



Condensing Wall Mounted Gas Fired

INSTALLATION, OPERATION & MAINTENANCE MANUAL

Models
GMHB227
GMHB380



Manufactured by:
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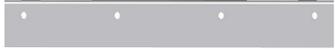
			
<p>Fully Assembled Boiler</p>	<p>Metal Wall Bracket</p>	<p>Safety Relief Valve 30 PSI (227) 50 PSI (380) Maximum 50 PSI</p>	<p>Temperature Gauge</p>
	<p>Includes essential documents.</p>	<p>Used for measuring outside temperature</p>	<p>Used for connecting condensate piping to boiler</p>
<p>Gas Shutoff Valve</p>	<p>Document Package</p>	<p>Outdoor Sensor (Optional)</p>	<p>Condensate Drain Connections</p>
 <p>Concentric to Two Pipe Adapter</p>			

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PHYSICAL DATA

Dimensions

DIMENSIONS		GMHB227	GMHB380
A	Height	30 " [763 mm]	37 ⁷ / ₁₆ " [951 mm]
B	Width	17 ³ / ₄ " [450 mm]	23 ⁵ / ₈ " [600 mm]
C	Depth	22 ⁵ / ₈ " [585mm]	25 ³ / ₈ " [644 mm]
D	Condensate Trap Connection	3/4" NPT	3/4" NPT
E	System Supply	1 ¹ / ₄ " NPT	1 ¹ / ₂ " NPT
F	Gas Connection	3/4" NPT	1 " NPT
G	System Return	1 ¹ / ₄ " NPT	1 ¹ / ₂ " NPT
Primary Water Content		1 ¹ / ₄ gal [4.73 L]	4.6 Gal (17.4L)

SYSTEM

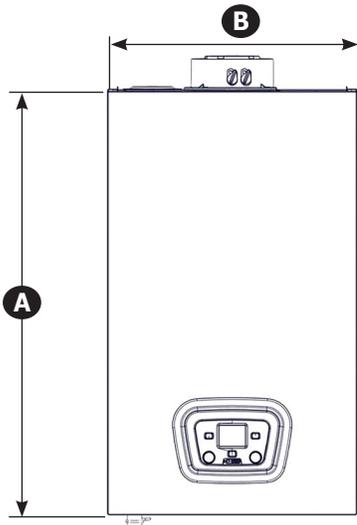
Central Heating (Sealed System)	GMHB227	GMHB380
Heat Exchanger Max Allowable Working Pressure	50 psig [3.45 bar]	80 psig [5.5 bar]
Max System Pressure	43.00 psig [2.96 bar]	43.00 psig [2.96 bar]*
Min System Pressure	7.25 psig [0.50 bar]	7.25 psig [0.50 bar]
Max System temperature	176°F [80°C]	176°F [80°C]
Pressure Relief Valve Setting*	30.00 psig [2.11 bar]	50.00 psig [3.44 bar]
Recommended System Pressure (cold)	21.7 psig [1.5 bar]	21.7 psig [1.5 bar]

* Onboard pressure switch display limit.

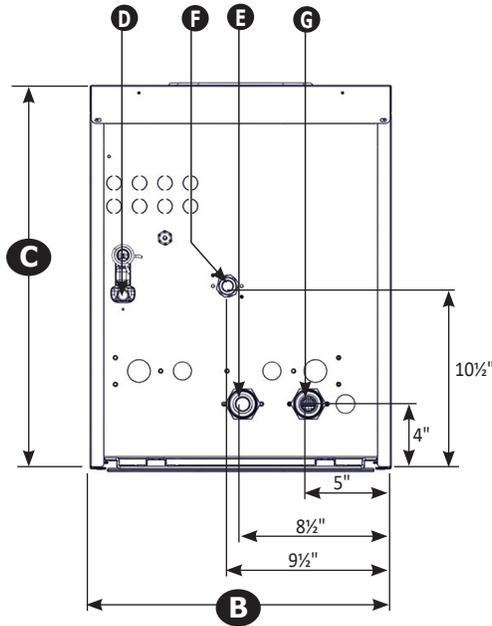
Pressure relief valve connection 3/4" NPT

PHYSICAL DATA

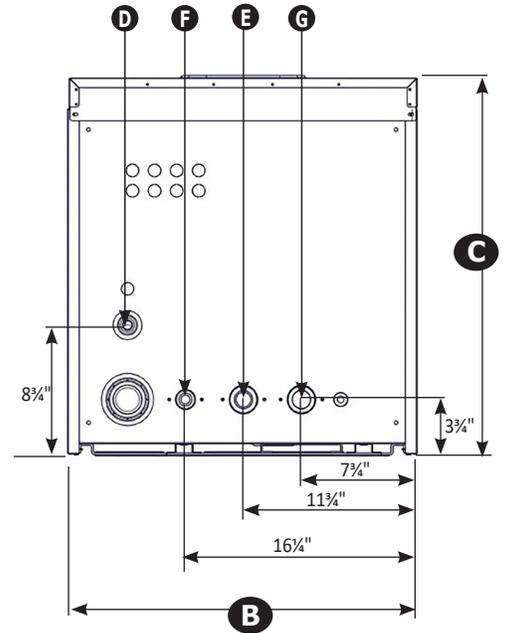
**Front View
All Models**



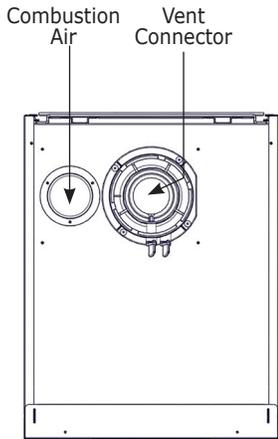
**GMHB227
ONLY
Bottom View
Dimensions**



**GMHB380
ONLY
Bottom View
Dimensions**



**Top View
All Models**



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

⚠ DANGER



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.

Water Temperature Setting	1st Degree Burn Exposure Time For An Adult	2nd and 3rd Degree Burn Exposure Time For An Adult
120° F	1 minute	5 minutes
130° F	5 seconds	30 seconds
140° F	2 seconds	5 seconds
150° F	1 second	1.5 seconds
160° F	Instantaneous	0.5 seconds

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 Fuel Gas Code, ANSI Z223.1/NFPA 54.
- 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.
- For use with natural gas or liquefied petroleum gases (LP/propane).
- GMHB380 single vent pipe option.

2.6 The unit MUST NOT:

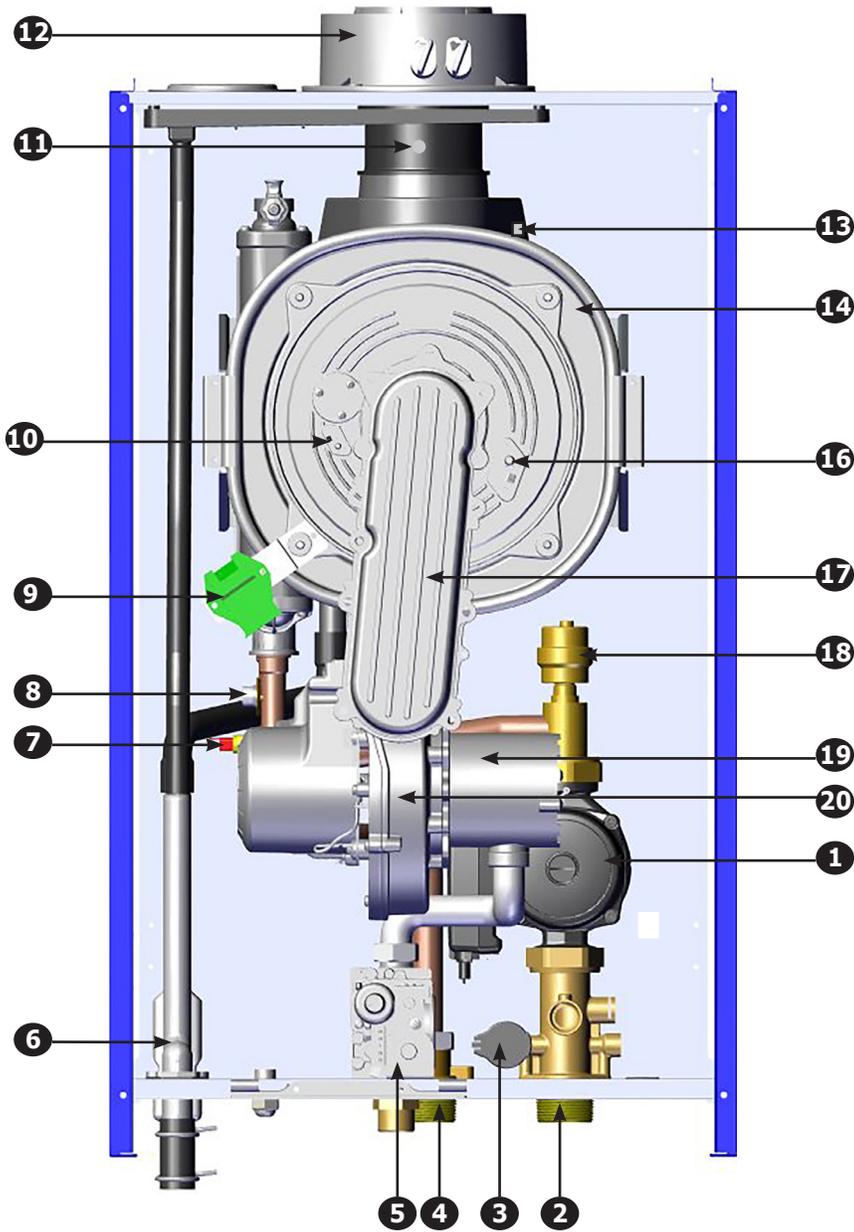
- Directly heat potable water. Indirect heating is acceptable.
- Heat water with non-hydronic heating system chemicals present (example, swimming pool water).
- Exceed:
 - (GMHB227) - 50 psig (3.44 bar)
 - (GMHB380) - 80 psig (5.5 bar)Maximum allowable working pressure, or drop below minimum system pressure 7.25 psig (.50 bar)
- Exceed 176°F (80°C) system design temperature.

2.7 Operational Features

- Modulating: (GMHB227) 20-100% Input Rate.
(GMHB380) 16-100% Input Rate.
- Integral Dual Limit.
- Integral Low Water Pressure Cutoff.
- Outdoor Temperature Reset. (Optional)
- Heat exchanger over heat protection.
- Recommended system pressure (cold) 21.7 psig (1.5 bar)

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

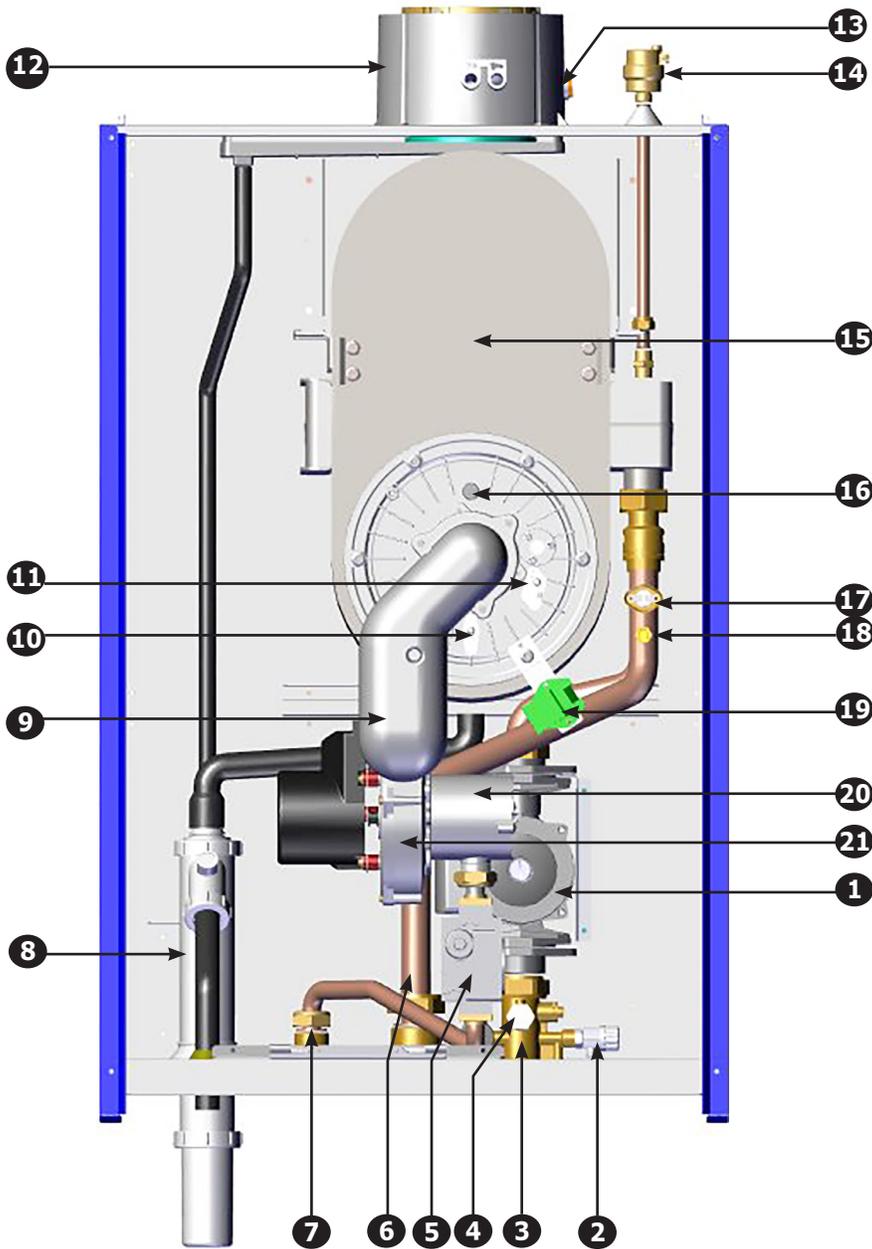
3 - COMPONENT LISTING



ITEM NO.	GMHB227
1	Pump
2	System Return
3	Low Water Pressure Cutoff
4	System Supply
5	Gas Valve
6	Condensate Trap
7	NTC Heating sensor (Supply/Return) QTY 2, (1 Shown for clarity)
8	Water Safety Thermostat
9	Spark Generator
10	Ignition Electrode
11	Flue Sensor
12	Coaxial Connector
13	Heat Exchanger Temperature Sensor
14	Heat Exchanger
15	Burner (not shown)
16	Flame Detection Electrode
17	Air/Gas Blend Manifold
18	Air Purge
19	Venturi
20	Fan

Illustrations are a depiction of the boiler for general location of parts and may vary depending on model.

3 - COMPONENT LISTING



ITEM NO.	GMHB380
1	Pump
2	Boiler Drain
3	System Return
4	Low Water Pressure Cutoff
5	Gas Valve
6	System Supply
7	Gas Supply
8	Condensate Trap
9	Air/Gas Blend Manifold
10	Ignition Electrode
11	Flame Detection Electrode
12	Coaxial Connector
13	Flue Sensor
14	De-Aerator
15	Heat Exchanger
16	Heat Exchanger Temperature Sensor
17	Water Safety Thermostat
18	NTC Heating sensor (Supply/Return) QTY 2, (1 Shown for clarity)
19	Spark Generator
20	Venturi
21	Fan
22	Burner (not shown)

Illustrations are a depiction of the boiler for general location of parts and may vary depending on model.

WARNING

Fire Hazard! Do not install on carpeting. Failure to follow these instructions could result in death or serious injury.

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

Dimension	Combustible Materials ⁽¹⁾	Service ⁽¹⁾⁽²⁾
Model GMHB227 - Top (A)	0" (0 mm)	11-13/16" (302 mm)
Model GMHB380 - Top (A)	0" (0 mm)	15-3/4" (400 mm)
Left Side (B)	1-3/4" (45 mm)	1-3/4" (45 mm)
Right Side (C)	1-3/4" (45 mm)	1-3/4" (45 mm)
Front (D)	1-3/4" (45 mm)	17 3/4" (450mm)
Back (E)	0" (0 cm)	0" (0 cm)
Model GMHB227 Bottom (F)	*9-7/8" (250 mm)	-
Model GMHB380 Bottom (F)	-	11-13/16" (302 mm)

⁽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

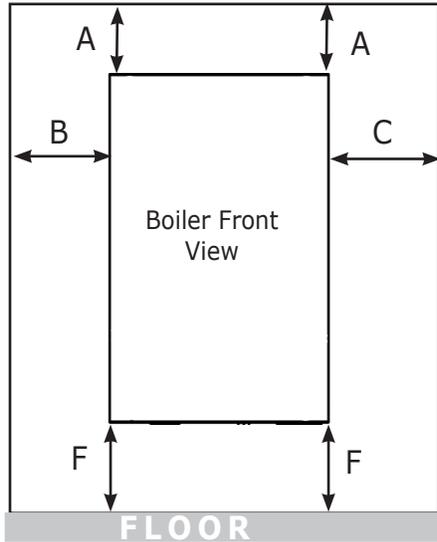


FIGURE 4-1b Clearance to Combustible Materials

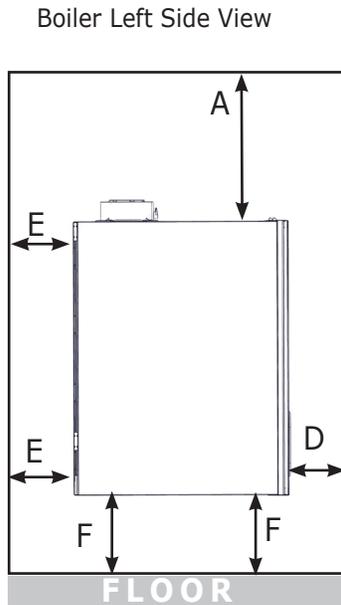


FIGURE 4-2a Service Clearances - Boiler Front

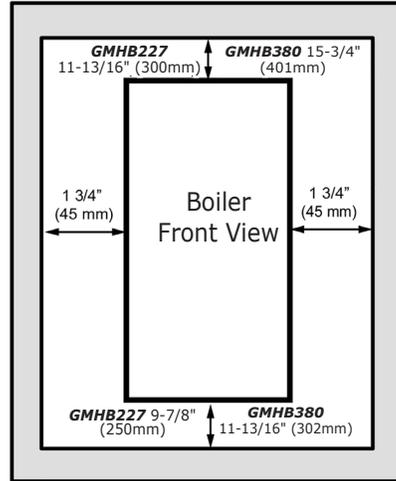


FIGURE 4-2b Service Clearances - Boiler Left side

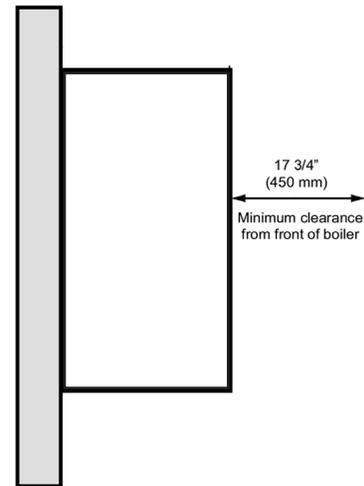
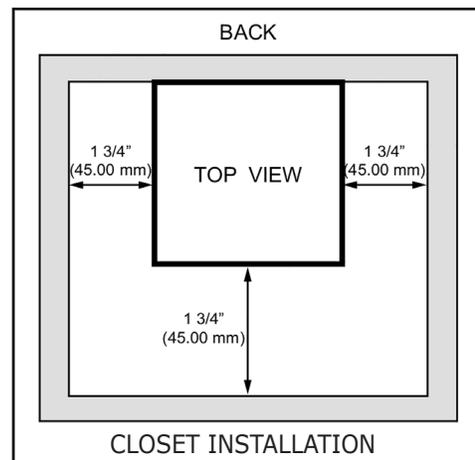


FIGURE 4-2c Service Clearances - Closet Installation

CLEARANCES REQUIRED FOR CLOSET INSTALLATION



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

! CAUTION

Boiler weight exceeds 140 pounds (63.5 kg). Do not lift boiler onto wall without assistance.

Note Lift boiler using chassis. Using front jacket, vent piping, water or gas fittings to lift boiler may cause damage to the boiler.

Note Use two (2) wrenches when tightening and fitting to pipe boiler's threaded fittings. Boiler's internal piping can be damaged if subjected to excessive torque.

4.2 Wall Mounting

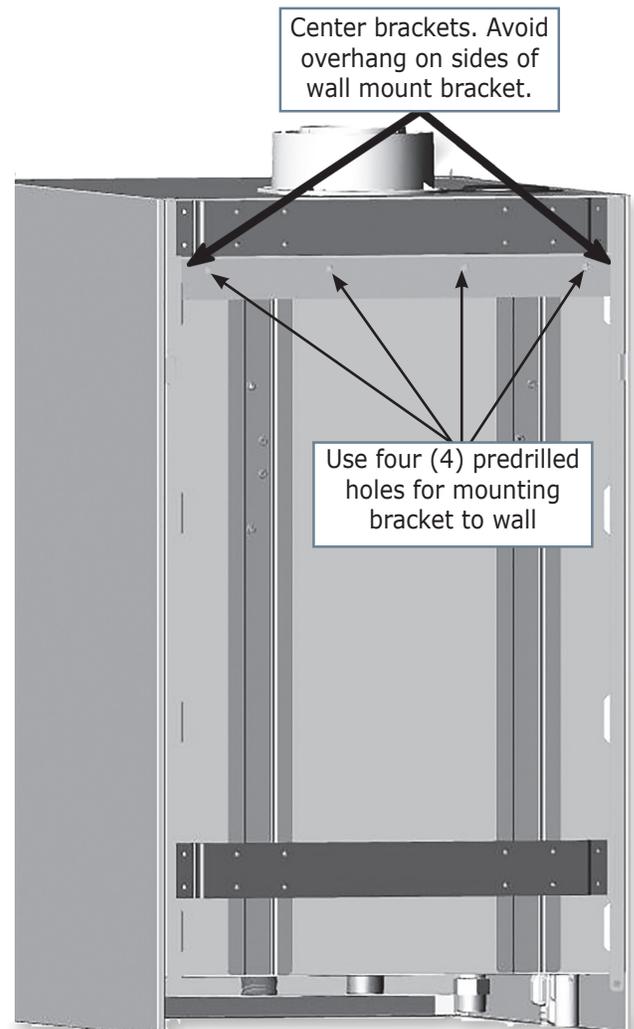
Pre-pipe supply and return water connections with factory fittings before wall mounting.

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 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.

FIGURE 4-3 Wall Mount Bracket (Included)



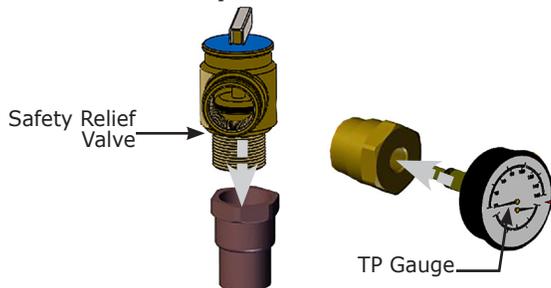
Note **GMHB227** - Boiler rated at 50 psig (3.5 Bar) maximum allowable working pressure.

GMHB380 - Boiler rated at 80 psig (5.5 Bar) maximum allowable working pressure.

Boiler provided with 50 psig (3.5 Bar) safety relief valve.

Note When installing safety relief valve it must be installed in a vertical position with spindle at top.

FIGURE 5-1 Safety Relief Valve



⚠ WARNING

- Poison hazard. Ethylene glycol is toxic. Do not use ethylene glycol.
- Never use automotive or standard glycol antifreeze, even ethylene glycol made for hydronic systems.
- Ethylene glycol can attack gaskets and seals used in hydronic systems.
- Do not use petroleum based cleaning or sealing compounds boiler system.
- Do not fill boiler or boiler system with softened water.
- Use only inhibited propylene glycol solutions certified by fluid manufacturer as acceptable for use with closed water heating system.
- Thoroughly clean and flush any system that used glycol before installing new Boiler.
- Provide user with Material Safety Data Sheet (MSDS) on fluid used.

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.

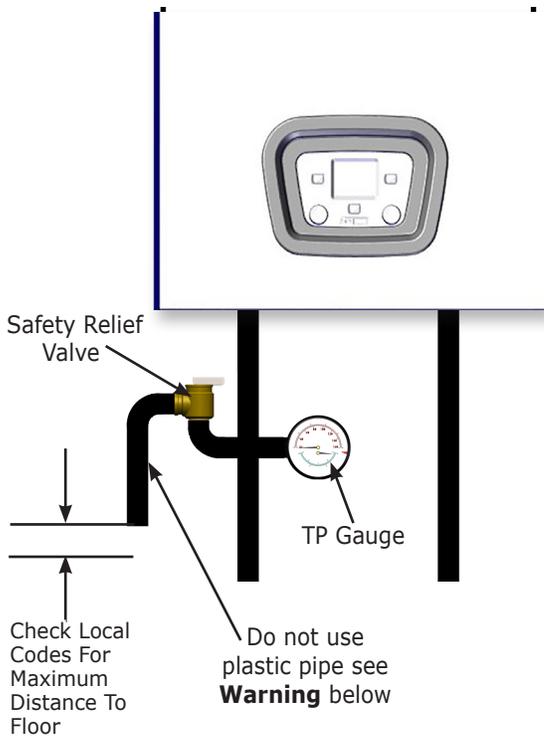
- Thoroughly clean and flush system before connecting to boiler.
- If oil is present in system water, use approved detergent to wash system.
- It is necessary to semi-annually check the water quality of central heating systems.
- Flush system to remove any solid objects such as metal chips, fibers, or Teflon tape, etc.
- 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 exchanger surfaces and accumulate in pump cavities causing reduced efficiency and premature wear.
- 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.
- 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

Note Do not expose boiler and condensate piping to freezing temperatures.

- 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.

