poses a potential burn hazard to people and pets. Insulate or shield the pipe where necessary to prevent risk.

Never drill through, or install screws into, the vent pipe or vent components.

Failure to properly install the vent piping could result in flue gas leakage, causing possible severe personal injury, death or substantial property damage.

Code compliance – Follow all applicable local codes when installing the vent system. Where codes differ from this manual, follow code requirements. Contact PB Heat if you have any questions regarding the installation.

\land WARNING

Terminate the vent and air piping following the guidelines in this manual. Avoid vent termination locations likely to be affected by winds, snowdrifts, people and pets. Protect building materials and vegetation from degradation caused by the flue gases and condensation.

A. BOILER VENT CONNECTION

1. The vent connection at the boiler is for Heat-Fab EZ-Seal vent piping only. To use Z-Flex Z-Vent venting you must install the Z-Vent adapter, part number 2SVSHTA03 (92-2) or 2SVSHTA04 (92-4).



EZ-Seal Vent Attachment



Z-Vent Adapter Attachment

- 2. *EZ-Seal Connection*: Insert EZ-Seal pipe male end into the boiler connection. Make sure the locking tabs slide under the EZ-Seal locking ring. Bend back locking tabs to complete the joint. Follow EZ-Seal instructions to complete the vent piping installation.
- 3. *Z-Vent Adapter Installation*: Insert male end of adapter into boiler vent connection. Make sure the locking tabs slide under the gear clamp on the adapter. Bend back the locking tabs (as in left illustration above). Then tighten the adapter gear clamp to finish the connection. Follow Z-Vent instructions to connect Z-Vent piping.



Figure 3B.1: Vertical Venting/Sidewall Air

4. Slope horizontal runs toward the boiler. All horizontal runs of vent pipe must slope continuously at least 1/4" per foot (21 mm per meter) to ensure condensate drains completely back to the boiler. DO NOT install the vent piping with any sections that could trap condensate.

B. VENT PIPING COMPONENTS

- 1. See Table 3B.1 for acceptable vent components. NO OTHER vent materials are acceptable.
- 2. Carefully follow the instructions supplied by the vent piping manufacturer.
- 3. The vent joints seal with elastomer rings in the pipe and fittings. Avoid damaging these seals.
- 4. Cutting Z-Vent Pipe (Z-Vent only DO NOT cut EZ-Seal Pipe): Length adjustments with Z-Vent pipe can be done by cutting the pipe, following the Z-Vent instructions. Be sure to cut the pipe squarely and to file the cut edge smooth after cutting. Rough pipe ends will damage the seals. Support the pipe when cutting to avoid making the pipe out of round.
- 5. Adjustable Lengths of EZ-Seal Pipe: Length adjustments with EZ-Seal piping are done with slip-fit adjustable length sections, not by cutting the pipe. Make sure the adjustable length does not jut into elbows or terminations. This could block flue gas and condensate flow.
- 6. Maximum Vent Piping Length: See the table in Figure 3B.1 for the maximum allowable length. Each elbow causes the same pressure drop as 10 feet of vent pipe, so the allowable length reduces 10 feet for each elbow used in the piping. When 45° elbows are used, two 45° elbows are equivalent to one 90° elbow.
- 7. Insulate the vent piping where it passes through unheated areas to prevent condensate freeze-up.
- 8. If the pipe passes through an occupied space, install a chase around the pipe, following the vent pipe instructions and applicable codes.
- 9. Clearance from Combustible Materials: Provide minimum clearance to all combustible materials of at least 2 inches (51 mm).
- 10. Using an Existing Chimney as a Chase: The vent piping can be routed through an existing STRAIGHT chimney. DO NOT vent directly into the chimney. Install the vent piping so it can be inspected after installation. Follow vent pipe manufacturer's instructions for chimney-as-chase installations.

C. SUPPORT THE VENT PIPING COMPLETELY

1. DO NOT use the boiler vent connection to support the vent piping. Provide support straps from the ceiling or noncombustible saddle or pedestal supports from the floor. This is required on ALL installations, regardless of the length of the horizontal piping connected to the boiler.

- 2. Install at least one support on every horizontal run. For horizontal runs longer than 5 feet (1.5 m), install a support every 3 feet (0.9 m).
- 3. Vent piping cannot be supported from above (such as relying on roof jack sections). You must install supports on the horizontal piping before the vent turns upward. Provide a support on the horizontal piping within 6 inches of every upturned elbow to support the vertical run.
- 4. Follow the vent pipe manufacturer's instructions for placement and installation of supports.

D. FLOOR AND WALL PENETRATIONS

- 1. Follow applicable codes and the vent pipe instructions to install fire stops, thimbles or other devices at all floor and wall penetrations.
- 2. Provide minimum 2 inches (51 mm) clearance to all combustible construction.

E. ROOF PENETRATIONS

Follow applicable codes and the vent pipe instructions to install a roof jack, flashing and support. Long extensions of vent pipe above the roof may require the use of guy supports as specified in the vent pipe instructions.

F. RAIN CAP TERMINATION

1. Use only the rain caps listed in Table 3B.1.

Table 3B.1: Vent and Air System Components

Next Common anto	92-2			92-4
Vent Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal 3"	Z-Vent 3"	EZ-Seal 4"	Z-Vent 4"
Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)	Not Required	2SVSHTA03	Not Required	2SVSHTA04
Rain Cap Vent Termination	5300CI	2SVSRCF03	5400CI	2SVSRCF04
Joint Sealant, as Needed	GE RTV106 or Equivalent			
Air Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Termination Elbow	9314TERM	2SVSTEX0390	9414TERM	2SVSTEX0490
Termination Pipe Section (1 ft)	9302	2SVEPWCF0301	9402	2SVEPWCF0401
Termination Thimble	9393S	2SVSWTE03	9493S	2SVSWTE04
Gear Clamp (Nose Clamp)	3" Clamp	7HS44XX	4" Clamp	7HS64XX
Air Piping/Components (Incl. Supports, Thimbles, etc.)		, CPVC, ABS, ed or Aluminum		, CPVC, ABS, ed or Aluminum

- 2. The rain cap exhaust opening must be at least 2 feet (0.6 m) above the highest roof point within 10 feet, as shown in Figure 3B.1. See the *National Fuel Gas Code, ANSI/NFPA 54* for details on pitched roof applications.
- 3. See Figure 3B.2 for additional minimum clearances.



Figure 3B.2: Termination Minimum Clearances

\Lambda WARNING

COMBUSTION AIR MUST BE UNCONTAMINATED

Construction dust: If the boiler is operated while the building is under construction it must be protected from wood, concrete, sheet rock and other types of dust. Failure to properly protect the boiler from construction dust will damage the boiler.

Combustion air contaminated with fluorocarbons or other halogenated compounds, such as laundry products, cleaning solvents and refrigerants will result in the formation of acids in the combustion chamber and vent piping. These acids will cause premature failure of the boiler and vent, causing possible severe personal injury, death or substantial property damage.

If the boiler room, or any room through which the air piping travels, may contain contaminants as listed above, you MUST seal air pipe joints with silicone RTV to prevent contaminants from entering the boiler combustion air. The finished air piping installation must be air-tight and water-tight.

G. AIR PIPE CONNECTION

- 1. Before installing the air piping, install the air pipe sidewall termination assembly (Item D, Figure 3B.1). See instructions following.
- Construct the air piping from PVC, CPVC or ABS plastic, or galvanized or aluminum metallic pipe (including flexible aluminum duct if desired).

\land NOTICE

When using metallic piping, seal all of the longitudinal seam joints in addition to the component joints.

3. Attach the air piping to the boiler air connection, preferably using silicone RTV to seal the connection. If the boiler room air is free of contaminants you can use metallic duct tape to seal the joints. With age, however, duct tape adhesives can loosen, so duct tape is not as reliable as silicone RTV.

- 4. If the installation is required to meet direct vent (sealed combustion) requirements, seal all joints withe silicone RTV. The air pipe installation must be air-tight and water-tight.
- 5. Maximum air piping length: See the table in Figure 3B.1, for the maximum allowable length. Each elbow causes the same pressure drop as 10 feet of vent pipe, so the allowable length reduces 10 feet for each elbow used in the piping. When 45° elbows are used, two 45° elbows are equivalent to one 90° elbow.

H. SUPPORTING AIR PIPING

- 1. DO NOT use the boiler air connection to support the air piping. Provide support straps from the ceiling or install wall brackets.
- 2. Provide at least one support on all air pipe installations.
- 3. Provide a support every 3 feet for air pipe lengths greater than 5 feet horizontally.
- 4. Provide a support on the horizontal piping within 6 inches of every upturned elbow to support the vertical run.

I. AIR PIPE TERMINATION

1. See Table 3B.1 for part numbers of the sidewall termination components required for Z-Vent and EZ-Seal air pipe installations. The air piping termination must be constructed using the stainless steel vent materials listed in Table 3B.1 to ensure the configuration is correct. DO NOT terminate the air piping with any other method.

2. Termination Assembly Components:

a. <u>Wall Thimble</u>: Use only the thimble listed in Table 3B.1. The hole in the thimble will prevent the pipe length (B) from being pushed inward. The raised portion of the pipe female end is too large to pass through the hole in the thimble. Follow the vent pipe manufacturer's instructions supplied with the thimble. If the wall thimble isn't long enough for the application, follow the vent manufacturer's instructions to add an extension.

<u>Alternate Construction</u>: The air pipe can be inserted through a hole without using a thimble. For this option, attach a storm collar on both the inside and outside walls at the penetration. Before attaching the collars, seal around the air pipe thoroughly with silicone RTV to prevent air leakage or insect access. The storm collar tightens around the vent pipe with a gear clamp. This prevents movement of the finished assembly. You will still need to use the length of vent pipe and the termination elbow described below.

b. <u>Length of Vent Pipe</u>: Use a 1-foot length of vent pipe as listed in Table 3B.1 unless the wall penetration requires a longer length. If a longer length is required, use a length of EZ-Seal or Z-Vent long enough for the application.

Insert the pipe from OUTSIDE, male end first. The pipe will stop at the raised section of the female end.



Figure 3B.1: Vertical Venting/Sidewall Air (Partially Repeated from Page 17)



Figure 3B.2: Sidewall Air Pipe Termination Assembly

c. <u>Gear Clamp</u>: Use a hose clamp or a gear clamp manufactured by the vent manufacturer (see Table 3B.2).

Slide the clamp over the male end of the pipe after the pipe has been inserted from outside.

From the inside, pull the pipe so it is firmly against the outside plate.

Push the gear clamp against the inside plate and tighten securely. This will prevent the termination assembly from being pushed outward.

d. <u>Termination Elbow</u>: Use only the termination elbow listed in Table 3B.2. The elbow must be pointed downward.

Before inserting the male end of the elbow into the pipe, apply a bead of silicone RTV and spread around the end.

Insert the termination elbow and secure using the vent pipe manufacturer's joint assembly procedure.

<u>Termination Location</u>: Install the air pipe termination where it meets the minimum clearances shown in Figure 3B.4.

Appliance exhaust outlets: Install the air intake at least 2 feet below and 5 feet horizontally from any appliance vent outlet.

Exiting below grade or minimum height: See Figure 3B.5. When the air pipe must exit the building below grade or below the minimum height for the termination elbow, install vertical piping as necessary for the termination elbow to be high enough to meet the minimum clearances of Figure 3B.4. Make sure to support the piping using wall brackets available from the vent pipe manufacturer.



Figure 3B.4: Minimum Clearances to Air Termination



Figure 3B.2: Using External Piping to Raise the Termination

J. MULTIPLE BOILER INSTALLATIONS

1. Venting Multiple Boilers:

- a. Each boiler must be individually vented. DO NOT use combined venting.
- b. Install multiple vents through the roof following all guidelines for single-vent installations.
- c. Install the vents so they are no closer than 12 inches on centers.

2. Air Piping for Multiple Boilers:

- a. Air for each boiler must be individually piped. DO NOT use combined air piping.
- b. Install multiple air pipes through the side wall following all guidelines for single-air pipe installations.
- c. Install the terminations so they are no closer than $12 \ \mbox{inches}$ on centers.

3C. VENT PIPING: THROUGH THE ROOF (SEPARATE TERMINATIONS)

WARNING

The vent piping operates with positive pressure. The vent piping must be completely sealed and securely supported.

Use only the vent components listed in this manual. Use of any other materials could result in vent system failure.

Exposed vent pipe poses a potential burn hazard to people and pets. Insulate or shield the pipe where necessary to prevent risk.

Never drill through, or install screws into, the vent pipe or vent components.

Failure to properly install the vent piping could result in flue gas leakage, causing possible severe personal injury, death or substantial property damage.

NOTICE

Code compliance – Follow all applicable local codes when installing the vent system. Where codes differ from this manual, follow code requirements. Contact PB Heat if you have any questions regarding the installation.

\Lambda WARNING

Terminate the vent and air piping following the guidelines in this manual. Avoid vent termination locations likely to be affected by winds, snowdrifts, people and pets. Protect building materials and vegetation from degradation caused by the flue gases and condensation.

A. BOILER VENT CONNECTION

1. The vent connection at the boiler is for Heat-Fab EZ-Seal vent piping only. To use Z-Flex Z-Vent venting you must install the Z-Vent adapter, part number 2SVSHTA03 (92-2) or 2SVSHTA04 (92-4).





EZ-Seal Vent Attachment Z-Vent Adapter

Attachment

- 2. EZ-Seal Connection: Insert EZ-Seal pipe male end into the boiler connection. Make sure the locking tabs slide under the EZ-Seal locking ring. Bend back locking tabs to complete the joint. Follow EZ-Seal instructions to complete the vent piping installation.
- 3. Z-Vent Adapter Installation: Insert male end of adapter into boiler vent connection. Make sure the locking tabs slide under the gear clamp on the adapter. Bend back the locking tabs (as in left illustration above). Then tighten the adapter gear clamp to finish the connection. Follow Z-Vent instructions to connect Z-Vent piping.





4. Slope horizontal runs toward the boiler. All horizontal runs of vent pipe must slope continuously at least 1/4" per foot (21 mm per meter) to ensure condensate drains completely back to the boiler. DO NOT install the vent piping with any sections that could trap condensate.

B. VENT PIPING COMPONENTS

1. See Table 3C.1 for acceptable vent components. NO OTHER vent materials are acceptable.

	92-2			92-4
Vent Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal 3"	Z-Vent 3"	EZ-Seal 4"	Z-Vent 4"
Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)	Not Required	2SVSHTA03	Not Required	2SVSHTA04
Rain Cap Vent Termination	5300CI	2SVSRCF03	5400CI	2SVSRCF04
Joint Sealant, as Needed	GE RTV106 or Equivalent			
Air Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Rain Cap Termination	5300CI	2SVSRCF03	5400CI	2SVSRCF04
Termination Pipe Section (3 ft)*	9307	2SVEPWCF0303	9407	2SVEPWCF0304
*Note: Standard air piping termination pipe section is 3 feet. A longer length can be used if needed.				
Air Piping/Components (Incl. Supports, Thimbles, etc.)		, CPVC, ABS, ed or Aluminum		, CPVC, ABS, ed or Aluminum

Table 3C.1: Vent System Components

- 2. Carefully follow the instructions supplied by the vent piping manufacturer.
- 3. The vent joints seal with elastomer rings in the pipe and fittings. Avoid damaging these seals.
- 4. Cutting Z-Vent Pipe (Z-Vent only DO NOT cut EZ-Seal Pipe): Length adjustments with Z-Vent pipe can be done by cutting the pipe, following the Z-Vent instructions. Be sure to cut the pipe squarely and to file the cut edge smooth after cutting. Rough pipe ends will damage the seals. Support the pipe when cutting to avoid making the pipe out of round.
- 5. Adjustable Lengths of EZ-Seal Pipe: Length adjustments with EZ-Seal piping are done with slip-fit adjustable length sections, not by cutting the pipe. Make sure the adjustable length does not jut into elbows or terminations. This could block flue gas and condensate flow.
- 6. Maximum Vent Piping Length: See the table in Figure 3C.1 for the maximum allowable length. Each elbow causes the same pressure drop as 10 feet of vent pipe, so the allowable length reduces 10 feet for each elbow used in the piping. When 45° elbows are used, two 45° elbows are equivalent to one 90° elbow.
- 7. Insulate the vent piping where it passes through unheated areas to prevent condensate freeze-up.

- 8. If the pipe passes through an occupied space, install a chase around the pipe, following the vent pipe instructions and applicable codes.
- 9. Clearance from combustible materials: Provide minimum clearance to all combustible materials of at least 2 inches (51 mm).
- 10. Using an existing chimney as a chase: The vent piping and air piping can be routed through an existing UNUSED and STRAIGHT chimney. DO NOT vent directly into the chimney. Install the vent piping so it can be inspected after installation. Follow vent pipe manufacturer's instructions for chimney-as-chase installations.

C. SUPPORT THE VENT PIPING COMPLETELY

- 1. DO NOT use the boiler vent connection to support the vent piping. Provide support straps from the ceiling or noncombustible saddle or pedestal supports from the floor. This is required on ALL installations, regardless of the length of the horizontal piping connected to the boiler.
- 2. Install at least one support on every horizontal run. For horizontal runs longer than 5 feet (1.5 m), install a support every 3 feet (0.9 m).
- 3. Vent piping cannot be supported from above (such as relying on roof jack sections). You must install supports on the horizontal piping before the vent turns upward. Provide a support on the horizontal piping within 6 inches of every upturned elbow to support the vertical run.
- 4. Follow the vent pipe manufacturer's instructions for placement and installation of supports.

D. FLOOR AND WALL PENETRATIONS

- 1. Follow applicable codes and the vent pipe instructions to install fire stops, thimbles or other devices at all floor and wall penetrations.
- 2. Provide minimum 2 inches (51 mm) clearance to all combustible construction.

E. ROOF PENETRATIONS

Follow applicable codes and the vent pipe instructions to install a roof jack, flashing and support. Long extensions of vent pipe above the roof may require the use of guy supports as specified in the vent pipe instructions.

F. RAIN CAP TERMINATION

- 1. Use only the rain caps listed in Table 3C.1.
- 2. The rain cap exhaust opening must be at least 2 feet (0.6 m) above the highest roof point within 10 feet, as shown in Figure 3C.1. See the *National Fuel Gas Code, ANSI/NFPA 54* for details on pitched roof applications.

3. See Figure 3C.2 for additional minimum clearances. The vent must always terminate at least 4 feet (1.2 m) above the air intake termination.



Figure 3C.2: Termination Minimum Clearances

\land WARNING

COMBUSTION AIR MUST BE UNCONTAMINATED

Construction dust: If the boiler is operated while the building is under construction it must be protected from wood, concrete, sheet rock and other types of dust. Failure to properly protect the boiler from construction dust will damage the boiler.

Combustion air contaminated with fluorocarbons or other halogenated compounds, such as laundry products, cleaning solvents and refrigerants will result in the formation of acids in the combustion chamber and vent piping. These acids will cause premature failure of the boiler and vent, causing possible severe personal injury, death or substantial property damage.

If the boiler room, or any room through which the air piping travels, may contain contaminants as listed above, you MUST seal air pipe joints with silicone RTV to prevent contaminants from entering the boiler combustion air. The finished air piping installation must be air-tight and water-tight.

G. AIR PIPE CONNECTION

1. Construct the air piping from PVC, CPVC or ABS plastic, or galvanized or aluminum metallic pipe (including flexible aluminum duct if desired).

NOTICE

When using metallic piping, seal all of the longitudinal seam joints in addition to the component joints.

- 2. Attach the air piping to the boiler air connection, preferably using silicone RTV to seal the connection. If the boiler room air is free of contaminants you can use metallic duct tape to seal the joints. With age, however, duct tape adhesives can loosen, so duct tape is not as reliable as silicone RTV.
- 3. If the installation is required to meet direct vent (sealed combustion) requirements, seal all joints with silicone RTV. The air pipe installation must be air-tight and water-tight.
- 4. The air piping connects to the stainless steel pipe section attached to the air intake rain cap termination (Item F, Figure 3C.1). See instructions following.
- 5. Maximum air piping length: See the table in Figure 3C.1 for the maximum allowable length. Each elbow causes the same pressure drop as 10 feet of vent pipe, so the allowable length reduces 10 feet for each elbow used in the piping. When 45° elbows are used, two 45° elbows are equivalent to one 90° elbow.

H. SUPPORTING AIR PIPING

- 1. DO NOT use the boiler air connection to support the air piping. Provide support straps from the ceiling or install wall brackets.
- 2. Provide at least one support on all air pipe installations.
- 3. Provide a support every 3 feet for air pipe lengths greater than 5 feet horizontally.
- 4. Provide a support on the horizontal piping within 6 inches of every upturned elbow to support the vertical run.

I. AIR PIPE TERMINATION

1. See Table 3C.1 for part numbers of the vertical termination components required for Z-Vent and EZ-Seal air pipe installations. The air piping termination must be constructed using the stainless steel vent materials listed in Table 3C.1 to ensure the configuration is correct. DO NOT terminate the air piping with any other method.

2. Termination Assembly Components:

a. <u>Rain Cap</u>: Use only the rain cap listed in Table 3C.1, the same cap as used on the vent termination.

Install the rain cap so it meets the minimum clearances shown in Figure 3C.2.

b. <u>Length of Vent Pipe</u>: Use a 3-foot length of vent pipe as listed in Table 3C.1 unless the roof penetration requires a longer length to meet minimum clearances. If a longer length is required, use a length of EZ-Seal or Z-Vent long enough for the application.

Attach the air piping to the male end (bottom end) of the stainless steel pipe.

c. Roof penetration components: Use the same components as used for the vent penetration.

J. MULTIPLE BOILER INSTALLATIONS

1. Venting Multiple Boilers:

- a. Each boiler must be individually vented. DO NOT use combined venting.
- b. Install multiple vents through the roof following all guidelines for single-vent installations.
- c. Install the vents so they are no closer than $12 \,$ inches on centers.
- d. Provide minimum 5 feet between the center line of any vent termination and any air intake termination.

2. Air Piping for Multiple Boilers:

- a. Air for each boiler must be individually piped. DO NOT use combined air piping.
- b. Install multiple air pipes through the side wall following all guidelines for single-air pipe installations.
- c. Install the terminations so they are no closer than $12 \ \mbox{inches}$ on centers.
- d. Provide minimum 5 feet between the center line of any vent termination and any air intake termination.

3D. VENT & AIR PIPING: THROUGH A SIDE WALL (COMBUSTION AIR FROM THE BOILER ROOM)

WARNING

The vent piping operates with positive pressure. The vent piping must be completely sealed and securely supported.

Use only the vent components listed in this manual. Use of any other materials could result in vent system failure.

Exposed vent pipe poses a potential burn hazard to people and pets. Insulate or shield the pipe where necessary to prevent risk.

Never drill through, or install screws into, the vent pipe or vent components.

Failure to properly install the vent piping could result in flue gas leakage, causing possible severe personal injury, death or substantial property damage.

NOTICE

Code compliance – Follow all applicable local codes when installing the vent system. Where codes differ from this manual, follow code requirements. Contact PB Heat if you have any questions regarding the installation.

\Lambda WARNING

Terminate the vent and air piping following the guidelines in this manual. Avoid vent termination locations likely to be affected by winds, snowdrifts, people and pets. Protect building materials and vegetation from degradation caused by the flue gases and condensation.

A. BOILER VENT CONNECTION

1. The vent connection at the boiler is for Heat-Fab EZ-Seal vent piping only. To use Z-Flex Z-Vent venting you must install the Z-Vent adapter, part number 2SVSHTA03 (92-2) or 2SVSHTA04 (92-4).





EZ-Seal Vent Attachment Z-Vent Adapter

Attachment

- 2. EZ-Seal Connection: Insert EZ-Seal pipe male end into the boiler connection. Make sure the locking tabs slide under the EZ-Seal locking ring. Bend back locking tabs to complete the joint. Follow EZ-Seal instructions to complete the vent piping installation.
- 3. Z-Vent Adapter Installation: Insert male end of adapter into boiler vent connection. Make sure the locking tabs slide under the gear clamp on the adapter. Bend back the locking tabs (as in left illustration above). Then tighten the adapter gear clamp to finish the connection. Follow Z-Vent instructions to connect Z-Vent piping.



Maximum total vent pipe length:

1–90° Ell	90 feet (27 m)			
2–90° Ells	80 feet (24 m)			
3–90° Ells	70 feet (21 m)			
4–90° Ells	60 feet (18 m)			
(2–45° Elbows = 1–90° Elbow)				

(The termination elbow does not have to be counted for the vent piping. If the vent piping contains no ells except the termination, vent pipe length can be up to 100 feet.)

Figure 3D.1: Vertical Venting/Sidewall Air

4. Slope horizontal runs toward the boiler. All horizontal runs of vent pipe must slope continuously at least 1/4" per foot (21 mm per meter) to ensure condensate drains completely back to the boiler. DO NOT install the vent piping with any sections that could trap condensate.

B. VENT PIPING COMPONENTS

1. See Table 3D.1 for acceptable vent components. NO OTHER vent materials are acceptable.

Vent Common and	92-2			92-4
Vent Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal 3"	Z-Vent 3"	EZ-Seal 4"	Z-Vent 4"
Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)	Not Required	2SVSHTA03	Not Required	2SVSHTA04
Joint Sealant, as Needed	GE RTV106 or Equivalent			
Termination Elbow	9314TERM	2SVSTEX0390	9414TERM	2SVSTEX0490
Termination Pipe Section (1 ft)	9302	2SVEPWCF0301	9402	2SVEPWCF0401
Termination Thimble	9393S	2SVSWTE03	9493S	2SVSWTE04
Gear Clamp (Nose Clamp)	3" Clamp	7HS44XX	4" Clamp	7HS64XX

Table 3D.1: Vent and Air System Components

- 2. Carefully follow the instructions supplied by the vent piping manufacturer.
- 3. The vent joints seal with elastomer rings in the pipe and fittings. Avoid damaging these seals.
- 4. Cutting Z-Vent Pipe (Z-Vent only DO NOT cut EZ-Seal Pipe): Length adjustments with Z-Vent pipe can be done by cutting the pipe, following the Z-Vent instructions. Be sure to cut the pipe squarely and to file the cut edge smooth after cutting. Rough pipe ends will damage the seals. Support the pipe when cutting to avoid making the pipe out of round.
- 5. Adjustable Lengths of EZ-Seal Pipe: Length adjustments with EZ-Seal piping are done with slip-fit adjustable length sections, not by cutting the pipe. Make sure the adjustable length does not jut into elbows or terminations. This could block flue gas and condensate flow.
- 6. Maximum Vent Piping Length: See the table in Figure 3D.1 for the maximum allowable length. Each elbow causes the same pressure drop as 10 feet of vent pipe, so the allowable length reduces 10 feet for each elbow used in the piping. When 45° elbows are used, two 45° elbows are equivalent to one 90° elbow.
- 7. Insulate the vent piping where it passes through unheated areas to prevent condensate freeze-up. Do not insulate the within 18 inches of the termination when it passes through a combustible wall.
- 8. If the pipe passes through an occupied space, install a chase around the pipe, following the vent pipe instructions and applicable codes.

9. Clearance from Combustible Materials: Provide minimum clearance to all combustible materials of at least 2 inches (51 mm).

C. SUPPORT THE VENT PIPING COMPLETELY

- 1. DO NOT use the boiler vent connection to support the vent piping. Provide support straps from the ceiling or noncombustible saddle or pedestal supports from the floor. This is required on ALL installations, regardless of the length of the horizontal piping connected to the boiler.
- 2. Install at least one support on every horizontal run. For horizontal runs longer than 5 feet (1.5 m), install a support every 3 feet (0.9 m).
- 3. Vent piping cannot be supported from above (such as relying on roof jack sections). You must install supports on the horizontal piping before the vent turns upward. Provide a support on the horizontal piping within 6 inches of every upturned elbow to support the vertical run.
- 4. Follow the vent pipe manufacturer's instructions for placement and installation of supports.
- 5. Follow applicable codes and the vent pipe instructions to install fire stops, thimbles or other devices at all floor and wall penetrations.
- 6. Provide minimum 2 inches (51 mm) clearance to all combustible construction.

