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

RESIDENTIAL BOILER MODELS
CH-80 / CH-100 / CH-120 / CH-150 / CH-180
CO-90 / CO-150 / CO-200

NSF/ANSI/CAN 372

HIGH EFFICIENCY CONDENSING GAS BOILER

INSTALLATION AND SERVICE MANUAL

QUICK CONTENTS

WARNING: If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- 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.

California Proposition 65 Warning: This product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

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

TABLE OF CONTENTS

1 IMPORTANT WARNINGS

1.1 Definitions

IMPORTANT

READ ALL OF THE FOLLOWING WARNINGS AND STATEMENTS BEFORE READING THE INSTALLATION INSTRUCTIONS

DANGER

Danger Sign: indicates the presence of an imminently hazardous situation that will cause death, serious personal injury or substantial property damage.

WARNING

Warning Sign: indicates the presence of a hazardous situation which can cause death, serious personal injury or substantial property damage.

CAUTION

Caution Sign plus Safety Alert Symbol: indicates a hazardous situation which will or can cause minor or moderate personal injury or property damage.

CAUTION

Caution Sign plus a lightning bolt indicates the risk of electric shock and the potential of hazards due to electric shock.

NOTICE

Notice Sign: indicates special instructions on installation, operation or maintenance that are important but not related to personal injury or property damage.

1.2 General warnings

WARNING

This Boiler must be installed by a licensed and trained Heating Technician, a qualified installer, service agency, or the gas supplier or the Warranty is void. Failure to properly install this unit could result in property damage, serious injury to occupants, or possibly death.

WARNING

Avoid electrical shock when servicing the appliance, by disconnecting the electrical supply prior to performing maintenance. Failure to comply with these instructions will result in substantial property damage, serious injury, or death.

WARNING

Failure to comply with these instructions will result in substantial property damage, serious injury, or death.

WARNING

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.

WARNING

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

WARNING

Prior to installing this product, the qualified installer must read all instructions included in this manual and all accompanying manuals/ documents with this appliance.

All installation steps required in these manuals must be performed in the proper order given.

DANGER

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

2 SAFETY GUIDELINES

2.1 English version

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.

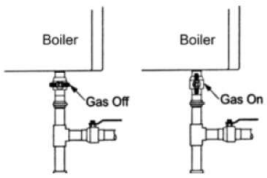
WHAT TO DO IF YOU SMELL GAS
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

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 on this label.
2. **Set the thermostat to the lowest setting**
3. **Turn off all electric power to the appliance.**
4. This appliance does not have a pilot. it is equipped with an ignition device which automaticly lights the burner. Do not try to light the burner by hand.
5. The manual gas shut off is located beneath the appliance cabinet, in the gas piping.
6. The manual gas shut off valve is located beneath the appliance cabinet; turn the handle to the full OFF position (perpendicular to the gas piping).



7. Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to next step.
8. Turn manual gas control valve to ON position (parallel to gas piping).
9. Turn on all electric power to the appliance.
10. Set the thermostat to the desired setting.
11. 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. **Set the thermostat to the lowest setting**
2. **Turn off all electric power to the appliance if service is to be performed**
3. The manual gas shut off valve is located beneath the appliance cabinet; turn the handle to the full OFF position (perpendicular to the gas piping).

2.2 Version français

POUR VOTRE SÉCURITÉ LISEZ AVANT DE METTRE EN MARCHE

AVERTISSEMENT: Quiconque ne respecte pas à la lettre les instructions dans la 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.

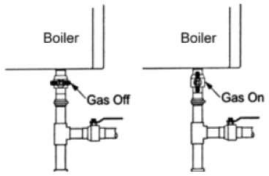
QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ
- Ne pas tenter d'allumer d'appareil.
- Ne touchez à aucun interrupteur ; ne pas vous servir des téléphones se trouvant dans le bâtiment.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.
- Si vous ne pouvez 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, même 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. **Réglez le thermostat à la température la plus basse**
3. **Coupez l'alimentation électrique de l'appareil**
4. Cette apparell ne comporte pas de veilleuse. Il intègre un dispositif d'allumage automatique du brûleur. N'essayez pas d'allumer manuellement le brûleur.
5. L'interrupteur de gaz principal se trouve directement sous la chaudière, sur la conduit d'alimentation en gaz.
6. L'interrupteur de gaz principal se trouve directement sous la chaudière. Tournez l'interrupteur de gaz principal dans le sens horaire pour couper l'alimentation en gaz.



7. Attendre cinq (5) minutes pour laisser échapper tout le gaz. Reniflez 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.
8. Tournez la vanne manuelle de contrôle du gaz en position ON (parallèle à la tuyauterie de gaz).
9. Mettez l'appareil sous tension.
10. Réglez le thermostat à la température désirée.
11. Si l'appareil ne se met pas en marche, suivez les instructions intitulées "Comment couper l'admission de gaz de l'appareil" et appelez un technicien qualifié ou le fournisseur de gaz.

Comment couper l'admission de gaz de l'appareil.

1. **Réglez le thermostat à la température la plus basse**
2. **Coupez l'alimentation électrique de l'appareil s'il faut procéder à l'entretien**
3. L'interrupteur de gaz principal se trouve directement sous la chaudière. Tournez l'interrupteur de gaz principal dans le sens horaire pourcouper l'alimentation en gaz.

2.3 For installations in the Commonwealth of Massachusetts

The following local requirements apply in addition to all other applicable NFPA requirements:
For direct-vent boilers, mechanical-vent heating appliances or domestic hot water equipment, where the bottom of the vent terminal and the intake is installed below four feet above grade, the following requirements must be met:

1) If not present on each floor level where there are bedrooms, a carbon monoxide detector and alarm must be placed in a living area outside the bedrooms. The carbon monoxide detector and alarm must comply with NFPA 72 (newest edition).
2) **A carbon monoxide detector and alarm must be located in the room that houses the boiler and/or equipment and must:**
   a) be powered by the same electrical circuit as the boiler and/or equipment so that only one service switch services both the boiler and the carbon monoxide detector;
   b) have battery back-up power;
   c) meet ANSI/UL 2034 Standards and comply with NFPA 72.
   d) have been approved and listed by a Nationally Recognized Testing Lab as recognized under 527 CMR.
3) A product-approved vent terminal must be used, and if applicable, a product approved air intake must be used. Installation must be performed in strict compliance with the manufacturer's instructions. A copy of the installation instructions must remain with the boiler and/or equipment at the completion of the installation.
4) A metal or plastic identification plate must be mounted at the exterior of the building, four feet directly above the location of vent terminal. The plate must be of sufficient size to be easily read from a distance of eight feet away and read "Gas Vent Directly Below".

For direct-vent boilers mechanical-vent heating boilers or domestic hot water equipment, where the bottom of the vent terminal and the intake is installed higher than four feet above grade, the following requirements must be met:

1) If not present on each floor level where there are bedrooms, a carbon monoxide detector and alarm must be placed in a living area outside the bedrooms. The carbon monoxide detector and alarm must comply with NFPA 72 (newest edition).
2) **A carbon monoxide detector must:**
   a) be located in the room where the boiler and/or equipment is located;
   b) be either hard-wired or battery powered or both; and:
   c) comply with NFPA 72.
3) A product-approved vent terminal must be used, and if applicable, a product- approved air intake must be used. Installation must be in strict compliance with the manufacturer's instructions. A copy of the installation instructions must remain with the boiler and/or equipment at the completion of the installation.

For installations in Massachusetts, code requires the boiler to be installed by a licensed plumber or gas fitter, and if antifreeze (glycol) is utilized, the installation of a reduced pressure back-flow preventer device is required in the boiler's cold water fill or make up water supply line.

CAUTION	This boiler is equipped with a pressure switch. In the event of a blocked vent the boiler will lockout. No attempt by the user/owner should be made to put the boiler back into operation. A qualified service technician must be notified of the issue. The boiler should only be reset by a qualified service technician after they have diagnosed and corrected the issue that caused the safety lockout of the boiler.
DANGER	• Should overheating occur or the gas supply fail to shut off, do not turn off or disconnect the electrical supply to the circulator. Instead, shut off the gas supply at a location external to the appliance. • Do not use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any gas control which has been under water. • **Scalding** Water temperatures over 125 ºF (52 ºC) can cause severe burns instantly, or death from scalds. Children, the disabled and the elderly are at the highest risk of being scalded. Feel water before bathing or showering. Read this manual entirely before setting domestic hot water setpoint(s).
NOTICE	We highly recommend the installation of a carbon monoxide (CO) detector in the boiler room for all installations.
WARNING	• WARNING: There are no user serviceable parts on this boiler. Warranty does not cover defects caused by attempts to service this boiler by someone other than a qualified gas service technician. These attempts could cause property damage, personal injury or loss of life. • WARNING: **Crystalline Silica** - Certain components in the combustion chamber may contain this potential carcinogen. Improper installation, adjustment, alteration, service or maintenance can cause property damage, serious injury (exposure to hazardous materials) or death. Refer to Section 19.2 for information on handling instructions and recommended personal protective equipment. Installation and service must be performed by a qualified installer, service agency or the gas supplier (who must read and follow the supplied instructions before installing, servicing, or removing this boiler. This boiler contains materials that have been identified as carcinogenic, or possibly carcinogenic, to humans). • a water heater that will be used to supply potable water shall not be connected to any heating system or component(s) previously used with a non-potable water heating appliance.

WARNING
WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury (exposure to hazardous materials) * or loss of life. Installation and service must be performed by a qualified installer, service agency or the gas supplier (who must read and follow the supplied instructions before installing, servicing, or removing this boiler). This boiler contains materials that have been identified as carcinogenic, or possibly carcinogenic, to humans.

Avertissement
AVERTISSEMENT: Une installation, un réglage, une modification, une réparation ou un entretien non conforme aux normes peut entraîner des dommages matériels, des blessures (exposition à des matières dangereuses) ou la mort. L'installation et l'entretien doivent être effectués par un installateur ou un service d'entretien qualifié ou le fournisseur de gaz (qui doivent avoir lu les instructions fournies avant de faire l'installation, l'entretien ou l'enlèvement de la chaudière et les respecter). Cette chaudière contient des matériaux qui ont été identifiés comme étant cancérogènes ou pouvant l'être.

Avertissement
(Pour installateurs francophones)

AVERTISSEMENT. 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 cet appareil ou de tout autre appareil.

— QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ :

•Ne pas tenter d'allumer d'appareils.

•Ne touchez à aucun interrupteur. Ne pas vous servir des téléphones dans le bâtiment où vous vous trouvez.

•Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.

•Si vous ne pouvez rejoindre le fournisseur de gaz, 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.

INTRODUCTION

Ce manuel est écrit pour l'utilisateur.
Le fabricant n'est pas responsable de tout dommage causé par ne pas suivre correctement de ces instructions. Pour service et réparation, utiliser seulement pièces de rechange du fabricant. Tout documentation produit par le fabricant est sous réserve de la loi sur le droit d'auteur. Ce manuel est sujet à changement sans préavis.

Explications:

CH = Chauffage central (pour objectif chauffage et/ ou eau chaude indirect)
CO = Combination : Chauffage central et eau chaude direct
DHW = Eau Chaude Sanitaire (ECS)
BCU = commande (burner control unit)
PB = écran (Pixel Button)

CONSIGNES DE SÉCURITÉ

AVERTISSEMENT. 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.

POUR VOTRE SÉCURITÉ LISEZ AVANT DE METTRE EN MARCHE
« 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 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. »

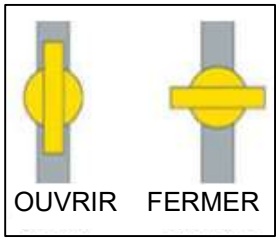
« D. N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau. »

Avertissement

Une installation, un réglage, une modification, une réparation ou un entretien non conforme aux normes peut entraîner des dommages matériels, des blessures (exposition à des matières dangereuses) ou la mort. L'installation et l'entretien doivent être effectués par un installateur ou un service d'entretien qualifié ou le fournisseur de gaz (qui doivent avoir lu les instructions fournies avant de faire l'installation, l'entretien ou l'enlèvement de la chaudière et les respecter. Cette chaudière contient des matériaux qui ont été identifiés comme étant cancérogènes ou pouvant l'être).

Comment couper l'admission de gaz de L'appareil:

1. Réglez le thermostat à la température la plus basse.
2. Coupez l'alimentation électrique de l'appareil s'il faut procéder à l'entretien
3. Le robinet d'arrêt de gaz est situé dessous la chaudière dans la conduite de gaz.
4. Tourner le robinet sens horaire à "OFF" (fermé) pour arrêter l'alimentation en gaz. Ne pas forcer.



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

Entretien et inspection

« Inspecter de façon visuelle le système d'évacuation pour déterminer la grosseur et l'inclinaison horizontale qui conviennent et s'assurer que le système est exempt d'obstruction, d'étranglement, de fuite, de corrosion et autres défaillances qui pourraient présenter des risques. »

L'entretien et l'inspection de la chaudière doivent être effectués aux occasions suivantes :

- **Lorsqu'un certain nombre de codes d'erreur et/ou de verrouillage semblables apparaissent.**
- **Au moins tous les 12 mois, l'entretien doit être fait pour assurer un fonctionnement sûr et efficace.**

Les dommages causés par le manque d'entretien ne seront pas couverts par la garantie

Retrait d'une chaudière existante.

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

« Sceller toutes les ouvertures non utilisées du système d'évacuation. »

« Inspecter de façon visuelle le système d'évacuation pour déterminer la grosseur et l'inclinaison horizontale qui conviennent et s'assurer que le système est exempt d'obstruction, d'étranglement, de fuite, de corrosion et autres défaillances qui pourraient présenter des risques.

« Dans la mesure du possible, fermer toutes les portes et les fenêtres du bâtiment et toutes les portes entre l'espace où les appareils toujours raccordés au système d'évacuation sont installés et les autres espaces du bâtiment. Mettre en marche les sécheuses, tous les appareils non raccordés au système d'évacuation commun et tous les ventilateurs d'extraction comme les hottes de cuisinière et les ventilateurs des salles de bain. S'assurer que ces ventilateurs fonctionnent à la vitesse maximale. Ne pas faire fonctionner les ventilateurs d'été. Fermer les registres des cheminées. » « Mettre l'appareil inspecté en marche. Suivre les instructions d'allumage. Régler le thermostat de façon que l'appareil fonctionne de façon continue. »

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

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

3 INTRODUCTION

This manual is the installation and service manual for the high-efficiency heating systems from the CH (Central Heating boilers) series and CO (Combi boilers) series. This manual is specifically written for the installer.

The distributor and manufacturer are not accountable for any damage caused by installers not correctly following these instructions.

For service and repair purposes use only original manufacturer sourced spare parts.

All documentation produced by the manufacturer is subject to copyright law.

This manual is subject to change without notice.

3.1 Terms and abbreviations

In this manual the following terms and abbreviations are used:

A (Amp)	Ampère
AFUE	Annual Fuel Utilization Efficiency
AHRI	Air-conditioning, Heating and Refrigeration Institute
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineering
bar	Unit of pressure (1 bar = 14.5 PSI)
BCU	Burner Control Unit
BTU	British Thermal Unit
°C	Degree Celsius
$CaCO_3$	Calcium carbonate
CH	Central Heating.
CO	1. Combi-boiler (CH & DHW) 2. Carbon monoxide
CO_2	Carbon dioxide
Combi	A boiler providing a combination of central heating and domestic hot water
CVPC	Chlorinated Polyvinyl Chloride, a thermoplastic
DHW	Domestic Hot Water
°F	Degree Fahrenheit
Hz	Hertz
LB	Digit-based Liquid Crystal Display Board
LCD	Liquid Crystal Display
LPG	Liquefied Petroleum Gas
MBH	1000 BTUs per hour
mg	Milligram
NFPA	National Fire Protection Association
NO_x	Mono-nitrogen oxides
NPT	National Pipe Thread, American standard for threaded pipes and fittings
NTC	Negative Temperature Coefficient, a quality of sensors and resistors
O_2	Oxygen
PB	Graphical Display Board
PCB	Printed Circuit Board

PEX	Cross-linked polyethylene
pH	Acidity degree
PID	Proportional Integral Derivative, a control concept used in automation
PP	Polypropylene, a thermoplastic
ppm	Particles per million
psi	Pounds per square inch, a unit of pressure
Pump	Circulator
PVC	Polyvinyl Chloride, a thermoplastic
PWM	Pulse Width Modulation
RCF	Refractory Ceramic Fibers
RT	Room Thermostat
TDS	Total Dissolved Solids, a characteristic used in water quality
UL	Underwriters Laboratories, American testing and certification institute
VAC	Volt Alternating Current
VDC	Volt Direct Current
W	Watt, SI unit of power
W.C.	Water column

3.2 Codes, standards and regulations

Installation, maintenance and repairs must be performed in strict accordance with the state and local requirements and regulations.

In the absence of local requirements, the following standards and regulations apply:

- ASME Boiler and Pressure Vessel Code — Section IV “Heating boilers”
- ASME Boiler and Pressure Vessel Code — Section VI “Recommended Rules for the Care and Operation of Heating Boilers”
- ANSI Z223.1 / NFPA 54 — National Fuel Gas Code (USA) newest edition
- ANSI / NFPA 70 — National Electrical Code (USA) newest edition
- ANSI / NFPA 211 — Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances
- CAN/CSA B149.1 — Natural Gas and propane installation code (CAN) newest ed.
- CAN/CSA C22.1 — Canadian Electrical Code Part 1 (CAN) newest edition

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.

3.3 Maintenance and inspection

For a good, safe and long-lasting operation of the boiler and to maintain warranty it is mandatory to carry out inspection, maintenance and service on the boiler at least once a year.

NOTICE	**Maintenance and inspection of the boiler must be carried out in the following situations:** • **When a number of similar error codes and/or lockouts appear.** • **At least once every 12 months to ensure safe and efficient operation.** **Damage caused by lack of maintenance will not be covered under warranty.**

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

More details on maintenance, inspections and repairs are covered in chapter 19.

4 TECHNICAL DATA CH / CO RESIDENTIAL BOILERS

4.1.1 *FUNCTIONAL INTRODUCTION*

The CH / CO boilers are central heating/combi boilers with a maximum high efficiency. Such a performance can be reached by, amongst other things, using a special heat exchanger made of stainless steel. This allows the flue gases to cool down below the condensation point, thus releasing extra heat. This has an immediate positive impact on the efficiency.

The CH / CO boiler is factory set for Natural gas.
Fuel used must have Sulphur rates with a maximum annual peak over a short period of time of 110 ppm (150 mg/m^3) and a maximum annual average of 22 ppm. (30 mg/m^3 average).

Boiler control includes:
- Cascade control for up to sixteen boilers
- Remote operation and heat demand indication from each boiler
- Weather compensation control – Outdoor reset.
- Indirect tank control (On heat only boiler models)

Connections for CH boilers:
- On/Off thermostat or modulating thermostat
- 0-10 VDC remote flow temperature (set point) control
- 0-10 VDC remote boiler input control
- Outdoor temperature sensor
- External indirect tank circulator or diverter valve
- PWM control for external boiler circulator.
- Low Water Cut Off
- System circulator
- External flow switch or external safety device.
- Modbus
- External system sensor
- DHW indirect sensor or aquastat.
- Alarm outputs

Connections for CO boilers:
- On/Off thermostat or modulating thermostat
- 0-10 VDC remote flow temperature (set point) control
- 0-10 VDC remote boiler input control
- Outdoor temperature sensor
- PWM control for external boiler circulator.
- Low Water Cut Off
- System circulator
- External flow switch or external safety device.
- Modbus
- External system sensor
- Alarm outputs

4.2 Location of burner controller version numbers

4.2.1 *HARDWARE VERSION*

Burner Controller Hardware Version
– To be found on the second line of the white sticker located at the side of the burner controller.
v.B = “Version B” for instance

Figure 4.1

Parameter Version
- To be found on the small sticker on the side of the burner controller.
957MN15_3Ri4n1

Figure 4.2

4.2.2 *SOFTWARE VERSIONS*

Press the menu button
- Go to Information
- Go to Software Versions.

Figure 4.3

Figure 4.4

4.3 Technical specifications datasheets

4.3.1 *TECHNICAL SPECIFICATIONS CH-80 / CO-90 / CH-100*

GENERAL					
Boiler category		-	IV, direct vent		
Type boiler			**CH-80**	**CO-90**	**CH-100**
Dimensions (h x w x d)		inch (mm)	28.2" x 17.4" x 16.9" (717mm x 442mm x 429mm)		
Water content		gallon (liter)	0.37 (1.4)	0.37 (1.4)	0.46 (1.75)
Weight (empty)		lbs (kg)	74 (34)	77 (35)	77 (35)
Supply/return connection CH		inch	NPT ¾"	NPT ¾"	NPT ¾"
Supply/return connection DHW		inch	NPT ¾"	NPT ½"	NPT ¾"
Gas connection		inch	NPT ¾"	NPT ¾"	NPT ¾"
Flue connection		inch (mm)	3" (80mm)	3" (80mm)	3" (80mm)
GAS CONSUMPTION			**Values min-max:**		
Natural gas		ft^3/h m^3/h	7.43 – 74.3 0.21 – 2.11	8.36 – 83.6 0.24 – 2.37	9.29 – 92.9 0.26 – 2.63
Propane [1]		ft^3/h m^3/h	3.20 – 32.0 0.09 – 0.91	3.60 – 36.0 0.10 – 1.02	4.0 – 40.0 0.11 – 1.13
Gas supply pressure nominal [2]	Nat. gas	Inch W.C./ (mbar)	7.0 (17.4)		
	Propane	Inch W.C./ (mbar)	11.0 (27.4)		
NOTES					

1 Using propane, maximum fan speed needs to be reduced

2 Nominal, minimum and maximum gas supply pressures are listed in the table below.

	p nom. inch W.C. (mbar)	p min. inch W.C. (mbar)	p max. inch W.C. (mbar)
Natural gas	7.0 (17.4)	3.5 (8.7)	10.5 (26.2)
Propane	11.0 (27.4)	8.0 (19.9)	13.0 (32.4)

Table 4.1

Type boiler			CH-80	CO-90	CH-100
O_2 flue gas [3]	Natural gas	Low Fire %	4.0 – 4.2		
		High Fire %	4.5 – 4.7		
	Propane	Low Fire %	5.9 – 6.1		
		High Fire %	5.4 – 5.6		
CO_2 flue gas [3]	Natural gas	Low Fire %	9.4 – 9.6		
		High Fire %	9.1 – 9.3		
	Propane	Low Fire %	9.7 – 9.8		
		High Fire %	10.1 – 10.2		
Flue gas temperature at combustion air temperature = 70 °F (20 °C)		°F (°C)	86 – 153 (30 – 67)		
Available pressure for the flue and inlet system [4]		Inch W.C. (Pa)	1 (250)	1.28 (320)	0.92 (230)
INSTALLATION					
Resistance boiler	ΔT = 20 F	ft.head (m.W.C.)	26.3 (8.0)	26.3 (8.0)	35.6 (10.9)
	ΔT = 35 F	ft.head (m.W.C.)	8.8 (2.7)	8.8 (2.7)	12.7 (3.9)
Pressure boiler min-max.		psi (bar)	11.6 – 43.5 (0.8 – 3.0)		
Max. supply temperature		°F (°C)	194 (90)		
DHW PERFORMANCE					
flow rate at ΔT = 77 °F		gal/min (l/min)	-	2.3 (8.7)	-
Pressure DHW min-max		psi (bar)	-	14.5 - 116 (1.0 -8.0)	-
Thermal Efficiency [6]		%		95.0	
ELECTRIC					
Minimum power consumption		W	140	140	140
Maximum power consumption		W	180	190	180
Standby power consumption		W	6	6	6
Power supply		V/Hz	120 / 60		
Protection class		-	IPX4D[5]		

NOTES

[3] O_2 (or CO_2) of the unit measured/set without the boiler front panel in place. Note: CO_2 value will increase by 1.5% with front panel in place.

[4] Maximum allowed combined resistance of flue gas and air supply piping at high fire

[5] For gas appliance with room air intake, only class IPX4D with special air inlet, otherwise the protection class is IP20 (see also figures 4.5 & 4.6 and tables 10.13 & 10.14)

[6] Efficiency of DHW performance measured according to ANSI Z21.10.3-2015 • CSA 4.3-2015

Table 4.2

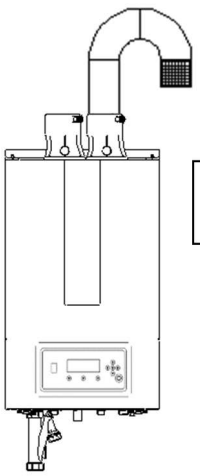


Figure 4.5

IPX4D Air inlet.
Two 90° Bends with a bird screen

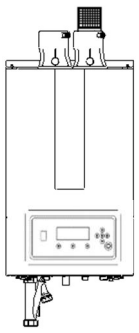


Figure 4.6

Boiler is IP20 applying a bird screen only

4.3.2 *TECHNICAL SPECIFICATIONS CH-120 / CO-150 / CH-150*

GENERAL					
Boiler category		-	IV, direct vent		
Type boiler			**CH-120**	**CO-150**	**CH-150**
Dimensions (h x w x d)		Inch (mm)	28.2" x 17.4" x 16.9" (717mm x 442mm x 429mm)		
Water content		Gallon (liter)	0.55 (2.1)	0.55 (2.1)	0.85 (3.2)
Weight (empty)		Lbs (kg)	83 (38)	86 (39)	97 (44)
Supply/return connection CH		inch	NPT ¾"	NPT ¾"	NPT ¾"
Supply/return connection DHW		inch	NPT ¾"	NPT ½"	NPT ¾"
Gas connection		inch	NPT ¾"	NPT ¾"	NPT ¾"
Flue connection		Inch (mm)	3" (80mm)	3" (80mm)	3" (80mm)
GAS CONSUMPTION			**Values min-max:**		
Natural gas		ft^3/h m^3/h	11.1 – 111.5 0.32 – 3.16	13.9 – 139.4 0.40 – 3.95	13.9 – 139.4 0.40 – 3.95
Propane [1]		ft^3/h m^3/h	4.8 – 48.0 0.14 – 1.36	6.0 – 60.0 0.17 – 1.7	6.0 – 60.0 0.17 – 1.7
Gas supply pressure nominal [2]	Nat. gas	Inch W.C./ (mbar)	7.0 (17.4)		
	Propane	Inch W.C./ (mbar)	11.0 (27.4)		

NOTES

1 Using propane, maximum fan speed needs to be reduced

2 Nominal, minimum and maximum gas supply pressures are listed in the table below.

	p nom. inch W.C. (mbar)	p min. inch W.C. (mbar)	p max. inch W.C. (mbar)
Natural gas	7.0 (17.4)	3.5 (8.7)	10.5 (26.2)
Propane	11.0 (27.4)	8.0 (19.9)	13.0 (32.4)

Table 4.3

Type boiler			CH-120	CO-150	CH-150
O_2 flue gas [3]	Natural gas	Low Fire %	4.0 – 4.2		
		High Fire %	4.5 – 4.7		
	Propane	Low Fire %	5.9 – 6.1		
		High Fire %	5.4 – 5.6		
CO_2 flue gas [3]	Natural gas	Low Fire %	9.4 – 9.6		
		High Fire %	9.1 – 9.3		
	Propane	Low Fire %	9.7 – 9.8		
		High Fire %	10.1 – 10.2		
Flue gas temperature at combustion air temperature = 70 °F (20 °C)		°F (°C)	86 – 153 (30 – 67)		
Available pressure for the flue and inlet system [4]		Inch W.C. (Pa)	1.04 (260)	1.61 (400)	1.36 (340)
INSTALLATION					
Resistance boiler	ΔT = 20 F	ft.head (m.W.C.)	25.2 (7.7)	25.2 (7.7)	47.6 (14.5)
	ΔT = 35 F	ft.head (m.W.C.)	9.7 (3.9)	9.7 (3.9)	15.8 (4.8)
Pressure boiler min-max.		psi (bar)	11.6 – 43.5 (0.8 – 3.0)		
Max. supply temperature		°F (°C)	194 (90)		
DHW PERFORMANCE					
flow rate at ΔT = 77 °F		gal/min (l/min)	-	3.4 (12.9)	-
Pressure DHW min-max		psi (bar)	-	14.5 - 116 (1.0 -8.0)	-
Thermal Efficiency [6]		%		93.7	
ELECTRIC					
Minimum power consumption		W	140	140	140
Maximum power consumption		W	190	220	200
Standby power consumption		W	6	6	6
Power supply		V/Hz	120 / 60		
Protection class		-	IPX4D[5]		

NOTES

[3] O_2 (or CO_2) of the unit measured/set without the boiler front panel in place. Note: CO_2 value will increase by 1.5% with front panel in place.

[4] Maximum allowed combined resistance of flue gas and air supply piping at high fire

[5] For gas appliance with room air intake, only class IPX4D with special air inlet, otherwise the protection class is IP20 (see also figures 4.5 & 4.6 on page 20, and tables 10.13 & 10.14)

[6] Efficiency of DHW performance measured according to ANSI Z21.10.3-2015 • CSA 4.3-2015

Table 4.4

4.3.3 *TECHNICAL SPECIFICATIONS CH-180 / CO-200*

GENERAL				
Boiler category		-	IV, direct vent	
Type boiler			**CH-180**	**CO-200**
Dimensions (h x w x d)		Inch (mm)	28.2" x 17.4" x 16.9" (717mm x 442mm x 429mm)	
Water content		Gallon (liter)	0.85 (3.2)	0.85 (3.2)
Weight (empty)		Lbs (kg)	98 (44)	101 (46)
Supply/return connection CH		inch	NPT ¾"	NPT ¾"
Supply/return connection DHW		inch	NPT ¾"	NPT ½"
Gas connection		inch	NPT ¾"	NPT ¾"
Flue connection		Inch (mm)	3" (80mm)	3" (80mm)
GAS CONSUMPTION			**Values min-max:**	
Natural gas		ft^3/h m^3/h	16.7 – 167.4 0.47 – 4.74	18.6 – 186.0 0.52 – 5.26
Propane [1]		ft^3/h m^3/h	7.2 – 72.1 0.2 – 2.04	8.0 – 80.0 0.23 – 2.27
Gas supply pressure nominal [2]	Nat. gas	Inch W.C./ (mbar)	7.0 (17.4)	
	Propane	Inch W.C./ (mbar)	11.0 (27.4)	

NOTES

1 Using propane, maximum fan speed needs to be reduced.

2 Nominal, minimum and maximum gas supply pressures are listed in the table below.

	p nom. inch W.C. (mbar)	p min. inch W.C. (mbar)	p max. inch W.C. (mbar)
Natural gas	7.0 (17.4)	3.5 (8.7)	10.5 (26.2)
Propane	11.0 (27.4)	8.0 (19.9)	13.0 (32.4)

Table 4.5

Type boiler			CH-180	CO-200
O_2 flue gas [3]	Natural gas	Low Fire %	4.0 – 4.2	
		High Fire %	4.5 – 4.7	
	Propane	Low Fire %	5.9 – 6.1	
		High Fire %	5.4 – 5.6	
CO_2 flue gas [3]	Natural gas	Low Fire %	9.4 – 9.6	
		High Fire %	9.1 – 9.3	
	Propane	Low Fire %	9.7 – 9.8	
		High Fire %	10.1 – 10.2	
Flue gas temperature at combustion air temperature = 70 °F (20 °C)		°F (°C)	86 – 153 (30 – 67)	
Available pressure for the flue and inlet system [4]		Inch W.C. (Pa)	1.61 (400)	1.97 (490)
INSTALLATION				
Resistance boiler	ΔT = 20 F	ft.head (m.W.C.)	68.4 (20.8)	68.4 (20.8)
	ΔT = 35 F	ft.head (m.W.C.)	22.6 (6.9)	22.6 (6.9)
Pressure boiler min-max.		psi (bar)	11.6 – 43.5 (0.8 – 3.0)	
Max. supply temperature		°F (°C)	194 (90)	
DHW PERFORMANCE				
flow rate at ΔT = 77 °F		gal/min (l/min)	-	4.6 (17.4)
Pressure DHW min-max		psi (bar)	-	14.5 - 116 (1.0 -8.0)
Thermal Efficiency [6]		%		95.4
ELECTRIC				
Minimum power consumption		W	150	150
Maximum power consumption		W	260	290
Standby power consumption		W	6	6
Power supply		V/Hz	120 / 60	
Protection class		-	IPX4D[5]	

NOTES

[3] O_2 (or CO_2) of the unit measured/set without the boiler front panel in place. Note: CO_2 value will increase by 1.5% with front panel in place.

[4] Maximum allowed combined resistance of flue gas and air supply piping at high fire

[5] For gas appliance with room air intake, only class IPX4D with special air inlet, otherwise the protection class is IP20 (see also figures 4.5 & 4.6 on page 20, and tables 10.13 & 10.14)

[6] Efficiency of DHW performance measured according to ANSI Z21.10.3-2015 • CSA 4.3-2015

Table 4.6

4.4 High altitude operation

High Altitude Operation
The boiler is designed to operate at its maximum listed capacity in installations at elevations less than or equal to 2000 ft (610 m) above Sea Level. Since the density of air decreases as elevation increases, maximum specified capacity will be de-rated for elevations above 2000 ft (610 m) in accordance with the table underneath.

Elevations	2000 ft (610 m)	3000 ft (914 m)	4000 ft (1219 m)	4500 ft (1372 m)	Above 4500 ft (1372 m)
In USA	No de-rate	De-rate by 4 %	De-rate by 8 %	De-rate by 10 %	De-rate 4% per 1000 ft.
In Canada	No de-rate	De-rate by 10%	De-rate by 10 %	De-rate by 10 %	De-rate 4% per 1000 ft.
In USA and Canada, de-rate by 4% extra for every 1000 ft. above 4500 ft.					

NOTICE

Combustion – At elevations above 2000 ft (610 m), the combustion of the appliance must be checked with a calibrated (altitude corrected) combustion analyzer to ensure safe and reliable operation. No orifices or high-altitude kits are needed, since the 1:1 Gas/Air ratio of the gas valve and the venturi will respond automatically to reduced air pressure.
It is the Installers responsibility to check the combustion of the appliance. Failure to follow these instructions may result in property damage, serious injury, or death.

Table 4.7

How to calculate De-rating at intermediate elevations for US:
Elevation between:
2000 and 3000 ft : (New value – 2000) x 0.004 **Example**: Elevation is 2600 ft. De-rating is (2600-2000)x0.004 = 2.4 %
3000 till 4000 ft : ((New value – 3000) x 0.004)+4 **Example**: Elevation is 3700 ft. De-rating is ((3700-3000)x0.004)+4 = 6.8 %
4000 till 4500 ft : ((New value – 4000) x 0.004)+8 **Example**: Elevation is 4200 ft. De-rating is ((4200-4000)x0.004)+8 = 8.8 %
Above 4500 ft : ((New value – 4500) x 0.004)+10 **Example**: Elevation is 4800 ft. De-rating is ((4800-4500)x0.004)+10 = 11.2 %

How to calculate De-rating at intermediate elevations for Canada:
Elevation between:
2000 till 4500 ft : All values de-rate by 10% **Example**: Elevation is 3600 ft. De-rating = 10 %
Above 4500 ft : ((New value – 4500) x 0.004)+10 **Example**: Elevation is 7600 ft. De-rating is ((7600-4500)x0.004)+10 = 22.4 %

4.5 DHW specifications CO models

CO models DHW specifications		
	DHW Input, MBH	
Model number	Min	Max
CO-90	9	90
CO-150	15	150
CO-200	20	200

Table 4.8

4.6 Heat exchanger information

The heat exchanger in this boiler is manufactured and certified by Sermeta.

ASME H

This table gives an overview of the ASME-H specifications as certified:

Boiler model	CRN number	Max. allowable water pressure	Max. allowable water temperature*	Min. relieve valve capacity	Heat exch. surface
CH-80 CO-90	T4804.4CL	50 Psi	210 °F	91 MBH	7.99 SQFT
CH-100	T4804.4CL	50 Psi	210 °F	136 MBH	9.99 SQFT
CH-120 CO-150	T4806.4CL	50 Psi	210 °F	182 MBH	11.99 SQFT
CH-150 CH-180 CO-200	T4807.4CL	50 Psi	210 °F	227 MBH	17.98 SQFT

The National Board number can be read from the label on the heat exchanger.
Alternatively, the manufacturer can be contacted for this number.
* the maximum supply temperature of the boiler is 194°F

Table 4.9

4.7 Specifications input, output, efficiency (AHRI)

Model number	CH Input, MBH [1]		Output [1] MBH	AHRI Net Ratings Water, MBH	AFUE %
	Min	Max			
CH-80	8	80	74	64	95.2
CO-90	9	80	74	64	95.2
CH-100	10	100	92	80	95.2
CH-120	12	120	110	96	95.2
CO-150	15	120	110	96	95.2
CH-150	15	150	139	121	95.2
CH-180	18	180	165	143	95.2
CO-200	20	180	167	145	95.2

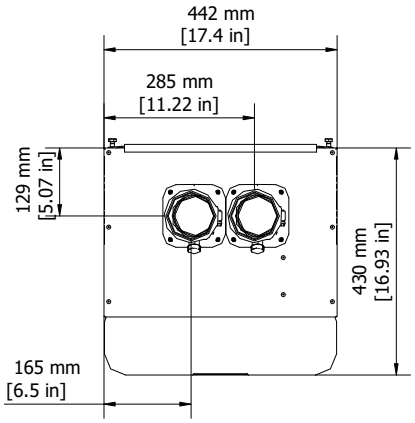
[1] Listed Input and Output ratings are at minimum vent lengths at Sea Level. Numbers will be lower with longer venting and/or altitudes greater than 2000 feet [610 m].

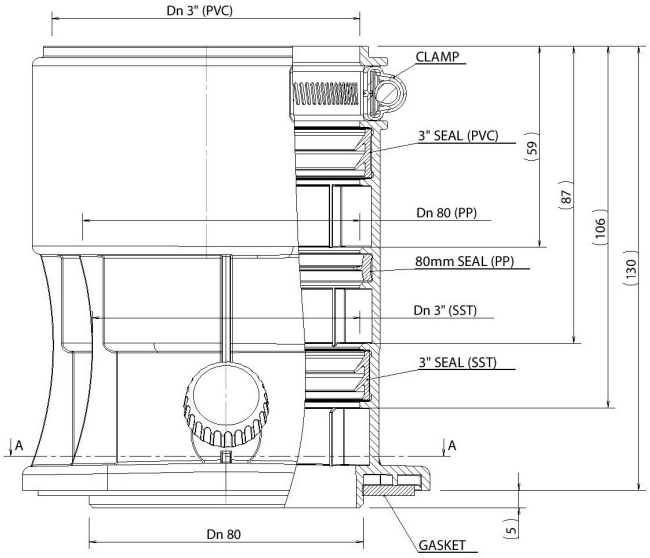
- Ratings have been confirmed by the Hydronics Section of AHRI.
- The ratings and efficiencies are based on standard test procedures and calculation methods as prescribed by the United States Department of Energy.
- It has been determined that these firing rates meet the ENERGY STAR guidelines for energy efficiency.

Table 4.10

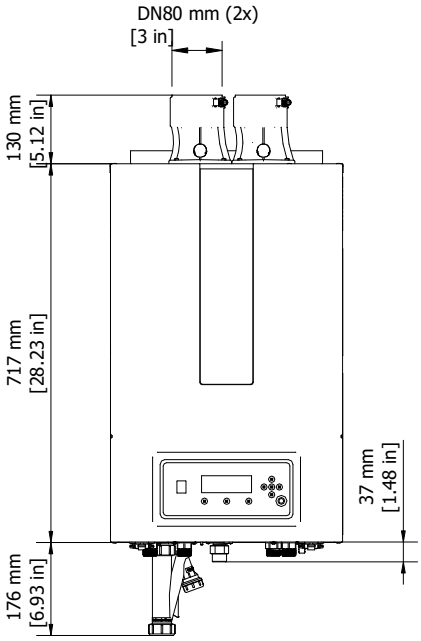
5 BOILER DIMENSIONS

5.1 CH-80 / CH-100 / CH-120 / CH-150 / CH-180



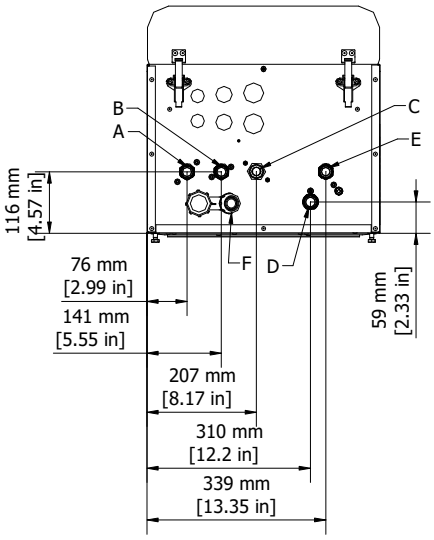


Vent connection



Connections CH boilers		
A	Supply	NPT ¾ “
B	(indirect) DHW Outlet	NPT ¾ “
C	Gas	NPT ¾ “
D	(indirect) DHW Inlet	NPT ¾ “
E	Return	NPT ¾ “
F	Condensate	Flexible hose Ø 1.06” (26.9 mm)

Table 5.1



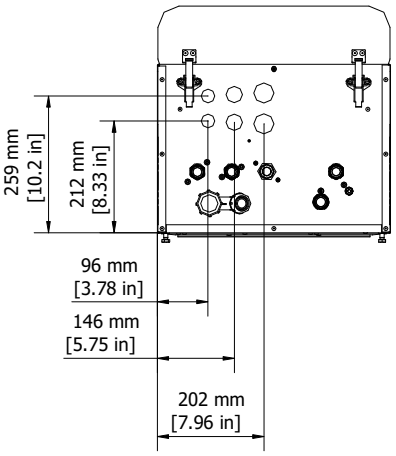
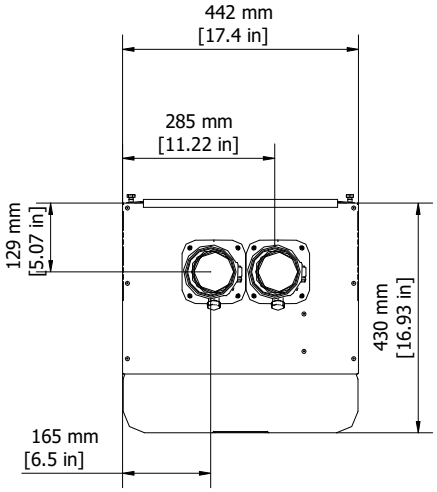
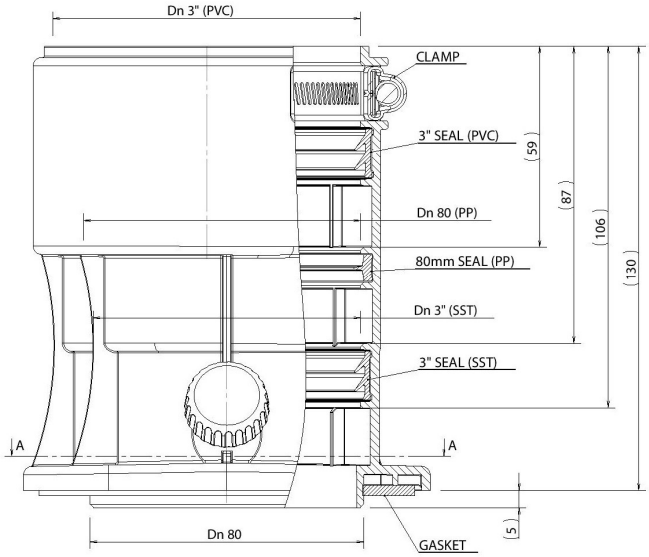


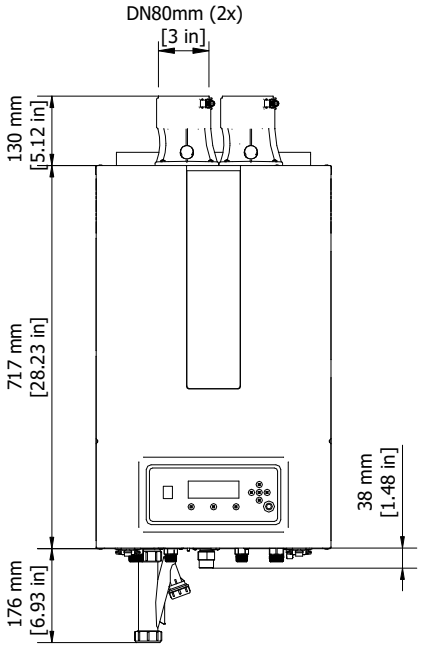
Figure 5.1

5.2 CO-90 / CO-150 / CO-200





Vent connection



Connections CO boilers		
A	Supply	NPT ¾ “
B	DHW Outlet	NPT ½ “
C	Gas	NPT ¾ “
D	DHW Inlet	NPT ½ “
E	Return	NPT ¾ “
F	Condensate	Flexible hose Ø 1.06” (26.9 mm)

Table 5.2

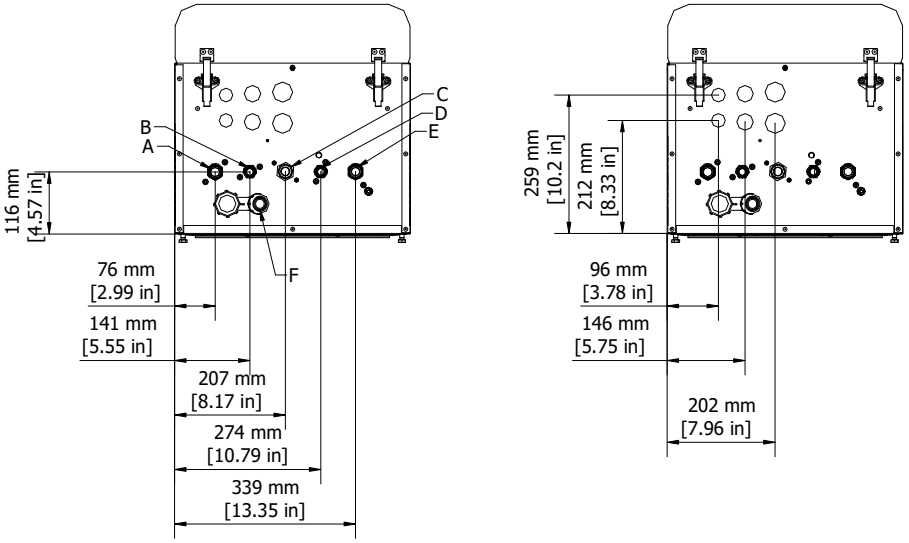


Figure 5.2

6 UNPACKING AND ACCESSORIES

6.1 Supplied with the boiler

The CH / CO boiler will be supplied with the following documents and accessories:

Qty	Description
1	Residential Installation and Service manual
1	Residential User Manual
1	Startup and commissioning check list
1	Wall bracket with locking plate and bolts
3	Spare nuts for the burner plate (in a bag attached to the front of the gas valve)
1	Spare fuse for the boiler controller (at the burner controller)
1	Bottom part of the condensate drain assembly
1	Pressure relief valve, 30 psi
1	Temperature & pressure gauge
1	¾" gas shutoff valve
1	Boiler drain valve

Table 6.1

After delivery, always check the boiler package to see if it is complete and without any defects. Report any defects or missing parts immediately to your supplier.

6.2 Optional Accessories

Depending on the selected boiler type, the selected controlling behavior for the central heating system and/or the optional use of an indirect tank, the following items are available as accessories. Contact your supplier for ordering.

Item	Part number
Residential Boiler Yearly Maintenance and Service Kit	S000.600.001.035
Propane conversion kit CH-80 and CO-90	S022.600.001.035
Propane conversion kit CH-100	S022.600.002.035
Propane conversion kit CH-120 and CO-150	S022.600.003.035
Propane conversion kit CH-150	S022.600.005.035
Propane conversion kit CH-180	S022.600.004.035
Propane conversion kit CO-200	S022.600.007.035
Outdoor (air) temperature sensor	S022.500.020
Dry well tank sensor for an Indirect Hot Water tank	S022.500.009
External flow temperature sensor for behind the cascade header 10kOhm@77°F	S022.500.021

Table 6.2

7 INSTALLATION LOCATION OF THE BOILER

7.1 General

The boiler must be positioned and installed by a qualified installer or the gas company in accordance with all applicable standards, local codes and regulations (see also paragraph 3.2). Commissioning of the boiler must be done by a qualified installer or technician, who has been trained for this type of boiler.

7.2 Boiler Installation Location Requirements

The installation of the boiler must meet the following location requirements:

- The installation of this boiler when installed using room air must comply with ANSI Z223.1/NFPA 54 (USA) or CAN/CSA B149.1 Natural gas and propane installation code (Canada).
- The flue gas pipes must be connected to the outside wall and/or the outside roof, see chapter 10.
- The installation area must be dry and frost-free.
- The boiler has a built-in fan that will generate noise, depending on the total heat demand. The boiler location must minimize any disturbance this might cause. Preferably mount the boiler on a solidly constructed wall or stand.
- There must be sufficient lighting available in the boiler room to work safely on the boiler.
- When a boiler is positioned at the highest point of the installation, the supply and return pipes must first protrude 20” above the top of the boiler, before these pipes go to the installation side. In other words, the water level must always be 20” above the top of the boiler and an automatic air vent must be installed in the supply or return pipe. It is recommended to install a low water cut off above the boiler, when the boiler is installed above the system or at the highest point in the installation.
- Do not install the boiler in a location where it will be exposed to temperatures of 100 °F or higher.
- Do not install the boiler in a location where it will be exposed to high levels of humidity and moisture or where condensation might fall onto the boiler.
- When the boiler is installed in a residential living space the installer must make sure that there is a carbon monoxide detector present in this living space.
- Make sure there is an open connection to the sewer to drain the condensate. This connection must be lower than the condensate drains level of the boiler. If not, a condensate pump will be required.
- Do not locate the boiler in an area which contains corrosive or other contaminants as outlined in section 10.8.1, especially Table 10.7 and Table 10.8.
- When considering installation locations, consideration must be given to the combustion air supply, specifically whether to use indoor air or sealed combustion.
- Do not allow the combustion air to come from a source or area which contains corrosive or other contaminants as outlined in section 10.8.1, especially Table 10.7 and Table 10.8.

The boiler must be positioned and installed by a qualified installer or gas company in accordance with all applicable standards, local codes and regulations. Commissioning of the boiler must be done by a qualified installer or technician, who has been trained for this type of boiler.
In the Commonwealth of Massachusetts this boiler must be installed by a licensed Plumber or Gas Fitter.

The installation area/room must have the following provisions:
- 120 V - 60 Hz power source socket with ground.
- Open connection to the sewer system for draining condensing water.
- A wall or stand to properly support the weight of the boiler.
- Depending on the current of the used circulator, apply a circuit breaker between 6 and 12 amps

NOTICE	The installation of the gas appliance must conform to the requirements of this manual and your local authority. 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
	The wall used for mounting the boiler must be able to hold the weight of the boiler, piping and fittings, and the weight of the water. If not, it is recommended to mount the boiler by means of a (optional) cascade stand.

CAUTION	The boiler must NOT be installed on or near carpeting.

7.3 Installation Clearances

When installing the boiler, the following table shows the clearances which are required, and which clearances are recommended considering service and maintenance. If the recommended clearances are not provided service or maintenance on the boiler might not be possible without removing the boiler from its space.

Model No.	Clearances to wall, ceiling and floor					
CH-80 CH-100 CH-120 CH-150 CH-180 CO-90 CO-150 CO-200	Distances – inches					
		A: Front	B: Top	C: Sides	D: Back	E: Bottom
	Minimum required clearances	1*	5	1*	0	12
	Recommended service clearances	12	6	1	0	12
	Clearances from combustible materials 1. Hot water pipes—at least 1/2" (12 mm) from combustible materials. 2. Vent pipe – at least 1" (25 mm) from combustible materials.					
	*** See closet / enclosure installation.**					

Table 7.1

Closet / enclosure installation
If the boiler is installed in closets or small enclosures which do not provide at least the recommended clearances, air openings must be provided to the front of the closet or enclosure.
These air openings must be maximum 12 inch from the top and maximum 12 inch from the bottom of the enclosure.
* To get enough air circulation one of those two values (Front or Sides) has to be at least 1” the other can be 0”.

Note

PVC venting is not permitted within the closet, alcove, or enclosure when the boiler is installed in a closet, alcove or small enclosure. See also chapter 10.

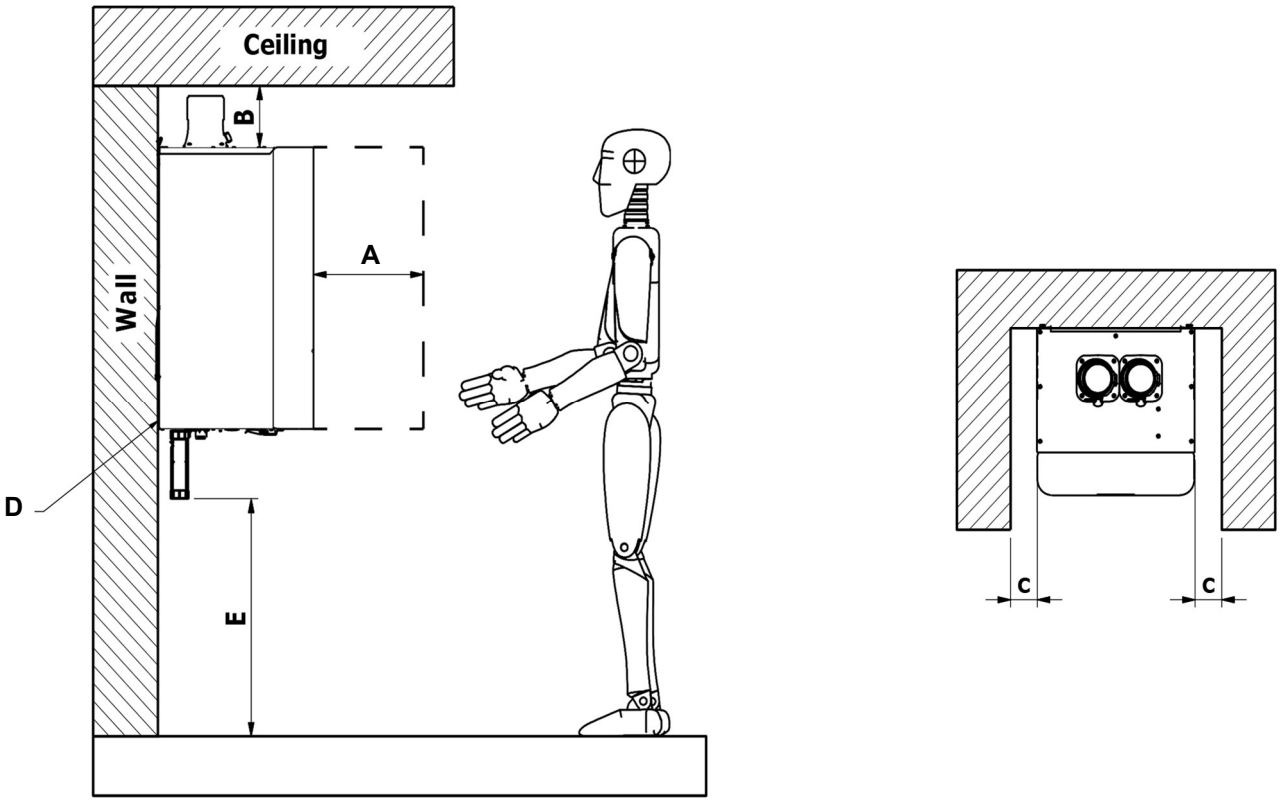


Figure 7.1

7.4 Mounting the boiler

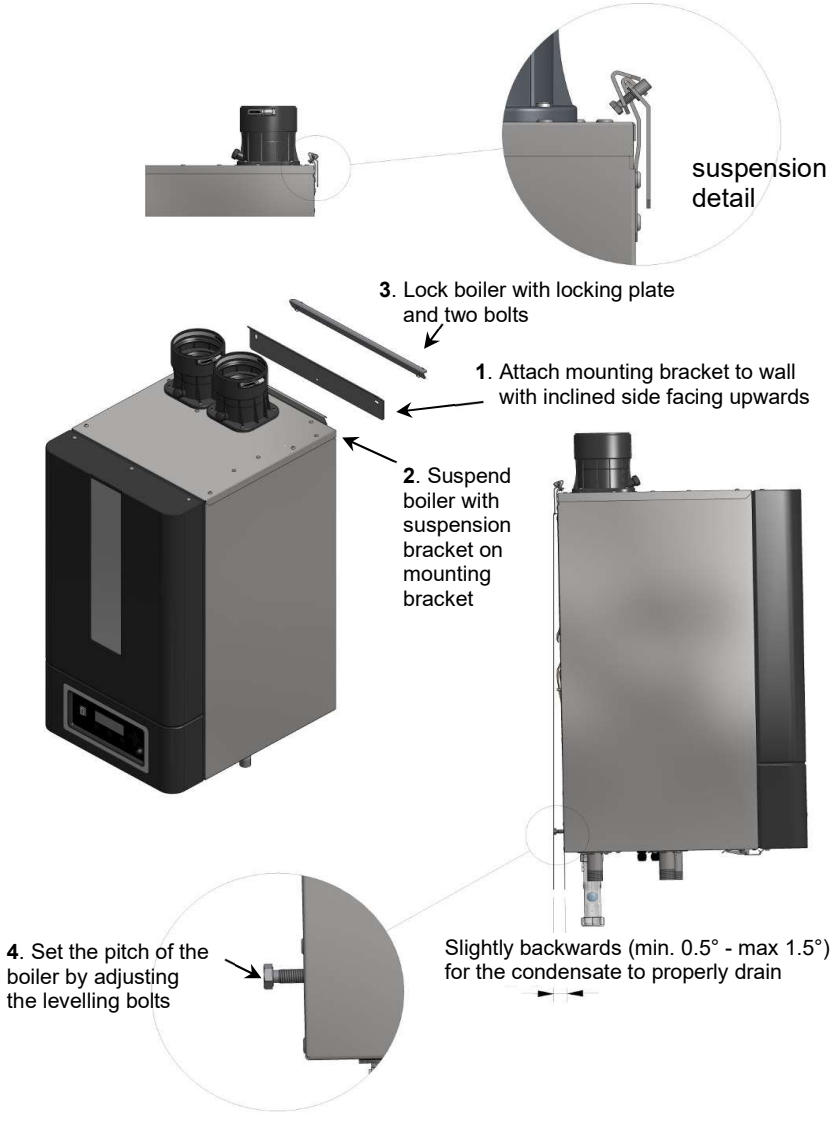
Before mounting and installing the boiler the following connections must be considered:

- Flue gas system and the flue gas pipe connections
- Air supply system and connections
- Supply and return pipe connections
- Condensate and pressure relief valve drainage
- Power supply (preferably a power connection positioned above the boiler)
- Gas pipe sizing.
- Automatic Air Vent Connection.

NOTICE	All lines/piping must be mounted free of tension. The weight of the installation components must be supported separately from the boiler so no force will be exerted on the connections. This might influence the mounting position of the boiler.

Tools needed for mounting the boiler: power drill, level, 13- and 10-mm wrenches.

Determine the position of the boiler by using the included suspension bracket or a suspension frame (when supplied). While marking the holes, ensure that the suspension bracket or frame is perpendicular, and the boiler does not lean forward. If necessary, adjust the position with the leveling bolts at the lower rear side of the back panel (see Figure 7.2). When the leveling bolts aren't sufficient, fill the gap behind the bolts to get the boiler in position. The optimal boiler position lies between the boiler hanging level and hanging slightly backwards (min. 0.5° - max 1.5°). This way, the condensate can properly drain. The boiler should not lean forward in the mounted position.



Lock the suspension bracket with the security cover before making any other connections to the boiler. This security cover will prevent the boiler from falling off the bracket. Do not use excessive force during the mounting of the boiler connections.

Figure 7.2

8 CONNECTIONS

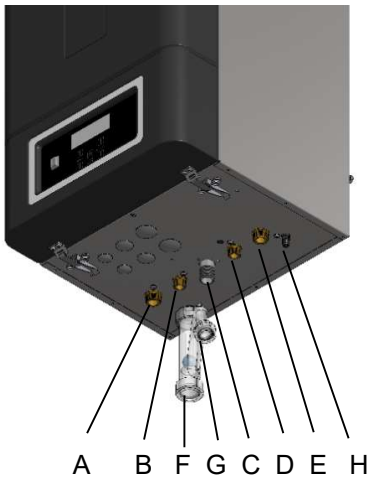
8.1 Connections CH boilers

Boiler connections CH boilers:

A – CH Supply
B – Indirect DHW Outlet
C – Gas
D – Indirect DHW Inlet
E – CH Return
F – Condensate trap clean out.
G – Condensate drain
H – Manual Drain.

Figure 8.1

8.2 Connections CO boilers



Boiler connections CO boilers:

A – CH Supply
B – DHW Outlet
C – Gas
D – DHW Inlet
E – CH Return
F – Condensate trap clean out.
G – Condensate drain
H – Manual Drain.