FIGURE 5-2 Safety Relief Valve Discharge Piping

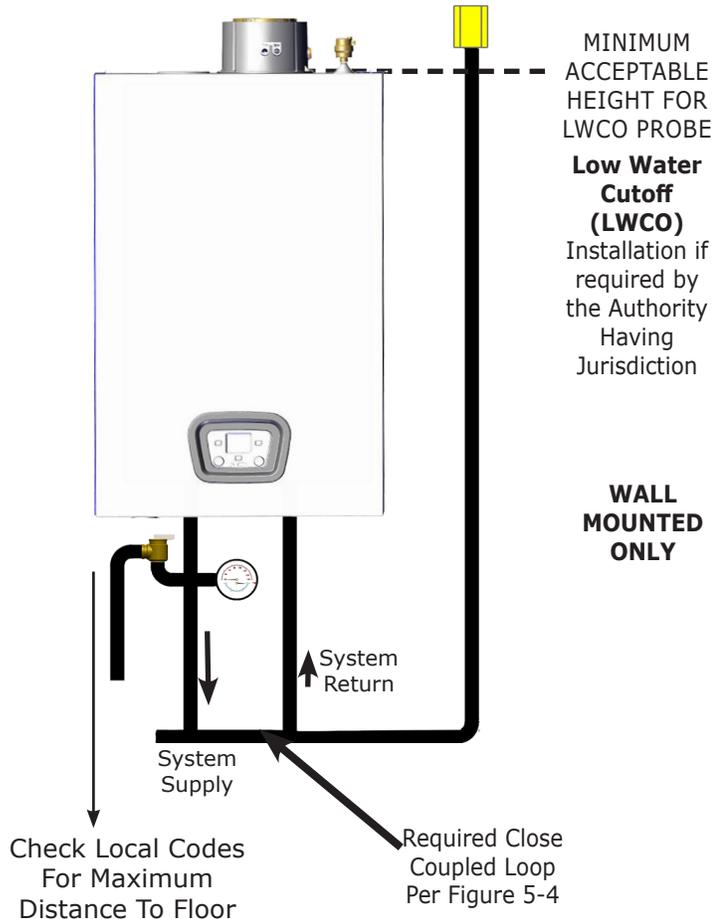


⚠ WARNING
 Burn and scald hazard. Safety relief valve could discharge steam or hot water during operation. Install discharge piping per these instructions.

5.3 Safety Relief Valve

- 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 3/4" 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).

FIGURE 5-3 System Piping - LWCO Probe Location



⚠ WARNING
 Fire, explosion hazard. Mount boiler vertically or slightly tilted backward to insure proper function of low water cutoff. Failure to follow these instructions could result in death or serious injury.

5.4 Low Water Cutoff

These guidelines are supplied when necessary to install an additional Low Water Cut Off (LWCO), for sensing a low water level condition in a boiler, as required by the Authority Having Jurisdiction.

- Boiler is equipped with Low Water Pressure Switch.
- Low Water Cutoff (LWCO) probe location. See figure 5-3 for minimum probe height. Do not install shutoff valve between boiler and LWCO probe.
- If using separate stand pipe, install air vent using tee to avoid nuisance shutdowns.
- Arrange piping to prevent water dripping onto boiler.
- Connect probe signal wires to shutdown terminal (BL) on control board.

5.5 Trim Piping

- Temperature - Pressure Gauge. Install temperature pressure gauge using piping provided with boiler. See figure 5-2. Boiler has integral drain valve located inside jacket directly underneath pump. Install provided external drain valve.

5.6 System Piping

- Systems with automatic fill valves require back flow prevention device.
- Single boiler system. See figure 5-4, for general guidance. Additional considerations:
 - Boiler control does not accommodate central heating pump. Installer is responsible for integration of central heating pumps with field sourced control.
 - 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 figure 5-5 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. Flush system (wash) clean after installing all piping. Debris or cutting oils, etc., left inside system will reduce heat transfer in heat exchanger. Small pieces of Teflon tape are eventually trapped in the water pump impeller and reduce water flow rate. Non-flushed systems have low energy efficiency and potential boiling noise due to ineffective heat transfer and reduced water flow rate. Flush all zones one by one, when flushing the system.
- Secure all valves/fittings to boiler.
- Connect system valve pipe work to the boiler.
- Route pressure relief valve discharge piping to the floor. Follow local code with respect to necessary distance to the floor. See Figures 5-2 and 5-3.

WARNING

Burn and scald hazard. Safety relief valve could discharge steam or hot water during operation. Install discharge piping per these instructions.

- Route pressure relief valve discharge piping to the floor. Follow local code with respect to necessary distance to the floor. See Figure 5-2.
- Verify all valves are closed.
- 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.

Note

Illustrations are meant to show system piping concept only. Installer responsible for all equipment and detailing required by authority having jurisdiction.

Piping Legend

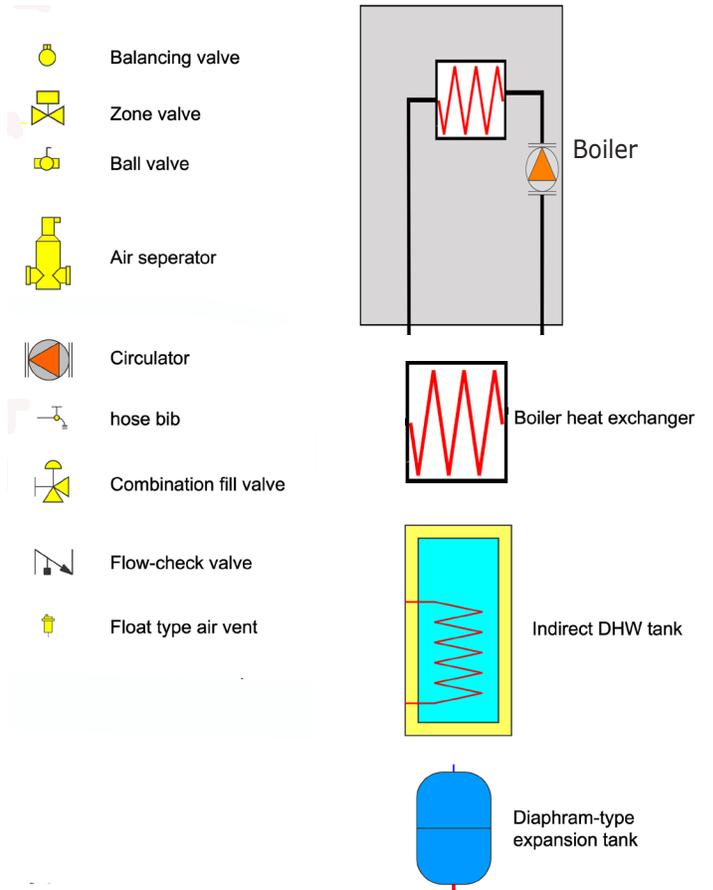
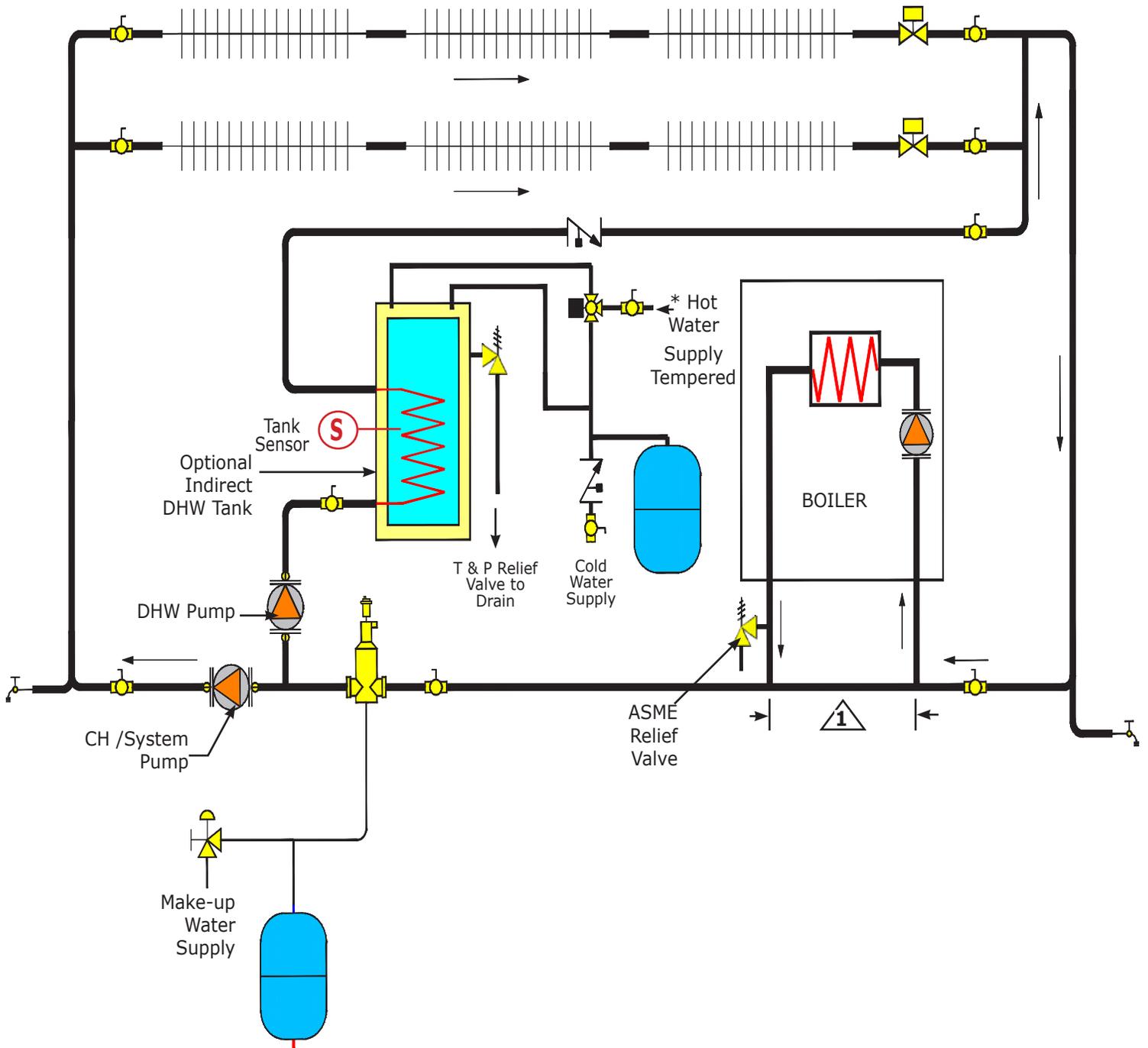


FIGURE 5-4 - Primary/Secondary, Zoned, WITH ZONE VALVES, (Optional) Indirect Tank



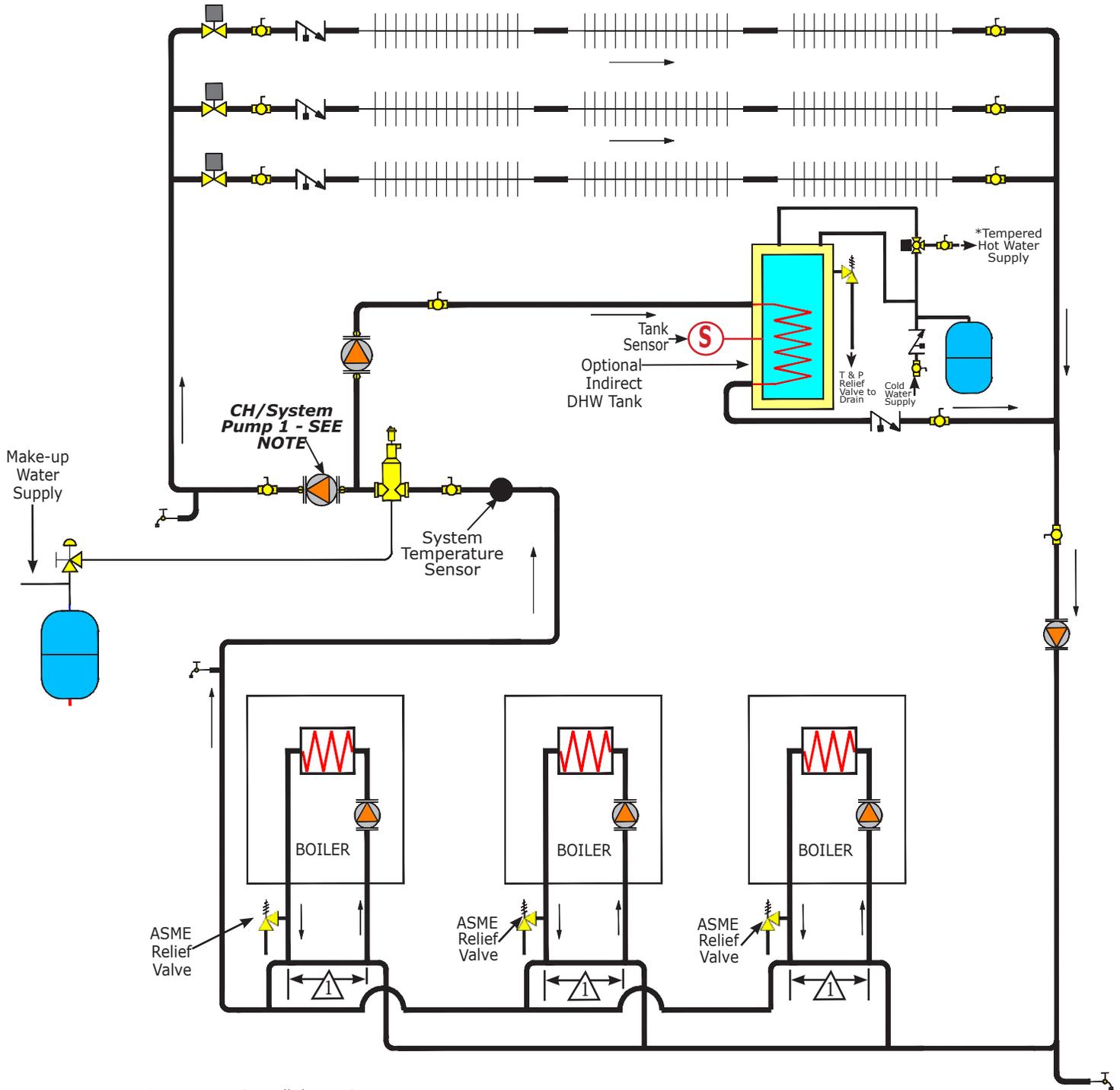
Note * Manufacturer requires all domestic hot water (DHW) installations use an anti-scald valve. Local codes may require additional equipment (expansion tank, relief valves, etc.) Select and size equipment to suit installation and meet code requirements.

Note 1 12" (305mm) Maximum Separation

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

5 - HYDRONIC PIPING

FIGURE 5-5 - Multiple Boilers with Individual Primary Secondary, Zone Valves and (Optional) Indirect



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 *CH/System Pump 1 must match total capacity of all boilers*

Note 12" (305mm) Maximum Separation

UP TO 6 BOILERS

# Boilers on Pipe Branch	Pipe Size
2	2
3	2½
4	3
5	3
6	4
7	4
8	4

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

WARNING

Fire, explosion, and asphyxiation hazard. Improper installation could result in death or serious injury. Read these instructions and understand all requirements before beginning installation.

WARNING

ABS/PVC venting shall not to be used this product. Use of DWV plumbing pipes to vent this boiler shall be prohibited.

Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenolsulfone) in venting systems shall be prohibited.

Covering non-metallic vent pipe and fittings with thermal insulation shall be prohibited.

Failure to follow these instructions could result in death or serious injury.

Note *Follow venting manufacturer's equivalent lengths for specialty fittings.*

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. (For 380 Only, optional 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.
- Use only manufacturer approved venting materials or venting materials primer and glue approved to: ULC S636 in Canada, or UL 1738 in the U.S.
- 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/ASTM F493.
- Vent system must have unrestricted movement through walls, ceilings and roof penetrations.
- Check for proper joint construction when joining pipe to fittings.
- If vent is penetrating ceilings and floors, openings must have means of fire stopping in joist areas and proper firestop spacer assemblies installed.
- Standard roof flashing methods must be used to install roof flashing.
- Frame wall and roof openings to provide support for attachment of termination assemblies.
- 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.m) or less. Allow for expansion/contraction of pipe.

- Venting shall be supported adjacent to each joint using steel strapping or equivalent. See Figure 6-1.
- Support horizontal sections of vent pipe to prevent sags capable of accumulating condensate.
- Assemble vent materials in accordance with venting manufacturer's instructions.
- Slope exhaust pipe minimum of 1/4" per foot, or vent manufacturer's recommendation, whichever is greater; back toward the boiler.
- Any "in line" elbows in flue system must be taken into consideration. First elbow on the top of the boiler is included in equivalent length calculations.
- Use U.V. Stabilized polypropylene when it will be exposed to sunlight, wind, or prone to freeze ups.

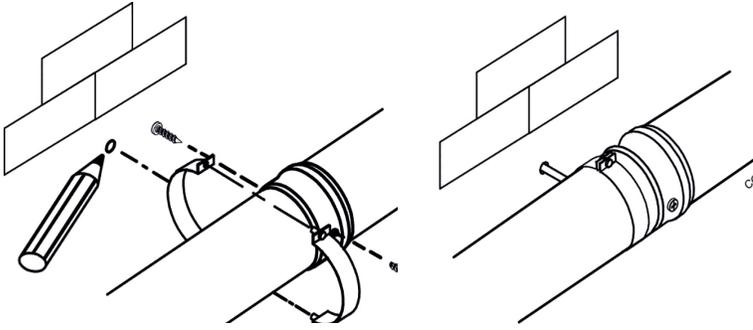
6.2 Removal of Existing Boiler From Common Vent System

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.

Figure 6-1 - Venting Support

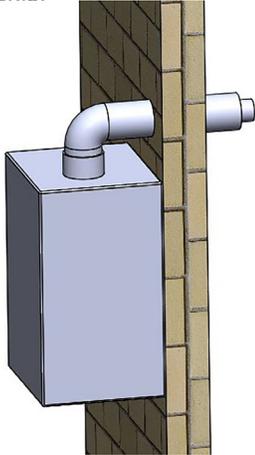


6.4 Securing Twin Pipe Polypropylene Venting

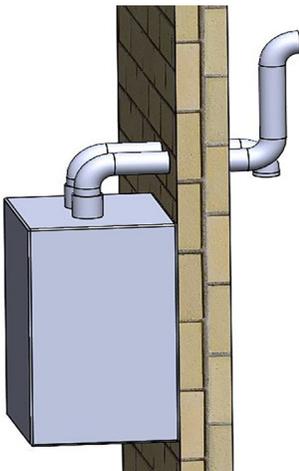
Note Venting manufacturer's use a device to secure single wall twin pipe polypropylene vent pieces to each other. Proper application of the securing mechanism is necessary for any use of twin pipe polypropylene venting on exhaust or air intake. Securing mechanism is for indoor use only and should not be used in outdoor applications. Follow venting manufacturer's instructions for applying the securing mechanism on twin pipe polypropylene venting.

6.3 Definitions

1. **Coaxial piping** - **Figure 6-2** exhaust and air intake pipe have a common axis.



2. **Twin Pipe** - **Figure 6-3** 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.



Example for Natalini venting system.

(For other venting system suppliers see their instructions.)

1. Place clamp so etched "UP" is facing up.
2. Open clamp slightly by separating circular areas from each other.
3. Slide male end of first pipe through open clamp so the shoulder of the female end of the pipe stops the clamp from sliding off the pipe.
4. Insert the male end of the second pipe into the clamp on the "up" etched side. Force the two pipes together.
5. Verify the two pipes are secure together with clamp in place.

Figure 6-4 - Natalini Clamp



6 - COMBUSTION AIR AND VENT PIPING

6.5 Approved Venting Materials

⚠ WARNING

Manufacturer recommends this condensing boiler be vented with approved polypropylene venting material. Use only materials listed below for vent pipe, intake air pipe, and fittings. Failure to comply could result in death or serious injury.

⚠ WARNING

- Covering non-metallic vent pipe and fittings with thermal insulation shall be prohibited.
- Use of cellular core PVC for venting flue gas could result in death, or serious injury.
- Coaxial venting shall be fastened with screws. Dual flue venting is NOT fastened with screws.

⚠ WARNING

Do not use cellular core pipe. Only specified sized pipes are to be used. When using venting material other than boiler manufacturer's venting, note the correct installation procedure. Failure to follow these instructions could result in death, or serious injury.

Installation shall conform to requirements of authority having jurisdiction or in absence of such requirements:

- USA - National Fuel Gas Code, ANSI Z223.1/NFPA 54.

1. Venting shall be properly supported.
2. Boiler shall not support any type of vent system.
3. All piping, glue, solvents, cleaners, fittings and components must conform to ASTM and ANSI standards. In Canada ULC S636 and in the USA UL 1738 schedule 40 CPVC are the only approved vent system to be used as an alternative to polypropylene venting for the exhaust pipe.
4. Manufacturer requires use of a mechanical fastener at every push-fit gasket connection when using a single wall polypropylene vent system.

6.6 Vent Termination

- Terminate combustion air and vent pipes with fittings or coaxial 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 and vent terminals as required by authority having jurisdiction.

Approved Polypropylene Manufacturers

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

Note: Maximum equivalent length may vary between manufacturers.

Vent Material Options			
GMHB227		GMHB380	
1	5"/3" [125mm/80m] polypropylene coaxial.	1	4" / 6" [110 mm / 1600 mm] polypropylene coaxial.
2	3" [80mm] polypropylene twin pipe. Shall be polypropylene on BOTH intake and exhaust.	2	4" [110mm] polypropylene twin pipe. Shall be polypropylene on BOTH intake and exhaust.
3	3" [80mm] flexible polypropylene for chimney exhaust vent, shall have rigid 3" [80mm] polypropylene on air intake.	3	4" [110mm] flexible polypropylene for chimney exhaust vent, shall have rigid 4" [110mm] polypropylene on air intake.
<p>* Note: Adapters and fittings used with all vent systems shall be from same manufacturer and compatible with the vent pipe. See list for approved Manufacturers.</p>			

WARNING

- Covering non-metallic vent pipe and fittings with thermal insulation shall be prohibited.
- Use of cellular core PVC for venting flue gas could result in death, or serious injury.
- Concentric venting shall be fastened with screws. Dual flue venting is NOT fastened with screws.

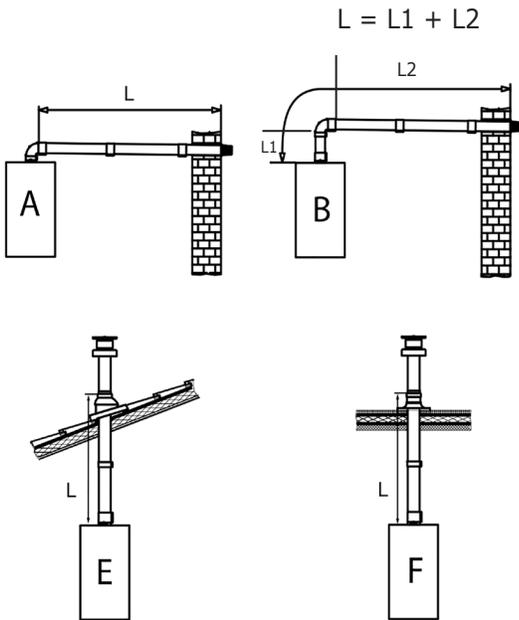
6.7 Coaxial Venting

A. Venting Instructions

Maximum Length = L	
A B	21' (6.4 m)
E F	21' (6.4 m)

Coaxial Elbows - Equivalent length	
Elbow	Total Length Reduction
45°	1' 8" (0.5 m)
90°	3' 4" (1.0 m)

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

FIGURE 6-4 Side Wall Concentric Venting

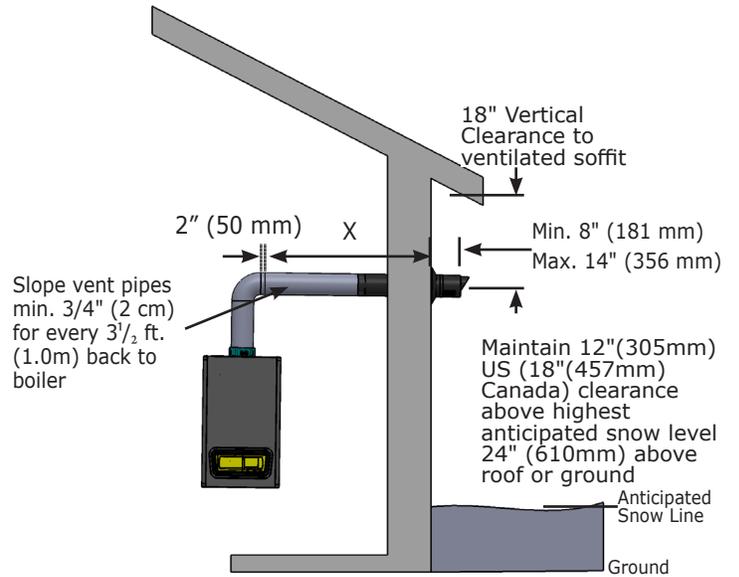
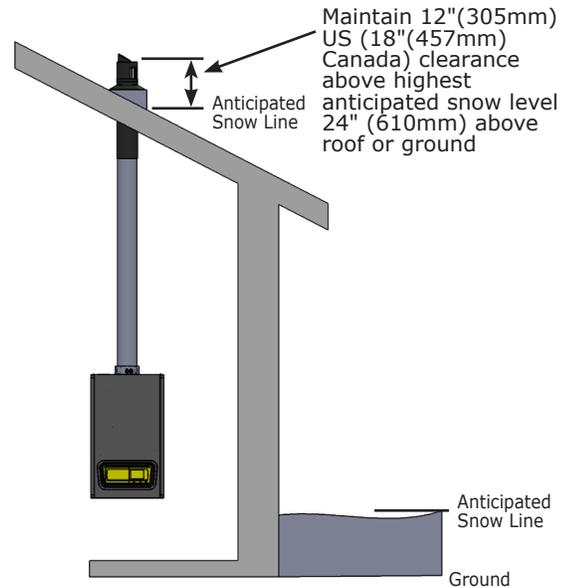


FIGURE 6-5 Roof Mount Concentric Venting



- The first elbow in horizontal run is NOT included in any equivalent length calculations

Elbow	Total Length Reduction
45°	1' 8" (0.5 m)
90°	3' 4" (1.0 m)

6.8A Indoor Air For Combustion (380 ONLY)

1. Provisions for combustion and ventilation air to be in accordance with the section "Air for Combustion and Ventilation," of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or Clause 8.2, 8.3 or 8.4 of Natural Gas and Propane Installation Code, CAN/CSA B149.1 (Canada), or as determined by the authority having jurisdiction.
 - a. Provide make-up air where exhaust fans, clothes dryers, and kitchen ventilation equipment interfere with proper operation.
 - b. National Fuel Gas Code recognizes several methods of obtaining adequate ventilation and combustion air. Requirements of the authority having jurisdiction may override these methods.
 - i. Engineered Installations. Must be approved by authority having jurisdiction.
 - ii. Refer to National Fuel Gas Code for requirements for louvers, grilles, screens, and air ducts.
 - iii. Mechanical Air Supply. Provide minimum of 0.35 cfm per Mbh for all appliances located within space. Additional requirements where exhaust fans installed. Interlock each appliance to mechanical air supply system to prevent main burner operation when mechanical air supply system not operating.
 - iv. Combination Indoor and Outdoor Air. Refer to National Fuel Gas Code for applicable information.
 - v. All Indoor Air. Calculate minimum allowable room volume for all appliances in space. Use a different method if minimum volume not available.
 01. Standard Method. Cannot be used if known air infiltration rate is less than 0.40 air changes per hour. Use equation, include total for all appliances: $\text{Volume} \geq 50 \text{ ft}^3 \times \text{Total Input [Mbh]}$
 02. Known Air Infiltration Rate. Use equation, include total for all appliances: $\text{Volume} \geq 21 \text{ ft}^3/\text{ACH} \times \text{Total Input [Mbh]}$. Do not use an air infiltration rate (ACH) greater than 0.60.
 03. Refer to National Fuel Gas Code for opening requirements between connected indoor spaces.
 - vi. All Outdoor Air. Provide permanent opening(s) communicating directly or by ducts with outdoors.
 01. Two Permanent Opening Method. Provide opening commencing within 12 inches of top and second opening commencing within 12 inches of bottom of enclosure. Refer to National Fuel Gas Code for required minimum free area.
 02. One Permanent Opening Method. Provide opening commencing within 12 inches of top of enclosure. Provide minimum clearance of 1 inch on sides/back and 6 inches on front of boiler (does not supersede clearance to combustible materials).
2. The area surrounding the boiler must be clear and free of combustible materials, gasoline, and other flammable liquids and vapors.
3. Combustion air must be drawn from a space free from contamination by the following chemicals. These items are incompatible with the materials used to construct the boiler.
 - a. Chlorine or fluorine compounds. These are present in many household products, including: water softener salts, laundry bleaches, detergents, adhesives, paints, varnishes, paint strippers, waxes, swimming pool and spa chemicals, and plastics.
 - b. Drywall dust and other particles present during construction or remodeling. It is recommended the boiler intake be sealed off if the boiler will not be used during the construction/remodeling period.
 - c. Do not allow the boiler to ingest fiberglass, insulation, etc.
 - d. Aerosols and refrigerants of any kind.
 - e. Compounds which may be found in commercial establishments, such as:
 - i. Hair spray and other beauty shop products.
 - ii. Cleaning agents used in dry cleaning facilities
 - iii. Chemicals used in auto body and metal working shops

B. Ventilation and Combustion Air (380) ONLY

Provisions for combustion and ventilation air in accordance with the section "Air for Combustion and Ventilation", of the *National Fuel Gas Code*, ANSI Z223.4/NFPA 54 or Clause 8.2, 8.3 or 8.4 of *Natural Gas and Propane Installation Code*, CAN/CSA B149.1, or applicable provisions of the local building code

6.9 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 (GMHB227 ONLY)

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 6-7)

Intake Vent	L1	49 ft (15m)
Exhaust Vent	L2	51 ft (15.5m)
Combined Vent	L1+L2	100 ft (30.5m)

Elbow	Total Length Reduction
45°	10" (0.3 m)
90°	2 ft (0.6 m)

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.

