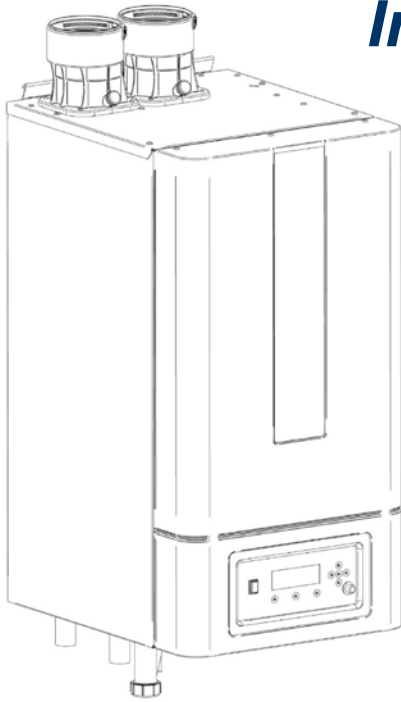


Installation and service manual

High efficiency condensing water heaters.



HWB-299
HWB-399
HWB-499



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 vapours 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 neighbour'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.



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

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.

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

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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 Water heater 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

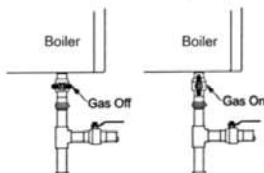
FOR YOUR SAFETY READ BEFORE OPERATING

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.

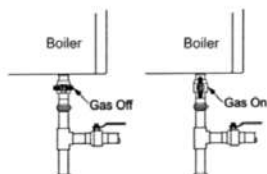
POUR VOTRE SÉCURITÉ LISEZ AVANT DE METTRE EN MARCHÉ

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. Attendre cinq (5) minutes pour laisser échapper tout le gaz. Reniflez tout autour de l'appareil, y compris près du plancher, pour déceler une odeur de gaz. Si vous sentez une odeur de gaz, ARRÊTEZ ! Passez à l'étape B des instructions de sécurité sur la portion supérieure (à gauche) de cette étiquette. S'il n'y a pas d'odeur de gaz, passez à l'étape suivante.
8. Tournez la vanne manuelle de contrôle du gaz ↻ en position ON (parallèle à la tuyauterie de gaz).
9. Mettez l'appareil sous tension.
10. Réglez le thermostat à la température désirée.
11. Si l'appareil ne se met pas en marche, suivez les instructions intitulées "Comment couper l'admission de gaz de l'appareil" et appelez un technicien qualifié ou le fournisseur de gaz.



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

1. 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.



This water heater is equipped with a pressure switch in the event of a blocked vent the water heater will lockout. No attempt by the user/owner should be made to put the water heater back into operation. A qualified service technician should be notified of the issue. The water heater should only be reset by a qualified service technician after they have diagnosed and corrected the issued that caused the safety lockout of the water heater.



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



Eco King Heating Products Inc. recommends the installation of a carbon monoxide detector in the water heater room for all installations.



WARNING: There are no user serviceable parts on this water heater. Warranty does not cover defects caused by attempts to service this water heater by someone other than a qualified gas service technician. These attempts could cause property damage, personal injury or loss of life.



WARNING

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



Avertissement

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



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



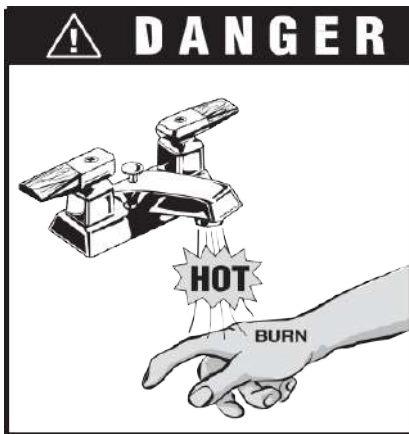
WARNING: Crystalline Silica - Certain components in the combustion chamber may contain this potential carcinogen. Improper installation, adjustment, alteration, service or maintenance can cause property damage, serious injury (exposure to hazardous materials) or death. Refer to Section 19 for information 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 water heater. This water heater contains materials that have been identified as carcinogenic, or possibly carcinogenic, to humans).



WARNING: Water temperatures over 125 °F (52 °C) can cause severe burns instantly or death from scalding. The water temperature is factory set at 140 °F (60 °C) to minimize legionella risk. Before bathing or showering always check the water temperature.

To meet commercial hot water requirements, the water heater setpoint is adjustable up to 190°F. However, water temperatures over 125°F can cause severe burns instantly or death from scalds. This is the preferred starting point for setting the control for supplying general purpose hot water.

Safety and energy conservation are factors to be considered when setting the water temperature on the water heater. The most energy efficient operation will result when the temperature setting is the lowest that satisfies the needs consistent with the application. The table below details the relationship of water temperature and time with regard to scald injury and may be used as a guide in determining the safest water temperature for your applications.



Water temperature over 125°F can cause instant severe burns or death from scalds.

Children, disabled, and elderly are at highest risk of being scalded.

See instruction manual before setting temperature at water heater.

Feel water before bathing or showering.

Use temperature limiting valves.

Temperature	Time to Produce Serious Burn
120°F	More than 5 minutes
125°F	1-1/2 to 2 minutes
130°F	About 30 seconds
135°F	About 10 seconds
140°F	Less than 5 seconds
145°F	Less than 3 seconds
150°F	About 1-1/2 seconds

Table courtesy of Shriners Burn Institute.

Maximum water temperatures occur just after burner has shut off. To find hot water temperature being delivered, turn on a hot water faucet and place a thermometer in the hot water stream and read the thermometer.

Time/Temperature Relationships in Scalds

The temperature of the water in the storage tank can be regulated by setting the temperature at the water heater. To comply with safety regulations, the setpoint was set at its lowest setting before shipment from the factory.



There is a Hot Water SCALD Potential if the water heater setpoint is set too high.



Hotter water increases the risk of SCALDING!



When this heater is supplying general purpose hot water requirements for use by individuals, a thermostatically controlled mixing valve for reducing point of use water temperature is recommended to reduce the risk of scald injury. Contact a licensed plumber or the local plumbing authority for further information.

2 INTRODUCTION

This manual is written for the installer and service technician.

Eco King Heating Products Inc. is not accountable for any damage caused by failure to correctly follow these instructions. For service and repair purposes use only original Eco King Heating Products Inc. spare parts.

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

This manual is subject to change without notice.

2.1 Explanations.

CHB/CB = Condensing Boiler

HWB = Hot Water Boiler for Hot Water (drinking water) usage only.

CH = Central Heating (for central heating purposes and/or indirect hot water)

BCU = burner control unit

PB = display board/ control panel (Pixel Button)

299/399/499 = Model number of the water heater.

2.2 Maintenance and inspection

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.

Maintenance and inspection of the water heater should be carried out at the following occasions:

- When a number of similar error codes and/or lockouts appear.
- At least every 12 months maintenance must be done to ensure safe and efficient operation.

Damage caused by lack of maintenance will not be covered under warranty

Ce manuel est écrit pour l'installateur et le technicien d'entretien.

Eco King Heating Products Inc. 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 Eco King Heating Products Inc.

Tout documentation produit par le fabricant est sous réserve de la loi sur le droit d'auteur. Ce manuel est sujet à changement sans préavis.

Explications.

CHB = Chaudière à condensation.

HWB = Chauffe-eau pour eau chaude sanitaire usage seulement.

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

BCU = commande (burner control unit)

PB = écran (Pixel Button)

299/399/499 = Modèle numéro de chaudière.

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 du chauffe-eau 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

2.3 For installations in the Commonwealth of Massachusetts.

The following local requirements apply in addition to all other applicable NFPA requirements:

For direct-vent water heaters, 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 comply:

- 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 shall be located in the room that houses the water heater and/or equipment and shall:**
 - a) Be powered by the same electrical circuit as the water heater and/or equipment such that only one service switch services both the water heater 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 shall be performed in strict compliance with the manufacturer's instructions. A copy of the installation instructions shall remain with the water heater and/or equipment at the completion of the installation.
- 4) A metal or plastic identification plate shall be mounted at the exterior of the building, four feet directly above the location of vent terminal. The plate shall be of sufficient size to be easily read from a distance of eight feet away and read "Gas Vent Directly Below".

For direct-vent water heaters mechanical-vent heating water heaters 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 comply:

- 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 shall:**
 - a) Be located in the room where the water heater and/or equipment is located;
 - b) Be either hard-wired or battery powered or both; and:
 - c) Shall 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 shall be in strict compliance with the manufacturer's instructions. A copy of the installation instructions shall remain with the water heater and/or equipment at the completion of the installation.

2.4 Important technical warnings and guidelines

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.

Maintenance and inspection of the water heater should be carried out at the following occasions:

- **When a number of similar error codes and/or lockouts appear.**
- **At least every 12 months maintenance must be done to ensure safe and efficient operation.**

Damage caused by lack of maintenance will not be covered under warranty

The Eco King Hot Water systems will, for a long period, comfortably meet your requirement of hot water of the right temperature at the right hour, provided that a few important conditions have been fulfilled regarding the installation.

Please follow all instructions and recommendations presented in this manual by Eco king, especially the ones concerning the next important topics:

- Water quality (also see §6.7 on page 29)

A first necessary condition is the quality of the water to be heated in the hot water heater.

Only potable water can be used with this water heater. Do not introduce pool or spa water, or any chemically treated water into the water heater.

Three values matter: hardness, total amount of dissolved solids and acidity. If water quality does NOT meet the requirements the system may be seriously damaged in time!

- ◆ Hardness should not exceed 205 PPM CaCO₃ (11,5°dH)
Water hardness leads to scale formation and may affect/damage the water heater. Hard water scaling must be avoided or controlled by proper water treatment.
- ◆ TDS (Total Dissolved Solids) should not exceed 450 PPM
- ◆ Hardness and TDS together may not exceed 450 PPM
- ◆ pH value should be between 6,5 and 7,5, measured cold
The actual values can be retrieved at your local water supplier.

If water quality doesn't meet the abovementioned requirements, a water treatment installation should be installed to improve water quality to the required levels, if possible.

- Water flow velocity and pump selection

For a given combination of water heaters and tanks, pump selection is very important with respect to the required flow velocity.

- Water flow velocity and piping diameters and lengths

Following the instructions and recommendations given in the referred paragraphs will highly improve the functioning and considerably lengthen the life time of your HW system.

Furthermore, for all Eco King appliances the next instructions and recommendations apply:

- ! *Never use aluminium or aluminium containing flue gas outlet*
- ! *Always fill the siphon before commissioning the water heater*
- ! *Always set the gas valves during commissioning the water heater, for the first time and after maintenance and/or installation changes*
- ! *Never place a ball valve between the safety valve and the water heater*
- ! *In a log, keep track of all situations regarding the appliance:
what, when, by whom, what actions and/or changes, what communication has been performed*

Eco King is not liable for any damage caused by inaccurately following these mounting instructions. Only Eco King parts may be used when carrying out any repair or service works.

Do not use chlorine based products for brazing.

When commissioning the water heater, the running of the water heater pump must be checked before leaving the installation.

Firing the water heater without water flow (but filled with water) will cause a boiling noise.

The Outlet and Inlet temperature are checked continuously. The temperature difference may not exceed the programmed value belonging to the actual power mode. If it does, the water heater will go in a lock-out.



The applied DHW pump must be controlled only by the HW water heater control. If, for any reason, an external pump control is applied *without written approval of Eco King*, the complete warranty on the HW water heater and all supplied parts will become invalid.

Minimum water pressure 15 psi.

Fuel used should have sulphur rates that comply with the next values: a maximum annual peak over a short period of time of 150 mg/m³ and an annual average of 30 mg/m³ maximum.

Combustion air must be free of contents of chlorine, ammonia, alkali agents. The air near a swimming pool, a washing machine or a laundry is containing these a.m. contents.

If the water heater is used in combination with a hot water tank without any other heat exchanger; the water heater should be equipped with a safety relief valve. In some cases also the tank should be equipped with a T&P relief valve. Always apply all applicable installation standards and regulations.

At first installation, the built-in automatic air vent should be open.

LEGIONNAIRES' DISEASE



An anti-Legionella function is present in the software and is default turned OFF when using mode 4 (Stand Alone) and is turned ON at DHW mode 1, Cascaded boilers. (its not possible to use the Anti-Legionella funtion at DHW mode 4.)

2.5 Pressure relief valve

This unit does not come with an approved pressure relief valve.

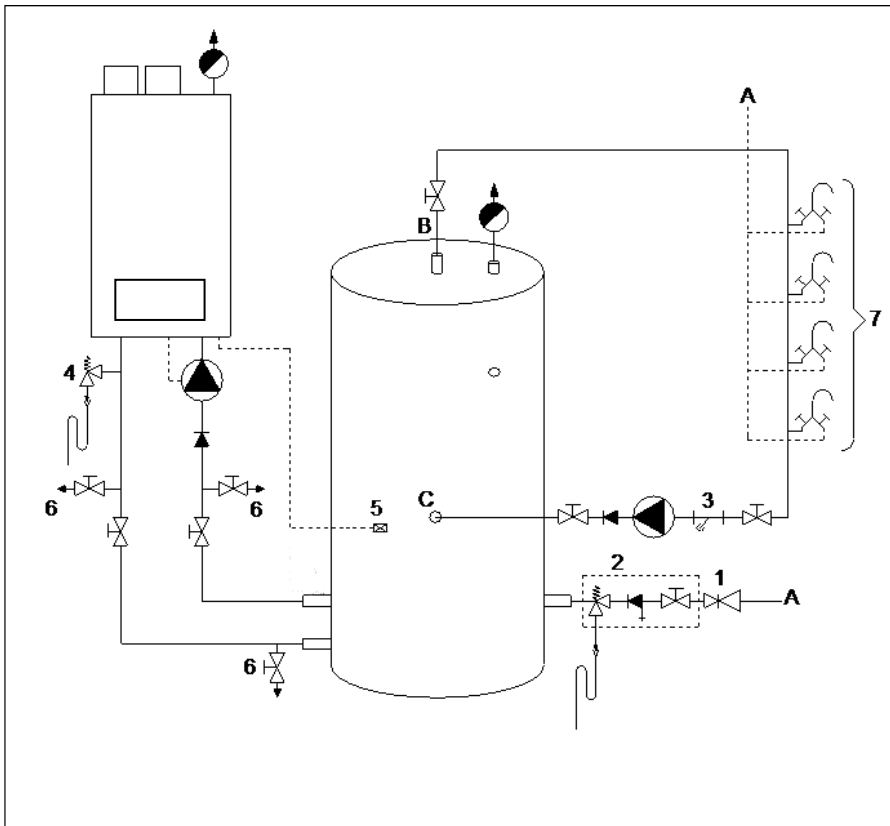
An approved pressure relief valve must be installed to the outlet of the water heater.

- The pressure relief valve must conform to ANSI Z21.22 or CAN 1-4.4 and installation must follow local codes.
- The BTUH rating of the relief valve must not be less than the BTUH input of the heater
- The pressure relief valve must not exceed the maximum working pressure indicated on the water heater rating plate.
- The discharge piping for the pressure relief valve must be directed so that the hot water cannot splash outward and cause damage or personal injury.
- Attach the discharge tube to the pressure relief valve and run the end of the tube to within 6 inches (152 mm) from the floor. This discharge tube must allow free and complete drainage without any restrictions.
- If the pressure relief valve discharges periodically, this may be due to thermal expansion in a closed water supply system. Contact the water supplier or a local plumbing professional on how to correct this situation. Do not plug the pressure relief valve.
- The pressure relief valve must be manually operated periodically to check for correct operation.
- Before operating the valve manually, check that it will discharge in a place for secure disposal.
- No valve must be placed between the relief valve and the water heater. DO NOT apply a closing valve or any other form of narrowing, because this might disturb the correct functioning of the safety valve.



Hot water could be released when the pressure relief valve is opened. This can result in severe personal injury. Before operating the pressure relief valve manually, check that it will discharge in a safe place. If water does not flow freely from the end of the discharge pipe, turn the gas supply and power OFF and call a qualified person to determine the cause. Refer to the pressure relief valve manufacturer's instructions for inspection and maintenance requirements.

The water heater and tank should be installed by a skilled installer according to all applicable standards and regulations for tap water installations. Use the next scheme as guideline. When multiple water heaters and tanks are applied, every combination has to be equipped with its own safety valve.



- A) Potable water inlet
 - B) Hot water supply circulation
 - C) Circulation return
- 1) Pressure relief valve (mandatory in case service water pressure is too high)
 - 2) Inlet combination with valve (mandatory)
 - 3) Apply filter if necessary (recommended)
 - 4) A suitable safety valve must be mounted near the water heater (mandatory)
This safety valve may never be isolated from the water heater by means of a closing valve
 - 5) Mount the tank sensor in an immersion bulb into the tank at 1/5 from the bottom of the tank
 - 6) Drain valve (recommended)
 - 7) Hot and cold-water mixers

	PUMP		FILTER
	NON- RETURN VALVE		INLET COMBINATION - Overflow - Controllable return valve - Valve
	VALVE		PRESSURE REGULATING VALVE
	SAFETY VALVE		
	AUTOMATIC VENT		



NOTICE

SAFETY COMPONENTS

The picture shows an example of a functional installation. The safety components as shown in the picture are NOT necessarily conform all applicable standards and regulations. **ALWAYS** have the system installed by a skilled installer. Safety must be added according to all applicable standards and regulations.

3 TECHNICAL DATA WATER HEATERS

3.1 Functional introduction

The HWB water heaters are central heating water heaters 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, and so release extra heat. This has an immediate positive impact on the efficiency.

The water heater is set for Natural gas.

Fuel used should have Sulphur rates with a maximum annual peak over a short period of time of 150 mg/m³ (110 ppm average) and an annual average of 30 mg/m³ . (22 ppm average)

Water heater control includes:

- Cascade control for up to sixteen water heaters
- Remote operation and heat demand indication from each water heater
- Anti-Legionnaires' disease function (Only available at DHW mode 1, cascaded Heaters)

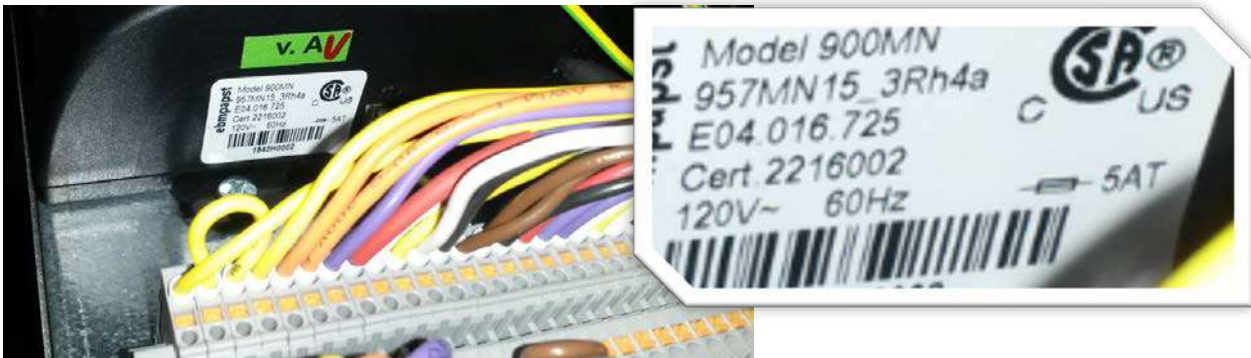
Connections for:

- Water heater pump
- PWM control for external water heater pump.
- System pump
- External flow switch or external safety device.
- Modbus
- External system sensor
- DHW sensor.
- External Ignition coil

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_3Rh4a

Burner Controller Software Versions

– Press the menu button (☰) , go to Information and then to Software Versions.

Information	
Software Versions	i
Water heater Status	
Water heater History	
Error Log	

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

3.3 Technical specifications datasheet

GENERAL				
Water heater, category	-	IV		
Water heater model		HWB-299	HWB-399	HWB-499
Dimensions (h x w x d)	inch (mm)	33.3 x 17.3 x 20.9 (845 x 440 x 530)		
Water content (estimated)	Gallon (liter)	1.32 (5.0)	2.19 (8.3)	2.74 (10.4)
Weight (empty)	Lbs. (kg)	169 (77)	183 (83)	187 (85)
Supply /return connection (boiler)	inch	NPT 1 ½"	NPT 1 ½"	NPT 1 ½"
Gas connection	inch	NPT 1"	NPT 1"	NPT 1"
Flue and air connection	inch (mm)	4" (100)	4" (100)	6" (150)
WATER HEATING		Values Low fire - High fire:		
Input gross natural gas	MMBTUS/hr	60 / 295	80 / 396	98 / 474
Input gross natural gas	kW	17.6 / 86.5	23.4 / 116	28.7 / 139
Input gross propane	MBTU/hr	60 / 294	80 / 397	98 / 473
Input gross propane	kW	17.6 / 86.1	23.4 / 116	28.7 / 139
Thermal efficiency natural gas ANSI Z21.10.3-2015-CSA 4.3-2015	%	96.8	95.6	97.4
Thermal efficiency propane ANSI Z21.10.3-2015-CSA 4.3-2015	%	95.5	95.8	95.4
Turndown ratio	1:x	5	5	5
Recovery rating @ 100 °F rise	gal/h	319	428	513
GAS CONSUMPTION		Values Low fire - High fire:		
Natural gas	ft ³ /h	54.8 - 274	74.3 - 368	91.0 - 441
	m ³ /h	1.6 - 7.8	2.1 - 10.4	2.6 - 12.5
Propane ¹	ft ³ /h	23.6 - 118	32.0 - 159	39.2 - 190
	m ³ /h	0.7 - 3.3	0.9 - 4.5	1.1 - 5.4
Gas supply pressure nominal ²	Nat. gas	inch WC (mbar)	7.0 (17.4)	
	Propane	inch WC (mbar)	11.0 (27.4)	
NOTES				
¹ Using propane, maximum fan speed needs to be reduced				
² Min. and max. gas supply pressures:				
	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)	

Water heater model			HWB-299	HWB-399	HWB-499
EMISSION			Values Low fire - High fire:		
CO ₂ flue gas ³	Natural gas	%	9.8 - 9.2		
	Propane	%	11.0 - 10.4		
O ₂ flue gas ³	Natural gas	%	3.7 - 4.7		
	Propane	%	4.1 - 5.0		
Flue gas temperature at combustion air temperature = 70 °F (20 °C)		°F (°C)	120 - 180 (50 - 80)		
Available pressure for the flue system ⁴		inch WC (Pa)	0.8 (200)		
INSTALLATION					
Resistance water heater	ΔT = 20 °F	ft.head (m.WC)	34 (10)	31 (9.3)	27 (8.1)
	ΔT = 27 °F	ft.head (m.WC)	20 (5.9)	17 (5.2)	15 (4.7)
Pressure boiler min-max.		psi (bar)	15.0 - 87.0 (1.0 - 6.0)		
Max. supply temperature		°F (°C)	160 (71)		
ELECTRIC					
Maximum power consumption		W	180	200	280
Power supply		V/Hz	120/60		
Protection class		-	IPX4D		
NOTES					
³ CO ₂ / O ₂ of the unit measured/set without the boiler front panel in place					
⁴ Maximum allowed combined resistance of flue gas and air supply piping at high fire					

3.4 High altitude operation.

High Altitude Operation

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

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

In USA and Canada, de-rate by 4% extra for every 1000 ft. above 4500 ft.



NOTICE

Combustion – At elevations above 2000 ft (610 m), the combustion of the appliance must be checked with a calibrated (altitude corrected) combustion analyzer to ensure safe and reliable operation. No orifices or high-altitude kits are needed, since the 1:1 Gas/Air ratio of the gas valve and the venturi will respond automatically to reduced air pressure.

It is the Installers responsibility to check the combustion of the appliance. Failure to follow these instructions may result in property damage, serious injury, or death.

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 derate by 10%

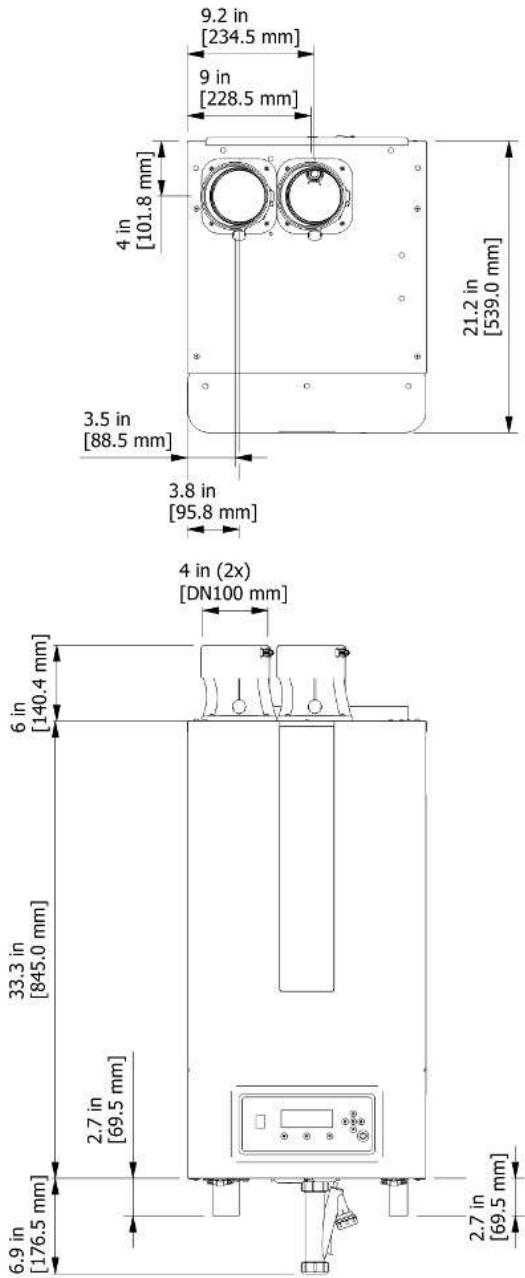
Example: Elevation is 3600 ft. De-rating = 10 %

Above 4500 ft : ((New value – 4500) x 0.004)+10

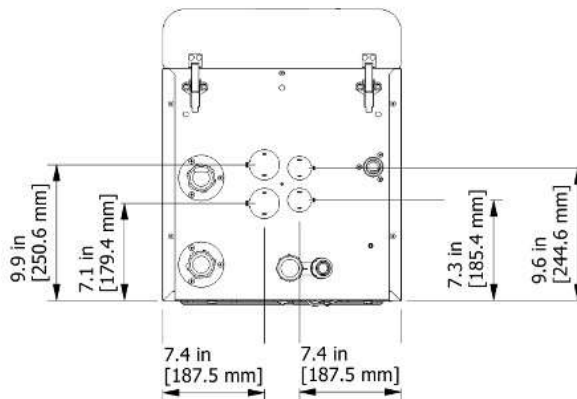
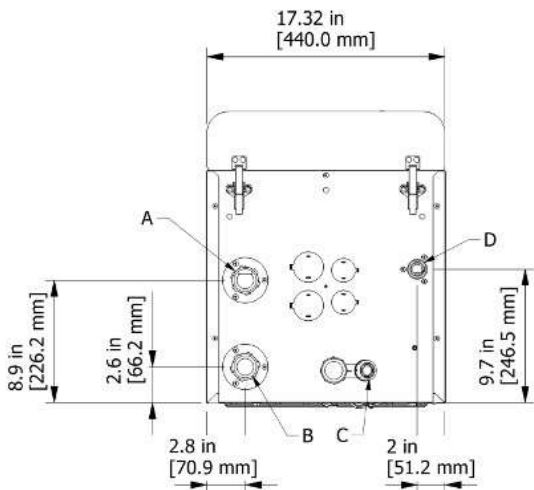
Example: Elevation is 7600 ft. De-rating is ((7600-4500)x0.004)+10 = 22.4 %

4 WATER HEATER DIMENSIONS

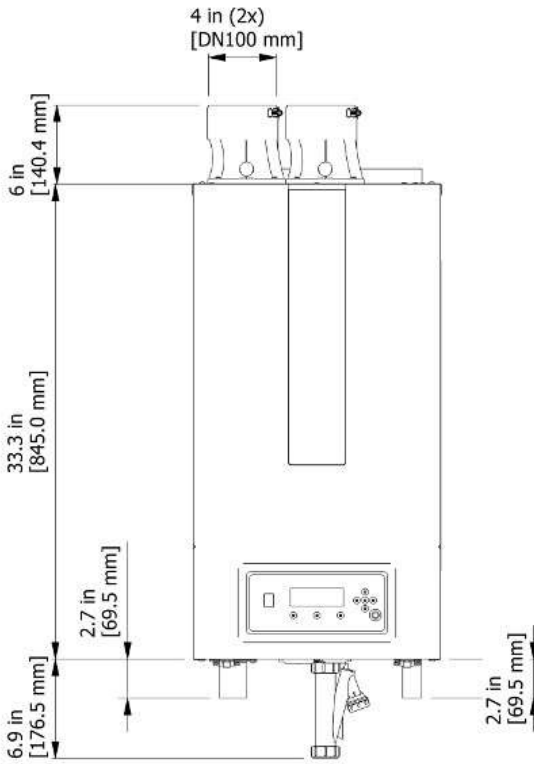
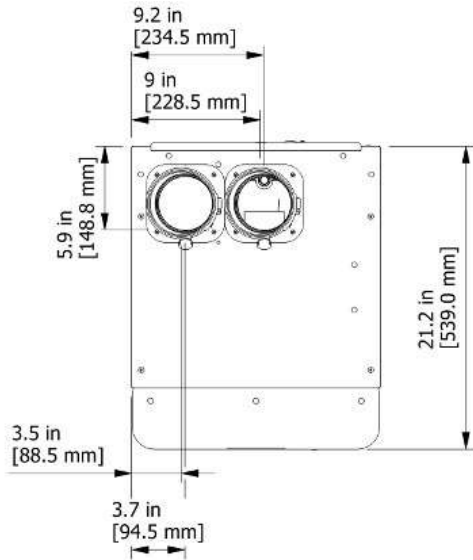
4.1 HWB-299



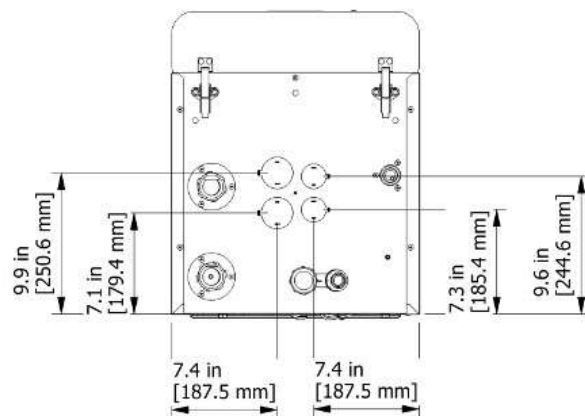
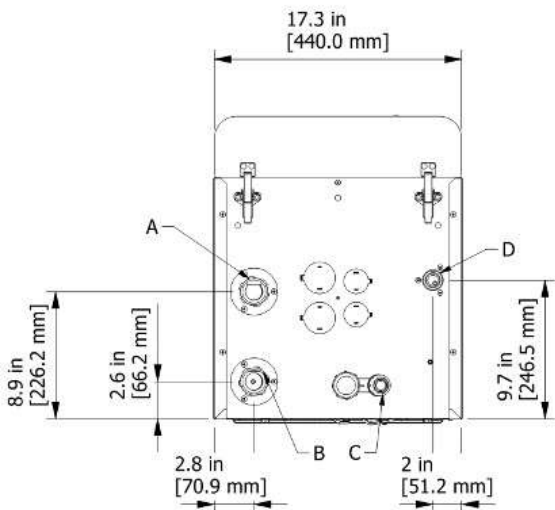
Connections		HWB-299
A	Hot water outlet	NPT 1½"
B	Cold water inlet	NPT 1½"
C	Condensate	Flexible hose Ø 1.06 " (26.9 mm)
D	Gas	NPT 1"



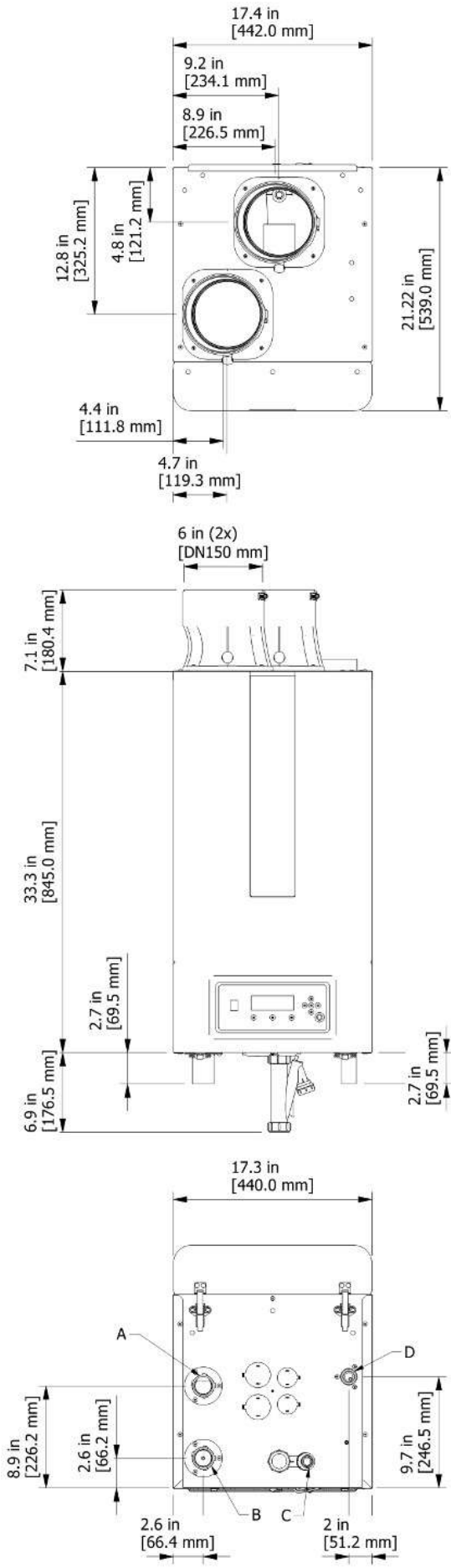
4.2 HWB-399



Connections		HWB-399
A	Hot water outlet	NPT 1½"
B	Cold water inlet	NPT 1½"
C	Condensate	Flexible hose Ø 1.06" (26.9 mm)
D	Gas	NPT 1"



4.4 HWB-499



Connections		HWB-499
A	Hot water outlet	NPT 1½"
B	Cold water inlet	NPT 1½"
C	Condensate	Flexible hose Ø 1.06" (26.9 mm)
D	Gas	NPT 1"

5 ACCESSORIES AND UNPACKING

5.1 Accessories

Depending on 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.

