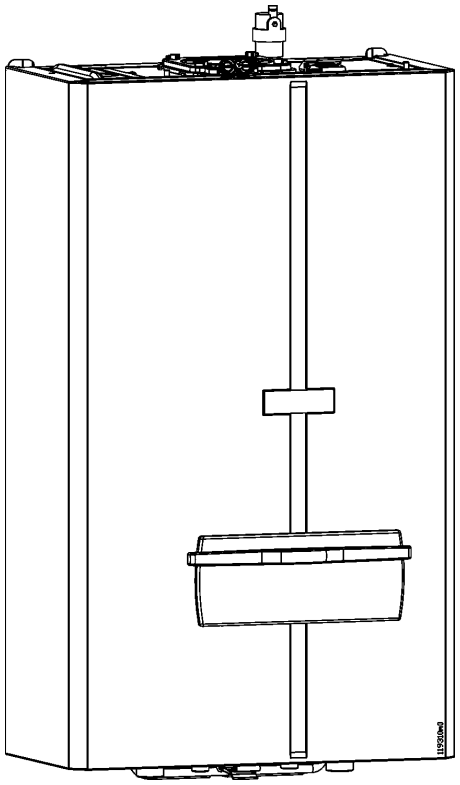
EMBASSY INDUSTRIES Inc.

Installation and maintenance instructions for gas-fired condensing hot water boiler

ONEX®



ASME certified

INSTALLER, THESE INSTRUCTIONS TO BE AFFIXED ADJACENT TO THE BOILER.

62403535.R00 9/02/2010

SAFETY INSTRUCTIONS

WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.

- **Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**

- **WHAT TO DO IF YOU SMELL GAS**

  - **Do not try to light any appliance.**
  - **Do not touch any electrical switch; do not use any phone in your building.**
  - **Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.**
  - **If you cannot reach your gas supplier, call the fire department.**

- **Installation and service must be performed by a qualified installer, service agency or the gas supplier.**

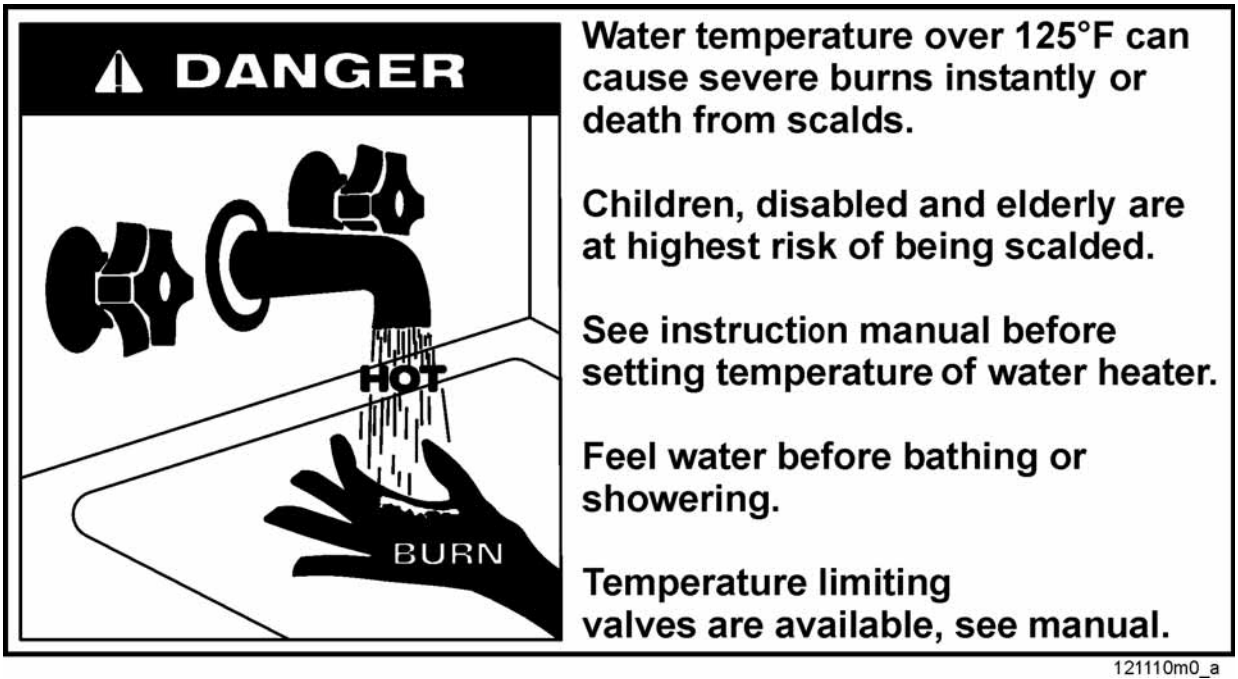
AVERTISSMENT: Assurez vous de bien suivre les instructions données dans cette notice pour réduire au minimum le risque d'incendie ou d'explosion ou pour éviter tout dommage matériel, toute blessure ou la mort

- **Ne pas entreposer ni utiliser d'essence ou ni d'autres vapeurs ou liquides inflammables à proximité de cette appareil ou de tout autre appareil.**

- **QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:**

  - **Ne pas tenter d'allumer l'appareil.**
  - **Ne touchez à aucun interrupteur, ne pas vous servir des téléphones se trouvant dans le bâtiment**
  - **Appelez immédiatement votre fournisseur de gas de puis un voisin. Suivez les instructions du fournisseur.**
  - **Si vous ne pouvez rejoindre le fournisseur, appelez le service des incendies**

- **L'installation et l'entretien doivent être assurés par un installateur ou un service d'entretien qualifié ou par le fournisseur de gaz.**



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SAFETY INSTRUCTIONS

FOR YOUR SAFETY READ BEFORE OPERATING

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

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

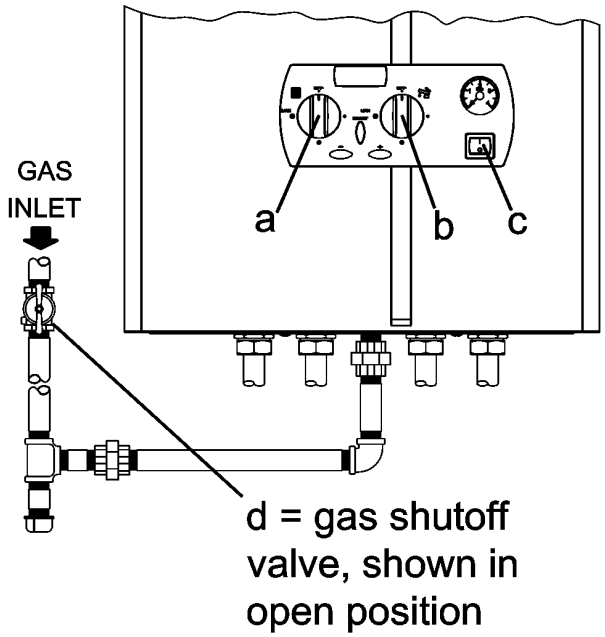
B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS
- Do not try to light any appliance.
- Do not touch any electric switch;
- Do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

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

OPERATING INSTRUCTIONS



a) Central heating regulation knob
b) D.H.W. regulation knob
c) Main electrical switch
d) Gas control knob

1. STOP! Read the safety information above on this label.
2. Turn off all electric power to the appliance.
3. Set the main switch "C" to zero and turn the two knobs "a" and "b" to their OFF position.
4. This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Close the manual gas shutoff valve "d" turning the knob "d" clockwise. Do not force.
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to next step.
7. Open the manual gas shutoff valve turning the knob "d" counterclockwise.
8. Turn on all electric power to the appliance, and set the main switch "c" to the "one" position.
9. Set knobs "a" and "b" to desired setting.
10. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

1. Turn off all electric power to the appliance if service is to be performed.
2. Set the main switch "c" to zero and turn the two knobs "a" and "b" to their OFF position.
3. Close the manual gas shutoff valve turning the knob "d" counterclockwise. Do not force.

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SAFETY INSTRUCTIONS

WARNING!!! These instructions must be read prior to installation. If the information in these instructions is not followed exactly, a fire or explosion may result, causing property damage, personal injury, or death.

☞ **Liability**
The manufacturer declines all liability, contractual or otherwise, for damages resulting from the incorrect installation of this boiler. This includes the failure to comply with the instructions provided by the manufacturer or from a failure to comply with the applicable local and national regulations in force. The manufacturer declines all liability, contractual or otherwise, for any damage to people, animals or property caused by the incorrect use of this boiler or inadequate or incorrect service or maintenance.

☞ **Hazards and Your Safety - Hot Water Can Scald!**
Water temperature over **125°F** (52°C) can cause severe burns instantly, or death from scalds. Children, the disabled, and the elderly are at highest risk of being scalded; see instruction manual before setting temperature at boiler! Feel water before bathing or showering.

☞ **If there is a smell of combustion products**, turn the unit off, air out the room and call a licensed authorized technician. Failure to take proper precautions can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

☞ **Qualified Technicians:**
Qualified technicians are individuals with specific, technical training in space heating systems, domestic hot water systems, fuel gas systems and electrical systems. These individuals must have the legally required qualifications.

☞ **Installation and Alterations:**
Licensed, authorized personnel must carry out the installation and calibration of the boiler. Never modify the boiler or its flue gas carrying components in any way. This boiler must be properly vented. Failure to follow these instructions could result in personal injury or death!

☞ **For safety and environmental reasons,** the packing materials must be properly disposed of. Any replaced part or packaging should never be left within the reach of children. Failure to follow these instructions could result in severe personal injury

☞ **Maintenance:**
at least once a year the user must call in a licensed authorized technician for routine maintenance.

☞ **In the event of a breakdown and/or malfunction of the boiler**, turn off the unit and do not make any attempt to repair it. The boiler must be serviced exclusively by a qualified technician using original spare parts. Failure to comply with this requirement may compromise the safety of the unit and void its warranty.

☞ **Use the service switch to disconnect the boiler from the electrical circuit** before carrying out any service or maintenance operations.

☞ **Electrical**
CAUTION: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

☞ ***ATTENTION:*** *Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Des erreurs de câblage peuvent entraîner un fonctionnement inadéquat et dangereux. S'assurer que l'appareil fonctionne adéquatement une fois l'entretirn terminé.*

☞ **Correct Use:**
This boiler must only be used for the purpose for which it has been expressly designed: heating of water for closed circuit systems for central heating and the production of domestic hot water.

☞ **Should overheating occur or the gas supply fail to shut off**, do not turn off or disconnect the electrical supply to the pump. Instead, shut off the gas supply at a location external to the appliance.

☞ ***En cas de surchauffe ou si l'alimentation de gaz ne peut être coupée****, ne pas couper ni débranch l'alimentation électrique de la ponpe. Fermer plutôt le robinet d'admission de gaz à l'extérieur de l'appareil*

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

☞ ***N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement.*** *Faites inspecter l'appareil par un tecnicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau.*

☞ **Do not obstruct the air intake or vent pipe terminals.** Failure to take proper precautions can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

☞ **Any optional extras or kit fitted subsequently must be original manufacturer parts.**

TABLE OF CONTENTS

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1 - INSTALLATION - CODE REQUIREMENTS

1.1 - National installation legislation

- The installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the latest edition of the ***National Fuel Gas Code, ANSI Z223.1/NFPA 54*** and or ***CAN/CSA B149.1, Natural Gas and Propane Installation Code.***

- Where required by the authority having jurisdiction, the installation must conform to the Standard for ***Controls and Safety Devices for Automatically Fired Boilers, ANSI/ ASME CSD-1***

2 - GENERAL INFORMATION

2.1 - Key to symbols used

WARNING!!! Failure to follow these indications can causing an explosion, extensive property damage, severe personal injury or death!

CAUTION!!!
Electrical caution! Risk of electric shock: failure to observe this warning may compromise the smooth running of the appliance or cause serious damage to individuals, animals or property.

CAUTION!!!
General caution. Failure to observe this warning may compromise the smooth running of the appliance or cause serious damage to individuals, animals or property.

NOTE:

● Operation symbol

☞ Important indication symbol

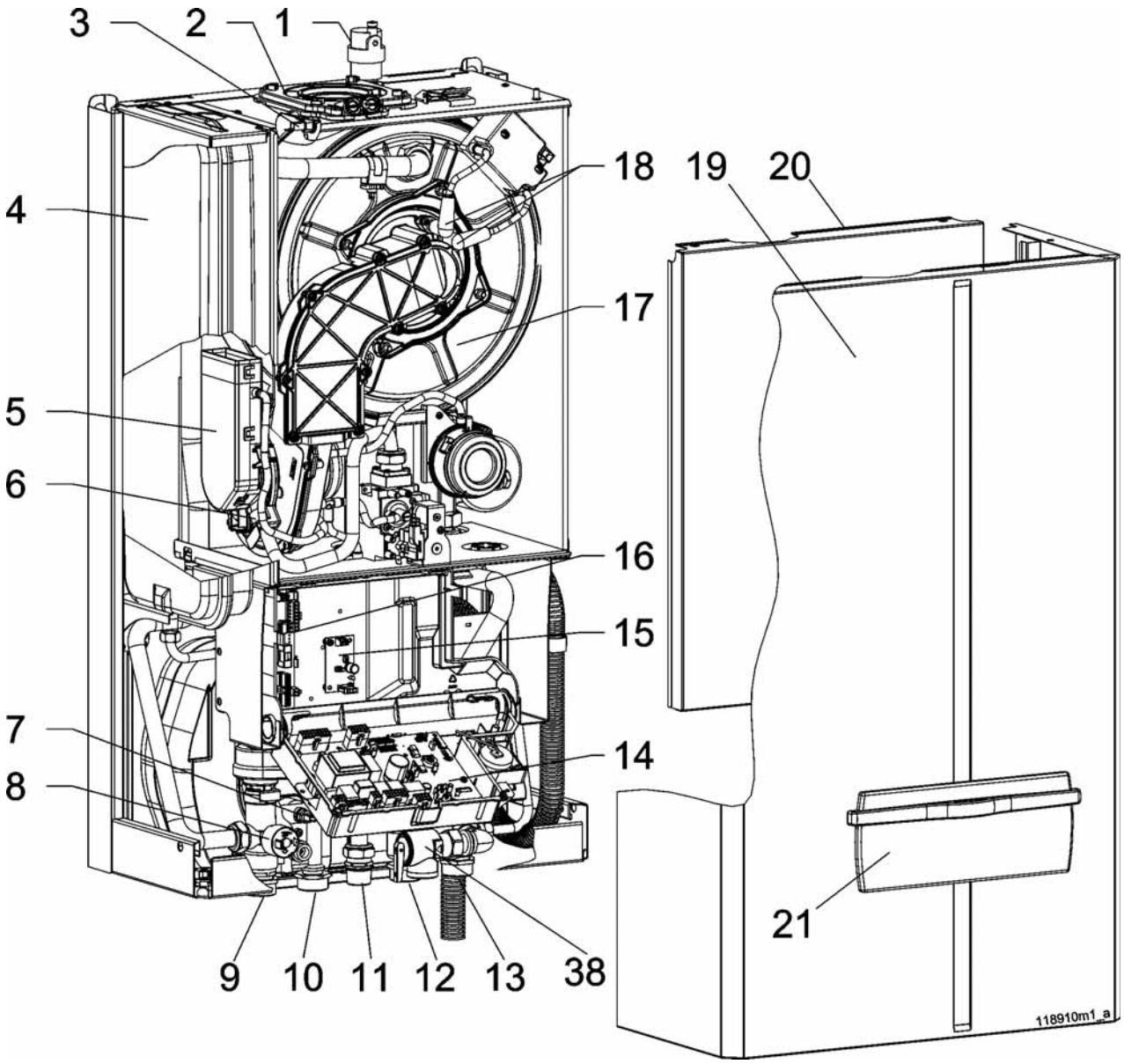
2.2 - Description of models:

160 XX

B = heating only version, for inside installation
C = combi version (space heating and instantaneous D.H.W. production), for inside installation.
OB = heating only version, for outdoor installation
OC = combi version (space heating and instantaneous D.H.W. production), for outdoor installation.

Modulating gas-fired, condensing hot water boiler, with sealed combustion chamber and pre-mix burner, with maximum power input of 160,000 Btu/hr (47 kW) and minimum of 30,000 Btu/hr (9 kW)

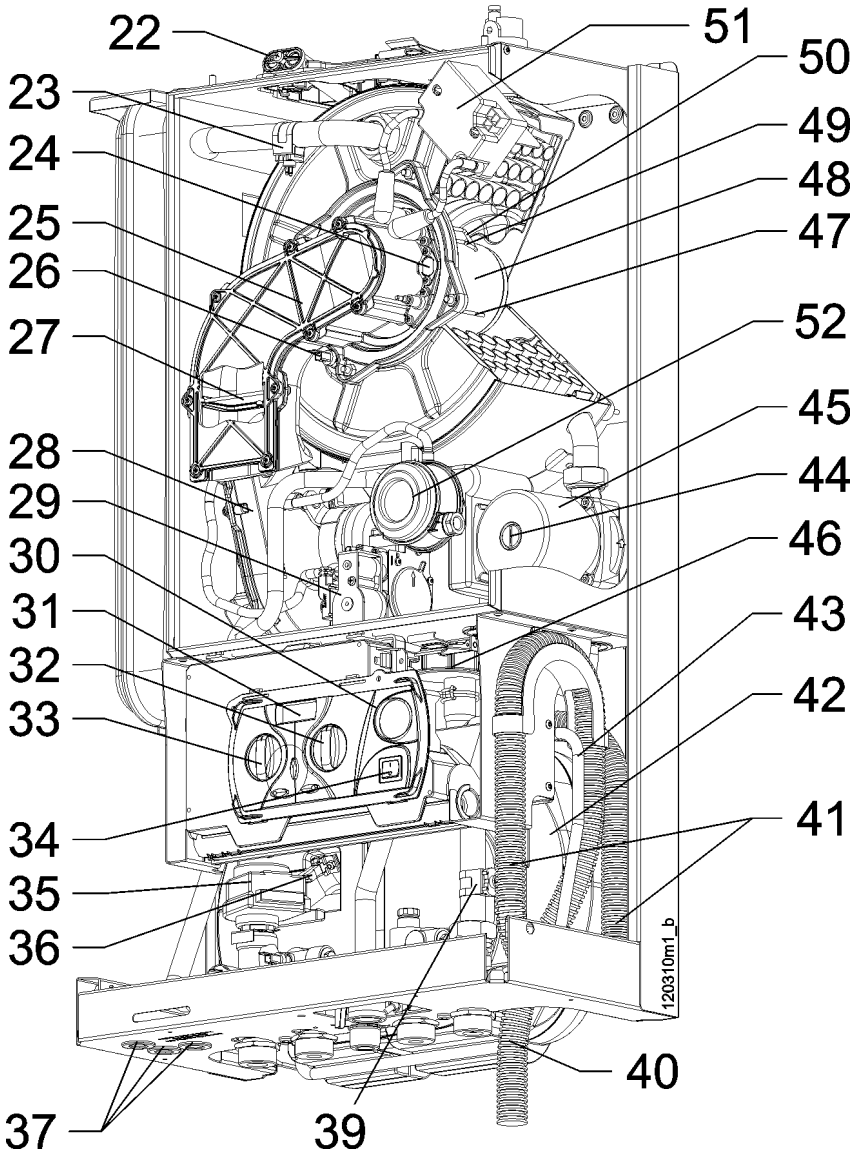
3 - MAIN COMPONENTS



1 - P/N 61206001 - Automatic air vent
2 - P/N 61405160 - Air intake and flue gas discharge fitting (venting system)
3 - P/N 62111015 - U7 flue gas temp. sensor and flue safety switch
4 - P/N 62201005 - Expansion tank (not present on 160B and 160OB models)
5 - P/N 62651016 - Inlet air plenum
6 - Air/gas mixer device (For P/N see Section 15)
7 - P/N 62111017 - U2 d.h.w. temp. sensor (not present on 160B and 160OB models)
8 - P/N 62113035 - Heating pressure switch (low water cut-off)
9 - Heating supply connection
10 - DHW connection (not present on 160B and 160OB models)
11 - Gas inlet connection
12 - Cold water connection (not present on 160B and 160OB models)
13 - Heating return connection
14 - P/N 62110076 - Power Control Board
15 - P/N 62118015 - Openterm interface board (optional)
16 - P/N 60507056 - Connection board
17 - P/N 62649004 - Primary heat exchanger
18 - P/N 60504206 - Spark cable
19 - External jacket (For P/N see Section 15)
20 - Combustion chamber door
21 - Instrument panel door

Figure 1 - Main components

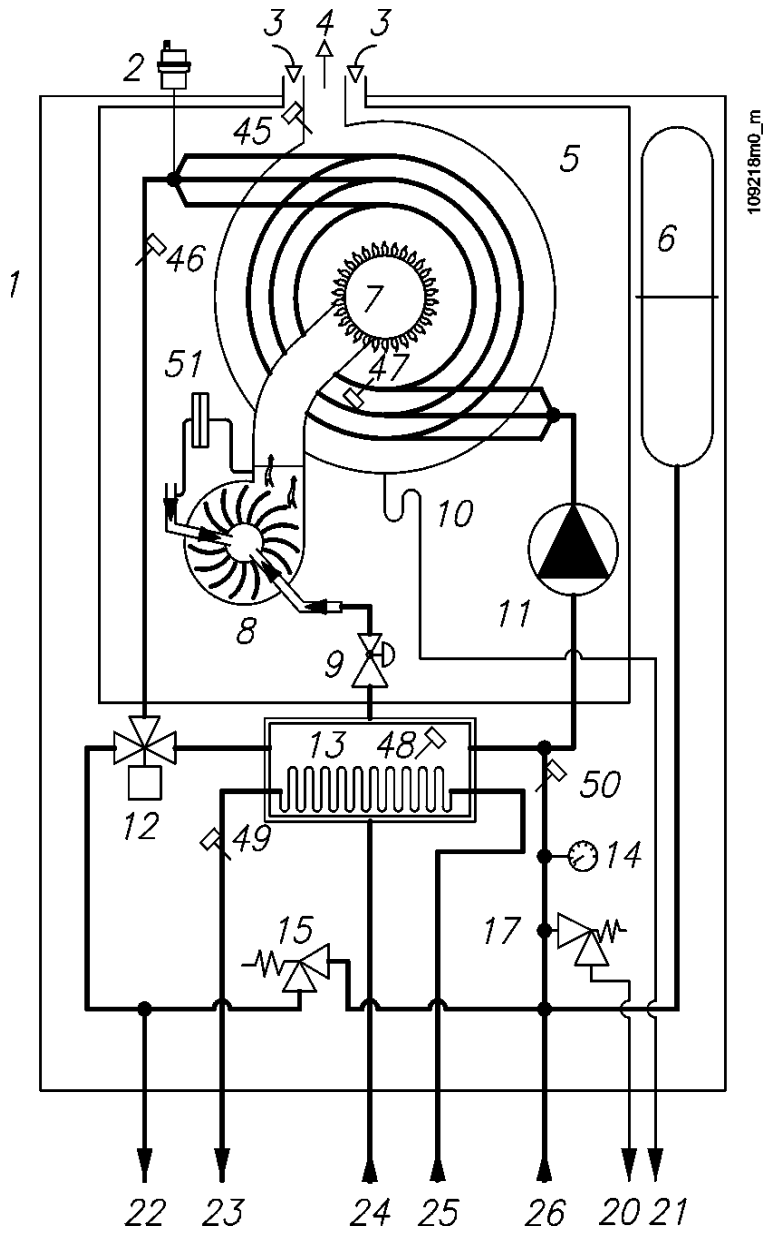
3 - MAIN COMPONENTS



22 - Combustion analysis tap (For P/N see Section 15)
23 - P/N 62111016 - U1 supply temperature sensor
24 - Burner window (For P/N see Section 15)
25 - Air/gas manifold (For P/N see Section 15)
26 - P/N 62111017 - U6 high temperature limit sensor
27 - Flue gases back flow preventer (For P/N see Section 15)
28 - P/N 61901029 - Fan
29 - P/N 61201040 - Gas valve
30 - P/N 62102009 - Heating pressure gauge
31 - Display
32 - Domestic hot water temperature control
33 - Heating temperature control
34 - P/N 60506019 - On/off power switch
35 - Three way valve (not present on 160B and 160OB models) (For P/N see Section 15)
36 - P/N 62110052 - U3 domestic cold water temp. sensor (not present on 160B and 160OB models)
37 - P/N 61101001 - Cable clamp
38 - P/N 61205010 - ASME Safety relief valve
39 - P/N 62111016 - U8 return temperature sensor
40 - P/N 60305073 - By-pass pipe (not present on 160B and 160OB models)
41 - P/N 60322010 - Condensation discharge pipe
42 - Secondary heat exchanger for domestic hot water production (not present on 160B and 160OB models) (For P/N see Section 15)
43 - P/N 62625064 - Expansion tank connection pipe (not present on 160B and 160OB models)
44 - Circulator pump screw (not present on 160B and 160OB models)
45 - P/N 62301031 - Circulator pump (not present on 160B and 160OB models)
46 - P/N 62630136 - Condensation discharge trap
47 - P/N 60505024 - Flame-proving electrode
48 - Burner (For P/N see Section 15)
49 - P/N 60505023 - Right ignition electrode
50 - P/N 60505022 - Left ignition electrode
51 - P/N 60510022 - Spark generator
52 - P/N 62113041 - Flue pressure switch

Figure 1 - Main components

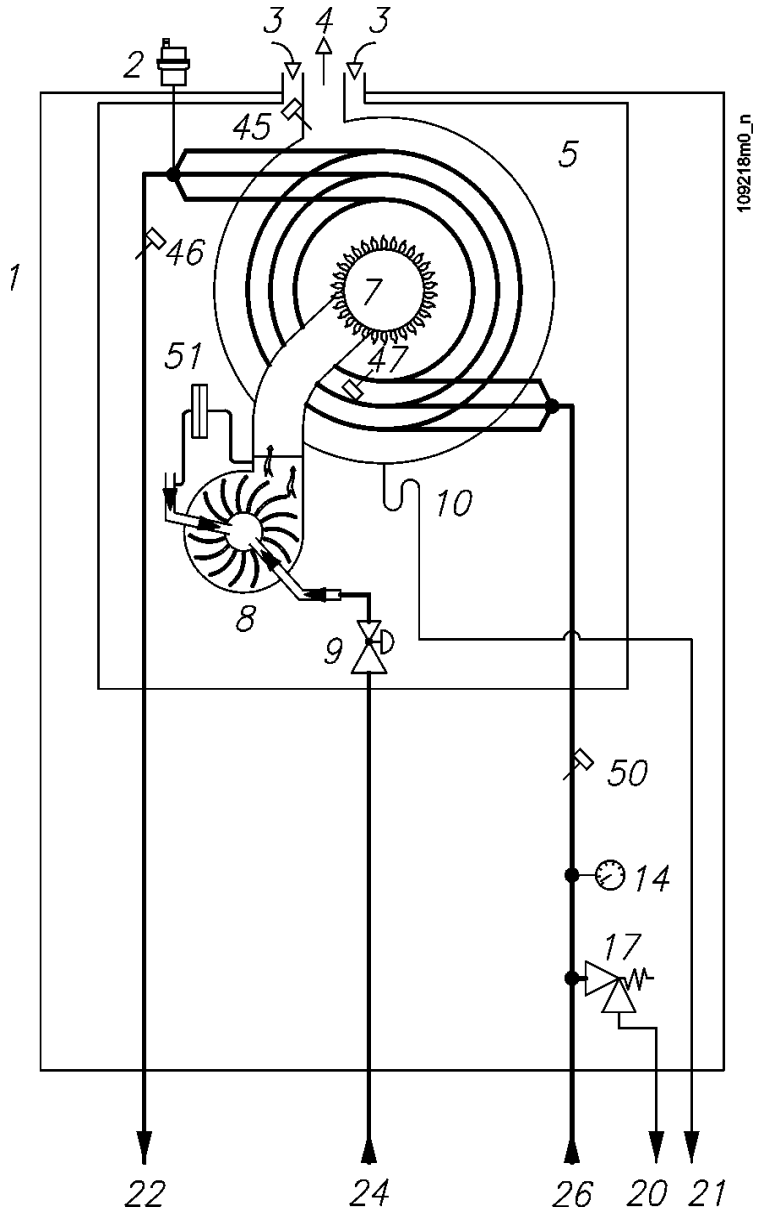
4 - FUNCTION OVERVIEW



Key to figure 2:
1 = boiler model 160C or 160OC
2 = automatic air vent
3 = air intake
4 = flue gases discharge
5 = sealed combustion chamber
6 = expansion tank
7 = burner
8 = fan
9 = gas valve
10 = condensate discharge trap
11 = circulator pump
12 = 3-way valve
13 = secondary heat exchanger for d.h.w.
14 = pressure gauge
15 = by-pass valve
17 = safety relief valve
21 = condensate discharge pipe
22 = heating supply pipe
23 = domestic hot water outlet
24 = gas inlet
25 = cold water inlet
26 = heating return pipe
45 = U7 = flue gas temperature sensor
46 = U1 = boiler temperature sensor
47 = U6 = high limit temperature sensor
48 = U3 = domestic cold water sensor/storage tank sensor
49 = U2 = domestic hot water temperature sensor
50 = U8 = return temperature sensor
51 = flue pressure switch

Figure 2 - 160C and 160OC Hydronic functional schematic

4 - FUNCTION OVERVIEW



Key to figure 3:
1 = boiler model 160B and 160OB
2 = automatic air vent
3 = air intake
4 = flue gases discharge
5 = sealed combustion chamber
7 = burner
8 = fan
9 = gas valve
10 = condensate discharge trap
14 = pressure gauge
17 = safety relief valve
20 = safety relief valve discharge
21 = condensation discharge pipe
22 = heating supply pipe
24 = gas inlet
26 = heating return pipe
45 = U7 = flue gas temperature sensor and high limit safety switch
46 = U1 = boiler temperature sensor
47 = U6 = high limit temperature sensor
50 = U8 = return temperature sensor
51 = flue pressure switch

Figure 3 - 160B and 160OB Hydronic functional schematic

4 - FUNCTION OVERVIEW

4.1 - Intended use and functions of the boiler

This gas-fired condensing boiler, is designed to be used for central heating and producing domestic hot water.
The maximum output heat is always guaranteed for the production of domestic hot water since it is given priority over space heating demands.
Follow the specific procedure in section 12.1 for the adjustment of the domestic hot water temperature.
Depending on the model choosen, the following system types can be created:

- 160C. Using this boiler model, a system can be created for the production of instantaneous domestic hot water and a heating system with heating elements functioning at temperatures ranging between 68°F (20°C) and 189°F (87°C).
The boiler can also function directly with a radiant floor panel, see section 5.9.
When connecting the boiler to the heating system the installer must consider the head loss of the heating system to verify that the boiler pump is adequate. Pump curve is shown in figure 5. The same verification must be done for the domestic installation, see figure 7.

- 160B. Using this boiler model, a heating system with heating elements functioning at temperatures ranging between 68°F *(20°C)* and 187°F *(87°C)* can be configured.
The boiler can also function directly with a radiant floor panel, see section 5.9.
The 160B model is not equipped with the components required for the production of domestic hot water. Also not included is the expansion tank and circulator pump, see figure 3.
To connect the boiler to the heating system, the installer must consider the loss of pressure generated by the boiler (see figure 6), and choose a pump capable of overcoming the head loss of both the boiler and the heating system.

- 160OC. This boiler is equal to the 160C model, but is intended for outdoor installation.

- 160OB. This boiler is equal to the 160B model, but is intended for outdoor installation.

All models can be connected to an indirect storage tank for the production of domestic hot water, section 7.

All models can be connected to a room thermostat, section 6.3 and 6.4.

Because boiler models 160OC and 160OB are usually installed outside the building, they need to be connected to a Remote Command, section 6.8.

An outdoor air temperature sensor can also be connected to the boiler for an outdoor reset supply temperature control for maximum fuel efficiency and comfort (see section 6.5). In this configuration the room thermostat will compensate by adjusting the room temperature. The room temperature compensation can be of an ON / OFF type or two-stage. For further information on the outdoor-air reset, refer to section 12.4.

☞ The boiler must be connected to a heating system and a domestic hot water supply with compatible specifications, performance and power rating.

☞ Before installation, thoroughly flush the heating and plumbing systems of any residue or impurities which might compromise the smooth running of the boiler.

☞ Only boilers model 160OC and 160OB are designed for outdoor installation. However also for these boilers you need to choose a sheltered place where it is protected from atmospheric elements including frost.

☞ Refer to figure 8 for minimum clearance distances for installation and future maintenance.

☞ Refer to section 5.2 for minimum clearance distances from combustible material.

4.2 - Setting of the boiler

Section 16 details the setting changes that should be made to best match the boiler's operation to the needs of each application.

4.3 - Efficiency up to 98%

When the outdoor reset is activated (an outside sensor is connected), this boiler is designed to always work at the maximum efficiency. It will automatically change the supply temperature in relation with the outdoor temperature (Outdoor reset). The graph in figure 4 shows an example on how it can work. This graph represents an installation where the supply and return temperatures are 139°F and 115°F respectively, and the outside temperature is 23°F. The outdoor reset drives the boiler, to progressively reduce the supply temperature and thereby optimize the efficiency. It changes from 87% when outside is -10°F, to 94.8% when outside is 23°F and up to 98% when the outside temperature rises up to 67°F.