D. SIDEWALL TERMINATION

- 1. See Table 3D.1 for part numbers of the sidewall termination components required for Z-Vent and EZ-Seal vent pipe installations. The vent termination must be constructed using the stainless steel vent materials listed in Table 3D.1 to ensure the configuration is correct. DO NOT terminate the air piping with any other method.
 - a. <u>Wall Thimble</u>: Use only the thimble listed in Table 3D.1. The hole in the thimble will prevent the pipe length (B) from being pushed inward. The raised portion of the pipe female end is too large to pass through the hole in the thimble. Follow the vent pipe manufacturer's instructions supplied with the thimble. If the wall thimble isn't long enough for the application, follow the vent manufacturer's instructions to add an extension.

Noncombustible Walls: For noncombustible walls ONLY, you can omit the thimble. For this option, attach a storm collar on both the inside and outside walls at the penetration. Before attaching the collars, seal around the vent pipe thoroughly with silicone RTV to prevent air leakage or insect access. The storm collar tightens around the vent pipe with a gear clamp. This prevents movement of the finished assembly. You will still need to use the length of vent pipe and the termination elbow described below.

VENT & AIR PIPING: THROUGH A SIDE WALL



Figure 3D.2: Termination Minimum Clearances

b. <u>Length of Vent Pipe</u>: Use a 1-foot length of vent pipe as listed in Table 3D.1 unless the wall penetration quires a longer length. If a longer length is required, use a length of EZ-Seal or Z-Vent long enough for the application.

Insert the pipe from OUTSIDE, male end first. The pipe will stop at the raised section of the female end.

c. <u>Gear Clamp</u>: Use a hose clamp or a gear clamp manufactured by the vent manufacturer (see Table 3D.1).

Slide the clamp over the male end of the pipe after the pipe has been inserted from outside.

From the inside, pull the pipe so it is firmly against the outside plate.

Push the gear clamp against the inside plate and tighten securely. This will prevent the termination assembly from being pushed outward.

d. <u>Termination Elbow</u>: Use only the termination elbow listed in Table 3D.1. The elbow must be pointed downward.

Before inserting the male end of the elbow into the pipe, apply a bead of silicone RTV and spread around the end.

Insert the termination elbow and secure using the vent pipe manufacturer's joint assembly procedure.

<u>Termination Location</u>: Install the vent pipe termination where it meets the minimum clearances shown in Figure 3D.3. Exiting below grade or snow line: See Figure 3D.4. When the vent pipe must exit the building grade or below the minimum height for the termination elbow, install vertical piping as necessary for the termination elbow to be high enough to meet the minimum clearances of Figure 3D.3. Make sure to support the piping using wall brackets available from the vent pipe manufacturer.

If the pipe extends more than 3 feet, insulate the external portion of the pipe and fittings with at least 1/2" closed-cell foam polyolefin pipe insulation.



Figure 3D.3: Termination Minimum Clearances



Figure 3D.4: Using External Piping to Raise the Termination

E. COMBUSTION AIR OPENINGS

Combustion air must be supplied from the boiler room as shown in Figure 1.1. Make sure the installation provides air openings as required by applicable codes and the Boiler manual.

F. MULTIPLE BOILER INSTALLATIONS

- 1. Each boiler must be individually vented. DO NOT use combined venting.
- 2. Install multiple vents through the side wall following all guidelines for single-vent installations.
- 3. Install the vents so they are no closer than 12 inches (305 mm) on centers.

To convert to metric dimensions: meters=feet x 0.3 millimeters=inches x 25.4

3E. VENT & AIR PIPING: THROUGH A SIDE WALL (SEPARATE TERMINATIONS)

WARNING

The vent piping operates with positive pressure. The vent piping must be completely sealed and securely supported.

Use only the vent components listed in this manual. Use of any other materials could result in vent system failure.

Exposed vent pipe poses a potential burn hazard to people and pets. Insulate or shield the pipe where necessary to prevent risk.

Never drill through, or install screws into, the vent pipe or vent components.

Failure to properly install the vent piping could result in flue gas leakage, causing possible severe personal injury, death or substantial property damage.

NOTICE

Code compliance – Follow all applicable local codes when installing the vent system. Where codes differ from this manual, follow code requirements. Contact PB Heat if you have any questions regarding the installation.

\land WARNING

Terminate the vent and air piping following the guidelines in this manual. Avoid vent termination locations likely to be affected by winds, snowdrifts, people and pets. Protect building materials and vegetation from degradation caused by the flue gases and condensation.

A. BOILER VENT CONNECTION

1. The vent connection at the boiler is for Heat-Fab EZ-Seal vent piping only. To use Z-Flex Z-Vent venting you must install the Z-Vent adapter, part number 2SVSHTA03 (92-2) or 2SVSHTA04 (92-4).



EZ-Seal Vent Attachment Z-Vent Adapter



Attachment

- 2. EZ-Seal Connection: Insert EZ-Seal pipe male end into the boiler connection. Make sure the locking tabs slide under the EZ-Seal locking ring. Bend back locking tabs to complete the joint. Follow EZ-Seal instructions to complete the vent piping installation.
- 3. Z-Vent Adapter Installation: Insert male end of adapter into boiler vent connection. Make sure the locking tabs slide under the gear clamp on the adapter. Bend back the locking tabs (as in left illustration above). Then tighten the adapter gear clamp to finish the connection. Follow Z-Vent instructions to connect Z-Vent piping.



Maximum total vent and air pipe lengths:

1–90° Ell	90 feet (27 m)			
2–90° Ells	80 feet (24 m)			
3–90° Ells	70 feet (21 m)			
4–90° Ells	60 feet (18 m)			
(2–45° Elbows = 1–90° Elbow)				

(The termination elbow does not have to be counted for the vent or air piping. If the piping contains no ells except the termination, maximum pipe length can be up to 100 feet.)

Figure 3E.1: Vertical Venting/Sidewall Air

VENT & AIR PIPING: THROUGH A SIDE WALL

4. Slope horizontal runs toward the boiler. All horizontal runs of vent pipe must slope continuously at least 1/4" per foot (21 mm per meter) to ensure condensate drains completely back to the boiler. DO NOT install the vent piping with any sections that could trap condensate.

B. VENT PIPING COMPONENTS

1. See Table 3E.1 for acceptable vent components. NO OTHER vent materials are acceptable.

Vent Components	92-2		92-4	
	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal 3"	Z-Vent 3"	EZ-Seal 4"	Z-Vent 4"
Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)	Not Required	2SVSHTA03	Not Required	2SVSHTA04
Termination Elbow	9314TERM	2SVSTEX0390	9414TERM	2SVSTEX0490
Termination Pipe Section (1 ft)	9302	2SVEPWCF0301	9402	2SVEPWCF0401
Termination Thimble	9393S	2SVSWTE03	9493S	2SVSWTE04
Gear Clamp (Nose Clamp)	3" Clamp	7HS44XX	4" Clamp	7HS64XX
Joint Sealant, as Needed	GE RTV106 or Equivalent			
Air Components	Heat-Fab	Z-Flex	Heat-Fab	Z-Flex
Termination Elbow	Same as Vent Termination		Same as Vent Termination	
Air Piping/Components (Incl. Supports, Thimbles, etc.)	3" PVC, CPVC, ABS, Galvanized or Aluminum		4" PVC, CPVC, ABS, Galvanized or Aluminum	

Table 3E.1: Vent and Air System Components

- 2. Carefully follow the instructions supplied by the vent piping manufacturer.
- 3. Install the sidewall vent termination before installing the vent piping.
- 4. The vent joints seal with elastomer rings in the pipe and fittings. Avoid damaging these seals.
- 5. Cutting Z-Vent Pipe (Z-Vent only DO NOT cut EZ-Seal Pipe): Length adjustments with Z-Vent pipe can be done by cutting the pipe, following the Z-Vent instructions. Be sure to cut the pipe squarely and to file the cut edge smooth after cutting. Rough pipe ends will damage the seals. Support the pipe when cutting to avoid making the pipe out of round.
- 6. Adjustable Lengths of EZ-Seal Pipe: Length adjustments with EZ-Seal piping are done with slip-fit adjustable length sections, not by cutting the pipe. Make sure the adjustable length does not jut into elbows or terminations. This could block flue gas and condensate flow.
- 7. Maximum Vent Piping Length: See the table in Figure 3E.1 for the maximum allowable length. Each elbow causes the same pressure drop as 10 feet of vent pipe, so the allowable length reduces 10 feet for each elbow used in the piping. When 45° elbows are used, two 45° elbows are equivalent to one 90° elbow.

- 8. Insulate the vent piping where it passes through unheated areas to prevent condensate freeze-up. If the vent terminates through a combustible wall, leave the last 18 inches of vent pipe uninsulated.
- 9. If the pipe passes through an occupied space, install a chase around the pipe, following the vent pipe instructions and applicable codes.
- 10. Clearance from Combustible Materials: Provide minimum clearance to all combustible materials of at least 2 inches (51 mm).

C. SUPPORT THE VENT PIPING COMPLETELY

- 1. DO NOT use the boiler vent connection to support the vent piping. Provide support straps from the ceiling or noncombustible saddle or pedestal supports from the floor. This is required on ALL installations, regardless of the length of the horizontal piping connected to the boiler.
- 2. Install at least one support on every horizontal run. For horizontal runs longer than 5 feet (1.5 m), install a support every 3 feet (0.9 m).
- 3. Vent piping cannot be supported from above (such as relying on roof jack sections). You must install supports on the horizontal piping before the vent turns upward. Provide a support on the horizontal piping within 6 inches of every upturned elbow to support the vertical run.
- 4. Follow the vent pipe manufacturer's instructions for placement and installation of supports.
- 5. Follow applicable codes and the vent pipe instructions to install fire stops, thimbles or other devices at all floor and wall penetrations.
- 6. Provide minimum 2 inches (51 mm) clearance to all combustible construction.

D. AIR PIPE CONNECTION

- 1. Before installing the air piping, install the air pipe sidewall termination assembly (Item F, Figure 3E.1). See instructions on next page.
- 2. Construct the air piping from PVC, CPVC or ABS plastic, or galvanized or aluminum metallic pipe (including flexible aluminum duct if desired).

NOTICE

When using metallic piping, seal all of the longitudinal seam joints in addition to the component joints.

3. Attach the air piping to the boiler air connection, preferably using silicone RTV to seal the connection. If the boiler room air is free of contaminants you can use metallic duct tape to seal the joints. With age, however, duct tape adhesives can loosen, so duct tape is not as reliable as silicone RTV.

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- 4. If the installation is required to meet direct vent (sealed combustion) requirements, seal all joints withe silicone RTV. The air pipe installation must be air-tight and water-tight.
- 5. <u>Maximum Air Piping Length</u>: See the table in Figure 3E.1 for the maximum allowable length. Each elbow causes the same pressure drop as 10 feet of vent pipe, so the allowable length reduces 10 feet for each elbow used in the piping. When 45° elbows are used, two 45° elbows are equivalent to one 90° elbow.

E. SUPPORTING AIR PIPING

- 1. DO NOT use the boiler air connection to support the air piping. Provide support straps from the ceiling or install wall brackets.
- 2. Provide at least one support on all air pipe installations.
- 3. Provide a support every 3 feet for air pipe lengths greater than 5 feet horizontally.
- 4. Provide a support on the horizontal piping within 6 inches of every upturned elbow to support the vertical run.

F. SIDEWALL TERMINATION ASSEMBLIES

- 1. Refer to Figure 3E.2 and see Table 3E.1 for part numbers of the sidewall termination components required for Z-Vent and EZ-Seal vent pipe installations. The vent termination must be constructed using the stainless steel vent materials listed in Table 3E.1 to ensure the configuration is correct. DO NOT terminate the air piping with any other method.
 - a. <u>Wall Thimble</u>: Use only the thimble listed in Table 3E.1. The hole in the thimble will prevent the pipe length (B) from being pushed inward. The raised portion of the pipe female end is too large to pass through the hole in the thimble. Follow the vent pipe manufacturer's instructions supplied with the thimble. If the wall thimble isn't long enough for the application, follow the vent manufacturer's instructions to add an extension.

Noncombustible Walls: For noncombustible walls ONLY, you can omit the thimble. For this option, attach a storm collar on both the inside and outside walls at the penetration. Before attaching the collars, seal around the vent pipe thoroughly with silicone RTV to prevent air leakage or insect access. The storm collar tightens around the vent pipe with a gear clamp. This prevents movement of the finished assembly. You will still need to use the length of vent pipe and the termination elbow described below.

<u>Air Intake Termination Alternate Construction</u>: Air pipe terminations can be installed without thimbles through all walls, whether combustible or noncombustible. The termination assemblies must use storm collars as described above for vent piping through noncombustible walls. b. <u>Length of Vent Pipe</u>: Use a 1-foot length of vent pipe as listed in Table 3E.1 unless the wall penetration quires a longer length. If a longer length is required, use a length of EZ-Seal or Z-Vent long enough for the application.

Insert the pipe from OUTSIDE, male end first. The pipe will stop at the raised section of the female end.

c. <u>Gear Clamp</u>: Use a hose clamp or a gear clamp manufactured by the vent manufacturer (see Table 3E.1).

Slide the clamp over the male end of the pipe after the pipe has been inserted from outside.

From the inside, pull the pipe so it is firmly against the outside plate.

Push the gear clamp against the inside plate and tighten securely. This will prevent the termination assembly from being pushed outward.

d. <u>Termination Elbows</u>: Use only the termination elbows listed in Table 3E.1. The elbows must be pointed downward.

Before inserting the male end of the elbow into the pipe, apply a bead of silicone RTV and spread around the end.



Figure 3E.2: Termination Minimum Clearances
Insert the termination elbow and secure using the vent pipe manufacturer's joint assembly procedure.

<u>Termination Location</u>: Install the vent pipe termination where it meets the minimum clearances shown in Figure 3E.3 and minimum spacing to air intakes as shown in Figure 3E.5.



Figure 3E.3: Vent Termination Minimum Clearances (See Figure 3E.4 for Required Spacing Between Terminations) Exiting Below Grade or Snow Line: See Figure 3E.4. When the vent pipe must exit the building below grade or below the minimum height for the termination elbow, install vertical piping as necessary for the termination elbow to be high enough to meet the minimum clearances of Figure 3E.3. Make sure to support the piping using wall brackets available from the vent pipe manufacturer.



Figure 3E.4: Using External Piping to Raise the Termination



Figure 3E.5: Minimum Spacing Between Vent and Air Termination Elbows (Vents must also be Placed to Meet the Minimum Spacings Shown in Figure 3E.3)

If the vent pipe extends more than 3 feet (0.9 m), insulate the external portion of the pipe and fittings with at least 1/2" closed-cell foam polyolefin pipe insulation. Air pipes do not have to be insulated.

2. <u>Spacing Between Vent and Air Terminations</u>: Place all vent and air terminations so they meet the clearances shown in Figure 3E.4. requires a longer length. If a longer length is required, use a length of EZ-Seal or Z-Vent long enough for the application.

G. MULTIPLE BOILER INSTALLATIONS

- 1. Each boiler must be individually vented and air pipes must be separate. DO NOT use combined venting or air piping.
- 2. Install multiple vent and air terminations through the side wall following all guidelines for single-vent/air installations.
- 3. Install the terminations so they are no closer than 12 inches (305 mm) on centers and all terminations comply with minimum clearances shown in Figure 3E.3 and Figure 3E.5.
- 4. See Figure 3E.5 for relative placement of vent and air terminals to ensure sufficient clearance.

To convert to metric dimensions: meters=feet x 0.3 millimeters=inches x 25.4

3F. VENT & AIR PIPING: THROUGH A SIDE WALL (CONCENTRIC TERMINATION)

\land WARNING

The vent piping operates with positive pressure. The vent piping must be completely sealed and securely supported.

Use only the vent components listed in this manual. Use of any other materials could result in vent system failure.

Exposed vent pipe poses a potential burn hazard to people and pets. Insulate or shield the pipe where necessary to prevent risk.

Never drill through, or install screws into, the vent pipe or vent components.

Failure to properly install the vent piping could result in flue gas leakage, causing possible severe personal injury, death or substantial property damage.

\land NOTICE

Code compliance – Follow all applicable local codes when installing the vent system. Where codes differ from this manual, follow code requirements. Contact PB Heat if you have any questions regarding the installation.

\land WARNING

Terminate the vent and air piping following the guidelines in this manual. Avoid vent termination locations likely to be affected by winds, snowdrifts, people and pets. Protect building materials and vegetation from degradation caused by the flue gases and condensation.

A. BOILER VENT CONNECTION

1. The vent connection at the boiler is for Heat-Fab EZ-Seal vent piping only. To use Z-Flex Z-Vent venting you must install the Z-Vent adapter, part number 2SVSHTA03 (92-2) or 2SVSHTA04 (92-4).



EZ-Seal Vent Attachment

- 2. Insert EZ-Seal pipe male end into the boiler connection. Make sure the locking tabs slide under the EZ-Seal locking ring. Bend back locking tabs to complete the joint. Follow EZ-Seal instructions to complete the vent piping installation.
- 3. The concentric vent/air termination must be done only with Saf-T Vent type SC vent components. This requires that all of the vent piping be Saf-T Vent EZ-Seal for compatibility. DO NOT apply this vent/air termination option using any other vent materials.



Maximum total vent and air pipe lengths:

1–90° E ll	90 feet (27 m)			
2–90° Ells	80 feet (24 m)			
3–90° E ll s	70 feet (21 m)			
4–90° E ll s	60 feet (18 m)			
(2–45° Elbows = 1–90° Elbow)				

Figure 3F.1: Vertical Venting/Sidewall Air

4. Slope horizontal runs toward the boiler. All horizontal runs of vent pipe must slope continuously at least 1/4" per foot (21 mm per meter) to ensure condensate drains completely back to the boiler. DO NOT install the vent piping with any sections that could trap condensate.

B. VENT PIPING COMPONENTS

1. See Table 3F.1 for acceptable vent components. NO OTHER vent materials are acceptable.

Table 3F.1:	Vent and	I Air System	Components
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New Common and	92-2	92-4	
Vent Components	Heat-Fab	Heat-Fab	
Vent Piping/Components (Incl. Supports, Thimbles, etc.)	EZ-Seal, 3" Piping Saf-T Vent SC Fittings for Termination Assembly	EZ-Seal, 4" Piping Saf-T Vent SC Fittings for Termination Assembly	
Termination Assembly:			
Single-wall Adapter	SC03ADEZ	SC04ADEZ	
• Air Intake Tee	SC03TAD3	SC04TAD3	
 6" Straight Section 	SC0366	SC0466	
 12" Straight Section 	SC03L12	SC04L12	
 Wall Plate (2 Required) 	SC03FS	SC04FS	
 Termination Adapter 	SC03HT	SC04HT	
 Mitered Termination 	9390	9490	
Joint Sealant, as Needed	nnt, as Needed GE RTV106 or Equivalent		
Air Components	Heat-Fab	Heat-Fab	
Air Piping/Components (Also Supports, Thimbles, etc.)	3" PVC, CPVC, ABS, Galvanized or Aluminum	4" PVC, CPVC, ABS, Galvanized or Aluminum	

- 2. Carefully follow the instructions supplied by the vent piping manufacturer.
- 3. Install the sidewall termination/concentric vent-air assembly (Item F, Figure 3F.1) before installing the vent or air piping.
- 4. The vent joints seal with elastomer rings in the pipe and fittings. Avoid damaging these seals.
- 5. Adjustable Lengths of EZ-Seal Pipe: Length adjustments with EZ-Seal piping are done with slip-fit adjustable length sections, not by cutting the pipe. Make sure the adjustable length does not jut into elbows or terminations. This could block flue gas and condensate flow.
- 6. Maximum Vent Piping Length: See the table in Figure 3F1 for the maximum allowable length. Each elbow causes the same pressure drop as 10 feet of vent pipe, so the allowable length reduces 10 feet for each elbow used in the piping. When 45° elbows are used, two 45° elbows are equivalent to one 90° elbow.
- 7. Insulate the vent piping where it passes through unheated areas to prevent condensate freeze-up.
- 8. If the pipe passes through an occupied space, install a chase around the pipe, following the vent pipe instructions and applicable codes.
- 9. Clearance from Combustible Materials: Provide minimum clearance to all combustible materials of at least 2" (51 mm).

C. SUPPORT THE VENT PIPING COMPLETELY

- 1. DO NOT use the boiler vent connection to support the vent piping. Provide support straps from the ceiling or noncombustible saddle or pedestal supports from the floor. This is required on ALL installations, regardless of the length of the horizontal piping connected to the boiler.
- 2. Install at least one support on every horizontal run. For horizontal runs longer than 5 feet (1.5 m), install a support every 3 feet (0.9 m).
- 3. Vent piping cannot be supported from above (such as relying on roof jack sections). You must install supports on the horizontal piping before the vent turns upward. Provide a support on the horizontal piping within 6 inches of every upturned elbow to support the vertical run.
- 4. Follow the vent pipe manufacturer's instructions for placement and installation of supports.
- 5. Follow applicable codes and the vent pipe instructions to install fire stops, thimbles or other devices at all floor and wall penetrations.
- 6. Provide minimum 2" (51 mm) clearance to all combustible construction.

D. AIR PIPE CONNECTION

- 1. Before installing the air piping, install the air pipe sidewall termination assembly (Item F, Figure 3F.1).
- Construct the air piping from PVC, CPVC or ABS plastic, galvanized or aluminum metallic pipe (including flexible aluminum duct if desired).

🔨 NOTICE

When using metallic piping, seal all of the longitudinal seam joints in addition to the component joints.

- 3. Attach the air piping to the boiler air connection, preferably using silicone RTV to seal the connection. If the boiler room air is free of contaminants you can use metallic duct tape to seal the joints. With age, however, duct tape adhesives can loosen, so duct tape is not as reliable as silicone RTV.
- 4. If the installation is required to meet direct vent (sealed combustion) requirements, seal all joints withe silicone RTV. The air pipe installation must be air-tight and water-tight.
- 5. Maximum air piping length: See the table in Figure 3F.1 for the maximum allowable length. Each elbow causes the same pressure drop as 10 feet of vent pipe, so the allowable length reduces 10 feet for each elbow used in the piping. When 45° elbows are used, two 45° elbows are equivalent to one 90° elbow.

E. SUPPORTING AIR PIPING

- 1. DO NOT use the boiler air connection to support the air piping. Provide support straps from the ceiling or install wall brackets.
- 2. Provide at least one support on all air pipe installations.
- 3. Provide a support every 3 feet for air pipe lengths greater than 5 feet horizontally.
- 4. Provide a support on the horizontal piping within 6 inches of every upturned elbow to support the vertical run.

F. SIDEWALL TERMINATION/CONCENTRIC VENT-AIR ASSEMBLY

- 1. See Table 3F.1 for part numbers of the sidewall termination components required for EZ-Seal vent pipe installations. The vent termination must be constructed using the stainless steel vent materials listed in Table 3E.1 to ensure the configuration is correct. DO NOT terminate the air piping with any other method.
 - a. <u>Wall Plates (2 Required)</u>: Use only the plates listed in Table 3F.1. Follow the vent manufacturer's instruction to prepare the wall and mount the plates.

The air space provided by the design of the SC type vent allows the concentric vent/air pipe to be run directly through combustible or noncombustible walls. No thimble is needed unless specified by applicable codes.

After the pipe (Item B) is inserted and placed, follow the vent manufacturer's instructions to insert self-tapping screws through the four tabs in each of the wall plates into the holes in the pipe. This secures the pipe in place.

Follow the vent pipe manufacturer's instructions for sealing around the plates and the pipe.

- b. <u>Length of Concentric Vent Pipe</u>: Use a 1-foot length of vent pipe as listed in Table 3F.1 unless the wall penetration quires a longer length. If a longer length is required, use a length of Heat-Fab type SC vent long enough for the application.
- c. <u>Air Intake Tee</u>: The air intake tee provides a connection for the air piping to feed air through the outer plenum of the type SC vent and fittings. Secure the vent pipe to the end following the vent pipe manufacturer's instructions for assembling joints. Attach the air pipe to the air connection using silicone RTV to seal the joint.
- d. <u>Termination Adapter</u>: Assembly the termination adapter to the type SC pipe, following the vent pipe manufacturer's instructions for making the joint.
- e. <u>Termination Screen</u>: Apply a bead of silicone RTV to the male end of the screen fitting before inserting into the adpatper. Bend the adpater tabs over the end of the screen fitting.

2. *Termination Locations*: Place all terminations so they meet the clearances shown in Figure 3F.3.



Figure 3F.2: Sidewall Concentric Vent Air Termination

G. MULTIPLE BOILER INSTALLATIONS

- 1. Each boiler must be individually vented and air pipes must be separate. DO NOT use combined venting or air piping.
- Install multiple vent/air terminations through the side wall following all guidelines for single-vent/air installations.
- 3. Install the terminations so they are no closer than 2 feet (0.6 m) on horizontal centers and 4 feet on vertical centers (Figure 3F.4).
- 4. All terminations must comply with minimum clearances shown in Figure 3F.3.



Figure 3F.3: Termination Minimum Clearances (See Figure 3F.4 for Required Spacing Between Terminations)



Figure 3F.4: Minimum Spacing Between Terminations (Terminations must also be Placed to Meet the Minimum Spacings Shown in Figure 3F.3)

> To convert to metric dimensions: meters=feet x 0.3 millimeters=inches x 25.4

4. WATER PIPING & CONTROLS

A. BOILER PIPING CONNECTIONS

1. The boiler supply and return connections are shown in Figure 4.1. Both connections are 1-1/4" NPT.



Figure 4.1: Relief Valve Piping

2. Size piping for the flow required. Piping connections to the Cast 92[™] boiler should generally be 1-1/4" NPT.

B. SYSTEM DESIGN

1. **Design Options:**

The Cast 92^{TM} boiler works well in a single or multipleboiler application for any type of system. The following pages include suggested piping diagrams for the following system options:

- a. Single boiler, zoning with zone valves (Figure 4.4).
- b. Single boiler, zoning with circulators (Figure 4.5).
- c. Multiple boilers, primary/secondary piping (Figure 4.6).
- d. Multiple boilers, parallel piping, reverse-return (Figure 4.7).
- e. Guidelines for chilled water systems (Figure 4.8).

All of the piping diagrams show the suggested piping for optional indirect-fired DHW tanks. Follow the DHW tank manufacturer's instructions for installation and piping. Make sure to size the DHW circulator and piping to provide the flow needed for the required recovery capacity.

2. Pipe Sizing:

Generally install 1-1/4" piping in the boiler circuit. Size system and other circuit piping based on a 20 °F temperature drop through the zones. For water-source heat pump systems, the primary circuit flow rate will usually be based on a 5°F temperature drop. Such high flow systems must be piped with the boiler on a separate loop.

3. Piping Guidelines:

🗥 WARNING

Support the piping — All piping and components must be supported such that no loads or stresses are applied to the boiler. Allow for thermal expansion in the piping design and passageways.

\land NOTICE

The piping diagrams in this manual omit piping components such as unions. Always install unions where needed to simplify piping and improve serviceability.

C. CIRCULATOR REQUIREMENTS

1. Boiler Postpurge Circulator:

\land NOTICE

The postpurge circulator supplied with the 92-2 (Figure 4.1), factory piped between the boiler supply and return connections, is NOT intended for use in the system. It must remain connected as supplied. The postpurge circulator is only used by the 92-2 for postpurge flow to remove residual heat in the combustion zone. The postpurge circulator includes an integral check valve to prevent by-pass flow during operation.

A CAUTION

The Cast 92[™] boiler requires a continuous minimum water flow for proper operation. The circulator for the boiler must be sized to overcome the head loss of the boiler and the heating system in order to achieve the required temperature rise. If the system contains hydronic antifreeze this must be considered when sizing the pump. The temperature rise across the boiler must never exceed 100°F (55.6°C).

2. Boiler Pressure Drop:

Assume a pressure drop of:

a. 1.9 feet w.c. (0.7 meter) for a flow rate of up to 18 GPM (68 LPM).

WATER PIPING AND CONTROLS

b. 7.5 feet w.c. (2.3 meters) for a flow rate of up to 36 GPM (136 LPM).

Maintain 92-2 flow rate between 2 GPM and 36 GPM (7.6 to 136 LPM).

Maintain 92-4 flow rate between 4 GPM and 72 GPM (15.2 to 272 LPM).

3. Boiler and System Circulators:

See the following pages for suggested piping for Cast 92[™] boilers. All circulators are supplied by the installer, except the factory-installed postpurge circulator on the 92-2.

