<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully Assembled Boiler</td>
<td></td>
</tr>
<tr>
<td>Metal Wall Bracket</td>
<td></td>
</tr>
<tr>
<td>Safety Relief Valve</td>
<td>(Maximum 50 PSI)</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
</tr>
<tr>
<td>Drain Valve</td>
<td>Used for measuring outside temperature</td>
</tr>
<tr>
<td>Gas Shutoff Valve</td>
<td>Used for connecting condensate piping to boiler</td>
</tr>
<tr>
<td>TP Gauge and Safety Relief Valve Connections</td>
<td></td>
</tr>
<tr>
<td>Document Package</td>
<td>Includes essential documents.</td>
</tr>
<tr>
<td>Outdoor Sensor</td>
<td></td>
</tr>
<tr>
<td>Condensate Drain Connections</td>
<td></td>
</tr>
</tbody>
</table>
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# Physical Data

## Table 1: Physical Data

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td>240</td>
</tr>
<tr>
<td><strong>Width (A)</strong></td>
<td>17-¾&quot; (450mm)</td>
</tr>
<tr>
<td><strong>Height (B)</strong></td>
<td>31-⅛&quot; (763mm)</td>
</tr>
<tr>
<td><strong>Depth (C)</strong></td>
<td>23&quot; (585mm)</td>
</tr>
<tr>
<td><strong>Bracket (D) Location on back of unit</strong></td>
<td>15-¾&quot; (403.2mm)</td>
</tr>
<tr>
<td><strong>Water Connections</strong></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>1&quot; (25.4mm)</td>
</tr>
<tr>
<td>Location (G)</td>
<td>3-¾&quot; (95.3mm)</td>
</tr>
<tr>
<td>Location (H) Return</td>
<td>9&quot; (228.6mm)</td>
</tr>
<tr>
<td>Location (I) Supply</td>
<td>5&quot; (127mm)</td>
</tr>
<tr>
<td><strong>Gas Connection</strong></td>
<td></td>
</tr>
<tr>
<td>Location (J)</td>
<td>3-¾&quot; (95.3mm)</td>
</tr>
<tr>
<td>Size</td>
<td>3/4&quot; NPT</td>
</tr>
<tr>
<td><strong>Condensate Drain Connection</strong></td>
<td></td>
</tr>
<tr>
<td>Location (J)</td>
<td>2-¼&quot; (57.2mm)</td>
</tr>
<tr>
<td>Size</td>
<td>3/4&quot; NPT</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
</tr>
<tr>
<td>Shipping</td>
<td>145 LBS (65.8)</td>
</tr>
<tr>
<td>Unit</td>
<td>120 LBS (54.5kg)</td>
</tr>
<tr>
<td><strong>Vent Connector</strong></td>
<td>80/125 mm</td>
</tr>
<tr>
<td><strong>Electrical Cord Length</strong></td>
<td>5 ft. (1.5m)</td>
</tr>
</tbody>
</table>

50 psi safety relief valve (3.44 bar)
Pressure relief valve connection 3/4" (22.2m)
1. Safety Information

Boiler installation shall be completed by qualified agency. See glossary for additional information.

⚠️ WARNING

Fire, explosion, asphyxiation and electrical shock hazard. Improper installation could result in death or serious injury. Read this manual and understand all requirements before beginning installation.

⚠️ WARNING

Do not tamper with or use this boiler for any purpose other than its intended use. Failure to follow these instructions could result in death or serious injury. Use only manufacturer recommended parts and accessories.

⚠️ CAUTION

Laceration, burn hazard. Metal edges and parts may have sharp edges and/or may be hot. Use appropriate personal protection equipment to include safety glasses and gloves when installing or servicing this boiler. Failure to follow these instructions could result in minor or moderate injury.

Become familiar with symbols identifying potential hazards.

This is the safety alert symbol. Symbol alerts you to potential personal injury hazards. Obey all safety messages following this symbol to avoid possible injury or death.

⚠️ DANGER

Indicates a hazardous situation which, if not avoided, WILL result in death or serious injury.

⚠️ WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠️ CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Note: Used to address practices not related to personal injury.

FOR YOUR SAFETY READ BEFORE OPERATING

Hot Water Can Scald!

Water heated to temperature for clothes washing, dish washing and other sanitizing needs can scald and cause permanent injury. Children, elderly, and infirm or physically handicapped persons are more likely to be permanently injured by hot water. Never leave them unattended in bathtub or shower. Never allow small children to use a hot water tap or draw their own bath.

If anyone using hot water in the building fits the above description, or if state laws or local codes require certain water temperatures at hot water taps, you must take special precautions:

• Use lowest possible temperature setting.
• Install some type of tempering device, such as an automatic mixing valve, at hot water tap or water heater. Automatic mixing valve must be selected and installed according to manufacturer's recommendations and instructions.
• Water passing out of drain valves may be extremely hot. To avoid injury:
  • Make sure all connections are tight.
  • Direct water flow away from any person.

<table>
<thead>
<tr>
<th>Water Temperature Setting</th>
<th>1st Degree Burn Exposure Time For An Adult</th>
<th>2nd and 3rd Degree Burn Exposure Time For An Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>120° F</td>
<td>1 minute</td>
<td>5 minutes</td>
</tr>
<tr>
<td>130° F</td>
<td>5 seconds</td>
<td>30 seconds</td>
</tr>
<tr>
<td>140° F</td>
<td>2 seconds</td>
<td>5 seconds</td>
</tr>
<tr>
<td>150° F</td>
<td>1 second</td>
<td>1.5 seconds</td>
</tr>
<tr>
<td>160° F</td>
<td>Instantaneous</td>
<td>0.5 seconds</td>
</tr>
</tbody>
</table>

Note: Warning for Infants, Children, and Elderly: Great care must be taken when exposing the aforementioned groups to warm or hot water as they can be badly burned in exposure times less than half of the time for an adult.
2 - INTRODUCTION

2.1 Installation shall conform to requirements of authority having jurisdiction or in absence of such requirements:
- United States
  - National Electrical Code, NFPA 70.

2.2 Where required by authority having jurisdiction, installation shall conform to Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1. Additional manual reset low water cutoff may be required.

2.3 Requirements for Commonwealth of Massachusetts:
Boiler installation must conform to Commonwealth of Massachusetts code 248 CMR which includes but is not limited to:
  - Installation by licensed plumber or gas fitter.

2.4 Manufacturer recommends use of Carbon Monoxide monitor may be requirement of local jurisdiction.

2.5 Designated Use
- Hot water heating boiler.
- Indoor installation.
- Closet or alcove installation.
- Direct vent boiler or single vent pipe.
- For use with natural gas or liquefied petroleum gases (LP/propane).

2.6 The unit MUST NOT:
- Directly heat potable water. Indirect heating is acceptable.
- Heat water with non-hydronic heating system chemicals present (example, swimming pool water).
- Exceed 50 psig (3.44 bar) maximum allowable working pressure, or drop below minimum system pressure 7.25 psig (.50 bar)
- Exceed 176°F (80°C) system design temperature.

2.7 Operational Features
- Modulating: 6.7:1 ratio.
- Integral Dual Limit.
- Integral Low Water Pressure Cutoff.
- Outdoor Temperature Reset.
- Heat exchanger over heat protection.
- Recommended system pressure (cold) 21.7 psig (1.5 bar)

Check our website frequently for updates: www.ecrinternational.com

Information and specifications outlined in this manual in effect at the time of printing of this manual. ECR International ECR reserves the right to discontinue, change specifications or system design at any time without notice and without incurring any obligation, whatsoever.
### Component Listing

1. Condensate trap
2. Gas Valve
3. Fan
4. Air/gas Mixer
5. Heat exchanger
6. Burner sight glass
7. Manual air vent
8. Flue sensor
9. Coaxial flue connector
10. Exhaust test port
11. Intake test port
12. Thermal fuse (#6 on wire diagram)
13. Exchanger flange high limit (#4 on wire diagram)
14. Ignition/Flame detection electrode
15. Spark generator
16. Automatic air vent
17. Auxiliary control board box
18. Air/gas venturi
19. Pump
20. Boiler drain
21. Low water pressure switch

**Legend**
- A: Condensate trap drain
- B: Gas inlet connection
- C: Heating supply connection
- D: Heating return connection
4.1 Boiler Location Considerations

- Ambient room temperature always above 32°F (0°C) to prevent freezing of liquid condensate.
- Approved for installation in closets or alcove provided it is correctly designed for that purpose.
- Not approved for outdoor installation.
- Protect gas ignition system components from water (dripping, spraying, rain, etc.) during operation and service (circulator replacement, condensate trap, control replacement, etc.).
- Access to outdoors to meet minimum and maximum pipe lengths for combustion air and vent piping. See section 6.
- Disposal of condensate. See section 6.
- Drainage of water (or water - antifreeze solution) during boiler service or from safety relief valve discharge. See section 5.
- Access to system water piping, gas supply, and electrical service. See sections 5, 7 and 8.
- Clearances to combustible materials and service clearances. See Table 2 and figures 4-1a - 4-2c.
- Boiler shall be installed on flat vertical wall which is capable of supporting the weight of the boiler.
- Boiler may be installed in any room or internal space, special attention shall be given to the requirements of the current electrical provisions with respect to the installation of the boiler in a room or internal space containing a bath or shower. Where a room-sealed boiler is installed in a room containing a bath or shower, it must not be possible for a person using the bath or shower to touch any electrical switch or boiler control utilizing line voltage electricity.
- Multiple Boilers can be wall mounted, placed side by side, or back to back.

### TABLE 2: BOILER CLEARANCES

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Combustible Materials (1)</th>
<th>Service (1)(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>DMG-240</td>
<td></td>
</tr>
<tr>
<td>Top (A)</td>
<td>0&quot; (0 mm)</td>
<td>11-13/16&quot; (300 mm)</td>
</tr>
<tr>
<td>Left Side (B)</td>
<td>1-3/4&quot; (45 mm)</td>
<td>1-3/4&quot; (45 mm)</td>
</tr>
<tr>
<td>Right Side (C)</td>
<td>1-3/4&quot; (45 mm)</td>
<td>1-3/4&quot; (45 mm)</td>
</tr>
<tr>
<td>Front (D)</td>
<td>1-3/4&quot; (45 mm)</td>
<td>17 3/4&quot; (450 mm)</td>
</tr>
<tr>
<td>Back (E)</td>
<td>0&quot; (0 mm)</td>
<td>0&quot; (0 mm)</td>
</tr>
<tr>
<td>Bottom (F)</td>
<td>0&quot; (0 mm)</td>
<td>*9-7/8&quot; (250 mm)</td>
</tr>
<tr>
<td>Combustion Air/Vent piping</td>
<td>0&quot; (0 mm)</td>
<td>6&quot; (160 mm)</td>
</tr>
</tbody>
</table>

(1) Required distances measured from boiler jacket.
(2) Service, proper operation clearance recommendation.

* Allowance for piping at the bottom of boiler not included.
4 - LOCATING BOILER

**FIGURE 4-1a Clearance to Combustible Materials**
(See Table 2, page 8)

![Diagram of Boiler Front View showing clearance dimensions](image1)

**FIGURE 4-1b Clearance to Combustible Materials**
Boiler Left Side View

![Diagram of Boiler Left Side View showing clearance dimensions](image2)

**FIGURE 4-2a Service Clearances - Boiler Front**
(See Table 2, page 8)

![Diagram of Boiler Front View showing service clearances](image3)

**FIGURE 4-2b Service Clearances - Boiler Left side**

![Diagram of Boiler Left Side View showing service clearances](image4)

**FIGURE 4-2c Service Clearances - Closet Installation**

**CLEARANCES REQUIRED FOR CLOSET INSTALLATION**

- 0 in. /0 mm between the Back of the Unit and the wall

![Diagram of Closet Installation showing clearances](image5)
4.2 Wall Mounting

Pre-pipe supply and return water connections with factory fittings before wall mounting.

Mount boiler on wall using wall mounting bracket included with unit.

- Verify boiler is level and upright. Mark position of holes for plumbing connections.
- If rear exit flue is used, mark position of hole for flue.
- For horizontally terminating units continue to mark the horizontal center line of flue across the wall to the side wall, then along side wall ensuring the lines have a downward pitch back to the boiler. This will give the position of the center of the hole for the flue.
- Cut 5-5/16” (135.00 mm) diameter hole in the wall for concentric flue
- Lift boiler and hang it on wall.
- Adjust the position of the boiler verify it is level.

For Direct Vent installations, air vents are not required in the room boiler is installed in, or when installed in closet or compartment.
5 - HYDRONIC PIPING

5.1 General

- Primary/Secondary piping required.
- Install piping in accordance with authority having jurisdiction.

- Support system piping and safety relief valve discharge piping. Boiler's internal piping and wall mount bracket can be damaged if subjected to excessive weight.
- Size central heating pump (and domestic hot water pump, if used) for system requirements only. Internal heat exchanger pump compensates for pressure drop through boiler internal piping and heat exchanger.
- Thoroughly clean and flush system before connecting to boiler.
- If oil is present in system water, use approved detergent to wash system.
- It is necessary to semi-annually check the water quality of central heating systems.
- Flush system to remove any solid objects such as metal chips, fibers, or Teflon tape, etc.
- Use purge valve to flush zoned systems, each zone separately. If purge valves and isolation valves are not installed, install them to properly clean the system.
- When purging installations that include standing iron radiators and systems with manual vents at high points, start with nearest manual air vent. Open the vent until water flows out, then close vent. Repeat this procedure, working toward furthest air vent.
- Install a basket strainer if large amounts of sediment is present. Keep basket clear of sediment build up.
- Install a magnetic dirt separator in the hydronic system where there are cast iron or steel components, or where the previous boiler was a cast iron heat exchanger. The abrasive, extremely fine sediment is difficult to remove and can deposit onto heat exchange surfaces and accumulate in pump cavities causing reduced efficiency and premature wear.
- Flush system until water runs clean and piping is free of sediment.
- Manufacturer recommends a water treatment product be used for sediment removal.

5.2 Special Conditions

- System piping exposed to freezing conditions: Use inhibited propylene glycol solutions certified by fluid manufacturer for use with closed water heating system. Do not use automotive or ethylene glycol.
- Boiler installed above radiation level (or as required by authority having jurisdiction). Integral low water pressure switch is provided in boiler.
- Boiler used in connection with refrigeration system. Install piping in parallel with boiler, with appropriate valves to prevent chilled medium from entering boiler.
- System piping connected to heating coils located in air handling unit exposed to refrigerated air circulation. Install flow control valves or other automatic means to prevent gravity circulation of boiler water during cooling cycle.
5.3 Safety Relief Valve and Air Vent

- Install safety relief valve using pipe fitting provided with boiler. See figure 5-1.
- Install safety relief valve with spindle in vertical position.
- Do not install shutoff valve between boiler and safety relief valve.
- Install discharge piping from safety relief valve.
- Use ¾" or larger pipe.
- Use pipe suitable for temperatures of 375°F (191°C) or greater.
- Individual boiler discharge piping shall be independent of other discharge piping.
- Size and arrange discharge piping to avoid reducing safety relief valve relieving capacity below minimum relief valve capacity stated on rating plate.
- Run pipe as short and straight as possible to location protecting user from scalding and properly drain piping.
- Install union, if used, close to safety relief valve outlet.
- Install elbow(s), if used, close to safety relief valve outlet and downstream of union (if used).
- Terminate pipe with plain end (not threaded).
5.5 Trim Piping

- **Temperature - Pressure Gauge.** Install temperature pressure gauge using piping provided with boiler. See figure 5-1. If using optional floor mount pedestal install as close to boiler supply fitting as practical and visible.
- Boiler has integral drain valve located inside jacket directly underneath pump. Install provided external drain valve.

5.6 System Piping

- See Table 4 for basic system piping configurations.
- Systems with automatic fill valves require back flow prevention device.
- Single boiler system. See figures 5-4, 5-5, for general guidance. Additional considerations:
  - Boiler control is designed for single central heating pump. Installer responsible for integration of multiple central heating pumps.
  - Boiler control allows domestic hot water prioritization. Function could be lost if central heating pump not directly connected to control system.
- Multiple boiler system. See figures 5-6, 5-7, and 5-8 for general guidance. Additional considerations:
  - Control system requires equivalent water temperatures entering each boiler to properly sequence and adjust system supply temperature.

**WARNING**

Burn and scald hazard. Verify all plastic caps are removed from boiler connections. Failure to follow these instructions could result in death or serious injury.