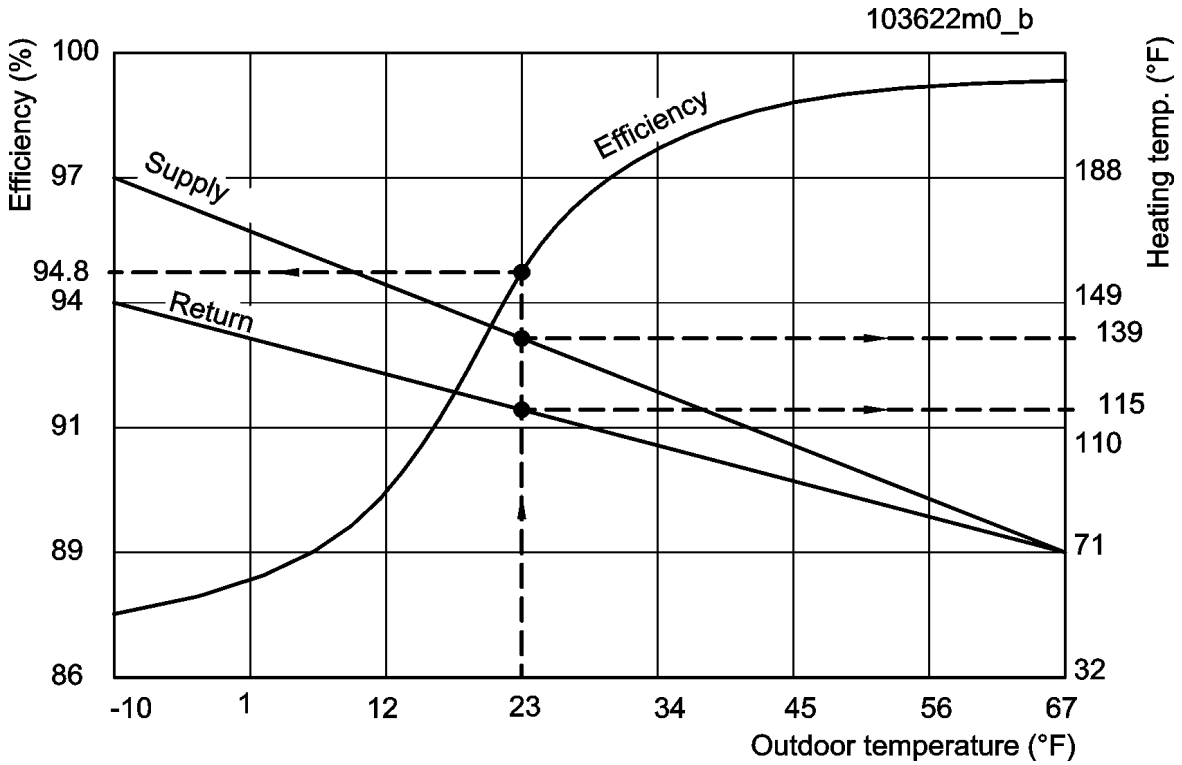


Figure 4 - Outdoor reset control to optimize the efficiency

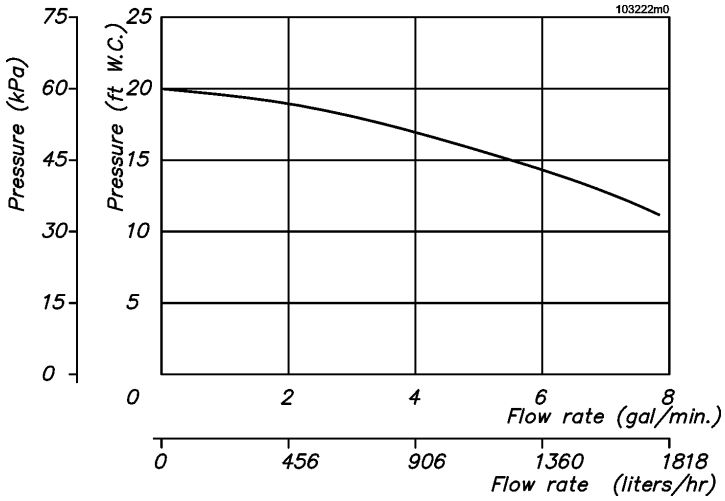


Figure 5 - Available Head for heating circuit for models “160C” and “160OC”

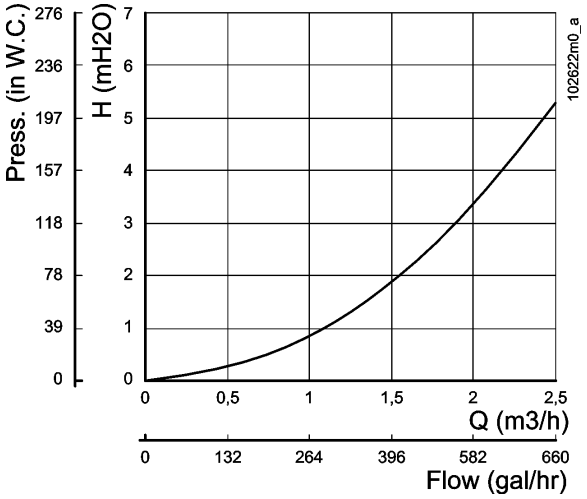


Figure 6 - Internal Boiler Head Loss for models “160B” and “160OB”

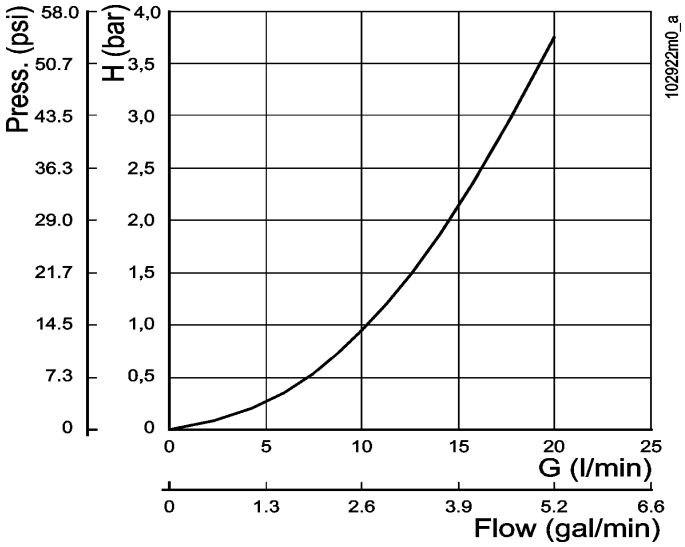


Figure 7 - Domestic Water Coil Head Loss for models “160C” and “160OC”

4.4 - Characteristic curves of heating system’s residual head

160C and 160OC boilers are fitted with a Grundfos circulator pump. The head available to supply flow through the heating system at the boiler connections is shown in graph form in figure 5.

4.5 - Boiler head loss curve

160B and 160OB boilers are not fitted with an internal pump. The installer needs to install an external pump as illustrated in figure 17, item “6”. Use the graph in figure 6 to choose the correct pump.

4.6 - Characteristic curve of the domestic side

160C and 160OC boilers, offers resistance to the passage of domestic water (see graph flow/ pressure of figure 7). The installer or the engineer must take account of this in order to ensure the correct domestic water flow to the utilities.

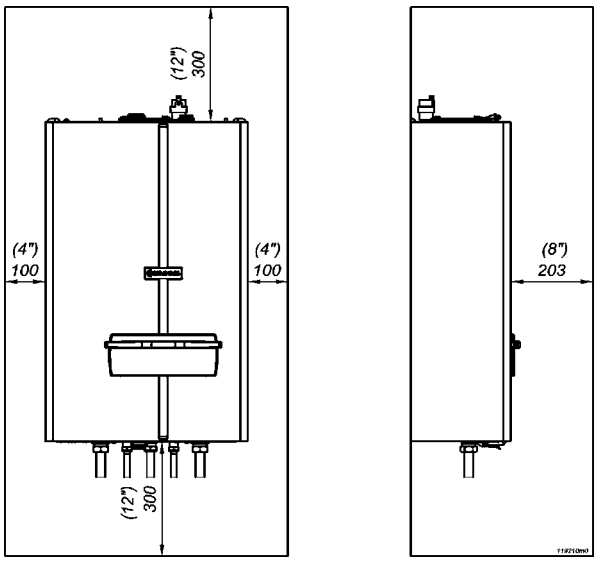
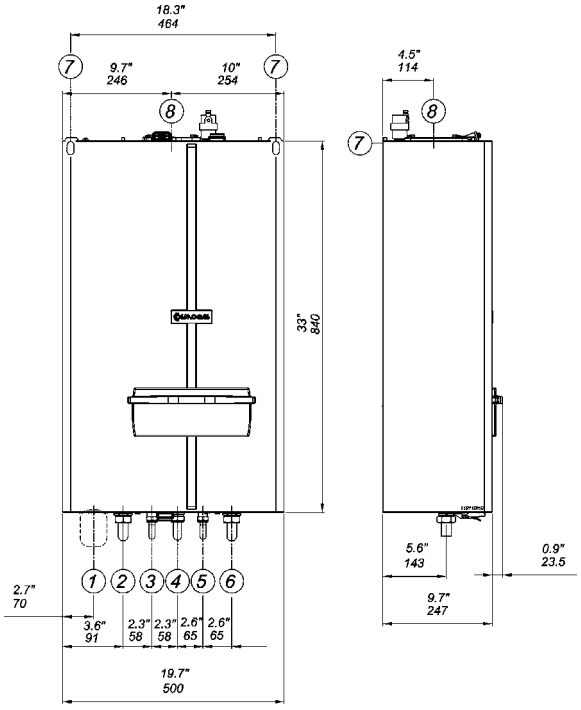


Figure 8 - Recommended minimum clearance distances for proper installation and servicing



1 = Area for power supply cable
2 = Heating supply connection (3/4")
3 = Domestic hot water connection (3/4") (absent in 160B model)
4 = Gas connection (3/4")
5 = Domestic cold water connection (3/4") (absent in 160B model)
6 = heating return connection (3/4")
7 = positions for boiler support
8 = Flue discharge/air intake connection

Figure 9 - Dimensions

5.1 - Clearances for installation and servicing for models

Figure 8 shows the clearances required for installation and servicing.
NOTE: Service clearances are not mandatory, but are recommended to ensure ease of service should it be required.

5.2 - Clearances from combustible material

This boiler may be installed directly onto a wall of combustible material with the following clearance:

Ceiling:	2 inches (51 mm)
Front:	2 inches (51 mm)
Rear:	0 inches (0 mm)
Sides:	2 inches (51 mm)
Floor:	2 inches (51 mm)

Concentric vent: 0 inches (0 mm)
Split vent (first 12" from the boiler): 1 inch (25 mm)
Split vent (after 12" from the boiler): 0 inches (0 mm)

5.3 - Choosing the installation location

CAUTION!!! The boiler must be installed on a vertical wall constructed to bear its weight or the boiler and building may be damaged.
NOTE: The boiler must never be installed on carpeting.

CAUTION!!! This boiler is not designed for direct outdoor installation. However a kit P/N 62610069 to convert the boiler for outdoor installation is available. If installed outside of the structure it must be sheltered so it is protected from rain, wind, sun and frost. NEVER place this boiler in a location that would subject it to temperatures at or near freezing. Failure to properly locate this boiler can result in premature failure voiding the warranty.

When locating the boiler the following factors must be considered:

- the location of vent/air intake terminals;
- connection to the gas supply;
- connection to the water supply;
- connection to the heating system;
- connection to the domestic hot water system;
- connection to the electrical supply;
- disposal of the condensation produced by the boiler;
- connection to the room thermostat;
- piping of the safety relief valve discharge;
- possible connection of the outdoor temperature sensor;
- possible connection of an indirect storage tank, see section 7.

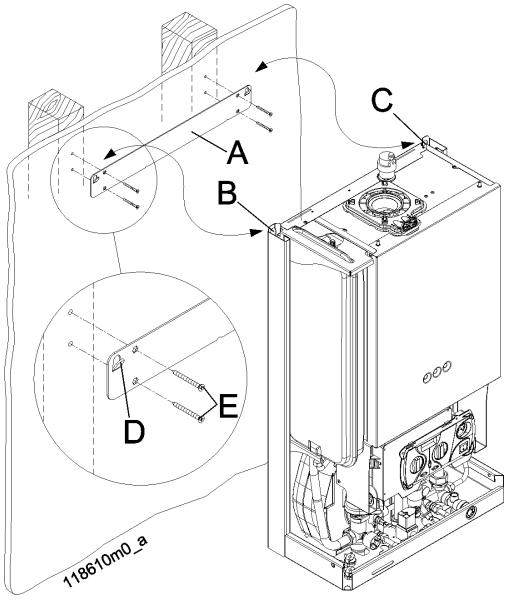


Figure 10 - Wall bracket installation

5.4 - Mounting the boiler

Refer to figure 10:

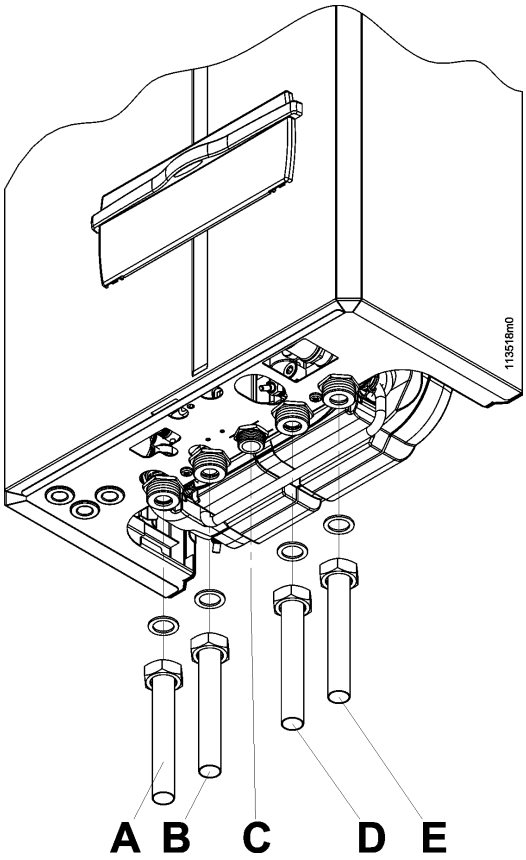
1. place the cardboard template, provided with the boiler, against the wall;
2. ensure that the template is plumb and the screw holes line up with the wall studs;

CAUTION!!! The wall bracket screws must be screwed into the buildings framing or other material capable of supporting the weight of the boiler or the boiler and building may be damaged.

3. mark the screw holes for the wall bracket, “A”;
4. remove the cardboard template;
5. install the wall bracket “A”, using the screws “E”, provided;
6. hang the boiler on the wall bracket, “A”, by hanging connections “B” and “C” on tabs “D”.

5.5 - Gas and water connections

The boiler comes with the fittings shown in figure 11.



A = heating system supply (3/4")
B = domestic hot water supply (3/4")
(Absent on 160B and 160OB models)
C = Inlet gas connection (3/4")
D = domestic cold water (3/4")
(Absent on 160B and 160OB models)
E = heating system return (3/4")

Figure 11 - Fittings supplied with the boiler

5.6 - Condensate disposal

WARNING! The condensate trap must be connected to the boiler per the following instructions or combustion gases will enter the room. This can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

This boiler produces water as a byproduct of combustion. The boiler is equipped with a condensate trap, figure 1, item 46, for the evacuation of condensate and to prevent the leakage of combustion products. The condensate trap drains through pipe “C” shown in figure 12. The condensation disposal system must:

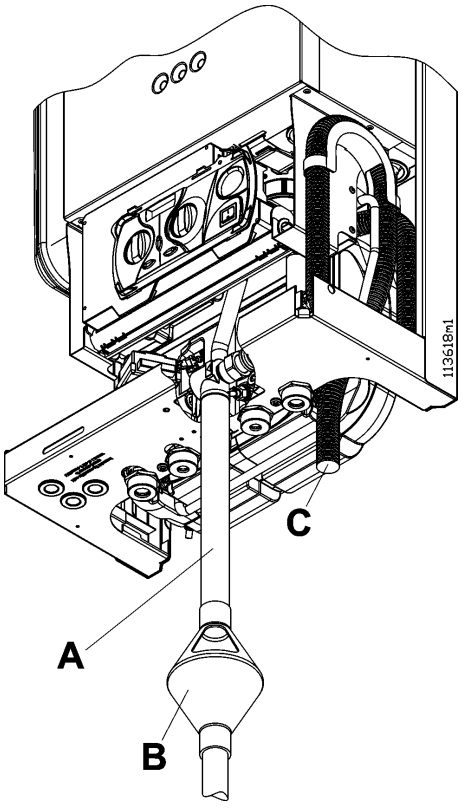
- ☞ be connected to the domestic waste disposal system by means of an appropriate trap capable of preventing the pressurization of the condensate system and the return of sewer gases (see figure 13);
- ☞ comply with national and/or local codes for condensate neutralizer between pipe “C” of figure 12 and the waste disposal system;
- ☞ be carried out with a pipe with an internal diameter equal to or greater than **1/2 in**, *13 mm*;
- ☞ be installed in such a way so as to avoid the freezing of the liquid;
- ☞ never discharge into gutters or rain collectors;
- ☞ be properly pitched towards the point of discharge avoiding high points, which could place the condensate system under pressure.

CAUTION!!! The condensate drainage system is designed to empty all the condensate produced by one boiler only. Each boiler must be equipped with its own condensate drainage system or the drainage system may malfunction.

5.7 - Relief valve

Each boiler is equipped with a safety relief valve set at ***30 psi*** *(2 bar)* which must be piped in accordance with the ANSI/ASME Boiler and Pressure Vessel Code, Section IV, to prevent scalding in the event of a discharge, see Figures 1, item “38” and figure 12.

WARNING!!! Failure to properly pipe the relief valve discharge can result in scalding of individuals and animals. Never install any type of valve between the boiler and the relief valve or an explosion causing extensive property damage, severe personal injury or death may occur!



A = 3/4" pipe extension (not provided)
B = Discharge device open to the atmosphere (not provided)
C = Condensate discharge pipe

Figure 12 - Relief valve connection

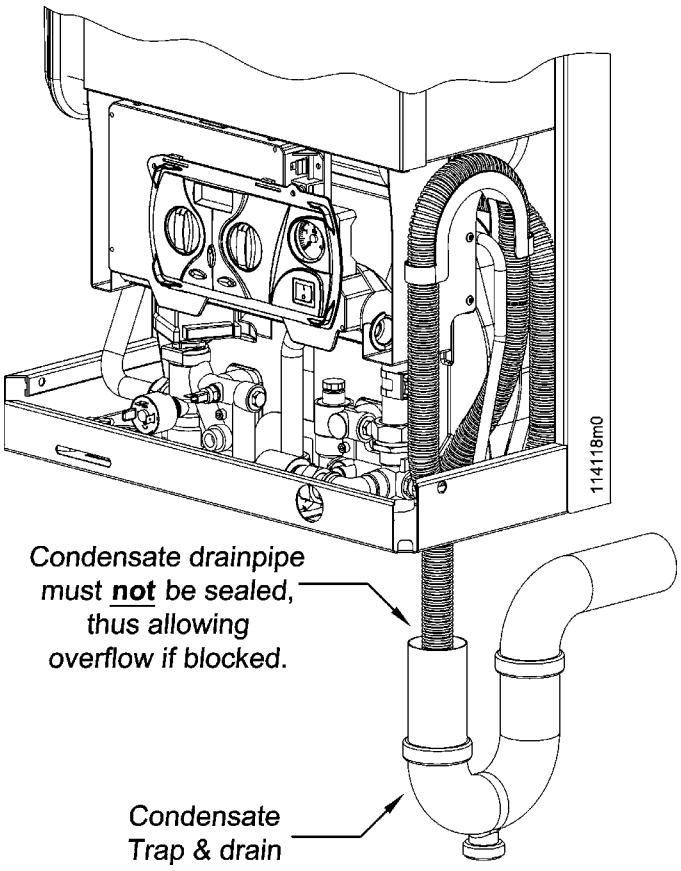


Figure 13 - Condensate trap and drain

5.8 - Supply and return piping

CAUTION!!! All heating system piping must be installed in accordance with the ANSI/ASME Boiler and Pressure Vessel Code, Section IV. All applicable local codes and ordinances must also be followed. If the boiler is installed above any radiation elements it must be fitted with a low water cutoff device installed above the normal boiler water level! Failure to do this can result in damage the unit and void the warranty!

CAUTION!!! This boiler must have adequate water flowing through it whenever the burner is on. Failure to do this will damage the unit and void the warranty!

CAUTION!!! Before connecting the boiler to the heating system the heating system must be thoroughly flushed to remove sediment, flux, filings and other foreign matter. An approved inhibitor should be added to the heating system water to prevent limestone and magnetite deposits from forming and to protect the boiler from galvanic corrosion.

CAUTION!!! This boiler is equipped with an ASME safety relief valve set at 30 psi *(2 bar)*. The heating system must be designed so that no piping or radiation elements are higher than 65 ft (*20 m)* or else the hydraulic head of the system will cause the relief valve to open.

CAUTION!!! The manufacturer cannot be held responsible for any damage caused by incorrect use of additives in the heating system.

☞Figure 11 illustrates the position of the supply and return pipes.

☞Install a metallic mesh filter on the return pipe to prevent any residue from the system returning to the boiler.

☞Do not use the appliance for adding any type of additive to the system.

5.8.1 - Converting a combi boiler into a heating only boiler

If you are in possession of a combi boiler (160C or 160OC) you can use it as a heating system only without using the domestic hot water circuit. To do so, simply plug the two fittings, items 3 and 5 of figures 9 and 10, and move switch No. 5 (see figure 21) from OFF position to ON position. Now knob 32 of figure 1 is disabled.

5.9 - Low temperature heating systems

CAUTION!!! When the boiler is installed in a low temperature system, the switch "6" in figure 21 must be placed in the ON position to prevent the supply water temperature from exceeding 113°F (45°C) or damage to the low temperature system components could occur (see section 5.9).

With switch "6" in figure 21, in the ON position, the boiler will maintain the supply water temperature between 68°F (20°C) and 113°F (45°C). No setting changes made from the control panel will cause the supply water temperature to exceed 113°F (45°C).

CAUTION!!! If the boiler is installed in a radiant panel heating system using plastic piping, precautions must be taken against corrosion caused by water oxygenation. If the piping does not incorporate an oxygen barrier, the radiant panel circuit must be isolated from the boiler using a titanium plate heat exchanger.

5.10 - Use of glycol and other chemicals

WARNING!!! Never use non-approved additives or toxic boiler treatment chemicals in the heating system as they can cause serious health problems or possibly death. Any additives introduced into the heating system must be recognized as safe by the United States Food and Drug Administration.

If glycol is used, it must be used in accordance with the instructions supplied with the product.

CAUTION!!! Any additives added to the heating system must not be added directly inside the boiler but through the heating system piping to prevent damage to the boiler.

5.11 - Domestic hot and cold water (only for 160C and 160OC models)

CAUTION!!! If the water hardness is greater than 9 gr/gal (150 mg/l) we recommend installing a water softener with filter.

☞Figure 11 illustrates the positioning of the domestic hot and cold water pipes.

☞For servicing purposes, install an isolation valve upstream from the cold water inlet.

☞To correctly set the domestic water flow, install an adjustable flow restrictor upstream the cold water inlet (see figure 15 item "12")

☞160C and 160OC boilers can be used as heating only boilers. No connection is needed to the domestic pipes "B" and "D" of figure 11.

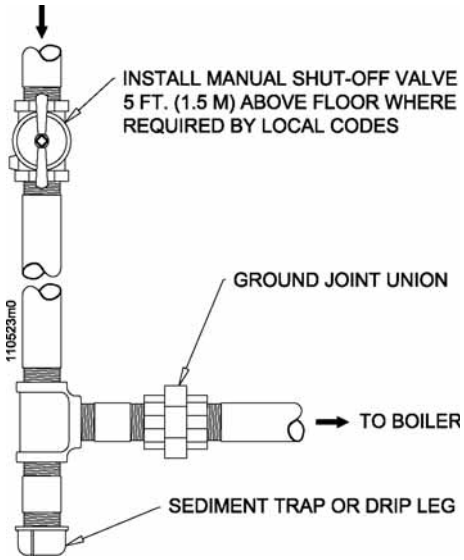


Figure 14 - Gas supply piping

5.12 - Gas supply piping

WARNING!!! Check that the type and the pressure of the gas supplied correspond with those required for the boiler as stated on the rating plate. Never use a gas different than that stated on the boiler rating plate. Failure to comply with this warning can result in a fire or explosion causing extensive property damage, severe personal injury or death!

- ☞If the gas type and/or the supply pressure do not match those stated on the boiler rating plate the boiler must be converted to the type of gas and/or supply pressure available. A conversion kit is supplied together with the boiler.
- ☞The boiler comes from the factory ready to be piped to the gas supply. The National Fuel Gas Code, ANSI Z223.1/NFPA 54 and local codes for gas piping requirements and sizing must be followed.
- ☞Install a manual gas shutoff valve and drip leg as shown in figure 14.

The gas supply piping to the boiler must be properly sized to guarantee that the gas supply meets the maximum requirements. If more than one appliance is supplied by the same gas supply pipe, the gas supply piping must be sized based on the maximum possible demand. Do not neglect the pressure drop due to pipe fittings. Table 1 below, should be used in conjunction with table 2 below, to ensure that the gas supply piping is sized properly. See section 14 for values of “maximum gas supply pressure” and “minimum gas supply pressure” and also section 11.7.

- ☞Before installation a thorough internal cleaning of the gas supply line should be performed. Figure 11 shows the positioning of the gas connection on the heater.
- ☞The boiler and its gas connection must be leak tested before placing the boiler in operation.
- ☞To avoid damaging the gas control, perform a leak test at a pressure of no greater than 20 in W.C. *(50 mbar)*.

WARNING!!! Never use an open flame to test for gas leaks. Always use an approved leak detection method. Failure to comply with this WARNING could result in an explosion!

- ☞The boiler and its individual shutoff valve must be disconnected from the gas supply piping during any pressure testing at test pressures in excess of 1/2 psi (*3.5 kPa)*.
- ☞The boiler must be isolated from the gas supply piping by closing its individual manual shutoff valve during any pressure testing at test pressures equal to or less than 1/2 psi (*3.5 kPa)*.

5.13 - Operating at high altitudes

For installations in the United States, the boiler is rated for operation at altitudes up to 2,000 ft (609 m). For installations at higher altitudes in the United States, follow local codes or, in the absence of local codes, follow ANSI Z223.1/NFPA No. 54, *The National Fuel Gas Code*. For installations in Canada, the boiler is rated for installations up to 2,000 ft (609 m). For installations above this altitude, follow local/provincial codes.

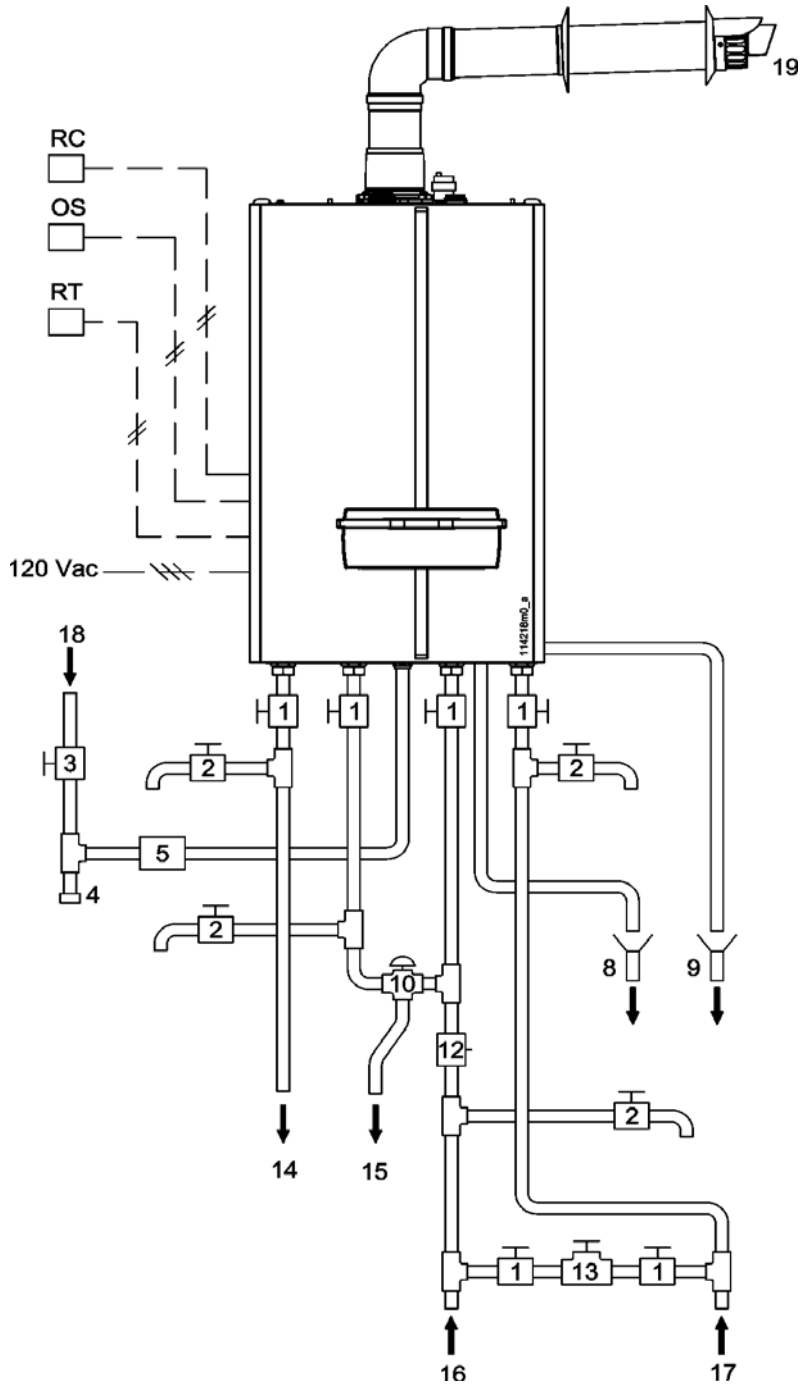
Table 1 - Gas Pipe Capacity

Nominal Iron Pipe Size	Pipe Length								
	10'	20'	30'	40'	50'	60'	80'	100'	150'
	Gas Pipe Capacity (ft^3/hr)								
3/4"	278	190	152	130	115	105	90	79	64
1"	520	350	285	245	215	195	170	150	120
1 1/4"	1050	730	590	500	440	400	350	305	250
1 1/2"	1600	1100	890	760	670	610	530	460	380

Note: Maximum pipe capacity in ft^3/hr is based on a 0.60 specific gravity gas at a pressure of 0.5 psig and a 0.3" WC pressure drop.

Table 2 - Equivalent Pipe Length Chart

Nominal Iron Pipe Size	Type of Pipe Fitting			
	90°	Tee (brach flow)	Gas Valve (full port)	Gas Cocks
	Equivalent length of pipe fittings in feet			
3/4"	2.06	4.12	0.48	1.25
1"	2.62	5.24	0.61	1.60
1 1/4"	3.45	6.90	0.81	2.15
1 1/2"	4.02	8.04	0.94	2.50



5.14 - Suggested piping and wiring connections for the 160C and 160OC versions Boiler

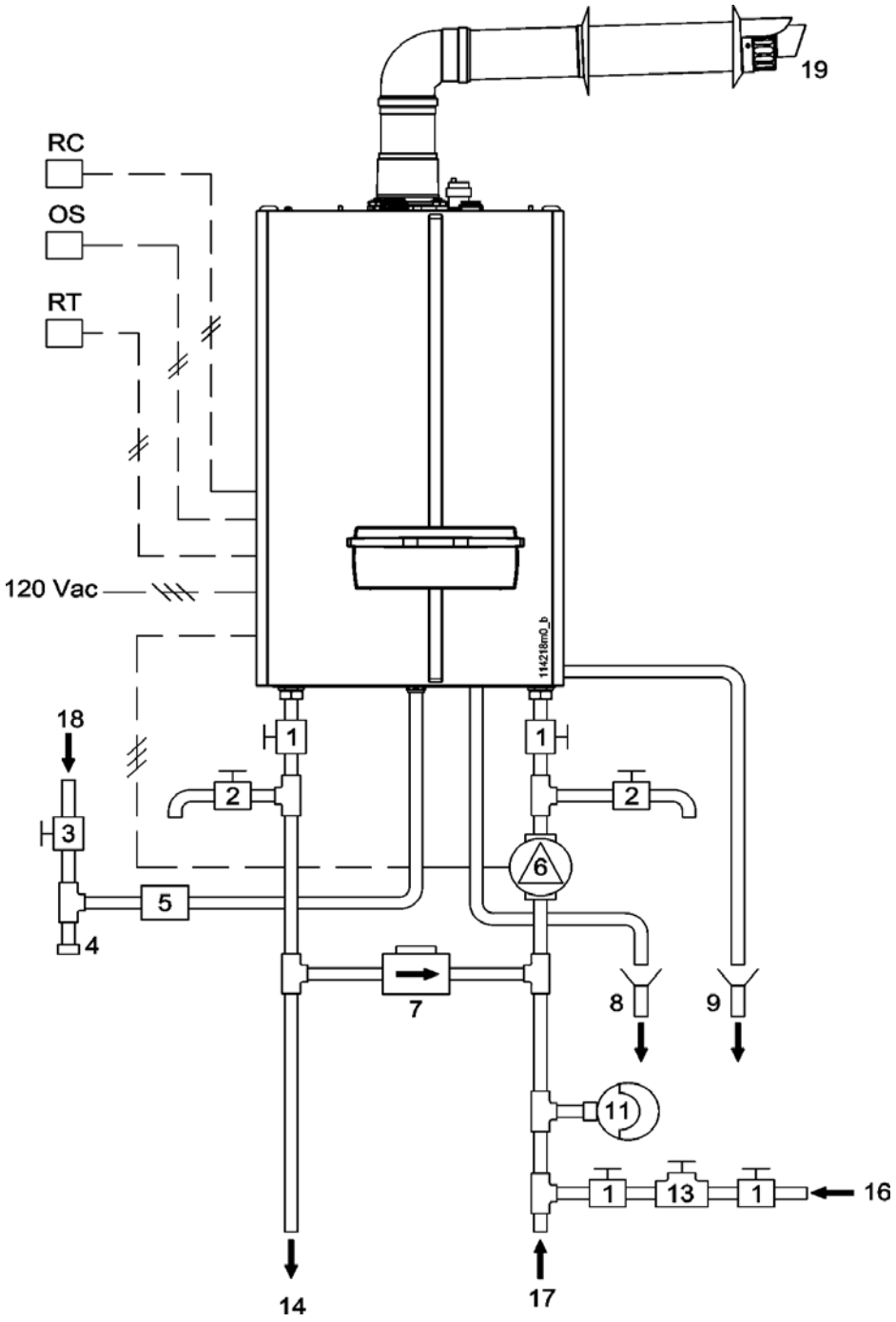
Figure 15 shows the suggested piping and wiring connection for boiler models 160C and 160OC.
All component listed below, except the flue terminal must be field supplied.

1 = ball valve
2 = drain valve
3 = Manual gas shut-off valve
4 = sediment trap
5 = ground joint union
8 = Relief valve drain
9 = Condensate drain
10 = Domestic mixing valve
12 = Flow restrictor
13 = Fill valve
14 = Heating supply
15 = Domestic Hot Water
16 = Cold water
17 = Heating return
18 = Gas supply
19 = Concentric vent/air intake terminal
OS = Outdoor sensor (optional)
RC = Remote command (only for 160OC model)
RT = Room thermostat
120 Vac = Electrical supply

Figure 15 - Typical piping and wiring connections for a boiler models 160C and 160OC

5.15 - Suggested piping and wiring connections for the 160B and 160OB versions Boiler

Figure 16 shows the suggested piping and wiring connections for boiler models 160B and 160OB.
All components listed below, except the flue terminal must be field supplied.