FIGURE 6-6 - Two Pipe Polypropylene System Adapter

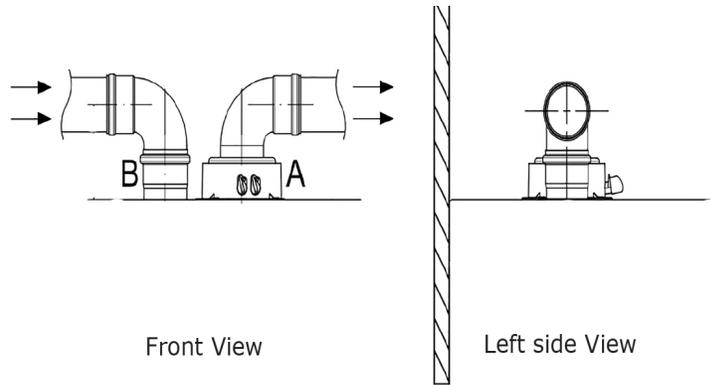
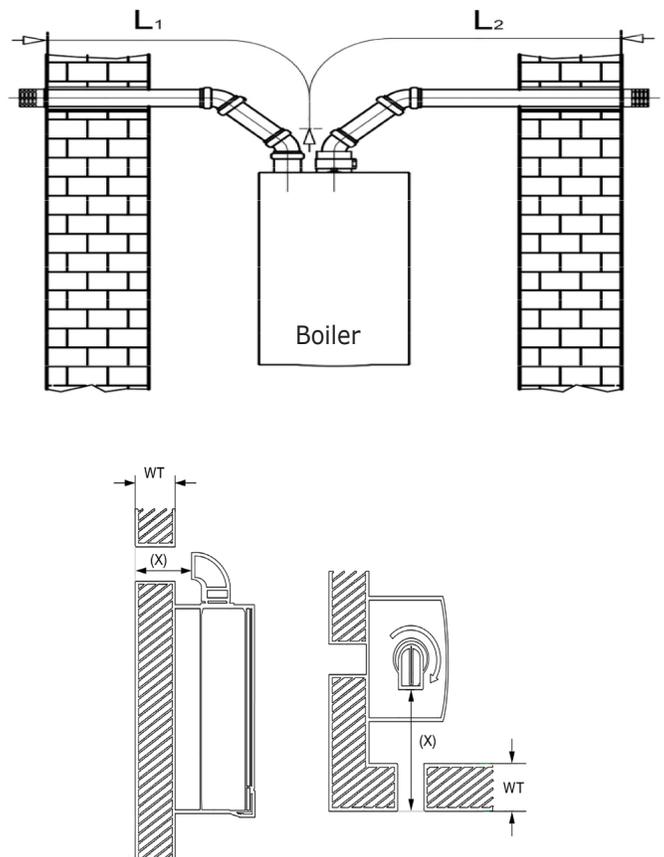


FIGURE 6-7 - Separated Horizontal Flue Termination



E. Securing Twin Pipe Polypropylene Venting

Note

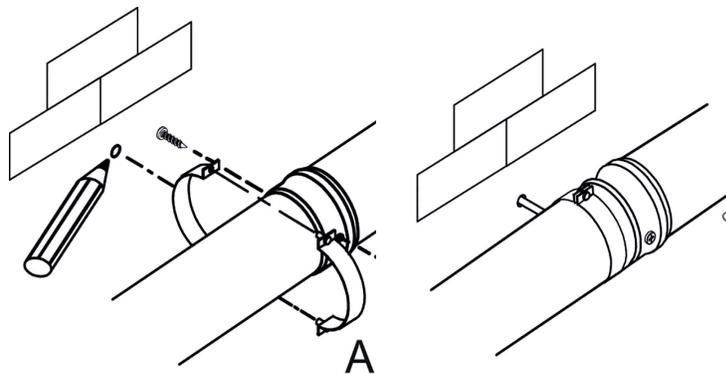
Venting manufacturer's use a device to secure single wall twin pipe polypropylene vent pieces to each other. Proper application of the securing mechanism is necessary for any use of twin pipe polypropylene venting on exhaust or air intake. Securing mechanism is for indoor use only and should not be used in outdoor applications. Follow venting manufacturer's instructions for applying the securing mechanism on twin pipe polypropylene venting.

Example for Natalini venting system.

(For other venting system suppliers see their instructions.)

1. Place clamp so etched "UP" is facing up.
2. Open clamp slightly by separating circular areas from each other.
3. Slide male end of first pipe through open clamp so the shoulder of the female end of the pipe stops the clamp from sliding off the pipe.
4. Insert the male end of the second pipe into the clamp on the "up" etched side. Force the two pipes together.
5. Verify the two pipes are secure together with clamp in place.

Figure 6-8 - Venting Support



6 - COMBUSTION AIR AND VENT PIPING

6.10 Venting Configurations

Various venting configurations can be applied to this boiler.

For guidance see Venting Configuration Table 5A and corresponding figures.

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.*

Table 5A - Combustion Air - Venting Locations

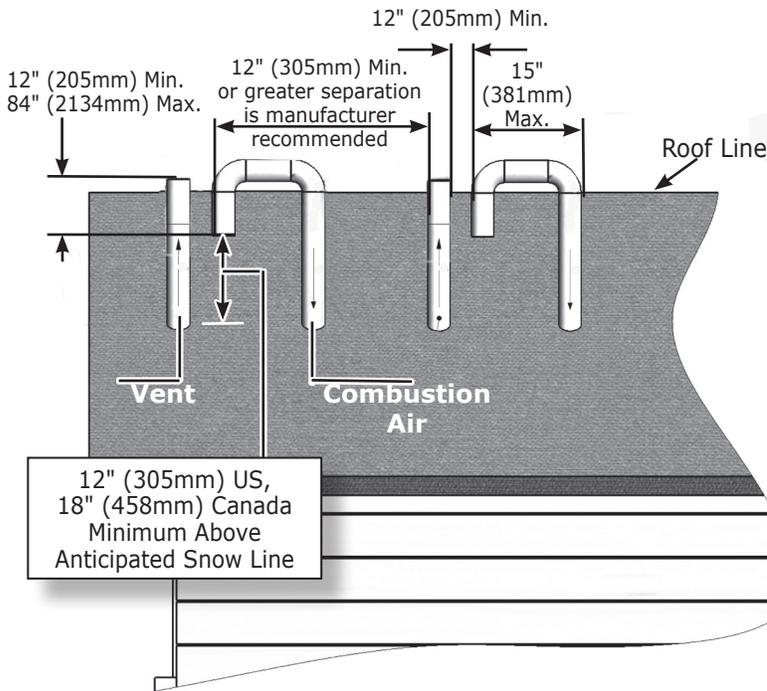
Flue Gas Location	Combustion Air Location	Flue Gas Terminals	Corresponding Figures
Roof	Roof	Two Pipe	Figure 6-9
	Side Wall	Single Pipe	Figure 6-13
	Inside Air	Single Pipe	(380) Figure 6-15
Sidewall	Roof	Single Pipe	Figure 6-14
	Side Wall	Two Pipe	Figures 6-10, 6-11, 6-12
	Inside Air	Single Pipe	(380) Figure 6-16

Table 5B - Combustion Air - Venting Terminal Type

Type	Location	Terminal Type	Corresponding Figures
Venting (Flue Gas)	Side Wall	S-Terminal with 90° elbow	Figure 6-10, 6-11
		T-Terminal	Figure 6-12, 6-14 (380) Figure 6-16
	Roof	Straight Terminal	Figure 6-9, 6-13
Combustion Air (Fresh Air)	Side Wall	Raised 90° down elbow	Figure 6-10
		90° down elbow	Figure 6-11, 6-13
	Roof	Raised 90° down elbow	Figure 6-9, 6-14

6 - COMBUSTION AIR AND VENT PIPING

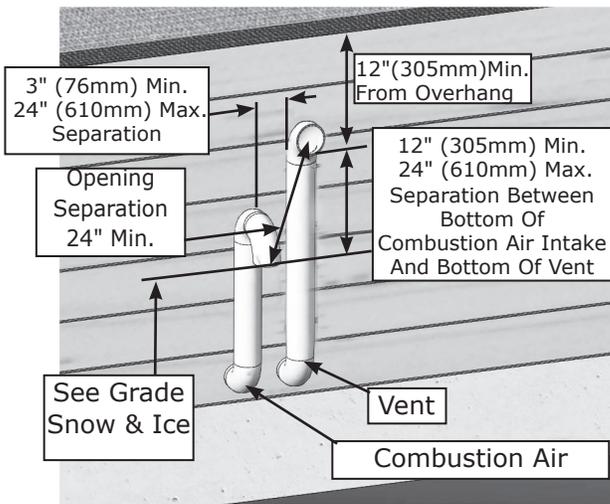
FIGURE 6-9 Two Pipe Roof Vent



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).
- Max. allowable total vertical vent length with outside exposure is 10 ft.(3.05m).
- 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 6-9.

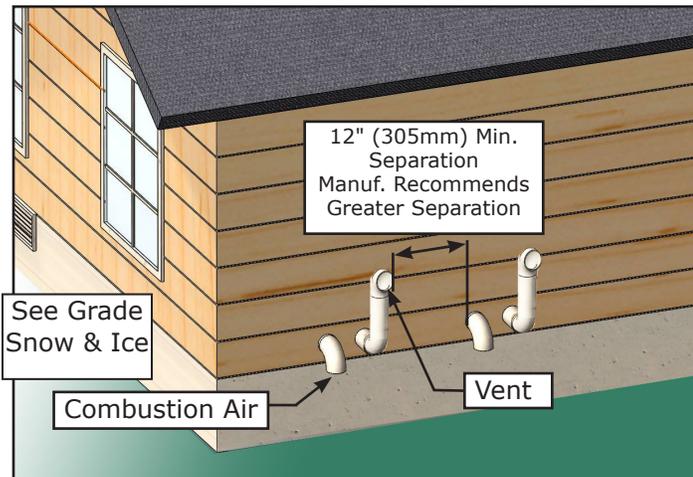
FIGURE 6-10 Two Pipe Side Wall Vent



Side Wall Terminations

- 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. separation between bottom of combustion air intake and bottom of vent.
- Multiple terminations as shown in 6-9, and 6-11 must be a min. of 12" (305mm) horizontally between vent of one termination and air 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.

FIGURE 6-11 Two Pipe Side Wall Vent (Multiple Appliances).



Grade, Snow & Ice

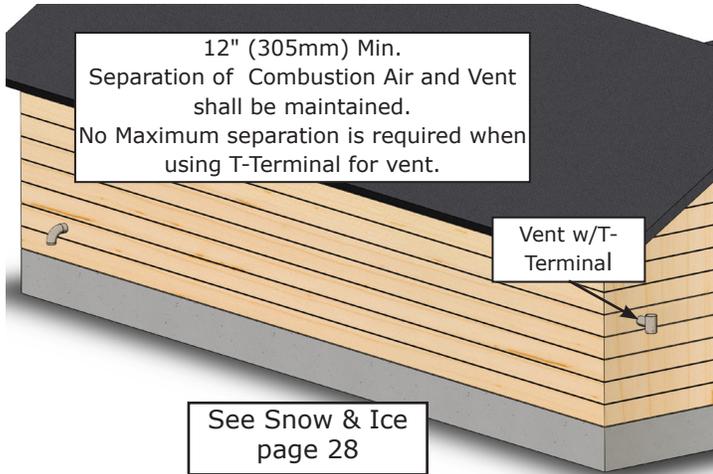
- Maintain 12"(305mm) US (18"(457mm) Canada) clearance above highest anticipated snow level 24" (610mm) above roof or ground.
- Avoid locations where snow may drift and block vent and combustion air. Ice or snow may cause boiler to shut down if vent or combustion air becomes obstructed.

Doors & Windows

- Combustion air and vent termination must be 12" (305mm) from or below doors, windows or gravity inlet.

6 - COMBUSTION AIR AND VENT PIPING

FIGURE 6-12 Side Wall Venting Terminal w/T-Terminal



Note Configurations of single pipe vent with flue on the sidewall, requires a tee as the vent terminal. See Figures 6-12, 6-14 and 6-21

Note If separation in Fig. 6-11 is not large enough to prevent cross flow contamination between flue gas and fresh air use T-Terminal as shown in Fig. 6-12. Use of T-Terminal for vent as shown in Fig. 6-12 does not have a max. separation requirement between flue gas and fresh air.

Fig. 6-13 Flue on Roof, Air Intake on Side Wall

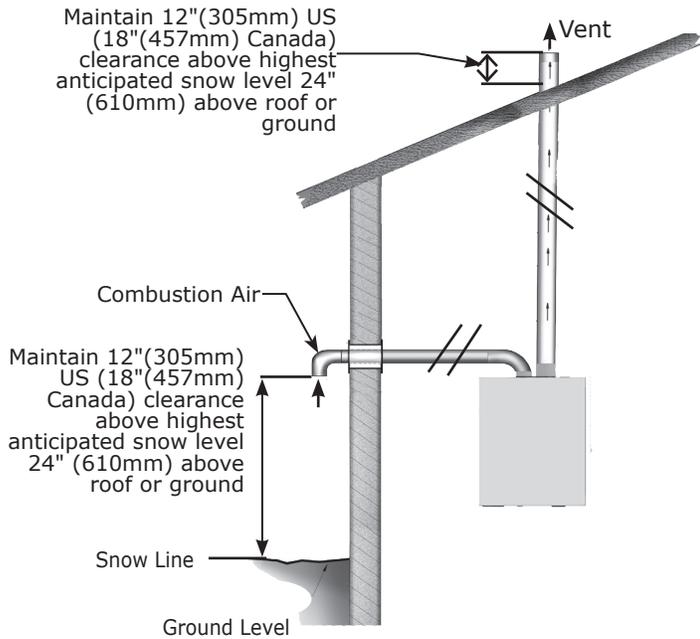
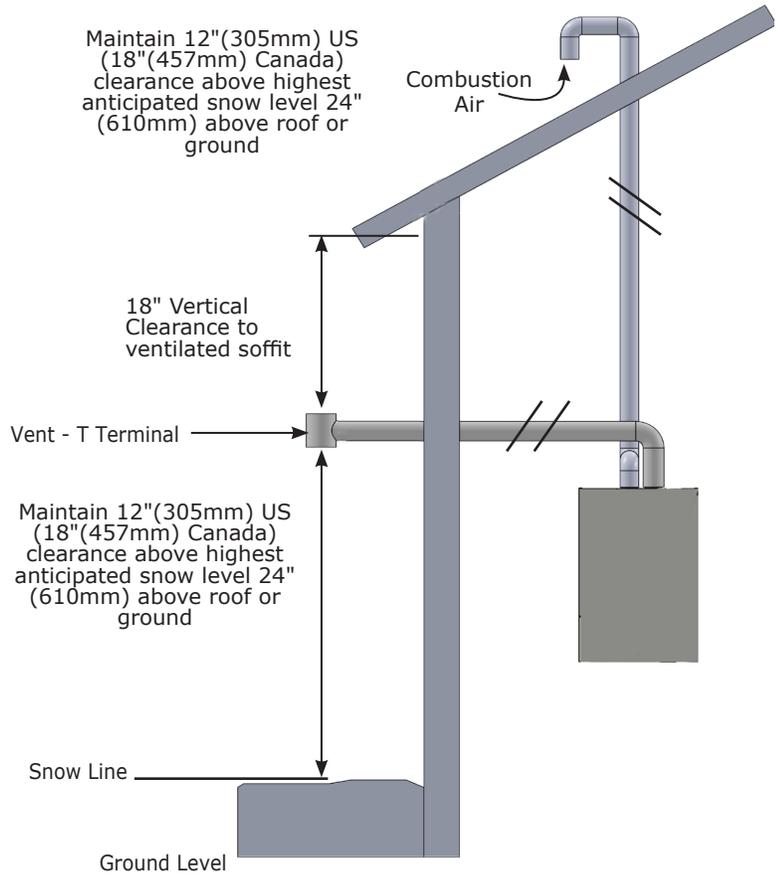


Fig. 6-14 Flue on Sidewall, Combustion Air on Roof

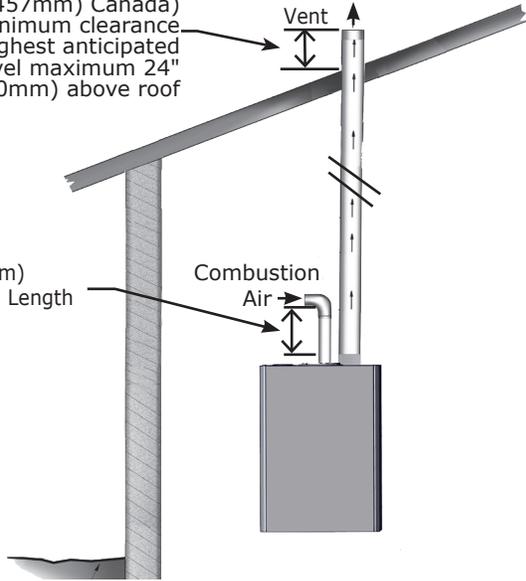


6 - COMBUSTION AIR AND VENT PIPING

FIGURE 6-15 Flue on Roof, Indoor Combustion Air (380 ONLY)

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 and Vent Piping Length Page 25.

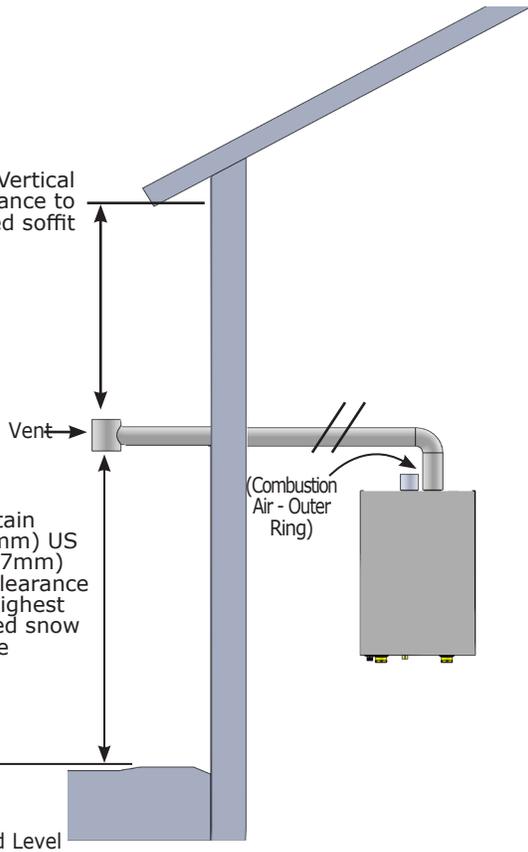
FIGURE 6-16 Flue on Sidewall, Inside Combustion Air (380 ONLY)

18" Vertical
Clearance to
ventilated soffit

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

Snow line

Ground Level



Combustion air and Vent Piping Length Page 23.

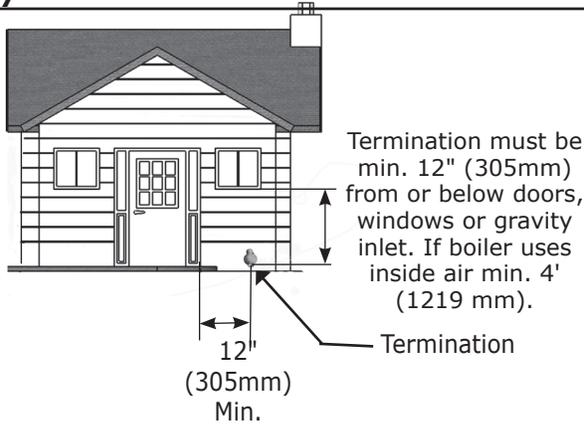
6 - COMBUSTION AIR AND VENT PIPING

6.11 Side Venting Terminal Requirements of :

- USA - National Fuel Gas Code, ANSI Z223.1/NFPA 54.

