

**Slant/Fin**

**VGH**



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



**RESIDENTIAL BOILER MODELS**

VGH-80-CH / VGH-100-CH / VGH-120-CH /  
VGH-150-CH / VGH-180-CH  
VGH-90-CO / VGH-150-CO / VGH-200-CO

**HIGH EFFICIENCY CONDENSING GAS BOILER**

**INSTALLATION AND SERVICE MANUAL**

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**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



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## **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.



### **WARNING**

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



# 1 SAFETY GUIDELINES

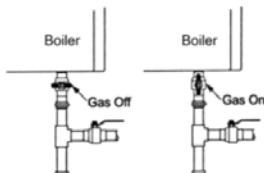
## FOR YOUR SAFETY READ BEFORE OPERATING

**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. Turn off all electric power to the appliance.
3. Set the thermostat to the lowest setting.
4. 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.
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. Turn off all electric power to the appliance if service is to be performed.
2. Set the thermostat to lowest setting.
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).

# CONSIGNES DE SÉCURITÉ.

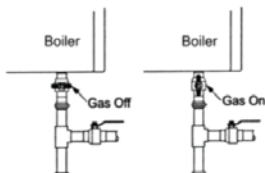
## POUR VOTRE SÉCURITÉ LISEZ AVANT DE METTRE EN MARCHÉ

**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 de 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 MARCHÉ


1. ARRÊTEZ! Lisez les instructions de sécurité sur la portion supérieure (à gauche) de cette étiquette.
2. Coupez l'alimentation électrique de l'appareil.
3. Réglez le thermostat à la température la plus basse.
4. Cet appareil 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. Attendez 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. Coupez l'alimentation électrique de l'appareil s'il faut procéder à l'entretien.
2. Réglez le thermostat à la température la plus basse.
3. 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.

 <b>CAUTION</b>	<p>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 issued that caused the safety lockout of the boiler.</p>
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 <b>DANGER</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• <b>Scalding</b> 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 domestic hot water setpoint(s).</li> </ul>
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 <b>NOTICE</b>	<p>We highly recommend the installation of a carbon monoxide (CO) detector in the boiler room for all installations.</p>
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 <b>WARNING</b>	<ul style="list-style-type: none"> <li>• <b>WARNING:</b> 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.</li> <li>• <b>WARNING: Crystalline Silica</b> - 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 18.2 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).</li> <li>• <b>WARNING:</b> 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.</li> <li>• 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.</li> </ul>
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 <b>WARNING</b>
<p><b>WARNING:</b> 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)</p>

 <b>Avertissement</b>
<p><b>AVERTISSEMENT:</b> 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 cancérigènes ou pouvant l'être).</p>

# 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.

Slant/Fin 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 de Slant/Fin. Toute 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:**

VGH = Chaudière à condensation

DHW = Eau Chaude Sanitaire (ECS)

CH = Chauffage central (pour objectif chauffage et/ ou eau chaude indirect)

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 MARCHÉ**

« 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. »

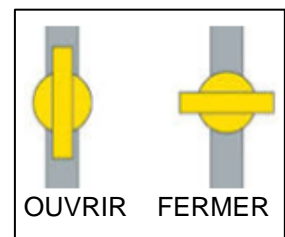
« D. N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau. »

## **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 cancérigènes 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 sècheuses, 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 (où) 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 (où) les codes d'installation CAN/CSA-B149.1. »



## 2 INTRODUCTION

This manual is the installation and service manual for the high-efficiency heating systems from the VGH-CH (Central Heating boilers) series and VGH-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 Slant/Fin spare parts.

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

This manual is subject to change without notice.

### 2.1 Terms and abbreviations

In this manual the following terms and abbreviations are used:

<b>A (Amp)</b>	Ampère
<b>AFUE</b>	Annual Fuel Utilization Efficiency
<b>AHRI</b>	Air-conditioning, Heating and Refrigeration Institute
<b>ANSI</b>	American National Standards Institute
<b>ASME</b>	American Society of Mechanical Engineers
<b>ASSE</b>	American Society of Sanitary Engineering
<b>bar</b>	Unit of pressure (1 bar = 14.5 PSI)
<b>BCU</b>	Burner Control Unit
<b>BTU</b>	British Thermal Unit
<b>°C</b>	Degree Celsius
<b>CaCO<sub>3</sub></b>	Calcium carbonate
<b>CH</b>	Central Heating.
<b>CO</b>	1. Combi-boiler (CH & DHW) 2. Carbon monoxide
<b>CO<sub>2</sub></b>	Carbon dioxide
<b>Combi</b>	A boiler providing a combination of central heating and domestic hot water
<b>CVPC</b>	Chlorinated Polyvinyl Chloride, a thermoplastic
<b>DHW</b>	Domestic Hot Water
<b>°F</b>	Degree Fahrenheit
<b>Hz</b>	Hertz
<b>LB</b>	Digit-based Liquid Crystal Display Board
<b>LCD</b>	Liquid Crystal Display
<b>LPG</b>	Liquefied Petroleum Gas
<b>MBH</b>	1000 BTUs per hour
<b>mg</b>	Milligram
<b>NFPA</b>	National Fire Protection Association
<b>NO<sub>x</sub></b>	Mono-nitrogen oxides
<b>NPT</b>	National Pipe Thread, American standard for threaded pipes and fittings
<b>NTC</b>	Negative Temperature Coefficient, a quality of sensors and resistors
<b>O<sub>2</sub></b>	Oxygen
<b>PB</b>	Graphical Display Board

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

## 2.2 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 "Heating boilers"
- ASME Boiler and Pressure Vessel Code Section "Recommended Rules for the Care and Operation of Heating Boilers"
- ANSI Z223.1 / NFPA 54 National Fuel Gas Code
- ANSI / NFPA 70 National Electrical Code
- ANSI / NFPA 211 Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances

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

## 2.3 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.

	<p><b>Maintenance and inspection of the boiler must be carried out in the following situations:</b></p> <ul style="list-style-type: none"> <li>• <b>When a number of similar error codes and/or lockouts appear.</b></li> <li>• <b>At least once every 12 months to ensure safe and efficient operation.</b></li> </ul> <p><b>Damage caused by lack of maintenance will not be covered under warranty.</b></p>
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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 18.

## 2.4 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 720 (2005 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 720 (2005 Edition); and
  - 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 720 (2005 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 720 (2005 Edition).
- 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.

### 3 TECHNICAL DATA VGH RESIDENTIAL BOILERS

#### 3.1.1 FUNCTIONAL INTRODUCTION

The VGH 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 VGH 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 150 mg/m<sup>3</sup> (110 ppm) and an annual average of 30 mg/m<sup>3</sup>. (22 ppm 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 VGH-CH boilers:

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

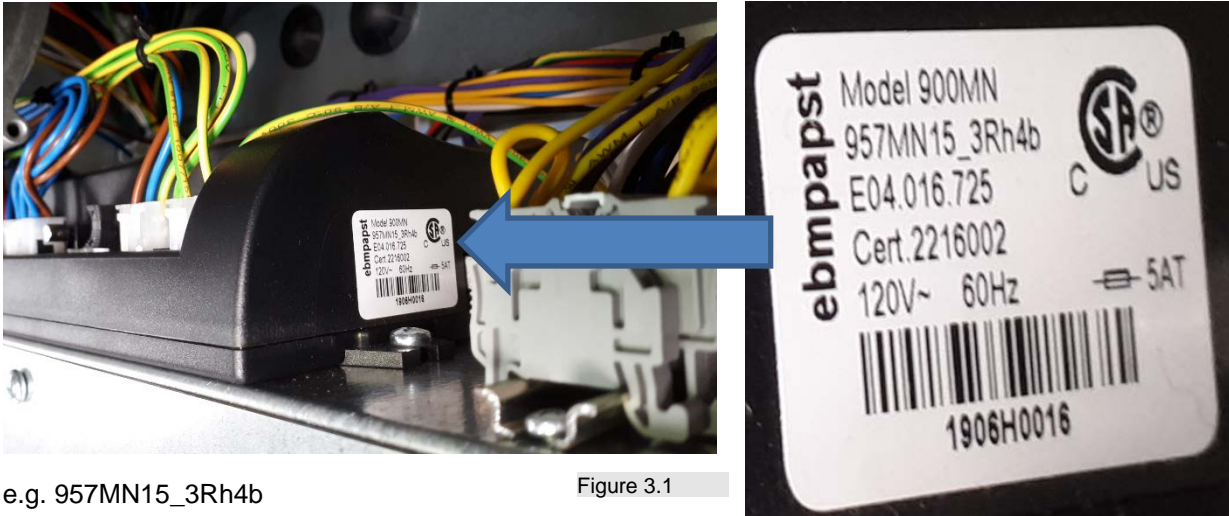
#### Connections for VGH-CO boilers:

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

### 3.2 Location of version numbers

#### Burner Controller Hardware Version

– To be found on the second line of the white sticker on the side of the burner controller.



e.g. 957MN15\_3Rh4b

Figure 3.1

#### Burner Controller Software Versions


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



Figure 3.2

Software Versions	
Display	[63EF 83BC]
Boiler	[5C79 14A9]
Device Group	900MN

Figure 3.3

### 3.3 Technical specifications datasheets

#### 3.3.1 TECHNICAL SPECIFICATIONS VGH-80-CH / VGH-90-CO / VGH-100-CH

<b>GENERAL</b>				
Boiler category	-	IV		
<b>Type boiler</b>		<b>VGH-80-CH</b>	<b>VGH-90-CO</b>	<b>VGH-100-CH</b>
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)	0.4 (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)
<b>GAS CONSUMPTION</b>		<b>Values min-max:</b>		
Natural gas	ft <sup>3</sup> /h m <sup>3</sup> /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 <sup>1</sup>	ft <sup>3</sup> /h m <sup>3</sup> /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 <sup>2</sup>	Nat. gas	Inch W.C./ (mbar)	7.0 (17.4)	
	Propane	Inch W.C./ (mbar)	11.0 (27.4)	
<b>NOTES</b>				
<sup>1</sup> Using propane, maximum fan speed needs to be reduced				
<sup>2</sup> Min. and max. 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 3. 1

Type boiler			VGH-80-CH	VGH-90-CO	VGH-100-CH
CO <sub>2</sub> flue gas <sup>3</sup>	Natural gas	Low Fire %	9.4 – 8.9		
		High Fire %	9.1 – 8.4		
	Propane	Low Fire %	9.8		
		High Fire %	10.1		
O <sub>2</sub> flue gas <sup>3</sup>	Natural gas	Low Fire %	4.1 – 5.0		
		High Fire %	4.6 – 6.0		
	Propane	Low Fire %	6.0		
		High Fire %	5.5		
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 <sup>4</sup>		Inch W.C. (Pa)	250	320	230
<b>INSTALLATION</b>					
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)		
<b>DHW PERFORMANCE</b>					
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 <sup>6</sup>		%	95.0		
<b>ELECTRIC</b>					
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 <sup>5</sup>		
<b>NOTES</b>					
<sup>3</sup> CO <sub>2</sub> or O <sub>2</sub> of the unit measured/set without the boiler front panel in place					
<sup>4</sup> Maximum allowed combined resistance of flue gas and air supply piping at high fire					
<sup>5</sup> For gas appliance type B23(P) (Room Air) only class IPX4D with special air inlet, otherwise the protection class is IP20 (see also picture below)					
<sup>6</sup> Efficiency of DHW performance measured according to ANSI Z21.10.3-2015 • CSA 4.3-2015					

Table 3. 2

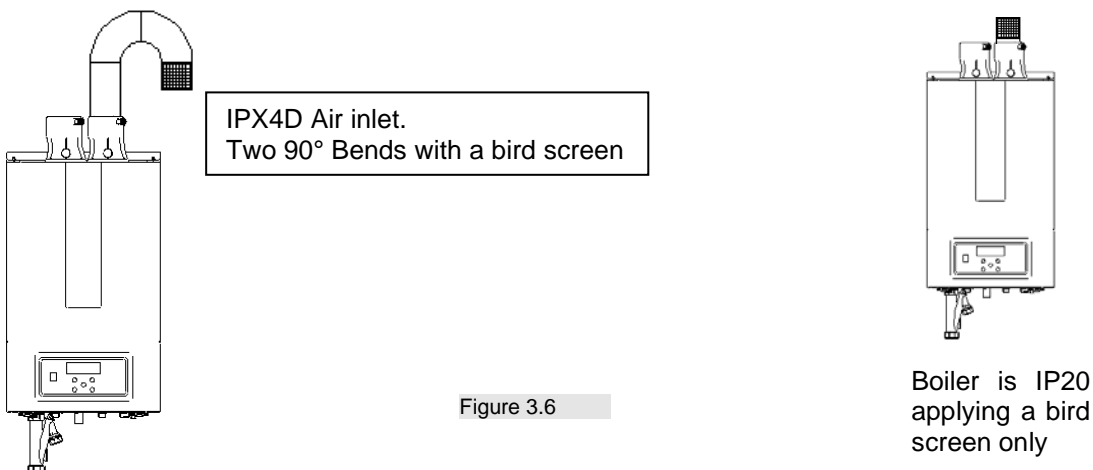


Figure 3.6

3.3.2 TECHNICAL SPECIFICATIONS VGH-120-CH / VGH-150-CO / VGH-150-CH

<b>GENERAL</b>				
Boiler category	-	IV		
<b>Type boiler</b>		<b>VGH-120-CH</b>	<b>VGH-150-CO</b>	<b>VGH-150-CH</b>
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)	0.83 (3.15)
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)
<b>GAS CONSUMPTION</b>		<b>Values min-max:</b>		
Natural gas	ft <sup>3</sup> /h m <sup>3</sup> /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 <sup>1</sup>	ft <sup>3</sup> /h m <sup>3</sup> /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 <sup>2</sup>	Nat. gas	Inch W.C./ (mbar)	7.0 (17.4)	
	Propane	Inch W.C./ (mbar)	11.0 (27.4)	
<b>NOTES</b>				
<sup>1</sup> Using propane, maximum fan speed needs to be reduced <sup>2</sup> Min. and max. 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 3. 3



Type boiler			VGH-120-CH	VGH-150-CO	VGH-150-CH
CO <sub>2</sub> flue gas <sup>3</sup>	Natural gas	Low Fire %	9.4 – 8.9		
		High Fire %	9.1 – 8.4		
	Propane	Low Fire %	9.8		
		High Fire %	10.1		
O <sub>2</sub> flue gas <sup>3</sup>	Natural gas	Low Fire %	4.1 – 5.0		
		High Fire %	4.6 – 6.0		
	Propane	Low Fire %	6.0		
		High Fire %	5.5		
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 <sup>4</sup>		Inch W.C. (Pa)	260	400	340
<b>INSTALLATION</b>					
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)		
<b>DHW PERFORMANCE</b>					
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 <sup>6</sup>		%	93.7		
<b>ELECTRIC</b>					
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 <sup>5</sup>		
<b>NOTES</b>					
<sup>3</sup> CO <sub>2</sub> or O <sub>2</sub> of the unit measured/set without the boiler front panel in place.					
<sup>4</sup> Maximum allowed combined resistance of flue gas and air supply piping at high fire					
<sup>5</sup> For gas appliance type B23(P) (Room Air) only class IPX4D with special air inlet, otherwise the protection class is IP20 (see also picture at page 19)					
<sup>6</sup> Efficiency of DHW performance measured according to ANSI Z21.10.3-2015 • CSA 4.3-2015					

Table 3. 4

### 3.3.3 TECHNICAL SPECIFICATIONS VGH-180-CH / VGH-200-CO

<b>GENERAL</b>			
Boiler category	-	IV	
<b>Type boiler</b>		<b>VGH-180-CH</b>	<b>VGH-200-CO</b>
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)	0.83 (3.15)	0.83 (3.15)
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)
<b>GAS CONSUMPTION</b>		<b>Values min-max:</b>	
Natural gas	ft <sup>3</sup> /h m <sup>3</sup> /h	16.7 – 167.4 0.47 – 4.74	18.6 – 186.0 0.52 – 5.26
Propane <sup>1</sup>	ft <sup>3</sup> /h m <sup>3</sup> /h	7.2 – 72.1 0.2 – 2.04	8.0 – 80.0 0.23 – 22.7
Gas supply pressure nominal <sup>2</sup>	Nat. gas	Inch W.C./ (mbar)	7.0 (17.4)
	Propane	Inch W.C./ (mbar)	11.0 (27.4)
<b>NOTES</b>			
<sup>1</sup> Using propane, maximum fan speed needs to be reduced.			
<sup>2</sup> Min. and max. 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 3. 5

Type boiler			VGH-180-CH	VGH-200-CO
CO <sub>2</sub> flue gas <sup>3</sup>	Natural gas	Low Fire %	9.4 – 8.9	
		High Fire %	9.1 – 8.4	
	Propane	Low Fire %	9.8	
		High Fire %	10.1	
O <sub>2</sub> flue gas <sup>3</sup>	Natural gas	Low Fire %	4.1 – 5.0	
		High Fire %	4.6 – 6.0	
	Propane	Low Fire %	6.0	
		High Fire %	5.5	
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 <sup>4</sup>		Inch W.C. (Pa)	400	490
<b>INSTALLATION</b>				
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)	
<b>DHW PERFORMANCE</b>				
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 <sup>6</sup>		%	95.4	
<b>ELECTRIC</b>				
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 <sup>5</sup>	
<b>NOTES</b>				
<sup>3</sup> CO <sub>2</sub> or O <sub>2</sub> of the unit measured/set without the boiler front panel in place				
<sup>4</sup> Maximum allowed combined resistance of flue gas and air supply piping at high fire				
<sup>5</sup> For gas appliance type B23(P) (Room Air) only class IPX4D with special air inlet, otherwise the protection class is IP20 (see also picture at page 19)				
<sup>6</sup> Efficiency of DHW performance measured according to ANSI Z21.10.3-2015 • CSA 4.3-2015				

Table 3. 6

### 3.4 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.					
 <b>NOTICE</b>	<b>Combustion</b> – At elevations above 2000 ft (610 m), the combustion of the appliance must be checked with a <u>calibrated</u> (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. <b>It is the Installers responsibility to check the combustion of the appliance.</b> Failure to follow these instructions may result in property damage, serious injury, or death.				

Table 3. 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 %

### 3.5 DHW specifications VGH-CO series

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


Table 3. 8

### 3.6 Heat exchanger information

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



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
VGH-80-CH / VGH-90-CO	461953	T4804.4CL	50 Psi	210 °F	91 MBH	7.99 SQTF
VGH -100-CH	461955	T4804.4CL	50 Psi	210 °F	136 MBH	9.99 SQFT
VGH -120-CH / VGH-150-CO	461959	T4806.4CL	50 Psi	210 °F	182 MBH	11.99 SQFT
VGH-150-CH / VGH-180-CH / VGH-200-CO	461963	T4807.4CL	50 Psi	210 °F	227 MBH	17.98 SQFT

\* the maximum supply temperature of the boiler is 194F

Table 3. 9

### 3.7 Specifications input, output, efficiency (AHRI)



DOE



Model number	CH Input, MBH <sup>1</sup>		Output <sup>1</sup> MBH	AHRI Net Ratings Water, MBH	AFUE %
	Min	Max			
VGH-80-CH	8	80	74	64	95.2
VGH-90-CO	9	80	74	64	95.2
VGH-100-CH	10	100	93	81	95.2
VGH-120-CH	12	120	111	97	95.2
VGH-150-CO	15	120	111	97	95.2
VGH-150-CH	15	150	140	122	95.2
VGH-180-CH	18	180	168	146	95.2
VGH-200-CO	20	180	168	146	95.2

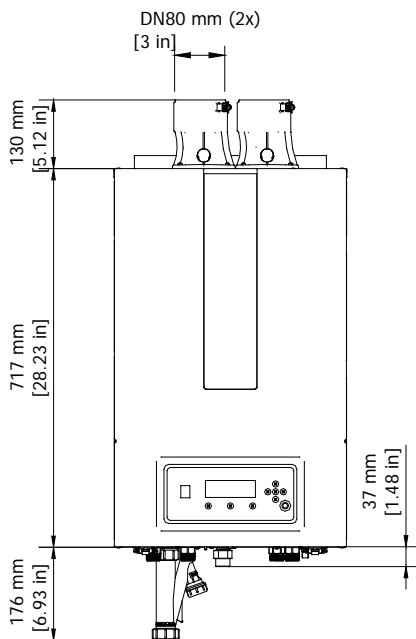
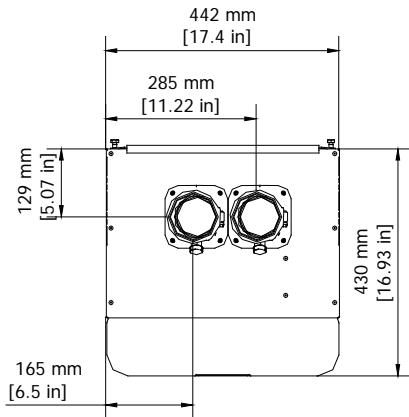
<sup>1</sup> Listed Input and Output ratings are at minimum vent lengths at Sea Level. Numbers will be lower with longer venting and/or altitudes greater than 2000 feet [610 m].

- 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.

Table 3. 10

## 4 BOILER DIMENSIONS

### 4.1 VGH-80-CH / VGH-100-CH / VGH-120-CH / VGH-150-CH / VGH-180-CH



Connections VGH-CH boilers		
<b>A</b>	Supply CH	NPT 3/4"
<b>B</b>	Indirect DHW	NPT 3/4"
<b>C</b>	Gas	NPT 3/4"
<b>D</b>	Indirect DHW	NPT 3/4"
<b>E</b>	Return CH	NPT 3/4"
<b>F</b>	Condensate	Flexible hose Ø 1.06" (26.9 mm)

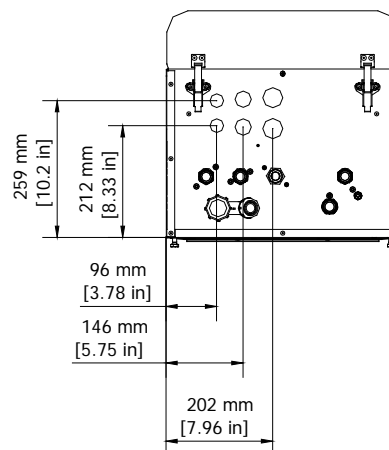
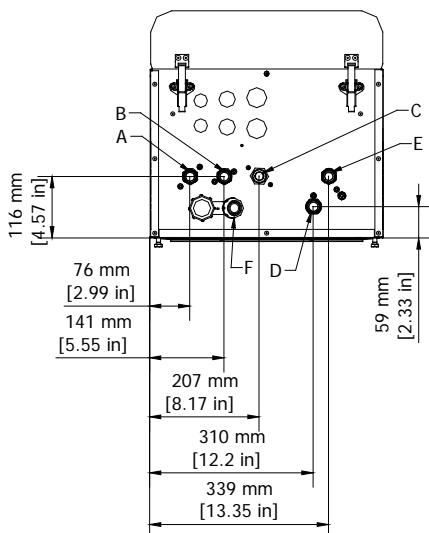
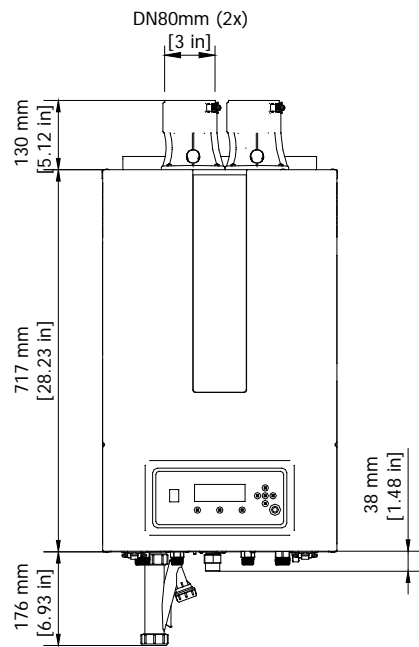
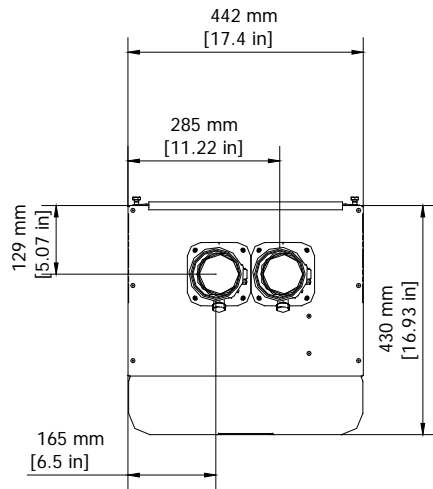


Figure 4.1

## 4.2 VGH-90-CO / VGH-150-CO / VGH-200-CO



Connections VGH-CO boilers		
<b>A</b>	Supply CH	NPT ¾"
<b>B</b>	Supply tap water	NPT ½"
<b>C</b>	Gas	NPT ¾"
<b>D</b>	Return tap water	NPT ½"
<b>E</b>	Return CH	NPT ¾"
<b>F</b>	Condensate	Flexible hose Ø 1.06" (26.9 mm)

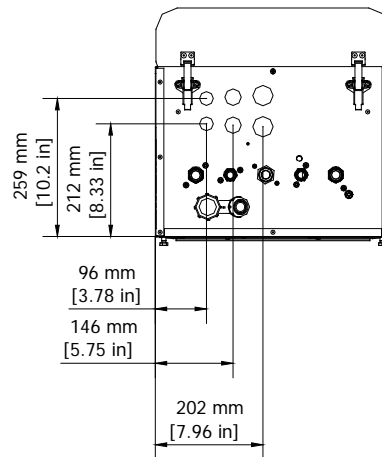
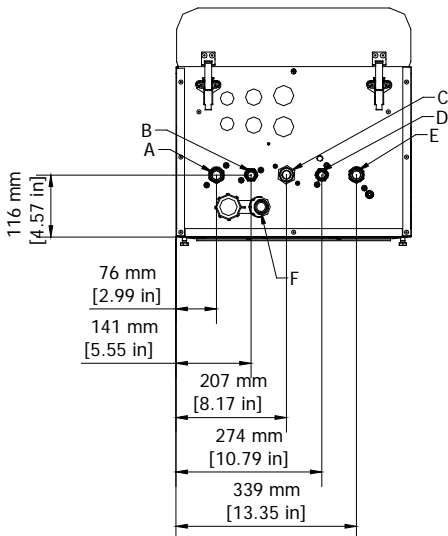


Figure 4.2

## 5 ACCESSORIES AND UNPACKING

### 5.1 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
Safety Flow Switch kit	81 7106 000
IP module	81 7111 000
Software + interface cable for programming the boiler with a computer/laptop	81 7135 000
External Ignition transformer with special burner controller; VGH-80-CH to VGH-120-CH	81 7276 000
External Ignition transformer with special burner controller; VGH-150-CH and VGH-180-CH	81 7277 000
External Ignition transformer with special burner controller; VGH-90-CO	81 7278 000
External Ignition transformer with special burner controller; VGH-150-CO	81 7279 000
External Ignition transformer with special burner controller; VGH-200-CO	81 7280 000
Special air inlet for IPX4D protection on B23(P) (Room Air) boilers	81 7281 000
Propane conversion kit VGH-80-CH and VGH-90-CO	81 7271 000
Propane conversion kit VGH-100-CH	81 7272 000
Propane conversion kit VGH-120-CH and VGH-150-CO	81 7273 000
Propane conversion kit VGH-150-CH	81 7275 000
Propane conversion kit VGH-180-CH	81 7274 000
Propane conversion kit VGH-200-CO	81 7304 000
VGH Residential Plumbing Kit Heating Only Boiler (VGH-xx-CH)	81 7154 000
VGH Residential Plumbing Kit Combi Boiler (VGH-xx-CO).	81 7155 000
Tank sensor for an Indirect Hot Water tank	81 7110 000
External flow temperature sensor for behind the low header 10kOhm@77°F	81 7109 000
MagFilter Pro XL	81 7284 000
Mag Flush Pro	81 7132 000
Heating System Cleaner	81 7133 000
Heating System Protector	81 7134 000
VGH Residential Yearly Maintenance Service Kit	81 7285 000
French I&O Manual Residential Boiler	81 7282 000
French User Manual residential Boiler	81 7283 000

Table 5. 1

### 5.2 Supplied with the boiler

The VGH boiler will be supplied with the following documents and accessories:

Qty	Description	Part number
1	Startup and commissioning check list	---
1	Wall bracket with locking plate and bolts	81 7264 000
3	Spare nuts for the burner plate (in a bag attached to the front of the gas valve)	See spare part list
1	Spare fuse for the boiler control (at the burner controller)	See spare part list
1	Bottom part of the condensate drain assembly	81 7263 000
1	Pressure/temperature residential VGH control kit	81 7288 000
This kit consists of		
1	ASME pressure 30 psi relief valve (packed into an additional box)	65 0550 000
1	Outdoor (air) temperature sensor: 10kOhm@25°C -B3977	81 7108 000
1	Temperature and pressure gauge	91 0373 061
1	¼ Gas shut off ball valve	83 3803 000
1	Boiler Drain	40 0201 000
1	Warranty card	41 1189 000
1	VGH Residential Installation and Service manual	81 7286 000
1	VGH Residential User Manual	81 7287 000

Table 5. 2

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 INSTALLATION LOCATION OF THE VGH

### 6.1 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 2.2). Commissioning of the boiler must be done by a qualified installer or technician, who has been trained for this type of boiler.

### 6.2 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 NFPA 54.
- The flue gas pipes must be connected to the outside wall and/or the outside roof, see chapter 9.
- 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.
- 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 9.8.1, especially Table 9.11 and Table 9.12.
- 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 9.8.1, especially Table 9.11 and Table 9.12.


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

 <b>NOTICE</b>	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.

 <b>CAUTION</b>	The boiler must <u>NOT</u> be installed on or near carpeting.
---	---

### 6.3 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					
VGH-80-CH VGH-100-CH VGH-120-CH VGH-150-CH VGH-180-CH VGH-90-CO VGH-150-CO VGH-200-CO	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
	<b>Clearances from combustible materials</b>					
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 6.1

#### 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 inch 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 9.

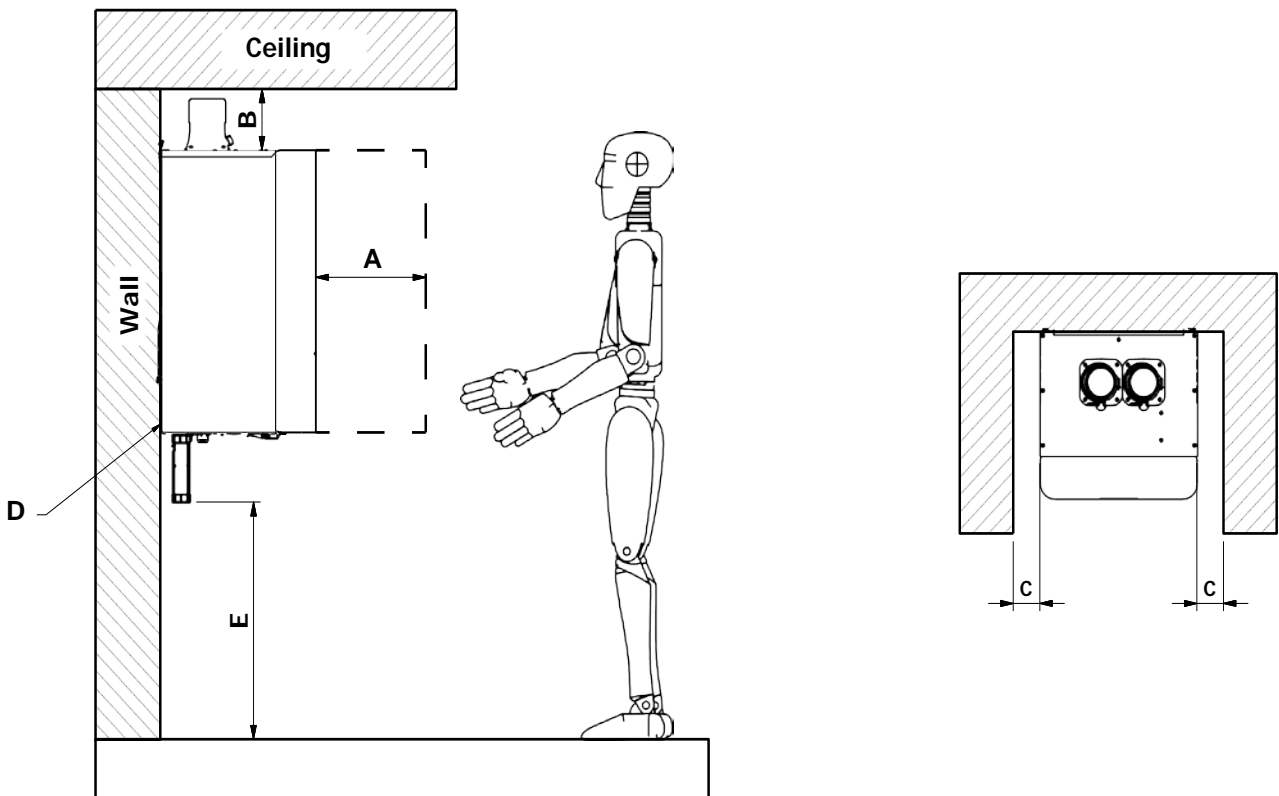


Figure 6.1

## 6.4 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 the power connection positioned above the boiler)
- Gas pipe sizing.
- Automatic Air Vent Connection.



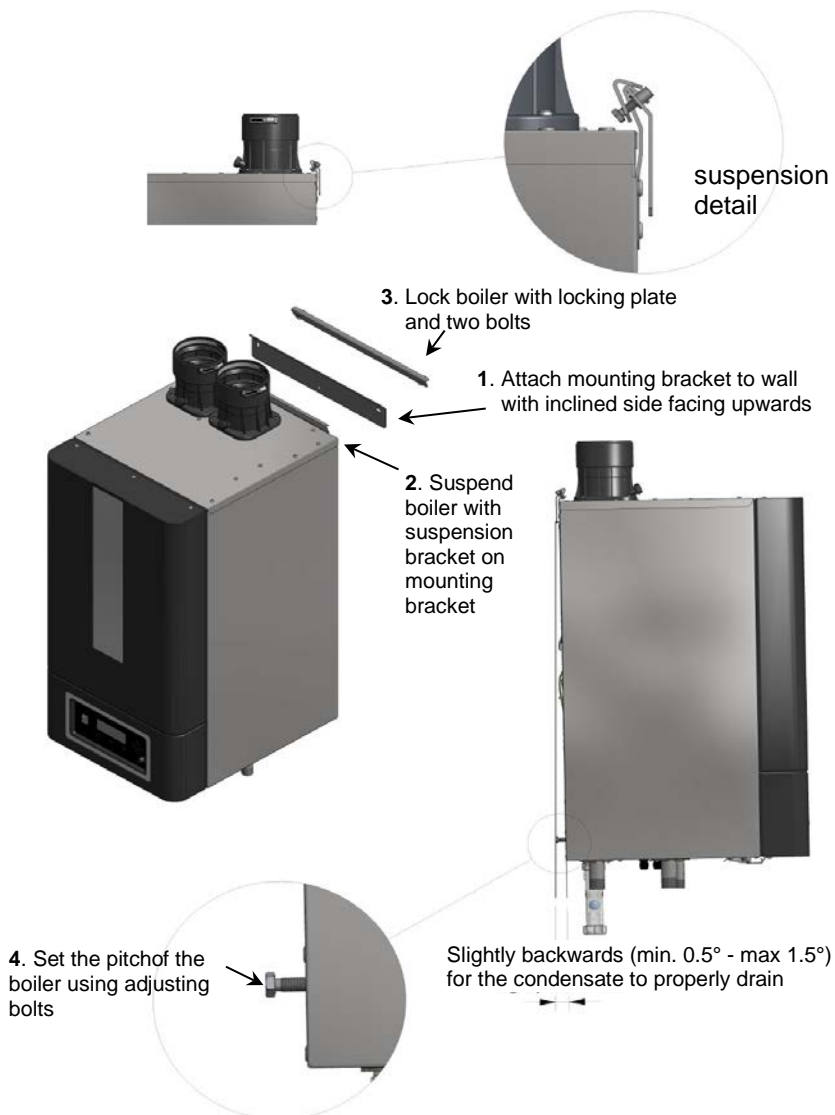
### NOTICE

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 6.2). When the leveling bolts aren't sufficient, fill the gap behind the bolts to get the boiler in position. The boiler position lies between the boiler hanging level and hanging slightly backwards (min. 0.5° - max 1.5°).

The boiler should not lean forward in the mounted position.

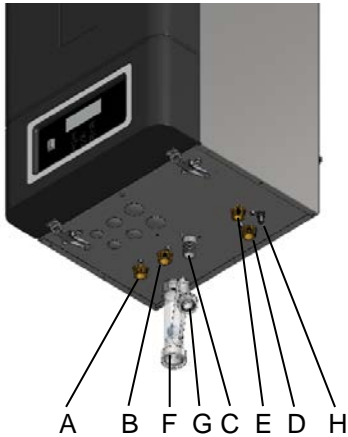


Lock the suspension bracket with the security cover before making any other connections to the boiler. This security cover will prevent the boiler from falling off the bracket. Don't use excessive force during the mounting of the boiler connections.

Figure 6.2

## 7 CONNECTIONS

### 7.1 Boiler connections VGH-CH types

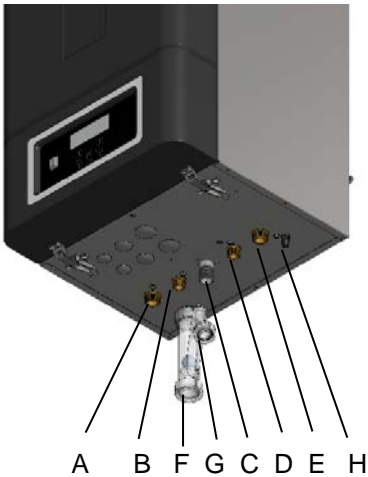


#### Boiler connections VGH-CH boilers:

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

Figure 7.1

### 7.2 Boiler connections VGH-CO types



#### Boiler connections VGH-CO boilers:

- A – Supply CH central heating
- B – Supply DHW
- C – Gas
- D – Cold water inlet DHW
- E – Return CH central heating
- F – Condensate trap clean out.
- G – Condensate drain
- H – Manual Drain.

Figure 7.2



Figure 7.3



## 7.3 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. 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.

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

Table 7.1

### 7.3.1 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 the NFPA54. 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 will be available at the boiler gas valve inlet at maximum boiler firing rate. See the technical specifications datasheets (paragraph 3.3) for minimum and maximum allowed gas pressures.

When an in-line regulator is used to drop gas pressure from 2 psi to 0.5 psi, it must be located at least 6 feet from the boiler.

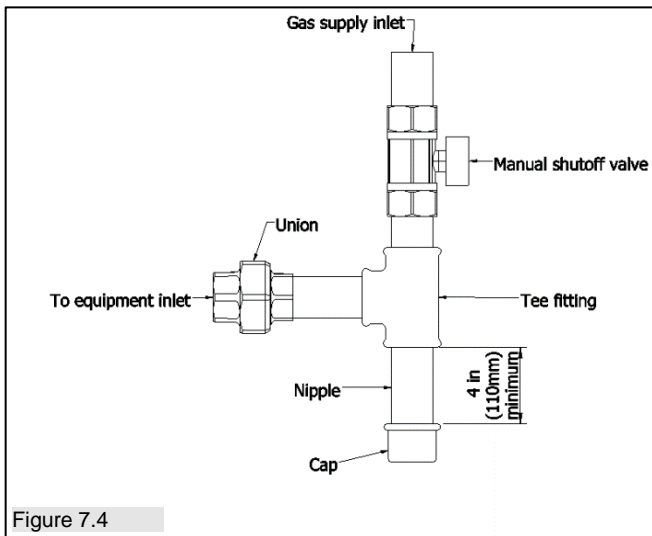
A minimum 1" diameter flex hose is required if flex gas hose will be used. Ensure that the gas line connection to the appliance does not exert any force or pressure on the gas valve.

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. Use common gas line sizing practices. Make sure the gas pressure is within specification during all conditions. Always use a pipe-threading compound. 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**



Install a manual Shutoff Valve. The valve must have been certified by a nationally accredited 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 (outside in open air) before putting the appliance into operation for the 1st time.



A sediment trap must be provided directly below the boiler.



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).

## 7.4 Condensate drain connection

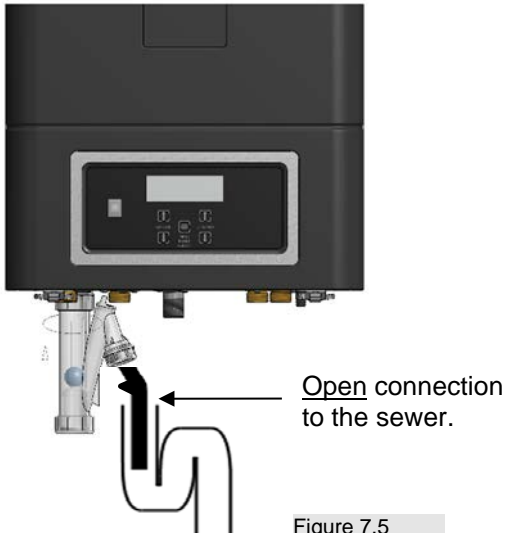


Figure 7.5

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  $\frac{3}{4}$  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**

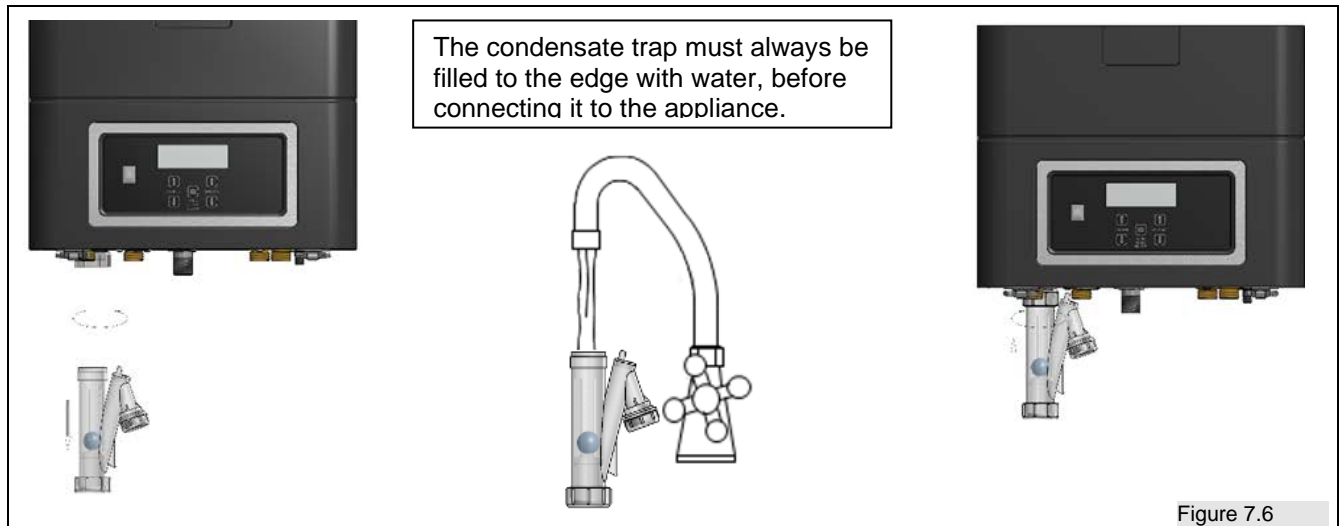


Figure 7.6

## 7.5 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  $\frac{3}{4}$ " NPT connections for heating. The table below lists the required piping sizes for correct operation of the boiler. If a slantfin plumbing kit is used (See §7.8) all the the bushing and piping is correctly sized and provided with the kit.