1 = ball valve
2 = drain valve
3 = Manual gas shut-off valve
4 = sediment trap
5 = ground joint union
6 = Circulator pump
7 = By pass valve
8 = Relief valve drain
9 = Condensate drain
10 = Domestic mixing valve
11 = Expansion tank
12 = Flow restrictor
13 = Fill valve
14 = Heating supply
15 = Domestic Hot Water
16 = Cold water
17 = Heating return
18 = Gas supply
19 = Concentric vent/air intake terminal
OS = Outdoor sensor (optional)
RC = Remote command (only for 160OB model)
RT = Room thermostat
120 Vac = Electrical supply

Figure 16 - Typical piping and wiring of a boiler models 160B and 160OB

6.1 - Electrical connections: overview

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

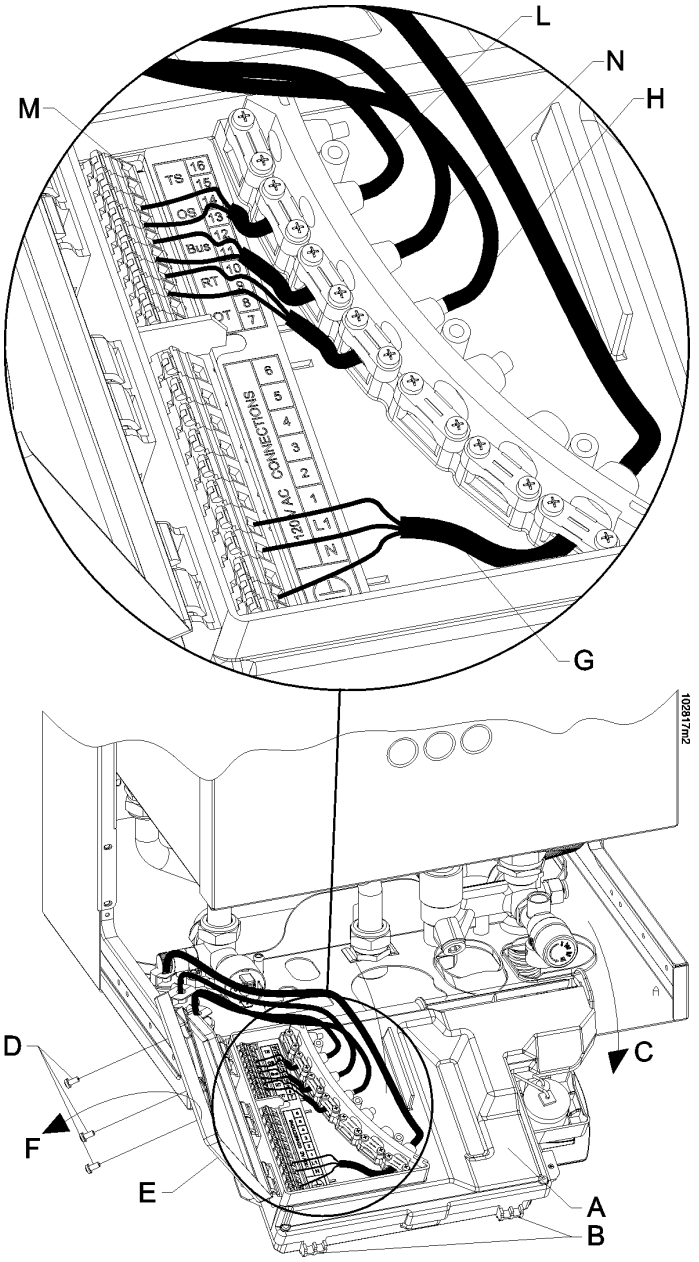
ATTENTION!!! Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Des erreurs de câblage peuvent entraîner un fonction-nement inadéquat et dangereux. S'assurer que l'appareil fonctionne adéquatement une fois l'entretirn terminé.

WARNING!!! The boiler must be electrically wired to ground in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the *National Electrical Code, ANSI/NFPA 70* and/or the *Canadian Electrical Code Part I, CSA C22.1, Electrical Code.*
This is an essential safety requirement which must be checked.

- ☞Check that the electrical system is adequate for the power consumption indicated on the rating plate.
- ☞Line voltage field wiring of any controls or other devices must conform to the temperature limitation of type T wire at 95°F (*35°C)*, above room temperature. Use copper conductors with a minimum size of #14 AWG. Low voltage wiring must not be less than #18 AWG with a neoprene, thermoplastic or other equivalent insulation having a minimum insulation thickness of 0.012 in, *(3 mm)*.
- ☞ A properly rated shut-off switch shall be located at the boiler.
- ☞Ensure that the polarity between live and neutral wires is maintained when connecting the boiler.

CAUTION!!! Ensure that heating and water piping is not used as a ground connections for the electric and telephone systems. This piping is completely unsuitable for this purpose and, could rapidly lead to serious corrosion damage to the boiler, piping and radiators, voiding the warranty

CAUTION!!! The boiler is not provided with any protection against lightening strikes.



A = Junction box
B = Plastic spring
C = Opening direction
D = Screws for junction box cover
E = Junction box cover
F = Junction box cover opening direction
G = Electrical supply cable
H = Room thermostat cable (optional)
L = Outside temperature sensor cable (optional)
M = Storage tank temperature sensor
N = Remote command cable (optional)

Figure 17 - Junction box

6 - INSTALLATION - Electrical connections

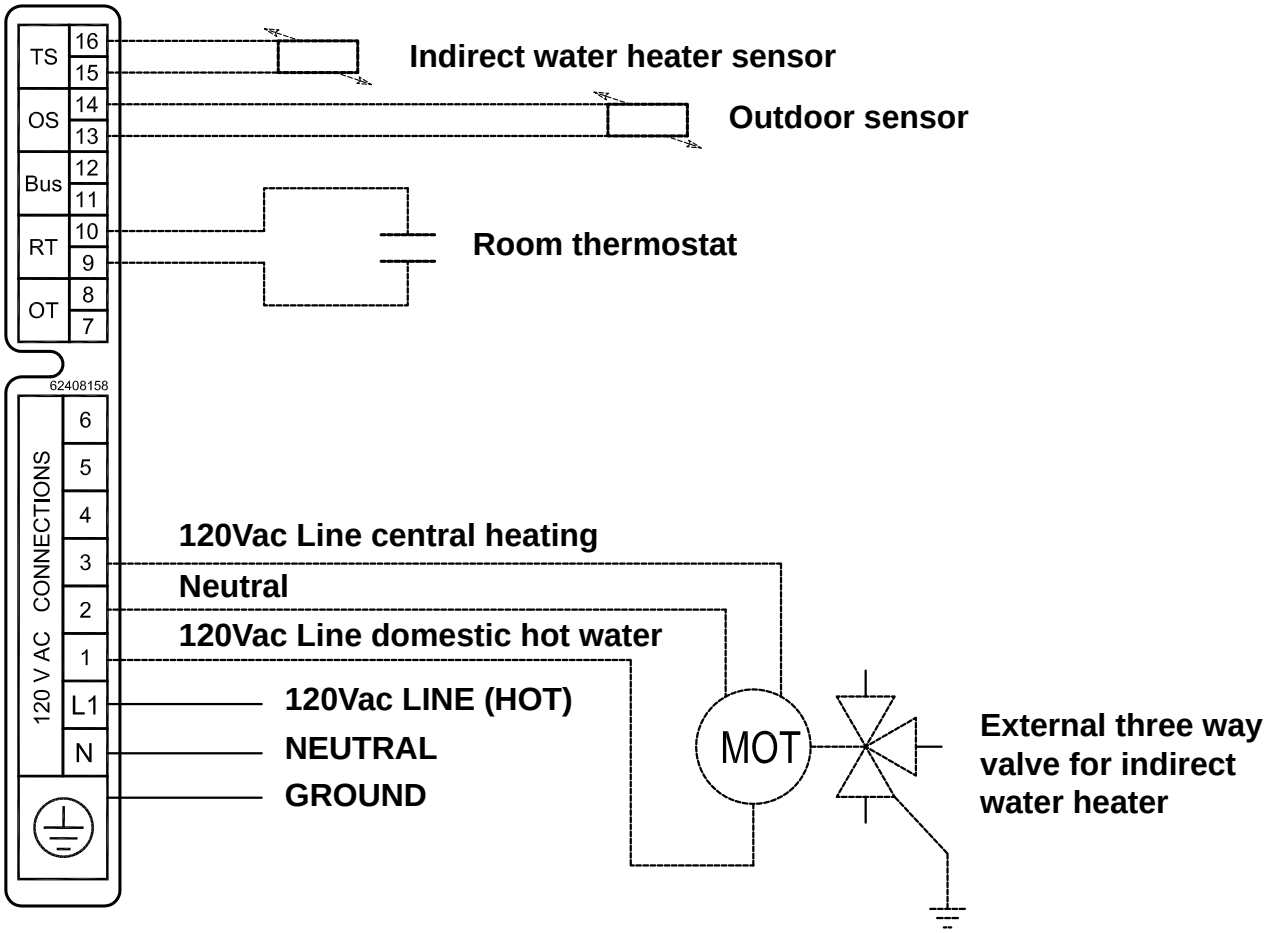


Figure 18 - Electrical connections

6.2 - Connecting the power supply cable

To connect the electrical power supply cable, follow the steps below while referring to figure 17 and 18:

1. remove the boiler casing following the instructions given in section 13.2;
2. press the two plastic springs tabs labeled “B” on the bottom side;
3. open panel “A” in the “C” direction;
4. remove the three screws labeled “D”;
5. open door “E” in the “F” direction;
6. install the power supply wires, “G” as shown;
7. strip the power supply wires being careful to leave the ground wire 1 in (25 mm) longer than the other two;
8. connect the ground wire to the ground terminal;
9. connect the 120 volt hot wire to terminal “L1”;
10. connect the 120 volt neutral wire to terminal “N”.

NOTICE! If the 120 volt power wires are inverted, the boiler will block, displaying error code E21.

NOTICE! If the boiler is not properly grounded, the boiler will block, displaying error code E23

6.3 - Choosing the room thermostat

This boiler is designed to function with any type of room thermostat which has an electrical contact with the following specifications:

- open (end call for heat); closed (call for heat);
- clean dry contact (not powered);
- electrical capacity of 24Vac, 1A.

6.4 - Thermostat wiring

Install the room thermostat in a part of the house where the temperature is as near to average as possible. Avoid areas subject to sudden temperature changes such as outside windows or doors, above radiation elements, near lamps, etc., (see figure 19).

Connect the room thermostat to the boiler by following the steps below:

1. remove the boiler casing according to the instructions given in section 13.2 and open the junction box per section 6.2;
2. use a two conductor cable with a minimum cross section of # 18 AWG between the boiler and the room thermostat;
3. route the cable through an empty cable clamp in the junction box
4. connect the cable leads to the “RT” terminals as shown in figure 18.

NOTICE! the maximum room thermostat cable length permitted is 65 ft (*20 m)*. For longer lengths, up to 300 ft (100 m) a shielded cable, with the shield connected to the ground, must be used.

WARNING!!! Since the room thermostat wires conduct 24 Vac, they must never be run through conduits containing 120Vac power wires or an electrical shock hazard will exist

6.5 - Installing the outdoor temperature sensor (optional)

Install the outdoor temperature sensor, on an exterior wall of the building facing NORTH or NORTH-EAST, at a height of between 4 ft (1.2 m) and 6 ft (1.8 m) from the ground level. On multi story buildings, install the sensor near the upper half of the second floor. Do not install the sensor above doors, windows or ventilation outlets nor directly under balconies or gutter pipes. Do not shield the outdoor temperature sensor. Do not install the sensor on walls without overhangs, or not protected from rain. To connect the outdoor temperature sensor to the boiler proceed as follows:

1. remove the boiler casing according to the instructions given in section 13.2 and open the junction box per section 6.2;
2. use a two conductor cable with a minimum cross section of # 18 AWG. between the boiler and the outdoor temperature sensor.

NOTICE! the maximum outdoor temperature sensor cable length permitted is 65 ft (20 m). For longer lengths, up to 300 ft (100 m) a shielded cable, with the shield connected to the ground, must be used;

WARNING!!! Since the outdoor temperature sensor wires conduct 24 Vac, they must never be run through conduits containing 120 Vac power wires or an electrical shock hazard will exist.

3. connect the outdoor temperature sensor cable leads to terminals OS as shown in figure 18;
4. connect the outdoor temperature sensor cable leads to the ends of the external temperature sensor.

Set the boiler so that it detects the outdoor temperature sensor, as follows:

1. press down the Reset button for 12 seconds until the display starts blinking and shows U 1;
2. then press and release the Reset button several times until the following CH parameter appears;
3. using the + and − keys, change the parameter value from 00 to 01 or 02 in relation to the type of climatic heat adjustment desired as explained in section 12.10;
4. press the Reset button repeatedly until exiting the menu; the display will no longer flash.

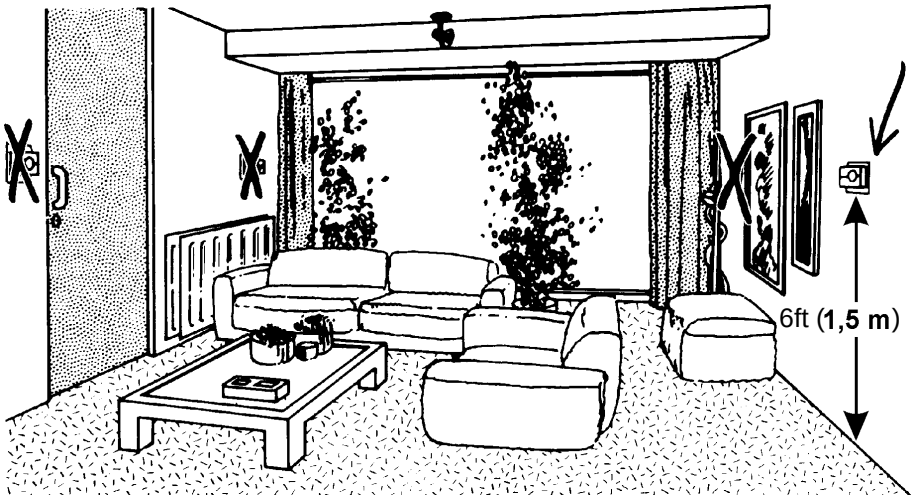


Figure 19 - Room thermostat location

6.6 - Wiring the circulator pump for 160B and 160OB models

Install the circulator pump as per figure 16 item “6”. Wire the pump to the boiler following the steps below while refering to figure 18:

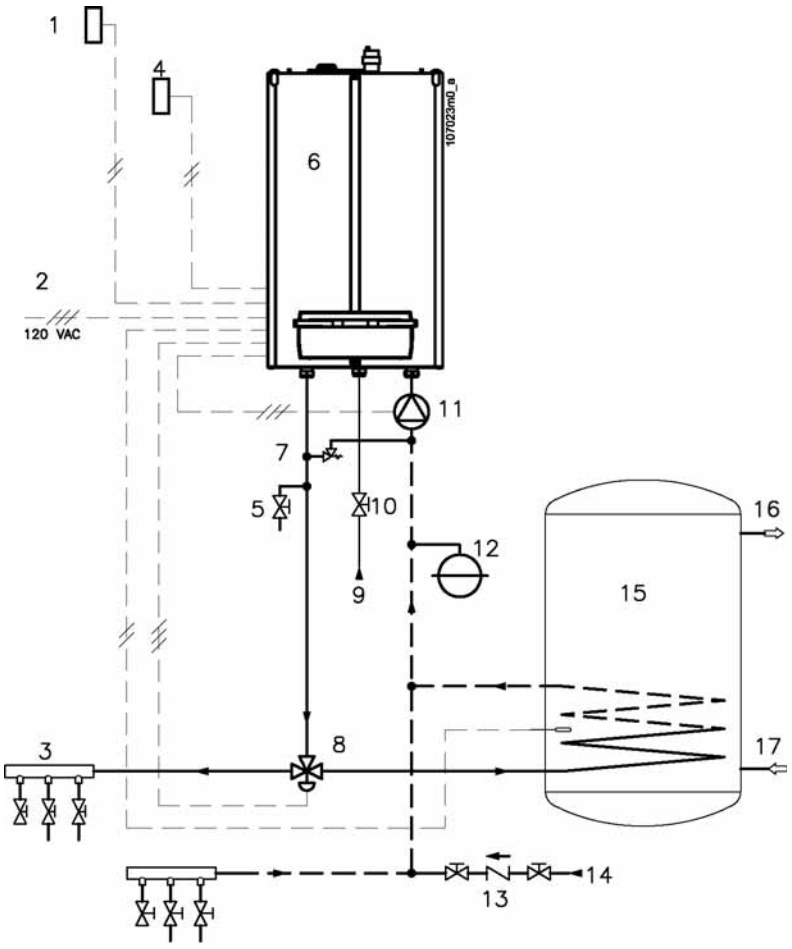
1. remove the boiler casing according to the instructions given in section 13.2 and open the junction box per section 6.2;
2. use a three wire cable with a minimum cross section of # 18 AWG between the boiler and the circulator pump;
3. route the circulator cable through an empty cable clamp in the junction box;
4. connect the Line and Neutral cable wires respectively to the “4 and 5” terminals in the junction box;
5. connect the Ground wire to an empty “Ground” connection inside the junction box.

NOTICE! If the 120 volt power wires are inverted, the boiler will lock-out, displaying error code L05.

6.7 - Alarm output

Inside the electrical box (see 13.15 and 13.16) there is an electrical connection for a 120Vac output that is energized each time the boiler goes into a lock-out or error condition. The Installer can use this output to activate any kind of external signalization devices such an audible alarm, phone, or other devices.

7 - INSTALLATION - Indirect storage tank connections



1 Outdoor temperature sensor (optional)
2 120Vac electrical supply
3 Heating system supply circuit
4 Room thermostat (field supplied)
5 Heating circuit drain valve (field supplied)
6 Boiler
7 By-pass valve (field supplied on models 160B and 160OB)
8 Three way valve (field supplied)
9 Gas supply
10 Manual gas shutoff valve (field supplied)
11 Circulator pump (field supplied on models 160B and 160OB)
12 Expansion tank (field supplied on models 160B and 160OB)
13 Automatic fill valve (field supplied)
14 Cold water inlet connection
15 Indirect storage tank (field supplied)
16 Domestic hot water outlet
17 Domestic cold water inlet

Figure 20 - Indirect storage tank connections

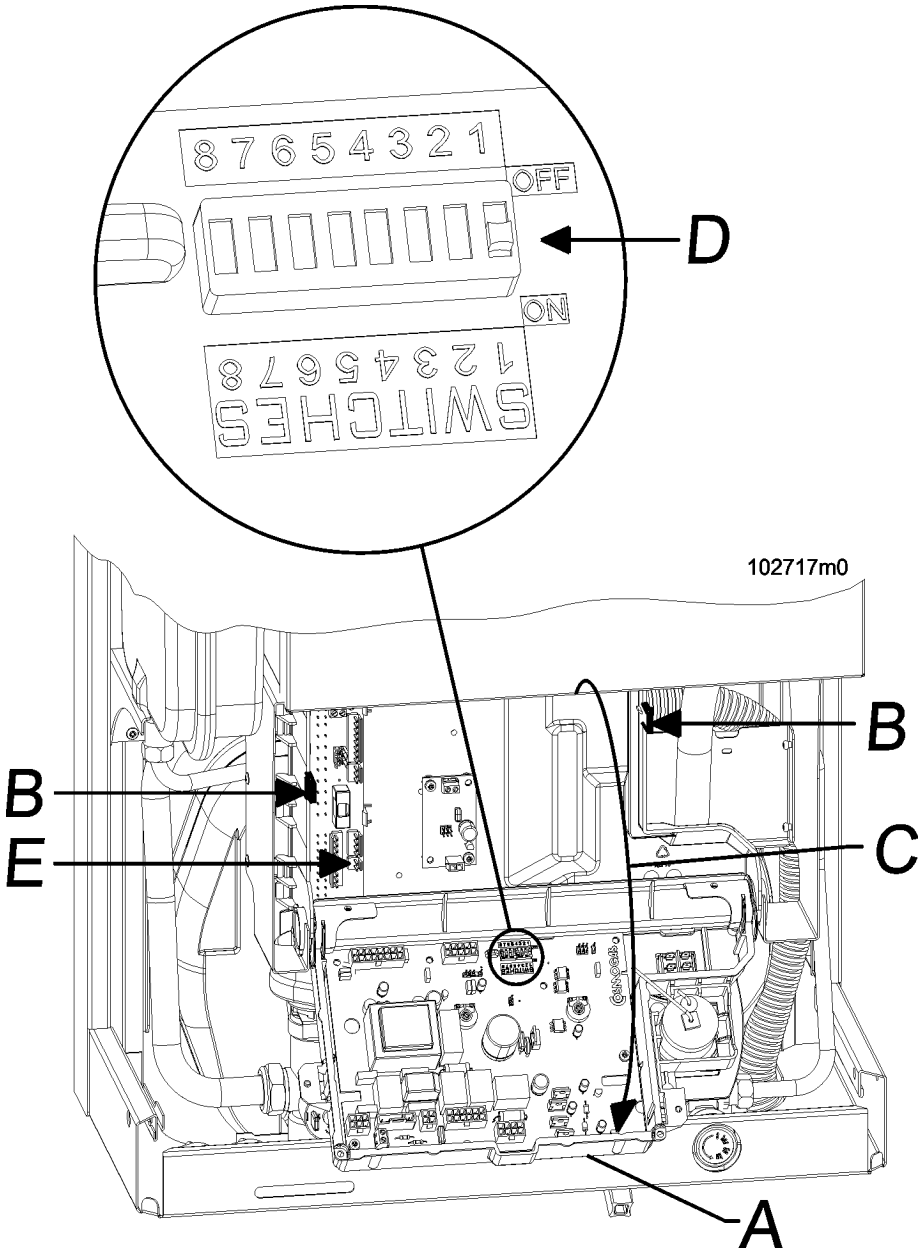
7.1 - Connecting the boiler to an indirect storage tank

All boilers listed in this manual, can be connected to an indirect storage tank as follows (the water and electrical connections must be made per figure 20): To make the electrical connections, follow the steps below while refering also to figure 20:

1. disconnect the boiler from the electrical supply;
2. remove the boiler casing according to the instructions given in section 13.2;
3. push the plastic spring tabs “B” shown in figure 21;
4. open the front half of the electrical box in the “C” direction as shown in figure 21;
5. move switch #1, item “D” in figure 21, to its “ON” position as marked on the control board;
6. ensure that switch #5 is in the OFF position;
7. on the rear side of the electrical junction box board, if present, disconnect the plug with two wires (see figure 21, item “E”), corresponding to wires #44 and #45.
8. on the rear side of the electrical box, disconnect the plug from the diverter valve (see figure 1, item “35”). When you disconnect the plug you must be sure the boiler is doing heating. If you are not sure light the boiler ON, wait the display show “F” and then light-off the boiler. Now you can disconnect the plug from the diverter valve.
9. use a # 18 AWG two wire cable to connect the indirect storage tank temperature sensor to terminals “TS”, item “M”, as per figure 18;
10. insert the probe of the tank temperature sensor into the socket of the storage tank.
11. use a #18 AWG four wire cable to connect the three way valve to terminals “1”, “2”, “3” and Ground as per figure 18 where:
    “1” = 120Vac Line for domestic side
    ”2” = Neutral
    “3” = 120Vac Line for heating side

WARNING!!! Since the indirect storage tank temperature sensor wires conduct 24 Vac, they must never be run through conduits containing 120 Vac power wires or an electrical shock hazard will exist.

WARNING!!! Once the boiler is connected to an indirect storage tank, it will perform a weekly antilegionella cycle. This cycle raises the storage tank temperature to 140°F one time per week.



A = Front cover of the electrical box
B = Plastic spring to open the electrical box
C = Direction to open the electrical box
D = Switches for the functional setting of the boiler

Figure 21 - Control board and junction box board details

8.1 - Removing of a boiler from a common venting system

WARNING!!! DO NOT connect this boiler or any other appliance using a positive pressure, in a common vent system! Failure to comply with this WARNING could result in the accumulation of carbon monoxide gas which can cause severe personal injury or death!

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

(a) Seal any unused openings in the common venting system.

(b) Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.

(c) Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

(d) Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

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

(f) After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.

(g) Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1 /NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Instal-lation Code. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1 /NFPA 54 and/or CAN/CSA B149. 1, Natural Gas and Propane Installation Code.

Au moment du retrait d'une chaudière existante, les mesures suivantes doivent être prises pour chaque appareil toujours raccordé au système d'évacuation commun et qui fonctionne alors que d'autres appareils toujours raccordés au système d'évacuation ne fonctionnent pas: système d'évacuation

(a) Sceller toutes les ouvertures non utilisées du système d'évacuation.

(b) Inspecter de façon visuelle le système d'évacuation pour déter-miner la grosser et l'inclinaison horizontale qui conviennent et s'assurer que le système est exempt d'obstruction, d'étrangle-ment de fruite, de corrosion et autres défaillances qui pourraient présenter des risques.

(c) Dans la mesure du possible, fermer toutes les portes et les fenêtres du bâtiment et toutes les portes entre l'espace où les appareils toujours raccordés du système d'évacuation sont installés et les autres espaces du bâtiment. Mettre en marche les sécheuses, tous les appareils non raccordés au système d'évacuation commun et tous les ventilateurs d'extraction comme les hottes de cuisinère et les ventilateurs des salles de bain. S'assurer que ces ventilateurs fonctionnent à la vitesse maximale. Ne pas faire fonctionner les ventilateurs d'été. Fermer les registres des cheminées.

(d) Mettre l'appareil inspecté en marche. Suivre les instructions d'allumage. Régler le thermostat de façon que l'appareil fonctionne de façon continue.

(e) Faire fonctionner le brûleur principal pendant 5 min ensuite, déterminer si le coupe-tirage déborde à l'ouverture de décharge. Utiliser la flamme d'une allunette ou d'une chandelle ou la fumée d'une cigarette, d'un cigare ou d'une pipe.

(f) Une fois qu'il a été déterminé, selon la métode indiquée ci-dessus, que chaque appareil raccordé au système d'évacuation est mis à l'air libre de façor adéquate. Remettre les portes et les fenêtres, les ventilateurs, les registres de cheminées et les appareils au gaz à leur position originale.

(g) Tout mauvais fonctionnement du systéme d'évacution commun devrait étré corrigé de façon que l'installation soit conforme au National Fuel Gas Code, ANSI Z223.1/NFPA 54 et (ou) aux codes d'installation CSA-B149. Si la grosseur d'une section du système d' évacuation doit étré modifiée, le système devrait étré modifié pour respecter les valeurs minimales des tableaux pertinents de l'appendice F du National Fuel Gas Code, ANSI Z223.1/ NFPA 54 et (ou) des codes d'installation CSA-B149.

8.2 - Venting systems

WARNING!!! The vent installation must be in accordance with Part 7, *Venting of Equipment*, of the latest edition of the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54 or section 7, *Venting Systems and Air Supply for Appliances*, of the CAN/CSA B149.1, *Natural Gas and Propane Installation* code or applicable provisions of the local building codes. Improper venting can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

WARNING!!! Under certain operating conditions the temperature of the boiler's flue gases may reach 230°F, *(110°C)*. Use only the polypropylene vent piping supplied with the boiler or a vent system listed by a nationally recognized testing agency for the application. Improper venting can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

☞Horizontal vent runs must be sloped upwards not less than 1/4 in/ft (*21 mm/m)*, from the boiler to the vent terminal.

☞The vent system shall be installed so as to prevent the accumulation of condensate. When horizontal vent runs exceed 5 ft *(1.5m)*, they must be supported at 3 ft *(0.98 m)*, intervals with overhead hangers.

☞Horizontal vent systems shall terminate at least 4 ft *(1.22 m)* below, 4 ft *(1.22 m)* horizontally from any door, window or gravity air inlet into any building. It must not terminate less than 4 ft *(1.22 m)* horizontally from, and in no case above or below, unless a 4 ft *(1.22 m)*, horizontal distance is maintained, from electric meters, gas meters, regulators and relief equipment and not less than 7 ft *(2.3 m)* from any adjacent public walkway. The bottom of the vent terminal(s) shall be located at least 5 ft *(1.5 m)* above the air intake terminal(s). Avoid terminal locations likely to be affected by winds, snowdrifts, people and pets. **Item unique to CANADA: vent system shall terminate at least 6 ft from electrical and gas meters.**

☞Due to the high efficiency of the boiler it may discharge what looks like white smoke especially when the outside air temperature is cold. This is a simply water vapor, a purely natural phenomenon and not a reason for concern.

☞The minimum clearance measurement between two vent end terminations of this kind of boilers shall be not less than 18" *(1 m)*.

WARNING!!! The exhaust vent and the air inlet lines (also in the coaxial version) must be supported to prevent sagging. To do this, use a suitable pipe clamp to support the lines. Pipe clamps shall support the line every 3 ft (1 m). Pipe clamp shall be fixed in correspondance of a wall stud. Improper supporting can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

8.3 - Design of the venting system

This boiler can be fitted with a very long venting system. However there is a relationship between the length of the venting system and the power input of the boiler. Figure 22 shows this relation which and installer must consider when in the designing stage of the venting.

The maximum length of the Split 80/80PP vent system is 300 ft (Air intake plus flue exhuast).

The maximum length of the concentric 60/100PP system is 70 ft.

Each 45° elbow inserted in the concentric or split venting system, has a loss of pressure equivalent to 2.5 ft of linear pipe.

Each 90° elbow inserted in the concentric or split venting system, has a loss of pressure equivalent to 5 ft of linear pipe.

Boilers model 160OC and 160OB can be fitted only with coaxial venting system (see section 10.1)

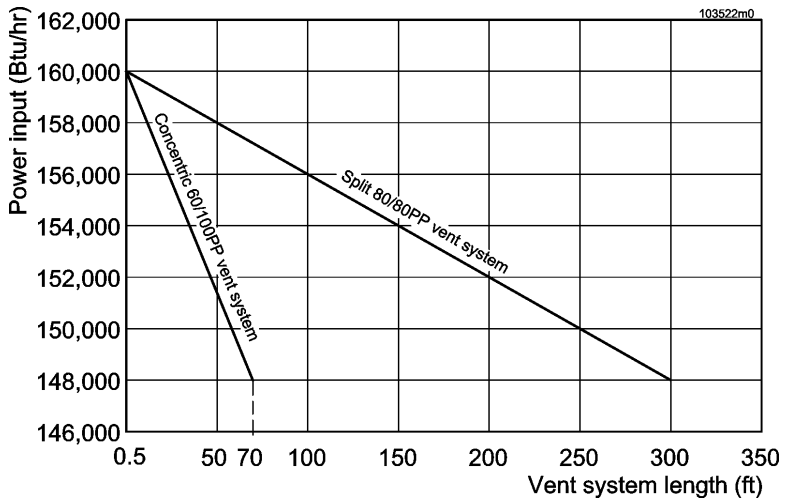
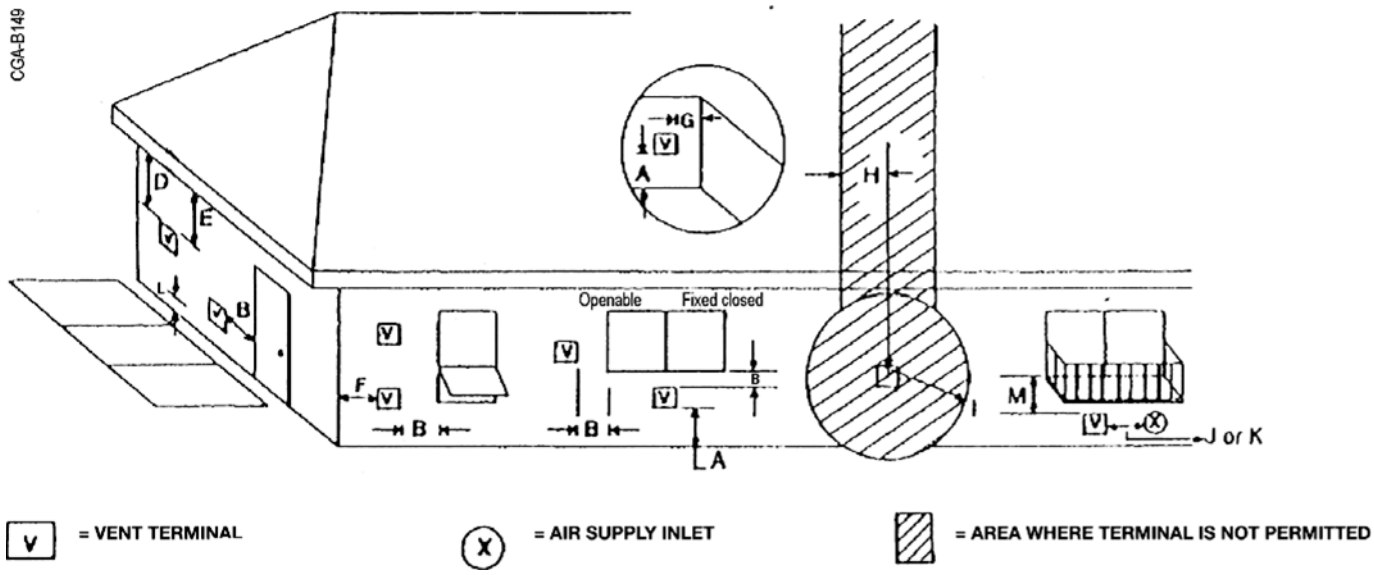


Figure 22 - Relation between Power input and Vent system length

8.4 - Flue terminal location in compliance with CAN/CSA B149



Vent Termination Minimum Clearances

A = 12” clearances above grade, veranda, porch, deck or balcony
B = 12” clearances to window or door that may be opened
D = 18” vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (0.6 m) from the centre line of the terminal
E = 18” clearance to unventilated soffit
F = 9” clearance to outside corner
G = 6” clearance to inside corner
H = 4 ft (USA) not to be installed above a gas meter/regulator assembly within H horizontally from the centre line of the regulator
H = 3 ft (CANADA) not to be installed above a gas meter/regulator assembly within H horizontally from the centre line of the regulator
I = 3 ft (USA) clearance to service regulator vent outlet
I = 6 ft (CANADA) clearance to service regulator vent outlet
J = 9” (USA) clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance
J = 12” (CANADA) clearance to non-mechanical air supply inlet to building or the combustion air inlet to any other appliance
K = 3 ft (USA) clearance to a mechanical air supply inlet
K = 6 ft (CANADA) clearance to a mechanical air supply inlet
L = 7 ft clearance above paved side-walk or a paved driveway located on public property (a vent shall not terminate directly above a side-walk or paved driveway which is located between two single family dwellings and serves both dwellings unless terminated 7ft above sidewalk)
M = 18” clearance under veranda, porch, deck or balcony (only permitted if veranda, porch, deck or balcony is fully open on a minimum of 2 sides beneath the floor

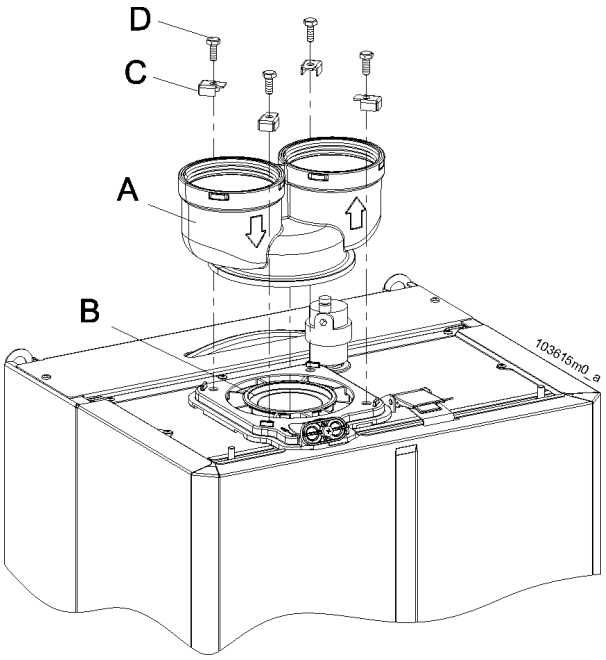


Figure 23 - Installation of Split fitting system

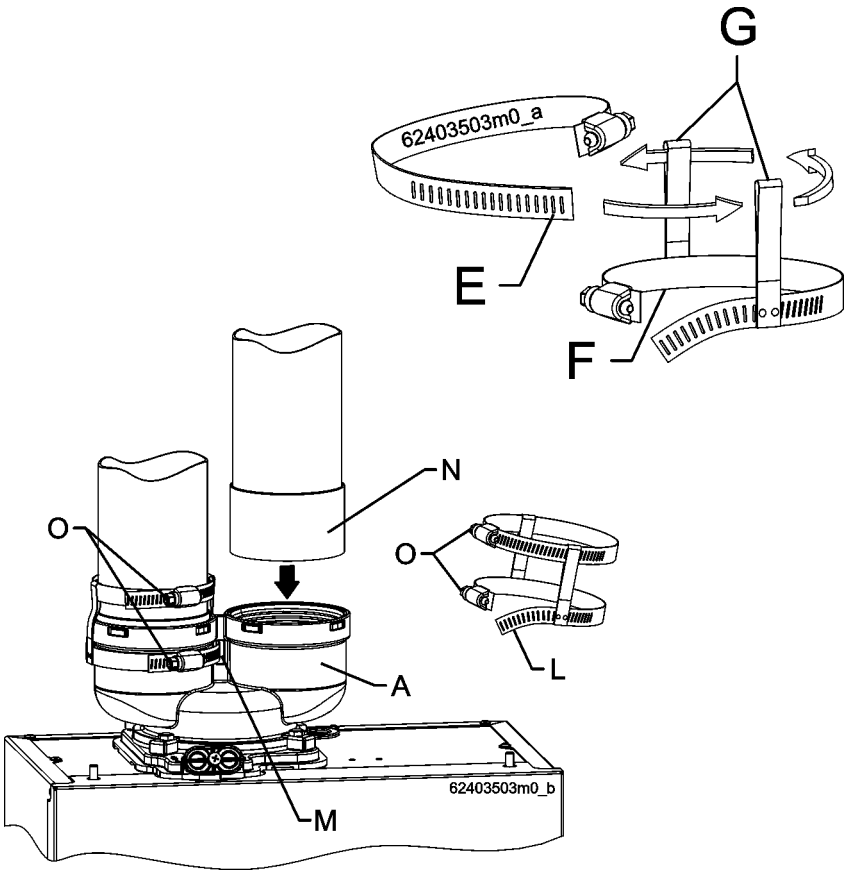


Figure 24 - Connecting the pipes to the boiler

9.1 - Split system (polypropylene) or AL29-4C (UL 1738/UL C 636) system

NOTE:This vent system is not available for 160OC and 160OB models

The boiler is not supplied with the fittings needed for separate vent and combustion air systems. A special kit must be ordered to connect the boiler to separate vent and combustion air systems. Figure 23 shows fitting “A” that can freely turn 360 degrees for optimum installation versatility.

