As an ENERGY STAR® Partner, PB Heat, LLC has determined that this product meets the ENERGY STAR guidelines for energy efficiency.
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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 judgment of PB Heat, LLC are as follows:

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

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

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

- **NOTICE**
  Indicates special attention is needed, but not directly related to potential personal injury or property damage.
**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.
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:**
   a. 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:**
   a. The boiler must be located such that piping for water, gas, vent and air can reasonably 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. **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.
   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:

**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>
<thead>
<tr>
<th>From</th>
<th>Inches</th>
<th>Millimeters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>6</td>
<td>153</td>
</tr>
<tr>
<td>Back</td>
<td>6</td>
<td>153</td>
</tr>
<tr>
<td>Left side</td>
<td>6</td>
<td>153</td>
</tr>
<tr>
<td>Right side</td>
<td>6</td>
<td>153</td>
</tr>
<tr>
<td>Front</td>
<td>6</td>
<td>153</td>
</tr>
<tr>
<td>Rear</td>
<td>6</td>
<td>153</td>
</tr>
<tr>
<td>Vent piping</td>
<td>2</td>
<td>51</td>
</tr>
<tr>
<td>System water piping</td>
<td>1</td>
<td>25.4</td>
</tr>
</tbody>
</table>

**Table 1.1: Minimum Clearances to Combustible Materials/Surfaces for ALL Installations (Figure 1.1)**

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)**

<table>
<thead>
<tr>
<th>From</th>
<th>Inches</th>
<th>Millimeters</th>
</tr>
</thead>
<tbody>
<tr>
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<td>610</td>
</tr>
<tr>
<td>Back</td>
<td>24</td>
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<tr>
<td>Right side</td>
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<td>610</td>
</tr>
<tr>
<td>Front</td>
<td>36</td>
<td>914</td>
</tr>
<tr>
<td>Rear</td>
<td>18</td>
<td>457</td>
</tr>
</tbody>
</table>

**Figure 1.1: Clearance to Combustibles Materials**

**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.

**Figure 1.2: Service/Operation Clearance References**

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:**
     1. 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.
     2. 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. **Free Area:** 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:
      1. **Metal Louver:** Multiply required free area of the opening times 1.7 to determine actual area of the required opening.
      2. **Wood Louver:** Multiply required free area of the opening times 5 to determine actual area of the required opening.
   b. **Tight Construction:** 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:
      1. 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.
      2. Weather-stripping has been added on openable windows and doors.
      3. Caulking or sealants are applied to areas such as joints around windows and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical, and gas lines, and in other openings.

4. **Conversion Factors:**
   - \( \text{In}^2/1,000 \text{BTUH} \) to \( \text{cm}^2/\text{kw} \): Multiply \( \text{In}^2/1,000 \text{BTUH} \) times 22
   - \( \text{In}^2/2,000 \text{BTUH} \) to \( \text{cm}^2/\text{kw} \): Multiply \( \text{In}^2/2,000 \text{BTUH} \) times 11
   - \( \text{In}^2/3,000 \text{BTUH} \) to \( \text{cm}^2/\text{kw} \): Multiply \( \text{In}^2/3,000 \text{BTUH} \) times 7.4
   - \( \text{In}^2/4,000 \text{BTUH} \) to \( \text{cm}^2/\text{kw} \): Multiply \( \text{In}^2/4,000 \text{BTUH} \) times 5.5

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

   - **WARNING**
   - ![Figure 1.3: Air opening options for combustion air drawn from boiler room](image)

   - 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).
**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 in² per 4,000 BTUH of all Cast 92™ 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 in² per 3,000 BTUH of all Cast 92™ 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™ 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 in² per 3,000 BTUH of all Cast 92™ 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.

⚠️ 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.

⚠️ 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.

2. 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.

C. BOILER PIPING — GENERAL

⚠️ WARNING

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.

⚠️ 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.
• 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.
When a Cast 92™ 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.
7. 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/air pipe, 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.

E. TERMINATIONS

1. Through-the-roof Terminations:
   Both vent and air piping must terminate with a Heat-fab 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)

<table>
<thead>
<tr>
<th>Vent Components</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vent Piping/Components (Incl. Supports, Thimbles, etc.)</td>
<td>EZ-Seal 3&quot;</td>
<td>Z-Vent 3&quot;</td>
</tr>
<tr>
<td>Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)</td>
<td>Not Required</td>
<td>2SVSHTA03</td>
</tr>
<tr>
<td>Rain Cap Vent Termination</td>
<td>5300CI</td>
<td>2SVSRCF03</td>
</tr>
<tr>
<td>Joint Sealant, as Needed</td>
<td>GE RTV106 or Equivalent</td>
<td></td>
</tr>
</tbody>
</table>
### G. VENT PIPED THROUGH THE ROOF
(AIR PIPED THROUGH SIDE WALL)

<table>
<thead>
<tr>
<th>Vent Components</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat-Fab EZ-Seal</td>
<td>Z-Vent 3&quot;</td>
<td>Heat-Fab EZ-Seal</td>
</tr>
<tr>
<td>Z-Flex Z-Vent</td>
<td>Z-Flex Z-Vent</td>
<td></td>
</tr>
</tbody>
</table>

#### 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

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

<table>
<thead>
<tr>
<th>Vent Components</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat-Fab EZ-Seal</td>
<td>Z-Vent 3&quot;</td>
<td>Heat-Fab EZ-Seal</td>
</tr>
<tr>
<td>Z-Flex Z-Vent</td>
<td>Z-Flex Z-Vent</td>
<td></td>
</tr>
</tbody>
</table>

#### 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

#### Termination Elbow
- 9314TERM: 2SVSTEX0390
- 9414TERM: 2SVSTEX0490

#### Termination Pipe Section (1 ft)
- 9302: 2SVEPWC0F0301
- 9402: 2SVEPWC0F0401

#### 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
- 4" PVC, CPVC, ABS, Galvanized or Aluminum

---

*Note: Standard air piping termination pipe section is 3 feet. A longer length can be used if needed.*
### I. VENT PIPED THROUGH A SIDE WALL (COMBUSTION AIR FROM THE BOILER ROOM)

<table>
<thead>
<tr>
<th>Vent Components</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vent Piping/Components (Incl. Supports, Thimbles, etc.)</td>
<td>Heat-Fab</td>
<td>Z-Flex</td>
</tr>
<tr>
<td>EZ-Seal</td>
<td>Z-Vent</td>
<td>EZ-Seal</td>
</tr>
<tr>
<td>3&quot;</td>
<td>3&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>Joint Sealant, as Needed</td>
<td>GE RTV106 or Equivalent</td>
<td></td>
</tr>
<tr>
<td>Termination Elbow</td>
<td>9314TERM</td>
<td>9414TERM</td>
</tr>
<tr>
<td>Termination Pipe Section (1 ft)</td>
<td>9302</td>
<td>2SVEPWCF0301</td>
</tr>
<tr>
<td>Termination Thimble</td>
<td>9393S</td>
<td>2SVSWTE03</td>
</tr>
<tr>
<td>Gear Clamp (Nose Clamp)</td>
<td>3&quot; Clamp</td>
<td>7HS44XX</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Vent Components</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vent Piping/Components (Incl. Supports, Thimbles, etc.)</td>
<td>Heat-Fab</td>
<td>Z-Flex</td>
</tr>
<tr>
<td>EZ-Seal</td>
<td>Z-Vent</td>
<td>EZ-Seal</td>
</tr>
<tr>
<td>3&quot;</td>
<td>3&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>Joint Sealant, as Needed</td>
<td>GE RTV106 or Equivalent</td>
<td></td>
</tr>
<tr>
<td>Termination Elbow</td>
<td>9314TERM</td>
<td>9414TERM</td>
</tr>
<tr>
<td>Termination Pipe Section (1 ft)</td>
<td>9302</td>
<td>2SVEPWCF0301</td>
</tr>
<tr>
<td>Termination Thimble</td>
<td>9393S</td>
<td>2SVSWTE03</td>
</tr>
<tr>
<td>Gear Clamp (Nose Clamp)</td>
<td>3&quot; Clamp</td>
<td>7HS44XX</td>
</tr>
</tbody>
</table>

### Air Components

<table>
<thead>
<tr>
<th>Air Piping/Components (Incl. Supports, Thimbles, etc.)</th>
<th>Heat-Fab</th>
<th>Z-Flex</th>
<th>Heat-Fab</th>
<th>Z-Flex</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
<td>Same as Vent Termination</td>
<td>4&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
<td>Same as Vent Termination</td>
<td></td>
</tr>
</tbody>
</table>

---

![Diagram of Venting and Air Inlet Piping](image-url)
### K. VENT & AIR PIPED THROUGH A SIDE WALL (CONCENTRIC VENT/AIR TERMINATION)

<table>
<thead>
<tr>
<th>Vent Components</th>
<th>92-2 Heat-Fab</th>
<th>92-4 Heat-Fab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vent Piping/Components (Incl. Supports, Thimbles, etc.)</td>
<td>EZ-Seal, 3&quot; Piping Saf-T Vent SC Fittings for Termination Assembly</td>
<td>EZ-Seal, 4&quot; Piping Saf-T Vent SC Fittings for Termination Assembly</td>
</tr>
<tr>
<td>Termination Assembly:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Single-wall Adapter</td>
<td>SC03ADEZ</td>
<td>SC04ADEZ</td>
</tr>
<tr>
<td>• Air Intake Tee</td>
<td>SC03TAD3</td>
<td>SC04TAD3</td>
</tr>
<tr>
<td>• 6' Straight Section</td>
<td>SC0366</td>
<td>SC0466</td>
</tr>
<tr>
<td>• 12' Straight Section</td>
<td>SC03L12</td>
<td>SC04L12</td>
</tr>
<tr>
<td>• Wall Plate (2 Required)</td>
<td>SC03FS</td>
<td>SC04FS</td>
</tr>
<tr>
<td>• Termination Adapter</td>
<td>SC03HT</td>
<td>SC04HT</td>
</tr>
<tr>
<td>• Mitered Termination</td>
<td>9390</td>
<td>9490</td>
</tr>
</tbody>
</table>

Joint Sealant, as Needed: GE RTV106 or Equivalent

<table>
<thead>
<tr>
<th>Air Components</th>
<th>Heat-Fab</th>
<th>Heat-Fab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Piping/Components (Also Supports, Thimbles, etc.)</td>
<td>3&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
<td>4&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
</tr>
</tbody>
</table>
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.

