Eco Heating Systems

Installation, service and user manual

Wall hung high efficiency water heater

CB 85 HW
CB 105 HW
CB 125 HW
CB 155 HW

E93.1804.901.C
Original Manual

TABLE OF CONTENTS

1 INTRODUCTION

This manual is written for:
- the installer
- system design engineer
- the service engineer
- the user

Eco Heating Systems Groningen B.V. is not accountable for any damage caused by following these instructions incorrectly. Use only original Eco Heating Systems Groningen B.V. spare parts for service and repair purposes. All documentation produced by the manufacturer is subject to copyright law.

1.1 Abbreviations

CB = Condensing Boiler
HW = Hot Water Boiler for Hot Water (drinking water) usage only.
BCU = burner control unit
PB = display board/ control panel (Pixel Button)
85/105/125/155 = Model number of the water heater.

2 SAFETY GUIDELINES

"FOR YOUR SAFETY READ BEFORE OPERATING"

WARNING:	Improper installation, adjustment, alteration, service or maintenance can cause property damage or personal injury. Installation and service must be performed by a qualified installer or service agency (who must read and follow the supplied instructions before installing, servicing, or removing this water heater).

"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 close to the floor because some gas is heavier than air and will settle on the floor."

"C. 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."

Without written approval of the manufacturer the internals of the water heater may not be changed. When these changes are executed without approval, the water heater certification is invalid.

WARNING: Water temperatures over 52 °C can cause severe burns instantly from scalding. The water temperature is factory set at 60 °C because of legionella prevention. Before bathing or showering always check the water temperature.

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

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

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

What to do if you smell gas:

- Don't use any electrical equipment.
- Don't press any switches.
- Close the gas supply.
- Ventilate the room (open the windows and/or outdoor water heater room doors).
- Immediately warn the installer.

	The manufacturer/supplier is not liable for any damage caused by inaccurately following of these mounting instructions. Only original parts may be used when carrying out any repair or service works.
	This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved.
	The protection class for gas appliance type B23(P) is IP20. Only with the special air inlet (see § 5.1 "Accessories"), the protection class is IPX4D.

2.1 Important technical warnings and guidelines

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

Maintenance and inspection of the water heater should be carried out at the following conditions:
• **When a number of similar error codes and/or lock-outs appear.** • **At least every 12 months maintenance must be done to ensure safe and efficient operation** **Damage caused by lack of maintenance will not be covered under warranty**

The Eco Heating Systems Hot Water systems will, for a long period, comfortably meet your requirement of hot water of the right temperature at the right hour, provided that a few important conditions have been fulfilled regarding the installation.
Please follow all instructions and recommendations presented in this manual by Eco Heating Systems, especially the ones concerning the next important topics:

- Water quality (also see § 8.1)

  A first necessary condition is the quality of the water to be heated in the water heater.
  Only potable water can be used with this water heater. Do not introduce pool or spa water, or any chemically treated water into the water heater.
  Three values matter: hardness, total amount of dissolved solids and acidity. If water quality does NOT meet the requirements the system may be seriously damaged in time!

  - Hardness should not exceed 196 PPM $CaCO_3$ (11 °dH = 14 °Clark). If the waterflow is enlarged, a water hardness up to 250 PPM (14 °dH = 17.5 °Clark) is acceptable.
    Water hardness leads to scale formation and may affect/damage the water heater. Hard water scaling must be avoided or controlled by proper water treatment.
  - TDS (Total Dissolved Solids) should not exceed 450 PPM
  - Hardness and TDS together should not exceed 450 PPM
  - pH value should be between 6.5 and 7.5, measured cold.

  The actual values can be retrieved at your local water supplier.

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

- Water flow velocity and pump selection

  For a given combination of water heaters and tanks, pump selection is very important with respect to the required flow velocity. Use the water heater exchanger resistance graphs to calculate the pump needed.

- Water flow velocity and pipe diameters and lengths
  The arguments that hold for pump selection, hold for piping design as well: all piping components added up are giving a certain total resistance which should not exceed a critical value at which the pump cannot realize the required flow velocity anymore.

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

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

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

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

Do not use chlorine based products for brazing. When commissioning the water heater, the running of the water heater pump must be checked before leaving the installation.

Firing the water heater without water flow (but filled with water) will cause a boiling noise and can damage the heat exchanger.

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

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

Minimum water pressure 1.0 bar.

Fuel used should have sulfur rates that comply with the next values: a maximum annual peak over a short period of time of 150 mg/m^3 and an annual average of 30 mg/m^3 maximum.

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

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

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

LEGIONNAIRES' DISEASE

An anti-Legionella function is present in the software and is default turned ON. See this manual for the programming options.

2.2 Safety valve

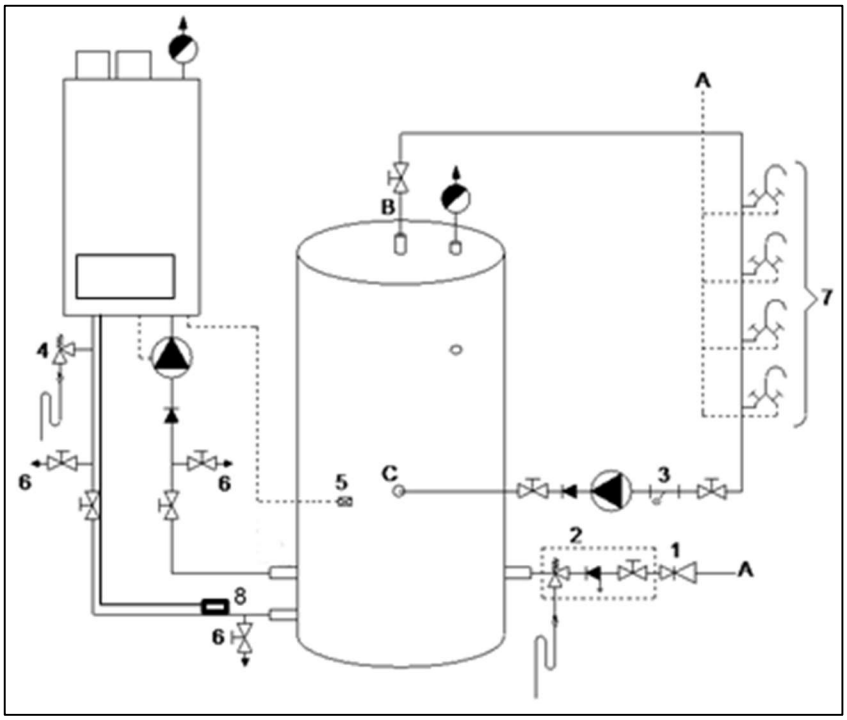
WARNING	Hot water could be released when the safety valve is opened. This can result in severe personal injury. Before operating the safety valve manually, check that it will discharge in a safe place. If water does not flow freely from the end of the discharge pipe, turn the gas supply and power OFF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

DO NOT apply a closing valve or any other form of narrowing between the water heater and the safety valve, because this might disturb the correct functioning of the safety valve.

The right safety valve has been supplied with the CB xxx HW water heater.

Water heater	Safety valves	Part number
CB 85-125 HW	27112 Prescor B ¾ - 10 bar - 150 kW	E04.015.090
CB 155 HW	29007 Prescor B 1 - 10 bar - 250 kW	E04.015.091

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



A) Potable water inlet
B) Hot water supply (circulation if applicable)
C) Circulation return

1) Pressure regulating valve (mandatory in case service water pressure is too high)
2) Inlet combination with valve (mandatory)
3) Apply filter if necessary (recommended)
4) A suitable safety valve must be mounted near the water heater (mandatory) This safety valve may never be isolated from the water heater by means of a closing valve
5) Remote tank sensor (necessary)
6) Drain valve (recommended)
7) Hot and cold-water mixers
8) Strap-on system temperature sensor (necessary)

	PUMP
	NON- RETURN VALVE
	VALVE
	SAFETY VALVE
	AUTOMATIC VENT

	FILTER
	INLET COMBINATION - Overflow - Non return valve - Valve
	PRESSURE REGULATING VALVE

WARNING	**If the installation is constructed in such a way that underpressure (Pabs<1 bar; Patm<0 bar) can occur in the tank, an aerator must be installed between the inlet combination and the tank, without any valve".**

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

3 TECHNICAL DATA HW WATER HEATERS

3.1 Functional introduction

The HW water heaters are water heaters with a maximum high efficiency. Such a performance can be reached by, amongst other things, using a special heat exchanger made of stainless steel. This allows the flue gases to cool down below the condensation point, and so release extra heat. This has an immediate positive impact on the efficiency.

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

Water heater control includes:
- Cascade control for up to sixteen water heaters
- Remote operation and heat demand indication from each water heater
- Anti-Legionnaires' disease function.

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

3.2 Location of version numbers

Parameter Version
- To be found on the small sticker at the side of the burner controller
e.g. **v.B** = "Version B".

Burner controller hardware version
- Mentioned at the second line on the white sticker at the side of the burner controller.
e.g. 957MN25_3Ri4n

Burner Controller Software Versions
– Press the menu button ☰ , go to Information and then to Software Versions.

Information
Software Versions
Boiler Status
Boiler History
Error Log

Software Versions	
Display	[BD65 814B]
Boiler	[515A 6C8B]
Device Group	900MN

3.3 Technical specifications datasheet

GENERAL					
Product identification number:		0063CT3633			
Gas Appliance Type	-	B23(P), C13, C33, C43,C53, C63,C83, C93, C(10)3, C(11)3, C(12)3, C(13)3, C(14)3, C(15)3			
Type boiler		**CB 85 HW**	**CB 105 HW**	**CB 125 HW**	**CB 155 HW**
Classification Netherlands (NL)		II2EK3P	II2EK3P	II2EK3P	II2EK3P
Classification UK (GB)		II2H3P	II2H3P	II2H3P	II2H3P
Classification Germany (DE)		II2E3P	II2E3P	II2E3P	II2ELL3P
Classification France (FR)		II2Esi3P	II2Esi3P	II2Esi3P	II2Esi3P
Classification Belgium (BE)		II2E(R)3P	II2E(R)3P	II2E(R)3P	II2E(R)3P
Classification Italy (IT)		II2H3P	II2H3P	II2H3P	II2H3P
Classification Turkey (TR)		I2H	I2H	I2H	I2H
Classification Ireland (IE)		II2H3P	II2H3P	II2H3P	II2H3P
Dimensions (h x w x d)	mm	**845 x 440 x 539**			
Water content estimated	liter	5.0	6.5	8.3	10.4
Weight (empty)	Kg	77	79	83	86
Flow/return connection (boiler)	Inch	R 1”	R 1”	R 1”	R 1¼”
Gas connection	Inch	R ¾”	R ¾”	R ¾”	R 1”
Flue connection twin pipe	Mm	100	100	100	150
Flue connection concentric pipe	Mm	100 / 150	100 / 150	100 / 150	N.A.
HEATING		**Values min-max:**			
Nominal input (gross) (G20)	kW	17.1 - 90.7	20.7 - 108.1	26.2 - 132.6	38.9 - 161.4
Nominal input (net) (G20)	kW	15.4 - 81.7	18.6 - 97.3	23.6 - 119.4	35.0 - 145.3
Nominal input (gross) (G25.3)	kW	17.4 - 88.6	20.8 - 105.7	26.4 - 129.7	39.3 - 158.0
Nominal input (net) (G25.3)	kW	15.7 - 79.7	18.7 - 95.2	23.8 - 116.9	35.4 - 142.2
Nominal input (gross) (G31)	kW	17.4 - 87.4	20.6 - 103.4	26.2 - 131.2	42.7 - 154.4
Nominal input (net) (G31)	kW	16.0 - 80.5	19.0 - 95.2	24.1 - 120.8	39.3 - 142.2
Nominal output 80/60 °C (G20)	kW	14.9 - 79.1	18.0 - 94.2	22.9 - 115.7	33.9 - 140.9
Nominal output 50/30 °C (G20)	kW	16.0 - 85.1	19.5 - 101.8	24.7 - 124.7	36.4 - 151.0
Nominal output 37/30 °C (G20)	kW	16.6 - 88.4	20.2 - 105.5	25.6 - 129.4	38.0 - 157.8
Nominal output 80/60 °C (G25.3)	kW	15.2 - 77.0	18.1 - 92.3	23.1 - 113.4	34.3 - 137.9
Nominal output 50/30 °C (G25.3)	kW	16.4 - 83.0	19.6 - 99.6	24.9 - 121.1	36.8 - 147.7
Nominal output 37/30 °C (G25.3)	kW	17.0 - 88.4	20.3 - 105.5	25.8 - 129.4	38.4 - 157.8
Efficiency (input 30%, return temperature 30 °C)	%	108.2%	108.4%	108.6%	108.7%
GAS CONSUMPTION		**Values min-max:**			
Natural gas (G20)	m^3/h	1.6 – 8.5	1.9 – 10.2	2.5 – 12.5	3.7 – 15.3
Natural gas (G25.3) [7]	m^3/h	1.8 – 9.2	2.2 – 11.6	2.8 – 14.2	4.1 – 16.3
Propane (G31) [1]	m^3/h	0.6 – 3.2	0.8 – 3.9	1.0 – 4.8	1.6 – 5.7
Gas supply pressure nominal [2] G20	mbar	20			
Gas supply pressure nominal [2] G25.3 [7]	mbar	25			
Gas supply pressure nominal [2] G31	mbar	37			

Type boiler			CB 85 HW	CB 105 HW	CB 125 HW	CB 155 HW
EMISSION		**Values min-max:**				
O_2 flue gas [3]	G20	%	6.8 - 6.0	6.8 - 6.0	6.8 - 6.0	6.8 - 6.0
	G25.3 [7])	%	5.8 - 6.1	5.8 - 6.1	5.8 - 6.1	5.8 - 6.1
	G31	%	6.7 – 4.9	6.7 – 5.2	6.4 – 5.2	6.4 – 5.2
CO_2 flue gas [3]	G20	%	7.9 - 8.4	7.9 – 8.4	7.9 – 8.4	7.9 – 8.4
	G25.3 [7])	%	8.4 – 8.2	8.4 – 8.2	8.4 – 8.2	8.4 – 8.2
	G31	%	9.3 - 10.5	9.3 – 10.3	9.5 – 10.3	9.5 – 10.3
NOx class		-	6			
Flue gas temperature at combustion air temperature = 20 °C		°C	60 - 90			
Mass flow flue gas (min/max)		g/s	8.0 - 42	10 - 51	12 - 62	15 - 76
Available pressure for the flue system [4]		Pa	200			
INSTALLATION						
Resistance water heater	ΔT = 12.5 K	m.W.C	9.0	9.5	9.5	8.5
	ΔT = 16.5 K		5.5	5.6	5.5	5.1
Pressure water heater max.		bar	8.0			
Max. water temperature		°C	85			
Pressure relief valve max. pressure		bar	10			
ELECTRIC						
Maximum power consumption [5]		W	190	280	280	280
Power supply		V/Hz	230 / 50			
Protection class [6]		-	IPX4D			

NOTES

[1] Using propane G31, a restriction needs to be placed and the maximum and minimum fan speed need to be changed.

[2] Min. and max. gas supply pressures:

	p nom [mbar]	p min [mbar]	p max [mbar]
G20	20	17	25
G25.3	25	20	30
G31	37	25	45

[3] O_2 / CO_2 of the unit measured/set without the water heater front panel in place

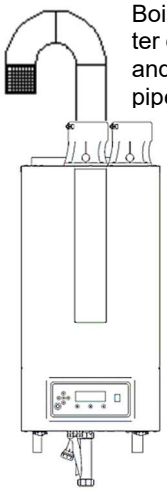
[4] Maximum allowed combined resistance of flue gas and air supply piping at high fire

[5] Power consumption is measured without circulation pump

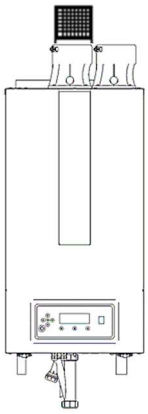
[6] For gas appliance type B23(P) only class IPX4D with special air inlet (see § 5.1 "Accessories"), otherwise the protection class is IP20.

[7] Only applicable to the Dutch manual.

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



Boiler is IP20 applying a dust filter or bird screen only



3.4 Table technical specifications ERP

Type water heater:		**CB 85**	**CB 105**	**CB 125**	**CB 155**
Load profile		XXL	XXL	3XL	3XL
	Unit				
Water heating energy efficiency (η_{wh})	%	**85.9**	**85.6**	**89.6**	**89.1**
Daily fuel consumption (Q_{fuel})	kWh	27.840	27.800	51.540	51.730
Daily electricity consumption (Q_{elec})	kWh	0.292	0.346	0.260	0.289
Emissions of nitrogen oxides (EN15502-1:2012+A1:2015)	mg/kWh	23.1	21.3	23.9	20.1
Sound power level, indoors (L_{WA}) (EN 15036-1:2006)	dB(A)	65.8	68.0	67.8	73.0

A water tank is needed when applying a CB-HW water heater appliance.

The efficiency of the complete installation depends on:

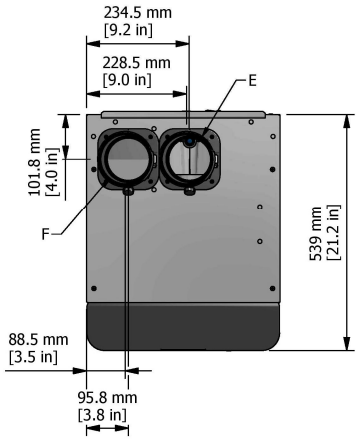
- type of water tank.
- volume of the water tank.
- number of tanks
- number of water heaters
- type of circulation pump.
- length of the connecting pipes.
- insulation of the connecting pipes.

The load profile might be higher depending on the applied tank volume.

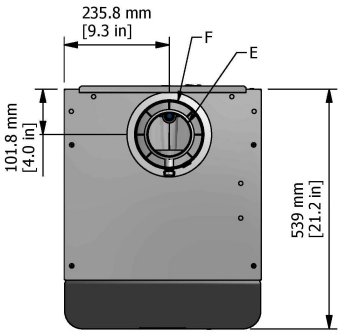
4 DIMENSIONS & CONNECTIONS

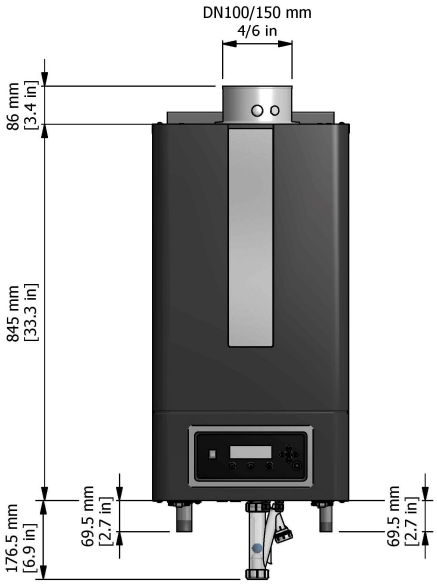
4.1 CB 85 HW & CB 105 HW

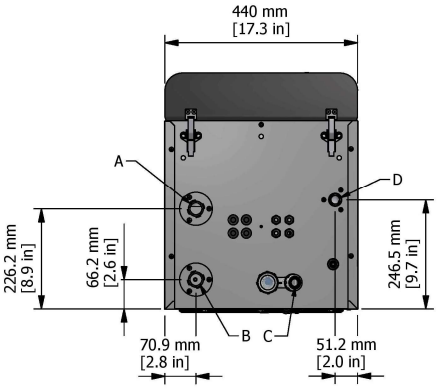
Twin Pipe

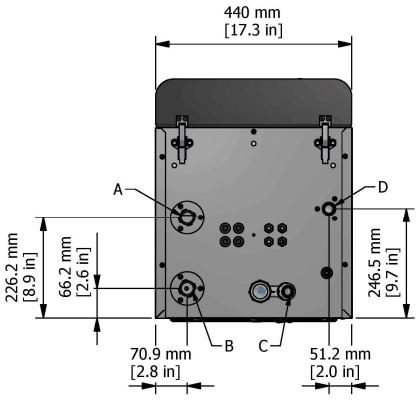


Concentric





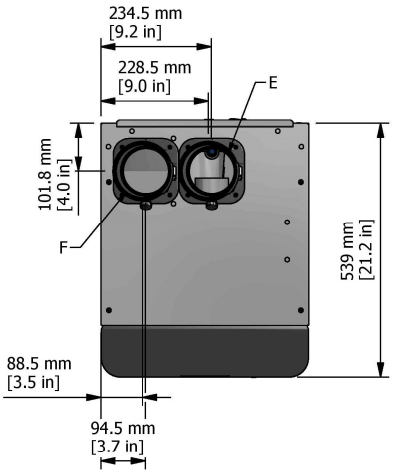




Connections		Twin Pipe	Concentric
A	Hot water Outlet	BSP 1”	
B	Cold water Inlet	BSP 1”	
C	Condensate	Flexible hose Ø 25 / 21 mm	
D	Gas	BSP ¾”	
E / F	Flue gas / Air inlet	100 / 100 mm	100 / 150 mm

4.2 CB-125-HW

Twin Pipe



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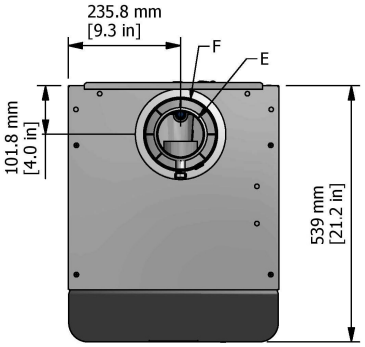
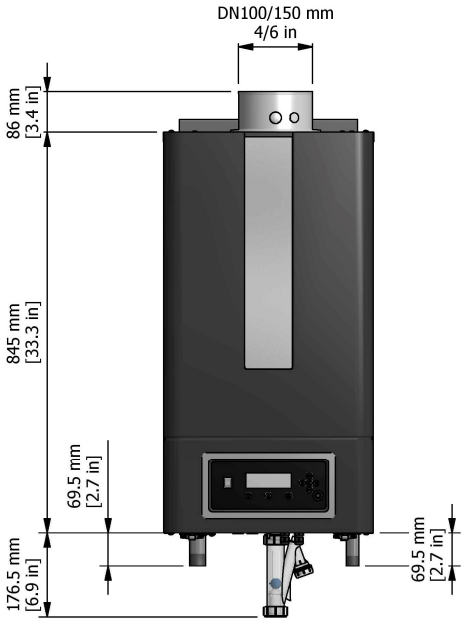
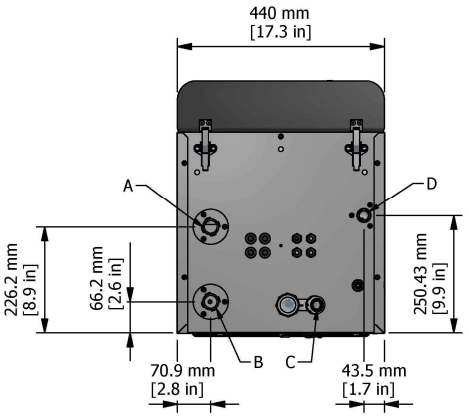
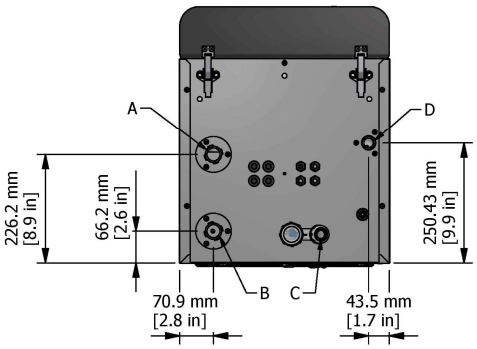




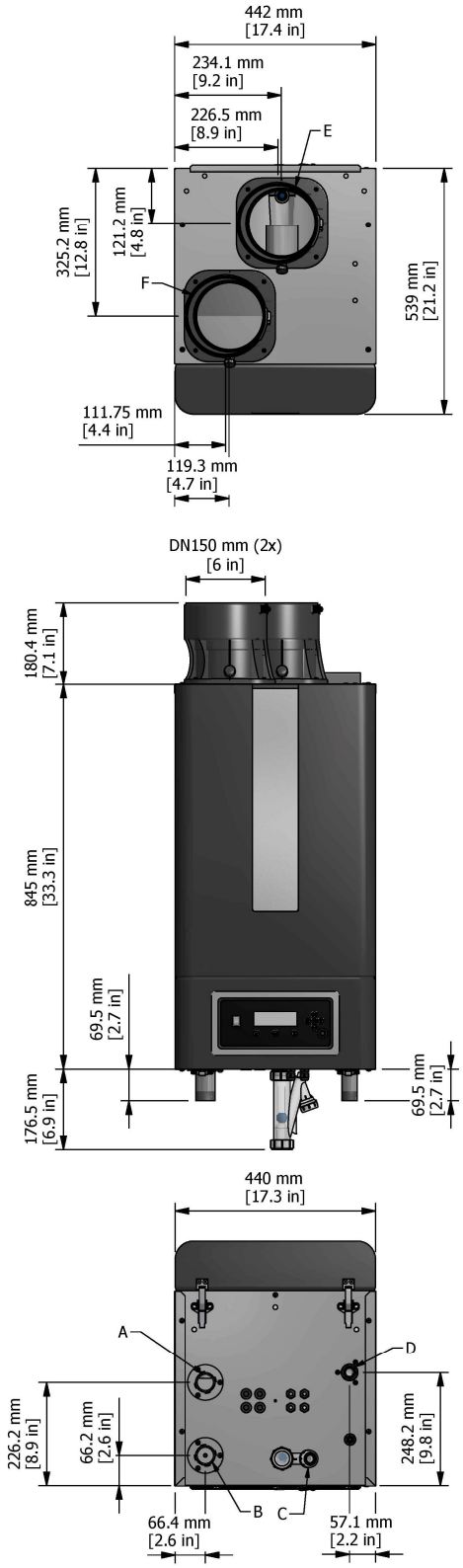




Connections		Twin Pipe	Concentric
A	Hot water Outlet	BSP 1”	
B	Cold water Inlet	BSP 1”	
C	Condensate	Flexible hose Ø 25 / 21 mm	
D	Gas	BSP ¾”	
E / F	Flue gas / Air inlet	100 / 100 mm	100 / 150 mm

4.3 CB-155-HW

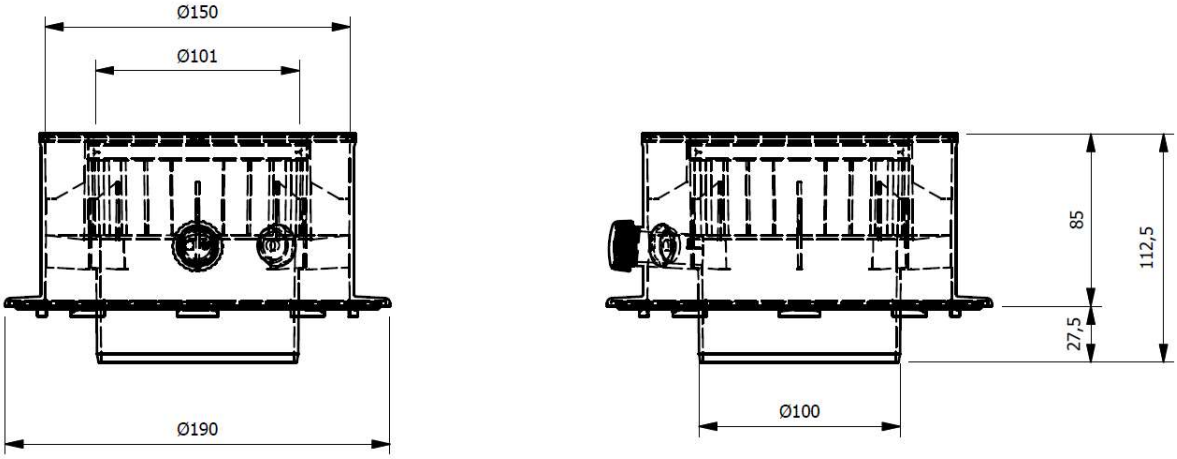
Twin Pipe



Connections		Twin Pipe CB 155
A	Hot water Outlet	BSP 1¼”
B	Cold water Inlet	BSP 1¼”
C	Condensate	Flexible hose Ø 25 / 21 mm
D	Gas	BSP 1”
E / F	Flue gas / Air inlet	150 / 150 mm

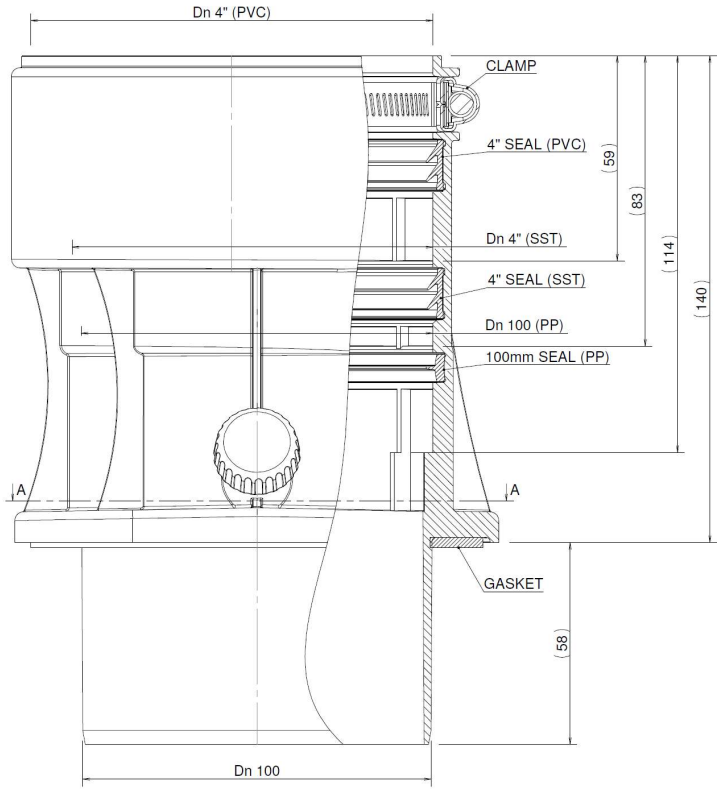
4.4 CB 85 - 125 HW Flue Spigot Dimensions

4.4.1 100 / 150 MM COAXIAL FLUE SPIGOT



Mat	Boiler	d_{nom} [mm]	$D_{outside}$ [mm]	d_{inside} [mm]	L_{insert} [mm]
SS	CB 85 HW, 105, 125	100	100 + 0.3 / - 0.7	101 + 0.3 / - 0.3	50 + 2 / - 2
SS	CB 85 HW, 105, 125	150	150 + 0.3 / - 0.7	151 + 0.5 / - 0.5	50 + 2 / - 2
PP	CB 85 HW, 105, 125	100	100 + 0.6 / - 0.6		50 + 20 / - 2
PP	CB 85 HW, 105, 125	150	150 + 0.9 / - 0.9		50 + 20 / - 2

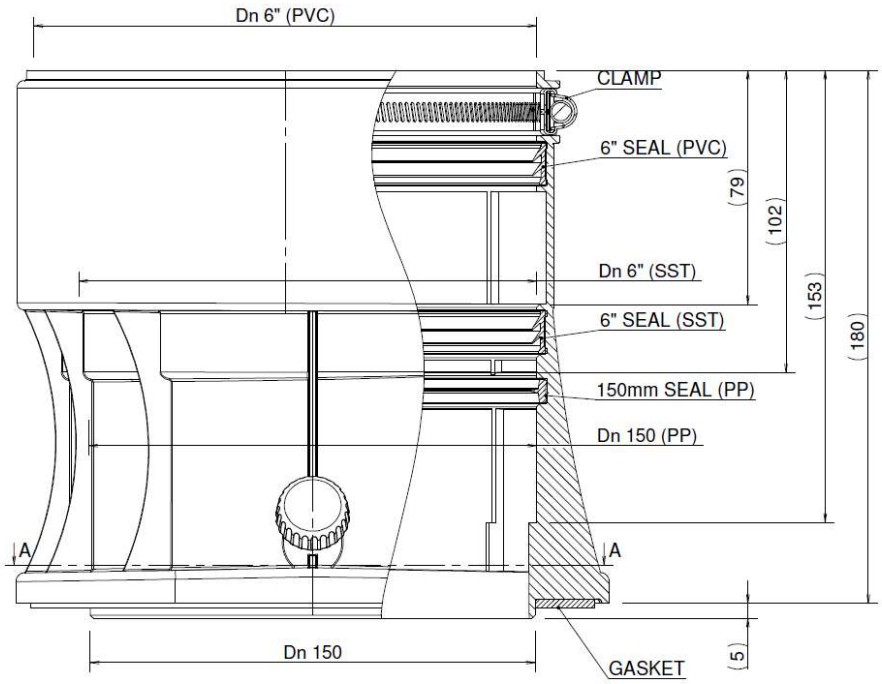
4.4.2 2 X 100 MM TWIN FLUE SPIGOTS



Mat	Boiler	d_{nom} [mm]	$D_{outside}$ [mm]	d_{inside} [mm]	L_{insert} [mm]
SS	CB 85, 105, 125 HW	100	100 + 0.3 / - 0.7	101 + 0.3 / - 0.3	83
PP	CB 85, 105, 125 HW	100	100 + 0.6 / - 0.6		114

4.5 CB 155 HW Flue Spigot Dimensions

4.5.1 2 X 150 MM TWIN FLUE SPIGOTS

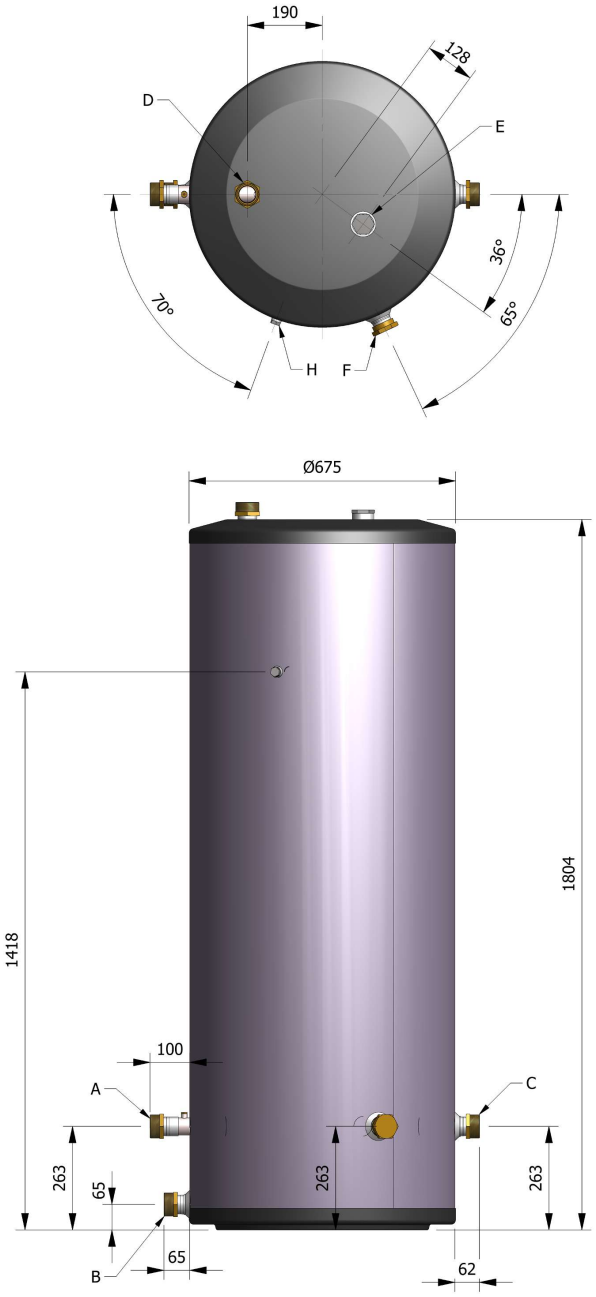


Mat	Boiler	d_{nom} [mm]	$D_{outside}$ [mm]	d_{inside} [mm]	L_{insert} [mm]
SS	CB 155 HW	150	150 + 0.3 / - 0.7	151 + 0.5 / - 0.5	102
PP	CB 155 HW	150	150 + 0.9 / - 0.9		153

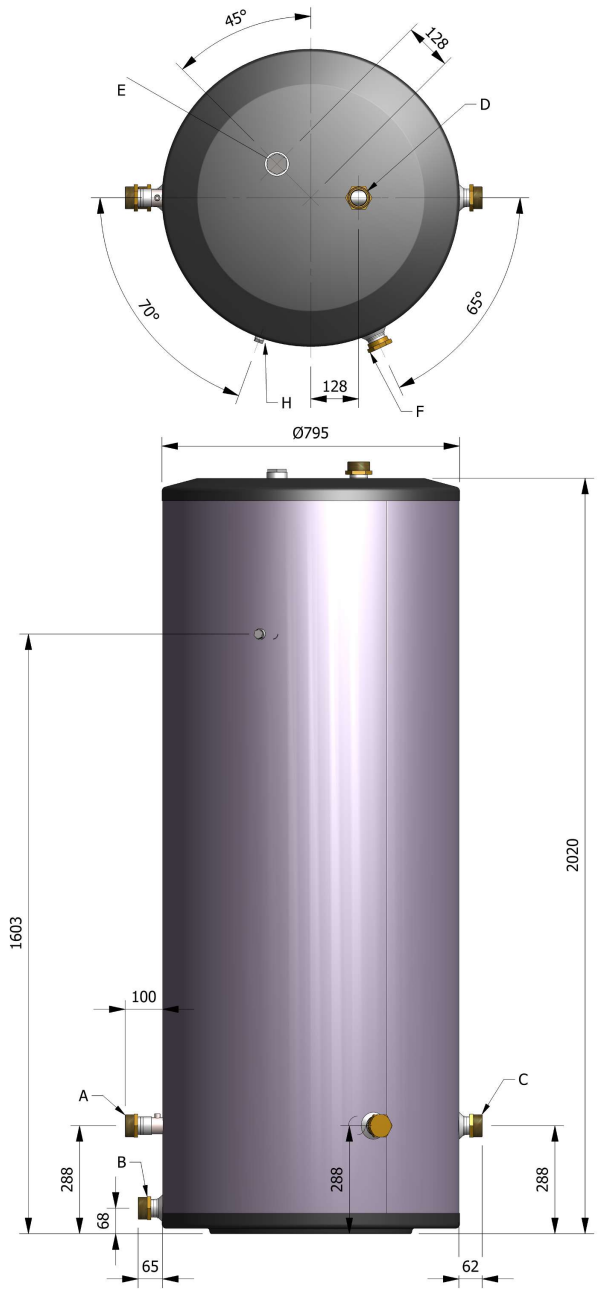
4.6 Tanks EWD300 - EWD500 - EWD750

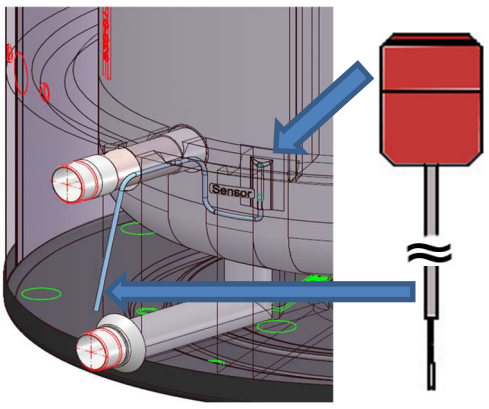
For the connections marked **A-H** see § 4.8.

EWD300



EWD500

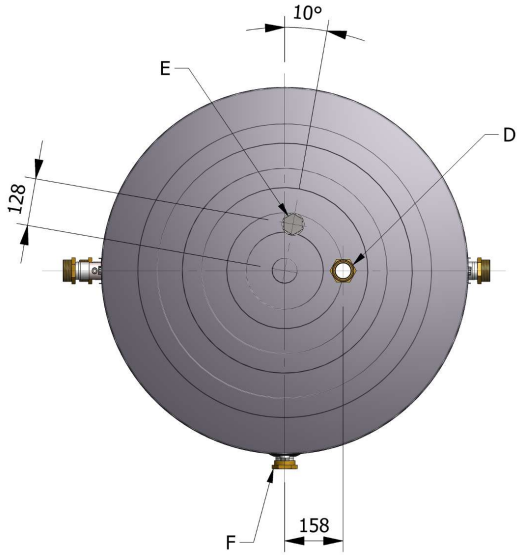


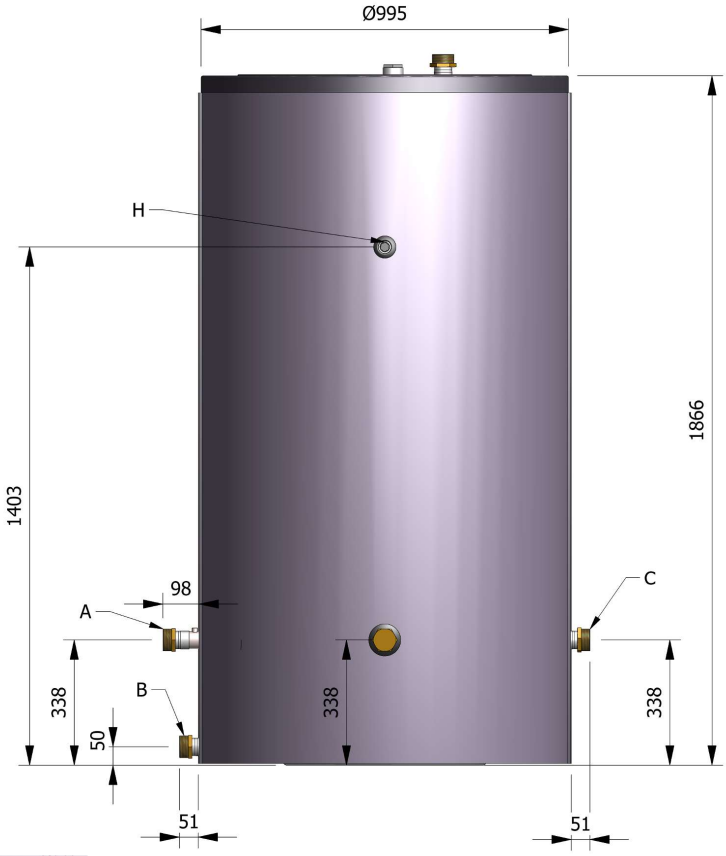


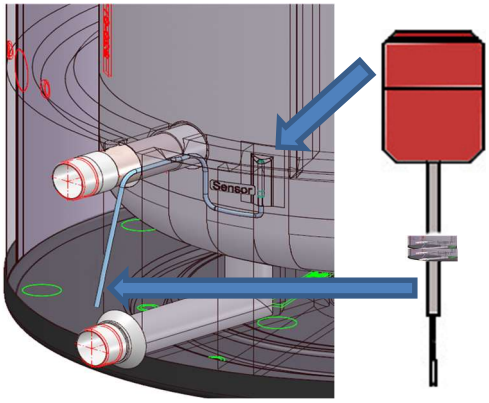
The EWD300, EWD500 and EWD750 are supplied including an already assembled slice sensor (directly glued to the tank, behind the insulation) The sensor has a cable with a length of 5 meter.

EWD750

For the connections marked **A-H** see § 4.8.







The EWD300, EWD500 and EWD750 are supplied including an already assembled slice sensor (directly glued to the tank, behind the insulation) The sensor has a cable with a length of 5 meter.