Figure 8.2

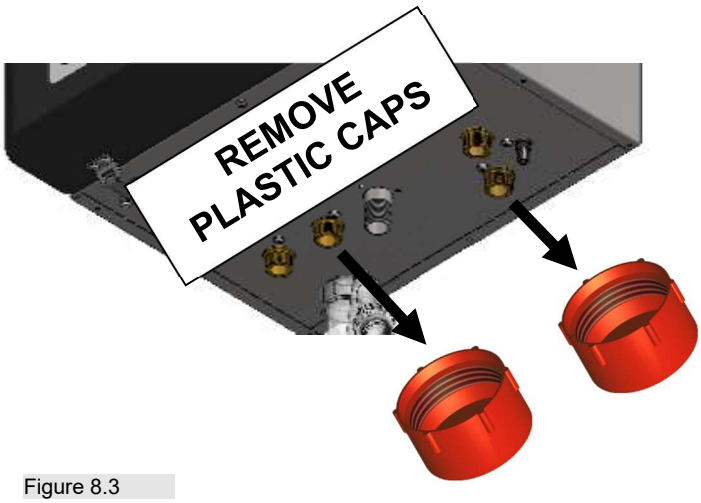
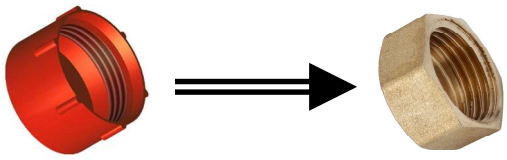


Figure 8.3

WARNING

ALWAYS REMOVE PLASTIC CAPS. Replace the plastic caps by bronze/brass caps when the DHW option is not used. A high pressure can build up.

The plastic caps can be blown off



8.3 Gas pipe connection

The gas supply piping must conform to all local codes and regulations and/or National Fuel Gas Code, ANSI Z223.1/NFPA 54 (USA) or CAN/CSA B149.1 Natural gas and propane installation code (Canada). Pipe size running to the appliance depends on the length of pipe, the number of fittings and the maximum input requirement of all gas appliances in the residence. See the gas sizing table below for help when sizing the gas connection. For information on propane sizing consult your local propane gas supplier.

Schedule 40 Black Steel Pipe in Cubic Feet of Natural Gas per Hour. (based on inlet pressure less than 2 psi, pressure drop of 0.3 W.C. and specific gravity 0.6)					
Nominal Pipe Size (In)	¾"	1"	1¼"	1½"	2"
Length (ft)					
10	273	514	1060	1580	3050
20	188	353	726	1090	2090
30	151	284	583	873	1680
40	129	243	499	747	1440
50	114	215	442	662	1280
60	104	195	400	600	1160
70	95	179	368	552	1090
80	89	167	343	514	989
90	83	157	322	482	928
100	79	148	304	455	877

Table 8.1

8.3.1 *GAS LINE CONNECTION*

Consult the gas code to determine gas pipe size. It is required to install a manual shutoff gas valve in front of the gas pressure regulator to make sure that the gas line can be closed in case of maintenance. The entire piping system, gas meter and regulator must be sized properly to prevent pressure drop greater than 1" W.C. as stated in ANSI Z223.1 / NFPA 54 and/or CAN/CSA B149.1. If you experience a pressure drop that is greater than 1" W.C., the regulator or gas line is undersized.

The boiler requires a nominal value of 7" to 10" W.C. of gas pressure when using Natural gas and 11 to 13" W.C. when using LPG; this should be available at the boiler gas valve inlet at maximum boiler firing rate. See the technical specifications datasheets (paragraph 4.3) for minimum and maximum allowed gas pressures.

When an in-line regulator is used to reduce gas pressure from 2 psi to 0.5 psi, it must be located at least 6 feet from the boiler. For Natural Gas install a 100% lockup gas pressure regulator in the gas supply line if inlet pressure can exceed 10.5" W.C. at any time. Adjust the lockup pressure regulator for 10.5" W.C. maximum gas pressure.

For Propane Gas contact the gas supplier to size pipes, tanks, and a 100% lockup gas pressure regulator. The propane gas pressure in the gas supply line cannot exceed 13" W.C. at any time. Adjust the lockup pressure regulator for 10.5" W.C. maximum pressure. The installation of the gas pressure regulator must follow all applicable local and national standards.

A minimum 1" diameter flex line is required if flex gas line is used. Ensure that the gas line connection to the appliance does not exert any force or pressure on the gas valve.

Create an installation layout in such a way that the piping does not interfere with the vent pipe, or any other serviceable components.

The appliance must be installed in such a way that the gas ignition system components are protected from water (dripping, spraying, rain etc.) during installation, operation and servicing.

No appreciable drop in line pressure should occur when any unit (or in the instance of a cascade installation when all of the installed units) lights or runs. Make sure the gas pressure is within specification during all conditions.

Always use a pipe-threading compound, approved for natural gas and/or propane gas. Apply sparingly to all male threads, starting at two threads from the end. Over-doping or applying dope to the female end, can result in a blocked gas line.

DO NOT TIGHTEN FITTINGS WITHOUT SUPPORTING THE GAS VALVE, A BACKING WRENCH MUST BE USED

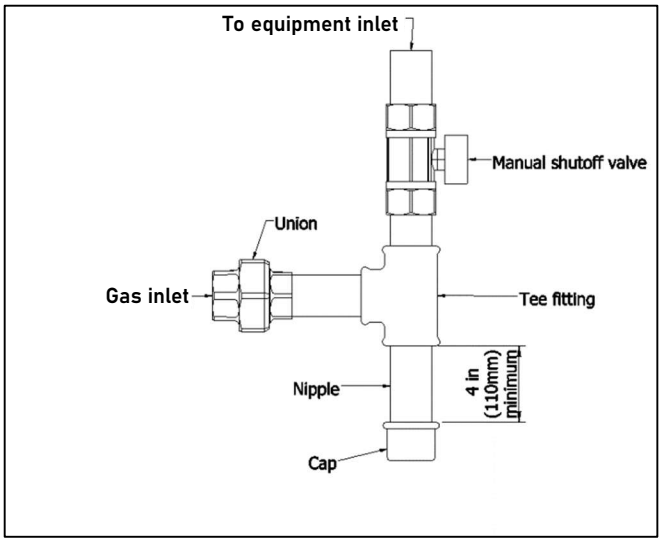


Figure 8.4

Install a manual “Equipment Shut-Off Valve. The valve must be listed by a nationally recognized testing lab. Should overheating occur or the gas supply fail to shut off, turn the manual gas shutoff valve to off (closed). The gas line piping can then safely be removed from the appliance for servicing.
Test the gas pipe for leaks from the boiler up to the gas pressure regulator.
Carefully vent the gas pipe before putting the appliance into operation for the first time.

WARNING

A sediment trap (drip leg) must be installed directly below the boiler as pictured in Figure 8.4. It must be at least 3 inch long to conform to the National Fuel Gas Code (NFPA 54/ ANSI Z223.1 for U.S. installs and CAN/CSA B149.1 for Canada). This leg is to be installed upstream of the shutoff valve and as close to the appliance as practicable.

The appliance and its gas connection must be leak tested before placing the appliance in operation.

WARNING

Strain on the gas valve and fittings may result in vibration, premature component failure and leakage and may result in a fire, explosion, property damage, serious injury or death.

Do not use an open flame to test for gas leaks. Failure to follow these instructions may result in fire.

When performing a pressure test on the gas line piping, the following guidelines must be followed.

- The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 0.5 psi (3.45 kPa).
- The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 0.5 psi (3.45 kPa).

8.4 Condensate drain connection

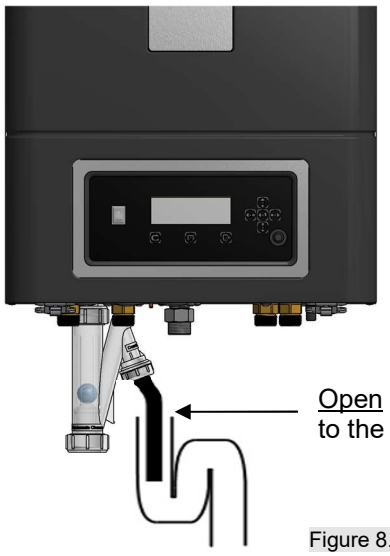


Figure 8.5

There must be an open connection of the condensate hose into the sewage system. A possible vacuum in the sewage system must never cause suction on the boiler's condensate drain hose.

The condensate drain is placed on the left at the back on the bottom of the boiler and has a ¾ inch hose discharge. Connect this flexible hose to the sewer system.

Use only plastic parts with the condensate drain. Metal lines are not allowed.

Blockage of this drain might damage the boiler. The drain connection is correct when the condensate can be seen flowing away, e.g. using a funnel. Any damage that might occur, when the drain is not installed correctly, is not covered by the warranty of the boiler.

⚠ **WARNING**	• The condensate the boiler produces is acidic and must be neutralized before disposal. • If not properly neutralized it may harm floor drains and/or pipes, particularly metal ones. Ensure that the drain, drainpipe, and anything that will come in contact with the condensate can withstand the acidity or neutralize the condensate before disposal. • **Damage caused by failure to install a neutralizer kit or to adequately treat condensate will not fall under the manufacturer's liability**. • When mounting the bottom part of the condensate trap, before commissioning the boiler and/or after maintenance, the condensate trap must **ALWAYS** be completely filled with water. • **This is a safety measure: the water in the condensate trap keeps the flue gases from leaking out of the heat exchanger via the condensate drain**

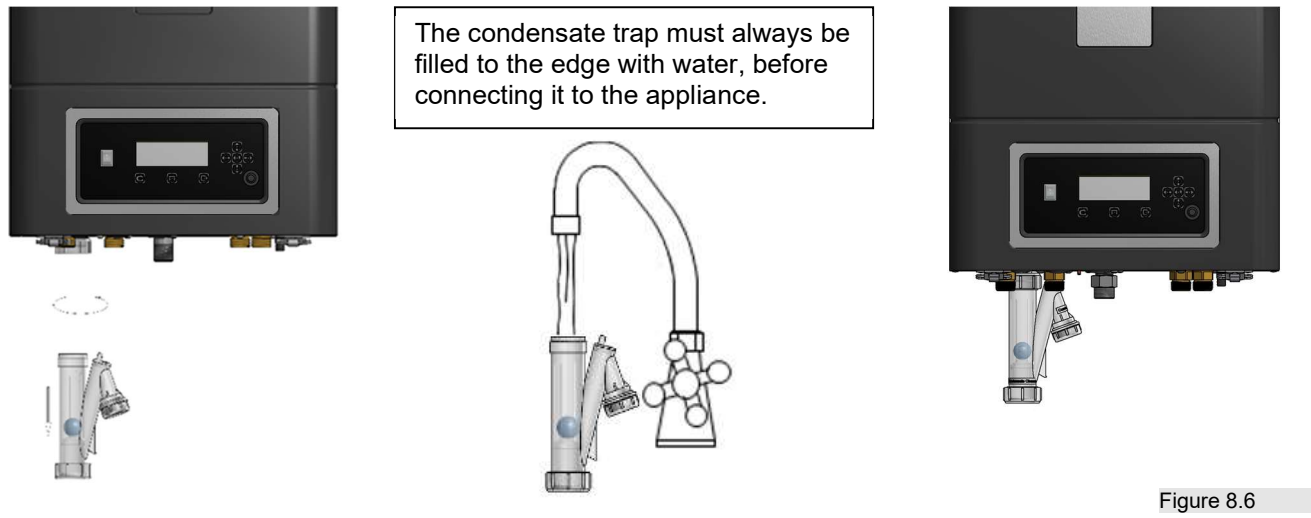


Figure 8.6

8.5 Flow and return connections

Use T-pieces for externally mounting the pressure relief valve and the boiler drain valve for servicing the boiler. We advise to install two service ball valves in the supply and return pipes underneath the boiler, so the boiler can be isolated from the heating system and eventually disconnected, when needed.
When using an external boiler circulator, this circulator must always be mounted in the return pipe of the heating system. Do not use chloride-based fluxes for soldering any pipes of the water system.
It is recommended to install service valves, so the boiler can be isolated from the heating system, when needed. Make sure that the pressure relief valve is mounted between the boiler and the service valves.
The heating connections on the boiler need to be increased in size through the use of a bushing or coupling before any piping is installed. All boilers come from the factory with 3/4" NPT connections for heating. The table below lists the required piping sizes for correct operation of the boiler.

Model	Boiler connection diameter	CH Required piping diameter	Indirect tank Required piping diameter
CH-80 / CH-100 / CH-120	¾"	1"	1"
CH-150 / CH-180	¾"	1 ¼"	1 ¼"
CO-90	¾"	1"	NA
CO-150	¾"	1 ¼"	NA
CO-200	¾"	1 ¼"	NA

Table 8.2

When using the indirect tank connections on the heat only boilers a bushing or coupling will be required to increase the piping diameter to 1" or 1 1/4" depending on the tank connections.

8.6 Expansion vessel

The capacity of the expansion vessel must be selected and based on the capacity of the central heating system and the static pressure. We recommend fitting the expansion vessel in the return pipe of the central heating system. It can be combined with the drain and feed valves for service.

8.7 Pressure relief valve

The boiler has no internal pressure relief valve, but a relief valve, especially selected for this boiler, is added to the boiler shipment and can be found in the box. This must be installed close to the boiler in the supply pipe of the heating system and no shutoff valve shall be placed between the relief valve and the boiler. When having cascaded boilers, each boiler must have its own pressure relief valve. The pressure relief valve's discharge must be piped to an open drain and to within 6 inches of the ground/floor. Always have an air gap between the pressure relief valve discharge piping and the drain to prevent a vacuum. No valve should be placed between the relief valve and the discharge line; do not plug or obstruct in any way the pressure relief discharge line.

⚠ **WARNING**	Burn and scald hazard. Safety relief valve could discharge steam or hot water during operation. Use pipe suitable for temperatures of 375ºF (191ºC) or greater. DO NOT use plastic pipe. Install discharge piping per these instructions.

8.8 Primary/Secondary Piping

The boiler has no internal bypass. The system is required to have primary/secondary piping to allow an adequate flow. One option for primary/secondary piping is to use closely spaced tees spaced 4 pipe diameters apart and a maximum of 12" apart. Another option for primary/secondary piping is to use a low loss header for this function.
The boiler flow will also be influenced when a pipe of the heating system is frozen / blocked. Make sure all heating pipes are free from the risk of frost. If there is the risk of freezing of the heating system, all the pipe section must be insulated and/or protected with the help of a heat tracing.

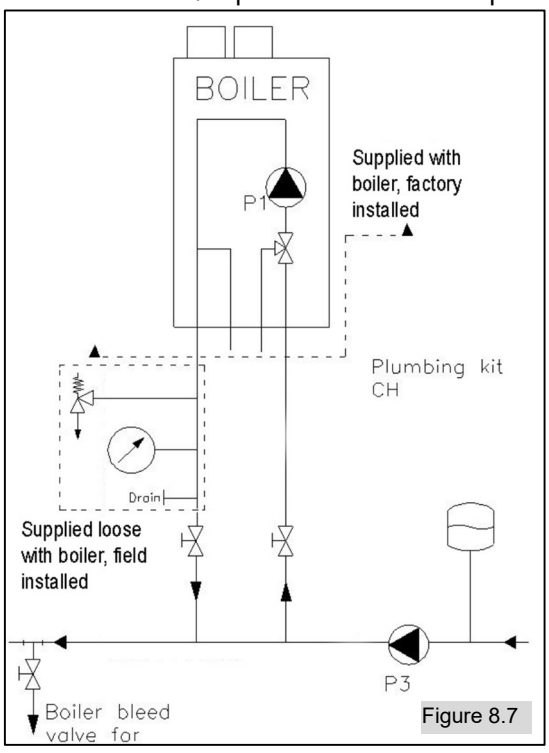


Figure 8.7

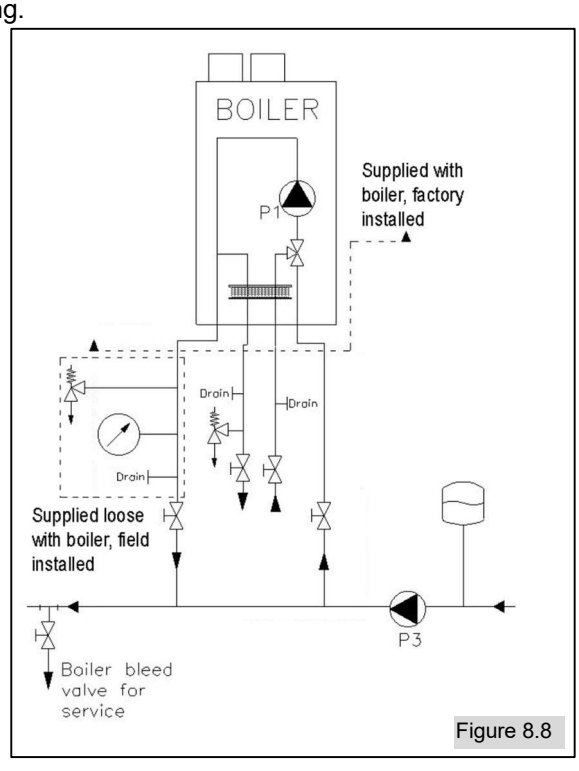


Figure 8.8

8.9 Circulator functionality

Delta T monitoring:
A high temperature difference between supply and return of the boiler can indicate a clogged heat exchanger or filter, or a defective circulator. The burner load automatically decreases when the Return/Supply temperature differential increases too much.
At maximum burner power ΔT is limited to 72°F and at low burner power a ΔT above 86°F is not allowed. Above these values the boiler modulates down until the temperature difference is between 72°F and 86°F. If the ΔT exceeds 94°F, the boiler will be temporarily switched off.

8.10 Frost protection

The boiler has a built-in frost protection that automatically activates the boiler circulator when the boiler return (water) temperature drops below 50°F / 10°C (programmable). When the boiler return temperature drops below 41°F / 5°C (programmable), the boiler is also ignited. The circulator and/or boiler will shut down as soon as the return temperature has reached 59°F / 15°C (programmable). The mentioned temperatures are related to the temperatures measured by the Return sensor of the boiler. This frost protection function will not fire up the boiler in case of a “general blocking” of the boiler demand.

NOTICE	This “Frost Protection” function is only useable for the boiler and not for the whole central heating system. Because it concerns a programmable setting, a boiler damaged by frost is not covered under warranty.

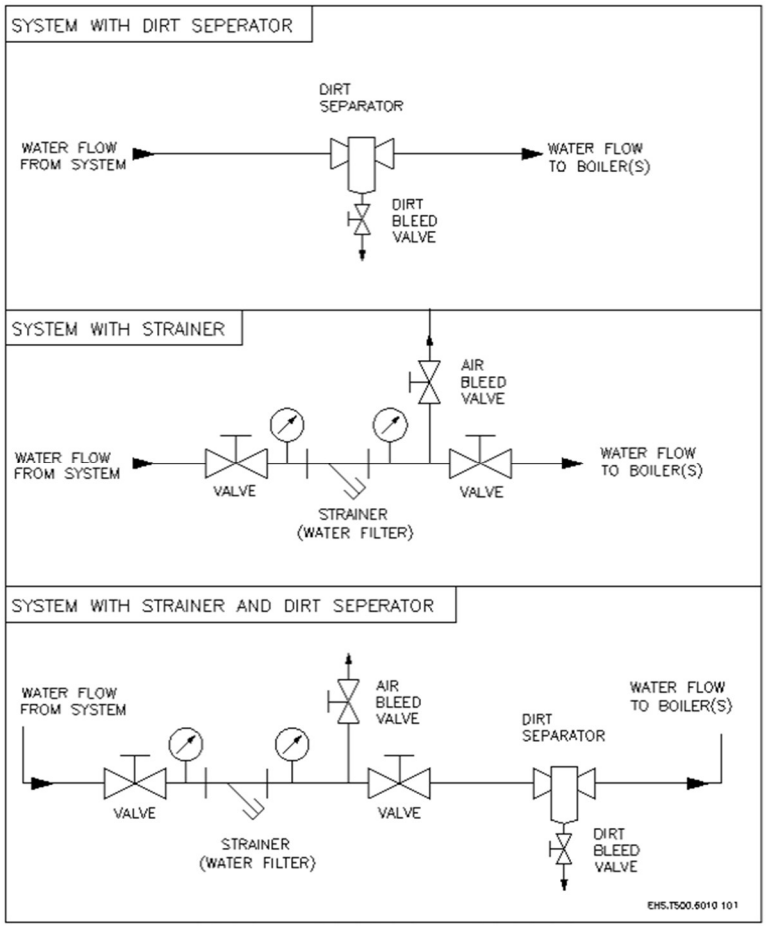


Figure 8.9

8.11 Installing a strainer and/or dirt separator

Always install a Y strainer and/or a dirt separator in the return pipe of the boiler; in such a way that the water going to the boiler is free of any debris/particles. When using a Y strainer always check a week after installation to determine the strainer cleaning interval. Advice is to mount valves before and after the strainer, including an air bleed valve, thus isolating the strainer from the heating circuit for service operations. Clean water is very important. Blocked and/or polluted heat exchangers, including failures and/or damages caused by this blockage are not covered by the warranty. In existing systems when replacing a cast iron boiler or when installing in a system with cast iron radiators or cast-iron piping, a magnetic dirt separator must be installed.

See Figure 8.9

It is advised to place pressure measuring gauges in front and behind the strainer. Clean the strainer (water filter) when the maximum delta P exceeds the value prescribed by the strainer manufacturer.

8.12 Scalding danger protection

- Water temperatures over 125 °F (52 °C) can cause severe burns instantly, or death from scalds.
- Children, the disabled and the elderly are at the highest risk of being scalded.
- Feel water before bathing or showering.
- Read this manual entirely before setting temperature for domestic hot water points.

Figure 8.10

Water Temperature °F	Time for 1st Degree Burn	Time for Permanent Burns 2nd & 3rd Degree
110	Normal Shower Temp	-
116	35 Minutes	45 Minutes
122	1 Minute	5 Minutes
131	5 Seconds	25 seconds
140	2 Seconds	5 Seconds
149	1 Second	2 Seconds
154	Instantaneous	1 Second

Source: United States Product Safety Commission

Table 8.2

NOTICE	**Hot water Scald burn warning for infants, children, and elderly - great care must be taken when exposing infants, children, or the elderly to warm or hot water as they can be badly burned quickly and at shorter exposure times. A temperature limiting device (anti-scald valve) is required (as per ASSE 1070).**

8.13 Supply and return connections and pressure relief valve (DHW).

A pressure relief valve (not provided) is required on the domestic water outlet side of the boiler for safety purposes Use T-pieces for externally mounting the pressure relief valve and the boiler drain valve for servicing the boiler. Do not use chloride-based fluxes for soldering any pipes of the water system. All boilers come from the factory with ½" NPT connections for combi DHW. The connections size needs to be increased to ¾" for correct operation of the boiler.

8.14 Temperature limiting device (DHW)

For CO boilers a temperature limiting device (anti-scald valve) is required for prevention of scalding hazards. The temperature limiting device (as per ASSE 1070) must be installed in accordance with local and national plumbing codes. Additional thermostatic / temperature limiting devices may be required at the domestic water fixtures in the dwelling.

8.15 Drain valves (DHW)

For a CO boiler a drain valve must be installed immediately before the domestic cold-water inlet connection as well as immediately after the domestic hot water outlet connection. This allows for easy flushing and descaling of the plate heat exchanger. Use T-pieces for externally mounting drain valves.

8.16 Shutoff valves (DHW)

One shutoff valve should be placed before the water inlet drain valve and one should be placed after the water outlet drain valve in order to isolate the rest of the DHW system.
Do not place a shutoff valve between the pressure relief valve and the boiler.

8.17 Central Heating Water quality

Contaminant	Maximum allowable level	Units
pH	7.5 to 9.5	
hardness	50 to 150	mg/l CaCo3
	2.92 to 8.76	grains/gallon
aluminum particles	< 0.2	mg/L
chlorides	150	ppm
TDS	350	ppm

Table 8.3

The pH value is reached with steady conditions. These steady conditions will occur, when after filling the heating system (pH around 7) with fresh water, the water loses its air because of the air bleeding operation and heating up (dead water conditions).

If there is the risk of water contamination by any kind of debris/chemicals in the period after installing, a plate heat exchanger must be used to separate the boiler circuit from the heating circuit.

It is advised to prevent the possible air intake and water leakage of the central heating system.

Fresh oxygenated water might damage the heat exchanger of the boiler and must therefore be prevented! Usual spots where air is most likely to seep in, are suction gaskets, circulators, air valves working as a venting pipe, O-rings / gaskets in stuffing box, underfloor heating pipes.

A micro bubble air elimination device must be installed in all heating systems. An air scoop is not acceptable as a substitute for a micro bubble air elimination device and should not be used in the installation. A few examples of acceptable devices are:

- Spirovent
- Taco 4900 Series
- Caleffi Discal

If an automatic feed valve is installed in the system, it should not be left open indefinitely. A continuous feed of fresh water could damage the system. It is recommended that after a short period of time following the installation of the boiler into a heating system, the automatic feed valve be closed.

WARNING	A water heater that will be used to supply potable water shall not be connected to any heating system or component(s) previously used with a non-potable water heating appliance.

8.18 Domestic Water Quality

Appropriate steps must be taken to ensure the internal plate heat exchanger does not become plugged by scale caused by hard water or sediment. If the plate heat exchanger becomes plugged by either scaling from hard water or sediment it is not the responsibility of the manufacturer.

	Maximum Level
Total Hardness	Up to 200 mg / L
Aluminum *	Up to 0.2 mg / L
Chlorides *	Up to 250 mg / L
Copper *	Up to 1.0 mg / L
Iron *	Up to 0.3 mg / L
Manganese *	Up to 0.05 mg / L
pH *	6.5 to 8.5
TDS (Total Dissolved Solids) *	Up to 500 mg / L
Zinc *	Up to 5 mg / L

Table 8.4 * Source: Part 143 National Secondary Drinking Water Regulations

NOTICE	If problems occur when using sanitary water outside of the above stated requirements, no recourse can be made to the terms of the limited warranty.

8.19 Use of glycol

To protect the system from freezing the use of glycol-based products can be considered. All materials used in the boiler are resistant to glycol.

Glycol in itself will acidify over time because of thermal degradation. This acidity will cause serious damage to most components in the heating system including the boiler. Because of this, specific anti-freeze products are available on the market for use in heating systems. These consist mainly of glycol, but they have additives added which act against internal corrosion and/or scale formation. An important part of these additives are so-called “balancers” which are added to the product, to absorb the increase of acidity of the glycol over time because of thermal degradation.

The chemical compatibility of specific anti-freeze products has been tested by the heat exchanger producer. These products mainly consist of glycol supplemented with the indicated additives. If these products are used according to the instructions, they will not harm the boiler.
The only approved anti-freeze products are:

Manufacturer	Type	Composition
Fernox	Alphi 11	consists of 97% Mono Propylene Glycol next to some additives.
Sentinel	X500	estimated as being between 90-100% Mono Propylene Glycol.
Rhomar	Rhogard	blended with VIRGIN Propylene Glycol
Noble	Noburst-100	Consists of mono propylene glycol next to some additives.
Noble	Noburst-RTU	Premixed to protection temperature concentration

Table 8.5

Maximum glycol concentration is 35%. This protects down to -10 °F.
Because of the higher viscosity of the glycol mixture, increase circulator head by approximately 20% at 35% glycol. For use with glycol, select a circulator with glycol compatible seals.
Because of the lower heat capacity of the glycol mixture, boiler BTU output will be reduced by approximately 10% at 35% glycol. No fan speed or maximum temperature reduction will be necessary.

If the boiler is used in a system with snow melt where antifreeze percentages are above the suppliers specified values, it must be isolated from the snow melt with a plate heat exchanger.

When using glycol in the boiler it is required to check the pH, conductivity, concentration, and all other water quality requirements listed in the manual in section “Water Quality” once per year, this is especially important with higher concentrations of glycol.

The only acceptable way to correctly check the concentration of the glycol mix the in the system and/or boiler heating loop is to use a refractometer. **A Refractometer must be used on the initial filling of the system and or boiler loop and during the yearly water quality tests**.

Replace the antifreeze every 5 years or sooner based on the instructions from the manufacturer or if the pH is out of the required range.

It is also required to use a magnetic dirt separator in the boiler system on the system return before the boiler or boiler return if any piping in the system is galvanized, steel, or black iron. When using glycol antifreeze in a heating system PVC, CPVC, and galvanized piping is not allowed to be used in any part of the heating system.

8.20 Chemical water treatment

When a boiler is installed in a new system or an existing installation, the system must be cleaned before the boiler is installed. The system must be cleaned using a system cleaner from the list below or an equivalent hydronic system cleaner. Follow the instructions provided by the system cleaner’s manufacturer. The system must then be drained and thoroughly flushed with clean water to remove any residual cleaner.

The system cleaner must NEVER be run through the boiler. For recommended cleaners see Table 7.6.

The chemical compatibility of several products for treatment of the central heating equipment have been tested on the heat exchangers and the boilers. See below for the list with corrosion inhibitors in preventative and curative treatment for gas fired central heating boilers.

If water treatment is required when filling the system or performing maintenance an inhibitor must be used. Follow the instructions provided by the inhibitor manufacturer when adding it to the system. The following is a list of approved inhibitors. Always check the water quality of the water and heat transfer fluid mixture in the system.

Never mix treatment chemical from different brands or anti-freezes from different brands as there is no way to ensure they are compatible.

The system cleaner must never be run through the boiler

Corrosion-/ Scale inhibitors and recommended suppliers						
Producers ->	Fernox	Sentinel	Sotin	ADEY	Noble	Rhomar
Inhibitors	Protector F1 / Alphi 11	X100, X500	Sotin 212	MC1+		Boiler Gard 921
Noise reducer		X200				
Cleaner	Restorer	X300		MC3+	Cleaner	Pro-Tek Al
Sludge remover	Protector F1, Cleaner F3	X400	Sotin 212			
Antifreeze	Alphi 11	X500				
Tightness		Leaker Sealer F4		MC4		

Table 8.6

Treatment type	Preventive	Curative
Fernox Protector F1	X	
Fernox Cleaner F3		X
Sentinel X100	X	
Sentinel X200	X	
Sentinel X300		X
Sentinel X400		X
Sentinel X500	X	
Fernox Alphi 11	X	
Sentinel Leaker Sealer F4	X	
Sotin 212		X
Adey MC1+	X	
Adey MC3+		X
Noble Noburst Cleaner		X
Rhomar Boiler Gard 921	X	
Rhomar Pro-Tek Al		X

Table 8.7

When using chemicals or any kind of additions:
Follow the instructions provided by the manufacturer.
Read the suppliers manual for the maximum allowable level/mixing ratio that can be used with the boiler. Warranty will be void if these instructions are not followed exactly.
Record the used products and mixing ratio in the log book, start-up-, check- and maintenance list.

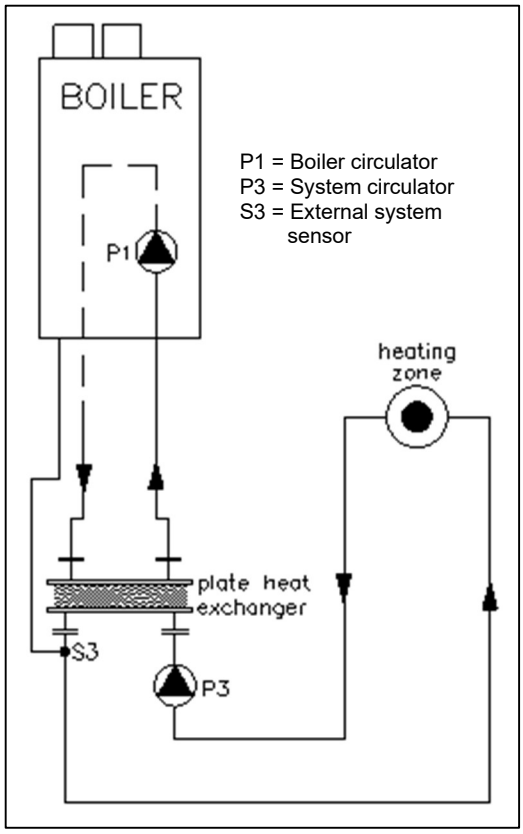


Figure 8.11

8.21Plastic piping in the heating system

When plastic pipes without oxygen barrier are used in the central heating system these must be separated from the boiler system by using a plate heat exchanger. Diffusion (through the plastic) can cause air to enter the heating system. This could damage the boiler, circulators and other components in the system.

Be aware that plastic piping is often used in underfloor heating systems. When no measures have been taken to prevent air from entering the boiler system, the warranty of the boiler and any boiler part may be deemed void.

Flush the system with fresh water
The water of the boiler and heating circuit must be free of any particles, debris and pollution. Therefore, the complete installation must always be thoroughly flushed with clean water before installing and using the boiler(s).
If a DHW circuit is present, in case of a combi (CO) boiler, the DHW circuit must be cleaned as well.

8.22 Automatic air purging

The De-Air sequence is a safety function starting at every power ON and is used to remove the air from the heat-exchanger. This function must be used after the system has been filled with water during the commissioning procedure, see paragraph 17.2.
The De-Air sequence does not start after a general reset (e.g. the locking error reset or 24 hours reset).
The display will show 'dAir' indicating that the controller is performing the De-Air sequence to purge the heat exchanger of air, by sequencing the boiler circulator OFF and ON.

The De-Air sequence can be cancelled by pressing and holding the Enter-button for 5 seconds.

CAUTION	Do not bypass the Dair function upon initial startup of the boiler or when water has been added to the boiler/system. Bypassing the Dair function may cause damage to the heat exchanger which could cause the boiler to fail. Bypassing the Dair function could lead to overheating or under heating resulting in property damage.

By default, the "De-Air" sequence takes about 14 minutes.

• 1st cycle: The 3-way valve moves to CH position and the general circulator is activated for 10 seconds, deactivated for 10 seconds, activated again for 10 seconds and then deactivated again for 10 seconds (DAir_Repeation_OnOff, which means ON/OFF/ON/OFF each time for 10 seconds = 40 seconds in total).
• 2nd cycle: Starts when first cycle is ended. The 3-way valve is moved to DHW position and repeats the same cycle of the circulator (DAir_Repeation_OnOff, which means ON/OFF/ON/OFF each time for 10 seconds = 40 second in total).

This sequence (1st cycles + 2nd cycles) is performed DAir_Number_Cycles times (if DAir_Number_Cycles is 10 'De-air' sequence lasts (10 x 40) x 2 = 800 seconds).
During De-Air sequence no heating or hot water demand will be served. When the water pressure is too low, or the pressure sensor is in error, the De-Air sequence will be suspended until the water pressure / sensor pressure is stable again. In that case the De-Air sequence will last longer than the estimated 14 minutes.

NOTICE	If a cascade system has been installed, after commissioning the system the automatic De-air function must be disabled by means of parameter 139: DAir active.

The following scheme shows the behavior of the 3-way valve and boiler circulator during one complete cycle of De-Air sequence with a DAir_Repetition_OnOff set to 2.

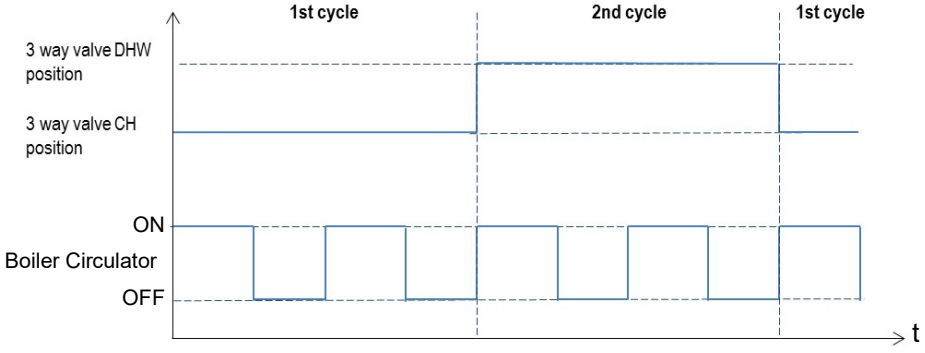


Figure 8.12

Relevant variables:

Specific Parameters	Level	(Default) Value	Range
De_Air_Config 0= DAir disabled; 1 = DAir enabled	Installer	0	0…1
De_Air_State Current state of DAir function	User		
DAir_Repeation_OnOff Number of repeating ON/OFF.	Installer	2	0…255
DAir_Number_Cycles Number of DAir cycles.	Installer	10	0…255

Table 8.8

8.23 Manual de-airing the heat exchanger

The heat exchanger of the boiler can be manually de-aired by means of the air-vent of the boiler. This air vent is situated at the top left of the boiler.

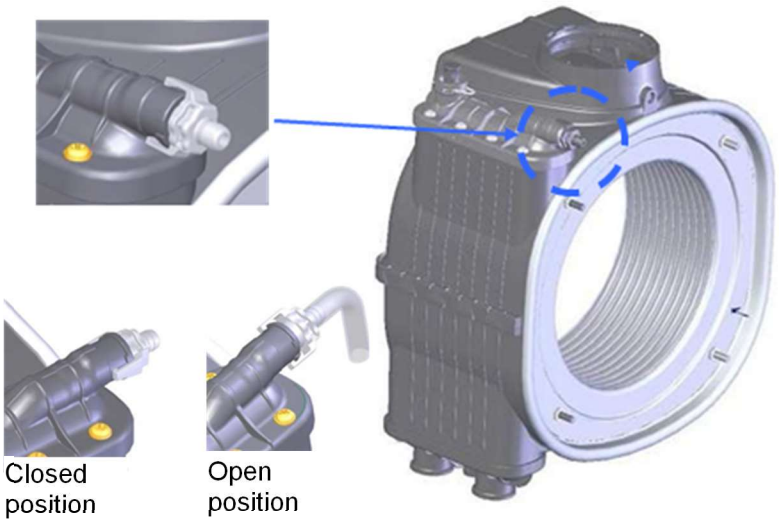


Figure 8.13

To manually de-air the heat exchanger:

- Use a flexible plastic tube with an inside/ outside diameter of 0.27/0.39 inch. Only de-aerate when the water and heat exchanger are cold,
- put a fitting with a tube to the air vent,
- slowly turn the vent counterclockwise open until the air escapes,
- The screwing and unscrewing of the air vent must be done manually only. Using a wrench or pliers is prohibited.
- A high torque caused by using a wrench or pliers could damage the functioning or the tightness of the manual air vent.
- when all the air is removed, close the air-vent and remove the tube.

NOTICE	With the air also a small amount of water can stream out; with the attached drain hose the drained water can be easily collected. Take care the drain tube ends outside the boiler so components and burner controller inside the boiler will not become wet.

8.24 Automatic Feed Valve

If an automatic feed valve is installed in the system, it should not be left open indefinitely. A continuous feed of fresh water could damage the system (fresh water is bringing fresh oxygen into the system). It is recommended that after 1 or 2 weeks following the installation of the boiler into a heating system that the automatic feed valve be closed.
A water meter can be used to detect and eliminate any water leakage as soon as possible.

8.25 Water pressure

The installation must be designed and built conformably to all applicable regulations and standards, including the right safety relief valves.

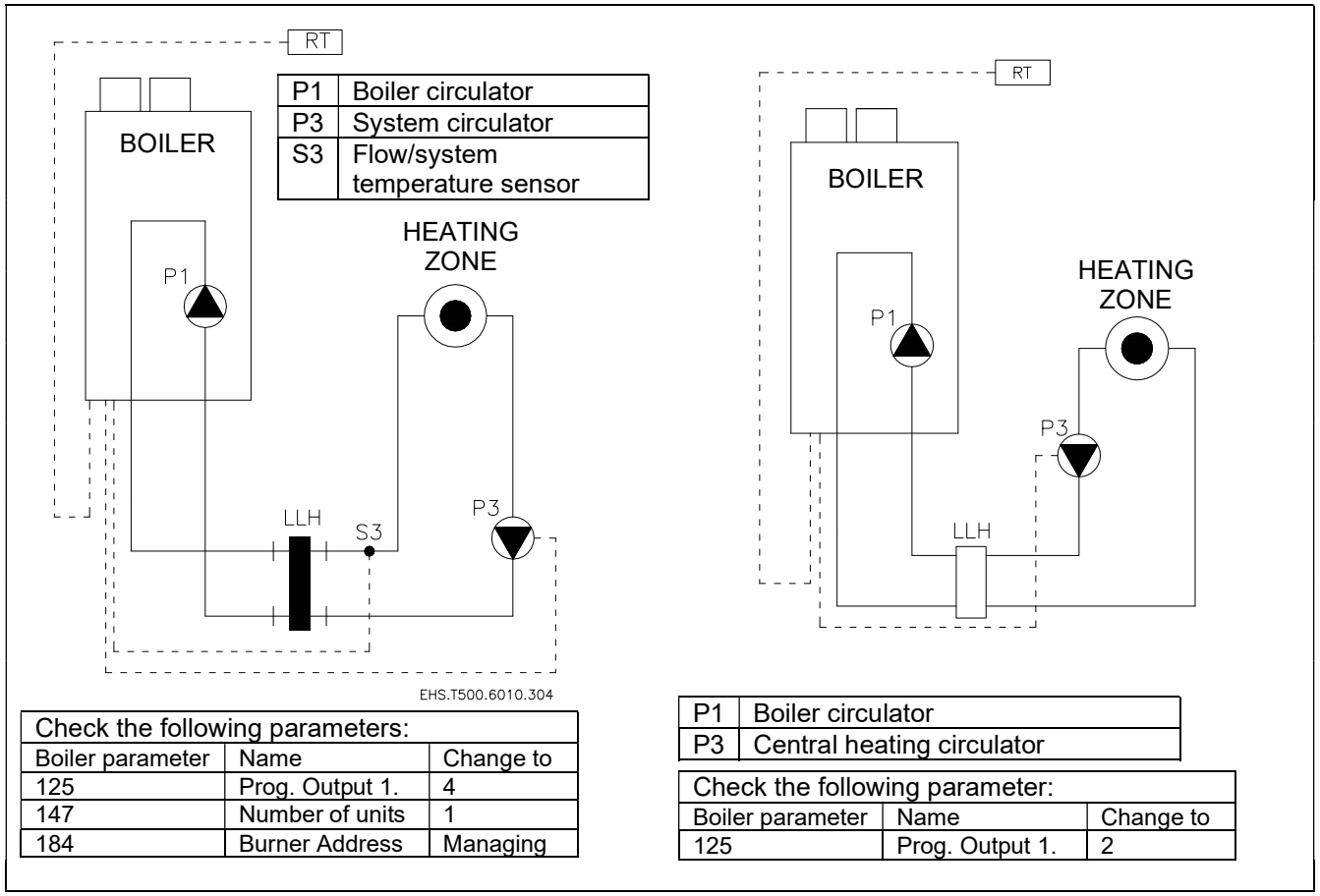
IMPORTANT: Always keep the pressure in the boiler lower than the value at which its safety relief valve opens.

Sensor
A water pressure sensor has been built into the boiler. The minimum water pressure in the boiler is 11.6 psi and the maximum pressure is 43.5 psi. The normal water pressure must be between 18 and 28 psi. The pressure sensor will stop the boiler from firing when the water pressure drops below 11.6 psi, and starts the boiler firing again when the water pressure reaches above 14.5 psi.
These values should never be changed in the boiler control settings. The boiler cannot be properly purged of air if the water pressure is less than 14.5 psi.

Higher pressure systems (e.g. in high buildings)
If a pressure higher than 43.5 psi is required for the heating system, the best solution is to separate the system from the boiler by means of a plate heat exchanger. In this way, the boiler pressure can remain under 43.5 psi.

8.26 Installation examples

8.26.1 *EXAMPLES OF A NORMAL SINGLE BOILER HEATING CIRCUIT WITH LOW LOSS HEADER (PREFERABLE)*



P1	Boiler circulator
P3	System circulator
S3	Flow/system temperature sensor

Check the following parameters:		
Boiler parameter	Name	Change to
125	Prog. Output 1.	4
147	Number of units	1
184	Burner Address	Managing

P1	Boiler circulator
P3	Central heating circulator

Check the following parameter:		
Boiler parameter	Name	Change to
125	Prog. Output 1.	2

Figure 8.14

Example of a Combi (CO) - DHW mode 5

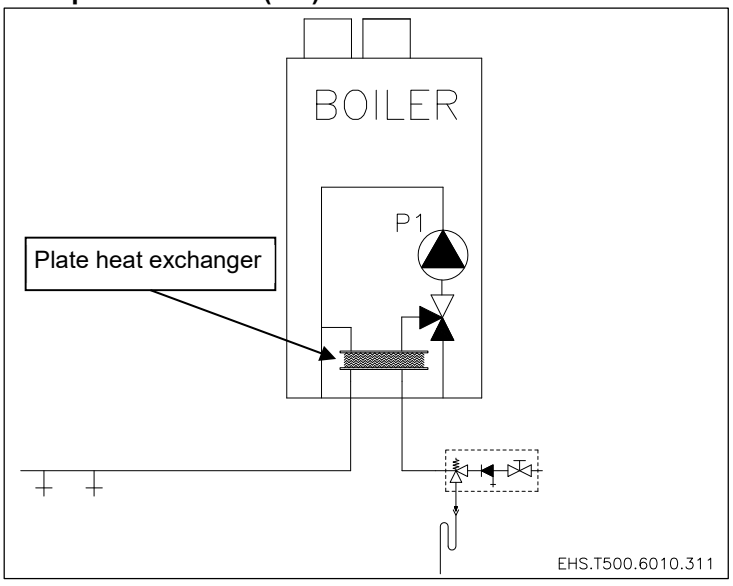
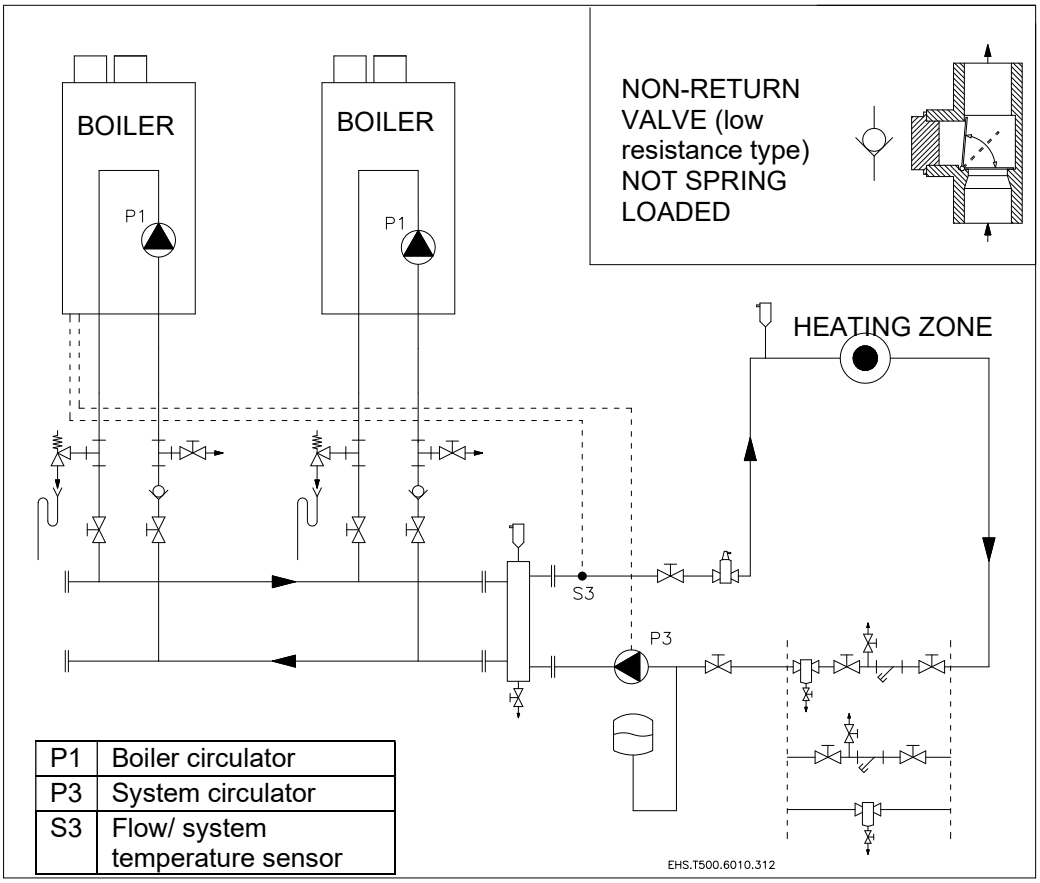


Figure 8.15

8.26.2 *EXAMPLE OF A MULTIPLE BOILER HEATING CIRCUIT WITH LOW LOSS HEADER*



	valve		strainer (water filter)		circulator
	air separator		pressure relief valve		automatic air vent
	dirt separator		condensate trap		expansion vessel
	low loss header				