Item	part number
System strap-on sensor, mandatory in case of Cascading Water Heaters 10kOhm@77°F (type B3977)	S022.500.008
External HW-Tank temperature sensor 10kOhm@77°F (type B3977), to be mounted into the immersion tube of the tank	S022.500.009
WIFI module. / IP module	S022.500.006
External Ignition transformer	S022.500.005
Propane kit for VMS Venturi hole Ø 6.2 HWB-299	S022.500.001
Propane kit for VMS Venturi hole Ø 6.7 HWB-399	S022.500.003
Propane kit for VMS Venturi hole Ø 7.2 HWB-499	S022.500.004
Gas pressure kit HWB-499 If protection from gas pressure faults is demanded, this kit is available. The kit consists of two gas pressure switches, with connections to the gas valve and cabling to connect to the burner controller. The gas pressure switches are factory set to the values for natural gas.	S022.500.007

5.2 Unpacking

The HWB water heater will be supplied with the following documents and accessories:

No	Description	Quantity
1	"Installation and service" manual.	1
2	"User instructions" manual.	1
3	External HW-Tank temperature sensor 10kOhm@77°F (type B3977), to be mounted into the immersion tube of the tank	1
4	Wall bracket with locking plate and bolts	1
5	Spare nuts for mounting the burner plate (in a bag attached to the front of the gas valve)	10
6	Spare fuses for the water heater control (At the burner controller)	10
7	Bottom part of the condensate drain assembly (packed into an additional box)	1

NB! A pump is separately available, it is not included in the water heater supply.

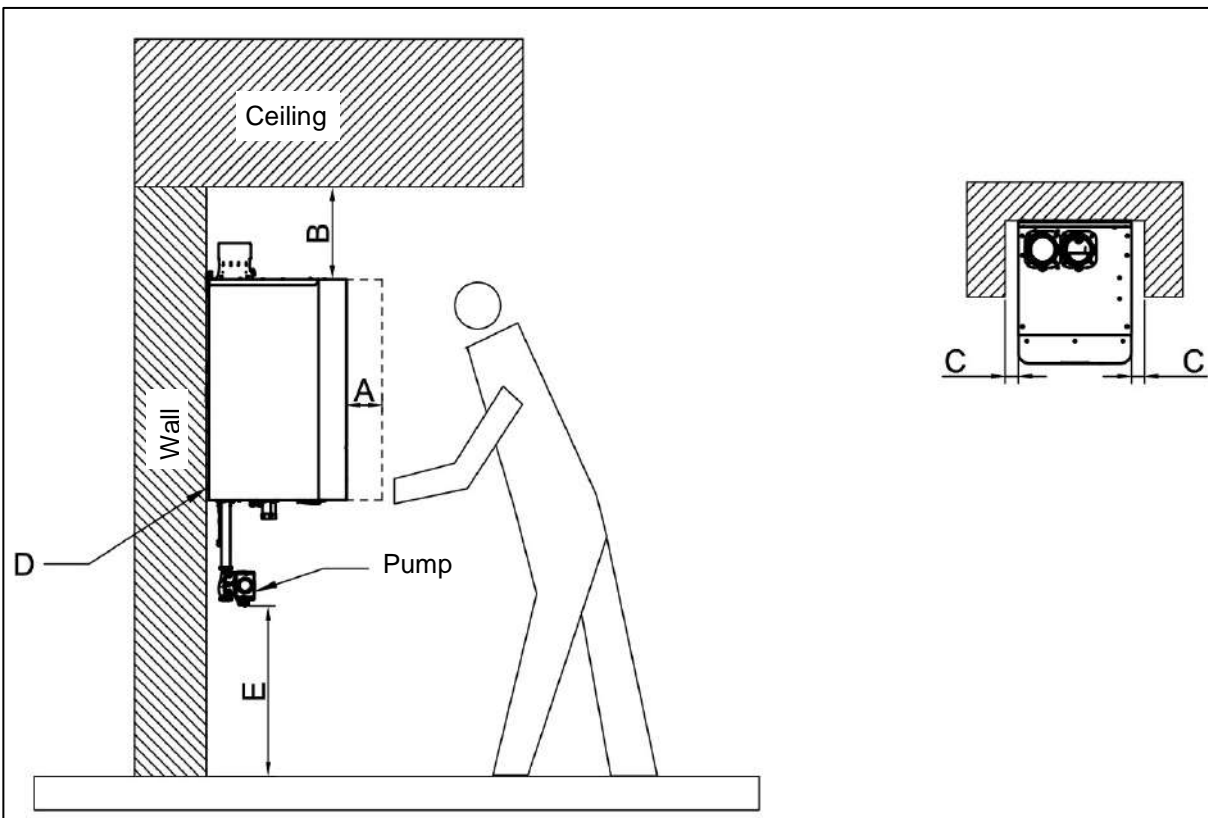
After delivery, always check the water heater package to see if it is complete and without any defects. Report any defects or missing parts immediately to your supplier.

6 INSTALLATION LOCATION OF THE HWB

6.1 Installation Clearances


On all sides of the water heater at least 2" of clearance should be applied to walls or wall units, 14" above the top side of the water heater and 10" from the bottom of the water heater.


All Models	Clearances to wall, ceiling and floor					
	Distances – inches					
		A: Front	B: Top	C: Sides	D: Back	E: Bottom
	Minimum service Clearances	6	12	2	0	10
	Recommended Service clearances	25	14	20	0	30
Clearances from combustible materials						
1. Hot water pipes—at least 1/4" (6 mm) from combustible materials.						
2. Vent pipe – at least 1" (25 mm) from combustible materials.						



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 water heater.
- Depending on the current of the used pump apply a circuit breaker between 6 and 12 amps

 NOTICE	The installation of the Eco King gas appliance must conform to the requirements of this manual, your local authority and the CAN/CGA B149 Installation Codes. 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 water heater must be able to hold the weight of the water heater, piping and fittings, and the weight of the water. If not, it is recommended to mount the water heater by means of a (optional cascade) stand.

 CAUTION	The water heater must NOT be installed on or near carpeting.
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6.2 ***Water heater Installation Location Requirements:***

- The installation of this water heater when installed using room air must comply to NFPA 54.
- The flue gas pipes must be connected to the outside wall and/or the outside roof. ("Flue gas instructions" manual.)
- The installation area must be dry and frost-free.
- The water heater has a built-in fan that will generate noise, depending on the total heat demand. The water heater location should minimize any disturbance this might cause. Preferably mount the water heater on a solidly constructed wall or stand.
- There must be sufficient lighting available in the water heater room to work safely on the water heater.
- Do not install the water heater in a location where it will be exposed to temperatures 100 °F or higher.
- Do not install the water heater in a location where it will be exposed to high levels of humidity and moisture or where condensation might fall onto the water heater.
- Make sure there is an open connection with the sewer to drain the condensate. This connection should be lower than the condensate drains level of the water heater, if not a condensate pump will be required.
- Do not locate the water heater in an area which contains corrosive or other contaminants as outlined in § 9.6 tables "Indoor air kit"
- When considering installation locations consideration must be given to the combustion air supply whether using indoor air or sealed combustion.
- Do not allow the combustion air to come from a source or area which contains corrosive or other contaminants.


The water heater must be positioned and installed by a qualified installer or the gas company in accordance with all applicable standards, local codes and regulations. Commissioning of the water heater must be done by a qualified installer or technician, who is trained for this type of water heater.

In the Commonwealth of Massachusetts this water heater must be installed by a licensed Plumber or Gas Fitter.

6.3 Mounting the water heater

Before mounting and installing the water heater the following connections should be considered:

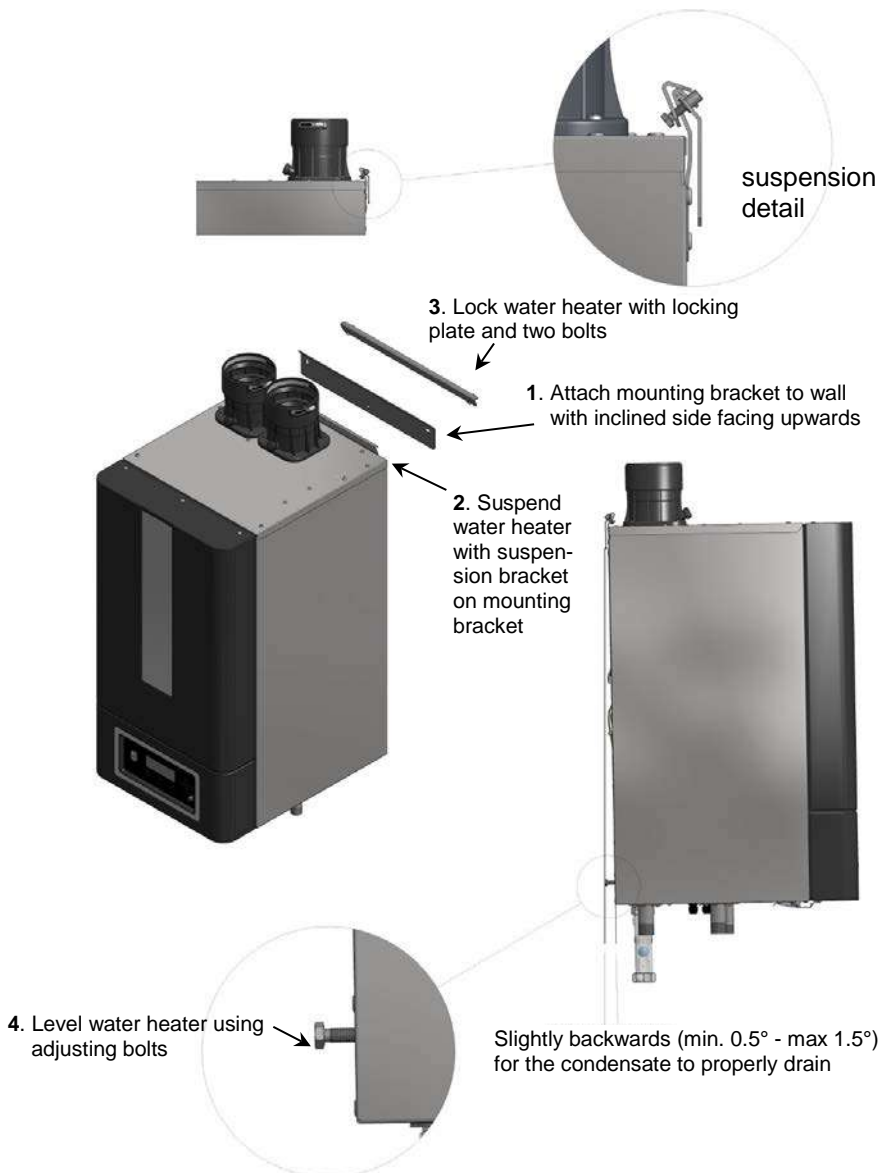
- Flue gas system and the flue gas pipe connections
- Air supply system and connections
- Hot water inlet and outlet pipe connections
- Condensate and pressure relief valve drainage
- Power supply (preferably the power connection positioned above the water heater)
- Gas pipe sizing.
- Automatic Air Vent Connection.

 NOTICE	All lines/piping must be mounted free of tension. The weight of the installation components should be supported separately from the water heater so there will be no standing forces on the connections. This might influence the mounting position of the water heater.
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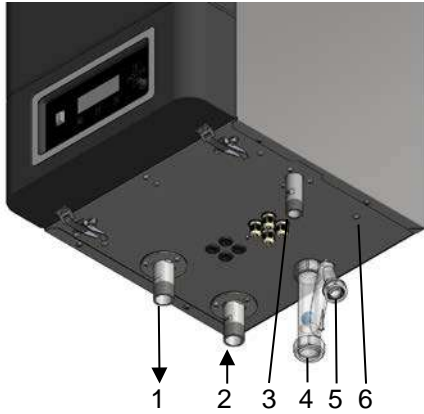
Determine the position of the water heater by using the included suspension bracket or a suspension frame (when supplied). While marking the holes, ensure that the suspension bracket or frame is perpendicular, and the water heater does not lean forward. If necessary, adjust the position with the leveling bolts at the lower rear side of the back panel (see figure below). When the leveling bolts aren't sufficient, fill the gap behind the bolts to get the water heater in position. The water heater position lies between the water heater hanging level and hanging slightly backwards (min. 0.5° - max 1.5°).

The water heater should not lean forward in the mounted position.

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



7 CONNECTIONS



7.1 Water heater connections

- 1 – Water outlet / Flow
- 2 – Water inlet / Return
- 3 – Gas
- 4 – Condensate trap clean out.
- 5 – Condensate drain
- 6 – Automatic air drain.

7.2 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. In Canada refer to CAN/CGA B149.1 installation code, and local codes for gas piping requirements and sizing. Pipe size running to the appliance depends on: Length of pipe; Number of fittings; Maximum input requirement of all gas appliances in the residence. See the gas sizing table below for help when sizing the gas connection. For information on propane sizing consult your local propane gas supplier.

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

7.2.1 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" wc as stated in the NFPA54. If you experience a pressure drop of greater than 1" w.c., regulator or gas line is undersized.

Eco King Heating Products Inc. recommends 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, will be available at the water heater gas valve inlet at maximum water heater firing rate. See technical specifications datasheet 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 a minimum of 6 ft from the water heater.

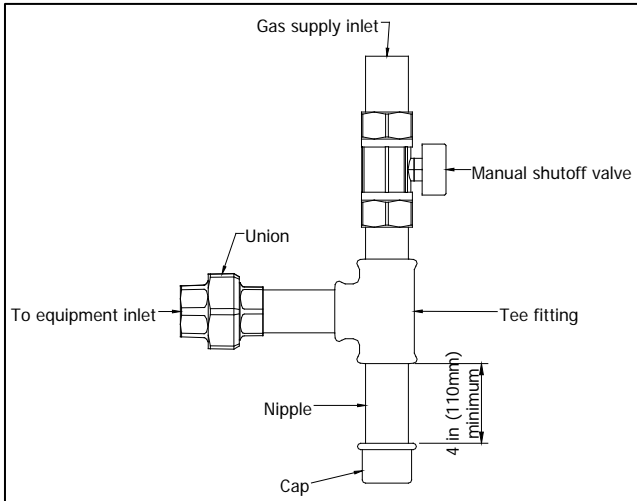
Eco King requires a minimum 1" diameter flex hose if flex gas hose is going to be used. Ensure that: the gas line connection to the appliance does not apply any weight or pressure to the gas valve.

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

The appliance shall be installed such 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 “Equipment Shut-Off Valve”. The valve must be listed by a nationally recognized testing lab. Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve. The gas line piping can safely be removed from the appliance for servicing.

Leak test the gas pipe from the water heater up to the gas pressure regulator.

Carefully vent the gas pipe (outside in open air) before putting appliance into operation for the 1st time;



A sediment trap must be provided directly below the water heater.



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.

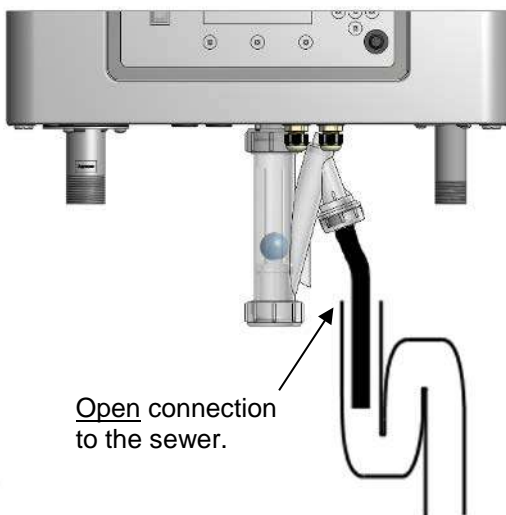
When performing a pressure test on the gas line piping, the following guidelines must be followed.

*The water heater 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 1/2 PSIG (3.45 kPa).

*The water heater 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 1/2 PSIG (3.45 kPa).

Gas pressure switch

If protection from gas pressure faults is demanded an optional kit is available. This kit consists of two gas pressure switches, with connections to the gas valve and cabling to connect to the burner controller. The gas pressure switches are factory set to the values for natural gas.



7.3 Condensate drain connection

The condensate drain is placed at the center and at the bottom of the water heater and has a 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 water heater. 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 water heater.

There should be an open connection of the condensate hose into the sewage system. A possible vacuum in the sewage system must never give the opportunity to suck on the water heater’s condensate drain hose.

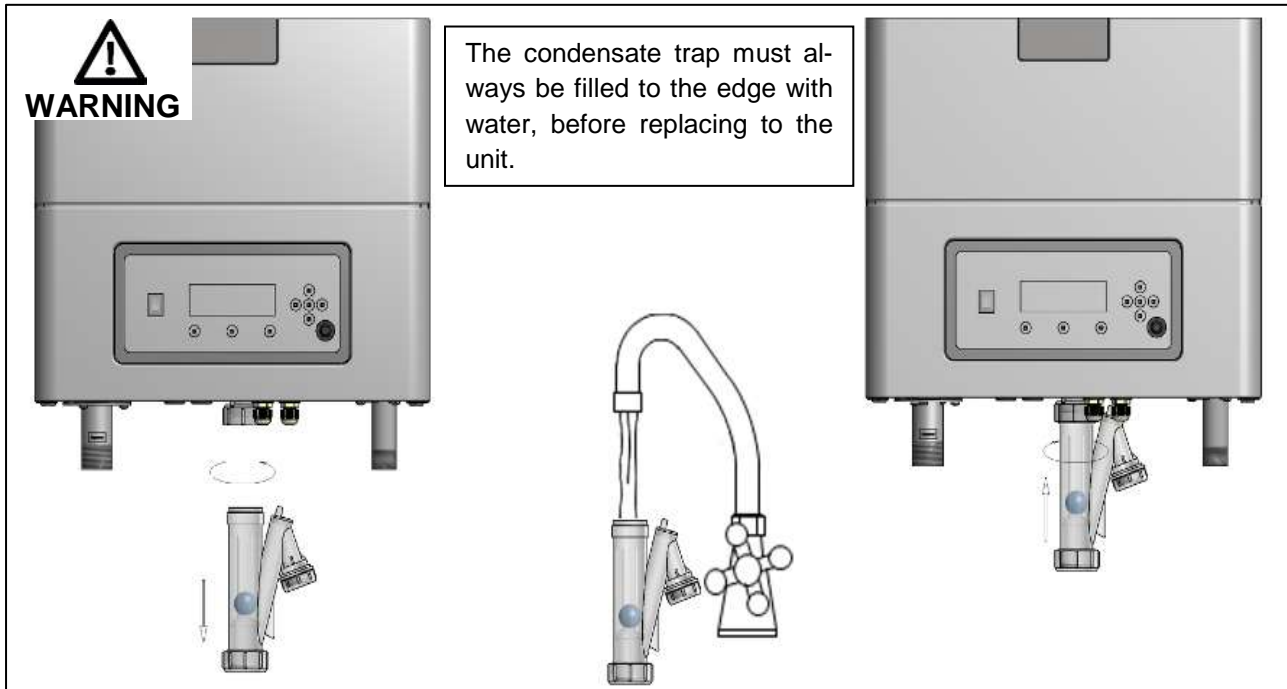


The condensate the water heater produces is acidic and should be neutralized before disposal. If not properly neutralized it may harm some floor drains and/or pipes, particularly those that are metal. Ensure that the drain, drainpipe, and anything that will come in contact with the condensate can withstand the acidity or neutralize the condensate before disposal.

Damage caused by failure to install a neutralizer kit or to adequately treat condensate will not be the manufacturer’s responsibility.



When mounting the bottom part of the condensate trap, before commissioning the water heater 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.



7.4 **NON-Return valve.**

All water heaters HWB-299, HWB-399 and HWB499 have a non-return valve installed in the gas-air mixing pipe just before the burner. Flue gas recirculation is prevented by the non-return valve. The prevention of recirculation also reduces standby losses through the flue of the water heater. This creates a higher thermal efficiency.

7.5 **Pump functionality**

Delta T monitoring:

A high temperature difference between supply and return of the water heater can indicate a clogged heat exchanger or filter, or a defective pump. The burner load automatically decreases when the Return/Supply temperature differential increases too much.

At maximum burner power ΔT is limited to 32.4 °F (18 °C) and at low burner power a ΔT above 46.8 °F (26 °C) is not allowed. Above these values the water heater modulates down until the temperature difference is between 32.4 °F (18 °C) °F and 46.8 °F (26 °C) °F. If the ΔT exceeds 55.6 °F (31 °C), the water heater will be temporarily switched off.

7.6 **Frost protection**

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

- NOTICE:
- This frost protection function is only protecting the water heater and not the whole sanitary system.
 - This frost protection function is only useable provided that water circulation through the system is possible - if not, the water heater goes in a lock-out.
 - Because it concerns a programmable setting, a water heater damaged by frost is not covered under warranty.

7.7 Water quality

In direct water heating appliances, the water flows directly through the heat exchanger of the water heater. Because all the time fresh water, containing dissolved minerals, is heated, scaling may occur. To prevent this, water quality must meet a number of standards.

The values are the following:

Water temperature max. = 160°F

Maximum allowed water hardness is 205 PPM or 205 mg/L CaCO₃ (= 11,5°dH)

TDS (total dissolved solids) may not exceed 450 PPM

Water hardness and TDS together may not exceed 450 PPM

The pH value of the water may not be under 6,5 and not above 7,5 (measured cold)

If water hardness is too high a water softening system is necessary.

If TDS alone or the combined value is higher than the abovementioned, the water should be heated by means of an indirect water heating appliance.

Minimum water hardness = 80 PPM or 80 mg/L CaCO₃ (= 4.5°dH)

Minimum TDS = 100 PPM

Water that's under these minimum values normally has a pH value which is aggressive and corrosive.



If water quality doesn't meet the abovementioned requirements, a water treatment installation should be installed to improve water quality to the required levels, if possible.

7.8 Flush the system with fresh water

When a water heater is installed in a new system or an existing installation the system must be cleaned before the water heater is installed. The system should then be drained and thoroughly flushed with clean water to remove any debris. The water of the water heater and heating circuit should be free of any particles, debris and pollution.

7.9 Automatic air purging of the heat exchanger

The De-Air sequence is a safety function starting at every power ON and is used to remove the air from the heat-exchanger. The De-Air sequence does not start after a general reset (such as 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 water heater pump OFF and ON. The installer/technician can cancel the De-Air sequence by pressing a specific key-button combination from the display. By default, "De-Air" sequence takes around 14 minutes.

- 1st cycle: The 3 ways valve moves to CH position and the general pump is activated for 10 seconds, deactivated for 10 seconds, activated again for 10 seconds and then deactivated again for 10 seconds (DAir_Repetition_OnOff, which means ON/OFF/ON/OFF each time for 10 seconds = 40 seconds in total).

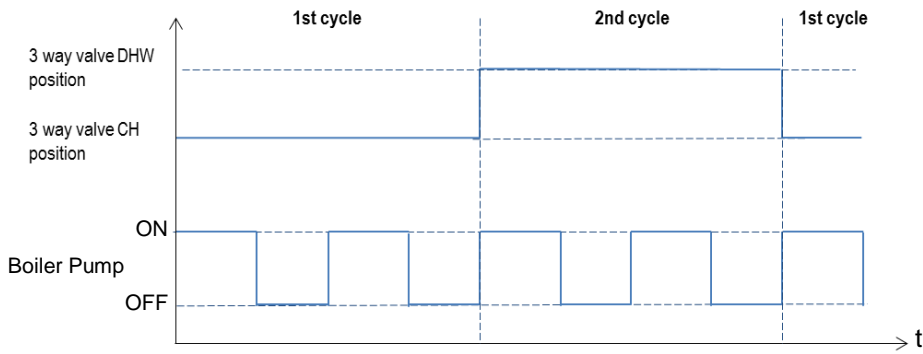
- 2nd cycle: it starts when 1st cycle is ended. The 3 ways valve is moved to DHW position and repeats the same cycling of the pump (DAir_Repetition_OnOff, which means ON/OFF/ON/OFF each time for 10 seconds = 40 second in total).

This sequence (1st cycles + 2nd cycles) is performed DAir_Number_Cycles times (if DAir_Number_Cycles is 10 'De-air' sequence lasts (10 x 40) x 2 = 800 seconds).

During De-Air sequence no heating or hot water demand will be served.

When the water pressure is too low, or pressure sensor is in error, the De-Air sequence will be suspended until water pressure / sensor pressure is stable again. In that case the De-Air sequence will last longer than the estimated 14 minutes.

The following scheme below shows the behavior of the 3-way valve and water heater pump during one whole cycle of De-Air sequence with a DAir_Repetition_OnOff set to 2.



Relevant variables:

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

7.10 Water pressure

The installation should be designed and built to conform to all applicable regulations and standards, including the right safety relief valves. **IMPORTANT:** Always keep the pressure in the water heater lower than the value at which its safety relief valve opens.

Sensor

A water pressure sensor has been built into the water heater. The minimum water pressure in the water heater is 15 psi and the maximum pressure is 87 psi. The normal water pressure should be between 22 and 50 psi. Or 22 and 75 psi when the optional pressure relief valve is used. The pressure sensor will stop the water heater from firing when the water pressure drops below 10 psi and starts the water heater firing again when the water pressure reaches above 15 psi. These values should never be changed in the water heater control settings. The water heater cannot be properly purged of air if the water pressure is less than 15 psi.

Higher pressure systems (e.g. using a water Booster Pump)

If a pressure higher than 87 psi is required for the heating system, the best solution is to separate the system from the water heater by means of a plate heat exchanger. In this way, the water heater pressure can remain under 87 psi. (60 psi recommended)

8 THE HWB SANITARY SYSTEM: INSTALLATION INSTRUCTIONS

8.1 The HWB system

The system is set up as shown in the next two examples, the first showing a combination of one water heater and one tank, the second showing a combination of two water heaters and two tanks. Other combinations are possible as well, contact your supplier.

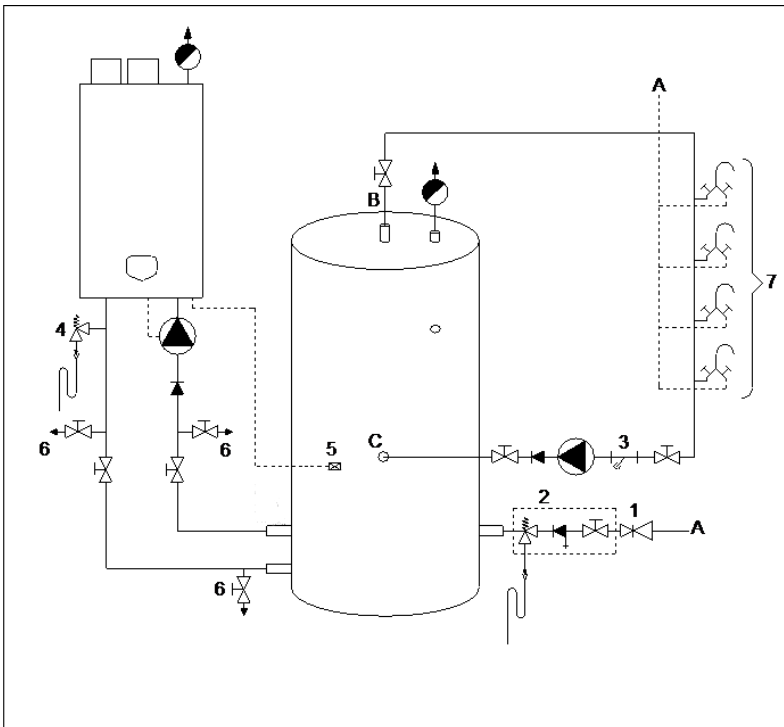
SAFETY COMPONENTS

NB! The pictures show examples of functional installations. The safety components as shown in these pictures are NOT necessarily conform all applicable standards and regulations.

ALWAYS have the installation installed by a skilled installer. Safety must be added according to all applicable standards and regulations.