- Thoroughly flush all hydronic piping.
- Secure all valves/fittings to boiler.
- Ensure washers supplied are utilized.
- Fit union connections to supply and return on boiler.
  - A. If soldering to boiler, ensure unions are not connected to supply and return piping, otherwise internal seals may be damaged.
  - B. Verify appropriately sized isolating valve with filter is fitted to heating return connection.
  - C. Fit pressure relief valve connection vertically before heating isolating valve.
- Connect supplied condensate trap to a drain. Verify there is continuous slope towards the drain, avoid level horizontal sections of tubing.

5.7 Heating System And Refrigeration

Boiler when used in connection with refrigeration system, must be installed so chilled medium is piped in parallel with the boiler with appropriate valves to prevent chilled medium from entering the boiler.

Boiler piping system of hot water boiler connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

5.8 Labor Savor Manifold Installation (supplied) See Figure 5-1

1. Boiler is supplied with union connection installed on boiler piping for connection to manifold.
2. Configure manifold to suit the application.

**Note** Identify BOILER supply and return when installing manifold.

3. Apply sealant and tighten manifold in place. Check for leaks.
Illustrations are meant to show system piping concept only. Installer responsible for all equipment and detailing required by authority having jurisdiction.

**Table 4 - System Piping Configurations**

<table>
<thead>
<tr>
<th>Single Boiler/ Multiple Boilers</th>
<th>Primary/Secondary Pumping</th>
<th>Zone Valves</th>
<th>Figure 5-4 / 5-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone Pumps</td>
<td></td>
<td>Figure 5-5 / 5-7</td>
<td></td>
</tr>
</tbody>
</table>

**WARNING**

Burn, Scald Hazard! Water temperature over 125°F (51°C) can cause severe burns and scalding. See User's Manual before setting water temperature. Failure to follow these instructions could result in death or serious injury.
**Note**

- Manufacturer requires all domestic hot water (DHW) installations use an anti-scald valve. Local codes may require additional equipment (expansion tank, relief valves, etc.) Select and size equipment to suit installation and meet code requirements.

- 12" (305mm) Maximum Separation

- Refer to pump manufacturer literature for proper pump sizing.
* Manufacturer requires all domestic hot water (DHW) installations use an anti-scald valve. Local codes may require additional equipment (expansion tank, relief valves, etc.) Select and size equipment to suit installation and meet code requirements.

Note

* Hot Water Supply Tempered

Refer to pump manufacturer literature for proper pump sizing.

Note

12” (305mm) Maximum Separation

Use external pump relay or Argo Zone Control to interface system pump to boiler.
5 - HYDROFIC PIPING

FIGURE 5-6 - Multiple Boilers Without Manifold, with Common Primary Secondary, Zone Valves and (Optional) Indirect

<table>
<thead>
<tr>
<th># Boilers on Pipe Branch</th>
<th>Pipe Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>2½</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: Manufacturer requires all domestic hot water (DHW) installations use an anti-scald valve. Local codes may require additional equipment (expansion tank, relief valves, etc.) Select and size equipment to suit installation and meet code requirements.

Note: 12" (305mm) Maximum Separation

Note: Use external pump relay or Argo Zone Control to interface system pump to boiler.

Note: Refer to pump manufacturer literature for proper pump sizing.

UP TO 6 BOILERS
5 - HYDRONIC PIPING

FIGURE 5-7 - Multiple Boilers Without Manifold, with Common Primary Secondary, Zone Pumps and (Optional) Indirect

<table>
<thead>
<tr>
<th># Boilers on Pipe Branch</th>
<th>Pipe Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>2½</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

* Manufacturer requires all domestic hot water (DHW) installations use an anti-scald valve. Local codes may require additional equipment (expansion tank, relief valves, etc.) Select and size equipment to suit installation and meet code requirements.

**Note**

12" (305mm) Maximum Separation

Use external pump relay or Argo Zone Control to interface system pump to boiler.

Refer to pump manufacturer literature for proper pump sizing.
6.1 General
- Installations shall comply with Authority having jurisdiction and in absence of such with:
  » U.S. ANSI Z223.1 /NFPA 54 in the United States
  » CSA B149.1 in Canada.
- This boiler requires a dedicated direct vent system or may be category IV Indoor air.
- Vent connections serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.
- Materials used in the U.S. shall comply with Authority having jurisdiction and in absence of such with: ANSI/ASTM D1785, ANSI/ASTM F441, ANSI/ASTF493, UL1738 or ULS636.
- Canadian installations only: All venting material, primer and glue must be listed to ULC S636.
- Canadian installations only: First 3 ft. (0.9m) of plastic vent pipe from vent connector must be readily accessible for visual inspection.
- Support piping in accordance with pipe manufacturer's instruction and authority having jurisdiction. In absence of manufacturer's instruction use pipe hooks, pipe straps, brackets, or hangers of adequate and strength located at intervals of 3 ft (1.0 m) or less. Allow for expansion/contraction of pipe.
- Venting system must be free to expand and contract.

6.2 Removal of Existing Boiler From Common Vent System
When existing boiler is removed from common venting system, common venting system is likely to be too large for proper venting of appliances remaining connected to it. After removal of existing boiler, following steps shall be followed with each appliance remaining connected to common venting system placed in operation, while other appliances remaining connected to common venting system are not in operation:
- Seal any unused openings in common venting system.
- Visually inspect venting system for proper size and horizontal pitch. Determine there is no blockage or restrictions, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- When practical, close all building doors, windows, and all doors between space in which appliances remaining connected to common venting system are located and other spaces of building. Turn on clothes dryer and any appliance not connected to common venting system.
- Turn on exhaust fans, such as range hoods and bathroom exhaust so they will operate at maximum speed. Do not operate summer exhaust fan. Close fireplace dampers.
• Turn on appliance being inspected. Follow lighting instructions. Adjust thermostat so appliances will operate continuously.

• Test for spillage at draft hood relief opening after 5 minutes of main burner operation. Use flame of match or candle, smoke from cigarette, cigar or pipe.

• Determine each appliance remaining connected to common venting system properly vents when tested as outlined above. Then return doors, windows, exhaust fans and any other gas-burning appliance to their previous condition of use.

• Any improper operation of common venting system should be corrected so installation conforms with National Fuel Code, ANSI Z223.1/NFPA 54 and/or Natural Gas and Propane Installation Code, CAN/CSA B149.1. When re-sizing any portion of common venting system, common venting system should be re-sized to approach minimum size as determined using appropriate tables in Chapter 13 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or Natural Gas and Propane Installation Code, CAN/CSA B149.1.

6.3 Definitions

1. **Coaxial piping** – Figure 6-1 exhaust and air intake pipe have a common axis.

2. **Twin Pipe** – Figure 6-2 Exhaust and intake air are separate pipes, can be terminated using single wall terminals from the vent manufacturer or field built configuration using elbows or tees.
6.4 Approved Venting Materials
Installation shall conform to requirements of authority having jurisdiction or in absence of such requirements:


A. Vent Material Options:
1. 80 mm/125 mm Polypropylene concentric (5 inch / 3 inch)
   or
   Follow venting manufacturer’s equivalent lengths for specialty fittings.

80 mm polypropylene twin pipe (MUST be polypropylene on BOTH intake and exhaust) ("3 inch")- conversion kit required.
   or

3" Twin pipe CPVC (PVC optional on intake ONLY).

B. Approved Polypropylene Manufacturers:
Must comply with UL 1738 or ULC S636. The following manufacturers have been evaluated:

- Natalini
- DuraVent®
- Centrotherm
- Z-Flex®

Note: Maximum equivalent length may vary between manufacturers.

C. Vent Termination
- Do not include termination for equivalent length calculations.
- Terminate combustion air and vent pipes with fittings or concentric vent kit.
  Use horizontal pipe for vent and 90° elbow for combustion air termination when using fittings.
- Separate vent terminal from air inlet terminal to prevent flue gas recirculation. If T-Terminal is used on flue pipe at sidewall, air inlet terminal shall be at least 36” or more away from vent terminal.
- Locate combustion air termination as far as possible from swimming pool, swimming pool pump house, and other sources of airborne chlorine.
- Locate combustion air intake and vent terminals as required by authority having jurisdiction.
- Use black ultra violet stabilized polypropylene when exposed to sunlight, wind, or prone to freeze ups.

D. Concentric Vent Screw Placement
Fasten two (2) screws through the outer intake pipe behind the gaskets at equal distances approximately 180° apart.
Use zinc coated sheet metal screws in accordance with vent pipe manufacturer's instructions.

1. Before securing the screws, verify pipe is inserted in accordance with pipe manufacturer's instructions.
2. When connecting vent pipes, follow vent pipe manufacturer's instructions regarding lubrication.
6.5 Coaxial

A. Venting Instructions

<table>
<thead>
<tr>
<th>Elbow</th>
<th>Total Length Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>45°</td>
<td>1' 8&quot; (0.5 m)</td>
</tr>
<tr>
<td>90°</td>
<td>3' 4&quot; (1.0 m)</td>
</tr>
</tbody>
</table>

Illustration shows examples of maximum equivalent lengths.

B. Coaxial Flue Options

- Standard horizontal termination is suitable only for horizontal applications.
- Maximum permissible equivalent vent length is 21 ft. (6.4 m)
- An "in line" elbows in flue system must be taken into consideration
- The first elbow in horizontal run is NOT included in any equivalent length calculations

<table>
<thead>
<tr>
<th>Elbow</th>
<th>Total Length Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>45°</td>
<td>1' 8&quot; (0.5 m)</td>
</tr>
<tr>
<td>90°</td>
<td>3' 4&quot; (1.0 m)</td>
</tr>
</tbody>
</table>
6.6 Twin Pipe Polypropylene and CPVC Systems
Twin pipe venting allows exhaust flue and intake flue to be separated from each other. Fresh air is drawn in at a different area from the flue terminal location.

A. Twin Pipe CPVC System
CPVC is approved for boiler exhaust. CPVC or PVC are both approved for air intake.
To transition from Coaxial at the top of the boiler to Twin Pipe CPVC/PVC a kit is available.

B. Twin Pipe Polypropylene System
Single wall polypropylene is used for both exhaust and air intake piping.
To transition from Coaxial at the top of the boiler to Twin Pipe polypropylene venting an adapter kit is available.

C. Twin Pipe Separated Flue
Exhaust and combustion air intake are not located in same general location.

D. Twin Pipe - Common Atmospheric Zone Termination

Twin Pipe Maximum Vent Lengths (See Figure 6-4)

<table>
<thead>
<tr>
<th></th>
<th>L1</th>
<th>49 ft (15m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake Vent</td>
<td>L1</td>
<td>49 ft (15m)</td>
</tr>
<tr>
<td>Exhaust Vent</td>
<td>L2</td>
<td>51 ft (15.5m)</td>
</tr>
<tr>
<td>Combined Vent</td>
<td>L1+L2</td>
<td>100 ft (30.5m)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elbow</th>
<th>Total Length Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>45°</td>
<td>10&quot; (0.3 m)</td>
</tr>
<tr>
<td>90°</td>
<td>2 ft (0.6 m)</td>
</tr>
</tbody>
</table>

Note: Do not count first elbow against maximum vent length.

Note: If using indoor air for combustion do not exceed 100ft (30m) exhaust vent pipe.
C. Mechanical Fastener Instructions - See Figure 6-5
Manufacturer recommends use of a mechanical fastener at every push-fit gasket connection when using a polypropylene vent. Follow vent manufacturer instructions or, if unavailable, below when installing mechanical fastener:

- Take dual flue mechanical fastener with larger hole in it and place it onto male end of pipe.
- Slide clamp all the way down the pipe with smaller opening of clamp towards female end of the pipe.
- Bend clamp over the female end of pipe "A" and slide male end of pipe "B" through clamp and into female end of pipe "A".

Mechanical fastener is necessary for dual fuel pipe.

**Note**
Dual flue spring clamp is for indoor use only and should not be used in outdoor applications.
### 6.7 Venting Configurations

Various venting configurations can be applied to this boiler. For guidance see Venting Configuration Table 5A and corresponding figures.

**Table 5A - Combustion Air - Venting Locations**

<table>
<thead>
<tr>
<th>Flue Gas Location</th>
<th>Combustion Air Location</th>
<th>Flue Gas Terminals</th>
<th>Corresponding Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>Roof</td>
<td>Two Pipe</td>
<td>Figure 6-6</td>
</tr>
<tr>
<td></td>
<td>Side Wall</td>
<td>Single Pipe</td>
<td>Figure 6-12, 6-11</td>
</tr>
<tr>
<td></td>
<td>Inside Air</td>
<td>Single Pipe</td>
<td>Figure 6-14</td>
</tr>
<tr>
<td>Sidewall</td>
<td>Roof</td>
<td>Single Pipe</td>
<td>Figure 6-13</td>
</tr>
<tr>
<td></td>
<td>Side Wall</td>
<td>Two Pipe</td>
<td>Figures 6-9, 6-10, 6-11</td>
</tr>
<tr>
<td></td>
<td>Inside Air</td>
<td>Single Pipe</td>
<td>Figure 6-15</td>
</tr>
</tbody>
</table>

**Table 5B - Combustion Air - Venting Terminal Type**

<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
<th>Terminal Type</th>
<th>Corresponding Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venting (Flue Gas)</td>
<td>Side Wall</td>
<td>S-Terminal with 90° elbow</td>
<td>Figure 6-9, 6-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T-Terminal</td>
<td>Figure 6-11, 6-13, 6-15</td>
</tr>
<tr>
<td></td>
<td>Roof</td>
<td>Straight Terminal</td>
<td>Figure 6-6, 6-10</td>
</tr>
<tr>
<td>Combustion Air (Fresh Air)</td>
<td>Side Wall</td>
<td>Raised 90° down elbow</td>
<td>Figure 6-9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>90° down elbow</td>
<td>Figure 6-10, 6-12</td>
</tr>
<tr>
<td></td>
<td>Roof</td>
<td>Raised 90° down elbow</td>
<td>Figure 6-8</td>
</tr>
</tbody>
</table>

**Note:** Use of vent covers may cause freezing. If using vent covers overall vent length must be considered. Failure to heed this information may compromise operation of this boiler.
### Side Wall Terminations
- 3" (76mm) Min. 24" (610mm) Max. vertical separation between combustion air intake and vent terminations.
- 12" (305mm) Min. 24" (610mm) Max. horizontal separation between vent of one termination and intake of next appliance. Manufacturer recommends greater separation.
- Max. allowable total outside exposure vent length equals 10 ft. (3.05m).
- Maintain a pitch of 1/2" per ft. (42mm/m) outside exposure back to boiler to ensure proper condensate drainage for horizontal runs.

### Roof Terminations
- 12" (205mm) Min. horizontal separation between combustion air intake and vent of same appliance.
- 12" (205mm) Min. 84" (2134mm) Max. vertical separation between combustion air intake and vent of different appliances.
- 15" (381mm) Max. horizontal length of vent.
- Min. vent/intake between different appliances 12" (305mm).
- Abandoned unused masonry chimney may be used as chaseway for combustion air and vent. Both combustion air and vent pipe must exit above top of chimney with clearances as shown in figure 6-6.

### Roof Line
- 12" (305mm) US, 18" (458mm) Canada Minimum Above Anticipated Snow Line

### Figure 6-6 Two Pipe Roof Vent
- 12" (305mm) Min. 84" (2134mm) Max.
- 12" (305mm) Min. or greater separation in manufacturer recommended
- 15" (381mm) Max.

### Figure 6-7 Two Pipe Side Wall Vent
- 3" (76mm) Min. 24" (610mm) Max. Separation horizontal separation between combustion air intake and vent terminations.
- 12" (305mm) Min. vertical separation between combustion air intake and vent terminations.
- 12" (305mm) Min. 24" (610mm) Max. horizontal separation between bottom of combustion air intake and bottom of vent.
- 12" (305mm) US, 18" (458mm) Canada Minimum Above Anticipated Snow Line

### Figure 6-8 Two Pipe Side Wall Vent (Multiple Appliances)
- 12" (305mm) Min. or greater separation in manufacturer recommended
- 12" (305mm) Min. 24" (610mm) Max. horizontal separation between combustion air intake and bottom of vent.

### Grade, Snow & Ice
- Maintain 12"(305mm) US (18"(457mm) Canada) clearance above highest anticipated snow level 24" (610mm) above roof or ground.
- Avoid locations where snow may drift and block vent and combustion air. Ice or snow may cause boiler to shut down if vent or combustion air becomes obstructed.

### Doors & Windows
- Combustion air and vent termination must be 12" (305mm) from or below doors, windows or gravity inlet.
**FIGURE 6-9 Side Wall Venting Terminal w/T-Terminal**

12" (305mm) Min. Separation of Combustion Air and Vent shall be maintained. No Maximum separation is required when using T-Terminal for vent.