Model	Boiler connection diameter	CH Required piping diameter	Indirect tank Required piping diameter
VGH-80-CH / VGH-100-CH / VGH-120-CH	3/4"	1"	1"
VGH-150-CH / VGH-180-CH	3/4"	1 1/4"	1 1/4"
VGH-90-CO	3/4"	1"	NA
VGH-150-CO /	3/4"	1 1/4"	NA
VGH-200-CO	3/4"	1 1/4"	NA

Table 7.2

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.

## 7.6 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. See Figure 7.7 and 7.8

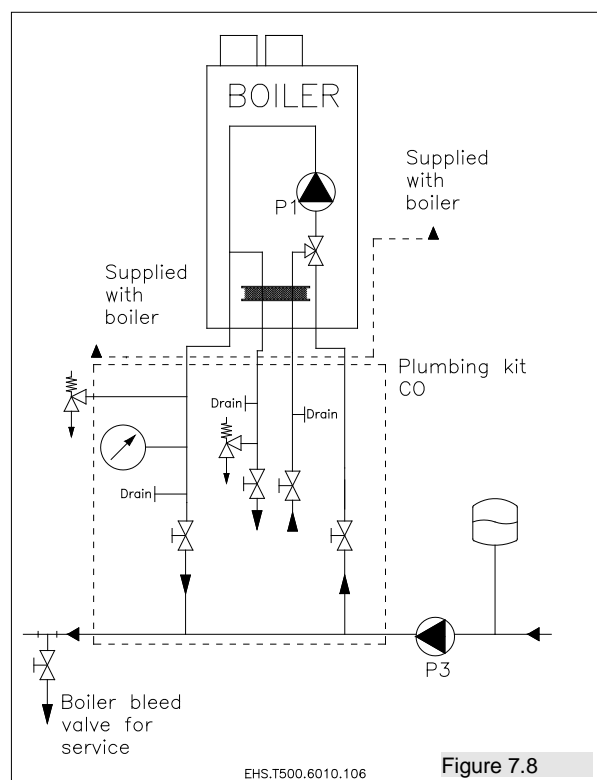
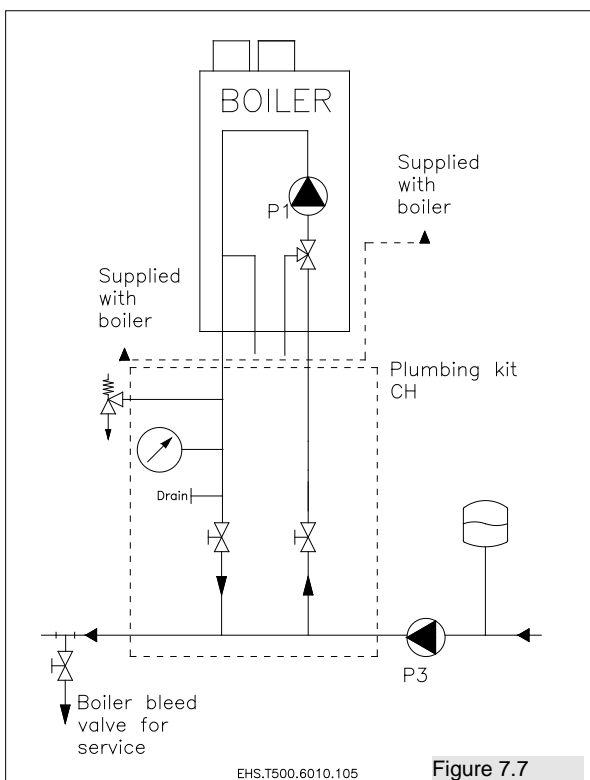
## 7.7 Pressure relief valve

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.

## 7.8 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.

Slant/Fin has available a boiler plumbing kit that is highly recommended to be used on all installations. The boiler plumbing kit (for part number see accessoires list §5.1) includes all of the items in figure 7.9 (CH) or 7.10 (CO). The Slant/Fin plumbing kit has a minimal pressure drop equivalent to less than 1 foot of head.





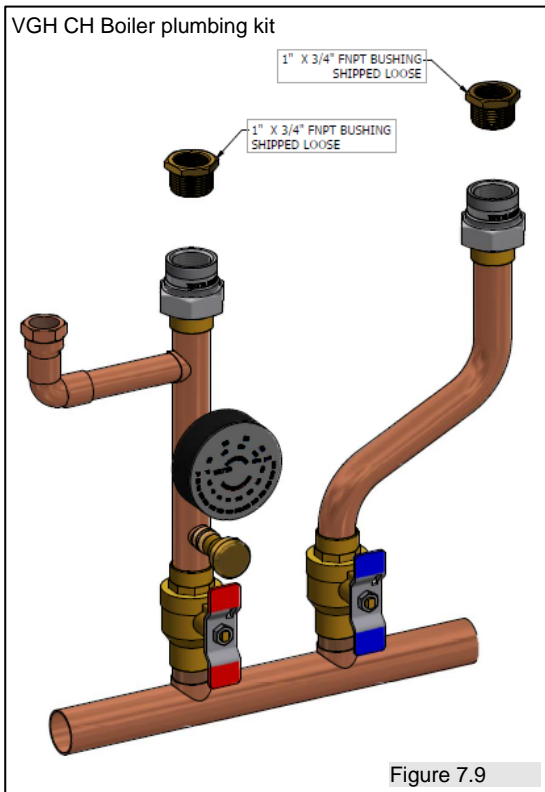


Figure 7.9

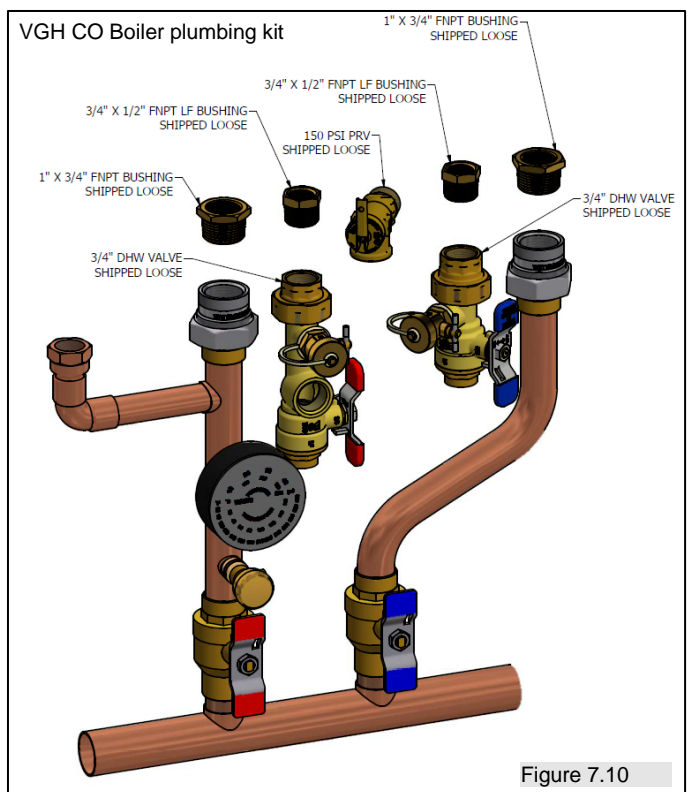


Figure 7.10

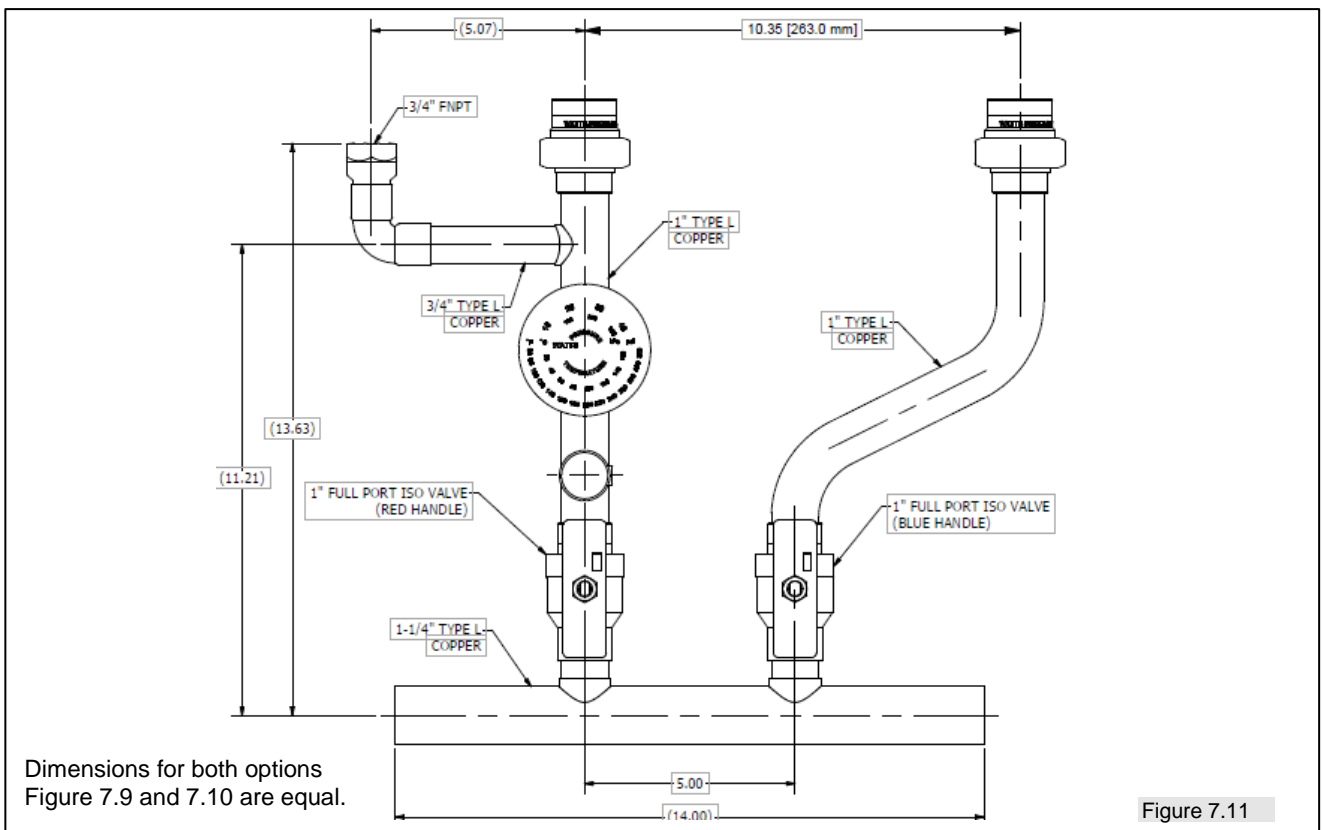


Figure 7.11

## 7.9 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  $\Delta T$  is limited to 72 °F and at low burner power a  $\Delta T$  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  $\Delta T$  exceeds 94 °F, the boiler will be temporarily switched off.

## 7.10 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 the 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 the 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.

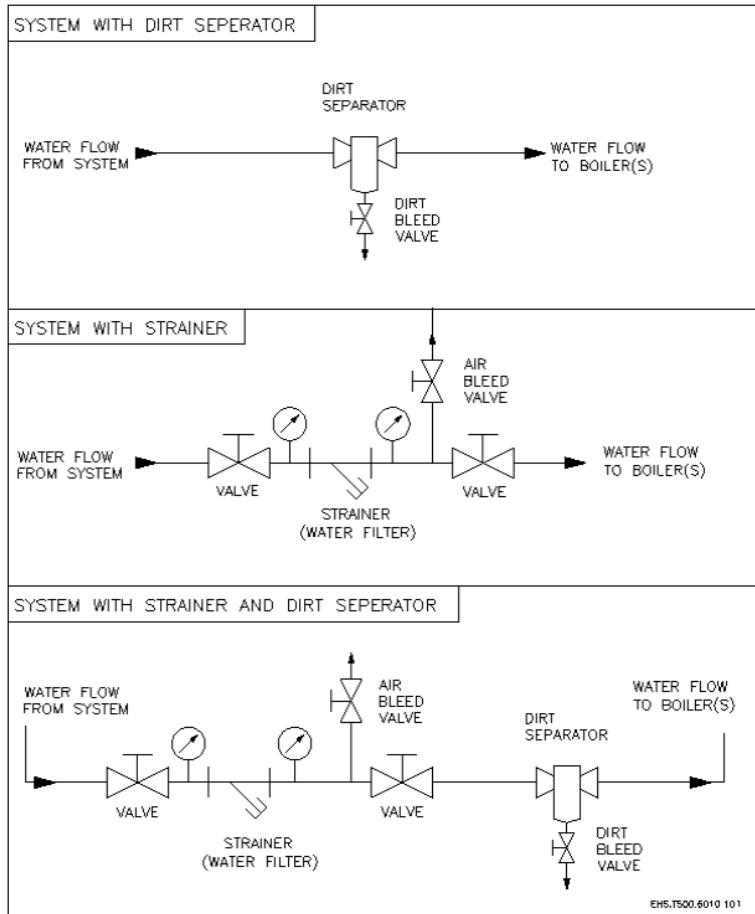


Figure 7.12

## 7.11 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 7.12

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

## 7.12 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 7.13

Water Temperature °F	Time for 1 <sup>st</sup> Degree Burn	Time for Permanent Burns 2 <sup>nd</sup> & 3 <sup>rd</sup> 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 7.2

 <b>NOTICE</b>	<p><b>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).</b></p>
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## 7.13 Supply and return connections and pressure relief valve.

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. A DHW pressure relief valve is included in the accessory plumbing kit for the combi boiler, the kit is highly recommended for all installations. The DHW combi boiler 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 1/2" NPT connections for combi DHW. The connections size needs to be increased to 3/4" for correct operation of the boiler. If a slantfin plumbing kit is used all the the bushing and piping is correctly sized and provided with the kit. (See §5.1 and §5.2 for part numbers)

## 7.14 Temperature limiting device (DHW)

For VGH-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 temperature limiting devices may be required at the domestic water fixtures in the dwelling.

## 7.15 Drain valves (DHW)

For a VGH-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. The Slant/Fin plumbing kit for the combi boiler includes a service valve kit that allows for the flushing of the plate heat exchanger.

## 7.16 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.

## 7.17 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 7.3

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 will lose 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.

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..

Do not use petroleum-based cleaning and sealing compounds in the boilers system as they could damage gaskets. When using antifreeze in the system always use an inhibited mono propylene glycol antifreeze approved for use in heating systems.

**Never use Ethylene glycol in a heating system as it is toxic and can damage gaskets.**

Read the antifreeze supplier's manual for the maximum allowed level of antifreeze that can be used with the boiler.


The pH and water quality of the system must be checked on a yearly basis when antifreeze is used in a system. 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.

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.

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.


 <b>WARNING</b>	<p>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.</p>
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## 7.18 Domestic Water Quality

Appropriate steps must be taken to ensure the brazed 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 Slant/Fin.

	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 7.4 \* Source: Part 143 National Secondary Drinking Water Regulations

 <b>NOTICE</b>	<p>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.</p>
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## 7.19 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
<b>Fernox</b>	Alphi 11	consists of 97% Mono Propylene Glycol next to some additives.
<b>Sentinel</b>	X500	estimated as being between 90-100% Mono Propylene Glycol.
<b>Rhomar</b>	Rhogard	blended with VIRGIN Propylene Glycol

Table 7.5

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 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.

It is required to check the frost protection and acidity of the mixture in the heating system every year to maintain the warranty of the boiler.

## 7.20 Chemical water treatment

The chemical compatibility of several products for treatment of the central heating equipment has 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.


The water quality of the mixture in the heating system and boiler must be within the requirements from Table 7.5

Corrosion-/ Scale inhibitors and recommended suppliers				
Producers ->	Fernox	Sentinel	Rhomar	Adey
Inhibitors	Protector F1 / Alphi 11	X100, X500	Pro-tek 922	MC1+
Noise reducer		X200		
Universal cleaner	Restorer, Cleaner F3	X300, X400	Hydro-Solv 9100	
Sludge remover	Protector F1, Cleaner F3	X400		
Antifreeze	Alphi 11	X500	Rhogard	
Tightness		Leaker Sealer F4		

Table 7.6

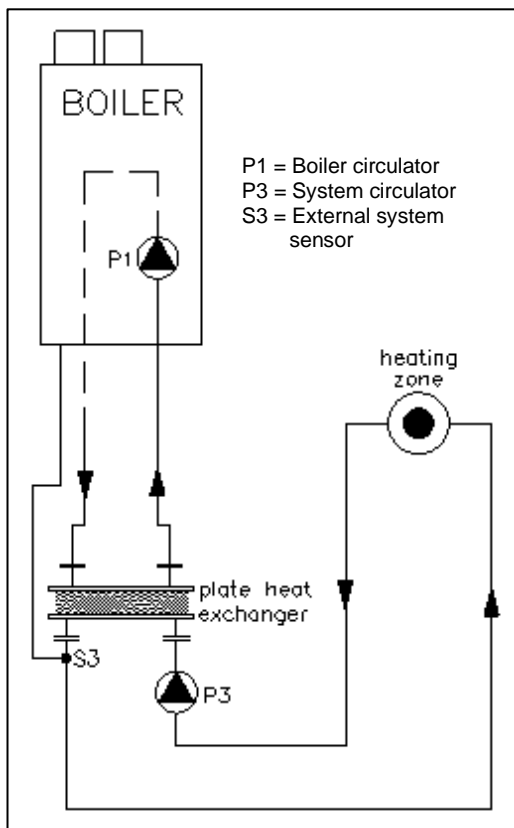
Treatment type	Preventive	Curative
Protector F1	X	
Cleaner F3	X	X
X100	X	
X200	X	
X300		X
X400		X
X500	X	
Alphi 11	X	
Leaker Sealer F4	X	
MC1+	X	

Table 7.7



**WARNING**

**When using chemicals or any kind of additions**  
 Follow the instructions provided by the manufacturer. Read the supplier's manual for the maximum allowed 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 + mixing ratio in the log book, start-up, check and maintenance list



## 7.21 Plastic piping in the heating system

When plastic pipes with no 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.

## 7.22 Underfloor heating

When using an underfloor heating system with non-oxygen barrier PEX, the boiler circuit must be separated from the heating circuit with a plate heat exchanger.

Figure 7.14

## 7.23 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.

## 7.24 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 16.2.

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.

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: It starts when 1st 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  $(10 \times 40) \times 2 = 800$  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.

 <b>NOTICE</b>	<p>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.</p>
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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.

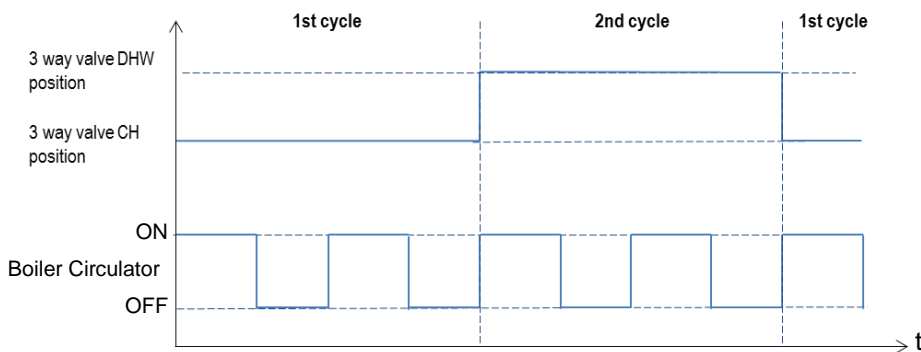


Figure 7.15

### Relevant variables:

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

Table 7.8

## 7.25 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.

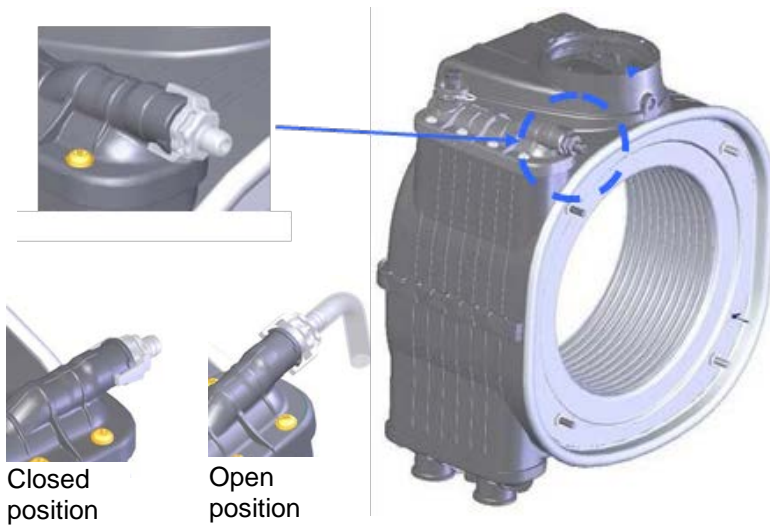


Figure 7.16

To manually de-air the heat exchanger:

- Use a plastic pvc tube with an inside/ outside diameter of 0.27/0.39 inch. Only deaerate when the water and heat exchanger are cold.
  - put a fitting with a tube to the air vent;
  - slowly turn the vent 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 (to avoid applying a torque above the one to be manually applied)
  - 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 attached drain hose the drained water can be easily collected. Take care the drain tube is outside the boiler so components and burner controller inside the boiler will not become wet.

## 7.26 Automatic Feed Valve

If an automatic feed valve is installed in the system, it must not be left open indefinitely. A continuous feed of fresh water could damage the system (fresh water brings fresh oxygen into 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 is closed. When using an automatic water refill system some precautions must be taken, like installing a water meter to measure and evaluate the total water volume added to the system. A water meter can be used to detect and eliminate any water leakage as soon as possible.

When an automatic feed valve system is used, some form of monitoring must take place to prevent continuously filling of the system with large amounts of oxygenated fresh water. This can occur when a leak in the system is not detected and the total water amount added is not being monitored.

## 7.27 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.



## 7.28 Installation examples

### 7.28.1 EXAMPLES OF A NORMAL SINGLE BOILER HEATING CIRCUIT WITH LOW LOSS HEADER (PREFERABLE)

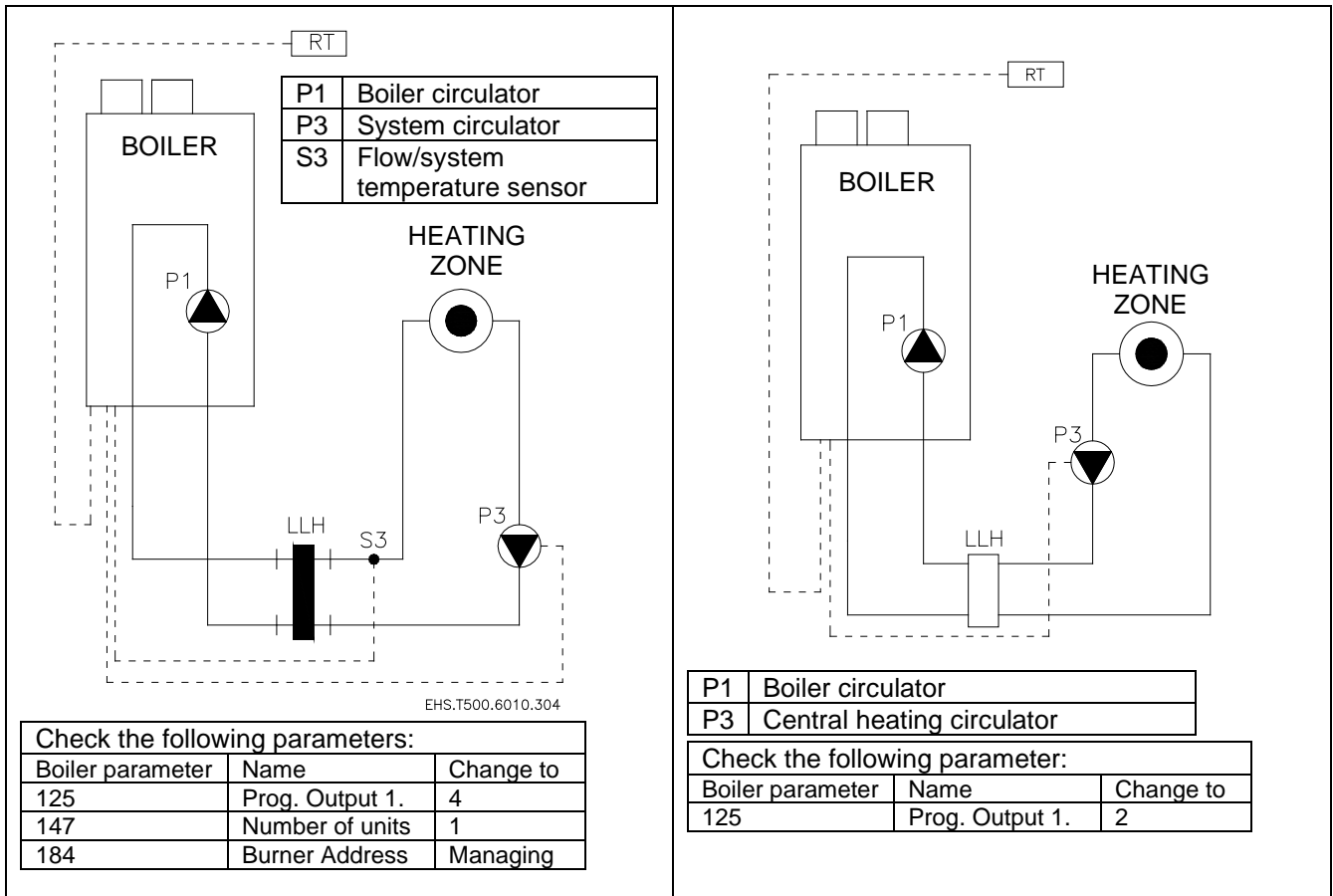


Figure 7.17

### Example of an Combi (CO) - DHW mode 5

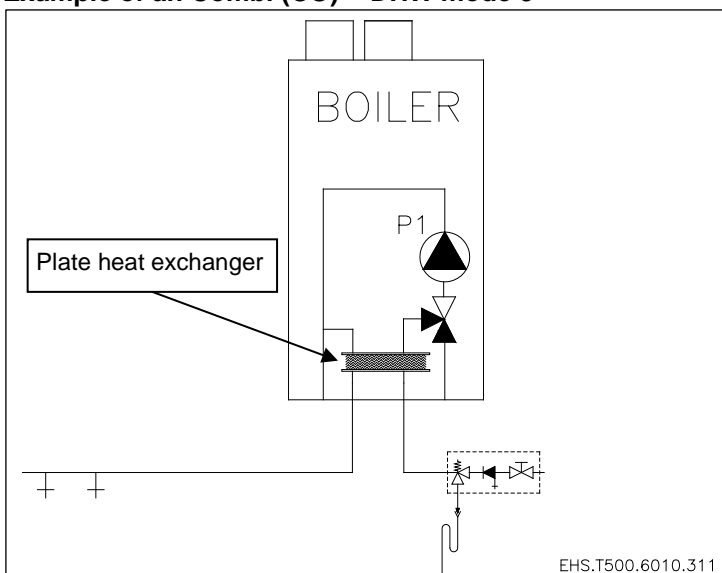
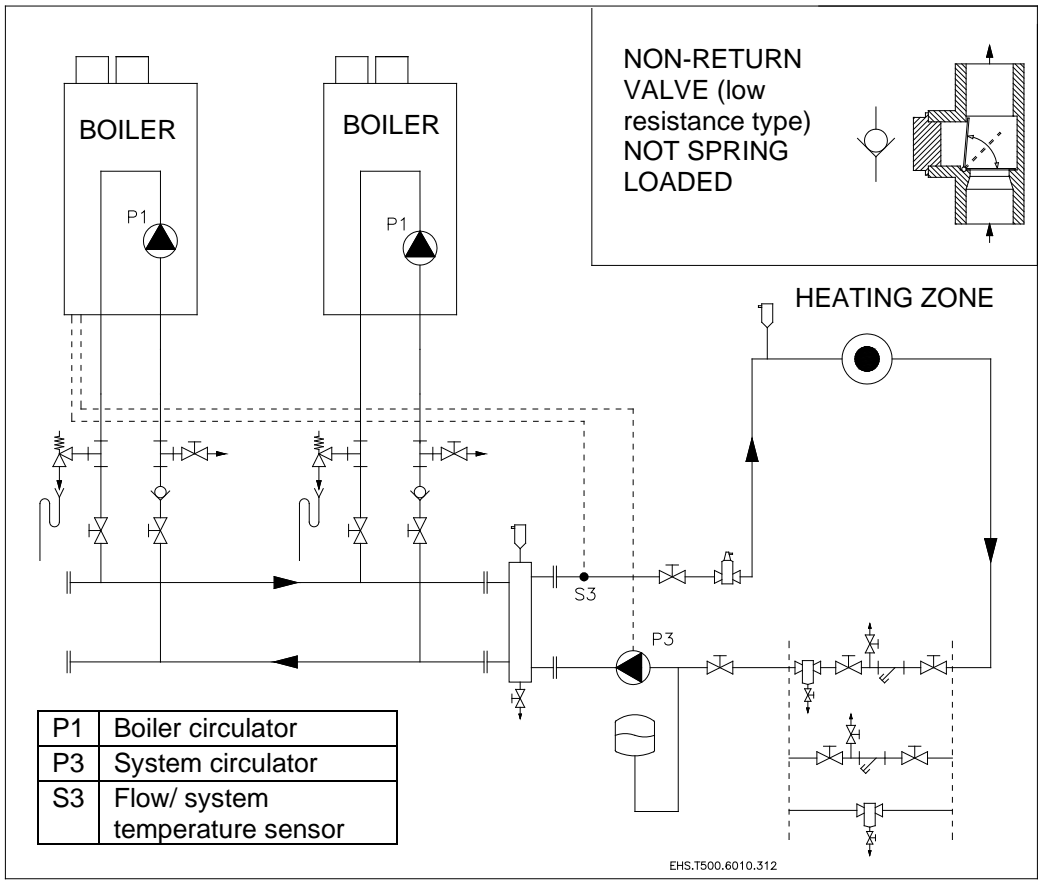


Figure 7.18

7.28.2 EXAMPLE OF A MULTIPLE BOILER HEATING CIRCUIT WITH LOW LOSS HEADER



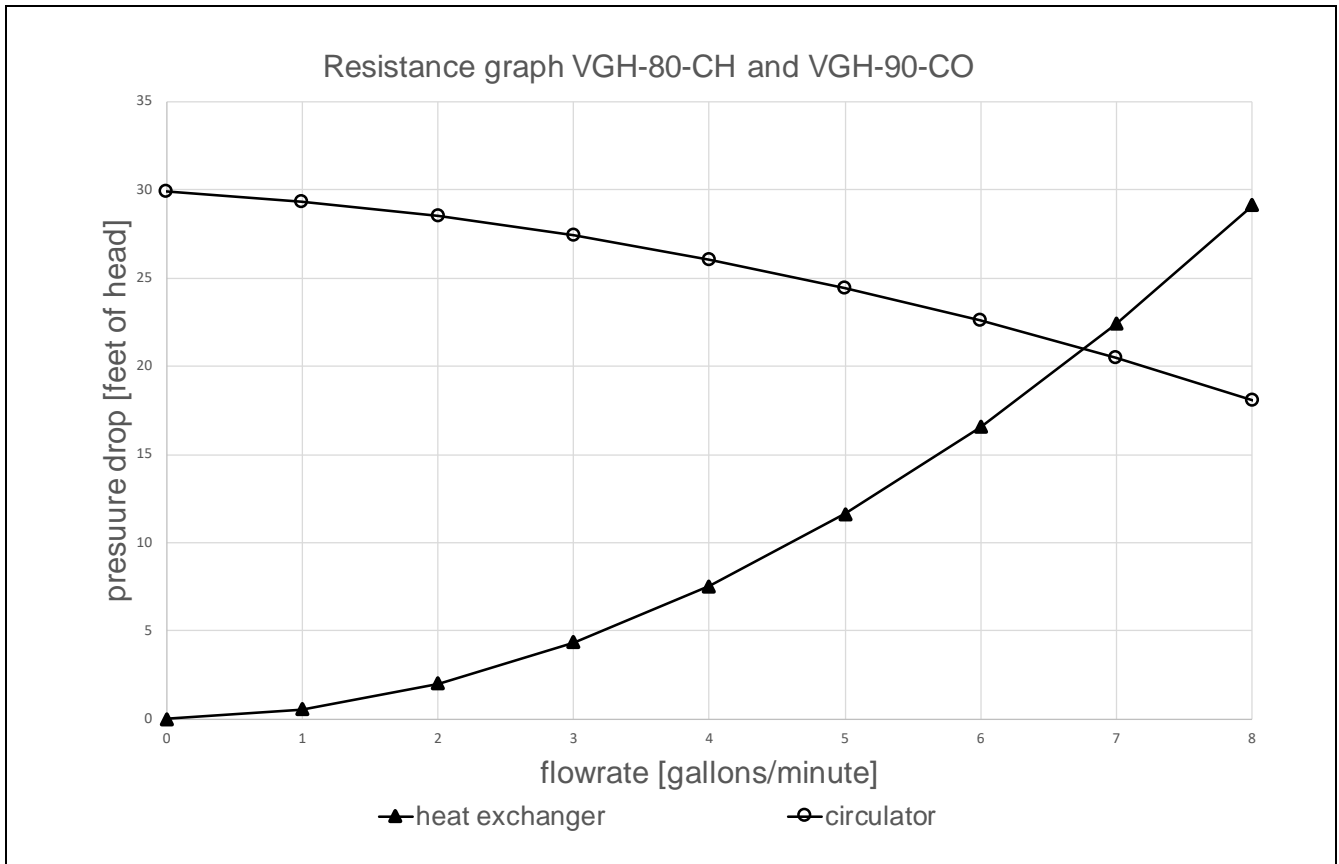
	valve		strainer (water filter)		circulator
	air separator		pressure relief valve		automatic air vent
	dirt separator		condensate trap		expansion vessel
	low loss header				