**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.

**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).

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**

<table>
<thead>
<tr>
<th>Component</th>
<th>92-2 (Heat-Fab)</th>
<th>92-4 (Z-Flex)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZ-Seal Kit</td>
<td>EZ-Seal 3&quot;</td>
<td>EZ-Seal 4&quot;</td>
</tr>
<tr>
<td>Z-Vent Kit</td>
<td>Z-Vent 3&quot;</td>
<td>Z-Vent 4&quot;</td>
</tr>
<tr>
<td>Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>Rain Cap Vent Termination</td>
<td>5300CI</td>
<td>5400CI</td>
</tr>
<tr>
<td>Joint Sealant, as Needed</td>
<td>GE RTV106 or Equivalent</td>
<td></td>
</tr>
</tbody>
</table>

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**

- 10 feet (3 m) minimum to wall or adjacent building
- 3 feet (0.9 m) minimum above roof or snow line
### 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.


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).

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.

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

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.

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.

Figure 3B.1: Vertical Venting/Sidewall Air
VENT & AIR PIPING: THROUGH THE ROOF

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 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

<table>
<thead>
<tr>
<th>Vent Components</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vent Piping/Components (Incl. Supports, Thimbles, etc.)</td>
<td>EZ-Seal 3&quot;</td>
<td>Z-Vent 3&quot;</td>
</tr>
<tr>
<td>Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)</td>
<td>Not Required</td>
<td>2SVSHTA03</td>
</tr>
<tr>
<td>Rain Cap Vent Termination</td>
<td>5300CI</td>
<td>2SVSRCF03</td>
</tr>
<tr>
<td>Joint Sealant, as Needed</td>
<td>GE RTV106 or Equivalent</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air Components</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Termination Elbow</td>
<td>9302</td>
<td>2SVSHTEX0190</td>
</tr>
<tr>
<td>Termination Pipe Section (1 ft)</td>
<td>9393S</td>
<td>2SVSHTE03</td>
</tr>
<tr>
<td>Gear Clamp (Nose Clamp)</td>
<td>3&quot; Clamp</td>
<td>7HS4XX</td>
</tr>
<tr>
<td>Air Piping/Components (Incl. Supports, Thimbles, etc.)</td>
<td>3&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
<td>4&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
</tr>
</tbody>
</table>

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.
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.

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

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.

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.

   a. Wall Thimble: 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.

   Alternate Construction: 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. Length of Vent Pipe: 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.
c. **Gear Clamp:** 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. **Termination Elbow:** 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.

**Termination Location:** 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.
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 inches on centers.

---

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

- Z-Vent or EZ-Seal Termination elbow
- Z-Vent or EZ-Seal pipe and elbows
- Wall supports from Z-Flex or Heat-Fab
- Z-Flex or Heat-Fab wall thimble and 1-foot vent length
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).

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.

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.

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.

**3C. VENT PIPING: THROUGH THE ROOF**

**SEPARATE TERMINATIONS**

**Figure 3C.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 3C.1 for acceptable vent components. NO OTHER vent materials are acceptable.

**Table 3C.1: Vent System Components**

<table>
<thead>
<tr>
<th>Vent Components</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heat-Fab</td>
<td>Z-Flex</td>
</tr>
<tr>
<td>Vent Piping/Components (Incl. Supports, Thimbles, etc.)</td>
<td>EZ-Seal 3&quot;</td>
<td>Z-Vent 3&quot;</td>
</tr>
<tr>
<td>Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)</td>
<td>Not Required</td>
<td>Not Required</td>
</tr>
<tr>
<td>Rain Cap Vent Termination</td>
<td>5300CI</td>
<td>2SVSRFC03</td>
</tr>
<tr>
<td>Joint Sealant, as Needed</td>
<td>GE RTV106 or Equivalent</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air Components</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heat-Fab</td>
<td>Z-Flex</td>
</tr>
<tr>
<td>Rain Cap Termination Pipe Section (3 ft)*</td>
<td>5300CI</td>
<td>2SVSRFC03</td>
</tr>
<tr>
<td></td>
<td>9307</td>
<td>2SVEPWCF0303</td>
</tr>
<tr>
<td>*Note: Standard air piping termination pipe section is 3 feet. A longer length can be used if needed.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Air Components (Incl. 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. 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.

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. **Rain Cap:** 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. **Length of Vent Pipe:** 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.

---

**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.

---

**NOTICE**

When using metallic piping, seal all of the longitudinal seam joints in addition to the component joints.
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 inches on centers.
   d. Provide minimum 5 feet between the center line of any vent termination and any air intake termination.
**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).

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.

**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.

**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.

**Maximum total vent pipe length:**

- 1–90° Ells: 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)

(The termination elbow does not have to be counted for the vent piping. If the vent piping contains no elbows 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.

Table 3D.1: Vent and Air System Components

<table>
<thead>
<tr>
<th>Vent Components</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heat-Fab</td>
<td>Z-Flex</td>
</tr>
<tr>
<td>Vent Piping/Components (Incl. Supports, Thimbles, etc.)</td>
<td>EZ-Seal 3&quot;</td>
<td>Z-Vent 3&quot;</td>
</tr>
<tr>
<td>Boiler Adapter (Adapts from EZ-Seal to Z-Vent Piping)</td>
<td>Not Required</td>
<td>2SVEPWCF0301</td>
</tr>
<tr>
<td>Joint Sealant, as Needed</td>
<td>GE RTV106 or Equivalent</td>
<td></td>
</tr>
<tr>
<td>Termination Elbow</td>
<td>9314TERM</td>
<td>2SVSTEX0390</td>
</tr>
<tr>
<td>Termination Pipe Section (1 ft)</td>
<td>9302</td>
<td>2SVEPWCF0301</td>
</tr>
<tr>
<td>Termination Thimble</td>
<td>9393S</td>
<td>2SVSTEX0390</td>
</tr>
<tr>
<td>Gear Clamp (Nose Clamp)</td>
<td>3&quot; Clamp</td>
<td>7HS44XX</td>
</tr>
</tbody>
</table>

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 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. Wall Thimble: 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.
b. **Length of Vent Pipe**: Use a 1-foot length of vent pipe as listed in Table 3D.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.

c. **Gear Clamp**: 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. **Termination Elbow**: 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.

**Termination Location**: 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.
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.

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

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 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.

**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).

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 3E.1: Vertical Venting/Sidewall Air**

Maximum total vent and air pipe lengths:

- 1–90° Ell: 90 feet (27 m)
- 2–90° Elks: 80 feet (24 m)
- 3–90° Elks: 70 feet (21 m)
- 4–90° Elks: 60 feet (18 m)

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

Table 3E.1: Vent and Air System Components

<table>
<thead>
<tr>
<th>Vent Piping/Components (Incl. Supports, Thimbles, etc.)</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZ-Seal Thimble, etc.</td>
<td>Heat-Fab</td>
<td>Z-Flex</td>
</tr>
<tr>
<td>3&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
<td>3&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>Z-Vent Thimble, etc.</td>
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<td>2SVSHTA03</td>
</tr>
<tr>
<td>4&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
<td>Not Required</td>
<td>2SVSHTA04</td>
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<td>9402</td>
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<tr>
<td>25VEWCF0301</td>
<td>Z-Vent</td>
<td>Z-Vent</td>
</tr>
<tr>
<td>Gear Clamp (Nose Clamp)</td>
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<td>9493S</td>
</tr>
<tr>
<td>3&quot; Clamp</td>
<td>25VEWCF0401</td>
<td></td>
</tr>
<tr>
<td>4&quot; Clamp</td>
<td>2SVSHTA03</td>
<td></td>
</tr>
<tr>
<td>Joint Sealant, as Needed</td>
<td>GE RTV106 or Equivalent</td>
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</tr>
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</table>

<table>
<thead>
<tr>
<th>Air Components</th>
<th>Heat-Fab</th>
<th>Z-Flex</th>
<th>Z-Flex</th>
</tr>
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<tbody>
<tr>
<td>Termination Elbow</td>
<td>Same as Vent Termination</td>
<td>Same as Vent Termination</td>
<td></td>
</tr>
<tr>
<td>Air Piping/Components (Incl. Supports, Thimbles, etc.)</td>
<td>3&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
<td>4&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
<td></td>
</tr>
</tbody>
</table>

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 uninsulated 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).

\[\textbf{NOTICE}\]

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 with silicone RTV. The air pipe installation must be air-tight and water-tight.

5. **Maximum Air 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.

**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. **Wall Thimble**: 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.

   b. **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.

   c. **Air Intake Termination Alternate Construction**: 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.

   d. **Gear Clamp**: 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.

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

   e. **Termination Elbows**: 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.
Insert the termination elbow and secure using the vent pipe manufacturer’s joint assembly procedure.

Termination Location: 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.

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

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. **Spacing Between Vent and Air Terminations:** 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)

**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.

**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).

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.