See Snow & Ice page 32

**Note**
Configurations of single pipe vent with flue on the sidewall, requires a tee as the vent terminal. See figures 6-17, 6-19 and 6-21

**Note**
If separation in Fig. 6-15 is not large enough to prevent cross flow contamination between flue gas and fresh air use T-Terminal as shown in Fig. 6-17. Use of T-Terminal for vent as shown in Fig. 6-17 does not have a max. separation requirement between flue gas and fresh air.

---

**Fig. 6-10 Flue on Roof, Air Intake on Side Wall**

Maintain 12"(305mm) US (18"(457mm) Canada) clearance above highest anticipated snow level 24" (610mm) above roof or ground

**Fig. 6-11 Flue on Sidewall, Combustion Air on Roof**

Maintain 12"(305mm) US (18"(457mm) Canada) clearance above highest anticipated snow level 24" (610mm) above roof or ground

18" Vertical Clearance to ventilated soffit
FIGURE 6-12 Flue on Roof, Indoor Combustion Air

Maintain 12" (305mm) US (18"(457mm) Canada) minimum clearance above highest anticipated snow level maximum 24" (610mm) above roof

24" (610mm) * Minimum Length

Combustion Air

FIGURE 6-13 Flue on Sidewall, Inside Combustion Air

18" Vertical Clearance to ventilated soffit

Maintain 12" (305mm) US (18" (457mm) Canada) clearance above highest anticipated snow line

NOTICE
Configurations of single pipe vent with flue on sidewall, requires tee as vent terminal. See figures 6-21 and 6-23.
6.8 Side Venting Terminal Requirements of:


<table>
<thead>
<tr>
<th>Venting terminal from doors and windows</th>
<th>See figure 6-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venting terminal from forced air inlet of other appliances</td>
<td>See figure 6-15</td>
</tr>
<tr>
<td>Venting terminal from snow level</td>
<td>See figure 6-16</td>
</tr>
<tr>
<td>Venting terminal from vegetation</td>
<td>See figure 6-17</td>
</tr>
<tr>
<td>Venting terminal from public walkway</td>
<td>See figure 6-18</td>
</tr>
</tbody>
</table>

**FIGURE 6-14**

Termination must be min. 12" (305mm) from or below doors, windows or gravity inlet. If boiler uses inside air min. 4' (1219 mm).

**Doors & Windows**

Combustion air and vent termination must be min. 12" (305mm) from or below doors, windows or gravity inlet. If boiler uses inside air min. 4' (1219 mm).

**Condensate**

Vent gas may condense, forming moisture, may be corrosive. Protect building materials at vent from exhaust of vent gas.

**FIGURE 6-15**

Termination 3' (0.9m) [If located within 10' (3m) of forced air inlet]

**Forced Air Inlet**

Terminate venting system minimum 3’ (914mm) above and 10’ (3.0m) from any forced air inlet (except boiler’s combustion air inlet).

**FIGURE 6-16**

3' (914mm) Minimum

**Grade, Snow & Ice**

Maintain 12"(305mm) US, 18"(457mm) Canada clearance above highest anticipated snow level, 24" (610mm) above roof.

Avoid locations where snow may drift and block vent and combustion air. Ice or snow may cause boiler to shut down if vent or combustion air becomes obstructed.

**"L" Corner**

Vent termination shall NOT be installed closer than 3' (914mm) from inside corner of “L” shaped structure.
Multiple Family Dwellings

Vent shall not terminate directly above paved sidewalk or paved driveway located between two single-family dwellings serving both dwellings.

Vegetation, Plants & Shrubs

Keep vent termination 3’ minimum (914mm) away from vegetation. Position termination where vent vapors will not damage plants/shrubs or air conditioning equipment.

Meters, Regulators, deck, porch

Vent termination US only - 4’ (1.2m), Canada - 6’ (1.9m) horizontally from, no case above or below, electric meters, gas meters, regulators, and relief equipment, or under deck or porch.

Walkways

Locate vent termination minimum 7’ (2.1m) above any public walkway, with consideration to condensate.

People or Pets

Locate combustion air and vent termination to prevent accidental contact with people or pets.

Stones, Balls, Etc.

Position combustion air and vent termination where it will NOT be damaged by foreign objects, such as stones, balls, etc.

Vapors

Position termination where vent vapors are not objectionable.

Eddy, Flue Gases

Position termination so it will not be effected by wind eddy, air born leaves, snow, or recirculated vent gases. Give consideration to excessive wind and locate away from windward side of building.
**Vent Termination Minimum Clearances**

<table>
<thead>
<tr>
<th></th>
<th>USA</th>
<th>CANADA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Clearance above grade, veranda, porch, deck, or balcony</td>
<td>12&quot; (305mm)</td>
</tr>
<tr>
<td>B</td>
<td>Clearance to window or door that may be opened</td>
<td>12&quot; (305mm)</td>
</tr>
<tr>
<td>C</td>
<td>Clearance to permanently closed window</td>
<td><em>12&quot; (305mm)</em></td>
</tr>
<tr>
<td>D</td>
<td>Vertical Clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (610 mm) from the center line of the terminal</td>
<td>18&quot; (457mm)</td>
</tr>
<tr>
<td>E</td>
<td>Clearance to unventilated soffit</td>
<td>18&quot; (457mm)</td>
</tr>
<tr>
<td>F</td>
<td>Clearance to outside corner</td>
<td>9&quot; (229mm)</td>
</tr>
<tr>
<td>G</td>
<td>Clearance to inside corner</td>
<td>6&quot; (152mm)</td>
</tr>
<tr>
<td>H</td>
<td>Clearance to each side of center line extended above meter/ regulator assembly</td>
<td>3 ft. (0.9m) within a height of 15 ft. (4.5m) above the meter/ regulator assembly</td>
</tr>
<tr>
<td>I</td>
<td>Clearance to service regulator vent outlet</td>
<td>3 ft. (0.9m)</td>
</tr>
<tr>
<td>J</td>
<td>Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance</td>
<td>12&quot; (305mm)</td>
</tr>
<tr>
<td>K</td>
<td>Clearance to mechanical air supply inlet</td>
<td><em>3 ft. (0.9m)</em></td>
</tr>
<tr>
<td>L</td>
<td>Clearance above paved sidewalk or paved driveway located on public property</td>
<td><em>7 ft. (2.1m)</em></td>
</tr>
<tr>
<td>M</td>
<td>Clearance under veranda, porch, deck or balcony</td>
<td><em>12&quot; (305mm)</em></td>
</tr>
</tbody>
</table>

* For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, clearance will be in accordance with local installation codes and requirements of gas supplier and these installation instructions.

(†) Vent shall not terminate directly above sidewalk or paved driveway located between two single family dwellings and serves both dwellings.

(‡) Permitted only if veranda, porch, deck or balcony is fully open on a minimum of one side beneath the floor.

**Note**

Local Codes or Regulations may require different clearances. Flue termination must be exposed to external air and position must allow free passage of air across it at all times. In certain weather conditions termination may emit a plume of steam. Avoid positioning termination where this may cause nuisance.
6.9 Multiple Boiler Venting - General

- For common exhaust system DuraVent® is the only approved vent manufacturer - DuraVent®. Use of check valve is mandatory. See Figure 6-20.

- See Figures 6-26, 6-27 and 6-28. Termination must be vertical through the roof. Sidewall horizontal terminal not allowed.

- Ensure minimum downward slope of 2 in (50.00 mm) for every 3 ft 4 in (1.00 m) of duct length toward boiler.

- Manufacturer recommends use of CO monitor, calibrate regularly per CO monitor manufacturer instructions.

- Place pipes at least 1 in (30 mm) from heat sources.

- Keep area clean and free of debris.

- Use only water (H₂O) as lubricant when inserting pipes together. Do NOT use any type of grease or similar substances.

- Do NOT use screws to secure pipes together.

- Before securing pipe with clamps, verify pipe is inserted per the vent manufacturer's recommendations.

- Install steel strapping (A) of pipe (B) distance of 10 in (250.0 mm) from boiler.

- Secure flue pipe to wall with supports 3 ft. (0.92 meters) from each other. Secure supports along the joint of each pipe.

6.10 Multiple Boiler Venting - Mounting Procedure - See Figures 6-20 thru 6-22

1. Vent pipes correctly mounted. See Figure 6-20.

2. Line horizontal common vent pipes with male end towards condensate collector end cap.

3. Follow vent manufacturer's instructions when assembling vent pipe to allow for expansion and contraction of vent pipe during use.

4. Hang horizontal common vent pipe, do not fully tighten clamps down.
5. Connect end cap and condensate trap to horizontal common vent pipe. See Figure 6-22.
6. Connect 90° elbows to horizontal common vent pipe for each boiler in cascade system.
7. Connect flue damper to 90° elbow for each boiler in cascade system.
8. Connect boiler flue adapter to flue damper for each boiler in cascade system. Ensure flue adapters allow for 3° or 2 in. per 3 ft. slope of horizontal collectors back towards condensate collector.
9. Connect intake air screen to flue adapter for each boiler in cascade system. Combustion air shall come from indoors only.
10. Connect cascade vent system to flue connection on top of boilers.
11. Secure flue adapters using approved clamps to wall. Ensure clamps are connected minimum of 10 in. from top of boiler. See Figure 6-23.
12. Secure approved clamp around flue adapter. Ensure clamp is locked in to proper position. See Figure 6-23.
   A. Position 1 - Clamping around bell end of adapter.
   B. Position 2 - Clamping around flue pipe adapter.
13. Maximum distance between supports for horizontal pipes 3 ft 4 in. Maximum distance between supports for vertical pipes 6 ft 7 in. See Figure 6-24.
14. Fully tighten horizontal common vent pipe supports.
6.11 Multiple Boiler Venting - Venting Layout

Available pressure at flue outlet is 0.40" w.c. (100pa)

<table>
<thead>
<tr>
<th>Heat Input (BTUH)</th>
<th>Heat Capacity (BTUH)</th>
<th>Number of Appliances</th>
<th>Maximum Vertical Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>6 in (150 mm)</td>
</tr>
<tr>
<td>241,000</td>
<td>216,000</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>482,000</td>
<td>432,000</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>964,000</td>
<td>864,000</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>1,446,000</td>
<td>1,296,000</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

*6 in. / 8 in. Vent System:

- Horizontal vent pipe size 6 in. (150 mm)
- Vertical vent pipe size 8 in. (200.00 mm).
- Length between vertical vent pipe and last horizontal vent collector pipe = 3 ft 4 in (1.00 m).
- For calculating other lengths between last collector and shaft, length of vertical height must be reduced by this additional length and by the numbers of bends according to the table.

<table>
<thead>
<tr>
<th>Elbow Type</th>
<th>6 in.</th>
<th>8 in.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Equivalent Length</td>
<td>Equivalent Length</td>
</tr>
<tr>
<td></td>
<td>5 ft 7 in</td>
<td>1.7m</td>
</tr>
<tr>
<td>45°</td>
<td>13 ft 1 in</td>
<td>4.0m</td>
</tr>
<tr>
<td>90°</td>
<td>13 ft 1 in</td>
<td>4.0m</td>
</tr>
</tbody>
</table>

6 in. Cascade Vent System Example

<table>
<thead>
<tr>
<th>Elbow Equivalent Length</th>
<th>45°</th>
<th>90°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Elbows</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Equivalent Length</td>
<td>-</td>
<td>13 ft 1 in (4.0m)</td>
</tr>
<tr>
<td>Total Equivalent Length</td>
<td>39 ft 4-21/64 in (12.0m)</td>
<td></td>
</tr>
</tbody>
</table>

Total Equivalent Length: 39 ft 4 - 21/64 in (12.0m)
Horizontal Length: 5 ft (1.5m)
Total Equivalent Horizontal Length: 44 ft. (13.4m)
Maximum Vertical Length: 98 ft. (29.9m)
Total Vertical Length: 54 ft. (16.5m)
A. Single Line System
System consisting of boilers arranged in line each connected to common exhaust manifold.

B. Back to Back System
This system consists of boilers installed back to back connected to a common exhaust manifold.
C. Double Line System
This system consists of boilers installed on two lines, connected to a common exhaust manifold.

**FIGURE 6-28**

Flue header size shall be calculated by qualified service agency during system design as required by local authority having jurisdiction.

### 6.12 Multiple Boiler Venting - Parameter Settings

To set parameter **P19** see section 9.

<table>
<thead>
<tr>
<th>PARAMETER P19</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revs/min (rpm) at minimum Power</strong></td>
<td></td>
</tr>
<tr>
<td>Natural Gas</td>
<td>LPG</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>
6.13 Condensate Piping

- Use materials acceptable to authority having jurisdiction. In absence of such authority:
  - USA - PVC or CPVC per ASTM D1785/D2845 Cement or primer per ASME D2564 or F493.
  - Canada - CSA or ULC certified PVC/CPVC pipe, fittings and cement.
- Connect condensate hose, hose clamps, and coupling to boiler drain trap as shown in figure 6-29.
- Connect condensate piping to 3/4" NPT coupling as shown.
- Slope condensate drain pipe minimum 1/4" per foot (21mm/m) away from boiler.
- Use field source condensate pump if boiler located below disposal point.
- Field source condensate neutralizing kit as required by authority having jurisdiction or for environmentally friendly condensate disposal.
7.1 General

- Use piping materials and joining methods acceptable to authority having jurisdiction. In absence of such requirements:
  - USA - National Fuel Gas Code, ANSI Z223.1/NFPA 54

- Size and install gas piping system to provide sufficient gas supply to meet maximum input at not less than minimum supply pressure. DMG-240 requires a gas rate of 242.59 ft³/h (6.87 m³/h) for Natural Gas (Gas A) and 95.04 ft³/h (2.69 m³/h) for Liquid Propane Gas (Gas E).

- Gas meter and supply pipes must be capable of delivering the listed quantity of gas in addition to demand from any other appliances in the house. DMG-240 requires a 3/4” (19.5 mm) gas supply pipe.

- Support piping with hooks straps, bands, brackets, dampen excessive vibrations and prevent strain on gas connection. Boiler will not support piping weight.

- Use thread (joint) compound (pipe dope) suitable for liquefied petroleum gas.

- Install external field sourced manual main gas shutoff valve, ground joint union, and sediment trap upstream of gas valve. See figures 7-2 and 7-3.

- Leak test boiler and gas line connections before placing boiler into operation.

7.2 LP Conversion

- See conversion instructions included with LP Conversion Kit. Purchased Separately.

---

**TABLE 7-2 Gas Supply Pressure**

<table>
<thead>
<tr>
<th>Gas Supply</th>
<th>Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>LP</td>
</tr>
<tr>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>3.0” w.c.</td>
<td>10.5” w.c.</td>
</tr>
<tr>
<td>(0.87 kPa)</td>
<td>(2.61 kPa)</td>
</tr>
</tbody>
</table>

---

**CAUTION**

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor’s phone. Follow gas supplier’s instructions.
- If you cannot reach your gas supplier, call the fire department.
7.3 Leak Check Gas Piping
Pressure test boiler and gas connection before placing boiler in operation.

- Pressure test over 1/2 psig (3.5 kPa). Disconnect boiler and its individual gas shutoff valve from gas supply system.
- Pressure test at 1/2 psig (3.5 kPa) or less. Isolate boiler from gas supply system by closing manual gas shutoff valve. See figure 7-3.
- Locate leakage using gas detector, noncorrosive detection fluid, or other leak detection method acceptable to authority having jurisdiction. Do not use matches, candles, open flames, or other methods that can provide ignition source.
- Correct leaks immediately and retest.
8.1 General
Electrically bond boiler to ground in accordance with requirements of authority having jurisdiction. Refer to:
- USA- National Electrical Code, ANSI/NFPA 70.

8.2 Electric Knockouts (Figure 8-1)
- Eight knockouts located on bottom of chassis.
  A. Thermostat (Section 8-10)
  B. Outdoor Reset (Section 8-9)
  C. Frost Protections (Section 8-12)
  D. DHW Sensor (Sections 8-11, 8-13)
  E. Release Input (Section 8-7)
  F. Shutdown Input (Section 8-15)
  G. Analog Input (Section 8-8, IF-01 board)
  H. Analog Output (Section 8-8, IF-01 board)
  I. Alarm (IF02 or SCU-SO2 board)
  J. External Heat System Pump (Section 8-8, SCU-S02 board)
  K. DHW Diverter/Pump (Section 8-8)
  L. External Gas Shutoff (Section 8-8)
  M. Minimum Gas Pressure Switch (Section 8-8)
  N. Solar Input (Section 8-8)

8.3 Electrical Connections
- Boiler requires 120V 60Hz power supply. Verify electrical supply is polarized.
- Boiler shall be grounded and on dedicated circuit.
- Shall be one common isolator, providing electrical isolation for boiler and any external controls. Using PVC insulated cable 18 AWGx3C 221°F / 105 °C.
- All wiring must be installed in accordance with requirements of the National Electrical Code and any additional national, state, or local code requirements having jurisdiction. All wiring must be N.E.C. Class 1.
- Canada, installation must conform to CSA C22.1 Canadian Electrical Code Part 1 and any local codes.
- If replacing original boiler wiring use only TEW 105ºC or equivalent.