4.7 ERP specifications Ecohs tanks

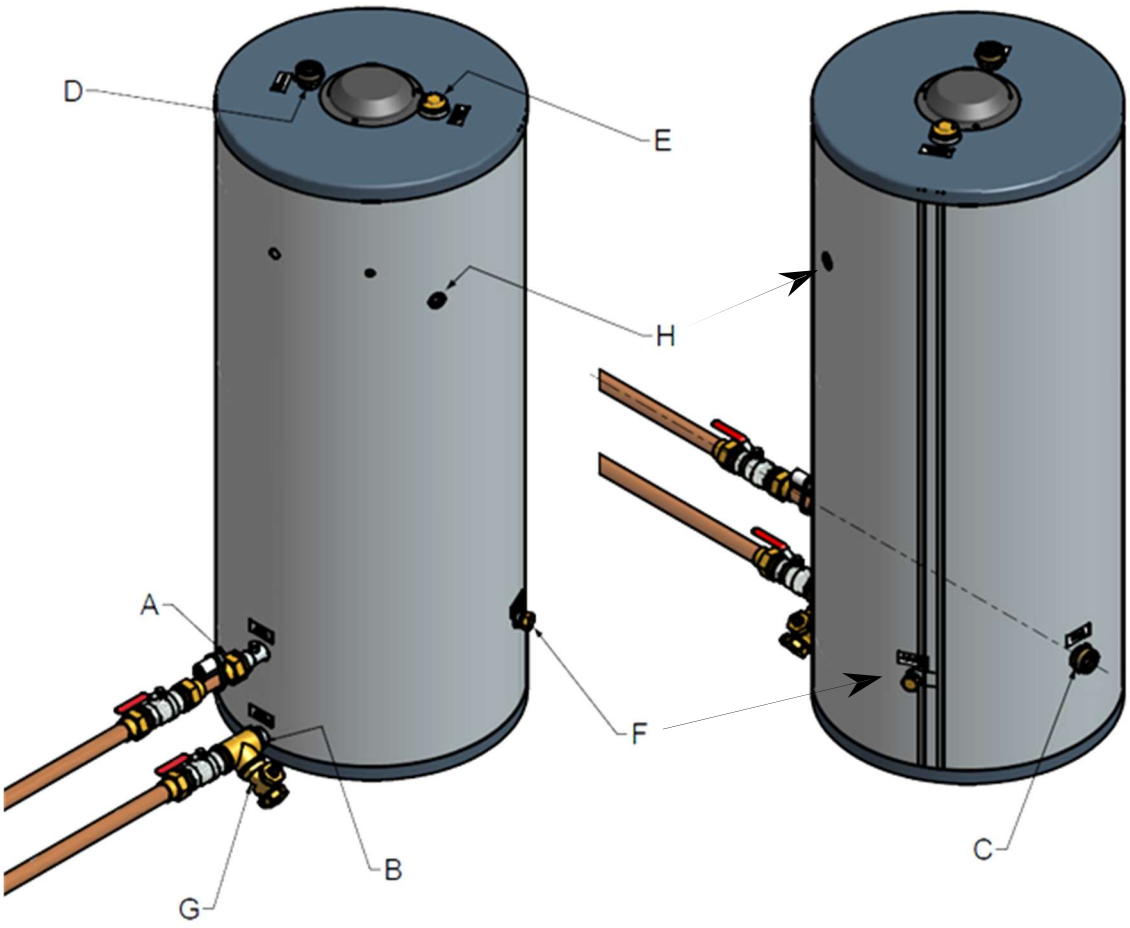
Type		EWD300	EWD500	EWD750
Energy efficiency class		B	B	C
Standing loss (S)	Watt	62	75	98
Volume (V)	liter	304	491	764
Weight (empty)	kg	31	48	75

4.8 Tank connections and sizes

Code	Connection	M / F[*1]	Remarks	EWD300	EWD500	EWD750
A	return to water heater	M	incl. reducing ring	R 2"	R 2"	R 2"
			excl. reducing ring	R 1½"	R 1½"	R 1½"
B	supply from water heater	M	incl. reducing ring	R 2"	R 2"	R 2"
			excl. reducing ring	R 1½"	R 1½"	R 1½"
C	cold water inlet	M	incl. reducing ring	R 2"	R 2"	R 2"
			excl. reducing ring	R 1½"	R 1½"	R 1½"
D[*2]	DHW outlet	M	incl. reducing ring	R 2"	R 2"	R 2"
			excl. reducing ring	R 1½"	R 1½"	R 1½"
E	free connection (T&P valve)	F	incl. plug	Rp 1½"	Rp 1½"	Rp 1½"
F	circulation return	M	incl. cap	R1½"	R1½"	R 1½"
G	bleed valve	-	-	-	-	-
H	thermometer connection	F	incl. plug	Rp ½"	Rp ½"	Rp ½"

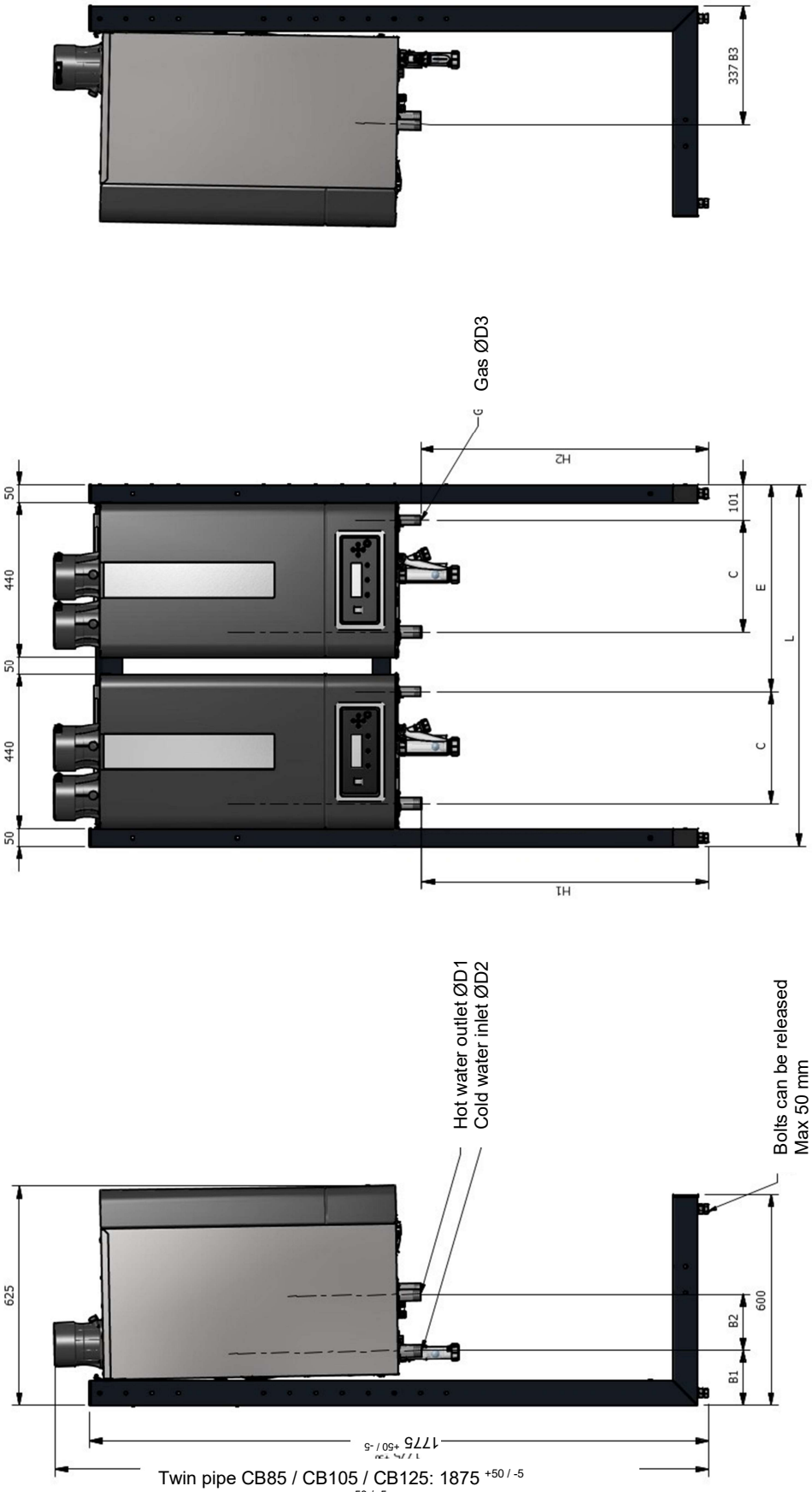
[*1] M = Male / Outer ; F = Female / Inner.

[*2] Reducing ring is factory fitted.



4.9 Cascade frames

Frames for two, three and four water heaters.



Twin pipe CB85 / CB105 / CB125: 1875 $^{+50 / -5}$
Twin pipe CB155: 1916$^{+50 / -5}$
Concentric CB85 / CB105 / CB125 / CB155: 1821$^{+50 / -5}$

4.9.1 Cascade frames dimensions

			CB 85 HW				CB 105 HW				CB 125 HW				CB 155 HW			
Number of casaded water heaters →			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
L	(frame)	mm	540	1030	1520	2010	540	1030	1520	2010	540	1030	1520	2010	540	1030	1520	2010
B1	(Cold water inlet)	mm	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157	157
B2	(Hot water outlet)	mm	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
B3	(gas)	mm	337	337	337	337	337	337	337	337	341	341	341	341	339	339	339	339
C	(water/gas)	mm	318	318	318	318	318	318	318	318	326	326	326	326	318	318	318	318
D1	(Hot water outlet		R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1 ¼ "	R 1 ¼ "	R 1 ¼ "	R 1 ¼ "
D2	(Cold water inlet)		R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1"	R 1 ¼ "	R 1 ¼ "	R 1 ¼ "	R 1 ¼ "
D3	(gas)		R ¾ "	R ¾ "	R ¾ "	R ¾ "	R ¾ "	R ¾ "	R ¾ "	R ¾ "	R ¾ "	R ¾ "	R ¾ "	R ¾ "	R 1"	R 1"	R 1"	R 1"
E1	(gas 2nd water heater)	mm	n.a.	591	591	591	n.a.	591	591	591	n.a.	583	583	583	n.a.	597	597	597
E2	(gas 3rd water heater)	mm	n.a.	n.a.	1081	1081	n.a.	n.a.	1081	1081	n.a.	n.a.	1073	1073	n.a.	n.a.	1087	1087
E3	(gas 4th water heater)	mm	n.a.	n.a.	n.a.	1571	n.a.	n.a.	n.a.	1571	n.a.	n.a.	n.a.	1563	n.a.	n.a.	n.a.	1577
H1	(Inlet / Outlet)	mm	820	820	820	820	820	820	820	820	820	820	820	820	820	820	820	820
H2	(gas)	mm	824	824	824	824	824	824	824	824	824	824	824	824	824	824	824	824

5 ACCESSORIES AND UNPACKING

5.1 Accessories

The following items are available as accessories.

Item	part number
Adhesive kit 04	S022.000.001
LOCTITE® SI 5366™ 50ml	S022.000.002
Air inlet filter kit CB 85 HW and CB 105 HW and CB 125 HW	S022.500.018
Air inlet filter kit CB 155 HW	S022.500.019
Software and interface cable to program the water heater with a computer/laptop	S022.500.015
External HW-Tank slice temperature sensor 10kOhm@25°C (for reparation, or for non-EWD tanks)	S029.000.001
External HW-Tank temperature sensor 10kOhm@25°C, to be mounted in the immersion tube of the tank	S022.500.009
External HW-Tank pipe strap-on temperature sensor 10kOhm@25°C to be mounted on the flow pipe of the tank, in a single or cascaded system	S022.500.021
External system pipe strap-on temperature sensor 10kOhm@25°C to be mounted on the return pipe of the tank, in a single or cascaded system	S022.500.021
External Ignition transformer	S022.500.016
LPG Conversion Kit CB 85 & 105	S022.500.001
LPG Conversion Kit CB 125	S022.500.004
LPG Conversion Kit CB 155	S022.500.010
Hot water tank, stainless steel, EWD300	E66.000.206
Hot water tank, stainless steel, EWD500	E66.000.207
Hot water tank, stainless steel, EWD750	E66.000.208
Base plate EWD300 and EWD500	S022.200.004
Base plate EWD750	S022.200.005
Pump, Grundfos UPMXL GEO 25-125N-180.	S022.500.026
Pump, Wilo Stratos Para Z 25/1-12	S022.500.024

5.2 Unpacking

The CB-HW water heater will be supplied with the following documents and accessories:

No	Description	Quantity
1	“Installation, user and service instructions” manual.	1
2	Safety valve	1
3	Wall bracket with locking plate and bolts	1
4	Spare nuts for mounting the burner plate (in a bag attached to the front of the gas valve)	3
5	Spare fuses for the water heater control (At the burner controller)	1
6	Bottom part of the condensate drain assembly (packed into an additional box)	1

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

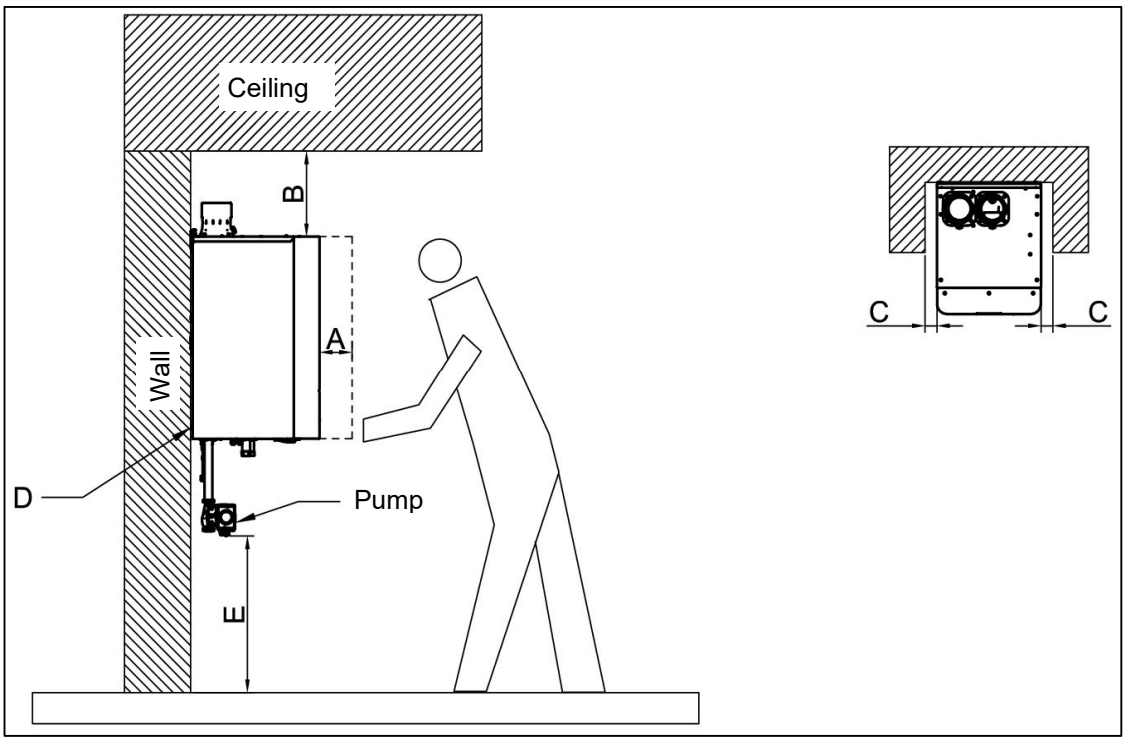
After delivery, always check the water heater package to see if it is complete and without any defects. Report any defects or missing parts immediately to your supplier.

6 INSTALLATION LOCATION OF THE CB-HW

6.1 Installation Clearances

On all sides of the water heater at least 5 cm of clearance should be applied to walls or wall units, 35 cm above the top side of the water heater and 25 cm from the bottom of the water heater.

Clearances to wall, ceiling and floor, distances in cm					
	A: Front	B: Top	C: Sides	D: Back	E: Bottom
Minimum service Clearances	15	30	5	0	25
Recommended Service clearances	64	35	50	0	75
Clearances from combustible materials: 1. Hot water pipes—at least 6 mm from combustible materials. 2. Vent pipe – at least 25 mm from combustible materials.					



The installation area/room must have the following provisions:

- 230 V - 50 Hz power source socket with ground.
- Open connection to the sewer system for draining condensing water.
- A wall or stand to properly support the weight of the water heater.

Note: The wall used for mounting the water heater must be able to hold the weight of the water heater, piping, fittings and the water. If not, it is recommended to mount the water heater by means of a (cascade) stand.

6.2 Water heater Installation Location Requirements:

- The ventilation of the water heater room must meet local and national standards and regulations, regardless of the selected supply of fresh air to the water heater.
- The flue gas pipes must be connected to the outside wall and/or the outside roof.
- The installation area must be dry and frost-free.
- The water heater has a built-in fan that will generate noise, depending on the total heat demand. The water heater location must minimize any disturbance this might cause. Preferably mount the water heater on a brick wall.
- There must be sufficient lighting available in the water heater room to work safely on the boiler.
- Remind the positioning of electrical components in relation to the temperature sensitivity.
- Make sure there is an open connection with the sewer to drain the condensate. This connection must be lower than the condensate drains level of the water heater.

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

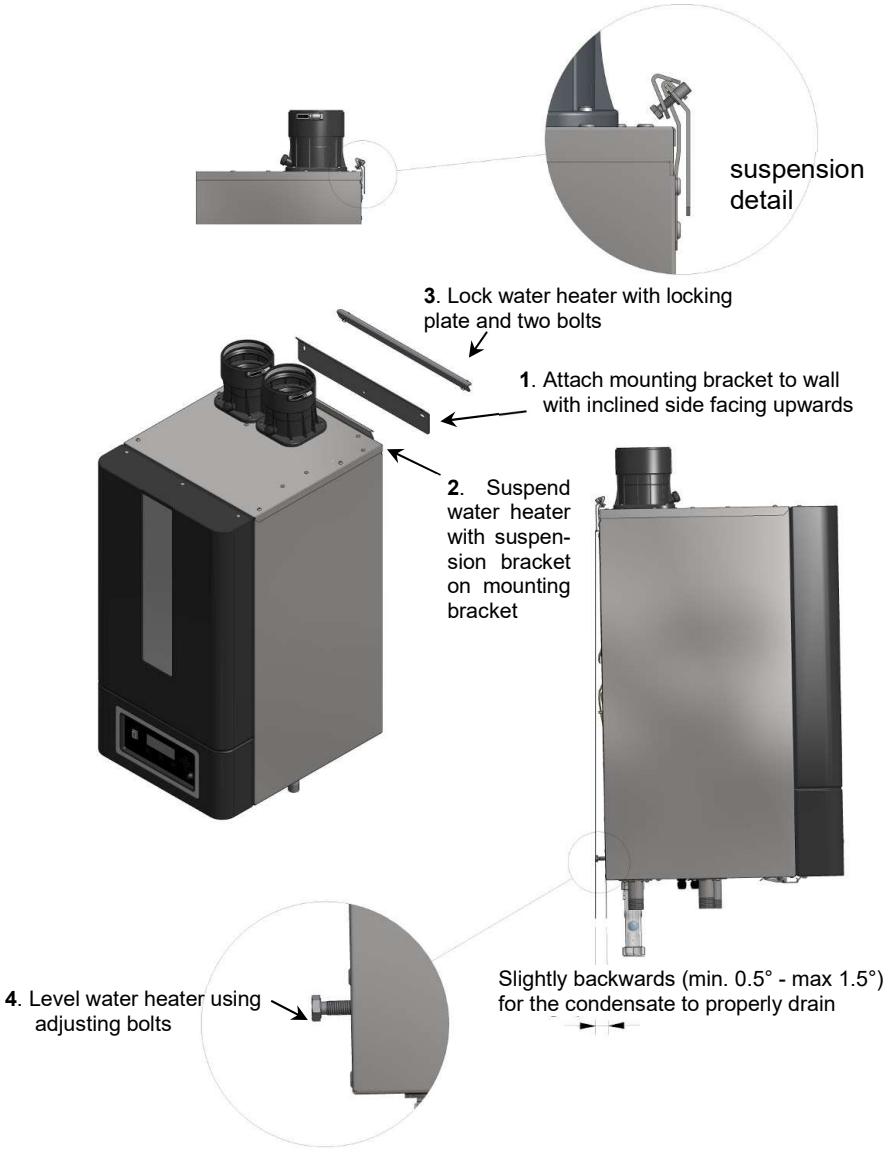
6.3 Mounting the water heater

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

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

⚠	All lines/piping must be mounted free of tension. The weight of the installation components should be supported separately from the water heater so there will be no standing forces on the connections. This might influence the mounting position of the water heater.

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



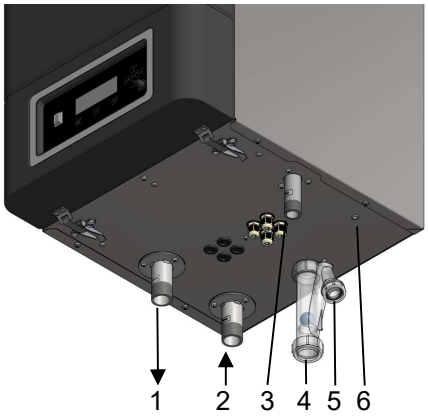
Lock the suspension bracket with the security cover before making any other connections to the water heater. This security cover will prevent the water heater from falling off the bracket. Do not use excessive force during the mounting of the water heater connections.

7 CONNECTIONS

7.1 Tank positioning

The tank must be placed on a stable floor, not too far from the water heater(s).
NB! This floor must be able to hold the weight of the water filled tank(s).

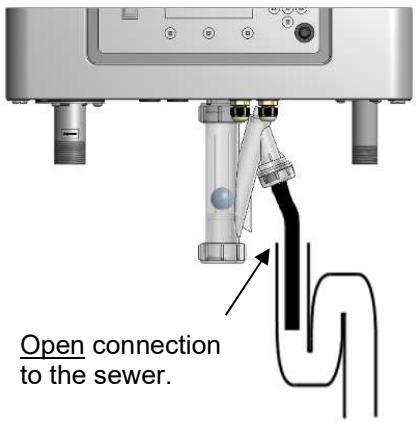
7.2 Water heater connections



1 – Hot Water / Supply
2 – Cold Water / Return
3 – Gas
4 – Condensate trap clean out.
5 – Condensate drain
6 – Automatic air drain.

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

7.3 Condensate drain connection



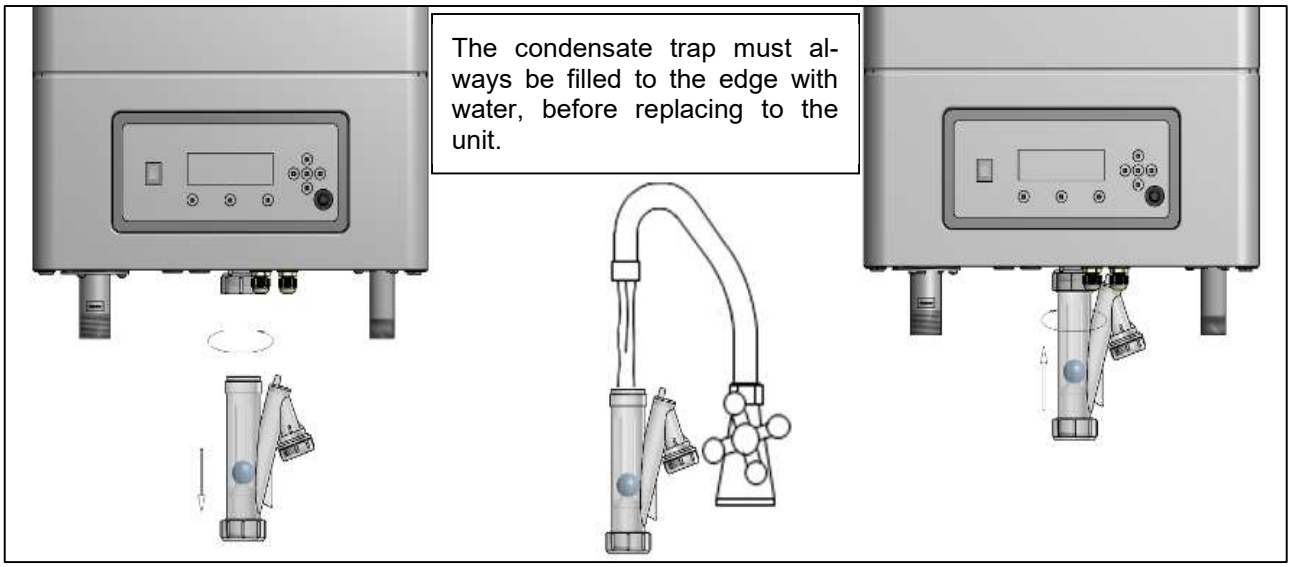
The condensate drain is placed at the center at the bottom of the water heater and has a ¾ inch hose discharge. Connect this flexible hose to the sewer system.

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

Blockage of this drain might damage the water heater. The drain connection is correct when the condensate can be seen flowing away, e.g. using a funnel. Any damage that might occur, when the drain is not installed correctly, is not covered by the warranty of the water heater.
There should be an open connection of the condensate hose into the sewage system. A possible vacuum in the sewage system must never result in sucking on the water heater's condensate drain hose.

WARNING

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



7.4 Non Return valve

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

7.5 Pump functionality

Delta T monitoring:
A high temperature difference between supply and return of the water heater can indicate a clogged heat exchanger or filter, or a defective pump. The burner load automatically decreases when the Return/Supply temperature differential increases too much.
At maximum burner power ΔT is limited to 18 ºC and at low burner power a ΔT above 26 ºC is not allowed. Above these values the water heater modulates down until the temperature difference is between 18 ºC and 26 ºC. If the ΔT exceeds 35 ºC, the water heater will be temporarily switched off.

7.6 Frost protection

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

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

7.7 Water quality

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

Water temperature max. = 85°C
Maximum allowed water hardness should not exceed 196 PPM $CaCO_3$ (11 °dH = 14 °Clark). If the water-flow is enlarged, a water hardness up to 250 PPM (14 °dH = 17.5 °Clark) is acceptable.
TDS (total dissolved solids) may not exceed 450 PPM
Water hardness and TDS together should not exceed 450 PPM
The pH value of the water may not be under 6.5 and not above 7.5 (measured cold)
If water hardness is too high a water softening system is necessary.
If TDS alone or the combined value is higher than the abovementioned, the water should be heated by means of an indirect water heating appliance.
Minimum water hardness = 80 PPM or 80 mg/L $CaCO_3$ (4.5°dH = 5 °Clark)
Minimum TDS = 100 PPM
Water that is under these minimum values normally has a pH value which is aggressive and corrosive.

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, if possible.

7.8 Flush the system with fresh water

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

7.9 De-Air sequence.

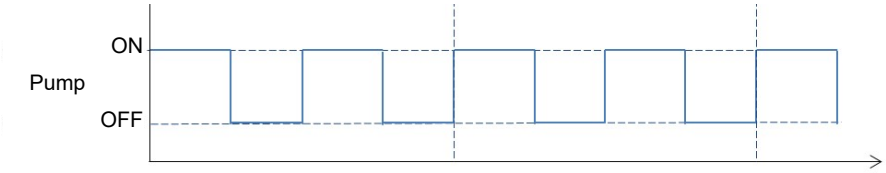
The De-Air sequence is a safety function starting at every power ON and is used to remove the air from the heat-exchanger. The De-Air sequence does not start after a general reset (as the locking error reset or 24 hours reset) The display will show 'dAir' indicating that the controller is performing the De-Air sequence to purge the heat exchanger of air, by sequencing the water heater pump OFF and ON. The installer/technician can cancel the De-Air sequence by pressing a specific key-button combination from the display.

The De-Air sequence consists of cycles.

- The general pump cycles in an ON/OFF pattern of 10 second periods. This is repeated for De-Air_Repetition_Cnt times.

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

The following scheme below shows the behavior of the general pump during one whole cycle of De-Air sequence with a De-Air_Repetition_Cnt set to 2:



Relevant variables:

Specific Parameters	Level	(Default) Value	Range
(149) De_Air_Config	2: Installer	1	0: 24 hour pump 1: Dair enabled 2: Dair disabled
De_Air_State	1: User	-	-
Current state of the DAir function.	1: User		
DAir_Repetition_OnOff Number of repeating ON/OFF.	2: Installer	2	0…255
DAir_Number_Cycles Number of DAir cycles.	2: Installer	3	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.

7.10 Water pressure

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

Sensor
A water pressure sensor has been built into the water heater. The minimum water pressure in the water heater is 1.0 bar and the maximum pressure is 8.0 bar. The pressure sensor will stop the water heater from firing when the water pressure drops below 0.7 bar and starts the water heater firing again when the water pressure reaches above 1.0 bar. 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 1.0 bar.

8 THE HW SANITAIRY SYSTEM: INSTALLATION INSTRUCTIONS

The CB-HW boilers are designed for use with one or more hot water tanks, because the boiler needs a minimum amount of water flow. To get an output temperature of 60°C, the temperature of the return should be within the range 43.5 – 47.5 °C.
In designing the hot water system there are some points to consider:

- How many boilers 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 boiler resulting in a smaller temperature difference between in- and output of the boiler:
    - If the water hardness is between 4 and 11 °dH (between 5 and 14 °Clark) the temperature difference between flow and return of the boiler should be 16.5 °C maximum
    - If the water hardness is between 11 and 14 °dH (between 14 and 17.5 °Clark) the temperature difference between flow and return should be 12.5 °C maximum
    - If the water hardness is above 14 °dH a water softener must be used. Also above 11 °dH a water softener could be considered, since an installation at 12.5 °C temperature difference will need bigger pipes and pumps. After softening, the water hardness should be minimum 4 °dH
- Pipework is to be made of copper or stainless steel pipes, diameters according or bigger than prescribed below. When using plastic pipes, make sure the inner diameter of the pipes is at least equal to the corresponding copper size.
- The applied pump must be a bronze or stainless steel pump and controlled only by the CB-HW water heater control. If, for any reason, an external pump control is applied *without written approval of Eco Heating systems* then the complete warranty on the CB-HW water heater and all delivered parts will become invalid.

8.1 Stand-alone set-up

The basic form of a HW installation is one water heater with one tank.

	CB-85-HW	CB-105-HW	CB-125-HW	CB-155-HW
Boiler flow at ΔT = 16.5 °C (m^3/h)	4.3	5.1	6.2	7.6
Pipework size at ΔT = 16.5 °C	42 x 1.5	42 x 1.5	42 x 1.5	54 x 1.5
Maximum pipe length (m) *	2 x 20	2 x 15	2 x 30	2 x 30
Pump advice at ΔT = 16.5 °C	1*	1*	2*	2*
Boiler flow at ΔT = 12.5 °C (m^3/h)	5.6	6.7	8.2	10.0
Pipework size at ΔT = 12.5 °C	42 x 1.5	54 x 1.5	54 x 1.5	54 x 1.5
Maximum pipe length (m) *	2 x 14	2 x 18	2 x 30	2 x 30
Pump advice at ΔT = 12.5 °C	2*	2*	X[1)]	X[1)]

Table 1: Pipe sizes and pumps *(see table 3)

[1)] **NB!** An X in the pump table doesn't necessarily mean that the corresponding installation cannot be built. If it can, it will need specific design effort and pump selection. Please consult your supplier for advice.

- Adding bends or valves to the pipe system influences water resistance and maximum pipe length. In the table below equivalent pipe lengths are given, which should be subtracted from the given maximum pipe length.

Copper pipe diameter *D*	Equivalent pipe length 90° bend R = 1 × D	Equivalent pipe length 45° bend R = 1 × D	Equivalent pipe length valve
mm×mm	*M*	*m*	*m*
42×1.5	0.5	0.3	0.1
54×1.5	0.8	0.3	0.2

Table 2: Equivalent pipe lengths

Pump number	Pump type
1	Grundfos UPMXL GEO 25-125N 180
2	Wilo Stratos Para Z 25/1-12

Table 3: Pump types

8.2 *Stand-alone configuration*

The setup of the boiler system depends on the type of boiler selected:

- EWD tanks have a patented mixing device inside, which mixes cold fresh water with hot water from the tank to provide feed water with the right temperature to the boiler. The setup is shown in § 8.2.1, figure 1
- When other tanks are used, it is necessary to mix the cold fresh water with warm water from the tank, outside of the tank. The mixed water will serve as input to the boiler. The setup is shown in § 8.2.2.

SAFETY COMPONENTS

NB! The pictures show examples of functional installations. The safety components as shown in these pictures are NOT necessarily conform all applicable standards and regulations.
ALWAYS have the installation installed by a skilled installer. Safety must be added according to all applicable standards and regulations.

WARNING	**If the installation is constructed in such a way that underpressure (Pabs<1 bar; Patm<0 bar) can occur in the tank, an aerator must be installed between the inlet combination and the tank, without any valve".**

8.2.1 CB-HW SETUP WITH EWD TANK

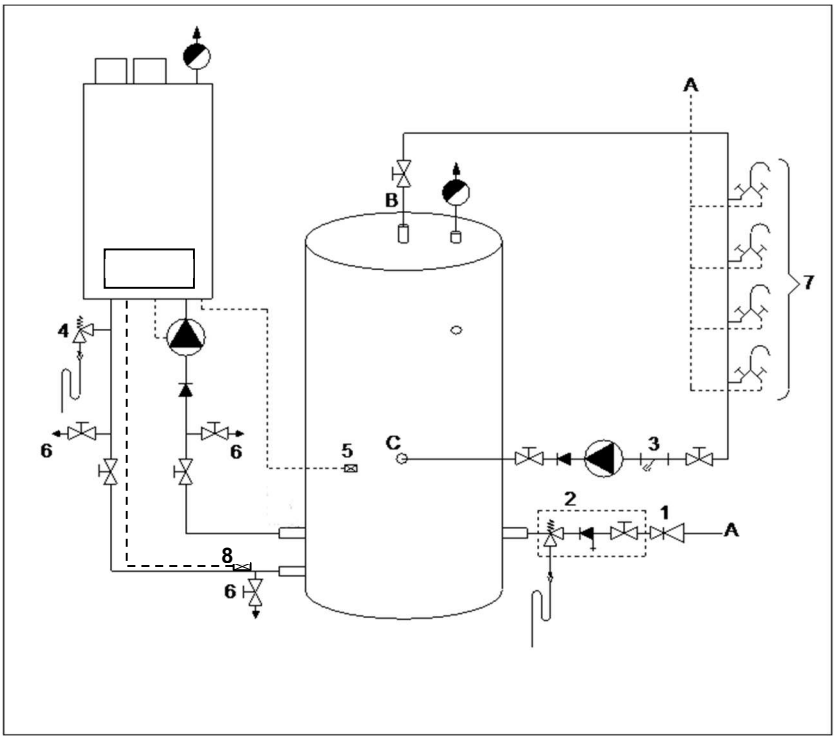


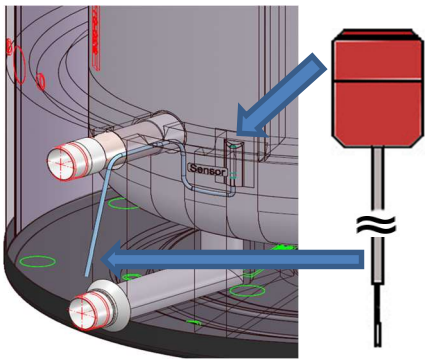
Fig. 1: *Example of one water heater and one EWD tank*

Explanation:

1) Pressure regulating valve (mandatory in case service pipe pressure is too high)
2) Inlet combination with valve (mandatory)
3) Apply filter if necessary (recommended)
4) A suitable safety valve must be mounted near the water heater (mandatory)
   This safety valve shall never be isolated from the water heater by means of a ball valve
5) The EWD tank has an pre-assembled sensor. Mount the tank sensor in an immersion bulb into the tank at 1/5 from the bottom of the tank when applying other tanks
6) Drain valve (recommended)
7) Hot and cold-water mixers
8) External pipe strap-on system sensor (necessary)

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

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



Sensor position at EWD tanks.

8.2.2 CB-HW SETUP WITH ONE NON-EWD TANK

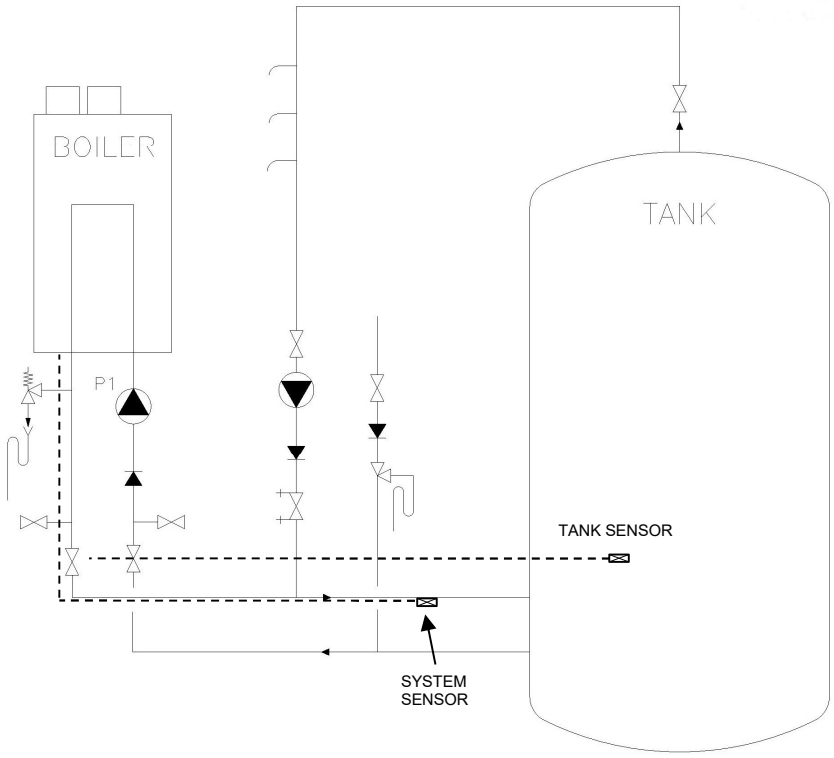


Fig. 2: Example of a combination of one water heater and one NON-EWD tank

	PUMP
	NON- RETURN VALVE
	VALVE
	SAFETY VALVE
	BALANCING VALVE
	Temperature sensor
	INLET COMBINATION - Overflow - Non return Inlet valve - Valve

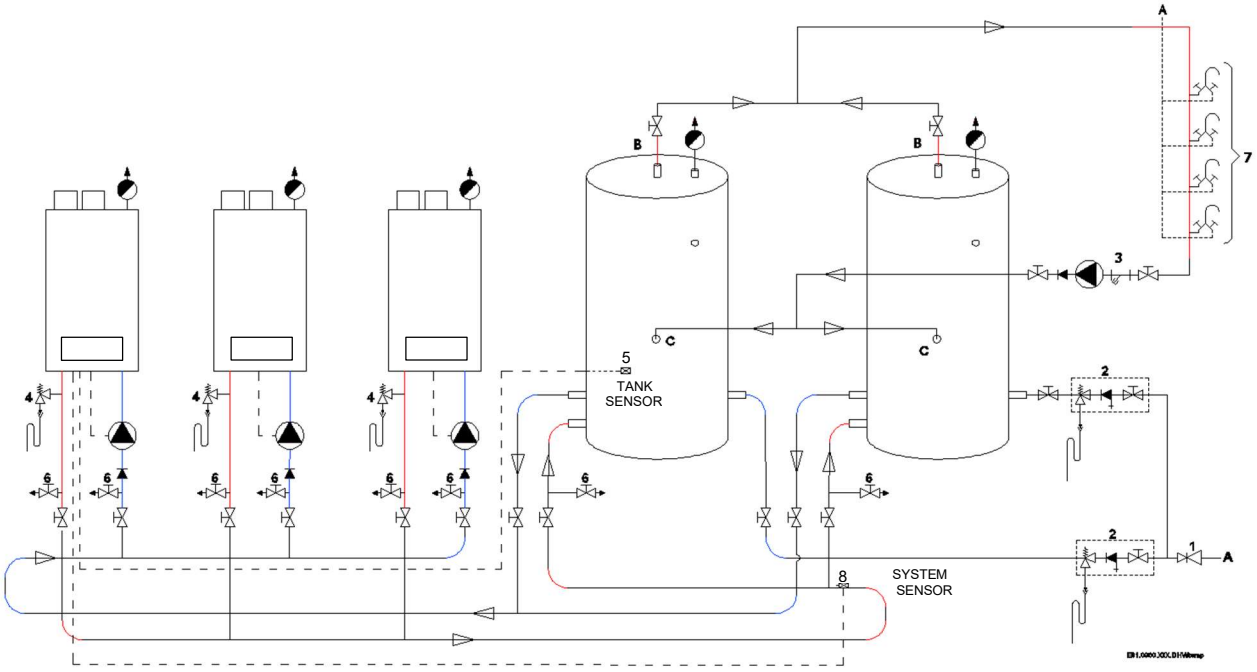
Explanation of the scheme: hot water recirculation is fed into the pipe from the water heater to the tank (2). If the tank has a separate connection for recirculation, use that connection preferably.

Use an immersion sensor (mounted into an immersion bulb into the tank at 1/5 from the bottom of the tank) and a strap-on sensor assembled to the supply pipe as close as possible to the tank.

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

8.3 Cascade set-up

HW water heaters and tanks can be installed cascaded in a number of possible combinations according to the instructions below.



Example of a combination of three water heaters and two tanks

⚠	For the installation of cascaded water heaters and tanks always consult your supplier. All requirements concerning pipe diameters and lengths and pump selection have to be calculated. By doing so you'll improve the well-functioning and the life time of your HW installation. Always use the Tichelmann system to connect multiple water heaters and/or tanks.

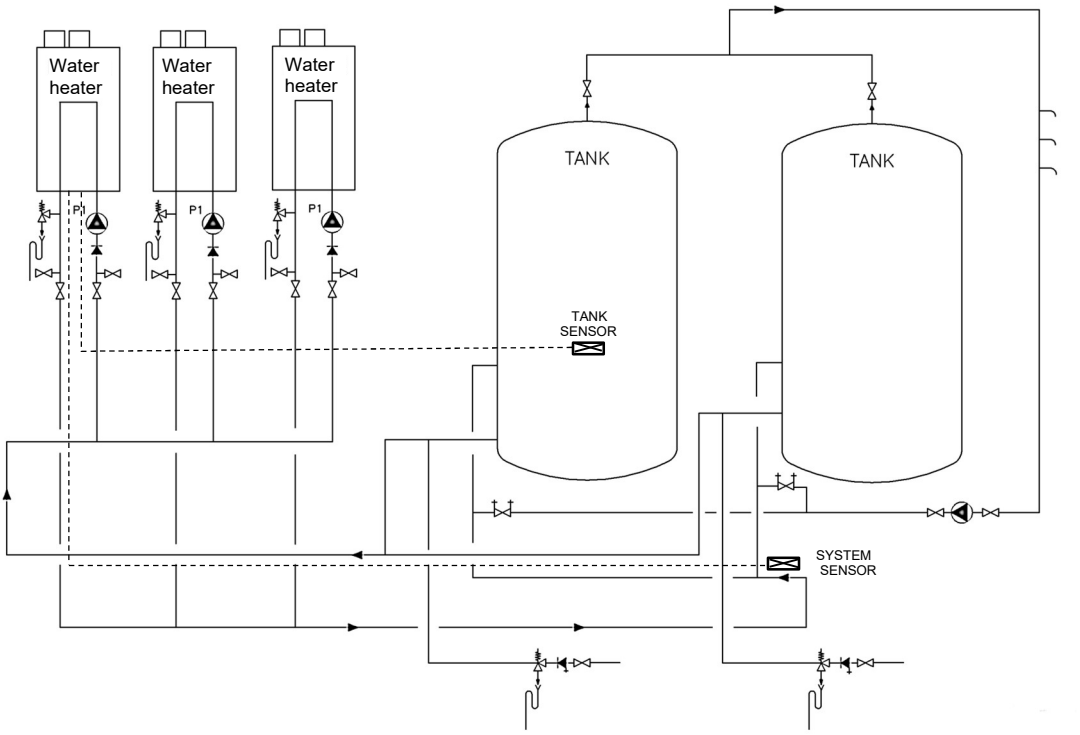
⚠ **WARNING**	**If the installation is constructed in such a way that underpressure (Pabs<1 bar; Patm<0 bar) can occur in the tank, an aerator must be installed between the inlet combination and the tank, without any valve".**

	PUMP
	NON- RETURN VALVE
	VALVE
	SAFETY VALVE
	AUTOMATIC AIR VENT
	FILTER
	Tank Bulb temperature sensor and Strap-on temperature sensor
	INLET COMBINATION - Overflow - Non return Inlet valve - Valve
	PRESSURE REGULATING VALVE

Extra explanation:

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

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



Example of a combination of three boilers and two non-EWD tanks

Notes:

- Connections on the water heater side should **always** be executed as drawn in the picture above.
- *Always apply safety components according to all applicable regulations.*
- To get a good mix of hot and cold water and therefore a better temperature arrangement of Water Heater and Tank the Supply and Return pipe of the tank should preferably be situated in the bottom 20% of the tank height.
- In case of more than one tank, mount the tank sensor on one of the tank outlets. The temperature of this tank will be assumed to be representative for all, provided that the installation design is correct.
- In the inlet (return) connection of the water heater no check valve is recommended.
- If needed, the water heater cascade control can handle up to twelve water heaters.
- For large capacity installations consult your supplier.

8.3.1 CASCADE CALCULATIONS

CB-HW water heaters and tanks can be cascaded in a number of possible combinations according to the instructions below. Pipe sizes should be selected conforming to the tables A, B and C below. These are minimum (copper) pipe sizes; selecting smaller pipes will result in a higher water resistance of the system, in higher temperature differences between flow and return of the boiler, and in a higher risk of calcification of the system.