**Figure 3F.1: Vertical Venting/Sidewall Air**

Maximum total vent and air pipe lengths:

- 1–90° Elfs 90 feet (27 m)
- 2–90° Elfs 80 feet (24 m)
- 3–90° Elfs 70 feet (21 m)
- 4–90° Elfs 60 feet (18 m)

(2–45° Elbows = 1–90° Elbow)
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 Air System Components

<table>
<thead>
<tr>
<th>Vent Components</th>
<th>92-2</th>
<th>92-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vent Piping/Components (Incl. Supports, Thimbles, etc.)</td>
<td>EZ-Seal, 3&quot; Piping</td>
<td>EZ-Seal, 4&quot; Piping</td>
</tr>
<tr>
<td>Termination Assembly:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Single-wall Adapter</td>
<td>SC03ADEZ</td>
<td>SC04ADEZ</td>
</tr>
<tr>
<td>• Air Intake Tee</td>
<td>SC03TAD3</td>
<td>SC04TAD3</td>
</tr>
<tr>
<td>• 6&quot; Straight Section</td>
<td>SC0366</td>
<td>SC0466</td>
</tr>
<tr>
<td>• 12&quot; Straight Section</td>
<td>SC03FS</td>
<td>SC04FS</td>
</tr>
<tr>
<td>• Wall Plate (if Required)</td>
<td>SC03HT</td>
<td>SC04HT</td>
</tr>
<tr>
<td>• Termination Adapter</td>
<td>9390</td>
<td>9490</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air Components</th>
<th>Heat-Fab</th>
<th>Heat-Fab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Piping/Components (Also Supports, Thimbles, etc.)</td>
<td>3&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
<td>4&quot; PVC, CPVC, ABS, Galvanized or Aluminum</td>
</tr>
</tbody>
</table>

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 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.

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. 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).

2. 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 with 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. Wall Plates (2 Required): 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. Length of Concentric Vent Pipe: Use a 1-foot length of vent pipe as listed in Table 3F.1 unless the wall penetration requires a longer length. If a longer length is required, use a length of Heat-Fab type SC vent long enough for the application.

   c. Air Intake Tee: 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. Termination Adapter: Assembly the termination adapter to the type SC pipe, following the vent pipe manufacturer’s instructions for making the joint.

   e. Termination Screen: Apply a bead of silicone RTV to the male end of the screen fitting before inserting into the adapter. Bend the adapter tabs over the end of the screen fitting.

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

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/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)

VENT & AIR PIPING: THROUGH A SIDE WALL

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.

B. SYSTEM DESIGN

1. Design Options:
The Cast 92™ boiler works well in a single or multiple-boiler 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.

   ![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:

   ![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.

   ![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).
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. **Boiler Circulator:** The circulator that flows water through the boiler 92-2 only.
   b. **System Circulator:** The circulator that flows water through the system, but not through the boiler.
   c. **Boiler/System Circulator:** 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™ 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.

---

**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.
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 in-line 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.

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.
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.

---

**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.

---

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

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

---

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

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

---

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

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

1. Closed-type expansion tank
2. Tank fitting
3. Cold water fill line
4. Check valve
5. Strainer
6. Balancing valve
7. Air separator
8. Isolation valves
9. System circulator
10. System supply
11. System return
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.

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

**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

1. **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.

**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

<table>
<thead>
<tr>
<th>Iron Pipe Size (inches)</th>
<th>Natural Gas Pipe Flow Capacity (cubic feet per hour)</th>
<th>Propane Gas Pipe Flow Capacity (cubic feet per hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4</td>
<td>350 325 250 175 125 85 65 50 40 30 20 10 5 2</td>
<td>250 200 150 120 100 75 65 50 40 30 20 10 5 2</td>
</tr>
<tr>
<td>1</td>
<td>650 550 450 350 300 250 200 150 120 100 75 65 50 40</td>
<td>400 350 300 250 200 150 120 100 75 65 50 40 30 20</td>
</tr>
<tr>
<td>1-1/4</td>
<td>1,050 900 700 600 500 400 350 300 250 200 150 120 100 75 65 50 40</td>
<td>650 550 450 350 300 250 200 150 120 100 75 65 50 40</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Iron Pipe Size (inches)</th>
<th>90° Elbow</th>
<th>45° Elbow</th>
<th>Tee</th>
<th>Gate Valve</th>
<th>Gas Cock</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.6</td>
<td>5.2</td>
<td>0.6</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>1-1/4</td>
<td>3.5</td>
<td>6.9</td>
<td>0.8</td>
<td>1.9</td>
<td>2.5</td>
</tr>
<tr>
<td>1-1/2</td>
<td>4.0</td>
<td>8.0</td>
<td>0.9</td>
<td>2.3</td>
<td>3.0</td>
</tr>
</tbody>
</table>

1. 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.

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

B. CONDENSATE LINE INSTALLATION

1. 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.
   Protect Tubing From Damage: 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.
   Prevent Freezing: 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”.

![Figure 6.1: Connecting a Condensate Drain Line]

C. CONDENSATE LINE REQUIREMENTS

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.

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

![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.
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.

**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

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 pre-wired. 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™ 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. Figures 7.3 and 7.4 show the correct ways to install the boiler circulator using a relay or motor starter.

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.

**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 to the electrical connection board as shown in Figure 7.7b.

**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)

**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.

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.

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.
**Electrical connection board**

*Located in center panel on boiler right side*

---

**1.**
- **POWER SERVICE**
  - GND
  - NEU
  - 120VAC
  - 15-amp fused service switch, by installer

**2.**
- **120VAC/60HZ/1Ph Power to boiler**

---

**The boiler is shipped with a jumper across the HEAT DEMAND terminals. Remove this jumper when using a thermostat or other external control to start the boiler.**

**DHW tank aquastat, when used**
(A DHW circulator and circulator relay will be required. Start the DHW circulator on call for heat from the tank aquastat.)

**Room thermostat, end switches or relay contacts**
(Connect thermostat, zone valve end switches, or remote start relay contact here. Test when done to ensure no stray voltage is present on any of the wires. See the Boiler manual for procedure.)

---

**24-mA optional input for sequencing boilers or providing remote setpoint.**

---

**Figure 7.7A: Cast 92™ Wiring Summary**
Postpurge circulator (92-2 only)
This circulator is factory pipe and wired. It circulates water in the boiler after shutdown to prevent overtemperature in the top of the boiler. **DO NOT remove or use in any other manner.** It cannot be used for system circulation.

Boiler circulator
(or boiler/system circulator)
This circulator must be supplied, piped and wired by the boiler installer. See the suggested piping diagrams in the Boiler manual for circulator application and piping. **IMPORTANT:** If the circulator motor is larger than 1/4 hp, connect the circulator using a motor contactor.

**Figure 7.7B: Cast 92™ Wiring Summary**
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 20-milliamp 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™ 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™ control uses proportional-integral-derivative 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

⚠️ 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:

   ![Image of Setup Menu Options]

   c. 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:

   ![Image of Setup Menu Options]

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

   ![Image of Setup Menu Options]

   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:

   ![LOC SETPT 180°F SOURCE AUTO]

   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.

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

   ![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°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:

   ![DHW SETPT 180°F]

   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:**

---

**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:

   ![IA RESET ON AVG TIME 60MIN]

   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:**

---

**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:

   ![OA SHUTDOWN ON OA SETPT 68°F]

   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.
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:
   ![Screen showing LOW WATER温度设置](image)
   3. Don’t use the arrow keys yet, but if you use the DOWN arrow twice, the display will show:
   ![Screen showing HI WATER温度设置](image)
   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.
   5. 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.
   6. HI OA: Set this to the outside temperature at which no heat is needed, usually 68°F or lower.
   7. 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°F for finned-tube baseboard systems.
   8. LO OA: 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:

   ![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 for 5 seconds. Then press SELECT 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 until the display returns to standby, or turn boiler ON/OFF switch off, then on.

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Default (Range)</th>
<th>Typical Line</th>
</tr>
</thead>
<tbody>
<tr>
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<td><img src="#" alt="next item" /> to select</td>
<td><img src="#" alt="next item" /> to select</td>
<td><img src="#" alt="next item" /> to select</td>
<td><img src="#" alt="to change value" /> to accept value and return to previous menu level</td>
<td>(Display shows two lines at a time; cursor indicates active line)</td>
</tr>
</tbody>
</table>

| 92-2 V XX | ![92-2 V 1.0](#) Shows firmware version number | ![92-2 V 1.0](#) |

**BOILERS**

<table>
<thead>
<tr>
<th><img src="#" alt="next item" /> to select</th>
<th><img src="#" alt="next item" /> to select</th>
<th><img src="#" alt="next item" /> to select</th>
<th><img src="#" alt="next item" /> to select</th>
<th><img src="#" alt="default" /></th>
<th><img src="#" alt="default" /></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="#" alt="to accept value and return to previous menu level" /></td>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="default" /> (Range)</td>
<td><img src="#" alt="default" /> (Range)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th># BOILERS</th>
<th>1 — display only</th>
<th>LEAD BOILER</th>
<th>1 — display only — the lead boiler is the boiler with a HEADER sensor connected</th>
<th>LEAD BOILER</th>
<th>1</th>
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<tbody>
<tr>
<td>HEAT BAND</td>
<td>30°F (10 to 50°F)</td>
<td>HEAT BAND</td>
<td>30°F</td>
<td>HEAT BAND</td>
<td>30°F</td>
</tr>
<tr>
<td>HEAT NET BOILERS 123456789ABCDEFG</td>
<td>Display only — shows 1 through the number of boilers on the network</td>
<td>BOILERS</td>
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<td>BOILERS</td>
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**SETPOINTS**

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<th><img src="#" alt="default" /></th>
<th><img src="#" alt="default" /></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="default" /> (Range)</td>
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<table>
<thead>
<tr>
<th>LOC SETPT</th>
<th>180°F (140 to 180°F)</th>
<th>LOC SETPT</th>
<th>180°F</th>
<th>LOC SETPT</th>
<th>180°F</th>
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<tbody>
<tr>
<td>SOURCE</td>
<td>AUTO (AUTO, 4-20MA)</td>
<td>SOURCE</td>
<td>AUTO</td>
<td>SOURCE</td>
<td>AUTO</td>
</tr>
<tr>
<td>DHW SETPT</td>
<td>180°F (140 to 180°F)</td>
<td>DHW SETPT</td>
<td>180°F</td>
<td>DHW SETPT</td>
<td>180°F</td>
</tr>
<tr>
<td>OP LIMIT</td>
<td>205°F (145 to 205°F)</td>
<td>OP LIMIT</td>
<td>215°F</td>
<td>OP LIMIT</td>
<td>215°F</td>
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<tr>
<td>LIMIT BAND</td>
<td>10°F (1 to 50°F)</td>
<td>LIMIT BAND</td>
<td>20°F</td>
<td>LIMIT BAND</td>
<td>20°F</td>
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**INDOOR AIR**

