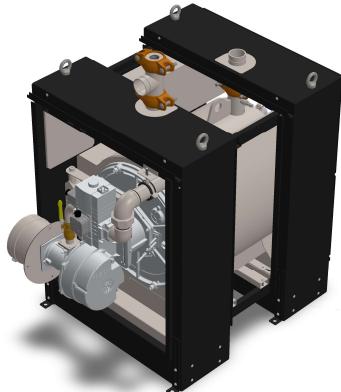


Hubbell PRIME NX Plus

Gas Fired Condensing Water Heater

Installation and Service Manual



NX1250

NX2000

4/19/24

NX3000

NX4000

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

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- **WHAT TO DO IF YOU SMELL GAS:**
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

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 Sign: indicates the presence of an imminently hazardous situation which can cause substantial property damage, serious personal injury or loss of life.



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



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



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



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



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

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.

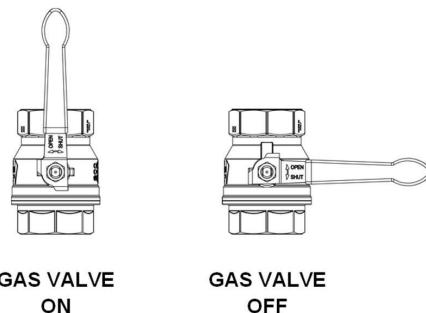
WHAT TO DO IF YOU SMELL GAS

- 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 (to the left) 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 at the back of the appliance cabinet, in the gas piping.
6. The manual gas shut off valve is located at the back of 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 the next step.



GAS VALVE
ON

GAS VALVE
OFF

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 at the back of the appliance cabinet; turn the handle  to the full OFF position (perpendicular to the gas piping).

**CAUTION**

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

**DANGER**

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

**NOTICE**

Hubbell Heaters recommends the installation of a carbon monoxide detector in the boiler room for all installations.

**WARNING**

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

**WARNING**

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

**Avertissement**

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

**DANGER**

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

**WARNING**

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 loss of life. 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 boiler. This boiler contains materials that have been identified as carcinogenic, or possibly carcinogenic, to humans).

CONSIGNES DE SÉCURITÉ.

POUR VOTRE SÉCURITÉ LISEZ AVANT DE METTRE EN MARCHE

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

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

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

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ

- Ne pas tenter d' allumer d'appareil.
- Ne touchez à aucun interrupteur ; ne pas vous servir des téléphones se trouvant dans le bâtiment.
- appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.

• Si vous ne pouvez rejoindre le fournisseur,appelez le service des incendies.

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

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

INSTRUCTIONS DE MISE EN MARCHE

1. ARRÉTEZ! 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.

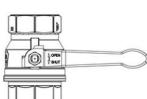
4. Cette appareil ne comporte pas de veilleuse. Il intègre un dispositif d' allumage automatique du brûleur. N' essayez pas d' allumer manuellement le brûleur.

5. L' interrupteur de gaz principal se trouve directement à l' arrière de la chaudière, sur la conduit d' alimentation en gaz.

6. L' interrupteur de gaz principal se trouve directement à l' arrière de la chaudière. Tournez l' interrupteur de gaz principal  dans le sens horaire pour couper l' alimentation en gaz.



GAZ ON



GAZ OFF

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, ARRÉTEZ ! 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 à l' arrière de la chaudière. Tournez l' interrupteur de gaz principal  dans le sens horaire pour couper l' alimentation en gaz.

2 INTRODUCTION

This manual is written for the installer and service technician.

Hubbell Heaters is not accountable for any damage caused by failure to correctly follow these instructions. For service and repair purposes use only original Hubbell Heaters spare parts.

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

This manual is subject to change without notice.

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

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

2.1 Explanations.

E = Industrial Boiler

DWH = Domestic Hot Water

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

BCU = burner control unit

PB = display board / control panel (Pixel Button)

TS = touch screen

1250/2000/3000/4000 = Model number of the boiler.

Explications

E = Chaudière industrielle.

DWH = Eau Chaude Sanitaire (ECS)

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

BCU = commande (burner control unit)

PB = écran (Pixel Button)

TS = écran tactile

1250/2000/3000/4000 = Modèle numéro de chaudière.

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.

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.

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

- When a number of similar error codes and/or lock-outs appear.
- At least every 12 months and/or after 2000 burning hours maximum, whichever comes first.
- maintenance must be done to ensure safe and efficient operation.

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

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

- Lorsqu'un certain nombre de codes d'erreur et/ou de verrouillage semblables apparaissent.
- Au moins tous les 12 mois et/ou après 2000 heures de combustion au maximum, selon la première éventualité.
- L'entretien doit être effectué pour garantir 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 boilers, mechanical-vent heating appliances or domestic hot water equipment, where the bottom of the vent terminal and the intake is installed below four feet above grade the following requirements must 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 boiler and/or equipment and shall:**
 - a) Be powered by the same electrical circuit as the boiler and/or equipment such that only one service switch services both the boiler and the carbon monoxide detector;
 - b) Have battery back-up power;
 - c) Meet ANSI/UL 2034 Standards and comply with NFPA 720 (2005 Edition); and
 - d) Have been approved and listed by a Nationally Recognized Testing Lab as recognized under 527 CMR.
- 3) A product-approved vent terminal must be used, and if applicable, a product approved air intake must be used. Installation shall be performed in strict compliance with the manufacturer's instructions. A copy of the installation instructions shall remain with the boiler and/or equipment at the completion of the installation. 7
- 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 boilers, mechanical-vent heating boilers or domestic hot water equipment where the bottom of the vent terminal and the intake is installed higher than four feet above grade the following requirements must 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 boiler 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 boiler and/or equipment at the completion of the installation.

3 TECHNICAL DATA E BOILERS

3.1 Functional introduction

The E is a central heating (B) boiler or domestic hot water (WH) heater 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 E 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)

Burner control includes:

- Cascade control for up to sixteen appliances
- Remote operation and heat demand indication from each boiler / water heater
- Weather compensation control – Outdoor reset.
- Tank control
- External Ignition coil
- Flow switch
- Low Water Cut Off

Connections for:

- On/Off or modulating thermostat
- 0-10 VDC remote flow temperature (set point) control
- 0-10 VDC remote boiler input control
- Outdoor temperature sensor
- External (indirect) tank pump or diverter valve
- Boiler pump
- PWM / 0-10V control for boiler pump
- System pump
- External safety devices
- Modbus
- External system sensor
- DWH indirect sensor or aquastat

3.2 Location of version numbers

Parameter Version

– To be found on the small sticker at the side of the burner controller v.A = "Version A" for instance.

Burner controller hardware version

– Mentioned at the second line on the white sticker at the side of the burner controller.



Burner Controller Software Versions

– Press the menu button  go to Information and then to Software Versions.

Information	Software Versions
Software Versions	[63EF 83BC]
Boiler Status	[5C79 14A9]
Boiler History	900MN
Error Log	

3.3 Technical specifications datasheet

GENERAL																
Boiler category	-	IV														
Model boiler / water heater		E-1250	E-2000	E-3000	E-4000											
Dimensions (l x w x h)	Inch m	55 x 34 x 47 1.4x0.87x1.2	68 x 34 x 47 1.73x0.87x1.2	79 x 46 x 59 2.01x1.17x1.5	95.5 x 46 x 59 2.43x1.17x1.5											
Water content	Gallon (liter)	11 (41.5)	16.2 (61.5)	34.6 (130.9)	45.3 (171.4)											
Weight (empty, outdoor unit)	Lbs (kg)	992 (450)	1213 (550)	1984 (900)	2314 (1050)											
Flow/return connection	Victaulic	2 ½"	2 ½"	4"	4"											
Gas connection	inch	NPT 2"	NPT 2"	NPT 2"	NPT 2"											
Vent connection	Inch (mm)	8" (200)	8" (200)	10" (250)	12" (300)											
Air connection	Inch (mm)	8" (200)	8" (200)	12" (300)	12" (300)											
GAS CONSUMPTION		Values min-max:														
Natural gas		ft ³ /h m ³ /h	208.4 – 1158 5.9 – 32.8	353.1 – 1858 10.0 – 52.6	554.4 – 2765 15.7 – 78.3											
Propane ¹		ft ³ /h m ³ /h	91.8 – 445 2.6 - 12.6	180.1 – 716.9 5.1 - 20.3	222.5 – 1112.4 6.3 - 31.5											
Gas supply pressure nominal ²	Nat. gas	inch W.C. (mbar)	7.0 (17.4)													
	Propane	inch W.C. (mbar)	11.0 (27.4)													
NOTES																
<ol style="list-style-type: none"> Using propane, maximum fan speed needs to be reduced Min. and max. gas supply pressures: 																
<table border="1"> <thead> <tr> <th></th><th>p nom inch W.C. (mbar)</th><th>p min inch W.C. (mbar)</th><th>p max inch W.C. (mbar)</th></tr> </thead> <tbody> <tr> <td>Natural gas</td><td>7.0 (17.4)</td><td>3.5 (8.7)</td><td>10.5 (26.2)</td></tr> <tr> <td>Propane</td><td>11.0 (27.4)</td><td>8.0 (19.9)</td><td>13.0 (32.4)</td></tr> </tbody> </table>						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)
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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)													

Model boiler			E-1250	E-2000	E-3000	E-4000							
O2 values are the leading values / CO2 are reference values			Low - High Fire Fire										
O ₂ flue gas Low fire - High fire	Natural gas	% (±0.2%)	6.5 – 5.2	6.5 – 5.2	6.5 – 4.7	6.5 – 4.7							
	Propane	% (±0.2%)	7.2 – 6.0	7.8 – 5.8	6.9 – 5.4	6.9 – 5.4							
CO ₂ flue gas Low fire - High fire	Natural gas	% (±0.1%)	8.1 – 8.8	8.1 – 8.8	8.1 – 9.1	8.1 – 9.1							
	Propane	% (±0.1%)	9.0 – 9.8	8.6 – 9.9	9.2 – 10.2	9.2 – 10.2							
Attention: The O₂ difference between High Fire and Low Fire should be minimal the difference mentioned in the table above, independent of the allowed tolerance. Eg. 6.5 – 5.2, the difference must be min. 1.3% O₂													
Flue gas temperature at combustion air temperature = 70 °F (20 °C)	°F (°C)		120 - 180 (50 - 80)										
Available flue length (air+vent size) ³	ft		150 + 150 (8" + 8")	115 + 115 (8" + 8")	150 + 150 (10" + 10")	150 + 150 (12" + 12")							
INSTALLATION													
Resistance boiler	ΔT = 20 F	ft.head (m.W.C.)	14 (4.3)	16.5 (5.0)	19.5 (6.0)	21 (6.4)							
	ΔT = 35 F	ft.head (m.W.C.)	4.5 (1.4)	5.1 (1.6)	6.5 (2.0)	7 (2.2)							
Max. pressure heating boiler	psi (bar)		160 (11.0)										
Max. supply temperature heating boiler	°F (°C)		194 (90)										
Max. pressure water heater	psi (bar)		160 (11.0)										
Max. supply temperature water heater	°F (°C)		185 (85)										
ELECTRIC													
Maximum power consumption	W	560	1160	1160	2440								
Appliance amperage	A	4.7	9.7	9.7	3 x 3.0								
Power supply	V/Hz	120 / 60			480 / 60								
Protection class	-	NEMA 1 (Indoor unit) and NEMA 4X (Outdoor unit)											
NOTES													
³ Maximum allowed combined resistance of flue gas and air supply piping at high fire													

3.4 High altitude operation.

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

How to calculate De-rating at intermediate elevations for US:

Elevation between:

2000 and 3000 ft : $(\text{New value} - 2000) \times 0.004$

Example: Elevation is 2600 ft. De-rating is $(2600-2000) \times 0.004 = 2.4 \%$

3000 till 4000 ft : $((\text{New value} - 3000) \times 0.004) + 4$

Example: Elevation is 3700 ft. De-rating is $((3700-3000) \times 0.004) + 4 = 6.8 \%$

4000 till 4500 ft : $((\text{New value} - 4000) \times 0.004) + 8$

Example: Elevation is 4200 ft. De-rating is $((4200-4000) \times 0.004) + 8 = 8.8 \%$

Above 4500 ft : $((\text{New value} - 4500) \times 0.004) + 10$

Example: Elevation is 4800 ft. De-rating is $((4800-4500) \times 0.004) + 10 = 11.2 \%$

How to calculate De-rating at intermediate elevations for Canada:

Elevation between:

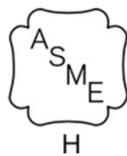
2000 till 4500 ft : All values derate by 10%

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

Above 4500 ft : $((\text{New value} - 4500) \times 0.004) + 10$

Example: Elevation is 7600 ft. De-rating is $((7600-4500) \times 0.004) + 10 = 22.4 \%$

3.5 Specifications



E series						
Model number	Input, MBH ¹		Gross Output ^{1,2} MBH	AHRI Net Ratings Water, MBH	Thermal Efficiency, %	Combustion Efficiency, %
	Min	Max				
E-1250-B	156	1250	1225	1065	98	98
E-2000-B	236	2000	1960	1704	98	98
E-3000-B	420	3000	2940	2557	98	98
E-4000-B	500	4000	3920	3409	98	98

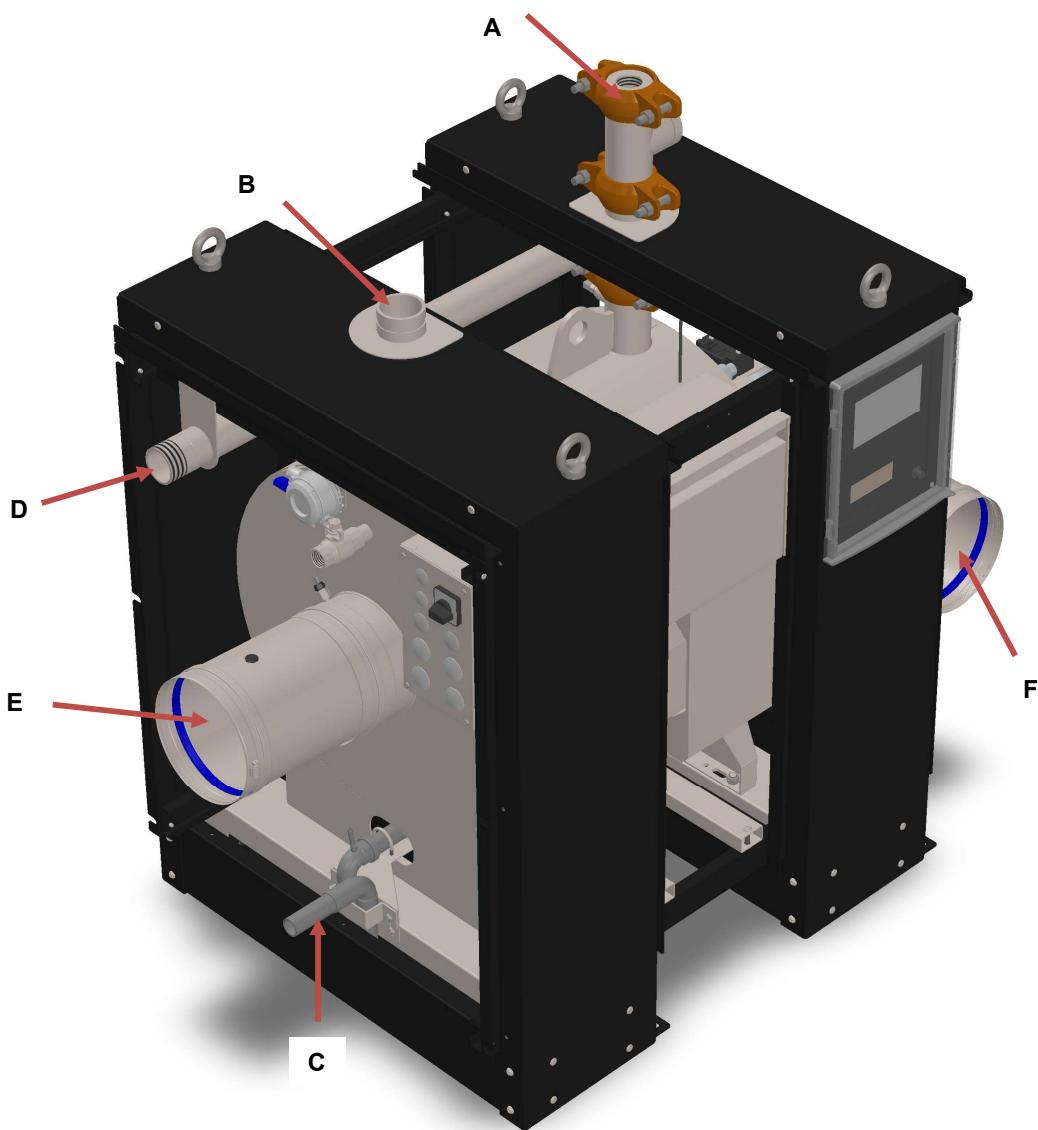
1 Listed Input and Output ratings are at minimum vent lengths at Sea Level. Numbers will be lower with longer venting and/or altitudes greater than 2000 feet [610 m].



E series		
Model number	Input Rate, MBH ¹	Thermal Efficiency, %
E-1250-WH	1250	99
E-2000-WH	2000	99
E-3000-WH	3000	99
E-4000-WH	4000	99

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

4 BOILER CONNECTIONS



Connections	E-1250	E-2000	E-3000	E-4000
A Supply	Victaulic 2½"	Victaulic 2½"	Victaulic 4"	Victaulic 4"
B Return	Victaulic 2½"	Victaulic 2½"	Victaulic 4"	Victaulic 4"
C Condensate	1 ¼ inch	1 ¼ inch	1 ½ inch	1 ¼ inch
D Gas	NPT 2"	NPT 2"	NPT 2"	NPT 2"
E Vent	8 inch	8 inch	10 inch	12 inch
F Air	8 inch	8 inch	12 inch	12 inch

5 ACCESSORIES AND UNPACKING

5.1 Accessories

Depending on the selected controlling behavior for the central heating system / hot water system and/or the optional use of a water tank, the following items are available as accessories.

Item	part number
Adhesive kit 04	S022.000.001
LOCTITE® SI 5366™ 50ml	S022.000.002
External flow temperature sensor 10kOhm@77°F	S022.500.021
Indirect tank sensor: 10kOhm@77°F (type B3977) for immersion	S022.500.009
WIFI / IP module	S022.500.006
Software + interface cable for programming the boiler with a computer/laptop	S022.500.015
2 Fuses, to provide 3 phase input for the E 1250, 2000 and 3000	
Relay, to connect an extra pump.	
Boiler casing (for outdoor application) E 1250	
Boiler casing (for outdoor application) E 2000	
Boiler casing (for outdoor application) E 3000	
Boiler casing (for outdoor application) E 4000	
4 height adjustable castor wheels	
4 height adjustable feet	
4 Vibration dampers	

5.2 Unpacking

The E boiler or water heater will be supplied with the following documents and accessories:

No	Description	Quantity
1	"Installation, user and service instructions" manual.	1
2	2" gas valve	1
3	ASME pressure relief valve (packed into an additional box).	1
4	Pipe section for mounting the pressure relief valve	1
5	Spare fuse for the boiler control (at the burner controller, located inside the electrical cabinet).	1

After delivery, always check the 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 E

6.1 Installation Clearances

Model No	Clearances to walls and ceiling.					
	Distances –inch					
	A: Front	B: Left side	C: Right side	D: Rear	E: Top ¹	
E-1250	Minimum service clearances	20"	24"	2"	20"	20"
E-2000						
E-3000	Minimum service clearances	20"	24"	2"	20"	30"
E-4000						
E-1250	Recommended service clearances	36"	36"	36"	36"	36"
E-2000						
E-3000	Recommended service clearances	50"	50"	36"	36"	36"
E-4000						

¹ Depending on type, size and locations of PRV

Clearances from combustible materials

Boiler / water heater – All sides, bottom and top 0" (0 mm) from combustible materials. Boiler shall be suitable for installation on a combustible floor

Hot water pipes - at least 1/4" (6 mm) from combustible materials.

Vent pipe – at least 1" (25 mm) from combustible materials.

The installation area/room must have the following provisions:

- power source socket with ground.
- Open connection to the sewer system for draining condensing water.

	<ul style="list-style-type: none">• The installation of the Hubbell E gas appliance must conform to the requirements of this manual and of your local authority.• Where required by the authority having jurisdiction, the installation must conform to the standard for Controls and Safety Devices for Automatically Fired Boilers ANSI/ASME CSD-1
--	---

6.2 Boiler / Water heater Installation Location Requirements:

- The installation of this boiler / 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. (§ 11.6)
- The installation area must be dry and frost-free.
- The boiler / water heater has a built-in fan that will generate noise, depending on the total heat demand. The boiler location should minimize any disturbance this might cause.
- There must be sufficient lighting available in the boiler room to work safely on the boiler.
- The floor used for placing the boiler must be able to hold the weight of the boiler, piping and fittings, and the weight of the water.
- The boiler / water heater must not be installed on carpeting.
- Do not install the boiler / water heater in a location where it will be exposed to temperatures 100 °F or higher.
- Do not install the boiler / water heater in a location where it will be exposed to high levels of humidity and moisture or where condensation might fall onto the boiler.
- When the boiler / water heater is used in connection with a refrigeration system, it must be installed so the chilled medium is piped in parallel with the boiler, with appropriate valves to prevent the chilled medium from entering the boiler.
- 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 boiler / water heater. If not, a condensate pump will be required.
- Do not locate the boiler in an area which contains corrosive or other contaminants as outlined in § 11.7 tables
- 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 as outlined in § 11.7 tables.

The boiler / 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 boiler must be done by a qualified installer or technician, who was trained for this type of boiler.

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

7 CONNECTIONS

7.1 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 codes, 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 building. See the gas sizing table below for help when sizing the gas connection. For information on propane sizing consult your local propane gas supplier, or the National Fuel Gas Code, ANSI Z223.1/NFPA 54.

Schedule 40 Black Steel Pipe in Cubic Feet of Natural Gas per Hour. (Based on inlet pressure less than 2 psi, pressure drop of 0.5 W.C. and specific gravity 0.6)					
Nominal Pipe Size (In)	1 1/4"	1 1/2"	2"	2 1/2"	3"
Length (ft)					
10	1390	2090	4020	6400	11300
20	957	1430	2760	4400	7780
30	768	1150	2220	3530	6250
40	657	985	1900	3020	5350
50	583	873	1680	2680	4740
60	528	791	1520	2430	4290
70	486	728	1400	2230	3950
80	452	677	1300	2080	3670
90	424	635	1220	1950	3450
100	400	600	1160	1840	3250

7.1.1 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.

Manual gas valves shall comply with the applicable provisions of the standard for Manually operated gas valves for appliances, appliance connector valves and hose end valves, ANSI Z21.15 / CSA 9.1, or the standard for Combination gas controls for gas appliances, ANSI Z21.78 / CSA 6.20.

The entire piping system, gas meter and regulator must be sized properly to prevent pressure drop greater than 1" wc as stated in the NFPA 54. If you experience a pressure drop of greater than 1" w.c., the regulator or gas line is undersized.

It is advised to apply a gas filter

See the technical specifications datasheet for minimum and maximum allowed gas pressures.

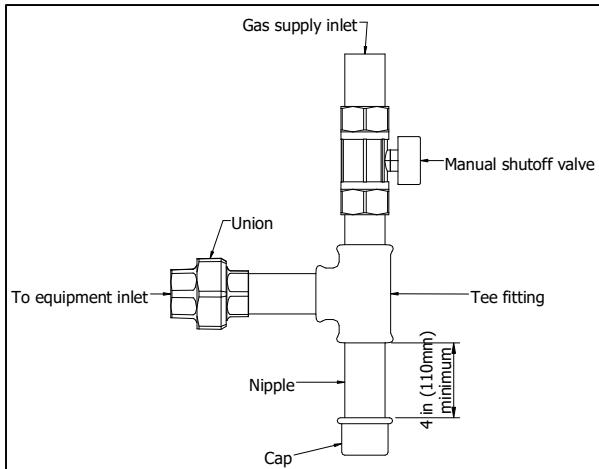
Ensure that: the gas line connection to the appliance does not apply any weight or pressure to the gas valve.

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

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 PIPE, 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 boiler / water heater up to the gas pressure regulator.

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



A sediment trap must be provided directly below the boiler.



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

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

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

*The boiler / 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 $\frac{1}{2}$ PSIG (3.45 kPa).

*The boiler / 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 $\frac{1}{2}$ PSIG (3.45 kPa).

7.2 Condensate drain connection

The condensate drain is placed at the back of the boiler / water heater and has a $1\frac{1}{4}$ inch pipe discharge. Connect this to the sewer system.

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

Blockage of the drain might damage the boiler / 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 boiler / water heater.

There should be an open connection of the condensate piping into the sewage system. A possible vacuum in the sewage system must not be able to draw the condensate drain empty.



The condensate the boiler / 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.



When mounting the condensate trap, before commissioning the boiler / 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.**



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

7.3 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)

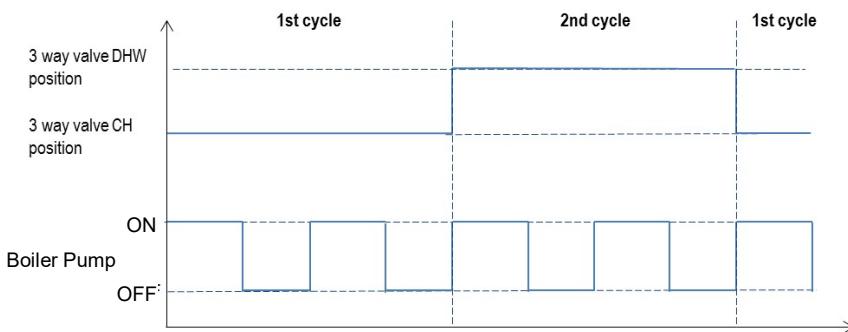
The display will show 'dAir' indicating that the controller is performing the De-Air sequence to purge the heat exchanger of air, by sequencing the boiler / water heater pump OFF and ON. The installer/technician can cancel the De-Air sequence by pressing a specific key-button combination from the display. By default, "De-Air" sequence takes around 14 minutes.

- 1st cycle: The 3 way valve moves to B 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 (= 40 seconds in total).
- 2nd cycle: starts when 1st cycle has ended. The 3 way valve is moved to DHW position and repeats the same cycling of the pump (= 40 second in total).

This sequence (1st cycles + 2nd cycles) is performed DAir_Number_Cycles times (Default DAir_Number_Cycles is 10, so the 'De-air' sequence lasts $(10 \times 40) \times 2 = 800$ seconds).

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

When the water pressure is too low, or pressure sensor is in error, the De-Air sequence will be suspended until the water 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 boiler / 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

De-Air sequence duration

The total duration of the De-Air sequence depends on the selected De-Air settings. With the default settings for De-Air the sequence takes 800 seconds to complete.

De-air for cascade systems

The de-air function is not available for cascaded systems. It is not possible to generate a burn demand for cascade as long as the de-air cycle is busy. When using a cascaded system it is recommended to configure the de-air function to either 24hr pump or disabled (After commission of the unit).

8 CENTRAL HEATING BOILER

8.1 *Flow and return connections*

When using a boiler pump, this pump should always be mounted in the return pipe of the heating system. Do not use chloride-based fluxes for soldering any pipes of the water system.

It is recommended to install service valves, so the boiler can be isolated from the heating system, when needed. Make sure that the pressure relief valve is mounted between the boiler and the service valves.

8.2 *The expansion vessel*

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

8.3 *Pressure relief valve*

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

8.4 *Primary Secondary Piping.*

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

8.5 *Pump functionality*

Delta T monitoring:

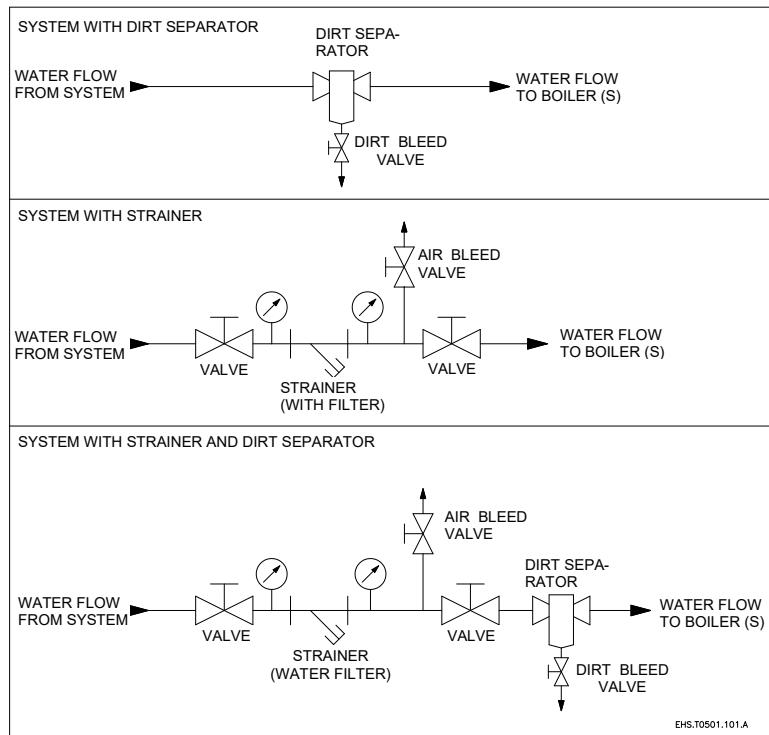
A high temperature difference between supply and return of the boiler can indicate a clogged heat exchanger or filter, or a defective pump. The burner load automatically decreases when the Return/Supply temperature differential increases too much. See § 16.

8.6 *Frost protection*

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

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

8.7 Installing a strainer and/or dirt separator



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

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

8.8 Water quality

Contaminant	Maximum allowable level	Units
pH	7.5 to 9.5	
Hardness	50 to 150	ppm CaCO ₃
	3.5 to 10.5	°e (Clark)
	2.8 to 8.4	°dH
Aluminum particles	< 0.2	mg/L
Chlorides	150	ppm
TDS	350	ppm

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

If there is the risk of contamination of the water by any kind of debris/chemicals in the period after installing, a plate heat exchanger should be used to separate the boiler circuit from the heating circuit (see drawing at the next page).

It is advised to prevent the possible air intake and water leakage of the central heating system. Fresh oxygenated water might damage the heat exchanger of the boiler and should therefore be prevented! Usual spots where air is most likely to seep in are: suction gaskets, pumps, air valve working as a venting pipe, O-rings / gaskets in stuffing box, under floor heating pipes.

When a boiler is installed in a new system or an existing installation the system must be cleaned before the boiler is installed. The system is required to be cleaned using a system cleaner from the list below or an equivalent hydronic system cleaner. Follow the instructions provided by the system cleaner manufacturer. The system should then be drained and thoroughly flushed with clean water to remove any residual cleaner. **The system cleaner must never be run through the boiler.** For recommended cleaners see the table in § 8.10.

Do not use petroleum-based cleaning and sealing compounds in the boilers system as they could damage gaskets.

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

- * Spirovent
- * Taco 4900 Series
- * Caleffi Discal

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

8.9 Use of glycol

To prevent the system from freezing, the use of glycol can be considered. All materials, used in the boiler, are resistant to glycol.

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

The chemical compatibility of three specific anti-freeze products has been tested by the heat exchanger producer. These products mainly consist of glycol next to the described additives.

If these products are used according to the instruction, they will not harm the boiler.

These anti-freeze products are:

Manufacturer	Type	Composition
Fernox	Alphi 11	consists of 97% Mono Propylene Glycol next to some additives.
Sentinel	X500	estimated as being between 90-100% Mono Propylene Glycol.
Rhomar	Rhogard	Blended with VIRGIN Propylene Glycol

When using other glycol-based antifreeze products make sure that it is an equivalent product to the products mentioned above which will behave exactly the same on all materials and equipment in the heating systems.

The use of glycol in the boiler system will result in an increase in the viscosity of the water/glycol mixture and a decrease in the heat transfer. When the boilers are used in a system with glycol the following requirements must be followed at all times. Never exceed a 50% mixture of glycol in the system. The boiler loop must be designed to operate at a 20°F Delta T.

When using glycol in the boiler it is required to check the pH, conductivity, and all other water quality requirements listed in the manual in section "Water Quality" once per year, this is especially important with higher concentrations of glycol. It is also required to use a magnetic dirt separator in the boiler system on the system return before the boiler or boiler return if any piping in the system is galvanized, steel, or black iron.

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

8.10 Chemical water treatment

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

If water treatment is required when filling the system or performing maintenance an inhibitor should be used. Follow the instructions provided by the inhibitor manufacturer when adding it to the system. The following is a list of approved inhibitors. Always check the water quality of the water and heat transfer fluid mixture in the system. The water quality of the mixture in the system and boiler must be within the stated requirements of table in § 8.8.

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

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



When using chemicals or any kind of additions:

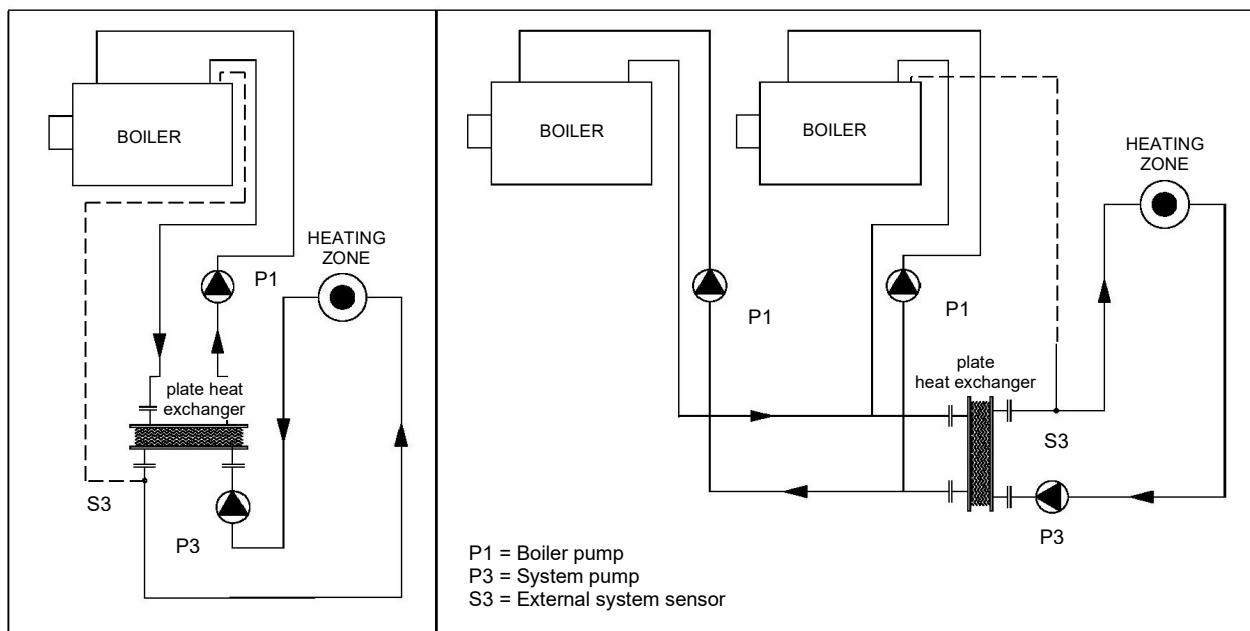
Follow the instructions provided by the manufacturer. Read the suppliers manual for the maximum allowable level/mixing ratio that can be used with the boiler. Warranty will be void if these instructions are not followed exactly. Record the used products and mixing ratio in the log book, start-up-, check-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

8.11 Flush the system with fresh water

The water of the boiler and heating circuit should be free of any particles, debris and pollution. Therefore, the complete installation must always be thoroughly flushed with clean water before installing and using the boiler(s).