Diameters D1 (= OUTLET and INLET of each water heater) (42 x 1,5 = Outside diameter mm x wall thickness mm e.g.)		
	ΔT = 16.5°C	**ΔT = 12.5°C**
CB 85 HW	42 x 1.5	42 x 1.5
CB 105 HW		54 x 1.5
CB 125 HW		
CB 155 HW	54 x 1.5	

Table **A:** *Connections directly on the water heater(s)*

Diameters D_T	(= TANK in- and outlet)					
CB 85 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	42 x 1.5	54 x 1.5	64 x 2.0	42 x 1.5	54 x 1.5	-
2 tanks	35 x 1.5	42 x 1.5	42 x 1.5	35 x 1.5	42 x 1.5	54 x 1.5
CB 105 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	42 x 1.5	54 x 1.5	-	54 x 1.5	64 x 2.0	-
2 tanks	35 x 1.5	42 x 1.5	54 x 1.5	35 x 1.5	54 x 1.5	54 x 1.5
CB 125 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	42 x 1.5	64 x 2.0	-	54 x 1.5	64 x 2.0	-
2 tanks	35 x 1.5	42 x 1.5	54 x 1.5	42 x 1.5	54 x 1.5	64 x 2.0
CB 155 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	54 x 1.5	-	-	54 x 1.5	-	-
2 tanks	42 x 1.5	54 x 1.5	54 x 1.5	42 x 1.5	54 x 1.5	64 x 2.0

Table **B:** *Connections directly on the water tank(s)*

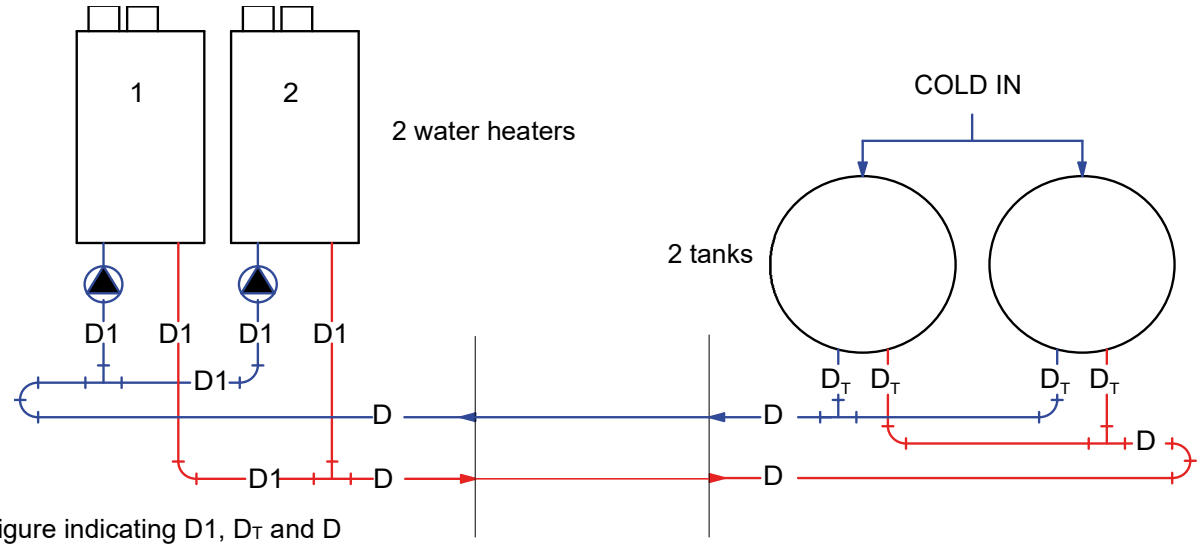


Figure indicating D1, D_T and D

Diameters D	(= Connection between water heaters and tanks))					
CB 85 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	42 x 1.5	54 x 1.5	64 x 2.0	42 x 1.5	54 x 1.5	-
2 tanks	42 x 1.5	54 x 1.5	64 x 2.0	42 x 1.5	54 x 1.5	76 x 2.0
CB 105 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	42 x 1.5	54 x 1.5	-	54 x 1.5	64 x 2.0	-
2 tanks	42 x 1.5	54 x 1.5	64 x 2.0	54 x 1.5	64 x 2.0	76 x 2.0
CB 125 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	42 x 1.5	64 x 2.0	-	54 x 1.5	76 x 2.0	-
2 tanks	42 x 1.5	64 x 2.0	76 x 2.0	54 x 1.5	76 x 2.0	88.9 x 2.0
CB 155 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	54 x 1.5	-	-	54 x 1.5	-	-
2 tanks	54 x 1.5	64 x 2.0	76 x 2.0	54 x 1.5	76 x 2.0	88.9 x 2.0

Table **C:** *Connection between boilers and tanks*

The final step is selecting the pump for each boiler. In table D below, a pump selection is made for every configuration from tables A, B and C. When applying this pump, the maximum allowable distance between water heaters and tanks is expressed as V_L. The definition of V_L is shown in fig.1. From this distance, extra resistance in the connecting pipes must be subtracted. These resistances are expressed as equivalent lengths and can be found in table E.

Pump codes and maximum distance V_L						
CB 85 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	X*	1: 2 x 9 m	2: 2 x 30 m	X*	-	-
2 tanks	1: 2 x 30 m	1: 2 x 25 m	1: 2 x 12 m	2: 2 x 13 m	2: 2 x 9 m	-
CB 105 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	X*	2: 2 x 30 m	-	X*	-	-
2 tanks	1: 2 x 13 m	1: 2 x 10 m	2: 2 x 30 m	2: 2 x 25 m	2: 2 x 9 m	-
CB 125 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	X*	2: 2 x 15 m	-	X*	-	-
2 tanks	2: 2 x 28 m	2: 2 x 25 m	2: 2 x 30 m	-	-	-
CB 155 HW	**number of cascaded water heaters ΔT = 16.5 °C**			**number of cascaded water heaters ΔT = 12.5 °C**		
	1	**2**	**3**	**1**	**2**	**3**
1 tank	X*	-	-	X*	-	-
2 tanks	2: 2 x 30 m	2: 2 x 18 m	2: 2 x 7 m	-	-	-

Table **D:** *Pump advice and corresponding maximum length V_L*

X*: single boiler and tank, see paragraph 8.1 for pipe lengths

- : A - in the table does not necessarily mean that the corresponding installation cannot be built. If it can, it will need specific design effort and pump selection. Please consult your supplier for advice.

Pump number	Pump type
1	Grundfos UPMXL GEO 25-125N 180
2	Wilo Stratos Para Z 25/1-12

Table 3: Pump specifications

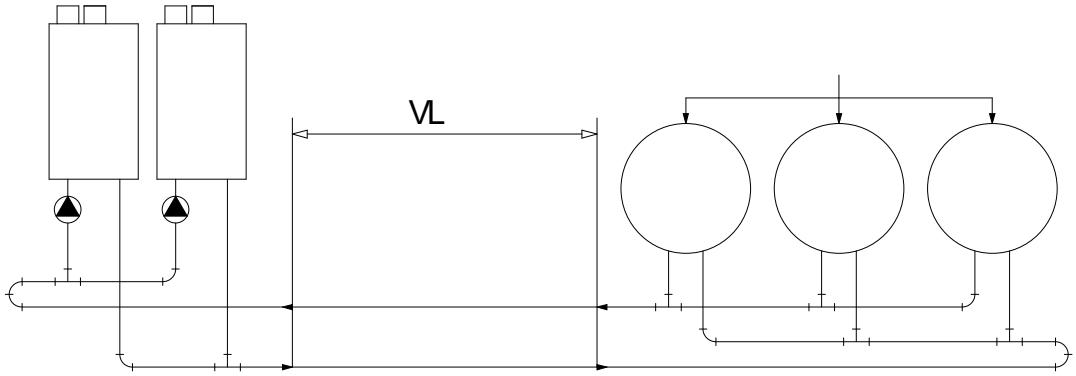


Figure 1: Definition of V_L, the maximum free length between boilers and tanks

Copper pipe diameter *D*	Equivalent pipe length 90° bend R = 1 × D	Equivalent pipe length 45° bend R = 1 × D	Equivalent pipe length valve
mm×*mm*	*m*	*m*	*m*
42×**1.5**	0.5	0.3	0.1
54×**1.5**	0.8	0.3	0.2
64×**2.0**	1.0	0.4	0.2
76×**2.0**	1.2	0.5	0.3

Table E: Equivalent pipe lengths

8.4 Elaborated examples

To elaborate the examples in this section, the rules of §§ 8.1and 8.3. are repeated below:

1. **Codes to a one water heater installation:**

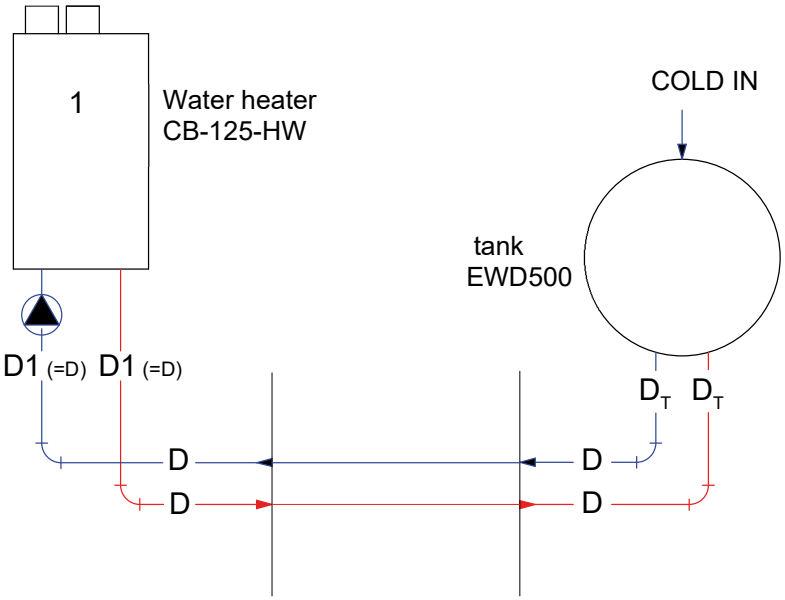
– There's only one flow pipe and one return pipe.
For the right diameter value see the table in § 8.1.

2. **Codes for cascades having two or more water heaters connected:**
Check the tables in § 8.3.1:

– Pipes directly connected to the water heater D1 are selected from table A
– Pipes directly connected to the tank D_T are selected from table B.
– The main pipes D between boilers and tanks are selected from table C

8.4.1 ONE CB 125 HW HEATER WITH ONE EWD500 TANK

Example 1

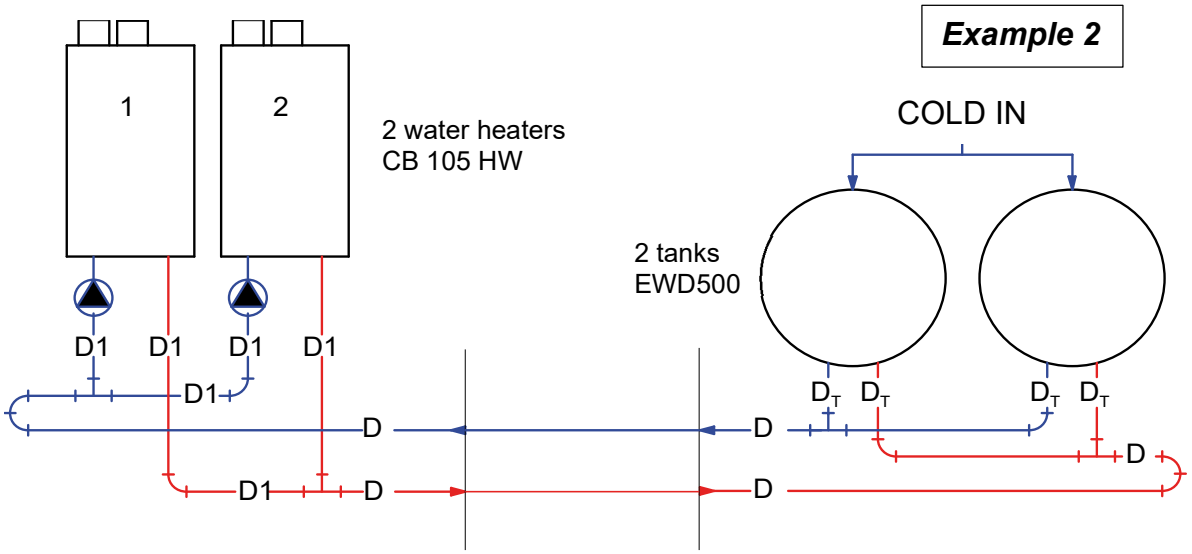


Water heater and tank connections:
For this system only one pipe size is needed.
No numbering of water heaters, tanks and connections is required.
From table 1 in paragraph 8.1: for 1 water heater CB-125-HW at ΔT = 16.5°C is D = 42×1.5 [mm×mm]

From table 1:
The maximum length of flow and return pipe 42×1.5 [mm×mm] is 2 x 30 m.
In case bends and/or valves are used, the maximum distance becomes less than 30 m (from table 2)

Pump
From table 1: Use pump **2**.

8.4.2 TWO CB 105 HW WATER HEATERS WITH TWO EWD500 TANKS

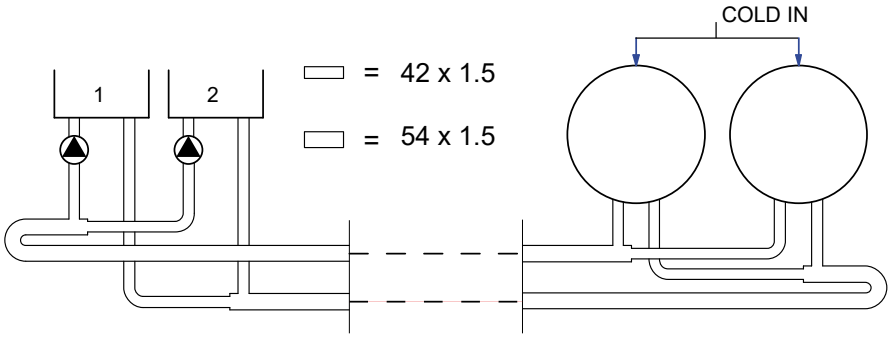


Water heater connections, encoding:
Number the water heaters: water heater-1 is the water heater furthest from the tank(s), see picture.
Encode the connection pipes directly connected to the water heaters: D1, see picture.
Encode the horizontal connection pipes:
- hot water pipes starting at water heater-1: D1 up to D (= in this example only D1 and D), see picture.
- return pipes starting at water heater-last (= water heater-2): D1 up to D (same remark), see picture.

Pipe sizes, water heater side:
Selecting ΔT = 16.5 °C, from tables A and C (§ 8.3.1), CB 105 HW:
- All pipes D1 in the picture must measure at least 42×1.5 [mm×mm] (table **A**)
- The pipes D must measure 54 x 1.5 [mm×mm] (table **C**)

Tank connections:
- From table B, for 2 tanks D_T = 42×1.5 [mm×mm].

For this system, pipes sized at least 42×1.5 [mm×mm] are to be applied for all connections directly on water heaters and tanks, and pipes sized at least 54×1.5 [mm×mm] for the connections between them.



Length of the connecting pipes water heaters ↔ tanks
From table D: The maximum <u>total</u> length of flow and return pipes 54 x 1.5 [mm×mm] is 2 x 10 m, the physical distance between water heaters and tanks is also 10 m, at max. Using bends and/or valves, this distance becomes less than 10 m. Use table **E**.

Pump: According to table **D**: Use two pumps type **1** (each water heater one pump).

8.5 Sensors

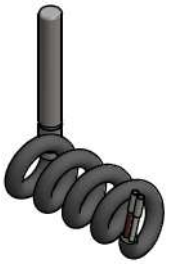
8.5.1 TANK SENSOR

The EWD300, EWD500 and EWD750 are supplied including an already assembled adhesive sensor (directly glued to the stainless steel tank behind the insulation, at the height of the tank supply pipe) The sensor has a cable with a length of 5 meter. Using other tanks the adhesive sensor is available as a spare part.

Use an immersion bulb sensor if the adhesive sensor can't be applied. The immersion sensor has to be fitted into an immersion pipe at 1/5 from the bottom of the tank. So at a tank with a total height of 200 cm the sensor has to be situated at 40 cm from the bottom.

The strap-on sensor is preferred in case an other tank is used and the adhesive or immersion bulb sensor cannot be applied. Assemble the strap-on sensor to the supply pipe of the tank as close as possible to the tank.

Connect the tank sensor to the connections 5 and 6 "DHW sensor"

 **S029.000.001** Repair set self adhesive sensor Sensor 30x40 mm Cable 5 meter.	 **S022.500.021** Strap on sensor.	 **S022.500.009** Bulb sensor Bulb Ø 6 mm, L= 45 mm. Cable 2 meter.

When using another type or brand sensor be sure it meets the following specifications:
NTC 10K@25°C (77 °F) B3977k 3%@60°C (140°F)

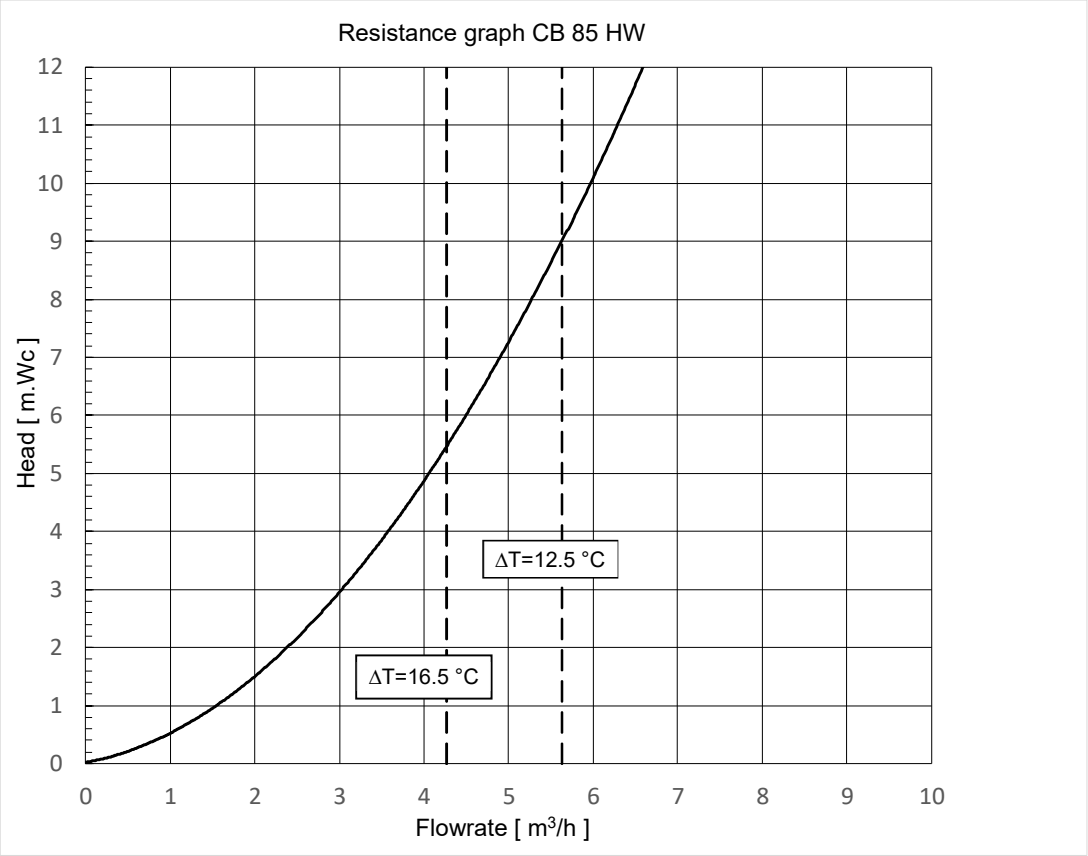
Temperature °C (°F)	Resistance (Ω)	Temperature °C (°F)	Resistance (Ω)	Temperature °C (°F)	Resistance (Ω)	Temperature °C (°F)	Resistance (Ω)
-40 (-40)	334275	10 (50)	19897	50 (122)	3599	100 (212)	674
-30 (-22)	176133	20 (68)	12493	60 (140)	2454	110 (230)	506
-20 (-4)	96761	25 (77)	10000	70 (158)	1748	120 (248)	384
-10 (14)	55218	30 (86)	8056	80 (176)	1252	130 (266)	296
0 (32)	32624	40 (104)	5324	90 (184)	912	140 (284)	230

8.5.2 SYSTEM SENSOR.

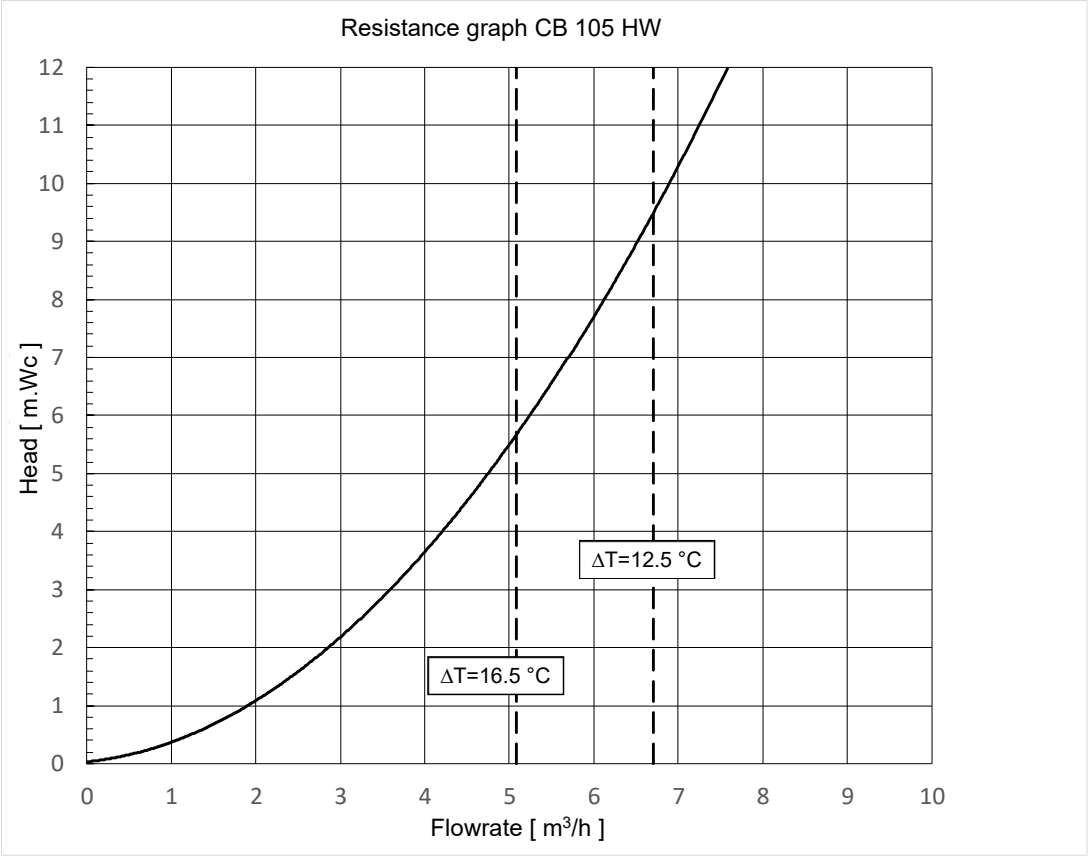
Always use a strap-on system sensor besides the immersion-, strap-on- or adhesive tank sensor. This strap-on sensor has to be connected to connections 3-4 "System Sensor" and mounted to the return pipe of the tank(s) as shown on the setup drawings in §§ 8.2 and 8.3. The strap-on system sensor has part number S022.500.021. Specifications equal to the tank sensor: NTC 10K@25°C (77 °F) B3977k 3%@60°C (140°F)

9 HEATEXCHANGER RESISTANCE GRAPHS

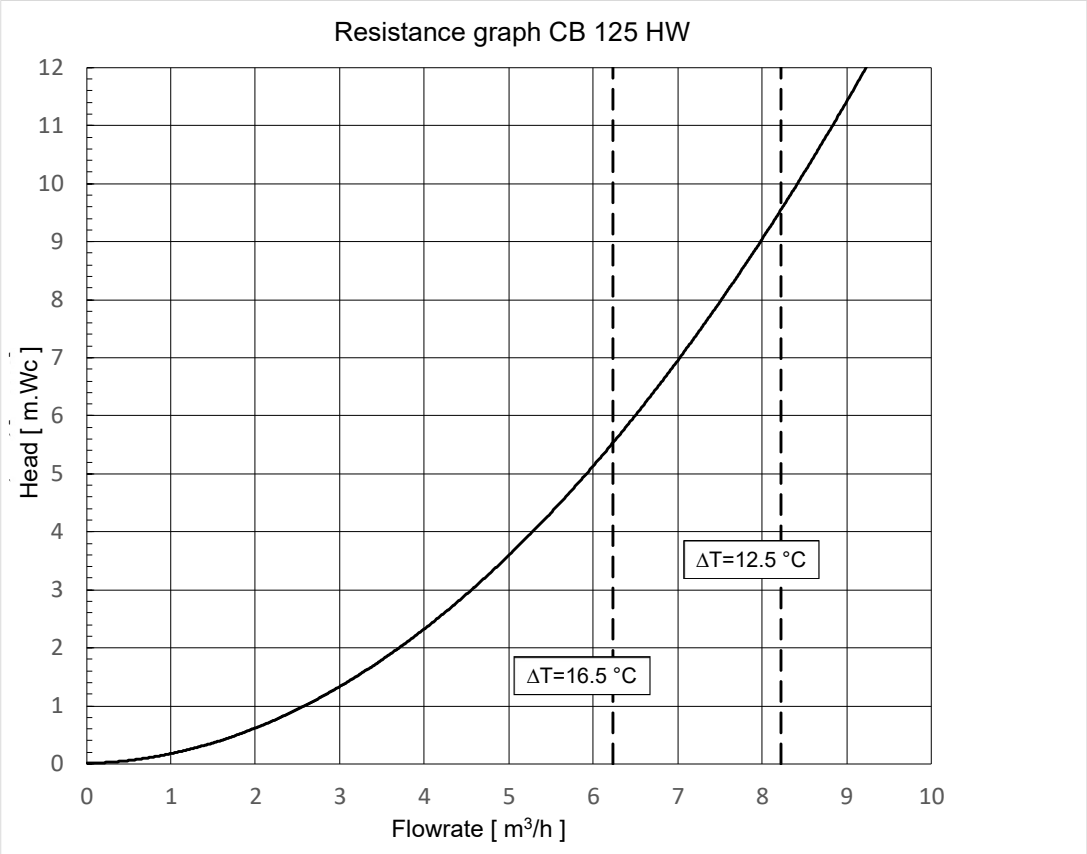
9.1 Resistance graph CB 85 HW



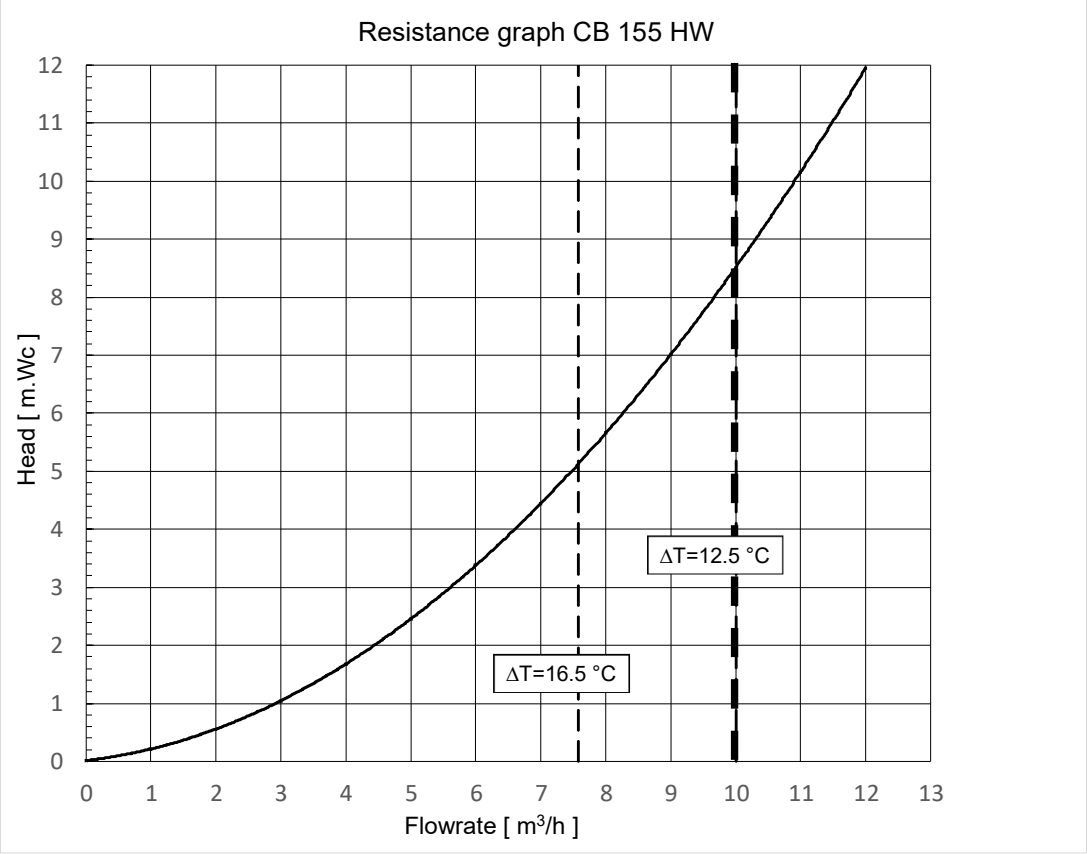
9.2 Resistance graph CB 105 HW



9.3 Resistance graph CB 125 HW



9.4 Resistance graph CB 155 HW



9.5 Minimum required pump head.

To prevent calcification of the heat exchanger, the speed of the water needs to be high. The design flow of the system should be at a delta T of 16.5 / 12.5 °C at high fire. To calculate the minimum required pump head, take the resistance of the water heater and add the resistance of the piping and tank to make a good design.
Normally, an extra 2 m.WC of head is sufficient to overcome the resistance of the pipe and tank.

Water heater ΔT = 16.5 °C	at flow rate	min. required head for water heater	min. required head for installation: +2 m.WC
	[m^3/h]	[m.WC]	[m.WC]
CB 85 HW	4.26	5.45	7.45
CB 105 HW	5.08	5.65	7.65
CB 125 HW	6.23	5.54	7.54
CB 155 HW	7.58	5.14	7.14

Water heater ΔT = 12.5 °C	at flow rate	min. required head for water heater	min. required head for installation: +2 m.WC
	[m^3/h]	[m.WC]	[m.WC]
CB 85 HW	5.63	9.00	11.00
CB 105 HW	6.70	9.50	11.50
CB 125 HW	8.23	9.56	11.56
CB 155 HW	10.01	8.53	10.53

9.6 Pump: maximum electric power

General
- The inrush current of a conventional pump is approximately 2½ x its nominal current.
- The maximum allowed switch current of the burner controller is 2 A.
- So the maximum current of the connected pumps is 2 A. Nominal.

Your supplier can offer two different pumps

Pump number	Pump type
1	Grundfos UPMXL GEO 25-125N 180
2	Wilo Stratos Para Z 25/1-12

Pump P1 meets this requirement. The pump main voltage connection can be directly connected to terminal 6-7-PE of the mains voltage connection terminal. The PWM cable must be connected to terminal 18-19 of the low voltage connection terminal.
Pump P2 has a high inrush current. Therefore it is not allowed to connect the main voltage connection of pump P2 directly to the boiler terminals. Connect the pump main voltage connection directly to the external (wall socket e.g.) main voltage. The PWM cable must be connected to terminal 18-19 of the low voltage connection terminal.

10 FLUE GAS AND AIR SUPPLY SYSTEM

10.1 General

The water heater has a positive pressure flue system. For a single boiler, the available combined pressure drop for the inlet and outlet system **is 200 Pa for the complete water heater range.**

The CB-HW water heater is for either using outdoor combustion air or for installation using indoor combustion air. All combustion air is drawn from outdoors or indoor. All products of combustion are vented directly outdoors. The Vent, and if applicable Air-Intake piping, must be piped to the outdoors. Under no conditions may this appliance vent gases into a masonry chimney. The internal safety system shuts down the water heater incase the temperature of the flue gasses becomes too high, after which the appliance will not run until re-started. Installations must comply with local requirements.

The front cover closes the housing air-tight, making sure air is only supplied by the vent air intake. Therefore, make sure the front cover is always placed in its position during operation of the appliance.
All flue resistance causes power decrease. At 200 Pa resistance the power decrease is 5%.

Notice:

- Install all horizontal flue components with an angle of 3° downwards in the direction of the water heater(roughly equal to five centimeters for every linear meter). When not installed accordingly, it may result in condensate building-up in the flue gas tube, eventually causing component failure.
- Wall flue terminals are generally used up to 80 kW. Using these terminals with larger capacities will give unpleasant large condensate clouds.
- 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 must be taken into account during the design phase of the heating installation.
- In line flue condensate drains **must** be used with flue runs longer than 4 meters with the condense drain pipe going to a sewage system.
- Because the flue gases can have a low temperature, the water heater needs to have a high efficiency approved stainless steel or plastic flue system. These materials, including the gaskets, must be usable for positive pressure flue gas systems and have a temperature class of **T120. Meaning: the parts must be certified for use at temperatures of minimal 120 °C** (See also warnings below).

Note:
In general, water heaters are certified with their own flue gas material. The water heater must be provided with high efficiency stainless steel or PP flue gas components available at the M&G group or Burgerhout B.V. The parts have to be qualified for a overpressure class P1 or H1 and a temperature class of T120 minimum.

For flue gas type B23, C13, C33, C43, C53 and C83 systems, use only flue gas and air supply parts of the approved supplier M&G group (Muelink & Grol) or Burgerhout B.V and only the parts mentioned in the DoP (declaration of performance): “No 001-MG-PP DoP” and No 001-MG-RVS DoP”. (With exception of O4 and O5) The concerning DoP’s can be found at the website of Muelink & Grol https://www.mg-flues.com/certifications/

WARNING: Before installing, read the installation manual(s) of the supplier of the flue gas and air supply parts included with the parts. Manuals for parts supplied can be found at:
www.mg-flues.com/instructions/ and http://burgerhout.nl/documenten/handleidingen/

Undermentioned manuals for parts supplied by ECO HS are applicable:

- Regulations regarding flue gas systems PP(s)
- Installation instructions clamps: Checklist
- Installation instructions Skyline 3000
- Installation instruction Multiline PP (Cascade)

10.2 C63 certified

The heater is C63 certified. This means that for this fluetype flue gas and air supply parts can be selected which have a separate CE marking according the building products regulations.
These parts must be able to handle the condensate forming (W) and transport, overpressure (P1) and must have a minimum temperature class of **T120**. Also it has to meet the requirements in the chapters 10.4 and 10.5.

CE string flue gas material	European standard	Temperature class	Pressure class	Resistance to condensate	Corrosion resistance class	Metal: liner specifications	Soot fire resistance class	Distance to combustible material	Plastics: location	Plastics: fire behavior	Plastics: enclosure
min. req. PP	EN 14471	T120	P1	W	1		O	30	I of E	C/E	L
min. req. SS	EN 1856-1	T120	P1	W	1	L20040	O	40			

A few examples of flue gas material suitable for ECO boilers:
CE String for PP: EN14471 T120 P1 W 2 O(30) I C/E L
CE String for Stainless Steel: EN1856-1 T250 P1 W V2-L50040 O (50)

When selecting flue gas systems, be aware that the minimum requirements are met. So only select flue gas materials having the same or better properties than this table.

WARNING:	Never use aluminum containing flue gas pipes in these boilers. Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.

Connecting diameters and tolerances:

mat	boiler	d_{nom} [mm]	$D_{outside}$ [mm]	d_{inside} [mm]	L_{insert} [mm]
St.St.	CB 85, CB 105, CB 125	100	100 + 0.3 / - 0.7	101 + 0.3 / - 0.3	50 +2 / - 2
St.St.	CB 155	150	150 + 0.3 / - 0.7	151 + 0.5 / - 0.5	50 + 2 / - 2
PP	CB 85, CB 105, CB 125	100	100 + 0.6 / - 0.6		50 + 20 / - 2
PP	CB 155	150	150 + 0.9 / - 0.9		50 + 20 / - 2

Multiple boilers can be connected to a common duct. See paragraph 10.7 and chapter 11 for the possibilities. A separate cascade manual is available at EcoHS. Consult the flue gas supplier for detailed information and engineering.

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

10.3 Polypropylene

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

10.3.1 FLEXIBLE POLYPROPYLENE

For use of flex pipe, it is recommended to have the vent material in 0 °C or higher ambient space temperature before bending at installation. No bends must be made to greater than 45° and ONLY installed in vertical or near vertical installations.

10.4 Stainless steel vent.

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

WARNING	Use only the materials and vent systems listed. DO NOT mix vent systems of different types or manufacturers. Failure to comply could result in severe personal injury or substantial property damage.
NOTICE	Installations must comply with applicable national, state, and local codes.
	Installation of a stainless-steel vent system must adhere to the stainless-steel vent manufacturer's installation instructions supplied with the vent system.

10.5 Air supply

When an air supply duct is connected from the outside of the building to the boiler, the water heater will operate as a room-independent water heater (closed boiler).

10.5.1 COMBUSTION AIR QUALITY

Combustion air must be free of contaminants. For example: chlorine, ammonia and/or alkali agents, dust, sand and pollen. Remind that installing a water heater near a swimming pool, a washing machine, laundry or chemical plants does expose combustion air to these contaminants.

10.5.2 AIR SUPPLY THROUGH HUMID AREAS

When the supply duct will be placed in a water heater room with moist air (for example: greenhouses), a double walled supply duct or an insulated duct must be used to prevent the possible condensation at the outside of the duct. It is not possible to insulate the internal air pipes of the water heater and therefore condensation at the internal air canals must be prevented.

When roof mounted, the air supply duct needs to be protected against rain, so no water will be entering the boiler.

10.5.3 AIR INLET PIPE MATERIALS

The air inlet pipe(s) must be sealed. Choose acceptable combustion air inlet pipe materials from the following list:
- PP
- Flexible propylene air intake
- Stainless Steel

10.6 Room air

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

- The equipment room MUST be provided with properly sized openings to assure adequate combustion air. These vents must be open and may not be closed or blocked. Requirements in accordance with national and local standards, e.g. NEN 3028 and BS 6644.
- 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.

10.6.1 AIR CONTAMINATION

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

WARNING	The water heater may 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 check for areas and products listed in the list below, with contaminants before installing the water heater or air inlet piping.
	If contaminants are found, you MUST: - remove contaminants permanently. or - relocate air inlet and vent terminations to other areas.
	The installation room has to have sufficient air supply vents. These vents must be open and shall not be closed or blocked. Requirements in accordance with national and local standards, e.g. NEN 3028 and BS 6644.

Corrosive Contaminants and Sources

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

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

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

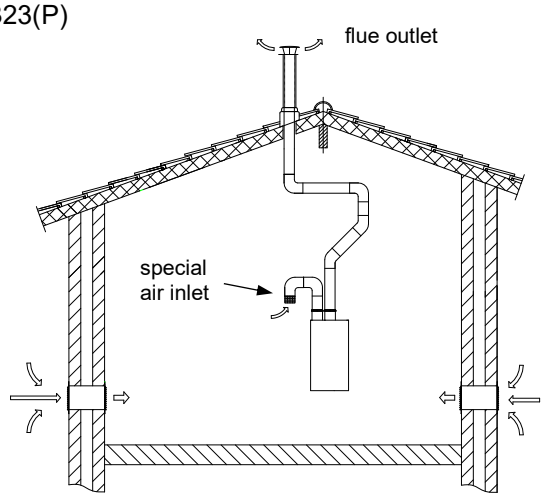
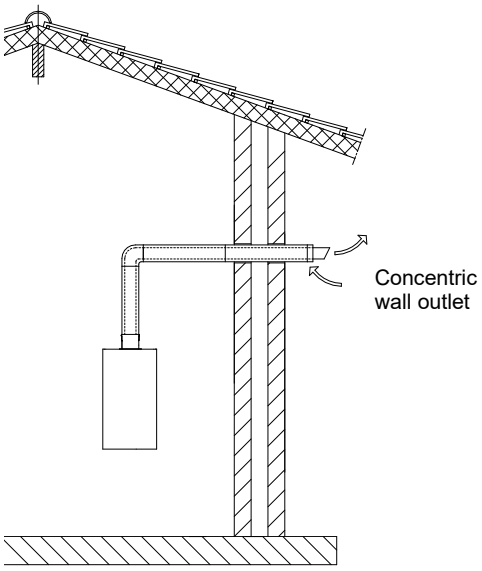
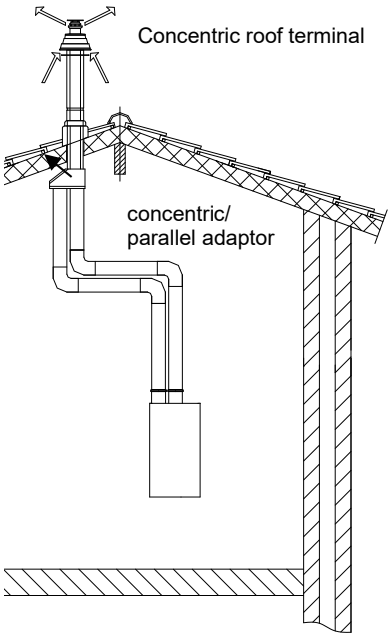
Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.

The vent for this appliance shall not terminate:

1. over public walkways;
2. near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or cause property damage;
3. where condensate vaper could cause damage or could be detrimental to the operation of regulators, relief valves, or other equipment.

10.8 Water heater categories - types of flue gas systems.

For C43 and cascade see manuals at the suppliers website: http://www.ecohs.nl/

Type according to EN 15502-2-1: 2012	Performance	Description
B23(P) 	Open Air supply from room	* Roof terminal * Without draught diverter * Water heater room air supply. * P = overpressure systems See: Typical examples - example C **Notice:** The installation room has to have sufficient air supply vents. These vents must be open and may not be closed or blocked. Requirements in accordance with national and local standards, e.g. NEN 3028 - § 6.5 and BS 6644. Note: Special air inlet needed for IPX4D protection class (accessory, see § 5.1).
C13 	Closed Air supply from outside	* Wall outlet. * Air supply inlet and flue gas outlet at the same air pressure zone. (a combined wall outlet e.g.). See: Typical examples - example E
C33 	Closed Air supply from outside	* Flue terminal at the roof. * Air supply inlet and flue gas outlet located at the same air pressure zone (a combined roof terminal e.g.). See: Typical examples - example B

<table>
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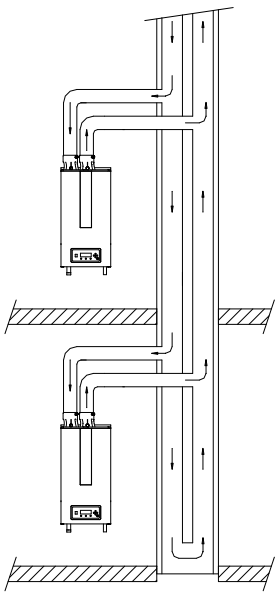
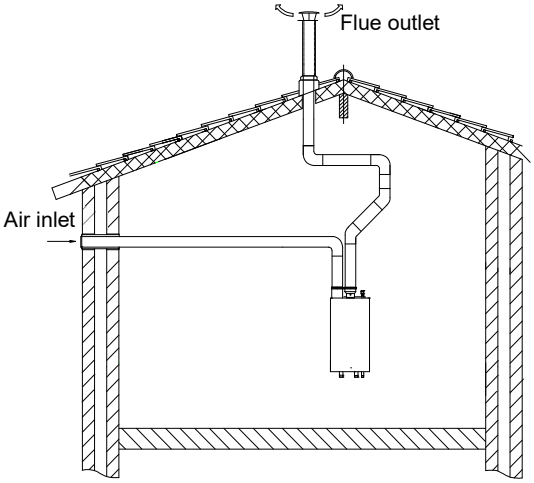
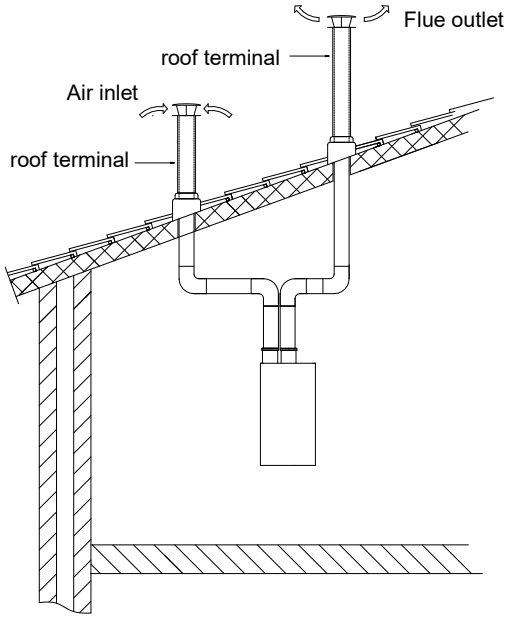
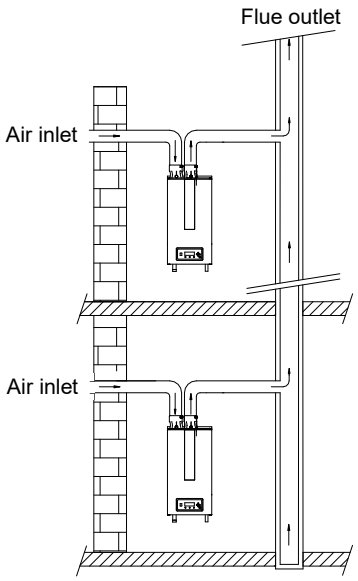
<td>C43
 
EHS.D0500.5010.400</td>
<td>Closed
Air supply from outside</td>
<td>Type C43. A type C4 appliance incorporating a fan upstream of the combustion chamber/heat exchanger.</td>
</tr>
<tr>
<td>C53
 
</td>
<td>Closed
Air supply from outside</td>
<td>*Separate air supply duct
*Separate flue gas discharge duct.
* Air supply inlet and flue gas outlet at different air pressure zones. But not at opposite walls.