Figure 7. 19

## 8 CIRCULATOR CHARACTERISTICS

### 8.1 Pressure drop and flow graphs

#### 8.1.1 BOILER RESISTANCE GRAPH VGH-80-CH / VGH-90-CO



#### 8.1.2 BOILER RESISTANCE GRAPH VGH-100-CH

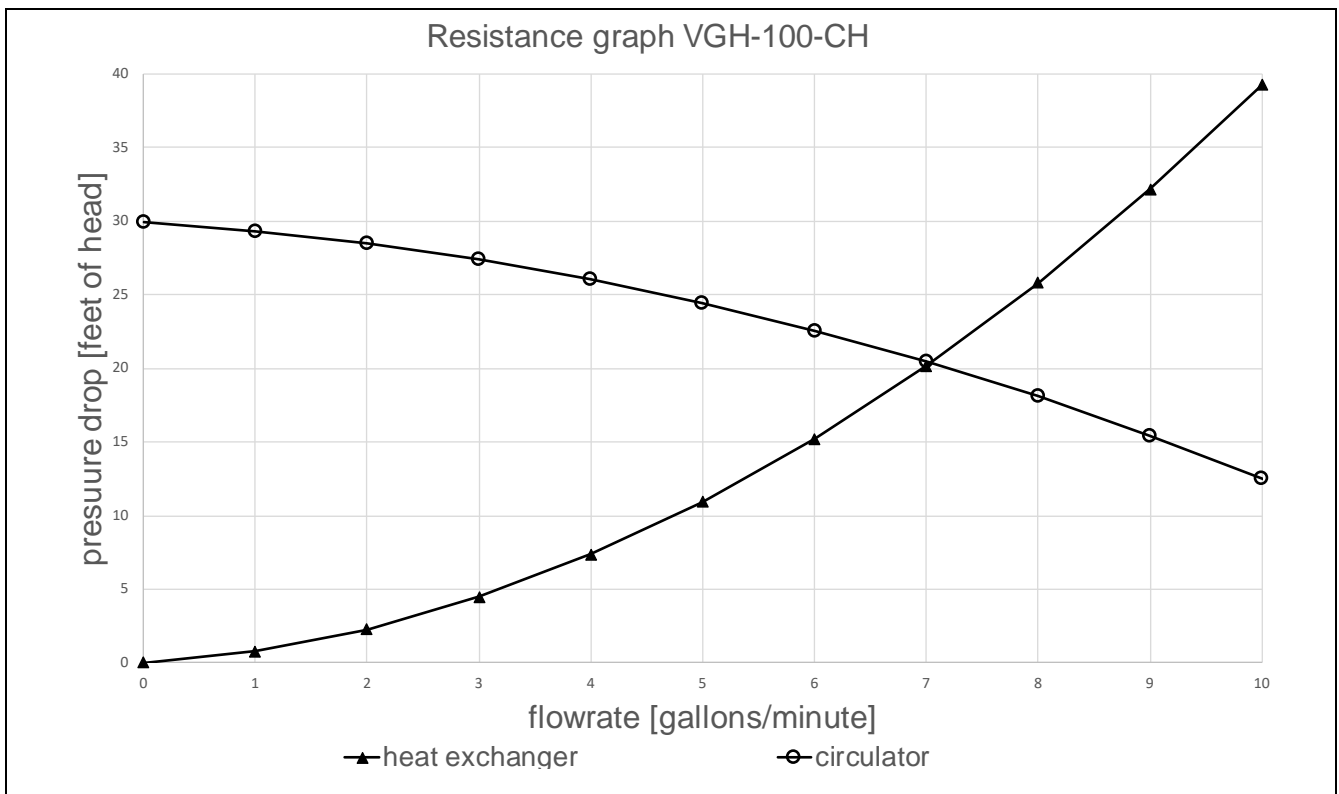


Figure 8.2

8.1.3 **BOILER RESISTANCE GRAPH VGH-120-CH / VGH-150-CO**

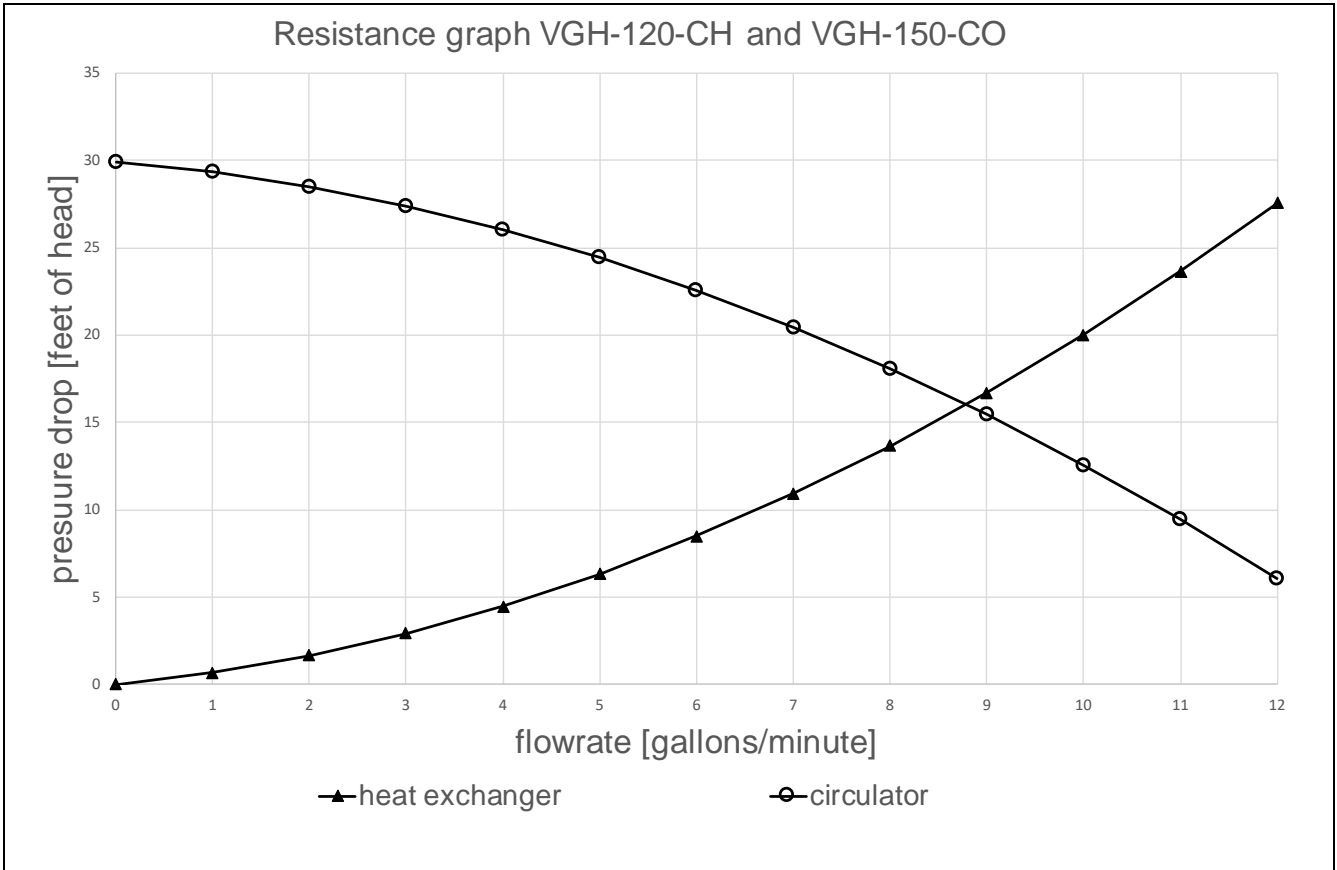


Figure 8.3

8.1.4 **BOILER RESISTANCE VGH-150-CH**

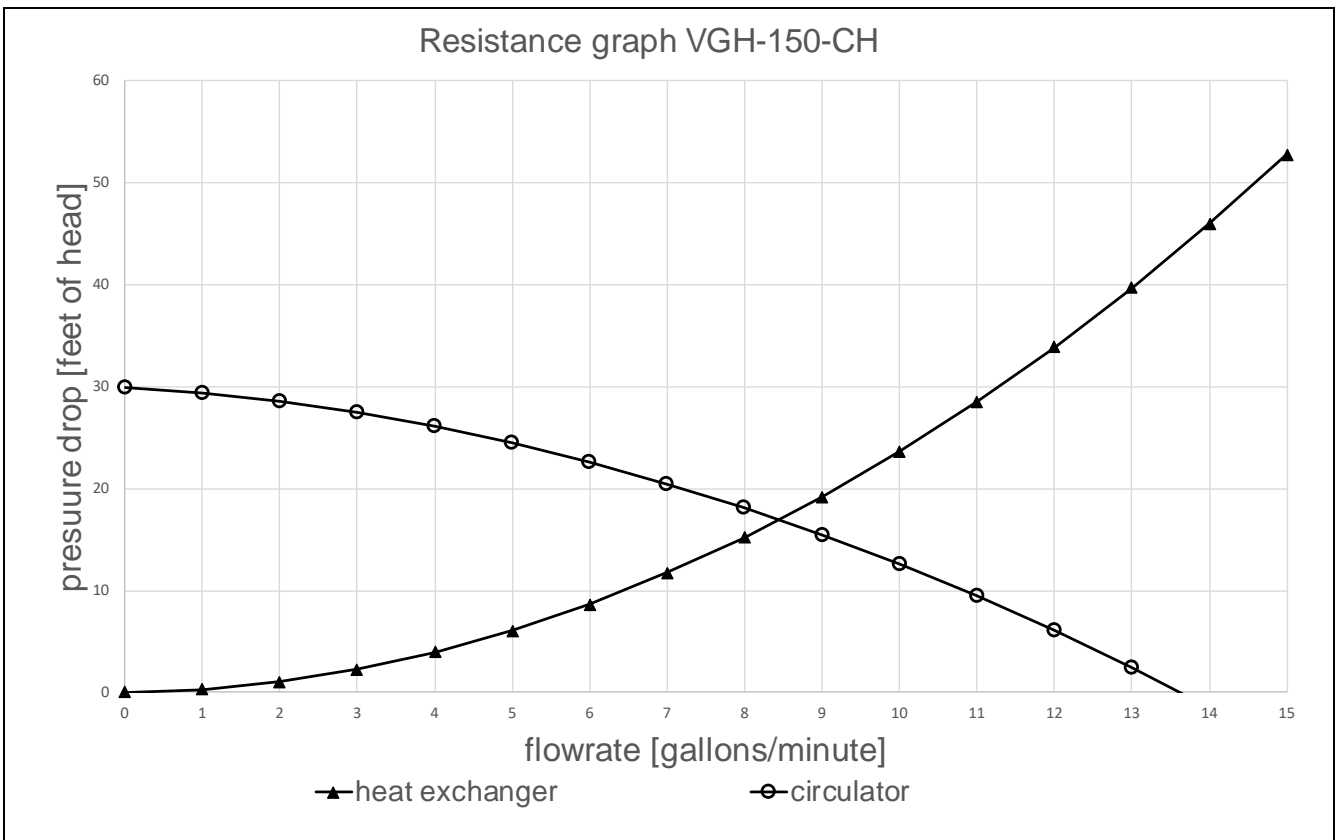


Figure 8.4

8.1.5 **BOILER RESISTANCE GRAPH VGH-180-CH / VGH-200-CO**

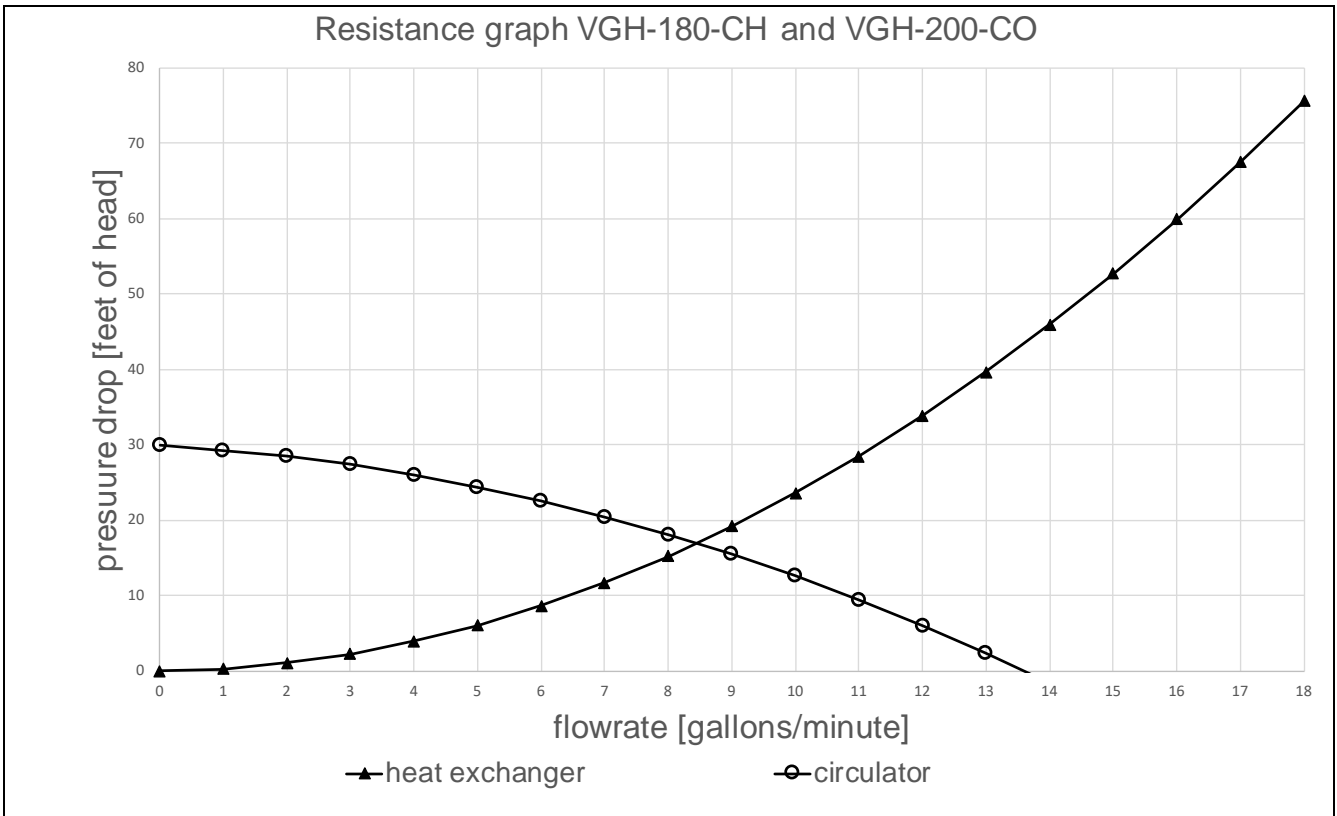


Figure 8.5

8.1.6 **GRAPH SHOWING THE AVAILABLE CIRCULATION PUMP HEAD**

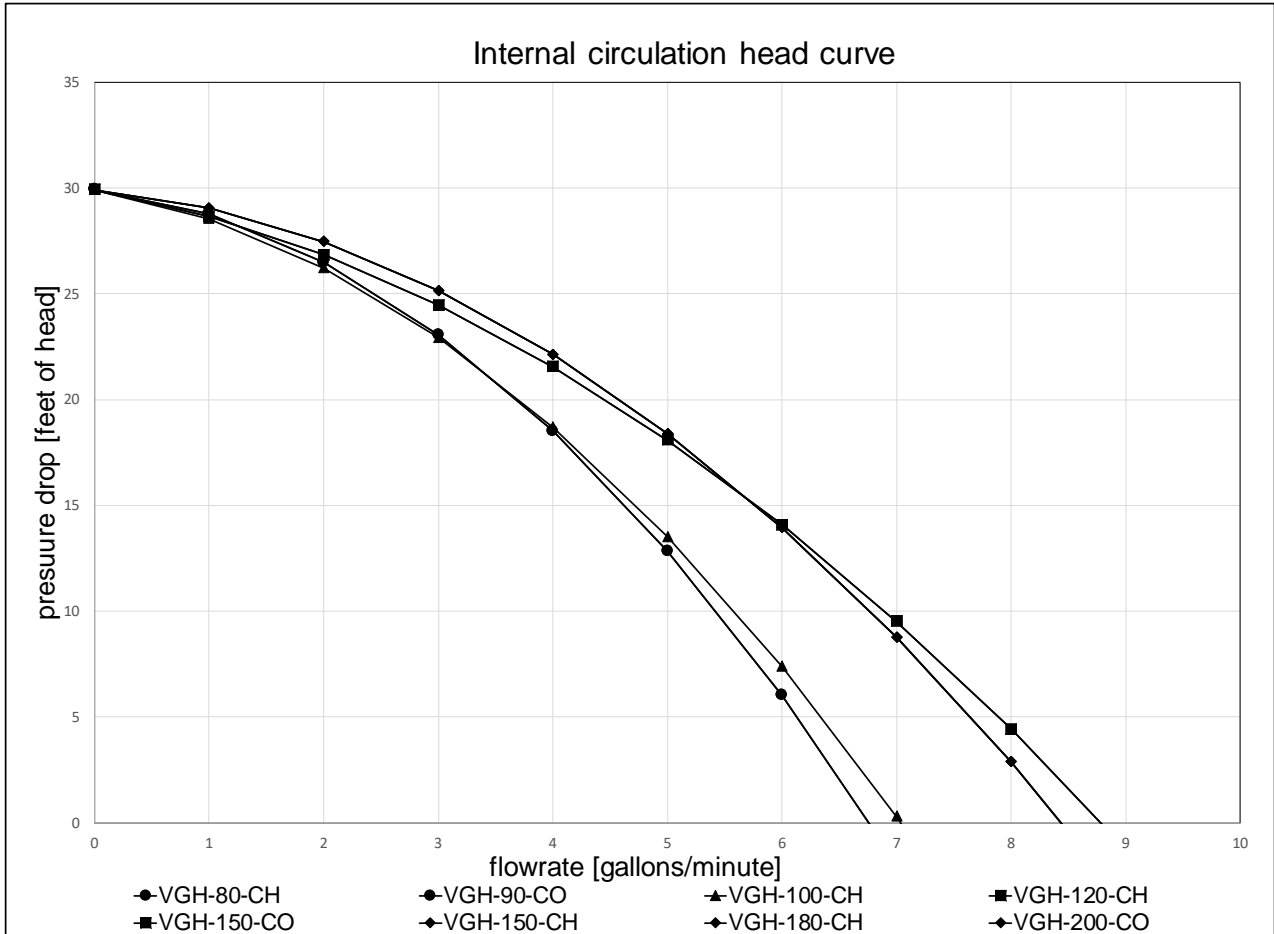


Figure 8.6

## 8.2 Minimum required circulator head.

The design flow of the boiler should be between a delta T of 20 °F and a delta T of 40°F at high fire depending 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. The Slant/Fin plumbing kit has a minimal pressure drop equivalent to less than 1 foot of head. 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.

$\Delta T = 20\text{ }^{\circ}\text{F}$	Minimum required flow		Pressure drop boiler including Slant/Fin plumbing kit	
	gal/min	m <sup>3</sup> /h	ft.W.C.	m.W.C.
<b>VGH-80-CH / VGH-90-CO</b>	7.60	1.73	27.3	8.3
<b>VGH-100-CH</b>	9.50	2.16	36.6	11.2
<b>VGH-120-CH / VGH-150-CO</b>	11.40	2.59	26.2	8.0
<b>VGH-150-CH</b>	14.25	3.24	48.6	14.8
<b>VGH-180-CH / VGH-200-CO</b>	17.10	3.88	69.4	21.2

Table 8.1

$\Delta T = 40\text{ }^{\circ}\text{F}$	Minimum required flow		Pressure drop boiler including Slant/Fin plumbing kit	
	gal/min	m <sup>3</sup> /h	ft.	m.W.C.
<b>VGH-80-CH / VGH-90-CO</b>	3.8	0.86	6.83	2.1
<b>VGH-100-CH</b>	4.76	1.08	10.00	3.0
<b>VGH-120-CH / VGH-150-CO</b>	5.73	1.30	7.89	2.4
<b>VGH-150-CH</b>	7.14	1.62	12.16	3.8
<b>VGH-180-CH / VGH-200-CO</b>	8.57	1.95	17.42	5.3

Table 8.2

## 8.3 Modulating circulator for CH demand

The VGH boiler is provided with an internal circulator which can be switched on or off. The internal circulator is set to speed settings 3 and this must never be changed. If the required flow is too low, an external circulator can be installed by connecting the external circulator to the PWM circulator connection (see paragraph 10.3.1).

The control supports PWM modulation for the general circulator. Parameter 136 has to be set to modulating (Factory set to on/off circulator) when using a modulating circulator. With this parameter the speed of the external modulator must be set. The boiler circulator is modulated when there is a demand for CH.

During any other demand, the PWM circulator will run at a fixed speed set by the Default Duty cycle parameter. How the circulator is modulated is controlled with the Modulating\_Pump\_Mode setting.

## 8.4 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	
<b>0</b>	Disabled	No circulator modulation; the PWM duty cycle is always 0%
<b>1</b>	Delta temperature modulation	Calculated duty cycle to create a delta temperature between the T_Supply and T_Return sensor
<b>2</b>	Fixed 20% speed	Fixed duty cycle of 20%
<b>3</b>	Fixed 30% speed	Fixed duty cycle of 30%
<b>4</b>	Fixed 40% speed	Fixed duty cycle of 40%
<b>5</b>	Fixed 50% speed	Fixed duty cycle of 50%
<b>6</b>	Fixed 60% speed	Fixed duty cycle of 60%
<b>7</b>	Fixed 70% speed	Fixed duty cycle of 70%
<b>8</b>	Fixed 80% speed	Fixed duty cycle of 80%
<b>9</b>	Fixed 90% speed	Fixed duty cycle of 90%
<b>10</b>	Fixed 100% speed	Fixed duty cycle of 100%

Table 8.3


## 8.5 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.

 <b>NOTICE</b>	The internal boiler pump/circulator is electrically connected to connections 6-7-PE Boiler Circulator (general pump) <b>BE AWARE</b> in the software the description “General Pump” is used for “Boiler Circulator”
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### DHW indirect tank circulator (circulator P2) – VGH-CH 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 – VGH-CH 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.

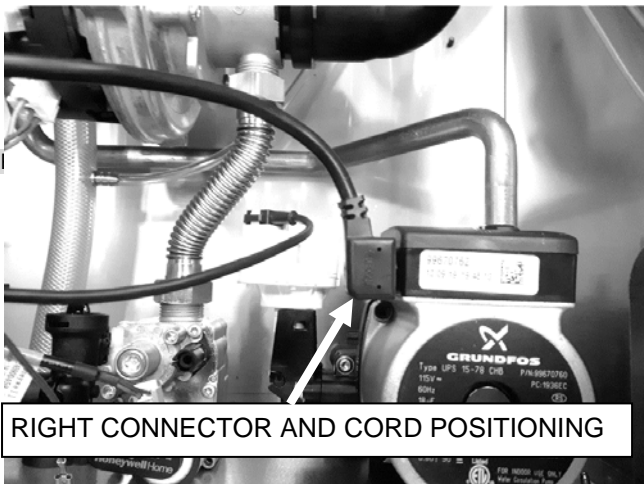
### Warning (ECM circulators)

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

 <b>WARNING</b>	Use an external relay if nominal circulator currents exceed 2 A.	 <b>NOTICE</b>	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.
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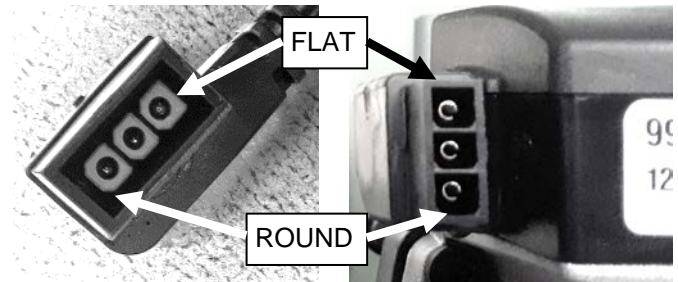
#### 8.5.1 CIRCULATOR POWER CORD POSITIONING

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



RIGHT CONNECTOR AND CORD POSITIONING

Picture 8.1



Picture 8.2


## 9 FLUE GAS AND AIR SUPPLY SYSTEM

### 9.1 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 CSA B149.1 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 always has been placed in its position during operation of the appliance.

 <b>NOTICE</b>	<ul style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.  <b>These parts must be certified for use at temperatures of minimal 70°C / 158°F.</b></li> </ul>
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#### 9.1.1 VENT SIZING



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

Table 9.1

 <b>NOTICE</b>	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:

VENT (FLUE GAS)   AIR INTAKE






### 9.1.2 VENT AND AIR INLET RESISTANCE TABLE

#### 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								
	VGH-80-CH	VGH-90-CO	VGH-100-CH	VGH-120-CH	VGH-150-CO	VGH-150-CH	VGH-180-CH	VGH-200-CO
2"	50 / 50	50 / 50	40 / 40	30 / 30	20 / 20	20 / 20	20 / 20	20 / 20
3"	150 / 150	150 / 150	150 / 150	150 / 150	100 / 100	100 / 100	100 / 100	100 / 100

Table 9.2

 <b>NOTICE</b>	<ul style="list-style-type: none"> <li>• For long lengths, check venting pipe and fittings for maximum allowable pressure.</li> <li>• This table should only be used for a single vent/air system for one boiler. Do <b>NOT</b> use this table for common vent systems with cascaded boilers.</li> </ul>
--	--

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

		Item\ size Eq. feet	
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	
Reducer 4"-3"	(based on small diameter)		0.5

Table 9.3

#### Terminals equivalent feet: for DuraVent PolyPro

BOILER	TERMINAL	size	part #	Eq. feet
VGH-80-CH / VGH-90-CO	concentric roof:	2" vent	2PPS-VKL / 2PPS-VK-TCL	18 ft
VGH-100-CH / VGH-120-CH	concentric wall:	2" vent	2PPS-HKL	10 ft
VGH-150-CO / VGH-150-CH	concentric roof:	3" vent	3PPS-VKL / 3PPS-VK-TCL	25 ft
VGH-180-CH / VGH-200-CO	concentric wall:	3" vent	3PPS-HKL	11 ft

Table 9.4

## 9.2 Vent and air intake pipe material

Items	Materials <sup>1)</sup>	Venting System Standards		Warning
		United States	Canada <sup>3)</sup>	
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 <sup>2)</sup>	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 the Closet/alcove of a Closet/alcove installation.

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 158°F (70°C) or higher.


Table 9.5

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>• Never use aluminum containing vent pipes in these boilers.</li> <li>• Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. Failure to follow instructions may result in serious injury or death.</li> <li>• In Canada, the first piece of vent piping must be readily accessible for inspection.</li> <li>• Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.</li> <li>• Failure to follow these instructions may result in property damage, personal injury or death.</li> </ul>
---	--

9.2.1 **APPROVED MANUFACTURERS**

**PVC/ CPVC venting:**

\* IPEX System 636

 <b>WARNING</b>	<p>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 IPEX PVC appliance without restrictions.</p>
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**Polypropylene venting:**

\* Duravent - PolyPro


\* Centrotherm - InnoFlue

**Stainless steel venting:**

\* Duravent - FasNSeal, FasNSeal Flex

\* Security Chimneys - Secure seal SS/SSD/SSID

\* HeatFab

 <b>NOTICE</b>	<p><b>Read the manual provided by the vent gas and air system supplier carefully.</b></p>
--	---

**9.3 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.


Approved PVC/ CPVC vent pipe and fittings:


**IPEX – System 636**

<b>Boiler</b>	<b>Fitting</b>	<b>2" Part #</b>	<b>3" Part #</b>
<b>VGH-80-CH / VGH-90-CO</b> <b>VGH-100-CH / VGH-120-CH</b> <b>VGH-150-CO / VGH-150-CH</b> <b>VGH-180-CH / VGH-200-CO</b>	Concentric Termination CPVC	197033	197107
	Low profile Termination	196984	196985
	FGV 45° Elbow CPVC	197169	197171
	FGV 90° Elbow CPVC	197199	197201
	Termination Vent Screen	196050	196051

Table 9.6

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>• 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 these instructions may result in property damage, personal injury or death.</li> <li>• Insulation may 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.</li> <li>• 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.</li> </ul>
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 <b>WARNING</b>	<b>PVC In Canada:</b> 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 CSA B149.1 Installation Code and local building codes.
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 <b>NOTICE</b>	<ul style="list-style-type: none"> <li>• In Canada, CPVC and PVC vent pipe, fittings and cement/ primer must be ULC-S636 certified.</li> <li>• Use only cleaners, primers, and solvents that are approved for the materials which are joined together.</li> <li>• 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).</li> </ul>
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### 9.3.1 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 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. 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.
  - e. Apply a second coat of cement to the pipe.
  - f. While the cement is still wet, insert the pipe into the fitting, if possible, twist the pipe a 1/4 turn as you insert it. **Note:** If voids are present, sufficient cement was not applied and joint could be defective.
  - g. Wipe excess cement from the joint removing ring or beads as it will needlessly soften the pipe.

## 9.4 Polypropylene

This product has been approved for use with polypropylene vent with the manufacturers listed. All terminations must comply with 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.

Approved polypropylene vent pipe and fittings.

Supplier	Type
Duravent	PolyPro
Centrotherm	InnoFlue

Table 9.7

Approved polypropylene terminations:

### Duravent – PolyPro

Boiler	Termination	Color	2" Order	2" Stock	3" Order	3" Stock
VGH-80-CH / VGH-90-CO VGH-100-CH / VGH-120-CH VGH-150-CO / VGH-150-CH VGH-180-CH / VGH-200-CO	Twin Pipe Side Wall	black	2PPS-HTPL	810009685	3PPS-HTPL	810009713
	Single Pipe Side Wall	stainless	2PPS-HSTL	810009684	3PPS-HSTL	810009712
	Bird Screen	stainless	2PPS-BG	810004341	3PPS-BG	810004355
	concentric roof	black	2PPS-VKL	810009692	3PPS-VKL	810009720
		terra-cotta	2PPS-VK-TCL	810009693	3PPS-VK-TCL	810009721
	concentric wall	white	2PPS-HKL	810009682	3PPS-HKL	810009710

Table 9.8

## Centrotherm Innoflue

Boiler	Termination	Color	2" Order #	3" Order #
VGH-80-CH / VGH-90-CO VGH-100-CH / VGH-120-CH VGH-150-CO / VGH-150-CH VGH-180-CH / VGH-200-CO	3" Twin Pipe Side Wall	black	ISLPT0202	ISLPT0303
	3" Termination Tee	black	ISTT0220	ISTT0320
	3" Termination Pipe	black	ISEP02 or ISEP0239	ISEP03 or ISEP0339
	3" Bird Screen	black	IASPP02	IASPP03
	3" Concentric roof termination		ICRT2439	ICRT3539
	3" Concentric wall termination		ICWT242	ICWT352

Table 9.9

## 9.5 Reducer

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



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

Supplier: Duravent.

Boiler	Size		Order #	STOCK#	A
VGH-80-CH / VGH-90-CO VGH-100-CH / VGH-120-CH VGH-150-CO / VGH-150-CH VGH-180-CH / VGH-200-CO	3" - 2"	80 – 60 mm	3PPS-R2L	810009714	5" / 130mm
	4" - 3"	100 – 80 mm	4PPS-R3L	810009746	5" / 130mm
	5" - 4"	130 – 100 mm	5PPS-R4L	810009764	7 <sup>5</sup> / <sub>8</sub> " / 193mm
	6" - 5"	150 – 130 mm	6PPS-R5L	810009785	7 <sup>3</sup> / <sub>4</sub> " / 197mm
	8" - 6"	200 – 150 mm	8PPS-R6L	810009801	5 <sup>15</sup> / <sub>16</sub> " / 150mm

Table 9.10

### 9.5.1 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.

 <b>DANGER</b>	<ul style="list-style-type: none"> <li>Insulation is prohibited from use on all types of plastic venting material: PVC, CPVC, and Polypropylene.</li> <li>Use only the adapters and vent system listed.</li> <li>DO NOT mix vent systems of different types or manufacturers.</li> <li>Failure to comply could result in severe personal injury, death, or substantial property damage.</li> </ul>
 <b>NOTICE</b>	<ul style="list-style-type: none"> <li>The installer must use a specific vent starter adapter at the flue collar connection.</li> <li>The adapter is supplied by the vent manufacturer to adapt to its vent system.</li> <li>Installations must comply with applicable national, state, and local codes.</li> <li>For Canadian installation, 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.</li> </ul>

## 9.6 Stainless steel vent



This product has been approved for use with stainless steel using the manufacturers listed.

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

Table 9.11

\*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.

 <b>WARNING</b>	<p>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.</p>
 <b>NOTICE</b>	<ul style="list-style-type: none"> <li>The installer must use a specific vent starter adapter at the flue collar connection, supplied by the vent manufacturer to adapt to its vent system.</li> <li>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.</li> <li>Installation of a stainless-steel vent system must adhere to the stainless-steel vent manufacturer's installation instructions supplied with the vent system.</li> </ul>

Approved Stainless Steel Terminations.

	Duravent	Security Chimneys	HeatFab
	FasNSeal	Secure Seal	Saf-T EZ Seal/ EZ 316
<b>Boiler</b>	<b>Termination</b>	<b>Termination</b>	<b>Termination</b>
VGH-80-CH / VGH-90-CO VGH-100-CH / VGH-120-CH VGH-150-CO / VGH-150-CH VGH-180-CH / VGH-200-CO	FSBS3 (bird screen wall) part.nr. 300236	SS3STAU (screen termination)	5390CI (horizontal termination)
	FSRC3 (rain cap roof) part.nr. 300325	SS3RC (rain cap roof)	5300CI (rain cap)

Table 9.12

## 9.7 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.

The air supply duct can be made of PVC, PP or Stainless steel

### 9.7.1 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 9.8.1, especially Table 9.11 and Table 9.12.

### 9.7.2 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.

### 9.7.3 AIR INTAKE/VENT CONNECTIONS

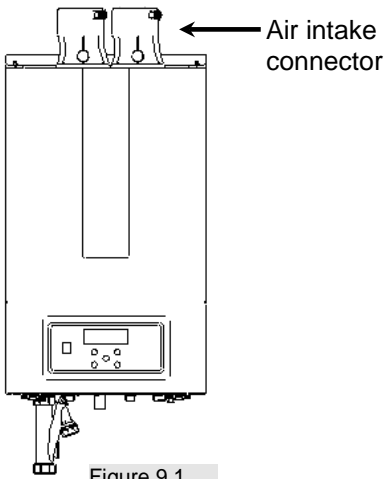


Figure 9.1

The combustion air intake connector (see Figure 9.1) 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.

### 9.7.4 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.

 <b>WARNING</b>	Using air intake materials other than those specified can result in personal injury, death or property damage.
 <b>NOTICE</b>	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.

The 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.


 <b>DANGER</b>	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.
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## 9.8 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 VGH-200-CO boiler needs approximately 10,000 ft<sup>3</sup> i.e. a room with dimensions 36' x 36' 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 air line from the outside.
- Using room air makes the unit vulnerable to combustion air contamination from within the building. Please review section 9.8.1 "Air contamination" in this manual, to ensure proper operation.

 <b>WARNING</b>	<p>When utilizing the single pipe method, provisions for combustion and ventilation air must be in accordance with: Local, state and national codes, laws, ordinances and regulations 9.3 Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1/NFPA 54.</p> <p>In Canada, the latest edition of CSA Standard B149 Installation Code for Gas Burning Appliances and Equipment.</p>
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Depending on the local situation, one of the following methods (from ANSI Z223.1/NFPA 54) applies:

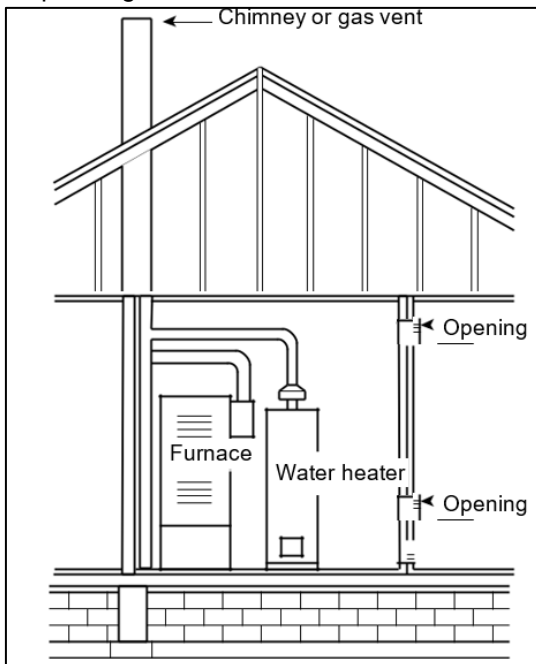


Figure 9.2

1. If the boiler is installed in a room with a volume of more than 50 ft<sup>3</sup> 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<sup>3</sup> 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<sup>2</sup> per 1,000 Btu/hr. If this room is on a different floor, the minimum free area is 2 inch<sup>2</sup> per 1,000 Btu/hr. Minimum free area is 100 inch<sup>2</sup> per air opening. The minimum dimension of an opening is 3 inch. 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.

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 inch.

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:

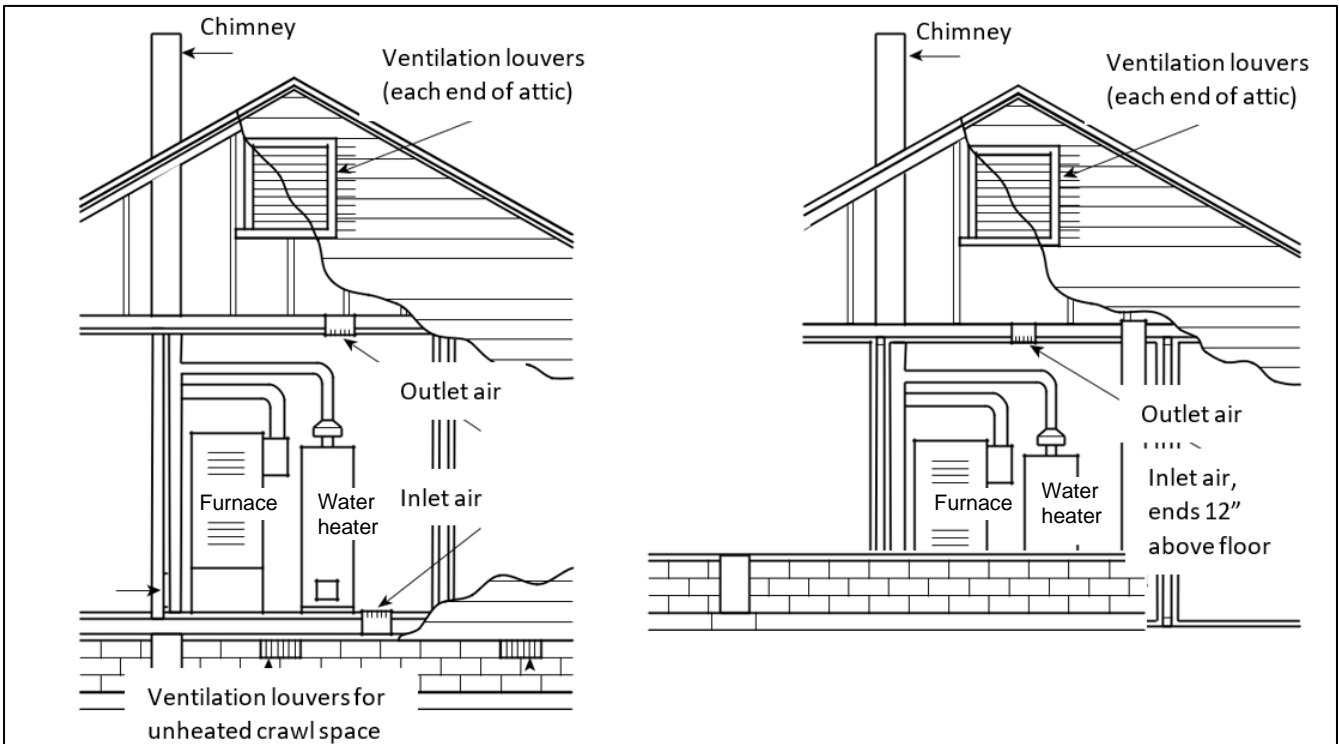


Figure 9.3

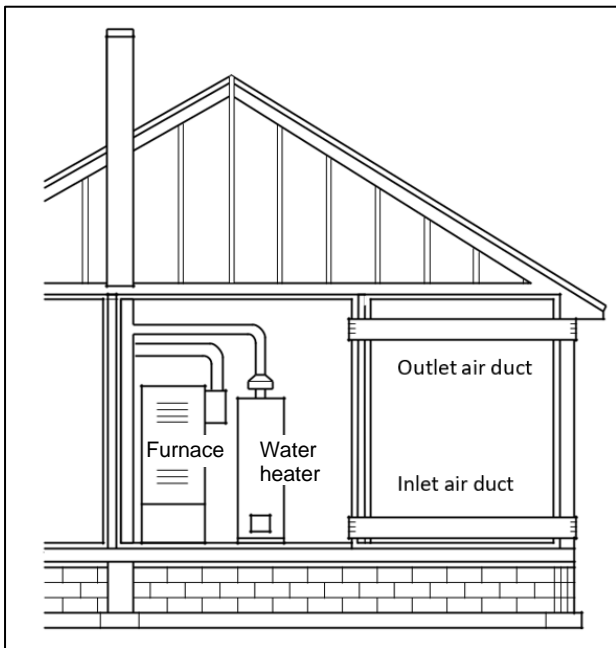


Figure 9.4

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<sup>2</sup> 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<sup>2</sup> per 2,000 Btu/hr of the aggregate input rating of all combustion appliances in the room.



**Indoor air parts:**

**Duravent**

Boiler	Termination	Color	3" Stock
All VGH Boilers	Bird Screen	stainless	810004355

Table 9.13

**Centrotherm**

Boiler	Termination	Color	3" Order
All VGH Boilers	Bird Screen	black	IASPP03

Table 9.14

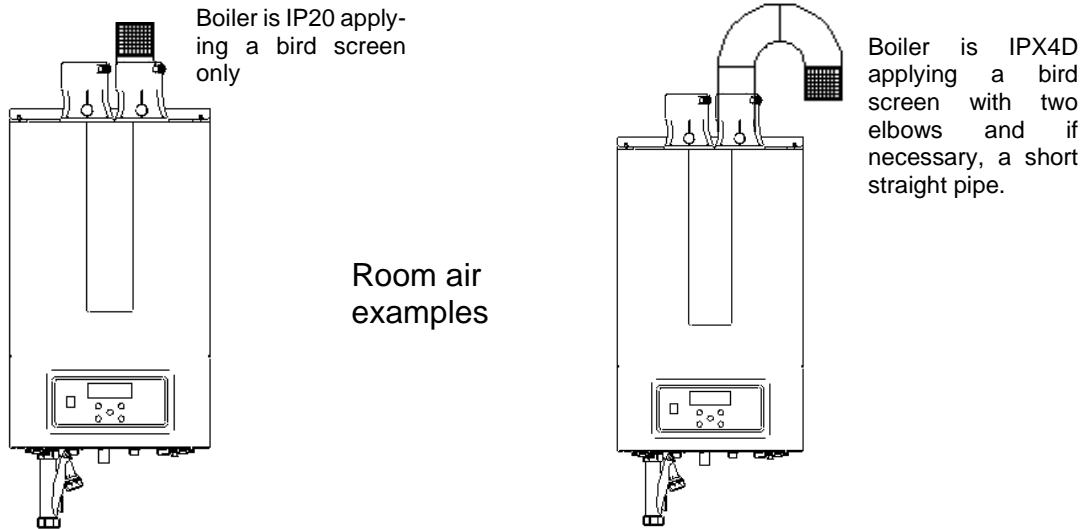



Figure 9.5

**9.8.1 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.

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>• The boiler should never be located in areas such as a laundry room or pool facility. These areas will always contain hazardous contaminants.</li> <li>• 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.</li> <li>• If contaminants are found, you <b>MUST</b>:             <ul style="list-style-type: none"> <li>• remove contaminants permanently</li> <li>or</li> <li>• relocate air inlet and vent terminations to other areas.</li> </ul> </li> </ul>
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## Corrosive Contaminants and Sources

<b>Products to avoid:</b>	<ul style="list-style-type: none"><li>• Spray cans containing chloro/fluorocarbons</li><li>• Permanent wave solutions</li><li>• Chlorinated waxes/cleaners</li><li>• Chlorine-based swimming pool chemicals</li><li>• Calcium chloride used for thawing</li><li>• Sodium chloride used for water softening</li><li>• Refrigerant leaks</li><li>• Paint or varnish removers</li><li>• Hydrochloric acid/muriatic acid</li><li>• Cements and glues</li><li>• Antistatic fabric softeners used in clothes dryers</li><li>• Chlorine-type bleaches, detergents, and cleaning solvents found in household laundry rooms</li><li>• Adhesives used to fasten building products and other similar products</li></ul>
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Table 9.11

<b>Areas likely to have contaminants:</b>	<ul style="list-style-type: none"><li>• Dry cleaning/laundry areas and establishments</li><li>• Swimming pools</li><li>• Metal fabrication plants</li><li>• Beauty shops</li><li>• Refrigeration repair shops</li><li>• Photo processing plants</li><li>• Auto body shops</li><li>• Plastic manufacturing plants</li><li>• Furniture refinishing areas and establishments</li><li>• New building construction</li><li>• Remodeling areas</li><li>• Garages with workshops.</li></ul>
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Table 9.12

## 9.9 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.

## 9.10 Install vent and combustion air piping

 <b>DANGER</b>	<ul style="list-style-type: none"> <li>The boiler must be vented and supplied with combustion and ventilation air as described in this section.</li> <li>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 9.13.2 of this manual.</li> <li>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.</li> <li>Failure to provide a properly installed vent and air system will cause severe personal injury or death.</li> </ul>
 <b>WARNING</b>	<ul style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>For closet and alcove installations, CPVC, polypropylene or stainless-steel material <b>MUST BE</b> used in the closet/alcove structure. Failure to follow this warning could result in fire, personal injury, or death.</li> <li>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.</li> </ul>
 <b>CAUTION</b>	<p>Improper installation of venting systems may result injury or death.</p>
 <b>NOTICE</b>	<ul style="list-style-type: none"> <li>Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 for U.S. installations or CSA B149.1 for Canadian installations.</li> <li>Follow the instructions in this manual when removing a boiler from an existing vent system.</li> </ul>


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.

You should use any of the vent/air piping methods covered in this manual. Do not attempt to install the boiler using any other means.

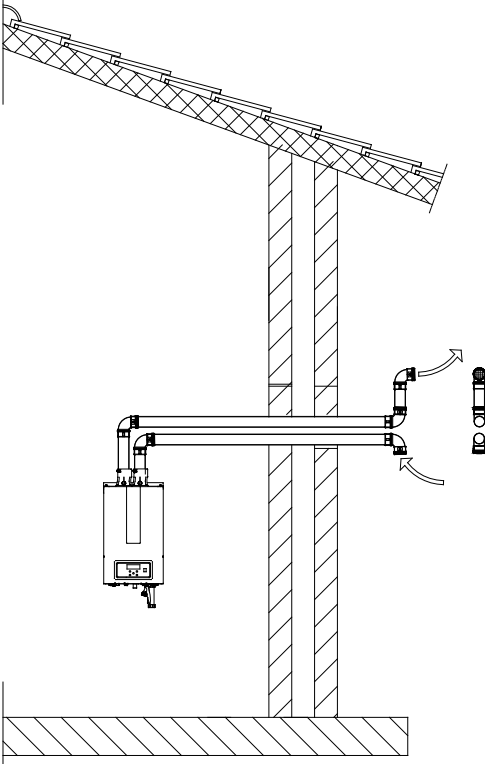
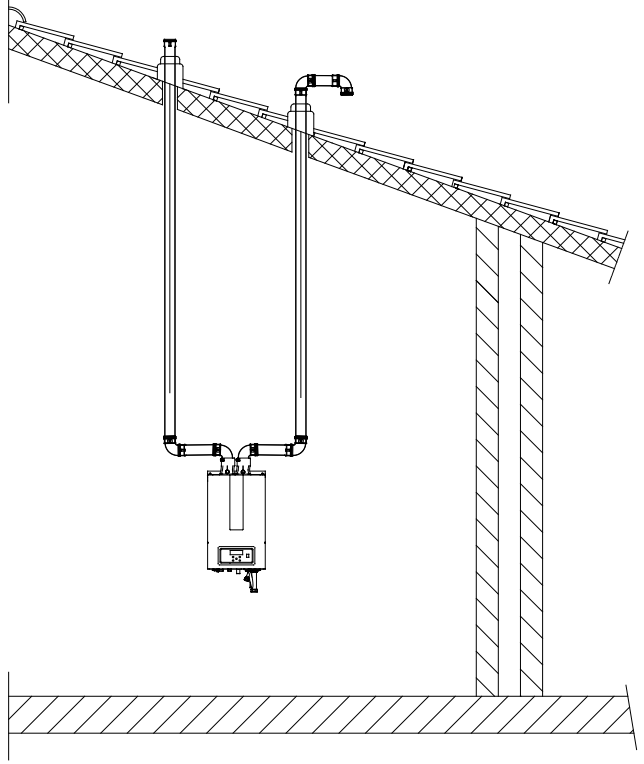
You must also install air piping from outside to the boiler air intake adapter, unless following the "Room Air" instructions in paragraph 9.8 of this manual. The resulting installation is direct vent (sealed combustion).