**WARNING**
Electrical shock hazard. Turn OFF electrical power supply at service panel before making electrical connections. Failure to do so could result in death or serious injury.

**Note**
Wiring diagrams can be found in Section 14 of this Manual.

**FIGURE 8-1 Electric Knockouts Bottom Of Boiler**

- 8 Wire Knockouts
- Front of Boiler
- Back of Boiler
8.4 Access To Connection Block
1. Unscrew two screws located under front panel. Remove panel.
2. Guide controller or thermostat wire through round grommet(s) on right side of boiler's bottom plate right.
3. Tilt control box forward by opening holding clips located on each side of boiler.
4. Open control panel cabinet by unfastening clip on front of control box. Push lip back for latch.
5. Run wire(s) through grommet(s) in control panel cabinet.
6. Unscrew wire clamp (to access connection block) and bring wires through.
7. Connect wires to appropriate terminals on connection block.
8. Firmly tighten wire clamps and close control panel cabinet.

Various thermostats and controllers can be connected to standard control PCB (X12 connection block).

8.5 Main Supply Connection
Main supply is connected to terminal block X1 which is high voltage (120V / 60Hz).
8.6 Shutdown Input

- Boiler has a shutdown input, input is on BL terminals of control board.
- Only suitable for potential free contacts.
- When using this input remove jumper cable.
- Change input setting using P36. See parameter Settings page 56.

8.7 Release Input

- Boiler has release input, input is on RL terminals of connector.
- Change input setting using P37. See parameter Settings page 56.
- Only suitable for potential free contacts.

8.8 Optional Electrical Connections:

**Auxiliary Control Box**

Control PCBs are located in auxiliary control box. See instructions provided with control PCB.
- Unclip PCB cover
- Remove cover

**Connection Options for 0-10V Control PCB (IF-01)**

**IF-01** control PCB is built into auxiliary control box. Refer to instructions supplied with product.

**Do not** connect freeze thermostat or room thermostat to boiler if using 0-10 V control PCB.

1. **Connection Status (Nc)** - If boiler locks out, a relay is de-energized and an alarm can be transmitted via a dry set of contacts (maximum 120 VAC-1A) on terminals Nc and C of the control board connection.

2. **Connection Status (OTm)** - Interface communicates with boiler control using Open Therm protocol. OTm connection must be connected to Open Therm input OT of boiler control.

3. **Analogue Input (0-10V)** - Control can be based on temperature or heat output. Two controls are described below. Analog control, 0-10 V signal must be connected to the interface.
4. **Analog Temperature-Based Control - 0 - 10 V**

Signal controls boiler supply temperature between 32°F (0°C) and 176°F (80°C). Control modulates on basis of supply temperature, heat output varies between minimum and maximum values based on supply temperature set point calculated by the controller. Jumper 2 on the interface is used to select either temperature control (°F/°C) or heat output control (%).

<table>
<thead>
<tr>
<th>Jumper 2</th>
<th>Input Signal (V)</th>
<th>Temperature (°F/°C)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 - 1.5</td>
<td>32-59 (0-15)</td>
<td>Boiler off</td>
</tr>
<tr>
<td></td>
<td>1.5 - 1.8</td>
<td>59.0-64.4 (15.0-18.0)</td>
<td>Hysteresis</td>
</tr>
<tr>
<td></td>
<td>1.8 - 10.0</td>
<td>64.4-176.0 (18.0-80.0)</td>
<td>Temperature required</td>
</tr>
</tbody>
</table>

5. **Analog Heat Output - Based Control - 0-10V**

Signal controls boiler output between 0% and 100%. Minimum and maximum values are limited. Minimum output is linked to boiler's modulation depth. Output varies between minimum and maximum value on basis of value determined by controller.

<table>
<thead>
<tr>
<th>Jumper 2</th>
<th>Input Signal (V)</th>
<th>Temperature (°F/°C)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.0 - 2.0</td>
<td>32-68 (0-20)</td>
<td>Boiler off</td>
</tr>
<tr>
<td></td>
<td>2.0 - 2.2&lt;sup&gt;1&lt;/sup&gt;</td>
<td>68-72 (20-22)</td>
<td>Hysteresis</td>
</tr>
<tr>
<td></td>
<td>2.0 - 10.0&lt;sup&gt;1&lt;/sup&gt;</td>
<td>72-176 (20-80)</td>
<td>Temperature output required</td>
</tr>
</tbody>
</table>

<sup>1</sup> Dependent on minimum modulation depth (set speeds, standard 20%)

6. **Analog Output - 0-10V** - Temperature or heat output can be chosen for this feedback message. The two controls are described briefly below. Jumper 1 on the interface is used to select either temperature control (°F/°C) or heat output control (%).

<table>
<thead>
<tr>
<th>Jumper 1</th>
<th>Input Signal (V)</th>
<th>Temperature (°F/°C)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>32-59 (0-15)</td>
<td>Boiler off</td>
</tr>
<tr>
<td></td>
<td>0.5</td>
<td>59-72 (15-20)</td>
<td>Hysteresis</td>
</tr>
<tr>
<td></td>
<td>2.0 - 10.0&lt;sup&gt;1&lt;/sup&gt;</td>
<td>72-176 (20-80)</td>
<td>Temperature required</td>
</tr>
</tbody>
</table>

<sup>1</sup> Dependent on minimum modulation depth (set speeds, standard 20%)
Connection Option For PCB (SCUS02)
If boiler is fitted with control PCB (SCUS02) it will automatically be recognized by the automatic boiler control.

If removing this PCB boiler will show fault code E38. To prevent this fault, auto-detect must be done after removing the PCB. See Auto-Detect.

LED status indicator D3 top right of control PCB indicates status:
• Continuous signal: PCB working normally.
• Flashing signal: No connection.
• No signal: No voltage or faulty PCB (Check wiring).

1. Heating System External Pump Control - External pump for heating system can be connected to Pump terminals of control board. Maximum input power is 300 VA/ 0.4 FHP. Auxiliary relay must be used for pump with larger input.

2. External Three-Way Valve (3WV) Control - External three-way valve (120 VAC) can be used when connecting DHW indirectly water heater. Neutral position of three-way valve can be set using parameter P34. Three-way valve is connected as follows:
   • N = neutral
   • C = heating system
   • D = indirect tank

If neutral position of three-way valve is adjusted with parameter P34 connect the pump as follows:
   • N = N pump.
   • C = L pump.
   • = Ground

3. External Gas Valve Control (EgV) - If there is a call for heat, alternating voltage of 120 VAC, 1 A (maximum) becomes available on EgV terminals of control board to control an external gas valve.

4. Operation Signal And Failure Signal (Status) - Alarm or operation signal is selected using parameter P40.
   • If boiler is operating, operation signal can be switched using dry set of contacts (maximum 120 VAC, 1 A) on NO and C terminals of the connection.
   • If boiler locks out, alarm can be transmitted using dry set of contacts (maximum 120 VAC, 1 A) on No and C terminals of connection.

5. Pressure Switch Minimum (GPS) - minimum gas pressure switch shuts boiler down if inlet gas pressure becomes too low. Connect minimum gas pressure switch to Gps terminals. Presence of gas pressure switch must be set using parameter P41.
Sensors supplied with this product are proprietary to the manufacturer. Use of aftermarket sensors will result in diminished performance.

### 8.9 1 K Ohm (1K Ω) Outdoor Temperature Sensor

- Outdoor Temperature
- Flow Temperature

- **P1** - Supply temperature (maximum)
- **P25** - Supply temperature (minimum)
- **P26** - "WWSD" (Warm Weather Shutdown)
- **P27** - Outdoor temperature (default)

If outdoor temperature sensor is connected, heating curve can be adjusted. Setting can be modified using parameters - **P1**, **P25**, **P26**, and **P27**.

- **1K Ω Outdoor Sensor, if used.**
  - A. Provided with boiler.
  - B. Locate 1 K Ω outdoor sensor to protect against wind and direct sunlight. Mounting instructions provided with sensor.
  - C. Maximum wire length is 100 ft (30m) for 22 ga. wire, or 150 ft (45m) for 18 ga. wire.
  - D. Connect wires to OUTDOOR SENSOR terminals. Wires are interchangeable.
  - E. Outdoor temperature sensors are a boiler accessory. Where there is an on/off thermostat, boiler will control the temperature with set point of the internal heating curve.

### 8.10 Central Heating Thermostat

- A. If a room thermostat with an anticipator is used, parameter P5 must be adjusted.
- B. Install thermostat in frequently occupied room.
- C. Connect 2 wire dry contact room thermostat to ON/OFF-OT terminals of boiler’s control board connection. **Note**: ON/OFF-OT terminals are NOT able to supply 24V to the thermostat.
- D. Use thermostat or boiler system control with dry contacts related 0.5 amps @ 120 VAC. Boiler control does **NOT** provide 24 VAC power to central heating thermostat.
- E. Locate and install thermostat per manufacturer’s instructions. Maximum wire length is 330 ft (100m) for 22 ga. wire.
- F. Connect wires to on/off - OT terminals. Wires are interchangeable.
- G. Boiler is not suitable for Nest type thermostat without the use of an isolation relay, such as Argo IR-882.

**Note**

Use dry contact for wires to On/Off OT terminal. E33 error code is displayed if voltage is sent back to the control board. If error is not corrected for extended period of time, this voltage can permanently damage control board.

If room thermostat with anticipator is used, parameter P5 must be adjusted.

---

**FIGURE 8-10 1k Ω Outdoor Temp Sensor**

**FIGURE 8-11 1k Ω Outdoor Temp Sensor Chart**
8.11 10 KΩ DHW Indirect Water Heater
Connect 10k Ω DHW indirect tank sensor or thermostat (TS) to "T dhw" terminals on control board.

8.12 Frost Protection
Frost protection in combination with ON/Off thermostat.

- If ON/Off thermostat is used, protect any rooms where there is a risk of freezing by using freeze thermostat (FT). Radiator valves or zone where there is risk of freezing must be open.

- Connect frost thermostat in parallel with On/Off room thermostat (RT) to ON/Off_OT terminals of control board connection.

Frost protection in combination with outdoor temperature sensor.

- Heating system can be protected against freezing in combination with 1 KΩ outdoor temperature sensor. Radiator valve or zone must be open where there is a risk of freezing.

- Connect 1 KΩ outdoor temperature sensor to "T out" terminals of control board.

- Frost protection activates when 1 KΩ outdoor temperature sensor reads a temperature lower than 10°F (-10°C). This can be adjusted using parameter P30. Circulation pump will switch on and operate continuously until the outdoor temperature increases past value set on parameter P30.
FIGURE 8-14 Example Of Hydronic Circuit With DHW Indirect Water Heater

- Connect 10 KΩ Indirect tank sensor to $T_{dhw}$ terminals as described in section 8.11.
- Connect CH (Central Heating) pump on terminal $N-L$ "Pump" of control PCB (SCU-02) see section 8.8.
- Connect DHW (Domestic Hot Water) pump on terminal $N-D$ "3wV" of control PCB (SCU-02) see section 8.8.

FIGURE 8-15 Example Of System Shutdown Input Connection

Example below shows connection of shutdown input for system connecting to auxiliary board. See section 8.6.
FIGURE 8-16 Wiring Diagram
9.1 Fill Condensate Trap with Water

**WARNING**

Asphyxiation hazard! Fill condensate trap before starting boiler to avoid combustion products escaping boiler. Failure to follow these instructions could result in death or serious injury.

- To fill the condensate trap pour water into exhaust vent until water begins to flow through the siphon.
- Visually inspect the siphon to ensure it is full with clean water.
- During operation check the condensate trap to ensure it draining properly.

![Condensate Drain Assembly](image)

Note: Condensate trap must be manually filled with water at initial start up.

9.2 Commission Setup (Water)

**Note**

To maintain boiler efficiency and prevent boiling inside the heat exchanger, flush entire heating system until clean.

- Check distribution system to ensure it is sized and installed correctly.
- Before filling, open all valves on the heating circuit in the installation.
- Flush heating system, including all heating zones.
- Fill boiler with potable water.
- Fill boiler and system piping with water (or antifreeze-water solution, if used). See antifreeze information page 11. Purge air from boiler using air vent. Purge air from system piping.
- Close air vent after all air is purged from both boiler and system piping.
- Inspect system piping and boiler connections. Repair any leaks immediately.
- Check water pressure gauge is between 14.7-22.1 psi (1-1.5 bar) when system water temperature is cold. If pressure is lower turn water off. Turn water on and restart the filling process very slowly to vent air. System must be turned not read pressure from display.
- Boiler is equipped with hydraulic pressure switch which prevents boiler from operating without water.
- Check there are no leaks from any water connections.
9.3 Commission Setup (Gas)

1. Check gas type supplied matches data shown on boiler’s rating plate.
2. Check gas piping to ensure it is sized and installed correctly.
3. Visually inspect piping to determine there are no open fittings or ends, and all valves at unused outlets are closed and plugged/capped.
4. Purge air from piping. Confirm there is a steady gas supply to the boiler.
5. Open main gas supply.
6. Open gas shutoff valve on boiler.
7. Unscrew two screws located under front panel, remove the panel.
8. Tilt control box forward by opening holding clips located on each side of the boiler.
9. Check gas supply pressure at pressure outlet "Pi" on gas valve unit.
10. Ensure all gas connections are tight.
11. Pressure test the gas line:
   A. Test pressure must not exceed 0.87 psig/60 mbar.
   B. Purge gas supply pipe within boiler by unscrewing pressure outlet on gas valve.
   C. Tighten the port when pipe has been sufficiently purged.
12. Check all gas connections in the boiler are tight.
13. Check piping and connections for leaks immediately after gas is turned on. Shut off gas supply and make necessary repairs if leaks are found.

9.4 Commission Setup (Electric)

1. Check electrical connections to thermostat and other external controls. Check any other connections to boiler.
2. Check all electrical connections, particularly the ground connection.
3. System test pumps - verify each pump is operational using vibration, noise and amp draw.

WARNING
Fire, explosion, and asphyxiation hazard! Boiler is set for natural gas from the factory. If propane is to be used the gas valve must be adjusted before turning boiler on. Failure to follow these instructions could result in death or serious injury.
9 - START UP PROCEDURE

9.5 Control Panel

Symbols

Information menu:
Reading the various current values

Chimney-sweeping position: Forced full or part load for CO2 measurement.

User menu: Parameters at user level can be changed.

Heating program deactivated: The heating function is deactivated.

Manual mode: Boiler is set to manual operation.

DHW program deactivated: DHW mode is deactivated.

Service menu: Parameters at installer level can be changed.


Fault: Boiler fault indicated. Can be seen from é code and red display.

Frost protection: Boiler running in frost protection mode.

Hour counter menu: Readout of operating hours, number of successful starts and hours on main supply.

ON/OFF switch: After 5 lock-outs, boiler must be switched OFF/ON again.

Boiler pump: Pump operates

Heating system function: Access to heating system temperature parameter.

DHW function: Access to potable hot water temperature parameter.

Yellow display with symbols: + service + A (Maintenance message).

Water pressure: Water pressure is too low.

Burner Level: Boiler is running at full or low load.

Locking keys: Key lock-out is activated.
9.6 Deaeration Function

Control performs the Deaeration function at initial start and after a reset of a locking error and after power up.

Before starting boiler deaeration function **must** be performed.

Rotate black cap on deaerator, located inside the boiler, counter clockwise $\bigcirc$ to ensure aerator is open. See Figure 9-3.

- When power is supplied to the boiler Deaeration function starts.
- Display shows 17 (Deaeration) and water pressure (Psi). See Figure 9-4.
- Boiler pump will run on and off for up to 10 minutes. This will purge air from the system.
- The burner will switch on for a few seconds to verify increasing temperature on flow/return sensors.
- Boiler is ready to start in standard operation.

Repeat Deaeration function at least 3 times switching boiler on off using $\bigcirc$ button.