See: Typical examples - example F</td>
</tr>
<tr>
<td>C63 - example
 
</td>
<td>Closed
Air supply from outside</td>
<td>* Appliance sold without flue/air-inlet ducts
* The flue gas parts are not part of the boiler. The water heater is intended to be connected to a separately approved and marketed system for the supply of combustion air and discharge of combustion products.
Condensate is allowed to go to the boiler.
* Air supply inlet and flue gas outlet not at opposite walls
* Technical data:
<table>
<tr><td>nominal $T_{flue\ gas}$</td><td>85 °C</td></tr>
<tr><td>nominal $Q_{fluegas}$</td><td>see 3.3[1)]</td></tr>
<tr><td>maximum $T_{fluegas}$</td><td>90 °C</td></tr>
<tr><td>min. load $T_{fluegas}$</td><td>35 °C</td></tr>
<tr><td>min. load $Q_{fluegas}$</td><td>see 3.3[1)]</td></tr>
<tr><td>nominal % O_2</td><td>see 3.3[1)]</td></tr>
<tr><td>max. allowed draft</td><td>70 Pa</td></tr>
<tr><td>max. pressure drop inlet-outlet</td><td>200 Pa</td></tr>
<tr><td>max $T_{air\ supply}$</td><td>40 °C</td></tr>
<tr><td>max recirculation</td><td>10 %</td></tr>
</table>
1) technical specifications datasheet
See: Typical examples - example A</td>
</tr>
</table>

C83



Closed
Air supply from outside

* Separate air supply duct from external wall.
*Flue gas discharge through individual or shared flue ducting built into the building.
* Air supply inlet and flue gas outlet at different air pressure zones.
* Condensate is not allowed to go to the boiler.

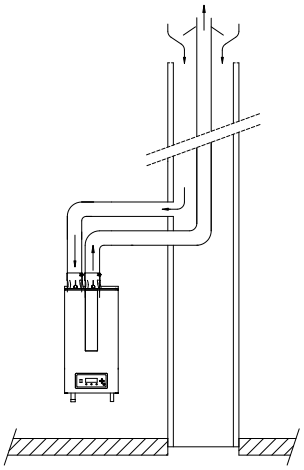
* Technical data:

nominal $T_{flue\ gas}$	85 °C
nominal $Q_{fluegas}$	see 3.3[1)]
maximum $T_{fluegas}$	90 °C
min. load $T_{fluegas}$	35 °C
min. load $Q_{fluegas}$	see 3.3[1)]
nominal % O_2	see 3.3[1)]

1) technical specifications datasheet

* Flue duct: Material: PP or SS
CE approved

C93

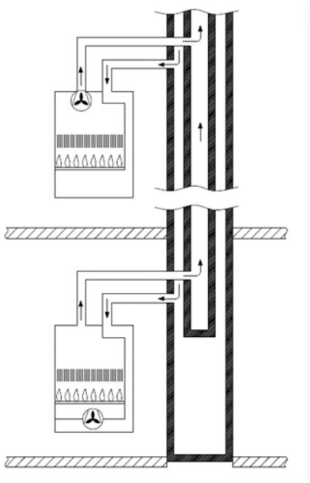


Closed
Air supply from outside

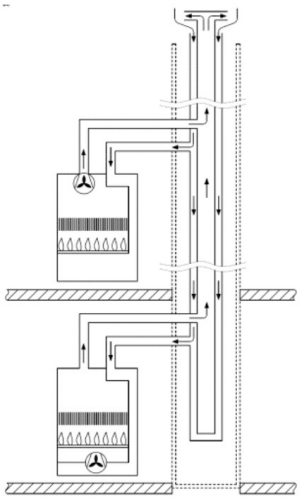
Type C93 . A type C9 appliance incorporating a fan upstream of the combustion chamber/heat exchanger.

Minimum required diameter/ cross section area:

boiler	diameter	area
CB 85, 105, 125	100 mm	7854 mm^2
CB 155	150 mm	17671 mm^2

<table>
<tr><th>Type according to EN 15502-2-1: 2012</th><th>Performance</th><th>Description</th></tr>
<tr><td>C10(3)
  </td><td>Closed or open
Air supply from out-side or room</td><td>Over pressure common flue system:
* Flue gas discharge through individual or shared flue ducting built into the building.
* Air supply inlet and flue gas outlet
* Condensate is not allowed to go to the boiler.
* Technical data:
<table><tr><td>nominal $T_{flue\ gas}$</td><td>85 °C</td></tr><tr><td>nominal $Q_{fluegas}$</td><td>see 3.3[1)]</td></tr><tr><td>maximum $T_{fluegas}$</td><td>90 °C</td></tr><tr><td>min. load $T_{fluegas}$</td><td>35 °C</td></tr><tr><td>min. load $Q_{fluegas}$</td><td>see 3.3[1)]</td></tr><tr><td>nominal % O_2</td><td>see 3.3[1)]</td></tr></table>1) technical specifications datasheet

* Flue ducting: Material: PP or SS, CE approved
* max. collector flue pressure 25 Pa

WARNING:
If other than M&G flue gas materials are used, please contact your boiler supplier.</td></tr>
<tr><td>C11(3)
  </td><td>Closed or open
Air supply from out-side or room</td><td>Over pressure common flue system:
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* Air supply inlet and flue gas outlet
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* Flue ducting: Only M&G multi PP and SS according to the C11 flue gas manual.
* max. collector flue pressure 85 Pa

Check the C11 Common Flue gas manual to calculate the flue gas system.</td></tr>
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 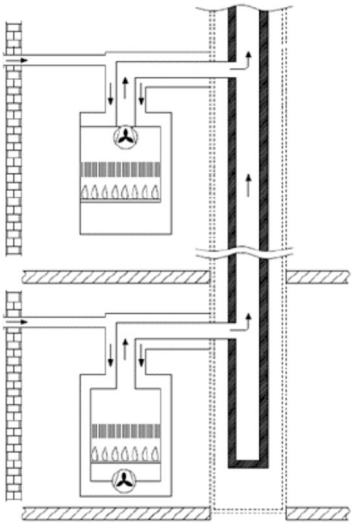 </td><td>Closed
Air supply from out-side</td><td>Over pressure common flue system:
* Flue gas discharge through individual or shared flue ducting built into the building.
* Air supply inlet and flue gas outlet
* Condensate is not allowed to go to the boiler.
* Technical data:
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* Flue ducting: Material: PP or SS, CE approved
* max. collector flue pressure 25 Pa</td></tr>
</table>

<table>
<tr>
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 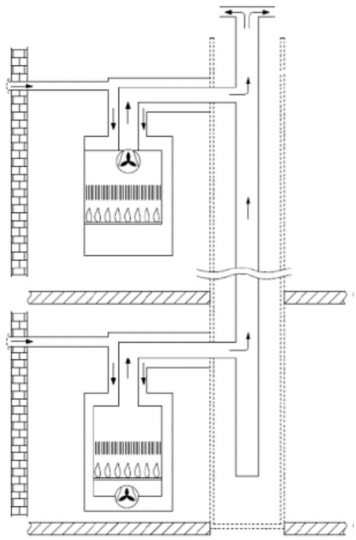 </td>
<td>Closed
Air supply from out-side</td>
<td>Over pressure common flue system:
* Flue gas discharge through individual or shared flue ducting built into the building.
* Air supply inlet and flue gas outlet
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<tr><td>min. load $Q_{fluegas}$</td><td>see 3.3[1)]</td></tr>
<tr><td>nominal % O_2</td><td>see 3.3[1)]</td></tr>
</table>
1) technical specifications datasheet
* Flue ducting: Only M&G multi PP and SS according to the C11 flue gas manual.
* max. collector flue pressure 85 Pa</td>
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<tr>
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 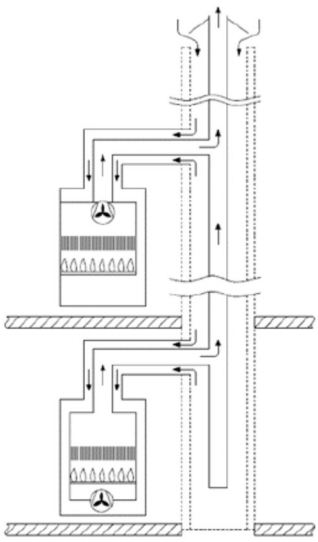 </td>
<td>Closed
Air supply from out-side</td>
<td>Over pressure common flue system:
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<tr><td>nominal % O_2</td><td>see 3.3[1)]</td></tr>
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* max. collector flue pressure 85 Pa</td>
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 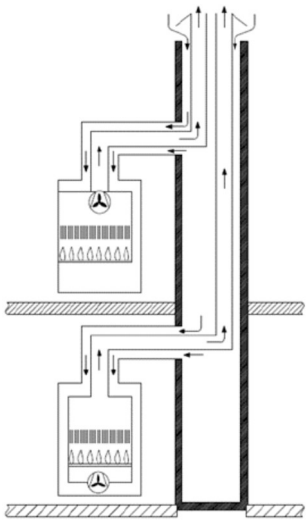 </td>
<td>Closed
Air supply from out-side</td>
<td>Over pressure common flue system:
* Flue gas discharge through individual ducting built into the building.
* Air supply inlet and flue gas outlet
* Condensate is not allowed to go to the boiler.
* Technical data:
<table>
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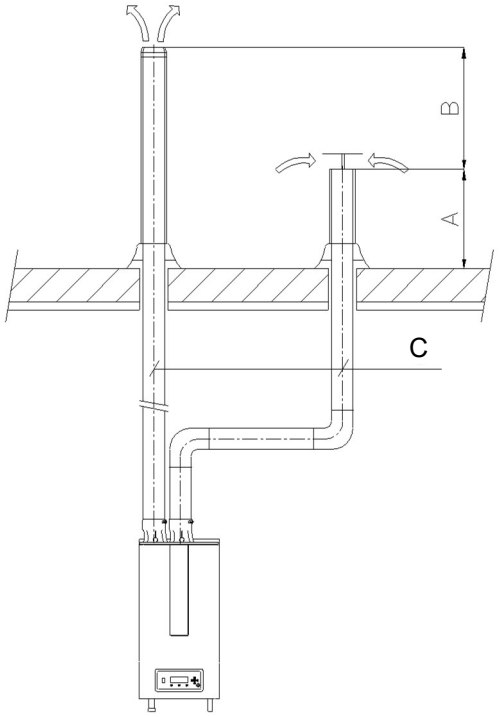
<tr><td>nominal % O_2</td><td>see 3.3[1)]</td></tr>
</table>
1) technical specifications datasheet
* Flue ducting: Only M&G multi PP and SS according to the C11 flue gas manual.</td>
</tr>
</table>

10.9 Pipe heights and mutual distances on a flat roof



Height A

This is the height of the air inlet. A rain hood must prevent rain entering the air supply system.
When the inlet and outlet are mounted on a flat roof, the inlet must be at least 60 cm above the roof surface and at least 30 cm above the maximum snow level.

Example 1:

If the maximum snow level on the roof surface is 45 cm, then the air inlet would be at 45 + 30 = 75 cm. This 75 cm is more than the minimum 60 cm, so the height must be 75 cm.

Example 2:

If the maximum snow level on the roof surface is 15 cm, then the air inlet would be at 15 + 30 = 45 cm. This 45 cm is less then the minimum 60 cm, so the height must be 60 cm.

Height difference B

This is the distance between the flue outlet and the air inlet.
The flue gas outlet must be at least 70 cm above the air inlet. It is advised to apply a conical outlet.
If no air inlet is used on the roof, the flue outlet must be situated at least 100 cm above the roof surface.

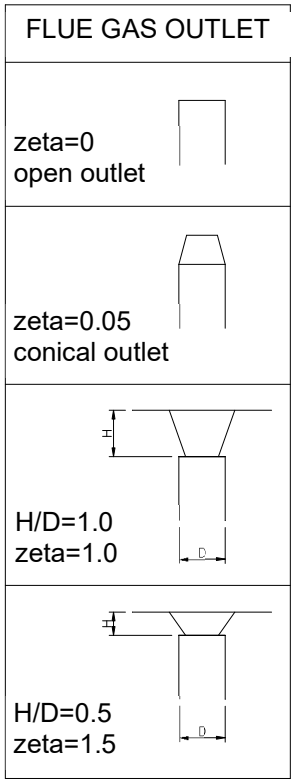
Distance C

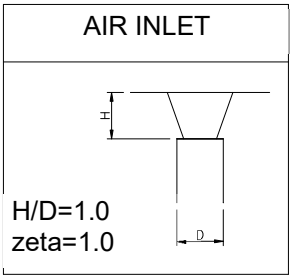
The horizontal mutual distance at roof level.
This distance must be at least 70 cm.

10.10 Flue gas and air supply resistance table

In the next section, for six typical flue gas outlet & air inlet configurations the maximum lengths of the straight pipes will be calculated. First all component resistance values are given in the next table:

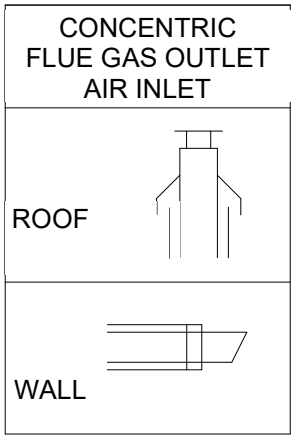
		PARALLEL	CB 85	CB 105	CB 125	CB 155
	Ø		RESISTANCE [Pa]			
FLUE GAS	100	straight tube/m	**2.8**	**4.0**	**6.0**	-
		45° bend	**6.4**	**9.0**	**13.6**	-
		90° bend	**10.2**	**14.5**	**21.9**	-
		Flue outlet zeta=0.05	**0.5**	**0.8**	**1.2**	-
		Flue outlet zeta=1.0	**10.8**	**15.3**	**23.0**	-
		Flue outlet zeta=1.5	**16.2**	**22.9**	**34.5**	-
	130	straight tube/m	0.7	1.0	1.5	2.2
		45° bend	1.3	1.8	2.7	4.0
		90° bend	3.0	4.3	6.4	9.5
		Flue outlet zeta=0.05	0.2	0.3	0.4	0.6
		Flue outlet zeta=1.0	3.6	5.1	7.7	11.4
		Flue outlet zeta=1.5	5.4	7.7	11.6	17.2
	150	straight tube/m	0.4	0.6	0.9	**1.3**
		45° bend	0.7	0.9	1.4	**2.1**
		90° bend	1.6	2.2	3.3	**4.9**
		Flue outlet zeta=0.05	0.1	0.1	0.2	**0.3**
		Flue outlet zeta=1.0	2.0	2.8	4.3	**6.3**
		Flue outlet zeta=1.5	3.0	4.3	6.4	**9.5**
		Roof terminal	3.4	4.8	7.3	**10.8**
		reducer 150 to 130	2.1	3.0	4.5	**6.6**
AIR SUPPLY	100	straight tube/m	3.2	4.6	6.9	-
		45° bend	7.4	10.5	15.7	-
		90° bend	11.9	16.8	25.3	-
		air inlet zeta=1.0	12.5	17.7	26.7	-
	130	straight tube/m	0.8	1.1	1.7	2.5
		45° bend	1.5	2.1	3.1	4.6
		90° bend	3.5	4.9	7.4	11.0
		air inlet zeta=1.0	4.2	5.9	9.0	13.3
	150	straight tube/m	0.5	0.7	1.0	**1.5**
		45° bend	0.8	1.1	1.6	**2.4**
		90° bend	1.8	2.6	3.9	**5.7**
		air inlet zeta=1.0	2.3	3.3	5.0	**7.3**





NOTICE: This table may only be used for a single flue/air system for one boiler.
Do NOT use this table for common flue systems with cascaded boilers.

		Boiler	CB 85	CB 105	CB 125	CB 155
	Ø mm	CONCENTRIC	RESISTANCE [Pa]			
FLUE GAS	100/150	straight tube/m	**2.9**	**4.1**	**6.2**	-
		45° bend	**6.4**	**9.0**	**13.6**	-
		90° bend	**10.2**	**14.5**	**21.9**	-
		roof terminal	**31.2**	**44.3**	**66.7**	-
		wall terminal	**10.8**	**15.3**	**23.0**	-
		adaptor	**0.4**	**0.6**	**0.9**	-
AIR SUPPLY	100/150	straight tube/m	**9.2**	**13.1**	**19.7**	-
		45° bend	**8.1**	**11.4**	**17.2**	-
		90° bend	**11.7**	**16.6**	**25.1**	-
		roof terminal	**43.3**	**61.4**	**92.4**	-
		wall terminal	**43.3**	**61.4**	**92.4**	-
		adaptor	**39.2**	**55.6**	**83.8**	-



*** Never reduce pipe diameters relative to water heater connections**
Values printed in grey applicable for <u>larger</u> pipe diameters than water heater connection

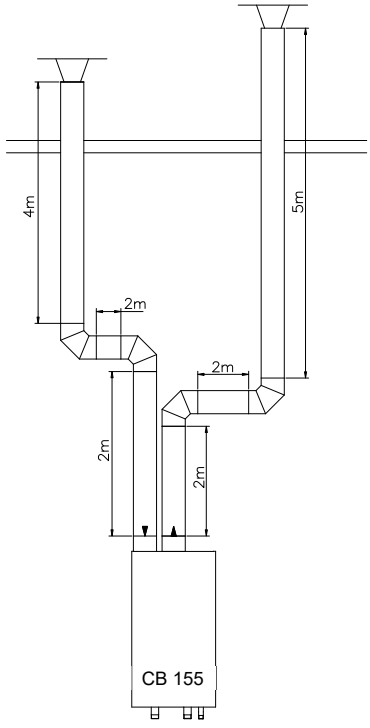
NOTICE: This table may only be used for a single flue/air system for one boiler.
Do NOT use this table for common flue systems with cascaded boilers.

10.11 Typical examples

A:	Twin pipe system with separate pipes for flue gas and air supply	**C63**
B:	Twin pipe system with separate pipes and concentric roof terminal	**C33**
C:	Single pipe for flue gas outlet only (air supply from water heater room)	**B23**
D:	Concentric pipe for flue gas/air supply (roof-mounted)	**C33**
E:	Concentric pipe for flue gas/air supply (wall-mounted)	**C13**
F:	Separate air supply duct & flue duct in different pressure zone	**C53**

NOTICE: specific resistance values of ECO-HS flue gas and air intake parts are used for these examples. Other suppliers can have deviating values!

10.11.1 EXAMPLE A: TWIN PIPE SYSTEM WITH SEPARATE PIPES FOR FLUE OUTLET AND AIR SUPPLY



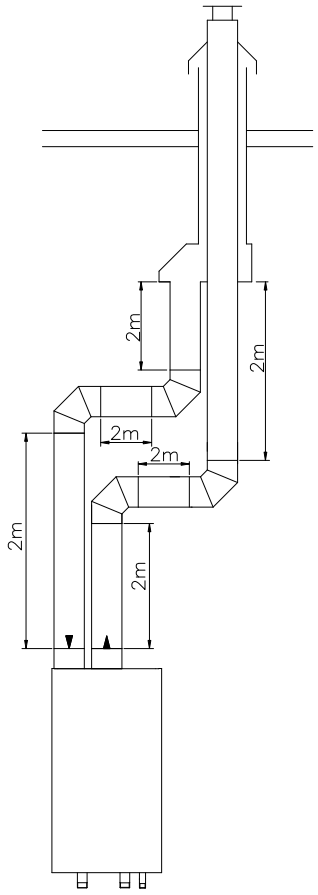
Calculation example with given lengths: checking resistance

Water heater type:		**CB 155**		
Flue gas	**Diameter: 150 mm**		**Number**	**Pa**	**Pa total**
	Straight tube /m	total	9	1.3	11.7
	Bend	90°	2	4.9	9.8
	Flue outlet	zeta=1.0	1	6.3	6.3
	Total resistance flue gas outlet:				**27.8**
Air supply	**Diameter: 150 mm**		**Number**	**Pa**	**Pa total**
	Straight tube /m	total	8	1.5	12.0
	Bend	90°	2	5.7	11.4
	Air inlet	zeta=1.0	1	7.3	7.3
	Total resistance air supply:				**30.7**
Total resistance flue gas outlet and air supply:					**58.5**

The total resistance is less than 200 Pa.
This flue gas/ air supply system is functional.

NOTE: ECO specific resistance values are used in this example.
Flue and air pipes of other suppliers can have other values

10.11.2 EXAMPLE B: TWIN PIPE SYSTEM WITH CONCENTRIC ROOF TERMINAL



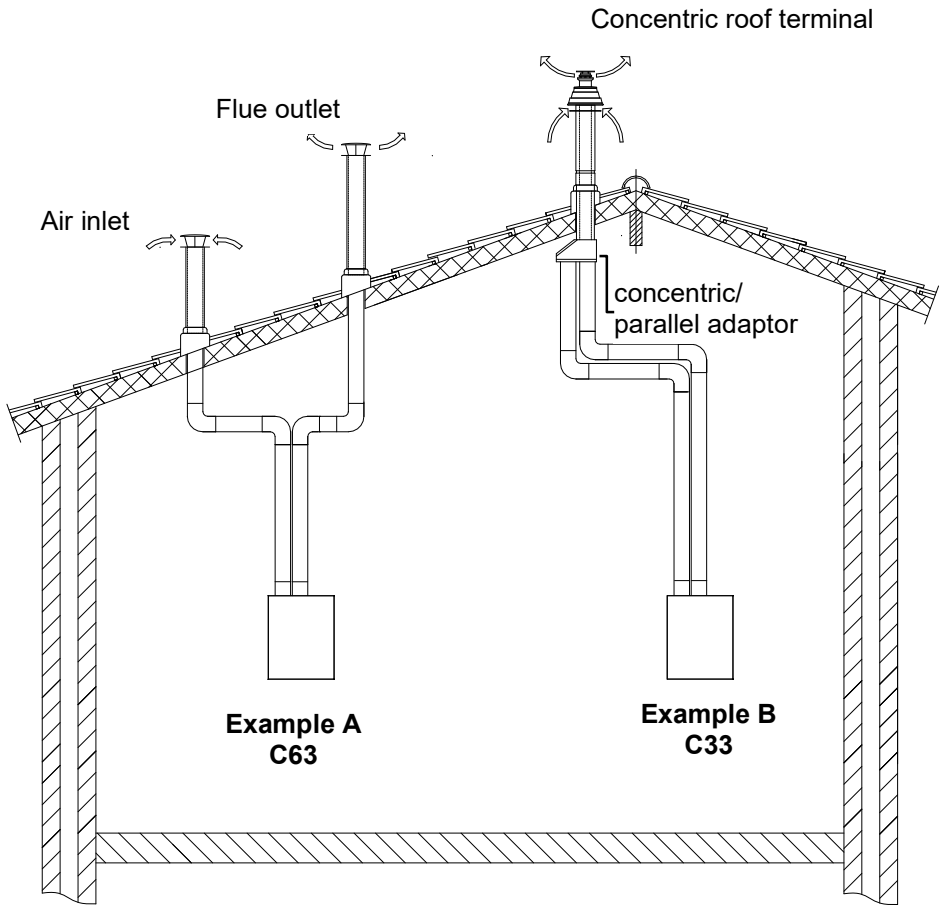
Calculation example with given lengths: checking resistance

Water heater type:		**CB 125**			
Flue gas	**Diameter: 100 mm**		**Number**	**Pa**	**Pa total**
	Straight tube /m	total	6	6.0	36.0
	Bend	90°	2	21.9	43.8
	Roof terminal	concentric 100/150	1	66.7	66.7
	Adaptor conc./par.	100-100 > 100/150	1	0.9	0.9
	Total resistance flue gas outlet:				**147.4**
Air supply	**Diameter: 100 mm**		**Number**	**Pa**	**Pa total**
	Straight tube /m	total	6	6.9	41.4
	Bend	90°	2	25.3	50.6
	Roof terminal	concentric 100/150	1	92.4	92.4
	Adaptor conc./par.	100-100 > 100/150	1	83.8	83.8
	Total resistance air supply:				**268.2**
Total resistance flue gas outlet and air supply:					**415.6**

The total resistance is more than 200 Pa.
This flue gas / air supply system is NOT functional.

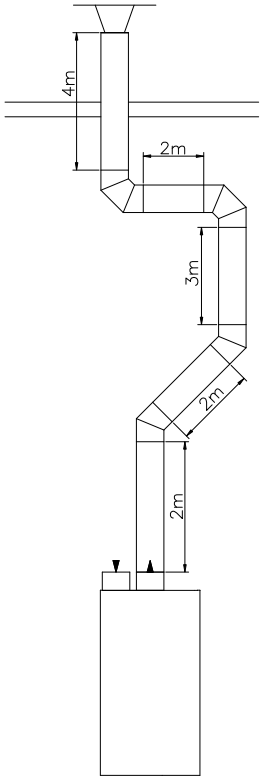
NOTE: ECO specific resistance values are used in this example.
Flue and air pipes of other suppliers can have other values

Examples A (C63) and B (C33) maximum pipe lengths



Example A (C63)					
water heater type →		**CB 85**	**CB 105**	**CB 125**	**CB 155**
Diameter air pipe	[mm]	100	100	100	150
Diameter flue pipe	[mm]	100	100	100	150
Diam. roof terminals	[mm]	100	100	100	150
Maximum pipe length **[m]** (flue & air total pipe length) includes: 4 bends 90° flue outlet zeta = 1.0 air inlet zeta =1.0		**41.4**	**22.7**	**8.1**	**110.1**

Example B (C33)					
water heater type →		**CB 85**	**CB 105**	**CB 125**	**CB 155**
Diameter air pipe	[mm]	100	NOT POSSIBLE use less bends and/or pipe length, or larger pipe diameter.	NOT POSSIBLE use less bends and/or pipe length, or larger pipe diameter.	NOT POSSIBLE use less bends and/or pipe length, or larger pipe diameter.
Diameter flue pipe	[mm]	100			
Concentric roof terminal	[mm]	100/150			
Maximum pipe length **[m]** (flue & air total pipe length) includes: 4 bends 90° adaptor par-conc conc. roof terminal		**3.4**			

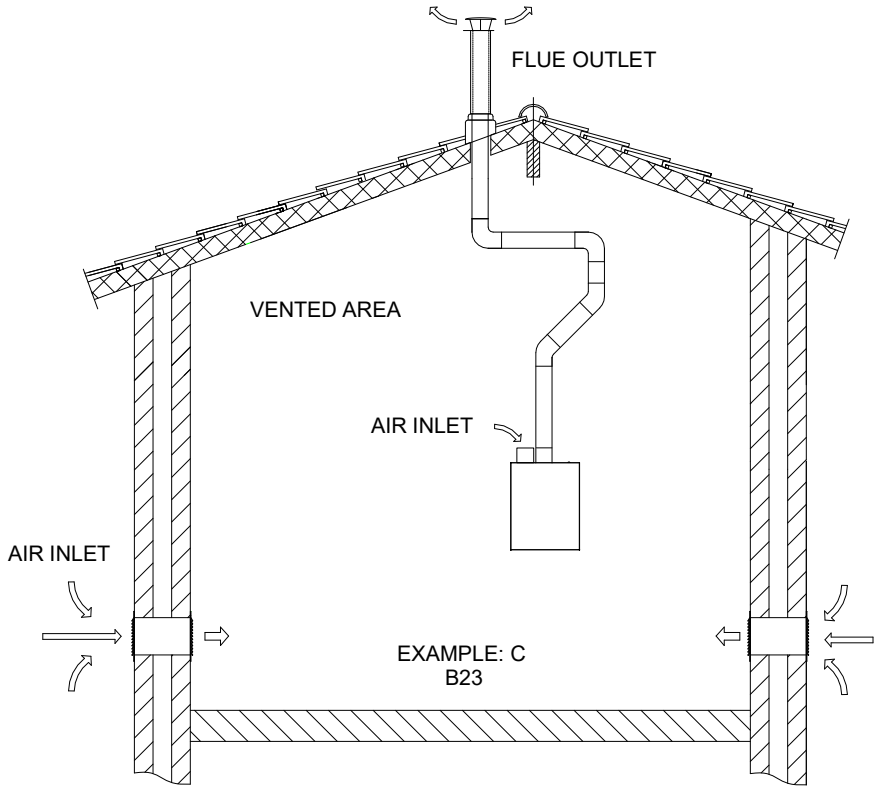


Calculation example with given lengths: checking resistance

Water heater type:		CB 105		
FLUE GAS	**Diameter: 100 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	13	4.0	52.0
	Bend	45°	2	9.0	18.0
	Bend	90°	2	14.5	29.0
	Flue outlet	zeta = 1.0	1	15.3	15.3
	Total resistance flue gas:				**114.3**

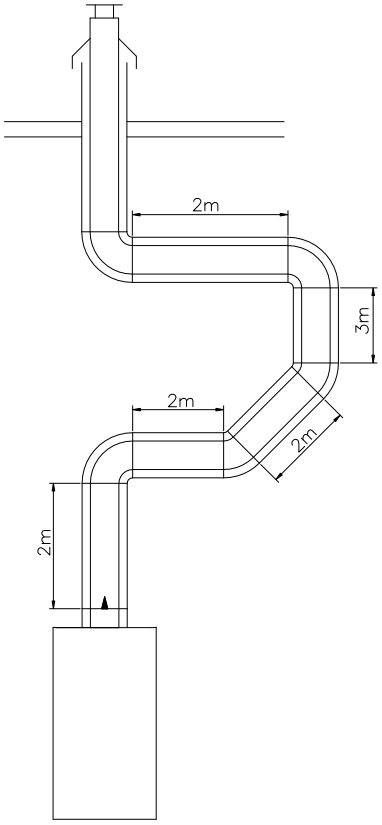
The total resistance is less than 200 Pa.
This flue gas / air supply system is functional.

NOTE: ECO specific resistance values are used in this example.
Flue and air pipes of other suppliers can have other values



Example C (B23, B23P)					
water heater type →		**CB 85**	**CB 105**	**CB 125**	**CB 155**
Diameter air pipe	[mm]	100	100	100	150
Diameter flue pipe	[mm]	100	100	100	150
Diam. roof terminal	[mm]	100	100	100	150
Maximum pipe length **[m]** includes: 2 bends 90° 2 bends 45°flue outlet zeta = 1.0		**55.7**	**34.4**	**17.7**	**138.2**

10.11.4 EXAMPLE D: CONCENTRIC FLUE GAS/AIR SUPPLY PIPE (ROOF-MOUNTED)



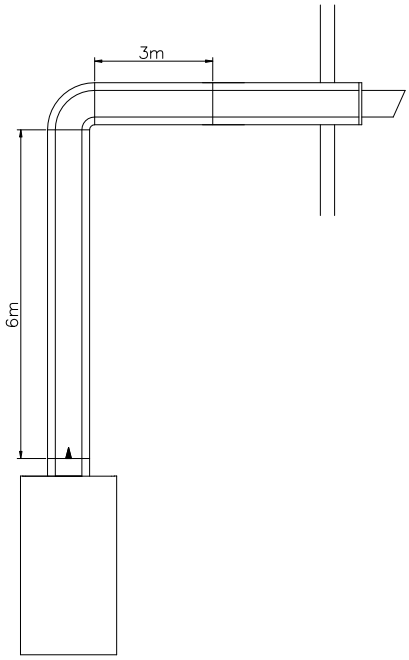
Calculation example with given lengths: checking resistance

Water heater type:		CB 85			
FLUE GAS	**Diameter: 100/150 mm.**		**Number**	**Pa**	**Pa total**
	Straight tube m	total	11	2.9	31.9
	Bend	45°	2	6.4	12.8
	Bend	90°	3	10.2	30.6
	Concentric terminal	roof	1	31.2	31.2
	resistance flue gas:				**106.5**
AIR SUPPLY	**Diameter: 100/150 mm.**		**Number**	**Pa**	**Pa total**
	Straight tube m	total	11	9.2	101.2
	Bend	45°	2	8.1	16.2
	Bend	90°	3	11.7	35.1
	Concentric terminal	roof	1	43.3	43.3
	resistance air supply:				**195.8**
	Total resistance flue gas and air supply:				**302.3**

The total resistance is more than 200 Pa.
This flue gas / air supply system is NOT functional.

NOTE: ECO specific resistance values are used in this example.
Flue and air pipes of other suppliers can have other values

10.11.5 EXAMPLE E: CONCENTRIC SYSTEM WALL OUTLET C13 (WALL-MOUNTED)



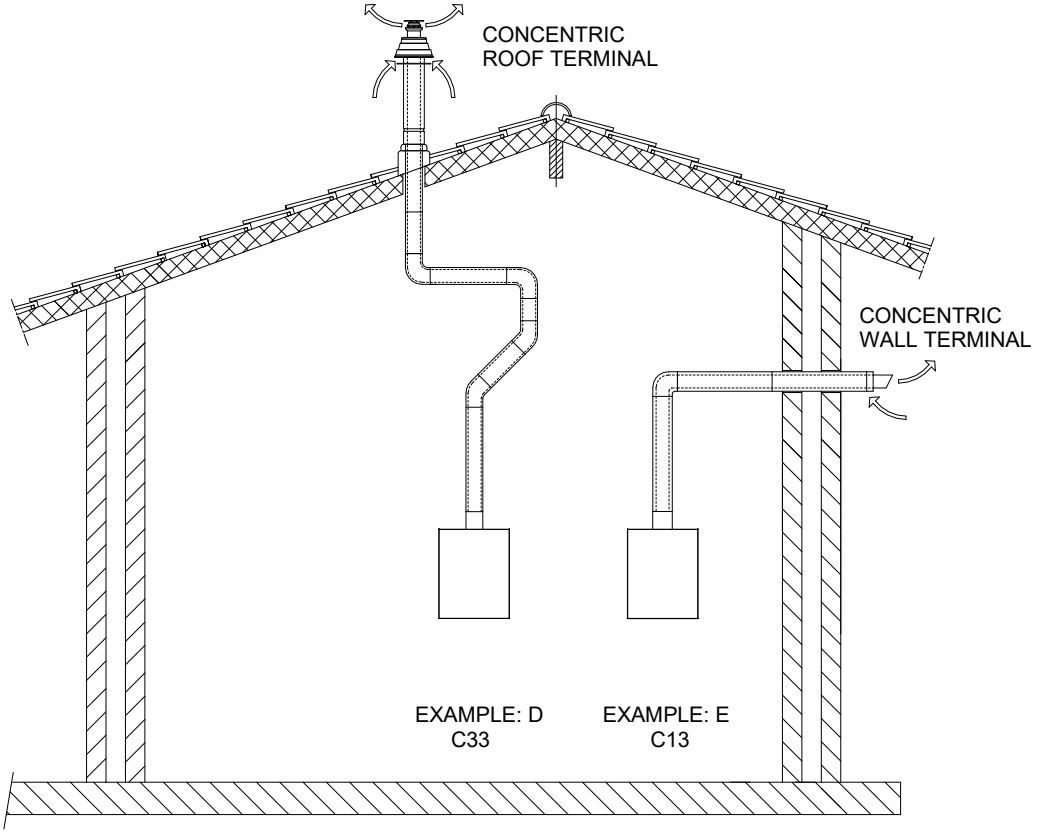
Calculation example with given lengths: checking resistance

Water heater type:		CB 85			
FLUE GAS	**Diameter: 100/150 mm.**		**Number**	**Pa**	**Pa total**
	Straight tube m	total	9	2.9	26.1
	Bend	90°	1	10.2	10.2
	Concentric terminal	wall	1	10.8	10.8
	resistance flue gas outlet:				**47.1**
AIR SUPPLY	**Diameter: 100/150 mm.**		**Number**	**Pa**	**Pa total**
	Straight tube m	total	9	9.2	82.8
	Bend	90°	1	11.7	11.7
	Concentric terminal	wall	1	43.3	43.3
	resistance air supply:				**137.8**
	Total resistance flue gas outlet and air supply:				**184.9**

The total resistance is less than 200 Pa.
This flue gas / air supply system is functional.

NOTE: ECO specific resistance values are used in this example.
Flue and air pipes of other suppliers can have other values

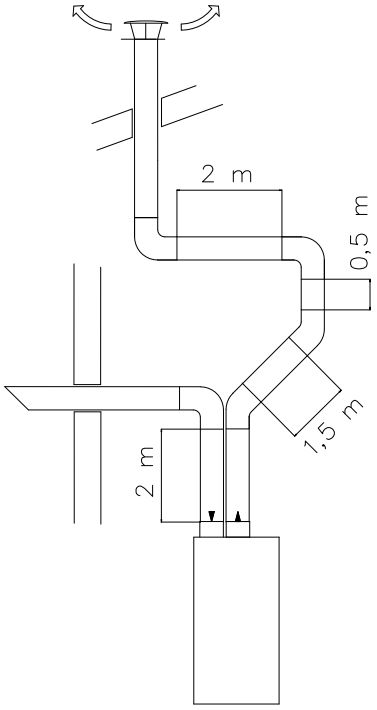
Examples D and E maximum pipe lengths



Example D (C33)				
water heater type →	**CB 85**	**CB 105**	**CB 125**	**CB 155**
Diameter concentric pipe [mm]	100/150	NOT POSSIBLE use less bends and/or pipe length, or larger pipe diameter.	NOT POSSIBLE use less bends and/or pipe length, or larger pipe diameter.	NOT POSSIBLE use less bends and/or pipe length, or larger pipe diameter.
Concentric roof terminal [mm]	100/150			
Maximum pipe length [m] includes: 2 bends 90° 2 bends 45° roof terminal	**2.5**			

Example E (C13)				
water heater type →	**CB 85**	**CB 105**	**CB 125**	**CB 155**
Diameter concentric pipe [mm]	100/150	100/150	100/150	NOT POSSIBLE use less bends and/or pipe length, or larger pipe diameter.
Concentric wall terminal [mm]	100/150	100/150	100/150	
Maximum pipe length [m] includes: 1 bend 90° wall terminal	**10.2**	**5.4**	**1.5**	

10.11.6 EXAMPLE F: SEPARATE AIR SUPPLY DUCT & FLUE DUCT IN DIFFERENT PRESSURE ZONE (C53)



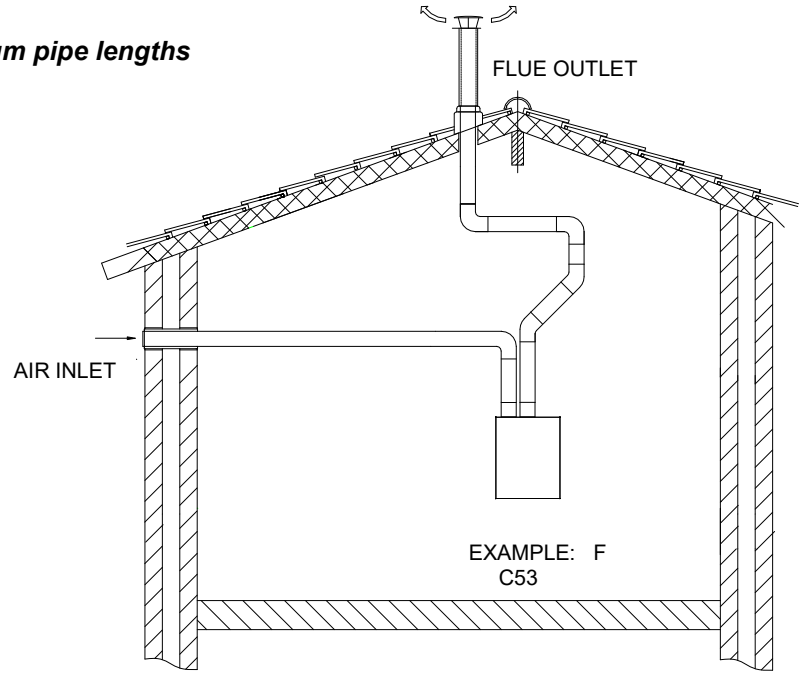
Calculation example with given lengths: checking resistance

Boiler type:		CB 105			
FLUE	**Diameter: 100 mm.**		**Number**	**Pa**	**Pa total**
	Straight tube m	total	6	4.0	24.0
	Bend	45°	2	9.0	18.0
	Bend	90°	2	14.5	29.0
	Flue outlet zeta = 1.0	roof	1	15.3	15.3
	resistance flue gas outlet:				**86.3**
AIR	**Diameter: 100 mm.**		**Number**	**Pa**	**Pa total**
	Straight tube m	total	2	4.6	9.2
	Bend	90°	1	16.8	16.8
	Air inlet zeta = 1.0	wall	1	17.7	17.7
	resistance air supply:				**43.7**
	Total resistance flue gas outlet and air supply:				**130.0**

The total resistance is less than 200 Pa.
This flue gas / air supply system is functional.

NOTE: ECO specific resistance values are used in this example.
Flue and air pipes of other suppliers can have other values

Example F maximum pipe lengths



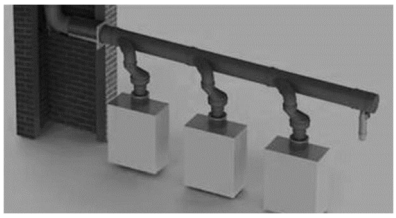
Example F (C53)					
boiler type →		**CB 85**	**CB 105**	**CB 125**	**CB 155**
Diameter wall terminal	[mm]	100	100	100	150
Diameter air pipe	[mm]	100	100	100	150
Diameter flue pipe	[mm]	100	100	100	150
Diameter roof terminal	[mm]	100	100	100	150
Maximum pipe length **[m]** (flue & air total pipe length) includes: air inlet zeta =1.0 3 bends 90° 2 bends 45° flue outlet zeta = 1.0		**41.1**	**22.4**	**7.8**	**111.1**

11 COMMON FLUE CASCADING

C10 Common flue gas systems.

WARNING:

If other than M&G flue gas materials are used, please contact your boiler supplier.



If using C10 flue gas system for a so called "CLV" system the following must be applied:
A data plate shall be present on the connection interface to the common flue duct. It shall contain the following information:
a) the common duct system is for C(10) boilers;
b) the maximum allowable combustion products mass flow rate;
c) the dimensions of the connection to the common ducts;
d) a warning when the boiler is disconnected the air outlet and the combustion product inlet openings shall be closed and checked on tightness.
e) the name of the manufacturer of the common flue duct or his identifying symbol.

C11 Common flue gas systems.

A special common flue gas calculation manual for C11 flue gas systems is available on request at your boiler supplier.