## 9.11 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.

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>• 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 CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.</li> <li>• The inlet for combustion air can never be located inside a room storing chemicals or contaminants as listed in section 9.8.1. Avoid installing the boiler in any area with possible contaminants.</li> <li>• If contaminants are found, you <b>MUST</b>:             <ul style="list-style-type: none"> <li>• remove contaminants permanently</li> <li>or</li> <li>• relocate the boiler and air intake to an area free from all possible contaminants.</li> </ul> </li> </ul>
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## 9.12 Direct venting options

<p><b>Two pipes wall</b> See paragraph 9.13 for more details.</p>  <p>Figure 9.6</p>	<p><b>Two pipes vertical</b> See paragraph 9.14 for more details.</p>  <p>Figure 9.7</p>
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**Concentric wall - two pipe to boiler**  
See paragraph 9.13 for more details.

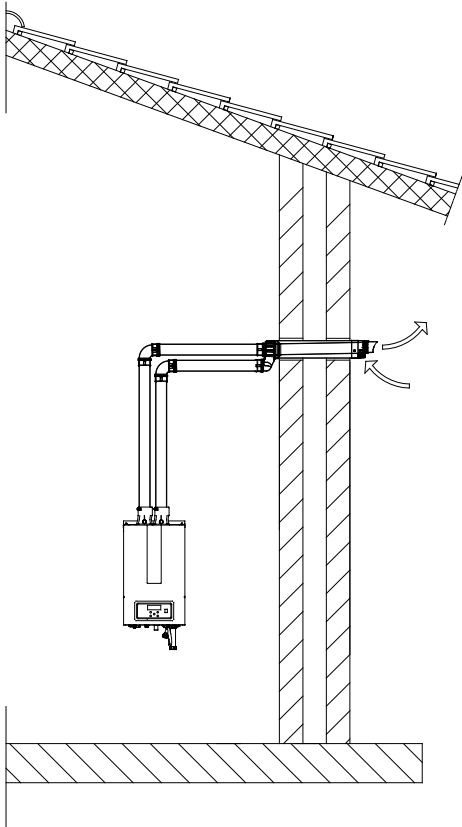


Figure 9.8

**Concentric wall - concentric to boiler**  
See paragraph 9.13 for more details.

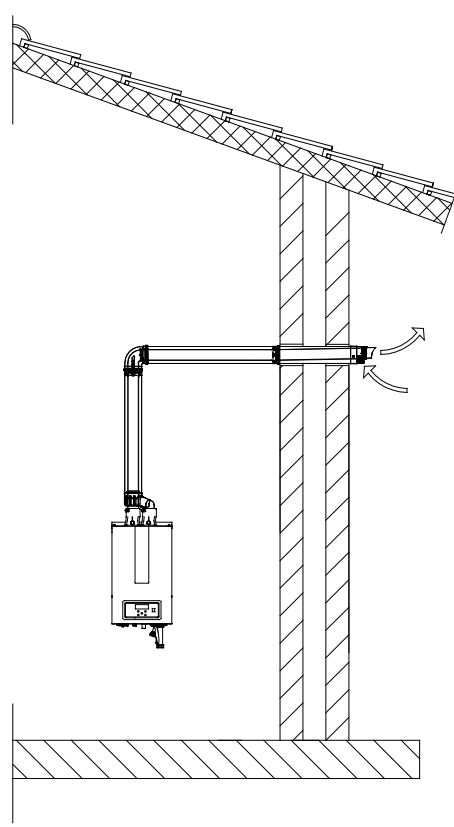


Figure 9.9

**Concentric vertical - two pipe to boiler**  
See paragraph 9.14 for more details.

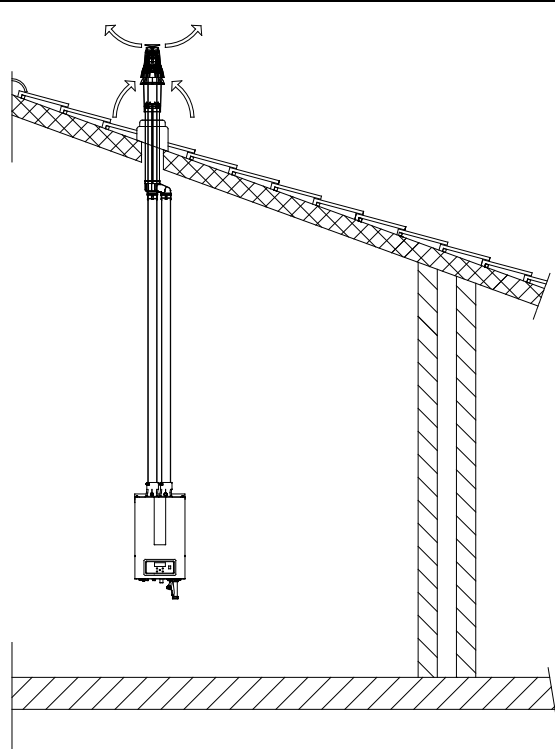


Figure 9.10

**Concentric vertical - concentric to boiler**  
See paragraph 9.14 for more details.

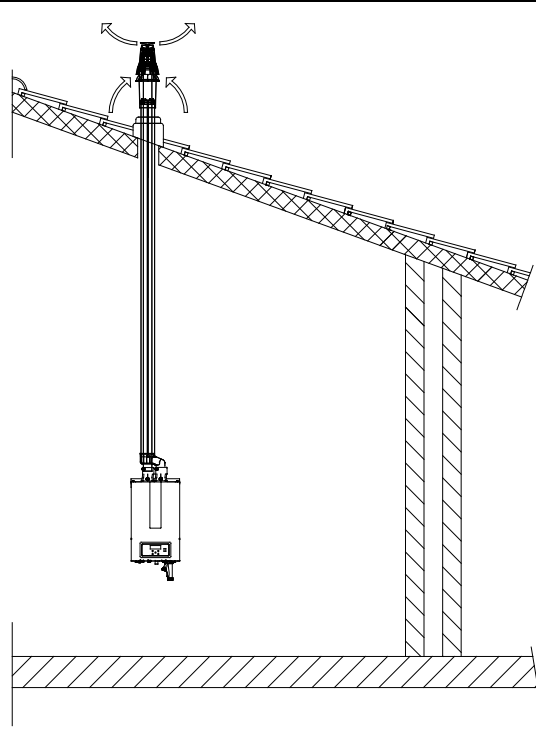
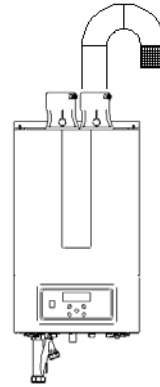
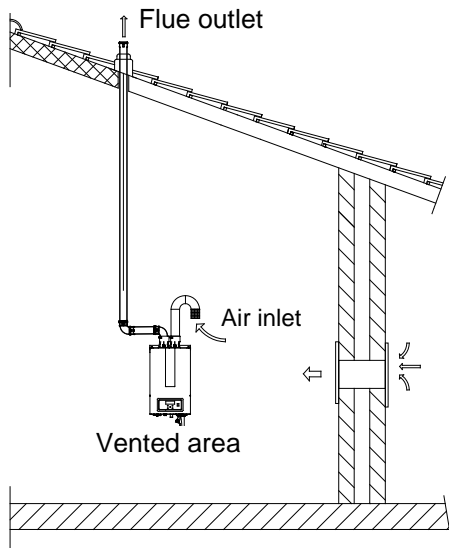
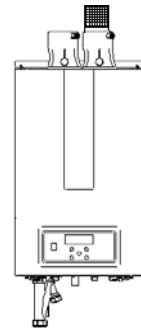


Figure 9.11

Open, Air supply from room,  
See paragraph 9.14 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 9.12

**Different pressure zone**  
See paragraph 9.13 for more details.

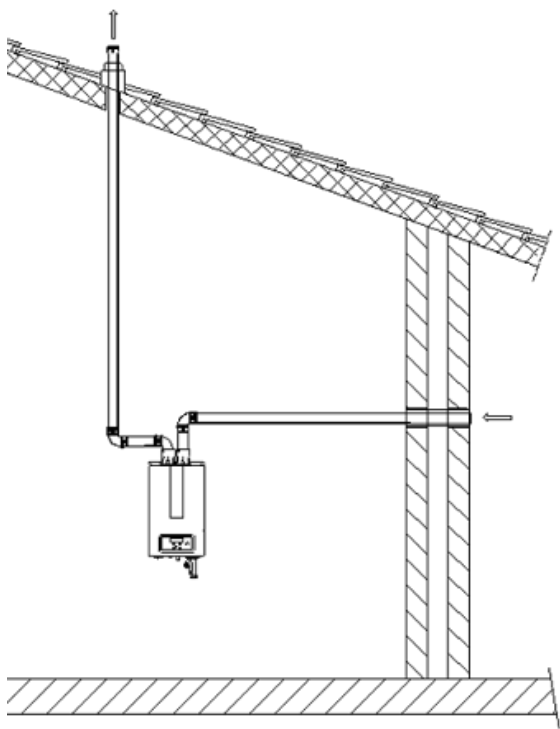




Figure 9.13

## 9.13 Wall (Horizontal) direct venting

### 9.13.1 VENT/AIR TERMINATION - WALL


 <b>WARNING</b>	<ul style="list-style-type: none"><li>• Follow instructions below when determining vent location to avoid possibility of severe personal injury, death, or substantial property damage.</li><li>• 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.</li><li>• Failure to comply could result in severe personal injury, death, or substantial property damage.</li></ul>
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 <b>CAUTION</b>	Maintain 12" of clearance above the highest anticipated snow level or grade, whichever is greater. Please refer to your local codes for the snow level in your area.
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### 9.13.2 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 9.1 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 9.15 and 9.16. 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 or an elbow pointed outward or away from the air inlet, as shown in Figure 9.15 and 9.16.

 <b>WARNING</b>	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.
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 <b>NOTICE</b>	PVC/CPVC or PP is acceptable air intake pipe material.
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5. Maintain clearances as stated in this manual. Also maintain the following:

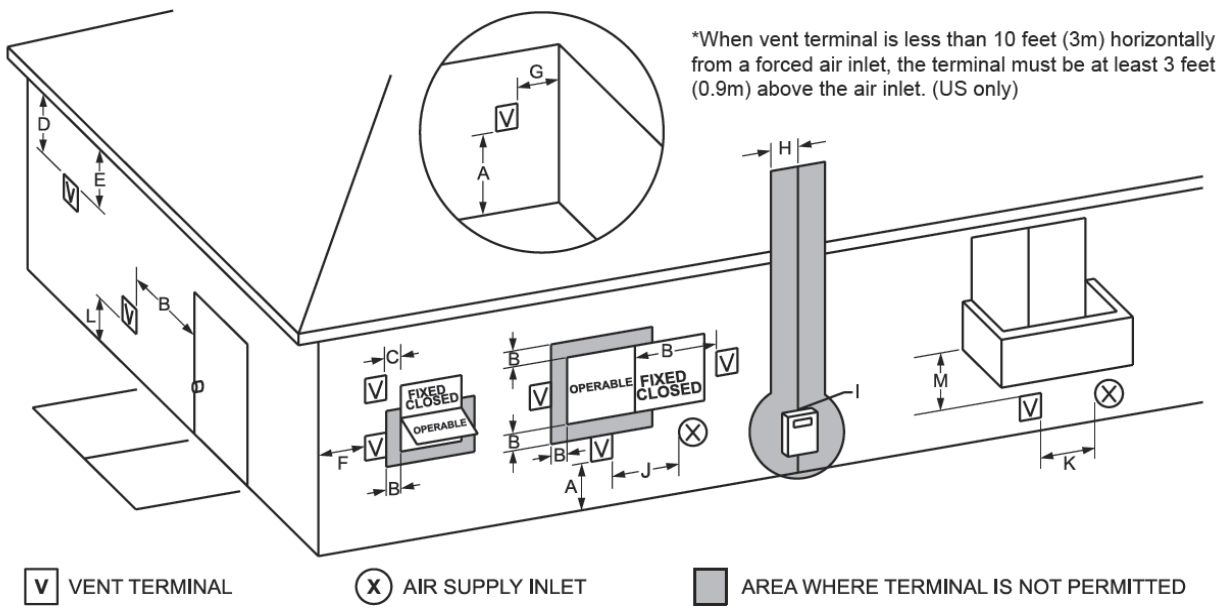


Figure 9.14

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	see note 4	3 ft (91 cm) within a height of 15 ft above the meter/regulator assembly
I	Clearance to service regulator vent outlet	see note 4	3 ft (91 cm)
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	3 ft (91 cm) above if within 10 ft (3 m) horizontally	6 ft (1.83 m)
L	Clearance above paved sidewalk or paved driveway located on public property	Vent termination not allowed.	7 ft (2.1 m)
M	Clearance under veranda, porch, deck, or balcony	see note 4	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 Installation Codes

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, 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.

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.

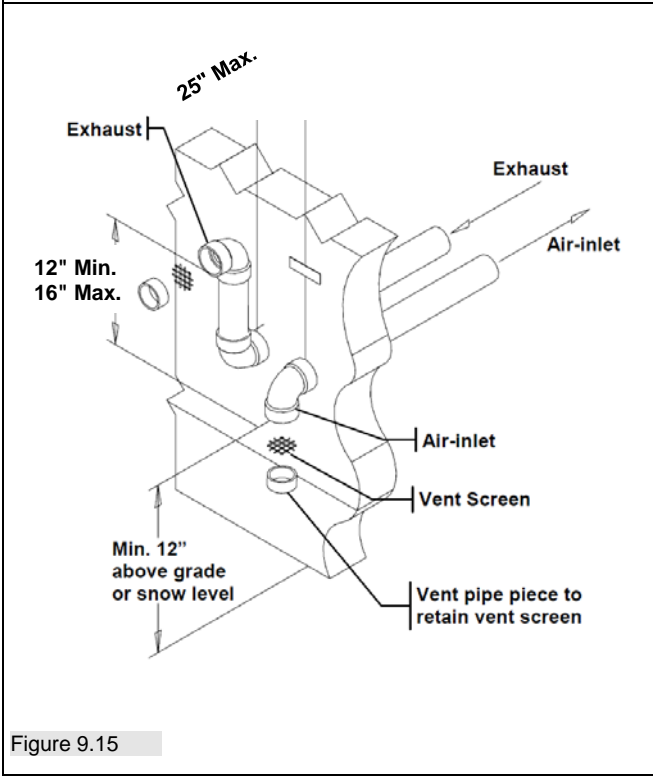


Figure 9.15

Alternate two pipe sidewall termination of air intake and exhaust vent

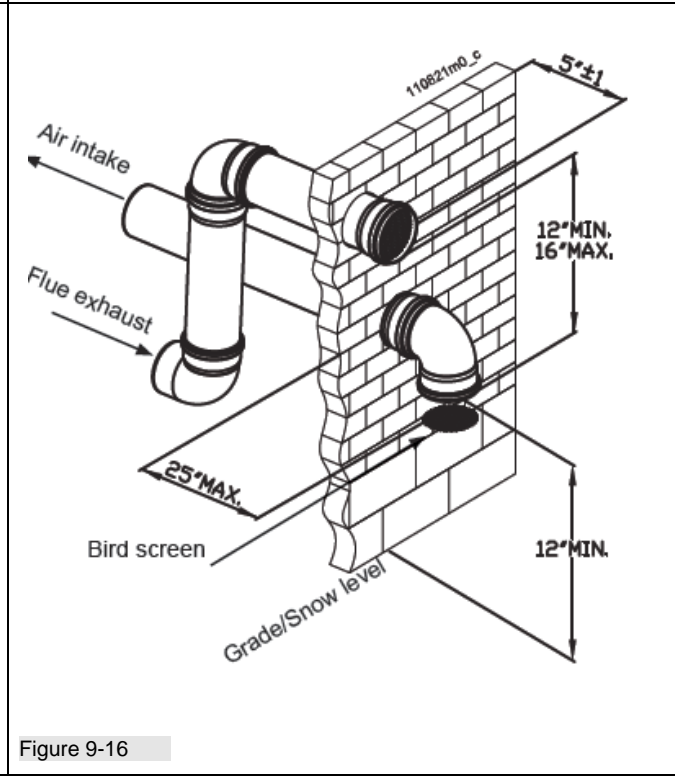


Figure 9-16

Two pipe sidewall termination assembly.

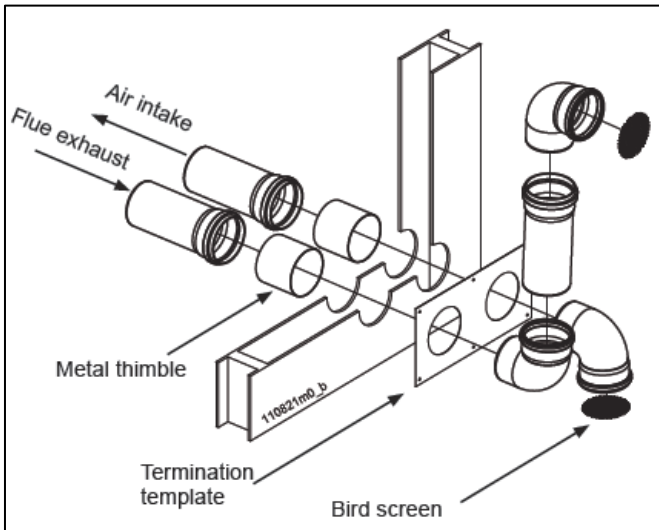



Figure 9.17

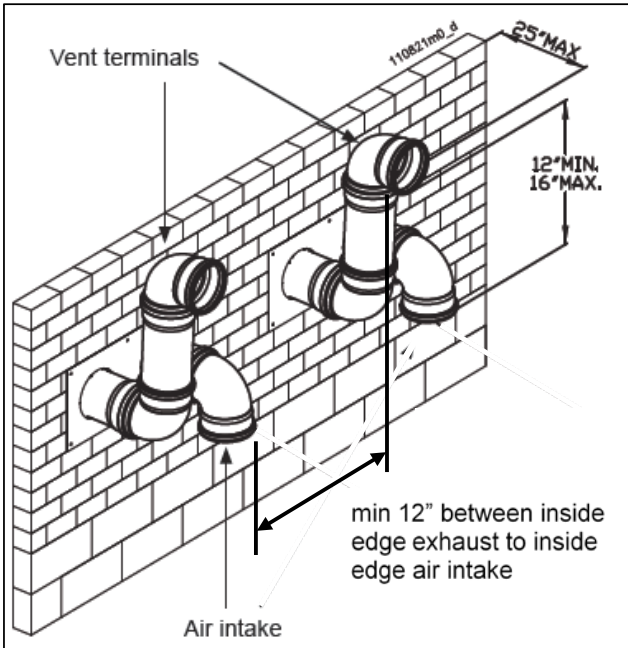
**Multiple vent/air terminations**

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

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

- 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 9.18 for U.S. installations. For Canadian installations, provide clearances required by CSA B149.1 Installation Code.
- 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.

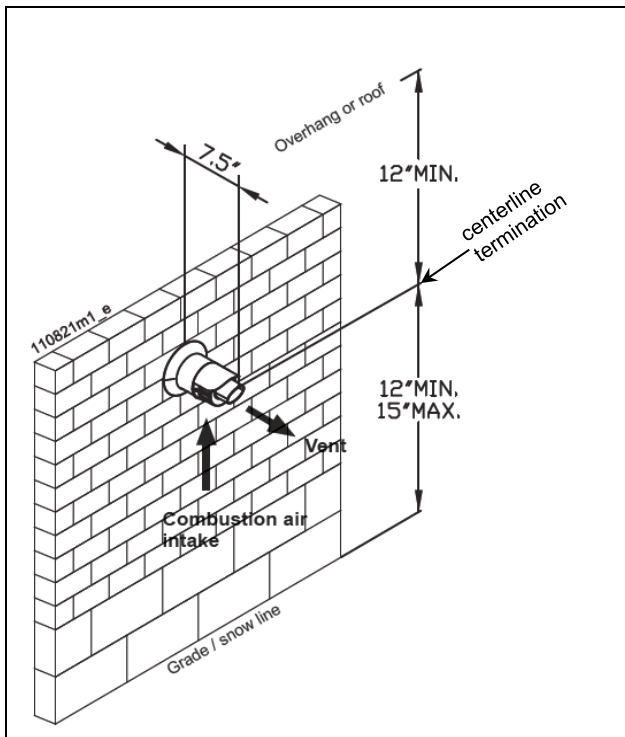
Two pipe multiple boilers vent terminations.



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

Figure 9.18

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 9.5 of this manual.

Concentric sidewall termination clearances:

Sidewall termination installation

- Determine the best location for the termination kit
- Reference paragraph 9.13.2 of this manual for general termination considerations.

Figure 9.19

 <b>WARNING</b>	<p>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.</p>
 <b>NOTICE</b>	<p>Ensure termination location clearance dimensions are as shown in the appropriate figures</p>
 <b>CAUTION</b>	<p>DO NOT use field-supplied couplings to extend concentric terminations. Airflow restriction will occur and may cause intermittent operation.</p>

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 9.20). 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 9.20. It is important that vent terminations be made as shown to avoid recirculation of flue gases.

Concentric sidewall multiple boilers termination.

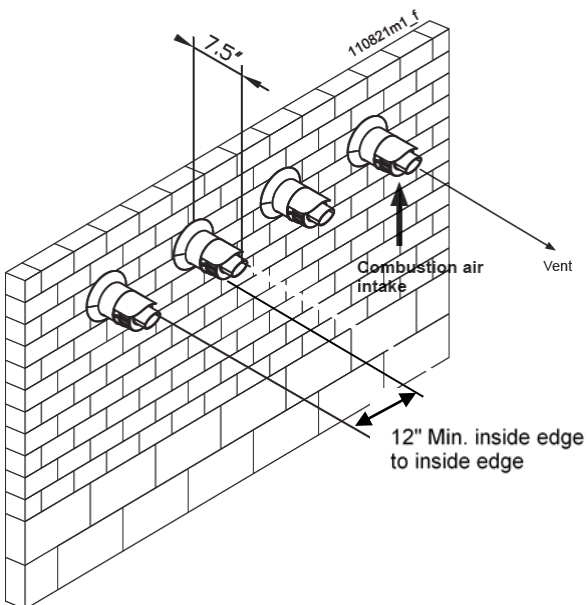



Figure 9.20

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

## 9.14 Roof (vertical) direct venting


### 9.14.1 VENT/AIR TERMINATION – VERTICAL

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

### 9.14.2 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 9.1 of this manual.
2. Prepare the vent termination and the air intake termination elbow (see Figure 9.21) 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 9.21.
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 9.21.
7. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block the vent pipe.

 <b>WARNING</b>	Rooftop exhaust vent and air intake inlet terminations must terminate in the same pressure zone.
--	--

### Two pipes vertical termination of air and vent.

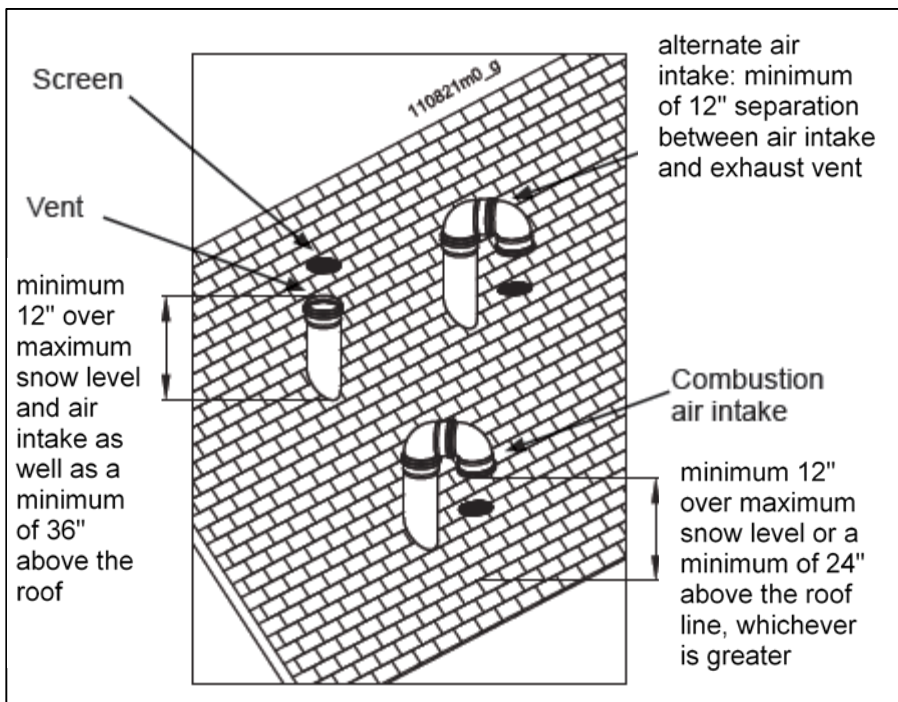



Figure 9.21

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.

Multiple vent/air terminations

1. When terminating multiple boilers, terminate each vent/air connection as described in this manual (Figure 9.22).

	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 and exhaust vent of another boiler for U.S. installations (see Figure 9.22). For Canadian installations, provide clearances required by CSA B149.1 Installation Code.

Vertical terminations with multiple boilers.

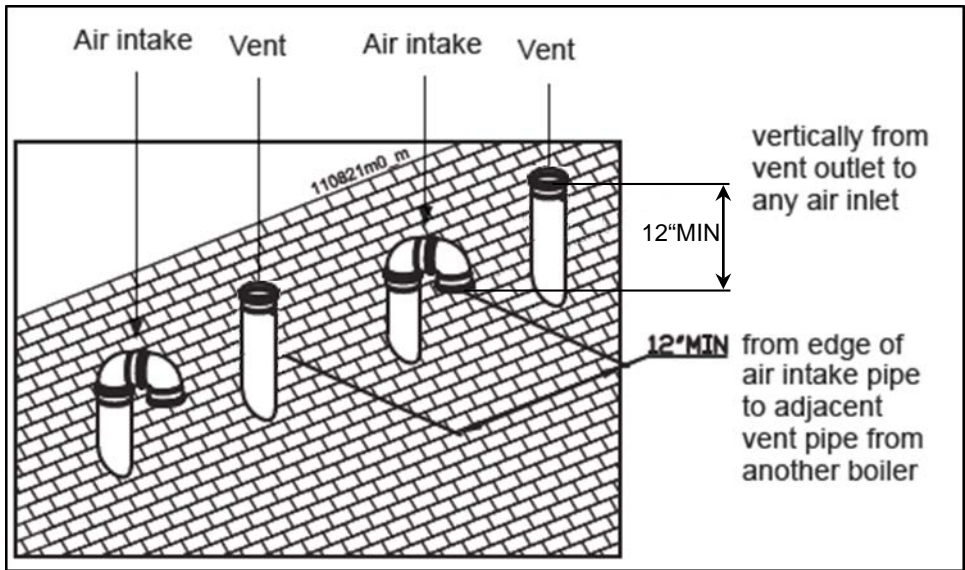


Figure 9.22

**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.

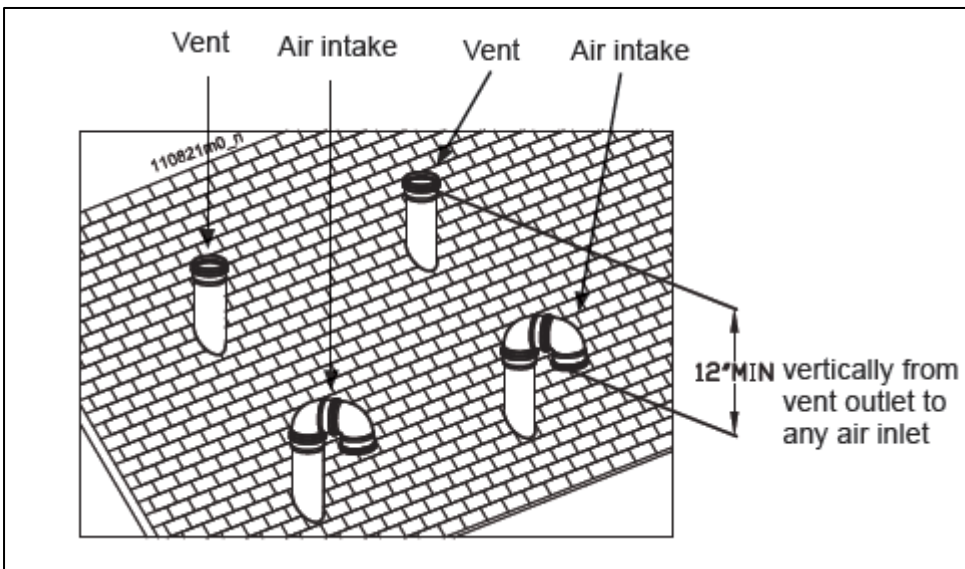


Figure 9.23

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



Concentric Vertical Termination.

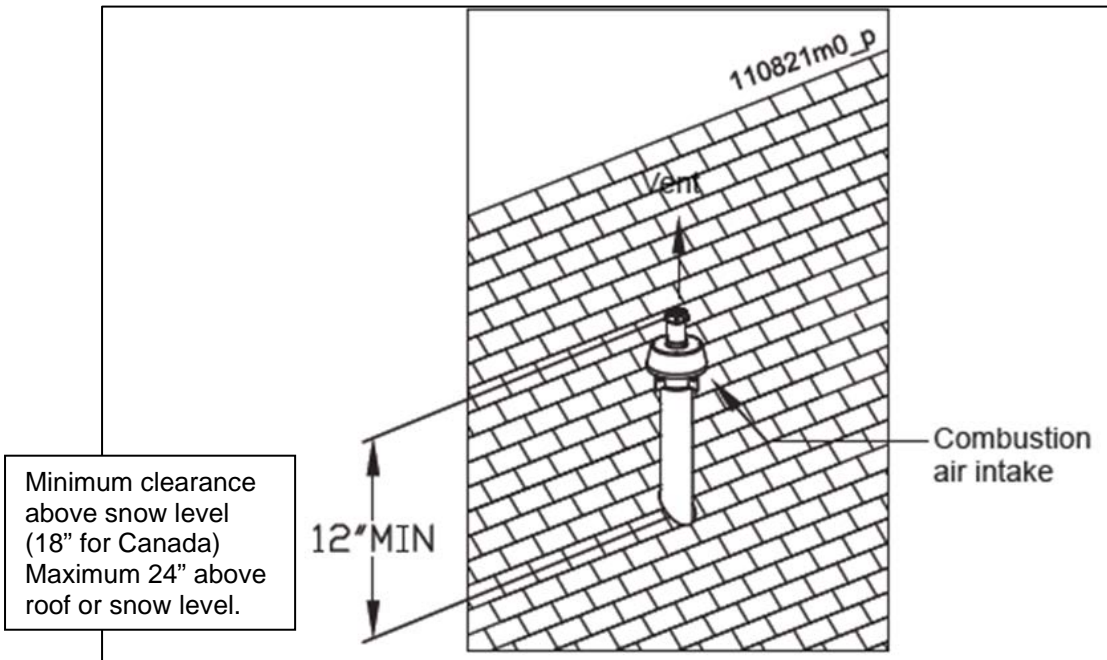


Figure 9.24

Do not install U-Bend or elbow on concentric termination



Figure 9.25

 <b>WARNING</b>	<p>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.</p>
 <b>NOTICE</b>	<ul style="list-style-type: none"> <li>Do not allow insulation or other materials to accumulate inside the pipe assembly when installing through the hole.</li> <li>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 9.24.</li> </ul>
 <b>CAUTION</b>	<p>DO NOT use field-supplied couplings to extend concentric terminations. Airflow restriction will occur.</p>

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 9.26). 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 9.26. 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.

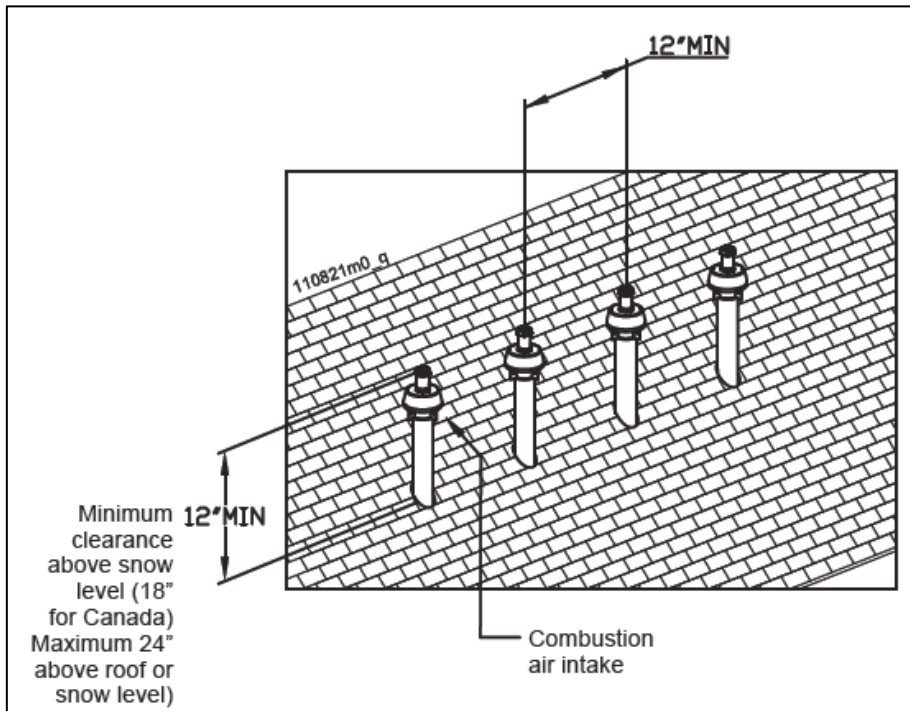


Figure 9.26

### 9.15 Common venting

The boilers from the VGH 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..

### 9.16 Existing Common Venting Guidelines


Do not common vent the VGH-boiler with the vent pipe of any other boiler or appliance. However, 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 the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Codes.

# 10 ELECTRICAL INSTALLATION

## 10.1 General

- For operation, the boiler needs a power supply of 120 VAC / 60Hz.
- The boiler main supply connection is polarity sensitive.
- The wiring for the connections can be entered at the bottom of the boiler through the wiring knockouts.

 <b>NOTICE</b>	<ul style="list-style-type: none"> <li>• 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.</li> </ul>
--	--

- 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.

## 10.2 Connection mains 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.
- On the high voltage terminal, connect to numbers: 8 = Line voltage (Hot); 9 = Neutral; PE = Ground.

## 10.3 Electrical connections VGH-CH/CO boilers

LOW VOLTAGE CONNECTIONS																												
28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
				-	+	-	+	Gnd					-	+			-	+	B	A	Gnd							
Safety switch 2	Safety switch 1	LWCO Extern	AL-BUS managing boiler	Pump control PWM	Flow switch DHW	0-10 Vdc	On/Off thermostat or modulating thermostat	AL-BUS depending boiler	Modbus				DHW sensor	System sensor	Outdoor sensor													
Interrupteur de sécurité 2	Interrupteur de sécurité 1	Eau basse coupure à l'extérieur	AL-BUS chaudière gérant	Commande de pompe PWM	Interrupteur de débit ECS	0-10 Vcc	Thermostat marche/ arrêt ou thermostat modulant	AL-BUS chaudière dépendant					Capteur ECS	Capteur de système	Capteur extérieur													



HIGH VOLTAGE CONNECTIONS																
 <b>MAXIMUM TOTAL OUTPUT 3,5 Amps NOMINAL</b>	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
	DHW TWV (3-way valve) Vanne ECS (3 voies) MAX 2 Amps	System pump Pompe du système MAX 2 Amps			Boiler circulator (general pump) Pompe interne (pompe générale) MAX 2 Amps			Mains supply Alimentation secteur				Alarm Alarme MAX 50W				

Figure 10.1

 <b>NOTICE</b> Read: "circulator" if the word "pump" is used
---

### High power ignitor

A separate connector for an external igniter is located on the wiring harness, near the boiler controller and labelled "High power ignitor". The "external ignition transformer" can be ordered, see paragraph 5.1. This accessory is provided with detailed mounting instructions.

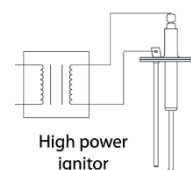


Figure 10.2



### 10.3.1 EXPLANATION OF THE LOW VOLTAGE CONNECTIONS VGH-CH BOILERS



<b>1-2</b>	<b>OUTDOOR SENSOR</b>
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.	
<b>3-4</b>	<b>SYSTEM SENSOR</b>
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 7.17 and 7.19) must be used when boilers are cascaded with the internal cascade manager. PARAMETER: boiler parameter 122, see paragraph 10.6.	
<b>5-6</b>	<b>DHW SENSOR</b>
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.	
<b>7-8-9</b>	<b>MODBUS</b>
Connections for a BMS. 7 = ground, 8 = A, 9 = B (A detailed manual is available at your supplier on request)	
<b>10-11</b>	<b>AL-BUS DEPENDING</b>
Cascade connections for the dependent boilers, must be parallel linked together. 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 20 of the managing boiler, and connections 11 of the dependent boilers to 21 of the managing boiler.	
<b>12-13</b>	<b>ON/OFF STAT OR MODULATING HEATING CIRCUIT</b>
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 10.6	
<b>14-15</b>	<b>0-10 VDC CONTROL SIGNAL</b>
These terminals are used for an external 0-10 VDC control input signal. NOTICE: Terminal 14 [+] (positive) and terminal 15 [-] (negative).	
<b>16-17-18</b>	<b>DHW - FLOW SWITCH</b>
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 10.6	
<b>19-20</b>	<b>PWM – CIRCULATOR CONTROL</b>
These connections are used to control the boiler circulator. The PWM signal determines the speed of the circulator, when there is a heat demand. 18 = Signal (PWM input), 19 = Ground (Signal ref.) Parameter 136 has to be set to modulating (factory set to on/off circulator) when using a modulating circulator.	
<b>21-22</b>	<b>AL-BUS MANAGING / CASCADE</b>
Cascade connection for the managing boiler. Link connection 21 of the managing boiler to connections 10 of the depending boilers, and connection 22 of the managing boiler to connections 11 of the depending boilers.	
<b>23-24</b>	<b>LWCO EXTERNAL</b>
To be used for an extra external Low Water Cut Off. The boiler goes into a lockout when this contact opens	
<b>25-26</b>	<b>SAFETY SWITCH 1</b>
To be used for an extra external safety switch. The boiler goes into a lockout when this contact opens	
<b>27-28</b>	<b>SAFETY SWITCH 2</b>
To be used for an extra external safety switch. The boiler goes into a lockout when this contact opens	

Table 10.1

### 10.3.2 EXPLANATION OF THE HIGH VOLTAGE CONNECTIONS VGH-CH BOILERS

<b>1-2-3-PE</b>	<b>3 WAY VALVE (TWV)</b>
This connection is internally connected to the 3-way valve in the appliance	
<b>4-5-PE</b>	<b>SYSTEM PUMP / DHW CIRCULATOR / CH CIRCULATOR</b>
Connections for the power supply of a central heating system circulator P3, see paragraph 8.5. for detailed electrical specifications. PARAMETER: boiler parameter 125, see paragraph 10.6 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. Therefore the parameter on output 1 needs to be changed from 4 (System circulator) to 3 (DHW circulator) (see paragraph 11.9.2). 4 = Line voltage (Hot) wire; 5 = Neutral wire; PE = Ground	
<b>6-7-PE</b>	<b>BOILER CIRCULATOR / GENERAL PUMP</b>
Connections for the power supply of the internal boiler circulator. (P1, see paragraph 8.5 for detailed specifications).	
<b>8-9-PE-PE</b>	<b>MAINS SUPPLY</b>
The power supply connection of the unit. 8 = Line voltage wire; 9 = Neutral wire, PE = Ground wire	
<b>10-11</b>	<b>ALARM RELAY</b>
A semiconductor alarm output. This is a triac 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. This 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 PARAMETER: boiler parameter 127, see paragraph 10.6.	
<b>X1-X2-X3</b>	<b>HIGH POWER IGNITER (external igniter)</b>
A separate connector for an external igniter is located on the wiring harness, near the boiler controller and labelled "High power ignitor". This is a connection for an external ignition transformer. Instead of the internal igniter, an external igniter can be connected. Available as an accessory, see paragraph 5.1. X1 = Neutral wire; X2 = not used; X3 = Line voltage (Hot) wire. PARAMETER: boiler parameter 126, see paragraph 10.6.	

Table 10.2

 <b>NOTICE</b>	<p>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.</p>
 <b>NOTICE</b>	<p>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"</p>

### 10.3.3 EXPLANATION OF THE LOW VOLTAGE CONNECTIONS VGH-CO BOILERS



<b>1-2</b>	<b>OUTDOOR SENSOR</b>
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.	
<b>3-4</b>	<b>SYSTEM SENSOR</b>
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 7.17 and 7.19) must be used when boilers are cascaded with the internal cascade manager. PARAMETER: boiler parameter 122, see paragraph 10.6.	
<b>5-6</b>	<b>DHW SENSOR</b>
If combi boiler this connection is connected to the internal sensor on the plate heat exchanger, for heating only boiler this connection can be used to connect a sensor for an indirect hot water tank.	
<b>7-8-9</b>	<b>MODBUS</b>
Connections for a BMS 7 = ground, 8 = A, 9 = B (A detailed manual is available at your supplier on request)	
<b>10-11</b>	<b>AL-BUS DEPENDING</b>
Cascade connections for the dependent boilers, must be parallel linked together. 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 21 of the managing boiler, and connections 11 of the dependent boilers to 22 of the managing boiler.	
<b>12-13</b>	<b>ON/OFF STAT OR MODULATING HEATING CIRCUIT</b>
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 10.6	
<b>14-15</b>	<b>0-10 VDC CONTROL SIGNAL</b>
These terminals are used for an external 0-10 VDC control input signal. NOTICE: Terminal 14 [+] (positive) and terminal 15 [-] (negative).	
<b>16-17-18</b>	<b>DHW - FLOW SWITCH</b>
This connection is internally connected to the flow sensor in a combi boiler and not used on heating only boilers.	
<b>19-20</b>	<b>PWM – CIRCULATOR CONTROL</b>
These connections are used to control the boiler circulator. The PWM signal determines the speed of the circulator, when there is a heat demand. 18 = Signal (PWM input), 19 = Ground (Signal ref.) Parameter 136 has to be set to modulating (factory set to on/off circulator) when using a modulating circulator.	
<b>21-22</b>	<b>AL-BUS MANAGING / CASCADE</b>
Cascade connection for the managing boiler. Link connection 21 of the managing boiler to connections 10 of the depending boilers, and connection 22 of the managing boiler to connections 11 of the depending boilers.	
<b>23-24</b>	<b>LWCO EXTERN</b>
To be used for an extra external Low Water Cut Off. The boiler goes into a lockout when this contact opens	
<b>25-26</b>	<b>SAFETY SWITCH 1</b>
To be used for an extra external safety switch. The boiler goes into a lockout when this contact opens	
<b>27-28</b>	<b>SAFETY SWITCH 2</b>
To be used for an extra external safety switch. The boiler goes into a lockout when this contact opens	

Table 10.3

### 10.3.4 EXPLANATION OF THE HIGH VOLTAGE CONNECTIONS VGH-CO BOILERS

<b>1-2-3-PE</b>	<b>3 WAY VALVE (TWV)</b>
This connection is internally connected to the 3-way valve in the appliance	
<b>4-5-PE</b>	<b>SYSTEM PUMP</b>
Connections for the power supply of a central heating system circulator P3, see paragraph 8.5. for detailed electrical specifications. PARAMETER: boiler parameter 125, see paragraph 10.6 4 = Line voltage (Hot) wire; 5 = Neutral wire; PE = Ground	
<b>6-7-PE</b>	<b>BOILER CIRCULATOR / GENERAL PUMP</b>
Connections for the power supply of the internal boiler circulator. (P1, see paragraph 8.5 for detailed specifications).	
<b>8-9-PE-PE</b>	<b>MAINS SUPPLY</b>
The power supply connection of the unit. 8 = Line voltage wire; 9 = Neutral wire, PE = Ground wire	
<b>10-11</b>	<b>ALARM RELAY</b>
A semiconductor alarm output. This is a triac 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 added to this. This 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 PARAMETER: boiler parameter 127, see paragraph 10.6.	
<b>X1-X2-X3</b>	<b>HIGH POWER IGNITER (external igniter)</b>
A separate connector for an external igniter is located on the wiring harness, near the boiler controller and labelled "High power ignitor". This is a connection for an external ignition transformer. Instead of the internal igniter, an external igniter can be connected. Available as an accessory, see paragraph 5.1. X1 = Neutral wire; X2 = Ionization; X3 = Line voltage (Hot) wire. PARAMETER: boiler parameter 126, see paragraph 10.6.	