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</thead>
<tbody>
<tr>
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<td><img src="#" alt="to return to previous menu level" /> back one level</td>
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<table>
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<th>DELTA TEMP</th>
<th>70°F</th>
<th>DELTA TEMP</th>
<th>70°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>(HI IAR%)</td>
<td>(HI IAR%)</td>
<td>(LO IAR%)</td>
<td>(LO IAR%)</td>
<td>(LO IAR%)</td>
<td>(LO IAR%)</td>
</tr>
<tr>
<td>10°F (10 to 20°F)</td>
<td>10°F (10 to 20°F)</td>
<td>20°F (10 to 20°F)</td>
<td>20°F (10 to 20°F)</td>
<td>20°F (10 to 20°F)</td>
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**VIEW IAR VALUES**

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</thead>
<tbody>
<tr>
<td><img src="#" alt="not changeable" /> here — shows values for 8 zones</td>
<td><img src="#" alt="not changeable" /> here — shows values for 8 zones</td>
<td><img src="#" alt="not changeable" /> here — shows values for 8 zones</td>
<td><img src="#" alt="not changeable" /> here — shows values for 8 zones</td>
<td><img src="#" alt="not changeable" /> here — shows values for 8 zones</td>
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<tr>
<td>70 70 70 70 70 70 70 70</td>
<td>70 70 70 70 70 70 70 70</td>
<td>70 70 70 70 70 70 70 70</td>
<td>70 70 70 70 70 70 70 70</td>
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**OUTDOOR AIR**

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<tbody>
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<table>
<thead>
<tr>
<th>OA SHUTDOWN</th>
<th>OFF (ON or OFF)</th>
<th>OA SHUTDOWN</th>
<th>OFF (ON or OFF)</th>
<th>OA SHUTDOWN</th>
<th>OFF (ON or OFF)</th>
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<tbody>
<tr>
<td>OA SETPT</td>
<td>68°F (40 to 100°F)</td>
<td>OA SETPT</td>
<td>68°F</td>
<td>OA SETPT</td>
<td>68°F</td>
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<tr>
<td>OA RESET</td>
<td>OFF (ON or OFF)</td>
<td>OA RESET</td>
<td>OFF (ON or OFF)</td>
<td>OA RESET</td>
<td>OFF (ON or OFF)</td>
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<tr>
<td>SET OA SETPTS</td>
<td>LOW WATER</td>
<td>LOW WATER</td>
<td>LOW WATER</td>
<td>LOW WATER</td>
<td>LOW WATER</td>
</tr>
<tr>
<td>(HI OA)</td>
<td>(HI OA)</td>
<td>(HI OA)</td>
<td>(HI OA)</td>
<td>(HI OA)</td>
<td>(HI OA)</td>
</tr>
<tr>
<td>140°F (60 to 150°F)</td>
<td>140°F (60 to 150°F)</td>
<td>180°F (70 to 180°F)</td>
<td>180°F (70 to 180°F)</td>
<td>180°F (70 to 180°F)</td>
<td>180°F (70 to 180°F)</td>
</tr>
<tr>
<td>70°F (50 to 90°F)</td>
<td>70°F (50 to 90°F)</td>
<td>10°F (-35 to +40°F)</td>
<td>10°F (-35 to +40°F)</td>
<td>10°F (-35 to +40°F)</td>
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**PUMP OPTIONS**

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<table>
<thead>
<tr>
<th>DELTA ENAB</th>
<th>OFF (ON or OFF)</th>
<th>DELTA ENAB</th>
<th>OFF (ON or OFF)</th>
<th>DELTA ENAB</th>
<th>OFF (ON or OFF)</th>
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<tr>
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<td>10°F (10 to 50°F)</td>
<td>DELTA TEMP</td>
<td>10°F (10 to 50°F)</td>
<td>DELTA TEMP</td>
<td>10°F (10 to 50°F)</td>
</tr>
<tr>
<td>PURGE TIME</td>
<td>0 seconds (0 to 255 seconds)</td>
<td>PURGE TIME</td>
<td>120s</td>
<td>PURGE TIME</td>
<td>120s</td>
</tr>
<tr>
<td>ALWAYS ON</td>
<td>NO (YES or NO)</td>
<td>ALWAYS ON</td>
<td>NO (YES or NO)</td>
<td>ALWAYS ON</td>
<td>NO (YES or NO)</td>
</tr>
<tr>
<td>MASTER PUMP</td>
<td>OFF (ON or OFF)</td>
<td>MASTER PUMP</td>
<td>OFF (ON or OFF)</td>
<td>MASTER PUMP</td>
<td>OFF (ON or OFF)</td>
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**NIGHT SETBACK**

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</thead>
<tbody>
<tr>
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<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
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<table>
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<tr>
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<th>SETBACK #</th>
<th>1 (1 through 4)</th>
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**OPTIONS**

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<th><img src="#" alt="default" /></th>
<th><img src="#" alt="default" /></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="to return to previous menu level" /> back one level</td>
<td><img src="#" alt="default" /> (Range)</td>
<td><img src="#" alt="default" /> (Range)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEMP SCALE</th>
<th>°F (°F or °C)</th>
<th>TEMP SCALE</th>
<th>°F</th>
<th>TEMP SCALE</th>
<th>°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEY CLICK</td>
<td>ON (ON or OFF)</td>
<td>KEY CLICK</td>
<td>ON</td>
<td>KEY CLICK</td>
<td>ON</td>
</tr>
<tr>
<td>SKIP PASSW</td>
<td>ON (ON or OFF)</td>
<td>SKIP PASSW</td>
<td>ON</td>
<td>SKIP PASSW</td>
<td>ON</td>
</tr>
<tr>
<td>BRIGHTNESS</td>
<td>50% (12, 25, 37, 50, 62, 75, 87, 100%)</td>
<td>BRIGHTNESS</td>
<td>50%</td>
<td>BRIGHTNESS</td>
<td>50%</td>
</tr>
</tbody>
</table>
### Table 8.1 (cont’d): Setup Menus

<table>
<thead>
<tr>
<th>LOG/RUNTIME</th>
<th>RUN HRS</th>
<th>Total time gas valve has been open</th>
<th>RUN HRS</th>
<th>1240</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOG ENTRY</td>
<td>LOG ENTRY</td>
<td>Current entry in the log</td>
<td>LOG ENTRY</td>
<td>327</td>
</tr>
<tr>
<td>SIZE</td>
<td>SIZE</td>
<td>The size of the data log</td>
<td>SIZE</td>
<td>1000</td>
</tr>
<tr>
<td>BOILER CYC</td>
<td>BOILER CYC</td>
<td>Number of times gas valve has been cycled on/off</td>
<td>BOILER CYC</td>
<td>5021</td>
</tr>
</tbody>
</table>

### AUX FUNCTIONS

<table>
<thead>
<tr>
<th>COMB AIR DAMPER IN USE?</th>
<th>YES (YES or NO)</th>
<th>COMB AIR DAMPER IN USE?</th>
<th>YES</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE RELAY #</td>
<td>OPT</td>
<td>USE RELAY #</td>
<td>OPT</td>
</tr>
<tr>
<td>PROOF TIME</td>
<td>2:00 (2 min, 0 sec) (0 to 4 minutes)</td>
<td>PROOF TIME</td>
<td>2:00</td>
</tr>
<tr>
<td>DHW PROTECTION IN USE?</td>
<td>NO (YES or NO)</td>
<td>DHW PROTECTION IN USE?</td>
<td>NO</td>
</tr>
</tbody>
</table>

### SYSTEM CLOCK

<table>
<thead>
<tr>
<th>TIME</th>
<th>TIME</th>
<th>11:20AM</th>
<th>DAY OF WEEK</th>
<th>MON</th>
<th>DAY</th>
<th>FRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAY OF WEEK</td>
<td>12:00AM</td>
<td>DAY OF WEEK</td>
<td>MON</td>
<td>DAY</td>
<td>FRI</td>
<td></td>
</tr>
<tr>
<td>MONTH</td>
<td>SUN</td>
<td>MONTH</td>
<td>JAN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAY</td>
<td>SEP</td>
<td>DAY</td>
<td>FRI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEAR</td>
<td>12</td>
<td>YEAR</td>
<td>2007</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### DISTRIBUTION CONTROL

<table>
<thead>
<tr>
<th>CONTROL</th>
<th>2007</th>
<th>HNET</th>
<th>CONTROL HNET</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCAL ADD</td>
<td>YES (Display only, not changeable here)</td>
<td>LOCAL ADD</td>
<td>255</td>
</tr>
<tr>
<td>CONSOLE ADD</td>
<td>Default = 1; Range = 1 to 247</td>
<td>CONSOLE ADD</td>
<td>255</td>
</tr>
</tbody>
</table>

### MODULAR BOILER

| 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 |
| 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 OFFSET | 5°F (0 to 50°F) | EARLY STOP > 5°F |
| BLR START TIME | 50 seconds (0 to 4 minutes) | > 0 MINUTES 30 SECONDS |

### MODULATION PID

| (P)ROPOR | 100 (0 to 100) | (P)ROPOR | 100 |
| (I)NTEGRAL= | 10 (0 to 100) | (I)NTEGRAL= | 10 |
| (D)ERIVAT = | 10 (0 to 100) | (D)ERIVAT = | 10 |
| BAND | 100°F (40 to 180°F) | BAND | 100°F |