11.1 Safety measures Common Flue Systems

In case CB-HW 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 CB-HW heaters are equipped with a Non-return valve to prevent recirculation of flue gas of a running heater through one or more heaters which are not running and are connected with a common flue system. This Non-return valve might leak over time by pollution, incorrect maintenance or other unexpected cause. 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 combination with combustion air drawn directly from the room, two safety measures have to be taken:

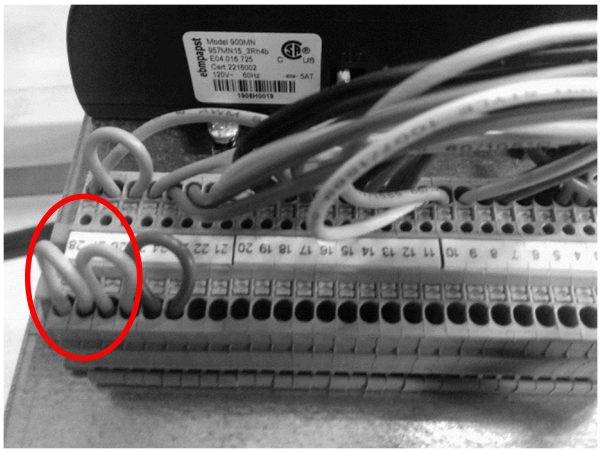
1. Guaranteed sufficient outside air supply for combustion and ventilation according local standards, codes and regulations.
2. Use an CO detector for alarm and switching module to switch off all the heaters. The CO alarm system must be according national and local standards.

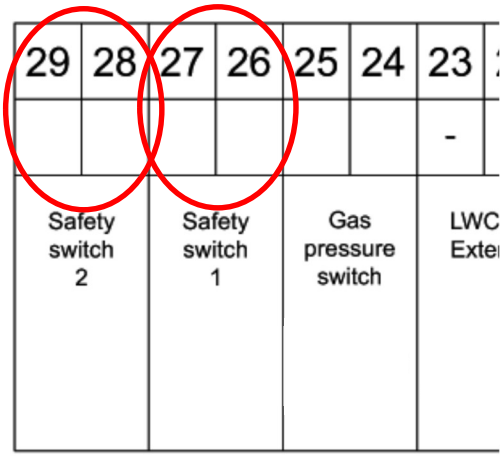
Additional Safety Advice

3. Use always the cascade manager of the 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 heaters, which do not necessarily have to be connected to the outside.

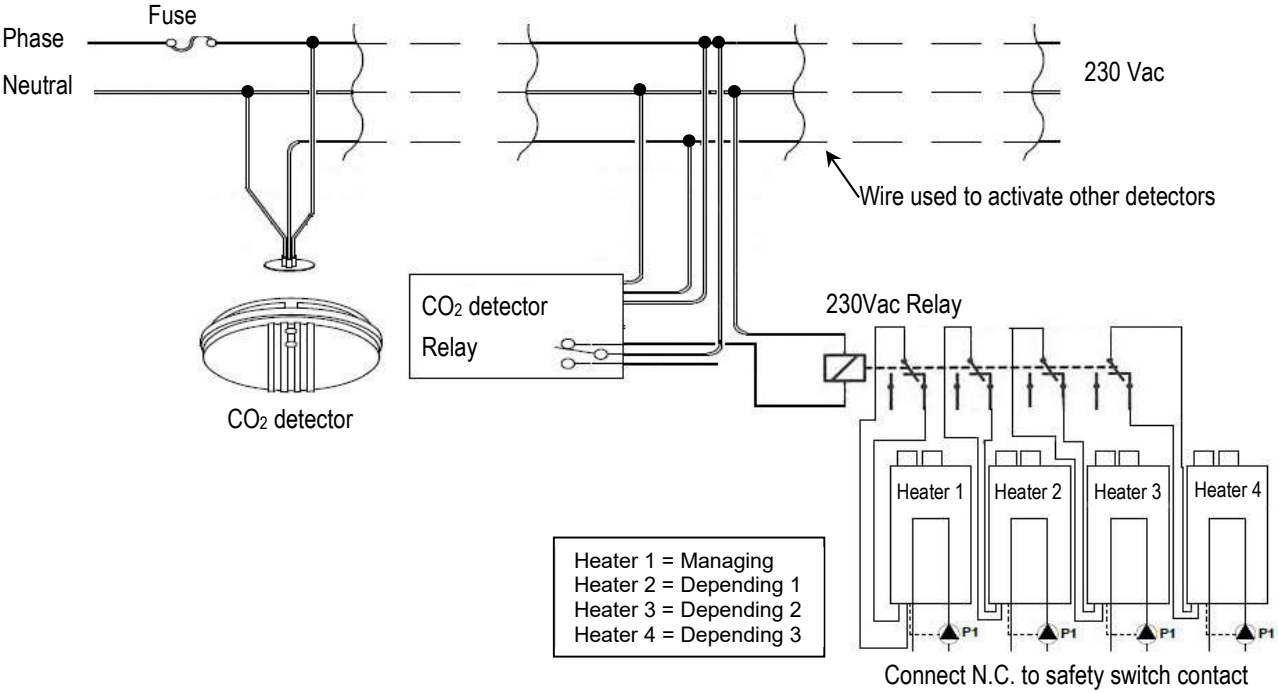
Ad 1. Guaranteed sufficient outside air supply for combustion and ventilation according local standards, codes and regulations.
The heater-room must have sufficient outside air supply for combustion and ventilation. There are many ways of creating sufficient outside air supply, depending on location of the heater-room in the building. The demands for the (size of the) heater-room and required ventilation is prescribed in local standards, codes and regulations.
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 e.g. 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 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 heater to switch off the heater in case of an alarm.
Remove the yellow wiring bridge and connect the N.C. contacts in series to the relay(s).





Low voltage connections HW heater.



Use an extra 230V multipole relay (number of poles equal to number of boilers). In case of power failure on the CO alarm system and modules the boilers 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 heaters will switch off in case of a CO alarm.

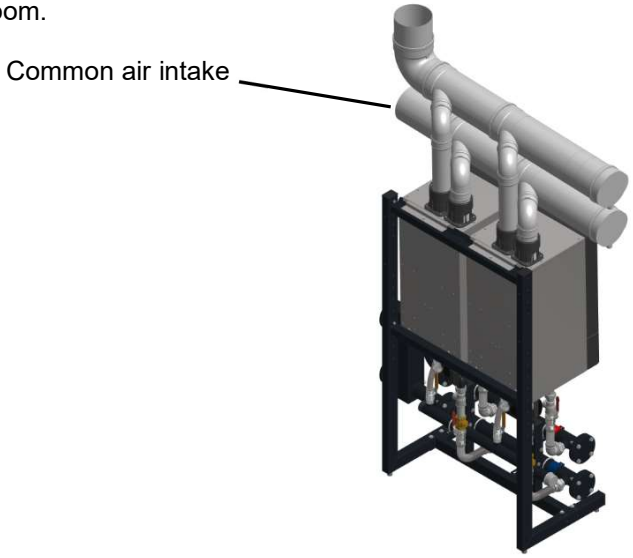
In case of an CO alarm, the display of the heater will mention: '*Max. thermostat lock error*'.

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

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

See manual § 16.3.5 : CASCADE – POWER BALANCE MODE
Several different power control modes can be selected to operate the cascade system.
• Power mode 0: Power control disabled; each heater modulates based on the system setpoint.
• Power mode 1: Power control algorithm to have a minimum number of heaters/heaters active.
• Power mode 2: Power control algorithm to have a maximum number of heaters/heaters active.
• Power mode 3: Power control algorithm to have a balanced number of heaters/heaters active.

Ad 4. Combine all air intake terminals of the heaters
Combine all air intake terminals of the heater, which do not necessarily 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 heaters and improve the air exchange in the room.



11.2 Existing common venting guidelines

Do not common vent the CB-HW water heater with the vent pipe of any other boiler or appliance. However, when an existing water heater is removed from an existing common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it. At the time of removal of an existing water heater, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation:

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

Any improper operation of the common venting system must be corrected so the installation conforms with the National standards.
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 the Standards and this manual.

12 ELECTRICAL INSTALLATION

12.1 General

- For operation, the water heater needs a power supply of 230 VAC/ 50Hz.
- The wiring for the connections can be entered at the bottom of the water heater through the cable glands.
- NOTICE: Before starting to work on the water heater, it must be switched off and the power supply to the water heater must be disconnected.
- Electrical wiring should be installed according to all applicable standards and regulations.
- Wiring the water heater should only be done by a qualified installer or licensed electrician where required that is skilled in working on electrical installations and according to all applicable standards.
- It is not allowed to change the internal wiring fitted by the manufacturer.
- A spare fuse is mounted on the casing of the burner controller.

12.2 Connection mains supply

- It is advised to use a flexible cable between the cabinet entry (at the bottom) and the connection terminal.
- The earth wire has to be longer than the phase and neutral wire.
- The power supply cable must be secured by tightening the cable gland at the bottom of the water heater casing.
- In case of a flexible cable: use crimp ferrules on each wire end for the terminal connections.
- On the mains voltage terminal, connect to numbers: 8 = Phase ; 9 = Neutral; PE = Earth.

12.3 Electrical connections

LOW VOLTAGE CONNECTIONS

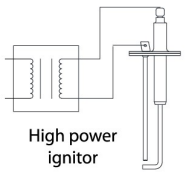
29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
						-	+	-	+	Gnd				-	+			-	+	B	A	Gnd						
Safety switch 2 Interrupteur de sécurité 2		Safety switch 1 Interrupteur de sécurité 1		Gas pressure switch Interrupteur de pression de gaz		LWCO Extern Eau basse coupée à l'extérieur		AL-BUS managing boiler AL-BUS chaudière gérant		Pump control PWM Commande de pompe PWM		DO NOT USE NE PAS UTI-LISER		DO NOT USE NE PAS UTI-LISER		DO NOT USE NE PAS UTI-LISER		AL-BUS depending boiler AL-BUS chaudière dépendant		Modbus			DHW sensor Capteur ECS		System sensor Capteur de systéme		DO NOT USE NE PAS UTI-LISER	

MAINS VOLTAGE CONNECTIONS

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

High power ignitor

A separate connector for an external igniter is located on the cable tree, near the water heater controller and labelled "High power ignitor".
The "external ignition transformer" can be ordered, see § 5.1 "Accessories".
This accessory is provided with detailed mounting instructions.



12.4 Explanation of the low voltage connections.

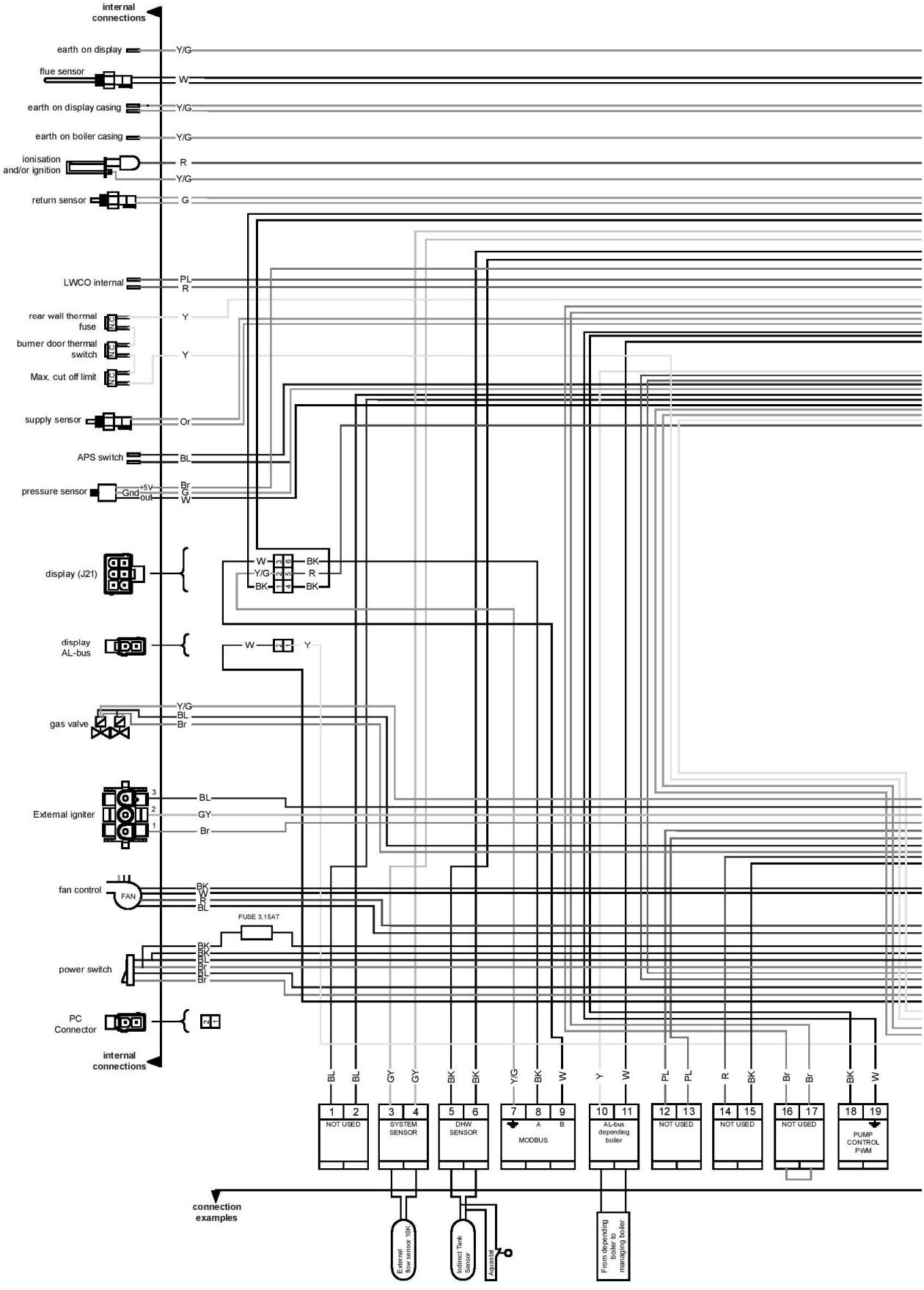
1-2	DO NOT USE
Do not connect wires to these terminals	
3-4	**SYSTEM SENSOR**
It is mandatory (single and cascaded heaters) to use also a pipe strap-on sensor besides the tank sensor. This system (Strap-on) sensor has to be connected to connections 3-4 “System Sensor” (Cascaded heaters need one system sensor connected to the managing boiler only.)	
5-6	**DHW SENSOR**
The tank sensor can be mounted in a bulb in the tank or glued to the tank dependent of the used type of sensor.	
7-8-9	**MODBUS**
Connections for a MODBUS communication signal. 7 = ground, 8 = A, 9 = B (A detailed Modbus bulletin is available at your supplier on request)	
10-11	**AL-BUS DEPENDING**
Cascade connections for the dependent water heaters, must be parallel linked together. NOTICE: link all connections 10 to 10 and all connections 11 to 11, do not mix these. Link connections 10 of the dependent water heaters to 20 of the managing water heater, and connections 11 of the dependent water heaters to 21 of the managing water heater.	
12-13	**DO NOT USE**
Do not connect wires to these terminals	
14-15	**DO NOT USE**
Do not connect wires to these terminals	
16-17	**DO NOT USE**
Do not connect wires to these terminals	
18-19	**PWM**
PWM pump signal, use this to control the pwm pump (Not used when an On/Off pump is used)	
20-21	**AL-BUS MANAGING**
Cascade connection for the managing water heater. Link connection 20 of the managing water heater to connections 10 of the depending water heaters, and connection 21 of the managing water heater to connections 11 of the depending water heaters.	
22-23	**LWCO EXTERN**
To be used for an extra external Low Water Cut Off. The water heater goes into a lockout when this contact opens	
24-25	**GAS PRESSURE SWITCH**
To be used for an extra external gas pressure switch. The water heater goes into a lockout when this contact opens PARAMETER: water heater parameter 118, see: 12.10 "programmable in- and outputs"	
26-27	**SAFETY SWITCH 1**
To be used for an extra external safety switch. The water heater goes into a lockout when this contact opens	
28-29	**SAFETY SWITCH 2**
To be used for an extra external safety switch. The water heater goes into a lockout when this contact opens	

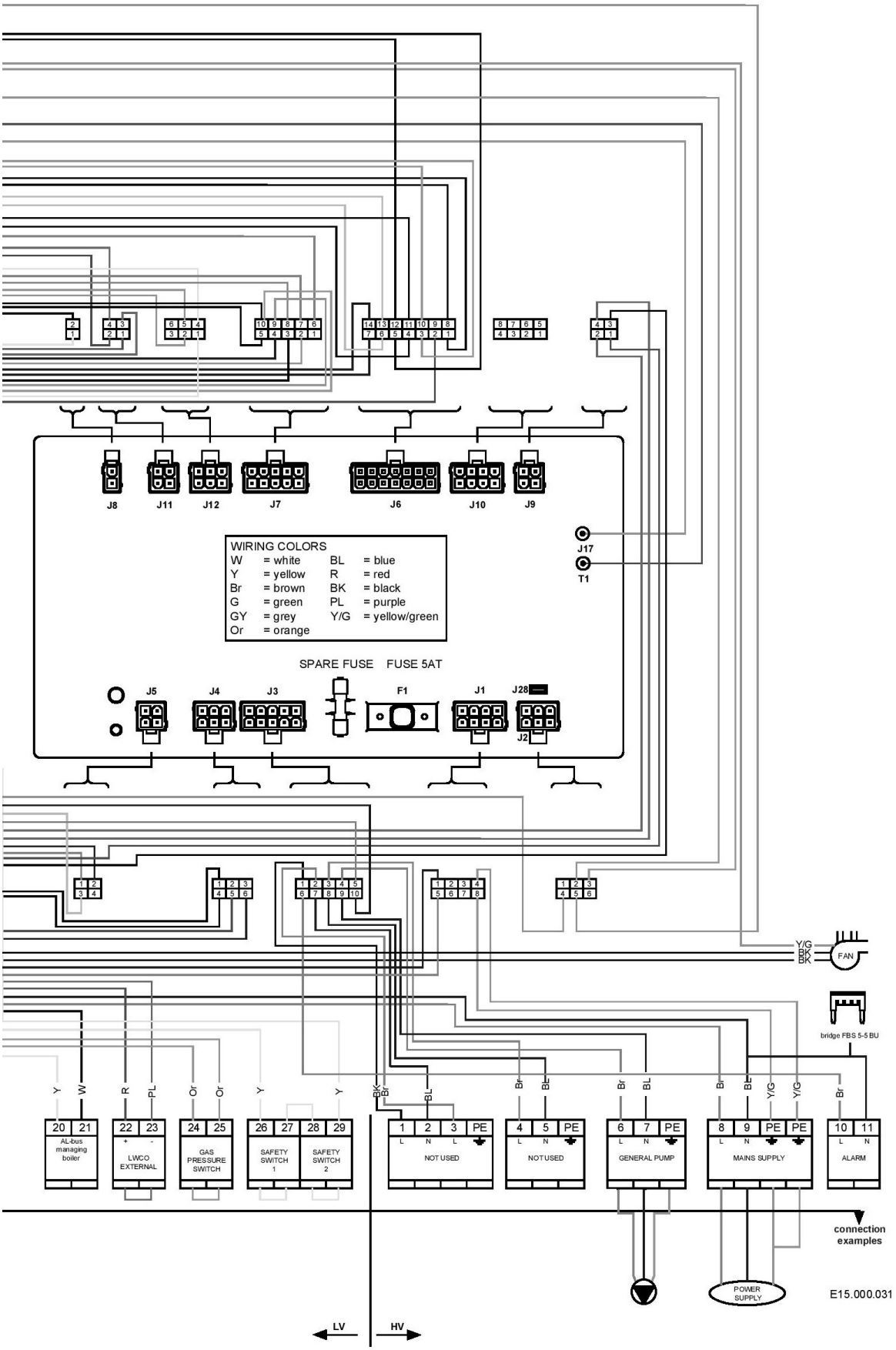
12.5 Explanation of the mains voltage connections.

1-2-3-PE	**DO NOT USE**
Do not connect wires to these terminals	
4-5-PE	**DO NOT USE**
Do not connect wires to these terminals	
6-7-PE	**GENERAL or WATER HEATER PUMP**
Connections for the power supply of a water heater pump. (P1, see chapter 8.5 for detailed electrical specifications).	
8-9-PE-PE	**MAINS SUPPLY**
The power supply connection of the unit. 8 = Line voltage wire; 9 = Neutral wire, PE = Ground wire	
10-11	**ALARM RELAY**
A semiconductor alarm output. This is a triac output with an active voltage of 230 VAC, it can only handle resistive loads between 5 and 50 Watt. E.g. an incandescent bulb of 10-50 watt can be added to this. Alternatively, a relay can be used. This alarm will be activated 60 seconds after an error has occurred. There are a few exceptions: - Alarm output will not be activated for a service warning; - Alarm output will not be activated for warning 202 (Appliance selection). 10 = Live wire; 11 = Neutral wire. ATTENTION: The neutral wire is connected to the neutral connection of the boiler Only use this neutral connection with a single water heater and a single alarm. PARAMETER: water heater parameter 127, see: 12.10 "programmable in- and outputs"	
X1-X2-X3	**HIGH POWER IGNITER (external igniter)**
A separate connector for an external igniter is located on the cable tree, near the water heater controller and labelled "High power ignitor". This is a connection for an external ignition transformer. Instead of the internal igniter, an external igniter can be connected. Available as an accessory, see § 5.1 "Accessories". X1 = Neutral wire; X2 = Ionisation; X3 = Live wire. PARAMETER: water heater parameter 126, see: § 12.10 "programmable in- and outputs".	

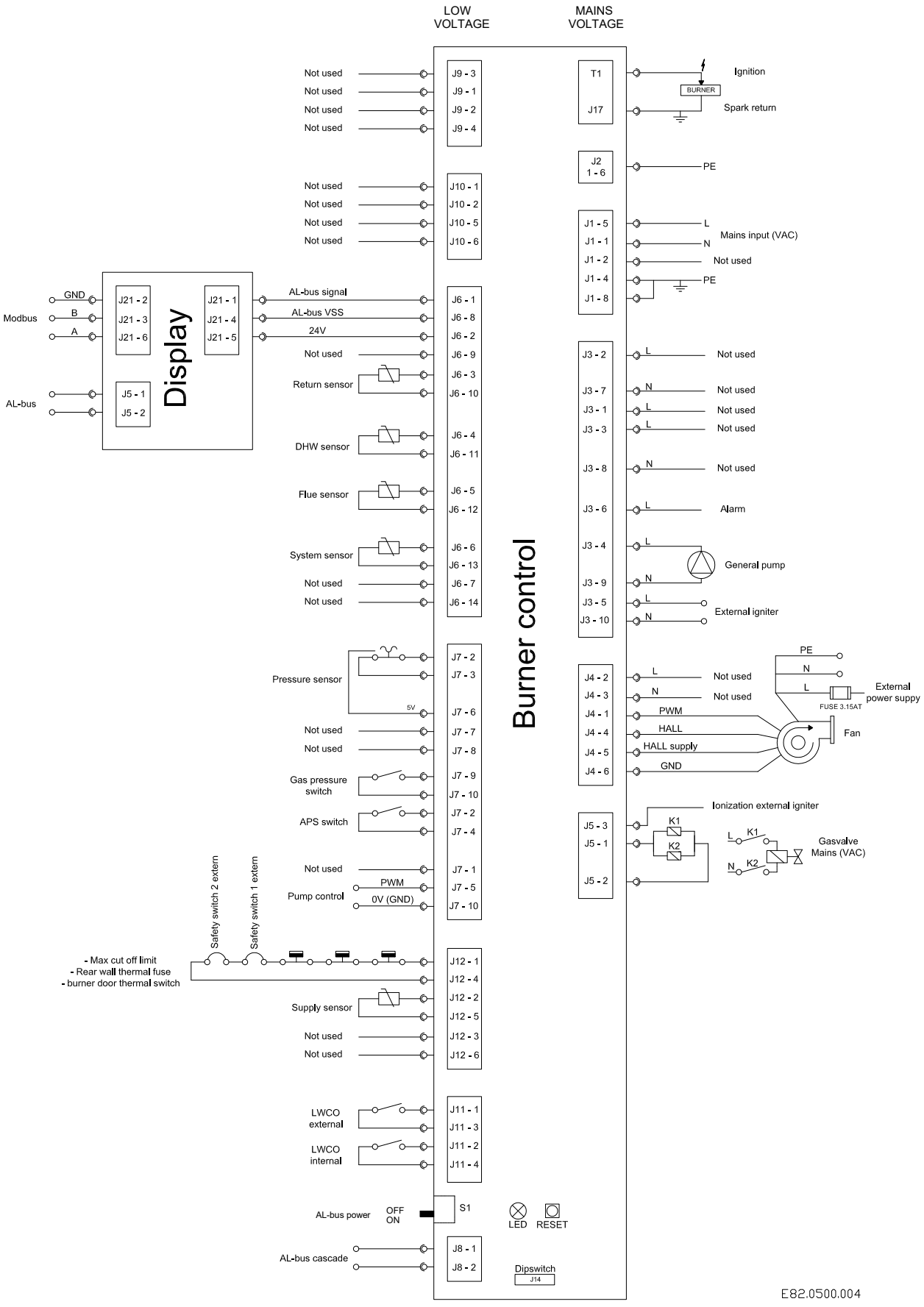
NOTICE	To all outputs following applies: maximum current 2 Amp each output. Total output of all currents combined maximum 3.5 Amp. The allowed inrush current of the pump is maximum 8 Amp.

12.6 Electrical schematic




J8
J11
J12
J7
J6
J10
J9
J17
T1
WIRING COLORS
W = white
Y = yellow
Br = brown
G = green
GY = grey
Or = orange
BL = blue
R = red
BK = black
PL = purple
Y/G = yellow/green
SPARE FUSE FUSE 5AT
J5
J4
J3
F1
J1
J28
J2
FAN
Y/G
BK
BK
bridge FBS 5-5 BU
20 21
AL-bus managing boiler
22 23
LWCO EXTERNAL
24 25
GAS PRESSURE SWITCH
26 27
SAFETY SWITCH 1
28 29
SAFETY SWITCH 2
1 2 3 PE
NOT USED
4 5 PE
NOT USED
6 7 PE
GENERAL PUMP
8 9 PE PE
MAINS SUPPLY
10 11
ALARM
connection examples
POWER SUPPLY
E15.000.031
LV
HV

12.7 Ladder/Logic Diagram



12.8 Sensor availability

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

	DHW Mode								
	0 N.A.	1	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
M = Mandatory, O = Optional, --- = Disabled, N.A. = Not Available.									

DHW mode 0 – Do not use
DHW mode 1 – Single and cascaded Water Heaters.
DHW mode 2 to 8 – Do not use.

12.9 NTC sensor curve

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

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

12.10 Programmable in- and outputs

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

water heater parameter	name	default setting	description	terminal
(117)	Prog. Input 2.	2	DHW flow switch	LV 16-17
(118)	Prog. Input 3.	2	Gas pressure switch	LV 24-25
(122)	Prog. Input 7.	3	Cascade sensor	LV 3-4
(124)	Prog. Input RT.	1	room thermostat on	LV 12-13
(125)	Prog. Output 1.	4	System pump	HV 4-5
(126)	Prog. Output 2.	0	Ext. Igniter	separate connector
(127)	Prog. Output 3.	6	Alarm semiconductor output	HV 10-11
(128)	Prog. Output 4.	18	3-way Valve DHW	HV 3-2-1

NOTICE

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

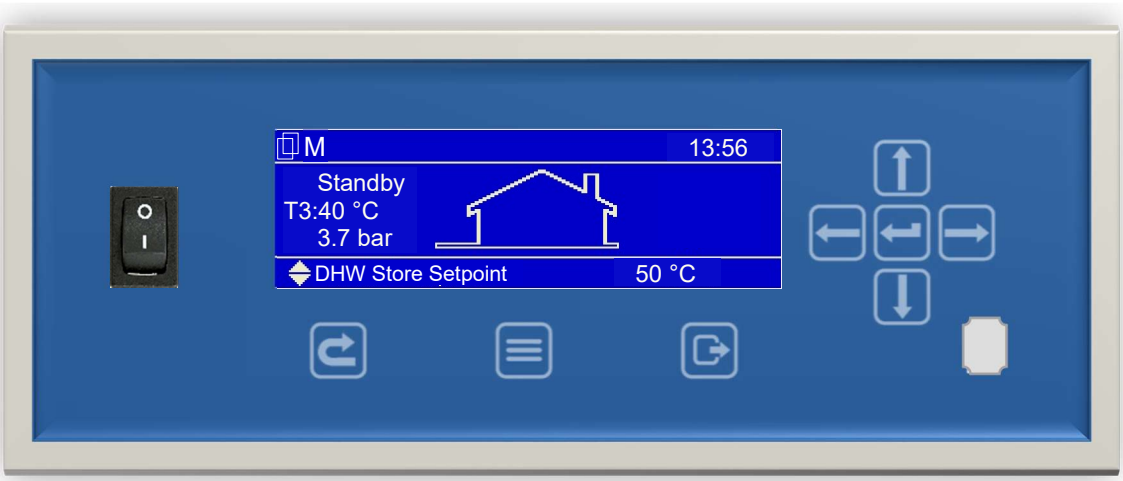
para-meter	Display:	**INPUTS:**	re-mark
(117)	Prog. Input 2.	0 Disabled	
		1 DHW flow sensor	N.A.
		2 DHW flow switch	
		3 CH flow sensor	N.A.
		4 CH flow switch	
(118)	Prog. Input 3.	0 Disabled	
		1 Drain switch	
		2 Gas pressure switch	
(122)	Prog. Input 7.	0 Disabled	
		1 T_Flue_2 sensor	N.A.
		2 T_Flue_2 with blocked flue	N.A.
		3 Cascade sensor	
		4 Blocked Flue switch	N.A.
		5 CH Sensor	
(124)	Prog. Input RT.	0 room thermostat off	
		1 room thermostat on	

	Display:	**OUTPUTS**:	
(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	1)
		2 CH pump	1)
		3 DHW pump	1)
		4 System pump	1)
		5 Cascade pump	1)
		6 Alarm relay	1)
		7 Filling valve	1)
		8 LPG tank	1)
		9 Ext. Igniter	1)
		10 Air damper	1)

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

Remarks:
1) Prog. output 2: (ext. igniter); this is a separate connector, the pin in the middle is for ionization, it has no PE connection. If earth is needed, it must be connected to the main earth terminal.
2) Prog. output 3: (alarm relay); this is a triac output with an active voltage of 230 VAC, it can only handle resistive loads between 5 and 50 Watt.

13 WATER HEATER CONTROLLER AND DISPLAY.



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

COMPUTER. Connector for computer cable

RESET. Reset lockout error

MENU. Enter the main menu

ESCAPE. Escape / Return to the status overview

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

LEFT. Return to previous menu item or Status overview

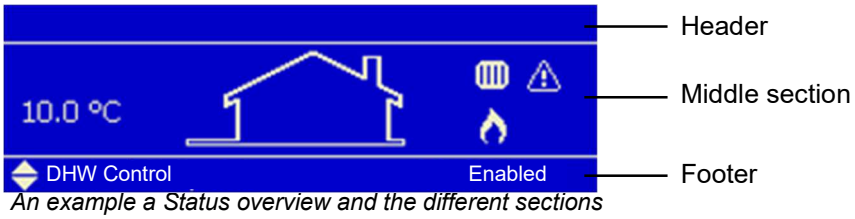
UP. Directly select Actual setpoint of DHW setpoint in the Status overview, push RIGHT to confirm and use UP or DOWN to adjust value.

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

ENTER. Confirm a setting or enter a menu item

13.1 Display and settings.

After communication has been established the following **Status overview** appears:
The Status overview has the 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 CH and/or DHW disabled icons when CH 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): ▪ 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	CH 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 level
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

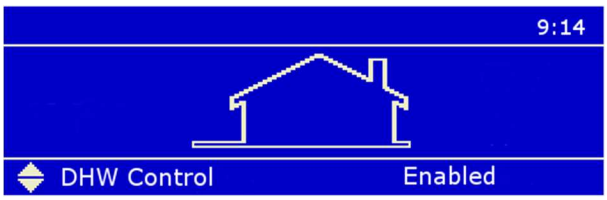
Note: Cascade dependents will only have the 'Calculated Setpoint' available.

13.2 Starting the water heater

If the water heater is not on make sure the gas switch beneath the water heater is open and the power cord is connected to the mains, use the on/off button to switch the water heater on. The following screen will occur:

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

The “De-Air” sequence is a safety function that starts at every power-up and is used to remove the air from the heat exchanger. The De-Air sequence takes around 14 minutes to complete. It can be cancelled by pressing the Enter button for over 5 seconds.
After completion or manual ending the “De-Air” sequence one of the following Status overview screens appears:



13.2.1 Set Actual DHW setpoint directly via the Status overview

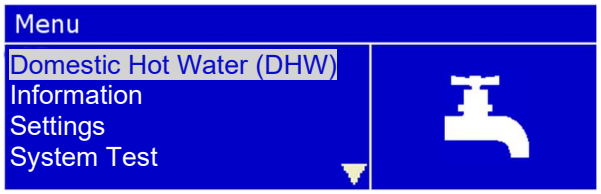
You can adjust the DHW setpoint directly on the bottom of the Status overview.

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.

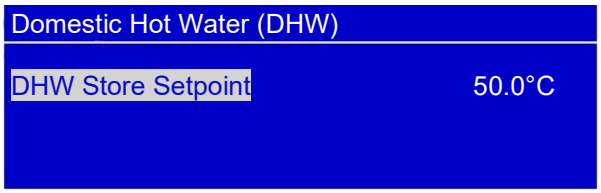
A setpoint is only visible on the display when no error or alert is active. In case of an active error or alert, the bottom right part of the display is used to display the error or alert text.

13.2.2 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 grey rectangle.



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



Use “DHW Store Setpoint” to set the warm water temperature

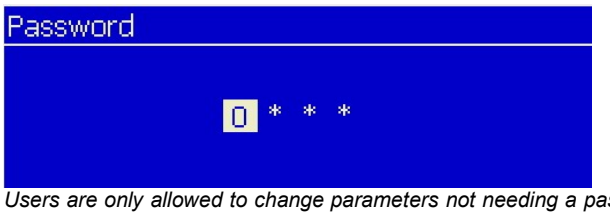
If you are inside the menu (or a menu item) and want to return directly to the Status overview press MENU ☰ or ESC ⎋ If you want to go back one step in the menu press BACK/LEFT ← .

13.2.3 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 and Factory user 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:



Users are only allowed to change parameters not needing a password. Installers have to contact their supplier for the password because of safety.

WARNING	Changing protected/safety parameters should only be conducted by experienced, licensed water heater operators and mechanics. Hazardous burner conditions can happen with improper operations.

Enter the password with the following steps:

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

Repeat this action for all numbers to enter the password.
During this action, if you want to return to the previous screen, just press MENU ☰ or ESC ⎋ to cancel. After the password is entered in correctly press ENTER/RIGHT to confirm and access the menu item.
When a correct password is entered the selected user-level is unlocked. 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 menu-option 'logout' appears, with which you can leave the installer menu.

The following menu items also 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

13.2.4 DE-AERATION SEQUENCE

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

The display will show the following string during DAir sequence:
• "Dair Running"
• "Dair Error Water Pressure"

The De-Air sequence can be cancelled by the user by pressing the ↵ button for min. 5 seconds.

13.2.5 LANGUAGE SETTINGS

The display supports the following languages:

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

13.2.6 CHANGE LANGUAGE VIA THE MENU

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.

13.2.7 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.

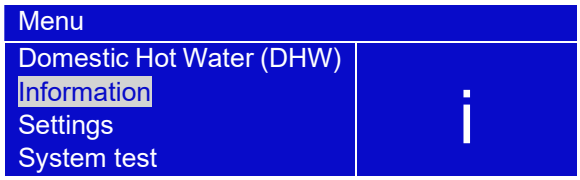
13.3 Water heater history

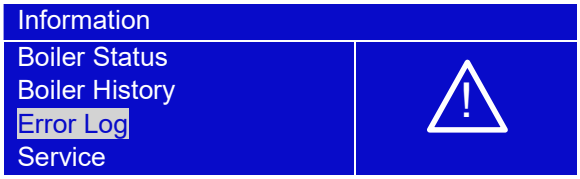
The water heater history found in the information menu displays several history counters that keep track of the water heater usage. The history cannot be erased and will continue for the burner controller life cycle. The following water heater history data is available:

(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

13.4 Error logging.

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





(Sub) Menu item	Description
Error Log	Show the error log (based on the selected filter options)
Filter Error Type	Filter errors based on the Error Type (Lockout/Blocking)
Filter Water heater ID (Cascade System only)	Filter errors based on Water heater 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.

The error log screen will show on the first line: Water heater ID for which water heater the error was detected (cascade system only), Error Code, (internal) Error Number, Error Type (Lockout/Blocking).
The second line will show the Error Description.
The bottom line will show the Time Stamp (date and time) when the error was detected (in the format as configured in the Date Time Settings menu), and also the selected error index from the total number of errors in the (filtered) error log. Only Time Stamp, Code and Description are displayed.

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

13.5 Service reminder

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

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

13.5.1 SERVICE OVERDUE LOGGING

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

13.5.2 RESET THE SERVICE REMINDER

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

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

13.5.3 MENU'S AND PARAMETERS

Service status information can be viewed: Menu/ Information/ Service.
Here the installer can also reset the Service reminder (accessible at installer level).

(Sub) Menu item	Description
Service history	View the Service history (log). For each service moment the Service overdue counter is stored. When the overdue counter is 0 hrs., it means service was done before the Service reminder was active. The log is ordered so the most recent service moment is shown first (on top of the list).
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.

13.6 General

The 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, 230V	
Flame establishing period		2 seconds	
Safety time		5 seconds	
Ignition attempts		3	
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]		mm^2 (AWG)	Cable length m (ft)
		0.25 (23)	100 (328.1 ft)
		0.5 (20)	200 (656.2 ft)
		0.75 (18)	300 (984.3 ft)
		1.0 (17)	400 (1312.3 ft)
		1.5 (15)	600 (1968.5 ft)
1) This consists the total length of the cable, not the length between two water heaters. The length differs with the diameter of the cable.			

13.6.1 PUMP START EVERY 24 HOURS

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

13.6.2 FROST PROTECTION

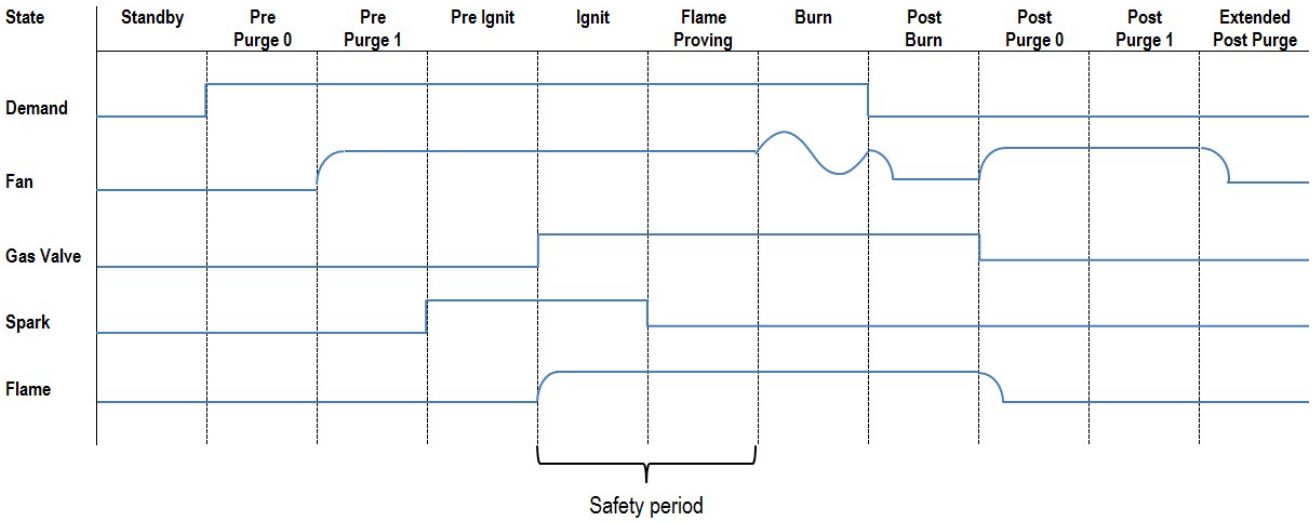
The Frost protection function protects the water heater and water heater loop from freezing.
The T_Supply and T_Return sensors are checked for generating a Frost protection demand.

- When any of the sensors drop below FP_Start_Pump the water heater loop pump is switched ON.
- When any of the sensors drop below FP_Start_Burn the water heater is fired.
- When all of the sensors measure above FP_Stop the Frost protection demand is ended.

When the demand for Frost protection is ended the pumps will post-circulate for DHW_Pump_Overrun.
Parameters are factory set: FP_Start_Pump is set at 10°C (50°F) and FP_Start_Burn is set at 5°C (41°F)

13.7 Ignition cycle

During the ignition cycle multiple safety checks are active



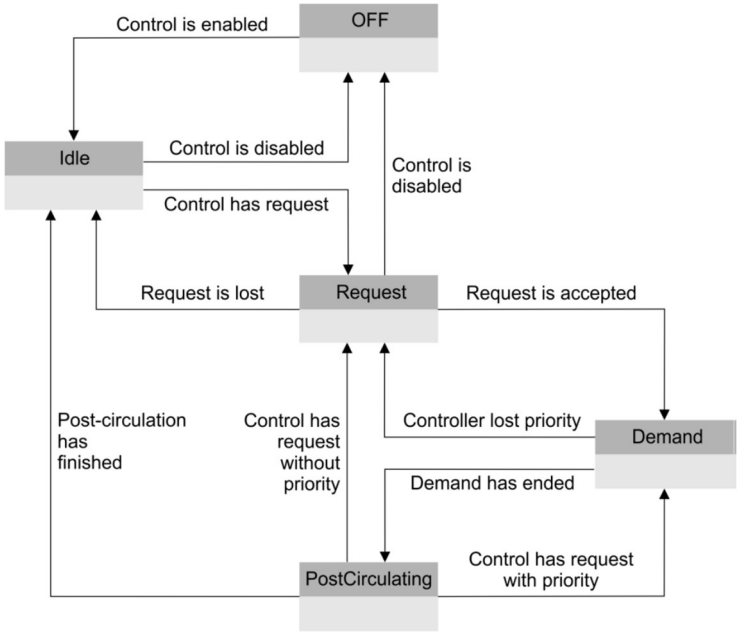
The table below shows the states of the burner ignition cycle, as shown in the diagram above:

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

During the ignition cycle multiple safety checks are active:

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

13.7.1 CONTROL FUNCTIONS



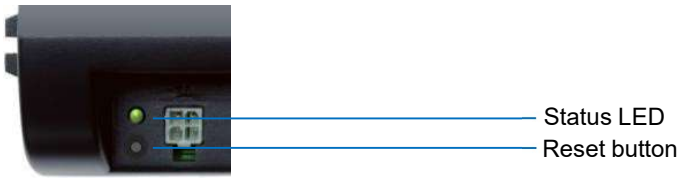
Dependent on the required functions of the appliance and connected sensors and components, several operation modes for Domestic Hot Water (DHW) can be selected, which are described hereafter.
The demand controls all work according to a defined state machine. The diagram below shows how the controller 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.

13.7.2 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.



900MN

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.

13.7.3 FLAME DETECTION

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

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

13.7.4 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 (1.0 µA + 0.2 µA) the minimal fan speed will be increased.
• When the flame current is above Flamerod_Setpoint + Flamerod_Delta + Flamerod_Delta * 2 (1.0 µA + 0.2 µA + 0.4 µA) the minimal fan speed will be decreased.

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

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

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

13.8 Demand for Domestic Hot water

13.8.1 DHW STORAGE WITH BULB AND STRAP-ON SENSOR; DHW MODE 1

Only use DHW mode 1 for a standalone water heater and for a Cascade water heater. Do not use another DHW mode because the water heater will not work properly. Also, the heater is programmed as Managing heater and a system sensor is needed next to a DHW sensor. The system sensor is a strap-on sensor connected to the supply pipe close to the storage vessel and the DHW sensor is an adhesive sensor or bulb on or in the storage vessel.

When installing the water heater always check what the local water hardness is. Default the water heater is set for a water hardness between 4 and 11 °dH the temperature difference between flow and return of the heater should be maximum 16.5 °C.

For the water heater a modulating pump is available, which will modulate on a delta T setpoint of 16.5^0C. This feature gives the water heater extra efficiency because the water heater stays in the condensing zone of the heat-exchanger if the setpoint of the storage vessel is below 65^0C.

Principles to design water heater system:

- If the water hardness is between 4 and 11 °dH the temperature difference between flow and return of the heater should be maximum 16.5 °C
- If the water hardness is between 11 and 14 °dH the temperature difference between flow and return should be maximum 12.5 °C
- If the water hardness is above 14 °dH use a water softener . Also above 11 °dH a water softener could be considered, since an installation at 12.5 °C temperature difference will need bigger pipes and pumps. After softening, the water hardness should be minimum 4 °dH.