8.12 Plastic piping in the heating system

When plastic pipes without oxygen barrier are used in the central heating system, these should be separated from the boiler system by using a plate heat exchanger. Diffusion (through the plastic) can cause air to enter the heating system. This could damage the boiler, pumps and other components in the system. Be aware that plastic piping is often used in under floor heating systems. When no measures have been taken to prevent the entrance of air into the boiler system, the warranty of the boiler and any boiler part may be deemed invalid.



8.13 Automatic Feed Valve

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

When using an automatic water refill system some precautions should be taken, like installing a water meter to measure and evaluate the total water volume that is added to the system. A water meter can be used to detect and eliminate any water leakage as soon as possible.

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

8.14 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 boiler lower than the value at which its safety relief valve opens.

Sensor

A water pressure sensor has been built into the boiler. The minimum water pressure in the boiler is 15 psi and the maximum pressure is 160 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 boiler from firing when the water pressure drops below 10 psi, and starts the boiler firing again when the water pressure reaches above 15 psi.

These values should never be changed in the boiler control settings. The boiler cannot be properly purged of air if the water pressure is less than 15 psi.

Higher pressure systems (e.g. in high buildings)

If a pressure higher than 160 psi is required for the heating system, the best solution is to separate the system from the boiler by means of a plate heat exchanger. In this way, the boiler pressure can remain under 160 psi.

8.15 Modulating pump for CH demand

It is possible to connect a 0-10V or PWM pump. The control supports modulation for the boiler pump. Parameter 136 has to be set to modulating (Factory set to on/off pump) when using a modulating pump.

The boiler pump is modulated when there is a demand for CH.

During any other demand, the PWM pump will run at a fixed speed set by the Default Duty cycle parameter. How the pump is modulated is controlled with the Modulating_Pump_Mode setting.

8.16 Modulating pump modes

There are several modulating pump modes implemented in the software.

By selecting a different modulating pump mode, the pump behavior can be changed. The following modulating pump modes are available.

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

8.16.1 DELTA TEMPERATURE MODULATION

When the modulating pump mode 1 Delta temperature modulation is selected, the pump modulates to create a T_{Delta} between the T_{Supply} and T_{Return} sensors. This modulation is only done when the control is in burn. When the boiler starts the duty cycle is kept at the Default Duty cycle setting for the time set by Burn Stabilize Time. After this time, the PID calculated duty cycle is used.

During modulation, the duty cycle output changes according to the following logic:

- Actual delta temperature is greater than the selected T_{Delta}
The pump speed increases so there is less time to cool down the heated water. This results in the T_{Return} temperature increasing.
- Actual delta temperature is smaller than the selected T_{Delta}
The pump speed decreases so there is more time to cool down the heated water. This results in the T_{Return} temperature decreasing.

8.16.2 PID CALCULATION SCALING

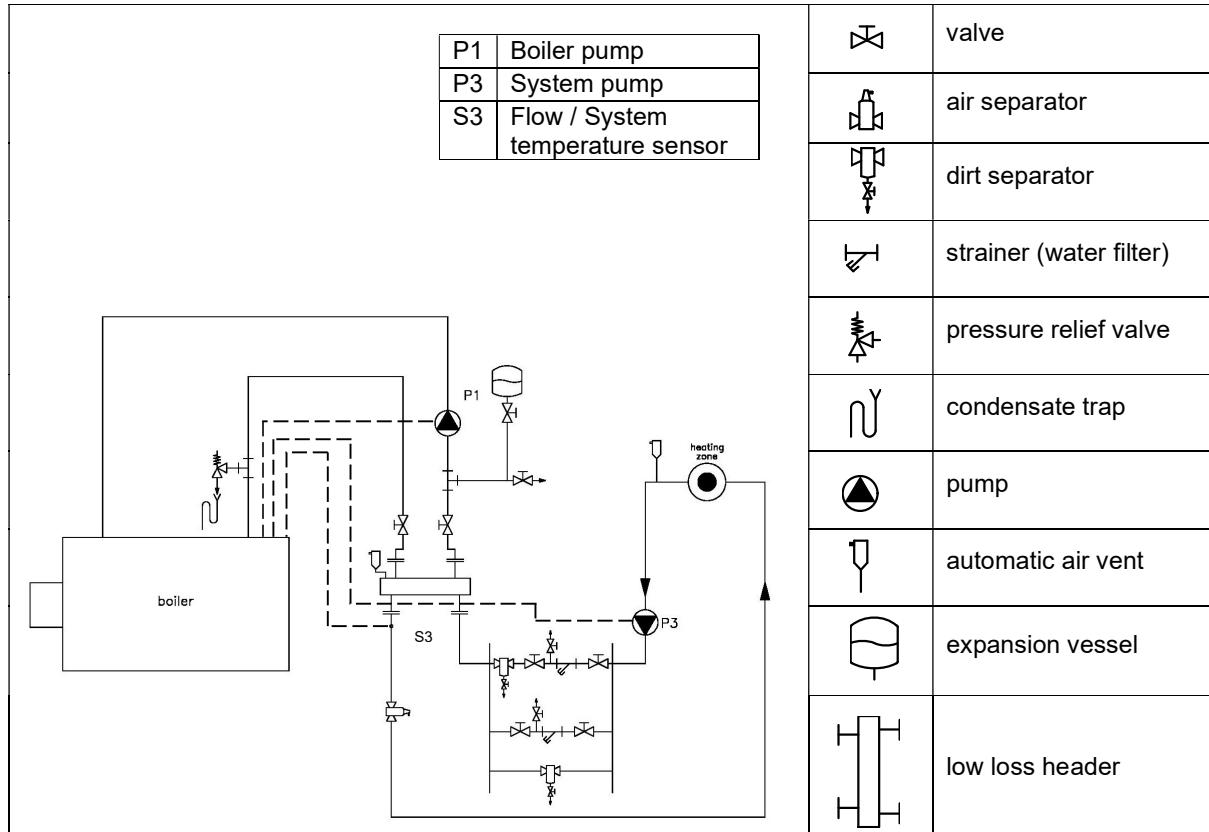
For a better burner modulation, the modulating pump PID calculation interval is slower when the T_{Supply} sensor is close to the actual B supply setpoint.

The temperature range in which this is limited is set by the PID Scaling Range parameter. When the T_{Supply} sensor is outside this range the PID calculation is performed every 100 ms. When the T_{Supply} sensor temperature is at its setpoint the PID calculation is performed every 1000 ms.

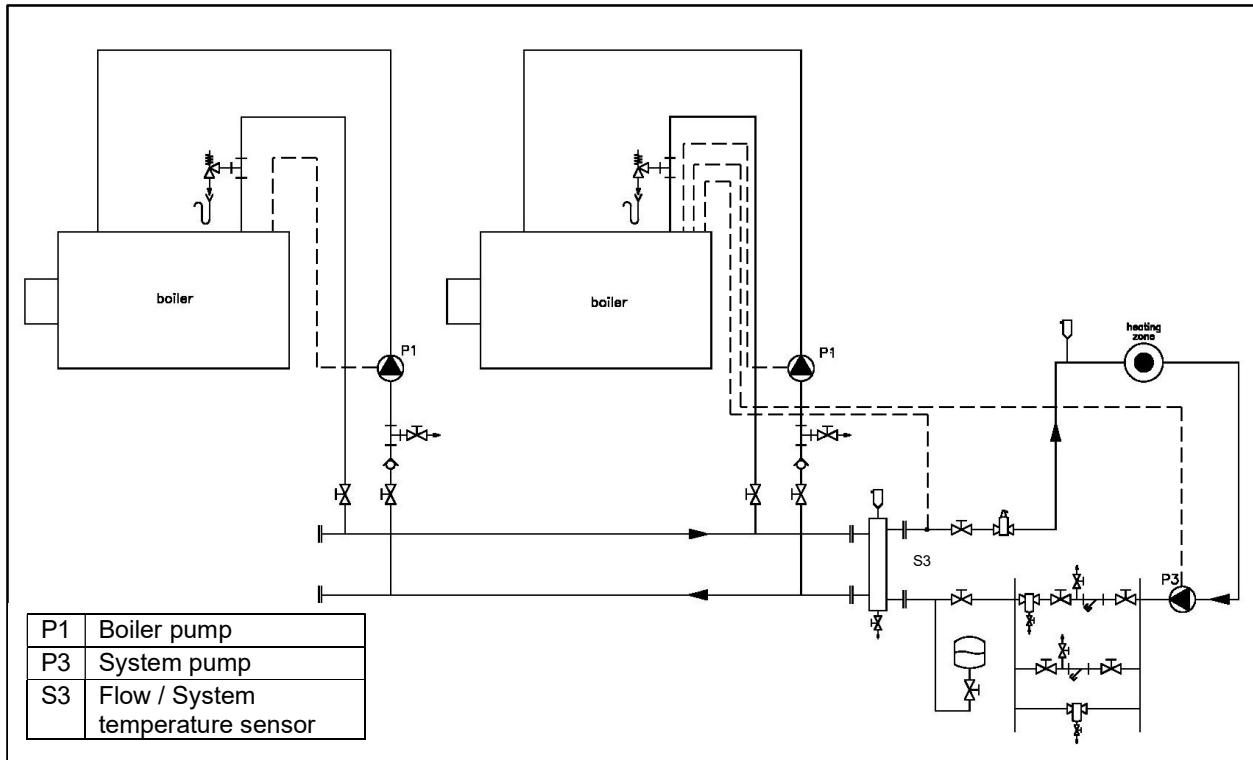
In the range set by the PID Scaling Range parameter the PID calculation speed is scaled in a linear way.

8.17 Installation examples

8.17.1 EXAMPLE OF A NORMAL SINGLE BOILER HEATING CIRCUIT WITH LOW LOSS HEADER



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



9 WATER HEATER

9.1 Water quality

In direct water heating appliances, tap 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 water must meet the specifications below:

Water temperature max. = 85°C / 185°F

The pH value of the water may not be under 6.0 and not above 7.5 (measured cold)

Minimum water hardness = 80 ppm or 80 mg/L CaCO₃ (= 4.7 grains per gallon)

Maximum water hardness = 205 ppm or 205 mg/L CaCO₃ (=12 grains per gallon)

When the waterflow is enlarged, the maximum water hardness can go up to 257 ppm or 15 grains per gallon.

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

9.2 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 will be used. The system should then be drained and thoroughly flushed with clean water to remove any debris. The water in the water heater and the circulation circuit should be free of any particles, debris and pollution.

9.3 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 160 psi. 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.

9.4 Water flow

The water heater is designed for use with one or more hot water tanks, because the water heater needs a minimum amount of water flow. The temperature difference between flow and return will be around 20°F

In designing the hot water system there are some points to consider:

- How many water heaters and how many tanks are needed to accommodate the desired domestic hot water flow.
- Water hardness: a high water hardness will lead to calcification of the heat exchanger, especially when water temperatures are high. Calcification can be delayed by increasing the waterflow through the water heater resulting in a smaller temperature difference between in- and output of the water heater. Minimum water flow according to following table

	E 1250	E 2000	E 3000	E 4000
Water hardness 80-205 ppm	110.5 gpm (=25.1 m ³ /h)	153.5 gpm (=34.9 m ³ /h)	239.4 gpm (=54.4 m ³ /h)	294.7 gpm (=66.9 m ³ /h)
Water hardness 205-257 ppm	147.3 gpm (=33.5 m ³ /h)	204.6 gpm (=40.5 m ³ /h)	319.2 gpm (=72.5 m ³ /h)	392.9 gpm (=89.2 m ³ /h)

From the graphs in chapter 10 you can see that the water heater has a higher water resistance at the enlarged flow. This leads to bigger pipes and bigger pumps. Therefore it can be feasible to use a water softener instead.

- Pipework is to be made of copper or stainless steel pipes, diameters according or bigger than prescribed in 9.5.
- The applied pump must be a bronze or stainless steel pump and controlled only by the E water heater control. If, for any reason, an external pump control is applied *without written approval of Hubbell Heaters* then the complete warranty on the E water heater and all delivered parts will become invalid.
- The DHW mode must be set at 1, and the water heater control must be set to managing, even with a single water heater.

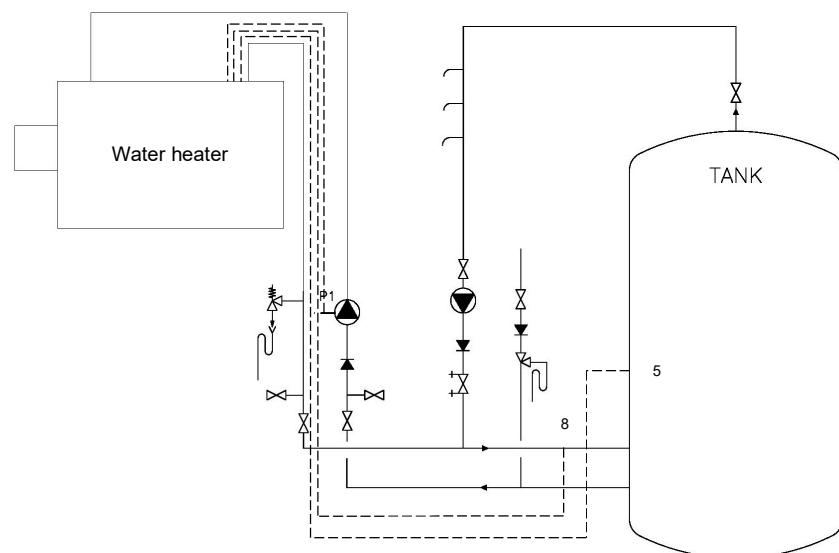
9.5 Installation instructions

9.5.1 STAND-ALONE SETUP

When one E appliance is installed with one tank, minimum pipesizes are:

	E 1250 WH	E 2000 WH	E 3000 WH	E 4000 WH
Water flow (gpm)	110.5	153.5	239.4	294.7
Pipework size (Copper schedule L)	3 1/2"	5"	8"	8"
Pipework size Stainless steel (schedule 5S)	2 1/2"	3 1/2"	6"	6"
Water flow (gpm)	147.3	204.6	319.2	392.9
Pipework size (Copper schedule L)	5"	6"	10"	-
Pipework size Stainless steel (schedule 5S)	3 1/2"	4"	8"	10"

Pipesizes in copper are bigger than pipesizes in stainless steel, because of erosion danger in copper pipes at higher water velocity.

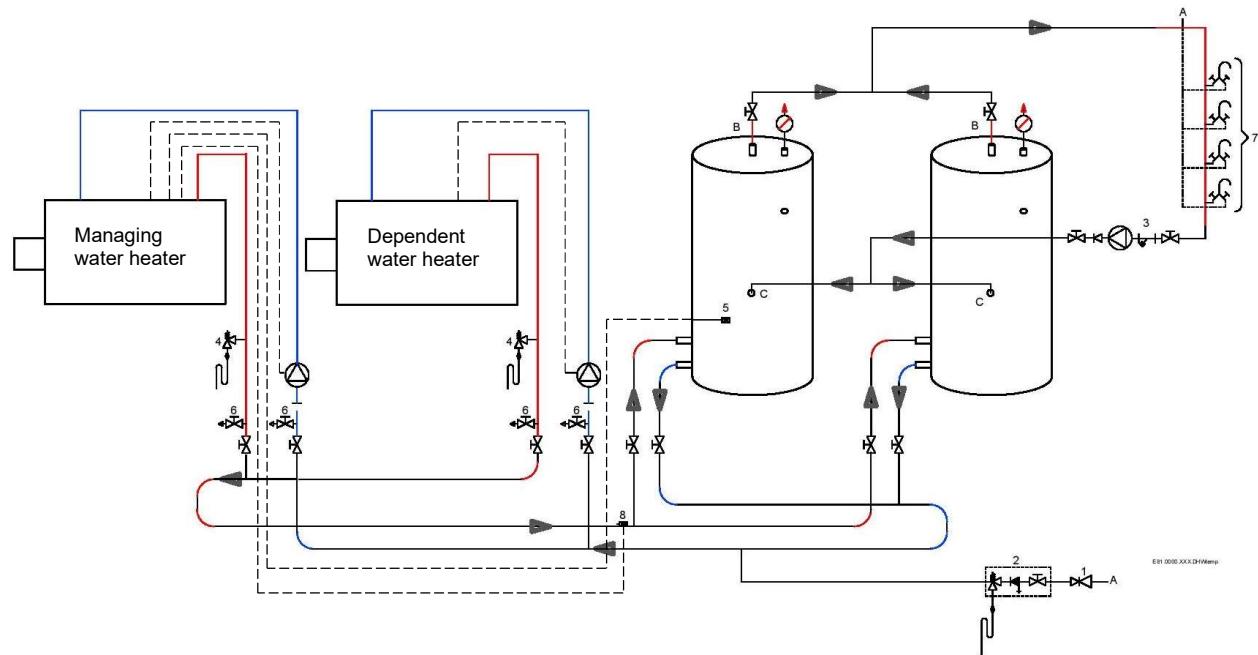


5: DHW / tank sensor, to be mounted in an immersion bulb into the tank, at approximately 1/5 of the height from the bottom.

8: (strap-on) system sensor, to be mounted on the pipe close to the heater. This sensor measures the supply temperature.

9.5.2 CASCADE SETUP

The E water heater can operate in cascade. Every water heater should have its own pump, no additional pumps are needed. Pipe sizes to be used depend on the number and type of water heaters, and the number and type of water tanks.



The drawing shows the connecting pipes between water heaters and tanks laid out following the so called 'Tichelmann system'. This is to level out differences in pipe resistance between flow and return.

Note the position of the DHW / tank sensor (5) and the system sensor (8).

Pipe sizes (**stainless steel**) for the common pipe part are given in below table.

Diameters D (= connection between water heaters and tanks)				
	Number of cascaded water heaters water hardness 80 – 205 ppm		Number of cascaded water heaters water hardness 205 – 257 ppm	
E 1250 WH	1	2	1	2
1 tank	2 1/2 inch	5 inch	3 1/2 inch	6 inch
2 tanks	2 1/2 inch	5 inch	3 1/2 inch	6 inch
E 2000 WH				
1 tank	3 1/2 inch	6 inch	4 inch	8 inch
2 tanks	3 1/2 inch	6 inch	4 inch	8 inch

9.5.3 RESISTANCE OF BENDS AND VALVES

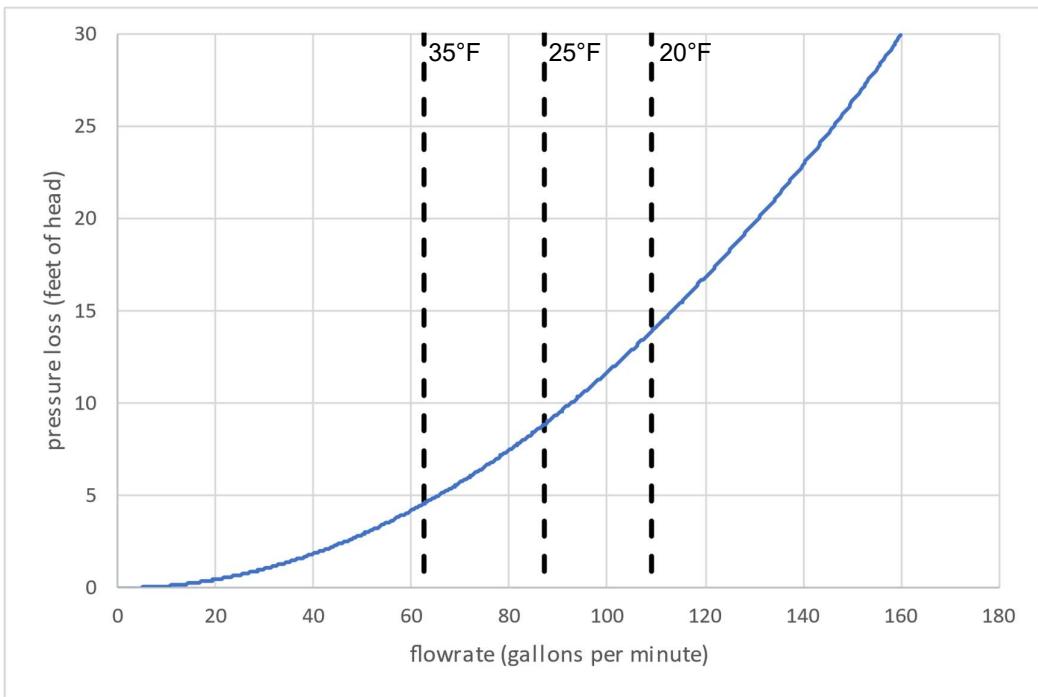
When you add bends and valves to your installation, extra resistance should be taken into account. Values for common accessories:

- Bend 45° ($r/D > 2$): 1 feet of pipe
- Bend 90° ($r/D > 2$): 1 1/2 feet of pipe
- Knee 90° : 8 feet of pipe
- Ball valve (full flow): 1 feet of pipe

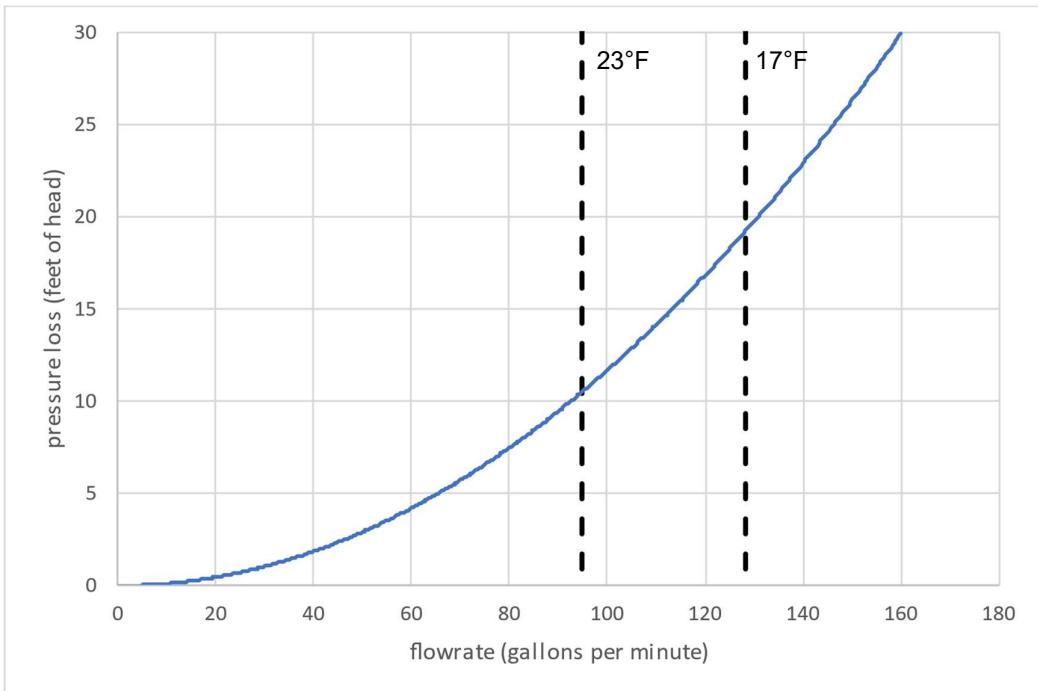
10 PUMP CHARACTERISTICS

10.1 Hydraulic graphs E-1250

10.1.1 BOILER RESISTANCE GRAPH E-1250-B

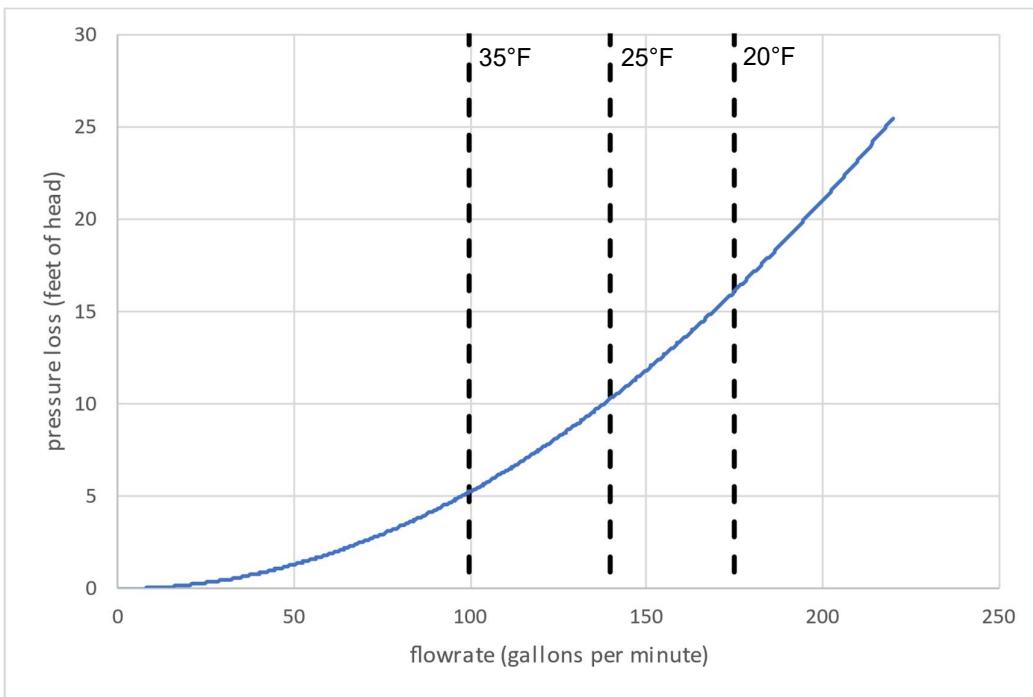


10.1.2 WATER HEATER RESISTANCE GRAPH E-1250-WH

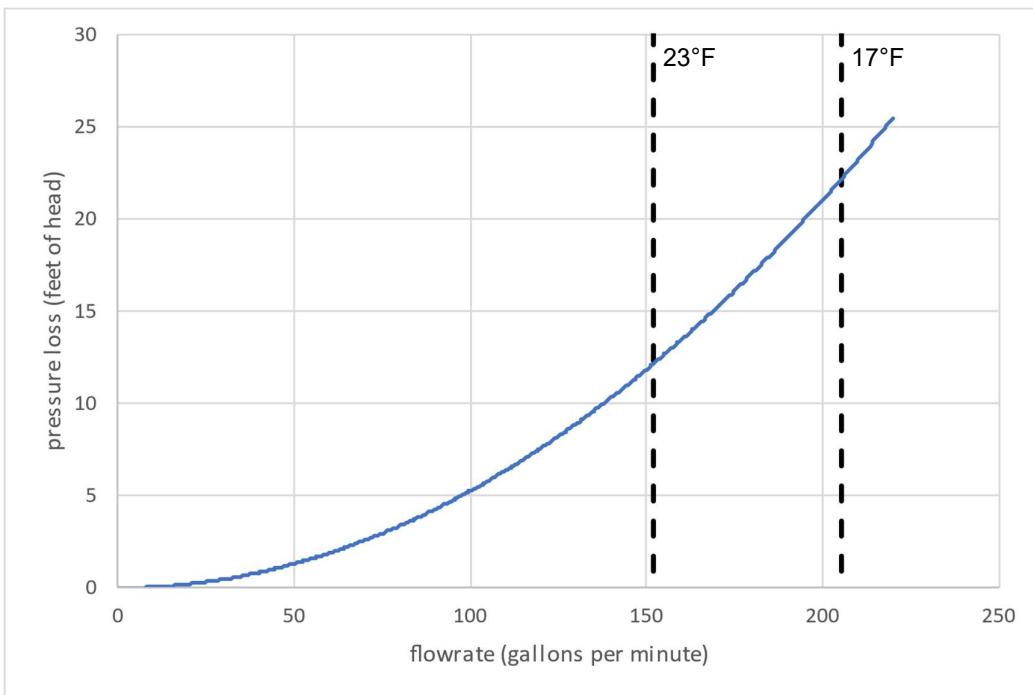


10.2 Hydraulic graphs E 2000

10.2.1 BOILER RESISTANCE GRAPH E-2000-B

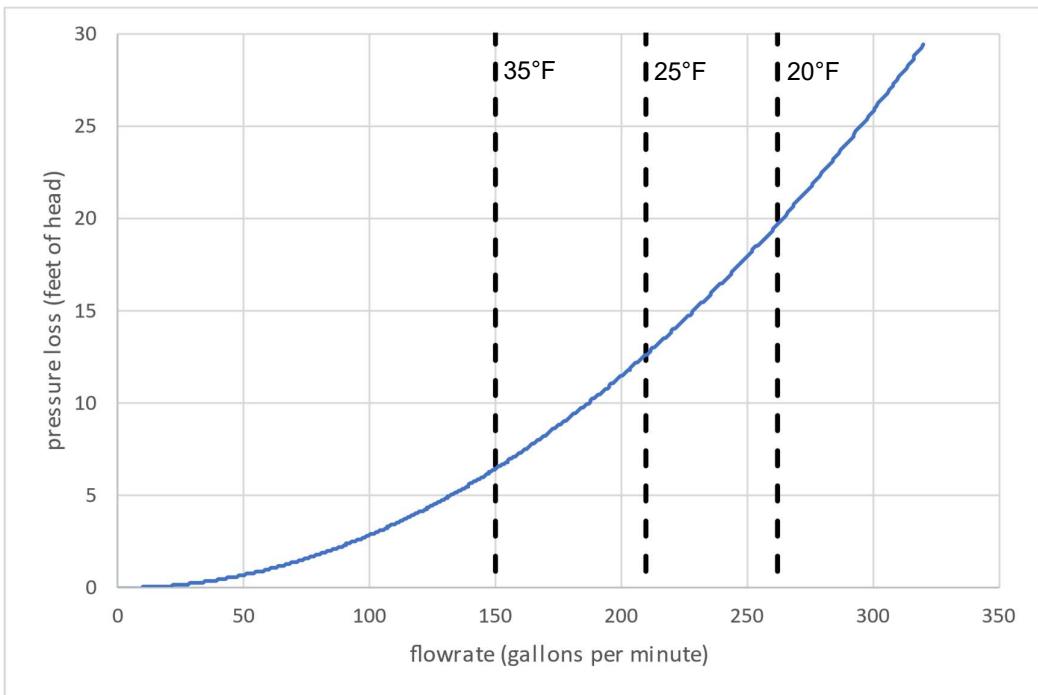


10.2.2 WATER HEATER RESISTANCE GRAPH E-2000-WH

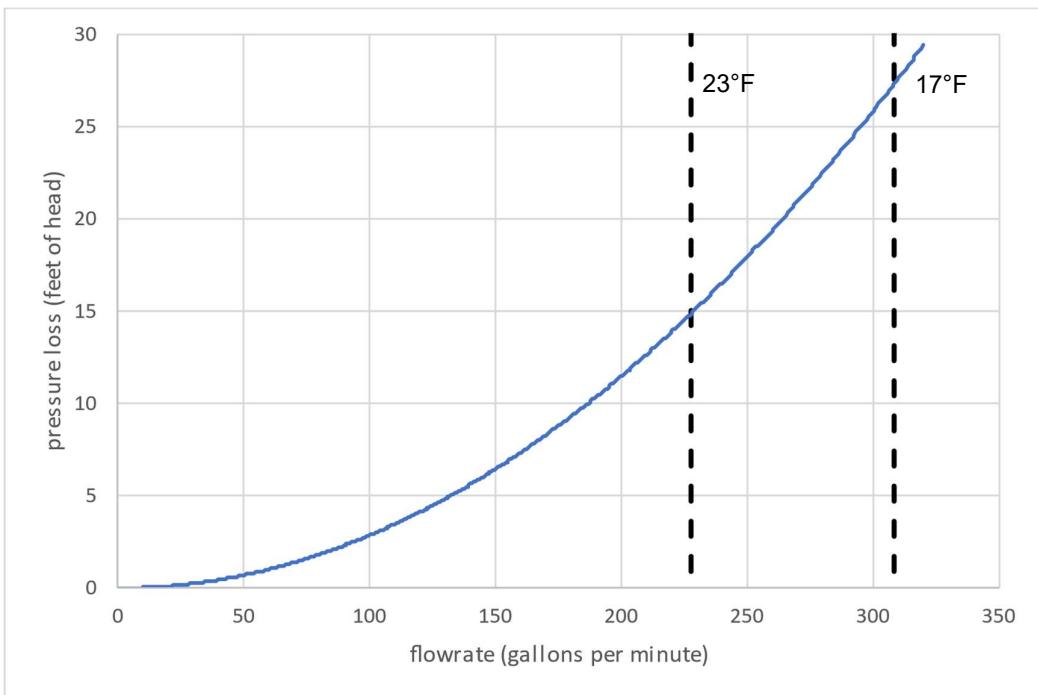


10.3 Hydraulic graphs E 3000

10.3.1 BOILER RESISTANCE GRAPH E-3000-B

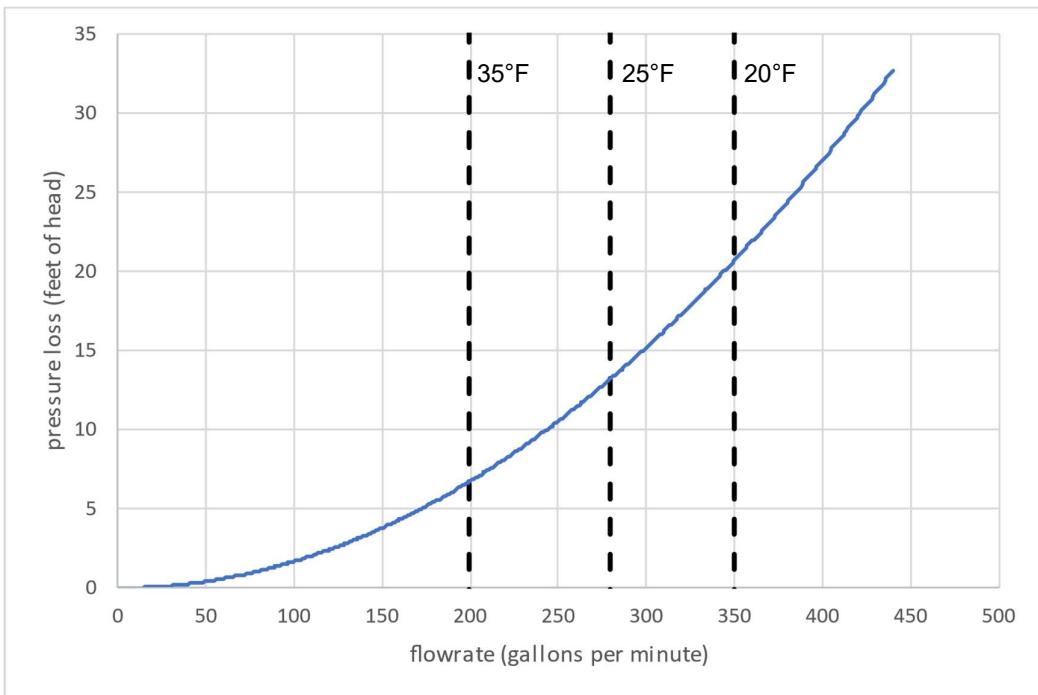


10.3.2 WATER HEATER RESISTANCE GRAPH E-3000-WH

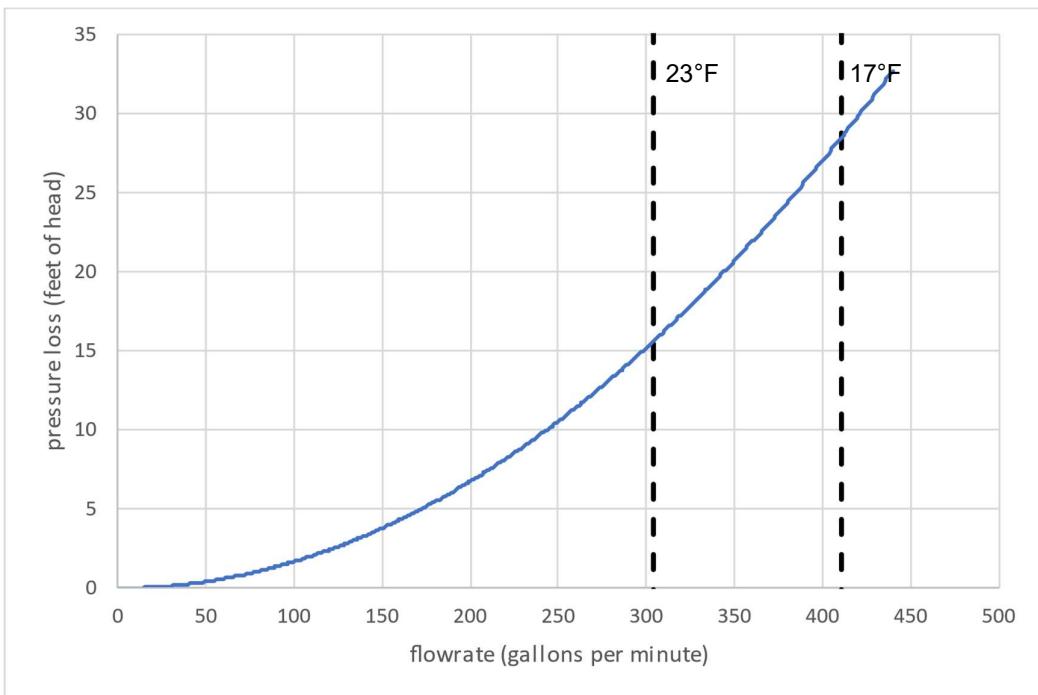


10.4 Hydraulic graphs E 4000

10.4.1 BOILER RESISTANCE GRAPH E-4000-B



10.4.2 WATER HEATER RESISTANCE GRAPH E-4000-WH



11 FLUE GAS AND AIR SUPPLY SYSTEM

11.1 General venting.

The boiler / water heater needs a positive category IV pressure vent system.

