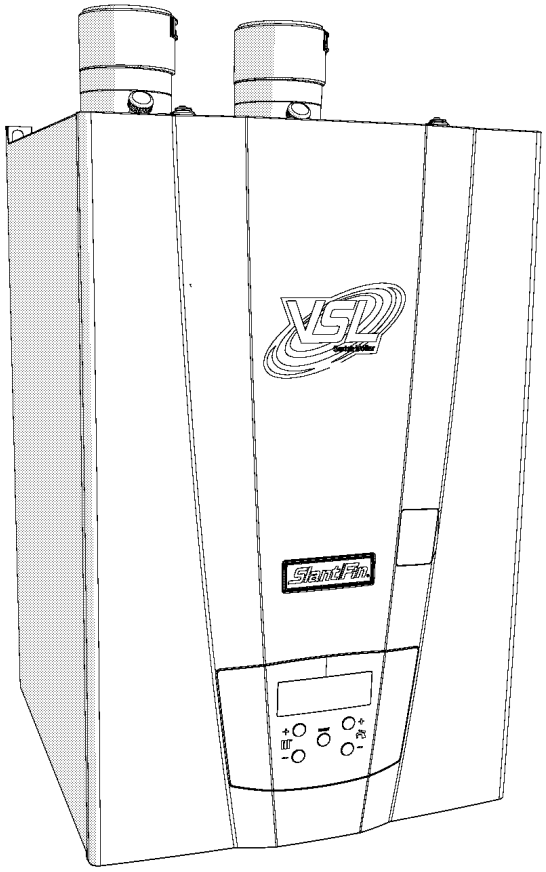
Slant/Fin®

This manual must be left with owner and should be hung on or adjacent to the boiler for reference.

VSL II Boiler

DIRECT-VENT SEALED COMBUSTION CONDENSING BOILER
HOT WATER MODEL VSL II 90A - 250A
GAS-FIRED BOILER FOR NATURAL AND L.P. PROPANE GASES

INSTALLATION, OPERATING AND MAINTENANCE INSTRUCTIONS



WARNING!!! This manual must only be used by a qualified heating installer / service technician. Read all instructions, including this manual, before installing. Perform steps in the order given. Failure to comply could result in severe personal injury, death, or substantial property damage.

Save this manual for future reference.

Heating Contractor	**Boiler Model Number**
Address	**Boiler Serial Number**
Phone Number	**Installation Date**

Part# 819507000 • Printed in USA 615

PUBLICATION VSLII-40

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.

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.

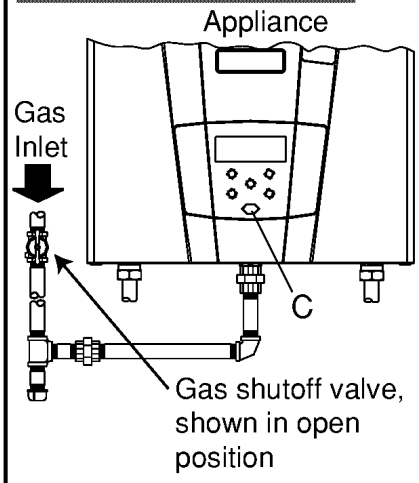
B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

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



1. STOP! Read the safety information above (to the left) on this label.
2. Set the main switch "C" to the off position and turn off all electric power to the appliance.
3. This appliance is equipped with an ignition device which automatically lights the burner. **Do not try** to light the burner by hand.
4. Close the manual gas shutoff valve turning the knob clockwise ↷ .Do not force.
5. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above (to the left) on this label. If you don't smell gas, go to the next step.
6. Open the manual gas shutoff valve turning the knob counterclockwise ↶ .
7. Turn on all electric power to the appliance, and set the main switch "C" to the on position.
8. Set an heating request following the installation manual.
9. 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.
3. Close the manual gas shutoff valve turning the knob clockwise ↷ . Do not force.

SAFETY INSTRUCTIONS

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.

SAFETY INSTRUCTIONS

POUR VOTRE SÉCURITÉ LISEZ AVANT D'ALLUMER

AVERTISSEMENT: Quiconque ne respecte pas à la lettre les instructions dans le présente notice risque de déclencher un incendie ou une explosion entraînant des dommages, des blessures ou la mort.

A. Cet appareil ne comporte pas de veilleuse. Il est muni d'un dispositif d'allumage qui allume automatiquement le brûleur. Ne tentez pas d'allumer le brûleur manuellement.

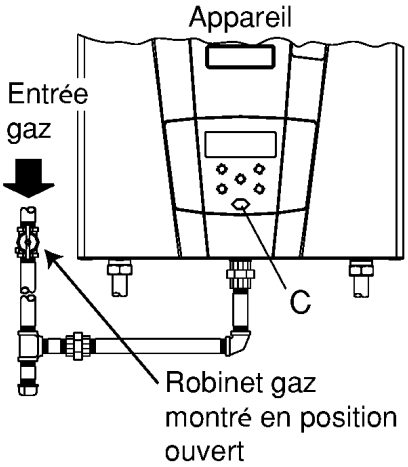
B. AVANT DE FAIRE FONCTIONNER, reniflez tout autour de l'appareil pour déceler une odeur de gaz. Reniflez près du plancher, car certains gaz sont plus lourds que l'air et peuvent s'accumuler au niveau du sol.

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:
- Ne pas tenter d'allumer d'appareil.
- Ne touchez à aucun interrupteur; ne pas vous servir des téléphones se trouvant dans le bâtiment.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.
- Si vous ne pouvez rejoindre le fournisseur, appelez le service des incendies.

C. Ne poussez ou tournez la manette d'admission du gaz qu'à la main; ne jamais utiliser d'outil. Si la manette reste coincée, ne pas tenter de la réparer; appelez un technicien qualifié. Le fait de forcer la manette ou de la réparer peut déclencher une explosion ou un incendie.

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

INSTRUCTIONS DE MISE EN MARCHE



1. ARRÊTEZ! Lisez les instructions de sécurité sur la portion supérieure (à gauche) de cette étiquette.
2. Positionner l'interrupteur "C" sur off et coupez l'alimentation électrique de l'appareil.
3. Cet appareil est muni d'un dispositif d'allumage qui allume automatiquement le brûleur. **Ne tentez pas** d'allumer le brûleur manuellement.
4. Fermer le robinet de l'admission du gaz tournant la manette dans le sens horaire ↷.
6. Attendre cinq (5) minutes pour laisser échapper tout le gaz. Renifléz tout autour de l'appareil, y compris près du plancher, pour déceler une odeur de gaz. Si vous sentez une odeur de gaz, ARRÊTEZ! Passez à l'étape B des instructions de sécurité sur la portion supérieure (à gauche) de cette étiquette. S'il n'y a pas d'odeur de gaz, passez à l'étape suivante.
7. Ouvrir le robinet de l'admission du gaz tournant la manette dans le sens antihoraire ↶.
8. Positionner l'interrupteur "C" sur la position d'allumage.
9. Tourner un demande de eau chauffe suivante le manuel d'installation.
10. Si l'appareil ne se pas en marche, suivez les instructions intitulées "Comment couper l'admission de gaz de l'appareil" et appelez un technicien qualifiè ou le fournisseur de gaz.

COMMENT COUPER L'ADMISSION DE GAZ DE L'APPAREIL

1. Coupez l'alimentation électrique de l'appareil s'il faut procéder à l'entretien.
2. Positionner l'interrupteur "C" sur eteint.
3. Fermer le robinet de l'admission du gaz tournant la manette dans le sens horaire ↷.

SAFETY INSTRUCTIONS

⚠ WARNING!!!

Installer: Read all instructions, including this manual, before installing. Perform steps in the order given.

User: This manual is for use only by a qualified heating installer. Refer to the User's Information Manual for your reference.

Maintenance: at least once a year the user must call a Qualified installer for routine maintenance.

Failure to comply with these provisions can cause a fire or explosion causing property damage, personal injury, or death.

⚠ WARNING!!! **If the information in this manual is not followed exactly, can result in a fire or explosion causing property damage, personal injury, or death.**

⚠ WARNING!!! **Qualified installer: qualified installer is an individual with specific, technical training in space heating systems, domestic hot water systems, fuel gas systems and electrical systems. This individual must have the legally required qualifications. Failure to comply with these provisions can cause a fire or explosion causing property damage, personal injury, or death.**

⚠ WARNING!!! **Installation and Alterations: Only a Qualified installer 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!**

⚠ WARNING!!! **Flue gas/air intake: You are only permitted to operate this appliance with the combustion air/flue gas system that has been specifically designed and approved. Failure to follow these instructions could result in excessive levels of carbon monoxide which can cause severe personal injury or death!**

⚠ WARNING!!! **Flue gas/air intake: 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!**

⚠ WARNING!!! **Flue gas/ air intake: If boiler installation is provided as replacement boiler, DO NOT connect new boiler venting to an existing vent system, if it is shared with other appliances. Failure to follow these instructions could result in excessive levels of carbon monoxide which can cause severe personal injury or death!**

⚠ WARNING!!! **Flue gas/air intake terminals: Do not restrict or seal any air intake or outlet openings (terminals). Failure to follow these instructions could result in excessive levels of carbon monoxide which can cause severe personal injury or death!**

NOTICE! Local approval of the flue system and the condensate connection to the public sewer system may be required.

NOTICE! Follow all local building regulations stipulating the installation rules at the time of installation.

CAUTION!!! **Installation location: The boiler must be located in an area where leakage of the unit or connections will not result in damage to the area adjacent to the boiler or to lower floors of the structure. When such locations cannot be avoided, it is recommended that a suitable drain pan, adequately drained, be installed under the boiler. The pan must not restrict combustion air flow.**

CAUTION!!! **Installation location: The boiler must not be installed on carpeting.**

⚠ WARNING!!! **Defects: If you find any defects, you must inform the owner of the system of the defect and the associated hazard in writing. Failure to follow these instructions could result in excessive levels of carbon monoxide a fire or explosion which can cause severe personal injury or death!**

CAUTION!!! **In the event of a breakdown and/or malfunction of the boiler, contact a qualified installer and do not make any attempt to repair it. The boiler must be serviced exclusively by a Qualified installer using original spare parts. Failure to comply with this requirement may compromise the safety of the unit.**

⚠ WARNING!!! **When servicing boiler, to avoid electric shock, disconnect electrical supply before performing maintenance. Failure to do so can cause severe personal injury or death.**

SAFETY INSTRUCTIONS

⚠ WARNING!!! **When servicing boiler, to avoid severe burns, allow boiler to cool before performing maintenance. Failure to do so can cause severe personal injury or death.**

⚠ 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 follow these instructions can cause cause a fire or explosion causing property damage, 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'entretirn terminé.***

⚠ WARNING!!! **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. Failure to follow these instructions could result in severe personal injury or death!**

⚠ WARNING!!! **Should overheating occur or the gas supply fail to shut off, do not turn off or disconnect electrical supply to circulator. Instead, turn off the manual gas shut-off valve external to the appliance. Failure to follow these instructions could result in fire or explosion which can cause severe personal injury or death!**

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

⚠ WARNING!!! **Do not use this appliance if any part has been under water. Immediately call a licensed authorized technician to inspect the appliance and to replace any part of the control system and any gas control, which has been under water. Failure to do so can cause severe personal injury or death.**

⚠ *ATTENTION!!!* ***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.***

⚠ WARNING!!! **Ensure the boiler and its controls are protected from dripping or spraying water during normal operation or service. Failure to do so can cause severe personal injury or death.**

NOTICE! When calling or writing about the boiler – Please have the boiler model and serial number from the boiler rating plate.

NOTICE! Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.

⚠ WARNING!!! **Only use the boiler in the combinations and with the accessories and spares listed in this manual. Failure to do so can cause severe personal injury or death.**

⚠ WARNING!!! **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 or death!**

CAUTION!!! **Do not use "homemade cures" or "boiler patent medicines". Serious damage to the boiler, personnel, and/or property may result.**

CAUTION!!! **Do not use petroleum-based cleaning or sealing compounds in the boiler system. Gaskets and seals in the system may be damaged. This can result in substantial property damage.**

NOTICE! The manufacturer declines all liability, contractual or otherwise (warranty included), for any damage to people, animals property or this same appliance, caused by:

a) - incorrect installation;
b) - failure to comply with this or any other instruction provided by the manufacturer;
c) - failure to comply with the applicable local and/or national regulations in force;
d) - incorrect use of this appliance
e) - inadequate or incorrect service
f) - inadequate or incorrect maintenance.

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1 - CODE REQUIREMENTS

1.1 - Regulations and guidelines

- 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;***

- the latest edition of the ***National Electric Code ANSI/NFPA 70*** and or ***Canadian Electrical Code Part 1 CSA C22.1.***

- 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***

- ***California Proposition 65*** lists chemical substances known to the state to cause cancer, birth defects, death, serious illness or other reproductive harm. This product may contain such substances, be their origin from fuel combustion (gas, oil) or components of the product itself.
Slant/Fin boiler complies with the State of California Lead Law (AB1953).

NOTICE!
Install CO detectors per local regulations.

NOTICE!
This appliance meets the safety and other performance requirements as specified in ANSI Z21.13 standard.

NOTICE!
Per DOE mandate, the operator control incorporates an automatic means (outdoor reset) of adjusting the boiler water temperature for hot water heating. The boiler must operate with the automatic means enabled.

NOTICE!
In accordance with Section 325 (f)(3) of the energy policy and conservation Act, this boiler is equipped with a feature that saves energy by reducing the boiler water temperature as the heating load decreases.

1.2- Commonwealth of Massachusetts Installation Requirements

In the Commonwealth of Massachusetts, the installation must be performed by a licensed plumber or gas fitter.

⚠ WARNING!!! Improper venting can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

(a) For all side wall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade, in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

1. INSTALLATION OF CARBON MONOXIDE DETECTORS. At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gasfitter shall observe that a hard wired carbon monoxide detector with an alarm and battery back-up is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gasfitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equip-ment. It shall be the responsibility of the property owner to secure the services of qualified licensed professionals for the installation of hard wired carbon monoxide detectors.
   a. In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery back-up may be installed on the next adjacent floor level.
   b. In the event that the requirements of this subdivision can not be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirements; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.
2. APPROVED CARBON MONOXIDE DETECTORS. Each carbon monoxide detector as required in accordance with the above provisions shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.
3. SIGNAGE. A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than one-half (1/2) inch in size, **"GAS VENT DIRECTLY BELOW. KEEP CLEAR OF ALL OBSTRUCTIONS".**
4. INSPECTION. The state or local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08(2)(a)1 through 4.

(b) Exemptions

The following equipment is exempt from 248 CMR 5.08(2)(a) 1 through 4:

1. The equipment listed in Chapter 10 entitled "Equipment Not Required To Be Vented" in the most current edition of NFPA 54 as adopted by the Board; and
2. Product Approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure used in whole or in part for residential purposes.

(c) MANUFACTURER REQUIREMENTS - GAS EQUIPMENT - VENTING SYSTEM PROVIDED.

When the manufacturer of Product Approved side wall horizontally vented gas equipment provides a venting system design or venting system components with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

1. Detailed instructions for the installation of the venting system design or the venting system components; and
2. A complete parts list for the venting system design or venting system.

(d) MANUFACTURER REQUIREMENTS – GAS EQUIPMENT - VENTING SYSTEM NOT PROVIDED.

When the manufacturer of a Product Approved side wall horizontally vented gas fueled equipment does not provide the parts for venting the flue gases, but identifies "special venting systems", the following requirements shall be satisfied by the manufacturer:

1. The referenced "special venting system" instructions shall be included with the appliance or equipment installation instructions; and
2. The "special venting systems" shall be Product Approved by the Board, and the instructions for that system shall include a parts list and detailed installation instructions.

(e) A copy of all installation instructions for all Product Approved side wall horizontally vented gas fueled equipment, all venting instructions, all parts lists for venting instructions, and/ or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

2 - GENERAL INFORMATION

2.1 - Key to symbols used

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

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

NOTICE! Indicates special instructions on installation, operation, or maintenance that are important but not related to personal injury or property damage.

☞ Important indication symbol

2.2 - Manufactured by

See last page of the present manual

2.3 - Description of models:

XXX XXXA

A = Tankless fully modulating gas fired hot water boiler (Wall hung installation).

90 = maximum input of 90,000 Btu/hr (26,40 kW).
130 = maximum input of 130,000 Btu/hr (38,1 kW)).
150 = maximum input of 150,000 Btu/hr (44 kW)).
199 = maximum input of 198,000 Btu/hr (58 kW).
250 = maximum input of 250,000 Btu/hr (73,2 kW).

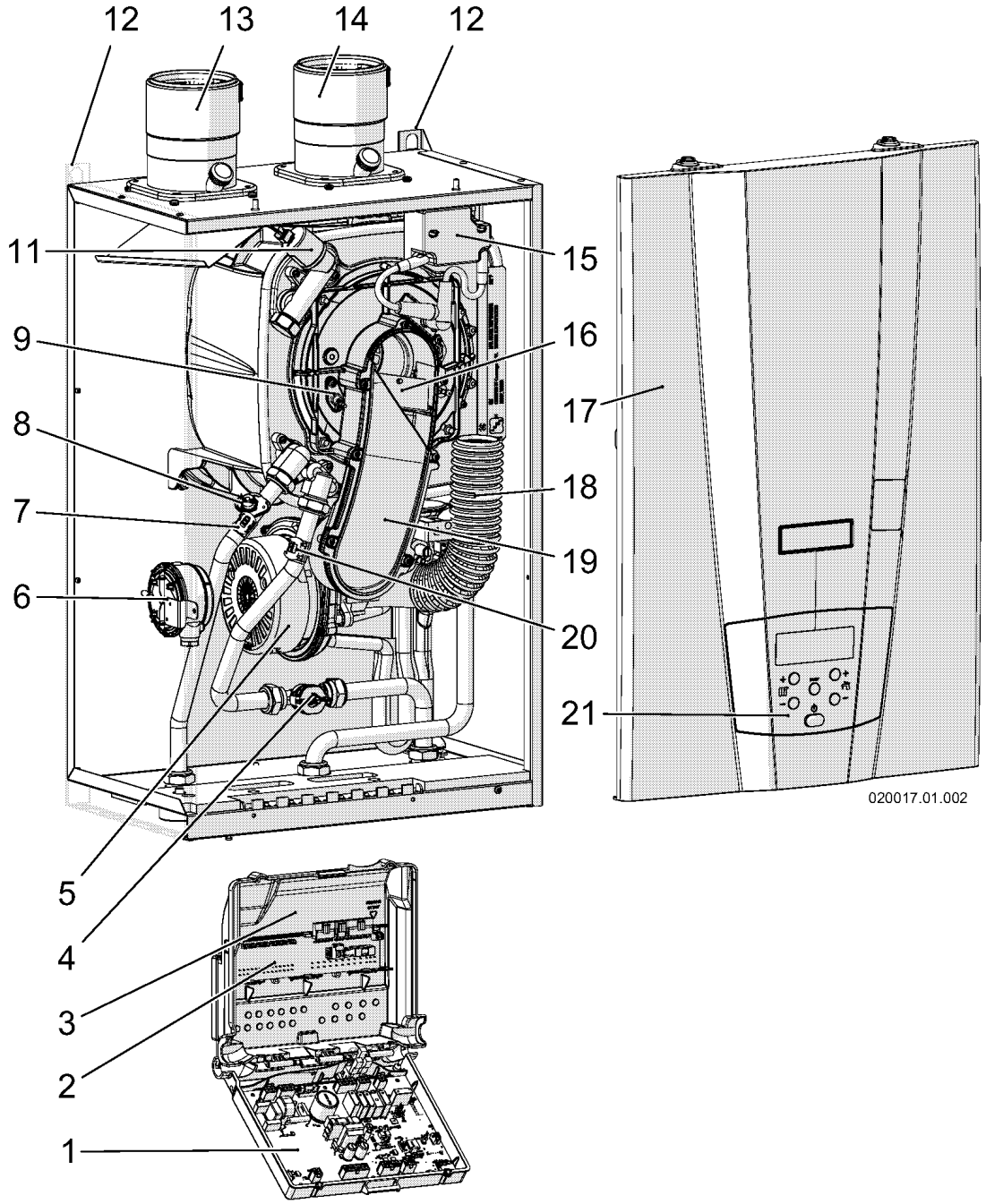
XXX = Manufacturer's reference of fully modulating, gas-fired, condensing hot water boiler

2.4 - Accessories included

This appliance is equipped with the following accessories:

Quantity	Description	Part number	Figure
1 of these kit depending on model	NAT to LP gas conversion kit for model 90A	62630201	
	NAT to LP gas conversion kit for models 130A and 150A	62630202	
	NAT to LP gas conversion kit for model 199A	62630203	
	NAT to LP gas conversion kit for model 250A	62630204	
1	Outdoor sensor	62110067	
1	Wall bracket	60411149	
4	Screw for wall bracket	60801097	
1	30PSI ASME Relief valve	61205010	
2	Calibrated straight tube D.28 L150	60303009	
2	Nut CH46X17	60109011	
2	1"1/4 Gasket	60701007	

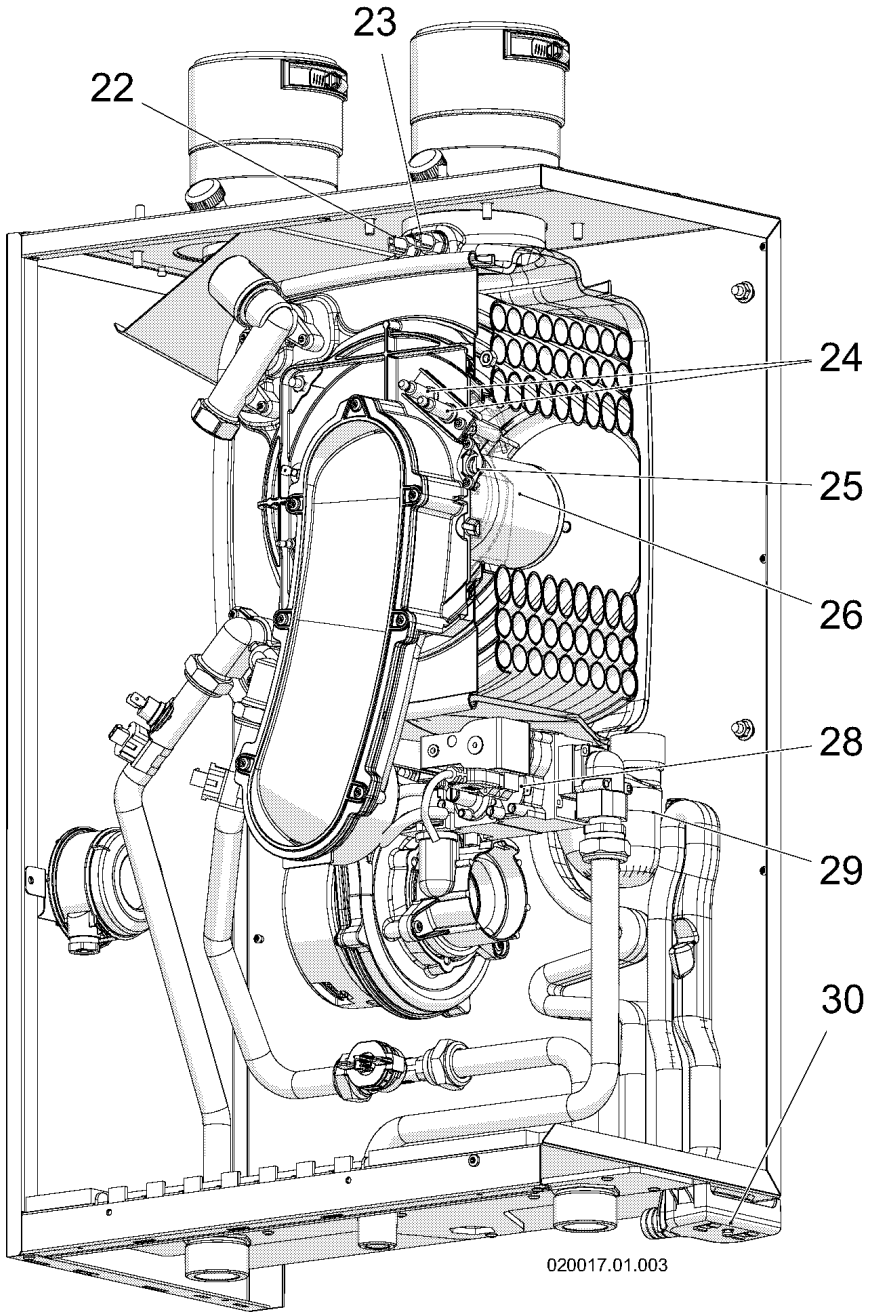
3 - MAIN COMPONENTS



1 - Power control board
2 - Connection board
3 - Electrical box
4 - Water flow meter
5 - Modulating Fan
6 - Flue blocked pressure switch
7 - Supply temperature sensor
8 - Hight Limit temperature switch
9 - Detenction electrode
10 - ----------
11 - Water pressure sensor
12 - Wall bracket mounting tabs
13 - Air intake
14 - Flue gas discharge
15 - Spark Generator
16 - back flue preventer
17 - Front Cover
18 - Air intake silencer
19 - Air/gas manifold
20 - Return temperature sensor
21 - Control panel

Figure 3-1 Main components for models 90A

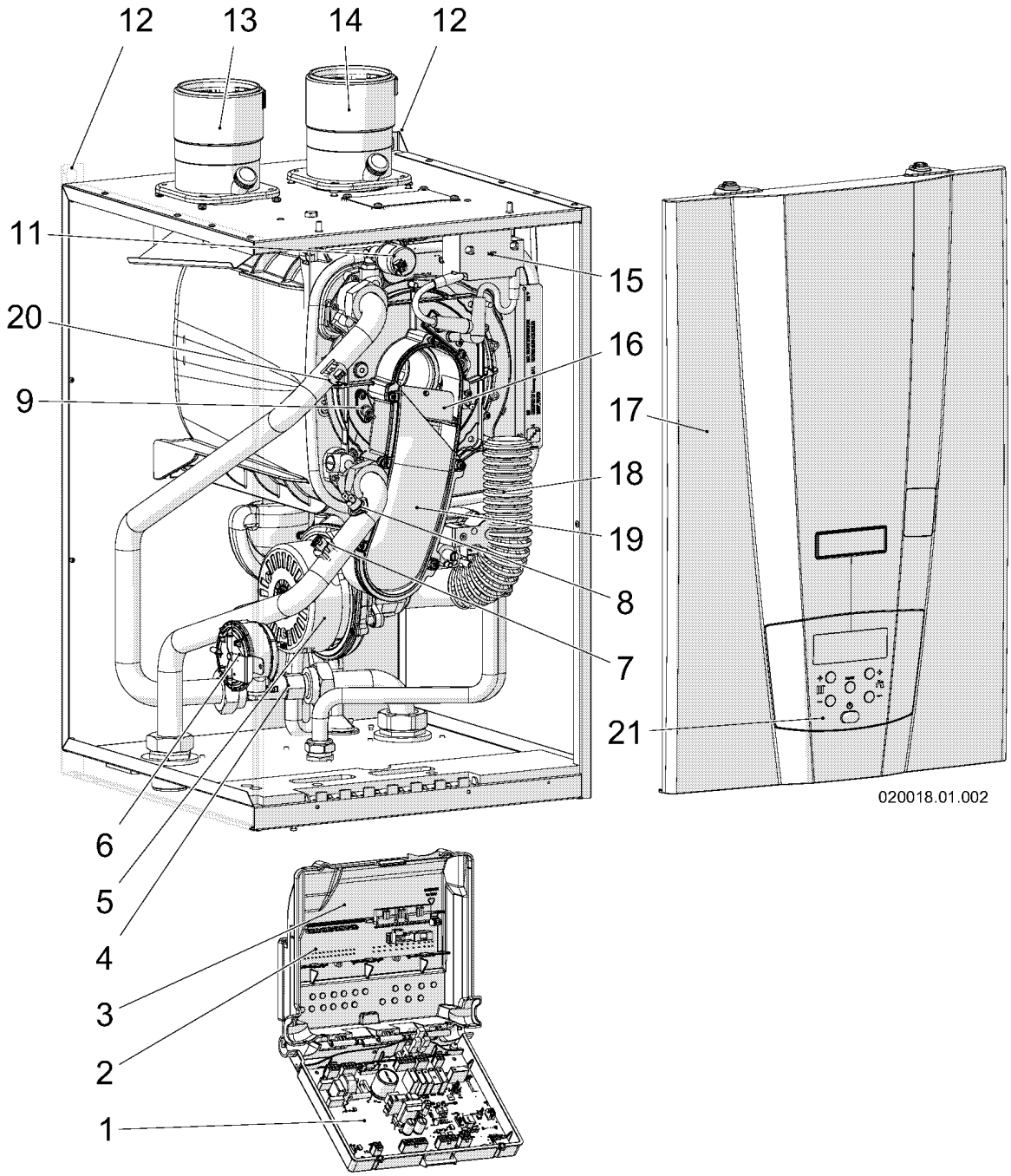
3 - MAIN COMPONENTS



22 - Flue gas temperature sensor (Blue color connector)
23 - High limit flue gas temperature fuse (Red color connector)
24 - Ignition electrodes
25 - Sight glass
26 - Burner surface
27 - ----------
28 - Gas valve
29 - Condensate trap
30 - Condensate collection tub

Figure 3-2 Main components for models 90A

3 - MAIN COMPONENTS



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11 - Water pressure sensor
12 - Wall bracket mounting tabs
13 - Air intake
14 - Flue gas discharge
15 - Spark Generator
16 - Flue gas check valve
17 - Front Cover
18 - Air intake silencer
19 - Air/gas manifold
20 - Return temperature sensor
21 - Control panel

Figure 3-3 Main components for models 130A, 150A, 199A and 250A

3 - MAIN COMPONENTS

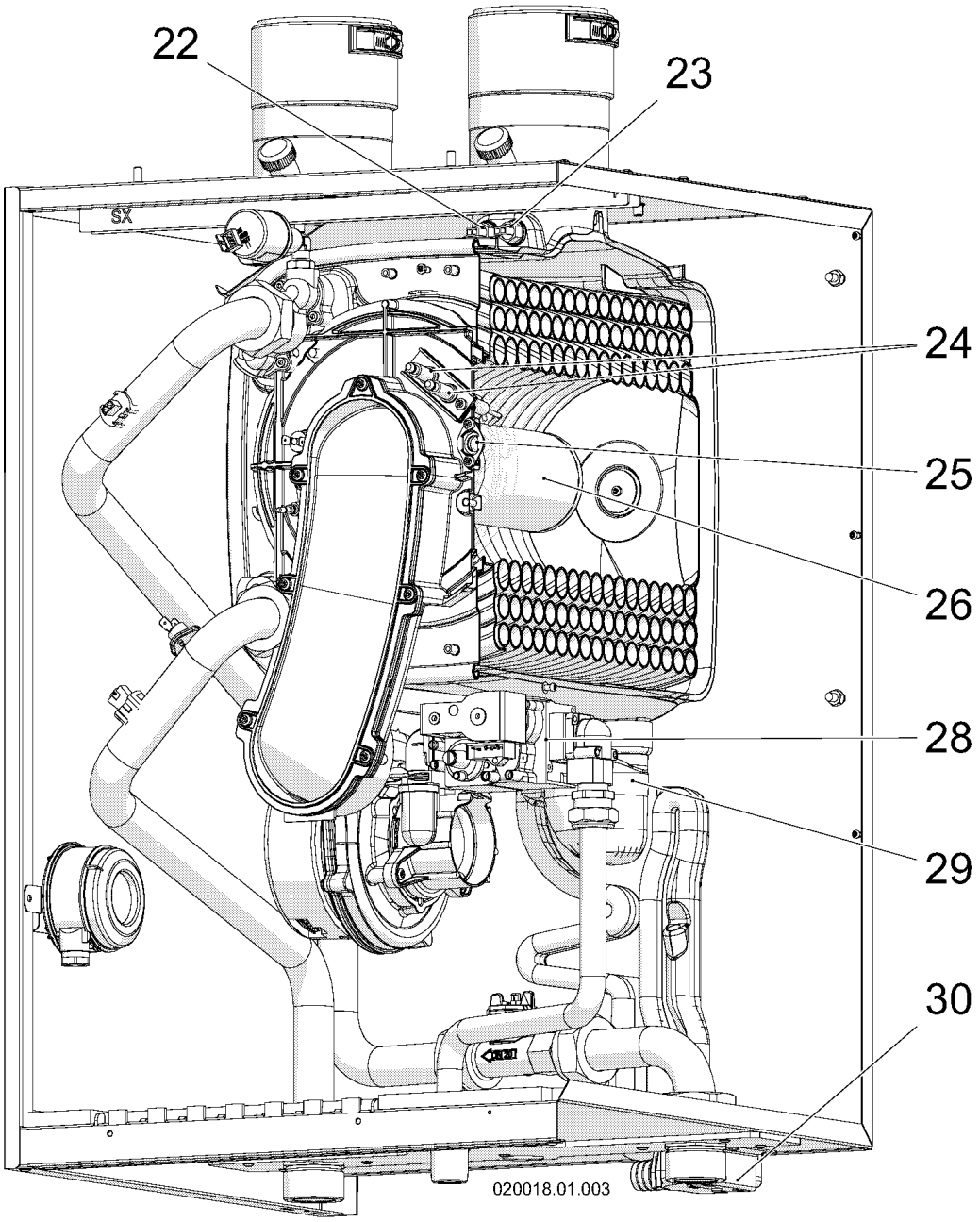

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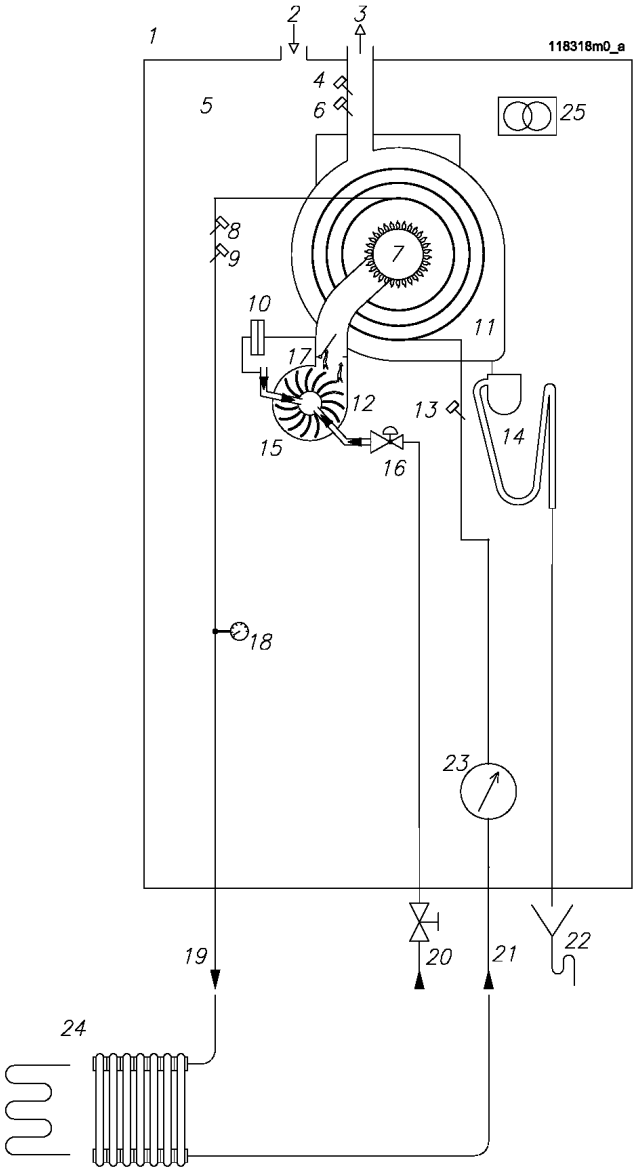
Figure 3-4 Main components for models 130A, 150A, 199A and 250A

4 - FUNCTION OVERVIEW



Key to figure 4-1:

1 - Boiler
2 - Air inlet
3 - Flue exhaust
4 - High limit flue gas temperature fuse
5 - Sealed air box
6 - Flue gas temperature sensor
7 - Premix burner
8 - Supply temperature sensor
9 - High limit supply temperature switch
10 - Blocked flue pressure switch
11 - Heat exchanger
12 - Modulating PWM fan
13 - Return temperature sensor
14 - Condensate trap
15 - Air/gas mixer
16 - Gas valve
17 - Flue gas check valve
18 - Water pressure sensor
19 - Heating supply
20 - Gas inlet
21 - Heating return
22 - Condensing drain
23 - Water flow meter
24 - Heating system
25 - Spark generator

Figure 4-1 - Hydronic functional schematic

4 - FUNCTION OVERVIEW

4.1 - Intended use and functions

The boiler is designed to be used for central heating systems for residential and light commercial use. Any other use is prohibited.
The boiler can be installed with a Direct Vent system or with a one pipe vent system using room air.
The boiler can be connected to an indirect water heater for the production of domestic hot water (Section 7.2.6).
The boiler can provide supply water to the heating system between 68F and 176F.
When connecting the boiler to the heating system the installer must consider the head loss of the boiler (see Figure 7-3) and the head loss of the heating system adequately size pumps.
Boiler can be connected to a room thermostat, Section 9.1.2.
An outdoor air temperature sensor must be connect to the boiler for the outdoor reset functionality of the control to operate. Using outdoor reset allows the boiler to operate at the highest efficiency (see Section 9.1.3). In this configuration the room thermostat will compensate by adjusting the room temperature.

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

4.2 - Thermal efficiency up to 98%

When the outdoor reset is activated (an outdoor sensor is connected), the boiler 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 4-2 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.

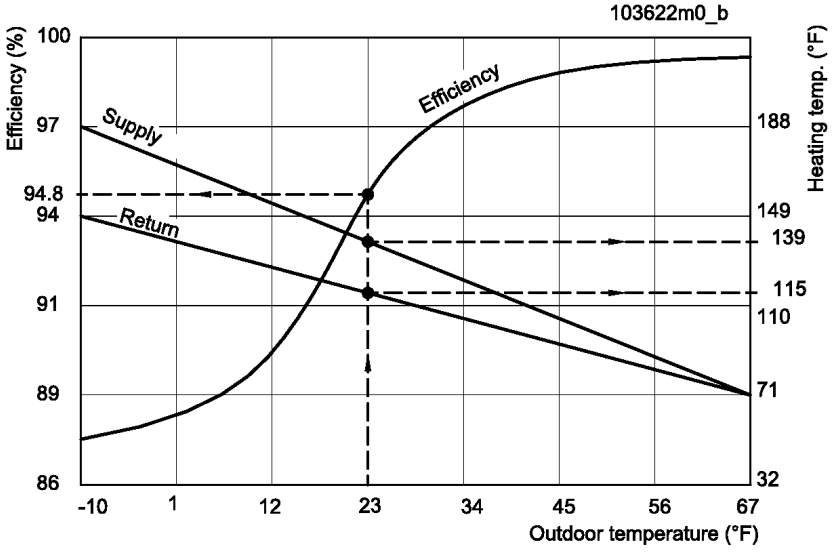


Figure 4-2 Outdoor reset control to optimize the efficiency

5 - INSTALLATION - Location

5.1 - Choosing the installation location

⚠ WARNING!!! **Do not store any flammable materials or liquids in the immediate vicinity of the boiler. A fire or explosion can result, causing severe personal injury, death, or substantial property damage.**

⚠ WARNING!!! **If the boiler is installed on a wall, this must be vertical and constructed to bear the boiler's weight or the boiler and building may damaged causing severe personal injury, death, or substantial property damage.**

⚠ WARNING!!! **Do not install the boiler on carpeting. Fire can result, causing severe personal injury, death, or substantial property damage.**

⚠ WARNING!!! **Provisions for combustion air and ventilation of the boiler room are always required, regardless whether the combustion air is taken from the outside (Direct Vent, sealed combustion) or inside (room air for combustion). Failure to comply with this provision could result in excessive levels of carbon monoxide or a fire, which can result in severe personal injury or death!**

⚠ WARNING!!! **Insufficient ventilation of the boiler room can lead to high air temperatures. Failure to comply with this provision could result in excessive levels of carbon monoxide or a fire, which can result in severe personal injury or death!**

⚠ WARNING!!! **Make sure that intake and exhaust openings are sufficiently sized and no reduction or closure of openings takes place. When the problem is not resolved, do not operate the boiler. Please note these restrictions and its dangers to the operator of the boiler. Failure to comply with this provisions could result in severe personal injury, death, or substantial property damage.**

⚠ WARNING!!! **LIQUEFIED PETROLEUM (L.P.) PROPANE GAS-FIRED BOILER LOCATION REQUIRES SPECIAL ATTENTION: 1994 UNIFORM MECHANICAL CODE, section 304.6: "LPG Appliances. Liquefied petroleum gas-burning appliances shall not be installed in a pit, basement or similar location where heavier-than-air-gas might collect. Appliances so fueled shall not be installed in an abovegrade under-floor space or basement unless such location is provided with an approved means for removal of unburned gas." Failure to comply with this provision could result in and explosion that can cause severe personal injury, death, or substantial property damage.**

CAUTION!!! **This boiler is not designed for direct outdoor installation. 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 or temperature that exceed 100°F (38°C). Failure to properly locate this boiler can result in premature failure.**

CAUTION!!! **This boiler must be installed in a location so that any water leaking from the boiler or piping connections or relief valve openings will not cause damage to the area surrounding the unit or any lower floors in the structure.**

CAUTION!!! **When installed in a room with thin walls or a thin floor, resonating noise may occur. Install noise reducing parts if required.**

CAUTION!!! **Do not allow too much dust to collect on the boiler.**

5.1.1 Location of a boiler

When locating the boiler the following factors must be considered:

- ☞ location of the openings for the ventilation of the boiler room regardless whether the combustion air is taken from the outside (Direct Vent, sealed combustion) or inside (room air for combustion).;
- ☞ location of vent and air intake terminals;
- ☞ connection to the gas supply;
- ☞ connection to the water supply;
- ☞ connection to the heating system;
- ☞ connection to the electrical supply;
- ☞ disposal of the condensation produced by the boiler;
- ☞ connection to the room thermostat or equivalent device;
- ☞ piping of the safety relief valve discharge;
- ☞ connection of the outdoor temperature sensor;
- ☞ possible connection of an indirect water heater.
- ☞ If flooding is possible, elevate the boiler sufficiently to prevent water from reaching the boiler

5 - INSTALLATION - Location

5.2 - Residential garage installation

Take the following precautions when installing the boiler in a residential garage. If the boiler is located in a residential garage, it should be installed in compliance with the latest edition of the National Fuel Gas Code, ANSI Z223.1 and/or CAN/CGA-B149 Installation Code.