Manually operated purge valve can also be performed by using purging valve on top of the heat exchanger.
9.7 Commissioning

- Tilt control box upwards. Fasten with clips located at the sides.
- Open main gas supply.
- Open gas shutoff valve on boiler.
- Plug boiler into an electrical socket.
- Turn boiler on using ON/OFF switch.
- Set controls (thermostats, control system) to generate a call for heat.

**Start-up cycle begins, this cannot be interrupted.**
During start-up cycle, display shows following information:
A short test where all segments of the display are visible.

- Fxx : Software version
- Pxx : Parameter version. Version numbers are displayed alternately.
- Air purge cycle is automatically carried out for 3 minutes.

9.8 Before Gas Conversion
When converting from natural gas (A) to propane gas (E), before calibrating gas valve, replace venturi assembly (B) as indicated in figure 9-6.
Disconnect gas pipe (threaded nut “C”) and remove three screws securing the flange.
Verify there are no gas leaks.

9.9 Gas Conversion (Propane)
Boiler is preset to operate on natural gas (A).
For operation with propane gas, carry out following:

1. Activate "Calibration function" to set boiler to operate on full load and on part load in Heating mode.
2. Adjust Fan Speed as indicated in table found in section "Parameter Settings" (if required).
4. Set air/gas ratio (O₂/CO₂ %): Full load and Part load as describe below.
5. Use combustion analyzer to properly set gas valve.
6. Allow time between adjustments for your combustion analyzer to sense adjusted CO₂ /O₂ level. This function is interrupted if the central heating supply temperature reaches its MAX. SETPOINT.

To measure combustion efficiency and emissions of products of combustion, boiler has two dedicated built in test ports.
One connection port is connected to exhaust flue (A), and allows monitoring of the quality of combustion products and combustion efficiency.
Other is connected to combustion air intake (B), used to check for recycling products for combustion.
The following can be measured at exhaust flue test port:
- temperature of combustion products
- oxygen (O₂) or carbon dioxide (CO₂) concentration;
- carbon monoxide (CO) concentration.
The temperature of combustion air must be measured on the intake test port (B) by inserting the measurement sensor approximately 3-3/16" (80.00 mm) (C) for the DMG-240.

### Natural Gas

<table>
<thead>
<tr>
<th>Venturi</th>
<th>Nozzle</th>
<th>Venturi</th>
<th>Nozzle</th>
</tr>
</thead>
<tbody>
<tr>
<td>in/mm</td>
<td>in/mm</td>
<td>in/mm</td>
<td>in/mm</td>
</tr>
<tr>
<td>1 7/16</td>
<td>30 7/32</td>
<td>5.3</td>
<td>1.18</td>
</tr>
<tr>
<td>30 7/32</td>
<td>30 5/32</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**FIGURE 9-6 Venturi and Nozzle**

**FIGURE 9-7 Combustion Air Temperature Ports**
9.10 Combustion Setup (High-Fire)

- Unscrew exhaust port plug at exhaust flue test port.
- Insert combustion analyzer into exhaust flue test port. Verify the opening around combustion analyzer probe is completely sealed when taking measurements.
- Set boiler to high-fire by pressing two buttons simultaneously. Display will show H3 and the symbol will appear.
- Measure percentage of O₂ or CO₂ in flue gases.
- Compare the measured values with values in table below.
- Adjust gas/air ratio using high-fire adjustment screw (V) if needed. Turn screw clockwise to reduce CO₂ level and counterclockwise to increase it.

9.11 Combustion Setup (Low-Fire)

- Unscrew exhaust port plug at exhaust flue test port.
- Insert combustion analyzer into exhaust flue test port. Verify the opening around combustion analyzer probe is completely sealed when taking measurements.
- Set boiler to low-fire by pressing two buttons simultaneously. If the boiler is already in combustion setup mode for high fire, press the (-) button several time until L3 is displayed on the screen.
- Measure percentage of O₂ or CO₂ in flue gases.
- Compare the measured values with values in table below. Remove front panel when comparing values.
- Adjust gas/air ratio using low-fire adjustment screw (K) if needed. Turn screw clockwise to increase CO₂ level and counterclockwise to decrease it.

### O₂/CO₂ Values at Low-Fire Natural Gas (A)

<table>
<thead>
<tr>
<th>Nominal value</th>
<th>Permitted value</th>
</tr>
</thead>
<tbody>
<tr>
<td>O₂ %</td>
<td>CO₂ %</td>
</tr>
<tr>
<td>5.7</td>
<td>8.5</td>
</tr>
<tr>
<td>5.4 - 6.1</td>
<td>8.3 - 8.7</td>
</tr>
</tbody>
</table>

### O₂/CO₂ Values at Low-Fire Propane Gas (E)

<table>
<thead>
<tr>
<th>Nominal value</th>
<th>Permitted value</th>
</tr>
</thead>
<tbody>
<tr>
<td>O₂ %</td>
<td>CO₂ %</td>
</tr>
<tr>
<td>6.4</td>
<td>9.6</td>
</tr>
<tr>
<td>6.1 - 6.70</td>
<td>9.4 - 9.8</td>
</tr>
</tbody>
</table>

9.12 Operational Check

- Inspect combustion air and vent piping. Verify pipe is not leaking and terminations are unobstructed. Verify vent gas discharge is not a nuisance or hazard.
- Verify boiler functions.
- Inspect condensate disposal system. Verify condensate flows adequately and is disposed properly.
- Check control module operation.
- Check field sourced limits, low water cutoffs, etc. per manufacturer’s instructions.

* Installer's guide only. Use test port to verify safe CO levels with door installed before leaving job site.
9.13 User Level Parameters

Parameters P1 to P8 can be adjusted by end user to meet heating system and DHW comfort needs.

Modification of factory settings may be detrimental to operation of the boiler.

- Press the two Menu buttons simultaneously and then (+) button until symbol flashes on the menu bar.
- Select the user menu using button, (P1) button is displayed with "1" flashing.
- Press button a second time, the central heating supply temperature value appears and flashes, e.g. 170°F.
- Change the value by pressing (-) button or (+) button. In this example using (-) to (140°F).
- Confirm the value with button, (P1) is displayed with "1" flashing.
- Press button 2 times to return to current operating mode.

9.14 Installer Level Parameters

Parameters P17 to dF (error code history) must only be modified by a qualified installer.

To prevent unwanted settings, some parameter settings can only be changed after special access code 0012 is entered.

Modification of factory settings may be detrimental to operation of the boiler.

- Press the two Menu buttons simultaneously and then (+) button until symbol flashes on the menu bar.
- Select the INSTALLER menu using the button. "CODE" appears on the display.
- Use (-) or (+) button to input the installer code "0012".
- Confirm using button, "P1" is displayed with "1" flashing.
- Press button a second time, the value will appear and flashes, for example [80°C (176°F)].
- Change the value by pressing the [-] or [+] button. [In this example using [-] to change the value to 60 °C (140 °F).]
- Confirm the value with the button, “P1” is displayed with 1 flashing. Button, “P1” is displayed with 1 flashing. If necessary, set other parameters by selecting them using the (-) or (+) button.
- Press button 2 times to return to current operating mode.
### 9 - START UP PROCEDURE

#### 9.15 Parameters Settings

Boiler control panel is set for most common heating systems. With these settings, most heating systems operate correctly; however, installer can adjust parameters according to their own preferences.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Adjustment Range</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Max flow temperature during CH mode (Set temperature)</td>
<td>68 to 194°F 20 to 90°C</td>
<td>176°F/80°C</td>
</tr>
<tr>
<td>P2</td>
<td>Desired DHW temperature</td>
<td>104 to 149°F 40 to 65 ºC</td>
<td>140°F/60°C</td>
</tr>
<tr>
<td>P3</td>
<td>Switch on/off CH/DH function</td>
<td>0 = Heating off / DHW off  1 = Heating on / DHW on  2 = Heating on / DHW off  3 = Heating off / DHW on</td>
<td>2</td>
</tr>
<tr>
<td>P4</td>
<td>Keeping warm for DHW comfort</td>
<td>0 = Always on  1 = Always off  2 = Controller</td>
<td>2</td>
</tr>
<tr>
<td>P5</td>
<td>Anticipation current on/off thermostat</td>
<td>0 = No  1 = Yes</td>
<td>0</td>
</tr>
<tr>
<td>P6</td>
<td>Amount of information on display</td>
<td>0 = Simple  1 = Extended  2 = Automatic</td>
<td>1</td>
</tr>
<tr>
<td>P7</td>
<td>Pump post run time CH</td>
<td>1 to 98 minutes 99 minutes = continuous</td>
<td>3</td>
</tr>
<tr>
<td>P8</td>
<td>Display brightness when backlight is active</td>
<td>0 = Low  1 = High</td>
<td>1</td>
</tr>
<tr>
<td>P17</td>
<td>Max fan speed during CH mode</td>
<td>Natural gas(1) (x100 rpm) 64  Propane (x100 rpm) 63</td>
<td></td>
</tr>
<tr>
<td>P18</td>
<td>Max fan speed during DHW mode</td>
<td>Natural gas(1) (x100 rpm) 64  Propane (x100 rpm) 63</td>
<td></td>
</tr>
<tr>
<td>P19</td>
<td>Minimum fan speed during CH + DHW mode</td>
<td>Natural gas(1) (x100 rpm) 16  Propane (x100 rpm) 15</td>
<td></td>
</tr>
<tr>
<td>P20</td>
<td>Offset on partload fan speed</td>
<td>Natural gas(1) (x100 rpm) 0  Propane 0</td>
<td></td>
</tr>
<tr>
<td>P21</td>
<td>Fan speed at the boiler start</td>
<td>(x100 rpm) 30</td>
<td></td>
</tr>
<tr>
<td>P22</td>
<td>Minimum water pressure for notification</td>
<td>5 = 7.3 psig/0.5 bar</td>
<td>5</td>
</tr>
<tr>
<td>P23</td>
<td>Maximum flow temperature for heating system</td>
<td>32 to 190°F 0 to 88°C</td>
<td>68°F/20°C</td>
</tr>
<tr>
<td>P24</td>
<td>Hysteresis anticycle CH</td>
<td>5 to 59°F -15 to 15°C</td>
<td>68°F/20°C</td>
</tr>
<tr>
<td>P25</td>
<td>Maximum outdoor temperature (for use with an outdoor temperature sensor only)</td>
<td>32 to 86°F 0 to 30°C</td>
<td>241</td>
</tr>
<tr>
<td>P26</td>
<td>Footpoint heating curve flow temperature Maximum outdoor temperature (for use with an outdoor temperature sensor)</td>
<td>32 to 194°F 0 to 90°C</td>
<td>68°F/20°C</td>
</tr>
</tbody>
</table>
### Parameters Settings - Continued

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Adjustment Range</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>P27</td>
<td>Clima point heating curve outside temperature (Only with an outdoor temperature sensor)</td>
<td>-22 to 32°F -30 to 0°C 241 = 5°F/-15°C</td>
<td>241</td>
</tr>
<tr>
<td>P28</td>
<td>Pump control, CH minimum speed</td>
<td>2 - 10 (x 10 % )</td>
<td>7</td>
</tr>
<tr>
<td>P29</td>
<td>Pump control, CH maximum speed</td>
<td>2 - 10 (x 10 % )</td>
<td>10</td>
</tr>
<tr>
<td>P30</td>
<td>Minimal outside temperature for frost protection</td>
<td>-22 to 32°F -30 to 0°C 246 = 14°F/-10°C</td>
<td>246</td>
</tr>
<tr>
<td>P31</td>
<td>Legionella protection calorifier</td>
<td>0 = No 1 = Yes 2 = Controller</td>
<td>1</td>
</tr>
<tr>
<td>P32</td>
<td>Set point raise at warming up calorifier</td>
<td>32 to 77°F 0 to 25°C</td>
<td>68°F/20°C</td>
</tr>
<tr>
<td>P33</td>
<td>Switch on hysteresis calorifier sensor</td>
<td>35.6 to 59°F 2 to 15°C</td>
<td>41°F/5°C</td>
</tr>
<tr>
<td>P34</td>
<td>3 way valve stand by: CH or DHW</td>
<td>0 = CH 1 = DHW</td>
<td>0</td>
</tr>
<tr>
<td>P35</td>
<td>Boiler type and control type</td>
<td>0 = Solo (+boiler) 1 = Process heat</td>
<td>0</td>
</tr>
<tr>
<td>P36</td>
<td>Function of blocking input</td>
<td>0 = CH enable 1 = Blocking without frost protection 2 = Blocking with frost protection 3 = Lock-out with frost protection</td>
<td>1</td>
</tr>
<tr>
<td>P37</td>
<td>Function of release input</td>
<td>0 = DHW enable 1 = Burner release</td>
<td>1</td>
</tr>
<tr>
<td>P38</td>
<td>Wait time for valid release signal</td>
<td>0 to 255 seconds 0 = No check</td>
<td>0</td>
</tr>
<tr>
<td>P39</td>
<td>Wait time for flue gas valve</td>
<td>0 to 255 seconds</td>
<td>0</td>
</tr>
<tr>
<td>P40</td>
<td>Position from alarm/operation signal relays</td>
<td>0 = Operation signal 1 = failure signal</td>
<td>1</td>
</tr>
<tr>
<td>P41</td>
<td>Minimum gas pressure detection</td>
<td>0 = no 1 = yes</td>
<td>0</td>
</tr>
<tr>
<td>P42</td>
<td>HRU connected</td>
<td>0 = no 1 = yes</td>
<td>0</td>
</tr>
<tr>
<td>P43</td>
<td>Mains L-N phase detection activated</td>
<td>0 = No 1 = Yes</td>
<td>0</td>
</tr>
<tr>
<td>P44</td>
<td>Service notification for boiler dependent maintenance</td>
<td>0 = Off 1 = ABC 2 = Custom</td>
<td>0</td>
</tr>
<tr>
<td>P45</td>
<td>Service hours for boiler connected to mains supply</td>
<td>1 to 255 (x 100h)</td>
<td>175</td>
</tr>
<tr>
<td>P46</td>
<td>Service hours for boiler burner</td>
<td>1 to 255 (x 100h)</td>
<td>30</td>
</tr>
</tbody>
</table>
### Parameters Settings - Continued

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Adjustment Range</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>P47</td>
<td>Modulate back when dT &gt; this parameter</td>
<td>41 to 140°F 5 to 60°C</td>
<td>140°F/60°C</td>
</tr>
<tr>
<td>P48</td>
<td>DHW stabilization time</td>
<td>10 to 100 seconds</td>
<td>30</td>
</tr>
<tr>
<td>P49</td>
<td>Display units</td>
<td>0 = Metric 1 = Imperial</td>
<td>1</td>
</tr>
<tr>
<td>P50</td>
<td>Factor for average flow temperature calculation</td>
<td>1 to 255 seconds</td>
<td>1</td>
</tr>
<tr>
<td>P51</td>
<td>Flue gas temperature</td>
<td>0 = PVC 65°C / 149°F 1 = CPVC 90°C / 194°F 2 = PP/SS 110°C / 230°F</td>
<td>1</td>
</tr>
<tr>
<td>P52</td>
<td>Air pressure sensor</td>
<td>0: Off 1: On</td>
<td>0</td>
</tr>
<tr>
<td>P53</td>
<td>DHW time out mode</td>
<td>0: None 1: Absolute</td>
<td>1</td>
</tr>
<tr>
<td>P54</td>
<td>DHW time out</td>
<td>10 to 180 minutes</td>
<td>150</td>
</tr>
<tr>
<td>P55</td>
<td>CH prior time</td>
<td>10 to 180 minutes</td>
<td>120</td>
</tr>
<tr>
<td>P56</td>
<td>RPM min antiwind</td>
<td>10 to 30 (*100rpm)</td>
<td>25</td>
</tr>
</tbody>
</table>

(1) Do not modify these factory settings unless absolutely necessary. E.g. to adapt the boiler to: Propane (gas E)

* Note: These are sea level values: please see Parameter Settings For High Altitude (section 2.2)
9.16 Reading Measured Values

The following current values can be read from the information menu.

- **St** = State
- **Su** = Sub-status
- **t1** = Supply temperature °F/°C
- **t2** = Return temperature °F/°C
- **t3** = DHW tank temperature °F/°C
- **t4** = Outdoor temperature °F/°C (Only with an outdoor 1k Ω temperature sensor: Optional)
- **t5** = Solar boiler temperature °F/°C
- **t6** = Flue gas temperature °F/°C
- **Sp** = Internal set point °F/°C
- **Fl** = Ionization current (μA)
- **ñf** = Fan speed in rpm
- **Pr** = Water pressure psig/bar
- **Po** = Supplied relative heat output (%).