Figure 8.16

9 CIRCULATOR CHARACTERISTICS

9.1 Pressure drop and flow graphs

9.1.1 *BOILER RESISTANCE GRAPH CH-80 / CO-90*

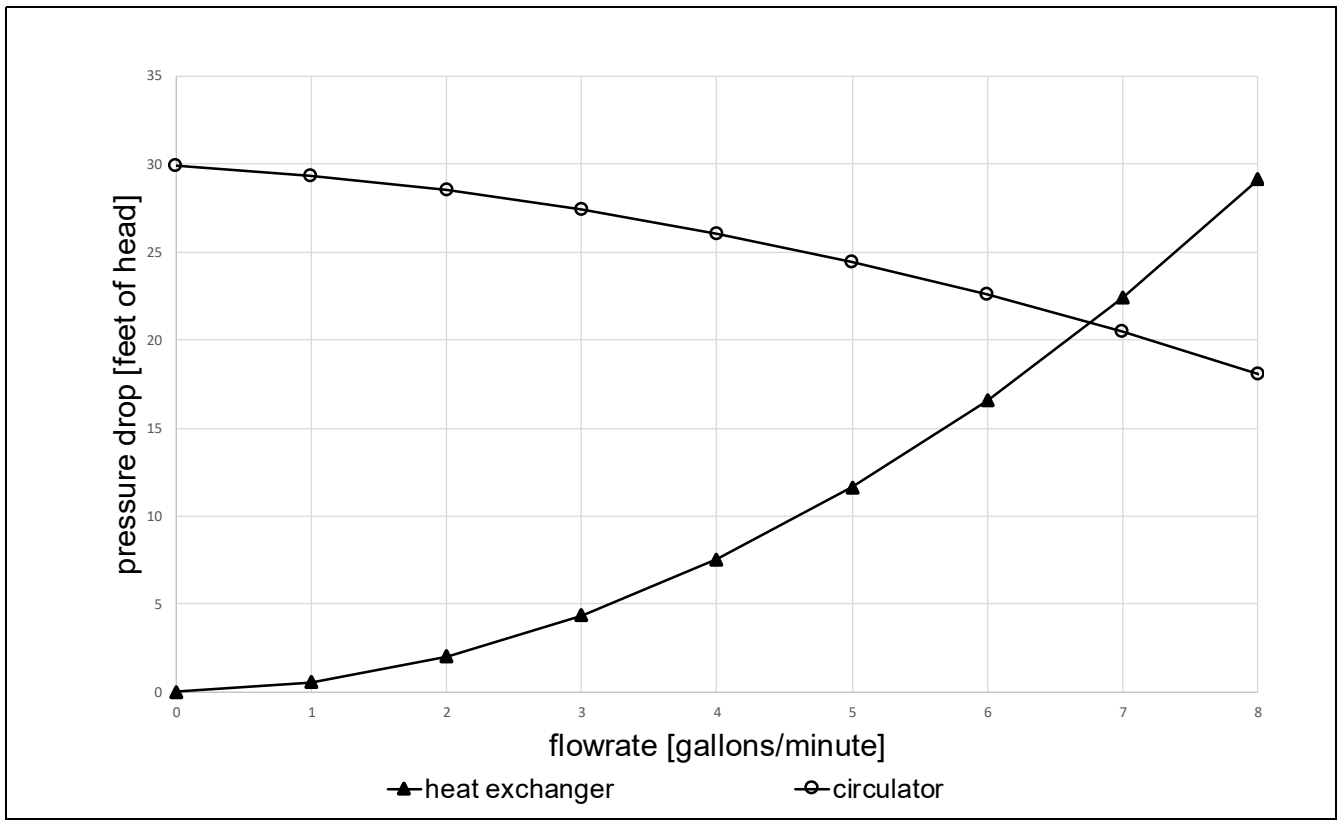


Figure 9.1

9.1.2 *BOILER RESISTANCE GRAPH CH-100*

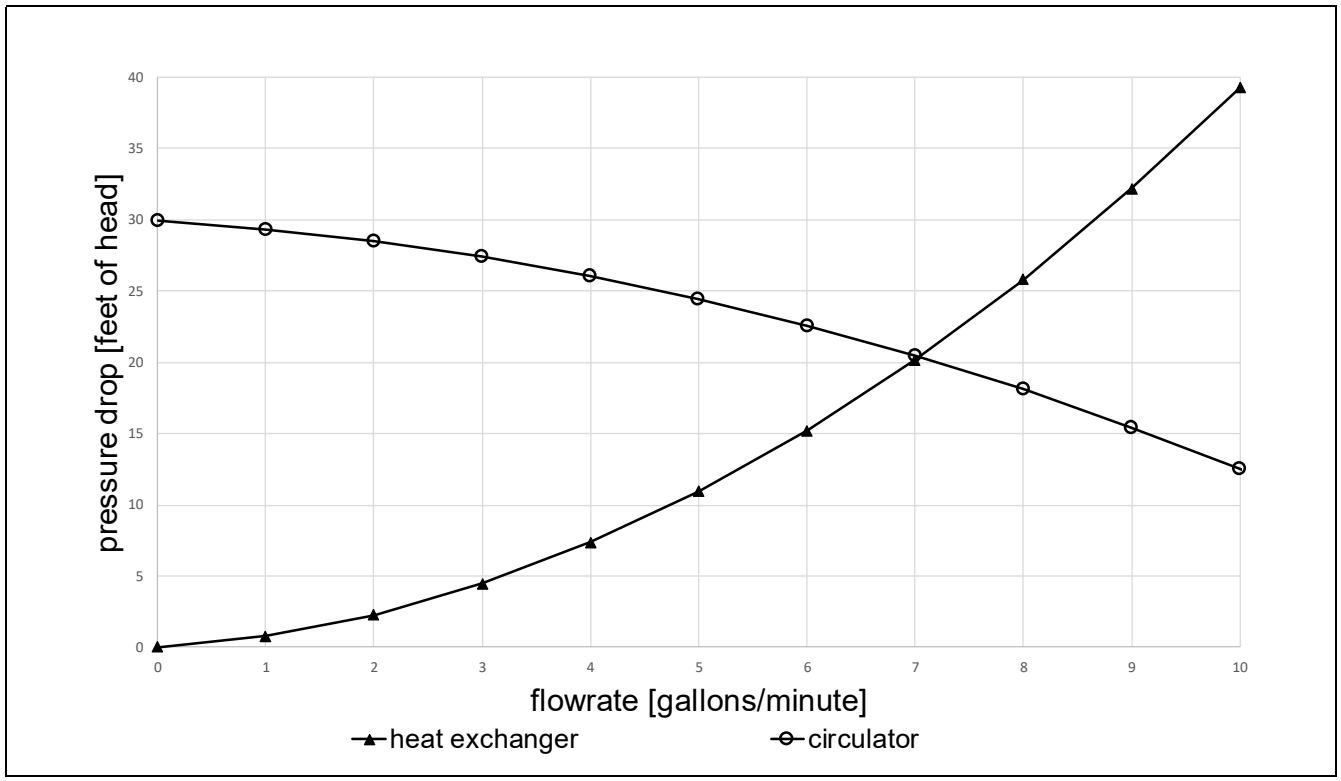


Figure 9.2

9.1.3 *BOILER RESISTANCE GRAPH CH-120 / CO-150*

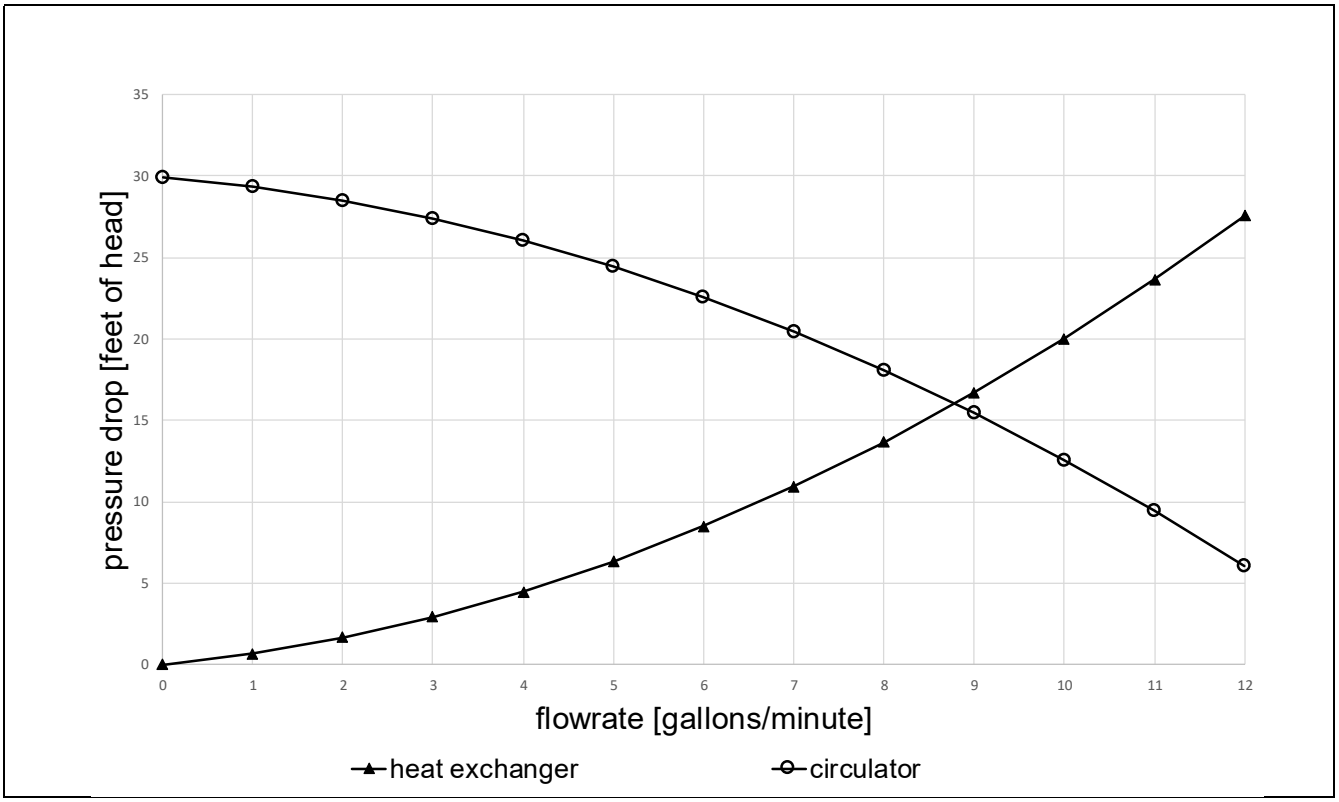


Figure 9.3

9.1.4 *BOILER RESISTANCE GRAPH CH-150*

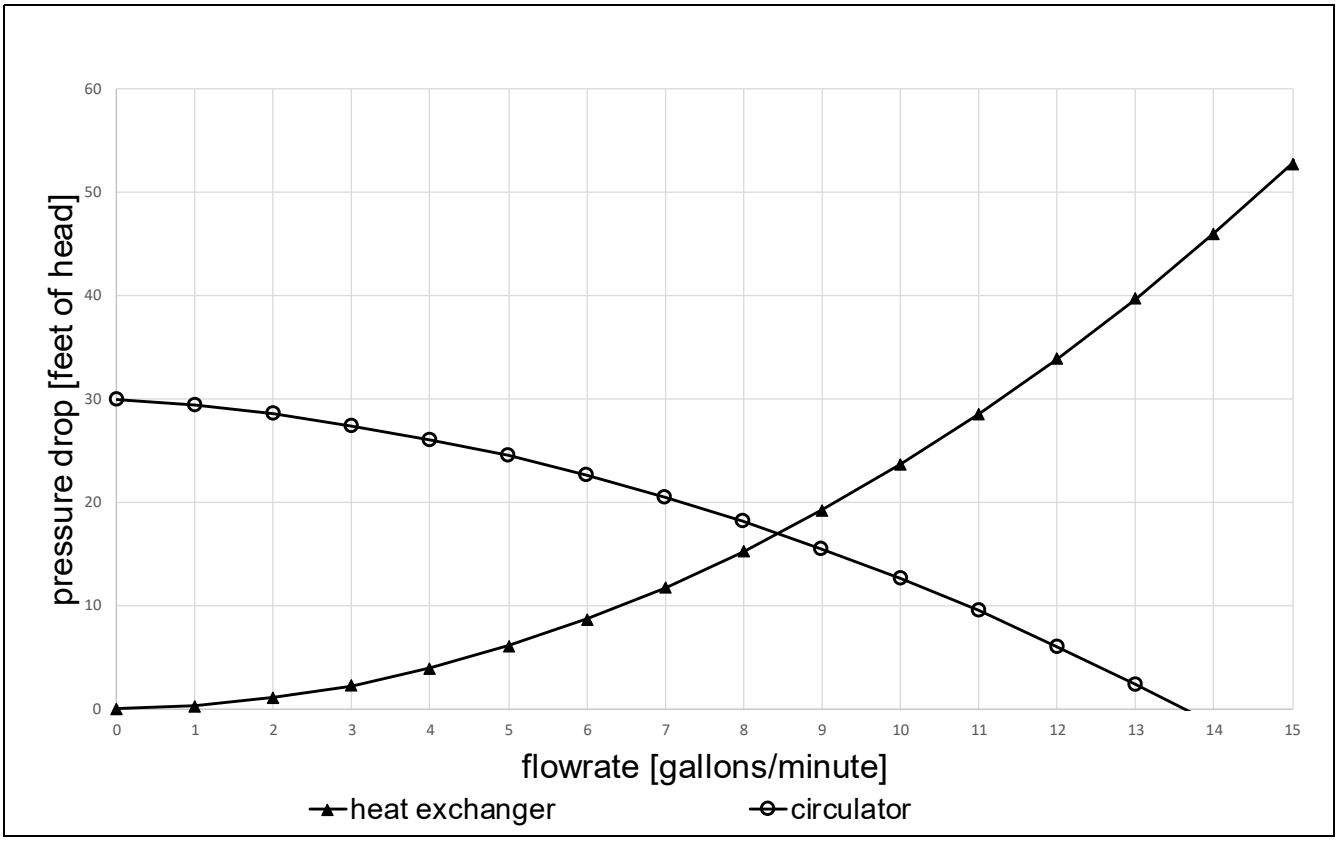


Figure 9.4

9.1.5 *BOILER RESISTANCE GRAPH CH-180 / CO-200*

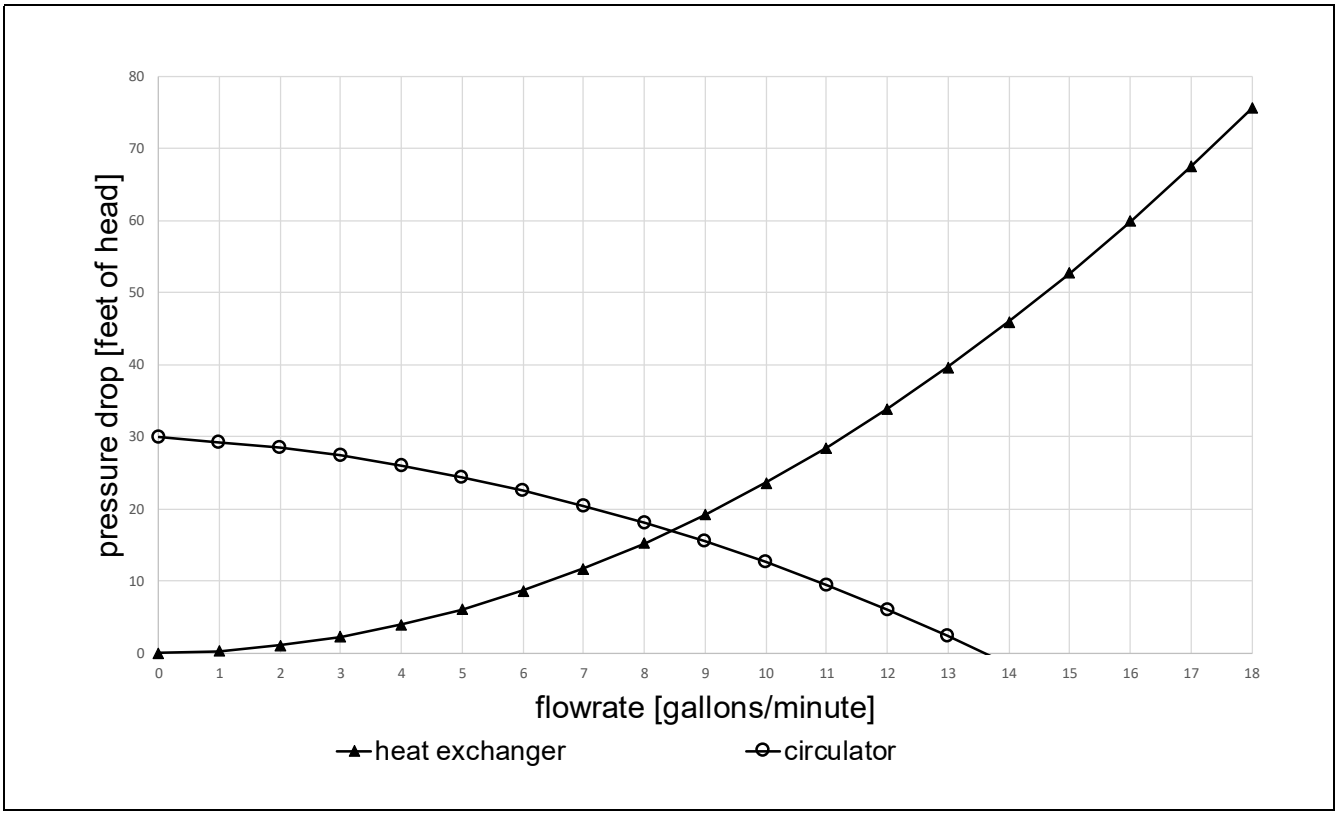


Figure 9.5

9.1.6 *GRAPH SHOWING THE AVAILABLE CIRCULATION PUMP HEAD*

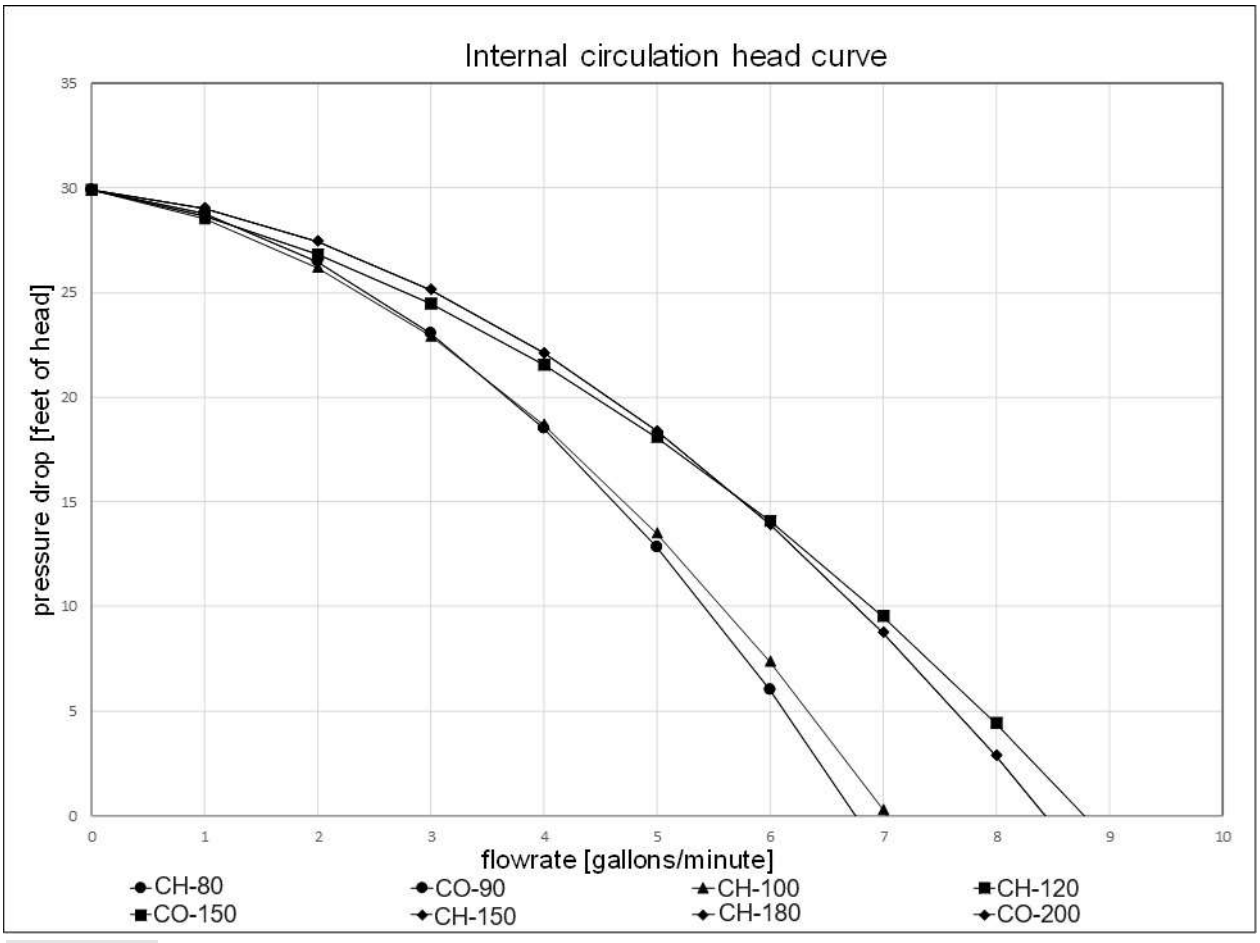


Figure 9.6

9.2 Minimum required circulator head.

The design flow of the boiler should be between a delta T of 20°F and a delta T of 45°F at high fire depending on boiler model and near boiler piping. When utilizing properly designed primary secondary piping the internal boiler circulator is sized to provide the required flow for the given model. To calculate the minimum required circulator head and flow for a specific Delta T, take the resistance of the boiler and add the resistance of the boiler loop piping to make a good design. If a smaller delta T is desired than the built-in boiler circulator can provide an external circulator can be added in the field external to the boiler in line with the boiler circulator on the return.

ΔT = 20 °F	Minimum required flow	
	gal/min	m^3/h
CH-80 / CO-90	7.60	1.73
CH-100	9.50	2.16
CH-120 / CO-150	11.40	2.59
CH-150	14.25	3.24
CH-180 / CO-200	17.10	3.88

Table 9.1

ΔT = 45 °F	Minimum required flow	
	gal/min	m^3/h
CH-80 / CO-90	3.38	0.77
CH-100	4.22	0.96
CH-120 / CO-150	5.07	1.15
CH-150	6.33	1.44
CH-180 / CO-200	7.60	1.73

Table 9.2

9.3 Modulating circulator for CH demand

The boiler is provided with an internal circulator. This circulator is set to speed setting 3 which must never be changed. When the resulting flow is too low, an external circulator can be installed by connecting the external circulator to the PWM circulator connection (see paragraph 11.3.1).
When using a modulating circulator, Parameter 136 has to be set to 1 delta T modulation (Factory set to disabled) Parameter 133 must then be set to the required delta T. The boiler circulator is modulated when there is a demand for CH. It is also possible to set parameter 136 to a fixed value (settings 2-10)
When using an on/off circulator set parameter 136 to 0.

9.4 Modulating circulator modes

There are several modulating circulator modes implemented in the software. By selecting a different modulating circulator mode, the circulator behavior can be changed. The following modulating circulator modes are available.

Modulating circulator mode		Details
0	Disabled	No circulator modulation; the PWM duty cycle is always 0%
1	Delta temperature modulation	Calculated duty cycle to create a delta temperature between the T_Supply and T_Return sensor
2	Fixed 20% speed	Fixed duty cycle of 20%
3	Fixed 30% speed	Fixed duty cycle of 30%
4	Fixed 40% speed	Fixed duty cycle of 40%
5	Fixed 50% speed	Fixed duty cycle of 50%
6	Fixed 60% speed	Fixed duty cycle of 60%
7	Fixed 70% speed	Fixed duty cycle of 70%
8	Fixed 80% speed	Fixed duty cycle of 80%
9	Fixed 90% speed	Fixed duty cycle of 90%
10	Fixed 100% speed	Fixed duty cycle of 100%

Table 9.3

9.5 Circulators: maximum electrical power

General

- The inrush current of a conventional circulator is approximately 2½ x its nominal current.
- The maximum switch current of the PCB is 4 A.
- The total current of PCB and gas valve is approx. 0.5 A. All circulators and valves for the boiler loop, DHW, and the system that are connected to the boiler should not exceed 3.5 A. (Combined power consumption of internal circulator P1 and three-way valve is 1 Amp) Use separate relays if higher currents are needed. The fan is separately connected to the main supply and has a fuse of 3.15 A.

Boiler circulator (circulator P1)

This circulator is part of the appliance. The maximum combined current for the boiler loop circulator and any additional circulators and valves should not exceed 2 A.

NOTICE	The internal boiler pump/circulator is electrically connected to connections 6-7-PE Boiler Circulator (general pump) BE AWARE in the software the description “General Pump” is used for “Boiler Circulator”

DHW indirect tank circulator (circulator P2) – CH models only

The circulator (circulator P2) is a DHW indirect tank circulator, meaning it is not part of the appliance. The maximum combined current for the indirect tank circulator and any additional circulators and valves must not exceed 2 A.
Only Heating Only **(CH)** boilers can use a DHW indirect tank circulator; Combi boilers **never** use a DHW indirect tank circulator.

3-way valve – CH models only

The combined nominal current of circulator P1 and the 3-way valve should not exceed 2 A.

System circulator (circulator P3)

The maximum combined current of circulator P3 and the other connected circulators should not exceed 2 A.

Warning (ECM circulators)

An ECM circulator cannot be powered directly by the boiler. Use a relay to isolate the boiler from the circulator.

WARNING	Use an external relay if nominal circulator current exceeds 2 A.	**NOTICE**	To all outputs following applies: maximum current 2 A each output. Total output of all currents combined maximum 3.5 A. (Combined power consumption of internal circulator P1 and three-way valve is 1 Amp) The inrush current of the 3-way valve and/or circulators is maximum 8 A.

9.5.1 *CIRCULATOR POWER CORD POSITIONING*

Be aware to connect the power cord right when replacing the circulator or after disconnecting the power cord for service. See pictures below:

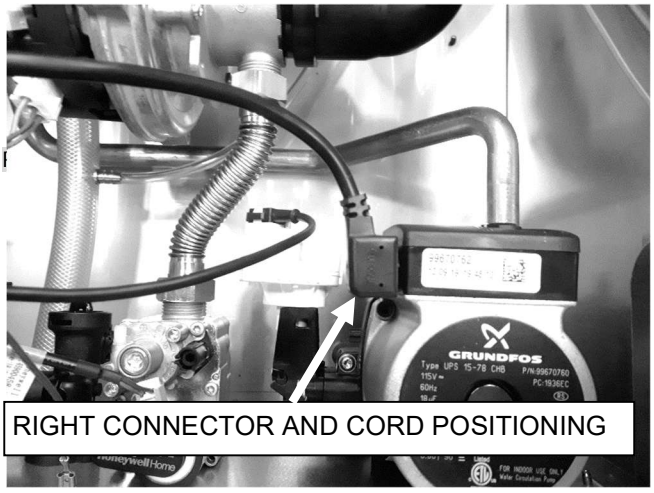


Figure 9.7

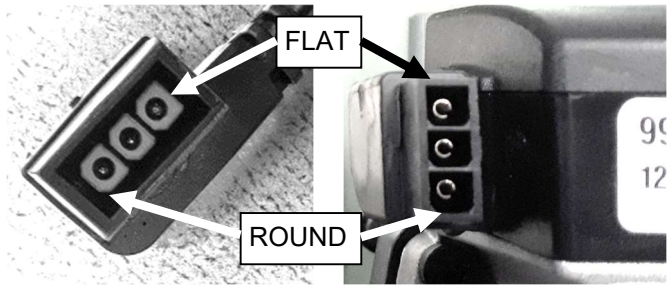


Figure 9.8

10 FLUE GAS AND AIR SUPPLY SYSTEM

10.1 General venting

The boiler has a positive pressure vent system.
The boiler is for either direct vent installation or for installation using indoor combustion air, category IV: appliance with sealed combustion requiring certain venting systems. All combustion air is drawn from outdoors or indoor. All products of combustion are vented directly outdoors. The vent, and if applicable air-intake piping, must be piped to the outdoors. Under no conditions should this appliance vent gases into a masonry chimney. The internal safety system shuts down the boiler in case the temperature of the flue gases becomes too high, after which the appliance will not run until manually restarted. Installations must comply with NFPA54/ANSI Z223.1 (USA) or CAN/CSA B149.1 Natural gas and Propane installation code (Canada) and local requirements.

The front cover creates an airtight enclosure making sure air is only supplied by the vent air intake. Therefore, make sure the front cover is always placed in its position during operation of the appliance.

NOTICE	• Install all horizontal vent components with a minimum angle of 3° downwards in the direction of the boiler (roughly equal to 1/4 inch per foot or 5 cm per meter). When not installed accordingly, it may result in condensate building-up in the vent gas tube, eventually causing component failure. • When using a wall terminal, there is the possible risk of ice buildup on surrounding parts/structures, because the condensate will freeze. This risk must be taken into account during the design phase of the heating installation. • Because the flue gases can have a low temperature, the boiler needs to have a high efficiency approved stainless steel or plastic vent system. These materials, including the gaskets, must be usable for positive pressure vent gas systems. **These parts must be certified for use at temperatures of minimal 70°C / 158°F**.

10.1.1 *VENT SIZING*

Boiler type	Intake Air and Vent Connection
CH-80 / CO-90 / CH-100 / CH-120 CO-150 / CH-150 / CH-180 / CO-200	3"

Table 10.1

NOTICE	Only 2" and 3" venting listed in this manual is permitted for use with the boiler.

Vent connector: used to provide a passageway for conveying combustion gases to the outside. A connector is provided on the unit for final connection. Vent piping must be supported as per the National Building Code, Section 305, Table 305.4 or as local codes dictate.

Connections vent gas (vent) and air supply:

WARNING
Failure to properly support the vent system can cause the venting system to fail, resulting in substantial property damage, serious injury, or death.

Figure 10.1

10.1.2 *VENT AND AIR INLET RESISTANCE TABLE (TWIN PIPE)*

Minimum and maximum allowed equivalent combined vent and air inlet length:

- Minimum venting length: two feet (2 ft) for all boilers.
- Maximum venting length: see table below.

Maximum Exhaust Length / Maximum Combustion Air Intake Length								
	CH-80	CO-90	CH-100	CH-120	CO-150	CH-150	CH-180	CO-200
2" PP	50 / 50	50 / 50	40 / 40	30 / 30	20 / 20	20 / 20	20 / 20	20 / 20
2" (C)PVC	35 / 35	40 / 40	20 / 20	10 / 10	10 / 10	-	-	-
3"	150 / 150	150 / 150	150 / 150	150 / 150	100 / 100	100 / 100	100 / 100	100 / 100

Table 10.2

NOTICE	• For long lengths, check venting pipe and fittings for maximum allowable pressure. • This table should only be used for a single vent/air system for one boiler. Do **NOT** use this table for common vent systems with cascaded boilers.

Pipe, elbows, tees - equivalent feet: for DuraVent PolyPro

		Item\ size	
Duravent	Polypro	2"	3"
1-ft Vent Pipe		1	1
1-ft Flex Pipe	(same diameter as rigid)	2	2
1-ft Flex Pipe	(upsized one diameter)	0.4	0.6
45 Elbow		3	3
90 Elbow		5	7
Tee		9	12
Reducer 3" - 2"	(based on small diameter)	1.6	

Table 10.3

Terminals equivalent feet: for DuraVent PolyPro

BOILER	TERMINAL	size	Eq. feet vent	Eq. feet air
CH-80 / CO-90 CH-100 / CH-120 CO-150 / CH-150 CH-180 / CO-200	concentric roof:	2" vent	18 ft	18 ft
	concentric wall:	2" vent	10 ft	18 ft
	concentric roof:	3" vent	25 ft	45 ft
	concentric wall:	3" vent	11 ft	45 ft

Table 10.4

10.1.3 *VENT AND AIR INLET RESISTANCE TABLE (CONCENTRIC)*

Maximum concentric length (feet)								
Size	CH-80	CO-90	CH-100	CH-120	CO-150	CH-150	CH-180	CO-200
2" / 4"	50	50	30	-	-	-	-	-
3" / 5"	150	150	130	100	100	80	60	60
4" / 6"	150	150	150	150	150	130	100	100

Table 10.4a

Pipe, elbows, tees - equivalent feet: for DuraVent PolyPro

	Item\ size		
Duravent Polypro	2" / 4"	3" / 5"	4" / 6"
1-ft Vent Pipe	1	1	1
45 Elbow	4	4	4
90 Elbow	5	5	6
Conc. roof terminal	15	20	20
Conc. wall terminal	10	15	15
2 x Reducer 3" –> 2" (based on small diameter)	2	-	-
2 x Enlarger 3" –> 4"	-	2	-
Adapter parallel –> concentric	12	6	7

Table 10.4b

10.2 Vent and air intake pipe material

Items	Materials [1]	Venting System Standards		Warning
		United States	**Canada [3]**	
Flue piping and Fittings	CPVC Schedule 40	ANSI/ASTM F441	All venting material in Canada must be ULC S636 approved.	All Vent materials and Air-Inlet materials being installed on gas fired appliances in CAN/US must meet the Standards listed in this Table. Failure to comply could result in fire, serious injury or death.
	PVC Schedule 40	ANSI/ASTM D1785		
	Stainless Steel SS	UL-1738		
	Polypropylene PP	-		
Air inlet piping and Fittings [2]	PVC - DWV	ANSI/ASTM D2265		
	Stainless Steel SS	UL-1738		
	Polypropylene PP	-		
Pipe cement	PVC	ANSI/ASTM D2564		
	CPVC	ANSI/ASTM F493		
Primers	PVC/CPVC	ANSI/ASTM F656		

Notes:
1 PVC venting (exhaust and air-inlet) is not permitted within Closet / Alcove installations.
2 The air-inlet does not require high temperature pipe material. Check applicable local codes for acceptable materials.
3 Use only vent gas material suitable for flue gas temperatures of 158ºF (70ºC) or higher.

Table 10.5

WARNING	• Never use aluminum containing vent pipes in these boilers. • Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. Failure to follow this instruction may result in serious injury or death. • In Canada, the first piece of vent piping must be readily accessible for inspection. • Covering non-metallic vent pipe and fittings with thermal insulation is prohibited. Failure to follow this instruction may result in property damage, personal injury or death.

10.2.1 *APPROVED MANUFACTURERS*

CPVC venting:
* IPEX System 636

WARNING	All models are designed to operate with flue gas temperature below 149°F / 65°C when set to the max CH temperature of 194°F / 90°C enabling PVC as a vent material without restrictions.

Polypropylene venting:
* Duravent – PolyPro, PolyPro Flex
* Centrotherm – InnoFlue, Innoflue Flex
* Centrotherm - Blitzflex (for air intake only)
* Z-Flex - Z-Dense
* Natalini – BH Class IIC Polyproylene, BH Class IIC Epoxy Coated Aluminum (air intake) / Polypropylene (exhaust)
* Snap Rabbit

Stainless steel venting:
* Duravent - FasNSeal, FasNSeal Flex, Duraseal DS, DSD, DSID
* Security Chimneys - Secure seal SS/SSD/SSID
* Heat Fab – Saf-T EZ Seal

Other manufacturers are allowed, as long as they comply to table 10.5 and comply to local codes and regulations.

NOTICE	**Read the manual provided by the vent gas and air system supplier carefully.**

10.3 PVC / CPVC

This product has been approved for use with the PVC / CPVC vent materials listed in this manual.
All terminations must comply with the listed options in this manual and be a single-wall vent offering.
For support and special connections required, see the manufacturer's instructions. All vent is to conform to standard diameter and equivalent length requirements established.

NOTICE	If these directions and those of the vent manufacturer differ, follow the more conservative requirements.

Approved PVC/ CPVC vent pipe and fittings:

IPEX – System 636

Boiler	Fitting
CH-80 / CO-90 CH-100 / CH-120 CO-150 / CH-150 CH-180 / CO-200	Concentric Termination CPVC *
	Low profile Termination
	FGV 45° Elbow CPVC
	FGV 90° Elbow CPVC
	Termination Vent Screen
	FGV Tee CPVC
* Concentric termination is for use in vertical installations only.	

Table 10.6

NOTICE	The use of bushings to reduce vent sizing is prohibited for both the exhaust venting and intake air venting system.
	Only standard and long sweep PVC elbows are allowed for use in the exhaust venting and intake air venting system.
WARNING	• The use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenol sulfone) in the exhaust venting system is prohibited. Failure to follow this instruction may result in property damage, personal injury or death. • Insulation shall not be used on PVC or CPVC or Polypropylene venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure. • The PVC / CPVC pipe and fittings must be cemented using an “All Purpose Cement” suitable for PVC and CPVC pipe. 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	**PVC In Canada:** In Canada, CPVC and PVC vent pipe, fittings and cement/ primer must be ULC-S636 certified. Safety authorities in some jurisdictions are not allowing PVC venting materials with appliances of any kind, even if System 636 certified. Check with the local safety inspector to verify compliance. Canadian installations must comply with the current CAN/CSA B149.1 Natural gas and propane installation code and local building codes.

NOTICE	• Use only cleaners, primers, and solvents that are approved for the materials which are joined together. • All PVC 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).

WARNING	venting materials from different systems cannot be mixed. Approved CPVC and PVC are considered the same system. PP venting cannot be mixed with PVC or CPVC venting.

WARNING	Failure to properly support the vent system can cause the venting system to fail, resulting in substantial property damage, serious injury, or death

10.3.1 *INSTRUCTIONS FOR WORKING WITH CEMENTING PVC/ CPVC PIPE CONNECTIONS*

1. Work from boiler to vent or air termination. Do not exceed lengths given in this manual for the air or vent piping.
2. Cut pipe to the required lengths and deburr the inside and outside of the pipe ends.
3. Chamfer the 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 must 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 and to the pipe end to approximately 1/2" beyond the socket depth.
   c. Apply a second primer coat to the fitting socket.
   d. All primers must be colored in a contrasting color so that inspectors can easily verify by the residual color on the pipe near the joints that the primer has been used.
   e. While primer is still wet, apply an even coat of approved cement to the pipe equal to the depth of the fitting socket along with an even coat of approved cement to the fitting socket.
   f. Apply a second coat of cement to the pipe.
   g. While the cement is still wet, insert the pipe into the fitting. When possible, twist the pipe a 1/4 turn as you insert it.
      Note: If voids are present, no sufficient cement was applied, and the joint could be defective.
   h. Wipe excess cement from the joint removing ring or beads as it will needlessly soften the pipe.

10.4 Polypropylene

This product has been approved for use with polypropylene vent from the manufacturers listed in table 10.7.
For support and special connections required, see the manufacturer's instructions.
All vent is to conform to standard diameter and equivalent length requirements established.

Approved suppliers polypropylene vent pipe and fittings.

Supplier	Type
Duravent	PolyPro
Centrotherm	InnoFlue
Z-flex	ZDense
Natalini	BH Class IIC Polypropylene, BH Class IIC Epoxy Coated Aluminium (air intake)/Polypropylene (exhaust)
Snap Rabbit	Single Wall Rigid

Table 10.5

To connect Centrotherm Innoflue piping to the boiler, first a transition piece needs to be installed: ISSA0303

Terminations (example):

Boiler	Termination
CH-80 / CO-90 / CH-100 / CH-120 / CO-150 / CH-150 / CH-180 / CO-200	Twin Pipe Side Wall
	Single Pipe Side Wall
	Bird Screen
	concentric roof
	Twin pipe roof
	Single pipe roof
	concentric wall
	Termination tee

Table 10.6

WARNING	Never insert a polypropylene street elbow directly into the vent adapter on the appliance, doing so could result in substantial property damage, serious injury, or death.

- Rigid polypropylene vent pipe must be installed with approved locking band clamps or connector rings and supports (wall strap or clamp, elbow or base, etc.). Consult vent manufacturer for complete list of required parts.
- Maintain 1/4 in. [6 mm] per foot slope back toward appliance on all horizontal runs.
- The use of a wall plate is required to seal rigid polypropylene vent pipe at the entrance of the chimney or chase to prevent mortar or cement from contacting the polypropylene vent pipe.
- Any termination piping external to the building must be UV resistant.
- Plastic venting systems shall not pass through rated fire separations without approved fire stopping installed in accordance with fire stopping manufacturers instructions.
- Prior to assembly of any joints, ensure joint gasket is present and properly installed. Contact vent manufacturer if gasket is missing or damaged. Verify the integrity of joints upon completion of the vent system.

10.5 Reducer

If a reduction of the flue gas pipe is made from 3" to 2" a reducer is required to make it fit.

Figure 10.2

Use to transition the vent system to a smaller diameter. Includes 1 adapter Connector clamp.

Supplier: Duravent.

Boiler	Size	
All	3" - 2"	80 – 60 mm

Table 10.9

Supplier: Centrotherm.

Boiler	Size	
All	3" - 2"	80 – 60 mm

Table 10.10

10.5.1 *FLEXIBLE POLYPROPYLENE*

For use of flex pipe, it is recommended to have the vent material in 32°F or higher ambient space before bending at installation. No bends should be made to greater than 45° and **only** installed in vertical or near vertical installations.

DANGER	• Insulation is prohibited from use on all types of plastic venting material: PVC, CPVC, and Polypropylene. • Use only the adapters and vent system listed. • DO NOT mix vent systems of different types or manufacturers. • Failure to comply could result in severe personal injury, death, or substantial property damage.
NOTICE	• The installer must use a specific vent starter adapter at the flue collar connection. • The adapter is supplied by the vent manufacturer to adapt to its vent system. • Installations must comply with applicable national, state, and local codes. • For Canadian installations, polypropylene vent must be listed as a ULC-S636 approved system. Installation of a polypropylene vent system must adhere to the vent manufacturer's installation instructions supplied with the vent system.

- Approved for vertical installations only, where a clean, structurally sound unused chimney or chase is used as a raceway.
- Vertical offsets must not exceed 45° and are limited to a maximum number of 2.
- Requires rigid polypropylene vent pipe with approved locking band clamps or connector rings and wall straps or support clamps from the appliance to the entrance of the chimney or chase.
- The use of a wall plate is required to seal rigid polypropylene vent pipe at the entrance of the chimney or chase to prevent mortar or cement from contacting the polypropylene vent pipe.

- Requires supports (elbow or base, flex chimney and bracket), spacers, chimney cap and end pipe. Consult vent manufacturer for complete list of required parts.
- Any termination piping external to the building must be UV resistant.
- Do not apply insulation directly to vent. Maintain vent manufacturers clearances to combustibles.
- Flex plastic venting systems shall not pass through rated fire separations.
- Prior to assembly of any joints, ensure joint gasket is present and properly installed. Contact vent manufacturer if gasket is missing or damaged. Verify the integrity of joints upon completion of the vent system.

WARNING	Do not install PVC, CPVC, or Polypropylene (rigid or flexible) in a multi-flue chimney. Only use an approved and certified metal venting system designed for use as a chimney liner in a multi-flue chimney.

10.6 Stainless steel vent

This product has been approved for use with stainless steel vent from the manufacturers listed in table 10.11.

Approved stainless steel vent pipe and fittings.

Supplier	Type
Duravent	FasNSeal, FasNSeal Flex
Security Chimneys	Secure Seal SS/SSD/SSID
Heat Fab	Saf-T EZ Seal, Saf-T EZ 316

Table 10.11

*Use of FasNSeal Flex smooth inner wall vent is to be used in vertical or near vertical sections only, taking precaution to ensure no sagging occurs of the vent system. Connect to the FasNSeal rigid vent using specially designed adapters and sealing method, see manufacturer's instructions.

WARNING	Use only the materials, vent systems, and terminations listed. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury, death, or substantial property damage.
NOTICE	• Installations must comply with applicable national, state, and local codes. Stainless steel vent systems must be listed as a UL-1738 approved system for the United States and a ULC-S636 approved system for Canada. • Installation of a stainless-steel vent system must adhere to the stainless-steel vent manufacturer's installation instructions supplied with the vent system.

Examples Stainless Steel Terminations.

	Duravent	Security Chimneys	HeatFab
	FasNSeal	Secure Seal	Saf-T EZ Seal / EZ 316
Boiler	**Termination**	**Termination**	**Termination**
CH-80 / CO-90 / CH-100 / CH-120 / CO-150 / CH-150 CH-180 / CO-200	bird screen wall termination tee rain cap roof	screen termination termination tee rain cap roof	elbow termination tee termination with screen rain cap

Table 10.12

10.7 Sealed Combustion Air supply

When an air supply pipe is connected from the outside of the building to the boiler, the boiler will operate as a sealed combustion boiler.

10.7.1 *COMBUSTION AIR QUALITY*

Combustion air must be free of contaminants. Do not install the intake for the combustion air venting in an area which contains corrosive or other contaminants as outlined in section 10.8.1, especially Table 10.7 and Table 10.8.

10.7.2 *AIR SUPPLY THROUGH HUMID AREAS*

When the combustion air pipe will run through an area with high humidity (for example: greenhouses), a double walled supply pipe or an insulated duct must be used to prevent the possible condensation on the outside of the pipe. It is not possible to insulate the internal air pipes of the boiler and therefore condensation at the internal air canals must be prevented.

When the intake combustion air is terminated vertically through a roof an approved termination designed to prevent water from entering into the combustion air pipe must be used.

10.7.3 *AIR INTAKE/VENT CONNECTIONS*

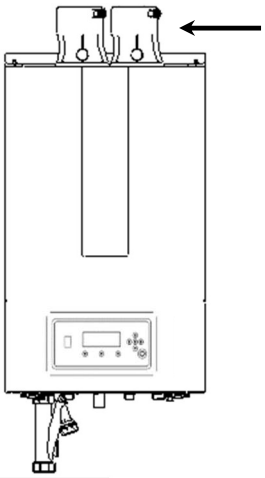


Figure 10.3

The combustion air intake connector (see Figure 10.3) is used to provide combustion air directly to the unit from outdoors. A connector is provided on the unit for final connection. Combustion air piping must be supported as per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.

10.7.4 *AIR INLET PIPE MATERIALS*

The air inlet pipe(s) must be sealed. Choose acceptable combustion air inlet pipe materials from the following list:

- PVC, CPVC or PP
- Flexible propylene air intake
- Galvanized steel vent pipe with joints and seams sealed as specified in this section.
- Type “B” double-wall vent with joints and seams sealed as specified in this section.
- AL29-4C, stainless steel material to be sealed to specification of its manufacturer.

WARNING	Using air intake materials other than those specified can result in personal injury, death or property damage.
NOTICE	The use of double-wall vent or 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.

Sealing of Type “B” double-wall vent material or galvanized vent pipe material used for air inlet piping on a wall or vertical rooftop Combustion Air Supply System:

a) Seal all joints and seams of the air inlet pipe using either Aluminum Foil Duct Tape meeting UL Standard 723 or 181A-P or a high-quality UL Listed silicone sealant such as those manufactured by Dow Corning or General Electric.
b) Do not install seams of vent pipe on the bottom of horizontal runs.
c) Secure all joints with a minimum of three (3) sheet metal screws or pop rivets. Apply Aluminum Foil Duct Tape or silicone sealant to all screws or rivets installed in the vent pipe.
d) Ensure that the air inlet pipes are properly supported.

PVC or CPVC air inlet pipe must 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. Follow the polypropylene or flexible polypropylene manufacturer’s instructions when using polypropylene material as an inlet pipe.
When a wall 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.

DANGER	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.

10.8 Room air

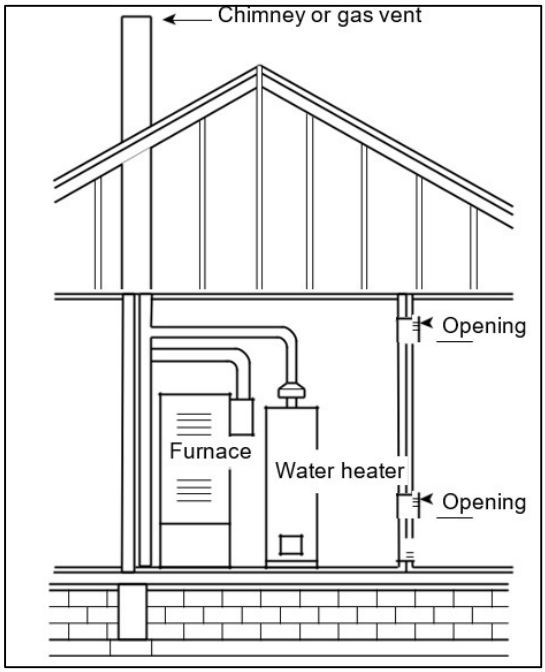
The boiler may be installed with a single pipe carrying the flue products to the outside while using combustion air from the room. In this case it is very important to provide adequate combustion air: as an example, in an unconfined space a CO-200 boiler needs approximately 2,300 ft^3/h i.e. a room with dimensions 17' x 17' x 8'. Failure to provide adequate combustion air can result in boiler failure, fire, explosion, severe personal injuries or death.

Other considerations and conditions:

- The boiler must be installed in a positive or neutral pressure room. If kitchen hoods or exhaust fans are present, makeup air must be provided.
- The boiler must be installed with an appropriate room air bird screen
- There will be a noticeable increase in noise level from the air inlet, compared with an airline from the outside.
- Using room air makes the unit vulnerable to combustion air contamination from within the building. Please review section 10.8.1 “Air contamination” in this manual, to ensure proper operation.

WARNING	When utilizing the single pipe method, provisions for combustion and ventilation air must be in accordance with: Local, state and national codes, laws, ordnances and regulations 9.3 Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1/NFPA 54. In Canada, the latest edition of CSA Standard B149 Installation Code for Gas Burning Appliances and Equipment.

Depending on the local situation, one of the following methods (from ANSI Z223.1/NFPA 54) applies:



1. If the boiler is installed in a room with a volume of more than 50 ft^3 per 1,000 Btu/hr of the aggregate input rating of all combustion appliances in the room, the infiltration rate of the room will provide adequate combustion air. No additional measures have to be taken. However, if the room is situated in a building with a known infiltration rate smaller than 0.40 ACH, the evaluation shall be with the KAIR method in ANSI Z223.1.

2. If the boiler is installed in a room with a volume of less than 50 ft^3 per 1,000 Btu/hr. of the aggregate input rating of all combustion appliances in the room, the room must have two separate air openings to an adjacent room. If this room is on the same floor, each opening must have a free area of minimum 1 $inch^2$ per 1,000 Btu/hr. If this room is on a different floor, the minimum free area is 2 $inch^2$ per 1,000 Btu/hr. Minimum free area is 100 $inch^2$ per air opening. The minimum dimension of an opening is 3 inches. If louvers are designed to cover the openings, the free area of these louvers should be considered. If these are not documented, count 25% for wooden louvers and 75 % for metal louvers.

Figure 10.4

The distance of the top of the upper opening to the top of the equipment room and from the bottom of the lower opening to the bottom of the room shall be within 12 inches.
Now check if the two rooms together have enough volume to conform to method 1.
If coupling to another room does not bring enough air, it will be necessary to provide outside air:

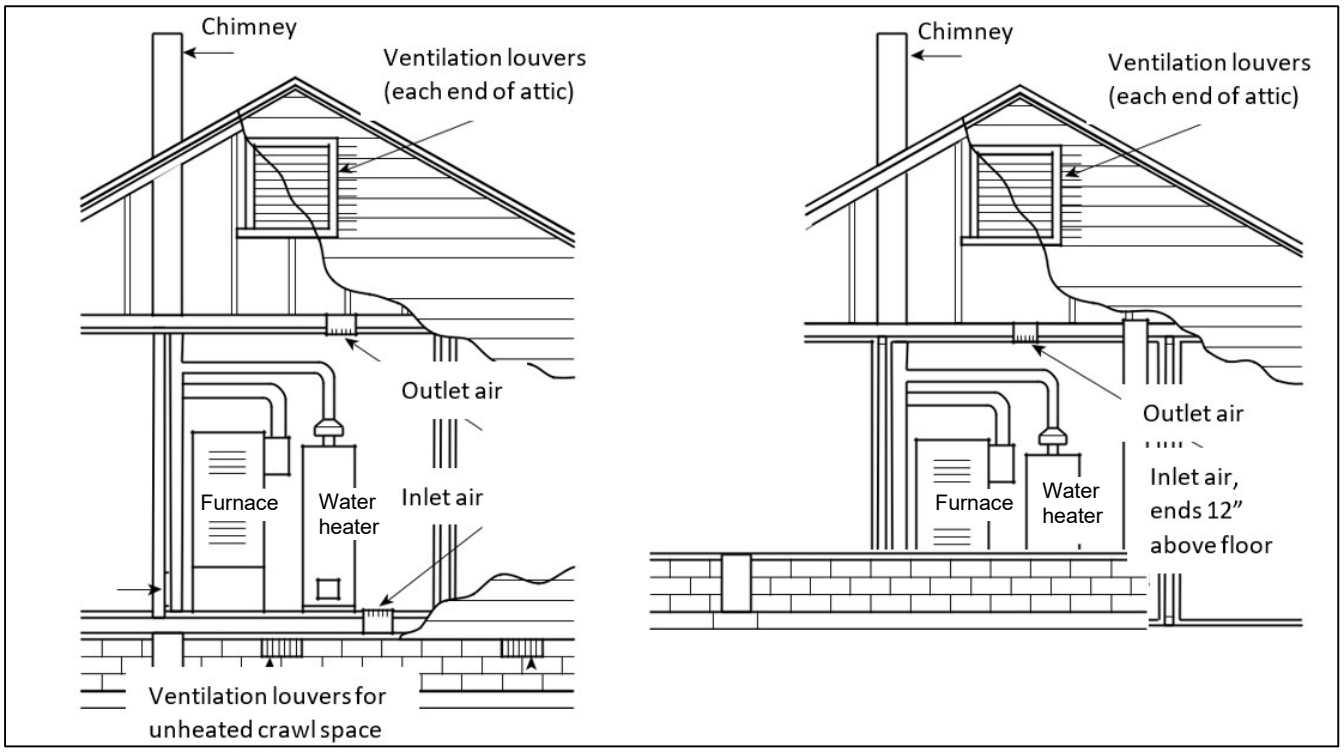
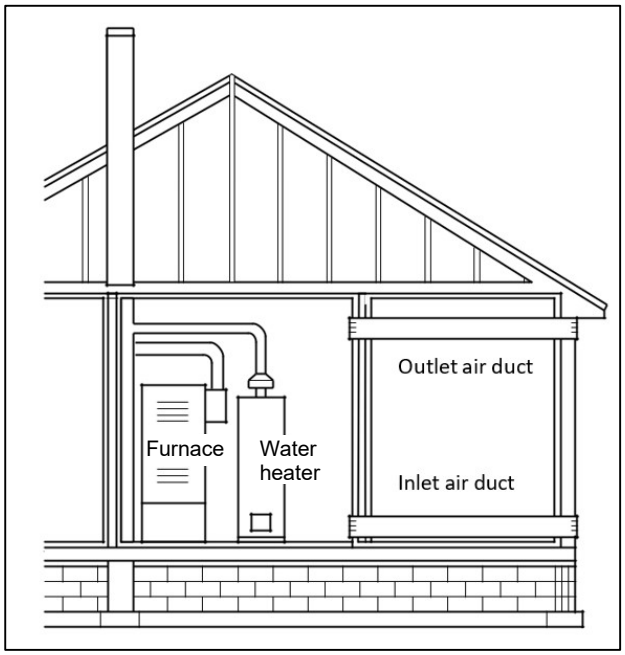


Figure 10.5



If combustion air is provided from the outside by means of vertical ducts like above, the free size of each opening must be minimal 1 inch^2 per 4,000 Btu/hr. of the aggregate input rating of all combustion appliances in the room.

If the outside air is provided by means of horizontal ducts, the free size of each opening must be minimal 1 inch^2 per 2,000 Btu/hr. of the aggregate input rating of all combustion appliances in the room.

Figure 10.6

Indoor air parts:

Duravent

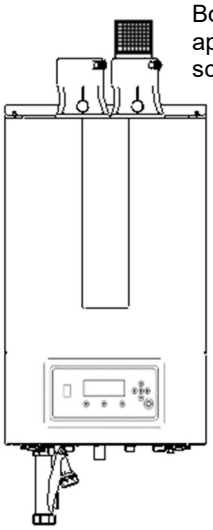
Boiler	Termination
All CH and CO Boilers	Bird Screen

Table 10.13

Centrotherm

Boiler	Termination
All CH and CO boilers Boilers	Bird Screen

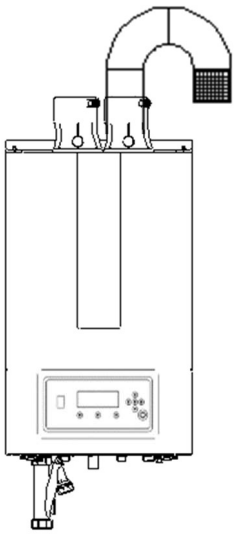
Table 10.14



Boiler is IP20 applying a bird screen only

Figure 10.7

Room air examples



Boiler is IPX4D applying a bird screen with two elbows and if necessary, a short straight pipe.

Figure 10.8

10.8.1 *AIR CONTAMINATION*

Pool and laundry products and common household and hobby products often contain fluorine or chlorine compounds. When these chemicals pass through the boiler, they can form strong acids. The acid can eat through the boiler wall, causing serious damage and presenting a possible threat of flue gas spillage or boiler water leakage into the building.
Please read the information given in the list below, with contaminants and areas likely to contain them. If contaminating chemicals will be present near the location of the boiler combustion air inlet, have your installer pipe the boiler combustion air and vent to another location, as per this manual.

WARNING	• The boiler should never be located in areas such as a laundry room or pool facility. These areas will always contain hazardous contaminants.
	• To prevent the potential of severe personal injury or death, check for areas and products listed in the list with contaminants below, before installing the boiler or air inlet piping.
	• If contaminants are found, you MUST:
	  • remove contaminants permanently
	  or
	  • relocate air inlet and vent terminations to other areas.

Corrosive Contaminants and Sources

Products to avoid:	• Spray cans containing chloral/fluorocarbons • 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

Table 10.7

Areas likely to have contaminants:	• Dry cleaning/laundry areas and establishments • Swimming pools • Metal fabrication shops • Beauty shops • Refrigeration repair shops • Photo processing plants • Auto body shops • Plastic manufacturing plants • Furniture refinishing areas and establishments • New building construction • Remodeling areas • Garages with workshops.

Table 10.8

10.9 Proper vent installation and type of gas vent or vent connector

For boilers for connection to gas vents or chimneys, vent installations must 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.
Vent connectors serving appliances vented by natural draft must not be connected into any portion of mechanical draft systems operating under positive pressure.

Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.
For Category IV venting, the venting system must be installed in accordance with the boiler manufacturer's installation instructions.

Non-combustible supports must be placed a minimum of every 4 feet on horizontal portions of the venting system to prevent sagging of the venting system. The supports must allow the boiler to be free from strain and prevent the weight of the venting system from resting on the boiler. The supports must allow for a ¼” (21 mm) slope upwards from the boiler to the termination. This will prevent the accumulation of condensate and allow it to drain back towards the boiler and reduce the risk of icing at the termination.

10.10 Install vent and combustion air piping

DANGER	• The 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 10.13.2 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 applicable codes. • Failure to provide a properly installed vent and air system will cause severe personal injury or death.
WARNING	• This appliance requires a special venting system. Use only approved stainless steel, PVC, CPVC or polypropylene pipe and fittings listed for vent pipe and fittings. Failure to comply could result in severe personal injury, death, or substantial property damage. • DO NOT mix components from different systems. The vent system could fail, causing leakage of flue products into the living space. Mixing of venting materials will void the warranty and certification of the appliance. • For closet and alcove installations, CPVC, polypropylene or stainless-steel flue material **MUST BE** used in the closet/alcove structure. Failure to follow this warning could result in fire, personal injury, or death. • 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.
CAUTION	Improper installation of venting systems may result in injury or death.
WARNING	For US installations only, for Direct Vent and Category IV appliances: The vent for this appliance shall not terminate: • over public walkways; or • near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or cause property damage; or • where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.
NOTICE	• Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 / NFPA 54 for U.S. installations or CAN/CSA B149.1 for Canadian installations. • Follow the instructions in this manual when removing a boiler from an existing vent system.

The boiler vent and air piping can be installed through the roof or through a wall. Follow the procedures in this manual for the method chosen. Refer to the information in this manual to determine acceptable vent and air piping length. Do not attempt to install the boiler using any other means.

You must also install air piping from outside to the boiler air intake adapter, unless following the "Room Air" instructions in paragraph 10.8 of this manual. The resulting installation is direct vent (sealed combustion).

10.11 Requirements for installation in Canada

1. Installations must be made with a vent pipe system certified to ULC-S636.
2. The first three (3) feet of plastic vent pipe from the appliance flue outlet must be readily accessible for visual inspection.
3. The components of the certified vent system must not be interchanged with other vent systems or unlisted pipe/ fittings. For concentric vent installations, the inner vent tube must be certified vent material in order to comply with this requirement.

⚠ **WARNING**	• When utilizing the single pipe 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/NFPA 54, in Canada, the latest edition of CAN/CSA B149.1 Natural gas and Propane installation code, or applicable provisions of the local building codes.
	• The inlet for combustion air can never be located inside a room storing chemicals or contaminants as listed in section 10.8.1. Avoid installing the boiler in any area with possible contaminants.
	• If contaminants are found, you MUST:
	  • remove contaminants permanently
	or
	  • relocate the boiler and air intake to an area free from all possible contaminants.

10.12 Direct venting options

Two pipes wall See paragraph 10.13 for more details.	**Two pipes vertical** See paragraph 10.14 for more details.

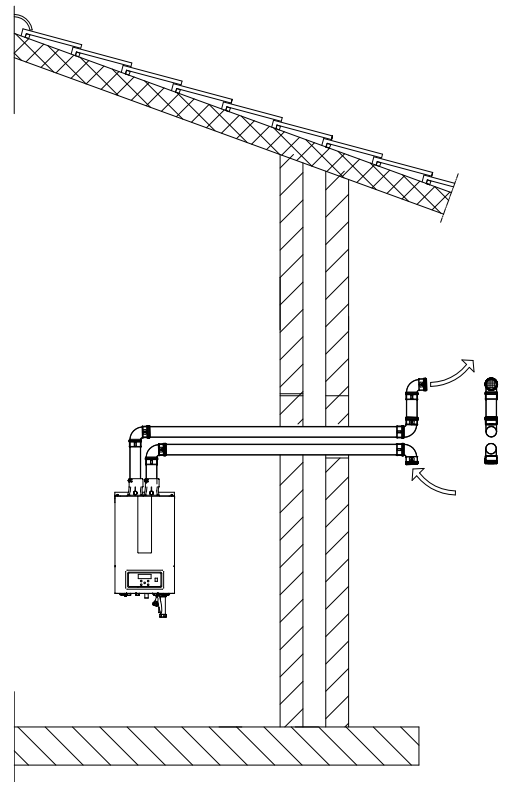
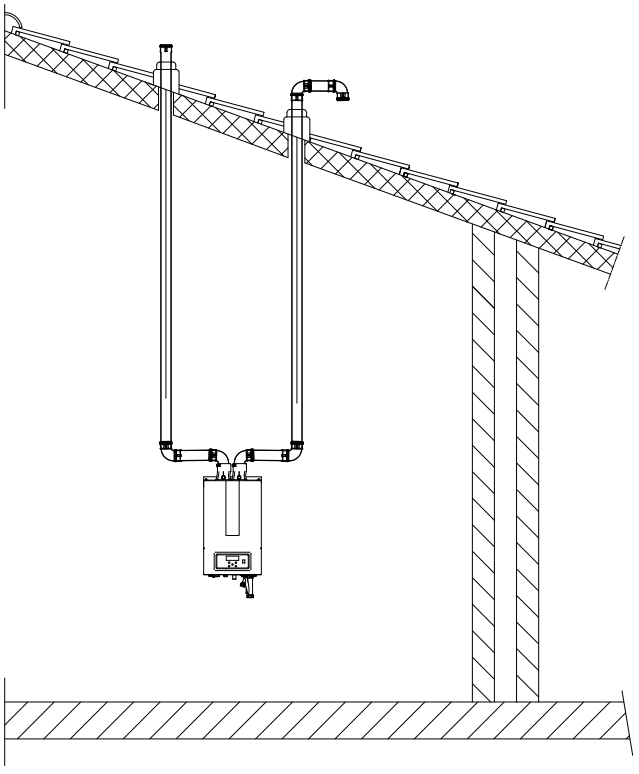

	

Figure 10.9	Figure 10.10

Concentric wall - two pipe to boiler
See paragraph 10.13 for more details.

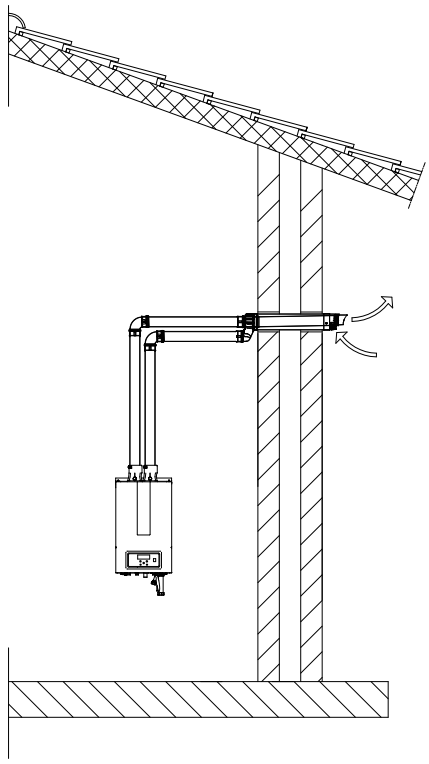


Figure 10.11

Concentric wall - concentric to boiler
See paragraph 10.13 for more details.

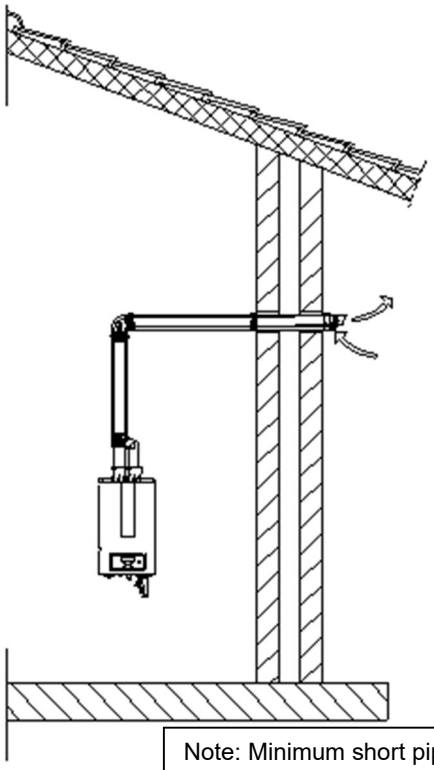


Figure 10.12

Note: Minimum short pipe lengths required. Air intake – 7" Exhaust outlet 12.5"

Single pipe wall (room air)
See § 9.13 for more details

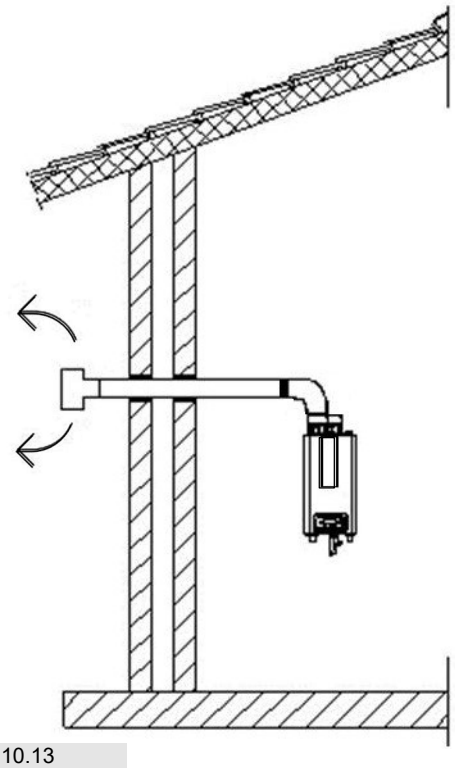


Figure 10.13

Single pipe roof (room air)
See § 9.14 for more details

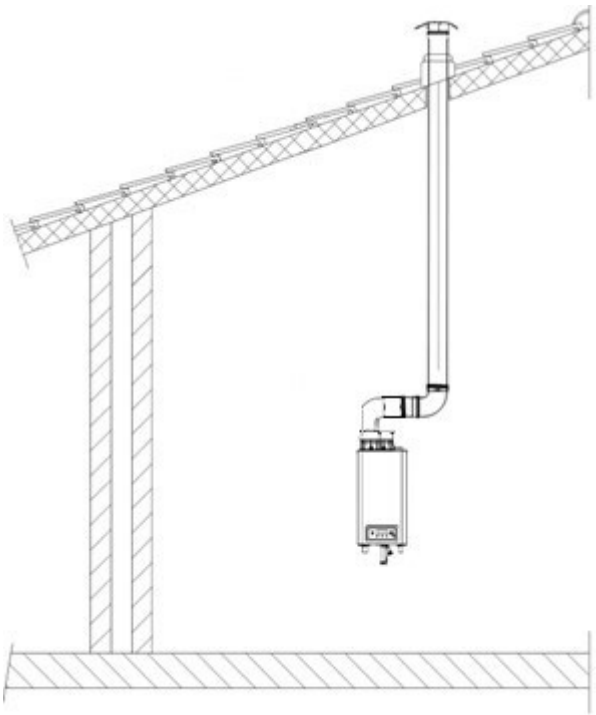


Figure 10.14

Concentric vertical - two pipe to boiler
See paragraph 10.14 for more details.

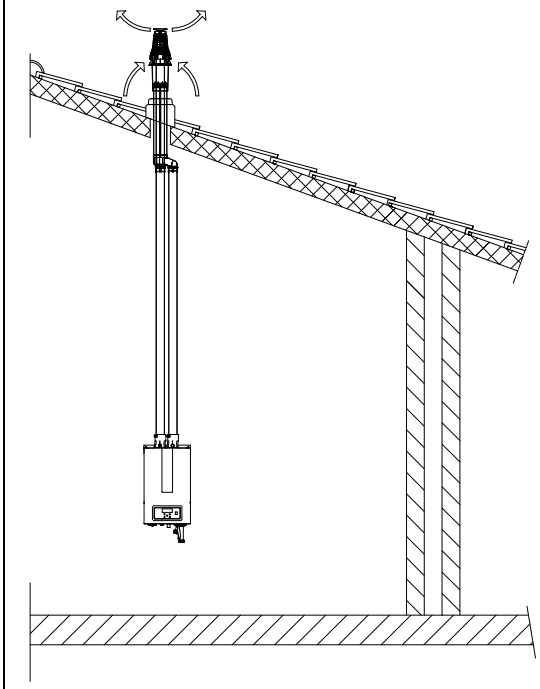
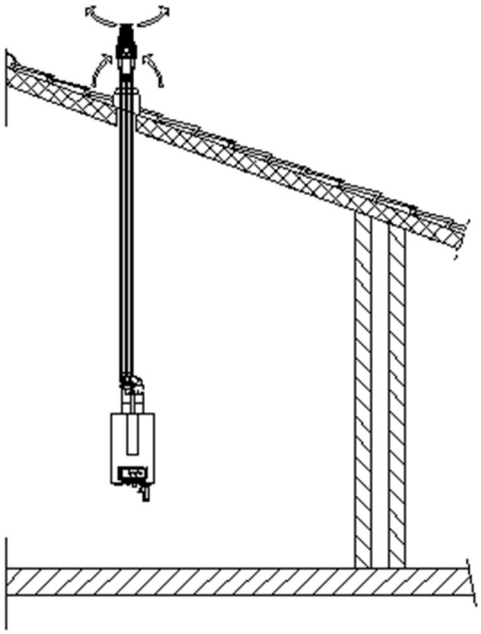


Figure 10.15

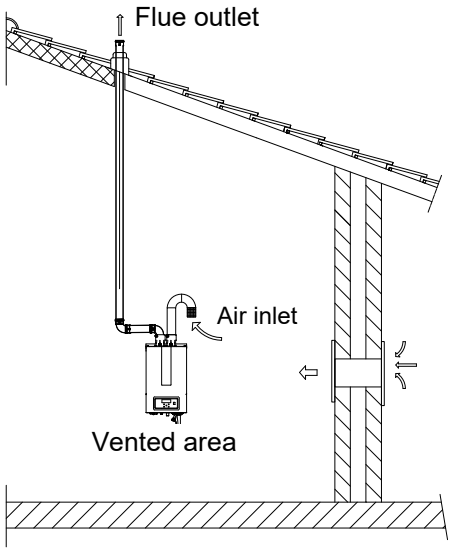
Concentric vertical - concentric to boiler
See paragraph 10.14 for more details.

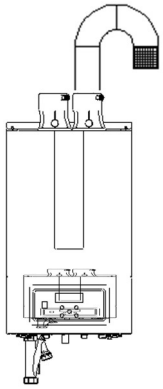


Note: Minimum short pipe lengths required. Air intake – 7" Exhaust outlet 12.5"

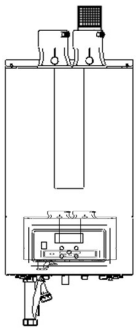
Figure 10.16

Open, Air supply from room,
See paragraph 10.14 for more details.





Boiler is IPX4D applying a bird screen with two elbows and if necessary, a short straight pipe.



Boiler is IP20 applying a bird screen only

Figure 10.17

10.13 Wall (Horizontal) direct venting

10.13.1 *VENT/AIR TERMINATION - WALL*

WARNING	• Follow instructions below when determining vent location to avoid possibility of severe personal injury, death, or substantial property damage. • A gas vent extending through an exterior wall must 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.