The boiler / water heater is for either direct vent installation or for installation using indoor combustion air. Under no conditions may this appliance vent flue gasses into a masonry chimney.

The internal safety system shuts down the boiler / 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 ANSI Z223.1/NFPA 54 (US) or CSA B149.1 (Canada) and local requirements.

 NOTICE	<ul style="list-style-type: none">Install all horizontal vent components with a minimum angle of 3° downwards in the direction of the boiler / water heater (roughly equal to 1/4 inch per foot or 21 mm 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 boiler / 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 90°C / 194°F (See also warnings below).
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11.1.1 VENT SIZING.

Boiler / water heater	Vent	Intake Air
E-1250, E-2000	8"	8"
E-3000	10"	12"
E-4000	12"	12"

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.

11.1.2 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 boiler / water heaters
- Maximum venting length: see table below.

Maximum Exhaust Length / Maximum Combustion Air Intake Length				
	E-1250	E-2000	E-3000	E-4000
8"	150' / 150'	115' / 115'	16' / 16'	
10"			150' / 150'	150' / 150'
12"				150' / 150'

 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 boiler / water heater. Do <u>NOT</u> use this table for common vent systems with cascaded boiler / water heaters.
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Pipe, elbows – equivalent feet:

Item\ size	8"	10"	12"
1 ft Vent Pipe	1 ft	1 ft	1 ft
45 Elbow	12 ft	15 ft	20 ft
90 Elbow	20 ft	23 ft	30 ft

11.2 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 441	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, personal injury or loss of life.
	Stainless Steel SS	UL-1738		
	Polypropylene PP	UL-1738		
Air inlet piping and Fittings ²⁾	PVC – DWV	ANSI/ASTM D2265		
	Stainless Steel SS	UL-1738		
	Polypropylene PP	UL-1738		
Pipe cement	CPVC	ANSI/ASTM F493		
Primer	CPVC	ANSI/ASTM F656		

Notes:

1 The air-inlet does not require high temperature pipe material. Check applicable local codes for acceptable materials.

2 Use only vent gas material suitable for flue gas temperatures of 194°F (90°C) or higher.

 WARNING	<ul style="list-style-type: none"> Never use aluminum containing vent pipes in these boiler / water heaters. Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel® (polyphenylsulfone) in non-metallic venting systems is prohibited. 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 loss of life. In Canada, the first piece of vent piping must be readily accessible for inspection. Covering non-metallic vent pipe and fittings with thermal insulation is prohibited. Failure to follow these instructions may result in property damage, personal injury or loss of life.
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11.2.1 APPROVED MANUFACTURERS

Polypropylene venting:

- * Duravent – PolyPro
- * Centrotherm – InnoFlue

CPVC venting:

- * IPEX System 636

Stainless steel venting:

- * Duravent – FasNSeal, FasNSeal Flex
- * Security Chimneys – Secure seal SS/SSD/SSID
- * Heat Fab – Saf-T Vent EZ Seal

Other manufacturers are allowed, as long as they comply to the table mentioned in Paragraph 11.2 and comply to local codes and regulations.

 NOTICE	READ THE MANUAL PROVIDED BY THE VENT GAS AND AIR SYSTEM SUPPLIER CAREFULLY
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11.3 Polypropylene vent

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 manufacturers.

SUPPLIER	TYPE
Duravent	PolyPro
Centrotherm	Innoflue

Approved polypropylene vent pipe and fittings:

	Duravent	Centrotherm
	Polypro	Innoflue
BOILER / WATER HEATER	TERMINATION	TERMINATION
E 1250	8PPS-HSTL (bird screen wall)	ISEP086 (end pipe)
E 2000	8PPS-VTMC (termination roof)	IASSS08 (bird screen)
E 3000		ISEP106 (end pipe) IASSS10 (bird screen)
E 4000		ISEP126 (end pipe) IASSS12 (bird screen)

To reduce the 12" inlet of the E 3000 to 10", Centrotherm item ISRD1210 can be used

11.3.1 FLEXIBLE POLYPROPYLENE

For use of flex pipe, it is recommended to have the vent material in 32°F or higher ambient space temperature before bending at installation. No bends should be made to greater than 45° and ONLY installed in vertical or near vertical installations. Pressure drop for flexible PP is 20% more than for rigid pipe.

 DANGER	<ul style="list-style-type: none"> Insulation is prohibited from use on 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, substantial property damage or loss of life.
 NOTICE	<ul style="list-style-type: none"> 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.

11.4 CPVC vent

This product has been approved for use with CPVC using 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.

SUPPLIER	TYPE
IPEX	System 636

Approved CPVC Terminations.

BOILER / WATER HEATER	TERMINATION
E 1250	
E 2000	196091 Vent screen

11.5 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 Vent EZ Seal

*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	<ul style="list-style-type: none"> 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, substantial property damage or loss of life.
 NOTICE	<ul style="list-style-type: none"> 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. 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 Vent EZ Seal/ EZ 316
BOILER / WATER HEATER	TERMINATION	TERMINATION	TERMINATION
E 1250	FSBS8 (bird screen wall)	SS8STA (screen termination)	5890CI (horizontal termination)
E 2000	FSRC8 (rain cap roof)	SS8RCU (rain cap roof)	5800CI (rain cap)
E 3000	FSBS10 (bird screen wall)	SS10STA (screen termination)	51090CI (horizontal termination)
	FSRC10 (rain cap roof)	SS10RCU (rain cap roof)	51000CI (rain cap)
E 4000	FSBS12 (bird screen wall)	SS12STA (screen termination)	51290CI (horizontal termination)
	FSRC12 (rain cap roof)	SS12RCU (rain cap roof)	51200CI (rain cap)

To reduce the 12" inlet of the E 3000 to 10", Duravent item FS1210TR or Security Chimneys item SS12TRD(10) can be used.

11.6 Sealed Combustion Air supply

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

11.6.1 COMBUSTION AIR QUALITY

Combustion air must be free of contaminants. Do not install the intake for the combustion air venting in an area which contains corrosive or other contaminants as outlined in § 11.6 tables "Room air".

11.6.2 AIR SUPPLY THROUGH HUMID AREAS

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

11.6.3 AIR INTAKE/VENT CONNECTION

The combustion air intake connector is situated at the back of the boiler / water heater. Combustion air piping must be supported per guidelines listed in the National Mechanical Code, Section 305, Table 305.4 or as local codes dictate.

11.6.4 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, property damage or loss of life.
 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 loss of life.
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11.7 Room air

Commercial applications utilizing the boiler / 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 equipment room MUST be provided with properly sized openings to assure adequate combustion air.
- There will be a noticeable increase in the noise level during normal operation from the inlet air opening.
- 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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11.7.1 AIR CONTAMINATION

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

 WARNING	<ul style="list-style-type: none">• The boiler / 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 loss of life, check for areas and products listed in the list below, with contaminants before installing the boiler / water heater or air inlet piping.• If contaminants are found, you MUST:<ul style="list-style-type: none">- remove contaminants permanently.or - relocate air inlet and vent terminations to other areas.
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Corrosive Contaminants and Sources

Products to avoid:	Spray cans containing chloro/fluorocarbons
	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
	Car body shops
	Plastic manufacturing plants
	Furniture refinishing areas and establishments
	New building construction
	Remodeling areas
	Garages with workshops.

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

For boiler / 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 boiler / 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 boiler / water heater to be free from strain and prevent the weight of the venting system from resting on the boiler / water heater. The supports should allow for a $\frac{1}{4}$ " (21 mm) slope upwards from the boiler / water heater to the termination. This will prevent the accumulation condensate and allow it to drain back towards the boiler / water heater and reduce the risk of icing at the termination.

11.9 Install vent and combustion air piping

 DANGER	<ul style="list-style-type: none">The boiler / 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.Inspect finished vent and air piping thoroughly to ensure all are airtight and comply with the instructions provided and with all requirements of applicable codes.Failure to provide a properly installed vent and air system can cause severe personal injury or loss of life.
 WARNING	<ul style="list-style-type: none">This appliance requires a special venting system. Use only approved stainless steel or polypropylene / CPVC pipe and fittings listed for vent pipe, and fittings. Failure to comply could result in severe personal injury, substantial property damage or loss of life.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.Do not connect any other appliance to the vent pipe or multiple boiler / water heaters to a common vent pipe. Failure to comply could result in severe personal injury, substantial property damage or loss of life.
 CAUTION	Improper installation of venting systems can result in personal injuries or loss of life.
 NOTICE	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. Follow the instructions in this manual when removing a boiler / water heater from an existing vent system.

The boiler / 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 boiler / water heater using any other means.

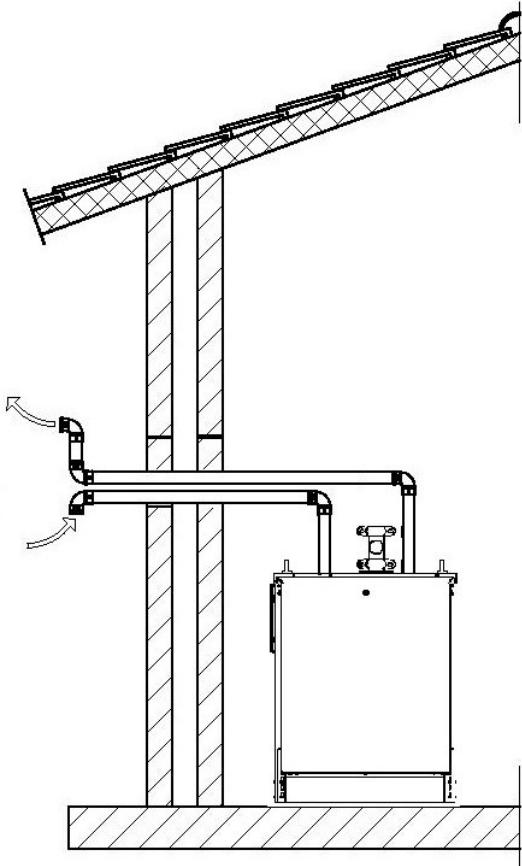
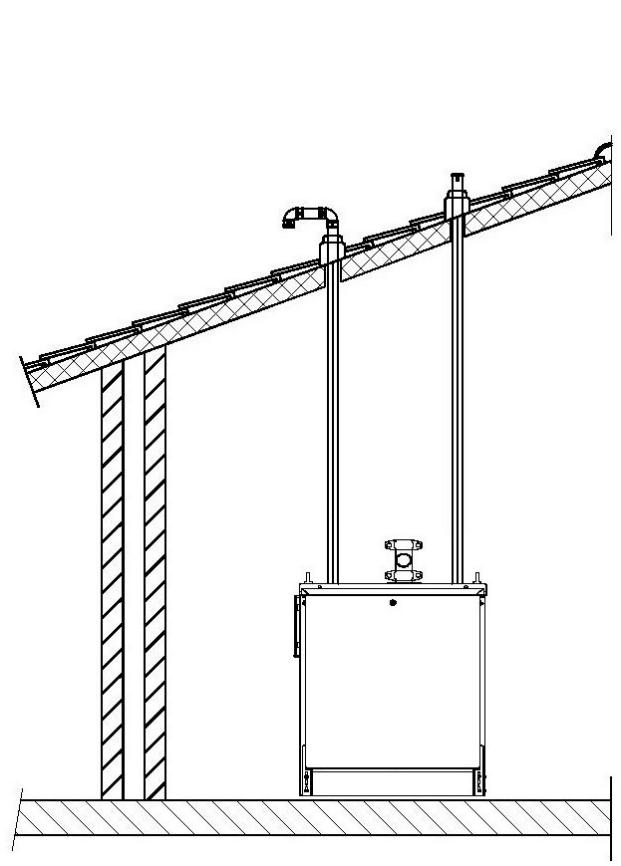
You must also install air piping from outside to the boiler / water heater air intake adapter, unless following the "Room Air" instructions in § 11.7 of this manual. The resultant installation is direct vent (sealed combustion).

11.10 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.

WARNING	<ul style="list-style-type: none">• 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.• The inlet for combustion air can never be located inside a room storing chemicals or contaminants as listed in section 11.7.1. Avoid installing the boiler / water heater in any area with possible contaminants.• If contaminants are found, you MUST: - remove contaminants permanently. or : - relocate the boiler / water heater and air intake to an area free from all possible contaminants.
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11.11 Direct venting options

Two pipe wall See page 45 for more details.	Two pipe vertical See page 49 for more details.
	

11.12 Wall (Horizontal) direct venting.

11.12.1 VENT/AIR TERMINATION - WALL

 WARNING	<ul style="list-style-type: none">Follow instructions below when determining vent location to avoid possibility of severe personal injury, substantial property damage or loss of life.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 substantial property damage, severe personal injury or loss of life.
 WARNING	<p>For US installations only, for Category II and Category IV appliances:</p> <p>The vent for this appliance shall not terminate:</p> <ul style="list-style-type: none">i) over public walkways; orii) near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or cause property damage.iii) where condensate vapor could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.
 CAUTION	Maintain 12" of clearance above the highest anticipated snow level or grade, whichever is greater. Please refer to your local codes for the snow level in your area

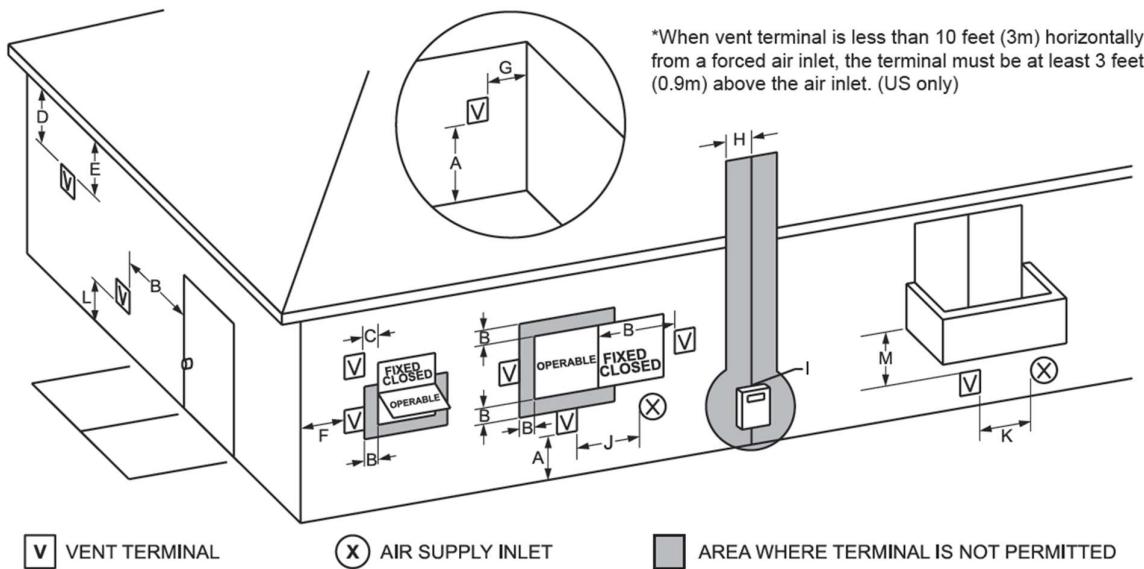
11.12.2 DETERMINE LOCATION

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 "Vent sizing" section 11.1.2 on page 40 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, court-yards, 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 boiler / water heater shutdown and possible blocked flue.
 NOTICE	PVC/CPVC or PP is acceptable air intake pipe material

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

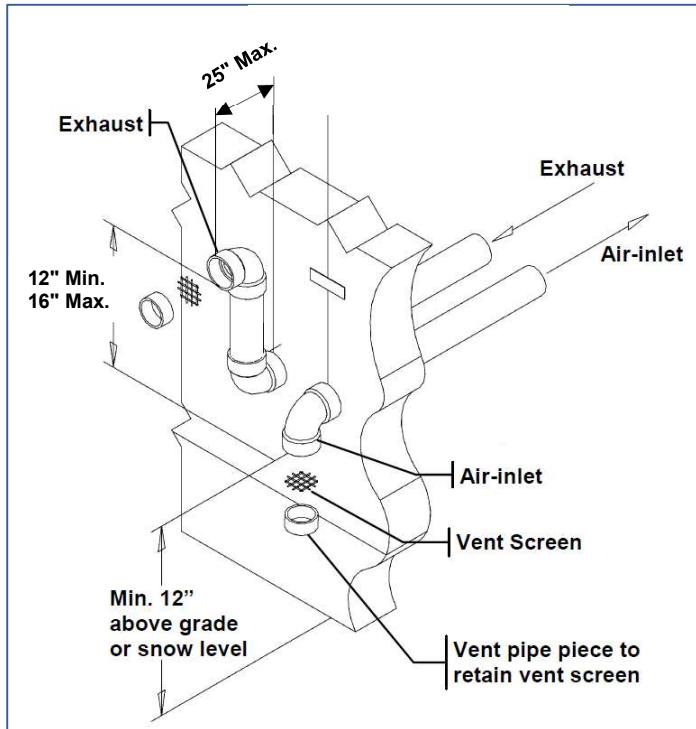


		US installations ¹	Canadian installations ²
A	Clearance above grade, veranda, porch, deck, or balcony	12 inch (30 cm) see note 3	12 inch (30 cm) see note 3
B	Clearance to window or door that may be opened	12 inch (30 cm)	36 inch (91 cm)
C	Clearance to permanently closed window	see note 4	see note 5
D	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	see note 5
I	Clearance to service regulator vent outlet	see note 4	Above a regulator within 3 ft (91 cm) horizontally of the vertical center line of the regulator vent outlet to a maximum vertical distance of 15 ft (4.5 m)
J	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	12 inch (30 cm);	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 inch (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.			

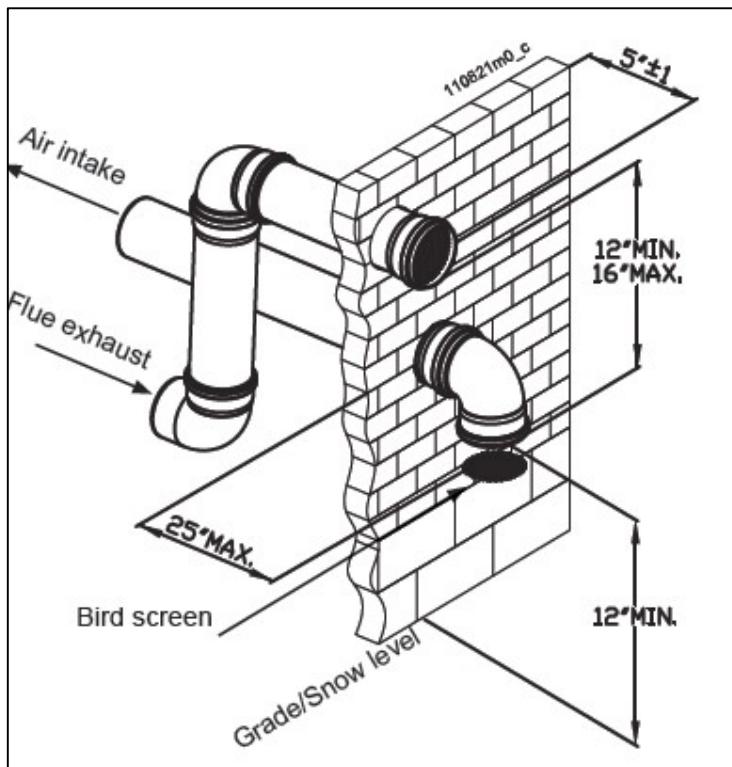
6. Locate terminations so they are not likely to be damaged by foreign objects, such as stones or balls, or subject to buildup of leaves or sediment.

Two pipe sidewall termination of air intake and exhaust vent.

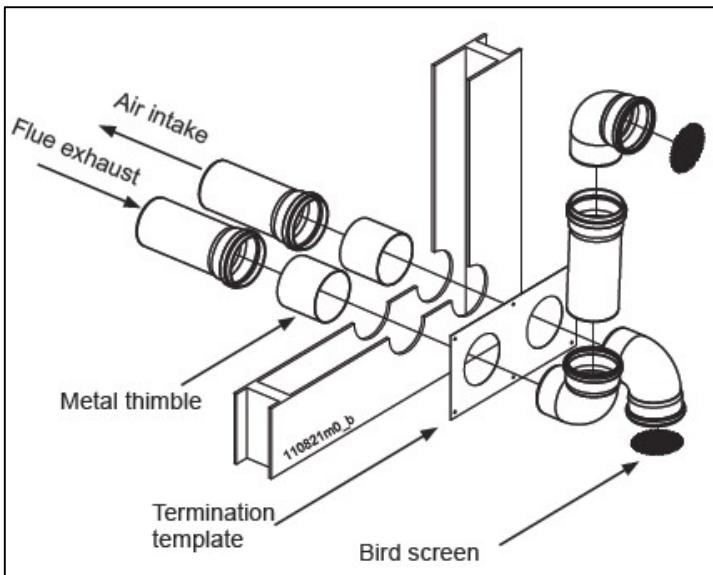
Alternate two pipe sidewall termination of air intake and exhaust vent.



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



Two pipe sidewall termination assembly.



Multiple vent/air terminations

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

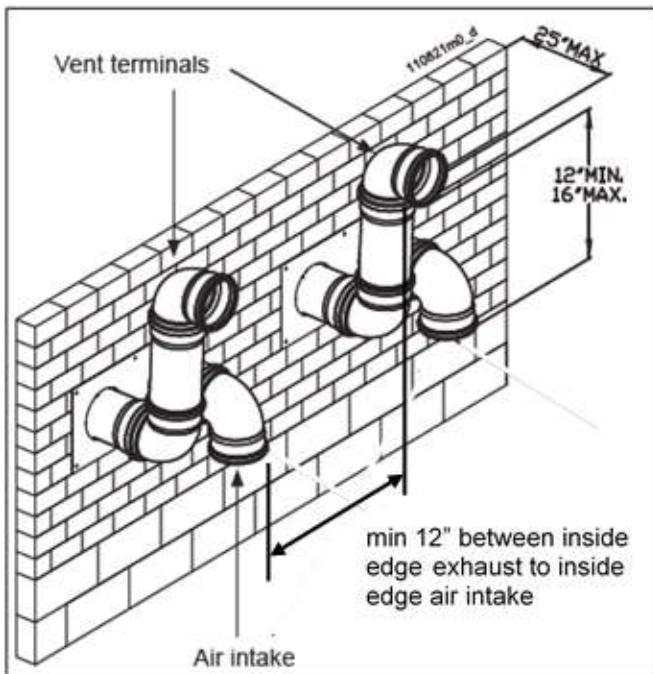


WARNING

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

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 boiler / water heater is part of a direct vent connection. It is not classified as a forced air intake with regard to spacing from adjacent boiler / water heater vents.

Two pipe multiple boiler / water heaters vent terminations.



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

11.13 Roof (Vertical) direct venting.

11.13.1 VENT/AIR TERMINATION – VERTICAL

WARNING	Follow instructions below when determining vent location to avoid possibility of substantial property damage, severe personal injuries, or loss of life.
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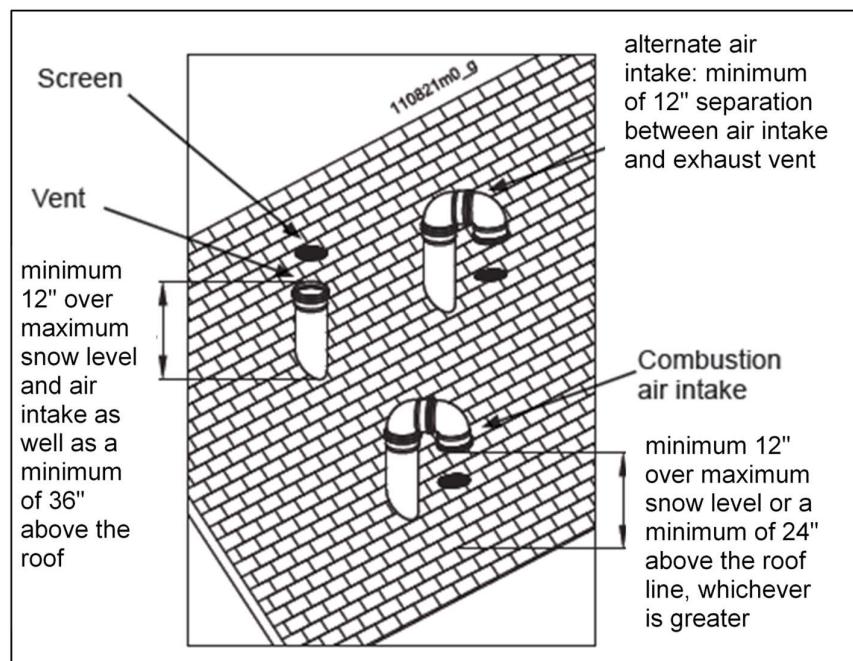
11.13.2 DETERMINE LOCATION

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 11.1.2 on page 40 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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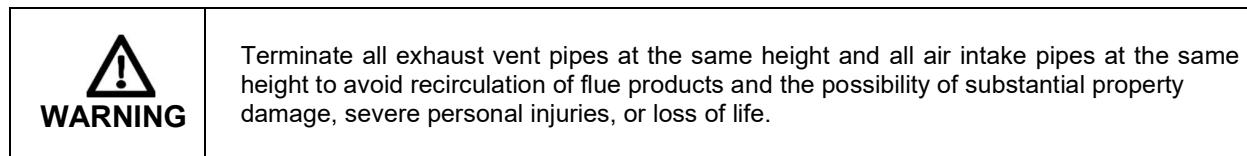
Two pipes vertical termination of air and vent.



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.

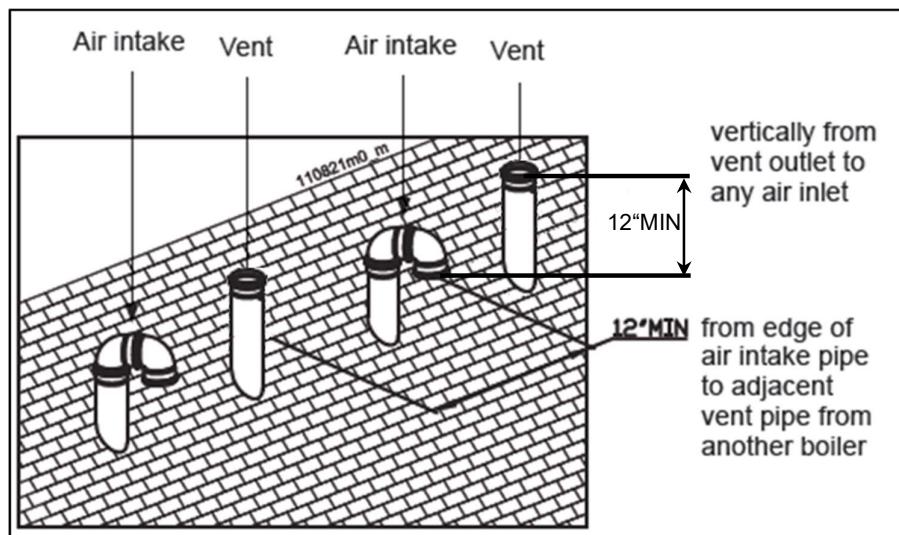
Multiple vent/air terminations

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



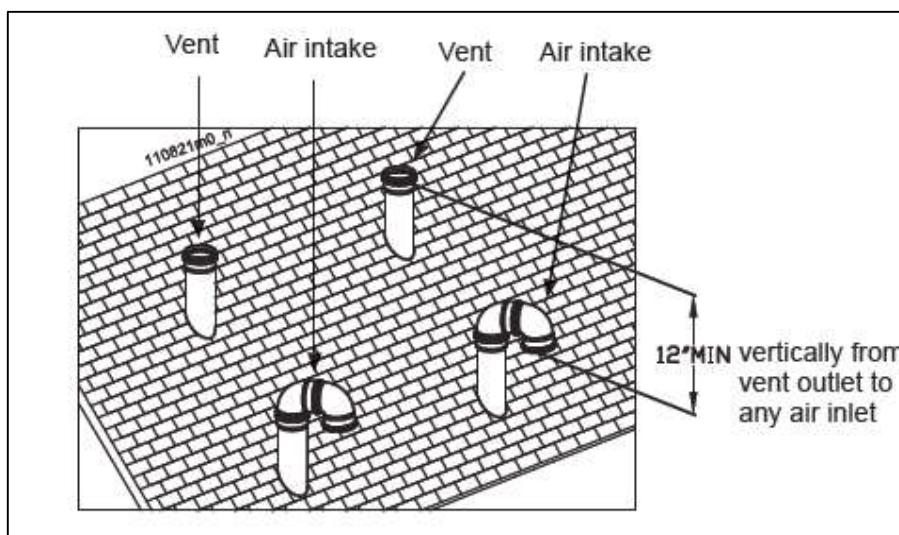
2. Place roof penetrations to obtain minimum clearance of 12 inches (305 mm) between outside edge of air intake an exhaust vent of another boiler / water heater for U.S. installations (see figure below). For Canadian installations, provide clearances required by CSA B149.1 Installation Code.

Vertical terminations with multiple boiler / 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 boiler / water heaters.



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

12 COMMON FLUE CASCADING

12.1 Appliance

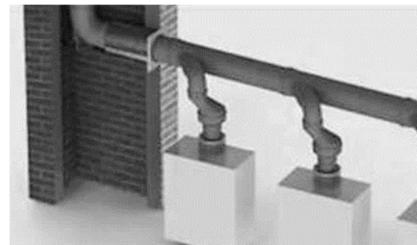
The E boiler / water heaters do not have an internal flue valve to prevent recirculation of the flue gases. If separated flue systems cannot be applied, a negative-pressure common flue system is preferred.

Calculation E (Valid for parts supplied by Duravent (M&G)).

		Minimum - Maximum vertical length in feet (ft).								
Type of boiler / water heater	Nr of boiler / water heaters	10"	12"	14"	16"	18"	20"	22"	24"	
E-1250	2	40-150	12-150	10-150	10-150	10-150	10-150	10-150	10-150	
	3	x	x	40-150	16-150	10-150	10-150	10-150	10-150	
E-2000	2	x	43-150	16-150	10-150	10-150	10-150	10-150	10-150	
	3	x	x	x	55-150	23-150	12-150	10-150	10-150	
E-3000	2	x	x	40-150	20-150	10-150	10-150	10-150	10-150	
	3	x	x	x	x	85-150	36-150	20-150	12-150	
E-4000	2	x	x	x	130-150	40-150	23-150	16-150	10-150	
	3	x	x	x	x	x	75-150	40-150	23-150	

Remark : This common flue system has an open outlet, one 90° bend, a 45° swiped back connection on the collector and 6 feet of horizontal pipe. If extra horizontal length or bends or other flue outlet are used, ask your supplier for a new calculation.

Remark : Above 12" no PP or CVPC flue parts are available. Calculations are based on use of stainless steel flue parts e.g. DuraStack and DuraStack Pro from Duravent, Secure Stack or Secure Stack Pro from Security Chimneys



12.2 Safety measures Common Flue Systems

Above is described that E boiler / water heaters can be used with a common flue system.

In case E boiler / water heaters are installed with a common flue system and the combustion air is drawn directly from the room, safety measures have to be taken.

Indicated hazard

The E boiler / water heaters are not equipped with a Non-return valve to prevent recirculation of flue gas of a running boiler / water heater through one or more boiler / water heaters which are not running and are connected with a common flue system. In case the combustion air is drawn from the room, flue gas might enter the room, which could lead to Carbon Monoxide (CO) poisoning.

Safety measures:

To cover this risk of Carbon Monoxide (CO) poisoning, in case of an overpressure common flue system in combination with combustion air drawn directly from the room, two safety measures have to be taken:

1. Guaranteed sufficient outside air supply for combustion and ventilation according to local standards, codes and regulations..
2. Use a CO detector for alarm and switching module to switch off all the boiler / water heaters. The CO alarm system must be according to UL 2034 standard.

Additional Safety Advice

3. Use always the cascade manager of the boiler / water heater and check if power mode 2 is switched on. Power mode 2 is selected at parameter 148.
4. Combine all air intake terminals of the boiler / water heaters, which do not necessary have to be connected to the outside.

Ad 1. Guaranteed sufficient outside air supply for combustion and ventilation according local standards, codes and regulations.

The boiler-room must have sufficient outside air supply for combustion and ventilation. There are many ways of creating sufficient outside air supply, depending on location of the boiler-room in the building. The demands for the (size of the) boiler-room and required ventilation is prescribed in local standards, codes and regulations, such as NFPA 54 paragraph 9.3.