Table 10.4

 <b>NOTICE</b>	<p>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.</p>
 <b>NOTICE</b>	<p>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"</p>

### 10.3.5 LADDER/LOGIC DIAGRAM VGH-CH/CO BOILERS

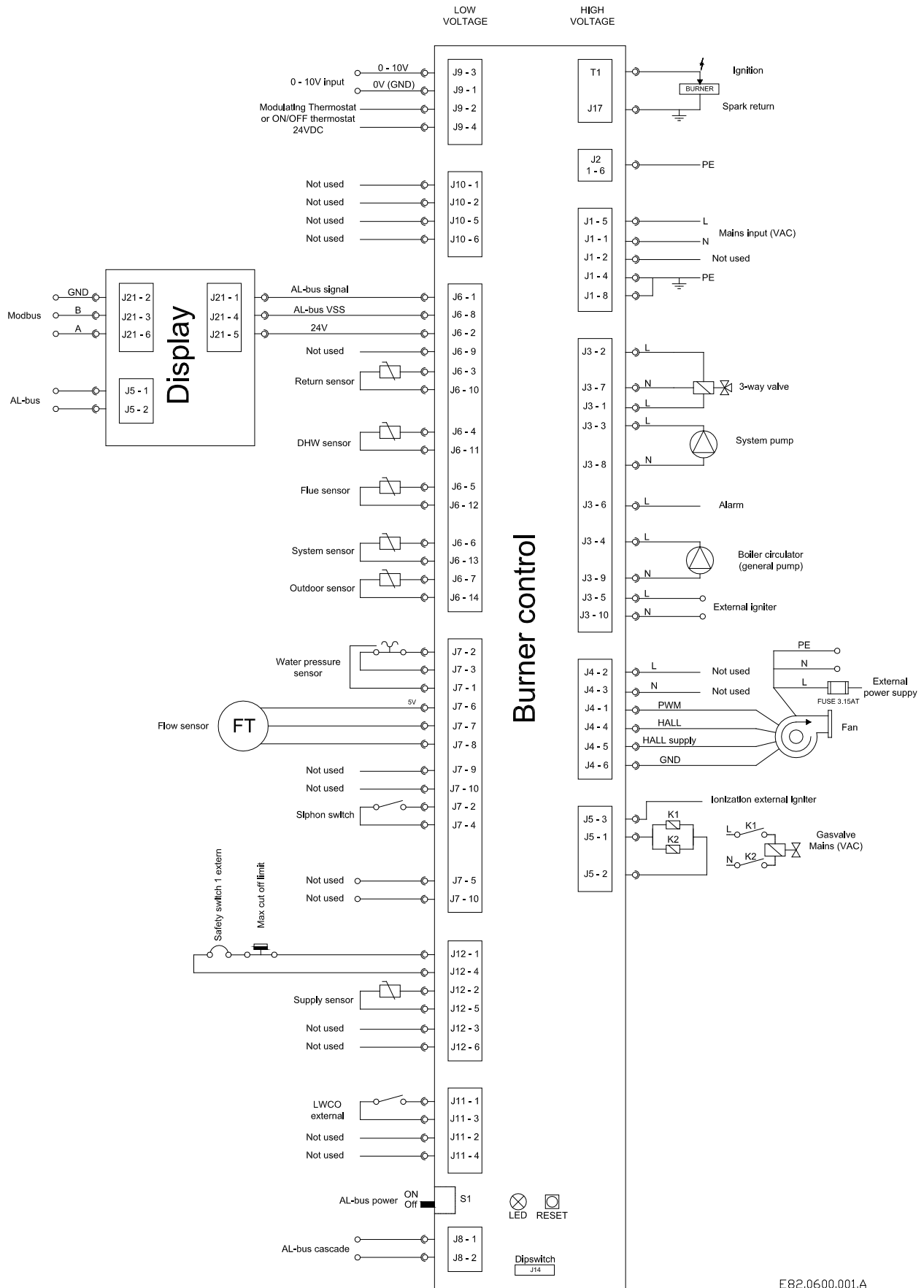


Figure 10.3

### 10.3.6 ELECTRICAL SCHEMATIC VGH-CH BOILERS

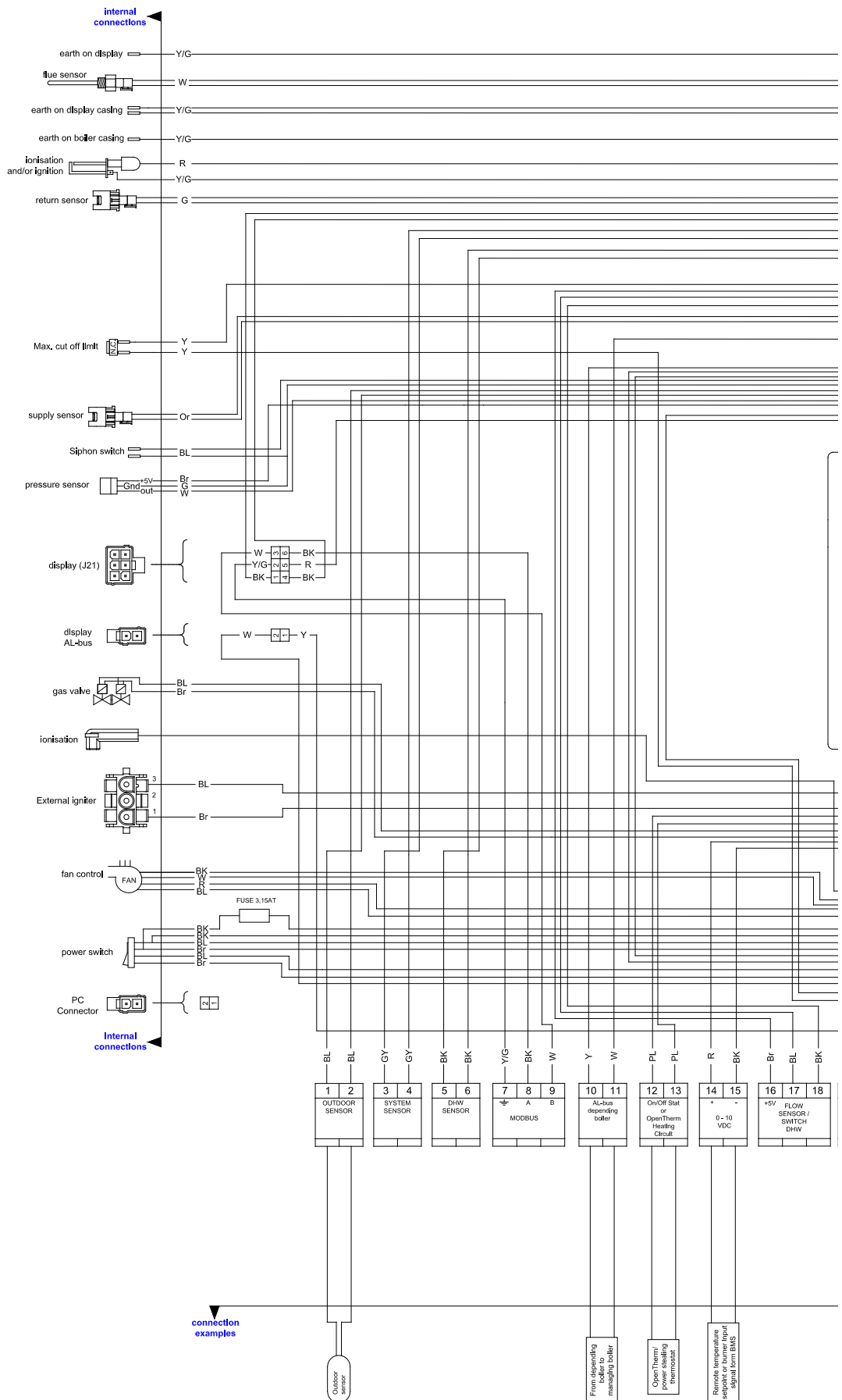


Figure 10.4

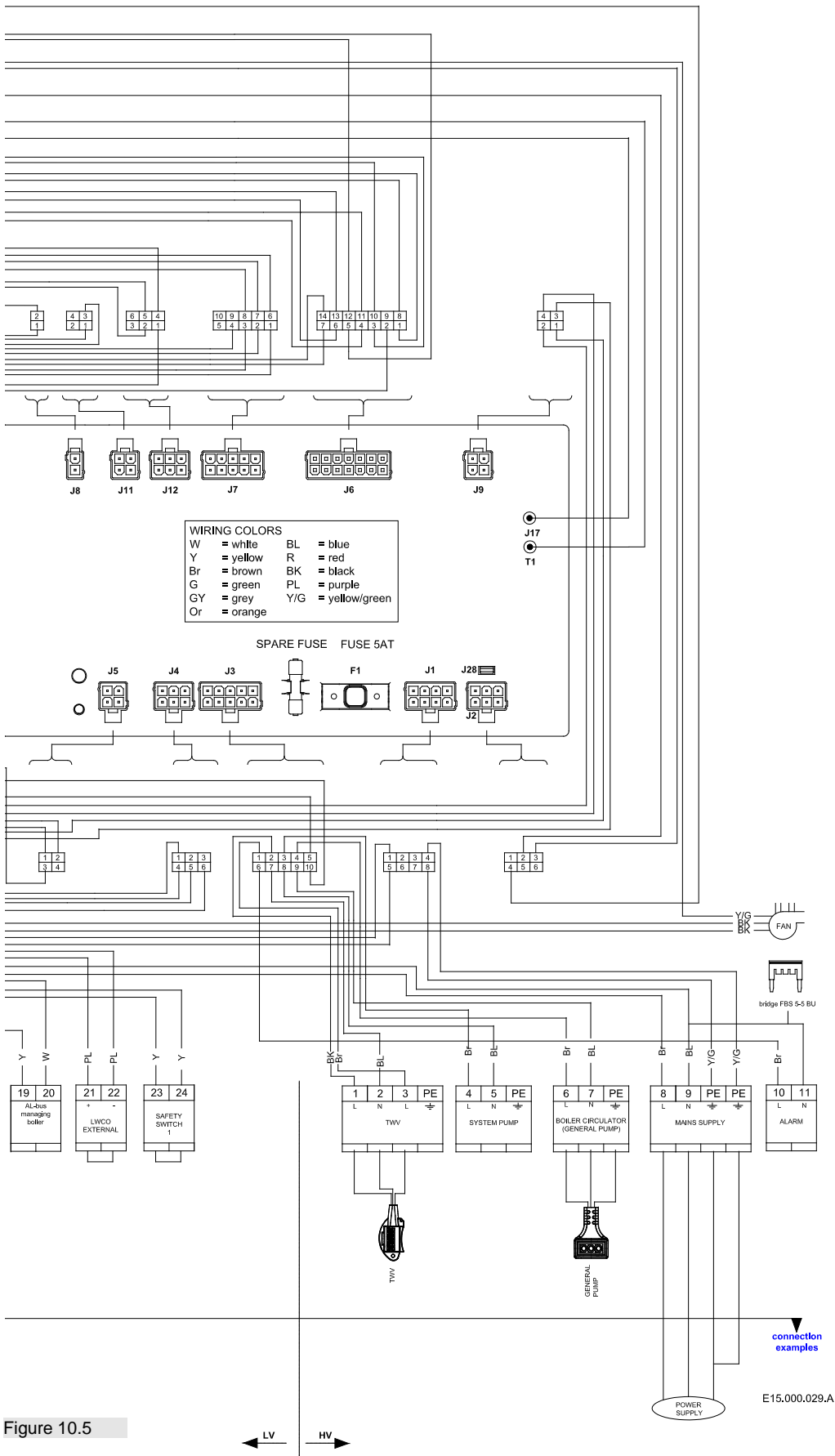


Figure 10.5

### 10.3.7 ELECTRICAL SCHEMATIC VGH-CO BOILERS

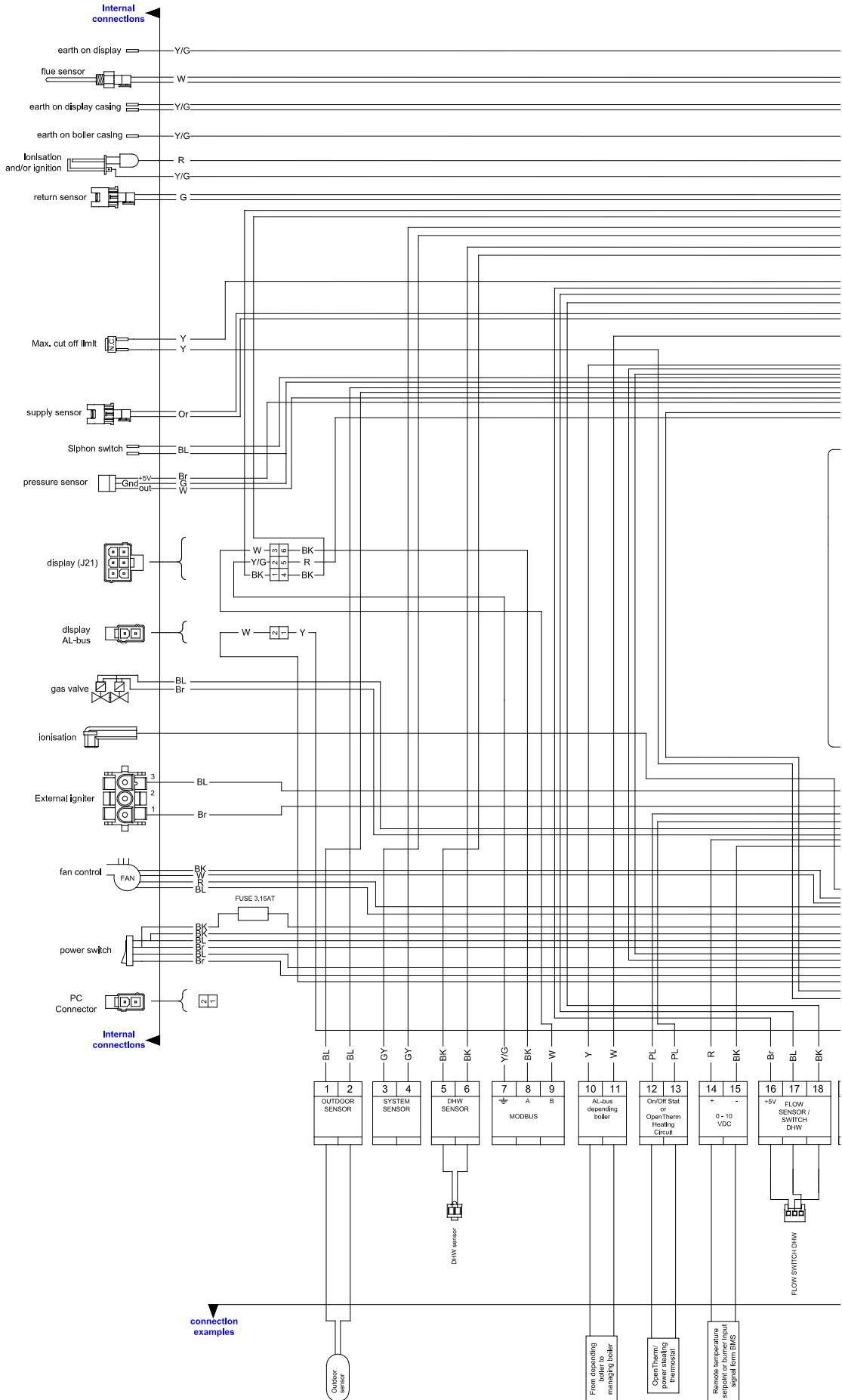


Figure 10.6



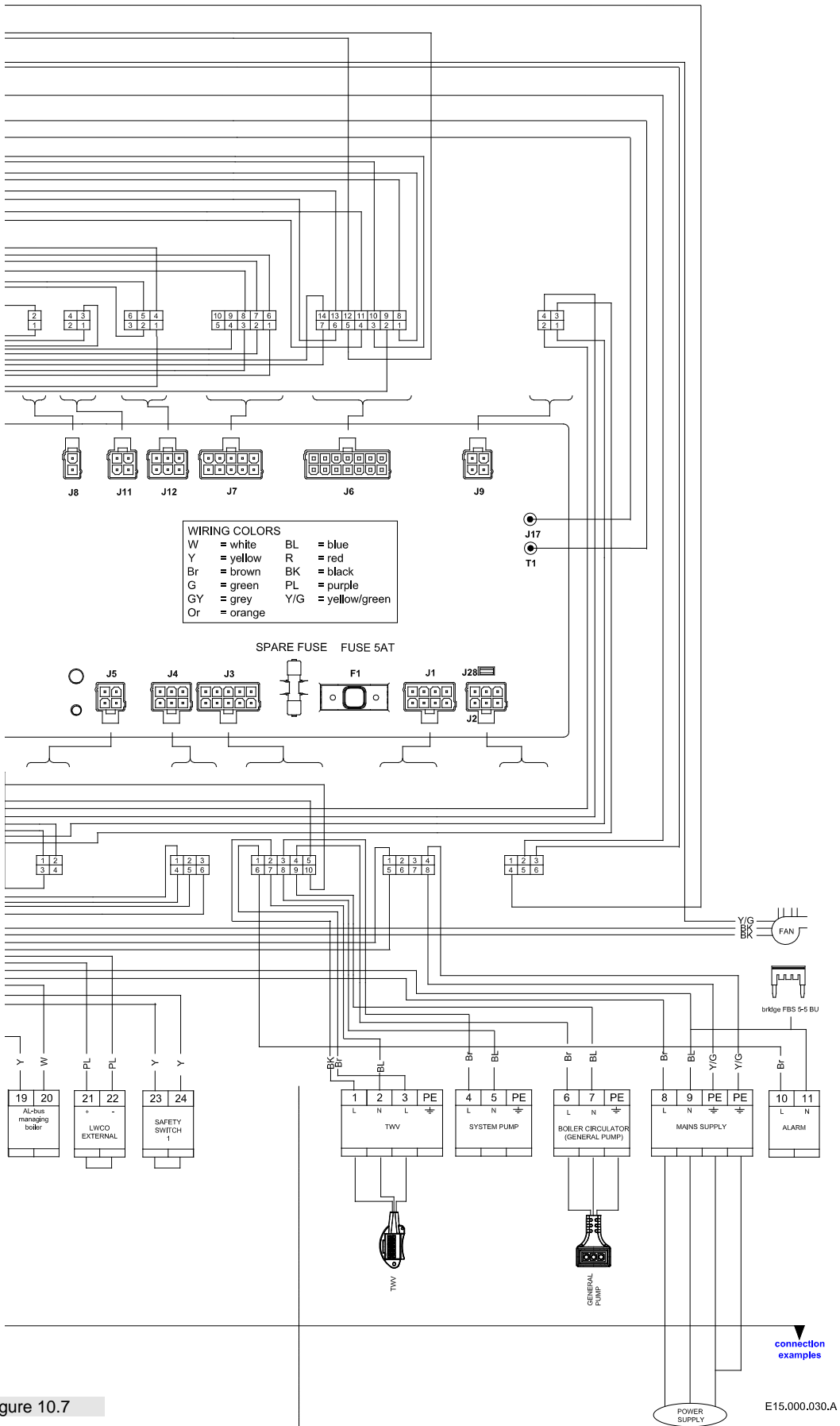


Figure 10.7

## 10.4 Sensor availability

### 10.4.1 SENSOR AVAILABILITY VGH-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 10.5

- 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	4	5	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 10.6

- DHW mode 0 – No Domestic Hot Water
- DHW mode 1 – Storage with sensor
- DHW mode 2 – Storage with thermostat
- 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 – Instantaneous water heating with plate heat exchanger, DHW-out sensor and rotary switch
- DHW mode 6 to 8 N.A.

### 10.4.2 SENSOR AVAILABILITY VGH-CO BOILERS

If the installed appliance is a VGH-CO combi boiler, the available sensors for the various CH modes are identical to the data presented in Table 10.5. A VGH-combi boiler always has its DHW mode set to 5. Other DHW modes are not available for Combi-boilers. Table 10.6 shows the available sensors for this mode.

## 10.5 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 10.7

## 10.6 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.	4	4	System pump	HV 4-PE-5
126	Prog. Output 2.	9	9	Ext. Igniter	separate connector
127	Prog. Output 3.	6	6	Alarm semi-conductor output	HV 10-11
128	Prog. Output 4.	18	N.A.	3-way Valve DHW	HV 1-2-3-PE

Table 10.8

 <b>NOTICE</b>	<p>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.</p>
--	---

parameter	Display:	INPUTS:	re-mark	parameter	Display:	OUTPUTS:	re-mark
(117)	Prog. Input 2.	0 Disabled		(127)	Prog. Output 3.	0 Disabled	
		1 DHW flow sensor	CO			1 Module pump	
		2 DHW flow switch	CH			2 CH pump	
		3 CH flow sensor	not used			3 DHW pump	
		4 CH flow switch	not used			4 System pump	
						5 Cascade pump	
						6 Alarm relay	CH/CO <sup>2)</sup>
						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: (ext. 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 output with an active voltage of 120 VAC, it can only handle resistive loads between 5 and 50 Watt.			
(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:	<b>OUTPUTS:</b>					
(125)	Prog. Output 1.	0 Disabled					
		1 Module pump					
		2 CH pump					
		3 DHW pump					
		4 System pump	CH/CO				
		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 <sup>1)</sup>	CH/CO				
		10 Air damper					

Table 10.9

# 11 USING THE DISPLAY

## 11.1 Display and buttons

Each type of the VGH Boiler series is provided with a digital display.

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

A PB-display will look like this:

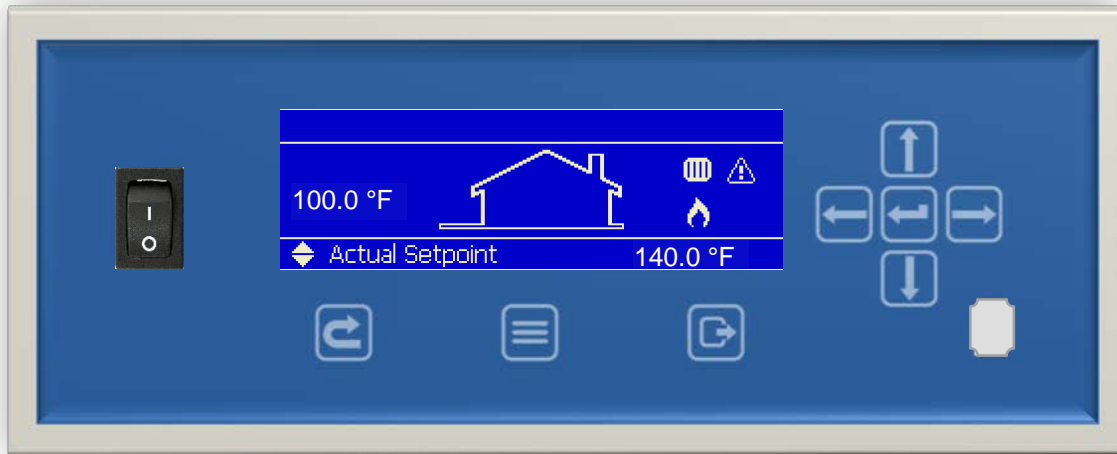


Figure 11.1











	ON/OFF. On/off switch. Switches electrical power to the boiler
	COMPUTER. Connector for computer cable
	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 11.2

### 11.1.1 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

Table 11.2

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

Table 11.1

## 11.2 Screens and settings

When the appliance is started the following screen is displayed:



Figure 11.3

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

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

### Heating Only boiler (VGH-CH)

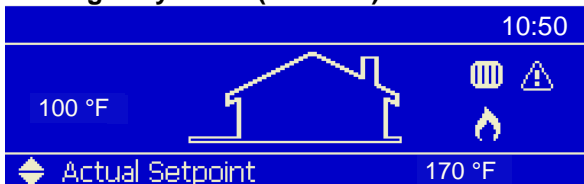


Figure 11.4

### Heating & DHW boiler (VGH-CO)

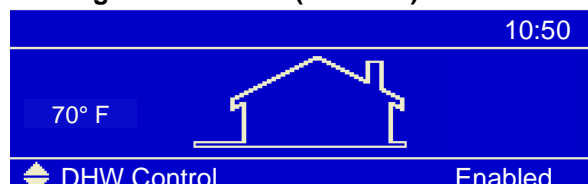


Figure 11.5

### 11.2.1 DE-AERATION SEQUENCE

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”
- “DAir Error Water Pressure”

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

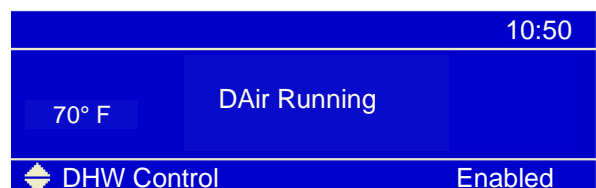


Figure 11.6

## 11.3 Control panel menu structure

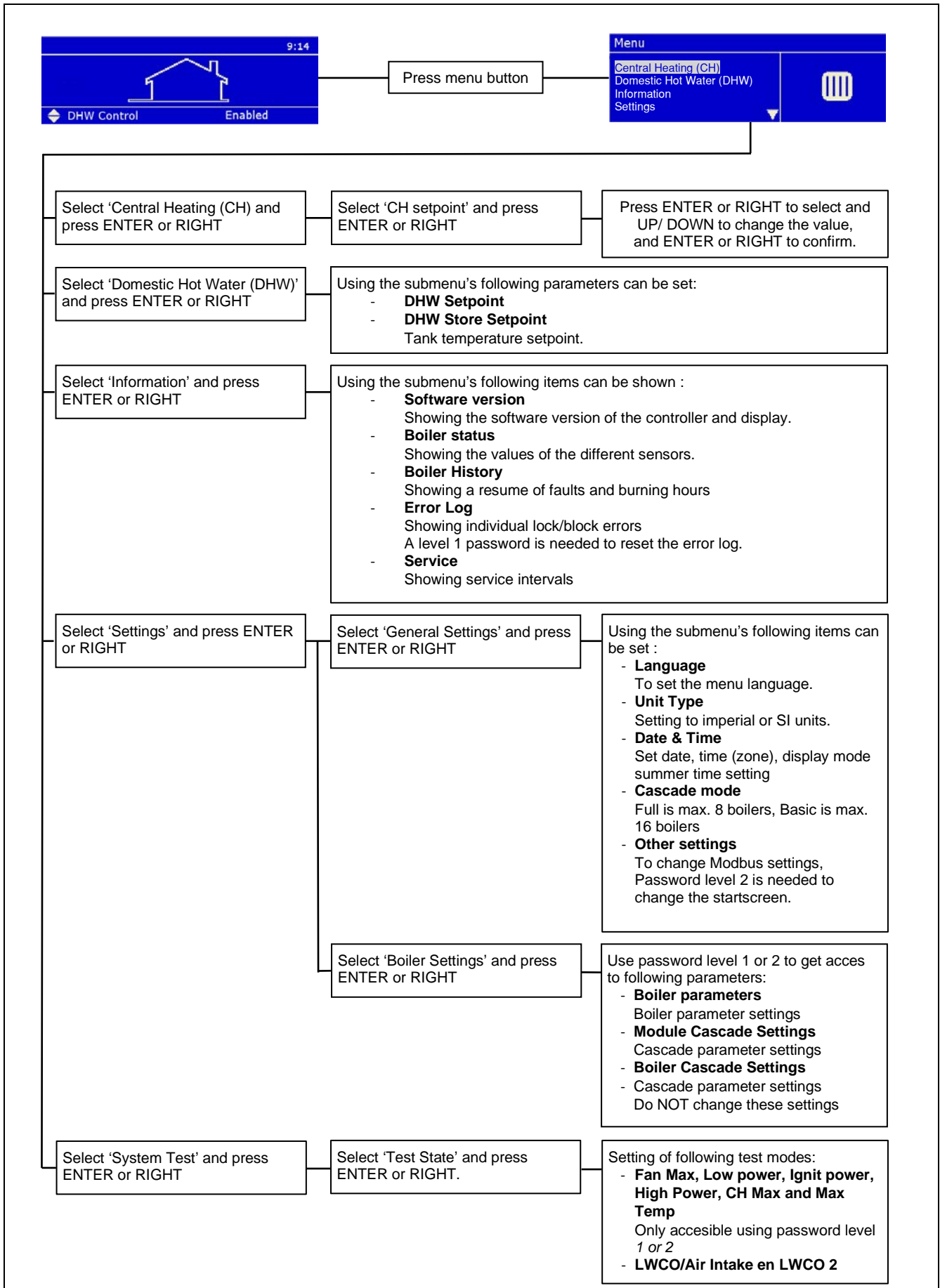


Figure 11.7

### 11.3.1 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  $\uparrow/\downarrow$  to select the mode, then press ENTER  $\leftarrow$  or RIGHT  $\rightarrow$  to confirm the mode and the Actual/DHW setpoint becomes directly settable. Use UP  $\uparrow$  or DOWN  $\downarrow$  to increase/decrease the setpoint. Press ENTER  $\leftarrow$  or RIGHT  $\rightarrow$  to confirm your alteration or press ESC  $\boxed{C}$  or LEFT  $\leftarrow$  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.

### 11.3.2 ENTERING THE MENU

Enter the menu by pressing the MENU  $\boxed{\equiv}$  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.

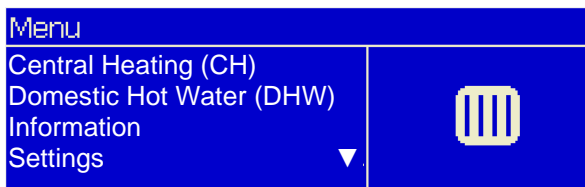


Figure 11.8

Enter a menu item by pressing ENTER  $\leftarrow$  or RIGHT  $\rightarrow$ . 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  $\boxed{\equiv}$  or ESC  $\boxed{C}$ . If you want to go back one step in the menu press BACK/LEFT  $\leftarrow$ .

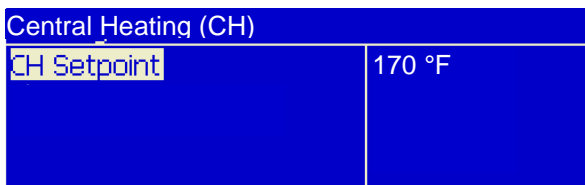


Figure 11.9

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:

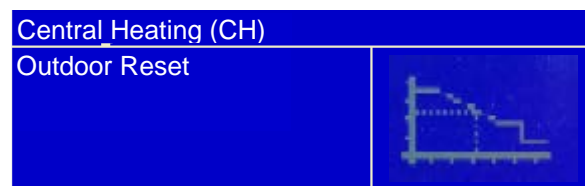


Figure 11.10

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

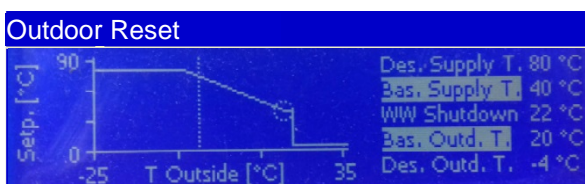


Figure 11.11

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  $\boxed{\equiv}$  or ESC  $\boxed{C}$ . If you want to go back one step in the menu press BACK/LEFT  $\leftarrow$ .

### 11.3.3 PROTECTED MENU ITEMS

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



Figure 11.12

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

 <b>WARNING</b>	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.

### 11.3.4 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



Figure 11.13



## 11.4 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 11.3

## 11.5 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.

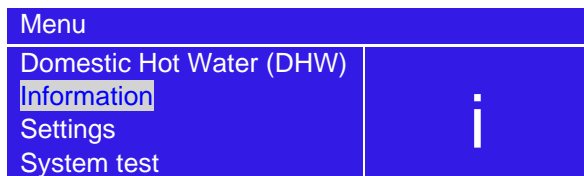


Figure 11.14

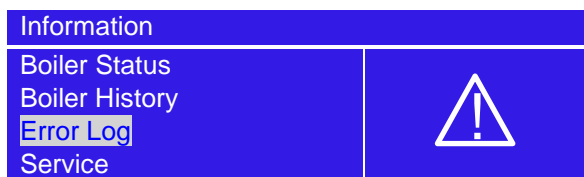


Figure 11.15

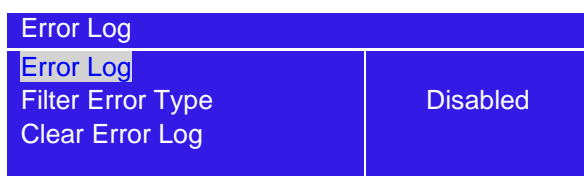


Figure 11.16

(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 11.4

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 11.17

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 11. 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 13.

## 11.6 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.

### 11.6.1 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.

### 11.6.2 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.

## 11.7 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	1.0 µA	
	Start-detection	1.5 µA	
Cable length AL-BUS <sup>1</sup>		AWG	Cable length (m)
		(mm <sup>2</sup> )	
		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)	

<sup>1)</sup> This concerns the total length of the cable, not the length between two boilers. The length differs with the diameter of the cable.

Table 11.5

### 11.7.1 CIRCULATOR START EXERCISE 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 at the start-up of the board.

### 11.7.2 FROST PROTECTION

The Frost protection function protects the boiler and boiler loop from freezing.

The T\_Supply, T\_Supply\_2 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

### 11.7.3 FLUE TEMPERATURE PROTECTION

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

- When the T\_Flue or T\_Flue\_2 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 °F (5 °C) and Max\_Flue\_Gas\_Temp.

Parameters are factory set.

### 11.7.4 APPLIANCE SELECTION

The control is designed to store specific parameter sets of different boiler models. By defining specific setting for different appliance models the same control can be used for a complete product range. Depending on which model the control is applied to, it will only be necessary to change a single parameter. When this parameter (138) is changed, the following settings are changed:

- Maximal fan speed
- Minimal fan speed
- Ignition speed\*
- Maximum flue gas temperature

\*Ignition speed is the same as Pre-Purge Speed and Post Purge speed.

The following appliances are available:

APPLIANCE SELECTION (Parameter 138)								
Boiler type:	80 CH	100 CH	120 CH	150 CH	180 CH	90 CO	150 CO	200 CO
Natural gas	50	52	54	50	52	50	50	50
Propane	51	53	55	51	53	51	51	51
Not Used	x			54 - 55		52-55	52-55	52-55

Table 11.6

#### Attention!

This does not apply to the external igniter BCU, see mounting instructions of that BCU.

## 11.8 Ignition cycle

During the ignition cycle multiple safety checks are active

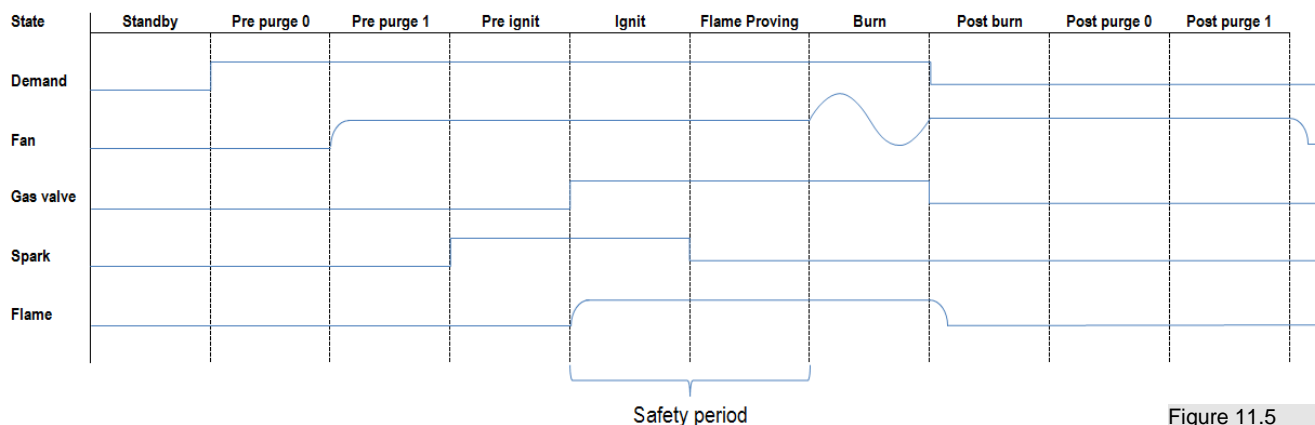


Figure 11.5

False flame detection	If flame is detected at the end of the pre-spark period ( <i>Pre-ignite</i> ) a lockout error occurs.
Re-ignition	If at the end of the safety period, no flame is detected, the control will go to post-purge in order to remove the unburned gas. After this a re-ignition attempt is started following the same cycle. The number of re-ignition attempts is limited to <i>Max_Ignit_Trials</i> after which a lockout occurs.
Flame establishing time	Sparking stops in the <i>Flame Proving</i> state to allow for ionization detection. The <i>Flame Proving</i> state takes <i>Safety_Period - Ignit_Period</i> .
Flame out too late	If at the end of the <i>Post purge 0</i> 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 boiler once. At the second flame loss the boiler will stop and blocking mode follows. The number of restarts is limited by the <i>Max_Flame_Trials</i> setting. (Default set to 1)
Fan supervision	The fan speed is continuously monitored.

Table 11.7

### 11.8.1 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 ( $\mu A$ ).

When the flame current is above *Flamerod\_Setpoint* plus *Flamerod\_Hysteresis* ( $1.0 \mu A$  plus  $0.5 \mu A$ ) a flame will be present. When the flame current is below *Flamerod\_Setpoint* ( $1.0 \mu A$ ) the flame will not be present.

## 11.8.2 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  $\mu$ A plus 0.2  $\mu$ A) the minimal fan speed will be increased.
- When the flame current is above Flamerod\_Setpoint plus Flamerod\_Delta plus Flamerod\_Delta \* 2 (1.0  $\mu$ A plus 0.2  $\mu$ A plus 0.4  $\mu$ A) 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 11.8

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

## 11.9 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 modes are available for CH:

- 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

### 11.9.1 ROOM THERMOSTAT ONLY; CH MODE 0 (DEFAULT SETTING)

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

For this mode the CH mode must be set to 0 and no outdoor sensor is needed.

If the room thermostat closes, the boiler and system circulators are switched ON. When the supply temperature drops CH\_Hysteresis\_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 the PID parameters for Central Heating.

If the supply temperature reaches a temperature CH\_Hysteresis\_Up above the CH\_Setpoint the boiler is switched OFF. However, if CH\_Setpoint plus CH\_Hysteresis\_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 (if this was not already happening) and the boiler and system circulators run ON for CH\_Post\_Pump\_Time.

#### 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\_Hysteresis\_Up, the control will wait a period of time (Anti\_Cycle\_Period  $\rightarrow$  180 sec.) 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.

### Adjustable Set Point Heating Parameters

Specific Parameters	Display menu #	Level	Default Value	Range
<b>CH_Mode</b>	PB1	Installer	1	Mode 0-5
<b>CH Setpoint</b> Sets the required supply temperature	PB3	Installer	185 °F (80 °C)	68.....194 °F (20.....90 °C)
<b>CH_Post_Circulator_Time</b>	PB5	Installer	120 sec.	10.....900 sec
<b>Anti_Cycle_Period</b>	PB9	Installer	180 sec	10.....900 sec
<b>Anti_Cycle_T_Diff</b> Aborts anti-cycle time when setpoint – actual supply temp > Anti_Cycle_T_Diff.	PB10	Installer	29 °F (16 °C)	0.....36 °F (0.....20 °C)

Table 11.9

#### 11.9.2 CH WITH AN OUTDOOR TEMPERATURE RESET AND THERMOSTAT; CH MODE 1

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

If the parameter CH\_Mode (PB1) 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 the outdoor sensor is connected, the boiler automatically uses Reset\_Curve\_Boiler\_Maximum (PB24).

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 11.8.1).