CAUTION	Maintain 12” of clearance above the highest anticipated snow level or grade, whichever is greater. Please refer to the local codes for the snow level in your area.

10.13.2 *DETERMINE LOCATION*

Locate the exhaust vent/air intake terminations using the following guidelines:

1. The total length of piping for exhaust vent or air intake must not exceed the limits given in the "General Venting" section, in paragraph 10.1 of this manual.
2. You must consider the surroundings when terminating the exhaust vent and air intake:
   a. Position the vent termination where exhaust gases 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 hazard of accidental contact of flue products with people or pets.
   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. When using two pipe terminations the air intake piping must terminate in a down-turned elbow as shown in Figure 10.19 and 10.20. This arrangement avoids recirculation of flue products into the combustion air stream.
4. The exhaust piping must terminate horizontally in a section of straight pipe, a termination tee, or an elbow pointed outward or away from the air inlet, as shown in Figure 10.19, 10.20 and 10.22.

WARNING	Do not exceed the maximum lengths of the outside vent piping stated in this manual. Excessive length exposed to the outside could cause freezing of condensate in the vent pipe, resulting in potential boiler shutdown and possibly a blocked flue.

NOTICE	PVC/CPVC or PP is acceptable as air intake pipe material.

5. Maintain clearances as stated in this manual. Also maintain the following:

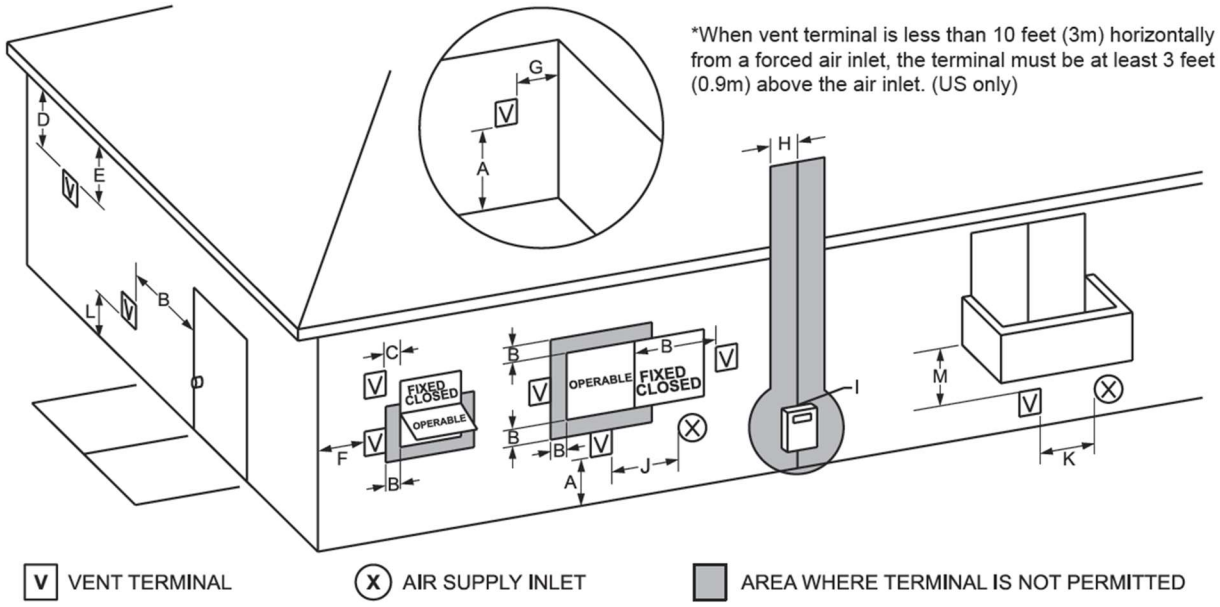


Figure 10.17

A	Clearance above grade, veranda, porch, deck, or balcony	12" (30 cm) see note 3	12" (30 cm) see note 3
B	Clearance to window or door that may be opened	Direct vent only: 12" (30 cm) Non-Direct vent: 4 ft (1.2 m) below or to side of opening; 1 ft (30 cm) above opening	36 inches (91 cm)
C	Clearance to permanently closed window	see note 4	see note 5
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 ft (61 cm) from the center line of the terminal	see note 4	see note 5
E	Clearance to unventilated soffit	see note 4	see note 5
F	Clearance to outside corner	see note 4	see note 5
G	Clearance to inside corner	see note 4	see note 5
H	Clearance to each side of center line extended above meter/regulator assembly	4 ft	4 ft
I	Clearance to service regulator vent outlet	4 ft	4 ft
J	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	Direct vent only: 12” (30 cm); Non-Direct vent: 4 ft (1.2 m) below or to side of opening; 1 ft (30 cm) above opening	3 ft (91 cm)
K	Clearance to a mechanical air supply inlet	10 ft horizontally from inlet or 3 ft above inlet	6 ft (1.83 m)
L	Clearance above paved sidewalk or paved driveway located on public property	7 ft (2.1 m) see note 7	7 ft (2.1 m) see note 7 and 8
M	Clearance under veranda, porch, deck, or balcony	12 inch, see note 6	12" (30 cm) see note 6
note 1: In accordance with the current ANSI Z223.1 / NFPA 54 National Fuel Gas Code			
note 2: In accordance with the current CAN/CSA-B149.1 Natural gas and propane installation code			
note 3: Maintain 12” of clearance above the highest anticipated snow level or grade or, whichever is greater. Please refer to your local codes for the snow level in your area			
note 4: For clearances not specified in ANSI Z223.1 / NFPA 54, clearance is in accordance with local installation codes and the requirements of the gas supplier.			
note 5: For clearances not specified in CAN/CSA-B149.1, clearance is in accordance with local installation codes and the requirements of the gas supplier			
note 6: Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.			
note 7: Not located above public walkways or other areas where condensate or vapor can cause a nuisance or hazard			
note 8: A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings			

Table 10.18

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.

Two pipe sidewall termination of air intake and exhaust vent.

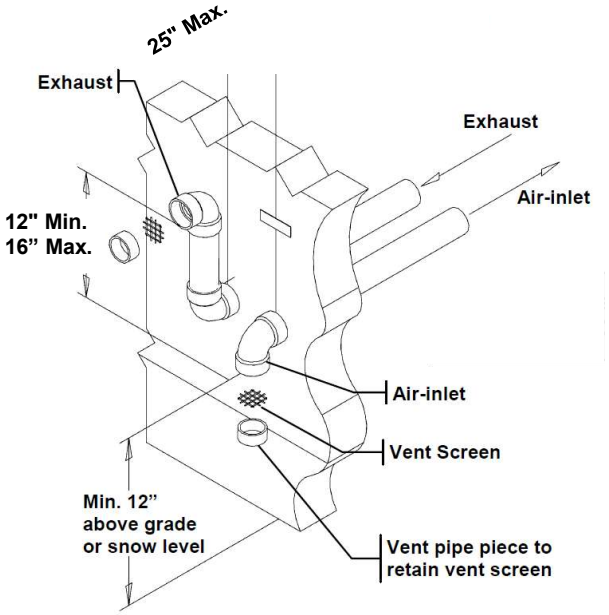


Figure 10.19

Alternate two pipe sidewall termination of air intake and exhaust vent

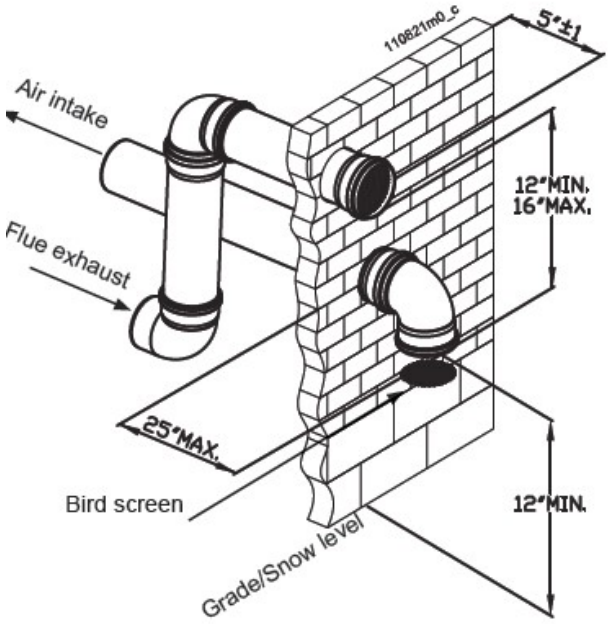


Figure 10.20

Two pipe sidewall termination assembly.

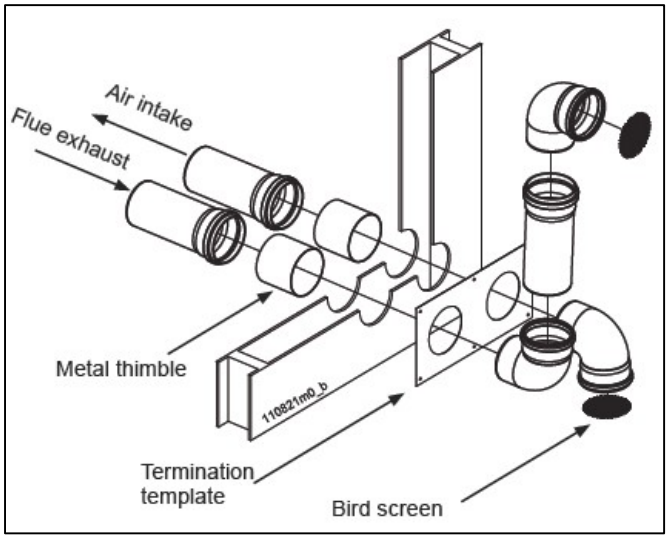


Figure 10.21

Assembly with termination tee

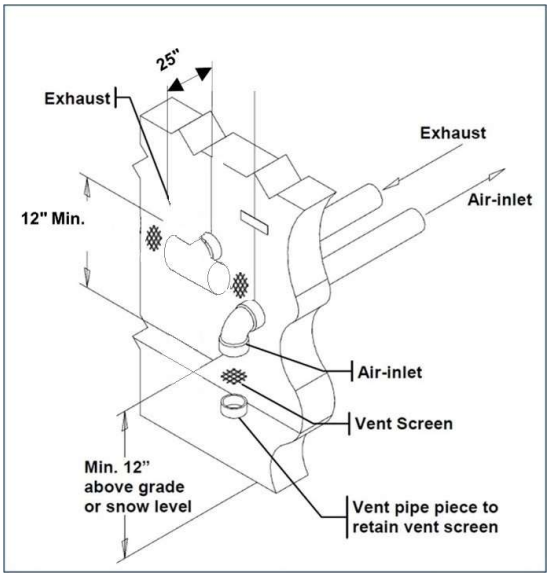


Figure 10.22

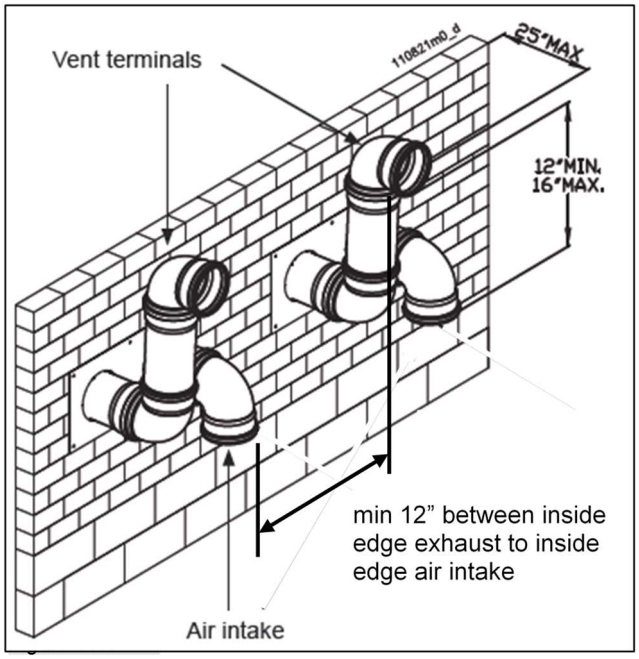
Multiple vent/air terminations

1. When terminating multiple boilers, terminate each vent/air connection as described in this manual.

WARNING	All vent pipes and air inlets must terminate at the same height to avoid possibility of severe personal injury, death, or substantial property damage.

2. Place wall penetrations to obtain minimum clearance of 12 inches (305 mm) between the inside edge of the exhaust vent and the inside edge of the air intake elbow, as shown in figure 10.23 for U.S. installations. For Canadian installations, provide clearances required by CAN/CSA B149.1 Installation Code.
3. The air inlet of the boiler is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler vents.

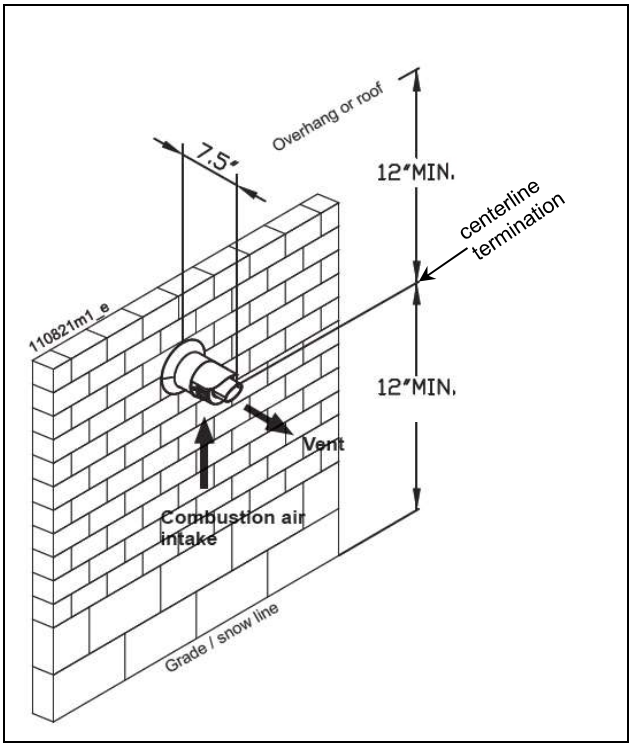
Two pipe multiple boilers vent terminations.



Note: Keep air intake at min. 12" above grade or snow line. Provide vent and air intake with bird screen.

Figure 10.23

Concentric Sidewall termination installation:



Wall termination – concentric vent

Description and usage: concentric combustion air and exhaust vent pipe termination. Both combustion air and exhaust vent pipes must attach to the termination kit. The termination kit must terminate outside the structure and must be installed as shown. The required combustion vent pipe materials are listed in Table 10. of this manual.

Concentric sidewall termination clearances:

Sidewall termination installation

- Determine the best location for the termination kit
- Reference paragraph 10.13.2 of this manual for general termination considerations.

Figure 10.24

WARNING	Do not operate the appliance with the rain cap removed from the concentric terminations or else recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.
NOTICE	Ensure termination location clearance dimensions are as shown in the appropriate figures
CAUTION	DO NOT use field-supplied couplings to extend concentric terminations. Airflow restriction will occur and may cause intermittent operation.

Multi venting wall terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see Figure 10.20). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations should be installed as shown in Figure 10.23. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

Concentric sidewall multiple boilers termination.

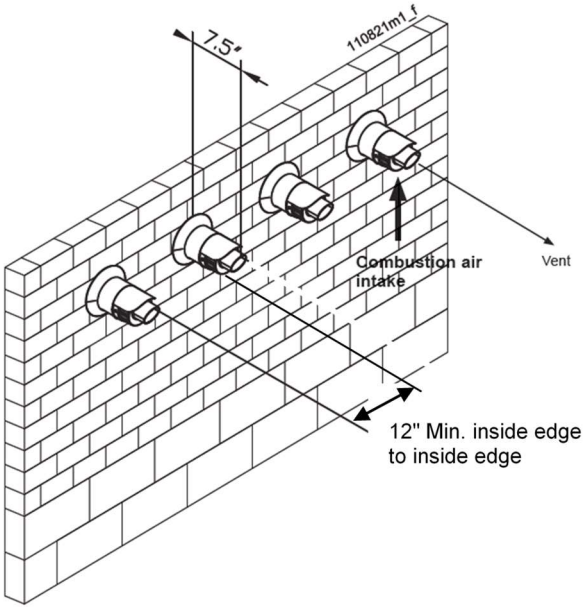


Figure 10.25

Note: keep the terminals horizontally in the same line and at min. 12” above grade or snow line.

10.14 Roof (vertical) direct venting

10.14.1 *VENT/AIR TERMINATION – VERTICAL*

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

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 the section 10.1 of this manual.
2. Prepare the vent termination and the air intake termination elbow (see Figure 10.26) by inserting bird screens.
3. The exhaust vent must terminate at least 3 feet above the highest place in which the exhaust vent penetrates the roof and at least 2 feet above any part of a building within 10 horizontal feet.
4. The air intake piping must terminate in a down-turned 180° direction utilizing two elbows, see Figure 10.26.
5. The exhaust piping must terminate in a vertical coupling as shown in . The top of the coupling must be at least 1 foot above the air intake. When the vent termination uses a rain cap, maintain at least 36" (914 mm) above the air inlet. The air intake pipe and exhaust vent pipe can be located in any desired position on the roof, provided that the exhaust vent termination is at least 1 foot above the air intake.
6. Maintain the required dimensions of the finished termination piping as shown in Figure 10.26.
7. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block the vent pipe.
8. 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.

WARNING	Rooftop exhaust vent and air intake inlet terminations must terminate in the same pressure zone.

Two pipes vertical termination of air and vent.

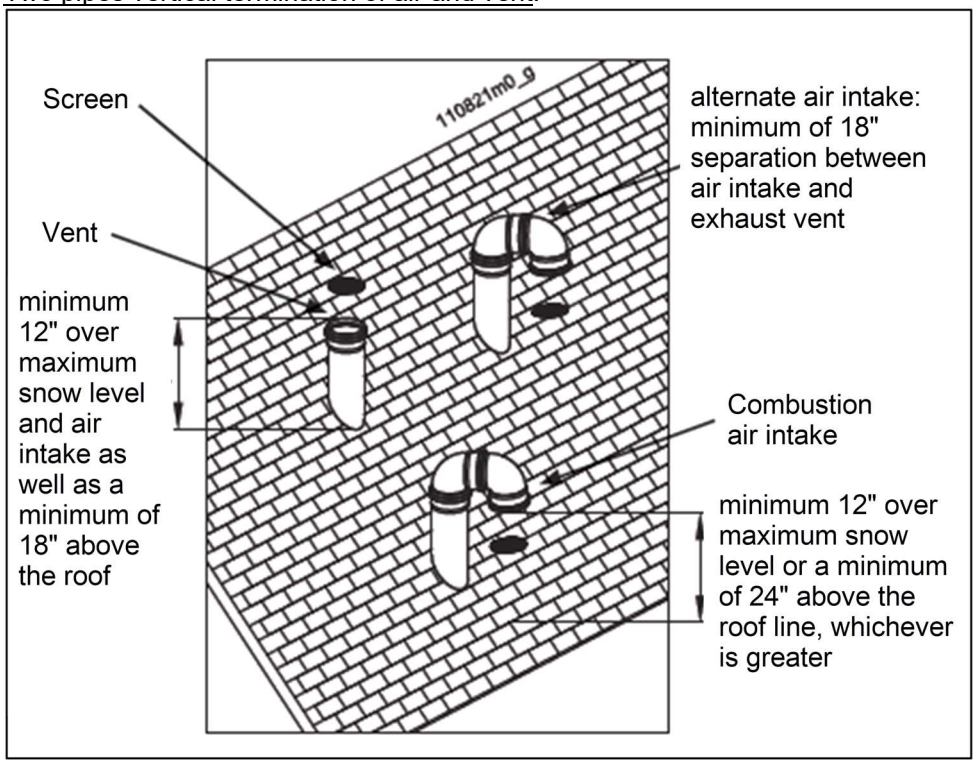


Figure 10.26

Multiple vent/air terminations

1. When terminating multiple boilers, terminate each vent/air connection as described in this manual (Figure 10.27).

WARNING	Terminate all exhaust vent pipes at the same height and all air intake pipes at the same height to avoid recirculation of flue products and the possibility of severe personal injury, death, or substantial property damage.

2. Place roof penetrations to obtain minimum clearance of 12 inches (305 mm) between outside edge of air intake an exhaust vent of another boiler for U.S. installations (see Figure 10.27). For Canadian installations, provide clearances required by CAN/CSA B149.1 Natural gas and propane installation code.

Vertical terminations with multiple boilers.

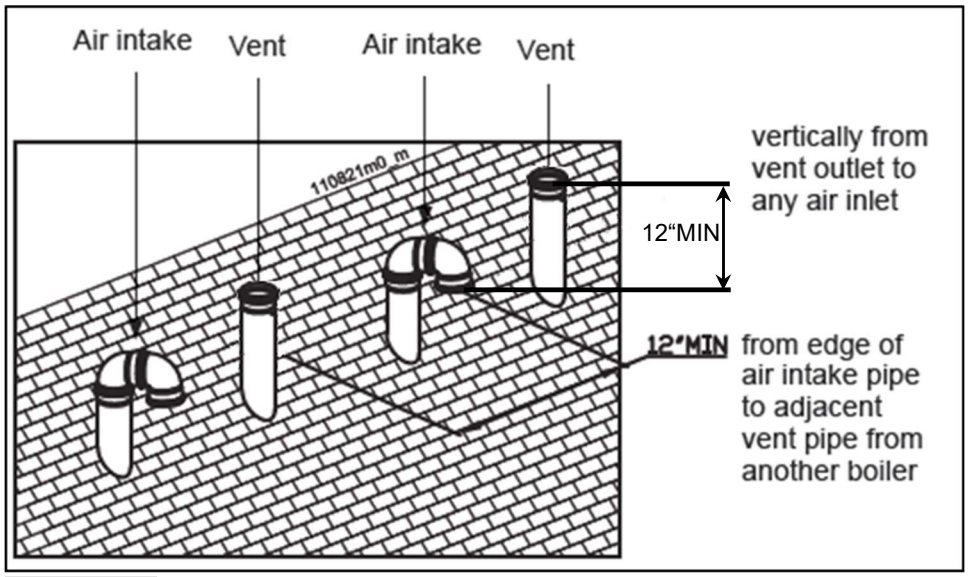


Figure 10.27

Note: keep terminals at min. 12" above grade or snow line. Provide exhaust vent and air intake with bird screen.

Alternate vertical terminations with multiple boilers.

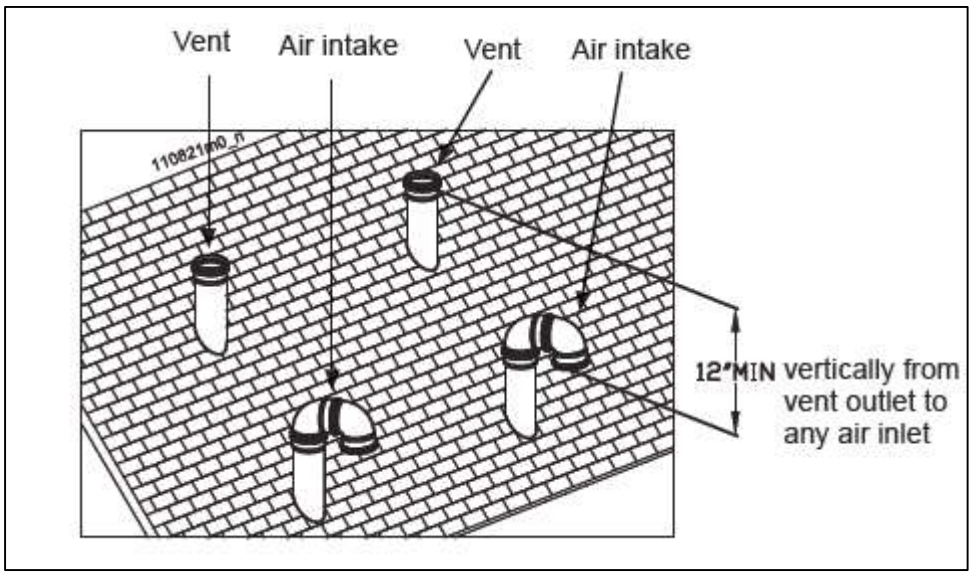


Figure 10.28

Note: keep the terminals at min. 12" above grade or snow line (min. 18" for Canada). Provide vent and air intake with bird screen.

Concentric Vertical Termination.

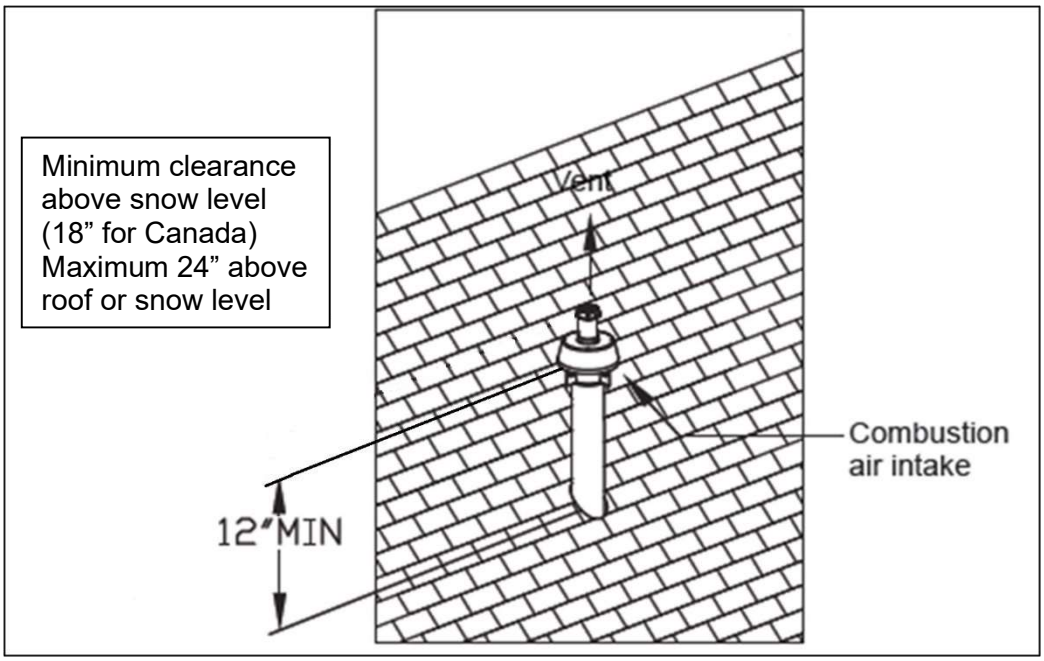


Figure 10.29

Do not install U-Bend or elbow on concentric termination

Figure 10.30

WARNING	Do not operate the appliance with the rain cap removed from the concentric terminations or else recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage or improper operation, personal injury, or death.
NOTICE	• Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole. • Ensure termination height is above the roof surface or anticipated snow level (12 inches (305 mm) in U.S.A. or 18 inches (457 mm) in Canada) as shown in Figure 10.24.
CAUTION	DO NOT use field-supplied couplings to extend concentric terminations. Airflow restriction will occur.

Multi venting vertical terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see Figure 10.26). NEVER common vent or breach vent this appliance. When two (2) or more direct vent appliances are vented near each other, two (2) vent terminations should be installed as shown in Figure 10.28. It is important that vent terminations be installed as shown to avoid recirculation of flue gases.

Concentric vent and combustion air vertical termination multiple boilers.

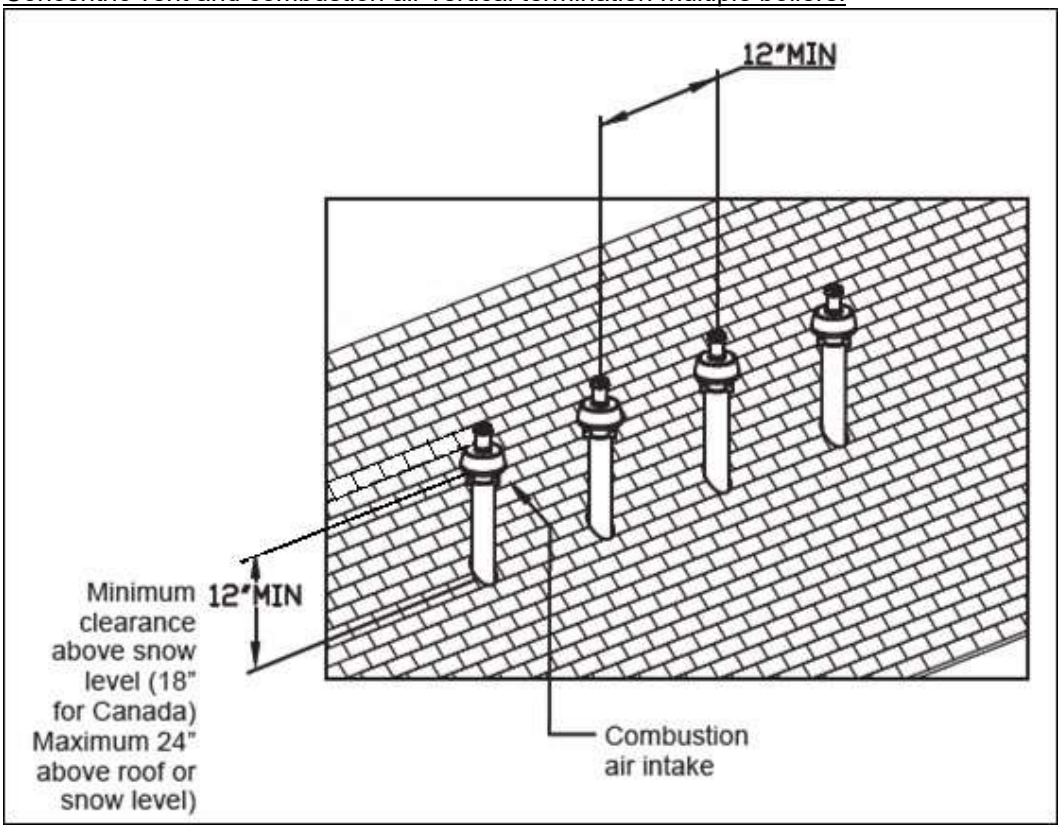


Figure 10.31

10.14.3 *COMMON VENTING*

The boilers from the CH / CO series have no internal flue gas check valve and need to be calculated for an external flue gas check valve system or a separated flue system. If separated flue systems cannot be applied, ask a flue gas supplier to calculate a common vent system utilizing external flue gas check valves.

10.15 Existing Common Venting Guidelines

When an existing boiler is removed from an existing 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 must be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

1) Seal any unused openings in the common venting system.
2) Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3) Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4) Put into operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
5) Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.
6) After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.
7) Any improper operation of the common venting system must 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 must be resized to approach the minimum size as determined using the appropriate tables in Chapter 13 in ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1.

11 ELECTRICAL INSTALLATION

11.1 General

- For operation, the boiler needs a power supply of 120 VAC / 60Hz.
- The boiler main supply connection is polarity sensitive: L-120 VAC, N-Neutral, PE-Earth ground (Figure 11.2).
- The wiring for the connections can be entered at the bottom of the boiler through the wiring knockouts. Separate knockouts are provided for both line voltage and low voltage wiring. Do not mix line voltage wiring and low voltage wiring in the same knockout

NOTICE	Before starting to work on the boiler, it must be switched off and the power supply to the boiler must be disconnected and the gas valve closed.

- Electrical wiring must be installed according to all applicable standards and regulations.
  In the USA, electrical installation must comply with NFPA 70, National Electrical Code – latest edition, and with any other national, state, provincial or local codes and regulations. In Canada, electrical installation must comply with CSA C22.1, Canadian Electrical Code part 1 – latest edition, and with any other state or local codes and regulations.
- Wiring the boiler must only be done by a qualified installer or, where required, a licensed electrician skilled in working on electrical installations and according to all applicable standards.
- It is not allowed to change the internal wiring fitted by the manufacturer.
- A spare fuse is mounted on the casing of the burner controller.

11.2 Connection power supply

- We advise to use a flexible cable between the cabinet entry (at the bottom) and the connection terminal.
- The ground wire has to be longer than the Line voltage (Hot) and neutral wire.
- The power supply cable must be secured by a strain-relief at the bottom of the boiler casing.
- In case of a flexible cable: use crimp ferrules on each wire end for the terminal connections.
- Line voltage terminals are polarity sensitive, connect wiring as follows: 8 = Line voltage, 120Vac; 9 = Neutral; PE = Earth ground (see Figure 11.2).

11.3 Electrical connections CH / CO boilers

LOW VOLTAGE CONNECTIONS

24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
		-	+	-	+				-	+			-	+	B	A	Gnd						
Safety switch 1 Interrupteur de sécurité 1		LWCO Extern Eau basse coupure à l'extérieur		AL-BUS managing boiler AL-BUS chaudière gérant		Flow switch DHW Interrupteur de débit ECS			0-10 Vdc 0-10 Vcc		On/Off thermostat or modulating thermostat Thermostat marche/ arrêt ou thermostat modulant		AL-BUS depending boiler AL-BUS chaudière dépendant		Modbus			DHW sensor Capteur ECS		System sensor Capteur de système		Outdoor sensor Capteur extérieur	

Figure 11.1

LINE VOLTAGE CONNECTIONS

	1	2	3	PE	4	5	PE	6	7	PE	8	9	PE	PE	10	11
	L1	N	L2	PE	L	N	PE	L	N	PE	L	N	PE	PE	L	N
MAXIMUM TOTAL OUTPUT 3,5 Amps NOMINAL	DHW TWV (3-way valve Vanne ECS (3 voies) MAX 2 Amps	DHW PUMP			System pump Pompe du système MAX 2 Amps			General pump Pompe générale MAX 2 Amps			Mains supply Alimentation secteur				Alarm Alarme MAX 50W	

Figure 11.2

11.3.1 *EXPLANATION OF THE LOW VOLTAGE CONNECTIONS CH BOILERS, FIGURE 11.1*

Low Voltage Terminals 1-2	**OUTDOOR SENSOR**
If an outdoor temperature sensor is connected, the boiler will control the supply water temperature by using a calculated setting based on outdoor reset curve, which is related to the outdoor temperature. (CH modes 1 and 2).	
Low Voltage Terminals 3-4	**SYSTEM SENSOR**
If a low loss header is used, this sensor measures the flow temperature at the system side. The sensor must be mounted on the supply pipe or in a sensor well at the system side, close to the low loss header. NOTICE: This sensor (see Figure 8.14 and 8.16) must be used when boilers are cascaded with the internal cascade manager. PARAMETER: boiler parameter 122, see paragraph 11.8.	
Low Voltage Terminals 5-6	**DHW SENSOR**
When an indirect hot water tank is installed, the DHW mode must be set to 1 or 2. When the DHW mode is set to 1, a sensor can be connected. This sensor must be mounted in a well in the tank. The boiler will now modulate towards the hot water setpoint. When the DHW mode is set to 2, an aquastat can be connected. When the set temperature is reached, the aquastat will switch off and the boiler will stop serving hot water.	
Low Voltage Terminals 7-8-9	**MODBUS**
Connections for a Building Management System (BMS). 7 = ground, 8 = A, 9 = B (A detailed Modbus manual is available at your supplier on request)	
Low Voltage Terminals 10-11	**AL-BUS DEPENDING**
Cascade connection for the dependent boilers, must be parallel linked together. See chapter 15. NOTICE: link all connections 10 to 10 and all connections 11 to 11, do not mix these. Link connections 10 of the dependent boilers to 19 of the managing boiler, and connections 11 of the dependent boilers to 20 of the managing boiler.	
Low Voltage Terminals 12-13	**ON/OFF STAT OR MODULATING HEATING CIRCUIT**
OPTION 1: An ON/OFF thermostat can be connected. If these terminals are bridged, the set/programmed flow temperature of the boiler will be used. OPTION 2: A modulating controller can be connected to these terminals. The boiler software will detect and use this modulating signal automatically. PARAMETER: boiler parameter 124, see paragraph 11.8	
Low Voltage Terminals 14-15	**0-10 Vdc CONTROL SIGNAL**
These terminals are used for an external 0-10 Vdc control input signal. NOTICE: Terminal 14 [+] (positive) and terminal 15 [-] (negative).	
Low Voltage Terminals 16-17-18	**DHW - FLOW SWITCH**
For DHW_Mode 3 a flow switch can be connected. If a water flow is present, the switch closes, and the DHW circulator is started. The temperature of the DHW is set with DHW_Setpoint. PARAMETER: boiler parameter 117, see paragraph 11.8	
Low Voltage Terminals 19-20	**AL-BUS MANAGING / CASCADE**
Cascade connection for the managing boiler. See chapter 15. Link connection 19 of the managing boiler to connections 10 of the depending boilers, and connection 20 of the managing boiler to connections 11 of the depending boilers.	
Low Voltage Terminals 21-22	**LWCO EXTERNAL**
To be used for an external Low Water Cut Off. The boiler goes into a lockout when this contact opens	
Low Voltage Terminals 23-24	**SAFETY SWITCH 1**
To be used for an external safety switch. The boiler goes into a lockout when this contact opens	

Table 11.1

11.3.2 *EXPLANATION OF THE LINE VOLTAGE CONNECTIONS CH BOILERS, FIGURE 11.2*

Line Voltage Terminals 1-2-3-PE	**3 WAY VALVE (TWV)**
This connection is internally connected to the 3-way valve in the appliance	
Line Voltage Terminals 4-5-PE	**SYSTEM PUMP / DHW CIRCULATOR / CH CIRCULATOR**
Connections for the power supply of a central heating system circulator P3, see paragraph 9.5.for detailed electrical specifications. PARAMETER: boiler parameter 125, see paragraph 11.8 When using DHW mode 1 or 2 and the coil in the tank has a high pressure drop an extra DHW circulator can be added. The pump can be connected to terminals 4-5-PE, and the parameter on output 1 needs to be changed from 2 (CH circulator) to 3 (DHW circulator) (see paragraph 11.8). 4 = Line voltage (Hot) wire; 5 = Neutral wire; PE = Ground	
Line Voltage Terminals 6-7-PE	**BOILER CIRCULATOR / GENERAL PUMP (internally connected)**
Connections for the power supply of the internal boiler circulator. (P1, see paragraph 9.5 for detailed specifications).	
Line Voltage Terminals 8-9-PE-PE	**MAINS SUPPLY**
The power supply connection of the unit. 8 = Line voltage wire; 9 = Neutral wire, PE = Ground wire	
Line Voltage Terminals 10-11	**ALARM RELAY**
A semiconductor alarm output. This is a triac (semiconductor) output with an active voltage of 120 VAC, it can only handle resistive loads between 5 and 50 Watt. E.g. an incandescent bulb of 10-50 Watt can be connected. For other lights or signals, a relay can be used. In this case a resistor must be added to provide the necessary resistive load. The alarm will be activated 60 seconds after an error has occurred. There are a few exceptions: - Alarm output will not be activated for a service warning; - Alarm output will not be activated for warning 202 (Appliance selection). 10 = Line voltage (Hot) wire; 11 = Neutral wire ATTENTION: The neutral wire is directly connected to the boiler mains neutral PARAMETER: boiler parameter 127, see paragraph 11.8.	

Table 11.2

NOTICE	To all outputs following applies: maximum current 2 A each output. Total output of all currents combined maximum 3.5 A. (Combined power consumption of internal circulator P1 and three way valve is 1 Amp) The inrush current of the 3-way valve and/or circulators is maximum 8 A.

NOTICE	The internal boiler pump/circulator is electrically connected to connections 6-7-PE Boiler Circulator (general pump) BE AWARE in the software the description “General Pump” is used for “Boiler Circulator”

11.3.3 *EXPLANATION OF THE LOW VOLTAGE CONNECTIONS CO BOILERS, FIGURE 11.1*

Low Voltage Terminals 1-2	**OUTDOOR SENSOR**
If an outdoor temperature sensor is connected, the boiler will control the supply water temperature by using a calculated setting based on outdoor reset curve, which is related to the outdoor temperature.	
Low Voltage Terminals 3-4	**SYSTEM SENSOR**
If a low loss header is used, this sensor measures the flow temperature at the system side. The sensor must be mounted on the supply pipe or in a sensor well at the system side, close to the low loss header. NOTICE: This sensor (see Figure 8.14 and 8.16) must be used when boilers are cascaded with the internal cascade manager. PARAMETER: boiler parameter 122, see paragraph 11.8.	
Low Voltage Terminals 5-6	**DHW SENSOR**
This connection is connected to the internal sensor on the plate heat exchanger,	
Low Voltage Terminals 7-8-9	**MODBUS**
Connections for a Building Management System (BMS) 7 = ground, 8 = A, 9 = B (A detailed Modbus manual is available at your supplier on request)	
Low Voltage Terminals 10-11	**AL-BUS DEPENDING**
Cascade connections for the dependent boilers, must be parallel linked together. See chapter 15. NOTICE: link all connections 10 to 10 and all connections 11 to 11, do not mix these. Link connections 10 of the dependent boilers to 19 of the managing boiler, and connections 11 of the dependent boilers to 20 of the managing boiler.	
Low Voltage Terminals 12-13	**ON/OFF STAT OR MODULATING HEATING CIRCUIT**
OPTION 1: An ON/OFF thermostat can be connected. If these terminals are bridged, the set/programmed flow temperature of the boiler will be used. OPTION 2: An Modulating controller can be connected to these terminals. The boiler software will detect and use this Modulating signal automatically. PARAMETER: boiler parameter 124, see paragraph 11.8	
Low Voltage Terminals 14-15	**0-10 Vdc CONTROL SIGNAL**
These terminals are used for an external 0-10 Vdc control input signal. NOTICE: Terminal 14 [+] (positive) and terminal 15 [-] (negative).	
Low Voltage Terminals 16-17-18	**DHW - FLOW SWITCH**
This connection is internally connected to the flow sensor in a combi boiler and not used on heating only boilers.	
Low Voltage Terminals 19-20	**AL-BUS MANAGING / CASCADE**
Cascade connection for the managing boiler. See chapter 15. Link connection 19 of the managing boiler to connections 10 of the depending boilers, and connection 20 of the managing boiler to connections 11 of the depending boilers.	
Low Voltage Terminals 21-22	**LWCO EXTERNAL**
To be used for an external Low Water Cut Off. The boiler goes into a lockout when this contact opens	
Low Voltage Terminals 23-24	**SAFETY SWITCH 1**
To be used for an external safety switch. The boiler goes into a lockout when this contact opens	

Table 11.3

11.3.4 *EXPLANATION OF THE LINE VOLTAGE CONNECTIONS CO BOILERS, FIGURE 11.2*

Line Voltage Terminals 1-2-3-PE	**3 WAY VALVE (TWV)**
This connection is internally connected to the 3-way valve in the appliance	
Line Voltage Terminals 4-5-PE	**SYSTEM PUMP / DHW CIRCULATOR / CH CIRCULATOR**
Connections for the power supply of a central heating system circulator P3, see paragraph 9.5. for detailed electrical specifications. PARAMETER: boiler parameter 125, see paragraph 11.8 4 = Line voltage (Hot) wire; 5 = Neutral wire; PE = Ground	
Line Voltage Terminals 6-7-PE	**BOILER CIRCULATOR / GENERAL PUMP (internally connected)**
Connections for the power supply of the internal boiler circulator. (P1, see paragraph 9.5 for detailed specifications).	
Line Voltage Terminals 8-9-PE-PE	**MAINS SUPPLY**
The power supply connection of the unit. 8 = Line voltage wire; 9 = Neutral wire, PE = Ground wire	
Line Voltage Terminals 10-11	**ALARM RELAY**
A semiconductor alarm output. This is a triac (semiconductor) output with an active voltage of 120 Vac, it can only handle resistive loads between 5 and 50 Watt. E.g. an incandescent bulb of 10-50 Watt can be connected. For other lights or signals, a relay can be used. In this case a resistor must be added to provide the necessary resistive load. The alarm will be activated 60 seconds after an error has occurred. There are a few exceptions: - Alarm output will not be activated for a service warning; - Alarm output will not be activated for warning 202 (Appliance selection). 10 = Line voltage (Hot) wire; 11 = Neutral wire ATTENTION: The neutral wire is directly connected to the boiler mains neutral PARAMETER: boiler parameter 127, see paragraph 11.8.	

Table 11.4

NOTICE	To all outputs following applies: maximum current 2 A each output. Total output of all currents combined maximum 3.5 A. (Combined power consumption of internal circulator P1 and three-way valve is 1 Amp) The inrush current of the 3-way valve and/or circulators is maximum 8 A.

NOTICE	The internal boiler pump/circulator is electrically connected to connections 6-7-PE Boiler Circulator (general pump) BE AWARE in the software the description “General Pump” is used for “Boiler Circulator”

11.4 Electrical schematics

11.4.1 *ELECTRICAL SCHEMATIC CH BOILERS*

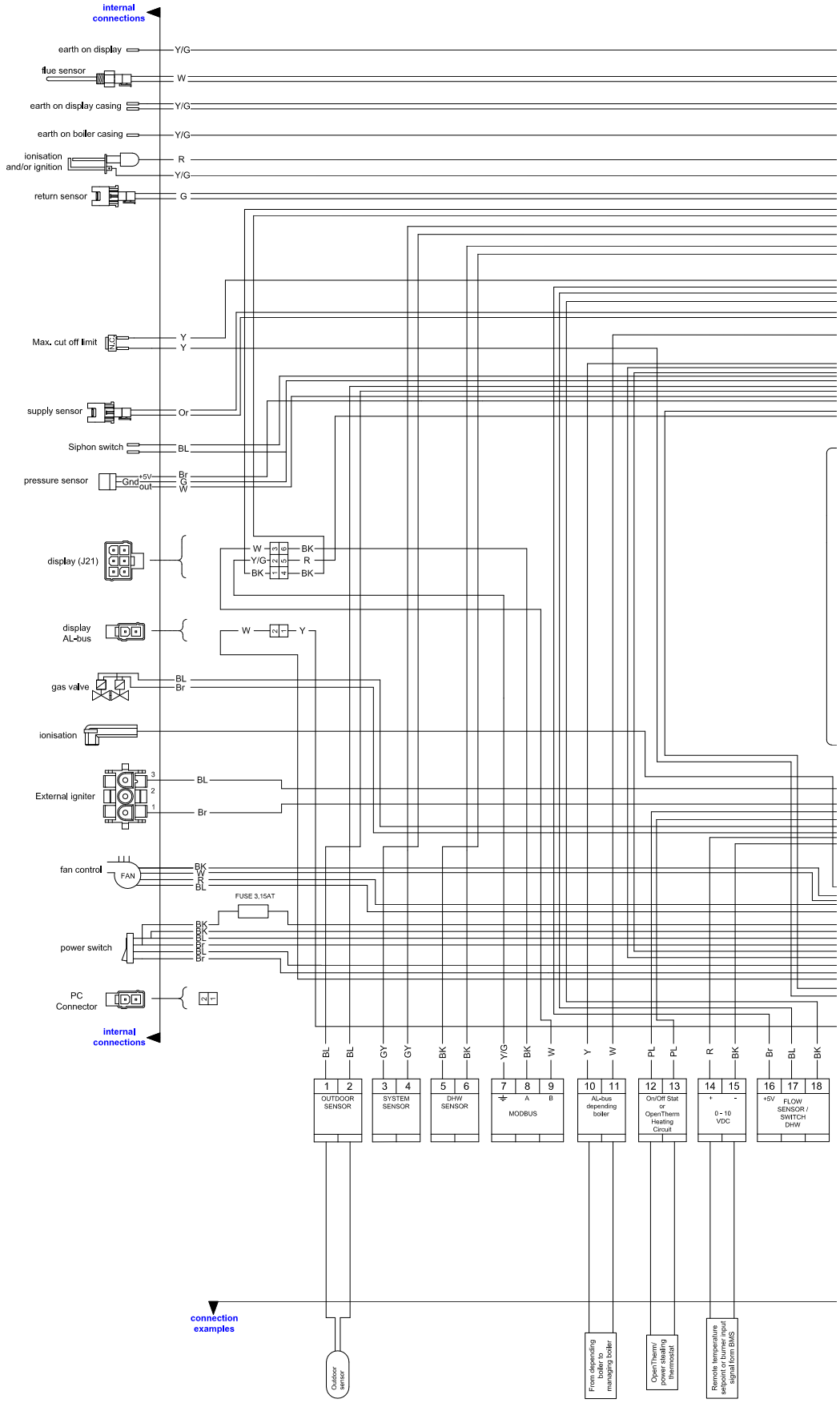


Figure 11.4

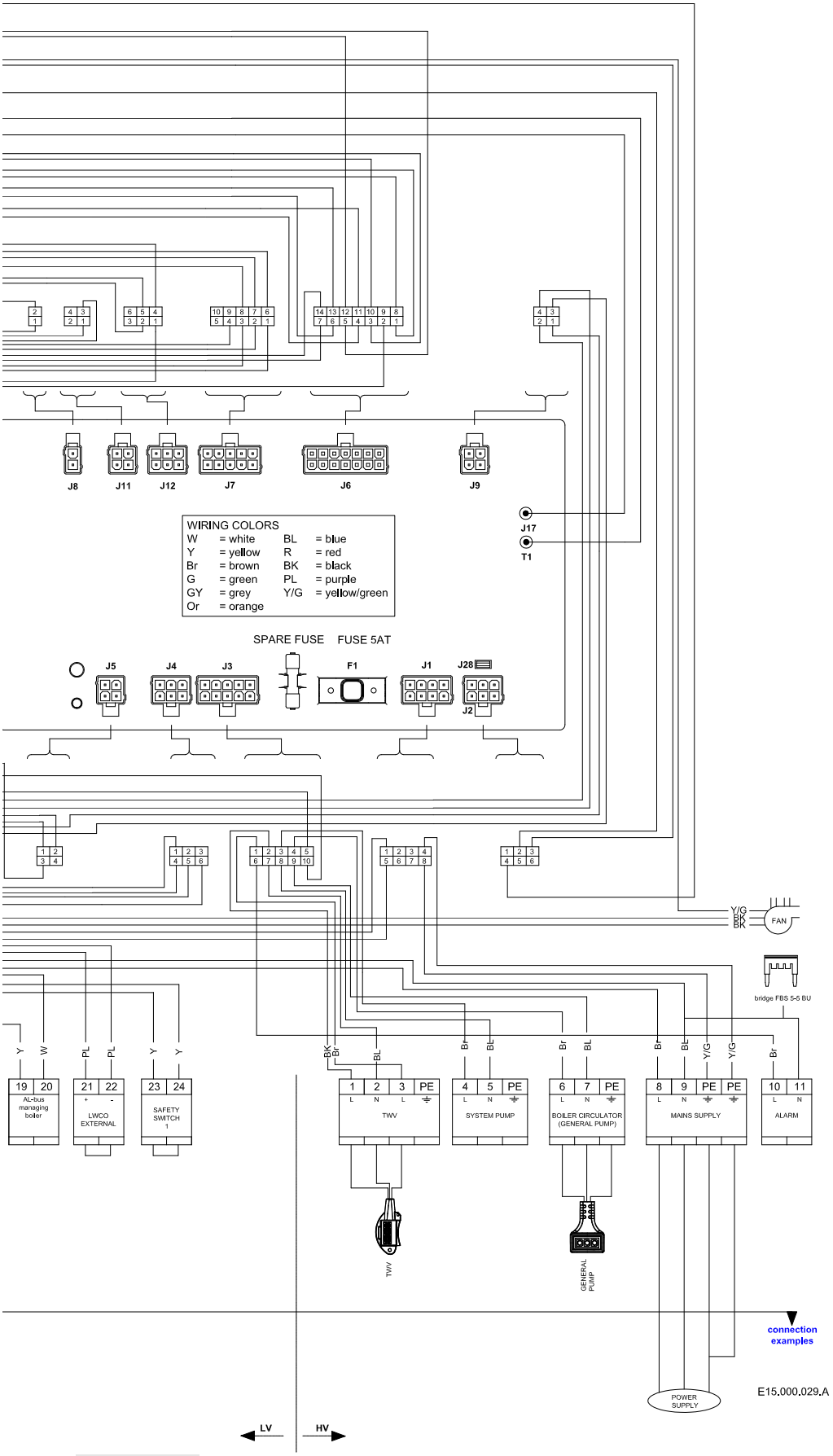

J8
J11
J12
J7
J6
J9
J17
T1
WIRING COLORS
W = white
Y = yellow
Br = brown
G = green
GY = grey
Or = orange
BL = blue
R = red
BK = black
PL = purple
Y/G = yellow/green
SPARE FUSE FUSE 5AT
J5
J4
J3
F1
J1
J28
J2
FAN
bridge FBS 5-5 BU
AL-bus managing boiler
LWCO EXTERNAL
SAFETY SWITCH 1
TWV
SYSTEM PUMP
BOILER CIRCULATOR (GENERAL PUMP)
MAINS SUPPLY
ALARM
GENERAL PUMP
POWER SUPPLY
connection examples
E15.000.029.A
LV
HV

Figure 11.5

11.4.2 *ELECTRICAL SCHEMATIC CO BOILERS*

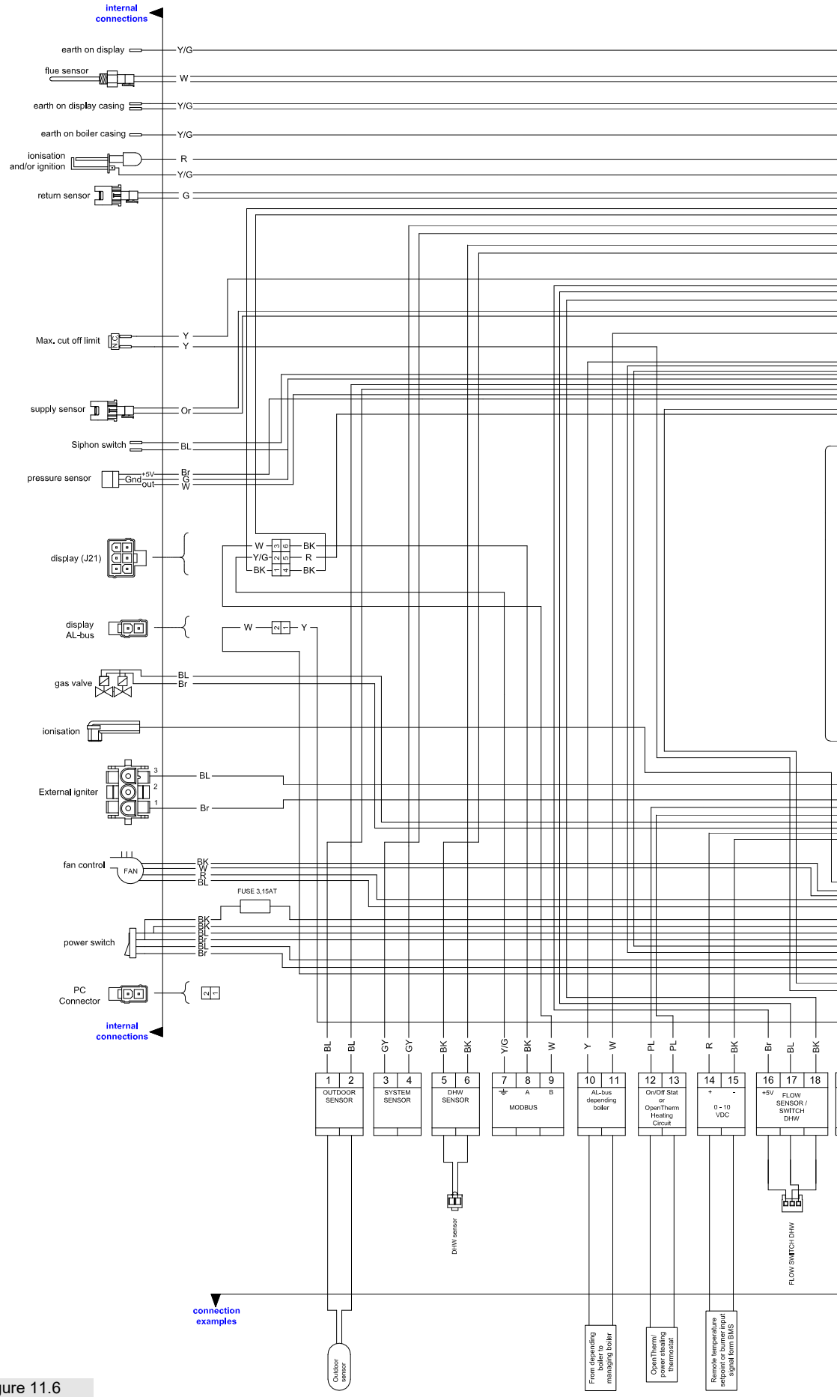


Figure 11.6

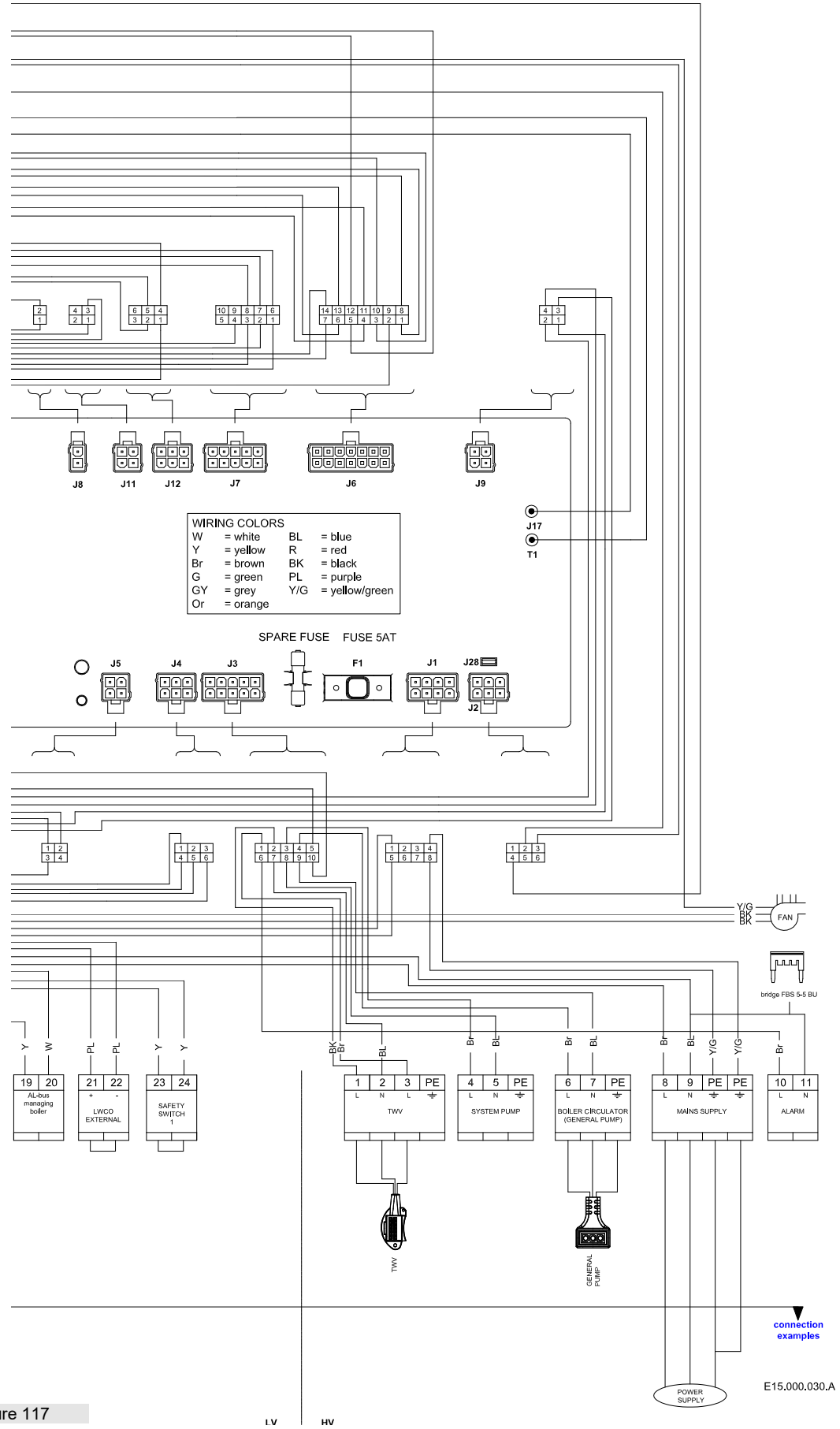

J8
J11
J12
J7
J6
J9
J17
T1
WIRING COLORS
W = white
Y = yellow
Br = brown
G = green
GY = grey
Or = orange
BL = blue
R = red
BK = black
PL = purple
Y/G = yellow/green
SPARE FUSE
FUSE 5AT
J5
J4
J3
F1
J1
J28
J2
FAN
bridge FBS 5-5 BU
AL-bus managing boiler
LWCO EXTERNAL
SAFETY SWITCH
TWV
SYSTEM PUMP
BOILER CIRCULATOR (GENERAL PUMP)
MAINS SUPPLY
ALARM
GENERAL PUMP
connection examples
POWER SUPPLY
E15.000.030.A
LV
HV

Figure 117

11.5 Ladder / Logic diagram

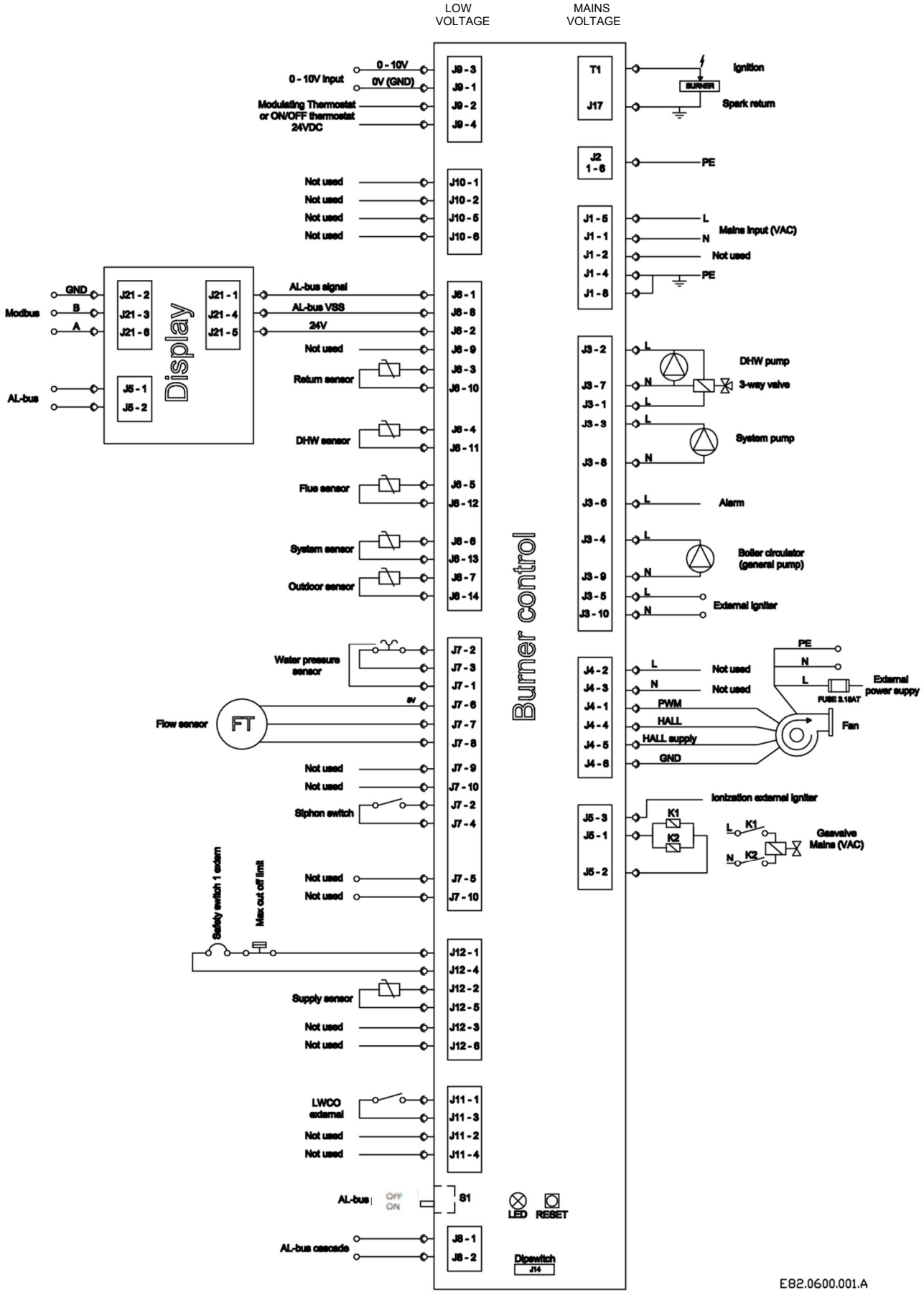


Figure 11.8

11.6 Sensor availability

11.6.1 *SENSOR AVAILABILITY CH BOILERS*

The following table shows the sensor availability for all CH and DHW control modes. Sensors not mentioned in the table are optionally available for other functions

	CH Mode					
	0	1	2	3	4	5
T_Supply	M	M	M	M	M	M
T_Return	O	O	O	O	O	O
T_DHW	O	O	O	O	O	O
T_Outdoor	---	M	M	O	O	
0-10 Volt	O	O	O	O	M	M
Water Flow DHW	O	O	O	O	O	---
RT Switch	M	M	M	M	M	---
M = Mandatory, O = Optional, --- = Disabled.						