8.1.1 STAND-ALONE SET-UP

The basic form of an HWB installation is one water heater with one tank. Shown in the picture are the principle components and connections. Apply parameter configuration DHW-mode 4 (default, stand alone)



	PUMP
	NON- RETURN VALVE
	VALVE
	SAFETY VALVE
	AUTOMATIC AIR VENT
	FILTER
	INLET COMBINATION - Overflow - Controllable Inlet valve - Valve
	PRESSURE REGULATING VALVE

Extra explanation:

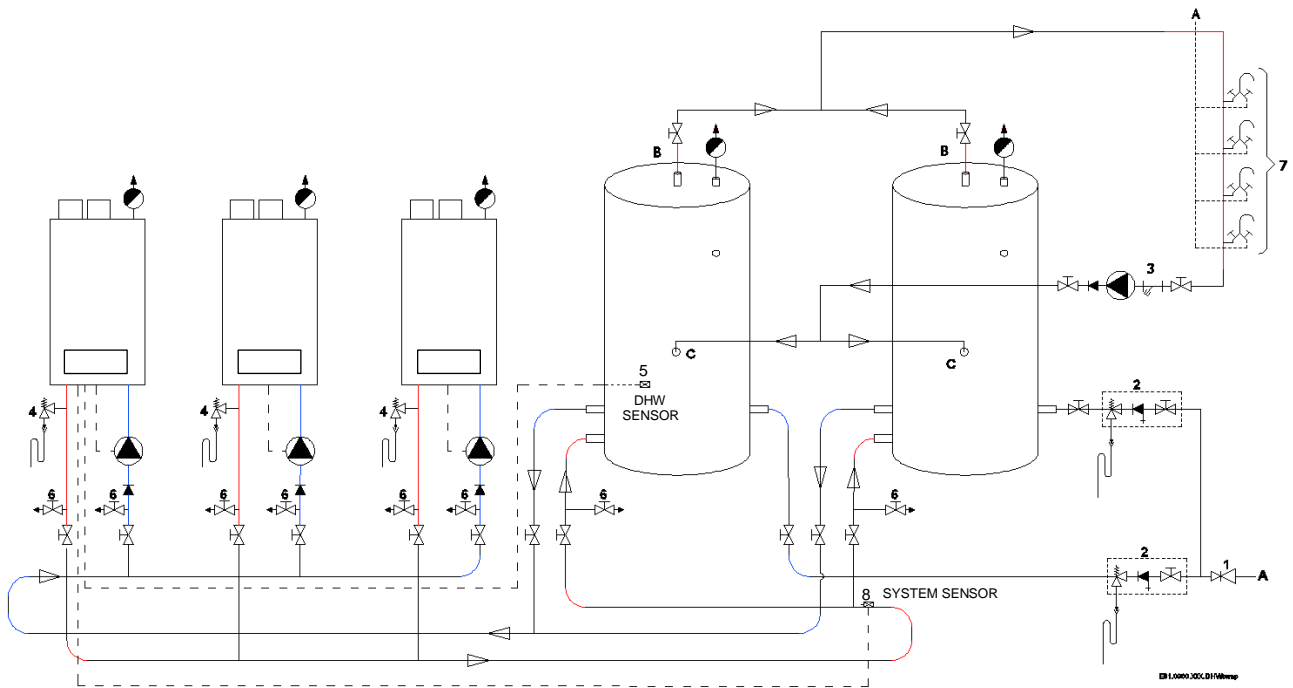
- 1) Pressure relief valve (mandatory in case service pipe pressure is too high)
- 2) Inlet combination with valve (mandatory)
- 3) Apply filter if necessary (recommended)
- 4) A suitable safety valve must be mounted near the water heater (mandatory)
This safety valve may never be isolated from the water heater by means of a ball valve
- 5) Mount the tank sensor in an immersion bulb into the tank at 1/5 from the bottom of the tank
- 6) Drain valve (recommended)
- 7) Hot and cold-water mixers

- A) Cold water inlet (service pipe)
B) Hot water supply circulation
C) Circulation return

Example of a combination of one water heater and one tank

8.1.2 CASCADE SET-UP

HWB water heaters and tanks can be installed cascaded in a number of possible combinations according to the instructions below. Apply parameter configuration DHW-mode 1



Example of a combination of three water heaters and two tanks

	PUMP
	NON- RETURN VALVE
	VALVE
	SAFETY VALVE
	AUTOMATIC AIR VENT
	FILTER
	INLET COMBINATION - Overflow - Controllable return valve - Valve
	PRESSURE REGULATING VALVE

Explanation:

- 1) Pressure relief valve (mandatory in case water pressure is too high)
- 2) Inlet combination with valve (mandatory)
- 3) Apply filter if necessary (recommended)
- 4) A suitable safety valve must be mounted near the water heater (mandatory)¹
This safety valve may never be isolated from the water heater by means of a ball valve
- 5) Mount the tank sensor in an immersion bulb into the tank at 1/5 from the bottom of the tank and the system sensor onto the return pipe as shown in the figure.^{2, 3}
- 6) Drain valve (recommended)
- 7) Hot and cold-water mixers
- 8) Mount the (strap-on) system sensor to the pipe close to the T-piece of the last tank as shown in the figure
This sensor measures the supply temperature from both heaters.

- A) Cold water inlet (service pipe)
B) Hot water supply circulation
C) Circulation return

Notes:

- Connections on the water heater side should **always** be executed as drawn in the picture above.
- ¹ Always apply safety components according to all applicable regulations.
- ³ In case of more than one tank, mount the tank sensor in one of the tanks. The temperature of this tank will be assumed to be representative for all, provided that the installation design is correct.
- In the inlet (return) connection of the water heater no check valve is recommended.
- If needed, the water heater control can handle up to sixteen water heaters.
- For large capacity installations consult your supplier.

8.1.3 PUMP CONTROL

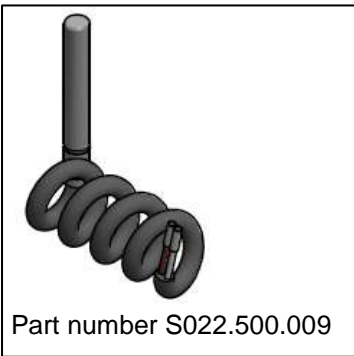


The applied pump must be a bronze or SS pump and controlled only by the HWB water heater control. If, for any reason, an external pump control is applied *without written approval of Eco King* then the complete warranty on the HWB water heater and all delivered parts will become invalid.

8.1.4 TANK SENSOR

The tank (immersion) sensor has to be mounted at 1/5 from the bottom of the tank. So at a tank with a total height of 80 inch the sensor has to be mounted at 16 inches from the bottom.

A bulb immersion tank sensor is standard supplied with the shipment.



When using another type or brand sensor be sure it meets the following specifications:

NTC 10K@77 °F (25°C) B3977k 3%@140°F (60°C)

Temperature °F (°C)	Resistance (Ω)	Temperature °F (°C)	Resistance (Ω)	Temperature °F (°C)	Resistance (Ω)	Temperature °F (°C)	Resistance (Ω)
-40 (-40)	334275	50 (10)	19897	122 (50)	3599	212 (100)	674
-22 (-30)	176133	68 (20)	12493	140 (60)	2454	230 (110)	506
-4 (-20)	96761	77 (25)	10000	158 (70)	1748	248 (120)	384
14 (-10)	55218	86 (30)	8056	176 (80)	1252	266 (130)	296
32 (0)	32624	104 (40)	5324	194 (90)	912	284 (140)	230

8.1.5 SYSTEM SENSOR IN CASE OF CASCADING HEATERS

When cascaded heaters and tanks are applied with DHW mode 4 its mandatory to use also a strap-on sensor besides the immersion tank sensor. This system sensor has to be connected to connections 3-4 "System Sensor"

The strap-on system sensor has part number S022.500.008 and same specifications as above mentioned.



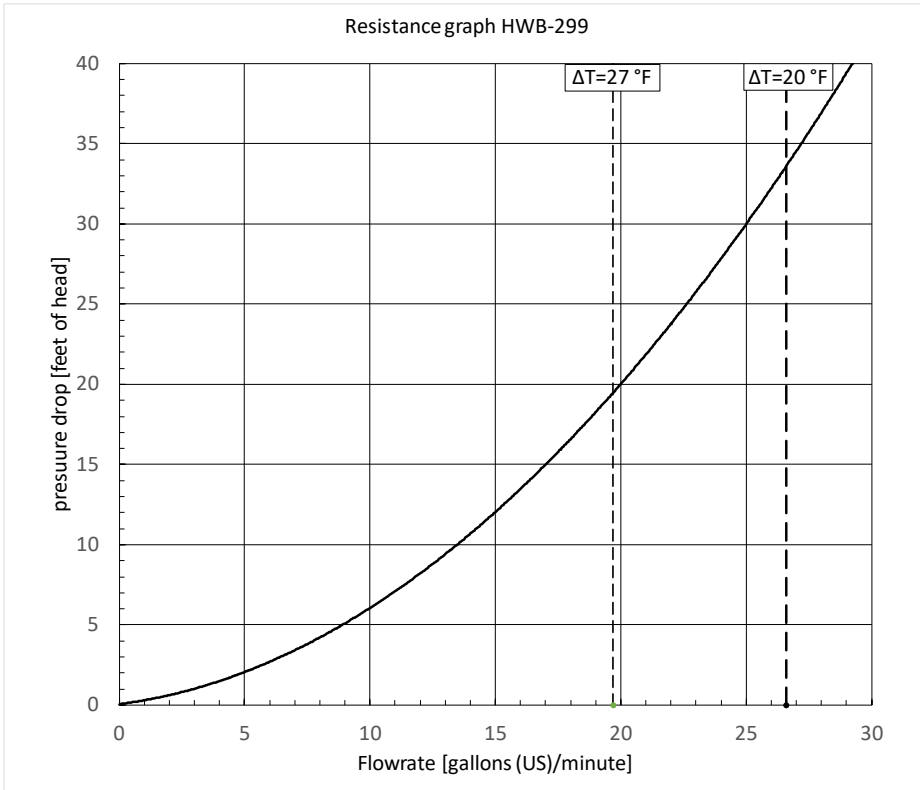
8.1.6 RETURN AND SUPPLY PIPING TANK

To get a good mix of hot and cold water and therefore a better temperature arrangement of Water Heater and Tank the Supply and Return pipe of the tank should be situated in the bottom 20% of the tank height preferable.

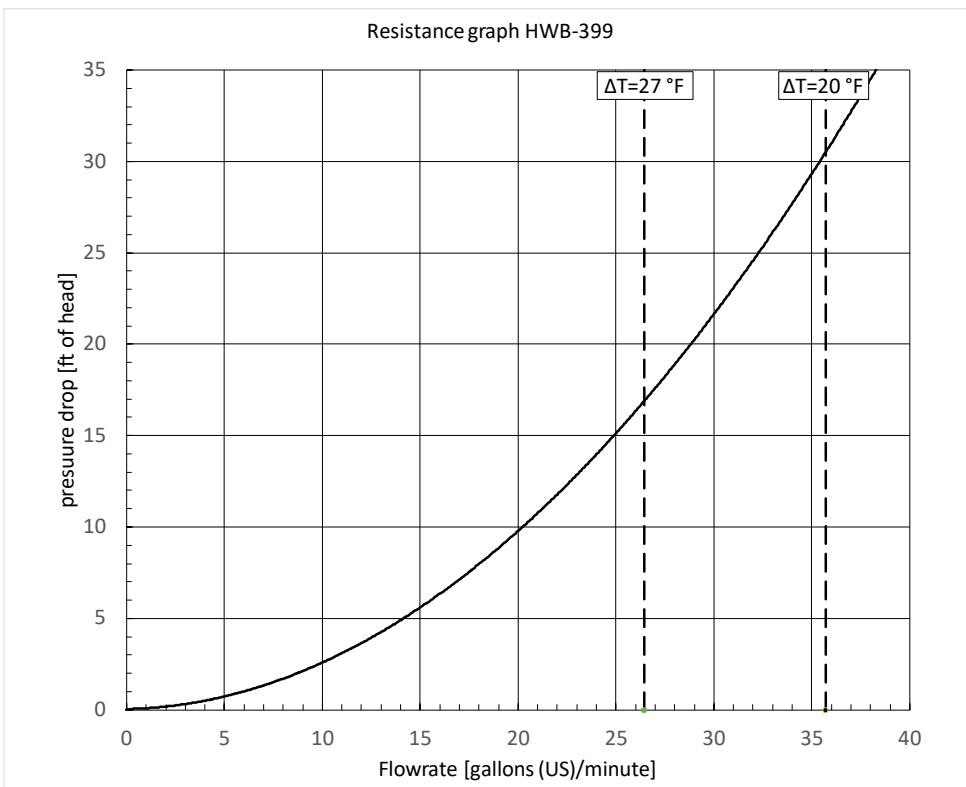
9 HEATEXCHANGER RESISTANCE GRAPHS

9.1 Hydraulic graphs

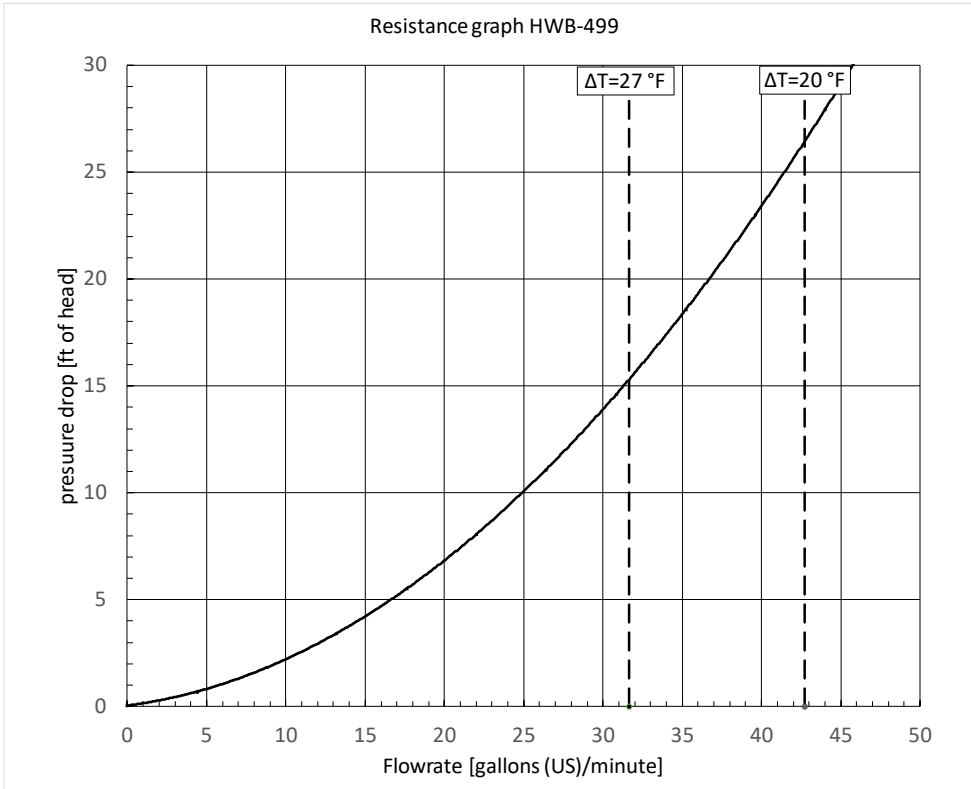
9.1.1 WATER HEATER RESISTANCE GRAPH HWB-299



9.1.2 WATER HEATER RESISTANCE GRAPH HWB-399



9.1.3 WATER HEATER RESISTANCE GRAPH HWB-499



9.2 Minimum required pump head.

To prevent calcification of the heat exchanger, the speed of the water needs to be high. The design flow of the system should be at a delta T of 27 °F (15 °C) at high fire. To calculate the minimum required pump head, take the resistance of the water heater and add the resistance of the piping and tank to make a good design. Normally, an extra 6.6 feet of head (2 m.WC) is sufficient to overcome the resistance of the pipe and tank.

Water heater ΔT = 27 °F (15 °C)	at flow rate		min. required head for water heater		min. required head for in- stallation + 6.6 feet.WC / +2 m.WC	
	[gpm]	[m ³ /h]	[ft.WC]	[m.WC]	[ft.WC]	[m.WC]
HWB-299	19.70	4.47	19.5	5.94	26.1	7.94
HWB-399	26.44	6.01	16.9	5.15	23.5	7.15
HWB-499	31.66	7.19	15.3	4.67	21.9	6.67

9.3 Pump: maximum electrical power

General

- The inrush current of a conventional pump 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 field supplied pumps and valves for the water heater loop, DHW, and the system that are connected to the water heater may not exceed 3.5 A. 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 slow blow.

Pump P1 - water heater pump.

This pump is NOT part of the appliance. The maximum combined current for the water heater loop pump and any additional pumps and valves may not exceed 2 A.

Pump P2 - calorifier pump.

Pump P2 is a DHW indirect tank pump, meaning it's not part of the appliance. The maximum combined current for the indirect tank pump and any additional pumps and valves may not exceed 2 A.

3-way valve.

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

Pump P3 - system pump.

The maximum combined current of pump P3 and the other connected pumps may not exceed 2 A.

Warning (ECM pumps):

When using an ECM pump, it cannot be powered directly by the water heater. Use a relay to isolate the water heater from the pump.

WARNING : Use an external relay if pump current exceeds 2 A.



NOTICE

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


10 FLUE GAS AND AIR SUPPLY SYSTEM

10.1 General venting.

The water heater has a positive pressure vent system.


The water heater 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, should be piped to the outdoors. Under no conditions may this appliance vent gases into a masonry chimney. The internal safety system shuts down the water heater in case the temperature of the flue gasses 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.

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

10.1.1 VENT SIZING.

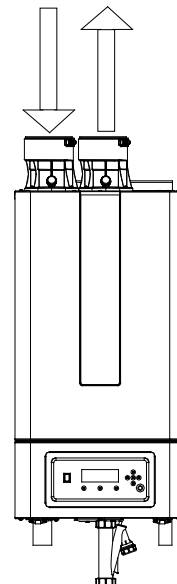
Water heater	Intake Air and Exhaust
HWB-299, HWB-399	4"
HWB-499	6"

 NOTICE	Increasing or decreasing combustion air or vent piping sizes is not permitted.
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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 per the National Building Code, Section 305, Table 305.4 or as local codes dictate.

Connections vent gas (vent) and air supply:

AIR INTAKE VENT
(FLUE GAS)




10.1.2 VENT AND AIR INLET RESISTANCE TABLE

Minimum and maximum allowable combined vent and air inlet length:

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

Maximum Exhaust Length / Maximum Combustion Air Intake Length			
	HWB-299	HWB-399	HWB-499
4"	228' / 228'	121' / 121'	92' / 92'
5"			359' / 359'
6"			605' / 605'

 NOTICE	For long lengths, check venting pipe and fittings for maximum allowable pressure.
	This table may only be used for a single vent/air system for one water heater. Do NOT use this table for common vent systems with cascaded water heaters.

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

Item\ size	4"	5"	6"
1 ft Vent Pipe	1 ft	1 ft	1 ft
1 ft Flex Pipe (same diameter as rigid)	2 ft	2 ft	NA
1 ft Flex Pipe (upsized one diameter)	0.6 ft	NA	NA
45 Elbow	5 ft	6 ft	6 ft
90 Elbow	12 ft	14 ft	14 ft
Tee	19 ft	21 ft	22 ft


Terminals equivalent feet: for DuraVent PolyPro

WATER HEATER	TERMINAL	size	part #	
HWB-299 HWB-399	concentric roof:	4" vent	4PPS-VKL 4PPS-VK-TCL	37 ft
	concentric wall:	4" vent	4PPS-HKL	13 ft
HWB-499	2 pipe wall:	6" vent	6PPS-HSTL	28 ft

10.2 Vent and air intake pipe material

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

Notes:
1 PVC venting (exhaust and air-inlet) is not permitted within 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.

 WARNING	<p>Never use aluminum containing vent pipes in these water heaters. 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. In Canada, the first piece of vent piping must be readily accessible for inspection.</p>
	<p>Covering non-metallic vent pipe and fittings with thermal insulation is prohibited. Failure to follow these instructions may result in property damage, personal injury or death.</p>

10.2.1 APPROVED MANUFACTURERS

PVC/ CPVC venting:


- * IPEX System 636

Polypropylene venting:

- * Duravent - PolyPro
- * Centrotherm - InnoFlue

Stainless steel venting:

- * Duravent - FasNSeal, FasNSeal Flex
- * Security Chimneys - Secure seal SS/SSD/SSID

 NOTICE	<p>READ THE MANUAL PROVIDED BY THE VENT GAS AND AIR SYSTEM SUPPLIER CAREFULLY</p>
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10.3 PVC/CPVC

This product has been approved for use with the PVC/CPVC vent materials listed in this manual. All terminations must comply with 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

WATER HEATER	FITTING	PART #
HWB-299 HWB-399	4" Concentric Termination CPVC	197021
	4" Low profile Termination	196986
	4" FGV 45° Elbow CPVC	197172
	4" FGV 90° Elbow CPVC	197202
	4" Termination Vent Screen	196052
HWB-499	6" FGV 45° Elbow CPVC	197173
	6" FGV 90° Elbow CPVC	197203
	6" Termination Vent Screen	196090

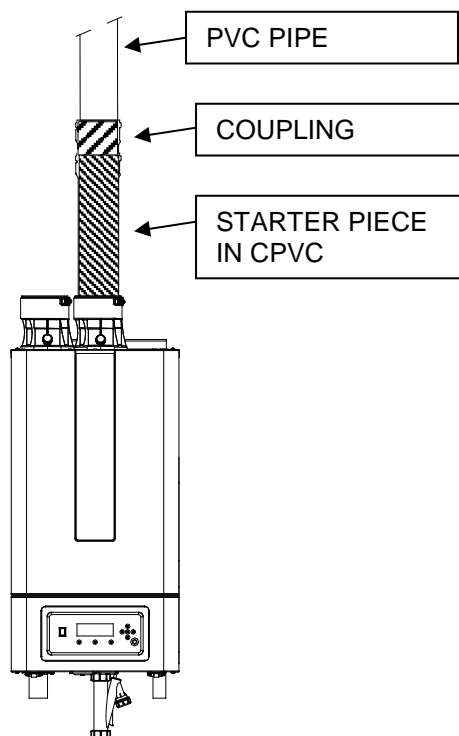
 WARNING	<p>PVC In Canada Safety authorities in some jurisdictions are not allowing PVC venting materials with appliances of any kind, even if System 636 certified. Check with the local safety inspector to verify compliance. Canadian installations must comply with the current CSA B149.1 Installation Code and local building codes.</p>																
 NOTICE	<p>PVC exhaust venting: When using PVC venting, the first part of exhaust venting must be approved CPVC or PP. This starter piece must have a minimum length (in feet) according to table:</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Design Supply Max. Limit</th> <th>HWB-299</th> <th>HWB-399</th> <th>HWB-499</th> </tr> </thead> <tbody> <tr> <td>176°F (80°C)</td> <td>0 ft</td> <td>0 ft</td> <td>0 ft</td> </tr> <tr> <td>185°F (85°C)</td> <td>0 ft</td> <td>2 ft</td> <td>0 ft</td> </tr> <tr> <td>194°F (90°C)</td> <td>0 ft</td> <td>4 ft</td> <td>0 ft</td> </tr> </tbody> </table> <p>WARNING: "Design Supply Max. Limit" limits the "CH setpoint" (supply temperature). Default setting for this limit is 194°F (90°C), for other temperatures the installer has to change this temperature in the installer menu, to match table above. This is "water heater parameter": no. (24) - "Design supply Max. Limit". (chapter "Screens and settings": menu/settings/water heater settings/(password)/water heater parameters)</p>	Design Supply Max. Limit	HWB-299	HWB-399	HWB-499	176°F (80°C)	0 ft	0 ft	0 ft	185°F (85°C)	0 ft	2 ft	0 ft	194°F (90°C)	0 ft	4 ft	0 ft
Design Supply Max. Limit	HWB-299	HWB-399	HWB-499														
176°F (80°C)	0 ft	0 ft	0 ft														
185°F (85°C)	0 ft	2 ft	0 ft														
194°F (90°C)	0 ft	4 ft	0 ft														
 WARNING	<p>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.</p> <p>The vent connection to the appliance must be made with the starter CPVC or PP pipe section provided with the appliance if PVC/CPVC vent is to be used. Failure to follow this warning could result in fire, personal injury, or death.</p> <p>Insulation should not be used on PVC or CPVC venting materials. The use of insulation will cause increased vent wall temperatures, which could result in vent pipe failure.</p> <p>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.</p>																
 NOTICE	<p>In Canada, CPVC and PVC vent pipe, fittings and cement/ primer must be ULC-S636 certified.</p> <p>Use only cleaners, primers, and solvents that are approved for the materials which are joined together.</p> <p>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 water heater (to allow drainage of condensate).</p>																

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

1. Work from the water heater to vent or air termination. Do not exceed the 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 should go a third to two-thirds into the fitting to ensure proper sealing after cement is applied.
6. Priming and Cementing:
 - a. Handle fittings and pipes carefully to prevent contamination of surfaces.
 - b. Apply a liberal even coat of primer to the fitting socket 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.

Near water heater PVC/ CPVC venting.

Starter piece must have a minimum length according table "PVC Exhaust Venting".



10.4 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

Approved polypropylene terminations:

Duravent - PolyPro



WATER HEATER	TERMINATION	COLOR:	ORDER #:	STOCK #:
HWB-299 HWB-399	4" Twin Pipe Side Wall	black	4PPS-HTPL	810009745
	4" Single Pipe Side Wall	Stainless	4PPS-HSTSL	810009744
	4" Bird Screen	Stainless	4PPS-BG	810004367
	4" concentric roof	black	4PPS-VKL	810009752
		terra-cotta	4PPS-VK-TCL	810009753
4" concentric wall	white	4PPS-HKL	810009742	
HWB-499	5" Roof	black	5PPS-VTML	810009770
	5" Single Pipe Side Wall	Stainless	5PPS-HSTL	810009763
	6" Roof	black	6PPS-VTML	810009791
	6" Single Pipe Side Wall	Stainless	6PPS-HSTL	810009784
	6" Bird Screen	Stainless	6PPS-BG	810004276

Centrotherm Innoflue

WATER HEATER	TERMINATION	COLOR	ORDER
HWB-299 HWB-399	4" Twin Pipe Side Wall	black	ISLPT0404
	4" Termination Tee	black	ISTT0420
	4" Termination Pipe	black	ISEP04 or ISEP0439
	4" Bird Screen	black	IASPP04
	4" Concentric roof termination		ICRT4679
	4" Concentric wall termination		ICWT462
HWB-499	5" Termination Tee	black	STT0520
	5" Bird Screen	stainless	IASSS05
	6" Termination Pipe	grey	ISEP0620 or ISEP0639
	6" Termination Tee	grey	ISTT0620
	6" Bird Screen	black	IASPP06
	6" Roof flashing		IAPRF06 or IAFRF06
	6" End pipe		ISEP06
	6" Wall plate		IAWP06BP
6" Support clamp		IASCM06	

10.4.1 FLEXIBLE POLYPROPYLENE

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

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



10.4.2 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

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

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

Approved Stainless Steel Terminations.

	Duravent	Security Chimneys	HeatFab
	FasNSeal	Secure Seal	Saf-T EZ Seal/ EZ 316
WATER HEATER	TERMINATION	TERMINATION	TERMINATION
HWB-299 HWB-399	FSBS4 (bird screen wall) FSRC4 (rain cap roof)	SS4STAU (screen termination) SS4RC (rain cap roof)	5490CI (horizontal termination) 5400CI (rain cap)
HWB-499	FSBS6 (bird screen wall) FSRC6 (rain cap roof)	SS6STAU (screen termination) SS6RC (rain cap roof)	5690CI (horizontal termination) 5600CI (rain cap)

10.5 Sealed Combustion Air supply

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

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

10.5.1 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.

10.5.2 AIR SUPPLY THROUGH HUMID AREAS

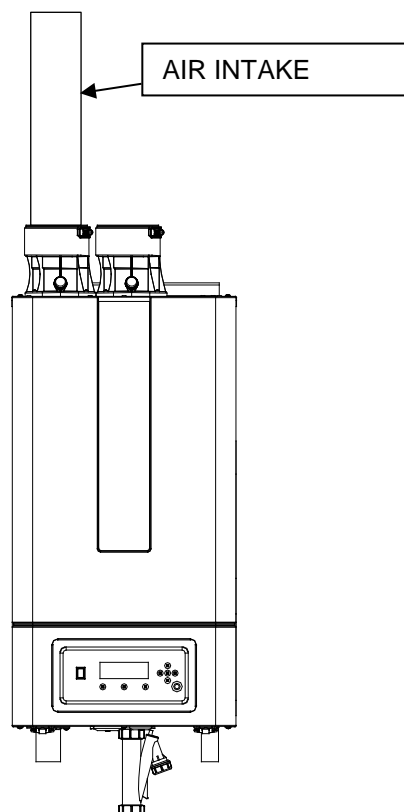
When the combustion air pipe will run through an area with high humidity (for example: greenhouses), a double walled supply pipe or an insulated duct must be used to prevent the possible condensation on the outside of the pipe. It is not possible to insulate the internal air pipes of the water heater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

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

10.5.3 AIR INTAKE/VENT CONNECTIONS.

Combustion air intake connector (fig. below). 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 per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.



Near water heater air piping:



10.5.4 AIR INLET PIPE MATERIALS

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

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

 WARNING	Using air intake materials other than those specified can result in personal injury, death or property damage.
 NOTICE	The use of double-wall vent or insulated material for the combustion air inlet pipe is recommended in cold climates to prevent the condensation of airborne moisture in the incoming combustion air.

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


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

The PVC or CPVC air inlet pipe should be cleaned and sealed with the pipe manufacturer’s recommended solvents and standard commercial pipe cement for the material used.

Proper sealing of the air inlet pipe ensures that combustion air will be free of contaminants and supplied in proper volume.

Follow the polypropylene or flexible polypropylene manufacturer’s instructions when using polypropylene material as an inlet pipe.


When a wall or vertical rooftop combustion air supply system is disconnected for any reason, the air inlet pipe must be resealed to ensure that combustion air will be free of contaminants and supplied in proper volume.

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

Commercial applications utilizing the water heater may be installed with a single pipe carrying the flue products to the outside while using combustion air from the equipment room. In order to use the room air venting option, the following conditions and considerations must be followed.

- The unit **MUST** be installed with the appropriate indoor air kit see table below.
- The equipment room **MUST** be provided with properly sized openings to assure adequate combustion air. Please refer to instructions provided with the indoor air kit.
- There will be a noticeable increase in the noise level during normal operation from the inlet air opening.
- Using the room air kit makes the unit vulnerable to combustion air contamination from within the building. Please review the section 9.6.1 "Air contamination" in this manual, to ensure proper installation.
- Vent system and terminations must comply with the standard venting instructions set forth in this manual.

 WARNING	When utilizing the single pipe method, provisions for combustion and ventilation air must be in accordance with Air for Combustion and Ventilation, of the latest edition of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, in Canada, the latest edition of CGA Standard B149 Installation Code for Gas Burning Appliances and Equipment, or applicable provisions of the local building codes.
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Indoor air kit:

Duravent

Water heater	Termination	Color	order	stock
HWB-299 HWB-399	4" Twin Pipe Side Wall	black	4PPS-HTPL	810009745
	4" Single Pipe Side Wall	Stainless	4PPS-HSTSL	810009744
	4" Bird Screen	Stainless	4PPS-BG	810004367
HWB-499	5" Roof	black	5PPS-VTML	810009770
	5" Single Pipe Side Wall	Stainless	5PPS-HSTL	810009763
	6" Single Pipe Side Wall	Stainless	6PPS-HSTL	810009784
	6" Bird Screen	Stainless	6PPS-BG	810004276


Centrotherm

Water heater	Termination	Color	order
HWB-299 HWB-399	4" Twin Pipe Side Wall	black	ISLPT0404
	4" Termination Tee	black	ISTT0420
	4" Termination Pipe	black	ISEP04 or ISEP0439
	4" Bird Screen	black	IASPP04
HWB-499	5" Termination Tee	black	STT0520
	6" Termination Pipe	grey	ISEP0620 or ISEP0639
	6" Termination Tee	grey	ISTT0620
	6" Bird Screen	black	IASPP06
	5" Bird Screen	Stainless	IASSS05

10.6.1 AIR CONTAMINATION

Pool and laundry products and common household and hobby products often contain fluorine or chlorine compounds. When these chemicals pass through the water heater, they can form strong acids. The acid can eat through the water heater wall, causing serious damage and presenting a possible threat of flue gas spillage or water heater 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 water heater combustion air inlet, have your installer pipe the water heater combustion air and vent to another location, per this manual.

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

Corrosive Contaminants and Sources

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

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

10.7 Proper vent installation and type of gas vent or vent connector.

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





Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.

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

For Category IV venting, the venting system shall be installed in accordance with the water heater manufacturer's installation instructions.

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

10.8 Install vent and combustion air piping

 DANGER	<p>The water heater must be vented and supplied with combustion and ventilation air as described in this section. Ensure the vent and air piping and the combustion air supply comply with these instructions regarding vent system, air system, and combustion air quality. See also sections "Determine vent location" at § 9.11.2 of this manual.</p> <p>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.</p> <p>Failure to provide a properly installed vent and air system will cause severe personal injury or death.</p>
 WARNING	<p>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.</p> <p>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.</p> <p>For closet and alcove installations, CPVC, polypropylene or stainless-steel material MUST BE used in the closet/alcove structure. Failure to follow this warning could result in fire, personal injury, or death.</p> <p>Do not connect any other appliance to the vent pipe or multiple water heaters to a common vent pipe. Failure to comply could result in severe personal injury, death, or substantial property damage.</p>
 CAUTION	<p>Improper installation of venting systems may result injury or death.</p>
 NOTICE	<p>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.</p> <p>Follow the instructions in this manual when removing a water heater from an existing vent system.</p>


The water heater 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 may use any of the vent/air piping methods covered in this manual. Do not attempt to install the water heater using any other means.