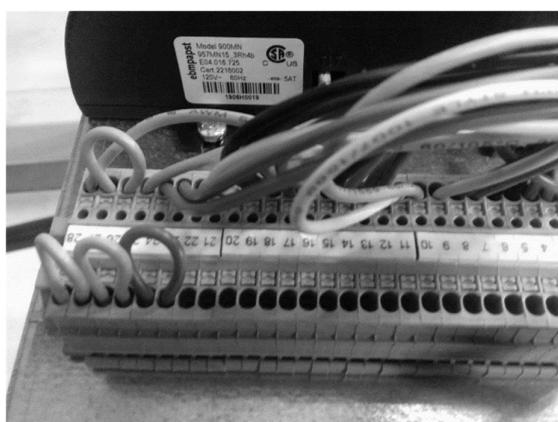
The execution and size of the outside air supply must be engineered and calculated by engineers thoroughly familiar with all aspects of the subject.

The outside air supply must be guaranteed during the lifetime of the installation. Risks of blocking or reducing the outside air supply, should be assessed and covered by this engineer and its design. Common obstacles in the outside air supply are eg. Venting opening closed/reduced by pollution, a cupboard, a parked truck / car, closed for heat loss arguments, etc, etc.

Ad 2. CO detection and switch off module:

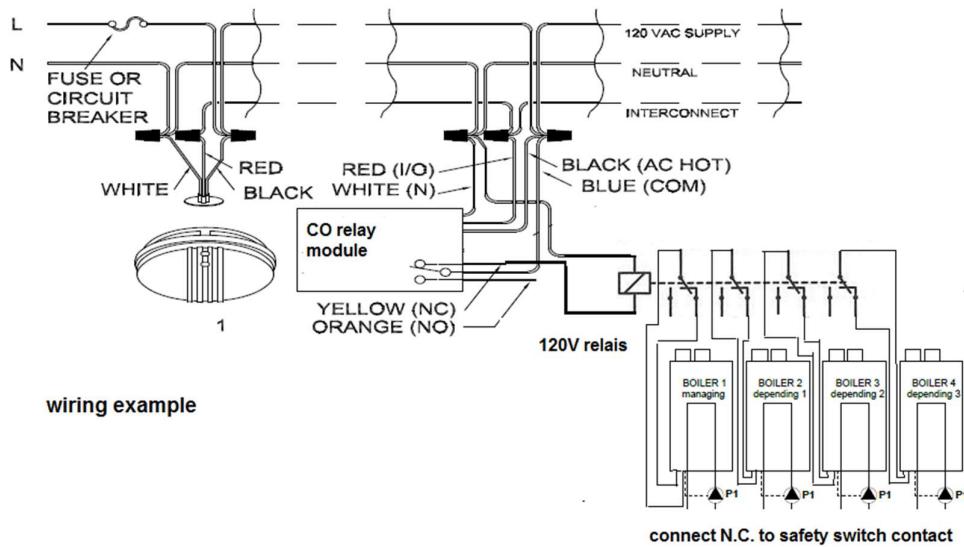
Use a CO detection system which has an alarming and switching module. Use a switching module that has an Normally Closed (N.C.) contact. The boiler / water heater safety loop will be extended with the CO detectors by connecting the N.C. contacts in series to the safety switch terminal connections 26/27 or 28/29 on the boiler / water heater to switch off the boiler / water heater in case of an alarm.

Remove the yellow wiring bridge and connect the N.C. contacts in series to the relay(s).



29	28	27	26	25	24	23	:
Safety switch 2	Safety switch 1	Gas pressure switch	LWC External				
Sécurité passer 2	Sécurité passer 1	Gas la pression passer	Eau ba coupé à l'extérieur				

Low voltage connections E boiler / water heater.



Use an extra 120V relay with 4 poles. In case of power failure on the CO alarm system and modules the boiler / water heaters will shut down. Mount, install, test and maintain the CO detector according to the manufacturer's instructions. Test the system at least monthly, to ensure the boiler / water heaters will switch off in case of a CO alarm.

In case of an CO alarm, the display of the boiler / water heater will mention: '*Max. thermostat lock error*'.

Ad 3. Use always the cascade manager of the boiler / water heater and check if power mode 2 is switched on (parameter 148)

Check parameter setting 148. This setting must be '*Power mode 2*'. Change parameter 148 to '*Power mode 2*' in case the current setting is different.

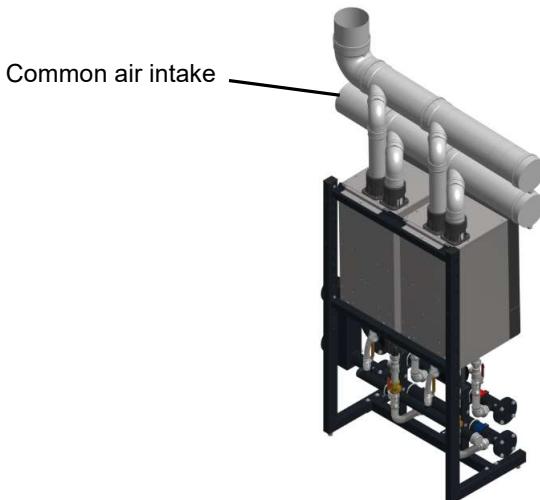
See manual 15.2.7 CASCADE – POWER BALANCE MODE

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

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

Ad 4. Combine all air intake terminals of the boiler / water heaters

Combine all air intake terminals of the boiler / water heater, which do not necessary have to be connected to the outside of the room. The purpose of a combined air intake is to have a controlled airflow towards the boiler / water heaters and to improve the air exchange in the room.



12.3 Existing Common Venting Guidelines.

Do not common vent the E boiler / water heater with the vent pipe of any other boiler or appliance. However, when an existing boiler / water heater of Category I is removed from an existing common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it. At the time of removal of an existing boiler / 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 must be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Code. When resizing any portion of the common venting system, the common venting system must be resized to approach the minimum size as determined using the appropriate tables in Chapter 13 in the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CSA B149.1, Natural Gas and Propane Installation Codes.

13 ELECTRICAL INSTALLATION

13.1 General

- NOTICE: Before starting to work on the boiler / water heater, it must be switched off and the power and gas supply to the boiler / water heater must be disconnected.
- The wiring for the connections can be entered at the back of the boiler / water heater through the wiring knockouts of the connection box. The box can be opened from the left side of the boiler / water heater. Remove the panel and unscrew the cover.
- The boiler / water heater main supply connection is polarity sensitive.
- Electrical wiring should be installed according to all applicable standards and regulations.
In the USA, the 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, the electrical installation must comply with CSA C22.1, Canadian Electrical Code part 1 – latest edition, and with any other state or local codes and regulations.
- Wiring the boiler / 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.

13.2 Connection mains supply

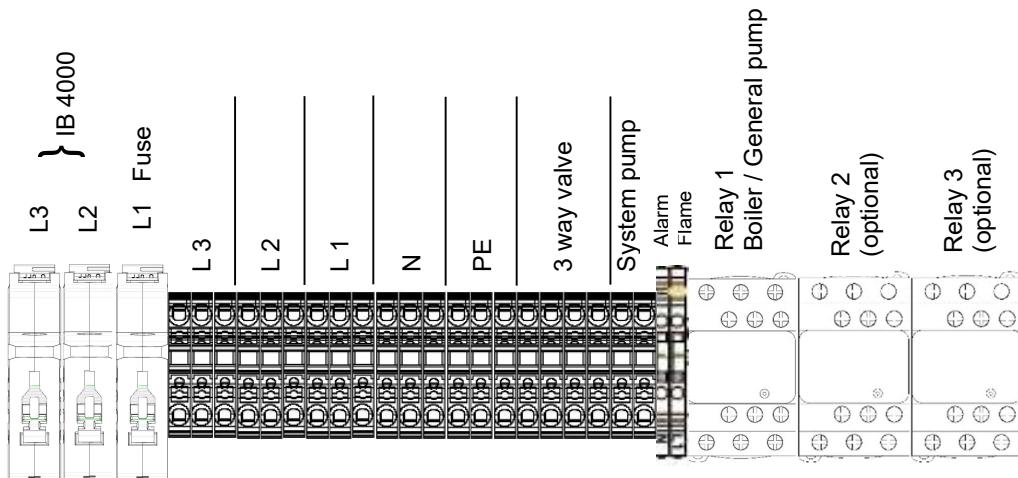
- It is advised to use a flexible cable between the cabinet entry (at the back) and the connection terminal.
- The power supply cable must be secured by tightening the cable gland at the back of the boiler / water heater casing.
- In case of a flexible cable: use crimp ferrules on each wire end for the terminal connections.
- Minimum 14 AWG wire should be used when connecting the boiler.

13.3 Mains voltage connections

For the E 1250, 2000 and 3000, a 120 V single phase power supply is needed. However, to connect three phase 208 – 240 V circulators, you can supply this voltage to the boiler. In this case you need fuses L2 and L3 (available as an accessory (§ 5.1)).

For the E 4000, a three phase 480 V power supply is needed. That means that three phase 480 V or single phase 277 V circulators must be used.

The boiler circulator (Heating or DHW) can be mounted to relay 1 in the electrical housing. When more circulators are needed (a system circulator, or a DHW circulator with a heating boiler) extra relays must be applied. These are available as an accessory (§ 5.1).



13.4 Explanation of the mains voltage connections

L1, L2, L3, N, PE		MAINS CONNECTION																		
On these connections the single phase or three phase power supply must be mounted.																				
Single phase connects to L1, N and PE,																				
Three phase connects to L1, L2, L3, N and PE																				
3-WAY VALVE		DIVERTER VALVE DHW indirect tank																		
If an indirect domestic hot water tank is installed, a 3-way valve can be used to divert hot water to the heating coil of the tank. This 3-way valve will open, when the indirect tank has a heat demand.																				
The 3-way valve can be connected to the connections 1-2-3-PE																				
1 = L1 wire (heating position); 2 = Neutral wire; 3 = L2 (hot water position); PE = Ground.																				
PARAMETER: boiler parameter 128, programmable output 4, see § 13.11 "programmable in- and outputs"																				
RELAY 3 (OPTIONAL)		DHW PUMP																		
If an indirect domestic hot water tank is installed, a DHW circulator can be used to divert hot water to the heating coil of the tank. This circulator will run, when the indirect tank has a heat demand.																				
The phase wire(s) of the pump must connect to relay 3, because the power demand of this pump is too high for the burner controller. Zero and Ground wires of the pump connect to the N and PE sections.																				
PARAMETER: boiler parameter 128, programmable output 4, see § 13.11 "programmable in- and outputs"																				
RELAY 2 (OPTIONAL)		SYSTEM PUMP																		
Connections for the power supply of a central heating system pump P3																				
The phase wire(s) of the pump must connect to relay 2, because the power demand of this pump is too high for the burner controller. Zero and Ground wires of the pump connect to the N and PE sections.																				
PARAMETER: boiler parameter 125, programmable output 1, see § 13.11 "programmable in- and outputs"																				
RELAY 1		BOILER PUMP / GENERAL PUMP																		
Connections for the power supply of a boiler pump P1.																				
The phase wire(s) of the pump must connect to relay 1, because the power demand of this pump is too high for the burner controller. Zero and Ground wires of the pump connect to the N and PE sections.																				
		FLAME (DRY CONTACT)																		
This connection closes when the boiler is burning. This signal can be used for a BMS																				
		ALARM (DRY CONTACT)																		
This connection closes within 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: boiler parameter 127, programmable output 3, see § 13.11 "programmable in- and outputs"																				

13.5 Low voltage connections

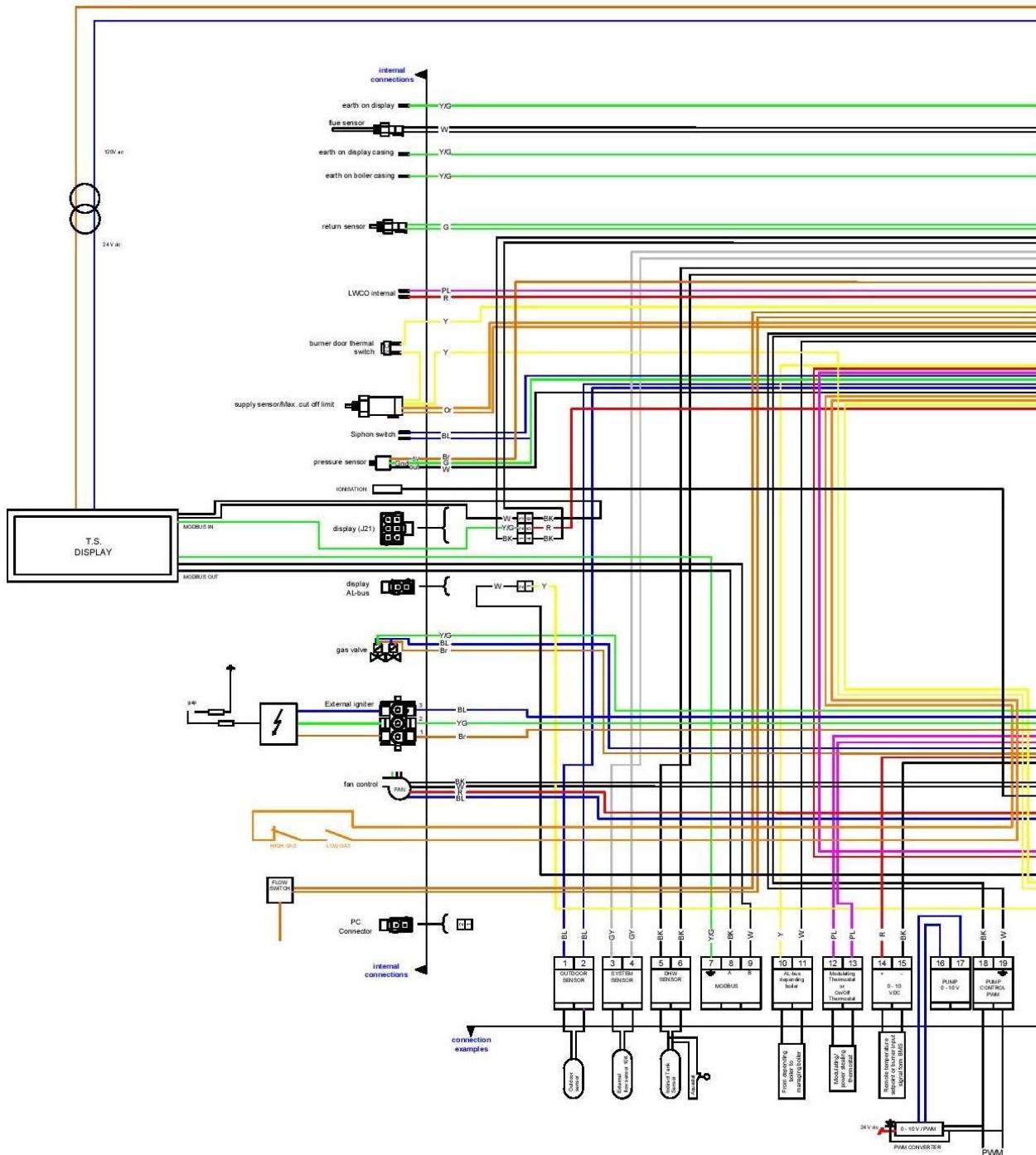
LOW VOLTAGE CONNECTIONS																												
29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
						-	+	-	+	Gnd		Gnd	+	-	+			-	+	B	A	Gnd						
Safety switch 2	Safety switch 1					LWCO Extern		AL-BUS managing boiler		Pump control PWM	Pump control 0-10V	0-10 Vdc	On/Off thermostat or modulating thermostat	AL-BUS depending boiler			Modbus		DHW sensor	System sensor	Outdoor sensor							
Interruuteur de sécurité 2	Interruuteur de sécurité 1					Eau basse coupure à l'extérieur		AL-BUS chaudière gérant		Commande de pompe PWM	Commande de pompe 0-10V	0-10 Vcc	Thermostat marche/arrêt ou thermostat modulant	AL-BUS chaudière dépendant			Capteur ECS	Capteur de système	Capteur extérieur									

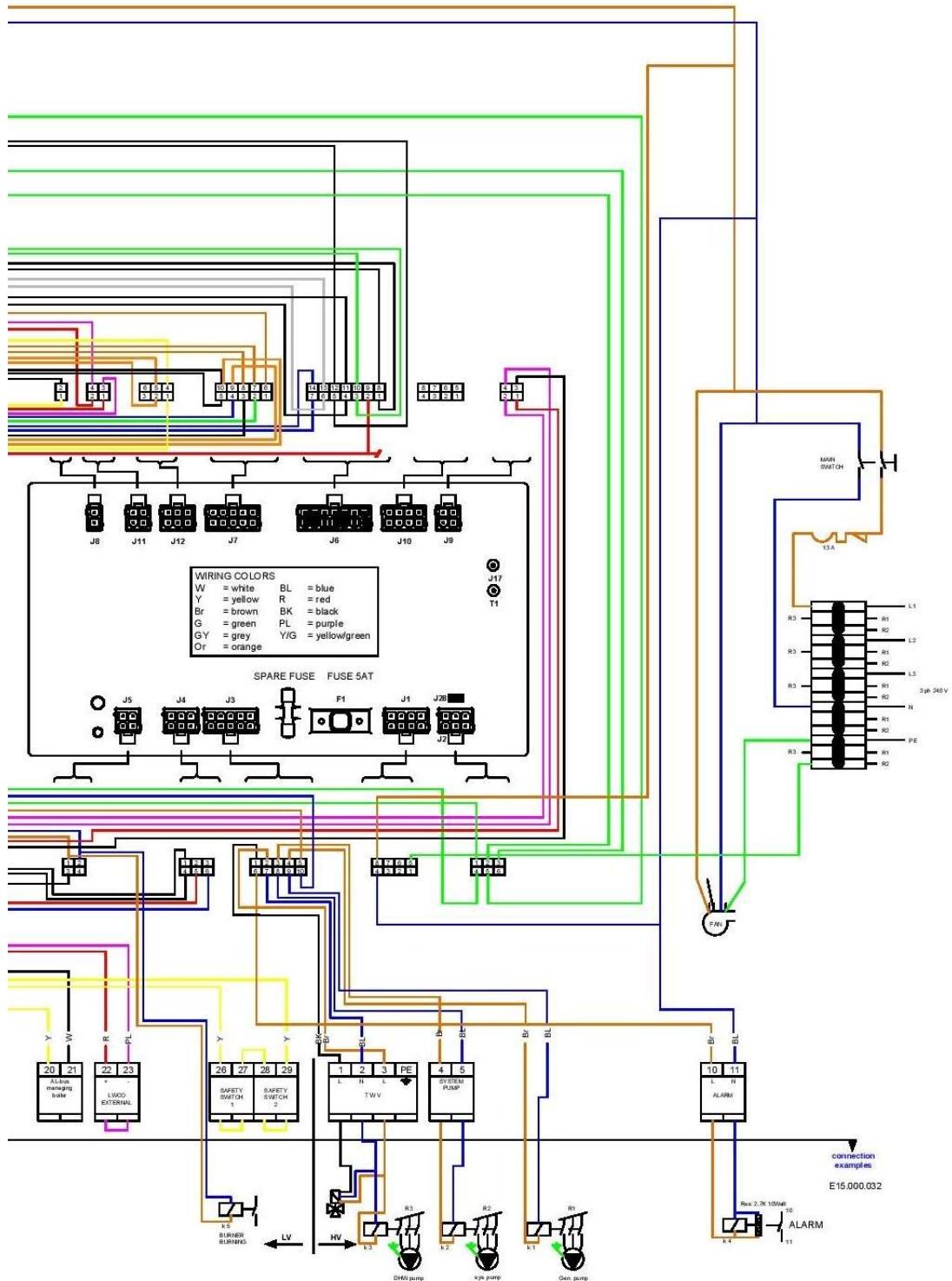
13.6 Explanation of the low voltage connections.

1-2	OUTDOOR SENSOR
(Only E-B) If an outdoor temperature sensor is connected, the boiler will control the supply water temperature by using a calculated setting based on an outdoor reset curve, which is related to the outdoor temperature.	
3-4	SYSTEM SENSOR
If a low loss header is used, this sensor measures the flow temperature at the system side. The sensor must be mounted on the supply pipe or in a sensor well at the system side, close to the low loss header. NOTICE: This sensor (see § 8.17) must be used when heating boilers are cascaded with the internal cascade manager. This sensor (see § 9.5) must be used when water heaters are installed (single heater AND cascade) PARAMETER: boiler parameter 122, see §13.11 "programmable in- and outputs"	
5-6	DHW SENSOR
When a hot water tank is installed with a heating boiler, the DHW mode must be set to 1 or 2. When the DHW mode is set to 1, an immersion sensor can be connected. This sensor should be mounted in a well in the tank. The boiler / 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 boiler / water heater will stop serving hot water. When the appliance is used as a Water Heater, the DHW mode must be set to 1.	
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 boiler / water heaters, these 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 boiler / water heaters to 20 of the managing boiler / water heater, and connections 11 of the dependent boiler / water heaters to 21 of the managing boiler / water heater.	
12-13	ON/OFF STAT OR MODULATING THERMOSTAT
(Only E-B) OPTION 1: An ON/OFF thermostat can be connected. If these terminals are bridged, the set/ programmed flow temperature of the boiler / water heater will be used. OPTION 2: A modulating controller can be connected to these terminals. The boiler software will detect and use this modulating signal automatically. PARAMETER: boiler parameter 124, see § 13.10 "programmable in- and outputs"	
14-15	0-10 VDC CONTROL SIGNAL
(Only E-B) These terminals are used for an external 0-10 VDC control input signal. This can be used for heating modes 4 and 5 NOTICE: Terminal 14 [+] (positive) and terminal 15 [-] (negative).	
16-17	0 - 10 V PUMP CONTROL
These connections are used to control the boiler pump. The 0-10V signal determines the speed of the pump, when there is a heat demand. 16 = Signal (0-10V), 17 = Ground Parameter 136 has to be set to modulating (Factory set to on/off pump) when using a modulating pump.	
18-19	PWM PUMP CONTROL
These connections are used to control the boiler pump. The PWM signal determines the speed of the pump, when there is a heat demand. 18 = Signal: PWM input (1), 19 = Ground: signal ref (2). Parameter 136 has to be set to modulating (Factory set to on/off pump) when using a modulating pump.	
20-21	AL-BUS MANAGING
Cascade connection for the managing boiler / water heater. Link connection 20 of the managing boiler / water heater to connections 10 of the depending boiler / water heaters, and connection 21 of the managing boiler / water heater to connections 11 of the depending boiler / water heaters.	
22-23	LWCO EXTERN
To be used for an extra external Low Water Cut Off. The boiler / water heater goes into a lockout when this contact opens.	
26-27	SAFETY SWITCH 1
To be used for an extra external safety switch. The boiler / 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 boiler / water heater goes into a lockout when this contact opens	

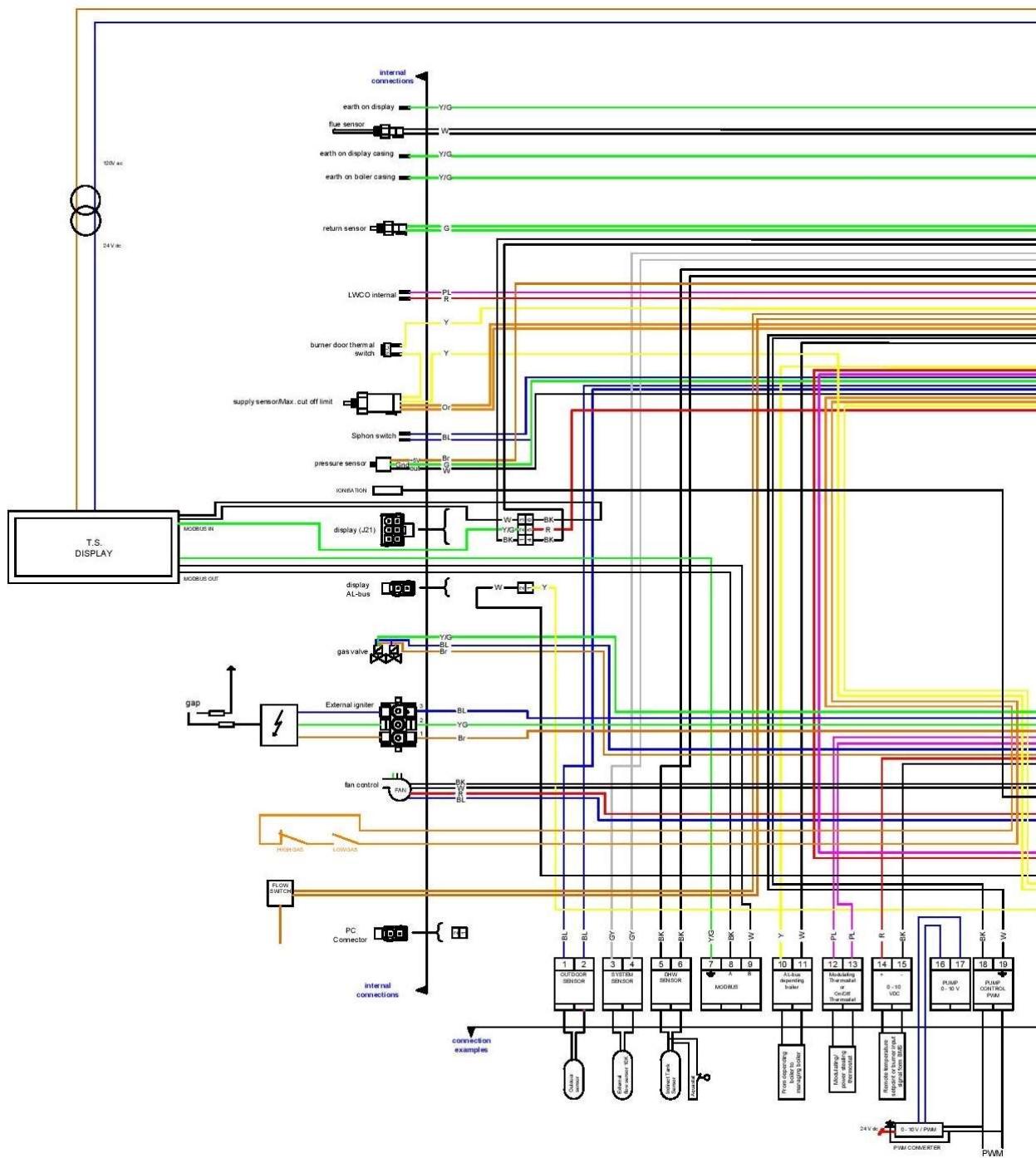
13.7 Electrical schematics

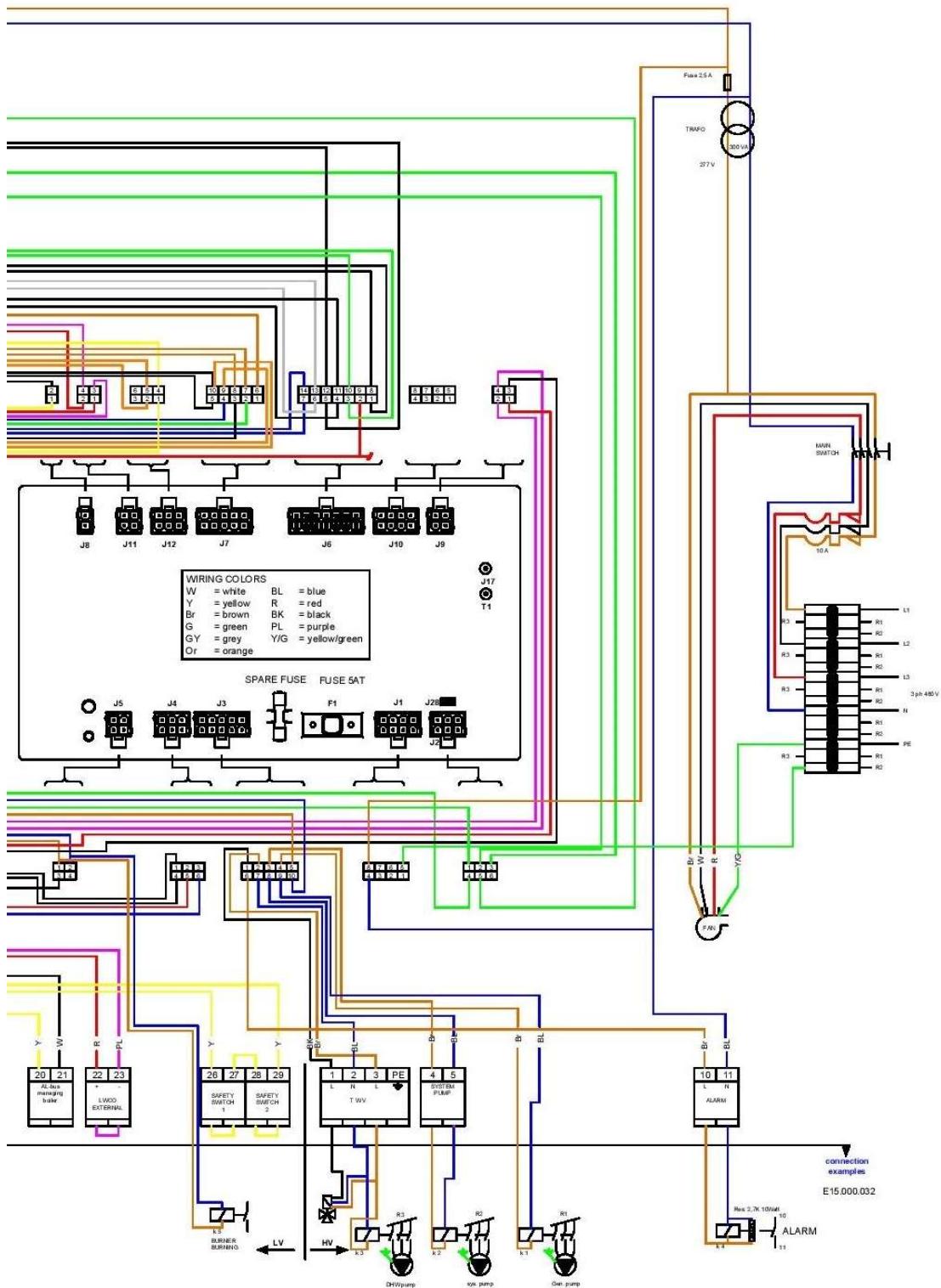
13.7.1 ELECTRICAL SCHEMATICS E-1250, -2000 AND -3000



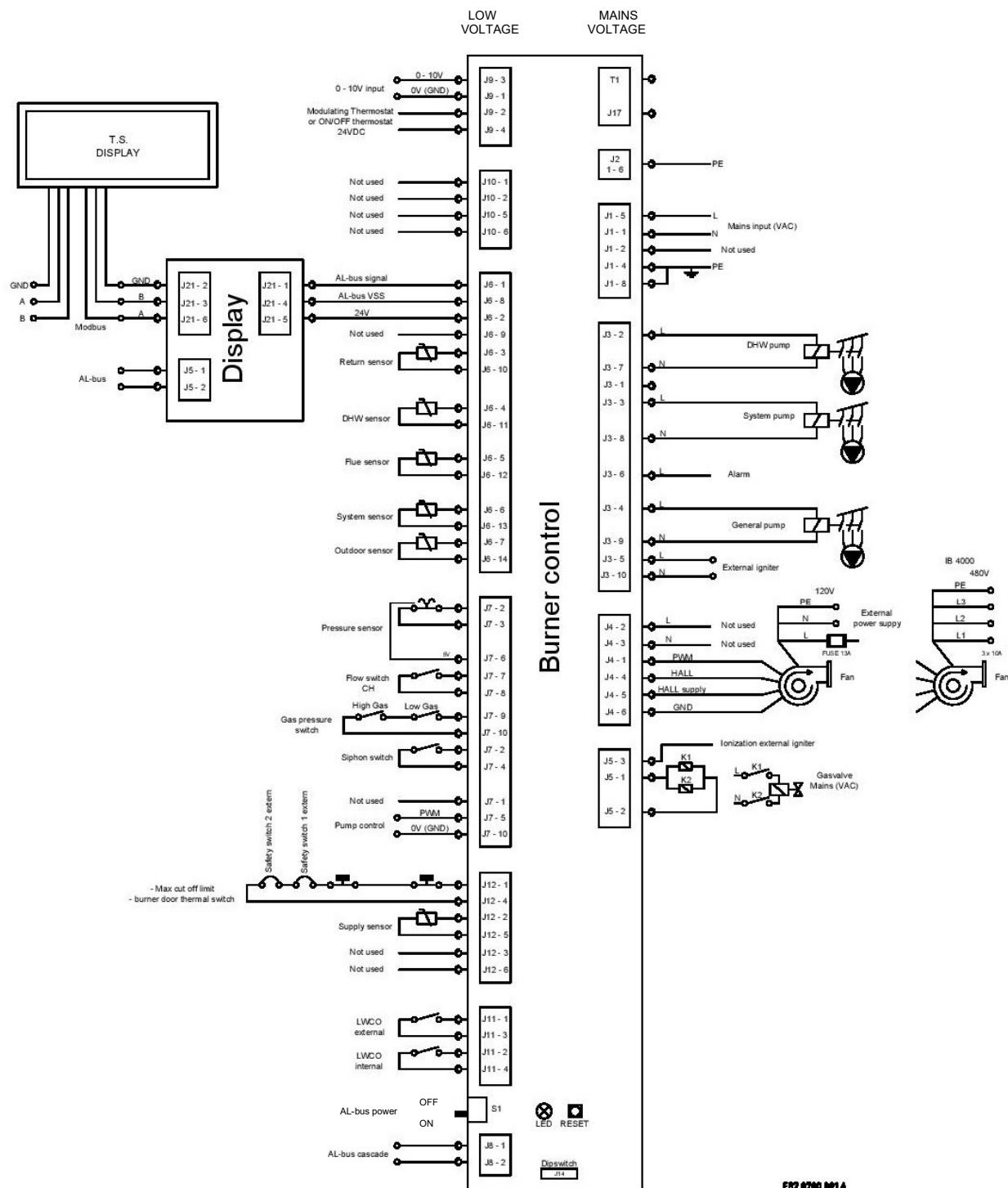


13.7.2 ELECTRICAL SCHEMATICS E-4000





13.8 Ladder/Logic Diagram



13.9 Sensor availability for central heating boilers

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

B Mode						
	0	1	2	3	4	5
T_Supply	M	M	M	M	M	M
T_Return	O	O	O	O	O	O
T_DHW	O	O	O	O	O	O
T_Outdoor	---	M	M	O	O	
0-10 Volt	O	O	O	O	M	M
Water Flow DHW	O	O	O	O	O	---
RT Switch	M	M	M	M	M	---
System sensor	O	O	O	O	O	O

M = Mandatory, O = Optional, --- = Disabled.

CH mode 0 – Central Heating demand with thermostat control

CH mode 1 – CH with an outdoor temperature reset and thermostat control

CH mode 2 – Central Heating with full outdoor temperature reset

CH mode 3 – Central Heating with permanent heat demand

CH mode 4 – Central Heating with analog input control of setpoint

CH mode 5 – Central Heating with analog input control of power output

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

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

DHW mode 0 – No Domestic Hot Water

DHW mode 1 – Storage with sensor

DHW mode 2 – Storage with thermostat

DHW mode 3 – Instantaneous water heating with plated heat exchanger, flow switch and DHW-out sensor

DHW mode 4 to 8 N.A.