- a. <u>Boiler Circulator</u>: The circulator that flows water through the boiler 92-2 only.
- b. <u>System Circulator</u>: The circulator that flows water through the system, but not through the boiler.
- c. <u>Boiler/System Circulator</u>: A circulator that flows water through the boiler and the system.

4. Circulator Activation:

See Section 7 of this manual for instructions on wiring boiler and system circulators.

The Cast 92^{TM} Control provides an isolated contact to operate the boiler circulator (or boiler/system circulator).

The system circulator must be activated by a relay supplied by the installer. This relay is usually activated by the system control or thermostat.

D. ADDITIONAL CONTROLS

1. Local codes or job specifications may require the use of additional controls, such as low water cut-offs, flow switches, and high limit controls. Refer to Section 7, "Electrical Connections", for auxiliary controls.

Follow the guidelines below to install typical controls in the piping.

2. Low Water Cut-off:

When the boiler is installed above terminal units, or when required by applicable codes, install a low water cut-off in the piping above the boiler. See suggested piping in the diagrams in this section.

Use a probe-type control when possible.

3. Flow Switch:

When a flow switch is required, install the switch in a section of the piping that will ensure enough flow to operate the switch.



Figure 4.1: Expansion Tank Comparison

4. Additional High Limit Controls:

For ASME CSD-1 or Canadian applications, or when required by applicable codes, install an additional high limit control in the supply piping above the boiler.

Make sure the limit control is set at least 20 °F above the highest operating temperature of the Cast 92^{TM} boiler.

E. EXPANSION TANK & AIR SEPARATION

The system must include an expansion tank to control thermal expansion. Install the tank as close as possible to the boiler, and locate on the suction side of the system circulator. Make sure the tank is sized large enough to handle the system volume.

1. **Diaphragm/Bladder Type Expansion Tank:** Diaphragm or bladder-type expansion tanks have a membrane that separates the water from the air in the tank. See Figure 4.1, left side. See Figure 4.2 for suggested piping.

Guidelines for Diaphragm/Bladder-type Expansion Tanks:

- Always remove the tank from the system before charging. This ensures the air pressure will be accurate. Make sure the charge pressure equals the required system cold-fill pressure (usually 12 psig).
- Install an automatic air vent on top of the air separator to remove air from the system.

WATER PIPING AND CONTROLS



Figure 4.2: Diaphragm or Bladder-yype Expansion Tank Suggested Piping

2. Closed-type Expansion Tank:

Closed-type tanks are those that have air above the water, in direct contact with the water. See Figure 4.1, right side. See Figure 4.3 for suggested piping.

Guidelines for Closed-type Expansion Tanks:

- NEVER use automatic air vents in systems with closed-type tanks. The air must be kept in the system, and returned to the tank, in order to keep the tank operating correctly. Automatic air vents will bleed air out of the system, resulting in waterlogging of the tank, causing the boiler relief valve to weep.
- Air separation is done by connecting from an inline air separator to the bottom of the expansion tank (Figure 4.3). The tank must be mounted above the air separator.
- Install a tank fitting in the bottom of the tank. It allows captured air to flow into the upper portion of the tank, facilitates filling, and reduces recirculation in the expansion tank piping.



Figure 4.3: Closed-type Expansion Tank Suggested Piping

3. Cold Water Fill:

Follow all applicable codes when connecting the cold water fill to the piping. Use a backflow preventer where required. See suggested piping on this and the following pages. Also consider installing a water meter on the cold water make-up line. The water meter will show if excessive make-up water is entering the system.

CAUTION

Undersized or waterlogged expansion tanks will cause excessive make-up water to enter the system. This will lead to section failure due to oxygen corrosion and lime deposits.

F. ZONING WITH ZONE VALVES

1. Flow Balancing and Control:

On large systems, or when using a high-head circulator, install a differential pressure by-pass valve to limit the head applied to the zone valves.

Some systems may require balancing valves to control flow in the loops.



2. DHW Operation, When Required:

The piping shown throughout this manual allows for domestic water heating without flow through the heating loop(s). This is important for summertime operation of DHW tanks.

Make sure to incorporate flow/check valves as shown. These prevent forced flow in idle zones.



1	Cast 92™ Boiler
2	Boiler Circulator
3	System Circulator
4	Boiler/System Circulator
5	Indirect-fired DHW Tank (when used)
6	DHW Circulator
7	Flow/Check Valve
8	Cold Water Fill Line
9	Expansion Tank (shown with diaphragm-type)
10	Air separator with automatic air vent (Replace air vent with piping to the tank fitting on closed-type expansion systems.)
11	Low water cut-off (when required)
12	Extra high limit (when required)
13	Zone valve
14	Zone circulator
15	Differential Pressure by-pass valve — Use when high-head circulator may cause noise, erosion or valve lifting problems when only a few zone valves are open.
16	Boiler postpurge circulator (see page 39) 92-2 only
17	Header sensor, required where shown
2	Isolation Valve
	Purge Valve — Suggested locations allow for improved system filling and draining and initial air elimination.
Ō	Temperature Gauge

20012

Figure 4.4: Suggested Piping — Single Boiler — Zone Valve Zoning — Two-Pipe or Series Loop (Left), or Primary/Secondary Piping (Right)

G. ZONING WITH CIRCULATORS

1. Sizing and Flow Control:

Size circulators to provide the flow needed for the individual zones.

Provide flow/check valves where shown to prevent gravity circulation or forced flow in idle zones.



2. **DHW Operation, When Required:** The piping shown throughout this manual allows for domestic water heating without flow through the

heating loop(s). This is important for summertime operation of DHW tanks.

Make sure to incorporate flow/check valves as shown. These prevent forced flow in idle zones.



1	Cast 92 [™] boiler			
2	Boiler circulator			
4	Boiler/system circulator			
5	Indirect-fired DHW tank (when used)			
6	DHW circulator			
7	Flow/check valve			
8	Cold water fill line			
9	Expansion tank (shown with diaphragm-type)			
10	Air separator with automatic air vent (Replace air vent with piping to the tank fitting on closed-type expansion systems.)			
11	Low water cut-off (when required)			
12	Extra high limit (when required)			
14	Zone circulator			
16	Boiler postpurge circulator (see page 39) 92-2 only			
17	Header sensor, required where shown			
Ĩ.	Isolation valve			
	Purge valve — Suggested locations allow for improved system filling and draining and initial air elimination.			
0-	Temperature gauge			

20013

Figure 4.5: Suggested Piping — Single Boiler — Circulator Zoning — Two-pipe or Series Loop (Left), or Primary/Secondary Piping (Right)

H. MULTIPLE BOILERS, PRIMARY/ SECONDARY

1. Sizing and Flow Control:

Size circulators to provide the flow needed for the individual zones.

Provide flow/check valves where shown to prevent gravity circulation or forced flow in idle zones.

2. DHW Operation, When Required:

The piping shown throughout this manual allows for domestic water heating without flow through the heating loop(s). This is important for summertime operation of DHW tanks.

Make sure to incorporate flow/check valves as shown. These prevent forced flow in idle zones.



1	Cast 92 ^{ns} boiler
2	Boiler circulator
3	System circulator
5	Indirect-fired DHW tank (when used)
6	DHW circulator
7	Flow/check valve
8	Cold water fill line
9	Expansion tank (shown with diaphragm-type)
10	Air separator with automatic air vent (Replace air vent with piping to the tank fitting on closed-type expansion systems.)
11	Low water cut-off (when required)
12	Extra high limit (when required)
16	Boiler postpurge circulator (see page 39) 92-2 only
17	Header sensor, required
2	Isolation value
0	Temperature gauge

Figure 4.6: Suggested Piping — Multiple Boilers — Primary/Secondary Piping, Reverse-return Boiler Headers

I. MULTIPLE BOILERS, PARALLEL FLOW

1. Sizing and Flow Control:

Size the boiler/system circulator to handle the flow needs of all zones. If using variable speed control of the boiler/system circulator, ensure that the flow never drops below the total minimum for all boilers connected. Do not exceed the maximum flow of 50 GPM through any boiler.

2. DHW Operation, When Required:

When heating system boilers are piped in parallel as in Figure 4.7, connect the DHW tank as a zone off of the main header or install boilers dedicated to the DHW application.



1	Cast 92™ boiler
4	Boiler/system circulator
5	Indirect-fired DHW tank (when used)
6	DHW circulator
8	Cold water fill line
9	Expansion tank (shown with diaphragm-type)
10	Air separator with automatic air vent (Replace air vent with piping to the tank fitting on closed-type expansion systems.)
11	Low water cut-off (when required)
12	Extra high limit (when required)
16	Boiler postpurge circulator (see page 39) 92-2 only
17	Header sensor, required
	Isolation valve
0	Temperature gauge

Figure 4.7: Suggested Piping — Multiple Boilers — Parallel-flow Piping, Reverse-return Headers

J. CHILLED WATER SYSTEMS

1. General:

Provide the piping components shown in Figure 4.8 when connecting a boiler to a chilled water system. The check valve (item 4) prevents chilled water from entering the boiler loop.

2. Sizing and Flow Control:

Size the system circulator to handle the flow needs of all zones. If using variable speed control of the system circulator, ensure that the flow never drops below the total minimum for all boilers connected.

The boiler loop can be any of the designs in this manual, or per standard engineering practices.

Use the balancing valve to adjust the boiler loop flow.

3. Expansion Tank/Air Control:

Chilled water systems generally use closed-type expansion tanks. DO NOT use automatic air vents in these systems. All air must be return to the expansion tank for the system to operate reliably.

CAUTION

If the boiler loop is connected to air handling units that use chilled water, install flow control devices to prevent gravity circulation in the boiler loop during the cooling cycle in the air handling units.



Figure 4.8: Suggested Piping — Boilers Connected to Chilled Water Systems

5. FUEL PIPING

A. CHECK THE GAS TYPE

The Cast 92[™] comes from the factory ready to be piped to the gas supply. If for any reason the boiler is not for the type of gas available at the installation site, call your PB Heat representative to resolve the problem. (See WARNING below.)

B. GAS SUPPLY COMPONENTS

- 1. Figure 5.1 depicts the proper way to connect the boiler to the gas supply piping. The gas connection at the boiler is 1/2" NPT.
 - a. *Item* 1: Install the gas line piping from the gas meter or branch in accordance with all applicable codes. See the next page for suggested sizing, or refer to the National Fuel Gas Code or Canadian Gas Code for recommendations.
 - b. *Item 2*: The manual shut-off valve must be installed in the supply piping. Install 5 feet above the floor where required by applicable codes.
 - c. *Item 3*: For all gas supply piping, use only clean, burr-free black iron pipe, supported independently from the boiler gas connection.
 - d. *Item 4*: Install a ground-joint union in the gas line for ease of installation and servicing.
 - e. *Item* 5: Provide a sediment trap at the bottom of the vertical section of the gas supply pipe upstream of the gas controls.
 - f. *Item 6*: The gas cock must be equipped with a pressure test port. This test port is used to measure the gas supply pressure at the boiler.
- 2. The gas line components in Figure 5.1 are not supplied with the boiler. They must be supplied by the boiler installer.

🗥 WARNING

Always use a wrench on the gas train components when making gas connections. Never over-tighten the piping components or a failure could result, causing possible severe personal injury, death or substantial property damage.

\land WARNING

Failure to adhere to the following could result in severe personal injury, death or substantial property damage.

- 1. Verify the Gas Type:
 - Check the boiler rating plate to make sure that the boiler is for the type of gas that will be used. If it is not, do not connect the boiler to the gas supply.

- 2. Support the Gas Line: Support the gas line with hangers. DO NOT allow gas train weight to rest on or cause bending of the boiler gas connection fitting.
- 3. Protect the Gas Connection Fitting: Use a 15/16" open-end wrench to hold the boiler gas connection fitting when tightening gas connection piping to the boiler.
- 4. Never Leak Test with Flame: Never use an open flame to test for gas leaks. Always use an approved leak detection method.
- 5. Protect the Boiler Gas Valve From Excessive Pressure
 - When pressure testing system gas piping, disconnect the gas piping from the boiler or isolate the boiler with the manual shut-off valve if test pressure will be higher than 1/2 psig (3.5 kPa).



Figure 5.1: Connecting Gas Supply Line

 1
 Piping From Gas Supply

 2
 Manual Gas Valve with Test Port (Use Tee-Handle Valve for Massachusetts Installations)

 3
 Piping Must be Clean and Burr-Free Black Iron Pipe

 4
 Ground-joint Union

 5
 Drip Leg with Cap

 6
 Gas Cock Pressure Test Port

C. GAS PIPING JOINTS

\land WARNING

Always use a pipe sealant that is suitable for use with LP gas. Failure to comply could result in an explosion, causing possible severe personal injury, death or substantial property damage.

- 1. Only use pipe dope listed for use with propane gas. Even natural gas may contain some amount of propane.
- 2. Use pipe dope sparingly. Excessive pipe dope can block pipe flow or foul gas train components.

D. GAS PIPE SIZING

 Required Supply Pressure at Boiler: Minimum gas supply pressure (natural gas or propane), both for flowing and static conditions: 2 inches (102 mm) water column.

Maximum gas supply pressure (natural gas or propane), both for flowing and static conditions: 14 inches (356 mm) water column.

2. Sizing Guidelines:

The sizing recommendations of Table 5.1 are taken from the *National Fuel Gas Code, ANSI Z223.1/NFPA* 54. Propane values are based on adjustment from propane specific gravity and pressure.

Table 5.1 allows for a pressure drop from the main supply regulator to the boiler of 0.3 inches (7.6 mm) water column for natural gas or propane.

For conditions not shown in Table 5.1, other pressure drops, or natural gas with other than 0.6 specific gravity, refer to the appropriate code guidelines for sizing.

3. Equivalent Length:

Do not neglect the pressure drop due to pipe fittings.

Equivalent length is the sum of the actual length of piping plus the total equivalent lengths of all fittings in the line from the main regulator to the boiler connection. See Table 5.2 for equivalent lengths of common fittings and components.

4. Multiple Appliances:

If more than one appliance is supplied by the same supply pipe, the piping must be sized based on the maximum possible demand.

\land WARNING

Undersized gas supply piping can cause the gas line pressure to become negative during operation of the Cast 92[™] boiler. This can cause pilot outages and operation failures of other appliances connected to the line, including gas ranges, water heaters, etc. Failure to properly size the gas lines can result in potential for severe personal injury, death or substantial property damage.

Table 5.1: Gas Flow Capacity for Black Iron Pipe

190 350	30 Gas Pij 152	40 De Flow (note	50 Capac	60 ity (cuł	80	100	150
190 350	-		•	ity (cut	nic foot		
350	152	(note	1 0		ne leel	per hou	r)
350	152		es I, Z,	& 3)			
		130	115	105	90	79	64
	285	245	215	195	170	150	120
730	590	500	440	400	350	305	250
1100	890	760	670	610	530	460	380
ropane	Gas Pi	pe Flow	v Capao	city (cul	bic feet	per hou	ır)
		(no	tes 2 &	: 3)			
118	94	81	71	65	56	49	40
220	175	150	135	120	105	95	75
455	365	310	275	250	220	190	155
 Natural gas flow capacity is based on 0.60 specific gravity. Refer to the National Fuel Gas Code, ANSI Z223.1/NFPA 54, for other pressure drops and other specif- ic gravity gases. 							
 The flow rates above allow for a pressure drop of: Natural gas — 0.30 inches water column, with gas pressure 14 inches water column or less. Propage — 0.30 inches water column, with gas pressure 14 inches water col- 							

3. To determine required flow rate in cubic feet per hour for all appliances connected to the gas line:

Natural gas — Divide total Btuh by the gas Btu per cubic foot rating (typically 1,000 Btu/ft³ nominal). Propane — Divide total Btuh by 2,500.

Table 5.2: Equivalent Feet of Pipe for Common Gas Line Components

Iron Pipe Size	Equivalent Feet of Pipe for Each Fitting					
(inches)	90° Elbow	Tee ¹	Gate Valve ²	Gas Cock ²		
1	2.6	5.2	0.6	1.5		
1-1/4	3.5	6.9	0.8	1.9		
1-1/2	4.0	8.0	0.9	2.3		
2	5.2	10.3	1.2	3.0		
1 Allows for flow through the branch of the tee						

Allows for flow through the branch of the tee.

2. Assumes valve is full open.

E. TEST ALL GAS PIPING FOR LEAKS

📐 WARNING

All gas piping, components and connections must be leak tested before putting the boiler in operation. Isolate the boiler from the gas supply piping if testing with pressure greater than 14 inches (12.7 mm) pressure. Failure to do so could result in severe personal injury, death or substantial property damage.

- 1. Check all gas piping components and joints for leaks. Use either a soap suds mixture, a gas leak detector or other suitable means.
- 2. After testing the system gas piping, remove the gas valve cover plate on the left side of the boiler (see illustration at right). Inspect and leak test around the interior gas line and gas valve. Replace the cover after completing the gas connection inspection and testing.



6. CONDENSATE DRAIN PIPING

A. FILL THE CONDENSATE TRAP

Before installing the condensate line, you must fill the condensate trap with water. This will prevent flue products from escaping into the room. To fill the trap:

- 1. Temporarily attach a 3/8" clear plastic hose to the condensate hose barb (see Figure 6.1).
- 2. Attach a funnel to the other end of the hose and hold the funnel so it is higher than the hose barb.
- 3. Pour water into the funnel until water backs up into the tube.
- 4. Remove the temporary plastic hose.

\land WARNING

The condensate trap must be filled when firing the boiler to prevent flue gases from escaping into the room.

B. CONDENSATE LINE INSTALLATION

- Condensate Tubing Material: The condensate tubing must be silicone rubber, 3/8" (9.5 mm) diameter.
- 2. Attachment: Feed the silicone rubber tubing through the condensate line exit opening and slide the tubing end onto the condensate line hose barb as shown in Figure 6.1.
- 3. Securing/Protecting the Condensate Line: Secure the Tubing: Secure the condensate line to the floor with clips or other means to prevent movement.

<u>Protect Tubing From Damage</u>: If foot traffic poses a risk to the tubing, install a cover over the tubing, or some other means to protect it from damage or movement.

<u>Prevent Freezing</u>: Do not route the line through, or terminate the line in, any area that could expose the condensate to freezing temperatures.

4. Floor Drain Termination:

If the condensate line can be routed to a floor drain, and applicable codes do not prohibit draining untreated condensate, terminate the condensate line so condensate can reliably flow to the drain.

5. Condensate Pump Termination:

If no gravity drain is available, install a condensate pump. Use only a pump designed for use with condensing furnaces and boilers. The pump must have an overflow switch to prevent damage from overflowing condensate. Wire the switch into the boiler limit circuit. See Section 8, "Boiler Control". 6. Neutralization:

When required by codes or preference, install an appropriate condensate neutralization system.

C. CONDENSATE LINE REQUIREMENTS

Λ WARNING

Failure to adhere to the following could result in condensate line leakage, resulting in potential for severe personal injury, death or substantial property damage.

- 1. Use only silicone rubber tubing, 3/8" (9.5 mm) diameter.
- 2. Protect the condensate line from damage and secure it in position.
- 3. Terminate the condensate line at an appropriate drain.
- 4. Do not install the condensate drain line such that it could be exposed to freezing temperatures.
- 5. Install a condensate pump if no appropriate drain is available.
- 6. Install a condensate neutralizing system when required.



Figure 6.1: Connecting a Condensate Drain Line

7. ELECTRICAL CONNECTIONS

🗥 WARNING

Electrical shock hazard — Disconnect all electrical power sources to the boiler before making any electrical connections.

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

A NOTICE

The electrical connections to this boiler must be made in accordance with all applicable local codes and the latest revision of the National Electrical Code, ANSI /NFPA-70. Installation should also conform to CSA C22.1 Canadian Electrical Code Part I if installed in Canada. Install a separate 120 volt 15 amp circuit for the boiler. A properly rated shut-off switch should be located at the boiler. The boiler must be grounded in accordance with the authority having jurisdiction, or if none, the latest revision of the National Electrical Code, ANSI/NFPA-70.

Line voltage field wiring of any controls or other devices must use copper conductors with a minimum size of #14 awg. Use appropriate wiring materials for units installed outdoors.

A. GENERAL

- 1. The wiring and control information in the Boiler manual is targeted at single-boiler, stand-alone installations. For multiple boilers and advanced options, Section 8, "Boiler Control".
- 2. See Figures 7.6 and 7.7 for a wiring summary.

B. POWER SUPPLY (120 VAC)

- 1. See Figures 7.1 and 7.2.
- 2. Connect minimum 14awg copper wire to the power



Figure 7.1: Electrical Connection Board



120VAC/60HZ/1Ph Power to boiler

Figure 7.2: 120VAC Power Service Terminals on Electrical Connection Board

connection as shown in Figure 7.2.

3. Install a fused service switch, mounted and installed in accordance with all applicable codes.

C. CIRCULATOR WIRING

1. Postpurge Circulator:

The circulator shipped installed with the 92-2 boiler cannot be used for system circulation. It must be used as supplied from the factory. It circulates water after the boiler stops firing to prevent potential damage from heat pocketing in the top of the heat exchanger.

The postpurge circulator is factory-piped and prewired. Do not change the usage, the wiring, the location or the piping.

2. Boiler Circulator:

See Section 4 of this manual for circulator piping.

Figure 7.5 shows wiring of the Boiler circulator (or boiler/system circulator) to the terminal strip of the Cast 92^{TM} electrical connection board.

ELECTRICAL CONNECTIONS

DO NOT directly connect a circulator with a motor larger than 1/4 hp. For larger motors, install a circulator relay or motor contactor . Figures 7.3 and 7.4 show the correct ways to install the boiler circulator using a relay or motor starter.



Figure 7.3: Wiring the Boiler Circulator Using a Circulator Relay (Required for Motors Over 1/4 hp)



Figure 7.4: Wiring the Boiler Circulator Using a Relay or Starter (Required for Motors Over 1/4 hp)

D. SENSOR WIRING

No Sensor Wiring is Necessary Unless:

- 1. Outdoor Reset Application: To operate with outdoor reset, purchase and install an outdoor sensor. Mount the sensor such that it is shielded from direct sunlight if possible and not likely to be covered by snow drifts or debris. Connect the outdoor sensor leads to the electrical connection board as shown in Figure 7.7b.
- 2. Header Sensor Application: As shown in the piping diagrams in this manual, a header sensor is needed if the boiler supply temperature may be different from the header temperature. If required, purchase and install a header sensor in an immersion well. Locate the sensor where it will accurately sense the system water supply temperature. Connect the sensor leads to the electrical connection board as shown in Figure 7.7b.

3. Return Water Temperature Sensor: The return water temperature sensor is optional, only needed if you want to automatically control the boiler postpurge pump cycle time. To use the return water temperature sensor, purchase and install the sensor in a well in the boiler return piping. Connect the sensor leads to the electrical connection board as shown in Figure 7.7b.



Figure 7.5: Circulator Wiring Terminal Strip

E. IAR (INDOOR AIR RESET) WIRING, WHEN USED

- 1. *Heat Demand Terminal Connections*: The end switch leads from the zone valves must connect to the Heat Demand terminals on the electrical connection board as shown in Figure 7.6 and Figure 7.7a.
- 2. See Figure 7.6 for typical wiring to the IAR inputs when using 4-wire zone valves without a zone controller. For other applications, such as circulator relays or zone controllers, see Appendix A in this manual. Also see Sections 8 and 8A.

A CAUTION

Polarity — The connections to the IAR positive terminals (IAR +) must be to the same location on the zone valve as the thermostat wire, as shown in Appendix A, Figure A1. The connections to the IAR negative terminals (IAR –) must be from the zone valve terminal connected to the 24VAC common line, as shown. Connecting the wires incorrectly can cause the transformer to be shorted out and damaged. Verify the wiring with a voltmeter.

A CAUTION

Always use a voltmeter to check the leads coming from the end switches of the zone valves. With the thermostat calling for heat, connect the voltmeter leads across the wires coming from the end switches. If the meter shows a voltage reading, the zone valve wires are incorrect. Change the wiring and retest. DO NOT connect the wires to the boiler until you have tested as described. Incorrect wiring can damage the boiler control or other system components.

3. If there is only one transformer feeding all of the zone valves in the system, you can omit the wires to the IAR negative terminals (IAR –) on all but one of the zone valves. This is because these terminals are jumpered internally on the electrical connection board. If there is more than one transformer, provide one wire from each transformer common side to one of the IAR negative terminals (IAR –).

F. DHW WIRING

- 1. To operate the boiler for domestic water heating with a storage tank, install and pipe the tank according to the tank manufacturer's instructions and the recommended piping diagrams in this manual. Consult the factory for applications not covered.
- 2. The circulator used for DHW must be operated by a circulator relay or zone controller that is activated when the tank aquastat calls for heat.
- 3. Connect the tank aquastat terminals across the DHW DEMAND terminals on the electrical connection board as shown in Figure 7.7A.



Figure 7.6: Indoor Air Reset Wiring to IAR Terminals with 4-wire Zone Valves and No Zone Controller

ELECTRICAL CONNECTIONS



Figure 7.7A: Cast 92[™] Wiring Summary





8. BOILER CONTROL: OPERATION

A. THE CAST 92[™] BOILER CONTROL

1. Control Overview:

The Cast 92[™] control monitors boiler temperature and limit circuit inputs, modulating boiler firing rate to meet demand. The control uses microprocessor electronics, watching time-average response from the system to anticipate how much heat the system needs. Coupled with the five-to-one turndown of the Cast 92[™] boiler, this results in maximum possible condensing-mode operation. The Cast 92[™] boiler will provide unmatched seasonal efficiency.

2. Indoor Air Reset (IAR):

The unique approach to boiler output regulation is its Indoor Air Reset function. The control monitors the demand from up to 8 different zones. Watching the demand duration and response to supply temperature, averaging over time, the control anticipates system needs. It sets boiler maximum firing rate and adjusts supply water temperature to fine-tune boiler heat output. All that is required to enable IAR is to connect thermostat circuit wires to the IAR inputs. The control can also be configured for outdoor reset operation, but IAR provides response based on system behavior rather than just looking at outdoor temperature.

3. The Cast 92[™] Control Platform:

Cast 92[™] controls are designed to provide an integrated boiler management system on every boiler. The platform provides multiple levels of selectivity. Cast 92[™] electronics can be operated as a simple single-boiler control, while still providing intelligent regulation of boiler firing rate to match system demand. With a few key strokes on the key pad, the Cast 92[™] control can operate as a sophisticated multiple-boiler controller, using simple RJ45 cable interfacing between units. The control can even accept external control commands from building managements systems (Modbus standard, with optional bridge for BACnet or LonWorks) or 20milliamp analog input from an external controller.

The control method used by the Cast 92[™] control is based on digital communications, which eliminates the need for analog control signals. Analog signal inputs are supported, but a higher level of control precision, repeatability and feedback is gained with digital communications. The Cast 92^{TM} control can be versatile, providing for operation in multiple ways:

- Operation as a stand-alone boiler.
- Operation as a boiler in a boiler network, using the on-board protocol.
- Operation as a member boiler in a boiler management system.
- Operation as a member of a remotely-controlled boiler network (20-milliamp regulation).
- Setpoint can be determined by the control or by a 20-milliamp input signal.

4. PID Response:

The Cast 92^{TM} control uses proportional-integralderivative calculations to determine the response to boiler water temperature changes. This means it not only looks at how far away the water temperature is from the setpoint temperature, but how fast the temperature is changing and how it has responded over time. This ensures the boiler won't make sudden unnecessary changes in firing rate.

5. Multiple Boiler Operation:

The Cast 92[™] control easily interfaces with other Cast 92[™] controls. Multiple boiler operation only requires RJ45 cables daisy-chained from boiler to boiler and a few key strokes setting up control behavior. The master boiler is automatically selected by connecting a sensor lead to its HEADER sensor terminals. The control recognizes the sensor and configures the boiler as the master. Other boilers only need to have an address assigned.

Among the advanced design features of the Cast 92[™] control is the MOD-MAX setting. This limits the firing rate of all boilers to a pre-set maximum (50% by default). This means all of the boilers will be run at a very efficient level until all boilers are on. Only then can firing rate increase above this setting. Boiler rotation can be first-on/first-off, first-on/last-off, or true rotation (the control monitors the total on time of all boilers, and rotates their usage so the total on time is the same for all).