You must also install air piping from outside to the water heater air intake adapter, unless following the "Room Air" instructions on page 46 of this manual. The resultant installation is direct vent (sealed combustion).

10.9 Requirements for installation in Canada

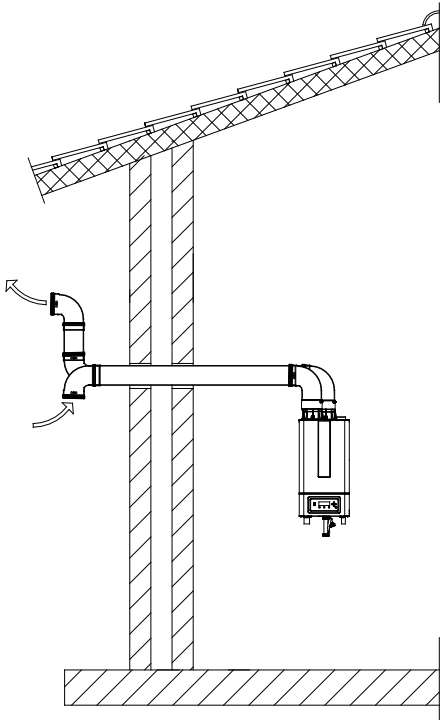
1. Installations must be made with a vent pipe system certified to ULC-S636.
2. The first three (3) feet of plastic vent pipe from the appliance flue outlet must be readily accessible for visual inspection.
3. The components of the certified vent system must not be interchanged with other vent systems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

 WARNING	<p>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.</p> <p>The inlet for combustion air can never be located inside a room storing chemicals or contaminants as listed in section 9.6.1. Avoid installing the water heater in any area with possible contaminants.</p> <p>If contaminants are found, you MUST: - remove contaminants permanently. or - relocate the water heater and air intake to an area free from all possible contaminants.</p>
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10.10 Direct venting options

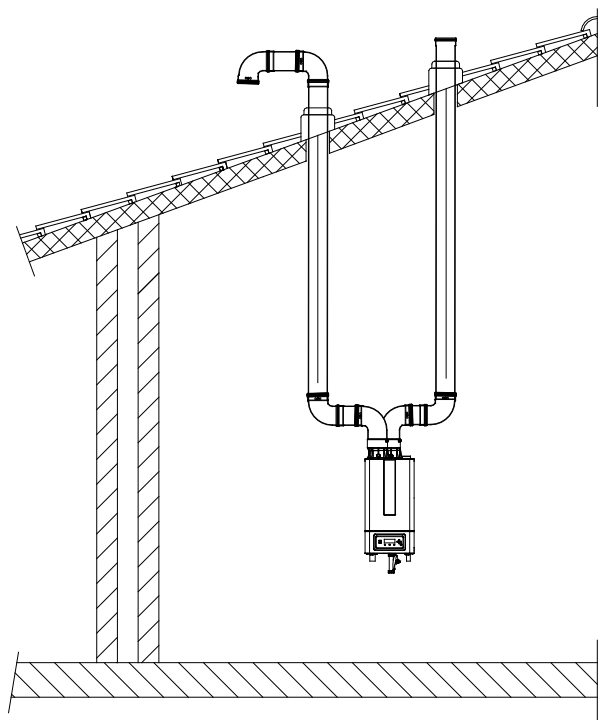
Two pipe wall

See page 53 for more details.



Two pipe vertical

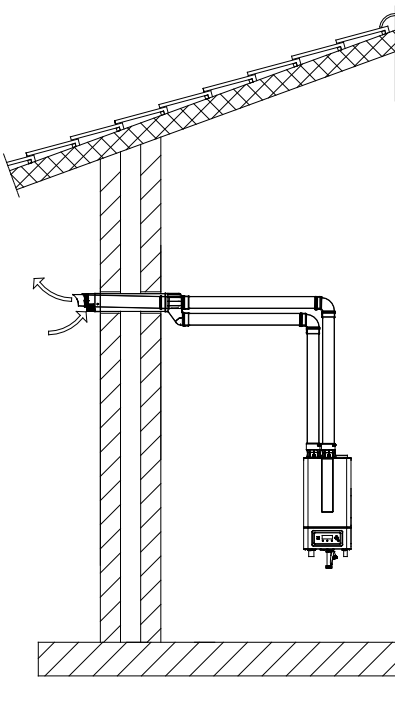
See page 53 for more details.



Concentric wall - two pipe to water heater

Water heaters HWB-299, HWB-399 only.

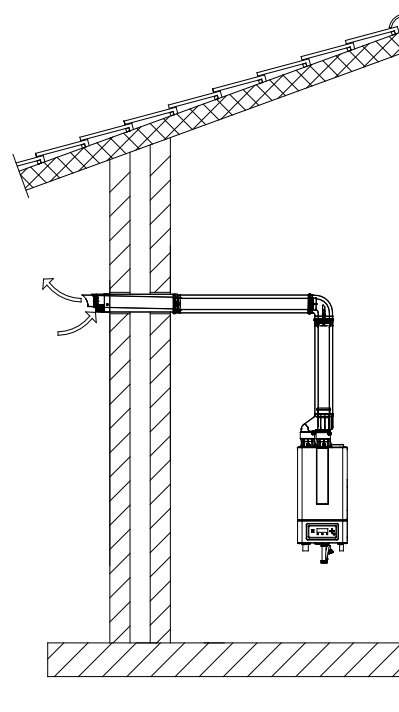
See page 51 for more details.



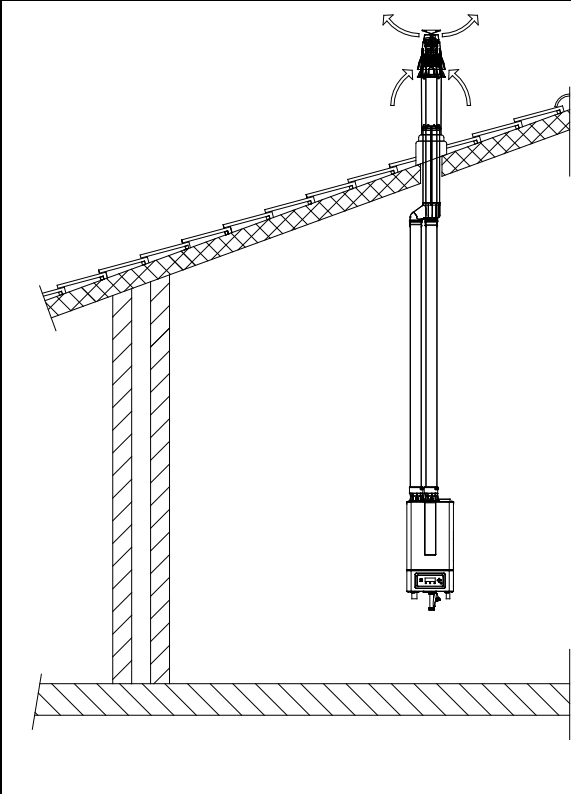
Concentric wall - concentric to water heater

Water heaters HWB-299, HWB-399 only.

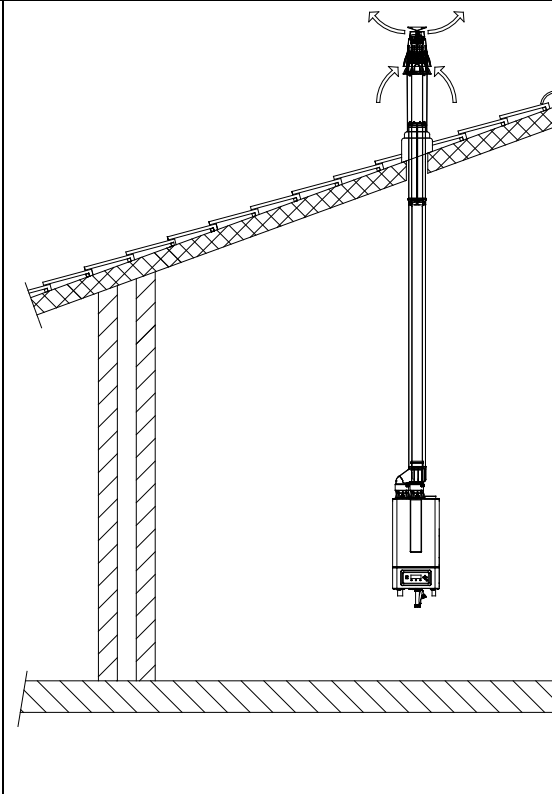
See page 51 for more details.



Concentric vertical - two pipe to water heater
Water heaters HWB-299, HWB-399 only.
See page 53 for more details





Concentric vertical - concentric to water heater
Water heaters HWB-299, HWB-399 only.
See page 53 for more details.



10.11 Wall (Horizontal) direct venting.

10.11.1 VENT/AIR TERMINATION - WALL


 WARNING	Follow instructions below when determining vent location to avoid possibility of severe personal injury, death, or substantial property damage.
	A gas vent extending through an exterior wall shall not terminate adjacent to a wall or below building extensions such as eaves, parapets, balconies, or decks. Failure to comply could result in severe personal injury, death, or substantial property damage.


 CAUTION	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
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10.11.2 DETERMINE LOCATION

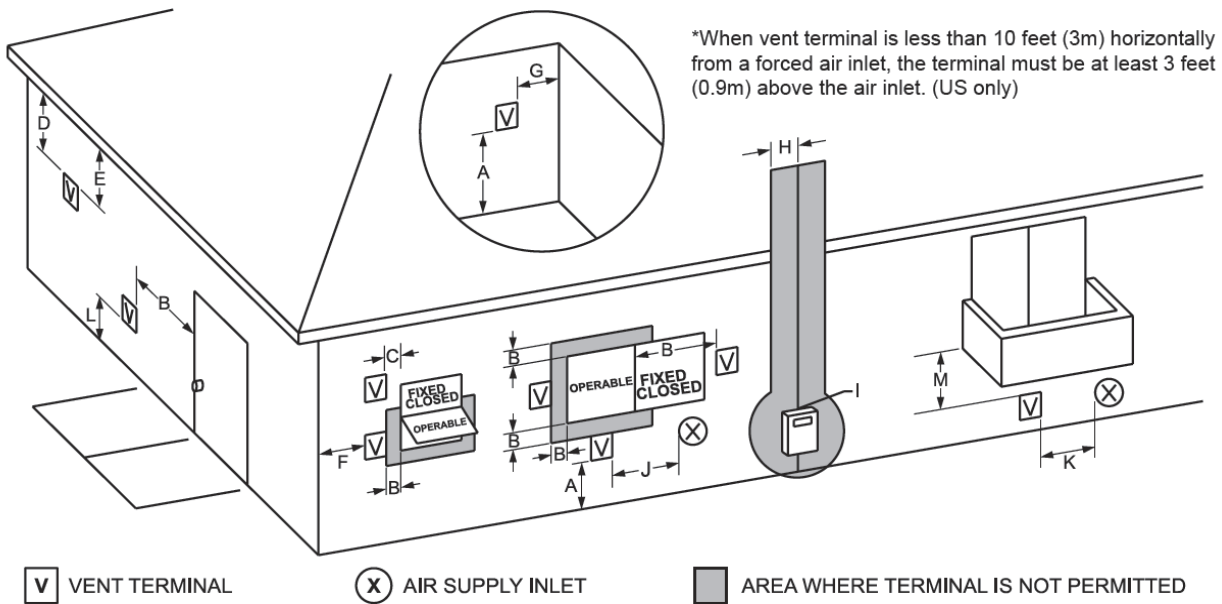
Locate the exhaust vent/air intake terminations using the following guidelines:

1. The total length of piping for exhaust vent or air intake must not exceed the limits given in the "General Venting" section on page 34 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 possibility 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 "Two pipe sidewall termination of air intake and exhaust vent". 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 figures "Two pipe sidewall termination of air intake and exhaust vent".

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



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) 299; 36" (91 cm) 399-499 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.

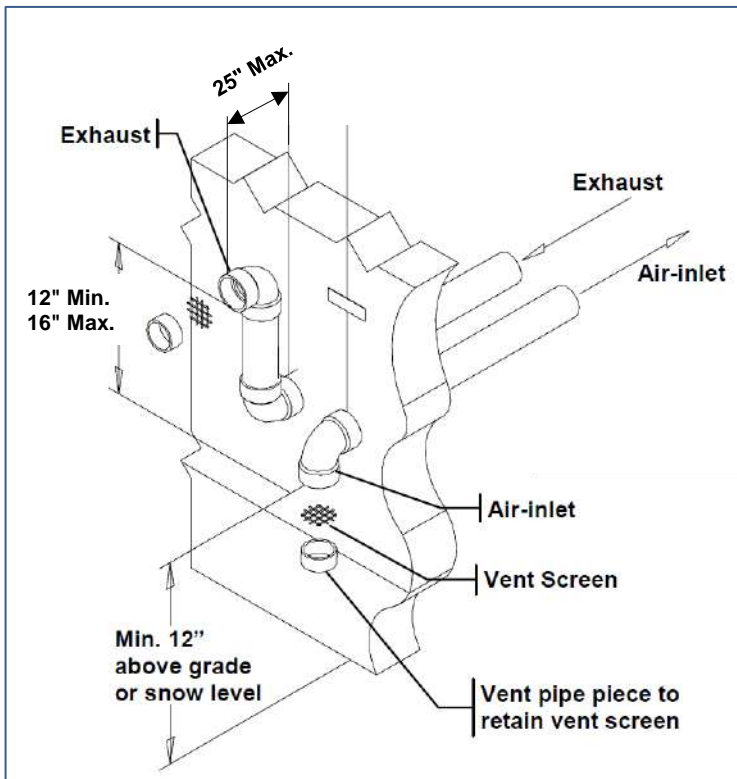
note 5: For clearances not specified in CAN/CSA-B149, clearance is in accordance with local installation codes and the requirements of the gas supplier

note 6: Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

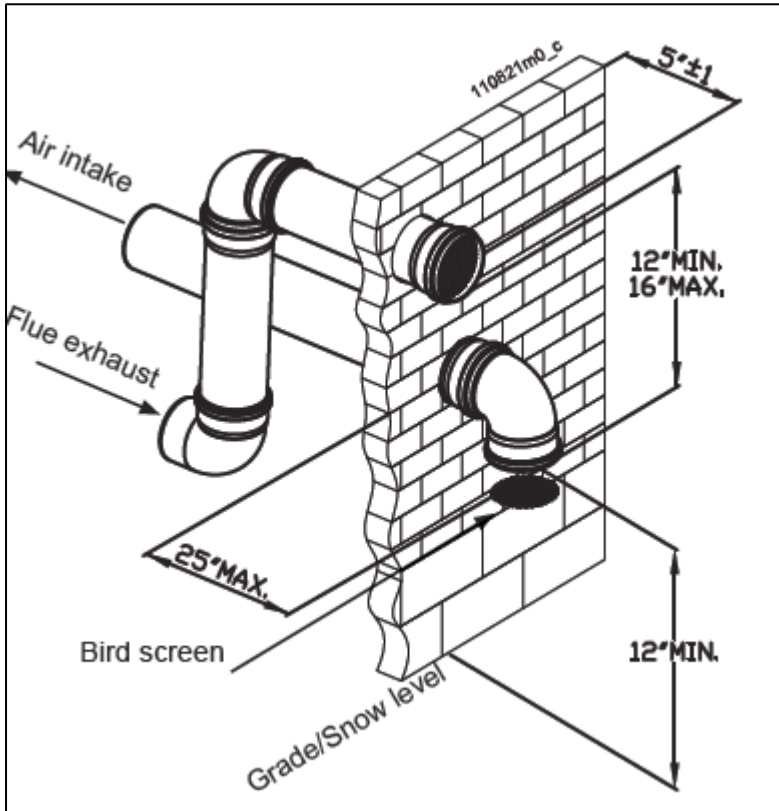
6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

Two pipe sidewall termination of air intake and exhaust vent.

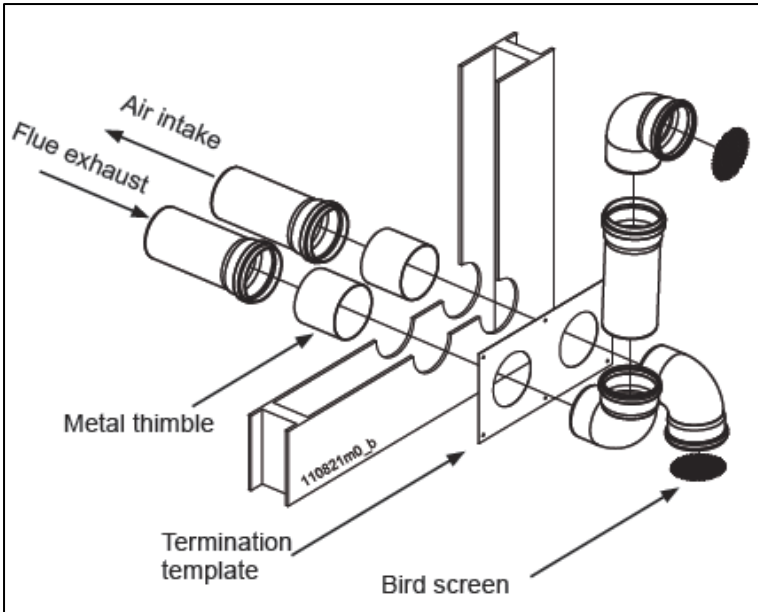
Alternate two pipe sidewall termination of air intake and exhaust vent.



Alternate two pipe sidewall termination of air intake and exhaust vent.




Two pipe sidewall termination assembly.



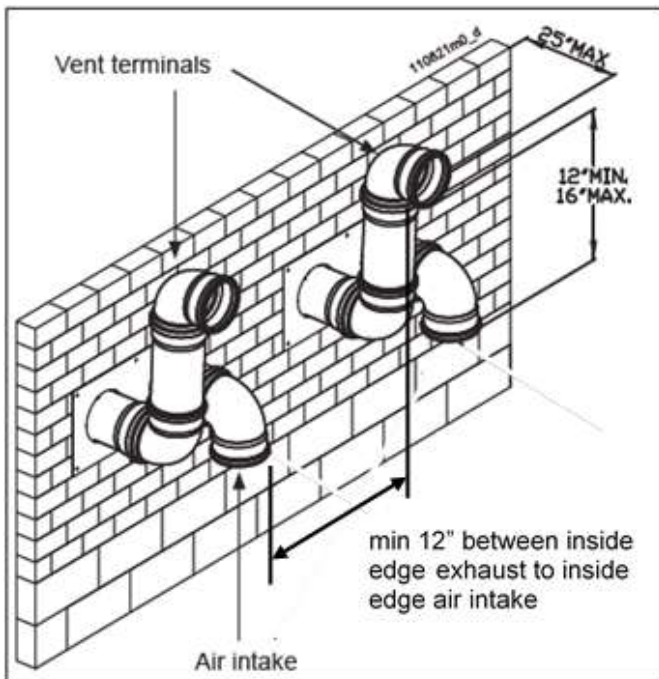
Multiple vent/air terminations

1. When terminating multiple water heaters, terminate each vent/air connection as described in this manual (figure below).

 WARNING	<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>
--	---

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

Two pipe multiple water heaters vent terminations.

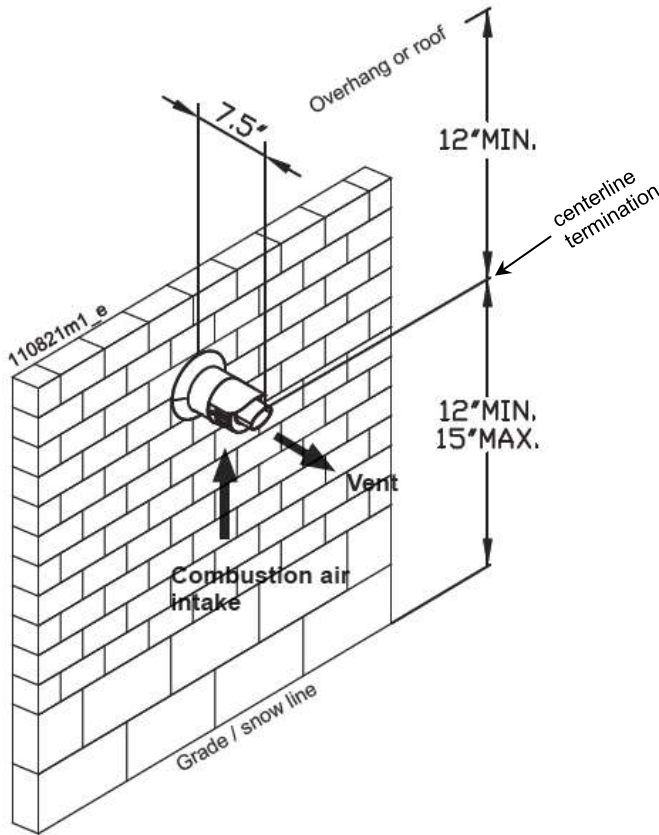


NOTE: Keep air intake at min. 12" from grade or snow line. Provide vent and air intake with bird screen.

Wall termination – concentric vent: water heaters HWB-299, HWB-399 only

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 below in figure below. The required combustion vent pipe materials are listed in the table in § 9.2 "Vent and air intake pipe material" of this manual.

Concentric sidewall termination clearances: water heaters HWB-299, HWB-399 only



Sidewall termination installation:

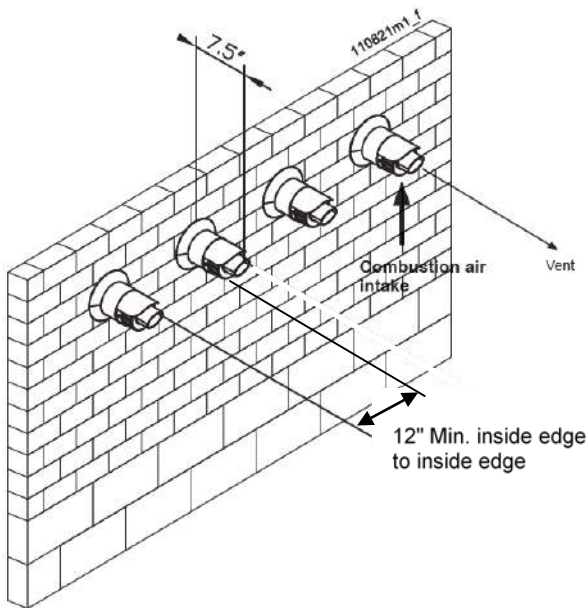
- Determine the best location for the termination kit (see figure above).
- Reference § 9.11.2 on page of this manual for general termination considerations.

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

Multi venting wall terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see figure below). 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 may be installed as shown in figure below. It is important that vent terminations be made as shown to avoid recirculation of flue gases.


Concentric sidewall multiple water heaters termination.



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

10.12 Roof (Vertical) direct venting.


10.12.1 VENT/AIR TERMINATION – VERTICAL

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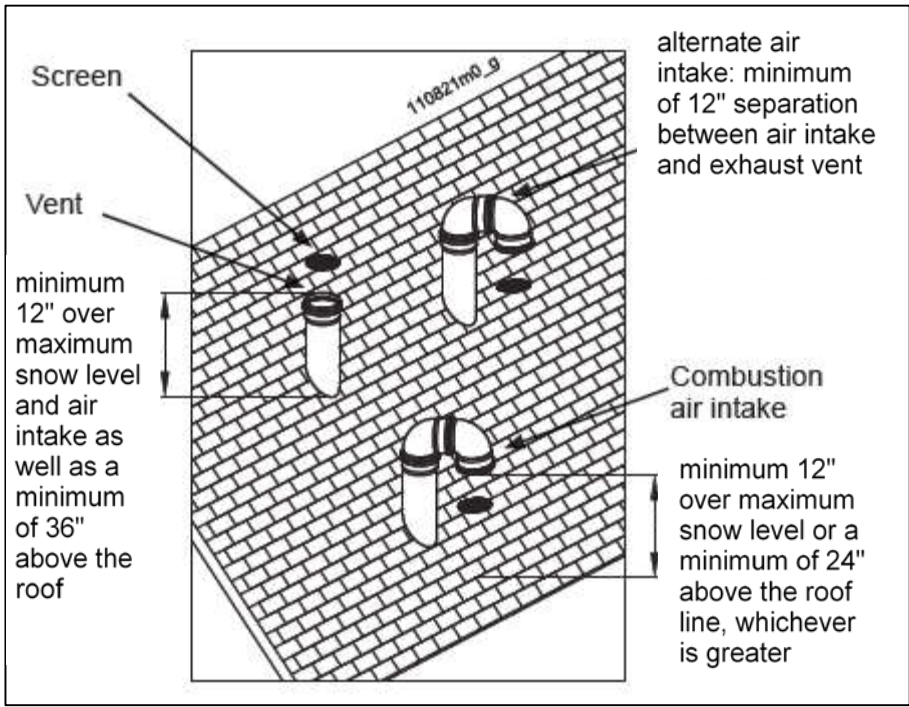
10.12.2 DETERMINE LOCATION

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 on page 34 of this manual.
2. Prepare the vent termination and the air intake termination elbow (figure below) 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 below
5. The exhaust piping must terminate in a vertical coupling as shown in figure below. 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 below.
7. Do not extend exposed vent pipe outside of building more than shown in this document. Condensate could freeze and block vent pipe.

 WARNING	Rooftop exhaust vent and air intake inlet terminations must terminate in the same pressure zone.
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Two pipes vertical termination of air and vent.



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.

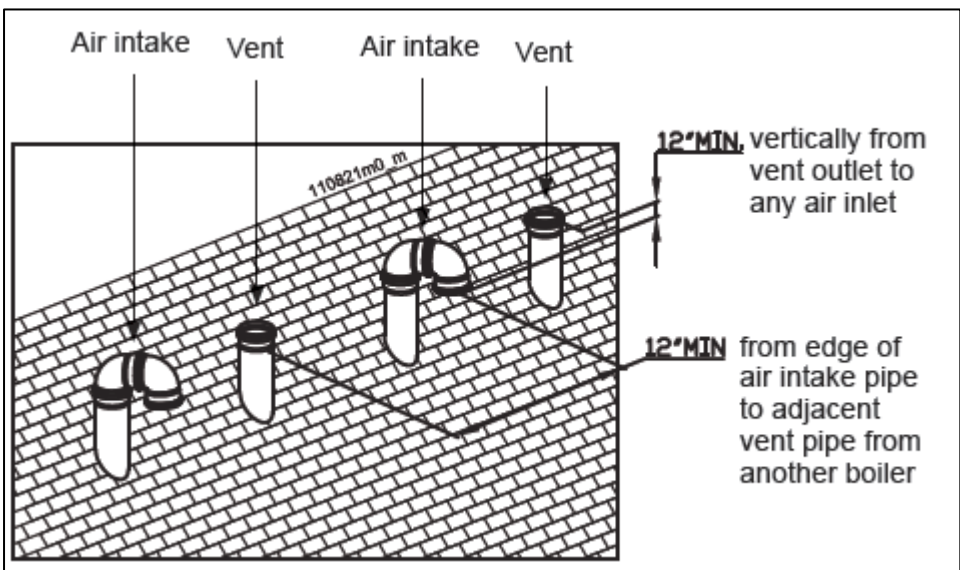
Multiple vent/air terminations

1. When terminating multiple water heaters, terminate each vent/air connection as described in this manual (figure below).

 WARNING	<p>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.</p>
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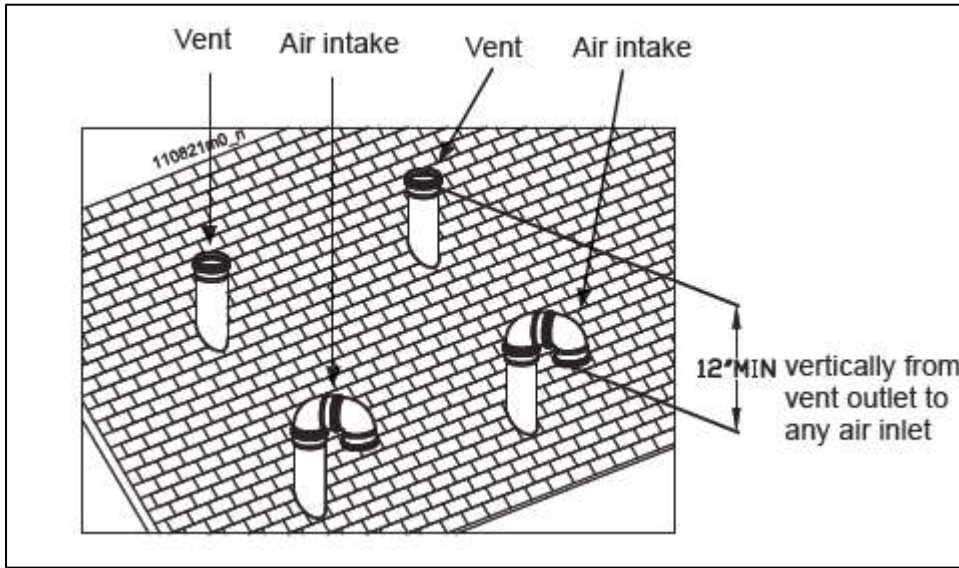
2. Place roof penetrations to obtain minimum clearance of 12 inches (305 mm) between outside edge of air intake an exhaust vent of another water heater for U.S. installations (see figure below). For Canadian installations, provide clearances required by CSA B149.1 Installation Code.

Vertical terminations with multiple water heaters.



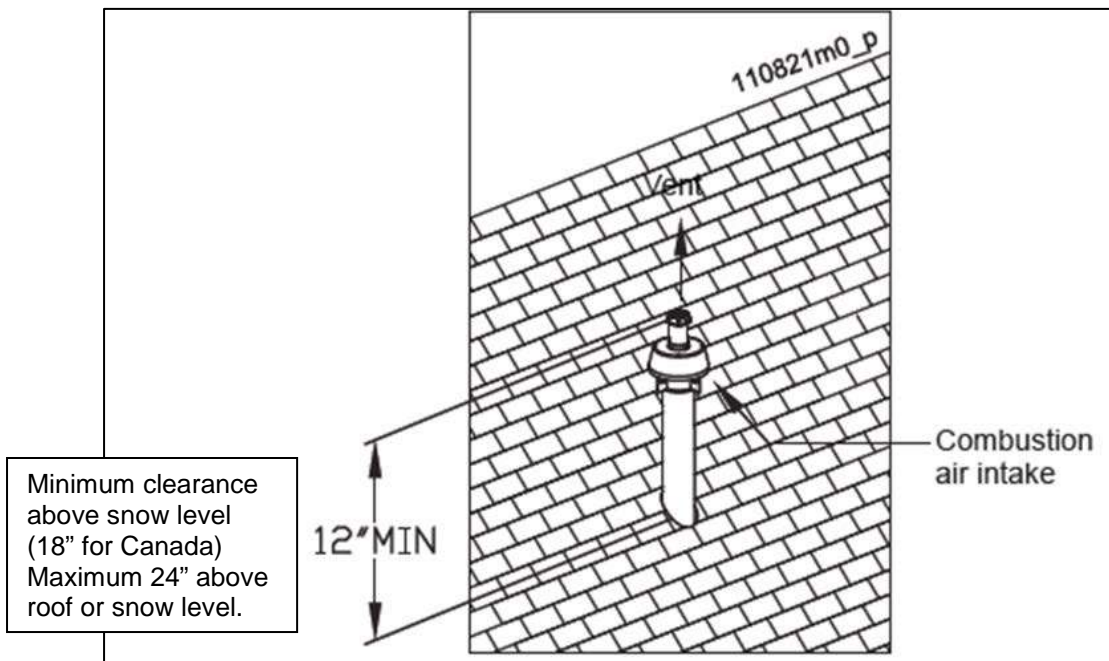
Note: keep the terminals at min. 12" above grade or snow line. Provide exhaust vent and air intake with bird screen.

Alternate vertical terminations with multiple water heaters.






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

Concentric Vertical Termination.