Reading the Current Values

1. Press the two buttons simultaneously. The symbol flashes.
2. Confirm using button. is displayed alternating with current status 3 (for example).
3. Press the button. is displayed, alternating with the current sub-status (for example).
4. Press the button. is displayed, alternating with the current flow temperature (for example).
5. Press the button successively to scroll down to the various parameters.
6. Press the button. is displayed, alternating with the internal set point (for example).
7. Press the button. is displayed, alternating with the current ionization current (for example).
8. Press the button. is displayed, alternating with the current fan rotation speed (for example).
9. Press the button. is displayed, alternating with the current water pressure (for example).
10. Press the button. is displayed, alternating with the current modulation percentage (for example).
11. Press the button. The readout cycle starts again with.
12. Press the button 2 times to return to the current operating mode.
# 9.17 Status And Sub-Status

The information menu gives the following status and sub-status information:

<table>
<thead>
<tr>
<th>State (St)</th>
<th>Sub-status (Su)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Rest</td>
</tr>
<tr>
<td>1</td>
<td>Short pre-purge of the fan</td>
</tr>
<tr>
<td>2</td>
<td>Control three-way valve</td>
</tr>
<tr>
<td>3</td>
<td>Start pump</td>
</tr>
<tr>
<td>4</td>
<td>sw checks sensor temperatures before the burner starts</td>
</tr>
<tr>
<td>10</td>
<td>Open flue gas damper/external gas valve</td>
</tr>
<tr>
<td>11</td>
<td>Increase fan speed</td>
</tr>
<tr>
<td>13</td>
<td>Pre-purge</td>
</tr>
<tr>
<td>14</td>
<td>Wait for release signal from RL connection</td>
</tr>
<tr>
<td>15</td>
<td>Burner on</td>
</tr>
<tr>
<td>17</td>
<td>Pre-ignition</td>
</tr>
<tr>
<td>18</td>
<td>Ignition</td>
</tr>
<tr>
<td>19</td>
<td>Flame detection</td>
</tr>
<tr>
<td>20</td>
<td>Intermediate ventilation</td>
</tr>
<tr>
<td>30</td>
<td>Temperature control</td>
</tr>
<tr>
<td>31</td>
<td>Limited temperature control (ΔT safety)</td>
</tr>
<tr>
<td>32</td>
<td>Output controlled by 0-10 v signal</td>
</tr>
<tr>
<td>33</td>
<td>Temperature protection gradient level 1 (Modulate down)</td>
</tr>
<tr>
<td>34</td>
<td>Temperature protection gradient level 2 (low-fire)</td>
</tr>
<tr>
<td>35</td>
<td>Temperature protection gradient level 3 (Blockage)</td>
</tr>
<tr>
<td>36</td>
<td>Modulate up for flame control</td>
</tr>
<tr>
<td>37</td>
<td>Temperature stabilization time</td>
</tr>
<tr>
<td>38</td>
<td>Cold start</td>
</tr>
<tr>
<td>40</td>
<td>Burner off</td>
</tr>
<tr>
<td>41</td>
<td>Post-purge</td>
</tr>
<tr>
<td>42</td>
<td>Close flue gas damper/external gas valve</td>
</tr>
<tr>
<td>43</td>
<td>Recirculation protection (checks to see if gas valve has closed)</td>
</tr>
<tr>
<td>44</td>
<td>Fan Stops</td>
</tr>
<tr>
<td>60</td>
<td>Pump post circulation</td>
</tr>
<tr>
<td>61</td>
<td>Pump off</td>
</tr>
<tr>
<td>62</td>
<td>Control three-way valve</td>
</tr>
<tr>
<td>63</td>
<td>Short-cycling counter activates</td>
</tr>
<tr>
<td>0</td>
<td>Wait for burner start</td>
</tr>
<tr>
<td>1</td>
<td>Short cycling protection function</td>
</tr>
<tr>
<td>xx</td>
<td>Shutdown codexx</td>
</tr>
<tr>
<td>0</td>
<td>Rest</td>
</tr>
<tr>
<td>2</td>
<td>Control three-way valve</td>
</tr>
<tr>
<td>3</td>
<td>Start pump</td>
</tr>
<tr>
<td>61</td>
<td>Pump off</td>
</tr>
<tr>
<td>61</td>
<td>Control three-way valve</td>
</tr>
</tbody>
</table>
9.18 Return To The Factory Settings:

- Press the two Menu buttons simultaneously and then (+) button until symbol flashes on the menu bar.
- Select the INSTALLER menu using "COdE" appears on the display.
- Use (-) or (+) button to input the installer code "0012".
- Confirm using button. P:1 is displayed with 1 flashing.
- Press the [+ ] button several times p:df is displayed with df flashing.
- Press button df:x is displayed with x flashing. This is the current value of X for dF. Check this against the value of X on the type plate.
- Enter the value of X shown on the type plate using the [-] or [+ ] button.
- Confirm the value with the button, df:y is displayed with y flashing. This is the current value of Y for du. Verify the value of y on the rating plate is the same.
- Enter the value of y shown on the rating plate using the [- ] or [+ ] button.
- Confirm value with the button. The factory settings are reset.
- Display returns to current operating mode.
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.

• This appliance is equipped with an ignition device which automatically lights burner. **Do NOT try to light this burner by hand.**

• Before operating smell all around appliance area for gas. Be sure to smell next to floor because some gas is heavier than air and will settle to the floor.

• **Use only your hand to turn the gas shutoff valve.** Never use tools. If valve will not turn by hand, do not try to repair it, call a qualified service technician. Force or attempted repair may result in fire or explosion.

• **Do not use this appliance if any part has been under water.** Immediately call a qualified service technician to inspect appliance and to replace any part of control system and any gas control which has been under water.

10.1 SEQUENCE OF OPERATION

• With demand for heat, pump circulates water through primary circuit.

• Combustion fan will come on and begin to operate at ignition speed.

• Once fan reaches ignition speed, control board will allow power to flow to spark generator and gas valve creating ignition in combustion chamber. Flame sensor will acknowledge presence of flame in combustion chamber and send a signal to control board.

• Temperature sensor will send signal to control board allowing the control board to increase / decrease speed of the fan. The combustion fan will in turn modulate gas rate accordingly.

• Once central heating loop temperature exceeds central heating loop setpoint unit will shutdown and go through 3 minute time delay (burner pause time) before another call for heat.

• During this time the pump will run for additional three minutes to dissipate any residual heat.

10.2 OPERATING INSTRUCTIONS

*Stop! Read Safety information above.*

• Set thermostat to lowest setting.

• Turn "OFF" all electrical power to appliance.

• This appliance is equipped with an ignition device which automatically lights the burner. **Do not try to light burner by hand!**

• Turn gas shutoff valve to closed position. Handle should be perpendicular to gas pipe.

• Wait 5 minutes for any gas to clear. Smell for gas, including near floor. If you smell gas, **STOP!** Follow instructions on this page: "**What To Do If You Smell Gas.**" If you do **not** smell gas, go to next step.

• Turn gas shutoff valve to the open position. Handle should be parallel to gas pipe.

• Turn "ON" electrical power to appliance.

• Set thermostat to desired setting.

• If the appliance will not operate, follow instructions TO **TURN OFF GAS TO APPLIANCE** and call your service technician or gas supplier.

⚠️ CAUTION

**WHAT TO DO IF YOU SMELL GAS**

• Do not try to light any appliance.

• Do not touch any electrical switch; do not use any phone in your building.

• Immediately call your gas supplier from a neighbor’s phone. Follow the gas supplier’s instructions.

• If you cannot reach your gas supplier, call the fire department.

10.3 TO TURN OFF GAS TO APPLIANCE

• Set thermostat to lowest setting.

• Turn "OFF" all electric power to appliance if service is to be performed.

• Turn gas shutoff valve handle to closed position. Handle should be perpendicular to gas pipe.
11.1 Beginning of Each Heating Season

- Check boiler area is free from combustible materials, gasoline, and other flammable vapors and liquids.

- Visually inspect combustion air and vent piping for proper operation. Check for and remove any obstruction to flow of combustion air or vent gases. Immediately repair or replace pipe showing deterioration or leakage. Reassemble per instructions in section 6. Ensure proper reassembly and resealing of system.

- Visually inspect condensate drain line for proper operation. Checking for deteriorated or plugged condensate drain line. Verify condensate trap drains freely and clean as required.

- Test safety relief valve for proper operation. Refer to valve manufacturer's instructions packaged with relief valve.

- Examine flue passages in heat exchanger, burner, condensate lines, and cleaning (if necessary) by following instructions in "Annual Examination and Cleaning of Boiler Components" in this section.

\section*{DANGER}
Before servicing, turn off electrical power to boiler at service switch. Close manual gas valve to turn gas supply OFF to boiler. Failure to comply will result in death or serious injury.

\section*{CAUTION}
Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

\textbf{Note}
Verify proper operation after servicing.

\textbf{Note}
Perform regular service and maintenance by qualified service agency at least once every 12 months to assure safe, trouble free operation and maximum efficiency.
11 - GENERAL MAINTENANCE AND CLEANING

• Circulator pump and combustion air blower motor furnished with boiler are permanently lubricated from factory and require no further lubrication. Lubricate field sourced pumps and/or motors according to pump and/or motor manufacturer’s instruction.

• Check following components are operating properly and are free of blockages or obstructions:
  • air vent;
  • check venturi air inlet for blockage and clean as required;
  • verify pressure test port cap and combustion test port are in place;
  • return temperature sensor clip must be securely seated on pipe; Check boiler for any sign of leaks.

• Check low water cutoff using user interface (if installed).
  • Check operation by pressing test button on low water cutoff.
    • "Low Water" LED should illuminate and burner should shut down.
    • Should get error message on User Interface (E36).
  • Every 5 years remove low water cutoff. Reinstall after cleaning.
  • Every 10 years replace low water cutoff.

• See Table 13 page 41 for flame signal rate at 100% firing rate (High fire).

• Visual inspection of flame through sight glass. Burner should be fully illuminated. See figure 11-1.

• Check heating system expansion tank.

11.2 Annual Shut Down Procedure

• Follow instructions “To Turn Off Gas To Appliance” unless boiler is also used to supply domestic hot water. See section 10.

• Drain system completely if system does not have antifreeze when heating system is to remain out of service during freezing weather.

• Drain condensate lines when boiler is to be exposed to freezing temperatures.

![WARNING]

Following service procedures must be performed by qualified service agent. Boiler owner shall not attempt these steps. Failure to do so could result in death or serious injury.

11.3 Annual Inspection and Cleaning of Boiler Components

• Obtain Burner Inspection Kit. Follow heat exchanger cleaning kit instructions for examination and cleaning.
11.4 Maintenance And Routine Servicing

Check and service boiler as necessary.

Frequency of servicing will depend upon installation conditions and usage, manufacturer recommends annually.

- Check flue termination outside verify it is not blocked.
- Operate boiler and verify operation of its controls and meets acceptable parameters.
- Ensure all system connections and fittings are tight and not leaking. Redo any joints and check the tightness of any fittings that may be leaking.
- Verify safety relief valve is in working order following its manufacturer's instructions.

To ensure boiler is operating at peak efficiency perform the following inspection:

- check appearance and tightness of gas and combustion circuit gaskets
- check condition and position of ignition/flame sensing electrode
- check condition of burner and ensure it’s secure to aluminum flange
- check for any dirt in combustion chamber. Use nylon brush with white vinegar and water to clean combustion chamber.
- heat exchanger cleaning kit is available see parts book for details
- check gas valve is calibrated correctly
- check there is no dirt in condensate trap
- check the central heating system pressure
- check on expansion tank pressure
- check vent system and clean it if necessary

Record details and maintain service history.

11.5 Component Replacement And Cleaning

1. Remove any deposits from heat exchanger using suitable soft brush. Do not use brush with metallic bristles.
2. Check condition of the combustion chamber insulation panels. Any damaged panels must be replaced.
3. Check condition of burner injector on the manifold, carefully clean it with a soft brush if necessary. Do not use a brush with metallic bristles this might damage the injector.
4. Remove any fallen deposits from bottom of inner case.
5. Clean burner with soft brush and check flame ports are clear. Blockages may be removed with stiffer brush.
6. Check condition of electrodes.
7. Check spark gap, positioning and height of electrodes.
8. Check fan impeller is clean and free to rotate.

CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Failure to follow these instructions could result in minor or moderate injury.

WARNING

Combustion chamber insulation in this product contains ceramic fiber material. Ceramic fibers can be converted to cristobalite in very high temperature applications. The International Agency for Research on Cancer (IARC) has concluded, Crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group1). Avoid breathing dust and contact with skin and eyes. Use NIOSH certified dust respirator (N95). This type of respirator is based on the OSHA requirements for cristobalite at the time this document was written. Other types of respirators may be needed depending on the job site conditions. Current NIOSH recommendations can be found on the NIOSH website http://www.cdc.gov/niosh/homepage.html. NIOSH approved respirators, manufacturers, and phone numbers are also listed on this website. Wear long-sleeved, loose fitting clothing, gloves, and eye protection. Apply enough water to the combustion chamber lining to prevent dust. Wash potentially contaminated clothes separately from other clothing. Rinse clothes washer thoroughly.


**11.6 Draining the Boiler**
- turn boiler off
- isolate electrical supply
- close boiler gas service cock
- allow boiler to cool
- drain boiler through onboard drain (item 19 page 7) or external drain valve.

**Draining the Heating Circuit**
- Follow all steps in 11.6.
- Close central heating flow and return valves.
- Connect suitable pipe to drain point.
- Route it to suitable container.
- Open drain tap.

**DANGER**
Before servicing, turn off electrical power to boiler at service switch. Close manual gas valve to turn gas supply OFF to boiler. Failure to comply will result in death or serious injury.
### TABLE 14: SEA LEVEL RATINGS
NATURAL AND PROPANE GASES

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Input, (MBH)(^{(1)})</th>
<th>Heating Capacity (MBH)(^{(2)})</th>
<th>Net AHRI Rating, Water (MBH)(^{(3)})</th>
<th>AFUE(^{(2)})</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMG-240</td>
<td>241 36</td>
<td>216 188</td>
<td>95.0</td>
<td></td>
</tr>
</tbody>
</table>

\(^{(1)}\) 1000 Btu/hr (British Thermal Units Per Hour)
\(^{(2)}\) Heating Capacity and AFUE (Annual Fuel Utilization Efficiency) are based on DOE (Department of Energy) test procedures.
\(^{(3)}\) Net AHRI Ratings based on piping and pickup allowance of 1.15. Contact Technical Support before selecting boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc.

---

### 12.1 Ratings and Capacities

- **Constructed and hydrostatically tested for maximum allowable working pressure of 50 psig (pounds per square inch gauge) (115 kPa) in accordance with ASME Boiler and Pressure Vessel Code, Section IV, Rules for Construction of Heating Boilers.**

- **In USA,** for elevations beyond 2,000-ft reduce input by 4% for each 1,000-ft above sea level in accordance with National Installation Code ANSI Z223.1

- **In Canada,** input rate is reduced by 10% for elevations 2,000-ft to 4,500-ft. Contact Provincial Authority having jurisdiction for Installations above 4500-ft (1350m) above sea level.

### Central Heating

<table>
<thead>
<tr>
<th>Central Heating</th>
<th>MAX</th>
<th>MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-2,000 Ft 0-610 m</td>
<td>2,000-4,500 Ft 610-1,370 m</td>
</tr>
<tr>
<td>Heating Input (Gross) MBH</td>
<td>241</td>
<td>228</td>
</tr>
<tr>
<td>Heating Input (Gross) kW</td>
<td>70.6</td>
<td>69.0</td>
</tr>
<tr>
<td>Heat Output (modulating) Btu/h</td>
<td>216,330</td>
<td>205,410</td>
</tr>
<tr>
<td>Heat Output (modulating) kW</td>
<td>63.4</td>
<td>60.2</td>
</tr>
<tr>
<td>Gas Rate A (Natural Gas) ft3/h</td>
<td>242.6</td>
<td>228.22</td>
</tr>
<tr>
<td>Gas Rate A (Natural Gas) m3/h</td>
<td>6.87</td>
<td>6.46</td>
</tr>
<tr>
<td>Gas Rate E (LPG Gas) ft3/h</td>
<td>95.0</td>
<td>90</td>
</tr>
<tr>
<td>Gas Rate E (LPG Gas) m3/h</td>
<td>2.69</td>
<td>2.55</td>
</tr>
<tr>
<td>Max. CH Water Temp. (Approx.) °F</td>
<td>176</td>
<td></td>
</tr>
<tr>
<td>Max. CH Water Temp. (Approx.) °C</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>
13.1 Troubleshooting

This boiler is fitted with an electronic regulation and control unit.