### FIRING MODE

| ROTATION | TRUE (True, FOFO, LOFO) | ROTATION | TRUE |
| MASTER 1ST | OFF | MASTER 1ST | OFF |

### SENSORS

<table>
<thead>
<tr>
<th>SENSOR#</th>
<th>OUTSIDE</th>
<th>SENSOR#</th>
<th>SUPPLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
<td>TYPEZ (TYPEZ, None, ON/OFF)</td>
<td>TYPE</td>
<td>TYPEZ</td>
</tr>
<tr>
<td>CALIBRATE ?</td>
<td>NO (YES or NO)</td>
<td>CALIBRATE ?</td>
<td>NO</td>
</tr>
</tbody>
</table>

### PASSWORD

| CHANGE PASSWORD OLD: >?________ | Press SELECT to enter old password using arrow keys and SELECT for each character | CHANGE PASSWORD OLD: >?________ |
| CHANGE PASSWORD NEW: >?________ | Press SELECT to enter new password using arrow keys and SELECT for each character | CHANGE PASSWORD NEW: >?________ |
| ACCEPT > | YES / YES or NO | CHANGE PASSWORD ACCEPT > YES |

### COMMUNICATIONS

| BAUD | 19200 | BAUD | 19200 |
| PARITY | EVEN (EVEN or ODD) | PARITY | EVEN |
| MODEM | NO (YES or NO) | MODEM | NO |

### LOAD DEFAULTS

| FACTORY CAL? | NO (YES or NO) | FACTORY CAL? | NO |
| FACTORY SET? | NO (YES or NO) | FACTORY SET? | NO |
| ARE YOU SURE? | NO (YES or NO) | ARE YOU SURE? | NO |

### SYSTEM

| UPDATE CTRL? | ARE YOU SURE? | NO (YES or NO) | UPDATE CTRL? |
Table 8.2: Setup Menus – Parameter Explanations

<table>
<thead>
<tr>
<th>Menu Item</th>
<th>Under...</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEAT BAND</td>
<td>BOILERS</td>
<td>The heat band is the height of the modulating band. When the water temperature is between ½ the heat band above or below the setpoint temperature, boiler firing rate modulates. Boilers are at minimum input at the upper end of the band and maximum input at the lower end of the band. Boilers come on only if the water temperature is below the band. Boilers stage off when the water temperature is above the band.</td>
</tr>
<tr>
<td>LOC SETPT</td>
<td>SETPOINTS</td>
<td>Setpoint temperature controlled by the Cast 92™ 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).</td>
</tr>
<tr>
<td>SOURCE</td>
<td>SETPOINTS</td>
<td>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 100/0.09 = 110°F.</td>
</tr>
<tr>
<td>DHW SETPT</td>
<td>SETPOINTS</td>
<td>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).</td>
</tr>
<tr>
<td>OP LIMIT</td>
<td>SETPOINTS</td>
<td>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.</td>
</tr>
<tr>
<td>LIMIT BAND</td>
<td>SETPOINTS</td>
<td>If the boiler outlet water temperature rises toward the limit setting (OP LIMIT, above), the Cast 92™ control will begin to reduce the boiler’s firing rate when the temperature gets within the LIMIT BAND degrees F below the operating limit setting. At the lower end of the limit band, the boiler can fire up to maximum input (100%). By the time the temperature reaches the upper end of the band (the OP LIMIT setting), the boiler is limited to minimum input (20%). The limit band reduces the likelihood of short cycling on boilers controlled by a master control or a remote control by reducing boiler maximum allowable firing rate as the temperature rises toward the limit setting. Make sure the lower end of the limit band is above the upper end of the heat band.</td>
</tr>
<tr>
<td>IA RESET</td>
<td>INDOOR AIR</td>
<td>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.</td>
</tr>
<tr>
<td>AVG TIME</td>
<td>INDOOR AIR</td>
<td>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.</td>
</tr>
<tr>
<td>SET IAR SETPTS</td>
<td>INDOOR AIR</td>
<td>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.</td>
</tr>
<tr>
<td>OA SHUTDOWN</td>
<td>OUTDOOR AIR</td>
<td>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.</td>
</tr>
<tr>
<td>OA SETPT</td>
<td>OUTDOOR AIR</td>
<td>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.</td>
</tr>
<tr>
<td>OA RESET</td>
<td>OUTDOOR AIR</td>
<td>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.</td>
</tr>
</tbody>
</table>
Table 8.2 (cont’d): Setup Menus – Parameter Explanations

<table>
<thead>
<tr>
<th>Menu Item</th>
<th>Under...</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW WATER@ HI OA</td>
<td>OUTDOOR AIR SET OA SETPTS</td>
<td>These temperatures determine the reset curve for supply water temperature. High water at low outside air means the design water temperature for maximum load (at ODT, or outside design temperature for the installation). The other end of the reset curve is the low water temperature at high outside air temperature. The low water temperature is generally equal to room temperature, meaning no heat input to the space would occur below this outside air temperature.</td>
</tr>
<tr>
<td>HI WATER@ LOW OA</td>
<td></td>
<td>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 (below). The pump will continue to run an additional period after this for the amount of time specified in PURGE TIME (below).</td>
</tr>
<tr>
<td>DELTA ENABLE</td>
<td>PUMP OPTIONS</td>
<td>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.</td>
</tr>
<tr>
<td>DELTA TEMP</td>
<td>PUMP OPTIONS</td>
<td>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.</td>
</tr>
<tr>
<td>PURGE TIME</td>
<td>PUMP OPTIONS</td>
<td>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.</td>
</tr>
<tr>
<td>ALWAYS ON</td>
<td>PUMP OPTIONS</td>
<td>If ALWAYS ON is set to “YES,” the boiler circulator never turns off.</td>
</tr>
<tr>
<td>MASTER PUMP</td>
<td>PUMP OPTIONS</td>
<td>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.</td>
</tr>
<tr>
<td>SETBACK#</td>
<td>NIGHT SETBACK</td>
<td>Setback number is the designator for the setback operation. Up to four (4) setback operations can be programmed.</td>
</tr>
<tr>
<td>ENTRY IS</td>
<td>NIGHT SETBACK</td>
<td>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.</td>
</tr>
<tr>
<td>TEMP SCALE</td>
<td>OPTIONS</td>
<td>Select Fahrenheit or Centigrade.</td>
</tr>
<tr>
<td>KEY CLICK</td>
<td>OPTIONS</td>
<td>If activated, the control beeps when a key is pressed.</td>
</tr>
<tr>
<td>SKIP PASSW</td>
<td>OPTIONS</td>
<td>The control can be programmed such that a password is required to change settings. Setting this to “ON” disables the password.</td>
</tr>
<tr>
<td>BRIGHTNESS</td>
<td>OPTIONS</td>
<td>Adjust the brightness of the display.</td>
</tr>
<tr>
<td>RUN HRS</td>
<td>LOG/RUNTIME</td>
<td>Displays the total time the boiler gas valve has been open.</td>
</tr>
<tr>
<td>LOG ENTRY</td>
<td>LOG/RUNTIME</td>
<td>Displays the current entry in the data log (see Table 11.1).</td>
</tr>
<tr>
<td>SIZE</td>
<td>LOG/RUNTIME</td>
<td>Displays the current number of entries in the data log.</td>
</tr>
<tr>
<td>BOILER CYC</td>
<td>LOG/RUNTIME</td>
<td>Displays the number of times the boiler gas valve has been cycled on, then off. It does not include failed ignition attempts.</td>
</tr>
<tr>
<td>COMB AIR DMPRIN USE?</td>
<td>AUX FNCTIONS</td>
<td>Select “YES” to connect a combustion air damper and its end switch to the electrical connection board.</td>
</tr>
<tr>
<td>USE RELAY #</td>
<td>AUX FNCTIONS</td>
<td>Only one relay is available.</td>
</tr>
<tr>
<td>PROOF TIME</td>
<td>AUX FNCTIONS</td>
<td>Set proof time long enough to be sure the combustion air damper can open and activate its end switch.</td>
</tr>
<tr>
<td>DHW PROTECTION</td>
<td>AUX FUNCTIONS</td>
<td>Select “YES” to have the control alarm and disable the DHW demand input if a DHW demand lasts for more than 60 minutes.</td>
</tr>
<tr>
<td>SYSTEM CLOCK</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>LOCAL ADD</td>
<td>ADVANCED SETUP DISTRIB CTRL</td>
<td>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.</td>
</tr>
<tr>
<td>Menu Item</td>
<td>Under...</td>
<td>Explanation</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CONSOLE ADD</td>
<td>ADVANCED SETUPDISTRIB CTRL</td>
<td>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.</td>
</tr>
<tr>
<td>ADD BOILER DLY</td>
<td>ADVANCED SETUPMODULAR BOILER</td>
<td>This is the minimum wait time before an additional boiler can fire when called on by the master boiler control.</td>
</tr>
<tr>
<td>SHED BOILER DLY</td>
<td>ADVANCED SETUPMODULAR BOILER</td>
<td>This is the minimum wait time before a boiler can shut down by the master boiler control.</td>
</tr>
<tr>
<td>MOD DELAY TIME</td>
<td>ADVANCED SETUP MODULAR BOILER</td>
<td>The boiler will remain at minimum fire when first starting until this amount of time has elapsed.</td>
</tr>
<tr>
<td>MOD MAX-LAST</td>
<td>ADVANCED SETUP MODULAR BOILER</td>
<td>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 removed, and all boilers can fire up to maximum input. Once any boiler is dropped offline, the limit is applied again.</td>
</tr>
<tr>
<td>STOP BAND OFFSET</td>
<td>ADVANCED SETUP MODULAR BOILER</td>
<td>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.</td>
</tr>
<tr>
<td>BLR START TIME</td>
<td>ADVANCED SETUP MODULAR BOILER</td>
<td>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).</td>
</tr>
<tr>
<td>(P)ROPOR =</td>
<td>ADVANCED SETUP MODULATION PID</td>
<td>This parameter should generally be left at factory default.</td>
</tr>
<tr>
<td>(I)NTEGRAL =</td>
<td>ADVANCED SETUP MODULATION PID</td>
<td>This parameter should generally be left at factory default.</td>
</tr>
<tr>
<td>(D)ERIVAT =</td>
<td>ADVANCED SETUP MODULATION PID</td>
<td>This parameter should generally be left at factory default.</td>
</tr>
<tr>
<td>BAND</td>
<td>ADVANCED SETUP MODULATION PID</td>
<td>This parameter should generally be left at factory default.</td>
</tr>
<tr>
<td>ROTATION</td>
<td>ADVANCED SETUP FIRING MODE</td>
<td>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.</td>
</tr>
<tr>
<td>MASTER 1ST</td>
<td>ADVANCED SETUP FIRING MODE</td>
<td>Set this to “ON” to always start the master boiler first, regardless of the rotation scheme selected.</td>
</tr>
<tr>
<td>SENSOR#</td>
<td>ADVANCED SETUP SENSORS</td>
<td>There are up to three sensors: OUTSIDE, HEADER and RETURN.</td>
</tr>
<tr>
<td>TYPE</td>
<td>ADVANCED SETUP SENSORS</td>
<td>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.</td>
</tr>
<tr>
<td>CALIBRATE ?</td>
<td>ADVANCED SETUP SENSORS</td>
<td>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.</td>
</tr>
<tr>
<td>CHANGE PASSWORD</td>
<td>ADVANCED SETUP PASSWORD</td>
<td>Use to set/change a password.</td>
</tr>
<tr>
<td>BAUD</td>
<td>ADVANCED SETUP COMMUNICATIONS</td>
<td>Use to set change a password.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not changeable. Always 19200.</td>
</tr>
</tbody>
</table>
Table 8.2 (cont’d): Setup Menus – Parameter Explanations