Do Not Install U-Bend or elbow on concentric termination

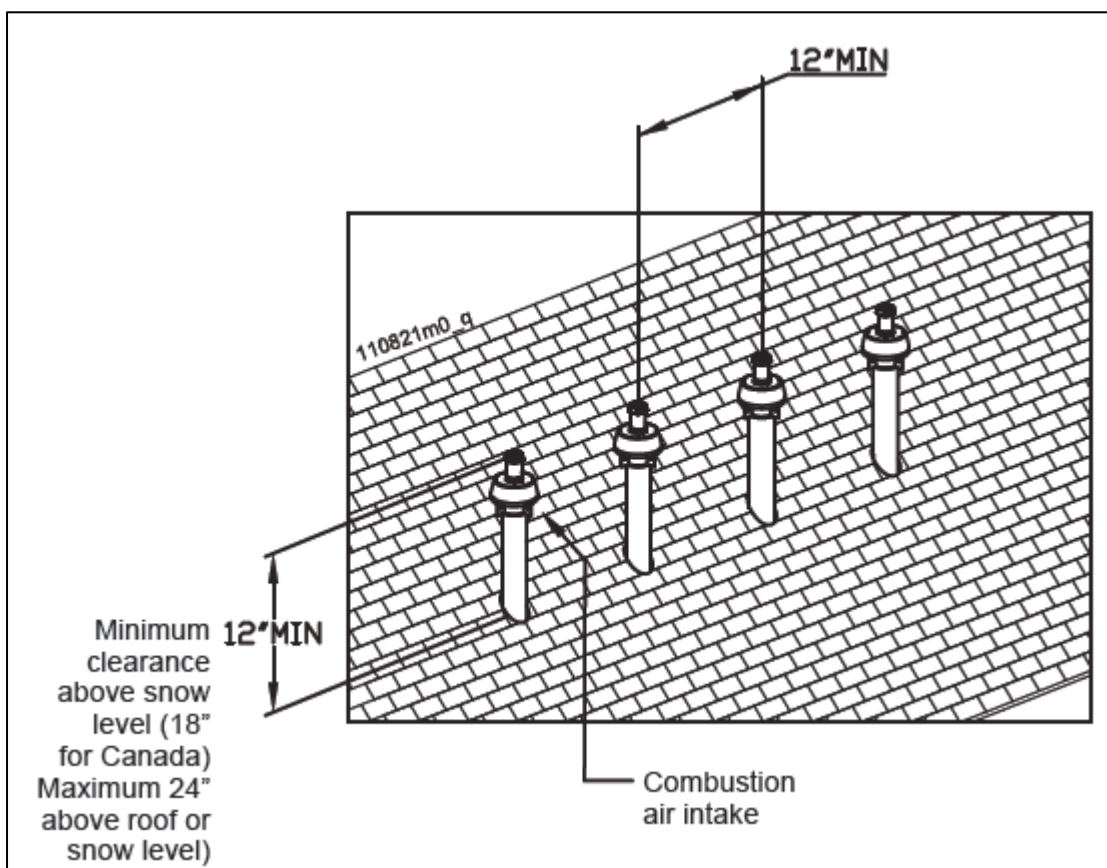


 WARNING	Do not operate the appliance with the rain cap removed on the concentric terminations or recirculation of combustion products may occur. Water may also collect inside the larger combustion air pipe and flow to the burner enclosure. Failure to follow this warning could result in product damage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

Multi venting vertical terminations

When two (2) or more direct vent appliances are vented near each other, each appliance must be individually vented (see figure below). 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 may be installed as shown in figure below. It is important that vent terminations be installed as shown to avoid recirculation of flue gases.

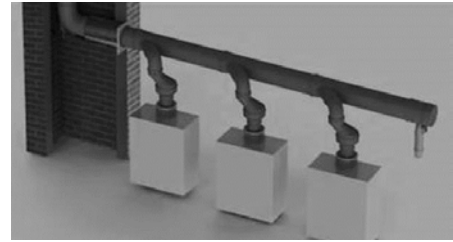
Concentric vent and combustion air vertical termination multiple water heaters.



11 CASCADING

11.1 Appliance

The Boilers have an internal flue gas valve for an overpressure system according to the table below.
 This device is needed to prevent recirculation of the flue gases.
 If separated flue systems cannot be applied, ask a flue gas supplier to calculate a zero-pressure common flue system.



11.1.1 CALCULATION HWB (VALID FOR PARTS SUPPLIED BY DURAVENT (M&G)).

Maximum vertical length in feet (m).					
Type of boiler	Number of appliances	DN150	DN150/200	DN200	DN200/300
HWB-299	3	100 ft (30 m)	100 ft (30 m)	100 ft (30 m)	100 ft (30 m)
	4	36 ft (11 m)	100 ft (30 m)	100 ft (30 m)	100 ft (30 m)
	5		100 ft (30 m)	100 ft (30 m)	100 ft (30 m)
	6		16 ft (5 m)	100 ft (30 m)	100 ft (30 m)
HWB-399	3	85 ft (26 m)	100 ft (30 m)	100 ft (30 m)	100 ft (30 m)
	4		100 ft (30 m)	100 ft (30 m)	100 ft (30 m)
	5		16 ft (5 m)	100 ft (30 m)	100 ft (30 m)
	6			100 ft (30 m)	100 ft (30 m)
CHB-499	3		100 ft (30 m)	100 ft (30 m)	100 ft (30 m)
	4		65 ft (20 m)	100 ft (30 m)	100 ft (30 m)
	5			20 ft (6 m)	100 ft (30 m)
	6				100 ft (30 m)

Remark 1: Dn 150/200 means: the diameter of the horizontal collector including the bend = 150 mm and after the bend the diameter of the vertical section is 200 mm with an adaptor of 150->200 mm

Remark 2: Length between shaft and last collector (no. A) = 3.3 ft (1 m).

Remark 3: For calculating other lengths between the last collector and the bend, the length of the vertical height must be reduced by the number of length and for bends the table below must be used.

11.1.2 TERMINALS EQUIVALENT FEET

Elbow type	Diameter	
	DN150	DN200
45°	5.6 ft (1.7 m)	12.5 ft (3.8 m)
90°	13.2 ft (4.0 m)	19 ft (5.8 m)

11.2 Existing Common Venting Guidelines.

Do not common vent the HWB water heater with the vent pipe of any other water heater or appliance. However, when an existing water heater 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 water heater, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation:

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

12 ELECTRICAL INSTALLATION

12.1 General

- For operation, the water heater needs a power supply of 120 VAC/ 60Hz.
- The water heater main supply connection is polarity sensitive.
- The wiring for the connections can be entered at the bottom of the water heater through the wiring knock-outs.
- NOTICE: Before starting to work on the water heater, it must be switched off and the power supply to the water heater must be disconnected.
- Electrical wiring should 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 water heater should only be done by a qualified installer or licensed electrician where required that is 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.

12.2 Connection mains supply

- It is advised to use a flexible cable between the cabinet entry (at the bottom) and the connection terminal.
- The earth wire has to be longer than the phase and neutral wire.
- The power supply cable must be secured by tightening the cable gland at the bottom of the water heater 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; 9 = Neutral; PE = Earth.

12.3 Electrical connections

LOW VOLTAGE CONNECTIONS

29	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	Gas pressure switch	LWCO Extern	AL-BUS managing boiler	DO NOT USE	Flow switch DHW	DO NOT USE	DO NOT USE	AL-BUS depending boiler	Modbus			DHW sensor	System sensor	DO NOT USE														
Interrupteur de sécurité 2	Interrupteur de sécurité 1	Interrupteur de pression de gaz	Eau basse coupée à l'extérieur	AL-BUS chaudière gérant	NE PAS UTILISER	Interrupteur de débit ECS	NE PAS UTILISER	NE PAS UTILISER	AL-BUS chaudière dépendant				Capteur ECS	Capteur de système	NE PAS UTILISER														

HIGH VOLTAGE CONNECTIONS

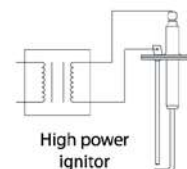
	1	2	3	PE	4	5	PE	6	7	PE	8	9	PE	PE	10	11
	L1	N	L2	PE	L	N	PE	L	N	PE	L	N	PE	PE	L	N
MAXIMUM TOTAL OUTPUT 3.5 Amps NOMINAL	DO NOT USE				DO NOT USE			GENERAL PUMP			MAINS SUPPLY				ALARM	
	NE PAS UTILISER				NE PAS UTILISER			Pompe générale MAX 2 Amps			Alimentation secteur				Alarme MAX 50W	

High power ignitor

A separate connector for an external igniter is located on the cable tree, near the water heater controller and labelled "High power ignitor".

The "external ignition transformer" can be ordered, see § 5.1 "Accessories".

This accessory is provided with detailed mounting instructions.




12.4 Explanation of the low voltage connections.

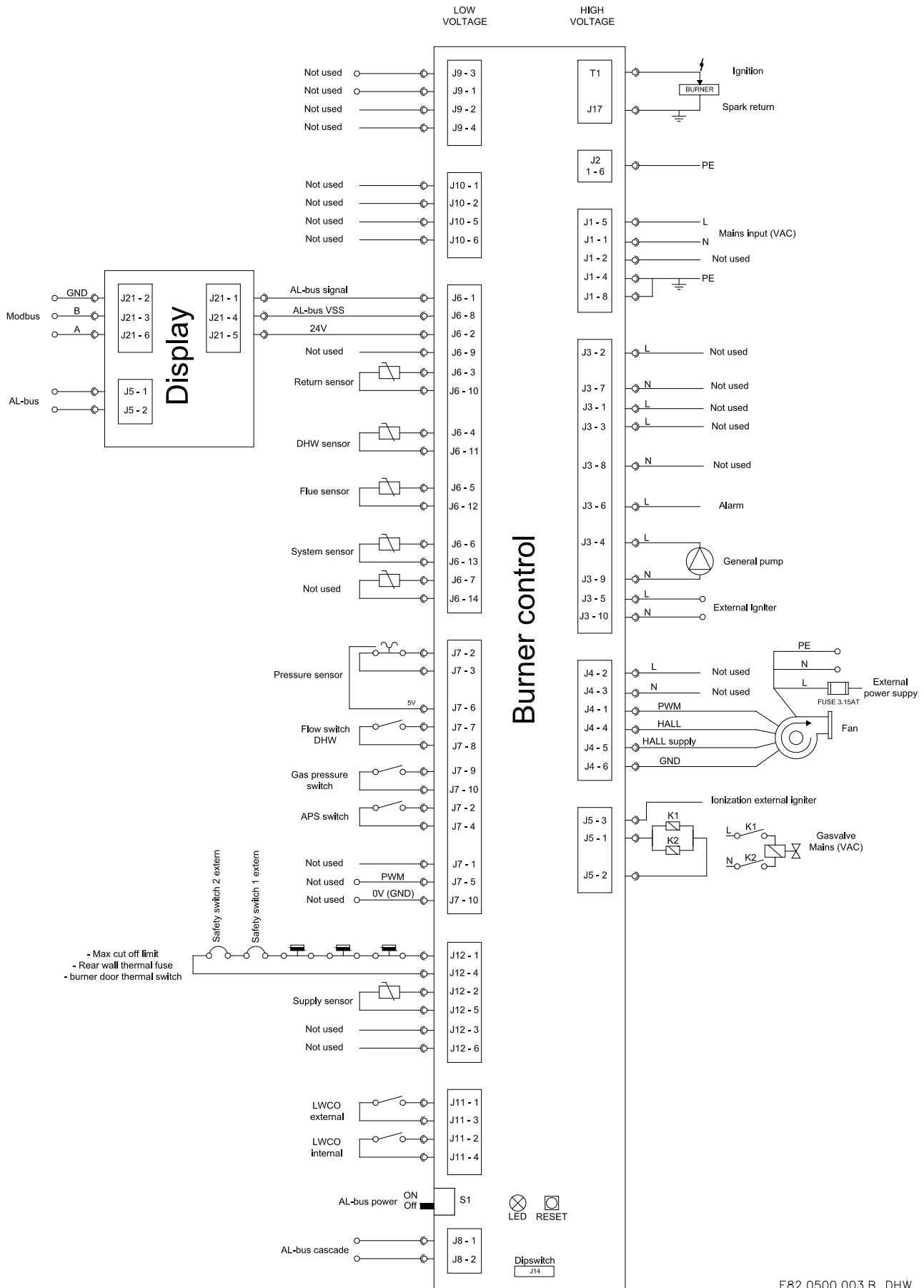
1-2	DO NOT USE
Do not connect wires to these terminals	
3-4	SYSTEM SENSOR
If a low loss header is used, this sensor measures the Outlet temperature at the system side. The sensor must be mounted on the supply pipe or in a sensor well at the system side, close to the low loss header. NOTICE: This sensor (see § 7.21) must be used when water heaters are cascaded with the internal cascade manager. PARAMETER: water heater parameter 122, see: 11.9 "programmable in- and outputs"	
5-6	DHW SENSOR
When an indirect hot water tank is installed, the DHW mode must be set to 1 or 2. When the DHW mode is set to 1, a sensor can be connected. This sensor should be mounted in a well in the tank. The water heater 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 water heater will stop serving hot water.	
7-8-9	MODBUS
Connections for a MODBUS communication signal. 7 = ground, 8 = A, 9 = B (A detailed Modbus bulletin is available at your supplier on request)	
10-11	AL-BUS DEPENDING
Cascade connections for the dependent water heaters, 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 water heaters to 20 of the managing water heater, and connections 11 of the dependent water heaters to 21 of the managing water heater.	
12-13	DO NOT USE
Do not connect wires to these terminals	
14-15	DO NOT USE
Do not connect wires to these terminals	
16-17	DHW - FLOW SWITCH
For DHW_Mode 3 a flow switch can be connected. If a water flow is present, the switch closes, and the DHW pump is started. The temperature of the DHW is set with DHW_Setpoint. PARAMETER: water heater parameter 117, see: 11.9 "programmable in- and outputs"	
18-19	DO NOT USE
Do not connect wires to these terminals	
20-21	AL-BUS MANAGING
Cascade connection for the managing water heater. Link connection 20 of the managing water heater to connections 10 of the depending water heaters, and connection 21 of the managing water heater to connections 11 of the depending water heaters.	
22-23	LWCO EXTERN
To be used for an extra external Low Water Cut Off. The water heater goes into a lockout when this contact opens	
24-25	GAS PRESSURE SWITCH
To be used for an extra external gas pressure switch. The water heater goes into a lockout when this contact opens PARAMETER: water heater parameter 118, see: 11.9 "programmable in- and outputs"	
26-27	SAFETY SWITCH 1
To be used for an extra external safety switch. The water heater goes into a lockout when this contact opens	
28-29	SAFETY SWITCH 2
To be used for an extra external safety switch. The water heater goes into a lockout when this contact opens	

12.5 Explanation of the high voltage connections.

1-2-3-PE	DO NOT USE
Do not connect wires to these terminals	
4-PE-5	DO NOT USE
Do not connect wires to these terminals	
6-PE-7	GENERAL or WATER HEATER PUMP
Connections for the power supply of a water heater pump. (P1, see chapter 8.5 for detailed electrical specifications).	
8-9-PE-PE	MAINS SUPPLY
The power supply connection of the unit. 8 = Line voltage wire; 9 = Neutral wire, PE = Ground wire	
10-11	ALARM RELAY
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 = Phase wire; 11 = Neutral wire PARAMETER: water heater parameter 127, see: 11.9 "programmable in- and outputs"	
X1-X2-X3	HIGH POWER IGNITER (external igniter)
A separate connector for an external igniter is located on the cable tree, near the water heater 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 § 5.1 "Accessories". X1 = Neutral wire; X2 = Ionization; X3 = Line wire. PARAMETER: water heater parameter 126, see: § 11.10 "programmable in- and outputs".	

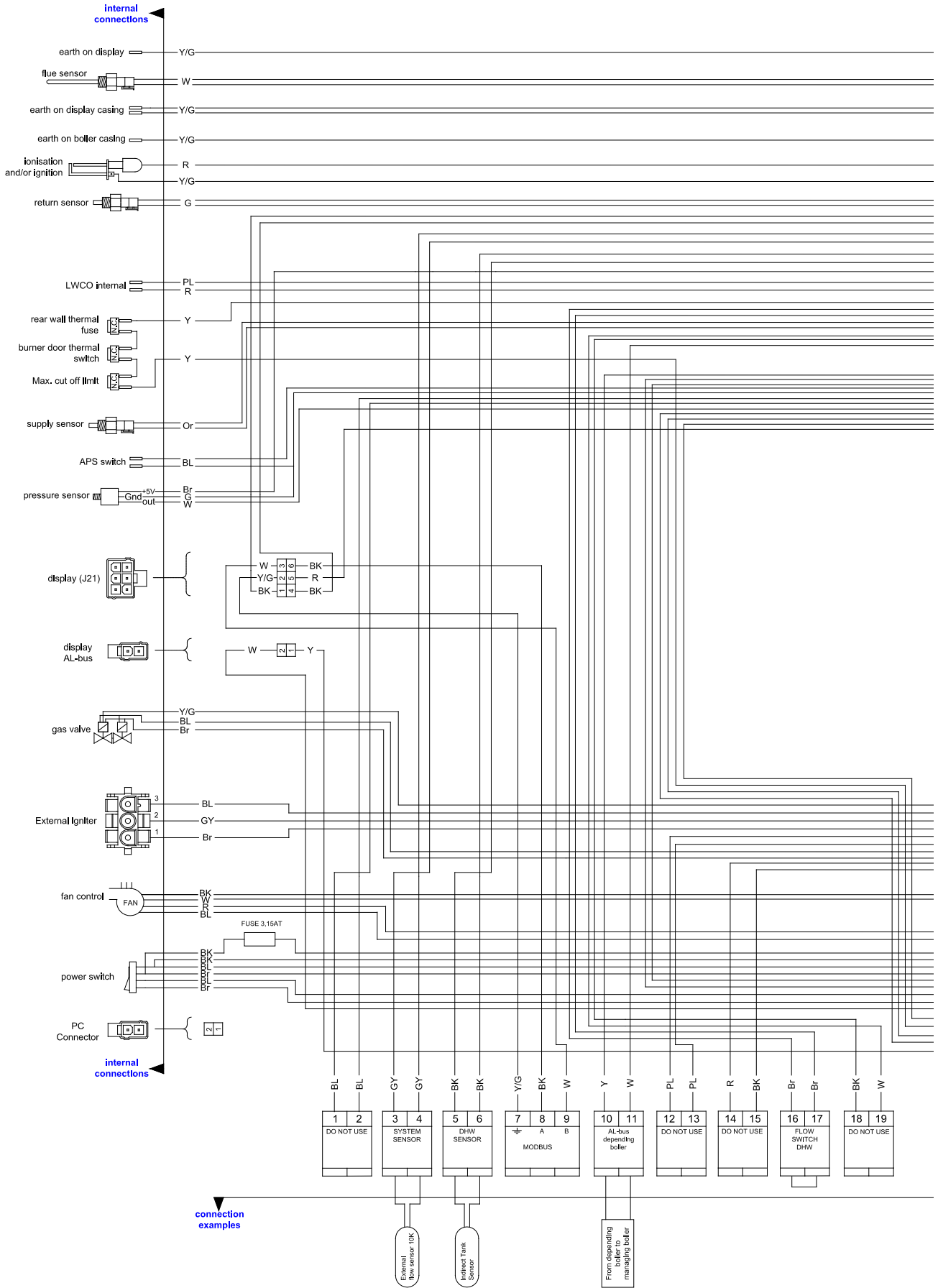
 NOTICE	<p>To all outputs following applies: maximum current 2 Amp each output. Total output of all currents combined maximum 3.5 Amp. The inrush current of the 3-way valve and/or pumps is maximum 8 Amp.</p>
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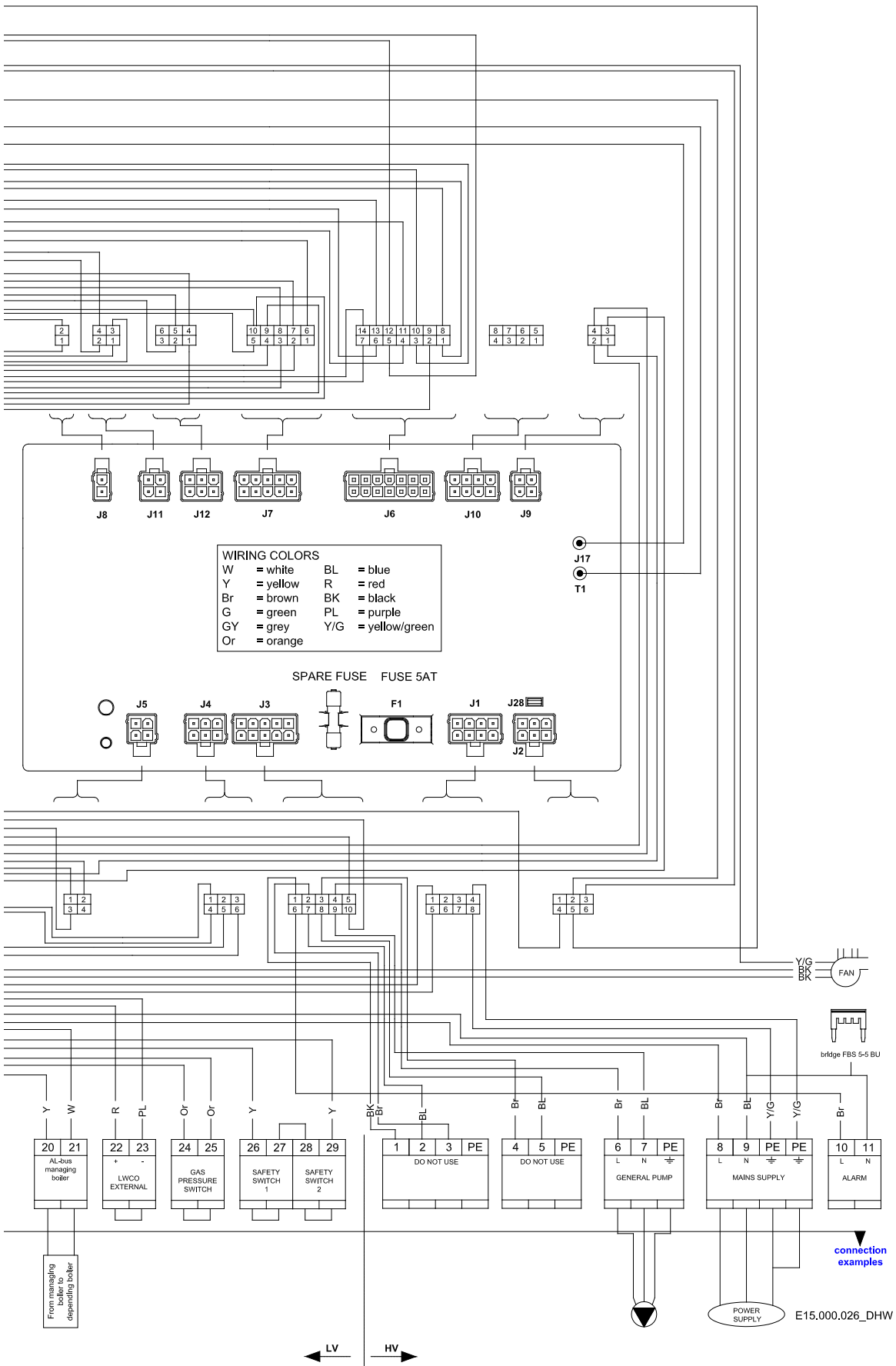
12.6 Ladder/Logic Diagram



E82.0500.003.B_DHW

12.7 Electrical schematics





12.8 Sensor availability

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

	DHW Mode								
	0 N.A.	1 N.A.	2	3 N.A.	4	5 N.A.	6 N.A.	7 N.A.	8 N.A.
T_Supply	O	M	M	O	M	O	M	M	M
T_Return	O	O	O	O	M	O	---	O	M
T_DHW	---	M	---	M	M	M	M	---	M
T_Outdoor	O	O	O	O	O	O	---	---	O
0-10 Volt	O	O	O	O	O	O	O	O	O
Water Flow DHW	O	O	O	O	O	M	O	M	M
RT Switch	O	O	M	O	O	O	O	O	O

M = Mandatory, O = Optional, --- = Disabled, N.A. = Not Available.

DHW mode 0 – Do not use

DHW mode 1 – Cascaded Water Heaters with bulb and system sensors.

DHW mode 2 – Do not use

DHW mode 3 – Do not use

DHW mode 4 – Stand Alone with immersion bulb sensor.

DHW mode 5 to 8 Do not use.

12.9 NTC sensor curve

All NTC sensors are according to this characteristic: NTC 10K@77 °F (25°C) B3977k 3%@140°F (60°C)

Temperature °F (°C)	Resistance (Ω)	Temperature °F (°C)	Resistance (Ω)	Temperature °F (°C)	Resistance (Ω)	Temperature °F (°C)	Resistance (Ω)
-40 (-40)	334275	50 (10)	19897	122 (50)	3599	212 (100)	674
-22 (-30)	176133	68 (20)	12493	140 (60)	2454	230 (110)	506
-4 (-20)	96761	77 (25)	10000	158 (70)	1748	248 (120)	384
14 (-10)	55218	86 (30)	8056	176 (80)	1252	266 (130)	296
32 (0)	32624	104 (40)	5324	194 (90)	912	284 (140)	230

12.10 Programmable in- and outputs

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

water heater parameter	name	default setting	description	terminal
(117)	Prog. Input 2.	2	DHW flow switch	LV 16-17
(118)	Prog. Input 3.	2	Gas pressure switch	LV 24-25
(122)	Prog. Input 7.	3	Cascade sensor	LV 3-4
(124)	Prog. Input RT.	1	room thermostat on	LV 12-13
(125)	Prog. Output 1.	4	System pump	HV 4-5
(126)	Prog. Output 2.	9	Ext. Igniter	separate connector
(127)	Prog. Output 3.	6	Alarm semiconductor output	HV 10-11
(128)	Prog. Output 4.	18	3-way Valve DHW	HV 3-2-1



NOTICE

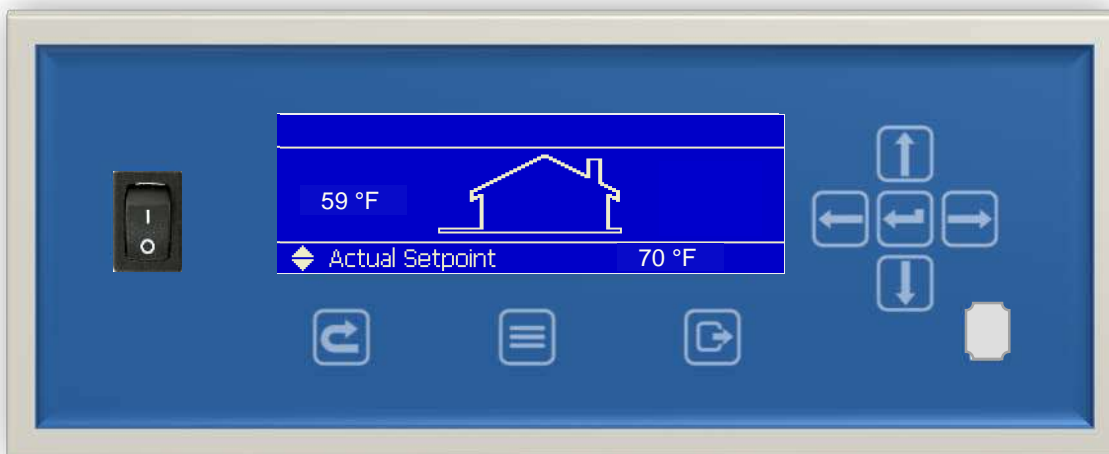
To all outputs following applies: maximum current 2 Amp each output.
Total output of all currents combined maximum 3.5 Amp.
The inrush current of the 3-way valve and/or pumps is maximum 8 Amp.











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	N.A.			1 Module pump	N.A.
		2 DHW flow switch				2 CH pump	N.A.
		3 CH flow sensor	N.A.			3 DHW pump	N.A.
4 CH flow switch		4 System pump	N.A.				
(118)	Prog. Input 3.	0 Disabled				5 Cascade pump	N.A.
		1 Drain switch				6 Alarm relay	2)
		2 Gas pressure switch				7 Filling valve	2)
(122)	Prog. Input 7.	0 Disabled				8 LPG tank	2)
		1 T_Flue_2 sensor	N.A.			9 Ext. Igniter	2)
		2 T_Flue_2 with blocked flue	N.A.	10 Air damper	2)		
		3 Cascade sensor					
		4 Blocked Flue switch	N.A.				
(124)	Prog. Input RT.	0 room thermostat off		(128)	Prog. Output 4.	0 Disabled	
		1 room thermostat on				1 Module pump	
Display:		OUTPUTS:				2 CH pump	
(125)	Prog. Output 1.	0 Disabled				3 DHW pump	
		1 Module pump				4 System pump	
		2 CH pump				5 Cascade pump	
		3 DHW pump				6 Alarm relay	
		4 System pump				7 Filling valve	
		5 Cascade pump				8 LPG tank	
		6 Alarm relay				9 Ext. Igniter	
		7 Filling valve		10 Air damper			
		8 LPG tank		11 empty			
		9 Ext. Igniter		12 empty			
10 Air damper		13 empty					
(126)	Prog. Output 2.	0 Disabled		14 empty			
		1 Module pump	1)	15 empty			
		2 CH pump	1)	16 empty			
		3 DHW pump	1)	17 3-way Valve CH			
		4 System pump	1)	18 3-way Valve DHW			
		5 Cascade pump	1)	19 3-way Valve CH (power when idle)			
		6 Alarm relay	1)	20 3-way Valve DHW (power when idle)			
		7 Filling valve	1)				
		8 LPG tank	1)				
		9 Ext. Igniter	1)				
10 Air damper	1)						

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 earth is needed, it must be connected to the main earth 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.

13 WATER HEATER CONTROLLER AND DISPLAY.






13.1 Display and buttons



	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

13.1.1 DISPLAY ICONS

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

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

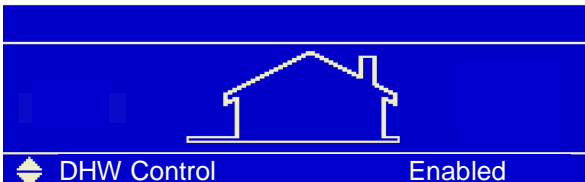
Water heater Status	
CH control state (Central Heating controller state)	RT_Input (Room thermostat open or closed)
0 → Idle	0=Open
1 → Request	1=Closed
2 → Demand	
3 → Post circulation	
4 → Off	

13.2 Screens and settings.

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:



13.2.1 SET ACTUAL SETPOINT/DHW SETPOINT DIRECTLY VIA THE STATUS OVERVIEW

You can adjust the DHW setpoint directly on the bottom of the Status overview.

Press UP/DOWN $\uparrow\downarrow$ to select the mode, then press CONFIRM \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 CONFIRM \leftarrow or RIGHT \rightarrow to confirm your alteration or press ESC \boxed{E} or LEFT \leftarrow to cancel.

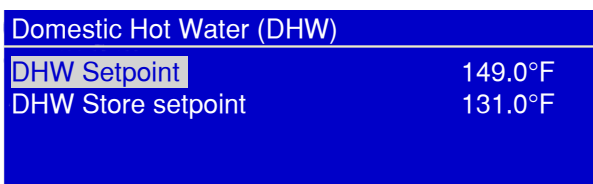
A setpoint is only visible on the display when no error or alert is active. In case of an active error or alert, the bottom right part of the display is used to display the error or alert text.

13.2.2 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.



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



Use "DHW Setpoint" in case of a single water heater with one tank.

Use "DHW Store Setpoint" in case of a cascaded system with multiple water heaters and/or tanks


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{E} . If you want to go back one step in the menu press BACK/LEFT \leftarrow .

13.2.3 PROTECTED MENU ITEMS

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



Users are only allowed to change parameters not needing a password. Installers have to use the password 1122 to change parameters protected by a password.