B. BEFORE CONTROL SETUP

\land CAUTION

Before beginning the control setup, remove the wires connected to the HEAT DEMAND and DHW DEMAND terminals on the electrical connection board (see Figure 7.7A). These must be removed to prevent a call for heat during the setup process.

Close the manual gas valve before proceeding to prevent any possibility of the boiler firing during setup.

C. THE CONTROL DISPLAY

- 1. Starting the Display:
 - a. Check all wiring to make sure it is complete and all wires are securely connected.
 - b. Verify that the HEAT DEMAND and DHW DEMAND wires are removed.
 - c. Turn on power to the boiler and then turn the boiler on/off switch ON.
 - d. The control will beep at least twice and the display will show the first STANDBY display in Figure 8.1. Note that pushing the DOWN button on the keypad will change the right side of the display as shown, providing information on various setpoints and parameters.
 - e. The display, LOC SET, means the setpoint temperature. Figure 8.1 shows the factory default values.

2. Accessing Setup Menus:

- a. With the display in STANDBY, press and hold the BACK key for 5 seconds.
- b. The display will change to:



- Press the SELECT key to select setup. (Note that pressing the DOWN key would change the selection to VIEW LOG.)
- d. The display will now show the first options in the setup menus:



e. Press the DOWN key to access additional menu options. Pressing the DOWN button once will change the display to:





Figure 8.1: Control Display During Standby (No Call for Heat) — Pressing the DOWN Key on the Keypad Changes the Display as Shown

- f. The cursor moves to the second line, indicating this option could now be selected with the SELECT key.
- g. Continuing to press the DOWN key will access these menu options:
 - BOILERS
 - SETPOINTS
 - INDOOR AIR
 - PUMP OPTIONS
 - NIGHT SETBACK
 - OPTIONS
 - LOG/RUNTIME
 - AUX FUNCTIONS
 - SYSTEM CLOCK
 - ADVANCED SETUP

D. RECOMMENDED SETTINGS

- 1. The following recommendations should cover most single-boiler applications.
- 2. The settings covered in Sections 8D through 8G are SETPOINTS, INDOOR AIR, OUTDOOR AIR and SYSTEM CLOCK.

E. ADJUST SETPOINTS

- 1. Setpoint Menus:
 - a. Use the arrow keys until the cursor points at SETPOINTS.
 - b. Press the SELECT button to enter the SETPOINTS menus. The menu selections available as you use the arrow keys will be:
 - LOC SETPOINT (means the local setpoint, or the target temperature of the boiler supply water; this is sensed by the SUPPLY sensor).
 - SOURCE (means whether the setpoint temperature is to be controlled at the boiler or by a remote device leave the default setting of AUTO unless you plan to use a remote controller with a 4-20ma output).
 - DHW SETPOINT (means the supply temperature the boiler will target when operating on a call for DHW heating; this uses the same sensor as the local setpoint).
 - OP LIMIT (means the operating limit temperature of the boiler).
 - LIMIT BAND (this is the differential for the limit function).

2. Set the Local Setpoint (LOC SETPT):

a. Use the arrow keys until the cursor points at LOC SETPT. The display will show:



b. The cursor must be pointing at LOC SETPT. The value shown may vary if the control has been adjusted before.

- c. Press the SELECT button to change the local setpoint value.
- d. The cursor will move to the temperature number.
- e. Use the arrow keys to increase or decrease the temperature to the desired setting.

If you hold down the arrow key the numbers will change faster after a brief waiting period.

- f. When the setting is correct, press the SELECT key to accept. Then press the BACK key to leave the local setpoint adjustment.
- g. The local setpoint should be set at the design water temperature for the heating units (typically 180°F for finned-tube baseboard, for example).

NOTICE

The setpoint must never be higher than the OP LIMIT setting minus the LIMIT BAND minus half of the HEAT BAND setting. This would cause the boiler to hit limit while trying to modulate.

Example: If LIMIT BAND is 20° F, OP LIMIT is 215° F, and HEAT BAND is 30° F, the local setpoint must never be higher than $215 - 20 - 30/2 = 180^{\circ}$ F.

- 3. Set the DHW Setpoint (DHW SETPT):
 - a. Skip this procedure if the boiler is not used for DHW heating.
 - b. Use the arrow keys until the cursor is at DHW SETPT. The display will be:



- c. With the cursor on DHW SETPT, press the SELECT key to change the value, using the same procedure as with the LOC SETPT adjustment.
- d. The DHW setpoint should usually be 190°F. To obtain this setpoint, you will also have to increase the OP LIMIT setting to 225 or 230°F so the boiler won't prematurely cycle on the limit function.
- e. When the DHW setting is complete, press SELECT and BACK to return to the setpoint menus.

4. Set OP LIMIT (Operating Limit):

- a. Use the same procedure as on the previous settings to change the operating limit temperature.
- b. Use the arrow keys to select OP LIMIT, then press SELECT.
- c. If the boiler setpoint is to be higher than 180°F, you will need to increase OP LIMIT. The maximum setting for OP LIMIT is 230°F. So the maximum allowable boiler setpoint is generally 190°F.
- d. Once the setting is correct, press SELECT, then BACK to return to the setpoint menus.

5. The LIMIT BAND:

Do not change the LIMIT BAND setting unless specific application demands require a change or when directed by the factory.

6. Return to Main Menus:

When the setpoints have all been adjusted as desired, press the BACK key until you return to SETPOINTS.

F. INDOOR AIR

- 1. General:
 - a. Use the indoor air reset option whenever possible. The indoor air technology monitors space heating demand to help the boiler operate at the highest possible efficiency throughout the season.
 - b. To apply indoor reset you must wire the IAR inputs and the HEAT DEMAND terminals as described in Section 7.

2. Enable or Disable IAR:

- a. The only setting for indoor air reset that you will need to make is to enable the function.
- b. Use the arrow keys until the cursor points to INDOOR AIR.
- c. Press SELECT to enter the indoor air menus.
- d. The display will show:



- e. The factory default setting is ON, or IAR enabled. If the boiler is wired for IAR, then leave the setting at ON.
- f. To change the setting to off, press SELECT with the cursor pointing at IA RESET.
- g. Press either arrow key and the value will change to OFF.
- h. Press SELECT to save and BACK to return to the main menus (INDOOR RESET again).

3. Return to Main Menus:

\land NOTICE

When you have finished with IAR, return to the main menus by using the BACK key.

G. OUTDOOR AIR

1. General:

📐 NOTICE

Skip this procedure if there is no outdoor sensor present.

When possible, use Indoor Air Reset instead of Outdoor Reset. IAR provides much better feedback on system needs.

2. OUTDOOR AIR Menu:

- a. Use the arrow keys until the cursor points at OUTDOOR AIR. Then press SELECT.
- b. The display will show the beginning of the OUTDOOR AIR menus:



- c. OUTDOOR AIR menus are:
 - OA SHUTDOWN (shuts the boiler down when outside temperature is above OA SETPT).
 - OA SETPOINT (outside temperature at which no heat is needed — used to shut down boiler above this temperature).
 - OA RESET (enables or disables outdoor reset function).
 - SET OA SETPTS (when outdoor reset is enabled, this leads to setpoint selections).

3. Outdoor Shutdown/Outdoor Setpoint:

- a. Enable or disable outdoor shutdown by pressing the SELECT button with the cursor on OA SHUTDOWN.
- b. Use the arrow keys to change from ON to OFF.
- c. Press SELECT to save, then BACK to return.
- d. Then arrow key to OA SETPT to set the desired outdoor air shutdown temperature.
- e. Press SELECT and the cursor will move to the temperature.
- f. Use the arrow keys to change the setting.
- g. Press SELECT, then BACK to accept and return.

4. Outdoor Reset:

- a. To set outdoor reset operation, use the arrow keys until the cursor points at OA RESET.
- b. The default setting is ON.
- c. To change the setting, press SELECT and use the arrow keys to change from ON to OFF.

BOILER CONTROL: OPERATION

- d. Press SELECT, then BACK.
- e. If outdoor reset is enabled, set the reset temperatures as follows:
 - 1. Use the arrow keys until the cursor points at SET OA SETPTS.
 - 2. Press SELECT and the display will show:



3. Don't use the arrow keys yet, but if you use the DOWN arrow twice, the display will show:



- 4. With the cursor on the setting you want to change, press the SELECT key, then use the arrow keys to change the temperature as you did for SETPOINTS.
- LOW WATER (@ HI OA): Set for the supply water temperature desired when the outside air is at the temperature when no heat is needed (HI OA). This should generally be set equal to room temperature, or 70°F unless the application calls for another setting.
- <u>HI OA</u>: Set this to the outside temperature at which no heat is needed, usually 68°F or lower.
- HI WATER (@LO OA): This is the required supply water temperature at design heating conditions; i.e. when outside air temperature is at ODT, the outdoor design temperature, or maximum heating conditions. This temperature would typically be 180° for finned-tube baseboard systems.

- 8. <u>LO OA</u>: This is the ODT, or design outdoor temperature for maximum heating requirements from the system.
- 9. Use the arrow keys to navigate to each of the above. Then adjust as required.
- 5. Return to Main Menus:

\land NOTICE

When you have finished with outdoor reset, return to the main menus by using the BACK key.

H. SET THE SYSTEM CLOCK

- 1. Use the arrow keys in the main menus to navigate to SYSTEM CLOCK. Use the procedures used for SETPOINTS and other adjustments to select and modify TIME, DAY OF WEEK, MONTH, DAY and YEAR.
- 2. Because the events log gives time of occurrence, it is best for the system clock to be correct.

NOTICE

After completing setup, press the BACK key until the display returns to STANDBY. Then turn off power and the boiler on/off switch. Reconnect HEAT DEMAND and DHW DEMAND wires.

Table 8.1: Setup Menus

To Enter Setup: From STANDBY, hold BACK and for 5 seconds. Then press SELECT and with cursor on SETUP. Make sure there is no call for heat at the boiler before attempting to perform setup adjustments. To return to STANDBY, press/release BACK and until the display returns to standby, or turn boiler ON/OFF switch off, then on.

Level 1	Level 2	Level 3	Level 4	Default {Range}	Typical Line
OO next item	OO next item	OO next item	OO next item	OO to change value	(Display shows two lines at a time;
select to select	select	select	to select	to accept value and return to previous	cursor indicates active line)
	back one level	back one level	back one level	menu level	active fille,
92-2 V X.X				Shows firmware version number	92-2 V 1.0
	# BOILERS			1 {1 to 16} — display only	# BOILERS 1
	LEAD BOILER			1 — display only — the lead boiler is the boiler with a HEADER sensor connected	LEAD BOILER 1
BOILERS	HEAT BAND			30 °F {10 to 50°F}	HEAT BAND 30°F
	HEAT NET BOILERS 123456789ABCDEFG			Display only — shows 1 through the number of boilers on the network	BOILERS 123456
	LOC SETPT			180°F {140 to 180°F}	LOC SETPT 180°F
	SOURCE			AUTO {AUTO, 4-20MA}	SOURCE AUTO
SETPOINTS	DHW SETPT			180°F {140 to 180°F}	DHW SETPT 180°F
	OP LIMIT			205°F {145 to 205°F}	OP LIMIT 215°F
	LIMIT BAND			10°F {1 to 50°F}	LIMIT BAND 20°F
	IA RESET			OFF {ON or OFF}	IA RESET OFF
	AVG TIME			60 MIN {30 to 120 minutes}	AVG TIME 60MIN
INDOOR AIR	SET IAR SETPTS	Delta temp @ HI IAR%		10°F {10 to 20°F} 70% {40 to 70%}	DELTA TEMP 10°F @ HI IAR% 70%
INDOOK AIK		Delta Temp @ Lo Iar%		20°F {10 to 20°F} 40% {40 to 70%}	DELTA TEMP 20°F @ LO IAR% 40%
	VIEW IAR VALUES			Display only, not changeable here — shows values for 8 zones	70 70 70 70 70 70 70 70
	OA SHUTDOWN			OFF {ON or OFF}	OA SHUTDOWN OFF
	OA SETPT			68°F {40 to 100°F}	OA SETPT 68°F
	OA RESET			OFF {ON or OFF}	OA RESET OFF
OUTDOOR AIR	SET OA SETPTS	LOW WATER @ HI OA		140°F {60 to 150°F} 70°F {50 to 90°F}	LOW WATER 140°F @ HI OA 70°F
		HI WATER @ LOW OA		180°F {70 to 180°F} 10°F {-35 to +40°F}	HI WATER 180°F @ LOW OA 10°F
	DELTA ENAB			OFF {ON or OFF}	DELTA ENAB OFF
	DELTA TEMP			10°F {10 to 50°F}	DELTA TEMP 10°F
PUMP OPTIONS	PURGE TIME			0 seconds {0 to 255 seconds}	PURGE TIME 120s
	ALWAYS ON			NO {YES or NO}	ALWAYS ON NO
	MASTER PUMP			OFF {ON or OFF}	MASTER PUMP OFF
	SETBACK # X			1 {1 through 4}	SETBACK # 2
		SETBACK		20°F {0 to 50°F}	ENTRY IS OFF
NIGHT SETBACK		ST DAY		SUN {SUN, MON, TUE, WED, THU, FRI, SAT}	ST DAY THU
	ENTRY IS OFF	ST TIME		12:00AM	ST TIME 3:00PM
		ENDDAY		SUN {SUN, MON, TUE, WED, THU, FRI, SAT}	ENDAY SAT
		ENDTIME		12:00AM	ENDTIME 10:00PM
	TEMP SCALE			°F {°F or °C}	TEMP SCALE °F
	KEY CLICK			ON {ON or OFF}	KEY CLICK ON
OPTIONS	SKIP PASSW			ON {ON or OFF}	SKIP PASSW ON
	BRIGHTNESS			50% {12, 25, 37, 50, 62, 75, 87, 100%}	BRIGHTNESS 50%

Table 8.1 (cont'd): Setup Menus

	1				1
	RUN HRS			Total time gas valve has been open	RUN HRS 1240
	LOG ENTRY			Current entry in the log	LOG ENTRY 327
LOG/RUNTIME	SIZE			The size of the data log	SIZE 1000
				Number of times gas valve has	
	BOILER CYC			been cycled on/off	BOILER CYC 5021
	COMB AIR DAMPER IN USE?			YES {YES or NO}	COMB AIR DAMPER IN USE? YES
	USE RELAY #			OPT	USE RELAY # OPT
AUX FUNCTIONS				2:00 (2 min, 0 sec) {0 to 4	
	PROOF TIME DHW PROTECTIONIN			minutes}	PROOF TIME 2:00
	USE?			NO {YES or NO}	DHW PROTECTION IN USE? NO
	TIME				TIME 11:20AM
	DAY OF WEEK			12:00AM	DAY OF WEEK MON
SYSTEM CLOCK	MONTH			SUN	MONTH JAN
	DAY			SEP	DAY FRI
	YEAR			12	YEAR 2007
		CONTROL		2007	
					CONTROL HNET
		HNET MASTER		HNET	HNET MASTER YES
	DISTRIB CTRL	LOCAL ADD		YES (Display only, not	LOCAL ADD 255
		ECONETIDD		changeable here)	LOOKETIDD 200
		CONSOLE ADD		Default = 1; Range = 1 to 247	CONSOLE ADD 255
		ADD BOILER DLY		10 minutes {0 to 15 minutes}	> 10 MINUTES > 0 SECONDS
		SHED BOILER DLY		2 minutes {0 to 15 minutes}	2 MINUTES > 0 SECONDS
	MODULAR BOILER	MOD DELAY TIME		10 seconds {0 to 60 minutes}	0 MINUTES > 10 SECONDS
		MOD MAX - LAST		50% {25 to 100%}	STOP MOD MAX > % 50
		STOP BAND OFSET		5°F {0 to 50°F}	EARLY STOP > 5°
		BLR START TIME		50 seconds {0 to 4 minutes}	0 MINUTES > 30 SECONDS
		(P)ROPOR =		100 {0 to 100}	(P)ROPOR = 100
		(I)NTEGRAL=		10 {0 to 100}	(I)NTEGRAL = 10
	MODULATION PID	(D)ERIVAT =		10 {0 to 100}	(D)ERIVAT = 10
		()			()
		BAND		100°F {40 to 18 0°F}	BAND 100°F
ADVANCED SETUP	FIRING MODE	ROTATION		TRUE {True, FOFO, LOFO}	ROTATION TRUE
ADVANCED SETUP		MASTER 1ST		OFF	MASTER 1ST OFF
		SENSOR#		OUTSIDE	SENSOR# SUPPLY
	SENSORS	TYPE		TYPEZ {TYPEZ, None,	
	SENSORS	TIFL		ON/OFF}	TYPE TYPEZ
	SENSORS	CALIBRATE ?		ON/OFF} NO {YES or NO}	CALIBRATE ? NO
				NO {YES or NO}	
	JENJORJ			NO {YES or NO} Press SELECT are enter old	CALIBRATE ? NO CHANGE PASSWORD
		CALIBRATE ?		NO {YES or NO} Press SELECT enter old password using arrow keys and	CALIBRATE ? NO
		CALIBRATE ? CHANGE PASSWORD		NO {YES or NO} Press SELECT are enter old	CALIBRATE ? NO CHANGE PASSWORD
		CALIBRATE ? CHANGE PASSWORD		NO {YES or NO} Press SELECT and enter old password using arrow keys and SELECT and for each character	CALIBRATE ? NO CHANGE PASSWORD
	PASSWORD	CALIBRATE ? CHANGE PASSWORD OLD:>? CHANGE PASSWORD		NO {YES or NO} Press SELECT and enter old password using arrow keys and SELECT for each character Press SELECT and enter new	CALIBRATE ? NO CHANGE PASSWORD OLD:>? CHANGE PASSWORD
		CALIBRATE ? CHANGE PASSWORD OLD:>?		NO {YES or NO} Press SELECT and enter old password using arrow keys and SELECT and for each character Press SELECT and enter new password using arrow keys and	CALIBRATE ? NO CHANGE PASSWORD OLD:>?
		CALIBRATE ? CHANGE PASSWORD OLD:>? CHANGE PASSWORD		NO {YES or NO} Press SELECT and enter old password using arrow keys and SELECT for each character Press SELECT and enter new	CALIBRATE ? NO CHANGE PASSWORD OLD:>? CHANGE PASSWORD
		CALIBRATE ? CHANGE PASSWORD OLD:>? CHANGE PASSWORD		NO {YES or NO} Press SELECT and enter old password using arrow keys and SELECT and for each character Press SELECT and enter new password using arrow keys and	CALIBRATE ? NO CHANGE PASSWORD OLD:>? CHANGE PASSWORD
		CALIBRATE ? CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>?		NO {YES or NO} Press SELECT and enter old password using arrow keys and SELECT and for each character Press SELECT and enter new password using arrow keys and SELECT and for each character	CALIBRATE ? NO CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? CHANGE PASSWORD
	PASSWORD	CALIBRATE ? CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? ACCEPT > BAUD		NO {YES or NO} Press SELECT for enter old password using arrow keys and SELECT for each character Press SELECT for enter new password using arrow keys and SELECT for each character YES / YES or NO 19200	CALIBRATE ? NO CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? CHANGE PASSWORD ACCEPT >YES BAUD 19200
		CALIBRATE ? CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? ACCEPT > BAUD PARITY		NO {YES or NO} Press SELECT are enter old password using arrow keys and SELECT are for each character Press SELECT are enter new password using arrow keys and SELECT are for each character YES / YES or NO 19200 EVEN {EVEN or ODD}	CALIBRATE ? NO CHANGE PASSWORD OLD:>? OLD:>? CHANGE PASSWORD NEW:>? NEW:>? CHANGE PASSWORD ACCEPT ACCEPT >YES BAUD 19200 PARITY EVEN
	PASSWORD	CALIBRATE ? CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? ACCEPT > BAUD PARITY MODEM		NO {YES or NO} Press SELECT and enter old password using arrow keys and SELECT and for each character Press SELECT and enter new password using arrow keys and SELECT and for each character YES / YES or NO 19200 EVEN {EVEN or ODD} NO {YES or NO}	CALIBRATE ? NO CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? CHANGE PASSWORD ACCEPT ACCEPT >YES BAUD 19200 PARITY EVEN MODEM NO
	PASSWORD	CALIBRATE ? CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? ACCEPT > BAUD PARITY		NO {YES or NO} Press SELECT are enter old password using arrow keys and SELECT are for each character Press SELECT are enter new password using arrow keys and SELECT are for each character YES / YES or NO 19200 EVEN {EVEN or ODD} NO {YES or NO} NO {YES or NO} NO {YES or NO}	CALIBRATE ? NO CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? CHANGE PASSWORD ACCEPT ACCEPT >YES BAUD 19200 PARITY EVEN MODEM NO FACTORY CAL? NO
	PASSWORD	CALIBRATE ? CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? ACCEPT > BAUD PARITY MODEM FACTORY CAL?	ARE YOU SURE>	NO {YES or NO} Press SELECT are enter old password using arrow keys and SELECT are for each character Press SELECT are enter new password using arrow keys and SELECT are for each character YES / YES or NO 19200 EVEN {EVEN or ODD} NO {YES or NO} NO {YES or NO}	CALIBRATE ? NO CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? CHANGE PASSWORD ACCEPT ACCEPT >YES BAUD 19200 PARITY EVEN MODEM NO FACTORY CAL? NO ARE YOU SURE> NO
	PASSWORD	CALIBRATE ? CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? ACCEPT > BAUD PARITY MODEM	ARE YOU SURE>	NO {YES or NO} Press SELECT are enter old password using arrow keys and SELECT are for each character Press SELECT are enter new password using arrow keys and SELECT are for each character YES / YES or NO 19200 EVEN {EVEN or ODD} NO {YES or NO} NO {YES or NO} NO {YES or NO}	CALIBRATE ? NO CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? CHANGE PASSWORD ACCEPT ACCEPT >YES BAUD 19200 PARITY EVEN MODEM NO FACTORY CAL? NO
	PASSWORD	CALIBRATE ? CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? ACCEPT > BAUD PARITY MODEM FACTORY CAL?	ARE YOU SURE>	NO {YES or NO} Press SELECT are enter old password using arrow keys and SELECT are for each character Press SELECT are enter new password using arrow keys and SELECT are for each character YES / YES or NO 19200 EVEN {EVEN or ODD} NO {YES or NO} NO {YES or NO}	CALIBRATE ? NO CHANGE PASSWORD OLD:>? CHANGE PASSWORD NEW:>? CHANGE PASSWORD ACCEPT ACCEPT >YES BAUD 19200 PARITY EVEN MODEM NO FACTORY CAL? NO ARE YOU SURE> NO

Table 8.2: Setup Menus - Parameter Explanations

Menu Item	Under	Explanation			
HEAT BAND	BOILERS	Boilers stage OFF when water temp is above heat band Boilers MODULATE Boilers MODULATE Boilers MODULATE Boilers stage ON when Boilers stage ON when water temp is below below the setpoint temperature, boiler firing rate modulates. Boilers are at minimum input at the lower end of the band and maximum input at the lower end of the band. Boilers stage off when the water temperature is below the band. Boilers stage off when the water temperature below the band. Boilers stage off when the water temperature is below the band. Boilers stage off when the water temperature perature is above the band.			
LOC SETPT	SETPOINTS	Setpoint temperature controlled by the Cast 92 TM control. NOTE: If the control is operated by a Master control or by a remote control (building management system, 4-20ma control, etc.), this setpoint temperature only comes into play when the 92-2 control is in override mode (such as by closing its Heat Demand or DHW Demand terminals).			
SOURCE	SETPOINTS	Specifies where the space heating setpoint temperature comes from: AUTO means the Cast 92 [™] control determines the setpoint (using local setpoint, outdoor reset or header temperature setpoint). The option is "4-20ma." If 4-20 ma is selected, the Cast 92 [™] control determines setpoint based on the signal it receives at the 4-20ma terminals on the connection board. The setpoint temperature (°F) equals the signal current (ma) divided by 0.09; example, a signal of 10ma will cause a setpoint of 10/0.09 = 110°F.			
DHW SETPT	SETPOINTS	This is the setpoint temperature for the boiler outlet water (or header water temperature) when the DHW Demand terminals see a closed contact (DHW tank temperature control calls for heat, for example).			
OP LIMIT	SETPOINTS	 This is the temperature at the boiler outlet (or header sensor) that will cause the control to shut down on high temperature limit. It must be high enough above the upper end of the heat band to avoid nuisance cycling. The maximum setting is 205°F. Example: If the boiler setpoint is 180°F, and the heat band is 30°F, the upper end of the heat band is 180 + 30/2 = 195°F. The limit band (see below) must be set at 10°F so the OP LIMIT setting can be: 195 + 10 = 205°F (maximum allowable setting). The operating limit setting (OP LIMIT) always limits boiler outlet water temperature, regardless of how the boiler is controlled (HeatNet member, 4-20ma control or stand-alone). The limit band (see below) determines when the boiler begins to be forced to reduce input as the outlet temperature rises toward the limit setting. 			
LIMIT BAND	SETPOINTS	Boiler firing rate is limited as water temperature enters the limit band			
IA RESET	INDOOR AIR	Activate indoor air reset by setting this to "ON." Zone wiring must be made to the IAR input terminals for IAR to operate. See Section 7 for details on wiring to the IAR terminals.			
AVG TIME	INDOOR AIR	The averaging time (AVG TIME) is the time span over which the control averages the results of zone demands. Leave this setting at the factory default unless directed otherwise by PB Heat Technical Support.			
SET IAR SETPTS	INDOOR AIR	Leave the delta temp settings at factory default settings unless directed otherwise by PB Heat Technical Support. The determine how much the control adjusts maximum allowable firing rate based on its monitoring of zone demand.			
OA SHUTDOWN	OUTDOOR AIR	When outdoor air shutdown is enabled (ON), the boiler and its circulating pump shut down when the outside temperature is above the outdoor air setpoint (OA SETPT). This requires an outdoor sensor when enabled.			
OA SETPT	OUTDOOR AIR	The boiler and its circulator shut down when the outside air temperature is above this setting if outdoor air shutdown is enabled (ON). This requires an outdoor sensor when enabled.			
OA RESET	OUTDOOR AIR	Set to "ON" to enable resetting the boiler outlet temperature (or header temperature) based on outside air temperature. Set to "OFF" to disable outdoor reset. This requires an outdoor sensor when enabled.			

Table 8.2 (cont'd): Setup Menus – Parameter Explanations

Menu Item	Under	Explanation	
Low Water@ HI OA HI Water@ Low OA	OUTDOOR AIR SET OA SETPTS	Boilers stage OFF when water temp is above heat band Image: Boilers stage OFF when water temp is above heat band Boilers MODULATE SETPOINT TEMP Boilers module SETPOINT TEMP Boilers stage ON when water temp is below heat band Boilers stage ON when water temp is below heat band	
DELTA ENABLE	PUMP OPTIONS	The boiler pump can be set to run after boiler shutdown to distribute residual heat to the heating system. Delta enable causes the boiler pump to run until the temperature difference between boiler inlet and outlet is less than DELTA TEMP (see below). The pump will continue to run an additional period after this for the amount of time specified in PURGE TIME (below).	
DELTA TEMP	PUMP OPTIONS	When DELTA ENABLE (above) is set to "ON," the boiler pump will run until the temperature difference across the boiler is less than DELTA TEMP. (The pump will run an additional time equal to the PURGE TIME.) An inlet temperature sensor is required.	
PURGE TIME	PUMP OPTIONS	The boiler pump can run after boiler shutdown to distribute heat remaining in the boiler water. PURGE TIME sets how long the boiler pump will run. (Also see DELTA TEMP, above.) NOTICE: For systems that shut off flow valves (such as zone valve systems) when the call for heat is satisfied, this option must be set to "0" to prevent dead-heading the pump.	
ALWAYS ON	PUMP OPTIONS	If ALWAYS ON is set to "YES," the boiler circulator never turns off.	
MASTER PUMP	PUMP OPTIONS	If set to "ON," the master control in the network will keep its pump contacts closed (running its pump and/or control valve) if no other boilers are operating. This is used to prevent dead-heading system flow.	
SETBACK#	NIGHT SETBACK	Setback number is the designator for the setback operation. Up to four (4) setback operations can be programmed.	
ENTRY IS	NIGHT SETBACK	Select "ON" to enable a setback operation. Then program the times, days and setpoint. The setpoint assigned will override the control's setpoint when setpoint is controlled locally. It will not override 4-20ma control or building management control.	
TEMP SCALE	OPTIONS	Select Fahrenheit or Centigrade.	
KEY CLICK	OPTIONS	If activated, the control beeps when a key is pressed.	
SKIP PASSW	OPTIONS	The control can be programmed such that a password is required to change settings. Setting this to "ON" disables the password.	
BRIGHTNESS	OPTIONS	Adjust the brightness of the display.	
RUN HRS	LOG/RUNTIME	Displays the total time the boiler gas valve has been open.	
LOG ENTRY	LOG/RUNTIME	Displays the current entry in the data log (see Table 11.1).	
SIZE	LOG/RUNTIME	Displays the current number of entries in the data log.	
BOILER CYC	LOG/RUNTIME	Displays the number of times the boiler gas valve has been cycled on, then off. It does not include failed ignition attempts.	
COMB AIR DMPRIN USE?	AUX FNCTIONS	Select "YES" to connect a combustion air damper and its end switch to the electrical connection board.	
USE RELAY #	AUX FNCTIONS	Only one relay is available.	
PROOF TIME	AUX FNCTIONS	Set proof time long enough to be sure the combustion air damper can open and activate its end switch.	
DHW PROTECTION	AUX FUNCTIONS	Select "YES" to have the control alarm and disable the DHW demand input if a DHW demand lasts for more than 60 minutes.	
SYSTEM CLOCK		Set the system clock (time, day of week, month, day and year) on start-up and after any power outage to ensure the data log time stamp information will be accurate.	
LOCAL ADD	ADVANCED SETUP DISTRIB CTRL	Assign each member boiler a unique address, beginning with "2" or higher. Enter any value from 2 to 16. NOTE: When the master boiler control displays the number of boilers on the network, it will show numbers above 9 as letters: 10=A; 11=B; 12=C; 13=D; 14=E, and 15=F. For example, if there are 12 boilers on the network, then the master control will show: "BOILERS 123456789ABC" when displayed in the BOILERS menu.	