WARNING! Under certain operating conditions the temperature of the boiler’s flue gases may reach 230°F, *(110°C)*. Use only the polypropylene vent piping supplied with the boiler or a vent system listed by a nationally recognized testing agency for the application. Improper venting can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

Pipes or elbows connected directly to the boiler, must be mechanically secure. Follow these instructions (make reference to figure 24):

1. prepare the two collars “G” with springs “E” and “F”;
2. insert the collars “L” in hole “M”;
3. insert pipe “N” inside fitting “A”
4. tight the two collars “O” in a manner to mechanically secure pipe “N” to fitting “A”.

☞Horizontal vent sections must always be pitched by at least 1/4 in/ft (21 mm/m) towards the boiler. Horizontal combustion air sections must always be pitched away from the boiler by at least 1/4 in/ft (21 mm/m) to prevent rain from entering the boiler. The vent and combustion air intake systems can be extended up to 300 ft. Each 90° elbow has is equivalent to 5 ft (1,5 m), of straight pipe. Each 45° elbow has is equivalent to 2.5 ft (0.75 m), of straight pipe.

9 - INSTALLATION - Split venting system

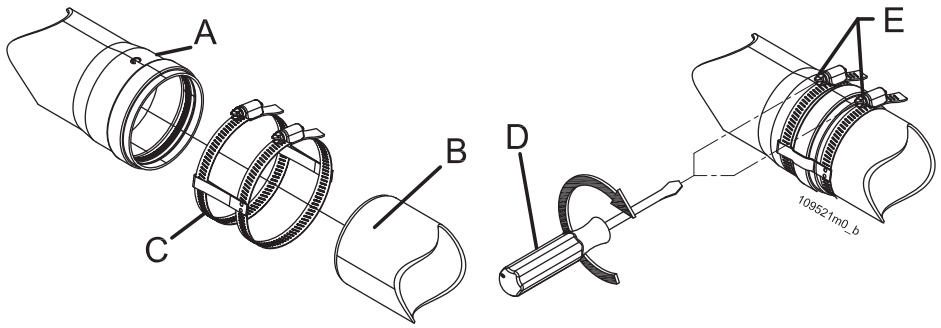


Figure 25 - Connecting extensions and elbows

☞Horizontal vent systems should be as short and straight as possible. The vent system must be both gas tight and watertight. All seams and joints must be joined and sealed in accordance with the vent system manufacturer's instructions.

WARNING!!! Carefully follow the installation steps below for the assembling the split pipe venting system (elbows and extensions), as illustrated in figure 25. it is necessary to properly insert the male side onto the female side and mechanically secure them by using the proper clamps. Improper venting can result in excessive levels of carbon monoxide or a fire, which can result in severe personal injury or death!

☞Mechanically secure each joint with the supplied clamps as shown in figure 25. Follow this procedure:

1. insert the Male side "B" into the Female side "A";
2. use clamp "C" to keep the two pipes together;
3. use screws "E" to tighten the clamp onto both pipes; **DO NOT** force.

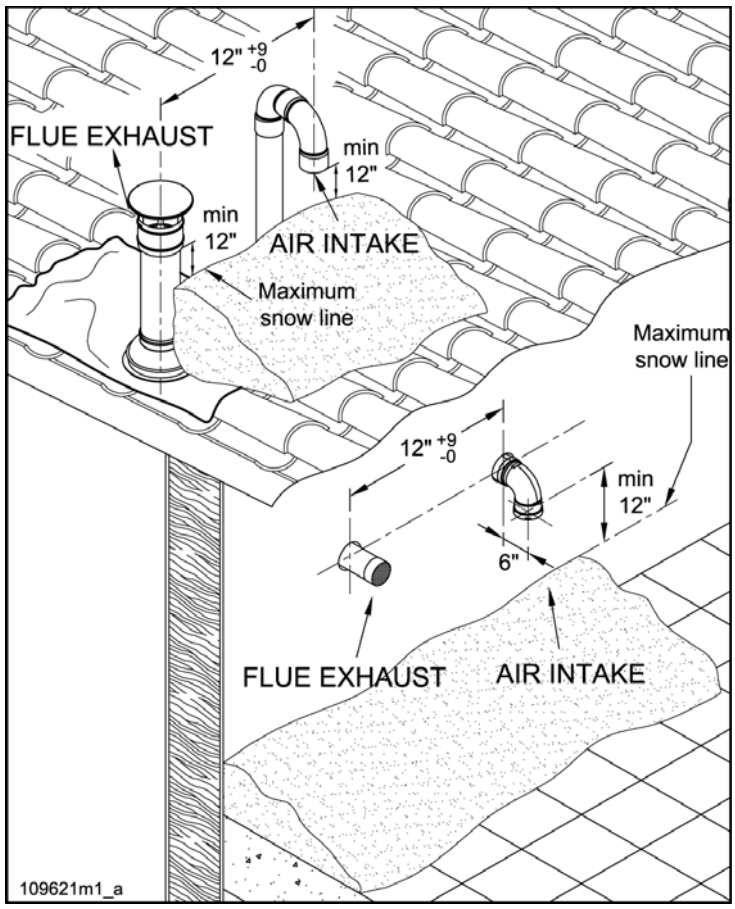


Figure 26 - Clearances of Split system

CAUTION!!! If vent and air intake terminals are located on the same wall,maintain the distances given in figure 26, between the vent and air intake, or flue gas recirculation may occur, causing improper boiler operation!

CAUTION!!! The air intake terminal must be protected from wind by a 90° elbow, see figure 26.

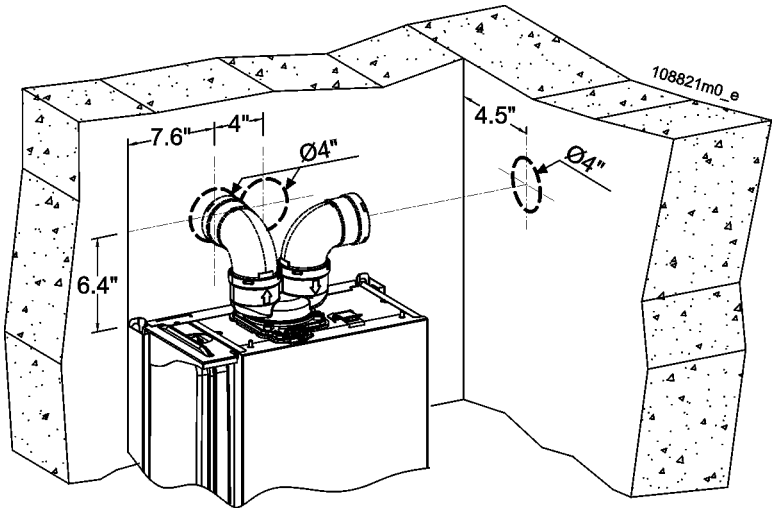
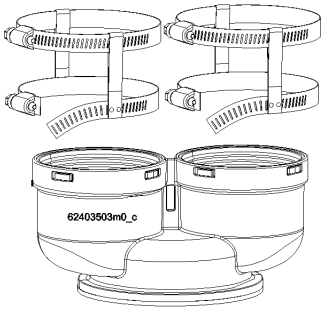


Figure 27 - Interaxes of Split system

9.2 - Split system components

Some of the most commonly used components for installing the Split polypropylene vent and combustion air systems are listed below:
62617286 - No. 1 - Split adaptor 80/80 PP
62617236 - No. 2 - 3ft PP M/F extension
62617240 - 60 ft PP flexible extension
62617241 - Spacer for PP flexible extension
62617244 - No. 3 - 90° PP M/F in line elbow
62617246 - 45° PP M/F in line elbow
62617249 - No. 4 - Secure clamp for PP extensions
62617306 - No. 5 - Split vertical terminal
61302003 - No. 6 - Air intake grid
61302004 - No. 7 - Flue exhaust grid

Note: the numbers after the codes correspond to the numbers in figure 28



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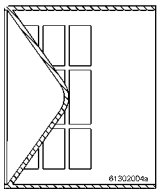
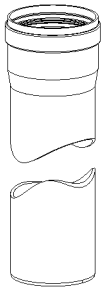


61302004



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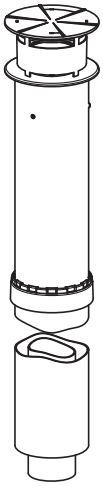

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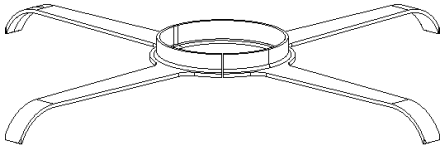

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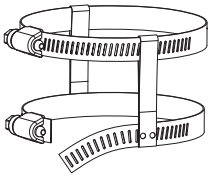

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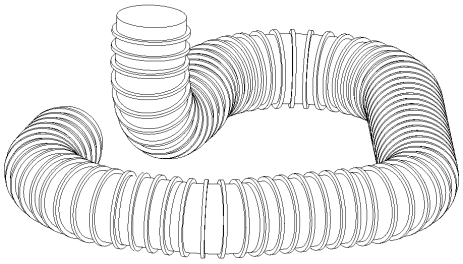
61302003



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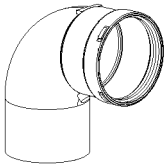

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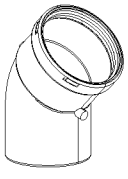


62617246

9.3 - Split system components

Some of the most commonly used components for installing the Split stainless steel vent and combustion air systems are listed here:

Terminal Type	Heatfab Saf T Vent Part Number	Pro Tech FasNSeal Part Number	Z FLex Part Number
Elbow Termination w/ Screen	9314TERM	n/a	2SVSTEX0390
Tee Termination w/ Screen	9330TEE	FSTT3	2SVSTTF-3
Mitered Termination w/ Screen	9390	n/a	n/a
Screen Termination	9392	FSBS3	2SVSTPF-3
Air Intake Tee	SC03TAD3	n/a	n/a

9.4 - Split system: installation examples

Three installation examples can be seen in figure 28:

1. the first example shows the vent system directly penetrating the roof with the collection of condensation inside the boiler itself. The combustion air system must be pitched outward 1/4 in/ft *(21 mm/m)* to prevent rainwater from entering the boiler.

WARNING!!! Roof penetrations must be made according to the vent manufacturer's instructions and prevailing codes. Failure to comply with this warning can result in a fire causing severe personal injury or death!

2. the second example shows the vent system run through a dormant chimney. Condensation is collected inside the boiler itself. The horizontal section of the vent system must be pitched 1/4 in/ft *(21 mm/m)* towards the boiler. The intake combustion air system must be pitched outward 1/4 in/ft *(21 mm/m)* to prevent rainwater from entering the boiler.
3. the third example shows the vent system run through a dormant chimney but the vent is done by the flexible polypropylene pipe. Condensation is collected inside the boiler itself. The horizontal section of the vent system must be pitched 1/4 in/ft *(21 mm/m)* towards the boiler. The intake combustion air system must be pitched outward 1/4 in/ft *(21 mm/m)* to prevent rainwater from entering the boiler.

WARNING!!! Under no conditions, shall this boiler vent gases directly into a masonry chimney, nor can an active chimney be used as a chase. Failure to comply with this warning can result in chimney or vent system failure causing excessive levels of carbon monoxide which can cause severe personal injury or death!

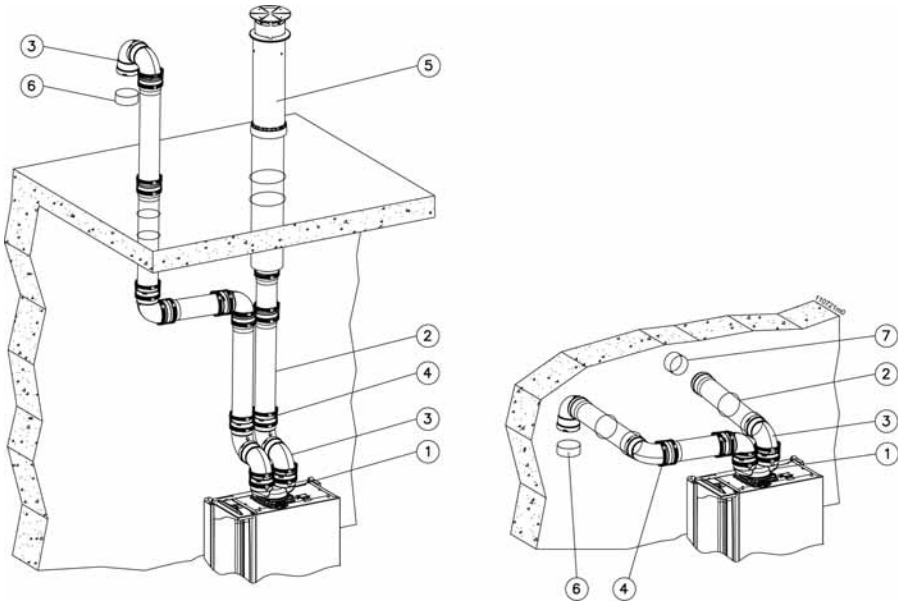
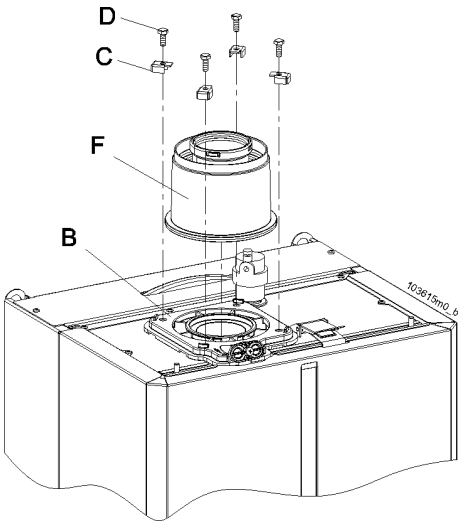


Figure 28 - Installation examples of the Split system (see section 9.2 for the reference of the numbers)

10 - INSTALLATION - Coaxial venting system



B = Connection flange
C = Fixing feet
D = Fixing screw
F = Coaxial vertical adaptor

Figure 29 - Installation of the coaxial fitting

10.1 - Coaxial system

The boiler is not supplied with the fittings needed for connecting a coaxial vent/combustion air system. A special kit must be ordered to connect the boiler with the Coaxial polypropylene vent. Figure 30 shows how to install the Coaxial fitting above the boiler:

WARNING!!! Carefully follow installation steps below, for the coaxial pipe assembly (elbows and extensions), as illustrated in figure 31. it is necessary to properly insert the internal and external pipe and mechanically secure them by using a stainless steel self tapping screw. Improper venting can result in excessive levels of carbon monoxide or a fire, which can result in severe personal injury or death!

In particular:
1. slip-fit the extension “1” and “2” (see figure 30) together;
2. drill a suitable hole “3” with a drill “4” (see figure 30) in a position where the two pipes “1” and “2” are overlapped;
3. insert a suitable stainless steel self tapping screw “5” and tight it with a screwdriver “6”

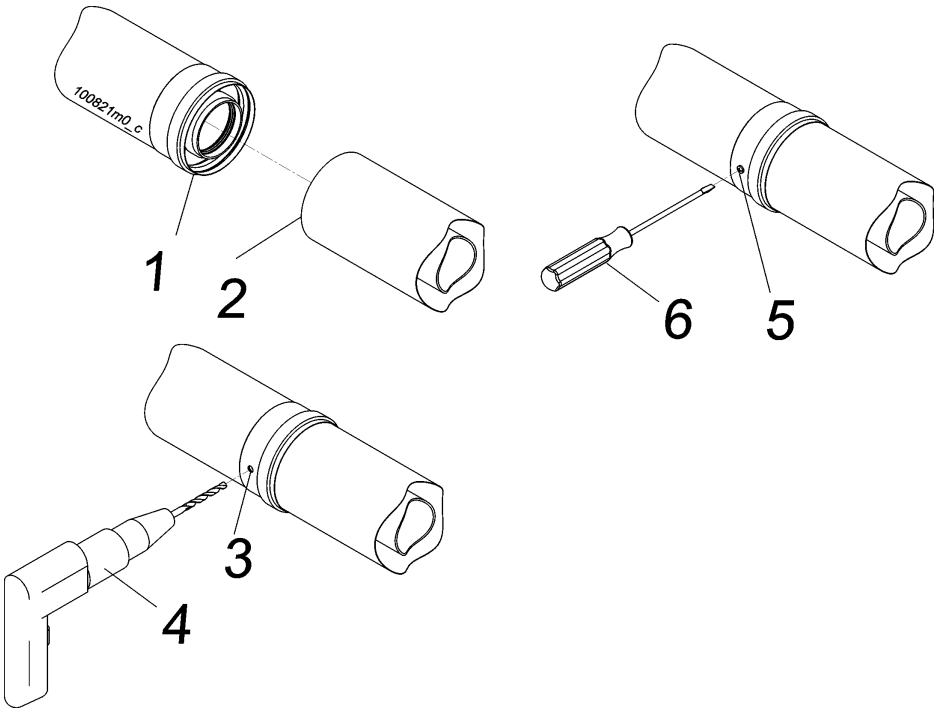


Figure 30 - Secure fixing extensions and elbows together

☞It is recommended that wall sleeve be used when installing the coaxial system through an exterior wall. This will allow the system to be easily slipped out for access during routine maintenance.

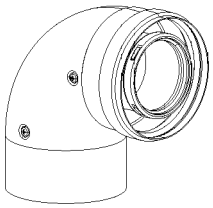
☞Horizontal coaxial systems must always be pitched by at least 1/4 in/ft, *(21 mm/m)* towards the boiler.

☞The Coaxial system should extend out of the wall to the dimensions shown in figure 32.

10.2 - Coaxial system components

The following coaxial polypropylene vent and combustion air system components are available, on request, for installing the Coaxial system

62617234 - No. 1 - In line 90° PP coaxial M/F elbow
62617252 - No. 6 - In line 45° PP coaxial M/F elbow
62617231 - No. 7 - 3ft (1m) PP coaxial extension
62617304 - No. 3 - PP coaxial roof end piece
62617232 - No. 5 - PP coaxial wall end piece
62617224 - No. 8 - PP straight coaxial adaptor
Note: the numbers after the codes correspond to the numbers in figure 31.



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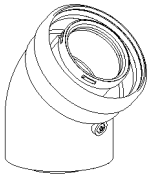

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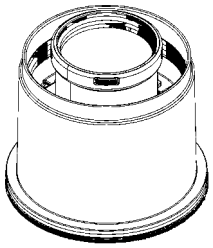

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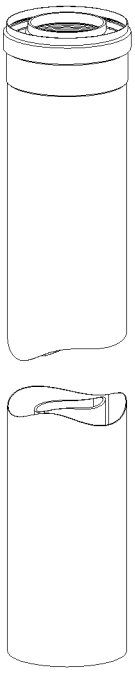
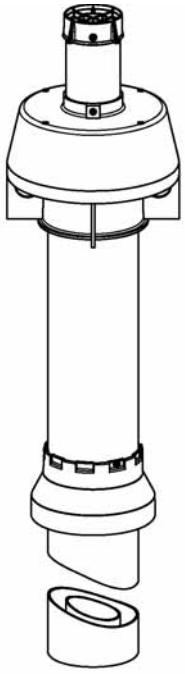
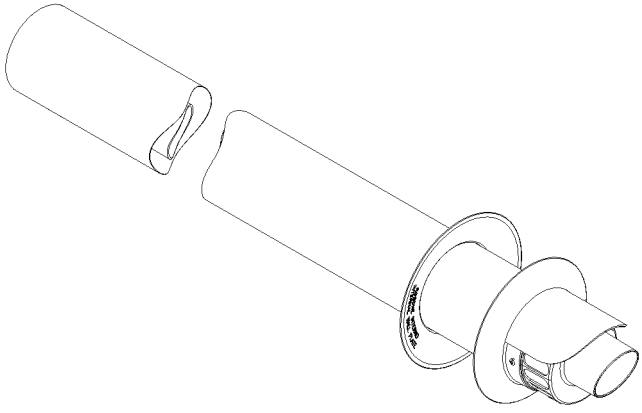


62617231



62617304



62617232

10.3 - Coaxial system components

Some of the most commonly used components for installing the coaxial stainless steel vent and combustion air system are listed here.

Terminal Type	Heatfab Saf T Vent Part Number	Pro Tech FasNSeal Part Number	Z FLex Part Number
Elbow Termination w/ Screen	9314TERM	n/a	2SVSTEX0390
Tee Termination w/ Screen	9390TEE	FSTT3	2SVSTTF-3
Mitered Termination w/ Screen	9390	n/a	n/a
Screen Termination	9392	FSBS3	2SVSTPF-3
Horizontal Termination Adapter	SC03HT	n/a	n/a

10.4 - Coaxial system: installation examples

When a coaxial vent and combustion air system is installed, figure 31, whether vertical or horizontal, it must be sloped 1/4 in/ft, *(21 mm/m)* towards the boiler.

CAUTION!!! Maintain the distances given in figure 32, between the vent terminal and the wall and also between the vent terminal and the ground level (snow line). Maintain 3 ft distance also between the vent terminals of two or multiple boilers (see figure 32).

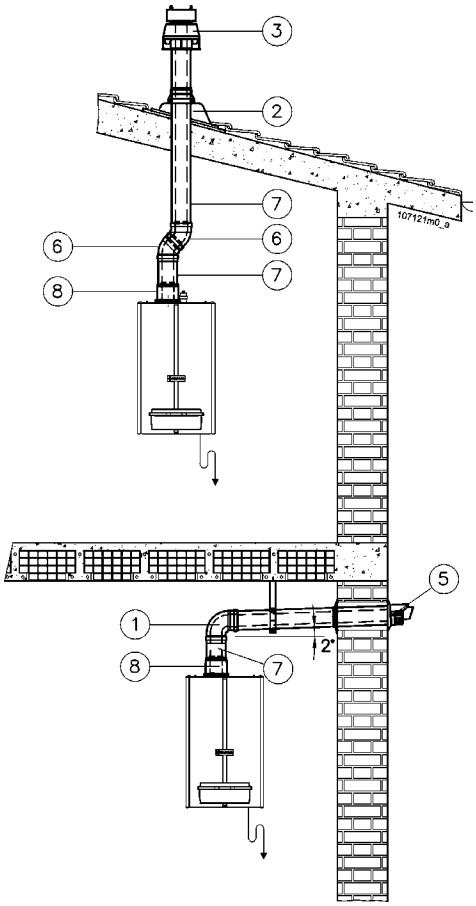


Figure 31 - Installation examples for the coaxial pipe (see section 10.2 for the reference of the numbers)

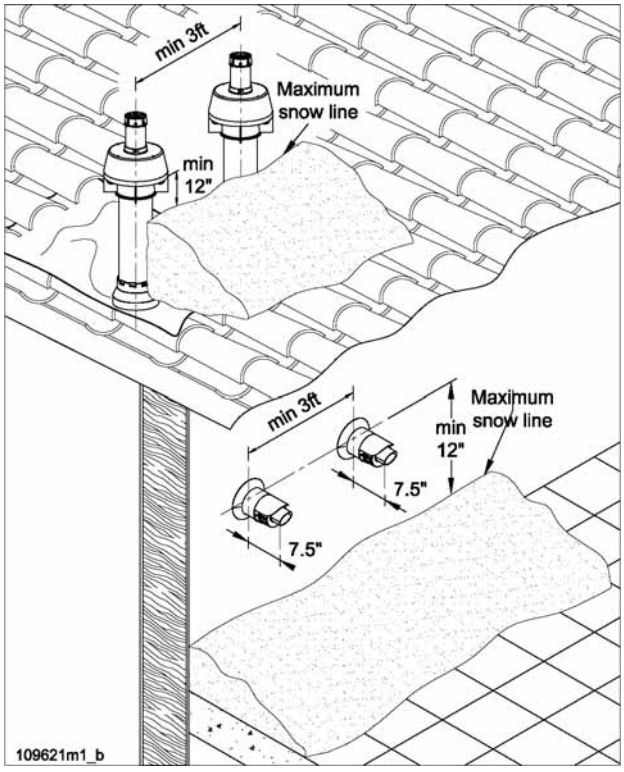


Figure 32 - Clearances for the coaxial vent terminal

11.1 - Operating

Before starting the boiler, the following must be done.

11.1.1 - User instructions

The user must be correctly instructed by the installer, on how to operate the boiler, in particular:

- ☞Make sure that the user keeps this manual and all other documentation included with the boiler.
- ☞Make sure that the user understands never to tamper with gas control settings and the risk of CO poisoning should an unauthorized individual do so
- ☞Make sure that the user is informed of all the special measures to be taken for combustion air inlet and discharging flue gases, and that these must not be modified.
- ☞Make sure that the user knows how to adjust temperatures, controls and the room thermostats for maximum efficiency.

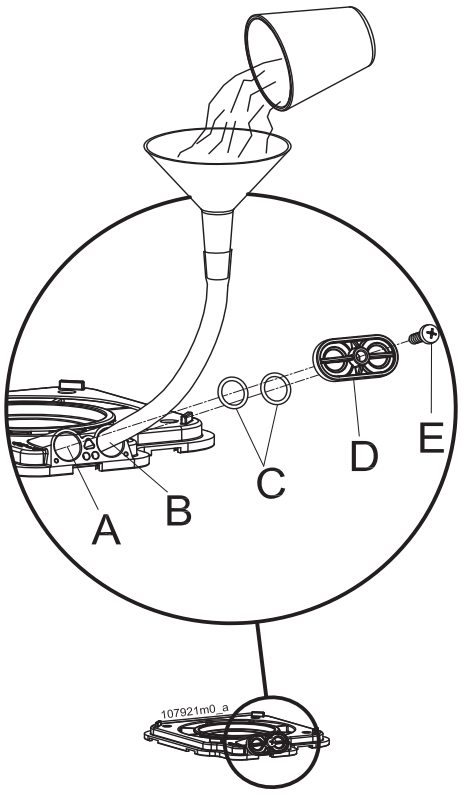


Figure 33 - Filling the condensate trap

11.1.2 - Filling the condensate trap

The condensate trap is positioned inside the boiler as shown in figure 1, item “46”. It must be filled with water to prevent the leakage of flue gases from the condensate drainpipe, item “41” in figure 1. To fill the condensate trap proceed as follows:

1. unscrew “E” screw (Figure 33);
2. remove flange “D” and O-Rings “C” (Figure 33)
3. With a rubber tube and a funnel, slowly pour approximately 4 oz. (100 ml), of water into the “B” opening - DO NOT put water into the “A” opening (Figure 33);
4. re-install flange “D” and O-Rings “C” and reinstall screw “E” (Figure 33).

WARNING!!! If boiler stays off for more than 3 months, repeat the above operation to again fill the condensate trap.

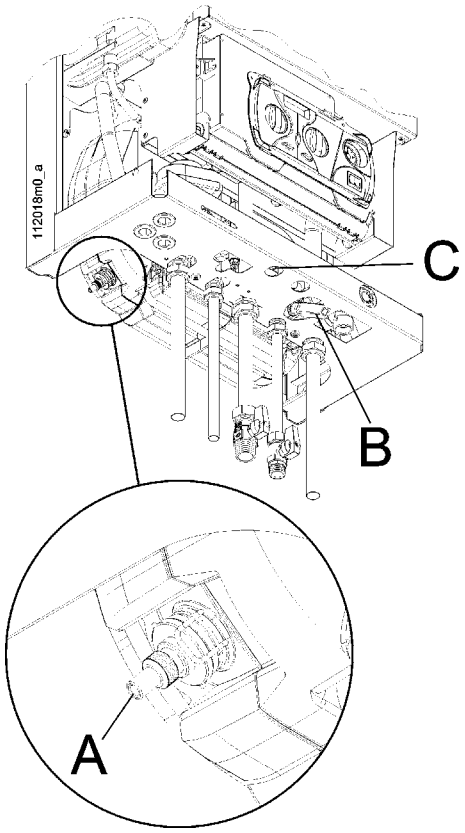


Figure 34 - Purge screw for the domestic hot water heat exchanger

11.1.3 - Filling the heating system

WARNING!!! Never use non-approved additives or toxic boiler treatment chemicals in the heating system as they can cause serious health problems or possibly death. Any additives introduced into the heating system must be recognized as safe by the United States Food and Drug Administration.

To fill the heating system, proceed as follows:

CAUTION! The heating system must be filled with clean water from the domestic water system. Contaminated water can damage the boiler voiding its warranty.

CAUTION!!! The addition of any chemical substances, such as anti-freeze, must be carried out according to the product instructions. Read and follow instructions in sections 13.10 and 13.11 to prevent problems.

1. open the automatic air vent, shown as item “1” in figure 1, two turns;
2. open the fill valve located under the boiler and proceed to fill the heating system and boiler until the pressure gauge, item “30” in figure 1, reads 20 psi (*1.5 bar)* and “FILL” disappears from the display;
3. check that there is no water leaking from the fittings. If there is the leaks must be eliminated;
4. close the fill valve;
5. check the pressure gauge during the purging process. If the pressure has dropped, re-open the fill valve to bring the pressure back up to 20 psi *(1.5 bar)*.

11.1.4 - Filling the domestic hot water heat exchanger (160C and 160OC models only)

Once the heating system has been filled and purged, the domestic hot water heat exchanger must be filled as follows:

1. connect a rubber tube to the pressure coupling “A” shown in figure 34 and place the end in an empty bucket or sink;
2. loosen screw “A” as shown in figure 34 until air can be heard escaping;
3. once the water runs clear of air bubbles tighten screw “A”;
4. remove the tube and check that there are no water leaks.

11.1.5 – Auto-purging the heating system

Each time the on/off power switch, item “34” in figure 1, is switched on, an auto-purging cycle lasting 3 minutes begins. The auto-purging process involves the turning the pump on and off in order to remove any air trapped in the heating system. Before starting the auto-purging cycle the automatic air vent, item “1” shown in figure 1 must be opened.

11.2 - General warnings concerning gas supply

When starting up the boiler for the first time the following must be checked:

- ☞That the boiler is supplied with the type of fuel that it is configured to use. Read sections 11.3 and 11.4
- ☞That the gas supply pressure is within the maximum and minimum values given in listed on the boiler rating plate. The gas supply pressure must be checked with boiler on and the boiler off.
- ☞That the gas supply system is provided with all the safety devices and controls required under current national and local codes.
- ☞That the vent and combustion air terminals are free from any blockages.
- ☞That the condensate drain tube is properly connected.

WARNING!!! 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.**

Failure to follow the above steps can result in a fire or explosion causing property damage, personal injury or loss of life!

11.3 - Confirming the boiler’s gas type

The type of gas and the gas supply pressure that the boiler is set up for is listed on the rating label.

The boiler can operate using one of the following two gases:

NATURAL GAS

Maximum supply pressure = 11 in.W.C. (*27.5 mbar).*
Minimum supply pressure = 1.5 in.W.C. (*3.8 mbar)*.

LP Gas

Maximum supply pressure = 13 in.W.C. *(32.5 mbar)*.
Minimum supply pressure = 8 in.W.C. *(20 mbar)*.

11.4 - Gas type conversion

If the gas available at the installation site is not the type the boiler is configured to use, the boiler must be converted. Special conversion kits are available for this purpose. The instruction inside the conversion kit must be followed.

WARNING!!! Conversion of the boiler to use another type of gas must be carried out by a qualified technician. Improper conversion of the gas valve could result in a fire or an explosion causing severe personal injury or death!