 WARNING	<p>Changing protected/safety parameters should only be conducted by experienced, licensed water heater operators and mechanics. Hazardous burner conditions can happen with improper operations that may result in PROPERTY LOSS, PHYSICAL INJURY, or DEATH.</p>
---	--

Enter the password with the following steps:

1. Use the UP/DOWN ↑↓ button to adjust the first number
2. Press CONFIRM ◀ 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.

The following menu items require a password*:

(Sub) Menu item	Location inside menu
Climatic Compensation	via 'Heating > Climatic compensation'
Water heater	via 'Settings > Water heater'

13.2.4 DE-AERATION SEQUENCE

The “De-Aeration” sequence is a safety function that starts at every power ON of the water heater 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”

13.2.5 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 Eco King Heating Products Inc. for instructions if the display is set to Chinese and needs to be reset to another language.

Please follow the next 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 CONFIRM ◀ button
3. Select “General Settings” (press UP/DOWN ↑↓ to highlight/select) and press the CONFIRM ◀ button
4. Select “Language” (press UP/DOWN ↑↓ to highlight/select) and press the CONFIRM ◀ button
5. Select the desired language (press UP/DOWN ↑↓ to highlight/select) and press the CONFIRM ◀ button



13.3 Water heater history

The history found in the information menu displays several history counters that keep track of the water heater usage. The history cannot be erased and will continue for the burner controller life cycle. The following history data is 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.

13.4 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 PB display will monitor the error codes it receives from the water heater(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 water heater ID of the water heater on which the error was detected. The error log can be viewed from the error log menu, which is located in the information menu.

Menu	
Domestic Hot Water (DHW)	
Information	
Settings	
System test	

Information	
Water heater Status	
Water heater History	
Error Log	
Service	

Error Log	
Error Log	Disabled
Filter Error Type	
Clear Error Log	

(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 Water heater ID (Cascade System)	Filter errors based on Water heater ID (Managing, Dep 1, Dep 2)
Clear Error Log	Clear the error log (protected by password)

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.

Error Log	
A014 (14) Lockout Air Switch Not Closed	
Wed 04-11-2018 14:50	1/32 ▼

The error log screen will show on the first line: Water heater ID for which water heater 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 picture 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.

13.5 Service reminder

The Service reminder will remind the owner/user of the appliance to service the appliance at a specified "Service_Interval", factory set on 2000 burn hours. When service is not done within this time, a service reminder will be shown on the screen: "Service is required!", alternating with the normal status display.

NOTE: with the message "Service is required" the water heater keeps running, but maintenance must be done before resetting this message.

13.5.1 SERVICE OVERDUE LOGGING

Menu/ Information/ Service/ Service history.

When the Service reminder has become active, the time (in hours) it takes before service is actually done 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.

13.5.2 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 remove the message "Service is required" go to: menu/ Information/ Service/ "Reset service reminder". Enter the installer password, the "Reset service reminder" can be set to "YES" for resetting the service reminder. The overdue time is recorded in the service history.

13.5.3 MENU'S AND PARAMETERS

Service status information can be viewed: Menu/ Information/ Service.

Here the installer can also reset the Service reminder (accessible at installer level).

(Sub) Menu item	Description
Service history	View the Service history (log). For each service moment the Service overdue counter is stored. When the overdue counter is 0 hrs, it means service was done before the Service reminder was active. The log is ordered so the most recent service moment is shown first (on top of the list).
Burn hours since last service	Shows the number of burn hours since the last service moment.
Burn hours till service	Shows the number of burn hours until service is required.
Reset service reminder	Reset the Service reminder (and store Service overdue counter in the service history). Installer must enter the installer password first before it can be reset.

13.6 General

The water heater controller is designed to function as a standalone control system 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 ¹		AWG (mm ²)	Cable length (m)
		23 (0.25)	328.1 ft (100)
		20 (0.5)	656.2 ft (200)
		18 (0.75)	984.3 ft (300)
		17 (1.0)	1312.3 ft (400)
		15 (1.5)	1968.5 ft (600)

¹⁾ This consists the total length of the cable, not the length between two water heaters. The length differs with the diameter of the cable.

13.6.1 PUMP START EXERCISE EVERY 24 HOURS

To protect the pump from getting stuck at a certain position it is forced to run for 10 seconds every 24 hours. This is done only for the water heater loop pump at the start-up of the board.

13.6.2 FROST PROTECTION

The Frost protection function protects the water heater and water heater 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_Pump the water heater loop pump is switched ON for CH.
- When any of the sensors drop below FP_Start_Burn the water heater 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 pumps will post-circulate for CH_Post_Pump_Period. Parameters are factory set.

13.6.3 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.

Water heater power limitation

All water heaters have a flue gas sensor. The control will limit the water heater power when the flue gas temperature reaches the set Max_Flue_Gas_Temp. The maximum water heater power is linearly limited when the flue gas temperature is within Max_Flue_Gas_Temp 41 °F (5 °C) and Max_Flue_Gas_Temp.

Parameters are factory set

13.6.4 APPLIANCE SELECTION

The control is designed to store specific parameter sets. When this parameter is changed the following settings can be changed:

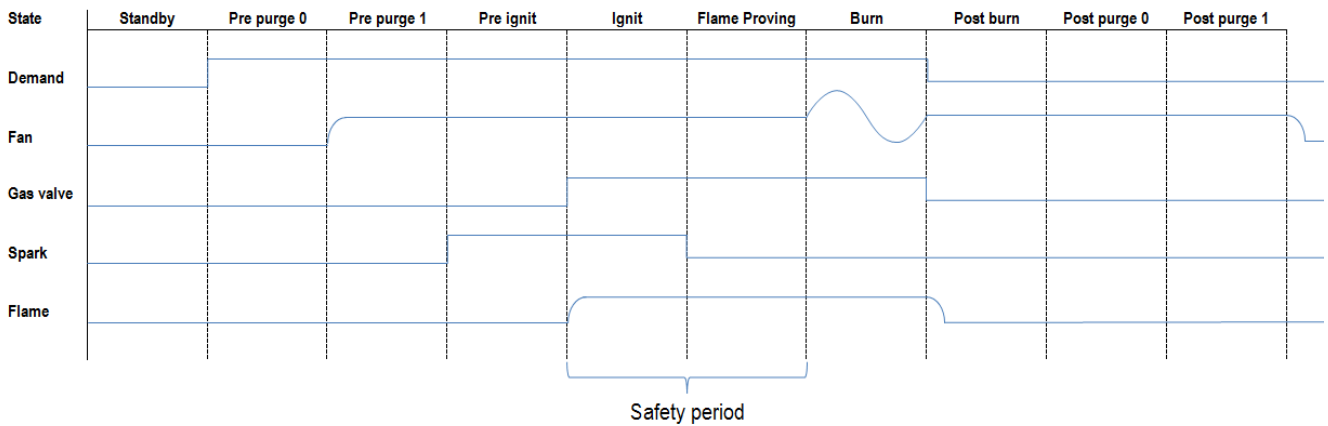
- Maximal fan speed
- Minimal fan speed
- Ignition speed*
- Maximum flue gas temperature

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

The parameter can be used for conversion from natural gas to propane, see § 18.5.

13.7 Ignition cycle

During the ignition cycle multiple safety checks are active



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 to remove the unburned gas. After this a re-ignition attempt is started following the same cycle.
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 water heater once. At the second flame loss the water heater 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.

13.7.1 FLAME DETECTION

When the water heater is firing, and the flame is not detected anymore, the gas valve will be closed, and the control will perform a post-purge, after which a restart will take place.

The presence of a flame is measured through the flame rod that points into the flame. The flame current is measured by the control as ionization in micro amps (μA).

When the flame current is above $\text{Flamerod_Setpoint} + \text{Flamerod_Hysterese}$ ($1.0 \mu\text{A} + 0.5 \mu\text{A}$) a flame will be present. When the flame current is below Flamerod_Setpoint ($1.0 \mu\text{A}$) the flame will not be present.

13.7.2 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 $\text{Flamerod_Setpoint} + \text{Flamerod_Delta}$ ($1.0 \mu\text{A} + 0.2 \mu\text{A}$) the minimal fan speed will be increased.
- When the flame current is above $\text{Flamerod_Setpoint} + \text{Flamerod_Delta} + \text{Flamerod_Delta} * 2$ ($1.0 \mu\text{A} + 0.2 \mu\text{A} + 0.4 \mu\text{A}$) 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

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

13.8 Demand for Domestic Hot Water

13.8.1 DHW STORAGE WITH BULB SENSOR; DHW MODE 1

Select DHW mode 1 if cascading of water heaters is required this can be done by changing parameter (35) DHW mode from 4 to 1. Default setting is DHW mode 4.

DHW Mode 1 is used for cascading water heaters set the cascade parameters according to paragraph “**15 cascade**” Connect the Depending water heater and the managing water heater. Attach the strap on sensor (system sensor) to the combined supply of the water heaters and connect this to the managing water heater, also connect the DHW sensor which measures the temperature in the tank to the managing boiler.

The DHW temperature in the tank is measured with sensor T_{Store} and set with parameter (115) $\text{DHW_Store_Setpoint}$. When this sensor drops below $\text{DHW_Store_Setpoint}$ minus (36) $\text{DHW_Store_Hyst_Down}$ the control detects a demand for the store and starts the DHW circulator.

If the supply temperature T_{Supply} is below

(115) $\text{DHW_Store_Setpoint}$ plus (38) $\text{DHW_Store_Supply_Extra}$ minus $\text{DHW_Supp_Hyst_Down}$ the boiler is started as well.

Factory set: $140^{\circ}\text{F} + 0^{\circ}\text{F} - 9^{\circ}\text{F} = 131^{\circ}\text{F}$ ($60^{\circ}\text{C} + 0^{\circ}\text{C} - 5^{\circ}\text{C} = 55^{\circ}\text{C}$)

(38) $\text{DHW_Store_Supply_Extra}$ this parameter is default set to 0 F because the supply temperature of the water is almost the same as the tank temperature.

When one of the water heaters in the cascade is ON, the power is PID-modulated so T_{System} is regulated towards the DHW_Setpoint plus $\text{DHW_Store_Supply_Extra}$.

The water heater is stopped when the supply temperature rises above $\text{DHW_Store_Setpoint}$ plus $\text{DHW_Store_Supply_Extra}$ plus (37) DHW_Supp_Hyst_Up .

Factory set: $140^{\circ}\text{F} + 0^{\circ}\text{F} + 7.2^{\circ}\text{F} = 147.2^{\circ}\text{F}$ ($60^{\circ}\text{C} + 0^{\circ}\text{C} + 4 = 64^{\circ}\text{C}$)

The demand for the tank is ended when the tank-sensor rises above $\text{DHW_Store_Setpoint}$ plus DHW_Store_Hyst_Up . The circulator continues $\text{DHW_Post_Pump_Period}$.

Factory set: $140^{\circ}\text{F} + 7.2^{\circ}\text{F} = 147.2^{\circ}\text{F}$ ($60^{\circ}\text{C} + 4^{\circ}\text{C} = 64^{\circ}\text{C}$)

Store warm hold function

Because of the presence of the indirect tank sensor (T_{Store}) the control can detect demand for holding the tank hot. If T_{Store} drops below $(115) DHW_Store_Setpoint$ minus $DHW_Store_Hold_Warm$ the boiler starts at minimum power.

Factory set: $140^{\circ}F - 5.4^{\circ}F = 134.6^{\circ}F$ ($60^{\circ}C - 3^{\circ}C = 57^{\circ}C$)

So if tank slowly cools down below $134.6^{\circ}F$ ($57^{\circ}C$) it will warm up to $147.2^{\circ}F$ ($64^{\circ}C$) if there is a consumption of hot water and the sensor drops below $131^{\circ}F$ ($55^{\circ}C$) the boiler will increase its power and the normal control will be active. The boiler stops if T_{Store} is higher than $DHW_Store_Setpoint$ plus $DHW_Store_Hyst_Up$.

Relevant variables

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

13.8.2 DHW MODE 4

DHW mode 4 – Instantaneous water heating with tank and DHW sensor

The DHW mode 4 is the default mode and can be used when using a stand-alone water heater, if waterheaters are cascaded use DHW Mode 1.

In DHW mode 4 the DHW_Out sensor (T_{DHW}) is used for both detecting DHW tapping and modulating the burner to the required $DHW_Setpoint$.

For stand-alone mode only the tank-sensor (DHW-sensor) has to be connected to the water heater.

Demand detection

For DHW mode 4 a demand is present when DHW tapping is detected.

During a demand the burner is started based on the T_{DHW} temperature.

Tap start detection

Tap detection for DHW mode 4 is done using the DHW sensor. DHW tapping is detected when:

The T_{DHW} temperature drops more than Tap_Drop_Delta per second.

Factory set: $1.8^{\circ}F$ ($1^{\circ}C$) per second

The T_{DHW} temperature drops below $(48) DHW/Tank Setpoint - Tap_Detect_Hyst_Down$.

Factory set: $140^{\circ}F - 3.6^{\circ}F = 136.4^{\circ}F$ ($60^{\circ}C - 2^{\circ}C = 58^{\circ}C$)

Tap stop detection When the internal tap detection hold timer has elapsed the tap detection can be ended. Under the following conditions a tap stop is detected:

The delta between the *Supply* and *Return* sensor is smaller than $Tap_Stop_Delta_Supply_Return$.

Factory set: $1.8^{\circ}F$ ($1^{\circ}C$) per second)

The delta between the *Return* and DHW sensor is greater than $Tap_Stop_Delta_Return_DHW$.

Factory set: $3.6^{\circ}F$ ($2^{\circ}C$) per second)

Burn demand The burner is PID modulated in relation to the T_{DHW} temperature to the $DHW_Setpoint$.

The burner is started for DHW mode 4 when the following conditions are met:

The T_{DHW} temperature drops below $(48) DHW/Tank Setpoint - DHW_Hyst_Down$.

Factory set: $140^{\circ}F - 5.4^{\circ}F = 134.6^{\circ}F$ ($60^{\circ}C - 3^{\circ}C = 57^{\circ}C$)

The burner is stopped for DHW mode 4 when the following conditions are met:

The T_{DHW} temperature rises over $(48) DHW/Tank Setpoint + DHW_Hyst_Up$.

$(48) DHW/Tank Setpoint + DHW_Hyst_Up$

Factory set: $140^{\circ}F + 5.4^{\circ}F = 145.4^{\circ}F$ ($60C + 3C = 63C$)

13.8.3 ANTI-LEGIONELLA PROTECTION

Anti-Legionella protection is enabled for DHW modes 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 is selected the boiler setpoint 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 Boiler_Setpoint plus DHW_Supp_Hysteresis_Up the boiler is switched OFF.

When the Anti_Legionella_Sensor is above Anti_Legionella_Setpoint minus 5.4 °F (minus 3 °C) for Anti_Legionella_Burn_Time the controller goes into post circulation and ends the Anti-Legionella demand. When the controller has powered up, the Anti_Legionella_Sensor temperature must reach a temperature of Anti_Legionella_Setpoint (for Anti_Legionella_Burn_Time) within 2 hours, otherwise the boiler is forced into Anti-Legionella demand.

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 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.

Below parameters can be set by the installer.

Parameter for installer (DHW mode 1 only)

Parameter	Factory Setting.
(107) Anti Legionella Day	Sunday
(108) Anti Legionella Hour	0 hrs

Following parameters cannot be set by the installer and 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

13.8.4 DISPLAY MENU STRUCTURE SUMMARY.

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

1. Central Heating (CH)	min.	max.	De- fault	unit	Access level	Description:
1.1 CH Setpoint	68 (20)	194 (90)	185 (85)	°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.	De- fault	unit	Access level	Description:
Des. Supply T.	68 (20)	194 (90)	185 (85)	°F (°C)	Installer	Set CH setpoint when outdoor temperature equals Des. Outd. T.
Bas. 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.	De- fault	unit	Access level	Description:
DHW Setpoint	104 (40)	160 (71)	140 (60)	°F (°C)	Installer	Set the DHW setpoint
DHW Store Setpoint	104 (40)	160 (71)	149 (65)	°F (°C)	Installer	Set the DHW store setpoint for DHW mode 1 and 2

3. Information	min.	max.	De- fault	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.	De- fault	unit	Access level	Description:
Display				xxxx xxxx	User	Display the software checksum
Boiler				xxxx xxxx	User	Display the boiler software checksum
Device Group				xxxMN	User	Display the boiler group ID

3.2 Boiler status	min.	max.	De-fault	unit	Access level	Description:
Flow Temperature				°F (°C)	User	Actual supply flow temperature
Flow 2 Temperature				°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				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

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

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

3.5 Service	min.	max.	De-fault	unit	Access level	Description:
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

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

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

A Time zone settings	min.	max.	De- fault	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.	De- fault	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.	De- fault	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

4.2.1 Boiler parameters	min.	max.	Default	unit	Access level	Description:	Display no:
CH mode	0	5	0	#	Installer	Set the CH mode	1
CH Setpoint	68 (20)	194 (90)	176 (80)	°F (°C)	Installer	Set the CH setpoint	3
Calc. Setp. Offset	-18 (-10)	18 (10)	0 (0)	°F (°C)	Installer	Set the offset for CH mode 1 / 2 calculated setpoint	185
Boiler Pump Overrun	0	900	20	sec.	Installer	Set the post-circulation time for the boiler/CH pump	5
CH Hysteresis Up	4 (2)	72 (40)	20 (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	10	sec.	Installer	Set the burner anti-cycling period	9
Anti-Cycle Temp. Diff.	0 (0)	36 (20)	29 (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	27 (81)	194 (90)	194 (90)	°F (°C)	Installer	Set the outdoor reset curve maximum setpoint	24
Warm Weather Shutdn	32 (0)	95 (35)	72 (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)	7 (4)	°F (°C)	Installer	Set the CH setpoint night setback temperature	28
DHW Mode	0	8	0	#	Installer	Set the DHW mode	35
DHW Tank Hyst. Down	0 (0)	18 (10)	9 (5)	°F (°C)	Installer	Set the DHW tank hysteresis down	36

cont: 4.2.1 Boiler parameters	min.	max.	Default	unit	Access level	Description:	Display no:
DHW Tank Hyst. Up	0 (0)	18 (10)	7.2 (4)	°F (°C)	Installer	Set the DHW tank hysteresis up	37
DHW Tank Supply Extra	0 (0)	54 (30)	0 (0)	°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)	140 (60)	°F (°C)	Installer	Set the DHW setpoint	48
DHW Store Setpoint	32 (0)	50 (10)	140 (60)	°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	#	Installer	Select the function for programmable input 2	117
Prog. Input 3.	0	2	2	#	Installer	Select the function for programmable input 3	118
Prog. Input 7.	0	5	3	#	Installer	Select the function for programmable input 7	122
Prog. Input RT.	0	1	1	#	Installer	Select the function for the programmable RT input	124
Prog. Output 1.	0	10	4	#	Installer	Select the function for programmable output 1	125
Prog. Output 2.	0	10	9	#	Installer	Select the function for programmable output 2	126
Prog. Output 3.	0	10	6	#	Installer	Select the function for programmable output 3	127
Prog. Output 4.	0	20	18	#	Installer	Select the function for programmable output 4	128
Mod. Pump dT	9 (5)	72 (40)	27 (15)	°F (°C)	Installer	Set the modulating pump target delta temperature	133
Mod. Pump Start Time	0	255	60	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	On/off	o/f or mod.	Installer	Set the modulating pump mode	136
Mod. Pump Min Pwr			45	%	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

4.2.2 Module Cascade Settings	min.	max.	Default	unit	Access level	Description:	Display no:
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)	122 (50)	°F (°C)	Installer	Set the emergency mode setpoint	74
Delay Per Start Next Mod.	0	1275	60	sec.	Installer	Set the delay time before the next module is started	75
Delay Per Stop Next Mod.	0	1275	30	sec.	Installer	Set the delay time before the next module is stopped	76
Delay Quick Start Next	0	1275	30	sec.	Installer	Set the fast delay time before the next module is started	142
Delay Quick Stop Next	0	1275	15	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)	10.8 (6)	°F (°C)	Installer	Set the hysteresis up after which a module is stopped	78
Hyst. Down Quick Start	0 (0)	72 (40)	14.4 (8)	°F (°C)	Installer	Set the fast hysteresis down after which a module is started	144
Hyst. Up Quick Stop	0 (0)	72 (40)	14.4 (8)	°F (°C)	Installer	Set the fast hysteresis up after which a module is stopped	145
Hyst. Up Stop All	0 (0)	108 (60)	18 (10)	°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	1	#	Installer	Set the power mode	148
Max. Setp. Offset Down	0 (0)	36 (20)	1.8 (1)	°F (°C)	Installer	Set the maximum setpoint offset down	79
Max. Setp. Offset Up	0 (0)	36 (20)	1.8 (1)	°F (°C)	Installer	Set the maximum setpoint offset up	80
Start Mod. Delay Fact.	0	60	0	min.	Installer	Set the setpoint modulation delay time	81
Next Module Start Rate	10	100	85	%	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	10	%	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

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

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

14 TEMPERATURE PROTECTION

The difference between Supply temperature and Inlet Temperature is continuously monitored. A too big difference can indicate a defective pump or a clogged heat exchanger. To protect the water heater, the burner controller reduces the input when the temperature difference ΔT becomes too high:

At maximum water heater input ΔT is limited to 32.4 °F (18 °C) - (*Hx_Diff_DeltaT_Min*)

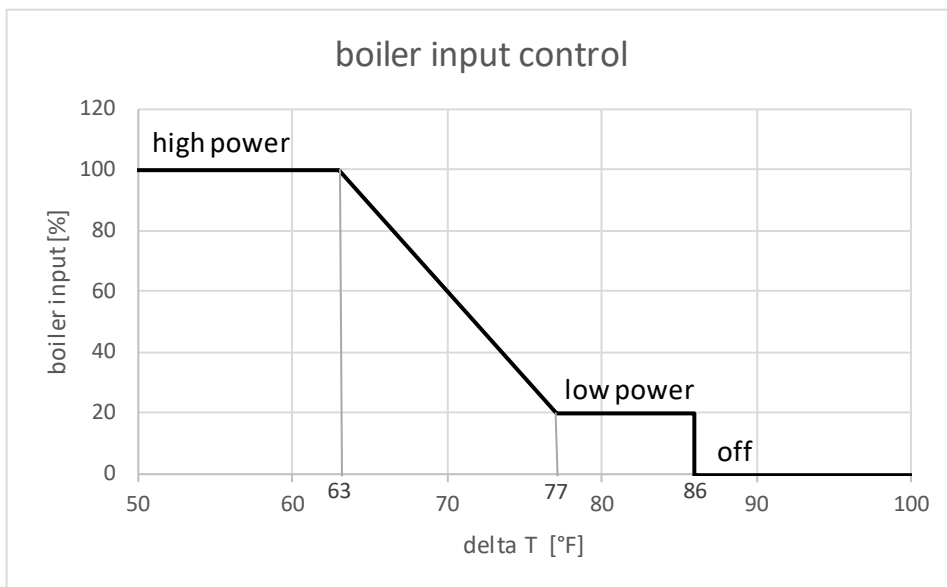
In between 32.4 °F (18 °C) and 46.8 °F(26 °C) water heater input modulates between minimum and maximum.

At minimum water heater input ΔT above 46.8 °F(26 °C) is allowed - (*Hx_Diff_DeltaT_Minplus 14 °F (+8 °C)*)

Above $\Delta T = 55.8$ °F (31 °C), the water heater is switched OFF during *HX_Diff_Max_Wait_Time*.

Relevant factory set variables

Parameter	Level	Factory Setting.	Range
HX Diff DeltaT Min	3: Factory	63 °F (35 °C)	18...144 °F (10 ...80 °C)
HX Diff Max Wait Time Wait time after upper limit primary heat exchanger differential has been exceeded.	3: Factory	180 Sec.	1...255 Sec.



15 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 BCU)

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

15.1 Water heater history.

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

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

15.2 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 for more than 20 hours	blocking code active for 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 is 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 is 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 is 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_PREPURGE	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 pump and waterflow and replace pump 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 seconds 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 time flame lost during 1 demand	bad gas supply or CO2 level is not correct or bad ignition rod	check gas supply pressure, check CO2 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 so 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 so 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 heat demand; 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.
36	GAS_PRESSURE_ERROR	Gas pressure switch open for more than E2_GPS_Timeout	wrong gas pressure on gas supply	Check if gas pressure is in limits of the gas pressure switch.

15.3 Blocking codes

Lock-out code	Error	Description	Cause	Solving
100	WD_ER-ROR_RAM	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
101	WD_ER-ROR_ROM	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
102	WD_ER-ROR_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 programmed BCU or PB	reset BCU or replace BCU and or display unit
104	WD_ER-ROR_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 overstay_Burning_Temp for a period of Max_Value_Period.	not enough water-flow overheat exchanger	Check functioning of the pump. Check/open all valves that might restrict the water flow through the unit. Check for an external system pump that influences flow through the unit. Check if the system resistance exceeds the spare capacity of the unit pump.
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	RE-FLO_TOO_HIGH	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
109	RE-FLO_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	RE-FLO2_TOO_HIGH	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
113	RE-FLO2_TOO_LOW	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

Lock-out code	Error	Description	Cause	Solving
116	LOW_WATER_PRESSURE_SENSOR	Low water pressure, generated when the pressure drops below Minimal_Pressure, or when the pressure drops below 4.5 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
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 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	Phase and neutral are wrongly connected	Change phase and neutral
136	T_EXCHANGE_BLOCK_ERROR	Exchange temperature exceeded 194 °F (90 °C).	water temperature is above 194 °F (90 °C).	Check pump functioning. Check/open all valves that might restrict water flow through the unit. Check external system pump(s) that influences flow through the unit. Check if the system resistance exceeds the spare capacity of the unit pump.

Lock-out code	Error	Description	Cause	Solving
155	WD_CONFIG_ERROR	Watchdog fan configuration setting error	wrongly programmed 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
164	LOWEX-FLOW_PROTECTION	Flow is too low, demand needs to be stopped with fan at ignition speed*, but no error needed to be stored at this time	not enough water flow through heat exchanger	Check functioning of the pump. Check/open all valves that might restrict the water flow through the unit. Check for an external system pump that influences flow through the unit. Check if the system resistance exceeds the spare capacity of the unit pump.
165	VSUP-PLY_TOO_LOW	Main supply voltage too low for more than 60 seconds	dip in power supply to boiler	check power supply
166	VSUP-PLY_TOO_HIGH	Main supply voltage too high for more than 60 seconds	peak in power supply to boiler	check power supply

15.4 Warnings

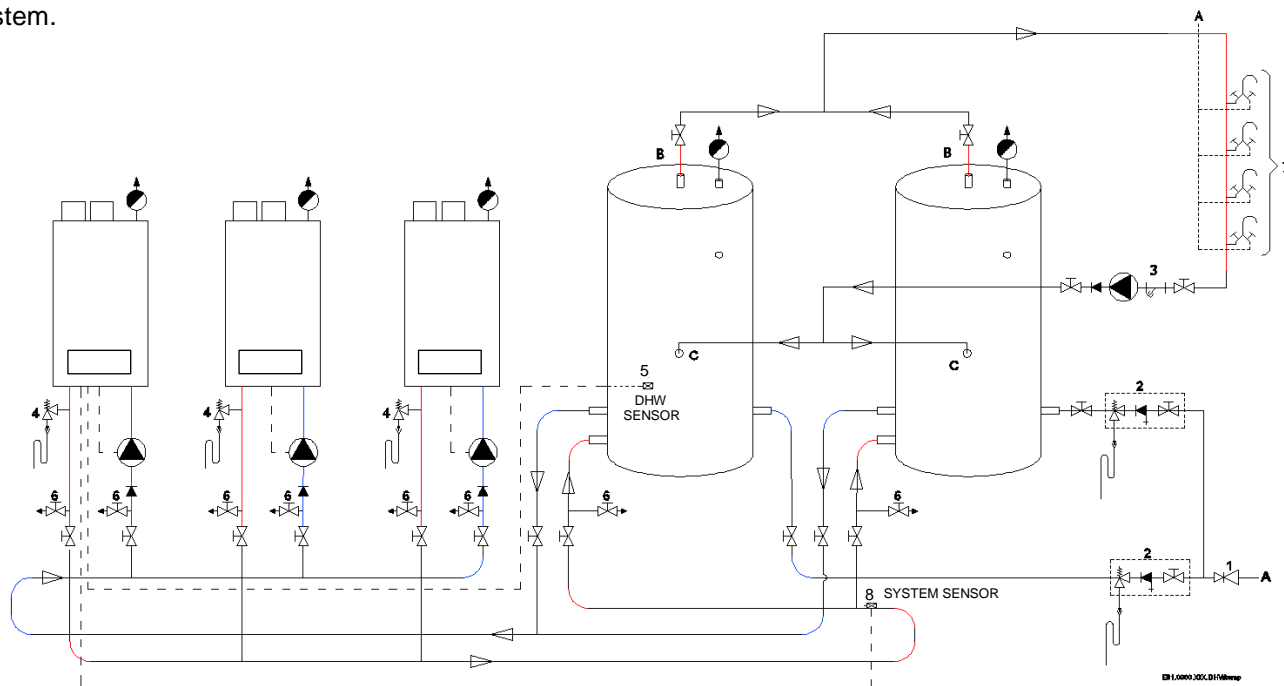
Error no.	Error	Description	Cause	Solving
200	CC_LOSS_COMMUNICATION	Cascade System: Managing cascade control lost communication with one of the depending.	connection between cascaded boilers is interrupted or wiring is broken	Check wiring between boiler or distance between boilers is too big
202	APP_SELECTION_ERROR	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 too big
204	T_OUTDOOR_WRONG	T_Outdoor sensor measures open/shorted	malfunctioning outdoor sensor or not connected or wrong CH-mode programmed	check connection to BCU or check resistance NTC sensor or change CH-mode
205	T_SYSTEM_WRONG	T_System sensor measures open/shorted	malfunctioning system sensor or not connected	check connection to BCU or check resistance NTC sensor
206	T_CASCADE_WRONG	T_Cascade sensor measures open/shorted	malfunctioning cascade sensor or not connected	check connection to BCU or check resistance NTC sensor

16 CASCADING

16.1 System setup

NOTE: for proper functioning of the system, some settings have to be changed, see § 15.4.2 "Emergency mode".

The water heater controller can control multiple water heaters in a cascade setup. A system sensor input is available on the main board to measure the cascade system supply temperature. A pump output is also available to run the system pump, as well as an output for the DHW pump. The system sensor is connected to the managing water heater and calculates the HW setpoint for the cascade system.



	PUMP
	NON- RETURN VALVE
	VALVE
	SAFETY VALVE
	AUTOMATIC AIR VENT
	FILTER
	INLET COMBINATION - Overflow - Controllable return valve - Valve
	PRESSURE REGULATING VALVE

Explanation:

- 1) Pressure relief valve (mandatory in case water pressure is too high)
 - 2) Inlet combination with valve (mandatory)
 - 3) Apply filter if necessary (recommended)
 - 4) A suitable safety valve must be mounted near the water heater (mandatory) ¹
This safety valve may never be isolated from the water heater by means of a ball valve
 - 5) Mount the tank sensor in an immersion bulb into the tank at 1/5 from the bottom of the tank and the system sensor onto the return pipe as shown in the figure. ^{2,3}
 - 6) Drain valve (recommended)
 - 7) Hot and cold-water mixers
 - 8) Mount the (strap-on) system sensor to the pipe close to the T-piece of the last tank as shown in the figure
This sensor measures the supply temperature from both heaters.
- A) Cold water inlet (service pipe)
B) Hot water supply circulation
C) Circulation return

Notes:

- Connections on the water heater side should **always** be executed as drawn in the picture above.
- ¹ Always apply safety components according to all applicable regulations.
- ³ In case of more than one tank, mount the tank sensor in one of the tanks. The temperature of this tank will be assumed to be representative for all, provided that the installation design is correct.
- In the inlet (return) connection of the water heater no check valve is recommended.
- If needed, the water heater control can handle up to sixteen water heaters.
- For large capacity installations consult your supplier.