13.10 Sensor availability for water heaters

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

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

Only DHW mode 1 – Storage with sensor – is available for water heaters, single or cascade.

13.11 NTC sensor curve

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

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

13.12 Programmable in- and outputs

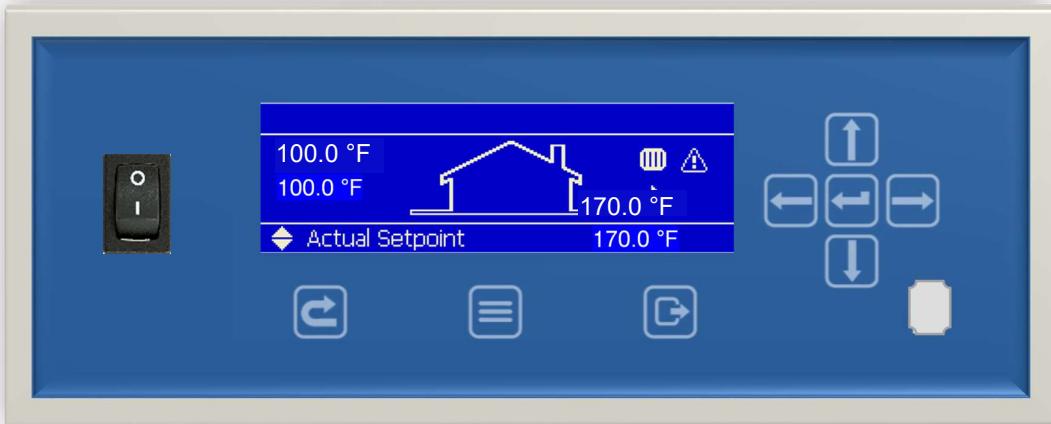
It is possible to re-program some in- and outputs to other functions. To do this use below list and go to: Menu\settings\boiler settings\"1122" (installer password)\boiler parameters

boiler 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	LV 12-13
(125)	Prog. Output 1.	2	CH pump	HV 4-5
(126)	Prog. Output 2.	0	Ext. Igniter	separate connector
(127)	Prog. Output 3.	6	Alarm semiconductor output	HV 10-11
(128)	Prog. Output 4.	3	DHW Pump	HV 2-3-PE

parameter	Display:	INPUTS:	re-mark	parameter	Display:	OUTPUTS:	re-mark
(117)	Prog. Input 2.	0 Disabled 1 DHW flow sensor 2 DHW flow switch 3 CH flow sensor 4 CH flow switch	N.A.	(127)	Prog. Output 3.	0 Disabled 1 Module pump 2 CH pump 3 DHW pump 4 System pump 5 Cascade pump 6 Alarm relay 7 Filling valve	N.A.
(118)	Prog. Input 3.	0 Disabled 1 Drain switch 2 Gas pressure switch				8 LPG tank 9 Ext. Igniter 10 Air damper	1) 1)
(122)	Prog. Input 7.	0 Disabled 1 T_Flue_2 sensor 2 T_Flue_2 with blocked flue 3 Cascade sensor 4 Blocked Flue switch 5 CH Sensor	N.A.	(128)	Prog. Output 4.	0 Disabled 1 Module pump 2 CH pump 3 DHW pump 4 System pump 5 Cascade pump 6 Alarm relay 7 Filling valve 8 LPG tank 9 Ext. Igniter 10 Air damper 11 empty 12 empty 13 empty 14 empty 15 empty 16 empty	1) 1) 1)
(124)	Prog. Input RT.	0 room thermostat off 1 room thermostat on				17 3-way Valve CH 18 3-way Valve DHW 19 3-way Valve CH (power when idle) 20 3-way Valve DHW (power when idle)	
	Display:	OUTPUTS:				Remark: 1) 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.	
(125)	Prog. Output 1.	0 Disabled 1 Module pump 2 CH pump 3 DHW pump 4 System pump 5 Cascade pump 6 Alarm relay 7 Filling valve 8 LPG tank 9 Ext. Igniter 10 Air damper					
(126)	Prog. Output 2.	0 Disabled 1 Module pump 2 CH pump 3 DHW pump 4 System pump 5 Cascade pump 6 Alarm relay 7 Filling valve 8 LPG tank 9 External igniter 10 Air damper					

14 BOILER / WATER HEATER CONTROLLER AND PB DISPLAY.

14.1 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

14.2 Screens and settings.

The PB screen is to be used during commissioning the boiler / water heater. All initial settings can be accessed via the PB display. On other occasions, e.g. maintenance, you can also use the touchscreen.



The above 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:

The Status overview has three different sections that show specific information:



An example a Status overview and the different sections

Header

- Left: For cascade systems the cascade icon is shown, with the cascade manager indication (M) or the dependent number.
- Center: Shows the B and/or DHW disabled icons when B and/or DHW is disabled
- Right: Shows the time (only if the real-time clock is available).

Icon	Description
	Cascade icon
	CH Disabled
	DHW Disabled

Middle section

- Left: Shows user-configured information (by default only the outside temperature):

Line	Info
Top	Burner state (when enabled)
Middle	Configured/selected temperature (one of the following): <ul style="list-style-type: none"> ▪ Outside temperature ▪ Demand based (Flow or DHW temperature based on active demand) ▪ Flow temperature ▪ DHW temperature ▪ System temperature (module cascade flow/supply temperature) ▪ Cascade temperature (boiler cascade flow/supply temperature)
Bottom	B water pressure (when enabled)

- Center: The house icon is always displayed.
- Right side: Shows several status icons:

Icon	Description
	CH demand
	DHW demand
	Emergency mode is active (for cascade systems only)
	Burner is on (and flame is detected)
	Frost protection is active
	Anti-legionella program is active.
	Error is set in the Main Control (see footer for error description)

Footer

Shows Error/Warning messages when an Error or Warning is set in the Main Control, otherwise a quick menu is displayed where the user can quickly edit setpoints and enable/disable CH or DHW.

Quick Menu / Parameter	Description	Value / Unit	User
CH Control	Enable/disable Central Heating		0: User
CH Setpoint	Edit Central Heating setpoint (when available)		0: User
Calculated Setpoint	Show the calculated setpoint (when available)		0: User
DHW Control	Enable/disable Domestic Hot Water		0: User
DHW (Store) Setpoint	Edit the DHW (Store) setpoint (when available).		0: User

Note: Cascade dependents will only have the 'Calculated Setpoint' available.

14.2.1 SET CH SETPOINT/DHW SETPOINT DIRECTLY VIA THE STATUS OVERVIEW

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

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

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

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

14.2.2 ENTERING THE MENU

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



Enter a menu item by pressing CONFIRM ← or RIGHT →.

The header shows your location inside the menu, as seen in the following image:

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



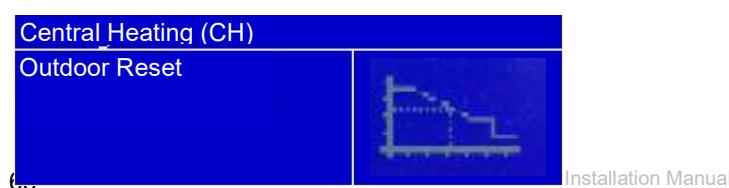
If CH-mode is set to:

CH mode 1 – CH with an outdoor temperature reset and thermostat control

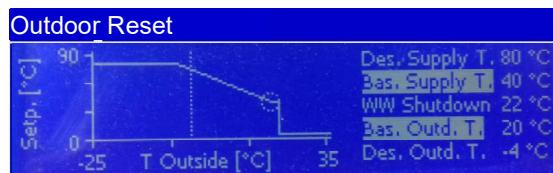
Or

CH mode 2 – Central Heating with full outdoor temperature reset

The following display will appear:



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



It is now possible to set the Outdoor reset curve by changing the parameters on the righthand of the screen.

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

14.2.3 PROTECTED MENU ITEMS

The display supports 3 different access levels; each with its own set of available menu items/parameters:

Level	Description
0: User	Basic info and settings only that are accessible for everyone.
1: Installer	Advanced information and settings; only to be accessed by an experienced installer/person.
2: Factory	Highest level information and settings, only available/relevant for factory Engineers.

Access the Installer level by entering the correct access code (password) for the desired user level. If a certain menu item has been selected, the following password screen will appear where a specific password has to be entered:



 WARNING	Changing protected/safety parameters should only be conducted by experienced, licensed boiler / water heater operators and mechanics. Hazardous conditions can happen with improper operations that may result in PROPERTY LOSS, PERSONAL INJURY, or LOSS OF LIFE.
---	--

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 correctly press ENTER/RIGHT to confirm.

When a correct password is entered the selected user-level is unlocked and the menu item can be accessed. This is displayed by an icon (padlock or key) in the top bar, the associated number indicates which user-level is unlocked (1:Installer, 2:Factory). In the main menu, an extra option 'Log out' appears. With this option you leave the protected user level.

The following menu items require a password*:

(Sub) Menu item	Location inside menu
Startup Settings	Settings / General Settings / Other Settings / Startup Settings
Boiler Parameters	Settings / Boiler Settings / Boiler Parameters
Module Cascade Settings	Settings / Boiler Settings / Module Cascade Settings
Boiler Cascade Settings	Settings / Boiler Settings / Boiler Cascade Settings

14.2.4 DE-AERATION SEQUENCE

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

14.2.5 LANGUAGE SETTINGS

The display supports the following languages:

▪ Chinese	▪ German	▪ Romanian
▪ Croatian	▪ Greek	▪ Russian
▪ Czech	▪ Hungarian	▪ Slovak
▪ Dutch	▪ Italian	▪ Slovene
▪ English	▪ Polish	▪ Spanish
▪ French	▪ Portuguese	▪ Turkish

The following paragraph describes how to change the display language. No matter which language you have set, the menu icons will always remain universal

14.2.6 CHANGE LANGUAGE VIA THE MENU

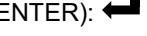
Please follow the next steps, which describe how to set the display to a specific language:

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

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

14.2.7 CHANGE THE LANGUAGE VIA THE MENU ICONS

The next steps describe how to change the display language via the icons displayed inside the menu, which can be useful if a foreign language is set, causing the user not able to understand the menu.

1. From the Status overview, press the MENU  button once.
Scroll down until the SETTINGS  icon appears on the right-side of the display (and press ENTER): 
2. In the following menu, press the SETTINGS icon  again (and press ENTER): 
3. In the following menu screen, select the LANGUAGE icon  (and press ENTER  to access the Language menu):
4. Select the desired language by scrolling through the list of available languages.
Press ENTER  to set the desired language, after you will automatically return to the General settings menu. Press ESC  a few times until you have reached the Status Overview again.

14.3 Boiler / water heater history

The boiler / water heater history found in the information menu displays several history counters that keep track of the boiler / water heater usage. The history cannot be erased and will continue for the burner controller life cycle. The following boiler / water heater 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).
Total system run time	Total hours 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.
Anti-Legionella count	Total number of completed anti-legionella cycles

14.4 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 boiler / 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 boiler ID of the boiler / 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	Information
Domestic Hot Water (DHW)	
Information	
Settings	
System test	
Error Log	
Error Log	
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 Boiler ID (Cascade System only)	Filter errors based on Boiler ID (Managing, Dep 1, Dep 2, etc.)
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: Boiler ID for which boiler / 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.

14.5 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 boiler / water heater keeps running, but maintenance must be done before resetting this message.

14.5.1 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.

14.5.2 SERVICE REMINDER IMPLEMENTATIONS

There are two types of service reminders: (Normal) Service reminder and Service shutdown

The (normal) Service reminder will only show the Service reminder message on the screen and will log how long the service is overdue. The appliance will remain fully operational. The optional Service shutdown prevents the boiler from firing when service is overdue.

14.5.3 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": 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.

14.5.4 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).
Hours since last service	Shows the number of hours (or burn hours) since the last service moment
Burn hours since last service	Shows the number of burn hours since the last service moment.
Hours till service	Shows the number of hours (or burn hours) until service is required
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.

14.6 General

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

	Mains input	1 x 5AT, 120V
Flame establishing period		2 seconds
Safety time		5 seconds
Ignition attempts		5
Pre-purge time		≥ 2...60 seconds (not safety critical)
Pre-ignition time		2 seconds (not safety critical)
Flame failure response time		< 1.0 second
Flame-current	Minimum Start-detection	1.0 µA 1.5 µA
Cable length AL-BUS ¹	AWG (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 boiler / water heaters. The length differs with the diameter of the cable.

14.6.1 PUMP START 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 boiler / water heater loop pump at the start-up of the board.

14.6.2 FROST PROTECTION

The Frost protection function protects the boiler / water heater and boiler / 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 boiler / water heater loop pump is switched ON for B.
- When any of the sensors drop below FP_Start_Burn the boiler / 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.

14.6.3 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.

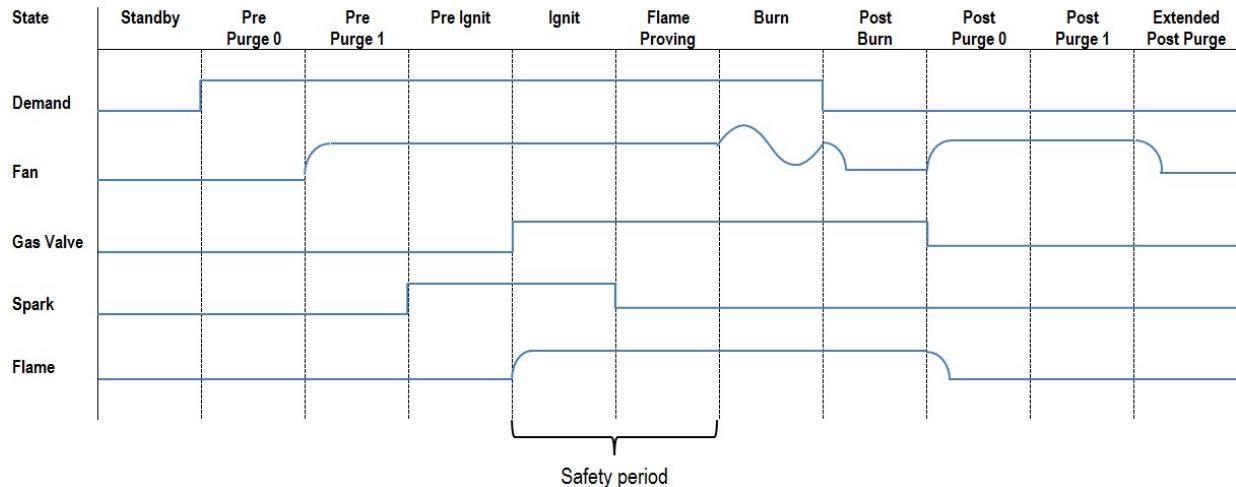
When the control is in a Flue_Gas_Error the fan will run at the minimum fan speed.

Boiler / water heater power limitation

All boiler / water heaters have a flue gas sensor. The control will limit the boiler / water heater power when the flue gas temperature reaches the set Max_Flue_Gas_Temp. The maximum boiler / water heater power is linearly limited when the flue gas temperature is within Max_Flue_Gas_Temp minus 9 F (5 °C) and Max_Flue_Gas_Temp. Parameters are factory set

14.7 Ignition cycle

During the ignition cycle multiple safety checks are active



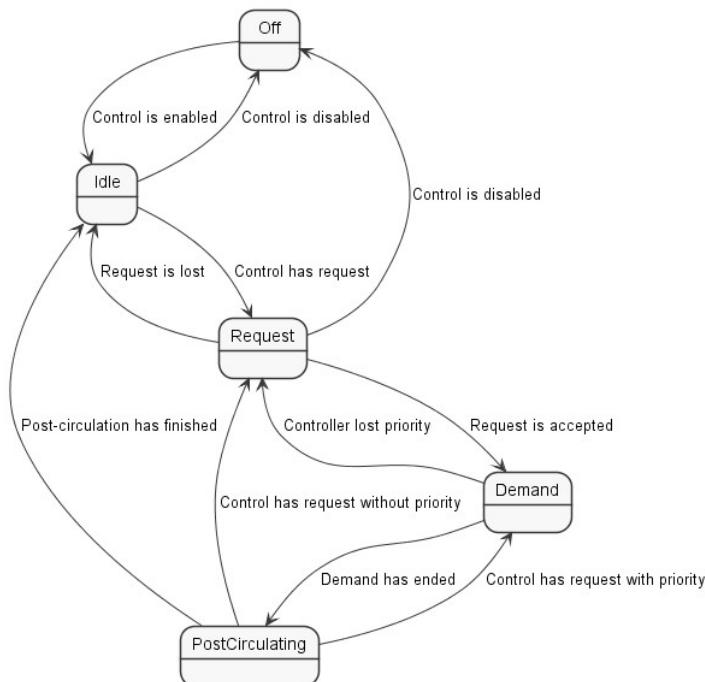
The table below shows the states of the burner ignition cycle, as shown in the diagram above:

#	Burner state	Actions
0	INIT	<ul style="list-style-type: none"> Controller initialization
1	RESET	<ul style="list-style-type: none"> Software reset (and initialization)
2	STANDBY	<ul style="list-style-type: none"> Standby (waiting for demand)
3	PRE_PURGE_0	<ul style="list-style-type: none"> Fan is not running When an APS is enabled the APS position is checked
4	PRE_PURGE_1	<ul style="list-style-type: none"> Fan starts at ignition speed When an APS is enabled the APS position is checked
5	PRE_IGNIT	<ul style="list-style-type: none"> Fan stays at ignition speed Igniter is started When a LPG tank is selected, the tank valve is opened
6	IGNIT	<ul style="list-style-type: none"> Fan stays at ignition speed The gas valve is opened Igniter stays on When a LPG tank is selected, the tank valve stays opened
7	FLAME_PROVING	<ul style="list-style-type: none"> Fan stays at ignition speed The gas valve stays opened The igniter is stopped When a LPG tank is selected, the tank valve stays opened
8	BURN	<ul style="list-style-type: none"> The fan is modulating The gas valve stays opened When a LPG tank is selected, the tank valve stays opened When an APS is enabled the APS position is checked
9	POST_BURN	<ul style="list-style-type: none"> Fan is set to minimum speed The gas valve stays opened
10	POST_PURGE_0	<ul style="list-style-type: none"> The fan is set at ignition speed The gas valve is closed When a LPG tank is selected, the tank valve is closed
11	POST_PURGE_1	<ul style="list-style-type: none"> Fan stays at ignition speed When an APS is enabled the APS position is checked
12	ERROR_CHECK	<ul style="list-style-type: none"> Blocking error is set Checking if blocking error can be removed (error situation is solved)
13	ALARM	<ul style="list-style-type: none"> Lockout error is set User must reset the lockout error (and the controller will reboot)
14	BURNER_BOOT	<ul style="list-style-type: none"> Finalize processes and reboot the control

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_Ignit</i>) a lockout error will occur.
Re-ignition	If at the end of the safety period no flame is detected the control will go to <i>Post_Purge</i> to remove any unburned gas. After this a re-ignition attempt is started following the same cycle. The number of re-ignition attempts is limited to <i>Max_Ignit_Trials</i> after which a lockout occurs.
Flame establishing time	Sparking stops in the <i>Flame_Proving</i> state to allow for ionization detection. The <i>Flame_Proving</i> state takes <i>Safety_Period - Ignit_Period</i> .
Flame out too late	If at the end of the <i>Post_Purge</i> 0 state the flame is still detected a lockout follows.
Flame loss	When a flame is lost during a burn cycle the control will restart the burner. The number of restarts is limited by the <i>Max_Flame_Trials</i> setting.
Fan supervision	The fan speed is continuously monitored. The following conditions for the fan speed are checked: <ul style="list-style-type: none"> ▪ The actual fan speed must be within 300RPM of the target fan speed ▪ When the fan speed dutycycle is within the lower/upper 5% of the PWM dutycycle range no errors will be generated since the fan is in the limits of its working range.

14.7.1 CONTROL FUNCTIONS



Dependent on the required functions of the appliance and connected sensors and components, several operation modes for Central Heating (B) and Domestic Hot Water (DHW) can be selected, which are described hereafter.

The demand controls all work according to a defined state machine. The diagram below shows how the controller states are implemented

Each state has a specific meaning for the controller. Below the various states are explained in more detail.

Controller State	Description
Off	The controller is disabled. The controller cannot generate request from this state. When the controller is enabled the controller state will move to the Idle state.
Idle	The controller is enabled. There is no request present. When a request becomes present the controller will move to the Request state. In case the controller is disabled the controller will move to the Off state.
Request	The controller is enabled. There is an active request present. The active request is not yet accepted by the demand controller. Once the active request is accepted the controller state moves to the Demand state. When the request is lost the controller state moves back to the Idle state. In case the controller is disabled the controller will move to the Off state.
Demand	The controller is enabled. There is an active request that has been accepted by the demand controller. The control is actively handling its heat-request. This state does not mean that the burner is on. The burner state can be monitored using the Burner State variable. When the active request is lost the controller will move to the post-circulating state. When the priority for the active request is lost the controller falls back to the Request state. In case the controller is disabled the controller moves to the Post-circulating state.
Post-circulating	The control is post-circulating. During this state the pumps continue to run for a short while. When the post-circulation time has finished the control moves to the Idle state. When the post-circulation time has finished and the control is no longer enabled the control moves to the Off state. When a higher priority demand becomes active the post-circulation is ended and the controller moves to the Idle state.

14.7.2 ON BOARD HMI AND LED COLORS.

On the burner controller a basic on-board Human Interface (HMI) is available which consists of a push button and a 2 color (red/green) LED. These are used to indicate basic status information about the control.



Control operational

When the control is operational and there are no errors present the LED will show as a constant green color.

Control locked

When the control is locked the LED will show as a constant red color. When the control is locked the control can be reset by using the push button. When the reset has been accepted the control is reset and the status LED will return to show the green color.

Control blocked

When the control is blocked the LED will alternate between green and red with a 1 second interval. When the blocking error is solved the LED will return to show only the green color.

Exceptions

In case the communication between the main and watchdog processor cannot be established the LED will not follow the status from the control. In this situation the watchdog processor will reset in an attempt to restore the communication. When this occurs the LED will appear as green with short pulses in which the LED is off.

14.7.3 FLAME DETECTION

When the boiler / 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. When the flame disappears 3 times within one heat demand the control will lockout.

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 (μ A).

When the flame current is above Flamerod_Setpoint + Flamerod_Hysteresis (1.0μ A + 0.5μ A) a flame will be present. When the flame current is below Flamerod_Setpoint (1.0μ A) the flame will not be present.

14.7.4 FLAME RECOVERY

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

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

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

14.8 Control functions

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

14.8.1 ROOM THERMOSTAT ONLY; CH MODE 0 (DEFAULT SETTING)

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

If the room thermostat closes, the boiler and system pumps are switched ON. When the supply temperature drops CH_Hysterese_Down below the CH_Setpoint (settable via the menu) the boiler is switched ON. The power for the boiler is PID regulated between T_Supply and the CH_Setpoint using the PID parameters for Central Heating.

If the supply temperature reaches a temperature CH_Hysterese_Up above the CH_Setpoint the boiler is switched OFF. However, if CH_Setpoint + CH_Hysterese_Up is greater than maximum setpoint the boiler switches OFF at the maximum setpoint.

If the room thermostat opens the boiler is switched OFF (if this was not already happening) and the boiler and system pumps run ON for CH_Post_Pump_Time.

Anti-cycle period

(This function is also applicable to all other CH modes) When the boiler is switched OFF because the supply temperature reaches CH_Setpoint + CH_Hysterese_Up, the control will wait a period of time (Anti_Cycle_Period →180 sec. settable) before it is allowed to be switched ON again.

This function is to prevent fast switching ON and OFF of the burner. However, when during the anti-cycle wait time the differential between setpoint and supply temperature gets greater than Anti_Cycle_T_Diff, anti-cycle will be aborted, and the burner is allowed to start. When the request for the active CH mode is lost during anti-cycling the anti-cycle will be aborted and the burner is allowed directly when a new CH request is generated.

Maximum CH power

(This function is also applicable to all other CH modes)

The maximum boiler power during CH operation can be limited with parameter P_CH_Max.

Minimum CH power

(This function is also applicable to all other CH and DHW modes)

The minimum boiler power during operation can be limited with parameter P_CH_Min.

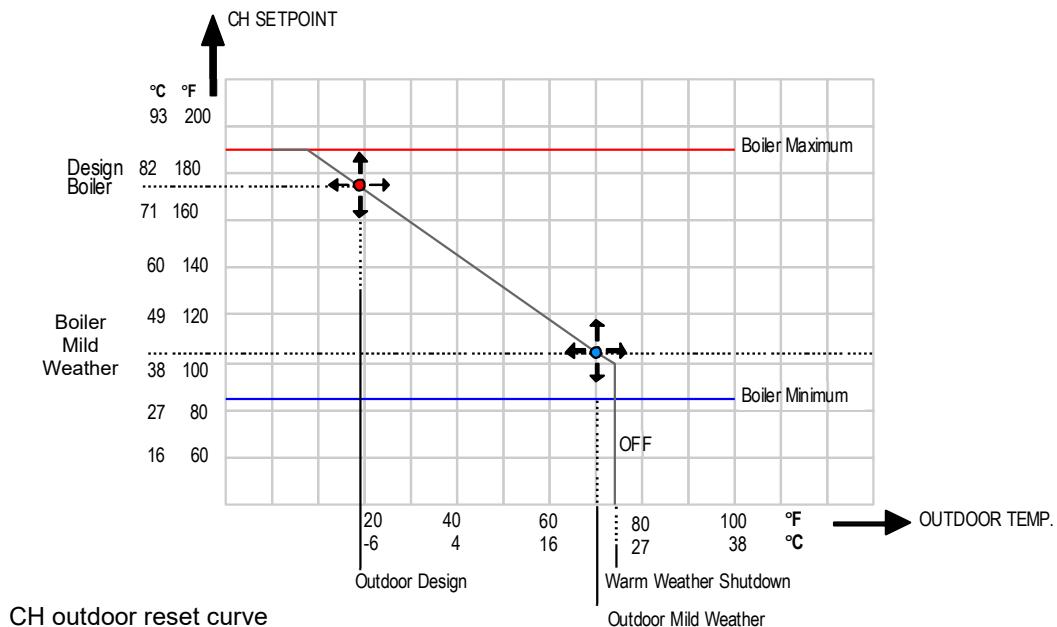
Adjustable Set Point Heating Parameters

Specific Parameters	Parameter nr.	Level	Default Value	Range
CH_Mode	1	2: Installer	0	Mode 0-5
CH_Setpoint Sets the required supply temperature.	3	1: User	185 °F (85 °C)	68.....194 °F (20.....90 °C)
CH_Pump_Overrun	5	2: Installer	120 sec.	10.....900 sec
Anti_Cycle_Period	9	2: Installer	180 sec	10.....900 sec
Anti_Cycle_T_Diff Aborts anti-cycle time when setpoint – actual supply temp >Anti_Cycle_T_Diff.	10	2: Installer	29 °F (16 °C)	0.....36 °F (0.....20 °C)
P_CH_Max Maximum boiler power for CH operation	14	2: Installer	100 %	1.....100 %
P_CH_Min Minimum boiler power for CH operation	15	2: Installer	1 %	1.....50 %

14.8.2 CH WITH AN OUTDOOR TEMPERATURE RESET AND THERMOSTAT; CH MODE 1

If the parameter CH_Mode is set to 1, the “Outdoor temperature reset with room thermostat” mode is selected. This mode will only function when an outdoor temperature sensor is connected. If the outdoor sensor is not connected, the boiler automatically uses Reset_Curve_Boiler_Maximum.

The setpoint is calculated depending on the outdoor temperature as indicated in the following graph and the boiler will react on the room thermostat (as described in § 14.8.1).



The outdoor reset curve can be changed by adjusting the design and mild weather reference temperatures. The calculated CH-setpoint is always limited between parameters Reset_Curve_Boiler_Minimum and Reset_Curve_Boiler_Maximum.

The outdoor temperature used for the CH_Setpoint calculation is measured once a minute and averaged with the previous measurement. This is to avoid commuting when the outside temperature changes rapidly.

If an “open” outdoor sensor is detected the CH_Setpoint will be equal to the Reset_Curve_Design_Boiler.

Shutdown temperature

When the outdoor temperature rises above Warm_Weather_Shutdown, the call for heat is blocked and the pumps are stopped. There is a fixed hysteresis of 1.8 °F (1 °C) around the Warm_Weather_Shutdown setting.

This means that the demand is stopped when the outdoor temperature has risen above Warm_Weather_Shutdown plus 1.8 °F (1 °C). When the outdoor temperature drops below Warm_Weather_Shutdown minus 1.8 °F (1 °C) again, the demand will also start again.

Boost function

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

Boiler Parameters		
(25) Warm Weather Shutdn	72 °F	▲
(26) Boost Temp increment	0 °F	
(27) Boost Time Delay	20 min	
(28) Night Setback Temp.	7 °F	▼

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

And have a default value of 0 °F (0 °C) and 20 min, so the function is switched off and can be activated by the installer by increasing parameter 26 by a number of degrees. Also, the time can be set when this parameter will be active in parameter 27 now set on 20 min.

CH_Setpoint increases again if the call for heat still is not satisfied in another time increment.

Setpoint adjustment

It is possible to adjust the calculated setpoint with parameter CH_Setpoint_Diff. The calculated setpoint can be increased or decreased with a maximum of 18 °F (10 °C). The CH setpoint limits (Reset_Curve_Boiler_Minimum and Reset_Curve_Boiler_Maximum) are respected while adjusting the setpoint.

Apart from the calculated setpoint the functionality is the same as described in § 14.8.1.

Adjustable Outdoor Reset parameters

Parameters	Parameter nr.	Level	Default Value	Range
CH_Mode	1	2: Installer	0	Mode 0-5
Reset_Curve_Design_Boiler Sets high boiler CH setpoint when outdoor temp. is equal to <i>Reset_Curve_Outdoor_Design</i> .	19	2: Installer	176 °F (80 °C)	32.....176 °F (0.....80 °C)
Reset_Curve_Outdoor_Design Sets the outdoor temp at which the boiler setpoint must be high as set by <i>Reset_Curve_Design_Boiler</i> .	20	2: Installer	23 °F (-5 °C)	-4.....41 °F (-20.....5 °C)
Reset_Curve_Boiler_Mild_Weather Sets low boiler CH setpoint when outdoor temp. is equal to <i>Reset_Curve_Outdoor_Mild_Weather</i> .	21	2: Installer	104 °F (40 °C)	32.....104 °F (0.....40 °C)
Reset_Curve_Outdoor_Mild_Weather Sets the outdoor temp at which the boiler setpoint must be low as set by <i>Reset_Curve_Mild_Weather</i> .	22	2: Installer	68 °F (20 °C)	32.....86 °F (0.....30 °C)
Reset_Curve_Boiler_Minimum Sets the lower limit for the CH setpoint (minimum).	23	2: Installer	86 °F (30 °C)	68.....194 °F (20.....90 °C)
Reset_Curve_Boiler_Maximum Sets the upper limit for the CH setpoint (maximum).	24	2: Installer	194 °F (90 °C)	68.....194 °F (20.....90 °C)
Warm_Weather_Shutdown Set max. outdoor temp. Above this temperature heat demand is blocked.	25	2: Installer	72 °F (22 °C)	32.....95 °F (0.....35 °C)
Boost_Temperature_Incr B setpoint increment when heat demand remains beyond <i>Boost_Time_Delay</i> .	26	2: Installer	0 °F (0 °C)	0.....36 °F (0.....20 °C)
Boost_Time_Delay	27	2: Installer	20 min.	1 – 120 min.
CH_Setpoint_Diff Adjusts the calculated CH setpoint.		1: User	0 °F (0 °C)	-18.....+18 °F (-10.....+10 °C)

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

14.8.3 CH WITH FULL OUTDOOR TEMPERATURE RESET; CH MODE 2

When CH_Mode is set to 2, full weather compensator is chosen. For this mode an outdoor sensor has to be connected. The CH_Setpoint is calculated on the same way as described in §12.8.2.

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

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

This can be done by connecting a relay contact or clock thermostat to terminal 12 and 13 on the low voltage connectors of the boiler. The room thermostat is only being used in this function to switch between a night setback temperature and a daytime temperature, there is always a constant demand for heat in CH mode 2.

The Night Setback temperature can be set by using the installer password and changing parameter 28 in the boiler parameters, default value is setpoint - 18 °F.

Boiler Parameters				
(25) Warm Weather Shutdn	72 °F	▲		
(26) Boost Temp increment	0 °F			
(27) Boost Time Delay	20 min			
(28) Night Setback Temp.	7 °F	▼		

Adjustable constant Circulation Parameters

Parameters	Parameter nr.	Level	(Default) Value	Settable
CH_Mode	1	2: Installer	0	Mode 0 - 5
Warm_Weather_Shutdown Set max. outdoor temp. Above this temperature heat demand is blocked.	25	2: installer	72 °F (22 °C)	32...95 °F (0...35 °C)
CH_Setpoint_Diff Adjusts the calculated CH setpoint.		1: User	0 °F (0 °C)	-18...18 °F (-10...10 °C)

14.8.4 CH WITH CONSTANT CIRCULATION AND PERMANENT HEAT DEMAND; CH MODE 3

For this mode the CH_Mode should be set to 3, no outdoor sensor is needed. The supply temperature is kept constantly at the setpoint temperature. The boiler is controlled in a similar way as described in §12.8.1.

When the room thermostat contact opens CH_Setpoint will be decreased with Night_Setback_Temp. In this condition the pump is always ON.

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

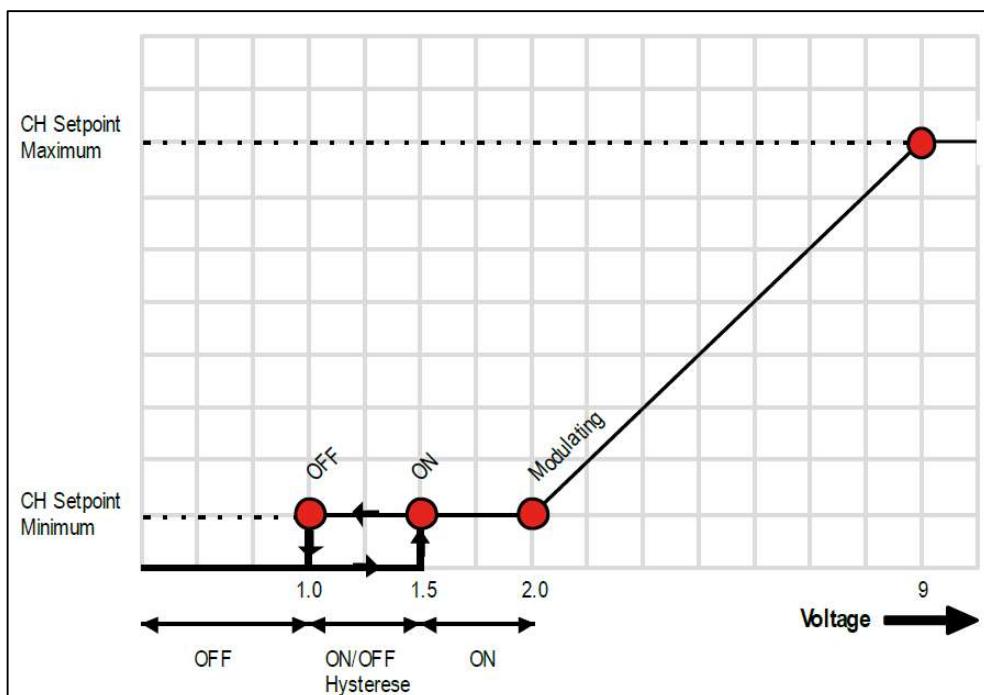
Parameters	Parameter nr.	Level	(Default) Value	Settable
CH_Mode	1	2: Installer	0	Mode 0 - 5
CH_Setpoint	3	1:User	185 °F (85 °C)	68.....194 °F (20.....90 °C)
Night_Setback_Temp	28	2: Installer	18 °F (10 °C)	0....54 °F (0....30 °C)

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

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

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

The CH_Setpoint_Min and CH_Setpoint_Max parameters can be adjusted to provide the desired temperature adjustment band. A heat request will be generated by an input of 1.5 volts or higher. The setpoint modulation will occur between 2 and 9 volts. The request for heat will be removed when the voltage drops below 1 volt.