11.5 - Start-up

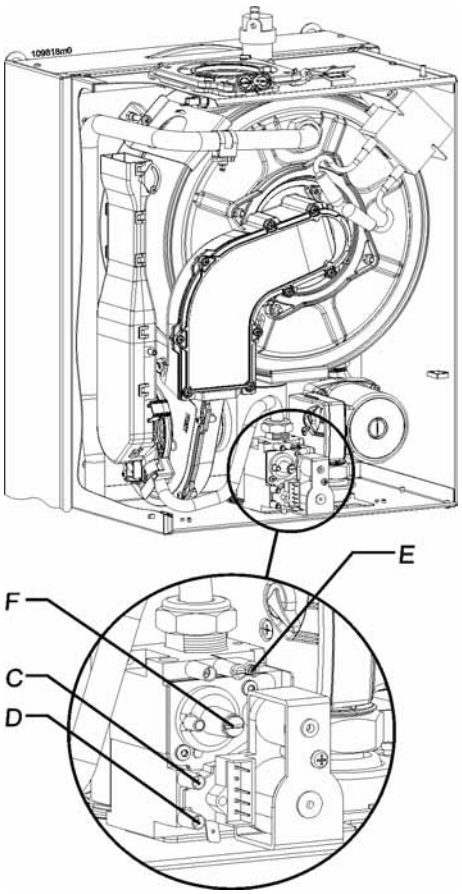
1. Open the manual gas shut off valve, figure 15 and 16, item “3”.
2. Switch the on/off power switch, item “34” in figure 1, to “on”.
3. If the display shows code E 21, it means that the polarity has not been observed between the hot and neutral wires. If this happens the wires must be switched.
4. Upon start-up, an F is shown for 2-3 minutes while the boiler goes through its heating system purge cycle as described in section 11.1.5. To by-pass this stage, press the + and − keys together until a blinking F appears. Then press the Reset button.
5. Rotate knobs “32” and “33” shown in figure 1 to the desired temperature.
6. The boiler will fire only when the room thermostat calls for heat. If an external temperature sensor is connected, check that the temperature calculated is higher than the minimum running temperature as explained in section 12.10.
7. If the pump indicator is illuminated, item “6” in figure 40, but the pump is not running, item “45” in figure 1, it may be stuck. If this is the case it can be released by removing screw “44” shown in figure 1 and turning the screw underneath.
8. If the pump indicator is illuminated but the heating system does not heat up, repeat the air purging operations on both the boiler and the heating system.

11.6 - Ignition control testing

After placing the boiler in operation, the ignition control's safety shutoff function must be tested as follow:

1. turn the power switch (item "34" in figure 1) to on;
2. close the room thermostat to create a call for heat;
3. turn knobs "32" and "33" in figure 1 to their maximum position;
4. wait a few minutes for the burner to light-up as indicated when light "3" shown in figure 40 stays illuminated.
5. close the manual gas shutoff valve, see figure 15 and 16, item "3";
6. after 40 seconds, the display must show L01;
7. open the manual gas shutoff valve, see figure 15 and 16, item "3";
8. verify your gas meter, gas flow must be zero.

WARNING!!! If gas flow occurs, close the manual gas shutoff valve and troubleshoot the system to determine why there is gas flow when the gas valve should be deenergized. Do not operate the boiler until the problem is resolved or a fire or explosion causing property damage, personal injury or loss of life may occur!



C - Service pressure port
D - Inlet gas pressure port
E - High fire, CO2 adjusting screw
F - Low fire, CO2 adjusting screw

Figure 35 - Gas valve

11.7 - Gas supply pressure checking and adjustment

The gas supply pressure must match that listed on the boiler rating label. Check the gas supply pressure by following the steps below:

1. close the manual gas shut off valve, figure 15 and 16, item "3";
2. follow the steps in section 13.2 to remove the front cover;
3. turn the screw in pressure port "D" shown in figure 35 three turns counterclockwise;
4. connect a manometer with graduations of at least 0.1 in.W.C. *(0.25 mbar)* to the inlet gas port "D" shown in figure 35;
5. open the manual gas shut off valve, figure 15 and 16, item "3";
6. check that the gas supply pressure does not exceed the "maximum gas supply pressure" as stated in section 14;
7. turn the power switch to on and generate a heat demand by turning knob "33" shown in figure 1 to its maximum setting. Also ensure that the room thermostat is calling for heat;
8. press the + and − keys at the same time for more than 10 seconds, the display will show F -;
9. press the + key until the display shows t -. Now the boiler will run for 10 minutes at maximum input;
10. check the manometer to make sure the gas supply pressure does not drop below the "minimum gas supply pressure" as stated on section 14. If the gas supply pressure does not fall within the above values, adjust the upstream gas pressure regulator to bring the gas supply pressure within the maximum and minimum range listed on section 14.

After verifying the correct gas pressures disconnect the manometer, turn the screw in pressure connection "D" in figure 35, clockwise until snug and check for any gas leaks.

CAUTION!!! Never force the pressure connection screw or the gas valve will be damaged!

WARNING!!! Never use an open flame to check for gas leaks, a fire or an explosion could result causing severe personal injury or death!

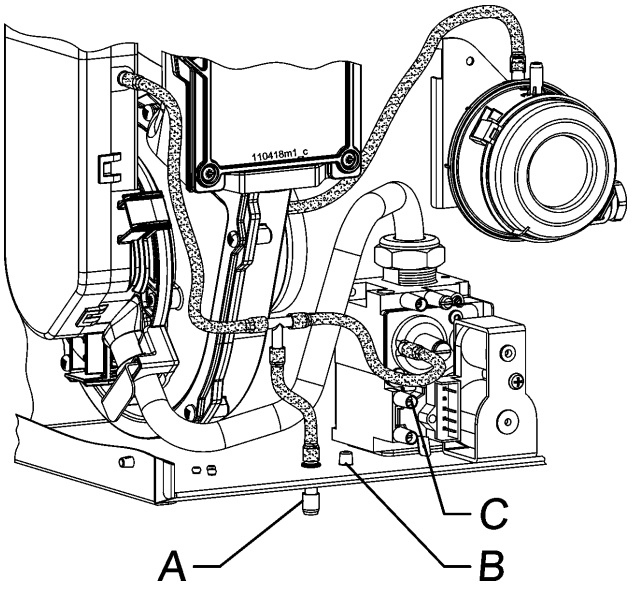


Figure 36 - Combustion air pressure probes

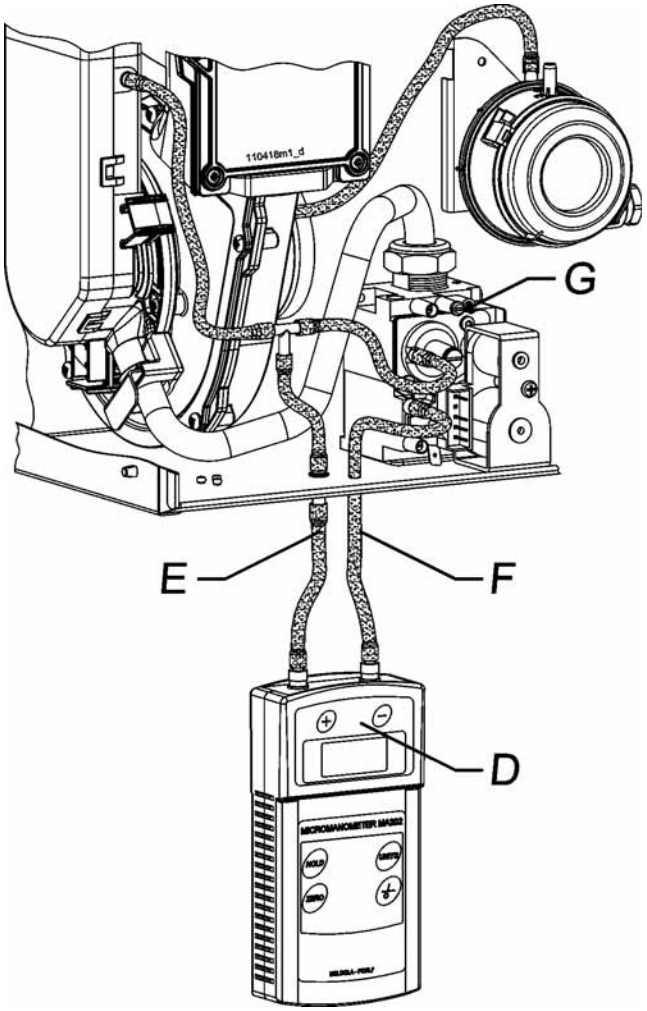


Figure 37 - Checking the combustion air pressure

11.8 - Check the combustion air pressure

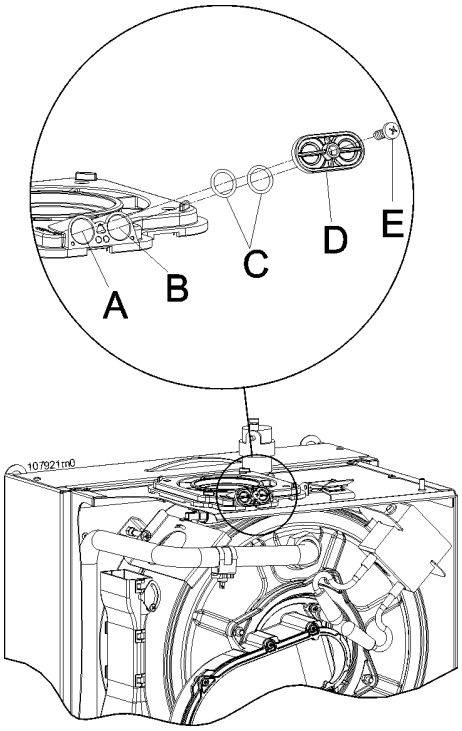
The boiler has a factory-set air/gas ratio. The pressure of the gas at the burner is indirectly controlled by the blower. The combustion air pressure must be checked as follows while refering to figures 36 and 37:

1. use a differential manometer with a precision of at least 0.1 in.W.C. (*0.25 mbar)*;
2. close the manual gas shut off valve, figure 15 and 16 item “3”;
3. open the boiler casing following section 13.2;
4. press the two plastic spring tabs labeled “B” shown in figure 21 and rotate the electrical box;
5. remove plug “B”;
6. turn pressure probe screw “C” one turn counterclockwise;
7. insert tube “F”, from the negative side of the manometer, through the opening of plug “B”, and connect it to pressure probe “C” as shown in figure 36;
8. remove plug “A” from the pressure probe and connect the differential positive side of the manometer to it;
9. the manometer connections must be made as shown in figure 37, to get the correct pressure reading;
10. replace panel “H” of figure 44 and latch it closed. If panel “H” is not properly in place the manometer reading will not be accurate;
11. turn the power switch to on, item “34” in figure 1;
12. press the + and − keys together for more than 10 seconds, until a blinking F − is displayed;
13. the combustion blower will run at maximum speed for 10 minutes. During this time the burner will not light;
14. compare the pressure on the manometer with the table in section 14 TECHNICAL DATA, “Combustion air pressure”. The combustion air pressure reading should be within ± 0.3 in.W.C. *(0.75 mbar)*;
15. if the combustion air pressure is too low, check that there are no obstructions in the combustion air and vent systems. Also make sure that panel “H” is properly sealed;
16. if the combustion air pressure is within tolerance press the Reset button to return the boiler to its normal running mode;
17. once the combustion air pressure check has been performed, disconnect the manometer, close pressure probe screw “C”, close the boiler casing, turn the manual gas shut off valve on and proceed with the check and adjustment of CO2, section 11.9.

11.9 - Checking and adjusting CO2 levels

Section 14 lists the correct CO2 ranges for a boiler running at normal operating conditions at an altitude below 3000 ft *(1000m)*. CO2 values outside of the ranges given in section 14 may lead to malfunctioning of the boiler and cause it to prematurely fail. To check the CO2 value, carry out a combustion analysis as follows while referencing figure 38:

1. carefully remove items “E”, “D” and “C” from the combustion air/ vent fitting:
2. generate a call for heat or, if this is not possible, fully open a hot water faucet;



A = air probe
B = flue gases probe
C = O-ring gaskets
D = probes cap
E = fixing screw

Figure 38 - Combustion analysis probes

3. press the + and − keys for more than 10 seconds, the display will show a blinking F -;
4. press the + key until the display shows t - if a call for heat has been generated or until 5 - is displayed if a domestic hot water demand has been generated. The boiler will now run for 10 minutes at low fire input.
5. wait 2 to 3 minutes for the CO2 to stabilize;
6. insert the probe of a calibrated combustion analyzer into port “B” and take a flue gas sample;
7. compare the CO2 reading with the low fire range given in section 14 making sure to use the range for the gas type in use. If the CO2 reading is outside the specified range, it must be adjusted.

To adjust the low fire CO2 proceed as follows:

1. use a screwdriver to remove the gas valve cap, item “F” in figure 35;
2. turn the regulator screw found under cap “F” clockwise to increase the CO2, counter-clockwise to decrease the CO2;
3. turn the regulator screw in small increments and wait for the CO2 to stabilize to prevent overshooting the desired value:
4. replace the gas valve cap, item “F” in figure 35;
5. seal screw “F” with red paint or nail polish to discourage tampering.

WARNING!!! Compare also CO (carbon monoxide) reading, with the value given in section 14. If this is higher STOP the boiler and call the service department (see phone number on the last cover page)

Now check and, if necessary, adjust high fire CO2:

6. press the + key until the display shows t - if a call for heat has been generated or until 5 - is displayed if a domestic hot water demand has been generated. The boiler will now run for 10 minutes at high fire input;
7. wait 2 to 3 minutes for the CO2 to stabilize;
8. insert the probe of a calibrated combustion analyzer into port “B” and take a flue gas sample;
9. compare the CO2 reading with the high fire range given in section 14 making sure to use the range for the gas type in use. If the CO2 reading is outside the specified range, it must be adjusted.

To adjust the CO2 proceed as follows:

1. use a screwdriver to turn screw “E” shown in figure 35;
2. turn screw “E” clockwise to reduce the CO2, counter-clockwise to increase the CO2;
3. turn screw “E” in small increments and wait for the CO2 to stabilize to prevent overshooting the desired value:
4. seal screw “E” with red paint or nail polish to discourage tampering;
5. press the Reset button to return the boiler to its normal operating mode.

WARNING!!! Compare also CO (carbon monoxide) reading, with the value given in section 14. If this is higher STOP the boiler and call the service department (see phone number on the last cover page

NOTE: During the 10 minutes override mode, if the demand on the boiler is low causing the flue gas temperature to increase rapidly. Boiler will go into lock out code L06. To reactivate it, press Reset button.

11.9.1 - Checking and adjusting CO2 levels without CO2 meter

WARNING!!! This is an emergency procedure: after the sequent procedure you must back, as soon as possible, on the boiler, with a combustion analyzer, to compare the CO (carbon monoxide) content with the reading on section 14. If CO (carbon monoxide) is higher STOP the boiler and call the service department (see phone number on the last cover page).

The ionisation current value is directly related to the CO2 value. Therefore,If you are not in possession of a CO2 meter, you can use the ionisation current value to correctly adjust the CO2 value.

"P" parameter value	Correspondent heat input (btu/hr)
100	160,000
92	150,000
85	140,000
77	130,000
69	120,000
62	110,000
54*	100,000
46	90,000
38	80,000
31	70,000
23	60,000
15	50,000
8	40,000
1	30,000

103122m0_b

*Factory set heat input, to adjust see section 11.10.

Figure 39 - Correspondence table to set space heating input

To do so, follow section 11.9 and instead of comparing the CO2 value, compare the right side of the display (ionisation current value) with the corrisponding “ionisation current” value in section 14.

Because the reading of the ionisation current is not a fixed value but can vary ± 3, you must compare the average value of the fluctuation, with the value in section 14 (see also section 13.12.4).

11.10 - Adjusting the heating capacity

This boiler has been engineered with an “intelligent” micro-processor control that will adjust the heating output to match the system demand. To maximize the effectiveness of the system, the parameters found in the “Installers menu”, in section 12.17, can be adjusted set the maximum heating output to the effective maximum load necessary for the system. The parameter can be adjusted from 100 (factory set value), to 1. The correspondence between value and heating output is given by table in figure 39.

NOTE: This setting, adjusts the heating input only. The domestic output is always 160,000 btu/hr for every value.

11.11 - Domestic hot water flow rate adjustment (160C and 160OC models only)

The volume of domestic hot water that the boiler can produce, depends on the flow rate of the domestic water system. If the flow rate is too high, the water will move through the heat exchanger without being adequately heated. It is therefore advisable to carry out the following adjustments:

1. switch the on/off power switch, item 34 in figure 1, to “on”;
2. adjust control “32” as shown in figure 1, to 130 °F *(50 °C)*;
3. fully open a hot water faucet. If a mixing type faucet with single lever is opened, the position must be fully to HOT;
4. set the mixing valve (item “10” of figure 15 to its maximum values)
5. wait 5 minutes for the temperature to stabilize;
6. if the water temperature is too low, reduce the water flow using a flow restrictor (item “12” of figure 15) until reaching the desired temperature (turn the flow restrictor in small increments and wait for the temperature to stabilize to prevent overshooting the desired value).

NOTE: Water flow should generally be regulated according to the values given in section 14, under the heading “instantaneous d.h.w. production (rise 75 °F *(42 °C)*)”.

11.12 - Cold start boiler

The boiler has a “cold start” mode. Any time the room thermostat opens, (no call for heat) the burner stops immediately. However even with the room thermostat contact open, the boiler will still run for freeze protection as described in section 12.14.

12 - USE

1 - Display of the parameters
2 - Display of the paramenters value.
3 - Light indicates the burner state:
Light-on = Burner ON;
Blinking = Burner OFF.
4 - Light indicating DHW service:
Light-on = DHW service ON;
Light-off = DHW service OFF.
5 - Light indicates the decimal.
6 - Light indicates CH service:
Light-on = CH service in function;
Light-off = CH service not function.
7 - Heating temperature control.
8 - Key for decreasing parameter values.
9 - Key for resetting shutdowns and for scrolling the list of parameters.
10 - Key for increasing parameter values.
11 - Domestic hot water temperature control.
12 - On/off power switch.
13 - Heating circuit pressure gauge.

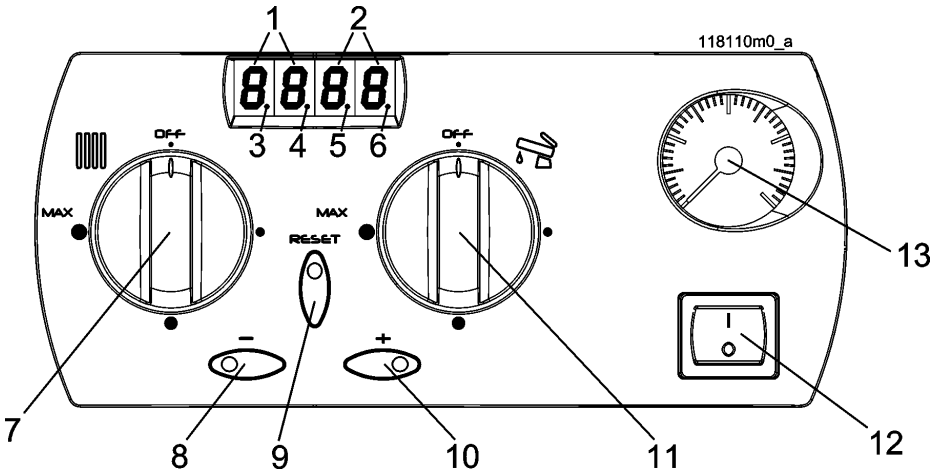


Figure 40 - Instrument panel

12.1 - Check Heating system pressure

If the pressure inside the heating circuit falls below 7psi (0,5 bar), the appliance switches off and the display “1” as per figure 40, shows FILL to indicate that it is necessary to restore the correct pressure. Proceed as follows:

1. open the filling cock;
2. check the pressure on the pressure gauge “13” of figure 40, it must reach a pressure of 20 psi (1,5 bar) and the indication FILL must disappear;
3. close the filling cock.

CAUTION!!! During normal operations, the filling cock must always remain in the closed position.

If, with time, the pressure drops, restore the correct value. This operation may have to be repeated several times during the first month of operations to remove any gas bubbles present.

12.2 - Overview

The boiler is pre-set with standard parameters. However, it is possible to make a number of changes or consult the parameters by means of using the “Users’ Menu” (see section 12.16). During functioning display “1” of figure “40” displays the status of the boiler and display “2” (see figure 40) shows the value of the parameter. The various operating statuses are shown in section 12.18.

Within the “Users’ Menu” (see section 12.16) it is possible to check the last lock-out or error which have occurred. In addition to the operating modes, the instrument panel provides important information on the current functioning of the boiler, via theindicators “3”, “4”, “5” and “6” of figure 40. In particular:
- the indicator “3” displays whether the burner is functioning (on) or whether it is off (blinking);
- the indicator “4” displays whether the domestic hot water service is on or off;
- the indicator “6” displays whether a heating service request is active (on) or nor (off).

12.3 - Displays

During normal operations, the parameters’ display “1” and the values’ display “2” (see figure 40) remain permanently on, if the ”Energy Saving” mode has not be activated (See section 12.15).

The parameters which can be displayed are shown with their meaning in table shown in section 12.18.

12.4 - Start-up procedure

1. Open the manual shutoff gas valve;
2. switch on electric power to the boiler;
3. If the display shows code E21, it means that the polarity has not been observed between phase and neutral;
4. on initial start-up, the appliance carries out an auto-purging cycle lasting two minutes. This is indicated by the appearance of F on the display;
5. wait two minutes until the end of the auto-purging cycle;
6. turn knob “7” of figure 40 until it reaches the heating temperature desired. Turn knob “11” of figure 40 until it reaches the domestic water temperature desired.

The flame control appliance will startup the burner.

If the burner fails to ignite within 15 seconds, the boiler will automatically attempt ignition another three times, after which if it fails to start-up, it will shut down and the display will show L01.

Press the Reset button in order to re-set normal operating conditions. The boiler will automatically attempt another start-up.

CAUTION!!! If the appliance frequently shuts down, contact a qualified technician to restore normal running conditions.

Now the boiler will continue to operate in relation to the service requested and will indicate the following on display “1”:

- d if a domestic water request is active;
- C if a heating request is active;
- 0 if there is no domestic water or heating request active.

12.5 - Summer mode

To disable the heating functions for a prolonged period, leaving only the domestic hot water function, switch OFF the heating temperature, until the wording OFF appears, by turning knob “7” of figure 40 to the minimum.

12.6 - Winter mode

In Winter mode, by means of the pump, the boiler sends the water to the system at the temperature set using knob “7” of figure 40.
When the temperature inside the boiler reaches the temperature set, the burner starts to modulate the flame so as to reduce the output to a minimum. If the temperature rises further, the burner shuts down. Simultaneously, the pump which sends the water to the system is switched on and off by the room thermostat. This can be noted, because indicator “6” of figure 40 switches on and off in correspondence with the on and off of the pump.
At first the pump may make a noise. This is due to the presence of residual air in the hydraulic system which will soon disappear on its own.
We recommend keeping the temperature set using knob “7” at the point shown by the symbols on the panel for a rational use of the boiler. If it is a particularly cold Winter and it is difficult to maintain the desired temperature, turn knob “7” to gradually higher values.

12.7 - Adjusting the domestic hot water temperature

The domestic hot water temperature is adjusted by turning knob “11” shown in figure 40. When the knob is turned, the display, item “1” in figure 40, shows a flashing d and the temperature being selected. The range within which the domestic hot water can be set is 104°F (40°C) to 140°F (60°C) or from 104°F (40°C) to 158°F (70°C) when an indirect storage tank is used.

12.8 - Heating system temperature adjustment

The boiler provides hot water to the heating system at the temperature set by adjusting knob “7” as shown in figure 40. The room thermostat turns the boiler’s circulator pump on in order to satisfy the heat demand of the rooms controlled by the thermostat.
To maximize the boilers’ performance, temperature knob “7” should be set at a value that is just sufficient to maintain the desired temperature of the rooms. As the weather gets colder, progressively increase the water temperature by adjusting knob “33”
When the weather gets milder turn the water temperature down. This extremely simple method is suitable for the following types of systems:

A - small systems with radiators where the thermostat is installed in a room whose temperature is characteristic of all the other rooms;

B - large systems with radiators, where each zone is controlled by its own room thermostat. Where zone valves are used the boiler pump is shutdown only when all the room thermostats are satisfied.

C - large systems with low temperature radiant panels, where each zone is controlled by its own room thermostat. Where zone valves are used the boiler pump is shutdown only when all the room thermostats are satisfied.

CAUTION!!! If the boiler is installed in a low temperature system follow the settings specified in section 5.9 or the heating system may be damaged.

12.9 - Heating system type selection

The boiler is factory set for wall stat control as per section 12.8. The heating system type can be changed by going to the "Installers' Menu" in section 12.17 and changing the CH parameter. One of the three following heating modes can be selected:
-CH = 00 "Wall stat control": follow section 12.8;
-CH = 01 "Outdoor reset control": follow section 12.10 (an outdoor temperature sensor is required);
-CH = 02 "Outdoor reset control with room compensation control": follow section 12.10 to 12.10.6 (an outdoor temperature sensor is required):

12.10 - Outdoor reset adjustment

While in the "Installers' Menu", set the CH parameter to 01. In this mode the heating supply water temperature, calculated temperature in figures 41 and 42, will be adjusted automatically based on the input from the outdoor temperature sensor. The relationship between the outdoor temperature and the supply water temperature, corresponds with the graphs shown in figures 41 and 42. In order to change the relationship between the supply water temperature and the outdoor temperature, all the parameters listed in the sections below must be set.-

12.10.1 - Outdoor reset applications

Outdoor reset is a sophisticated way to maximize comfort and boiler efficiency. It is suitable for the following system types:
A - small systems, with radiators where the thermostat is installed in a room whose temperature is characteristic of all the other rooms. The room thermostat is used to turn the boiler on and off.
B - Iarge systems, with radiators, where each zone is controlled by its own room thermostat. Where zone valves are used the boiler pump is shutdown only when all the room thermostats are satisfied (see to an appropriate electrical system).
C - small systems, with low temperature radiant panels where the thermostat is installed in a room whose temperature is characteristic of all the other rooms. The room thermostat is used to turn the boiler on and off. In this type of system it is necessary to consider that the radiant panel systems sometimes have long lag times. It may be necessary to adapt the heating system and use the "Reaction" Cn parameter in order to compensate.
D - Iarge systems with low temperature radiant where each zone is controlled by its own room thermostat. Where zone valves are used the boiler pump is shutdown only when all the room thermostats are satisfied.

CAUTION! If the boiler is installed in a low temperature system, follow the settings specified in section 5.9 or the heating system may be damaged.

12.10.2 - Outdoor reset adjustment precautions

When making adjustments to change the supply temperature, it is advisable to first set the suggested default values for the desired curves shown in figures 41 and 42. If these default values do not produce a satisfactory result, then proceed to make the appropriate adjustments bearing in mind that:
A - each parameter must be very gradually;
B - after each parameter change, wait at least 24 hours in order to see the result;
C - the closer the adjustment curve matches the actual load of the building, the greater the comfort and the energy savings will be;
D - knob "37" in figure 40 can be used to make the small line shifts, "b", shown in figures 41 and 42. These shifts will change the supply water temperature up to 18°F *(10°C)*.

12.10.3 - Outdoor reset: setting parameters

Refer to section 12.16 and set:

- 0A = "The angle of the curve", which can be adjusted between 0.1 and 5.0. Suggested starting values are: 0.6 for "low temperature" systems; 1.6 for "high temperature" systems;
- 0b = "Minimum heating temperature". When the calculated temperature drops below this value the heating service stops. The range of adjustment is between 68°F (*20°C)* and 140°F *(60°C)*. The suggested starting values are: 86°F *(30°C)* for "low temperature" systems; 104°F *(40°C)* for "high temperature" systems;
- 0c = "Maximum heating temperature". This parameter is the limit of the supply heating temperature. Its range of adjustment is between 86°F *(30°C)* and 194°F *(90°C)*. The suggested starting values are: 113°F *(45°C)* for "low temperature" systems; 176°F *(80°C)* for "high temperature" systems.

Refer to section 12.17 and set:

- Cn = "Reaction" of the calculated temperature with respect to the outdoor temperature input. The range of adjustment is between 1°F *(1°C)* and 18°F *(10°C)*. A low "Reaction" value results in a constant dwelling temperature but extended time in reaching full running conditions and responding to outdoor temperature changes. A high "Reaction" value results in reaching full running conditions quickly, but may cause oscillations in the dwelling temperature. It is advised to maintain a "Reaction" value between 1 and 2;
- br = "Fix point" is the heating calculated temperature, when the outdoor temperature is 68°F *(20 °C)*. It is called "Fix Point" because it is also the angle fulcrum of the curve. The suggested starting values are: 92°F *(33°C)* for "low temperature" systems 122 °F *(50°C)* for "high temperature" systems.

12.10.4 - Outdoor reset: zone adjustments

The default values previously suggested are for boilers using an outdoor temperature sensor installed in dwellings with average heat loss in areas where the outside temperature for the calculation of the heat requirement is 23°F *(-5°C)*. In the event that the climatic zone is different, adjust the gradient of the curve, parameter 0A, to obtain a calculated temperature of 176°F *(80°C)* for high temperature systems, see Figure 41. For "Low Temperature" systems adjust the gradient of the curve, parameter 0A, to obtain a calculated temperature of 113°F *(45°C)*, see Figure 42.

12.10.5 - Outdoor reset activation

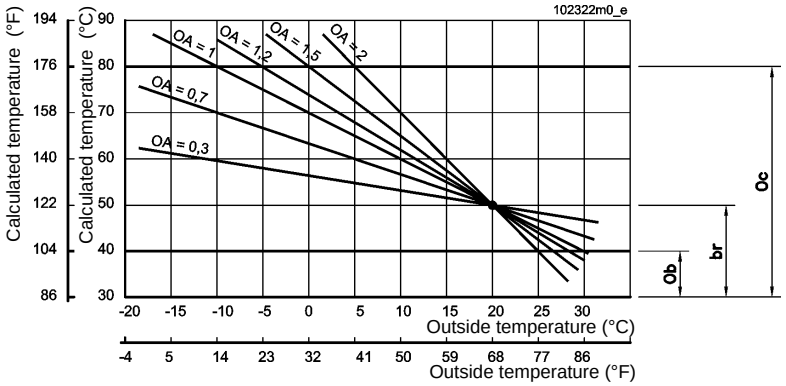
Once selected, reset adjustment is completely automatic and will switch off at the end of the heating season and switch back on at the beginning of the heating season. When the "Calculated temperature" is lower than the "Minimum heating temperature", parameter 0b, the heating service switches off. When the "Calculated temperature" exceeds the "Minimum heating temperature", parameter 0b, the heating service switches back on. If for some reason the heating service doesn't match the load, use knob "7" in figure 40, to raise or lower the calculated temperature and match the "Minimum heating temperature" on an advanced or delayed basis.

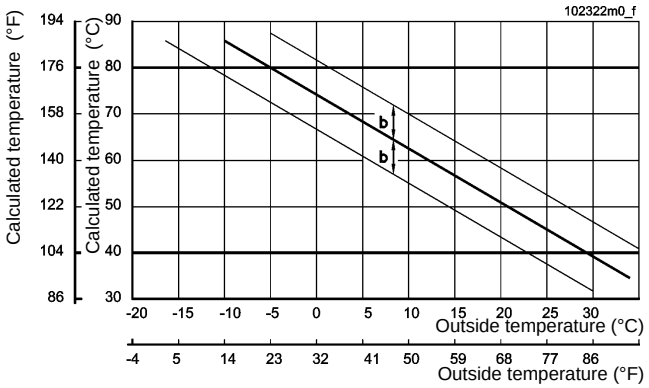
12.10.6 – Outdoor reset with room compensation

While in the "Installers' Menu" (Section 12.17) set the CH parameter to 02. The system will function exactly as described in the previous "Outdoor reset adjustment" sections except that now the boiler pump will stay on permanently. The opening of the room thermostat contacts will translate into a parallel downward movement of the curve in figure 41 or 42. The value by which the curve moves downwards can be adjusted by the tn parameter present in the "Installers' Menu", see section 12.17. The tn parameter can range from 1°F *(1°C)* to 36°F, *(20°C)*. The suggested values for this parameter are:

- 18°F *(10°C)* for high temperature radiator systems;
- 6°F *(3°C)* for low temperature radiant panel systems

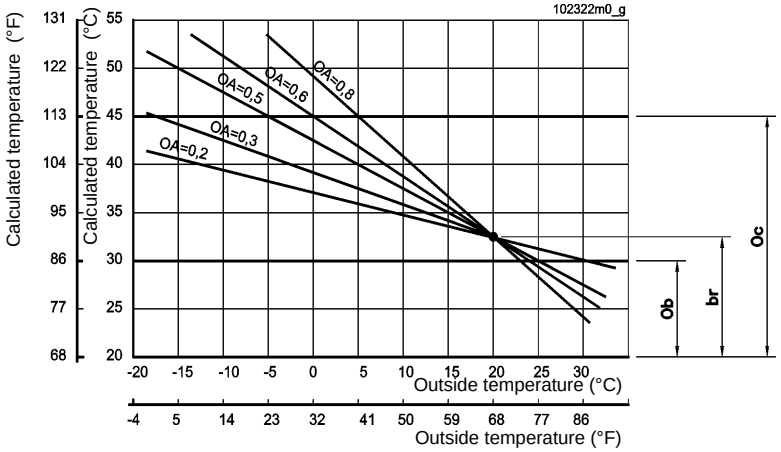
Values of this parameter that are too high may translate into room temperature instability. Values that are too low may make the action of the room thermostat ineffective. Climatic adjustment with room compensation can be used in all the systems described in section 12.10.1. The advantage being that the constant running of the pump will stabilize and standardize the room temperatures. This is especially true when some loops in the heating system have considerably greater volume than others.

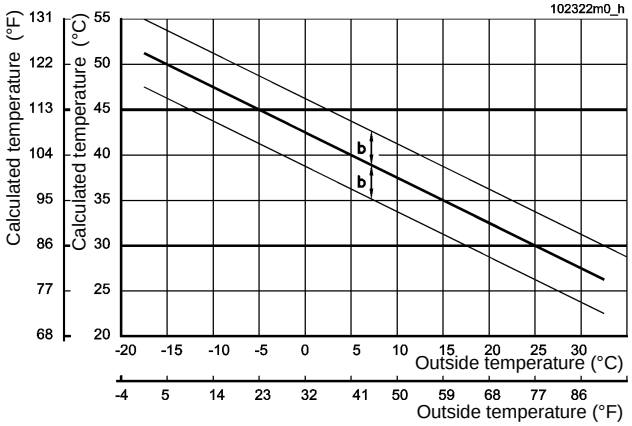




OA = Slope of the line
Ob = Minimum heating temperature
Oc = Maximum heating temperature
br = “Fix point” of the angle fulcrum of the line
b = parallel shift of the line (adjusted by the heating knob, item “7” of figure 40)

Figure 41 - Graphs of the outdoor reset adjustment for “high temperature” systems





OA = Slope of the line
Ob = Minimum heating temperature
Oc = Maximum heating temperature
br = “Set point” of the angle fulcrum of the line
b = parallel shift of the line (adjusted by the heating knob, item “7” of figure 40)

Figure 42 - Graphs of the outdoor reset adjustment for “low temperature” systems

12.11 - Boiler switch settings

The control board shown in figure 1, item “14”, and figure 22, contains a series of switches that allow the boiler to be configured to match the application. The table below lists each switch and its corresponding funtions.