Table 8.2 (cont'd): Setup Menus – Parameter Explanations

Menu Item	Under	Explanation	
CONSOLE ADD	ADVANCED SETUPDISTRIB CTRL	This is used only when the boilers are regulated by a building management system, using MODBUS, BACNET or LONWORKS. Assign each member boiler AND the master boiler a unique address, an value from 1 to 247.	
ADD BOILER DLY	ADVANCED SETUPMODULAR BOILER	This is the minimum wait time before an additional boiler can fire when called on by the master boiler control.	
SHED BOILER DLY	ADVANCED SETUPMODULAR BOILER	This is the minimum wait time before a boiler can shut down by the master boiler control.	
MOD DELAY TIME	ADVANCED SETUP MODULAR BOILER	The boiler will remain at minimum fire when first starting until this amount of time has elapsed.	
MOD MAX-LAST	ADVANCED SETUP MODULAR BOILER	This sets the maximum firing percentage for boilers during times that some boilers are not firing. It limits input of the boilers to keep them as efficient as possible. Once all boilers are started (during high heat demand periods), this limit is remove, and all boilers can fire up to maximum input. Once any boiler is dropped offline, the limit is applied again.	
STOP BAND OFSET	ADVANCED SETUP MODULAR BOILER	This setting helps reduce short-cycling when water temperature is within the heat band. If the water temperature rises to the top of the heat band less the STOP BAND OFFSET before a boiler just added has completed its modulation delay time, the boiler will shut down. Example, if the top of the heat band is 190°F and stop band offset is 15°F, a newly-added boiler will shut down if the temperature reaches 175°F (190 - 15) before its modulation delay time has ended.	
BLR START TIME	ADVANCED SETUP MODULAR BOILER	DO NOT CHANGE — This is the time from receiving a call for heat to when a boiler begins its modulation operation (running at minimum fire).	
(P)ROPOR =	ADVANCED SETUP MODULATION PID	This parameter should generally be left at factory default.	
(I)NTEGRAL =	ADVANCED SETUP MODULATION PID	This parameter should generally be left at factory default.	
(D)ERIVAT =	ADVANCED SETUP MODULATION PID	This parameter should generally be left at factory default.	
BAND	ADVANCED SETUP MODULATION PID	This parameter should generally be left at factory default.	
ROTATION	ADVANCED SETUP FIRING MODE	Select the rotation method. True rotation attempts to fire all boilers an equal amount of time. First on/first off jogs between boilers to balance usage. Last on/first off maintains the same rotation sequence at all times.	
MASTER 1ST	ADVANCED SETUP FIRING MODE	Set this to "ON" to always start the master boiler first, regardless of the rotation scheme selected.	
SENSOR#	ADVANCED SETUP SENSORS	There are up to three sensors: OUTSIDE, HEADER and RETURN.	
ТҮРЕ	ADVANCED SETUP SENSORS	Type Z is for a thermistors sensor (as supplied by PB Heat). "None" means do not use this sensor. ON/OFF looks for an external dry contact closure.	
CALIBRATE ?	ADVANCED SETUP SENSORS	Use this function only if the response to a sensor indicates the control calibration may be off. Calibrate the control by attaching a 10k precision resistor across the sensor terminals. Select "YES" after "CALIBRATE ?." The control will measure the resistance and establish a trim value (in ohms) for the sensor input. The control display will show the trim value setting. The trim value must not exceed +/- 200 ohms. If it does, verify that the resistor is correctly connected. If so, the sensor input is bad. Contact PB Heat for recommended action. If the trim setting is acceptable, press the SELECT key to accept. The display will show, "TRIM VALUE SET!" After a slight delay, the display will return to the sensors menu.	
CHANGE PASSWORD	ADVANCED SETUP PASSWORD	Use to set/change a password.	
BAUD	ADVANCED SETUP COMMUNICATIONS	Not changeable. Always 19200.	

Table 8.2 (cor	nt'd): Setup	Menus – Paramet	er Explanations
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Menu Item	Under	Explanation
PARITY	ADVANCED SETUP COMMUNICATIONS	Select even or odd as required by communications port used.
MODEM	ADVANCED SETUP COMMUNICATIONS	Select "YES" only if a modem is installed.
LOAD DEFAULTS	ADVANCED SETUP	 Load the factory defaults when you want to be sure nothing has been changed or after you have loaded new firmware. 1. Disconnect wires to the Heat Demand terminals and any other remote operation wiring. There must be no call for heat during the process. 2. Navigate the control display to "LOAD DEFAULTS." 3. To restore factory calibration settings or factory settings, section either of the options and select "YES" for the prompt, "ARE YOUR SURE?"
FIRMWARE VERSION (UPDATE CONTROL?)	ADVANCED SETUP SYSTEM	 The firmware version in the control must match the version in this manual in order to ensure accuracy of the installation/operation information. The control displays the firmware version number when Setup is accessed. To update the control's firmware, obtain a disk from PB Heat. Disconnect wires to the Heat Demand terminals and any other remote operation wiring. There must be no call for heat during the process. Record all setup information for the application before proceeding. Insert the Firmware Update Program disk into the computer. The program will start and show an option screen. Select "Install USB Drivers" to install the program onto the computer. After the USB driver installation is complete, select "Install Firmware Update." Plug a USB cable into the control connection board, with the other connected to the computer. THE CABLE MUST BE CONNECTED BEFORE STARTING THE FIRMWARE UPDATE PROGRAM. Start the Firmware Update Program. It will auto detect the 92-2 control. The program dialog box will automatically show the control's comport number in the first box. The second box will show the firmware file number. Make sure this is the correct file. If not, use the " " box to the right of the file name to navigate to the correct file. Navigate to the control. NOTICE: The firmware must be downloaded now for the 92-2 control to function again. Return to the computer. Select "UPDATE." The computer program will ask to turn the boiler off, then back on. After the power is cycled on the boiler, the download will start. If the download is interrupted or fails, turn the boiler ON/OFF switch OFF, then ON. Restart the firmware download program to start the download. (The boiler will appear unresponsive during this time because it is wating for the download to take place.) When the download is complete, the boiler will power cycle. The display should show STANDBY. If the firm

9. BOILER CONTROL: MULTIPLE BOILERS OVERVIEW

9A: MULTIPLE BOILERS – CAST 92[™] CONTROL

- The Cast 92[™] control can control up to (16) Cast 92[™] boilers using built-in software and hardware.
- Use the RS485 interface on each boiler and connect with RJ45 cables (or shielded wires).
- The header water temperature setpoint can be set by the master boiler or by a 4-20ma input from an external controller.
- Member boilers can override master boiler control if they receive a contact closure on the Heat Demand or DHW Demand terminals.

9B: MULTIPLE BOILERS - (BMS)

- This method uses the Cast 92[™] control's built-in communications capabilities to accept Modbus protocol inputs from a building management system. The master boiler control sequences and modulates the boiler network to accomplish the demands from the building management system.
- Boiler setup is essentially the same as for method 1, with the exception that each boiler must be assigned both a network address and an address for the Modbus interface.
- An additional bus is required to interface with systems using BACnet or LonWorks protocol.
- The master boiler will take control and regulate the boiler network if signal from the BMS is lost or times out.

9C: MULTIPLE BOILERS – EXTERNAL 4-20MA CONTROL

- Up to 5 boilers can be controlled by an external control that provides a 4-20ma input signal. The external controls must also activate each boiler by closing a contact across the boiler's 4-20ma Remote Enable contacts.
- Member boilers can override external boiler control if they receive a contact closure on the Heat Demand or DHW Demand terminals.

9A. BOILER CONTROL: MULTIPLE BOILERS (CAST 92[™] CONTROL)

\land WARNING

Electrical shock hazard – Disconnect all electrical power sources to the boiler before making any electrical connections.

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

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

The electrical connections to this boiler must be made in accordance with all applicable local codes and the latest revision of the National Electrical Code, ANSI /NFPA-70. Installation should also conform to CSA C22.1 Canadian Electrical Code Part I if installed in Canada. Install a separate 120 volt 15 amp circuit for the boiler. A properly rated shut-off switch should be located at the boiler. The boiler must be grounded in accordance with the authority having jurisdiction, or if none, the latest revision of the National Electrical Code, ANSI/NFPA-70.

Line voltage field wiring of any controls or other devices must use copper conductors with a minimum size of #14 awg. Use appropriate wiring materials for units installed outdoors.

A. OVERVIEW: CONTROL SETUP SEQUENCE

A CAUTION

Install all boilers according to the instructions in this manual before attempting to set up the control system.

- 1. Install all boilers per this manual.
- 2. Close the external gas valve on every boiler.
- 3. Wire all boilers following the guidelines in this section.
- 4. Attach a header sensor to the master boiler ONLY. The 92-2 control automatically configures the boiler with a header sensor as the master.
- 5. Set the master boiler control parameters using its display/keypad.
- 6. Set the master boiler's termination DIP switches.
- 7. Set the termination DIP switches on the member boilers.
- 8. Set the member boilers' control parameters using their display/keypads.

- 9. Follow the instructions in this manual to start-up each boiler before proceeding further.
- 10. Finish by connecting cables between the communications boards of all of the boilers and verifying network operation.

B. POWER SUPPLY (120 VAC)

- 1. See Figure 9A.1 and Figure 9A.2.
- 2. Connect minimum 14awg copper wire to the power connection as shown in Figure 9A.2.
- 3. Install a fused service switch, mounted and installed in accordance with all applicable codes.



Figure 9A.1: Electrical Connection Board

C. CIRCULATOR WIRING

1. Postpurge Circulator (92-2 only):

The circulator shipped installed with the boiler cannot be used for system circulation. It must be used as supplied from the factory. It circulates water after the boiler stops firing to prevent potential damage from heat pocketing in the top of the heat exchanger.

The postpurge circulator is factory-piped and prewired. Do not change the usage, the wiring, the location or the piping.

2. Boiler Circulator:

See Section 4 for circulator piping.

Figure 9A.3, Figure 9A.4, and Figure 9A.5 show wiring of the Boiler circulator (or boiler/system circulator) to the terminal strip of the 92-2 electrical connection board.

DO NOT directly connect a circulator with a motor larger than 1/4 hp. For larger motors, install a circulator relay or motor contactor. Figure 9A.3 and Figure 9A.4 show the correct ways to install the boiler circulator using a relay or motor starter.

BOILER CONTROL: MULTIPLE BOILERS









D. IAR (INDOOR AIR RESET) WIRING, WHEN USED

- 1. *Heat Demand Terminal Connections*: The end switch leads from the zone valves must connect to the Heat Demand terminals on the electrical connection board as shown in Figure 9A.7.
- 2. See Figure 9A.6 for typical wiring to the IAR inputs when using 4-wire zone valves without a zone controller. For other applications, such as circulator relays or zone controllers, see Appendix A.







Figure 9A.5: Circulator Wiring Terminal Strip
A CAUTION

Polarity – The connections to the IAR positive terminals (IAR +) must be to the same location on the zone valve as the thermostat wire, as shown in Figure A1. The connections to the IAR negative terminals (IAR –) must be from the zone valve terminal connected to the 24VAC common line, as shown. Connecting the wires incorrectly can cause the transformer to be shorted out and damaged. Verify the wiring with a voltmeter.

A CAUTION

Always use a voltmeter to check the leads coming from the end switches of the zone valves. With the thermostat calling for heat, connect the voltmeter leads across the wires coming from the end switches. If the meter shows a voltage reading, the zone valve wires are incorrect. Change the wiring and retest. DO NOT connect the wires to the boiler until you have tested as described. Incorrect wiring can damage the boiler control or other system components.

3. If there is only one transformer feeding all of the zone valves in the system, you can omit the wires to the IAR negative terminals (IAR –) on all but one of the zone valves. This is because these terminals are jumpered internally on the electrical connection board. If there is more than one transformer, provide one wire from each transformer common side to one of the IAR negative terminals (IAR –).

E. SENSOR WIRING

- 1. *Header Sensor is Required*: A header sensor must be installed in the system supply piping. Connect the header sensor ONLY to the master boiler. Install the header sensor in an immersion well. Locate the sensor where it will accurately sense the system water supply temperature. Connect the sensor leads to the electrical connection board as shown in Figure 9A.8.
- 2. Outdoor Reset Application: To operate with outdoor reset, purchase and install an outdoor sensor. Mount the sensor such that it is shielded from direct sunlight if possible and not likely to be covered by snow drifts or debris. Connect the outdoor sensor leads to the master boiler's electrical connection board as shown in Figure 9A.8. (Member boilers could have their own outdoor sensor if they will be operated in override mode by closing the Heat Demand terminals.)
- 3. *Return Water Temperature Sensor*: The return water temperature sensor is optional, only needed if you want to automatically control the boiler postpurge pump cycle time. Install the sensor in a well in the boiler return piping. Connect the sensor leads to the electrical connection board as shown in Figure 9A.8.

F. DHW WIRING

- 1. To operate the boiler for domestic water heating with a storage tank, install and pipe the tank according to the tank manufacturer's instructions and the recommended piping diagrams in this manual. Consult the factory for applications not covered.
- 2. The circulator used for DHW must be operated by a circulator relay or zone controller that is activated when the tank aquastat calls for heat.
- 3. Connect the tank aquastat terminals across the DHW DEMAND terminals on the master boiler's electrical connection board as shown in Figure 9A.7. (Member boilers could be connected to tank aquastats if they are piped appropriately and intended to operate in override mode.)



Figure 9A.6: Indoor Air Reset Wiring to IAR Terminals with 4-wire Zone Valves and No Zone Controller



Figure 9A.7: Cast 92[™] Wiring Summary — Wiring to Electrical Connection Board



Figure 9A.8: Cast 92[™] Wiring Summary — Wiring to Electrical Connection Board (Continued)

G. EXTERNAL INTERLOCKS

- 1. Wire external limits and flow switch, when used, as shown in Figure 9A.9.
- 2. If wiring to and from a motorized combustion air damper, follow the guidelines given in Figure 9A.9. Connect only to the master boiler.

A CAUTION

If any of the member boilers is to operate in override mode, and the system is equipped with a combustion air damper, you must provide special wiring in order to ensure the damper opens and proves when the boiler fires. This must be done without compromising the wiring between the master boiler and the damper.

H. OVERRIDES — CONTROL PRIORITIES

- 1. The Cast 92[™] control can provide override operation for any or all member boilers in a network. This requires the boilers be piped with appropriate isolation piping and controls.
- 2. Override is done by closing a contact across the Heat Demand or DHW Demand terminals of any boiler. These priority inputs override all network controls or 4-20mA input controls to the boiler.
- DHW Demand: The DHW Demand closure takes priority for ALL boilers, including the master and all members. When DHW Demand closes, the boiler or boilers immediately switch to DHW operation, including setting the water temperature to the DHW Setpoint.
- 4. Space Heating, Heat Demand: If any member boiler sees closure across its Heat Demand terminals it will begin operation in space heating mode independently of commands from the master boiler or 4-20mA input source.

A CAUTION

Do not wire boilers for override operation unless the piping design provides automatic isolation of the overriding boilers. The master boiler would be unable to properly control system water temperature if member boilers were to input heat to the system without control from the master. DHW operation, in particular, would raise the supply temperature from overriding boilers to the DHW Setpoint.

<u>∧</u> Notice

Override operation control setup – Boilers must be set up with operating parameters necessary during their override operation; i.e., local setpoint, DHW setpoint, etc.

 Summary — Priority Sequence is: Priority 1 = DHW Demand Priority 2 = Heat Demand

Priority 3 = Cast 92[™] Control input

I. SET TERMINATION DIP SWITCHES

- The control network needs to recognize the beginning and end of the network. This requires setting the four DIP switches on each boiler's electrical connection board.
- 2. See Figure 9A.9 for location of the switches.



Figure 9A.9: Termination DIP Switches

 See Table 9A.1 for required settings. The table gives settings for control modulation — local control and for remote control from a building management system (Modbus protocol).

Table 9A.1: Termination DIP Switch Settings

Boiler	HeatNet	Modbus*
	Switch 1: ON	Switch 1: ON
Master	Switch 2: ON	Switch 2: ON
Master	Switch 3: ON	Switch 3: OFF
	Switch 4: ON	Switch 4: OFF
	Switch 1: ON	Switch 1: ON
Last Member	Switch 2: ON	Switch 2: ON
Last Member	Switch 3: OFF	Switch 3: OFF
	Switch 4: OFF	Switch 4: OFF
	Switch 1: OFF	Switch 1: OFF
Other Members	Switch 2: OFF	Switch 2: OFF
Other Members	Switch 3: OFF	Switch 3: OFF
	Switch 4: OFF	Switch 4: OFF
*Note: Modbus setup is for applications controlled by a building management system. For systems using BACnet or LonWorks, a bridge board is used to interface with the 92-2 control. The switch is "on" when in the down position		

4. DO NOT connect the communications cables (or shielded wires) between boilers until all boilers have had parameters set and then been started up.

and "off" when in the up position.

Λ WARNING

Close the external manual gas valve on every boiler before proceeding. DO NOT open any gas valve, or attempt to fire any boiler, until the boilers have been set up and verified per this manual.

Failure to comply could cause a boiler failure, leading to possible severe personal injury, death or substantial property damage.

J. SET CONTROL PARAMETERS ON KEYPADS

\land NOTICE

Before turning boilers on to set parameters, disconnect all call for heat wiring at the electrical connection boards. This will prevent the boiler for attempting to cycle during the setup process.

- 1. See Section 8, "Boiler Control" for a complete list of control parameters and explanations.
- 2. Carefully read the parameter explanations in Table 8A.1.
- When adjusting the limit band, operating limit (OP LIMIT), local setpoint (LOC SETPOINT) and DHW setpoint, make sure the operating temperature bands do not overlap or cause potential for nuisance cycling.
- 4. *Indoor Air Reset:* Use this option whenever possible. The indoor air technology monitors space heating demand to help the boiler operate at the highest possible efficiency throughout the season. To operate with IAR, you must wire to the IAR input terminals as described in 9C.F.
- 5. *System Clock*: Set the system clock on all boilers to ensure the time stamps will be accurate in the data logs.
- 6. Turn on the power to each boiler and set the on/off switch to ON as you set its parameters.
- 7. Use the boiler's keypad to enter the parameters as described in Section 8.
- 8. After setting a boiler's parameters, turn the power off to the boiler until you are ready to start the boiler up.
- 9. Set the master boiler and each member boiler, following the guidelines given in Table 9A.2.

K. START-UP BOILERS

- 1. Turn off power to all boilers.
- 2. Follow all instructions in the this manual to start-up each boiler and verify operation.

L. CONNECT NETWORK CABLES

\land WARNING

Electrical shock hazard – Turn off power to each boiler before attempting to connect the network cables.

\land NOTICE

Before turning boilers on to check network operation, disconnect all call for heat wiring at the electrical connection boards. This will prevent the boiler for attempting to cycle during the setup process.

Table 9A.2: Control Parameters

Parameter	Master Boiler	Member Boiler
		(see notes)
HEAT BAND	Set on master boiler only	
LOC SETPOI NT	Set	HD only1
SOURCE	Set	HD or DHW only1,2
DHW SETPOINT	Set if DHW will be used	DHW only2
OP LIMIT	Set	Set
LIMIT BAND	Set	Set
IA RESET	ON if IAR is used, or set to OFF	Do not set
OA SHUTDOWN	Set ON if usedor set to OFF	HDOA only3
OA SETPOINT	Set if used	HDOA only3
OA RESET	Set if used	HDOA only3
OA SETPTS	Set if used	HDOA only3
DELTA ENABLE	Set if used	Set if used
DELTA TEMP	Set if used	Set if used
PURGE TIME	Set if used	Set if used
ALWAYS ON	Set if used	Set if used
MASTER PUMP	Set if used	Do not set
NIGHT SETBACK	Set on master boiler only	
OPTIONS (all)	Set	Set
AUX FUNCTIONS	Set on master boiler only	
SYSTEM CLOCK	Set	Set
LOCAL ADD	Automatic	Set (beginning at 2)
CONSOLE ADD	Automatic	Set (beginning at 2)
MODULAR BOILER	Set on master boiler only	
MODULATION PID	Set on master boiler only	
FIRING MODE	Set on master boiler only	
SENSOR #	Set	HD/HDOA only1,3
TYPE	Set	HD/HDOA only1,3
CALIBRATE ?	On any boiler if required	
PASSWORD	Set	Set
COMMUNICATIONS	Set	Set
LOAD DEFAULTS	On any boiler if required	
SYSTEM	On any boiler if required	

Notes:

1. HD Only means to set the parameter for a member boiler only if it is wired for Heat Demand override.

2. DHW Only means to set the parameter for a member boiler only if it is wired for DHW Demand override.

3. HDOA Only means to set these parameters only if the member boiler will be operated with outdoor reset when put in override mode with closure across its Heat Demand terminals (requires outdoor sensor connected to boiler).

M. MASTER BOILER CABLE

- 1. Connect an RJ45 cable to the master boiler H-Link OUT block (item 2, Figure 9A.10) or 3-wire shielded cable to the H-Link terminal strip (item 4, Figure 9A.10). The other end of this cable will be attached to the first member boiler in following steps.
- 2. Turn on power to the master boiler and set its on/off switch to ON.
- 3. You should hear at least 2 beeps.
- 4. The control's firmware version number will display.
- 5. After the control's timer finishes, the display will show STANDBY and SYS SET. This verifies that the master boiler is setup correctly as the master. The same display will show on member boilers when there is a call for heat from the master boiler. When there is no call for heat at a member boiler, the display will show LOC SET instead.



- 6. If the master is functioning correctly, the yellow LED's on the H-Link jack ports will blink. The blinking indicates that the master is trying to communicate with member boilers.
- 7. If a FAULT message is displayed, clear the faults until the STANDBY message is displayed. Refer to troubleshooting suggestions at the end of this manual if you cannot resolve the issue.

N. MEMBER BOILER CABLES

- 1. Begin with the first member boiler.
- 2. Plug the other end of the master boiler's communications cable to the member boiler's input port (Figure 9A.10, item 2 for RJ45 cable or item 4 for 3-wire cable).
- 3. Connect cables to all of the member boilers by cabling from one to the next. Connect incoming cables to item 1 or 4, Figure 9A.10. Connect outgoing cables to item 2 or 4. (Note that shielded cable wires will share terminals when using item 4.)

O. CHECK THE NETWORK

- 1. Turn the power on and the on/off switch to ON for all of the member boilers.
- 2. Allow time for each boiler to initialize.
- 3. After about 30 seconds, the master boiler should recognize the member boilers.
- 4. Navigate to the BOILERS menu, then to HEAT NET BOILERS display. The master control will show the boilers it recognizes. Values from 10 to 15 will display as letters (10=A, 11=B, 12=C, 13=D, 14=E and 15=F).



- 5. If the display shows a blank space, such as "123_56789ABC," the control does not detect the missing boiler (boiler 4). Check the yellow LED on the communication port of the missing boiler.
- 6. NORMAL Connection: LED should flash steadily, about twice per second.
- 7. TERMINATION Incorrect: LED will flash rapidly and stay on.
- 8. OPEN Connection: LED does not flash at all.
- 9. If a FAULT message is displayed, clear the faults until the STANDBY message is displayed. Refer to troubleshooting suggestions at the end of this manual if you cannot resolve the issue.

P. START THE SYSTEM

- 1. Turn off power to all boilers.
- 2. Connect all call for heat wiring to the boilers.

- 3. Turn on power to all boilers and turn the on/off switches to ON.
- 4. The boilers should now operate normally.
- 5. The master boiler will sequence and modulate boilers as necessary to control the water temperature.
- 6. The master boiler will show the number of boilers firing as well as the temperature and heat band display. Use the UP/DOWN keys to scroll through the displays to watch the process of starting and stopping boilers.



	Description
	Description
1	RJ45 HeatNet cable IN from master or previous member
2	RJ45 HeatNet cable OUT to next member boiler
3	Shielded wire (3-2ire), option to RJ45 cable, HeatNet communications INPUT and connection for additional boilers on the network
4	Shielded wire (option to RJ45 cable) Modbus INPUT from building management system
5	USB cable port (for USB cable connection to a PC — required when updating control firmware)
6	RJ45 cable from building management system, when used
7	Plug for insertion into Cast 92 [™] control electrical connection panel
8	NOT SHOWN — An optional plug-in bridge is required to interface with building management systems that use BACnet or LonWorks protocol. The Cast 92 [™] control supports Modbus protocol with no additional components except the RS485 interface board.

Figure 9A.10: RS485 Communications Board

9B. BOILER CONTROL: MULTIPLE BOILERS BUILDING MANAGEMENT CONTROL (BMS)

A. OVERVIEW

- 1. This method uses an RS485 digital communications cable with the Modbus protocol to control a boiler or boiler network.
- The boiler or boiler network will operate as in the Cast 92[™] control method (Section 9A). But, instead of the HEAT DEMAND input, a software form of the HEAT DEMAND input is used (address 40001 — Boiler/System Enable/Disable).
- The System Setpoint Timer needs to be loaded periodically to allow the boiler system to revert to the Cast 92[™] local control from the master boiler in the event communications is lost.
- 4. The Modbus protocol allows writing and reading registers using Modbus commands. An optional BACnet or LonWorks bridge module can be used to connect the Modbus network to a BACnet or LonWorks network.
- 5. This method allows enabling and disabling the boiler or control system; changing setpoints; and reading boiler status or temperatures remotely, using digital commands from a Building Management System.
- 6. The master boiler assumes the role of MEMBER, RTU, 192Kb, 8 bits, Even Parity, 1 stop bit, when connected to a BMS.
- 7. The Member Boilers should not be connected to a BMS system other than to view read-only addresses.

B. MODBUS REGISTERS

- 1. See Table 9B.1; Table 9B.2 and Table 9B.3 for register requirements.
- 2. The system setpoint timer and system setpoint work in tandem to externally control the operating setpoint.
- The setpoint (countdown) timer should be loaded with a timeout value (in seconds) prior to writing the system setpoint.
- 4. When the timer reaches zero, the control assumes that the BMS is no longer operating and the local setpoint (saved on the master control) is reloaded.
- 5. This is a fail-safe feature used to help safeguard the system in case of BMS failure.
- 6. If the setpoint timer is not written, a default timeout value of 60 seconds is assumed.
- 7. To write the system clock, registers 40009 40015 must first be loaded with the correct date and time. Then, a 1 must be written to register 16 to write the date and time to the system clock.