Table 11.5

CH mode 0 – Central Heating demand with thermostat control
CH mode 1 – CH with an outdoor temperature reset and thermostat control
CH mode 2 – Central Heating with full outdoor temperature reset
CH mode 3 – Central Heating with permanent heat demand
CH mode 4 – Central Heating with analog input control of setpoint
CH mode 5 – Central Heating with analog input control of power output

	DHW Mode								
	0	1	2	3 N.A.	4 N.A.	5 N.A.	6 N.A.	7 N.A.	8 N.A.
T_Supply	O	M	M	O	M	O	M	M	M
T_Return	O	O	O	O	M	O	---	O	M
T_DHW	---	M	---	M	M	M	M	---	M
T_Outdoor	O	O	O	O	O	O	---	---	O
0-10 Volt	O	O	O	O	O	O	O	O	O
Water Flow DHW	O	O	O	O	O	M	O	M	M
RT Switch	O	O	M	O	O	O	O	O	O
M = Mandatory, O = Optional, --- = Disabled, N.A. = Not Available.									

Table 11.6

DHW mode 0 – No Domestic Hot Water
DHW mode 1 – Storage with sensor
DHW mode 2 – Storage with thermostat
DHW mode 3 to 8 N.A.

11.6.2 *SENSOR AVAILABILITY CO BOILERS*

If the installed appliance is a CO combi boiler, the available sensors for the various CH modes are identical to the data presented in Table 11.5. A CO combi boiler always has its DHW mode set to 5. Other DHW modes are not available for Combi-boilers. Table 11.6 shows the available sensors for this mode.

11.7 NTC sensor curve

All NTC sensors are according to this characteristic: NTC 10K@25°C B3977k

Temperature		Resistance	Temperature		Resistance	Temperature		Resistance	Temperature		Resistance
°C	°F	(Ω)	°C	°F	(Ω)	°C	°F	(Ω)	°C	°F	(Ω)
-30	-22	175203	20	68	12488	70	158	1753	120	248	387
-25	-13	129289	25	77	10000	75	167	1481	125	257	339
-20	-4	96360	30	86	8059	80	176	1256	130	266	298
-15	5	72502	35	95	6535	85	185	1070	135	275	262
-10	14	55047	40	104	5330	90	194	915	140	284	232
-5	23	42158	45	113	4372	95	203	786	145	293	206
0	32	32555	50	122	3605	100	212	677	150	302	183
5	41	25339	55	131	2989	105	221	586	155	311	163
10	50	19873	60	140	2490	110	230	508	160	320	145
15	59	15699	65	149	2084	115	239	443	165	329	130

Table 11.7

11.8 Programmable in- and outputs

It is possible to re-program some in- and outputs to other functions. To do this use the list below and go to: Menu\settings\boiler settings\"1122" (installer password)\boiler parameters.

Boiler parameter	Name	Default setting CH	Default setting CO	Description	Terminal
117	Prog. Input 2.	2	1	DHW flow switch/sensor	LV 16-17-18
122	Prog. Input 7.	3	3	Cascade sensor	LV 3-4
124	Prog. Input RT.	1	1	Room thermostat on	LV 12-13
125	Prog. Output 1.	2	2	CH-pump	HV 4-PE-5
126	Prog. Output 2.	0	0	External Igniter	separate connector
127	Prog. Output 3.	6	6	Alarm semi-conductor output	HV 10-11
128	Prog. Output 4.	20	20	3-way valve	HV 1-2-3-PE

Table 11.8

NOTICE	To all outputs following applies: maximum current 2 A each output. Total output of all currents combined maximum 3.5 A. The inrush current of the 3-way valve and/or circulators is maximum 8 A.

para-meter	Display:	**INPUTS:**	remark
(117)	Prog. Input 2.	0 Disabled	
		1 DHW flow sensor	CO
		2 DHW flow switch	CH
		3 CH flow sensor	not used
		4 CH flow switch	not used

para-meter	Display:	**INPUTS:**	re-mark
(122)	Prog. Input 7.	0 Disabled	
		1 T_Flue_2 sensor	not used
		2 T_Flue_2 with blocked flue	not used
		3 Cascade sensor	CH/CO
		4 Blocked Flue switch	not used
		5 CH Sensor	not used
(124)	Prog. Input RT.	0 Room thermostat off	
		1 Room thermostat on	CH/CO

	Display:	**OUTPUTS**:	
(125)	Prog. Output 1.	0 Disabled	
		1 Module pump	
		2 CH pump	CH/CO
		3 DHW pump	
		4 System pump	
		5 Cascade pump	
		6 Alarm relay	
		7 Filling valve	
		8 LPG tank	
		9 Ext. Igniter	
		10 Air damper	
(126)	Prog. Output 2.	0 Disabled	
		1 Module pump	
		2 CH pump	
		3 DHW pump	
		4 System pump	
		5 Cascade pump	
		6 Alarm relay	
		7 Filling valve	
		8 LPG tank	
		9 Ext. Igniter [1)]	
		10 Air damper	

para-meter	Display:	**OUTPUTS**:	remark
(127)	Prog. Output 3.	0 Disabled	
		1 Module pump	
		2 CH pump	
		3 DHW pump	
		4 System pump	
		5 Cascade pump	
		6 Alarm relay	
		7 Filling valve	
		8 LPG tank	
		9 Ext. Igniter	
		10 Air damper	
(128)	Prog. Output 4.	0 Disabled	
		1 Module pump	
		2 CH pump	
		3 DHW pump	
		4 System pump	
		5 Cascade pump	
		6 Alarm relay	
		7 Filling valve	
		8 LPG tank	
		9 Ext. Igniter	
		10 Air damper	
		11 empty	
		12 empty	
		13 empty	
		14 empty	
		15 empty	
		16 empty	
		17 3-way Valve CH	
		18 3-way Valve DHW	
		19 3-way Valve CH (power when idle)	
		20 3-way Valve DHW (power when idle)	CH / CO

Remarks:
1) Prog. output 2: (external igniter); this is a separate connector, the pin in the middle is for ionization, it has no PE connection. If ground is needed, it must be connected to the main ground terminal.
2) Prog. output 3: (alarm relay); this is a triac (semiconductor) output with an active voltage of 120 VAC, it can only handle resistive loads between 5 and 50 Watt.

Table 11.9

12 DISPLAY AND PARAMETERS

12.1 Display and buttons

Each type of the CH / CO Boiler series is provided with a digital display.

- PB-display – a pixel-based graphical user interface

The PB-display will look like this:

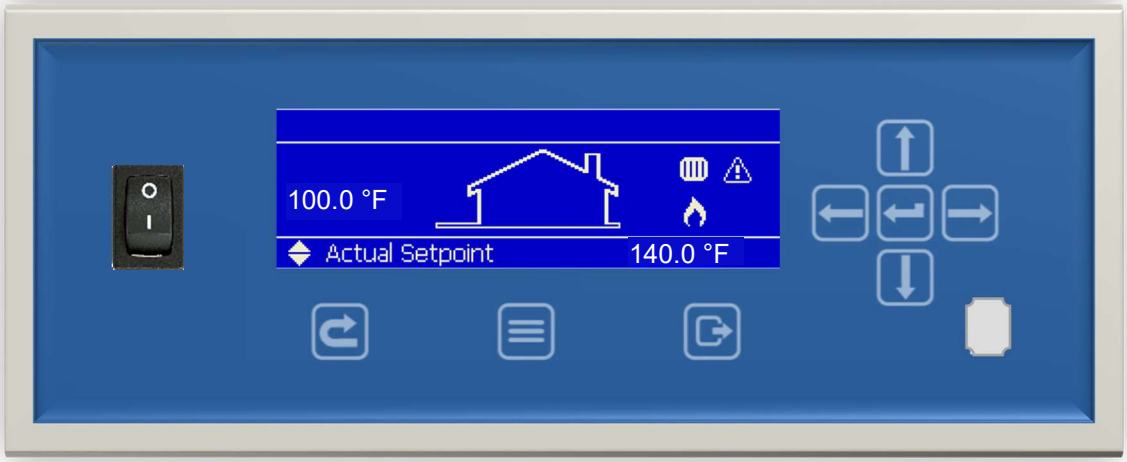


Figure 12.1

ON/OFF. On/off switch. Switches electrical power to the boiler

COMPUTER. Connector for computer cable (Accessory, see §5.1)

RESET. Reset lockout error

MENU. Enter the main menu

ESCAPE. Escape / Return to the status overview

RIGHT. Enter a menu item or confirm selection in Status overview (when directly setting Actual setpoint or DHW setpoint)

LEFT. Return to previous menu item or Status overview

UP. Directly select Actual setpoint of DHW setpoint in the Status overview, push RIGHT to confirm and use UP or DOWN to adjust value.

DOWN. Directly select Actual setpoint of DHW setpoint in the Status overview push RIGHT to confirm and use UP or DOWN to adjust value.

ENTER. Confirm a setting or enter a menu item

Figure 12.2

12.1.1 *DISPLAY ICONS*

The following table gives a short description of the icons that can be visible on the main screen during operation:

Icon	Description
	Central Heating demand
	Domestic Hot Water demand
	Indicates that the appliance burner is ON
	Cascade Emergency Mode active
	Error notification

Boiler Status	
CH control state (Central Heating controller state)	**RT_Input** (Room thermostat open of closed)
0 →Idle	0=Open
1 →Request	1=Closed
2 →Demand	
3 →Post circulation	
4 →Off	

Table 12.1

12.2 Screens and settings

When the appliance is started the following screen is displayed:

Figure 12.3

This screen is active during power up and will remain active until communication with the Main Control (the AL-BUS) has been established.

Figure 12.4

The “De-Aeration” sequence is a safety function that starts at every power ON of the boiler and is used to remove the air from the heat-exchanger. The DAir sequence does not start after a general reset (like the locking error reset or 24 hours reset)

The display will show the following string during DAir sequence:
• “Dair Running”

The De-Air sequence can be cancelled by pressing and holding the ENTER-button on the display for 5 seconds

CAUTION	Do not bypass the Dair function upon initial startup of the boiler or when water has been added to the boiler/system. Bypassing the Dair function may cause damage to the heat exchanger which could cause the boiler to fail. Bypassing the Dair function could lead to overheating or under heating resulting in property damage.

After communication has been established the following **Status overview** appears:

Heating Only boiler (CH models)

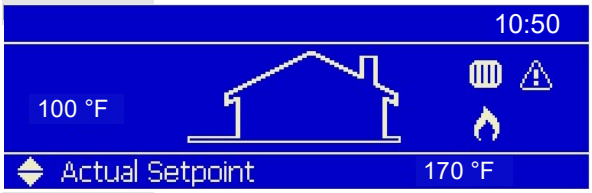


Figure 12.5

Heating & DHW boiler (CO models)

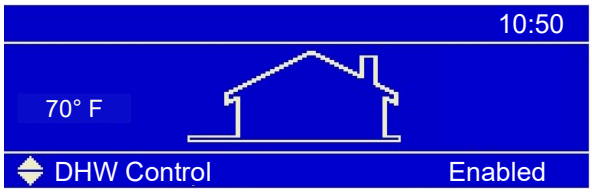
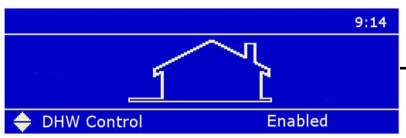
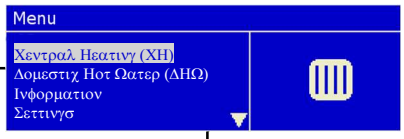


Figure 12.6

12.3 Control panel menu structure



Press menu button



Select 'Central Heating (CH) and press ENTER or RIGHT

Select 'CH setpoint' and press ENTER or RIGHT

Press ENTER or RIGHT to select and UP/ DOWN to change the value, and ENTER or RIGHT to confirm.

Select 'Domestic Hot Water (DHW)' and press ENTER or RIGHT

Using the submenu's following parameters can be set:
- **DHW Setpoint**
- **DHW Store Setpoint**
  Tank temperature setpoint.

Select 'Information' and press ENTER or RIGHT

Using the submenu's following items can be shown:
- **Software version**
  Showing the software version of the controller and display.
- **Boiler status**
  Showing the values of the different sensors.
- **Boiler History**
  Showing a resume of faults and burning hours
- **Error Log**
  Showing individual lock/block errors
  A level 1 password is needed to reset the error log.
- **Service**
  Showing service intervals

Select 'Settings' and press ENTER or RIGHT

Select 'General Settings' and press ENTER or RIGHT

Using the submenu's following items can be set :
- **Language**
  To set the menu language.
- **Unit Type**
  Setting to imperial or SI units.
- **Date & Time**
  Set date, time (zone), display mode summertime setting
- **Cascade mode**
  Full is max. 8 boilers, Basic is max. 16 boilers
- **Other settings**
  To change Modbus settings, Password level 2 is needed to change the start screen.

Select 'Boiler Settings' and press ENTER or RIGHT

Use password level 1 or 2 to get access to following parameters:
- **Boiler parameters**
  Boiler parameter settings
- **Module Cascade Settings**
  Cascade parameter settings
- **Boiler Cascade Settings**
  Cascade parameter settings
  Do NOT change these settings

Select 'System Test' and press ENTER or RIGHT

Select 'Test State' and press ENTER or RIGHT.

Setting of following test modes:
- **Fan Max, Low power, Ignit power, High Power, CH Max and Max Temp**
  Only accessible using password level *1 or 2*
- **LWCO/Air Intake and LWCO 2**

Figure 12.7

12.3.1 *SET ACTUAL SETPOINT/DHW SETPOINT DIRECTLY VIA THE STATUS OVERVIEW*

When CH is active, you can adjust the Actual setpoint directly on the bottom of the Status overview. When DHW is active, you can adjust the DHW setpoint directly on the bottom of the Status overview.

This means that when CH is active, you cannot set the DHW setpoint directly via the Status overview. When DHW is active, you also cannot set the Actual setpoint (CH setpoint) directly via the Status overview.

Press UP/DOWN ↑↓ to select the mode, then press ENTER ↵ or RIGHT → to confirm the mode and the Actual/DHW setpoint becomes directly settable. Use UP ↑ or DOWN ↓ to increase/decrease the setpoint.
Press ENTER ↵ or RIGHT → to confirm your alteration or press ESC ⎋ or LEFT ← to cancel.

A setpoint is only visible on the display when no error or alert is active. In case of an active error or alert, the bottom right part of the display is used to display the error or alert text.

12.3.2 *ENTERING THE MENU*

Enter the menu by pressing the MENU ☰ button once. The header in the display shows you are inside the main menu. While scrolling through the menu you will see that the selected menu item is shown in a white rectangle.

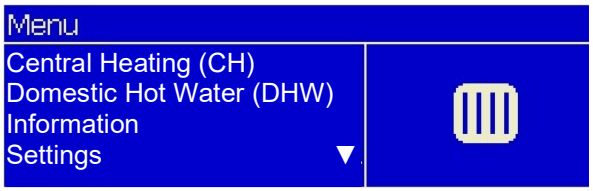


Figure 12.8

Enter a menu item by pressing ENTER ↵ or RIGHT →.
The header shows your location inside the menu, as seen in the following image:

If you are inside the menu (or a menu item) and want to return directly to the Status overview press MENU ☰ or ESC ⎋ If you want to go back one step in the menu press BACK/LEFT ← .

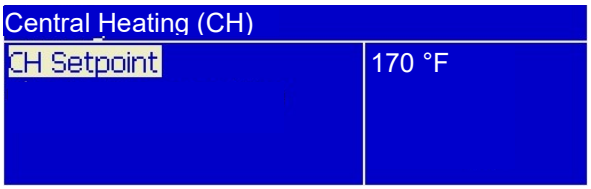


Figure 12.9

If CH-mode is set to:
CH mode 1 – CH with an outdoor temperature reset and thermostat control
or
CH mode 2 – Central Heating with full outdoor temperature reset
The following display will appear:

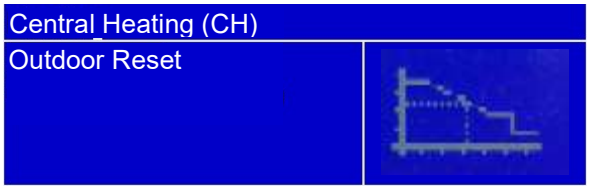


Figure 12.10

Enter a menu item by pressing ENTER ↵ or RIGHT →
The header shows your location inside the menu, as seen in the following image:

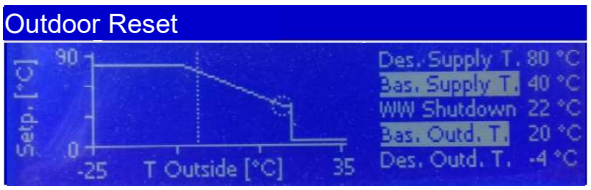


Figure 12.11

It now is possible to set the Outdoor reset curve by changing the parameters on the righthand of the screen.
If you are inside the menu (or a menu item) and want to return directly to the Status overview press MENU ☰ or ESC ⎋ If you want to go back one step in the menu press BACK/LEFT ← .

12.3.3 *PROTECTED MENU ITEMS*

Some menu items are protected and only accessible via a password*. The following password screen will appear:

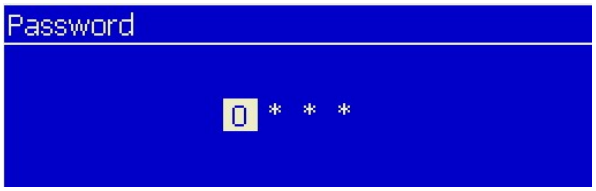


Figure 12.12

** Installers have to use the password 1122 to change parameters protected by a password.*

WARNING	Changing protected/safety parameters should only be conducted by experienced, licensed installers and service technicians or a service agency or the gas supplier. Hazardous burner conditions can occur due to improper operations which may result in property loss, physical injury, or death.

Enter the password with the following steps:

1.Use the UP/DOWN ↑↓ button to adjust the first number
2.Press ENTER ↵ or RIGHT → to confirm and to go to the following number

Repeat this action for all numbers to enter the password.
During this action, if you want to return to the previous screen, just press MENU ☰ or ESC ⎋ to cancel. After the password is entered in correctly, the menu item will become available.

12.3.4 *LANGUAGE SETTINGS*

The display has a number of different language options, such as English, French, Chinese and Italian.
BE AWARE: DO NOT set the language to the Chinese Language if you are not familiar with this language. Contact your installer for instructions if the display is set to Chinese and needs to be reset to another language.
Please follow the following steps, which describe how to set the display to a specific language:

1. From the Status Overview, press the MENU ☰ button once
2. Select “Settings” (press UP/DOWN ↑↓ to highlight/select) and press the ENTER ↵ button
3. Select “General Settings” (press UP/DOWN ↑↓ to highlight/select) and press the ENTER ↵ button
4. Select “Language” (press UP/DOWN ↑↓ to highlight/select) and press the ENTER ↵ button
5. Select the desired language (press UP/DOWN ↑↓ to highlight/select) and press the ENTER ↵ button

- For Chinese select ‘中文’.
- For Croatian select ‘Hrvatski’.
- For Czech select ‘Česky’.
- For Dutch select ‘Nederlands’
- For English select ‘English’.
- For French select ‘Français’.
- For German select ‘Deutsch’
- For Greek select ‘Ελληνικά’.
- For Hungarian select ‘Magyar’
- For Italian select ‘Italiano’
- For Polish select ‘Polski’.
- For Portuguese select ‘Português’.
- For Romanian select ’Românesc’.
- For Russian select ‘Русский’
- For Slovak select ‘Slovenský’.
- For Slovene select ’Slovenščina’.
- For Spanish select ‘Español’.
- For Turkish select ‘Türkçe’.

Table 12.2

Press ESC to go back in the menu and return to the Status overview.

12.4 Boiler history

The boiler history found in the information menu displays several history counters that keep track of the boiler usage. The history cannot be erased and will continue for the entire burner controller life cycle. The following boiler history data are available:

(Sub) Menu item	Description
Successful Ignitions	Number of successful ignitions.
Failed Ignitions	Number of failed ignitions.
Flame Failures	Number of flame failures (loss of flame).
Operation Days	Number of days that the appliance is operational (powered ON).
CH Burner Hours	Number of hours that the appliance has burned for Central Heating.
DHW Burner Hours	Number of hours that the appliance has burned for Domestic Hot Water.

Table 12.3

12.5 Error logging

Error logging is available. This functionality is linked to the Real-Time Clock functionality.
Errors will be logged for a stand-alone system or for a complete cascade system (based on the cascade settings). The display will monitor the error codes it receives from the boiler(s) and if an error code is a new error code the error will be stored in the error log. An error will be logged with a (real-time clock) time stamp (date and time) when the error was detected and a boiler ID of the boiler on which the error was detected.
The error log can be viewed from the error log menu, which is located in the information menu.

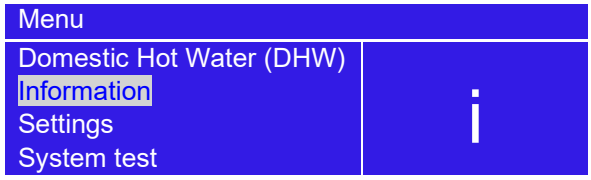


Figure 12.14

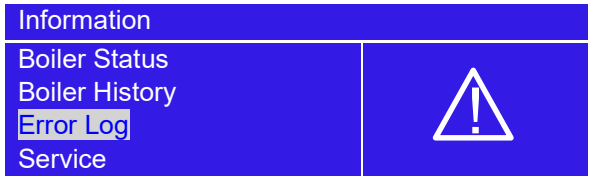


Figure 12.15

Figure 12.16

(Sub) Menu item	Description
Error Log	Show the error log (based on the selected filter options)
Filter Error Type	Filter errors based on the Error Type (Lockout/Blocking)
Filter Boiler ID (Cascade System only)	Filter errors based on Boiler ID (Managing, Dep 1, Dep2, etc.)
Clear Error Log	Clear the error log (protected by password)

Table 12.4

When no filtering option is selected (Disabled) the error log will show all errors for that category. So, if both filters are disabled, the error log will show all the errors in the log.

Figure 12.17

The error log screen will show on the first line: Boiler ID for which boiler the error was detected (cascade system only), Error Code, (internal) Error Number, Error Type (Lockout/Blocking).

The second line will show the Error Description.
The bottom line will show the Time Stamp (date and time) when the error was detected (in the format as configured in the Date Time Settings menu), and also the selected error index from the total number of errors in the (filtered) error log. Only Time Stamp, Code and Description is displayed.

Example see Figure 12. above. A014 = Error code. (14) = Error Number (tracking number, 1-15 errors are stored maximum). Lockout = Error type. Air Switch Not Closed = Error description. Wed 04-11-2018 14:50 = Time stamp when the error occurred.

NOTICE	A list of all error codes and how to solve them is provided in chapter 14.

12.6 Service reminder

The Service reminder will remind the owner/user of the appliance that the appliance needs to be serviced. The "Service_Interval" is factory set at 2000 burn hours. When service is not done within this time, a service reminder will be shown:

- on the screen: "Service is required!" is displayed, alternating with the normal status display;

NOTICE	If the message “Service is required” is shown, the boiler will continue running, but maintenance must be carried out before this message is reset.

12.6.1 *SERVICE OVERDUE LOGGING*

Menu/ Information/ Service/ Service history.
When the Service reminder has become active, the time (in hours) before service actually has been completed is being logged. This time is called the Service Overdue Time.
A maximum of 15 service moments can be logged by the system. When the log is full it will overwrite the oldest log entry. Each time the Service reminder is reset, a new service moment is logged (counted) and the Service Overdue counter will be stored in the log/history.

12.6.2 *RESET THE SERVICE REMINDER*

It is possible to reset the Service reminder counters before the Service reminder was actually active. This must be done when the appliance was serviced before the Service reminder was active. This means an overdue counter of 0 hours will be stored on the log (which makes sense because the service was not overdue but ahead of schedule).

To reset the Service Reminder on the PB-display:

- Select Information in the main menu
- Select Service and then "Reset service reminder".
- Enter the installer password.
- "Reset service reminder" can be set to "YES" for resetting the service reminder. The overdue time is recorded in the service history.

12.7 General

The boiler controller is designed to function as a standalone control unit for intermittent operation on heating appliances with a premix (modulating) burner and a pneumatic air-gas system.

Mains input	1 x 5AT, 120V		
Flame establishing period	2 seconds		
Safety time	5 seconds		
Ignition attempts	5		
Pre-purge time	≥ 2…60 seconds (not safety critical)		
Pre-ignition time	2 seconds (not safety critical)		
Flame failure response time	< 1.0 second		
Flame-current	Minimum Start-detection	1.0 µA 1.5 µA	
Cable length AL-BUS[1]		AWG (mm²)	Cable length (m)
		23 (0.25)	328.1 ft (100)
		20 (0.5)	656.2 ft (200)
		18 (0.75)	984.3 ft (300)
		17 (1.0)	1312.3 ft (400)
		15 (1.5)	1968.5 ft (600)
1) This concerns the total length of the cable, not the length between two boilers. The length differs with the diameter of the cable.			

Table 12.5

12.7.1 *CIRCULATOR START EVERY 24 HOURS*

To protect the circulator from getting stuck at a certain position it is forced to run for 10 seconds every 24 hours. This is done only for the boiler loop circulator.

12.7.2 *FROST PROTECTION*

The Frost protection function protects the boiler and boiler loop from freezing.
The T_Supply and T_Return sensors are checked for generating a Frost protection demand.

- When any of the sensors drop below FP_Start_Circulator the boiler loop circulator is switched ON for CH.
- When any of the sensors drop below FP_Start_Burn the boiler is fired.
- When all of the sensors measure above FP_Stop the Frost protection demand is ended.

When the demand for Frost protection is ended the circulators will post-circulate for CH_Post_Circulator_Period.
Parameters are factory set

12.7.3 *FLUE TEMPERATURE PROTECTION*

The flue temperature protection function protects against the flue gas reaching a too high temperature.

- When the T_Flue sensor measures above the Max_Flue_Gas_Temp, the control generates a Flue_Gas_Error.
- When the Flue Switch closes, the control generates a Flue_Gas_Error.

When the control is in a Flue_Gas_Error the fan will run at the minimum fan speed.

Boiler power limitation
All boilers have a flue gas sensor. The control will limit the boiler power when the flue gas temperature reaches the set Max_Flue_Gas_Temp. The maximum boiler power is linearly limited when the flue gas temperature is within Max_Flue_Gas_Temp minus 9 ºF (5 ºC) and Max_Flue_Gas_Temp.

Parameters are factory set.

WARNING	Repeated flue gas errors could indicate an issue with the boiler or the exhaust flue venting. If repeated errors occur check the boiler to ensure it is running correctly, has sufficient flow, and that the heat exchanger has been serviced and cleaned at the required maintenance intervals. Check to ensure there are no blockages in the venting or terminations. Failure to follow these instructions could result in substanial property damage, serious injury, or death

12.8 Ignition cycle

During the ignition cycle multiple safety checks are active

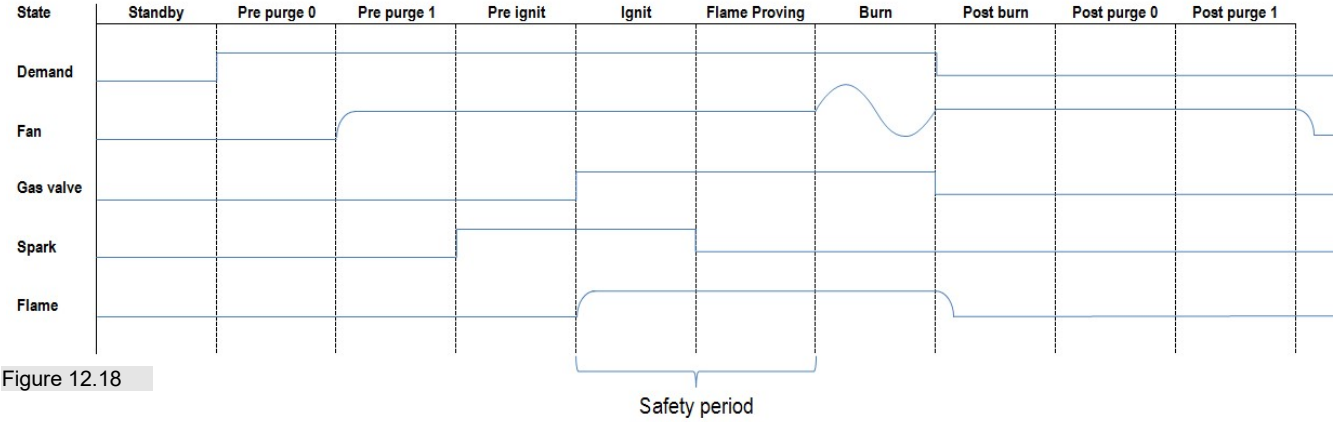


Figure 12.18

The table below shows the states of the burner ignition cycle, as shown in the diagram above:

#	Burner state	Actions
0	INIT	▪ Controller initialization
1	RESET	▪ Software reset (and initialization)
2	STANDBY	▪ Standby (waiting for demand)
3	PRE_PURGE_0	▪ Fan is not running ▪ When an APS is enabled the APS position is checked ▪ Circulator starts ▪ Air damper check is performed
4	PRE_PURGE_1	▪ Fan starts at ignition speed ▪ When an APS is enabled the APS position is checked
5	PRE_IGNIT	▪ Fan stays at ignition speed ▪ Igniter is started ▪ When a LPG tank is selected, the tank valve is opened
6	IGNIT	▪ Fan stays at ignition speed ▪ The gas valve is opened ▪ Igniter stays on ▪ When a LPG tank is selected, the tank valve stays opened
7	FLAME_PROVING	▪ Fan stays at ignition speed ▪ The gas valve stays opened ▪ The igniter is stopped ▪ When a LPG tank is selected, the tank valve stays opened
8	BURN	▪ The fan is modulating ▪ The gas valve stays opened ▪ When a LPG tank is selected, the tank valve stays opened ▪ When an APS is enabled the APS position is checked
9	POST_BURN	▪ Fan is set to minimum speed ▪ The gas valve stays opened
10	POST_PURGE_0	▪ The fan is set at ignition speed ▪ The gas valve is closed ▪ When a LPG tank is selected, the tank valve is closed
11	POST_PURGE_1	▪ Fan stays at ignition speed ▪ When an APS is enabled the APS position is checked
12	ERROR_CHECK	▪ Blocking error is set ▪ Checking if blocking error can be removed (error situation is solved)
13	ALARM	▪ Lockout error is set ▪ User must reset the lockout error (and the controller will reboot)
14	BURNER_BOOT	▪ Finalize processes and reboot the control

Table 12.5a

During the ignition cycle multiple safety checks are active, none of the initiation timing settings are adjustable:

False flame detection	If a flame is detected at the end of the pre-spark period (*Pre_Ignit*) a lockout error will occur.
Re-ignition	If at the end of the safety period no flame is detected the control will go to *Post_Purge* to remove any unburnt gas. After this a re-ignition attempt is started following the same cycle. The number of re-ignition attempts is limited to *Max_Ignit_Trials* after which a lockout occurs.
Flame establishing time	Sparking stops in the *Flame_Proving* state to allow for ionization detection. The *Flame_Proving* state takes *Safety_Period - Ignit_Period*.
Flame out too late	If at the end of the *Post_Purge* 0 state the flame is still detected a lockout follows.
Flame loss	When a flame is lost during a burn cycle the control will restart the burner. The number of restarts is limited by the *Max_Flame_Trials* setting.
Fan supervision	The fan speed is continuously monitored. The following conditions for the fan speed are checked: ▪ The actual fan speed must be within 300RPM of the target fan speed ▪ When the fan speed duty cycle is within the lower/upper 5% of the PWM duty cycle range no errors will be generated since the fan is in the limits of its working range.

Table 12.6

12.8.1 *FLAME DETECTION*

When the boiler is firing, and the flame is not detected anymore, the gas valve will be closed, and the control will perform a post-purge, after which a restart will take place.
The presence of a flame is measured through the flame rod that points into the flame. The flame current is measured by the control as ionization in micro amps (µA).

When the flame current is above Flamerod_Setpoint plus Flamerod_Hysterese (1.0 µA plus 0.5 µA) a flame is present. When the flame current is below Flamerod_Setpoint (1.0 µA) the flame will not be present.

12.8.2 *FLAME RECOVERY*

When the ionization current is too low, the system responds by increasing the minimal fan speed, in order to keep the flame present. This is done by increasing the minimal fan speed when the ionization current is too low.

Whenever the ionization current is high enough, the minimal fan speed will be decreased again. When the flame still disappears the minimal fan speed will be increased for the next burn cycle.

- When the flame current is below Flamerod_Setpoint plus Flamerod_Delta (1.0 µA plus 0.2 µA) the minimal fan speed will be increased.
- When the flame current is above Flamerod_Setpoint plus Flamerod_Delta plus Flamerod_Delta * 2 (1.0 µA plus 0.2 µA plus 0.4 µA) the minimal fan speed will be decreased.

When the flame still disappears the minimal fan speed will be increased for the next burn cycle.

No. of flame losses	Description
0	Minimal fan speed as set in the system
1	In between minimal and ignition fan speed
2	Ignition fan speed

Table 12.7

When the system successfully completes a burn cycle, the minimal fan speed will be reset to the set minimal fan speed in the system.

12.9 Control functions Central Heating

Depending on the required functions of the appliance and connected sensors and components, several operation modes for Central Heating (CH) can be selected.

The following CH modes are available for both Heating Only (CH) and Combi (CO) boilers:
- CH mode 0 – Central Heating demand with thermostat control
- CH mode 1 – CH with an outdoor temperature reset and thermostat control
- CH mode 2 – Central Heating with full outdoor temperature reset
- CH mode 3 – Central Heating with permanent heat demand
- CH mode 4 – Central Heating with analog input control of setpoint
- CH mode 5 – Central Heating with analog input control of power output

12.9.1 *ROOM THERMOSTAT ONLY; CH MODE 0*

This mode is available (and default) to both Heating Only (CH) and Combi (CO) boilers.

For this mode the CH mode must be set to 0 and no outdoor sensor is needed.
When the room thermostat closes, the boiler and system circulators are switched ON. When the supply temperature drops CH_Hysterese_Down below the CH_Setpoint (settable via the menu) the boiler is switched ON. The power for the boiler is PID regulated between T_Supply and the CH_Setpoint using PID parameters for Central Heating.
If the supply temperature reaches a temperature CH_Hysterese_Up above the CH_Setpoint the boiler is switched OFF. However, if CH_Setpoint plus CH_Hysterese_Up is greater than the maximum setpoint the boiler switches OFF at the maximum setpoint.
If the room thermostat opens the boiler is switched OFF and the boiler and system circulators keep running during Boiler_Pump_Overrun.

Anti-cycling time
(This function is also applicable to all other CH modes).
When the boiler is switched OFF because the supply temperature reaches CH_Setpoint plus CH_Hysterese_Up, the control will wait a period of time (Anti_Cycle_Period = 180 seconds) before it is allowed to be switched ON again. This function is to prevent short cycling ON and OFF of the boiler. However, when during the anti-cycle wait time the differential between setpoint and supply temperature gets greater than Anti_Cycle_T_Diff, anti-cycle will be aborted, and the boiler is allowed to start.

Maximum CH power
(This function is also applicable to all other CH modes)
The maximum boiler power during CH operation can be limited with parameter Max. Power CH (parameter 14)

Minimum CH power
(This function is also applicable to all other CH and DHW modes)
The minimum boiler power during operation can be limited with parameter Min. Power CH (parameter 15)

Adjustable Thermostat Heating Parameters

Specific Parameters	Display parameter	Level	Default Value	Range
CH Mode	1	Installer	0	Mode 0-5
CH Setpoint Sets the required supply temperature	3	Installer	176 ºF (80 ºC)	68…..194 ºF (20…..90 ºC)
Boiler Pump Overrun	5	Installer	120 sec.	10…..900 sec
Anti Cycle Period	9	Installer	180 sec	10…..900 sec
Anti Cycle Temp. Diff Aborts anti-cycle time when setpoint – actual supply temp > Anti_Cycle_T_Diff	10	Installer	29 ºF (16 ºC)	0…..36 ºF (0…..20 ºC)
Max. Power CH Maximum boiler power for CH operation	14	Installer	100 %	1…..100 %
Min. Power CH Minimum boiler power for CH operation	15	Installer	1 %	1…..50 %

Table 12.8

12.9.2 *CH WITH AN OUTDOOR TEMPERATURE RESET AND THERMOSTAT; CH MODE 1*

This mode is available to both Heating Only (CH) and Combi (CO) boilers.

If the parameter CH Mode (parameter 1) is set to 1, the “Outdoor temperature reset with room thermostat” mode is selected. This mode will only function when an outdoor temperature sensor is connected. If no outdoor sensor is connected, the boiler automatically uses Design Supply Temp. (parameter 19*)* as the setpoint.

The setpoint is calculated depending on the outdoor temperature as indicated in the following graph and the boiler will react on the room thermostat (as described in paragraph 12.9.1).

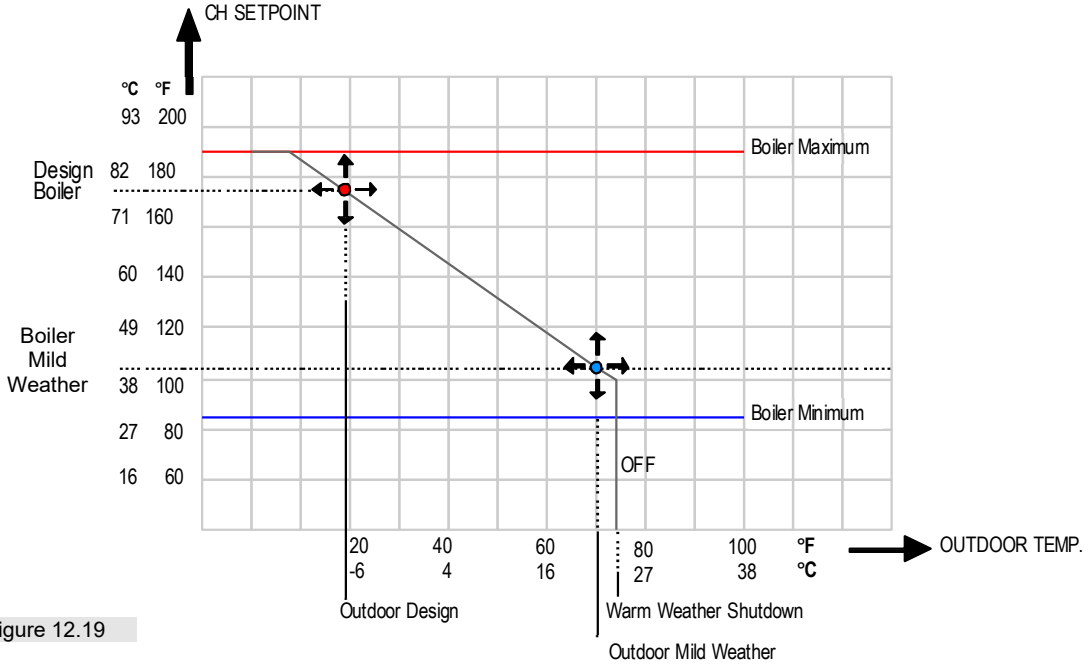


Figure 12.19

CH outdoor reset curve
The outdoor reset curve can be changed by adjusting the design and mild weather reference temperatures. The calculated CH-setpoint is always limited between parameters Design Supply Min. Limit (parameter 23) and Design Supply Max. Limit (parameter 24).

The outdoor temperature used for the CH_Setpoint calculation is measured once a minute and averaged with the previous measurement. This is to avoid commuting when the outside temperature changes rapidly. If an “open” outdoor sensor is detected the CH_Setpoint will be equal to Design Supply Temp. (parameter 19).

Shutdown temperature
When the outdoor temperature rises above Warm_Weather_Shutdown (parameter 25), the heat demand is blocked, and the circulators are stopped. There is a fixed hysteresis of 1.8 °F (1 °C) around the Warm_Weather_Shutdown setting. This means that the demand is stopped when the outdoor temperature has risen above Warm_Weather_Shutdown plus 1.8 °F (plus 1 °C). When the outdoor temperature drops below Warm_Weather_Shutdown minus 1.8 °F (minus 1 °C) again, the demand will start again.

Boost function
The outdoor reset boost function increases the CH_Setpoint by a prescribed increment (Boost_Temperature_Incr) if a demand for heat continues beyond the pre-set time limit (Boost_Time_Delay).

Boiler Parameters		
(25) Warm Weather Shutdn	72 °F	▲
(26) Boost Temp increment	0 °F	
(27) Boost Time Delay	20 min	
(28) Night Setback Temp.	18 °F	▼

Figure 12.20

Parameters 26 Boost Temp Increment and 27 Boost Time Delay have default values of 0 °F and 20 min, so the function is switched off and can be activated by the installer by increasing parameter 26 by a number of degrees. Also, the time can be set when this parameter will be active in parameter 27 (now set at 20 min).
CH_Setpoint increases again if the demand for heat still is not satisfied in another time increment.

Setpoint adjustment
It is possible to adjust the calculated setpoint with parameter CH_Setpoint_Diff. The calculated setpoint can be increased or decreased with a maximum of 50 °F (10 °C). The CH setpoint limits (Reset_Curve_Boiler_Minimum and Reset_Curve_Boiler_Maximum) are respected while adjusting the setpoint.
Apart from the calculated setpoint the functionality is the same as described in paragraph 12.9.1.

Adjustable Outdoor Reset parameters

Parameters	display parameter	Level	Default Value	Range
CH_Mode	1	Installer	0	Mode 0-5
Design Supply Temp. Sets high boiler CH setpoint when outdoor temp. is equal to *Design_Outdoor_Temp.*	19	Installer	176 ºF (80 ºC)	32…..176 ºF (0…..80 ºC)
Design Outdoor Temp. Sets the outdoor temp at which the boiler setpoint must be high as set by *Design_Supply Temp.*	20	Installer	23 ºF (-5 ºC)	-4…..41 ºF (-20…..5 ºC)
Baseline Supply Temp. Sets low boiler CH setpoint when outdoor temp. is equal to *Baseline_Outdoor_Temp.*	21	Installer	104 ºF (40 ºC)	32…..104 ºF (0…..40 ºC)
Baseline Outdoor Temp. Sets the outdoor temp at which the boiler setpoint must be low as set by *Baseline_Supply_Temp.*	22	Installer	68 ºF (20 ºC)	32…..86 ºF (0…..30 ºC)
Design Supply Min. Limit Sets the lower limit for the CH setpoint (minimum).	23	Installer	68 ºF (20 ºC)	68…..194 ºF (20…..90 ºC)
Design Supply Max. Limit Sets the upper limit for the CH setpoint (maximum).	24	Installer	185 ºF (85 ºC)	68…..194 ºF (20…..90 ºC)
Warm Weather Shutdn Set maximum outdoor temperature. Above this temperature heat demand is blocked.	25	Installer	72 ºF (22 ºC)	32…..95 ºF (0…..35 ºC)
Boost Temp Increment CH setpoint increment when heat demand remains beyond *Boost_Time_Delay*.	26	Installer	0 ºF (0 ºC)	0…..54 ºF (0…..30 ºC)
Boost Time Delay	27	Installer	20 min.	1 – 120 min.
CH Setpoint Diff Adjusts the calculated CH setpoint.	109	User	0 ºF (0 ºC)	-18…..18 ºF (-10….10 ºC)

Table 12.9

Status variables	Range
Actual_CH_Setpoint Calculated CH setpoint, based on outdoor reset curve	68...194 ºF (20.....90 ºC)

Table 12.10

12.9.3 *CH WITH CONSTANT CIRCULATION SYSTEM OUTDOOR RESET; CH MODE 2*

This mode is available to both Heating Only (CH) and Combi (CO) boilers.

When CH_Mode is set to 2, full weather compensator is chosen. For this mode an outdoor sensor has to be connected. The CH_Setpoint is calculated in the same way as described in paragraph 12.9.2.

However, the demand does not depend on the Room Thermostat input but on the outdoor temperature and the outdoor reset setpoint. When the outdoor temperature is below Warm_Weather_Shutdown (settable) CH demand is created.

During the night an RT input signal from an external clock can lower the CH_Setpoint. When the RT input opens CH_Setpoint will be decreased with Night_Setback_Temp (parameter 28). The RT input does not influence the CH demand directly !

This can be done by connecting a relay contact or clock thermostat to terminal 12 and 13 on the low voltage connectors of the boiler (see paragraph 11.3.1). The room thermostat is only being used in this function to switch between a night setback temperature and a daytime temperature, there is always a constant demand for heat in CH mode 2.
The Night Setback temperature can be changed by changing parameter 28 in the boiler parameters; the default value is 18 °F.

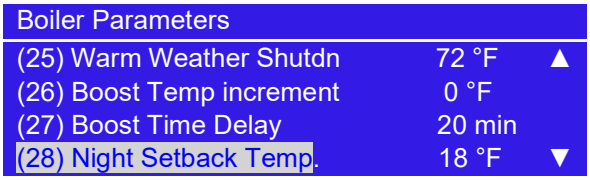


Figure 12.21

Adjustable constant Circulation Parameters

Parameters	Display parameter	Level	(Default) Value	Range
CH Mode	1	Installer	0	Mode 0 - 5
Warm Weather Shutdn Set maximum outdoor temperature. Above this temperature, heat demand is blocked.	25	Installer	72 ºF (22 ºC)	32...95 ºF (0...35 ºC)
Night Setback Temp. Lowering CH setpoint during the night	28	Installer	18 ºF (10 ºC)	0…54 ºF (0…30 ºC)
CH_Setpoint_Diff Adjusts the calculated CH setpoints	109	User	0 ºF (0 ºC)	-18...18 ºF (-10...10 ºC)

Table 12.11

12.9.4 *CH WITH CONSTANT CIRCULATION AND PERMANENT HEAT DEMAND; CH MODE 3*

This mode is available to both Heating Only (CH) and Combi (CO) boilers.

In CH Mode 3 no outdoor sensor is needed. The supply temperature is kept constantly at the setpoint temperature. The boiler is controlled in a similar way as described in paragraph 12.9.1. When the room thermostat contact opens CH_Setpoint will be decreased with Night_Setback_Temp.
In this mode the circulator is always ON.
Please note that the circulator starts every 24 hours function is not performed during this mode.

Parameters	Display parameter	Level	(Default) Value	Range
CH_Mode	1	Installer	0	Mode 0 - 5
CH_Setpoint	3	Installer	176 ºF (80 ºC)	68…..194 ºF (20…..90 ºC)

Table 12.12

12.9.5 *CENTRAL HEATING WITH ANALOG INPUT CONTROL OF SETPOINT; CH MODE 4*

This mode is available to both Heating Only (CH) and Combi (CO) boilers.

In CH mode 4 of operation, the boiler CH setpoint is controlled by an analog input signal provided by a remote means such as a Building Management System or a system controller. The analog input 0-10 Vdc is used to adjust the boiler setpoint between the CH Setpoint Minimum and the CH Setpoint Maximum settings.

The minimum analog input signal will correspond with the CH Setpoint Minimum parameter and the maximum analog input signal will correspond to the CH Setpoint Maximum parameter. All other safety and control functions associated with the boiler will react normally to adverse condition and override control of the analog signal to prevent an upset condition. This means for example that when the signal is going up faster than the boiler can regulate that the boiler will slow down to prevent overshoot in temperature.

The CH Setpoint Minimum and CH Setpoint Maximum parameters can be adjusted to provide the desired temperature adjustment band. A heat request will be generated by an input of 1.5 Volts or higher. Setpoint modulation will occur between 2 and 9 Volts. The request for heat is removed when voltage drops below 1 Volt.

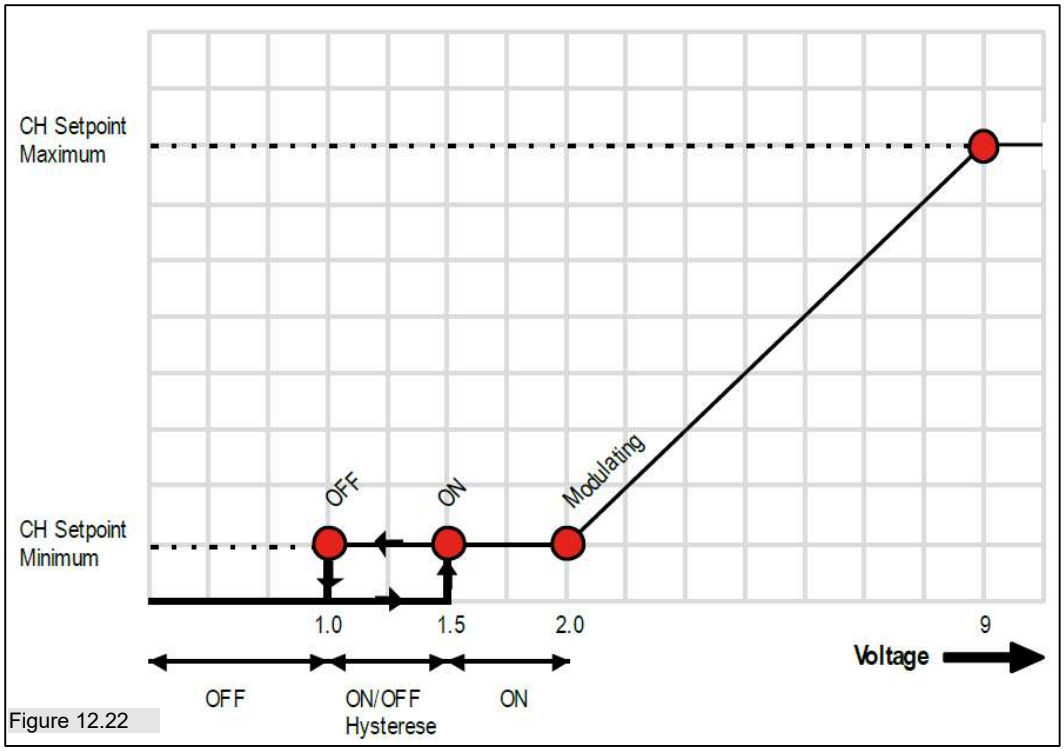


Figure 12.22

- RT input must be shorted to generate heat demand. / Min/Max CH power setting is limiting 0-10V range.

Parameters	Display parameter	Level	(Default) Value	Range
CH Mode	1	Installer	0	Mode 0, 1, 2, 3, 4, 5
CH Setpoint Minimum	110	Installer	68 ºF (20 ºC)	68...194 ºF (20...90 ºC)
CH Setpoint Maximum	111	Installer	185 ºF (85 ºC)	68...194 ºF (20...90 ºC)

Table 12.13

12.9.6 *CH WITH ANALOG INPUT CONTROL OF POWER OUTPUT; CH MODE 5*

This mode is available to both Heating Only (CH) and Combi (CO) boilers.

In CH mode 5 of operation, the boiler power (boiler input) is controlled by an analog input signal provided by a remote means such as a Building Management System or a system controller. The analog input 0-10 Vdc is used to adjust the boiler power output between the minimum boiler input and the maximum boiler input settings.

The minimum analog input signal value will correspond to the minimum modulation rate and the maximum modulation analog input signal value will correspond to the maximum modulation rate.
All other safety and control functions associated with the boiler will react normally to adverse condition and override control of the analog signal to prevent an upset condition.

CH Mode 5 will not work in cascade.

A heat request will be generated by an input of 1.5 Volts or higher. The fan speed modulation will occur between 2.0 and 9.0 Volts. The request for heat will stop when the voltage drops below 1 Volt.

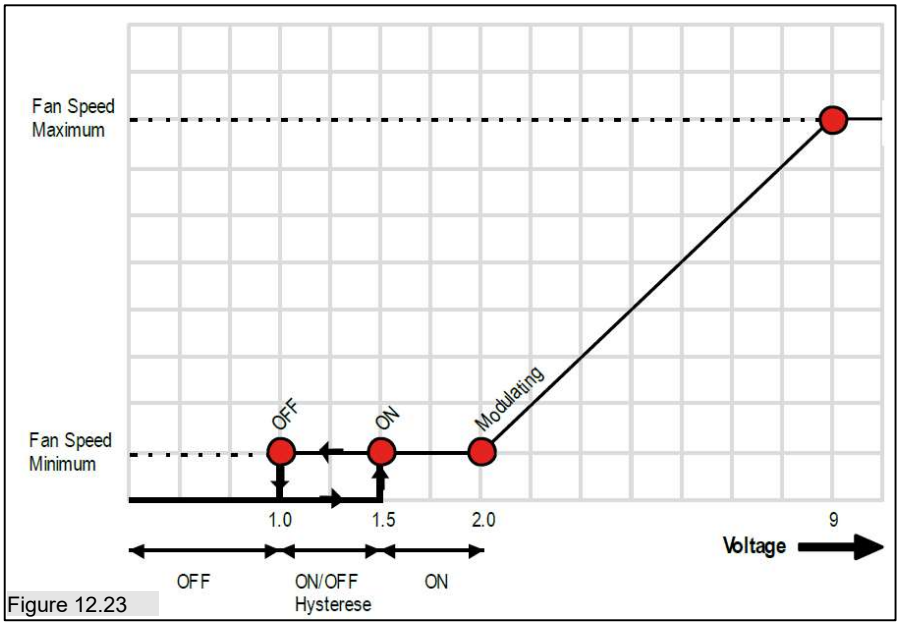


Figure 12.23

- CH mode 5 will work without sensors.
- RT input must be shorted to generate demand

Parameters	Display parameter	Level	(Default) Value	Range
CH Mode	1	Installer	0	Mode 0, 1, 2, 3, 4, 5

Table 12.14

Using CH mode 5 the temperature needs to be controlled by an external temperature controller. When the boiler has a supply temperature of 203 ºF (95ºC) the boiler switches off and shows a blocking code "High Temp Error" (105), wait until the temperature has dropped to 194 ºF (90 ºC) now the boiler will start again.
So the external controller needs to reduce the 0-10V signal or switch the boiler off before it reaches 203 ºF (95ºC).
When connecting the 0-10V signal the room thermostat signal needs to be bridged to activate the signal.

When using a modulating pump on pwm signal the pomp will only run on the fixed PWM signal. This signal can be modified in parameter (136) Mod. Pump Mode. The pomp will not modulate on delta T setpoint. If it is neccessary to use a delta T controlled setpoint of the pump use CH-mode 4.

12.10 Control Functions Domestic Hot Water

Depending on the type and required functions of the appliance and connected sensors and components, several operation modes for Domestic Hot Water (DHW) can be selected.

The following modes are available for DHW **and only available for Heating Only boilers (CH models).**
- DHW mode 0 – No Domestic Hot Water
- DHW mode 1 – Storage with sensor
- DHW mode 2 – Storage with thermostat

Following modes are not used. Contact your supplier for further information if necessary.
- DHW mode 3 – Instantaneous water heating with plate heat exchanger, flow switch and DHW-out sensor
- DHW mode 4 – Instantaneous water heating with plate heat exchanger and DHW-out sensor

DHW mode 5 is the only mode available for Combi boilers (CO models).
- DHW mode 5 – Instantaneous water heating with plate heat exchanger, DHW-out sensor and rotary switch

12.10.1 *NO DOMESTIC HOT WATER; DHW MODE 0*

This mode is only available for Heating Only boilers (CH models).
No domestic hot water is available. The T_DHW_Out sensor does not need to be connected.

12.10.2 *HIGH PRESSURE DROP INDIRECT TANK DHW MODE 1 AND 2 (CH BOILERS ONLY)*

When using DHW mode 1 or 2 and the coil in the tank has a high pressure drop an extra DHW circulator can be added. The pump can be connected to terminals 4-5-PE. In that case, parameter 125 (program output 1) needs to be changed from 2 (CH circulator) to 3 (DHW circulator) (see the table in §11.8).

Please note that this means that a system circulator can not be controlled anymore because it is occupied by the DHW circulator. The system circulator can be powered by an auxiliary power supply and will run 24/7 therefore an open header or T-piece is needed to make the boiler work correctly. Or an external controller must control the system circulator and switch on and off on heat demand from the system. Another option is to connect the DHW pump to the connections of the 3-way valve. This option is discussed in example 4 (figure 21.4) of chapter 21.

Below table shows the maximum available pressure drop that can be used with the boiler itself without the need of an additional DHW circulator. Whenever an indirect storage tank with a greater pressure drop is used, an additional DHW circulator is necessary. With the 180-CH there is always an additional DHW circulator necessary because the internal circulator has not enough capacity to maintain a delta T of 35ºF.

Boiler type	**maximum pressure drop coil @ delta T of 35ºF**	**unit**
CH-80	17	ft.head (w.c.)
CH-100	11	ft.head (w.c.)
CH-120	12	ft.head (w.c.)
CH-150	2	ft.head (w.c.)
CH-180	External DHW pump required	

Table 12.15

See figure 20.4 (System example 4) for a schematic drawing.

12.10.3 *DHW STORAGE WITH SENSOR; DHW MODE 1*

This mode is only available for Heating Only boilers (CH models).

Mode 1: DHW is prepared by warming up a store. The 3-way valve in the Heating Only boiler will be activated when this mode is used. The indirect tank can be connected directly to the connections under the boiler.