CAUTION!!! Improper setting of these switches could cause the boiler to malfunction resulting in improper system performance. Only a qualified technician, with an in-depth knowledge of the boilers’ control system, should change them.

SWITCH	Position	Description
1	OFF	Boiler with production of instantaneous D.H.W.
	ON	Boiler with production of D.H.W. via storage tank
2	OFF	Boiler with production of instantaneous D.H.W.
	ON	Position not available for this serie of boilers
3	OFF	Heating pressure switch, Low Water Cut Off, disabled
	ON	Heating pressure switch, Low Water Cut Off, enabled
4	OFF	EBM PAPST brand fan
	ON	Position not available for this serie of boilers
5	OFF	Combination boiler for heating and D.H.W.
	ON	Boiler for heating only
6	OFF	High temperature heating service, 86°F (30°C) and 176°F (80°C)
	ON	Low temperature heating service, 68°F (20°C) and 113°F (45°C)
7	OFF	Boiler configuration change, disabled
	ON	Boiler configuration change, enabled
8	OFF	Maximum heating supply water temperature of 176°F (80°C)
	ON	Maximum heating supply water temperature of 189°F (87°C)

12.12 - Delays, alarms and protective actions

To protect the life of the appliance, improve comfort, and maximize energy savings, the following timings have been incorporated into the control logic:

a - Pump delay: each time the room thermostat is satisfied, the circulator pump continues to run for 1 minute;

b - DHW delay: each time the domestic hot water demand is satisfied, a 2 minutes delay must pass before the heating service is allowed to restart;

c - Protection against legionnaires bacteria: if the boiler is connected to a DHW storage tank the boiler will increase the tank temperature to 140°F *(60°C)* every seven days, prevent the formation of legionnaires bacteria. This function is displayed by AL.

d - DHW alarm: if the call for domestic hot water lasts for longer than two hours, an A 01 alarm is generated. This function is only for boilers set up to provide instantaneous DHW.

e - Time delay in restarting the burner: in its normal functing state, except when providing domestic water, every time the burner stops, there is a delay time of 3 minutes before the boiler restarts again.

12.13 - Circulator pump and three way valve protection

During the summer months, the circulator is run once a day for around 15 seconds to prevent it from seizing. At the same time, the three way valve (if present) is activated for the same reason.

12.14 - Freeze protection

CAUTION!!! For the freeze protection function to work, the boiler must remain connected to the electrical and gas supplies with knobs “7” and “11” in figure 40, in the OFF position.

Once the boiler has reached a temperature of 45 °F *(7°C)*, the heating pump will automatically comes on. Boiler is built in with its own by-pass valve (see figure 2, item “15”, against any closed zone vale).
If the temperature falls below 35°F *(2°C)*, the burner will light to prevent the boiler from freezing.
If the boiler will not be used for more than a year it should be drained per sections 13.10 and 13.11.

12.15 - Display in energy saving mode

If desired, the display, items “1” and “2” in figure 40, can be switched permanently off, with the exception of when it displays errors or settings. To switch the display off, access the “Installers’ Menu”, in section 12.17 and set the 5 parameter at a value other than zero. Keep in mind that each value will correspond to a delay in minutes until the display goes into Energy Saving mode.

12.16 - “Users’ menu”

When entering the “Users’ menu”, the display, item “1” in figure 40, will start blinking indicating that a change of mode has taken place. To access the “Users’ menu” (see also section 16 to better understand the several menus):

1. press the Reset button for 2 seconds until the display starts blinking;
2. press and release the Reset button several times until the desired parameter is displayed;
3. use the + or − keys, to change the value of the selected parameter.
4. press Reset to save the parameter change before going to the next parameter.

When the last parameter has been reached and the Reset button pressed, the display will stop blinking indicating exit from the menu.

NOTE: If no key is pressed for more than 60 seconds, the control automatically exits the “Users’ menu”. Any parameter change not saved using the Reset button, will be lost.

The table below lists each “Users’ menu” parameter, what it affects and its adjustment range.

PARAMETER	DESCRIPTION	INFORMATION ON DISPLAY ITEM “2” of figure 40
0A	Adjustment of the curve angel as shown in figures 41 and 42 when outdoor reset is active per section 12.9.	Setting range: 0,1 to 5,0
0b	Adjustment of the “Minimum heating temperature” as shown in figures 41 and 42 when outdoor reset is active per section 12.9.	Setting range: see section 12.10.3
0c	Adjustment of the “Maximum heating temperature” as shown in figures 41 and 42 when outdoor reset is active per section 12.9.	Setting range: see section 12.10.3
b	Adjustment of the parallel shift of the curve as shown in figures 41 and 42 when outdoor reset is active per section 12.9.	The adjustment is made by turning knob “7” shown in figure 40. The selected curve can be shifted up or down by 18°F *(10°C)*.
c	Display of the calculated heating temperature when outdoor reset is active per section 12.9, or display of the temperature set by knob “7” shown in figure 40.	Temperature display only with a range between 68°F *(20°C)* and 189°F *(87°C)*.
d	Display of the domestic hot water temperature when set by knob “11” shown in figure 40.	Temperature display only with a range between 104 °F *(40°C)* and 158°F *(70°C)*, see section 12.7
E	Display of last error code registered, section 12.18.2	Error code display per section 12.18.2
L	Display of last lockout occurred, section 12.18.1	Fault code per section 12.18.1

12.17 - “Installer’s menu”

CAUTION!!! Changing these parameters could cause the boiler and therefore the system to malfunction. For this reason, only a qualified technician who has in-depth knowledge of the boiler should change them.

The boiler’s micro-processor makes this menu of parameters available to the qualified technician for the analysis of the functioning and adjustment of the appliance to the system. When entering the “Installers’ Menu”, the display item “1” in figure 40, will start to blink indicating that a change of mode has taken place. To access the “Installers’ Menu” just (see also section 16):

1. press the Reset button down for 12 seconds until the parameter is displayed; U 1
2. press and release the Reset button to scroll through the list of the parameters;
3. once the parameter has been displayed, it can be changed using the + or − keys;
4. press and release the Reset button to confirm the amended data before moving to the next parameter.

When the last parameter has been reached and the Reset button pressed, the display will stop blinking indicating an exit from the menu.

NOTE: If no key is pressed for more than 60 seconds, the control automatically exits the “Installers’ menu”. Any parameter change not saved using the Reset button, will be lost.

The next table lists each “Installers’ menu” parameter, what it affects and its adjustment range.

PARAMETER	DESCRIPTION	INFORMATION ON DISPLAY ITEM “2” of figure 40
U 1	Boiler and heating supply temperature, measured by U1 sensor	Value in °F (cannot be changed)
U2	Domestic hot water temperature, measured by U2 sensor	Value in °F (cannot be changed)
U3	Domestic cold water (or storage tank) temperature, measured by U3 sensor	Value in °F (cannot be changed)
U4	Outdoor temperature, measured by U4 sensor	Value in °F (cannot be changed) (displayed only if outdoor reset is active, as per section 12.9)
U5	Ionization current value	Value from 0 to 99 (cannot be changed) (30 corresponds to a current of 1uA) (99 corresponds to a current of 5.5 uA)
U6	High limit temperature, measured by U6 sensor	Value in °F (cannot be changed)
U7	Flue gas temperature, measured by U7 sensor	Value in °F (cannot be changed)
U8	Heating return temperature, measured by U8 sensor	Value in °F (cannot be changed)
ty	Type of basic setting of control board	Can be changed in accordance with the instructions indicated in the gas conversion kit
rt	Status of room thermostat contact	00 = contact open (heating service off) 01 = contact closed (heating service on)
F	Measurement of fan speed rotation	Value in g/1’/100 (rpm/100) (cannot be changed)

Continued

PARAMETER	DESCRIPTION	INFORMATION ON DISPLAY ITEM “2” of figure 40
P	BTU input for heating service	Adjustable according to the instructions of section 11.10
CH	Heating service funtioning mode	Can be changed: 00 = thermostatic adjustment (sse section 12.8); 01 = outdoor reset (see section 12.10); 02 = outdoor reset with room compensation (see section 12.10.6);
Cn	Reaction to external temperature	Can be changed from 1 to 10 (active only with outdoor reset). See section 12.10.1 for its adjustment.
br	Angle fulcrum of climatic adjustment	Can be changed for 16°F (-9°C) to 149°F (65°C) (active only with outdoor reset). See section 12.10.3 fort its adjustment.
tn	Reduction of temperature generated by the opening of the room thermostat	Can be changed from 1°F (1°C) to 36°F (20°C) (active only with outdoor reset featuring room compensation) See section 12.10.6 for its adjustment.
L	Boiler knobs’ status	Can be changed 01 = knobs present; 00 = knobs absent.
S	Display “1” and “2” as per figure 40 energy saver	Can be changed: 00 = display always on; any other value, corresponds to a delay in the switching off of the display, expressed in minutes (see also section 12.15)
PS	Parameter disable for this kind of boiler	
dE	Domestic sensitivity setting	Can be changed between 1 and 10°F. Default value is 4°F. To increase sensitivity set it to 2°F
St	Minimum domestic setpoint during sleep mode	Can be changed between 104 and 122°F. Default value is 104°F. **Never** set domestic setpoint (see section 12.7) at a value lower than this parameter).
CP	Proportional band of the heating PID modulation	Can be changed between 1 and 99. Default value is 15. Can be modified only in conjunction with factory technicians.
CI	Integral of the heating PID modulation	Can be changed between 1 and 99. Default value is 30. Can be modified only in conjunction with factory technicians.
AC	Burner Anticycling: minimum delay from a burner light-off to the sequent light-on. Value expressed in sec x 10	Can be changed between 1 and 54. Default value is 18 (180 sec). Can be modified only in conjunction with factory technicians.

12.18 - Diagnostics

During the normal operation of the boiler, the display, of figure 40, continually shows the operating status of the boiler as shown below (see also section 16):

PARAMETER DISPLAY (ITEM "1", FIGURE 40)	PARAMETER REFERENCE	DISPLAY READ OUT (ITEM "2", FIGURE 40)
0	Boiler in stand-by mode or pause (no request for heating or domestic hot water)	Boiler temperature (°F)
P	Anti-freeze function active	Boiler temperature (°F)
A	Boiler not in lock-out mode but in Attention mode.	01 = Boiler temperature (°F) Domestic hot water service active for more than 120 minutes. Turn domestic hot water to OFF position to reinstate heating. 02 = Connection interrupted between boilers in a module
FILL	System pressure too low, system must be filled. See section 12.1.	No display
d	Domestic hot water service on	Domestic hot water temperature (°F)
C	Heating service on	Heating temperature (°F)
L	Boiler in lock-out mode. To reset it, press the Reset button. If the lock-out occurs frequently, contact a professionally qualified technician.	Lock-out code (see section 12.18.1 for decodification).
E	Blocking error. Contact a professionally qualified technician. Blocking errors automatically reset if the condition causing the block disappears	Error code (see section 12.18.2 for decodification).
F	Auto-purging procedure that last 3 minutes in progress (see section 12.4).	Boiler temperature (°F)
AL	Boiler in Anti-legionella functioning (see section 12.12)	Storage tank temperature (°F)

12.18.1 - Diagnostics: “L” lock-outs

“L” Code	Lock-out description	Checks to make	Solutions
L01	No flame detected after three ignition attempts.	Check: a-correct gas supply pressure (see section 11.7); b-ignition spark (see section 13.4); c-correct combustion air pressure (see section 11.8); d-120Vac at the gas valve; e-resistance of the two gas valve coils should be 0.18 kohm and 1.1 kohm; f- If the burner lights, but goes out at the end of the ignition attempt, check: that the ionization current is set at a value greater than 60 (follow procedure in section 13.12.4)	a-If the gas supply pressure is incorrect, it must be adjusted to the correct pressure; b-If spark is not present, check for correct ignition ectrode position and gap as per section 13.4; If position is correct, check for 120Vac at the supply of the spark generator. c-if the combustion air pressure is incorrect, inspect the vent system and eliminate any obstructions; d-if the voltage to the gas valve is not 120Vac the power control board must be replaced; e-if the resitance of the gas valve coils is not 0.18 kohm and/or 1.10 kohm, the gas valve must be replaced. f-If the ionization current is not greater than 60, confirm that the the CO2 content is adjusted properly (see section 11.9). Check the flame detection electrode (section 13.4) and if necessary replace it, check the integrity of the flame detection electrode electrical wires.
L02	Flame extinguishes three times.	Check: a-that the ionization current is set at a value greater than 60 (follow procedure in section 13.12.4); b-check that vent terminal is not being adversely affected by wind;	a-If the ionization current is not greater than 60, confirm that the the CO2 content is adjusted properly (see section 11.9). Check the flame detection electrode (section 13.4) and if necessary replace it, check the integrity of the flame detection electrode electrical wires. b-If vent terminal is being adversely affected by wind it must be relocated.
L03	Boiler temperature is over 203°F (95°C).	Check that the circulator pump is working	If the circulator pump is bad, replace it, if is good, replace the power control board
L04	Gas valve command relay		Replace the power control board
L05	Safety relay	Check for correct polarity of the wires to the pump. Try to switch the wires.	If the pump won’t run replace it. If the pump is good try to replace the power control board.
L06	Flue gas sensor over 230°F (110°C)	Check: a - that the electrical resistance of the flue gas sensor complies with the graph in section 13.13; b - that the efficiency of the boiler is over 86%	a-If the flue gas sensor resistance does not correspond with the correct values, replace it; b-if the boiler efficiency is less than 86% and the CO2 content is correct, the primary heat exchanger has to be replaced and proper water treatment methods employed to prevent mineral build up on the water side
L07	Electrical circuit of flue gas sensor is interrupted	Check that the electrical resistance of the flue gas sensor corresponds with the graph in section 13.13;	If the sensor resistance does not correspond with the correct values, replace it;
L08	Spark generator relay		Replace the power control board
L09	RAM memory		Replace the power control board
L10	E2prom memory damaged		Replace the power control board
L12	E2prom memory damaged		Replace the power control board
L13	Program error		Replace the power control board
L14	Program error		Replace the power control board
L15	Program error		Replace the power control board
L16	Program error		Replace the power control board
L17	The temperature difference between the U1 and U6 sensors is too great	Check that: a - the electrical resistance of the two sensors corresponds with the graph in section 13.13; b -check that the heating water flow is not too low.	a-If one or both sensors does not have the correct resistance value, it must be replaced; b-If temperature difference between U1 and U8 is higher than 55°F at maximum input, the heating water flow rate is too low. The heating water flow rate must be corrected.

12.18.1 - Diagnostics: “L” lock-outs (continued)

“L” Code	Lock-out description	Controls	Solutions
L18	Program error		Replace the power control board
L19	Flame sensed for 10 seconds, after the closure of the gas valve		Call technical service
L20	Flame sensed before opening of the gas valve.		Call technical service
L25	U1 or U6 sensor increase its temperature too fast	Check: a - that the heating water flow is not too low; b - that the circulator pump is working	a - If temperature difference between U1 and U8 is higher than 55°F (13°C), at maximum input, the heating water flow rate is too low. The heating water flow rate must be corrected. b - If the pump works, replace the power control board.
L32	Program error		Replace the power control board
L33	Fan rotation error	Check that the voltage to the fan is 163(±10)Vdc.	If the fan is powered with 163Vdc, replace the fan. If the voltage to the fan is not 163 Vdc, replace the board.
L45	Heating circuit filling time longer than 10 minutes.	Check: a - that the heating pressure switch setting pressure, FILL appears when the pressure drops below 8.7 psi (0,6 bar), and disappears when the pressure rises above 22 psi (1.5 bar); b - check that there are no water leaks in the heating system.	a -If the heating pressure switch is not correctly set, it must be replaced; b - if the system has a leak, it must be fixed.
L46	Filling of heating circuit repeated 16 times in 24 hours		
L47	Flue pressure switch open time longer than 60 minutes	Check: a - that no obstructions are in the flue discharge/air intake line b - check the flue pressure switch setting point, setting is 4.5 in.W.C c - check that the electrical resistance of the flue gas sensor corresponds with the graph in section 13.14; d - check that the electrical connection cables between the flue pressure switch, the flue sensor and the power control board.	a -If ther’is an obstruction, it must be removed; b - If the flue pressure switch is not correctly set, it must be replaced; c - If the flue sensor resistance does not correspond, it must be replaced; d - if the electrical circuit is damaged, it must be repaired; if the previous four cases do not apply, replace the power control board

12.18.2 - Diagnostics: “E” blocking errors

“E” Code	Blocking description	Checks to make	Solutions
E01	U1 boiler temperature sensor circuit interrupted.	Check that the electrical resistance of the sensor corresponds with the graph in section 13.14; check that the electrical connection cables between the sensor and the power control board have continuity and carry current	If the sensor resistance does not correspond, it must be replaced; if the electrical circuit is damaged, it must be repaired; if the previous two cases do not apply, replace the power control board
E02	U2 domestic hot water temperature sensor circuit interrupted.	Check that the electrical resistance of the sensor corresponds with the graph in section 13.14; check that the electrical connection cables between the sensor and the power control board have continuity and carry current	If the sensor resistance does not correspond, it must be replaced; if the electrical circuit is damaged, it must be repaired; if the previous two cases do not apply, replace the power control board
E04	U8 return temperature sensor circuit interrupted	Check that the electrical resistance of the sensor corresponds with the graph in section 13.14; check that the electrical connection cables between the sensor and the power control board have continuity and carry current	If the sensor resistance does not correspond, it must be replaced; if the electrical circuit is damaged, it must be repaired; if the previous two cases do not apply, replace the power control board
E07	U3 cold water temperature or storage tank sensor circuit interrupted	Check that the electrical resistance of the sensor corresponds with the graph in section 13.14; check that the electrical connection cables between the sensor and the power control board have continuity and carry current	If the sensor resistance does not correspond, it must be replaced; if the electrical circuit is damaged, it must be repaired; if the previous two cases do not apply, replace the power control board
E08	U6 boiler temperature sensor circuit interrupted.	Check that the electrical resistance of the sensor corresponds with the graph in section 13.14; check that the electrical connection cables between the sensor and the power control board have continuity and carry current	If the sensor resistance does not correspond, it must be replaced; if the electrical circuit is damaged, it must be repaired; if the previous two cases do not apply, replace the power control board
E11	U1boiler temperature sensor circuit short-circuited.	Check that the electrical resistance of the sensor corresponds with the graph in section 13.14; check that the electrical connection cables between the sensor and the power control board have continuity and carry current	If the sensor resistance does not correspond, it must be replaced; if the electrical circuit is damaged, it must be repaired; if the previous two cases do not apply, replace the power control board
E12	U2 domestic hot water temperature sensor circuit short-circuited	Check that the electrical resistance of the sensor corresponds with the graph in section 13.14; check that the electrical connection cables between the sensor and the power control board have continuity and carry current	If the sensor resistance does not correspond, it must be replaced; if the electrical circuit is damaged, it must be repaired; if the previous two cases do not apply, replace the power control board
E13	Erroneous temperature reading.		Replace the power control board

12.18.2 - Diagnostics: “E” blocking errors (continued)

“E” Code	Blocking description	Checks to make	Solutions
E14	U8 return temperature sensor short-circuited	Check that the electrical resistance of the sensor corresponds with the graph in section 13.14; check that the electrical connection cables between the sensor and the power control board have continuity and carry current	If the sensor resistance does not correspond, it must be replaced; if the electrical circuit is damaged, it must be repaired; if the previous two cases do not apply, replace the power control board
E15	U4 outside sensor short-circuited	Check that the electrical resistance of the sensor corresponds with the graph in section 13.15; check that the electrical connection cables between the sensor and the power control board have continuity and carry current	If the sensor resistance does not correspond, it must be replaced; if the electrical circuit is damaged, it must be repaired; if the previous two cases do not apply, replace the power control board
E16	Erroneous temperature reading.		Replace the power control board
E17	U3 cold water temperature or storage tank sensor circuit shorted	Check that the electrical resistance of the sensor corresponds with the graph in section 13.14; check that the electrical connection cables between the sensor and the power control board have continuity and carry current	If the sensor resistance does not correspond, it must be replaced; if the electrical circuit is damaged, it must be repaired; if the previous two cases do not apply, replace the power control board
E18	U6 boiler temperature sensor circuit shorted	Check that the electrical resistance of the sensor corresponds with the graph in section 13.14; check that the electrical connection cables between the sensor and the power control board have continuity and carry current	If the sensor resistance does not correspond, it must be replaced; if the electrical circuit is damaged, it must be repaired; if the previous two cases do not apply, replace the power control board
E19	E2prom memory damaged		Replace the command and control board
E20	Flame presence with gas valve closed		Replace the gas valve
E21	Phase and neutral inverted	Invert phase and neutral	If phase and neutral are correctly wired, replace the power and control board
E22	Electrical supply frequency other than 60Hz	Check the electrical frequency of the system. Check if CS parameter is at 03	If the electrical supply frequency is other than 60Hz, contact the electric company; if the mains frequency is 60Hz, replace the command and control board. Make sure that the CS parameter is at 03.
E23	Ground connection is absent	Check if the boiler is properly grounded	if the boiler is properly grounded, replace the power control board
E30	Erroneous temperature reading.		Replace the power control board
E31	Erroneous temperature reading.		Replace the power control board
E32	Erroneous temperature reading.		Replace the power control board
E33	Erroneous temperature reading.		Replace the power control board
E42	Program error		Replace the power control board
E50	Error in the boiler TYPE selection	Push ON switches 7 an set again the correct TYPE.	If TYPE value is correct, change the power control board
E51	Reset button pressed too often in a short period time		

13 - MAINTENANCE

13.1 - General precaution

WARNING!!! Never store combustible materials, gasoline or any product containing flammable vapors and liquids in the vicinity of the boiler. Failure to comply with this warning can result in extensive property damage, severe personal injury or death!

WARNING!!! Never obstruct the flow of combustion and ventilation air. Failure to provide adequate combustion air for this boiler can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

CAUTION!!! Before performing any maintenance operations, shut the boiler off, close the manual gas shut-off valve, figures 15 and 16 item "3", and shut off electrical power to the boiler. Follow the Operating Instructions outlined in the section "SAFETY INSTRUCTION".

WARNING!!! If maintenance is performed on the vent-air intake system it must be properly reassembled and sealed. Failure to properly maintain the vent-air system can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

WARNING!!! Servicing, inspection and adjustment must be done by a trained technician in accordance with all applicable local and national codes. Improper servicing or adjustment could damage the boiler! Failure to comply with this warning can result in a fire or explosion causing property damage, personal injury or loss of life!

13.2 - Removing the casing

In order to remove the casing, follow the steps below while refering to figure 43:

1. remove screws "A";
2. raise latch "C";
3. remove the front cover;
4. press the two plastic springs, item "L", down;
5. lower the electrical box;
6. lift latch "G";
7. pull the bottom of cover "H" out by around 4 in (10 cm);
8. lift cover "H" up by around 1in (2 cm) and remove it.

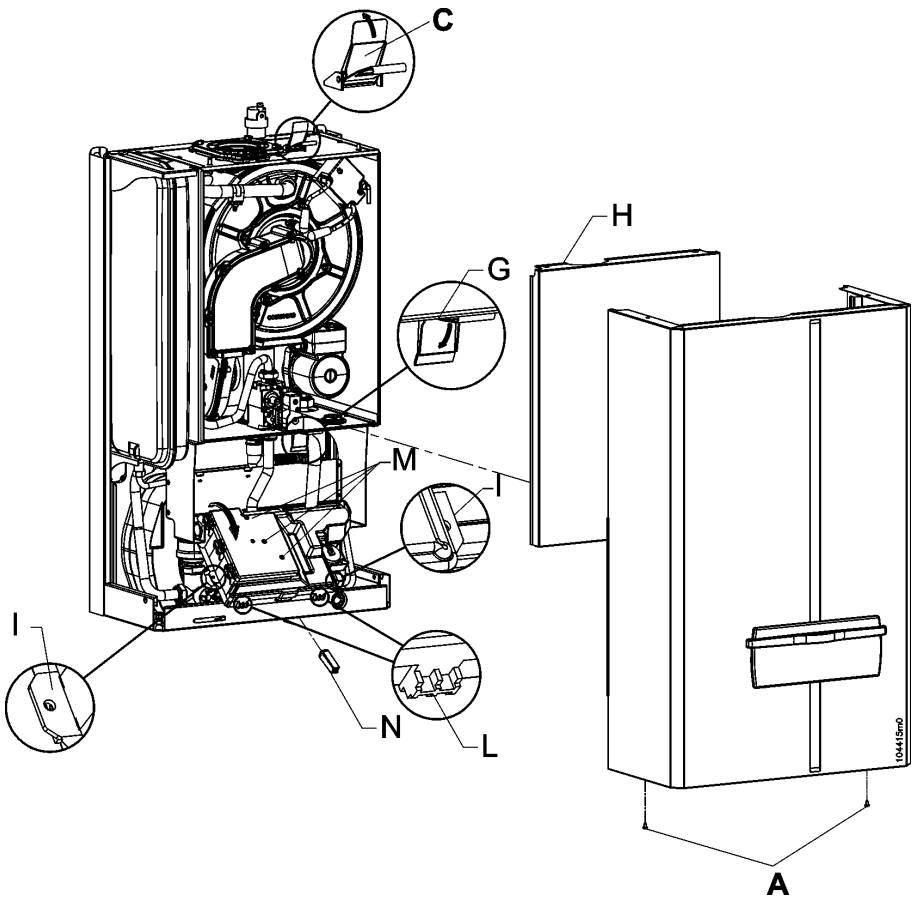


Figure 43 - Removing the casing on models 160C and 160B

13.3 - Cleaning the burner and primary heat exchanger, flue gas side

The burner and primary heat exchanger must be cleaned every year. To correctly clean the burner and the flue gas side of the heat exchanger follow the steps below:

1. follow the steps in section 13.2 to gain access the internal components;
2. unscrew nut “D” from the gas valve (taking care not to loose gasket “E” in figure 46);
3. disconnect the wires from the ignition electrodes and the wire from the flame detection electrode, figure 1, details “18” and “47”;
4. disconnect the wire from safety sensor “F” in figure 44;
5. unscrew the four nuts “C” in figure 44;
6. prepare a suitable cover for the gas valve outlet under nut “D” so that no dirt, water, or other foreign objects can fall into the gas valve during cleaning;
7. remove the entire fan - burner assembly, detail “A” in figure 44;
8. use a cylindrical brush with plastic bristles to clean the inside of the combustion chamber, detail “H” in figure 44;
9. use a vacuum cleaner to remove any unburned residue from the combustion chamber, detail “H” in figure 44;
10. using the same vacuum cleaner, clean the surfaces of the burner and around the electrodes;

WARNING!!! Before proceeding to the next step, verify that the electrical supply to the boiler, and any other electrical supply near the boiler, is off. Failure to comply with this warning can cause extensive property damage, severe personal injury or death!

WARNING!!! while performing the next step, carefully wash only the inside of the combustion chamber “H” of figure 44, and do not get water on the outside of the combustion chamber opening. Failure to comply with this warning can cause extensive property damage, severe personal injury or death!

11. using only water, wash the inside of the combustion chamber, detail “H” in figure 44. The water, will drain into the condensate drain. Clean the condensate trap (see section 13.6) before reassembling components;
12. reassemble the components by proceeding in reverse order;
13. open the manual gas shutoff valve;
14. restore electrical power to the boiler;
15. check that there are no gas leaks.

WARNING!!! Never use an open flame to test for gas leaks. Always use an approved leak detection method. Failure to comply with this warning can cause extensive property damage, severe personal injury or death!

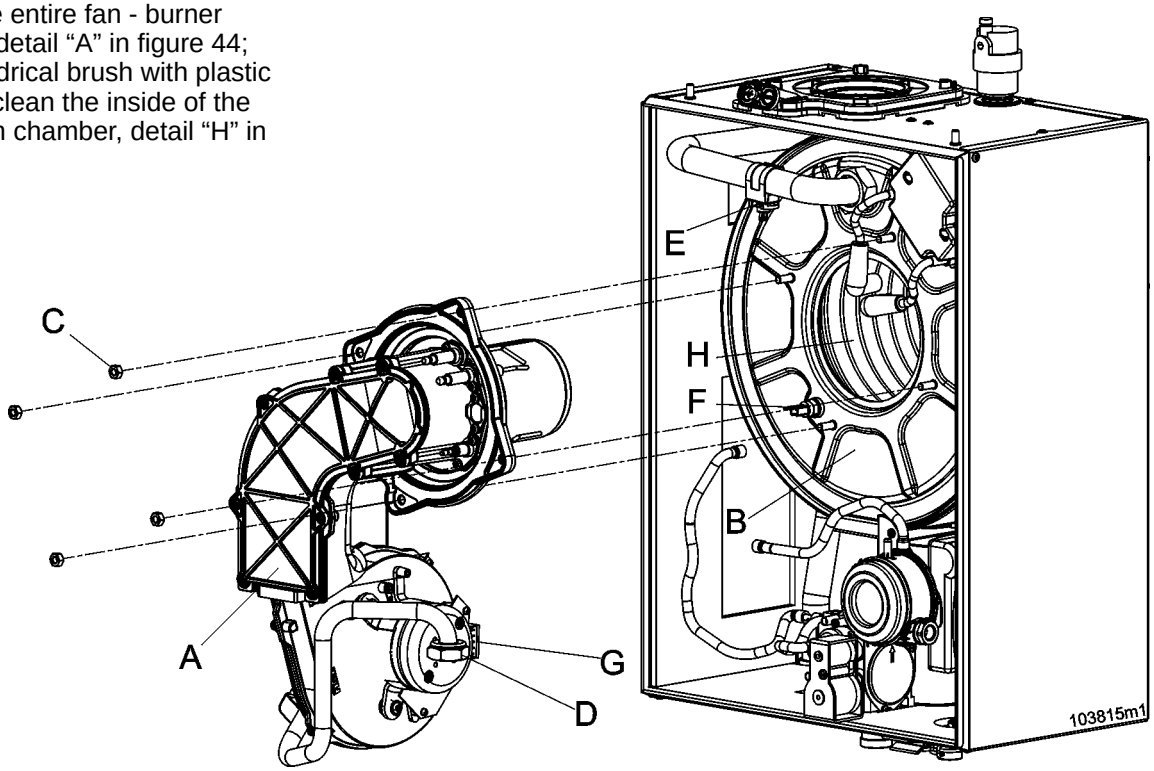


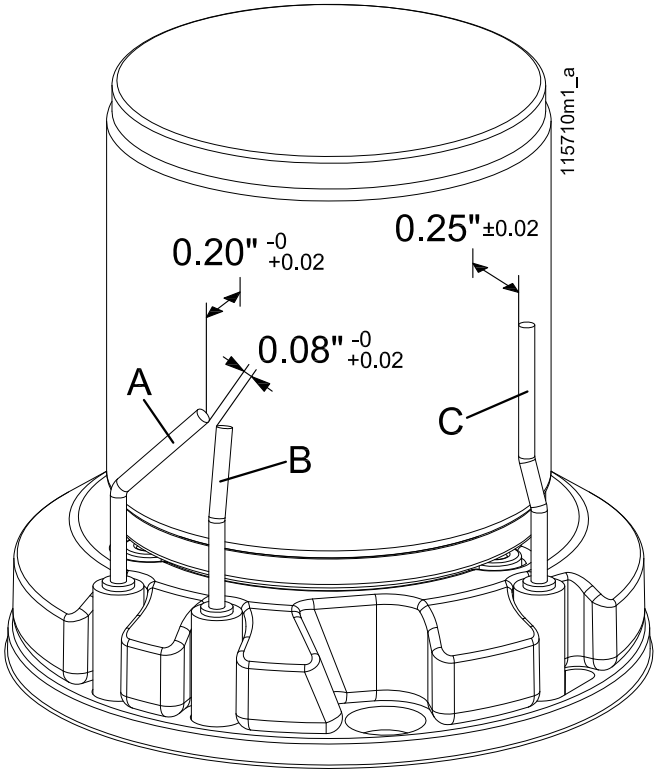
Figure 44 - Remove the fan-burner assembly unit

13.4 - Correct positioning of the ignition and flame detection electrodes

For the boiler to work properly the electrodes must be positioned as shown in figure 45:

- ☞the distance between the ignition electrodes “A” and “B”, must be between 0.08 in *(2 mm)*, and 0.10 in *(2.5 mm)*;
- ☞the distance of the ignition electrodes to the burner surface must be between 0.20 in *(5.0 mm)*, and 0.22 in (*5.5 mm)*;
- ☞the distance of the flame detection electrode to the burner surface must be between 0.23 in *(6.0 mm)*, and 0.27 in *(7.0 mm)*.

For a correct functioning of the boiler the below distances shall be verified with an hand caliper.

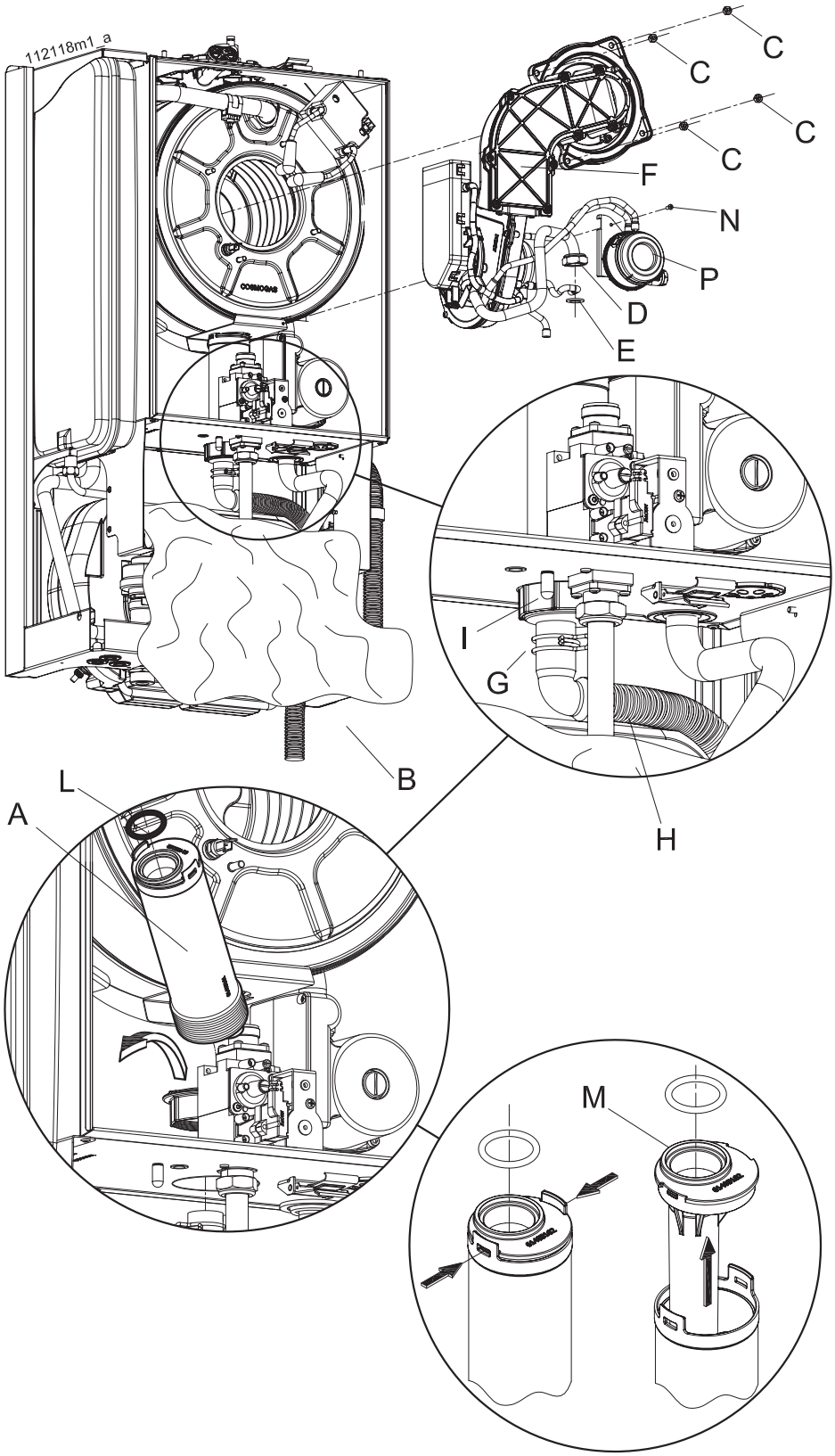


A = Left ignition electrode
B = Right ignition electrode
C = Flame detection electrode

Figure 45 - Positioning electrodes on burner (Use an hand caliper to verifie the distances of the electrodes)

13.5 - Domestic hot water heat exchanger (only for 160C and 160OC model)

The production of DHW takes place in the secondary heat exchanger, detail “42” in figure 1. If this heat exchanger looses efficiency over time, it may be necessary to clean or replace it.