Table 9B.1: Modbus Holding (Read/Write) Registers

Address	Data Type	Description	Valid Values/Range
40001	Unsigned	Boiler/System Enable/Disable	0 = Disabled/Off 1 = Enabled/On
40002	Unsigned	System Setpoint Timer (1)	0 – 65535 Seconds
40003	Unsigned	System Setpoint (1)	40°F – 220 °F
40004	Unsigned	Outdoor Air Reset Enable/Disable	0 = Disabled/Off 1 = Enabled/On
40005	Unsigned	Outdoor Air Setpoint	40°F -100 °F
40006	Unsigned	Water Temperature at High Outside Air	60°F -150 °F
40007	Unsigned	High Outside Air Temperature	50°F -90 °F
40008	Unsigned	Water Temperature at Low Outside Air	70°F -220 °F
40009	Signed	Low Outside Air Temperature	-35°F -40 °F
40010	Unsigned	Set Clock – Month (2)	0 – 11
40011	Unsigned	Set Clock – Day of Month (2)	1 – 31
40012	Unsigned	Set Clock – Year (2)	0 – 99
40013	Unsigned	Set Clock – Hours (2)	0 – 23
40014	Unsigned	Set Clock – Minutes (2)	0 – 59
40015	Unsigned	Set Clock – Seconds (2)	0 – 59
40016	Unsigned	Set Clock - Day of Week (2)	1 – Monday 7 – Sunday
40017	Unsigned	Set Clock – After the Set Clock Registers listed above have been written, a 1 must be written to this location to set the clock. (2)	1

Table 9B.2: Boiler Status Flags

Bit	Description	Bit	Description
0	Disabled	16	Pilot Valve
1	Local Override	17	Blower
2	Alarm	18	Ignition Alarm
3	Failed	19	Valve Alarm
4	Member Error	20	High Limit
5	Boiler Running	21	Air Prove Switch
6	Pump Running	22	XS Factory
7	Spare 3 Interlock	23	Software Operator
8	8 LWCO Interlock 24 Header Sensor 1		Header Sensor not Present
9	VFD Interlock 25 Supply Sensor not Pre		Supply Sensor not Present
10	Gas Prove	26	Return Sensor not Present
11	Spare 4	27	Outside Air Sensor not Present
12	Operator Interlock	28 —	
13	Water Prove (Flow) Interlock	e (Flow) Interlock 29 —	
14	Air Prove UV Sensor Interlock	30 Master Boiler	
15	Main Valve	31	Present (Boiler Detected)

C. BACNET OR LONWORKS PROTOCOLS

- 1. Install the correct bridge to adapt to building management systems using BACnet or LonWorks protocols.
- The bridge translates the BACnet or LonWorks input to the Modbus protocol for compatibility with the Cast 92™ controls.

D. WIRING AND SET-UP

- 1. Wire and set up the master boiler and member boilers exactly as in Section 9A.
- 2. ALL control parameters must be set up just as in Section 9A.
- 3. The ONLY difference in setup is the termination DIP switch settings. Use the settings for Modbus communications given in Table 9A.1.
- 4. Connect communications cables (RJ45 or shield-wire cables) between the control communications boards as for the local control method.
- 5. Verify network operation BEFORE connecting the building management system.

E. CONNECT THE BMS CABLE

- DO NOT connect the building management system cable until the boiler network has been proven to operate independently. The system is designed to revert to local control by the master boiler should communications with the building management system be lost.
- 2. Turn off power to the master boiler.
- 3. See Figure 9A.10. Connect an RJ45 cable to the BMS input port, item 6. Or use shielded wire cable, connected to terminal block, item 3.

F. VERIFY BMS/HEATNET OPERATION

- 1. Turn on power to the master boiler.
- 2. Allow the master boiler to initialize.
- 3. Verify operation with the building management system.

Table 9B.3: Modbus Input (Read-only) Registers

Address	Data Type	Description	Valid Values/Range
30001	Unsigned	Boilers Running	0 – 16
30002	Unsigned	Modulation (% BTU Load)	0 – 100
30003	Signed	Header / System Temperature	32 – 250 °F
30004	Signed	Supply Temperature	32 – 250 °F
30005	Signed	Return Temperature	32 – 250 °F
30006	Signed	Outside Air Temperature	-40 – 250 °F
30007	Signed	Spare Input 1	-32768 to 32767
30008	Signed	Spare Input 2	-32768 to 32767
30009	Unsigned	Clock – Month	0 – 11
30010	Unsigned	Clock – Day	1 – 31
30011	Unsigned	Clock – Year	0 – 99
30012	Unsigned	Clock – Hours	0 – 23
30013	Unsigned	Clock – Minutes	0 – 59
30014	Unsigned	Clock – Seconds	0 – 59
30015	Unsigned	Clock – Day of Week	1 – Monday 7 – Sunday
30016 - 30047	Unsigned	Boilers 1 – 16 status flag (32-bit) registers. The upper 16-bits of each 32-bit register is stored at odd numbered addresses 30016 -30046. The lower 16-bits of each 32-bit register is stored at even numbered addresses 30017 - 30047.	See the Boiler Status Flags Table Below
30048 – 30079	Unsigned	Boilers 1 – 16 runtime (32-bit) registers. The upper 16-bits of each 32-bit register is stored at odd numbered addresses 30048 – 30078. The lower 16-bits of each 32-bit register is stored at even numbered addresses 30049 – 30079. When the upper and lower registers are combined they form a 32-bit unsigned integer that is the number of seconds that the boiler has been running. For instance: (((Register 29) * 65536) + Register 30) = Boiler 1 runtime in seconds.	0 – 4294967295 Seconds

9C. BOILER CONTROL: MULTIPLE BOILERS EXTERNAL 4–20MA CONTROL

\land WARNING

Electrical shock hazard – Disconnect all electrical power sources to the boiler before making any electrical connections.

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

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

\land NOTICE

The electrical connections to this boiler must be made in accordance with all applicable local codes and the latest revision of the *National Electrical Code, ANSI /NFPA-70.* Installation should also conform to CSA C22.1 Canadian Electrical Code Part I if installed in Canada. Install a separate 120 volt 15 amp circuit for the boiler. A properly rated shut-off switch should be located at the boiler. The boiler must be grounded in accordance with the authority having jurisdiction, or if none, the latest revision of the *National Electrical Code, ANSI/NFPA-70.*

Line voltage field wiring of any controls or other devices must use copper conductors with a minimum size of #14 awg. Use appropriate wiring materials for units installed outdoors.

A. OVERVIEW — CONTROL SETUP SEQUENCE

A CAUTION

Follow the Boiler manual – Install the boilers according to this manual before attempting to set up the control system.

- 1. This method can be used for from 1 to 5 boilers.
- 2. Install all boilers per this manual.
- 3. Close the external gas valve on every boiler.
- 4. Wire all boilers following the guidelines in this section.
- 5. DO NOT install a header sensor on any of the boilers.
- 6. Disconnect the wires to the boilers' Remote Enable terminals (and any override wiring to Heat Demand or DHW Demand terminals) to ensure there will be no call for heat while proceeding.
- 7. Set the boilers' control parameters using their display/keypads.

- 8. Follow the instructions in this manual to start-up each boiler before proceeding further.
- 9. Finish by reconnecting call for heat wiring, then operating the complete system to verify operation in all modes.

B. CONNECT 4-20MA WIRING

See Figure 9C.6 for wiring from the 4-20mA controller. The control must provide the 4-20mA signal and a contact for each boiler to enable its operation by closing across the Remote Enable contact.

C. POWER SUPPLY (120 VAC)

- 1. See Figure 9C.1 and Figure 9C.2.
- 2. Connect minimum 14awg copper wire to the power connection as shown in Figure 9C.2.
- 3. Install a fused service switch, mounted and installed in accordance with all applicable codes.



Figure 9C.1: Electrical Connection Board

D. CIRCULATOR WIRING

1. Postpurge Circulator (92-2 only):

The circulator shipped installed with the boiler cannot be used for system circulation. It must be used as supplied from the factory. It circulates water after the boiler stops firing to prevent potential damage from heat pocketing in the top of the heat exchanger.

The postpurge circulator is factory-piped and prewired. Do not change the usage, the wiring, the location or the piping.

2. Boiler Circulator:

See Section 4 for circulator piping.

Figure 9C.3, Figure 9C.4, and Figure 9C.5 show wiring of the Boiler circulator (or boiler/system circulator) to the terminal strip of the 92-2 electrical connection board.

DO NOT directly connect a circulator with a motor larger than 1/4 hp. For larger motors, install a circulator relay or motor contactor . Figure 9C.3 and Figure 9C.4 show the correct ways to install the boiler circulator using a relay or motor starter.







Figure 9C.3: Wiring the Boiler Circulator Using a Circulator Relay (Required for Motors over 1/4 hp)







Figure 9C.5: Circulator Wiring Terminal Strip

E. 4-20MA OPERATION

- 1. A 4.02 mA current signal will start the boiler, at low fire. A 20mA signal will cause the boiler to go to full input.
- 2. Between these input signal limits, the boiler modulates. The boiler firing rate percentage is equal to the percentage of the signal between 0 and 20 mA. Example, a signal of 12 mA is 60% of 20 mA, so the boiler firing rate would be 60% of max.
- 3. In addition to the 4-20mA signal, the remote controller must also close a contact across each boiler's Remote Enable contact in order for the boiler to fire.
- 4. See Figure 9C.6 for wiring. Notice that the boiler 4-20mA terminals are wired in series.

E IAR (INDOOR AIR RESET) WIRING — APPLY ONLY IF USING SPACE HEATING OVERRIDE MODE

- IAR can only be used if one or more of the boilers is wired and piped for override operation. Override would occur when a contact closed across the Heat Demand terminals. While this contact is closed, the boiler will operate based on Cast 92[™], including feedback for IAR if wired.
- 2. If override operation will be used, and you want to operate with IAR when in override mode, follow the instructions under Section 9A in this manual to wire for IAR.

G. SENSOR WIRING

- 1. Header sensor cannot be used when the boilers are configured for remote operation by a 24-mA source.
- 2. Outdoor Reset Application can be Done Only in Override Mode: To operate with outdoor reset, purchase and install an outdoor sensor. Mount the sensor such that it is shielded from direct sunlight if possible and not likely to be covered by snow drifts or debris. Connect the outdoor sensor leads to the master boiler's electrical connection board as shown in Figure 9A.8. (Member boilers could have their own outdoor sensor if they will be operated in override mode by closing the Heat Demand terminals.)
- 3. *Return Water Temperature Sensor*: The return water temperature sensor is optional, only needed if you want to automatically control the boiler postpurge pump cycle time. Install the sensor in a well in the boiler return piping. Connect the sensor leads to the electrical connection board as shown in Figure 9A.8. Each boiler requires a return water temperature sensor.

H. DHW WIRING — ONLY IF USING DHW OVERRIDE MODE

1. The boiler (or boilers) must be piped with isolation valves and wired for override operation. Override of the 4-20mA input will occur if a contact closes across the boiler's DHW Demand terminals.

- 2. To operate the boiler for domestic water heating with a storage tank, install and pipe the tank according to the tank manufacturer's instructions and the recommended piping diagrams in this manual. Consult the factory for applications not covered.
- 3. The circulator used for DHW must be operated by a circulator relay or zone controller that is activated when the tank aquastat calls for heat.
- 4. Connect the tank aquastat terminals across the DHW DEMAND terminals on the master boiler's electrical connection board as shown in Figure 9A.7. (Member boilers could be connected to tank aquastats if they are piped appropriately and intended to operate in override mode.)External interlocks
- 5. Wire external limits and flow switch, when used, as shown in Figure 9C.7.
- 6. The combustion air interlocks cannot be used when operating with a 24-mA remote control. Combustion air damper control must be done by the remote control system.

I. OVERRIDES — CONTROL PRIORITIES

- The Cast 92[™] control can provide override operation for any or all member boilers. This requires the boilers be piped with appropriate isolation piping and controls.
- 2. Override is done by closing a contact across the Heat Demand or DHW Demand terminals of any boiler. These priority inputs override all 4-20mA input controls to the boiler.
- DHW Demand The DHW Demand closure takes priority for ALL boilers, including the master and all members. When DHW Demand closes, the boiler or boilers immediately switch to DHW operation, including setting the water temperature to the DHW Setpoint.
- 4. Space heating, Heat Demand If any member boiler sees closure across its Heat Demand terminals it will begin operation in space heating mode independently of commands from the 4-20mA input source.

Do not wire boilers for override operation unless the piping design provides automatic isolation of the overriding boilers.

NOTICE

Override operation control setup — Boilers must be set up with operating parameters necessary during their override operation; i.e., local setpoint, DHW setpoint, etc.

- 5. Summary Priority Sequence is: Priority 1 = DHW Demand
 - Priority 2 = Heat Demand
 - Priority 3 = 4-20mA Input/Enable



Figure 9C.6: Cast 92[™] Wiring Summary — Wiring to Electrical Connection Board



Figure 9C.7: Cast 92[™] Wiring Summary — Wiring to Electrical Connection Board (Continued)

📐 WARNING

Close the external manual gas valve on every boiler before proceeding. DO NOT open any gas valve, or attempt to fire any boiler, until the boilers have been set up and verified following the instructions in this manual.

Failure to comply could cause a boiler failure, leading to possible severe personal injury, death or substantial property damage.

J. SET CONTROL PARAMETERS ON KEYPADS

🔨 NOTICE

Before turning boilers on to set parameters, disconnect all call for heat wiring at the electrical connection boards, including the wiring to the boilers' Remote Enable terminals. This will prevent the boiler for attempting to cycle during the setup process.

- 1. See Section 8, "Boiler Control", for a complete list of control parameters and explanations.
- 2. Carefully read the parameter explanations in Table 8.2.
- 3. When adjusting the limit band, operating limit (OP LIMIT), local setpoint (LOC SETPOINT) and DHW setpoint, make sure the operating temperature bands do not overlap or cause potential for nuisance cycling.
- 4. *System Clock*: Set the system clock on all boilers to ensure the time stamps will be accurate in the data logs.
- 5. Turn on the power to each boiler and set the on/off switch to ON as you set its parameters.
- 6. Use the boiler's keypad to enter the parameters as described in Section 8B.
- 7. After setting a boiler's parameters, turn the power off to the boiler until you are ready to start the boiler up following the Boiler manual instructions.

K. START-UP BOILERS

- 1. Turn off power to all boilers.
- 2. Follow all instructions in this manual to start-up each boiler and verify operation.

L. START THE SYSTEM

- 1. Turn off power to all boilers.
- 2. Connect all call for heat wiring to the boilers.

- 3. Turn on power to all boilers and turn the on/off switches to ON.
- 4. The boilers should now operate normally.
- 5. The remote 4-20mA controller will sequence and modulate boilers as necessary to control the water temperature.

Table 9C.1: Control Parameters

Parameter	When to Set (See Notes)	
HEAT BAND	Set	
LOC SETPOINT	HD only1	
SOURCE	HD only1	
DHW SETPOINT	DHW only2	
OP LIMIT	Set	
LIMIT BAND	Set	
IA RESET	HD only1	
OA SHUTDOWN	HD or HDOA only1,3	
OA SETPOINT	HD or HDOA only1,3	
OA RESET	HDOA only3	
OA SETPTS	HDOA only3	
DELTA ENABLE	Set if used	
DELTA TEMP	Set if used	
PURGE TIME	Set if used	
ALWAYS ON	Set if used	
MASTER PUMP	Set as required	
NIGHT SETBACK	HD only1	
OPTIONS (all)	Set	
AUX FUNCTIONS	DO NOT use	
SYSTEM CLOCK	Set	
LOCAL ADD	DO NOT use	
CONSOLE ADD	DO NOT use	
MODULAR BOILER	DO NOT use	
MODULATION PID	DO NOT use	
FIRING MODE	DO NOT use	
SENSOR #	HD/HDOA only1,3	
TYPE	HD/HDOA only1,3	
CALIBRATE ?	Only as required	
PASSWORD	Set	
COMMUNICATIONS	Only as required	
LOAD DEFAULTS	Only as required	
SYSTEM	Only as required	

Notes:

- 1. HD Only means to set the parameter for a member boiler only if it is wired for Heat Demand override.
- DHW Only means to set the parameter for a member boiler only if it is wired for DHW Demand override.
- 3. HDOA Only means to set these parameters only if the member boiler will be operated with outdoor reset when put in override mode with closure across its Heat Demand terminals (requires outdoor sensor connected to boiler).

10. FILL AND TEST THE SYSTEM

\land WARNING

Failure to adhere to the following could result in boiler section failure, resulting in potential for severe personal injury, death or substantial property damage.

- 1. Flush and clean the system before filling.
- 2. Provide clean water to fill the system
- 3. Water quality must be as prescribed in this manual.

Follow the System Water Checklist:

Follow the guidelines in this section to fill and test the system. The system water quality must meet the conditions given, and you and the owner must make sure the conditions will be maintained throughout the life of the boiler.

A. CLOSED SYSTEMS ONLY

Do not apply the Cast 92[™] boiler on open systems, such as direct heating of domestic water, swimming pool heating or process applications that use system water. For these applications, you must install a heat exchanger.

B. HARD WATER CONDITIONS

- 1. If water hardness exceeds 7 grains, use a water softener in the fill line to soften the water before it enters the system.
- 2. On multiple boiler commercial installations, the large volume of water in the system can contain substantial mineral salts, even if the fill water hardness is less than 7 grains. These salts can deposit in the boiler heat exchanger as limestone, causing possible section damage. Commercial installations should usually be filled with soft water to avoid this problem.

C. PREVENT OXYGEN CORROSION

- 1. Make sure the system is provided with adequate automatic air elimination, including an in-line air separator and automatic air vents (diaphragm or bladder tank systems) or piping to the expansion tank (closed-type expansion tank systems).
- 2. Do not connect the Cast 92[™] boiler to a system that contains non-barrier radiant tubing. Non-barrier tubing can allow oxygen to enter the system, causing oxygen corrosion of the boiler heat exchanger.

D. FLUSH AND CLEAN THE SYSTEM

1. Flush the system to remove sediment, flux, filings and other foreign matter. Use cleaning chemicals sold for use in hydronic systems.

- 2. Replacement boiler installations often have large amounts of accumulated sediment and corrosion that must be removed to ensure boiler life and reliable operation.
- 3. Flush each zone of multi-zone systems individually using the purge valves and isolation valves in the system.
- 4. Flush until the water runs clean.
- 5. After flushing the system thoroughly, use trisodium phosphate or other chemical sold for cleaning hydronic systems to remove sediment and sludge.

<u> WARNING</u>

Use caution when working with chemicals, following all guidelines specified by the chemical supplier and the applicable codes.

E. PURGE AIR FROM THE SYSTEM

- 1. The system should be installed with purge valves such as those shown in the suggested piping in this manual. Purging is the most efficient way to fill the system and remove most of the air.
- 2. Connect a hose to a purge valve and run the hose to an appropriate draining area. (When filling with antifreeze solution, run the hose back to the solution tank.)
- 3. Close all isolation valves in the system.
- 4. Open the manual valve (or quick-fill valve) on the make-up water line. (When filling the system with glycol, connect from the glycol pump to one of the purge valves with a hose.)
- 5. Purge each zone separately by opening the isolation valves for that zone, allowing water to push the air through and fill the zone. After filling the zone, close the isolation valves and move to the next zone.
- 6. Fill and purge the boiler loop in the same manner.
- 7. After the boiler is operated for a while, air entrained in the fill water will bubble out of the water as it heats, and will have to be removed by using air vents in the system.

F. ADD A CHEMICAL INHIBITOR

After purging and filling the system, add a chemical inhibitor sold for use in hydronic systems to prevent limestone and magnetite deposits from forming, and to protect the boiler from galvanic corrosion.

G. WATER PH

- 1. The boiler water must be slightly basic, never acidic. Use litmus paper to check pH, which should range from 6.5 minimum to 11 maximum.
- 2. If pH does not comply, provide water chemistry correction from a qualified water treatment specialist. If required, make sure that the owner is aware and that the regimen will be continued.

H. ANTIFREEZE

- 1. Antifreeze for hydronic systems contains propylene glycol and an inhibitor. Without the inhibitor the glycol is actually corrosive. So the system water must be checked at least annually to ensure that the inhibitor is at the correct level.
- 2. Never use galvanized piping in a system that contains antifreeze. Never use chromate water treatment. Either of these will react with the inhibitor in the antifreeze mix.
- 3. Antifreeze Concentration: If not using a pre-mixed antifreeze solution, determine the amount of antifreeze to add based on the total volume of the system piping, the boiler and the expansion tank. Follow the antifreeze manufacturer's instructions for the ratio of glycol required for the lowest expected exposure temperature. NEVER use a glycol mix greater than 50%.
- 4. *Prevent Leaks*: Glycol will escape more easily than water through any leak in the system. So the glycol concentration will reduce if a leak is allowed to continue. Eliminate all leaks in the system and have the owner frequently inspect the visible portions of the system for leaks periodically. Do not use circulators or valves with packing glands, the packing glands can weep.
- 5. Install a Water Meter: Because the system must be installed with automatic water make-up to ensure pressure will always be at least 12 psig, you should install a water meter with one half-gallon resolution on the make-up water line. This will allow monitoring to see if excessive make-up water is entering the system.
- 6. *Circulator Sizing*: Glycol/water mixtures do not move heat as well as water only. The circulator size must be increased to account for this. As a rule of thumb, increase the flow rate by 15%. Assume a 10% reduction in pressure drop compared to water only at a give flow rate.
- 7. *Constant Circulation*: For areas of the system that will be exposed to low temperatures, use continuous circulation to keep the water moving in the pipes.
- 8. *Expansion Tank Sizing*: Increase the expansion tank size about 20% to account for the effects of the antifreeze.
- 9. Indirect Heat Exchangers: Output from indirect heat exchangers (including indirect water heaters) can drop substantially when using antifreeze/water. Make sure the exchanger is sized correctly for the application.

Λ WARNING

Use only antifreeze sold for use in hydronic systems — Never use automotive antifreeze. Automotive antifreeze and ethylene glycol are toxic to humans and animals and will damage rubber components in the system.

Make sure the owner is aware that the antifreeze must be checked periodically by a qualified technician to ensure the concentration is correct and that the inhibitor level is adequate.

Obtain the MSDS for the antifreeze and leave a copy with the owner. Follow antifreeze manufacturer's guidelines for application and maintenance.

Failure to follow these guidelines could result in system or boiler failure, causing possible severe personal injury, death or substantial property damage.

I. SYSTEM PRESSURE

1. Once the system is cleaned, filled, purged and treated as required, set the make-up water pressure reducing valve to the correct cold-fill pressure. This is usually 12 psig for systems using 30 psig relief valves. For higher pressure systems, set the cold-fill pressure such that the system pressure will never exceed about 80% of the boiler relief valve setting when system water temperature reaches the maximum operating temperature that the system and boiler temperature controls will allow.

📐 WARNING

The pressure in the boiler must never be below 12 psig. Lower pressure could allow localized boiling in the boiler heat exchanger, causing possible damage and section failure.

- 2. At cold fill, the water level in closed-type expansion tanks should not be above center. Use the tank fitting to verify tank water level is correct.
- 3. As the system heats up, the water will expand, causing the system pressure to increase. If the expansion tank is properly sized and installed, the system pressure will never exceed about 80% of the relief valve set pressure (24 psig for typical residential systems).
- 4. If the system operating pressure becomes too high, check the expansion tank to ensure it is large enough. For closed-type expansion tanks, make sure there are no leaks in the piping or the tank and the tank fitting is correctly installed. For diaphragm or bladder-type tanks, you may have to remove the tank from the system and verify that it can hold pressure. If it cannot hold pressure, the membrane may be damaged.

WARNING

If the system pressure is allowed to rise too high, the boiler relief valve will open, allowing water to escape from the system. The resultant addition of make-up water will cause mineral deposits and oxygen corrosion in the boiler.

FILL AND TEST THE SYSTEM

J. FINAL CHECKS

- 1. After the system is cleaned, filled and purged, and the system pressure is correctly set, make sure the water chemistry is correct. The pH and chemistry must be as required (and specified by the chemical treatment specialist when required).
- 2. Make sure all valves are correctly set. Isolation and fill valves should be open before start-up. Purge valves must be closed.
- 3. Open the valve on each automatic vent in the system about one quarter turn to allow venting.
- 4. Thoroughly inspect the system for leaks or weeping valves.

\land WARNING

Eliminate all system leaks to prevent excessive make-up water, which introduces oxygen as well as lime-forming minerals. This can lead to heat exchanger damage, resulting in possible severe personal injury, death or substantial property damage.

5. Watch the boiler pressure/temperature gauge throughout the start-up process. Make sure the pressure never drops below 12 psig and never goes higher than 80% of the boiler relief valve setting pressure.

11. START-UP PROCEDURE

🗥 WARNING

Failure to adhere to the following could result in severe personal injury, death or substantial property damage.

- 1. Accessibility: The boiler must be accessible from both the right and left sides in order to do a correct start-up/adjustment. Make sure the flame window on the left side and the gas valve throttle adjustment opening in the jacket top are accessible. See Figure 11.5.
- 2. Follow the Start-up Checklist: Perform the start-up check list procedures before starting the boiler.
- 3. Turn Off Power and Fuel Supply: Turn off electrical power to boiler if not already off. Close the main manual gas valve at the boiler.
- 4. Verify the Gas Type: Check the boiler rating plate to make sure that the boiler is for the type of gas that will be used. If it is not, do not the boiler will have to be adjusted for the correct gas, for both high fire and low fire.
- 5. Install Boiler Per This Installation Manual: Read and follow all instructions for installation, venting, and control set up.

All water piping, gas piping, vent piping and air piping must be complete before starting the boiler.

- 6. Check Gas Piping for Leaks: Check all gas piping for leaks, including the boiler interior gas piping and connections, per Section 5 of this manual.
- 7. Never Leak Test with Flame: Never use an open flame to test for gas leaks. Always use an approved leak detection method.
- 8. Propane Gas Applications: The odorant in propane gas can fade over time, reducing or eliminating the gas odor. This makes the gas undetectable by smell. Before start-up, and periodically afterwards, have the propane supplier check/verify the odorant level.
- 9. Never Attempt to Measure Gas Valve Outlet Pressure: Do not attempt to measure the boiler gas valve outlet pressure. The high negative pressure in the venturi can suck fluid out of a manometer, pulling it into the gas valve. This would destroy

the gas valve, rendering it unusable.

\land WARNING

Should overheating occur or gas supply fail to shut off:

Do not interrupt water flow to the boiler. Instead, shut off gas supply to the boiler with the manual valve in the gas supply line.

A. START-UP CHECKLIST

1. Read this Manual:

Read and familiarize yourself with this manual before proceeding with start-up.

2. Check the Boiler Area:

Make sure there are no combustible materials or chemicals that could cause air contamination in the boiler room.

3. Verify Vent Piping:

Inspect vent piping to be sure all joints are secure and properly sealed.

Verify vent piping supports are correctly placed and secure.

Check vent termination to be sure it is correct and not obstructed.

Measure total vent pipe length and note the number of fittings. Make sure the vent complies with Sections 3 through 3F.

4. Verify Combustion Air and Ventilation:

If combustion air is supplied from the boiler room, make sure air openings agree with the requirements given in this manual.

If combustion air is piped to the boiler:

- a. Inspect air piping to be sure all joints are secure and properly sealed.
- b. Verify air piping supports are correctly placed and secure.
- c. Check air inlet termination to be sure it is correct and not obstructed.
- d. Measure the air piping length and note the number of fittings. Make sure the air piping complies with the Sections 3 through 3F.

Verify ventilation openings to the boiler room. Even if air is piped to the boiler, the boiler room must have ventilation openings as specified in this manual.

5. Verify Electrical Connections:

Before turning power on to the boiler:

- a. Remove the electrical box covers on the right side of the boiler.
- b. Inspect all wiring and connections. Make sure there are no loose connections or wires.

6. Controls:

Follow the instructions in Sections 8 and 9A through 9C to set the operating temperatures and parameters required for the installation (if not already done).

Set limit controls to their lowest settings.

Verify thermostat circuits following the procedure given in Sections 8 and 9A through 9C (if not already done).

7. Verify Boiler/System Water Piping:

Inspect all water piping. Make sure it complies with this manual.

Check the boiler relief valve. Verify the relief valve setting is correct for the application.

Make sure the boiler and system are full of water and that the system has been purged and is ready for operation.

<u>System Pump</u>: Activate the system pump if it is not controlled by the Cast 92[™] Control.