16.2 Water Heater Cascade Setup.

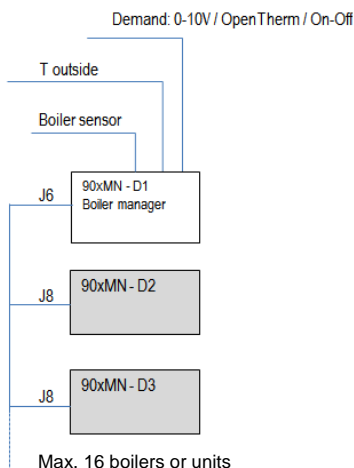
In order for the system to work for cascade the communication busses must be parallel linked together. The managing water heater uses the AL-bus connection 20-21 for the cascade. The depending water heaters must be connected to the managing water heater on the 10-11 connection terminals.

It is important that the power on the 10-11 connection terminals on all dependent water heaters is switched to the OFF position.

(see also §14.2.1) All water heaters in the cascade system must have a unique address selected.

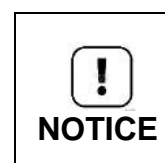
Before commissioning a cascade installation, a number of parameters have to be changed.

These parameters can be programmed on the unit itself.



WARNING

Changes in parameter may only be carried out by a skilled commissioning/service engineer, who has had specific training for setting up the HWB range water heaters. He will be able to check whether the installation functions correctly after the parameter change has been done.



NOTICE

Parameters for cascade operation are found in the Module cascade settings menu, located in the Water heater settings menu. Parameters in the Water heater cascade settings menu should not be used.

16.2.1 SETTING THE WATER HEATER ADDRESS



NOTICE

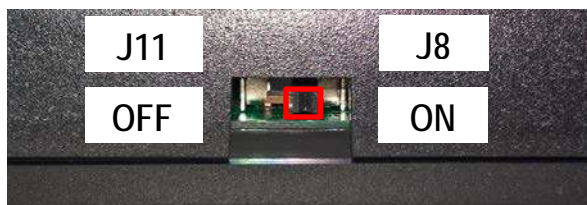
Address rules

The cascade managing address (parameter 184) must be set to 'Managing' on the managing water heater. The cascade depending addresses (parameter 184) must be set in a logical numbered order from 1: Dep. 1, Dep. 2 etc. on the depending water heaters. The total number of water heaters in the cascade must be stored in parameter 147 on the managing water heater.

When the number of water heaters 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: Comm. Lost with module.

The managing water heater of the cascade system is connected to the AL-BUS connection on terminals 20-21. This connection also provides the power for the communication bus. The depending water heaters are all parallel connected to the managing water heater communication bus.

The bus power is provided by the managing water heater on terminals 20-21, switch S1 must be set in the OFF position (all controls).



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

16.2.2 E2PROM ADDRESS SELECTION THROUGH E2PROM SETTING.

This setting can be changed on the water heater control.

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

16.2.3 CASCADE – HEATING ONLY MANAGING WATER HEATER

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

- The outdoor temperature sensor connected to the managing water heater will be the outdoor sensor for the cascade operation
- The system sensor (T_System) connected to the managing water heater will be the control sensor for the cascade supply temperature.
- The (modulating) thermostat connected to the managing water heater 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 water heater calculates a required water heater setpoint, to achieve the requested Cascade_Setpoint.

The managing water heater provides the calculated setpoint to all dependent water heaters. The modulating power of the dependent water heaters is PID controlled based on the calculated setpoint and dependent water heater supply temperature.

Cascade HW setpoint adaption

When the system temperature is not high enough the setpoint for all water heaters will be adjusted.

The water heater setpoint will be increased when the system temperature drops below Cascade_Setpoint and decreased when it rises above Cascade_Setpoint temperature.

Dependent Water heater

The HW mode for the cascade is defined by the setting of the managing water heater. HW mode settings on dependents are ignored. In case a water heater is set as dependent (Address = 2-8/16) the setpoint is always provided by the managing water heater.

The modulating power of the ALL water heaters is PID controlled by the water heater itself by comparing the calculated setpoint from the managing water heater and T_Supply. The managing water heater itself will be controlled in the cascade system as it would as if it was a dependent water heater. Only the pumps and sensor inputs are used.

Water heater input Rates

A cascade system operates most effective and efficiently when all of the water heaters in the system are the same size.

16.2.4 CASCADE – DOMESTIC HOT WATER SETTINGS

In the installer DHW menu of the managing water heater control the DHW_Mode should be set.

Available DHW modes in cascade are mode 1 or 2.

Dependent Water heater

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

Managing Water heater

If there is a request for a "Store Warm Hold" for the tank and no central heating request the managing water heater 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 water heater and cascade are burning for the central heating system.

16.2.5 CASCADE – START/STOP SEQUENCE

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

Quick Starting and Stopping Water heaters

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.

16.2.6 CASCADE – POWER BALANCE MODE

Several different power control modes can be selected to operate the cascade system.

- Power mode 0: Power control disabled, each water heater modulates based on the system setpoint.
- Power mode 1: Power control algorithm to have a minimum amount of water heaters/water heaters active.
- Power mode 2: Power control algorithm to have a maximum amount of water heaters/water heaters active.
- Power mode 3: Power control algorithm to have a balanced amount of water heaters/water heaters active.

16.3 Cascade – Water heater rotation

The water heater rotation function can change the start/stop sequence for the cascade water heaters.

The parameter Water heater_Rotation_Interval sets the number of days after which the sequence is updated.

When Water heater_Rotation_Interval is set to 0 water heater rotation is disabled.

When the parameter Burner_Rotation_Interval is updated the water heater 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 water heater):

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

With parameter First_Dependent_To_Start the current depending that is first to start in the sequence is selected.

When the water heaters are rotated the parameter First_Dependent_To_Start is automatically updated to the next depending. When water heater rotation is disabled the parameter First_Dependent_To_Start is reset to 0.

When the First_Dependent_To_Start is manually changed the control will clear all demand of the cascade control. After this is will start cascade demand generation with the new selection for First_Dependent_To_Start.

16.3.1 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_Dependent_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_Dependent_To_Start.

Relevant variables

Specific Parameters	Level	(Default) Value	Range
Burner_Rotation_Interval	2: Installer	5	0...30 (0: Disabled)
First_Dependent_To_Start	2: Installer	1	1...8/16

16.4 Cascade Error handling

16.4.1 CASCADE FROST PROTECTION

Frost protection on a cascade is active on two levels

1. Frost protection for burner cascade

The 'frost protection' function for a burner cascade is related to the water heater sensor temperatures. When the supply / Inlet temperatures of the managing water heater are below:

<i>Cascade_Frost_Protection:</i>	The cascade CH/system pump and the general pump of the managing boiler start running.
<i>Cascade_Frost_Protection minus 9 °F (minus 5 °C)</i>	Cascade heat demand is activated; the general pumps of all the cascaded boilers will be started. Demand with setpoint <i>Cascade_Frost_Protection</i> allows the boilers to start burning until the Inlet temperature of the managing boiler is above <i>Cascade_Frost_Protection plus 9 °F (plus 5 °C)</i> .

2. Frost protection on boiler

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

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

Specific Parameters	Level	(Default) Value	Range
Cascade frost protection Temperature for frost protection	2: Installer	59 °F (15 °C)	50...86 °F (10...30 °C)

16.4.1 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.

NOTE: the default setting is 122 °F (50 °C)! Make sure the right temperature is set.

Specific Parameters	Level	(Default) Value	Range	Parameter
Permit Emergency Mode	Installer	Yes	Yes/No	Module Cascade parameter 72
Emergency Setpoint	Installer	122 °F (50 °C)	68 - 194 °F (20 - 90 °C)	Module Cascade parameter 75
Dair active	Installer	Yes	Yes/No	Boiler parameter 139

Table 15-1

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 on "yes".
- Module Cascade parameter no. 75: "Emergency_Setpoint" has to be set on the right temperature.
- Boiler parameter no. 139: "Dair active" has to be set on "No".

NOTE: do not de-activate the Dair function before commissioning the system and adjusting the boilers!

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

16.4.2 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 BCU (parameter 147). When powering on 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.

17 SYSTEM TEST.

For testing the system at fixed power rates, a system test can be activated via the Installer menu. Via the system test the water heater 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 water heater
2	Low power	The water heater starts and after the ignition period has finished the water heater stays at low power
3	Ignition power	The water heater starts and stays at ignition power
4	High power	The water heater starts and after the ignition period has finished the water heater stays at high power
5	High power limited	The water heater starts and after the ignition period has finished the water heater 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>

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 water heater will switch OFF. When the supply temperature cools down to 194 °F (90 °C) the water heater will start again.

During the system test the water heater and system pump will be ON.

As the water heater 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.

Please note that for DHW Mode_7 and DHW Mode_8 the Actual_Flow_Rate must be higher than Flow_Rate_Start + Flow_Rate_Hyst in order that the board can go into system test.

18 COMMISSIONING THE WATER HEATER

18.1 *First: flushing the water heater with water*

After installation of the water heater the first step, before commissioning, is to flush the water heater and the whole heating installation with fresh water to remove pollution, debris and other materials that might cause a blocking. This must also be done with heating installations, where only the water heater is replaced.

Existing and new heating systems must be cleaned with a hydronic system cleaner; see additional information in section 7.12. System cleaner must be drained and thoroughly flushed with clean water to remove any residual cleaner, prior to installing a new water heater. NEVER leave a system cleaner for longer than recommended by the manufacturer of the cleaner. Never put system cleaner inside the water heaters heat exchanger.

18.2 *Second: filling & venting the water heater and the system*

After flushing the water heater and the installation the system can be filled with fresh water. Fill the water heater and the heating system by using the appropriate filling valve. The water pressure of the system normally lies between 21.8 and 40 psi (1.5 and 2.0 bar) – see § 7.20 'Water pressure'

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

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

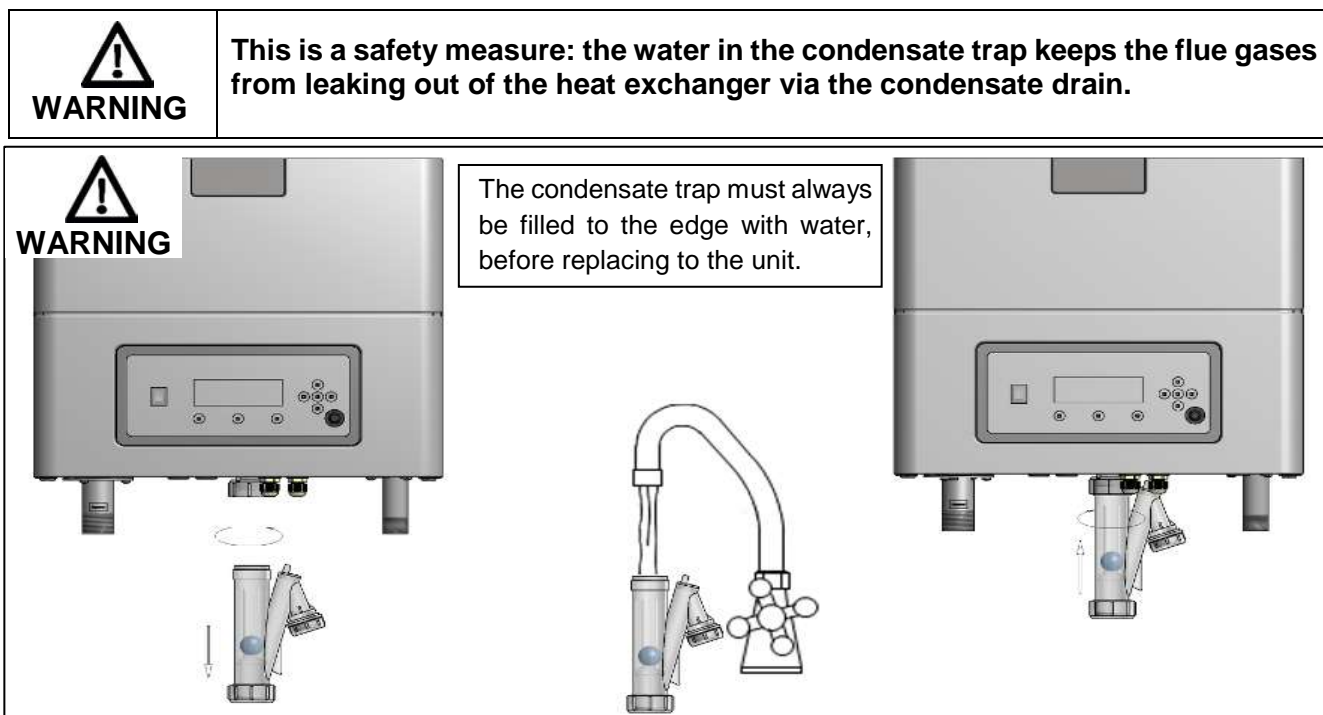
18.3 *Third: check the water flow*

Before starting the water heater ensure the pump is installed and operating correctly and that there are no obstructions or closed valves that could prevent water flow through the heat exchanger.

NOTICE: Always ensure the water heater pump is functioning correctly and that there is flow through the heat exchanger after working on the water heater or system.

18.4 *Mounting Condensate Trap*

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



When the water heater receives a heat demand the electronics will start the operation of the water heater. Before the water heater is used, the water heater must be adjusted and set at the minimum and maximum load.

18.5 Checking gas pressure

Check the gas pressure available at the gas connection pipe of the water heater. Use the pressure nipple [3] of the gas safety valve for this measurement. Chapter 18.1.2 shows the position of the 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

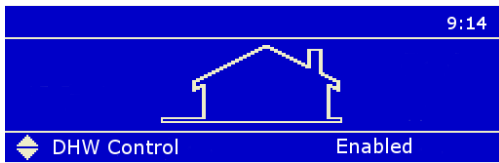
18.6 Firing for the first time

After the commissioning of the water heater and the described previous actions, the water heater display will show the following graph.



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:



The display describes:

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

19 ADJUSTING AND SETTING THE WATER HEATER

Before carrying out any adjusting of the burner, carefully read this complete chapter.

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 water heater may then be wired to an electrically grounded power supply source. The water heater should always be connected to a disconnect or external power shutoff. The water heater 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.

19.1 Introduction

The water heater must always be adjusted in the next situations:

- A new water heater is installed
- As part of a service/maintenance check, in case the CO₂ values turns out to be incorrect.
- The gas valve has been (re)placed.
- Gas conversion to propane. Prior to adjustments, follow the procedure in 18.5
- The venturi has been replaced. Prior to adjustments, follow the procedure in 18.4
- The fan has been replaced
- The flue gas check valve has been replaced

In any of the cases described, always check the gas/air ratio of the combustion figure (CO₂) at maximum and minimum input. First set the water heater 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 in § 18.1.1. A drawing of the gas valve(s) and setting screws is given in § 18.1.2. In § 18.2 a general procedure, conform which the adjustments must be carried out, is presented. § 18.3 describes the specific adjustments to be made when the venturi is replaced, and § 18.4 describes the changes needed when the gas type is set to propane.

19.1.1 COMBUSTION TABLE

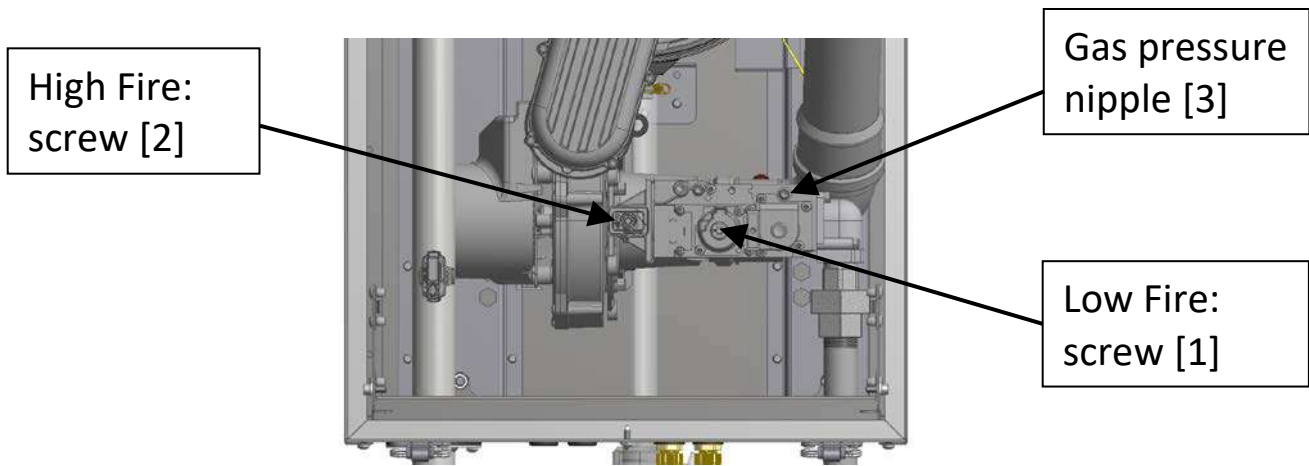
Table: CO₂ values for maximum and minimum load.¹⁾

gas type	water heater type	CO ₂ / O ₂ [%]	
		High Fire	Low Fire
natural gas	HWB-299, HWB-399, HWB-499	9.2 / 4.7	9.8 / 3.7
propane ²⁾³⁾	HWB-299, HWB-399, HWB-499	10.4 / 5.0	11.0 / 4.1

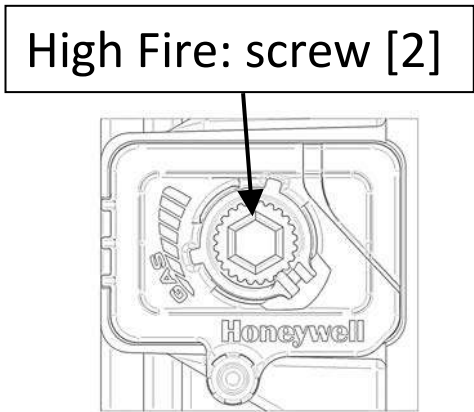
1) All values measured without front door.
 2) For propane: a conversion kit (orifice) has to be mounted, see 18.4.
 3) For propane: appliance type must be changed, see 18.4

19.1.2 SETTING SCREWS VENTURI- AND GAS VALVES: DRAWINGS

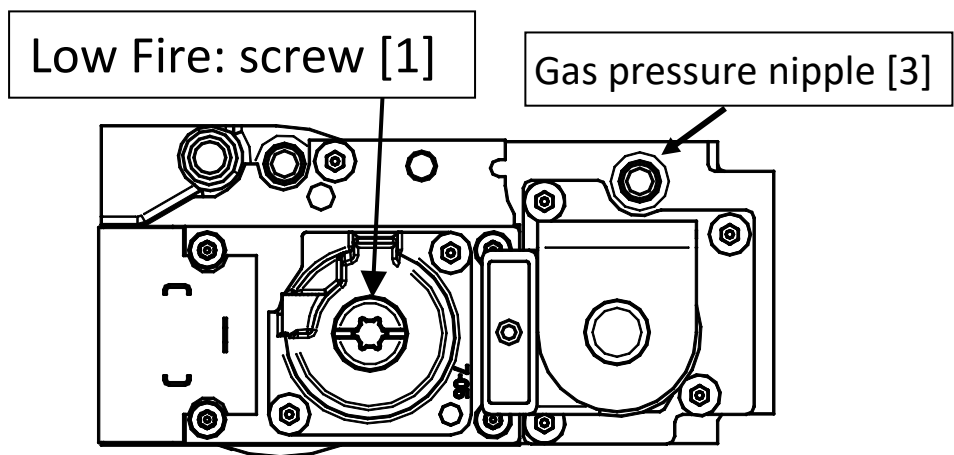
Location of the setting screws:



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






Low Fire: gas valve adjustment screw: Torx T40.



19.2 Adjustment procedures

Procedure 1: adjust at High Fire

Carry out the next steps:




1. From status screen, press MENU  .→ "Central Heating/ Information/ Settings/ System Test"
2. Press UP/DOWN $\uparrow\downarrow$ to select "System Test"
3. Press CONFIRM  to activate the system test. → "Test State: Off"
4. Press CONFIRM  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 water heater becomes active, after about 10 seconds, the water heater burns at high fire.


If the water heater doesn't start, open screw [2] two turns 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 10 seconds for the water heater 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 CO₂ percentage at the flue gas test port on the vent connection.
7. By setting screw [2], adjust the gas valve to obtain the CO₂ value of the table in § 18.1.1.
8. To return to the status screen, and stop the water heater, press ESCAPE  or MENU  3 times, or RESET once. 

Increase CO₂

CO ₂ ↑		O ₂ ↓
-------------------	---	------------------

 Turn screw [2] right (clockwise)

Decrease CO₂

CO ₂ ↓		O ₂ ↑
-------------------	---	------------------

 Turn screw [2] left (counterclockwise)


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

Procedure 2: adjust at Low Fire

Carry out the next steps:

1. Press UP/DOWN $\uparrow\downarrow$ multiple times to select "Low Power" → "Test State: **Low Power**".
After about 10 seconds, the water heater burns at low fire.
2. Measure the CO₂ percentage at the flue gas test port on the vent connection.
3. By setting screw [1], adjust the gas valve to obtain the CO₂ value of the table in § 18.1.1.

Increase CO₂




CO ₂ ↑		O ₂ ↓
-------------------	---	------------------

 Turn screw [1] right (clockwise)

Decrease CO₂

CO ₂ ↓		O ₂ ↑
-------------------	---	------------------

 Turn screw [1] left (counterclockwise)

4. To return to the status screen, and stop the water heater, 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 table in § 18.1.1. values best

19.3 Venturi Replacement Adjustment

A new venturi is shipped with an unknown setting. It must be adjusted before it can be used in the water heater.

- First, turn setting screw [2] on the venturi clockwise until you feel resistance. This means that the valve is open, *do not try to tighten the screw any further.*
- Now turn screw [2] counterclockwise 38 turns.

After this, perform adjustments according to 18.2.

19.4 Conversion from natural gas to propane



Conversion of the water heater to a different gas type must be performed by a certified technician. Parameter 138 must be set correctly!
Wrong setting can lead to damage to the appliance or shorten the lifespan of the appliance!
The warranty of the device will expire if a wrong selection has been made.

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

Required parts: (see § 5.1 Accessories)

Propane kit for VMS Venturi hole Ø 6.2 HWB-299

Propane kit for VMS Venturi hole Ø 6.7 HWB-399

Propane kit for VMS Venturi hole Ø 7.2 HWB-499

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

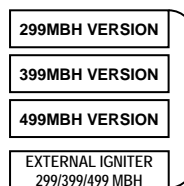
1. check boiler model
2. check burner controller type
3. mount the orifice
4. set parameter 138
5. adjust the CO₂ / O₂ percentage
6. confirmation: apply the propane sticker and mark the boxes

1. Check water heater model. Check if you have a 299, 399 or 499 water heater. The model number is on the dataplate, on the inside of the water heater casing, top side.

2. Check burner controller type.

Check which controller type is installed, see picture.

- if a model number is on the sticker on the controller, the water heater is equipped with an internal igniter.
- if a sticker "EXTERNAL IGNITER 299/399/499 MBH" is present on the controller, the water heater is equipped with an external igniter.



Picture 18. 1

3. Mount the orifice:

Water heater type	Orifice Inner Diameter
HWB-299	6.2
HWB-399	6.7
HWB-499	7.2

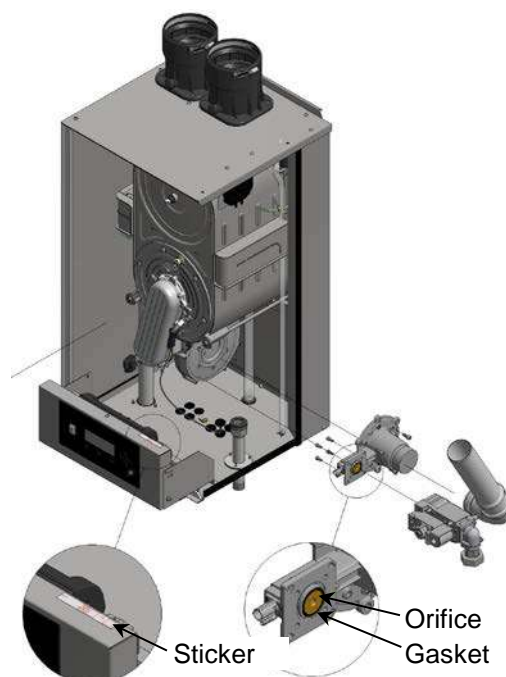
Table 18. 1

Converting the boiler to propane is done by placing a propane orifice between gas valve and venturi. By using the correct orifice size (see table), the measured CO₂ (O₂) percentage in the flue gas will already be close to the desired value.

Installing the orifice (see also picture):

Required tools: wrench 55, hex key 5 mm and hex key 4 mm.

1. Close the external gas shutoff valve and disconnect the electrical power before opening the water heater.
2. Use a wrench to open the coupling in the gas line in the water heater. The three screws, with which the venturi is mounted onto the fan, can now be removed.
3. Venturi and gas combination valve can now be separated. The orifice is to be placed between venturi and gas combination valve. The rounded side of the orifice must be on the side of the gas combination valve.
The orifice must be mounted into the gas entrance of the venturi and secured with the rubber gasket.
4. Venturi and gas combination valve can now be reconnected.
5. Remount the gas combination valve and the venturi onto the fan. Close the union in the internal gas line.
6. Now open the external gas valve.
7. Check for gas leaks.
8. Reconnect the electrical power.
9. If in operation, check again for gas leaks on all parts that have been apart.




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.

	Controller version	Boiler model	fan speed high fire	Parameter 138 for propane (LP)
INTERNAL IGNITER	299MBH Version	HWB-299	6450	51
	399MBH Version	HWB-399	6700	53
	499MBH Version	HWB-499	7600	55
EXTERNAL IGNITER	EXTERNAL IGNITER 299/399/499 MBH	HWB-299	6450	51
		HWB-399	6700	53
		HWB-499	7600	55

Table 18. 3

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

 WARNING!	In case a CSD kit (gas pressure switch kit) is mounted (on the gas valve), adjust the right-hand pressure switch to 9.0 inch. w.c !
---	---

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

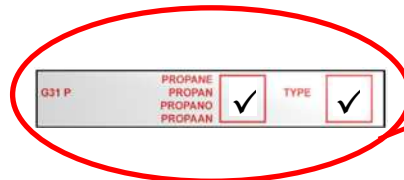
5. Adjust the CO₂ / O₂ percentage

Perform C/ O₂ adjustments according to the procedures in the installation manual; § 18.2, using the values in table § 18.1.1.

6. Confirmation

When finished:


- Apply the corresponding sticker at the appropriate position in the boiler.
- Mark the box for the used gas type.
- Mark the box, indicating that the correct value has been set for the appliance type.




E73.1628.901



Picture 18. 6

 WARNING!	Please ensure the water heater is clearly labelled if operating on propane supply!
--	--

 NOTICE	It is possible to improve the ignition spark by using an external ignition transformer. Available on request, see the accessories list.
--	---

19.1 Start Up Checklist

Installation/start-up checklist

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

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

Water heater information	
Model	
Serial number	
Installation date	
Cascade installation (Y/N)	(YES/NO)
Number of water heaters	
Type of water heaters in cascade	



After filling in form please send a copy by e-mail to: sales@ecokingheating.com or send a copy to address:

King Heating Products HEAD OFFICE,
Unit. 103-2567 192nd Street
Surrey, BC V3S 3X1

Venting information		
Direct vent or using combustion air from indoor?	indoor / outdoor	
	Air inlet	Flue outlet
Diameter		
Total length		
Length horizontal		
Length vertical		
Length sloped at°		
Number elbows 90°		
Number elbows 60°		
Number elbows 45°		
Number elbows 30°		
Air intake location (e.g. roof/ wall)		
Distance vertical from roof		
Distance from (closest) wall		
Common air intake system	(YES/NO)*	
If YES => how many Air intake's are joined?		
Air intake (under)pressure (on top of water heater)		
Possibility of dust/chemicals drawn in to 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 water heater)		

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 drain pipe?	(YES/NO)
Total drop in height from water heater to drain piping exit point	
Any additional trap points?	(YES/NO)
Perform PH test and register PH value	
Condensate neutralizer installed	(YES/NO)

Water circulation & temperature regulation (for DHW)	
Piping diameter	
Total length of straight pipe between water heater & 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)



****Gas valve
Pressure Nipple**

Gas supply	
Type of Gas from installation	
Is gas isolation valve installed under water heater 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 should be turned on and running at full load)	
Is there a secondary gas pressure regulator before the water heater?	(YES/NO)
If YES what is the length of the Gas piping in between?	
If YES what is the Brand & Model?	

Combustion settings		unit:
Set for NG (Natural Gas) or LP (Liquid Propane)?	NG or LP?	
If LP is the right gas orifice mounted?	(YES/NO)	
diameter gas orifice for LP?		mm
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 Flue pressure		Pa
If cascaded with a common flue system; run all appliances, measure the flue pressure at low- and at high fire.		Pa

Electronics & Power supply		unit:
Version Burner Controller Hardware (see § 3.2 for location)		
Version Burner Controller Firmware (see § 3.2 for location)		
is ground connected to building grounding system	(YES/NO)	
Voltage incoming (Hot to Neutral)		V
Voltage incoming (Hot to Neutral)		V
Voltage measured between Ground and Neutral		V
Total of amperage switched by the Water heater Control is below 3.5 A or 400 W		A

Additives	
Used descaling products	
Water hardness	

20 INSPECTION, MAINTENANCE AND SERVICE.

20.1 General

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


Inspection, maintenance and service of the water heater should also be carried out on the next occasion


- **When a number of similar error codes and/or lockouts appear.**
- **At least every twelve months maintenance must be done to ensure safe and efficient operation.**

Damage caused by the lack of maintenance will not be covered under warranty

Service intervals

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

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

 WARNING	INSPECTION, MAINTENANCE AND SERVICE MUST BE EXECUTED FOR A SAFE AND EFFICIENT OPERATION OF THE WATER HEATER.
---	--

20.2 Safety instructions Crystalline Silica

 WARNING	Warning Crystalline Silica – Read instructions below carefully
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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 should 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 should also be replaced. Only use the insulation disk that is supplied by the boiler manufacturer. The same procedure must be applied on the insulation and gaskets fitted on the burner door.

Refractory Ceramic Fibers (RFC)

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 should 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 the table in § 19.2 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 the table in § 19.2 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 water heater. 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"> • Avoid Contact with the skin and eyes • Avoid breathing in the dust in the combustion chamber • Avoid transferring the contamination from clothing and items at the job site
Personal Protective Equipment	<ul style="list-style-type: none"> • Wear long-sleeved shirt and pants, gloves, and safety goggles • Wear a respirator with a N95 rated filter efficiency or better. ¹
Working Environment	<ul style="list-style-type: none"> • Use water to reduce airborne dust levels when cleaning the combustion chamber • Do not dry sweep silica dust. Pre-wet or use a vacuum with a high efficiency HEPA filter • Take all possible steps to provide adequate ventilation in the water heater room
Clean-up	<ul style="list-style-type: none"> • Remove all contaminated clothing after use. Store in sealable container until cleaned • Wash contaminated clothing separately from other laundry and rinse washing machine after use to avoid contaminating other clothes. • Wash all exposed body areas gently with soap and water after contact.
Disposal	<ul style="list-style-type: none"> • Discard used RCF components by sealing in an airtight plastic bag. RCF and crystalline silica are not classified as hazardous wastes in the United States and Canada.
First aid	<ul style="list-style-type: none"> • If contact with eyes: Flush with water for at least 15 minutes. Seek immediate medical attention if irritation persists • If contact with skin: Wash affected area gently with soap and water. Seek immediate medical attention if irritation persists. • If breathing difficulty develops: Leave the area and move to a location with clean fresh air. Seek immediate medical attention if breathing difficulties persist. • Ingestion: Do not induce vomiting. Drink plenty of water. Seek immediate medical attention

Notes:

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

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>.

20.3 Inspection, maintenance and service.

Inspection, maintenance and service including the replacement of water heater 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 water heater 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.
- CO2 % 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

During maintenance, the following items in bold listed below of the water heater must be checked and inspected.
NOTICE: Before starting to work on the water heater:

- Switch off the electrical power to the water heater (service switch and/or unplug water heater)
- Close the gas valve to block gas supply to the water heater

Customer comments

Comments and remarks from the customer should 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 water heater control. This information can be used to specify the maintenance and service proceedings in relation to the water heater (parts).