13.6 - Condensate trap cleaning

The condensate trap must be cleaned every year. Follow the steps below to properly clean the condensate trap and its associated components while refering to figure 46:

1. run the fan as described in section 13.12.2, to minimize the amount of liquid present in the trap, item “A”;
2. follow the steps in section 13.2 to gain access the internal components;
3. carefully cover the electrical panel with a waterproof material, “B”, to prevent water from entering the electrical system;
4. grip spring clamp “G” with a pair of pliers and slide it downwards;
5. pull the condensation trap hose “H” off the trap;
6. remove the fan-burner assembly unit, follow steps of section 13.3;
7. protect the gas valve outlet, from entering any object or condensing water;
8. unscrew nut “I” from the bottom of the trap, “A”, and pull it upwards, taking care not to spill the condensation;
9. open the condensate trap taking care not to loose o-ring “L” and clean the inside “M”;
10. re-assemble everything in reverse order, taking care that o-ring “L” is placed in the proper location;
11. refill the condensate trap per section 11.1.2.

Figure 46 - Removing the condensing trap

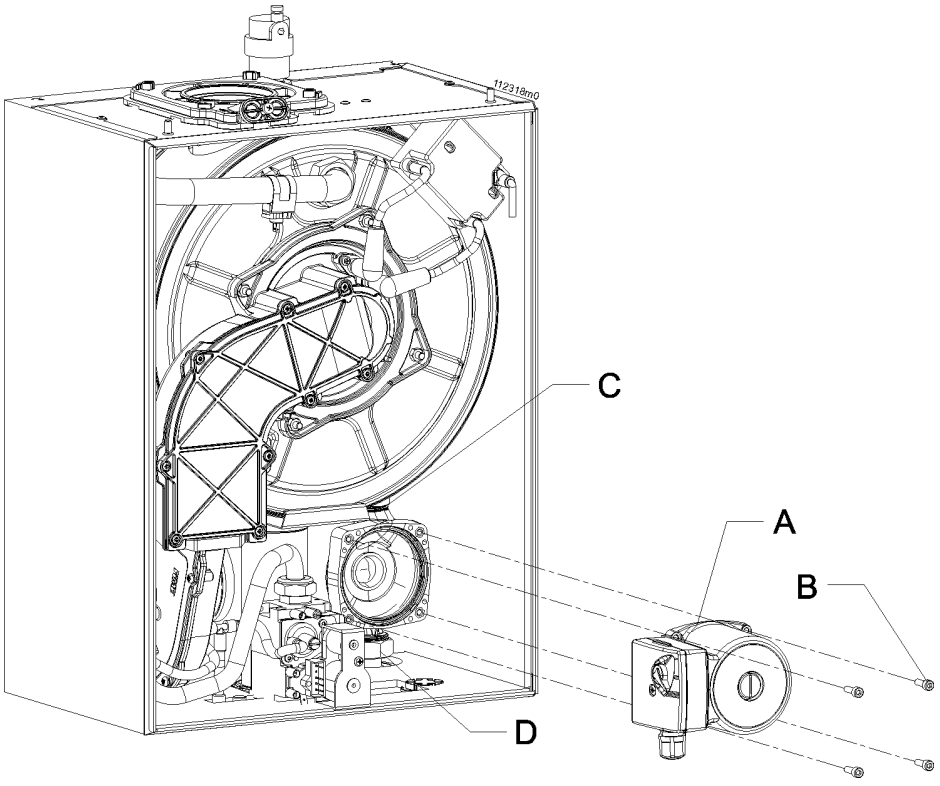


Figure 47 - Replacing the pump motor (only for 160C and 160OC models)

13.7 - Circulator pump motor replacement (only for 160C and 160OC models)

To replace the circulator pump follow the steps below while, refering to figure 47:

1. follow the steps in section 13.10 to isolate and drain the water from the boiler;
2. follow the steps in section 13.2 to gain access the internal components;
3. remove screws “B”;
4. remove the circulator pump motor “A”;
5. label the electrical wires of the circulator pump motor, phase and neutral must be respected;
6. disconnect the electrical wires from the circulator pump motor
7. install the new circulator pump motor and reassemble the boiler
8. open the heating system isolation valves and heating system fill valve
9. follow the steps in section 11.1.3 to bleed the air from the heating system.

NOTE: If display shows L05 reverse polarity (phase and neutral) to the pump

13.8 - Expansion tank pressure (only for 160C and 160OC models)

To check the expansion tank pressure follow the steps below:

1. follow the steps in section 13.10 to isolate and drain the water from the boiler
2. follow the steps in section 13.2 to gain access the internal components;
3. check the pressure of the expansion tank, item “4” of figure 1 (The air inlet probe is on the top of the expansion tank). It must be 14 psi (*1 bar)*. If the pressure is lower recharge the expansion tank while letting the water run out of the heating system drain valve.

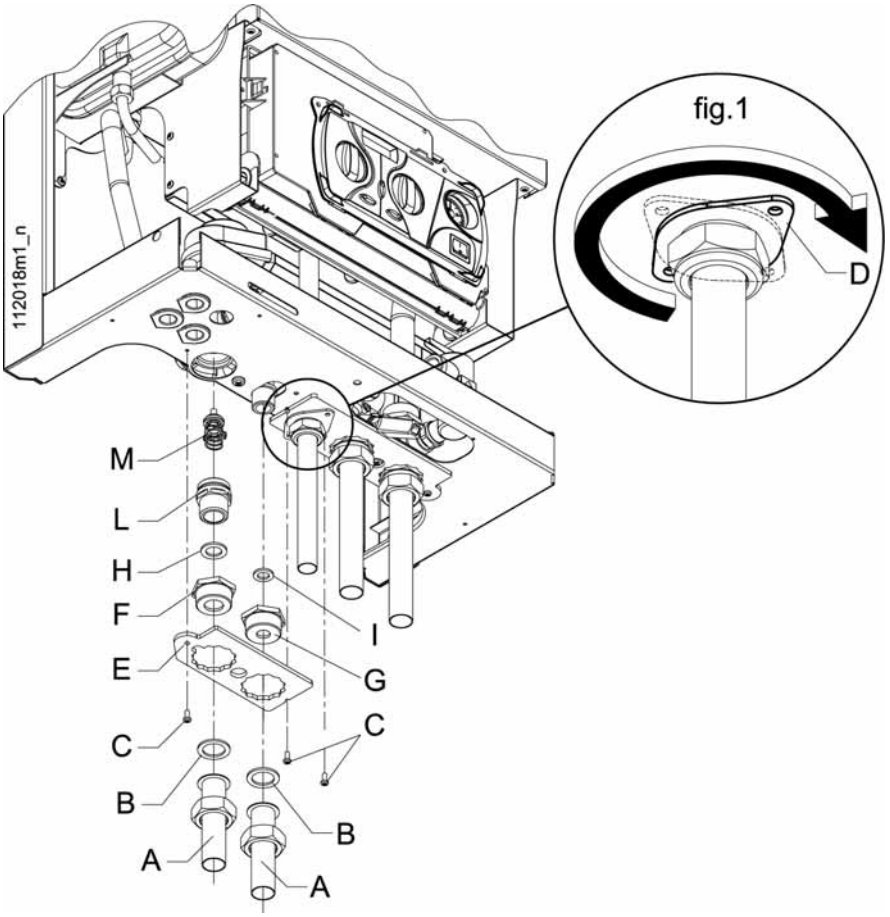


Figure 48 - Supply fittings removal (only for 160-C model)

13.9 - 3-way valve removal (only for 160-C and 160OC models)

The 3-way valve, details “M” and “Q” in figures 48 and 49, directs hot water produced by the primary heat exchanger to the heating circuit or to the secondary heat exchanger for the production of D.H.W. To replace or clean it, follow the steps below while referring to figures 48 and 49:

1. follow the steps in section 13.10 to isolate and drain the water from the boiler;
2. follow the steps in section 13.2, to gain access the internal components;
3. disconnect fittings “A”;
4. remove screws “C”;
5. rotate “D” flange in the sense of the black arrow (See particular fig. 1);
6. remove the bracket “E”;
7. remove fitting “F”;
8. remove fitting “L”;
9. remove fitting “M” and check its state.
10. remove spring “N”;
11. remove servomotor “O”;
12. remove the fitting “P”
13. remove the spring “Q” and check for any dirt.

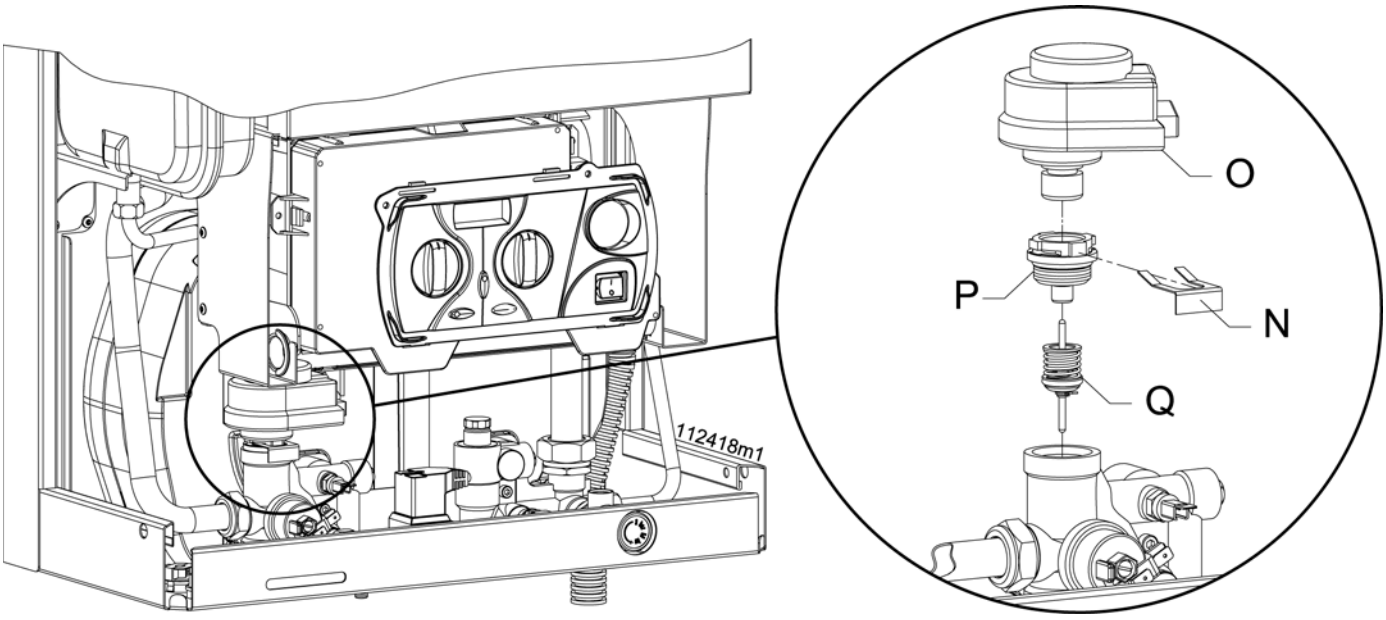


Figure 49 - 3-way valve servomotor removal

13 - MAINTENANCE

13.10 - Draining the heating side of the boiler

To drain the heating side of the boiler follow the steps below:

1. allow the water inside to cool by switching off the room thermostat and turning knob “7” in figure 40 to minimum. Wait until the display, item “1” in figure 40, shows a temperature less than 104°F *(40°C)*;
2. turn off the boiler;
3. shut off electrical power to the boiler;
4. close the manual gas shutoff valve, figures 16 and 17 item “3”;
5. close the boiler isolation valves in the heating system. If isolation valves haven’t been installed, the entire heating system will have to be drained.
6. close the heating system fill valve;
7. follow the steps in section 13.2 or 13.3, to gain access the internal components;
8. connect a hose to the boiler drain valve and place the other end in a sink or some other suitable drain;
9. open the boiler drain valve and drain the boiler;
10. if boiler isolation valves have not been installed in the heating system open any bleed valves at the highest point of the system;
11. after draining out all the water, close the bleed valves and the boiler drain valve.

WARNING!!! Do not recover and/ or re-use water drained from the heating circuit for any purpose as it could be contaminated. Failure to comply with this warning can cause extensive property damage, severe personal injury or death!

13.11 - Draining the domestic hot water side of the boiler

To drain the domestic hot water side of the boiler follow the steps below:

1. turn off the boiler;
2. close the valve in the water main supplying the DHW system;
3. open all the hot and cold faucets in the building;
4. if there isn’t a faucet or drain valve below the boiler level, disconnect DHW connections 10 and 12 in figure 1.

13.12 – Overrides

To carry out specific checks covered in the manual, it is possible to override the control logic of the boiler. See the next:

13.12.1 - Auto-purging

To reset the auto-purging procedure press the + and − keys together for 10 seconds. When the blinking F - appears on the display, -press Reset.

13.12.2 - Fan

To run just the fan at full speed press the + and − keys together for 10 seconds, until the blinking F - appears on the display. The fan will run at full speed for 10 minutes. To shut the fan off before the 10 minutes is up press the Reset key.

13.12.3 – Minimum and maximum output

The boiler can be run at its minimum or maximum output in both the heating and domestic hot water modes by following the steps below:

1. generate a demand for the mode to be overridden:
   - for heating turn up the room thermostat and turn knob “37” in figure 40 to its maximum;
   - for domestic hot water turn knob “11” in figure 40 to its maximum and fully open a hot water faucet;
2. press the + and − keys together for more than 10 seconds, until a blinking F - appears on the display;
3. press the + key until the display shows:
   - t - for minimum heating output;
   - t - for maximum heating output adjusted by P parameter, see section 11.10;
   - t - for maximum heating output;
   - S - for minimum DHW output;
   - S - for maximum DHW output;
4. press the Reset key in order to restore the boiler to normal running conditions.

13.12.4 – Checking the flame current

While running at the minimum and maximum output described in section 13.12.3, the display will show the letter of the mode checked. In the second part of the display the value of the ionization current will be shown. 30 corresponds to a current of 1 uA, 99 to a current of 5.5 uA. The flame current must always be at the correspondent value as shown in section 14, header “ionisation current”. If the value is not within the above values, check:

a - positioning of the flame sensor electrod as per section 13.4;
b - CO2 content as per section 11.9;
c - combustion air pressure as per section 11.8.

13.13 - Water and flue temperature sensor

The boiler has a number of sensors that measure temperature. The electrical resistance between the sensor wires must correspond with the values shown in figure 50.

The temperature sensors are: U1; U2, U3, U5, U6, U7 and U8. The location of each sensor can be found in figures 1 and section 13.15 and 13.16.

13.14 - Outdoor temperature sensor (optional)

An outdoor temperature sensor can be connected to the boiler (see section 6.5). The electrical resistance existing between the sensor wires must correspond with the values shown in figure 51.

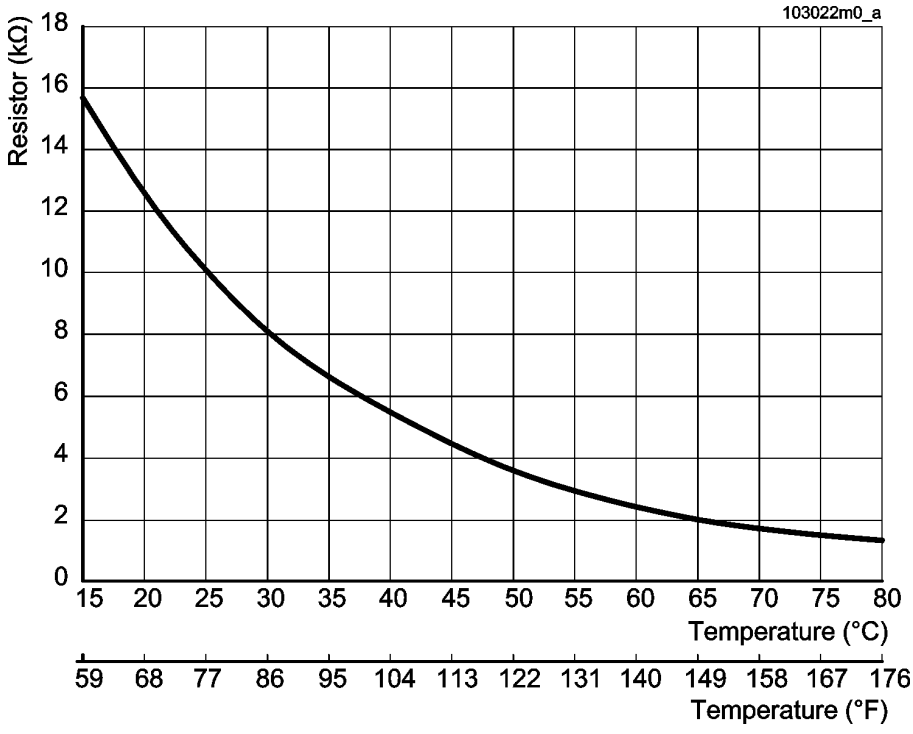


Figure 50 - Water temperature sensors’ curve

Figure 51 - Outdoor temperature sensor curve

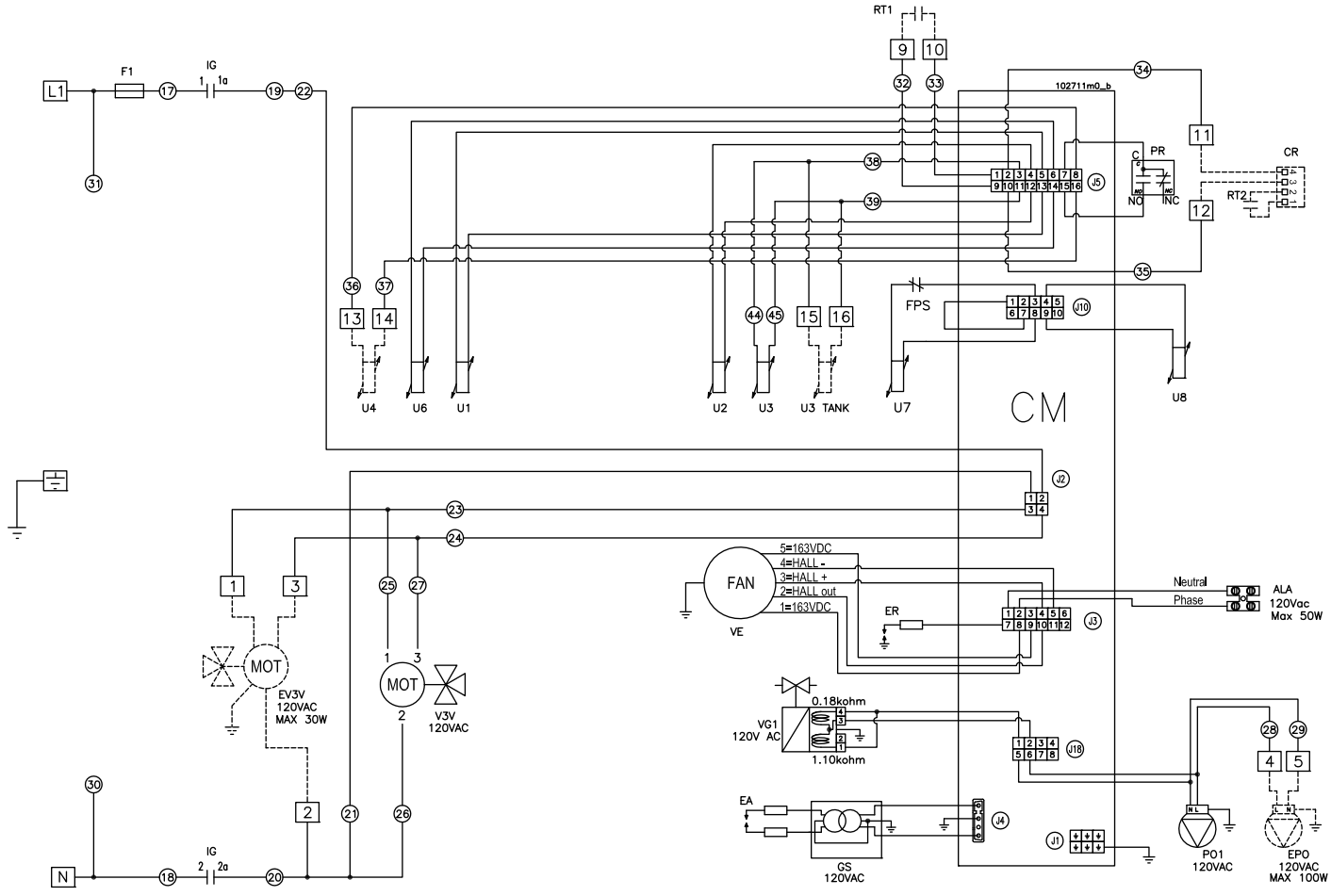
13.15 - Functional wiring diagram

WARNING!!! Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation! Verify proper operation after servicing Failure to comply with this warning can cause extensive property damage, severe personal injury or death!

ATTENTION!!! Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Des erreurs de câblage peuvent entraîner un fonctionnement inadéquat et dangereux. S'assurer que l'appareil fonctionne adéquatement une fois l'entretien est terminé.

LEGEND:

ALA - Alarm output
CM - Power control board
CR - Remote command (only for 160OB and 160OC models)
EA - Ignition electrode
ER - Flame detection electrode
EPO - External pump (REQUIRED FOR MODELS 160B and 160OB)
EV3V - External three way valve (optional)
F1 - Fuse 2Amps
FPR - Flue pressure switch
GS - Spark generator
IG - Main electrical switch
J1 - Six poles connector
J2 - Four poles connector
J3 - Twelve poles connector
J4 - Four poles connector
J5 - Sixteen poles connector
J10 - Ten poles connector
J18 - Height poles connector
U1 - Supply temperature sensor
U2 - Domestic hot water temperature sensor
U3 - Domestic cold water temperature sensor
U3 TANK - Storage tank temperature sensor (optional)
U4 - Outside temperature sensor
U6 - Heating Safety high limit temperature sensor
U7 - Flue gases temperature sensor with integrated safety high limit switch
U8 - Return temperature sensor
PO1 - Heating pump
PR - Heating pressure switch
SDC - Electrical connection board
RT1 - Room thermostat connection
RT2 - Room thermostat connection on remote control "CR" (optional)
VE - Fan
VG1 - Gas valve
V3V - Three way valve



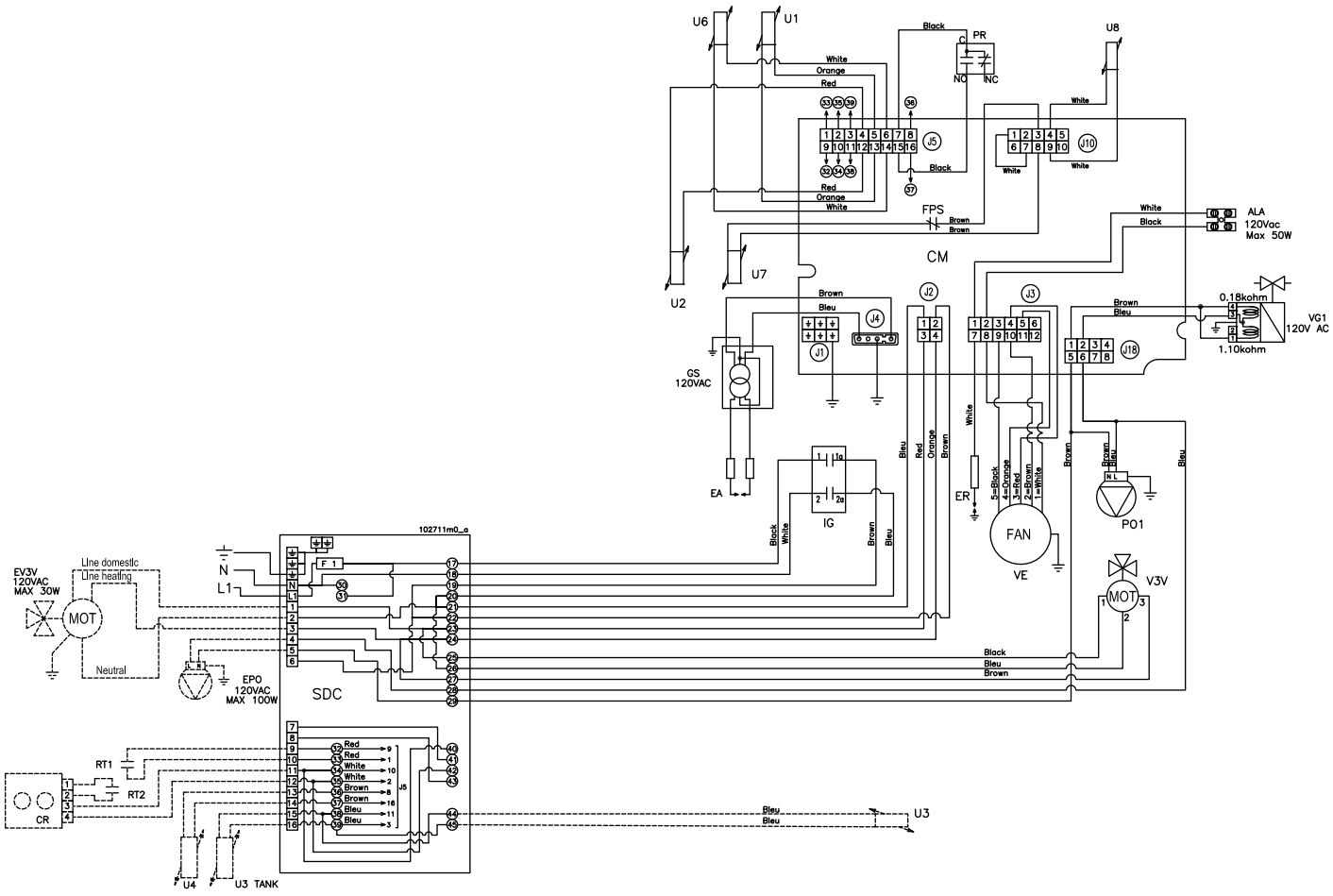
13.16 - Multiwire wiring diagram

WARNING!!! Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation! Verify proper operation after servicing Failure to comply with this warning can cause extensive property damage, severe personal injury or death!

ATTENTION!!! Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Des erreurs de câblage peuvent entraîner un fonctionnement inadéquat et dangereux. S'assurer que l'appareil fonctionne adéquatement une fois l'entretien est terminé.

LEGEND:

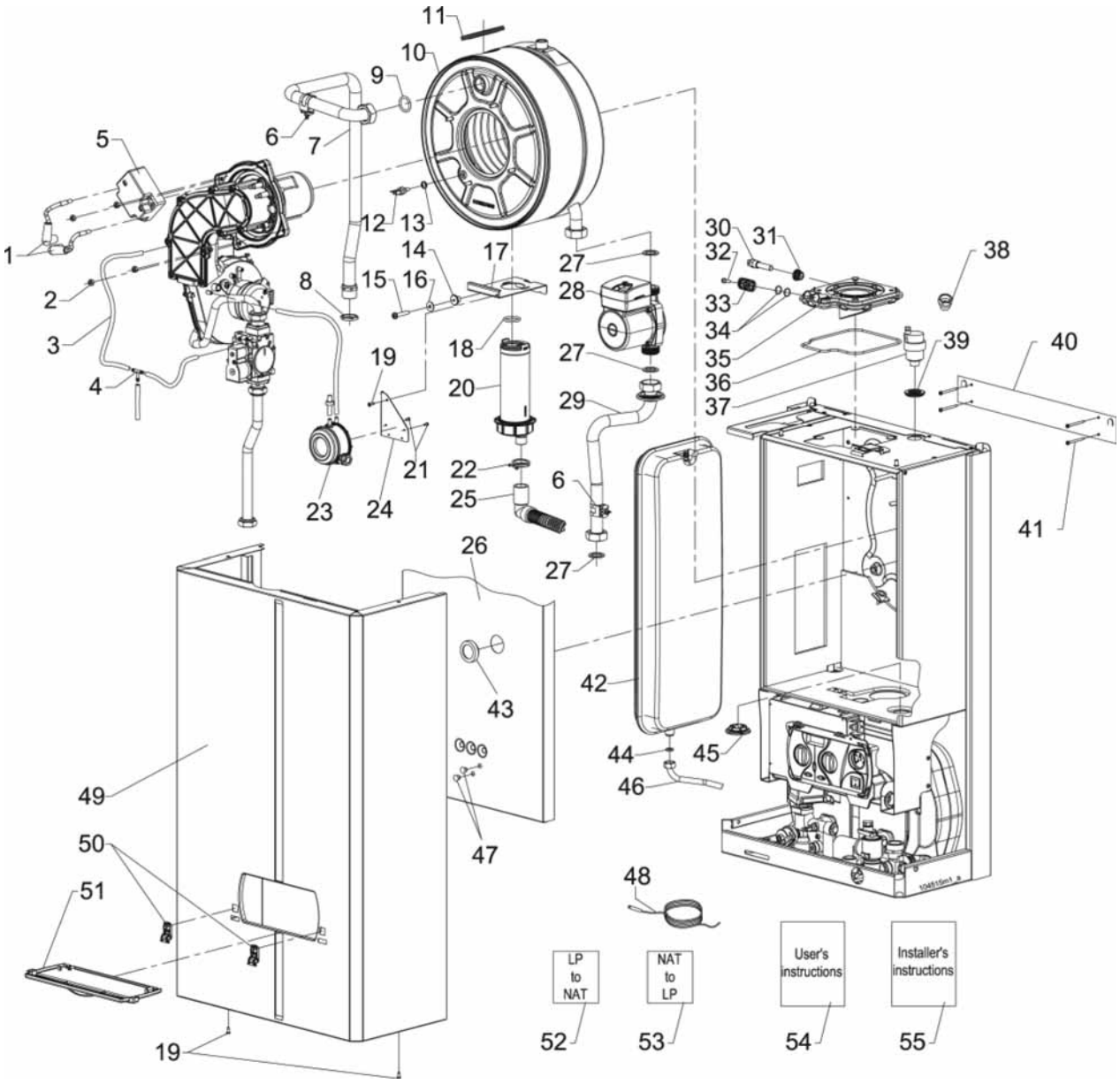
ALA - Alarm output
CM - Power control board
CR - Remote command (only for 160OB and 160OC models)
EA - Ignition electrode
ER - Flame detection electrode
EPO - External pump (REQUIRED FOR 160B and 160OB models)
EV3V - External three way valve (optional)
F1 - Fuse 2Amps
FPR - Flue pressure switch
GS - Spark generator
IG - Main electrical switch
J1 - Six poles connector
J2 - Four poles connector
J3 - Twelve poles connector
J4 - Four poles connector
J5 - Sixteen poles connector
J10 - Ten poles connector
J18 - Height poles connector
U1 - Supply temperature sensor
U2 - Domestic hot water temperature sensor
U3 - Domestic cold water temperature sensor
U3 TANK - Storage tank temperature sensor (optional)
U4 - Outside temperature sensor
U6 - Heating Safety high limit temperature sensor
U7 - Flue gases temperature sensor with integrated safety high limit switch
U8 - Return temperature sensor
PO1 - Heating pump
PR - Heating pressure switch
SDC - Electrical connection board
RT1 - Room thermostat connection
RT2 - Room thermostat connection on remote control "CR" (optional)
VE - Fan
VG1 - Gas valve
V3V - Three way valve