8. Verify Gas Piping and Connections:

Before starting the boiler, smell around the area for presence of gas odorant. Immediately locate and correct any leak.

Connect a manometer to the manual gas valve outlet test port. Open the valve and measure the gas pressure. It must not be above 1/2 psig (3.5 kPa).



Open the main manual gas valve and check the gas piping and joints in the boiler. Check for leaks, if not already done, following the instructions in Section 5.

9. Prepare the Condensate System:

Verify the condensate line is connected to the boiler, correctly installed and terminated.

Turn on power to the condensate pump (if used).

Make sure the condensate neutralization system (if used) is functional.

Slide the condensate hose off of the boiler condensate hose barb. Connect a clear plastic tube (3/16" diameter) to the hose barb. Pour water into the tube until water backs into the tube at the hose barb, indicating the trap is full.

After filling the condensate trap, remove the fill hose.

Reattach the condensate line to the boiler condensate hose barb.



10. **Turn on Power and Gas:** Turn on power to the boiler.

Open the manual gas valve.

11. Operating Instructions:

Adjust system controls or thermostats to call for heat.

Read about the Cast 92[™] control display on page 88. Then start the boiler following the Operating instructions on page 89.

The boiler must be checked and adjusted, if necessary, after starting. Once the boiler has started, follow the instructions beginning on page 90 to check boiler operation and adjust as needed, using instruments.

12. If the Boiler Doesn't Start:

Check external limit controls, low water cut-offs, etc. to be sure they are closed.

Check the Cast 92^{TM} control display for indications of faults.

Are control settings correct for the application?

Is the gas supply on, and is gas pressure within acceptable range?

Are room thermostats or building controls calling for heat?

Are all electrical connections intact?

If none of the above resolve the problem, follow Section 12, Troubleshooting.

NOTICE

To reset the Cast 92[™] control from lockout: Turn the boiler on/off switch OFF, then back ON.

NOTICE \wedge

For more information: See Sections 8, 9A, 9B, 9C and 12 for additional information and troubleshooting.

Setpoint Heat band Actual temperature

Default readout shows local setpoint or header setpoint; use arrow keys to change to show DHW setpoint, supply temperature, outside temperature, and other values; use the DOWN key to see other values, such as DHW setpoint and supply temp

The **UPPER LEFT** display shows boiler status.

During start sequence, this area will indicate what is happening and then switch to "RUN %____". The RUN % is the % of full input.

If there is a call for heat and the supply (or header) temperature is within the Heat band, the display will show "HEATING" until the call for heat stops or the temperature drops low enough for the control to start the boiler.

The LOWER LEFT display shows the heat band (temp range from min to max input) and setpoint on the bottom, and the actual temperature along the top. This tells you where the temperature is within the control range.

Figure 11.1: HeatNet Control Display During Operation

Table 11.1: Boiler Sequence of Operation, Fault States and HeatNet Control Display Information					

Normal Condition	Blower Status	Time	Ignition Status	Gas Valve Status	Display (upper left)
Standby (not heat call)	OFF		OFF	OFF	STANDBY
	OFF (Flow switch and other interlocks in the flow switch circuit must prove)	10 Seconds	OFF	OFF	FLOW WAIT
Start (call for heat)	OFF if supply temperature is above the bottom of the heat band; circulator runs, but boiler does not fire yet	Demand	OFF	OFF	HEATING
	ON at purge RPM (55% of maximum) when supply temperature drops below the bottom of the heat band	10 Seconds			PRE PURGE
Ignition Trial	ON at ignition RPM (30% of maximum)	4 seconds	ON	ON	IGN 30%
Flame is Sensed (Stabilization period)	ON at ignition RPM (30% of maximum)	6 seconds	OFF	ON	IGN 30%
Operate on Demand	ON at RPM based on demand (control determines firing rate % based on demand and rate of change, etc.)	Demand	OFF	ON	RUN %XXX
End Call for Heat	ON at purge RPM (55% of maximum)		OFF	OFF	POST PRGE
Ignition Failure	ilure ON at purge RPM Boiler restarts a normal sequence Control will try 3 times, then lockout		Normal display unless t (alternating to:) Date &	hree attempts fail, then sh Time of lockout	ows: IGN LOCKOUT
Flame Failure	ON at purge RPM for postpurge Boiler res	tarts a normal sequence	Normal display unless i	gnition is unsuccessful thr	ee times after restart

B. LIGHTING & OPERATING PROCEDURES

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING

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

- A. This boiler 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 boiler area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor. See below.
- C. Use only your hand to turn the gas valve handle. 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 boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any gas control that has been under water.

WHAT TO DO IF YOU 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.

OPERATING INSTRUCTIONS

WARNING

Do not attempt to operate this boiler unless it has been started, adjusted and maintained at least annually by a qualified heating service technician.

- 1. STOP! Read the safety information above on this label.
- 2. Set the thermostat to lowest setting. Turn off all electrical power to the boiler. Press the boiler ON/OFF switch to **OFF**.
- 3. DO NOT TRY TO LIGHT THE BURNER BY HAND.
- 4. Turn manual gas valve handle clockwise \frown to **CLOSE** the gas valve. (Gas valve may have lever handle. Valve location will vary by installations.)
- 5. 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. If you don't smell gas, go to the next step.
- 6. Turn manual gas valve handle counterclockwise 🖍 to **OPEN** the gas valve.
- 7. Turn ON all electrical power to the boiler.
- 8. Set the thermostat to its highest setting. Press the ON/OFF switch to **ON**.
- 9. The DISPLAY will cycle through the ignition sequence, and show "RUN" when the boiler is operating.
- 10. If the boiler does not operate, follow the instructions below to "TURN OFF GAS TO BOILER." Call your service technician or gas supplier.



TO TURN OFF GAS TO BOILER

- 1. Set the thermostat to its lowest setting.
- 2. Turn off all electric power to the boiler if service is to be performed.
- 3. Turn manual gas valve handle clockwise r to **CLOSE**. DO NOT FORCE THE HANDLE.

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Figure 11.2: Lighting & Operating Instructions

C. TURN THE BOILER OFF

- 1. Turn OFF the boiler on/off switch and allow the boiler to cycle off.
- 2. CLOSE the manual gas valve.
- 3. *Multiple Boiler Applications*: Disconnect the communications cable or 3-wire connection to the boiler connection board. (Replace when done.)

D. CHECK IGNITION

- 1. With the manual gas valve CLOSED, start the boiler with the on/off switch.
- 2. Look into the flame window, left side of the boiler (Figure 11.5).
- 3. When ignition starts, the spark should jump between the electrodes, not to other surfaces.
- 4. The spark should be strong and steady. If the spark is acceptable, turn the boiler on/off switch OFF. Then proceed with the start-up adjustment procedure.
- 5. If the spark jumps to ground or is unsteady, turn the boiler OFF. See the Maintenance section of this manual for the procedure to remove and inspect the electrode assembly. Replace the electrode assembly if it is damaged or not within specifications.

E. INSERT COMBUSTION ANALYZER PROBE

\land WARNING

The boiler must be checked and adjusted using combustion test instruments. Failure to accurately measure flue gas analysis and adjust the boiler as needed could result in severe personal injury, death or substantial property damage.

1. After the boiler has cycled off, loosen the hose clamp covering the flue gas sampling hole (Figure 11.3).

A CAUTION

The flue gas vent pipe may be hot. Touching the pipe with unprotected skin could result in a severe burns.

- 2. Slide the hose clamp off of the sample opening.
- 3. Insert the combustion analyzer probe into the sample opening.
- 4. If using an electronic analyzer, zero and calibrate it before proceeding.
- 5. If using a chemical analyzer, make sure that the fluid is fresh and is at room temperature. Have a monoxer and test tubes available to test carbon monoxide levels.

F. CHECK HIGH FIRE OPERATION

1. Remove the electrical panel cover on the right side of the boiler as in Figure 11.4.

\land WARNING

Electrical shock hazard — The electrical box contains line-voltage wiring and contacts. Use caution when working in the electrical box to avoid contact with line-voltage elements. Turn off power to the boiler panel if necessary.

- 2. Connect a jumper wire across the high-fire terminals of the connector board (Figure 11.4). These terminals are located on the lower row as shown.
- 3. Turn the boiler on/off switch ON.
- 4. The boiler will start at about 30% of maximum input and immediately go to high fire.
- 5. Observe the flame through the flame window (left side of boiler; see Figure 11.5).
 - a. The flame should be blue and well-defined, with white traces.
 - b. If the flame is too lean (too much air), it will be light blue and unsteady.
 - c. If the flame appears reddish, or there are red areas on the burner surface, turn the boiler OFF and reduce fuel with the gas valve throttle.
- 6. Check the analyzer. A rapid increase in CO is an indicator of bad combustion. Turn the boiler OFF and reduce fuel input as explained in Section 11G.



Figure 11.3: Flue Gas Sampling Hole



Figure 11.4: Electrical Panel

G. ADJUST GAS VALVE THROTTLE SETTING

1. Allow Combustion to Stabilize: Allow the boiler to operate 15 minutes, or as needed to obtain a steady reading on the analyzer.

Λ WARNING

If the flame or burner surface appear red, DO NOT allow the boiler to run without adjusting the gas valve throttle to reduce fuel input as described below. Proceed with final throttle setting only if the flame is visually acceptable (blue and steady).

 Acceptable CO₂/O₂ Values: The CO₂/O₂ values must be within the limits given in Table 11.1. The flame must be blue and steady as discussed in Section 11F. CO must be no higher than 50 ppm.

Table 11.1:	Acceptable	CO ₂ and	O ₂	Values
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Natural Gas – High Fire	$CO_2 \ / \ O_2$	Natural Gas – Low Fire	$CO_2 \ / \ O_2$
Minimum %	8.4 / 6.2	Minimum %	7.5 / 7.8
Maximum %	9.5 / 4.2	Maximum %	8.2 / 6.5
Propane – High Fire	$CO_2 \ / \ O_2$	Propane – Low Fire	$CO_2 \ / \ O_2$
Minimum %	9.3 / 6.2	Minimum %	8.2 / 7.8
Maximum %	10.7 / 4.2	Maximum %	9.1 / 6.5

3. Adjusting Gas Input with Throttle Screw – Max Input:

a. Adjust gas input with the throttle screw adjustment using a long-shank common bit screwdriver inserted through the hole in the jacket top, Figure 11.5.



Figure 11.5: Throttle Adjustment and Flame Window

- b. When adjusting the throttle setting, make changes in half-turn increments. Allow the flame to stabilize before adjusting each time. (Reduce gas input if the flame or burner appears red.)
- c. If CO₂ is Too HIGH (O₂ Too Low):
 - REDUCE gas by turning the adjustment CLOCKWISE (one half turn at a time). Recheck the analyzer and flame after each half turn.
- d. If CO2 is Too LOW (O2 Too High):
 - INCREASE gas by turning the adjustment COUNTERCLOCKWISE (one half turn at a time). Recheck the analyzer and flame after each half turn.

H. VERIFY GAS INLET PRESSURE

With the boiler operating at high fire, check the gas pressure at the manual gas valve. Gas pressure should never fall off by more than 2 inches w.c. (50 mm).

START-UP PROCEDURE

I. TO METER GAS INPUT (NATURAL GAS ONLY)

- 1. Meter gas input with the high-fire jumper in place.
- 2. Turn off all other gas appliances that use the same gas meter as the boiler.
- 3. Call your gas supplier and ask for the heating value of the gas (Btu per cubic foot).
- 4. Start the boiler and let it run for 15 minutes (high-fire jumper in place).
- 5. With the boiler operating, clock the time in SECONDS that it takes to burn10 cubic feet of gas at high fire.
- 6. Insert the heating value and the time, in seconds, into the formula below.

Input = [Gas Btu per cubic foot] x [3600] x [10] \div [seconds]

7. If the computed rate exceeds the desired input rate or 200,000 Btuh, reduce the gas input with the gas throttle adjustment.

\land WARNING

Never operate the boiler at an input higher than its rating. Excess input can result in overheating and damage to the heat exchanger and boiler components.

J. CHECK LOW FIRE OPERATION

- 1. Turn the boiler on/off switch OFF.
- 2. Remove the high-fire contact jumper. Connect the jumper wire across the low-fire terminals of the connector board (Figure 11.4). These terminals are located on the lower row as shown.
- 3. Turn the boiler on/off switch ON.
- 4. The boiler will start at about 30% of input and then move to the low fire condition.
- 5. Make sure the flame is blue and steady, NOT red or light blue and unsteady.
- 6. If the flame or burner appears red, or if the CO_2 or O_2 are outside the ranges of Table 11.1, turn the boiler on/off switch OFF.
- 7. Refer to Section 11M for instructions to adjust the gas valve low-fire setting.
- 8. If flame and CO₂/O₂/CO are acceptable, no further gas valve adjustments are needed. Replace the gas valve cover plate. Remove the low-fire jumper and replace the electrical panel cover.

Λ WARNING

Changing from propane to natural gas or natural gas to propane — When adjusting the boiler for a different gas, the low-fire gas adjustment must be changed using the procedure in Section 11M.

K. WHEN IS LOW FIRE ADJUSTMENT REQUIRED?

\land NOTICE

Adjust the gas valve low-fire setting ONLY if the flame is unacceptable, the CO_2 , O_2 or CO are out of acceptable range or you are changing fuels. You will need to remove the boiler jacket top and adjust the gas valve low-fire setting as described below.

The boiler jacket top must be removed when it is necessary to access the gas valve low-fire adjustment screw or other interior components, such as the blower motor. Use the procedure below.

L. REMOVING THE BOILER JACKET TOP

1. See Figure 11.6.



Figure 11.6: Removing Boiler Jacket Top

- 2. Remove the three thumb screws securing the filter access plate.
- 3. Remove and set aside the filter access cover and gasket.
- 4. Pull back on the filter clamp and remove the filter.
- 5. Hold the filter clamp back as in Figure 11.6.
- 6. Squeeze the conical grommet sides and maneuver the grommet out of the opening in the jacket top.
- 7. If there is no air pipe attached to the air inlet, leave the air inlet plate in place.
- 8. If air is piped to the air inlet plate, remove the air inlet plate and gasket by removing the four screws that secure it to the jacket top. Make sure the air piping is properly supported.
- 9. Remove the seven Phillips-head screws securing the jacket top to the jacket sides.
- 10. Lift off the jacket top. (Leave the wire harnesses connected.)
- 11. Move the insulation aside if necessary.

M. ADJUSTING THE LOW-FIRE SETTING

\land NOTICE

DO NOT adjust the low-fire setting unless low-fire flame or combustion are unacceptable.

1. See Figure 11.7 for the location of the gas valve low-fire adjustment. Use a 2-mm hex wrench.



Figure 11.7: Gas Valve Adjustments

2. When adjusting the low-fire setting, make changes in half-turn increments. Allow the flame to stabilize before adjusting each time. (Reduce gas input if the flame or burner appears red.)

- If CO₂ is Too HIGH (O₂ Too Low): REDUCE gas by turning the adjustment COUNTERCLOCKWISE (one half turn at a time). Recheck the analyzer and flame after each half turn.
- 4. If CO₂ is Too LOW (O₂ Too High): INCREASE gas by turning the adjustment CLOCKWISE (one half turn at a time). Recheck the analyzer and flame after each half turn.

N. REPLACE THE BOILER JACKET TOP

- 1. To replace the jacket top, reverse this order above. Make sure insulation is in place.
- 2. Slide the conical grommet over the blower inlet Then seat the grommet ring into the hole in the jacket top.
- 3. Reattach the air inlet plate if it was removed. Inspect the air piping to make sure it was not displaced.
- 4. Pull the air filter clamp back. Replace the filter, gasket and access cover. Secure with the three thumbscrews. Replace the gas valve cover plate if removed.
- 5. Remove the low-fire jumper from the connection board. Replace the electrical panel cover.

O. MEASURE FLAME CURRENT

🕂 WARNING

Electrical shock hazard — The electrical box contains line-voltage wiring and contacts. Use caution when working in the electrical box to avoid contact with line-voltage elements. Power must be on to measure flame current.

- 1. With the boiler operating at low fire (low-fire jumper in place), measure the flame current.
- 2. Remove the upper electrical panel cover (upper right side of boiler).
- 3. Attach microammeter leads to the flame current test pins of the Fenwal ignition module as in Figure 11.8.
- 4. The flame current should be approximately 6 microamps, and never less than 1 microamp.
- 5. If flame current is acceptable, continue with setup. If flame current is too low, check the ignition electrode/flame rod assembly following the instructions in Section 13 of this manual.

P. CHECK BOILER MODULATION

- 1. Remove the low-fire jumper from the electrical connection panel (see Figure 11.4).
- The boiler firing rate should change to meet demand. The Cast 92[™] control display will show the percentage of maximum firing rate (between 20% and 100%).

Q. TEST FLAME FAILURE MODES

- 1. Flame Loss:
 - a. With the boiler running in normal operation, close the manual gas valve on the incoming gas line.
 - b. Within 0.8 second after the flame goes out, the boiler gas valve should shut off.
 - c. The Cast 92[™] control will restart operation with prepurge, then continue through a normal start cycle.
 - d. With the manual gas valve closed, the boiler should attempt ignition three times, then lockout, as described below.

2. Ignition Failure:

- a. Make sure there is a call for heat.
- b. Turn the boiler on/off switch OFF.
- c. Close the manual gas valve on the gas supply line.
- d. Turn the boiler on/off switch ON.
- e. The boiler should start a regular cycle.
- f. When the boiler attempts ignition, no flame will occur. Within 4 seconds of ignition start, the control will close the boiler gas valve and attempt another start.
- g. After three failed ignition attempts, the Fenwal control will lockout.
- h. The boiler will shut off and the Cast 92[™] control display will show "LOCKOUT."</sup>
- i. Open the manual gas valve.
- j. Reset the controls by turning the boiler on/off switch off, then on again.
- k. The boiler should restart and operate normally.

R. TEST CONTROL & INTERLOCK OPERATION

- 1. Test Control Operating Limit Function:
 - a. Allow the boiler to fire until the supply temperature reaches the upper end of the control band.
 - b. The boiler should gradually cycle to minimum input (firing rate = 20%), then turn off.

2. Test External Controls:

- a. Lower the setting of external limit controls below the supply water temperature. Verify that the controls shut down as required.
- b. Test operation of low water cut-offs, flow switches and other external devices.
- c. Test external gas pressure interlocks, if used.
- d. Test/verify operation of combustion air dampers and end switches, if used.

3. **DHW Applications:**

For DHW applications, verify that the boiler operates on demand from the indirect water heater and shuts off as required.

S. FILL OUT THE COMBUSTION TEST RECORD

After completing Section 11, "Start-up Procedure", complete the Combustion Test Record Sheet in Appendix B.



Figure 11.8: Throttle Adjustment and Flame Window

12. TROUBLESHOOTING

Table 12.1

Accessing and using the LogEnter Setup: From STANDBY, hold BACK of for 5 seconds. Then press DOWN **Q** until the cursor points to VIEW LOG. Press SELECT of with the cursor on VIEW LOG.

The screen will now show the most recent entry in the log. Use the arrow keys to scroll through the log entries (entry number and date are on the first line of the log screen).

Each log entry includes three screens as described below. The top line remains the same in all three, and contains the date stamp and entry number.

An entry is made each time a change in demand occurs, or when demand changes from heating to DHW or back, each prepurge and postpurge occurrence, and each ignition sequence. An entry is also made when any of the Screen 3 events (below) occurs. These events may be errors, faults or notification of setback activity.

Screen 1 — Date stamp



Screen 2 — Outside temp and mod percentage



Shows the modulation percentage (from 20 to 100%). Mod readings can often be an indicator of boiler status. Examples: 45% may indicate prepurge, while 30% may indicate the boiler was in ignition sequence.

Outside air temperature, if sensor connected; otherwise, display = NA

Screen 3 — Status or messages (see right)



NOTICE: The second line will show typical reading as shown unless an error code is displayed. See codes at right.

Displays "HD" for heat demand, "DH" for DHW demand, "NC" is there is no call for heat, or "LK" if boiler is called to heat by the master boiler

 Display will show "P" if boiler pump was on; "M" if main valve was open; "D" if combustion air damper was energized; "B" if blower was on; and"I" if ignition cycle was in process

"B" indicates bypass pump was on; 100 or other value shows the IAR MAX INPUT value if there was a heat demand at the time

Screen 3 — Messages:

- NO FLOW SENSED
- OPERATE HIGH LIMIT (high limit tripped)
- SETPT LIMIT
 (OP LIMIT reached)
- SETBACK #___IS ACT (setback initiated, shows 1 to 4)
- SETBACK #___EXPIRED (setback completed, shows 1 to 4)
- COMBUST AIR FAIL
- SYST RESET OURWP (internal control processor error detection)
- OUTDOOR RESET
- OPEN, with SUPPLY, HEADER, OA or RETURN (sensor is open)
- SHORT, with SUPPLY, HEADER, OA or RETURN (sensor is shorted)
- FOUND BOILER # (master boiler detecting member boiler)
- LOST BOILER # (master boiler losing signal from member boiler)
- IGN LOCKOUT
- USER INTERLOCK
- BLOCKED FLUE
- BLOCKED INLET
- IAR COMM FAILURE (indicates problem with wiring between control and connection board)
- IGN LOCKOUT RETRY
- BLOWER PROVE FAULT (blower did not prove during pre-purge time)

Table 12.1 (cont'd)

Situtation	Suggested Procedure
Nothing happens when the power switch is turned on.	 Check 120VAC power to connection board. Verify power is connected per wiring diagrams. The Power switch light (ON -Position) should illuminate if power is wired correctly. If the Ignition Control is active, but the front panel display is inactive check: Cable and cable polarity from the control board to the display. Check for 120vac on the primary of the transformer and 24vac on the secondary. If one of the 24vac interlocks has been shorted to ground or the 24vac output is low, the transformer may be damaged or a 24vac circuit may be miswired. The Cast 92[™] control is equipped with resettable fuses on the power input circuit. Wiring power incorrectly to the unit will cause these fuses to open. Once the incorrect wiring is corrected, the fuses should reset themselves in less than 5 minutes.
The display shows combustion air damper failure.	 If you are not using the combustion air damper then it needs to be disabled in the AUX FUNCTIONS menu. The prove switch for the combustion air damper is not closing. Check to make sure the dampers are being controlled by the output relay you specified when programming for the damper. Also check to make sure the prove switch is working properly. If there is no proving switch, you must put a jumper wire across input connection (USER INTRLK). If these steps have been done and you continue to get the error message, check the sensor TYPE specified in the SENSORS menu. If it is set to NONE, the controller will not recognize the closed circuit. Set the Sensor type to ON/OFF.
The display is displaying ran- dom characters or the control keeps resetting.	 There may exist a grounding problem with the controller or one of the boilers, pumps, contactors or other devices connected to it. If all grounding is correct, there may be an issue with radiated or induced electrical noise (interference). This may be caused by arcing across a contactor's contacts when starting a pump motor or a large electrical load. It may also be caused by the ignition transformer being improperly grounded or the spark gap being out of adjustment. Attempt to identify the noise source: What is the boiler/controller trying to do at the time of the failure? Is the boiler on the same circuit as the noise source? (The boiler should have isolated power.) Are shielded sensor wires used? (Ensure the shields are grounded only at the boiler control end.) Are any sensors or sensor wires located near a transmitting antenna? (Move sensor)
There are no heating boilers on.	 Check the settings for OA SETPOINT and OA RESET If the outdoor air temperature is above the OA SETPOINT and OA RESET is on, the circulator pump relay will be locked out and the heating boilers will not fire. If the water temperature is within the heating band around the setpoint, boilers will not come on. The water temperature must fall below the lower band limit to begin firing boilers.
Unable to change the # of Boilers in the BOILERS menu.	 Using the Cast 92[™] control for multiple boiler operation, the Cast 92[™] control auto-detects the boilers in the system and adjusts the number of boilers accordingly. If the number of boilers is not being detected properly as the actual number of boilers in the system, check each boiler. There can only be (1) master boiler, but there can be up to 15 member boilers. Make sure only the master boiler has a Header Sensor connected. Verify that each boiler's cable is in place. Verify that each boiler has a unique address assigned (ADVANCED SETUP, DISTRIB CTRL, LOCAL AD).
The BOILERS menu only indicates one boiler, but there are member boilers connected. The amber light blinks on all of the boilers communication's jacks.	 Verify that the latest version of firmware is installed on all boilers. All boilers in a system must have the same firmware revision (version). Verify the proper termination is set on the Master and the last Member boiler.
Boilers are detected but then lost and then detected again.	 The control communications cable may be receiving interference from the blower, ignition, or other form of radiated electrical noise. Termination of the jumpers may not be correct or there is more than one master. Ensure that the termination dip switchs are set on the MASTER boiler and only the LAST MEMBER boiler. All of the other member boilers should have their termination dip switches OFF. There may be two or more MASTER boilers. Ensure that only one header sensor is present and connected to the HEADER input. There should be no wires or sensors connected to the HEADER input if the boiler is operating as a member. Verify that the communication cables are of a shielded or twisted pair type. Shielding of the cable is required. Minimize possible electrical interference by routing the communications cables away from electrical noise sources, such as motors, ignition controls, contactors, etc.
Only the MASTER boiler Fires, but the system has many boilers and is using the Cast 92™ Control.	 In order for the MASTER boiler to act as a MASTER1., the header sensor must be set to TYPEZ, and there must be a header sensor present. At power-up, the header sensor is auto detected. If the temperature of the header sensor at power-up is greater than -25 °F and less than 240 °F it is considered a valid sensor. The boiler will default to the MEMBER mode if the temperature is not in this range, and can only be run locally or by external inputs. The Cast 92[™] control needs a communications cable daisy-chained between boilers. Ensure that a good connection is made on the communications board and that the lights on the dual RJ45 jacks flash (roughly twice a second). The MASTER is the only one that should flash with no communications cables plugged in.
You get the error message – WATER FLOW SWITCH or WAITING FOR FLOW. You have forgotten the	 If the control does not sense a closed circuit at input connection, FLOW SWITCH, check to make sure the circuit for the circulator pump is correct, that the pump is being energized, and that the flow prove switch is working properly. If there is no flow prove switch, check to make sure that a jumper wire has been connected across the FLOW SWITCH terminals. Turn the ON/OFF switch off. Then depress and hold the ESC key while turning it back on. This will load the default password
password. Firmware update program starts	"AAAAAA".
to load, but then stops.	Ensure that the USB driver for your PC/Laptop computer is properly installed.

13. MAINTENANCE

A. READ BEFORE PROCEEDING

📐 WARNING

Failure to adhere to the following could result in severe personal injury, death or substantial property damage.

1. Licensed Technician Only:

The procedures in this manual must only be done by a qualified service technician. Some details of service procedures are left to the expected good practices of a qualified technician.

2. Electrical Shock Hazard:

Except when the boiler must be tested or adjusted with the power on, always turn power OFF before servicing the boiler.

3. Burn or Scald Risk:

Always allow the boiler and parts to cool before attempting to service or remove. Some parts may be very hot.

Do not open water piping components unless the water has been allowed to cool to avoid scald hazard from spraying hot water.

4. Test/verify the Boiler After Servicing:

Following service of any kind, verify that the boiler, controls and system devices are fully functional by performing the appropriate start-up testing procedures given in this manual.

5. **Seals:**

If any pressure-tight seal is broken for servicing (such as combustion chamber/burner seals, air or vent piping joints or seals, or gas piping joints or seals, make sure the seal is restored when servicing is complete. Gaskets must be in good position and placed as originally installed.

6. Read the Instructions:

Do not attempt the procedures in this manual without thoroughly reading the instructions given. Follow all instructions.

7. If Problems Can't be Resolved:

If following the procedures in this manual do not resolve problems, contact PB Heat for technical support to resolve the issues.

B. HANDLING CERAMIC FIBER AND FIBERGLASS MATERIALS

\land WARNING

The Cast 92[™] boiler contains some ceramic fiber and fiberglass materials. Ceramic fiber materials, such as the burner gasket, may contain carcinogenic particles (chrystobalites) after exposure to heat. Airborne particles from fiberglass or ceramic fiber components have been listed as potentially carcinogenic by the State of California. Take the following precautions when removing, replacing and handling these items.