☞ Appliances located in residential garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling shall be installed not less than 18 inches (46 cm) above the floor.

☞ The appliance shall be located or protected so that it is not subject to physical damage by a moving vehicle.

5.3 - Closet and alcove installations

This boiler is approved for the installation in an alcove or in a closet, adhere to the following rules and regulations regarding clearances, ventings, ventilation openings as per this manual and the National Fuel Gas Code, ANSI Z223.1 /NFPA 54 and/ or CAN/CSA B149.1, Natural Gas and Propane Installation Code.

⚠ WARNING!!! Do not use PVC pipe material into a closet or alcove. Failure to follow this warning could result in excessive levels of carbon monoxide or a fire, which can cause severe personal injury or death!

5.4 - Clearances for installation and servicing

Figure 5-2 shows the minimum clearances required for installation and servicing.

NOTICE! Service clearances are not mandatory, but are recommended to ensure ease of service should it be required.

5.5 - Clearances from combustible material

This boiler may be installed directly onto a wall of combustible material. See also Figure 5-1 for other clearances from combustible materials

5.6 - Vent and combustion air piping

This boiler requires a special vent system, designed for pressurized venting.
The boiler is to be used for either direct vent installation or for installation using room combustion air. When room air is considered see Section 10.10.
Vent and air may be vented vertically through the roof or out a side wall, unless otherwise specified. You may use any of the vent/air piping methods covered in Section 10.

⚠ WARNING!!! Do not attempt to install the boiler using any other venting / air intake methods than that explained on Section 10. Failure to follow this warning could result in excessive levels of carbon monoxide or a fire, which can cause severe personal injury or death!

Be sure to locate the boiler such that the vent and air piping can be routed through the building and properly terminated.
The vent/air piping lengths, routing and termination method must all comply with the methods and limits given in Section 10.

MINIMUM CLEARANCES FROM COMBUSTIBLE MATERIALS		SUGGESTED SERVICE
Ceiling	2 inches (51 mm)	11.81 inches (300 mm)
Front	2 inches (51 mm)	23.62 inches (600 mm)
Rear	0 inches (0 mm)	0 inches (0 mm)
Sides	2 inches (51 mm)	3.93 inches (100 mm)
Floor	2 inches (51 mm)	11.81 inches (300 mm)
Concentrinc vent	0 inches (0 mm)	1/2 inch (13 mm)
Split vent (two pipes), first 3 ft from the appliance	1 inch (25 mm)	1 inch (25 mm)
Split vent (two pipes), after 3 ft from the appliance	1/4 inches (7 mm)	1 inch (25 mm)
Supply and return piping	1/4 inches (7 mm)	1 inch (25 mm)

Figure 5-1; Clearances from combustible material

5.7 - Prevent combustion air contamination

Install air inlet piping for the boiler as described in Section 10. Do not terminate vent/air in locations that can allow contamination of combustion air. Refer to Section 10.2, for products and areas which may cause contaminated combustion air.

⚠ WARNING!!! Ensure that the combustion air will not contain any of the contaminants listed in Section 10.2. Contaminated combustion air will damage the boiler, resulting in possible severe personal injury, death or substantial property damage.

5.8 - Transporting the boiler

⚠ WARNING!!! Always lift and carry the boiler with a hand truck or special equipment. Failure to comply with this provisions could result in severe personal injury or death.

CAUTION!!! The boiler may be damaged when it is improperly secured and transported.

CAUTION!!! The unpacked boiler may be damaged when not protected against contamination

- ☞ Only transport the boiler using the right transportation equipment, such as a hand truck with a fastening belt or special equipment for maneuvering steps.
- ☞ During transportation the boiler must be secured on the transportation equipment to prevent it from falling off.
- ☞ Protect all parts against impacts if they are to be transported.
- ☞ Observe the transportation markings on the packaging.
- ☞ Leave the protective covers on the connections.
- ☞ During transportation cover the flue gas and air intake connections at the top of the boiler with plastic film

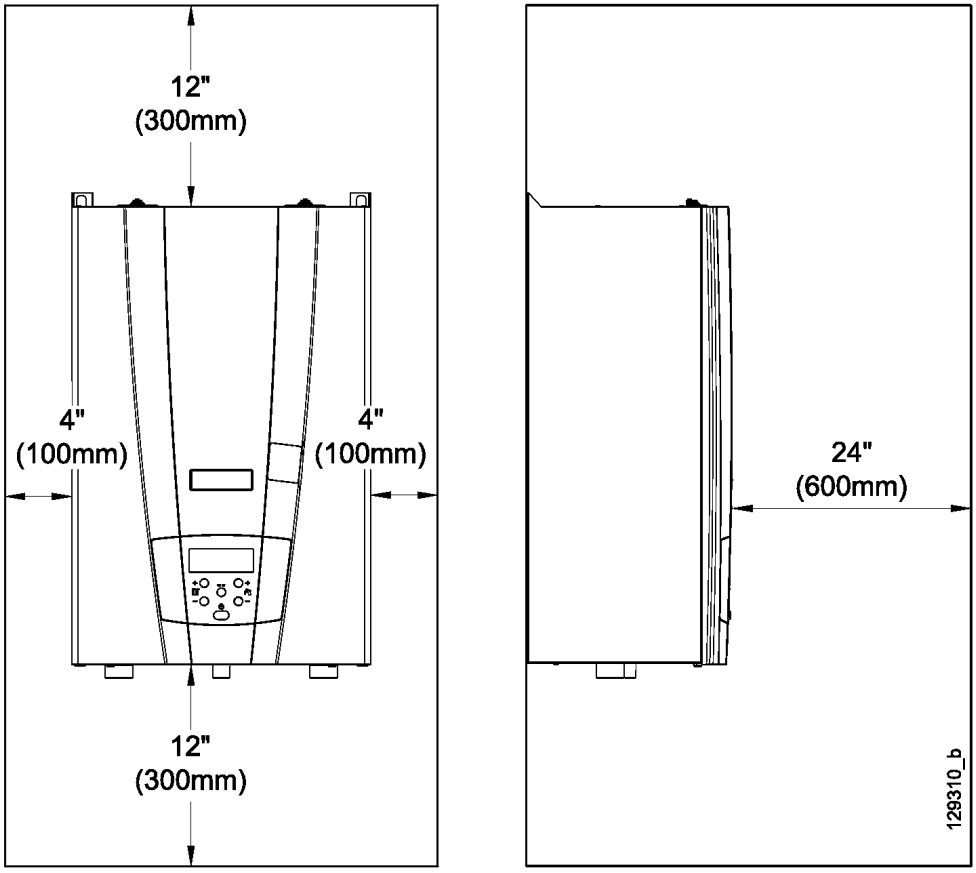


Figure 5-2 Recommended minimum clearance distances for proper installation and servicing

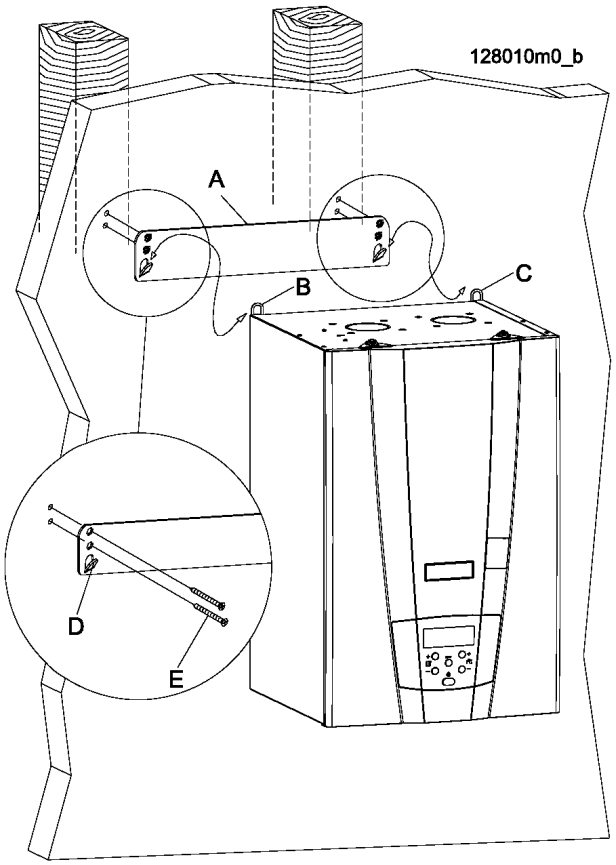
6 - INSTALLATION - Mounting the boiler

6.1 - Mounting the boiler

Refer to Figure 6-1:

WARNING!!! 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 causing severe personal injury, death, or substantial property damage.

1. mark the screw holes for the wall bracket, “A”;
2. install the wall bracket “A”, using the screws “E”, provided;
3. hang the boiler on the wall bracket, “A”, by hanging connections “B” and “C” on tabs “D”.

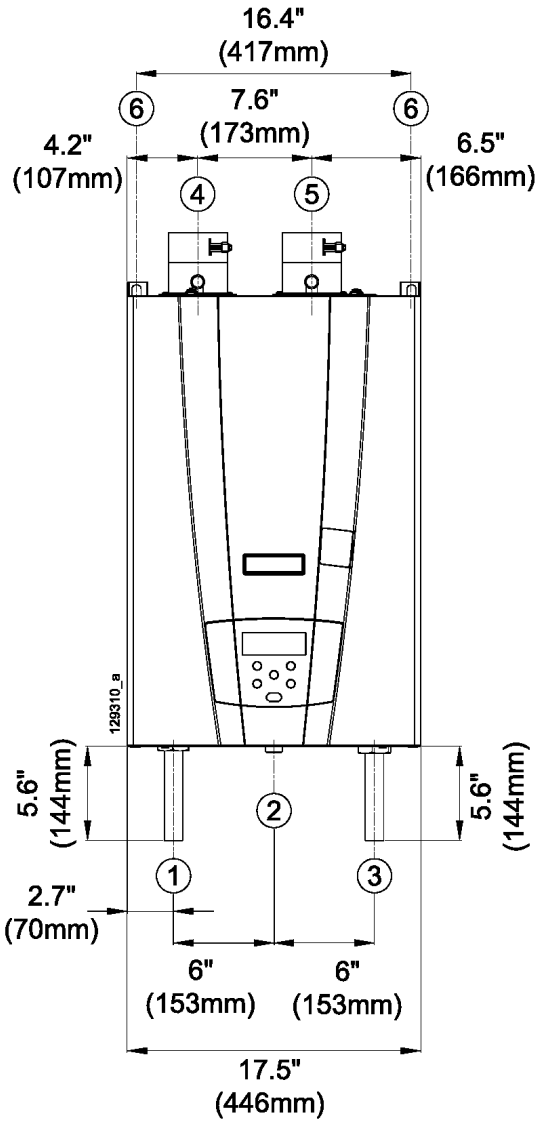


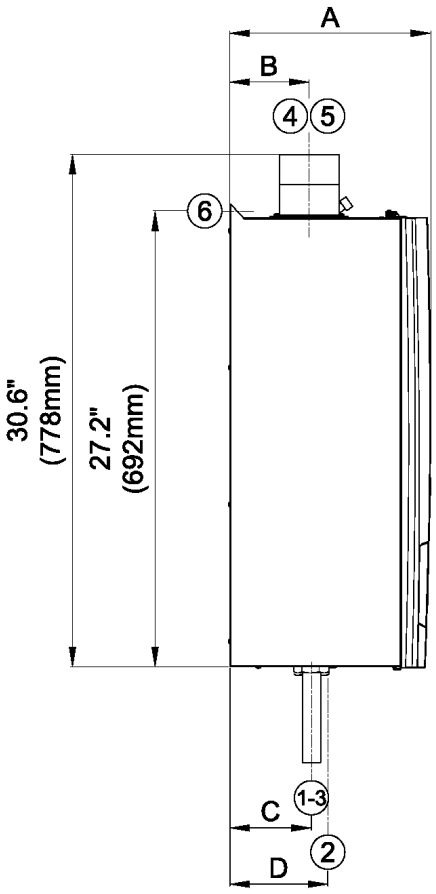
A = wall bracket
B = boiler support
C = boiler support
D = tabs for hanging boiler
E = Self tapping screws

Figure 6-1 Wall bracket installation

6.2 - Dimensions

Figure 6-2 report all dimensions of each boiler model.





1 - Heating supply connection (1")
2 - Gas inlet (3/4")
3 - Heating return connection (1")
4 - Air intake connection (3")
5 - Flue discharge connection (3")
6 - positions for boiler support

REF	MODELS				
	90A	130A	150A	199A	250A
A	12 inch (305 mm)	19 inch (484 mm)			
B	4,7 inch (120 mm)	7 inch (175 mm)			
C	5 inch (127 mm)	5 inch (127 mm)			
D	6 inch (152 mm)	8 inch (203 mm)			

Figure 6-2 Dimensions.

7 - INSTALLATION - boiler water connection

7.1 - Boiler and system Water quality

7.1.1 Boiler water chemistry

CAUTION!!! Risk of system damage due to unsuitable heating system water. If the heating water is not within the requirements outlined in this section, the system water must be separated from the boiler water by a plate heat exchanger able to resist the corrosion. Unsuitable heating system water promotes lime scale fouling, corrosion and deposits formation. This can result in boiler damage and malfunction.

Scale and Corrosion
Free oxygen can cause the formation of rust (iron oxides), which degrade metallic materials.
Magnetite is formed in un-inhibited water if there is electrolytic action in the presence of oxygen.
Sludge is formed when calcium compounds, primarily CaCO3, are heated. Rust and magnetite, when combined with sludge, can form a very hard scale, which significantly reduces system efficiency and life expectancy of the heating system. Scale reduces heat exchange due to its low heat conductivity and so may cause very dangerous localized overheating. Waterside corrosion of all heating circuit surfaces is also a major concern.

Make-up or Feed Water Quality
Make-up or feed water is water added to a closed hydronic system to replenish water lost through evaporation, maintenance, or leakage. The quality of make-up or feed water, which may contain dissolved oxygen, minerals and other dissolved contaminants, is extremely important. Makeup feed water must be limited to less than 5% of the total system volume per year. If 5% or more makeup water is require on an annual basis this water must be treated to prevent scale build and the introduction of oxygen into the system.

Treating Water to Prevent Freezing
When using anti-freeze solutions, their compatibility with the heat exchanger and other components of the heating system must be determined prior to use. If a glycol solution is used as anti-freeze protection, a backflow preventer must be installed upstream of the fill/makeup valve.
Only virgin propylene glycol should be used for systems requiring freeze protection, and it must be treated with an inhibitor compatible with the particular chemical treatment being used in the system. Note: The ph of the glycol water mixture in the system must be checked on a yearly basis. Follow the glycol manufacturer's guidelines for replacing the glycol in the system. Also if the ph of the glycol water mixture in the system is outside the range allowed for the boiler 7.5 to 9.5 the system must be treated or the glycol water mixture must be changed. Use only inhibited propylene glycol solutions, formulated for hydronic systems. Ethylene glycol is toxic and can attack gaskets and seals used in hydronic systems and is prohibited from use with the boiler.

⚠ 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.

⚠ WARNING!!! Use only inhibited propylene glycol solutions, which are specifically formulated for hydronic systems. Ethylene glycol is toxic and can attack gaskets and seals used in hydronic systems. Failure to comply with this provisions could result in severe personal injury, death or substantial property damage.

Water Treatment Certification
When using chemical treatments in hydronic systems, it is necessary to ensure that the chosen treatment is appropriate and certified by the manufacturer for such environments. The manufacturer should also guarantee that the treatment, when applied according to the manufacturer's recommendations, will not cause harm to the boiler, pumps, piping, and other components of the hydronic boiler system.

7.1.2 Testing and maintenance of water quality

Water in the installation should be checked, monitored, and treated for the following conditions and characteristics:

- **Hardness** – High hardness of the available water is measured in grains of hardness and indicates the quantity of minerals (mostly calcium and magnesium) which are dissolved in the water. Hardness substantially contributes to the formation of scaling, which is highly undesirable. The total hardness must be less than 200 ppm total dissolved solids (TDS).
- **Artificial Softness** – Do NOT use artificially softened water. Artificial softening agents generally use salt, which creates a chloride water chemistry, a major contributor to the corrosion of the types of metals used in hydronic systems. Elevated salt levels also contribute to higher conductivity levels, another undesirable characteristic in hydronic systems.
- **Chloride** – Concentrations of chlorides in system water should be less than 150 ppm.
- **Conductivity** – Dissolved metals and minerals increase the conductivity of water and indicate the presence of corrosive agents, which can lead to fouling in the system. Additionally, high conductivity contributes to galvanic corrosion. Conductivity should be less than 3000 µS.
- **pH** – The pH, a measure of the acidic, neutrality, and alkalinity of the water, must always be between 7.5 and 9.5.

☞**Oxygen** – All precautions should be taken to avoid the formation and localization of oxygen in the water of a heating system. Water that is low in minerals (soft water) absorbs oxygen much more readily than mineralized (hard) water. For this reason it is necessary that in heating systems using floor radiant heating, the plastic pipes used be impermeable to oxygen.

☞**Scale and Corrosion** – The use of an inhibitor is advisable to treat feed and make-up water and to protect heating systems against scale, corrosion and microbiologic growth. To prevent freezing, the use of an anti-freezing agent together with the inhibitor is advisable. Qualified companies can also provide boiler de-scaling.

☞**Water treatment** is also advisable in the following cases:
- Very large heating systems
- High quantities of replenished water due to leakages or maintenance work

7.1.3 System flushing, treatment, and cleansing

Note that prior to cleaning the heating system, the boiler MUST be isolated from the piping to prevent introduction of containments, including sludge, into the boiler.

CAUTION!!! Cleaning solution and inhibitors used must be compatible with heat exchanger material. Corrosion/scale inhibitor will be ineffective if added to a dirty system; therefore, it is very important to clean the system first.

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

When cleaning, treating, and maintaining, a heating system, consult a qualified professional. The following are tips/guidelines for cleaning a heating system – these do NOT take precedence over detailed instructions from qualified professionals.

☞Make sure to use an appropriate amount of cleaning solution, carefully following the manufacturer's instructions. Follow the chemical manufacturer's recommendations when introducing cleaning agents into the system.

☞Ensure that the cleaning solution is circulated thoroughly in the system.

☞Flush the system thoroughly to remove the maximum amount of contaminants. When emptying the system, make sure it is done as quickly as possible using all drain off points and ensuring all low lying pipework is fully drained. Opening all bleed valves ensures the system will be completely emptied.

☞A reliable test to determine if a system is clean is if the Total Dissolved Solids (TDS) of the water being drained is within 10% of the make-up water TDS. This indicates that sufficient contamination has been flushed from the system. If the difference in TDS is more than 10%, it is recommended to repeat the cleaning process until that is achieved. A turbidity test can be used as an alternate way to determine if a system is clean.

☞For boiler retrofit/replacement installation, it will be necessary to repeat the cleaning process until the draining water appears to be clear. Once clear, the above TDS comparison (or a turbidity test) should be performed.

☞If a flushing machine is used in the cleaning process, carefully follow the manufacturer's instructions. If the flushing machine is designed to flush individual zones, the TDS comparison must be made between each zone and the make-up water, or the turbidity test performed for each zone.

☞Add corrosion and scale inhibitor after the system has been declared clean, using the appropriate amount recommended by the manufacturer. Introduce the protector/scale inhibitor to the system following the chemical treatment manufacturer's instructions. Adding inhibitor to a dirty system reduces its effectiveness. When refilling the system, ensure the boiler is not air-bound by opening the pressure-relief valve. Leave the relief valve open until a steady flow of water is observed. Close the valve and finish filling the system.

7.1.4 Water Quality Maintenance and Warranty

Heat exchanger failures due to improperly cleaned/treated and poorly maintained water are not covered under warranty. Scheduled system/ boiler water maintenance is required to maintain the heat exchanger warranty. Boiler manufacturer shall reserve the right to require maintenance records when evaluating warranty claims.

7.1.5 Water Treatment Analysis and Scheduling

The proper mixture of water, chemical treatment, and glycol (if used) should be ascertained based on a sample of the system water and the make-up water. Your local water treatment company, may analyze your sample. Adjust the chemical composition of your system water based on the analysis. After this initial analysis, the chemical composition of your system water should be tested at the beginning of each heating season. For boilers operating year round, this analysis should be made at least twice a year.

7 - INSTALLATION - boiler water connections

7.2 - Supply and return piping

The boiler is supplied with an ASME safety relief valves set at 30 PSI *(2 bar)* that must be installed at the time of the boiler installation. However, this boiler can be equipped with relief valves set at maximum 50 PSI *(3,4 bar)* that is the maximum working pressure.

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.**

CAUTION!!! **The heating system must be designed so that no piping or radiation elements are higher than the corrispondent maximum pressure of the relief valve or else the hydraulic head of the system will cause the relief valve to open.**

CAUTION!!! **This boiler can supply heating water at a temperature up to 203°F (95°C) (setup of the safety high limit thermostat) and pressure of 50PSI (3,4 bar). If the heating system is built with materials not able to resist to this temperature and pressure, the qualified installer must supply and install a device that will shut-off the boiler before the system material's maximum operating temperature and pressure are met.**

CAUTION!!! **Do not use the boiler to directly heat domestic hot water, swimming pool or spa water.**

System water piping methods

This boiler is designed to function in a closed loop pressurized system no less than 15 psi (1 bar). Each boiler installation must have an air elimination device, which will remove air from the system. Install the boiler so the gas ignition system components are protected from water (dripping, spraying, etc.), during appliance operation for basic service of circulator replacement, valves, and others.

Low water cutoff device

On a boiler installed above radiation level, some states and local codes require a low water cutoff device at the time of installation.
The low water cutoff terminals are present within the line voltage junction box.

CAUTION!!! **This boiler is capable of servicing multiple temperature loop systems. It is the responsibility of the installer to protect the loops with lower temperature requirements from higher temperatures that may be required by other loops**

Floor radiant heating systems

Setting parameter 3015 (see Section 17), the boiler will maintain the maximum supply water temperature at that range temperature. No setting changes made from the control panel will cause the supply water temperature to exceed the maximum stated.

CAUTION!!! **In order to prevent damage to radiant heating systems ensure that an automatic safety shutoff device is installed that will limit the water temperature going to the radiant heating system.**

7 - INSTALLATION - boiler water connections

7.2.1 - Near boiler heating piping components

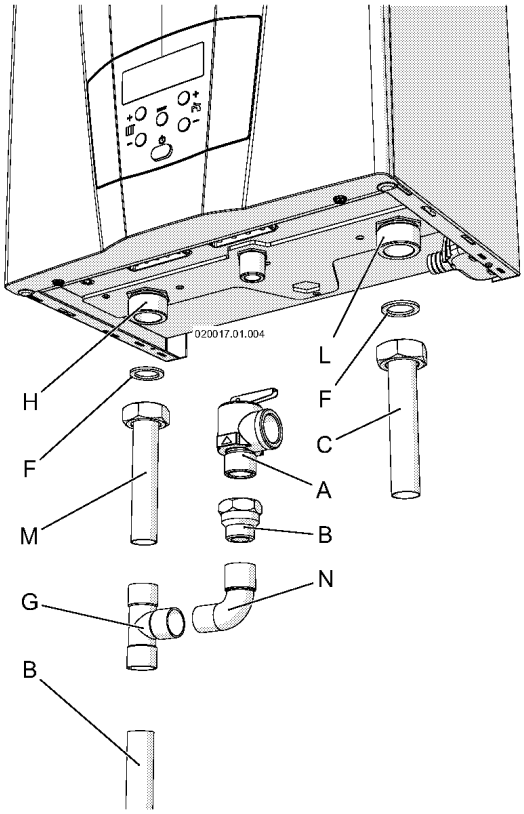
Primary secondary piping must be used at all times with this boiler. Failure properly size and install primary secondary piping may cause damage to the boiler. There are two standardized methods for primary secondary piping, the first is to use closely spaced tees (see figure 7-5). The second method is to use a third part hydraulic separator also called a low loss header.

1. Boiler system piping: boiler system piping MUST be properly sized. Reducing the pipe size can restrict the flow rate through the boiler, causing inadvertent high limit shutdowns and poor system performance.
2. Boiler system pump (local pump): Field supplied. The system pump MUST be sized to meet the specified flow requirements. See the sizing chart for pump sizing information.
3. Indirect water heater circulating pump: Field supplied. The pump MUST be sized to meet the specified flow requirements. Consult the indirect water heater operating guide to determine flow characteristics for the selected product used.
4. Boiler isolation valves: Field supplied. Full port ball valves are required. Failure to use full port ball valves could result in a restricted flow rate through the boiler.
5. Check valve: Field supplied. Check valves are recommended for installation as shown in Figure 7-5. Failure to install these valves could result in a reverse flow condition during pump(s) off cycle. Both the boiler loop pump as well as the indirect water heater pump should have integral check valves.
6. Domestic indirect hot water isolation valves: Field supplied. Full port ball valves are required. Failure to use full port ball valves could result in a restricted flow rate through the boiler.
7. If the boiler is connected to an indirect water heater for domestic hot water, an Anti-scald mixing valve (Field supplied) is highly recommended.
8. Unions: Field supplied. Recommended for unit serviceability.
9. Pressure relief valve: Factory supplied. The pressure relief valve is sized to ASME specifications (see also Section 7.2.2) and must be installed by the installer at the time of the boiler installation (follow Section 7.2.2).
10. Indirect water heater: field supplied. This boiler may be piped to an indirect water heater to heat domestic hot water with the space heat transfer medium. The indirect water heater is connected to the system supply piping. A pump controlled by the boiler's control will regulate the flow of water through the indirect water heater. The indirect water heater's temperature will be regulated by the boiler's control. The boiler is pre-configured to control the operation of the DHW pump with Domestic Hot Water Prioritization programming.
11. Dirt trap: Field supplied. A dirt trap is recommended on the system return to remove system particles from older hydronic systems and protect newer systems. **NOTICE!** Filter will be able to stops particles with an equivalent volume of a spheres with diameter of 0.04" (1mm);

CAUTION!!! **It is up to the installer to ensure the minimum system flow is not less than required at Section 15, header "Minimum water flow". If the flow is lower, the boiler automatically stops the burner.**

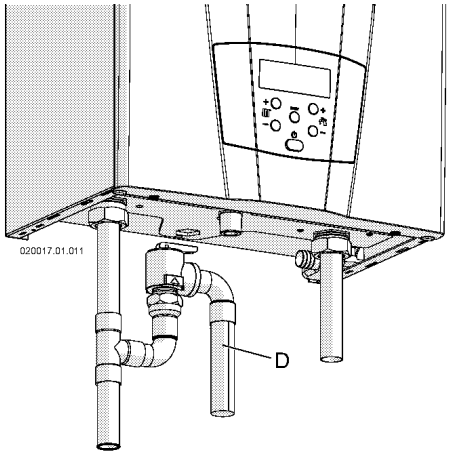
⚠ WARNING!!! **The National Standard Plumbing Code, the National Plumbing Code of Canada and the Uniform Plumbing Code limit the pressure of the heat transfer fluid to less than the minimum working pressure of the potable water system up to 30 psi maximum. Also, the heat transfer fluid must be water or other non-toxic fluid having a toxicity of Class 1, as listed in Clinical Toxicology of Commercial Products, 5th Edition. Failure to comply with this provisions could result in severe personal injury or death.**

7 - INSTALLATION - boiler water connections



A = ASME pressure relief valve (factory supplied)
B = Connection fitting
C = 1" Copper fitting (factory supplied)
F = 1 1/4" gasket (factory supplied)
G = Connection fitting
H = Supply connection
L = Return connection
M = 1" Copper fitting (factory supplied)
N = Connection fitting

Figure 7-1 Relief valve installation



D = Relief valve discharge piping

Figure 7-2 Pipe the discharge of the pressure relief valve

7.2.2 - Relief valve

This boiler is supplied with a Safety Relief valve that must be installed by the installer at the time of the boiler installation and in accordance with the ANSI/ASME Boiler and Pressure Vessel Code, Section IV.
To install the relief valve, you have to (make reference to Figure 7-1):

1 - Using gasket "F" connect fitting "M" to the boiler supply connection "H" with the intermediary of the gasket "F";
2 - install the tee "G" on the fitting "M";
3 - Install the elbow "N" on the tee "G";
4 - install the 3/4" female treaded fitting "B" on the elbow "N";
5 - Installa the relief valve "A" on the fitting "B";
6 - Connect the other fitting "C" to the return connection "L" with the intermediary of the gasket "F";

Pipe the relief valve discharge as shown in Figure 7-2 to prevent scalding in the event of a discharge. Provide piping that is the same size as the safety relief valve outlet.

⚠ WARNING!!! Failure to properly pipe the relief valve discharge can result in scalding of individuals and animals.

⚠ WARNING!!! 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!

⚠ WARNING!!! Never block or plug the outlet of the safety relief valve or an explosion causing extensive property damage, severe personal injury or death may occur!

7 - INSTALLATION - boiler water connections

7.2.3 - Expansion Tank and Makeup Water

Install an expansion tank. Ensure the expansion tank is properly sized for the boiler volume (See Section 15, header "Content of water") and the system volume, temperature and pressure.

CAUTION!!! **Undersized expansion tanks will cause system water to be lost through the pressure relief valve and cause additional makeup water to be added to the system. Eventual boiler failure can result due to this excessive makeup water addition, compromising the functionality of the unit.**

The expansion tank must be located as shown in Figure 7-5 when using a primary/secondary piping arrangement or as per recognized design methods. Refer to the expansion tank manufacturer instructions for additional installation details.
Connect the expansion tank to an air separator only if the air separator is located on the suction side (inlet) of the system circulator.
Always locate and install the system fill connection at the same location as the expansion tank connection to the system.

7.2.4 - Local boiler pump

The boiler is not supplied with a factory installed pump. The installer must field supply the correctly sized pump. To correctly size the pump for the boiler loop see figure 7-3 and the pump sizing table below. Piping information can be found in figure 7-5 and wiring information may be found in figure 9-3. The maximum amperage the pump may draw when directly connected to the boiler is 2.9, if a pump with 3 amps or greater is used and isolation relay must be placed between the pump and the boiler.

CAUTION!!! **It is up to the installer to ensure the minimum system flow at any time is not less than the value as stated into Section 15 header "Minimum water flow". If the flow is lower, the boiler automatically stops the burner.**

To connect a heating pump (CH pump) on the secondary loop see Figure 7-5 and electrically connect the pump on terminals as shown on Figure 9-3. A field supplied pump relay must be installed if the pump current draw is greater than 3 amps.

7.2.5 - Sizing heating system

Size the pump, piping and system components required in the space heating system, using recognized design methods.

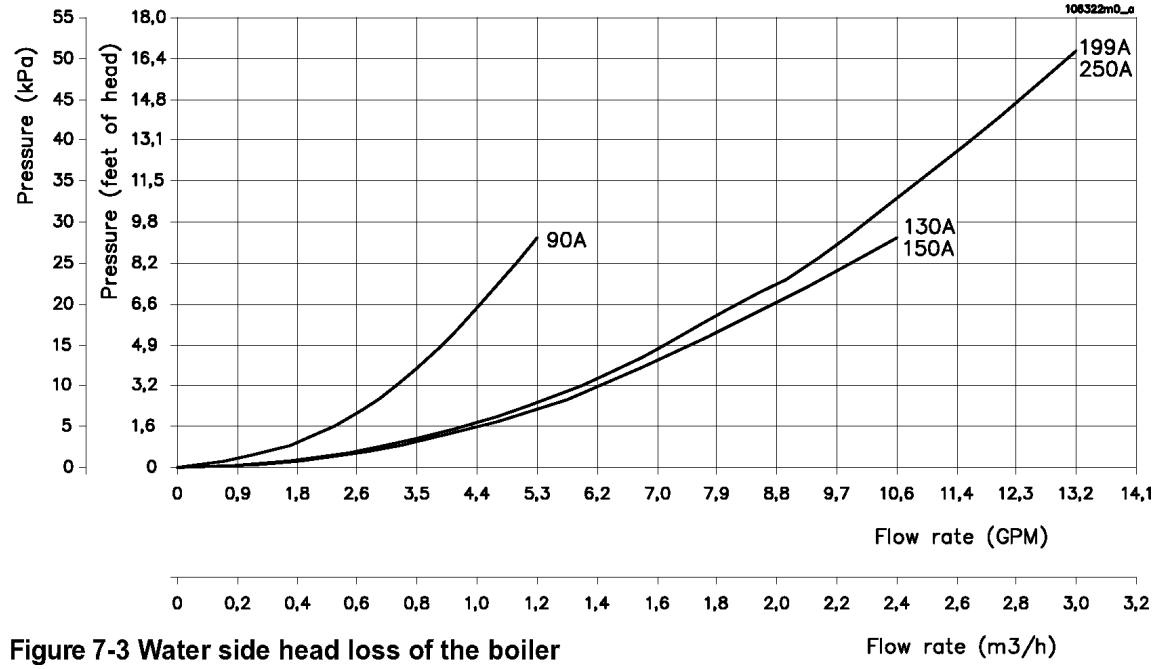


Figure 7-3 Water side head loss of the boiler

7 - INSTALLATION - boiler water connections

20°F ΔT System					
Boiler Model	GPM	Feet of Head	Grundfos Model	Taco pump Model	Wilo Model
90A	8	21,3	UPS26-99 (Speed 3)	0011	Star 30 F
150A	13	13	UPS26-99 (Speed 2)	0011	Star 17 FX
199A	18	28	UPS26-150 (Speed 3)	2450	Top-S 1.5x40
250A	22	NA	NA	NA	NA

25°F ΔT System					
Boiler Model	GPM	Feet of Head	Grundfos Model	Taco pump Model	Wilo Model
90A	7	17	UPS26-99 (Speed 2)	0014	Star 30 F
150A	11	11	UPS26-99 (Speed 2)	0012	Star 17 FX
199A	14	19	UPS26-99 (Speed 3)	0013	Top-S 1.25x25
250A	18	28	UPS26-150 (Speed 3)	2450	Top-S 1.5x40

30°F ΔT System					
Boiler Model	GPM	Feet of Head	Grundfos Model	Taco pump Model	Wilo Model
90A	5	9	UPS15-58 (Speed 2)	008	Star S 21 F
150A	9	7	UPS15-58 (Speed 3)	0010	Star S 21 F
199A	12	15	UPS26-99 (Speed 2)	0011	Star 30 F
250A	15	22	UPS26-150 (Speed 2)	2450	Top-S 1.25x35

40°F ΔT System					
Boiler Model	GPM	Feet of Head	Grundfos Model	Taco pump Model	Wilo Model
90A	4	6,5	UPS15-58 (Speed 1)	007	Star S 21 F
150A	7	4	UPS15-58 (Speed 2)	007	Star S 21 F
199A	9	8,5	UPS15-58 (Speed 3)	0012	Star S 21 F
250A	11	12,5	UPS26-99 (Speed 2)	0014	Star 17 FX

Figure 7-4 Sizing chart for the pump installed on the boiler primary loop (Local pump)

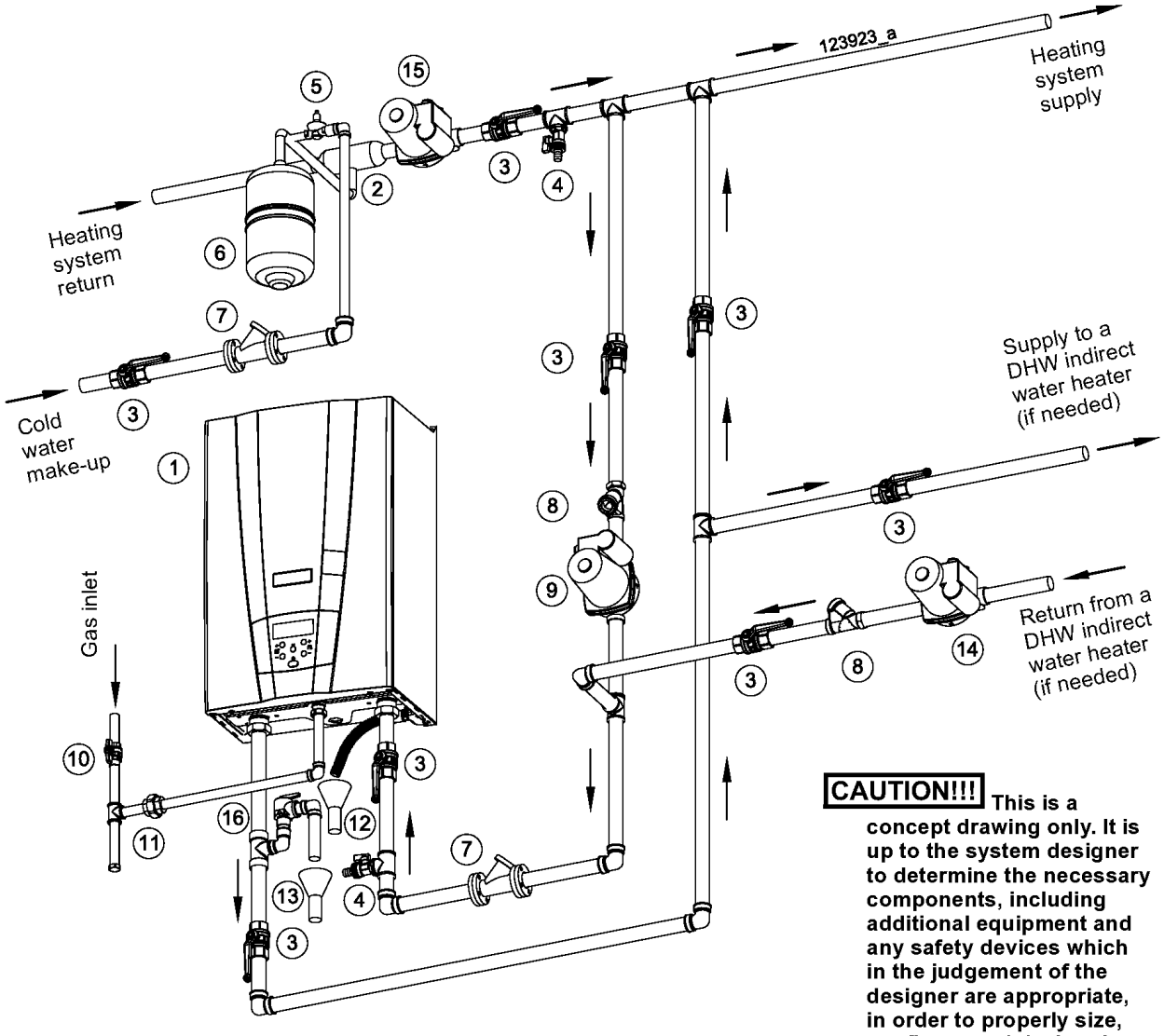
7.2.6 - Domestic Hot Water system piping when using an indirect water heater

See Figure 7-5, for recommended piping to an indirect water heater. This recommended piping configuration ensures priority is given to the production and recovery of DHW. Refer to Figure 9-3 to wire the indirect water heater pump (DHW pump)

Anti-scald mixing valve: Check local code to see if a anti-scald valve is required for use with an indirect domestic hot water heater. A field supplied anti-scald valve is highly recommended for all domestic hot water installations.

⚠ WARNING!!! Install an anti scald mixing valve downstream domestic hot water piping. Failure to comply with this provision can result in scalding of individuals and animals causing, severe personal injury or death!