Water heater History	
Successful Ignitions	32
Failed Ignitions	10
Flame Failures	0
Operation Days	0 days ▼

Water leakage

The water pressure of the heating installation should be more than 21 psi (1.0 bar) and at a maximum of 45 psi (4.0 bar) in normal operation. When the water pressure drops below the minimum occasionally, there might be a water leak. Check the water heater and 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 water heater 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 to ensure the flow there are no obstructions for 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 should be checked for a correct functioning. Any gas pipe or fitting that have been opened or adjusted should be checked for leaks.

Remove complete burner unit

The complete water heater 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 six M6 nuts, the ignition cable and the thermal fuse cables. Close the gas tap under the water heater and loosen the gas coupling by untighten the swivel joint 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 water heater housing. **NOTICE:** Watch out not to damage the burner plate insulation during this operation.

While removing the complete burner unplug both of the electrical and controlling cables of the fan. After all this dismantle the venturi on the suction side of the fan and check the blade wheel of the fan.

 WARNING	<p>Warning</p> <p>Crystalline Silica – Read instructions of § 19.2 carefully</p>
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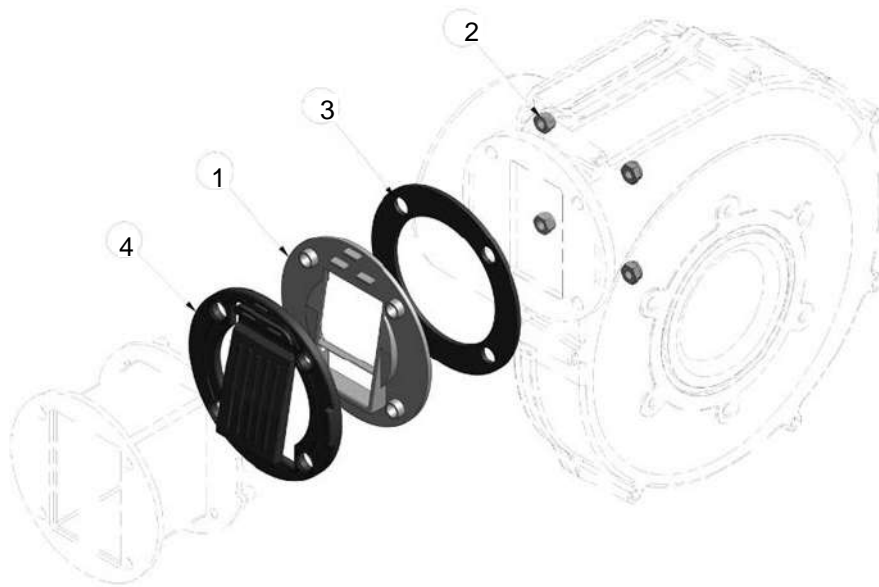
Checking Non-return Valve (NRV)

The non-return valve is placed directly after the fan and has to be replaced every year during maintenance. Replace the non-return valve by removing the 4 nuts that are holding the fan. All the parts included in the NRV maintenance kit must be replaced the gaskets, NRV seat, lock nuts, and non-return valve, do not reuse any of the old parts.


Reassemble the Non-return valve to the burner unit be sure that the nuts are tightened again so no air/gas mixture is leaking into the cabinet. Check during startup of the water heater to ensure no gas mixture is leaking on these gaskets near the non-return valve.

Replace parts 1 to 5 of the check valve once a year.

Needed tools: Wrench 55, 10 and 8 mm, Hex key 5 mm



- 1 = Seat check valve small
- 2 = Lock nut M5 DIN985
- 3 = Gasket gas air mixing
- 4 = check valve small

 WARNING	<p>Always check gaskets on non-return valve for air/gas leakage!!</p>
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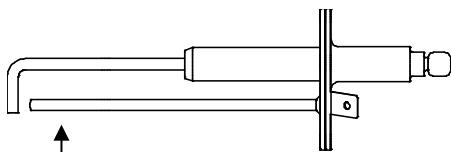
Burner

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.

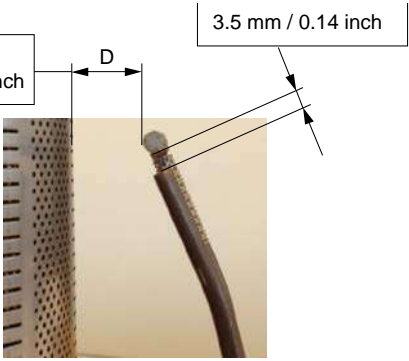
Ignition / ionization electrode

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 should be cleaned annually by lightly rubbing its surface with a dollar bill. Emory cloth, sandpaper, and any other abrasive material should never be used to clean the electrode.

Needed tools: Phillips #2 screwdriver.



D = 8 - 10 mm
 D = 0.315 - 0.393 inch





Warning

Crystalline Silica – Read instructions of § 19.2 carefully

Burner door thermostat

Needed tool: Wrench 16 mm.

This thermostat is activated if the temperature of the burner door has been too high. In this case, it has to be replaced (spare part).

Replacement:

- Disconnect the wiring and remove the thermostat.
- Tighten the burner door's thermostat with a torque of 2 Nm.
- Reconnect the wiring.



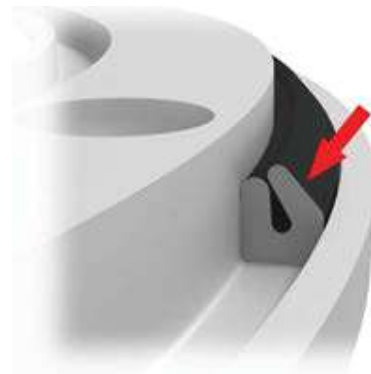
Burner door gaskets

If any part of a gasket has discolored, changed texture, or hardened then, the rubber has cured and/or has damages, these gaskets must be replaced. Notice: only use the gaskets that are supplied by the water heater manufacturer.

Burner door gasket replacement:



- Remove the old gasket
- Place a new gasket in its groove.
- Respect the mounting direction.



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.

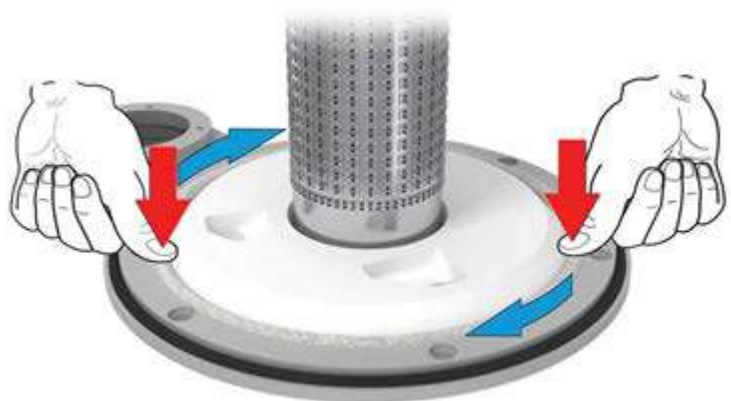
- Remove electrodes.

- Remove the braids by sliding under the periphery a thin tool to loosen the braids and remove it.
- Remove and clean the residues of the braids and silicone glue.



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

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





Warning

Crystalline Silica – Read instructions of § 19.2 carefully

Rear wall insulation disk; changing procedure:

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

- be sure the heat exchanger is cooled down, wait a few hours after burning. In this way, the protective film is not sticking anymore on the rear side of this insulation disk.
- make the insulation wet, by spraying water over it. This in order to keep airborne dust to a minimum.

- with a knife, cut a cross in the insulation disk, avoiding the central insert (on the back, not visible)

- make a square cut around the central insert

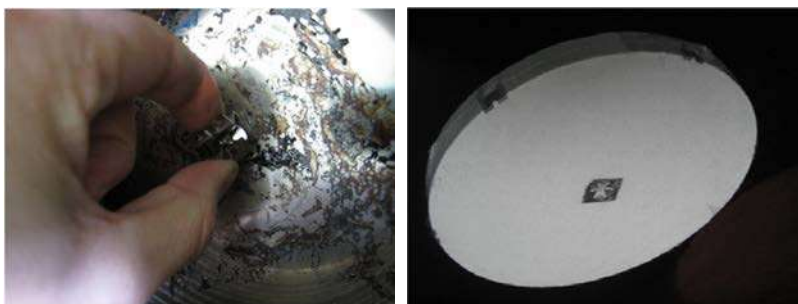
- remove the segments

- remove the central insert



The new disc has the clip on the back.

- do **NOT** remove the 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 the fitting is ok.



Replacement of burner door insulation.

Removal of the insulation:

- remove electrode
- remove the defective insulation by sliding under the periphery of the insulation a thin tool to loosen the insulation and remove it.



- remove and clean the residues of the insulation and silicone glue

Install the new insulation:

- put two dots of glue silicone, temperature-resistant (Loctite 5366 or Otoseal S17), according to the location indicated.
- make sure that the burner is in proper condition, remove any possible insulation residues on the burner
- put a plastic protection skirt around the burner to protect the insulation from the burner.
- engage the insulation carefully and place it in contact with the two dots of silicone glue
- remove the plastic protection skirt
- check the condition of the electrode, if necessary, replace it
- reinstall electrodes- mount the burner door correctly back onto the heat exchanger, taking in account the correct torque values, see § 19.3.1



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 noises and fan failures. Check the fan also for any water damages. In doubt always replace the fan of the water heater.

Condensate trap

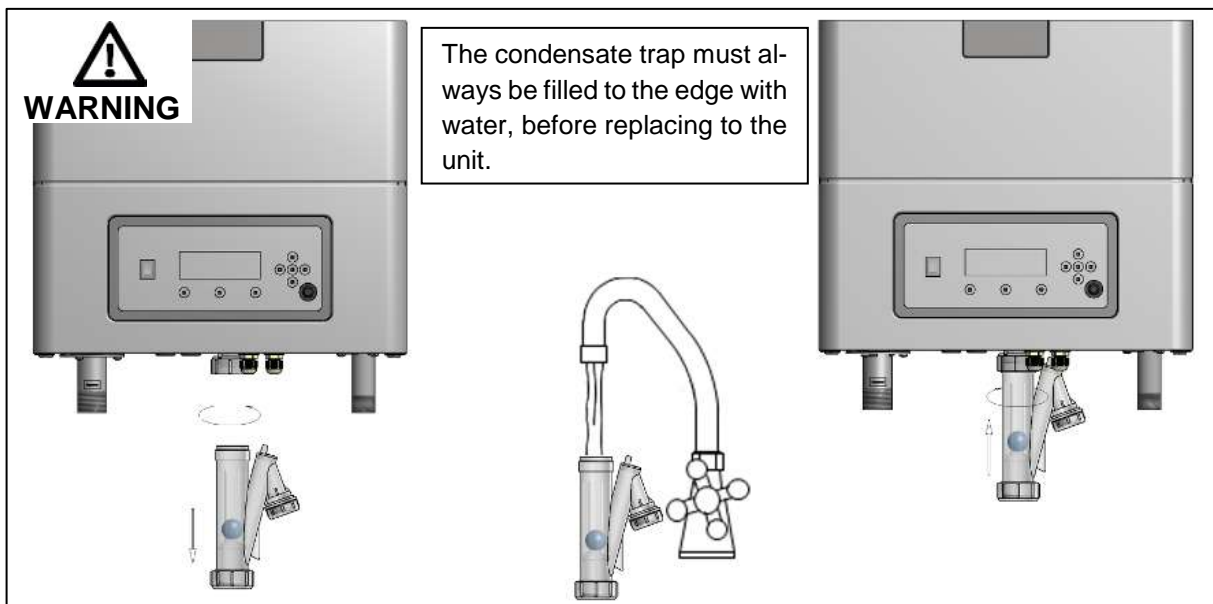
Disassemble the condensate trap and clean every part of it. Check the condensate trap connection of the heat exchanger for any blocking or pollution and clean it (if necessary). Check the functioning of the condensate trap by pouring clean tap water in the water heater combustion chamber (when burner door is removed). This water will exit the heat exchanger by the condensate trap. Notice: don't wet the rear wall insulation.



WARNING

When mounting the bottom part of the condensate trap, before commissioning the water heater 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.



Heat exchanger and water heater 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 water heater combustion chamber with water. Never expose the refractory insulation in the back of the combustion chamber to water or get it wet. Don't forget afterwards to clean the condensate trap once again.

Gas/air ratio

With every service check and/or maintenance of the water heater always check the gas/air ratio by measuring the CO₂ percentage (flue gas) at the maximum and minimum load of the water heater. If necessary, adjust these values. See for information chapter "Adjusting and setting the water heater" chapter 18.

Pump (supplied separated from the water heater)

Check the electrical parts and the motor of the pump for a correct functioning. The pump must generate a sufficient water flow over the (heat exchanger of) the water heater. When the pump produces noise, is operational for more than five years or has signs of water leakage it is recommended to replace the pump as a precaution.



WARNING

When faults and abnormalities are found by the service technician during service and maintenance and these are not repairable, this information should be reported to the owner/end-user of the installation. Also, the owner/end-user should be advised how to fix these faults and these faults should be reported in the service report / log file of the water heater.

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 water heater again.

Cleaning the combustion chamber and heat exchanger with acid or alkali products is prohibited.

20.3.1 MOUNTING THE BURNER DOOR

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:

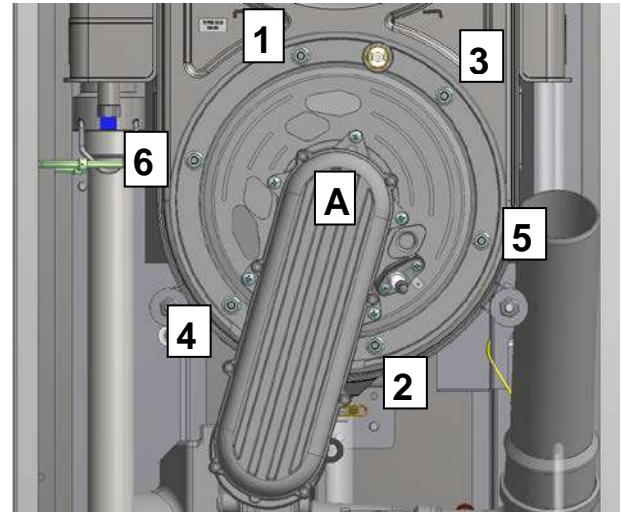
- Place the burner door with its holes over the six threaded studs.
Careful! When handling too rough or misplacing the holes over the threaded studs, the burner door insulation and/or gaskets can be damaged. Ensure that the door is well positioned with respect to the threaded studs, before pushing it onto the exchanger.
- Keep the burner door firmly 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 the picture
- The specified torque value for tightening the burner door flange nuts is **70.8-inch lbs. (8 Nm)**

Tighten in given order.

torque value = 8 Nm



20.4 Maintenance Checklist



Allowing the water heater to operate with a dirty combustion chamber will hurt operation. Failure to clean the heat exchanger as required by the manual and dictated by the operating location could result in water heater failure, property damage, personal injury, or death. Such product failures ARE NOT covered under warranty

Periodic maintenance should be performed once a year by a qualified service technician to assure that all the equipment is operating safely and efficiently. The owner should make necessary arrangements with a qualified heating contractor for periodic maintenance of the heater. The technician must also inform the owner that the lack of proper care and maintenance of the water heater may result in a hazardous condition.

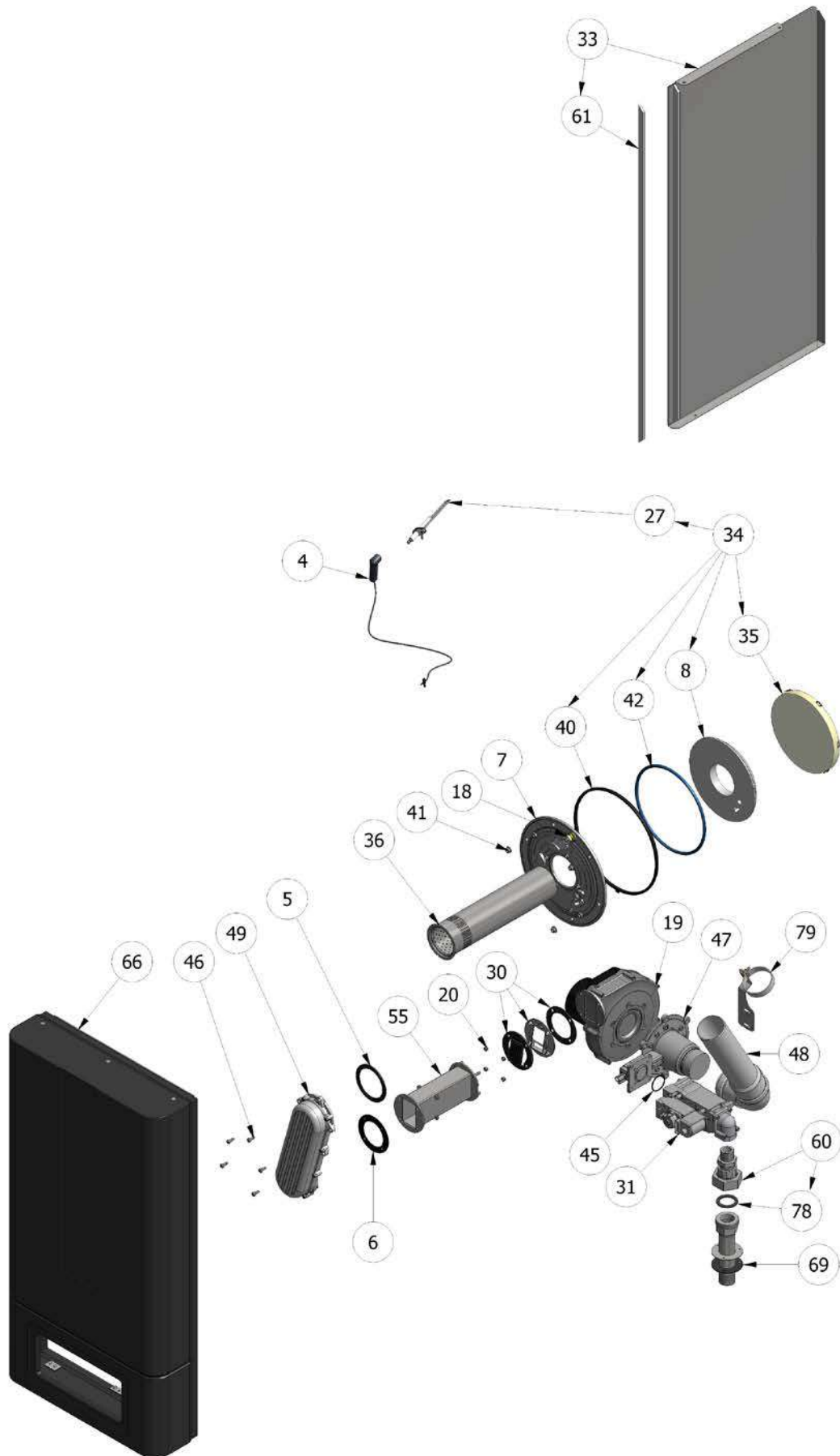
Maintenance Table

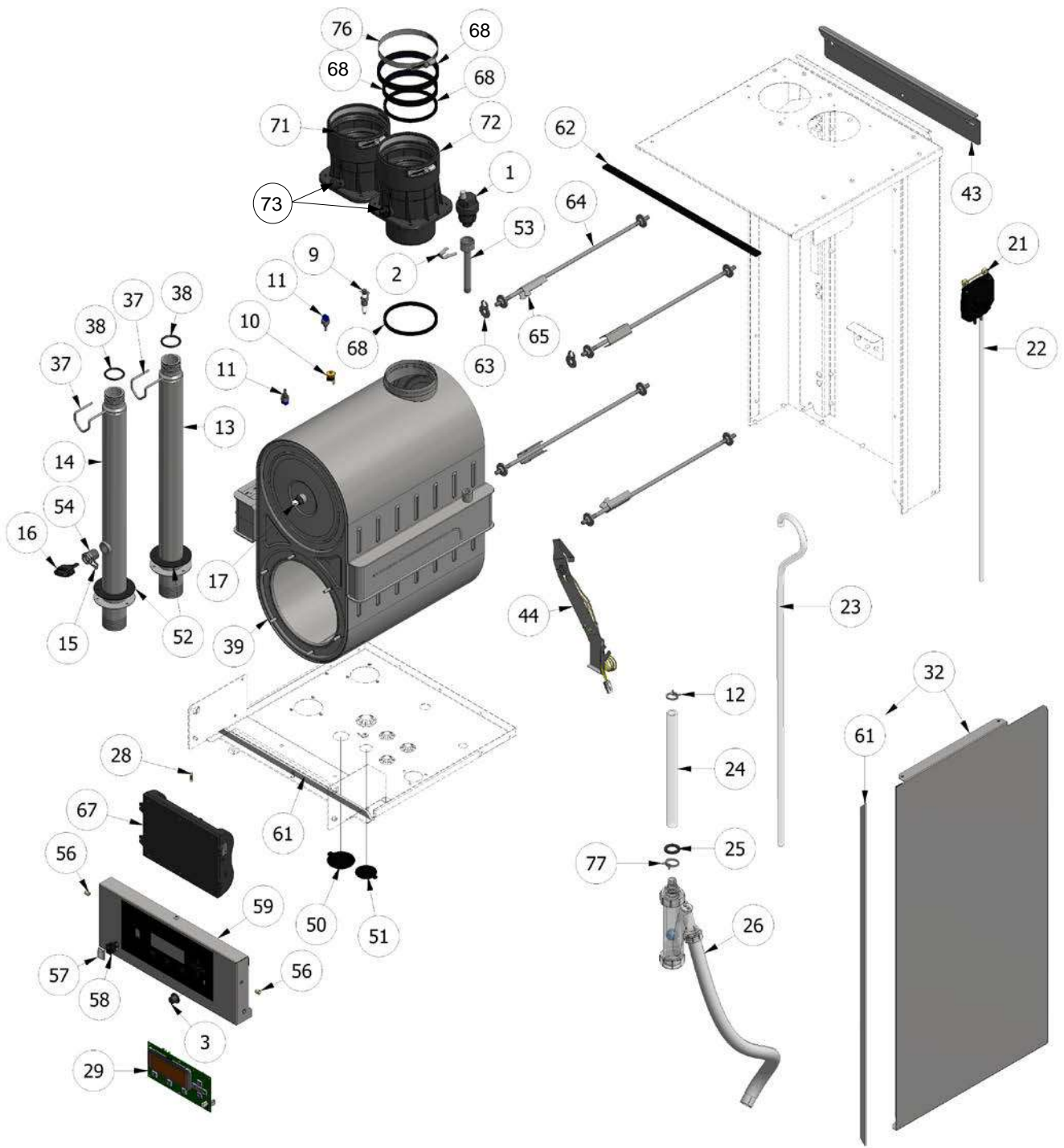
Inspection Activities		Date Last Completed			
		1 st Year	2 nd Year	3 rd Year	4 th Year
Near water heater piping	Check system and water heater piping for any sign of leakage. Take off water heater cover and inspect connections in water heater for any leaks or corrosion				
Vent	Check condition of all vent pipe and joints				
	Check to ensure vent termination 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 CO2 at high and low fire				
Visual and Temperature	Do 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. Also see maintenance section of manual				
Spark igniter	Ensure spacing of igniter prongs are aligned properly.				
Replace NRV	Replace non-return valve every year. And be sure it is not leaking gas after reassembling.				
Condensate trap	Disconnect condensate hose and trap. Ensure no blockage, rinse and clean out. Fill completely again with fresh water and re-install				
Relief Valve	Check to make sure it is not weeping				
Pump and Fan	Listen to sound of the pump and fan. If either makes noise during operation, it is recommended to replace the part.				
Low water cut-off	Check the LWCO is not leaking and check for right pressure value by draining the water from the water heater and comparing the value with a calibrated meter equipment				
Homeowner	Question homeowner before maintenance if they have any issues and after done, confirm activities you performed during maintenance visit				
Used descaling products	Check the descaling products				
Water hardness					

21 USER INSTRUCTIONS

After installing and commissioning of the water heater, demonstrate the operation of the entire central heating system to the end-user. The user should be made familiar with all safety precautions of the water heater and the installation. The user should be instructed that service and maintenance of the water heater is required every twelve months. Regular service and maintenance are essential for a safe and proper operation of the water heater. Hand over the documents supplied with the water heater.

22 SPARE PARTS.





POS.	DESCRIPTION	Part Number	HWB-299	HWB-399	HWB-499
1	Set air vent HW	S005.500.001	X	X	X
2	Locking clip air vent	E01.002.171	X	X	X
3	Rubber plug ø 15	E05.001.092	X	X	X
4	Ignition cable	E04.016.583	X	X	X
5	Gasket Burner & gas/air inlet pipe	E07.001.029	X	X	X
6	Gasket gas/air inlet pipe & fan 58 mm	E07.001.049	X	X	X
7	Burner door right sided ignition (metal sheet burner)	E04.000.473	X	X	X
8	Burner door isolation right sided ignition hole Ø 70.5	E04.000.455	X	X	X
9	Sensor LWCO	E04.016.727	X	X	X
10	Temperature switch 90° C	E04.016.732	X	X	X
11	NTC sensor 1/8" SS	E04.016.287	X	X	X
12	Hose clamp Ø 20.62 (DW13)	E04.010.143	X	X	X
13	Inlet pipe HWB-299 1½" (NPT)	E02.000.388	X	NA	NA
14	Outlet pipe HWB-299 1½" (NPT)	E02.000.389	X	NA	NA
13	Inlet pipe HWB-399 1½" (NPT)	E02.000.383	NA	X	NA
14	Outlet pipe HWB-399 1½" (NPT)	E02.000.382	NA	X	NA
13	Inlet pipe HWB-499 1½" (NPT)	E02.000.385	NA	NA	X
14	Outlet pipe HWB-499 1½" (NPT)	E02.000.384	NA	NA	X
15	Clip for WPS 10 bar	E04.010.236	X	X	X
16	Water pressure sensor 10 bar CH	E04.016.731	X	X	X
17	NTC flue gas sensor ¼" 10 KOHM = R25 B=3977K t2	E04.016.694	X	X	X
18	Burner door thermostat 260 °C M5	E04.016.667	X	X	X
19	Radial Blower RG148/300W (120VAC)	E04.016.721	X	X	X
20	Set nuts M5 self-locking (4 pcs) DIN985 elvz	S008.500.003	X	X	X
21	Air pressure switch DL 2 ET with S-clip (US)	E04.000.447	X	X	X
22	Hose pressure switch	E04.007.149	X	X	X
23	Hose air vent	E04.007.148	X	X	X
24	PVC hose Ø21xØ15	E04.007.145	X	X	X
25	Gasket siphon / bottom plate Ø30xØ21x3	E07.003.102	X	X	X
26	Condensate drain assembly l=800	E05.000.146	X	X	X
27	Electrode set Commercial Boiler	S004.500.002	X	X	X
28	Box 10 pcs Fuse 5 AT	S04.016.582	X	X	X
29	Pixel Button Display	S04.000.460	X	X	X
30	Seat check valve	S008.500.002	X	X	X
31	Modulating Gas Valve	S008.500.005	X	X	X
32	Side panel right	S011.500.001	X	X	X
33	Side panel left	S011.500.002	X	X	X
34	Universal maintenance kit HWB	S004.500.003	X	X	X
35	Rear wall insulation 16 mm	S004.500.004	X	X	X
36	Burner HWB-299 l=210	E04.012.025	X	NA	NA
36	Burner HWB-399 l=296	E04.012.027	NA	X	NA
36	Burner HWB-499 l=359	E04.012.044	NA	NA	X
37	Spring coupling Ø 4-32	E09.002.021	X	NA	NA
37	Spring coupling Ø 4-39.2	E09.002.022	NA	X	NA
37	Spring coupling Ø 4-46	E09.002.023	NA	NA	X
38	O-ring Ø26x20x3.6	E07.002.032	X	NA	NA
38	O-ring Ø33.50x4	E07.002.033	NA	X	NA
38	O-ring Ø40x4	E07.002.034	NA	NA	X
39	Heat Exchanger D20 HWB-299	S004.500.010	X	NA	NA
39	Heat Exchanger D20 HWB-399	S004.500.011	NA	X	NA
39	Heat Exchanger D20 HWB-499	S004.500.012	NA	NA	X
40	Gasket burner door - heat exchanger	S07.004.035	X	X	X
41	Set nuts with flange M6 (10 pcs)	S06.023.001	X	X	X
42	Gasket-cord burner door	S07.004.065	X	X	X
43	Wall bracket	S01.001.014	X	X	X

POS.	DESCRIPTION	Part Number	HWB-299	HWB-399	HWB-499
44	Rear wall thermostat 100-180 (16 mm rear wall)	S01.000.288	X	X	X
45	O-ring 33.4x2	S07.002.018	X	X	X
46	Set round head screw M5x14 self-thread-cutting (5 pcs)	S06.023.002	X	X	X
47	Set. Venturi VMS L	S008.500.004	X	NA	NA
47	Venturi VMS N	S008.500.008	NA	X	NA
47	Set. Venturi VMS P	S008.500.009	NA	NA	X
48	Silencer with restriction ring Ø36	S024.500.001	X	NA	NA
48	Silencer with restriction ring Ø44	S024.500.002	NA	X	NA
48	Silencer without restriction ring	S024.500.003	NA	NA	X
49	Gas-air mixing pipe	S03.000.164	X	X	X
50	Push-in cable blanking plug SR6275 item 551851	E04.005.113	X	X	X
51	Push-in cable blanking plug SR6275 item 551850	E04.005.112	X	X	X
52	Gasket Outlet/Inlet pipe 1½"	E07.001.124	X	X	X
53	Extension pipe air vent	E04.015.099	X	X	X
54	Nipple for RPS D15	E04.002.128	X	X	X
55	Offset piece HWB-299	E02.000.338	X	NA	NA
55	Offset piece HWB-399	E02.000.336	NA	X	NA
55	Offset piece HWB-499	E02.000.335	NA	NA	X
56	Spring plunger 8mm	E05.001.280	X	X	X
57	Dustcover ON/OFF switch	E04.010.229	X	X	X
58	Main switch	E04.016.724	X	X	X
59	Electronics holder	S006.500.002	X	X	X
60	Gas pipe HWB-299 & HWB-399	S003.500.001	X	X	NA
60	Gas pipe HWB-499	S003.500.002	NA	NA	X
61	Silicone seal 13x5 self-adhesive L=838mm	E07.004.073	X	X	X
62	EPDM seal 15x6 self-adhesive L=435mm	E07.004.076	X	X	X
63	Special washer heat exchanger	E01.004.197	X	X	X
64	Anchoring bar HWB-299	S01.000.358	X	NA	NA
64	Anchoring bar HWB-399	S011.500.003	NA	X	NA
64	Anchoring bar HWB-499	S01.000.361	NA	NA	X
65	Bracket heat exchanger	E01.003.101	X	X	X
66	Front panel Commercial Boiler	S010.500.002.171	X	X	X
67	Burner control HW (US) HWB-299 & HWB-399 & HWB-499	S165021.171	X	X	X
68	Seal EPDM 4" SST & PVC	S016.500.010	X	X	NA
68	Seal EPDM 6" SST & PVC	S016.500.011	NA	NA	X
69	Gasket gas pipe 1"	E07.003.117	X	X	X
70	Harness HV/LV	E04.016.741	X	X	X
71	Boiler air connector PP 100-100-4"	E04.018.135	X	X	NA
71	Boiler air connector PP 150-150-6"	E04.018.133	NA	NA	X
72	Boiler connector PP 100-100-4"	E04.018.134	X	X	NA
72	Boiler connector PP 150-150-6"	E04.018.132	NA	NA	X
73	Measuring Cap M20x2 RAL-9011	S016.500.002	X	X	X
76	Clamp Galv. 4"	S016.500.008	X	X	NA
76	Clamp Galv. 6"	S016.500.009	NA	NA	X
77	Threaded spring clamp Ø23.83 (DW15)	E04.010.241	X	X	X
78	Gasket Ø44xØ32x3	E07.003.112	X	X	X
79	Silencer bracket	S003.500.003	X	X	X

Your distributor:



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ecokingheating.com
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