Control system is a microprocessor, Comfort Master®, which controls and protects the boiler. If a fault is detected anywhere in the boiler, boiler will lock out and display will show the fault code as follows:

- Red flashing display:
  - The symbol
  - The "RESET" symbol

Descriptions of each error code are given in the table below.

To reset an error code, press button for 2 seconds.

If the error code continues to display, search for the cause in error table and follow instructions given in solution section.

### Error Code Table

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
<th>Probable Causes</th>
<th>Checking/Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>E00</td>
<td>Storage unit PSU parameter not found</td>
<td>Bad connection</td>
<td>Check the wiring</td>
</tr>
<tr>
<td>E01</td>
<td>The safety parameters are incorrect</td>
<td>Bad connection PSU defective</td>
<td>Check the wiring Replace PSU</td>
</tr>
<tr>
<td>E02</td>
<td>Supply temperature sensor short circuited</td>
<td>Bad connection Sensor fault Sensor not/poorly connected</td>
<td>Check the wiring Check sensors are operating correctly Replace sensor if necessary (CHART 1)</td>
</tr>
<tr>
<td>E03</td>
<td>Supply temperature sensor open circuit</td>
<td>Bad connection Sensor fault Sensor not/poorly connected</td>
<td>Check the wiring Check sensors are operating correctly Replace sensor if necessary (CHART 1)</td>
</tr>
<tr>
<td>E04</td>
<td>Temperature of heat exchanger too low.</td>
<td>Bad connection Sensor fault Sensor not/poorly connected</td>
<td>Check the wiring Replace sensor if necessary Purge air in heating system Check for water circulation (direction, pump, valves) Check water pressure Check sensors are operating correctly Check sensors have been correctly fitted Check cleanliness of heat exchanger (CHART 1)</td>
</tr>
<tr>
<td>E05</td>
<td>Heat exchanger temperature too high</td>
<td>Bad connection Sensor fault No circulation</td>
<td>Check the wiring Replace sensor if necessary Purge air in heating system Check for water circulation (direction, pump, valves) Check water pressure Check sensors are operating correctly Check sensors have been correctly fitted Check cleanliness of heat exchanger (CHART 1)</td>
</tr>
<tr>
<td>E06</td>
<td>Return temperature sensor short circuited</td>
<td>Bad connection Sensor fault Sensor not /poorly connected</td>
<td>Check the wiring Check sensor has been correctly fitted Check sensors are operating correctly (CHART 1)</td>
</tr>
<tr>
<td>E07</td>
<td>Return temperature sensor open circuit</td>
<td>Bad connection Sensor fault Sensor not /poorly connected</td>
<td>Check the wiring Check sensor has been correctly fitted Check sensors are operating correctly (CHART 1)</td>
</tr>
<tr>
<td>E08</td>
<td>Return temperature too low</td>
<td>Bad connection Sensor fault Sensor not/poorly connected</td>
<td>Check the wiring Replace sensor if necessary Purge air from heating system Check for water circulation (direction, pump, valves) Check water pressure Check sensors are operating correctly Check sensors have been correctly fitted Check cleanliness of heat exchanger (CHART 1)</td>
</tr>
<tr>
<td>E09</td>
<td>Return temperature too high</td>
<td>Bad connection Sensor fault Sensor not/poorly connected</td>
<td>Check the wiring Replace sensor if necessary Purge air from heating system Check for water circulation (direction, pump, valves) Check water pressure Check sensors are operating correctly Check sensors have been correctly fitted Check cleanliness of heat exchanger (CHART 1)</td>
</tr>
</tbody>
</table>
## Error Code Table

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
<th>Probable Causes</th>
<th>Checking/Solution</th>
</tr>
</thead>
</table>
| E10, E11   | Temperature difference between the supply and return temperatures too great | Sensor fault  
Sensor not/poorly connected  
No circulation | Replace the sensor if necessary  
Purge the air in the heating system  
Check for water circulation (direction, pump, valves)  
Check that the sensors are operating correctly  
Check the cleanliness of the heat exchanger  
Check that the heating pump is operating correctly  
(Chart 4) |
| E12        | Temperature of heat exchanger is above the normal range (high-limit thermostat Safety Thermostat) | Bad connection  
Sensor fault  
Sensor not/poorly connected  
No circulation | Check the wiring  
Replace the sensor if necessary  
Purge the air in the heating system  
Check for water circulation (direction, pump, valves)  
Check that the sensors are operating correctly  
Check the cleanliness of the heat exchanger  
Check that parameter P35 has been set correctly  
(Chart 3) |
| E14        | 5 burner start-up failures | No ignition | Check spark generator wiring  
Check the ionization/ignition electrode  
Check the condition of the burner  
Check the grounding  
Defective control SU PCB  
(Chart 5) |
| E16        | False flame signal | Ionization current present when there should not be a flame  
Ignition transformer defective  
Gas valve defective  
The burner remains very hot: CO too high | Check the ionization/ignition electrode  
Check the gas valve and replace if necessary  
Recalibrate the CO2  
(Chart 2) |
| E17        | Problem on SU PCB | Bad connection  
Defective SU PCB | Check the wiring  
Inspect the SU PCB and replace it if need be |
| E34        | Fan fault | Bad connection  
Fan defective | Replace Fan if necessary  
Check for adequate draw on the flue connection  
(Chart 7) |
| E35        | Supply and return reversed | Bad connection  
Sensor fault  
Sensor not/poorly connected  
Water circulation direction reversed | Replace the sensor if necessary  
Check for water circulation (direction, pump, valves)  
Check that the sensors are operating correctly  
Check that the sensors have been correctly fitted  
(Chart 4) |
| E36        | Flame loss | No ionization current | Purge the gas supply to remove air  
Check that the gas valve is fully opened  
Check the supply pressure  
Check the operation and setting of the gas valve  
Check that the air inlet and exhaust flue are not blocked  
Check that there is no recirculation of flue gases  
(Chart 6) |
## Error Code Table

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
<th>Probable Causes</th>
<th>Checking/Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>E37</td>
<td>Communication error with SU PCB</td>
<td>Bad connection</td>
<td>Check whether the SU PCB has been correctly fitted in connector on PCU PCB</td>
</tr>
<tr>
<td>E38</td>
<td>Communication error with SCU PCB</td>
<td>Bad connection</td>
<td>Check the wiring Replace SCU PCB</td>
</tr>
<tr>
<td>E39</td>
<td>Shutdown input in locked-out mode</td>
<td>Bad connection</td>
<td>Check the wiring Find external problem Check the parameters (CHART 8)</td>
</tr>
<tr>
<td>E40</td>
<td>HRU unit test error</td>
<td>Bad connection</td>
<td>Check the wiring Find the external problem Check the parameters (CHART 9)</td>
</tr>
<tr>
<td>E41</td>
<td>No water temperature change during deaeration/air purge</td>
<td>Bad connection Supply/Return sensor damaged No water circulation</td>
<td>Check the sensor connection Replace sensor Check the pump connection</td>
</tr>
<tr>
<td>E42</td>
<td>Low water cutoff disconnected or water pressure too low</td>
<td>Bad connection Water pressure low</td>
<td>Check the wiring Refill the system Check for leaks (CHART 10)</td>
</tr>
<tr>
<td>E43</td>
<td>No water temperature change during boiler operation (burner on)</td>
<td>Bad connection Supply/Return sensor damaged No water circulation</td>
<td>Check the sensor connection Replace the sensor Check the pump connection (CHART 11)</td>
</tr>
<tr>
<td>E44</td>
<td>Difference between supply/return temperature too high</td>
<td>Bad connection Supply/Return sensor damaged No water circulation</td>
<td>Check sensor connection Replace sensor Check pump connection</td>
</tr>
</tbody>
</table>

### 13.2 Shutdowns and Lock-outs

#### Blockage

If a blockage condition continues to exist after several start up attempts, boiler will switch into lock-out (fault) mode. The boiler can only start operating again once cause(s) of the lock-out have been rectified and after pressing button.

#### Lock-out Mode

A temporary lock-out caused by an unusual occurrence in the boiler's operation. E.g. Display gives code of blocked flue (code St9). Boiler control will try to re-start several times. Boiler will start up again after blocking condition(s) have been eliminated.

Shutdown codes can be read out as follows:

- Press the two buttons simultaneously.
- Confirm by pressing button. "St" is displayed, alternating with the shutdown code "9".
- Press the (+) button. "Su" appears on the screen.

Boiler will start again automatically when reason for blocking has been removed.
## Shutdown Code Table

<table>
<thead>
<tr>
<th>Shutdown Code</th>
<th>Description</th>
<th>Probable Causes</th>
<th>Checking/Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Su:0</td>
<td>Parameter error</td>
<td>Parameter error on the PSU PCB</td>
<td>Reset df and dU Restore parameters</td>
</tr>
<tr>
<td>Su:1</td>
<td>Maximum supply temperature exceeded</td>
<td>Non-existent or insufficient circulation / sensor error</td>
<td>Check the circulation (direction, pump, valves) Reasons for the heat demand</td>
</tr>
<tr>
<td>Su:2</td>
<td>Maximum increase of the supply temperature has been exceeded</td>
<td>Non-existent or insufficient water circulation / sensor error</td>
<td>Check the circulation (direction, pump, valves) Check the water pressure Check sensors are operating correctly Check sensor has been correctly fitted Check cleanliness of heat exchanger</td>
</tr>
<tr>
<td>Su:7</td>
<td>Max difference between T. supply/return exceeded</td>
<td>Non-existent or insufficient circulation / sensor error</td>
<td>Check the circulation (direction, pump, valves) Check the water pressure Check the sensors are operating correctly Check that the sensor has been correctly fitted Check the cleanliness of the heat exchanger</td>
</tr>
<tr>
<td>Su:8</td>
<td>No release signal</td>
<td>External cause Parameter error Bad connection</td>
<td>Correct the external cause Check the parameters Check the wiring</td>
</tr>
<tr>
<td>Su:9</td>
<td>Line and neutral of power supply are mixed up (if P43=1)</td>
<td>Power supply incorrectly wired Floating or 2 phase network</td>
<td>Line and neutral mixed up Set parameter p43 to 0</td>
</tr>
<tr>
<td>Su:10</td>
<td>Shutdown input is open</td>
<td>External cause Parameter error Bad connection</td>
<td>Correct the external cause Check the parameters Check the wiring</td>
</tr>
<tr>
<td>Su:11</td>
<td>Shutdown input active or frost protection active</td>
<td>External cause Parameter error Bad connection</td>
<td>Correct the external cause Check the parameters Check the wiring</td>
</tr>
<tr>
<td>Su:13</td>
<td>Communication error with the SCU PCB</td>
<td>Bad connection with BUS SCU PCB not installed in boiler</td>
<td>Check the wiring Carry out automatic detection to find aux. PCB’s</td>
</tr>
<tr>
<td>Su:15</td>
<td>Gas pressure too low</td>
<td>Non-existent or insufficient gas Pressure. Incorrect setting of the Gps gas pressure switch on SCU PCB</td>
<td>Check that the gas valve is fully opened Check the supply pressure Check whether the Gps gas pressure control system has been correctly fitted Replace the Gps gas pressure control system if need be</td>
</tr>
<tr>
<td>Su:16</td>
<td>Configuration fault or SU PCB not recognized</td>
<td>Wrong SU PCB for this boiler</td>
<td>Replace the SU PCB</td>
</tr>
<tr>
<td>Su:17</td>
<td>Configuration fault or default parameter table incorrect</td>
<td>Parameter dF-dU error on the PSU PCB</td>
<td>Reset df and dU Restore parameters</td>
</tr>
<tr>
<td>Su:18</td>
<td>Configuration fault or PSU PCB not recognized</td>
<td>Wrong PSU PCB for this boiler</td>
<td>Replace the PSU PCB</td>
</tr>
<tr>
<td>Su:19</td>
<td>Configuration fault or parameters “df-du” unknown</td>
<td>---</td>
<td>Reset df and dU Restore parameters</td>
</tr>
<tr>
<td>Shutdown Code</td>
<td>Description</td>
<td>Probable Causes</td>
<td>Checking/Solution</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Su:20</td>
<td>Identification running</td>
<td>---</td>
<td>No action required</td>
</tr>
<tr>
<td>Su:21</td>
<td>Communication error with SU PCB</td>
<td>Bad connection</td>
<td>Check whether SU PCB has been correctly fitted in the connector on SU PCB</td>
</tr>
<tr>
<td>Su:22</td>
<td>No flame during operation</td>
<td>No ionization current</td>
<td>Purge gas supply to remove air</td>
</tr>
<tr>
<td>Su:23</td>
<td></td>
<td></td>
<td>Check gas valve is fully opened</td>
</tr>
<tr>
<td>Su:24</td>
<td></td>
<td></td>
<td>Check supply pressure</td>
</tr>
<tr>
<td>Su:25</td>
<td></td>
<td></td>
<td>Check operation and setting of gas valve</td>
</tr>
<tr>
<td>Su:26</td>
<td></td>
<td></td>
<td>Check air inlet and exhaust are not blocked</td>
</tr>
<tr>
<td>Su:27</td>
<td></td>
<td></td>
<td>Check there is no recirculation of combustion gases</td>
</tr>
<tr>
<td>Su:28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su:29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su:30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su:31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su:32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su:33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su:34</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Su:35</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) These lock-outs are not stored in fault memory
(2) tFG: flue gas sensor

Note: Replace the SU PCB, Replace flue high limit.

Diagram 1: Troubleshooting Flowchart

Diagram 2: System Diagram for Boiler Installation
13.3 Error History

Boiler control is equipped with error memory which, records last 16 errors. In addition to storing error codes, the following data is also saved:

- Number of times that the error occurred: \( n:xx \).
- Boiler operating mode selected: \( St:xx \).
- The supply temperature \( t1:xx \) and the return temperature \( t2:xx \) when the error occurred.

To view the error history, enter access code 0012.

13.4 Error History Readout

- Press two buttons simultaneously and then \( + \) button until the \( \Delta \) symbol flashes on the menu bar.
- Select the installers menu using \( \leftarrow \) button. "CODE" appears on the display.
- Use \( - \) or \( + \) button to input installer code 0012.
- Press \( \leftarrow \) button. "Er:xx" appears on the display.
- The fault list can be displayed by pressing \( - \) or \( + \) button.
- Confirm using \( \leftarrow \) button. "Er:xx" is displayed with "xx" flashing = Last error which occurred, for example "2".
- Use \( - \) or \( + \) buttons to scroll through faults.
- Press \( \leftarrow \) button to display details of faults or shutdowns.
- Press \( - \) or \( + \) buttons to view the following information:
  - \( n:1 \) = Number of times that the error occurred.
  - \( hr \) = The number of operating hours.
  - \( St \) = State.
  - \( Su \) = Sub-status.
  - \( t1 \) = Supply temperature °F/°C.
  - \( t2 \) = Return temperature °F/°C. \( t3 \) = DHW tank temperature °F/°C.
  - \( t4 \) = Outdoor temperature °F/°C (Only with an outdoor temperature sensor).
  - \( t5 \) = Solar panel temperature °F/°C. \( t6 \) = Flue gas temperature °F/°C.
  - \( Sp \) = Internal set point °F/°C.
  - \( fi \) = Ionization current (μA).
  - \( nf \) = Fan speed in rpm.
  - \( Pr \) = Water pressure psi/bar.
  - \( Po \) = Supplied relative heat output (%).
- Press \( \leftarrow \) button to interrupt display cycle. "Er:xx" is displayed with "xx" flashing = Last error which occurred.
- Use \( - \) or \( + \) button to scroll through faults.
- Press \( \leftarrow \) button to show fault list.
- Press \( \leftarrow \) button 2 times to exit error history.
13.5 Optional Sensors

1. 1 KΩ Outdoor Air Sensor, if used.
   A. Boiler automatically recognizes sensor when used.
   B. See Chart 1 for sensor data. Sensor part number BD710487302V
   C. Locate outdoor sensor to protect against wind and direct sunlight. Mounting instructions provided with sensor.
   D. Maximum wire length is 100 ft (30m) for 22 ga. wire, or 150 ft (45m) for 18 ga. wire.

2. 10 KΩ Sensor for Indirect DHW Tank (Heating Only Boiler).
   A. See Chart 2 for sensor data.