<table>
<thead>
<tr>
<th>Menu Item</th>
<th>Under...</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARITY</td>
<td>ADVANCED SETUP</td>
<td>Select even or odd as required by communications port used.</td>
</tr>
<tr>
<td>MODEM</td>
<td>ADVANCED SETUP</td>
<td>Select “YES” only if a modem is installed.</td>
</tr>
<tr>
<td>LOAD DEFAULTS</td>
<td>ADVANCED SETUP</td>
<td>Load the factory defaults when you want to be sure nothing has been changed or after you have loaded new firmware.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Disconnect wires to the Heat Demand terminals and any other remote operation wiring. There must be no call for heat during the process.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Navigate the control display to “LOAD DEFAULTS.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. To restore factory calibration settings or factory settings, section either of the options and select “YES” for the prompt, “ARE YOUR SURE?”</td>
</tr>
<tr>
<td>FIRMWARE VERSION</td>
<td>ADVANCED SETUP</td>
<td>The firmware version in the control must match the version in this manual in order to ensure accuracy of the installation/operation information.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The control displays the firmware version number when Setup is accessed. To update the control’s firmware, obtain a disk from PB Heat.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Disconnect wires to the Heat Demand terminals and any other remote operation wiring. There must be no call for heat during the process.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Record all setup information for the application before proceeding.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Insert the Firmware Update Program disk into the computer. The program will start and show an option screen.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Select “Install USB Drivers” to install the program onto the computer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. After the USB driver installation is complete, select “Install Firmware Update.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. 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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. 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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. 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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10. Select “YES” to update the control.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11. NOTICE: The firmware must be downloaded now for the 92-2 control to function again.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12. Return to the computer. Select “UPDATE.” The computer program will ask to turn the boiler off, then back on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13. After the power is cy cled on the boiler, the download will start.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14. 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 waiting for the download to take place.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15. When the download is complete, the boiler will power cycle. The display should show STANDBY.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16. If the firmware does not load correctly, the display will remain blank. Try running the firmware program again.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17. Check that the boiler performs properly.</td>
</tr>
</tbody>
</table>
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)

**A. OVERVIEW: CONTROL SETUP SEQUENCE**

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.

**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 pre-wired. 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.
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.
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.)

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

**BOILER CONTROL: MULTIPLE BOILERS**

**Electrical connection board**
(Located in center panel on boiler right side)

1. **POWER SERVICE**
   - GND
   - NEU
   - 120VAC
   - 15-amp fused service switch, by installer

2. **120VAC/60HZ/1Ph**
   - Power to boiler

The boiler is shipped with a jumper across the HEAT DEMAND terminals. Remove this jumper when using a thermostat or other external control to start the boiler.

DHW tank aquastat, when used
(A DHW circulator and circulator relay will be required. Start the DHW circulator on call for heat from the tank aquastat.)

Master boiler: Room thermostats, end switches or relay contacts
(Connect thermostat, zone valve end switches, or remote start relay contact here. Test when done to ensure no stray voltage is present on any of the wires. See the Boiler manual for procedure.)

Member boiler: Connect override contacts only
(Individual boilers, if piped appropriately, can be activated for override operation, such as DHW heating or emergency space heating.)

4-20mA input option — for remote setpoint control ONLY
(Connect remote temperature control 4-20mA input wires here when remote setpoint is required. Setpoint temperature will equal milliamps/0.09; example: 11 mA would cause a setpoint of 11/0.90 = 122°F.)
**Postpurge circulator (92-2 only)**

This circulator is factory pipe and wired. It circulates water in the boiler after shutdown to prevent overtemperature in the top of the boiler. **DO NOT remove or use in any other manner.** It cannot be used for system circulation.

**Boiler circulator**

(or boiler/system circulator)

This circulator must be supplied, piped and wired by the boiler installer. See the suggested piping diagrams in the Boiler manual for circulator application and piping. **IMPORTANT:** If the circulator motor is larger than 1/4 hp, connect the circulator using a motor contactor.

**24V AC INTERLOCKS**

- **HIGH LIMIT**
- **FLOW SWITCH**
- **USER INTNLK**

- Remove factory jumper across FLOW SWITCH terminals when using a flow switch.

**Connect combustion air damper ONLY to the master boiler.**

**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.

**WARNING**

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.
3. 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.

**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.

**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 = Cast 92™ Control input

I. SET TERMINATION DIP SWITCHES

1. 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](image)

3. 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>
<thead>
<tr>
<th>Boiler</th>
<th>HeatNet</th>
<th>Modbus*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Master</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switch 1: ON</td>
<td>Switch 1: ON</td>
<td></td>
</tr>
<tr>
<td>Switch 2: ON</td>
<td>Switch 2: ON</td>
<td></td>
</tr>
<tr>
<td>Switch 3: ON</td>
<td>Switch 3: OFF</td>
<td></td>
</tr>
<tr>
<td>Switch 4: ON</td>
<td>Switch 4: OFF</td>
<td></td>
</tr>
<tr>
<td><strong>Last Member</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switch 1: ON</td>
<td>Switch 1: ON</td>
<td></td>
</tr>
<tr>
<td>Switch 2: ON</td>
<td>Switch 2: ON</td>
<td></td>
</tr>
<tr>
<td>Switch 3: OFF</td>
<td>Switch 3: OFF</td>
<td></td>
</tr>
<tr>
<td>Switch 4: OFF</td>
<td>Switch 4: OFF</td>
<td></td>
</tr>
<tr>
<td><strong>Other Members</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switch 1: OFF</td>
<td>Switch 1: OFF</td>
<td></td>
</tr>
<tr>
<td>Switch 2: OFF</td>
<td>Switch 2: OFF</td>
<td></td>
</tr>
<tr>
<td>Switch 3: OFF</td>
<td>Switch 3: OFF</td>
<td></td>
</tr>
<tr>
<td>Switch 4: OFF</td>
<td>Switch 4: OFF</td>
<td></td>
</tr>
</tbody>
</table>

*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 and “off” when in the up position.

4. **CAUTION**

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

4. **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 = Cast 92™ Control input

6. **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

**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.
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. **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