Venting terminal from doors and windows	See figure 6-17
Venting terminal from forced air inlet of other appliances	See figure 6-18
Venting terminal from snow level	See figure 6-19
Venting terminal from vegetation	See figure 6-20
Venting terminal from public walkway	See figure 6-21

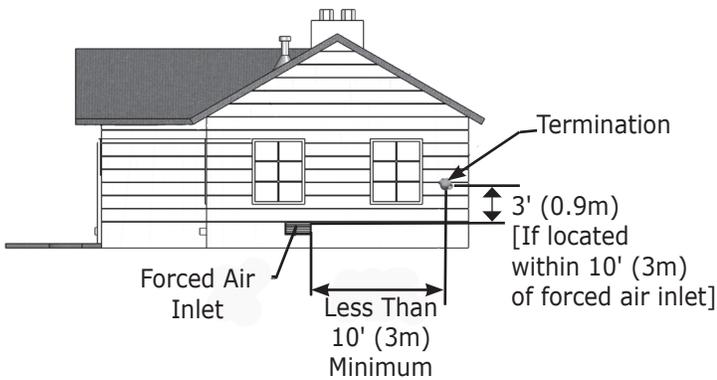
FIGURE 6-17



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).
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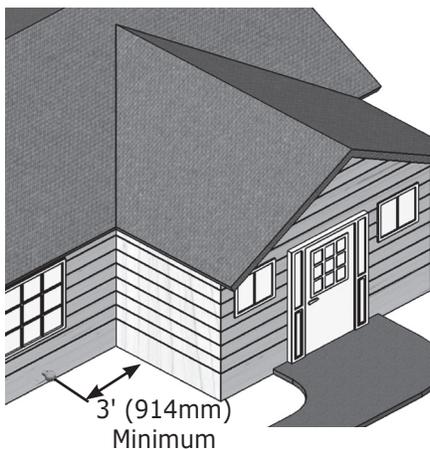
Condensate	Vent gas may condense, forming moisture, may be corrosive. Protect building materials at vent from exhaust of vent gas.
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FIGURE 6-18



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).
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FIGURE 6-19

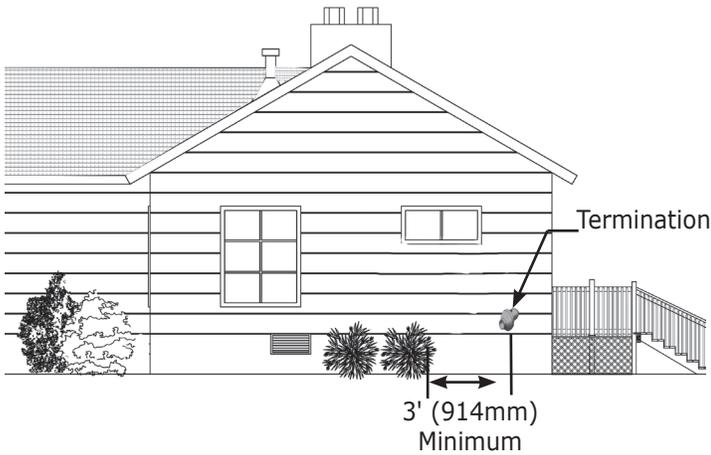


Grade, Snow & Ice	Maintain 12"(305mm) US, 18"(457mm) Canada clearance above highest anticipated snow level, 24" (610mm) above roof. Avoid locations where snow may drift and block vent and combustion air. Ice or snow may cause boiler to shut down if vent or combustion air becomes obstructed.
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"L" Corner	Vent termination shall NOT be installed closer than 3' (914mm) from inside corner of "L" shaped structure.
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6 - COMBUSTION AIR AND VENT PIPING

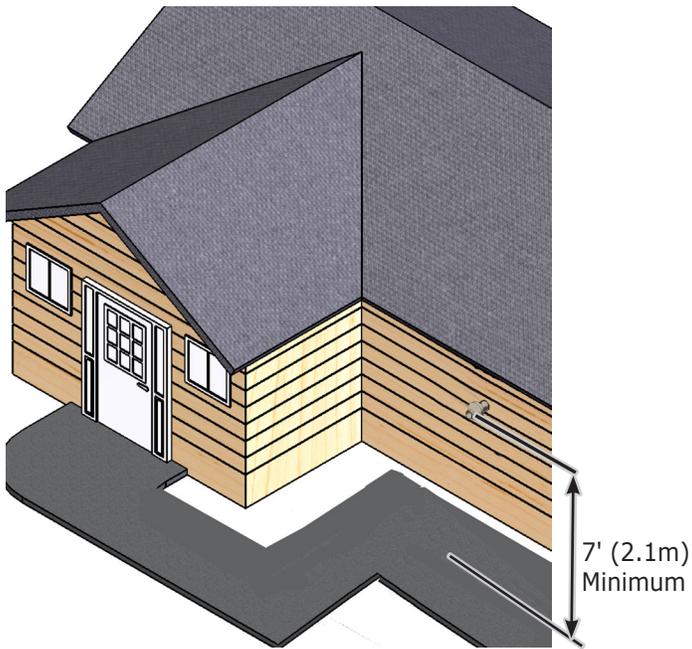
FIGURE 6-20



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.
--	--

FIGURE 6-21



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.
----------------------------	---

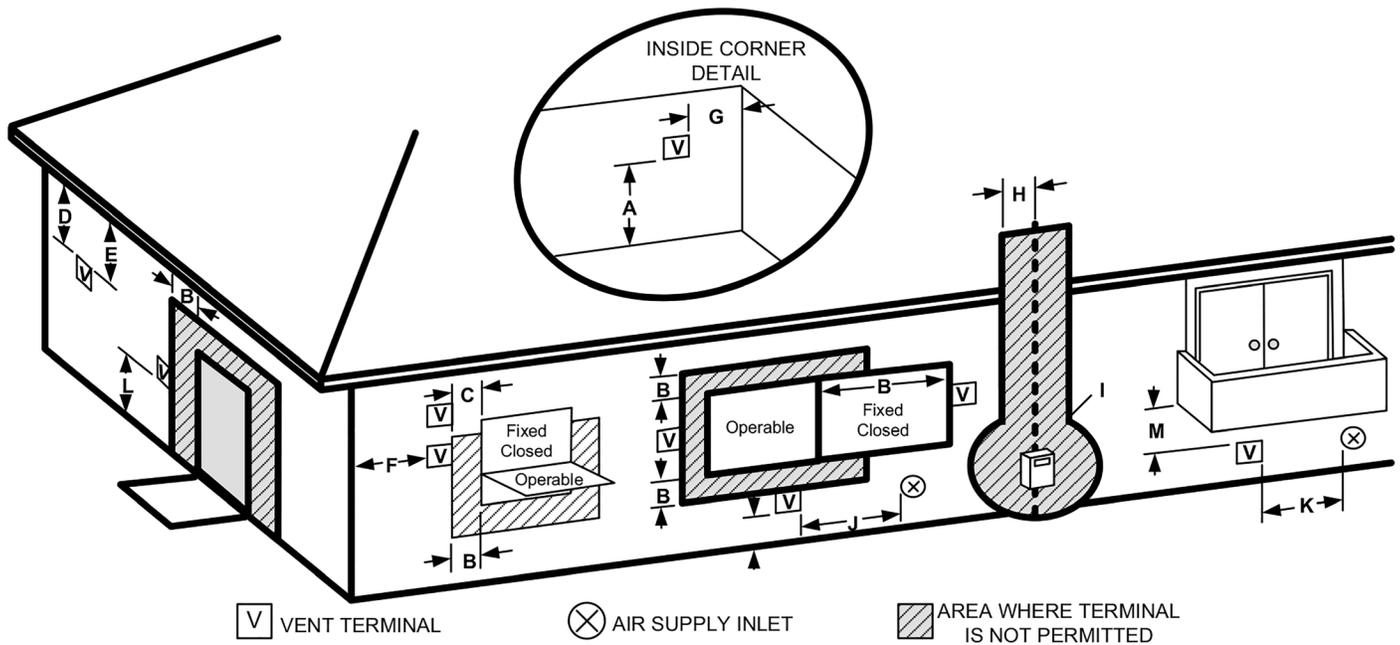
Multiple Family Dwellings	Vent shall not terminate directly above paved sidewalk or paved driveway located between two single-family dwellings serving both dwellings.
----------------------------------	--

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.
-------------------------	---

6 - COMBUSTION AIR AND VENT PIPING

FIGURE 6-22 Flue Termination Location



Vent Termination Minimum Clearances			
		USA	CANADA
A	Clearance above grade, veranda, porch, deck, or balcony	12" (305mm)	12" (305mm)
B	Clearance to window or door that may be opened	12" (305mm)	3 ft. (0.9m)
C	Clearance to permanently closed window	*12" (305mm)	*12" (305mm)
D	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	18" (457mm)	18" (457mm)
E	Clearance to unventilated soffit	18" (457mm)	18" (457mm)
F	Clearance to outside corner	9" (229mm)	9" (229mm)
G	Clearance to inside corner	6" (152mm)	6" (152mm)
H	Clearance to each side of center line extended above meter/ regulator assembly	3 ft. (0.9m) within a height of 15 ft. (4.5m) above the meter/regulator assembly	3 ft. (0.9m) within a height of 15 ft. (4.5m) above the meter/regulator assembly
I	Clearance to service regulator vent outlet	3 ft. (0.9m)	3 ft. (0.9m)
J	Clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance	12" (305mm)	3 ft. (0.9m)
K	Clearance to mechanical air supply inlet	*3 ft. (0.9m)	6 ft. (1.8m)
L	Clearance above paved sidewalk or paved driveway located on public property	*7 ft. (2.1m)	7 ft. (2.1m) ¹
M	Clearance under veranda, porch, deck or balcony	*12" (305mm) ²	12" (305mm) ²
*	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.		
(¹)	Vent shall not terminate directly above sidewalk or paved driveway located between two single family dwellings and serves both dwellings.		
(²)	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.

⚠ WARNING

Asphyxiation hazard. DO NOT use screws to secure piping together. Failure to follow these instructions could cause death or serious injury.

⚠ WARNING

Cascade venting of condensing boilers shall be vented with DuraVent® polypropylene venting material. Failure to follow these instructions could result in death or serious injury.

6.12 Multiple Boiler Venting - General

- For common exhaust system DuraVent® is the only approved vent manufacturer - DuraVent®. Use of check valve is mandatory. See Figure 6-23.
- See Figures 6-29, 6-30 and 6-31. 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.
- Do not mix boiler sizes on the same piping manifold.

6.13 Multiple Boiler Venting - Mounting Procedure - See Figures 6-23 thru 6-25

1. Vent pipes correctly mounted. See Figure 6-23.
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 6-25.
6. Connect 90° elbows to horizontal common vent pipe for

FIGURE 6-23 Correctly Mounted Piping

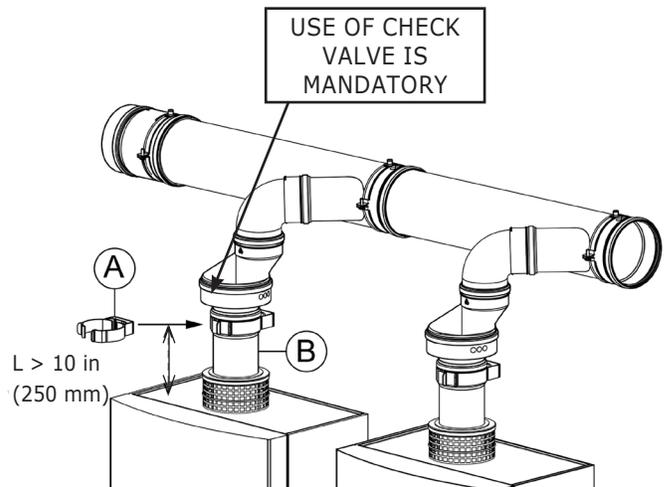


FIGURE 6-24 Correctly Mounted Piping

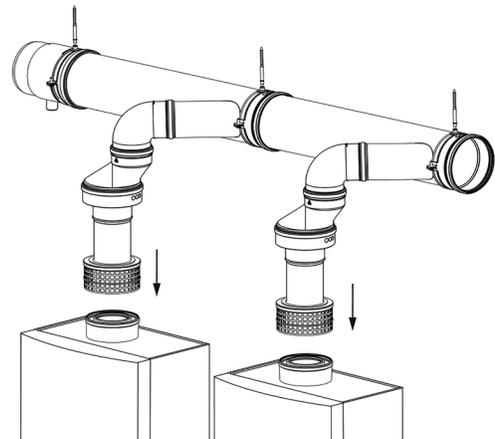
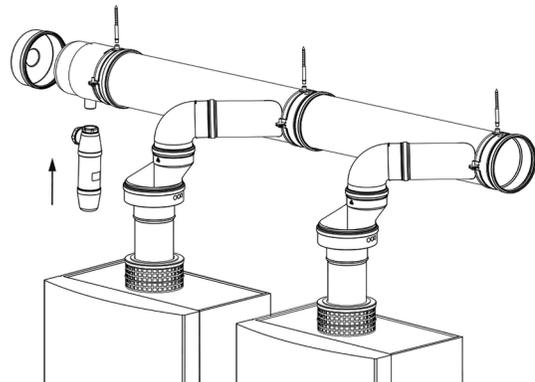
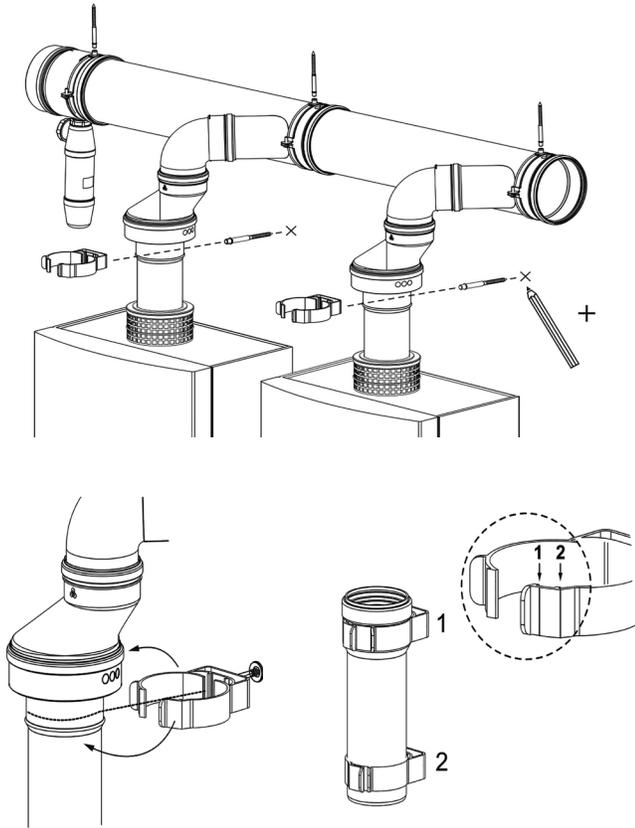


FIGURE 6-25 Correctly Mounted Piping



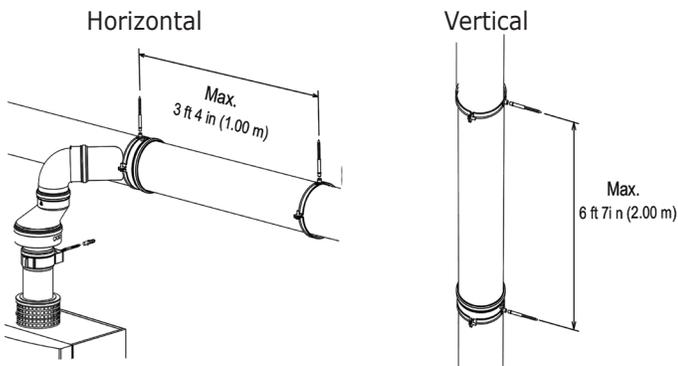
6 - COMBUSTION AIR AND VENT PIPING

FIGURE 6-26 Secure Clamp around Flue Adapter



- 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 6-26.
 12. Secure approved clamp around flue adapter. Ensure clamp is locked in to proper position. See Figure 6-26.
 - 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 6-27.
 14. Fully tighten horizontal common vent pipe supports.

FIGURE 6-27 Maximum Distance Between Supports



6.14 Multiple Boiler Venting - Venting Layout

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

Number of Appliances	Maximum Vertical Length					
	6 in (150 mm)		*6 in / 8 in (150 / 200 mm)		8 in (200 mm)	
1						
2	98.4 ft	30m	98.4 ft	30m	98.4 ft	30m
4	98.4 ft	30m	98.4 ft	30m	98.4 ft	30m
6	-	-	98.4 ft	30m	98.4 ft	30m

***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.

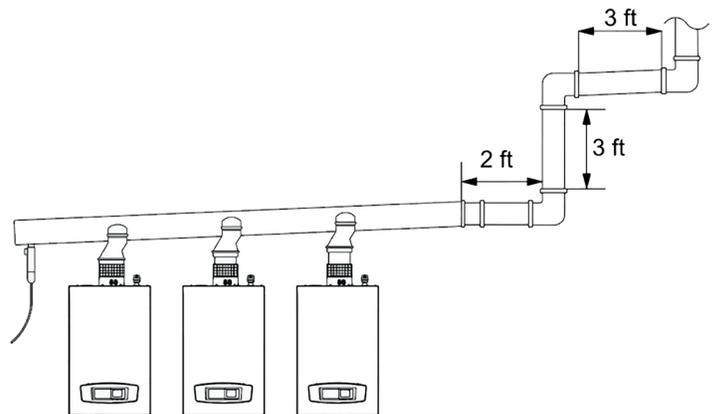
Elbow Type	6 in.		8 in.	
	Equivalent Length		Equivalent Length	
45°	5 ft 7 in	1.7m	12 ft	3.8 m
90°	13 ft 1 in	4.0m	19 ft	5.8 m

6 in. Cascade Vent System Example

Elbow Equivalent Length	45°	90°
Number of Elbows	-	3
Equivalent Length	-	13 ft 1 in (4.0m)
Total Equivalent Length	39 ft 4-21/64 in (12.0m)	

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)

FIGURE 6-28



A. Single Line System

System consisting of boilers arranged in line each connected to common exhaust manifold.

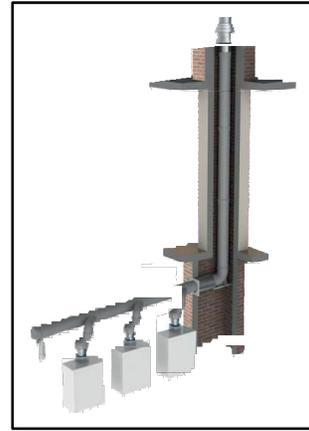
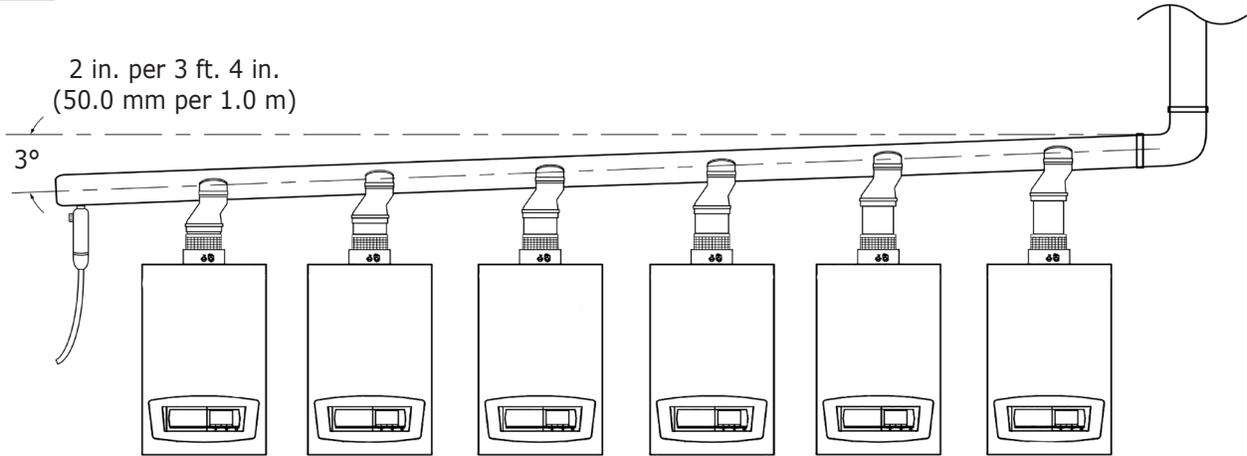


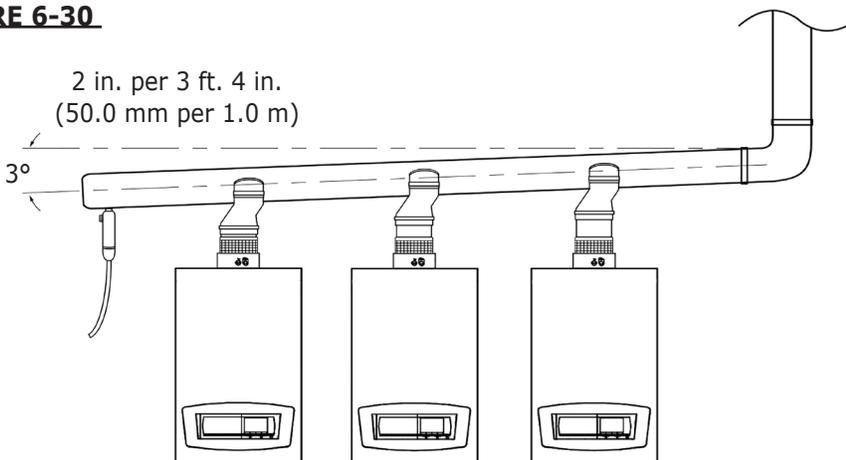
FIGURE 6-29



B. Back to Back System

This system consists of boilers installed back to back connected to a common exhaust manifold.

FIGURE 6-30



C. Double Line System

This system consists of boilers installed on two lines, connected to a common exhaust manifold.

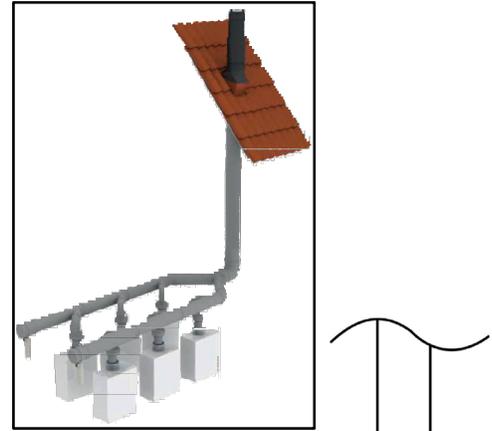
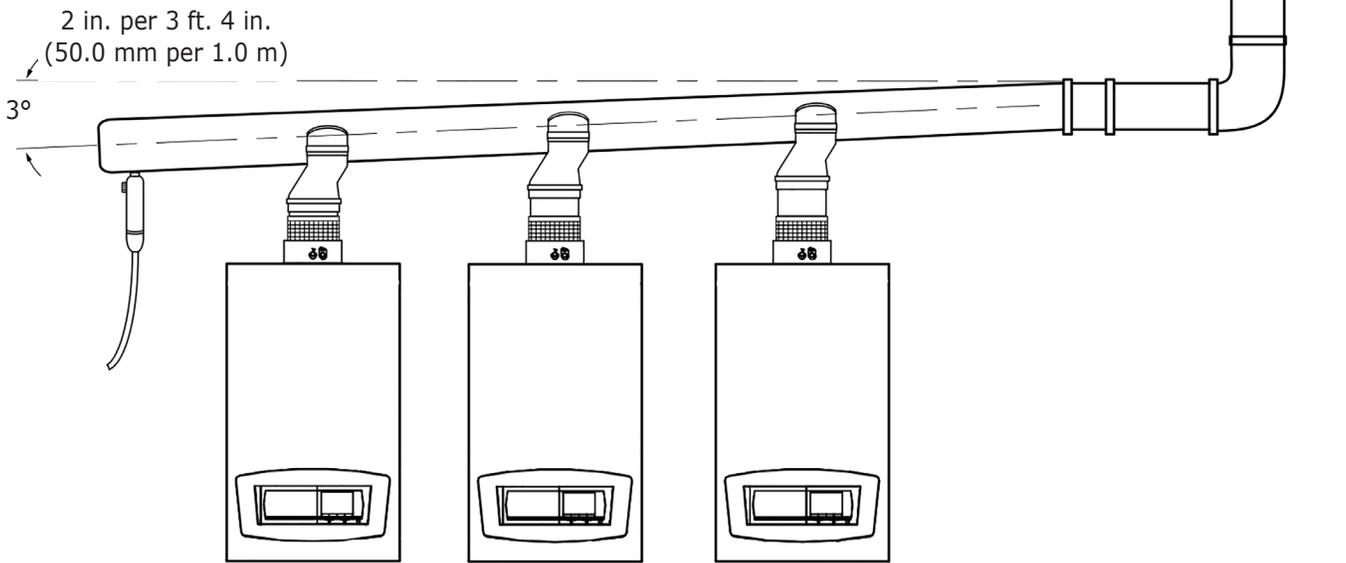


FIGURE 6-31



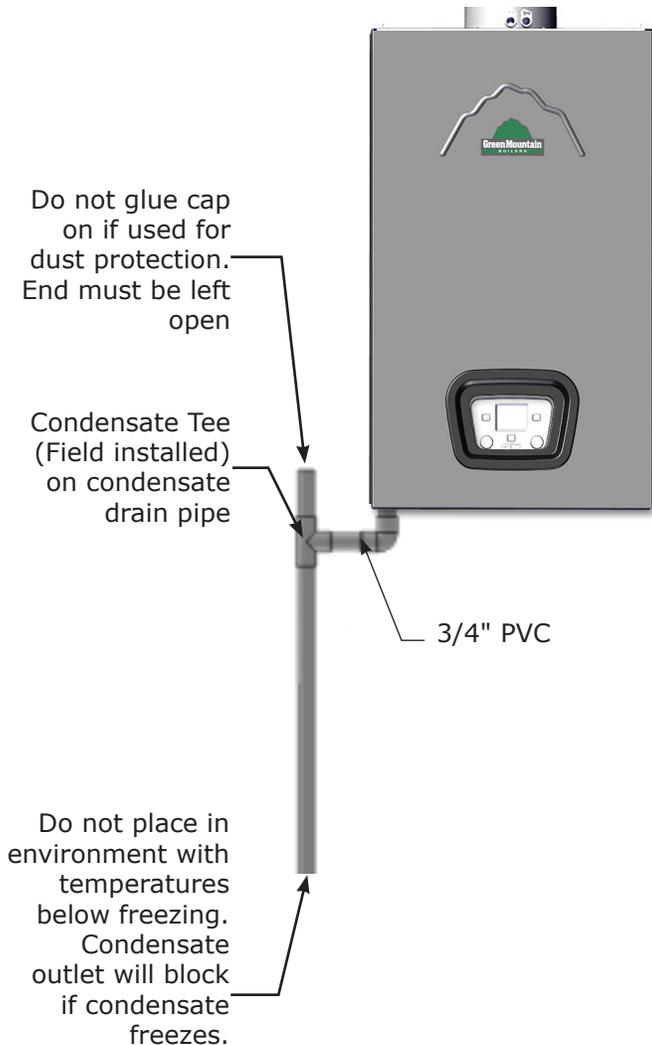
6.15 Multiple Boiler Venting - Parameter Settings

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

PARAMETER P19 Revs/min (rpm) at minimum Power	
Natural Gas	LPG
30	30

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

FIGURE 6-32 Condensate Drain



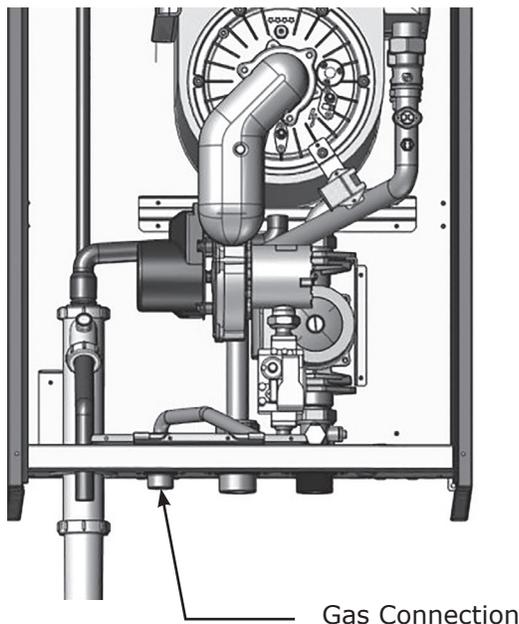
6.16 Condensate Piping

- 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.
- No external trap needed if the drain line is connected to an open drain or condensate pump. If the boiler is plumbed directly to a drain line in the building follow local code on the installation of an external trap.
- Connect condensate hose, hose clamps, and coupling to boiler drain trap as shown in figure 6-32.
- Connect condensate piping to 3/4" NPT coupling as shown.
- Slope condensate drain pipe minimum 1/4" per foot (21mm/m) away from boiler.
- Support condensate pipe to eliminate any sagging.
- Use field source condensate pump if boiler located below disposal point.
- Condensate pump should have overflow switch. Condensate from Boiler is slightly acidic and may cause property damage if overflow.
- Field source condensate neutralizing kit as required by authority having jurisdiction or for environmentally friendly condensate disposal.