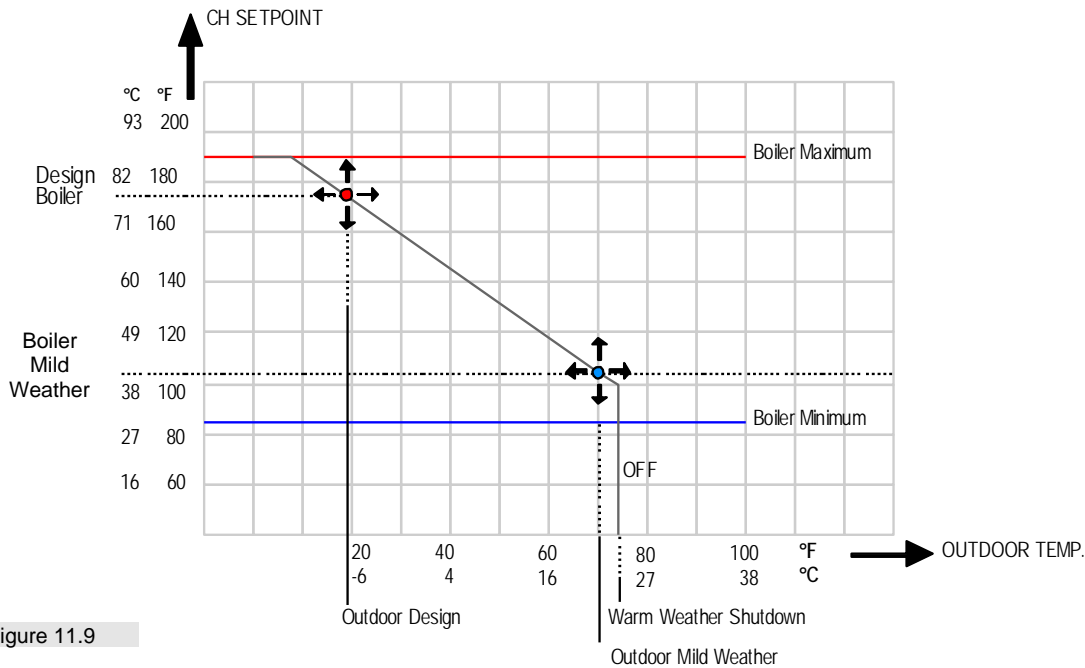


Figure 11.9

#### 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 Reset\_Curve\_Boiler\_Minimum (PB23) and Reset\_Curve\_Boiler\_Maximum (PB24).

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 the Reset\_Curve\_Design\_Boiler (PB19).

#### Shutdown temperature

If the outdoor temperature rises above Warm\_Weather\_Shutdown (PB25), 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 also 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	32 °F	
(27) Boost Time Delay	20 min	
(28) Night Setback Temp.	40 °F	▼

Figure 11.20

These are parameters 26 Boost Temp Increment and 27 Boost Time Delay.

They have a default value of 32 °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 11.8.1.

### Adjustable Outdoor Reset parameters

Parameters	display menu #	Level	Default Value	Range
<b>CH_Mode</b>	PB1	Installer	1	Mode 0-5
<b>Reset_Curve_Design_Boiler</b> Sets high boiler CH setpoint when outdoor temperature is equal to <i>Reset_Curve_Outdoor_Design</i> .	PB19	Installer	176 °F (80 °C)	32.....176 °F (0.....80 °C)
<b>Reset_Curve_Outdoor_Design</b> Sets the outdoor temp at which the boiler setpoint must be high as set by <i>Reset_Curve_Design_Boiler</i> .	PB20	Installer	23 °F (-5 °C)	-4.....41 °F (-20.....5 °C)
<b>Reset_Curve_Boiler_Mild_Weather</b> Sets low boiler CH setpoint when outdoor temp. is equal to <i>Reset_Curve_Outdoor_Mild_Weather</i> .	PB21	Installer	104 °F (40 °C)	32.....104 °F (0.....40 °C)
<b>Reset_Curve_Outdoor_Mild_Weather</b> Sets the outdoor temp at which the boiler setpoint must be low as set by <i>Reset_Curve_Mild_Weather</i> .	PB22	Installer	68 °F (20 °C)	32.....86 °F (0.....30 °C)
<b>Reset_Curve_Boiler_Minimum</b> Sets the lower limit for the CH setpoint (minimum).	PB23	Installer	68 °F (20 °C)	68.....194 °F (20.....90 °C)
<b>Reset_Curve_Boiler_Maximum</b> Sets the upper limit for the CH setpoint (maximum).	PB24	Installer	185 °F (85 °C)	68.....194 °F (20.....90 °C)
<b>Warm_Weather_Shutdown</b> Set max. outdoor temp. Above this temperature heat demand is blocked.	PB25	Installer	72 °F (22 °C)	32.....95 °F (0.....35 °C)
<b>Boost_Temperature_Incr</b> CH setpoint increment when heat demand remains beyond <i>Boost_Time_Delay</i> .	PB26	Installer	32 °F (0 °C)	32.....68 °F (0.....20 °C)
<b>Boost_Time_Delay</b>	PB27	Installer	20 min.	1 – 120 min.
<b>CH_Setpoint_Diff</b> Adjusts the calculated CH setpoint.	PB185	User	0 °F (0 °C)	-18.....18 °F (-10.....10 °C)

Table 11.10

Status variables	Range
<b>Actual_CH_Setpoint</b> Calculated CH setpoint, based on outdoor reset curve	68...194 °F (20.....90 °C)

Table 11.11

### 11.9.3 CH WITH CONSTANT CIRCULATION SYSTEM OUTDOOR RESET; CH MODE 2

This mode is available to both Heating Only (VGH-CH) and Combi (VGH-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 11.9.2.

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 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 (PB 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 10.3.1). 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 set by using the installer password and changing parameter 28 in the boiler parameters; the default value is setpoint - 50 °F.

Boiler Parameters		
(25) Warm Weather Shutdn	72 °F	▲
(26) Boost Temp increment	32 °F	
(27) Boost Time Delay	20 min	
(28) Night Setback Temp.	40 °F	▼

Figure 11.21

#### Adjustable constant Circulation Parameters

Parameters	Display menu #	Level	(Default) Value	Range
<b>CH_Mode</b>	<i>PB 1</i>	Installer	0	Mode 0 - 5
<b>Warm_Weather_Shutdown</b> Set max. outdoor temp. Above this temp. heat demand is blocked	<i>PB 25</i>	Installer	72 °F (22 °C)	32...95 °F (0...35 °C)
<b>CH_Setpoint_Diff</b> Adjusts the calculated CH setpoints	<i>PB 3</i>	User	0 °F (0 °C)	-18...18 °F (-10...10 °C)

Table 11.12



### 11.9.4 CH WITH CONSTANT CIRCULATION AND PERMANENT HEAT DEMAND; CH MODE 3

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

For this mode the CH\_Mode must be set to 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 11.9.1. When the room thermostat contact opens CH\_Setpoint will be decreased with Night\_Setback\_Temp. In this condition the circulator is always ON.

Please note that the circulator starts every 24 hours function is not performed during this mode. In this mode the circulator will be running continuously.

Parameters	Display menu #	Level	(Default) Value	Range
CH_Mode	PB 1	Installer	0	Mode 0 - 5
CH_Setpoint	PB 0003	Installer	176 °F (80 °C)	68.....194 °F (20.....90 °C)

Table 11.13

### 11.9.5 CENTRAL HEATING WITH ANALOG INPUT CONTROL OF SETPOINT; CH MODE 4

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

CH mode is set to 4. In this mode 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\_Min and the CH\_Setpoint\_Max settings.

The minimum analog input signal will correspond with the CH\_Setpoint\_Min 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\_Min and CH\_Setpoint\_Max 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. The setpoint modulation will occur between 2 and 9 volts. The request for heat will be removed when the voltage drops below 1 volt.

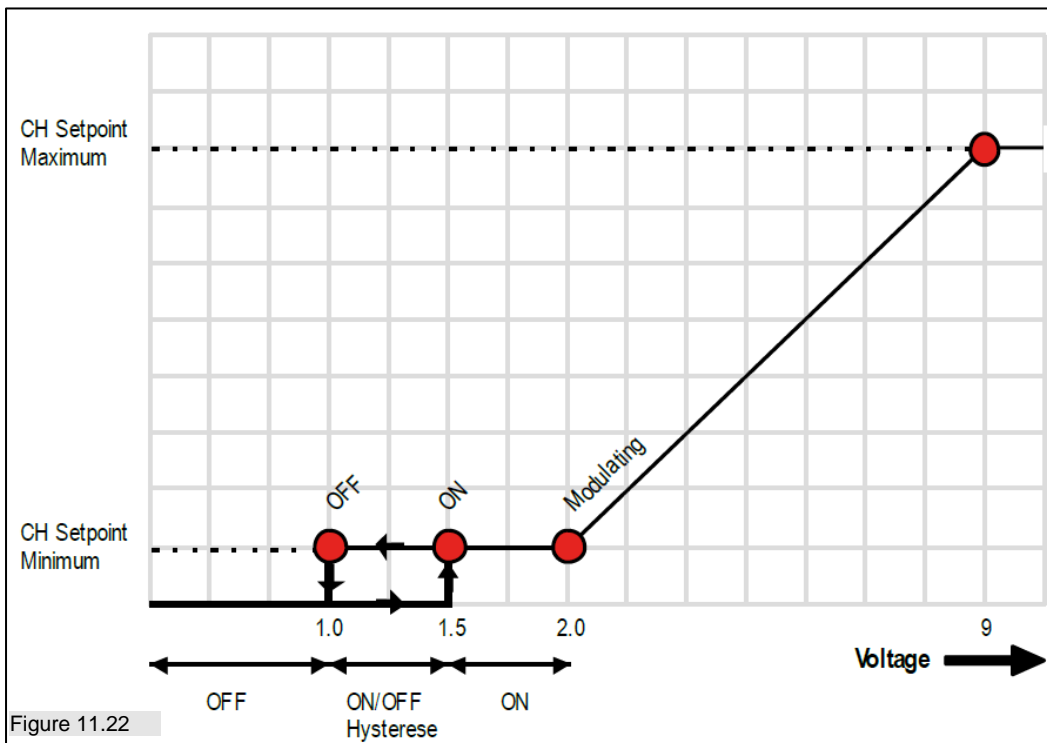


Figure 11.22

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

Parameters	Display menu #	Level	(Default) Value	Range
CH_Mode	PB 1	Installer	0	Mode 0, 1, 2, 3, 4, 5
CH_Setpoint_Minimum	PB 23	Installer	68 °F (20 °C)	68...194 °F (20...90 °C)
CH_Setpoint_Maximum	PB 24	Installer	185 °F (85 °C)	68...194 °F (20...90 °C)

Table 11.14

### 11.9.6 CH WITH ANALOG INPUT CONTROL OF POWER OUTPUT; CH MODE 5

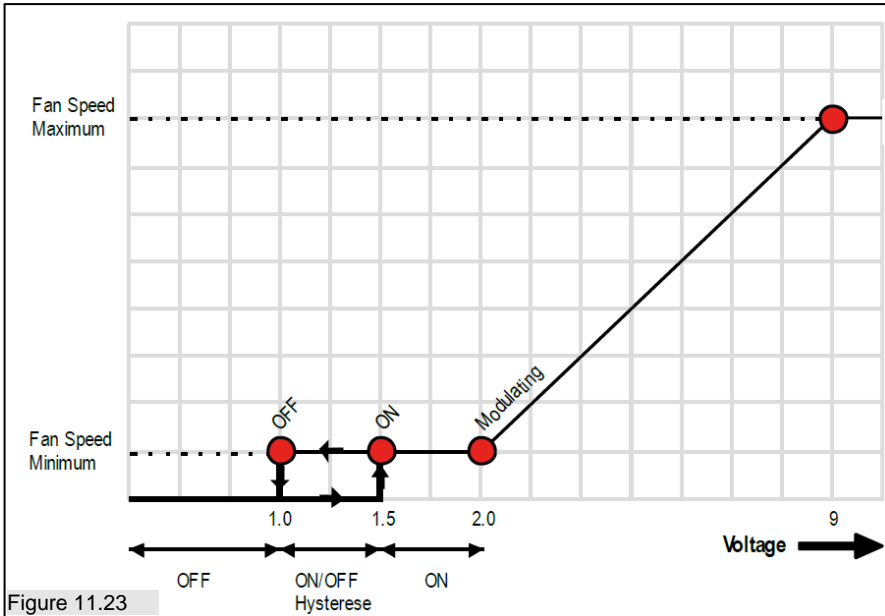
This mode is available to both Heating Only (VGH-CH) and Combi (VGH-CO) boilers.

In this mode 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.

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.



- CH mode 5 will work without sensors.

Parameters	Display menu #	Level	(Default) Value	Range
CH_Mode	PB1	Installer	0	Mode 0, 1, 2, 3, 4, 5
CH_Setpoint_Maximum	PB24	Installer	194 °F (90 °C)	68...194 °F (20...90 °C)

Table 11.15

## 11.10 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 (VGH-CH)**.

- 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 (VGH-CO).**

- DHW mode 5 – Instantaneous water heating with plate heat exchanger, DHW-out sensor and rotary switch

### 11.10.1 NO DOMESTIC HOT WATER; DHW MODE 0

**This mode is only available for Heating Only boilers (VGH-CH).**

No domestic hot water is available. The T\_DHW\_Out sensor does not need to be connected.

### 11.10.2 HIGH PRESSURE DROP INDIRECT TANK DHW MODE 1 AND 2 (VGH-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. Therefore the parameter on output 1 needs to be changed from 4 (System circulator) to 3 (DHW circulator) (see table 10.9).

This can be done by entering the boiler settings and change parameter “(125) Prog. Output1.” from 4 to 3.

Please note that this means that a system circulator can't 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.

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 35°F.

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

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

### 11.10.3 DHW STORAGE WITH SENSOR; DHW MODE 1

**This mode is only available for Heating Only boilers (VGH-CH).**

Mode 1: DHW is prepared by warming up a store. There is a 3-way valve already in a Heating Only boiler and will be activated when this mode is used, connect an indirect tank 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 (PB: 115). When this sensor drops below DHW\_Store\_Setpoint (PB: 115) minus DHW\_Store\_Hyst\_Down (PB: 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\_Store\_Supply\_Extra minus DHW\_Supp\_Hyst\_Down 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\_Store\_Supply\_Extra.

The boiler is stopped when the supply temperature rises above DHW\_Store\_Setpoint (PB: 115) plus DHW\_Store\_Supply\_Extra (PB: 38) plus DHW\_Supp\_Hyst\_Up (PB:37).

The demand for the tank is ended when the tank-sensor rises above DHW\_Store\_Setpoint plus DHW\_Store\_Hyst\_Up. The circulator continues DHW\_Post\_Pump\_Period (PB: 44).

## DHW Priority

Standard DHW demand has priority (*PB: 43*) over CH demand but the priority period is limited up to *DHW\_Max\_Priority\_Time* (*PB43*). 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*.

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

Table 11.16

## 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 menu #	Level	(Default) Value	Range
<b>DHW_Mode</b>	<i>PB 01</i>	Installer	0	0, 1, 2, 3, 4, 5, 6, 7, 8
<b>DHW_Store_Setpoint</b> sets the desired DHW temperature	<i>PB 115</i>	User	122°F (50 °C)	104 ... 160 °F (40...71 °C)
<b>DHW_Store_Hyst_Down</b> Point where boiler starts for heat demand = setpoint - hysteresis	<i>PB 36</i>	Installer	7.2°F 4 °C)	0 ... 36 °F (0...20 °C)
<b>DHW_Supp_Hyst_Up</b> Boiler stops firing when setpoint + hysteresis up is reached	<i>PB 37</i>	Installer	5.4°F 3 °C)	0 ... 36 °F (0...20 °C)
<b>DHW_Store_Supply_Extra</b> increases the supply temperature to the storage until <i>DHW-Store_Setpoint plus DHW_Store_Supply_Extra</i>	<i>PB 38</i>	Installer	27 °F (15 °C)	0... 54 °F (0...30 °C)

Table 11.17

Status Variables	Value
<b>DHW control state</b> Central Heating controller state	0 → Idle
	1 → Request
	2 → Demand
	3 → Post circulation
	4 → Off

Table 11.18

### 11.10.4 DHW STORAGE WITH THERMOSTAT; DHW MODE 2

**This mode is only available for Heating Only boilers (VGH-CH).**

In this mode DHW is prepared by warming up an indirect tank.

There is a 3-way valve already in a Heating Only boiler and will be activated when this mode is used, connect an indirect tank directly to the connections under the boiler.

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.

If the supply temperature *T\_Supply* drops below *DHW\_Store\_Setpoint minus DHW\_Supp\_Hyst\_Down* 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\_Supp\_Hyst\_Up*. The demand for DHW ends when the indirect tank thermostat/aquastat opens. The circulator continues *DHW\_Post\_Circulator\_Period* after the DHW demand has stopped.

For DHW priority, see paragraph 11.10.3.

## Relevant variables

Specific Parameters	Display menu #	Level	(Default) Value	Range
DHW_Mode	PB 1	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	PB 115	User	122°F (50 °C)	104...185 °F (40...85 °C)
DHW_Priority	PB 42	Installer	2	0=Time, 1=OFF, 2=ON
DHW_Max_Priority_Time Sets the maximum time for either DHW or CH priority.	PB 43	Installer	60 min.	
DHW_Post_Pump_Period	PB 44	Installer	20 sec.	10...900

Table 11.19

### 11.10.5 INSTANTANEOUS WATER HEATING WITH PLATE HEAT EXCHANGER; DHW MODE 5

#### This is the only mode available for Combi boilers (VGH-CO).

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 menu #	Level	(Default) Value	Range
DHW_Mode	PB 1	Installer	0 for CH 5 for CO	0, 1, 2,3, 4, 5, 6, 7, 8
DHW_Setpoint Sets the desired DHW temperature	PB 48	User	122 °F (50 °C)	86...176 °F (30...80 °C)

Table 11.20

### 11.10.6 ANTI-LEGIONELLA PROTECTION

#### This option is only available for Heating Only boilers (VGH-CH).

Anti-Legionella is enabled for CH-boilers for the 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 Anti\_Legionella\_Sensor must reach a temperature above Anti\_Legionella\_Setpoint for a time specified by Anti\_Legionella\_Burn\_Time.

If 7 days have passed and these conditions are not met, the boiler is forced to heat-up the system for Anti-Legionella. When the Anti\_Legionella\_Sensor temperature is below Anti\_Legionella\_Setpoint the control switches ON the circulators, when the Anti\_Legionella\_Sensor temperature is above Anti\_Legionella\_Setpoint plus 9 °F (plus 5 °C) the control stops the circulators.

When DHW Mode 1 has been selected, the setpoint of the boiler will be at Anti\_Legionella\_Setpoint plus DHW\_Store\_Supply\_Extra.

If the supply temperature drops below the Boiler\_Setpoint the boiler is started as well. The boiler is PID controlled towards the Boiler\_Setpoint. When the supply temperature rises above the boiler setpoint plus the DHW\_Supp\_Hysteresis\_Up the boiler is switched OFF.

Every time an Anti-Legionella demand has ended the Anti\_Legionella\_Active\_Counter is incremented to indicate how many Anti-Legionella actions have been performed. Also, the Anti\_Legionella\_Wait\_time is started in order to delay the next Anti-Legionella cycle.

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.

#### Parameters are factory set.

Parameter	Factory Setting.
Anti_Legionella_Setpoint Setpoint for Anti-Legionella demand	140 °F (60 °C)
Anti_Legionella_Burn_Time	30 Min.
Anti_Legionella_Wait_Time Wait time for Anti-Legionella demand	120 min after cold start, 168 h after first successful Anti-Legionella demand

Table 11.21

## 11.11 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 15).

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

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

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

<b>3.2 Boiler status</b>	<b>min.</b>	<b>max.</b>	<b>Default</b>	<b>unit</b>	<b>Access level</b>	<b>Description:</b>
Flow Temperature				°F (°C)	User	Actual supply flow temperature
Flow 2 Temperature			(Not used)	°F (°C)	User	Actual supply 2 flow temperature
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				°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/clos	User	Actual RT input status
Water Pressure				psi (Bar)	User	Actual CH water pressure
Fan Speed						
Ionization				uA	User	Actual ionization current
State					User	Actual burner state
Error				#	User	Actual internal error code
Calculated Setpoint				°F (°C)	User	Actual CH setpoint

<b>3.3 Boiler history</b>	<b>min.</b>	<b>max.</b>	<b>Default</b>	<b>unit</b>	<b>Access level</b>	<b>Description:</b>
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				hrs.	User	Display the amount of burn hours for CH
DHW Burner Hours				hrs.	User	Display the amount of burn hours for DHW

<b>3.4 Error Log</b>	<b>min.</b>	<b>max.</b>	<b>Default</b>	<b>unit</b>	<b>Access level</b>	<b>Description:</b>
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

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

<b>4 Settings</b>	<b>min.</b>	<b>max.</b>	<b>Default</b>	<b>unit</b>	<b>Access level</b>	<b>Description:</b>
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

4.1.2 unit type	min.	max.	Default	unit	Access level	Description:
Metric (°C, bar)			°C/bar	°C/bar	User	Select Metric units
Imperial (°F, psi)			x	°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
<b>A. Time Zone Settings</b>					User	Enter the time zone settings menu
<b>B. Display Settings</b>					User	Enter the display settings menu

A Time zone settings	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 dig.	User	Select how the day of month is displayed
Month					User	Select how the month is displayed
Year			4	2 or 4 dig.	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:
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



4.2 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

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	uA	installer	read out flame signal

4.2.1 Boiler parameters	min.	max.	Default	unit	Access level	Description:	Display no:
CH mode	0	5	1	#	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	185
Boiler Pump Overrun	0	900	120	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
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
Design Supply Temp.	39 (4)	194 (90)	185 (85)	°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 Des. Supply T.	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 Bas. Supply T.	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)	18 (10)	7.2 (4)	°F (°C)	Installer	Set the DHW tank hysteresis down	36

4.2.1 Boiler parameters	min.	max.	Default	unit	Access level	Description:	Display no:
DHW Tank Hyst. Up	0 (0)	18 (10)	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 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 Setpoint	102 (39)	158 (70)	122 (50)	°F (°C)	Installer	Set the DHW setpoint	48
DHW Store Setpoint	32 (0)	50 (10)	122 (50)	°F (°C)	Installer	Set the DHW storage setpoint	115
PreHeat mode	on	off	off	-	Installer	Set the PreHeat Eco mode	64
Prog. Input 2.	0	4	2 (CH) 1 (CO)	#	Installer	Select the function for programmable input 2 See paragraph 10.6	117
Prog. Input 7.	0	5	3	#	Installer	Select the function for programmable input 7 See paragraph 10.6	122
Prog. Input RT.	0	1	1	#	Installer	Select the function for the programmable RT input See paragraph 10.6	124
Prog. Output 1.	0	10	4	#	Installer	Select the function for programmable output 1 See paragraph 10.6	125
Prog. Output 2.	0	10	9	#	Installer	Select the function for programmable output 2 See paragraph 10.6	126
Prog. Output 3.	0	10	6	#	Installer	Select the function for programmable output 3 See paragraph 10.6	127
Prog. Output 4.	0	20	20	#	Installer	Select the function for programmable output 4 See paragraph 10.6	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			wilo		Installer	Set the modulating pump model	135
Mod. Pump Mode	20	100	mod	o/f or mod.	Installer	Set the modulating pump mode	136
Mod. Pump Min Pwr			30	%	Installer	Set the modulating pump minimum duty cycle	137
Appliance Type	50	55	50	#	Installer	Set the appliance type	138
Dair active	0	1	yes	Yes/ No	Installer	Enable/disable the De-Air function	139
Anti Legionella Day	mon	sun	Sunday		Installer	Select the day for the anti-legionella cycle	107
Anti Legionella Hour	0	23	0	hrs.	Installer	Select the time for the anti-legionella cycle	108

<b>4.2.2 Module Cascade Settings</b>	<b>min.</b>	<b>max.</b>	<b>Default</b>	<b>unit</b>	<b>Access level</b>	<b>Description:</b>	<b>Display no:</b>
Burner Address			Stand alone		Installer	Set the cascade burner address	184
Permit Emergency Mode			Yes	Yes/No	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 Boiler cascade settings menu must not be used.

4.2.3 Boiler Cascade Settings	min.	max.	Default	unit	Access level	Description:	Display no:
Boiler Address			stand alone		Installer	Set the cascade boiler address	73
Permit Emergency Mode	0	1	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

## 12 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  $\Delta T$  (Delta T) becomes too high:

At maximum boiler input  $\Delta T$  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  $\Delta T$  above 77 °F (43 °C) is allowed - (*Hx\_Diff\_DeltaT\_Min plus 14 °F (+8 °C)*)

Above  $\Delta T = 86$  °F (48 °C), the boiler is switched OFF during *HX\_Diff\_Max\_Wait\_Time*.

### Relevant factory set variables

Parameter	Level	Factory Setting	Range
<b>HX Diff DeltaT Min</b>	Factory	63 °F (35 °C)	18....144 °F (10 ....80 °C)
<b>HX Diff Max Wait Time</b> Wait time after upper limit primary heat exchanger differential has been exceeded.	Factory	180 Sec.	1....255 Sec.

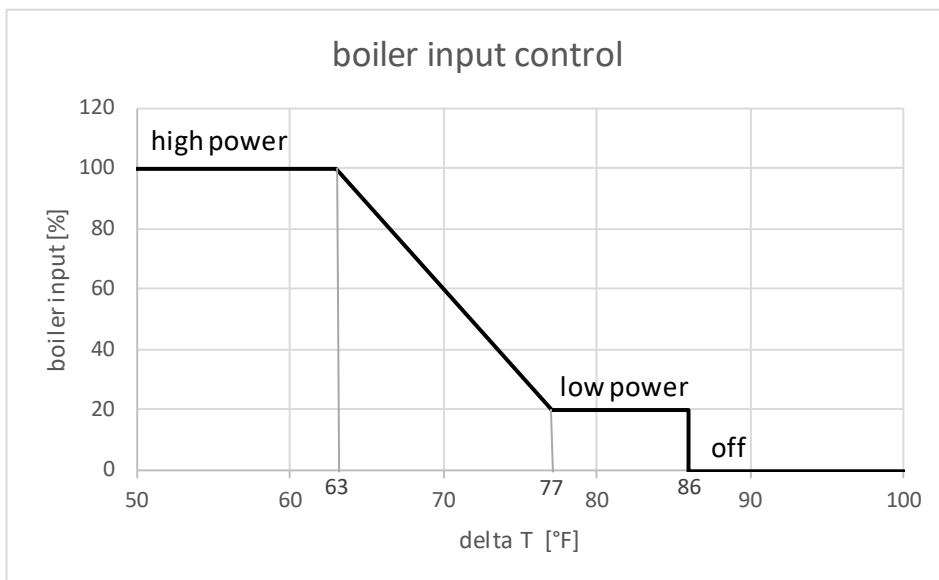


Figure 12.1

## 13 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.

### 13.1 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

## 13.2 Lockout codes

Lock out code	Error	Description	Cause	Solving
0	E2PROM_READ_ERROR	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
1	IGNIT_ERROR	Five unsuccessful ignition attempts in a row	no gas, wrongly adjusted gas valve	check gas supply and adjust gas valve, reset BCU
2	GV_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	Control had a blocking error more than 20 hours	blocking code active more than 20 hours	reset and check blocking code
5	FAN_ERROR_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_ERROR_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_ERROR_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	E2PROM_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
13	APS_NOT_OPEN	Air pressure switch not opening during pre-purge 0	electrical circuit is short circuited, or APS is jammed	check wiring or replace APS
14	APS_NOT_CLOSED_IN_PRE_PURGE	Air pressure switch not closing during pre-purge 1	no air transport to the burner; flue or air inlet is blocked, or APS is jammed, or air signal hose not connected to the air intake pipe or water in hose	check if there are any obstructions in the flue or air intake, replace APS if jammed, connect air hose to the air intake pipe, remove any water from the hose.
15	MAX_TEMP_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	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 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).

Lock out code	Error	Description	Cause	Solving
16	FLUE_GAS_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 to 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
20	FLAME_OUT_TOO_LATE	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_IGNIT	Flame is detected before ignition	wrong earthing of BCU and boiler	check earthing of BCU and boiler
22	TOO_MANY_FLAME_LOSS	Three times flame lost during 1 demand	bad gas supply or CO <sub>2</sub> level is not correct or bad ignition rod	check gas supply pressure, check CO <sub>2</sub> level and adjust if necessary, replace ignition rod or replace ignition cable.
23	CORRUPTED_ERROR_NR	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 expansion vessel on internal leak
28	FILL_TIME_ERROR	Filling takes too long	if output is programmed as filing 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 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_1_ERROR	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
35	APS_NOT_CLOSED_IN_POST_PURGE	Air pressure switch not closing during post-purge 1	no air transport to the burner after heating de-mand; flue or air inlet is blocked or APS is jammed or air signal hose not connected to the air intake pipe or water in hose	check if there are any obstructions in the flue or air intake, replace APS if jammed, connect air hose to the air intake pipe, remove any water from the hose.

Table 13.1

### 13.3 Blocking codes

Blocking 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
102	WD_ERROR_STACK	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
103	WD_ERROR_REGISTER	Internal software error	wrongly program-med BCU or PB	reset BCU or replace BCU and or display unit
104	WD_ERROR_XRL	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 overheat 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_HIGH	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
107	REFHI_TOO_LOW	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
108	REFLO_TOO_HIGH	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
109	REFLO_TOO_LOW	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
110	REFHI2_TOO_HIGH	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
111	REFHI2_TOO_LOW	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
112	REFLO2_TOO_HI GH	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
113	REFLO2_TOO_LO W	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 Minimal_Pressure, or when the pressure drops below 11.6 psi.	not enough water pressure	fill up the system and check if there are any water leakages
118	WD_COMM_ERROR	Watchdog communication error	wrong programmed BCU or PB	reset BCU or replace BCU and or display unit
119	RETURN_OPEN	Return sensor open	malfunctioning return sensor or not connected	check connection to BCU or check resistance NTC sensor
120	SUPPLY_OPEN	Supply sensor open	malfunctioning supply sensor or not connected	check connection to BCU or check resistance NTC sensor
122	DHW_OPEN	DHW sensor open	malfunctioning DHW sensor or not connected	check connection to BCU or check resistance NTC sensor



Block- ing code	Error	Description	Cause	Solving
123	FLUE_OPEN	Flue sensor open	malfunctioning flue sensor or not connected	check connection to BCU or check resistance NTC sensor
125	OUTDOOR_OPEN	Outdoor sensor open	malfunctioning outdoor sensor or not connected or wrong CH-mode programmed	check connection to BCU or check resistance NTC sensor or change CH-mode
126	RETURN_SHORTED	Return sensor shorted	malfunctioning return sensor or short circuiting	check connection to BCU or check resistance NTC sensor
127	SUPPLY_SHORTED	Supply sensor shorted	malfunctioning supply sensor or short circuiting	check connection to BCU or check resistance NTC sensor
129	DHW_SHORTED	DHW sensor shorted	malfunctioning DHW sensor or short circuiting	check connection to BCU or check resistance NTC sensor
130	FLUE_SHORTED	Flue sensor shorted	malfunctioning flue sensor or short circuiting	check connection to BCU or check resistance NTC sensor
132	OUTDOOR_SHORTED	Outdoor sensor shorted	malfunctioning outdoor sensor or short circuiting	check connection to BCU or check resistance NTC sensor
133	NET_FREQ_ERROR	Net freq. error detected by the watchdog	wrong frequency from power grid or aggregate	check frequency on the mains of the boiler (60Hz)
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
135	PHASE_NEUTRAL_REVERSED	Live and neutral of the main voltage power supply input are reversed	Line voltage (Hot) and neutral are wrongly connected	change Line voltage (Hot) and neutral
136	T_EXCHANGE_BLOCK_ERROR	Exchange temperature exceeded 194 °F (90 °C).	water temperature is above 194 °F (90 °C).	check the 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.
155	WD_CONFIG_ERROR	Watchdog fan configuration setting error	wrongly program-med BCU or PB	reset BCU or replace BCU and or display unit
162	FILL_WARNING	Error is generated immediately when the pressure drops below Minimal_Pressure. Demand has stopped, but no error needs to be stored at this time.	the water pressure is below the minimum pressure level	refill the system until the pressure is above 1 bar or 14.5 psi

Block- ing code	Error	Description	Cause	Solving
164	LOWEXFLOW_P ROTECTION	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 the 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.
165	VSUPPLY_TOO_ LOW	Main supply voltage too low for more than 60 seconds	dip in power supply to boiler	check power supply
166	VSUPPLY_TOO_ HIGH	Main supply voltage too high for more than 60 sec.	peak in power supply to boiler	check power supply

Table 13.2


### 13.4 Warnings

Warning no.	Warning	Description	Cause	Solving
200	CC_LOSS_ COMMUNICATION	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
202	APP_SELECTION_ ERROR	Unknown appliance model selected	wrongly programmed parameters	replace BCU
203	CC_LOSS_BOILER_ COMM	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	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

Table 13.3

# 14 CASCADING

## 14.1 System setup

 <b>NOTICE</b>	For proper functioning of the system, certain settings have to be changed. See paragraph 14.2
--	--

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 14.1. System configuration for handling DHW indirect tank or Central Heating demand. All boilers handle **either** indirect tank **or** Central Heating demand at one time.

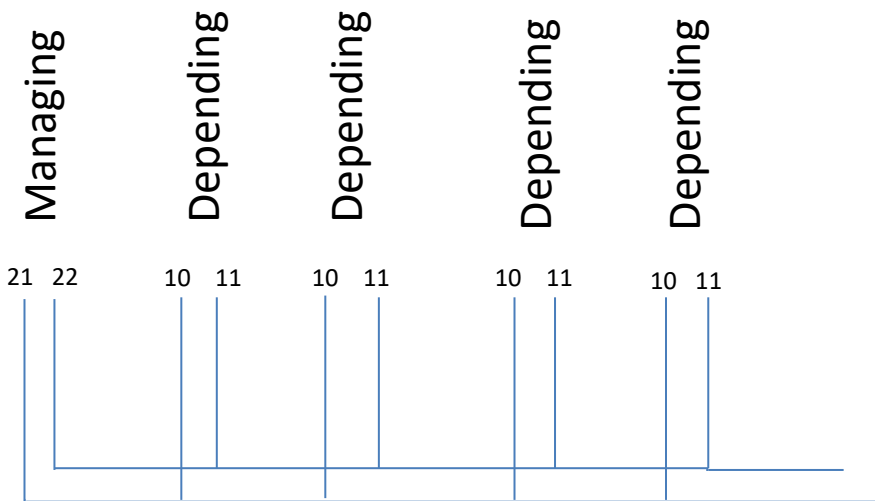


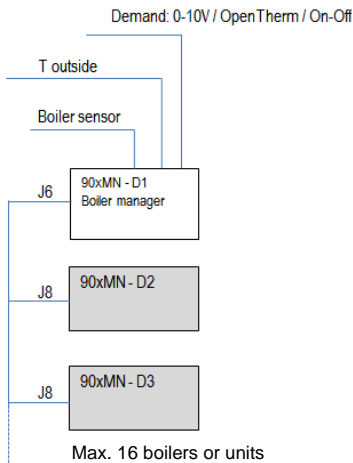
Figure 14.1

## 14.2 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 21-22 for the cascade. The 10-11 connection terminals of the depending boilers must be connected to 21-22 connection terminals of the managing boiler (see paragraph 10.3.1). 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 14.2.1).

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.



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

 <b>NOTICE</b>	<p>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.</p>
-------------------	--

Figure 14.2

### 14.2.1 SETTING THE BOILER ADDRESS

 <b>NOTICE</b>	<b>Address rules</b>
<p>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 1: Dep. 1, Dep. 2 etc. on the depending boilers.          The total number of boilers in the cascade must be stored in parameter 147 on the managing boiler.</p> <p>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 1, 2 and 3 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.</p>	

The managing boiler of the cascade system is connected to the AL-BUS connection on terminals 21-22. 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 21-22, switch S1 must be set in the OFF position (all controls).

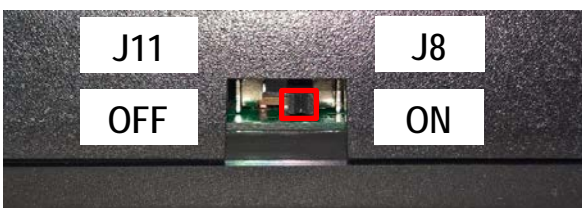


Figure 14.3

The boiler address can be set through an e2prom setting or via the Switch input available on the control. Each boiler must be configured with its own unique address.

### 14.2.2 E2PROM ADDRESS SELECTION THROUGH E2PROM SETTING

This setting can be changed on the boiler control.

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

Table 14.1

### 14.2.3 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. SlantFin 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.

### 14.2.4 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.

### 14.2.5 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 14.2

#### Relevant variables

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

Table 14.3

### 14.2.6 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.

### 14.2.7 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.

## 14.3 Cascade – Boiler rotation

The boiler rotation function can change the start/stop sequence for the cascade boilers.

The parameter Boiler\_Rotation\_Interval sets the number of days after which the sequence is updated. When Boiler\_Rotation\_Interval is set to 0 boiler rotation is disabled.

When the parameter Burner\_Rotation\_Interval is updated the boiler rotation days left will be initialized to the new Burner\_Rotation\_Interval setting.

When for example *Burner\_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 14.4

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

#### 14.3.1 NEXT DEPENDING TO START SELECTION

When the cascade `Burner_Rotation_Interval` has passed the control will perform the cascade rotation. At this moment the next available control based on the current `First_Dependig_To_Start` is selected. A depending 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_Dependig_To_Start`.

#### Relevant variables

Specific Parameters	Display menu #	Level	(Default) Value	Range
<code>Burner_Rotation_Interval</code>	<i>PB 84</i>	Installer	5	0...30 (0: Disabled)
<code>First_Dependig_To_Start</code>	<i>PB 175</i>	Installer	1	1...8/16

Table 14.5

## 14.4 Cascade Error handling

#### 14.4.1 CASCADE FROST PROTECTION

Frost protection on a cascade is active on two levels

#### Frost protection for burner cascade

The 'frost protection' function for a burner cascade is related to the boiler sensor temperatures. Reactions on the supply / return temperatures of the managing boiler are as follows:

<code>Cascade_Frost_Protection</code> :	Below this temperature the cascade CH/system pump and the general pump of the managing boiler start running.	Default: 59 °F (15 °C)
<code>Cascade_Frost_Protection</code> minus 9 °F (minus 5 °C):	Below this temperature the cascade heat demand is activated; the general/boiler pumps of all the cascaded boilers will be started and the boilers start burning.	59 minus 9 = 50 °F (15 minus 5 = 10 °C)
<code>Cascade_Frost_Protection</code> plus 9 °F (plus 5 °C):	Above this temperature, the boilers stop burning.	59 plus 9 = 68 °F (15 plus 5 = 20 °C)

Table 14.6

#### 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	Display menu #	Level	(Default) Value	Range
<b>Cascade frost protection</b> Temperature for frost protection	<i>PB 155</i>	Installer	59 °F (15 °C)	50...86 °F (10...30 °C)

Table 14.7

#### 14.4.1 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.

 <b>NOTICE</b>	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
<b>Emergency_Mode</b>	<i>PB 72</i>	User	Yes	Yes/No
<b>Emergency_Setpoint</b>	<i>PB 74</i>	Installer	158 °F (70 °C)	68...194 °F (20...90 °C)
<b>DAir active</b>	<i>PB 139</i>	Installer	Yes	Yes/No

Table 14.8

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".

 <b>NOTICE</b>	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.

#### 14.4.2 MANAGING BOILER ERROR

When the managing boiler is in error mode this boiler is not used anymore for the cascade system.

However, depending on the error code, the circulators connected to the managing boiler still can be active for the cascade system. When the managing unit is reset from lockout state, the cascade controllers are re-initialized.



## 15 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 <i>CH_max_power</i>
6	High limit error test	Simulates the <i>Max_Temp_Error</i>
7	Low water cut-off 1 error test	Simulates the <i>LWCO_1_Error</i>
8	Low water cut-off 2 error test	Simulates the <i>LWCO_2_Error</i>

Table 15.1

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 203 °F (95 °C). When this temperature is reached the boiler will switch OFF.

When the supply temperature cools down to 194 °F (90 °C) 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.

## 16 COMMISSIONING THE BOILER

### 16.1 First: flushing the boiler with water

After installation of the boiler, 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 7.17). 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 boiler's heat exchanger.

### 16.2 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 paragraph 7.27.

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.


The heat exchanger must be de-aired by means of the manual de-air vent in the boiler (see also paragraph 7.24).

#### 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.

To manually de-air the heat exchanger: (see also § 7.24)

- Use a plastic pvc tube with an inside/outside diameter of 0.27/0.39 inch. Only de-air when the water and heat exchanger are cold.
- put a short, fitting drain hose on the air vent;
- slowly turn the vent open until the air starts flowing out;

 <b>NOTICE</b>	<b>Only use your hands when opening and closing this vent NEVER use tools on this vent.</b>
--	---

(with the air also a small amount of water will stream out; with 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.

**If 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.


### 16.3 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.

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

## 16.4 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.

 <b>WARNING</b>	<p>When mounting the bottom part of the condensate trap, before commissioning the boiler and/or after maintenance, the condensate trap must <b>ALWAYS</b> be <u>completely</u> filled with water.</p> <p><b>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.</b></p>
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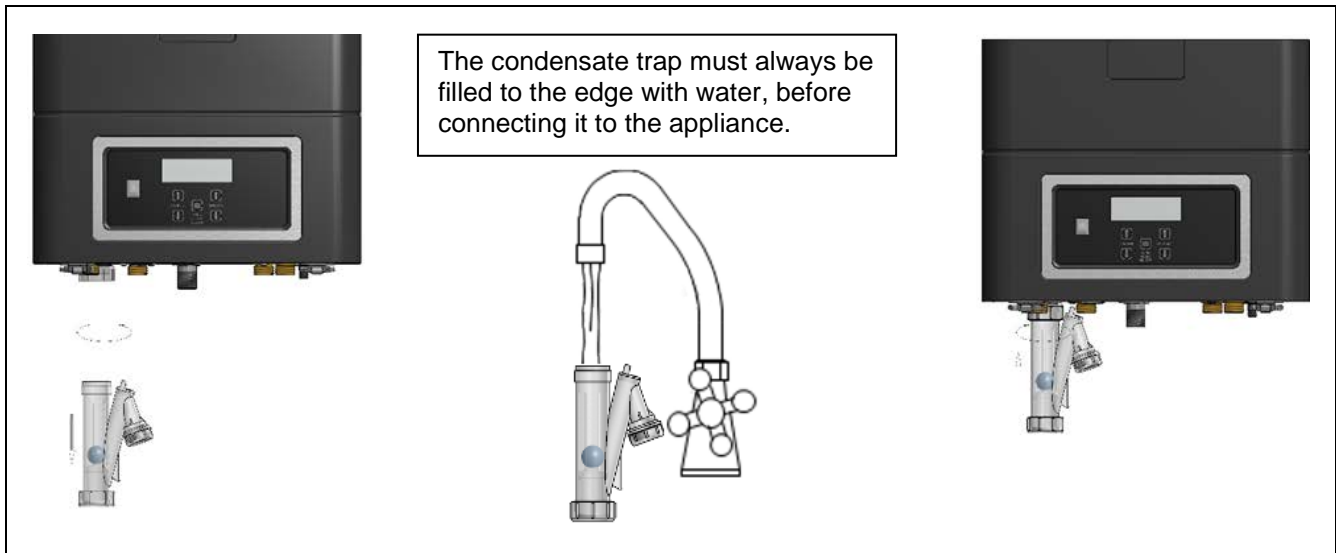


Figure 16.1

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.