The DHW temperature in the tank is measured with sensor T_Store and set with parameter DHW_Store_Setpoint (parameter 115). When this sensor drops below DHW_Store_Setpoint (par. 115) minus DHW_Tank_Hyst_Down (parameter 36) the control detects a demand for the store and starts the general and DHW circulator.
If the supply temperature T_Supply is below DHW_Store_Setpoint plus DHW_Tank_Supply_Extra minus DHW_Tank_Supp_Hyst_Dn the boiler is started as well.

When the boiler is ON the power is PID-modulated so T_Supply is regulated towards DHW_Setpoint plus DHW_Tank_Supply_Extra.

The boiler is stopped when the supply temperature rises above DHW_Store_Setpoint (parameter 115) plus DHW_Tank_Supply_Extra (parameter 38) plus DHW_Tank_Supp_Hyst_Up (parameter 37).
The demand for the tank is ended when the tank-sensor rises above DHW_Store_Setpoint plus DHW_Tank_Hyst_Up. The circulator continues DHW_Pump_Overrun (parameter 44).

DHW Priority
Standard DHW demand has priority over CH demand but the priority period is limited up to DHW_Max_Priority_Time (parameter 43). The priority timer starts when both CH and DHW demand are present. After the DHW_Max_Priority_Time is achieved, the control will switch from DHW to CH operation. CH has priority now for a maximum period of DHW_Max_Priority_Time.
Different DHW Priority types can be chosen using the *DHW_Priority* parameter (parameter 42):

DHW priority	Description
0 → Time	DHW has priority to CH during DHW_Max_Priority_Time
1 → OFF	CH always has priority to DHW
2 → ON	DHW always has priority to CH
Default *DHW_Priority* is set to 2 (ON).	

Table 12.16

Store warm hold function
Because of the presence of the indirect tank sensor (*T_Store*) the control can detect demand for holding the indirect tank hot. If *T_Store* drops below *DHW_Store_Setpoint minus DHW_Store_Hold_Warm* the boiler starts at minimum power. The boiler stops if *T_Store* is higher than *DHW_Store_Setpoint plus DHW_Store_Hyst_Up*.

Relevant variables

Specific Parameters	Display parameter	Level	(Default) Value	Range
DHW Mode	35	Installer	0	0, 1, 2, 3, 4, 5, 6, 7, 8
DHW Store Setpoint sets the desired DHW Tank temperature	115	User	122ºF (50 ºC)	104 ... 160 °F (40....71 °C)
DHW Tank Hyst. Down Point where boiler starts for heat demand = setpoint – hysteresis	36	Installer	7.2ºF (4 ºC)	0 ... 36 °F (0....20 °C)
DHW Tank Hyst. Up Boiler stops firing when setpoint + hysteresis up is reached	37	Installer	5.4ºF (3 ºC)	0 ... 36 °F (0....20 °C)
DHW Tank Supply Extra increases the supply temperature to the storage until DHW-Store_Setpoint plus DHW_Store_Supply_Extra	38	Installer	27 °F (15 °C)	0... 54 °F (0...30 °C)
DHW Store Hold Warm	41	Installer	5.4ºF (3 ºC)	0... 18 °F (0....10 °C)

Table 12.17

Status Variables	Value
DHW control state	0 → Idle
	1 → Request
	2 → Demand
	3 → Post circulation
	4 → Off

Table 12.18

12.10.4 *DHW STORAGE WITH THERMOSTAT; DHW MODE 2*

This mode is only available for Heating Only boilers (CH models).

In this mode DHW is prepared by warming up an indirect tank. The 3-way valve in the Heating Only boiler will be activated when this mode is used. The indirect tank can be connected directly to the connections under the boiler.

In this mode, the temperature of the DHW in the indirect tank is regulated by a thermostat/aquastat (instead of a sensor), which must provide only an open/closed signal to the control.

When the thermostat/aquastat closes, the control detects a demand from the DHW indirect tank and starts the DHW circulator. When the supply temperature T_Supply drops below DHW_Store_Setpoint minus DHW_Tank_Supp_Hyst_Dn the boiler starts. When the boiler is ON the power is PID-controlled based on T_Supply toward DHW_Store_Setpoint.

The boiler is stopped when the supply temperature rises above DHW_Store_Setpoint plus DHW_Tank _Supp_Hyst_Up. The demand for DHW ends when the indirect tank thermostat/aquastat opens. The circulator continues DHW_Pump_Overrun after the DHW demand has stopped.

For DHW priority, see paragraph 12.10.3.

Relevant variables

Specific Parameters	Display parameter	Level	(Default) Value	Range
DHW Mode	35	Installer	0	0, 1, 2,3, 4, 5, 6, 7, 8
DHW Store Setpoint Sets the supply temperature from the boiler to prepare DHW in the indirect tank	115	User	122ºF (50ºC)	104...185 ºF (40...85 ºC)
DHW Priority	42	Installer	2	0=Time, 1=OFF, 2=ON
DHW Max Priority Time Sets the maximum time for either DHW or CH priority.	43	Installer	60 min.	
DHW Pump Overrun	44	Installer	20 sec.	10...900

Table 12.19

12.10.5 *INSTANTANEOUS WATER HEATING WITH PLATE HEAT EXCHANGER; DHW MODE 5*

This is the only DHW mode available for Combi boilers (CO models).
The other DHW modes are not available for Combi boilers.

In DHW mode 5 the water flow through a plate heat exchanger is checked with a DHW-out sensor and a rotary switch. In this DHW mode the DHW-sensor is used for modulating the burner to the required DHW setpoint. The rotary switch is used for detecting tap demand and detecting whether the burner can stay ON.

Specific Parameters	Display parameter	Level	(Default) Value	Range
DHW Mode	35	Installer	0 for CH 5 for CO	0, 1, 2, 3, 4, 5, 6, 7, 8
DHW Setpoint Sets the desired DHW temperature	48	User	122ºF (50ºC)	86...176ºF (30...80ºC)

Table 12.20

12.10.6 *PREHEAT*

This option is only available for Combi boilers (CO models)

In order to achieve a quick response for supply of sanitary water the plated heat-exchanger (DHW Plate) can be kept warm with a preheating function.

Following preheating modes are available:

Preheat mode	Description
0: Off	Preheat mode is disabled
1: Anti-Frost	In this mode the heat exchanger is kept at the Anti_Frost_Setpoint
2: Eco mode	In this mode the heat exchanger is kept at the Eco_Setpoint
3: Comfort mode	In this mode the heat exchanger is kept at the *Preheat_Setpoint* temperature, which equals *DHW_Setpoint* - 5°C - *Pre_Heat_Hyst_Down*

Table 12.21

When preheat is active, the burner operates at minimal power during Pre_Heat_Burner_On_Max_Time. After that, the burner will be off during Pre_Heat_Burner_Off_Interval_Time.

When the active *DHW_Mode* detects a tap demand during preheat the DHW mode demand will have priority. When the DHW demand is ended the preheat start/stop conditions are checked to either continue or end the preheat demand.

Specific Parameters	Display parameter	Level	(Default) Value	Range
Pre Heat Mode	64	Installer	2	0 - 3
Pre Heat Eco Setpoint	65	Installer	86ºF (30ºC)	68...140ºF (20...60ºC)
Pre Heat Hyst Down		Factory	9ºF (5ºC)	

Table 12.22

12.10.7 *ANTI-LEGIONELLA PROTECTION*

This option is only available for Heating Only boilers (CH models).

Anti-Legionella can be enabled for CH-boilers in DHW mode with an external tank with a sensor (DHW Mode 1). To prevent legionella a special function is implemented in the software.

When DHW Mode 1 is selected the Anti-Legionella protection will be checked on the T_DHW_Out sensor. At least once every 168 hours (= 7 days) the measured sensor temperature must reach a temperature above *Anti_Legionella_Setpoint + DHW Tank Supply Extra* (parameter 38) for at least *Anti_Legionella_Burn_Time*. When this condition has not been met an Anti-Legionella request is forced to heat up the system. Note that the interval of 168 hours is a fixed parameter and cannot be changed.

After a cold boot of the control the Anti-legionella cycle is forced to start after 120 minutes. This is also a fixed parameter and cannot be changed.

When the Anti-legionella request is active the measured sensor temperature must stay above *Anti_Legionella_Setpoint + DHW Tank Supply Extra – 3°C* for at least *Anti_Legionella_Burn_Time*. When the measured sensor temperature drops below this level the *Anti_Legionella_Burn_Time* is reloaded.

The anti-legionella demand has priority over any DHW and CH demand. However, when the anti-legionella protection is active and there is no heat or burn demand because the Anti_Legionella_Sensor is already at a high enough temperature CH/DHW demand will be accepted as normal.

These parameters are settable.

Specific Parameters	Display parameter	Level	(Default) Value	Range
Anti_Legionella_Day	107	Installer	Sunday	Monday...Sunday
Anti_Legionella_Hour	108	Installer	0 hrs.	0...23 hrs
Anti_Legionella	206	Installer	Enable	Enable / Disable

Table 12.23

These parameters are factory set and cannot be changed.

Parameter	Factory Setting.
Anti Legionella Setpoint Setpoint for Anti-Legionella demand	140 ºF (60 ºC)
Anti Legionella Burn Time	30 minutes
Anti Legionella Wait Time Wait time for Anti-Legionella demand	120 minutes after cold start, 168 hours after first successful Anti-Legionella demand

Table 12.24

WARNING	**Bacteria can develop in the domestic water system if certain minimum water temperatures are not maintained.** **Failure to maintain at least 140°F [60°C] domestic hot water temperature or not using the Antilegionella function can result in bacteria development, which can result in serious injury, or death.**

12.11 Menu structure display

Menu structure Display:	Access level	Description:
1. Central Heating (CH)	User	Enter the Central Heating (CH) menu
2. Domestic Hot Water (DHW)	User	Enter the Domestic Hot Water (DHW) menu
3. Information	User	Enter the Information menu
4. Settings	User	Enter the Settings menu
5. System Test	User	Enter the System Test menu (see chapter 16).
6. Logout	Installer	Set the user level back to 0: User

1. Central Heating (CH)	min.	max.	Default	unit	Access level	Description:
1.1 CH Setpoint	68 (20)	194 (90)	176 (80)	°F (°C)	Installer	Set the CH setpoint if CH mode is 0
1.2 Outdoor Reset					User	Enter the Outdoor Reset menu if CH mode is 1 or 2

1.2 Outdoor reset	min.	max.	Default	unit	Access level	Description:
Design Supply Temp.	68 (20)	194 (90)	176 (80)	°F (°C)	Installer	Set CH setpoint when outdoor temperature equals Design Outdoor Temp.
Baseline Supply Temp.	68 (20)	194 (90)	104 (40)	°F (°C)	Installer	Set CH setpoint when outdoor temperature equals Baseline Outdoor Temp.
Warm Weather Shutdn	32 (0)	95 (35)	72 (22)	°F (°C)	Installer	Set outdoor temperature above which CH demand is locked.
Baseline Outdoor Temp.	32 (0)	86 (30)	68 (20)	°F (°C)	Installer	Set the outdoor temperature at which CH setpoint is set to Baseline Supply Temp.
Design Outdoor Temp.	-13 (-25)	77 (25)	23 (-5)	°F (°C)	Installer	Set the outdoor temperature at which CH setpoint is set to Design Supply Temp.

2. Domestic Hot Water (DHW)	min.	max.	Default	unit	Access level	Description:
DHW Setpoint	104 (40)	160 (71)	122 (50)	°F (°C)	Installer	Set the DHW setpoint
DHW Store Setpoint	104 (40)	160 (71)	122 (50)	°F (°C)	Installer	Set the DHW store setpoint for DHW mode 1 and 2

3. Information	min.	max.	Default	unit	Access level	Description:
3.1 Software versions					User	Enter the Software Versions menu
3.2 Boiler Status					User	Enter the Boiler Status menu
3.3 Boiler History					User	Enter the Boiler History menu
3.4 Error Log					User	Enter the Error Log menu
3.5 Service					User	Enter the Service menu

3.1 Software versions	min.	max.	Default	unit	Access level	Description:
Display				xxxx xxxx	User	Display the software checksum
Boiler				xxxx xxxx	User	Display the boiler software checksum
Device Group				xxxMN	User	Display the boiler group ID

3.2 Boiler status	min.	max.	Default	unit	Access level	Description:
Flow Temperature				°F (°C)	User	Actual supply flow temperature
Flow 2 Temperature			(Not used)	°F (°C)	User	Actual supply 2 flow temperature
Return Temperature				°F (°C)	User	Actual return temperature
DHW Temperature				°F (°C)	User	Actual DHW temperature
DCW Temperature				°F (°C)	User	Actual DCW temperature
Outside Temperature				°F (°C)	User	Actual outside temperature
Flue Temp				°F (°C)	User	Actual flue gas temperature
Flue 2 Temp			(Not used)	°F (°C)	User	Actual flue gas 2 temperature
System Temperature				°F (°C)	User	Actual system temperature
0-10 V Input						
Flowrate				l/min	User	Actual DHW flowrate
RT Input				open/close	User	Actual RT input status
Gas Pr Sw				open/close	User	Gas pressure switch input
Flow Switch				open/close	User	CH/DHW) Flow switch input
Air Fl Sw				open/close	User	Air pressure switch input
Water Pressure				psi (Bar)	User	Actual CH water pressure
Fan Speed				rpm		
Ionization				µA	User	Actual ionization current
State					User	Actual burner state
Error				#	User	Actual internal error code
Calculated Setpoint				°F (°C)	User	Actual CH setpoint
Module Setpoint				°F (°C)	User	Actual Module/dependent/burner setpoint (Only for module cascade.)

3.3 Boiler history	min.	max.	Default	unit	Access level	Description:
Successful Ignitions				#	User	Display the number of successful ignitions
Failed Ignitions				#	User	Display the number of failed ignitions
Flame Failures				#	User	Display the number of flame losses
Operation Days				days	User	Display the total time in operation
CH Burner Hours				hours	User	Display the amount of burn hours for CH
DHW Burner Hours				hours	User	Display the amount of burn hours for DHW

3.4 Error Log	min.	max.	Default	unit	Access level	Description:
Error Log					User	Display the complete error log
Filter Error Type					User	Set the error log filter
Clear Error Log					Installer	Clear the complete error log

3.5 Service	min.	max.	Default	unit	Access level	Description:
Service history					User	Display the service history
Burn hours since last service				hours	User	Display the burn hours since last service
Burn hours till service				hours	User	Display the hours remaining until next service
Operation Days				days	User	Display the total time in operation

4 Settings	min.	max.	Default	unit	Access level	Description:
4.1 General Settings					User	Enter the General Settings menu
4.2 Boiler Settings					User	Enter the Boiler Settings menu

4.1 General settings	min.	max.	Default	unit	Access level	Description:
4.1.1 Language					User	Enter the Language menu
4.1.2 Unit Type					User	Enter the Unit Type menu
4.1.3 Date & Time					User	Enter the Date & Time menu
4.1.4 Cascade Mode					User	Enter the Cascade Mode menu
4.1.5 Other Settings					User	Enter the Other Settings menu

4.1.1 Language	min.	max.	Default	unit	Access level	Description:
English			English		User	Select the English language
Italiano					User	Select the Italian language
Русский					User	Select the Russian language
Hrvatski					User	Select the Croatian language
中文					User	Select the Chinese language
Français					User	Select the French language
Español					User	Select the Spanish language
Türkçe					User	Select the Turkish language
Deutsch					User	Select the German language
Slovenský					User	Select the Slovak language
Nederlands					User	Select the Dutch language
Polski					User	Select the Polish language
Česky					User	Select the Czech language
Ελληνικά					User	Select the Greek language
Magyar					User	Select the Hungarian language
Português					User	Select the Portuguese language
Românesc					User	Select the Romanian language
Slovenščina					User	Select the Slovene language

4.1.2 unit type	min.	max.	Default	unit	Access level	Description:
Metric (°C, bar)				°C/bar	User	Select Metric units
Imperial (°F, psi)				°F/psi	User	Select Imperial units

4.1.3 Date & Time	min.	max.	Default	unit	Access level	Description:
Date				dd-mm-yy	User	Set the current date
Time				hh:mm	User	Set the current time
A. Time Zone Settings					User	Enter the time zone settings menu
B. Display Settings					User	Enter the display settings menu

A Time zone setting	min.	max.	Default	unit	Access level	Description:
Time Zone Correction					User	Set the time zone correction
Daylight Savings Time					User	Select the daylight savings time mode

B Display settings	min.	max.	Default	unit	Access level	Description:
Time Notation			24h	24h / 12h	User	Select 24h or 12h time notation
Date Order					User	Select the date-format
Day of Month			2	1 or 2 digits	User	Select how the day of month is displayed
Month					User	Select how the month is displayed
Year			4	2 or 4 digits	User	Select how the year is displayed
Date Separation Character					User	Select the date separation character
Day of Week					User	Select how the day of week is displayed
Seconds			no	yes / no	User	Select if seconds are displayed

4.1.4 Cascade mode	min.	max.	Default	unit	Access level	Description:
Full			Full	Full	Installer	Select full cascade mode for more data for max 8 boilers
Basic					Installer	Select basic cascade mode for 9 to 16 boilers

4.1.5 Other settings	min.	max.	Default	unit	Access level	Description:
Status Overview Settings					User	Configure which information is shown on the Status overview
Modbus Address	0	255	1	0…255	User	Select the Modbus communication address
Modbus Stop bits	1	2	2	1 – 2	User	Select the number of Modbus communication stop bits

4.1.5.1 Status Overview Settings	min.	max.	Default	unit	Access level	Description:
Water Pressure				Off/On	User	Enable/disable the CH water pressure
State				Off/On	User	Enable/disable the burner state
Temperature selection ID					User	Enable/disable the temp. selection ID[Tx] where x is the number of the selection.
Temperature selection					User	Select which temperature is displayed: Outside temperature [T0] Demand based [T1] (Flow or DHW temperature based on active demand) Flow temperature [T2] ; DHW temperature [T3] ; System temperature [T4] (module cascade flow/supply temp.) Cascade temperature [T5] (boiler cascade flow / supply temp.)

4.2 Boiler settings	min.	max.	Default	unit	Access level	Description:
4.2.1 Boiler Parameters					Installer	Enter the Boiler Parameters menu
4.2.2 Module Cascade Settings					Installer	Enter the Module Cascade Settings menu
4.2.3 Boiler Cascade Settings					Installer	Enter the Boiler Cascade Settings menu
4.2.4 Service					Installer	Enter the Service menu

4.2.1 Boiler parameters	min.	max.	Default	unit	Access level	Description:	Dis-play no:
CH mode	0	5	0	#	Installer	Set the CH mode	1
CH Setpoint	68 (20)	194 (90)	176 (80)	°F (°C)	Installer	Set the CH setpoint	3
Calc. Setp. Offset	-18 (-10)	18 (10)	0 (0)	°F (°C)	Installer	Set the offset for CH mode 1 / 2 calculated setpoint	109
CH Min Setpoint	68 (20)	122 (50)	68 (20)	°F (°C)	Installer	Set the minimum CH setpoint (0-10V modes)	110
CH Max Setpoint	122 (50)	194 (90)	185 (85)	°F (°C)	Installer	Set the maximum CH setpoint (0-10V modes)	111
Boiler Pump Overrun	0	900	60	sec.	Installer	Set the post-circulation time for the boiler/CH pump	5
CH Hysteresis Up	4 (2)	72 (40)	5.4 (3)	°F (°C)	Installer	Set the CH hysteresis up	7

4.2.1 Boiler parameters	min.	max.	Default	unit	Access level	Description:	Dis-play no:
CH Hysteresis Down	4 (2)	36 (20)	9 (5)	°F (°C)	Installer	Set the CH hysteresis down	112
Anti-Cycle Period	10	900	180	sec.	Installer	Set the burner anti-cycling period	9
Anti-Cycle Temp. Diff.	0 (0)	36 (20)	28.8 (16)	°F (°C)	Installer	Set the burner anti-cycling differentia	10
Max. Power CH	1	100	Dep. Unit	%	Installer	Set the maximum CH burner power	14
Min. Power CH	1	100	1	%	Installer	Set the minimum CH burner power	15
CH PID P	0	1275	20		Installer	Set the PID P factor for CH	16
CH PID I	0	1275	1000		Installer	Set the PID I factor for CH	17
Design Supply Temp.	39 (4)	194 (90)	176 (80)	°F (°C)	Installer	Set CH setpoint when outdoor temperature equals Des. Outd. T.	19
Design Outdoor Temp.	-13 (-25)	77 (25)	23 (-5)	°F (°C)	Installer	Set the outdoor temperature at which CH setpoint is set to Design Supply Temp.	20
Baseline Supply Temp	39 (4)	194 (90)	104 (40)	°F (°C)	Installer	Set CH setpoint when outdoor temperature equals Bas. Outd. T.	21
Baseline Outdoor Temp	32 (0)	86 (30)	68 (20)	°F (°C)	Installer	Set the outdoor temperature at which CH setpoint is set to Baseline Supply Temp.	22
Design Supply Min. Limit	39 (4)	180 (82)	68 (20)	°F (°C)	Installer	Set the outdoor reset curve minimum setpoint	23
Design Supply Max. Limit	81 (27)	194 (90)	185 (85)	°F (°C)	Installer	Set the outdoor reset curve maximum setpoint	24
Warm Weather Shutdn	32 (0)	95 (35)	71.6 (22)	°F (°C)	Installer	Set outdoor temperature above which CH demand is blocked	25
Boost Temp Increment	0 (0)	54 (30)	0 (0)	°F (°C)	Installer	Set the setpoint boost function temperature increment	26
Boost Time Delay	0	120	20	min.	Installer	Set the setpoint boost function delay time	27
Night Setback Temp.	0 (0)	54 (30)	18 (10)	°F (°C)	Installer	Set the CH setpoint night setback temperature	28
DHW Mode	0	8	0 (CH) 5 (CO)	#	Installer	Set the DHW mode	35
DHW Tank Hyst. Down	0 (0)	36 (20)	7.2 (4)	°F (°C)	Installer	Set the DHW tank hysteresis down	36
DHW Tank Hyst. Up	0 (0)	36 (20)	5.4 (3)	°F (°C)	Installer	Set the DHW tank hysteresis up	37
DHW Tank Supply Extra	0 (0)	54 (30)	27 (15)	°F (°C)	Installer	Set the DHW tank supply setpoint offset	38
DHW Tank Supp Hyst Dn	0 (0)	36 (20)	9 (5)	°F (°C)	Installer	Set the DHW tank supply hysteresis down	39
DHW Tank Supp Hyst Up	0 (0)	36 (20)	9 (5)	°F (°C)	Installer	Set the DHW tank supply hysteresis up	40
DHW Tank Hold Warm	0 (0)	18 (10)	5.4 (5)	°F (°C)	Installer	Set the Tank Hold Warm hysteresis down	41
DHW Priority	0	2	on	0-2	Installer	Set the DHW priority mode	42
DHW Max. Priority Time	1	255	60	min.	Installer	Set the maximum DHW priority time	43
DHW Pump Overrun	0	900	20	sec.	Installer	Set the DHW post-circulation time	44
DHW Tank PID P	0	1275	100		Installer	Set the DHW tank PID P factor	45
DHW Tank PID I	0	1275	300		Installer	Set the DHW tank PID I factor	46
DHW Setpoint	102 (39)	158 (70)	122 (50)	°F (°C)	Installer	Set the DHW setpoint	48
DHW Store Setpoint	86 (30)	194 (90)	122 (50)	°F (°C)	Installer	Set the DHW storage setpoint	115
DHW Hysteresis Down	0 (0)	68 (20)	2 (1)	°F (°C)	Installer	Set the DHW hysteresis down	49
DHW Hysteresis Up	4 (2)	68 (20)	13 (7)	°F (°C)	Installer	Set the DHW hysteresis up	50

4.2.1 Boiler parameters	min.	max.	Default	unit	Access level	Description:	Dis-play no:
DHW Instant PID P	0	1275	Dep. Unit		Installer	Set the DHW instantaneous PID P factor	51
DHW Instant PID I	0	1275	Dep. Unit		Installer	Set the DHW instantaneous PID I factor	52
DHW On Off Period	10	60	30	sec.	Installer	Set the on/off modulation period	63
Preheat mode	Off	Comf.	Eco	-	Installer	Set the Preheat mode See paragraph 11.10.6	64
PreHeat Eco Setpoint	68 (20)	140 (60)	86 (30)	°F (°C)	Installer	Set the Preheat Eco mode setpoint See paragraph 11.10.6	65
DHW Max. Limit	32 (0)	194 (90)	176 (80) CH 122 (50) CO	°F(°C)	Installer	Limiting DHW setpoint max.	91
DHW Min. Limit	68 (20)	122 (50)	86 (30)	°F (°C)	Installer	Limiting DHW setpoint min.	96
Fan Speed Maximum	0	12750	dep. unit	rpm	Installer	Set the maximum fan speed	92
Fan Speed Minimum	0	12750	dep. unit	rpm	Installer	Set the minimum fan speed	93
Fan Speed Ignition	0	12750	dep. unit	rpm	Installer	Set the ignition fan speed	94
Prog. Input 1.	0	3	1	#	Installer	Select the function for programmable input 1	116
Prog. Input 2.	0	4	2 (CH) 1 (CO)	#	Installer	Select the function for programmable input 2. See § 10.6.	117
Prog. Input 3.	0	2	0	#	Installer	Select the function for programmable input 3. See § 10.6.	118
Prog. Input 7.	0	5	3	#	Installer	Select the function for programmable input 7. See § 10.6.	122
Prog. Input RT.	0	1	1	#	Installer	Select the function for the programmable RT input See paragraph 11.8	124
Prog. Output 1.	0	10	2	#	Installer	Select the function for programmable output 1 See paragraph 11.8	125
Prog. Output 2.	0	10	0	#	Installer	Select the function for programmable output 2 See paragraph 11.8	126
Prog. Output 3.	0	10	6	#	Installer	Select the function for programmable output 3 See paragraph 11.8	127
Prog. Output 4.	0	20	20	#	Installer	Select the function for programmable output 4 See paragraph 11.8	128
Mod. Pump dT	9 (5)	72 (40)	36 (20)	°F (°C)	Installer	Set the modulating pump target delta temperature	133
Mod. Pump Start Time	0	255	120	sec.	Installer	Set the modulating pump start up time	134
Mod. Pump Type	0	1	wilo		Installer	Set the modulating pump model	135
Mod. Pump Mode	0	10	mod	o/f or mod.	Installer	Set the modulating pump mode	136
Mod. Pump Min Pwr	0	100	30	%	Installer	Set the modulating pump minimum duty cycle	137
Appliance Type	50	55	dep. unit	#	Installer	Set the appliance type	138
Dair active	0	1	yes	Yes/ No	Installer	Enable/disable the De-Air function	139
Nominal Flow	0	10	0	l/min	Installer	Sets the nominal flow	141
Anti Legionella Day	mon	sun	Sunday		Installer	Select the day for the anti-legionella cycle	107
Anti Legionella Hour	0	23	0	hours	Installer	Select the time for the anti-legionella cycle	108
Frost Protection	Dis.	Ena.	Enabled	-	Installer	Switch Frost protection on/off	205
Anti Legionella	Dis.	Ena.	Enabled	-	Installer	Anti Legionella protection on/off	206
DHW Detection Delay	0	255	0	s.	Installer	Sets the detection delay.	207

4.2.2 Module Cascade Settings	min.	max.	Default	unit	Access level	Description:	Dis-play no:
Burner Address	0	16	0: Stand alone		Installer	Set the cascade burner address	184
Permit Emergency Mode	No	Yes	Yes		Installer	Enable/disable the cascade emergency mode	72
Emergency Setpoint	68 (20)	194 (90)	158 (70)	°F (°C)	Installer	Set the emergency mode setpoint	74
Delay Per Start Next Mod.	0	1275	200	sec.	Installer	Set the delay time before the next module is started	75
Delay Per Stop Next Mod.	0	1275	180	sec.	Installer	Set the delay time before the next module is stopped	76
Delay Quick Start Next	0	1275	50	sec.	Installer	Set the fast delay time before the next module is started	142
Delay Quick Stop Next	0	1275	30	sec.	Installer	Set the fast delay time before the next module is stopped	143
Hyst. Down Start Module	0 (0)	72 (40)	9 (5)	°F (°C)	Installer	Set the hysteresis down after which a module is started	77
Hyst. Up Stop Module	0 (0)	72 (40)	7.2 (4)	°F (°C)	Installer	Set the hysteresis up after which a module is stopped	78
Hyst. Down Quick Start	0 (0)	72 (40)	18 (10)	°F (°C)	Installer	Set the fast hysteresis down after which a module is started	144
Hyst. Up Quick Stop	0 (0)	72 (40)	10.8 (6)	°F (°C)	Installer	Set the fast hysteresis up after which a module is stopped	145
Hyst. Up Stop All	0 (0)	108 (60)	14.4 (8)	°F (°C)	Installer	Set the hysteresis up at which all modules are stopped	146
Number of Units	0	16	1	#	Installer	Set the no. of modules expected in the cascade system	147
Power Mode	0	3	2	#	Installer	Set the power mode	148
Max. Setp. Offset Down	0 (0)	36 (20)	0 (0)	°F (°C)	Installer	Set the maximum setpoint offset down	79
Max. Setp. Offset Up	0 (0)	36 (20)	36 (20)	°F (°C)	Installer	Set the maximum setpoint offset up	80
Start Mod. Delay Fact.	0	60	60	min.	Installer	Set the setpoint modulation delay time	81
Next Module Start Rate	10	100	80	%	Installer	Set the next module start rate	82
Next Module Stop Rate	10	100	25	%	Installer	Set the next module stop rate	83
Module Rotation Interval	0	30	5	days	Installer	Set the rotation interval	84
First Module to Start	0	17	1	#	Installer	Set the first module to start in the rotation cycle	149
PwrMode2 Min Power	0	100	20	%	Installer	Set the power mode 2 minimum power	152
PwrMode2 Hysteresis	0	100	40	%	Installer	Set the power mode 2 hysteresis	153
Post-Pump Period	0	255	30	sec.	Installer	Set the cascade post-circulation period	154
Frost Protection	50 (10)	86 (30)	59 (15)	°F (°C)	Installer	Set the frost-protection setpoint	155

NOTICE	Parameters for cascade operation are found in the Module cascade settings menu, located in the Boiler settings menu. Parameters in the below **Boiler cascade settings** menu must not be used.

4.2.3 Boiler Cascade Settings	min.	max.	Default	unit	Access level	Description:	Dis-play no:
Boiler Address	0	16	stand-alone		Installer	Set the cascade boiler address	73
Permit Emergency Mode	No	Yes	Yes	Yes/ No	Installer	Enable/disable the cascade emergency mode	156
Emergency Setpoint	68 (20)	194 (90)	158 (70)	°F (°C)	Installer	Set the emergency mode setpoint	157
Delay Per Start Next Blr	0	1275	1275	sec.	Installer	Set the delay time before the next boiler is started	158
Delay Per Stop Next Blr.	0	1275	1275	sec.	Installer	Set the delay time before the next boiler is stopped	159
Delay Quick Start Next	0	1275	400	sec.	Installer	Set the fast delay time before the next boiler is started	160
Delay Quick Stop Next	0	1275	240	sec.	Installer	Set the fast delay time before the next boiler is stopped	161
Hyst. Down Start Boiler	0 (0)	72 (40)	9 (5)	°F (°C)	Installer	Set the hysteresis down after which a boiler is started	162
Hyst. Up Stop Boiler	0 (0)	72 (40)	4 (2)	°F (°C)	Installer	Set the hysteresis up after which a boiler is stopped	163
Hyst. Down Quick Start	0 (0)	72 (40)	18 (10)	°F (°C)	Installer	Set the fast hysteresis down after which a boiler is started	164
Hyst. Up Quick Stop	0 (0)	72 (40)	7 (4)	°F (°C)	Installer	Set the fast hysteresis up after which a boiler is stopped	165
Hyst. Up Stop All	0 (0)	108 (60)	14 (8)	°F (°C)	Installer	Set the hysteresis up at which all boilers are stopped	166
Number of boilers	0	16	1	#	Installer	Set the number of boilers expected in the cascade system	167
Power Mode	0	3	2	#	Installer	Set the power mode	168
Max. Setp. Offset Down	0 (0)	36 (20)	0 (0)	°F (°C)	Installer	Set the maximum setpoint offset down	169
Max. Setp. Offset Up	0 (0)	36 (20)	36 (20)	°F (°C)	Installer	Set the maximum setpoint offset up	170
Start Mod. Delay Fact.	0	255	20	min.	Installer	Set the setpoint modulation delay time	171
Next Boiler Start Rate	10	100	80	%	Installer	Set the next boiler start rate	172
Next Boiler Stop Rate	10	100	25	%	Installer	Set the next boiler stop rate	173
Boiler Rotation Interval	0	30	5	days	Installer	Set the rotation interval	174
First Boiler to Start	1	17	1	#	Installer	Set the first boiler to start in the rotation cycle	175
PwrMode2 Min Power	0	100	20	%	Installer	Set the power mode 2 minimum power	180
PwrMode2 Hysteresis	0	100	40	%	Installer	Set the power mode 2 hysteresis	181
Post-Pump period	0	255	30	sec.	Installer	Set the cascade post-circulation period	182

4.2.4 Service	min.	max.	Default	unit	Access level	Description:
Service Interval	Dis	25400	2000	hours	Installer	Set the service interval
Reset Service Reminder	no	yes	no	yes/no	Installer	Reset the service history

5 System test	min.	max.	Default	unit	Access level	Description:
Test State			off		installer	set test state (for adjusting CO2 level's)
Fan speed			xxxx	rpm	installer	read out fan speed
Ionization			x.x	µA	installer	read out flame signal

Table 12.25

13 TEMPERATURE PROTECTION

The difference between Supply temperature and Return Temperature is continuously monitored. To large of a difference can indicate a defective pump or a clogged heat exchanger. To protect the boiler, the burner controller reduces the input when the temperature difference ΔT (Delta T) becomes too high:

At maximum boiler input ΔT is limited to 63°F (35°C) - (*Hx_Diff_DeltaT_Min)*

In between 63°F (35°C) and 77°F (43°C) boiler input modulates between minimum and maximum.

At minimum boiler input ΔT above 77°F (43°C) is allowed - (*Hx_Diff_DeltaT_Min plus 14°F (+8°C)*

Above ΔT = 86°F (48°C), the boiler is switched OFF during *HX_Diff_Max_Wait_Time*.

Relevant factory set variables

Parameter	Level	Factory Setting
HX Diff DeltaT Min	Factory	63ºF (35ºC)
HX Diff Max Wait Time Wait time after upper limit primary heat exchanger differential has been exceeded.	Factory	180 Sec.

Table 13.1

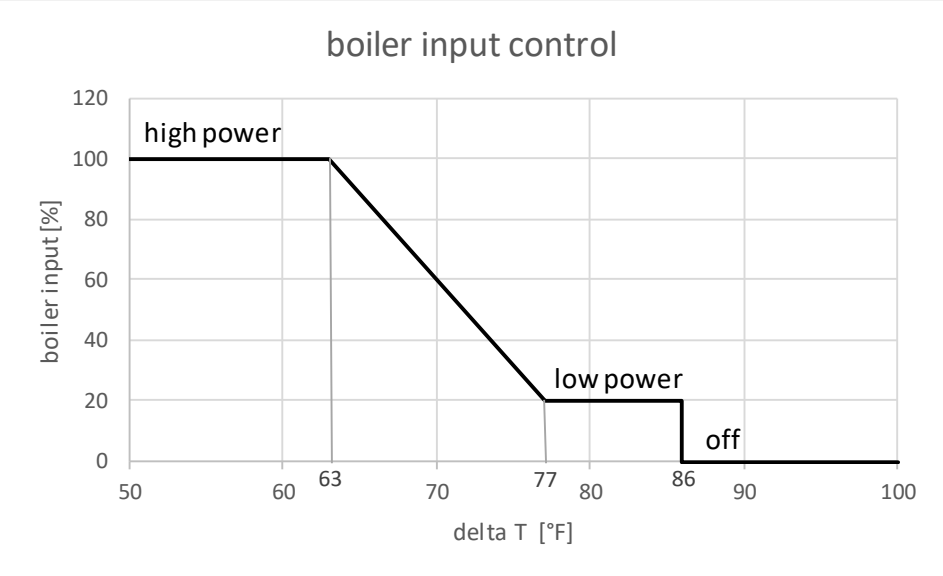


Figure 13.1

14 ERROR INFORMATION

Errors can be divided in three groups:

- Manual reset locking errors (can only be reset by the reset button).
- Blocking errors (will disappear when error is gone).
- Warnings (will disappear when the warning is gone, not stored in the controls e2prom).

The boiler circulator will continue to run during most locking and blocking error codes. This is to prevent the freezing of the Central Heating circuit when the boiler is in error during the winter period. For some non-volatile lockouts the circulator will not be running, also see the error tables in this chapter for more details.

14.1 Boiler history

The last 15 lockouts and 15 blocking errors are stored in the boiler control. This boiler history can be shown via the Boiler History screen via the installer boiler status menu in one of the advanced displays.

- Successful ignitions
- Failed Ignitions
- Flame Failures
- Operation days
- CH Burner Hours
- DHW Burner Hours

14.2 Lockout codes

Lock out code	Error	Description	Cause	Solving
0	EEPROM Read Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
1	Ignition Error	Five unsuccessful ignition attempts in a row	no gas, wrongly adjusted gas valve	check gas supply and adjust gas valve, reset BCU
2	GasValve Relay Error	Failure detected in the gas valve relay	short circuit in coil of the gas valve, water on wiring or gas valve	reset BCU replace gas valve or wiring harness
3	Safety Relay Error	Failure detected in safety relay	safety relay is not working correctly	reset BCU or replace BCU
4	Blocking Too Long Error	Control had a blocking error more than 20 hours	blocking code active more than 20 hours	reset and check blocking code
5	Fan Not Running	Fan is not running for more than 60 seconds	electrical wiring not correctly connected, or fan malfunctioning	check wiring or replace Fan if not solved check fuse on BCU or replace BCU
6	Fan Too Slow	Fan runs too slow for more than 60 seconds	electrical wiring not correctly connected, or fan malfunctioning	check wiring or replace Fan if not solved check fuse on BCU or replace BCU
7	Fan Too Fast	Fan runs too fast for more than 60 seconds	electrical wiring not correctly connected, or fan malfunctioning	check wiring or replace Fan if not solved check fuse on BCU or replace BCU
8	RAM Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
9	Wrong EEPROM Signature	Contents of E2prom is not up to date	outdated E2prom	reset BCU or replace BCU
10	EEPROM Error	Wrong safety parameters in E2prom	wrongly programmed BCU or PB	reset BCU or replace BCU
11	State Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU
12	ROM Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU
15	Max. Thermostat Lock Error	The external overheat protection is enabled or the T_Supply sensor measures a temp. of over Prot_Overheat_Temp - SGOverheat_Duplex_Tolerance for a period of Max_Value_Period	wiring of clixon is missing or burner door clixon tripped because of overheating of the burner door or the water flow is restricted, or back wall thermal fuse has tripped because rear wall insulation disc (combustion chamber) is damaged or broken.	check wiring, check burner door gasket and replace burner door gasket and reset clixon on burner door or check circulator and waterflow and replace circulator or increase water flow check also if valves are closed or check if rear wall fuse is broken if so replace and also replace rear wall insulation disc (combustion chamber).
16	Max. Flue Lock Error	Flue temperature exceeded the maximum flue temperature	there is no water in the heat exchanger or flue gas sensor is malfunctioning or heat exchanger is overheated.	check if flue sensor is working correctly if not so replace flue sensor. Check waterflow, if too low increase waterflow.
17	Stack Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
18	Instruction Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
19	Ion Check Failed	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit

Lock out code	Error	Description	Cause	Solving
20	Flame Out Too Late Error	Flame still present 10 sec. after closing the gas valve	wrong earthing of BCU and boiler	check earthing of BCU and boiler
21	Flame Before Ignition	Flame is detected before ignition	wrong earthing of BCU and boiler	check earthing of BCU and boiler
22	Too Many Flame Failures	Three times flame lost during 1 demand	bad gas supply or CO_2 level is not correct or bad ignition rod	check gas supply pressure, check CO_2 level and adjust if necessary, replace ignition rod or replace ignition cable.
23	Corrupted Error Number	Error code RAM byte was corrupted to an unknown error code.	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
27	Filling Too Much	Too many automated filling attempts in a short time period	if output is programmed as filing valve and there are too many filing attempts	check if there is a leak in the central heating system or if the boiler itself is leaking also check the expansion vessel on internal leak
28	Fill Time Error	Filling takes too long	if output is programmed as filling valve and filling takes more than 10 minutes	check if there is a leak in the central heating system or if the boiler itself is leaking also check the expansion vessel on internal leak
29	PSM Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
30	Register Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
32	T. Exchange Diff Error	The 2 exchange sensors deviate too much for more than 60 seconds	there is not enough water flow through the heat exchanger	check if the general pump is running and if all valves are open to make enough flow
33	LWCO/Air intake block	Low water cut off 1 error	there is no water in the heat exchanger or not electrically connected	check if there is enough water in the heat exchanger if not: fill up the system
34	LWCO 2 Error	Low water cut off 2 error	there is no water in the heat exchanger or not electrically connected	check if there is enough water in the heat exchanger if not: fill up the system

Table 14.1

14.3 Blocking codes

Block-ing code	Error	Description	Cause	Solving
100	WD Error Ram	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
101	WD Error Rom	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
105	High Temp Error	T_Supply sensor measures over stay_Burning_Temp for a period of Max_Value_Period.	not enough waterflow causes overheating of the heat exchanger	check functioning of the circulator. check/open all valves that might restrict the water flow through the unit. check for external system circulator that influences flow through the unit. check if system resistance exceeds the spare capacity of unit circulator.
106	Refhi Too Hi Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
107	Refhi Too Lo Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
108	Reflo Too Hi Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
109	Reflo Too Lo Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
110	Refhi2 Too Hi Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
111	Refhi2 Too Lo Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
112	Reflo2 Too Hi Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
113	Reflo2 Too Lo Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
114	False Flame	Flame is detected in a state in which no flame is allowed to be seen	wrong earthing of BCU and boiler	check earthing of BCU and boiler
116	Low Water Pressure Sensor	Low water pressure, occurs when the pressure drops below drops below 11.6 psi.	not enough water pressure	fill up the system and check if there are any water leakages
118	WD Communication Error	Watchdog communication error	wrong programmed BCU or PB	reset BCU or replace BCU and or display unit
119	T Return Open	Return sensor open	malfunctioning return sensor or not connected	check connection to BCU or check resistance NTC sensor
120	T Supply Open	Supply sensor open	malfunctioning supply sensor or not connected	check connection to BCU or check resistance NTC sensor
122	T DHW Open	DHW sensor open	malfunctioning DHW sensor or not connected	check connection to BCU or check resistance NTC sensor
123	T Flue Open	Flue sensor open	malfunctioning or not connected flue sensor	check connection to BCU or check resistance NTC sensor
125	T Outdoor Open	Outdoor sensor open	malfunctioning or not connected outdoor sensor or wrong CH-mode programmed	check connection to BCU or check resistance NTC sensor or change CH-mode

Block-ing code	Error	Description	Cause	Solving
126	T Return Shorted	Return sensor shorted	malfunctioning return sensor or short circuiting	check connection to BCU or check resistance NTC sensor
127	T Supply Shorted	Supply sensor shorted	malfunctioning supply sensor or short circuiting	check connection to BCU or check resistance NTC sensor
129	T DHW Shorted	DHW sensor shorted	malfunctioning DHW sensor or short circuiting	check connection to BCU or check resistance NTC sensor
130	T Flue Shorted	Flue sensor shorted	malfunctioning flue sensor or short circuiting	check connection to BCU or check resistance NTC sensor
132	T Outdoor Shorted	Outdoor sensor shorted	malfunctioning outdoor sensor or short circuiting	check connection to BCU or check resistance NTC sensor
134	Reset Button Error	Too many resets in a short time period	reset too many times by user or installer	wait or disconnect and reconnect power supply
136	T_Exchange Block Error	Exchange temperature exceeded 194 ºF (90 ºC).	water temperature is above 194 ºF (90 ºC).	check circulator operation. check/open all valves that might restrict water flow through the unit. check external system circulator(s) influencing the flow through the unit. check if system resistance exceeds the spare capa-city of the unit circulator.
155	WD Config Error	Watchdog fan confi-guration setting error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
164	Ex. Low Flow Protection	Flow is too low, demand needs to be stopped with fan at ignition speed*, but no error needed to be stored at this time	not enough water flow through heat exchanger	check circulator operation. check/open all valves that might restrict water flow through the unit. check external system circulator(s) influencing the flow through the unit. check if system resistance exceeds the spare capacity of the unit circulator.
168	Flue Temperature too high	Flue sensor measures above 203°F	Dirty combustion chamber	Clean the combustion chamber, especially the spaces between the coils
169	ADC Unstable	ADC measurements detected too many unstable measurements	Defect sensor or unstable 0-10V input signal	Check sensors and 0-10V input

Table 14.2

14.4 Warnings

Warning no.	Warning	Description	Cause	Solving
200	Comm. Lost with module	Cascade System: Managing cascade control lost communication with one of the depending.	connection between cascaded boilers is interrupted or wiring is broken parameter 147 is not set correctly	check wiring between boiler or distance between boilers is to big or set par. 147 to the total number of connected boilers
202	App. Selection Error	Unknown appliance model selected	wrongly programmed parameters	replace BCU
203	Comm. Lost with boiler	Dual Cascade System: Managing cascade control lost communication with one of the depending.	connection between cascaded boilers is interrupted or wiring is broken	check wiring between boiler or distance between boilers is to big
204	T Outdoor Wrong	T_Outdoor sensor measures open/shorted	malfunctioning outdoor sensor or not connected or wrong CH-mode programmed	check connection to BCU or check resistance NTC sensor or change CH-mode
205	T System Wrong	T_System sensor measures open/shorted	malfunctioning system sensor or not connected	check connection to BCU or check resistance NTC sensor
206	T Cascade Wrong	T_Cascade sensor measures open/shorted	malfunctioning cascade sensor or not connected	check connection to BCU or check resistance NTC sensor
207	Heat-Exchanger protection active	The heat-exchanger protection function is actively blocking the burn demand		

Table 14.3

15 CASCADING

15.1 System setup

NOTICE	For proper functioning of the system, certain settings have to be changed. See paragraph 15.2

The boiler controller can control multiple boilers in a cascade setup.
A system sensor input is available on the main board to measure the cascade system supply temperature. A circulator output is also available to run the system circulator, as well as an output for the DHW circulator.
When the CH supply temperature is calculated based on an outdoor sensor, only one outdoor sensor is needed. This sensor is connected to the managing boiler and calculates the CH setpoint for the cascade system.
A cascade system can be used with an DHW indirect tank. A DHW circulator and sensor can be connected to the managing boiler.

Cascade boiler pump connections for system configuration as shown in Figure 15.1.
System configuration for handling DHW indirect tank or Central Heating demand.
All boilers handle **either** indirect tank **or** Central Heating demand at one time.

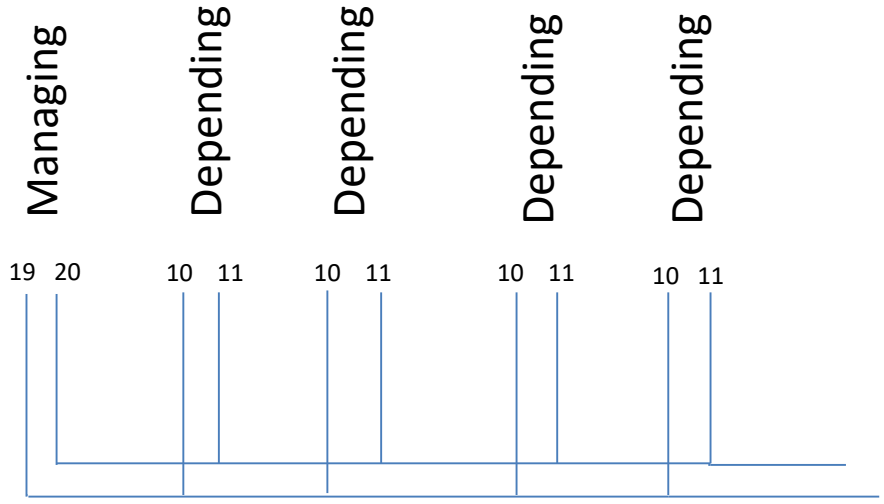


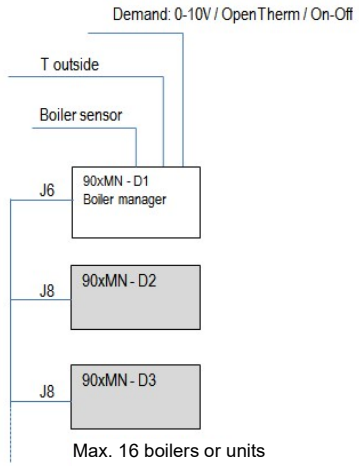
Figure 15.1

15.2 Boiler cascade communication setup

In order for the system to work for cascade the communication busses must be parallel linked together. The managing boiler uses the AL-bus connection 19-20 for the cascade. The 10-11 connection terminals of the depending boilers must be connected to 19-20 connection terminals of the managing boiler.

It is important that the power on the 10-11 connection terminals on all dependent boilers is switched to the OFF position (see also paragraph 15.2.1 and figure 15.3).

All boilers in the cascade system must have a unique address selected.
Before commissioning a cascade installation, a number of parameters have to be changed.
These parameters can be programmed on the unit itself.



WARNING	Changes in parameters must only be carried out by a skilled commissioning/service installer, who has had specific training for setting up the CH / CO boilers. The installer will be able to check whether the installation functions correctly after changing the parameters.

NOTICE	Parameters for cascade operation are found in the Module cascade settings menu, located in the Boiler settings menu. Parameters in the Boiler cascade settings menu must not be used.

Figure 15.2

15.2.1 *SETTING THE BOILER ADDRESS*

NOTICE

Address rules

The cascade managing address (parameter 184) must be set to 'Managing' on the managing boiler.
The cascade depending addresses (parameter 184) must be set in a logical numbered order from 2: Dep. 2, Dep. 3 etc. on the depending boilers. Each boiler must be configured with its own unique address.
The total number of boilers in the cascade must be stored in parameter 147 on the managing boiler.

When the number of boilers is set to 4, the first three depending controls are expected to be available for the cascade. In this case depending controls 2, 3 and 4 must be selected. When any of these 3 are not present on the communication bus the managing control detects the loss of a depending control and generates the warning: CC_LOSS_COMMUNICATION.

The address setting can be changed on the boiler control (Parameter 184).

Boiler address	Boiler operation	Function of sensor input terminal 3-4
0 (default	Standalone burner	No function
1	1st boiler (managing)	System sensor
2	2nd boiler (depending)	No function
3	3rd boiler (depending)	No function
4	4th boiler (depending	No function
↓	↓	
16	16th boiler (depending)	No function

Table 15.1

The managing boiler of the cascade system is connected to the AL-BUS connection on terminals 19-20
This connection also provides the power for the communication bus. The depending boilers are all parallel connected to the managing boiler communication bus.
The bus power is provided by the managing boiler on terminals 19-20, switch S1 must be set in the OFF position (all controls).

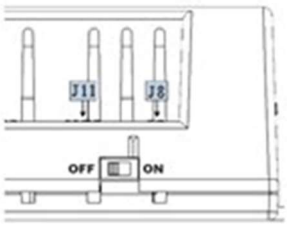


Figure 15.3

15.2.2 *CASCADE – HEATING ONLY (CH) MANAGING BOILER*

When a boiler is set as Managing (Address = 1), the controller of this boiler will drive the cascade. The CH mode of this managing boiler applies to all other boilers. It is only required to set the CH mode on the managing boiler.

- The outdoor temperature sensor connected to the managing boiler will be the outdoor sensor for the cascade operation
- The system sensor (T_System) connected to the managing boiler will be the control sensor for the cascade supply temperature.
- The (modulating) thermostat connected to the managing boiler will be the CH heat demand input for the cascade system.

Based on the system temperature (T_System) and the requested Cascade_Setpoint the managing boiler calculates a required boiler setpoint, to achieve the requested Cascade_Setpoint.
The managing boiler provides the calculated setpoint to all dependent boilers. The modulating power of the dependent boilers is PID controlled based on the calculated setpoint and dependent boiler supply temperature.

Cascade CH setpoint adaption
When the system temperature is not high enough the setpoint for all boilers will be adjusted.
The boiler setpoint will be increased when the system temperature drops below Cascade_Setpoint and decreased when it rises above Cascade_Setpoint temperature.

Depending Boiler
The CH mode for the cascade is defined by the setting of the managing boiler. CH mode settings on dependents are ignored. In case a boiler is set as dependent (Address = 2-8/16) the setpoint is always provided by the managing boiler.
The modulating power of the ALL boilers is PID controlled by the boiler itself by comparing the calculated setpoint from the managing boiler and T_Supply. The managing boiler itself will be controlled in the cascade system as it would as if it was a dependent boiler. Only the circulators and sensor inputs are used.

Boiler input Rates
A cascade system operates most effectively and efficiently when all of the boilers in the system are the same size. The manufacturer highly recommends that all the boilers in a cascade system are the same size/model. Sizing all the boilers the same will prevent unbalanced wear on the boilers and their components.

15.2.3 *CASCADE – DOMESTIC HOT WATER SETTINGS*

In the Boiler Settings menu, the installer must set the DHW_Mode of the managing boiler.
Available DHW modes in cascade are mode 1 or 2 for CH-boilers.

Dependent Boiler
In case a boiler is set as dependent (Address = 2-8/16) the DHW setpoint is always provided by the managing boiler, the internal control of the setpoint functions are disabled.

Managing Boiler
If there is a request for a “Store Warm Hold” for the tank and no central heating request the managing boiler is going to burn for the DHW tank. This (the heating of the DHW tank) is interrupted when there comes a central heating request and the managing boiler and cascade are burning for the central heating system.

15.2.4 *CASCADE – DHW PRIORITY*

The boiler cascade system has multiple options for priority and parallel DHW and heating.
The following levels of priority are configurable (and possible):

Priority level		Description
0)	Switch Priority	When both CH and DHW demand have to be served, the priority is given to the DHW demand for a given interval (indicated with parameter Minute_Switch_Priority). As soon as the interval has expired the priority switches to CH demand. The interval time will be reloaded, and priority will switch again after the interval is over.
1)	CH	The priority is permanently given to CH Demand
2)	DHW	The priority is permanently given to DHW Demand

Table 15.2

Relevant variables

Specific parameters	Display parameter	Level	(Default) Value	Range
DHW Priority Both, CH or DHW priority, Parallel	42	Installer	2	0, 1, 2
DHW Max Priority Timer Interval time for switching the priority	43	Installer	60 min.	1..60 min.

Table 15.3

15.2.5 *CASCADE – START/STOP SEQUENCE*

The managing boiler sends the calculated Cascade_Setpoint to the dependent boilers. The power of the boilers is PID controlled based on the Calculated_Setpoint and T_Supply. Depending on the temperature difference between T_System and Cascade_Setpoint (CH or DHW) the dependent boilers will start or stop using different algorithms.

Quick Starting and Stopping Boilers
When there is a big difference between the T_System and the Cascade_Setpoint the call for a start or stop of the next or last depending is done quicker.

15.2.6 *CASCADE – POWER BALANCE MODE*

Several different power control modes can be selected to operate the cascade system.
- Power mode 0: Power control disabled; each boiler modulates based on the system setpoint.
- Power mode 1: Power control algorithm to have a minimum number of boilers active.
- Power mode 2: Power control algorithm to have a maximum number of boilers active.
- Power mode 3: Power control algorithm to have a balanced number of boilers active.

15.3 Cascade – Boiler rotation

The boiler rotation function can change the start/stop sequence for the cascade boilers.
The parameter Module_Rotation_Interval sets the number of days after which the sequence is updated. When Module_Rotation_Interval is set to 0 boiler rotation is disabled.
When the parameter Module_Rotation_Interval is updated the boiler rotation days left will be initialized to the new Module_Rotation_Interval setting.

When for example *Module_Rotation_Interval* = 5 the start sequence is as following (x is the last boiler):

Days	Start/Stop sequence
Day 0-5	1-2-3-4-5..x
Day 5-10	2-3-4-5..x-1
Day 10-15	3-4-5..x-1-2
Day 15-20	4-5..x-1-2-3
Day 20-25	5..x-1-2-3-4

Table 15.4

With parameter First_Module_To_Start the current depending that is first to start in the sequence is selected.
When the boilers are rotated the parameter First_Module_To_Start is automatically updated to the next boiler.
When boiler rotation is disabled the parameter First_Module_To_Start is reset to 0.
When the First_Module_To_Start is manually changed the control will clear all demand of the cascade control. After this is will start cascade demand generation with the new selection for First_Module_To_Start.

15.3.1 *NEXT DEPENDING TO START SELECTION*

When the cascade Module_Rotation_Interval has passed the control will perform the cascade rotation. At this moment the next available control based on the current First_Module_To_Start is selected.
A control is available when the control is present on the communication bus and the control is not blocked by an error.

When the control is not available the control is skipped as the next First_Module_To_Start.

Relevant variables

Specific Parameters	Display menu #	Level	(Default) Value	Range
Module Rotation Interval	84	Installer	5	0…30 (0: Disabled)
First Module To Start	175	Installer	1	1…8/16

Table 15.5

15.4 Cascade Error handling

15.4.1 *CASCADE FROST PROTECTION*

Frost protection on a cascade is active on two levels

Frost protection for module cascade
The 'frost protection' function for a Module cascade is related to the system sensor temperature. When the sensor value is below:

Spec. Parameter	Parameter nr.		Default value	Range
Frost Protection	Module cascade settings: 155		15°C	10 - 30°C
Frost Protection plus 9°F (5°C)		The Cascade pump (system pump) is started	15 plus 5 = 20°C	
Frost Protection minus 9°F (5°C)		Cascade heat demand is activated; the general pumps of all the cascaded water heaters will be started.	15 minus 5 = 10°C	

Table 15.6

Frost protection on boiler
As last protection the controllers for the boilers can force themselves to burn.

If the boiler supply/return temperature drops below 41°F (5°C) the boiler starts at minimum power and continues burning until the lowest of both supply and return temperatures are above 59°F (15°C).

Specific Parameters	Parameter nr.	Level	(Default) Value	Range
Frost protection Temperature for frost protection	Boiler settings Parameter 205	2: Installer	Enable	Enable / Disable

Table 15.7

15.4.1 *EMERGENCY MODE*

Managing boiler error
When the managing boiler is in error mode, the depending boilers can go into the "Emergency Mode", if enabled. In emergency mode the system setpoint is set to the temperature of the Emergency Setpoint and all cascaded boilers start burning on this setpoint.

NOTICE	The default setting is 158 °F (70 °C). Make sure the right temperature is set.

Loss of cascade communication
The burner controller of the managing boiler is aware of how many dependents should be present in the system. The total number of boilers is stored in the e2prom (parameter 147). When starting the system, the leading boiler has to detect all depending boilers within 60 seconds.
When not, all dependent boilers are detected the control will show the CC_Loss_Communication warning. When the communication with any of the depending boilers is lost during operation, the control will show the CC_Loss_Communication warning after 60 seconds, which is purely informative and will not block the control.

Specific Parameters	Display menu #	Level	(Default) Value	Range
Emergency_Mode	72	User	Yes	Yes/No
Emergency_Setpoint	74	Installer	158 ºF (70 ºC)	68...194 ºF (20...90 ºC)
DAir active	139	Installer	Yes	Yes/No

Table 15.8

For proper functioning of this emergency mode, the following settings are necessary in the managing boiler (installer password required):
- Module Cascade parameter no. 72: "Permit_Emergency_Mode" has to be set to "yes".
- Module Cascade parameter no. 75: "Emergency_Setpoint" has to be set to the right temperature.
- Boiler parameter no. 139: "Dair active" has to be set to "No".

NOTICE	Do not de-activate the DAir function before the boilers have been commissioned and adjusted to the correct settings.

When the managing unit is reset from lockout state, the cascade controllers are re-initialized.

16 SYSTEM TEST

For testing the system at fixed power rates, a system test can be activated via the Installer menu.
In the main menu of the display, select the option System Test. This option is password protected.

Via the system test the boiler can be started without CH or DHW being present. The system test has priority.

The following modes are available:

System test mode		Description
0	Not active	System test mode not active
1	Fan only	The fan is forced to run at maximum speed without starting the boiler
2	Low power	The boiler starts and after the ignition period has finished the boiler stays at low power
3	Ignition power	The boiler starts and stays at ignition power
4	High power	The boiler starts and after the ignition period has finished the boiler stays at high power
5	High power limited	The boiler starts and after the ignition period has finished the boiler stays at high power limited by the parameter *CH_max_power*
6	High limit error test	Simulates the *Max_Temp_Error*
7	Low water cut-off 1 error test	Simulates the *LWCO_1_Error*
8	Low water cut-off 2 error test	Simulates the *LWCO_2_Error*

Table 16.1

Before running the system test modes first check if the heat can also be dissipated. Note that during this mode the supply temperature can be raised above 203ºF (95ºC). When this temperature is reached the boiler will switch OFF. When the supply temperature cools down to 194ºF (90ºC) the boiler will start again.

During the system test the boiler and system circulator will be ON.
As the boiler will run at fixed power rates there is no setpoint control active.
Also, the flame recovery is not active during system test demand. All other safety functions remain active.