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

Parameters	Parameter nr.	Level	(Default) Value	Settable
CH_Mode	1	2: Installer	0	Mode 0, 1, 2, 3, 4, 5
CH_Setpoint_Minimum	110	2: Installer	68 °F (20 °C)	68...194 °F (20...90 °C)
CH_Setpoint_Maximum	111	2: Installer	194 °F (90 °C)	68...194 °F (20...90 °C)

14.8.6 CH WITH ANALOG INPUT CONTROL OF POWER OUTPUT; CH MODE 5

In this mode of operation, the temperature needs to be controlled by an external temperature controller. When the boiler has a supply temperature of 203°F (95°C) the boiler switches off and shows a blocking code “High Temp Error” (105) wait until the temperature has dropped to 194°F (90°C) now the boiler will start again.

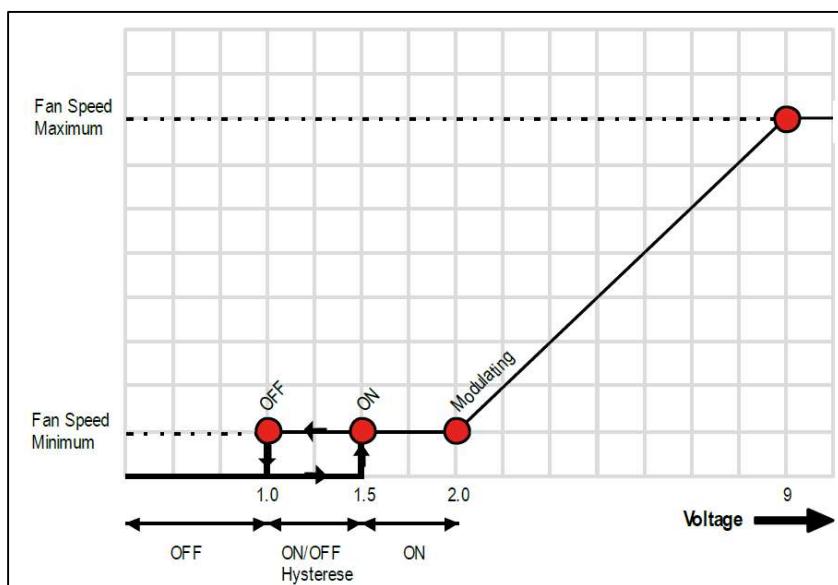
So the external controller needs to reduce the 0-10V signal or switch the boiler off before it reaches 203°F (95°C). When connecting the 0-10V signal the room thermostat signal needs to be bridged to activate the signal.

When using a modulating pump on pwm signal the pump will only run on a fixed pwm signal. This signal can be changed in parameter(136) Mod. Pump Mode. The pump will not modulate on delta T setpoint. When you want to use a delta T controlled setpoint of the pump use CH-mode 4

The minimum analog input signal value will correspond to the minimum modulation rate and the maximum modulation analog input signal value will correspond to the maximum modulation rate.

All other safety and control functions associated with the boiler will react normally to adverse condition and override control of the analog signal to prevent an upset condition.

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



- CH mode 5 will work without sensors.
- The room thermostat signal needs to be bridged to activate the 0 – 10 V signal.

Parameters	Parameter nr.	Level	(Default) Value	Settable
CH_Mode	1	2: Installer	0	Mode 0, 1, 2, 3, 4, 5

14.9 Demand for Domestic Hot Water

Two possibilities exist for generating Domestic Hot Water:

- The boiler is used for heating and Domestic Hot Water. In this case you need an indirect tank (a tank with a heat-exchanging spiral inside) or a plated heat exchanger to separate heating from DHW. DHW modes 1, 2 or 3 apply.
- The boiler is used for Domestic Hot Water only. In this case a direct tank can be used, and the DHW flows through the water heater. In this case you must use DHW mode 1 (this is the standard setting), and a single water heater must be configured as managing. This means that a system sensor must be installed next to the tank sensor.

14.9.1 No DOMESTIC HOT WATER; DHW MODE 0

No domestic hot water is available. This is the standard setting for heating boilers.

14.9.2 DHW STORAGE WITH SENSOR; DHW MODE 1

Mode 1: DHW is prepared by warming up a store. Either a DHW pump or 3-way valve can be used to switch to DHW mode.

The DHW temperature in the tank is measured with sensor *T_Store* and set with parameter *DHW_Store_Setpoint*. When this sensor drops below *DHW_Store_Setpoint* minus *DHW_Store_Hyst_Down* the control detects a demand for the store and starts the general and DHW circulator.

If the supply temperature *T_Supply* is below *DHW_Store_Setpoint* plus *DHW_Store_Supply_Extra* minus *DHW_Supp_Hyst_Down* the water heater is started as well.

When the water heater is ON, the power is PID-modulated so *T_Supply* is regulated towards *DHW_Setpoint* plus *DHW_Store_Supply_Extra*.

The water heater is stopped when the supply temperature rises above *DHW_Store_Setpoint* plus *DHW_Store_Supply_Extra* plus *DHW_Supp_Hyst_Up*.

The demand for the tank is ended when the tank-sensor rises above *DHW_Store_Setpoint* plus *DHW_Store_Hyst_Up*. The circulator continues *DHW_Post_Pump_Period*.

DHW Priority

Standard DHW demand has priority over CH demand but the priority period is limited up to *DHW_Max_Priority_Time*. The priority timer starts when both CH and DHW demand are present. After the *DHW_Max_Priority_Time* is achieved, the control will switch from DHW to CH operation. CH has priority now for a maximum period of *DHW_Max_Priority_Time*.

Different DHW Priority types can be chosen:

DHW priority	Description
0 → Time	DHW has priority to CH during <i>DHW_Max_Priority_Time</i>
1 → OFF	CH always has priority to DHW
2 → ON	DHW always has priority to CH

Default *DHW_Priority* is set to 2.

Store warm hold function

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

Relevant variables

Specific Parameters	Parameter nr	Level	(Default) Value	Range
DHW_Mode	35	2: Installer	0	0, 1, 2, 3, 4, 5, 6, 7, 8
DHW_Store_Setpoint Sets the desired DHW temperature.	115	1: User	149 °F (65 °C)	104...160 °F (40...71 °C)
DHW_Store_Supply_Extra Increases the supply temperature to the store until <i>DHW_Store_Setpoint</i> + <i>DHW_Store_Supply_Extra</i> .	38	2: Installer	27 °F (15 °C)	0...54 °F (0...30 °C)

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

14.9.3 DHW STORAGE WITH THERMOSTAT; DHW MODE 2

In this mode DHW is prepared by warming up an indirect tank. Either a DHW pump or 3-way valve can be used to switch to DHW mode. The temperature of the DHW in the indirect tank is regulated by a thermostat/aquastat (instead of a sensor), which should provide only an open/closed signal to the control.

When the thermostat/aquastat closes the control detects a demand from the DHW indirect tank and starts the DHW pump.

If the supply temperature *T_Supply* drops below *DHW_Store_Setpoint* minus *DHW_Supp_Hyst_Down* the water heater starts. When the water heater is ON the power is PID-modulated based on *T_Supply* toward *DHW_Store_Setpoint*.

The water heater is stopped when the supply temperature rises above *DHW_Store_Setpoint* plus *DHW_Supp_Hyst_Up*.

The demand for DHW ends when the indirect tank thermostat/aquastat opens. The circulator continues *DHW_Post_Circulator_Period* after the DHW demand has stopped.

DHW priority

See §12.9.2 – DHW Mode 1 – Storage with sensor

Relevant variables

Specific Parameters	Parameter nr.	Level	(Default) Value	Range
DHW_Mode	35	2: Installer	0	0, 1, 2, 3, 4, 5, 6, 7, 8
DHW_Store_Setpoint Sets the supply temperature from the boiler to prepare DHW in the indirect tank	115	2: User	149 °F (65 °C)	104...160 °F (40...71 °C)
DHW_Priority	42	[·]	2	0=Time, 1=OFF, 2=ON
DHW_Max_Priority_Time Sets the maximum time for either DHW or CH priority.	43	2: Installer	60 min.	
DHW_Pump_Overrun	44	2: Installer	120 sec.	10...900

14.9.4 INSTANTANEOUS WATER HEATING WITH PLATED HEAT EXCHANGER; DHW MODE 3

In DHW mode 3 the water flow through a plated heat exchanger is checked with a flow switch. If the switch closes a water flow is detected, and either a DHW pump or a 3-way valve can be used to switch to DHW mode. The temperature of the DHW is set with *DHW_Setpoint*.

If the *T_DHW_Out* sensor drops below *DHW_Setpoint* minus *DHW_Hyst_Down* the burner starts. When the burner is on, the power is PID-controlled based on *T_DHW_Out* toward *DHW_Setpoint*. The burner stops when the *T_DHW_Out* temperature rises above *DHW_Setpoint* plus *DHW_Hyst_Up*. When the flow switch opens the demand for the tapping is ended and the burner stops. The pump continues *DHW_Post_Pump_Period*.

Specific Parameters	Parameter nr.	Level	(Default) Value	Range
DHW_Mode	35	2: Installer	0	0, 1, 2, 3, 4, 5, 6, 7, 8
DHW_Setpoint Sets the desired DHW temperature	48	2: User	140 °F (60 °C)	86...176 °F (30...80 °C)
DHW_Pump_Overrun	44	2: Installer	20 s	10...900 s

14.9.5 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 water heater 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 water heater setpoint will be at Anti_Legionella_Setpoint plus DHW_Store_Supply_Extra.

If the supply temperature drops below the Boiler_Setpoint the water heater is started as well. The water heater is PID controlled towards the Boiler_Setpoint. When the supply temperature rises above Boiler_Setpoint plus DHW_Supp_Hysteresis_Up the water heater 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 water heater 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(DHW Modus 1 only)

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

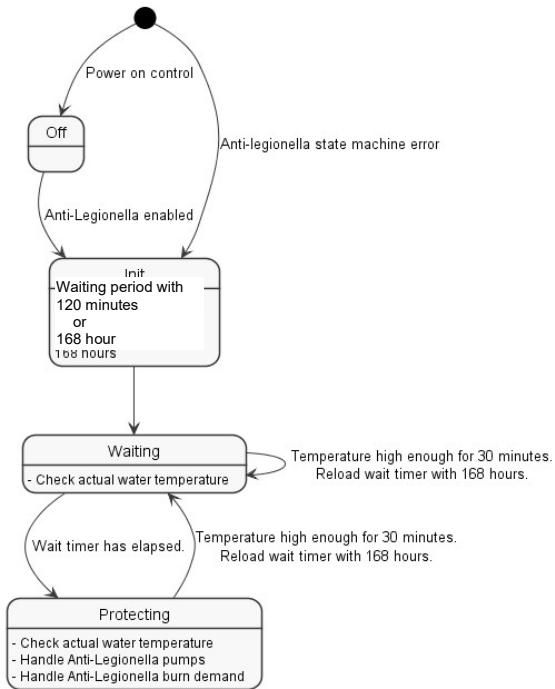
Following parameters cannot be set by the installer and are factory set

Parameter	Factory Setting.
Anti_Legionella_Setpoint (Setpoint for Anti-Legionella demand)	158 °F (70 °C)
Anti_Legionella_Burn_Time	30 Min.
Anti_Legionella_Wait_Time	Wait time for Anti-Legionella demand.

After a cold boot of the control the Anti-legionella cycle is forced to start after 120 minutes.

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

The diagram below shows how the state machine for Anti-Legionella is implemented.



Burn demand generation

When the anti-legionella control has an active request a burn demand can be generated. The burn demand is generated according to the following rules

Start demand

- The demand is started when the measured sensor temperature is below the burner setpoint

Stop demand

- The demand is stopped when the measured sensor temperature is above the burner setpoint + 5°C

Status information

Every time an anti-legionella demand ends the Anti_Legionella_Active_Counter is incremented to indicate how many anti-legionella actions have been performed. This counter can be found in the 'Boiler History' screen in LabVision PC software.

14.9.6 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
6. Reset Password			Installer	Reset the user-level back to 0: User.

1. Central Heating (CH)	min.	max.	Default	unit	Access level	Description:
1.1 CH Setpoint	68 (20)	194 (90)	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.	Default	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.	Default	unit	Access level	Description:
DHW Setpoint	102 (39)	158 (70)	140 (60)	(°F) (°C)	Installer	Set the DHW setpoint
DHW Store Setpoint	32 (0)	194 (90)	149 (65)	(°F) (°C)	Installer	Set the DHW store setpoint for DHW mode 1 and 2

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

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

3.2 Boiler status	min.	max.	Default	unit	Access level	Description:
Flow Temperature				°F/°C	User	Actual supply flow temperature
Flow 2 Temperature				°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/close	User	Actual RT input status
Gas Pressure Switch				open/clos	User	Gas pressure switch input
Flow Switch				open/clos	User	CH/DHW) Flow switch input
Air Fl Sw				open/clos	User	Air pressure switch input
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
Module Setpoint				°F/°C	User	Actual Module/dependent/burner setpoint (Only for module cascade.)

3.3 Boiler history	min.	max.	Default	unit	Access level	Description:
Successful Ignitions				#	User	Display the number of successful ignitions
Failed Ignitions				#	User	Display the number of failed ignitions
Flame Failures				#	User	Display the number of flame losses
Operation Days				days.	User	Display the total time in operation
CH Burner Hours				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.	Default	unit	Access level	Description:
Error Log					User	Display the complete error log
Filter Error Type					User	Set the error log filter
Clear Error Log					Installer	Clear the complete error log

3.5 Service	min.	max.	Default	unit	Access level	Description:
Service history					User	Display the service history
Burn hours since last service				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.	Default	unit	Access level	Description:
4.1 General Settings					User	Enter the General Settings menu
4.2 Boiler Settings					User	Enter the Boiler Settings menu

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

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

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

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

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

B Display settings	min.	max.	Default	unit	Access level	Description:
Time Notation			24h	24h/12h	User	Select 24h or 12h time notation
Date Order			DMY		User	Select the date-format
Day of Month			2	1 or 2 dig.	User	Select how the day of month is displayed
Month			short text		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			Short text		User	Select how the day of week is displayed
Seconds			no	yes/no	User	Select if seconds are displayed

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

4.1.5 Other settings	min.	max.	Default	unit	Access level	Description:
Modbus Address	0	255	1	0...255	User	Select the Modbus communication address
Modbus Stop bits	1	2	2	1 – 2	User	Select the number of Modbus communication stop bits

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

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

4.2.1 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)	185 (85)	°F (°C)	Installer	Set the CH setpoint	3
Calc. Setp. Offset	-18 (-10)	18 (10)	0 (0)	°F (°C)	Installer	Set the offset for CH mode 1 / 2 calculated setpoint	109
CH Min Setpoint	68 (20)	122 (50)	68 (20)	°F (°C)	Installer	Set the minimum CH setpoint (0-10V modes)	110
CH Max Setpoint	122 (50)	194 (90)	185 (85)	°F (°C)	Installer	Set the maximum CH setpoint (0-10V modes)	111
Boiler Pump Overrun	0	900	120	sec.	Installer	Set the post-circulation time for the boiler/CH pump	5
CH Hysteresis Up	3.6 (2)	72 (40)	13 (7)	°F (°C)	Installer	Set the CH hysteresis up	7
CH Hysteresis Down	3.6 (2)	36 (20)	27 (15)	°F (°C)	Installer	Set the CH hysteresis down	112
Anti-Cycle Period	10	900	180	sec.	Installer	Set the burner anti-cycling period	9
Anti-Cycle Temp. Diff.	0 (0)	36 (20)	28.8 (16)	°F (°C)	Installer	Set the burner anti-cycling differential	10
Max. Power CH	1	100	100	%	Installer	Set the max. CH burner power	14
Min. Power CH	1	100	1	%	Installer	Set the minimum CH burner power	15
CH PID P	0	1275	40		Installer	Set the PID P factor for CH	16
CH PID I	0	1275	400		Installer	Set the PID I factor for CH	17
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)	179 (82)	68 (20)	°F (°C)	Installer	Set the outdoor reset curve minimum setpoint	23
Design Supply Max. Limit	81 (27)	194 (90)	194 (90)	°F (°C)	Installer	Set the outdoor reset curve maximum setpoint	24
Warm Weather Shutdn	32 (0)	95 (35)	71 (22)	°F (°C)	Installer	Set outdoor temperature above which CH demand is blocked	25
Boost Temp Increment	0 (0)	54 (30)	0 (0)	°F (°C)	Installer	Set the setpoint boost function temperature increment	26
Boost Time Delay	0	120	20	min.	Installer	Set the setpoint boost function delay time	27
Night Setback Temp.	0 (0)	54 (30)	18 (10)	°F (°C)	Installer	Set the CH setpoint night setback temperature	28
DHW Mode	0	8	0	#	Installer	Set the DHW mode	35
DHW Tank Hyst. Down	1.8 (0)	18 (10)	9 (5)	°F (°C)	Installer	Set the DHW tank hysteresis down	36
DHW Tank Hyst. Up	0 (0)	18 (10)	9 (5)	°F (°C)	Installer	Set the DHW tank hysteresis up	37
DHW Tank Supply Extra	0 (0)	54 (30)	27 (15)	°F (°C)	Installer	Set the DHW tank supply setpoint offset	38
DHW Tank Supp Hyst Dn	0 (0)	36 (20)	9 (5)	°F (°C)	Installer	Set the DHW tank supply hysteresis down	39
DHW Tank Supp Hyst Up	0 (0)	36 (20)	9 (5)	°F (°C)	Installer	Set the DHW tank supply hysteresis up	40
DHW Priority	0	2	on	0-2	Installer	Set the DHW priority mode	42
DHW Max. Priority Time	1	255	60	min.	Installer	Set the maximum DHW priority time	43
DHW Pump Overrun	0	900	20	sec.	Installer	Set the DHW post-circulation time	44
DHW Tank PID P	0	1275	100		Installer	Set the DHW tank PID P factor	45
DHW Tank PID I	0	1275	300		Installer	Set the DHW tank PID I factor	46

cont.: 4.2.1 Boiler parameters	min.	max.	Default	unit	Access level	Description:	Display no:
DHW Setpoint	102 (39)	158 (70)	140 (60)	°F (°C)	Installer	Set the DHW setpoint	48
DHW Store Setpoint	32 (0)	194 (90)	149 (65)	°F (°C)	Installer	Set the DHW storage setpoint	115
DHW Hysteresis Down	0 (0)	36 (20)	7.2 (4)	°F (°C)	Installer	Set the DHW hysteresis down	49
DHW Hysteresis Up	3.6 (2)	36 (20)	7.2 (4)	°F (°C)	Installer	Set the DHW hysteresis up	50
DHW Instant PID P	0	1275	100		Installer	Set the DHW instantaneous PID P factor	51
DHW Instant PID I	0	1275	160		Installer	Set the DHW instantaneous PID I factor	52
DHW On Off Period	10	60	30	sec.	Installer	Set the on/off modulation period	63
PreHeat mode	on	off	off	-	Installer	Set the PreHeat Eco mode	64
PreHeat Eco Setpoint	32 (0)	176 (80)	86 (30)	°F (°C)	Installer	Set the PreHeat Eco setpoint	65
DHW Max. Limit	32 (0)	194 (90)	176 (80)	°F (°C)	Installer	Limiting DHW setpoint max.	91
DHW Min. Limit	68 (20)	122 (50)	86 (30)	°F (°C)	Installer	Limiting DHW setpoint min.	96
Fan Speed Maximum	0	12750	dep unit	rpm	Installer	Set the maximum fan speed	92
Fan Speed Minimum	0	12750	dep unit	rpm	Installer	Set the minimum fan speed	93
Fan Speed Ignition	0	12750	dep unit	rpm	Installer	Set the ignition fan speed	94
Prog. Input 1.	0	3	1	#	Installer	Select the function for programmable input 1	116
Prog. Input 2.	0	4	2	#	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	2	#	Installer	Select the function for programmable output 1	125
Prog. Output 2.	0	10	0	#	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	3	#	Installer	Select the function for programmable output 4	128
Mod. Pump dT	9 (5)	72 (40)	36 (20)	°F (°C)	Installer	Set the modulating pump target delta temperature	133
Mod. Pump Start Time	0	255	60	sec.	Installer	Set the modulating pump start up time	134
Mod. Pump Type			Linear inv		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			35	%	Installer	Set the modulating pump minimum duty cycle	137
Appliance Type	50	55	50	#	Installer	Set the appliance type	138
Dair active	no	yes	yes	yes/no	Installer	Enable/disable the De-Air function	139
Nominal Flow	0	10	0	l/min	Installer	Sets the nominal flow	141
Anti Legionella Day	mon	sun	Sunday		Installer	Select the day for the anti-legionella cycle	107
Anti Legionella Hour	0	23	0	hrs.	Installer	Select the time for the anti-legionella cycle	108
Frost Protection			Enabled	Ena/Dis	Installer	Switch Frost protection on/off	205
Anti Legionella			Enabled	Ena/Dis	Installer	Anti Legionella protection on/off	206
DHW Detection Delay	0	255	0		Installer	Sets the detection delay.	207

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)	158 (70)	°F (°C)	Installer	Set the emergency mode setpoint	74
Delay Per Start Next Mod.	0	1275	90	sec.	Installer	Set the delay time before the next module is started	75
Delay Per Stop Next Mod.	0	1275	60	sec.	Installer	Set the delay time before the next module is stopped	76
Delay Quick Start Next	0	1275	20	sec.	Installer	Set the fast delay time before the next module is started	142
Delay Quick Stop Next	0	1275	10	sec.	Installer	Set the fast delay time before the next module is stopped	143
Hyst. Down Start Module	0 (0)	72 (40)	14 (8)	°F (°C)	Installer	Set the hysteresis down after which a module is started	77
Hyst. Up Stop Module	0 (0)	72 (40)	10 (5)	°F (°C)	Installer	Set the hysteresis up after which a module is stopped	78
Hyst. Down Quick Start	0 (0)	72 (40)	22 (12)	°F (°C)	Installer	Set the fast hysteresis down after which a module is started	144
Hyst. Up Quick Stop	0 (0)	72 (40)	12 (7)	°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	2	#	Installer	Set the power mode	148
Max. Setp. Offset Down	0 (0)	36 (20)	4 (2)	°F (°C)	Installer	Set the maximum setpoint offset down	79
Max. Setp. Offset Up	0 (0)	36 (20)	18 (10)	°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	80	%	Installer	Set the next module start rate	82
Next Module Stop Rate	10	100	25	%	Installer	Set the next module stop rate	83
Module Rotation Interval	0	30	5	days	Installer	Set the rotation interval	84
First Module to Start	0	17	1	#	Installer	Set the first module to start in the rotation cycle	149
PwrMode2 Min Power	0	100	15	%	Installer	Set the power mode 2 minimum power	152
PwrMode2 Hysteresis	0	100	35	%	Installer	Set the power mode 2 hysteresis	153
Post-Pump Period	0	255	30	sec.	Installer	Set the cascade post-circulation period	154
Frost Protection	50 (10)	86 (30)	59 (15)	°F (°C)	Installer	Set the frost-protection setpoint	155

NOTICE	Parameters for cascade operation are found in the Module cascade settings menu, located in the Boiler settings menu. Parameters in the below Boiler cascade settings menu must not be used.						
4.2.3 Boiler Cascade Settings	min.	max.	Default	unit	Access level	Description:	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 set-point	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)	3.6 (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)	7.2 (4)	°F (°C)	Installer	Set the fast hysteresis up after which a boiler is stopped	165
Hyst. Up Stop All	0 (0)	108 (60)	14.4 (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	#	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

Service					Installer	Description:
Reset Service Reminder	no	yes	no	yes/no	Installer	Reset the service history

15 TOUCH SCREEN

The E boiler has a touch screen attached, with which you can see the state of the boiler / water heater, control the main parameters and view errors. Also you can set the fan speed at predefined levels, needed to verify combustion settings (O_2 / CO_2). Not all parameters can be accessed via the touchscreen. At installation and commissioning, parameter setting and configuration should therefore preferably be done at the PB screen (described in chapter 14), mounted directly below the touch screen.

15.1 Menu buttons

In the touchscreen user interface the following basic menu buttons are available.



Home

Return to the module screen



Graph

Access the performance graph of the module



Errors

Access the Error history screen



Service

Access the service history screen



Settings

Access the Settings screen

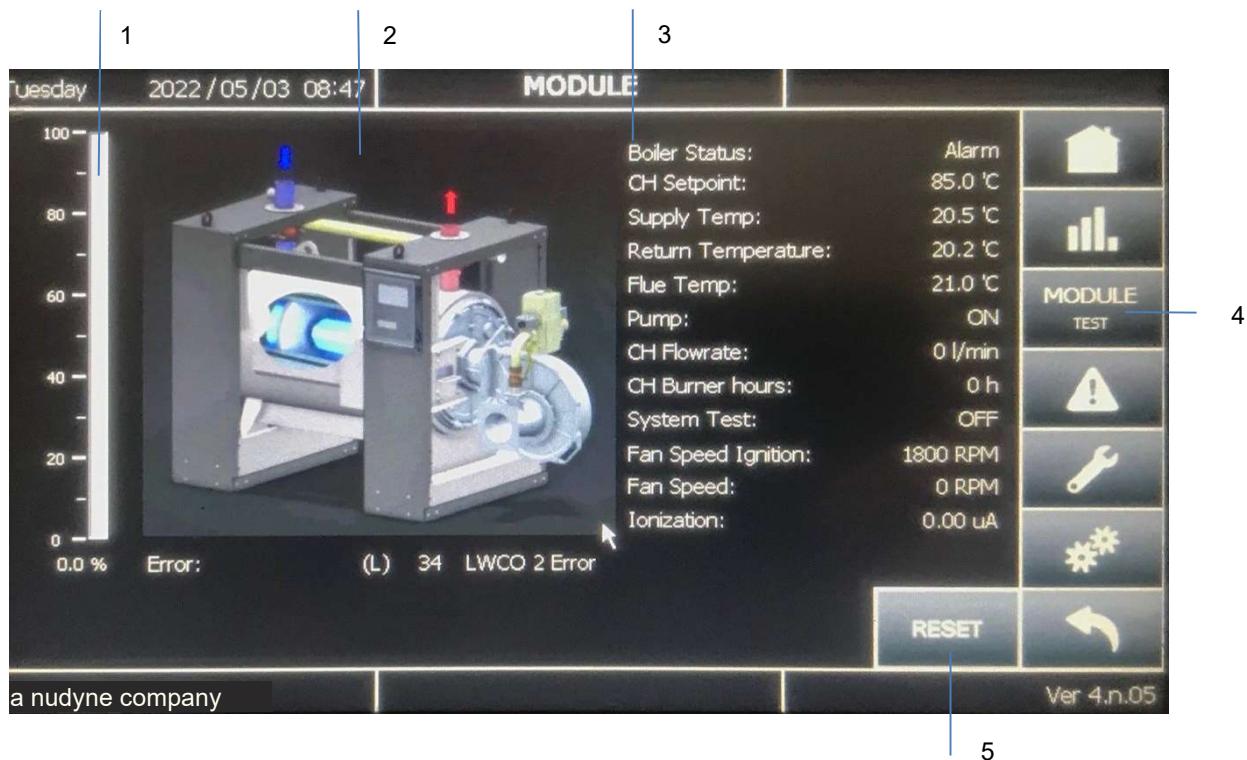


Return

Return to the previous screen

15.2 Module screen

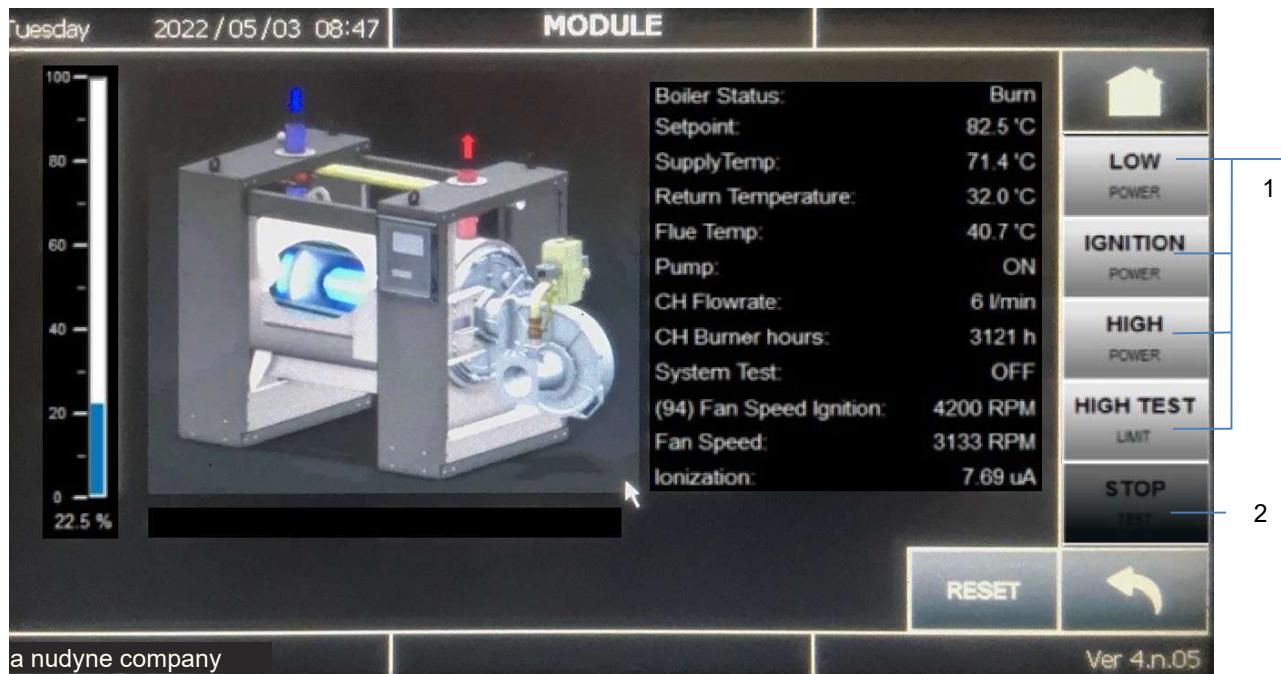
The module screen shows the status information of the boiler / water heater. From this screen all available settings, graphs and tests can be accessed.



No.	Description
1	Power bar, displays the power level of the selected module. Power level is displayed in [%] when metric units are selected. If imperial units are selected the power level is displayed [KBtu] but without power bar.
2	Default module image.
3	Shows status information of the selected module.
4	Module test button, opens the Module test screen. See § 15.3 next page.
5	Reset button

15.3 Module test screen

With the module test screen you can set the boiler / water heater at predefined power levels, which can be used to check combustion settings of the boiler (O₂ / CO₂).



No.	Description
1	Buttons to start one of the following Module tests:
	Module test
	Description
	Low power
	Burner system test low power
	Ignition power
	Burner system test ignition power
	High power
	Burner system test high power
	High test limit
	High limit temperature switch functionality test
2	Stop test button, used to stop an active system test (only available during performance of one of the module tests).

16 TEMPERATURE PROTECTION

The difference between Supply temperature and Return Temperature is continuously monitored. A too big difference can indicate a defective pump or a clogged heat exchanger, and could lead to micro-boiling. In this situation the water is heated over 212 °F and vapour bubbles develop which generate boiling noises. To protect the boiler / water heater, the burner controller reduces the input when the temperature difference ΔT becomes too high:

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

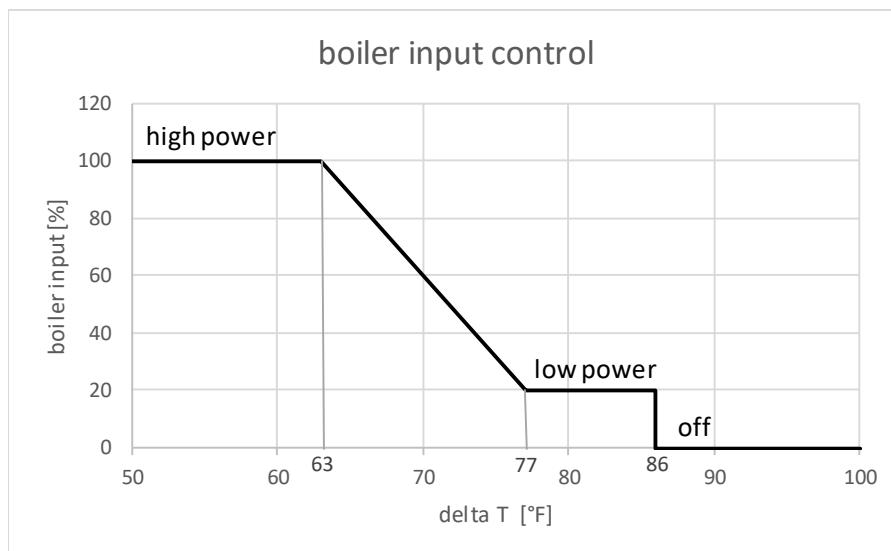
In between 63 °F (35 °C) and 77 °F(43 °C) boiler / water heater input modulates between minimum and maximum.

At minimum boiler / water heater input ΔT above 77 °F (43 °C) is allowed (Hx_Diff_DeltaT_Min plus 14 °F (+8 °C)).

Above $\Delta T = 86$ °F (48 °C), the boiler / 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 (1080 °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.



17 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 boiler / water heater pump will continue to run during most locking and blocking error codes. This is to prevent the freezing of the Central Heating circuit when the boiler / 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.