7 - INSTALLATION - boiler water connections



1 = Boiler
2 = Air separator
3 = Ball valve
4 = Drain valve
5 = Filling valve
6 = Expansion tank
7 = Filter
8 = Check valve
9 = Local boiler pump
10 = Manual gas shut-off valve (Install manual shut-off valve 5 ft (1.5m) above floor)
11 = Ground joint union
12 = Condensate drain
13 = Relief valve drain
14 = Indirect water heater pump (DHW pump) (if needed)
15 = Heating pump (CH pump)
16 = ASME relief valve

Figure 7-5 Typical piping of the boiler

8 - INSTALLATION - Condensate disposal

8.1 - Condensate disposal

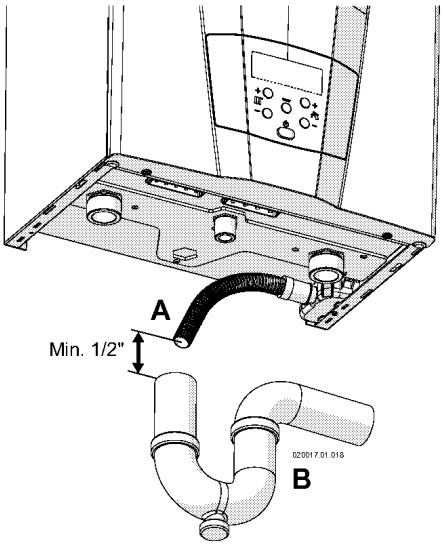
⚠ WARNING!!! The condensate trap must be connected to the boiler per the following instructions or combustion gases will enter the room. This can result in excessive levels of carbon monoxide which can cause severe personal injury or death!

This boiler produces water as a byproduct of combustion. The boiler is equipped with a condensate trap, Figures 3-2 and 3-4, item "29", for the evacuation of condensate and to prevent the leakage of combustion products. The condensate drains through pipe shown in Figure 8-1 item "A".

- ☞ Slope condensate tubing down and away from the boiler into a drain (Figure 8-1 item "B") or condensate neutralizer. Condensate from the boiler will be slightly acidic (around pH 4). Install a neutralizer if required by local codes. A neutralizer is suggested for all installations.

CAUTION!!! The condensate discharge line must be of materials approved by the authority having jurisdiction. In the absence of other authority, PVC and CPVC pipe must comply with ASTM D1785 or D2845. Cement and primer must comply with ASME D2564 or F493. For Canada use CSA or ULC certified PVC or CPVC pipe, fittings, and cement.

- ☞ Condensate piping must comply with national and/or local codes for condensate neutralizer between pipe "A" of Figure 8-1 and the waste disposal system
- ☞ Condensate piping must be carried out with a pipe with an internal diameter equal to or greater than **1/2 in** *(13 mm)*;
- ☞ Condensate piping must be installed in such a way so as to avoid the freezing of the liquid;
- ☞ Condensate piping must never discharge into gutters or rain collectors;
- ☞ Condensate piping must be properly pitched towards the point of discharge avoiding high points, which could place the condensate system under pressure.



A = Condensate drain hose (factory supplied)
B = Condensate trap and drain (field supplied and installed)

Figure 8-1 Condensate drain

- ☞ Condensate piping must have an open connection the buildings sewer system, this connection must provide for an air gap between the condensate drain hose of the boiler and the sewer drain line. The drain line must have a minimum diameter 1.25".

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.

A condensate removal pump is required if the boiler is below the drain. When installing a condensate pump, select one approved for use with condensing boilers and furnaces. The pump should have an overflow switch to prevent property damage from condensate spillage.

COMMONWEALTH OF MASSACHUSETTS SPECIAL REQUIREMENT
When the boiler is installed and used in the Commonwealth of Massachusetts, a neutralization unit MUST be installed in the condensate removal system.

9 - INSTALLATION - Electrical connections

9.1 - Electrical connections: overview

⚠ WARNING!!! ELECTRICAL SHOCK HAZARD Turn off electrical power supply before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

⚠ WARNING!!! Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation, severe personal injury or death. Be sure of a correct functioning after the servicing.

⚠ 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.*

NOTICE! Wiring must be N.E.C. Class 1. Use only type 105°C wire or equivalent.

Installation must comply with:

1. National Electrical Code and any other national, state,provincial, or local codes, or regulations.
2. In Canada, CSA C22.1 Canadian Electrical Code Part 1, and any local codes.

☞ Check that the electrical system is adequate for the power consumption indicated on the rating plate or in Section 15.

☞ 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 *(0.3 mm)*.

☞ A properly rated shut-off switch shall be located nearest to the boiler for any maintenance use.

☞ 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.

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

9.1.1 - Connecting the power supply cable

Provide and install a fused disconnect or service switch (15 amp recommended) as required by the code. To connect the electrical power supply cable, follow the steps below while referring to Figures 9-1 and 9-3:

1. remove the boiler casing following the instructions given in Section 14.2 and open the junction box cover;
2. install the power supply wires to terminals "L1" and "N". connect the ground wire to the ground terminal;
3. connect the 120 volt hot wire to terminal "L1";
4. 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 Err 65.

9.1.2 - Room 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 9-2).

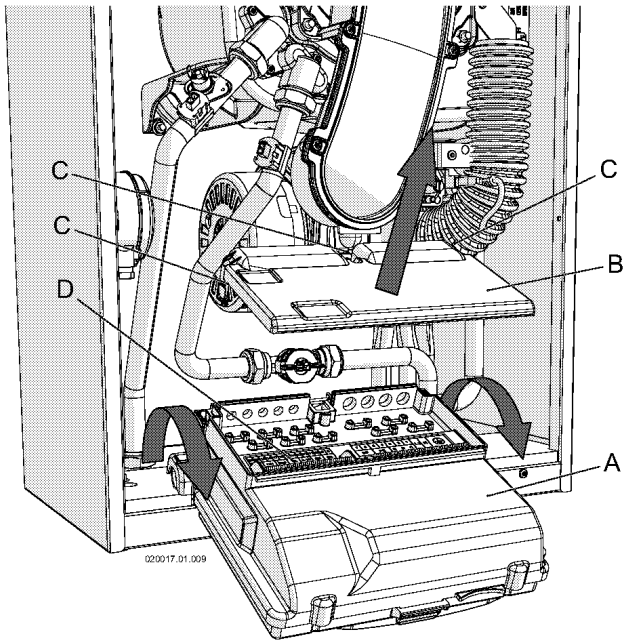
Connect the room thermostat to the boiler by following the steps below:

1. remove the boiler casing according to the instructions given in Section 14.2 and open the junction box cover;
2. use a two conductor cable with a minimum cross section of #18 AWG between the boiler and the room thermostat;
3. connect the cable leads to the "14" and "15" terminals as shown in Figure 9-3.

NOTICE! the maximum room thermostat cable length permitted is 32 ft (10 m). For longer lengths, up to 300ft (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 run through conduits containing 120Vac power wires or an electrical shock hazard will exist.

9 - INSTALLATION - Electrical connections



A = Electrical box
B = Junction box cover
C = Plastic spring
D = Connection board

Figure 9-1 Junction box

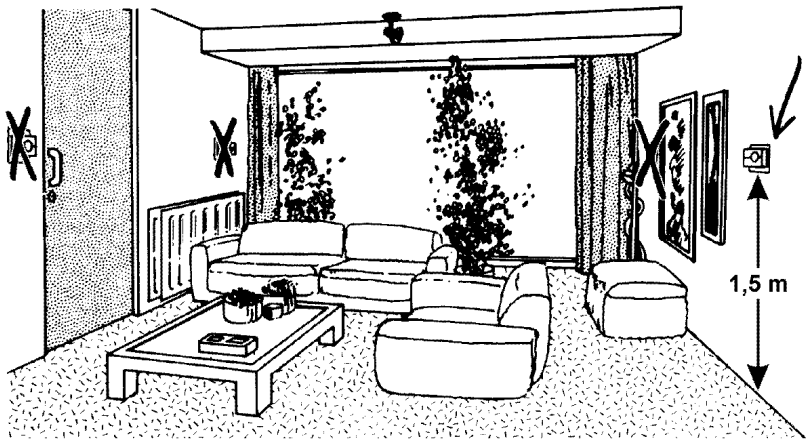


Figure 9-2 Room thermostat location

9.1.3 - Installing the outdoor temperature sensor

The outdoor temperature sensor is supplied with the boiler. 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 install the outdoor sensor near or above any heat source such as lights or dryer/ exhaust vent terminations. Do not shield the outdoor temperature sensor. Do not install the sensor on walls without overhangs, or not protected from rain. Connect the outdoor temperature sensor to the boiler to terminals "10" and "11" (See figure 9-3):

1. 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 32 ft (10 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 run through conduits containing 120 Vac power wires or an electrical shock hazard will exist.

2. 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. Gain access to the installers' menu (see Section 13.13);
2. Set parameter 2003 to 1

9.2 - Connecting the boiler to an indirect water heater

This boiler, can be connected to an indirect water heater as follow:

1. The water connection must be made per Figure 7-5.
2. The indirect water heater pump (DHW pump) must be connected to terminals “2” and “3” (See Figure 9-3); a field supplied pump relay must be installed if the pump current draw is grater than 3 amps.
3. The indirect water heater temperature sensor (Tank sensor) must be connected to terminals “8” and “9” (See Figure 9-3). The sensor must be placed into the indirect water heater in a way that can detect the water temperature (Follow the indirect water heater instruction).
4. Set the boiler so that it detects the indirect water heater sensor, as follows:
   a. Gain access to the Factory menu (see Section 17);
   b. Set parameter 3012 to 1.

Follow Section 13.5 to set the desired indirect water heater temperature.

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

9.2.1 Indirect water heater priority selection

The boiler is factory set for DHW priority. This means that the boiler will stay in DHW mode until the capacity of the indirect water heater reaches temperature. In some cases this will result in the house cooling because the central heating function was stopped by the DHW priority mode. Once the indirect water heater is satisfied the boiler will automatically return to central heating.

Priority selection is a functionality that toggles between CH and DHW demand when they are both active at the same time. The priority selection is set with the 2067 (DHW Priority) parameter in the “Installers’ menu” (see Section 13.13).

If parameter 2067 is set to “0” and a call for heat and domestic water are present at the same time, the boiler will give priority to the indirect water heater for the time period specified in parameter 2063. At the end of that time period, the boiler will switch to heating priority for the length of time specified in parameter 2063. If a call for domestic operation is still present the boiler will switch back to priority mode for the indirect water heater for the time specified in parameter 2063.

If parameter 2067 is set to “1” the boiler will give priority to heating only.

If parameter 2067 is set to “2” the boiler will give priority to indirect water heater only.

9 - INSTALLATION - Electrical connections

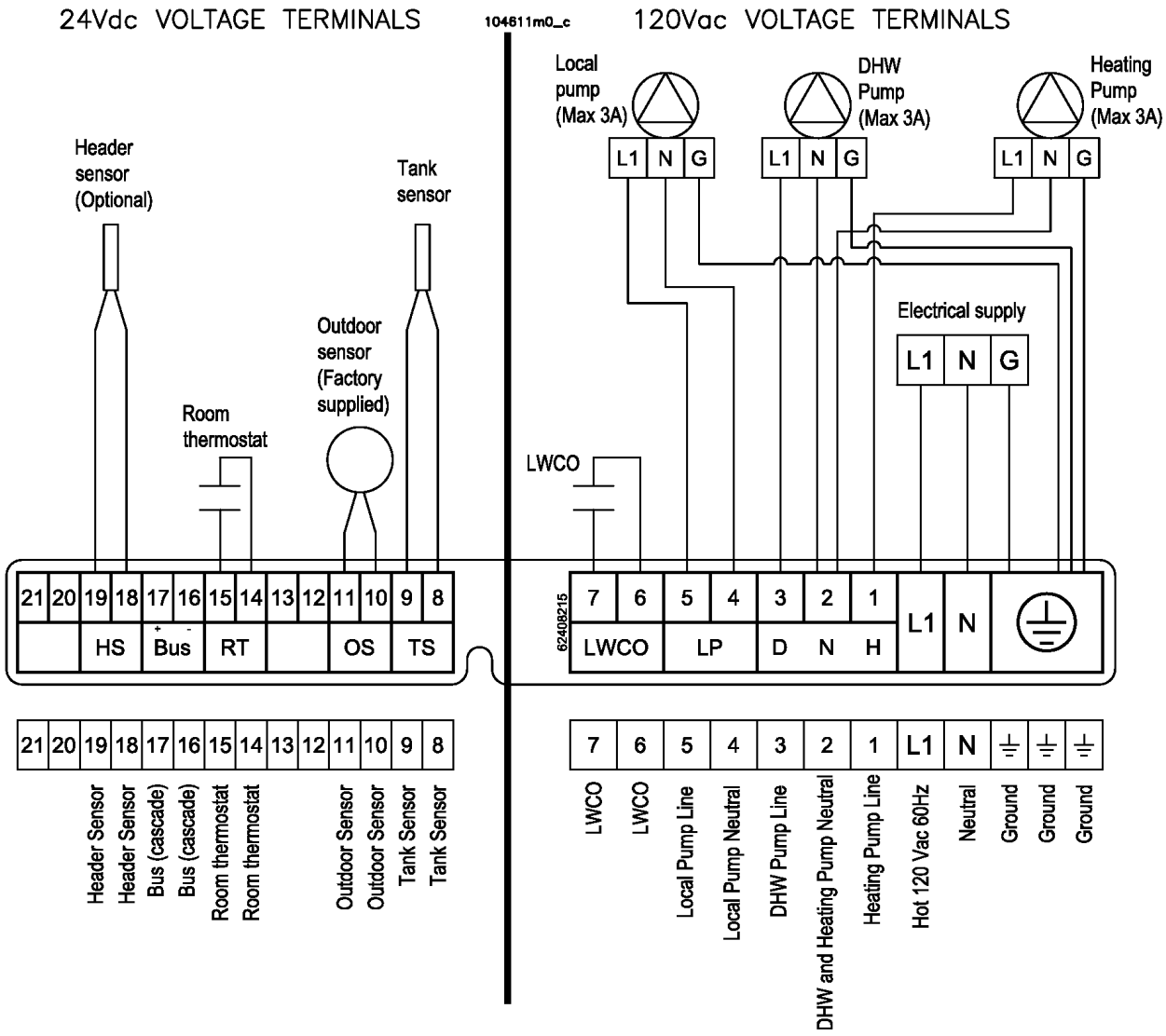


Figure 9-3 Electrical customer connection

9.3 - Connecting the boiler in cascade

Boilers can be installed in cascade, up to a maximum of 8 boilers, with a configuration like in Figure 9-4. Many other configurations can be done (ask to the manufacturer for conceptual drawings). The cascade is managed by the same control of the manager boiler.
To connect the boiler in cascade you have to operate as follow:

1 - make piping installation as shown in Figure 9-4;
2 - make the wiring installation as shown in Figure 9-5;
3 - gain access to the manager boiler (the boiler nearest the low loss header) and set parameter 3001 = 1 and parameter 3050 to a value correspondent to the number of dependent boilers (if you have 3 dependent boilers like on Figure 9-4 you have to set parameter 3050 = 3)
4 - gain access to the Dependent boiler #2. Here, set the parameter 3001 = 2 and move the switch S4 (S4 switch is inside the control board as illustrated on Figure 9-5) in the OFF position (see Figure 9-5). Also be sure parameter 2003 is set to 0.
5 - gain access to the next dependent boilers and repeat, on each dependent, the same procedure like in precedent step 4, considering that parameter 3001 will take the increment value corresponding to the dependent boiler and move the switch S4 in the OFF position (see Figure 9-5). Be sure parameter 2003 is set to 0 on each dependent boiler.

For water, gas, flue exhaust and air intake connections, ask for conceptual drawings to the boiler manufacturer. For the local pump sizing you can make reference to Figure 7-4.

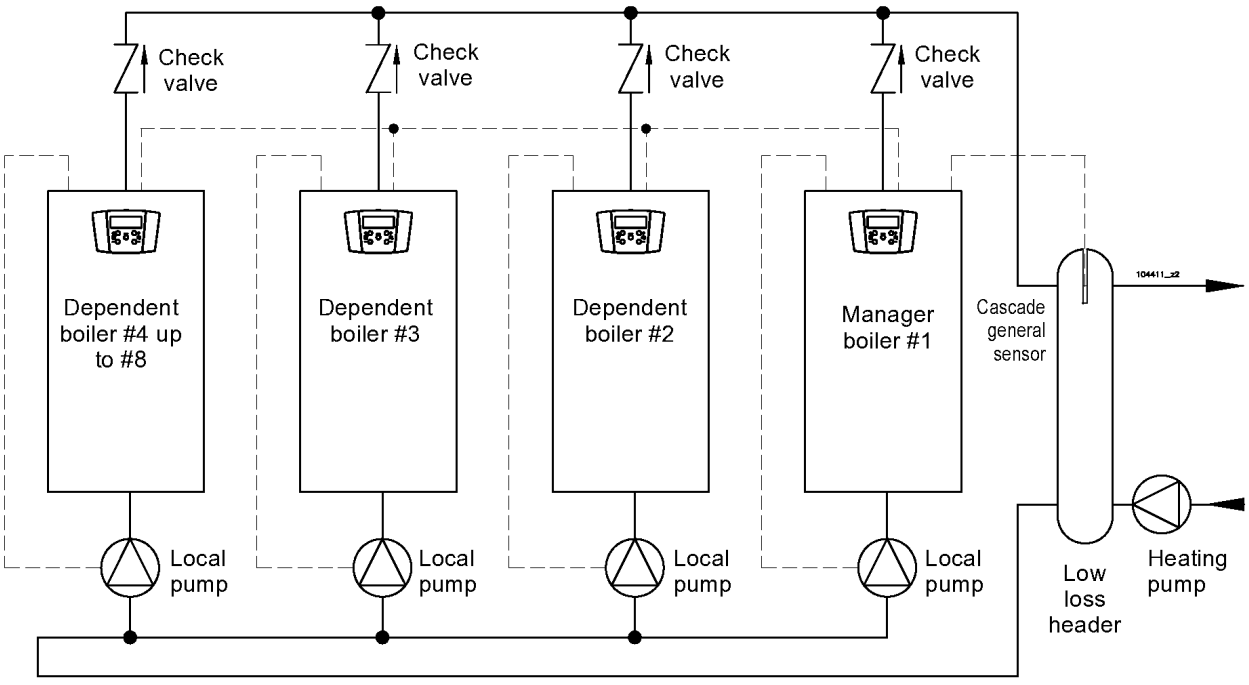


Figure 9-4 Cascade conceptual scheme (maximum 8 boilers)

9 - INSTALLATION - Electrical connections

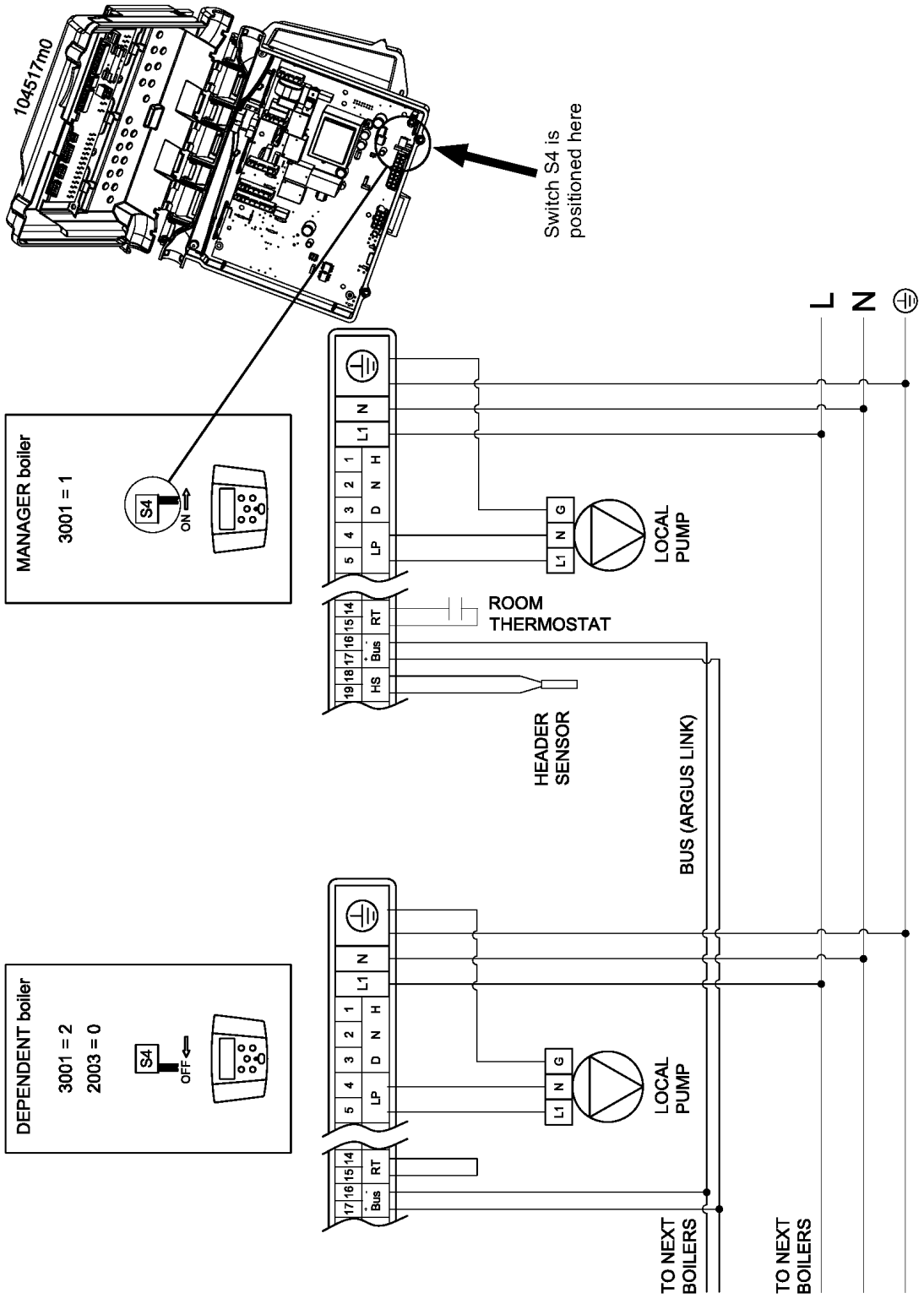


Figure 9-5 Cascade electrical wiring (maximum 8 boilers)

10 - INSTALLATION - Vent and combustion air

10.1 - 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) Alter 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 Installation 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 Annex G of the National Fuel Gas Code, ANSI Z223.1 /NFPA 54 and/or CAN/CSA B149. 1, Natural Gas and Propane Installation Code.

10.2 - Prevent combustion air contamination

Install air inlet piping as described in this Section. You must pipe combustion air to the boiler air intake. Do not terminate vent/air in locations that can allow contamination of combustion air.

⚠ WARNING!!! Contaminated combustion air will damage the boiler, resulting in possible severe personal injury, death or substantial property damage.

Ensure that the combustion air will not contain any of the follow contaminants.

Products that may contaminated the air combustion:
- Permanent wave solutions;
- Chlorinated waxes/cleaners;
- Chlorine-based swimming pool chemicals;
- Calcium chloride used for thawing;
- Sodium chloride used for water softening;
- Refrigerant leaks;
- Paint or varnish removers;
- Hydrochloric acid/muriatic acid;
- Cements and glues;
- Antistatic fabric softeners used in clothes dryers;
- Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms;
- Adhesives used to fasten building products and other similar products;

Do not pipe combustion air near sources of products that may contaminate the air combustion, like:
-Dry cleaning/laundry areas and establishments;
- Swimming pools;
- Metal fabrication plants;
- Beauty shops;
- Refrigeration repair shops;
- Photo processing plants;
- Auto body shops;
- Plastic manufacturing plants;
- Furniture refinishing areas and establishments;
- Remodeling areas;
- Garages with workshops.

10.3 - Venting and combustion air piping systems

⚠ WARNING!!! The vent installation must be in accordance with part *Venting of Appliances*, of the latest edition of the *National Fuel Gas Code*, ANSI Z223.1/NFPA 54 or section, *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!!! All vent pipes must be mechanically fixed. Improper venting can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

⚠ WARNING!!! The exhaust vent and the air inlet lines, 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!

NOTICE! the exhaust pipe must be pitched a minimum of a 1/4 inch per foot back to the boiler (to allow drainage of condensate).

NOTICE! The vent system shall be installed so as to prevent the accumulation of condensate.

NOTICE! 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.

This boiler requires a special vent system, designed for pressurized venting.
You must install air piping from outside to the boiler air intake. The resultant installation is Direct Vent (sealed combustion).
The boiler is to be used for either Direct Vent installation or for installation using room combustion air. When room air is considered, see Section 10.10.
Vent and air must terminate near one another and may be vented vertically through the roof or out a side wall, unless otherwise specified. You may use any of the vent/air piping methods from Figure 10-1 to Figure 10-6. Do not attempt to install this boiler using any other means.

⚠ WARNING!!! DO NOT mix components from different systems. The vent system could fail, causing leakage of flue products into the living space. Use only approved materials listed on Figures 10-7 and 10-8. Improper materials or mixing materials can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

⚠ WARNING!!! Use of cellular foam core PVC and CPVC or Radel for venting system is not allowed. Use of improper materials can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

Be sure to locate the boiler such that the vent and air piping can be routed through the building and properly terminated.
The vent/air piping lengths, routing and termination method must all comply with the methods and limits given in Section 10.4

10 - INSTALLATION - Vent and combustion air

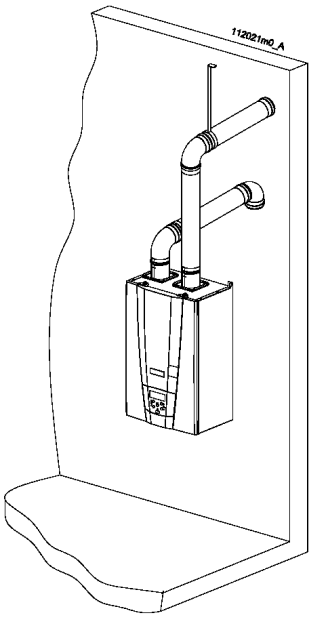


Figure 10-1 Side wall two pipes (Direct venting).

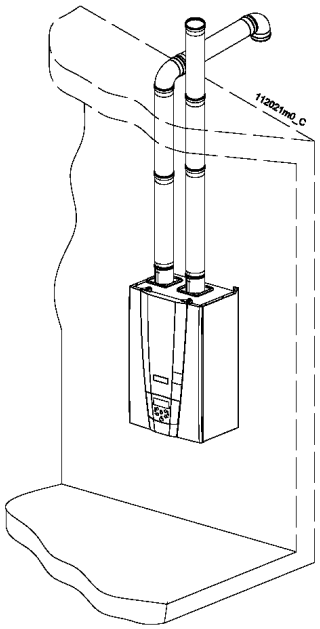


Figure 10-2 Vertical two pipes (Direct Venting).

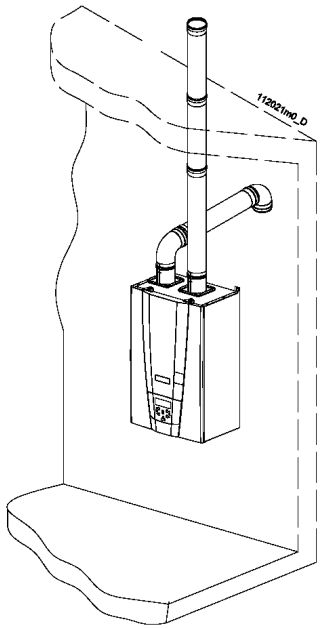


Figure 10-3 Side wall air intake, vertical vent (Direct venting).

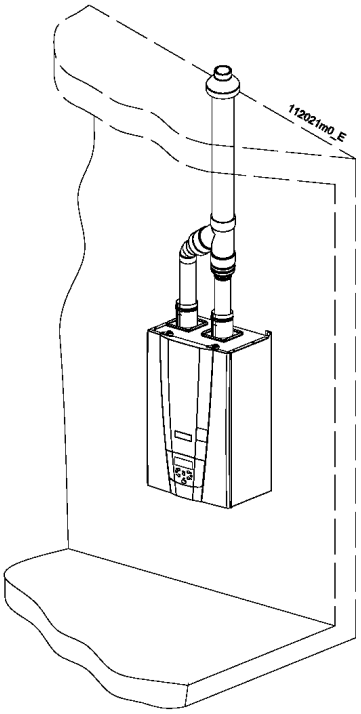


Figure 10-4 Vertical concentric (Direct venting).

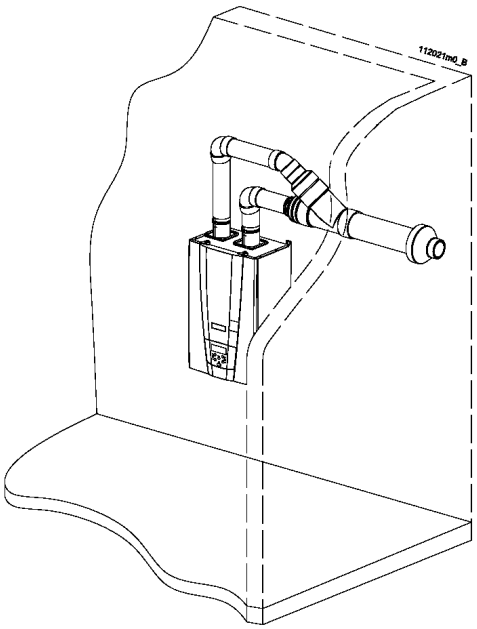


Figure 10-5 Side wall concentric (Direct venting).

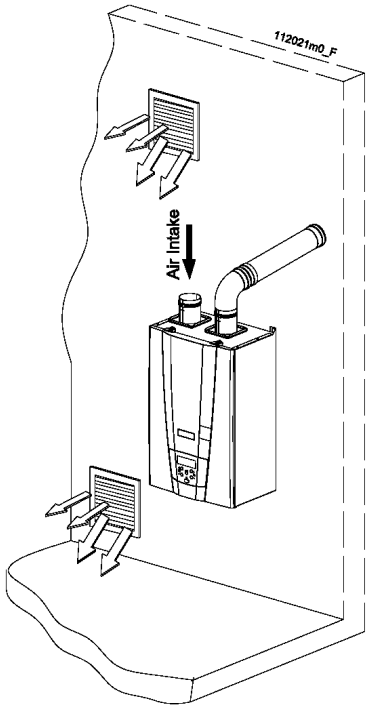


Figure 10-6 Side wall (or vertical in a roof) one pipe venting, combustion air from room (not Direct venting).

10.4 - Minimum / Maximum allowable combustion air and vent piping lengths

The maximum length of the two pipes vent system is 160 equivalent ft (Air intake plus flue exhaust). However, each single pipe can't be longer than 80 equivalent feet.

Each 45° elbow inserted in the venting system, has a loss of pressure equivalent to 3 ft of linear pipe.

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

The minimum length of the venting sytem is 1 ft (357 mm).

Vent pipe materials and fittings must comply with the following standards			
Item	**Material**	**Standard for installation in USA**	**Standard for installation in CANADA**
Vent pipe	PVC schedule 40/80	ANSI/ASTM D2665	ULC-S636
	CPVC schedule 40/80	ANSI/ASTM F441	
	Polypropylene	ULC-S636	
	Stainless steel AL29-4C	UL 1738	
Vent fittings	PVC schedule 40	ANSI/ASTM D2466	
	PVC schedule 80	ANSI/ASTM D2467	
	CPVC schedule 80	F439	
	Polypropylene	ULC-S636	
	Stainless steel AL29-4C	UL 1738	
Pipe cement/primer	PVC	ANSI/ASTM D2564	
	CPVC	ANSI/ASTM F493	

WARNING!!! Use of cellular foam core PVC, cellular core CPVC, ABS and Radel for venting system is not allowed

Figure 10-7 Approved vent materials

10.5 - Install vent and combustion air piping

⚠ WARNING!!! This boiler must be vented and supplied with combustion and ventilation air as described in this section. Ensure the vent and air piping and the combustion air supply comply with these instructions regarding vent system, air system, and combustion air quality. See also Section 10.2 of this manual. Inspect finished vent and air piping thoroughly to ensure all are airtight and comply with the instructions provided and with all requirements of all applicable codes. Failure to provide a properly installed vent and air system will result in excessive levels of carbon monoxide or fire that can result in severe personal injury, death or property damage!

⚠ WARNING!!! Using vent materials other than those listed in Figures 10-7 and 10-8, failure to properly seal all seams and joints, mixing of venting materials or failure to follow vent pipe and fittings manufacturer's instructions can result in excessive levels of carbon monoxide or fire that can result in severe personal injury, death or property damage!

⚠ WARNING!!! Use of cellular core PVC, cellular core CPVC and ABS or Radel for venting system is not allowed. Use of improper materials can result in excessive levels of carbon monoxide or fire which can result in severe personal injury, death or property damage!

⚠ WARNING!!! Use only the materials listed in Figure 10-7 and Figure 10-8 for vent pipe, and fittings. Failure to comply could result in excessive levels of carbon monoxide or fire which can result in severe personal injury, death or property damage!

NOTICE! Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

For installation in Canada, vent pipe system must be certified to ULC-S636 (see Figure 10-7).

Approved vent manufacturers and items				
Item	**Family of the Material**	**Manufacturer/supplier**	**Applicable to models**	**Manufactur. Part Number**
3" Concentric roof or wall terminal	PVC	IPEX (System 636)	90 to 250	196006
3" Concentric roof or wall terminal	CPVC	IPEX (System 636)	90 to 250	197009
3" Two (and single) pipes roof or wall terminal (90° elb.)	PVC	IPEX (System 636)	90 to 250	196025
3" Two (and single) pipes roof or wall terminal (90° elb.)	CPVC	IPEX (System 636)	90 to 250	197201
3" Wall termination kit	PVC	IPEX (System 636)	90 to 250	081219
3" Low profile wall termination kit	PVC	IPEX (System 636)	90 to 250	196985
3" Bird screen	PVC/CPVC	IPEX (System 636)	90 to 250	196051
3" (80mm) Two (and single) pipes roof or wall terminal (90° elb.)	Polypropylene	Centrotherm (Innoflue System)	90 to 250	ISELL0387UV
3" (80mm) Bird screen	Polypropylene	Centrotherm (Innoflue System)	90 to 250	IASPP03
3" Two (and single) pipes roof or wall terminal (90° elb.)	Stainless steel	Duravent (FasNSeal)	90 to 250	FSELB9003
3" Bird screen	Stainless steel	Duravent (FasNSeal)	90 to 250	FSBS3

Figure 10-8 Approved vent manufacturers and items

10.6 - Air inlet pipe materials:

⚠ WARNING!!! The air inlet pipe(s) must be sealed. Improper sealed can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

Choose acceptable combustion air inlet pipe materials from the following list:
- PVC, cellular core CPVC or ABS
- AL29-4C, stainless steel material to be sealed to specification of its manufacturer.
- Polypropylene material to be sealed to specification of its manufacturer.

⚠ WARNING!!! Using air intake materials other than those specified, mixing the specified materials, failure to properly seal all seams and joints or failure to follow the manufacturer's instructions can result in flue gas recirculation, spillage of flue products and carbon monoxide emissions causing severe personal injury or death.

NOTICE! The use of insulated material for the combustion air inlet pipe is recommended in cold climates to prevent the condensation of airborne moisture in the incoming combustion air.

10.6.1 - Sealing of PVC, CPVC or ABS air inlet pipe

The PVC, CPVC, or ABS air inlet pipe should be cleaned and sealed with the pipe manufacturer's recommended solvents and standard commercial pipe cement for the material used. Proper sealing of the air inlet pipe ensures that combustion air will be free of contaminants and supplied in proper volume.
When a sidewall or vertical rooftop combustion air supply system is disconnected for any reason, the air inlet pipe must be resealed to ensure that combustion air will be free of contaminants and supplied in proper volume.

⚠ WARNING!!! Failure to properly seal all joints and seams as required in the air inlet piping may result in flue gas recirculation, spillage of flue products and carbon monoxide emissions causing severe personal injury or death.

10.7 - PVC/CPVC vent piping materials

⚠ WARNING!!! Use only the materials listed in Figures 10-7 and 10-8 for vent pipe, and fittings. DO NOT mix vent systems of different types or manufacturers, unless listed in this manual. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING!!! This appliance requires a special venting system. Use only the vent materials, primer, and cement specified in this manual to make the vent connections. Failure to follow this warning could result in fire, personal injury, or death.

⚠ WARNING!!! Do not insulate PVC/CPVC exhaust pipe nor install into an enclosure, or any other obstruction thereby preventing the cooling of the exhaust pipe. Failure to follow this warning could result in excessive levels of carbon monoxide or a fire, which can cause severe personal injury or death!

⚠ WARNING!!! Improper installation of PVC or CPVC systems may result in excessive levels of carbon monoxide or a fire, which can cause severe personal injury or death!

⚠ WARNING!!! All vent pipes must be glued, properly supported, and the exhaust must be pitched a minimum of a 1/4 inch per foot back to the boiler (to allow drainage of condensate). Failure to follow this warning could result in excessive levels of carbon monoxide or a fire, which can cause severe personal injury or death!

NOTICE! Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

For installation in Canada, vent pipe system must be certified to ULC-S636 (see Figures 10-7).

NOTICE! Installation of a PVC/CPVC vent system should adhere to the PVC/CPVC vent manufacturer's installation instructions supplied with the vent system.

10.7.1 - Installing PVC/CPVC vent and air piping

NOTICE! Use only cleaners, primers, and solvents that are approved for the materials which are joined together.

1. Work from the boiler to vent or air termination. Do not exceed the lengths given in Section 10.4.
2. Cut pipe to the required lengths and deburr the inside and outside of the pipe ends.
3. Bevel outside of each pipe end to ensure even cement distribution when joining.
4. Clean all pipe ends and fittings using a clean dry rag (Moisture will retard curing and dirt or grease will prevent adhesion).
5. Dry fit vent or air piping to ensure proper fit up before assembling any joint. The pipe should go a third to two-thirds into the fitting to ensure proper sealing after cement is applied.
6. Priming and Cementing:
   a. Handle fittings and pipes carefully to prevent contamination of surfaces.
   b. Apply a liberal even coat of primer to the fitting socket.
   c. Apply a liberal even coat of primer to the pipe end to approximately 1/2" beyond the socket depth.
   d. Apply a second primer coat to the fitting socket.
   e. While primer is still wet, apply an even coat of approved cement to the pipe equal to the depth of the fitting socket.
   f. While primer is still wet, apply an even coat of approved cement to the fitting socket.
   g. Apply a second coat of cement to the pipe.
   h. While the cement is still wet, insert the pipe into the fitting, if possible twist the pipe a 1/4 turn as you insert it. **NOTICE!** If voids are present, sufficient cement was not applied and joint could be defective.
   i. Wipe excess cement from the joint removing ring or beads as it will needlessly soften the pipe.

10 - INSTALLATION - Vent and combustion air

10.7.2 - PVC/CPVC air intake connection

Combustion Air Intake connection (see Figure 10-9 Item "A"). This connection is used to provide combustion air directly to the boiler from outdoors. Combustion air piping must be supported per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.
To connect a PVC/CPVC pipe to the air intake connection proceed as follow while referring to Figure 10-9:

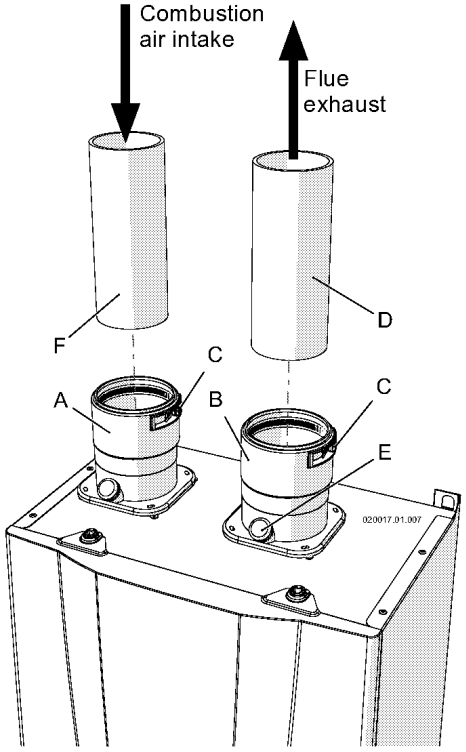
1. Insert the air inlet PVC/CPVC pipe, for 2" into the adapter "A";
2. tight the clamp "C" to mechanically secure the adapter "A" to the pipe.

10.7.3 - PVC/CPVC vent connection

Vent connection (see Figure 10-9 Item "B"). This connection is used to provide a passageway for conveying combustion gas to the outside. Vent piping must be supported per the National Building Code, Section 305, Table 305.4 or as local codes dictate.
To connect a PVC/CPVC pipe to the vent connection proceed as follow while referring to Figure 10-9:

1. Insert the flue exhaust PVC/CPVC pipe, for 2" into the adapter "B";
3. tight the clamp "C" to mechanically secure the adapter "B" to the pipe.

⚠ WARNING!!! Do not insulate PVC/CPVC exhaust pipe nor install into an enclosure or any other obstruction thereby preventing the cooling of the exhaust pipe. Failure to follow this warning could result in excessive levels of carbon monoxide or a fire, which can cause severe personal injury or death!