NOTICE

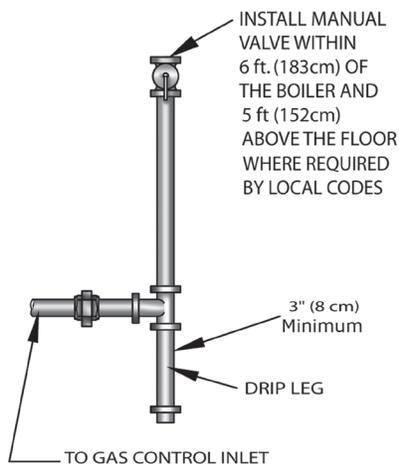
Manufacturer requires an air vent be used to prevent condensate line vacuum lock.

FIGURE 7-1 Gas Connection



Note Use two (2) wrenches when tightening and fitting to pipe boiler's threaded fittings. Boiler's internal piping can be damaged if subjected to excessive torque.

Figure 7-2- Drip Leg



⚠ 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.

7.1 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.

Required Gas Rate	GMHB227	GMHB380
Natural Gas =	225 FT ³ /H (6.39 M ³ /H)	377 FT ³ /H (10.7 M ³ /H)
LP =	89 FT ³ /H (2.5 M ³ /H)	149 FT ³ /H (4.2 M ³ /H)

- 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. Support piping with hooks straps, bands, brackets, hangers, or building structure components to prevent or 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.

Gas Supply		Pressure	
Natural Gas		LP	
Min	Max	Min	Max
3.0	13.5	5.0	13.5

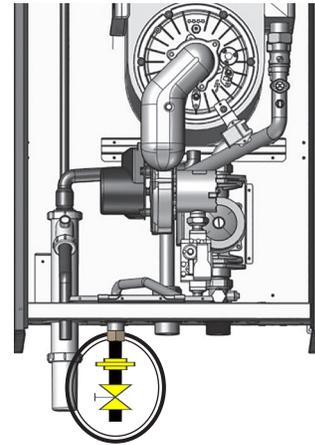
DANGER

Fire Hazard. Do not use matches, candles, open flames, or other methods providing ignition source. Failure to comply will result in death or serious injury.

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.

FIGURE 7-3 Manual Main Gas Shutoff Valve Outside Boiler Jacket



Manual Main Gas Shutoff Valve

8 - ELECTRICAL CONNECTIONS

⚠ DANGER

Electrocution Hazard! HIGH VOLTAGE - Connections in terminal block M1 are high voltage (120V / 60Hz). Before making connections, verify appliance is disconnected from power supply. Respect the input polarity on terminal block M1: L (LINE) - N (NEUTRAL). Failure to follow these instructions WILL result in death or serious injury.

⚠ 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.

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.
- Install all wiring in accordance with requirements of National Electrical Code and any additional national, state, or local code requirements having jurisdiction. All wiring shall be N.E.C. Class 1.
- Boiler shall be electrically grounded in accordance with the National Electrical Code, ANSI/NFPA No. 70-latest edition.
- Boiler requires a 120V 60Hz power supply. Ensure electrical supply is polarized.
- There shall only be one common isolator, providing complete electrical isolation, for boiler and any external controls. Using PVC insulated cable 12 AWGx3C 221°F (105 °C).

8.2 Electrical Connections

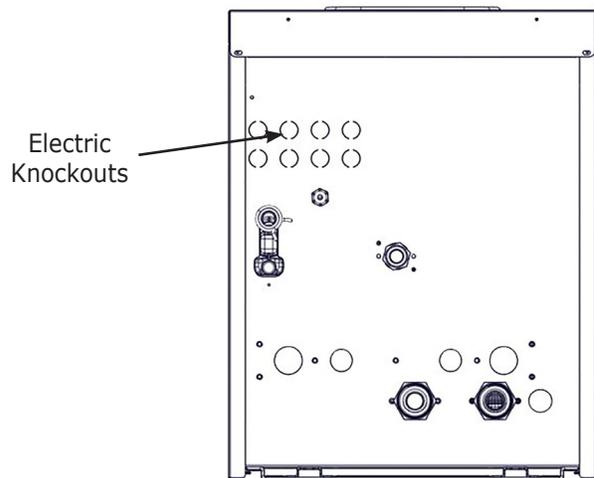
- Boiler requires 120V 60Hz power supply. Verify electrical supply is polarized.
- Boiler shall be grounded and on dedicated circuit.
- Shall be one common isolator, providing electrical isolation for boiler and any external controls. Using PVC insulated cable 18 AWGx3C 221°F (105°C).
- All wiring must 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 105°C or equivalent.
- If appliance is connected to in floor system, install limit thermostat to prevent latter from overheating

Note

Wiring diagrams can be found in Appendix A of this Manual.

FIGURE 8-1 Electric Knockouts Bottom Of Boiler

Illustration shown, illustration is for location purposes, wiring knockouts found same general location on all sizes.



⚠ DANGER

Electrocution Hazard! HIGH VOLTAGE - Connections in terminal block M1 are high voltage (120V / 60Hz). Before making connections, verify appliance is disconnected from power supply. Respect the input polarity on terminal block M1: L (LINE) - N (NEUTRAL). Failure to follow these instructions WILL result in death or serious injury.

8.3 Access To Connection Block

1. Ensure there is no line voltage at boiler.
2. Unscrew two screws located under front panel. Remove front cover.
3. Guide controller or thermostat wire through round grommet(s) on right side of boiler's bottom plate right.
4. Tilt control box forward by opening holding clips located on left side of boiler.
5. Expose M1 and M2 terminal blocks by removing screw from plastic cover on left. See Figure 8-3.
6. Remove plastic from channel in plastic cover. Run wires through new opening.
7. Connect wires to appropriate terminals on connection block.
8. Tilt control box back to original position. Ensure clip on left side is fully engaged.
9. Replace front cover and screws under front panel.
10. Turn power to boiler on.

Various thermostats and controllers can be connected to standard control PCB.

8.4 Main Supply Connection

Main supply is connected to terminal block **M1** which is high voltage (120V / 60Hz).

Fuses, 3.15 A, are incorporated in the power supply terminal block. To check or replace fuse pull out black fuse carrier.

TERMINAL BLOCK M1

- (L) = Live (brown)
- (N) = Neutral (light blue).
- = Ground (yellow-green).
- (1) (2) = contact for 120V Room Thermostat.

TERMINAL BLOCK M2

Terminals 1 - 2: bus connection of programmable room unit (supplied as accessory)

Terminals 4 - 5: outdoor temperature sensor connection (supplied as accessory)

Terminal 3 : not used.

Terminals 6 - 7 - 8: see section 8.6.

Terminals 9 - 10: Indirect storage tank sensor connection for GMHB227 and GMHB380 models.

FIGURE 8-2 Terminal Block Locations

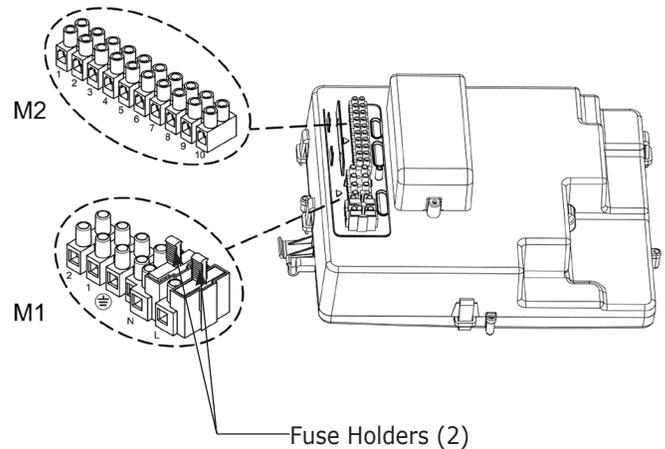
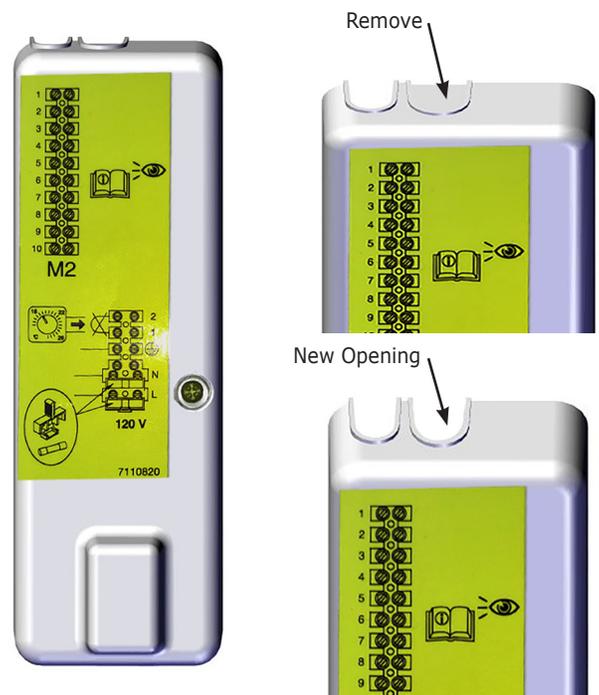


FIGURE 8-3 Terminal Plastic Cover with Knockouts



8.5 Install Room Thermostat

Install room thermostat on inside wall. Do not install where it will be influenced by drafts, hot or cold water pipes, lighting fixtures, television, sun rays or near a fireplace.

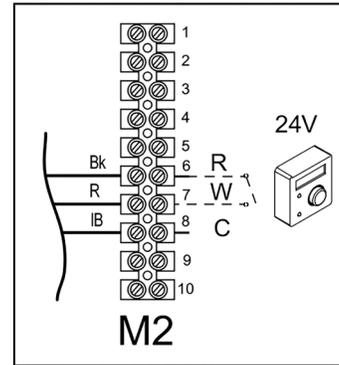
Dry contact only - do not apply 24 volts between 6 and 7.

Connect 24V Room Thermostat

- turn power off to boiler;
- access terminal block **M2**;
- connect 24V room thermostat to terminals **6(R)-7(W)-8(C)**; Do not apply dry volt between 2 terminals. Dry contact only.
- turn boiler power on;
- verify room thermostat operates per thermostat manufacturer instructions.

NOTE: maximum load allowed is 10 mA

FIGURE 8-4 Thermostat Connections



**24V Room
Thermostat**

8.6 Optional Electrical Connections

A. 1 K Ohm (1K Ω) Outdoor Temperature Sensor

To connect this accessory, see figure 8-5, terminals 4-5, and instructions supplied with sensor.

B. Setting "Kt" Climate Curve

When external sensor is connected to boiler, the electronic board adjusts the flow temperature calculated according to set Kt coefficient.

Select required curve by rotating right knob as indicated in chart below for selecting the appropriate curve (00 to 90).

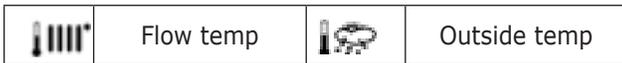
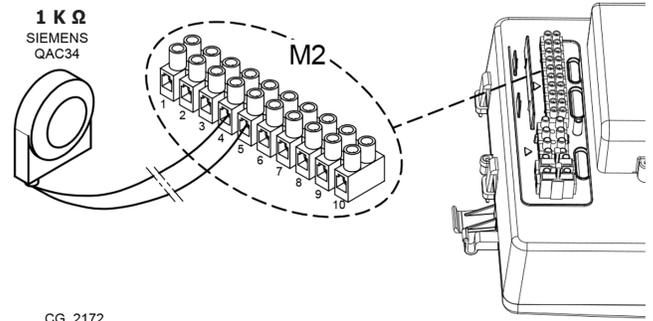
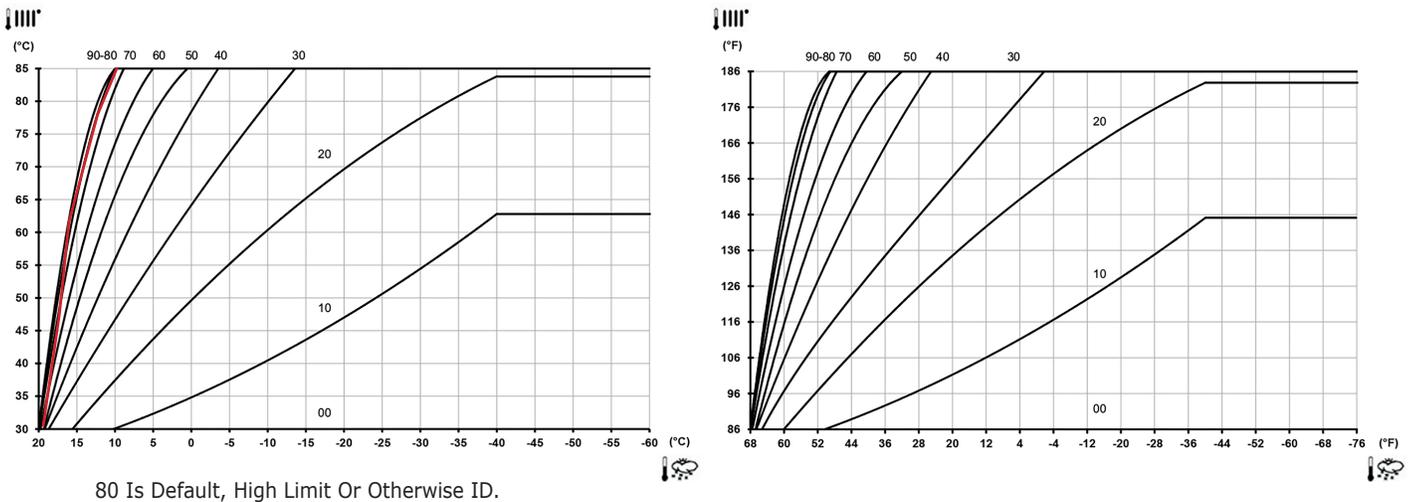


FIGURE 8-5 1K Ω Outdoor Sensor Connections



CG_2172

FIGURE 8-6 Kt Climate Curves

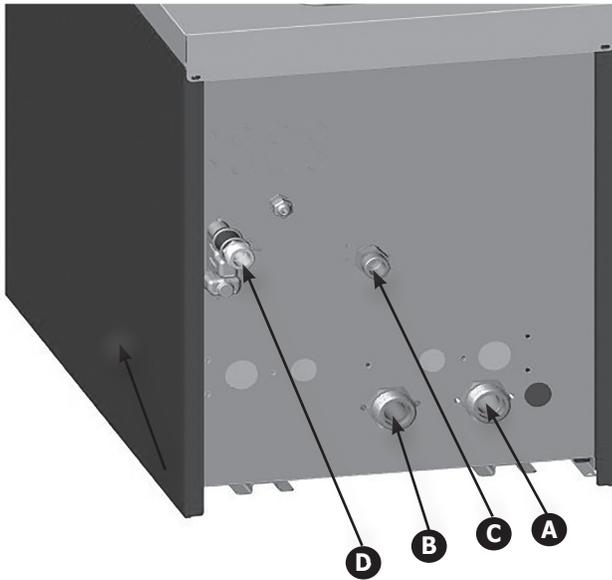


NOTE:

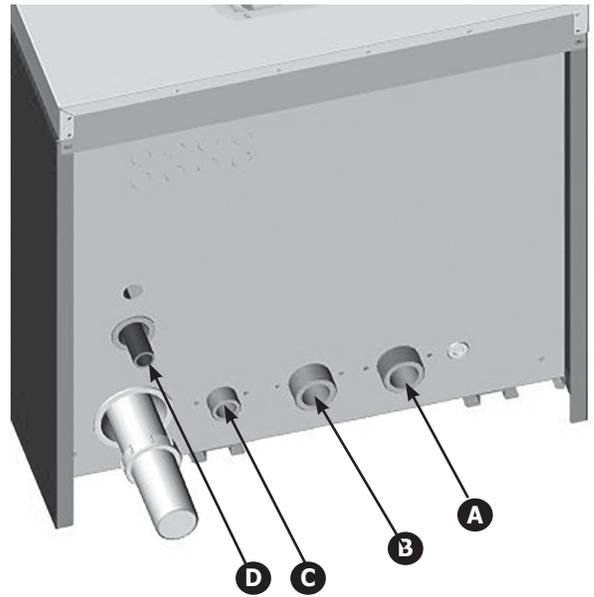
Temperatures below -40 °F (-40 °C), maximum heating flow temperature set point no longer increases, curves shown on graph become horizontal.

9.1 Central Heating System Connections

GMHB227 HEATING ONLY
WITH OPTIONAL INDIRECT DHW CONNECTION



GMHB380 HEATING ONLY



LEGEND		GMHB227	GMHB380
*	Pressure Relief Valve	30.00 psig	50 psig
A	Heating return connection	1" NPT	1 1/4" NPT
B	Heating supply connection	1" NPT	1 1/4" NPT
C	Gas connection	3/4" NPT	1" NPT
D	Drain connection for condensate	3/4 NPT	3/4 Hose

* Not Shown

9.2 System Start Up

Follow all codes and regulations when filling the boiler.

Use drain taps to allow system to completely drain.

Thoroughly flush the heating system before boiler is connected and again after first heating.

- (227) Open Aerator valve located on heat exchanger. See Figure 9-1.
- (227) Boiler is fitted with automatic air vent positioned on pump Vent and is fitted with adjustable sealing cap. See Figure 9-1.
- (380) has vent at the top of the boiler. See Illustration Page 9 of this manual.
- Open central heating flow and return valves. Spindle is flat in-line with valve.
- Open fill point valve on filling system until water begins to flow. To aid venting boiler drain may be open until water flows out. Close drain as soon as water appears.
- Systems using radiators to remove air - Vent each radiator in turn, starting with lowest in the system.
- It is important the pump is properly vented to avoid running it dry and damaging its bearings. Unscrew and remove cap from center of pump. Use screwdriver. Rotate exposed spindle about half turn, replace cap.
- Check operation of heating pressure relief valve. Pull lever on top of valve upwards lifting the seat. This will allow water to escape from system. Check water is escaping from the system.
- Open cold water supply inlet valve. Turn on all hot water taps. Allow water to flow until no air is present. Turn off taps. See page 4- Physical Data and section 2.7 Operational Features.
- Recommended system pressure 21.7 psig.

9.3 Fill Condensate Trap with Water

⚠ WARNING

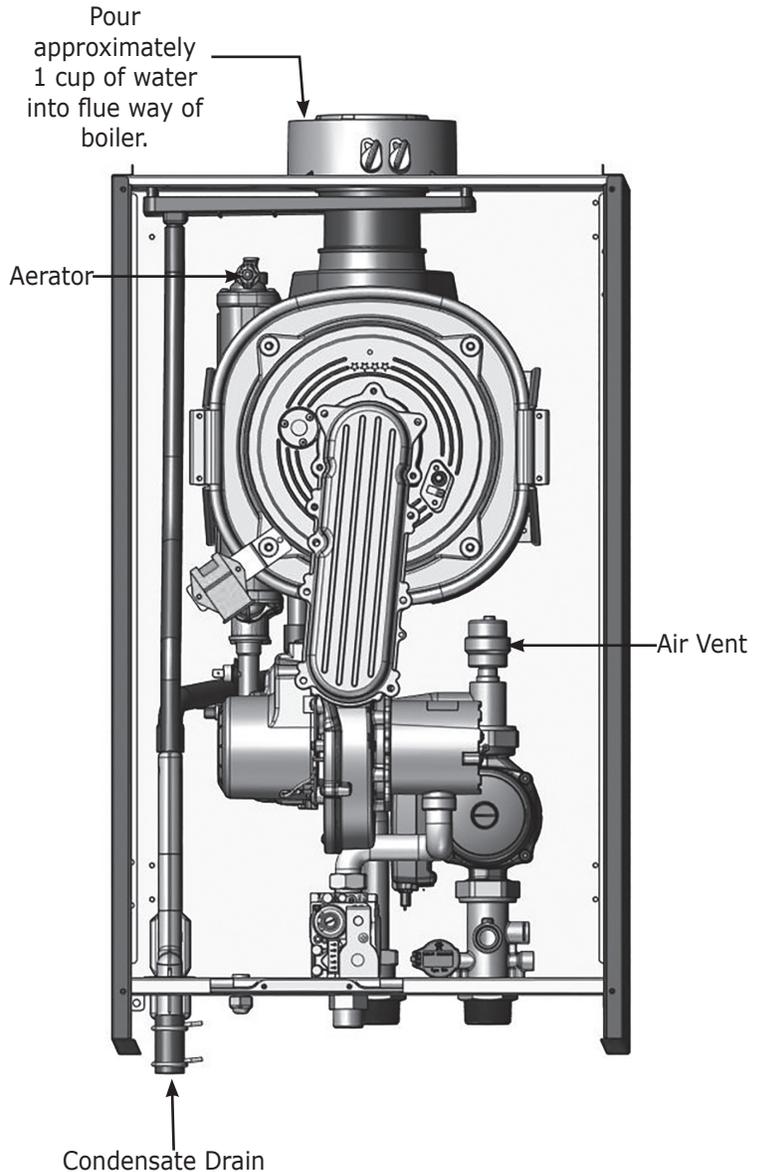
Asphyxiation hazard! Fill condensate trap before starting boiler to avoid combustion products escaping boiler. Failure to follow these instructions could result in death or serious injury.

- 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 condensate trap to ensure it drains properly.

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

FIGURE 9-1 Condensate Drain Assembly

Model 227 shown (380 at top of boiler)



9 - START UP PROCEDURE

9.4 Commission Setup (Electric)

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

9.5 Control Panel

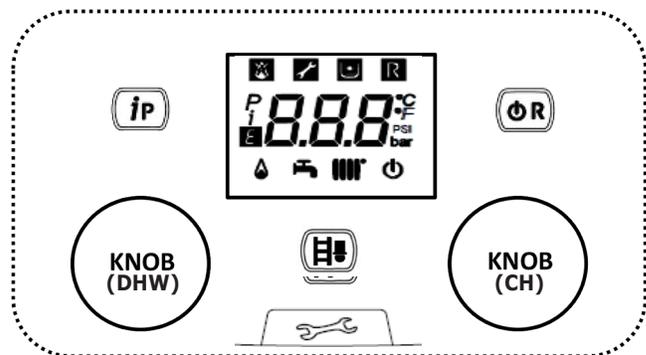
Control display will light immediately when power is applied. Press and hold **(iP)** for 6 seconds, to display information as shown in the table below. Press **(iP)** to exit.

Refer to Appendix B for more information.

i	DESCRIPTION	i	DESCRIPTION
00	Secondary fault internal code	09	Setpoint Central Heating (°F/°C)
01	Heating flow temperature (°F/°C)	10/11	Manufacturing information
02	Outdoor temperature (°F/°C)	12	Flue sensor temperature (°F/°C)
03	Indirect Tank DHW temperature (boiler CH only)	13	Manufacturing information
04	Domestic hot water temperature (boiler with plate exchanger)	14	Identification Open Therm communication
05	Water pressure in heating system (PSI/bar)	15	Manufacturing information
06	Heating return temperature (°F/°C)	16	Manufacturing information
07	Thermo fuse status (000/001)	17	Fan speed ("17"x100)
08	Not used	18	Manufacturing information

BUTTONS Key

LEFT KNOB	DHW temperature adjustment (CW to increase the temperature and CCW to decrease it)
RIGHT KNOB	Heating water temperature adjustment (CW to increase the temperature and CCW to decrease it)
(iP)	Boiler operating information
(E)	Operating mode: DHW - DHW & Heating - Heating Only
(O/R)	Off - Reset - Exit menu/functions



SYMBOL Key

	Off: heating and DHW disabled (only boiler frost protection is active)		Burner lit
	Ignition fault		DHW operating mode enabled
	Boiler/system water pressure low		Heating mode enabled
	Call a qualified service technician	P	Programming menu
R	Manual reset fault ((O/R))	i	Boiler information menu
E	Fault in progress	°C, °F, bar, PSI	Set unit of measurement (SI/US)

⚠ 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.

NOTICE

All connections shall be made and water added before performing this function.

9.6 Commission Setup (Overview)

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. Ensure gas connections are tight
4. Purge air from piping. Confirm there is a steady gas supply to the boiler.
5. Pressure test the gas line:
 - A. Test pressure must not exceed 15" w.c./37 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.
6. Open main gas supply.
7. Open gas shutoff valve on boiler.
8. Tilt control box forward by opening holding clip located on side of the boiler.
9. Check gas supply pressure at pressure outlet "Pi" on gas valve unit. See Figure 9-3.
10. Ensure all gas connections are tight.
11. Check all gas connections in the boiler are tight.
12. Check piping and connections for leaks immediately after gas is turned on. Shut off gas supply and make necessary repairs if leaks are found.
13. See Figure 9.3 for location of Throttle and Offset Screws on modulating gas valve.

9.7 De-Aeration Function (See Figure 9-2)

Used to eliminate air inside the heating circuit when boiler is installed or after maintenance when water is drained from primary circuit.

1. Follow chart in Figure 9-2 to turn power to boiler on. Code "000" appears on the display. Appliance is ready for "commissioning" procedure.
2. Press **[H]** and hold for 6 seconds. "On" appears on the display for 2 seconds followed by code "312" indicating "de-aeration" function is active. This function lasts 10 minutes.
3. Open aeration valve to allow complete de-aeration.
4. To manually exit this function, press **[iP]** button and hold for 6 seconds.

5. Close aeration valve.
6. If venting function is interrupted by power blackout, start function again when power is restored. Press **[iP]** and **[H]** together and hold at same time for at least 6 seconds.
7. If display shows fault **E118** (low pressure in hydraulic circuit) during de-aeration function, open filling tap on appliance and restore correct pressure.

NOTICE

During initial ignition, burner may not ignite. This may cause boiler to shut down until any air in gas pipes is vented. Repeat ignition procedure until gas reaches the burner. To reset boiler operation, press **[O/R]** for at least 2 seconds.

9.8 Commissioning

When lighting the boiler for the first time perform the following procedure:

1. See Figure 9.3 for location of Throttle and Offset Screws on modulating gas valve.
2. Set boiler to High Power using Section 9.12 Chimney Sweep.
3. Perform combustion test on HIGH fire using calibrated combustion analyzer. Adjust CO₂ to within specifications by rotating the Throttle Screw, counter-clockwise ↺ to increase CO₂ level, clockwise ↻ to decrease CO₂ level. See Figure 9-3. After adjusting CO₂ to correct level, verify:
 - (1) CO PPM level is in specified range
 - (2) flame signal is in specified range (> 1 Micro-Amp)
 CO₂ level, for HIGH fire are given in the Combustion Table. Switch to LOW fire in boiler System Test. Turn right knob counter-clockwise ↺ until power level is 0%. Adjust Offset Screw slowly and in small steps, no more than 1/8 of a turn each time.
4. Perform combustion test on LOW fire using calibrated combustion analyzer. Adjust CO₂ to within specifications by turning Offset Screw, clockwise ↻ to increase CO₂ level, counter-clockwise ↺ to decrease CO₂ level. After adjusting CO₂ to correct level, verify
 - (1) CO PPM level is in specified range and
 - (2) flame signal is in specified range (> 1 Micro-Amp).
 CO₂ level, CO PPM level, and flame signal for LOW fire. See tables page 52.
5. Exit System Test mode by pressing both **[H]** and **[O/R]** buttons for 6 seconds.
6. Check ignition quality 4 times with front jacket off. Close manual gas valve for 5 seconds and then re-open it. Boiler will go through post purge – prepurge – ignition sequence. Reset boiler if boiler goes into lockout.