**WARNING**

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

**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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Master Boiler</th>
<th>Member Boiler (see notes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEAT BAND</td>
<td>Set on master boiler only</td>
<td></td>
</tr>
<tr>
<td>LOC SETPOINT</td>
<td>Set</td>
<td>HD only1</td>
</tr>
<tr>
<td>SOURCE</td>
<td>Set</td>
<td>HD or DHW only1,2</td>
</tr>
<tr>
<td>DHW SETPOINT</td>
<td>Set if DHW will be used</td>
<td>DHW only2</td>
</tr>
<tr>
<td>OP LIMIT</td>
<td>Set</td>
<td>Set</td>
</tr>
<tr>
<td>LIMIT BAND</td>
<td>Set</td>
<td>Set</td>
</tr>
<tr>
<td>IA RESET</td>
<td>ON if IAR is used, or set to OFF</td>
<td>Do not set</td>
</tr>
<tr>
<td>OA SHUTDOWN</td>
<td>Set ON if user set to OFF</td>
<td>HDOA only3</td>
</tr>
<tr>
<td>OA SETPOINT</td>
<td>Set if used</td>
<td>HDOA only3</td>
</tr>
<tr>
<td>OA RESET</td>
<td>Set if used</td>
<td>HDOA only3</td>
</tr>
<tr>
<td>OA SETPTS</td>
<td>Set if used</td>
<td>HDOA only3</td>
</tr>
<tr>
<td>DELTA ENABLE</td>
<td>Set if used</td>
<td>Set if used</td>
</tr>
<tr>
<td>DELTA TEMP</td>
<td>Set if used</td>
<td>Set if used</td>
</tr>
<tr>
<td>PURGE TIME</td>
<td>Set if used</td>
<td>Set if used</td>
</tr>
<tr>
<td>ALWAYS ON</td>
<td>Set if used</td>
<td>Set if used</td>
</tr>
<tr>
<td>MASTER PUMP</td>
<td>Set if used</td>
<td>Do not set</td>
</tr>
<tr>
<td>NIGHT SETBACK</td>
<td>Set on master boiler only</td>
<td></td>
</tr>
<tr>
<td>OPTIONS (all)</td>
<td>Set</td>
<td>Set</td>
</tr>
<tr>
<td>AUX FUNCTIONS</td>
<td>Set on master boiler only</td>
<td></td>
</tr>
<tr>
<td>SYSTEM CLOCK</td>
<td>Set</td>
<td>Set</td>
</tr>
<tr>
<td>LOCAL ADD</td>
<td>Automatic</td>
<td>Set (beginning at 2)</td>
</tr>
<tr>
<td>CONSOLE ADD</td>
<td>Automatic</td>
<td>Set (beginning at 2)</td>
</tr>
<tr>
<td>MODULAR BOILER</td>
<td>Set on master boiler only</td>
<td></td>
</tr>
<tr>
<td>MODULATION PID</td>
<td>Set on master boiler only</td>
<td></td>
</tr>
<tr>
<td>FIRING MODE</td>
<td>Set on master boiler only</td>
<td></td>
</tr>
<tr>
<td>SENSOR #</td>
<td>Set</td>
<td>HD/HD0A only1,3</td>
</tr>
<tr>
<td>TYPE</td>
<td>Set</td>
<td>HD/HD0A only1,3</td>
</tr>
<tr>
<td>CALIBRATE ?</td>
<td>On any boiler if required</td>
<td></td>
</tr>
<tr>
<td>PASSWORD</td>
<td>Set</td>
<td>Set</td>
</tr>
<tr>
<td>COMMUNICATIONS</td>
<td>Set</td>
<td>Set</td>
</tr>
<tr>
<td>LOAD DEFAULTS</td>
<td>On any boiler if required</td>
<td></td>
</tr>
<tr>
<td>SYSTEM</td>
<td>On any boiler if required</td>
<td></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. RJ45 HeatNet cable IN from master or previous member</td>
</tr>
<tr>
<td>2. RJ45 HeatNet cable OUT to next member boiler</td>
</tr>
<tr>
<td>3. Shielded wire (3-2ire), option to RJ45 cable, HeatNet communications INPUT and connection for additional boilers on the network</td>
</tr>
<tr>
<td>4. Shielded wire (option to RJ45 cable) Modbus INPUT from building management system</td>
</tr>
<tr>
<td>5. USB cable port (for USB cable connection to a PC — required when updating control firmware)</td>
</tr>
<tr>
<td>6. RJ45 cable from building management system, when used</td>
</tr>
<tr>
<td>7. Plug for insertion into Cast 92™ control electrical connection panel</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

Figure 9A.10: RS485 Communications Board
A. OVERVIEW

1. This method uses an RS485 digital communications cable with the Modbus protocol to control a boiler or boiler network.

2. 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).

3. 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.

3. 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

<table>
<thead>
<tr>
<th>Address</th>
<th>Data Type</th>
<th>Description</th>
<th>Valid Values/Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>40001</td>
<td>Unsigned</td>
<td>Boiler/System Enable/Disable</td>
<td>0 = Disabled/Off, 1 = Enabled/On</td>
</tr>
<tr>
<td>40002</td>
<td>Unsigned</td>
<td>System Setpoint Timer (1)</td>
<td>0 – 65535 Seconds</td>
</tr>
<tr>
<td>40003</td>
<td>Unsigned</td>
<td>System Setpoint (1)</td>
<td></td>
</tr>
<tr>
<td>40004</td>
<td>Unsigned</td>
<td>Outdoor Air Reset Enable/Disable</td>
<td>0 = Disabled/Off, 1 = Enabled/On</td>
</tr>
<tr>
<td>40005</td>
<td>Unsigned</td>
<td>Outdoor Air Setpoint</td>
<td></td>
</tr>
<tr>
<td>40006</td>
<td>Unsigned</td>
<td>Water Temperature at High Outside Air</td>
<td>60°F - 150°F</td>
</tr>
<tr>
<td>40007</td>
<td>Unsigned</td>
<td>High Outside Air Temperature</td>
<td>50°F - 90°F</td>
</tr>
<tr>
<td>40008</td>
<td>Unsigned</td>
<td>Water Temperature at Low Outside Air</td>
<td>70°F - 220°F</td>
</tr>
<tr>
<td>40009</td>
<td>Signed</td>
<td>Low Outside Air Temperature</td>
<td>-35°F - 40°F</td>
</tr>
<tr>
<td>4010</td>
<td>Unsigned</td>
<td>Set Clock – Month (2)</td>
<td>0 – 11</td>
</tr>
<tr>
<td>4011</td>
<td>Unsigned</td>
<td>Set Clock – Day of Month (2)</td>
<td>1 – 31</td>
</tr>
<tr>
<td>4012</td>
<td>Unsigned</td>
<td>Set Clock – Year (2)</td>
<td>0 – 99</td>
</tr>
<tr>
<td>4013</td>
<td>Unsigned</td>
<td>Set Clock – Hours (2)</td>
<td>0 – 23</td>
</tr>
<tr>
<td>4014</td>
<td>Unsigned</td>
<td>Set Clock – Minutes (2)</td>
<td>0 – 59</td>
</tr>
<tr>
<td>4015</td>
<td>Unsigned</td>
<td>Set Clock – Seconds (2)</td>
<td>0 – 59</td>
</tr>
<tr>
<td>4016</td>
<td>Unsigned</td>
<td>Set Clock – Day of Week (2)</td>
<td>1 – Monday, 7 – Sunday</td>
</tr>
<tr>
<td>4017</td>
<td>Unsigned</td>
<td>Set Clock – After the Set Clock</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 9B.2: Boiler Status Flags

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

1. Install the correct bridge to adapt to building management systems using BACnet or LonWorks protocols.

2. 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

1. 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**

<table>
<thead>
<tr>
<th>Address</th>
<th>Data Type</th>
<th>Description</th>
<th>Valid Values/Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>30001</td>
<td>Unsigned</td>
<td>Boilers Running</td>
<td>0 – 16</td>
</tr>
<tr>
<td>30002</td>
<td>Unsigned</td>
<td>Modulation (% BTU Load)</td>
<td>0 – 100</td>
</tr>
<tr>
<td>30003</td>
<td>Signed</td>
<td>Header / System Temperature</td>
<td>32 – 250 °F</td>
</tr>
<tr>
<td>30004</td>
<td>Signed</td>
<td>Supply Temperature</td>
<td>32 – 250 °F</td>
</tr>
<tr>
<td>30005</td>
<td>Signed</td>
<td>Return Temperature</td>
<td>32 – 250 °F</td>
</tr>
<tr>
<td>30006</td>
<td>Signed</td>
<td>Outside Air Temperature</td>
<td>-40 – 250 °F</td>
</tr>
<tr>
<td>30007</td>
<td>Signed</td>
<td>Spare Input 1</td>
<td>-32768 to 32767</td>
</tr>
<tr>
<td>30008</td>
<td>Signed</td>
<td>Spare Input 2</td>
<td>-32768 to 32767</td>
</tr>
<tr>
<td>30009</td>
<td>Unsigned</td>
<td>Clock – Month</td>
<td>0 – 11</td>
</tr>
<tr>
<td>30010</td>
<td>Unsigned</td>
<td>Clock – Day</td>
<td>1 – 31</td>
</tr>
<tr>
<td>30011</td>
<td>Unsigned</td>
<td>Clock – Year</td>
<td>0 – 99</td>
</tr>
<tr>
<td>30012</td>
<td>Unsigned</td>
<td>Clock – Hours</td>
<td>0 – 23</td>
</tr>
<tr>
<td>30013</td>
<td>Unsigned</td>
<td>Clock – Minutes</td>
<td>0 – 59</td>
</tr>
<tr>
<td>30014</td>
<td>Unsigned</td>
<td>Clock – Seconds</td>
<td>0 – 59</td>
</tr>
<tr>
<td>30015</td>
<td>Unsigned</td>
<td>Clock – Day of Week</td>
<td>1 – Monday 7 – Sunday</td>
</tr>
<tr>
<td>30016</td>
<td>Unsigned</td>
<td>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.</td>
<td>See the Boiler Status Flags Table Below</td>
</tr>
<tr>
<td>30048</td>
<td>Unsigned</td>
<td>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.</td>
<td>0 – 4294967295 Seconds</td>
</tr>
</tbody>
</table>
A. OVERVIEW — CONTROL SETUP SEQUENCE

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.

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.

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 pre-wired. 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.2: 120VAC Power Service Terminals on Electrical Connection Board

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

Figure 9C.4: Wiring the Boiler Circulator Using a Relay or Starter (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.

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

1. 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

1. 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.

3. 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.

**CAUTION**

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
**BOILER CONTROL: MULTIPLE BOILERS**

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

The boiler is shipped with a jumper across the HEAT DEMAND terminals. Remove this jumper when using a thermostat or other external control to start the boiler.

Use these terminals only during boiler setup as given in the Boiler manual.

Use ONLY if wiring and piping for Override mode:
- DHW tank aquastat, when used
  - (A DHW circulator and circulator relay will be required. Start the DHW circulator on call for heat from the tank aquastat.)

Use ONLY if wiring and piping for Override mode:
- (Connect thermostat, zone valve end switches, or remote start relay contact here. Test when done to ensure no stray voltage is present on any of the wires. See the Boiler manual for procedure.)

The resistive load across the 24mA source is 250 ohms per boiler.
Figure 9C.7: Cast 92™ Wiring Summary — Wiring to Electrical Connection Board (Continued)
J. SET CONTROL PARAMETERS ON KEYPADS

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

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

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).
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.

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 chromium 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 given 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.

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.

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.

5. 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.

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.
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.

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.

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.
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.

**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.
   
   **System Pump:** 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).

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

**NOTICE**

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

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

• 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.

WHAT TO DO IF YOU SMELL GAS

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 (\(\bigcirc\)) 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 (\(\bigtriangleup\)) 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 (\(\bigcirc\)) to **CLOSE.** DO NOT FORCE THE HANDLE.

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

**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).

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

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.
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.