A = Air intake connection
B = Flue exhaust connection
C = mechanically secure clamp
D = PVC/CPVC exhaust pipe (Field provided)
E = Combustion analization probe
F = PVC/CPVC air inlet pipe (Field provided)

Figure 10-9 PVC/CPVC air intake/ vent connection

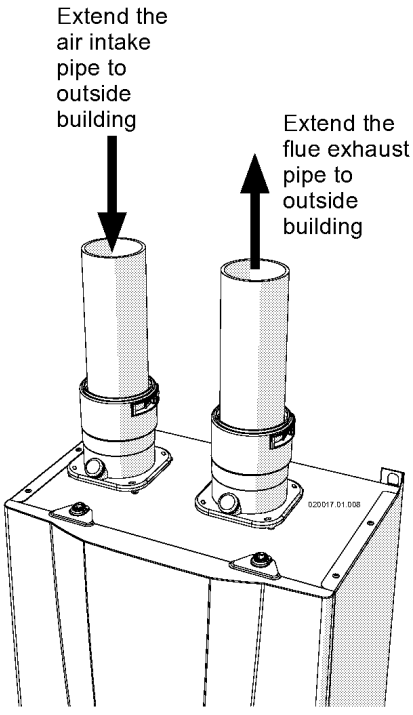


Figure 10-10 PVC/CPVC air intake/Vent connection correctly in place

10.8 - Stainless steel vent piping materials

⚠ WARNING!!! Use only the materials, vent systems, and terminations listed in Figures 10-7 and 10-8. DO NOT mix vent systems of different types or manufacturers, unless listed in this manual. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING!!! This appliance requires a special venting system. The field provided vent pipe must be connected to the heater following Section 10.8.2. Failure to follow this warning could result in fire, personal injury, or death.

⚠ WARNING!!! Improper installation of Stainless steel systems may result in injury or death.

⚠ WARNING!!! Use only water-based lubricants on joints. Never use hydrocarbons-based lubricants because they would destroy gaskets. Failure to follow this warning could result in excessive levels of carbon monoxide, which can cause severe personal injury or death!

NOTICE! Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

NOTICE! For installation in Canada, vent pipe system must be certified to ULC-S636 (see Figure 10-7).

NOTICE! All vent pipes connections must be secured following manufacturer instruction, properly supported, and the exhaust must be pitched a minimum of a 1/4 inch per foot back to the heater (to allow drainage of condensate).

NOTICE! Installation of a stainless steel vent system should adhere to the stainless steel vent manufacturer's installation instructions supplied with the vent system.

10 - INSTALLATION - Vent and combustion air

10.8.1 - Stainless steel air intake connection

Combustion Air Intake connection (see Figure 10-11 Item "A"). This connection is used to provide combustion air directly to the heater from outdoors. Combustion air piping must be supported per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.

To connect a stainless steel pipe to the air intake connection proceed as follow while referring to Figure 10-11:

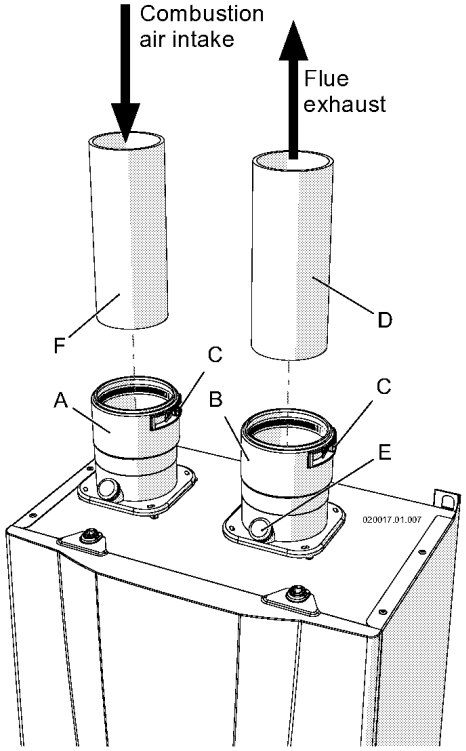
1. Insert the air intake pipe "F" into adapter "A". Adapter "A" have three gaskets, use the useful able to tight and seal the stainless steel pipe.
2. Tight the secure clamp "C" to mechanically fix the pipe "F" to the adapter "A".

10.8.2 - Stainless steel vent connection

Vent connection (Figure 10-11 item "B") is used to provide a passageway for conveying combustion gases to the outside. Vent piping must be supported per the National Building Code, Section 305, Table 305.4 or as local codes dictate.

To connect a stainless steel pipe to the vent connection proceed as follow while referring to Figure 10-11:

1. Insert the vent pipe "D" into adapter "B". Adapter "B" have three gaskets, use the useful able to tight and seal the stainless steel pipe.
2. Tight the secure clamp "C" to mechanically fix the pipe "D" to the adapter "B".



A = FLue exhaust connection
B = Air intake connection
C = mechanically secure clamp
D = Flue exhaust Stainless steel pipe (Field provided)
E = Combustion analization probe
F = Stainless steel air inlet pipe (Field provided)

Figure 10-11 Stainless steel air intake/vent connection

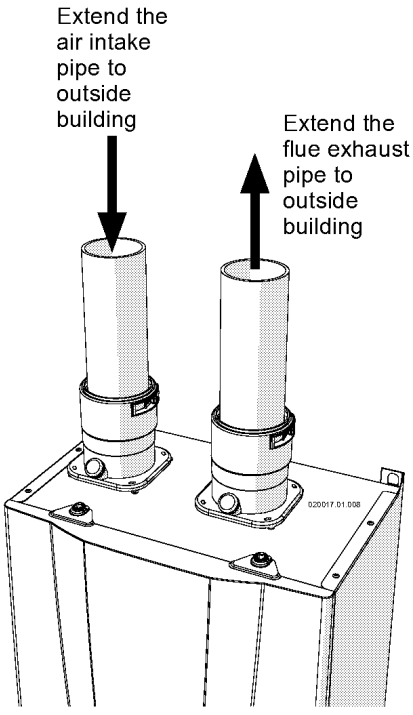


Figure 10-12 Stainless steel air intake/Vent connection correctly in place

10.9 - Polypropylene vent piping materials

⚠ WARNING!!! Use only the materials listed in Figures 10-7 and 10-8 for vent pipe, and fittings. DO NOT mix vent systems of different types or manufacturers, unless listed in this manual. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING!!! This appliance requires a special venting system. The field provided vent pipe must be connected to the boiler following Section 10.9.2. Failure to follow this warning could result in fire, personal injury, or death.

⚠ WARNING!!! Do not insulate polypropylene exhaust pipe nor install into an enclosure, or any other obstruction thereby preventing the cooling of the exhaust pipe. Failure to follow this warning could result in excessive levels of carbon monoxide or a fire, which can cause severe personal injury or death!

⚠ WARNING!!! Improper installation of Polypropylene systems may result in injury or death.

⚠ WARNING!!! Use only water-based lubricants on joints. Never use hydrocarbons-based lubricants because they would destroy gaskets. Failure to follow this warning could result in excessive levels of carbon monoxide, which can cause severe personal injury or death!

NOTICE! Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

For installation in Canada, vent pipe system must be certified to ULC-S636 (see Figure 10-7).

NOTICE! All vent pipes connections must be secured following manufacturer instruction, properly supported, and the exhaust must be pitched a minimum of a 1/4 inch per foot back to the boiler (to allow drainage of condensate).

NOTICE! Installation of a Polypropylene vent system should adhere to the polypropylene vent manufacturer's installation instructions supplied with the vent system.

10 - INSTALLATION - Vent and combustion air

10.9.1 - Polypropylene air intake connection

Combustion Air Intake connection (see Figure 10-13 Item “A”) is used to provide combustion air directly to the boiler from outdoors. Combustion air piping must be supported per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.

To connect a polypropylene pipe to the air intake connection proceed as follow while referring to Figure 10-13:

1. Insert the air intake pipe “F” into adapter “A”. Adapter “A” have three gaskets, use the useful able to tight and seal the polypropylene pipe.
2. Tight the secure clamp “C” to mechanically fix the pipe “F” to the adapter “A”.

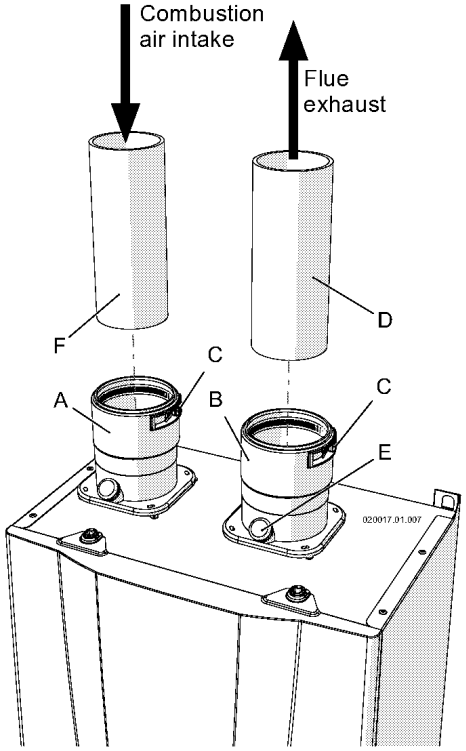
10.9.2 - Polypropylene vent connection

Vent connection (Figure 10-13 item “C”) is used to provide a passageway for conveying combustion gases to the outside. Vent piping must be supported per the National Building Code, Section 305, Table 305.4 or as local codes dictate.

To connect a polypropylene pipe to the vent connection proceed as follow: while referring to Figure 10-13:

1. Insert the vent pipe “D” into adapter “B”. Adapter “B” have three gaskets, use the useful able to tight and seal the polypropylene pipe.
2. Tight the secure clamp “C” to mechanically fix the pipe “D” to the adapter “B”.

⚠ WARNING!!! Do not insulate polypropylene exhaust pipe nor install into an enclosure or any other obstruction thereby preventing the cooling of the exhaust pipe. Failure to follow this warning could result in excessive levels of carbon monoxide or a fire, which can cause severe personal injury or death!



A = Air intake connection
B = Flue exhaust connection
C = mechanically secure clamp
D = Polypropylene exhaust pipe (Field provided)
E = Combustion analization probe
F = Polypropylene air inlet pipe (Field provided)

Figure 10-13 Polypropylene air intake/vent connection

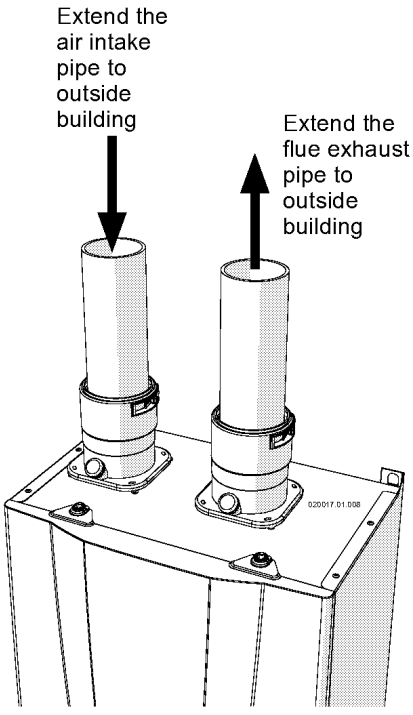


Figure 10-14 Polypropylene air intake/Vent connection correctly in place

10.10 - Single pipe vent (not sealed combustion)

For boilers for connection to flue vents or chimneys, vent installations shall be in accordance with "Venting of Equipment," of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or "Venting Systems and Air Supply for Appliances", of the Natural Gas and Propane Installation Code, CAN/CSA B149.1, or applicable provisions of the local building codes.

⚠ WARNING!!! When utilizing the single pipe vent method, provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.

Commercial applications utilizing this boiler may be installed with a single pipe carrying the flue products to the outside while using combustion air from the equipment room. In this case the following conditions and considerations must be followed.

⚠ WARNING!!! The equipment room MUST be provided with properly sized openings to assure adequate combustion air from outside. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE! There will be a noticeable increase in the noise level during normal operation from the inlet air opening.

NOTICE! Vent system and terminations must comply with the venting instructions set forth in Sections 10.1, 10.2, 10.3, 10.4, 10.5, 10.7, 10.8 and 10.9.

⚠ WARNING!!! Use only the materials, vent systems, and terminations listed in Figures 10-7 and 10-8. DO NOT mix vent systems of different types or manufacturers, unless listed in this manual. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING!!! Fire danger due to flammable materials or liquids. Do not store flammable materials and liquids in the immediate vicinity of the boiler.

⚠ WARNING!!! Boiler must be clear and free from combustible materials, gasoline and other flammable vapors and liquids, and corrosive liquids and vapors. Never use chlorine and hydrocarbon containing chemicals (such as spray chemicals, solution and cleaning agents, paints, glues etc.) in the vicinity of the boiler. Do not store and use these chemicals in the boiler room. Avoid excessive dust formation and build-up. Failure to comply could result in fire, severe personal injury, death, or substantial property damage.

⚠ WARNING!!! Where exhaust fans, clothes dryers, and kitchen ventilation systems interfere with the operation of appliances, makeup air shall be provided. Failure to follow this warning could result in excessive levels of carbon monoxide, which can cause severe personal injury or death!

NOTICE! For installation in Canada, vent pipe system must be certified to ULC-S636 (see Figure 10-7).

NOTICE! All vent pipes connections must be secured following manufacturer instruction, properly supported, and the exhaust must be pitched a minimum of a 1/4 inch per foot back to the boiler (to allow drainage of condensate).

NOTICE! Vent pipe system shall be installed in a way to prevent accumulation of condensate;

10.10.1 - Combustion Air and Ventilation openings

⚠ WARNING!!! Make sure that combustion air and ventilation openings are sufficiently sized and no reduction or closure of openings takes place. Please note these restrictions and its dangers to the operator of the boiler and to the homeowner. Failure to comply could result in severe personal injury, death, or substantial property damage.

Outdoor combustion air shall be provided through opening(s) to the outdoors.

Two Permanent Openings Method. Two permanent openings, one commencing within 12 in. (300 mm) of the top and one commencing within 12 in. (300 mm) of the bottom, of the room shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors, as follows:

1. Where directly communicating with the outdoors or where communicating to the outdoors through vertical ducts, each opening shall have a minimum free area of 1 in^2 each 4000 Btu/hr (550 mm^2/kW) of total input rating of all appliances located in the room.
2. Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 in^2 each 2000 Btu/hr (1100 mm^2/kW) of total input rating of all appliances located in the room.

One Permanent Opening Method.
One permanent opening, commencing within 12 in. (300 mm) of the top of the room, shall be provided. The appliances shall have clearances of at least 1 in. (25 mm) from the sides and back and 6 in. (150 mm) from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that freely communicate with the outdoors and shall have a minimum free area of 1 in^2 each 3000 Btu/hr (700 mm^2 / kW) of the total input rating of all appliances located in the room.

Louvers and Grilles
To properly size permanent openings for combustion air, consideration must be given to the design of louvers or grilles to maintain the required net free area of each opening for the combined size of all gas equipment in the space. When the free area through a design of louver, grille, or screen is known, it shall be used in calculating the size opening required to provide the free area specified. When the louver and grille design and free area are not known, it shall be assumed that wood louvers have 25 percent free area, and metal louvers and grilles have 75 percent free area. Non-motorized louvers and grilles shall be fixed in the open position. The openings in louvers, grilles, and screens shall never be smaller than 1⁄4".

10.10.2 - Determine location

Locate the vent termination using the following guidelines:

1. The total length of piping for vent must not exceed the limits given in the Section 10.4.
2. You must consider the surroundings when terminating the vent:
   a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
   b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
   c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
   d. Avoid possibility of accidental contact of flue products with people or animals.
   e. Do not locate the terminations where wind eddies could affect performance or cause recirculation, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.
   f. Do not terminate above any door or window. Condensate can freeze, causing ice formations.
   g. Locate or guard vent to prevent condensate damage to exterior finishes.
3. The vent piping must terminate as shown in Figures 10-15 or 10-16.

⚠ WARNING!!! Do not exceed the maximum lengths of the outside vent piping shown in Figures 10-15 or 10-16. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential boiler shutdown.

4. Maintain clearances as expected by "Venting of Equipment," of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or "Venting Systems and Air Supply for Appliances" of the Natural Gas and Propane Installation Code, CAN/CSA B149.1, or applicable provisions of the local building codes. Also maintain the following:
   a. Vent must terminate:
      - At least 6 feet from adjacent walls.
      - No closer than 12 inches below roof overhang.
      - At least 7 feet above any public walkway.
      - At least 3 feet above any forced air intake within 10 feet.
      - No closer than 4 feet below or horizontally from any door or window or any other gravity air inlet.
   b. Do not terminate closer than 4 feet horizontally from any electric meter, gas meter, regulator, relief valve, or other equipment. Never terminate above or below any of these within 4 feet horizontally. **Item unique to CANADA: vent system shall terminate at least 6 ft from electrical and gas meters.**
5. Locate termination so it is not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

10.11 - Sidewall termination - Two pipes

10.11.1 - Vent/air termination

⚠ WARNING!!! A gas vent extending through an exterior wall shall not terminate adjacent to a wall or below building extensions such as eaves, parapets, balconies, or decks. Failure to comply could result in severe personal injury, death, or substantial property damage.

⚠ WARNING!!! Do not connect any other appliance to the vent pipe or multiple boilers to a common vent pipe. Failure to comply could result in severe personal injury, death, or substantial property damage.

NOTICE! Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

10.11.2 - Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the Section 10.4.
2. You must consider the surroundings when terminating the vent and air:
   a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
   b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
   c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
   d. Avoid possibility of accidental contact of flue products with people or animals.
   e. Do not locate the terminations where wind eddies could affect performance or cause recirculation, such as inside building corners, near adjacent buildings or surfaces, window wells, stairwells, alcoves, courtyards, or other recessed areas.
   f. Do not terminate above any door or window. Condensate can freeze, causing ice formations.
   g. Locate or guard vent to prevent condensate damage to exterior finishes.

10 - INSTALLATION - Vent and combustion air

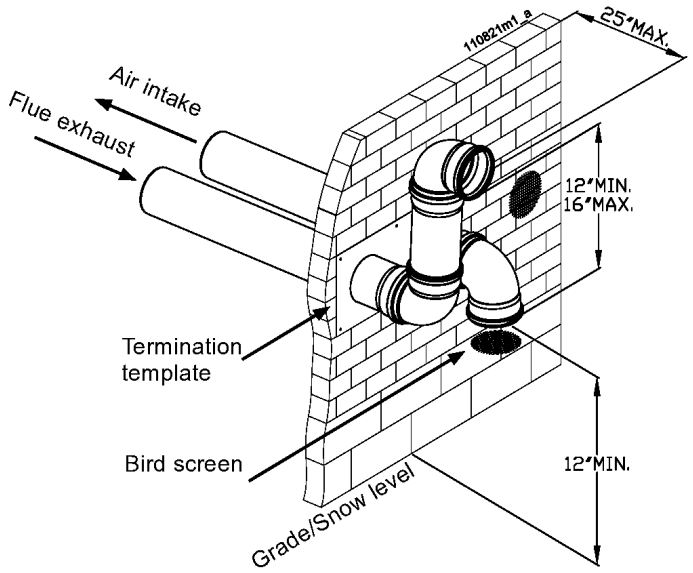


Figure 10-15 Two pipes sidewall termination of air and vent

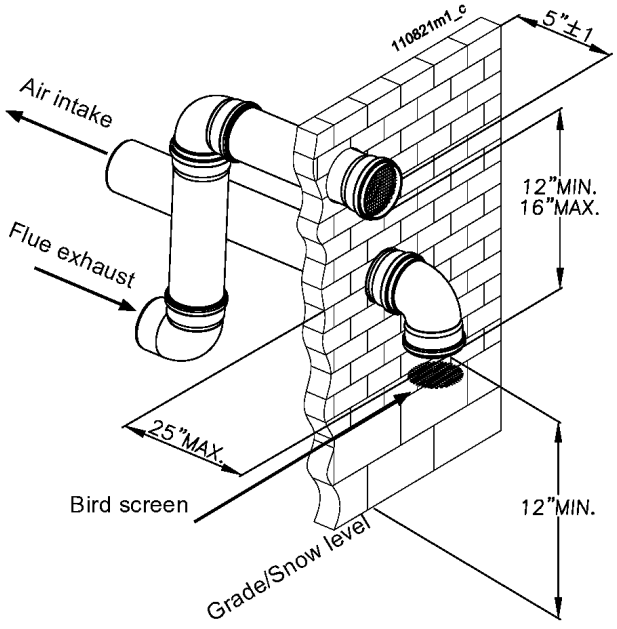


Figure 10-16 Two pipes sidewall termination of air and vent (if space permits)

3. The air piping must terminate in a down-turned elbow as shown in Figures 10-15 and 10-16. This arrangement avoids recirculation of flue products into the combustion air stream.
4. The vent piping must terminate as shown in Figures 10-15 and 10-16. A low profile kit can also be used, like shown in Figure 10-17.

⚠ WARNING!!! Do not exceed the maximum lengths of the outside vent piping shown in Figures 10-15 and 10-16. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential boiler shutdown.

5. Maintain clearances as shown in Figures 10-15, 10-16 and 10-17. Also maintain the following:
   a. Vent must terminate:
      - At least 6 feet from adjacent walls.
      - No closer than 12 inches below roof overhang.
      - At least 7 feet above any public walkway.
      - At least 3 feet above any forced air intake within 10 feet.
      - No closer than 12 inches below or horizontally from any door or window or any other gravity air inlet.

   b. Air inlet must terminate at least 12 inches above grade or snow line; at least 12 inches below the vent termination;
   c. Do not terminate closer than 6 feet horizontally from any electric meter, gas meter, regulator, relief valve, or other equipment. Never terminate above or below any of these within 6 feet horizontally.
6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

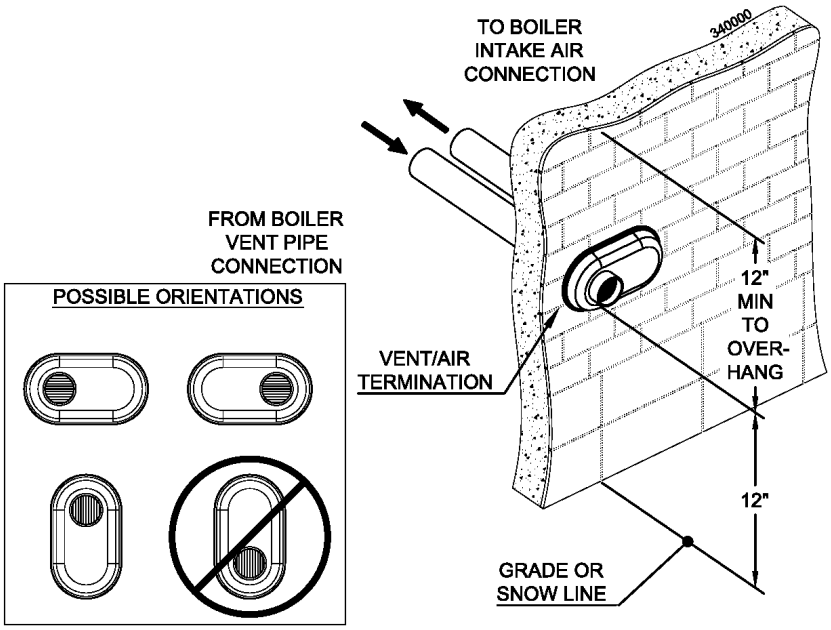


Figure 10-17 Two pipes sidewall termination of air and vent with low profile kit

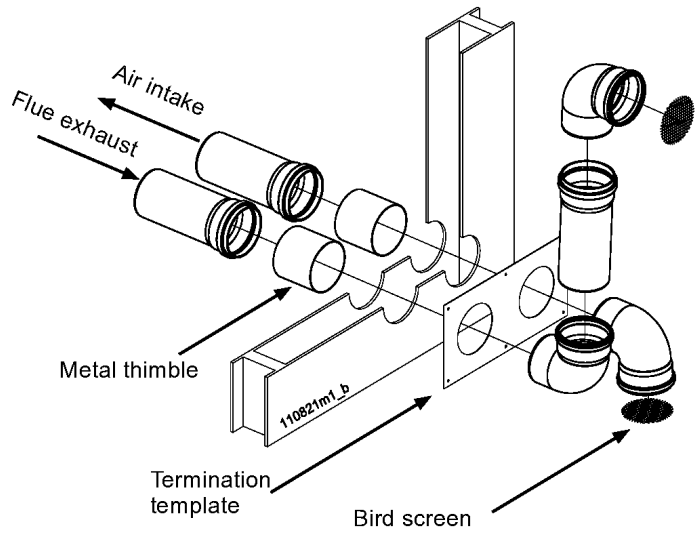


Figure 10-18 Two pipes sidewall termination assembly

10.11.3 - Prepare wall penetrations

1. Air pipe penetration:
   a. Cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter;
   b. Insert a galvanized metal thimble in the vent pipe hole as shown in Figure 10-18.
3. Use a sidewall termination plate as a template for correct location of hole centers.
4. Follow all local codes for isolation of vent pipe when passing through floors or walls.
5. Seal exterior openings thoroughly with exterior caulk.

10.11.4 - Termination and fittings

1. The air termination coupling must be oriented at least 12 inches above grade or snow line as shown in Figures 10-15 and 10-16.
2. Maintain the required dimensions of the finished termination piping as shown in Figures 10-15 and 10-16.
3. Do not extend exposed vent pipe outside of the building more than what is shown in Figures 10-15 and 10-16. Condensate could freeze and block vent pipe.

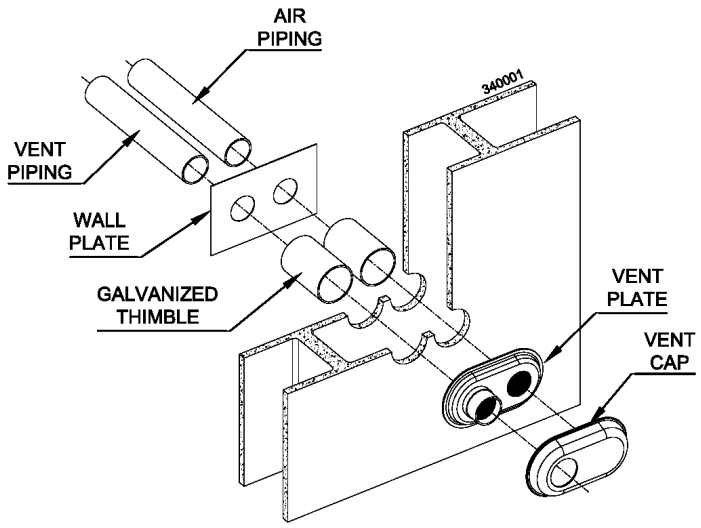


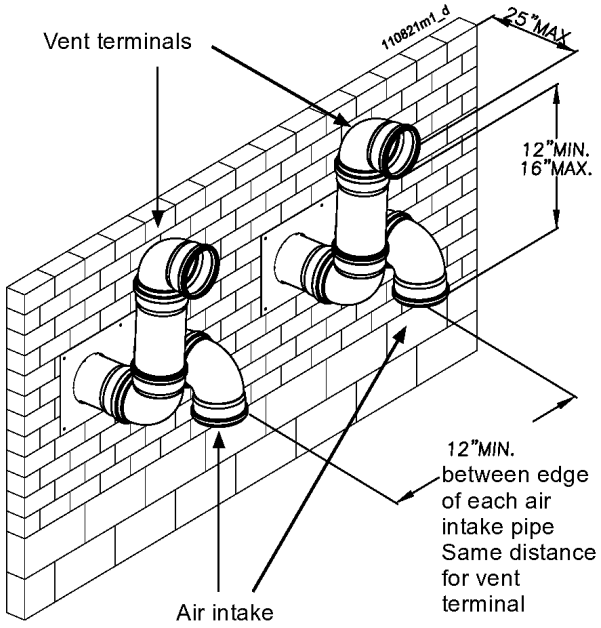
Figure 10-19 Two pipes low profile kit sidewall termination assembly

10.11.5 - Multiple vent/air terminations

1. When terminating multiple boilers, terminate each vent/air connection as shown in Figure 10-20 and 10-21.

⚠ WARNING!!! All vent pipes and air inlets must terminate at the same height to avoid possibility of air inlet flue contamination that could result in excessive levels of carbon monoxide which can cause severe personal injury or death!

2. Place wall penetrations to obtain minimum clearance of 12 inches between edge of air inlet and adjacent vent outlet, as shown in Figures 10-20 and 10-21 for U.S. installations. For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
3. The air inlet is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.



NOTICE! keep the air intake at min. 12" from grade or snow line. Provide vent and air intake with bird screen

Figure 10-20 Two pipes multiple boilers vent terminations

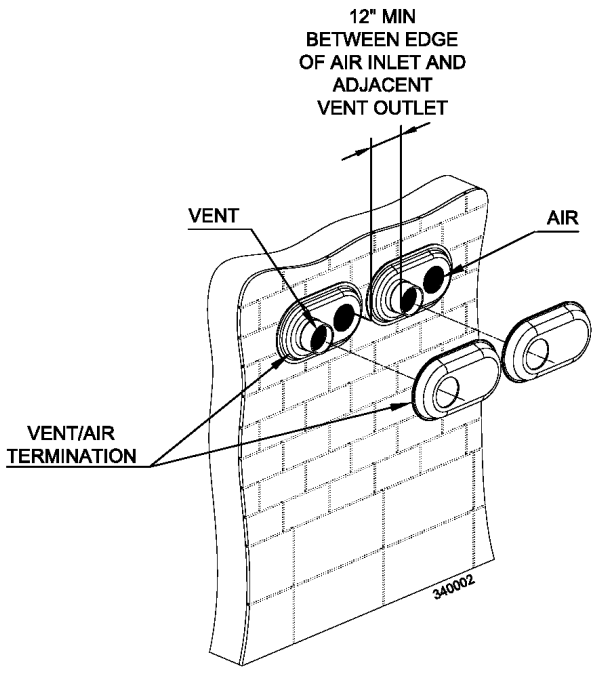


Figure 10-21 Two pipes multiple boilers low profile vent terminations

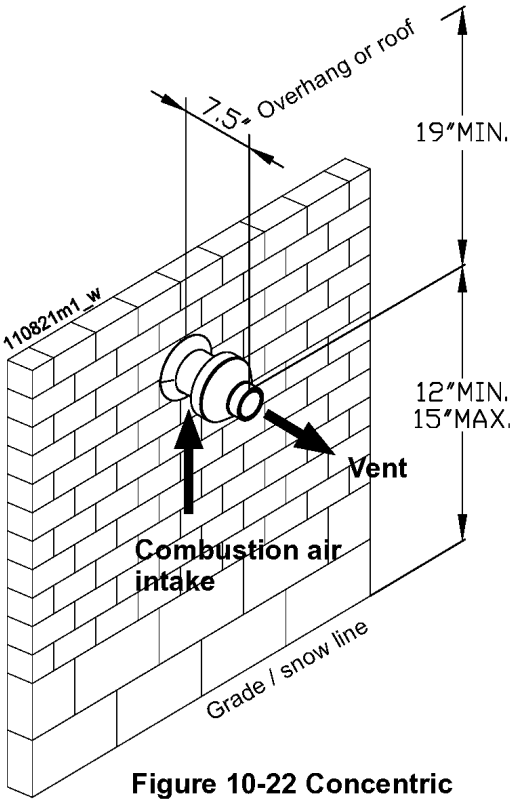


Figure 10-22 Concentric sidewall termination clearances

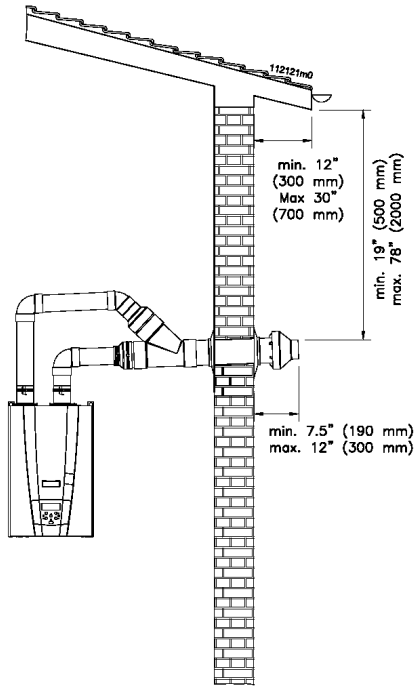


Figure 10-23 Concentric sidewall termination clearances

10.12 - Sidewall termination – Concentric vent

10.12.1 - Description and usage

The termination kit must terminate outside the structure and must be installed as shown in Figure 10-22.
The required concentric termination kit as well as combustion air and vent pipe materials are listed in Figures 10-7 and 10-8.
The termination ending must be protected from rain, see Figure 10-23.

10.12.2 - Sidewall termination installation

1. Determine the best location for the termination kit (see Figures 10-22 and 10-23).
2. The total length of piping for vent or air must not exceed the limits given in Section 10-4.
3. You must consider the surroundings when terminating the vent and air:
   a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
   b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
   c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
   d. Avoid possibility of accidental contact of flue products with people or animals
   e. Do not terminate above any door or window. Condensate can freeze, causing ice formations.
   f. Locate or guard vent to prevent condensate damage to exterior finishes.
4. Cut one (1) hole 5 inch diameter into the structure to install the termination kit.
5. Install the Concentric vent kit following the concentric kit manufacturer's instruction.

NOTICE! Ensure termination location clearance dimensions are as shown in Figures 10-22 and 10-23.

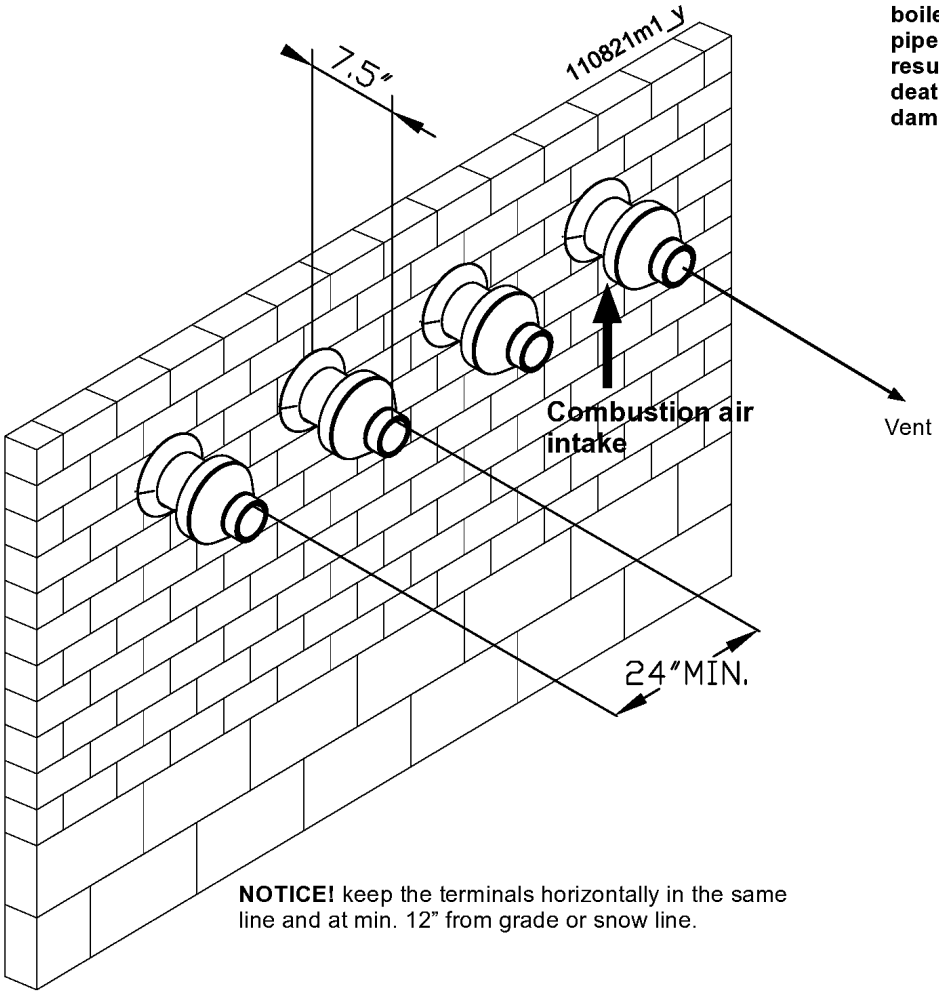
CAUTION!!! **DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur and may cause intermittent operation.**

6. Operate the appliance one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

10.12.3 - Multiventing sidewall terminations

When two or more direct vent appliances are vented near each other, each appliance must be individually vented and vent terminations may be installed as shown in Figure 10-24. It is important that vent terminations be made as shown to avoid recirculation of flue gas.

⚠ WARNING!!! Do not connect any other appliance to the vent pipe or multiple boilers to a common vent pipe. Failure to comply could result in severe personal injury, death, or substantial property damage.



NOTICE! keep the terminals horizontally in the same line and at min. 12" from grade or snow line.

Figure 10-24 Concentric sidewall multiple boilers terminations

10.13 - Vertical termination - Two pipes

⚠ WARNING!!! Follow instructions below when determining vent location to avoid possibility of severe personal injury, death or substantial property damage.

⚠ WARNING!!! Do not connect any oher appliance to the vent pipe or multiple boilers to a common vent pipe. Failure to comply could result in severe personal injury, death, or substantial property damage.

Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 for Canadian installations.

10.13.1 - Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in the Section 10.4.
2. The vent must terminate at least 3 feet above the highest place in which the vent penetrates the roof and at least 2 feet above any part of a building within 10 horizontal feet.
3. The air piping must terminate in a down-turned 180° return pipe no further than 2 feet from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.
4. The vent piping must terminate at least 1 foot above the air intake. The air inlet pipe and vent pipe can be located in any desired position on the roof, but must always be no further than 2 feet apart and with the vent termination at least 1 foot above the air intake.
5. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

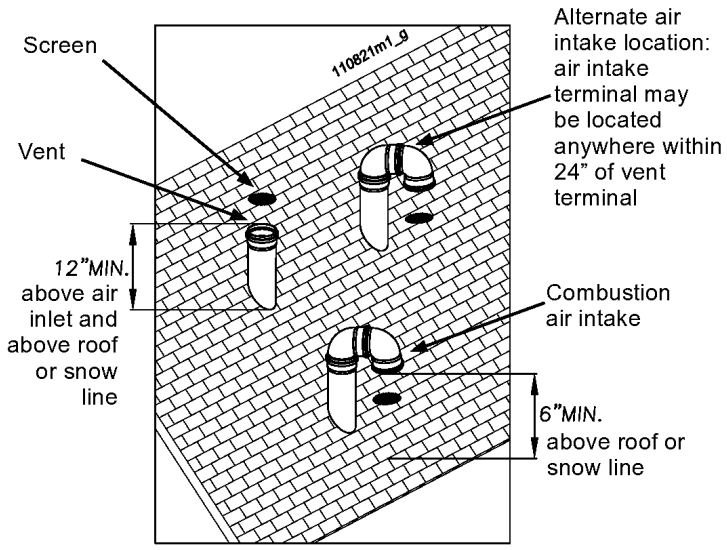


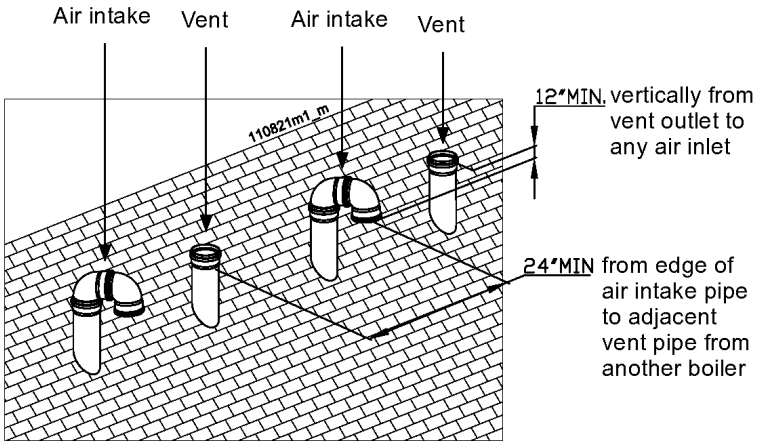
Figure 10-25 Two pipes vertical terminations of air and vent

10.13.2 - Prepare roof penetrations

1. Air pipe penetration: cut a hole for the air pipe. Size the air pipe hole as close as desired to the air pipe outside diameter.
2. Vent pipe penetration:
   a. Cut a hole for the vent pipe. For either combustible or noncombustible construction, size the vent pipe hole with at least a 1/2 inch clearance around the vent pipe outer diameter;
   b. Insert a galvanized metal thimble in the vent pipe hole.
3. Space the air and vent holes to provide the minimum spacing shown in Figure 10-25 and listed in Section 10.13.1.
4. Follow all local codes for isolation of vent pipe when passing through floors, ceilings, and roofs.
5. Provide flashing and sealing boots sized for the vent pipe and air pipe.