14 - TECHNICAL DATA

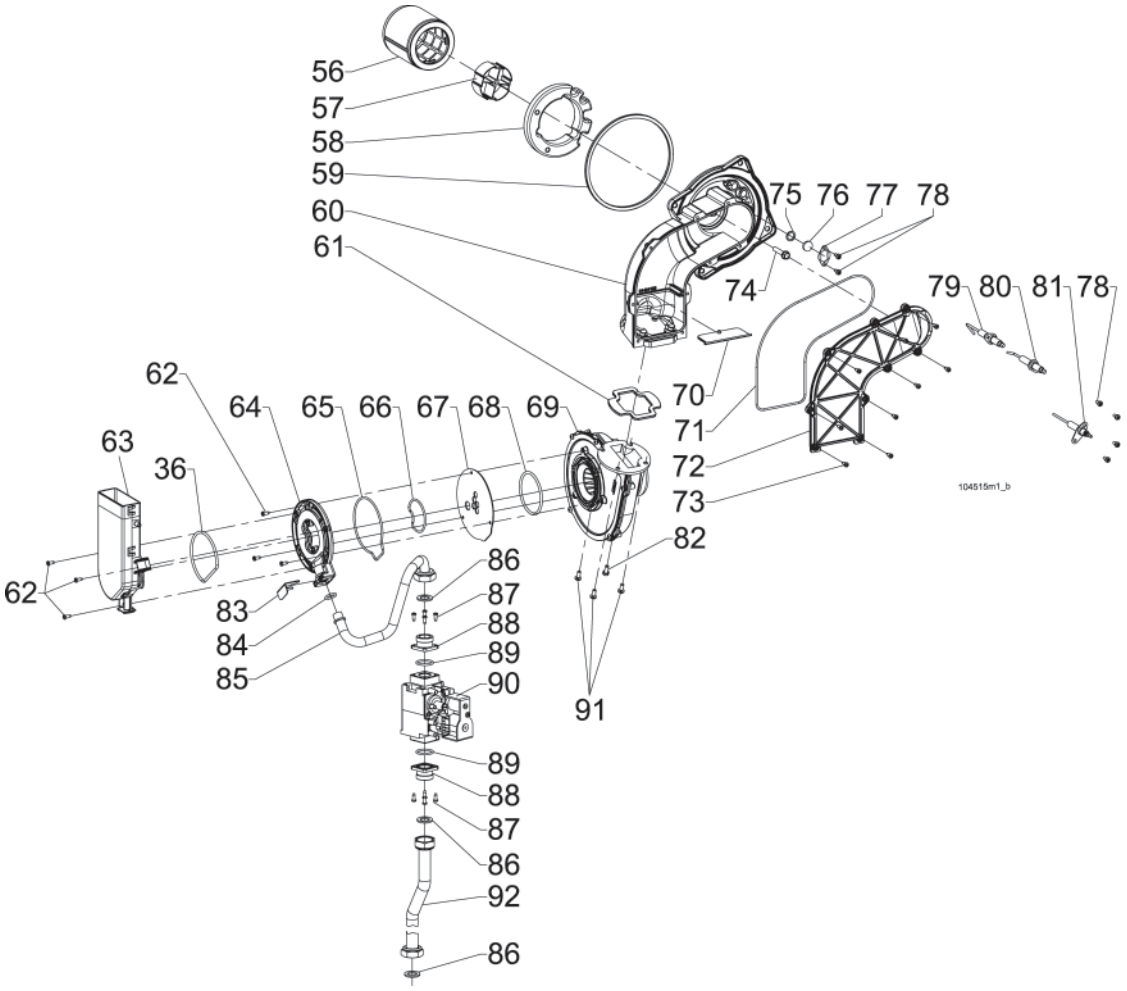
MODEL			**GC-160-B; GC-160-C, OX-160-B; OX-160-C SS-160-C;**
Country of destination			USA and Canada
Type of boiler			Direct Vent boiler
Category of discharge chimney			IV
CSA certificate N°			2045300 (114696)
Maximum Heat input		Btu/hr	160,000
Minimum heat input		Btu/hr	30,000
Efficiency at maximum heat input (160°F/140°F)		%	93
Maximum Heat output (160°F/140°F)		Btu/hr	148,800
Efficiency at minimum heat input (122°F/86°F)		%	97
Minimum heat output (122°F/86°F)		Btu/hr	29,100
Gas flow rate	Natural gas	cu. ft./hr	156
	LP Gas	gal/hr	1.75
Gas supply pressure	Natural gas	In.W.C.	7
	LP Gas	In.W.C.	11
Minimum gas supply pressure	Natural gas	In.W.C.	1.5
	LP Gas	In.W.C.	8
Maximum gas supply pressure	Natural gas	In.W.C.	11
	LP Gas	In.W.C.	13
Combustion air pressure with min. length	Natural gas	In.W.C.	2.5 to 3.1
	LP Gas	In.W.C.	2.1 to 2.7
Combustion air pressure with max. length	Natural gas	In.W.C.	2.1 to 2.7
	LP Gas	In.W.C.	1.8 to 2.4
Instantaneous d.h.w production (rise 75°F)		gal/min	4.32
Maximum heating temperature		°F	189
Minimum heating temperature		°F	68
Maximum heating pressure		PSI	30
Minimum heating pressure		PSI	8
Maximum pressure of domestic hot water circuit		PSI	150
Minimum pressure of domestic hot water circuit		PSI	1
Capacity of expansion tank		gal	2.64
Supply voltage			120Vac - 60Hz
Absorbed electric power		W	170
Flue gas pipes diameter (split)		“ (mm)	3.15 (80)
Max. length flue gas pipes (split)		ft	300
Flue gas pipes diameter (coaxial)		“ (mm)	2.36/3.94 (60/100)
Max. length flue gas pipes (coaxial)		ft	70
Equivalent length of one elbow		ft	45° elbow = 3ft, 90° elbow = 5ft
CO (Carbon monoxide) with natural gas		ppm	<150
CO (Carbon monoxide) with LP gas		ppm	<250
NOx (0% O2 with natural gas)		ppm	<30
CO2 (Carbon dioxide) for Natural gas at high fire		%	8.6 to 9.2
CO2 (Carbon dioxide) for Natural gas at low fire		%	8.2 to 8.6
CO2 (Carbon dioxide) for LP gas at high fire		%	9.7 to 10.6
CO2 (Carbon dioxide) for LP gas at low fire		%	9.2 to 9.8
Ionisation current for Natural gas at high fire			74 to 80
Ionisation current for Natural gas at low fire			81 to 87
Ionisation current for LP gas at high fire			71 to 77
Ionisation current for LP gas at low fire			83 to 89
Maximum flue gas temperature		°F	230
Flue gas flow-mass		lb/hr	160
Head pressure available for flue vent/air intake line		In.W.C.	3.6
Maximum condensation flow rate		gal/hr	1.32
Average acidity of condensation		PH	4
Boiler weight (160C and 160OC models)		lb	100
Boiler weight (160B and 160OB models)		lb	90

15 - SPARE PARTS



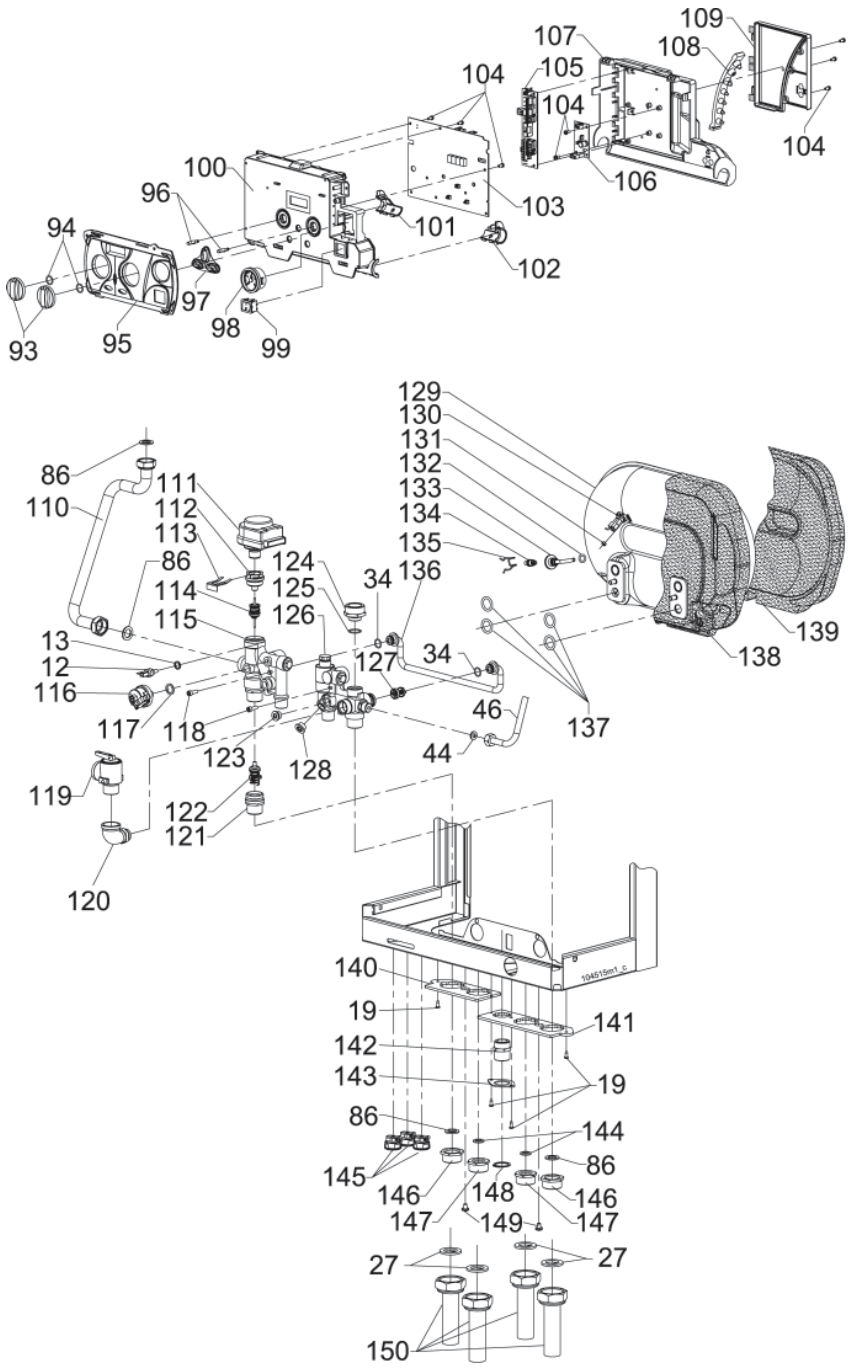
1 - 60504206 CABLE UL IGNITOR CONN 90° L155
2 - 60802005 NUT ZINC COATED 6MA
3 - 60320001 SILICONE PIPE D 4X8
4 - 61405036 TEE FOR DRY WATER CONDENSATION
5 - 60510022 SPARK GENERATOR NO CABLE UL
6 - 62111016 SENSOR NTC 10 KOHM A KLIP DIAM.22
7 - 62622011 COPPER PIPE D22 M/F 3/4"G-1"G
8 - 60802018 3/4" RING NUT
9 - 60702030 O-RING NBR 2,62 X 20,63
10 - 62649004 PRIMARY HEAT EXCHANGER C.R.R ASME
11 - 60702047 GASKET EPDM X OSSIDO D84 H7
12 - 62111017 SENSOR NTC 10 KOHM 1/8"
13 - 60803027 GASKET COPPER 1/8" SP.1,5
14 - 61405025 SILICONE TAP
15 - 60801116 SCREW 6X35 ZINC TC-CR
16 - 60803011 WASHER 6X18X1,5 PIA-ZIN-LAR UNI6593
17 - 60406074 BRACKET SIPHON L84 H130 P32
18 - 60702055 O-RING 134 EPDM 3,53 X 25,8
19 - 60801043 SCREW SELFTAPPING 3.9 X 9.5 CROSS HEAD
20 - 62630136 SIPHON
21 - 60801100 SCREW SELFTAPPING 2.9 X 6.5 CROSS HEAD
22 - 60806020 SPRING 28,7
23 - 62113041 PRESSURE SWITCH ON 4,5 INWC
24 - 60406092 BRACKET PRESSURE SWITCH
25 - 60322012 POLIETYLENE PIPE L=1000
26 - 60402037 SEALING CHAMBER DOOR
27 - 60701001 1"G GASKET
28 - 62301031 PUMP GRUNDFOS UP 15/58U BRUTE USA
29 - 62622012 COPPER PIPE D22 RETURN SEALING CHAMBER
30 - 62111015 SENSOR NTC 10K BAIO
31 - XXX #N/D
32 - 60801132 SCREW 4,8X19 ZINC AF TC-CR UNI6954
33 - 61405164 PLUG FOR FLUE AIR FITTING
34 - 60702052 O-RING 2050 EPDM 1,78 X 12,42
35 - 61405160 DISCHARGE RACCORD PP
36 - 60702035 GASKET ROUND SPONGE D.3,5 MM IP44 S3

15 - SPARE PARTS



37 - 61206001 AUTOMATIC AIR VENT
38 - 60101119 3/8G MALE to 1/8NPT FEMALE BUSHING
39 - 60703033 GASKET EPDM D38 F20 SP6
40 - 60411085 45xx WALL MOUNTING BRACKET
41 - 60801097 SCREW SELFTAPPING 5X50 WOOD
42 - 62201005 EXP TANK LT. 8 561X203X80 RETT.
43 - 60815012 GLASS WINDOW WITH GASKET
44 - 60701005 3/8" G GASKET
45 - 61102006 FAIRLEAD 6 POLES SILICONE
46 - 62625064 EXP TANK PIPE
47 - 61405219 PLASTIC CAP TPP 8.5
48 - 62110071 TANK SENSOR
49 - 62610067 EXTERNAL JACKET 500X840X245
50 - 61405167 DOOR SUPPORT
51 - 62610065 DOOR ABS
52 - 62630152 LP TO NATURAL CONVERSION KIT FOR 45 SERIES
53 - 62630151 NATURAL TO LP CONVERSION KIT FOR 45 SERIES
54 - 62417004 45XX USER'S INSTRUCTIONS
55 - 62403466 45XX INSTALLER'S INSTRUCTIONS
56 - 62629036 BURNER HEAD
57 - 61504029 EXTRUSION L.25MM
58 - 60909008 THERM. INSULATION VERMICULITE D117 F74 SP21,5
59 - 60703032 GASKET. SIL. D157 F145 H6,7
60 - 61404108 BASE MANIFOLD AIR ALUMINUM
61 - 60703030 GASKET SIL.MANIFOLD FAN D83 SP3,5
62 - 60801136 SCREW SELFTAPPING 4X12 TC S-TT UNI-8112
63 - 62651016 MANIFOLD AIR CUTTED
64 - 61404114 MIXER AIR/GAS "COSMOMIX"
65 - 60702049 O-RING 3350 NBR 2,62 X 88,57
66 - 60702048 O-RING 3200 NBR 2,62 X 50,47
67 - 60408261 DIAPHRAGM COSMOMIX 9 HOLES D.10
68 - 60702056 O-RING 165 NBR 3,53 X 61,91
69 - 61901029 FAN 45 KW USA
70 - 61405174 BACK FLUE-GASES PREVENTER
71 - 60702051 O-RING 3825 SIL 2,62 X 209,22
72 - 61404109 COVER MANIFOLD AIR ALUMINUM
73 - 60801080 SCREW SELFTAPPING 4X10 TC S-TT UNI-8112
74 - 60801111 SELFTAPPING BOLT 6.3X38
75 - 60701013 GASKET FRIZITE D15,5 F11,5 SP1,5
76 - 60815011 GLASS PIREX D15,5 SP3,3
77 - 60404253 FLANGE L21,2 H34
78 - 60801081 SCREW SELFTAPPING 4X8 TC S-TT NI-8112
79 - 60505022 LEFT IGNITION ELECTRODE
80 - 60505023 RIGHT IGNITION ELECTRODE
81 - 60505024 DETECTION ELECTRODE
82 - 60801102 SCREW 5X12 EXAGONAL HEAD
83 - 60406069 SPRING MIXER
84 - 60702050 O-RING 3056 NBR (118) 2,62X13,95
85 - 62624125 GAS PIPE (SIT) USA
86 - 60701006 GASKET 3/4P 24X15X2 KLINSIL
87 - 60801014 SCREW 4X10 ZINC TC-CR
88 - 60101224 FLANGE GAS 32X32 3/4P
89 - 60702029 O-RING 130 2,62 X 22,22
90 - 61201040 GAS VALVE SIGMA848 120V
91 - 60801021 BOLT 5X12 CROSS HEAD
92 - 62623249 PIPE D18 F/F 3/4P-3/4P SIT USA
93 - 62103009 CONTROL KNOB S3
94 - 60702041 O-RING NBR 1,6 X 11,1
95 - 61405203 FRONT INTERFACE
96 - 61405151 TREE POTMETER-KNOB
97 - 61405190 KEYS RUBBER 3 POSITIONS

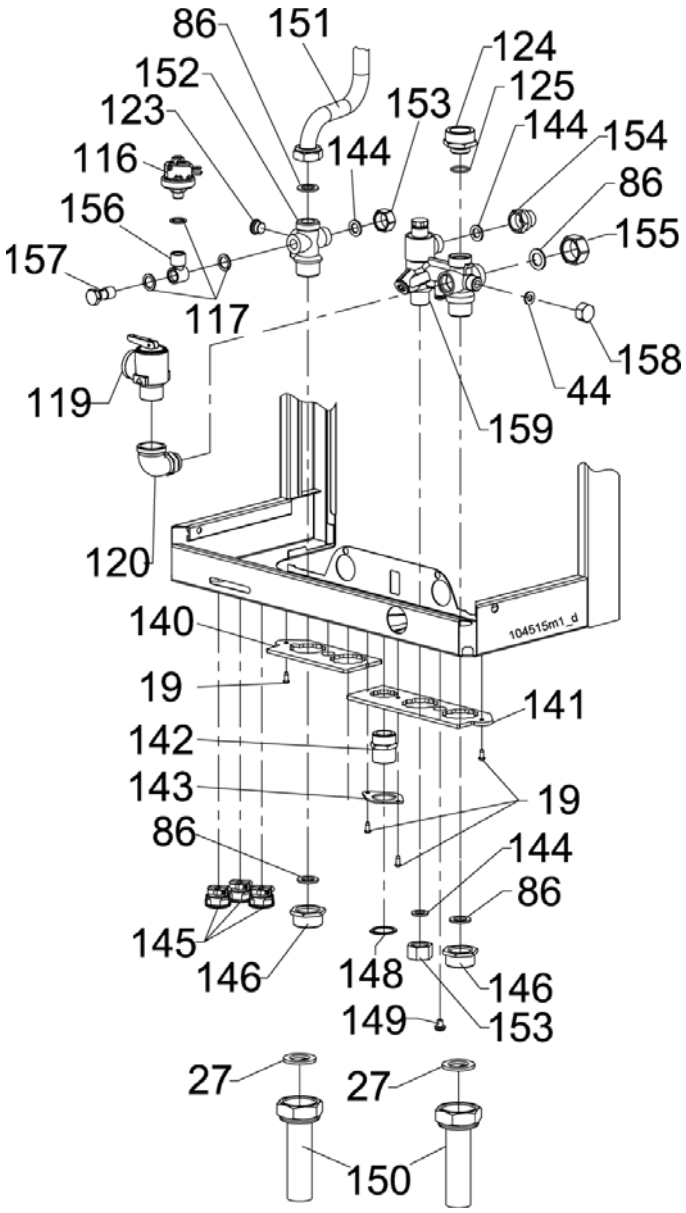
15 - SPARE PARTS



Bottom of the boiler for 160C and 160OC models

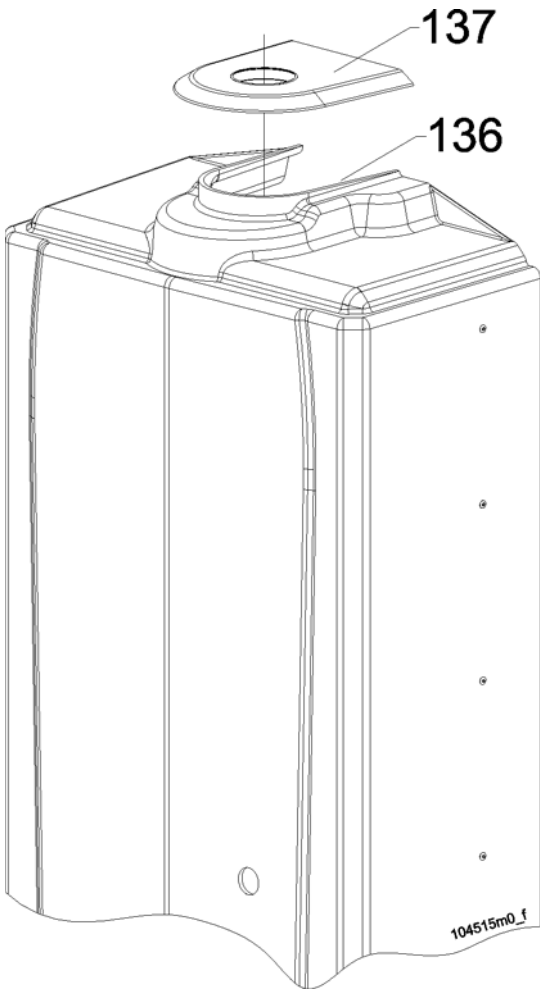
98 - 62102009 PRESSURE GAUGE DIAM.38 - 1/4" PSI
99 - 60506019 GAS VALVE SERVICE SWITCH
100 - 61405184 BASE ELECTRICAL BOX
101 - 61405186 FAIRLEAD SX
102 - 61405188 FAIRLEAD DX
103 - 62110076 POWER CONTROL BOARD PHC 120V
104 - 60801138 SCREW 4X8 ZINC TC-CR DIN4042
105 - 60507056 JUNCTION BOARD 45
106 - 62118015 INTERFACE OPENTERM
107 - 61405185 COVER ELECTRICAL BOX
108 - 61103011 FAIRLEAD 7 EXIT
109 - 61405189 COVER JUNCTION BOX
110 - 62623246 PIPE SUPPLY SEALING CHAMBER
111 - 61203015 3 WAY VALVE MOTOR 120V
112 - 61202024 PLUG PISTON BODY OT.
113 - 60808002 SPRING FORCK 3V
114 - 61202027 UPPER PISTON
115 - 61408005 HYDRONIC SUPPLY GROUP.
116 - 62113034 HEATING PRESSURE SWITCH
117 - 60704003 GASKET COPPER 1/4P
118 - 60801134 SCREW 5X18 ZINC TC-ES-INC UNI5931
119 - 61205010 ASME SAFETY RELIEF VALVE
120 - 60101247 ELBOW BRASS 3/4P F 1/2P M WITH RING NUT AND O-RING
121 - 61202025 COVER PISTON HEATING
122 - 61202028 PISTON HEATING SIDE
123 - 60107005 PLUG BRASS 1/4P M WITH O-RING
124 - 60110028 NIPPLE OT 1"-22X1,5 MM
125 - 60702036 O-RING 2075 EPDM 1,78 X 18,77
126 - 61408007 HYDRONIC RETURN GROUP
127 - 61202026 BY-PASS VALVE
128 - 60701006 3/8" MALE CAP
129 - 62653003 DOMESTIC HEAT EXCHANGER "ACQUAJET"
130 - 62110052 SENSOR NTC 10 KOHM KLIP WITH SCREW
131 - 60802008 NUT ZINC COATED 4MA
132 - 60702053 O-RING 3037 EPDM 2,62 X 9,19
133 - 62628001 PURGING PIPE
134 - 61206011 PURGING VALVE M10X1
135 - 60808003 FORCK BY-PASS PIPE
136 - 60305073 BY-PASS PIPE
137 - 60702054 O-RING 4075 EPDM 3,53 X 18,64
138 - 60901022 FRONT THERM. INSULATION "ACQUAJET"
139 - 60901023 REAR THERM. INSULATION "ACQUAJET"
140 - 60440008 BRACKET EXAGONAL HOLES SHORT
141 - 60440009 BRACKET EXAGONAL HOLES LONG
142 - 60110025 NIPPLE OTT 3/4NPT-3/4P USA
143 - 60411117 BRACKET EXAGONAL HOLE SMALL
144 - 60701004 1/2" G GASKET
145 - 61101001 FAIRLEAD PA 107 SCREW HILO 3,5X14,5
146 - 60101011 CONNECTION BRASS 3/4P TO 1P

15 - SPARE PARTS



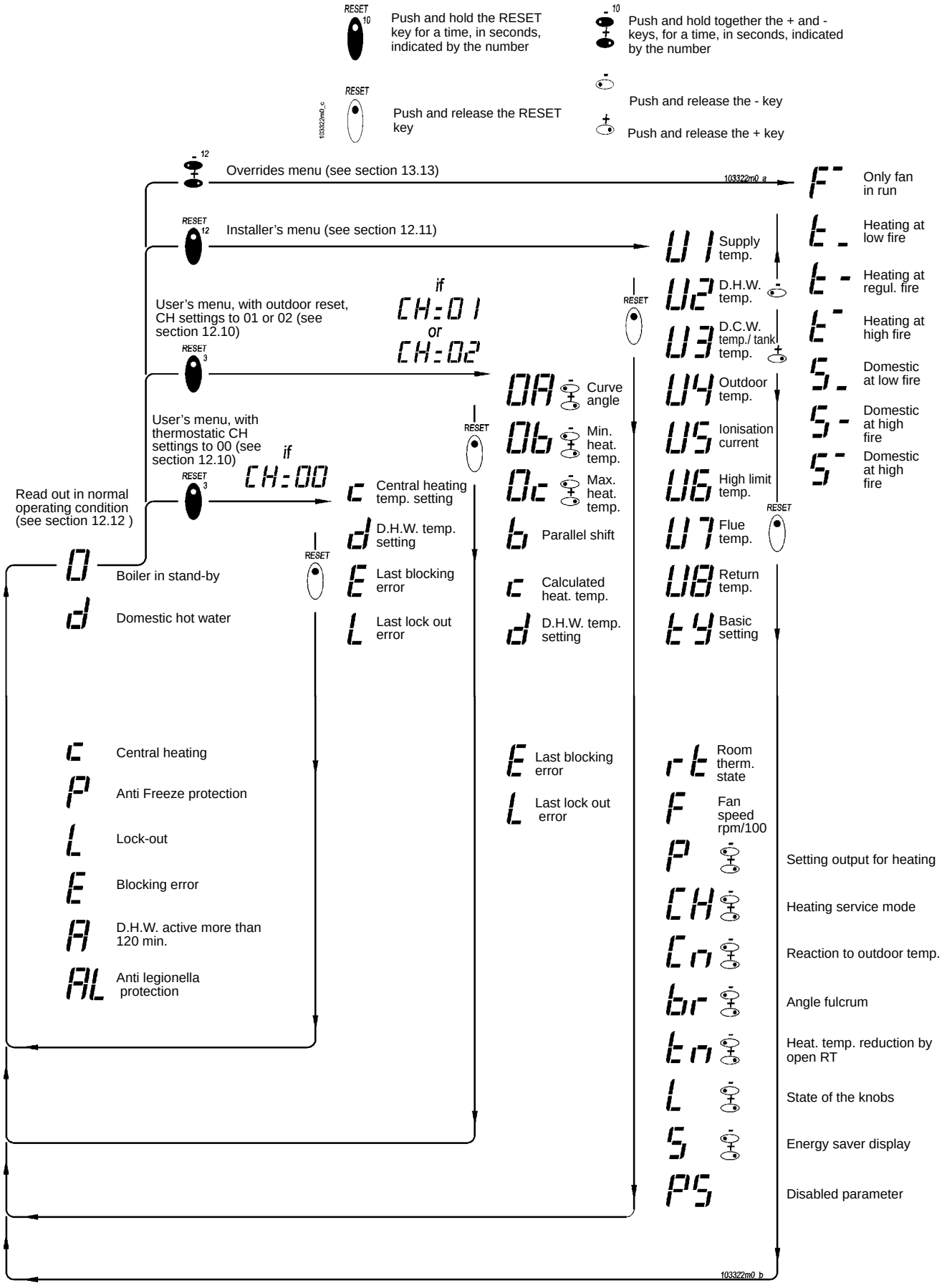
Bottom side of the 160-B model

147 - 60101225 CONNECTION BRASS 1/2P TO 1P
148 - 60802018 3/4" NUT
149 - 60801135 SCREW 6X8 ZINC TC-CR DIN7985
150 - 60310002 COPPER PIPE 1"GAS TO 3/4"
151 - 62623248 SUPPLY PIPE FOR ONLY HEATING
152 - 61408008 HYDRONIC SUPPLY GROUP ONLY HEATING
153 - 60101124 1/2P CAP
154 - 60101193 1/2"-1/4" FF BRASS FITTING
155 - 60107014 PLUG BRASS 3/4P F
156 - 60101190 FITTING D12 1/4 1/4M
157 - 60101217 FITTING 1/4M CH17
158 - 60107015 PLUG BRASS 3/8P F
159 - 61408009 HYDRONIC RETURN GROUP ONLY HEATING



External jacket for 160OB and 160OC models

16 - READ OUT FLOW CHART



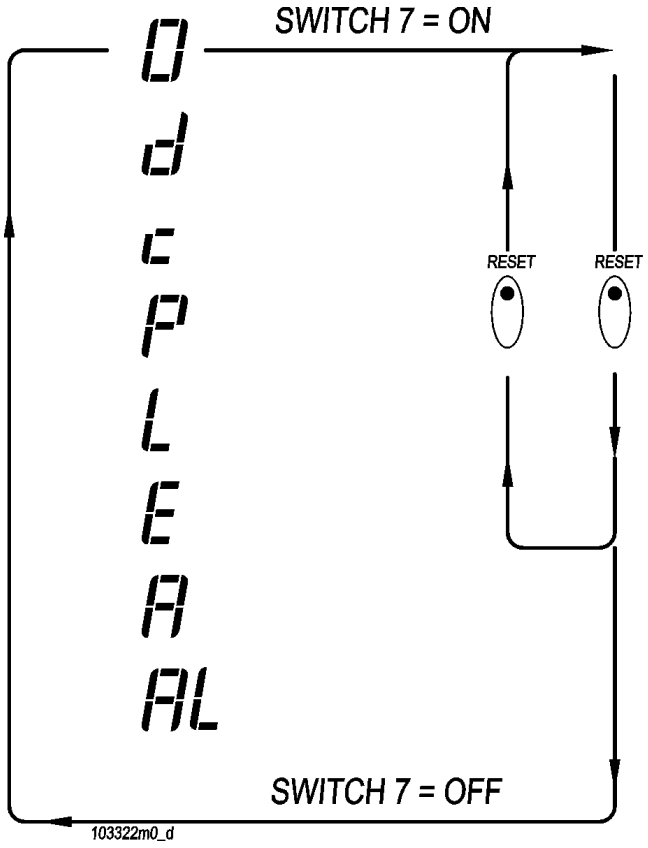
16 - READ OUT FLOW CHART

CAUTION!!! Changing these parameters could cause the boiler and therefore the system to malfunction. For this reason, only a qualified technician who has in-depth knowledge of the boiler should change them.

The boiler's micro-processor makes this menu of parameters available to the qualified technician for the setting of the appliance.

To enter this menu you must:
1. turn the main electrical supply Off;
2. move the switch No. 7 (see figure 22, item "D") to the ON position;
3. turn the main electrical supply On. Now "ty" is displayed. Use plus and minus keys to change the value; use RESET key to save the value and swap to the next parameter.

To exit this menu you must:
1. turn the main electrical supply Off;
2. move the switch No. 7 (see figure 22, item "D") to the Off position.

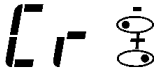


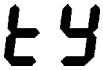

Basic functionalities selection and Speed blower selection (see below for more explications).


Main electrical supply and temperature unit selection (see below for more explication).


Domestic functionalities selection. Must be always at 00

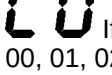

Master or slave selection in a module configuration. Must be always at 00.

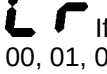

Rotating selection in a module configuration. Must be always at 00.

 can assume the follow values:
61 - for 160xx at NATURAL gas;
62 - for 160xx at LP gas;

 can assume the follow values:
00 - 230Vac, 50Hz, °C;
01 - 230Vac, 50Hz, °F;
02 - 120Vac, 60Hz, °C;
03 - 120Vac, 60Hz, °F

 can assume the follow values:
00, 01 and 02. Must be always at 00.

 If readable, can assume the follow values:
00, 01, 02, 03, 04, 05, 06, 07 and 08. Must be always at 00.

 If readable, can assume the follow values:
00, 01, 02, 03, 04, 05, 06, 07 and 08. Must be always at 00.

17 - LIMITED CONDENSING WATER HEATER WARRANTY

WHAT DOES THIS LIMITED WARRANTY COVER?

This limited warranty covers the Heat Exchanger for leakage, thermal shock or other malfunction caused by defects in materials and/or workmanship. It extends to the first buyer and to any subsequent owner(s) as long as the water heater remains installed at its original place of installation. This limited warranty shall constitute buyer/owner's exclusive remedy with respect to the Heat Exchanger. As such, the manufacturer disclaims all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose. The manufacturer shall not be liable for any special, direct, indirect, consequential, punitive or incidental damages of any kind, or labor, expenses, lost profits lost opportunities, or similar damages of any kind related to the Heat Exchanger.

FIVE YEARS OF COVERAGE!

Model number and serial number are found on the rating plate affixed to the water heater. Heat exchangers are warranted against leakage and thermal shock for 5 years. Parts are warranted for 1 year. Any replacement heat exchanger under this warranty shall remain in warranty only for the unexpired portion of the original warranty.

WHAT DOES THIS LIMITED WARRANTY NOT COVER?

1. this limited warranty does not cover leakage or other malfunction caused by:

a. Defective installation and specifically, any installation which is made:
   I) in violation of applicable state or local plumbing, housing or building codes, or
   II) without a certified American Gas Association, ASME, or comparable Temperature Pressure Relief Valve, or
   III) contrary to the written instructions furnished with the unit.

b. Adverse local conditions and specifically, sediment or lime precipitate in the tubes and/or headers or corrosive elements in the atmosphere.

c. Misuse and specifically, operation and maintenance contrary to the written instruction furnished with the unit, disconnection, alteration or addition of non-approved components or apparatus, operation with fuels or at settings other than those set forth on the rating plate, or accidental or other exterior damage.

2. This warranty also does not cover:

a. Production of noise, odors, discoloration or rusty water.

b. Damage to surrounding area or property caused by leakage or malfunction.

c. All labor costs associated with the replacement and/or repair of the unit, including:
   I) examination and replacement of parts claimed to be defective
   II) any freight, shipping or delivery charges;
   III) any removal, installation or reinstallation charges;
   IV) any material and/or permits required for installation, reinstallation or repair;
   V) charges to return the water heater and/or components to the manufacturer.

d. Any failed component of the water heater system not manufactured as part of the water heater.

e. Any water heater altered without prior written approval from the manufacturer.

f. Any damage or failure due to contaminated air, including, but not limited to, sheetrock particles, plasterboard particles, lint, dirt or dust, entering the water heater or any of its components.

g. Any damage or failure due to chemically contaminated combustion air, including, but not limited to, chlorine gas, halogenated hydrocarbons, Freon, entering the water heater or any of its components.

h. Any water heater that has been damaged as a result of natural disasters, including, but not limited to, lightning, fire, earthquake, hurricanes, tornadoes or floods.

WHAT WILL WE DO TO CORRECT PROBLEMS?

If a defect occurs within the warranty period we will:

1. Provide a comparable replacement manufacture, or at our option, repair any unit which develops a leak in the heat exchanger within the warranty period.
2. Provide a replacement part, or at our option, repair any part which fails to function within the parts warranty period. To obtain a replacement, you must return the defective part to our manufacturing facility. We reserve the right to verify any claims of defect by inspection.

CONDITIONS

We will not:

1. Repair or replace any water heater, or part, subject to conditions outlined in "What Does This Limited Warranty Not Cover?"
2. Reimburse any costs associated with repair and/or replacement.
3. Replace and/or repair any water heater without complete model number/serial number.
4. Replace any water heater without prior receipt of actual rating plate from the appliance.

HOW TO KEEP YOUR WARRANTY IN EFFECT?

To facilitate warranty service, you should:

1. Retain all bills of sale or receipts for proof of installation, etc.
2. Contact your installer or dealer as soon as any problem or defect is noticed.
3. When necessary, allow our representative to inspect the unit.
4. For your reference, fill in the Model and Serial Number found on the unit's Rating Plate:

Model Number _____

Serial Number _____

Date of Installation _____

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