17.1 Boiler history.

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

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

17.2 Lockout codes

Lock out code	Error	Description	Cause	Solving
0	EEPROM Read Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
1	Ignition Error	Five unsuccessful ignition attempts in a row	no gas, wrongly adjusted gas valve, bad igniter	check gas supply and adjust gas valve, reset BCU, check igniter.
2	GasValve Relay Error	Failure detected in the gas valve relay	short circuit in coil of the gas valve, water on wiring or gas valve	reset BCU replace gas valve or wiring harness
3	Safety Relay Error	Failure detected in safety relay	safety relay is not working correctly	reset BCU or replace BCU
4	Blocking Too Long Error	Control had a blocking error for more than 20 hours	blocking code active for more than 20 hours	reset and check blocking code
5	Fan Not Running	Fan is not running for more than 60 seconds	electrical wiring not correctly connected, or fan is malfunctioning	Check wiring or replace Fan if not solved check fuse on BCU or replace BCU
6	Fan Too Slow	Fan runs too slow for more than 60 seconds	electrical wiring not correctly connected, or fan is malfunctioning	Check wiring or replace Fan if not solved check fuse on BCU or replace BCU
7	Fan Too Fast	Fan runs too fast for more than 60 seconds	electrical wiring not correctly connected, or fan 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	out dated E2prom	reset BCU or replace BCU
10	EEPROM Error	Wrong safety parameters in E2prom	wrongly programmed BCU or PB	reset BCU or replace BCU
11	State Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU
12	ROM Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU
15	Max. Thermostat Lock Error	The external overheat protection is enabled or the T_Supply sensor measures a temp. of over Prot_Overheat_Temp - SGOverheat_Duplex_Tolerance for a period of Max_Value_Period	Burner door clixon tripped because of overheating of the burner door or the water flow is restricted	Check burnerdoor 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
16	Max. Flue Lock Error	Flue temperature exceeded the maximum flue temperature	There is no water in the heat exchanger or flue gas sensor is malfunctioning or heat exchanger is overheated.	Check if flue sensor is working correctly if not so replace flue sensor. Check waterflow if 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

Lock out code	Error	Description	Cause	Solving
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 Error	Flame still present 10 seconds after closing the gas valve	wrong earthing of BCU and boiler / water heater	Check earthing of BCU and boiler / water heater
21	Flame Before Ignition	Flame is detected before ignition	wrong earthing of BCU and boiler / water heater	Check earthing of BCU and boiler / water heater
22	Too Many Flame Failures	Three time flame lost during 1 demand	bad gas supply or CO ₂ level is not correct or bad ignition rod	check gas supply pressure, check CO ₂ level and adjust if necessary, replace ignition rod or replace ignition cable.
23	Corrupted Error Number	Error code RAM byte was corrupted to an unknown error code.	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
27	Filling Too Much	Too many automated filling attempts in a short time period	If output is programmed as filling valve and there are to many filling attempts	Check for leaks in the central heating system or if the boiler it self 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 it self 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	Not enough water flow through the heat exchanger	Check if the general pump is running and if all valves are open to make enough flow
33	LWCO/Air intake block	Low water cut off 1 error	No water in the heat exchanger or LWCO not 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	No water in the heat exchanger or LWCO not connected	Check if there is enough water in the heat exchanger if not so fill up the system
36	Gas Pressure Error	Gas pressure switch open for more than E2_GPS_Timeout	wrong gas pressure on gas supply or gas pressure switch is not connected	Check if gas pressure is in limits of the gas pressure switch. Check cables.
38	Flue Pressure Locking	More than 3 flue pressure switch errors in 24 hrs. have occurred.	syphon is clogged	Clean syphon

17.3 Blocking codes

Code	Error	Description	Cause	Solving
100	WD Error Ram	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
101	WD Error Rom	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
102	WD Error Stack	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
103	WD Error Register	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit

Code	Error	Description	Cause	Solving
104	WD Error Xrl	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
105	High Temp Error	T_Supply sensor measures over Stay_Burning_Temp for a period of Max_Value_Period.	not enough waterflow over 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.
106	Refhi Too Hi Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
107	Refhi Too Lo Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
108	Reflo Too Hi Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
109	Reflo Too Lo Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
110	Refhi2 Too Hi Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
111	Refhi2 Too Lo Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
112	Reflo2 Too Hi Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
113	Reflo2 Too Lo Error	Internal hardware error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
114	False Flame	Flame is detected in a state in which no flame is allowed to be seen	wrong earthing of BCU and boiler / water heater	Check earthing of BCU and boiler / water heater
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 Communication Error	Watchdog communication error	wrong programmed BCU or PB	reset BCU or replace BCU and or display unit
119	T Return Open	Return sensor open	malfunctioning return sensor or not connected	check connection to BCU or check resistance NTC sensor
120	T Supply Open	Supply sensor open	malfunctioning supply sensor or not connected	check connection to BCU or check resistance NTC sensor
122	T DHW Open	DHW sensor open	malfunctioning DHW sensor or not connected	check connection to BCU or check resistance NTC sensor
123	T Flue Open	Flue sensor open	malfunctioning flue sensor or not connected	check connection to BCU or check resistance NTC sensor
125	T Outdoor Open	Outdoor sensor open	malfunctioning outdoor sensor or not connected or wrong B-mode programmed	check connection to BCU or check resistance NTC sensor or change B-mode
126	T Return Shorted	Return sensor shorted	malfunctioning return sensor or short circuiting	check connection to BCU or check resistance NTC sensor
Code	Error	Description	Cause	Solving

127	T Supply Shorted	Supply sensor shorted	malfunctioning supply sensor or short circuiting	check connection to BCU or check resistance NTC sensor
129	T DHW Shorted	DHW sensor shorted	malfunctioning DHW sensor or short circuiting	check connection to BCU or check resistance NTC sensor
130	T Flue Shorted	Flue sensor shorted	malfunctioning Flue sensor or short circuiting	check connection to BCU or check resistance NTC sensor
132	T Outdoor Shorted	Outdoor sensor shorted	malfunctioning Outdoor sensor or short circuiting	check connection to BCU or check resistance NTC sensor
134	Reset Button Error	Too many resets in a short time period	Reset many times by user or installer	wait or disconnect and reconnect power supply
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.
155	WD Config Error	Watchdog fan configuration setting error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
156	Flue Pressure Error	Flue pressure switch is closed.	Syphon clogged or vent blocked	Clean syphon. Check vent.
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 Check for leaks.
164	Ex. Low Flow Protection	Flow is too low, demand needs to be stopped with fan at ignition speed*, but no error needed to be stored at this time	not enough water flow through the 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.
167	Low Gas Pressure	The low gas pressure switch input is detected as OPEN.	Gas pressure is too low or cable is defect	Check gas pressure. Check setting gas pressure switch. Check cables.
168	Flue Temperature Too High	Flue temperature exceeded the maximum flue temperature	Flue gasses are too hot.	Clean heat exchanger.
169	ADC Unstable	ADC measurement detected too many unstable measurements.		

17.4 Warnings

Error no.	Error	Description	Cause	Solving
200	Comm. Lost with module	Cascade System: Managing cascade control lost communication with one of the depending.	connection between cascaded boiler / water heaters is interrupted or wiring is broken	Check wiring between boiler / water heater or distance between boiler / water heaters is to big
202	App. Selection Error	Unknown appliance model selected	wrongly programmed parameters	replace BCU
203	Comm. Lost with boiler	Dual Cascade System: Managing cascade control lost communication with one of the depending.	connection between cascaded boiler / water heaters is interrupted or wiring is broken	Check wiring between boiler / water heater or distance between boiler / water heaters is to big
204	T Outdoor Wrong	T_Outdoor sensor measures open/shorted	malfunctioning outdoor sensor or not connected or wrong B-mode programmed	check connection to BCU or check resistance NTC sensor or change B-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 Or wrong cascade settings (boiler cascade settings) used: set para 73 to standalone and use MODULE cascade settings for cascading
207	Heat-Exchanger protection active	The heat-exchanger protection function is actively blocking the burn demand		

18 CASCADING

18.1 System setup

NOTE: for proper functioning of the system, some settings have to be changed, see § 18.5.2 "Emergency mode".

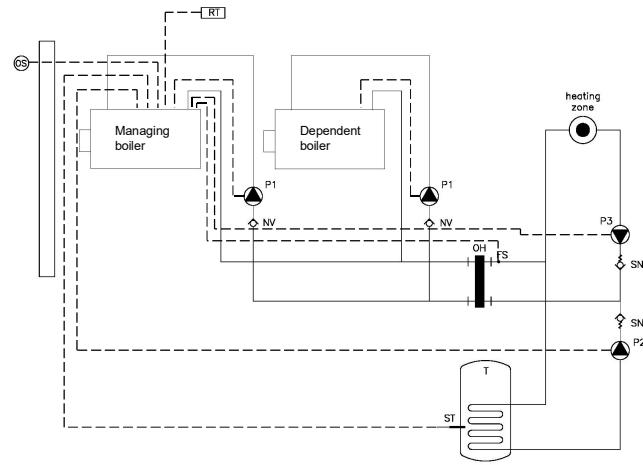
The boiler / water heater controller can control multiple boiler / water heaters in a cascade setup.

Heating Boiler

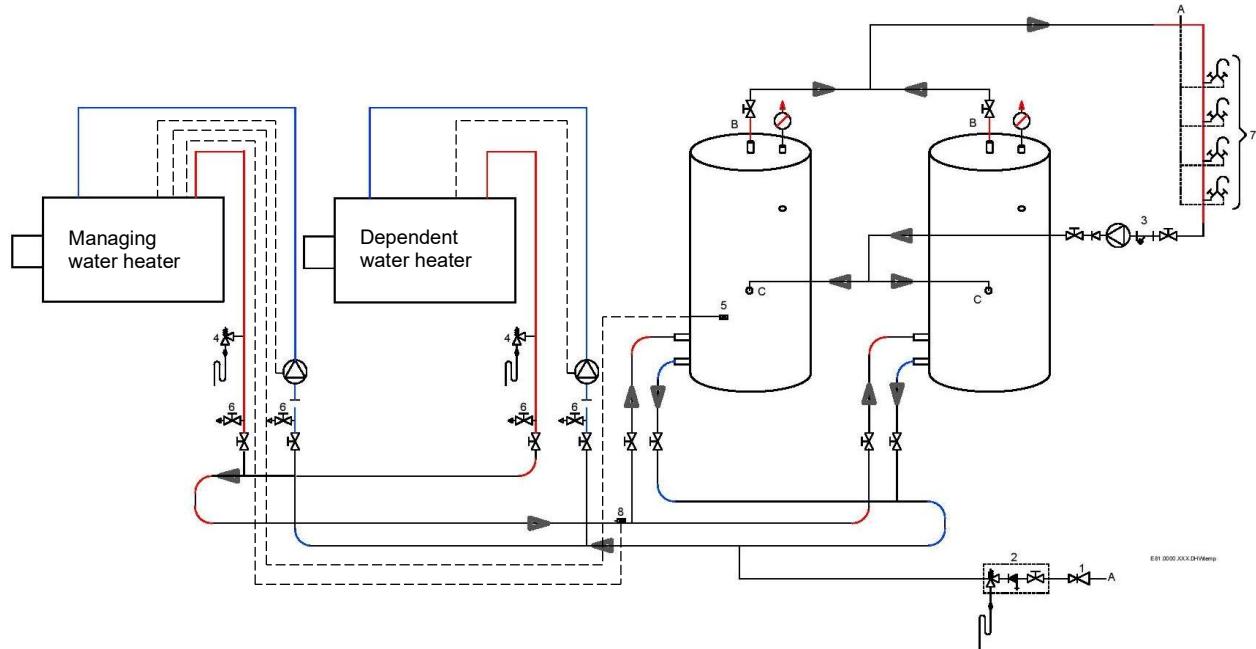
A system sensor input is available on the main board to measure the cascade system supply temperature. A pump output is also available to run the system pump, as well as an output for the DHW pump. When the CH supply temperature is calculated based on an outdoor sensor, only one outdoor sensor is needed. This sensor is connected to the managing boiler / water heater and calculates the CH setpoint for the cascade system.

A CH cascade system can be used with an DHW indirect tank. A DHW pump and sensor can be connected to the managing boiler / water heater.

All boilers handle **either** indirect tank **or** Central Heating demand at one time.



Water heater



The sensors (DHW sensor (5) and system sensor (8)) are equal to a stand-alone water heater and should only be connected to the managing water heater.

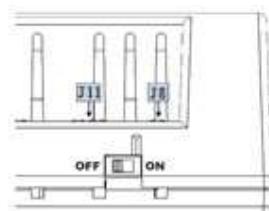
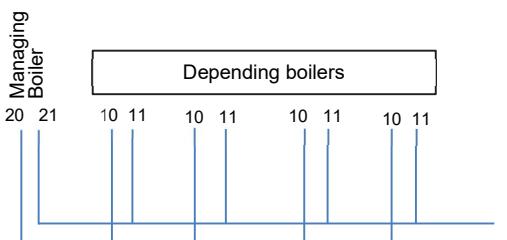
Each unit needs its own separate pump, so no additional pumps are needed. The managing water heater calculates the HW setpoint for the cascade system.

18.2 Quick-guide cascade set-up

Below a quick set-up, all settings are described in detail in the successive chapters

1. Link the boiler / water heaters with a 2-wire cable in parallel.

Connect 20 on the managing boiler / water heater to 10 on the dependent boiler / water heaters and connect 21 on the managing boiler / water heater to 11 on the dependent boiler / water heaters.



2. Set the switch "bus power" at the side of the controller to the off position.

Note the line of the bottom of the controller on above picture to determine the off position.

3. Change the burner address on every boiler / water heater that is part of the cascade

Parameter: Menu - Settings - Boiler settings - **Module Cascade Settings** - Parameter 184 (Burner Address) (**DO NOT USE Boiler Cascade Settings**)

On managing boiler / water heater: set as manager

On dependent boilers / water heaters: set as dep 2, dep 3 etc.

4. Change number of units on manager boiler / water heater only

Parameter: Menu - Settings - Boiler settings - Module Cascade Settings - Parameter 147 (Number of units)

On managing boiler / water heater: set at total amount of units that are part of the cascade (= managing + amount of dependents)

On dependent boiler / water heaters: set at 1 (= default setting)

5. Select correct CH / DHW mode on managing boiler / water heater only

Parameter: Menu - Settings - Boiler settings - Boiler parameters - Parameter 1 (CH mode)

CH mode 0 – Central Heating demand with thermostat control

CH mode 1 – Central Heating with an outdoor temperature reset and thermostat control

CH mode 2 – Central Heating with full outdoor temperature reset

CH mode 3 – Central Heating with permanent heat demand

CH mode 4 – Central Heating with analog input control (0-10V) of setpoint

CH mode 5 – Central Heating with analog input control (0-10V) of power output

DHW mode 1 – Storage with sensor

6. Connect required sensors to the managing boiler / water heater only

DHW temperature sensor required at Low voltage connections 5 and 6.

System temperature sensor required at Low voltage connections 3 and 4.

7. Deactivate de-air on managing boiler / water heater only after de-airing the boiler / water heaters and system

Parameter: Menu - Settings - Boiler settings - Boiler parameters - Parameter 139 (Dair active)

On managing boiler / water heater: set to No

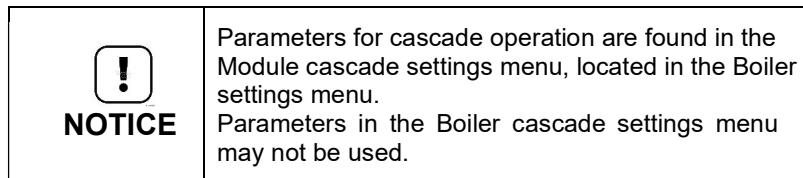
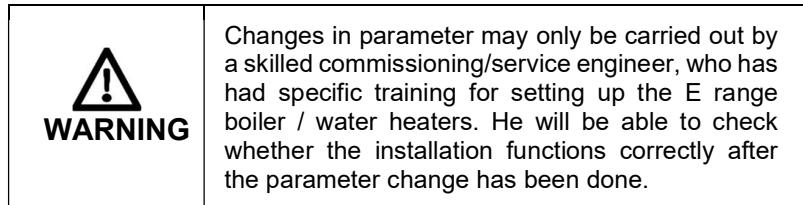
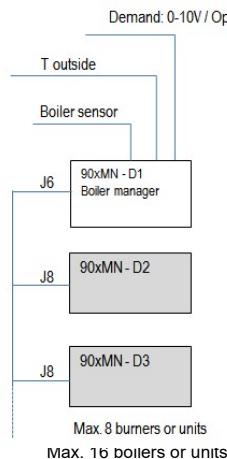
18.3 Boiler cascade communication setup.

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

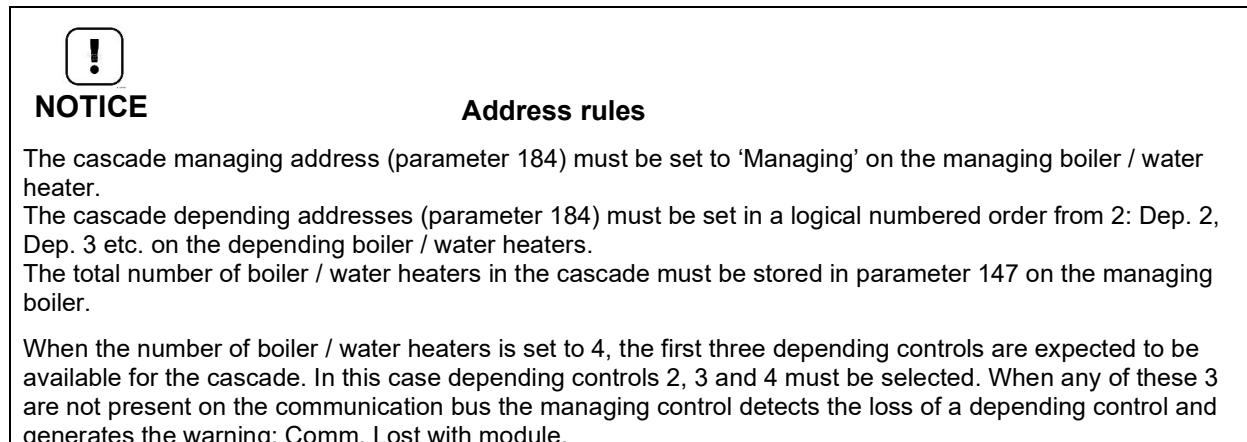
It is important that the power on the 10-11 connection terminals on all dependent boiler / water heaters is switched to the OFF position (see also § 18.2.1).

All boiler / water heaters in the cascade system must have a unique address selected (see also § 18.2.1).

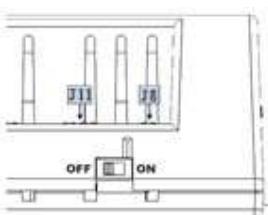
Before commissioning a cascade installation, a number of parameters have to be changed. These parameters can be programmed on the unit itself.



18.3.1 SETTING THE BOILER ADDRESS



The managing boiler / 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 boiler / water heaters are all parallel connected to the managing boiler / water heater communication bus.



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

18.3.2 SETTING OF THE CASCADE PARAMETERS

Enter the main menu by pushing the menu button now select settings by toggling the up and down arrow and enter settings by pushing the enter button.



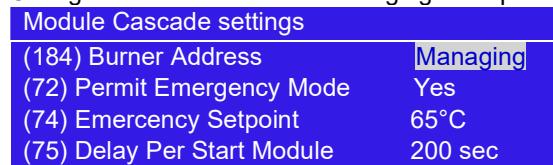
Now select Boiler Settings



Select the Module Cascade Settings



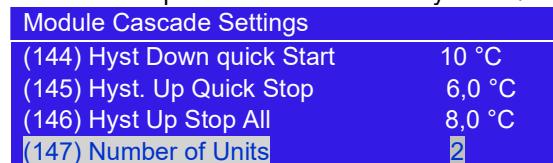
Change burner address into Managing or Dependent



This setting can be changed on the controller.

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

Now select in parameter 147 how many boiler / water heaters (units) are in the cascade



18.3.3 CASCADE – HEATING ONLY

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

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

Based on the system temperature (T_System) and the requested Cascade_Setpoint the managing boiler calculates a required boiler setpoint, to achieve the requested Cascade_Setpoint.

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

Cascade CH setpoint adaption

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

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

Dependent Boiler

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

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

Boiler input Rates

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

18.3.4 CASCADE – HEATING AND DHW

Domestic hot water

When an indirect tank is attached, in the installer DHW menu of the managing boiler controller the DHW_Mode must be set. Available DHW modes in boiler cascade are mode 1 = sensor or 2 = aquastat (see § 14.9 "Demand for Domestic Hot Water").

Dependent Boiler

In case a boiler is set as dependent (parameter 184: "Burner address") the DHW setpoint is always provided by the managing boiler, the internal control of the setpoint functions are disabled.

Managing Boiler

If there is a request for a "Store Warm Hold" for the tank and no central heating request the managing boiler is going to burn for the DHW tank. The heating of the DHW tank is interrupted when there comes a central heating request and the managing boiler and cascade are burning for the central heating system.

DHW priority

The boiler cascade system has multiple options for priority and parallel DHW and heating.

The following levels of priority are configurable (and possible):

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

Relevant variables

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

18.3.5 CASCADE – DOMESTIC HOT WATER ONLY

When a water heater is set as Managing (Address = 1), the controller of this water heater will control the cascade. The DHW mode of this managing water heater applies to all other water heaters. Therefore, in the installer DHW menu of the managing water heater control the DHW_Mode should be set.

Available DHW mode in cascade is mode 1 only.

- The system sensor (T_System) connected to the managing water heater will be the control sensor for the cascade supply temperature.

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 the measured system temperature.

18.3.6 CASCADE – START/STOP SEQUENCE

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

Quick Starting and Stopping Boiler / 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.

18.3.7 CASCADE – POWER BALANCE MODE

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

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

18.4 Cascade – Boiler rotation

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

The parameter Boiler_Rotation_Interval sets the number of days after which the sequence is updated. When Boiler_Rotation_Interval is set to 0 boiler / water heater rotation is disabled.

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

Days	Start/Stop sequence
Day 0-5	1-2-3-4-5-6..x
Day 5-10	2-3-4-5-6..x-1
Day 10-15	3-4-5-6..x-1-2
Day 15-20	4-5-6..x-1-2-3
Day 20-25	5-6..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 boilers are rotated the parameter First_Dependent_To_Start is automatically updated to the next depending. When boiler 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 will start cascade demand generation with the new selection for First_Dependent_To_Start.

18.4.1 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	Parameter nr.	Level	(Default) Value	Range
Module_Rotation_Interval	84	2: Installer	5	0...30 (0: Disabled)
First_Dependent_To_Start	149	2: Installer	1	1...8/16

18.5 Cascade Error handling

18.5.1 CASCADE FROST PROTECTION

Frost protection on a cascade is active on two levels

1. Frost protection for cascade

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

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

2. Frost protection on boiler / water heater

As last protection the controllers for the boiler / water heaters can force themselves to burn.

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

Specific Parameters	Parameter nr.	Level	(Default) Value	Range
Cascade frost protection Temperature for frost protection	155	2: Installer	59 °F (15 °C)	50...86 °F (10...30 °C)
Boiler / water heater frost protection Temperature for frost protection	205	2: Installer	59 °F (15 °C)	50...86 °F (10...30 °C)

18.5.2 EMERGENCY MODE

Managing boiler / water heater error

When the managing boiler / water heater is in error mode, the depending boiler / water heaters 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 boiler / water heaters start burning on this setpoint.

NOTE: the default emergency setpoint is 158 °F (70 °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	158 °F (70 °C)	68 - 194 °F (20 - 90 °C)	Module Cascade parameter 74
Dair active	Installer	Yes	Yes / No	Boiler parameter 139

For proper functioning of this emergency mode, the following settings are necessary in the managing boiler / water heater (installer password required):

- Module Cascade parameter no. 72: "Permit_Emergency_Mode" has to be set on "yes".
- Module Cascade parameter no. 74: "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 boiler / water heaters !

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

18.5.3 LOSS OF CASCADE COMMUNICATION

The burner controller of the managing boiler / water heater 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 must 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.

19 SYSTEM TEST.

For testing the system at fixed power rates, a system test can be activated via the Installer menu on the PB, or via the touchscreen. Via the system test the boiler / water heater can be started without CH or DHW demand being present. The system test has priority.

The following modes are available:

System test mode		Description
0	Not active	System test mode not active
1	Fan only	The fan is forced to run at maximum speed without starting the boiler / water heater
2	Low power	The boiler / water heater starts and after the ignition period has finished the boiler / water heater stays at low power
3	Ignition power	The boiler / water heater starts and stays at ignition power
4	High power	The boiler / water heater starts and after the ignition period has finished the boiler / water heater stays at high power
5	High power limited	The boiler / water heater starts and after the ignition period has finished the boiler / 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 boiler / water heater will switch OFF. When the supply temperature cools down to 194 °F (90 °C) the boiler / water heater will start again.

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

As the boiler / 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.

20 COMMISSIONING THE BOILER / WATER HEATER

20.1 First: flushing the boiler with water

After installation of the boiler the first step, before commissioning, is to flush the boiler 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 boiler 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 boiler. NEVER leave a system cleaner for longer than recommended by the manufacturer of the cleaner. Never put system cleaner inside the boilers heat exchanger.

20.2 Second: filling & venting the boiler and the system

After flushing the boiler and the installation the system can be filled with fresh water. Fill the boiler and the heating system by using the appropriate filling valve. The water pressure of the system normally lies between 22 and 40 psi (1.5 and 2.0 bar) – see § 7.20 'Water pressure'

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

20.3 Third: check the water flow

Before starting the boiler 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.

20.4 Mounting Condensate Trap

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

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

20.5 Checking gas pressure

Check the gas pressure available at the gas connection pipe of the boiler / water heater when it is at high fire. 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

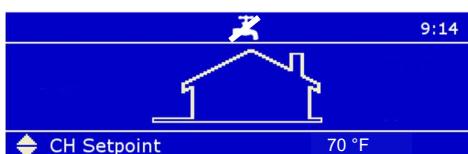
20.6 Firing for the first time

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

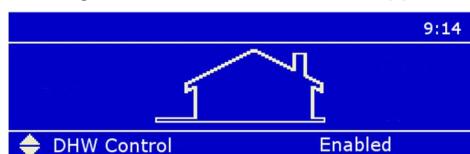


This screen is active during power up and will remain active until communication with the main Control has been established.

After communication has been established one of the following Status overview screens appears:



OR



Central Heating AND Domestic Hot Water

The display describes:

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

21 ADJUSTING AND SETTING THE BOILER / 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, personal injury or loss of life.



As soon as the appliance has been fully installed (with regard to hydraulics, filling and de-aeration of installation, gas, flue gas, air intake, wiring etc.) according to the preliminary installation instructions, the boiler / water heater may then be wired to an electrically grounded power supply source. The boiler / water heater should always be connected to a disconnect or external power shutoff. The boiler / 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.

21.1 Introduction

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

- A new boiler / water heater is installed
- As part of a service/maintenance check, in case the O₂ / 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 21.5
- The fan has been replaced

In any of the cases described, always check the gas/air ratio of the combustion figure (O₂) at maximum and minimum input. First set the boiler / 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 § 21.1.1. A drawing of the gas valve(s) and setting screws is given in § 21.1.2. In § 18.2 a general procedure, conform which the adjustments must be carried out, is presented. § 21.3 describes the specific adjustments to be made when the venturi is replaced, and § 21.4 describes the changes needed when the gas type is set to propane.

21.1.1 COMBUSTION TABLE

Table: O₂ / CO₂ values for maximum and minimum load. O₂ settings are leading; CO₂ settings are reference values.¹⁾

Attention: The O₂ difference between High Fire and Low Fire should be minimal the difference mentioned in the table above, independent of the allowed tolerance. Eg. 6.5 – 5.2, the difference must be min. 1.3% O₂

Gas type ¹⁾	boiler / wa-	O ₂ [%] ($\pm 0.2\%$)		CO ₂ [%] ($\pm 0.1\%$)	
		max input	min input	max input	min input
Natural gas	E-1250	5.2	6.5	8.8	8.1
	E-2000	5.2	6.5	8.8	8.1
	E-3000	4.7	6.5	9.1	8.1
	E-4000	4.7	6.5	9.1	8.1

	boiler / wa-	O ₂ [%] ($\pm 0.2\%$)		CO ₂ [%] ($\pm 0.1\%$)	
		max input	min input	max input	min input
Propane	E-1250	6.0	7.8	9.8	8.6
	E-2000	6.0	7.8	9.8	8.6
	E-3000	5.4	6.9	10.2	9.2
	E-4000	5.4	6.9	10.2	9.2

21.1.2 COMBUSTION TABLE LOW NOx

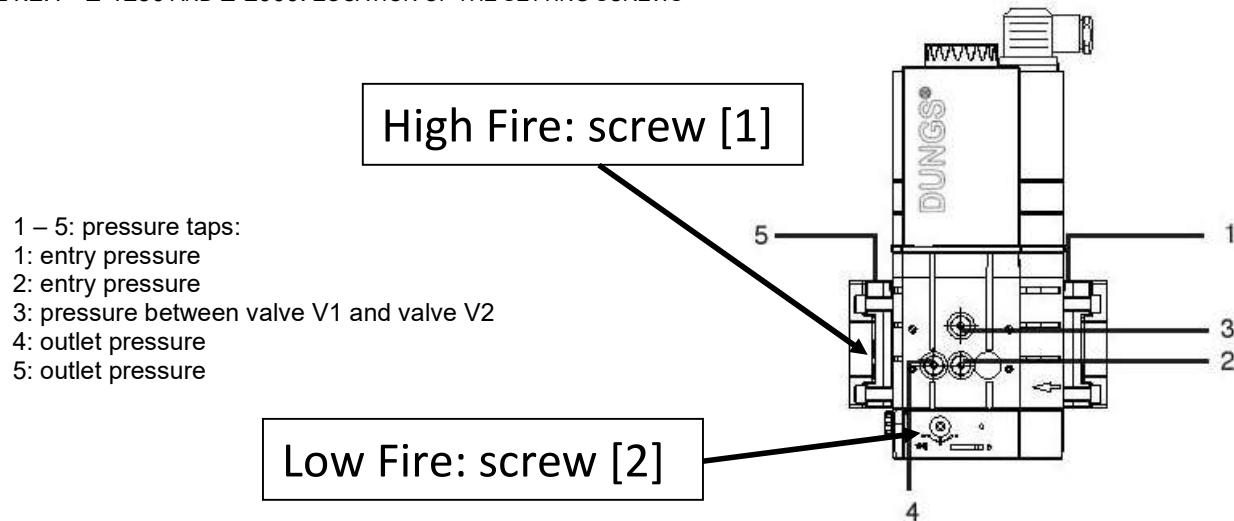
It is possible to adapt the boiler / water heater to Low NOx operation with the following settings:

- For E-1250 and E-2000, below settings result in less than 20 ppm NOx at 3%O₂
- For E-3000 and E-4000, below settings result in less than 9 ppm NOx at 3%O₂

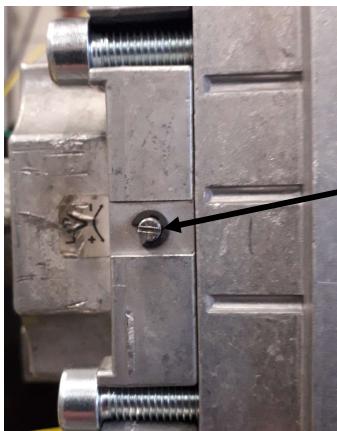
Gas type ¹⁾	boiler / wa-	O₂ [%] (±0.2%)		CO₂ [%] (±0.1%)	
		max input	min input	max input	min input
Natural gas	E-1250	6.3	7.2	8.1	7.6
	E-2000	6.3	7.2	8.1	7.6
	E-3000	7.5	8.3	7.5	7.1
	E-4000	7.5	8.3	7.5	7.1

21.2 Setting screws gas valves: drawings

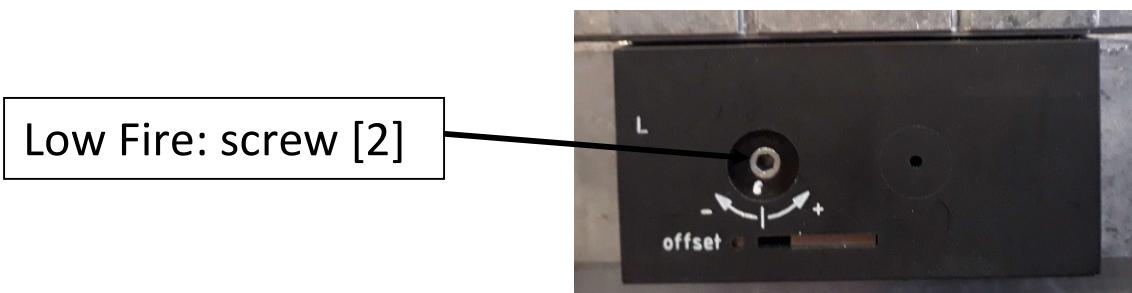
21.2.1 E-1250 AND E-2000: LOCATION OF THE SETTING SCREWS



High Fire: adjustment screw: use small flat screwdriver

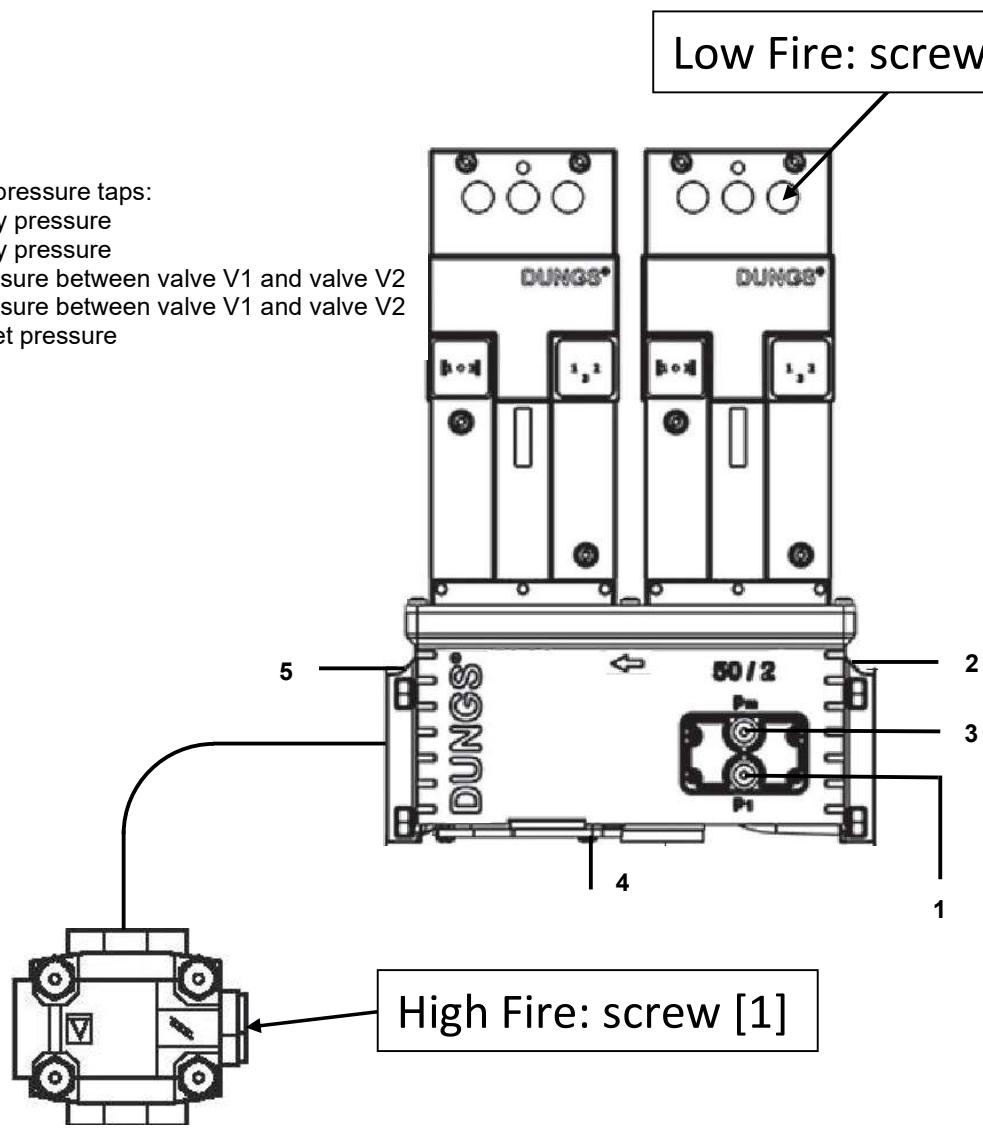


Low Fire: adjustment screw: use Allen key 2 1/2 mm.