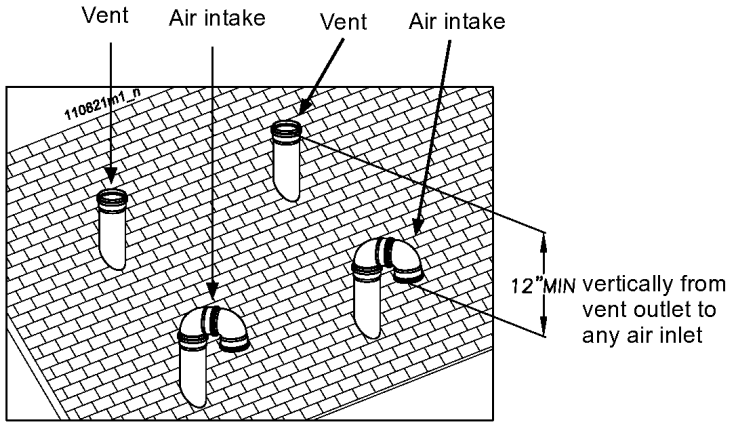
10.13.3 - Termination and fittings

1. Prepare the vent termination and the air termination elbow (Figure 10-25) by inserting bird screens.
2. The air piping must terminate in a down-turned 180° return bend as shown in Figure 10-25. Locate the air inlet pipe no further than 2 feet from the center of the vent pipe. This placement avoids recirculation of flue products into the combustion air stream.
3. Maintain the required dimensions of the finished termination piping as shown in Figure 10-25.
4. Do not extend exposed vent pipe outside of building more than shown in Figure 10-25. Condensate could freeze and block vent pipe.



NOTICE! keep the terminals at min. 12" from grade or snow line. Provide vent and air intake with bird screen.

Figure 10-26 Two pipes Multiple boilers vertical terminations



NOTICE! keep the terminals at min. 12" from grade or snow line. Provide vent and air intake with bird screen.

Figure 10-27 Alternate vertical terminations with multiple boilers

10.13.4 - Multiple vent/air terminations

1. When terminating multiple boilers, terminate each vent/air connection as shown in Figures 10-26 and 10-27.

⚠ WARNING!!! Terminate all vent pipes at the same height and all air pipes at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

2. Place roof penetrations to obtain minimum clearance of 12 inches between edge of air intake elbow and adjacent vent pipe of another boiler for U.S. installations (see Figures 10-26 and 10-27). For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
3. The air inlet is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.

10.14 - Vertical termination – Concentric vent

10.14.1 - Description and usage

Both combustion air and vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed as shown in Figure 10-28.

10.14.2 - Determine location

Locate the vent/air terminations using the following guidelines:

1. The total length of piping for vent or air must not exceed the limits given in Section 10.4.
2. The concentric terminal must terminate at least 3 feet above the highest place in which the vent penetrates the roof and at least 2 feet above any part of a building within 10 horizontal feet.
3. Locate termination so it is not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

10.14.3 - Vertical termination installation

1. Determine the best location for the termination kit (see Figure 10-29).
2. The total length of piping for vent or air must not exceed the limits given in Section 10.4.
3. You must consider the surroundings when terminating the vent and air:
   a. Position the vent termination where vapors will not damage nearby shrubs, plants or air conditioning equipment or be objectionable.
   b. The flue products will form a noticeable plume as they condense in cold air. Avoid areas where the plume could obstruct window views.
   c. Prevailing winds could cause freezing of condensate and water/ice buildup where flue products impinge on building surfaces or plants.
   d. Avoid possibility of accidental contact of flue products with people or animals
   e. Do not terminate above any door or window. Condensate can freeze, causing ice formations.
   f. Locate or guard vent to prevent condensate damage to exterior finishes.
4. Cut one (1) hole into the structure to install the termination kit.
5. Install the Concentric vent kit following the concentric kit manufacturer's instruction.

NOTICE! Ensure termination location clearance dimensions are as shown in Figures 10-28 and 10-29.

NOTICE! Ensure termination height is above the roof surface or anticipated snow level (12 inches in U.S.A. or 18 inches in Canada) as shown in Figure 10-28.

CAUTION!!! **DO NOT use field-supplied couplings to extend pipes. Airflow restriction will occur and may cause intermittent operation.**

6. Operate the appliance one (1) heat cycle to ensure combustion air and vent pipes are properly connected to the concentric vent termination connections.

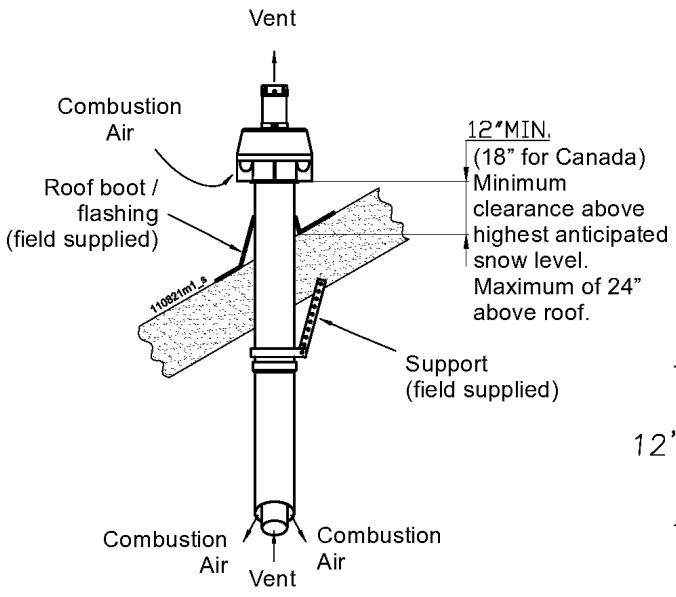
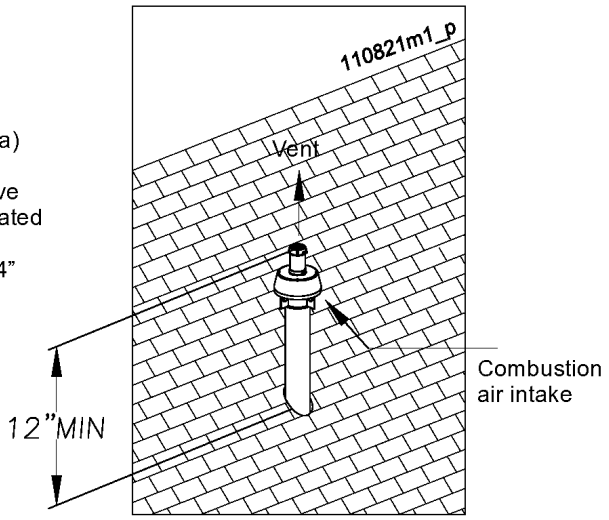


Figure 10-28 Concentric vertical terminations



Minimum clearance above snow level (18" for Canada) Maximum 24" above roof or snow level)

Figure 10-29 Concentric vertical terminations

10.14.4 - Multiventing vertical terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see Figure 10-30).

⚠ WARNING!!! NEVER common vent or breach vent this appliance to avoid possibility of severe personal injury, death, or substantial property damage.

When two or more direct vent appliances are vented near each other, two vent terminations may be installed as shown in Figure 10-30. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

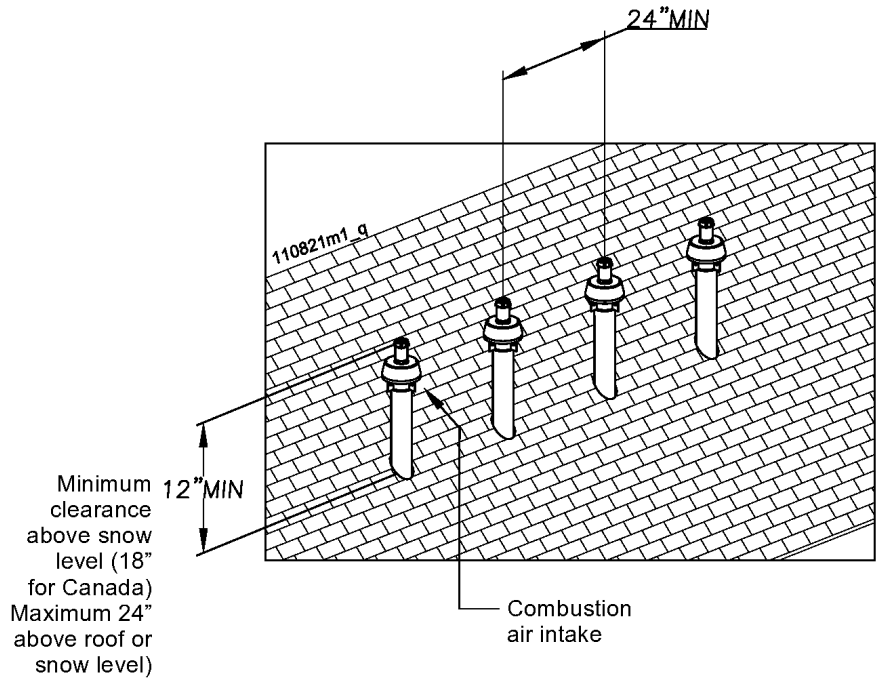


Figure 10-30 Concentric multiple boilers vertical terminations

11 - INSTALLATION - Gas supply

11.1 - 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!

Connecting gas supply piping:

1. Refere to Figure 11-1 to pipe gas to the boiler.
   a. Install ground joint union for servicing, when required.
   b. Install a manual shutoff valve in the gas supply piping, outside boiler jacket
   c. Manual main shutoff valves, must be identified by the installer.
2. Install sediment trap / drip leg. (see Figure 11-1).
3. Support piping with hangers, not by the boiler or its accessories.

⚠ WARNING!!! Do not attempt to support the weight of the piping with the boiler or its accessories. Failure to comply could result in severe personal injury, death, or substantial property damage.

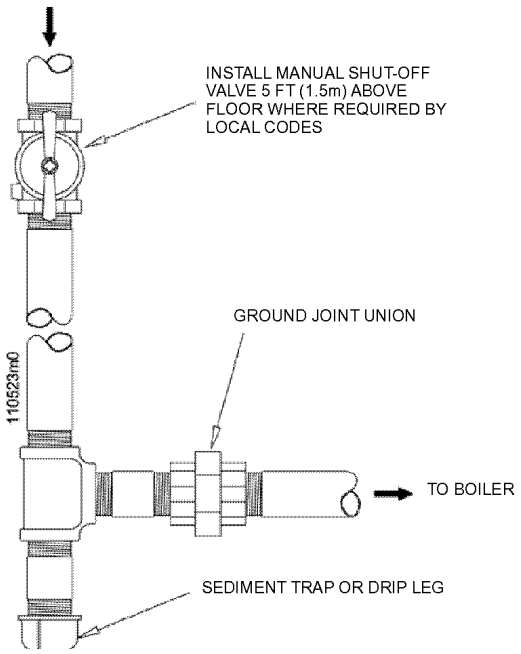
4. Purge all air from the gas supply piping.
5. Before placing the boiler in operation, check the boiler and its gas connection for leaks.
   a. The appliance must be disconnected from the gas supply piping system during any pressure testing of that system at a test pressure in excess of 1/2 PSIG (3.5 kPa).
   b. The appliance must be isolated from the gas supply piping system by closing a manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 PSIG (3.5 kPa).
   c. The appliance and its gas connection must be leak tested before placing it in operation.

⚠ 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!

6. Use pipe sealing compound compatible with propane gas. Apply sparingly only to male threads of the pipe joints so that pipe dope does not block gas flow.

⚠ WARNING!!! Failure to apply pipe sealing compound can result in severe personal injury, death, or substantial property damage.

⚠ WARNING!!! This boiler is typically shipped ready to fire on natural gas. Check boiler rating plate to determine which fuel the boiler is set for. If set to natural gas, it may be converted to LP following instruction on Section 11.6. Failure to comply could result in severe personal injury, death, or substantial property damage.



⚠ WARNING!!! Manual main shutoff valve, must be identified by the installer. Failure to comply could result in fire or explosion that can cause severe personal injury, death, or substantial property damage.

Figure 11-1 Gas supply piping

11.2 - Pipe sizing for natural gas

Refer to Figure 11-2 for pipe length and diameter. For additional gas pipe sizing information, refer to ANSI Z223.1 (or B149.1 for Canadian installations).

Natural gas supply pressure requirements

1. Pressure required at the gas valve inlet pressure port:
   - Maximum 13"W.C. with no flow (lockup) or with boiler off.
   - Minimum 3"W.C. with gas flowing (verify during high fire).
2. Install 100% lockup gas pressure regulator in supply line if inlet pressure can exceed 13"W.C. at any time. Adjust lockup regulator for 13"W.C. maximum.

11.3 - Propane Gas

⚠ WARNING!!! These boilers are typically shipped ready to fire on natural gas. Check boiler rating plate to determine which fuel the boiler is set for. If set to natural gas, it may be converted to LP by following instruction on Section 11.6. Failure to comply could result in severe personal injury, death, or substantial property damage.

Pipe sizing for propane gas

Contact gas supplier to size pipes, tanks, and 100% lockup gas pressure regulator.

Propane supply pressure requirements:

1. Adjust propane supply regulator provided by the gas supplier for 13"W.C. maximum pressure.
2. Pressure required at gas valve inlet pressure port:
   - Maximum 13"W.C. with no flow (lockup) or with boiler off.
   - Minimum 3"W.C. with gas flowing (verify during high fire).

⚠ WARNING!!! Ensure that the high gas pressure regulator is at least 6 - 10 ft upstream of the appliance. Failure to comply could result in severe personal injury, death, or substantial property damage.

	Iron Pipe size (in)							
Nominal:	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4
Actual ID:	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Cubic Feet of Gas per Hour							
10	273	514	1060	1580	3050	4860	8580	17500
20	188	353	726	1090	2090	3340	5900	12000
30	151	284	583	873	1680	2680	4740	9660
40	N/A	243	499	747	1440	2290	4050	8270
50	N/A	215	442	662	1280	2030	3590	7330
60	N/A	195	400	600	1160	1840	3260	6640
70	N/A	179	368	552	1060	1690	3000	6110
80	N/A	167	343	514	989	1580	2790	5680
90	N/A	157	322	482	928	1480	2610	5330
100	N/A	148	304	455	877	1400	2470	5040
125	N/A	131	269	403	777	1240	2190	4460
150	N/A	119	244	366	704	1120	1980	4050
175	N/A	N/A	224	336	648	1030	1820	3720
200	N/A	N/A	209	313	602	960	1700	3460
250	N/A	N/A	185	277	534	851	1500	3070

NOTICE! Maximum pipe capacity is based on a 0.60 specific gravity gas at a pressure of 0.5 PSIG and a 0.3"WC pressure drop

Figure 11-2 Gas pipe capacity for natural gas

11 - INSTALLATION - Gas supply

11.4 - Check inlet gas supply pressure

⚠ WARNING!!! DO NOT adjust or attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment. Attempting to alter or measure the gas valve outlet pressure could result in damage to the valve, causing excessive levels of carbon monoxide, which can result in severe personal injury or death!

NOTICE! The maximum inlet gas pressure must not exceed the value specified by the manufacturer and that the minimum value listed is for the purposes of input adjustment.

The gas piping must be sized for the proper flow and length of pipe, to avoid excessive pressure drop. Both the gas meter and the gas regulator must be properly sized for the total gas load.
If you experience a pressure drop greater than 1"W.C., the meter, regulator, or gas line is undersized or in need of service.

1. Follow Section 12.7 to check the inlet gas supply pressure.
2. If gas supply pressure is within normal range and no adjustments are needed, proceed on to step 4.
3. If the gas pressure is out of range, contact the gas utility, gas supplier, qualified installer or service agency to determine the necessary steps to provide proper gas pressure to the boiler.
4. Turn the power switch to the "OFF" position.
5. Shut off the manual gas shut off valve.
6. After verifying the correct gas pressures disconnect the manometer, turn the screw in pressure connection "D" in Figure 11-5, 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, or a fire or an explosion could result causing severe personal injury or death!

11.5 - Operating at high altitudes

For installations in the United States:
the heater is rated for operation at altitudes up to 10,000 ft (3078 m). For altitude above 2,000 ft (610 m) check and adjust the CO2 level following Section 12.8. This will result in an authomatic input downrate of 3% each 1,000 ft (305 m) altitude.

For installation in Canada:
the heater is rated for operation at altitudes up to 4,500 ft (1372 m). For altitude above 2,000 ft (610 m) check and adjust the CO2 level following Section 12.8. This will result in an authomatic input downrate of 3% each 1,000 ft (305 m) altitude.

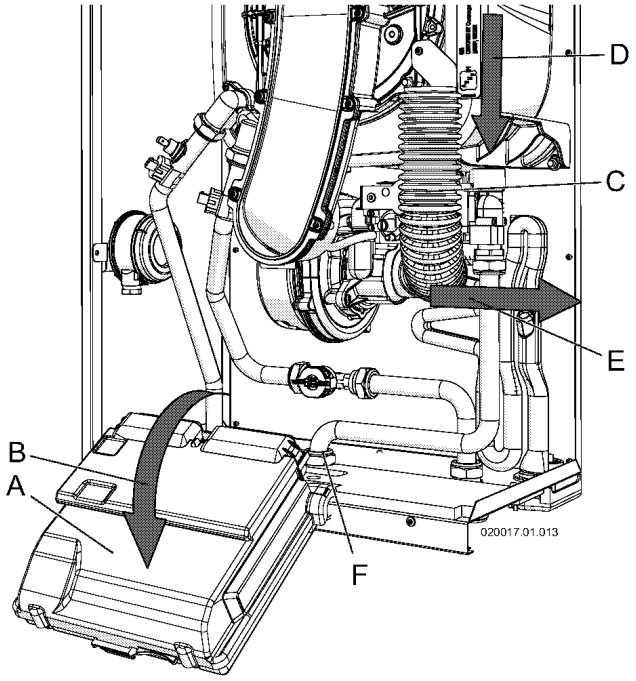


Figure 11-3 Remove the air inlet drum

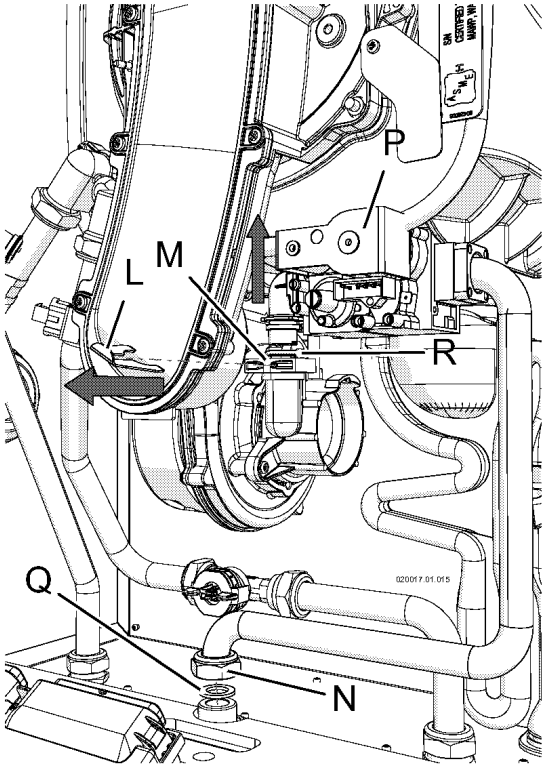


Figure 11-4 Lift the gas valve

11.6 - Convert a boiler from Natural Gas to Propane gas or viceversa

WARNING!!! The gas conversion shall be performed by a qualified service agency in accordance with these instructions and all applicable codes and requirements of the authority having jurisdiction. The information in these instructions must be followed to minimize the risk of fire or explosion or to prevent property damage, personal injury or death. The qualified service agency is responsible for the proper conversion of the boiler. The installation is not proper and complete until the operation of the converted appliance is checked as specified in this instructions.

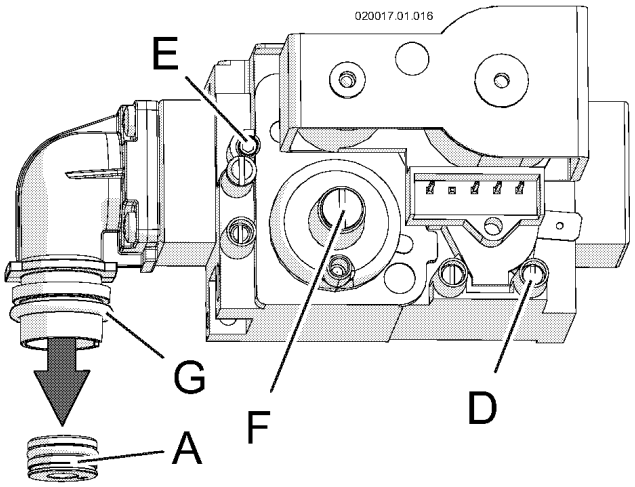
WARNING!!! The conversion shall be carried out in accordance with the requirements of the provincial authorities having jurisdition and in accordance with the requirements of the *CAN-B149.1* and *CAN1-B149.2 installation code.*

Contents:
The conversion kit (supplied with the boiler) is composed of the following elements, which are necessary for the gas change:
- a label rating stating the new gas setting;
- an instruction sheet;
- a brass orifice stamped and identified follow Figure 11-6 (for the model 199A at Natural gas, the orifice is not expected);

Installing:
in order to make the gas change please follow the instructions below:

1 - turn off the power to the boiler;

11 - INSTALLATION - Gas supply



A = Gas orifice
D = Gas inlet pressure port
E = High fire CO2 regulator
F = Never use this screw (This screw is NOT the pressure regulator)

Figure 11-5 Gas valve and Gas orifice

2 - close the manual gas shut off valve;
3 - dismantle the jacket of the boiler, follow Section 14.2;
4 - open the electrical box "A" in the "B" direction (see Figure 11-3)
5 - Push down, then rotate in the front direction and then pull in the right direction, the air inlet drum (See figure 11-3 item "C")
6 - unscrew nut "N" as per Figure 11-4;
7 - pull and remove spring "L" (see figure 11-4);
8 - pull up and remove the gas valve "P" as per Figure 11-4 (take care attention to o-ring "G" of Figure 11-5);
9 - replace orifice "A" of Figure 11-5, for the correct one for type of gas used. Verify that the stamping on the orifice matches the Figure 11-6 (**NOTICE!** 199A model at Natural gas is without orifice);
10 - reistall the gas valve, taking care attention to the o-ring "G" of Figure 11-5 and to the gasket "Q" of Figure 11-4;
11 - Insert againt the spring "L" of Figure 11-4;
12 - tight nut "N" of Figure 11-4;
13 - open the manual gas shut off valve;
14 - check for any gas leaks on nut "N" of Figure 11-4;

	U.M	90A	130A	150A	199A	250A
Orifice stamping for Natural gas	mm	4.7	8.4	8.4	No orifice	11
Orifice stamping for LP gas	mm	3.7	5.7	5.7	7	7.2
CO2 (Carbon dioxide) for Natural gas at high fire	%	8.6 to 8.9				
CO2 (Carbon dioxide) for Natural gas at low fire	%	8.5 to 9				
CO2 (Carbon dioxide) for LP gas at high fire	%	9.6 to 9.8				
CO2 (Carbon dioxide) for LP gas at low fire	%	9.5 to 11.5				
O2 (Oxygen) for Natural gas at high fire	%	5.6 to 5.1				
O2 (Oxygen) for Natural gas at low fire	%	5.8 to 4.9				
O2 (Oxygen) for LP gas at high fire	%	6.3 to 6.0				
O2 (Oxygen) for LP gas at low fire	%	6.4 to 3.4				
CO (Carbon monoxide) for Natural gas at high and low fire	ppm	Less than 150				
CO (Carbon monoxide) for LP gas at high and low fire	ppm	Less than 250				

Figure 11-6 Settings of the boiler for NATURAL GAS and LP GAS

11 - INSTALLATION - Gas supply

ATTENTION!!!
This heater has been converted for use with
LP GAS
- Maximum inlet gas pressure: 13 In.W.C.
- Minimum inlet gas pressure: 3 In.W.C.
-Manifold pressure: (see rating plate)
-Input rating: (see rating plate)
This water heater was converted on (day-month-year)
_____ to _____ gas
with kit n°_____
by_____
_____
(name and address of organization making this conversion, who accepts the responsibility for the correctness of this conversion).

Figure 11-7 Label for LP gas boiler

ATTENTION!!!
This heater has been converted for use with
NATURAL GAS
- Maximum inlet gas pressure: 13 In.W.C.
- Minimum inlet gas pressure: 3 In.W.C.
-Manifold pressure: (see rating plate)
-Input rating: (see rating plate)
This water heater was converted on (day-month-year)
_____ to _____ gas
with kit n°_____
by_____
_____
(name and address of organization making this conversion, who accepts the responsibility for the correctness of this conversion).

Figure 11-8 Label for Natural gas boiler

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

15 - turn the power on to the boiler;
16 - turn completely counter clockwise the screw "E" of Figure 11-5;
17 - Checking gas supply pressure following Section 12.7. The minimum gas supply pressure must not be less than 3"WC (7.6 mbar) and the maximum gas supply pressure must not be higher than 13"WC (33 mbar).
18 - Verifying the CO2 rate and its eventual adjustment following Section 12.8: The boiler during its normal operation, within a maximum altitude of 4500 ft, has a CO2 exhaust rate as shown in Figure 11-6. If not within range of value shown, malfunctions will occur.

⚠ WARNING!!! The CO (carbon monoxide) level should not exceed values given in Figure 11-6, when combustion is correct. Failure to comply with this requirement could result in severe personal injury, death or substantial property damage.

⚠ WARNING!!! All combustion measurements must be performed with calibrated equipment to ensure proper reading and accuracy. Failure to comply with this requirement could result in severe personal injury, death or substantial property damage.

⚠ WARNING!!! If the combustion levels are not within the range given in Figure 11-6 for the firing rate, shut the boiler down and contact your distributor or the boiler manufacturer (see reference in the last cover page). Failure to comply with this requirement could result in severe personal injury, death or substantial property damage.

19 - check the capacity of the boiler following Section 12.9
20 - Attach to the front of the boiler the appropriate conversion label, found in the conversion kit (see Figure 11-7 or Figure 11-8), stating the new type of gas adjustment of the boiler.
a - Apply the label in Figure 11-7 if the boiler has been converted to **LP GAS**;
b - Apply the label in Figure 11-8 if the boiler has been converted to **NATURAL GAS**.
c - Complete the information requested by the label of Figures 11-7 and 11-8.

12 - START-UP

12.1 - Operating

Before starting the boiler, the following must be done.

12.1.1 - User instructions

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

- ☞Make sure that the user understands that combustion air and ventilation openings must not be restricted/ closed/ or mdified in any way.
- ☞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 in any way.
- ☞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 knows how to adjust temperatures, controls and the room thermostats for maximum efficiency.

12.1.2 - Filling the condensate trap

The condensate trap is positioned inside the boiler as shown in Figures 3-2 through 3-4, item "29". It must be filled with water to prevent the leakage of flue gases from the condensate drainpipe, item "A" in Figure 8-1. To fill the condensate trap proceed follow Section 14.5.1.

⚠ WARNING!!! If boiler stays off for more than 3 months, repeat the above operation to refill the condensate trap. Failure to follow this warning could result in excessive levels of carbon monoxide, which causing severe personal injury or death!

12.1.3 - Filling the heating system

⚠ WARNING!!! Never use non-approved additives or toxic heater 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.

CAUTION!!! Refer to Section 7.1 for the quality of the water to fill up the system. Water out from values stated on Section 7.1 can result in premature heat exchanger damage.

To fill the heating system, proceed as follows:

1. open any automatic air vent in the heating system;
2. open the fill valve and proceed to fill the heating system and boiler until the pressure gauge, item "M" in Figure 13-1, reads the pressure for that the heating system is sized and "Err 59" disappears from the display; ("Err 59" displaing is set at 15PSI. If you want to increase the water pressure intervention level, set parameter 3022 to the desired new value (See Section 17)
3. check that there is no water leaking from 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 to the desired value.

12.2 - 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 Section 11.
- ☞That the gas supply system is provided with all safety devices and controls required under current national and local codes.
- ☞That the vent and combustion air terminals are properly connected (see Section 11) and free from any blockages.
- ☞That the condensate drain tube is properly connected (see Section 8).

CAUTION!!! To avoid corrosion inside heat exchanger, gas used should have sulphur rates inside maximum annual peak over a short period of time of 150 mg/ m3 and an annual average of 30 mg/m3.

⚠ 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!

12 - START-UP

12.3 - 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 = 13 in.W.C. *(33.0 mbar)*.
Minimum supply pressure = 3 in.W.C. *(7.6 mbar)*.

or

LP Gas

Maximum supply pressure = 13 in.W.C. *(33.0 mbar)*.
Minimum supply pressure = 3 in.W.C. *(7.6 mbar)*.

12.4 - 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. A propane conversion kit is supplied with the boiler. Follow the instruction in Sections 11.6.

⚠ WARNING!!! Conversion of the boiler to use another type of gas must be carried out by a qualified technician. Improper conversion of the boiler could result in excessive levels of carbon monoxide, fire or an explosion causing severe personal injury or loss of life!

12.5 - Start-up

1. Open the manual gas shut off valve (Figure 7-5 item "10").
2. Switch the on/off power switch, item "T" in Figure 13-1.
3. The boiler will fire only when the room thermostat calls for heat and the heating temperature settings is higher than the actual supply temperature. Press buttons or to select the desired heating temperature. If the external temperature sensor is connected (See Section 9.1.3), check that the calculated temperature (See Section 13.12, parameter 1012 or parameter 1107 if boilers are in cascade) is higher than the actual boiler temperature and that the outdoor temperature (See Section 13.12, parameter 1004) is lower than "warm wheather shut down temperature", (parameter 2020 into Section 13.13).
4. If the boiler is connected to an indirect water heater (See Section 7.2.6) press buttons and to select the desired domestic hot water temperature.
5. If the display gives a Low water flow error (see Section 13.16), repeat the air purging operations.

12.6 - 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 "T" in Figure 13-1) to on;
2. follow Section 13.6 to create a call for heat;
3. wait a few seconds for the burner to light-up as indicated by icon .
4. close the manual gas shutoff valve, see Figure 7-5 item "10";
5. after 3 minutes, the display must show Loc 01 and icon;
6. open the manual gas shutoff valve, see Figure 7-5 item "10";
7. 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!

12.7 - Gas supply pressure checking

⚠ WARNING!!! DO NOT adjust or attempt to measure gas valve outlet pressure. The gas valve is factory-set for the correct outlet pressure. This setting is suitable for natural gas and propane, requiring no field adjustment. Attempting to alter or measure the gas valve outlet pressure could result in damage to the gas valve, causing excessive levels of carbon monoxide, which can result in severe personal injury or death!

Check the gas supply pressure by following the steps below:

1. close the manual gas shut-off valve, Figure 7-5 item "10";
2. follow the steps in Section 14.2 to remove the front cover;
3. turn the screw in pressure port "D" shown in Figure 12-1 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 12-1;
5. open the manual gas shut off valve, Figure 7-5 item "10";
6. check that the gas supply pressure does not exceed 13 in.W.C. If the gas supply pressure is higher than 13 in.W.C. adjust the upstream gas pressure regulator to bring the gas supply pressure between 12"WC and 13"WC;
7. turn the power switch to on and generate a heat demand by pressing button to its maximum setting. Also ensure that the room thermostat is calling for heat and operate upstream the unit to verifiy the system is able to dissipate all heat generated.
8. give 3 minutes to boiler to reach the maximum capacity. Check parameter 1040 is at the same value of parameter 1043 (Section 13.12).
9. check the manometer to make sure the gas supply pressure does not drop below 3 in.W.C. (7.6 mbar). If the gas supply pressure is lower

than 3 in.W.C. means that your gas line or your gas pressure regulator are not correctly sized;

CAUTION!!! **Do not attempt to adjust your upstream gas pressure regulator. This was already adjusted for the maximum inlet gas pressure.**

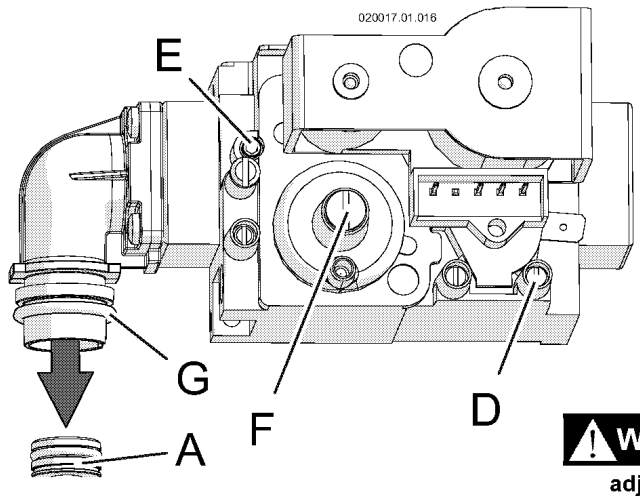
⚠ WARNING!!! **DO NOT adjust screws "E" and/or "F" (Figure 12-1). These screws are factory-set for the correct gas flow and outlet pressure. Attempting to alter the gas valve setting could result in excessive levels of carbon monoxide that can cause severe personal injury, death, or substantial property damage.**

After verifying the correct gas pressures:

1. push button  up to see OFF word on Display to bring the unit into stand-by;
2. close the manual gas shut-off valve, Figure 7-5 item "10";
3. disconnect the manometer;
4. turn the screw in pressure connection "D" in Figure 12-1, clockwise until snug;
5. open the manual shut off gas valve;
6. check pressure port "D" (Figure 12-1) 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!**



A - Gas orifice
D - Inlet gas pressure probe
E - CO2 adjusting screw
F - Factory adjusted regulator (Should never be touched)
G - O-ring gasket

Figure 12-1 Gas valve

⚠ WARNING!!! **DO NOT adjust screws "E" and/or "F" (Figure 12-1). These screws are factory-set for the correct gas flow and outlet pressure. Attempting to alter the gas valve setting could result in in excessive levels of carbon monoxide that can cause severe personal injury, death, or substantial property damage.**

12.8 - Checking and adjusting CO2 levels

Figure 11-6 lists the correct CO2 ranges for a boiler running at normal operating conditions at an altitude below 4500 ft *(1371m)*. CO2 values outside of the ranges given in Figure 11-6 may lead to malfunctioning of the boiler and cause it to prematurely fail. To check the CO2 value, proceed as follow:

⚠ WARNING!!! During this procedure compare also CO (carbon monoxide) reading, with the value given in Figure 11-6. If this is higher, STOP the boiler and call the Factory service department (see phone number on the last cover page). Failure to comply with this requirement could result in severe personal injury, death or substantial property damage.

1. If it is not already present, create a combustion analisys probe site at 8" after the flue gas exhaust connection (see Figures 10-9, 10-11 or 10-13, item "E"). To do so, follow the vent pipe manufacturers' instruction.
2. generate a call for heat and wait until the boiler is firing;
3. gain access to the "Installers' menu" and set parameter 2010 to HIGH (see Section 13.13). The boiler will now run for 20 minutes at high fire input;
4. wait 2 to 3 minutes for the CO2 to stabilize;
5. insert the probe of a calibrated combustion analyzer into the combustion analisys probe "E" of Figures 10-9, 10-11 or 10-13 and take a flue gas sample;
6. compare the CO2 reading with the high fire range given in Figure 11-6, 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 operating on the "E" screw of Figure 12-1. Use a 2.5mm Allen Wrench to turn the screw (clockwise to reduce the CO2 level, counter-clockwise to increase the CO2 level) in quarter turn increments and wait for the CO2 to stabilize to prevent overshooting the desired value;
7. when CO2 level matches the value of Figure 11-6, seal screw "E" with red paint or nail polish to discourage tampering.
8. set value of parameter 2010 to LOW. The boiler will now run for 20 minutes at low fire input;
9. wait 2 to 3 minutes for the CO2 to stabilize;
10. compare the CO2 reading with the low fire range given in Figure 11-6, making sure to use the range for the gas type in use. The CO2 reading must be inside the specified range; If not, STOP the boiler and call the Factory service department (see phone number on the last cover page).
11. set parameter 2010 to OFF to return the boiler to its normal operating mode.
12. close the combustion analisys probe "E" of Figures 10-9, 10-11 or 10-13 with a suitable cap in accordance with the vent pipe manufacturers' instruction.

⚠ WARNING!!! Once the cap "F" of Figures 10-9, 10-11 or 10-13 is right in place, with the boiler at high fire, check that it is absent from leakage and is mechanically fixed. Improper cap fixing can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

12.9 - Check the capacity input

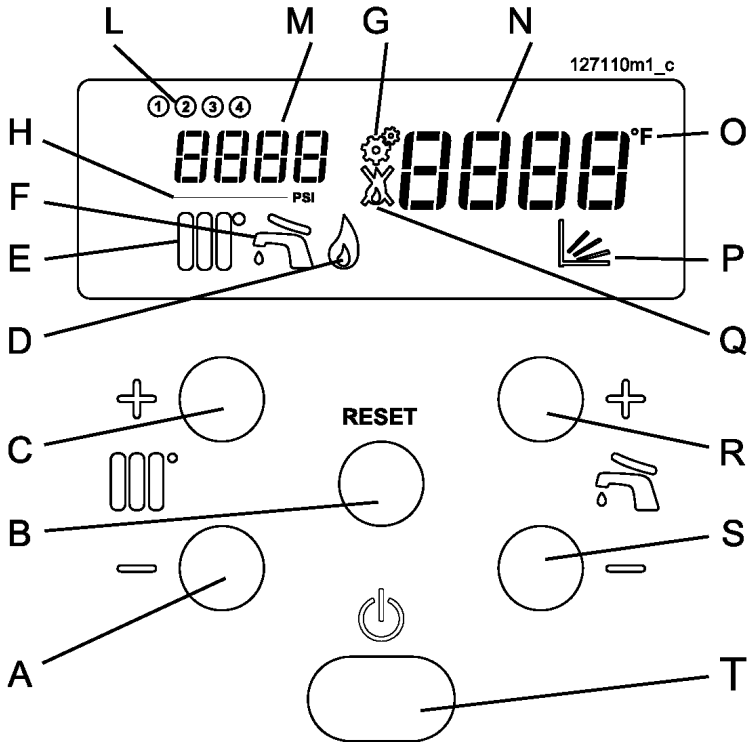
The boiler has a factory-set air/gas ratio. The pressure of the gas at the burner is indirectly controlled by the blower. The only way to check the boiler capacity input is to clock the gas meter. To do so proceed as follow:

1. operate upstream the boiler opening all valves in a way that all heat generated by the boiler can be dissipated by the heating system;
2. turn the power switch (item "T" in Figure 13-1) to on;
3. gain access to the "Installers' menu" and set parameter 2010 to HIGH (see Section 13.13). The boiler will now run for 20 minutes at high fire input;
4. wait 2 to 3 minutes for the boiler to stabilize;
5. measure the capacity input to the gas meter. This must match with the value given in Section 15 header "Maximum heat input" with a tolerance of +/- 10%. (For the calculation of the btu/hr, for Natural gas, multiply the measured flow in ft3/hr by 1075. For LP gas multiply the measured flow in ft3/hr by 2500).
6. if the capacity input is too low, check:
   a) that there are no obstructions in the combustion air and/or vent systems;
   b) check that the flue and air intake length match with the rules of Section 10.4.;
7. if the capacity input is within tolerance, set parameter 2010 to OFF to back to normal operating condition.
8. if the capacity input is higher than the expected value, repeat the procedure of Section 12.8.

12.10 - Minimum water flow

This unit is protects itself against low water flow. A water flow meter (item "4", Figures 3-1 and 3-3) continuously monitors the water flow within the boiler. If the water flow decrease below the minimum required flow, the burner automatically shuts Off and after 3 minutes an error is displayed.

13 - USE



A - Key to reduce the supply water temperature;
B - Multifunctional key: reset any lockouts; access to user and installer menu.
C - Key to increase the supply water temperature;
D - Flame icon, is present when the flame is present;
E - Radiator icon. Present when heating is enabled to work. Blinking when heating is active;
F - Faucet icon. Present when an indirect water heater is enabled to work. Blinking when an indirect water heater (coil water heater) is in load;
H - Unit of measure of the water system pressure;
L - Cascade boiler indicators: Light when boiler is burning; blinking when boiler is in lockout or in blocking error:

① = Boiler 1 (manager)

② = Boiler 2 (dependent)

③ = Boiler 3 (dependent)

④ = Boiler 4 (dependent)

M - Water pressure gauge and indicator of the parameters
G - Icon indicating access to the installer menu
N - Supply water temperature gauge and indicator of the parameters value
O - Unit of measure of the temperature
P - Icon displayed when the outdoor sensor is active
Q - Flame crossed icon: is present when the appliance is in lockout or blocking error condition
R - Multifunctional key: increase the indirect water heater temperature; scroll the parameters; increase the parameters' value;
S - Multifunctional key: decrease the indirect water heater temperature; scroll the parameters; decrease the parameters' value;
T - On-Off Main power switch

Figure 13-1 Control panel

13 - USE

13.1 - Check water pressure

If the pressure inside the water circuit falls below the minimum pressure for the system, the appliance switches off and the display "N" as per Figure 13-1, shows Err 59 to indicate that it is necessary to restore the correct pressure. Open the filling valve and check the pressure on the pressure gauge "M" of Figure 13-1, the word Err 59 will disappear when the pressure back at the right value.
To prevent accidental relief valve openings, fill the circuit slowly.