The system test automatically stops after 10 minutes, after which the system continues with normal demand handling. When the system test mode is changed during an active system test, the 10-minute timer is restarted.

17 COMMISSIONING THE BOILER

17.1 First: flushing the boiler with water

After installation of the boiler and before commissioning, the first step is to flush the boiler and the whole heating installation with fresh water to remove pollution, debris and other material that might cause a blockage. This must also be done with heating installations, where only the boiler has been replaced.
If a DHW circuit is present, in case of a combi (CO) boiler, the DHW circuit must be cleaned as well.

Existing and new heating systems must be cleaned with a hydronic system cleaner (see additional information in paragraph 8.17). System cleaner must be drained and thoroughly flushed with clean water to remove any residual cleaner, prior to installing a new boiler. **NEVER** leave a system cleaner in the system for longer than recommended by the cleaner's manufacturer. **NEVER** put system cleaner inside the boilers heat exchanger.

NOTICE	Make sure the cleaners comply with the Chemical water treatment section of the manual § 8.20.

17.2 Second: filling & venting the boiler and the system

After flushing the boiler and the installation, the system can be filled with fresh water. Fill the boiler and the heating system by using the appropriate filling valve. The water pressure of the system normally lies between 18 and 28 psi (1.2 and 1.9 bar) – see § 8.25.

The boiler has an automatic air vent situated inside the boiler. This vent is always open, and the venting outlet goes via a plastic tube through the bottom to the outside. Shortly after putting the boiler into operation, check the water pressure and add or remove some water to obtain the required pressure.

Manual de-airing the heat exchanger
The heat exchanger of the boiler must be manually de-aired by means of the air-vent of the boiler. This air vent is situated at the top left of the boiler.

To manually de-air the heat exchanger: (see also § 8.23)

- put a short, fitting drain hose on the air vent; direct the outlet away from the boiler !
- slowly turn the vent open until the air starts flowing out;

NOTICE	**Only use your hands when opening and closing this vent. NEVER use tools on this vent.**

  (with the air also a small amount of water will stream out; with the attached drain hose the drained water can be easily collected)
- when all the air is removed, close the air-vent and remove the drain hose.

When a cascade system has been installed, the automatic De-air function must be disabled by means of parameter 139 - DAir active.

During the commissioning, make sure that no water can enter the boiler and make contact with the electrical parts.

17.3 Third: check the water flow

Before starting the boiler, ensure that the circulator is operating correctly and that there are no obstructions or closed valves that could prevent water from flowing through the heat exchanger.

NOTICE	Always ensure the boiler circulator is functioning correctly and that there is flow through the heat exchanger after working on the boiler or system.

17.4 Mounting the Condensate Trap

When mounting the bottom part of the condensate trap, before commissioning the boiler and/or after maintenance, it must **ALWAYS** be completely filled with water.

WARNING	When mounting the bottom part of the condensate trap, before commissioning the boiler and/or after maintenance, the condensate trap must **ALWAYS** be completely filled with water. **This is a safety measure: the water in the condensate trap keeps the flue gases from leaking out of the heat exchanger via the condensate drain.**

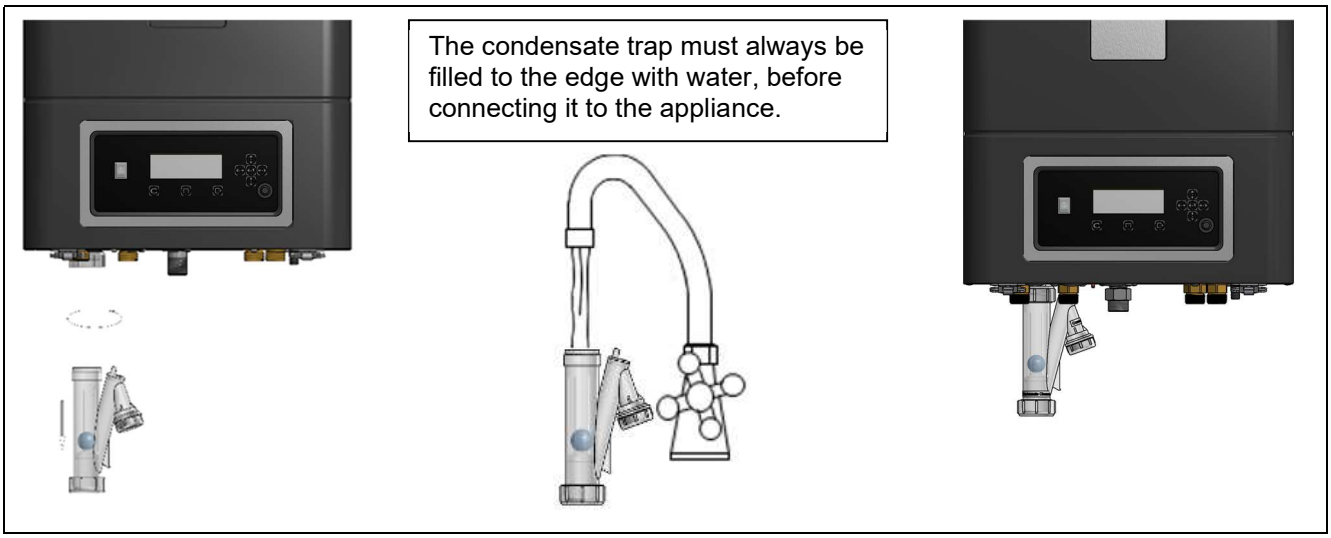


Figure 17.1

When the boiler receives a heat demand the electronics will start the operation of the boiler. Before the boiler is used, the boiler must be adjusted and set to the minimum and maximum load/temperature.

17.5 Checking gas pressure

Check the gas pressure available at the gas connection pipe of the boiler. Use the pressure nipple [3] of the gas safety valve for this measurement. Figure 18.1 shows the position of the gas pressure nipple [3]

Min. and max. gas supply pressures:

Type of Gas	p nom [inch W.C./ mbar]	p min [inch W.C./ mbar]	p max [inch W.C./ mbar]
Natural gas	7.0 / 17.4	3.5 / 8.7	10.5 / 26.2
Propane	11.0 / 27.4	8.0 / 19.9	13.0 / 32.4

Table 17.1

17.6 Firing for the first time

After the commissioning of the boiler and completing the previously described required actions, the display screen will show the following:

Figure 17.2

This screen is active during power up and will remain active until communication with the main Control has been established. After communication has been established the Dair mode is running and the following screen appears:

Figure 17.3

The “De-Air” sequence is a safety function that starts at every power-up and is used to remove the air from the heat exchanger. The De-Air sequence takes around 4 minutes to complete. It can be cancelled by pressing the Enter button for over 5 seconds.

CAUTION	Do not bypass the Dair function upon initial startup of the boiler or when water has been added to the boiler/system. Bypassing the Dair function may cause damage to the heat exchanger which could cause the boiler to fail. Bypassing the Dair function could lead to overheating or under heating resulting in property damage.

After completion or manual ending the “De-Air” sequence one of the following Status overview screens appears:

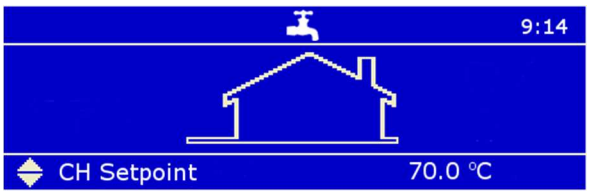


Figure 17.4 Central Heating only

OR

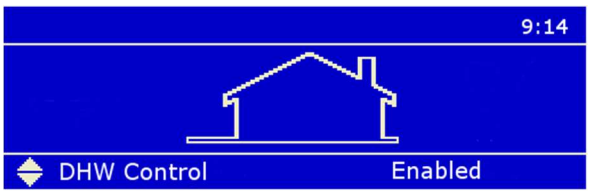


Figure 17.5 Central Heating AND Domestic Hot Water

The display describes:

- The actual operation for heating or hot water
- The temperature setting

18 ADJUSTING AND SETTING THE BOILER

WARNING	Before carrying out any adjustments of the burner, carefully read this chapter entirely. The initial lighting of the appliance must be performed by a licensed Gas Technician. Failure to follow these instructions may result in property damage, serious injury or death. As soon as the appliance has been fully installed (with regard to hydraulics, filling and de-aeration of installation, gas, flue gas, air intake, wiring etc.) according to the preliminary installation instructions, the boiler should then be wired to an electrically grounded power supply source. The boiler must always be connected to a disconnect or external power shutoff. The boiler must be electrically bonded to the ground in accordance with the requirements of the local authority having jurisdiction or, in the absence of such requirements, the National Electrical Code, ANSI/NFPA 70, and or/the Canadian Electrical Code Part I, CSA C22.1 Electrical Code.

18.1 Introduction

The boiler must always be adjusted in the following situations:

- A new boiler has been installed.
- As part of a service/maintenance check, in case the O_2 values turn out to be incorrect.
- The gas valve has been replaced.
- Gas conversion to propane. Prior to adjustments, follow the procedure in 18.4.
- The venturi/gasvalve has been replaced. Follow the procedure in 18.2
- The fan has been replaced.

In any of the cases described, always check the gas/air ratio of the combustion figure (O_2 / CO_2) at maximum and minimum input.

First, set the boiler at maximum load and subsequently at minimum load, and repeat if necessary (adjustments at maximum load influence values at minimum load and vice versa).

Chapter overview:
First, all necessary values are given in adjustment Table 18.1. A drawing of the gas valve(s) and setting screws is given in paragraph 18.1.2. In paragraph 18.2 a general procedure, conform which the adjustments must be carried out, is presented. Paragraph 18.4 describes the specific adjustments to be made when the gas type is set to propane.

18.1.1 *COMBUSTION TABLE*

Table 1: O_2 and CO_2 values for low fire and high fire for all boiler types. [1)]

O_2 flue gas	Natural gas	Low Fire %	4.0 – 4.2
		High Fire %	4.5 – 4.7
	Propane[2)3)]	Low Fire %	5.9 – 6.1
		High Fire %	5.4 – 5.6
CO_2 flue gas	Natural gas	Low Fire %	9.4 – 9.6
		High Fire %	9.1 – 9.3
	Propane[2)3)]	Low Fire %	9.6 – 9.8
		High Fire %	10.0 – 10.2

1) All values measured without front door. Note: CO_2 value will increase 1.5% with front door installed.
2) For propane: the venturi must be completely replaced, see 18.4.
3) For propane: the fan speeds must be changed, see 18.4.

Table 18.1

18.1.2 *SETTING GAS VALVE SCREWS.*

Location of the setting screws:

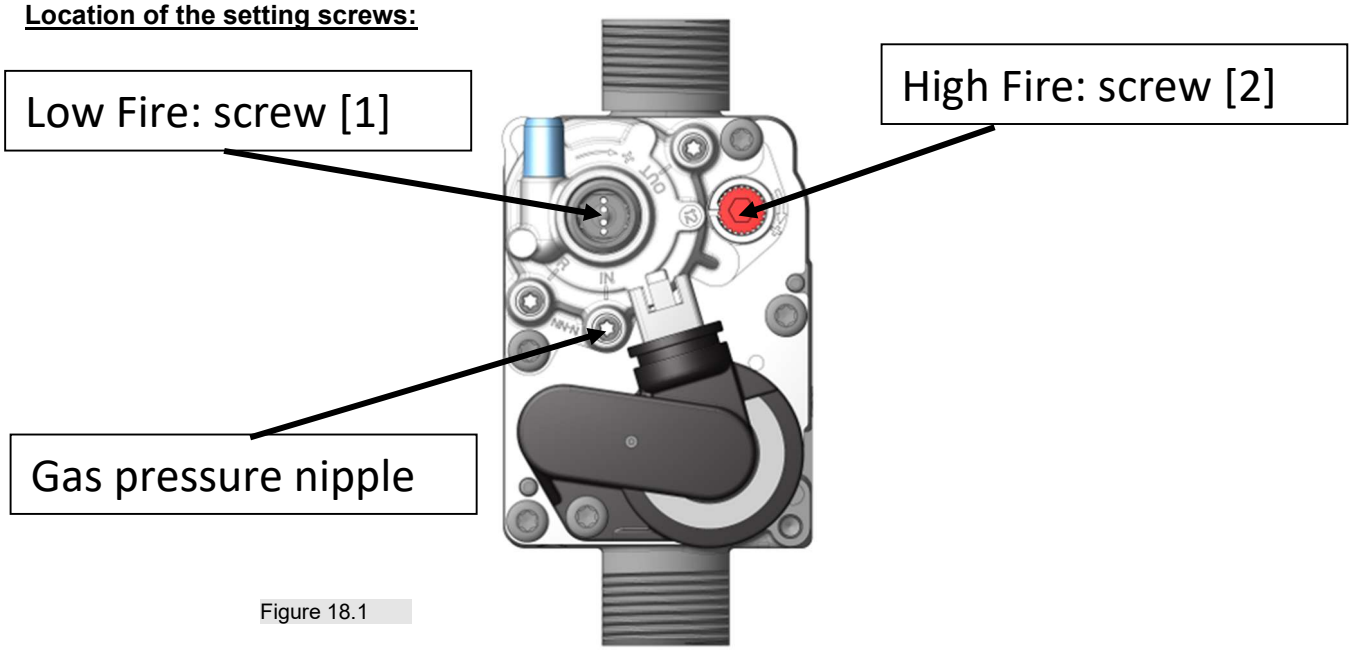


Figure 18.1

Low Fire: gas valve adjustment screw: Torx T40.
NOTE: Remove the cover screw to get access to the low fire adjustment screw.

+ Rotate clockwise (to the right) provides the boiler with more gas and therefore the O_2 percentage drops and the CO_2 percentage rises.
- Rotate anticlockwise (to the left) provides the boiler with less gas and therefore the O_2 percentage rises and the O_2 percentage drops.

High Fire: adjustment screw: use hex key 4 mm (5/32 Allen wrench)

+ Rotate clockwise (to the right) provides the boiler with more gas and therefore the O_2 percentage drops and the CO_2 percentage rises.
- Rotate anticlockwise (to the left) provides the boiler with less gas and therefore the O_2 percentage rises and the CO_2 percentage drops.

How to Reset the gas valve to factory settings

Use below procedure in case the setting screws are at an unknown setting (e.g. because of a replacement gas valve) and the boiler does not start burning.

Reset High fire adjustment screw (2):
1 - Rotate the high fire screw clockwise (to the right) till it blocks (be careful: rotate gently)
2 - Rotate the high fire screw anticlockwise (to the left) counting the number of turns according the table below

Type of boiler	Number of turns anti clockwise
CH-80 / CO-90	6
CH-120 / CH-100	5
CO-150 / CH-150 / CH-180 / CO-200	4

Table 18.2

If the boiler does not start, rotate the high fire screw an extra half turn clockwise

Now proceed with the "O_2 / CO_2 Adjustment procedures" chapter 18.2

18.2 O_2 / CO_2 Adjustment procedures

The adjustment of the low fire screw is much more sensitive than the high fire screw. Only make small adjustments 1/8th of a turn at a time and then wait for the boiler to stabilize and give the combustion analyzer enough time to draw in a stable sample.

Procedure 1: adjust at High Fire

Carry out the following steps:

1. From status screen, press MENU ☰.
2. Press UP/DOWN ↑↓ to select "System Test"
3. Fill in the Installer password.
4. Press ENTER ↵ to activate the system test. → "Test State: Off"
5. Press ENTER ↵ to activate the test state. → "Test State: **Off**"
6. Press UP/DOWN ↑↓ multiple times to select "High Power" → "Test State: **High Power**".
   The boiler becomes active; after about 10 seconds the boiler burns at high fire.
   If the boiler does not start, first check gas pressure, then open screw 1/2 turn extra - clockwise
   Note: once the test state is active, it is not necessary to press a button; selecting the desired power is sufficient.
   Wait a minimum of 20 seconds for the boiler to stabilize before taking combustion readings between changes and adjustments to the combustion.
   For your information "Fan speed" and "Ionization" are displayed.
7. Measure the CO_2 percentage at the flue gas test port on the vent connection.
8. By setting screw [2], adjust the gas valve to obtain the O_2 value of Table 18.1.
9. To return to the status screen, and stop the boiler, press ESCAPE ⎋ or MENU ☰ 3 times, or RESET ↺ once.

Decrease O_2	O_2 ↓ [2] CO_2 ↑	**Turn screw [2] right (clockwise)**
Increase O_2	O_2 ↑ [2] CO_2 ↓	**Turn screw [2] left (counterclockwise)**

The system test automatically stops after 10 minutes, after this the system continues with normal demand handling. When the system test mode is changed during an active system test, the 10-minute timer is restarted.

Procedure 2: adjust at Low Fire

Carry out the following steps:

1. Press UP/DOWN ↑↓ multiple times to select "Low Power" → "Test State: **Low Power**".
   After about 20 seconds, the boiler burns at low fire.
2. Measure the CO_2 percentage at the flue gas test port on the vent connection.
3. By setting screw [1], adjust the gas valve to obtain the O_2 value of Table 18.1.

Decrease O_2	O_2 ↓ [1] CO_2 ↑	**Turn screw [1] right (clockwise)**
Increase O_2	O_2 ↑ [1] CO_2 ↓	**Turn screw [1] left (counterclockwise)**

4. To return to the status screen, and stop the boiler, press ESCAPE ⎋ or MENU ☰ 3 times, or RESET ↺ once.

The system test automatically stops after 10 minutes, after this the system continues with normal demand handling. When the system test mode is changed during an active system test, the 10-minute timer is reloaded.

Repeat procedures 1 and 2 until measured values match the values from Table 18.1 best.

Remount the cap on the the flue gas test port.

18.3 Venturi adjustment

The venturi is a fixed part and needs no adjustments.

18.4 Conversion from natural gas to propane

WARNING	Adjustment of the boiler to a different gas type must be performed by a certified technician, qualified installer or gas company

Use only parts/conversion kits obtained from the supplier and intended to be used with this particular boiler. Every conversion kit is provided with instructions how to assemble the kit to the boiler.

WARNING	**In order to convert the boiler from natural gas to propane the venturi must be completely exchanged for a propane compatible venturi.**

Secondly, parameters 92, 93 and 94 (fan speed) have to be changed in the software of the boiler to complete the conversion to propane.

Every conversion kit is provided with instructions how to assemble the kit to the boiler.

Converting the boiler to propane (LP) requires the following actions (details below).

1. check boiler model
2. check venturi type
3. exchange the venturi
4. set fan speed
5. adjust the O_2 / CO_2 percentage
6. check the gas pressure
7. confirmation: apply the propane sticker and mark the box

1. Check boiler model. Check the boiler model. The model number can be found on the data plate, on the outside of the boiler casing, right hand, top side.

2. Check venturi type. Check if the venturi type matches the boiler model.

3. Exchange the venturi:
Converting the boiler to propane is done by exchanging the venturi between gas valve and fan.

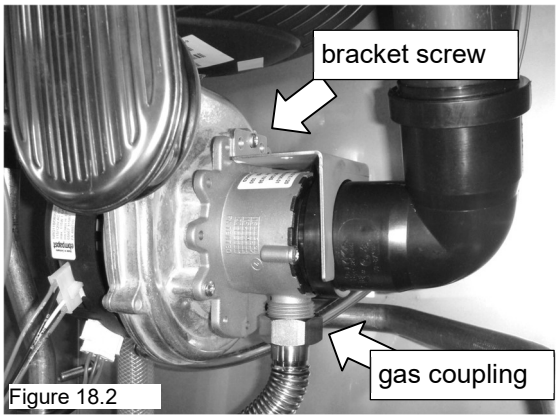


Figure 18.2

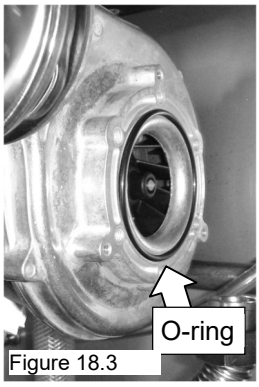


Figure 18.3

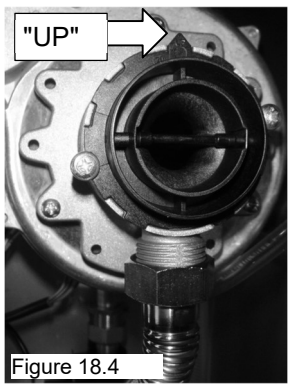


Figure 18.4

<u>Exchanging the venturi</u> (see also pictures):
Required tools: wrench 30, screwdriver Phillips no. 2.

1. Close the external gas shutoff valve and disconnect the electrical power before opening the boiler.
2. Remove the bracket screw (see picture) and pull off the air intake.
3. Use a wrench to open the coupling on the venturi (see picture) in the gas line.
4. Remove the two remaining screws, so the venturi comes free.
5. The propane venturi can now be mounted, be sure the O-ring is positioned correctly.
6. Check that the indicator "UP" is pointing upward (see picture).
7. Remount the gas line on the venturi by tightening the coupling, ensuring the gasket is in place.
8. Remount the air intake and the bracket. Position the air intake correctly.
9. Now open the external gas valve.
10. Check for gas leaks.
11. Reconnect the electrical power.
12. When in operation, check again for gas leaks on all parts that have been apart.

4. Set fan speed

The fan speeds have to be changed in the software of the boiler according to the table below:

Boiler model	Fan speed high fire Parameter 92		Fan speed low fire Parameter 93		Fan speed ignition Parameter 94	
	Propane	Natural gas	Propane	Natural gas	Propane	Natural gas
CH-80	6850	7450	1400	1350	2000	6000
CH-100	6500	6750	1400	1300	2000	5000
CH-120	6900	6800	1350	1250	3000	3500
CH-150	7150	7100	1450	1300	3000	3500
CH-180	6900	6900	1350	1300	3000	3500
CO-90	7700	8100	1550	1550	2000	5000
CO-150	8300	8000	1550	1400	3000	3500
CO-200	7600	7600	1450	1400	3000	3500

Table 18.3

1. From status screen, press MENU button once.
2. Press UP/DOWN ↑ ↓ to select "Settings" and press ENTER ↵
3. Press UP/DOWN ↑ ↓ to select "Boiler Settings" and press ENTER ↵
4. Enter installer password '1122' by pressing UP/DOWN ↑ ↓ and LEFT ← / RIGHT →.
5. Press UP/DOWN ↑ ↓ to select "Boiler parameters" and press ENTER ↵
6. Press UP/DOWN ↑ ↓ to select parameter "(92) Fan Speed Maximum" and press ENTER ↵
7. Press UP/DOWN ↑ ↓ to adapt the fan speed according to the table and press ENTER ↵
8. Press UP/DOWN ↑ ↓ to select parameter "(93) Fan Speed Minimum" and press ENTER ↵
9. Press UP/DOWN ↑ ↓ to adapt the fan speed according to the table and press ENTER ↵
10. Press UP/DOWN ↑ ↓ to select parameter "(94) Fan Speed Ignition" and press ENTER ↵
11. Press UP/DOWN ↑ ↓ to adapt the fan speed according to the table and press ENTER ↵

To return to the status screen, press ESCAPE ⎋ or MENU ☰ 4 times, or RESET ↺ once.

WARNING!	Check during start-up of the boiler no gas mixture is leaking on all parts that have been apart!

5. Adjust the O_2 / CO_2 percentage

Perform O_2 / CO_2 adjustments according to the procedures in this manual "Adjusting and setting the boiler". Use the propane values from table 18.1.

6. Check the gas pressure

Measure the gas pressure at high fire. The dynamic pressure should be at least 8.0 inch w.c. If there are more boilers in the boiler room the gas pressure should be checked on the boiler at the end of the gas line, with all boilers burning at high fire. If the gas pressure is too low: check gas lines, reducers and propane tank.

7. Confirmation

When finished:
- Apply the corresponding sticker at the appropriate position in the boiler.
- Mark the box "Propane" for the used gas type.
- Mark the box "Type", indicating that parameters 92 and 93 have been set for this boiler type.

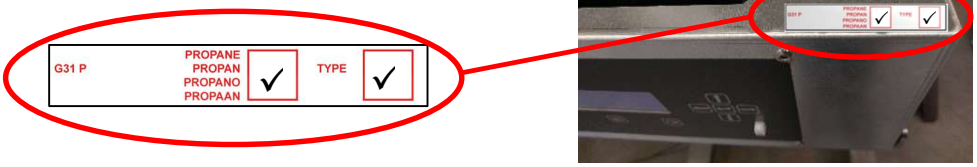


Figure 18.5

WARNING	Ensure that the boiler is clearly labelled if operating on propane gas!

18.5 Start Up Checklist

Installation/start-up checklist

Installer information	
Company	
Engineer name	
Address	
Postal code	
City	
State/province	
Tel. number	

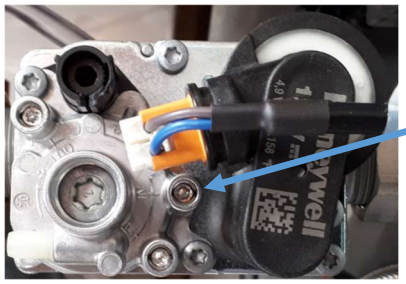
Site information	
Site name	
Site contact (owner/ end-user)	
Address	
Postal code	
City	
State/province	
Tel. number	

Boiler information	
Model	
Serial number	
Installation date	
New boiler or replacement	
Cascade installation	(YES / NO)
Number of boilers	
Type of boilers in cascade	

Venting information		
Direct vent or using combustion air from indoor?	indoor / outdoor	
	Air inlet	**Flue outlet**
Diameter		
Total length		
Length horizontal		
Length vertical		
Length sloped at …..°		
Number elbows 90°		
Number elbows 60°		
Number elbows 45°		
Number elbows 30°		
Air intake location (e.g. roof/ wall)		
Distance vertical from roof		
Distance from (closest) wall		
Common air intake system	(YES / NO)*	
If YES => how many Air intakes are joined?		
Air intake (under)pressure (on top of boiler)		
Possibility of dust / chemicals drawn into air intake?	(YES / NO)*	
If YES => of which kind?		
Distance from Flue outlet (top of chimney) vertical		
Distance from Flue outlet (top of chimney) horizontal		
Is there a condensate drain installed to common flue system?		
Flue outlet pressure (on top of boiler)		

Condensate Drain	
Check the level of the heat exchanger; It must have a slight angle from the rear to ensure that the condensate drains from the heat exchanger.	(YES / NO)
Condensate trap (from package) installed according installation manual ?	(YES / NO)
Inside diameter of drain piping	mm/inch
Is there a definite air gap between the condensate trap and the connection to drainpipe ?	(YES / NO)
Total drop in height from boiler to drain piping exit point	
Any additional trap points ?	(YES / NO)
Perform PH test and register PH value	
Condensate neutralizer installed	(YES / NO)

Water circulation & temperature regulation (for DHW)	
Piping diameter	
Total length of straight pipe between boiler & tank	
Number of elbows	
Number of tees	
Temperature rise between inlet and outlet after 5 min. cold-start operating max. power	°C / °F
Water temperature setpoint	
Test of Water Flow Switch (DHW)?	(YES / NO)
Minimum required water pressure in system set to 14.5 psi (1.0 bar)?	(YES / NO)



Gas supply	
Type of Gas from installation	
Is gas isolation valve installed under boiler according to installation manual?	(YES / NO)
Which diameter gas isolation valve is installed?	
Gas piping (inside) diameter	
Gas piping material (if possible, specify mark/type)	
Gas piping flexible (YES / NO)	(YES / NO)
Gas piping inside structure (e.g. smooth / corrugated)	
Measured Gas pressure @Gas valve (Static) **	
Measured Gas pressure @Gas valve (dynamic - all gas appliances in the building must be turned on and running at full load)	
Is there a secondary gas pressure regulator before the boiler?	(YES / NO)
If YES what is the length of the Gas piping in between?	
If YES what is the Brand & Model?	

Combustion settings		unit:
Set for NG (Natural Gas) or LP (Liquid Propane)?	NG or LP?	
In case of LP: is the right venturi mounted?	(YES / NO)	
O2 level at high fire …%		%
O2 level on low fire …%		%
Flue pressure @ O2 measuring point at high fire		Pa
Flue pressure @ O2 measuring point at low fire		Pa
If cascaded with common flue system run all appliances at HIGH fire and measure the flue pressure		Pa
If cascaded with a common flue system; run all appliances at LOW fire and measure the flue pressure		Pa

Electronics & Power supply		unit:
Version Burner Controller Hardware (see paragraph 4.2 for location)		
Version Burner Controller Firmware (see paragraph 4.2 for location)		
Is ground connected to building grounding system?	(YES / NO)	
Voltage incoming (Hot to Neutral)		V
Voltage incoming (Hot to Ground)		V
Voltage measured between Ground and Neutral		V
Total of amperage switched by the Boiler Control is below 3.5 A or 400 W ?		A

Additives	
Used chemical additions	
Mixing ratio	

Table 18. 4

19 INSPECTION, MAINTENANCE AND SERVICE

19.1 General

For a good, safe and long-lasting operation of the boiler and to maintain warranty it is mandatory to carry out inspection, maintenance and service on the boiler at least once a year.

NOTICE	**Maintenance and inspection of the boiler must be carried out in the following situations:** • **When a number of similar error codes and/or lockouts appear.** • **At least once every 12 months to ensure safe and efficient operation.** **Damage caused by lack of maintenance will not be covered under warranty.**

Service intervals
The normal service frequency for the boiler is once a year. Every year the boiler must be cleaned and checked, according to the maintenance procedures. If there is doubt whether the boiler is operating with the correct water and/or combustion air quality, it is advised that a first check is executed already after six months. This check serves to determine the frequency of the future services. The maximum interval between two services is one year.

WARNING	**Inspection, maintenance and service must be executed for a safe and efficient operation of the boiler**

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

19.2 Safety instructions Crystalline Silica

WARNING	**Warning** **Crystalline Silica – Read instructions below carefully**

Refractory Insulation
The refractory insulation of the heat exchanger (located on the rear wall inside the heat exchanger and burner door) must be inspected. If this insulation disk shows any signs of (water) damage or degradation it must be exchanged. Also check if there are any indications in the combustion chamber of a high condensate level (caused by a blocked condensate trap) that might have wetted the rear wall insulation. When this has happened, the rear wall insulation must also be replaced.
Only use the insulation disk that is supplied by the boiler manufacturer.
The same procedure must be applied to the insulation and gaskets fitted on the burner door.

Personal Protective Equipment Required - Read the following warnings and handling instructions carefully before commencing any service work in the combustion chamber. The insulating material on the inside of the burner plate and the rear combustion chamber wall contain *Refractory Ceramic Fibers* and must never be handled without personal protective equipment. When disturbed as a result of servicing, these substances become airborne and, if inhaled, may be hazardous to your health.

Potential Carcinogen - Use of *Refractory Ceramic Fibers* in high temperature applications (above 1805 °F) can result in the formation of Crystalline Silica (cristobalite), a respirable silica dust. Repeated airborne exposure to crystalline silica dust may result in chronic lung infections, acute respiratory illness, or death. Crystalline silica is listed as a (potential) occupational carcinogen by the following regulatory organizations: International Agency for Research on Cancer (IARC), Canadian Centre for Occupational Health and Safety (CCOHS), Occupational Safety and Health Administration (OSHA), and National Institute for Occupational Safety and Health (NIOSH). Failure to comply with handling instructions in table 19.1 may result in serious injury or death.

Crystalline Silica - Certain components in the combustion chamber may contain this potential carcinogen. Read warnings and handling instructions pertaining to Refractory Ceramic Fibers before commencing service work in the combustion chamber. Take all necessary precautions and use recommended personal protective equipment as required. Installation and service must be performed by a qualified installer, service agency or the gas supplier who must read and follow the Installation, Operation, and Service Manual before performing any work on this boiler. Improper installation, adjustment, alteration, service or maintenance can cause property damage, serious injury (exposure to hazardous materials) or death.

Avoid Breathing Fiber Particulates and Dust

Precautionary Measures:
Do not remove or replace RCF parts or attempt any service work involving RCF without following the guidelines and wearing the following personal protective equipment outlined in the table below:

Avoid the Following	• Avoid contact with the skin and eyes. • Avoid breathing in the dust in the combustion chamber. • Avoid transferring the contamination from clothing and items at the job site.
Personal Protective Equipment	• Wear long-sleeved shirt and pants, gloves, and safety goggles. • Wear a respirator with a N95 rated filter efficiency or better.[1]
Working Environment	• When cleaning the combustion chamber with a vacuum cleaner use water to reduce airborne dust levels. • Do not dry sweep silica dust. Pre-wet or use a vacuum with a high efficiency HEPA filter. • Take all possible steps to provide adequate ventilation in the boiler room.
Clean-up	• Remove all contaminated clothing after use. Store in sealable container until cleaned. • Wash contaminated clothing separately from other laundry and rinse washing machine after use to avoid contaminating other clothes. • Wash all exposed body areas gently with soap and water after contact.
Disposal	• Discard used RCF components by sealing them in an airtight plastic bag. RCF and crystalline silica are not classified as hazardous wastes in the United States and Canada.
First aid	• If contact with eyes: Flush with water for at least 15 minutes. Seek immediate medical attention if irritation persists. • If contact with skin: Wash affected area gently with soap and water. Seek immediate medical attention if irritation persists. • If breathing difficulty develops: Leave the area and move to a location with clean fresh air. Seek immediate medical attention if breathing difficulties persist. • Ingestion: Do not induce vomiting. Drink plenty of water. Seek immediate medical attention.

Notes:
[1] Respirator recommendations based on OSHA and CCOHS requirements at the time this document was written. Consult your local regulatory authority regarding current requirements for respirators, personal protective equipment, handling, and disposal of RCF's.

Refractory Ceramic Fibers (RCF)
For more information on Refractory Ceramic Fibers, the risks, recommended handling procedures and acceptable disposal practices contact the organization(s) listed below:

United States (OSHA): Telephone directory listing under United States Government - Department of Labor - Occupational Safety and Health Administration; or website http://www.osha.gov.

Canada (CCOHS): Telephone directory listing under Government Blue Pages Canada - Health and Safety - Canadian Centre for Occupational Health and Safety; or website http://www.ccohs.ca.

Table 19.1

19.3 Inspection, maintenance and service tasks

Inspection, maintenance and service including the replacement of boiler parts must only be carried out by a licensed professional, service agency or the gas supplier. Apart from the maintenance proceedings it is required to maintain a service log for each boiler that includes all of the following information:

- Serial number
- Date and time of maintenance
- Name of maintenance engineer
- Which parts were exchanged during maintenance?
- Which settings (software) were changed during maintenance
- Special remarks / findings
- Future aspects that need extra attention
- Additional aspects: measurement reports, complaints by the (end)-user, lock-out codes, etc.
- Static Gas Pressure inches W.C.
- CO_2 % at high and low fire
- Gas Pressure at high fire
- Gas Pressure at low fire
- pH of the water or water/glycol in the system
- Name of service company
- Date of service

NOTICE	**Before starting work on the boiler:** • **Switch off the electrical power to the boiler (service switch and/or unplug boiler)** • **Close the gas valve to block the gas supply to the boiler**

During maintenance, the following items (listed below in bold) regarding the boiler must be checked and inspected.

- **Customer comments**

Comments and remarks from the customer must be analyzed and used to find possible causes for any occurring problems and complaints.

- **Service history**

The operational and fault history (total amount and since the last service) can be viewed in the boiler control
This information can be used to specify the maintenance and service proceedings in relation to the boiler (parts).

Boiler History	
Successful Ignitions	32
Failed Ignitions	10
Flame Failures	0
Operation Days	0 days ▼

Figure 19.1

- **Water leakage**

The water pressure of the heating installation must be more than 11.6 psi (0.8 bar) and at a maximum of 43.5 psi (3.0 bar) in normal operation. When the water pressure drops below the minimum occasionally, there might be a water leak. Check the complete heating installation for any water leakages and have these repaired.
Higher water pressures are allowed with the use of a different relief valve and a pressure switch kit

- **Flue gas & air supply**

The flue gas pipes, and the air supply pipes must be checked for gas tightness. Also check if the mounting of these pipes is correct, safe and not damaged. Check the top side of the boiler housing for signs of water leakage and traces of water coming from the air supply pipe, the air vent or any condensate coming from the flue gas pipes.
Check, in order to guarantee the supply flow, that there are no obstructions in front of the exhaust venting or the intake combustion air venting.
Check that all intake and exhaust venting has been properly reassemble and sealed before leaving the job site

- **Gas supply & safeties**

The gas pipes must be checked for gas tightness. Also check if the mounting of these pipes is correct, safe and not damaged. Any built-in safeties must be checked for a correct functioning. Any gas pipe or fitting that have been opened or adjusted must be checked for leaks.

- **Remove complete burner unit**

The complete burner unit consists of the fan and venturi, the burner plate and the internal burner. To make more space to dismantle the complete burner unit pull down the burner controller unit.
To remove this part for an internal heat exchanger check:

- close the gas shutoff valve under the boiler
- Shutoff the electrical connection
- remove the ignition cables
- loosen the gas coupling under the venturi.
- remove the air intake pipe from the venturi.
- remove the four M6 nuts

After this, take out the complete burner unit by moving it forward out of the boiler housing.

CAUTION	**Watch out not to damage the burner plate insulation during this operation.**

While removing the complete burner unplug both of the electrical and controlling cables of the fan. Next dismantle the venturi on the suction side of the fan and check the blade wheel of the fan.

WARNING	**Warning** **Crystalline Silica – Read instructions of § 19.2 carefully**

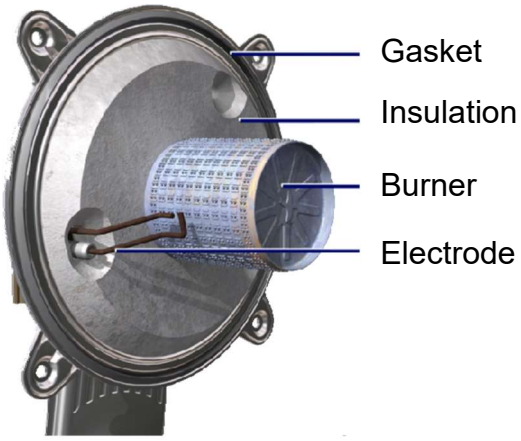


Figure 19.2

- **Burner**

Check the burner surface to see if it has damages, signs of rust and/or cracks. When the burner surface is damaged the burner must be replaced. The burner can be cleaned by using a soft (non-metallic) brush. The dust can be removed with a vacuum cleaner or pressurized air.

- **Ignition electrode**

Check if the distances between the electrodes and between the electrode and the burner are according to figure 19.22. When these are not correct, try to bend the electrodes into the right position. Notice: the electrodes undergo high temperatures, therefore the electrodes become hard and are difficult to bend. Before trying to bend an electrode that has already been used ensure a replacement electrode is available on hand.

While bending used electrodes they might break or burst. Check the electrode, after bending, for any tear/crack and signs of rust. When they are damaged in any manner or rusty, replace the electrode. Also replace the electrode when there is a crack in the ceramic insulation of the electrode. When the electrode is replaced, also the gasket must be replaced. The electrode must be cleaned annually by lightly rubbing its surface. Emery cloth, sandpaper or any other abrasive material must **NEVER** be used to clean the electrode.

- **Gasket**

If any part of a gasket has a discolored, changed texture, has been hardened, the rubber has cured and/or has damages, these gaskets must be replaced. **Note**: only use gaskets that are supplied by the boiler manufacturer.

- **Insulation**

If the insulation is damaged or has been wet, it must be replaced.

- **Heat exchanger and boiler combustion chamber**

After the removal of the complete burner unit check if there is any debris and dirt in the heat exchanger. The coils of the heat exchanger can be cleaned by using a **non-metallic** brush. After this the dirt and dust can be removed with a vacuum cleaner and by flushing the boiler combustion chamber with water. Never expose the refractory insulation in the back of the combustion chamber to water or let it get wet. Do not forget to clean the condensate trap once again afterwards. Do not use acid or alkali products for cleaning, with the exception of white vinegar with max. 7% acetic acid. Afterwards always rinse with fresh water. Ensure that the insulation remains dry.
A plastic card can be used to clean in between the coils.

- **Cleaning the interior of the heat exchanger.**

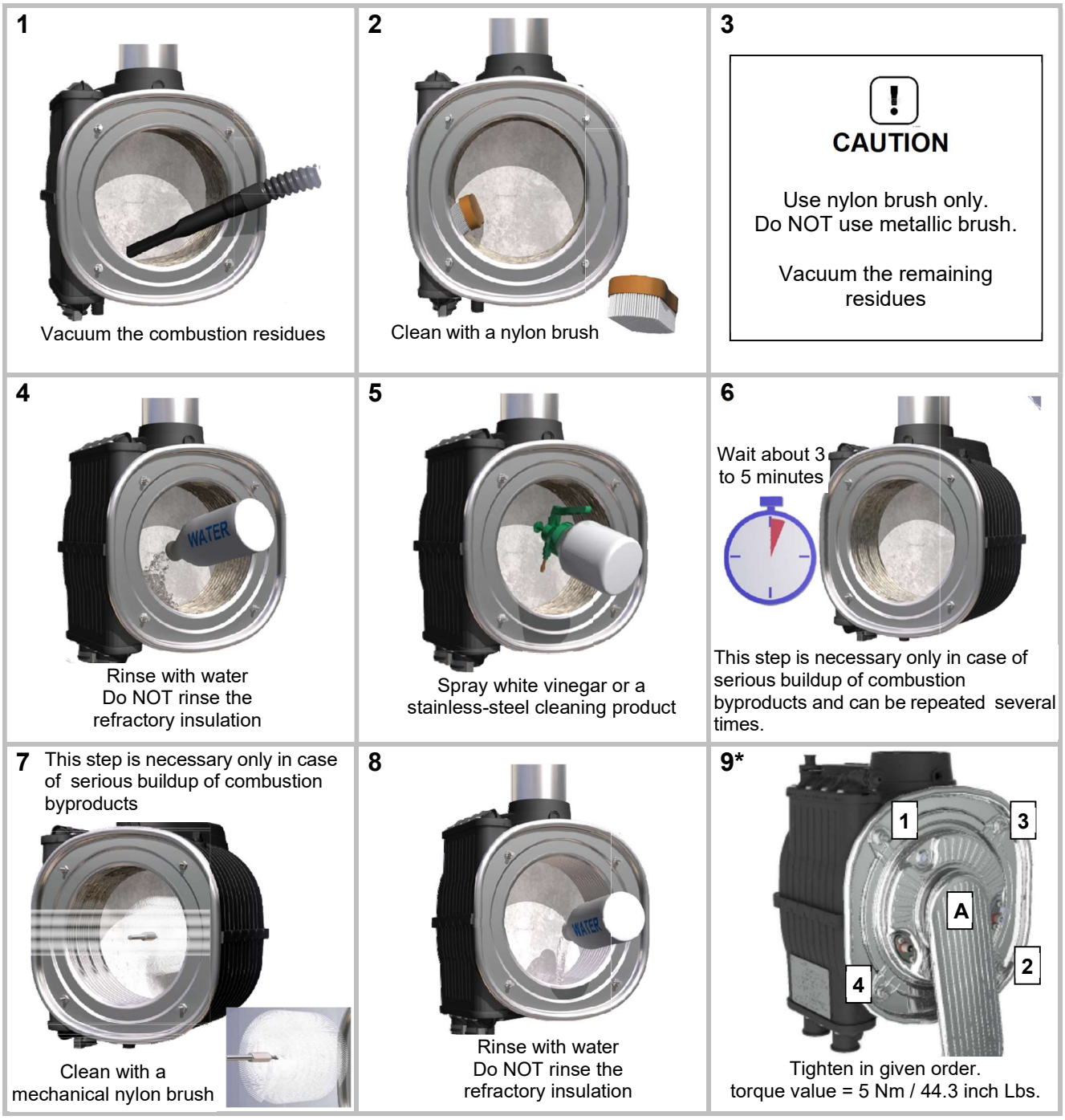


Figure 19.3

- **Fan**

When the fan blades are polluted and dirty, carefully clean the blades with a soft brush. Notice: do not use too much force on the blades or else the fan might be out of balance and run irregularly, causing noise and fan failures. Also check the fan for any water damage. In doubt always replace the fan of the boiler.

- **Circulator (internal)**

Check the electrical parts and the motor of the circulator for a correct functioning. The circulator must generate a sufficient water flow over the (heat exchanger of) the boiler. When the circulator produces noise, has been operational for more than ten years or shows signs of water leakage it is recommended to replace the circulator as a precaution.

- **Condensate trap**

Disassemble the condensate trap and clean every part of it. Check the condensate trap connection of the heat exchanger for any blockage or pollution and clean it (if necessary). Check the functioning of the condensate trap by pouring clean tap water in the boiler combustion chamber (when the burner door is removed). This water will exit the heat exchanger by the condensate trap. Notice: do not wet the rear wall insulation.

WARNING	When mounting the bottom part of the condensate trap, before commissioning the boiler and/or after maintenance, the condensate trap must **ALWAYS** be completely filled with water. **This is a safety measure: the water in the condensate trap keeps the flue gases from leaking out of the heat exchanger via the condensate drain.**

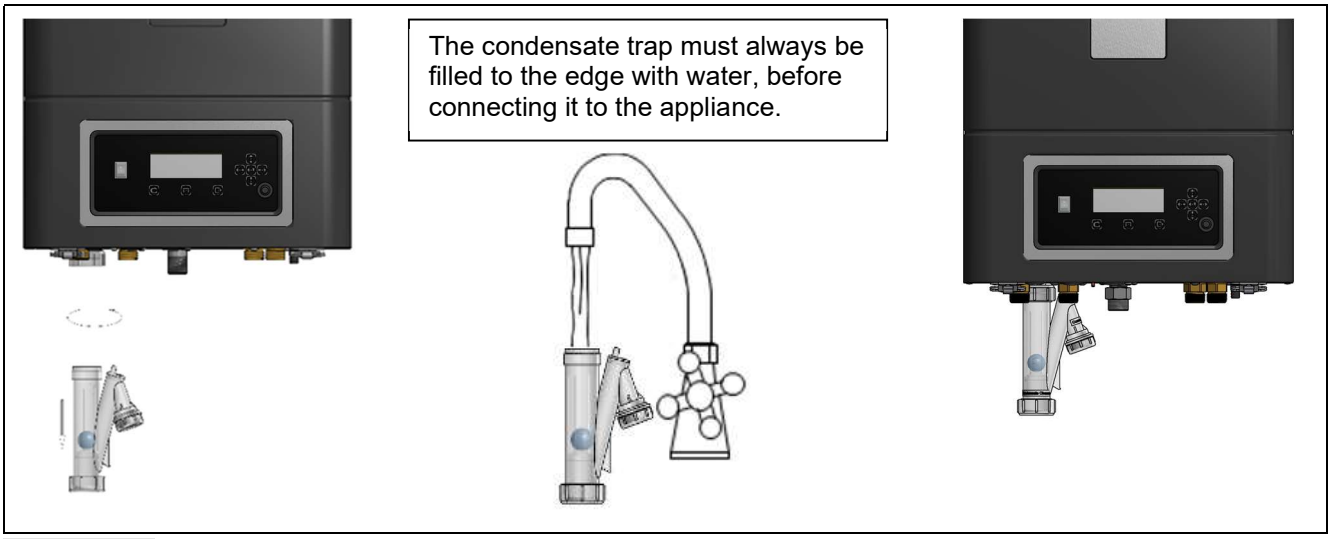


Figure 19.4

- **Gas/air ratio**

With every service check and/or maintenance of the boiler always check the gas/air ratio by measuring the O_2 percentage (flue gas) at the maximum and minimum load of the boiler. If necessary, adjust these values. For more information see chapter 18.

WARNING	• When faults and abnormalities are discovered by the service technician during service or maintenance and these prove not to be repairable, this must be reported to the owner/end-user of the installation. The owner/end-user must also be advised how to fix these faults. Finally, these faults must be reported in the service report / log file of the boiler. • During service and maintenance, the gas, supply air, flue gas and condensate connections are disconnected, checked and replaced. Make sure that all these components are mounted correctly before commissioning the boiler again. • Cleaning the combustion chamber and heat exchanger with acid or alkali products is prohibited, with the exception of white vinegar with max. 7% acetic acid. See figure 19.3

19.4 Replacing Heat exchanger parts.

WARNING	**Warning** **Crystalline Silica – Read instructions in § 19.2 carefully**

19.4.1 *REPLACEMENT OF THE BURNER DOOR GASKET*

If any part of a gasket has a discolored, changed texture, has been hardened, the rubber has cured and/or has damages, these gaskets must be replaced. **Note**: only use gaskets that are supplied by the boiler manufacturer.

Burner door gasket replacement:

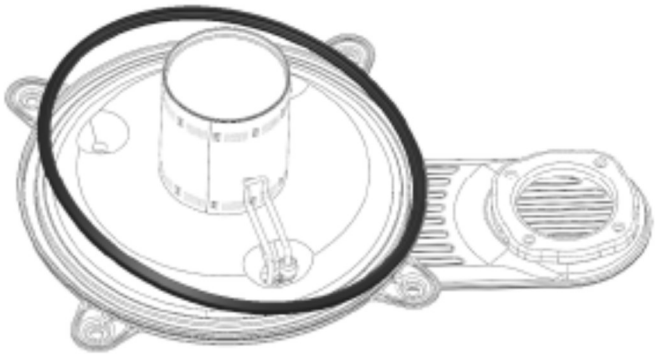


Figure 19.5

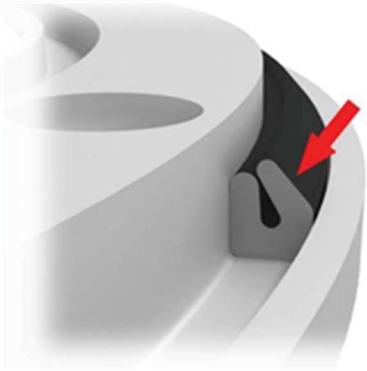


Figure 19.6

- Remove the old gasket
- Place a new gasket in its groove.
- Respect the mounting direction.
- Reassembling of the burner door set on the heat exchanger according to paragraph 19.5

19.4.2 *FIBER BRAID REPLACEMENT*

If the high temp braided rope is damaged and needs to be changed, it has to be replaced by new braids using the method described below. The high temp braided rope is fixed by silicone glue.

- Remove the braids by sliding a thin tool under the periphery to loosen the braids and remove it.
- Remove and clean the residues of the braids and the silicone glue.

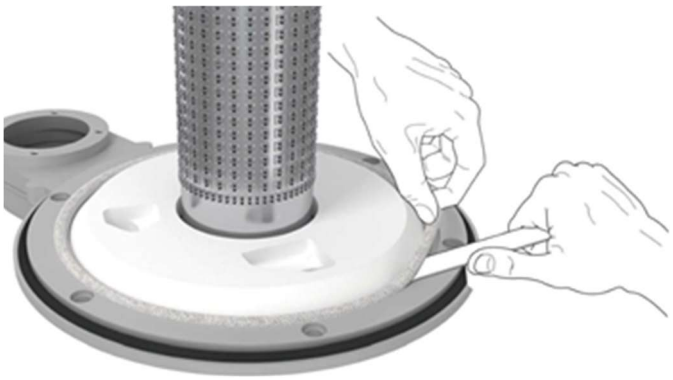


Figure 19.7

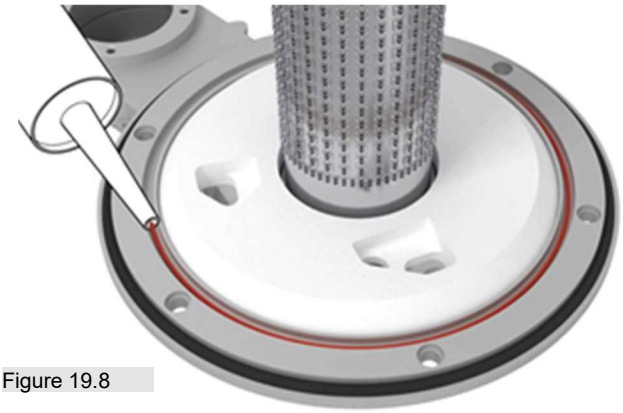


Figure 19.8

- Put a thin string of temperature-resistant silicone glue in the seal housing. (Loctite 5366 or Ottoseal S17)

- Engage the high temp braided rope and place it in contact with the glue and press the braids.

Figure 19.9

19.4.3 *REPLACEMENT OF THE BURNER DOOR INSULATION.*

The insulation burner door is fitted to the burner diameter and is fixed by 2 glue silicone dots. If the insulation is damaged and needs to be changed, it has to be replaced by a new insulation using the method described below.

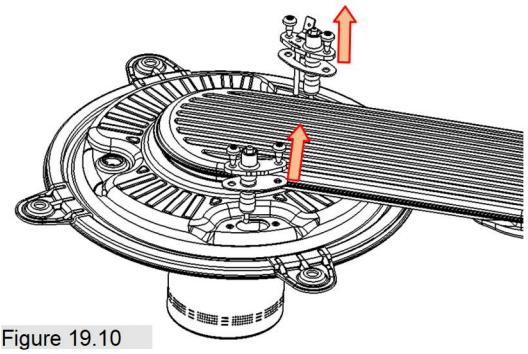


Figure 19.10

1. Remove both electrodes by unscrewing the fixing screws.

2. Remove the defective/damaged insulation by sliding under the periphery of the insulation a thin tool (for example, a ruler) to loosen the insulation and remove it without damaging the glass fibre braid that is glued.

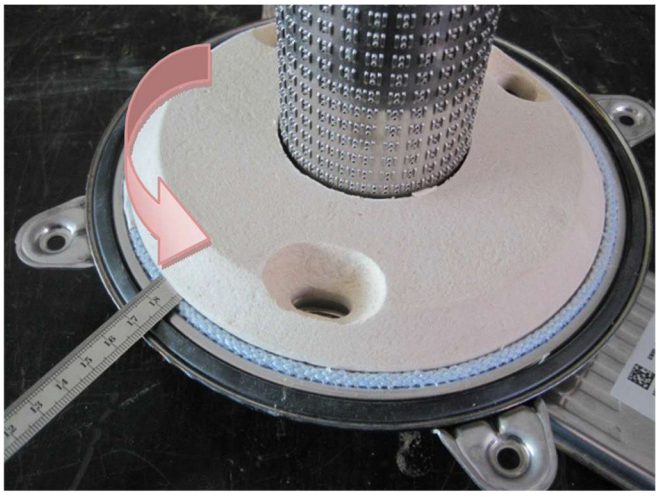


Figure 19.11

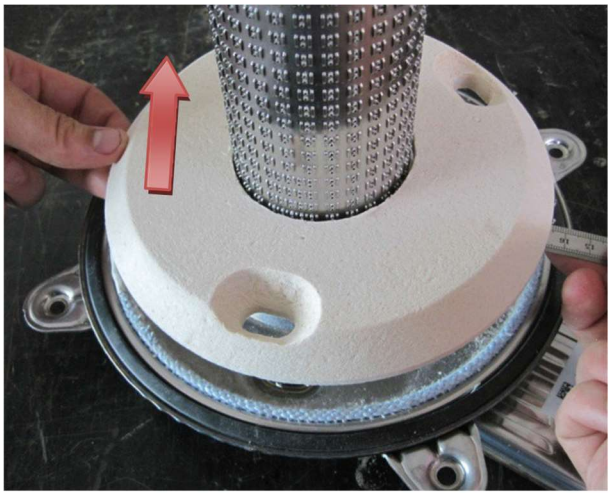


Figure 19.12

2.1 Remove and clean the rests of the insulation and silicone glue.
2.2 Put 2 dots of temperature-resistant silicone glue (Loctite 5366 or Ottoseal S17), according to the location indicated on figure 19.13 (next page)
2.3 Make sure that the burner is in proper condition, remove any possible insulation residues on the burner.
2.4 Engage the insulation and place it in contact with the 2 dots of silicone glue

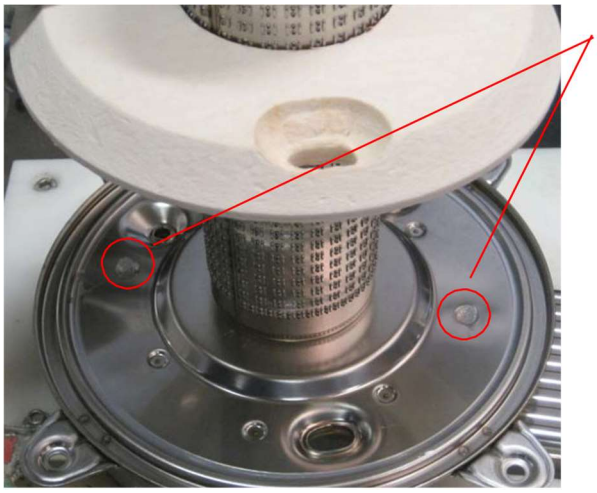


Figure 19.13

2 dots of silicone glue «Loctite 5366 or Ottoseal S17»

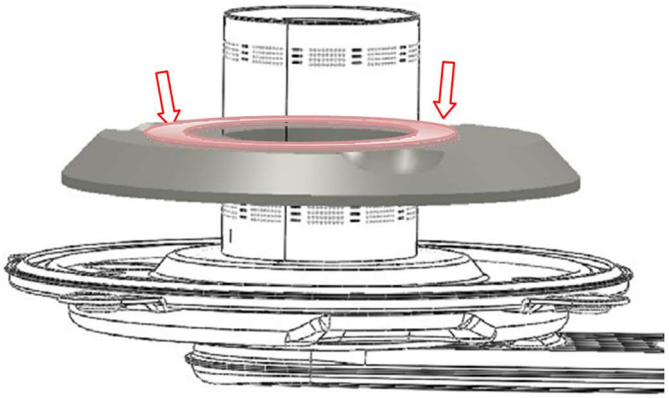


Figure 19.14

3. Check the condition of the electrodes, if necessary replace them.
   Reassemble the electrodes equipping them with new gaskets and respecting the location of each electrode as well the tightening torque of the 4 screws of 2.5 Nm (22.1-inch Lbs).

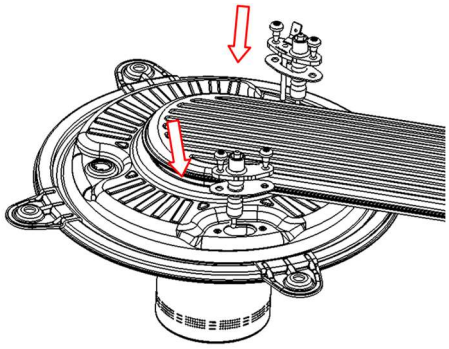


Figure 19.15

4. Check the distance of the electrodes to the burner, as well as the gap between the ignition electrodes. Correct the gap if necessary.

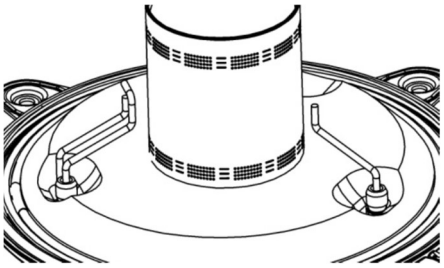


Figure 19.16

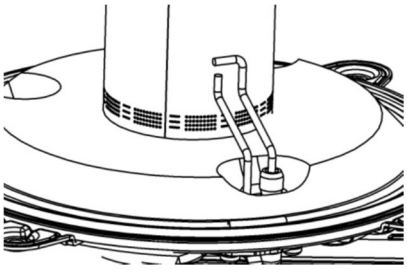


Figure 19.17

19.4.4 *REPLACEMENT OF THE REAR WALL INSULATION DISK*

If the insulation disk is degraded or damaged, it must be replaced.

- Ensure that the heat exchanger has cooled down; wait a few hours after burning. In this way the protective film of the new insulation disc will not stick to the back wall of the combustion chamber.
- Wet the insulation by spraying water over it. This in order to keep airborne dust to a minimum.

- with a knife, cut a cross in the insulation disk, avoiding the central insert (on the back, not visible)

- make a square cut around the central insert

- remove the segments

- remove the central insert

The new disc has the clip on the back.

- do **NOT** remove the protective film on the new disc
- with the central insert on the back, place the new insulation disk by pushing it to the rear of the wall. A "click" means it is correctly fitted.


Figure 19.18


Figure 19.19


Figure 19.20

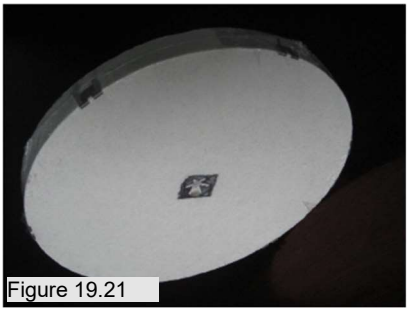


Figure 19.21

19.4.5 *REPLACEMENT IGNITION / IONIZATION ELECTRODE*

When the complete burner is removed, it is very easy to check the ignition electrode. First check if the distances between the electrodes and between the electrode and the burner are according to the figure below. When these are not correct, try to bend the electrodes into the right position. Notice: the electrodes undergo high temperatures, therefore the electrodes become hard and are difficult to bend. While bending used electrodes they might break or burst. Check the electrode, after bending, for any tear/crack and signs of rust. When they are damaged in any manner or rusty, replace the electrode. Also replace the electrode when there is a crack in the ceramic insulation of the electrode. When the electrode is replaced, also the gasket must be replaced. The electrode must be cleaned annually by lightly rubbing its surface. Emery cloth, sandpaper or any other abrasive material must **NEVER** be used to clean the electrode.
Reassemble the electrodes equipping them with new gaskets and paying attention to the location of each electrode as well the tightening torque of the screws of 2.5 Nm (22.1 inch Lbs).