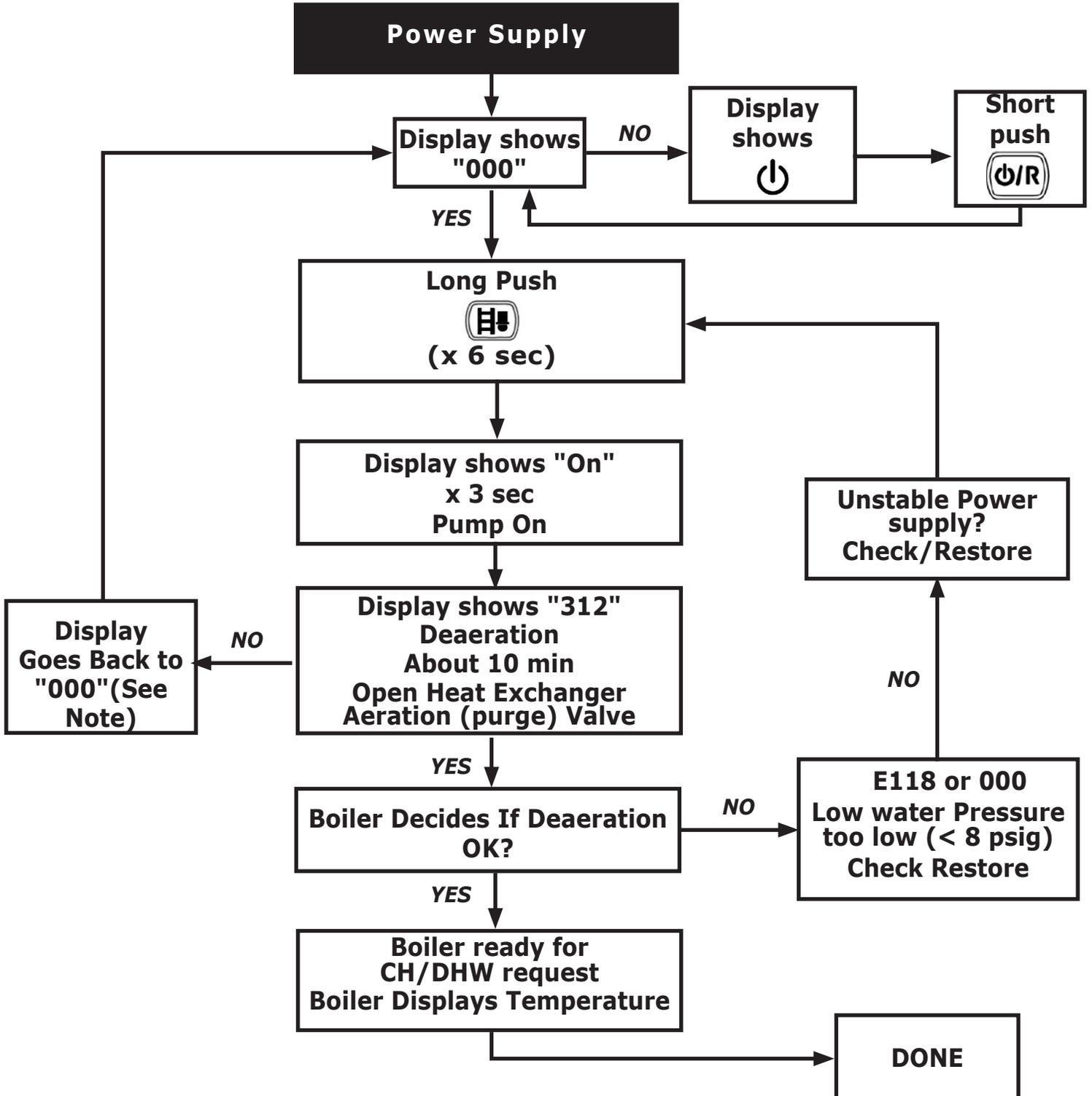
9 - START UP PROCEDURE

FIGURE 9-2 - Commissioning Function Flow Chart

To complete the function check:

- Power supply (120V; 60Hz + T-fuse)
- Gas Pressure - (See Sections 7-1 and 7-2)

Gas Supply		Pressure	
Natural Gas		LP	
Min	Max	Min	Max
3.0	10.5	5.0	13.5



9.9 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 9-3.

Disconnect gas pipe (threaded nut "C") and remove three screws securing the flange.

Verify there are no gas leaks.

Model	Natural Gas				Propane			
	Venturi		Nozzle		Venturi		Nozzle	
	in	mm	in	mm	in	mm	in	mm
GMHB227	1 3/16	30	7/32	5.3	1.18	30	5/32	4
GMHB380	1 1/2	38	3/8	9.5	1 1/2	38	3/16	5

9.10 Gas Conversion (Propane)

Boiler is preset to operate on natural gas (A).

For operation with propane gas, carry out following:

1. Change venturi assembly per LP conversion kit instructions.
2. Change **PO2** to "**01**".
3. Adjust Fan Speed **P70**, **P71** and **P72** as needed. Note changing **PO1** does not change **P70**, **P71**, **P72**, each must be changed separately. See Section 10.3.6
4. Modify fan speeds using parameters **P17**, **P18** and **P19**.
5. Set air/gas ratio (O₂/CO₂ %): Full load and Part load as described below.
6. Use combustion analyzer to properly set gas valve.
7. 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 air intake test port (B) by inserting the measurement sensor approximately 3-3/16" (80.00 mm) (C). For

GMHB227 port (B) is blocked off if using a 2 pipe vent conversion kit.

FIGURE 9-3 Gas Valve

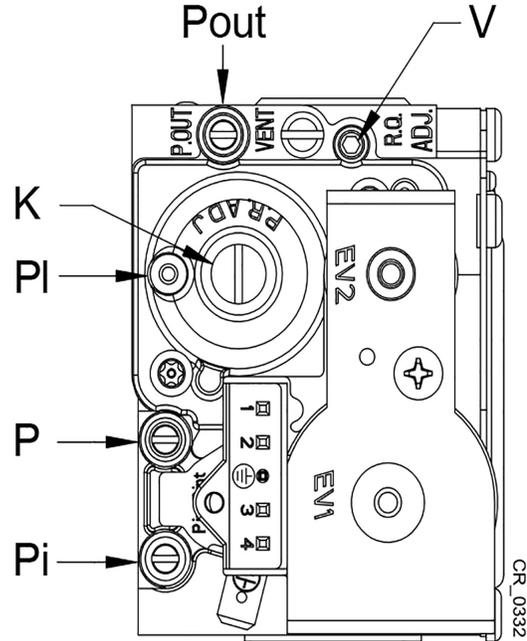


FIGURE 9-4 Venturi and Nozzle

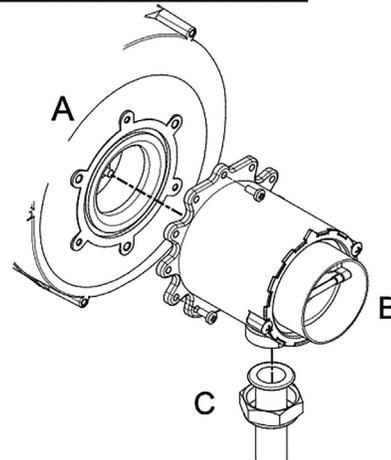
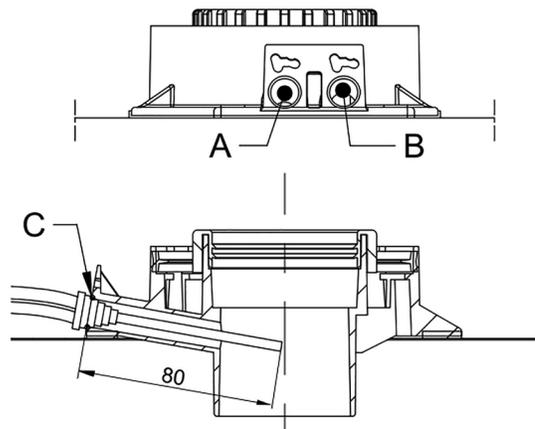


FIGURE 9-5 Combustion Air Temperature Ports



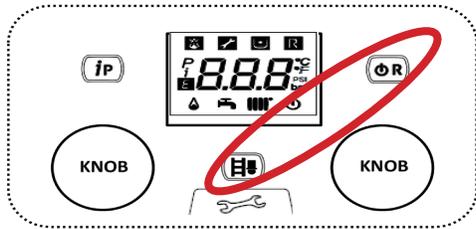
9.11 Gas Valve Calibration and CO₂ Adjustment:

Chimney Sweep Function = Manual CO₂ adjustment. CO₂ values shall be checked and adjusted if outside the required range.

Enable Chimney Function/CSF (Service):

- To enter Chimney function press  and  simultaneously with a long push.
- To enter CSF the Right Knob has to be moved.

When CSF is active the display shows "ON" (2 seconds) and code **304** with boiler power in %:



Turn Right Knob clockwise  and increase power of the boiler at 100%.

1. Calibrating MAXIMUM heat output

Check CO₂ measured at the flue test port, with boiler operating at maximum heat capacity, matches that indicated in Combustion Table below. If it does not, turn adjustment screw (**V-Throttle**) on gas valve. Turn the screw clockwise  to decrease level of CO₂ and counter-clockwise  to increase it.

Turn Right knob counter-clockwise  and decrease power of boiler at 0%.

2. Calibrating REDUCED heat output

Check the CO₂ measured at the flue test port, with boiler operating at minimum heat capacity, matches that indicated in Combustion Table below. If it does not, turn the adjustment screw (**K-OFFSET**) on the gas valve. Turn the screw clockwise  to increase the level of CO₂ and counter-clockwise  to decrease it.

To exit Chimney/CSF function press  and  simultaneously with a long push, or it will automatically time out after 25 minutes.

FIGURE 9-6 Aerator (GMHB227 shown)

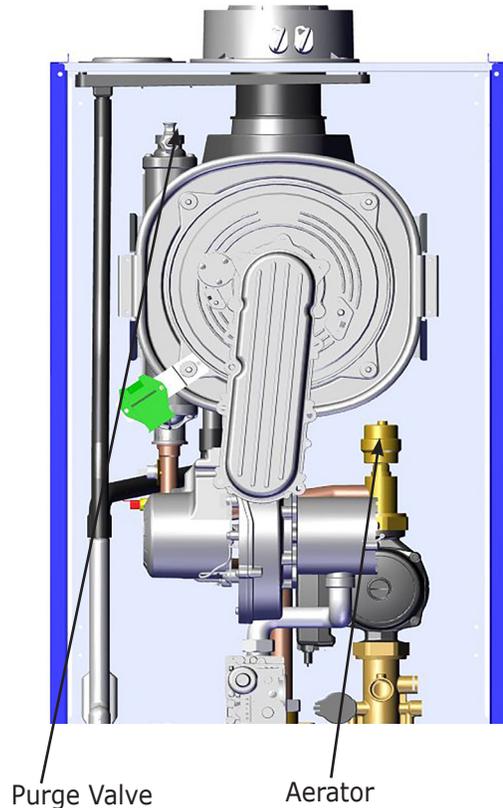


FIGURE 9-7 Aerator Top Of Boiler (380)



9.12 Chimney Sweep Function (CO₂ Adjust)

For correct boiler operation, content of (CO₂- O₂) in the combustion flue must be within tolerances indicated in table below.

COMBUSTION TABLE

CO₂ Values Natural Gas (A) at High Fire		
Front Panel	CO₂ %	
	Nominal	Range
ON	9.3	9.1 - 9.5
OFF*	8.9	8.5 - 9.0

CO₂ Values Propane Gas (E) at High Fire		
Front Panel	CO₂ %	
	Nominal	Range
ON	10	9.8 - 10.2
OFF*	9.6	9.2 - 9.7

O₂/CO₂ Values at Low-Fire Natural Gas (A)			
Nominal value		Permitted value	
O ₂ %	CO ₂ %	O ₂ %	CO ₂ %
5.7	8.5	5.4 - 6.1	8.3 - 8.7

O₂/CO₂ Values at Low-Fire Propane Gas (E)			
Nominal value		Permitted value	
O ₂ %	CO ₂ %	O ₂ %	CO ₂ %
6.4	9.6	6.1 - 6.70	9.4 - 9.8

NOTICE

- Press (Φ/R) to display instantaneous flow temperature for 15 seconds.
- Use a regularly calibrated combustion analyzer for combustion analysis.

⚠ 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.

9.13 Check Firing Rate

1. Measure input, if a gas meter is installed in the system.
 - Turn off gas to all other appliances.
 - Activate some heating zones to dissipate heat.
 - Set boiler on high fire using Chimney Sweep Function.
 - Use ½, 1 or 2 cu ft dial on gas meter. Measure time required for two or more complete revolutions. Measure time for one or more minutes.
 - Calculate input.

For Metric formulas- See Glossary

For Natural Gas :

$$\text{Input (MBH)} = \frac{3600 \times \text{cu ft}}{\text{seconds}}$$

Example: Natural Gas - Gas flow from

Meter = 2 cu ft

Measured time = 72 seconds

$$\text{Input Rate (MBH)} = \frac{3600 \times 2 \text{ cu ft}}{72 \text{ seconds}} = 100 \text{ MBH}$$

For Propane (LP):

$$\text{Input (MBH)} = \frac{9160 \times \text{cu ft}}{\text{seconds}}$$

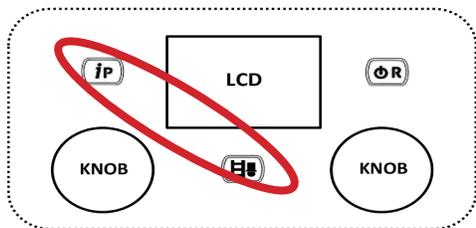
2. Compare measured input to Table below. If calculated input is not in range given in Table below, check firing rate again after setting the combustion following steps in section 9.18.

Table 9-2 Input Rate @ High Fire (MBH)

Approximate Rate @ 100% Fire (MBH)	
Size	
GMHB227	227
GMHB380	380

9.14 Parameter Setting Menu

To set PCB parameters proceed as follows:



1. Press **H/E** and **i/P** together for about 6 seconds, the display shows "PO1" alternating with its valve (01);
2. The parameter setting menu is divided in pages, each with 10 parameters (i.e. Px0-Px9).
3. **O/R**: short push to go to the next page (e.g. from P10-P19 page to p20-P19 page).
4. **i/P**: short push to go to the previous page (e.g. from P20-P19 page to P10-P19 page)
5. **Address/Page Knob**: turning Left Knob permits scrolling between the parameter within the current selected page.
6. If **Data Knob** (Right Knob) is moved, "NOP" is seen on the display to inform the user that moving the Data Knob has no consequences → **NOP= No OPeration**.
7. **H/E** short push: parameter visualized in display is selected and the board goes in the Value setting menu.
8. **O/R**: short push to go to next page (e.g. from values 10-19 page to 20-29 page)
9. **i/P**: short push to go to previous page (e.g. from values 20-29 page to 10-19 page)
10. **Data Knob**: turning Right Knob permits scrolling the values in the current selected page.
11. **H/E**: short push to save the value visualized on the display and return to parameter setting menu.
12. **Address/Page Knob**: returns to Parameter setting menu without saving the current value (escape function).

This function ends after 3 minutes, or by pressing **i/P** and **H/E** simultaneously with a long push.

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.

⚠ 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.

10.2 Testing For Gas Leaks And Purging The Gas Supply

- With boiler gas service cock closed (spindle flats at right angles to valve). Pressure test gas supply and inlet pipe work connection to boiler gas service cock for soundness.
- Loosen screw of pressure inlet gas test port on gas valve. See Figure 9-3 Gas Valve. Verify gas supply is ON. Open boiler service cock to purge.
- Retighten test port screw and test for gas leaks. Close boiler gas shutoff device.

10.1 Boiler Sequence Of Operation

- With demand for heating, pump circulates water through the primary circuit.
- Combustion fan will come on and begin to run 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 signal to control board.
- Temperature sensor will send signal to control board allowing control board to increase / decrease fan speed. Combustion fan will in turn modulate gas rate accordingly.
- Once central heating loop temperature exceeds central heating loop setpoint the 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.

10.3 Boiler Controls

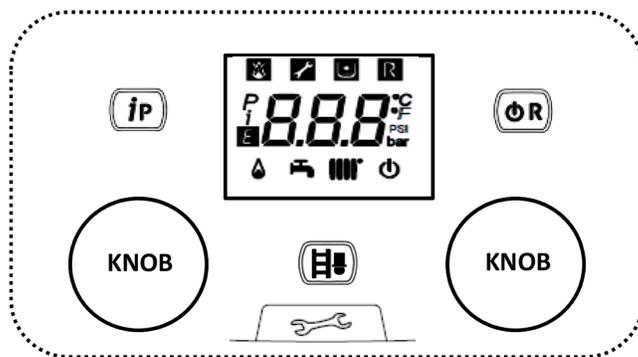
For correct boiler ignition, proceed as follows:

- Check system pressure is correct;
- Power boiler;
- Open manual gas shut off valve (positioned under boiler);
- Select required heating mode. Push **(⊖/R)** to select operating mode. See page 60 - Operating Modes.

BUTTON Key

LEFT KNOB	DHW temperature adjustment (CW to increase the temperature and CCW to decrease it)
RIGHT KNOB	Heating water temperature adjustment (CW to increase the temperature and CCW to decrease it)
(iP)	Boiler operating information
(H)	De-aeration (Long Push)/ Comfort Function (Short Push) [†]
(⊖/R)	Off - Reset - Exit menu/functions - Mode Selections (Combi) DHW- DHW & Heating - Heating Only

[†] Comfort Function (Combi Models) - Boiler cycles on as required to maintain heat exchanger temperature; DHW to tap is available sooner.



SYMBOL Key

	Off: Heating and DHW disabled (only boiler frost protection is active)		Burner lit
	Ignition fault		DHW operating mode enabled
	Boiler/system water pressure low		Heating mode enabled
	Call a qualified service technician	P	Programming menu
R	Manual reset fault (⊖/R) *	i	Boiler information menu
E	Fault in progress*	°C, °F, bar, PSI	Set unit of measurement

*Note: If **E** is displayed without **R**, boiler will resume operation once fault is corrected.

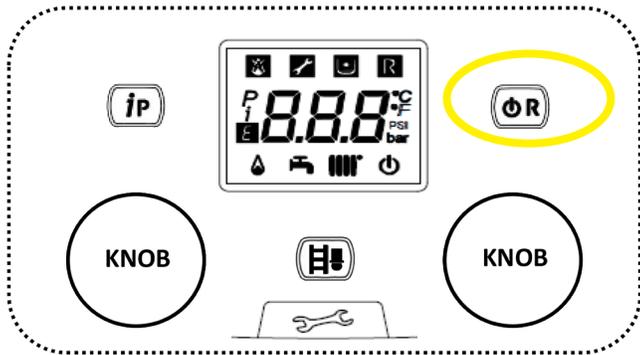
If **E** and **R** are displayed, fault must be corrected and **(⊖/R)** pushed to reset the boiler to resume operation.

PUSH DURATION:

Push type	Time
Very short push	0.5 Second
Short push	1 Second to 4 Seconds
Long push	6 Seconds or More

10 - OPERATING INSTRUCTIONS

10.3.1 Boiler Operating Mode

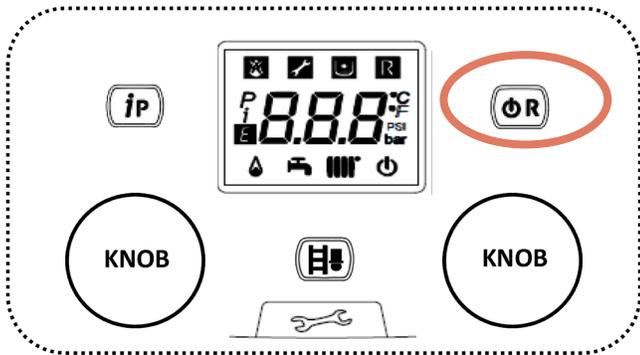


To change the boiler *MODE* press **φ/R** with a very short push. The mode changes are as follows:

Boiler Start Mode	Boiler Mode After Pressing φ/R
OFF	DHW only (<i>COMBI</i> only)
DHW only	CH and DHW (<i>COMBI</i> only)
CH and DHW	CH only (<i>COMBI</i> only)
CH only	OFF (All Models)

10.3.2 Reset

If **R** Manual Reset fault is displayed.



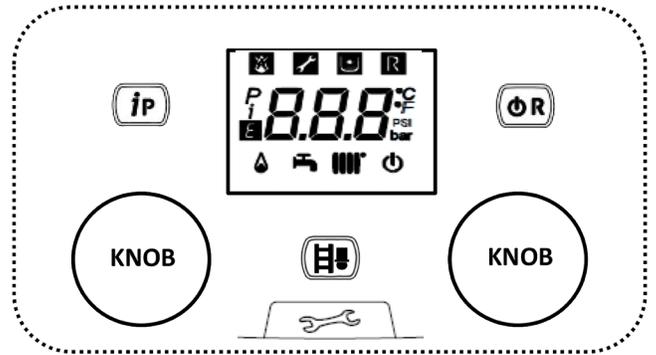
To reset the boiler press **φ/R** with a short push (1 to 3 seconds).

SYMBOL DISPLAYED	OPERATING MODE
	DHW
	DHW & HEATING
	HEATING ONLY
	FROST PROTECTION

To enable the appliance in DHW - Heating or Heating only press **φ/R** repeatedly and choose one of three available modes.

To disable the boiler operating modes and keep the frost protection function enabled, press **φ/R** for at least 3 seconds. Just the symbol **φ** appears on the display (the display backlighting flashes if the boiler is blocked).

10.3.3 Control Function



Knobs

Left and Right Knobs: main use is to adjust respectively the DHW and CH SetPoints.

Left Knob is also called **Address/Page** Knob

Right one is also called **Data** Knob for their functionality in the settings menu (see below).

Push Buttons

Three push buttons:

1. "Info parameter" **i/P** button, in upper-left position
2. Comfort/De-aeration/Enter **⏏** button in the center position
3. Operating mode/Reset **φ/R** button in upper-right position

Quick Reference Tables

Control functionality is described in the following table:

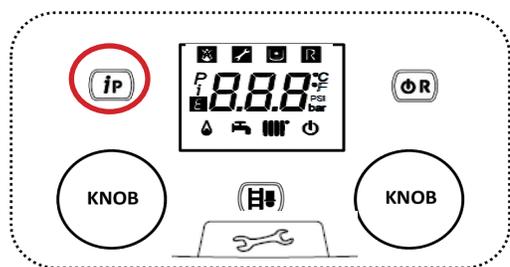
Main Functions	Buttons
Boiler mode selection	φ/R very short push
RESET	φ/R short push
Comfort function	⏏ short push
De-aeration	⏏ long push
Chimney (CSF)	⏏ + φ/R long push (enters Chimney, becomes CSF moving Right Knob CH)

10 - OPERATING INSTRUCTIONS

Special functions	Buttons/Knobs
INFO menu	long push
↳ Next page	↳ short push
Previous page	short push
Scroll within a page*	Address/Page Knob (Left Knob DHW)
Escape	long push
Parameter setting menu	+ long push
↳ Next page	↳ short push
Previous page	short push
Scroll within a page	Address/Page Knob (Left Knob DHW)
Enter in value setting menu	short push
↳ Value +10	↳ short push
Value -10	short push
Scroll within the values *	Data Knob (Right Knob CH)
Enter (to save)	short push
Escape (without saving)	Address/Page Knob (Left Knob DHW)
Exit	+ long push
Command menu	+ long push
↳ Next page	↳ short push
Previous page	short push
Scroll within a page	Address/Page Knob (Left Knob DHW)
Enter	short push

* Knob design does not change scrolling position when pressing the buttons to turn pages. Thus, if display was on P19, pushing will advance to P29. Rotate knob counter clockwise (↶) to view P20-P28.

10.3.4 INFO MENU (User/Service)



To enter in INFO menu press with a long push.

This functions ends after 3 minutes, or by pressing with a long push.

The INFO menu is divided in pages, each with 10 parameters (i.e. Ax0 – Ax9).

While in the INFO menu:

: short push to go to the next page (e.g. from A10-A19 page to A20-A29 page)

: short push to go to the previous page (e.g. from A20-A29 page to A10-A19)

Address/Page Knob: turning Left Knob permits scrolling between the parameters within the current selected page.*

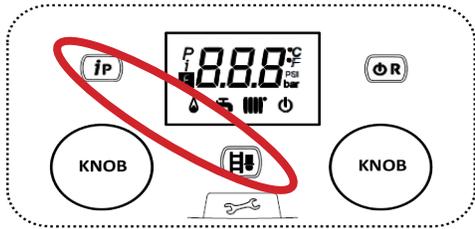
- A00: Error subcode
- A01: CH temperature
- A02: External temperature (if present)
- A03: DHW temperature
- A04: DHW temperature
- A05: Water pressure
- A06: Return temperature
- A07: Thermofuse state 0/1 (0 = open, 1 = closed)
- A09: CH setpoint elaboration
- A10: Combustion version
- A11: Application version

- A14: OT Communication setting (0=Plug & Play, 1=OT B&P, 2=OT Std, 4=if board do not receive ID2 from master)(*)
- A16: LTU36 counter
- A17: Fan speed (rpm/100)
- A19: Software Version

NOTE: Parameter numbers not listed are not present on this model.