CAUTION!!! During normal operations, the filling valve 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 air bubbles present.
If after one month the pressure continue to decrease, call a qualified service technician.

CAUTION!!! Continual fresh make-up water will reduce boiler life. Mineral buildup in the heat exchanger reduces heat transfer, overheats the stainless steel heat exchanger, and causes failure. Addition of oxygen carried in by makeup water can cause internal corrosion in system components. Leaks in boiler or piping must be repaired at once to prevent makeup water entering the boiler.

13.2 - 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 13.12) and the "Installers' Menu" (see Section 13.13).
During functioning display "N" of Figure 13-1, displays the supply temperature, and display "M" (see Figure 13-1) shows the pressure of the water. The various operating statuses are shown with other icons as per Figure 13-1.

13.3 - Displays

During normal operations, the display remain permanently off, except appliance go into Lockout, or in Blocking error.
In any case, pressing any key, display will light on and will stay light on for 5 minutes from the last pressing key.

13.4 - Start-up procedure

1. Open the manual gas shutoff valve;
2. switch on electric power to the boiler;
3. If the display shows code Err 65, it means that the polarity has not been observed (Call service department to restore the situation, do not attempt to repair it);
4. press key  or  to setup the supply temperature desired, then press RESET key to save the changement.
5. press key  and  to setup the indirect water heater desired temperature, then press RESET key to save the changement.

The flame control appliance will start-up the burner.
If the burner fail to ignite within 60 seconds, the boiler will automatically attempt ignition another four times, after which if it fail to start-up, it will shut down and the display will show Loc 1 together icon  .

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

CAUTION!!! If the appliance frequently show a lockout, contact a qualified technician to restore normal running conditions. Do not attempt to repair it.

13.5 - Indirect water heater temperature adjustment

To control the indirect water heater temperature you have to use keys  and  . When the keys are pressed, the display, item "N" in Figure 13-1, shows the indirect water heater setpoint being selected. The range within which the indirect water heater can be set is 104°F (40°C) to 140°F (60°C).

WARNING!!! Water temperature over 125°F can cause severe burns instantly or death from scalds. Children, disabled and elderly are at highest risk of being scalded. Feel water before bathing or showering.

13.6 - Heating temperature adjustment

The boiler supply hot water at the temperature set by adjusting keys  or  as shown in Figure 13-1. The room thermostat turns the circulator pumps on in order to satisfy the heat demand of the rooms controlled by the thermostat. To maximize the boilers' performance, the heating temperature, should be set at a value that is just sufficient to maintain the desired temperature of the rooms.

13.7 - Outdoor reset adjustment

While in the "Installers' Menu" (Section 13.13), set the 2003 parameter to 1. In this mode the heating supply temperature, calculated temperature in Figure 13-2, 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 Figure 13-2. In order to change the relationship between the supply water temperature and the

outdoor temperature, all parameters listed in Section 13.7.2 must be set.

13.7.1 - Outdoor reset applications

Outdoor reset is a sophisticated way to maximize comfort and boiler efficiency. When making adjustments to change the supply temperature, it is advisable to first set the suggested default values for the desired curve shown in Figure 13-2. 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 changed 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;

13.7.2 - Outdoor reset: setting parameters

Refer to Section 13.13 and set:

- 2020 = "Warm weather shutdown temperature". When the outdoor temperature decrease below this value the heating system is forced to shut down. Suggested starting value is 72°F (22°C).

- 2021 = "Winter outdoor temperature". Is the design winter temperature used for the basic heat load calculation.

- 2022 = "Winter supply temperature". Is the supply temperature correspondent to the "Winter outdoor temperature" (parameter 2021). Suggested values are 104°F (40°C) for floor radiant panels or 158°F (70°C) for radiators heating systems.

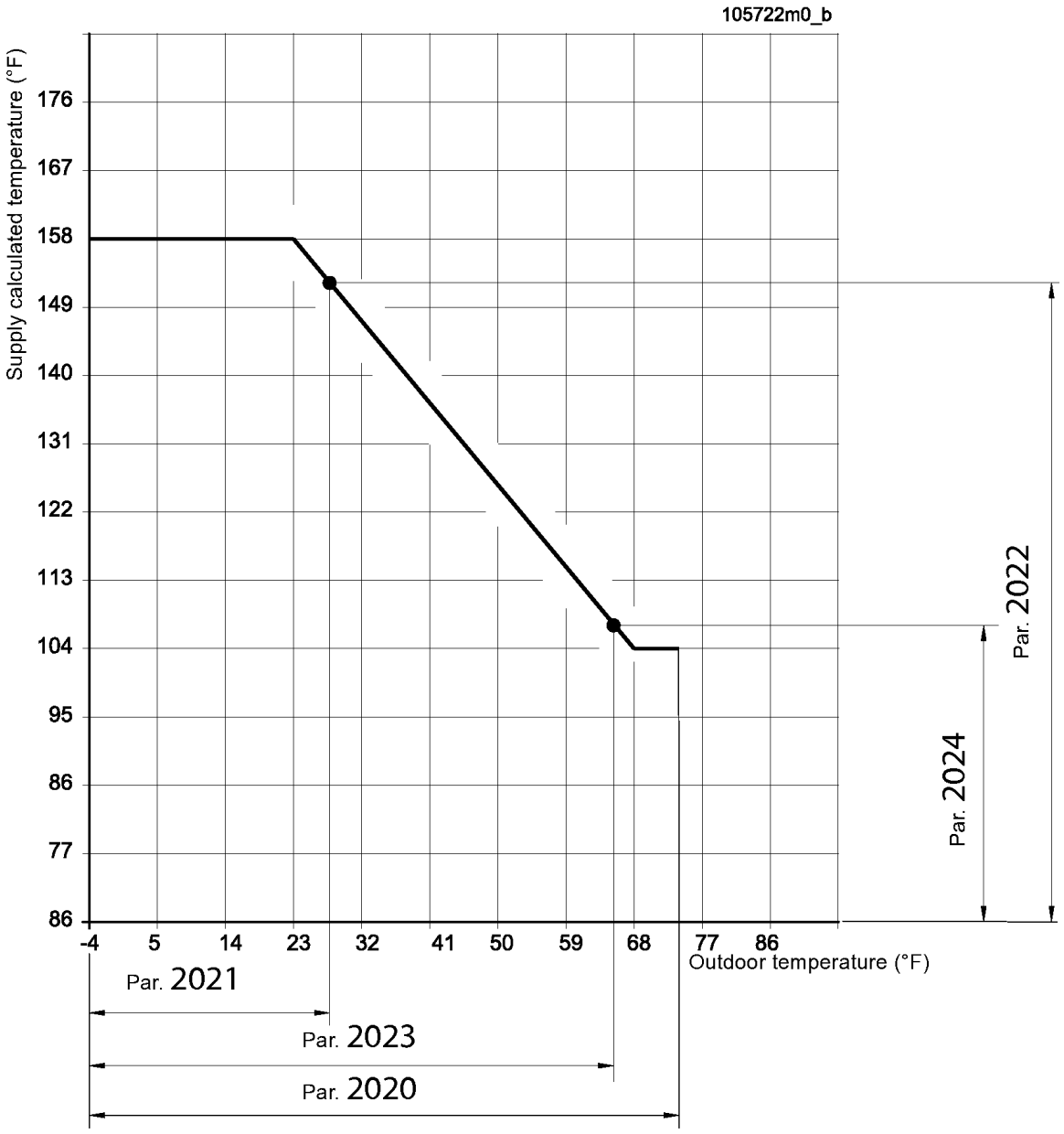
- 2023 = "Spring outdoor temperature". Is the typical spring outdoor temperature you want the heating service to the minimum capacity. Suggested value is 64°F (18°C).

- 2024 = "Spring supply temperature". Is the supply temperature correspondent to the "Spring outdoor temperature" (parameter 2023). Suggested values are 86°F (30°C) for floor radiant panels or 108°F (42°C) for radiators heating systems.

Once selected, reset adjustment is completely automatic; when the outdoor temperature is higher than parameter 2020 ("Warm weather shutdown temperature") the heating service switches off. When the outdoor temperature reduce below parameter 2020 ("Warm weather shutdown temperature"), the heating service switches back on. If, for some reason the heating service doesn't match the load, using parameters 2022 (during cold winter) and 2024 (during spring season), to rise or lower the calculated temperature and match the desired room temperature.

Outdoor Reset Parameters	Description	Default setup	Baseboard heat emitters and convectors	Cast iron and/or steel panel radiators / high temp Hydronic air handlers	Low temp Hydronic air handlers / staple up radiant	In slab radiant
2020	Warm wheather shutdown temperature (over this setting the heating is turned off)	69	70	70	70	70
2021	Typical outdoor winter design temperature (°F)	14	10	10	10	10
2022	Typical supply temperature during outdoor winter design temperature (°F)	176	176	160	140	120
2023	Typical outdoor spring temperature (just before you want the heating service to be switched off) (°F)	69	65	65	65	65
2024	Typical supply temperature during outdoor spring temperature (°F)	110	110	100	120/100	70

Outdoor sensor Parameters settings



Par. 2020 = Warm weather shutdown temperature

Par. 2021 = Winter outdoor temperature

Par. 2022 = Winter supply temperature

Par. 2023 = Spring outdoor temperature

Par. 2024 = Spring supply temperature

Figure 13-2 - Graph of the outdoor reset settings

13.8 - 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 4 minutes;

b - DHW delay: each time the domestic hot water demand is satisfied, a 4 minutes delay pass before the end of the service (if a need for heating is present the 4 minutes delay are by-passed);

c - Time delay in restarting the burner: in its normal functioning state, every time the burner stops, there is a delay time of 3 minutes before the burner starts again.

13.9 - Circulator pump protection

During stand by state, circulators pumps run once a day for around 15 seconds to prevent them from seizing.

13.10 - Boiler's Freeze protection

CAUTION!!! **For the freeze protection function to work, the boiler must remain connected to the electrical and gas supplies with DHW and heating service switched to OFF**

CAUTION!!! **The freeze protection program in the boiler will only protect the boiler and not the entire heating system. If the system is shut down on a regular basis or has the potential to freeze additional measures must be taken to protect the system from freezing.**

CAUTION!!! **Do not deactivate the boiler freeze protection program. If the indoor air temperature of the building where the boiler is located drops to 40F or below it is the responsibility of the owner to take preventative measures to prevent the boiler and system from freezing.**

Once the boiler has reached a temperature of 50 °F *(10 °C)*, the heating pump will automatically turn on. If the temperature falls below 41 °F *(5 °C)*, the burner will light to prevent the boiler from freezing.
If the boiler will not be used for long time it should be drained per Section 14.6.

13.11 - Display in energy saver mode

The display, in Figure 13-1, is switched off each time no key is touched for at least 5 minutes, with the exception of when it displays errors or settings.

13 - USE

13.12 - "Users' menu"

Pressing RESET key for 2 seconds, you will enter the "Users' menu". When entering the "Users' menu", the display, item "M" in Figure 13-1, will start showing parameters from 1000.

Press keys − and + to scroll all parameters inside this menu. All parameters into this "Users' menu" are reading only.

Parameter	Parameter's description	Units
1001	Supply temperature	°F
1002	Indirect water heater temperature	°F
1004	Outdoor sensor temperature	°F
1006	Flue gas temperature	°F
1007	Return temperature	°F
1008	Ionisation current	µA (micro ampere)
1009	State of the Local pump	ON/OFF
1010	State of the CH pump	ON/OFF
1011	State of the DHW pump	ON/OFF
1012	Calculated CH setpoint (when outdoor sensor is enabled)	°F
1040	Actual Fan speed	rpm/min
1041	Ignition fan speed	rpm/min
1042	Low power fan speed	rpm/min
1043	High power fan speed	rpm/min
1051	Last lockout number	\
1052	Last Blocking error	\
1053	Number of flame failures	no
1055	Number of failed ignitions	no
1056	Total hours of operation	Hr x 10
1057	Total hours of operation of the indirect water heater	Hr x 10
1059	**Interval between Lockouts. May be: 1:MIN; 2:HRS; 3:DAY; 4:WK	
1060	**Interval between Blocking errors. May be: 1:MIN; 2:HRS; 3:DAY; 4:WK	
1062	Water flow	GPM
1101	CASCADE: number of boilers ON	n
1102	CASCADE: header temperature	°F
1103	CASCADE: any boiler into Lockout	/
1104	CASCADE: any boiler into Blocking Error	/
1106	CASCADE: system is in emergency mode	/
1107	CASCADE: current cascade setpoint	°F
1120	CASCADE: boiler 1 modulating level	%
1121	CASCADE: boiler 2 modulating level	%
1122	CASCADE: boiler 3 modulating level	%
1123	CASCADE: boiler 4 modulating level	%

** How to read the timer values:
Eg: If it shows 1:29, it means 29 minutes;
Eg: If it shows 2:12, it means 12 hours;
Eg: If it shows 3:15, it means 15 days;
Eg: If it shows 4:26, it means 26 weeks;

13.13 - "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 diagnostic and adjustment of the appliance to the system.
When entering the "Installers' Menu", the display in Figure 13-1, will start to show the icon and parameters over 2000 indicating that a change of mode has taken place.

To access the "Installers' Menu" (see also Section 16 to better understand the several menus) proceed as follow:
1. press and hold together buttons RESET and − for 5 seconds until the icon is displayed;
2. release the two precedent buttons;
3. press and release the − and + buttons to scroll through the list of the parameters;
4. once the parameter has been displayed, it can be changed pressing the RESET button (value start to blinking) and using the − and + keys you can change the value;
5. press and release the RESET button to confirm the amended data before moving to the next parameter.
6. To exit the "installers' Menu", press and hold RESET button for more than 5 seconds until the icon stops to be displayed.

NOTICE! 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 parameter, what it affects and its adjustment range.
Custom value column is at your convenience to record changed values in the event you need to change the control board.

Parameter	Parameter's description	M.U.	Range	Boilers' factory settings	Custom. value
2001	Heating minimum Power	%	1 to 50	1	
2002	Heating maximum Power	%	1 to 100	100	
2003	CH mode	nn	00: CH with thermostat; 01: CH with RT and outdoor reset; 02: CH with full outdoor reset; 03: CH with permanent heat demand; 04: CH with 0-10 Vcc input (an 885IF board must be added)	0	
2004	Wait time after max differential	sec	10 to 30	30	
2005	Post CH pump time	sec	10 to 900	120	
2010	System test:	\	Off, Low, Ign, High (Set back parameter to OFF to exit from this state)	OFF	
2011	System test: Local pump	\	On or OFF	OFF	
2012	System test: CH pump	\	On or OFF	OFF	
2013	System test: DHW pump	\	On or OFF	OFF	
2014	Display test (when RESET button is pushed all display icons will light-on. Next RESET buttons back in settings menu)	\	\	\	
2020	Warm weather shutdown temperature	°F	32 to 95	69	
2021	Reset curve design: winter outdoor temperature	°F	-4 to 41	24	
2022	Reset curve design: winter supply temperature	°F	32 to 176	176	
2023	Reset curve design: spring outdoor temperature	°F	32 to 86	69	
2024	Reset curve design: spring supply temperature	°F	32 to 104	104	
2027	Night setback temperature	°F	2 to 90	18	

Continue

2042	Anti cycling: time	sec	10 to 900	180	
2043	Anti cycling: differential temperature	°F	0 to 36	28	
2062	DHW post pump time	sec	10 to 255	120	
2063	DHW max priority time	min	1 to 60	30	
2067	DHW priority		0 = (TIME), DHW has priority to CH during DHW max priority time (2063) 1 = (OFF), CH always has priority to DHW. 2 = (ON), DHW always has priority to CH	2	
2100	Display: delay to shut off	min	0 to 30	5	
2101	CASCADE Emergency mode (If sensor 1102 fail)	\	no or yES	Yes	
2102	CASCADE Emergency setpoint	°F	68 to 149	113	
2103	CASCADE start delay time	sec	1 to 900	180	
2104	CASCADE stop delay time	sec	1 to 900	180	
2105	CASCADE start boiler diff.	°F	0 to 36	9	
2106	CASCADE stop boiler diff.	°F	0 to 36	9	
2107	CASCADE calculated setpoint. Max offset up.	°F	1 to 36	18	
2108	CASCADE calculated setpoint. Max offset down.	°F	1 to 36	36	
2109	CASCADE next boiler start rate	%	1 to 100	70	
2110	CASCADE next boiler stop rate	%	1 to 100	10	
2111	CASCADE rotation interval	Days	0 to 9	6	
2113	CASCADE start modulation delay factor	min	0 to 60	5	
2114	Post local pump time	sec	0 to 255	120	
2200	System test: all burners together.	/	Off, Low, Ign, High	Off	
2201	System test: Boiler 1 (Manager)	/	Off, Low, Ign, High	Off	
2202	System test: Boiler 2	/	Off, Low, Ign, High	Off	
2203	System test: Boiler 3	/	Off, Low, Ign, High	Off	
2204	System test: Boiler 4	/	Off, Low, Ign, High	Off	
2205	System test: Boiler 5	/	Off, Low, Ign, High	Off	
2206	System test: Boiler 6	/	Off, Low, Ign, High	Off	
2207	System test: Boiler 7	/	Off, Low, Ign, High	Off	
2208	System test: Boiler 8	/	Off, Low, Ign, High	Off	

13.14 - Diagnostic

During normal operation display can show the below informations:

Parameter	Parameter description	Visualization on display “N” (see Figure 13-1)
AFro	Boiler is doing antifreezing protection	Supply temperature (°F)
	Light fixed = Indirect water heater enabled Blinking = indirect water heater loading	Indirect water heater temperature (°F)
	Light fixed = Hot water supply enabled Blinking = Hot water supply active	Supply temperature (°F)

13.15 - Diagnostic: Lockouts “Loc”

To RESET a lockout, siply press RESET key.
Below the list of lockout codes.

Loc	Description	Checks	Solutions
Loc 01	No flame detected after five ignition attempts.	a-correct gas supply pressure (see Section 12.7); b-ignition spark (see Section 14.4); c-correct amount of gas (see sections 12.9); 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 4uA (follow procedure in section 14.1.10)	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 electrode position and gap as per section 14.4; If position is correct, check for 120Vac at the supply of the spark generator. c-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 4uA, confirm that the the CO2 content is adjusted properly (see section 12.8). Check the flame detection electrode (section 14.4) and if necessary replace it, check the integrity of the flame detection electrode electrical wires.
Loc 02	Gas valve not supplied before try to ignition	a - Check LWCO connection b - Check Flue blocked pressure switch c - Check High limit temperature switch d - Check High limit flue temperature fuse	**⚠ WARNING!!! If the high limit temperature fuse melt, before any replacement, it is mandatory to contact the appliance manufacturer to prevent any permanent damages to the heat exchanger. Failure to comply with this requirement can result in excessive levels of carbon monoxide which can result in severe personal injury or death!**
Loc 03	Gas valve lost cable connection during fire	a - Check the integrity of the wires connections between gas valve and control board	a - If wires are interrupted, replace the wires b - If wires are ok try to replace the gas valve or the power control board
Loc 04	Gas valve relay not closing	a - Check the integrity of the wires connections between gas valve and control board	a - If wires are interrupted, replace the wires b - If wires are ok try to replace the gas valve or the power control board
Loc 05	Gas valve circuit	a - Check LWCO connection b - Check Flue blocked pressure switch c - Check High limit temperature switch d - Check High limit flue temperature fuse	**⚠ WARNING!!! If the high limit temperature fuse melt, before any replacement, it is mandatory to contact the appliance manufacturer to prevent any permanent damages to the heat exchanger. Failure to comply with this requirement can result in excessive levels of carbon monoxide which can result in severe personal injury or death!**
Loc 06	Safety relay open error		Replace the power control board
Loc 07	Safety relay closed error		Replace the power control board
Loc 11	Blocking error over 20 hr	Press RESET button to see the Blocking error reference and proceed follow it	
Loc 12	Fan error	a - Check for 120Vac power connection of the fan b - Check PWM connection of the fan	a - If no 120Vac is present replace the power control board b - If no PWM signal, replace power control board c - Try to replace the fan
Loc 13	Internal software error		Replace the power control board
Loc 14	Internal software error		Replace the power control board
Loc 15	Internal software error		Replace the power control board
Loc 16	Internal software error		Replace the power control board
Loc 17	Internal software error		Replace the power control board
Loc 18	Internal software error		Replace the power control board

Continue

Loc 19	Internal software error		Replace the power control board
Loc 20	Internal software error		Replace the power control board
Loc 21	Internal software error		Replace the power control board
Loc 22	Internal software error		Replace the power control board
Loc 23	Internal software error		Replace the power control board
Loc 24	Internal software error		Replace the power control board
Loc 25	Gas valve circuit	a - Check LWCO connection b - Check Flue blocked pressure switch c - Check High limit temperature switch d - Check High limit flue temperature fuse	**⚠ WARNING!!! If the high limit temperature fuse melt, before any replacement, it is mandatory to contact the appliance manufacturer to prevent any permanent damages to the heat exchanger. Failure to comply with this requirement can result in excessive levels of carbon monoxide which can result in severe personal injury or death!**
Loc 26	Internal software error		Replace the power control board
Loc 27	Flame present with closed gas valve		Replace the gas valve
Loc 28	Flame present with closed gas valve		Replace the gas valve
Loc 29	Internal software error		Replace the power control board
Loc 30	Internal software error		Replace the power control board
Loc 31	Five times flame lost during one demand	a) Check detection electrode; b) Check for any obstruction on air inlet / flue exhaust sytem c) Check for any air inlet contamination from combustion gas (Eg. flue exhaust terminal too much near air inlet terminal)	a) Try to replace detection electrode b) Remove any obstruction c) Remove the cause of the air inlet contamination
Loc 32	Internal software error		Replace the power control board
Loc 33	Internal software error		Replace the power control board
Loc 34	Internal software error		Replace the power control board
Loc 35	Internal software error		Replace the power control board
Loc 36	Internal software error		Replace the power control board
Loc 37	Internal software error		Replace the power control board

13.16 - Diagnostic: Blocking errors "Err"

Blocking errors are generated by a permanent fault. Ther'is no way to unlock the unit other than to resolve the cause of the fault.

Err	Description	Checks	Solutions
Err 45	Internal software error		Replace the power control board
Err 46	Internal software error		Replace the power control board
Err 47	Internal software error		Replace the power control board
Err 48	Internal software error		Replace the power control board
Err 49	Internal software error		Replace the power control board
Err 50	Internal hardware error		Replace the power control board
Err 51	Internal hardware error		Replace the power control board
Err 52	Internal hardware error		Replace the power control board
Err 53	Internal hardware error		Replace the power control board
Err 54	Flame is detected in a state in which no flame is allowed to be seen.		Replace the power control board
Err 55	Low water pressure error	Check pressure sensor	Replace the pressure sensor
Err 56	Low water pressure error	Check pressure sensor	Replace the pressure sensor
Err 57	Low water pressure error	Check pressure sensor	Replace the pressure sensor
Err 58	Low water pressure error	Check pressure sensor	Replace the pressure sensor
Err 59	Low water pressure error	a - Check the pressure into the water system and eventually increase it	a - If water system pressure is over parameter 3022, replace the water pressure sensor
Err 60	High flue gas temperature error	a - Check the combustion efficiency. Combustion Efficiency must be higher than 88%. b - Check the flue gas temperature sensor match Section 14.7	a - If combustion efficiency is lower than 88%, try to clean the flue gas side and the water side of the heat exchanger; b - If flue temperature sensor do not match Section 14.7, it must be replaced.
Err 61	Return temperature is higher than stay burning temperature	Check if temperature sensor match Section 14.7	If temperature sensor do not match Section 14.7, it must be replaced.
Err 62	Block drain switch is active (N/A)	N/A	N/A
Err 64	No correct Frequency signal or no correct ground connection or no communication with the WD	a - Check the frequency signal. It must be between 55 and 65Hz b - Check the ground connection (between ground and neutral it must be 0 volt)	a - If out of range, ask your electrical supplier. b - If the ground connection is not right ask to your electrical supplier Diversely try to replace the power contro board
Err 65	Hot neutral reversed	Check supply voltage polarity	Reverse supply voltage polarity, if it's the case
Err 66	Net freq. error detected in the main	Check the frequency signal. It must be between 55 and 65Hz	If out from range, ask your electrical supplier. Diversely try to replace the power contro board
Err 67	Faulty earth connection	Check the earth connection to the appliance	Repristinate the earth connection
Err 68	Watchdog communication error		Replace the power control board
Err 72	Supply sensor open	Check if temperature sensor match Section 14.7	If temperature sensor do not match Section 14.7, it must be replaced.
Err 73	Return sensor open	Check if temperature sensor match Section 14.7	If temperature sensor do not match Section 14.7, it must be replaced.
Err 76	DHW sensor open	Check if temperature sensor match Section 14.7	If temperature sensor do not match Section 14.7, it must be replaced.
Err 80	Supply sensor shorted	Check if temperature sensor match Section 14.7	If temperature sensor do not match Section 14.7, it must be replaced.
Err 81	Return sensor shorted	Check if temperature sensor match Section 14.7	If temperature sensor do not match Section 14.7, it must be replaced.
Err 84	DHW sensor shorted	Check if temperature sensor match Section 14.7	If temperature sensor do not match Section 14.7, it must be replaced.
Err 86	Flue sensor shorted	Check if temperature sensor match Section 14.7	If temperature sensor do not match Section 14.7, it must be replaced.
Err 87	Reset button error	Too many reset button pushing in 60 sec	
Err 93	Appliance selection error	Check the list of 3000 parameters (Section 17)	
Err 107	Internal software error		Replace the power control board
Err 108	Internal software error		Replace the power control board

Err 109	Internal software error		Replace the power control board
Err 110	N/A		
Err 111	N/A		
Err 112	Internal software error		Replace the power control board
Err 113	Internal software error		Replace the power control board
Err 114	Too low water flow	a - Check water flow into the system (parameter 1062), it must be higher than parameter 3035.	a - Increase the water flow into the system b - Check for any obstruction into the water system
Err 115	Cascade; boiler master failure		Reset via 3013 parameter
Err 116	Cascade communication failure	a - Bus communication interrupted a - boiler is not working	a - check for the bus communication b - repristinate the boiler that is light off.

13.17 - Boiler shut down

1. Follow “To Turn Off Gas to Appliance” on page 2 of this manual.
2. Do not drain the system unless exposure to freezing temperatures will occur.
3. Do not drain the system if it is filled with an antifreeze solution.

13.18 - How to clean the appliance jacket

To clean the appliance jacket, use only a soft cloth dampened with water. Do not use aggressive or abrasive agents.

14 - MAINTENANCE

14.1 - Care and maintenance

This section must be brought to the attention of the user by the installer so that the user can make the necessary arrangements with a qualified service agency for the periodic care and maintenance of the boiler. User must check its boiler follow Figure 14-1 column “User maintenance”.
The installer must also inform the user that the lack of proper care and maintenance of this boiler and any fuel burning equipment may result in an hazardous condition.

Installer should discuss contents of Section 14 (User’s section) with the user.
A trained and qualified service technician should perform the inspection listed in these instructions before each heating season and at regular intervals.

⚠ 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!

Service and maintenance schedules

Service Technician

Annual Startup:

- Address reported problems (Follow Section 14.1.1);
- Check all piping for gas leaks (Follow Section 14.1.2)
- Verify flue and air lines in good condition and sealed tight (Follow Section 14.1.3);
- Check system water pressure/system piping/expansion tank (Follow Section 14.1.4);
- Check control settings (Follow Section 14.1.5);
- Check ignition and flame sense electrodes (Follow Section 14.1.6);
- Check wiring and connections (Follow Section 14.1.7);
- Perform start up checkout and performance verification (Follow Section 14.1.8);
- Flame inspection (Follow Section 14.1.9);
- Check flame signal (Follow Section 14.1.10);
- Inspect combustion chamber. Clean and vacuum if necessary. Clean the heat exchanger if the flue temperature is 63°F (35°C) above return water temperature (Follow Section 14.3).
- Inspect thermal insulations inside the combustion chamber and replace them in case are no more intact (Follow Section 14.3.1)
- Clean condensate trap and fill with fresh water (Follow Section 14.5).
- Check the capacity input (Follow Section 12.9).
- Check relief valve (Follow Section 14.1.11);
- Test low water cut-off (if used) (Follow Section 14.1.19);
- Reset low water cut-off button (if used) (Follow Section 14.1.20)

User maintenance

Daily:
- Check boiler area (Follow Section 14.1.12);
- Check pressure gauge (Follow Section 14.1.13);

Monthly:
- Visually inspect vent piping and vent termination screen (Follow Section 14.1.14);
- Visually inspect air piping and air termination screen (Follow Section 14.1.15);
- Visually inspect condensate drain system (Follow Section 14.1.16);
- Visually inspect the vent for signs of of damage

Every six month:
- Visually inspect boiler piping (gas and water) for leaks (Follow Section 14.1.17);

End of season months:
- Shut boiler down (unless boiler used for domestic hot water) (Follow Section 14.1.18);

Figure 14-1 - Service and Maintenance Schedules

14 - MAINTENANCE

⚠ 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!

⚠ 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!!! Before performing any maintenance operations, shut the boiler off, close the manual gas shut-off valve (Figure 7-5 item "10") and shut electrical power off to the boiler. Follow the Operating Instructions outlined in the section "SAFETY INSTRUCTIONS" (Page 3 of this manual).

14.1.1 - Address reported problems

Inspect any problems reported by the owner and correct before proceeding.

14.1.2 - Check all piping for gas leaks

1. Inspect all gas piping and verify to be leak free.
2. Check for gas leaks: using soap solution, check for gas leaks from meter to appliance including all pipes and fittings and boiler connection. Use liquid soap solution for all gas testing.

⚠ WARNING!!! Do not check for gas leaks with an open flame. Use the bubble test. Failure to use the bubble test or check for gas leaks with an open flame can cause explosion, severe personal injury, death, or substantial property damage.

14.1.3 - Verify flue and air lines in good condition and sealed tight;

1. Check for obstruction, condensation, corrosion and physical damage, water stains, any signs of rust, other corrosions or separation of the vent and air intake piping.
2. Check outside terminations. Screens and louvers should be free of any debris and must be cleaned as required.

14.1.4 - Check system water pressure/system piping/expansion tank;

1. Check water piping and accessories for leaks. Slightest leaks should be corrected.
2. Check the system to be full of water and pressure to remain stable at correct setting on gauge.

CAUTION!!! Eliminate all system or boiler leaks. Continual fresh makeup water will reduce boiler life. Minerals can build up in sections, reducing heat transfer, overheating heat exchanger, and causing heat exchanger failure. Leaking water may also cause severe property damage.

14.1.5 - Check control settings

1. Set boilers setpoint to low enough to end call for heat (see Sections 13.5 and 13.6. Gas valve should close and burner should stop firing. Fan go into a post purge, then shuts off.
2. Control Safety Shutdown test: with the burner firing, close the manual gas shut off valve (Figure 7-5 item "10") . Gas valve should close and burner should stop firing. The boiler will try for ignition five times, then should lock out with a "Loc 1" error shown on the display. Open the manual gas shut-off valve, and 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!

3. press the "Reset" button to return to normal operation.

14.1.6 - Check ignition and flame sense electrodes

1. Remove the fan-burner assembly unit (see Section 14.3)
2. Remove any deposits accumulated on the ignition/flame sense electrode using emery cloth.
3. Check electrodes positioning meet Section 14.4

14.1.7 - Check wiring and connections

Inspect all boiler wiring, making sure wires are in good condition and securely attached.

14.1.8 - Perform performance verification.

1. Run the unit at maximum input following Section 12.9. When in steady state, check the efficiency using a recognized methods.

14 - MAINTENANCE

2. Verify cold water pressure is correct and that operating pressure does not go too high (could be a problem on the expansion tank).

14.1.9 - Flame inspection

1. Inspect flame through sigh glass.
2. If the flame is unsatisfactory at either high fire or low fire, clean the burner following Section 14.3.

14.1.10 - Check flame signal

1. Start unit and perform the procedure of Section 12.8 to check the flame signal.
2. At high fire and low fire the flame signal (parameter 1008) should be within values given in Section 15, header "ionisation current". A lower flame signal may indicate a fouled or damaged flame sense electrode. If cleaning the flame sense electrode does not improve, ground wiring is in good condition, and ground continuity is satisfactory, replace the flame sense electrode.

14.1.11 - Check relief valve

Inspect the relief valve and lift the lever to verify flow. Before operating any relief valve, ensure that it is piped with its discharge in a safe area to avoid severe scald potential. Read Section 7.2.2 before proceeding further. Relief valve should be re-inspected at least once every three years, by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions may corrode the valve or its components over time, rendering the valve inoperative. Such conditions are not detectable unless the valve and its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the user.

⚠ WARNING!!! Failure to re-inspect the relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death, or substantial property damage.

14.1.12 - Check boiler area

⚠ WARNING!!! To prevent potential of severe personal injury, death, or substantial property damage, eliminate all materials discussed below from the boiler vicinity and the vicinity of the boiler combustion air inlet.

If contaminants are found: Remove products immediately from the area. If they have been there for an extended period, call a qualified service technician to inspect the boiler for possible damage from acid corrosion.

If products cannot be removed, immediately call a qualified service technician to re-pipe vent and air piping and locate vent termination/air intake away from contaminated areas.

1. Combustible/flammable materials -- Do not store combustible materials, gasoline or any other flammable vapors or liquids near the boiler. Remove immediately if found.
2. Air contaminants -- Products containing chlorine or fluorine, if allowed to contaminate the boiler intake air, will cause acidic condensate in the boiler. This will cause significant damage to the boiler if allowed to continue. Read the list of potential materials listed in Section 10.2. If any of these products are in the room from which the boiler takes its combustion air, they must be removed immediately or the boiler combustion air (and vent termination) must be relocated to another area.

14.1.13 - Check pressure gauge

1. Make sure the pressure reading on the boiler pressure gauge (item "M" of Figure 13-1) does not exceed the maximum working pressure. Higher pressure may indicate a problem with the expansion tank.

14.1.14 - Check vent piping

Visually inspect the vent outlet termination to be sure it is unobstructed. Visually inspect the entire length of the flue gas vent piping for any signs of blockage, leakage, or deterioration of the piping. Notify your qualified service technician at once if you find any problems.

⚠ WARNING!!! Failure to inspect the vent system as noted above and have it repaired by a qualified service technician can result in vent system failure, causing severe personal injury or death.

14.1.15 - Check air piping

1. Visually inspect the air inlet termination to be sure it is unobstructed. Inspect the entire length of air piping to ensure piping is intact and all joints are properly sealed.
2. Call your qualified service technician if you notice any problems.

14.1.16 - Check condensate drain system

1. Visually inspect the condensate drain line, condensate fittings and condensate trap for signs of weeping or leakage.
2. If you detect signs of leakage, immediately contact your qualified service technician to inspect the boiler and system.

14 - MAINTENANCE

14.1.17 - Check boiler piping (gas and water)

1. If gas odor or leak is detected, immediately shut down the boiler following the procedures on page 3. Call a qualified service technician.
2. Visually inspect for leaks around water piping. Also inspect the circulators, relief valve, and fittings. Immediately call a qualified service technician to repair any leaks.

⚠ WARNING!!! Have leaks fixed at once by a qualified service technician. Failure to comply could result in severe personal injury, death, or substantial property damage.

14.1.18 - Shut boiler down

1. Follow "To Turn Off Gas to Appliance" on page 3 of this manual.
2. Do not drain the system unless exposure to freezing temperatures will occur.
3. Do not drain the system if it is filled with an antifreeze solution.

14.1.19 - Test low water cutoff (if installed)

If the system is equipped with a low water cutoff, test the low water cutoff periodically, following the low water cutoff manufacturer's instructions.

14.1.20 - Reset button (low water cutoff)

Testing the low water cut-off shuts the unit off. Press the RESET button on the low water cutoff to turn the unit back on.

14.2 - Remove the casing

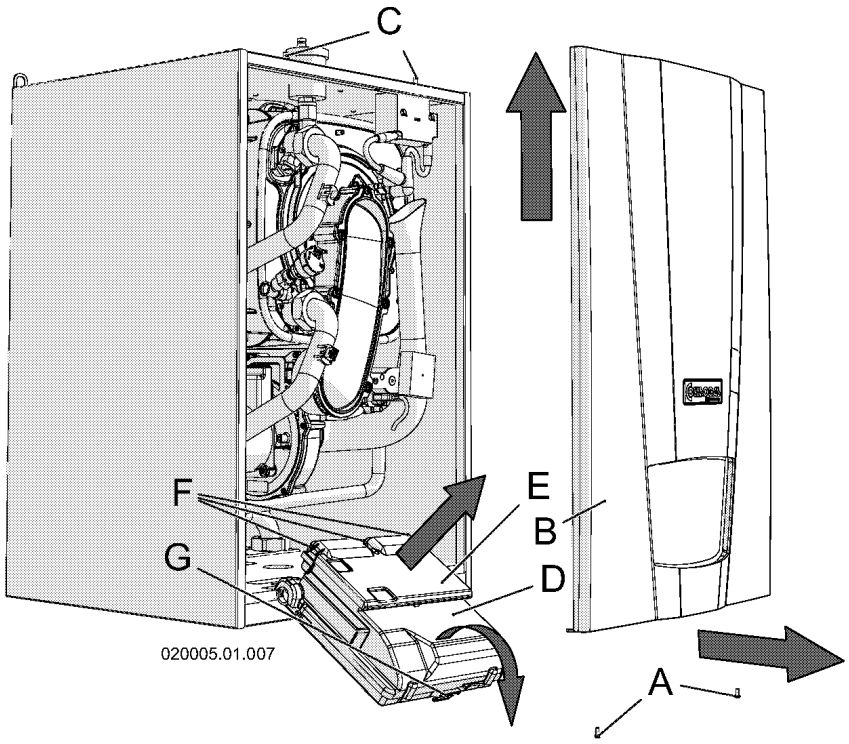
In order to remove the casing, follow the steps below while refering to Figure 14-2:

1. Remove screws "A"
2. Pull by hands cover "A" from the lower side;
3. Push up by hands the front cover "B" and remove it from appliance;
4. pull back from upper side the electrical box "G";

Now you can gain access to all components inside boiler.

To gain access to the junction box:

1. Open the cover "E" by pressing plastic springs "F".



A = fixing screws
B = front cover
C = Front cover fixing hooks
D = Electrical box
E = Junction box cover
F = Junction box plastic springs
G = Plastic spring

Figure 14-2 Remove the casing

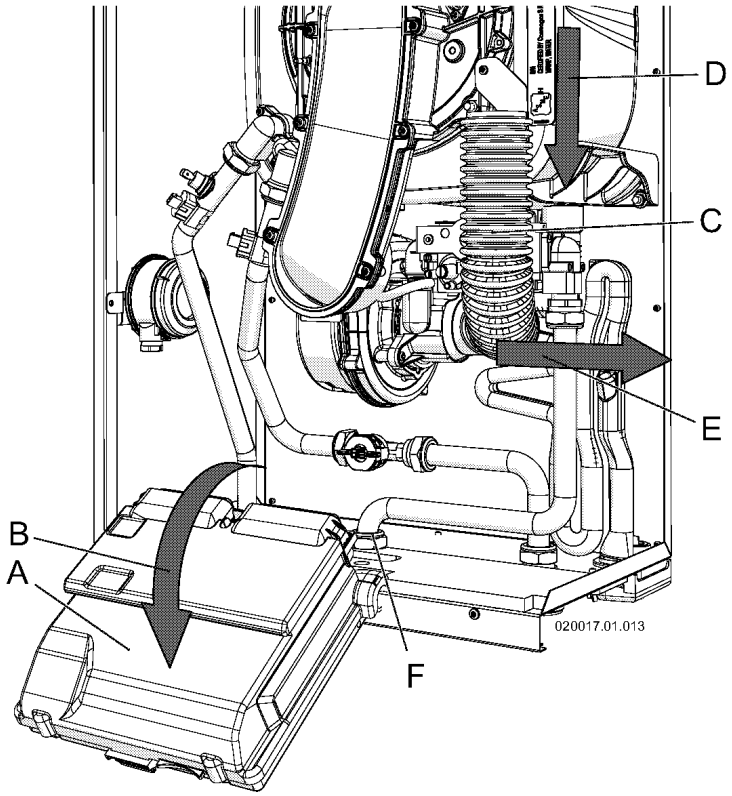


Figure 14-3 Remove the air inlet silencer

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

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

⚠ WARNING!!! Before proceeding to the next step, verify that the electrical supply to the boiler, and any other electrical supply near the boiler, are off. Verify that the manual gas shut off valve is closed. Failure to comply with this warning can cause fire, explosion, extensive property damage, severe personal injury or death!