It is possible to check if the flow over the heat-exchanger is according to this principles:

1. This can be done by changing parameter (136) “Mod. Pump Mode” from “Modulating” to “Fixed 100%” the pump will run now at 100% speed.
2. Open a tapping point for hot water and be sure that the heater is running at 100% power, now the delta T should be 16.5 °C or lower for water hardness below 11 °dH and 12.5 °C or lower for above 11 °dH. For determining the delta T read out in the Information menu by selecting heater status now check the “Flow temperature” minus the “Return Temperature”.
3. If the delta T is within limits change back parameter 136 to “Modulating”. If it is not within limits: replace the pump by a bigger pump or check if there are any obstructions between the water heater and the storage vessel. Or use a water softener when having a water hardness above 11 °dH.
4. When using a delta T below 12.5 °C also change parameter (133) “Mod. Pump dT” from 16°C to 12°C. Also change parameter (137) “Mod. Pump Min Pwr” from 45% to 75%.
5. Check if the water heater is working correctly by opening a tapping point on large and small amount of water.
6. When using a DHW_Store_Setpoint above 70°C use a fixed setpoint for the pump because the water heater will not condensate at high temperatures. Repeat point 1 and 2 and lower the % until your above the 16.5°C or 12.5°C now increase the fixed setpoint by one step (10%). The delta T should be 16.5°C or 12.5°C or smaller depending on water hardness below or above 11°dH.

	Warning: the warranty will void if these design requirements are not met.

DHW Mode 1 is also used for cascaded water heaters. Set the cascade parameters according to chapter “**16 cascade**“ Connect the Depending water heaters and the managing water heater. Attach the strap on sensor (system sensor) to the combined supply of the water heaters and connect this to the managing water heater, also connect the DHW sensor which measures the temperature in the tank to the managing heater.

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_Tank_Hyst_Down the control detects a demand for the store and starts the DHW circulator.

If the supply temperature T_Supply is below DHW_Store_Setpoint plus DHW_Tank_Supply_Extra minus DHW_Tank_Supp_Hyst_Dn the heater is started as well. The power is PID-modulated so T_Supply is regulated towards the DHW_Store_Setpoint plus DHW_Tank_Supply_Extra.

DHW_Tank_Supply_Extra is default set to 0ºC because the supply temperature of the water is almost the same as the tank temperature.

The water heater is stopped when the supply temperature rises above DHW_Store_Setpoint plus DHW_Tank_Supply_Extra plus DHW_Tank_Supp_Hyst_Up.

The demand for the tank is ended when T_Store rises above DHW_Store_Setpoint plus DHW_Tank_Hyst_Up. The circulator continues DHW_Pump_Overrun.

Store warm hold function
Because of the presence of the indirect tank sensor (*T_Store*) the control can detect demand for holding the tank hot. If T_Store drops below DHW_Store_Setpoint minus DHW_Store_Hold_Warm the heater starts at minimum power. DHW_Store_Hold_Warm is factory set at 3ºC

If there is a consumption of hot water and the tank sensor drops below DHW_Store_Setpoint minus DHW_Tank_Hyst_Down the heater will increase its power and the normal control will be active.

Parameters	Parameter number	Level	Default value	Range
DHW Mode	35	2: Installer	1	0 - 8
DHW Store Setpoint	115	2: Installer	60°C	0 - 90°C
DHW Tank Hyst. Down	36	2: Installer	2°C	0 - 10°C
DHW Tank Hyst. Up	37	2: Installer	3°C	0 - 10°C
DHW Tank Supply Extra	38	2: Installer	0°C	0 - 30°C
DHW Tank Supp Hyst Dn	39	2: Installer	2°C	0 - 20°C
DHW Tank Supp Hyst Up	40	2: Installer	20°C	0 - 20°C
DHW Pump Overrun	44	2: Installer	20 s	0 – 900 s

Relevant variables

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

13.8.2 ANTI-LEGIONELLA PROTECTION

Anti-Legionella protection is enabled for DHW mode 1 with an external tank with a sensor. To prevent legionella a special function is implemented in the software.

• The Anti-Legionella protection will be checked on the T_Store 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 heater is forced to heat-up the system for Anti-Legionella. When the DHW Sensor temperature is below Anti_Legionella_Setpoint the control switches ON the circulators, when the DHW Sensor temperature is above Anti_Legionella_Setpoint plus 5 °C (plus 9 °F) the control stops the circulators.

The heater setpoint will be Anti_Legionella_Setpoint plus DHW_Tank_Supply_Extra.

If the supply temperature drops below the Heater_Setpoint the heater is started. The heater is PID controlled towards the Heater_Setpoint. When the supply temperature rises above Heater_Setpoint plus DHW_Supp_Hysterese_Up the heater is switched OFF.

When the DHW Sensor has been above Anti_Legionella_Setpoint 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 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 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 DHW demand will be accepted as normal.

Below parameters can be set by the installer.

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

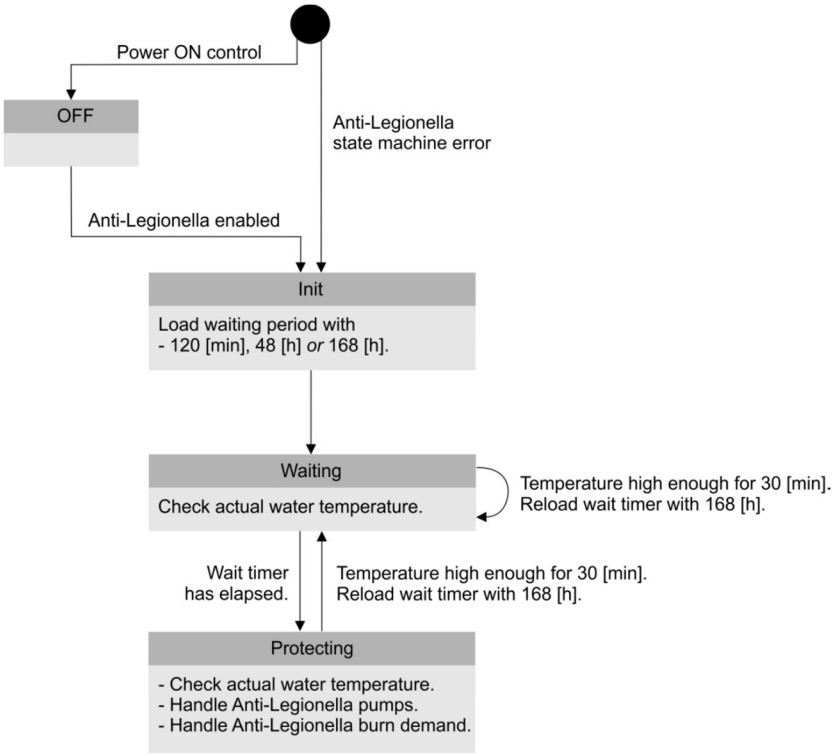
Following parameters cannot be set by the installer and are factory set

Parameter	Factory Setting.
Anti_Legionella_Setpoint (Setpoint for Anti-Legionella demand)	70 ºC
Anti_Legionella_Burn_Time	30 Min.
Anti_Legionella_Wait_Time Wait time for Anti-Legionella demand.	120 min after cold start, 168 h after first successful Anti-Legionella demand

When the control is powered the anti-legionella algorithm will be initialized when enabled. The initial wait time before an anti-legionella cycle is started is initialized as following:

- Anti-legionella enabled AND Water temperature < *Anti_Legionella_Setpoint – 3°C.*
  - Anti-legionella wait time initialized to 120 [min].
- Anti-legionella enabled AND Water temperature >= *Anti_Legionella_Setpoint – 3°C.*
  - Anti-legionella wait time initialized to 48 [h].
- Anti-legionella enabled AND *Anti_Legionella_At_Boot* disabled.
  - Anti-legionella wait time initialized to 168 + 2 [h].

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.

13.9 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. Logout	Installer	Reset the user-level back to 0: User.

1. Central Heating (CH)	**min.**	**max.**	**Default**	**unit**	**Access level**	**Description:**
1.1 CH Setpoint (par 3)	20	90	90	°C	User	Set the CH setpoint if CH mode is 0
1.2 Outdoor Reset					Installer	Enter the Outdoor Reset menu if CH mode is 1

1.2 Outdoor reset	**min.**	**max.**	**Default**	**unit**	**Access level**	**Description:**
Design Supply Temp. (par. 19)	20	90	90	°C	Installer	Set CH setpoint when outdoor temperature equals Design Outdoor Temperature.
Baseline Supply Temp. (par 21)	20	90	40	°C	Installer	Set CH setpoint when outdoor temperature equals Baseline Outdoor Temperature.
Warm Weather Shutdown (par 25)	0	35	22	°C	Installer	Set outdoor temperature above which CH demand is locked.
Design Outdoor Temp. (par 20)	-25	25	-5	°C	Installer	Set the outdoor temperature at which CH setpoint is set to Design Supply Temp.
Baseline Outdoor Temp. (par 22)	0	30	20	°C	Installer	Set the outdoor temperature at which CH setpoint is set to Baseline Supply Temp.

2. Domestic Hot Water (DHW)	**min.**	**max.**	**Default**	**unit**	**Access level**	**Description:**
DHW Setpoint (par 48)	40	71	60	°C	Installer	Set the DHW setpoint
DHW Store Setpoint (115)	40	71	60	°C	User	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				°C	User	Actual supply flow temperature
Flow 2 Temperature				°C	User	Actual supply 2 flow temperature
Return Temperature				°C	User	Actual return temperature
DHW Temperature				°C	User	Actual DHW temperature
DCW Temperature				°C	User	Actual DCW temperature
Outside Temperature				°C	User	Actual outside temperature
Flue Temp				°C	User	Actual flue gas temperature
Flue 2 Temp				°C	User	Actual flue gas 2 temperature
System Temperature				°C	User	Actual system temperature
Cascade Temperature				°C	User	Actual casc. flow/supply temp.
0-10 V Input				V	User	Actual 0-10 V input value
Flowrate				l/min	User	Actual DHW flowrate
Gas Pr Sw				open/close	User	Gas pressure switch input
Flow Switch				open/close	User	CH/DHW) Flow switch input
Air Fl Sw				open/close	User	Air pressure switch input
Water Pressure				Bar	User	Actual CH water pressure
Fan Speed				rpm	User	Actual fan speed
Ionization				µA	User	Actual ionization current
State					User	Actual burner state
Error				#	User	Actual internal error code
Calculated Setpoint				°C	User	Actual CH setpoint
Module Setpoint				°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	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	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)			˚C/bar	˚C/bar	User	Select Metric units
Imperial (˚F, psi)			x	˚F/psi	User	Select Imperial units

4.1.3 Date & Time	min.	max.	Default	unit	Access level	Description:
Date				dd-mm-yy	User	Set the current date
Time				hh:mm	User	Set the current time
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			UTC +00:00		User	Set the time zone correction
Daylight Savings Time			Disabled		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 Digits	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:
Status Overview Settings					User	Configure which information is shown on the Status overview
Modbus Address	0	255	1	0…255	User	Select the Modbus communication address
Modbus Stop bits	1	2	2	1 – 2	User	Select the number of Modbus communication stop bits

4.1.5.1 Status Overview Settings	min.	max.	Default	unit	Access level	Description:
Water Pressure			On	Off/On	User	Enable/disable the CH water pressure view
State			On	Off/On	User	Enable/disable the burner state view
Temperature selection ID			On		User	Enable/disable the temperature 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	20	90	90	ºC	Installer	Set the CH setpoint	3
Calc. Setp. Offset	-10	10	0	ºC	Installer	Set the offset for CH mode 1 / 2 calculated setpoint	109
CH Min Setpoint	20	50	20	ºC	Installer	Set the minimum CH setpoint (0-10V modes)	110
CH Max Setpoint	50	90	85	ºC	Installer	Set the maximum CH setpoint (0-10V modes)	111
Boiler Pump Overrun	0	900	20	sec.	Installer	Set the post-circulation time for the boiler/CH pump	5
CH Hysteresis Up	0	20	20	ºC	Installer	Set the CH hysteresis up	7
CH Hysteresis Down	0	20	5	ºC	Installer	Set the CH hysteresis down	112
Anti-Cycle Period	10	900	10	sec.	Installer	Set the burner anti-cycling period	9
Anti-Cycle Temp. Diff.	0	20	16	ºC	Installer	Set the burner anti-cycling differentia	10
Max. Power CH	1	100	100	%	Installer	Set the maximum CH burner power	14
Min. Power CH	1	100	1	%	Installer	Set the minimum CH burner power	15
CH PID P	0	1275	40		Installer	Set the PID P factor for CH	16
CH PID I	0	1275	180		Installer	Set the PID I factor for CH	17
Design Supply Temp.	20	90	90	ºC	Installer	Set CH setpoint when outdoor temperature equals Design Outdoor T.	19
Design Outdoor Temp.	-25	25	-5	ºC	Installer	Set the outdoor temperature at which CH setpoint is set to Design Supply Temp.	20
Baseline Supply Temp	20	90	40	ºC	Installer	Set CH setpoint when outdoor temperature equals Baseline Outdoor T.	21
Baseline Outdoor Temp	0	30	20	ºC	Installer	Set the outdoor temperature at which CH setpoint is set to Baseline Supply Temp.	22
Design Supply Min. Limit	4	82	20	ºC	Installer	Set the outdoor reset curve minimum setpoint	23
Design Supply Max. Limit	27	90	90	ºC	Installer	Set the outdoor reset curve maximum setpoint	24
Warm Weather Shutdn	0	35	22	ºC	Installer	Set outdoor temp. above which CH demand is blocked	25
Boost Temp Increment	0	30	0	ºC	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	30	10	ºC	Installer	Set the CH night setback temp.	28
DHW Mode	0	8	1		Installer	Set the DHW mode	35
DHW Tank Hyst. Down	0	20	2	ºC	Installer	Set the DHW tank hysteresis down	36
DHW Tank Hyst. Up	0	20	3	ºC	Installer	Set the DHW tank hysteresis up	37
DHW Tank Supply Extra	0	30	0	ºC	Installer	Set the DHW tank supply setpoint offset	38
DHW Tank Supp Hyst Dn	0	20	2	ºC	Installer	Set the DHW tank supply hysteresis down	39
DHW Tank Supp Hyst Up	0	20	20	ºC	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	60		Installer	Set the DHW tank PID P factor	45

cont.: 4.2.1 Boiler parameters	min.	max.	Default	unit	Access level	Description:	Display no:
DHW Tank PID I	0	1275	180		Installer	Set the DHW tank PID I factor	46
DHW/Tank Setpoint	40	71	60	ºC	Installer	Set the DHW setpoint	48
DHW Store Setpoint	40	71	60	ºC	Installer	Set the DHW storage setpoint	115
DHW Hysteresis Down	0	20	3	ºC	Installer	Set the DHW hysteresis down	49
DHW Hysteresis Up	2	20	3	ºC	Installer	Set the DHW hysteresis up	50
DHW Instant PID P	0	1275	400		Installer	Set the DHW instantaneous PID P factor	51
DHW Instant PID I	0	1275	1200		Installer	Set the DHW instantaneous PID I factor	52
DHW On Off Period	10	60	10	sec.	Installer	Set the on/off modulation period	63
PreHeat mode	on	off	off	-	User	Set the PreHeat Eco mode	64
PreHeat Eco Setpoint	0	80	30	ºC	Installer	Set the PreHeat Eco setpoint	65
DHW Max. Limit	0	90	85	ºC	Installer	Limiting DHW setpoint max.	91
DHW Min. Limit	20	50	30	ºC	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	4	#	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	18	#	Installer	Select the function for programmable output 4	128
Mod. Pump dT	5	40	16	ºC	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 inverse		Installer	Set the modulating pump model	135
Mod. Pump Mode	20	100	mod.	o/f or mod.	Installer	Set the modulating pump mode	136
Mod. Pump Min Pwr			35	%	Installer	Set the modulating pump minimum duty cycle	137
Appliance Type	50	55	dep unit	#	Installer	Set the appliance type	138
Dair active	0	1	yes	Yes / No	Installer	Enable/disable the De-Air function	139
Nominal Flow	0	10	0	L / min	Installer	Sets the nominal flow	141
Anti Legionella Day	mon	sun	Sunday		Installer	Select the day for the anti-legionella cycle	107
Anti Legionella Hour	0	23	0	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			Master		Installer	Set the cascade burner address	184
Permit Emergency Mode			Yes	Yes/No	Installer	Enable/disable the cascade emergency mode	72
Emergency Setpoint	20	90	50	°C	Installer	Set the emergency mode setpoint	74
Delay Per Start Next Mod.	0	1275	60	sec.	Installer	Set the delay time before the next module is started	75
Delay Per Stop Next Mod.	0	1275	30	sec.	Installer	Set the delay time before the next module is stopped	76
Delay Quick Start Next	0	1275	30	sec.	Installer	Set the fast delay time before the next module is started	142
Delay Quick Stop Next	0	1275	15	sec.	Installer	Set the fast delay time before the next module is stopped	143
Hyst. Down Start Module	0	40	5	°C	Installer	Set the hysteresis down after which a module is started	77
Hyst. Up Stop Module	0	40	12	°C	Installer	Set the hysteresis up after which a module is stopped	78
Hyst. Down Quick Start	0	40	8	°C	Installer	Set the fast hysteresis down after which a module is started	144
Hyst. Up Quick Stop	0	40	14	°C	Installer	Set the fast hysteresis up after which a module is stopped	145
Hyst. Up Stop All	0	60	16	°C	Installer	Set the hysteresis up at which all modules are stopped	146
Number of Units	0	16	1	#	Installer	Set the no. of modules expected in the cascade system	147
Power Mode	0	3	1	#	Installer	Set the power mode	148
Max. Setp. Offset Down	0	40	2	°C	Installer	Set the maximum setpoint offset down	79
Max. Setp. Offset Up	0	40	0	°C	Installer	Set the maximum setpoint offset up	80
Start Mod. Delay Fact.	0	60	0	min.	Installer	Set the setpoint modulation delay time	81
Next Module Start Rate	10	100	85	%	Installer	Set the next module start rate	82
Next Module Stop Rate	10	100	25	%	Installer	Set the next module stop rate	83
Module Rotation Interval	0	30	5	days	Installer	Set the rotation interval	84
First Module to Start	0	17	1	#	Installer	Set the first module to start in the rotation cycle	149
PwrMode2 Min Power	0	100	20	%	Installer	Set the power mode 2 min. power	152
PwrMode2 Hysteresis	0	100	10	%	Installer	Set the power mode 2 hysteresis	153
Post-Pump Period	0	255	30	sec.	Installer	Set the cascade post-circulation period	154
Frost Protection	10	30	15	°C	Installer	Set the frost-protection setpoint	155

⚠	Parameters for cascading are found in the **Module Cascade Settings** menu, submenu of the Boiler settings menu**.** Parameters in the **Boiler Cascade Settings** menu should **not** be used.

4.2.3 Boiler Cascade Settings	min.	max.	Default	unit	Access level	Description:	Dis-play 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	20	90	70	°C	Installer	Set the emergency mode setpoint	157
Delay Per Start Next Blr	0	1275	1275	sec.	Installer	Set the delay time before the next boiler is started	158
Delay Per Stop Next Blr.	0	1275	1275	sec.	Installer	Set the delay time before the next boiler is stopped	159
Delay Quick Start Next	0	1275	400	sec.	Installer	Set the fast delay time before the next boiler is started	160
Delay Quick Stop Next	0	1275	240	sec.	Installer	Set the fast delay time before the next boiler is stopped	161
Hyst. Down Start Boiler	0	40	5	°C	Installer	Set the hysteresis down after which a boiler is started	162
Hyst. Up Stop Boiler	0	40	2	°C	Installer	Set the hysteresis up after which a boiler is stopped	163
Hyst. Down Quick Start	0	40	10	°C	Installer	Set the fast hysteresis down after which a boiler is started	164
Hyst. Up Quick Stop	0	40	4	°C	Installer	Set the fast hysteresis up after which a boiler is stopped	165
Hyst. Up Stop All	0	60	8	°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	20	0	°C	Installer	Set the maximum setpoint offset down	169
Max. Setp. Offset Up	0	20	20	°C	Installer	Set the maximum setpoint offset up	170
Start Mod. Delay Fact.	0	255	20	min.	Installer	Set the setpoint modulation delay time	171
Next Boiler Start Rate	10	100	80	%	Installer	Set the next boiler start rate	172
Next Boiler Stop Rate	10	100	25	%	Installer	Set the next boiler stop rate	173
Boiler Rotation Interval	0	30	5	days	Installer	Set the rotation interval	174
First Boiler to Start	1	17	2	#	Installer	Set the first boiler to start in the rotation cycle	175
PwrMode2 Min Power	0	100	20	%	Installer	Set the power mode to min. 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 O_2 level's)
Fan speed			xxxx	rpm	installer	read out fan speed
Ionization			x.x	µA	installer	read out flame signal

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

14 TEMPERATURE PROTECTION

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

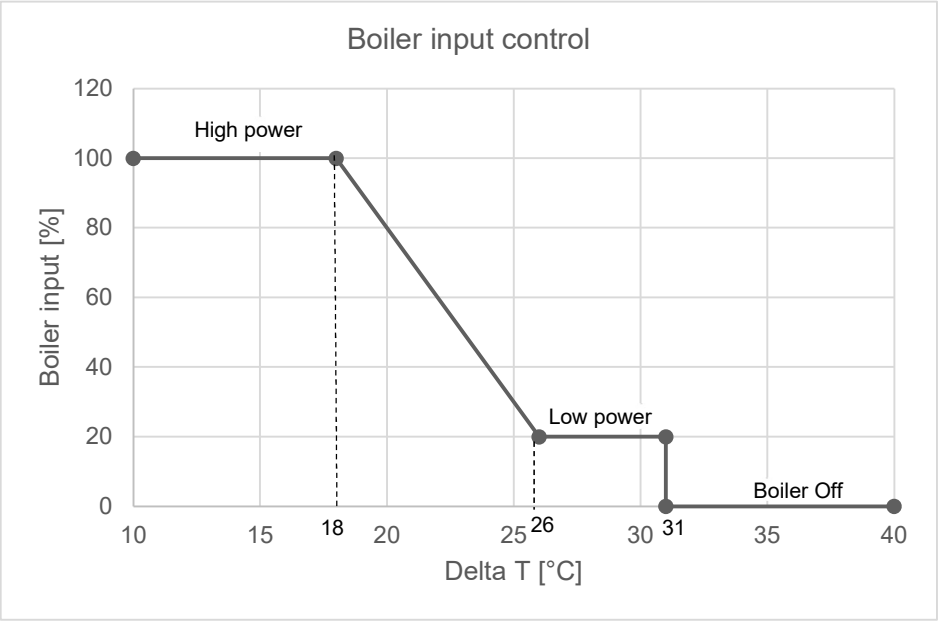
At maximum water heater input ΔT is limited to 18 °C

In between 18 °C and 26 °C water heater input modulates between minimum and maximum.

At minimum water heater input ΔT above 26 °C
Above ΔT = 31 °C, the water heater is switched OFF during *HX_Diff_Max_Wait_Time*.

Relevant factory set variables

Parameter	Level	Factory Setting.
HX Diff DeltaT Min	3: Factory	18 ºC
HX Diff Max Wait Time Wait time after upper limit primary heat exchanger differential has been exceeded.	3: Factory	0 Sec.



15 ERROR INFORMATION.

Errors can be divided in three groups:

• Non-volatile locking errors (can only be reset by the reset button).
• Blocking errors (will disappear when error is gone)
• Warnings (will disappear when the warning is gone, not stored in the BCU)

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

15.1 Water heater history.

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

- Successful ignitions
- Failed Ignitions
- Flame Failures
- Anti-legionella count
- Total system run time
- CH Burner Hours
- DHW Burner Hours

15.2 Lockout codes

Lock-out code	Error	Description	Cause	Solving
0	EEPROM Read Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
1	Ignition Error	Five unsuccessful ignition attempts in a row	no gas, wrongly adjusted gas valve	check gas supply and adjust gas valve, reset BCU
2	GasValve Relay Error	Failure detected in the gas valve relay	short circuit in coil of the gas valve, water on wiring or gas valve	reset BCU replace gas valve or wiring harness
3	Safety Relay Error	Failure detected in safety relay	safety relay is not working correctly	reset BCU or replace BCU
4	Blocking Too Long Error	Control had a blocking error 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
13	Air Switch Not Open	Air pressure switch not opening during pre-purge 0	electrical circuit is short circuited or APS is jammed	check wiring or replace APS
14	Air Switch Not Closed	Air pressure switch not closing during pre-purge 1	no air transport to the burner; flue or air inlet is blocked or APS is jammed or air signal hose not connected to the air intake pipe or water in hose	Check if there are any obstructions in the flue or air intake, replace APS if jammed, connect air hose to the air intake pipe, remove any water from the hose.
15	Max. 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 or back wall thermal fuse has tripped because rear wall insulation disc (combustion chamber) is damaged or broken.	Check burner door gasket and replace burner door gasket and reset clixon on burner door or check pump and waterflow and replace pump or increase water flow check also if valves are closed or check if rear wall fuse is broken if so replace and also replace rear wall insulation disc (combustion chamber).
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

Lock-out code	Error	Description	Cause	Solving
18	Instruction Error	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
19	Ion Check Failed	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
20	Flame Out Too Late Error	Flame still present 10 seconds after closing the gas valve	wrong earthing of BCU and boiler	Check earthing of BCU and boiler
21	Flame Before Ignition	Flame is detected before ignition	wrong earthing of BCU and boiler	Check earthing of BCU and boiler
22	Too Many Flame Failures	Three time flame lost during 1 demand	bad gas supply or O_2 level is not correct or bad ignition rod	check gas supply pressure, check O_2 level and adjust if necessary, replace ignition rod or replace ignition cable.
23	Corrupted Error Number	Error code RAM byte was corrupted to an unknown error code.	wrongly programmed BCU or PB	reset BCU or replace BCU and or display unit
27	Filling Too Much	Too many automated filling attempts in a short time period	If output is programmed as filing valve and there are to many filing attempts	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
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 2nd exchange sensors deviate too much for more than 60 seconds	There is not enough water flow through the heat exchanger	Check if the pump is running and if all valves are open to make enough flow
33	LWCO/Air intake block	Low water cut off 1 error	There is no water in the heat exchanger or not electrically connected	Check if there is enough water in the heat exchanger if not so fill up the system
34	LWCO 2 Error	Low water cut off 2 error	There is no water in the heat exchanger or not electrically connected	Check if there is enough water in the heat exchanger if not so fill up the system
35	Air Switch Not Closed	Air pressure switch not closing during post-purge 1	no air transport to the burner after heat demand; flue or air inlet is blocked or APS is jammed or air signal hose not connected to the air intake pipe or water in hose	Check if there are any obstructions in the flue or air intake, replace APS if jammed, connect air hose to the air intake pipe, remove any water from the hose.
36	Gas Pressure Error	Gas pressure switch open for more than E2_GPS_Timeout	wrong gas pressure on gas supply or loose wiring on connections terminal	Check if gas pressure is in limits of the gas pressure switch. Check wire bridge 24-25 at low voltage connection terminal

15.3 Blocking codes

Blocking code	Error	Description	Cause	Solving
100	WD Error Ram	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and / or display unit
101	WD Error Rom	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and / or display unit
102	WD Error Stack	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and / or display unit
103	WD Error Register	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and / or display unit
104	WD Error Xrl	Internal software error	wrongly programmed BCU or PB	reset BCU or replace BCU and / or display unit
105	High Temp Error	T_Supply sensor measures over Stay_Burning_Temp for a period of Max_Value_Period.	not enough waterflow 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	Check earthing of BCU and boiler
116	Low Water Pressure Sensor	Low water pressure, generated when the pressure drops below Minimal_Pressure, or when the pressure drops below 0,3 bar .	Not enough water pressure	Fill up the system and check if there are any water leakages
118	WD Communication Error	Watchdog communication error	wrongly 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 Or Cascade System: Depending boilers parameter 35 “DHW Mode” not changed to 0	malfunctioning DHW sensor or not connected	check connection to BCU or check resistance NTC sensor OR Modify parameter 35 (DHW Mode) to 0 of depending boilers only
123	T Flue Open	Flue sensor open	malfunctioning flue sensor or not connected	check connection to BCU or check resistance NTC sensor

Blocking code	Error	Description	Cause	Solving
125	T Outdoor Open	Outdoor sensor open	malfunctioning outdoor sensor or not connected or wrong CH-mode programmed	check connection to BCU or check resistance NTC sensor or change CH-mode
126	T Return Shorted	Return sensor shorted	malfunctioning return sensor or short circuiting	check connection to BCU or check resistance NTC sensor
127	T Supply Shorted	Supply sensor shorted	malfunctioning supply sensor or short circuiting	check connection to BCU or check resistance NTC sensor
129	T DHW Shorted	DHW sensor shorted	malfunctioning DHW sensor or short circuiting	check connection to BCU or check resistance NTC sensor
130	T Flue Shorted	Flue sensor shorted	malfunctioning flue sensor or short circuiting	check connection to BCU or check resistance NTC sensor
132	T Outdoor Shorted	Outdoor sensor shorted	malfunctioning Outdoor sensor or short circuiting	check connection to BCU or check resistance NTC sensor
134	Reset Button Error	Too many resets in a short time period	Reset many times by user or installer	wait or disconnect and reconnect power supply
136	T_Exchange Block Error	Exchange temperature exceeded 194 ºF (90 ºC).	water temperature is above 194 ºF (90 °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
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.
164	Ex. Low Flow Protection	Flow is too low, demand needs to be stopped with fan at ignition speed*, but no error needed to be stored at this time	not enough water flow through heat exchanger	Check 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.
168	Flue Temperature Too High	Flue temperature is higher than set maximum	Flue side clogging of heat exchanger	Clean the heat exchanger, especially between the coils

15.4 Warnings

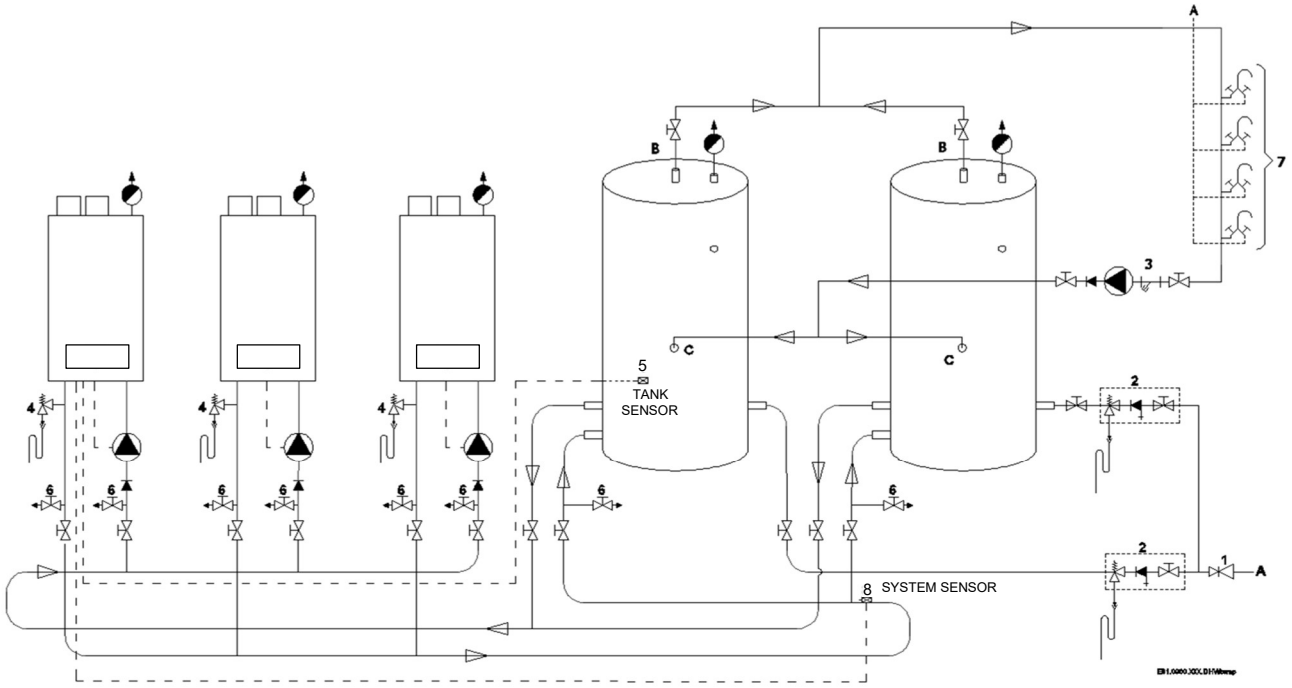
Error no.	Error	Description	Cause	Solving
200	Comm. Lost with module	Cascade System: Managing cascade control lost communication with one of the depending.	connection between cascaded boilers is interrupted or wiring is broken or parameter 147 on the master boiler is wrong	Check wiring between boiler or distance between boilers is to big or set parameter 147
202	App. Selection Error	Unknown appliance model selected	wrongly programmed parameters	replace BCU
203	Comm. Lost with boiler	Dual Cascade System: Managing cascade control lost communication with one of the depending.	connection between cascaded boilers is interrupted or wiring is broken	Check wiring between boiler or distance between boilers is to big
204	T Outdoor Wrong	T_Outdoor sensor measures open/shorted	malfunctioning outdoor sensor or not connected or wrong CH-mode programmed	check connection to BCU or check resistance NTC sensor or change CH-mode
205	T System Wrong	T_System sensor measures open/shorted	malfunctioning system sensor or not connected	check connection to BCU or check resistance NTC sensor
206	T Cascade Wrong	T_Cascade sensor measures open/shorted	malfunctioning cascade sensor or not connected	check connection to BCU or check resistance NTC sensor. 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		

16 CASCADING

16.1 System setup

NOTE: for proper functioning of the system, some settings have to be changed, see § 16.5.1 "Emergency mode".

The water heater controller can control multiple water heaters in a cascade setup.
The sensors (DHW sensor and system sensor) are equal to a stand-alone 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 system sensor is connected to the managing water heater and calculates the HW setpoint for the cascade system.



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

Explanation:

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

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

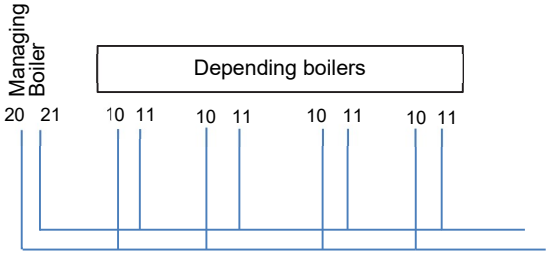
Notes:

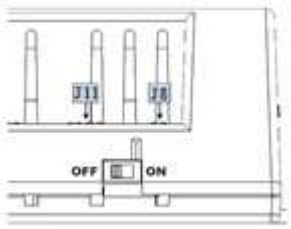
- Connections on the water heater side should **always** be executed as drawn in the picture above.
- [1] *Always apply safety components according to all applicable regulations.*
- [3] In case of more than one tank, mount the tank sensor in one of the tanks. The temperature of this tank will be assumed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

16.2 Quick-guide cascade set-up

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

1. **Link the boilers with a 2-wire cable in parallel.**
   Connect 20 on the managing boiler to 10 on the dependent boilers and connect 21 on the managing boiler to 11 on the dependent boilers.





2. **Set the switch "bus power on" at the side of the boiler control to the off position.**
   Note the line of the bottom of the boiler control on above picture to determine the off position.

3. **Change the burner address on every boiler that is part of the cascade**
   Parameter: Menu - Settings - Boiler settings - **Module Cascade Settings** - Parameter 184 (Burner Address)
   On managing boiler: set as manager (=default setting)
   On dependent boilers: set as dep 2, dep 3, etc.
   (**DO NOT USE Boiler Cascade Settings)**

4. **Change number of units on managing boiler only**
   Parameter: Menu - Settings - Boiler settings - **Module Cascade Settings** - Parameter 147 (Number of units)
   On managing boiler: set at total number of units that are part of the cascade (= managing + number of depending)
   On depending boilers: set at 1 (= default setting)

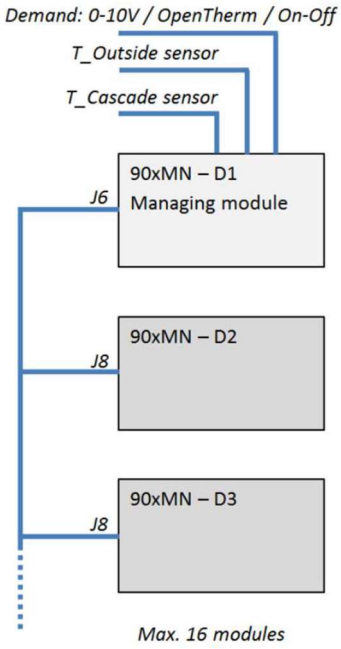
5. **Change parameter 35 "DHW Mode" of depending boilers only.**
   Parameter: Menu - Settings - Boiler settings – Boiler Parameters - Parameter 35 (DHW Mode)
   Set Mode to 0 for depending boilers only. This causes a crossed-out tap at the normal display. If this setting is forgotten the message MN:DHW Sensor Open appears.

6. **Connect required sensors to the managing boiler only**
   DHW / tank 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 only after de-airing the boilers and system**
   Parameter: Menu - Settings - Boiler settings - Boiler parameters - Parameter 139 (Dair active)
   On managing boiler: set to No

16.3 Water heater cascade communication setup.

In order for the system to work for cascade the communication busses must be parallel linked together. The managing water heater uses the AL-bus connection 20-21 for the cascade. The depending water heaters must be connected to the managing water heater on the 10-11 connection terminals.
It is important that the power on the 10-11 connection terminals on all water heaters is switched to the OFF position. (see also §16.2.1) All water heaters in the cascade system must have a unique address selected.
Before commissioning a cascade installation, a number of parameters have to be changed.
These parameters can be programmed on the unit itself.



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

NOTICE	Parameters for cascade operation are found in the **Module cascade settings** menu, located in the Boiler settings menu. Parameters in the **Boiler cascade settings** menu should **NOT** be used.

16.3.1 SETTING THE WATER HEATER ADDRESS

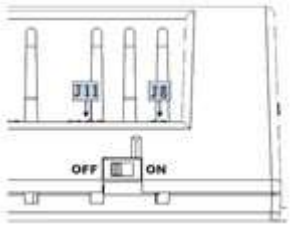
NOTICE

Address rules

The cascade managing address (parameter 184) must be set to 'Managing' on the managing water heater.
The cascade depending addresses (parameter 184) must be set in a logical numbered order from 2: Dep. 2, Dep. 3 etc. on the depending water heaters.
The total number of water heaters in the cascade must be stored in parameter 147 on the managing water heater.

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

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



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

16.3.2 SETTING OF THE CASCADE PARAMETERS

1. 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.

Menu
Central Heating
Domestic Hot Water (DHW)
Information
Settings

2. Now select Boiler Settings and enter the right password to continue.

Settings
General Settings
Boiler Settings

3. Select **Module Cascade Settings** and NOT Boiler Cascade Settings

Boiler Settings
Boiler Parameters
Module Cascade Settings
Boiler Cascade Settings

4. Change burner address into Managing or Dependent with the correct sequence number. (Dep2 is the first depending boiler e.g.)

Module Cascade Settings	
(184) Burner Address	Managing
(72) Permit Emergency Mode	Yes
(74) Emergency Setpoint	65°C
(75) Delay Per Start Next Mod.	200 sec

Heater address	Heater Operation	Function of sensor input terminal 3-4
Stand-alone	Not possible	No function
Managing (default)	1st boiler (**managing**)	System sensor
2	2nd boiler (depending)	No function
3	3rd boiler (depending)	No function
4	4th boiler (depending)	No function
↓	↓	
16	16th boiler (depending)	No function

Never select “Stand alone” with a water heater. The water heater will not function right. A single water heater must be configured to Managing.

5. Now select in parameter 147 how many water heaters (units) are in the cascade

Module Cascade Settings	
(144) Hyst Down Quick Start	10 °C
(145) Hyst. Up Quick Stop	6.0 °C
(146) Hyst Up Stop All	8.0 °C
(147) Number of Units	2

16.3.3 CASCADE – MANAGING WATER HEATER

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.

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

Water heater input Rates
A cascade system operates most effective and efficiently when all of the water heaters in the system are the same type. (so all HW 85 e.g.)

16.3.4 CASCADE – DEPENDING WATER HEATER

In case a water heater is set as depending (Parameter 184, Address = 2-8/16) the DHW setpoint is always provided by the managing water heater, the internal control of the setpoint functions are disabled.

SET parameter 35 to Mode 0 on depending boilers only, “Menu-Settings-Boiler Settings-Boiler Parameters- Parameter “35 DHW Mode” This causes a crossed-out tap symbol at the normal display. If this setting is forgotten the message MN: DHW Sensor Open appears.

16.3.5 CASCADE – POWER BALANCE MODE

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

16.4 Cascade – Water heater rotation

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

When for example *Module_Rotation_Interval* = 5 the start sequence is as following (x is the last 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_Module_To_Start the current water heater that is first to start in the sequence is selected.
When the water heaters are rotated the parameter First_Module_To_Start is automatically updated to the next water heater. When water heater rotation is disabled the parameter First_Module_To_Start is reset to 0.
When the First_Module_To_Start is manually changed the control will clear all demand of the cascade control. After this is will start cascade demand generation with the new selection for First_Module_To_Start.

16.4.1 NEXT MODULE TO START SELECTION

When the cascade Module_Rotation_Interval has passed the control will perform the cascade rotation. At this moment the next available control based on the current First_Module_To_Start is selected.
A 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_Module_To_Start.

Relevant variables

Specific Parameters	Level	(Default) Value	Range
(84) Module Rotation Interval	2: Installer	5	0…30 (0: Disabled)
(149) First Module To Start	2: Installer	1	1…8/16

16.5 Cascade Error handling

16.5.1 CASCADE FROST PROTECTION

Frost protection on a cascade is active on two levels.

1. Frost protection for Module cascade

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

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

2. Frost protection on water heater

As last protection the controllers for the heaters can force themselves to burn. See also § 7.6

If the water heater supply/Inlet temperature drops below 5 °C the water heater starts at minimum power and continues burning until the lowest of both supply and Inlet temperatures are above 15 °C.

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

16.5.2 EMERGENCY MODE

Managing water heater error

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

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

Specific Parameters	Parameter nr.	Level	(Default) Value	Range
Permit Emergency Mode	Module Cascade parameter 72	Installer	Yes	Yes/No
Emergency Setpoint	Module Cascade parameter 74	Installer	50 ºC (122 ºF)	20 - 90 °C (68 - 194 °F)
Dair active	Boiler parameter 139	Installer	Yes	Yes/No

For proper functioning of this emergency mode, the following settings are necessary in the managing 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 heaters!

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

16.5.3 LOSS OF CASCADE COMMUNICATION

The burner controller of the managing water heater is aware of how many dependents should be present in the system. The total number of heaters is stored in the BCU (parameter 147). When powering on the system the leading water heater has to detect all depending heaters within 60 seconds.
When not all dependent heaters are detected the control will show the CC_Loss_Communication warning. When the communication with any of the depending heaters 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.

16.5.4 MANAGING WATER HEATER ERROR

When the managing water heater is in error mode this boiler is not used anymore for the cascade system.
However depending on the error code, the pumps connected to the managing water heater still can be active for the cascade system. When the managing unit is reset from lockout state, the cascade controllers are re-initialized.

17 SYSTEM TEST.

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

The following modes are available:

System test mode		Description
0	Not active	System test mode not active
1	Fan only	The fan is forced to run at maximum speed without starting the water heater
2	Low power	The water heater starts and after the ignition period has finished the water heater stays at low power
3	Ignition power	The water heater starts and stays at ignition power
4	High power	The water heater starts and after the ignition period has finished the water heater stays at high power
5	High power limited	The water heater starts and after the ignition period has finished the water heater stays at high power limited by the parameter *CH_ max_ power*
6	High limit error test	Simulates the *Max_Temp_Error*
7	Low water cut off 1 error test	Simulates the *LWCO_1_ Error*
8	Low water cut off 2 error test	Simulates the *LWCO_2_ Error*

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

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

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

18 COMMISSIONING THE WATER HEATER

18.1 First: flushing the water heater with water

After installation of the water heater the first step, before commissioning, is to flush the water heater and the whole installation with fresh water to remove pollution, debris and other materials that might cause a blocking. This must also be done with installations, where only the water heater is replaced.
Existing and new systems must be cleaned with a hydronic system cleaner. System cleaner must be drained and thoroughly flushed with clean water to remove any residual cleaner, prior to installing a new water heater. NEVER leave a system cleaner for longer than recommended by the manufacturer of the cleaner.
Never put system cleaner inside the water heaters heat exchanger.