10.3.5 Parameter Setting Menu

To set PCB parameters proceed as follows:



1. Press **H** and **i/P** together for about 6 seconds, the display shows "PO1" alternating with its value (01);
2. The parameter setting menu is divided in pages, each with 10 parameters (ie Px0-Px9).
3. **P/R**: short push to go to the next page (e.g. from P10-P19 page to P20-P19 page). See Note.
4. **i/P**: short push to go to the previous page (e.g. from P20-P19 page to P10-P19 page). See Note.
5. **Address/Page Knob**: turning Left Knob permits scrolling between the parameter within the current selected page. See Note.
6. If **Data Knob** (Right Knob) is moved, "NOP" is seen on the display to inform the user that moving the Data Knob has no consequences → **NOP= No OPeration**.
7. **H** short push: parameter visualized in display is selected and the board goes in the Value setting menu.
8. **P/R**: short push to go to next page (e.g. from values 10-19 page to 20-29 page)
9. **i/P**: short push to go to previous page (e.g. from values 20-29 page to 10-19 page)
10. **Data Knob**: turning Right Knob permits scrolling the values in the current selected page.
11. **H**: short push to save the value visualized on the display and return to parameter setting menu.
12. **Address/Page Knob**: returns to Parameter setting menu without saving the current value (escape function).

This function always ends after 3 minutes, or sooner by pressing **i/P** and **H** simultaneously with a long push.

Note → Knob design does not change scrolling position when moving back and forth between pages. If display was on P07, a short push of **P/R** will result in P17 display. Rotate knob to reach P11 through P16.

10.3.6 Description Of Parameters

- P70** Ignition fan speed setting: Fan Speed = **P70** * 100 rpm
- P71** Maximum fan speed: Fan speed = 3500 + **P71** * 25 rpm
- P72** Minimum fan speed: Fan speed = 750 + **P72** * 10rpm

Example

- To set ignition speed at 3000 rpm **P70** = 30
- To set max fan speed at 5800 rpm **P71** = 92
- To set min fan speed at 1100 rpm **P72** = 35

Note:

Parameters in Grey are not visible unless **P22** is set at 22.

10 - OPERATING INSTRUCTIONS

10.3.6 Description of Parameters

Parameter	Parameter Description	GMHB 227 NG	GMHB 227 LPG	GMHB 380 NG	GMHB 380 LPG
P01	DHW Modulation	0	0	0	0
P02	gas type selection	0	1	0	1
P03	Boiler setting 00= instantaneous combi boiler 02= instantaneous combi boiler with DHW micro tank 03= instantaneous combi boiler with pre heat 04= only heating boiler with DHW thermostat (system boiler 1) 05= only heating boiler for external DHW tank 06= boiler with DHW storage tank 07 = Heating only 08 = only heating boiler 09 = storage tank 3 (simple solar) 10 = instantaneous boiler for solar application 11 = instantaneous boiler for solar application with DHW micro-tank 13 = instantaneous boiler with pre-heat for solar application 15= only heating boiler with DHW pump for external tank 16= boiler with DHW storage tank and DHW pump with plate to plate DHW heat exchanger 17 = System boiler 2 (04 without pump) 18 = only heating boiler with DHW pump for external tank 19= System boiler 3	8	8	8	8
P04	Manufacturer information. Shall be set to 02. Ignore all other options.	2	2	2	2
P05	Manufacturer information. Shall be set to 04. Ignore all other options.	4	4	4	4
P06	Outdoor reset input configuration 00= with an outdoor sensor connected, the outdoor temperature value helps to calculate the supply temperature setpoint 01= with an outdoor sensor connected, the display shows the outdoor temperature value (no influence on supply temperature) 02= no function is associated 03= heating request input (e.g. telephonic trigger) 04 = Low temperature safety thermostat 05 = DHW pump activation	0	0	0	0
P07	Aux input configuration 00..02 = No function is associated 03 = This is an input contact for CH request (e.g. trigger phone). When contact CN2 is closed and Room Thermostat (RT) requiring heat switches burner on. Note: verify heating mode is enabled (winter or heat only mode) 04 = This is an input contact for Low Temperature Thermostat (e.g. floor heating system). When Low Temperature Thermostat connected on CN2 cuts out, burner switches off and display shows E178 anomaly. Note: verify heating mode is enabled (winter or heat only mode) 05 = This is an input contact for external DHW recirculation pump. When contact CN2 is closed the pump runs for a specific period. To enable input it is necessary to set parameter P04 or P05 = 08 and P69 = 05. Pump will run at P19 minutes (Summer/Winter mode or Only Winter mode) or P19/2 minutes (only Summer mode).	0	0	0	0
P08	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P09	Manufacturer information. Set to 1. Ignore other options.	0	0	0	0
P10	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P11	Manufacturer information. Shall be set to 02. Ignore all other options.	2	2	2	2
P12	Manufacturer information. Shall be set to 0. Ignore all other options.	0	0	0	0
P13	Max CH power setting	100	100	100	100

10 - OPERATING INSTRUCTIONS

10.3.6 Description of Parameters- Continued

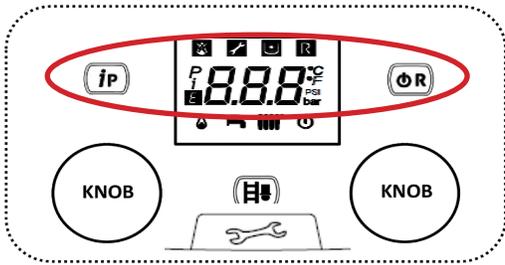
Parameter	Parameter Description	GMHB 227 NG	GMHB 227 LPG	GMHB 380 NG	GMHB 380 LPG
P14	Max DHW power setting	100	100	100	100
P15	Min CH power setting	0	0	0	0
P16	Maximum Central Heating setpoint (°C) 00= 176° F (80°C) 01= 113°F (45°C)	0	0	0	0
P17	Pump overrun time in heating mode (min)	3	3	3	3
P18	Maximum overrun time before a new relight of burner in heating mode (min)	3	3	3	3
P19	Manufacturer information. Shall be set to 7. Ignore all other options.	7	7	7	7
P20	Pump overrun time in DHW Mode (0...255 seconds)	30	30	30	30
P21	Anti-legionella function setpoint setting 00= disabled 60...67 = enabled (setpoint value °C)	0	0	0	0
P22	Set at "22" to display and edit parameters from P42 onward.	0	0	0	0
P23	Maximum DHW setpoint (°C) (55°C ...60°C) (131°F - 140°F)	60	60	60	60
P24	DHW start delay (sec)	35	35	35	35
P25	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P26	Manufacturer information. Set to 9. Ignore other options.	9	9	9	9
P27	Manufacturer information. Set to 26. Ignore other options.	26	26	26	26
P28	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P29	Manufacturer information. Set to 7. Ignore other options.	7	7	7	7
P30	Manufacturer information. Set to 10. Ignore other options.	10	10	10	10
P31	Manufacturer information. Set to 20. Ignore other options.	20	20	20	20
C00	Fault History C00				
C01	Fault History C1				
C02	Fault History C2				
C03	Fault History C3				
C04	Fault History C4				
C05	Fault History C5				
C06	Fault History C6				
C07	Fault History (lock-out) C07				
C08	Fault History (lock-out) C08				
C09	Fault History (lock-out) C09				
P42	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P43	Manufacturer information. Set to 1. Ignore other options.	1	1	1	1
P44	°C/°F selection (also changes pressure to bar/psig)	1	1	1	1
P45	Manufacturer information. Set to 1. Ignore other options.	1	1	1	1
P46	Manufacturer information. Set to 63. Ignore other options.	63	63	63	63
P47	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P48	Manufacturer Information. Shall be set to 0. Ignore other options.	0	0	0	0
P49	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P50	Manufacturer information. Set to 25. Ignore other options.	25	25	25	25
P51	Manufacturer information. Set to 25. Ignore other options.	25	25	25	25

10 - OPERATING INSTRUCTIONS

10.3.6 Description of Parameters- Continued

Parameter	Parameter Description	GMHB 227 NG	GMHB 227 LPG	GMHB 380 NG	GMHB 380 LPG
P52	Manufacturer information. Set to 90. Ignore other options.	90	90	90	90
P53	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P54	Manufacturer information. Set to 20. Ignore other options.	20	20	20	20
P55	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P56	DHW Frost protection enable/disable	0	0	0	0
P57	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P58	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P59	Manufacturer information. Set to 3. Ignore other options.	3	3	3	3
P60	Manufacturer information. Set to 1. Ignore other options.	1	1	1	1
P61	Manufacturer information. Set to 36. Ignore other options.	36	36	36	36
P62	Manufacturer information. Set to 9. Ignore other options.	9	9	9	9
P63	Manufacturer information. Set to 8. Ignore other options.	8	8	8	8
P64	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P65	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P66	Manufacturer information. Set to 98. Ignore other options.	98	98	98	98
P67	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P68	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P69	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P70	Ignition fan speed (Fan speed = $F70 \times 100 \text{rpm}$) (Consult factory before adjusting)	33	33	40	40
P71	Maximum fan speed (Fan speed = $5000 + F71 \times 10 \text{rpm}$)	90	90	125	174
P72	Minimum fan speed (Fan speed = $750 + F71 \times 10 \text{rpm}$)	115	108	95	135
P73	Manufacturer Information. Shall be set to indicated value. Ignore other options.	5	5	6	6
P74	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P75	Not used	-	-	-	-
P76	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P77	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P78	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P79	DWH switch off offset (0..15°C; 0: fixed Off value; 1..15 Off=DHW setpoint+F79)	0	0	0	0
P80	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P81	Manufacturer information. Set to 1. Ignore other options.	1	1	1	1
P82	Manufacturer information. Set to 4. Ignore other options.	4	4	4	4
P83	Manufacturer information. Set to 25. Ignore other options.	25	25	25	25
P84	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P85	Manufacturer information. Set to 0. Ignore other options.	0	0	0	0
P86	Manufacturer information. Set to 1. Ignore other options.	1	1	1	1

10.3.7 Command Functions (Service)



To enter the Command functions menu press **i/P** and **O/R** with a long push.

This function ends after 3 minutes or by pressing **i/P** and **O/R** simultaneously with a long push.

After accessing the Special functions menu "F00" is displayed.

Address/Page Knob is used to scroll between **FXX** parameters.

FXXX VALUE	FUNCTION
F00	No function related.
F01	De-aeration (same function can be started also pushing H with a long push)
F02	Manual control function
F03	(Reserved for future use)

When a parameter is selected, by pressing **H**, the board exits from the Command functions menu and the related function starts.

10.4 Boiler Operation

Domestic hot water supply always takes priority over central heating.

Demand for hot water required during central heating period, boiler automatically switches to hot water mode until demand is satisfied i.e. storage water is to required temperature.

This interruption in central heating is only when demand for hot water is present and should not be noticed by the User.

10.5 Central Heating Mode

1. Call for heat. Pump will start to circulate central heating water.
2. Fan will run. Once fan speed is reached burner will light.
3. Burner output automatically adjusts to suit system demand; as temperature of water in boiler approaches that set by adjustable temperature selector, burner output is reduced.
4. When set temperature is reached, burner is turned off and fan stops. Pump continues to run for three minutes to remove residual heat build up in boiler. Burner will not relight for 3 minutes.
5. If CH sensor has not registered pre-set temperature but room thermostat is satisfied the burner is turned off. Fan stops. Pump continues to run for three minutes. In this instance there is no 3 minute delay before burner relights.
6. If there is demand for DHW during 3 minute burner delay, boiler will operate to provide DHW until tap is closed. Boiler will immediately revert to provide CH if there is demand.

10.6 Frost Protection

Boiler has a built in frost thermostat which automatically turns boiler and pump on.

If water in boiler falls below 41°F (5°C), providing the display is switched on, boiler will operate until water temperature in the system reaches approximately 86°F (30°C).

Frost protection is for the boiler only and not for complete Central Heating System.

10.7 Pump

If display is switched on and boiler has not operated for 24 hours for heating or hot water, pump will operate automatically for one minute every 24 hours.

10.8 Low Water Pressure Sensor (Internal)

This device protects the primary exchanger from damage. It will not allow the boiler to run in a LOW water pressure situation. Low water condition occurs when water pressure drops below 7.0 psi (0.5 bar), approximately.

11 - GENERAL MAINTENANCE AND CLEANING

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.

CAUTION

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

Note

Verify proper operation after servicing.

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.

- 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.
- Visual inspection of flame through sight glass. Burner should be fully illuminated.
- Check heating system expansion tank.

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.
- After opening any part of the combustion chamber for maintenance the gaskets must be replaced. Refer to parts list for correct gasket kit.
- Check CO₂ and CO at high fire and low fire. Adjust if required. See Combustion Tables Section 9-12 for proper values.
- 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.

11 - GENERAL MAINTENANCE AND CLEANING

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.

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. NIOSH stated First Aid. Eye: Irrigate immediately. Breathing: Fresh air.

WARNING

Before servicing, turn off electrical power to boiler at service switch. Close manual gas valve to turn gas supply OFF to boiler. Test for gas leaks on any gas carrying components after servicing. Service not complete until appliance operation verified per Installation, Operation & Maintenance Manual provided with boiler.

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.

NOTICE

Perform regular service and maintenance by qualified service agency at least once every 12 months to assure safe, trouble free operation and maximum efficiency.

11.2 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 terminal outside and ensure it is not blocked.
- Operate boiler. Check operation of boiler's controls.
- Ensure all system connections and fittings are sound. Correct any joints and fittings that maybe leaking.
- Follow safety valve manufacturer recommendations for service.

To ensure boiler operates at peak efficiency, following checks must be performed every year:

- check appearance and tightness of gas and combustion circuit gaskets
- check condition and position of ignition and flame sensing electrodes
- check condition of burner and its connection to aluminum front plate
- check for dirt in combustion chamber. Use vacuum cleaner for this cleaning operation
- check gas valve is calibrated correctly
- check there is no dirt in condensate trap
- check central heating system pressure
- check expansion tank pressure
- check vent system, clean if necessary
- check water cleanliness
- clean dirt separator, if used
- If using glycol mixture, check glycol PH, replace if out of range

Record details and maintain service history.

11.3 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.
9. Replace used gaskets with new gaskets, see parts literature for correct gasket kit number.

⚠ 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.

11.4 Draining the Boiler

- turn boiler off
- isolate electrical supply
- close boiler gas service cock
- allow boiler to cool
- drain boiler through onboard drain if available or external drain valve.

11.5 Draining the Heating Circuit

- Follow all steps in 11.4.
- Close central heating flow and return valves.
- Connect suitable pipe to drain point.
- Route it to suitable container.
- Open drain tap.

11.6 Final Commissioning

- Allow heating system to heat. Balance the system to achieve temperature difference across heating supply and return pipes at the boiler.
- Check system for proper volume and pressure. See page 4 for acceptable volume and pressure.
- Turn off boiler.
- Thoroughly flush water pipe work. Clean filters in heating return and supply water isolating valves.
- Repressurize the system.

11.7 Final Assembly

- Place front jacket in position over boiler. Ensure bottom is located behind the control panel. Secure in position at top using screws previously removed.
- If boiler is to be left in service with the User, set controls and room thermostat.
- If boiler is not to be handed over immediately, close boiler gas service valve and turn off electrical supply.
- If there is possibility of boiler being left during frost conditions drain boiler and system. See section 11: Component Replacement Or Periodic Cleaning. Manufacturer recommends attaching a label to the boiler drawing attention to the fact that the system has been drained.

NOTICE

When servicing the appliance, check the condition and position of flame sensing electrode and replace it if necessary.

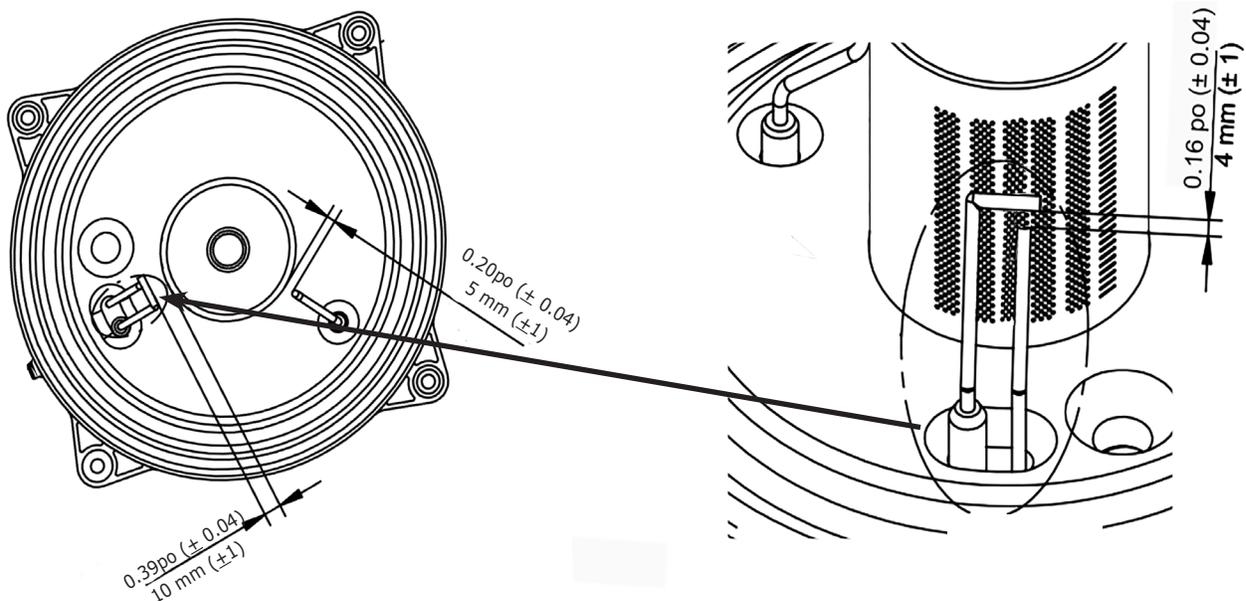
11.8 Replacement Parts

Perform Automatic Calibration procedure described as follows if one or more of the following components are replaced. Check and adjust CO₂% value as indicated in the Combustion Table.

Components replaced:

- Primary heat exchanger
- Fan
- Gas valve
- Gas nozzle
- Burner
- Flame sensing electrode

11-1 Electrodes -(GMHB227 shown)



11.9 User Information

Advise and demonstrate to User the following important information:

- A. Turn Boiler on and off. How to operate system controls.
- B. Importance of annual servicing of boiler to ensure safe and efficient operation.
- C. Servicing or replacement of parts shall be carried out by a qualified personnel.
- D. Ensure boiler controls and room thermostat, if fitted, are set to User's requirements.
- E. Tell User about sealed system pressure.
- F. Tell User if display is active and boiler has not operated for 24 hours for heating or hot water, the pump will automatically operate for 1 minute.
- G. Explain to User an internal frost thermostat is fitted in boiler, and electrical supply to boiler must be left on for thermostat to operate. Frost protection protects the boiler, not the system.
- H. Show User position of pressure relief valve discharge pipe.
- I. Leave this Installation, Operation and Maintenance Manual with User for use on future calls.

11.10 Safety Flue Thermostat - DO NOT disable this safety device.

Safety Flue Thermostat found on the flue inside the boiler, interrupts flow of gas to the burner if the temperature overheats.

After verifying the cause of the trip, press  for about 2 seconds.

NOTICE

When servicing the appliance, check the condition and position of flame sensing electrode and replace it if necessary.

11.11 Gasket Kit

Before beginning service on the boiler ensure that a maintenance service kit is on hand to replace gaskets that have been opened.

**TABLE 14: SEA LEVEL RATINGS
NATURAL AND PROPANE GASES**

Model Number	Input, (MBH) ⁽¹⁾		Heating Capacity (MBH) ⁽¹⁾⁽²⁾	Net AHRI Rating, Water (MBH) ⁽¹⁾⁽³⁾	AFUE ⁽²⁾	Thermal Efficiency
	Maximum	Minimum				
GMHB227	227	45	210	183	95.0	
GMHB380	379	62	348	303		95.0
⁽¹⁾ 1000 Btu/hr (British Thermal Units Per Hour) ⁽²⁾ Heating Capacity, Thermal Efficiency, 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.

13.1 Initial Fault Finding Checks

1. Check gas, water and electrical supplies are available at the boiler.
2. Electrical supply = 120V ~ 60 Hz.
3. Preferred minimum gas pressure is 7" H₂O (17.4 mbar) for Natural gas and 11" H₂O (27.4) mbar for LPG.
4. Carry out electrical system checks, i.e. Grounding, Resistance to Earth, Short Circuit and Polarity with a suitable meter.

NOTE: These checks must be repeated after any servicing or fault finding.

5. Ensure all external controls are calling for heat and check all external and internal fuses. Before any servicing or replacement of parts, ensure gas and electrical supplies are isolated.

Fault Listings:

1. If fault occurs on the boiler an error code may be shown by the display.

E 20, **E** 28, **E** 40, **E** 50, **E** 160, **E** 321 indicate possible faulty components.

E 53 shows possible obstruction in the flue duct.

E 55 indicates PCB is not setting/calibrated.

E 71, **E** 72, **E** 77, **E** 78 e **E** 92 indicate possible wrong calibration. A new calibration is needed.

E 92 shows possible flue recirculation in the flue duct.

E 83...87 shows possible error of communication with Room units (Go to section P)

E 110 shows overheat of the primary.

E 117 is displayed when the primary water pressure is more than 2.7 bar.

E 118 is displayed when the primary water pressure is less than 0.5 bar.

E 125 is displayed in either of two situations:-

- A. If within a time between 15..30 seconds of the burner lighting the boiler temperature has not changed by 1°C.
- B. If within 10 minutes of the burner lighting the boiler temperature twice exceeds the selected temperature by 30°C. In these instances poor primary circulation is indicated.

E 128 is displayed if there has been a flame failure during normal burner operation.

E 133 , **E** 134 and **E** 135 indicate the gas supply has been interrupted, ignition has failed or flame has not been detected.

2. By pressing the 'Reset' button for between 1-3 seconds when **E** 110, **E** 125, **E** 133, **E** 134, **E** 135 , **E** 09, **E** 15, **E** 128 and **E** 384 are displayed it is possible to relight the boiler.

3. If this does not have any effect, or error codes are displayed regularly further investigation is required.

13.2 Error Diagnostics

The Green Mountain PCB allows the display to list errors accrued in the boiler.

PCB has a counter which increases itself only if the anomaly is consecutive repetition. Non consecutive errors do not increase the counter.

To display all the information for each error consult Appendix B and scroll the list until P32 parameter.

Parameters from P32 to P38 (C00 to C06) are referred to errors which do not need to be reset (e.g. DHW sensor fault);

Parameters from P39 to P41 (C07 to C09) are referred to errors which require reset (e.g. safety thermostat).

PCB has another counter which displays how long ago the error occurred. The range of this counter is from 0 (the day in which the error occurred) to 99 (up to 3 months).

E.g. 45 indicates the error occurred one month and half ago.

The history of errors of each parameter (**Pxx**-see the error table) are displayed in the following order:

- Error number (C00 is the latest error)
- Error code
- Consecutive counter for the same error
- Number of days elapsed from the error event
- System Status
- Phase Status
- CH flow temperature value during the error event

See the following table for error codes:

The **system status** is the operating mode before the error.

00	Stand-by
01	DHW request
02	Controller stop function active
03	CH request
04	Preheat function active
05	CH frost protection function active
06	DHW frost protection function active
07	Post-circulation pump active
08	Overheating circulation pump function active

The **phase status** is a special operating mode before the error.