1. follow the steps in Section 14.2 to gain access to the internal components;
2. Push the air inlet silencer “C” in the “D” direction
3. rotate the air inlet silencer “C” (Figure 14-3) in the front direction;
4. pull in the right direction “E” (Figure 14-3) the air inlet silencer and remove it from the fan;
5. unscrew nut “N” (Figure 14-4). Take care attention to the gasket “Q” (Figure 14-4).
6. take away the spring “L” as per Figure 14-4.
7. remove the electrical plug from the gas valve;
8. Remove the gas valve from its position (see Figure 14-5). Take care attention to the o-ring “G” of Figure 14-5;
9. unscrew the four nuts “B” in Figure 14-6;
10. remove the entire fan - burner assembly, detail “C” in Figure 14-6;
11. use a cylindrical brush with plastic bristles to clean the inside of the combustion chamber, detail “D” in Figure 14-6;
12. use a vacuum cleaner to remove any unburned residue from the combustion chamber “D” in Figure 14-6;

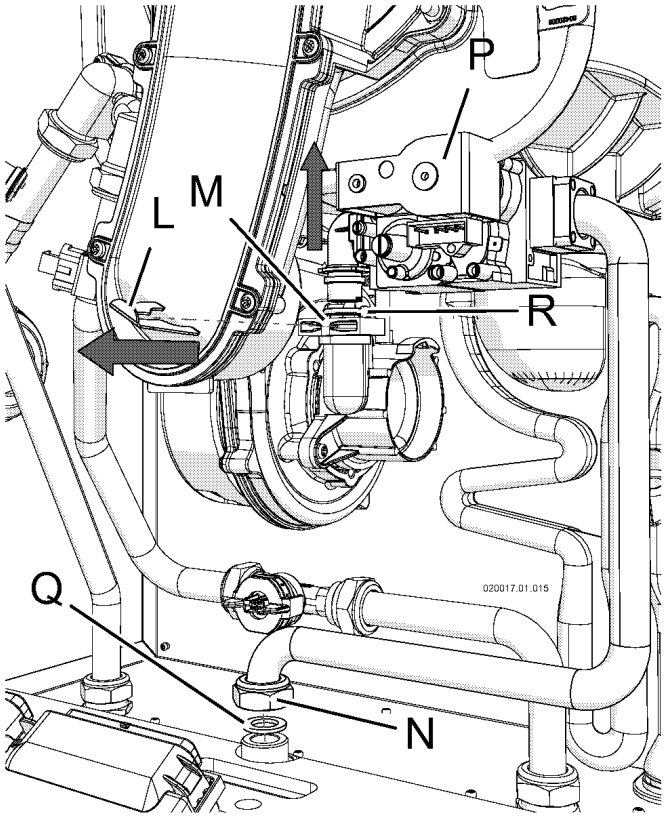


Figure 14-4 Nut and spring that fixes the gas valve

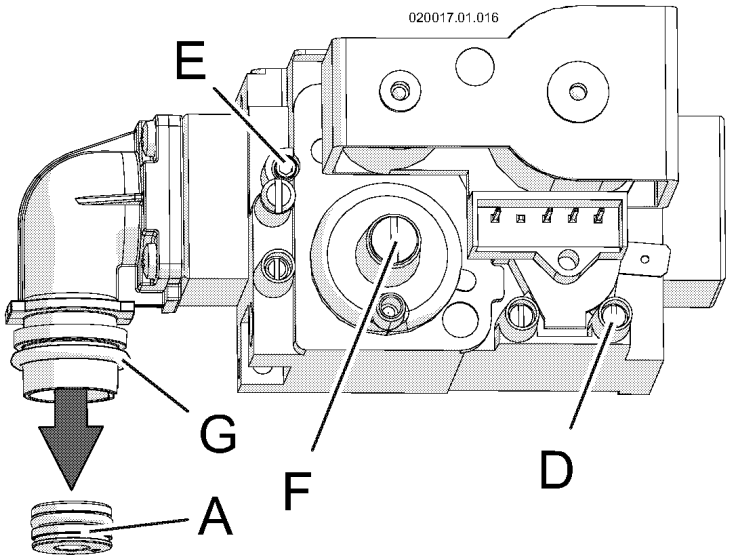


Figure 14-5 Remove the gas valve

13. using the same vacuum cleaner, clean the surfaces of the burner and around the electrodes;

⚠ WARNING!!! while performing the next step, carefully wash only the inside of the combustion chamber "D" of Figure 14-6, 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!

14. using only water, wash the inside of the combustion chamber, detail "D" in Figure 14-6. The water, will drain into the condensate drain;
15. replace gasket "H" as per Figure 14-7 (Part number for this gasket is 60703047). Take care that the gasket and its site are clean.

⚠ WARNING!!! Take care attention to the gasket "H" (Figure 14-7) during reassemble. When finish, perform on it a leakage test with the burner firing. Always use an approved leak detection method. Failure to comply with this warning can cause fire, extensive property damage, severe personal injury or death!

16. reassemble the components by proceeding in reverse order. Taking care attention in the reinstalling of gasket "Q" of Figure 14-4 and of the o-ring "G" of Figure 14-5. These must be in good condition. If not they must be replaced with some new one;
17. open the manual gas shutoff valve;
18. 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 fire, extensive property damage, severe personal injury or death!

19. restore electrical power to the boiler;

14 - MAINTENANCE

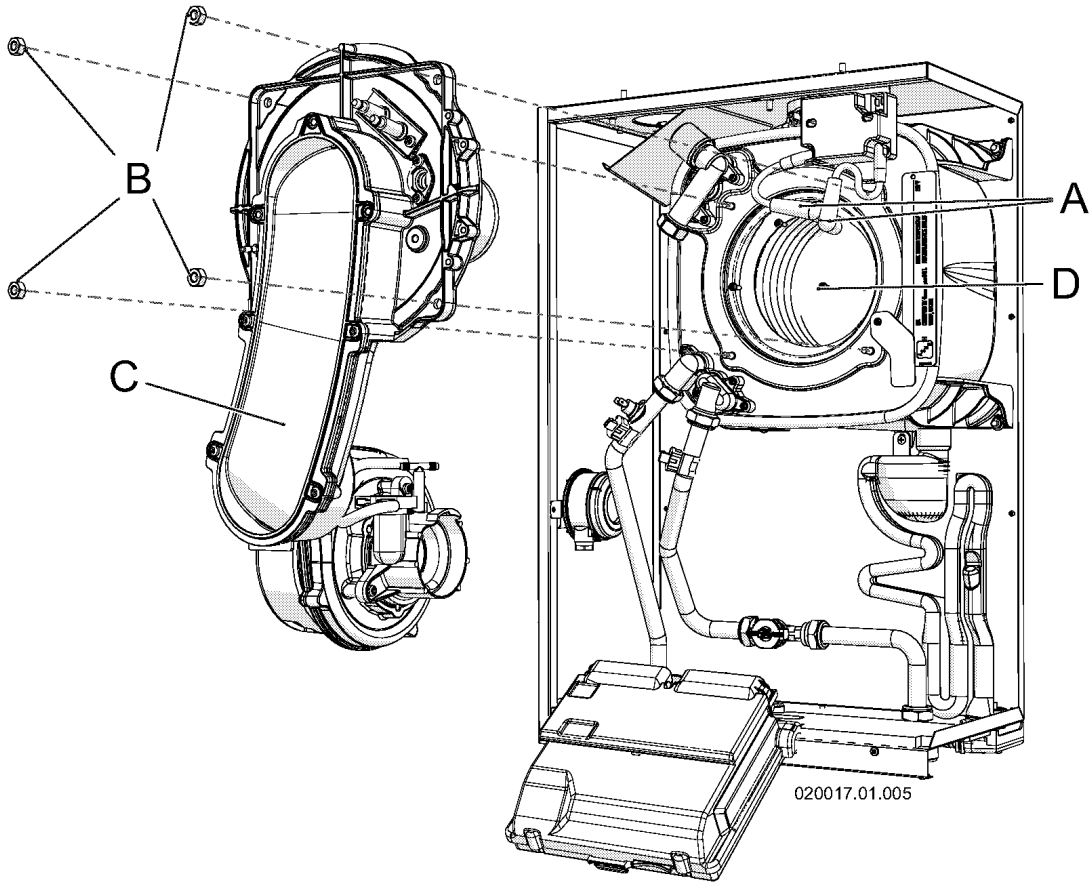
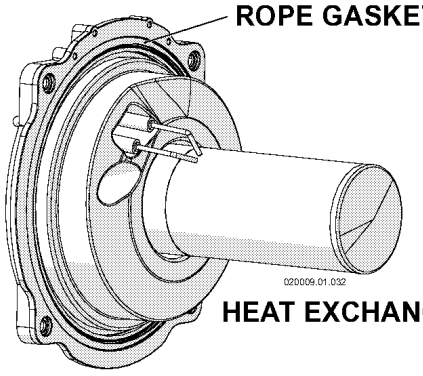


Figure 14-6 Remove the fan burner assembly



CAUTION!!! **If gasket is damaged DO NOT reuse, the heat exchanger door must be replaced.**

NOTICE ! Rope gasket is intended for sealing combustion. If damaged DO NOT reuse, the heat exchanger door must be replaced. Consult factory for replacement heat exchanger door.

14.3.1 - Thermal insulations

Thermal insulations must be checked every year and replaced in case they are not intact. See Figure 14-7 where the thermal insulations (items “C” and “E” are showned already removed from heat exchanger and burner.

A = Screw;
B = Washer;
C = Thermal insulation;
E = Thermal insulation;
F = Thermal insulation;
G = Burner;
Q = Thermal insulation;
H = Gasket;
L = Ignition electrodes;
M = Screw;
N = Detection electrode
P = Screw.

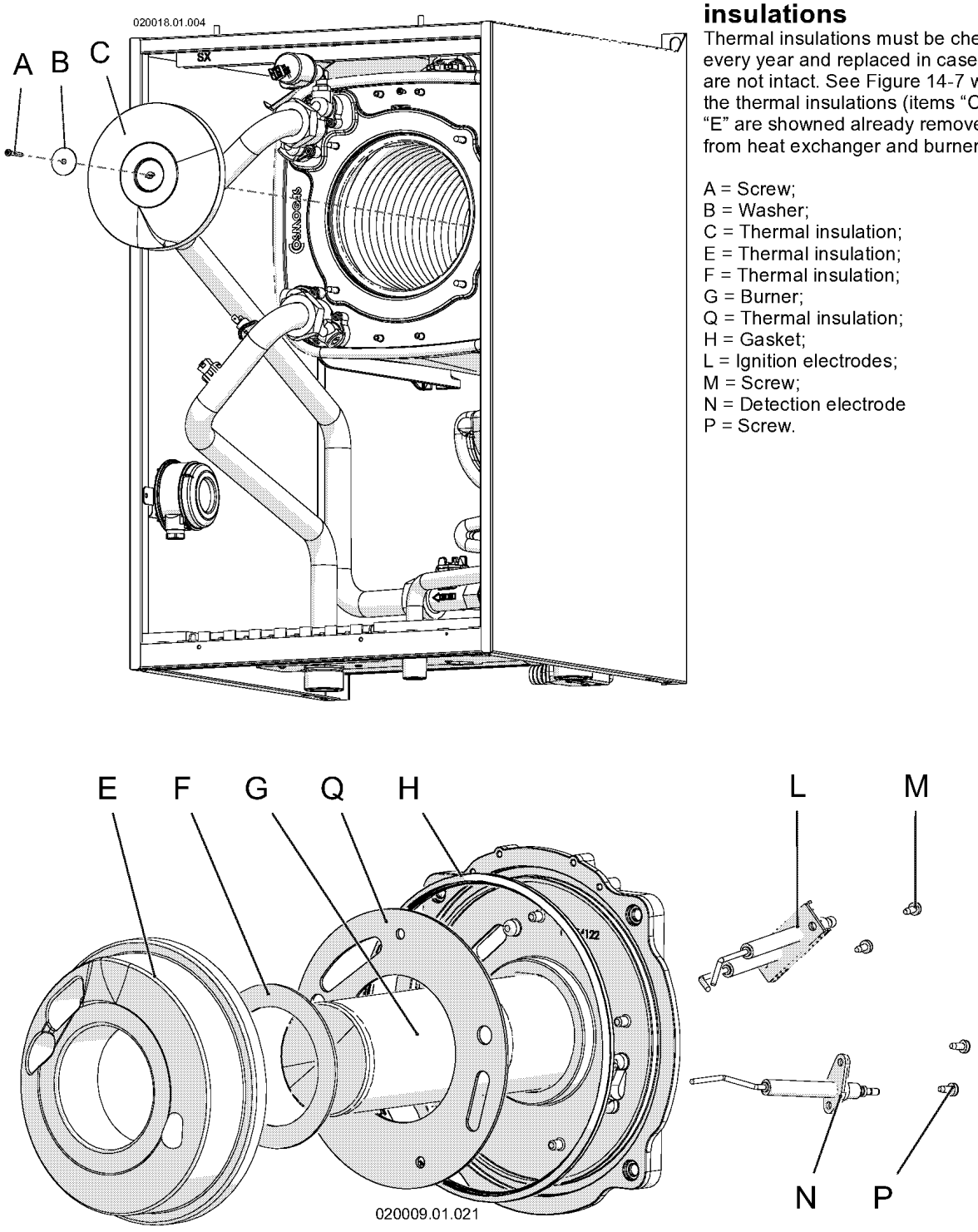
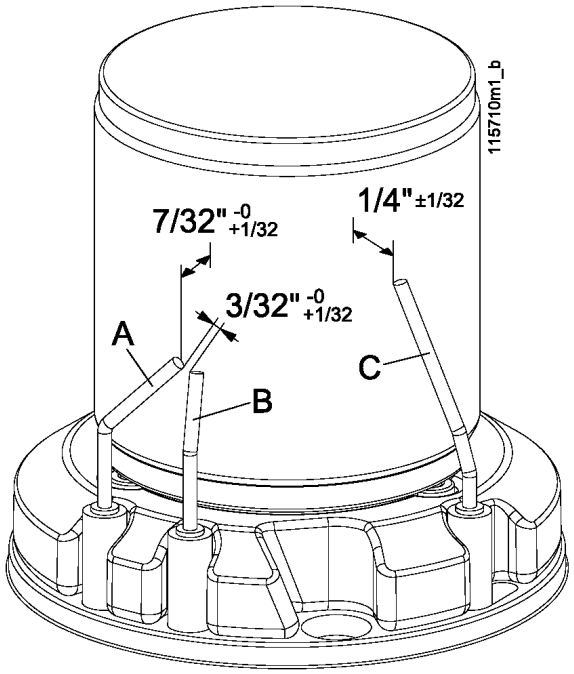


Figure 14-7 Thermal insulations on burner and combustion chamber



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

Figure 14-8 Electrodes positioning on burner (Use a hand caliper to verify the distances)

14.4 - Correct positioning of the ignition and flame detection electrodes

For the boiler to work properly the electrodes must be positioned as shown in Figure 14-8:

- 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)*.

NOTICE! To insure correct functioning of boiler the distances listed above shall be carefully verified using a either a set of calipers or a blade type gap gauge.

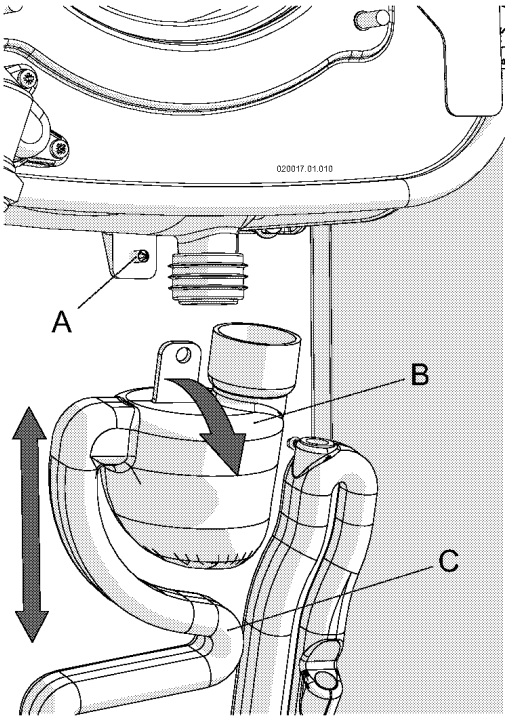


Figure 14-9 Condensate trap removing

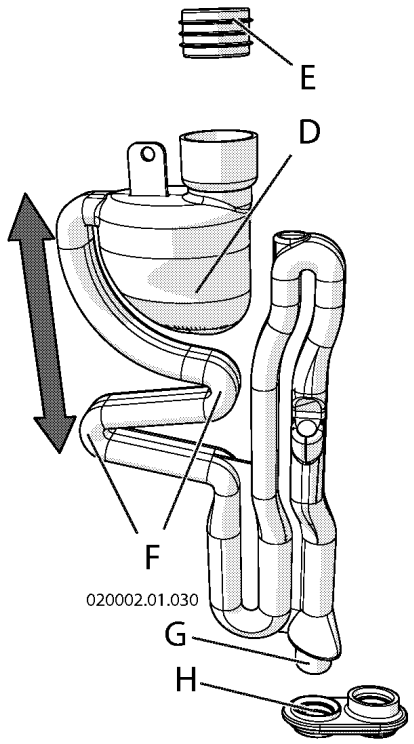


Figure 14-10 Condensate trap

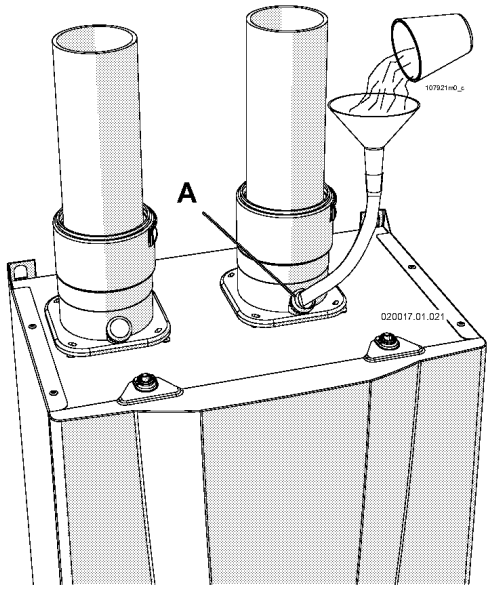


Figure 14-11 Fill the condensate trap

14.5 - Condensate trap maintenance and cleaning

The condensate trap must be checked every year and cleaned if required. Follow the steps below to properly inspect the trap: How to operate:

1. follow the steps in Section 14.3 to remove the fan burner unit from heat exchanger;
2. Pull the condensate trap and remove it from stud "A" (see Figure 14-9);
3. push down the condensate trap "B" (Figure 14-9);

CAUTION!!! **When the trap is pulled out take pay special attention before puttin it on floor, because it is full of condensate water. To avoid any leakage from the top, it is suggestable to bend it for 2 to 5 % in the discharge pipes direction to empty some condensate water. Leaking condensate water may cause severe property damage.**

4. Pull back the condensate trap "B" and remove it from boiler;
5. Wash with fresh water the inside of the trap;
6. re-install the condensate trap taking care attention that the connection "G" (Figure 14-10) of the trap "D" (Figure 14-10) will be inserted into the site "H" (figure 14-10) present inside the boiler jacket;

⚠ WARNING!!! **The condensate trap must be filled with water to prevent flue gas emissions from escaping during unit operation. Failure to comply with this requirement can result in excessive levels of carbon monoxide which can cause severe personal injury or death!**

7. open the manual gas shutoff valve;
8. restore electrical power to the boiler;

14.5.1 - Fill the condensate trap

After clean the condensate trap, it must be refilled of water, to avoid flue gas leakage from the discharge of the condensate trap. To fill the condensate trap, operate as follow:

1. Remove the cap "A" as per Figure 14-11;
2. connect a rubber pipe to a funnel and insert the rubber pipe into the opening for the combustion analisys probe of Figure 14-11;
3. pour 1/4 gall of water inside the funnel; the water will drain into the heat exchanger and will fill the condensate trap;
4. close the combustion analisys probe with the cap "A" of Figure 14-11.

⚠ WARNING!!! **Once the cap "A" of Figure 14-11 is right in place, with the boiler at high fire, check that it is absent from leakage and is mechanically fixed. Improper cap fixing can result in excessive levels of carbon monoxide which can result in severe personal injury or death!**

14 - MAINTENANCE

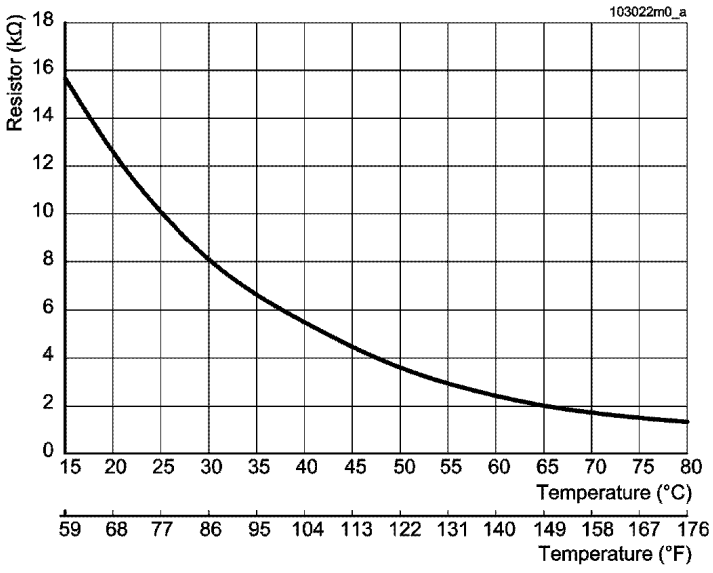


Figure 14-12 Water and flue temperature sensors curve

14.6 - Draining the water from the boiler

To drain the water from the unit, follow the steps below:

1. cool down the unit setting the control temperature to the minimum (see Section 13.5 and 13.6) and wait the temperature gauge "N" of Figure 13-1 shows less than 104°F (40°C);
2. turn the power off to the boiler;
3. close the manual gas shutoff valve, Figure 7-5 item "10";
4. 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.
5. check that the heating system fill valve is closed;
6. connect a hose to the field installed drain valves and place the other end of the hose in a sink or other suitable drain;
7. open the drain valves and wait for all water drain;
8. if the unit isolation valves have not been installed, open any bleed valves at the highest point of the system;
9. after draining out all the water, close the bleed valves and the unit drain valves;

NOTICE! The boiler cannot be drained completely of water without purging the unit with an air pressure of 30 psi.

⚠ 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!

14.7 - 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 14-12.

Figure 14-13 Outdoor temperature sensor curve

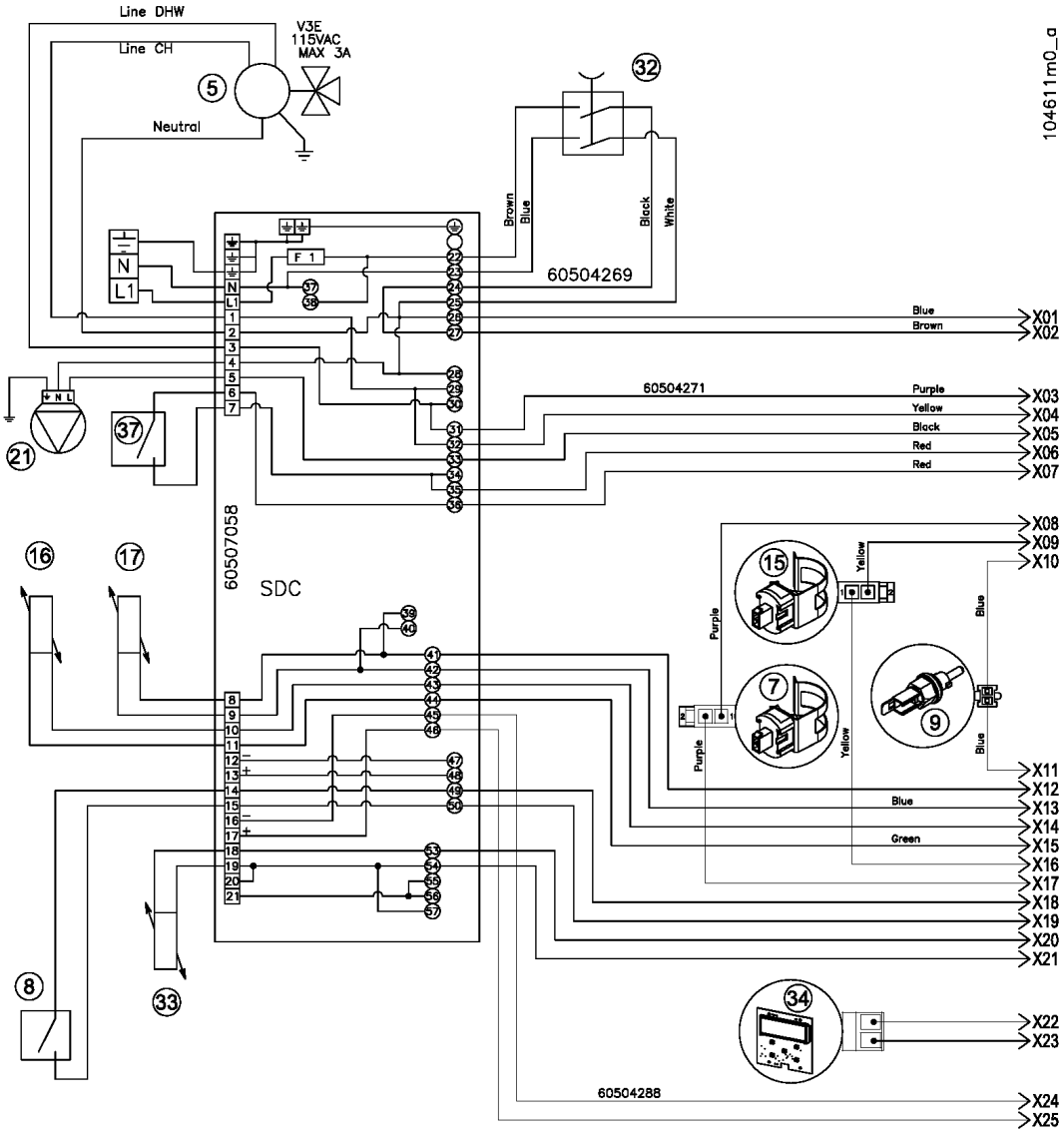
14.8 - Outdoor temperature sensor

An outdoor temperature sensor can be connected to the boiler (see Section 9.1.3). The electrical resistance existing between the sensor wires must correspond with the values shown in Figure 14-13.

14 - MAINTENANCE

14.9 - 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!**

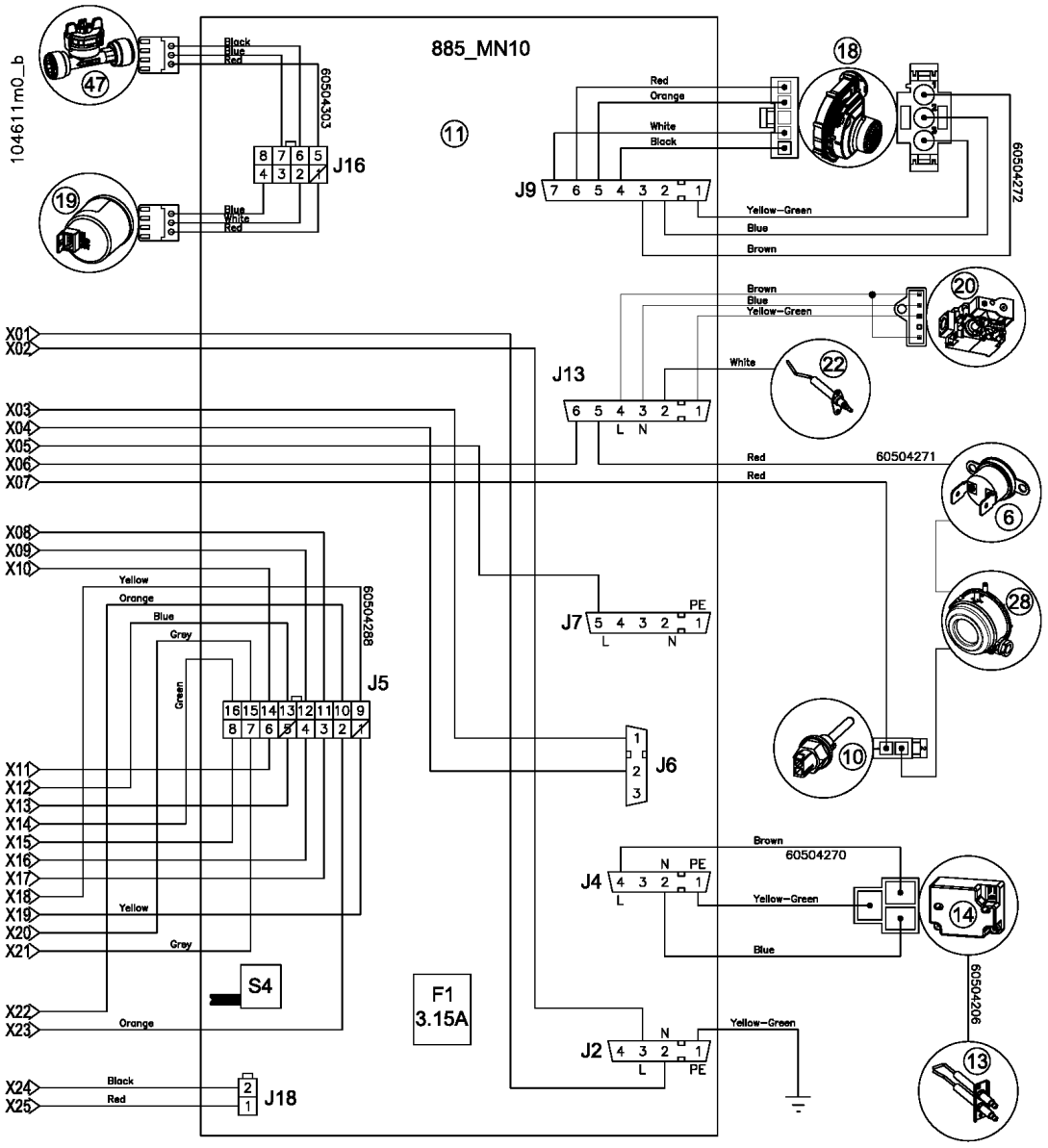


14 - MAINTENANCE

⚠ 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 to electrical schemes:

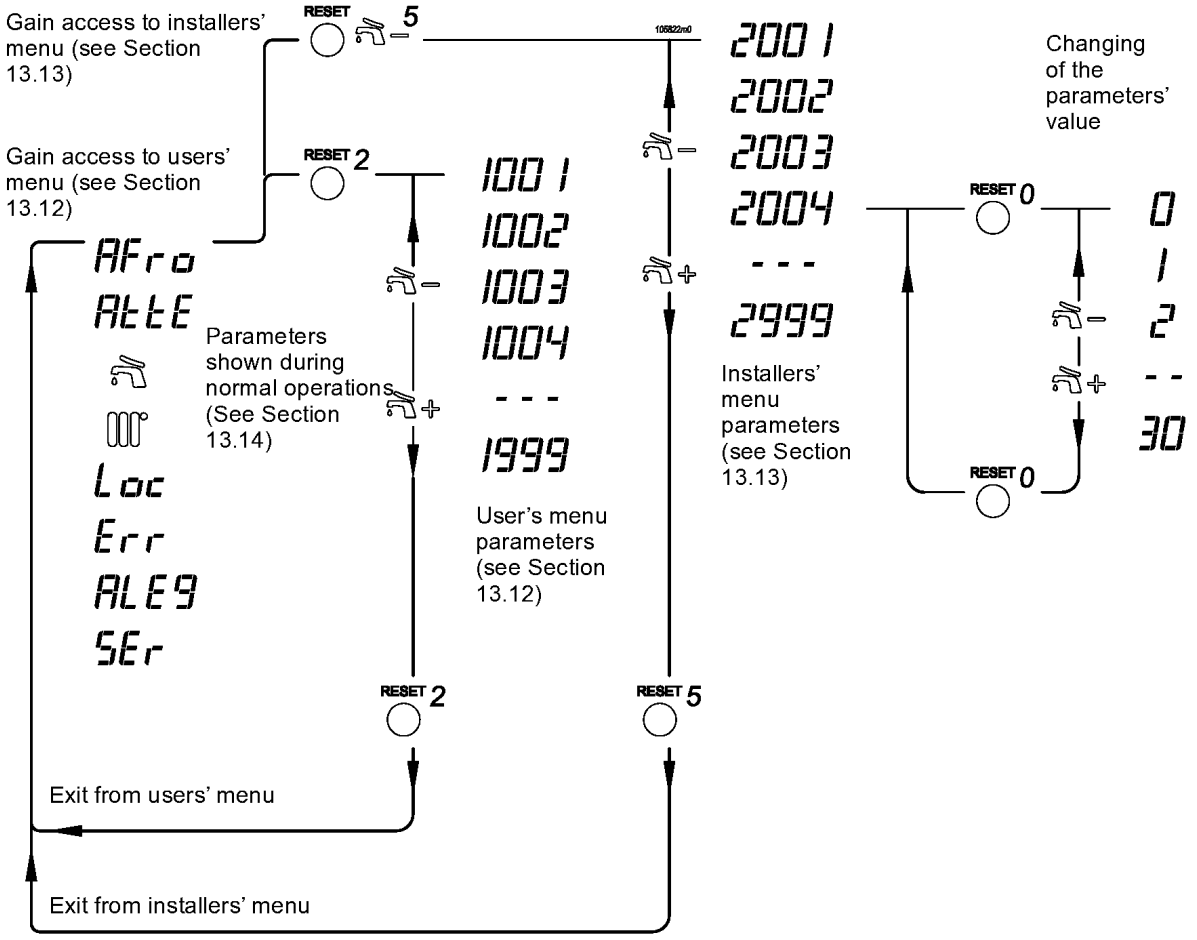
5 - Three way valve (optional) (max 3 Amp)
6 - High limit supply temperature switch
7 - Supply temperature sensor
8 - Room thermostat
9 - Flue gas temperature sensor
10 - High limit flue gas temperature fuse
11 - Control board Fuse - F1 5x20 3A
13 - Ignition electrodes
14 - spark generator
15 - Return temperature sensor
17 - Tank sensor
18 - Modulating PWM fan
19 - Water pressure sensor
20 - Gas valve
21 - Local pump (max 3 Amps)
22 - Detection electrode
28 - Blocked flue pressure switch
32 - Main electrical switch
33 - Header sensor (for cascade)
34 - Display
37 - Low water cut-off
47 - Water Flow meter
SDC - connection board



15 - TECHNICAL DATA

Boiler MODEL		**90A**	**130A**	**150A**	**199A**	**250A**
Category of discharge chimney		IV				
Maximum Heat input	Btu/hr	90,000	130,000	150,000	198,000	250,000
Minimum heat input	Btu/hr	20,000	36,000	36,000	43,000	50,000
Turndown ratio		4.5 : 1	3.6 : 1	4.2 : 1	4.6 : 1	5 : 1
Number of burners		1				
Gas flow rate (Natural gas)	ft3/hr	90	130	150	198	250
Gas flow rate (LP gas)	ft3/hr	36	52	60	79.2	100
Min / Max gas pressure (Nat. and LP)	In.W.C.	3 / 13				
Min / Max heating water temperature	°F	68 / 180				
Min / Max indirect water heater temperature	°F	68 / 140				
Min / Max water pressure	PSI	8 / 130	8 / 160	8 / 160	8 / 160	8 / 160
Minimum water flow	GPM	1.4	2	2	4	4
Content of water	gal	1	1.5	1.5	2	2
Supply voltage / Frequence		120Vac / 60Hz				
Absorbed electric power	W	60	75	80	130	250
Air intake / Flue gas pipes diameter	inch	3				
Max. length venting system flue exhaust	ft	80				
Max. length venting system air intake	ft	80				
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 8.9				
CO2 (Carbon dioxide) for Natural gas at low fire	%	8.5 to 9				
CO2 (Carbon dioxide) for LP gas at high fire	%	9.6 to 9.8				
CO2 (Carbon dioxide) for LP gas at low fire	%	9.5 to 11.5				
O2 (Oxygen) for Natural gas at high fire	%	5.6 to 5.1				
O2 (Oxygen) for Natural gas at low fire	%	5.8 to 4.9				
O2 (Oxygen) for LP gas at high fire	%	6.3 to 6.0				
O2 (Oxygen) for LP gas at low fire	%	6.4 to 3.4				
Ionisation current	uA (Micro Amps)	4 to 7				
Maximum flue gas temperature	°F	203				
Maximum water condensate flow	GPM	0.013	0.019	0.022	0.029	0.036
Average acidity of condensation	PH	4				
Boiler weight (empty of water)	lb	77	93	93	99	99

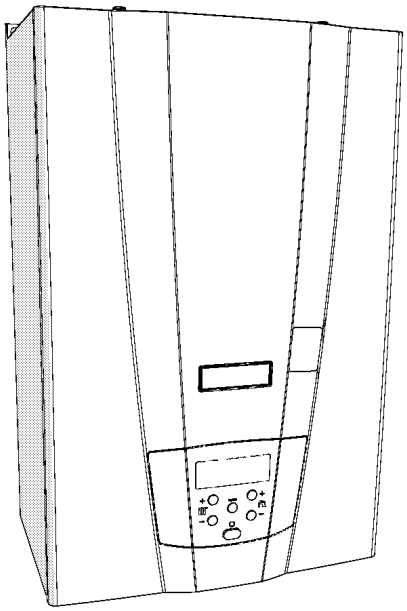
16 - READ OUT FLOW CHART



Where:

Simbol	Description
RESET 0	Push RESET button
RESET 2	Push and hold for at least 2 seconds the reset button
RESET 5	Push and hold for at least 5 seconds the reset button
RESET 5	Push and hold together for a time in seconds explained by the number the RESET button and button
	Push button
	Push button

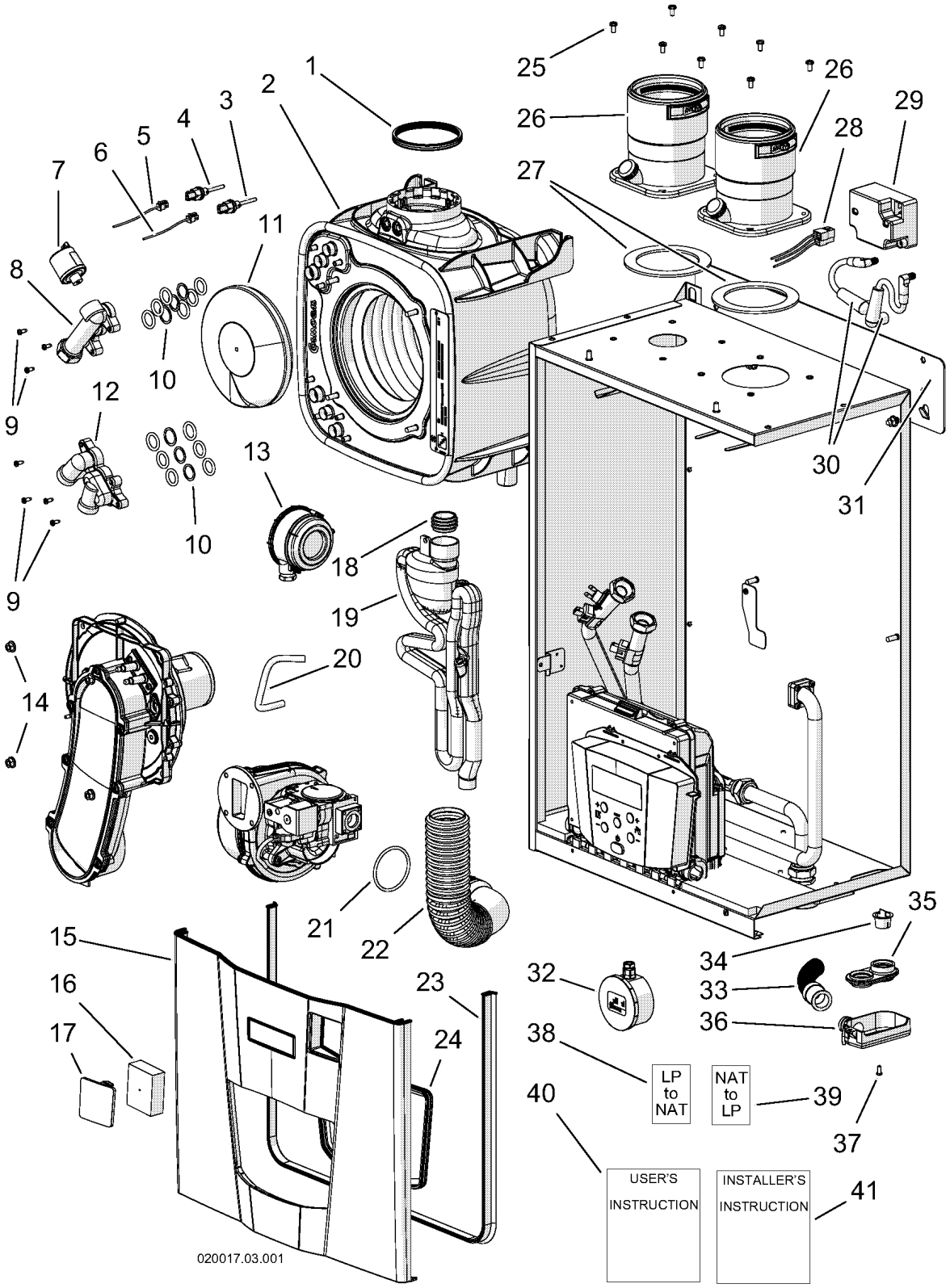
Spare parts for gas-fired condensing hot water heaters series:



90A

DESCRIPTION	MOD
90A	A

WARNING!!! Only use the heater in the combinations and with the spare parts listed in this manual. Failure to do so can cause severe personal injury or death.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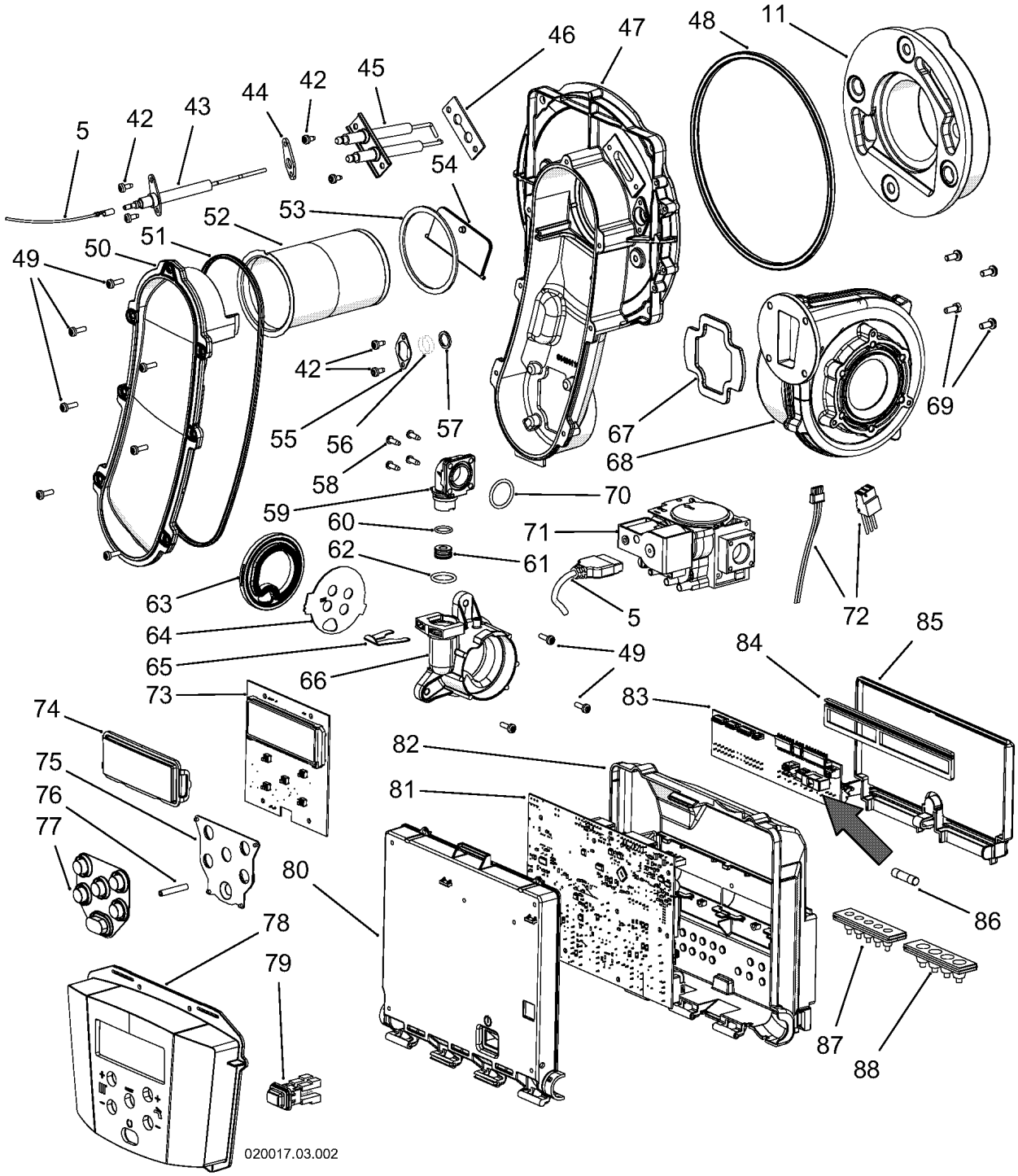
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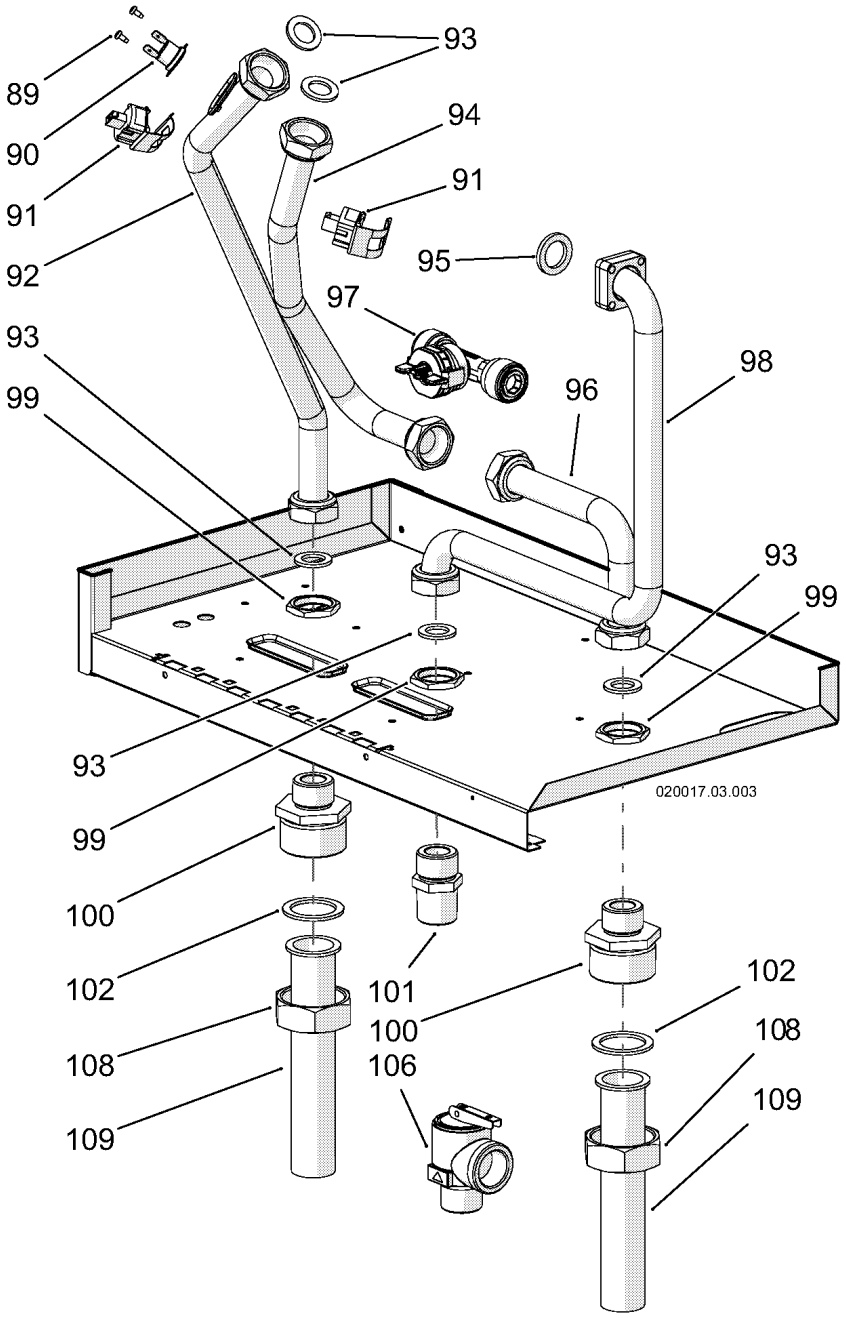
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18 - SPARE PARTS 90A

DESCRIPTION	MOD.
BOILER 90A	A

N	CODE	DESCRIPTION	MOD
1	60702063	2 LIPS JOINT D.81,4 H.7,5	A
2	62649017	CONDENSING HEAT EXCHANGER 70KW 15T ASME M/A	A
3	62111041	BAYONETTE SENSOR NTC 10K 2P MOLEX	A
4	62111042	BAYONETTE FUSE 102°C 2P MOLEX	A
5	60504271	GAS CABLE V. UL 885	A
6	60504288	SENSOR CABLE UL 885	A
7	62113045	PRESSURE GAUGE 0-10 BAR	A
8	61408017	BRASS UPPER BY-PASS CONNECTION 2/1	A
9	60801014	SCREW 4X10 ZINC TC-CR	A
10	62616111	KIT FOR 6 OR AND 3 WASHERS	A
11	62632006	KIT THERMAL INSULATIONS	A
12	61408015	BRASS LOWER BY-PASS CONNECTION	A
13	62113046	PRESSURE SWITCH ON 3,2 INWC	A
14	60802005	NUT ZINC COATED 6MA	A
15	62610105	COMPLETE FRONT COVER 90A-250A SLANT/FIN	A
16	60907036	POLYURETHANE CAP FOR BOILER SETTING	A
17	61405262	CAP FOR BOILER SETTING	A
18	60702073	3 LIPS EPDM JOINT D32.4 F24.4	A
19	61405276	CONDENSATE DISCHARGE SIPHON	A
20	60320001	SILICONE PIPE D.4X8	A
21	60702072	O-RING 156 NBR 3,53 X 52,39	A
22	62651054	HIGH POWER SILENCER GROUP	A
23	60703051	1 LIP EXTRUDED JOINT	A
24	60703050	1 LIP SHAPED JOINT	A
25	60801159	SCREW 4X14 GALVANIZED	A
26	61405350	VENT ADAPTOR AS/SC 3P	A
27	60702102	GASKET EPDM 80X110X3	A
28	60504270	CABLE IGNITER UL 885	A
29	60510022	SPARK GENERATOR	A
30	60504206	CABLE UL IGNITOR CONN 90° L155	A
31	60411149	WALL BRACKET 100X489	A
32	62110067	OUTDOOR SENSOR	A
33	60322017	CORRUGATED PIPE D.20	A
34	61405314	TANG PLUG TAPERED 18.3-20.8	A
35	60702069	EPDM BLACK JOINT 75X35 2 HOLES	A
36	61405268	DISCHARGE KETTLE 80X47	A
37	60801043	SCREW SELFTAPPING 3.9 X 9.5 CROSS HEAD	A
38	62630205	LP TO NAT GAS CONV KIT 90A SLANT FIN	A
39	62630201	NAT TO LP GAS CONV KIT 90A SLANT FIN	A
40	62417023	VSLII SLANT FIN 90A-250A USER INSTRUCTION	A
41	62403606	VSLII SLANT FIN 90A-250A INSTALLER INSTRUCTION	A
42	60801080	SCREW SELFTAPPING 4X10 TC S-TT UNI-8112	A
43	60505029	DETECTION ELECTRODE	A
44	60701023	GASKET KERASIL 325R SQ 38X17X2	A
45	60505028	IGNITION ELECTRODE	A
46	60701022	GASKET KERASIL 325R SQ 56X22X2	A

18 - SPARE PARTS 90A

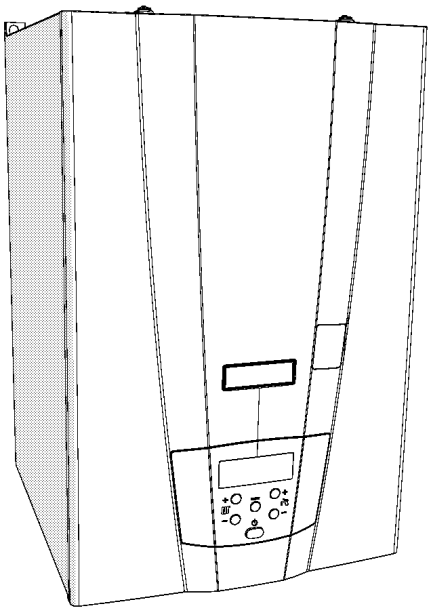
DESCRIPTION	MOD.
BOILER 90A	A

N	CODE	DESCRIPTION	MOD
47	61404118	COLLECTOR BASE FOR BURNER D.73	A
48	60703047	SIL. GASKET D.200 F.188 H.7,2	A
49	60801108	SELFTAPPING SCREW 4X14 TCC-NP UNI-8112	A
50	61404119	MANIFOLD COVER D.73	A
51	60703048	SIL. GASKET D.215 F.210 H.5,4	A
52	62629046	FIBER BURNER D.70 H120	A
53	60701019	KERASIL GASKET 325R SQ Ø 80.5 MM	A
54	61405174	BACK FLUE-GASES PREVENTER	A
55	60404253	FLANGE L21,2 H34 SP1	A
56	60815013	PIREX GLASS D15,5 SP5	A
57	60701013	GASKET FRIZITE D15,5 F11,5 SP1,5	A
58	60801136	SCREW SELFTAPPING 4X12 TC S-TT UNI-8112	A
59	61404121	90° INTERNAL ELBOW	A
60	60702052	O-RING 2050 EPDM 1,78 X 12,42	A
61	60114102	GAS DIAPHRAGM D.15,5 H8 HOLE D.4,7	A
61	60114101	GAS DIAPHRAGM D.15,5 H8 HOLE D.3,7	A
62	60702065	O-RING 2,62 X 17,86	A
63	60702064	SHAPED GASKET DIAM. 71,2 H. 9,2	A
64	60406131	5 HOLES DIAPHRAGM GAS	A
65	60807012	PLATE CLAP	A
66	61404120	COSMOMIX GAS MIXER	A
67	60703030	SILICON GASKET D83 SP3,5	A
68	61901038	ELECTRIC FAN NRG118 61W 115V	A
69	60801021	BOLT 5X12 CROSS HEAD	A
70	60702029	O-RING 130 2,62 X 22,22	A
71	61201040	GAS VALVE SIGMA848 120V	A
72	60504272	FAN CABLE UL 885	A
73	62110089	DISPLAY TYPE 885LB01	A
74	61405264	DISPLAY GLASS	A
75	61405259	PLASTIC BUTTONS COVER	A
76	60503060	SPACER 5X1,2 L=30	A
77	61405254	6 BUTTONS SWITCH	A
78	61405336	FRONT COVER WITHOUT LOGO	A
79	60506029	BUTTON SWITCH	A
80	61405255	CARD BOX BASE	A
81	62110088	CONTROL BOARD 885MN10 110 V	A
82	61405256	PANEL COVER	A
83	60507061	CONNEXION CARD 185,6 X 42 USA	A
84	60703052	RECTANGULAR SIL. GASKET 179X26	A
85	61405257	CONNECTIONS BOARD COVER	A
86	60503068	FUSE 1 P 1/4 X 1/4 3,15A RIT.	A
87	61103014	5 EXITS GUM D.8	A
88	61103013	4 EXITS GUM D.12	A
89	60801100	SCREW SELFTAPPING 2.9 X 6.5 CROSS HEAD	A
90	62101079	AUTOMATIC SAFETY THERMOSTAT 95°C	A
91	62111035	CLIP SENSOR 2 POLES D18 MM	A

DESCRIPTION	MOD.
BOILER 90A	A

N	CODE	DESCRIPTION	MOD
92	62623367	COPPER TUBE D.18	A
93	60701006	GASKET 3/4P 24X15X2 KLINSIL	A
94	62623366	COPPER TUBE D.18	A
95	60702101	GASKET 27X18X3 NBR EN549	A
96	62623365	COPPER TUBE D.18 3/4P-3/4P 90°	A
97	61212013	VORTEX FLOW SENSOR DN15 3/4'	A
98	62626004	STAINLESS STEEL PIPE D.18 GAS 90	A
99	60802018	3/4" RING NUT	A
100	60110049	BRASS NIPPLE 1P1/4 - 3/4P H=46	A
101	60110050	NIPPLE LAITON 3/4" GAZ -3/4" NPT H=46	A
102	60701008	1"1/2 GASKET	A
103	xxxxxxxx	#N/D	x
104	xxxxxxxx	#N/D	x
105	xxxxxxxx	#N/D	x
106	61205010	3/4NPT M 30PSI ASME SAFETY RELIEF VALVE	A
107	xxxxxxxx	#N/D	x
108	60303009	CALIBRATED STRAIGHT TUBE D.28 L150	A
109	60109011	CAP CH46X17	A

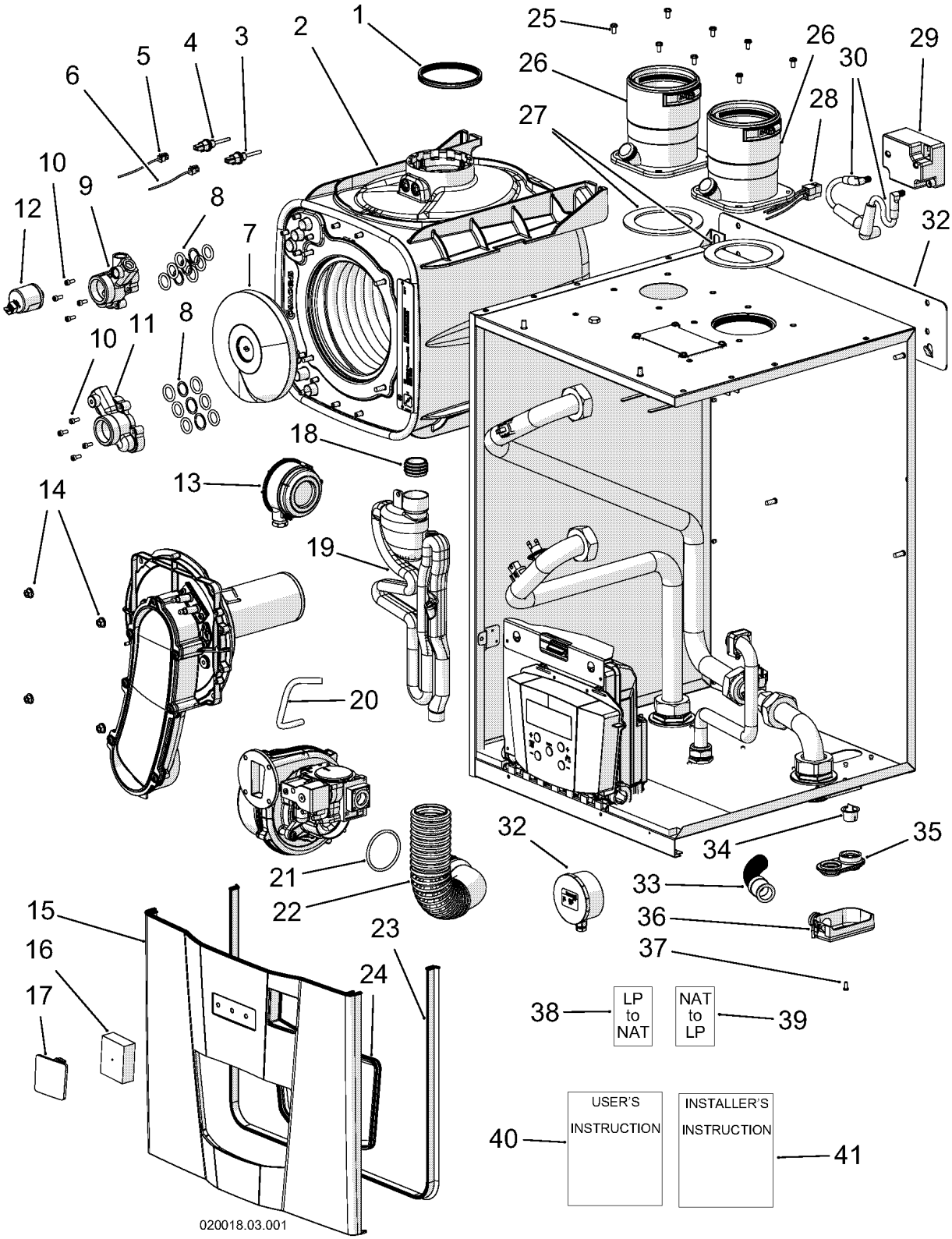
Spare parts for gas-fired condensing hot water heaters series:



130A
150A
199A
250A

DESCRIPTION	MOD
130A	B
150A	C
199A	D
250A	E

WARNING!!! Only use the heater in the combinations and with the spare parts listed in this manual. Failure to do so can cause severe personal injury or death.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USER'S INSTRUCTION
INSTALLER'S INSTRUCTION
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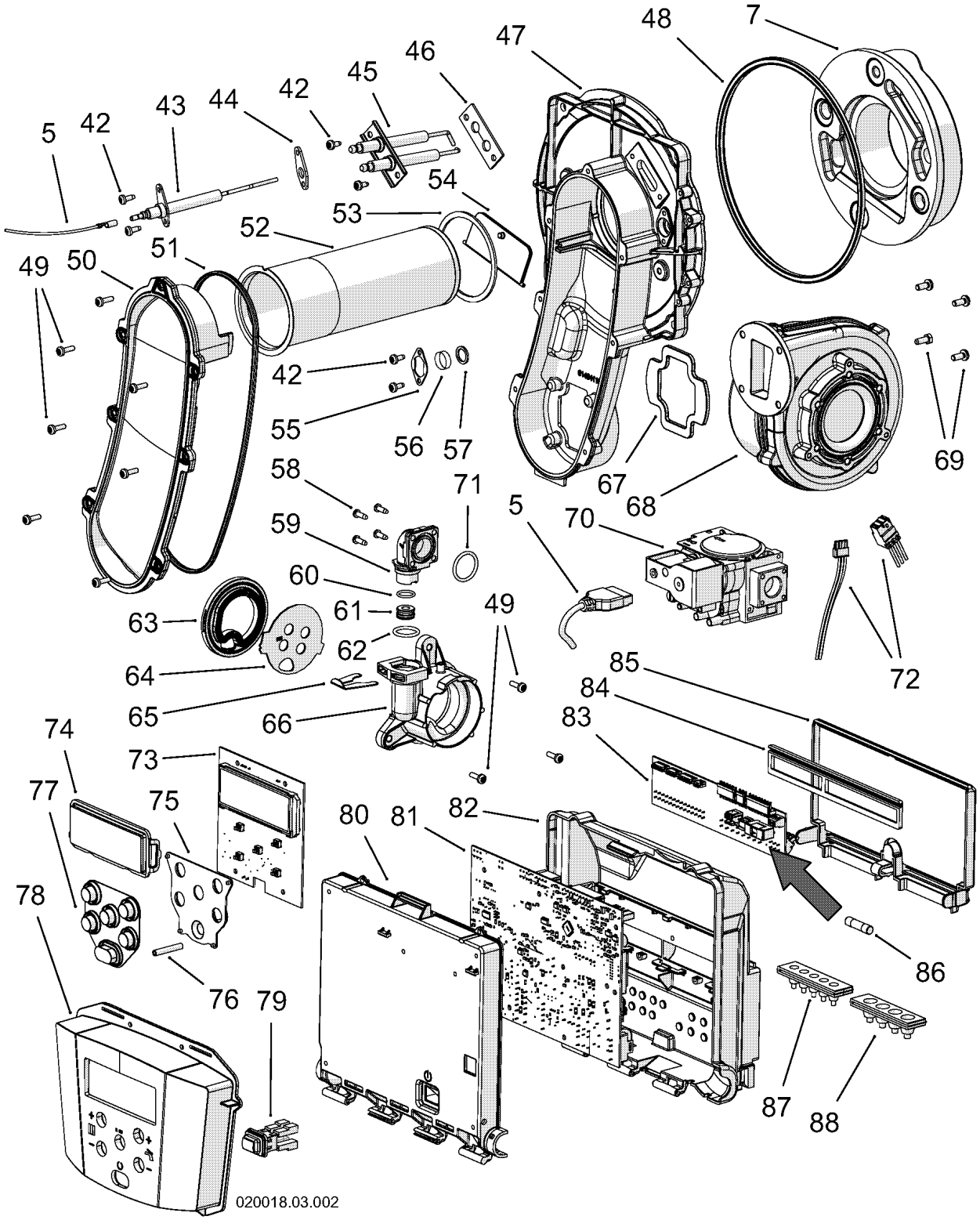
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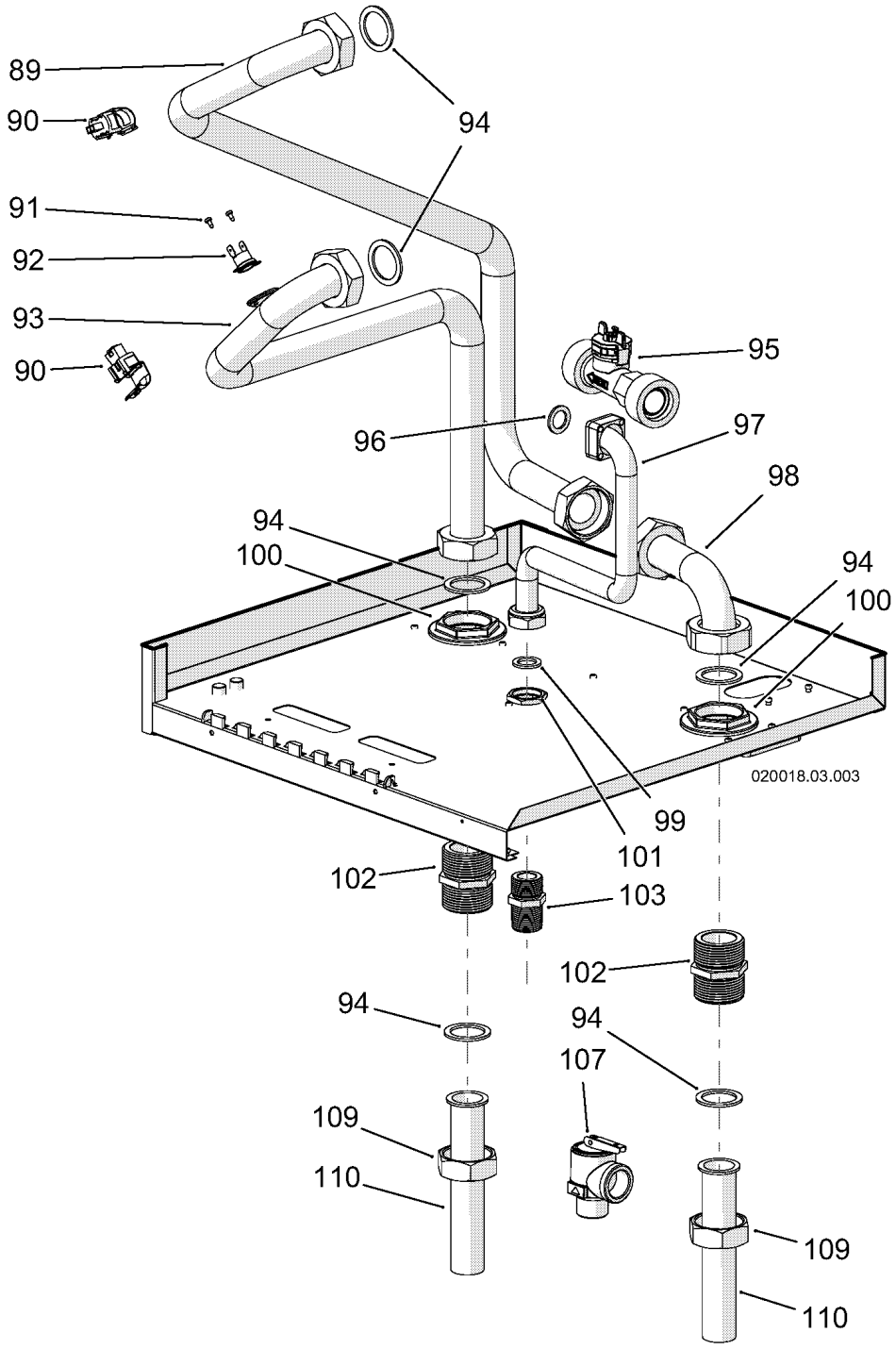
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DESCRIPTION	MOD.	DESCRIPTION	MOD.
BOILER 130A	B	BOILER 199A	D
BOILER 150A	C	BOILER 250A	E

N	CODE	DESCRIPTION	MOD
1	60702063	2 LIPS JOINT D.81,4 H.7,5	BCDE
2	62649053	CONDENSING HEAT EXCHANGER 58KW 12T ASME H	BC
2	62649018	CONDENSING HEAT EXCHANGER 70KW 15T ASME H	DE
3	62111041	BAYONETTE SENSOR NTC 10K 2P MOLEX	BCDE
4	62111042	BAYONETTE FUSE 102°C 2P MOLEX	BCDE
5	60504271	GAS CABLE V. UL 885	BCDE
6	60504288	SENSOR CABLE UL 885	BCDE
7	62632006	KIT THERMAL INSULATIONS	BCDE
8	62616111	KIT FOR 6 OR AND 3 WASHERS	BCDE
9	61408013	BRASS CONNECTION 1"1/4 RETURN	BCDE
10	60801151	SCREW 4X10 GALVANIZED	BCDE
11	61408014	BRASS CONNECTION 1"1/4 SUPPLY	BCDE
12	62113045	PRESSURE GAUGE 0-10 BAR	BCDE
13	62113046	PRESSURE SWITCH ON 3,2 INWC	BCDE
14	60802005	NUT ZINC COATED 6MA	BCDE
15	62610105	COMPLETE FRONT COVER 90A-250A SLANT/FIN	BCDE
16	60907036	POLYURETHANE CAP FOR BOILER SETTING	BCDE
17	61405262	CAP FOR BOILER SETTING	BCDE
18	60702073	3 LIPS EPDM JOINT D32.4 F24.4	BCDE
19	61405276	CONDENSATE DISCHARGE SIPHON	BCDE
20	60320001	SILICONE PIPE D.4X8	BCDE
21	60702072	O-RING 156 NBR 3,53 X 52,39	BCDE
22	62651054	HIGH POWER SILENCER GROUP	BCDE
23	60703051	1 LIP EXTRUDED JOINT	BCDE
24	60703050	1 LIP SHAPED JOINT	BCDE
25	60801159	SCREW 4X14 GALVANIZED	BCDE
26	61405350	VENT ADAPTOR AS/SC 3P	BCDE
27	60702102	GASKET 80X110X3	BCDE
28	60504270	CABLE IGNITER UL 885	BCDE
29	60510022	SPARK GENERATOR	BCDE
30	60504206	CABLE UL IGNITOR CONN 90° L155	BCDE
31	60411149	WALL BRACKET 100X489	BCDE
32	62110067	OUTDOOR SENSOR	BCDE
33	60322017	CORRUGATED PIPE D.20	BCDE
34	61405314	TANG PLUG TAPERED 18.3-20.8	BCDE
35	60702069	EPDM BLACK JOINT 75X35 2 HOLES	BCDE
36	61405268	DISCHARGE KETTLE 80X47	BCDE
37	60801043	SCREW SELFTAPPING 3.9 X 9.5 CROSS HEAD	BCDE
38	62630206	LP TO NAT GAS CONV KIT 130A 150A SLANT FIN	BC
38	62630207	LP TO NAT GAS CONV KIT 199A SLANT FIN	D
38	62630208	LP TO NAT GAS CONV KIT 250A SLANT FIN	E
39	62630202	NAT TO LP GAS CONV KIT 130A 150A SLANT FIN	BC
39	62630203	NAT TO LP GAS CONV KIT 199A SLANT FIN	D
39	62630204	NAT TO LP GAS CONV KIT 250A SLANT FIN	E
40	62417023	VSLII SLANT FIN 90A-250A USER INSTRUCTION	BCDE
41	62403606	VSLII SLANT FIN 90A-250A INSTALLER INSTRUCTION	BCDE

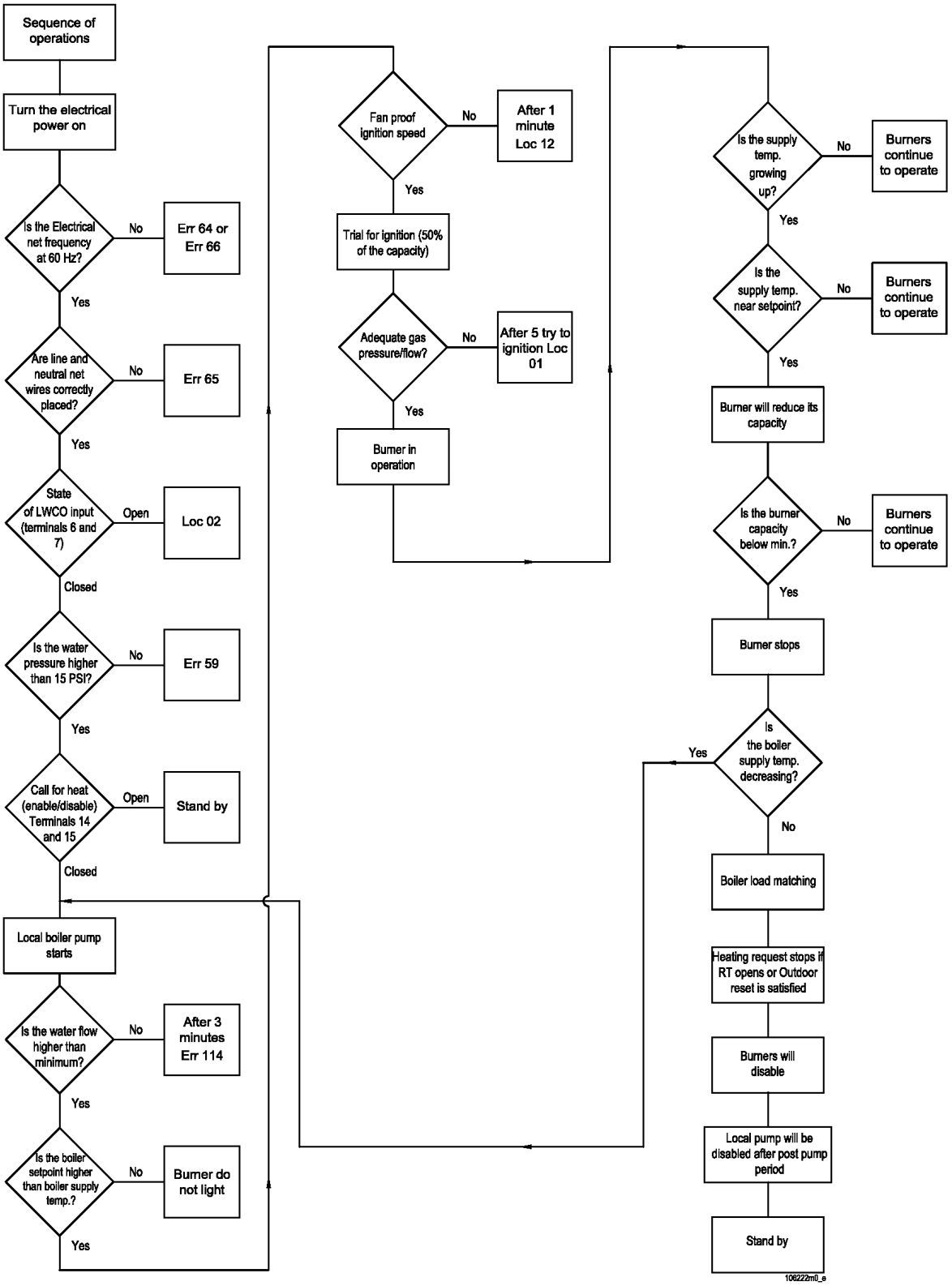
DESCRIPTION	MOD.	DESCRIPTION	MOD.
BOILER 130A	B	BOILER 199A	D
BOILER 150A	C	BOILER 250A	E

N	CODE	DESCRIPTION	MOD
42	60801080	SCREW SELFTAPPING 4X10 TC S-TT UNI-8112	BCDE
43	60505029	DETECTION ELECTRODE	BCDE
44	60701023	GASKET KERASIL 325R SQ 38X17X2	BCDE
45	60505028	IGNITION ELECTRODE	BCDE
46	60701022	GASKET KERASIL 325R SQ 56X22X2	BCDE
47	61404118	COLLECTOR BASE FOR BURNER D.73	BCDE
48	60703047	SIL. GASKET D.200 F.188 H.7,2	BCDE
49	60801108	SELFTAPPING SCREW 4X14 TCC-NP UNI-8112	BCDE
50	61404119	MANIFOLD COVER D.73	BCDE
51	60703048	SIL. GASKET D.215 F.210 H.5,4	BCDE
52	62629045	FIBER BURNER D.70 H200	BCDE
53	60701019	KERASIL GASKET 325R SQ Ø 80.5 MM	BCDE
54	61405174	BACK FLUE-GASES PREVENTER	BCDE
55	60404253	FLANGE L21,2 H34 SP1	BCDE
56	60815013	PIREX GLASS D15,5 SP5	BCDE
57	60701013	GASKET FRIZITE D15,5 F11,5 SP1,5	BCDE
58	60801136	SCREW SELFTAPPING 4X12 TC S-TT UNI-8112	BCDE
59	61404121	90° INTERNAL ELBOW	BCDE
60	60702052	O-RING 2050 EPDM 1,78 X 12,42	BCDE
61	60114104	GAS DIAPHRAGM D.15,5 H8 HOLE D.8,4	BC
61	60114096	GAS DIAPHRAGM D.15,5 H8 HOLE D.5,7	BC
61	60114093	GAS DIAPHRAGM D.15,5 H8 HOLE D.7	D
61	60114105	GAS DIAPHRAGM D.15,5 H8 HOLE D.11	E
61	60114103	GAS DIAPHRAGM D.15,5 H8 HOLE D.7,2	E
62	60702065	O-RING 2,62 X 17,86	BCDE
63	60702064	SHAPED GASKET DIAM. 71,2 H. 9,2	BCDE
64	60406138	AIR MIXER DIAPHRAGM 5 D.10-1 D.17	BC
64	60406144	AIR MIXER DIAPHRAGM 6 D.10	DE
65	60807012	PLATE CLAP	BCDE
66	61404120	COSMOMIX GAS MIXER	BCDE
67	60703030	SILICON GASKET D83 SP3,5	BCDE
68	61901038	ELECTRIC FAN NRG118 61W 115V	BC
68	61901036	BOILER FAN 135 KW 115V	D
68	61901042	ELECTRIC FAN NRG137 250W 115V	E
69	60801021	BOLT 5X12 CROSS HEAD	BCDE
70	61201040	GAS VALVE SIGMA848 120V	BCDE
71	60702029	O-RING 130 2,62 X 22,22	BCDE
72	60504272	FAN CABLE UL 885	BCDE
73	62110089	DISPLAY TYPE 885LB01	BCDE
74	61405264	DISPLAY GLASS	BCDE
75	61405259	PLASTIC BUTTONS COVER	BCDE
76	60503060	SPACER 5X1,2 L=30	BCDE
77	61405254	6 BUTTONS SWITCH	BCDE
78	61405336	FRONT COVER WITHOUT LOGO	BCDE
79	60506029	BUTTON SWITCH	BCDE
80	61405255	CARD BOX BASE	BCDE

DESCRIPTION	MOD.	DESCRIPTION	MOD.
BOILER 130A	B	BOILER 199A	D
BOILER 150A	C	BOILER 250A	E

N	CODE	DESCRIPTION	MOD
81	62110088	CONTROL BOARD 885MN10 110 V	BCDE
82	61405256	PANEL COVER	BCDE
83	60507061	CONNEXION CARD 185,6 X 42 USA	BCDE
84	60703052	RECTANGULAR SIL. GASKET 179X26	BCDE
85	61405257	CONNECTIONS BOARD COVER	BCDE
86	60503068	FUSE 1 P 1/4 X 1/4 3,15A RIT.	BCDE
87	61103014	5 EXITS GUM D.8	BCDE
88	61103013	4 EXITS GUM D.12	BCDE
89	62621190	COPPER PIPE D28	BCDE
90	62111035	CLIP SENSOR 2 POLES D18 MM	BCDE
91	60801100	SCREW SELFTAPPING 2.9 X 6.5 CROSS HEAD	BCDE
92	62101079	AUTOMATIC SAFETY THERMOSTAT 95°C	BCDE
93	62621188	COPPER PIPE D28 SLANT. NO WELD	BCDE
94	60701007	1"1/4 GASKET	BCDE
95	61212014	VORTEX FLOW SENSOR	BCDE
96	60702101	GASKET 27X18X3 NBR EN549	BCDE
97	62626005	STAINLESS STEEL PIPE D.18 GAS 130-150	BC
97	62626006	STAINLESS STEEL PIPE D.18 GAS 199	D
97	62626007	STAINLESS STEEL PIPE D.18 GAS 250	E
98	62621147	COPPER PIPE D28 F/F 1P1/4 1P1/2 L=105	BCDE
99	60701006	GASKET 3/4P 24X15X2 KLINSIL	BCDE
100	60802027	LOCK G 1 1/4P D65 SP10	BCDE
101	60802018	3/4" RING NUT	BCDE
102	60110048	BRASS NIPPLE 1"1/4 F.29 H=52	BCDE
103	60110050	NIPPLE LAITON 3/4" GAZ -3/4" NPT H=46	BCDE
104	xxxxxxxx	#N/D	x
105	xxxxxxxx	#N/D	x
106	xxxxxxxx	#N/D	x
107	61205010	3/4NPT M 30PSI ASME SAFETY RELIEF VALVE	BCDE
108	xxxxxxxx	#N/D	x
109	60109011	CAP CH46X17	BCDE
110	60303009	CALIBRATED STRAIGHT TUBE D.28 L150	BCDE

19 - SEQUENCE OF OPERATION



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