21.2.2 E-3000 AND E-4000: LOCATION OF THE SETTING SCREWS

1 – 5: pressure taps:
 1: entry pressure
 2: entry pressure
 3: pressure between valve V1 and valve V2
 4: pressure between valve V1 and valve V2
 5: outlet pressure

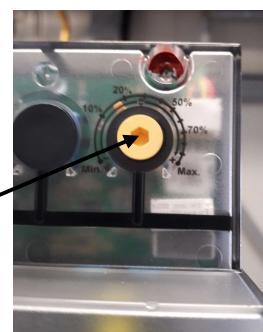


High Fire: adjustment screw: use Allen key 2 ½ mm



High Fire: screw [1]

Low Fire: adjustment screw: use Allen key 4 mm



Low Fire: screw [2]

21.3 Adjustment procedures

21.3.1 E-1250 AND E-2000: COMBUSTION ADJUSTMENT

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   to select "System Test" Press CONFIRM 
3. Password needed to continue
4. Press CONFIRM  to activate the test state. → "Test State: **Off**"
5. Press UP/DOWN   multiple times to select "High Power" → "Test State: **High Power**".

The steps 1-5 can also be performed with the touch screen, and without password, see Chapter 15.

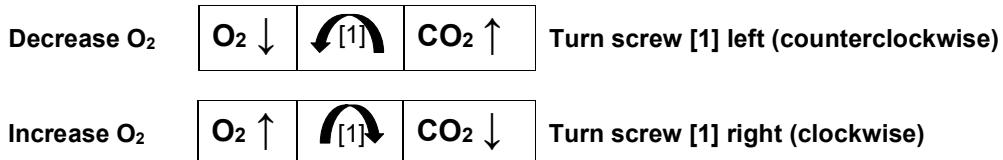
The boiler / water heater becomes active. After some time, the boiler / water heater burns at high fire.

If the boiler / water heater doesn't start, open screw [1] a quarter of a turn extra - counterclockwise

Note: once the test state is active, it is not necessary to press a button, selecting the desired power is sufficient. Wait a for the boiler / water heater to stabilize before taking combustion readings between changes and adjustments to the combustion.

6. Measure the O₂ percentage at the flue gas test port on the vent connection.
7. By setting screw [1], adjust the gas valve to obtain the O₂ value of the table in § 21.1.1 or § 21.1.2.
8. To return to the status screen, and stop the boiler / 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 restarted.

Procedure 2: adjust at Low Fire

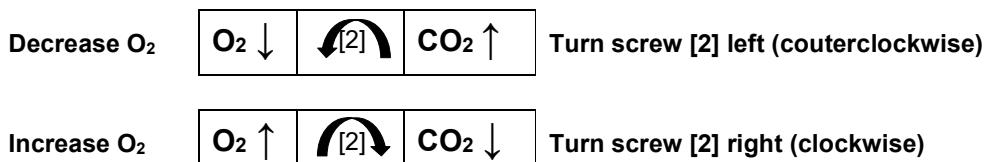
Carry out the next steps:

1. Press UP/DOWN   multiple times to select "Low Power" → "Test State: **Low Power**".

Step 1 can also be performed with the touch screen, see Chapter 15.

Wait for the boiler / water heater to stabilize.

2. Measure the O₂ percentage at the flue gas test port on the vent connection.
3. By setting screw [2], adjust the gas valve to obtain the O₂ value of the table in § 21.1.1 or § 21.1.2.



4. To return to the status screen, and stop the boiler / 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 § 21.1.1. values best

21.3.2 E-3000 AND E-4000: COMBUSTION ADJUSTMENT

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   to select "System Test" Press CONFIRM 
3. Password needed to continue
4. Press CONFIRM  to activate the test state. → "Test State: Off"
5. Press UP/DOWN   multiple times to select "High Power" → "Test State: High Power".

The steps 1-5 can also be performed with the touch screen and without password, see Chapter 15.

The boiler / water heater becomes active. After some time, the boiler / water heater burns at high fire. If the boiler / water heater doesn't start, open screw [1] a quarter of a turn extra - counterclockwise. Note: once the test state is active, it is not necessary to press a button, selecting the desired power is sufficient. Wait for the boiler / water heater to stabilize before taking combustion readings between changes and adjustments to the combustion.

6. Measure the O₂ percentage at the flue gas test port on the vent connection.
7. By setting screw [1], adjust the gas valve to obtain the O₂ value of the table in § 21.1.1 or § 21.1.2.
8. To return to the status screen, and stop the boiler / water heater, press ESCAPE  or MENU  3 times, or RESET  once.

Decrease O ₂	  	Turn screw [1] left (counterclockwise)
Increase O ₂	  	Turn screw [1] right (clockwise)

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   multiple times to select "Low Power" → "Test State: Low Power".

Step 1 can also be performed with the touch screen, see Chapter 15.

Wait for the boiler / water heater to stabilize.

2. Measure the O₂ percentage at the flue gas test port on the vent connection.
3. By setting screw [2], adjust the gas valve to obtain the O₂ value of the table in § 21.1.1 or § 21.1.2.

NOTE: Be careful, screw 2 is very sensitive

Decrease O ₂	  	Turn screw [2] right (clockwise)
Increase O ₂	  	Turn screw [2] left (counterclockwise)

4. To return to the status screen, and stop the boiler / 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 the table values best.

21.4 Conversion from natural gas to propane

 WARNING	<p>Conversion of the boiler / water heater to a different gas type must be performed by a certified technician.</p> <p>Parameter 92 and 93 must be set correctly!</p> <p>Wrong setting can lead to damage to the appliance or shorten the lifespan of the appliance!</p> <p>The warranty of the device will expire if a wrong selection has been made.</p>
---	--

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

1. Set fan speed: parameter 92 and 93
2. Adjust the O₂ percentage
3. Check the gas pressure
4. Change the setting of the the low gas pressure switch
5. Confirmation: apply the propane sticker and mark the boxes.

1. Set fan speed

The fan speed has to be changed in the software of the boiler / water heater according to the tables below.:

Boiler / water heater type	fan speed high fire parameter 92 propane	fan speed high fire parameter 92 natural gas	Fan speed low fire parameter 93 propane	Fan speed low fire parameter 93 natural gas
E 1250	5100	5300	1200	950
E 2000	4450	4300	900	700
E 3000	4300	4150	850	750
E 4000	5050	5200	850	850

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

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

2. Adjust the O₂ percentage

Perform O₂ adjustments according to the procedures in the installation manual; § 21.2, using the propane values in table § 21.1.1.

3. Check the gas pressure

Measure the gas pressure at high fire. The dynamic pressure should be at least 8.0 inch w.c. (19.9 mbar). If there are more boiler / water heaters in the boiler / water heater room the dynamic gas pressure should be checked on the boiler / water heater at the end of the gas line, with all boiler / water heaters burning at high fire. If the gas pressure is too low, check gas lines, reducers and propane tank.

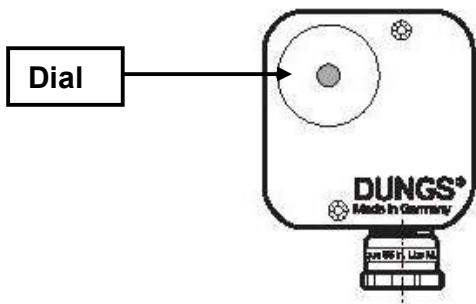
4. Change the setting of the low gas pressure switch

Because the minimum gas pressure for propane is higher than for natural gas, the setting of the gas pressure switch at the right side of the gasvalve needs to be changed.

	Setting low gas pressure switch (In. W.C.)	Setting high gas pressure switch (In. W.C.)
E 1250, E 2000, E 3000, E 4000	Natural gas: 2" * LP gas: 6"	Natural gas: 2" * LP gas: 2"

* Factory set setpoint

How to set the low gas pressure switch when the gas type is changed:



1. Remove the cover from the gas pressure switch
2. Turn the dial to the new pressure
3. Remount the cover

5. Confirmation

When finished:

- Apply the corresponding sticker at the appropriate position in the boiler / water heater.
- Mark the box for the used gas type.
- Mark the box "Type", indicating that the correct parameter values have been set for this boiler / water heater



Please ensure the boiler / water heater is clearly labelled if operating on propane supply!

21.5 Start Up Checklist

Installation/start-up checklist

Installer information		Site information	
Company		Site name	
Engineer name		Site contact (owner/enduser)	
Address		Address	
Postal code		Postal code	
City		City	
State/province		State/province	
Telephone number		Telephone number	

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



After filling in form
please send a
copy to address:

Hubbell Heaters.

P.O. Box 288
Stratford, CT
06615, USA

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		
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 the common flue system?		
Flue outlet pressure (on top of boiler)		

Condensate Drain	
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 boiler to drain piping exit point	
Any additional trap points?	(YES / NO)
Perform PH test and register PH value	
Condensate neutralizer installed	(YES / NO)

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

Gas supply	
Type of gas	
Is the gas isolation valve installed 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 boiler?	(YES / NO)
If YES what is the length of the Gas piping in between?	
If YES what is the Brand & Model?	

Combustion settings		unit:
Set for NG (Natural Gas) or LP (Liquid Propane)?	NG or LP?	
O2 level at high fire ...%		%
O2 level on low fire ...%		%
Flue pressure @ O2 measuring point at high fire		Pa
Flue pressure @ O2 measuring point at low fire		Pa
If cascaded with 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 measured between Ground and Neutral		V
Total amperage switched by the Boiler Control is below 3.5 A or 400 W?		A

Additives	
Used chemical additions	
Mixing Ratio	

22 INSPECTION, MAINTENANCE AND SERVICE.

22.1 General

For a good, safe and long-time operation of the boiler and to maintain warranty it is mandatory to carry out inspection, maintenance and service on the boiler / water heater at least once a year and/or after 2000 burning hours maximum, whichever comes first..

Inspection, maintenance and service of the boiler / water heater should also be carried out on the following occasions:

- When a number of similar error codes and/or lock-outs appear.
- At least every twelve months and/or after 2000 burning hours maximum, whichever comes first, 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 boiler / water heater is once a year and/or after 2000 burning hours maximum, whichever comes first. Every year the boiler / water heater should be cleaned and checked, according to the maintenance procedures. If there is doubt whether the boiler / 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 and/or after 2000 burning hours maximum, whichever comes first.



INSPECTION, MAINTENANCE AND SERVICE MUST BE EXECUTED FOR A SAFE AND EFFICIENT OPERATION OF THE BOILER.

"Caution: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

"Verify proper operation after operation servicing."

22.2 Safety instructions Crystalline Silica



Warning

Crystalline Silica – Read instructions below carefully

Refractory Insulation

The refractory insulation of the heat exchanger (located on the rear wall inside the heat exchanger and burner door) must be inspected. If this insulation disk shows any signs of (water) damage or degradation it 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 / water heater 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 on page 125 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 § 20.2 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 boiler / 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 boiler / 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>.

22.3 Inspection, maintenance and service.

Inspection, maintenance and service including the replacement of boiler / 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 boiler / 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.)
- O₂ / CO₂ % at high and low fire
- Gas Pressure at high fire
- Gas Pressure at low fire
- pH of the water or water/glycol in the system
- name of service company
- date of service

During maintenance, the following items in bold listed below of the boiler / water heater must be checked and inspected.

NOTICE: Before starting to work on the boiler / water heater:

- Switch off the electrical power to the boiler / water heater (service switch and/or unplug boiler / water heater)
- Close the gas valve at the back of the boiler / 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 boiler / water heater control

This information can be used to specify the maintenance and service proceedings in relation to the boiler / water heater (parts).

Boiler 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 15 psi (1.0 bar) and at a maximum of 160 psi (11.0 bar) in normal operation. When the water pressure drops below the minimum occasionally, there might be a water leak. Check the boiler / water heater and the complete heating installation for any water leakages and have these repaired.

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 back side of the boiler / 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.

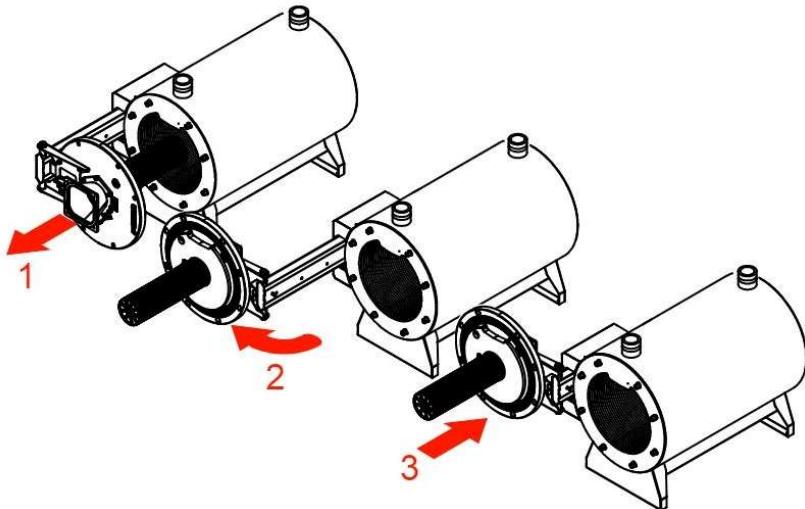
Check to ensure there are no obstructions for the exhaust venting or the intake combustion air venting. Check that all intake and exhaust venting has been properly reassembled and sealed before leaving the job site.

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.

Open burner unit

To open the heat exchanger for an internal check: remove the eight M14 nuts (Allen key 12 mm), the ignition cables, the thermal fuse cables, the gas switch cables and the gas valve cables. Close the gas tap behind the boiler / water heater and loosen the right side flange on the gas valve (Allen key 6 mm). Unplug both of the electrical and controlling cables of the fan. After all this open the heat exchanger.



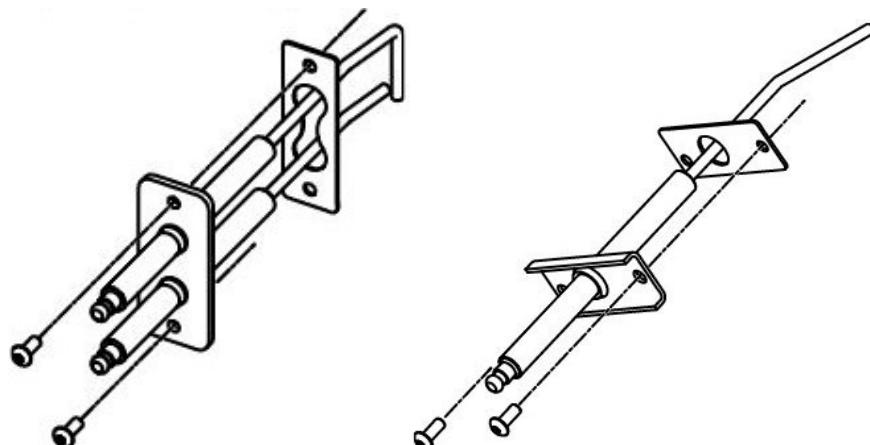
 WARNING	Warning Crystalline Silica – Read instructions of § 22.2 carefully
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Burner

Check the burner surface to see if it has damage, 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 is 5-10 mm, and between the electrode and the burner is 8-10 mm. When these distances 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.



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 new burner door's thermostat with a torque of 2 Nm.
- Reconnect the wiring.



Burner door gasket

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

Burner door gasket replacement:

- Remove the old gasket
- Place the new gasket in its groove.



Fiber braid rope replacement

If the high temp braided rope is damaged and needs to be changed, it has to be replaced by a new rope using the method described below. **Notice:** only use the braided rope that is supplied by the boiler / water heater manufacturer.

- Remove the braided rope by sliding under the periphery a thin tool (e.g. screwdriver) to loosen the braided rope and remove it.
- Remove and clean the residues of the rope
- Engage the new high temp braided rope



Warning

Crystalline Silica – Read instructions of § 22.2 carefully

Rear wall insulation disk; changing procedure:

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

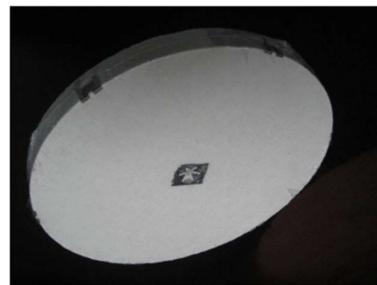
- be sure the heat exchanger is cooled down, wait a few hours after burning. In this way, the protective film of the new disk will not stick to the back wall of the heat exchanger.
- make the insulation wet, by spraying water over it. This in order to keep airborne dust to a minimum.

- 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 electrodes
- loosen the 4 clamps that hold the insulation. (Allen key 3 mm)
- Lift the insulation carefully, do not touch the burner surface



Install the new insulation:

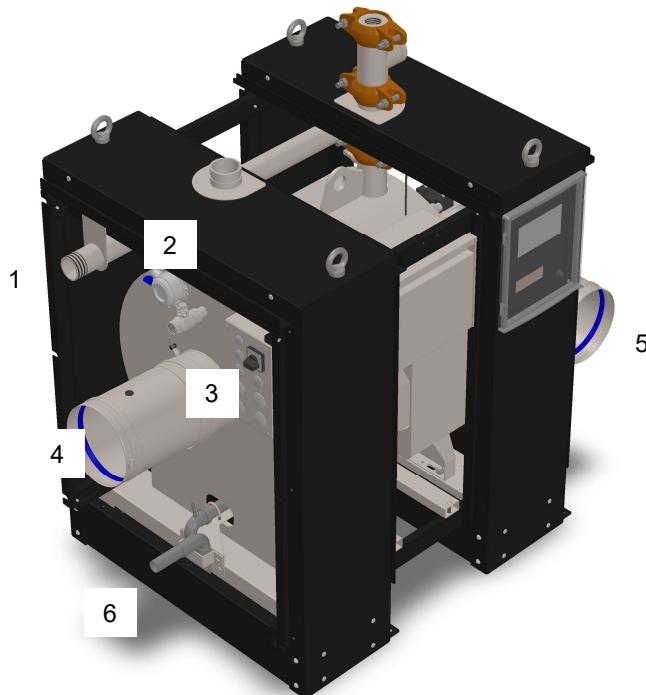
- make sure that the burner is in proper condition, remove any possible insulation residues on the burner.
- transport the insulation over the burner to the burner door
- engage the insulation carefully.
- install the 4 clamps to hold the insulation
- check the condition of the ignition electrode, if necessary replace it
- reinstall electrodes and mount the burner door correctly back onto the heat exchanger, taking in account the correct torque values, see § 22.3.1

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 boiler / water heater.

Condensate trap

The condensate trap is situated at the back panel.



- 1 – Gas line
- 2 – Flue pressure switch
- 3 – Cable input
- 4 – Flue
- 5 – Air entry
- 6 – Condensate trap



The condensate trap can be twisted one quarter turn to the left, after which it can be pulled off.

Check the condensate trap for any blocking or pollution and clean it (if necessary). After remounting the condensate trap, check the functioning of it by pouring clean tap water in the boiler / water heater combustion chamber (when the 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 re mounting the condensate trap, before commissioning the boiler / water heater and/or after maintenance, the condensate trap must ALWAYS be <u>completely</u> 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.
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Heat exchanger and boiler / 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 boiler / 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 boiler / water heater always check the gas/air ratio by measuring the O₂ percentage (flue gas) at the maximum and minimum load of the boiler / water heater. In case you have an outdoor version, take off the front panel before measuring. If necessary, adjust these values. See for information "Adjusting and setting the boiler / water heater" chapter 21.

Pump (supplied separated from the boiler / water heater)

Check the electrical parts and the motor of the pump for correct functioning. The pump must generate a sufficient water flow over the (heat exchanger of) the boiler / 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	<ul style="list-style-type: none">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 boiler / 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 boiler / water heater again.Cleaning the combustion chamber and heat exchanger with acid or alkali products is prohibited.
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22.3.1 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:

- Swing the door so that the burner points in the direction of the heat exchanger.
- Push the burner door onto the heat exchanger. Lift the door so that the holes fit on the burner door.
- Place the M14 bolts and tighten them. The specified torque value for tightening the burner door flange bolts is 700 lb inch (**80 Nm**)
- Reconnect the gas line.
- Reconnect the fan, the igniters, the gas valve etc.
- Start the boiler / water heater and check for gas leaks.

22.4 Maintenance Checklist

 WARNING	<p>Allowing the boiler / 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 boiler / water heater failure, property damage, personal injury, or loss of life.</p> <p>Such product failures ARE NOT covered under warranty</p>
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Periodic maintenance should be performed once a year and/or after 2000 burning hours maximum, whichever comes first, 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 boiler / water heater may result in a hazardous condition.

Maintenance Table

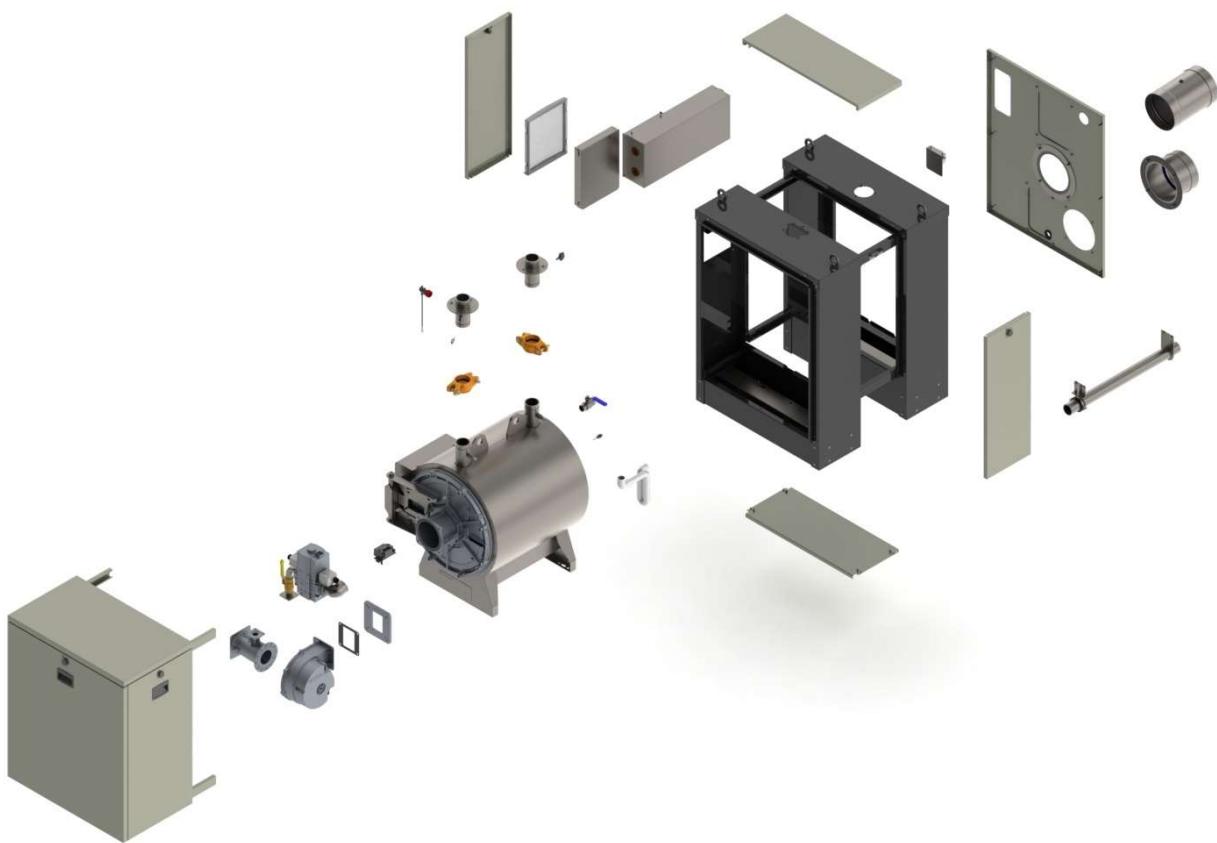
Inspection Activities		Date Last Completed			
		1 st Year	2 nd Year	3 rd Year	4 th Year
Near boiler piping	Check system and boiler piping for any sign of leakage. Take off top plate and inspect connections in boiler for any leaks or corrosion				
Vent	Check condition of all vent pipe and joints				
	Check to ensure vent termination is not blocked or obstructed				
Gas	Check gas piping, test for leaks and signs of aging. Record gas pressure and note pressure drop upon start-up. Record O2 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.				
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				
Low water cut-off	Check the LWCO is not leaking and check for right functioning by draining the water from the boiler.				
Homeowner	Question owner before maintenance if they have any issues and after done, confirm activities you performed during maintenance visit				
Chemical additions	Check the chemical additives and add or renew if the mixing ratio is out of spec.				
Mixing Ratio					

23 USER INSTRUCTIONS

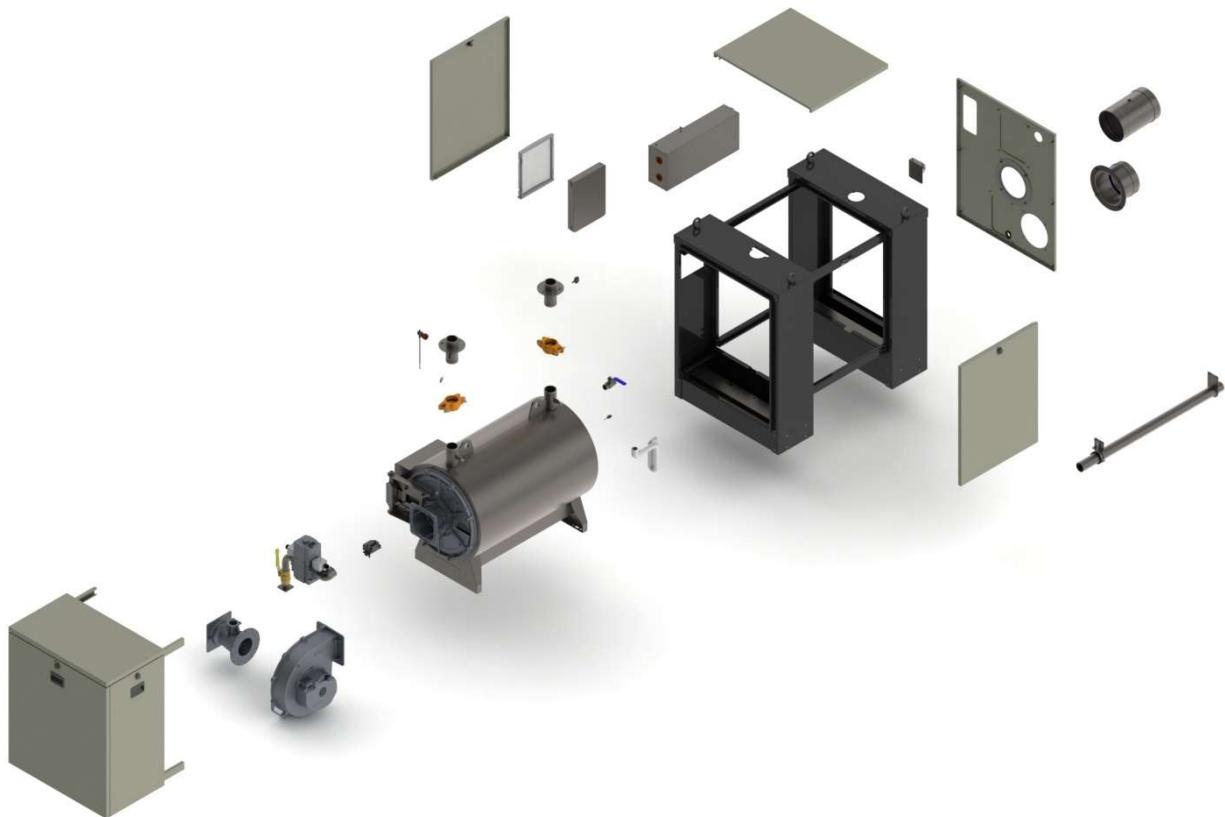
After installing and commissioning of the boiler, demonstrate the operation of the entire central heating system to the end-user. The user should be made familiar with all safety precautions of the boiler and the installation. The user should be instructed that service and maintenance of the boiler is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

24 SPARE PARTS.

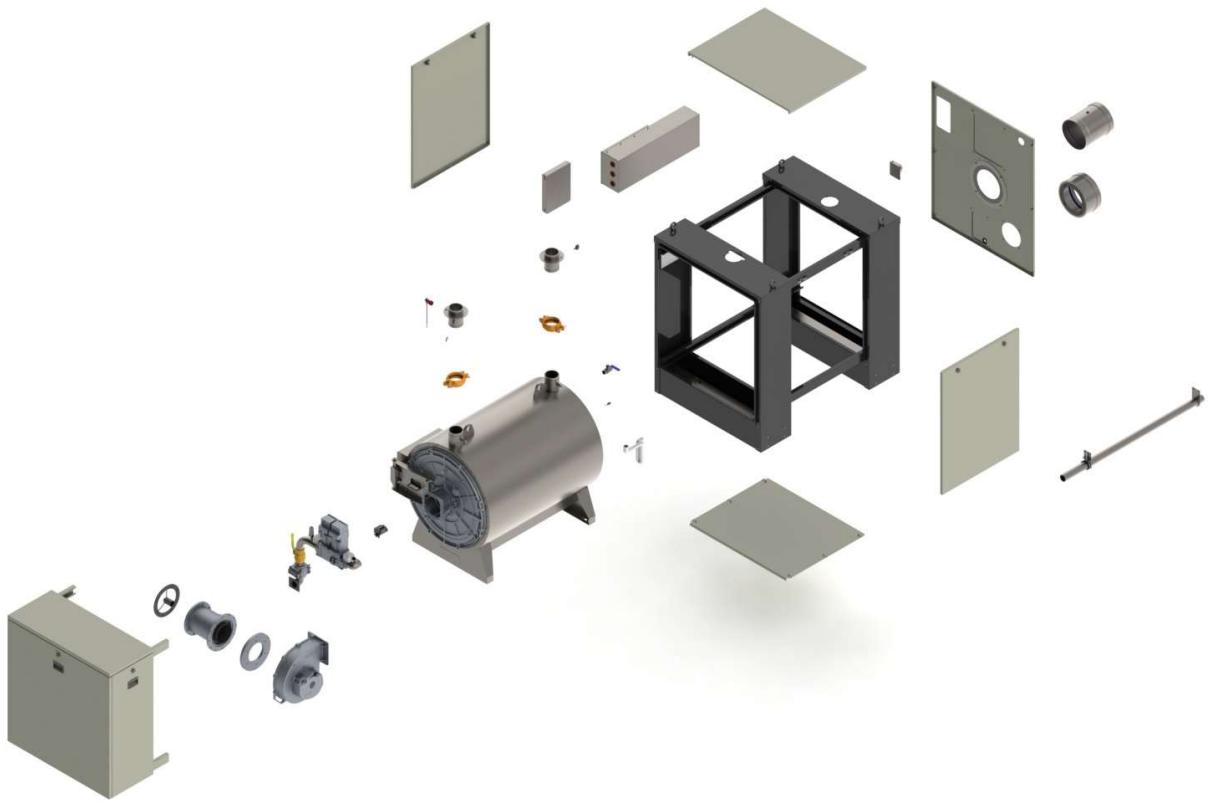
24.1 E-1250



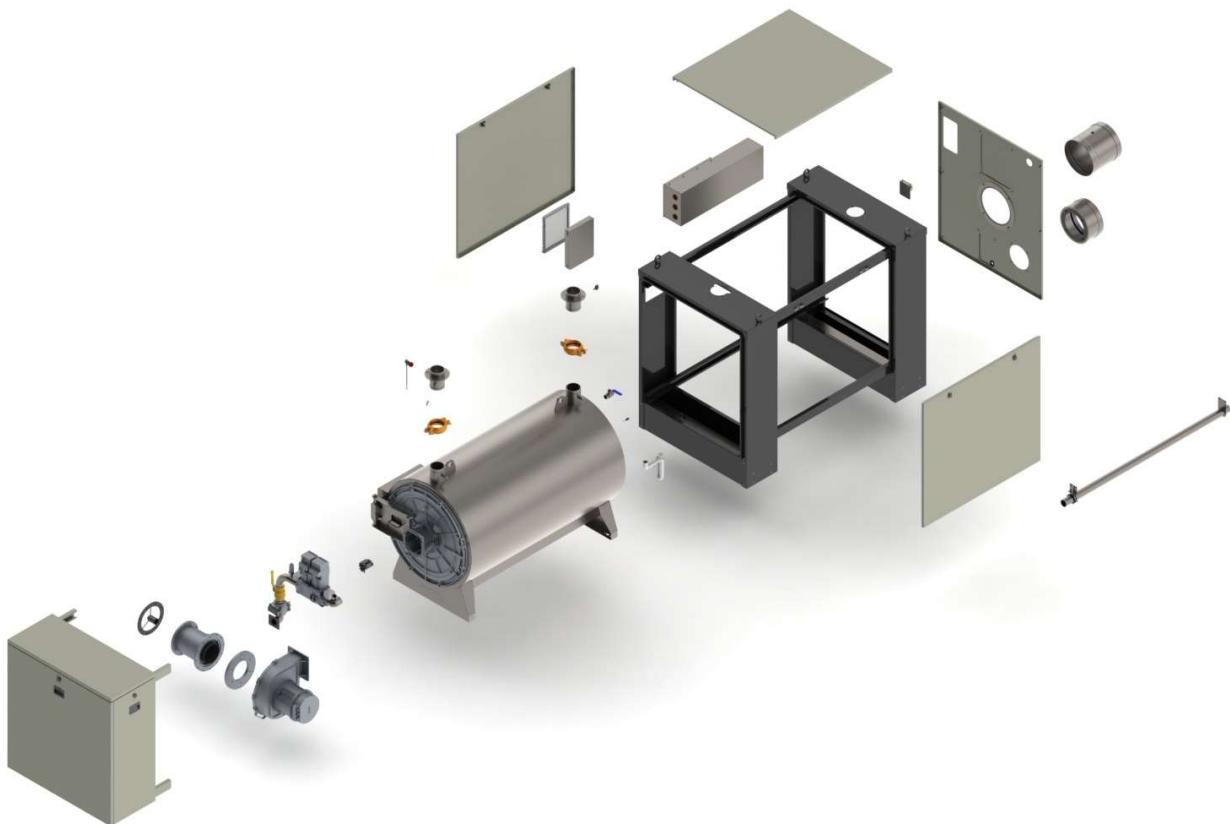
24.2 E 2000



24.3 E 3000



24.4 E 4000



Your distributor:



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