00	Stand-by
01	Pre-purging function active
03	Ignition load purging between the first attempt and second one.
04	Ignition load first attempt
05	Operation active
06	Lock out
08	Second ignition load attempt
11	Ignition load purging between the second attempt and the third one
14	Third ignition load attempt
15	Post-purging function
16	Overheating post-purging function active

Diagnostic is carried out to the display in a different way. It depends on the type of PCB used, as described in the following table:

Diagnostic Error Display:

C00
E133
=02
000
03
F05
75°C
In event of no error, historical error values are = 00

Table 13.3 Error Table for Installer

Use this table for error reporting:

		ERROR NUMBER	ERROR CODE	CONSECUTIVE COUNTER FOR SAME ERROR	NUMBER OF DAYS ELAPSED FROM ERROR EVENT	SYSTEM STATUS	PHASE STATUS	CH FLOW TEMPERATURE VALUE DURING ERROR EVENT
NO RESET ERROR	P32	C00						
	P33	C01						
	P34	C02						
	P35	C03						
	P36	C04						
	P37	C05						
	P38	C06						
RESET ERROR	P39	C07						
	P40	C08						
	P41	C09						

13 - TROUBLE SHOOTING

Table 13.4 Error Codes

ERROR CODE	INTERNAL CODE	ERROR	ACTION
E09		Gas valve connection fault	Check the cable PCB/gas valve and gas valve plug
E10		External probe fault	Check the sensor
E11		External RF probe fault	Check the sensor
E12		Differential water flow switch fault (still open)	Check the water flow switch
E13		Differential water flow switch (still close)	Check the water flow switch
E15		Gas valve command fault	Check the cable PCB/gas valve, replace PCB if it necessary
E18		Water refill activated	Function active message
E19		Maximum time of water refill	Check the refill hydraulic
E20	1	Central heating NTC sensor fault (s.c.)	Check the sensor
E20	2	Central heating NTC sensor fault (o.c.)	Check the sensor
E40	1	Return central heating NTC sensor fault (s.c.)	Check the sensor
E40	2	Return central heating NTC sensor fault (o.c.)	Check the sensor
E28	001/539	Flue NTC sensor fault (s.c.)	Check the sensor
E28	002/540	Flue NTC sensor fault (o.c.)	Check the sensor
E50	1	DHW NTC sensor fault (tank boiler) (s.c.)	Check the sensor
E50	2	DHW NTC sensor fault (tank boiler) (o.c.)	Check the sensor
E53		Obstruction on the flue pipe	Check obstruction on the flue pipe
E55		PCB to be set by the "Calibration Function"	Enable the Calibration function
E71		Fan parameter Out of range in auto calibration	Check the fan speed
E72		Combustion test Out of range in auto calibration	Check the correct position and integrity of the sensing electrode, and the cable
E77		Current out of range	Check the correct position and integrity of the sensing electrode, flue recirculation, enable the automatic calibration function before to replace components.
E78		Minimum gas valve current	Low gas pressure .Check the correct position and integrity of the sensing electrode, flue recirculation, CO2 value in ignition, enable the automatic calibration function before to replace components.
E79		Maximum gas valve current	Check the correct position and integrity of the sensing electrode, flue recirculation, enable the automatic calibration function before to replace components.
E83/84/ 85/86/87		No communication	Check cable between room unit and PCB or RF link.
E92		Combustion test alarm during auto-setting	Check flue recirculation
E109		Pre-circulation alarm	Check the correct circulation of the water and the pump
E110/ R	437	Boiler max temperature exceeded for gradient (probable pump jammed or air in the circuit)	Check the correct circulation of the water and the pump

R = REQUIRES RESET

13 - TROUBLE SHOOTING

ERROR CODE	INTERNAL CODE	ERROR	ACTION
E110/R	438	Boiler max temperature exceeded for over temperature (probable pump jammed or air in the circuit)	Check the correct circulation of the water and the pump
E110		Safety thermostat sensor tripped	Check the sensor
E117	566	Water pressure HIGH (>43 psig) (> 2.9 bar)	Check the water pressure
E118		Water pressure LOW (<7 psig) (< 0.5 bar)	Check the water pressure
E124		Condensate pump alarm	Check the external condensate pump
E125/R	500	Water circulation fault (over temperature)	Check the correct circulation of the water and the pump
E125/R	501	Water circulation fault (flatness on the flow)	Check the correct circulation of the water and the pump
E125/R	502	Water circulation fault (flatness on the return)	Check the correct circulation of the water and the pump
E127		Temperature Anti-legionella not reached	
E128/R		Safety error for frequently loss of flame	Check the sensing electrode and the cable, flue recirculation, enable the automatic calibration function before to replace components..
E129		Safety error for frequently loss of flame with max correction during the ignition	Check the sensing electrode and the cable, flue recirculation, enable the automatic calibration function before to replace components..
E130/R	528	Flue NTC sensor tripped (warning or lockout)	Check the thermostat, the correct circulation of the water and the pump. Check the status of the primary exchanger
E131		Flue thermostat sensor tripped (lockout)	Check the sensor, correct circulation of the water and the pump. Check the status of the primary exchanger
E132		Ignition failure (<35 tries)	Boiler will continue ignition attempts.
E133/R	0	Gas supply fault (no ignition)	Check the power supply, sensing electrode, spark electrode and cable. Check flue recirculation, gas supply pressure, continuity between burner and ground
E133/R	1	No ignition (frozen / obstruction condensate trap)	Check the correct operation of the condensate trap
E134/R		Gas valve open without gas	Check the gas pressure, sensing electrode, spark electrode and cable, replace the PCB if it necessary
E135		Internal error	Verify cables; Replace PCB
E154		Plausibility test (flow/return)	Check the correct circulation of the water and the pump, check the correct position of the sensors
E160		Fan fault	Check the fan and the cable
E169		Air pressure switch closed	Check obstruction on the flue pipe
E178		Low temperature safety thermostat	Check the sensor and the correct circulation of the water and the pump
E317/162		Wrong power supply electrical frequency (Hz)	Check the frequency (Hz) and the power supply
E384/164/R		Fault flame (parasitic flame)	Check the correct operation of the gas valve, humidity on the PCB and on the detection electrode
E385/165		Under voltage	Check the power supply (V~)

R = REQUIRES RESET

13 - TROUBLE SHOOTING

13.5 Errors In Fault History Only

ERROR CODE	INTERNAL CODE	ERROR	ACTION
E62		Anti wind activation with increase of the minimum fan speed	Check the position of the terminal of the flue duct. No other action to do
E63/E65		Combustion level out of range	Check flue recirculation and the combustion levels.
E65		Maximum value of the speed reached/ correction of the flame signal	Check flue recirculation and the combustion levels.
E66		Obstruction of the flue duct at minimum power	Check obstruction on the flue duct.
E67		Antiwind activation at maximum power	Check the position of the terminal of the flue duct.
E69		Combustion level out of range	Check flue recirculation and the combustion levels.
E70		Flame signal problem/micro interruption of the flame signal	Check cable and integrity of the sensing electrode, verify the continuity between burner and earth.
E73		Modified Flame signal	No action to do

13.6 Optional Equipment

IMPORTANT: Sensors supplied with this boiler are proprietary to the manufacturer. Use of alternate market sensors *WILL* diminish boiler performance.

CHART 1 - 1 k Ohm OUTDOOR AIR SENSOR DATA			
T [°F]	R [Ohm]	T [°F]	R [Ohm]
-4.0	7,578	53.6	1,690
-2.2	7,193	55.4	1,621
-0.4	6,831	57.2	1,555
1.4	6,489	59.0	1,492
3.2	6,166	60.8	1,433
5.0	5,861	62.6	1,375
6.8	5,574	64.4	1,321
8.6	5,303	66.2	1,268
10.4	5,046	68.0	1,218
12.2	4,804	69.8	1,170
14.0	4,574	71.6	1,125
15.8	4,358	73.4	1,081
17.6	4,152	75.2	1,040
19.4	3,958	77.0	1,000
21.2	3,774	78.8	962
23.0	3,600	80.6	926
24.8	3,435	82.4	892
26.6	3,279	84.2	858
28.4	3,131	86.0	827
30.2	2,990	87.8	796
32.0	2,857	89.6	767
33.8	2,730	91.4	740
35.6	2,610	93.2	713
37.4	2,496	95.0	687
39.2	2,387	96.8	663
41.0	2,284	98.6	640
42.8	2,186	100.4	617
44.6	2,093	102.2	595
46.4	2,004	100.4	617
48.2	1,920	102.2	595
50.0	1,840	104.0	575
51.8	1,763	106.0	556

CHART 2 - 10 K Ohm INDIRECT TANK SENSOR DATA			
T [°F]	R [Ohm]	T [°F]	R [Ohm]
32.0	32,505	86.0	8,060
33.8	30,898	87.8	7,726
35.6	29,381	89.6	7,407
37.4	27,946	91.4	7,103
39.2	26,590	93.2	6,813
41.0	25,308	95.0	6,537
42.8	24,094	96.8	6,273
44.6	22,946	98.6	6,021
46.4	21,859	100.4	5,781
48.2	20,829	102.2	5,551
50.0	19,854	104.0	5,332
51.8	18,930	105.8	5,123
53.6	18,054	107.6	4,923
55.4	17,223	109.4	4,732
57.2	16,436	111.2	4,549
59.0	15,689	113.0	4,374
60.8	14,980	114.8	4,207
62.6	14,306	116.6	4,047
64.4	13,667	118.4	3,894
66.2	13,060	120.2	3,748
68.0	12,483	122.0	3,608
69.8	11,935	123.8	3,473
71.6	11,414	125.6	3,345
73.4	10,919	127.4	3,222
75.2	10,447	129.2	3,104
77.0	9,999	131.0	2,991
78.8	9,572	132.8	2,882
80.6	9,166	134.6	2,778
82.4	8,779	136.4	2,679
84.2	8,411	138.2	2,583

**Figure 13-1 Temperature-Resistance Chart for
Supply and Return Temperature Sensors**

T (°C)	T (°F)	R (Ohm)
-40	-40	309396
-30	-22	171840
-20	-4	98932
-10	14	58879
0	32	36129
10	50	22804
20	68	14773
25	77	12000
30	86	9804
40	104	6652
50	122	4607
60	140	3252
70	158	2337
80	176	1707
90	194	1266
100	212	952
110	230	726
120	248	560
130	266	438
140	284	345
150	302	275

- **APPLIANCE** - Device to convert gas into energy; term includes any component, control, wiring, piping or tubing required to be part of the device.
- **ANSI** - American National Standards Institute, Inc. oversees creation and maintenance of voluntary consensus standards, including ANSI Z21.13/CSA 4.9: Gas-Fired Low Pressure Steam and Hot Water Boilers.
- **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**
 - Natural Gas**
$$\text{MBH} = \frac{127,116 \times \text{cu meters}}{\text{Seconds}}$$

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

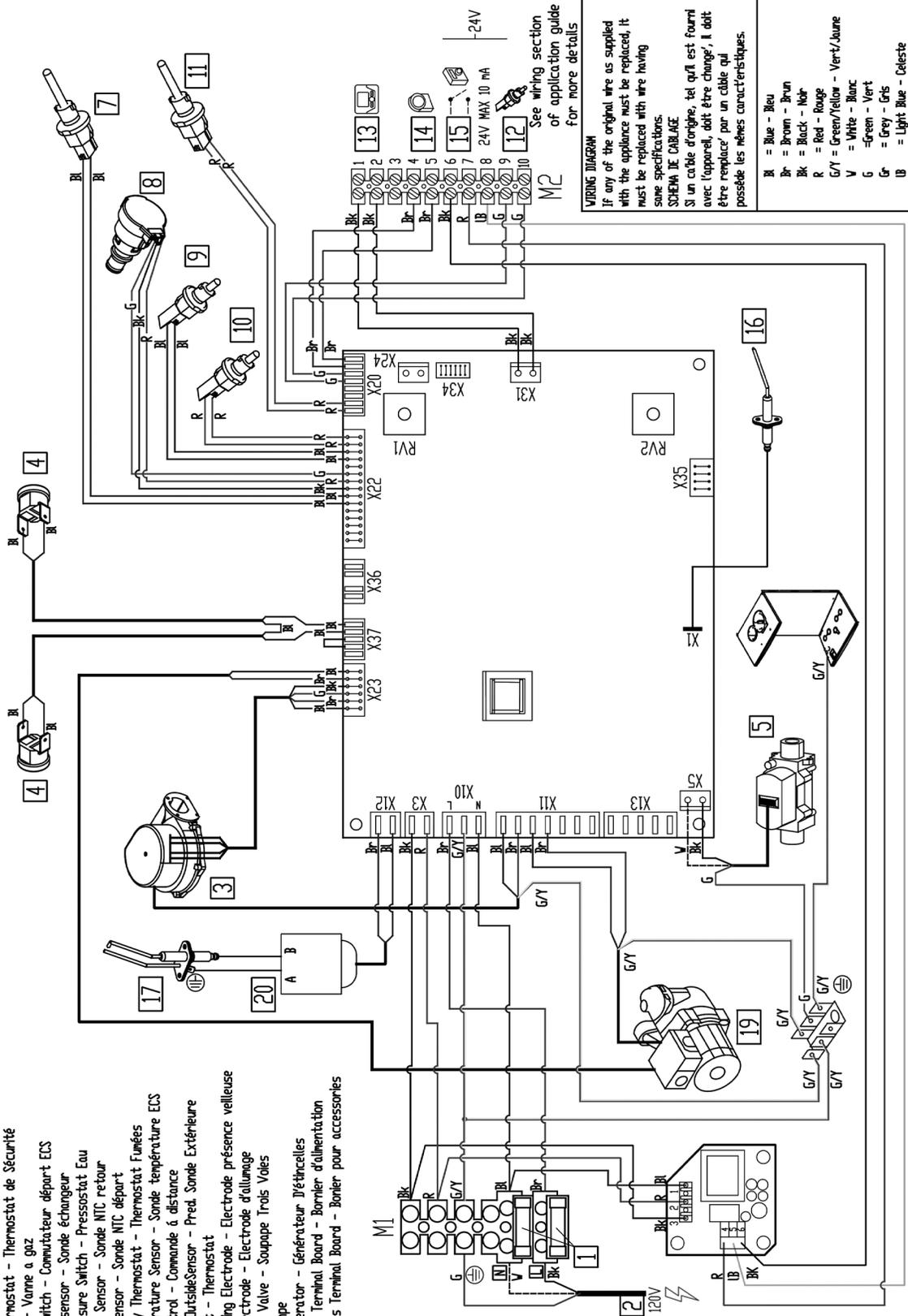
$$\text{MBH} = \frac{127,116 \times 0.1}{100} = 127 \text{ MBH}$$
 - Propane Gas (LP)**
$$\text{MBH} = \frac{383,482 \times \text{cu meters}}{\text{Seconds}}$$
- **PRESSURE TEST** - Operation performed to verify gas tight integrity of gas piping following its installation or modification.

- **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.

A-1 MODEL GMHB227

LEGEND - LEGENDE:

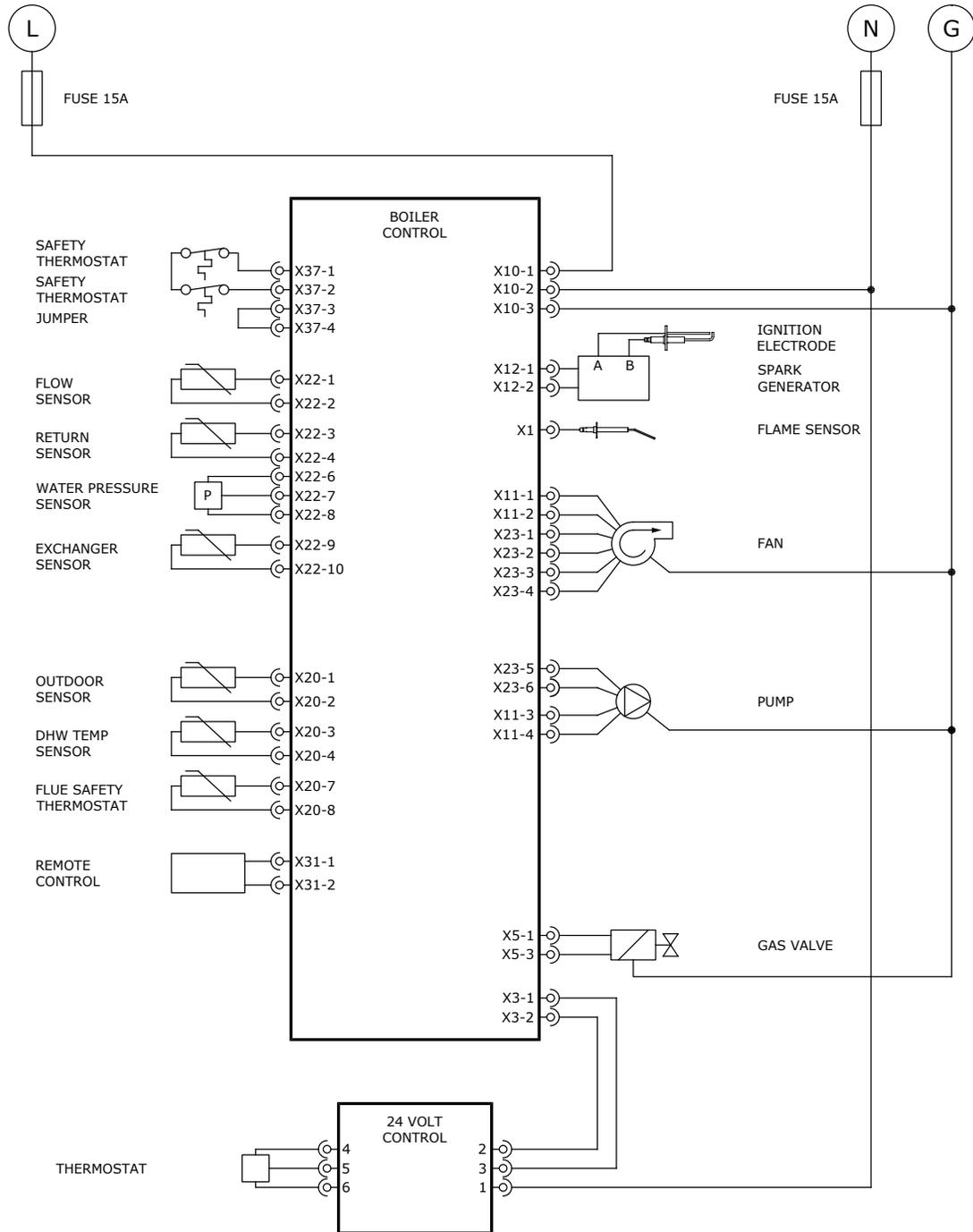
- 1-FUSES 2, 15 A - Fusibles 2, 15 A
- 2-Supply 120V - 60Hz - Alimentation
- 3-Fan - Ventilator
- 4-Safety Thermostat - Thermostat de Sécurité
- 5-Gas Valve - Vanne à gaz
- 6-RHV Flow Switch - Commutateur départ ECS
- 7-Exchanger sensor - Sonde échangeur
- 8-Water Pressure Switch - Pressostat Eau
- 9-NTC return Sensor - Sonde NTC retour
- 10-NTC flow sensor - Sonde NTC départ
- 11-Flue Safety Thermostat - Thermostat Fumées
- 12-RHV temperature Sensor - Sonde température ECS
- 13-Remotecontrol - Commande à distance
- 14-Prev. for Drivside/Sensor - Pred. Sonde Extérieure
- 15-Thermostat - Thermostat
- 16-Flame Sensing Electrode - Electrode présence veilleuse
- 17-Ignition Electrode - Electrode d'allumage
- 18-Three Way Valve - Soupape Trois Voies
- 19-Pump - Pompe
- 20-Spark Generator - Générateur Triélectelles
- M1-Main Power Terminal Board - Bornier d'alimentation
- M2-Accessories Terminal Board - Bornier pour accessoires



WIRING DIAGRAM
 If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wire having same specifications.
SCHEMA DE CÂBLAGE
 Si un câble d'origine, tel qu'il est fourni avec l'appareil, doit être changé, il doit être remplacé par un câble qui possède les mêmes caractéristiques.

Bk	= Blue - Bleu
Br	= Brown - Brun
Bk	= Black - Noir
R	= Red - Rouge
G/Y	= Green/Yellow - Vert/Jaune
V	= White - Blanc
G	= Green - Vert
Gr	= Grey - Gris
LB	= Light Blue - Celeste

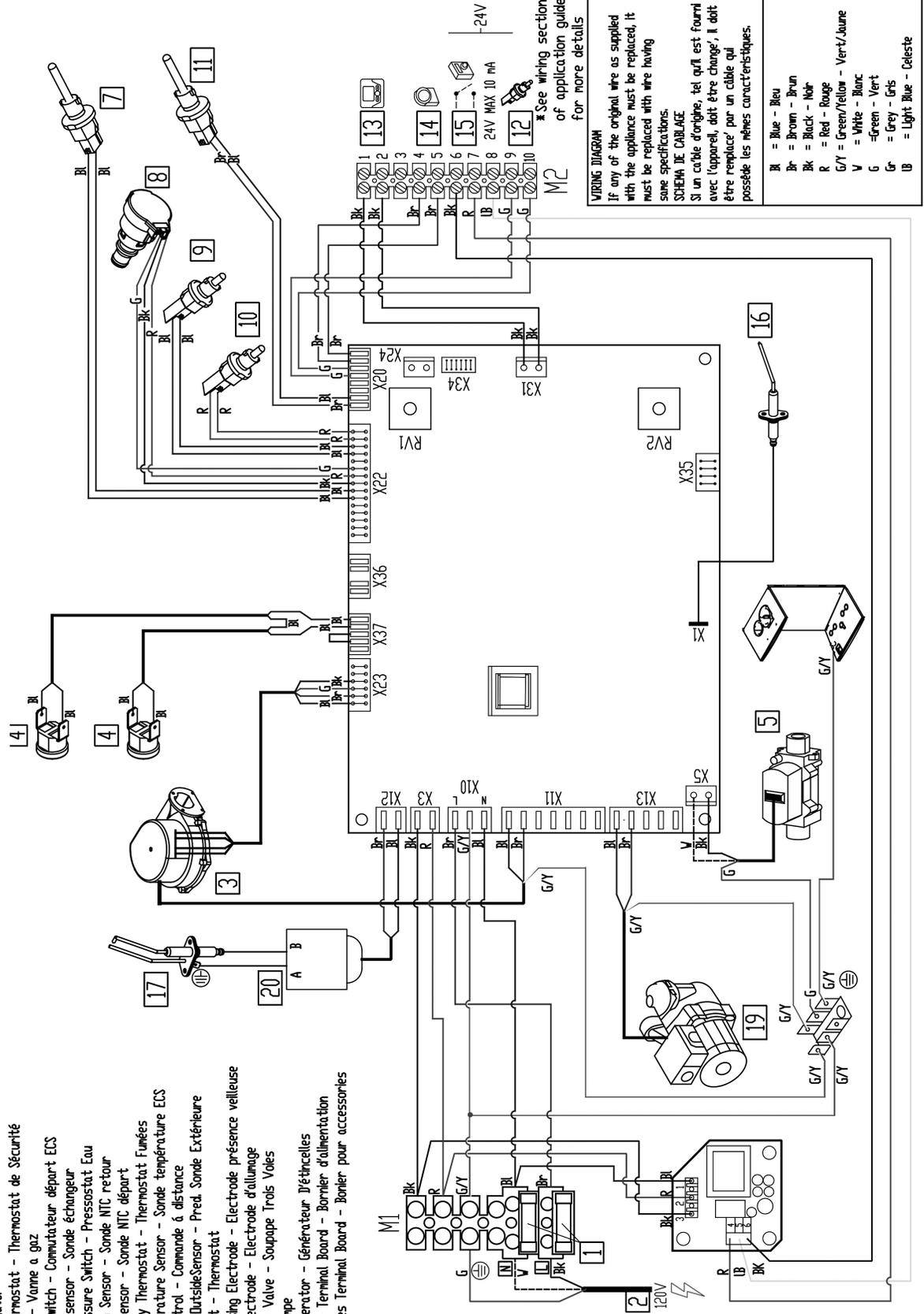
A-1 MODEL GMHB227 - LADDER DIAGRAM



A-2 MODEL GMHB380

LEGEND - LEGENDE

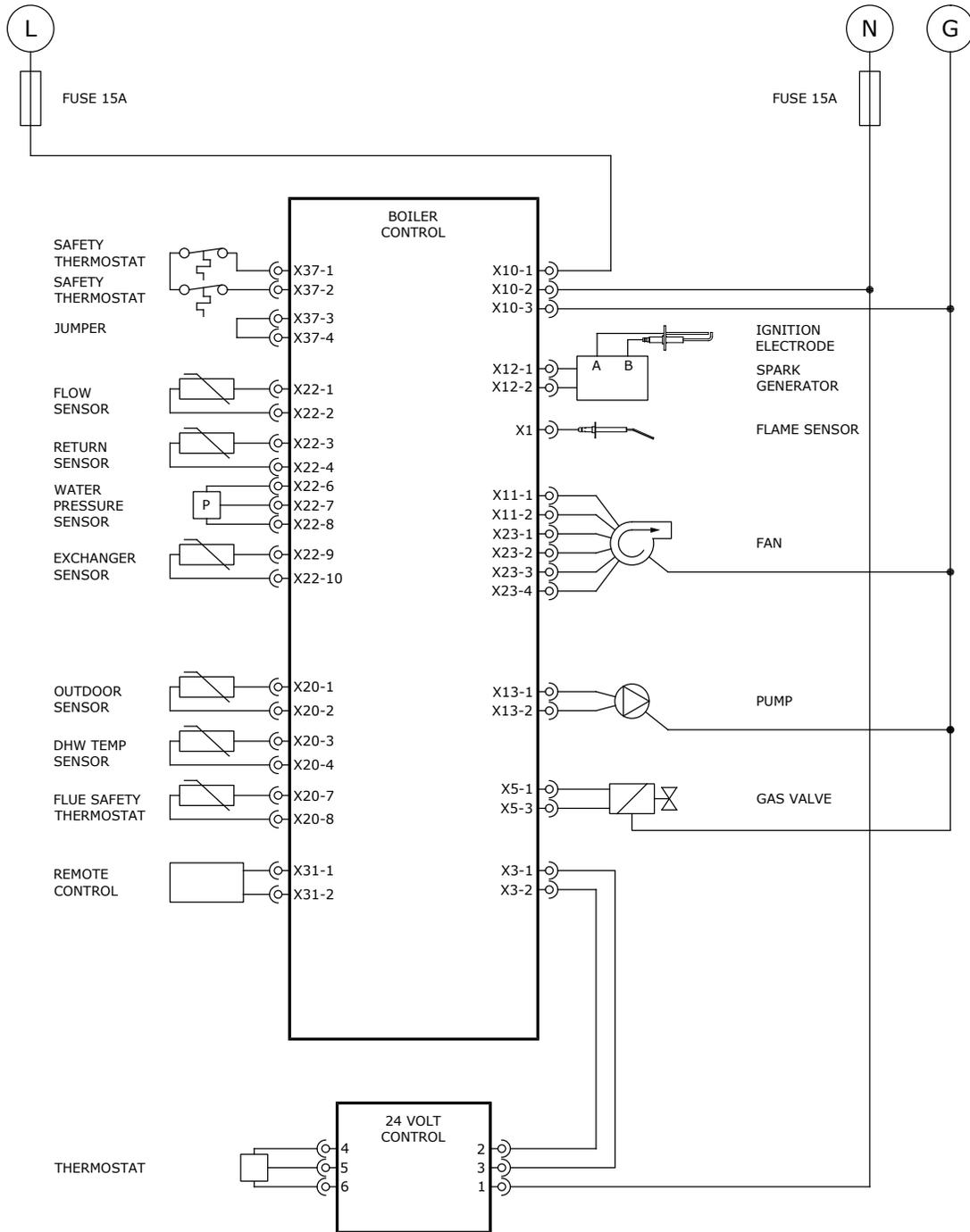
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- 5-Gas Valve - Vanne à gaz
- 6-3HW Flow Switch - Commutateur départ ECS
- 7-Exchanger sensor - Sonde échangeur
- 8-Water Pressure Switch - Pressostat Eau
- 9-NTC return Sensor - Sonde NTC retour
- 10-NTC flow sensor - Sonde NTC départ
- 11-Flue Safety Thermostat - Thermostat Fumées
- 12-3HW temperature Sensor - Sonde température ECS
- 13-Remotecontrol - Commande à distance
- 14-Prev. for OutsideSensor - Pred. Sonde Extérieure
- 15-Thermostat - Thermostat
- 16-Flame Sensing Electrode - Electrode présence veilleuse
- 17-Ignition Electrode - Electrode d'allumage
- 18-Three Way Valve - Soupape Trois Voies
- 19-Pump - Pompe
- 20-Spark Generator - Générateur d'étincelles
- M1-Main Power Terminal Board - Bornier d'alimentation
- M2-Accessories Terminal Board - Bornier pour accessoires



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 If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wire having same specifications.
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 Si un câble d'origine, tel qu'il est fourni avec l'appareil, doit être changé, il doit être remplacé par un câble qui possède les mêmes caractéristiques.

B	= Blue - Bleu
Br	= Brown - Brun
Bk	= Black - Noir
R	= Red - Rouge
G/Y	= Green/Yellow - Vert/Jaune
V	= White - Blanc
G	= Green - Vert
Gr	= Grey - Gris
LB	= Light Blue - Céleste

A-3 MODELS - GMHB380 LADDER



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.



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All specifications subject to change without notice.

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