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

After flushing the water heater and the installation the system can be filled with fresh water.
The water heater has an automatic air vent situated inside the water heater. This vent is always open and the venting outlet goes via a plastic tube through the bottom to the outside.

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

18.3 Third: check the water flow

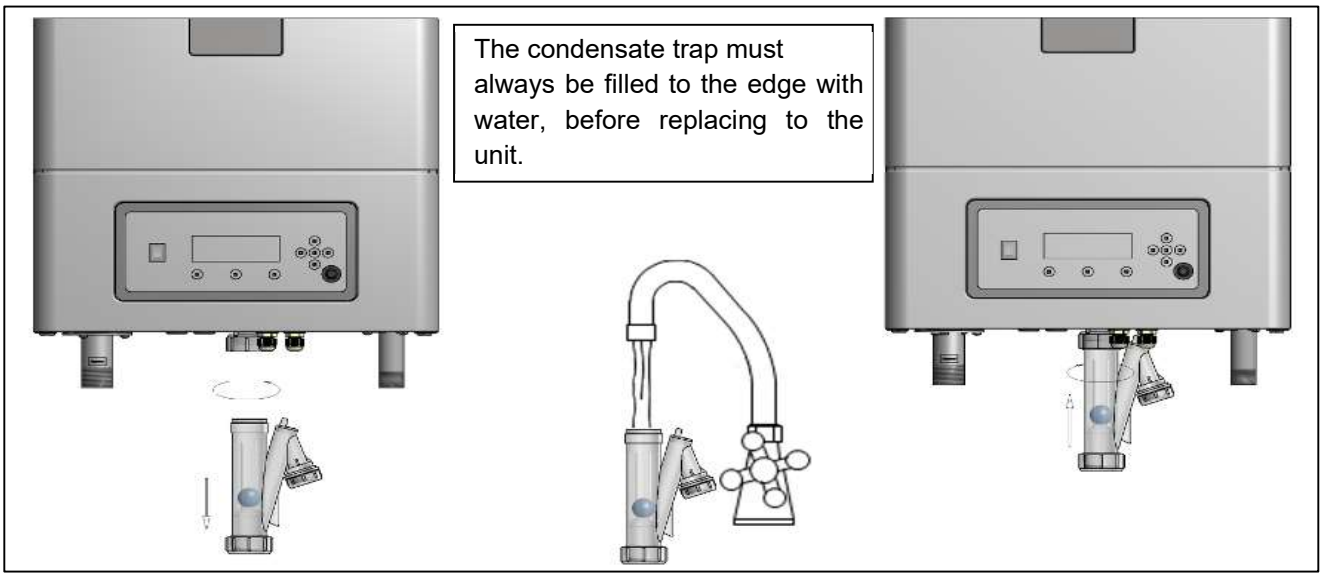
Before starting the water heater ensure the pump is installed and operating correctly and that there are no obstructions or closed valves that could prevent water flow through the heat exchanger.

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

18.4 Mounting the Condensate Trap

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



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

18.5 Checking gas pressure

Check the gas pressure available at the gas connection pipe of the water heater. Use the pressure nipple [3] of the gas safety valve for this measurement. Chapter 19.1.2 shows the position of the pressure nipple [3]

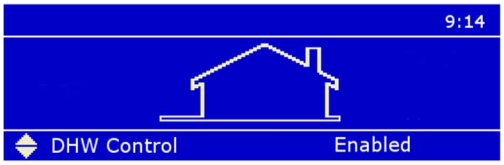
Minimum and maximum gas supply pressures:

Type of Gas	[mbar]	p min [mbar]	p max [mbar]
Natural gas	20	17	25
Propane	37	25	45

18.6 Firing for the first time

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

This screen is active during power up and will remain active until communication with the main Control has been established.
After communication has been established one of the following Status overview screens appears:



The display describes:

- The actual operation for hot water
- The temperature setting

19 ADJUSTING AND SETTING THE WATER HEATER

WARNING	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 or serious injury. As soon as the appliance has been fully installed (with regard to hydraulics, filling and de-aeration of installation, gas, flue gas, air intake, wiring etc.) according to the preliminary installation instructions, the water heater may then be wired to an electrically grounded power supply source. The water heater should always be connected to a disconnect or external power shut off and must be electrically bonded to the ground according to all applicable standards and regulations.

19.1 Introduction

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

- A new water heater is installed
- As part of a service/maintenance check, in case the O_2 values turns out to be incorrect.
- The gas valve has been (re)placed.
- Gas conversion to propane. Prior to adjustments, follow the procedure in 19.5
- The venturi has been replaced. Prior to adjustments, follow the procedure in 19.4
- The fan has been replaced
- The flue gas check valve has been replaced

In any of the cases described, always check the gas/air ratio of the combustion figure (O_2) at maximum and minimum input. First set the water heater at maximum load and subsequently at minimum load, and repeat if necessary (adjustments at maximum load influence values at minimum load and vice versa).

Chapter overview:
First, all necessary values are given in adjustment table in § 19.1.1. A drawing of the gas valve(s) and setting screws is given in § 19.1.2. In § 19.2 a general procedure, conform which the adjustments must be carried out, is presented. § 19.3 describes the specific adjustments to be made when the venturi is replaced, and § 19.4 describes the changes needed when the gas type is set to propane.

19.1.1 COMBUSTION TABLE

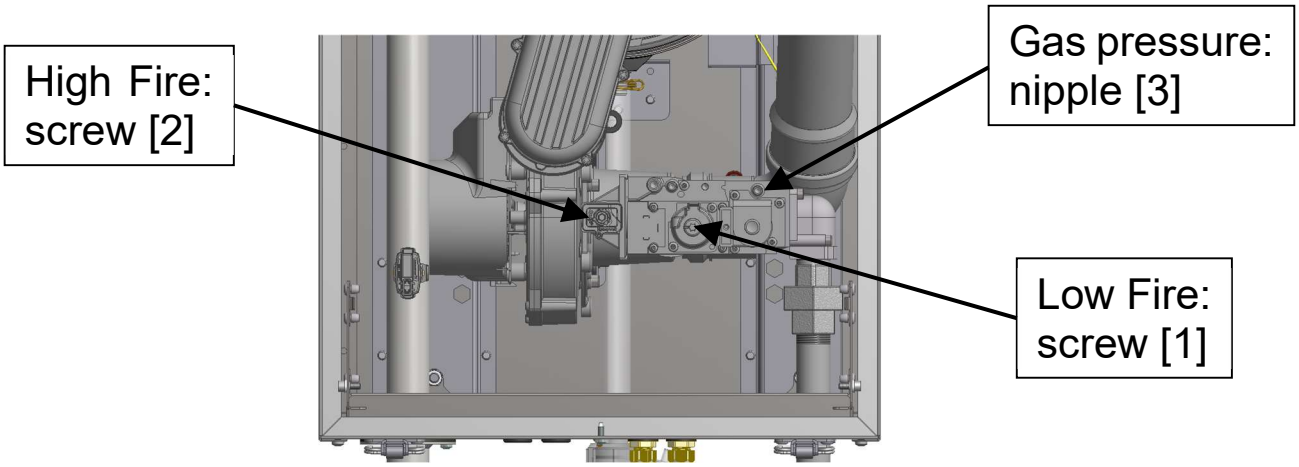
Table: O_2 / CO_2 values for maximum and minimum load. [1)]

	O_2 / CO_2 [%]		**O_2 / CO_2 [%]**		**O_2 / CO_2 [%]**	
Gas type:	**natural gas G20**		**natural gas G25.3**		**propane G31 [2) 3)]**	
Heater type	max load	min load	max load	min load	max load	min load
CB 85	6.0 / 8.4	6.9 / 7.9	6.1 / 8.2	5.7 / 8.4	4.9 / 10.5	6.7 / 9.3
CB 105	6.0 / 8.4	6.9 / 7.9	6.1 / 8.2	5.7 / 8.4	5.2 / 10.3	6.7 / 9.3
CB 125	6.0 / 8.4	6.9 / 7.9	6.1 / 8.2	5.7 / 8.4	5.2 / 10.3	6.4 / 9.5
CB 155	6.0 / 8.4	6.9 / 7.9	6.1 / 8.2	5.7 / 8.4	5.2 / 10.3	6.4 / 9.5

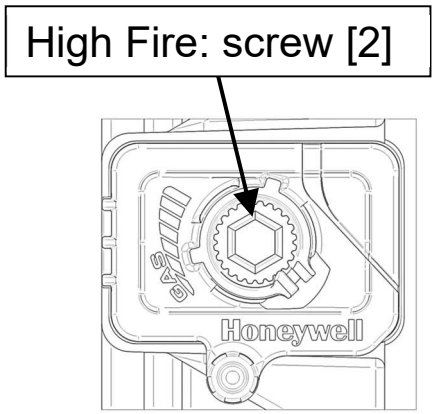
Allowed tolerances are O_2 ± 0.2 and CO_2 ± 0.1
1) All values measured without front door.
2) For propane: a conversion kit (orifice) has to be mounted, see § 19.4.
3) For propane: Parameter 92 and 93 (fan speed) must be changed, see § 19.4

19.1.2 SETTING SCREWS VENTURI- AND GAS VALVES: DRAWINGS

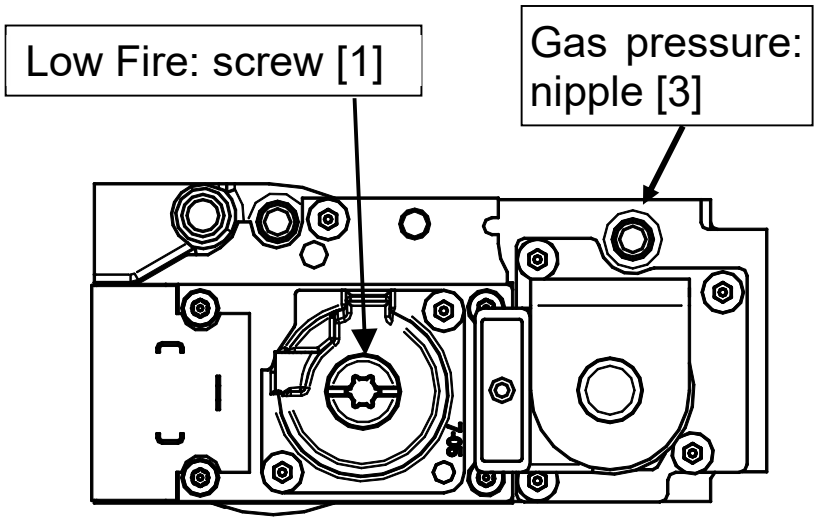
Location of the setting screws:



High Fire: venturi adjustment screw: use hex key 4 mm



Low Fire: gas valve adjustment screw: Torx T40.



19.2 Adjustment procedures

Procedure 1: adjust at High Fire

Carry out the next steps:

1. From status screen, press MENU ☰ .→"Central Heating/ Information/ Settings/ System Test"
2. Press UP/DOWN ↑↓ 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 water heater becomes active, after about 10 seconds, the water heater burns at high fire.
   If the water heater doesn't start, open screw [2] two turns extra - clockwise
   Note: once the test state is active, it is not necessary to press a button, selecting the desired power is sufficient.
   Wait for the water heater to stabilize before taking combustion readings and do adjustments.
   For your information, "Fan speed" and "Ionization" are displayed.
6. Measure the O_2 percentage at the flue gas test port on the vent connection.
7. By setting screw [2], adjust the gas valve to obtain the O_2 value of the table in § 19.1.1.
8. To return to the status screen, and stop the water heater, press ESCAPE ⎋ or MENU ☰ 3 times, or RESET ↩ once.

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

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

Procedure 2: adjust at Low Fire

Carry out the next steps:

1. Press UP/DOWN ↑↓ multiple times to select "Low Power" → "Test State: **Low Power**".
   Wait for the water heater to stabilize before taking combustion readings and do adjustments.
2. Measure the O_2 percentage at the flue gas test port on the vent connection.
3. By setting screw [1], adjust the gas valve to obtain the O_2 value of the table in § 19.1.1.

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

4. To return to the status screen, and stop the 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 § 19.1.1. values best

19.3 Venturi Replacement Adjustment

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

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

Water heater type	Number of turns ↶
CB 85 HW	56
CB 105 HW	45
CB 125 HW	40
CB 155 HW	36

After this, perform adjustments according to 19.2.

19.4 Conversion from natural gas to propane

WARNING	Conversion of the heater to a different gas type must be performed by a certified technician. Parameter 92 and 93 must be set correctly! Wrong setting can lead to damage to the appliance or shorten the lifespan of the appliance! The warranty of the device will expire if a wrong selection has been made. Before starting conversion: close the gas supply and switch off the electrical power!

Use only parts/conversion kits obtained from Eco Heating Systems Groningen B.V. and intended to be used with this particular water heater.
Every conversion kit is provided with instructions how to assemble the kit to the water heater.

Required parts: (Installation Manual "Accessories")
Propane orifice CB 85 and CB 105
Propane orifice CB 125
Propane orifice CB 155

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

1. Check water heater model
2. Mount the orifice
3. Set parameter 92 and 93
4. Adjust the O_2 / CO_2 percentage
5. Measure the gas pressure
6. Confirmation: apply the propane sticker and mark the boxes

1. Check water heater model. Check if you have a CB 85, 105, 125 or 155 water heater. The model number is on the data plate, on the inside of the water heater casing, top side.

2. Mount the orifice:

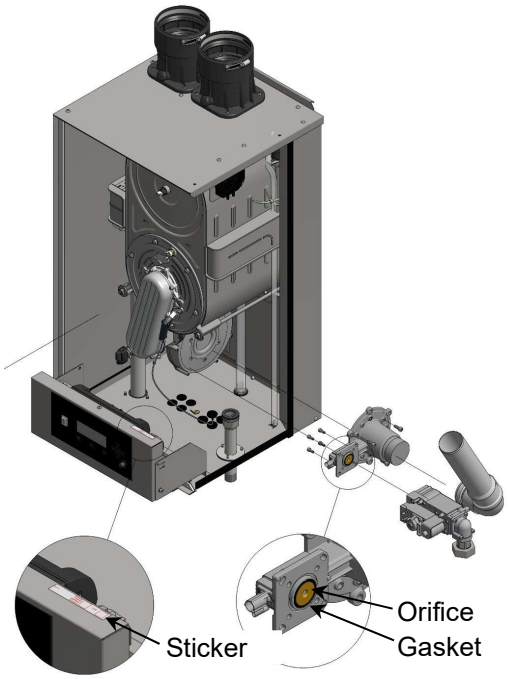
Water heater type	Orifice Inner Diameter
CB 85 HW	6.2
CB 105 HW	6.2
CB 125 HW	7.2
CB 155 HW	7.5

Converting the water heater to propane is done by placing a propane orifice between gas valve and venturi. By using the correct orifice size (see table), the measured O_2 (CO_2) percentage in the flue gas will already be close to the desired value.

<u>Installing the orifice</u> (see also picture):
Required tools: wrench 55, hex key 5 mm and hex key 4 mm.

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

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



3. Set parameter 92 and 93

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

Water heater type	fan speed high fire parameter 92		Fan speed low fire parameter 93	
	Propane G31	Nat. gas	Propane G31	Nat. gas
CB 85 HW	6500	7400	1850	1800
CB 105 HW	7300	7900	2000	1900
CB 125 HW	7200	7950	1950	2000
CB 155 HW	5750	6450	2000	1800

1. From status screen, press MENU button once.
2. Press UP/DOWN ↑ ↓ to select "Settings" and press ENTER ↵
3. Press UP/DOWN ↑ ↓ to select "Water heater Settings" and press ENTER ↵
4. Enter installer password by pressing UP/DOWN ↑ ↓ and LEFT ← / RIGHT →.
5. Press UP/DOWN ↑ ↓ to select "Water heater 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.

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

4. Adjust the O_2/ CO_2 percentage

Perform O_2 / CO_2 adjustments according to the procedures in § 19.2;

	O_2 / CO_2 (%)Propane G31	
water heater type	max load	min load
CB 85	4.9 / 10.5	6.7 / 9.3
CB 105	5.2 / 10.3	6.7 / 9.3
CB 125	5.2 / 10.3	6.4 / 9.5
CB 155	5.2 / 10.3	6.4 / 9.5

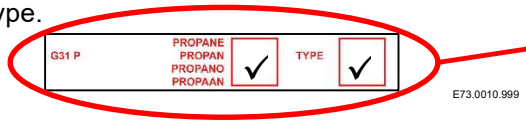
REMARKS:
Allowed tolerances are O_2 ± 0.2 and CO_2 ± 0.1
All values measured without front door.

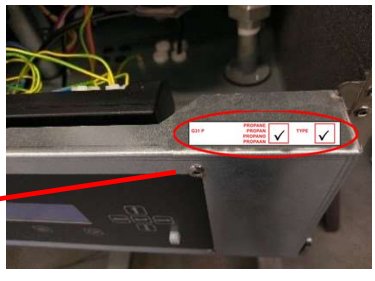
5. Check the gas pressure

Measure the gas pressure at high fire. The dynamic pressure should be at least 25 mbar. If there are more boilers in the boiler room the gas pressure should be checked on the boiler at the end of the gas line, with all boilers burning at high fire. If the gas pressure is too low: check gas lines, reducers and propane tank.

6. Confirmation

When finished:
- Apply the corresponding sticker at the appropriate position in the water heater.
- Mark the box “Propane” for the used gas type.
- Mark the box “Type”, indicating that the correct parameter values have been set for this boiler type.





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

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

19.5 Start Up Checklist

Installation/start-up checklist

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

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

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

Eco Heating Systems

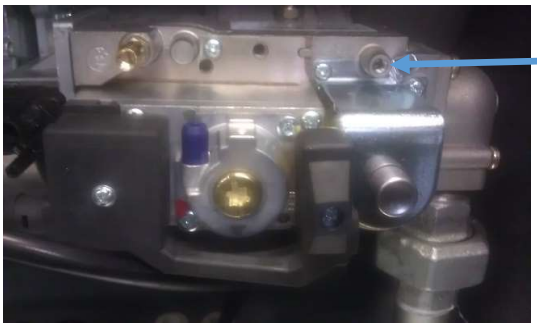
After filling in form please send a copy by e-mail to: sales@ecohs.nl or send a copy to address:

Eco Heating Systems.
P.O. Box 5145
9700 GC Groningen The Netherlands

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

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

Water circulation & temperature regulation (for DHW)	
Piping diameter	
Total length of straight pipe between water heater& tank	
Number of elbows	
Number of tees	
Temperature rise between inlet and outlet after 5 min. cold-start operating max. power	°C / °F
Water temperature setpoint	
Test of Water Flow Switch (DHW)?	(YES / NO)



**Gas valve
Pressure Nipple

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

Combustion settings		unit:
Set for NG (Natural Gas) or LP (Liquid Propane)?	NG or LP?	
If LP is the right gas orifice mounted?	(YES / NO)	
diameter gas orifice for LP?		mm
O_2 / CO_2 level at high fire …%		%
O_2 / CO_2 level on low fire …%		%
Flue pressure @ O_2 / CO_2 measuring point at high fire		Pa
Flue pressure @ O_2 / CO_2 measuring point at low fire		Pa
If cascaded with common flue system run all appliances at high fire and measure Flue pressure		Pa
If cascaded with common flue system run all appliances at low fire and measure Flue pressure		Pa

Electronics & Power supply		unit:
Version Burner Controller Hardware (see § 3.2 for location)		
Version Burner Controller Firmware (see § 3.2 for location)		
is ground connected to building grounding system	(YES / NO)	
Voltage incoming (Hot to Neutral)		V
Voltage incoming (Hot to Ground)		V
Voltage measured between Ground and Neutral		V
Total of amperage switched by the Water heater Controller is below 3.5 A or 800 W		A

Additives	
Used chemical additions	
Mixing Ratio	

20 INSPECTION, MAINTENANCE AND SERVICE.

20.1 General

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

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

- **When a number of similar error codes and/or 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 water heater is once a year and/or after 2000 burning hours maximum, whichever comes first. Every service interval the water heater should be cleaned and checked, according to the maintenance procedures. If there is doubt whether the water heater is operating with the correct water and/or combustion air quality, it is advised that a first check is already executed after six months. This check serves to determine the frequency of the future services. The maximum interval between two services is one year and/or after 2000 burning hours maximum, whichever comes first.

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

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

20.2 Inspection, maintenance and service.

Inspection, maintenance and service including the replacement of water heater parts must only be carried out by a licensed professional, service agency or the gas supplier. Apart from the maintenance proceedings it is required to maintain a service log for each water heater that includes all of the following information:

- Serial number
- Date and time of maintenance
- Name of maintenance engineer
- Which parts were exchanged during maintenance
- Which settings (software) were changed during maintenance
- Special remarks / findings
- Future aspects that need extra attention
- Additional aspects: measurement reports, complaints by the (end)-user, lock-out codes, etc.
- Static Gas Pressure inches W.C.
- O_2 % at high and low fire
- Gas Pressure at high fire
- Gas Pressure at low fire
- pH of the water in the system
- name of service company
- date of service

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

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

Customer comments
Comments and remarks from the customer should be analyzed and used to find possible causes for any occurring problems and complaints.

Service history
The operational and fault history (total amount and since the last service) can be viewed in the water heater control. This information can be used to specify the maintenance and service proceedings in relation to the water heater (parts).

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

Water leakage
The water pressure of the installation should be more than 1.0 bar and at a maximum of 8.0 bar in normal operation. When the water pressure drops below the minimum occasionally, there might be a water leak. Check the water heater and the complete heating installation for any water leakages and have these repaired.

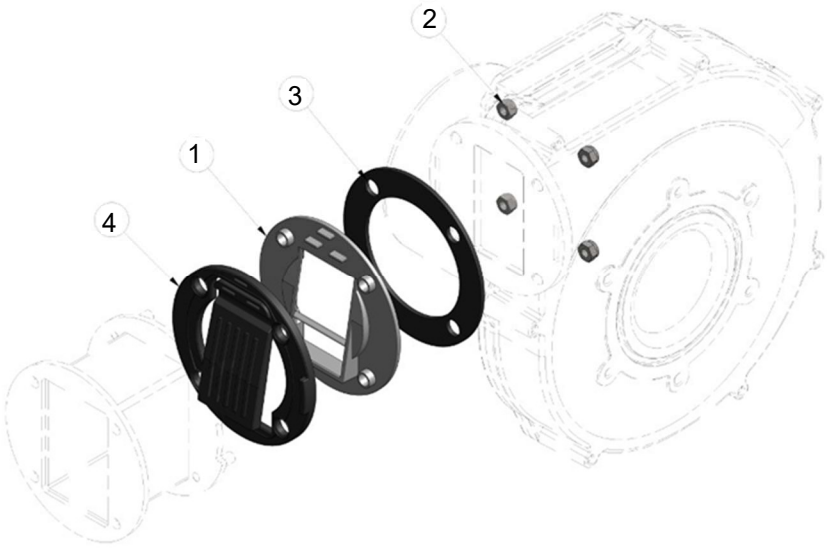
Flue gas & air supply
The flue gas pipes and the air supply pipes must be checked for gas tightness. Also check if the mounting of these pipes is correct, safe and not damaged. Check the top side of the water heater housing for signs of water leakage and traces of water coming from the air supply pipe, the air vent or any condensate coming from the flue gas pipes. Check to ensure the flow there are no obstructions for the exhaust venting or the intake combustion air venting. Check that all intake and exhaust venting has been properly reassemble and sealed before leaving the job site

Gas supply & safeties
The gas pipes must be checked for gas tightness. Also check if the mounting of these pipes is correct, safe and not damaged. Any built-in safeties should be checked for a correct functioning. Any gas pipe or fitting that have been opened or adjusted should be checked for leaks.

Remove complete burner unit
The complete burner unit consists of the fan, venturi, gas valve, the burner plate and the internal burner. To make more space to dismantle the complete burner unit pull down the burner controller unit.
To remove this part for an internal heat exchanger check: remove the six M6 nuts, the ignition cable and the thermal fuse cables. Close the gas tap under the water heater and loosen the gas coupling by untighten the swivel joint under the gas valve. Remove the air intake pipe from the venturi.
After this, take out the complete burner unit by moving it forward out of the water heater housing. NOTICE: Watch out not to damage the burner plate insulation during this operation.
While removing the complete burner unplug both of the electrical and controlling cables of the fan. After all this dismantle the venturi on the suction side of the fan and check the blade wheel of the fan.

Checking Non-return Valve (NRV)
The non-return valve is placed directly after the fan and has to be replaced once every five years during maintenance. For CB 85, 105 and 125 HW: Replace the non-return valve by removing the 4 nuts that are holding the fan. All the parts included in the NRV maintenance kit must be replaced: the gaskets, NRV seat, lock nuts, and non-return valve. Do not reuse any of the old parts.
Reassemble the Non-return valve to the burner unit. Be sure that the nuts are tightened again so no air/gas mixture is leaking into the cabinet. Check during start-up of the boiler to ensure no gas mixture is leaking on these gaskets near the non-return valve.
For the CB 155 HW a separate NRV maintenance kit is available.

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



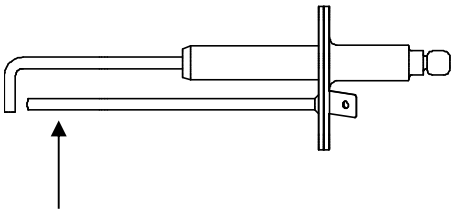
1 = Seat check valve small
2 = Lock nut M5 DIN985
3 = Gasket gas air mixing
4 = Check valve small

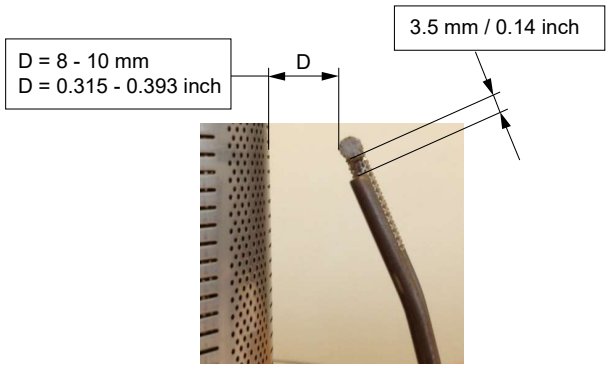
WARNING	Always check gaskets on the non-return valve for air/gas leakage!!

Burner
Check the burner surface to see if it has damages, signs of rust and/or cracks. When the burner surface is damaged the burner must be replaced. The burner can be cleaned by using a soft (non-metallic) brush. The dust can be removed with a vacuum cleaner or pressurized air.

Ignition / ionization electrode
When the complete burner is removed, it is very easy to check the ignition electrode. First check if the distances between the electrodes and between the electrode and the burner are according to the figure below. When these are not correct, try to bend the electrodes into the right position. Notice: the electrodes undergo high temperatures, therefore the electrodes become hard and are difficult to bend. While bending used electrodes they might break or burst. Check the electrode, after bending, for any tear/crack and signs of rust. When they are damaged in any manner or rusty, replace the electrode. Also replace the electrode when there is a crack in the ceramic insulation of the electrode. When the electrode is replaced, also the gasket must be replaced. The electrode should be cleaned annually by lightly rubbing its surface with cleaning cloth. Emory cloth, sandpaper, and any other abrasive material should never be used to clean the electrode.

Needed tools: Phillips #2 screwdriver.





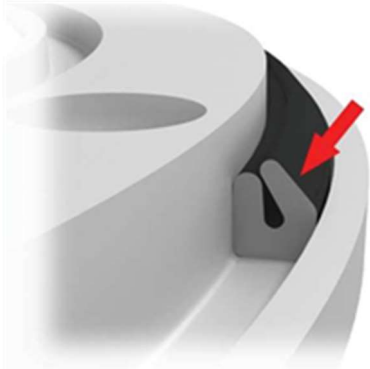
Burner door thermostat
Needed tool: Wrench 16 mm.
This thermostat is activated if the temperature of the burner door has been too high. In this case, it has to be replaced (spare part).

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

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

Burner door gasket replacement:

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



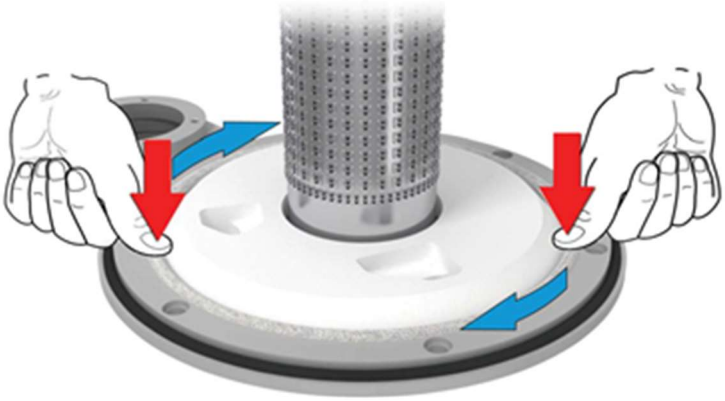
Fiber braid replacement

If the high temp braided rope is damaged and needs to be changed, it has to be replaced by new braids using the method described below.

The high temp braided rope is secured by silicone glue.

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

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



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

Insulation

The insulation of the heat exchanger (located on the rear wall inside the heat exchanger and burner door) must be inspected. If this insulation disc shows any signs of (water) damage or degradation it must be exchanged. Also check if there are any indications in the burner room of a high condensate level (caused by a blocked condensate trap) that might have wetted the rear wall insulation. When this has happened the rear wall insulation must also be replaced.

Only use the insulation disc that is supplied by the heater manufacturer.

The same procedure must be applied on the insulation and gaskets fitted on the burner door.

Rear wall insulation disk; changing procedure:

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

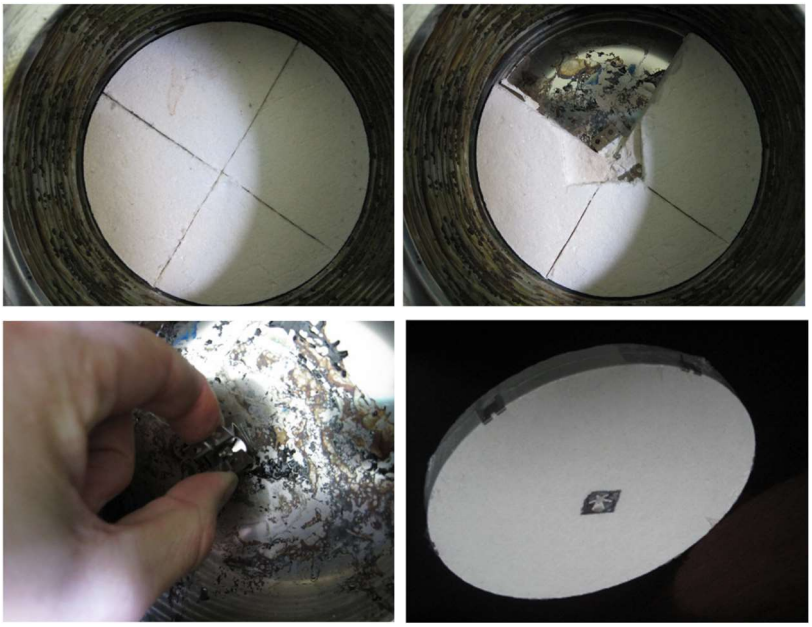
- Wait until the heat exchanger has cooled down. This is to prevent sticking of the protective film of the new insulating disc to the heat exchanger.
- to prevent debris from falling in between the coils, place a sheet (e.g. paper) on the bottom, beneath the disc.
- make the insulation wet, by spraying 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



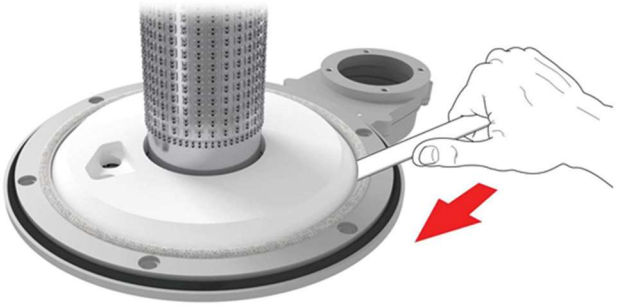
The new disc has the clip on the back.

- do **NOT** remove the protective film on the new insulation 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:

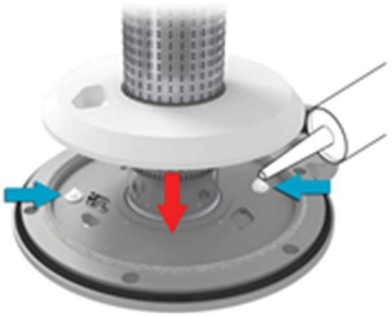
- remove the electrode
- remove the defective insulation by sliding under the periphery of the insulation a thin tool to loosen the insulation and remove it.



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

Install the new insulation:

- put two dots of temperature-resistant silicone glue, (Loctite 5366 or Otto seal S17), according to the location indicated.
- make sure that the burner is in proper condition, remove any possible insulation residues on the burner
- engage the insulation carefully and place it in contact with the two dots of silicone glue
- check the condition of the electrode, if necessary replace it
- reinstall the electrode and mount the burner door correctly back onto the heat exchanger, taking in account the correct torque values, see § 20.2.2



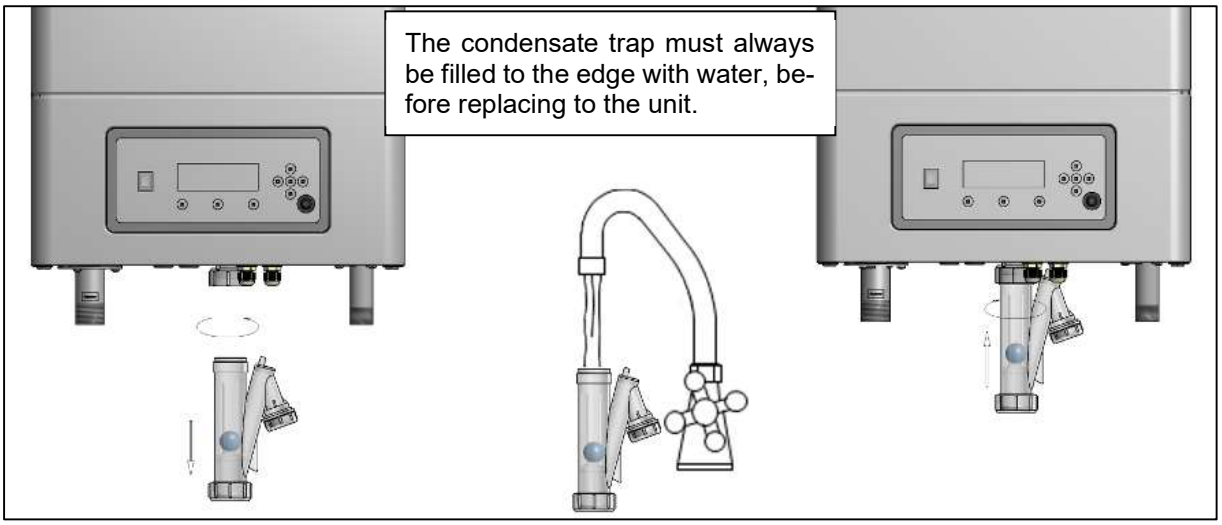
Fan

When the fan blades are polluted and dirty, carefully clean the blades with a soft brush. Notice: do not use too much force on the blades or else the fan might be out of balance and run irregularly, causing noises and fan failures. Check the fan also for any water damages. In doubt always replace the fan of the water heater.

Condensate trap

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

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



Heat exchanger and water heater combustion chamber

After the removal of the complete burner unit check if there is any debris and dirt in the heat exchanger. The coils of the heat exchanger can be cleaned by using a **non-metallic** brush. After this the dirt and dust can be removed with a vacuum cleaner and by flushing the water heater combustion chamber with water. Never expose the refractory insulation in the back of the combustion chamber to water or get it wet. Don't forget afterwards to clean the condensate trap once again.

Gas/air ratio

With every service check and/or maintenance of the water heater always check the gas/air ratio by measuring the O_2 percentage (flue gas) at the maximum and minimum load of the water heater. If necessary, adjust these values. See for information chapter "Adjusting and setting the water heater" chapter 19.

Pump (supplied separated from the water heater)

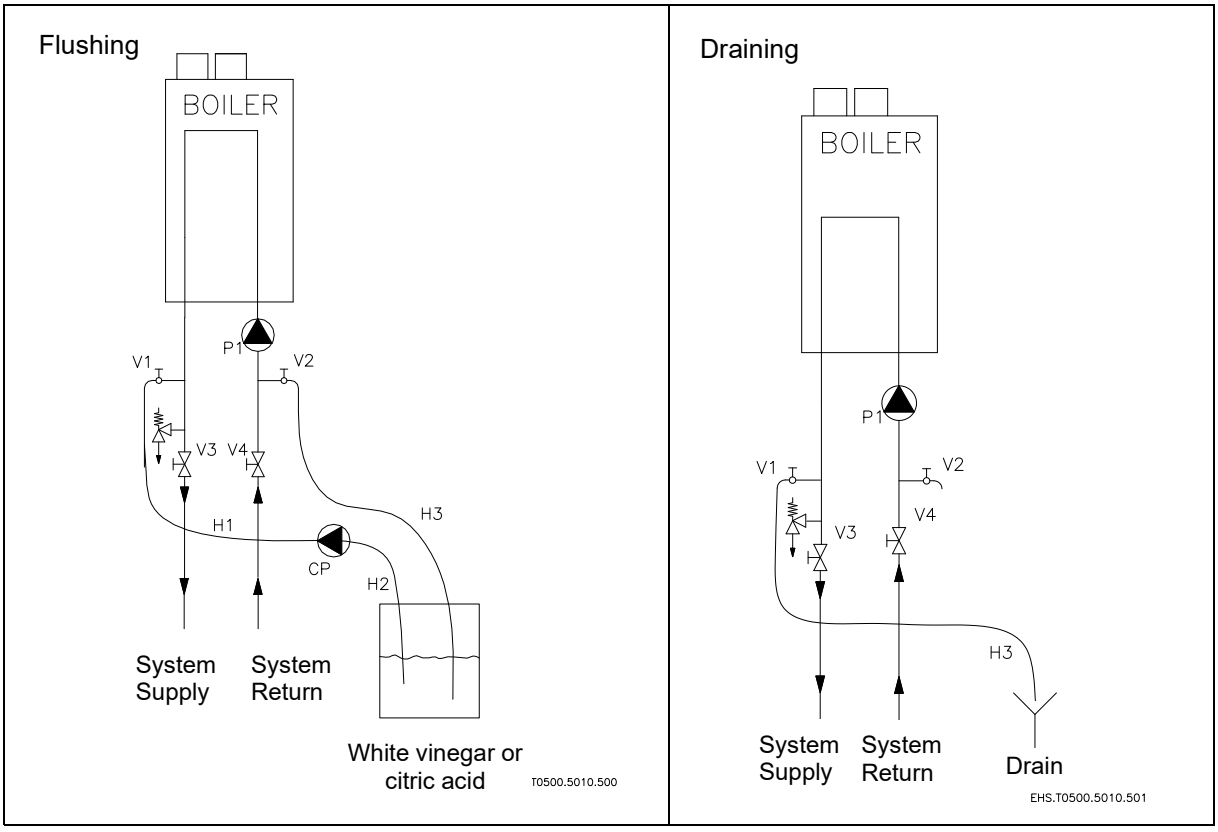
Check the electrical parts and the motor of the pump for a correct functioning. The pump must generate a sufficient water flow over the (heat exchanger of) the water heater. When the pump produces noise, is operational for more than five years or has signs of water leakage it is recommended to replace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

WARNING	When faults and abnormalities are found by the service technician during service and maintenance and these are not repairable, this information should be reported to the owner/end-user of the installation. Also the owner/end-user should be advised how to fix these faults and these faults should be reported in the service report / log file of the water heater. During service and maintenance, the gas, supply air, flue gas and condensate connections are disconnected, checked and replaced. Make sure that all these components are mounted correctly before commissioning the water heater again. Cleaning the combustion chamber and heat exchanger with acid or alkali products is prohibited.

20.2.1 DECALCIFYING OF THE HEAT EXCHANGER

Cleaning the Heat exchanger (Every 2-year maintenance or as needed based on water quality)
The heat exchanger should be cleaned at the service interval every 2 years. Failure to flush the heat exchanger will cause damage to it. Follow the procedure below for cleaning the heat exchanger.

1. Turn off the DHW function on the boiler.
2. Check if pump P1 is resistant to the detergent
3. Close the shutoff valves on both the hot water and cold-water lines (V3 and V4).
4. Connect the pump outlet hose (H1) to the hot water line at service valve (V1).
5. Connect the drain hose (H3) to the service valve (V2).
6. Pour approximately 20 liter of virgin, food grade, white vinegar or citric acid into pail.
7. Place the drain hose (H3) and the hose (H2) to the pump (CP) inlet into the cleaning solution.
8. Open both service valves (V1 and V2) on the hot water and cold-water lines.
9. Operate the pump (CP) and allow the cleaning solution to circulate through the heat exchanger for at least 45 minutes.
10. Turn off the pump (CP).
11. Rinse the cleaning solution from the heat exchanger as follows:
    - Remove the free end of the drain hose (H3) from the pail
    - Close service valve, (V2), and open shutoff valve, (V4). Do not open shutoff valve, (V3).
    - Disconnect both H1 and H3 from the service valves
    - Connect H3 to V1 and place the end of the hose in a drain
    - Allow water to flow through the heat exchanger for 5 minutes
    - Close service valve, (V1), and open shutoff valve, (V3).
12. Disconnect all hoses.



20.2.2 MOUNTING THE BURNER DOOR

IMPORTANT:
Before mounting the burner door, make sure that its gaskets and insulation are in excellent shape.
If any signs of damage or ageing are present, these parts must be replaced.

The burner door must be mounted back on the heat exchanger as follows:
- Place the burner door with its holes over the six threaded studs. The unit must be tilted a little to the right to get the fan motor past the water pipe. Also mind the condensate hose.

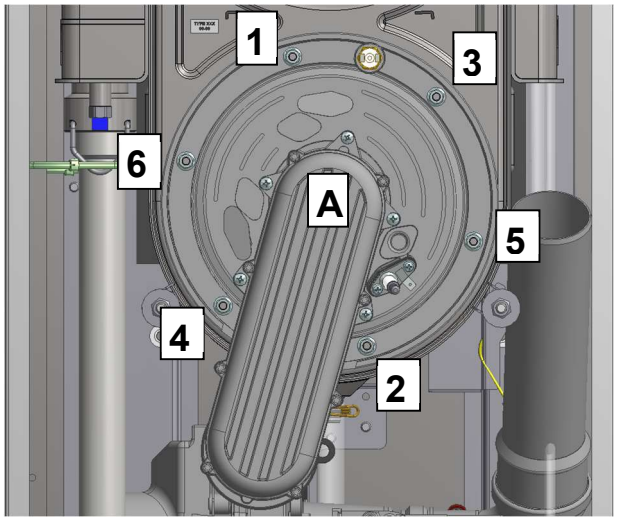
Careful! When handling too rough or misplacing the holes over the threaded studs, the burner door insulation and/or gaskets can be damaged.

- Ensure that the door is well positioned with respect to the threaded studs, before pushing it onto the exchanger.
- Keep the burner door firmly in place by pushing the gas/air premix manifold with one hand at the middle at point A.
- Hand tighten the flange nuts with the other hand as far as possible onto the threaded studs.

Now the burner door is in place and the nuts can be tightened with a torque wrench.
- Tighten the nuts in the order given in the picture. The specified torque value for tightening the burner door flange nuts is **8 Nm**

Tighten in given order.

torque value = 8 Nm



When done servicing the service reminder can be reset, see § 13.5 on pages 80/81.

20.3 Instructions for the user

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

20.4 Recycling

When the water heater has reached the end of its technical or economical lifespan, it must be disposed of in the correct way.

Never discard your old device together with regular waste. Put it into a municipal waste collection depot for electrical and electronic equipment.