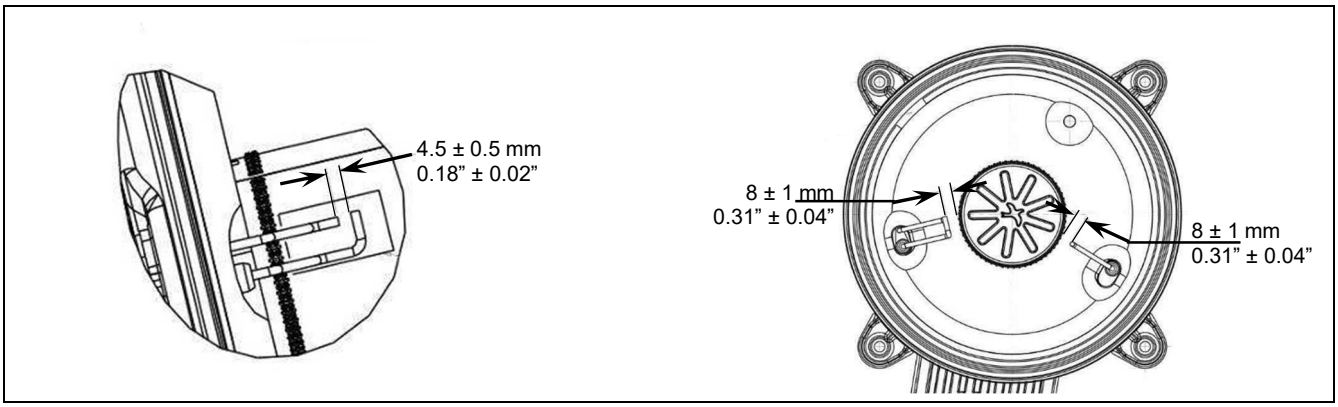


Figure 19.22

19.5 Remounting the burner door

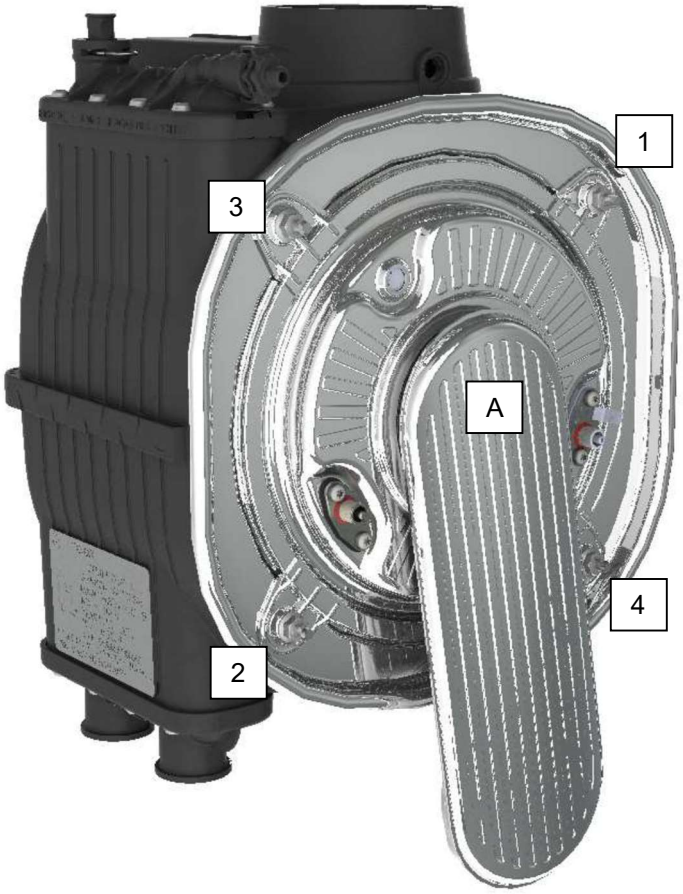


Figure 19.23

Before mounting the burner door, make sure that its gaskets and insulation are in excellent shape.
If any signs of damage or ageing are present, these parts must be replaced.

The burner door must be mounted back on the heat exchanger as follows:
• Ensure that the door is well positioned with respect to the threaded studs, before pushing it onto the exchanger.
• Place the burner door with its holes over the four threaded studs.
Careful! When handling too rough or misplacing the holes over the threaded studs, the burner door insulation and/or gaskets can be damaged.
• Keep the burner door in place by pushing the gas / air premix manifold with one hand at the middle at point A.
• Hand tighten the flange nuts with the other hand as far as possible onto the threaded studs.

Now the burner door is in place and the nuts can be tightened with a torque wrench.
• Tighten the nuts in the order given in figure 19.23
• The specified torque value for tightening the burner door flange nuts is 3.7 foot lbs. (5 Nm).

19.6 Cleaning the Brazed Plate Heat exchanger

Cleaning the Brazed Plate Heat exchanger (Every 2-year maintenance or as needed based on water quality)
The brazed plate heat exchanger should be cleaned at the service interval every 2 years. Failure to flush the brazed plate heat exchanger can cause damage to it. Follow the procedure below for cleaning the brazed plate heat exchanger.

1. Turn off the DHW function on the boiler.
2. Close the shutoff valves on both the hot water and cold-water lines (V3 and V4).
3. Connect pump outlet hose (H1) to the hot water line at service valve (V1).
4. Connect drain hose (H3) to service valve (V2).
5. Pour approximately 4 gallons of virgin, food grade, white vinegar or citric acid into pail.
6. Place the drain hose (H3) and the hose (H2) to the pump (CP) inlet into the cleaning solution.
7. Open both service valves (V1 and V2) on the hot water and cold-water lines.
8. Operate the pump (CP) and allow the cleaning solution to circulate through the brazed plate heat exchanger for at least 45 minutes.
9. Turn off the pump (CP).
10. Rinse the cleaning solution from the brazed plate heat exchanger as follows:
    - Remove the free end of the drain hose (H3) from the pail
    - Close service valve, (V2), and open shutoff valve, (V4). Do not open shutoff valve, (V3).
    - Disconnect both H1 and H3 from the service valves
    - Connect H3 to V1 and place the end of the hose in a drain
    - Allow water to flow through the brazed plate heat exchanger for 5 minutes
    - Close service valve, (V1), and open shutoff valve, (V3).
11. Disconnect all hoses.

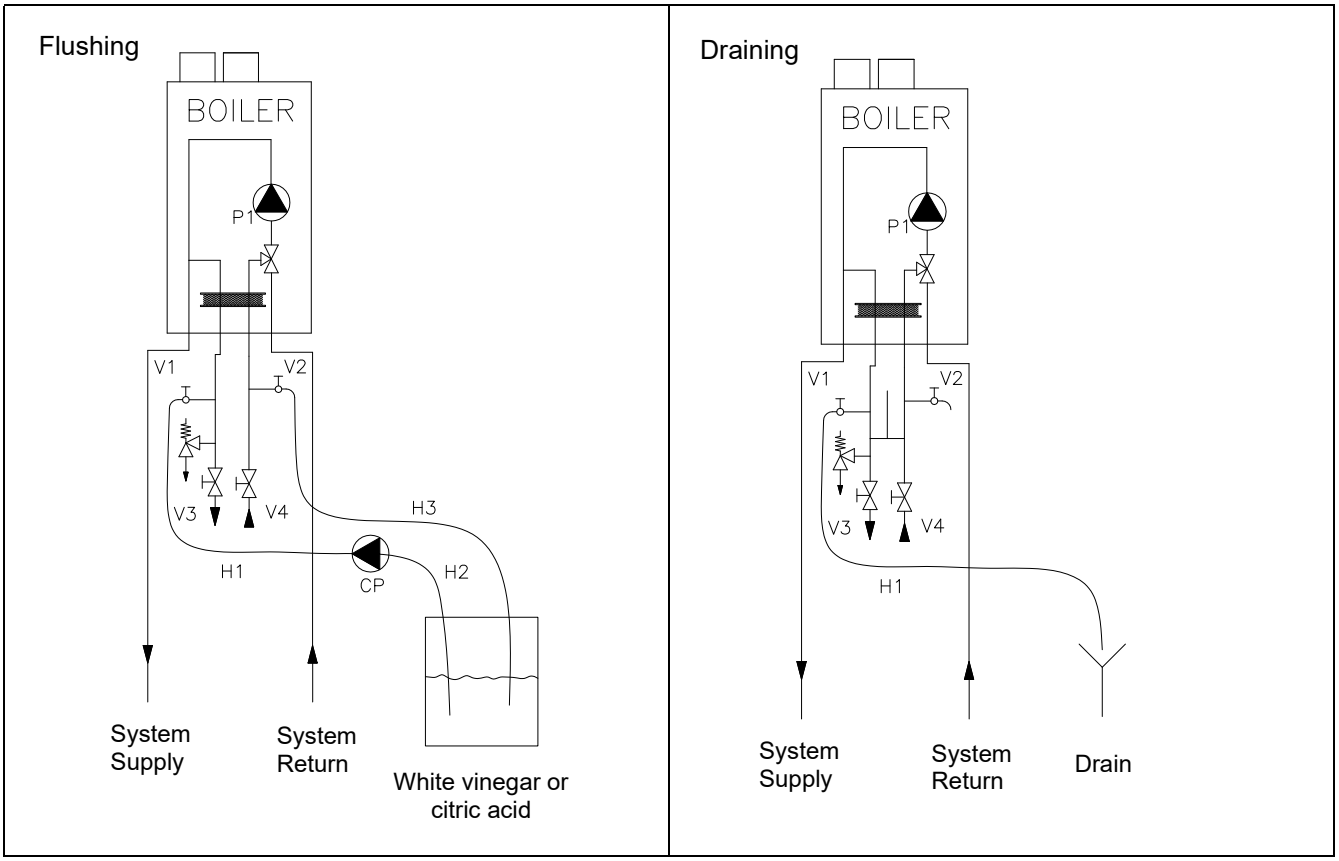


Figure 19.24

19.7 Maintenance Checklist

WARNING	Allowing the boiler to operate with a dirty combustion chamber will be detrimental to its operation. Failure to clean the heat exchanger as required by the manual and dictated by the operating location could result in boiler failure, property damage, personal injury, or death. Such product failures **ARE NOT** covered under warranty

Periodic maintenance must be performed once a year by a qualified service technician to guarantee that the equipment is operating safely and efficiently. The owner must make necessary arrangements with a qualified heating contractor for yearly maintenance of the boiler. The technician must inform the owner that the lack of proper care and maintenance of the boiler could result in a hazardous condition.

Maintenance Table

Inspection activities		Date Last completed			
		1st year	2nd year	3rd year	4th year
Near boiler piping	Check system and boiler piping for any sign of leakage. Take off boiler cover and inspect connections in boiler for any leaks or corrosion.				
Vent	Check condition of all vent pipes and joints.				
	Check to ensure vent termination is not blocked or obstructed.				
Gas	Check gas piping, test for leaks and signs of aging. Record gas pressure and note pressure drop upon start-up. Record CO_2 at high and low fire.				
Visual and Temperature	Do a visual inspection of all system components and verify programmed temperature settings.				
Connections	Check wire connections and make sure they are tight.				
Combustion chamber	Check burner tube and combustion chamber coils. Clean with nylon brush and vacuum. Avoid touching white ceramic fiber. See also chapter 19.				
Spark igniter	Ensure spacing of igniter prongs are aligned properly.				
Condensate trap	Disconnect condensate hose and trap. Ensure there is no blockage. Rinse and clean out. Fill completely again with fresh water and re-install.				
Relief valve	Check to make sure it is not leaking.				
Circulator and fan	Listen to the sound of the circulator and of the fan. If either makes noise during operation, it is recommended to replace the part.				
Homeowner	Ask homeowner before maintenance if they have any issues. After completing maintenance inform homeowner which activities you performed during maintenance visit.				
Chemical additions	Check the chemical additives and add or renew if the mixing ratio is out of spec. Check and record the ph of the fluid in the system				
Mixing ratio					

Table 19.2

20 USER INSTRUCTIONS

After installing and commissioning of the boiler, the installer is obliged to do the following:

- Demonstrate the operation of the entire heating system to the end-user;
- Make the user familiar with all safety precautions of the boiler and the installation
- Instruct the user that service and maintenance of the boiler is required at least once every twelve months Regular service and maintenance are essential for a safe and proper operation of the boiler.
- Hand over the user manual and all other documents supplied with the boiler to the end-user.

21 INSTALLATION EXAMPLES

The following schematics present several examples of heating installations:

WARNING	**All schematics are purely functional. Safety components, bypass, control devices and so on must be added to conform to all applicable standards and regulations.**

System Example 1

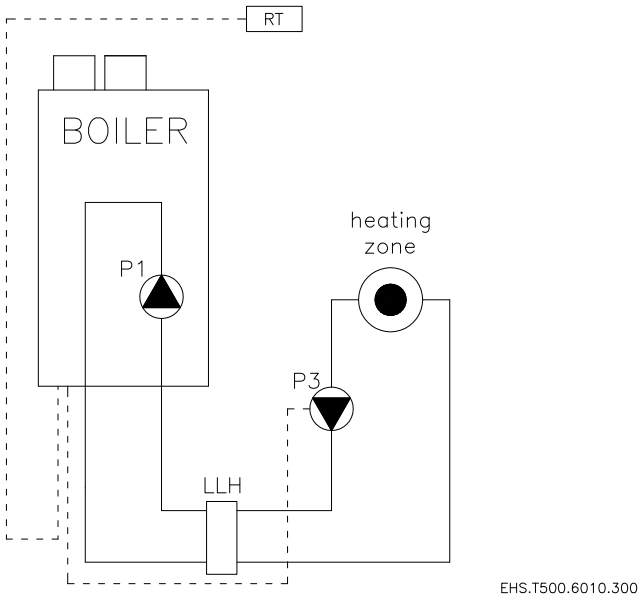


Figure 21.1

CH mode 0

Low Voltage Connections		
	Name	**Wire terminal**
RT	Room thermostat	12-13
High Voltage Connections		
P1	Boiler circulator	6-7-PE
P3	Central heating circulator	4-5-PE
LLH	Low Loss Header	

Check the following parameter:		
Boiler parameter	Name	Change to
125	Prog. Output 1.	2

System Example 2

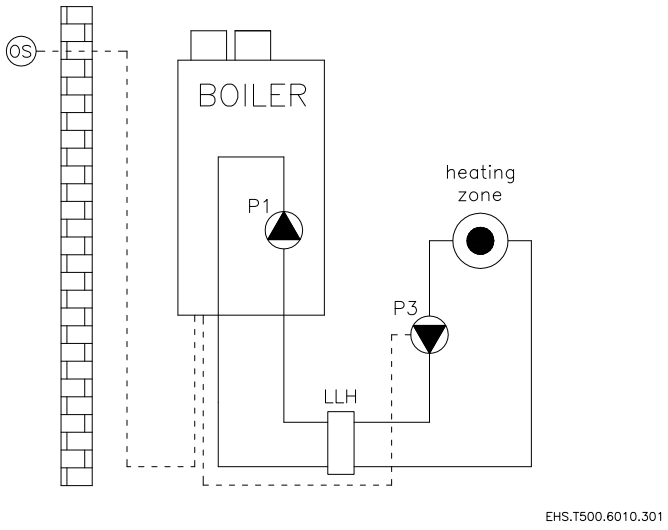


Figure 21.2

CH mode 2

Low Voltage Connections		
	Name	**Wire terminal**
OS	Outdoor temperature sensor	1-2
High Voltage Connections		
P1	Boiler circulator	6-7-PE
P3	Central heating circulator	4-5-PE
LLH	Low Loss Header	

Check the following parameter:		
Boiler parameter	Name	Change to
125	Prog. Output 1.	2

System Example 3

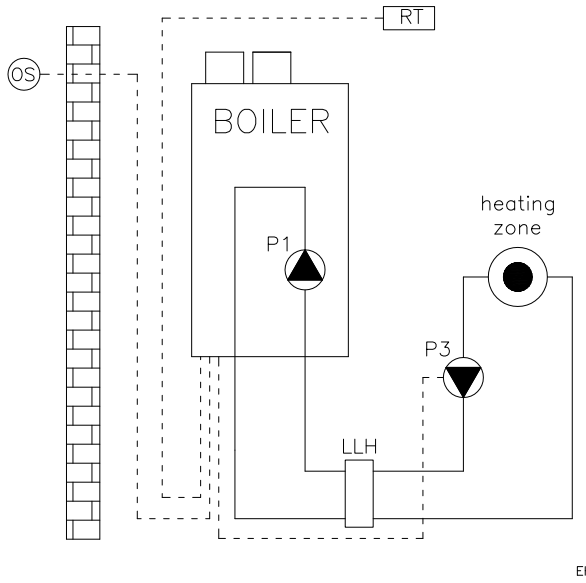


Figure 21.3

CH mode 1

Low Voltage Connections		
	Name	**Wire terminal**
RT	Room thermostat	12-13
OS	Outdoor temperature sensor	1-2

High Voltage Connections		
P1	Boiler circulator	6-7-PE
P3	System heating circulator	4-5-PE
LLH	Low Loss Header	

Check the following parameter:		
Boiler parameter	Name	Change to
125	Prog. Output 1.	2

System Example 4

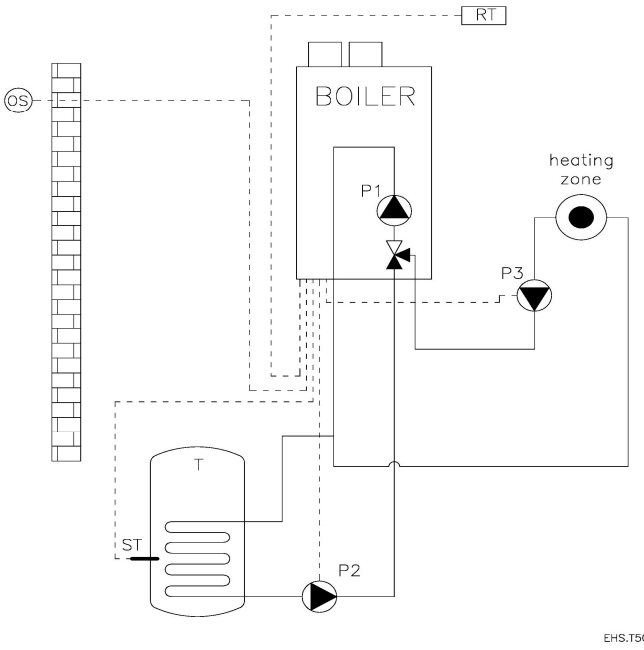


Figure 21.4

CH mode 1
DHW mode 1/2

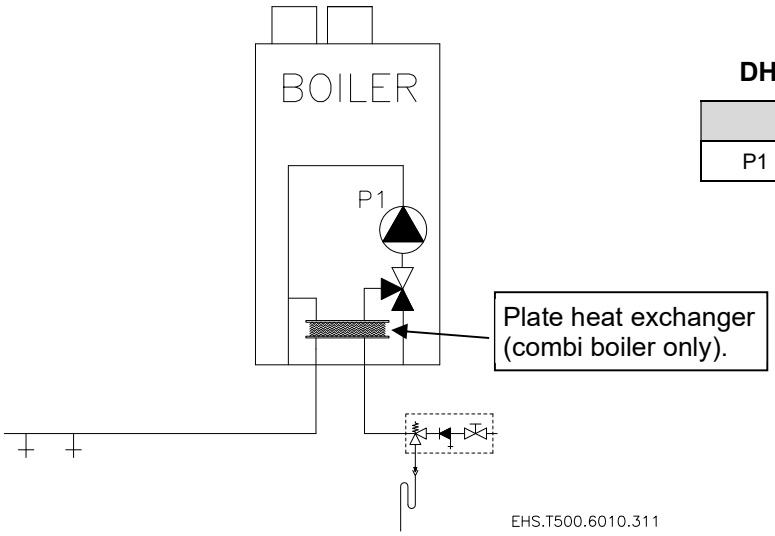
Low Voltage Connections		
	Name	**Wire terminal**
RT	Room thermostat	12-13
FS	Flow temperature sensor	3-4
OS	Outdoor temperature sensor	1-2
ST	DHW tank thermostat or sensor	5-6
T	DHW indirect Tank	

High Voltage Connections		
P1	Boiler circulator	6-7-PE
P2	DHW circulator	2-3-PE
P3	System heating circulator	4-5-PE
DV	Diverter valve (3-way-valve)	1-2-3-PE

Explanation: When you need both P2 and P3, P2 must be connected parallel to the 3-way valve. Check parameter 125, it must be set to 2. Check maximum current draw, when necessary use a relay.

When P3 is not needed, P2 can be connected to 4-5 PE. Now a parameter change is necessary: Program Output 1 (parameter 125) must be set to 3 to accommodate the DHW pump.

System example 5



DHW mode 5

High Voltage Connections		
P1	Boiler circulator	6-7-PE

Figure 21.5

System example 6

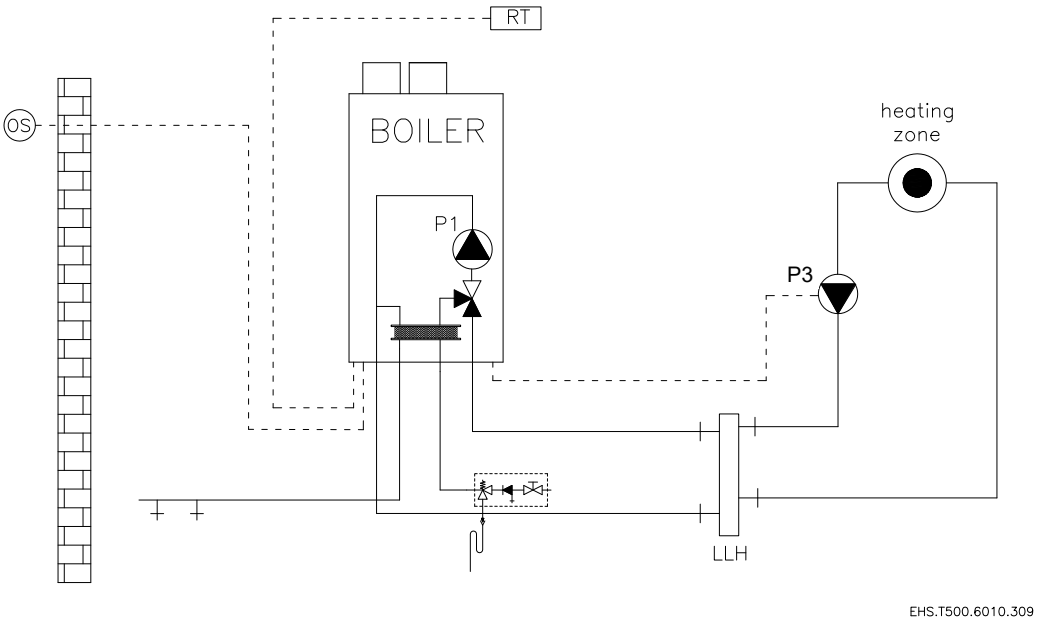


Figure 21.6

CH mode 1 DHW mode 5		
Low Voltage Connections		
	Name	**Wire terminal**
RT	Room thermostat	12-13
OS	Outdoor temperature sensor	1-2
High Voltage Connections		
P1	Boiler circulator	6-7-PE
P3	Central heating circulator	4-5-PE
DV	Diverter valve (3-way-valve)	1-2-3-PE
LLH	Low Loss Header	

Check the following parameter:		
Boiler parameter	Name	Change to
125	Prog. Output 1.	2

System example 7

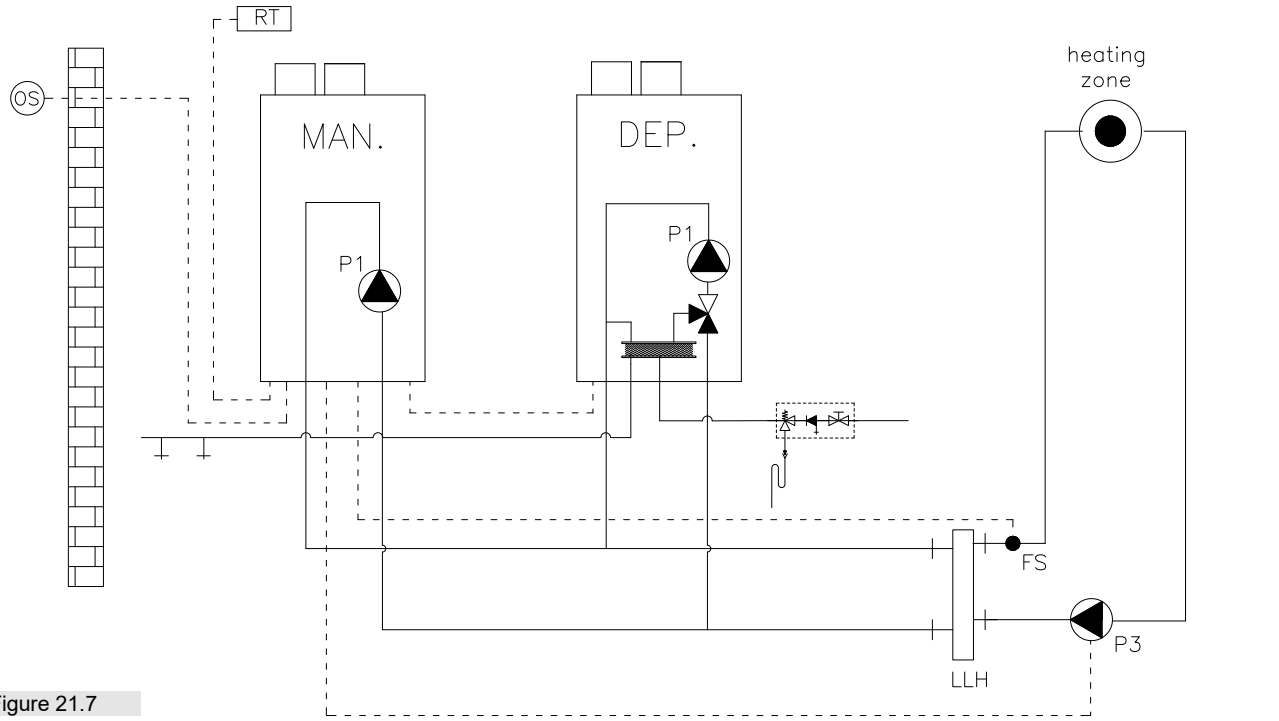


Figure 21.7

CH mode 1 DHW mode 5		
Low Voltage Connections		
	Name	**Wire terminal**
RT	Room thermostat	12-13
FS	Flow temperature sensor	3-4
OS	Outdoor temperature sensor	1-2
High Voltage Connections		
P1	Boiler circulator	6-7-PE
P3	System circulator	4-5-PE
DV	Diverter valve (3-way-valve)	1-2-3-PE
LLH	Low Loss Header	

Check the following parameters:		
Boiler parameter	Name	Change to
125	Prog. Output 1.	4
147	Number of units	2
184	Burner Address	Managing and DEP2

Sensors must be connected to the Managing boiler

22 SPARE PARTS CH-xx

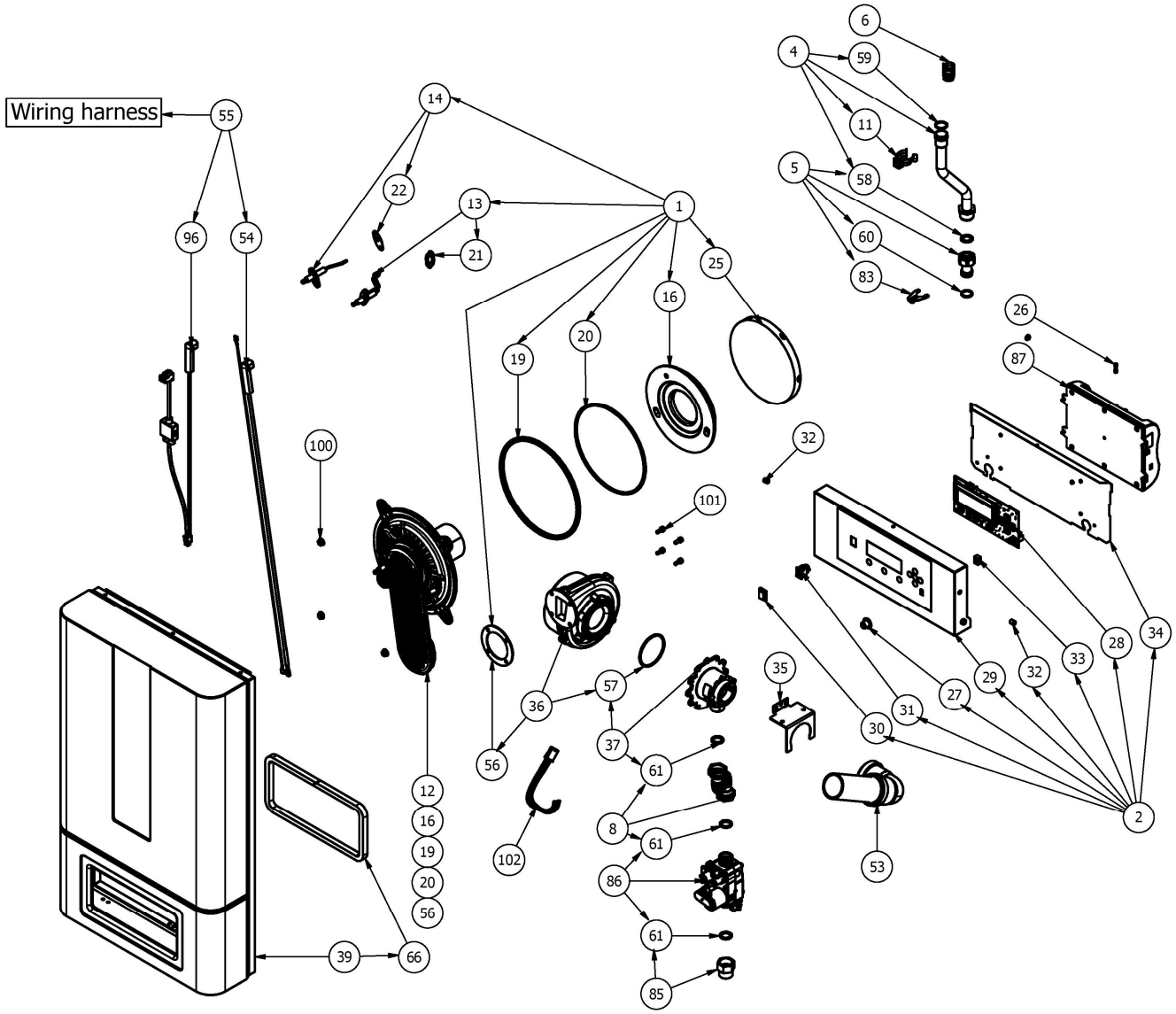


Figure 22.1

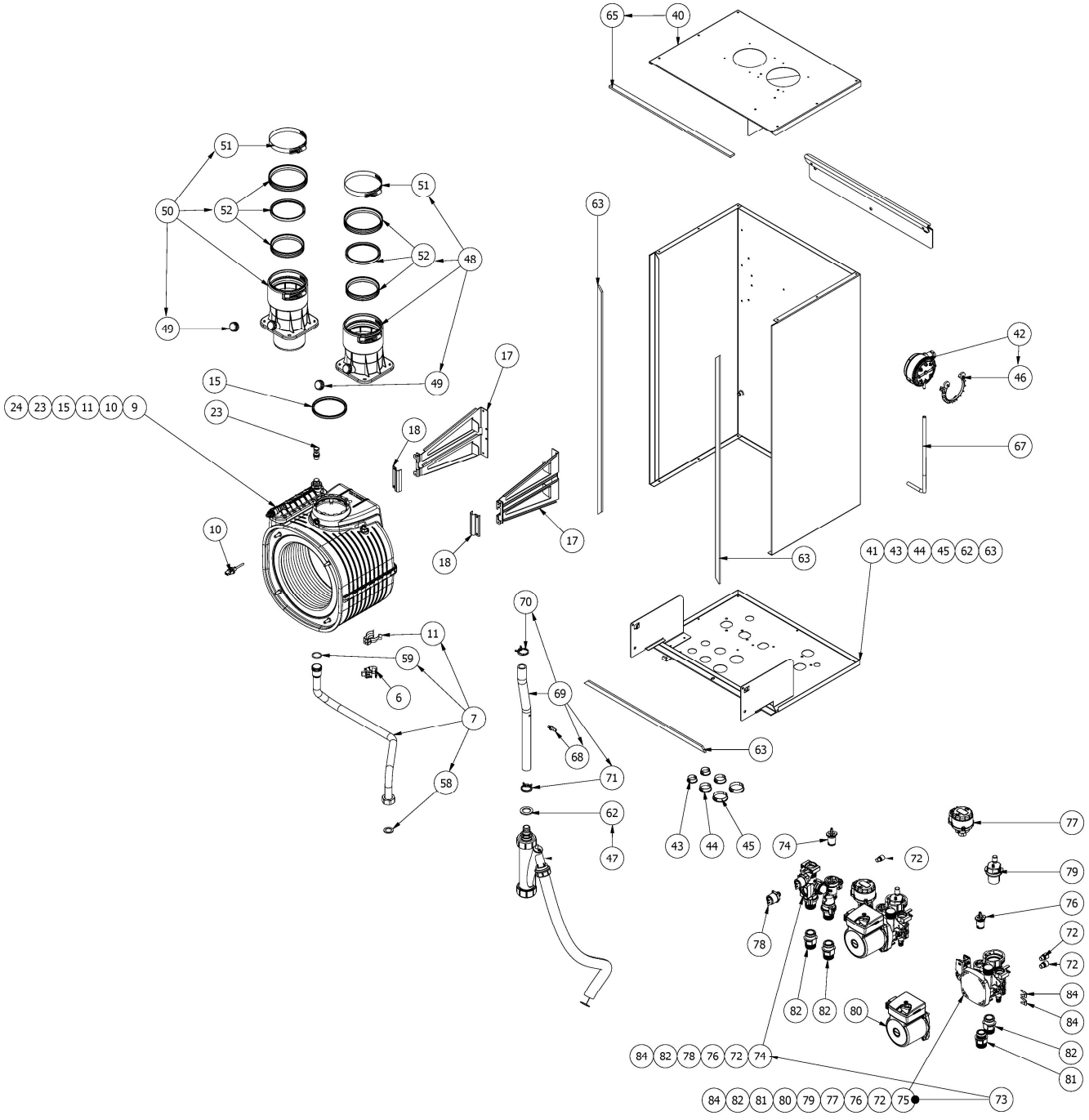


Figure 22.2

Remarks:

All parts are supplied with glued/bonded parts, such as grounding lips, strips, isolation, stickers. Also bolts and nuts are supplied if necessary.

22.1 Spare part list CH-xx

Pos	Description	Part number	CH-xx Type				
			80	100	120	150	180
1	Residential Yearly Maintenance Service Kit	S000.600.001.035	x	x	x	x	x
2	Set. Electronics holder	S000.600.002.035	x	x	x	x	x
4	Supply Pipe section one CH-80/CO-90/CH-100	S001.600.004	x	x	NA	NA	NA
4	Supply Pipe section one CH-120/CO-150	S001.600.005	NA	NA	x	NA	NA
4	Supply Pipe section one CH-150/CH-180/CO-200	S001.600.006	NA	NA	NA	x	x
5	Connection pipe between hydro block and supply section one	S001.600.007	x	x	x	x	x
6	Sensor NTC 10KOhm Ø18 mm	S001.600.008	x	x	x	x	x
7	Return pipe CH-80/CH-100/CH-120/CO-90/ CO-150	S002.600.001	x	x	x	NA	NA
7	Return pipe CH-150/CH-180/CO-200	S002.600.002	NA	NA	NA	x	x
8	Gas Pipe CH-80/CH-100/CO-90	S003.600.001	x	x	NA	NA	NA
8	Gas Pipe CH-120/CO-150	S003.600.002	NA	NA	x	NA	NA
8	Gas Pipe CH-150/CH-180/CO-200	S003.600.003	NA	NA	NA	x	x
9	Heat exchanger CH-80/CO-90	S004.600.001	x	NA	NA	NA	NA
9	Heat exchanger CH-100	S004.600.002	NA	x	NA	NA	NA
9	Heat exchanger CH-120/CO-150	S004.600.003	NA	NA	x	NA	NA
9	Heat exchanger CH-150/CH-180/CO-200	S004.600.004	NA	NA	NA	x	x
10	NTC Flue gas sensor 10 KOHM = R25 B=3977K	S004.600.005	x	x	x	x	x
11	Sermeta quick connect clip	S004.600.006	x	x	x	x	x
12	Burner door CH-80/CO-90	S004.600.007.035	x	NA	NA	NA	NA
12	Burner door CH-100	S004.600.008.035	NA	x	NA	NA	NA
12	Burner door CH-120/CO-150	S004.600.009.035	NA	NA	x	NA	NA
12	Burner door CH-150/CH-180/CO-200	S004.600.010.035	NA	NA	NA	x	x
13	Ignition Electrode	S004.600.011.035	x	x	x	x	x
14	Ionization Electrode	S004.600.012.035	x	x	x	x	x
15	Heat exchanger flue outlet gasket 80mm	S004.600.013	x	x	x	x	x
16	Burner Door refractory insulation	S004.600.014.035	x	x	x	x	x
17	Heat Exchanger Bracket CH-80/CO-90	S004.600.015	x	NA	NA	NA	NA
17	Heat Exchanger Bracket CH-100	S004.600.016	NA	x	NA	NA	NA
17	Heat Exchanger Bracket CH-120/CO-150	S004.600.017	NA	NA	x	NA	NA
17	Heat Exchanger Bracket CH-150/CH-180/CO-200	S004.600.018	NA	NA	NA	x	x
18	Bracket Heat Exchanger Clip	S004.600.019	x	x	x	x	x
19	Burner door gasket	S004.600.020.035	x	x	x	x	x
20	Fiber Braid for burner door Ø187.5x4 mm	S004.600.021.035	x	x	x	x	x
21	Ignition Electrode gasket	S004.600.022	x	x	x	x	x
22	Ionization Electrode gasket	S004.600.023	x	x	x	x	x
23	Heat exchanger drain plug	S004.600.024	x	x	x	x	x
24	Heat exchanger drain O-ring	S004.600.025	x	x	x	x	x
25	Back Wall refractory insulation	S004.600.026.035	x	x	x	x	x
26	Box 10 pcs. fuse 5 AT	S006.200.001	x	x	x	x	x
27	Rubber plug Ø13 mm	S006.200.004	x	x	x	x	x
28	Pixel Button Display	S006.500.001.035	x	x	x	x	x
29	Display front panel	S006.500.002	x	x	x	x	x

Table 22.1

Pos	Description	Part number	CH-xx Type				
			80	100	120	150	180
30	Dustcover ON/OFF switch	S006.500.004	x	x	x	x	x
31	Power Supply Switch	S006.500.005	x	x	x	x	x
32	Spring plunger 8mm	S006.500.006	x	x	x	x	x
33	EPDM sealing for EBM 957	S006.500.007	x	x	x	x	x
34	Mounting plate burner control	S006.600.002.901.903	x	x	x	x	x
35	Bracket air intake damper	S008.600.001	x	x	x	x	x
36	Combustion Blower NRG118/115W (120VAC)	S008.600.003.035	x	x	x	x	NA
36	Combustion Blower RG148/300W (120VAC)	S008.600.009.035	NA	NA	NA	NA	x
37	Venturi (natural gas) CH-80	S008.600.005	x	NA	NA	NA	NA
37	Venturi (natural gas) CH-100	S008.600.006	NA	x	NA	NA	NA
37	Venturi (natural gas) CH-120	S008.600.002	NA	NA	x	NA	NA
37	Venturi (natural gas) CH-150	S008.600.007	NA	NA	NA	x	NA
37	Venturi (natural gas) CH-180	S008.600.008	NA	NA	NA	NA	x
38	Wall mounting plate with locking bracket	S009.100.001	x	x	x	x	x
39	Front Boiler Cover	S010.600.001.035	x	x	x	x	x
40	Top panel	S011.600.001	x	x	x	x	x
41	Bottom panel CH	S011.600.002	x	x	x	x	x
42	Pressure switch	S011.600.003	x	x	x	x	x
43	Knock Out Seal ½" nylon	S011.600.004	x	x	x	x	x
44	Knock Out Seal ¾" nylon	S011.600.005	x	x	x	x	x
45	Knock Out Seal 1" nylon	S011.600.006	x	x	x	x	x
46	Snap ring pressure switch	S011.600.007	x	x	x	x	x
47	Condensate drain assembly	S012.200.002.915	x	x	x	x	x
48	3 in 1 one intake air vent connector 80mm / 3"	S015.600.001	x	x	x	x	x
49	Combustion Test port Cap M20x2 Ral-9012	S016.500.002	x	x	x	x	x
50	3 in 1 one exhaust vent connector 80mm / 3"	S016.600.001	x	x	x	x	x
51	Clamp Boiler connector Ø80 mm	S016.600.002	x	x	x	x	x
52	3 in 1 one exhaust connector gasket kit 80mm / 3" (contains all 3 gaskets)	S016.600.003	x	x	x	x	x
53	Intake air Silencer CH-80, CH-100, CH-120	S024.600.001	x	x	x	NA	NA
53	Intake air Silencer CH-150, CH-180	S024.600.002	NA	NA	NA	x	x
54	Wiring harness ignition cable + earth cable	S031.600.004	x	x	x	x	x
55	Type B cable harness Residential Boiler	S031.600.001	x	x	x	x	x
56	Sealing mix tube and fan Ø58mm (open)	S032.200.002	x	x	x	x	x
57	O-ring Ø63x3 mm	S032.600.001	x	x	x	x	NA
57	O-ring Ø70x3 mm	S032.600.011	NA	NA	NA	NA	x
58	Gasket Ø23xØ18x1 mm	S032.600.002	x	x	x	x	x
59	O-ring Ø22xØ2 mm	S032.600.003	x	x	x	x	x
60	O-ring Ø17.86x2,62	S032.600.004	x	x	x	x	x
61	Gasket Ø23.5xØ17.8x2 mm	S032.600.005	x	x	x	x	x
62	Gasket Ø30xØ21x3 mm	S032.600.006	x	x	x	x	x
63	Silicone seal 13x5 mm self-adhesive ± 11 yd.	S032.600.008	x	x	x	x	x
65	EPDM seal 15x5 mm self-adhesive ± 65 yd.	S032.600.009	x	x	x	x	x
66	EPDM seal 10x12 mm self-adhesive ± 43 yd.	S032.600.010	x	x	x	x	x

Table 22.2

Pos	Description	Part number	CH-xx Type				
			80	100	120	150	180
67	Hose pressure switch	S034.600.001	x	x	x	x	x
68	Hose coupling	S035.600.001	x	x	x	x	x
69	PVC hose Ø27x19 mm with inlays	S035.600.002	x	x	x	x	x
70	Hose clamp 25-28 mm	S035.600.003	x	x	x	x	x
71	Hose spring clamps Ø23.83 mm (DW15)	S035.600.004	x	x	x	x	x
72	Hydro block plug	S036.600.001	x	x	x	x	x
73	Hydro block CH (heating)	S036.600.002	x	x	x	x	x
74	Hydro block CH-Flow Group	S036.600.003	x	x	x	x	x
75	Hydro block CH-Return Group	S036.600.004	x	x	x	x	x
76	Hydro block Plug	S036.600.007	x	x	x	x	x
77	3-way valve	S036.600.009	x	x	x	x	x
78	Pressure sensor Eltek	S036.600.010	x	x	x	x	x
79	Automatic air vent in hydro block	S036.600.011	x	x	x	x	x
80	Circulator Motor UPS/R	S036.600.013	x	x	x	x	x
81	Union 3/4" NPT Pump house	S036.600.015	x	x	x	x	x
82	Union 3/4" NPT Flow Group	S036.600.016	x	x	x	x	x
83	Clip D18	S036.600.018	x	x	x	x	x
84	Clip D10	S036.600.019	x	x	x	x	x
85	Adapter ¾" BSP to ¾" NPT	S037.600.001	x	x	x	x	x
86	Gas Valve (120VAC)	S037.600.002	x	x	x	x	x
87	Burner Control 900MN (120VAC) CH-80,100,120	S195010.035	x	x	x	NA	NA
87	Burner Control 900MN (120VAC) CH-150,180	S195040.035	NA	NA	NA	x	x
96	Wiring harness Ionisation + Gas valve cable	S031.600.003	x	x	x	x	x
100	Burner door nut 4 pcs.	S004.600.027	x	x	x	x	x
101	4 Hex nuts for fan including spring locks	S008.600.013	x	x	x	x	x
102	Extension cable	S031.600.007	NA	NA	NA	NA	x

Table 22.3

23 SPARE PARTS CO-xx

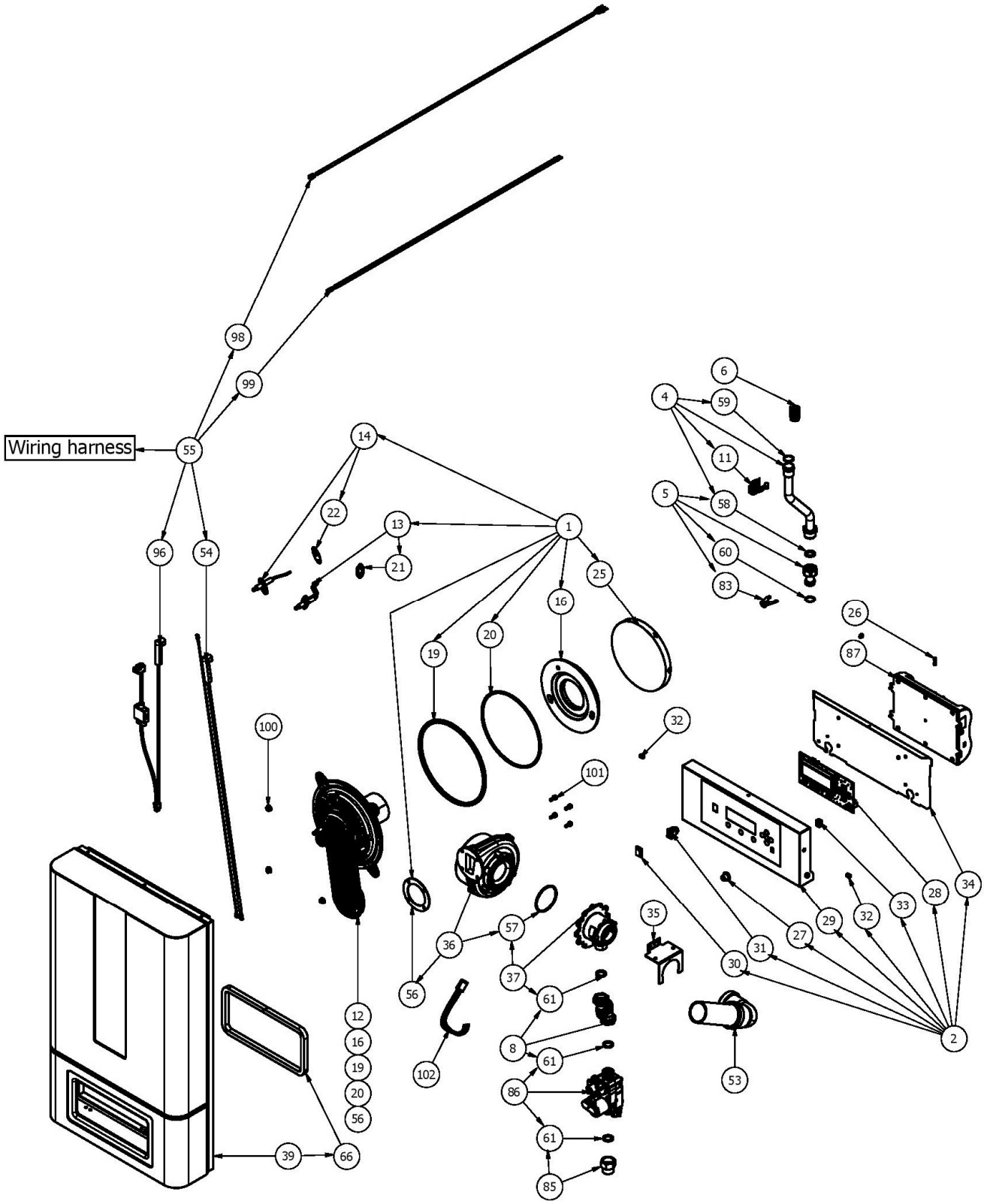


Figure 23.1

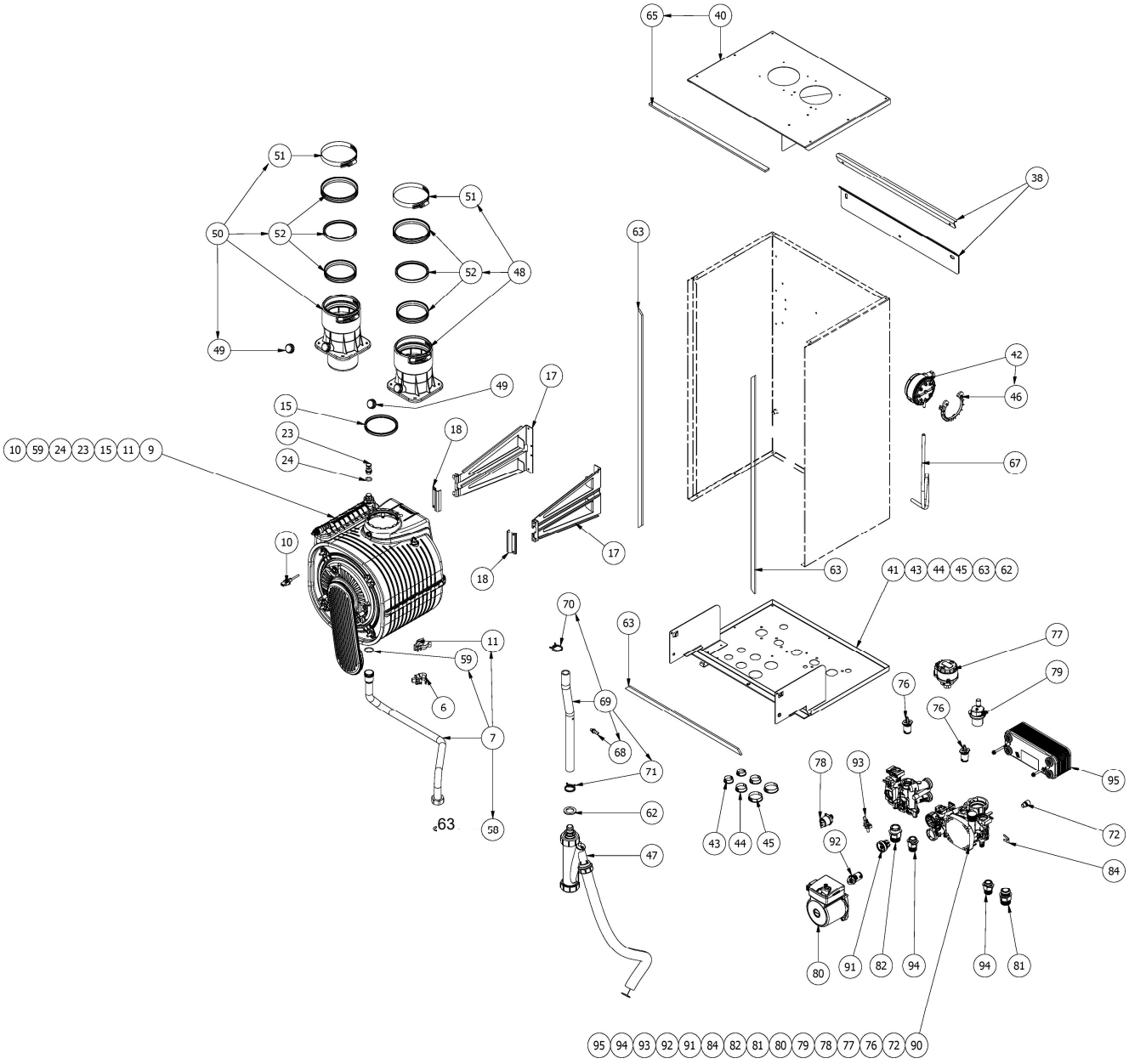


Figure 23.2

Remarks:

All parts are supplied with glued/bonded parts, such as grounding lips, strips, isolation, stickers. Also bolts and nuts are supplied if necessary.

23.1 Spare part list CO-xx

Pos.	Description	Part number	CO-xx Type		
			90	150	200
1	Residential Yearly Maintenance Service Kit	S000.600.001.035	x	x	x
2	Set Electronics holder	S000.600.002.035	x	x	x
4	Supply Pipe section one CH-80/CO-90/CH-100	S001.600.004	x	NA	NA
4	Supply Pipe section one CH-120/CO-150	S001.600.005	NA	x	NA
4	Supply Pipe section one CH-150/CH-180/CO-200	S001.600.006	NA	NA	x
5	Connection pipe between hydro block and supply section one	S001.600.007	x	x	x
6	Sensor NTC 10KOhm Ø18 mm	S001.600.008	x	x	x
7	Return pipe CH-80/CH-100/CH-120/CO-90/ CO-150	S002.600.001	x	x	NA
7	Return pipe CH-150/CH-180/CO-200	S002.600.002	NA	NA	x
8	Gas Pipe CH-80/CH-100/CO-90	S003.600.001	x	NA	NA
8	Gas Pipe CH-120/CO-150	S003.600.002	NA	x	NA
8	Gas Pipe CH-150/CH-180/CO-200	S003.600.003	NA	NA	x
9	Heat exchanger CH-80/CO-90	S004.600.001	x	NA	NA
9	Heat exchanger CH-120/CO-150	S004.600.003	NA	x	NA
9	Heat exchanger CH-150/CH-180/CO-200	S004.600.004	NA	NA	x
10	NTC Flue gas sensor 10 KOHM = R25 B=3977K	S004.600.005	x	x	x
11	Sermeta quick connect clip	S004.600.006	x	x	x
12	Burner door CH-80/CO-90	S004.600.007.035	x	NA	NA
12	Burner door CH-120/CO-150	S004.600.009.035	NA	x	NA
12	Burner door CH-150/CH-180/CO-200	S004.600.010.035	NA	NA	x
13	Ignition Electrode	S004.600.011.035	x	x	x
14	Ionization Electrode	S004.600.012.035	x	x	x
15	Heat exchanger flue outlet gasket 80 mm	S004.600.013	x	x	x
16	Burner Door refractory insulation	S004.600.014.035	x	x	x
17	Heat Exchanger Bracket CH-80/CO-90	S004.600.015	x	NA	NA
17	Heat Exchanger Bracket CH-120/CO-150	S004.600.017	NA	x	NA
17	Heat Exchanger Bracket CH-150/CH-180/CO-200	S004.600.018	NA	NA	x
18	Bracket Heat Exchanger Clip	S004.600.019	x	x	x
19	Burner door gasket	S004.600.020.035	x	x	x
20	Fiber Braid for burner door Ø187.5x4 mm	S004.600.021.035	x	x	x
21	Ignition Electrode gasket	S004.600.022	x	x	x
22	Ionization Electrode gasket	S004.600.023	x	x	x
23	Heat exchanger drain plug	S004.600.024	x	x	x
24	Heat exchanger drain O-ring	S004.600.025	x	x	x
25	Back Wall refractory insulation	S004.600.026.035	x	x	x
26	Box 10pcs Fuse 5 AT	S006.200.001	x	x	x
27	Rubber plug Ø13 mm	S006.200.004	x	x	x
28	Pixel Button Display	S006.500.001.035	x	x	x
29	Display front panel	S006.500.002	x	x	x
30	Dustcover ON/OFF switch	S006.500.004	x	x	x

Table 23.1

Pos.	Description	Part number	CO-xx Type		
			90	150	200
31	Power Supply Switch	S006.500.005	x	x	x
32	Spring plunger 8 mm	S006.500.006	x	x	x
33	EPDM sealing for EBM 957	S006.500.007	x	x	x
34	Mounting plate burner control	S006.600.002.901.903	x	x	x
35	Bracket air intake damper	S008.600.001	x	x	x
36	Combustion Blower NRG118/115W (120VAC)	S008.600.003.035	x	x	NA
36	Combustion Blower RG148/300W (120VAC)	S008.600.009.035	NA	NA	x
37	Venturi (natural gas) CO-90	S008.600.010	x	NA	NA
37	Venturi (natural gas) CO-150	S008.600.011	NA	x	NA
37	Venturi (natural gas) CO-200	S008.600.012	NA	NA	x
38	Wall mounting plate with locking bracket	S009.100.001	x	x	x
39	Front Boiler Cover	S010.600.001.035	x	x	x
40	Top panel	S011.600.001	x	x	x
41	Bottom panel CO	S011.600.008	x	x	x
42	Pressure switch	S011.600.003	x	x	x
43	Knock Out Seal ½" nylon	S011.600.004	x	x	x
44	Knock Out Seal ¾" nylon	S011.600.005	x	x	x
45	Knock Out Seal 1" nylon	S011.600.006	x	x	x
46	Snap ring pressure switch	S011.600.007	x	x	x
47	Condensate drain assembly	S012.200.002.915	x	x	x
48	3 in 1 one intake air vent connector 80mm / 3"	S015.600.001	x	x	x
49	Combustion Test port Cap M20x2 Ral-9012	S016.500.002	x	x	x
50	3 in 1 one exhaust vent connector 80mm / 3"	S016.600.001	x	x	x
51	Clamp Boiler connector Ø80 mm	S016.600.002	x	x	x
52	3 in 1 one exhaust connector gasket kit 80mm / 3" (contains all 3 gaskets)	S016.600.003	x	x	x
53	Intake air Silencer CO-90, CO-150	S024.600.001	x	x	NA
53	Intake air Silencer CO-200	S024.600.002	NA	NA	x
54	Wiring harness ignition cable + earth cable	S031.600.004	x	x	x
55	Type B cable harness Residential Boiler	S031.600.001	x	x	x
56	Sealing mix tube and fan Ø58mm (open)	S032.200.002	x	x	x
57	O-ring Ø63x3 mm	S032.600.001	x	x	NA
57	O-ring Ø70x3 mm	S032.600.011	NA	NA	x
58	Gasket Ø23xØ18x1 mm	S032.600.002	x	x	x
59	O-ring Ø22xØ2 mm	S032.600.003	x	x	x
60	O-ring Ø17.86x2.62 mm	S032.600.004	x	x	x
61	Gasket Ø23.5xØ17.8x2	S032.600.005	x	x	x
62	Gasket Ø30xØ21x3 mm	S032.600.006	x	x	x
63	Silicone seal 13x5 mm self-adhesive ± 11 yd.	S032.600.008	x	x	x
65	EPDM seal 15x5 mm self-adhesive ± 65 yd.	S032.600.009	x	x	x
66	EPDM seal 10x12 mm self-adhesive ± 43 yd.	S032.600.010	x	x	x
67	Hose pressure switch	S034.600.001	x	x	x
68	Hose coupling	S035.600.001	x	x	x
69	PVC hose Ø27x19 mm with inlays	S035.600.002	x	x	x
70	Hose clamp 25-28 mm	S035.600.003	x	x	x

Table 23.2

Pos.	Description	Part number	CO-xx Type		
			90	150	200
71	Hose spring clamps Ø23.83 (DW15)	S035.600.004	x	x	x
72	Hydro block plug	S036.600.001	x	x	x
76	Hydro block Plug	S036.600.007	x	x	x
77	3-way valve	S036.600.009	x	x	x
78	Pressure sensor Eltek	S036.600.010	x	x	x
79	Automatic air vent in hydro block	S036.600.011	x	x	x
80	Circulator Motor UPS/R	S036.600.013	x	x	x
81	Union 3/4" NPT Pump house	S036.600.015	x	x	x
82	Union 3/4" NPT Flow Group	S036.600.016	x	x	x
83	Clip D18	S036.600.018	x	x	x
84	Clip D10	S036.600.019	x	x	x
85	Adapter ¾" BSP to ¾" NPT	S037.600.001	x	x	x
86	Gas Valve (120VAC)	S037.600.002	x	x	x
87	Burner Control 900MN (120VAC) CO-90	S195020.035	x	NA	NA
87	Burner Control 900MN (120VAC) CO-150	S195030.035	NA	x	NA
87	Burner Control 900MN (120VAC) CO-200	S195050.035	NA	NA	x
90	Hydro block CO (combi)	S036.600.005	x	x	x
91	Flow sensor assembly	S036.600.006	x	x	x
92	Flow restrictor assembly	S036.600.008	x	x	x
93	Sensor NTC 10KOhm 25°C	S036.600.012	x	x	x
94	Union 1/2" NPT DHW	S036.600.017	x	x	x
95	Plate Heat exchanger DHW	S036.600.014	x	x	x
96	Wiring harness Ionisation + Gas valve cable	S031.600.003	x	x	x
98	Wiring harness DHW Flow sensor	S031.600.005	x	x	x
99	Wiring harness DHW temp sensor	S031.600.006	x	x	x
100	Burner door nut 4 pcs.	S004.600.027	x	x	x
101	4 Hex nuts for fan including spring locks	S008.600.013	x	x	x
102	Extension cable	S031.600.007	NA	NA	x

Table 23.3

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