## 16.5 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 17.1 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 16.1

## 16.6 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 16.2

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 one of the following Status overview screens appears:

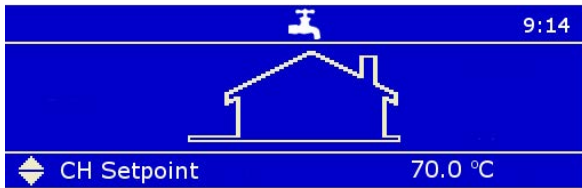


Figure 16.3

Central Heating only

OR

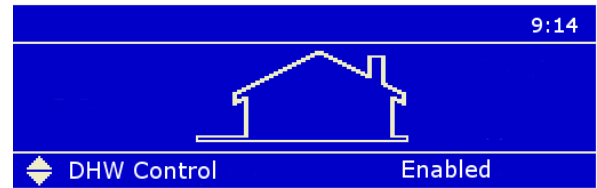


Figure 16.4

Central Heating AND Domestic Hot Water

The display describes:

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

# 17 ADJUSTING AND SETTING THE BOILER

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.

## 17.1 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 CO<sub>2</sub> values turn out to be incorrect.
- The gas valve has been replaced.
- Gas conversion to propane. Prior to adjustments, follow the procedure in 17.3.
- The venturi/gasvalve has been replaced. Prior to adjustments, follow the procedure in 17.3
- The fan has been replaced.

In any of the cases described, always check the gas/air ratio of the combustion figure (CO<sub>2</sub>) 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 17.1. A drawing of the gas valve(s) and setting screws is given in paragraph 17.1.2. In paragraph 17.2 a general procedure, conformably to which the adjustments must be carried out, is presented. Paragraph 17.3 describes the specific adjustments to be made when the gasvalve/venturi is replaced, and paragraph 4 describes the changes needed when the gas type is set to propane.

#### 17.1.1 COMBUSTION TABLE

Table 1: CO<sub>2</sub> and O<sub>2</sub> values for high fire and low fire for all boiler types. <sup>1)</sup>

CO <sub>2</sub> flue gas	Natural gas	High Fire %	9.1 – 8.4
		Low Fire %	9.4 – 8.9
	Propane <sup>2)3)</sup>	High Fire %	10.1
		Low Fire %	9.8
O <sub>2</sub> flue gas	Natural gas	High Fire %	4.6 – 6.0
		Low Fire %	4.1 – 5.0
	Propane <sup>2)3)</sup>	High Fire %	5.5
		Low Fire %	6.0

1) All values measured without front door.

2) For propane: the gasvalve/venturi must be completely replaced, see 17.3.

3) For propane: appliance type must be changed, see 17.3.

Table 17.1

17.1.2 **SETTING SCREWS GAS VALVE: DRAWINGS**

**Location of the setting screws:**

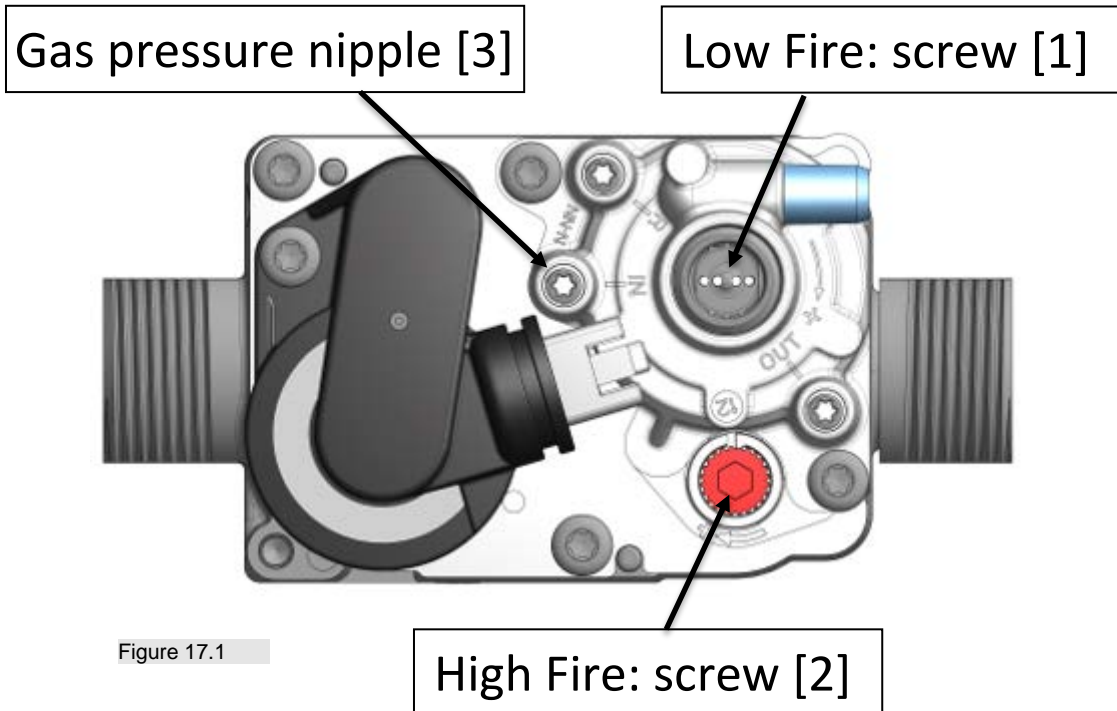


Figure 17.1

**Low Fire:** gas valve adjustment screw: Torx T40.

NOTE: Remove the cover screw to get access to the low fire adjustment screw.




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

## 17.2 CO<sub>2</sub> / O<sub>2</sub> 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 at least 20 seconds 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  $\uparrow\downarrow$  to select "System Test"
3. Press ENTER  to activate the system test. → "Test State: Off"
4. Press ENTER  to activate the test state. → "Test State: **Off**"
5. Press UP/DOWN  $\uparrow\downarrow$  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 doesn't start, first check gas pressure, second 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.


6. Measure the CO<sub>2</sub> percentage at the flue gas test port on the vent connection.
7. By setting screw [2], adjust the gas valve to obtain the CO<sub>2</sub> value of Table 17.1.
8. To return to the status screen, and stop the boiler, press ESCAPE  or MENU  3 times, or RESET  once.

Increase CO<sub>2</sub>

CO <sub>2</sub> ↑		O <sub>2</sub> ↓
-------------------	---	------------------

 Turn screw [2] right (clockwise)

Decrease CO<sub>2</sub>

CO <sub>2</sub> ↓		O <sub>2</sub> ↑
-------------------	--	------------------

 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  $\uparrow\downarrow$  multiple times to select "Low Power" → "Test State: **Low Power**".  
After about 10 seconds, the boiler burns at low fire.
2. Measure the CO<sub>2</sub> percentage at the flue gas test port on the vent connection.
3. By setting screw [1], adjust the gas valve to obtain the CO<sub>2</sub> value of Table 17.1.

Increase CO<sub>2</sub>




CO <sub>2</sub> ↑		O <sub>2</sub> ↓
-------------------	---	------------------

 Turn screw [1] right (clockwise)

Decrease CO<sub>2</sub>

CO <sub>2</sub> ↓		O <sub>2</sub> ↑
-------------------	---	------------------

 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 17.1 best.

## 17.3 Venturi adjustment

The venturi is a fixed part and needs no adjustments.

## 17.4 Conversion from natural gas to propane



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 your Slant/Fin distributor and intended to be used with this particular boiler. Every conversion kit is provided with instructions how to assemble the kit to the boiler.



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

Secondly, parameter 138 (appliance type) has to be changed in the software of the boiler to complete the conversion to propane.

Use only parts/conversion kits obtained from Slant/Fin and intended to be used with this particular boiler. 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 parameter 138
5. adjust the CO<sub>2</sub> / O<sub>2</sub> percentage
6. 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 dataplate, on the outside of the boiler casing, right hand, top side.

**2. Check gasvalve/venturi type.** Check if the venturi type matches the boiler model.

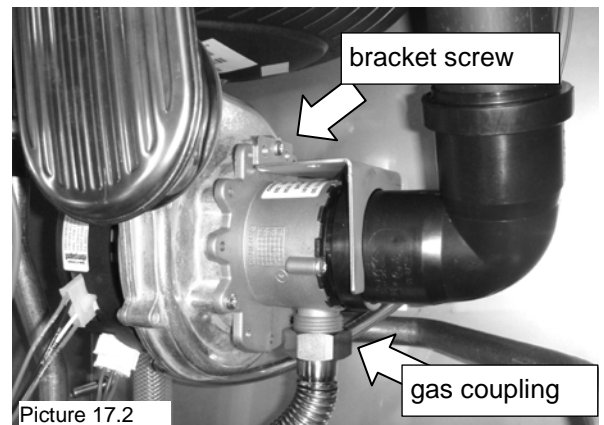
### 3. Exchange the venturi:

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

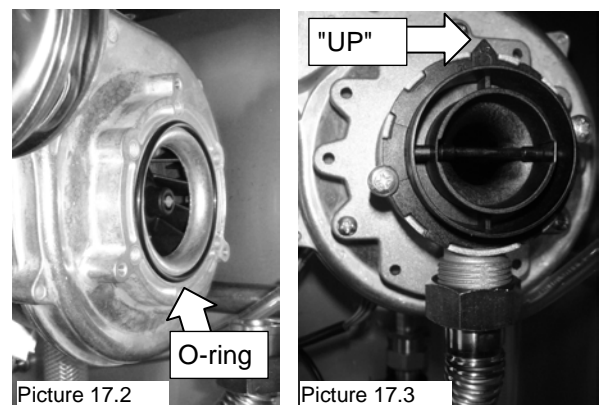
Exchanging the venturi (see also pictures):

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, ensure 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. If in operation, check again for gas leaks on all parts that have been apart.



Picture 17.2



Picture 17.2

Picture 17.3

13.




#### 4. Set parameter 138

Parameter 138 has to be changed in the software of the boiler according to the following table:  
NB: fan speed is given to verify.

Boiler model	Fan speed high fire for propane (LP)	Parameter 138 for propane (LP)
VGH-80-CH	6850	51
VGH-100-CH	6450	53
VGH-120-CH	6900	55
VGH-150-CH	7150	51
VGH-180-CH	6900	53
VGH-90-CO	7700	51
VGH-150-CO	8300	51
VGH-200-CO	7600	51

Table 17.1

1. From status screen, press MENU button once.
2. Press UP/DOWN  $\updownarrow$  to select "Settings" and press ENTER  $\leftarrow$ .
3. Press UP/DOWN  $\updownarrow$  to select "Boiler Settings" and press ENTER  $\leftarrow$ .
4. Enter installer password by pressing UP/DOWN  $\updownarrow$  and LEFT  $\leftarrow$  /RIGHT  $\rightarrow$ .
5. Press UP/DOWN  $\updownarrow$  to select "Boiler Parameters" and press ENTER  $\leftarrow$ .
6. Press UP/DOWN  $\updownarrow$  to select parameter "(138) Appliance Type" and press ENTER  $\leftarrow$ .
7. Press UP/DOWN  $\updownarrow$  to change the parameter according to the table, and press ENTER  $\leftarrow$ .
8. To return to the status screen, press ESCAPE  $\square$  or MENU  $\equiv$  4 times, or RESET  $\curvearrowright$  once.

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

#### 5. Adjust the CO<sub>2</sub>/ O<sub>2</sub> percentage

Perform CO<sub>2</sub>/O<sub>2</sub> adjustments according to the procedures in this manual "Adjusting and setting the boiler". Use the values of the "Combustion table".

#### 6. 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 parameter 138 has been set for this boiler type.

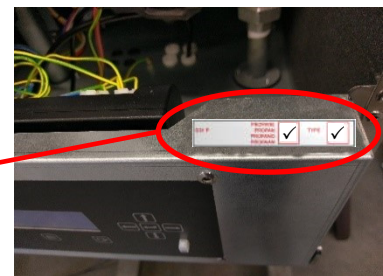
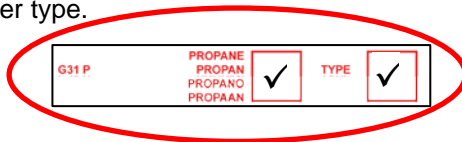




Figure 17.4

 <b>WARNING</b>	<p>Ensure that the boiler is clearly labelled if operating on propane gas!</p>
---	--

 <b>NOTICE</b>	<p>It is possible to improve the ignition spark by using an external ignition transformer. Available on request, see paragraph 5.1.</p>
--	---

## 17.5 Start Up Checklist

### Installation/start-up checklist

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

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

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



After filling in form please send a copy by e-mail to: [techservice@slantfin.com](mailto:techservice@slantfin.com)  
Mention in the subject line:  
**Boiler Registration**

or send a copy to address  
**Slant/Fin Corp.**  
100 Forest Drive  
Greenvale, NY 11548

Venting information		
Direct vent or using combustion air from indoor?	indoor / outdoor	
	<b>Air inlet</b>	<b>Flue outlet</b>
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 intake's 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)

<b>Water circulation &amp; temperature regulation (for DHW)</b>	
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 valve  
Pressure Nipple**

<b>Gas supply</b>	
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?	

<b>Combustion settings</b>		unit:
Set for NG (Natural Gas) or LP (Liquid Propane)?	NG or LP?	
In case of LP: is the right venturi mounted?	(YES/NO)	
CO2 level at high fire ...%		%
CO2 level on low fire ...%		%
Flue pressure @ CO2 measuring point at high fire		Pa
Flue pressure @ CO2 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

<b>Electronics &amp; Power supply</b>		unit:
Version Burner Controller Hardware (see paragraph 3.2 for location)		
Version Burner Controller Firmware (see paragraph 3.2 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


<b>Additives</b>	
Used chemical additions	
Mixing Ratio	

Table 17. 2

# 18 INSPECTION, MAINTENANCE AND SERVICE


## 18.1 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.

 <b>NOTICE</b>	<p><b>Maintenance and inspection of the boiler must be carried out in the following situations:</b></p> <ul style="list-style-type: none"><li>• <b>When a number of similar error codes and/or lockouts appear.</b></li><li>• <b>At least once every 12 months to ensure safe and efficient operation.</b></li></ul> <p><b>Damage caused by lack of maintenance will not be covered under warranty.</b></p>
--	---


### 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.

 <b>WARNING</b>	<p><b>Inspection, maintenance and service must be executed for a safe and efficient operation of the boiler</b></p>
---	---

 <b>CAUTION</b>	<ul style="list-style-type: none"><li>• <b>Label all wires prior to disconnection when servicing controls</b></li><li>• <b>Wiring errors can cause improper and dangerous operation</b></li><li>• <b>Verify proper operation after operation servicing</b></li></ul>
---	--

## 18.2 Safety instructions Crystalline Silica

 <b>WARNING</b>	<p><b>Warning</b></p> <p><b>Crystalline Silica – Read instructions below carefully</b></p>
---	--

### 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 burner room 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 18.1 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 (see Table 18.1). 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	<ul style="list-style-type: none"> <li>• Avoid contact with the skin and eyes.</li> <li>• Avoid breathing in the dust in the combustion chamber.</li> <li>• Avoid transferring the contamination from clothing and items at the job site.</li> </ul>
Personal Protective Equipment	<ul style="list-style-type: none"> <li>• Wear long-sleeved shirt and pants, gloves, and safety goggles.</li> <li>• Wear a respirator with a N95 rated filter efficiency or better.<sup>1</sup></li> </ul>
Working Environment	<ul style="list-style-type: none"> <li>• When cleaning the combustion chamber with a vacuum cleaner use water to reduce airborne dust levels.</li> <li>• Do not dry sweep silica dust. Pre-wet or use a vacuum with a high efficiency HEPA filter.</li> <li>• Take all possible steps to provide adequate ventilation in the boiler room.</li> </ul>
Clean-up	<ul style="list-style-type: none"> <li>• Remove all contaminated clothing after use. Store in sealable container until cleaned.</li> <li>• Wash contaminated clothing separately from other laundry and rinse washing machine after use to avoid contaminating other clothes.</li> <li>• Wash all exposed body areas gently with soap and water after contact.</li> </ul>
Disposal	<ul style="list-style-type: none"> <li>• 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.</li> </ul>
First aid	<ul style="list-style-type: none"> <li>• If contact with eyes: Flush with water for at least 15 minutes. Seek immediate medical attention if irritation persists.</li> <li>• If contact with skin: Wash affected area gently with soap and water. Seek immediate medical attention if irritation persists.</li> <li>• If breathing difficulty develops: Leave the area and move to a location with clean fresh air. Seek immediate medical attention if breathing difficulties persist.</li> <li>• Ingestion: Do not induce vomiting. Drink plenty of water. Seek immediate medical attention.</li> </ul>

Table 18.1

#### Notes:

<sup>1</sup> 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>.

### 18.3 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<sub>2</sub> % at high 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

 <b>NOTICE</b>	<p><b>Before starting work on the boiler:</b></p> <ul style="list-style-type: none"> <li>• <b>Switch off the electrical power to the boiler (service switch and/or unplug boiler)</b></li> <li>• <b>Close the gas valve to block the gas supply to the boiler</b></li> </ul>
--	--

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 18.1

- **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 boiler unit consists of the fan, venturi, gas valve, 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:

- remove the four M6 nuts
- remove the ignition cables
- close the gas shutoff valve under the boiler
- loosen the gas coupling under the gas valve
- remove the air intake pipe from the venturi.

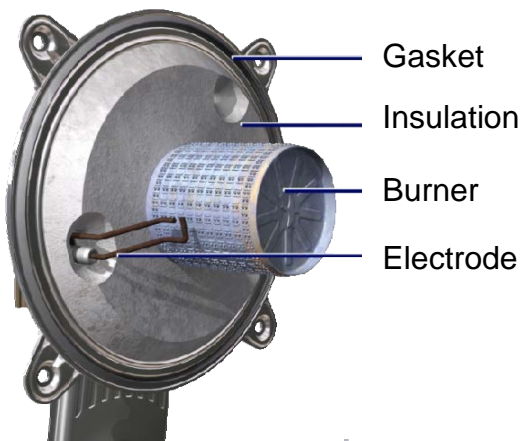


After this, take out the complete burner unit by moving it forward out of the boiler housing.

 <b>CAUTION</b>	<b>Watch out not to damage the burner plate insulation during this operation.</b>
---	---

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.

 <b>WARNING</b>	<b>Warning</b> <b>Crystalline Silica – Read instructions of § 18.2 carefully</b>
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• **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 18.19. 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.

Figure 18.2

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.**

<p><b>1</b></p>  <p>Vacuum the combustion residues</p>	<p><b>2</b></p>  <p>Clean with a nylon brush</p>	<p><b>3</b></p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <p><b>CAUTION</b></p> <p>Use nylon brush only. Do NOT use metallic brush.</p> <p>Vacuum the remaining residues</p> </div>
<p><b>4</b></p>  <p>Rinse with water Do NOT rinse the refractory</p>	<p><b>5</b></p>  <p>Spray white vinegar or stainless-steel cleaning product</p>	<p><b>6</b></p>  <p>Wait about 3 to 5 minutes</p> <p>This step is necessary only in case of serious buildup of combustion byproducts and can be repeated several times.</p>
<p><b>7</b> This step is necessary only in case of serious buildup of combustion byproducts</p>  <p>Clean with a mechanical nylon brush</p>	<p><b>8</b></p>  <p>Rinse with water Do NOT rinse the refractory</p>	<p><b>9*</b></p>  <p>Tighten in given order. torque value = 5 Nm / 44.3 inch Lbs.</p>

**9\*• Mounting the burner door**

Figure 18.3

**IMPORTANT:**

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:

- 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.
- Ensure that the door is well positioned with respect to the threaded studs, before pushing it onto the exchanger.
- 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 18.4.
- The specified torque value for tightening the burner door flange nuts is 44.3 inch lbs (5 Nm).




- **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.

- **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 burner door is removed). This water will exit the heat exchanger by the condensate trap. Notice: do not wet the rear wall insulation.

 <b>WARNING</b>	<p>When mounting the bottom part of the condensate trap, before commissioning the boiler and/or after maintenance, the condensate trap must <b>ALWAYS</b> be <u>completely</u> filled with water.</p> <p><b>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.</b></p>
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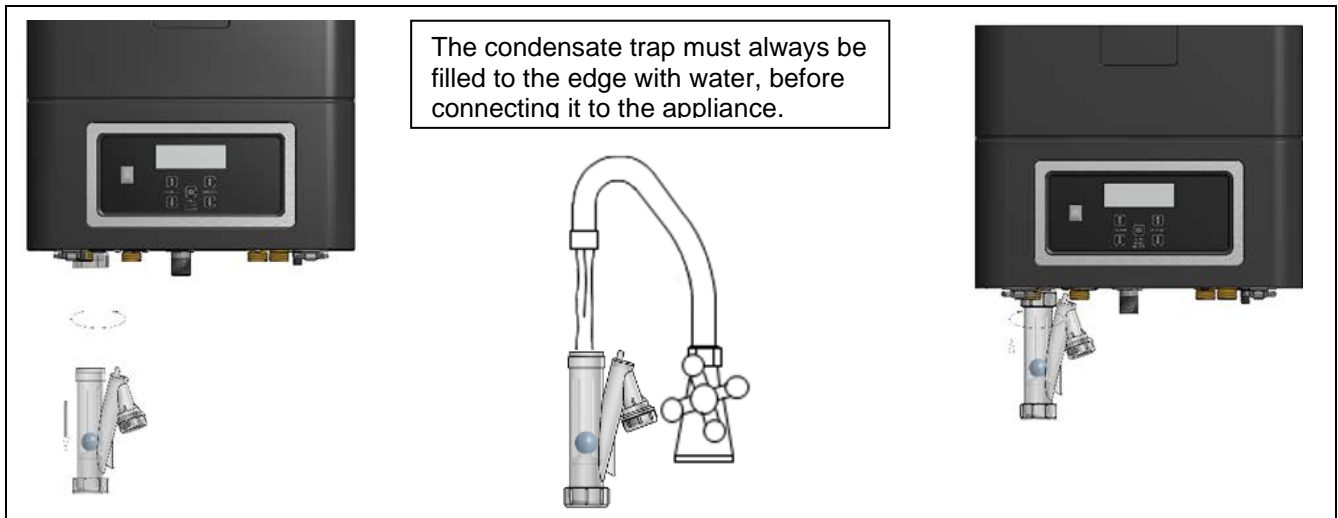



Figure 18.5

- **Gas/air ratio**

With every service check and/or maintenance of the boiler always check the gas/air ratio by measuring the CO<sub>2</sub> percentage (flue gas) at the maximum and minimum load of the boiler. If necessary, adjust these values. For more information see chapter 17.

- **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.

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> <li>• 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.</li> </ul>
---	--

## 18.4 Replacing Heatexchanger parts.



### Warning

Crystalline Silica – Read instructions in § 18.2 carefully

#### 18.4.1 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:

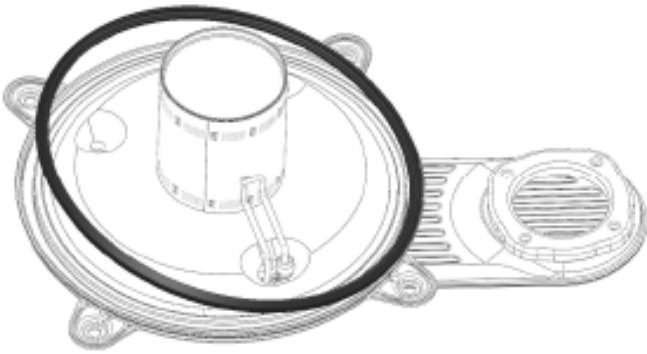


Figure 18.6

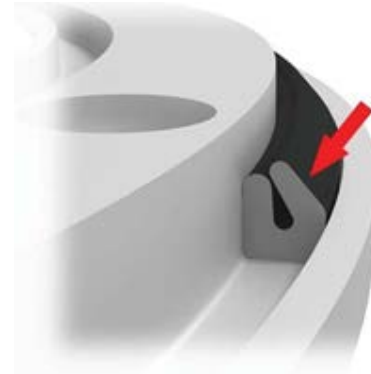


Figure 18.7

- 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 §19.4.3 point 5

#### 18.4.2 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 maintained by silicone glue.

- Remove electrodes.
- 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 18.8



Figure 18.9

- Put a thin string of glue silicone temperature-resistant in the seal housing. (Loctite 5366 or Ottoseal S17)

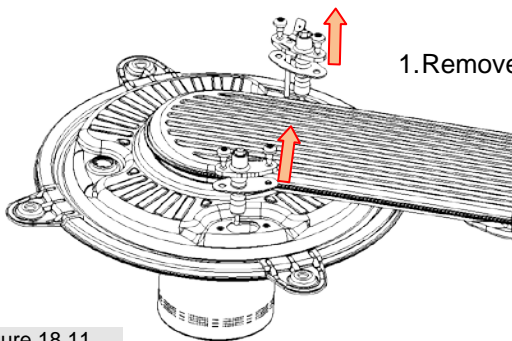
- Engage the high temp braided rope and place it in contact with the glue and press the braids.
- Reinstall electrodes



Figure 18.10

### 18.4.3 REPLACEMENT OF THE BURNER DOOR INSULATION.

The insulation burner door is fitted to the burner diameter and is maintained 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.



1. Remove the electrodes by unscrewing the 4 fixing screws.

Figure 18.11

2. Remove the defective/damaged insulation 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 braid that is glued.

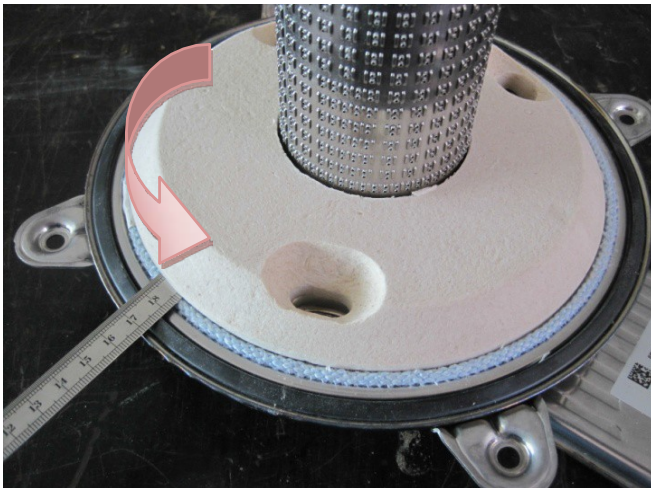


Figure 18.12

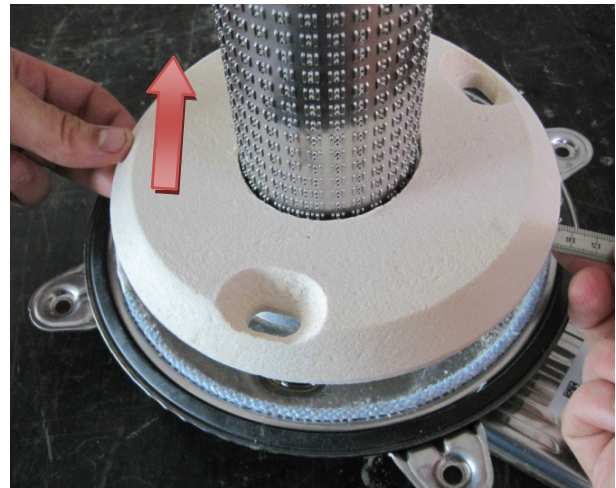


Figure 18.13

- 2.1 Remove and clean the rests of the insulation and glue silicone.
- 2.2 Put 2 dots of glue silicone, temperature-resistant (Loctite 5366 or Ottoseal S17), according to the location below indicated
- 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 glue silicone

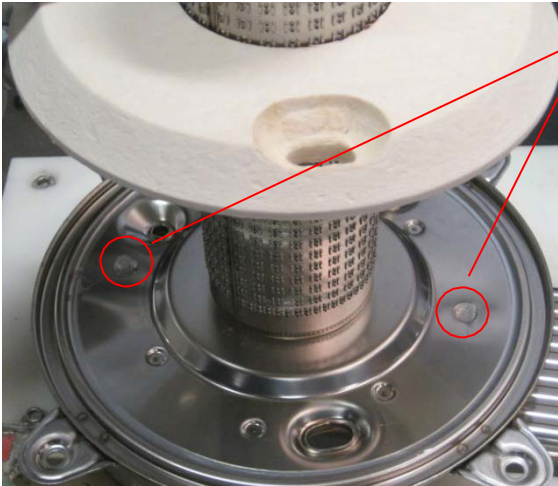


Figure 18.14

2 dots of glue silicone «Loctite 5366 ou Ottoseal S17»

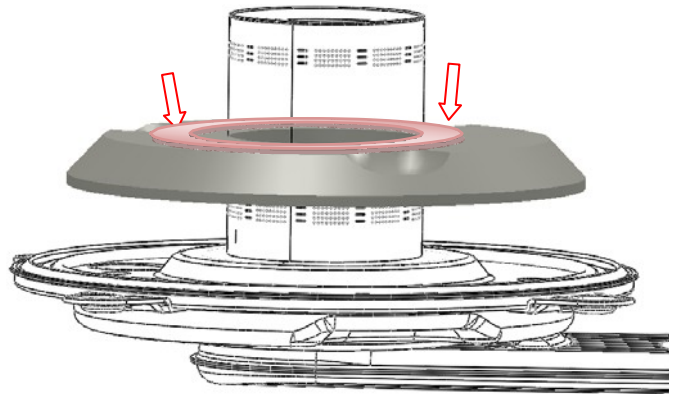


Figure 18.15

3. Check the condition of the electrodes, if necessary replace them. Reassembly the electrodes equipping them with new gaskets and respecting the location of each electrode as well the tightening torque of the 4 screws of 2.5Nm (22.1 inch Lbs).

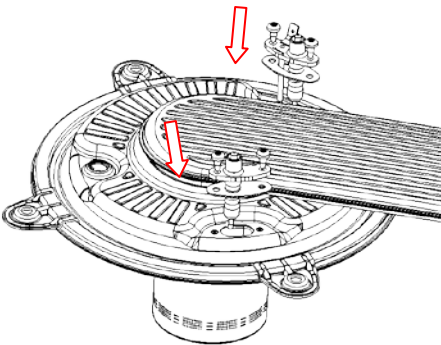


Figure 18.16

4. Check the position of the electrodes against the burner, as well as the distance of the ignition electrodes wires. Correct the electrodes gap if necessary

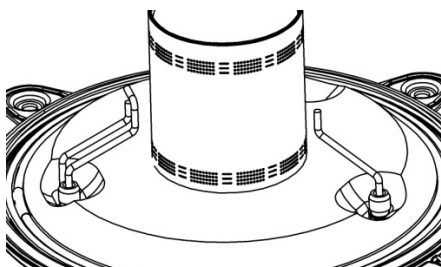


Figure 18.17

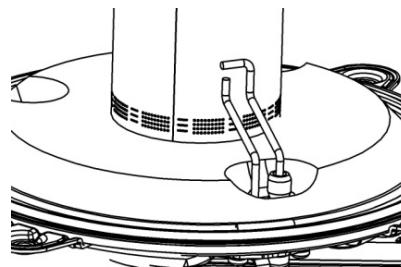


Figure 18.18

5. Reassemble the burner door set on the heat exchanger following the tightening torque of the nuts of 5 Nm (44.3 inch Lbs).



#### 18.4.4 REPLACEMENT OF THE REAR WALL INSULATION DISK

If the insulation disk has been degraded or damaged, it has to be replaced.

- Ensure that the heat exchanger has cooled down; wait a few hours after burning. In this way the protective film is no longer sticking to the rear side of this insulation disk.
- 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)



Figure 18.4.4.1

- make a square cut around the central insert



Figure 18.4.4.2

- remove the segments

- remove the central insert

The new disc has the clip on the back.

- do **NOT** remove the 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 18.4.4.3

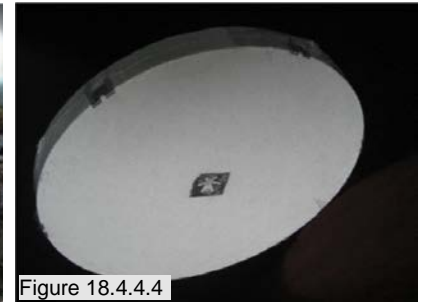


Figure 18.4.4.4

#### 18.4.5 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 4 screws of 2.5Nm (22.1 inch Lbs).

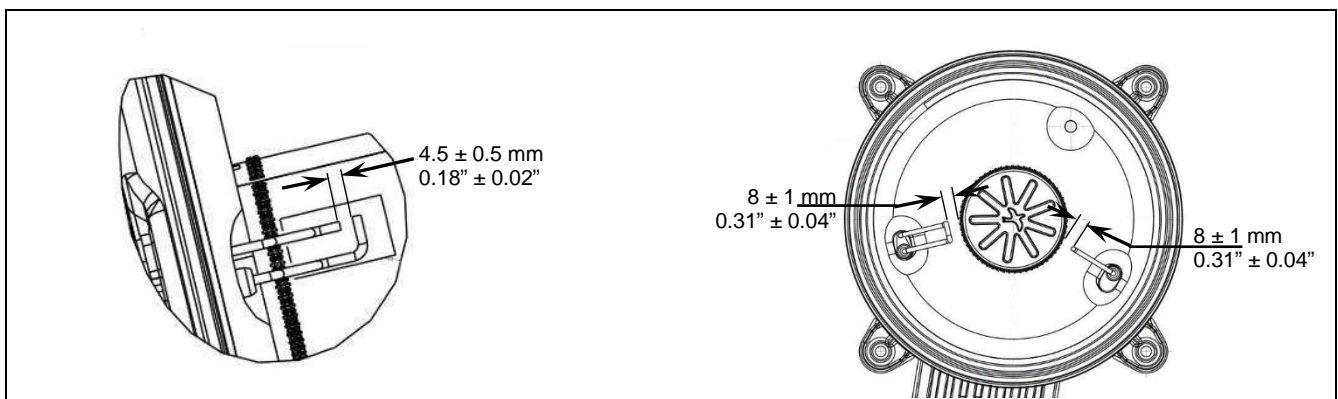


Figure 18.19

## 18.5 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 will 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.

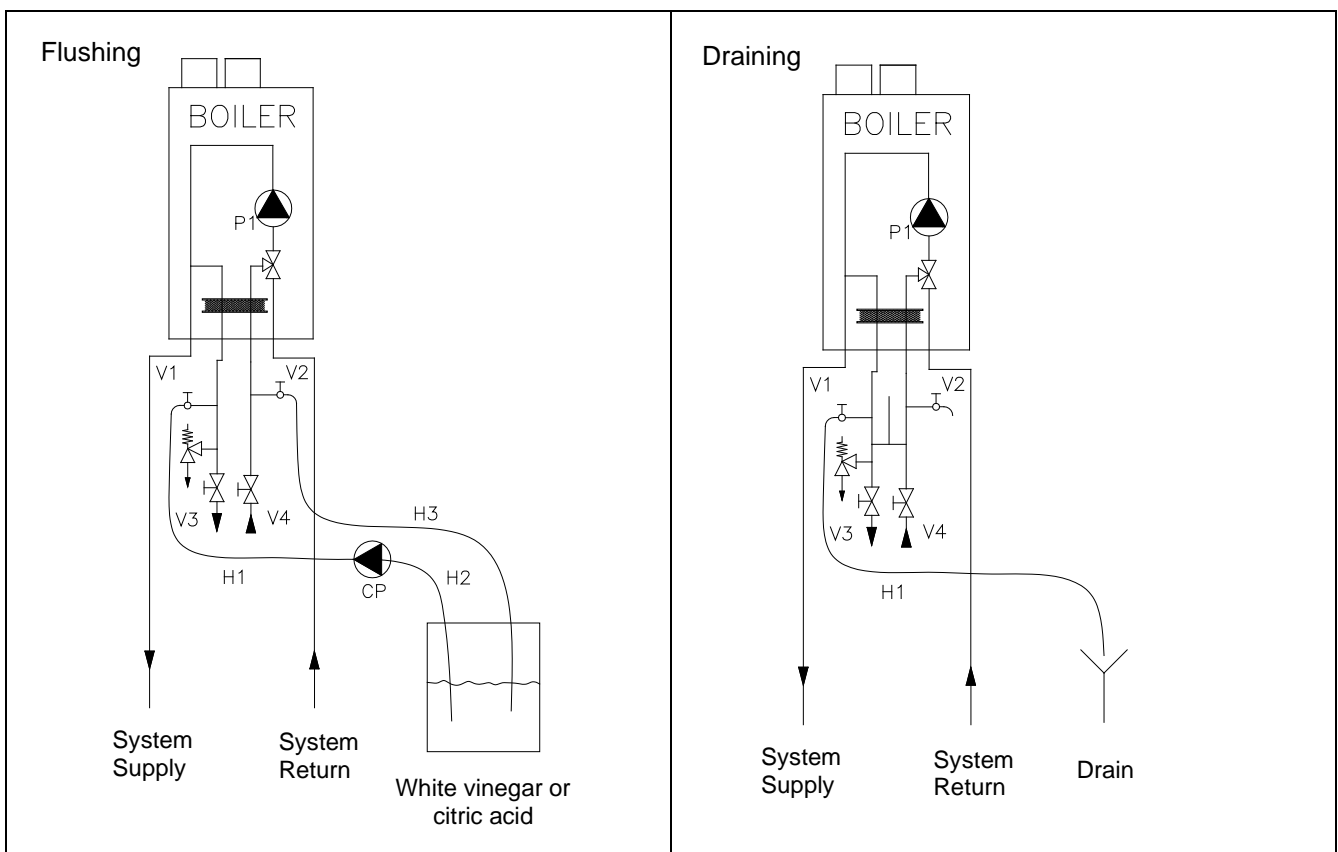



Figure 18.20

## 18.6 Maintenance Checklist

	<p>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 <b>ARE NOT</b> covered under warranty</p>
---	--

Periodic maintenance must be performed once a year by a qualified service technician to guarantee that all 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 also inform the owner that the lack of proper care and maintenance of the boiler may result in a hazardous condition.

### Maintenance Table

Inspection activities		Date Last completed			
		1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> 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 <sub>2</sub> 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 18.				
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.				
Low water cut-off	Check the low water cut-off (LWCO) is not leaking and check for right pressure value by draining the water from boiler and comparing the value with a calibrated meter.				
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 18.2


# 19 USER INSTRUCTIONS

After installing and commissioning of the boiler, the installer is obliged to do the following:

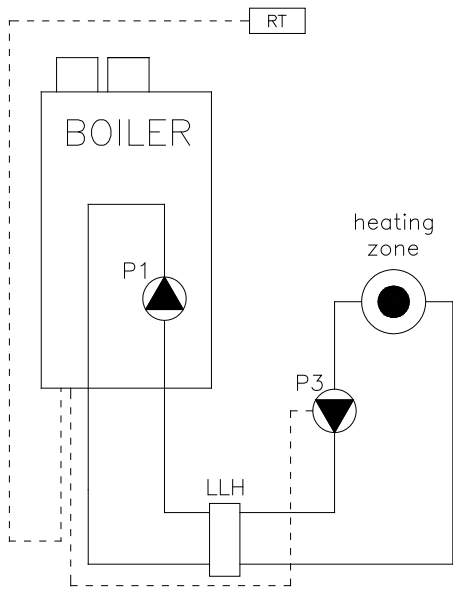
- Demonstrate the operation of the entire heating system to the end-user;
- Make the user familiar with all safety precautions of the boiler and the installation
- Instruct the user that service and maintenance of the boiler is required at least once every twelve months  
Regular service and maintenance 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.