21 MAINTENANCE CHECKLIST

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

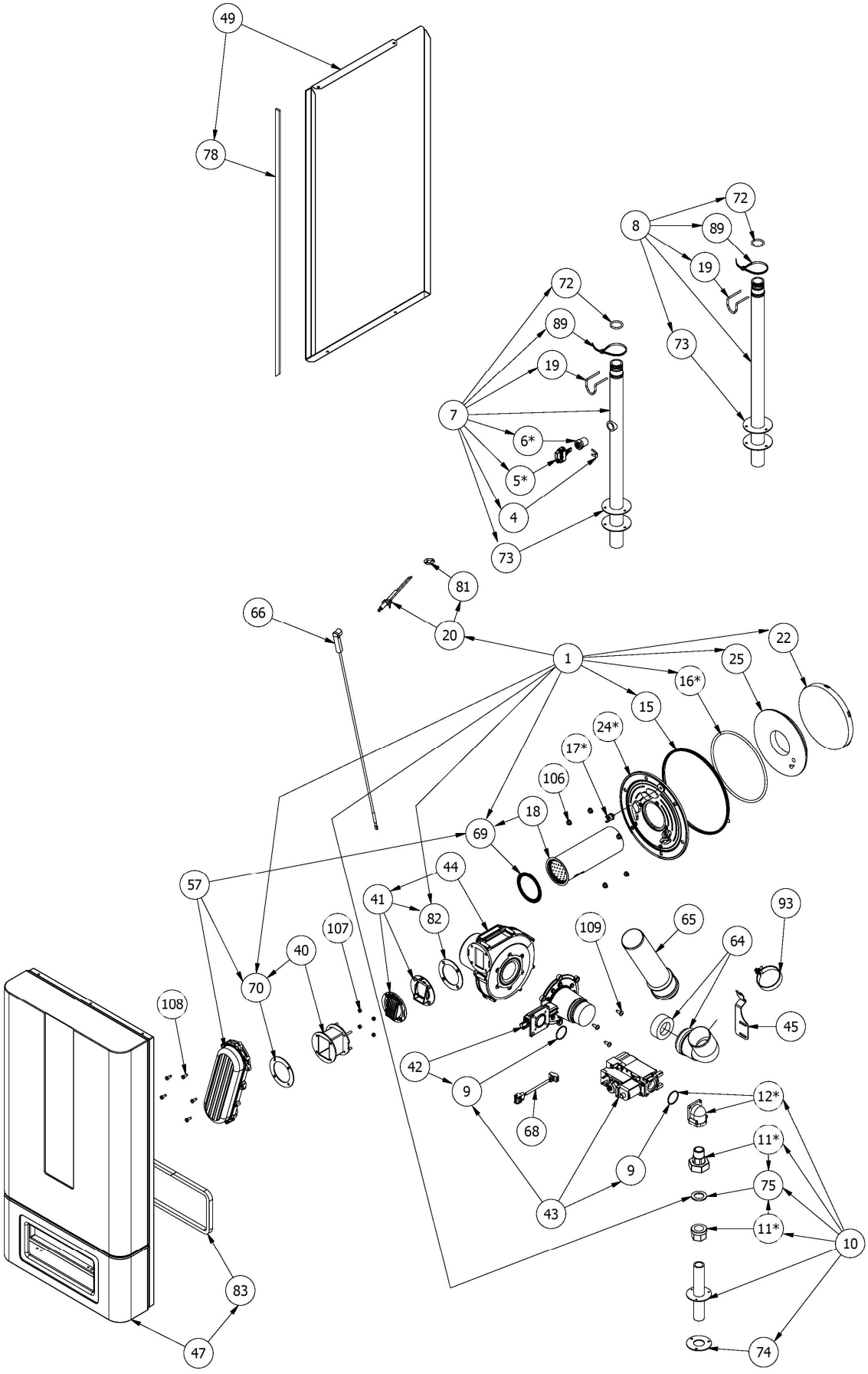
Periodic maintenance should be performed once a year by a qualified service technician to assure that all the equipment is operating safely and efficiently. The owner should make necessary arrangements with a qualified heating contractor for periodic maintenance of the heater. The technician must also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

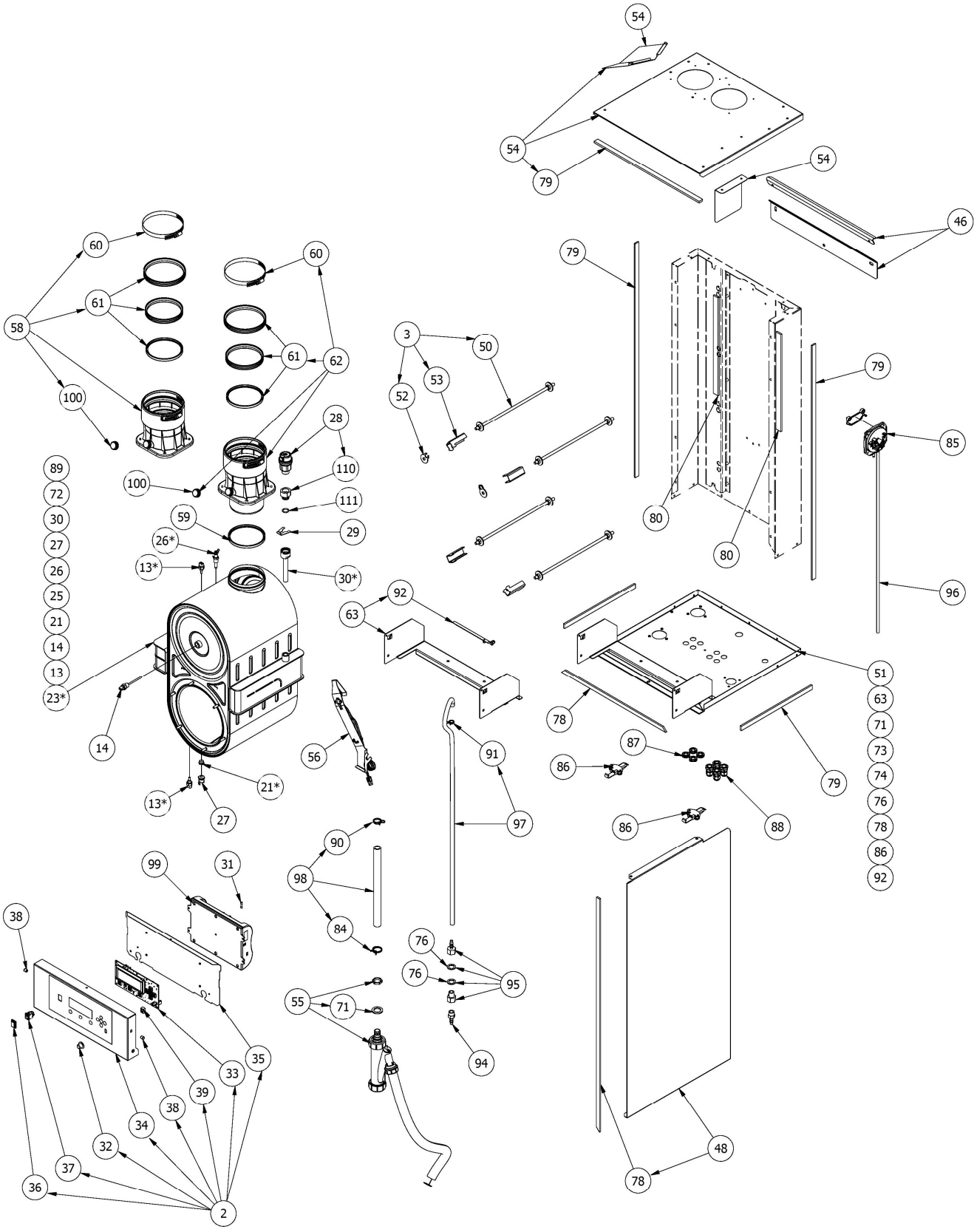
Maintenance Table

Inspection Activities		**Date Last Completed**			
		1st Year	2nd Year	3rd Year	4th Year
Near water heater piping	Check system and water heater piping for any sign of leakage. Take off water heater cover and inspect connections in water heater for any leaks or corrosion				
Vent	Check condition of all vent pipes and joints				
	Check to ensure vent termination not blocked or obstructed				
Gas	Check gas piping, test for leaks and signs of aging. Record gas pressure and note pressure drop upon start-up. Record O_2 / CO_2 at high and low fire				
Visual and Temperature	Do visual inspection of all system components and verify programmed temperature settings				
Connections	Check wire connections and make sure they are tight				
Combustion chamber	Check burner tube and combustion chamber coils. Clean with nylon brush and vacuum. Avoid touching white ceramic fiber. Also see maintenance section of manual				
Spark igniter	Ensure spacing of igniter prongs are aligned properly.				
Replace NRV	Replace the non-return valve every 5 years. Be sure it is not leaking gas after reassembling.				
Condensate trap	Disconnect condensate hose and trap. Ensure there is no blockage, then rinse and clean out. Fill completely again with fresh water and re-install				
Relief Valve	Check to make sure it is not weeping				
Pump and Fan	Listen to the sound of the pump and fan. If either makes noise during operation, it is recommended to replace the part.				
Low water cut-off	Check that the LWCO is not leaking and check for right pressure value by draining the water from the water heater and comparing the value with a calibrated meter equipment				
Homeowner	Question homeowner before maintenance if there are any issues and after done, confirm activities you performed during the maintenance visit				
Chemical additions	Check the chemical additives and add or renew if the mixing ratio is out of spec.				

22 SPARE PARTS

22.1 CB-85-HW, CB-105-HW and CB-125-HW exploded view





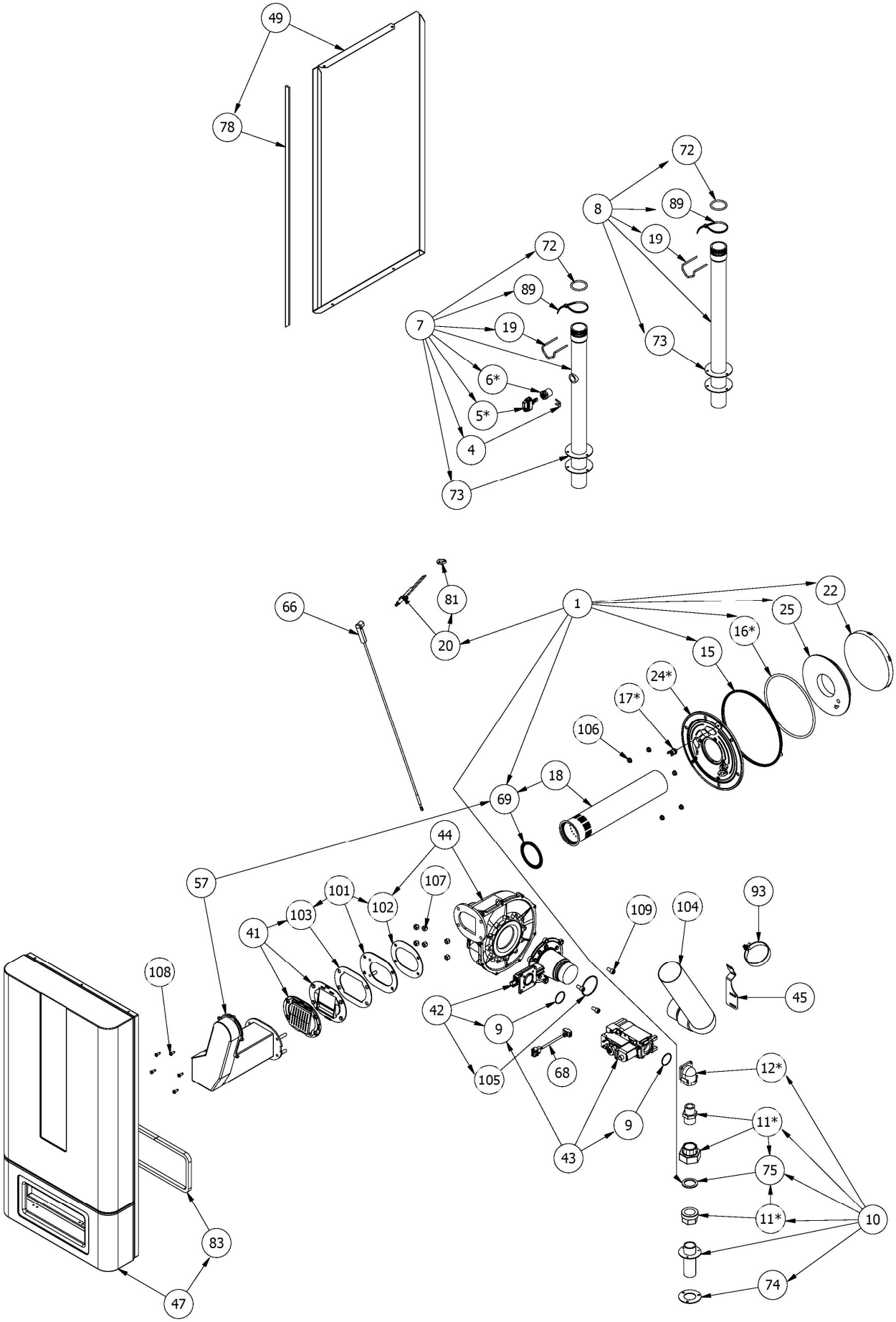
67 → Wiring harness

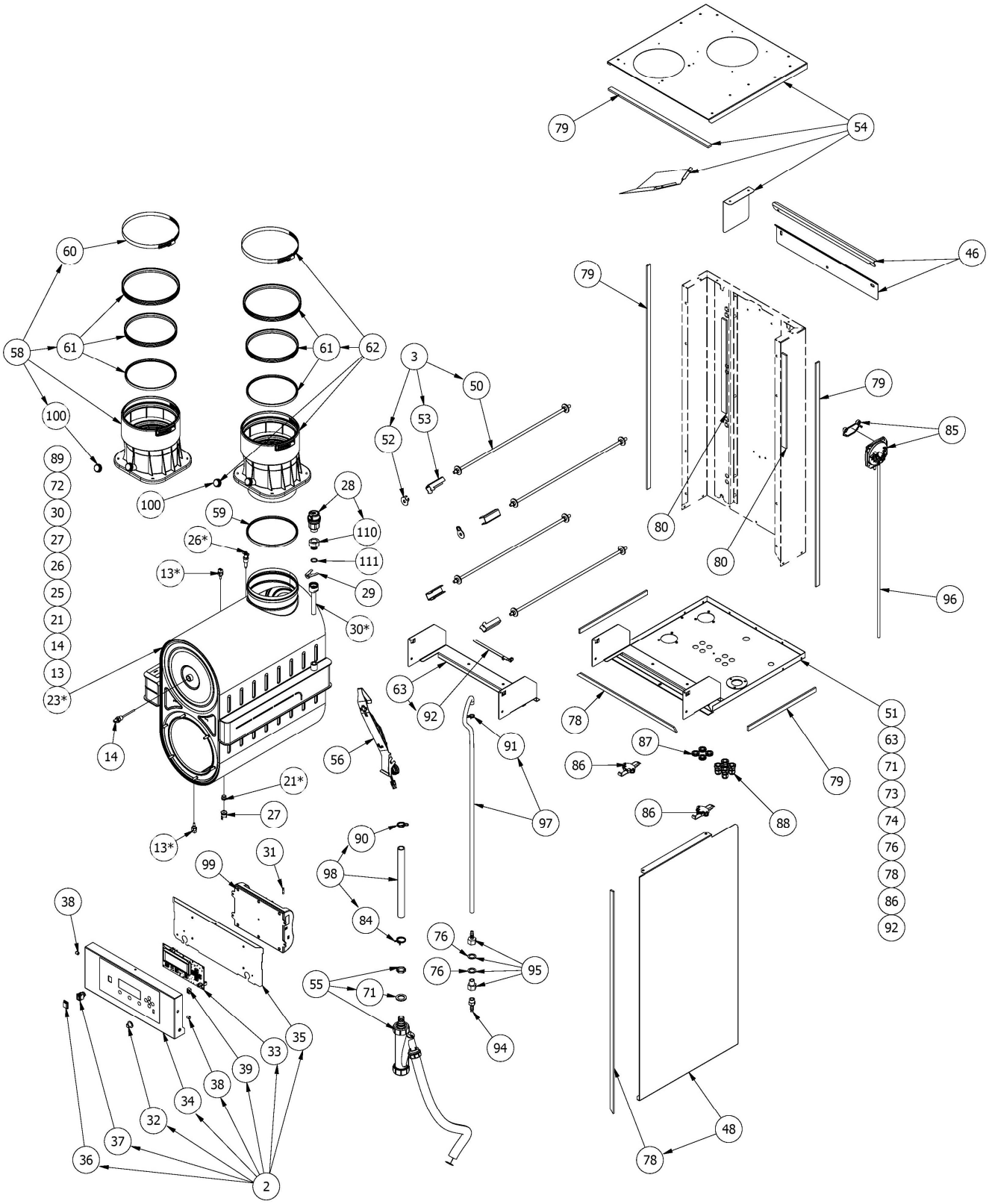
Remarks:

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

*= installation additions (see sparepart list)

22.2 CB-155-HW exploded view





67 → Wiring harness

Remarks:

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

*= installation additions (see sparepart list)

22.3 List of partnumbers CB 85 HW – CB 155 HW

POS.	DESCRIPTION	Part Number	*)	85 HW	105 HW	125 HW	155 HW
1	Set. Universal maintenance kit CB 85, 105, 125, 155	S000.500.001	2	x	x	x	x
2	Set. Electronics holder	S000.500.002		x	x	x	x
3	Set. Anchoring bar CB 85	S000.500.007		x	NA	NA	NA
3	Set. Anchoring bar CB 105	S000.500.008		NA	x	NA	NA
3	Set. Anchoring bar CB 125	S000.500.009		NA	NA	x	NA
3	Set. Anchoring bar CB 155	S000.500.010		NA	NA	NA	x
4	Clip for WPS 10bar	S001.500.003		x	x	x	x
5	Water pressure sensor 10bar	S001.500.009		x	x	x	x
6	Nipple for RPS D15	S001.500.005	1	x	x	x	x
7	Flow pipe CB 85	S001.500.010		x	NA	NA	NA
7	Flow pipe CB 105, 125	S001.500.011		NA	x	x	NA
7	Flow pipe CB 155	S001.500.012		NA	NA	NA	x
8	Return pipe CB 85	S002.500.006		x	NA	NA	NA
8	Return pipe CB 105, 125	S002.500.007		NA	x	x	NA
8	Return pipe CB 155	S002.500.008		NA	NA	NA	x
9	O-ring gas valve connection	S003.100.007		x	x	x	x
10	Gas pipe CB 85, 105, 125	S003.500.003		x	x	x	NA
10	Gas pipe CB 155	S003.500.004		NA	NA	NA	x
11	Malleable coupling, flat sealing surfaces, GF331, ¾"	S003.500.005	1	x	x	x	NA
11	Malleable coupling, flat sealing surfaces, GF330, 1"	S003.500.007	1	NA	NA	NA	x
12	Hooked gas valve VR4615 connection	S003.500.006	1	x	x	x	x
13	NTC sensor 1/8" SS	S004.100.018	1	x	x	x	x
14	NTC flue gas sensor ¼" 10 KOHM = R25 B=3977K t2	S004.100.019		x	x	x	x
15	Seal Burner door	S004.200.004		x	x	x	x
16	Insulation fibre braid burner door	S004.200.008	2	x	x	x	x
17	Burner door thermostat 260° C (M5)	S004.200.009	1	x	x	x	x
18	Burner CB 85, 105	S004.200.010		x	x	NA	NA
18	Burner CB 125	S004.200.011		NA	NA	x	NA
18	Burner CB 155	S004.500.020		NA	NA	NA	x
19	Spring fastconnection CB 105, 125	S004.200.012		NA	x	x	NA
19	Spring fastconnection CB 155	S004.200.013		NA	NA	NA	x
19	Spring fast connection CB 85	S004.200.014		x	NA	NA	NA
20	Electrode	S004.500.002		x	x	x	x
21	Reducing coupling G¼ x M5	S004.500.003	1	x	x	x	x
22	Backwall isolation 16mm	S004.500.004		x	x	x	x
23	Heat exchanger CB 85	S004.500.027	2	x	NA	NA	NA
23	Heat exchanger CB 105	S004.500.028	2	NA	x	NA	NA
23	Heat exchanger CB 125	S004.500.029	2	NA	NA	x	NA
23	Heat exchanger CB 155	S004.500.030	2	NA	NA	NA	x
24	Burner door right sided ignition (metal sheet burner)	S004.500.013	2	x	x	x	x
25	Burner door isolation right sided ignition hole Ø70,5	S004.500.014		x	x	x	x
26	Sensor LWCO	S004.500.015	1	x	x	x	x
27	Clixon 90° C	S004.500.016	1	x	x	x	x
28	Automatic air vent with adapter	S005.500.006		x	x	x	x
29	Locking clip air vent	S005.500.003		x	x	x	x
30	Extension pipe air vent	S005.500.004	1	x	x	x	x
31	Box 10pcs Fuse 5 AT	S006.200.001		x	x	x	x
32	Rubber plug Ø13	S006.200.004		x	x	x	x
33	Pixel Button Display	S006.500.001		x	x	x	x
34	Display front panel	S006.500.002		x	x	x	x
35	Mounting plate burner control	S006.500.003		x	x	x	x
36	Dustcover ON/OFF switch	S006.500.004		x	x	x	x
37	Main switch	S006.500.005		x	x	x	x
38	Spring plunger 8mm	S006.500.006		x	x	x	x

*1) Install with S022.000.001
*2) Install with S022.000.002

POS.	DESCRIPTION	Part Number		85 HW	105 HW	125 HW	155 HW
39	EPDM sealing for EBM 957	S006.500.007		x	x	x	x
40	Offset piece CB 85	S008.500.001		x	NA	NA	NA
40	Offset piece CB 125	S008.500.006		NA	NA	x	NA
40	Offset piece CB 105	S008.500.010		NA	x	NA	NA
41	Seat check valve CB 85, 105, 125	S008.500.002		x	x	x	NA
41	Seat check valve CB 155	S008.500.013		NA	NA	NA	x
42	Venturi CB 85	S008.500.004		x	NA	NA	NA
42	Venturi CB 105	S008.500.008		NA	x	NA	NA
42	Venturi CB 125, 155	S008.500.009		NA	NA	x	x
43	Modulating gas valve VR4615	S008.500.012		x	x	x	x
44	Radial Blower CB 85	S008.500.014		x	NA	NA	NA
44	Radial Blower CB 105	S008.500.015		NA	x	NA	NA
44	Radial Blower CB 125	S008.500.016		NA	NA	x	NA
44	Radial Blower CB 155	S008.500.017		NA	NA	NA	x
45	Mounting plate silencer	S008.500.019		x	x	x	x
46	Wall mounting plate	S009.100.001		x	x	x	x
47	Front panel	S010.500.001		x	x	x	x
48	Side panel right	S011.500.001		x	x	x	x
49	Side panel left	S011.500.002		x	x	x	x
50	Anchoring bar CB 125	S011.500.003		NA	NA	x	NA
50	Anchoring bar CB 105	S011.500.004		NA	x	NA	NA
50	Anchoring bar CB 155	S011.500.005		NA	NA	NA	x
50	Anchoring bar CB 85	S011.500.006		x	NA	NA	NA
51	Bottom panel CB 85, 105	S011.500.010		x	x	NA	NA
51	Bottom panel CB 125	S011.500.011		NA	NA	x	NA
51	Bottom panel CB 155	S011.500.012		NA	NA	NA	x
52	Special washer heat exchanger	S011.500.013		x	x	x	x
53	Clamping bracket heat exchanger	S011.500.014		x	x	x	x
54	Top panel CB 85, 105, 125	S011.500.015		x	x	x	NA
54	Top panel CB 155	S011.500.016		NA	NA	NA	x
55	Condensate drain assembly l=800	S012.200.002		x	x	x	x
56	Backwall clixon	S013.500.001		x	x	x	x
57	Gas-air mixing pipe CB 85, 105, 125	S014.500.001		x	x	x	NA
57	Gas-air mixing pipe CB 155	S014.500.002		NA	NA	NA	x
58	Boiler air connector CB 85, 105, 125	S015.500.001		x	x	x	NA
58	Boiler air connector CB 155	S015.500.002		NA	NA	NA	x
59	Seal EPDM CB 85, 105, 125	S016.100.011		x	x	x	NA
59	Seal EPDM CB 155	S016.500.003		NA	NA	NA	x
60	Clamp galvanized CB 85, 105, 125	S016.500.008		x	x	x	NA
60	Clamp galvanized CB 155	S016.500.009		x	x	x	NA
61	Set. Seal EPDM Adapter CB 85, 105, 125	S016.500.010		x	x	x	NA
61	Set. Seal EPDM Adapter CB 155	S016.500.011		NA	NA	NA	x
62	Boiler flue gas connector CB 85, 105, 125	S016.500.012		x	x	x	NA
62	Boiler flue gas connector CB 155	S016.500.014		NA	NA	NA	x
63	Connection bar display holder	S021.500.001		x	x	x	x
64	Elbow silencer CB 85, 105	S024.500.002		x	x	NA	NA
64	Elbow silencer CB 125	S024.500.003		NA	NA	x	NA
65	Extension pipe silencer CB 85, 105, 125	S024.500.004		x	x	x	NA
66	Ignition cable	S031.200.001		x	x	x	x
67	Harness HV/LV	S031.500.001		x	x	x	x
68	Adapter cable fan	S031.500.002		x	x	x	x
69	Gasket Burner & gas/air inlet pipe	S032.200.001		x	x	x	x
70	Gasket gas/air inlet pipe & fan CB 85, 105, 125	S032.200.002		x	x	x	NA
71	Gasket siphon/bottom plate	S032.200.003		x	x	x	x
72	O-ring flow/return pipe CB 155	S032.200.005		NA	NA	NA	x
72	O-ring flow/return pipe CB 85	S032.200.006		x	NA	NA	NA
72	O-ring flow/return pipe CB 105, 125	S032.500.003		NA	x	x	NA

POS.	DESCRIPTION	Part Number		85 HW	105 HW	125 HW	155 HW
73	Gasket flow/return pipe CB 85, 105 125	S032.500.014		x	x	x	NA
73	Gasket flow/return pipe CB 155	S032.500.002		NA	NA	NA	x
74	Gasket gas pipe CB 155	S032.500.004		NA	NA	NA	x
74	Gasket gas pipe CB 85, 105, 125	S032.500.004		x	x	x	NA
75	Gasket malleable coupling CB 85, 105, 125	S032.500.005		x	x	x	NA
75	Gasket malleable coupling CB 155	S032.500.018		NA	NA	NA	x
76	Gasket Condensate drain/bottom plate	S032.500.006		x	x	x	x
78	Silicone seal 13x5 self adhesive L=10m	S032.500.008		x	x	x	x
79	EPDM seal 15x6 self adhesive L=5m	S032.500.009		x	x	x	x
80	EPDM seal 20x5 self adhesive L=5m	S032.500.010		x	x	x	x
81	Gasket electrode	S032.500.011		x	x	x	x
82	Gasket gas/air mixing CB 85, 105, 125	S032.500.012		x	x	x	NA
83	EPDM seal 10x12 self adhesive L=5m	S032.500.013		x	x	x	x
84	Hose clamp Ø23,83 (DW15)	S033.500.001		x	x	x	x
85	Air pressure switch DL 2 E with S-clip 140/160 Pa (EU)	S033.500.014		x	x	x	x
86	Quick-action clamp	S033.500.003		x	x	x	x
87	Blind grommet Ø18,5mm	S033.500.004		x	x	x	x
88	Cable Gland M16x1,5 Black	S033.500.005		x	x	x	x
89	Ty-Rap Heat resistant 3,5x200 mm	S033.500.006		x	x	x	x
90	Hose clamp Ø20,62 (DW13)	S033.500.007		x	x	x	x
91	Hose clamp Ø12,7 (DW8)	S033.500.015		x	x	x	x
92	Cable tie with rivet	S033.500.009		x	x	x	x
93	PVC bracket CB 85, 105, 125	S033.500.010		x	x	x	NA
93	PVC bracket CB 155	S033.500.011		NA	NA	NA	x
94	NPT Male Connector 3/8	S033.500.012		x	x	x	x
95	NPT Female Connector 3/8	S033.500.013		x	x	x	x
96	Hose pressure switch	S034.500.001		x	x	x	x
97	Hose air vent	S034.500.002		x	x	x	x
98	Hose condensate trap CB 85, 105, 125	S034.500.003		x	x	x	NA
98	Hose condensate trap CB 155	S034.500.004		NA	NA	NA	x
99	Burner control CB 85, 105, 125, 155 HW	S160011		x	x	x	x
100	Measuring Cap M20x2 Ral-9011	S016.500.002		x	x	x	x
101	Adapter check valve CB 155	S008.500.018		NA	NA	NA	x
102	Gasket v1 gas-air mixing CB 155	S032.500.015		NA	NA	NA	x
103	Gasket v2 gas-air mixing CB 155	S032.500.016		NA	NA	NA	x
104	Silencer CB 155	S024.500.005		NA	NA	NA	x
105	O-ring venturi/silencer CB 155	S032.500.017		NA	NA	NA	x
106	10x Flanging head nut M6	S004.200.005		x	x	x	x
107	4x Nut M5 DIN985	S008.500.003		x	x	x	NA
108	5x Screw M5x14 DIN7500C	S014.500.003		x	x	x	NA
108	5x Screw M5x12 DIN7500C	S014.500.004		NA	NA	NA	x
109	3x Screw M6x16 DIN7500C (venturi CB 85, 105)	S008.500.020		x	x	NA	NA
109	3x Screw M6x16 DIN912 (venturi CB 125)	S008.500.021		NA	NA	x	NA
109	3x Screw M8x16 DIN912 (venturi CB 155)	S008.500.022		NA	NA	NA	x
110	Air vent coupling G1/2" with clip connection	S005.500.005		x	x	x	x
111	O-ring air vent/coupling	S032.500.019		x	x	x	x

23 USER'S PART

This section is written for the user.
Eco Heating Systems is not accountable for any damage caused by incorrect following these instructions.
For service and repair purposes use only original Eco Heating Systems spare parts.
All documentation produced by the manufacturer is subject to copyright law.

23.1 Abbreviations.

CB = Condensing Boiler
HW = Hot Water Boiler for Hot Water (drinking water) usage only.
CH = Central Heating (for central heating purposes and/or indirect hot water)
BCU = burner control unit
PB = display board/ control panel (Pixel Button)
85/105/125/155 = Model number of the water heater.

23.2 Safety guidelines

"FOR YOUR SAFETY READ BEFORE OPERATING"

"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 close to the floor because some gas is heavier than air and will settle on the floor."

What to do if you smell gas:

- Don't use any electrical equipment.
- Don't press any switches.
- Close the gas supply.
- Ventilate the room (open the windows and/or outdoor water heater room doors).
- Immediately warn the installer.

"C. 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."

Without written approval of the manufacturer the internals of the water heater may not be changed. When these changes are executed without approval, the water heater certification is invalid.

WARNING: Water temperatures over 52 °C can cause severe burns instantly from scalding. The water temperature is factory set at 60 °C because of legionella prevention. Before bathing or showering always check the water temperature.

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

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

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

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage or personal injury. Installation and service must be performed by a qualified installer or service agency (who must read and follow the supplied instructions before installing, servicing, or removing this water heater).

23.3 To turn off gas to the appliance

1. Turn off all electric power to the appliance if service is to be performed.
2. The main gas switch is situated underneath the heater in the gas supply line.
3. Turn the valve clockwise  to “OFF.” to close the gas supply. **Do not use excessive force.**

“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.”

23.4 Maintenance and inspection

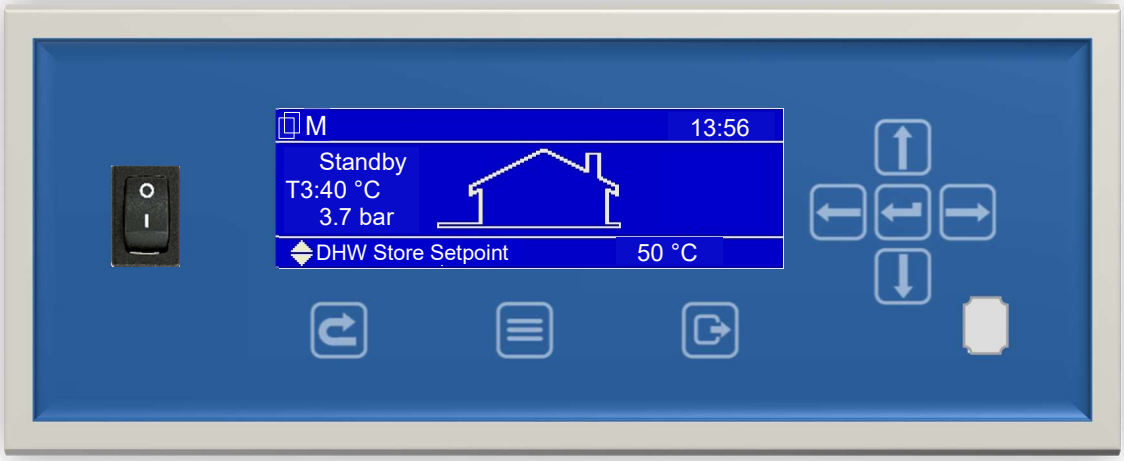
Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.

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

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

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

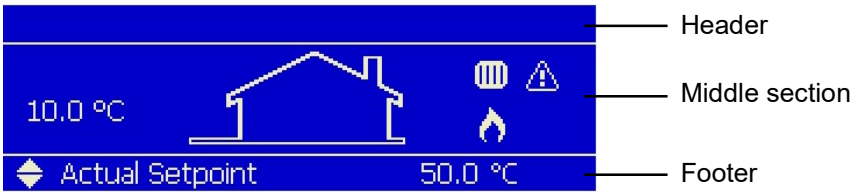
23.5 Display and buttons



	On/off switch. Switches electrical power to the water heater
	Connector for computer cable
	Reset lockout error
	Main Menu
	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

23.6 Screens and settings

After communication has been established the following **Status overview** appears:
The Status overview has the 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 CH and/or DHW disabled icons when CH 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): ▪ 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	CH 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 level
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

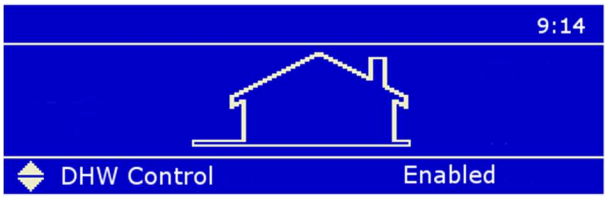
Note: Cascade dependents will only have the 'Calculated Setpoint' available.

23.7 Starting the water heater.

If the water heater is not on make sure the gas switch beneath the water heater is open and the power cord is connected to the mains, use the on/off button to switch the water heater on. The following screen will occur:

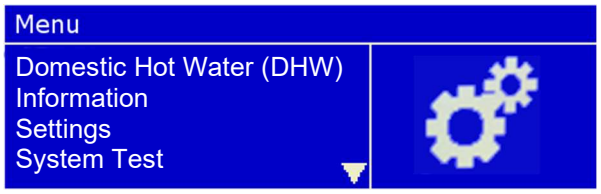
This screen is active during power up until communication with the main Control has been established.
After communication has been established the Dair mode is running and the following screen appears:

The “De-Air” sequence is a safety function that starts at every power-up and is used to remove the air from the heat exchanger. The De-Air sequence takes around 14 minutes to complete. It can be cancelled by pressing the Enter button for over 5 seconds.
After completion or manual ending the “De-Air” sequence one of the following Status overview screens appears:



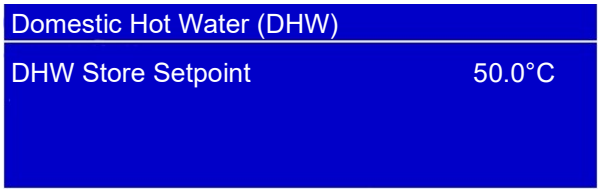
23.7.1 ENTERING THE MENU

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:



Use “DHW Store Setpoint” to set the Hot Water temperature

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 ← .

23.8 Changing the Setpoint DHW.

This can be done directly via the Status overview (as shown below) or via the MENU.
You can adjust the DHW setpoint directly on the bottom of the Status overview.

23.8.1 Set Actual setpoint/DHW setpoint directly via the Status overview

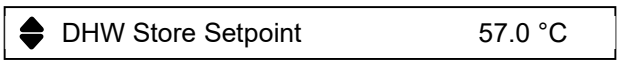
You can adjust the DHW setpoint directly on the bottom of the Status overview.

Press UP/DOWN ↑↓ 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.

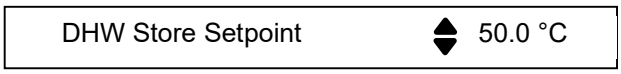
A setpoint is only visible on the display when no error or alert is active. In case of an active error or alert, the bottom right part of the display is used to display the error or alert text.

23.8.2 Changing the DHW setpoint directly.

Only applicable if this function is available.
Press the UP or DOWN button to select the mode:



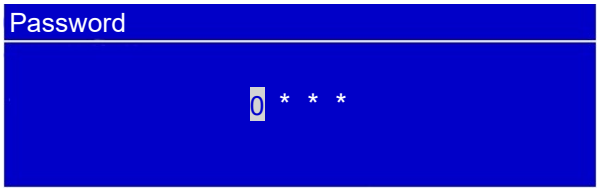
57.0 °C is just an example of a possible temperature value.
Use the left/right buttons to move the ▲▼ sign to the front of the temperature digits.



Use UP/DOWN buttons to increase/decrease the setpoint.
Press the ENTER or RIGHT button to confirm your alteration or press the BACK or LEFT button to cancel.

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

23.9 Password



Menu's protected by a password are only accessible by the installer.
Passwords are always customer specific and (for safety reasons) will be provided to the installer only!
The following menu items require a password:

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

23.10 Available Menu items

Depending on the installed/programmed options by the installer following menu items could be visible.

Menu / Parameter	Description	Value / Unit
Central Heating (CH)	Enter the Central Heating (CH) menu	
Domestic Hot Water (DHW)	Enter the Domestic Hot Water (DHW) menu	
Information	Enter the Information menu	
Settings	Enter the Settings menu	
System Test	Enter the System Test menu	

23.10.1 CENTRAL HEATING (CH)

Do not use or change these settings

Menu / Parameter	Description	Value / Unit
CH Setpoint	Set the CH setpoint	°C/°F
Outdoor reset	Enter the Outdoor Reset menu	

23.10.2 DOMESTIC HOT WATER (DHW)

Menu / Parameter	Description	Value / Unit
DHW Store Setpoint	Set the DHW store setpoint	°C/°F
DHW Setpoint	Set the DHW store setpoint for DHW mode 1 and 2	°C/°F

23.10.3 INFORMATION

Menu / Parameter	Description	Value / Unit
Software versions	Enter the Software Versions menu	
Boiler Status	Enter the Boiler Status menu	
Boiler History	Enter the Boiler History menu	
Error Log	Enter the Error Log menu	
Service	Enter the Service menu	

23.10.4 SOFTWARE VERSIONS

Menu / Parameter	Description	Value / Unit
Display	Display the software checksum	[xxxx xxxx]
Boiler	Display the boiler software checksum	[xxxx xxxx]
Device Group	Display the boiler group ID	xxxMN

23.10.5 WATER HEATER STATUS

Menu / Parameter	Description	Value / Unit
Flow Temperature	Actual supply flow temperature	°C/°F
Flow 2 Temperature	Actual supply 2 flow temperature	°C/°F
Return Temperature	Actual return temperature	°C/°F
DHW Temperature	Actual DHW temperature	°C/°F
DCW Temperature	Actual DCW temperature	°C/°F
Outside Temperature	Actual outside temperature	°C/°F
Flue Temp	Actual flue gas temperature	°C/°F
Flue 2 Temp	Actual flue gas 2 temperature	°C/°F
System Temperature	Actual system temperature	°C/°F
0-10 V Input	Actual 0-10 V input value	V
Flowrate	Actual DHW flowrate	l/min
RT Input	Actual RT input status	open/closed
Water Pressure	Actual CH water pressure	bar/psi
Fan Speed	Actual fan speed	RPM
Ionization	Actual ionization current	uA
State	Actual burner state	
Error	Actual internal error code	#
Calculated Setpoint	Actual CH setpoint	°C/°F

23.10.6 WATER HEATER HISTORY

Menu / Parameter	Description	Value / Unit
Successful Ignitions	Display the number of successful ignitions	#
Failed Ignitions	Display the number of failed ignitions	#
Flame Failures	Display the number of flame losses	#
Operation Days	Display the total time in operation	days
CH Burner Hours	Display the amount of burn hours for CH	hrs.
DHW Burner Hours	Display the amount of burn hours for DHW	hrs.

23.10.7 ERROR LOG

Menu / Parameter	Description	Value / Unit
Error Log	Display the complete error log	
Filter Error Type	Set the error log filter	
Clear Error Log	Clear the complete error log	

23.10.8 SERVICE

Menu / Parameter	Description	Value / Unit
Service history	Display the service history	
Burn hours since last service	Display the burn hours since last service	hrs.
Burn hours till service	Display the hours remaining until next service	hrs.
Reset Service Reminder	Reset the service reminder	

23.10.9 SETTINGS

Menu / Parameter	Description	Value / Unit
General Settings	Enter the General Settings menu	
Boiler Settings	Enter the Boiler Settings menu	

23.10.10 GENERAL SETTINGS

Menu / Parameter	Description	Value / Unit
Language	Enter the Language menu	
Unit Type	Enter the Unit Type menu	
Date & Time	Enter the Date & Time menu	
Cascade mode	Enter the Cascade Mode menu	
Other Settings	Enter the Other Settings menu	

23.10.11 LANGUAGE

Menu / Parameter	Description	Value / Unit
English	Select the English language	English
Français	Select the French language	Français
中文	Select the Chinese language	中文
Italiano	Select the Italian language	Italiano

23.10.12 UNIT TYPE

Menu / Parameter	Description	Value / Unit
Metric (˚C, bar)	Select Metric units	˚C, bar
Imperial (˚F, psi)	Select Imperial units	˚F, psi

23.10.13 DATE & TIME

Menu / Parameter	Description	Value / Unit
Date	Set the current date	dd-mm-yyyy
Time	Set the current time	hh:mm
Time Zone Settings	Enter the time zone settings menu	
Display Settings	Enter the display settings menu	

23.10.14 TIME ZONE SETTINGS

Menu / Parameter	Description	Value / Unit
Time Zone Correction	Set the time zone correction	
Daylight Savings Time	Select the daylight savings time mode	

23.10.15 DISPLAY SETTINGS

Menu / Parameter	Description	Value / Unit
Time Notation	Select 24h or 12h time notation	24h/12h
Date Order	Select the date-format	
Day of Month	Select how the day of month is displayed	1 or 2 digits
Month	Select how the month is displayed	
Year	Select how the year is displayed	2 or 4 digits
Date Separation Character	Select the date separation character	
Day of Week	Select how the day of week is displayed	
Seconds	Select if seconds are displayed	yes/no

23.10.16 CASCADE MODE

Note: for proper functioning of the cascade system, some settings have to be changed, see § 16.4.1 "Emergency mode" in the installation manual.

Menu / Parameter	Description	Value / Unit
Full	Select full cascade mode	
Basic	Select basic cascade mode	

23.10.17 OTHER SETTINGS

Menu / Parameter	Description	Value / Unit
Modbus Address	Select the Modbus communication address	0…255
Modbus Stop bits	Select the number of Modbus communication stop bits	1 – 2
Startup Settings	Select the start-up logo (if enabled)	

23.10.18 BOILER SETTINGS

Menu / Parameter	Description	Value / Unit
Boiler Parameters	Enter the Boiler Parameters menu	
Module Cascade Settings	Enter the Module Cascade Settings menu	
Boiler Cascade Settings	Enter the Boiler Cascade Settings menu	
Service	Enter the Service menu	

23.11 Boiler History

The water heater history (found in the information menu) displays several history counters that keep track of the water heater usage.

The following 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).
Operation days	Number of days that the appliance is operational (powered ON).
CH Burner Hours	Number of hours that the appliance has burned for Central Heating.
Anti-Legionella count	Total number of completed anti-legionella cycles
DHW Burner Hours	Number of hours that the appliance has burned for Domestic Hot Water.

23.12 Error logging

Errors will be logged for a stand-alone system or for a complete cascade system (based on the cascade settings). The display will monitor the error number(s) it receives from the water heater(s): new errors will be stored in the error log.
An error will be logged with a (Real Time Clock) time stamp (date and time) when the error was detected and a water heater ID of the water heater on which the error was detected.

Note: the error log is a completely different error logging mechanism than the one used by the burner control itself. Therefore, the error log is different from the (internal) error history of the burner control.

The error log can be seen from the error log menu, which is located in the Information menu. In the Error log menu the following options can be selected:

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

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.

The following table describes what is displayed inside the Error log:

Error Log content	Description
First line	- Boiler ID (for which boiler the error was detected – cascade system only) - Error code (internal) - Error number - Error type (lockout/blocking)
Second line	- Error description
Bottom line	- Time Stamp (date and time) when the error was detected (in the format configured in the Date & Time settings menu) - The selected error index from the total numbers of errors in the (filtered) error log

23.13 Service reminder

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

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

When the Service reminder has become active, the time it takes before service is actually done is being logged (in hours). This time is called the Service Overdue Time.
The Service reminder can be reset by the installer who services the appliance.

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

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

End of customer section.

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