---

### Chart 1 - Outdoor Air Sensor Data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-4.0</td>
<td>7,578</td>
<td>53.6</td>
<td>1,690</td>
</tr>
<tr>
<td>-2.2</td>
<td>7,193</td>
<td>55.4</td>
<td>1,621</td>
</tr>
<tr>
<td>-0.4</td>
<td>6,831</td>
<td>57.2</td>
<td>1,555</td>
</tr>
<tr>
<td>1.4</td>
<td>6,489</td>
<td>59.0</td>
<td>1,492</td>
</tr>
<tr>
<td>3.2</td>
<td>6,166</td>
<td>60.8</td>
<td>1,433</td>
</tr>
<tr>
<td>5.0</td>
<td>5,861</td>
<td>62.6</td>
<td>1,375</td>
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<tr>
<td>6.8</td>
<td>5,574</td>
<td>64.4</td>
<td>1,321</td>
</tr>
<tr>
<td>8.6</td>
<td>5,303</td>
<td>66.2</td>
<td>1,268</td>
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<tr>
<td>10.4</td>
<td>5,046</td>
<td>68.0</td>
<td>1,218</td>
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<tr>
<td>12.2</td>
<td>4,804</td>
<td>69.8</td>
<td>1,170</td>
</tr>
<tr>
<td>14.0</td>
<td>4,574</td>
<td>71.6</td>
<td>1,125</td>
</tr>
<tr>
<td>15.8</td>
<td>4,358</td>
<td>73.4</td>
<td>1,081</td>
</tr>
<tr>
<td>17.6</td>
<td>4,152</td>
<td>75.2</td>
<td>1,040</td>
</tr>
<tr>
<td>19.4</td>
<td>3,958</td>
<td>77.0</td>
<td>1,000</td>
</tr>
<tr>
<td>21.2</td>
<td>3,774</td>
<td>78.8</td>
<td>962</td>
</tr>
<tr>
<td>23.0</td>
<td>3,600</td>
<td>80.6</td>
<td>926</td>
</tr>
<tr>
<td>24.8</td>
<td>3,435</td>
<td>82.4</td>
<td>892</td>
</tr>
<tr>
<td>26.6</td>
<td>3,279</td>
<td>84.2</td>
<td>858</td>
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### Chart 2 - Indirect Tank Sensor Data

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**DOMESTIC HOT WATER SENSOR:** If the DHW sensor is shorted it will act as a closed thermostat and boiler will continuously fire.
Troubleshooting Chart 2

**E16 - False Flame Signal**

1. **Turn Off All Heat Calls**
2. Inspect Burner through sight glass. Is flame present?
   - **NO**
   - **YES**
3. **Initiate heat call. Check CO₂ at high fire is 9.1-9.5%**
   - **In Range**
   - **Out of Range**
4. **Replace Gas Valve**
5. **Replace Flame Sense**
6. **Adjust Gas Mixture See Section 9. Re-check. E-16 still present?**
   - **YES**
   - **NO**
7. **Replace Flame Sense**

Condition Corrected
Troubleshooting Chart 3

**E12 - High Temperature**

Is High Limit Jumper Plug in Place?

- **YES**
- **NO**

Is external High Limit Switch off?

- **YES**
- **NO or N/A**

Reset Switch

Check switches 4 and 5 in wire diagram. Both electrical connected and continuity?

- **YES**
- **NO**

Check Boiler Pump OK?

- **YES**
- **NO**

Water Circulation Adequate?

- **YES**
- **NO**

Purge air in system

Replace Pump

Repair Piping

Replace Heat Exchanger

Does heat exchanger switch 6 (in wire diagram) have continuity?

- **YES**
- **NO**

Re-install plug

Repair plug or replace switch
13 - TROUBLE SHOOTING

Troubleshooting Chart 4

**E10, E11** - Temperature Difference Between Supply and Return Too Great

**E35** - Supply and Return Sensors Reversed

Is return line warmer than supply line?

- **YES**
- **NO**

Check water pressure. Is water pressure at least 15 psig?

- **YES**
- **NO**

Are any water valves partially closed?

- **YES**
- **NO**

Open all valves

Check wire harness against wiring diagram. Are Supply sensor wires green and Return Sensor wires red?

- **YES**
- **NO**

Check wire plugs are securely connected to sensors.

- **YES**
- **NO**

Check both sensors are properly inserted into pipe lines.

- **YES**
- **NO**

Refer to temperature sensor chart

- **YES**
- **NO**

Replace sensor

Replace control board

Onboard pump operation properly?

- **YES**
- **NO**

Possible air in system. De-aerate

Error Code is accurate. Correct system piping.

Wire connections are reversed. Correct wiring connections.

Assure wire harness plugs are securely connected to sensors

Repair sensor insertion into pipe lines

Replace pump

Replace sensor

Replace control board
Troubleshooting Chart 5

E14 - Burner Start Up Failures

Is this a new boiler on first startup?
- **YES**
- **NO**

LP installation?
- **YES**
- **NO**

LP Conversion Kit installed?
- **NO**
- **YES**

Install Conversion Kit

Is the gas shutoff valve closed?
- **NO**
- **YES**

Open the gas shutoff valve

Check all wires including igniter and gas valve are connected and tight
- **YES**
- **NO**

Connect All Wires And Assure Secure Fit

Are ground wires attached and boiler properly grounded?
- **YES**
- **NO**

Provide Proper Ground

Has all air been purged from gas line?
- **NO**
- **YES**

Purge all air from gas line

Check gas inlet pressure at least equals rating plate requirements.
- **NO**
- **YES**

Press RESET for two (2) seconds and retry.
- **Is there a strong, consistent spark?**
  - **NO**
  - **YES**

Remove igniter and inspect. Is there contamination?
- **YES**
- **NO**

Clean Or Replace Igniter

Does the boiler ignite?
- **YES**
- **NO**

Restart the boiler and place into high fire

chimney sweep. Go to display and check flame current. Is there at least 3 mA?
- **YES**
- **NO**

Hold the igniter and retry ignition. Is there a spark?
- **YES**
- **NO**

Replace Spark Generator

Check Venting For Obstruction And Or Wind Effects

Remove burner and inspect. Any sign of damage to burner surface?
- **NO**
- **YES**

Replace Burner

Check interior of heat exchanger for debris or other signs of blockage
- **YES**
- **NO**

Replace Gas Valve

Clean Heat Exchanger
Troubleshooting Chart 6

### E36 - Burner Flame Loss

1. **LP Installation?**
   - NO
   - YES

2. **LP Conversion kit installed?**
   - NO
   - YES
   - **NO**
   - **YES**

3. **Install LP Conversion Kit**

4. **Is gas shutoff valve fully open?**
   - NO
   - YES
   - **NO**
   - **YES**

5. **Open Gas shutoff valve.**

6. **Check all wires including igniter and gas valve are connected and tight.**
   - NO
   - YES
   - **YES**
   - **NO**

7. **Are ground wires attached? Is boiler properly grounded?**
   - NO
   - YES
   - **NO**
   - **YES**

8. **Connect all wires assure secure fit.**

9. **Has all air been purged from gas line?**
   - NO
   - YES
   - **NO**
   - **YES**

10. **Purge all air from gas line.**

11. **Check gas inlet pressure at least equals rating plate requirements**
   - NO
   - YES
   - **NO**
   - **YES**

12. **Check gas line for obstructions**

13. **Refer to section 6 of IOM and correct vent terminations**

14. **Remove igniter and inspect. Is there damage or contamination?**
   - NO
   - YES
   - **YES**
   - **NO**

15. **Clean or Replace Igniter**

16. **Restart boiler. Go to display and check flame current. Is there at least 3 mA?**
   - NO
   - YES
   - **YES**
   - **NO**

17. **Check venting for obstruction and/or wind effects**
   - NO
   - YES
   - **NO**
   - **YES**

18. **Clear Vent Obstruction**

19. **Replace Spark Generator**

20. **Check interior of heat exchanger for debris or signs of blockage**
   - NO
   - YES
   - **YES**
   - **NO**

21. **Replace gas valve**

22. **Clean Heat Exchanger**

23. **Remove burner and inspect. Any sign of damage to burner surface?**
   - NO
   - YES
   - **YES**
   - **NO**

24. **Replace Burner**
Troubleshooting Chart 7

E34 - Fan Fault

Check all wires including blower valve are connected and tight

YES  NO

Check venting for obstruction (both inlet and exhaust)

NO  YES

Replace Blower Assembly  Clear Vent Obstruction

Connect all wires and assure secure fit

Troubleshooting Chart 8

E39 - Shutdown Input In Locked Out Mode

Check BL connection on control board terminal strip. Is this function being utilized?

YES  NO

Are the wire connections secure?

NO  YES

Secure wire connections

Check external accessories are correct

YES  NO

Check external accessories are correct

Replace Control Board  Change Installation Parameters As Required

Repair/Replace External Accessory Item As Required

Is factory installed jumper securely in place?

YES  NO

Install jumper securely in place
Troubleshooting Chart 9

**E40 - HRU/URC Unit test error**

Is HRU terminal being used on the auxiliary SCU board (see section 8)?

- YES
- NO

Is wiring connection to HRU terminal secure?

- NO
- YES

Fix Wiring Connection

Is Parameter P42 set to 1?

- NO
- YES

Set P42 to 1

- OK
- Not OK

Done

Is wiring connection from SCU board to main board secure?

- YES
- NO

Fix Wiring Connection

Is P42 parameter set to 0?

- YES
- NO

Set P42 to 0

- OK
- NOT OK

Done

Replace SCU board

- NOT OK
- OK

Replace Main Control Board

Done

Is HRU accessory operating properly?

- NO
- YES

Correct HRU Accessory
**Troubleshooting Chart 10**

**E42 - Low Water Pressure**

Check system water pressure with tridicator or other device. Is water pressure at least 15 psig?

**YES**

Complete System Water Pressure

**NO**

Secure Wire Harness Connections

Check wire harness connections are secure

**OK**

Correct Installation

**NOT OK**

Replace Sensor.

Is low water pressure sensor (item 12 in wiring diagram) securely installed to block?

**Yes**

Done

**NO**

Correct Installation

Replace Control Board

The error code is accurate. Correct water pressure and/or correct system leaks.

**Note:** This error code refers to the onboard low water pressure switch, not any field installed external low water cutoff device.
Troubleshooting Chart 11

**E43 - No Water Temperature Difference During Operation**

- Start Boiler.
- Is supply line warmer than return line?
  - **YES**
  - **NO**

  - Onboard pump operating properly?
    - **YES**
    - **NO**

      - Possible air in the system. De-aerate.
      - **NOT OK**
      - **OK**

      - **Done**

  - Check both sensors are properly inserted into pipe lines.
    - **NO**
    - **YES**

      - Repair Sensor Insertion Into Pipe Lines.
      - Refer to Temperature Sensor Chart (both sensors)
        - **OK**
        - **Not OK**

      - Replace Sensor
      - Replace Control Board

- Check wire plugs are securely connected to temperature sensors.
  - **NO**
  - **YES**

  - Assure wire harness plugs are securely connected to sensors
### Figure 13-1 Temperature-Resistance Chart for Supply and Return Temperature Sensors

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**APPLIANCE** - Device to convert gas into energy; term includes any component, control, wiring, piping or tubing required to be part of the device.


**ASTM** - American Society for Testing and Materials. ASTM International is one of largest voluntary standards development organizations in world trusted source for technical standards for materials, products, systems, and services. Known for their high technical quality and market relevancy, ASTM International standards have important role in information infrastructure that guides design, manufacturing and trade in the global economy.

**AUTHORITY HAVING JURISDICTION** - Individual or organization adopting and enforcing codes, rules, and by-laws governing various concerns of community. Commonly referred to as "final authority" for any matters relating to LIFE SAFETY and BUILDING CONSTRUCTION within a community.

**BOILER** - Appliance intended to supply hot liquid for space-heating, processing or power purposes.

**Btu** - Abbreviation for British Thermal Unit. Quantity of heat required to raise temperature of 1 pound of water 1°F.

**BURNER** - Device for final conveyance of gas or mixture of gas and air, to combustion zone.

**CALIBRATE** - Make fine adjustments or divide into marked intervals for optimal measuring.

**COMBUSTION** - Rapid oxidation of fuel gases accompanied by production of heat or heat and light. Complete combustion of fuel is possible only in presence of adequate supply of Oxygen.

**COMBUSTIBLE MATERIAL** - Materials made of or surfaced with wood, compressed paper, plant fibers, or other materials capable of being ignited and burned. Such material shall be considered combustible even though flame-proofed, fire-retardant treated, or plastered.

**COMBUSTION AIR** - Air that is drawn into an appliance to mix with fuel and support combustion.

**CONDENSATE** - Liquid separated from flue gas due to reduction in temperature.

**DIRECT VENT BOILER** - Boiler constructed and installed so all combustion air is derived directly from outdoors and all vent gases are discharged to outdoors.

**DOMESTIC** - Relating to household usage as opposed to commercial usage.

**DOMESTIC WATER** - Potable drinking water - tap water.

**DRAFT** - Pressure difference causes gases or air to flow through a chimney, vent, flue or appliance.

**FLA** - Full load amps.

**FLUE** - Enclosed passageway for conveying combustion gases.

**FLUE GASES** - Products of combustion plus excess air in appliance flues or heat exchanger.

**GAS SUPPLIER** - Party that sells commodity of Natural Gas (Gas A) or LPG (Gas E).

**HIGH-VOLTAGE** - Circuit involving potential of not more than 600 volts and having circuit characteristics in excess of those of low-voltage circuit.

**IGNITER** - Device utilizing electrical energy to ignite gas at main burner.

**LEAK CHECK** - Operation performed on gas piping system to verify system does not leak.

**LICENSED QUALIFIED INSTALLER / SERVICE TECHNICIAN** - any individual, firm, corporation or company that either directly or through a representative is engaged in the installation, replacement, repair or servicing of gas piping, venting systems, appliances, components, accessories, or equipment, and whose representative is experienced and trained, in such work and has complied with the requirements of the authority having jurisdiction.

**LOW WATER CUTOFF** - Device constructed to automatically cut off fuel supply when surface of water in boiler falls to lowest safe water level.

**LOW-VOLTAGE** - Circuit involving potential of not more than 30 volts.

**METRIC GAS METERS**

<table>
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<th>Natural Gas</th>
<th>MBH = 127,116 x [\text{cu meters} / \text{Seconds}]</th>
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</table>
| Propane Gas (LP) | MBH = \[
\frac{383,482 \times \text{cu meters}}{\text{Seconds}}\] |

For example: Gas Meter measures 0.1 cubic Meters in 100 seconds

MBH = \[
\frac{127,116 \times 0.1}{100} = 127 \text{ MBH}\]

PN 240011656 REV. F [02/28/2019]
• **PRESSURE TEST** - Operation performed to verify gas tight integrity of gas piping following its installation or modification.

• **PURGE** - To free gas conduit of air or gas, or mixture of gas and air.

• **PURGE TIME** - Period of time intended to allow for dissipation of any unburned gas or residual products of combustion.

• **QUALIFIED AGENCY** - Any individual, firm, corporation, or company engaged in and responsible for:
  - Installation, testing, or replacement of gas piping, or connection, installation, testing, repair or servicing of appliances and equipment.
  - Experienced in such work.
  - Familiar with all precautions required.
  - Complies with all requirements of authority having jurisdiction.

• **SAFETY RELIEF VALVE** - Valve designed to relieve pressure in hot water supply system when pressure exceeds pressure capability of equipment.

• **SAFETY SHUTOFF DEVICE** - Device that will shut off gas supply to controlled burner in event source of ignition fails.

• **SEDIMENT TRAP** - Gas piping arrangement designed to collect any liquid or solid contaminant before reaching gas valve.

• **SERVICE** - Supply, installation, or maintenance of goods carried out by a Qualified Installer / Service Technician.

• **TWO PIPE SYSTEM** - Type of venting that allows for exhaust flue and intake air piping to be separated from each other. Fresh air may be drawn in at a different area from where flue terminal is located.

• **VENT** - Passageway used to convey flue gases from appliance vent connector to outdoors.

• **VENTING SYSTEM** - Continuous open passageway from of appliance vent connector to outdoors for purpose of removing flue or vent gases.
IMPORTANT

In accordance with Section 325 (f) (3) of the Energy Policy and Conservation Act, this boiler is equipped with a feature that saves energy by reducing the boiler water temperature as the heating load decreases. This feature is equipped with an override which is provided primarily to permit the use of an external energy management system that serves the same function.

THIS OVERRIDE MUST NOT BE USED UNLESS AT LEAST ONE OF THE FOLLOWING CONDITIONS IS TRUE:

• An external energy management system is installed that reduces the boiler water temperature as the heating load decreases.
• This boiler is not used for any space heating
• This boiler is part of a modular or multiple boiler system having a total input of 300,000 BTU/hr or greater.
• This boiler is equipped with a tankless coil.