# 20 INSTALLATION EXAMPLES

The following schematics present several examples of heating installations:

	<p><b>All schematics are purely functional.</b>  <b>Safety components, bypass, control devices and so on must be added to conform to all applicable standards and regulations.</b></p>
---	--

## System Example 1



EHS.T500.6010.300

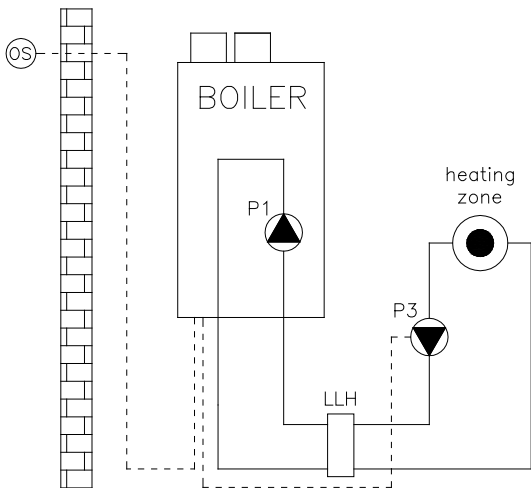
Low Voltage Connections		
	Name	Wire terminal
RT	Room thermostat	12-13

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

Figure 20.1

## System Example 2



EHS.T500.6010.301

## CH mode 2

Low Voltage Connections		
	Name	Wire terminal
OS	Outdoor temperature sensor	1-2

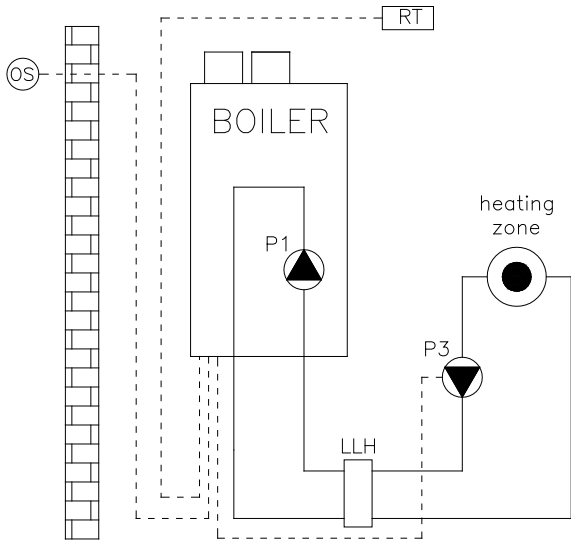
High Voltage Connections		
P1	Boiler circulator	6-7-PE
P3	Central heating circulator	4-5-PE
LLH	Low Loss Header	

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

Figure 20.2



### System Example 3



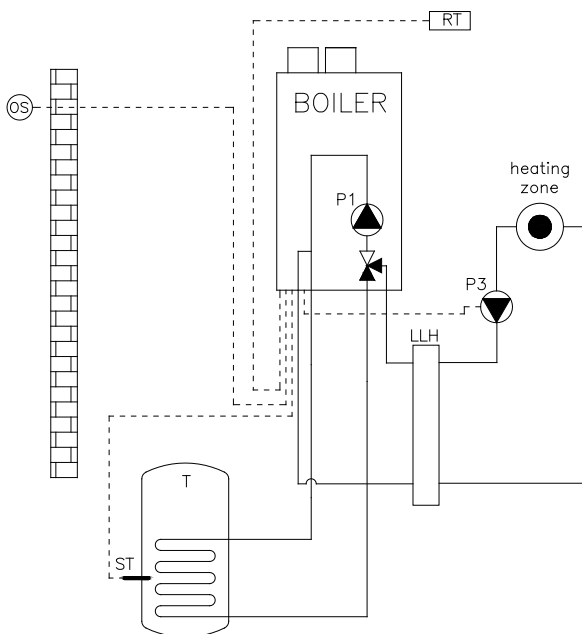
EHS.T500.6010.302

Figure 20.3

### 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	

### System Example 4



EHS.T500.6010.303

Figure 20.4

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
P3	System heating circulator	4-5-PE
DV	Diverter valve (3-way-valve)	1-2-3-PE
LLH	Low Loss Header	

### System example 5

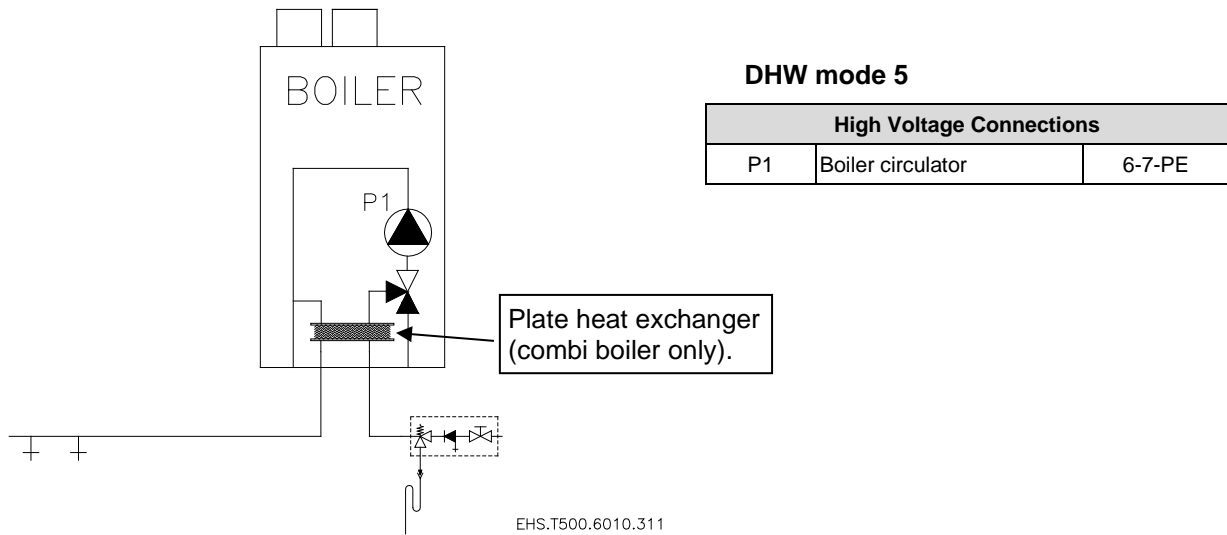


Figure 20.5

### System example 6

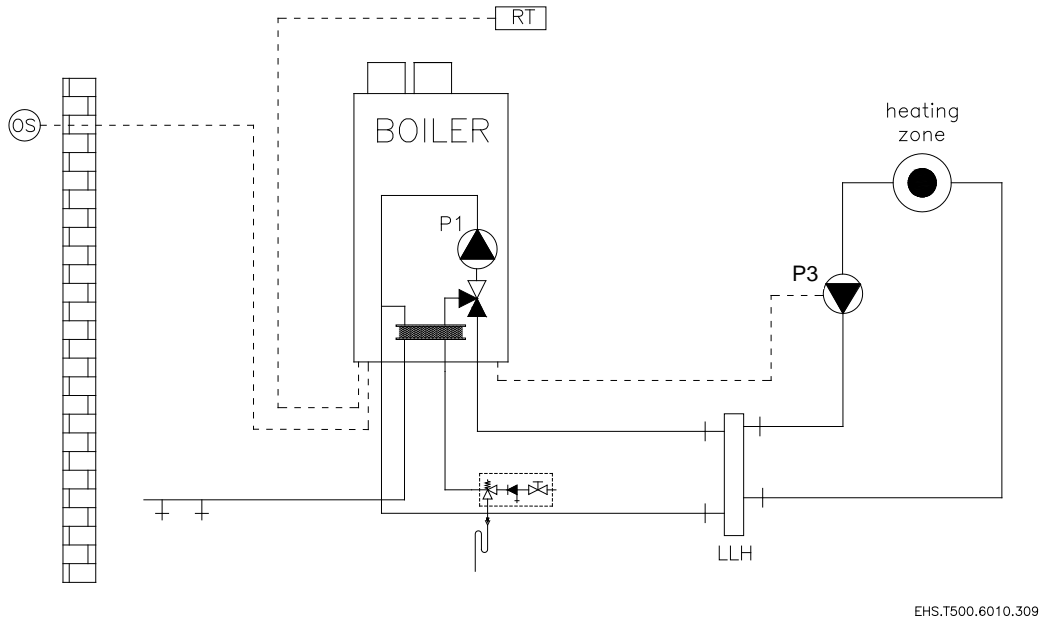


Figure 20.6

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

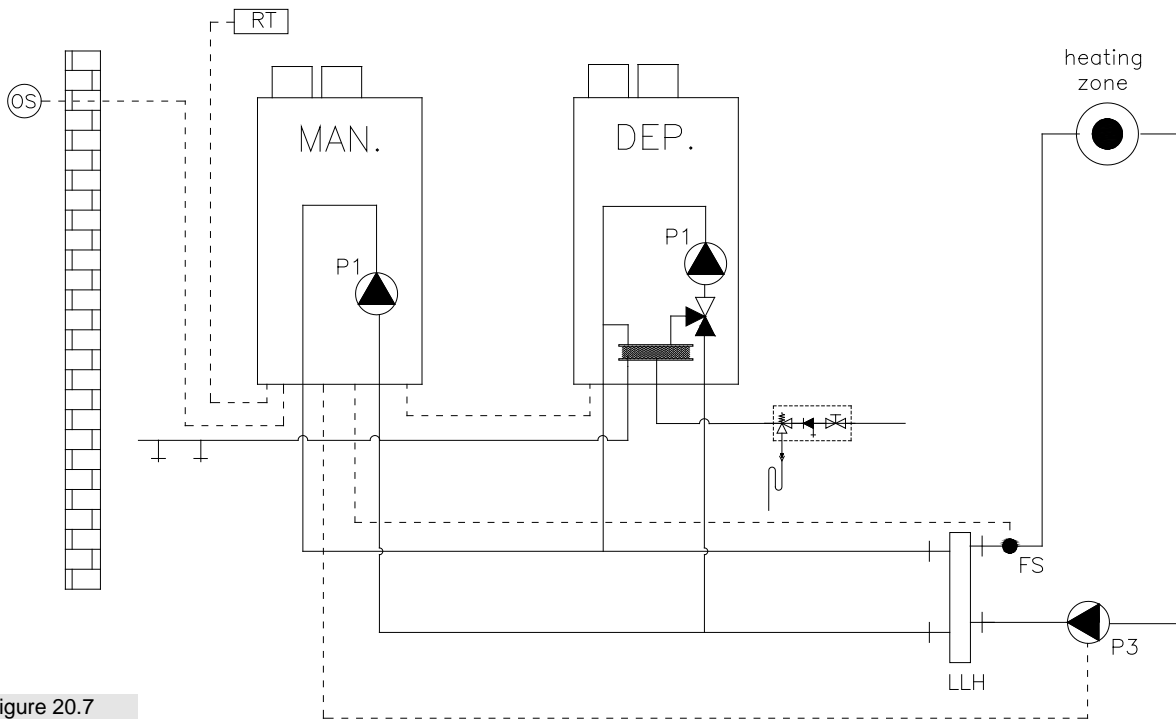


Figure 20.7

EHS.T500.6010.309

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 / DEP1

## 21 SPARE PARTS VGH-xx-CH

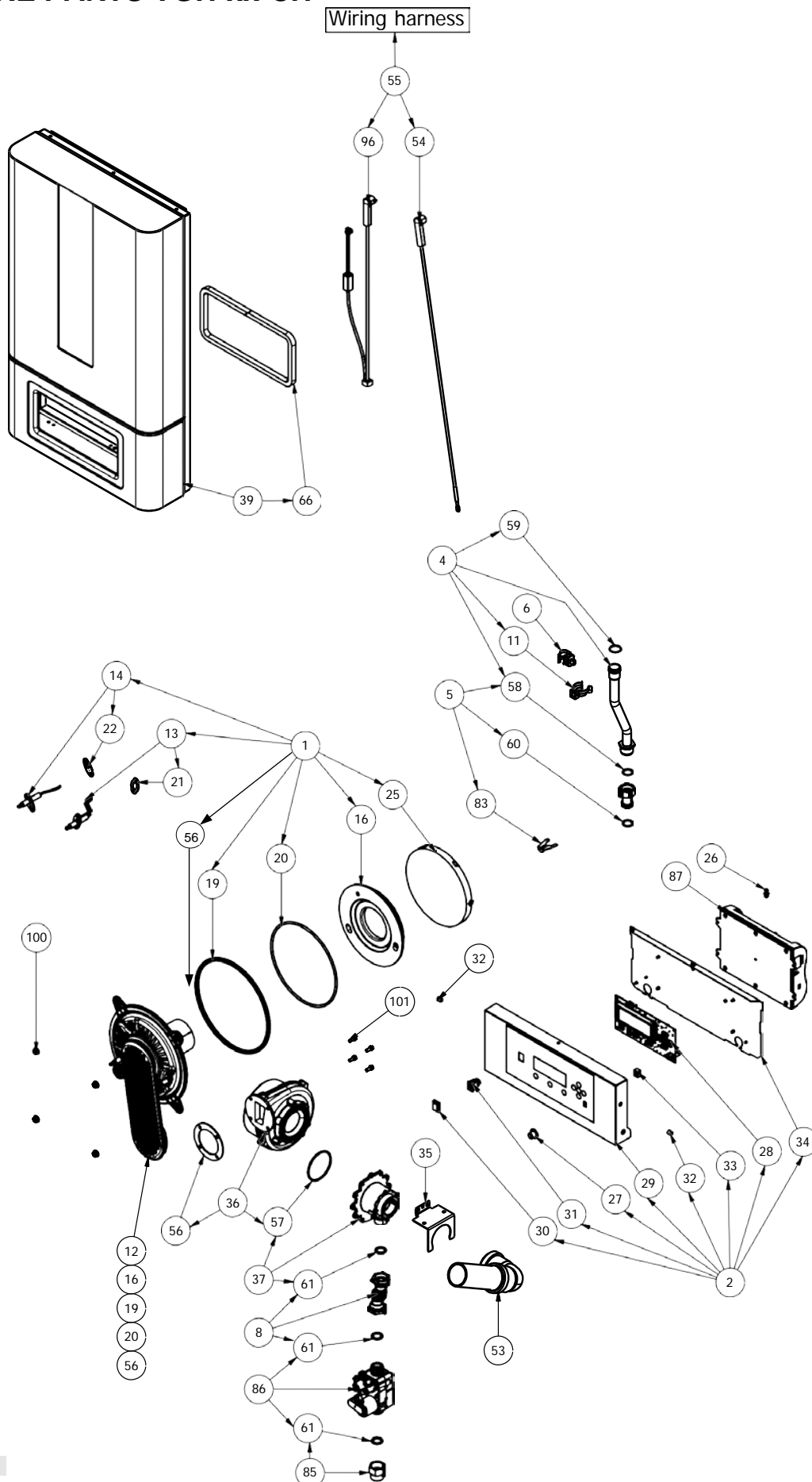
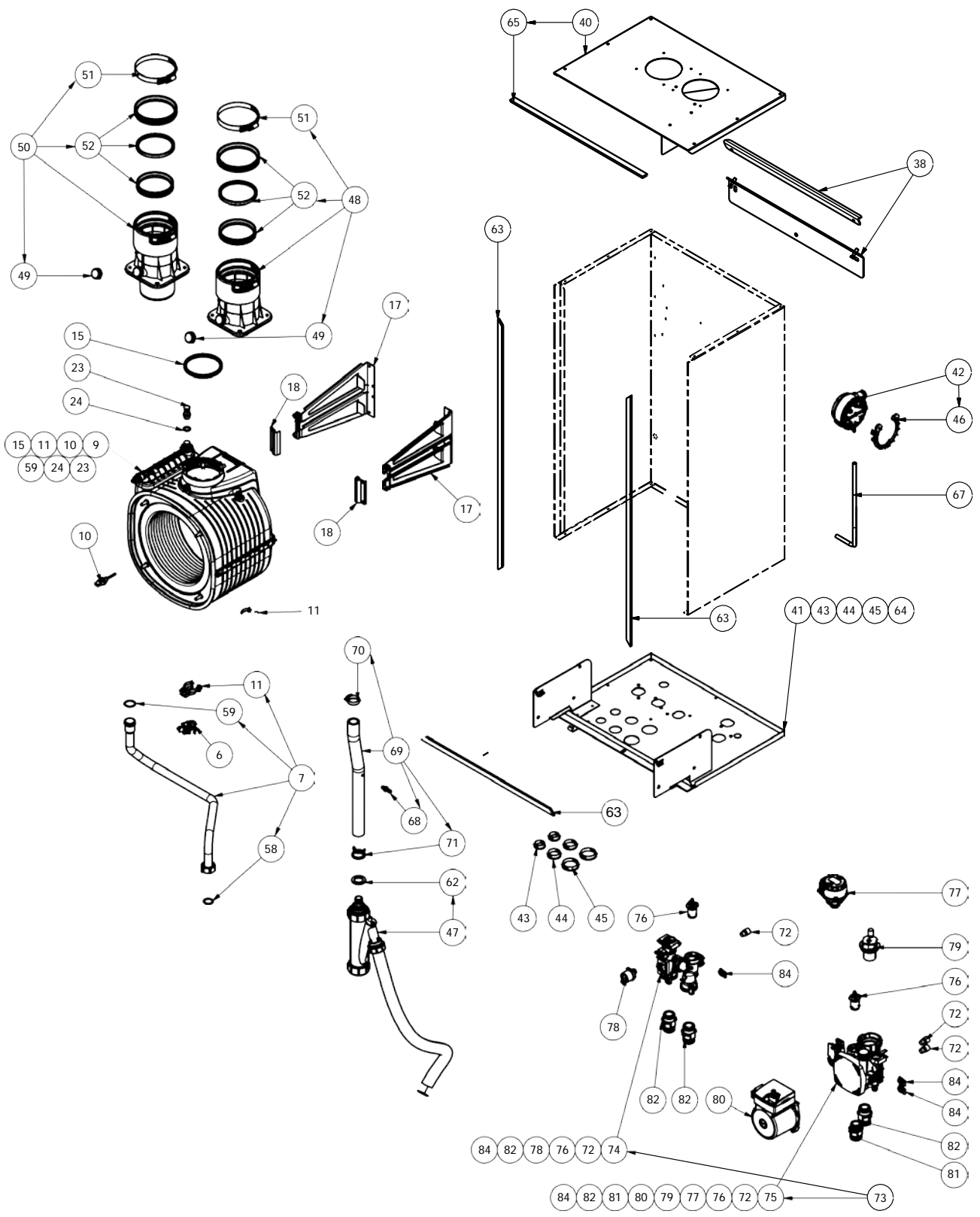


Figure 21.1



**Remarks:**

All parts are supplied with glued/bonded parts, such as grounding lips, strips, isolation, stickers. Also bolts and nuts are supplied if necessary.

Figure 21.2

## 21.1 Spare part list VGH-xx-CH

Pos	Description	Partnumber	VGH-xx-CH Type				
			80	100	120	150	180
1	VGH Residential Yearly Maintenance Service Kit	81 7285 000	x	x	x	x	x
2	Set. Electronics holder	81 7073 000	x	x	x	x	x
4	Supply Pipe section one VGH-80CH/100CH	81 7187 000	x	x	NA	NA	NA
4	Supply Pipe section one VGH-120CH/150CO	81 7188 000	NA	NA	x	NA	NA
4	Supply Pipe section one VGH-150CH/180CH/200CO	81 7189 000	NA	NA	NA	x	x
5	Connection pipe between hydroblock and supply section one	81 7190 000	x	x	x	x	x
6	Sensor NTC 10KOhm Ø18 mm	81 7248 000	x	x	x	x	x
7	Return pipe 80CH/100CH/120CH/90CO/150CO	81 7243 000	x	x	x	NA	NA
7	Return pipe 150CH/180CH/200CO	81 7244 000	NA	NA	NA	x	x
8	Gas Pipe 80CH/100CH/90CO	81 7195 000	x	x	NA	NA	NA
8	Gas Pipe 120CH/150CO	81 7196 000	NA	NA	x	NA	NA
8	Gas Pipe 150CH/180CH/200CO	81 7197 000	NA	NA	NA	x	x
9	Heat exchanger 80CH/90CO	81 7201 000	x	NA	NA	NA	NA
9	Heat exchanger 100CH	81 7202 000	NA	x	NA	NA	NA
9	Heat exchanger 120CH/150CO	81 7203 000	NA	NA	x	NA	NA
9	Heat exchanger 150CH/180CH/200CO	81 7204 000	NA	NA	NA	x	x
10	NTC Flue gas sensor 10 KOHM = R25 B=3977K quick connect	81 7225 000	x	x	x	x	x
11	Sermeta quick connect clip	81 7249 000	x	x	x	x	x
12	Burner door 80CH/90CO	81 7250 000	x	NA	NA	NA	NA
12	Burner door 100CH	81 7251 000	NA	x	NA	NA	NA
12	Burner door 120CH/150CO	81 7252 000	NA	NA	x	NA	NA
12	Burner door 150CH/180CH/200CO	81 7253 000	NA	NA	NA	x	x
13	Ignition Electrode	81 7216 000	x	x	x	x	x
14	Ionization Electrode	81 7218 000	x	x	x	x	x
15	Heat exchanger flue outlet gasket 80mm	81 7193 000	x	x	x	x	x
16	Burner Door Insulation	81 7182 000	x	x	x	x	x
17	Heat Exchanger Bracket VGH-80CH/90CO	81 7258 000	x	NA	NA	NA	NA
17	Heat Exchanger Bracket VGH-100CH	81 7259 000	NA	x	NA	NA	NA
17	Heat Exchanger Bracket VGH-120CH/150CO	81 7260 000	NA	NA	x	NA	NA
17	Heat Exchanger Bracket VGH-150CH/180CH/200CO	81 7261 000	NA	NA	NA	x	x
18	Bracket Heat Exchanger Clip	81 7174 000	x	x	x	x	x
19	Burner door gasket	81 7180 000	x	x	x	x	x
20	Fiber Braid for burner door Ø187.5x4 mm	81 7186 000	x	x	x	x	x
21	Ignition Electrode gasket	81 7217 000	x	x	x	x	x
22	Ionization Electrode gasket	81 7219 000	x	x	x	x	x
23	Heat exchanger drain plug	81 7206 000	x	x	x	x	x
24	Heat exchanger drain O-ring	81 7205 000	x	x	x	x	x
25	Refractory insulation	81 7289 000	x	x	x	x	x
26	Box 10pcs Fuse 5 AT	81 7291 000	x	x	x	x	x
27	Rubber plug Ø13 mm	81 7245 000	x	x	x	x	x
28	Pixel Button Display	81 7031 000	x	x	x	x	x
29	Display front panel	81 7167 000	x	x	x	x	x

Table 21.1

Pos	Description	Partnumber	VGH-xx-CH Type				
			80	100	120	150	180
30	Dustcover ON/OFF switch	81 7071 000	x	x	x	x	x
31	Power Supply Switch	81 7072 000	x	x	x	x	x
32	Spring plunger 8mm	81 7070 000	x	x	x	x	x
33	EPDM sealing for EBM 957	81 7185 000	x	x	x	x	x
34	Mounting plate burner control	81 7224 000	x	x	x	x	x
35	Bracket air intake damper	81 7173 000	x	x	x	x	x
36	Combustion Blower NRG118/115W (120VAC)	81 7241 000	x	x	x	x	NA
36	Combustion Blower RG148/300W (120VAC)	81 7242 000	NA	NA	NA	NA	x
37	Venturi (natural gas) 80-CH	81 7231 000	x	NA	NA	NA	NA
37	Venturi (natural gas) 100-CH	81 7232 000	NA	x	NA	NA	NA
37	Venturi (natural gas) 120-CH	81 7230 000	NA	NA	x	NA	NA
37	Venturi (natural gas) 150-CH	81 7233 000	NA	NA	NA	x	NA
37	Venturi (natural gas) 180-CH	81 7234 000	NA	NA	NA	NA	x
38	Wall mouting plate with locking bracket	81 7264 000	x	x	x	x	x
39	Front Boiler Cover	81 7194 000	x	x	x	x	x
40	Top panel	81 7268 000	x	x	x	x	x
41	Bottom panel CH	81 7171 000	x	x	x	x	x
42	Pressure switch	81 7239 000	x	x	x	x	x
43	Knock Out Seal ½" nylon	81 7220 000	x	x	x	x	x
44	Knock Out Seal ¾" nylon	81 7221 000	x	x	x	x	x
45	Knock Out Seal 1" nylon	81 7222 000	x	x	x	x	x
46	Snap ring pressure switch	81 7267 000	x	x	x	x	x
47	Condensate trap	81 7263 000	x	x	x	x	x
48	3 in 1 one intake air vent connector 80mm / 3"	81 7169 000	x	x	x	x	x
49	Combustion Test port Cap M20x2 Ral-9012	81 7293 000	x	x	x	x	x
50	3 in 1 one exhaust vent connector 80mm / 3"	81 7170 000	x	x	x	x	x
51	Clamp Boiler connector Ø80 mm	81 7181 000	x	x	x	x	x
52	3 in 1 one exhaust connector gasket kit 80mm / 3" (contains all 3 gaskets)	81 7262 000	x	x	x	x	x
53	Intake air Silencer	81 7265 000	x	x	x	x	x
54	Ignition cable BIC	81 7215 000	x	x	x	x	x
55	Type B cable harness Residential Boiler	81 7269 000	x	x	x	x	x
56	Sealing mix tube and fan Ø58mm (open)	81 7246 000	x	x	x	x	x
57	O-ring Ø63x3 mm	81 7228 000	x	x	x	x	NA
57	O-ring Ø70x3 mm	81 7229 000	NA	NA	NA	NA	x
58	Gasket Ø23xØ18x1 mm	81 7199 000	x	x	x	x	x
59	O-ring Ø22xØ2 mm	81 7227 000	x	x	x	x	x
60	O-ring Ø17.86x2,62	81 7226 000	x	x	x	x	x
61	Gasket Ø23.5xØ17.8x2 mm	81 7198 000	x	x	x	x	x
62	Gasket Ø30xØ21x3 mm	81 7200 000	x	x	x	x	x
63	Silicone seal 13x5 mm self adhesive	81 7266 000	x	x	x	x	x
65	EPDM seal 15x5 self mm adhesive	81 7184 000	x	x	x	x	x
66	EPDM seal 10x12 self mm adhesive	81 7183 000	x	x	x	x	x

Table 21.2

Pos	Description	Partnumber	VGH-xx-CH Type				
			80	100	120	150	180
67	Hose pressure switch	81 7209 000	x	x	x	x	x
68	Hose coupling	81 7208 000	x	x	x	x	x
69	PVC hose Ø27x19 mm with inlays	81 7240 000	x	x	x	x	x
70	Hose clamp 25-28 mm	81 7207 000	x	x	x	x	x
71	Hose spring clamps Ø25.40 mm	81 7297 000	x	x	x	x	x
72	Hydroblok plug	81 7214 000	x	x	x	x	x
73	Hydroblock CH (heating)	81 7210 000	x	x	x	x	x
74	Hydroblock CH-Flow Group	81 7211 000	x	x	x	x	x
75	Hydroblock CH-Return Group	81 7212 000	x	x	x	x	x
76	Hydroblock Plug	81 7168 000	x	x	x	x	x
77	3 way valve	81 7164 000	x	x	x	x	x
78	Pressure sensor Eltek	81 7238 000	x	x	x	x	x
79	Automatic air vent in hydroblock	81 7166 000	x	x	x	x	x
80	Circulator Motor UPS/R	81 7223 000	x	x	x	x	x
81	Union 3/4" NPT Pump house	81 7299 000	x	x	x	x	x
82	Union 3/4" NPT Flow Group	81 7300 000	x	x	x	x	x
83	Clip D18	81 7302 000	x	x	x	x	x
84	Clip D10	81 7303 000	x	x	x	x	x
85	Adapter ¾" BSP to ¾" NPT	81 7165 000	x	x	x	x	x
86	Gas Valve (120VAC)	81 7257 000	x	x	x	x	x
87	Burner Control 900MN (120VAC) 80-100-120 CH	81 7175 000	x	x	x	NA	NA
87	Burner Control 900MN (120VAC) 150-180 CH	81 7178 000	NA	NA	NA	x	x
96	Wiring harness Ionisation + Gasvalve cable	81 7294 000	x	x	x	x	x
100	Burner door nut	81 7290 000	x	x	x	x	x
101	Hex nuts for fan incl spring locks	81 7292 000	x	x	x	x	x

Table 21.3



## 22 SPARE PARTS VGH-CO

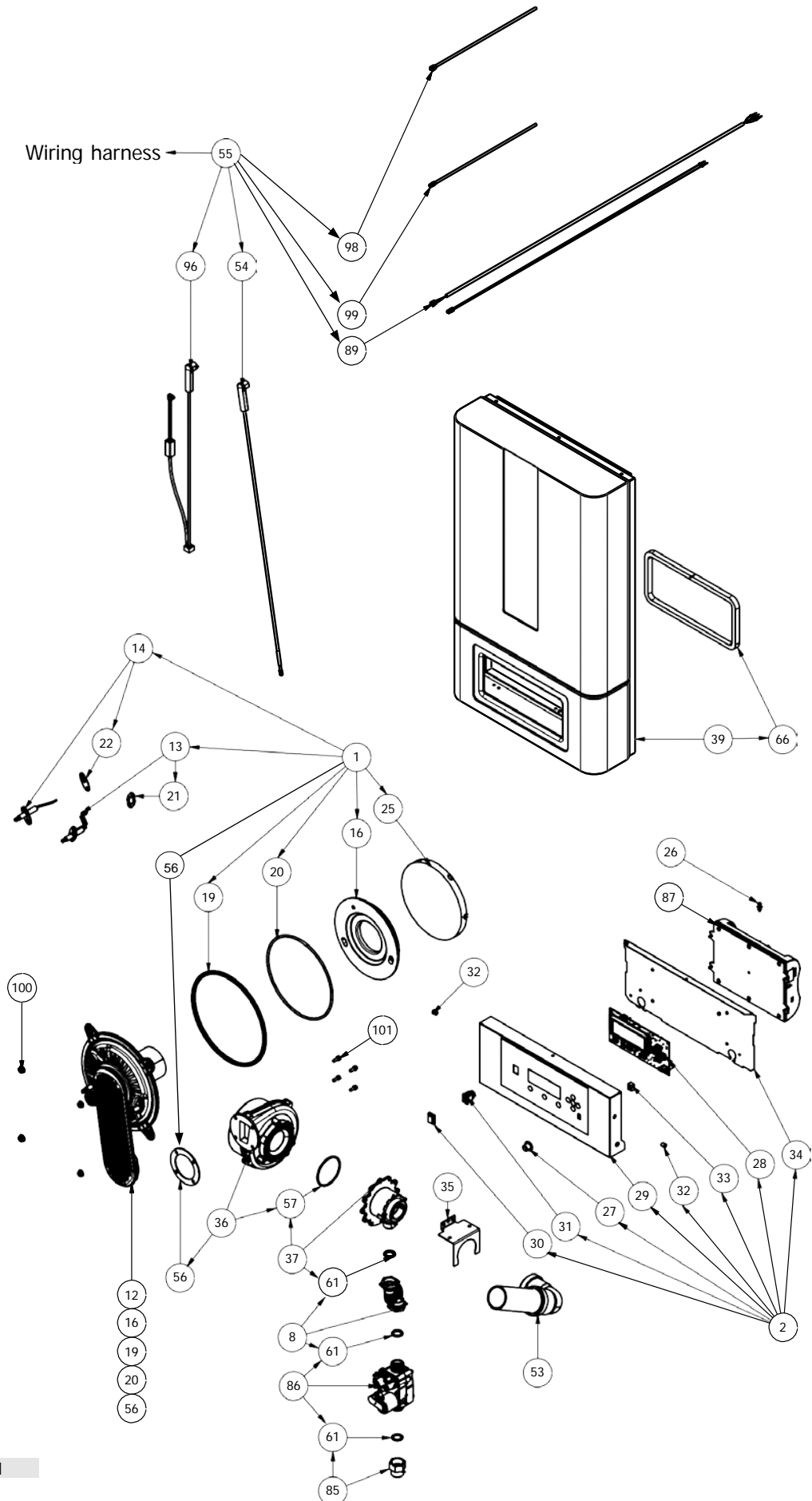
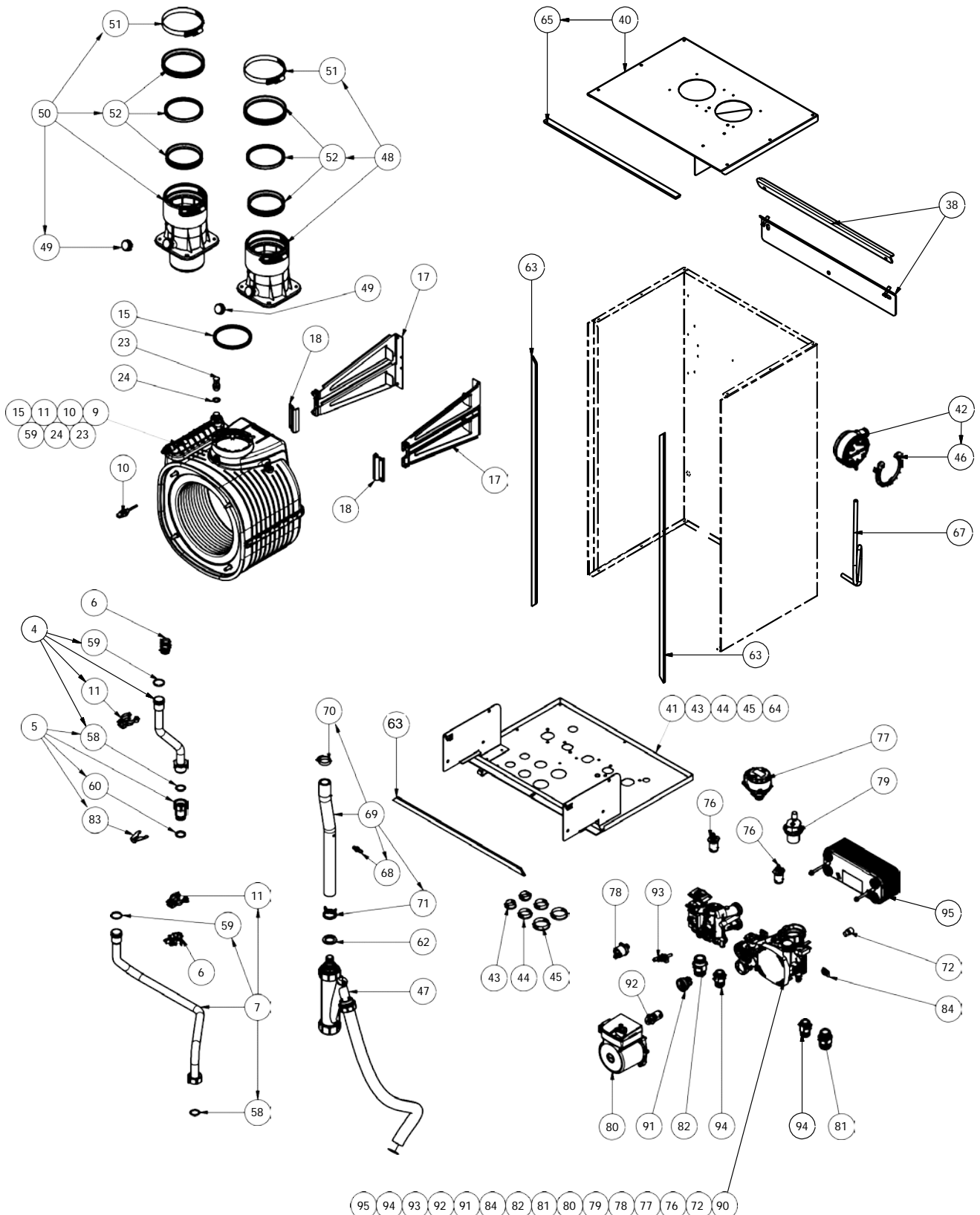


Figure 22.1



**Remarks:**

All parts are supplied with glued/bonded parts, such as grounding lips, strips, isolation, stickers. Also bolts and nuts are supplied if necessary.

Figure 22.2

## 22.1 Spare part list VGH-xx-CO

Pos.	Description	Partnumber	VGH-xx-CO Type		
			90	150	200
1	VGH Residential Yearly Maintenance Service Kit	81 7285 000	x	x	x
2	Set Electronics holder	81 7073 000	x	x	x
4	Supply Pipe section one VGH-80CH/90CO/100CH	81 7187 000	x	NA	NA
4	Supply Pipe section one VGH-120CH/150CO	81 7188 000	NA	x	NA
4	Supply Pipe section one VGH-150CH/180CH/200CO	81 7189 000	NA	NA	x
5	Connection pipe between hydroblock and supply section one	81 7190 000	x	x	x
6	Sensor NTC 10KOhm Ø18 mm	81 7248 000	x	x	x
7	Return pipe 80CH/100CH/120CH/90CO/150CO	81 7243 000	x	x	NA
7	Return pipe 150CH/180CH/200CO	81 7244 000	NA	NA	x
8	Gas Pipe 80CH/100CH/90CO	81 7195 000	x	NA	NA
8	Gas Pipe 120CH/150CO	81 7196 000	NA	x	NA
8	Gas Pipe 150CH/180CH/200CO	81 7197 000	NA	NA	x
9	Heat exchanger 80CH/90CO	81 7201 000	x	NA	NA
9	Heat exchanger 120CH/150CO	81 7203 000	NA	x	NA
9	Heat exchanger 150CH/180CH/200CO	81 7204 000	NA	NA	x
10	NTC Flue gas sensor 10 KOHM = R25 B=3977K quick connect	81 7225 000	x	x	x
11	Sermeta quick connect clip	81 7249 000	x	x	x
12	Burner door 80CH/90CO	81 7250 000	x	NA	NA
12	Burner door 120CH/150CO	81 7252 000	NA	x	NA
12	Burner door 150CH/180CH/200CO	81 7253 000	NA	NA	x
13	Ignition Electrode	81 7216 000	x	x	x
14	Ionization Electrode	81 7218 000	x	x	x
15	Heat exchanger flue outlet gasket 80 mm	81 7193 000	x	x	x
16	Burner Door Insulation	81 7182 000	x	x	x
17	Heat Exchanger Bracket VGH-80CH/90CO	81 7258 000	x	NA	NA
17	Heat Exchanger Bracket VGH-120CH/150CO	81 7260 000	NA	x	NA
17	Heat Exchanger Bracket VGH-150CH/180CH/200CO	81 7261 000	NA	NA	x
18	Bracket Heat Exchanger Clip	81 7174 000	x	x	x
19	Burner door gasket	81 7180 000	x	x	x
20	Fiber Braid for burner door Ø187.5x4 mm	81 7186 000	x	x	x
21	Ignition Electrode gasket	81 7217 000	x	x	x
22	Ionization Electrode gasket	81 7219 000	x	x	x
23	Heat exchanger drain plug	81 7206 000	x	x	x
24	Heat exchanger drain O-ring	81 7205 000	x	x	x
25	Refractory insulation	81 7289 000	x	x	x
26	Box 10pcs Fuse 5 AT	81 7291 000	x	x	x
27	Rubber plug Ø13 mm	81 7245 000	x	x	x
28	Pixel Button Display	81 7031 000	x	x	x
29	Display front panel	81 7167 000	x	x	x
30	Dustcover ON/OFF switch	81 7071 000	x	x	x

Table 22.1

Pos.	Description	Partnumber	VGH-xx-CO Type		
			90	150	200
31	Power Supply Switch	81 7072 000	x	x	x
32	Spring plunger 8 mm	81 7070 000	x	x	x
33	EPDM sealing for EBM 957	81 7185 000	x	x	x
34	Mounting plate burner control	81 7224 000	x	x	x
35	Bracket air intake damper	81 7173 000	x	x	x
36	Combustion Blower NRG118/115W (120VAC)	81 7241 000	x	x	NA
36	Combustion Blower RG148/300W (120VAC)	81 7242 000	NA	NA	x
37	Venturi (natural gas) 90-CO	81 7235 000	x	NA	NA
37	Venturi (natural gas) 150-CO	81 7236 000	NA	x	NA
37	Venturi (natural gas) 200-CO	81 7237 000	NA	NA	x
38	Wall mouting plate with locking bracket	81 7264 000	x	x	x
39	Front Boiler Cover	81 7194 000	x	x	x
40	Top panel	81 7268 000	x	x	x
41	Bottom panel CO	81 7172 000	x	x	x
42	Pressure switch	81 7239 000	x	x	x
43	Knock Out Seal ½" nylon	81 7220 000	x	x	x
44	Knock Out Seal ¾" nylon	81 7221 000	x	x	x
45	Knock Out Seal 1" nylon	81 7222 000	x	x	x
46	Snap ring pressure switch	81 7267 000	x	x	x
47	Condensate trap	81 7263 000	x	x	x
48	3 in 1 one intake air vent connector 80mm / 3"	81 7169 000	x	x	x
49	Combustion Test port Cap M20x2 Ral-9012	81 7293 000	x	x	x
50	3 in 1 one exhaust vent connector 80mm / 3"	81 7170 000	x	x	x
51	Clamp Boiler connector Ø80 mm	81 7181 000	x	x	x
52	3 in 1 one exhaust connector gasket kit 80mm / 3" (contains all 3 gaskets)	81 7262 000	x	x	x
53	Intake air Silencer	81 7265 000	x	x	x
54	Ignition cable BIC	81 7215 000	x	x	x
55	Type B cable harness Residential Boiler	81 7269 000	x	x	x
56	Sealing mix tube and fan Ø58mm (open)	81 7246 000	x	x	x
57	O-ring Ø63x3 mm	81 7228 000	x	x	NA
57	O-ring Ø70x3 mm	81 7229 000	NA	NA	x
58	Gasket Ø23xØ18x1 mm	81 7199 000	x	x	x
59	O-ring Ø22xØ2 mm	81 7227 000	x	x	x
60	O-ring Ø17.86x2.62 mm	81 7226 000	x	x	x
61	Gasket Ø23.5xØ17.8x2	81 7198 000	x	x	x
62	Gasket Ø30xØ21x3 mm	81 7200 000	x	x	x
63	Silicone seal 13x5 mm self adhesive	81 7266 000	x	x	x
65	EPDM seal 15x5 mm self adhesive	81 7184 000	x	x	x
66	EPDM seal 10x12 mm self adhesive	81 7183 000	x	x	x
67	Hose pressure switch	81 7209 000	x	x	x
68	Hose coupling	81 7208 000	x	x	x
69	PVC hose Ø27x19 mm with inlays	81 7240 000	x	x	x
70	Hose clamp 25-28 mm	81 7207 000	x	x	x

Table 22.2

Pos.	Description	Partnumber	VGH-xx-CO Type		
			90	150	200
71	Hose spring clamps Ø 25.40 mm	81 7297 000	x	x	x
72	Hydroblok plug	81 7214 000	x	x	x
76	Hydroblock Plug	81 7168 000	x	x	x
77	3 way valve	81 7164 000	x	x	x
78	Pressure sensor Eltek	81 7238 000	x	x	x
79	Automatic air vent in hydroblock	81 7166 000	x	x	x
80	Circulator Motor UPS/R	81 7223 000	x	x	x
81	Union 3/4" NPT Pump house	81 7299 000	x	x	x
82	Union 3/4" NPT Flow Group	81 7300 000	x	x	x
83	Clip D18	81 7302 000	x	x	x
84	Clip D10	81 7303 000	x	x	x
85	Adapter ¾" BSP to ¾" NPT	81 7165 000	x	x	x
86	Gas Valve (120VAC)	81 7257 000	x	x	x
87	Burner Control 900MN (120VAC) 90 CO	81 7176 000	x	NA	NA
87	Burner Control 900MN (120VAC) 150 CO	81 7177 000	NA	x	NA
87	Burner Control 900MN (120VAC) 200 CO	81 7179 000	NA	NA	x
89	Type C cable harness Residential Boiler	81 7270 000	x	x	x
90	Hydroblock CO (combi)	81 7213 000	x	x	x
91	Flow sensor assembly	81 7192 000	x	x	x
92	Flow restrictor assembly	81 7191 000	x	x	x
93	Sensor NTC 10KOhm 25°C	81 7247 000	x	x	x
94	Union 1/2" NPT DHW	81 7301 000	x	x	x
95	Plate Heat exchanger DHW	81 7298 000	x	x	x
96	Wiring harness Ionisation + Gasvalve cable	81 7294 000	x	x	x
98	Wiring harness DHW Flow sensor	81 7295 000	x	x	x
99	Wiring harness DHW temp sensor	81 7296 000	x	x	x
100	Burner door nut 4 pcs.	81 7290 000	x	x	x
101	Hex nuts for fan incl spring locks	81 7292 000	x	x	x

Table 22.3







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