1. Protective Measures:

Avoid breathing dust and avoid contact with skin or eyes. Wear long-sleeved, loose-fitting clothing, gloves and eye protection. Use a NIOSH N95 certified respirator. This respirator meets requirements for protection from chrystobalites. The actual job requirements or NIOSH regulations may require other or additional protection. For information, refer to the NIOSH website,

http://www.cdc.gov/niosh/homepage.html.

2. Ceramic Fiber Removal:

Ceramic fiber removal: To prevent airborne dust, thoroughly wet ceramic fiber with water before handling. Place ceramic fiber materials in a plastic bag and seal to dispose.

Avoid blowing, tearing, sawing or spraying fiberglass or ceramic fiber materials. If such operations are necessary, wear extra protection to prevent breathing dust.

Wash work clothes separately from other laundry. Rinse clothes washer thoroughly afterwards to prevent contamination of other clothing.

3. NIOSH First Aid Procedures:

Eye exposure — irrigate immediately

Breathing — fresh air.

C. CLEANING THE AIR FILTER

- 1. Turn the boiler on/off switch OFF.
- 2. Remove the three thumb screws that secure the filter access plate (see Figure 13.1).
- 3. Remove the filter access plate and gasket.
- 4. Pull the filter clamp back and remove the air filter.
- 5. Inspect the filter and the filter enclosure area for dust or debris.
- 6. Clean the filter, if necessary, by washing under running water. Shake off excess water and towel dry.

MAINTENANCE

WARNING

If the filter enclosure and blower inlet show signs of drywall dust, construction debris or other deposits, you may need to inspect the burner. Follow the procedure in this section. Accumulation of debris in the burner can result in burner damage and potential for severe personal injury, death or substantial property damage.

- 7. If the filter is damaged or cannot be cleaned effectively, obtain a replacement filter from your boiler distributor.
- 8. To replace the air filter, pull the filter clamp back, insert the filter, and allow the clamp to secure the filter in place.
- 9. Replace the filter access cover gasket and access cover.
- 10. Replace the three thumbscrews and finger tighten securely.
- 11. Turn the boiler on/off switch ON.

D. ACCESSING THE ELECTRODE ASSEMBLY

- 1. Turn the boiler on/off switch OFF.
- 2. If the boiler ignition electrodes or flame rod appear to be operating incorrectly, remove and inspect the assembly as follows.

\land WARNING

Do not remove the electrode assembly while the boiler is operating. Allow the boiler and electrode assembly to cool before attempting removal to avoid possible burns. Failure to comply could result in severe personal injury.

- 3. With the boiler and manual gas valve closed, remove the upper electrical box cover (right side of boiler).
 - Remove the two 1/4" bolts that secure the electrode/flame rode assembly to the boiler (Figure 13.1).
 - b. The electrode spacing must be $1/8^{\prime\prime}$ (3.2 mm) as shown in Figure 13.2.
- 4. If the electrodes or flame rod are damaged or the tip spacing is incorrect, replace the assembly. The electrodes are NOT adjustable.
- 5. Re-install the assembly in the boiler.

\land WARNING

Make sure the electrode plate gasket is in good condition and that the assembly is securely bolted to the boiler. The combustion chamber operates with a positive pressure. Failure to comply could result in severe personal injury, death or substantial property damage.



Figure 13.1: Accessing the air filter





Figure 13.2: Electrode/Flame Rod Assembly Inspection

E. ACCESSING THE BURNER

\land WARNING

If the filter enclosure and blower inlet show signs of drywall dust, construction debris or other deposits, you may need to inspect the burner. Follow the procedure below. Accumulation of debris in the burner can result in burner damage and potential for severe personal injury, death or substantial property damage.

\land NOTICE

Perform this procedure only if evidence indicates the burner may be fouled or damaged.

- 1. Turn the boiler on/off switch OFF.
- 2. Close the manual gas valve.
- 3. Remove the boiler jacket top following the procedure given in Section 11L.
- 4. Disconnect the gas supply piping at the ground joint union installed adjacent to the boiler.
- 5. Carefully remove the upper insulation (item 4, Figure 13.3) that covers the upper section cover. See Figure 13.3. Set the insulation aside for reuse.

\land WARNING

The upper insulation must be replace after completing this work to prevent overheating of the gas valve, blower and jacket top.

- 6. To access the bolts and nuts that secure the upper section cover:
 - a. Remove the sheet metal cover plate at the flame observation window (item 1, Figure 13.3).
 - b. Remove the plastic plug from the jacket rear (item 2, Figure 13.3).
 - c. Remove the upper electrical panel cover plate (item 3, Figure 13.3).
 - d. Removing these items provides open-end wrench access to the $1/4^{\rm "}$ bolts and nuts.
- 7. Remove the seven 1/4" bolts, nuts and washers that secure the upper section cover (item 2, Figure 13.4). Note for reinstallation that there is a flat washer on both sides of the assembly and a lock washer on top.
- 8. Disconnect the three wire harnesses at the gas valve and blower (items 2 and 3, Figure 13.4). In this illustration, the wires are not shown.
- 9. Lift the upper cover plate/blower/gas valve assembly off of the section assembly. (The upper section cover gasket is adhered to the bottom the cover with silicone RTV.)
- 10. The burner is now exposed.

- 11. Lift the burner up as in Figure 13.5 and inspect both sides. (The burner gasket is adhered to the bottom the cover with silicone RTV.)
- 12. Look down into the section assembly to verify it is clean. If the heat exchanger is blocked with sediment or shows damage, contact PB Heat immediately for corrective action.
- 13. If the burner is damaged, obtain a replacement burner from your distributor. Install the new burner.
- 14. If the burner is fouled with debris, attempt to clean by using a shop vacuum. Be careful not to damage the burner surface. If the burner cannot be cleaned, obtain a replacement from your distributor.
- 15. Inspect the ceramic fiber chamber (item 3, Figure 13.5) and fiber gasket (item 2, Figure 13.5). Make sure they are in good condition, or replace.
- 16. Replace the burner or install a new one.
- 17. Replace all components in the reverse order from above.

\land WARNING

Use extreme care when replacing the upper section cover. The seal must be secure to avoid potential of carbon monoxide leakage or heat damage caused by flue gas spillage. Inspect all components to ensure they are in good condition and correctly installed. Soap suds leak test the gas line, particularly the ground joint union, to ensure the gas line is intact after servicing. Follow servicing by a complete startup/test procedure of the boiler.



Figure 13.3: Preparing to Remove Upper Section Cover



Figure 13.4: Upper Cover Bolt Locations



Figure 13.5: Burner and Chamber

ANNUAL START-UP

\land WARNING

The boiler and system must be inspected, started and serviced at least annually by a qualified service technician. Follow all procedures specified in this manual. Failure to inspect, test and maintain the boiler and system could result in severe personal injury, death or substantial property damage.

\land WARNING

Electrical shock hazard — Use caution when working on the boiler where electrical components are exposed. Turn off power to the boiler if necessary to avoid potential for electrical shock.

F. ANNUAL START-UP OVERVIEW

1. Perform Start-up, Section 11:

Perform the complete start-up, testing and inspection procedures given on pages 86 through 94 to ensure the boiler and system comply with the requirements in this manual.

In addition, perform the additional follow-up procedures given below.

2. Perform Follow-up Procedures:

Operating conditions or abuse can damage the boiler or system components. The start-up checklist that follows includes inspections and testing intended to verify that the boiler and system are still fully functional.

G. ANNUAL START-UP CHECKLIST

- 1. Discuss system performance with the homeowner or boiler operator.
 - a. Ask the homeowner or boiler operator to rate the performance of the heating system over the last season.
 - b. If the homeowner or boiler operator identifies boiler or system problems, identify the cause and adjust or repair as necessary.

2. Inspect the Air Filter:

a. Remove, inspect (and clean if needed) the air filter. (See instructions in Section 13C.)

ΜARNING

If the filter enclosure and blower inlet show signs of drywall dust, construction debris or other deposits, you may need to inspect the burner. Follow the procedure in the Maintenance section. Accumulation of debris in the burner can result in burner damage and potential for severe personal injury, death or substantial property damage.

🗥 WARNING

If the burner is removed for inspection, also inspect the boiler heat exchanger. If the heat exchanger is damaged or blocked with debris, consult the factory for corrective action. Operating the boiler with a damaged or obstructed heat exchanger could result in severe personal injury, death or substantial property damage.

- 3. Verify Boiler Water Treatment:
 - a. If the system requires water treatment, make sure the treatment is being performed as required. Ensure that the water softener, if used, is operational and is being maintained.
 - b. If the system uses antifreeze, check the antifreeze concentration and inhibitor level. If the levels are low, check for leaks or other causes. Adjust the antifreeze level or refill the system as indicated.

4. Check Expansion Tank & Air Vents:

- a. Inspect the relief valve and piping to be sure there are no signs of relief valve leakage.
- b. If the relief valve has been weeping, make sure the expansion tank is not waterlogged or undersized.
- c. When performing the boiler start-up, watch the pressure gauge as the boiler and system heat up. If the pressure rises too fast or too high, the relief valve is not working properly. Correct the problem as required.
- d. Make sure all air vents are operating correctly.

5. Inspect and Test the Relief Valve:

Follow the instructions on the relief valve label to inspect and test the boiler relief valve.

\land WARNING

When discharging the relief valve, make sure there is not risk of spraying water to you or others.

6. Condensate Line Maintenance:

 Make sure the condensate line, condensate pump and neutralization system, if used, are operational.

- b. Remove the condensate line at the boiler hose barb connection.
- c. Pour water into the line and make sure the water drains freely. Flush or replace the line if necessary.
- d. Fill the condensate trap by attaching a 3/8-inch clear plastic tube to the hose barb. Pour water into the tubing until the trap is full.
- e. Remove the clear tubing and reattach the condensate line to the boiler hose barb.

7. Perform a Complete Start-up:

Inspect, adjust and start-up the boiler and system components as instructed on pages 86 through 94. Perform all procedures to ensure the boiler and system are operating properly.

8. Review with Homeowner/Operator:

- a. Review the User's information manual with the homeowner or operator.
- b. Make sure that all maintenance procedures are being followed and that all instructions are clear and understood.

14. REPAIR PARTS

Repair parts are available from your local PB Heat, LLC distributor or from Parts To Your Door (www.partstoyourdoor.com).

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



Figure 14.1: General Repair Parts – Cast 92-2™

Table 14.1: General Repair Parts – Cast 92-2™

		Quantity	
	Description	Required	Stock Code
1	TRIDICATOR 20-1022	1	54353
2	RIGHT JACKET PANEL 03-1752	1	N/A
3	ABS SIDE MEDALLION 60-5625	1	N/A
4	OFF LABEL 42-5238	1	N/A
5	MAIN POWER SWITCH 58-1555	1	54354
6	ON LABEL 42-5237	1	N/A
7	BASE ASSEMBLY 70-1223	1	N/A
8	FRONT JACKET PANEL 03-1750	1	N/A
9	PORT COVER 03-1754	2	N/A
10	3/8 – 16 X 3/4 HX HD FLANGE BOLT 57-4114	7	N/A
11	BLANK BOX ASSEMBLY 70-1421	1	N/A
12	DOCKING STATION 60-5626	1	N/A
13	VIEWPORT COVER 03-1755	1	N/A
14	5/16-18 X 1-1/4 HX BOLT 57-1501	2	N/A
15	SIGHT GLASS HOLDER 01-1649	1	54355
16	INNER SIGHT GLASS GASKET 59-1106	1	54356
17	SIGHT GLASS 60-4280	1	54357
18	SIGHT GLASS GASKET 59-1107	1	54358
19	10-32 THUMBSCREW 57-3657	3	N/A
20	FILTER BOX TOP COVER 03-1765	1	54359
21	UPPER FILTER BOX GASKET 59-1090	1	54360
22	COMBUSTION AIR FILTER 59-1089	1	54361
23	ABS UPPER COVER 60-5624	1	54362
24	FILTER BOX ADAPTER GASKET 59-1091	1	54363
25	FILTER BOX ADAPTER 70-1237	1	54364
26	1/4-20 X 1 NYLOK SC HD CAP SCREW 57-2913	4	N/A
27	1/2" FLEX GAS LINE 54-3234	1	54365
28	GAS TRAIN SUPPORT BRACKET 70-6689	1	N/A
29	DUNGS GAS VALVE 02-1580	1	54366
30	INLET SHROUD – GAS VALVE 02-1582	1	54367
31	MESH BURNER 70-6674	1	54368
32	1-3/4 HOLE CAP 58-2215	1	N/A
33	PRESSURE RELIEF VALVE 30 P.S.I. 22-1203	1	54369
34	LEFT SIDE JACKET PANEL 03-1753	1	N/A
35	IGNITOR ASSEMBLY 70-1231	1	54370
36	24V IGNITION CONTROL 02-4296	1	54371
37	IGNITION COVER 03-1756	1	54372
38	HIGH LIMIT 02-3928	1	54373
39	SUPPLY SENSOR 02-3927	1	54374
40	IGNITION BOX COVER 03-1776	1	N/A
41	TACO 005 W/INTERNAL FLOW CHECK 09-1520	1	54375
42	FLUE ADAPTER 56-3346	1	54376
43	TERMINAL BOX COVER 03-1761	1	N/A N/A
44	TERMINAL BOX 03-1760	1	N/A
45	24 AC TRANSFORMER 26-3211	1	54377
46	BREAK - OUT BOARD 02-4288	1	54378
47	PRESSURE SWITCH 02-5210 CERAMIC FIBER CHAMBER 45-1274	2	54379 54380
48		1 1	54380 54381
49 50	UPPER BURNER GASKET 59-1103	1	54381 54382
50	UPPER CASTING COVER 01-1640 100 WATT AMETEK BLOWER 58-1837	1	54382 54383
51	#6 X 1/2" BLK OXIDE SCREW 57-3413	2	54383 N/A
52	#0 X 1/2 BLK OAIDE SCREW 57-3413 BUTTON GUARD 03-1759	1	N/A N/A
53	REMOVABLE BOILER CONTROL 70-1422	1	N/A
54	IGNITION WIRE 40-5413	1	54384 54385
	GASKET IGNITOR BLOCK 59-1112	1	54415
	COMPLETE DRAIN ASSEMBLY 70-1244	1	54415
	COMILLIL DIMIN AGGLMDLI /0-1244	1	J1110



* Available as Complete Drain Assembly

Figure 14.2: General Repair Parts – Cast 92-4™



Figure 14.2 (cont'd): General Repair Parts – Cast 92-4™

Table 14.2: General Repair Parts – Cast 92-4™

	Description	Quantity Required	Stock Code
1	ABS UPPER COVER 60-5646	1	N/A
2	RIGHT SIDE JACKET PANEL 03-1806	1	N/A
3	FRONT JACKET WELDMENT 70-1672	1	N/A
4	DISPLAY MOUNT PLATE 03-1809	1	N/A
5	CONTROL OVERLAY 60-5645	1	N/A
6	ILLUMINATED ROCKER SWITCH 58-1536	1	54390
7	ON-OFF LABEL 42-5330	1	N/A
8	BREAK OUT BOARD 02-4288	1	54378
9	THUMB SCREW FOR FILTER BOX 57-3657	4	N/A
10	10-32 UNC-0.375 SCREW GREEN 57-3630	1	N/A
11	COPPER LUGS 58-1080	2	N/A
12	CONTROL BOARD ASSY 02-4291	1	54391
13	BASE ASSY 70-1680	1	N/A
14	TUBING 54-3229	1	N/A
15	3/8 NPT X 1/2 BARD FITTING NYLON 56-5534	2	N/A
16	ELBOW 1" 56-3269	1	N/A
17	CPVC BOTTOM PLUG 56-4704	1	N/A
18	NIPPLE 1" x 6" 53-1169	1	N/A
19	3/8 NPT X 1/2 BARD FITTING NYLON 56-5534	1	N/A
20	1" MOUNTING CLAMP 56-5911	1	N/A
21	DRAIN MOUNTING BRACKET 03-1650	1	N/A
22	3/8 – 16 X 3/4 FLANGE HEAD HEX BOLT WASHER HD 57-4114	11	N/A
23	LIGHTING INSTRUCTION 42-5230	1	N/A
24	Cast 92™ – RESIDENTIAL RATING LABEL 42-2999	1	N/A
25	LEFT SIDE JACKET PANEL 03-1804	1	N/A
26	JACKET SPACER 03-1808	7	N/A
27	5/16 X 1-1/4 ALL SCREW BUTTON HD 57-3659	2	N/A
28	5/16 LOCK WASHER 57-4701	2	N/A
20	CASTED SIGHT GLASS HOLDER 01-1649	1	54355
30	INNER SIGHT GLASS GASKET 59-1106	1	54356
31	#8 X 1/2 TYPE B PHILLIPS HEAD SCREW 57-3407	34	N/A
32	VIEW PORT GLASS 60-4280	1	54357
33	INSULATION SIGHT GLASS 59-1107	1	54358
34	REAR JACKET PANEL 03-1802	1	N/A
35	TRIDICATOR PRESURE/TEMP. GAUGE 20-1022	1	54353
36	1-1/4 X 3/4 BUSHING 56-4226	1	N/A
37	3/4 NPT X CLOSE NIPPLE 53-1120	1	N/A N/A
37	3-4 X 3-4 F TO F 30 PSI 535K BTU PER HOUR RELIEF VALVE 22-1203	1	54369
39	CERAMIC CHAMBER 45-1272	1	54400
40	CERAMIC CHAMBER 43-1272	1	54400
40			54401
41 42	MESH BURNER 70-1209 UPPER CASTING COVER 01-1642	1	54402
43	100W PRE-MIX BLOWER 58-1837	1	54383
44	INLET ADAPTER CASTING 01-1651	1	54404
45	DUNGS INTAKE ADAPTER GB 057 02-1590	1	54405
46	DUNGS AIR INTAKE ADAPTER GB 057 02-1589	1	54406
47	DUNGS GAS VALVE GAS VALVE MODEL GB-057 HO XP, 24 VAC 02-1581	1	54407

REPAIR PARTS

	Description	Quantity Required	Stock Code
48	PIPE SEALING GROMMET 59-1115	1	54408
49	FILTER BOX COVER 03-1811	1	54409
50	FILTERBOX GASKET – CLOSED CELL NEOPRENE 59-1113	1	54410
51	COMBUSTION AIR FILTER 59-1109	1	54411
52	FILTER BOX 03-1810	1	54412
53	FILTER BOX LABEL 42-5223	1	N/A
54	1/4 LOCK WASHER 57-4708	4	N/A
55	1/4-20 X 5/16 UNC SC HD CAP SCR 57-2915	4	N/A
56	HIGH LIMIT 02-3928	1	54373
57	SUPPLY SENSOR 02-3927	1	54374
58	1-1/4" X 3" SUPPLY NIPPLE 53-1274	2	N/A
59	1/4 ID X 9/16 OD FLAT WASHER 57-4624	4	N/A
60	IGNITION COVER BOX 03-1816		N/A
61	10-32 BRASS Cast 92™ URL NUT 57-2731	4	N/A
62	DOUBLE BARBED 1-4 X 1-8 NPT FEMALE 56-5741	2	N/A
63	THIN BRASS HEX NUT 1/8-27 57-2630	2	N/A
64	1-4 TUBE X 1-4 NPT 56-5742	1	N/A
65	1/4 TUBE X 1/8 NPT 56-5740	2	N/A
66	IGNITION BOX STATIONARY BRKT 03-1818	1	N/A
67	4" 90 DEG FLUE ADAPTER 56-3345	1	54413
68	1/4" SQ HD PIPE PLUG 56-4605	1	N/A
69	3/8 C I PLUG 56-4560	1	N/A
70	WIRE RACEWAY 03-1822	1	N/A
71	IGNITION ASSY 70-1231	1	54370
72	IGN. BLOCK GASKET 59-1112	1	54415
73	1/4 ALUMINUM TUBING FLUE ADAPTER 54-1601	1	N/A
74	1/4 ALUMINUM TUBING FILTER BOX 54-1601	1	N/A
75	24V 50 WATT BASLER TRANSFORMER 26-3211	1	54377
76	COMMUNICATIONS BOARD 02-4279	1	54414
77	IGNITION CONTROL 2 SEC 02-4296	1	54371
78	PRESSURE SWITCH 02-5208	2	54379
	IGNITION LEAD WIRE 40-5413	1	54385
*	COMPLETE DRAIN ASSEMBLY 70-1244	1	54416

Table 14.2 (cont'd): General Repair Parts – Cast 92-4™

15. BOILER RATINGS & SPECIFICATIONS

Table 15.1: Boiler Ratings & Specifications

CAST 92™ BOILER RATINGS AND SPECIFICATIONS			
Boiler Model	Units	92-2	92-4
AFUE (Doe Seasonal Efficiency)	%	90.0	90.0 (Thermal)
CSA Input (Max)	Btuh	199,000	399,000
CSA Input (Min)	Btuh	40,000	80,000
Maximum Allowable Working Pressure	PSIG kPa	100 700	
Water Supply and Return Connections	Inches, NPT	1-1/4	
Boiler Water Volume	Gallons Liters	4.75 18.0	7.125 27.0
Shipping Weight	Pounds Kg	510 231	697 315
Operating Weight	Pounds Kg	540 245	753 341
Fuels		Natural Gas or Propane	
Gas Connection Size	Inches, NPT	1/2	3/4
Gas Supply Pressure, Minimum	Inches w.c. mm w.c.	2 50.8	
Gas Supply Pressure, Maximum	Inches w.c. mm w.c.	14 356	
Vent Connection Size	Inches mm	3 76.2	4 101.6
Vent Options	Direct Vent or Category IV and II		
Combustion Air Options	Air from boiler room or ducted to boiler from outside		
Combustion Air Adapter Size	Inches mm	3 76.2	4 101.6
Electrical Requirements			
Voltage		120 vac/60 hz/1-phase	
Current Draw (120-Volt Power Line)	Amperes	2.75	5

APPENDIX A. SUGGESTED WIRING

IAR (INDOOR AIR RESET) WIRING, WHEN USED WIRING FOR 3-WIRE ZONE VALVES WITHOUT A ZONE CONTROLLER

- 1. Heat Demand Terminal Connections Using 3-wire Zone Valves: The end switch leads from the zone valves must connect to the Heat Demand LEFT SIDE (+) terminal on the electrical connection board as shown in Figure A1.
- 2. *IAR Connections*: See Figure A1 for typical wiring to the IAR inputs when using 3-wire zone valves without a zone controller. For other applications, see Section 8, "Boiler Control", of this manual.

A CAUTION

Polarity — The connections to the IAR positive terminals (IAR +) must be to the same location on the zone valve as the thermostat wire, as shown in Figure A1. The connections to the IAR negative terminals (IAR –) must be from the zone valve terminal connected to the 24VAC common line, as shown. Connecting the wires incorrectly can cause the transformer to be shorted out and damaged.

A CAUTION

3-wire zone valves: You will have to rewire existing 3wire zone valves to meet the requirements shown in Figure A1. Move the thermostat lead and the 24VAC hot lead to the CENTER terminal of the valve. Move the 24VAC common lead to the outer terminal of the valve. Discard existing wires connected to the end switch terminals. Install a new wire single wire from each end switch to the Heat Demand LEFT SIDE (+) terminal as shown in Figure A1.

A CAUTION

3-wire zone valves: Always use a voltmeter to verify the wiring is correct. The center terminal of the valve must be 24VAC to ground when the thermostat is calling for heat. The motor common terminal (outer post) must not have voltage. Change the wiring and retest. DO NOT connect the wires to the boiler until you have tested as described. Incorrect wiring can damage the boiler control or other system components.

3. If there is only one transformer feeding all of the zone valves in the system, you can omit the wires to the IAR negative terminals (IAR –) on all but one of the zone valves. This is because these terminals are jumpered internally on the electrical connection board. If there is more than one transformer, provide one wire from each transformer common side to one of the IAR negative terminals (IAR –).



Figure A1: Indoor Air Reset Wiring to IAR Terminals with 3-wire Zone Valves and No Zone Controller

(See Figure 21a for terminal block 6 location)

IAR (INDOOR AIR RESET) WIRING, WHEN USED WIRING FOR CIRCULATOR RELAYS (RELAYS MUST HAVE 24VAC COMMON TERMINALS)

\land NOTICE

Relays must have a 24VAC common terminal: The IAR inputs require a connection to the 24VAC common of the circulator relay to operate. If the circulator relays do not have a 24VAC common terminal, you cannot connect to the IAR inputs. To operate with indoor reset, you will have to remove the existing relays and replace with a circulator zoning controller or install relays that provide a 24VAC common terminal.

- 1. Heat Demand Terminal Connections Using Circulator Relays: The end switch leads from the relays must connect to the Heat Demand terminals on the electrical connection board as shown in Figure A2.
- 2. *IAR Connections*: See Figure A1 for typical wiring to the IAR inputs when using circulator relays. For other applications, see Section 8, "Boiler Control", of this manual.

A CAUTION

Polarity — The connections to the IAR positive terminals (IAR +) must be as shown in Figure A2. The connections to the IAR negative terminals (IAR -) must be from the 24VAC common terminals of the circulator relays, as shown. Connecting the wires incorrectly can cause the transformer to be shorted out and damaged.

\Lambda NOTICE

Verify 24VAC switched lead from thermostat: Before connecting the wires to the IAR terminals, use a voltmeter to verify the 24VAC hot lead is NOT powered when the thermostat is not calling for heat.



Figure A2: Indoor Air Reset Wiring to IAR Terminals with 3-wire Zone Valves and No Zone Controller

(See Figure 21a for terminal block 6 location)

IAR (INDOOR AIR RESET) WIRING, WHEN USED WIRING FOR TYPICAL ZONE CONTROLLER

- 1. *Heat Demand Terminal Connections*: The end switch leads from the controller must connect to the Heat Demand terminals on the electrical connection board as shown in Figure A3.
- 2. *IAR Connections*: See Figure A3 for typical wiring to the IAR inputs when using a zone controller. For other applications, see Section 8, "Boiler Control", of this manual.

A CAUTION

Polarity — The connections to the IAR positive terminals (IAR +) must be to the same location on the zone valve as the thermostat wire, as shown in Figure A3. The connections to the IAR negative terminals (IAR –) must be from the zone controller's 24VAC common terminal as shown. Connecting the wires incorrectly can cause the transformer to be shorted out and damaged.

Λ NOTICE

Thermostat terminal connections: Use a voltmeter to verify the wiring is correct. Measure the voltage on the thermostat terminals with the zone controller powered, BEFORE connecting any wires. The IAR positive terminal connections (IAR +) must be to the side of the thermostat connections that have zero voltage.

\land NOTICE

DHW priority zone: Most zone controllers will provide a priority zone for connection to a DHW tank aquastat and circulator. The priority switch will turn off space heating when there is a DHW call. Read the controller manufacturer's instructions to determine which zone is set up for priority operation.

APPENDIX A. SUGGESTED WIRING



Figure A3: Indoor Air Reset Wiring to IAR Terminals, Heat Demand and DHW Demand Using Typical Zone Controller for Either Circulators or Zone Valves (See Figure 7.7A for terminal block 2 and 6 locations)

APPENDIX B. COMBUSTION TEST RECORD

Peerless[®] CAST 92[™] Combustion Test Record

Contact:			
Company Name:			
A			
Address:			
Phone Number:			
Fax Number:			
Email Address:			
	Jobsite	Data	
Job Name:			
Jobsite Address:			
	Boiler I	Data	
Boiler Model:		Boiler Serial No.:	
Manufacture Date:		Startup Date:	
	Gas Pres	ssure	
Static Inlet Gas Pressure		Inlet Gas Pressure	
(in. w.c.) [With Boiler Off]:		Drop After Boiler Startup (in. w.c.):	
High Fire Outlet Gas		Low Fire Outlet Gas	
Pressure (in. w.c.):	Combustion	Pressure (in. w.c.):	
Flame Signal	Compastion	Flame Signal	
High Fire (μA):		Low Fire (μA) :	
CO ² High Fire (%):		CO2 Low Fire (%):	
CO High Fire (ppm):		CO Low Fire (ppm):	
Fan Speed High Fire:		Fan Speed Low Fire:	
Excess Air		Excess Air	
High Fire (%):		Low Fire (%):	
Exhaust Temperature High Fire (°F):		Exhaust Temperature Low Fire (°F):	
System Information			
Water Pressure:		Condensate Line Size:	
Vent Length		Vent Diameter:	
(Total Equivalent Feet):			

Peerless[®] CAST 92[™]

Gas 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.





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