   **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).

2. Acceptable CO$_2$/O$_2$ Values:
   The CO$_2$/O$_2$ 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**
<table>
<thead>
<tr>
<th></th>
<th>Natural Gas – High Fire</th>
<th>Natural Gas – Low Fire</th>
<th>Propane – High Fire</th>
<th>Propane – Low Fire</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CO$_2$ / O$_2$</td>
<td>CO$_2$ / O$_2$</td>
<td>CO$_2$ / O$_2$</td>
<td>CO$_2$ / O$_2$</td>
</tr>
<tr>
<td>Minimum %</td>
<td>8.4 / 6.2</td>
<td>7.5 / 7.8</td>
<td>9.3 / 6.2</td>
<td>82 / 7.8</td>
</tr>
<tr>
<td>Maximum %</td>
<td>9.5 / 4.2</td>
<td>8.2 / 6.5</td>
<td>10.7 / 4.2</td>
<td>9.1 / 6.5</td>
</tr>
</tbody>
</table>

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.
   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 CO$_2$ is Too HIGH (O$_2$ 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 CO$_2$ is Too LOW (O$_2$ 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 burn 10 cubic feet of gas at high fire.

6. Insert the heating value and the time, in seconds, into the formula below.

\[
\text{Input} = \frac{[\text{Gas Btu per cubic foot}] \times [3600] \times [10]}{\text{seconds}}
\]

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

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\textsubscript{2}, O\textsubscript{2} or CO 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 CO\textsubscript{2}/O\textsubscript{2}/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.

K. WHEN IS LOW FIRE ADJUSTMENT REQUIRED?

**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.

L. REMOVING THE BOILER JACKET TOP

1. See Figure 11.6.

**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.

**NOTICE**

Adjust the gas valve low-fire setting ONLY if the flame is unacceptable, the CO\textsubscript{2}, O\textsubscript{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.

**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**

**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.

**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.

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.)

3. **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**

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).
2. 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%).

![Figure 11.7: Gas Valve Adjustments](image-url)
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.”
   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.

S. FILL OUT THE COMBUSTION TEST RECORD

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

Figure 11.8: Throttle Adjustment and Flame Window

After completing Section 11, “Start-up Procedure”, complete the Combustion Test Record Sheet in Appendix B.
12. TROUBLESHOOTING

Table 12.1

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

```
10:37 PM 01/29 687
H20 175°F SET180°F
```

<table>
<thead>
<tr>
<th>Time of day</th>
<th>Date</th>
<th>Entry number (from 1 to 1000, highest number is most recent entry)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:37 PM</td>
<td>01/29</td>
<td>687</td>
</tr>
<tr>
<td>H20</td>
<td>175°F</td>
<td>SET180°F</td>
</tr>
</tbody>
</table>

Screen 2 — Outside temp and mod percentage

```
10:37 PM 01/29 687
OA 12 MOD% 30
```

<table>
<thead>
<tr>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outside air temperature, if sensor connected; otherwise, display = NA</td>
</tr>
</tbody>
</table>

Screen 3 — Status or messages (see right)

```
10:37 PM 01/29 687
-B100- PMDBI HD
```

<table>
<thead>
<tr>
<th>Displays &quot;HD&quot; for heat demand, &quot;DH&quot; for DHW demand, &quot;NC&quot; is there is no call for heat, or &quot;LK&quot; if boiler is called to heat by the master boiler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display will show &quot;P&quot; if boiler pump was on; &quot;M&quot; if main valve was open; &quot;D&quot; if combustion air damper was energized; &quot;B&quot; if blower was on; and &quot;I&quot; if ignition cycle was in process</td>
</tr>
</tbody>
</table>

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

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 detecting 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)

<table>
<thead>
<tr>
<th>Situation</th>
<th>Suggested Procedure</th>
</tr>
</thead>
</table>
| Nothing happens when the power switch is turned on. | 1. Check 120VAC power to connection board. Verify power is connected per wiring diagrams.  
2. The Power switch light (ON -Position) should illuminate if power is wired correctly.  
3. 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.  
4. 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. | 1. If you are not using the combustion air damper then it needs to be disabled in the AUX FUNCTIONS menu.  
2. 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.  
3. If there is no proving switch, you must put a jumper wire across input connection (USER INTRLK).  
4. 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. |
| 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. | 1. 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.  
2. 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.  
3. Make sure only the master boiler has a Header Sensor connected.  
4. Verify that each boiler’s cable is in place.  
5. 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. | 1. Verify that the latest version of firmware is installed on all boilers.  
2. All boilers in a system must have the same firmware revision (version).  
3. Verify the proper termination is set on the Master and the last Member boiler. |
| Boilers are detected but then lost and then detected again. | 1. The control communications cable may be receiving interference from the blower, ignition, or other form of radiated electrical noise.  
2. Termination of the jumpers may not be correct or there is more than one master.  
   • Ensure that the termination dip switches 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 communications 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. | 1. In order for the MASTER boiler to act as a MASTER1., the header sensor must be set to TYPE2, and there must be a header sensor present.  
2. 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.  
3. 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. | 1. 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 probe switch is working properly.  
2. If there is no flow probe switch, check to make sure that a jumper wire has been connected across the FLOW SWITCH terminals. |
| You have forgotten the password. | Turn the ON/OFF switch off. Then depress and hold the ESC key while turning it back on. This will load the default password “AAAAAA”. |
| Firmware update program starts 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

⚠️ 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.
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.

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).
   a. 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" (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.

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.
E. ACCESSING THE BURNER

**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.

**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.
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" 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.

**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 start-up/test procedure of the boiler.

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

![Figure 13.3: Preparing to Remove Upper Section Cover](image)

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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.)

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.

**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 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.

**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.

Figure 13.4: Upper Cover Bolt Locations

Figure 13.5: Burner and Chamber
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.

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

6. **Condensate Line Maintenance:**
   a. 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™

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Quantity Required</th>
<th>Stock Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TRIDICATOR 20-1022</td>
<td>1</td>
<td>54353</td>
</tr>
<tr>
<td>2</td>
<td>RIGHT JACKET PANEL 03-1752</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>3</td>
<td>ABS SIDE MEDALLION 60-5625</td>
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</tr>
<tr>
<td>4</td>
<td>OFF LABEL 42-5238</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>5</td>
<td>MAIN POWER SWITCH 58-1555</td>
<td>1</td>
<td>54354</td>
</tr>
<tr>
<td>6</td>
<td>ON LABEL 42-5237</td>
<td>1</td>
<td>N/A</td>
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<tr>
<td>7</td>
<td>BASE ASSEMBLY 70-1223</td>
<td>1</td>
<td>N/A</td>
</tr>
<tr>
<td>8</td>
<td>FRONT JACKET PANEL 03-1750</td>
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<td>N/A</td>
</tr>
<tr>
<td>9</td>
<td>PORT COVER 03-1754</td>
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<tr>
<td>10</td>
<td>3/8 – 16 X 3/4 HX HD FLANGE BOLT 57-4114</td>
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<td>11</td>
<td>BLANK BOX ASSEMBLY 70-1421</td>
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<td>DOCKING STATION 60-5626</td>
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<td>VIEWPORT COVER 03-1755</td>
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<td>5/16-18 X 1 1/4 HX BOLT 57-1501</td>
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<td>SIGHT GLASS HOLDER 01-1649</td>
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<td>INNER SIGHT GLASS GASKET 59-1106</td>
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<td>19</td>
<td>10-32 THUMBSCREW 57-3657</td>
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<td>20</td>
<td>FILTER BOX TOP COVER 03-1765</td>
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<td>21</td>
<td>UPPER FILTER BOX GASKET 59-1090</td>
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<td>22</td>
<td>COMBUSTION AIR FILTER 59-1089</td>
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<td>27</td>
<td>1/2” FLEX GAS LINE 54-3234</td>
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<td>28</td>
<td>GAS TRAIN SUPPORT BRACKET 70-6689</td>
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<tr>
<td>29</td>
<td>DUNGS GAS VALVE 02-1580</td>
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<td>30</td>
<td>INLET SHROUD – GAS VALVE 02-1582</td>
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<tr>
<td>31</td>
<td>MESH BURNER 70-6674</td>
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</tr>
<tr>
<td>32</td>
<td>1-3/4 HOLE CAP 58-2215</td>
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<td>33</td>
<td>PRESSURE RELIEF VALVE 30 PS.I 22-1203</td>
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<td>LEFT SIDE JACKET PANEL 03-1753</td>
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<td>IGNITOR ASSEMBLY 70-1231</td>
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<td>36</td>
<td>24V IGNITION CONTROL 02-4296</td>
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<td>37</td>
<td>IGNITION COVER 03-1756</td>
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Figure 14.2: General Repair Parts – Cast 92-4™

* Available as Complete Drain Assembly
Figure 14.2 (cont’d): General Repair Parts – Cast 92-4™
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## 15. BOILER RATINGS & SPECIFICATIONS

### Table 15.1: Boiler Ratings & Specifications

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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.

⚠️ 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.

⚠️ CAUTION

3-wire zone valves: You will have to rewire existing 3-
wire 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.

⚠️ 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 WITH CIRCULATOR RELAYS (RELAYS MUST HAVE 24VAC COMMON TERMINALS)

**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.

**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.

**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.

**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.

**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.

**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.
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)
## Peerless® Cast 92™ Combustion Test Record

<table>
<thead>
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<th>Contact:</th>
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<td>Fax Number:</td>
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### Jobsite Data

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### Boiler Data

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<td>Startup Date:</td>
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### Gas Pressure

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<th>Inlet Gas Pressure Drop After Boiler Startup (in. w.c.):</th>
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<td>High Fire Outlet Gas Pressure (in. w.c.):</td>
<td>Low Fire Outlet Gas Pressure (in. w.c.):</td>
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### Combustion Readings

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<tr>
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<tr>
<td>Fan Speed High Fire:</td>
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### System Information

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<tr>
<td>Vent Length (Total Equivalent Feet):</td>
<td>Vent Diameter:</td>
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</table>
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.

Peerless® CAST 92™
Gas Boilers

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

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